TOWN OF EATONVILLE

Comprehensive Stormwater Plan Update

October 2013

Prepared by:

AHBL

Prepared for:

Town Of Eatonville

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Section 1
EXECUTIVE SUMMARY

1.1 Introduction

The Eatonville Comprehensive Stormwater Plan (Plan) is an update to the draft 2003 Eatonville Stormwater Management Program (Program). The 2003 Program was comprised of an evaluation of the existing surface water management system, with primary focus on correcting conveyance problems and improving water quality.

The Plan updates the Drainage Problem Identification List and creates a prioritized capital improvement project list, and ranked to emphasize projects that will result in measurable improvements to Lynch Creek, Ohop Creek, and the Mashel River. This Plan also positions the Town to be in compliance with Ecology's Basic Stormwater Program (Puget Sound Plan).

Infiltration-based low impact development (LID) practices are also an important change from the 2003 Program. LID practices have the opportunity to enhance the summer low flows in the Mashel River and are encouraged where feasible within the Plan.

A critical change to the Plan is the establishment of prioritization criteria for capital improvement projects (CIP). The new prioritization criteria place special emphasis on the use of LID practices as a way of enhancing the Mashel River. The Plan evaluates and ranks candidate CIP projects through the lens of the benefits associated with flood hazard reduction, infiltration potential, environmental benefit, community considerations, and additional project information. The six highest ranking projects were further developed with detailed project descriptions and opinions of probable design and construction cost.

Through the use of computer modeling, results of past studies (2003 Program), and input from staff from the Town and the Nisqually Tribe, the Plan identifies existing and potential future conveyance problems within the study area. Based on the typical activities within urban areas, general water quality problems were described along with programmatic solutions. A combination of regulatory requirements, public education, increased maintenance activities, and capital improvements are recommended to implement the programmatic solutions.

The major Plan elements include the following:

- Development of public education opportunities to inform the community of water quality issues, potential solutions, and maintain Eatonville's position as the "rain garden capital of the United States."
- Conceptual analysis of localized conveyance issues and water quality problems, and development of a prioritized list of drainage system improvements that emphasize solutions to not only correct conveyance issues, but will also result in water quality improvements to Lynch Creek, Ohop Creek, and the Mashel River.
- Development of capital improvements program needs.
- Development of maintenance and operations program needs.
- Development of a program that identifies program management and engineering needs.
- Development of the total program costs.
- Development of funding analysis including an examination of the Town's Stormwater Fund and the rates that would be necessary to support the operations and maintenance activities required under the Plan.

The Town of Eatonville's stormwater conveyance system requires maintenance, inspection and repair to prevent and/or correct localized flooding, erosion, and water quality problems. Implementing the Plan will aid in preventing future localized flooding, improve water quality in Lynch and Ohop Creeks, and enhance summer low flows in the Mashel River. The local drainage system in the Town consists primarily of a piped system with ditches. None of these systems are classified as streams that support aquatic habitat. Therefore, no habitat problems or solutions are discussed.

The use of LID practices as a major stormwater management approach will be more easily facilitated if code amendments are made. Section 5 and Appendix I contain draft code language that will make the integration of LID practices into future projects more achievable and measurable.

A list of capital projects to address existing problems is included in the Plan. Completion of these projects will improve the operation and efficiency of the existing infrastructure system. Completion of these projects is not required for compliance with existing and pending regulatory requirements, but will result in appreciable improvements to water quality and mitigate known conveyance problems in both constructed and natural systems.

The Plan includes development of a maintenance and operations program which identifies system maintenance and operations needs designed to ensure system reliability, and methods and standards that promote water quality.

The Plan also summarizes program management, public education, engineering, plan review and inspection needed for the Town to work towards compliance with Ecology's Basic Stormwater Program. Total program costs were developed based on the regulatory compliance recommendations, capital improvements projects, operation and maintenance program, public education, engineering, enforcement, and administration costs.

1.2 Next Steps

The Plan is an important step in developing a stormwater management program that will benefit local residents and property owners by improving water quality and minimizing localized flooding issues. Equally important, the Plan is also an important implementation element for the Town's obligations and responsibilities under the Nisqually River Basin Water Quality Implementation Plan for Lynch Creek.

Lynch Creek has a Total Maximum Daily Load (TMDL) designation for fecal coliform. The Town's responsibilities include investigating sources of fecal coliform in the Town's stormwater discharge into Lynch Creek. A program for Illicit Discharge Detection and Elimination (IDDE) is recommended for the Town's operations and maintenance program.

As recommended in Section 3.4, a video inspection of the Town's conveyance system, particularly the oldest portions of the system in and near Center Street West and East, can help to identify inappropriate connections to the storm system from private sanitary sewers and areas where the storm system runs near to or under septic systems. Once the illicit connections and compromised pipe sections are identified, the areas should be prioritized for improvements.

A summary of important next steps include:

1. Explore inter-local agreements and other partnerships that will provide funding for the program implementation as well as the funding for needed capital improvement projects.
2. Survey the conveyance system including channels, culverts and floodways.
3. Survey the storage system including the ponds and control structures.
4. Video inspect the conveyance system particularly Center Street West.

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Section 2
INTRODUCTION

2.1 Introduction

The Town of Eatonville, located between the Mashel River and Lynch Creek in south Pierce County, received a grant from the EPA through the Nisqually Tribe to update its draft Stormwater Management Program (2003 Program). The work contained herein builds on the substantial work completed by the Town Council in conjunction with RW Beck in 2003.

The Comprehensive Stormwater Plan (Plan), was developed on the premise that addressing stormwater in Eatonville is a critical part of salmon habitat restoration in the Mashel River, Ohop Creek and Lynch Creek. The Town is uniquely located in a critical area for salmon habitat and watershed health, and the Mashel River and Ohop Creek are the two highest priority salmon bearing tributaries to the Nisqually River. The bulk of Eatonville's stormwater is directed away from the Mashel River and sent untreated into Ohop Creek, via Lynch Creek. Lynch Creek has been listed by the Washington State Department of Ecology (Ecology) for fecal coliform exceedance. The Mashel River has low flows in the summer and early fall causing the river to be too warm for young fish and too low for adult fish to migrate upstream. The Mashel River has been listed by Ecology for temperature exceedance. The Nisqually Tribe in partnership with the South Puget Sound Salmon Enhancement Group has improved habitat through the placement of multiple engineered log jams.

The Town is not yet subject to the requirement for a National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Permit. Although the Town is not yet subject to this permit, the updated Stormwater Management Program will provide a framework for potential future permit requirements.

2.2 Purpose

The purpose of this document is to update the draft Program prepared for the Town of Eatonville in 2003 by RW Beck. Specifically, this update focuses on modifying the plan to facilitate a gradual transition from a conventional stormwater management system to a Town-wide LID stormwater management system and strategy. The transition will result in greater infiltration of stormwater, reducing the load on the Town's conveyance systems and improving water quality in the Mashel River and Lynch Creek.

2.3 Plan Overview

This Plan is an update to the 2003 Program, building upon the work completed by the Town and RW Beck in 2003. As such, the 2003 Program is referenced heavily within this document and is also incorporated in its entirety as Appendix A. The Plan includes:

> Section 1: Preparation of a Quality Assurance Project Plan (QAPP) for all modeling tasks. The QAPP includes a detailed outline of the tasks and associated work program necessary to provide quality assurance in completing the hydrologic and hydraulic computer model of the Town's drainage basins. The QAPP is included as Appendix B.
>
> Section 2: Creation of a GIS map of the existing Eatonville stormwater system to develop a clearer understanding of how stormwater is captured, where it is conveyed by Eatonville's current stormwater system, and a baseline of existing conditions. The Existing Stormwater Inventory Map is presented in Figure 3-3 (reduced scale) and is provided in Appendix D at 1"=300'. The existing conveyance system is described in Section 3.
>
> Section 3: Creation of a GIS map of impervious surfaces in the Eatonville area to develop a more precise approximation of impervious surfaces in Town. The analysis of impervious surface cover is intended to support the development of an alternative rate structure facilitating a market-based incentive for private investment in LID facilities. This map is found in Appendix D.
>
> Section 4: Updating of the Town's work on the 2003 Program, the hydrologic and hydraulic computer is refined to better understand of how stormwater is likely to behave in Eatonville's current system and to test and evaluate LID retrofit options. The hydrologic and hydraulic modeling is described in detail in Section 4.
>
> Section 5: Evaluation of Eatonville's current codes and standards with state regulations. This work includes review of draft updates previously prepared during Eatonville's work with the Puget Sound Partnership to develop a list of code and standard updates to integrate LID into the City's land use and engineering regulations and standards. This is included in Section 5.
>
> Section 6: Review and updating of the list of drainage problems and solutions included in the 2003 Program. This Section includes identifying LID solutions for the documented drainage problems and a methodology for the prioritization of infiltration practices. The updated drainage problem identification and solutions lists, along with a solutions prioritization matrix, are presented in Section 6.

Section 7: Review and updating of the operations and maintenance section of the 2003 Program to include LID maintenance and operations practices. The operations and maintenance requirements for the stormwater system are included in Section 7.

Section 8: Review and updating of the program management, public education, and engineering section for the emphasis on green stormwater infrastructure practices. This Section also includes research of potential partnering opportunities with city, county, state, tribal, and non-profit organizations that aim to more fully integrate green stormwater infrastructure practices into local new and retrofit project designs.

Section 9: Preparation of a framework for a new stormwater rate system that will incentivize the use of LID practices by private property owners. This Section also includes projections of the cost for implementing the stormwater program and potential grant and loan sources for financing capital improvement projects.

2.4 Authority and Cooperation

Preparation of the Comprehensive Stormwater Management Plan was authorized by the Town of Eatonville in an agreement with AHBL, Inc. dated June 25, 2012.

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Section 3
CHARACTERISTICS OF THE STUDY AREA

3.1 Study Area

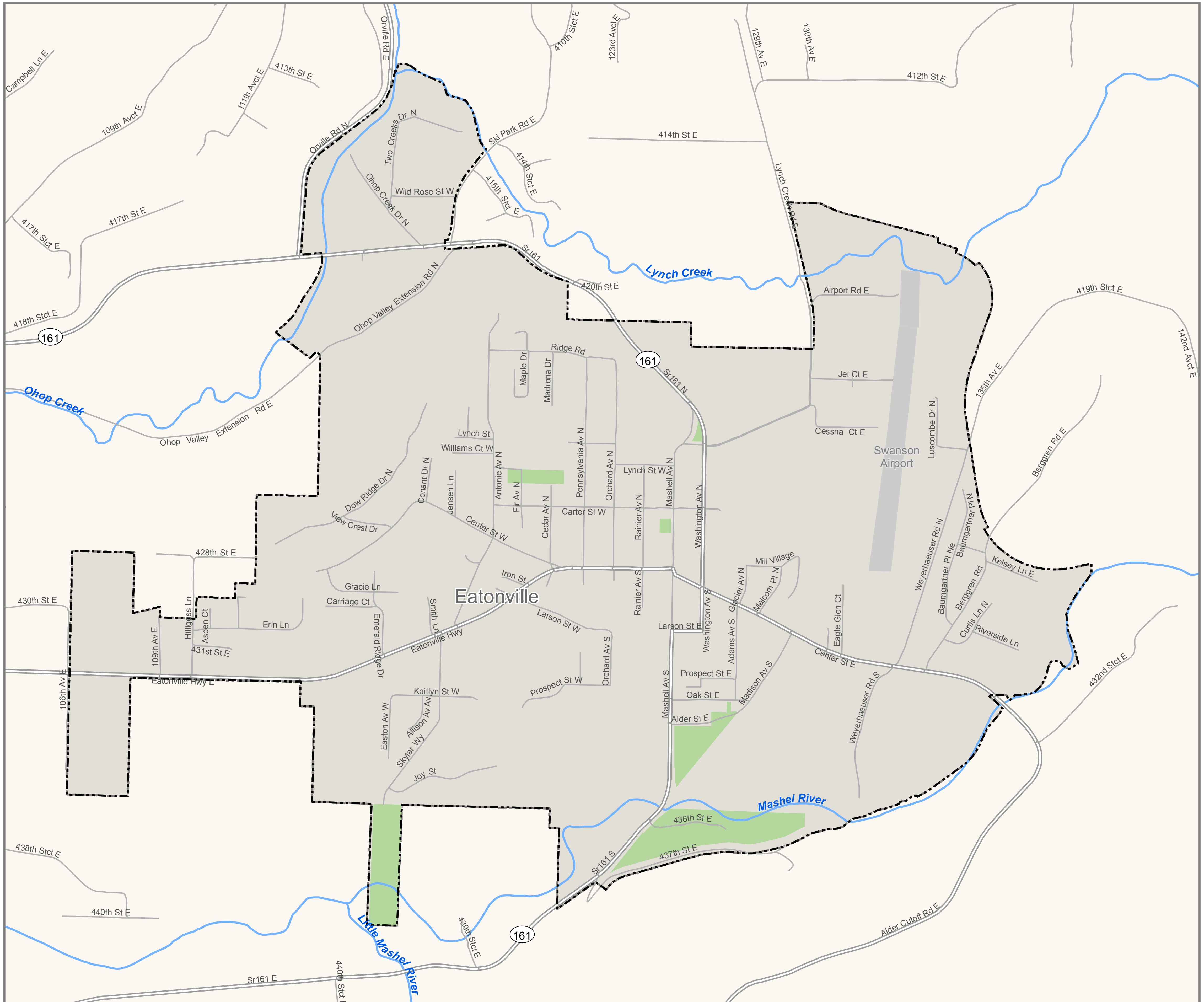
The study area includes all land within the corporate limits of the Town of Eatonville. The engineering analysis of the stormwater conveyance system was limited to the areas that drain into the Town's two main stormwater drainage systems that discharge into Lynch Creek and the Mashel River. An engineering analysis was not performed on the network of drywells and independent infiltration systems (e.g., Kelsey Lane East, Williams Additions, or Eagle Court). Refer to Figure 3-1 for a map of the Town limits.

3.2 Soils and Topography

Eatonville's soils are generally classified into one of the following four soil series: (1) Barneston Gravelly Coarse Loamy Sand, (2) Dupont Muck, (3) Kapowsin Gravelly Loam, and (4) Scamman Silt Loam. The Hydrologic Soils Group ranges from B (Barneston) to D (Dupont) where a classification of 'A' is most permeable and 'D' is least permeable. There are no soils with an 'A' classification in the Town. Figure 3-2 presents the soils map of the Town and additional soils information is found in Appendix C.

The Town is bounded on the south by the Mashel River and on the north by Lynch and Ohop Creeks. The topography indicates that, in general, stormwater tends to converge from the surrounding areas into the Town proper and then flows either north towards Lynch Creek or south towards the Mashel River. A substantial portion of the Town ranges in elevation from 800 to 900 feet above sea level.

Town of Eatonville



Legend

Town Limits

Streams

Parks

State Context Map

0 0.125 0.25 Miles

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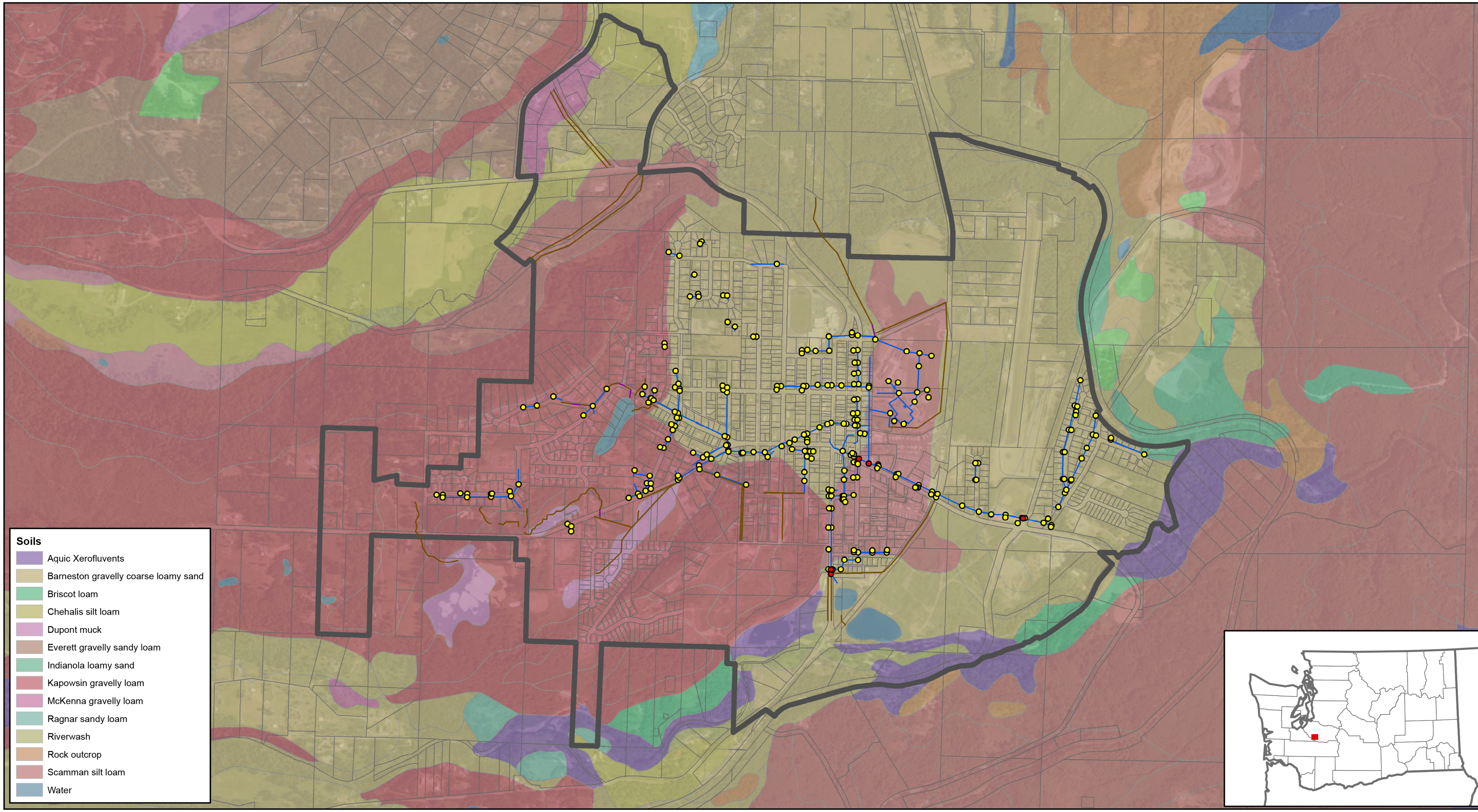
FIGURE 3-1
VICINITY MAP



LEGEND

Manhole
Town Limits
Catch Basin
Parcel
Culvert
Ditch
Pipe

0 1500
Scale in Feet

Map Projection:
Washington State Plane South,
NAD 1983, Feet

Source: NRCS (soils),
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

FIGURE 3-2

SOILS MAP
EATONVILLE AND VICINITY

AHBL/EATONVILLE SW EVALUATION/WA

Path: M:\Projects\2012\12393162_Eatonville_SW_Evaluation\MXD\12393162_F02_Soils.mxd Date: 5/9/2013 User: THammond

Golder Associates

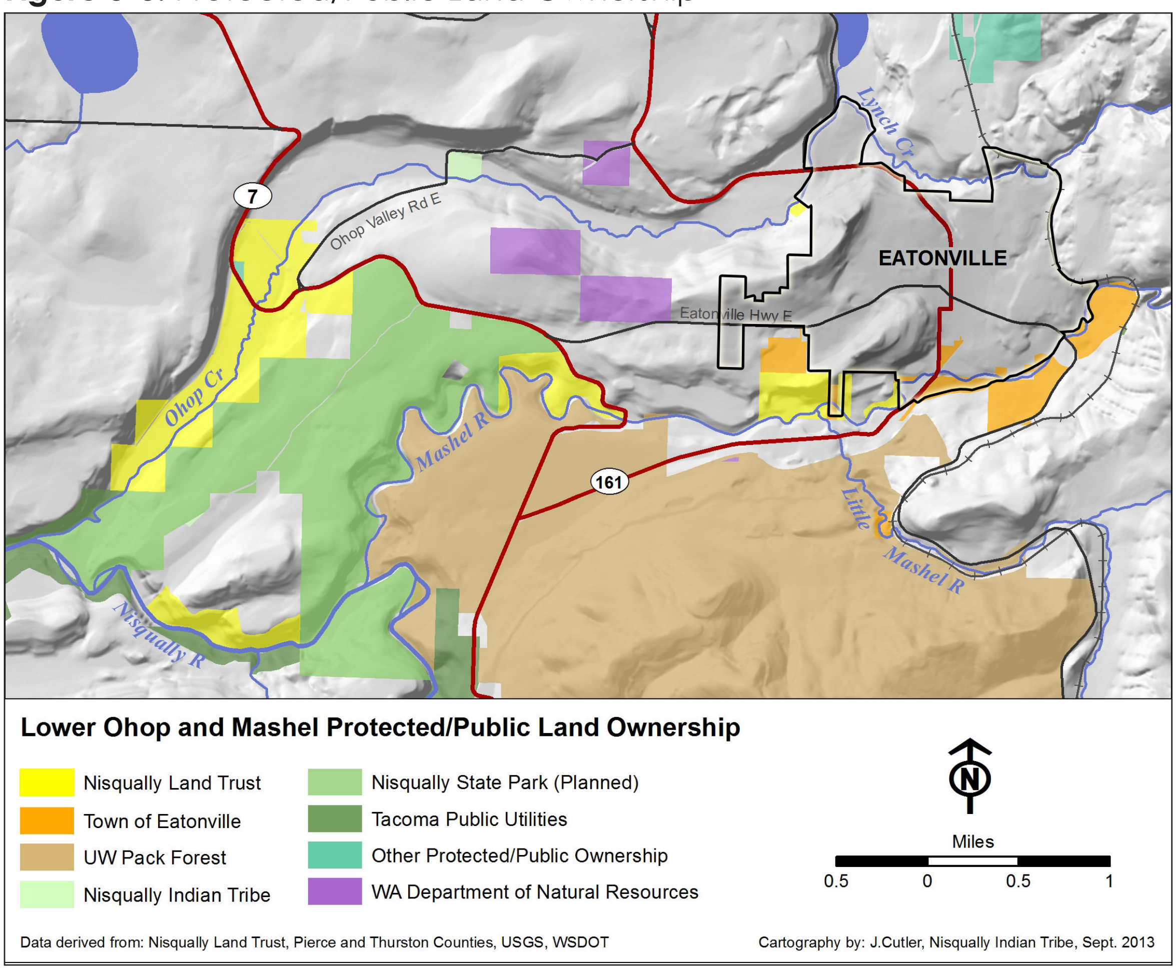
3.3 Land Use

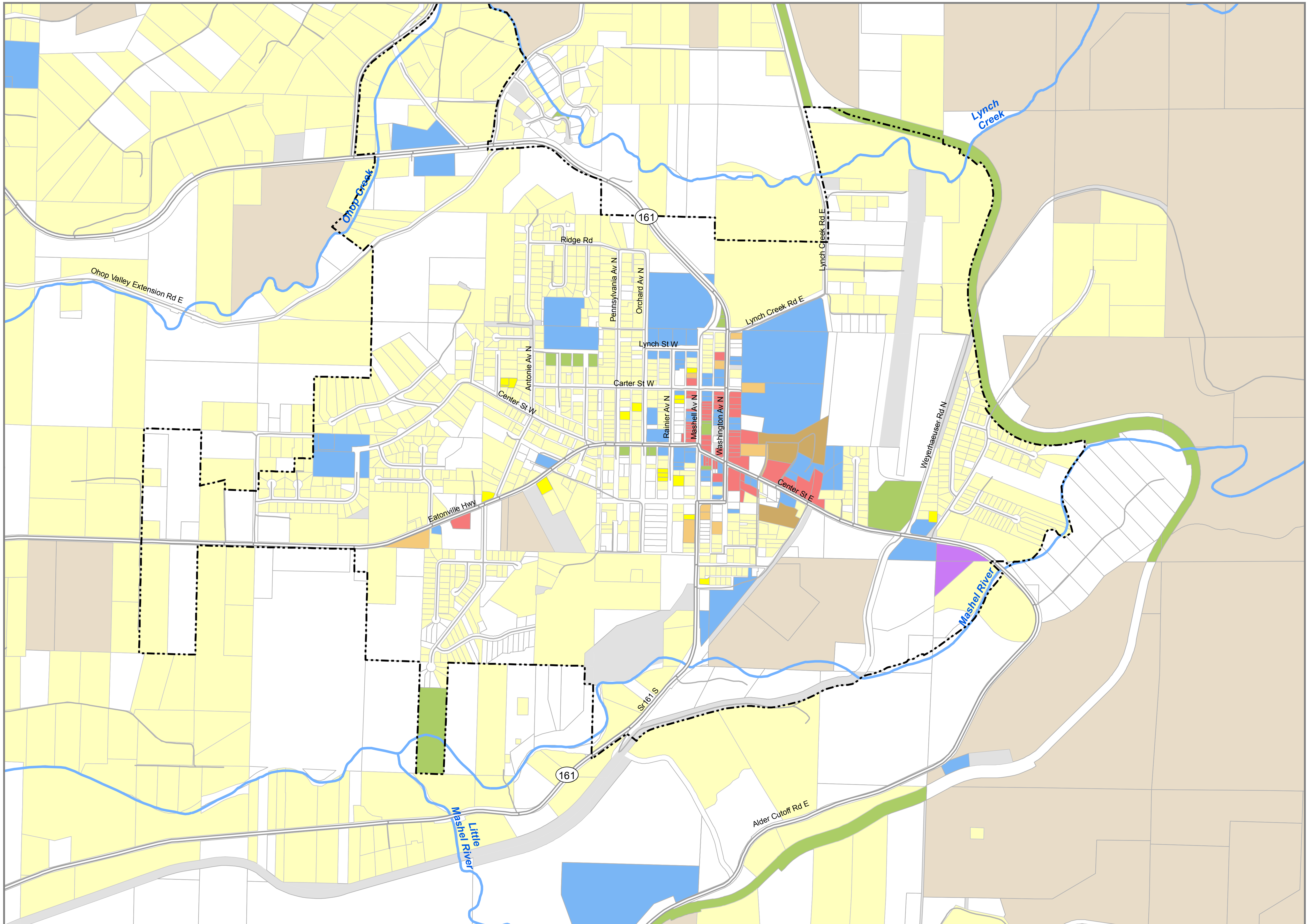
There is significant protection of the Mashel River within the corporate limits of Eatonville and downstream in Pierce County. The Nisqually Land Trust and the Town of Eatonville hold protective ownership within Town while the Nisqually Land Trust, the Nisqually State Park, Tacoma Public Utilities, and the UW Pack Forest hold protective ownership downstream in Pierce County (See Figure 3-3).

Lynch Creek meanders in and out of the northern limits of the Town. According to mapping provided by the Nisqually Indian Tribe, there is no protected/public land ownership along Lynch Creek within the Town of Eatonville (See Figure 3-3).

Existing land use was confirmed by comparing Pierce County Assessor-Treasurer data with existing land use mapping maintained by the Town. Tax Parcels are designated according to Assessor-Treasurer land use codes. Future land use was identified during the Town's preparation of its Comprehensive Plan. Existing land uses in the study area primarily consist of single- and multi-family residential, commercial, industrial, and an airport. Figure 3-4 shows existing land uses.

Figure 3-3: Protected/Public Land Ownership





Town of Eatonville

Current Land Use

- Household, single family units
- Household, 2-4 units
- Household, multiunits (5 or more)
- Mobile home parks or courts
- Cultural, Entertainment and Recreational
- Manufacturing
- Resource Production and Extraction
- Services
- Retail Trade
- Transportation, Communication, and Utilities
- Undeveloped Land and Water Areas
- Parcel Boundaries
- Town Limits
- Streams

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0 0.125 0.25 Miles

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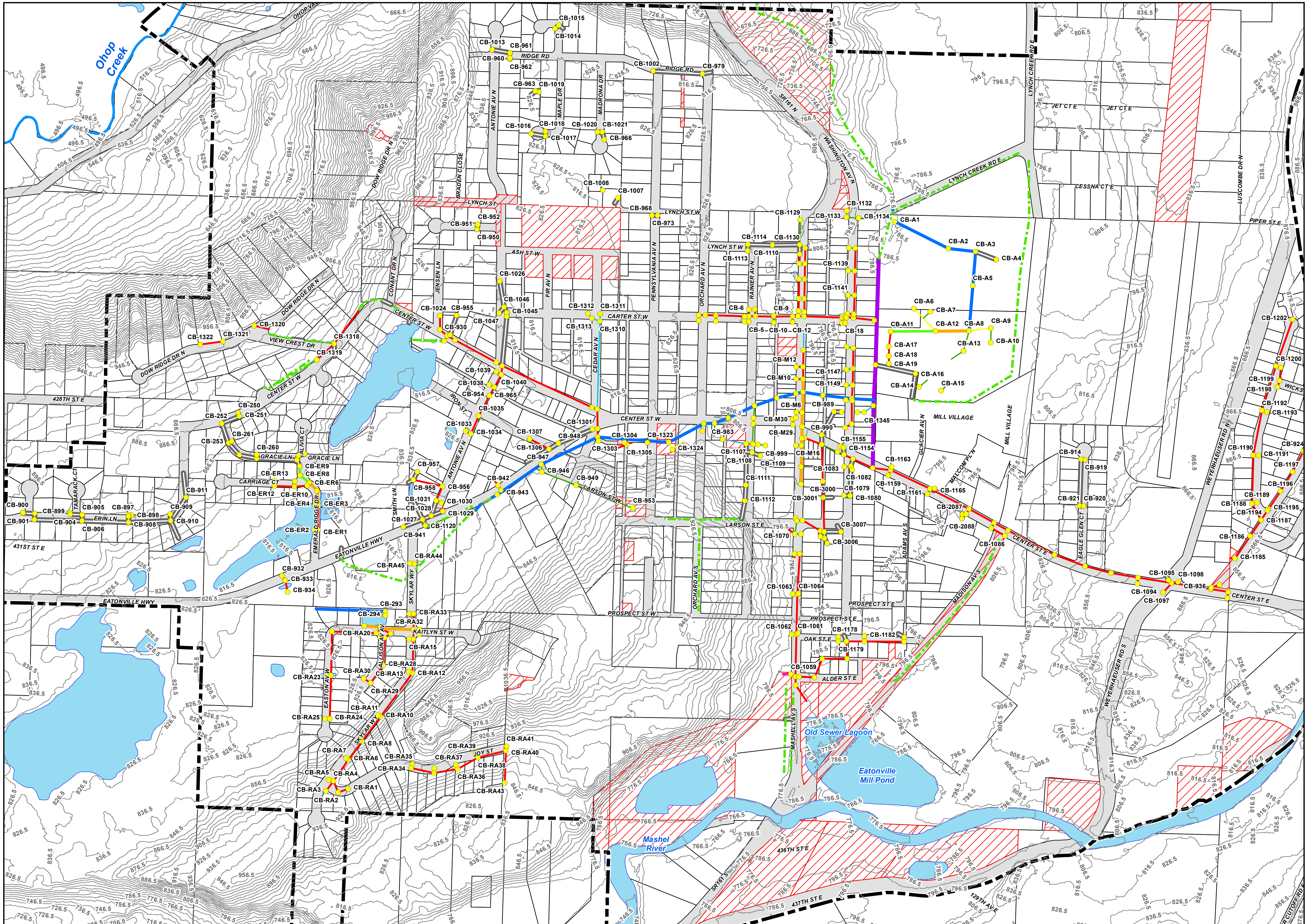
FIGURE 3-4 CURRENT LAND USE MAP



Town of Eatonville

- Town Limits
- Tax Parcels
- Public Parcels
- Waterbodies
- Streams
- Channel
- Catch Basin

Conduit

Diameter in Inches

- No Data
- 6
- 8
- 10
- 12
- 14
- 15
- 18
- 24
- 36

0 300 600 Feet

A full-size print of this map is found in Appendix D.

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FIGURE 3-5
STORMWATER INVENTORY MAP

3.4 Stormwater Structure Inventory & Mapping

Stormwater structure inventory and mapping were based on data provided from the 2003 Program with revisions based on limited field measurements / observations and record drawings of recent projects. This data was then used to develop the hydraulic computer model to identify conveyance capacity and potential flooding problems. See Appendix D for the updated Stormwater Inventory Worksheets and Figure 3-5 for the Existing Stormwater Inventory Map.

The recent projects that were included in the update include Mashell Avenue, Carter Street, and Washington Avenue Improvements. Record drawings were provided by the Town for Mashell Avenue and Carter Street Improvements. Plans for Washington Avenue improvements were provided at the 50% Construction Document design phase.

The 2003 Program referenced the Pierce County Control Monument, NAD 83/91 State Plane Coordinate System for the horizontal datum, and NGVD29 for the vertical datum. The information on the road improvement projects identified in the previous paragraph was adjusted to convert the vertical data to match that used in the 2003 Program. Record drawings for Mashell Avenue referenced NAVD88 for the vertical datum while Carter Street used an assumed datum for relative reference. The Mashell Avenue elevations were converted to NGVD29 using a difference of 3.465-ft from NAVD88 (conversion factor from NOAA's VERTICON web application). The Carter Street elevations were estimated to be roughly 1.5-feet difference based on elevations that were assumed to not have changed during construction.

During the field investigation, several discrepancies in the original data were investigated. Pipe routing was reviewed as well as additional measurements were performed from catch basin rim for suspect areas. The field investigation corrected several measurements. Drainage ditches, ponds, and culverts were also reviewed; however, data collected was constrained to field estimates of channel dimensions and pipe diameters.

The modeling effort within the current scope of work has allowed significant updates to the 2003 Program. The projects within Mashell Avenue, Carter Street, and Washington Avenue were included in the update and several incorrect slopes and pipe sizes within the Center Street West and East systems were corrected. Pipe routing from Lynch Street and Larson Street was corrected based on field observations. In addition, the sub-basin delineation was further refined and the hydrology was more accurately modeled using the latest hydrological model for western Washington and precipitation data generated for eastern Pierce County. To build upon these improvements, additional data collection work can be done to further improve the accuracy of the model and improve the plan. As opportunity arises, the following data needs should be considered:

1. Survey channels, culverts and floodways, particularly at the following locations:
    a. Channel located south of Lynch Creek Rd and west of Eatonville Elementary School
    b. Channel located south of Eatonville Highway from Emerald Ridge Drive to just east of Antonie Avenue North
2. Survey ponds, including control structures, if present, for the following locations:
    a. Near intersection of Center Street West and Jensen Lane
    b. Near intersection of Eatonville Highway and Emerald Ridge Drive

    c. Old Lagoon Pond to determine depth and volume as well as geotechnical explorations to determine existing soils at the bottom of the lagoon and distance to infiltrative soils
    d. Eatonville Mill Pond to explore replenishing depth of water with stormwater instead of potable water
3. Video inspect the Center Street West system to determine precise horizontal and vertical locations, and pipe size, and materials
4. Confirm all connections to the main collector trunk (Trunk 4). During the field investigation, it was unclear how each of the trunks connected to the main trunk system. Suggest utility locate and TV inspections
5. Survey invert elevations for Antonie Avenue. GPS data was provided by the 2003 Program
6. Verify the vertical datum for Carter Street

3.5 Existing Surface Water System

There are two main discharge locations for the Town. Approximately 80% of the stormwater runoff from the Town discharges to the north to Lynch Creek. Runoff from the southern 20% of the Town discharges to the Mashel River. In this report the north basin systems (trunks) are numbered and the south basin trunks are lettered to help distinguish between the two. The naming convention has been maintained from the 2003 Program, including catch basin (CB) numbers, trunk numbers and basin numbers. Added trunks have been numbered based on the trunk to which they are tributary. The existing stormwater system of the Town of Eatonville is shown in Figure 3-5.

North Basin (Lynch Creek)

3.5.1 Trunk 1 - Center Street West System

The upstream end of Trunk 1 is located at an existing pond near the intersection of Jensen Lane and Center Street West. East of Cedar Avenue, the system meanders outside of the right-of-way of Center Street West under private properties. The system discharges flows to the Main Collector (Trunk 4). Please refer to the 2003 report in Appendix A for a more detailed description of this system.

Field investigations corrected information on pipe routing and catch basin depths between Orchard and Washington Avenues. The system inventory worksheet and models were updated to reflect field observations.

The connection to the Main Collector (Trunk 4), east of Washington Avenue, could not be identified. It most likely occurs within private property and could possibly be a tee connection. The hydraulic model assumes a tee connection.

At the upstream (west) end of the system, an existing pond outfalls into the system. A control structure was not found during the field investigation so the pond was assumed to have a weir outlet. The pond size was estimated based on maps, aerial photography, and field observations. See Chapter 4 for additional assumptions made during hydraulic modeling.

Flowing water was observed in the system from Orchard Avenue to Washington Avenue even though the weather was dry at the time of observation. It is believed that this system regularly has water and is fed from the Eatonville Highway system (Trunk 6).

3.5.2 Trunk 2 – Carter Street System

The Carter Street system starts at the intersection of Orchard Avenue North and Carter Street West and heads east within the Carter Street right-of-way until it discharges to the Main Collector (Trunk 4). The system also collects flow from the Washington Avenue and Mashell Avenue systems north of Carter Street. The connection to the Main Collector (Trunk 4) is assumed to be a tee connection.

Carter Street has had recent storm improvements according to record drawings. Record drawings were at an assumed elevation, thus some level of error may be present in the hydraulic model. An assumed conversion of 1.5-feet lower than the record drawing elevations was used based on comparisons of the existing topographic survey with the as-built data.

3.5.3 Trunk 2a – Mashell North of Carter Street System

This system starts near the intersection of Lynch Street West and Mashell Avenue and flows south to Carter Street.

3.5.4 Trunk 3 – Lynch Street System

The 2003 Program showed the Lynch Street stormwater system flowing north in Mashell Avenue and east to Lynch Creek Road. The Mashell Avenue record drawings showed the Lynch Street storm system being intercepted at the intersection of Lynch Street and Mashell Avenue and flowing south in the Mashell Avenue improvements.

During the field investigation, it was found that CB-1129 and CB-1133 in Lynch Street were not connected and that it appeared CB-1129 drained south to CB-1130 based on observations. According to record drawings, CB-1130 drainage was picked up by the Mashell Avenue improvements. As such, the tributary areas were modeled entering Mashell Avenue at this intersection and the Lynch Street System is not included in the hydraulic model.

3.5.5 Trunk 4 – Main Collector System

The Main Collector system is located within private property east of, and parallel to, Washington Avenue. The system is 36-inches in diameter and discharges flows to a channel located west of the Eatonville Elementary School parking lot.

The channel is located in a wooded depression that likely supports some flooding prior to impacting downstream private properties. The dimensions of the channel and floodway were estimated based on field observations because thick brush and brambles prevented accurate measurements.

The channel crosses under Lynch Creek Road via a 24-inch culvert. A 2-foot square, box culvert is located immediately downstream of the 24-inch culvert. The box culvert then discharges flows to a channel that makes its way down a wooded ravine towards Lynch Creek.

The 2003 Program provided two different estimated overtopping elevations for Lynch Creek Road at the 24-inch culvert. The lower value of 786.50 was chosen for the current model as it more closely matched contour data. The culvert was reported in the 2003 Program as having between 4.2 and 12.8 feet of freeboard between the north and south sides of the road. Based on field observations, a depth of 10-feet was assumed.

3.5.6 Trunk 5 - Center Street East System

The Center Street East system starts at the intersection of Berggren Road and Center Street East and flows west to CB-993 which is located east of Washington Avenue South. A secondary part of the system collects flows from the intersection of Mashell Avenue and Center Street East as well as collecting flows from Larson Street. Flows from CB-993 head north to the Main Collector (Trunk 4). Please refer to the 2003 Program in Appendix A for an additional description of this system.

During field investigation, an attempt to review CB-993 was made. However, the catch basin manhole cover was unable to be removed.

3.5.7 Trunk 5a – Mashell West of Center Street East System

This system will provide a future connection to the Center Street West (Trunk 1). It currently starts north of the Center Street and Mashell Avenue intersection, just south of the Center Street West (Trunk 1) system, and connects to Center Street East (Trunk 5) system before heading south down Mashell Avenue to where it terminates.

Two valves are located within Trunk 5a, one of which is located at CB-M7 and prevents flows from Center Street West from heading south along Mashell Avenue. The second valve is located at CB-M3, which is located at the southeast corner of the intersection of Mashell Avenue and Center Street East. Although the system is hydraulically connected to Center Street East, flows can continue south to where the system ends at CB-M26. The rim elevation of CB-M26 is above the outlet invert to Center Street East system, so flows eventually travel east to Center Street East. Standing water is expected in the dead end portion of the system.

See Section 3.6 for further discussion of the future diversion to Mashel River.

3.5.8 Trunk 6 – Eatonville Highway System

The Eatonville Highway System (Trunk 6) starts near the intersection of Emerald Ridge Drive and Eatonville Highway West. A series of culverts, channels, and floodways are located within private property south of Eatonville Highway. The system then outfalls to a ditch located within the Eatonville Highway right-of-way where it then enters a pipe and catch basin system. The system connects to Center Street West (Trunk 1) system near the three way intersection of Center Street West, Eatonville Highway and Cedar Avenue.

During the field investigation, a significant amount of water was observed within the channel located on private property. The channel has a floodplain and is more than 8-feet below Eatonville Highway.

This system was modeled beginning at the culvert that brings flows into the Eatonville Highway right-of-way.

South Basin (Mashel River)

3.5.9 Trunk A – Mashell Avenue South System

Trunk A is located within Mashell Avenue South starting just south of Larson Street and discharges to a biofiltration swale which conveys flows to the Old Sewer Lagoon located south of Alder Street and east of Mashell Avenue. The Old Sewer Lagoon has an overflow route that discharges flows to the Mashel River.

3.5.10 Trunk B – Alder Street South System

The Alder Street System meanders from the intersection of Oak Street and Madison Avenue, west along Oak Street, through a grassed alley between Oak Street and Alder Street and then west in Alder Street to the Mashell Avenue South system (Trunk A).

Miscellaneous

3.5.11 Infiltration Systems

Infiltration systems within the Berggren Road subdivision and within the Ridge Road subdivision and associated sub-basins were not considered in the hydrologic and hydraulic models.

3.5.12 Existing Rain Gardens

Multiple rain gardens have been constructed in Eatonville, particularly along Orchard Avenue. The infiltration rates of the rain gardens are not known, so they have not been included in the hydrologic and hydraulic models.

3.6 Future Diversion to the Mashel River

The Town stormwater conveyance system currently drains predominately to Lynch Creek in the north with a minor portion draining to the Mashel River in the south. The Mashel River experiences low flows in the summer. Because of this, a future goal of the Town is to reverse the flow direction and have the majority of the its stormwater conveyance system to drain to Mashel River.

As part of the 2011 Mashell Avenue improvement project, two gate valves were installed in the new storm system. One valve is located along the Center Street West system (Trunk 1) on the south side of a catch basin located in Mashell Avenue (CB-M7). This valve is currently closed. The second valve is located at the southeast corner of the Center Street and Mashell Avenue intersection between the Mashell system and Center Street East system (Trunk 5). This valve is located east of CB-M3 and is currently open.

The purpose of these valves is that in the future the valve located at CB-M7 can be opened and the east pipe plugged. This would re-direct the Center Street West system (Trunks 1 and 6) south to Mashell Avenue South. Additionally, the valve located on the east side of CB-M3 could be closed, causing flows to continue south down Mashell Avenue South. An additional 300 linear feet of pipe is needed to connect to the south system.

The permitting and design of the diversion is not included within the current CIP.

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Section 4
HYDROLOGIC & HYDRAULIC COMPUTER ANALYSIS FOR EXISTING CONVEYANCE CONDITIONS

4.1 Introduction

The hydrologic and hydraulic analysis in the 2003 Program was updated to achieve the following goals:

1. Update the conveyance system model based on newly acquired information and recent construction
2. Identify flooding problems based upon the updated information
3. Inform the development of LID strategies to use as solutions

The hydrologic analysis is presented in Section 4.2 and the hydraulic analysis is presented in Section 4.3.

4.2 Hydrology

Hydrology was modeled using WWHM3 with extended rainfall data from Pierce County per Pierce County standard methodology for three scenarios:

1. Existing conditions.
2. Future conditions assuming full build-out and conventional urban stormwater management.
3. Future conditions assuming full build-out but applying LID to infiltrate stormwater where feasible.

The WWHM3 modeling software was used to generate runoff flows from each of the sub-basins, for the 25-year storm event. The following input parameters were used:

- Pierce County Extended Rainfall Data
- Sub-basin Areas
- Land Classifications
- Impervious Area Coverage

Output from the model are peak flows similar to the 25-year, 24-hour event. Table 4-1 presents a summary of sub-basin data for the three scenarios described above. Figure 4-1 presents the sub-basin delineation map.

4.2.1 Pierce County Extended Rainfall Data

The Pierce County Extended Rainfall Data was obtained from the Pierce County website. The Pierce County Mean Annual Precipitation Map (included with the data), showed that Eatonville is located within the 40-42 inch precipitation zone in east Pierce County. The 158-year, 15-minute precipitation time series and the 158 year, 24-hour evaporation time series for the “40-inch east basin” was used in WWHM3.

4.2.2 Subbasin Delineation

The sub-basin delineation from the 2003 Program was reviewed for accuracy and further refined based on new infrastructure and a closer examination of topography. See Figure 4-1 for the Sub-basin Map.

4.2.3 Land Classifications

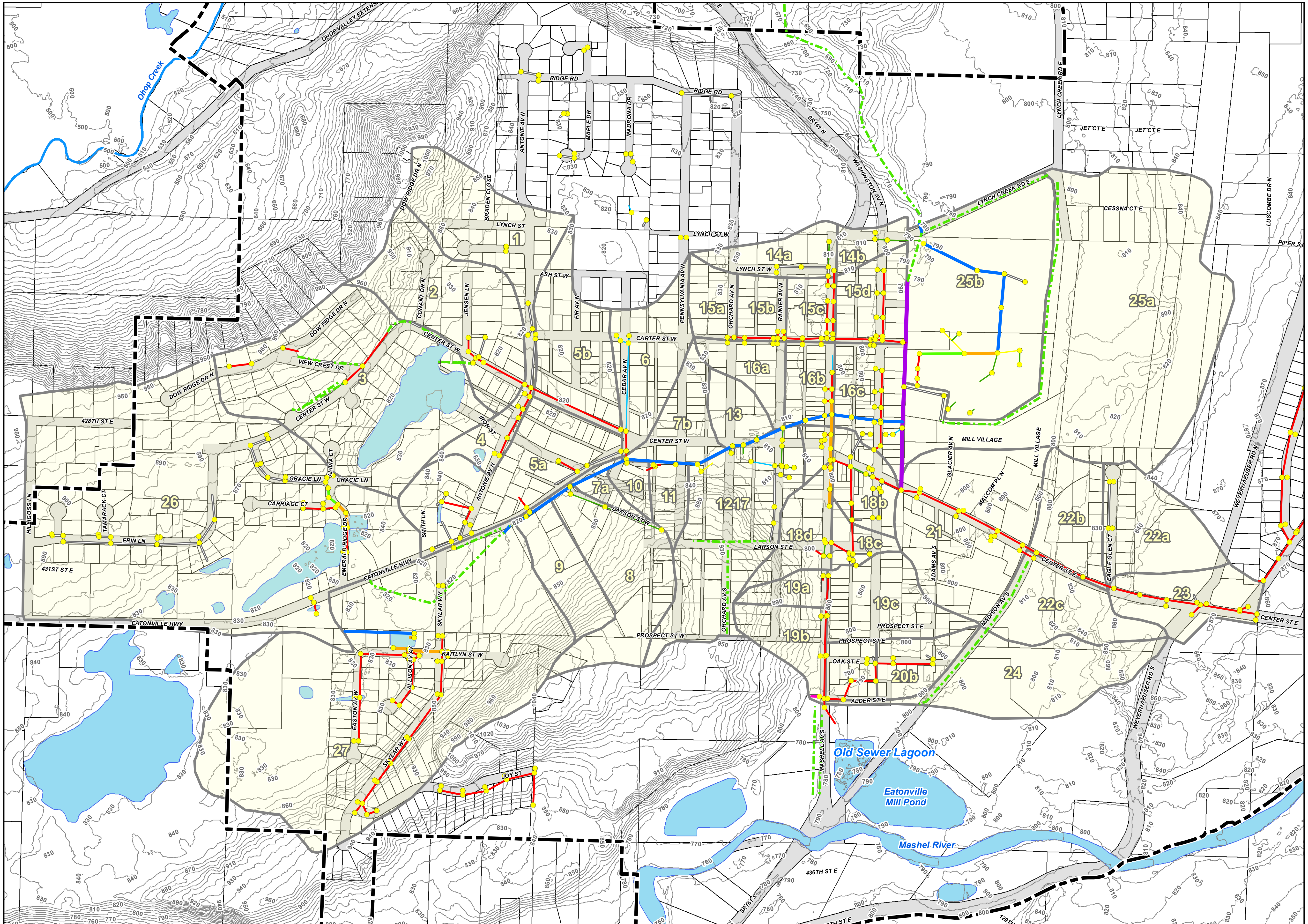
Soil types, slopes, and land coverage are required for modeling hydrology. From the Pierce County Stormwater Management and Site Development Manual, the predominant soils found in the Town are classified into the following Hydrologic Soil Groups: Barneston Gravelly Coarse Loamy Sand = B, Dupont Muck = D, Kapowsin Gravelly Loam = D and Scamman Silt Loam = D.

Slopes were approximated based on the topographic information generated by GIS data layers. Slopes were generalized as Flat (0-5%), Moderate (5-15%), and Steep (>15%).

Pervious land coverage was modeled as lawn while impervious areas were modeled as roads. Impervious area classification does not affect the hydrologic calculation, so further subdivision of impervious areas into roof, parking, road, etc. was not necessary.

4.2.4 Existing Conditions

Model input for the existing condition scenario was extracted from various sources. The existing impervious surface coverage was developed from GIS data and measured for each sub-basin. From the total sub-basin area and the total impervious area, the total pervious area was calculated. The 2003 Program provided soil coverage areas in each basin. Using the percentage of soil coverage for each soil designation, it was assumed that existing pervious surfaces would have the same percentage within each soil classification. Percent of slopes in each classification was also assumed to be equal. See Appendix E for a summary of these results.



Town of Eatonville

- Tax Parcels
- Storm Basins
- Waterbodies
- Streams

Conduit

Diameter in Inches

- No Data
- 6
- 8
- 10
- 12
- 14
- 15
- 18
- 24
- 36
- Catch Basin
- Channel

0 300 600 Feet

AHBL

FIGURE 4-1
SUBBASIN MAP

4.2.5 Future Build-Out Conditions Assuming Standard Urban Stormwater Managment Practices

The sub-basin delineation from the 2003 Program provided future impervious cover percentages and was divided into land use zone and soils. This information was further subdivided based on slope classification. Percent impervious and total basin area was then used to calculate impervious areas in acres. Slopes were delineated based on maps provided by the 2003 Program. See Appendix E for a summary of these results.

4.2.6 Future Build-out Conditions Assuming LID Practices

In addition to modeling the existing and future conditions, an LID scenario was developed. This scenario assumes that in the future build-out conditions new developments will provide LID to the maximum extent feasible for both private and public developments. This scenario does not include any improvements to the existing conveyance system.

In order to develop the peak flow hydrographs that would result from extensive use of LID, a flow reduction factor was assigned based on the presence of infiltrative soils in an area. Reduction factors were assigned ranging from 0% for areas with no infiltration, to 10% up to 75% for areas located within infiltrative soils. Reduction factors are also based on the percentage of the sub-basin located in the infiltrative area and also the extent of development in the basin in the existing conditions compared to the future build-out conditions.

The south basin (Sub-basins 19 and 20) are tributary to a future regional infiltration pond located at the Old Sewer Lagoon. Although this solution is likely to help with impacts to Mashel River, a downstream infiltration system does not relieve a stressed conveyance system and thus these basins are modeled with flow reduction factors assuming no infiltration in Sub-basin 19 and minimal infiltration in Sub-basin 20.

Appendix E contains a table of reduction factors assumed and a brief review of each sub-basin for developing these assumptions.

4.2.7 Hydrologic Modeling Results

The hydrologic model was used to develop hydrographs that can then be used in the hydraulic model to understand the capacity of the conveyance system. Accepted practice in Western Washington is to use the 25-year storm for conveyance capacity analysis. In order to input the hydrologic data into the hydraulic model, hydrographs were extracted from WWHM3 for an historical event with peak flows similar to the 25-year event.

Table 4-1 presents a summary of the 25-year peaks for the existing, future build out conventional and future build out LID scenarios. Pervious and impervious areas are provided in this table for comparison purposes between the existing and future scenarios. A review of the data summarized in Table 4-1 shows the results of applying LID principles to areas of the Town that have infiltrative soils. Based upon our assumed flow rate reductions, 25 of the 43 sub-basins (58%) show a reduction in peak flow at the 25-year full build-out scenario. The reduction is substantial in areas of the Town that are underlain by infiltrative soils and are expected to further develop such as the areas along Center Street East. Areas in the center of Town could also substantially reduce runoff if LID development principles are applied to construct “green streets” in alleys and along Center Street West.

Table 4-1: Subbasin Data

Subbasin No.	Subbasin Area (acres)	Out Fall Node	Development Scenarios						
			Existing Scenario			Development Assumptions		Future Conventional Scenario	Future LID Scenario*
			Pervious Area (acres)	Impervious Area (acres)	25-Year Peak Flow (CFS)	Pervious Area (acres)	Impervious Area (acres)	25-Year Peak Flow (CFS)	25-Year Peak Flow (CFS)
1	13.07	CB-1041	8.69	4.38	3.200	5.60	7.47	4.767	3.814
2	15.48	PO-4	11.59	3.89	3.518	7.10	8.38	5.678	5.678
3	31.86	PO-4	24.21	7.65	8.012	14.13	17.73	11.859	11.859
4	2.95	CB-1041	2.18	0.77	0.662	1.03	1.92	1.082	1.082
5a	14.91	CB-1300	9.75	5.16	3.650	5.89	9.02	5.125	5.125
5b	10.30	CB-1309	6.17	4.13	2.193	3.19	7.11	3.582	1.791
6	8.70	CB-1308	4.98	3.72	1.981	2.35	6.35	3.222	1.611
7a	1.45	CB-1302	1.07	0.38	0.383	0.44	1.02	0.645	0.645
7b	5.30	CB-1325	2.56	2.74	1.413	0.95	4.35	2.168	1.084
8	12.60	CB-945	11.22	1.38	2.750	6.17	6.43	4.459	4.459
9	6.00	CB-944	4.67	1.33	1.522	3.30	2.70	1.992	1.992
10	1.57	CB-1302	1.33	0.24	0.347	0.50	1.07	0.677	0.474
11	2.54	CB-1325	2.15	0.39	0.615	0.75	1.79	1.139	1.139
12/17	17.71	CB-1331X	12.47	5.24	4.644	5.66	12.05	7.413	6.301
13	3.30	CB-1328	1.33	1.97	1.004	0.40	2.90	1.443	1.010
14a	4.74	CB-M24	1.64	3.10	1.568	1.33	3.41	1.715	1.372
14b	2.33	CS-6	1.18	1.15	0.596	0.27	2.06	1.022	0.716
15a	3.34	CB-1339	1.82	1.52	0.803	0.63	2.71	1.388	0.694
15b	3.07	CB-1336	1.12	1.95	0.991	0.58	2.49	1.241	0.869
15c	3.04	CB-984	1.11	1.93	0.953	0.58	2.46	1.241	0.869
15d	5.62	CB-1142	2.68	2.94	1.529	1.07	4.55	2.295	1.606
16a	4.13	CB-1331X	1.85	2.28	1.168	0.54	3.59	1.787	0.893
16b	3.98	CB-M7	1.26	2.72	1.372	0.52	3.46	1.722	1.378

*For assumptions used to model the Future LID Scenario, Please reference Appendix E.

Table 4-1: Subbasin Data

Subbasin No.	Subbasin Area (acres)	Out Fall Node	Development Scenarios						
			Existing Scenario			Development Assumptions		Future Conventional Scenario	Future LID Scenario*
			Pervious Area (acres)	Impervious Area (acres)	25-Year Peak Flow (CFS)	Pervious Area (acres)	Impervious Area (acres)	25-Year Peak Flow (CFS)	25-Year Peak Flow (CFS)
16c	7.01	CB-970	1.54	5.47	2.736	0.91	6.10	3.063	2.450
18a	1.31	CB-M3	0.26	1.05	0.530	0.17	1.14	0.572	0.515
18b	4.88	CB-992	0.70	4.18	2.162	0.63	4.25	1.019	0.917
18c	2.24	CB-3002	1.04	1.20	0.751	0.29	1.95	1.002	1.002
18d	5.12	CB-1071	3.28	1.84	1.602	0.67	4.45	2.519	1.764
19a	2.34	CB-1065	1.71	0.63	0.713	0.56	1.78	1.128	1.128
19b	4.98	CB-1058	4.23	0.75	1.314	1.20	3.78	2.370	2.370
19c	8.41	CB-1060	5.39	3.02	2.310	1.93	6.48	3.466	3.466
20	7.12	CB-1057	-	-	-	2.22	4.90	2.690	2.152
20a	2.87	CB-1180	1.61	1.26	0.795	-	-	-	
20b	4.24	CB-1057	2.64	1.60	1.084	-	-	-	
21	19.05	CB-1164	6.59	12.46	7.009	3.17	15.88	8.222	8.222
22a	9.20	CB-1091	7.08	2.12	1.126	2.21	6.99	3.503	0.876
22b	7.20	CB-994	4.01	3.19	1.693	1.80	5.40	2.708	1.083
22c	8.64	CB-1089	7.56	1.08	0.957	1.2	7.42	3.718	0.929
23	7.50	CB-935	3.17	4.33	2.214	1.13	6.38	3.174	2.222
25a	50.70	CB-1344	39.32	11.38	6.808	11.66	39.04	19.543	9.772
25b	27.80	CS-6	17.08	10.72	7.606	14.46	13.34	8.708	8.708
26	74.60	PO-E4	55.34	19.26	19.78	29.10	45.51	27.029	27.029
27	65.00	PO-E4	51.85	13.15	14.808	35.10	29.90	19.940	19.940

*For assumptions used to model the Future LID Scenario, Please reference Appendix E.

4.3 Hydraulics

The hydraulic analysis of the Town's stormwater system was performed using CivilStorm V8i for AutoCAD Civil 3D 2012. Figure 4-2 displays the pipes and catchbasins analyzed. This section covers the data, input parameters and assumptions used in the hydraulic model including:

- Catchment area information
- Stormwater system inventory
- Open channels
- Ponds
- Outfalls

4.3.1 Catchment Area Information

Within Civil Storm, the phrase "catchment area" is used in place of the term "sub-basin". To import the hydrology for each catchment area from WWHM3, a "User Defined Hydrograph" function within CivilStorm was used. As discussed in the previous section, the hydrograph was developed from the historical storm event with similar peak flow as the calculated 25-year storm event. The 24-hour storm event window was centered on the peak 15-minute peak flow. See Table 4-1 for the sub-basin data and the outfall nodes assigned.

4.3.2 Stormwater Inventory

The stormwater system inventory was compiled from data provided in the 2003 report with additions and adjustments from record drawings and field observations as described in Chapter 3. Reconciliation of horizontal and vertical locations was made to enable consistent modeling.

4.3.2.1 Piped Conveyance

The existing piped conveyance system in the Town consists of pipes ranging from 6" to 36" in diameter and constructed of multiple types of materials. Hydraulic modeling was performed on pipes 12" diameter and above. Materials were assumed from information provided by the Town, verified in some instances by field observations. Four Manning's roughness coefficients (n values) for pipe materials were used:

- Concrete, n=0.013
- Corrugated metal, n=0.024
- Ductile iron, n=0.012
- PVC, n=0.010

These Manning's coefficients are the standard used in the CivilStorm program and agree with industry standards.

4.3.2.2 Open Channel Conveyance

Stormwater is also conveyed through open channels in various locations, most notably on the west side of Town along Eatonville Highway and on the west side of the Elementary School. Many of the open conveyance systems are located on private property and inaccessible for field measurement. Assumptions of geometry, slope, and material were made to estimate channel and floodplain cross-sections for entry into the hydraulic model. Two Manning's roughness coefficients (n values) for open channels were used:

- Natural stream, clean, n=0.030
- Natural stream, weedy, n=0.045

These coefficients were chosen as they matched most closely with observed conditions. They are standards used in the CivilStorm program and in the industry.

4.3.2.3 Stormwater Ponds

Stormwater ponds were modeled to account for potential storage at two locations. Survey information was unavailable, so dimensions were based on aerial photography and field observations.

The pond located near the intersection of Jensen Lane and Center Street West was included in the model. Catchments 2 and 3 are tributary to this pond. The pond was modeled with an assumed weir outlet to a channel which then drains to CB-1315 at the west end of the Center Street West system. The pond was assumed to be 3-feet in depth.

The channel located south of Eatonville Highway was modeled as a shallow pond to account for a portion of the flood plain available for storage. Catchments 26 and 27 are tributary to this pond. The pond was modeled with a culvert outlet. The pond was entered with an assumed 2-feet of depth. The lower half of the pond was entered with a smaller footprint while the upper half was entered with a larger footprint to simulate a channel with floodplain.

4.3.2.4 Outfalls

North Outfall – Lynch Creek

The northerly portion of the Town's storm system outfalls to a channel located just north of Lynch Creek Road. The channel flows north to where it discharges into Lynch Creek. Survey data was not available for this channel. Based on contour information, it was determined that the slope of the channel would provide capacity to convey flows away from the outfall without impacting the upstream system. The outfall was thus modeled at this location as a free outfall with no tailwater.

South Outfall – Mashel River

The southerly portion of the Town's storm system discharges to a biofiltration swale located south of Alder Street and east of Mashell Avenue. The biofiltration swale then discharges to Old Sewer Lagoon. The Old Sewer Lagoon has an overflow weir that outfalls to the Mashel River.

Design and survey information were unavailable for the biofiltration swale and lagoon. According to Town staff observations, the lagoon has not experienced overtopping or backing up into the biofiltration swale. The outfall was, therefore, modeled as a free outfall at an assumed distance from the last catch basin in the system.

4.3.3 Hydraulic Modeling Results

Several scenarios were modeled to predict stresses on the Town's conveyance system. The scenarios included the existing condition, the 25-year full build-out condition using conventional stormwater practices, and the 25-year full build-out condition using LID stormwater practices. Both the north and south basins were modeled under each of these three scenarios.

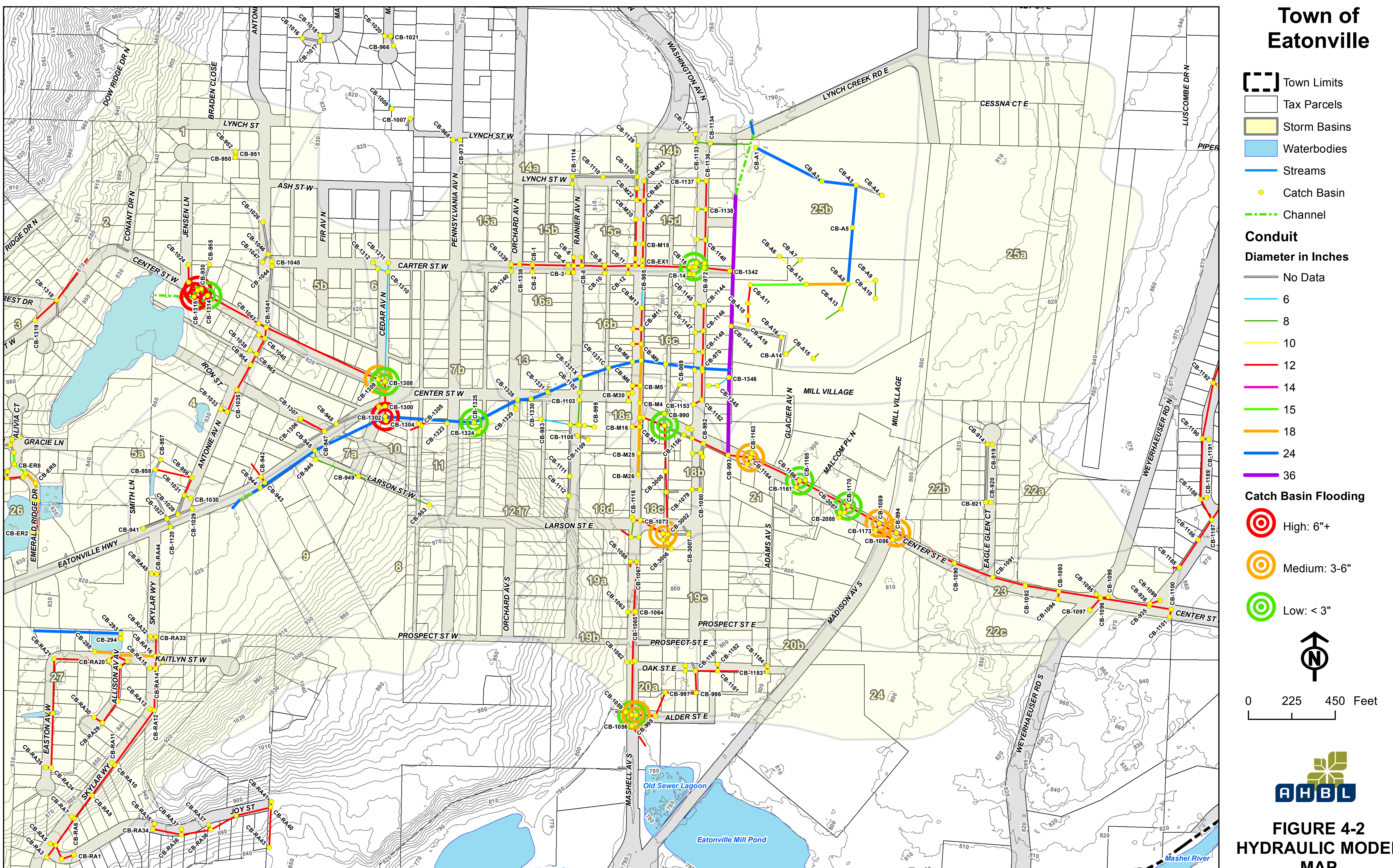


FIGURE 4-2
HYDRAULIC MODEL MAP

Table 4-2 presents the results of the model, showing where catch basins are predicted to over-top (flood). The table shows some over-topping of catch basins occurring in the existing conditions during a 25-year storm event, more over-topping if full build-out occurs with conventional stormwater practices, and reduced over-topping, even at full build-out conditions, if LID practices are implemented. Figure 4-2 represents graphically the locations where over-topping of catch basins is predicted at the future full build-out condition using conventional stormwater practices. The information in Figure 4-2 and Table 4-2 was used to inform the selection of Capital Improvements Projects detailed in Section 6 of this Plan.

A more detailed description of the effects of using LID practices on the conveyance system follows:

4.3.3.1 LID Modeling Results

The future LID scenario yields a reduction in the overall stress of the conveyance system. It does not eliminate it fully. The following summarizes what each trunk experiences in this scenario versus the conventional system (See Appendix E for profiles).

<u>Trunk 1 – Center Street West:</u> Flooding is eliminated at CB-1325 and CB-1314. Flooding is reduced at CBs-1302, 1308, 1309, 931 and 1315. Although CBs 1314, 931 and 1315 are outside of the infiltrative area and upstream sub-basins were modeled without flow reduction factors, these catch basins experience surcharge flows from downstream. Since the downstream system experiences reduced flows and a lower hydraulic grade line, flooding at these catch basins is also eliminated.

<u>Trunk 2 – Carter Street:</u> Flooding is eliminated at catch basins located at the Washington Avenue and Carter Street intersection. This system is relatively flat near the intersection, which creates reduced capacity. The reduced flows upstream and the lowered hydraulic grade line at the Trunk 4 connection significantly reduce the hydraulic grade line at this intersection.

<u>Trunk 4 – Main Collector west of Eatonville Elementary School:</u> At 11.95 hours into the simulated 24-hour storm event, Trunk 4 experiences peak hydraulic grade line at the connections to the main collector line. In the LID scenario, the hydraulic grade line is lower, which helps reduce upstream backwater which lessens the impacts the upstream systems. At 12.15/12.20 hours into the storm, this line experience maximum flooding at the Lynch Creek Road crossing. In the LID scenario, flooding is reduced by 0.8-feet.

<u>Trunk 5 – Center Street East:</u> Flooding is eliminated at CB-994 and CB-1089 and slightly reduced for all flooding experienced between Madison Avenue and Mashell Avenue. This basin has some of the largest potential for infiltration because sub-basins 22a, b and c are large basins with low development and a high percentage of impervious area in the future build-out. Even so, low pipe slopes between Madison Avenue and Mashell Avenue (less than or equal to 0.5% with pipe between CB-1000 and CB-1156 sloping in reverse) greatly restrict the capacity of the system.

<u>Trunk 5a – Mashell Avenue West of Center Street East:</u> This trunk experiences a heavy surcharge from Trunk 5, and thus experiences relatively low reduction in catch basin over-topping by the application of LID within the sub-basins in the area. Reduction in flows in Trunk 5, however, is important for alleviating capacity issues in Trunk 5a.

Trunk 6 – Eatonville Highway: Upstream sub-basins for this trunk are located in non-infiltrative zones. Reduction in flooding at CB-1302 can be attributed to improvements along Trunk 1.

Trunk A – Mashell Avenue South: Flooding at CB-1058 is eliminated due to reduced flows in sub-basin 20, which reduces stresses at the Trunk B connection.

Trunk B – Alder Street South: Flooding at CB -1057 and 1058 is eliminated.

Table 4-2: Catch Basin Flooding

Catch Basin Label	Rim Elevation (Ft)	Existing		Future Conventional		Future LID	
		Maximum Hydraulic Grade (ft)	Maximum Flooding Depth (Ft)	Maximum Hydraulic Grade (Ft)	Maximum Flooding Depth (Ft)	Maximum Hydraulic Grade (Ft)	Maximum Flooding Depth (Ft)
CB-1164	791.49	791.79	0.3	791.92	0.43	791.81	0.32
CB-1166	793.98	794.14	0.16	794.18	0.2	794.06	0.08
CB-1170	796.73	796.86	0.13	796.86	0.13	796.83	0.1
CB-1089	799.21	799.47	0.26	799.6	0.39	799.19	0
CB-994	801.22	801.35	0.13	801.5	0.28	799.99	0
CB-1090	826.41	823.47	0	823.57	0	823.38	0
CB-1091	840.15	836.78	0	836.88	0	836.68	0
CB-1092	850.25	847.01	0	847.04	0	846.98	0
CB-1093	859.11	853.99	0	854.03	0	853.96	0
CB-1096	862.1	855.52	0	855.64	0	855.45	0
CB-935	861.55	856.57	0	856.77	0	856.51	0
CB-1100	858.14	856.57	0	856.77	0	856.51	0
CB-1101	860.03	857.45	0	857.45	0	857.45	0
CB-993	792.12	788.8	0	790.92	0	788.53	0
CB-1346	792.04	788.71	0	790.85	0	788.44	0
CB-1344	792.13	788.16	0	790.35	0	787.93	0
CB-992	793.18	789.37	0	790.93	0	789.25	0
CB-1085	793.1	790.08	0	790.93	0	790.08	0
CB-1156	792.15	791.1	0	791.1	0	791.1	0
CB-1000	792.09	792.23	0.14	792.23	0.14	792.22	0.13
CB-980	796.1	794.53	0	794.44	0	794.38	0
CB-931	814.27	814.02	0	815.31	1.04	814.23	0
CB-1314	815.22	814.02	0	815.31	0.09	814.23	0
CB-1043	818.44	814.02	0	815.31	0	814.23	0
CB-1041	818.38	814.02	0	815.31	0	814.23	0
CB-1309	811.97	812.23	0.26	812.3	0.33	812.17	0.2
CB-1308	812.1	812.22	0.12	812.3	0.2	812.17	0.07
CB-1300	811.54	810.74	0	811.18	0	811.11	0
CB-1302	810.11	810.54	0.43	810.62	0.51	810.59	0.48
CB-1325	807.9	807.83	0	808.02	0.12	807.77	0
CB-1328	807.26	805.94	0	806.23	0	805.88	0
CB-1330	806.52	805.56	0	805.85	0	805.51	0
CB-1331	806.63	804.97	0	805.28	0	804.93	0
CB-1331C	801.84	800.49	0	800.61	0	800.49	0
CB-M8	799.49	798.74	0	798.96	0	798.73	0
CB-M7	799	797.58	0	797.64	0	797.58	0
CB-1001	794.71	793.62	0	793.74	0	793.61	0
CB-970	792.17	789.64	0	790.93	0	789.62	0
CB-1331X	804.85	803.5	0	803.85	0	803.49	0
CB-1340	822.26	820.52	0	820.6	0	820.43	0
CB-1339	822.24	820.52	0	820.6	0	820.43	0
CB-1338	822.15	820.1	0	820.15	0	820.05	0
CB-1336	813.71	812.05	0	812.1	0	811.98	0
CB-1332	805.96	804.41	0	804.51	0	804.3	0

*Shaded cells refer to catch basins that experience over-topping.

Table 4-2: Catch Basin Flooding, cont.

Catch Basin Label	Rim Elevation (Ft)	Existing		Future Conventional		Future LID	
		Maximum Hydraulic Grade (ft)	Maximum Flooding Depth (Ft)	Maximum Hydraulic Grade (Ft)	Maximum Flooding Depth (Ft)	Maximum Hydraulic Grade (Ft)	Maximum Flooding Depth (Ft)
CB-984	804.37	802.81	0	803	0	802.7	0
CB-985	804.41	802.22	0	802.29	0	802.15	0
CB-972	793.55	792.25	0	793.43	0	791.21	0
CB-1342	790.32	788.8	0	788.83	0	788.77	0
CB-1	821.66	817.86	0	817.91	0	817.81	0
CB-4	816.81	812.68	0	812.73	0	812.63	0
CB-8	813.15	810.71	0	810.75	0	810.66	0
CB-11	805.48	803.32	0	803.4	0	803.23	0
CB-15	794.49	792.98	0	794.48	0	792.3	0
CB-16	794.03	792.74	0	794.11	0.08	791.81	0
CB-1143	793.57	792.55	0	793.44	0	791.22	0
CB-1142	793.56	792.26	0	793.44	0	791.22	0
CB-1140	794.08	792.26	0	793.44	0	791.22	0
CB-1138	794.55	792.26	0	793.44	0	791.8	0
CB-1136	794.55	792.39	0	793.44	0	792.39	0
CB-1137	795.19	792.77	0	793.44	0	792.77	0
CB-1315	812.86	814.02	1.16	815.31	2.45	814.23	1.37
CB-1145	792.8	790.73	0	790.93	0	790.73	0
CB-1144	792.8	790.43	0	790.93	0	790.43	0
CB-1146	792.12	789.87	0	790.93	0	789.87	0
CB-1148	791.91	789.68	0	790.93	0	789.66	0
CB-1152	792.44	790.02	0	790.93	0	790.02	0
CB-1153	792.39	790.06	0	790.93	0	790.06	0
CB-M24	806.04	804.24	0	804.26	0	804.18	0
CB-M22	805.73	803.86	0	803.87	0	803.81	0
CB-M23	805.98	803.82	0	803.85	0	803.73	0
CB-M21	805.53	803.82	0	803.85	0	803.73	0
CB-M19	805.03	803.6	0	803.63	0	803.52	0
CB-M20	805.25	802.93	0	803	0	802.93	0
CB-M17	804.75	802.93	0	803	0	802.93	0
CB-M18	805.16	803.31	0	803.34	0	803.24	0
CB-EX2	805.04	802.81	0	803	0	802.72	0
CB-EX1	804.94	802.79	0	802.8	0	802.75	0
CB-944	819.54	814.59	0	814.61	0	814.61	0
CB-945	822.39	810.8	0	810.86	0	810.86	0
CB-M13	800.79	797.86	0	797.94	0	797.85	0
CB-M11	799.64	797.86	0	797.94	0	797.85	0
CB-M9	799.21	797.86	0	797.94	0	797.85	0
CB-M3	797.74	794.58	0	794.53	0	794.51	0
CB-M1	796.71	794.58	0	794.53	0	794.51	0
CB-M25	796.06	794.58	0	794.53	0	794.51	0
CB-M26	795.18	794.58	0	794.53	0	794.51	0
CB-1118	794.54	793.43	0	793.66	0	793.43	0
CB-1071	795.13	793.43	0	793.66	0	793.43	0

*Shaded cells refer to catch basins that experience over-topping.

Table 4-2: Catch Basin Flooding, cont.

Catch Basin Label	Rim Elevation (Ft)	Existing		Future Conventional		Future LID	
		Maximum Hydraulic Grade (ft)	Maximum Flooding Depth (Ft)	Maximum Hydraulic Grade (Ft)	Maximum Flooding Depth (Ft)	Maximum Hydraulic Grade (Ft)	Maximum Flooding Depth (Ft)
CB-1073	794.1	793.42	0	793.65	0	793.42	0
CB-3003	793.22	793.41	0.19	793.47	0.25	793.41	0.19
CB-3002	793.52	793.41	0	793.47	0	793.41	0
CB-1067	795.87	792.54	0	792.54	0	792.54	0
CB-1065	796.94	791.67	0	791.73	0	791.73	0
CB-1060	794.78	790.47	0	790.62	0	790.59	0
CB-1058	784.55	781.59	0	784.57	0.02	783.79	0
CB-1056	782.58	780.21	0	782.29	0	781.74	0
CB-1088	795.63	793.55	0	793.55	0	793.55	0
CB-1184	794.57	789.74	0	789.74	0	789.74	0
CB-1183	794.62	789.35	0	789.35	0	789.35	0
CB-1181	789.4	785.44	0	785.44	0	785.44	0
CB-1180	787.83	784.94	0	784.59	0	784.57	0
CB-996	788.61	784.1	0	784.59	0	783.8	0
CB-997	785.53	783	0	784.59	0	783.8	0
CB-998	788.68	782.53	0	784.58	0	783.8	0
CB-1057	784.25	781.6	0	784.58	0.33	783.8	0

*Shaded cells refer to catch basins that experience over-topping.

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Section 5
REGULATIONS

5.1 Introduction

This section includes a review of the existing Town, state, and federal policies, regulations and ordinances relevant to stormwater management. To move toward more widespread use of LID practices to manage stormwater, the Town may wish to consider the preparation of new and/or amended regulatory language to its existing codes and standards to remove barriers.

The Puget Sound Partnership prepared guidance on the integration of LID into local municipal codes. The guidance, titled "Integrating LID Into Local Codes: A Guidebook for Local Governments," is a step-by-step document to assist both NPDES permittees and non-permitees with the process of integrating LID into local development standards.

The Town prepared a suite of amendments to its codes and standards to better facilitate the use of LID practices (see Appendix I). Although the adoption of new and/or amended regulatory language is necessary to implement the Plan, the removal of LID barriers will make integrating the practices much easier for applicants and Town staff alike.

5.2 Relevant Town Policies, Ordinances, and Regulations

This section provides an overview of Eatonville's policies, ordinances, and regulations relevant to stormwater management. The Town's regulations are set forth in the Eatonville Municipal Code (EMC), which includes several chapters related to environmental requirements. The Town's Comprehensive Plan and Comprehensive Storm Drainage Report are also summarized.

5.2.1 Eatonville Municipal Code (EMC)

5.2.1.1 Chapter 13.24 - Storm Drain Utility

This chapter establishes the drainage utility and the corresponding rules and regulations for the Town including definitions, rates, system development charges, billing and collection, charges for new construction, collection and penalties with respect to bill payment, and rate adjustments. It also adopts the Town of Eatonville Storm Drainage Report.

5.2.1.2 Chapter 15.04 - Environmental Policy

This chapter adopts the policies of the State Environmental Policy Act (SEPA) as expressed in the Revised Code of Washington (RCW) 43.21C.010 and 43.21C.020.

5.2.1.3 Chapter 15.08 - Shoreline Management Plan (SMP)

This chapter satisfies the requirements of the Shoreline Management Act of 1971. The document designated as the "Shoreline Management Use Regulations" for Pierce County (Title 20), adopted by the Town in 1975 and revised April 1981, is adopted as the Shoreline Management Master Plan (SMP) of the Town. The SMP sets forth environmental designations intended to provide a uniform basis for applying policies to varying shoreline uses.

The SMP will need to be updated in the future to comply with new state guidelines once they are completed. On November 29, 2000, Ecology adopted new shoreline master program guidelines (Chapter 173 26 WAC), however the Shorelines Hearings Board invalidated those guidelines in August 2001. Parties to the litigation that resulted in the Hearings Board decision achieved a settlement in December 2002 to address the specific issues in the ruling by the Hearings Board, but the new rule to implement this settlement has not yet been issued by Ecology. The new rule will provide details on how local governments can achieve the level of protection required by the Shoreline Management Act. The guidelines will limit the amount and types of development allowed adjacent to streams, lakes, and marine waters in Washington State. The shoreline guidelines will apply only to new development and redevelopment.

It is the general purpose of the program to encourage uses appropriate to the desired character of that environment and at the same time to place standards and restrictions on development and use activities so that they do not disrupt or destroy the character of that environment. The SMP defines what types of land uses are permitted in the various shoreline areas and defines setbacks for development.

The SMP is considered an element of the Town of Eatonville's Comprehensive Plan and the SMP Use Activity Regulations (as adopted from the Pierce County Shoreline Management Use Regulations, Chapter 20.20) supplement the Town of Eatonville Municipal Code.

5.2.1.4 Chapter 15.16 - Wetlands Protection

This chapter was developed to protect wetlands from degradation by requiring site planning to avoid or minimize damage to wetlands wherever possible. Most activities not dependent upon a wetland location will be located at upland sites, and will achieve no net loss of regulated wetlands by requiring restoration or enhancement of degraded wetland or creation of new wetland to offset losses that are unavoidable.

5.2.1.5 Chapter 15.20 - Sensitive Areas

This chapter was developed to comply with the requirements of the Growth Management Act, which was passed by the Washington State Legislature in 1990. The Growth Management Act is discussed in greater detail later in this section; however, a brief summary as it relates to the EMC is given here.

The Growth Management Act requires the fastest growing counties (including Pierce County and the municipalities within Pierce County) to comply with the Act. The Act requires these municipalities to develop local comprehensive land use plans and development regulations. It also requires that municipalities classify, designate, and develop regulations to protect certain critical areas prior to the completion of comprehensive land use plans. These critical areas include:

- Fish and Wildlife Habitat Conservation Areas
- Wetlands
- Aquifer recharge areas
- Geologically hazardous areas
- Flood hazard areas

The intent of the critical area designation is to require municipalities to provide regulatory protection of these critical areas prior to the development and adoption of comprehensive land use plans that meet the standards of the Act. In this way, the conservation of critical areas can be accomplished while more detailed studies and discussions occur during the development of comprehensive plans that will ultimately determine a long-term approach to critical area protection.

EMC Chapter 15.20 includes critical environmental area protection goals; definition of regulated activities; permit process and application requirements; rating system for streams and wetlands; required buffer areas for streams and wetlands; road and utility development requirements in critical areas; stormwater drainage and erosion control requirements; and allowed development activities in streams, wetlands and buffers.

5.2.1.6 Chapter 15.24 - Flood Damage Prevention

This chapter satisfies the requirements for the Town's participation in the Federal Flood Insurance Program. This chapter adopts by reference a 1986 Federal Insurance Administration (FIA) report entitled "Flood Insurance Study, Town of Eatonville, Washington, Pierce County" and associated Flood Insurance Rate

Maps (FIRM), which establish the areas of special flood hazard. Special flood hazard areas are subject to a one percent or greater chance of flooding in any given year as shown in the above-mentioned maps. . This chapter establishes a development permit application, review procedures, and new development standards for proposed development in special flood hazard areas.

5.2.1.7 Chapter 16.54 - Stormwater Management and Erosion Control

This chapter was developed to control the adverse effects of erosion and sedimentation related to buildings and construction (EMC Title 16). Chapter 16.54 adopts the 1997 Pierce County Stormwater Management and Site Development Manual.

5.2.2 Eatonville Comprehensive Plan

The Comprehensive Plan and EIS was developed to meet the requirements of the Growth Management Act (GMA). The Comprehensive Plan contains several elements, including environmental protection, housing economic development, community facilities and services, land use, transportation and utilities.

5.2.3 Eatonville Flood Insurance Study (FEMA, 1986)

This study investigates the existence and severity of flood hazards in the Town and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study identified a 100-year floodplain and floodway, as mandated by the National Flood Insurance Program (NFIP). This study is adopted in the Town of Eatonville's Municipal Code Chapter 15.24 described earlier in this section.

5.3 Relevant State Regulations and Programs

5.3.1 Puget Sound Partnership's Action Agenda

The Puget Sound Action Agenda is a road map that lays out the work needed to achieve an ambitious goal: restoring the health of Puget Sound by 2020. The 2012/2013 Action Agenda identifies key ongoing programs, local priorities for different areas of the Sound and more than 200 specific actions that must be implemented over the next two years to stay on track toward our recovery targets.

Three region-wide priorities are emphasized in the 2012/13 Action Agenda:

1. Prevent pollution from urban stormwater runoff. Polluted runoff from roads, roofs, parking lots, and other paved areas is the biggest threat to Puget Sound's water quality. Although we have many tools and technologies for reducing stormwater pollution, we need to make much fuller use of them if we are to stop contamination from flowing into the Sound.
2. Protect and restore habitat. Restoring damaged shorelines and protecting salmon habitat along the many rivers and streams that flow into Puget Sound is necessary to save salmon and honor tribal treaty rights. We must stop destroying habitat, protect what we have left, and substantially restore the critical habitats that we have lost.
3. Restore and re-open shellfish beds. Shellfish harvesting is a major Puget Sound industry, and a tribal treaty right. Both are threatened by pollution that has closed more than 7,000 acres of Puget Sound beaches. Shellfish health begins on land, through reduction of pollution from rural and agricultural lands and maintenance and repair of failing septic tanks.

5.3.2 Washington State Department of Fish and Wildlife (WSDFW) / Hydraulic Project Approval (HPA)

The Washington State Department of Fish and Wildlife (WSDFW) requires a Hydraulic Project Approval (HPA) for construction activities that use, divert, obstruct, or change the natural flow or bed of any waters of the state (RCW 75.20. l 00). The purpose of the requirements, which are administered through the HPA permit process, is to protect fish habitat in stream channels and prevent erosion, and to protect freshwater and near-shore marine aquatic life. Any construction activity such as channel widening or culvert improvements within the ordinary high water of any stream would fall under the HPA permit requirements. In some instances, WSDFW is also extending their permitting authority to include developments creating new impervious surfaces in excess of 5,000 square feet even if the project does not include work within the ordinary high water mark. The rationale for extending their permit authority is that such a project will affect the hydrologic regime of downstream stream habitats.

5.3.3 Growth Management Act (GMA)

Enacted on July 1, 1990, the Growth Management Act (GMA), is intended to manage growth in Washington's fastest growing counties through the adoption of local comprehensive land use plans and development regulations. Eatonville has a Comprehensive Plan that was adopted under the GMA. Like other towns, cities, and counties required to plan under GMA, the Town will be required to perform a major 10-year update prior to December 31, 2016.

5.3.4 State Floodplain Regulations

Chapter 86.16 RCW establishes statewide authority through regulations promulgated by Ecology for coordinating the floodplain management regulation elements of the National Flood Insurance Program (NFIP). Under Chapter 173-158 WAC, Ecology requires local governments to adopt and administer regulatory programs compliant with the minimum standards of the NFIP. Ecology provides technical assistance to local governments for both identifying the location of the 100-year (base) floodplain and in administering its floodplain management ordinances.

Ecology also establishes land management criteria in the base floodplain area by adopting the federal standards and definitions contained in 44 CFR, Parts 59 and 60, as minimum state standards. In addition to adopting the federal standards, the state regulations provide for additional regulation of residential development in the floodplain.

A Flood Insurance Study and associated Flood Insurance Rate Maps for the Town of Eatonville were published in July 1986 and adopted by the Town.

5.4 Relevant Federal Regulations & Programs

5.4.1 National Pollutant Discharge Elimination System

The Town of Eatonville will not be required to obtain an NPDES Phase II permit because it does not meet the threshold requirements for an urbanized area.

5.4.2 Endangered Species Act (ESA)

5.4.2.1 Overview

Puget Sound Steelhead and Chinook salmon were listed as threatened by the National Marine Fisheries Service (NMFS) in 2007 and 2005, respectively. When evaluating the Town's stormwater program, it is important to be aware of how the Endangered Species Act (ESA) if 1973 (as it relates to fish species) can impact the Town's activities. Puget Sound and its tributary streams in the vicinity of the Town of Eatonville provide habitat, or may provide habitat, for aquatic species listed as threatened or endangered under the ESA of 1973. The ESA prohibits killing or harming an endangered species in any way, including significant modification of critical habitat for that species. The ESA requires federal agencies to develop programs to conserve endangered and threatened species and assist in species recovery. Under the ESA, a species likely to become extinct in the foreseeable future is categorized as "endangered" while one likely to become endangered unless action is taken is categorized as ''threatened."

The ESA is jointly administered by the Secretaries of the Department of Commerce (DOC) and the Department of the Interior (DOI) (16 U.S.C. § 1532 [15]). The National Marine Fisheries Service (NMFS), an agency under the DOC, is responsible for marine species including anadromous fish, some sea turtles, and marine mammals.

The U.S. Fish and Wildlife Service (USFWS), an agency under the DOI, is responsible for terrestrial species and resident aquatic species.

Although the ESA is a federal statute, its implementation can affect local jurisdictions and their citizens in several ways. A listing can potentially affect a wide variety of activities including, but not limited to, stormwater management practices, infrastructure improvements, land use planning, maintenance of existing facilities, and private development proposals.

The body of federal legislation that is commonly termed the "Endangered Species Act" is comprised of 11 sections, six of which are commonly referenced in relation to regulatory actions. These include:

- Section 4: Determination of Endangered and Threatened Species;
- Section 6: Cooperation With States;
- Section 7: Interagency Cooperation;
- Section 9: Prohibited Acts;
- Section 10: Exceptions; and
- Section 11: Penalties and Enforcement.

5.4.2.2 Section 4: The 4(d) Rulemaking Process

In June 2000, the NMFS adopted a rule prohibiting the ''take" (which includes harass, harm, pursue, hunt, shoot, wound, kill, trap, or collect; or to attempt any of these things) of 14 groups of salmon and steelhead listed as threatened under the ESA. NMFS adopted the take rule under section 4(d) of the ESA. This rule prohibits anyone from taking a listed salmon or steelhead, except in cases where the take is associated with an approved program. The 4(d) rule approves some specific existing state and local programs, and creates a means for NMFS to approve additional programs if they meet certain standards set out in the rule. The 4(d) rule for salmon took effect 180 days after it was published in the Federal Register (January 2001). The 4(d) rule for steelhead took effect 60 days after it was published in the Federal Register (September 2000).

In addition to the 4(d) rule, the ESA provides a variety of tools for saving species threatened with extinction. Under section 7 of the ESA, no Federal agency may fund, permit or carry out any activity that will jeopardize their continued existence. That is why projects that require a federal permit or have federal funding must go through a “consultation” with NMFS (for salmon and steelhead) or the USFWS (for Bull Trout). This “consultation” is to make sure that the project will adequately limit any impacts and qualify for an “incidental” take of listed species. Another tool is under Section 10 of the ESA that allows NMFS to issue incidental take permits for specific activities like research that usually do not apply to a municipality.

Back under Section 4(d), the ESA requires that activities of state and local governments, tribes, and private citizens be controlled so they do not lead to extinction of listed species. To comply with this, NMFS has established protective rules for threatened species. The rules need not prohibit all “take” though. The 4(d) rule can “limit” the situations to which the take prohibitions apply. But NMFS offers 4(d) “limits” only for those programs or activities that will not impair properly functioning habitat of listed species. In accordance with this provision, NMFS has established 13 general categories of programs that can qualify for 4(d) limits on the take prohibitions. NMFS will evaluate programs under these 13 categories that wish to be granted a 4(d) limit on take prohibitions. Limit No. 10 - Road Maintenance is a category where a municipal program could be evaluated by NMFS for a 4(d) limit on take prohibitions. Limit No. 12 - Municipal, Residential, Commercial, and Industrial Development and Redevelopment (MRCI) is another category where a municipal program could be evaluated by NMFS for a 4(d) limit on take prohibitions. The Tri County effort described below has obtained NMFS approval of Road Maintenance and is working to obtain NMFS approval of MRCI programs so that any jurisdiction that adopts these programs would then be eligible for the 4(d) limit on take prohibition.

The ESA does not directly require jurisdictions to change their practices to conform to the take limits described in the final rule. The take limits provide a way for jurisdictions to make sure an activity or program does not violate the take prohibitions. Without this assurance, jurisdictions would risk ESA penalties when an activity in question is determined to result in a take of a listed fish.

The 4(d) rule also provides a list of activities that have a high risk of resulting in a “take” of the listed threatened or endangered salmonids. The following list includes items that could be included in design standards that would prohibit activities that the 4(d) rule has determined are likely to result in injury or harm to listed salmonids. Town design standards should prohibit:

- Construction of structures like culverts, berms, or dams that eliminate or impede a listed species’ ability to migrate or gain access to habitat.
- Removal, addition, or alteration of rocks, soil, gravel, vegetation or other physical structures that is essential to the integrity and function of a listed species’ habitat.
- Removal of water or otherwise altering streamflow in a manner that significantly impairs spawning, migration, feeding, or other essential behavioral patterns.
- Construction of dams or water diversion structures with inadequate fish screens or passage facilities.
- Construction of inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent to or above a listed species’ habitat.

- Operations that substantially disturb soil and increase the amount of sediment going into streams.

The following list includes items that should be included in the Town's regulations so that these activities that the 4(d) rule has determined are likely to result in injury or harm to listed salmonids would be illegal.

- Discharge of pollutants, such as oil, toxic chemicals, radioactivity, carcinogens, mutagens, teratogens, or organic nutrient-laden water (including sewage water) into a listed species' habitat is prohibited.
- The release of non-indigenous or artificially propagated species into a listed species' habitat or into areas where they may gain access to that habitat is prohibited.

The 4(d) rule has determined that the following list of maintenance related items are likely to result in injury or harm to listed salmon. The Town's maintenance program should not:

- Maintain structures like culverts, berms, or dams if maintenance eliminates or impedes a listed species' ability to migrate or gain access to habitat.
- Remove, poison, or contaminate plants, fish, wildlife, or other biota that the listed species requires for feeding, sheltering, or other essential behavioral patterns.
- Remove, add, or alter rocks, soil, gravel, vegetation or other physical structures that are essential to the integrity and function of a listed species' habitat.
- Remove water or otherwise alter streamflow in a manner that significantly impairs spawning, migration, feeding, or other essential behavioral patterns.
- Operate dams or water diversion structures with inadequate fish screens or passage facilities.
- Maintain or operate inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent to or above a listed species' habitat.

The Nisqually River, of which the Mashel River and Lynch Creek are tributaries, contains Essential Fish Habitat (EFH) for Chinook, Coho, and Pink Salmon under the Magnuson-Stevens Fishery Conservation and Management Act. EFH means those waters and substrate are necessary to fish for spawning, breeding, feeding, or growth to maturity and includes the aquatic areas and their associated physical, chemical, and biological properties that are used by fish.

The Streamnet Database, at http://www.streamnet.org, confirms that Chinook and, Coho Salmon are known to spawn and rear in the Nisqually River tributaries in the vicinity of the Town of Eatonville. Pink Salmon use these tributaries for migration.

5.4.2.3 Section 6: Cooperation with States

Although Section 6 is entitled "Cooperation with States," the law only requires agencies to "cooperate to the maximum extent practicable" with the states. Such cooperation includes "consultation with the states concerned before acquiring any land or water, or interests therein, for the purpose of conserving any endangered species or threatened species" (16 U.S.C. § 1535[a]). The ESA does not require the federal government to delegate any authority to state or local governments concerning the conservation or recovery of listed species, although provisions for this are made in Section 10 of the ESA (see below).

5.4.2.4 Section 7: Federal Responsibilities

Section 7 requires the federal government and its agencies to conserve listed species and to ensure that any projects or actions it authorizes, funds, or implements are not likely to jeopardize listed species or destroy or adversely modify their critical habitat. Under Section 7, the federal agency with permit or funding authority must review a project to determine if the project "may affect" a listed species (50 C.F.R. § 402.07). If a project is determined to affect a listed species, the federal agency must consult with the USFWS or NMFS (or both), depending on the species (50 C.F.R. § 402.14). An informal or "conference" process is required if' a project may affect a proposed species (50 C.F.R. § 402.13). Section 7 requires the preparation of a Biological Assessment (BA) (also termed Biological Evaluation [BE]) for projects with a federal link or "nexus" to determine what, if any, effects the project or action may have on a listed species (50 C.F.R. § 402.12). A BA/BE may also be required for species that are proposed for listing, but not yet formally listed. At this time, Coho is a candidate species in the Puget Sound region.

The purpose of a BA/BE is to review the biological requirements of a listed species to determine potential effects of the project or action on those species (50 C.F.R. § 402.12). After the consultation process is complete, the USFWS or the NMFS will issue a Biological Opinion (BO) (50 C.F.R. § 402.15). The BO will determine if the project or action would result in "jeopardy" or the destruction or modification of critical habitat (50 C.F.R. § 402.14[h][3]). If a project or action is determined to affect a species that has been proposed for listing, the federal lead agency must complete an informal consultation with either the USFWS or NMFS, but the results of the subsequent conference is non-binding.

Section 7 consultation is only required for projects that may lead to construction. If a local construction project has a federal nexus, either through federal funding or a requirement for a federal permit, review of that action will be necessary under Section 7. Common federal permits or actions requiring review under Section 7 include the following:

- National Environmental Policy Act (NEPA) reviews for proposed construction projects;
- Corps of Engineers Clean Water Act Section 10 and Section 404 permits; and
- Funding for construction projects derived from a federal source.

Funding does not have to be in the form of a direct grant from a federal agency. Many types of grant programs are administered by state or local agencies, but these programs often include full or partial federal funding. Such programs include urban development block grants, clean water programs, and most forms of transportation funding.

5.4.2.5 Section 9: Prohibition of "Take"

Under Section 9 of the ESA, individuals and groups within U.S. jurisdiction are specifically prohibited from "taking" or otherwise harming a listed species (16 U.S.C. § 1538 [a][l][b]). "Take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct," any fish, wildlife, or plant that has been listed as Threatened or Endangered (16 U.S.C. § 1532 [19]). Subsequent interpretation and clarification by federal courts and agencies have expanded "harm" to include indirect actions which may result in the death or injury of protected species including significant habitat modification which may impair "essential behavior patterns, including breeding, feeding, or sheltering" (50 C.F.R. § 17.3).

Whereas the Section 7 process, as stated in the law (16 U.S.C. § 1536) and implementing regulation (50 C.F.R. § 402), includes specific instructions and requirements for review by federal agencies, Section 9 simply states “with respect to any endangered species of fish or wildlife listed pursuant to [Section 4 of the ESA] it is unlawful for any person subject to the jurisdiction of the United States to take any such species within the United States or the territorial sea of the United States” (16 U.S.C. § 1538[a][l][b]). While Section 9 arguably includes a much broader range of prohibited actions by simply prohibiting take, unlike Section 7, the language of Section 9 does not include a parallel process by which take is evaluated and adjudicated. To deal in part with the ambiguity, the 4(d) rulemaking process often includes criteria that NMFS or USFWS will use in determining what constitutes “take.”

5.4.2.6 Section 10: State and Local Involvement

Although the ESA does not require the federal government to impart any authority to state, or local governments or private parties concerning the conservation or recovery of listed species, the recent policy of federal agencies has been to provide state and local governments and large private landowners the opportunity to develop and implemented their own protection and conservation measures. These are accomplished through voluntary, although legally binding, agreements provided for under Section 10 of the ESA (16 U.S.C. § 1530). The types of agreements allowed under Section 10 include Candidate Conservation Agreements, Safe Harbor Agreements, and Habitat Conservation Plans (HCPs). These plans can provide specific legal protection for actions not included as exemptions under 4(d) rules, but these agreements require a significant amount of coordination and legal efforts to implement.

5.4.2.7 Section 11: Third Party Lawsuits

Section 11 of the ESA specifically enables “citizen suits” for the purpose of: 1) enjoining a person or agency alleged in volition of any provision in the ESA; 2) compelling federal agencies to list a specific species; and 3) compelling the government to enforce protective measures upon the listing of a species (16 U.S.C. § 1540 [g][l]). In addition, Section 11 provides specific penalties for violations of the ESA including civil fines and criminal judgments (16 U.S.C. § 1540 [a] and 16 U.S.C. § 1540 [b], respectively).

5.4.2.8 ESA as it Relates to Eatonville

ESA regulated species occurring or having the potential to occur in the vicinity of the Town of Eatonville, as indicated in Section 4, would be identified by either the National Oceanic and Atmospheric Administration (NOAA) Fisheries or the U.S. Fish and Wildlife Services (USFWS).

Section 6
DRAINAGE PROBLEM IDENTIFICATION & PROBLEM SOLUTIONS

6.1 Introduction

This section identifies documented drainage problems and identifies potential project solutions intended to ameliorate the issue(s). Objectives of the Plan include increasing the amount of surface water entering the soils in an effort to increase summer base flows in local waterways and to improve water quality in those waterways. Infiltration opportunities exist throughout the Town in the form of both small and larger capital improvement projects (CIPs). Smaller projects, such as individual LID practices (e.g., dry well or rain garden), can be located within public rights of way, while larger drainage retrofit designs, such as regional stormwater detention/infiltration facilities, may be integrated into the design of larger road and infrastructure projects as they are constructed throughout the Town. Green Street projects are effective ways to integrate multiple LID drainage design retrofit projects into the retrofit and redesign of major road segments.

6.2 Capital Improvement Development Process

Using the following four-step analysis, candidate CIPs were identified to help meet the plan objectives:

1. Drainage problems throughout the Town were documented by modeling the capacity of the Town's existing drainage system.
2. Low Impact Development and conventional retrofit designs were evaluated.
3. Selected designs were developed to create an updated, and prioritized list of LID-based CIP projects and associated costs.
4. The list of CIP projects proposed in the 2003 Program were reviewed and confirmed, along with the identification of a number of new CIP projects.

6.2.1 Step 1: Problem Identification and Sources of Information

The 2003 Program identified 15 individual drainage problems (DPs) and included a number of CIP projects to mitigate the drainage problems. Table 6-1 A summarizes the documented drainage problems. The DPs were re-evaluated to determine the suitability of LID solutions in place of the conventional engineering solutions included in the 2003 Program. The hydraulic modeling analysis performed under this Plan confirmed most of the 2003 drainage problems (Note: DPs 01, 06, 08, and 13 from the 2003 Program were not included in the 2013 hydraulic modeling analysis).

While confirming most of the 2003 drainage problems, the 2013 model also identified five new, additional areas subject to frequent flooding. These new drainage problems are identified with the prefix '2013', and are shown in Table 6-1 B. All drainage problems were assessed for potential mitigation through the use of localized infiltration practices such as bioretention and other LID techniques.

Table 6-1 A shows relevant characteristics of the 15 DPs; Table 6-1 B shows characteristics of the problem areas newly identified in the 2013 modeling. The column titled "Potential LID BMPs" evaluates the use of LID techniques, while the column titled "Conventional Solution where LID is Impractical" shows where conventional solutions are recommended to solve flooding problems identified in the hydraulic model. See Attachment 6.A for additional detail on the content of Tables 6-1 A and B.

6.2.2 Step 2: Evaluation of Problems and Identification of CIP Projects

In order to develop LID based designs and correlate them with identified drainage problem areas, the drainage problems and their proposed LID design solutions were correlated with local soils to determine porosity and optimize the amount of infiltration. Using previously developed soil porosity information, areas with high stormwater infiltration potential and adequate soil treatment depth to provide water quality treatment were identified based on soil type mapping developed by Golder Associates (See Appendix C).

The identified drainage problem areas were also evaluated based on physical features such as available right-of-way, favorable topography, size of drainage basin, etc., as shown in Table 6-1 A. Low Impact Development BMPs were identified where conditions were feasible to infiltrate stormwater either at the flooding site or in the upstream basin to reduce flows to the flood site. The 2003 Program included 15 drainage problems which were proposed to be addressed by 14 capital projects. The 2013 analysis indicates that at least nine of those problems can be resolved with LID BMPs, and that the remaining problems will still need to be resolved using conventional engineering solutions. Two of the proposed CIP projects have the potential to benefit from a combination of design options, such as increasing ditch capacity by widening as well as the addition of bioinfiltration capabilities through the soil/grass lined ditch bottom. Drainage problems 1, 6, and 13 are not conducive to LID solutions due to their location in poor soils. Feasible LID solutions were found for all five of the new flood problems identified in 2013 (See Table 6-1 B). All 14 LID projects are represented graphically on Figure 6-1.

In addition to using LID to address drainage/flooding problems, the entire Town was evaluated for other infiltration opportunities. This analysis located a number of additional opportunities for maximizing stormwater infiltration which are not associated with flooding, but based on the presence of favorable soils, infrastructure characteristics, and adequate quantities of surface water runoff flow. To take advantage of these favorable soils throughout the study area, 13 additional LID-based improvement projects have been identified and are listed in Table 6-2.

6.2.3 Step 3: Rating and Ranking Process of CIP Projects

The third step in the LID CIP development process was to rate and rank each project and identify preliminary design and construction costs. In order to conduct the rating and ranking, CIP design criteria were created consisting of five categories. The potential scores for each of the 15 criteria ranged from 0 to 5. Higher points were awarded to those projects that would be the most likely to achieve the Town's objectives. The scoring of some categories was additionally weighted to prioritize relevant importance of criteria, such as flood mitigation and high infiltration potential. The highest potential total score is 160, as shown in Table 6.2.3.

The attributes of all 14 candidate CIP projects were scored according to the rating criteria, and the results are shown in Table 6.2.4 in ranked order. Project scores range from 84 to 136 points. The top six highest ranked projects are described in Section 6.2.4. More detailed project descriptions and cost estimates are presented in Attachment F.

6.2.4 Step 4: Top 6 Capital Improvement Project Descriptions and Cost Estimates

Listed below is a brief description of the six highest ranked CIP projects that were developed using the rating and ranking process described above.

- *CIP #1 - Bioretention Trench East of Madison Avenue South (Project ID "B")*
  This project will mitigate flooding during the 25-year storm event at CB 994. This project will also provide water quality treatment of half of Madison Avenue South through converting 400 linear feet of roadside ditch into a bioretention swale.

- *CIP #2 - Infiltration Pond at Sewage Lagoon (Project ID "I")*
  This project will mitigate flooding during the 25-year storm event at CB 1056. This project will provide water quality pretreatment through 200 linear feet of a bioretention swale before discharging into an infiltration pond constructed by modifying the existing sewage lagoon.

- *CIP #3 - Green Street and Bioretention Trench on Center Street #1 (Project ID "E")*
  This project will mitigate flooding during the 25-year storm event at CB 1309. This project will reconstruct approximately 650 feet of Center Street to relocate the conveyance system out of private property and into the right-of-way and provide water quality treatment for half of Center Street between Antonie Avenue North and Cedar Avenue North by adding 400 linear feet of roadside bioretention.

Table 6-1 A: Drainage Problem Summary

2003 DP Number	Problem Location per 2003 report	Flood problem per 2013 model	Conveyance Problem per 2013 Model	Soil Type/ Depth to GW or Imp. Layer (inches) (1)	Relative Infiltration Potential	Existing Conveyance	Undersized ditch?	Catch Basin Number	Flood Depth at CB	Up basin opportunities for dispersed LID	Proximity to Public Site	Road Classification	Potential LID BMPs	Conventional Solution Where LID is Impractical	Comments	2013 CIP project to mitigate DP
1	Intersection of Hill Top Area and Eatonville Highway West (Larson Street West)			K, 18-30	Insignificant based on upstream area, soils	No	Y			Insignificant upstream basin area	Right-of-way	Arterial/Local intersection	Bioinfiltration swale	CB and pipe	Intersection; no formal drainage system in this area	Drainage problem not evident in 2013 modeling
2	Intersection of Hill Top Area and Eatonville Highway West			near B >80 at Park	Moderate if conveyed to Larson Street West		Y	CB 945		Insignificant: poor soils	Flows to Center Street parcels	Arterial	Bioinfiltration swale	Increase ditch capacity/ provide better connection to CB 945	Intersection; B soil approximately 1 block north of Larson Street West	C, F
3	Center Street West between Eatonville Highway West and Washington Avenue South	Y	Y	In and near B, >80	Significant: upstream subbasin size large and good soils along Center Street West			CB 1325	0-3”	Existing Orchard Avenue and Library rain gardens may mitigate flooding; significant potential remains given soils and relatively flat area	Passes public parcels on Center Street	Arterial	Infiltration trench; wet well; bioinfiltration swale			C, D, E, G, H, J, L, M
4	Antonie Avenue North from Williams Addition and Center Street West			B, >80	Moderate: soils, relatively flat					Moderate: good soils; relatively flat area	Right-of-way	Local	Infiltration trench; wet well; bioinfiltration swale		Contributes to DP10	L
5	Center Street West to Dow Addition	Y	Y	K, 18-30	Insignificant, soils		Y			Insignificant: poor soils	Determine if opportunities at lake	Local		Upsize pipe to downstream infiltration at DP10	Contributes to DP10	D
6	Intersection Antonie Avenue South and Eatonville Highway West			K, 18-30	Potentially significant at end of pipe facility		Y			Insignificant, poor soils in large upstream basins	Right-of-way	Arterial		Pipe to downstream conveyance	Contributes to DP02	Drainage problem not evident in 2013 modeling
7	Lynch Creek Road at culvert		Y	B>80	Limited area at culvert site	No				Good infiltration potential upstream to reduce flows	Right-of-way	Local	`		Lack of capacity in trunk line conveyance may be resolved with infiltration BMPs in the upper basin	A thru H and J thru M
8	Eatonville Highway West near west town limits			K, 18-30	Insignificant, poor soils in large upstream basins		Y			Insignificant, poor soils in large upstream basins	Right-of-way	Arterial		Increase ditch capacity		Drainage problem not evident in 2013 modeling

Table 6-1 A: Drainage Problem Summary, cont.

2003 DP Number	Problem Location per 2003 report	Flood problem per 2013 model	Conveyance Problem per 2013 Model	Soil Type/ Depth to GW or Imp. Layer (inches) (1)	Relative Infiltration Potential	Existing Conveyance	Undersized ditch?	Catch Basin Number	Flood Depth at CB	Up basin opportunities for dispersed LID	Proximity to Public Site	Road Classification	Potential LID BMPs	Conventional Solution Where LID is Impractical	Comments	2013 CIP project to mitigate DP
9	Eatonville Highway West between Antonie Avenue North and Center Street West	Y		K, 18-30	Potentially significant at end of pipe facility at Center Street West			CB 1302		Insignificant, poor soils in large upstream basins	Right-of-way	Arterial		Increase ditch capacity and correct grade at Larson Street		C
10	Center Street West near Jensen Lane North thru Cedar Avenue North	Y	Y	K, 18-30	Insignificant area drains to good soil			CB 1315	3" - 6"		Determine if opportunities at lake	Local			Determine function of lake overflow; does Lake need to connect to Center Street storm system?	D, E
10		Y		K, 18-30				CB 931	>6 "			Local				
10		Y		K, 18-30				CB 1314	0-3"			Local				
10		Y	Y	B>80	Potentially significant at end of pipe facility at Center Street			CB 1309	3" - 6"		Passes 3 potential Center Street parcels	Local	Bioinfiltration swale, Infiltration trench, dry well			
10		Y	Y	B>80				CB 1308	0-3"			Local				
10		Y	Y	B>80				CB 1300	3" - 6"			Local				
10		Y	Y	B>80				CB 1302	>6 "			Local				
11	Pennsylvania. Avenue North between Lynch Street West and Carter Street West			B>80	Significant given soils	No				moderate for residential area given soils	Right-of-way	Local	Bioinfiltration swale, Infiltration trench, dry well			M
12	Washington Avenue between Larson Street West and Prospect Street East	Y	Y	B, 1 block down grade	None	No		CB 3003	3" - 6"		Right-of-way	Local	Insignificant given small basin and distance to good soils	Disconnect storm from sanitary sewer	If problem recurs, runoff could be conveyed south to good soils.	A
13	Adams Avenue South (South of Center and North of Prospect)			K, 18-30		No					Right-of-way	Local	Insignificant given small basin and distance to good soils	Improve roadside conveyance		Drainage problem not evident in 2013 modeling
14	Center Street East between Bergeren Road North and Washington Avenue South	Y	Y	B>80	Significant if conveyed to Madison			CB 994	3" - 6"	Six 2011 rain gardens on Baumgartner Pl NE may mitigate flooding; additional potential on Eagle Glen Ct. N.	East of Madison Avenue	Arterial	Infiltration trench; wet well; bioinfiltration swale			A, B
14		Y	Y	B>80	Significant if conveyed to Madison			CB 1089	3" - 6"		Right-of-way	Arterial	Infiltration trench; wet well; bioinfiltration swale			

Table 6-1 A: Drainage Problem Summary, cont.

2003 DP Number	Problem Location per 2003 report	Flood problem per 2013 model	Conveyance Problem per 2013 Model	Soil Type/ Depth to GW or Imp. Layer (inches) (1)	Relative Infiltration Potential	Existing Conveyance	Undersized ditch?	Catch Basin Number	Flood Depth at CB	Up basin opportunities for dispersed LID	Proximity to Public Site	Road Classification	Potential LID BMPs	Conventional Solution Where LID is Impractical	Comments	2013 CIP project to mitigate DP
14		Y	Y	K, 18-30 in lower reach	None in lower reach			CB 1170	0-3”		Right-of-way	Arterial			Minor flooding could be eliminated by infiltrating upstream areas.	
14		Y	Y	K, 18-30 in lower reach	None in lower reach			CB 1166	0-3”		Right-of-way	Arterial			Minor flooding could be eliminated by infiltrating upstream areas.	
14		Y	Y	K, 18-30 in lower reach	None in lower reach			CB 1164	3” - 6”		Right-of-way	Arterial	Infiltration trench; wet well; bioinfiltration swale		Minor flooding could be eliminated by infiltrating upstream areas	
15	36-inch Trunk main to Lynch Creek Road	Y		S 11-16 except for small area of B>80 near Lynch Creek road				CB 1140	0-3”	Moderate: good soils; relatively flat area	Right-of-way	Arterial	Infiltration trench; wet well; bioinfiltration swale		See DP 2013-3 at Carter Street. Note backwater shown from culvert at Lynch Creek Road is not accurate; Ditch will overtop, but survey info not available	A thru H and J thru M
15		Y	Y	B>80				CB 1142	0-3”	Moderate: good soils; relatively flat area		Arterial	Infiltration trench; wet well; bioinfiltration swale		Lack of capacity in trunk may be mitigated by upstream infiltration BMPs to reduce trunk flows	Drainage problem not evident in 2013 modeling

Notes:

1 B = Barneston gravelly coarse loamy sand, a soil with high infiltration potential
K = Kapowsin gravelly loam, minimal infiltration potential
S = Skamman sil loam, low infiltration potential

Table 6-1 B: Drainage Problem Summary

2013 DP #	Location/ Description	Flood problem per 2013 model	Conveyance Problem per 2013 Model	Soil Type/ Depth to GW or Imp. Layer (inches)	CB #	Flood Depth at CB	Comments	Potential LID BMPs	Upstream basin opportunities for LID	Proximity to Public Site	Road Type	Potential Infiltration Volume	Conventional Solution	2013 CIP project to mitigate DP
2013-1	Mashell Ave. at Alder St.	Y		B>80 at lower reach; upper basin is S, 11-16	1057, 1058	3" - 6"	Existing conveyance to Sewage Lagoon site	DW at local flooding; then regional Infiltration trench; wet well; bioinfiltration swale	Significant based on upstream basin size, available public space, soils	Lower reach of pipe is at Sewage Lagoon Site	Res	Significant based on upstream basin size, available public; soils	Upsize conveyance pipe	I
2013-2	Carter St. W. at Washington Ave. S.	Y	Y	K, 18-30	1142, 1143	0-3"		Infiltration trench; wet well; bioinfiltration swale	Moderate, soils	Right-of-way	Res/Arterial	Moderate, soils		K
2013-3	Larson St.	Y	Y	K, 18-30	3003	3" - 6"	Backwater at Trunk 5 might be mitigated by infiltration in CIPs A and B to reduce flows in Trunk 5.		None, soils	Right-of-way	Res	None, soils	Retrofit of conveyance system in Trunk 5 from CB 1000 to CB 1085; See Note 1	A, B, J
2013-4	Connect Center St. to regional infiltration at Sewage Lagoon site			K, 18 – 30 in middle reach; B> 80 in upper and lower reaches	CB-M7 to CB 1056		Divert Center St.subbasins from Lynch Cr. To Mashel River basin	Not applicable	Not applicable	Discharge at Sewage Lagoon	Res/Arterial	Significant based on upstream basin size, available public area; soils	See Note 2.	Not applicable
2013-5	Realign Center St. conveyance to ROW			B>80	CB 1300 to CB 1328 CB 1331 to CB M7		Relocate conveyance from private property to right-of-way; presents opportunity to build infiltration with street reconstruction.	Infiltration trench; wet well; bioinfiltration swale	Significant based on upstream basin size, available public space, soils	Right-of-way	Res/Arterial	Significant based on upstream basin size, soils		J
2013-6	Center St. E. Trunk 5	Y	Y	B>80 in upper half of Trunk 5 reach; S 11-16 in lower half	CB 1000	0-3"	Given poor soils in lower reach, look at CIP A and B first	Infiltration trench; wet well; bioinfiltration swale, upper reach only	Significant: however, CIP projects A and B may be more cost effective	Right-of-way	Res/Arterial	Significant based on upstream basin size, soils	New conveyance in Mashall; size dependant on amount of infiltration in contributing basin. Could be combined with street reconstruction.	A, B

Notes:

1 Larson Street : CB 3003 experiences backwater from Trunk 5 CB 1000

2 Connect Center Street to Sewage Lagoon regional facility

Soils Notes:

B = Barneston gravelly coarse loamy sand, a soil with high infiltration potential

K = Kapowsin gravelly loam, minimal infiltration potential

S = Skamman sil loam, low infiltration potential

Table 6-2: Capital Improvement Projects Summary Table

LID Project #	Contributing Subbasin #	Location	Associated CB	Primary Drainage Problem Mitigated	Secondary Drainage Problem Mitigated	Public Property?	LID Options	Relative Infiltration Volume	Comments	Description of BMP	Shallow Groundwater Destination per Golder Associates Figure 4
A	18	Washington Avenue between Larson Street West and Prospect Street East	CB 3003	DP 12		Yes	If conveyed 1 block down grade to good soils.		Priority ranked #3 in 2003 CIP list. Town used sanitary sewer to act as temporary underdrain; standing water problem still exists.		
B	22, 23	East of Madison Avenue South	CB 994	DP 14	DP 15, DP 07, 2013-3	Yes		Medium	Significant upstream basin can be diverted for infiltration.	400 LF bioinfiltration trench	Mashel
C	7a, 8, 9, 10, 26, 27	Parcel at Iron Street and Eatonville Highway	CB 1302	DP 02, DP 09	DP 03	Private	BIS	Medium	An end of pipe approach due to long conveyance; also high visibility site for rain garden. Ensure this project is constructed in the public ROW.	4 foot diameter, 6 foot deep DW	Ohop
D	2, 3	Center Street right-of-way west of Antonie Avenue North	CB 931	DP 10		Yes	DW	Low	Contributing area limited to intersection, some roadway. This project is a good candidate for a Green Street project.	400 LF bioinfiltration trench	Ohop
E	5	Center Street right-of-way between Antonie Avenue North And Cedar Avenue North	CB 1309	DP 10		Yes	BIS	Medium	Existing Center Street improvements are minimal here. This project is a good candidate for a Green Street project.	400 LF bioinfiltration trench	Ohop
F	6, 10	Parcel south of Center Street near Cedar Avenue North	CB 1300	DP 02		Unknown	BIS	High	High visibility; confirm if one of parcels north and south of right-o-way is public; one is now private. If confirmed to be private, relocate this project to public ROW in the nearby traffic island.	4 foot diameter, 6 foot deep DW	Ohop
G	7b, 11	Parcel south of Center Street at Pennsylvania Avenue North	CB 1325	DP 03		Community Center	DW	Low	High visibility, but little available space.	4 foot diameter, 6 foot deep DW	Groundwater divide
H	13, 1217	Parcel south of Center Street at Rainier Avenue	CB 1331	DP 03	DP 15, DP 07	City Hall Complex	DW	Low	High visibility, but little available space.	4 foot diameter, 6 foot deep DW	Groundwater divide
I	19, 20, 24	Sewage Lagoon Site	CB 1056	2013-1		Yes	BIS	High	Contributing basin is large. This project will not help increase dry seasonal flows to the Mashel River because of the close proximity to the river.	200 LF pretreatment biofiltration swale to infiltration pond	Mashel
J	2, 5, 6, 7, 8, 9, 10	Center Street reconstruction, Cedar Avenue to Mashall Avenue	CB 1300 to CB 1328; CB 1331 to CB M7	DP 03	DP 15, DP 07	Yes	BIS, Pond	High	Contributing basin is very large. The Center Street reconstruction should extend from Eatonville Highway and Larson Street to Mashell Avenue. This is a federally classified highway and is eligible for federal funding. Transforming into a Green Steet project would impact projects F, G, and H.	3 blocks of reconstructed street with bioinfiltration swales; trunk line relocation	Groundwater divide
K	15	Carter Street between Rainier Avenue North and Washington Avenue North	CB 1142, CB 1143	2013-2	DP 15, DP 07	Public or Private	BIS	Medium	Locations based on resident interest if public/ private. Carter Street is new, so work is not proposed as part of this project. However, the alley between Mashell Avenue and Rainer Avenue may be a good location to site a facility.	400 LF bioinfiltration trench	Groundwater divide
L	1	Antonie Avenue North of Center Street	CB 1043	DP 04	DP 15, DP 07, DP 03	Yes	BIS, RG	Medium	Upstream basin soils are poor; BMPs on Antonie Street could infiltrate upstream runoff. This location is a good candidate for a Green Street project. The street does not have sidewalks, both are built-out to zoning, and both have deteriorated street.	400 LF bioinfiltration trench	Ohop
M	6, 7	Pennsylvania Avenue North of Center Street	CB -1325	DP 03	DP 15, DP 07	Yes	BIS, RG	Medium	Soils are good, basin is small. This location is a good candidate for a Green Street project. The street does not have sidewalks, both are built-out to zoning, and both have deteriorated street.	400 LF bioinfiltration trench	Ohop
N	N/A	Westside of Eatonville Elementary School	N/A	N/A	N/A	Yes	BIS, RG	High	Feasibility study of centrifugal device followed by bioinfiltration to provide treatment prior to discharging to Lynch Creek.	400 LF bioinfiltration trench	Lynch

DW = Drywell
IT = Infiltration Trench
BIS = Bioinfiltration Swale
RG = Rain Garden

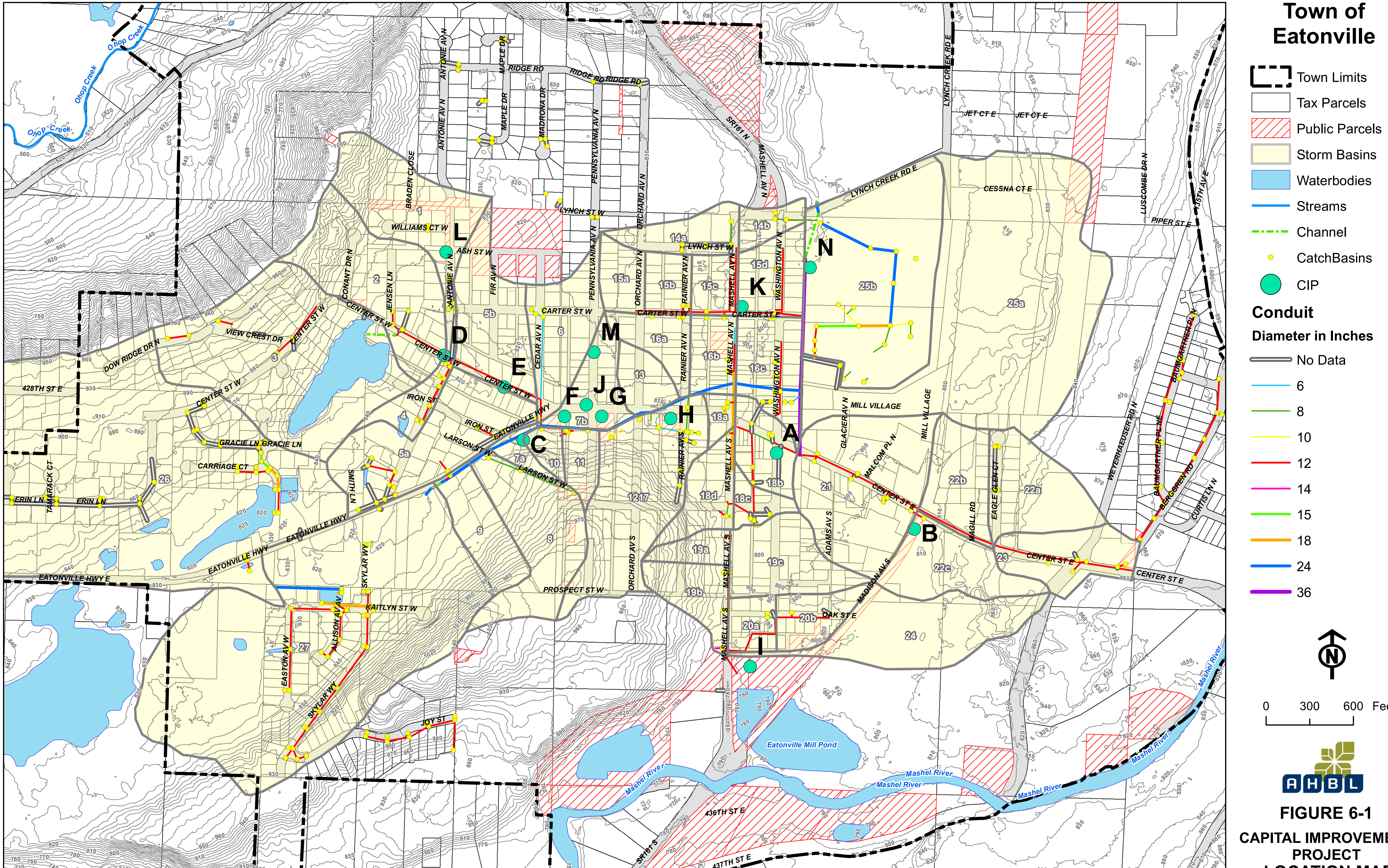

FIGURE 6-1
CAPITAL IMPROVEMENT PROJECT LOCATION MAP

Table 6-3: Rating and Ranking Criteria

Criteria Number	General Category	Specific Category	Score Range	Weight	Highest Potential Score
1	Flood Hazard Reduction	Flood Location	0 = no impact, 3= impacts private property, 5 = impacts public streets in terms of traffic, infrastructure and public safety	1	5
		Flood Source	0 = no flooding, 3 = Private Water, 5 = Public Water	1	5
		Flood Depth	0 = 0 inches, 3 = 3-6 inches 5 = More than 6 inches	3	15
2	Infiltration Potential	Soil Type	0 = All other Soils Types in the City, 3 = Briscot loam, Chehalis silt loam, 5 = Barneston gravelly coarse loamy sand, Everett gravelly sandy loam, Indianola loamy sand, Ragnar sandy loam	3	15
3	Environmental	Water Quality	0 = No WQ Treatment, 5 = WQ Treatment	3	15
		Detention	0 = No Detention Benefit, 5 = Detention Benefit	3	15
		Permitting	0 = Challenging/Lengthy Permitting Process 3 = Some Permitting Required 5 = No Permitting Required	2	10
4	Community Considerations	Operation and Maintenance	0 = 6-month O&M Required, 3 = Annual O&M, 5 = No O&M Required,	1	5
		Proximity/Availability to Right-of-Way or Public Lands	0 = No ROW or Public Lands Available, 3 = Limited ROW or Public Lands Available, 5 = ROW or Public Lands Available	3	15
		Constructability	0 = Difficult, 3 = Medium Difficulty, 5 = Easy	2	10
		Availability of Funding	0 = No Grant Funding Available, 3 = Some Grant Funding Available , 5 = Grant Funding Available	3	15
		Aesthetics	0 = No Aesthetics Impacts, 3 = Occasional Positive Aesthetics Impacts (Seasonal), 5 = Constant Positive Aesthetic Impacts	1	5
		Public Acceptance	0 = No Public Acceptance, 3 = Some Public Acceptance, 5 = Public Acceptance	2	10
5	Additional Project Information	Low Impact Development	0 = Not an LID Project, 3 = LID Components to Project, 5= LID Project	3	15
		Basin Location	0 = Other, 3 = Lynch Creek Basin, 5 = Mashel River Basin	2	10
				Total	**160**

Table 6-3: Rating and Ranking Criteria

Criteria Number	General Category	Specific Category	Score Range	Weight	Highest Potential Score
1	Flood Hazard Reduction	Flood Location	0 = no impact, 3= impacts private property, 5 = impacts public streets in terms of traffic, infrastructure and public safety	1	5
		Flood Source	0 = no flooding, 3 = Private Water, 5 = Public Water	1	5
		Flood Depth	0 = 0 inches, 3 = 3-6 inches 5 = More than 6 inches	3	15
2	Infiltration Potential	Soil Type	0 = All other Soils Types in the City, 3 = Briscot loam, Chehalis silt loam, 5 = Barneston gravelly coarse loamy sand, Everett gravelly sandy loam, Indianola loamy sand, Ragnar sandy loam	3	15
3	Environmental	Water Quality	0 = No WQ Treatment, 5 = WQ Treatment	3	15
		Detention	0 = No Detention Benefit, 5 = Detention Benefit	3	15
		Permitting	0 = Challenging/Lengthy Permitting Process 3 = Some Permitting Required 5 = No Permitting Required	2	10
4	Community Considerations	Operation and Maintenance	0 = 6-month O&M Required, 3 = Annual O&M, 5 = No O&M Required,	1	5
		Proximity/Availability to Right-of-Way or Public Lands	0 = No ROW or Public Lands Available, 3 = Limited ROW or Public Lands Available, 5 = ROW or Public Lands Available	3	15
		Constructability	0 = Difficult, 3 = Medium Difficulty, 5 = Easy	2	10
		Availability of Funding	0 = No Grant Funding Available, 3 = Some Grant Funding Available , 5 = Grant Funding Available	3	15
		Aesthetics	0 = No Aesthetics Impacts, 3 = Occasional Positive Aesthetics Impacts (Seasonal), 5 = Constant Positive Aesthetic Impacts	1	5
		Public Acceptance	0 = No Public Acceptance, 3 = Some Public Acceptance, 5 = Public Acceptance	2	10
5	Additional Project Information	Low Impact Development	0 = Not an LID Project, 3 = LID Components to Project, 5= LID Project	3	15
		Basin Location	0 = Other, 3 = Lynch Creek Basin, 5 = Mashel River Basin	2	10
				Total	**160**

Table 6-4: Rating and Ranking of CIP Projects

						Flood Hazard Reduction			Infiltration Potential	Environmental			Community Considerations					Additional Project Information		
Table 6-4 Rating and Ranking of CIP Projects					Criteria	Flood Location	Source of Flood Water	Flood Depth	Soil Type	Water Quality	Detention	Permitting	Operation and Maintenance Frequency	Proximity/Availability to Right-of-Way or Public Lands	Constructability	Availability of Funding	Positive Aesthetic Impact to Community	Low Impact Development	Basin Location	Total
					Weight	1	1	3	3	3	3	2	1	3	2	3	1	3	2	Max = 160
					Score Range	0 = no impact, 3= impacts private property, 5 = impacts public streets in terms of traffic, infrastructure and public safety	0 = no flooding, 3 = Private Water, 5 = Public Water	0 = 0 inches, 2 = 0-3 inches, 3 = 3-6 inches 5 = More than 6 inches	0 = All other Soils Types in the City, 3 = Briscot loam, Chehalis silt loam, 5 = Barneston gravelly coarse loamy sand, Everett gravelly sandy loam, Indianola loamy sand, Ragnar sandy loam	0 = No WQ Treatment, 5 = WQ Treatment	0 = No Detention Benefit, 3 = Some Detention Benefit (i.e. DW), 5 = Detention Benefit (i.e IT, BIS)	0 = Challenging/ Lengthy Permitting Process, 3 = Some Permitting Required, 5 = No Permitting Required	0 = 6-month O&M Required (i.e. BIS, IT, RG), 3 = Annual O&M (i.e. DW, Pond), 5 = No O&M Required	0 = No ROW or Public Lands Available, 3 = Limited ROW or Public Lands Available, 5 = ROW or Public Lands Available	0 = Difficult, 3 = Medium Difficulty (i.e. IT, BIS), 5 = Easy (i.e. DW)	0 = No Grant Funding Available, 3 = Some Grant Funding Available , 5 = Grant Funding Available	0 = Low 3 = Medium 5 = High	0 = Not an LID Project, 3 = LID Components to Project, 5 = LID Project	0 = Other, 3 = Lynch or Ohop Creek Basin, 4 = Groundwater Divide, 5 = Mashel River Basin	
Project ID	**CIP #**	**Type of Project**	**Contributing Subbasin #**	**Location**	**Associated CB**	Scoring: 0 to 160														
B	#1	LID	22, 23	East of Madison Avenue South	CB 994	5	5	3	5	5	5	3	0	5	3	5	5	5	5	136
I	#2	LID	19, 20, 24	Sewage Lagoon Site	CBs 1057, 1058	5	5	3	5	5	5	3	2	5	5	5	5	3	5	136
E	#3	LID	5	Center Street right-of-way between Antonie Avenue North And Cedar Avenue North	CB 1309	5	5	3	5	5	5	3	0	5	3	5	5	5	3	132
J	#4	LID	2, 5, 6, 7, 8, 9, 10	Center Street reconstruction, Cedar Avenue to Mashell Avenue	CB 1300 to CB 1328; CB 1331 to CB M7	5	5	5	5	5	5	0	0	5	0	5	5	5	4	128
H	#5	LID	13, 1217	Parcel south of Center Street at Rainier Avenue South	CB 1331	5	5	0	5	5	3	3	3	5	5	5	5	5	4	126
M	#6	LID	6, 7	Pennsylvania Avenue north of Center Street	CB 1325	5	5	2	5	5	4	3	0	5	3	5	5	5	3	126
K		LID	15	Carter Street between Rainier and Washington Avenues	CB 1142, CB 1143	4	5	2	5	5	5	3	0	3	3	5	5	5	4	124
D		LID	2, 3	Center Street right-of -way east of Antonie Avenue North	CB 931	5	5	5	0	5	5	3	0	5	3	5	5	5	3	123
L		LID	1	Antonie Avenue North of Center Street	CB 1043	5	5	0	5	5	5	3	0	5	3	5	5	5	3	123
N		LID	N/A	Westside of Elementary School	N/A	0	0	0	0	5	5	3	0	5	3	5	5	5	3	98
F		LID	6, 10	Parcel south of Center St. near Cedar Avenue North	CB 1300	5	5	3	5	5	0	3	3	3	5	3	0	3	3	101
G		LID	7b, 11	Parcel south of Center Street at Pennsylvania Avenue North	CB 1325	5	5	2	5	5	0	3	3	3	5	3	0	3	4	100
C		LID	7a, 8, 9, 10, 26, 27	Parcel at Iron St. and Eatonville Highway	CB 1302	3	5	5	0	5	0	3	3	0	5	3	0	3	3	81
A		Conventional		Washington Avenue between Larson St. W. and Prospect Street East (DP 12)	CB 3003	5	5	3	5	0	0	5								

- *CIP #4 - Green Street and Bioretention Trench on Center Street #2 (Project ID "J")*
  This project includes 3 blocks of reconstructed roadway including installation of 800 feet of bioretention swales. This project also includes relocation of approximately 1,000 lineal feet of 36-inch diameter stormwater trunk line out of private property and into the right-of-way.

- *CIP #5 - Drywell at Rainier Avenue South (Project ID "H")*
  This project will mitigate flooding during the 25-year storm event at CB 1331. This project includes constructing a 72-inch diameter by 6-foot deep drywell.

- *CIP #6 - Green Street and Bioinfiltration Trench at Pennsylvania Avenue North (Project ID "M")*
  This project will mitigate flooding during the 25-year storm event at CB 1325. This project will reconstruct approximately 600 feet of Pennsylvania Street and provide water quality treatment for half of Pennsylvania Street by constructing 400 linear feet of roadside bioretention.

A summary opinion of probable project cost is shown in the table below, with a detailed cost estimate for each project presented in Attachment F.

Table 6-5: Summary of CIP Design and Construction Cost

Project Number	Project Name	Opinion of Design and Construction Cost
CIP #1 - LID Project B	Bioinfiltration Trench East of Madison Ave S.	$120,000
CIP #2 - LID Project I	Infiltration Pond at Sewage Lagoon	$690,000
CIP #3 - LID Project E	Green Street and Bioinfiltration Trench at Center St. #1	$540,000
CIP #4 - LID Project J	Green Street and Bioinfiltration Trench at Center St. #2	$1,780,000
CIP #5 - LID Project H	Drywell at Rainier Ave S	$90,000
CIP #6 - LID Project M	Green Street and Bioinfiltration Trench at Pennsylvania Ave N	$530,000
TOTAL		**$3,750,000**

6.3 Water Quality

A water quality analysis was performed within Sections 6.3 and 6.5 of the 2003 Program and is summarized below. In general, the runoff from the Town flows primarily into Ohop Creek (including Lynch Creek) and the Mashel River, and both are impaired. The Nisqually Basin TMDL (2005) identified Ohop Creek for listing on the 303(d) list for fecal coliform and the Mashel River for temperature. The Mashel River impairment is largely the result of low in-stream flow during the summer months. Roughly 75% of Town stormwater is released from a pipe, untreated, to an unnamed creek/ditch which flows to Lynch Creek, a tributary of Ohop Creek. The remaining 25% of collected stormwater flows from a pipe, untreated, directly into the Mashel River.

All of the proposed LID capital improvement projects have the potential to improve water quality. Water quality treatment is realized by diverting street runoff into LID and conventional detention facilities prior to infiltration and/or direct discharge into adjacent receiving waters. Water quality, along with site infiltration capacity, flood hazard mitigation, and the availability of funding, are the heaviest weighted criteria used to evaluate and rank the capital projects.

6.4 Town's Stormwater Outfalls/Discharges

Because of the importance and ability to affect both water quality and as habitat functions, the Plan also examines the nature and characteristics of the Town's two main surface water outfalls.

6.4.1 Mashel River Outfall

The Town has previously studied some aspects of the feasibility of redirecting a large percentage of stormwater collected and conveyed in the Town from the Lynch Creek (Ohop Creek) Outfall (untreated) to the Mashel River Outfall. Some infrastructure, such as valves and conveyance piping, were installed during recent street improvements. Should the redirection occur, these improvements should enhance the flows in the Mashel River.

A study is also suggested to confirm the feasibility of converting the existing decommissioned sewage treatment lagoon near the Mashel River Outfall into an interactive/educational, bioengineered LID stormwater treatment, detention, and infiltration facility. This potential project would require a review of the legal, regulatory, critical areas, and cultural resource-related issues. A pre-engineering feasibility assessment would include conducting a survey, reviewing alternative designs, estimating costs, and conducting various technical investigations including geotechnical and hydrologic and materials testing at the site of the old sewage lagoon.

6.4.2 Lynch Creek Outfall

Due to space limitations, there are few opportunities for treating stormwater near the Lynch Creek Outfall. One potential site for bioretention is an open ditch at the west side of Eatonville Elementary School, identified as LID Project N. A bioretention facility could be preceded by a mechanical device, such as a centrifuge, if it is determined that additional mechanical treatment is necessary. It is recommended that options for treatment site and methods near the Lynch Creek sub-basin be explored to optimize treatment goals.

The focus of this suggested preliminary engineering study would be to address flooding issues through infiltration and LID BMPs, which would concurrently also improve water quality. Presently, the lack of data prevents further evaluation of specifically targeted recommendations to improve water quality. Additional study would help quantify the potential benefits of the major CIPs and focus on optimizing the water quality treatment facility types, locations, size, flows, etc. based on water quality related data of existing conditions and potential benefits. To the benefit of the Lynch Creek and Mashel River outfalls, additional study could include the evaluation of the impacts of diverting and treating stormwater in the old sewage lagoon.

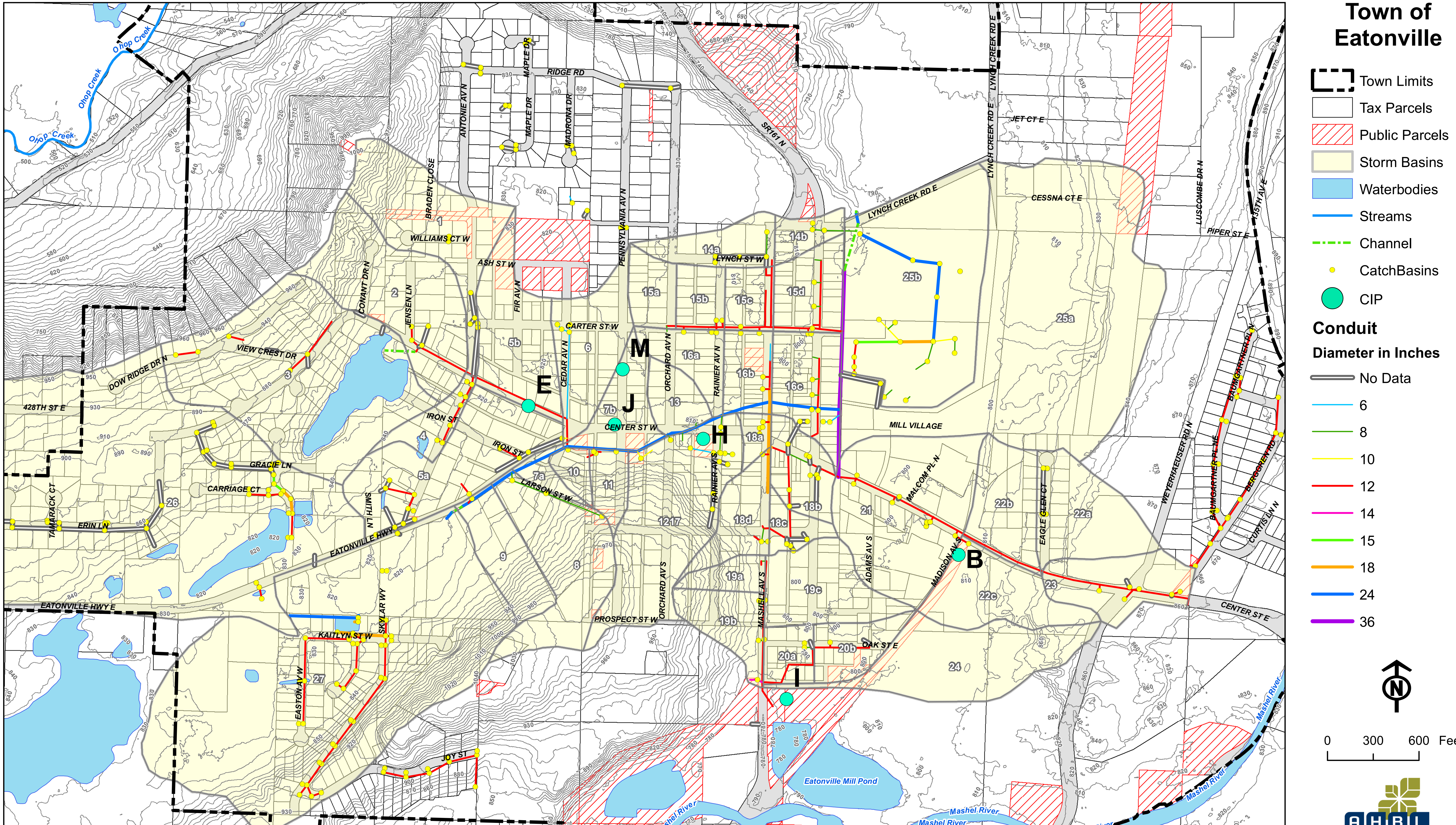

FIGURE 6-2
6 TOP CIP PROJECTS LOCATION MAP

Section 7
OPERATION & MAINTENANCE

7.1 Introduction

This section provides an update to the stormwater operation and maintenance program developed in 2003. The update consists of a review of current practices and development of a program that includes best practices for standard urban stormwater system maintenance and LID practices.

The 2003 Program notes that “[T]he objective of a stormwater operation and maintenance program is to assure the reliability and dependability of the stormwater infrastructure. Such a program is designed to minimize life-cycle costs, protect the lives and property of the Town’s residents and businesses, reduce local flooding and enhance water quality. An operations and maintenance program includes an analysis of the frequencies and levels of maintenance required to achieve water quality objectives, ensure reliability, and achieve the lowest life-cycle cost.”

Due to extensive budget cuts in the past few years, the Town has not had a stormwater operation and maintenance program. Emergencies are dealt with on a case-by-case basis with staff from the water utility occasionally performing stormwater maintenance. Beginning in 2013, stormwater utility fees are being collected with the majority of the funds generated going towards operation and maintenance (see Section 8). This section provides the basic program for satisfactory maintenance and operations.

7.2 Current Stormwater Maintenance Program

As noted above, Eatonville has not had a formal stormwater operation and maintenance program for several years. The only consistent stormwater-related maintenance that occurs is weekly street sweeping that is paid for out of the roads budget. Response to drainage complaints is performed by the Town water utility crew on a case-by-case basis.

7.3 Proposed Stormwater Maintenance Program

As the Town moves toward a stormwater system comprised of LID practices, its operations and maintenance program will need to adapt to the differing maintenance needs of the LID facilities. It is expected that the majority of LID practices that will be used in the Town are drywells, pervious pavement, and bioretention facilities. LID maintenance guidelines and checklists are provided in Appendix H. In compiling the Proposed Stormwater Maintenance Program (Table 7-1), the following assumptions were made:

1. Cleaning catch basins, drywells, manholes and pipes will continue to be contracted out.
2. Street sweeping (both pervious and impervious pavements) will continue to be contracted out.
3. Street sweeping of pervious pavements will use high-pressure wash with suction.
4. The cost for one FTE maintenance staff person is $59,000 per year, inclusive of benefits and overhead. The Town may choose to allocate the FTE funding to other than one full time staff person. For example, the allocation may fund one permanent part-time position and one or two temporary or seasonal positions.

Table 7-1: Proposed Stormwater Maintenance Program

Item No.	Maintenance Activity	Units to be Maintained	Production Unit	Freq. (times/yr)	Daily Production	Crew Size	Annual Crew Days	Annual Person Days	Full-time Labor Equiv.	Annual Labor Cost	Annual Other Cost	Total Annual Cost	Percent of Program
1	Clean Catch Basins, Drywells & Manholes	412	Each	1	NA	NA	NA	NA	NA	$0	$6,000	$6,000	12%
2	Clean Roadside Ditches (remove sediments)	17,250	LF	1	2,000	3	9	26	0.10	$7,962	$0	$7,962	16%
3	Clean Roadside Ditches (vegetation control - string trimmer)	3,450	LF	2	1,000	1	7	7	0.03	$2,123	$0	$2,123	4%
4	Clean Roadside Ditches (vegetation control - mower)	13,800	LF	3	2,100	1	20	20	0.08	$6,066	$0	$6,066	12%
5	Clean Storm Drain Pipes (non-perforated)	39,689	LF	0.25	2,000	2	5	10	0.04	$3,053	$0	$3,053	6%
6	Clean Storm Drain Pipes (perforated)	3,375	LF	0.25	2,000	2	0	1	0.00	$260	$0	$260	0.5%
7	Clean Culverts	20	Each	1	10	2	2	4	0.02	$1,231	$0	$1,231	2%
8	Clean Detention Ponds (remove sediments)	3	Each	0.2	1	2	1	1	0.00	$369	$0	$369	1%
9	Clean Detention Ponds (vegetation control)	3	Each	0.2	1	2	1	1	0.00	$369	$0	$369	1%
10	Repair/Replace/ Install New Catch Basins, Dry Wells, Manholes	412	Each	0.01	1	3	4	12	0.05	$3,785	$1,500	$5,285	11%
11	Street Sweeping	1	LS	52	NA	NA	NA	NA	NA	$0	$6,000	$6,000	12%
12	Emergency Maintenance	1	Each	28	8	2	4	7	0.03	$2,154	$0	$2,154	4%
13	Drainage Complaints & Flood Response	1	Each	4	8	2	1	1	0.004	$308	$0	$308	1%
14	Disposal Costs (catch basin cleaning & street sweeping)	NA	NA	NA	NA	NA	NA	NA	NA	$0	$0	$0	0%
15	Raingarden Trash and Weed Removal	4	EA	2	2	2	4	8	0.031	$2,462	$0	$2,462	5%
16	Raingarden Mulching & Planting	4	EA	1	4	2	1	2	0.008	$615	$1,500	$2,115	4%
17	Pervious Pavement Cleaning & Repair	0	SF	0.2	5,000	NA	NA	NA	NA	$0	$0	$0	0%
18	Other O&M	NA	NA	NA	NA	NA	NA	NA	NA	$0	$3,550	$3,550	7%
Total								**100**	**0.38**	**$30,755**	**$18,550**	**$49,305**	**100%**

Table 7-2: Supporting Information: Current Stormwater Maintenance Program Labor

Item No.	Maintenance Activity	Notes Regarding the Units to be Maintained	Notes Regarding the Frequency	Notes Regarding the Daily Production
1	Clean Catch Basins, Drywells, and Manholes	Contracted out.	4 days once per year.	Prioritized - (1) Key areas including Washington & Center Streets, Carter Street, Antonie Street; (2) 1/3 of systems on six year rotation.
2	Clean Roadside Ditches (remove sediments)	Dump Truck and Backhoe used.	72 hours x 3 staff = 216 hours per year.	Approximately 1% of the total length of drainage ditches is actually drainage swales. No distinction is made in the program due to the minimal length of swales.
3 & 4	Clean Roadside Ditches (vegetation control)	Riding Mower, Brush Hog, and String Trimmer used.	20 hours per week for 6 months (April through October); Hilltop area & near maintenance bldg, View Crest once every two weeks.	Assumptions: Approximately 20% of the total length of ditches is mowed yearly using weedeaters; Approximately 80% of the ditches are mowed 3 times per year using a mower.
5 & 6	Clean Storm Drain Pipes (perforated and non-perforated)	Source: inventory based field review and information provided by the Town.	Assumption: Done on an as needed/ emergency basis.	
7	Clean Culverts	Source: inventory based on information provided by the Town.		
8 & 9	Clean Detention Ponds (remove sediments and vegetation control)	Source: inventory based on information provided by the Town.		
10	Repair/Replace/Install New Catch Basins, Dry Wells, Manholes	Source: inventory based on information provided by the Town.	Assumption: Done on an as needed basis.	
11	Street Sweeping Contracted out. Weekly street sweeping for 4 hours per week No current cost to Storm Drain Fund. Currently funded through Street Fund.			
12	Emergency Maintenance	Source: Town staff	Assumption: Done on an as needed basis	

Table 7-2: Supporting Information: Current Stormwater Maintenance Program Labor, cont.

Item No.	Maintenance Activity	Notes Regarding the Units to be Maintained	Notes Regarding the Frequency	Notes Regarding the Daily Production
13	Drainage Complaints & Flood Response	Source: Town staff	12 Calls per Year. 4 Hours x 2 Staff = 8 Hours per Year	
14	Disposal Costs (catch basin cleaning and street sweeping)			Assumption: Cost merged with other items.
15	Raingarden Trash and Weed Removal	Source: Town staff		
16	Raingarden Mulching & Planting		Assumption: each raingarden mulched once per year	Costs of mulch added
17	Pervious Pavement Cleaning & Repair		Assumption: Pressure wash annually with industrial machine at 2,500 psi.	No pervious pavement installed to date

Table 7-3: Supporting Information: Current Stormwater Maintenance Program Costs

Item No.	Maintenance Activity	Notes Regarding the Program Cost
1-17	Various	Labor costs are based on a fully burdened labor rate of $38.46 per hour and 2080 working hours per year for a cost of $80,000 per FTE.
14	Disposal Costs	Disposal costs are assumed to be merged with other expense items.
18	Other O&M	Source: Town of Eatonville 2003 Budget. Includes: operating supplies ($1,000), tools/minor equipment ($50), communications ($3,000), and miscellaneous ($500).

7.4 Low Impact Development Maintenance Requirements

The maintenance needs of landscaped LID facilities such as bioretention is different in character than maintenance of facilities such as pipes, ditches, catch basins, and detention ponds. Landscaped LID facilities depend upon soils and plants to provide stormwater treatment and infiltration. Thus, the maintenance needs are more similar to landscape maintenance than traditional pipe/ditch and catch basin maintenance. An aesthetic value is part of the maintenance of the LID facilities and jurisdictions can find it challenging to forecast the amount of maintenance needed for proper functioning. Maintenance staff must be educated on the maintenance requirements necessary to ensure proper functioning of a LID facility versus the additional maintenance that may be desired for enhanced aesthetic values. The concept of level of service (LOS) has been used successfully in other jurisdictions throughout the Puget Sound. The City of Seattle has developed a complete and detailed description of each level of service and compiled this information into the "Green Stormwater Operations and Maintenance Manual." This manual, included in Appendix H, is a recommended resource that the Town can use to guide its LID maintenance and operations activities. A reasonable target for a small town such as Eatonville is LOS C. Level of Service C ensures the continued functioning of LID facilities for stormwater treatment and infiltration activities, but does not address aesthetic issues. Community groups and volunteers can be used to maintain vegetated facilities to a higher aesthetic level, should that be desirable. Even programs that rely heavily on the use of donated labor will incur costs associated with the coordination and inspection of volunteers' work. Section 8 discusses the role a stormwater manager would have in coordinating activity.

Section 8
PROGRAM MANAGEMENT, PUBLIC EDUCATION & ENGINEERING

8.1 Introduction

This section describes the Town's program management, public education, and engineering activities related to stormwater management. This section provides estimates of staff resources needed for these activities and funding opportunities to implement both the capital and programmatic elements of the comprehensive stormwater plan, or Plan. Table 8-1 represents a current snapshot of agencies and organizations with resources that can assist with the implementation of the stormwater outreach and education. A phased campaign schedule and list of suggested activities and resources is provided at Table 8-2.

8.2 Program Management, Public Education, and Engineering

8.2.1 Program Management

Stormwater program management includes budgeting stormwater-related projects and activities, staff work planning, regulatory compliance, resource allocation, and supervision. It also includes coordination between staff and elected officials regarding stormwater planning and policies, and coordinating with outside agencies and organizations supporting the implementation of the Plan, and the outreach and education elements (Campaign). It was estimated, with input from Town staff, that the existing effort for these tasks is approximately 0.25 FTE, and staff preference is to contract these requirements and provide contract management oversight in the overall implementation. See Table 8-1.

8.2.2 Public Education and Outreach

The Town will implement a public education and outreach program, or Campaign that inspires the majority of residents to participate in the implementation of the Plan that recruits champions who in turn recruit and educate others to change behavior, and creates a vibrant and decentralized implementation of LID practices. Table 8.1 identifies education and outreach expenditures totaling $1,910 in 2013. This does not cover the education and outreach needs of the program. Rather, this amount represents the remnant monies not used for maintenance (SWM Element 5) or other activities (SWM Element 10). A successful Campaign conducted around implementing the Plan will accomplish these objectives:

- Educates and inspires Eatonville residents to change behavior that ultimately reduces stormwater impacts on the downstream reaches of Ohop Creek, Mashel River, and Lynch Creek that flow into the Nisqually River and eventually Puget Sound.
- Creates the opportunities for all Eatonville residents to participate in the implementation of the Plan in a meaningful way.
- Informs and attracts outside investors of resources and develops partnerships and collaborations as a way for others to participate.
- Completes the funding and implements the capital and programmatic elements of the Plan.

8.2.2.1 Partnerships and Collaboration

Partnership, collaboration and creating advocacy are essential to leveraging the limited outreach and education and capital funding resources that will be generated by the stormwater utility. This section describes the highest priority opportunities with additional opportunities identified in Table 8-1.

- The Nisqually Tribe and its Natural Resources Division represent the Nisqually Watershed as the lead entity in a number of forums that are important to the Plan implementation. Lead entities are local, watershed-based organizations that develop local salmon habitat recovery strategies and then recruit organizations to do habitat protection and restoration projects that will implement the strategies. The Natural Resources Division serves as the technical lead entity and salmon recovery coordinator for the Tribe, manages the projects lists that are proposed for SRFB and other regional funding, and develops the scope of work and contracts for EPA Tribal Grants for Action Agenda implementation. The Natural Resources Division also works closely with the Town of Eatonville staff to implement and maintain essential habitat improvements along Ohop Creek, Lynch Creek and the Mashel River, three key spawning tributaries of the Nisqually River that intersect the Town's boundaries. Natural Resources has also partially funded the Town Planner position for the past few years as an investment into implementing and maintaining habitat improvement projects. This is an essential relationship to continue and further develop.

- The Nisqually River Foundation is a 501(c)3 organization that provides staff support to the Nisqually River Council, develops and maintains the Nisqually Watershed Stewardship Plan, and manages a number of ongoing grant opportunities. The Town has a seat on the River Council, which meets monthly. The Foundation is currently leading an EPA grant funded, two-year (2013-2014), rain garden training and implementation program that will install 6 to 8 rain gardens in priority locations in the Town. This $130,000 program brings together a number of support organizations to install LID

Table 8-1: Collaboration and Partnership Opportunities

Organization	Program	Type	Web Site Address	Contact Info	Notes
Nisqually Tribe	Lead Entity for Salmon Recovery	Tribal	http://www.nisqually-nsn.gov	Cynthia Iyall, Tribal Chair, 360.456.5221	Charitable Fund proponent; Advocacy for Plan and Campaign
Nisqually Tribe Natural Resources	Salmon Recovery Technical Support to Tribe	Tribal	http://www.nisqually-nsn.gov/content/natural-resources	David Troutt, Director, 360.456.5221 x2134	Advocacy and resource support for Plan and Campaign implementation; Nisqually Stream Stewards support to outreach and education
Nisqually River Council (NRC)	Nisqually River Stewardship	NGO	http://nisquallyriver.org	Ashley Von Essen, Nisqually River Council Program Coordinator, 360.438.8715	Advocacy for Plan and Campaign; Eatonville has seat on the Council
Nisqually River Foundation (NRF)	Support to NRC	NonProfit	http://nisquallyriver.org/who-we-are/nisqually-river-foundation/	Justin Hall, Executive Director, NRF, 360.438.8715	Grant funding support; River Education Project; Advocacy for Plan and Campaign; Representation on Alliance for Healthy South Sound
Nisqually Land Trust	Natural Resource Conservation	NonProfit	http://www.nisquallylandtrust.org/	Joe Kane, Executive Director, 360.489.3400	Land acquisition in Eatonville; potential stormwater infiltration areas; Advocacy for Plan and Campaign
Stewardship Partners	Natural Resource Conservation	NonProfit	http://www.stewardshippartners.org/	David Burger, Executive Director, 206.292.9875	Advocacy for Plan and Campaign; funding for rain garden construction, outreach and education
WSU Extension	LID Education	University	http://puyallup.wsu.edu/stormwater/	Curtis Hinman, Director, 253.445.4590	Outreach and education support; Pierce County WSU Extension; Advocacy for Plan and Campaign
Pierce Conservation District	Natural Resource Conservation	Special Purpose District	http://www.piercecountycd.org/funding.html	Ryan Mello, Executive Director, 253.845.9770 x107	Green Partnership Fund; staff support to outreach and education for Campaign; outside grant support
Pierce County SWM	NPDES Management	County	http://www.co.pierce.wa.us/index.aspx?NID=1595	Harold Smelt, Director, 253.798.2725	Interlocal agreement; grant partnership opportunities; outreach and education support staff; Advocacy for Plan and Campaign
Pierce County SWM	Outreach and Education	County	http://www.piercecountywa.org/index.aspx?NID=2812	Tiffany Odell, Outreach and Education Coordinator, 253.798.2468	SWM staff support for education activities, campaign information sharing and collabortion
Pierce County Executive	Pierce County Sustainability Program	County	http://www.co.pierce.wa.us/?nid=2058	Ryan Dicks, Sustainability Manager, 253.798.8603	Advocacy for Plan and Campaign; outreach and education support

Table 8-1: Collaboration and Partnership Opportunities, cont.

Organization	Program	Type	Web Site Address	Contact Info	Notes
Eatonville Chamber of Commerce	Business Advocacy and Development	NonProfit	http://www.eatonvillechamber.com/	Jackie Sparrow, Treasurer, 360.832.6165	Advocacy and outreach support for Plan and Campaign; recruit businesses as early adopters for LID retrofit
Eatonville School District	Education	K-12 Schools	http://www.eatonville.wednet.edu/education/school/school.php?sectionid=150&	Rich Stewart, Superintendent, 360.879.1026	Outreach and education support and advocacy for Plan and Campaign; students engaged in NRF rain garden programs;
State Legislature	Funding and Policy	State	http://app.leg.wa.gov/DistrictFinder/	District 2 - Senator Becker, Rep Wilcox, Rep Alexander	Legislative advocacy for Plan and Campaign
Federal Legislature	Funding and Policy	Federal	http://www.govtrack.us/congress/members/WA/8	Senators Murray and Cantwell; Rep Reichert	Legislative advocacy for Plan and Campaign
Pierce County Council District 3	Funding and Policy	County	http://www.co.pierce.wa.us/index.aspx?NID=1382	Jim McCune, County Councilmember, 253.798-6626	Legislative advocacy for Plan and Campaign; possible County resources for Plan and Campaign
Puget Sound Regional Council	Outreach and Resources	NGO	http://www.psrc.org	Rick Olson, Dir Gov Relations & Media, 206.971.3050	Legislative advocacy and regional outreach support for Plan and Campaign
Master Builders Association Pierce County	Built Green	NGO	http://www.builtgreenpierce.org/about.php	Tiffany Speir, Executive Officer, 253.272.2112	Built Green promotes site ecosystem protection, water conservation, and "green" building materials. Advocacy for Plan and Campaign
Earth Economics	Natural Resource Conservation	NonProfit	http://www.eartheconomics.org/Default.aspx	Jennifer Harrison Cox, Managing Director, 253.539.4801	Advocacy for Plan and Campaign
NW EcoBuilding Guild South Sound Chapter	Sustainable Building Technology	NonProfit	http://www.ecobuilding.org/guild-chapters/olympia	John Ketola, Steering Committee President, 360.456.1224	Advocacy for Plan and Campaign
Ched-Angier Production Co	Saving the Ocean Series and River of Kings Producer	For Profit	http://chedd-angier.com/pages/aboutus.html	Anne-Marie Singh, Associate Producer, 617.987.0700 x4	Advocacy and potential donor contacts for Plan and Campaign implementation; national distribution for updates of River of Kings

Table 8-1: Collaboration and Partnership Opportunities, cont.

Organization	Program	Type	Web Site Address	Contact Info	Notes
Pierce County Solid Waste Management	Environmental Education Program for Secondary Schools	County	http://www.piercecountywa.org/index.aspx?NID=1507	Ryan Misley, Environmental Educator, 253.798.4685	Resources for outreach and education support in local schools
National Wildlife Federation	Protecting Puget Sounds Flood Plains	NonProfit	http://www.nwf.org/Pacific-Region.aspx	206.285.8707	Advocacy for Plan and Campaign; outreach and education support
The Rose Foundation	Watershed Protection	NonProfit	http://www.rosefdn.org/section.php?id=156	510.658.0702	Watershed Grants geared towards larger groups who are prepared to submit a detailed proposal and administer a large grant. Anticipated that Watershed Grants will range from $10,000 - $60,000.
Forterra	Natural Resource Conservation	NonProfit	http://www.forterra.org/	Jordan Rash, Conservation Director, 253.274.5673	New financing tools and support NLT as needed on transactions or helping Eatonville density as in smart growth development
Puget Sound Partnership (PSP)	Puget Sound Recovery	State	http://www.psp.wa.gov/staff.php	Stephanie Suter, Ecosystem Recovery Coordinator, 360.464.2013	Advocacy for Plan and Campaign; project coordination between Town, Tribe, LIO and Alliance; early alert for grant opportunies
ECONet PSP	Outreach	State & County	http://www.psp.wa.gov/econet.php	Chris Towe, Pierce County ECO Net Coordinator, 253.845.2973	ECO Net resources, Puget Sound Starts Here campaign information, press releases, event flyers, publications; early alert for grant opportunies
Mount Rainier National Park	Park Management	Federal	http://www.nps.gov/mora/index.htm	Randy King, Superintendent, 360.569.2211	Advocacy for Plan and Campain; majority of Park employees live in Eatonville
Association of Washington Cities	Outreach and Resources	NGO	http://www.awcnet.org	Michelle Harvey, 360.753.4137	Advocacy for Plan and Campaign; Municipal Excellence Awards
Resource Media	Media Technical Support	NonProfit	http://www.resource-media.org	Brendan McLaughlin, Managing Program Director, 206.374.7795 x108	Technical media support; possible grant support through TRFF
KCTS 9	Media Production	NonProfit	http://kcts9.org/programs	Katie Campbell, Multimedia Journalist, 206.443.7235	Environmental and stormwater focus; create advocacy for Plan and Campaign

Table 8-1: Collaboration and Partnership Opportunities, cont.

Organization	Program	Type	Web Site Address	Contact Info	Notes
NW Trek	Tacoma Metro Parks	Special Purpose District	http://www.nwtrek.org/	Jessica Moore, Ed Program Coord, 360.832.7160	Outreach and education support and advocacy for Plan and Campaign; Eatonville residents use Trek
Thurston County	LID Incentive Progam	County	http://www.co.thurston.wa.us/stormwater/utility/utility-credit.html	Rich Doenges, 360.754.4106	Information resource support for varying incentive programs
City of Puyallup	LID Incentive Progam	City	http://www.cityofpuyallup.org/services/public-works/stormwater-management/programs/puyallup-rain-gardens/	Joy Rodriguez, Associate Stormwater Engineer, 253.841.5549	Information resource support for cost share incentive program
Salmon Safe	Natural Resource Conservation	NonProfit	http://salmonsafe.org	Dan Kent, Executive Director, 503.232.3750	3rd party certification for surface water credit program; Salmon Safe designation for the Town
Earth Systems NW	Rain Water Harvesting	For Profit	http://www.earthsystemsnw.com	Bruce Hostetter, Owner, 206.619.4773	Rain water harvesting consulting and Campaign resource; Advocacy for Campaign and Plan

projects in priority infiltration areas identified in the Plan, trains and leads local high school students to design and install rain gardens as part of their senior culminating graduation requirements, and delivers an outreach and education message to Eatonville residents. The Town should collaborate with the Foundation and River Council to guide this project and develop with the Foundation future grant opportunities with outside organizations, such as the EPA, The Russell Family Foundation, and the Boeing Corporation.

- Stewardship Partners and Washington State University Extension launched in 2011 the 12,000 Rain Gardens in Puget Sound campaign, whose goal is to see 12,000 rain gardens installed within the 12 Puget Sound counties by 2016. Rain gardens that have been installed in Eatonville are included in the registry that is part of the campaign. Both organizations actively support rain garden construction, outreach, and education. Stewardship Partners, a Seattle based nonprofit, has extensively supported rain garden construction in Eatonville and is prepared to invest in additional grant-funded clustered rain garden and related LID installations in the future.

- The Pierce Conservation District (PCD) is a special purpose non-regulatory agency authorized by the State Legislature to protect and conserve the natural resources of Pierce County. It promotes sustainable agriculture by assisting local individuals and communities across Pierce County. The PCD is staffed and willing to provide to the Town a number of value added services, detailed below, that would directly support implementation of the Plan if the Town Council adopts a resolution allowing the Pierce County Assessor-Treasurer to assess rates to fund the programs of the PCD. The process steps are outlined in the Appendix I - Pierce Conservation District. The annual rate per parcel varies according to use, between $3.95 and $5, or a total between $5,056 and $6,400 each year. Other Pierce County jurisdictions that are PCD members include: Buckley, DuPont, Fircrest, Gig Harbor, Lakewood, Milton, Puyallup, Steilacoom, Sumner, Tacoma, University Place. Unincorporated Pierce County Pierce Country properties surrounding Eatonville, and the County as a whole, participate in this program.

Example PCD services related to stormwater:

- Water quality monitoring and water quality monitor volunteer training and management
- Volunteer recruiting and management of LID project implementation, such as rain gardens, rain barrels, pervious pavers and detention cisterns
- Access to various free workshops for landowners related to water quality improvement, LID, land management, etc.
- Conservation project scoping, assistance with project design, and implementation
- Participation in its municipal employees' Stormwater Roundtable
- Other sustainable agriculture, water quality, soil conservation, and stormwater improvement related services and programs

- Pierce County Surface Water Management (SWM). The Town of Eatonville is uniquely located at the nexus of Ohop Creek, Mashel River and Lynch Creek, important salmon spawning tributaries of the Nisqually River. Stormwater from the Town exits its boundaries and flows essentially untreated into these stream reaches that are managed by Pierce County. This creates a logical partnership opportunity between the Town and Pierce County, who operates under a Phase I NPDES permit issued by the Department of Ecology. SWM is the technical entity that develops and implements capital and outreach and education programs to keep the County in compliance with its Phase I permit responsibilities. Eatonville can explore leveraging its limited capital and outreach and education stormwater utility funds by negotiating an interlocal agreement with SWM. The agreement would describe how each would share funding opportunities, such as access to SWRLID grant programs, reduced cost use of SWM outreach and education materials, and stormwater monitoring. Joint grant applications between jurisdictions for SWRLID and related grant programs are more highly valued and are seen as more competitive.

- The Puget Sound Partnership (Partnership) is the Washington State agency tasked with coordinating the recovery of Puget Sound. The Partnership's Action Agenda prioritizes cleanup and improvement projects, coordinates federal, state, local, tribal and private resources, and ensures cooperative engagement. The Partnership through its Agenda recognizes that runoff from roads, roofs, parking lots, and other pollution generating surfaces is the biggest threat to Puget Sound's water quality. The Town of Eatonville creates advocacy for its exemplary stormwater capital and education/outreach program by collaboratively engaging the Partnership through the organizations it has developed that prioritize and implement corrective actions. The entry point for the Town for this relationship building is through its representatives on the Alliance for a Healthy South Sound, the local integrating organization. The Alliance meets regularly and has created in-depth processes through which it is refining a list of key threats to ecosystem health. It is articulating strategies and actions that support ecosystem recovery. The Action Agenda contains references, shown below, which appear to show a path for the Town to join the process.

    1. Alliance strategic initiatives – page 430 provides this detail:

       <u>Strategic Initiative: Prevention of Pollution from Urban Stormwater Runoff</u>
       Support non-NPDES mandated stormwater programs in smaller communities (e.g.; Eatonville)

    2. Alliance advocacy roles - page 433 establishes this:

Advocacy	Notes
Support efforts of non-NPDES mandated communities to manage stormwater	Small communities may wish to emulate the Eatonville stormwater management program with, but not limited to, LID and rainwater gardens

- The Puget Sound Partnership's EcoNet or Education, Communication and Outreach Network, is a Sound-wide network of professionals working to help save Puget Sound, and there are twelve local ECO Networks across the twelve Puget Sound Counties. Eatonville is represented in the Pierce County EcoNet, hosted and coordinated by the Pierce Conservation District. Town staff will receive training through the Pierce County EcoNet in the use of social media tools, use of press release and event templates, and logos to create a local implementation of the Puget Sound Starts Here campaign. The EcoNet is also a valuable source of newly released grant information that will help the Town implement its Plan. EcoNet is a collaboration forum where grant resources may be shared and a forum for the Town to share information of the progress of its unique Plan implementation.

- Resource Media is a nonprofit media and communications organization that can help the Town implement its outreach and education program and reach donors and granting organizations for the long term capital program. Resource Media can create the branding and marketing tools that will help define success, identify target audiences and values, and tactics that make sense given available resources. Resource Media has a long standing working relationship with The Russell Family Foundation. It is very possible that TRFF would respond favorably to an Eatonville grant request to fund a support contract with Resources Media.

8.2.2.2 LID Program Incentives

The Town's outreach and education campaign has been underway for some time. This section includes additional ideas and perspective for its evolution and development. The Campaign is a choreographed mix of many individual and group efforts, developed and implemented over multiple years. These efforts are bound together by the objectives described above, by the creativity and determination of the Eatonville residents and its leadership, and by the collaboration with partners and the resources and energy those relationships will bring. Campaign highlights and resources are discussed here, and a phased Campaign schedule and list of suggested activities is provided at Table 8-2.

Table 8-2: 5 Year Campaign Schedule

Campaign Activity and Resources	Lead (L) and Supporting (S) Partners	Notes
Year 1: 1st Quarter		
Develop detailed campaign implementation plan - annual updates	L-Town; S-NRF	Utilize outline and shape according to anticipated resources. Create detailed plan for 1st year and placeholders for rest. NRF, Nisqually River Foundation
Press release and announcements of Plan and Campaign	L-Town; S-NRF, PCD	Announce 2-year NRF Rain Garden Program; Borrow from Puget Sound Starts Here (PSSH) Pierce ECO Net and other campaigns; mailers in utility bills to all rate payers; in depth Eatonville Dispatch news story
Assess grant and partnership opportunities	L-Town; S- NRF, Advisory	Regularly attend Nisqually River Council Meetings - brief on Plan and Campaign
NRF Rain Garden design efforts underway	L-NRF	Establish rain garden locations and working, rain garden design with students, recruiting business owners
Grant applications	L-Town, NRF	National Estuary Program, The Russell Family Foundation, Boeing Corporation
Year 1: 2nd Quarter		
Submit capital projects to 3-year HWS	L-Town; S-NRD	NRD, or Natural Resources Division, Habitat Work Schedule, or HWS
Prepare Town Council for Pierce Conservation District (PCD) Resolution	L-Town; S-PCD	
Establish advisory committee	L- Town; S-NRF	Broad representation to guide Campaign and Plan
Develop media tools	L-NRF; S-Town	FaceBook, Twitter, website Update, campaign brochure, event templates and slide presentation
NRF Rain Garden design efforts underway	L-NRF	Outreach to school district and Eatonville residents continues
Nisqually Streams Stewards Events	L-NRD; S-NRF	Rain garden maintenance event or related

Table 8.2: 5 Year Campaign Schedule

Campaign Activity and Resources	Lead (L) and Supporting (S) Partners	Notes
Year 1: 3rd Quarter		
NRF rain garden installation event	L-NRF; S-Town	Rain garden installation
Negotiate interlocal agreement with Pierce County SWM	L-Town; S-PCD, NRF, NCR, Others	Coordinated effort between PCD, NRF, NRC, and Town staff
Outreach to recruit additional collaboration partners	L-Town; S-PCD, NRF	Assumes Town joins PCD, who will develop staff support plan; plan with additional partners
Grant Applications	L-Town, NRF, PCD, SP	Green Partnership Fund, Nisqually Charitable Fund, others
Define and develop target audience sectors	L-NRF, PCD, SP, Advisory; S-Town	Create market segments and contact methods
Media consultant hired; Campaign and Plan Consultant hired	L-Town; S-RM, NRF, Advisory	Assumes grant from TRFF to hire consultant and assumes Resource Media (RM); tools and messaging developing for target audiences; assumes Boeing or other grant to hire stormwater plan coordinator
Stewardship Partners (SP) Rain Garden Installation Event	L-SP; S-NRF, PCD	Assumes rain garden cluster or mix of LID installations - pervious pavers, rain barrels, detention cisterns, rain garden maintenance
Salmon Days Outreach Event	L-NSS, NRF, PCD	Annual Eatonville outreach event
Year 1: 4th Quarter		
NRF Rain Garden community education events; Nisqually Land Trust activities (NLT); Nisqually Stream Stewards (NSS)	L-NRF, NLT	Winter planting events in and around Eatonville; maintain NLT properties in Eatonville; classroom activities around rain garden design
Update Detailed Campaign Plan for Year 2	L-Town; S-Media, Advisory	Update market sectors, lessons learned, assess grant and other available resources
Update Plan and Campaign to advocacy groups	L-Town; S-NRF	Healthy South Sound Alliance, NRC, Association of Washington Cities, PSRC, elected officials

Table 8.2: 5 Year Campaign Schedule

Campaign Activity and Resources	Lead (L) and Supporting (S) Partners	Notes
Year 2: 1st Quarter		
Press release and announcements of Plan and Campaign Updates	L-Town; S-NRF, PCD	2-year NRF Rain Garden Program update; mailers in utility bills to all rate payers; in depth media news event
NRF Rain Garden design efforts underway	L-NRF	Rain garden design with students, recruiting business owners
Grant applications	L-Town	National Estuary Program; The Russell Family Foundation; Boeing Corporation
Special announcement of available incentives	L-Town	Based on stormwater utility budget and available grants
Year 2: 2nd Quarter		
Puget Sound Starts Here (PSSH) community event	L-SWM, PCD; SNRF	Placeholder for Campaign community event; Borrow from Puget Sound Starts Here (PSSH) Pierce ECO Net and other campaigns
Submit capital project updates to 3-year HWS	L-Town; S-NRD	Habitat Work Schedule
Nisqually Streams Stewards Events	L-NRD; S-NRF	Rain garden maintenance or other Eatonville event
Year 2: 3rd Quarter		
NRF rain garden installation event	L-NRF; S-Town	Rain garden installation - celebrate accomplishments at end of two year program
Grant applications	L-Town, NRF, PCD, SP	Green Partnership Fund, Nisqually Charitable Fund, others

Table 8.2: 5 Year Campaign Schedule, cont.

Campaign Activity and Resources	Lead (L) and Supporting (S) Partners	Notes
Salmon Days Outreach Event	L-NSS, NRF, PCD	Annual Eatonville outreach event
Outreach to recruit additional collaboration partners	L-Town; S-PCD, NRF	Develop staff support plan; plan with additional partners
Year 2: 4th Quarter		
Stewardship Partners (SP) Rain Garden Installation Event	L-SP; S-NRF, PCD	Assumes rain garden cluster or mix of LID installations - pervious pavers, rain barrels, detention cisterns, rain garden maintenance
NRF Rain Garden community education events; Nisqually Land Trust activities (NLT); Nisqually Stream Stewards (NSS)	L-NRF, NLT	Winter planting events in and around Eatonville; maintain NLT properties in Eatonville; classroom activities around rain garden design
Update Detailed Campaign Plan for Year 3	L-Town; S-Media, Advisory, Others	Update market sectors, lessons learned, assess grant and other available resources
Update Plan and Campaign to advocacy groups	L-Town; S-NRF	Healthy South Sound Alliance, NRC, Association of Washington Cities, PSRC, elected officials
Year 3: 1st Quarter		
Press release and announcements of Plan and Campaign Updates	L-Town; S-NRF, PCD	2-year NRF Rain Garden Program update; mailers in utility bills to all rate payers; in depth media news event
Special announcement of available incentives	L-Town; S-NRF	Based on stormwater utility budget and available grants
Year 3: 2nd Quarter		
Puget Sound Starts Here (PSSH) community event	L-SWM, PCD	Placeholder for Campaign community event; Borrow from Puget Sound Starts Here (PSSH) Pierce ECO Net and other campaigns
Submit capital project updates to 3-year HWS	L-Town; S-NRD	Habitat Work Schedule
Nisqually Streams Stewards Events	L-NRD; S-NRF, Others	Rain garden maintenance or other Eatonville event

Table 8.2: 5 Year Campaign Schedule, cont.

Campaign Activity and Resources	Lead (L) and Supporting (S) Partners	Notes
Year 3: 3rd Quarter		
Stewardship Partners (SP) Rain Garden Installation Event	L-SP; S-NRF, PCD	Assumes rain garden cluster or mix of LID installations - pervious pavers, rain barrels, detention cisterns, rain garden maintenance
Grant applications	L-Town, NRF, PCD, SP	Green Partnership Fund, Nisqually Charitable Fund, others
Salmon Days Outreach Event	L-NSS, NRF, PCD	Annual Eatonville outreach event
Outreach to recruit additional collaboration partners	L-Town; S-PCD, NRF	Develop staff support plan; plan with additional partners
Year 3: 4th Quarter		
Update Detailed Campaign Plan for Year 4	L-Town; S-Media, Advisory, Others	Update market sectors, lessons learned, assess grant and other available resources
NRF Rain Garden community education events; Nisqually Land Trust activities (NLT); Nisqually Stream Stewards (NSS)	L-NRF, NLT	Winter planting events in and around Eatonville; maintain NLT properties in Eatonville; classroom activities around rain garden design
Present updated Plan and Campaign to advocacy groups	L-Town; S-NRF	Healthy South Sound Alliance, NRC, Association of Washington Cities, PSRC, elected officials
Year 4: 1st Quarter		
Press release and announcements of Plan and Campaign Updates	L-Town; S-NRF, PCD	Announce rain garden installation program; mailers in utility bills to all rate payers; in depth media news event
Special announcement of available incentives	L-Town	Based on stormwater utility budget and available grants

Table 8.2: 5 Year Campaign Schedule, cont.

Campaign Activity and Resources	Lead (L) and Supporting (S) Partners	Notes
Year 4: 2nd Quarter		
Puget Sound Starts Here (PSSH) community event	L-SWM, PCD, Others	Placeholder for Campaign community event; Borrow from Puget Sound Starts Here (PSSH) Pierce ECO Net and other campaigns
Submit capital project updates to 3-year HWS	L-Town; S-NRD	Habitat Work Schedule
Nisqually Streams Stewards Events	L-Town; S-NRF	Rain garden maintenance or other Eatonville event
Year 4: 3rd Quarter		
Grant applications	L-Town, NRF, PCD, SP	Green Partnership Fund, Nisqually Charitable Fund, others
Salmon Days Outreach Event	L-NSS, NRF, PCD	Annual Eatonville outreach event
Outreach to recruit additional collaboration partners	L-Town; S-PCD, NRF, Others	Develop staff support plan; plan with additional partners
Year 4: 4th Quarter		
Update Detailed Campaign Plan for Year 5	L-Town; S-Media, Advisory, Others	Update market sectors, lessons learned, assess grant and other available resources
Present updated Plan and Campaign to advocacy groups	L-Town; S-NRF	Healthy South Sound Alliance, NRC, Association of Washington Cities, PSRC, elected officials
NRF Rain Garden community education events; Nisqually Land Trust activities (NLT); Nisqually Stream Stewards (NSS)	L-NRF, NLT	Winter planting events in and around Eatonville; maintain NLT properties in Eatonville; classroom activities around rain garden design
Stewardship Partners (SP) Rain Garden Installation Event	L-SP; S-NRF, PCD	Assumes rain garden cluster or mix of LID installations - pervious pavers, rain barrels, detention cisterns

Table 8.2: 5 Year Campaign Schedule, cont.

Campaign Activity and Resources	Lead (L) and Supporting (S) Partners	Notes
Year 5: 1st Quarter		
Press release and announcements of Plan and Campaign Updates	L-Town; S-NRF, PCD	Announce rain garden installation program; mailers in utility bills to all rate payers; in depth media news event
Special announcement of available incentives	L-Town	Based on stormwater utility budget and available grants
Year 5: 2nd Quarter		
Puget Sound Starts Here (PSSH) community event	L-SWM, PCD	Placeholder for Campaign community event; Borrow from Puget Sound Starts Here (PSSH) Pierce ECO Net and other campaigns
Submit capital project updates to 3-year HWS	L-Town; S-NRD	Habitat Work Schedule
Nisqually Streams Stewards Events	L-Town; S-NRF	Rain garden maintenance or other Eatonville event
Year 5: 3rd Quarter		
Stewardship Partners (SP) Rain Garden Installation Event	L-SP; S-NRF, PCD	Assumes rain garden cluster or mix of LID installations - pervious pavers, rain barrels, detention cisterns
Outreach to recruit additional collaboration partners	L-Town; S-PCD, NRF	Develop staff support plan; plan with additional partners
Grant applications	L-Town, NRF, PCD, SP	Green Partnership Fund, Nisqually Charitable Fund, others

- Eatonville is the Rain Garden Capital. Low summer flows and polluted rain water endangering salmon and degrading spawning habitat prompted a blitz of grant funded rain garden construction and generated positive national media attention over the past several years. The almost 30 rain gardens installed in Eatonville since 2008 against a population of 2,500 sets up the claim that Eatonville has the highest per-capita rain gardens installed of any jurisdiction in the United States.

  This claim was repeated in a two-episode PBS documentary, River of Kings, filmed entirely in the Nisqually Watershed and portions in the Town of Eatonville. River of Kings is currently being broadcast nationally on local PBS stations across the county, and it aired in the Pacific NW February 2013. These episodes are part of a larger collection of documentaries in the Saving the Ocean series, hosted by marine biologist Carl Safina, who travels the world seeking out a far-flung group of unsung heroes – scientists, conservationists, local communities - that are hard at work inventing, advocating, and implementing solutions.

  Safina describes, in the River of Kings, the unusual Nisqually Watershed coalition of Tribal leaders, private partners, and government agencies working to restore the river from top to bottom, from its source in the glaciers of Mount Rainier to the estuary that empties into Puget Sound. The Eatonville segment illustrates how the Town is implementing solutions to mitigate the urban stormwater impacts on local streams and contribute to salmon recovery.

  The online video, transcript, and current play schedule create an almost readymade media kit that can be used to strengthen branding Eatonville as the rain garden capital and to reach out to donors regionally and nationally that supported funding the Saving the Ocean series. Follow-on media efforts can include filming short interview updates and pairing some of the series' subjects to show how progress is being made with stormwater protections in the Town. A coordinated Campaign effort can keep Eatonville in the positive media spotlight by following up with the Saving the Ocean producer to offer these as introductions to the episodes now being shown on local public television stations around the county. Weaving all of this into the local education campaign continually reminds Eatonville residents and partners they are creating success.

  Thirty rain gardens constructed in Eatonville, and more on the way, is the result of several years of collaborative effort by many of the partners listed before - Nisqually River Foundation and its Education Program, Stewardship Partners, Town of Eatonville residents, and the Nisqually Tribe and its Stream Stewards education program. The Nisqually River Foundation continues to duplicate this success by leading a well-financed grant effort to construct six to eight rain garden installations over a two-year period, recruiting high school students to lead the planning and installation as a fulfillment of their culminating project requirements for graduation. Adult mentors, rain garden installation contractors, and outreach partners will assist implementing the extensive education, installation and outreach activities that are planned. Rain garden project sites selected will be consistent with the capital project location plan that the Plan update team has developed. This is an extraordinary opportunity for the Town to leverage an already-funded project that meets the Campaign objectives and promises to infiltrate stormwater into target areas.

- Campaign resources and planning. Suggested campaign resources, some which will have to be created or identified, are described in some detail here with additional detail provided in Table 8-2.

  Create media outreach tools. A full suite media tool box is necessary to help define and communicate the Plan and the Campaign. These tools and their maintenance may require the assistance of a professional media organization. These can include:
  - Developing a separate Campaign website or augmenting the existing Town website that describes the Plan, the Campaign and progress (requires regular updates)
  - Establishing Facebook, Twitter and other social media presence that announces activities and progress (requires regular updates)
  - Developing a compelling slide presentation that describes the Town, its unique location in the watershed, the stormwater problem it is trying to solve, the Plan and the steps and progress being made (requires regular updates)
  - Developing equally compelling presentation brochures and handout materials (requires regular updates)
  - Creating event, outreach and press release templates
  - Creating messaging and branding development, such as “Eatonville – the Rain Garden Capital” and “Disconnect Eatonville” slogans and logos

- Establishing an advisory group. Creating a broadly represented advisory group will help guide and inform the development of the Campaign and implementation of the Plan. This can include interested home, business, and institutional surface water rate payers, Town Council and staff, property managers and real estate professionals, business association members, interested collaborative partners, and the general public.

  Creating advocacy can begin with identifying the Eatonville organizations and residents that are willing to assist this effort by becoming informed and then recruiting others to deliver the Campaign message. This peer-to-peer and one-on-one communications method was used successfully to recruit homeowners “champions” to install and plant the clusters of rain gardens at their properties along Eatonville’s Baumgartner Place North and Orchard Avenue. The advisory group can help get things started identifying these resources.

  Identifying and understanding target audiences will help in crafting and delivering specific messages to get the desired results. One target audience can be the pool of surface water rate payers who will be affected by a change in surface water fees and who may be interested in implementing LID or taking advantage of a specific incentive program. Helpful information to develop would be name, site location, type of property, amount of impervious surfaces, additional contact information, and the priority for LID implementation.

  Other audience segments can include students in schools and at different class levels, the public who don’t live in Town but utilize services or provide services, and so on. The advisory group and media support can assist with the identification of relevant groups and how to reach them.

- Identifying and prioritizing incentive LID programs. Incentives, more fully described under Section 9.3.3, can include incentives and cost share that are grant-based as funds are available, such as rain garden installations, rain barrel and detention cistern installation, and pervious driveways or sidewalks. Incentives can also be ongoing and permanent surface water rate reductions associated with the retrofit installation of LID BMPs. Incentives are resources, which when highlighted and included in the Campaign, can help create interest and enthusiasm for the Plan implementation.

- Prioritizing capital and programmatic grant fund opportunities. Implementing the Plan will take a multi-year effort and careful allocation of Town and collaborative partner resources. Time should be given to analyzing the lists provided, identifying additional opportunities, and prioritizing for action the most valuable use of limited staff resources. Stormwater impacts on Puget Sound are increasingly being recognized as one of the highest priorities for the allocation of state and federal resources.

  Establishing and maintaining collaborative partnerships is essential for the implementation of the Plan, the Campaign, and creating advocacy. The partnerships and collaboration strategies identified here include several relationships that are already in place. As with grant fund opportunities, the Town staff and partners should analyze these and other opportunities and reach out to the principals in each funding organization.

8.2.3 Engineering

Engineering associated with stormwater management includes many activities, including: plan review and construction inspection, engineering for minor drainage problems, maintaining stormwater system data such as the Town's mapping and stormwater facilities inventory, stormwater system planning, development and administration of construction standards, response to drainage complaints, and engineering support for maintenance programs.

Based on conversations with Town staff, engineering activities are integrated with the stormwater program management responsibilities, and there currently is no position responsible for program management. The Town will also need to initiate an inspection program for private drainage facilities and an illicit discharge detection and elimination (IDDE) prevention program. IDDE is needed to support the Nisqually River Basin Water Quality Implementation Plan for Lynch Creek which is the Total Maximum Daily Load (TMDL) plan for Fecal Coliform Bacteria and Dissolved Oxygen. The Town should consider budgeting approximately $40,000 for the initial detection, survey, and mapping of illicit discharges into its stormwater system.

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Section 9
FUNDING ANALYSIS

9.1 Introduction

This section documents and analyzes the Town's Storm Drain Fund (SDF) fees and revenues. A stormwater rate analysis was conducted to determine a reasonable SDF fee to generate additional revenue for the Town's future Stormwater Management Program (SWM). The Town's existing SWM Program is underfunded and understaffed, as presented below.

9.2 Existing Stormwater Utility, Fees and Revenue

In 2012, the Town adopted Resolution 2012-III that set rates for a storm drainage service charge. The rates set forth in this resolution were developed to be consistent with the methods and approach contained in the 2003 Program. See Appendix J for Resolution 2012-III.

Resolution 2012-III established six types of users ranging from Residential Users to Large Commercial Users. Table 9.1 provides the total number of rate users by type and their 2013 monthly storm drainage service charge.

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Resolution 2012-III established six types of users ranging from Residential Users to Large Commercial Users. Table 9-1 provides the total number of rate users by type and their 2013 monthly storm drainage service charge.

Table 9-1: Stormwater Fee User and Monthly Rate

Rate User Description	Total Number of Users	2013 Monthly Storm Drainage Service Charge
Total Storm Large Commercial	52	$22.80
Total Storm Medium Commercial	23	$15.30
Total Storm Apartments	100	$4.00
Total Storm Small Commercial	89	$7.60
Total Storm Residential	872	$7.60
Total Storm Low Income	12	$4.00 (1)
Total	**1,413**	

(1) Assumed to be equal to the lowest stormwater rate of $4.00/month.

The 2013 Budget Position Report projects the Town will generate approximately $111K in revenue from the storm drainage service charge. The Town anticipates generating an additional $93.5K from other sources of revenue, including the 2013 Budget, late penalties, storm drainage buy-in fees, investment interest, and miscellaneous revenues. The Storm Drainage Fund balance at the start of 2013 was $34K. See Appendix G for the 2012 and 2013 Budget Position Reports.

A Stormwater Rate Analysis was performed to determine a rate to generate revenue to support the SWM Program. New revenues will be used for implementing new activities of the Town's future SWM Program including: Elements #1 Public Education and Outreach, #2 Public Involvement and Participation, #5 Municipal Operation and Maintenance, and #10 Additional Activities, as described in Section 8.

A proposed rate increase of 5% each year is proposed as a baseline to account for inflation and cost of living increases. An additional $0.50 per year increase is proposed to generate additional revenue for the new activities listed above. Alternatively, the Town could elect to allocate some of the new revenue toward building a larger fund balance to be used for future grant matches and/or the design and construction of future CIP projects described in Section 6. For the purposes of this analysis, it was assumed that the number of users would not change. Table 9-2 presents the proposed annual rate increases over the next ten years.

Table 9-2: Proposed Stormwater Fee Increases

User Description	2014	2015	2016	2017	2018	2019	2020	2021	2022
Large Commercial	$24.44	$26.16	$27.97	$29.87	$31.86	$33.96	$36.15	$38.46	$40.88
Medium Commercial	$16.57	$17.89	$19.29	$20.75	$22.29	$23.90	$25.60	$27.38	$29.25
Apartments	$4.70	$5.44	$6.21	$7.02	$7.87	$8.76	$9.70	$10.68	$11.72
Small Commercial	$8.48	$9.40	$10.37	$11.39	$12.46	$13.59	$14.76	$16.00	$17.30
Residential	$8.48	$9.40	$10.37	$11.39	$12.46	$13.59	$14.76	$16.00	$17.30
Low Income	$4.70	$5.44	$6.21	$7.02	$7.87	$8.76	$9.70	$10.68	$11.72
Total Proposed Revenue	$123,931	$137,015	$150,754	$165,180	$180,327	$196,231	$212,931	$230,465	$248,876

Appendix G provides the detailed SDF rate study calculations.

Revenue from the Stormwater Utility Fee and expenditures associated with implementing the program described in this plan are identified in Table 9-3. Assuming the rate changes identified in this Plan are adopted, the Fund will generate a small balance for use on emergency activities.

Table 9-3: Stormwater Engineering, Public Education, and Program Management

Program Element	Cost
1. Surface Water Program Management	
• Budgeting	$35,000
• Funding Development	
• Work Planning	
• Resource Allocation and Staff Supervision	
• Coordination with Elected Officials and Resource Agencies	
• Engineering Plan Review	
• Maintain Drainage Inventory	
• Stormwater Planning	
• Administer Construction Standards	
2. Professional Services	
3. Insurance and Taxes	$10,000
4. Public Education	$2,000
Total	**$47,000**

The design and management of the stormwater program employs a combination of retrofit redevelopment incentives, new construction implementation of stormwater BMPs emphasizing LID practices, and integration of the Outreach Campaign, which strategically installs retrofit small-scale LID projects across the Town. The Plan identifies and ranks 14 capital projects with detailed estimates for the top six provided in Section 6.

Table 9-4: Stormwater Engineering, Public Education, and Program Management

Program Element	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Operations and Maintenance (see Section 7)	$49,305	$51,770	$54,359	$57,077	$59,931	$62,927	$66,073	$69,377	$72,846	$76,488
Program Management, Education, and Engineering (see Table 9-2)	$47,000	$49,350	$51,818	$54,408	$57,129	$59,985	$62,984	$66,134	$69,440	$72,912
Illicit Discharge Detection and Elimination (IDDE)	$10,000	$10,000	$10,000	$10,000	$2,500	$2,625	$2,756	$2,894	$3,039	$3,191
Expenditures	$106,305	$111,120	$116,176	$121,485	$119,559	$125,537	$131,814	$138,405	$145,325	$152,591
Revenue	$111,469	$123,931	$137,015	$150,754	$165,180	$180,327	$196,231	$212,931	$230,465	$248,876
Surplus/Deficit	$5,164	$12,811	$20,839	$29,269	$45,621	$54,790	$64,417	$74,526	$85,140	$96,285
Operations and Program Management Funning Balance	$5,164	$17,975	$38,813	$68,082	$113,703	$168,493	$232,910	$307,436	$392,576	$488,860

Capital improvement project costs, which were described in Section 6 and Appendix F total approximately $3,750,000 and are summarized I Table 9-5. The fund balance will be adequate to maintain the existing system, but will not generate the resources necessary to fund any but the smallest capital improvement projects. LID Project H can be funded out of the Stormwater Utility Fund beginning in 2017 or LID Project H can be funded in 2018. However, using the fund anything but the smallest of CIP construction projects will deplete it of the necessary reserves to respond to emergency repairs. Instead, the funding of the majority of the CIP list will likely continue to occur through the acquisition of grants.

Table 9-5: Summary of CIP Costs

Ranking	CIP Identification No.	Name	Opinion of Cost Total
1	LID Project B	Bioinfiltration Trench East of Madison Avenue South	$120,000
2	LID Project I	Inflitration Pond at Sewage Lagoon	$690,000
3	LID Project E	Green Street and Bioretention Trench at Center St. #1	$540,000
4	LID Project J	Green Street and Bioretention Trench at Center St. #2	$1,780,000
5	LID Project H	Drywell at Rainier Avenue South	$90,000
6	LID Project M	Green Street and Bioretention Trench at Pennsylvania Avenue North	$530,000
		Total	**$3,750,000**

9.3 Funding Opportunities and Considerations

There are a variety of grants and other funds for supplementing the monies that the Town receives from its Stormwater Utility. Most of the funding programs described below are for the planning, design and construction of new or retrofit stormwater improvements. Some of the programs would also fund the outreach and education program elements that are described in this Plan. The Department of Ecology provides capacity funds for stormwater program management, but these funds are only available to municipalities covered under an NPDES permit. This section explores many of the currently available funding opportunities as well as strategies to encourage the private construction of stormwater improvements through the incentives.

9.3.1 Funding opportunities

There are abundant local and regional grant programs available to the Town of Eatonville. These have the capacity to fund the prioritized capital projects list, both in planning and construction, and potentially the outreach and education program elements. High priority example opportunities are described in this narrative and additional opportunities are identified in Table 9-6.

Table 9-6: Grant Matrix - Eatonville

Funding Source	Program	Type	Call for Projects	App Due	Award Date	Match	Web Site Address	Contacts	Notes
Washington State Department of Ecology	National Estuary Program	State	Annually	4/5/2013	-	None	http://www.ecy.wa.gov/groundsheet/grants_fed_watershed.html	Kim Harper, 425.649.4451	Conducting watershed-based stormwater retrofit planning and pre-design in Puget Sound watersheds
Washington State Department of Ecology	SWRLID Program	State	Annually	TBA	-	25%	http://www.ecy.wa.gov/programs/wq/funding/FundingPrograms/OtherFundingPrograms/StWa12a/FY12aStWa.html	Patricia Brommer, 360.407.6216	Provides funds for permit holders to plan, design, and construct stormwater retrofit or low-impact development (LID) projects
Washington State Department of Ecology	Centennial Clean Water Grant	State	Annually	November	-	None	http://www.ecy.wa.gov/programs/wq/funding/FundingPrograms/Centennial/Cent.html	David Dunn, 360.407.6566	
Washington State Department of Ecology	Section 319 Federal Grant Program	State	Annually	December	-	None	http://www.ecy.wa.gov/programs/wq/funding/FundingPrograms/Section319/Sec319Prgm.html	Alissa Ferrell, 360.407.6509	
Washington State Recreation and Conservation Office	Land and Water Conservation Fund	State	February 1 even numbered years	May 1 - even numbered years	June 1 - odd numbered years	50%	http://www.rco.wa.gov/grants/lwcf.shtml	360.902.3000	Land acquisition for purposes on creating stormwater infiltration areas in natural and open spaces. Requires recreation and conservation plan prior to application
Washington State Recreation and Conservation Office	SRFB	State	Annually	TBA		None	http://www.rco.wa.gov/boards/srfb.shtml	Kim Gridley, 360.456.5221 x2145	Protect and restore salmon habitat. Apply through Nisqually Tribe
EPA Grants to Tribes - NWIFC	Puget Sound Action Agenda	Federal	Annually	TBA	-	None	http://www.epa.gov/pugetsound/funding/	David Troutt, 360.456.5221 x2134	Tribal projects to protect and restore Puget Sound, consistent with the Puget Sound Action Agenda. Apply through Nisqually Tribe

Table 9-6: Grant Matrix - Eatonville, cont.

Funding Source	Program	Type	Call for Projects	App Due	Award Date	Match	Web Site Address	Contacts	Notes
Nisqually Tribe	Charitable Fund	Tribal	Annually	TBA	-	None	http://www.nisqually-nsn.gov/sites/default/files/forms/2012_CharitableFundsGuidelines_Final.pdf	Chelsie Sharp, 360.456.5221 x1179	Nisqually Tribe awards grants to local charitable and government programs through a competitive grant application process
Pierce Conservation District	Green Partnership Fund	County	Annually	November	April	None	http://www.piercecd.org/gpf.html	Melissa Buckingham, 253.845.9770 x109	Grants can be used for on the ground LID projects tied to a priority stream reach. Must be a PCD member
Pierce Conservation District	Staff Support for Outreach Programs	County	Ongoing	-	-	None	http://www.piercecountycd.org/home.html	Ryan Mello, 253.845.9770 x107	Negotiated outreach services for the Town. Must be a PCD member
Greater Tacoma Community Foundation - Vibrant Community	Resource Conservation	Private	January	April	-	None	https://www.gtcf.org/vibrant-community	253.383.5622	5 focus areas including environment; $10,000 grant limit
The Russell Family Foundation	Environmental Sustainability Program	Private	October, January, July	Febuary, May, November	-	None	http://www.trff.org/environmental-sustainability/	Holly Powers, 253.857.1666	TRFF has a specific environmental focus on polluted runoff and green stormwater infrastructure outreach and education, and media and messaging development
The Boeing Corporation	Corporate Citizenship Grants	Private	Annually	March	October	None	http://www.boeing.com/boeing/companyoffices/aboutus/community/nw_region/wa_env.page	Shyla Miller, 206.851.1391	Town must partner with eligible non profit to apply for projects that implement elements of the Plan and Campaign
EcoTrust	Whole Watershed Restoration Iniative	NonProfit	December	-	-		http://www.ecotrust.org/wwri/	Kate Carone, WWRI Program Coordinator, 503.467.0814	Public-private competitive grant program that focuses on salmon habitat restoration efforts in areas of high ecological importance in Oregon, Washington and Idaho. Various funding levels

Table 9-6: Grant Matrix - Eatonville, cont.

Funding Source	Program	Type	Call for Projects	App Due	Award Date	Match	Web Site Address	Contacts	Notes
Transportation Improvement Board	Multiple programs for aterial, corrdidor, preservation and sidewalk	State	1-Jun	15-Aug	15-Nov	Based on Population	http://www.tib.wa.gov/grants/Applications.cfm	360.586.1140	Reconstructing or maintaining the transportation infrastructure. Funding is distributed regionally, with projects competing only in their own region. Possible stormwater focus
Washington State Department of Commerce	General Purpose Block Grant	State	January	-	May	None	http://www.commerce.wa.gov/Programs/Infrastructure/CDBG-Program-Overview/Pages/GeneralPurposeGrants.aspx	Kaaren Roe, 360.725.3018	Public facilities such as water, wastewater and streets - public infrastructure
USDA Rural Development	Waste and Wastewater Disposal Programs	Federal	Annually	-	-	None	http://www.rurdev.usda.gov/wa/UTLwwdlg.htm	Gayle Hoskison, 360.704.7760	Loans, grants and loan guarantees storm drainage facilities in rural areas and cities and towns of 10,000 or less. Grants to nonprofit organizations to provide technical assistance and training to assist rural communities with their water, wastewater, and solid waste problems.

- National Estuary Program (NEP) Watershed Protection and Restoration Grant program is managed by the Washington Department of Ecology. This is a multiple year program through 2016, and it is currently funded at $1.8M for 2013. Maximum grant awards are $250,000 for conducting watershed-based stormwater retrofit planning and pre-design in target watersheds in the Puget Sound basins. The Town of Eatonville applied assistance on April 5, 2013. This program varies in what it funds from year to year but the current RFP is an excellent fit for the Town's program and the intention of the funding program is to support the continued development and implementation of watershed-based retrofit projects.

- EPA Grants to the Nisqually Tribe. The Northwest Indian Fisheries Commission develops and carries out a multiple year program to make sub awards and manage funding specifically for Tribal projects to protect and restore Puget Sound, consistent with the Puget Sound Action Agenda. Three million dollars ($3M) is awarded annually. A portion of these funds from the Nisqually Tribe were used to finance this Plan and install 6 - 8 rain gardens in association with a two-year outreach and education program. The Town should continue to identify capital projects for this program in collaboration with the Nisqually Tribe.

- Stormwater Retrofit and LID Competitive Grant Program, or SWRLID. The Washington State Legislature annually appropriates grants to the Department of Ecology for local governments covered by National Pollution Discharge Elimination System, or NPDES, Phase I and II permits to address stormwater management and control. The appropriation provides funds for permit holders to plan, design, and construct LID stormwater retrofit projects. In fiscal year 2012, the State Legislature appropriated $67M to fund 117 projects statewide. Maximum project award is $1M and the receiving jurisdiction provides 25% match funds. Eatonville is not a Phase I or II jurisdiction, however if the Town enters into an interlocal partnership agreement with Pierce County, which operates under a Phase I NPDES permit, it would be eligible to participate in these and other grant opportunities. There is more discussion about interlocal agreements in the Partnerships and Collaboration opportunities (See Section 8.2.2.1).

- Salmon Recovery Funding Board, or SRFB. Salmon recovery grants are awarded by the Salmon Recovery Funding Board to protect and restore salmon habitat. Average annual funding for Puget Sound is $18M, a portion of which is allocated to the Nisqually watershed. The Nisqually Indian Tribe runs an annual project selection process through the Nisqually River Council to review and prioritize project proposals for salmon recovery funding. Typical salmon recovery projects funded are for in-stream habitat restoration projects and acquisition of priority salmon habitat. If a project plan can make a case that increased infiltration of Eatonville stormwater also increases the local low flows of the Mashel River, this could be an important project for salmon recovery. Projects of this type have not been submitted before, and some changes in policy may be necessary at the Recreation and Conservation Office so that these can be submitted to compete for SRFB funding. Nisqually Tribe Natural Resources Division would process and include Eatonville capital projects in its 3-year Habitat Work Schedule, which is then prioritized by the Salmon Habitat Work Group and approved by the Nisqually River Council. "Eatonville Stormwater Reduction – Project 11-OHOP-1009" remains in the schedule for future capital project submissions.

- Nisqually Tribe Charitable Fund. Each year the Nisqually Tribe awards grants to local charitable and government programs through a competitive grant application process. The source is a required distribution of a percentage of table winnings – $2.5M in 2012, with individual awards up to $50,000. The Town of Eatonville has received grants to support salaried positions, and nonprofit groups have used these funds to construct several rain garden projects in the Town.

- The Green Partnership Fund is a competitive grant program for natural resource protection funded and maintained by the Pierce Conservation District. The fund awards $75,000 - $100,000 annually, with individual project limits of $10,000. Grants can be used for on the ground LID projects tied to a priority stream reach, such as rain garden and cistern installations protecting the Mashel River, and these would be competitive proposals. Eatonville would be required to join the Conservation District's fee assessment system in order to be eligible for this and the District's outreach and education support programs. This is described in more detail in Section 8.2.2.1.

- The Russell Family Foundation (TRFF). The Russell Family Foundation's environmental team has made investments in the Nisqually Watershed and Eatonville area in the past through the Nisqually River Foundation, the nonprofit that supports the Nisqually River Council and natural resource conservation in the watershed. The Russell Family Foundation has a specific environmental focus on polluted runoff and green stormwater infrastructure outreach and education, and media and messaging development. The Town is eligible to apply during the next grant cycle. Grant awards are upwards of $50,000. A TRFF LID demonstration project is currently underway at the Eatonville Town Hall.

- The Boeing Corporation maintains a corporate citizenship grant program that in part supports local strategies to protect and restore Puget Sound and its watersheds with a focus on stormwater management. Letters of inquiry are submitted between March and July each grant cycle year, and only 501(c)3 nonprofits are eligible to apply. Grant awards are upwards of $50,000. The Town could partner with the Nisqually River Foundation to apply for projects that implement elements of the Plan.

9.3.2 Funding

The Surface Water Utility provides funding for activities related to operations and maintenance, with just a small amount to fund public education. Outside grant funding is critical, and a number of grant sources have been identified in Table 9-6. The highest priority opportunities are detailed in the narrative. Capital program implementation should be phased to match available grant resources and new sources as they are identified.

The National Estuary Program, SRFB, SWRLID, and EPA Grants to Tribes provide the largest awards. The SRFB grants for salmon recovery provide long term funding that has promising potential.

Plan implementation can also be phased in other ways, such as by breaking larger projects into smaller funding packages. Another approach includes using ongoing Campaign resources (Tables 8-1 and 8-2), and an Incentive Program to strategically choreograph the installation of many more smaller BMPs, such as rain gardens, pervious pavements, and detention cisterns.

9.3.3 LID Funding Incentives

Incentives that encourage installation of retrofit of stormwater facilities with LID BMPs are divided into individual grant programs and rate reduction programs, both as resources will allow. Once incentive programs have been identified and instituted, they will be leveraged and communicated through the Campaign outlined in Table 8-2.

Outside grants will allow the Town annually to offer residential, commercial and institutional property owners cash payments to install stormwater facilities such as rain gardens, detention cisterns, and pervious sidewalks and driveways. These would be distributed on a first come, first served basis, with priority to important infiltration or flow reduction areas until funds are exhausted each year. Grants can be full funding or cost share, and in return the property owner signs a covenant that is registered with the property record and guarantees a certain level of maintenance and time period. An example cost share program recently established by the City of Puyallup is referenced in Table 8-1.

Rate reduction programs are similarly managed, but here the property owner is responsible for the costs of installation and will have more flexibility in deciding which paths to take in return for a specified rate reduction incentive. The Town must identify the site development and stormwater flow reductions and water quality standards that must be achieved and the documentation that must be provided to ensure the standards have been met. Documentation requirements should be as short and as least onerous as possible but effectively demonstrate that requirements have been met. An example program for unincorporated Thurston County is referenced in Table 8-1.

Small scale, distributed LID installations need not be tied to cash payment. Rain water harvesting and reuse, for example, reduces increasingly costly potable water consumption. This creates a built in incentive for the capture and reuse of relatively clean roof rainfall for domestic uses, such as irrigation, laundry, and toilet flushing.

Rain water harvesting is measured in the thousands of gallons, and even large cisterns are often unable to store all of the rainfall collected through the year. Encouraging a rain water harvesting program that redirects the overflow into approved infiltration structures has very positive and tangible results: lowers the water consumption from intake wells along the Mashel River, potentially increases the number of dwelling unit connections that can be made to the Town water supply, infiltrates rainfall from impervious roof surfaces, and reduces the cost of drinking water.

Island County, City of Seattle and King County have adopted codes which allow tying properly treated harvested roof rain water to the potable water supply of residential properties. Pierce County adopting a similar rain water catchment strategy will allow the Town of Eatonville then to create a similar code that simplifies the plumbing needed to bring rain water into the home for potable use. This will dramatically increase the incentive potential.

There are a variety of opportunities for the Town to pay for upgrades to its stormwater system and encourage the use of green infrastructure. Some municipalities have provided reductions in the monthly surface water utility fee for users that employ and maintain functioning green stormwater infrastructure on their property. Eatonville should carefully consider this approach to ensure that fee reductions granted to customers using LID do not render the stormwater utility undercapitalized to perform its program objectives.

Appendix A

Draft Report
Stormwater Management Program

January 2003

Draft Report

Stormwater Management Program

Town of Eatonville

January 2003

Draft Report

Stormwater Management Program

Town of Eatonville

January 2003

R·W·BECK

CERTIFICATE OF ENGINEER

TOWN OF EATONVILLE
COMPREHENSIVE STORMWATER MANAGEMENT PLAN

The technical material and data contained in this report were prepared under the supervision and direction of the undersigned, whose seal as a registered professional engineer licensed to practice as such in the State of Washington, is affixed below.

Steven J. Swenson
Project Manager

Beverley L. Charlish
Project Engineer

TOWN OF EATONVILLE
STORMWATER MANAGEMENT PROGRAM

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Section 1

EXECUTIVE SUMMARY

Section 1
EXECUTIVE SUMMARY

The Eatonville Stormwater Management Program report consists of an evaluation of the existing surface water management system, with primary focus on correcting flooding problems, and improving water quality. This will position the Town to be in compliance with Ecology's Basic Stormwater Program (Puget Sound Plan). The study area includes the incorporated area of the Town of Eatonville.

Through the use of computer modeling, results of past studies, and input from Town staff, the plan identifies existing and potential future flooding problems within the study area. Based on the typical activities within urban areas, general water quality problems were described along with programmatic solutions. A combination of regulatory requirements, public education, increased maintenance activities, and capital improvements is recommended to solve these problems. The major plan elements include the following:

- Recommendation for adoption of a new Stormwater Management Ordinance that includes minimum requirements for new development and redevelopment, prohibits illicit discharges into surface waters, and requires maintenance of privately owned stormwater facilities.
- Development of public education opportunities to inform the community of water quality issues, and, specifically, the new ordinance and its requirements.
- Conceptual analysis of localized flooding, and water quality problems and solutions, and development of a prioritized list of drainage system improvements.
- Development of Capital Improvements Program needs.
- Development of Maintenance and Operations Program needs.
- Development of a program that identifies program management, public education and engineering needs.
- Development of the total program costs.
- Development of funding analysis.
- Recommendation of plan for implementation, with input from Town Staff and elected officials.

The Town of Eatonville experiences some flooding, erosion, and water quality problems. Implementing the recommended program changes described in Section 10 will aid in preventing future localized flooding, improving the existing water quality, and protecting and enhancing valuable environmental resources. The local drainage system in the Town consists primarily of a piped system with ditches. None of these systems are classified as streams that support aquatic habitat. Therefore, no habitat problems or solutions are discussed.

Recommendations are made for new regulations. The Town's existing drainage standards are contained in several ordinances and should be replaced with a new stormwater ordinance that will bring the Town into compliance with Washington State Department of Ecology requirements by adopting minimum requirements or the Ecology Manual in its entirety. This ordinance should also include prohibition of illicit discharges and standards regarding the maintenance and operation of public and private facilities.

The Town should accompany adoption of this new ordinance with a public education program designed to inform and educate affected parties about the new requirements.

A list of capital projects to solve existing problems was developed for review and approval by the Town. Completion of these projects will improve the operation and efficiency of the existing infrastructure system. Completion of these projects is not required for compliance with existing and pending regulatory requirements.

The plan included development of a Maintenance and Operations Program which identifies system maintenance and operations needs designed to ensure system reliability, and methods and standards that promote water quality. The Maintenance and Operations Program developed meets regulatory requirements and will require an annual budget of approximately $33,000 which includes the equivalent of approximately 0.48 full-time equivalent (FTE) staff persons. This represents an increase of 0.03 FTE maintenance personnel over the current maintenance program.

The plan also summarizes program management, public education, engineering, plan review and inspection needed for the Town to work towards compliance. The annual budget for these needs is approximately $42,220 which includes approximately 0.40 FTE staff persons. This represents an increase of 0.15 FTE over the current program. Table 1-1 contains a summary of the total program needs.

Table 1–1
Total Program Needs

Brief Description	Annual Cost	Stormwater Improvement Projects Cost
Capital Improvement Program[1]	TBD	$ 4,177,400
Annual Maintenance & Operations Program (0.48 FTE)	$ 32,953	
Program Management, Public Education, and Engineering (0.40 FTE)	$ 42,220	
Totals:	$ 75,173	$ 4,177,400

1 Table 6-4

Total program costs were developed based on the regulatory compliance recommendations, capital improvements projects, operation and maintenance program, public education, engineering, enforcement, and administration costs. Projected rate increase impacts including projected revenues from modified utility rates are summarized in Table 9-3.

Section 2

INTRODUCTION

Section 2
INTRODUCTION

2.1 Purpose

The Town of Eatonville is located on the Mashel River in southern Pierce County along State Route 161 and U.S. Highway 7. The town is located approximately 35 miles southeast of the City of Tacoma as shown in Figure 2-1. The Town limits are shown on Figure 2-2.

The regulatory climate for the management of surface water resources has changed in recent years. Through the Puget Sound Water Quality Management Plan and Action Plan (Puget Sound Plan), Phase II of the Federal National Pollutant Discharge Elimination System (NPDES) Stormwater Permit Program, and the Endangered Species Act (ESA), municipalities in the Puget Sound Basin are required to develop stormwater programs that address water quality and fish habitat protection.

Although the Town of Eatonville is not yet required to obtain an NPDES Phase II Permit, the purpose of this Comprehensive Stormwater Management Plan update is to:

- Position the Town to be in compliance with Ecology's Basic Stormwater Program (Puget Sound Plan), and the Endangered Species Act.
- Recommend adoption of new stormwater management ordinances that meet current regulatory requirements and protects against future flooding, reduces water quality problems, and protects environmental resources.
- Identify existing flooding and conveyance problems.
- Determine needed improvements to the surface water system to correct existing flooding problems, and avoid future problems.
- Recommend Programmatic Solutions to water quality problems.
- Develop and prioritize capital improvements program needs.
- Develop a long-term maintenance and operation program that ensures system reliability and incorporates maintenance methods and standards that promote water quality.
- Develop a program to meet program management, public education and engineering needs.
- Provide the Town of Eatonville with total program costs and a recommended financial plan that enables the program to be implemented.

The Stormwater Management Program focuses on the Town's internal drainage system in order to minimize local flooding problems, to improve water quality and maintenance, to comply with regulatory requirements, and to protect downstream aquatic resources. Any flooding from the Mashel River is not covered by this plan and is addressed under other Town programs.

2.2 Authority and Cooperation

Preparation of this Comprehensive Stormwater Management Plan was authorized by the Town of Eatonville in an engineering agreement with R. W. Beck dated March 27, 2000.

2.3 Scope of Work

The scope of work was developed through discussions between the Town, and R. W. Beck staff. The plan is intended to provide the information necessary for the Town to implement a stormwater program that meets Ecology's requirements for local government compliance. It will create a coordinated long-term management approach to issues affecting flooding, water quality, and protection of aquatic resources.

2.4 Previous Studies

Previous studies relevant to stormwater management conducted in the study area were reviewed to collect information. Brief summaries of the reports are provided in Section 5.

Figure 2-1
Locator Map

Stormwater Management Program
Town of Eatonville

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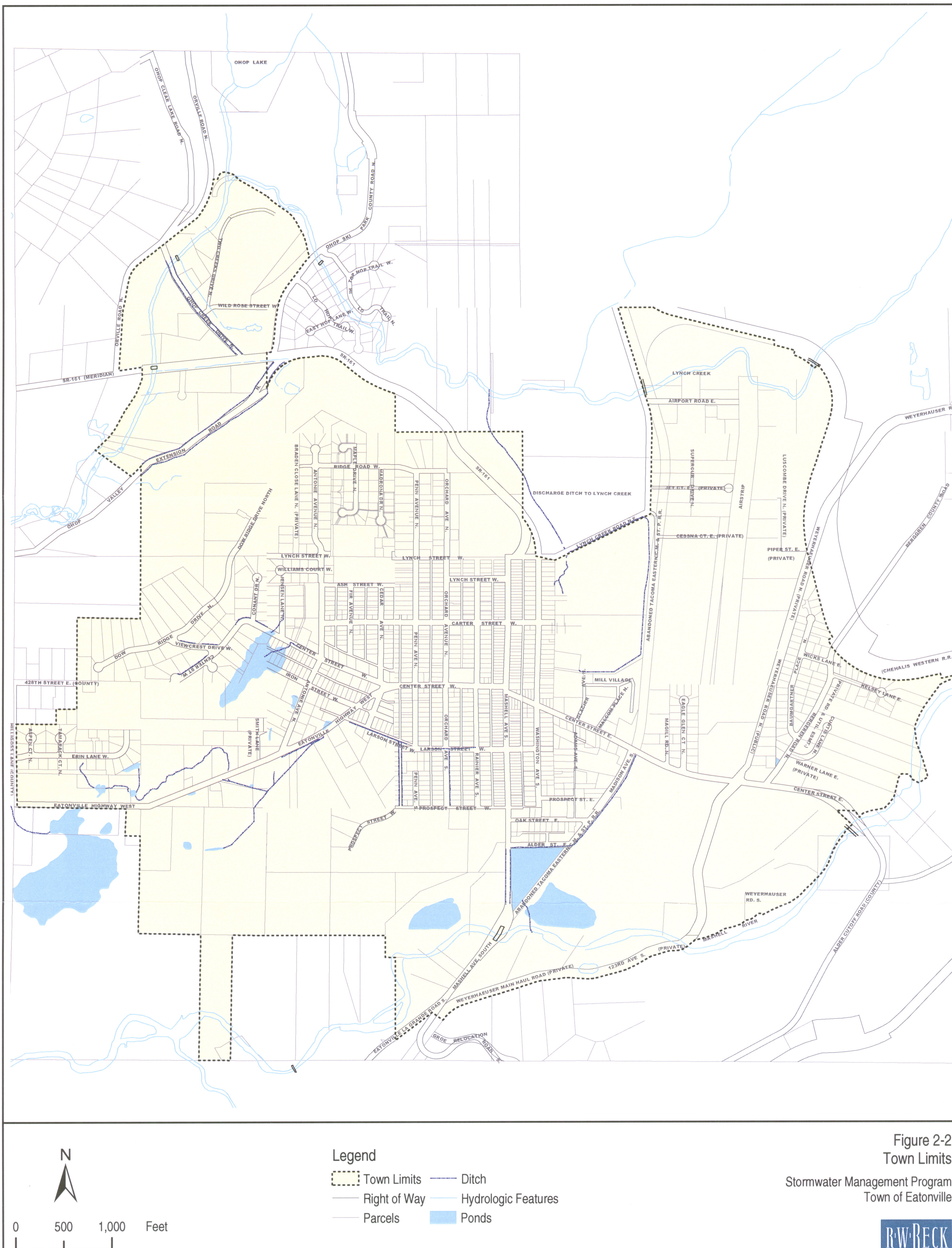

Figure 2-2
Town Limits

Stormwater Management Program
Town of Eatonville

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Section 3

CHARACTERISTICS OF THE STUDY AREA

Section 3
CHARACTERISTICS OF THE STUDY AREA

3.1 Study Area

The study area includes the incorporated limits for the Town of Eatonville as provided by the Town in their parcel map developed by Sitts & Hill. An inventory of the Town's storm drainage system was performed for the entire Town. The engineering analysis of the stormwater conveyance system was performed only on the areas that drain into the Town's main stormwater drainage system that ultimately discharges into Lynch Creek. Engineering analysis was not performed on the minor stormwater drainage systems that include the portion of the Town that drains into the Mashel River, as well as the network of drywells and independent infiltration systems (e.g., Kelsey Lane East, Williams Additions). The water quality and resource protection elements of the Stormwater Management Program include the entire Town. Refer to Figure 2-2 for the Town limits.

3.2 Topography and Soils

The Town is bounded on the south by the Mashel River and on the north by Lynch Creek. The topography indicates that, in general, flow tends to converge from the surrounding areas into the Town proper and then flows north towards Lynch Creek. Figure 4-1 shows the subbasin delineation based on the contour data, and is useful in understanding flow patterns. A substantial portion of the Town elevation ranges from 800 to 835 feet.

There are four soil types indicated in the study area: (1) Barneston Gravelly Coarse Sandy Loam, (2) Dupont Muck, (3) Kapowsin Gravelly Loam, and (4) Scamman Silt Loam. Figure 3-1 shows both the topography and soils in the study area. The Hydrologic Soils Group ranges from B to D (See Section 4, Table 4-1) where a classification of 'A' is most permeable and 'D' is least permeable. The soils in the Town of Eatonville area tend toward impermeability.

3.3 Land Use

Existing land use is determined by Pierce County according to their Land Use Codes. Tax Parcels are designated according to those land use codes. Future land use is determined through the zoning code of the Town. The land use in the study area consists of single family residential, multi-family residential, commercial, industrial, and the airport. Figure 3-2 shows the zoning map.

3.4 Stormwater Structure Inventory & Mapping

Considerable time was spent researching and compiling data describing the Town's stormwater system. This task had two functions. One was to provide the Town with an inventory of its stormwater structures. This inventory determines the scope of Maintenance and Operations activities (Section 7), and is intended to give the Town an overall understanding of its stormwater system. The second was to use the information collected in order to assemble the hydraulic computer model which determined conveyance capacity and identified existing or potential flooding problems. The inventory data list in Appendix A is presented in two versions to reflect these functions. A copy of the Inventory Map is also included in Appendix A for reference. The first version of the inventory data list is a complete listing of all of the stormwater structures that were located during the Sitts & Hill GPS survey and the second version is the listing of the stormwater structures organized by the actual drainage systems that they belong to so that the inventory is easier to follow.

Although initially the Town provided 'as-built' drawings from land development projects and street improvement projects, to compile structure and invert information, at a later date the Town contracted with Sitts & Hill to locate and collect catch basin grate elevations using GPS methodology. The catch basin elevation and location information that was gathered by Sitts and Hill was determined to be a more reliable source of data and was used to construct the new stormwater inventory map. The as-built data was abandoned. To calculate invert elevations of the storm drainage system, measure downs (the distance from the grate elevation to the invert of the pipes at the stormwater structure) were collected by the Town operations staff and provided to R.W. Beck. The invert elevations were then calculated by R. W. Beck by subtracting the measure down distances from the grate elevation provided by Sitts & Hill. In addition to the measure down information, the Town staff also provided information showing the pipe sizes and connections between the stormwater structures. Additional surveys of the drainage ditch on the south side of Eatonville Highway West and the centerline of the portion of the discharge ditch to Lynch Creek that is within the Town were also conducted. The stormwater structures located at the school property were not included in the Sitts & Hill survey, and were added from information obtained from 'as-built' drawings.

Although the measure downs that were needed for the hydraulic modeling of the trunk systems are complete, the measure downs are not complete for all of the stormwater structures originally surveyed by Sitts & Hill. It is recommended that the Town complete this task when staff time is available. Additionally, for the measure downs that were completed, there are discrepancies regarding pipe size, pipe material, and invert elevations that could not be resolved during the data collection process. The model also revealed a number of negative pipe slopes based on the invert information provided. Although the hydraulic modeling described in Section 4 always assumed the smaller pipe size and hydraulically rougher pipe material when discrepancies occurred, the Town should ultimately verify that these anomalies are true and are not errors in the data provided by the Town as part of the measure down work.

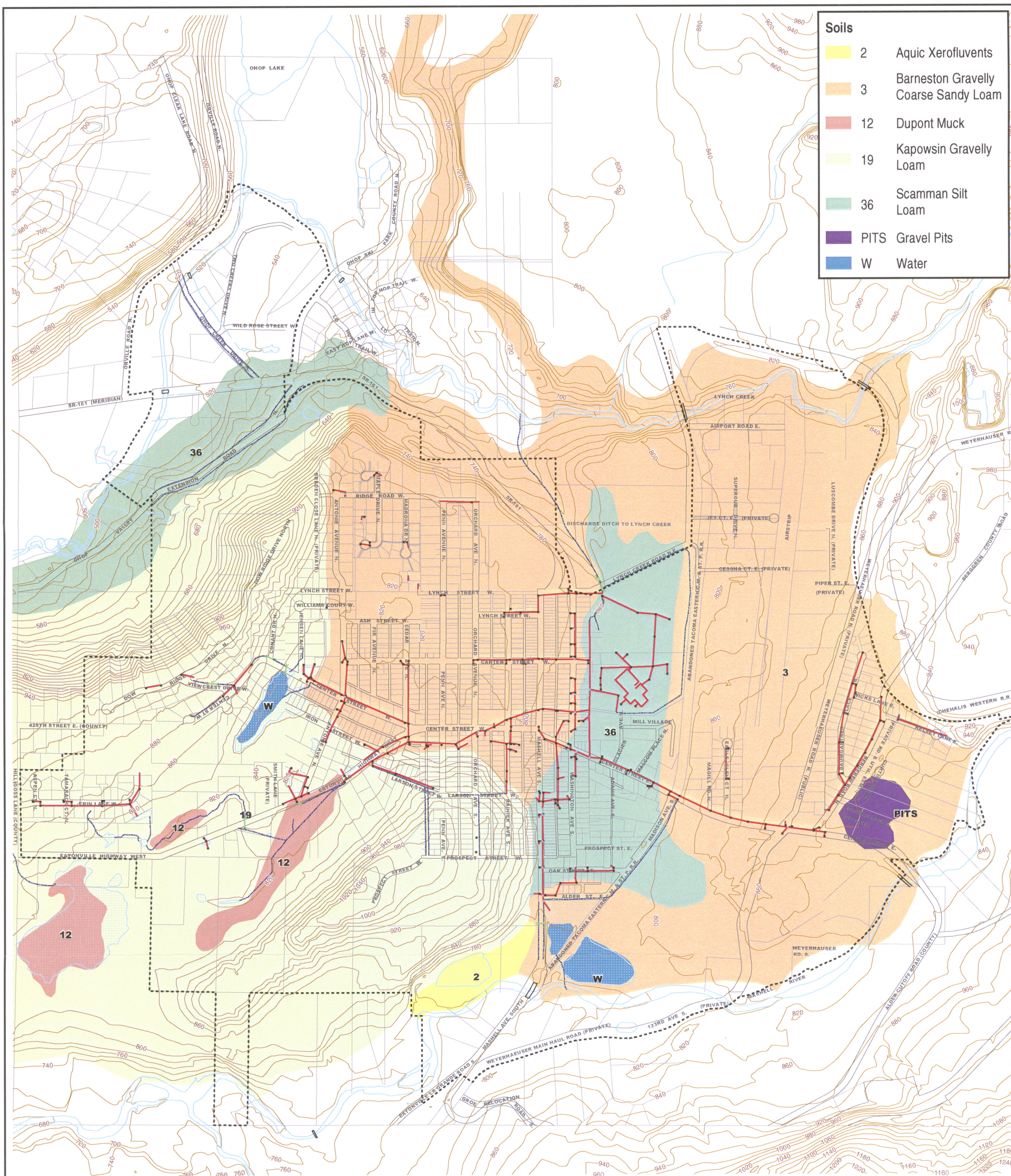

Figure 3-1
Soils
Stormwater Management Program
Town of Eatonville

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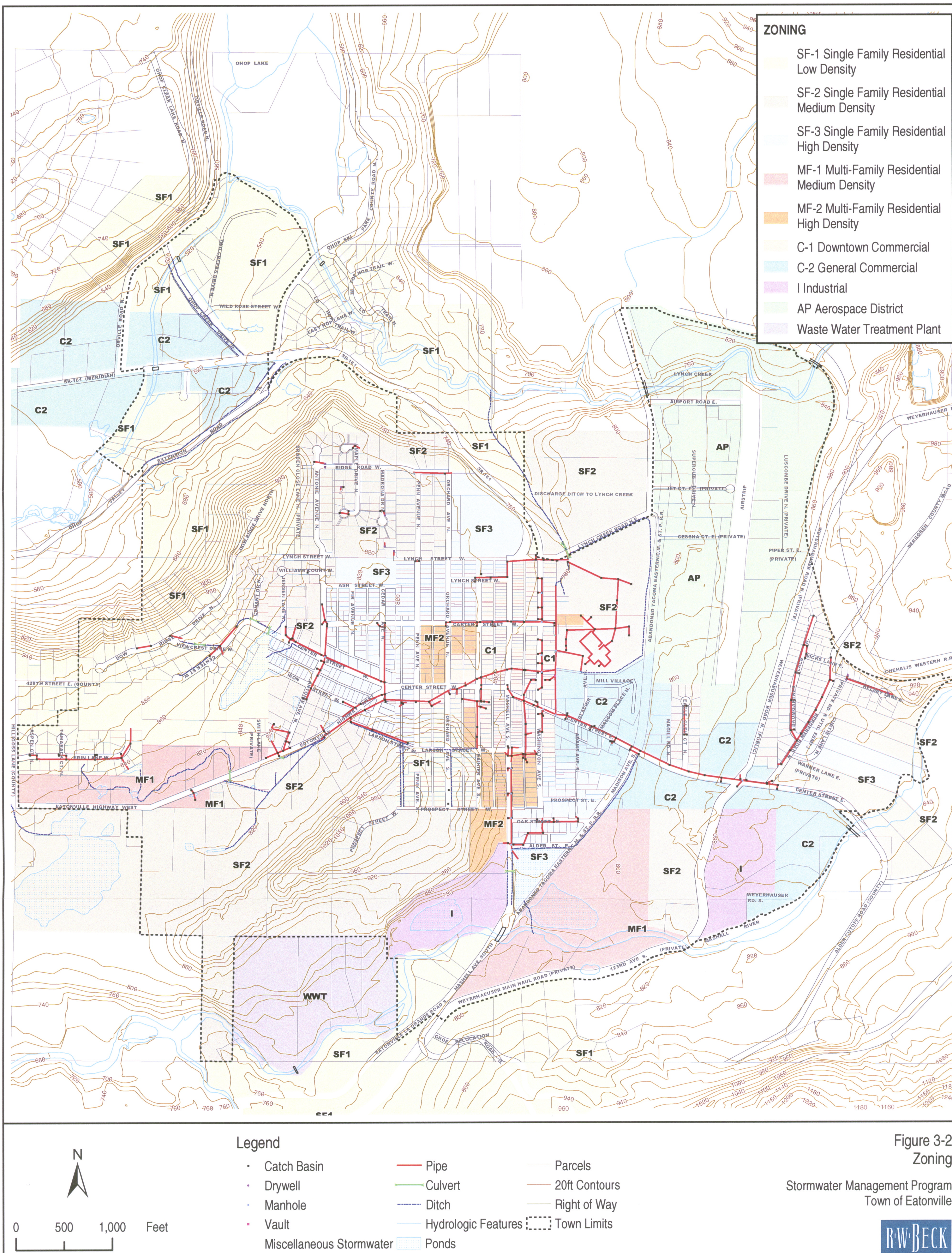

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As a part of the capital improvement project list (Section 6), a professional survey of the system is strongly recommended, and should provide answers to some of the outstanding stormwater system inventory discrepancies. If discrepancies remain after the survey is performed that may affect a capital improvement project, a TV/video evaluation could be considered.

Additionally, topographic information derived from the orthophotos obtained from Pierce County was used to locate a number of hydrologic features which were not included as a part of the stormwater structure data collection, and have been incorporated into the stormwater inventory map.

3.5 Existing Surface Water System

The existing stormwater system of the Town of Eatonville is shown in Figure 3-3. There are three main drainage systems that serve the Town of Eatonville that are referred to as the Center Street West system, the Center Street East system, and the Mashell Avenue South system.

3.5.1 Center Street West System

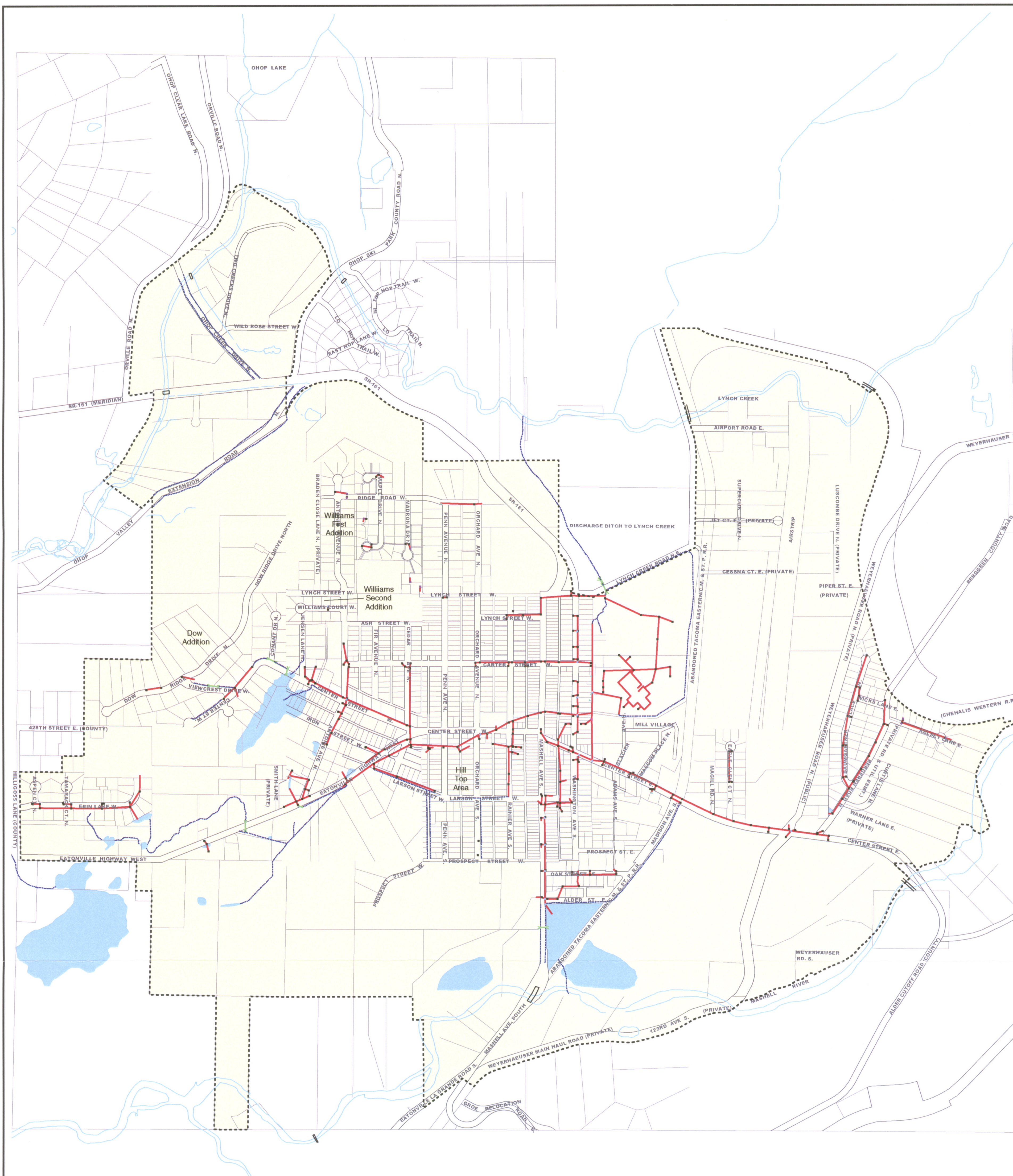
The Center Street West system (Trunk 1 in System 1 of Abridged Stormwater Inventory Worksheets in Appendix A) begins with a series of ditches, culverts and pipes linking the Dow Addition to the Town's main stormwater storage area southwest of Center Street West at Jensen Lane North. The stormwater drains into the 12-inch system beginning at Center Street West near Jensen Lane North and this trunk system continues southeast along Center Street West with system branches connecting to it at Antonie Avenue North on both north and south side of Center Street West as well as a branch system connection at Cedar Avenue North. The 12-inch system turns south across Center Street West where it intersects with a branch that runs along the north side of Eatonville Highway West. The Center Street West system crosses the Eatonville Highway and connects with a major system that collects drainage along both sides of Eatonville Highway West (Trunk 6 in System 1 of Abridged Stormwater Inventory Worksheets in Appendix A). This tributary starts on the north side of the highway with a ditch conveyance system that begins at the private detention pond at Erin Lane West and connects across Eatonville Highway West to the piped system. This major tributary provides flood storage in several areas along its length (see Figure 4-1 for Subbasin Delineation). After connecting with the Eatonville Highway tributary, the main trunk becomes 24-inch before it heads east along Center Street West.

The 24-inch trunk headed east is the oldest portion of the stormwater system. The 24-inch pipe travels northeast from the south side of Center Street West at Orchard Avenue South to north of Center Street West at Rainier Avenue North. A branch connects at Rainier Avenue and on both sides of the trunk at Washington Avenue. The 24-inch trunk then connects to the 36-inch trunk system headed north to Lynch Creek. Connections to the 36-inch trunk occur at the Eatonville school property. There is also a branch connection at Carter Street West (Trunk 2 in System 1 of

Abridged Stormwater Inventory Worksheets in Appendix A) which begins at Orchard Avenue North. The 36-inch trunk system pipe discharges into an open channel system. A branch located along Lynch Street West (Trunk 3 in System 1 of Abridged Stormwater Inventory Worksheets in Appendix A) as well as drainage from inside the school property boundary discharge into the main open channel system just before it passes through a culvert under Lynch Creek Road NE. The open channel continues down a ravine until it discharges into Lynch Creek.

3.5.2 Center Street East System

The Center Street East system (Trunk 5 in System 1 of Abridged Stormwater Inventory Worksheets in Appendix A) begins at Center Street East near Bergeren Road North. The 12-inch pipe continues west along Center Street East where it connects with the 36-inch trunk headed north to Lynch Creek. From the information provided at the structure heading north, this pipe is 12-inch, but at the next structure to the north, the pipe coming in from the south is 36-inch. The exact location of this transition in this pipe reach is unknown, but in the hydraulic model discussed in Section 4, a 12-inch pipe size was used for the entire reach. There is also a branch to this system that flows east to the 36-inch trunk that drains an area bounded by Washington Avenue South, Larson Street West, Mashell Avenue South and Center Street East (Part of Trunk 5 and Trunk 7 in System 1 of Abridged Stormwater Inventory Worksheets in Appendix A).



Legend

- Catch Basin
- Drywell
- Manhole
- Vault
- Miscellaneous Stormwater Structures
- Pipe
- Culvert
- Ditch
- Hydrologic Features
- Ponds
- Parcels
- Right of Way
- Town Limits

N

0 500 1,000 Feet

Figure 3-3
Existing Stormwater System
Stormwater Management Program
Town of Eatonville

R·W·BECK

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3.5.3 Mashell Avenue South System

The Mashell Avenue South system drains into the Mashel River. It begins at Mashell Avenue South just south of Larson Street West and continues south along Mashell Avenue South (Trunk A in System 2 of Abridged Stormwater Inventory Worksheets in Appendix A). A branch connects at Alder Street East and the pipeline continues to where it discharges into a bioswale/detention pond which in turn discharges into the Mashel River (Trunk B in System 2 of Abridged Stormwater Inventory Worksheets in Appendix A).

3.5.4 Infiltration Systems

There are also isolated independent systems which use dry wells and perforated pipes for infiltration. Examples are the systems at Bergeren Road North and Kelsey Lane East at the east end of the Town. Other infiltration systems are located at the north end of Town in the Williams First Addition near Ridge Road West and Maple Drive North.

Section 4

HYDROLOGIC AND HYDRAULIC COMPUTER ANALYSIS FOR EXISTING CONVEYANCE CONDITIONS

Section 4
HYDROLOGIC AND HYDRAULIC COMPUTER ANALYSIS FOR EXISTING CONVEYANCE CONDITIONS

4.1 Introduction

XP-SWMM 2000 version 8.05 was used to model the hydrology and hydraulics of the Town of Eatonville drainage basin systems for the purposed of identifying flooding problems and developing solutions to the flooding problems. XP-SWMM simulates the hydrologic runoff from subbasins contributing flow to these systems and then routes the flow through the drainage system, which consists of both open channels and pipes. XP-SWMM is divided into three modules: RUNOFF, SANITARY (TRANSPORT), and HYDRAULICS (EXTRAN). For the purposes of this project, only two modules were used. The RUNOFF module was used to simulate the runoff flows (hydrology) and the HYDRAULICS module was used to simulate the capacity (hydraulics) of the main trunk.

This section discusses the input parameters used in the RUNOFF and HYDRAULICS modules as well as describing the modeling approach at specific sites for the existing conveyance conditions model. Section 6 discusses the modifications made to the model to develop solutions to conveyance problems identified by modeling the existing system under future land use conditions.

This analysis of the existing drainage system will define how it will function in a 25-year storm under future land use conditions. To do this, hydraulic modeling of the existing drainage system was performed using flows (hydrology) generated from the RUNOFF module under future land use conditions.

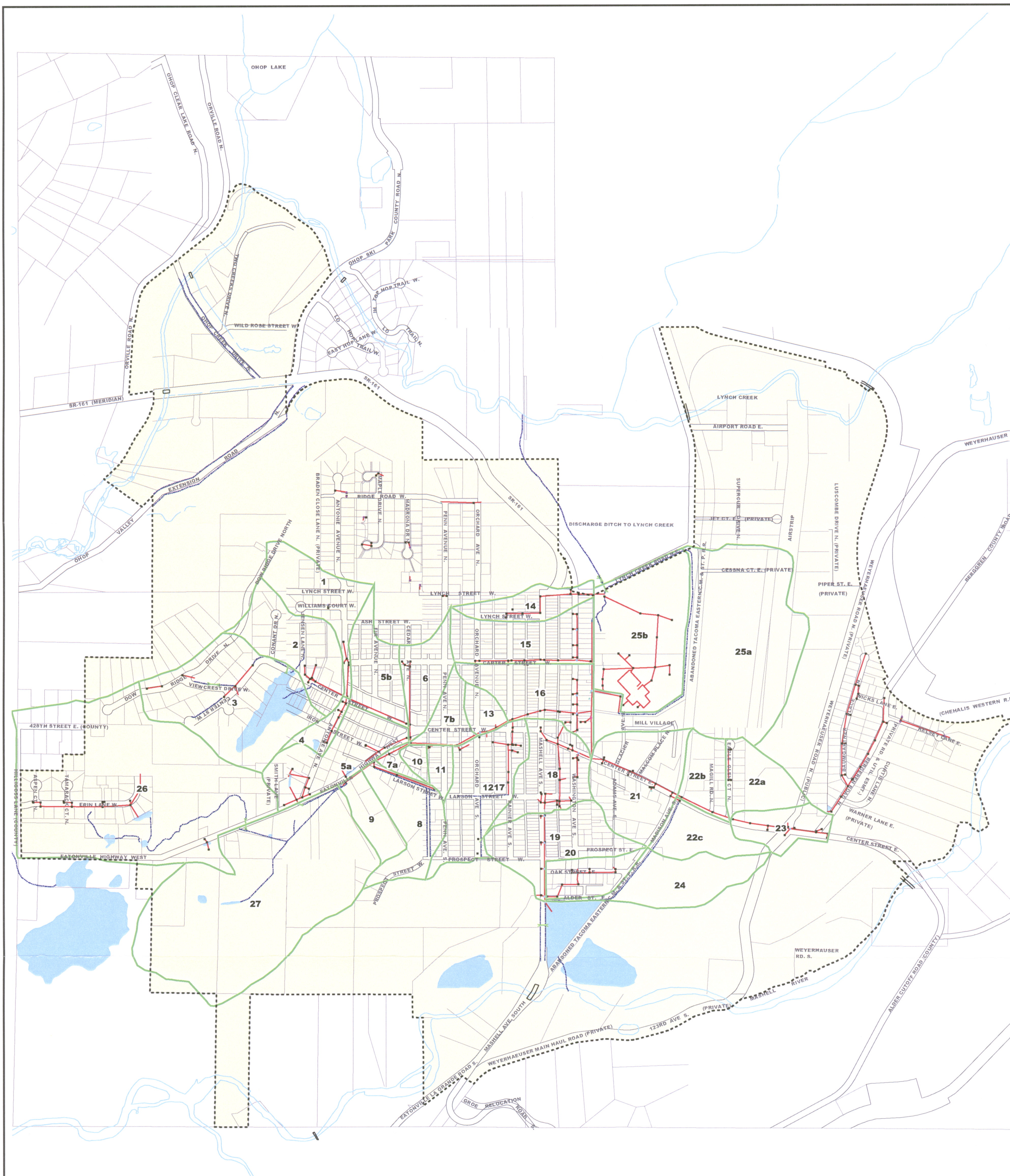
4.2 Runoff

The RUNOFF module using the Santa Barbara Unit Hydrograph (SBUH) method was used to generate flows from each of the subbasins. Key SBUH data and input parameters include:

- Subbasin area
- Time of concentration
- Runoff curve numbers
- Percent imperviousness

- Rainfall hyetographs

The values of the first four of the above parameters are shown for each of the subbasins in Table 4-1 for future land use. A description of how these parameters were calculated is contained in the following subsections. Refer to Figure 4-1 for the subbasin delineation. The rainfall hyetograph data used was from the 1999 Pierce County Stormwater Management and Site Development Manual, Table E.3. How this rainfall data was used in the SWMM model is described in Section 4.25. In addition to the five parameters, Table 4-1 lists the SWMM node ID indicating the node where the flow from a particular subbasin was input into the model. Refer to Appendix B for Figure B1 showing the schematic of links and nodes used for the model.



Legend

- Subbasins
- Catch Basin
- Drywell
- Manhole
- Vault

Miscellaneous Stormwater Structures

- Pipe
- Culvert
- Ditch
- Hydrologic Features
- Ponds
- Parcels
- Right of Way
- Town Limits

N

0 500 1,000 Feet

Figure 4-1
Subbasin Delineations

Stormwater Management Program
Town of Eatonville

R·W·BECK

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Table 4-1
Subbasin Data

Subbasin No.	Subbasin Area (Ac)	Soil Type Number (1)	Tc (min)	Runoff Curve Number	Impervious Area (%)	SWMM Model Node ID
1	13.1	3, 19	69.7	92	57%	1041
2	15.5	3, 19	32.1	92	54%	931
3	31.9	3, 19, W	48.3	93	51%	1315
4	3.0	3, 19	96.8	94	65%	1041
5A	14.9	3, 12, 19	563.1	93	60%	1300
5B	10.3	3	23.3	93	69%	1309
6	8.7	3	255.2	93	73%	1308
7A	1.5	3, 19	27.2	94	70%	1302
7B	5.3	3	15.8	94	82%	1325
8	12.6	19	21.1	92	51%	945
9	6.0	12, 19	28.4	91	45%	944
10	1.6	3, 19	41.4	94	68%	1302
11	2.5	3, 19	11.6	94	71%	1325
12/17	17.7	3, 19	86.6	94	68%	1331X
13	3.3	3	18.9	95	88%	1328
14	7.1	3	220.5	94	77%	D3
15	15.1	3, 36	186.5	94	81%	D2
16	15.1	3, 36	29.5	95	87%	970
17	Combined with Subbasin No 12					
18	13.6	3, 19, 36	34.3	96	87%	993
19	15.7	3, 19, 36	104.7	96	77%	1067 (2)
20	7.1	3, 36	37.7	95	69%	1058 (2)
21	19.1	3, 36	46.0	96	83%	1164
22A	9.2	3	54.8	93	76%	1091
22B	7.2	3	25.9	93	75%	994
22C	8.6	3, 36	74.6	95	86%	1089
23	7.5	3	142.8	95	85%	935
24	13.6	3, 36	39.4	94	72%	1056 (2)
25A	50.7	3, 36	68.7	93	77%	1344
25B	27.8	3, 36	367.8	93	48%	D4
26	74.6	12, 19	34.4	93	61%	N55
27	65.0	12, 19	117.2	92	46%	N57

Notes : (1) 3 - Barneston gravelly coarse sandy loam, Hydrologic Soils Group B
12 - Dupont muck, Hydrologic Soils Group D
19 - Kapowsin gravelly loam, Hydrologic Soils Group C
36 - Scamman silt loam, Hydrologic Soils Group D
(2) This portion of the stormwater system was not modeled.

The following sections describe the assumptions associated with all the parameters listed above.

4.2.1 Subbasin Area

The study area was subdivided by delineating 31 subbasins based on the topography provided in Pierce County's GIS data and drainage system information provided by the Town of Eatonville. In addition, subbasins were subdivided and flows were apportioned by area in order to provide flow information at known flooding problem locations. GIS software was used to determine the area of each subbasin. Refer to Figure 4-1 for the subbasin delineation, and Table 4-1 for subbasin area acreage.

4.2.2 Time of Concentration

From the 1999 Pierce County Stormwater Management and Site Development Manual, time of concentration is the sum of the travel times for sheet flow, shallow concentrated flow, and channel flow. With sheet flow, the friction value (n_s) is a modified Manning's effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges and rocks, and erosion and transportation of sediment. These n_s values are for very shallow flow depths of about 0.1 foot and are only used for travel lengths up to 300 feet. After a maximum of 300 feet, sheet flow is assumed to become shallow concentrated flow. Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where lines indicated streams appear on United States Geological Survey (USGS) quadrangle sheets. See Appendix A for specific subbasin Time of Concentration calculation sheets.

4.2.3 Curve Numbers

Curve numbers are used to account for the interception, depression storage, the amount of infiltration that occurs before runoff begins and the infiltration rate after runoff begins. Curve number values have been developed and evaluated in terms of soil type, soil cover, and land use (Roberson, Cassidy, & Chaudry, 1988). Curve Numbers were developed for the Town of Eatonville subbasins based on a weighted average by area according to land use (Town of Eatonville Zoning) and soil type. Note that Eatonville zones MF-1 (Multi-Family) and MF-2 treated as Pierce County Commercial category, and Eatonville zone AP (Airport) treated as Pierce County Industrial category. See Appendix B for subbasin summary worksheets.

4.2.4 Percent Imperviousness

The percent impervious area for the subbasins was determined for the future land use condition. The future land use impervious area was estimated based on the zoning as defined in the Town's Zoning Map (Figure 3-2). It was assumed that the zoning layer represented future maximum build-out. Note that maximum build-out assumes that all roof leaders in the basin will be tied directly to the storm drain system. The percent impervious was based on the zoning coverage as provided by the Town. The percent impervious area for future land use based on zoning is shown in Table 4-1.

4.2.5 Rainfall Hyetographs

The SCS Type 1A Rainfall Distribution, 24-Hour Duration, as provided by the 1999 Pierce County Stormwater Management and Site Development Manual, was used with 3.5-inches for the 25-year 24-hour storm event from NOAA isopluvial maps for the Eatonville area.

4.3 Hydraulics

The HYDRAULICS module was used to simulate the hydraulics of the drainage system as the flows change during the course of a storm event. Figure A1 in Appendix A shows the schematic of the links and nodes used in the model. The details of the solution conditions are discussed in Section 6.2.2, Drainage Solution Analysis.

This section describes key HYDRAULICS data and input parameters including:

- Pipe inverts, shape, diameters, and lengths
- Ditch inverts, shape, and lengths
- Manning's coefficient
- Detention and other storage systems.

4.3.1 Pipe/Ditch Data Sources

Considerable time was spent researching and compiling data describing the Town's stormwater system in order to assemble the model. The various sources used include invert data collected by Town staff, a field survey by Sitts & Hill (as contracted with the Town of Eatonville) that included coordinates and rim elevations for the stormwater structures, as well as one drainage ditch on the south side of Eatonville Highway West and the centerline of the discharge ditch to Lynch Creek. Additionally, orthophotos, survey information derived from the orthophotos, and GIS data including parcel data and contour information were obtained from Pierce County.

Horizontal datum used by Pierce County was the NAD83, Washington State Plane South Zone, horizontal 91, and the vertical datum was the NGVD29. Sitts & Hill datum used was the Pierce County Control Monument, NAD83/91 State Plane Coordinate System. The orthophotos were taken in May 1999.

4.3.2 Manning's Coefficient

The Manning's roughness coefficients assigned for the pipe systems were based on material type. A Manning's coefficient of 0.013 was used for concrete pipe and ductile iron pipe, and a Manning's coefficient of 0.024 was used for corrugated metal pipe and PVC corrugated pipe.

The Manning's roughness coefficients assigned for the natural channel sections were based on similar field conditions. For most natural conveyance systems, the Manning's coefficient assigned to the channel was 0.045, which represents a small grass-lined channel that is somewhat overgrown with weeds or brush. The overbank Manning's coefficient was estimated at 0.06 based on the information available. The Manning's coefficients were based on methodologies presented in *Open Channel Flow (F.M. Henderson, 1966) and Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains* (USGS Water-Supply Paper 2339, 1989).

4.3.3 Detention and Other Storage Systems

Survey or as-built information regarding stormwater detention areas was not available for these areas. Storage volumes were estimated from the contour information obtained from Pierce County. Flood storage is located on the south side of Eatonville Highway West where currently a ditch system is located to convey stormwater to the Town of Eatonville stormwater system. Detention storage is located just West of Center Street West near Jensen Lane North. Private ponds were not included in the model.

4.3.4 Tailwater Elevation

The tailwater elevation is the water surface elevation at the downstream end of the system being evaluated. From the Pierce County contour data, the elevation at Lynch Creek was determined to be 632 feet. The open channel from the Town to the discharge point in Lynch Creek was assumed to be 3 feet deep and its length was estimated based on an assumed path from Lynch Creek Road NE to Lynch Creek.

The model was extended to a discharge point at Lynch Creek, and free discharge at that point was assumed. Also assumed at the discharge point was the water depth, which in the model was set at the minimum of either normal depth or critical depth. The ditch channel from Lynch Creek Road NE to the discharge point at Lynch Creek is steep, such that inaccuracies incurred from those assumptions would be negligible.

4.4 SWMM COMPUTER MODELING RESULTS

Table 4-2 lists peak flows at locations within the Town of Eatonville for future land use conditions estimated for the 25-year recurrence interval. Refer to Appendix B for Figure B1 showing the schematic links and nodes used for the model. Water surface elevations are listed in Table 4-3 for the same rainfall event. The water surface elevations were reviewed and flooding was noted when the water surface elevation was estimated to be higher than the ground elevation.

Table 4-2
Computer Modeling Results – Existing Conveyance System - Links

SWMM Model LINK ID	Location Description	TOTAL 25-year Flow (cfs)
CENTER STREET WEST SYSTEM		
L54	Center St W. near Jensen Ln N.	8.67
L1	Center St W. near Jensen Ln N.	2.84
L2	Center St W. at Antonie Av N.	2.84
L3	Center St W. between Antonie Av N. & Cedar Av N.	3.29
L4	Center St W. at Cedar Av N.	12.88
L5	Intersection of Center St W. & Eatonville Hwy S.	13.73
L6	Cedar Av S. near Intersection of Center St W. & Eatonville Hwy S.	15.61
L51	N-S Across Eatonville Hwy W. Southwest of Antonie Av N.	26.58
L52	Ditch on South side of Eatonville Hwy W. Southwest of Antonie Av N.	22.65
L57	Ditch on South side of Eatonville Hwy W. Southwest of Antonie Av N.	18.00
L53	Ditch on South side of Eatonville Hwy W. Southwest of Antonie Av N.	3.43
L29	Eatonville Hwy W. between Antonie Av N. & Iron St W.	1.18
L30	From Eatonville Hwy W. near Iron St W. to Cedar Av S.	6.25
L7	From Cedar Av S. near Intersection of Center St W. & Eatonville Hwy S. to South of Center St W. near Penn Av N.	19.94
L8	From South of Center St W. near Penn Av N. to Center St W. at Orchard Av S.	23.92
L9	Center St W. near Orchard Av S.	23.34
L10	Center St W. between Orchard Av N. & Rainier Av S.	23.34
L11	From Center St W. between Orchard Av N. & Rainier Av S. to Rainier Av S.	23.34
L12	Rainier Av S. North of Center St W.	23.34
L13	North of Center St W. between Rainier Av S. & Mashell Av S.	32.00
L14	North of Center St W. between Rainier Av S. & Mashell Av S.	29.56
L15	North of Center St W. at Mashell Av S.	29.59
L16	North of Center St E. between Mashell Av S. & Washington Av S.	33.25
L17	North of Center St E. between Mashell Av S. & Washington Av S.	33.47
L22	North of Center St E. between Washington Av S. and school property	55.44
L23	North of Center St E. and East of Washington Av S. at school property along 36-inch discharge pipe to Lynch Creek	56.71
L24	North of Center St E. and East of Washington Av S. at school property along 36-inch discharge pipe to Lynch Creek	67.56
L25	North of Center St E. and East of Washington Av S. at school property along 36-inch discharge pipe to Lynch Creek	69.83
L26	CMP Culvert N-S across Lynch Creek Rd N.E.	71.50
L27	Ditch between CMP Culvert and 36-inch Concrete Box Culvert	75.98
L56	36-inch Concrete Box Culvert	75.98
L28	Discharge Ditch to Lynch Creek North of Lynch Creek Rd N.E.	75.97
L45	2 - 24-inch Concrete Culverts	75.97
L46	Discharge Ditch to Lynch Creek North of Lynch Creek Rd N.E.	75.97

Table 4-2 (Continued)
Computer Modeling Results – Existing Conveyance System - Links

SWMM Model LINK ID	Location Description	TOTAL 25-year Flow (cfs)
CENTER STREET EAST SYSTEM		
L31	Center St E. at Bergeren Rd N.	0.46
L32	Center St E. between Bergeren Rd N. & Weyerhaeuser Rd N.	1.84
L33	Center St E. at Weyerhaeuser Rd N.	1.84
L34	Center St E. between Weyerhaeuser Rd N. & Eagle Glen Ct N.	2.08
L35	Center St E. between Weyerhaeuser Rd N. & Eagle Glen Ct N.	1.96
L36	Center St E. from Eagle Glen Ct N. to Magill Rd N.	6.35
L37	Center St E. from Magill Rd N. to Madison Av S.	5.37
L38	Center St E. at Madison Av S.	9.81
L39	Center St E. between Madison Av S. & Malcom Pl N.	13.09
L40	Center St E. between Madison Av S. & Malcom Pl N.	13.19
L41	Center St E. between Malcom Pl N. & Washington Av S.	36.84
L42	Center St E. between Malcom Pl N. & Washington Av S.	33.86
L43	North of Center St E. and East of Washington Av S. along 36-inch discharge pipe to Lynch Creek	29.61
L44	North of Center St E. and East of Washington Av S. along 36-inch discharge pipe to Lynch Creek	28.44

Table 4-3
Computer Modeling Results – Existing Conveyance System - Nodes

SWMM Model Node ID	Location Description	Rim or Overflow Elevation (ft)	25-Year WSEL (ft)	Flooding (Y/N)	Freeboard (ft)
CENTER STREET WEST SYSTEM					
1315	Center St W. near Jensen Ln N.	814.27	814.78	Y	0
931	Center St W. near Jensen Ln N.	814.27	815.62	Y	0
1043	Center St W. at Antonie Av N.	818.44	817.36	N	1.1
1041	Center St W. at Antonie Av N.	818.38	817.60	N	0.8
1309	Center St W. at Cedar Av N.	811.97	812.60	Y	0
1308	Center St W. at Cedar Av N.	812.10	812.57	Y	0
1300	Eatonville Hwy W. at Center St W.	811.54	811.81	Y	0
N55	North side of Eatonville Hwy W. Southwest of Antonie Av N.	820.00	817.97	N	2.0
N56	South side of Eatonville Hwy W. Southwest of Antonie Av N.	820.00	817.97	N	2.0
N57	South side of Eatonville Hwy W. Southwest of Antonie Av N.	820.00	817.97	N	2.0
N61	South side of Eatonville Hwy W. at intersection point of drainage ditch	820.00	817.97	N	2.0
944	Eatonville Hwy W. between Antonie Av N. & Larson St W.	819.54	817.97	N	1.6
945	Eatonville Hwy W. near Larson St W.	822.39	819.39	N	3.0
1302	Cedar Av S. near Eatonville Hwy W.	810.11	810.42	Y	0
1325	South of Center St W. near Penn Av N.	807.90	808.35	Y	0
1328	Center St W. near Orchard Av N.	807.26	807.01	N	0.2
1330	Center St W. near Orchard Av N.	806.52	806.28	N	0.2
1331	Center St W. between Orchard Av N. & Rainier Av S.	806.63	805.30	N	1.3
1331B	North of Center St W. near Rainier Av S.	804.85	803.82	N	1.0
1331X [1]	North of Center St W. near Rainier Av S.	802.99	803.38	Y	0
1331C	North of Center St W. between Rainier Av S. & Mashell Av S.	801.84	801.77	N	0.1
986	Mashell Av S. North of Center St W.	799.39	799.59	Y	0
987	Mashell Av S. North of Center St W.	798.63	798.95	Y	0
1001	North of Center St E. between Mashell Av S. & Washington Av S.	794.71	795.05	Y	0
970	Washington Av S. North of Center St E.	792.17	793.50	Y	0
D1 [1]	North of Center St E. near school property along 36-inch discharge pipe to Lynch Creek	792.99	793.35	Y	0
1344	North of Center St E. at school property along 36-inch discharge pipe to Lynch Creek	792.13	792.46	Y	0
D2 [1]	North of Center St E. at Carter St W. near school property along 36-inch discharge pipe to Lynch Creek	790.99	789.93	N	1.1
D3 [1]	East of Washington Av S. at Lynch Creek Rd N.E.	786.99	782.82	N	4.2
D4 [1]	North of Lynch Creek Rd N.E.	791.99	779.14	N	12.8
D5-A [1]	North of Lynch Creek Rd N.E. at 36-inch Box Culvert	780.40	778.97	N	1.4
D5-B [1]	North of Lynch Creek Rd N.E. at 36-inch Box Culvert	780.35	778.55	N	1.8
D6 [1]	North of Lynch Creek Rd N.E. along discharge ditch to Lynch Creek	730	727.46	N	2.5
D7 [1]	North of Lynch Creek Rd N.E. along discharge ditch to Lynch Creek	700	698.19	N	1.8
D8 [1]	North of Lynch Creek Rd N.E. along discharge ditch to Lynch Creek	635	633.19	N	1.8
CENTER STREET EAST SYSTEM					
1100	Center St E. near Bergeren Rd N.	858.14	858.83	Y	0
935	Center St E. at Bergeren Rd N.	861.55	858.83	N	2.7
1096	Center St E. near Weyerhaeuser Rd N.	862.10	856.84	N	5.3
1093	Center St E. between Weyerhaeuser Rd N. & Eagle Glen Ct N.	859.11	854.39	N	4.7
1092	Center St E. between Weyerhaeuser Rd N. & Eagle Glen Ct N.	850.25	847.05	N	3.2
1091	Center St E. at Eagle Glen Ct N.	840.15	840.26	Y	0
1090	Center St E. at Magill Rd N.	826.41	826.73	Y	0
994	Center St E. at Madison Av S.	801.22	801.49	Y	0
1089	Center St E. near Madison Av S.	799.21	799.53	Y	0
1170	Center St E. between Madison Av S. & Malcom Pl N.	796.73	797.12	Y	0
1166	Center St E. between Malcom Pl N. & Glacier Av N.	793.98	794.37	Y	0
1164	Center St E. near Glacier Av N.	791.49	793.44	Y	0
993	Center St E. between Glacier Av N. & Washington Av S.	792.12	793.43	Y	0
1346	North of Center St E. near school property	792.04	793.41	Y	0

Notes:

1 Note the rim/ground elevation is estimated/assumed NOT surveyed.

Section 5

STORMWATER REGULATIONS

Section 5
STORMWATER REGULATIONS

5.1 Introduction

This section includes a review of the existing Town, state, and federal policies, regulations and ordinances relevant to stormwater management. It then provides a table that summarizes these regulations and lists recommended actions to bring the Town of Eatonville into compliance.

5.2 Relevant Town Policies, Ordinances, and Regulations

This section provides an overview of the Town of Eatonville's policies, ordinances, and regulations relevant to stormwater management. The Town's regulations are set forth in the Eatonville Municipal Code (EMC), which includes several chapters related to environmental requirements. The Town's Comprehensive Plan and Comprehensive Storm Drainage Report are also summarized.

5.2.1 Eatonville Municipal Code (EMC)

5.2.1.1 Chapter 13.24 — Storm Drain Utility

This chapter establishes the drainage utility and the corresponding rules and regulations for the Town including definitions, rates, system development charges, billing and collection, charges for new construction, collection and penalties with respect to bill payment, and rate adjustments. It also adopts the Town of Eatonville Storm Drainage Report.

5.2.1.2 Chapter 15.04 — Environmental Policy

This chapter adopts the policies of the State Environmental Policy Act (SEPA) as expressed in the Revised Code of Washington (RCW) 43.21C.010 and 43.21C.020.

5.2.1.3 Chapter 15.08 — Shoreline Management Plan (SMP)

This chapter satisfies the requirements of the Shoreline Management Act of 1971. The document designated as the "Shoreline Management Use Regulations" for Pierce County (Title 20), adopted by the Town in 1975 and revised April 1981, is adopted as the Shoreline Management Master Plan (SMP) of the Town. The SMP sets forth environmental designations intended to provide a uniform basis for applying policies to varying shoreline uses.

The SMP will need to be updated in the future to comply with new state guidelines once they are completed. On November 29, 2000, Ecology adopted new shoreline master program guidelines (Chapter 173-26 WAC), however the Shorelines Hearings Board invalidated those guidelines in August 2001. Parties to the litigation that resulted in the Hearings Board decision achieved a settlement in December 2002 to address the specific issues in the ruling by the Hearings Board, but the new rule to implement this settlement has not yet been issued by Ecology. The new rule will provide details on how local governments can achieve the level of protection required by the Shoreline Management Act. The guidelines will limit the amount and types of development allowed adjacent to streams, lakes, and marine waters in Washington State. The shoreline guidelines will apply only to new development and redevelopment.

It is the general purpose of the program to encourage uses appropriate to the desired character of that environment and at the same time to place standards and restrictions on development and use activities so that they do not disrupt or destroy the character of that environment. The SMP defines what types of land uses are permitted in the various shoreline areas and defines setbacks for development.

The SMP is considered an element of the Town of Eatonville's Comprehensive Plan and the SMP Use Activity Regulations (as adopted from the Pierce County Shoreline Management Use Regulations, Chapter 20.20) supplement the Town of Eatonville Municipal Code.

5.2.1.4 Chapter 15.16 — Wetlands Protection

This chapter was developed to protect wetlands from degradation by requiring site planning to avoid or minimize damage to wetlands wherever possible. Most activities not dependent upon a wetland location will be located at upland sites, and will achieve no net loss of regulated wetlands by requiring restoration or enhancement of degraded wetland or creation of new wetland to offset losses that are unavoidable.

5.2.1.5 Chapter 15.20 — Sensitive Areas

This chapter was developed to comply with the requirements of the Growth Management Act, which was passed by the Washington State Legislature in 1990. The Growth Management Act is discussed in greater detail later in this section; however, a brief summary as it relates to the EMC is given here.

The Growth Management Act requires the fastest growing counties (including Pierce County and the municipalities within Pierce County) to comply with the Act. The Act requires these municipalities to develop local comprehensive land use plans and development regulations. It also requires that municipalities classify, designate, and develop regulations to protect certain critical areas prior to the completion of comprehensive land use plans. These critical areas include:

- Fish and Wildlife Habitat Conservation Areas

- Wetlands
- Aquifer recharge areas
- Geologically hazardous areas
- Flood hazard areas

The intent of the critical area designation is to require municipalities to provide regulatory protection of these critical areas prior to the development and adoption of comprehensive land use plans that meet the standards of the Act. In this way, the conservation of critical areas can be accomplished while more detailed studies and discussions occur during the development of comprehensive plans that will ultimately determine a long-term approach to critical area protection.

EMC Chapter 15.20 includes critical environmental area protection goals; definition of regulated activities; permit process and application requirements; rating system for streams and wetlands; required buffer areas for streams and wetlands; road and utility development requirements in critical areas; stormwater drainage and erosion control requirements; and allowed development activities in streams, wetlands and buffers.

5.2.1.6 Chapter 15.24 — Flood Damage Prevention

This chapter satisfies the requirements for the Town's participation in the Federal Flood Insurance Program. This chapter adopts by reference a 1986 Federal Insurance Administration (FIA) report entitled "Flood Insurance Study, Town of Eatonville, Washington, Pierce County" and associated Flood Insurance Rate Maps (FIRM), which establish the areas of special flood hazard. Special flood hazard areas are subject to a one percent or greater chance of flooding in any given year as shown in the above-mentioned maps. This chapter establishes a development permit application, review procedures, and new development standards for proposed development in special flood hazard areas.

5.2.1.7 Chapter 16.54 — Stormwater Management and Erosion Control

This chapter was developed to control the adverse effects of erosion and sedimentation related to buildings and construction (EMC Title 16). Chapter 16.54 adopts the 1997 Pierce County Stormwater Management and Site Development Manual.

5.2.2 Eatonville Comprehensive Plan

The 1993 Comprehensive Plan and EIS was developed to meet the requirements of the Growth Management Act (GMA). The plan contains several elements, including environmental protection, housing economic development, community facilities and services, land use, transportation and utilities.

5.2.3 Eatonville Comprehensive Storm Drainage Report

The 1986 Eatonville Comprehensive Storm Drainage Report was developed to promote sound development policies and storm drainage planning. It provided a sample drainage ordinance which described and defined general procedures and requirements. The report also included more specific development procedures and requirements.

The report describes the existing system including area soils, topography, and drainage system capacities. Future development potential is addressed with respect to drainage issues. A series of recommendations are made to establish a consistent approach for stormwater management, and a list of capital improvement projects is recommended.

The report was a cursory look at the existing drainage patterns within the Town that were easily visible. No inventory , or hydraulic analysis of the drainage system was performed, nor was a hydrologic analysis performed to estimate amounts of runoff in different frequency events.

The Storm Drainage Report was adopted as part of the Eatonville Municipal Code (EMC) Chapter 13.24 establishing a storm drainage utility.

5.2.4 Eatonville Flood Insurance Study (FEMA, 1986)

This study investigates the existence and severity of flood hazards in the Town and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study identified a 100-year floodplain and floodway, as mandated by the National Flood Insurance Program (NFIP). This study is adopted in the Town of Eatonville's Municipal Code Chapter 15.24 described earlier in this section.

5.3 Relevant State Regulations and Programs

5.3.1 Puget Sound Water Quality Action Team and Work Plan (Puget Sound Plan Requirements)

The Puget Sound Water Quality Protection Act, passed during the 1996 Legislative session, creates a new approach to water quality protection in the Puget Sound Basin. A 13-member Puget Sound Water Quality Action Team and nine-member Puget Sound Council now lead water quality protection efforts in the Puget Sound Basin. The Action Team assumes responsibility for implementing the 1994 Puget Sound Water Quality Management Plan (see below), which was previously the responsibility of the Puget Sound Water Quality Authority (PSWQA). The Action Team, with guidance from the Puget Sound Council, must also develop biennial work plans that identify both state and local actions necessary to correct regional water quality problems. It is the policy of the state to implement the 1994 Puget Sound Water Quality Management Plan to the maximum extent possible.

5.3.1.1 Puget Sound Water Quality Management Plan

The Puget Sound Water Quality Management Plan (Puget Sound Plan), establishes a comprehensive plan to protect and improve water quality and aquatic resources in

Puget Sound. The PSWQA was directed to identify water quality problems and corresponding pollution sources affecting marine life and human health, and to develop effective pollution control and management programs that could be implemented in a comprehensive multi-jurisdictional manner throughout the Puget Sound basin.

The 1994 plan incorporates and builds on the Authority's 1991, 1989, and 1987 management plans. The 1994 plan is also the draft Puget Sound Comprehensive Conservation and Management Plan (CCMP) under the Puget Sound Estuary Program, as authorized by the federal Clean Water Act.

As noted above, the Puget Sound Water Quality Action Team replaced the PSWQA during the 1996 Legislative session. While the PSWQA no longer exists, the intent of the Puget Sound Action Team is to implement the many elements of the 1994 Puget Sound Plan. A number of programs regarding stormwater management have been included in the 1994 plan. State authority to require jurisdictions to implement the provisions contained within the 1994 Puget Sound Plan is inherent in the 1996 Puget Sound Water Quality Protection Act, discussed previously. These programs are as follows:

5.3.1.1.1 Development Standards and Operations and Maintenance Programs for all Municipalities

The provisions within the 1994 Puget Sound Plan for achieving the program's goal of controlling pollution from stormwater is to implement best management practices (BMPs), assess their effectiveness, and, as necessary, require further water quality controls that may include treatment. This includes a requirement for jurisdictions to adopt a stormwater management ordinance (or ordinances) with minimum standards for new development and redevelopment. The ordinances are to be substantially equivalent to Ecology's model ordinances.

These ordinances shall address, at a minimum: (1) the control of off-site water quality and quantity impacts; (2) the use of source control best management practices and treatment best management practices; (3) the effective treatment, using best management practices, of the 6-month design storm for proposed development; (4) the use of infiltration, with appropriate precautions, as the first consideration in stormwater management; (5) the protection of stream channels and wetlands; (6) erosion and sedimentation control for new construction and redevelopment projects; (7) local enforcement of these stormwater controls.

In addition, each municipality shall also develop and enforce operation and maintenance programs and ordinances for new and existing public and private stormwater systems. Each municipality shall maintain records of new public and private storm drainage systems and appurtenances.

The 1994 plan also requires that in conjunction with the runoff control ordinances for new development and redevelopment, each jurisdiction shall adopt a stormwater management technical manual containing state-approved BMPs. A local government may adopt the Ecology Technical Manual or prepare its own technical manual as long as it has technical standards equivalent to those included in Ecology's 2001 Stormwater Management Manual for Western Washington.

Education programs to inform citizens about stormwater and its effects on water quality, flooding, and fish-wildlife habitat, and to discourage dumping of waste material or pollutants into storm drains, are also included in the Education and Public Involvement Program and the Household Hazardous Waste Program sections of the 1994 plan.

Each municipality that adopts a comprehensive land use plan and development regulations under the provisions of Chapter 36-70A RCW (the Growth Management Act), shall incorporate the goals of the local stormwater program into the goals of the comprehensive plan and shall incorporate the stormwater management ordinances into the development regulations.

Consistent with the Growth Management Act, each local jurisdiction in the Puget Sound Basin is expected to cooperate with neighboring jurisdictions in growth management, stormwater planning and stormwater basin planning.

Ecology will monitor compliance with these requirements, reviewing the status of municipality operation and maintenance and runoff control programs every two years to ensure consistent and adequate implementation. Ecology's oversight role shall pertain only to compliance with the objectives of the plan's stormwater program and appropriate rules and statutes and technical suggestions to improve implementation. This should ensure maximum flexibility and creativity for local governments to resolve site-specific stormwater problems in accordance with their land use and other local policies.

Comprehensive Urban Stormwater Programs

Each municipality must develop and implement a comprehensive stormwater management program in order to:

- Control erosion and manage the quantity and the quality of stormwater runoff from public and private activities.
- Protect and enhance water quality, and achieve water quality and sediment quality standards.
- Reduce the discharge of pollutants to the maximum extent practicable within the constraints of federal and state laws.
- Protect beneficial uses, as described in Chapter 173-201 WAC.
- Achieve the four items above in a manner that makes efficient use of limited resources to address the most critical problems first.

Each urban stormwater program shall seek to control the quality and quantity of runoff from public facilities and industrial, commercial, and residential areas, including streets and roads. Each program shall cover both new and existing development. Early action by urbanized areas that are prepared to implement stormwater control programs is encouraged. Emphasis shall be placed on controlling stormwater through source controls and BMPs. Where local programs are not effectively solving stormwater problems, Ecology shall ensure compliance through its oversight role. Each municipality shall have the flexibility to design its own program, but the content, priorities, and deadlines for compliance shall be subject to review by Ecology for consistency with the Puget Sound Plan.

In some cases, significant stormwater problems may be originating in urbanized areas outside of a local jurisdiction. In those situations, the sequencing of areas for urban stormwater programs may be modified to address problems in shared watersheds. The neighboring jurisdictions will develop local coordination mechanisms to cooperatively resolve the identified problems. Where joint programs are not developed, Ecology shall ensure consistency in programs through its oversight role.

At a minimum, each urban stormwater program shall include:

- Identification and ranking of significant pollutant sources and their relationship to the drainage system and water bodies through an ongoing assessment program.
- Investigations and corrective actions of problem storm drains.
- Programs for operation and maintenance of storm drains, detention systems, ditches and culverts.
- A water quality response program, to investigate sources of pollutants, and respond to citizen complaints or emergencies such as spills, fish kills, illegal hookups, dumping and other water quality problems. These investigations should be used to support compliance/enforcement efforts.
- Assurance of adequate local funding for the stormwater program through surface water utilities, sewer charges, fees, or other revenue-generating sources.
- Local coordination arrangements such as interlocal agreements, joint programs, consistent standards, or regional boards or committees.
- Ordinances requiring implementation of stormwater controls for new development and redevelopment.
- A stormwater public education program aimed at residents, businesses and industries in the urban area.
- Inspection, compliance, and enforcement measures.
- An implementation schedule.
- If, after implementation of the control measures listed in the points above, there are still discharges that cause significant environmental problems, retrofitting of existing development and/or treatment of discharges from new and existing development may be required.

Stormwater quality in public stormwater systems in commercial and industrial areas shall have a high priority in the municipal programs. Ecology shall determine, in compliance with EPA regulations and in consultation with local governments, the appropriate approach to controlling stormwater discharges from industrial and commercial facilities that are not currently required to have stormwater NPDES or point source discharge permits. Stormwater controls are included in NPDES permits for discharges of stormwater from commercial and industrial point source facilities, which are addressed in the Industrial Discharges Program.

Ecology shall have oversight responsibilities for the urban stormwater programs. Ecology shall review each urban stormwater program every two years to ensure consistent and adequate implementation and report to the Action Team.

5.3.1.1.2 Local Government Stormwater Assistance Service

The intent of the 1994 Puget Sound Plan and subsequent Puget Sound Water Quality Work Plan is to provide technical assistance to local governments through staff who have hands-on experience with (1) the design and implementation of stormwater programs at the local level, (2) current Best Management Practices for stormwater, and (3) local basin characteristics. Ecology shall assist the municipality with current stormwater expertise to establish a technical assistance service.

This service will support the exchange of technical information and assistance on stormwater among local governments, will train Ecology and local government staff in current practices and real world application and problems in stormwater technology, and will operate as an integral part of the state technical assistance program. The service will have the goal of acting as an in-the-field branch of Ecology's technical assistance program.

5.3.1.1.3 Guidance and Model Ordinances

Ecology will prepare and update guidance and model ordinances for stormwater programs for all municipalities and for comprehensive urban stormwater programs. All municipalities will adopt stormwater programs that include minimum requirements for new development and redevelopment set by the plan and in guidance developed by Ecology.

The guidance shall include:

- Procedures for developing local programs, including procedures for review and approval of programs.
- Minimum requirements for runoff controls and system maintenance required in local ordinances.
- Minimum requirements for control of private sector maintenance of private drainage systems.
- Minimum requirements for operation and maintenance programs, including record keeping requirements for drainage systems and facilities.
- Methods for assuring practical and appropriate disposal procedures for decant water, solid, and other substances from drainage system clean out and maintenance. Methods shall address catch basins, oil/water separators, pipelines, swells, detention/ retention basins and other appropriate drainage elements.

Additionally, the guidance for the comprehensive urban stormwater programs will include:

- Procedures for identification and ranking of significant pollutant sources and their relationship to the drainage system and water bodies
- Procedures for source tracing investigations, including sampling of problem storm drains.
- Procedures for investigations, implementation of spill control measures, enforcement, and remedial actions.
- Methods for assuring adequate local funding for the urban stormwater program.
- Provisions for agreements with neighboring jurisdictions when stormwater and watersheds do not follow jurisdictional boundaries.
- Requirements for public education programs.
- Requirements for retrofitting and/or treatment measures, if necessary.
- Procedures for inspection, compliance, and enforcement measures.
- Requirements for implementation schedules.
- Methods to coordinate stormwater management with other watershed habitat protection and growth management activities.

The guidance will lay out acceptable approaches to control stormwater from new development and redevelopment, such as water quality policies for use in SEPA, NPDES, and other permit decisions; density controls to limit development in sensitive areas; development standards to limit the amount of impervious surfaces; regional detention ponds; oil separators or other treatment facilities; grading and drainage ordinances; erosion control programs; buffers next to waterways; preservation of wetlands; and other appropriate elements.

5.3.2 Washington State Department of Fish and Wildlife (WSDFW)/Hydraulic Project Approval (HPA)

The Washington State Department of Fish and Wildlife (WSDFW) requires a Hydraulic Project Approval (HPA) for construction activities that use, divert, obstruct, or change the natural flow or bed of any waters of the state (RCW 75.20.100). The purpose of the requirements, which are administered through the HPA permit process, is to protect fish habitat in stream channels and prevent erosion, and to protect freshwater and near-shore marine aquatic life. Any construction activity such as channel widening or culvert improvements within the ordinary high water of any stream would fall under the HPA permit requirements. In some instances, WSDFW is also extending their permitting authority to include developments creating new impervious surfaces in excess of 5,000 square feet even if the project does not include work within the ordinary high water mark. The rationale for extending their permit authority is that such a project will affect the hydrologic regime of downstream stream habitats.

5.3.3 Growth Management Act (GMA)

Enacted on July 1, 1990, the Growth Management Act (GMA), is intended to manage growth in Washington's fastest growing counties through the adoption of local comprehensive land use plans and development regulations. A 1995 GMA amendment requires all counties and cities in Washington to include the best available science in developing policies and development regulations to protect the functions and values of critical areas.

5.3.4 State Floodplain Regulations

Chapter 86.16 RCW establishes statewide authority through regulations promulgated by Ecology for coordinating the floodplain management regulation elements of the National Flood Insurance Program (NFIP). Under Chapter 173-158 WAC, Ecology requires local governments to adopt and administer regulatory programs compliant with the minimum standards of the NFIP. Ecology provides technical assistance to local governments for both identifying the location of the 100-year (base) floodplain and in administering their floodplain management ordinances.

Ecology also establishes land management criteria in the base floodplain area by adopting the federal standards and definitions contained in 44 CFR, Parts 59 and 60, as minimum state standards. In addition to adopting the federal standards, the state regulations provide for additional regulation of residential development in the floodplain.

A Flood Insurance Study and associated Flood Insurance Rate Maps for the Town of Eatonville were published in July 1986 and adopted by the Town as discussed in Part 5.2 of this section.

5.4 Relevant Federal Regulations & Programs

5.4.1 National Pollutant Discharge Elimination System

5.4.1.1 Federal Stormwater Management Policy

In 1990, the federal government adopted the National Pollutant Discharge Elimination System (NPDES) Phase I Rule, which addressed priority sources of pollutant runoff, including stormwater pollution from medium and large Municipal Separate Storm Sewer Systems (MS4s), industrial sources, and construction sites disturbing at least five acres.

In 1999, the federal government adopted the NPDES Phase II Rule that primarily regulates smaller MS4s not covered under Phase I and construction activities of between one and five acres. **Under the 1999 NPDES Phase II Rule and Ecology's list of Phase II communities, the Town of Eatonville will <u>not</u> be required to obtain an NPDES Phase II permit because it does not meet the threshold requirements for an Urbanized Area. The following information is provided for reference only.**

5.4.1.2 NPDES Phase II Objectives

The United States Environmental Protection Agency's (EPA's) objectives in developing the Phase II regulations include:

- Providing a comprehensive stormwater program that designates and controls additional sources of stormwater discharges to protect water quality, pursuant to CWS Section 402 (p)(6)
- Addressing discharges of stormwater from activities not addressed by Phase I, including:
  - All construction site activities involving clearing, grading and excavating land equal to or greater than one acre (including projects that are comprised of several sites of less than one acre each)
  - "Light" industrial activities not exposed to stormwater (light industrial activities exposed to stormwater are covered under Phase I)
  - MS4s located in urbanized areas not covered under Phase I
  - Municipally owned industrial facilities that were addressed under Phase I but granted an extension under ISTEA (Intermodal Surface Transportation Efficiency Act)
- Facilitating and promoting watershed planning as a framework for implementing water quality programs wherever possible

EPA aims to achieve these objectives by balancing nationwide automatic designation and locally based designation. EPA will designate, on a nationwide basis, that the NPDES Phase II rule is applicable to the following:

- Stormwater discharges from small MS4s located in urbanized areas
- Construction activities that result in land disturbance equal to or greater than one acre

EPA believes that these designation criteria address the main sources of stormwater pollution causing significant degradation of surface waters. Permitting authorities (Ecology, in Washington State) may designate additional Phase II permittees, such as additional small MS4s and categories or individual sources of stormwater discharges that are problematic in specific communities.

5.4.1.3 NPDES Phase II Permitting Authority for the State of Washington

The State of Washington is authorized to administer the federal NPDES program and Ecology is the state agency with responsibility for the following:

- Issuing NPDES permits
- Issuing the menu of appropriate BMPs in cases of general permits
- Supporting local programs:
  - Overseeing programs

- Ensuring municipalities have adequate legal authority
- Providing Technical Assistance
- Providing waivers for some or all permit requirements

Ecology has stated that it will issue one general permit for all Phase II permittees that will describe permit conditions for all small MS4s in order for them to be in compliance with the federal NPDES Phase II Rule. According to the federal rule, each Phase II permittee is required to submit a notice of intent (NOI) to be covered under the general permit as well as the permit application by March 10, 2003. In Washington, these two documents are combined into a single permit application.

According to the federal rule the NPDES permitting authority (Ecology) was supposed to issue a final general permit by December 8, 2002. Based on recent conversations with Ecology, the expected date for issuance of the final general permit ranges between Fall 2003 and Fall 2004. The expiration date of the first permit term for the general permit will be five years after its issuance.

The federal rule specifies that the regulated MS4 programs, described in this case in Ecology's general permit, must be developed and implemented within the first five year permit term.

5.4.1.4 Stormwater Management Requirements under NPDES Phase II

(1) For MS4s

The EPA requires, under the Phase II regulation, that all owners/operators of small MS4s reduce the discharge of pollutants from a regulated system to the "maximum extent practicable" to protect water quality (Federal Register Vol. 63, p. 1574). At a minimum, jurisdictions regulated under Phase II must:

- Specify BMPs for six minimum control measures and implement them to the "maximum extent practicable."
- Identify measurable goals for control measures.
- Show an implementation schedule of activities or frequency of activities.
- Define the entity responsible for implementation.

(2) For Construction and Other Activities

Construction activities that disturb one to five acres must also be regulated under an NPDES Phase II permit. The NPDES permitting authority may also require that other facilities and industrial and construction activities, as well as small MS4s outside urbanized areas, be designated on a case-by-case or categorical basis.

Each of these requirements is discussed in more detail in the subsections that follow.

5.4.1.5 BMPs for Six Minimum Control Measures

Municipal stormwater management programs must specify best management practices (BMPs) for the following six minimum control measures:

(1) Public Education and Outreach Minimum Control Measure

- A public education program must be implemented to distribute educational materials to the community.
- The community should be made aware about the impacts of stormwater discharges to waterbodies and the steps needed to reduce stormwater pollution
- Municipalities are encouraged to work with other governmental entities and civic, environmental, and industrial organizations to develop an education/outreach program more efficiently

(2) Public Participation/Involvement Minimum Control Measure

- The public must be involved in developing the municipality's stormwater program by following applicable state, tribal and local public notice requirements.
- All economic and ethnic groups should be included.
- Examples of public involvement/participation that should be considered include public hearings, citizen advisory boards, and working with citizen volunteers.

(3) Illicit Discharge Detection and Elimination Minimum Control Measure

- The goal of this control measure is for the Phase II MS4 permittee to demonstrate awareness of their system, using maps or other existing documents.
- They also must develop a storm sewer system map that shows all outfalls, and the location/name of all waters of the US that receive discharges.
- A Phase II MS4 permittee must effectively prohibit illicit discharges into the separate storm sewer system.
- Appropriate enforcement procedures must be implemented.
- A Phase II MS4 permittee must develop and implement a plan to detect and address illicit discharges (including illegal dumping) to the system.
- Public employees, businesses, and the general public must be informed of the hazards associated with illegal discharges and improper disposal of waste.

(4) Construction Site Runoff Control Minimum Control Measure

- Phase II MS4 permittees must develop, implement, and enforce a program to reduce nonpoint source pollution from construction sites with a land disturbance of more than one acre.
- A regulatory mechanism must be used to control erosion and sediment from applicable construction sites to the maximum extent practicable and allowable under state, tribal or local law.
- Existing erosion and sediment control ordinances may suffice, if approved by the NPDES permitting authority.

(5) Post-Construction Runoff Control Minimum Control Measure

- Phase II MS4 permittee must develop, implement, and enforce a program that addresses stormwater runoff from new development and redevelopment projects that result in land disturbances of at least an acre and that discharge to their MS4.
- Appropriate structural and non-structural BMPs must be used.
- Controls must ensure that water quality impacts are minimized.
- Adequate long-term operation and maintenance of BMPs connected to a regulated MS4 must be addressed.
- The goal, at a minimum, should be to maintain pre-development runoff conditions.
- EPA encourages the use of preventive measures, including non-structural BMPs, which are usually thought to be more cost-effective.

(6) Pollution Prevention/Good Housekeeping Minimum Control Measure

- Phase II MS4 permittees must develop and implement cost-effective operation and maintenance, as well as training programs, with the goal of preventing or reducing pollutant runoff from municipal operations.

5.4.1.6 Measurable Goals for Control Measures

The requirement allowing each permittee to identify its own measurable goals for each control measure is unique to Phase II. Communities regulated under Phase I were subject to more prescriptive compliance requirements. Examples of measurable goals include:

- Inspecting or repairing a certain number of drain inlets each year.
- Conducting street-sweeping operations a certain number of times each year.
- Inspecting municipal right-of-ways to identify illicit discharges.
- Conducting a certain number of training classes for municipal operations each year.
- Reporting the help of a certain number of volunteers each year to perform water quality monitoring or education/outreach activities.

5.4.1.7 Implementation Schedule of Activities or Frequency of Activities

Regulated communities must show an implementation schedule of activities or frequency of activities that will be done as part of the stormwater management program. An example might include the following entries:

Sweep Town streets	X times per year
Vacuum storm drain inlets	Y times per year
Conduct classroom stormwater education	Z times per year
Implement Household Hazardous Waste Program	by a certain date

5.4.1.8 Entity Responsible for Implementation

Regulated communities must also indicate who is responsible for the stormwater management program. There must be one entity or person responsible for the entire program.

The Phase II regulations are amenable to creative implementation strategies, as they encourage communities to take a watershed or cooperative approach. Communities may also be covered under a neighboring Phase I community, or allow another entity, such as a county, to implement certain minimum control measures or portions of minimum control measures. The regulated entity, however, is still responsible for complying with the requirements of the permit.

5.4.1.9 Phase II Permitting Process

Because Eatonville does not meet the NPDES Phase II Rule threshold requirements, the Phase II Rule as it relates to MS4s will not be applicable to the Town. The Phase II Program for Construction Activities and Industrial Activities still applies to the Town. This section is provided for informational purposes.

5.4.1.9.1 Phase II Small MS4

A general permit will most likely be issued by Ecology to cover Phase II MS4s in Washington. Permittees will need to submit a permit application Ecology to be covered under a general permit by March 10, 2003. As part of this application, an applicant may be required to identify and submit the following information:

- The BMPs that will be implemented.
- The measurable goals for the minimum control measures.
- The month and year in which each BMP will be started and completed or the frequency of action if it is ongoing.
- The person(s) responsible for implementing or coordinating the stormwater management program.

5.4.1.9.2 Phase II Regulated Construction Site

Under the Phase I program, for land disturbing activities greater than five acres, a notice of intent (NOI) was required for coverage under a general construction permit. For the Phase II Rule, EPA is not specifying NOI requirements for construction sites of between one and five acres applying for coverage under a general permit. While EPA recognizes the benefit of NOIs—which allow for better outreach and dissemination of information—federal regulators are sensitive to the burden being placed on the regulated community and on the NPDES regulators. Therefore, it is up to Ecology, as the NPDES permitting authority, to determine whether it will require NOI submission for construction sites disturbing less than five acres. Ecology is currently revising its construction stormwater general permit and expects to reissue this permit in June 2003.

5.4.1.9.3 Phase II Industrial Stormwater Permit

Industrial sites requiring permits as determined by standard industrial classification (SIC) codes are required to obtain an NPDES permit for industrial activities. Some Town facilities may subject to this requirement, possibly including the Town's wastewater treatment plant if it has a capacity greater than 1 MGD, and the road maintenance yard. The deadline for permit application is January 30, 2003.

Ecology issued its current Industrial Stormwater General Permit in August 2002. Since that date, the permit has been appealed, and hearing on the issues raised by the appeals is scheduled to begin in June 2003. In the meantime, Ecology's current permit is applicable, and the permit application can be obtained from Ecology's website.

5.4.1.10 NDPES Phase II Ongoing Requirements

Under the Phase II rule, regulated communities must conduct periodic evaluations and assessments of their stormwater management practices, maintain records, and prepare required reports according to Table 5-1.

Table 5-1
Minimum Reporting Requirements

Evaluation and Assessment Requirements	Record Keeping Requirements	Reporting Requirements
■ Evaluate program compliance	■ Keep records required by the NPDES permitting authority for at least three years	■ Submit annual reports to the permitting authority for the first permit term
■ Evaluate the appropriateness of identified BMPs	■ Submit the records when requested by the permitting authority	■ In subsequent terms, submit reports in years two and four or more frequently as required
■ Evaluate progress toward achieving measurable goals The NPDES permitting authority may determine monitoring requirements appropriate to your watershed. EPA encourages participation in a group monitoring project.	■ Make records and stormwater management plan accessible to the public during regular working hours ▪ A reasonable copying fee may be charged ▪ Advance notice of up to two days for copying may be requested	■ Reports should include: ▪ Status of permit condition compliance ▪ Appropriateness of identified BMPs ▪ Progress toward achieving measurable goals for each measure ▪ Results of data collected and analyzed during the reporting period ▪ A summary of the activities that will take place during the next reporting period ▪ Any changes in measurable goals

5.4.2 Endangered Species Act (ESA)

5.4.1.11 Overview

When evaluating the Town's stormwater program, it is important to be aware of how the ESA (as it relates to fish species) can impact the Town's activities. Puget Sound and its tributary streams in the vicinity of the Town of Eatonville provide habitat, or may provide habitat, for aquatic species listed as threatened or endangered under the Endangered Species Act of 1973. The ESA prohibits killing or harming an endangered species in any way, including significant modification of critical habitat for that species. The ESA requires federal agencies to develop programs to conserve endangered and threatened species and assist in species recovery. Under the ESA, a species likely to become extinct in the foreseeable future is categorized as "endangered" while one likely to become endangered unless action is taken is categorized as "threatened."

The ESA is jointly administered by the Secretaries of the Department of Commerce (DOC) and the Department of the Interior (DOI) (16 U.S.C. § 1532 [15]). The National Marine Fisheries Service (NMFS), an agency under the DOC, is responsible for marine species including anadromous fish, some sea turtles, and marine mammals.

The U.S. Fish and Wildlife Service (USFWS), an agency under the DOI, is responsible for terrestrial species and resident aquatic species.

Although the ESA is a federal statute, its implementation can affect local jurisdictions and their citizens in several ways. A listing can potentially affect a wide variety of activities including, but not limited to, stormwater management practices, infrastructure improvements, land use planning, maintenance of existing facilities, and private development proposals.

The body of federal legislation that is commonly termed the "Endangered Species Act" is comprised of 11 sections, six of which are commonly referenced in relation to regulatory actions. These include:

- Section 4: Determination of Endangered and Threatened Species;
- Section 6: Cooperation With States;
- Section 7: Interagency Cooperation;
- Section 9: Prohibited Acts;
- Section 10: Exceptions; and
- Section 11: Penalties and Enforcement.

5.4.1.12 Section 4: The 4(d) Rulemaking Process

In June 2000, the NMFS adopted a rule prohibiting the "take" (which includes harass, harm, pursue, hunt, shoot, wound, kill, trap, or collect; or to attempt any of these things) of 14 groups of salmon and steelhead listed as threatened under the ESA. NMFS adopted the take rule under section 4(d) of the ESA. This rule prohibits anyone from taking a listed salmon or steelhead, except in cases where the take is associated with an approved program. The 4(d) rule approves some specific existing state and local programs, and creates a means for NMFS to approve additional programs if they meet certain standards set out in the rule. The 4(d) rule for salmon took effect 180 days after it was published in the Federal Register (January 2001). The 4(d) rule for steelhead took effect 60 days after it was published in the Federal Register (September 2000).

In addition to the 4(d) rule, the ESA provides a variety of tools for saving species threatened with extinction. Under section 7 of the ESA, no Federal agency may fund, permit or carry out any activity that will jeopardize their continued existence. That is why projects that require a federal permit or have federal funding must go through a "consultation" with NMFS (for salmon and steelhead) or the USFWS (for Bull Trout). This "consultation" is to make sure that the project will adequately limit any impacts and qualify for an "incidental" take of listed species. Another tool is under Section 10 of the ESA that allows NMFS to issue incidental take permits for specific activities like research that usually do not apply to a municipality.

Back under Section 4(d), the ESA requires that activities of state and local governments, tribes, and private citizens be controlled so they do not lead to extinction of listed species. To comply with this, NMFS has established protective rules for threatened species. The rules need not prohibit all "take" though. The 4(d) rule can "limit" the situations to which the take prohibitions apply. But NMFS offers 4(d) "limits" only for those programs or activities that will not impair properly functioning habitat of listed species. In accordance with this provision, NMFS has established 13 general categories of programs that can qualify for 4(d) limits on the take prohibitions. NMFS will evaluate programs under these 13 categories that wish to be granted a 4(d) limit on take prohibitions. Limit No. 10 – Road Maintenance is a category where a municipal program could be evaluated by NMFS for a 4(d) limit on take prohibitions. Limit No. 12 – Municipal, Residential, Commercial, and Industrial Development and Redevelopment (MRCI) is another category where a municipal program could be evaluated by NMFS for a 4(d) limit on take prohibitions. The Tri County effort described below has obtained NMFS approval of Road Maintenance and is working to obtain NMFS approval of MRCI programs so that any jurisdiction that adopts these programs would then be eligible for the 4(d) limit on take prohibition.

The ESA does not directly require jurisdictions to change their practices to conform to the take limits described in the final rule. The take limits provide a way for jurisdictions to make sure an activity or program does not violate the take prohibitions. Without this assurance, jurisdictions would risk ESA penalties when an activity in question is determined to result in a take of a listed fish.

The 4(d) rule also provides a list of activities that have a high risk of resulting in a "take" of the listed threatened or endangered salmonids. The following list includes items that could be included in design standards that would prohibit activities that the 4(d) rule has determined are likely to result in injury or harm to listed salmonids. Town design standards should prohibit:

- Construction of structures like culverts, berms, or dams that eliminate or impede a listed species' ability to migrate or gain access to habitat.
- Removal, addition, or alteration of rocks, soil, gravel, vegetation or other physical structures that are essential to the integrity and function of a listed species' habitat.
- Removal of water or otherwise altering streamflow in a manner that significantly impairs spawning, migration, feeding, or other essential behavioral patterns.
- Construction of dams or water diversion structures with inadequate fish screens or passage facilities.
- Construction of inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent to or above a listed species' habitat.
- Operations that substantially disturb soil and increase the amount of sediment going into streams.

The following list includes items that should be included in the Town's regulations so that these activities that the 4(d) rule has determined are likely to result in injury or harm to listed salmonids would be illegal.

- Discharge of pollutants, such as oil, toxic chemicals, radioactivity, carcinogens, mutagens, teratogens, or organic nutrient-laden water (including sewage water) into a listed species' habitat is prohibited.

- The release of non-indigenous or artificially propagated species into a listed species' habitat or into areas where they may gain access to that habitat is prohibited.

The 4(d) rule has determined that the following list of maintenance related items are likely to result in injury or harm to listed salmon. The Town's maintenance program should not:

- Maintain structures like culverts, berms, or dams if maintenance eliminates or impedes a listed species' ability to migrate or gain access to habitat.
- Remove, poison, or contaminate plants, fish, wildlife, or other biota that the listed species requires for feeding, sheltering, or other essential behavioral patterns.
- Remove, add, or alter rocks, soil, gravel, vegetation or other physical structures that are essential to the integrity and function of a listed species' habitat.
- Remove water or otherwise alter streamflow in a manner that significantly impairs spawning, migration, feeding, or other essential behavioral patterns.
- Operate dams or water diversion structures with inadequate fish screens or passage facilities.
- Maintain or operate inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent to or above a listed species' habitat.

Chinook salmon in Puget Sound were federally listed as threatened species by the National Marine Fisheries Services in March of 1999. Bulltrout in Puget Sound and coastal waters were listed as threatened species by the US Fish and Wildlife Service in October 1999, and Coho salmon are currently candidate species in the Puget Sound.

The Nisqually River, of which the Mashel River and Lynch Creek are tributaries, contains Essential Fish Habitat (EFH) for Chinook, Coho, and Pink Salmon under the Magnuson-Stevens Fishery Conservation and Management Act. EFH means those waters and substrate are necessary to fish for spawning, breeding, feeding, or growth to maturity and includes the aquatic areas and their associated physical, chemical, and biological properties that are used by fish.

The Streamnet Database, at http://www.streamnet.org, confirms that Chinook and Coho Salmon are known to spawn and rear in the Nisqually River tributaries in the vicinity of the Town of Eatonville. Pink Salmon use these tributaries for migration.

5.4.1.13 Section 6: Cooperation with States

Although Section 6 is entitled "Cooperation with States," the law only requires agencies to "cooperate to the maximum extent practicable" with the states. Such cooperation includes "consultation with the states concerned before acquiring any land or water, or interests therein, for the purpose of conserving any endangered species or threatened species" (16 U.S.C. § 1535[a]). The ESA does not require the federal government to delegate any authority to state or local governments concerning the conservation or recovery of listed species, although provisions for this are made in Section 10 of the ESA (see below).

5.4.1.14 Section 7: Federal Responsibilities

Section 7 requires the federal government and its agencies to conserve listed species and to ensure that any projects or actions it authorizes, funds, or implements are not likely to jeopardize listed species or destroy or adversely modify their critical habitat. Under Section 7, the federal agency with permit or funding authority must review a project to determine if the project "may affect" a listed species (50 C.F.R. § 402.07). If a project is determined to affect a listed species, the federal agency must consult with the USFWS or NMFS (or both), depending on the species (50 C.F.R. § 402.14). An informal or "conference" process is required if a project may affect a proposed species (50 C.F.R. § 402.13). Section 7 requires the preparation of a Biological Assessment (BA) (also termed Biological Evaluation [BE]) for projects with a federal link or "nexus" to determine what, if any, effects the project or action may have on a listed species (50 C.F.R. § 402.12). A BA/BE may also be required for species that are proposed for listing, but not yet formally listed. At this time, Coho is a candidate species in the Puget Sound region.

The purpose of a BA/BE is to review the biological requirements of a listed species to determine potential effects of the project or action on those species (50 C.F.R. § 402.12). After the consultation process is complete, the USFWS or the NMFS will issue a Biological Opinion (BO) (50 C.F.R. § 402.15). The BO will determine if the project or action would result in "jeopardy" or the destruction or modification of critical habitat (50 C.F.R. § 402.14[h][3]). If a project or action is determined to affect a species that has been proposed for listing, the federal lead agency must complete an informal consultation with either the USFWS or NMFS, but the results of the subsequent conference is non-binding.

Section 7 consultation is only required for projects that may lead to construction. If a local construction project has a federal nexus, either through federal funding or a requirement for a federal permit, review of that action will be necessary under Section 7. Common federal permits or actions requiring review under Section 7 include the following:

- National Environmental Policy Act (NEPA) reviews for proposed construction projects;
- Corps of Engineers Clean Water Act Section 10 and Section 404 permits; and
- Funding for construction projects derived from a federal source.

Funding does not have to be in the form of a direct grant from a federal agency. Many types of grant programs are administered by state or local agencies, but these programs often include full or partial federal funding. Such programs include urban development block grants, clean water programs, and most forms of transportation funding.

5.4.1.15 Section 9: Prohibition of "Take"

Under Section 9 of the ESA, individuals and groups within U.S. jurisdiction are specifically prohibited from "taking" or otherwise harming a listed species (16 U.S.C. § 1538 [a][1][b]). "Take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct," any fish, wildlife, or plant that has been listed as Threatened or Endangered (16 U.S.C. § 1532 [19]). Subsequent interpretation and clarification by federal courts and agencies have expanded "harm" to include indirect actions which may result in the death or injury of protected species including significant habitat modification which may impair "essential behavior patterns, including breeding, feeding, or sheltering" (50 C.F.R. § 17.3).

Whereas the Section 7 process, as stated in the law (16 U.S.C. § 1536) and implementing regulation (50 C.F.R. § 402), includes specific instructions and requirements for review by federal agencies, Section 9 simply states "with respect to any endangered species of fish or wildlife listed pursuant to [Section 4 of the ESA] it is unlawful for any person subject to the jurisdiction of the United States to take any such species within the United States or the territorial sea of the United States" (16 U.S.C. § 1538[a][1][b]). While Section 9 arguably includes a much broader range of prohibited actions by simply prohibiting take, unlike Section 7, the language of Section 9 does not include a parallel process by which take is evaluated and adjudicated. To deal in part with the ambiguity, the 4(d) rulemaking process often includes criteria that NMFS or USFWS will use in determining what constitutes "take."

5.4.1.16 Section 10: State and Local Involvement

Although the ESA does not require the federal government to impart any authority to state, or local governments or private parties concerning the conservation or recovery of listed species, the recent policy of federal agencies has been to provide state and local governments and large private landowners the opportunity to develop and implemented their own protection and conservation measures. These are accomplished through voluntary, although legally binding, agreements provided for under Section 10 of the ESA (16 U.S.C. § 1530). The types of agreements allowed under Section 10 include Candidate Conservation Agreements, Safe Harbor Agreements, and Habitat Conservation Plans (HCPs). These plans can provide specific legal protection for actions not included as exemptions under 4(d) rules, but these agreements require a significant amount of coordination and legal efforts to implement.

5.4.1.17 Section 11: Third Party Lawsuits

Section 11 of the ESA specifically enables "citizen suits" for the purpose of: 1) enjoining a person or agency alleged in volition of any provision in the ESA; 2) compelling federal agencies to list a specific species; and 3) compelling the government to enforce protective measures upon the listing of a species (16 U.S.C. § 1540 [g][1]). In addition, Section 11 provides specific penalties for violations of the ESA including civil fines and criminal judgements (16 U.S.C. § 1540 [a] and (16 U.S.C. § 1540 [b], respectively).

5.4.1.18 ESA as it Relates to Eatonville

ESA regulated species occurring or having the potential to occur in the vicinity of the Town of Eatonville, as indicated in Section 4, would be identified by either the National Oceanic and Atmospheric Administration (NOAA) Fisheries (formerly National Marine Fisheries Service (NMFS)) or the U.S. Fish and Wildlife Services (USFWS).

5.4.1.19 County and Local Efforts to Respond to ESA

At the time when ESA listings of threatened fish species occurred, it was recognized by all levels of government that planning and regulatory activities in the region needed to be reevaluated. In addition, development and business interests began to inquire as to how this listing would affect them. To prepare a response to the listings that would attempt to consider all public and private needs in a coordinated fashion; several different planning and analysis efforts were begun. The following section presents a brief description of ESA response activities that are now ongoing that could affect stormwater planning in the Town of Eatonville.

Even before the National Marine Fisheries Service (NMFS) formally proposed that wild native Chinook salmon in the Puget Sound basin be listed as threatened under the Endangered Species Act, Pierce County, and other jurisdictions had begun to evaluate what they might do individually and together to address the reasons for salmon decline. The process of evaluating the current health and viability of the Chinook in each watershed began with compilation of data describing habitat conditions, population distribution and abundance. Along with these fisheries assessments, two other efforts were begun. An analysis was initiated of the actions each government body regularly undertakes, funds, or permits others to undertake, which could affect potentially listed salmon species and their habitat. An inventory was also begun to identify all the projects currently underway, and those expected to begin soon, that included federal funding since the proposed listing initiated additional federal agency consultation and review requirements, that were not previously needed.

Shortly after the proposal to list chinook salmon, the executives of King, Pierce and Snohomish Counties began drawing regional interests together. They formed an inclusive steering committee which would work together to identify a strategy for the region to recover salmon populations. This strategy would have the broad goal of recovering salmon stocks to numbers adequate to sustain the population and to provide harvestable salmon for Native American Tribes pursuant to their individual treaty rights.

Soon all jurisdictions within the Puget Sound basin, the area affected by the potential listings, began to communicate on this issue. However, a smaller group composed of King, Pierce, and Snohomish Counties determined to work closely together in a Tri County Effort (TCE) to meet their salmon conservation and recovery goals.

The participants in the TCE described above have set out a strategy for action. The goals of the TCE are to prepare for long term recovery of listed species, and to develop a response to ESA listing actions. The strategy used to accomplish this is to:

- Create watershed-based efforts called WRIA (Water Resource Inventory Area) Salmon Conservation Plans for each river system in these three counties.
- Use the umbrella TCE to address policy issues that affect multiple watersheds.

The Strategy can be described as five basic tasks:

- Identify long-term recovery objectives and steps towards achieving them.
- Inventory, at individual jurisdictional levels, all activities potentially affecting salmon.
- Undertake watershed assessments including determination of the watershed-specific factors for decline.
- Develop Draft WRIA Salmon Conservation Plans.
- Obtain NMFS approval of the proposed Road Maintenance (accomplished) and Municipal, Residential, Commercial, and Industrial Development and Redevelopment (MRCI) programs.

This strategy is designed to coordinate the various jurisdictions' efforts to collect and characterize the information necessary to create responses that will fit in a framework appropriate for the whole region. The TCE has received NMFS approval of Regional Road Maintenance ESA Program Guidelines and the TCE is working to obtain NMFS approval of a proposed MRCI program described above so that any jurisdiction that adopts the program would then be eligible for the 4(d) rule limit on take prohibition.

5.5 Summary Table

Table 5-3 summarizes the regulations discussed in this section and lists recommended actions to bring the Town of Eatonville into compliance.

Table 5-3
Town of Eatonville – Stormwater Management Program Update
Program Requirements

<table>
<tr><th rowspan="2">Stormwater Program Activity</th><th colspan="4">Requirements</th><th rowspan="2">Town Status</th><th rowspan="2">Plan of Action</th></tr>
<tr><th>Ecology's Basic and Comprehensive Stormwater Program [1]</th><th>NPDES Phase II Final Federal Rule [2]</th><th>Endangered Species Act 4(d) Rule [3]</th><th>Other Regulatory Programs</th></tr>
<tr><td>A. Develop Needed Regulations:

A.1. Develop Stormwater Design and Construction Standards for New Development and Redevelopment</td><td>• Adopt a Stormwater Management Ordinance that includes minimum requirements defined by the Department of Ecology (Ecology) for new development and redevelopment.
• In a Stormwater Management Ordinance, either: 1) adopt a Technical Manual equivalent to Ecology's Stormwater Management Manual for the Puget Sound Basin (the Ecology Manual) that contains the minimum requirements, or 2) refer to a Technical Manual as guidance only to be used to meet Ecology's minimum requirements. In the latter case, the minimum requirements must be contained in the ordinance. [4]
• The Stormwater Management Ordinance and/or Technical Manual must include thresholds and definitions of new development, redevelopment, land disturbing activities, and existing conditions that are substantially equivalent to Ecology's minimum requirements.
• The Stormwater Management Ordinance must include or adopt a Technical Manual that presents BMPs that are equivalent to those contained in the Ecology Manual. Include a BMP selection and site planning process equivalent to the process in the Ecology Manual.
• Include an exceptions or variance process in the Stormwater Management Ordinance and/ or Technical Manual that is similar in content to that contained in the Ecology Manual.
• Incorporate provisions for stormwater management into local growth management regulatory actions implemented under the Growth Management Act.</td><td>Construction Site Stormwater Runoff Control Design and Construction Standard Requirements are as follows:
• The owner or operator of a regulated small municipal separate storm sewer system (MS4) must develop, implement, and enforce a program to reduce nonpoint source pollution from construction sites of more than one acre.
• A regulatory mechanism must be used to control erosion and sediment to the maximum extent practicable and allowable under state, tribal or local law.
• Existing erosion and sediment control ordinances may suffice, if approved by the NPDES permitting authority.
• Procedures must be included for site inspection and enforcement of control measures.
• Procedures must be implemented to obtain input from the public.
• Water quality impacts must be addressed through site plan review processes.
• Construction site operators must control wastes generated at site.
Post-Construction Stormwater Management in New Development and Redevelopment Design and Construction Standard Requirements are as follows:
• Owners or operators of regulated small MS4s must develop, implement, and enforce a program that addresses Stormwater runoff from new development and redevelopment projects that result in land disturbances of at least an acre and that discharge to their MS4.</td><td>The 4(d) Rule provides a list of activities that have a high risk of resulting in a "take" of the listed threatened or endangered salmonids. The following list includes items that could be included in design standards that would prohibit activities that the 4(d) rule has determined are likely to result in injury or harm to listed salmonids. Design standards should prohibit:
• Construction of structures like culverts, berms, or dams that eliminate or impede a listed species' ability to migrate or gain access to habitat.
• Removal, addition, or alteration of rocks, soil, gravel, vegetation or other physical structures that are essential to the integrity and function of a listed species' habitat.
• Removal of water or otherwise altering streamflow in a manner that significantly impairs spawning, migration, feeding, or other essential behavioral patterns.
• Construction of dams or water diversion structures with inadequate fish screens or passage facilities.
• Construction of inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent to or above a listed species' habitat.
• Operations that substantially disturb soil and increase the amount of sediment going into streams.</td><td></td><td>The Town does not have an ordinance(s) that meets the minimum requirements defined by Ecology's Basic and Comprehensive Program under the Puget Sound Plan. Because the Town is not required to obtain an NPDES Phase II permit, the Town will not be subject to NPDES requirements for new ordinances. The Town also does not have a program approved by the National Marine Fisheries Service (NMFS) in place that gives it an exemption from the ESAs "take" prohibition for listed salmonids.</td><td>To satisfy the Puget Sound Plan requirements, the Town must develop a new Stormwater Management Ordinance using Ecology's Model Stormwater Management Ordinance as a guide. The new ordinance should be linked to a Stormwater design manual in one of the following two ways:
1) adoption of the Washington State Department of Ecology (Ecology) Technical Manual as a guidance manual, or
2) development of Stormwater standards that include minimum requirements equivalent to Ecology's [4].
A program approved by NMFS exists for road maintenance but not for other municipal activities. The Town should adopt the approved guidelines for road maintenance. The Town should also monitor the development of an approved program for municipal activities and adopt this program if and when it becomes available.
The Town may also rely on local projects, that have federal permitting or funding, to obtain an incidental take statement (ITS) from the Section 7 ESA consultation process with other federal agencies. Entities complying with the terms and conditions of an ITS are protected from ESA "take" liability.
The Town may require Industrial Stormwater General Permits for its Wastewater Treatment Plant and for its Road Maintenance Yard. Note the deadline for this permit is January 30, 2003.</td></tr>
</table>

Stormwater Program Activity	Requirements: Ecology's Basic and Comprehensive Stormwater Program [1]	Requirements: NPDES Phase II Final Federal Rule [2]	Requirements: Endangered Species Act 4(d) Rule [3]	Requirements: Other Regulatory Programs	Town Status	Plan of Action
A.1. Develop Stormwater Design and Construction Standards (cont'd)		• Appropriate structural and non-structural BMPs must be used. • Controls must ensure that water quality impacts are minimized. • Adequate long-term operation and maintenance of BMPs connected to a regulated MS4 must be addressed. • The goal, at a minimum, should be to maintain pre-development runoff conditions. • EPA encourages the use of preventive measures, including non-structural BMPs, which are usually thought to be more cost-effective.				
A.2. Regulations to Prevent Illicit Discharges	• Through an ongoing assessment program, identify and rank significant pollutant sources and determine their relationship to the drainage system and water bodies. • Investigate and take corrective actions for problem storm drains, including sampling. • Implement a water quality response program to investigate sources of pollutants, spills, fish kills, illegal hookups, dumping, and other water quality problems. These investigations should be used to support compliance/ enforcement efforts.	To prevent illicit discharges, the following Detection and Elimination activities are required: • The owner or operator of a regulated small MS4 must demonstrate awareness of their system, using maps or other existing documents. • They also must develop a storm sewer system map that shows all outfalls, and the location/ name of all waters of the US that receive discharges. • A Phase II community must effectively prohibit illicit discharges into the separate storm sewer system. • Appropriate enforcement procedures must be implemented. • A Phase II community must develop and implement a plan to detect and address illicit discharges (including illegal dumping) to the system. • Public employees, businesses, and the general public must be informed of the hazards associated with illegal discharges and improper disposal of waste.	The following list includes items that could be included in Town regulations that would prevent activities that the 4(d) rule has determined are likely to result in injury or harm to listed salmonids. • Standards shall prohibit discharge of pollutants, such as oil, toxic chemicals, radioactivitiy, carcinogens, mutagens, teratogens, or organic nuturient-laden water (including sewage water) into a listed species' habitat. • Standards shall prohibit release of non-indigenous or artificially propagated species into a listed species' habitat or into areas where they may gain access to that habitat.		The Town does not have regulations in place that specifically prohibit illicit discharges into its storm sewer system. The Town does have an inventory of its storm sewer system, but it does not include information on water quality.	The Town must implement an ordinance that prohibits the discharge of illicit materials into its storm drain system or other receiving waters. [5,6]

Stormwater Program Activity	Requirements				Town Status	Plan of Action
	Ecology's Basic and Comprehensive Stormwater Program [1]	NPDES Phase II Final Federal Rule [2]	Endangered Species Act 4(d) Rule [3]	Other Regulatory Programs		
A.3. Other Regulations				State Growth Management Act requires permits for activities in environmentally "critical areas".	The Town has these regulations in place. Regulations for Critical Areas – Chapter 15.20, establishes buffers for critical areas. Chapter 15.24 establishes criteria for flood hazard areas.	No action is required.
				State Shoreline Management Act requires permits for activities along shorelines of the State.	The Town has adopted a shoreline management program that regulates development in the Urban Environment along the shoreline in accordance with the Shoreline Management Act.	No action is required. But the Town's Shorelines program may need to be updated in the near future.
				State Hydraulic Project Approval - The Department of Fish and Wildlife issues Hydraulic Project Approvals (HPA) for construction activities that affect streams.	The Town does not issue these permits. They are issued by the State of Washington Department of Fish and Wildlife.	Action is required to obtain this permit when the Town engages in construction activities that need to obtain an HPA.
				State Floodplain Regulations - The Federal Flood Insurance program has requirements for local governments to administer development in flood plains in order to continue participating in the flood insurance program. FEMA administers the federal program and this authority is given to the Department of Ecology in Washington State. The State, in turn, requires jurisdictions within the State that want to participate in the federal flood insurance program to implement their own regulations for development in flood plains that comply with the State and Federal requirements.	The Town requires compliance with the State Flood Control Act in its Storm Drain Utility Ordinance. The Town also regulates activities in flood plains through EMC Chapter 15.24 - Flood Damage Prevention.	No action is required.

Stormwater Program Activity	Requirements				Town Status	Plan of Action
	Ecology's Basic and Comprehensive Stormwater Program [1]	NPDES Phase II Final Federal Rule [2]	Endangered Species Act 4(d) Rule [3]	Other Regulatory Programs		
A.3. Other Regulations (cont'd)				Section 404 of the Clean Water Act requires a permit for activities classified by the Corps of Engineers as fill in wetlands. At the federal level, the Corps of Engineers regulates the discharge of dredged or fill material into waters of the United States, including wetlands. TMDL Plans – The Federal Clean Water Act requires NPDES authorized states, such as Washington, to list water quality impaired water bodies and to prepare total maximum daily load (TMDL) plans for water bodies that do not meet state water quality standards. These plans set total maximum limits on point and nonpoint source pollutants that can be discharged to each water body without exceeding state water quality standards. Local entities are responsible for implementing programs to address the water quality problems.	Section 404 permits are issued by the Corps of Engineers and not the Town. However, the Town's Wetlands Protection ordinance regulates development in wetlands. To our knowledge, there are no water quality impaired water bodies in the Town.	No action is required. Mashel River and Lynch Creek are not on the 303(d) list. No action is required.
B. Maintenance & Operations **B.1. Maintenance of Public Facilities** **B.2. Maintenance of Private Facilities**	• Develop and enforce an operations and maintenance program and ordinance for new and existing public and private Stormwater systems.	Develop a Pollution Prevention/ Good Housekeeping program for Municipal Operations that accomplishes the following: • Owners or operators of small MS4s must develop and implement a cost-effective operation and maintenance as well as employee training program with the goal of preventing or reducing pollutant runoff from municipal operations.	The following list of items should be included in a maintenance plan to prevent activities that the 4(d) rule has determined are likely to result in injury or harm to listed salmon. Maintenance plan shall prohibit: • Maintenance of structures like culverts, berms, or dams if maintenance eliminates or impedes a listed species' ability to migrate or gain access to habitat. • Removing, poisoning, or contaminating plants, fish, wildlife, or other biota that the listed species requires for feeding, sheltering, or other essential behavioral patterns. • Removal, addition, or alteration of rocks, soil, gravel, vegetation or other physical structures that are essential to the integrity and function of a listed species' habitat.		The Town performs maintenance on its storm sewer system, but not at the frequency needed to reduce the amount of pollutants discharged into receiving waters. The Town does not have an ordinance in place that requires private property owners to maintain private systems.	Three actions are recommended as follows: 1) Complete an operations and maintenance program (that will be completed as part of this plan), 2) Prepare an operations and maintenance ordinance including standards for new and existing public and private systems and a requirement for privately owned systems to be maintained. The ordinance should be based on Ecology's Model Stormwater Maintenance Ordinance, and 3) Expand the current operation and maintenance program to include inspection of those private systems that are privately maintained and include enforcement.

<table>
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<tr><td>B. Maintenance & Operations (cont'd)</td><td></td><td></td><td>• Removal of water or otherwise altering streamflow in a manner that significantly impairs spawning, migration, feeding, or other essential behavioral patterns.
• Operation of dams or water diversion structures with inadequate fish screens or passage facilities.
• Maintenance or operation of inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent to or above a listed species' habitat.</td><td></td><td></td><td></td></tr>
<tr><td>C. Public Education</td><td>• Implement education programs to inform citizens and businesses about Stormwater and its effects on water quality, flooding, and fish and wildlife habitat, and to discourage dumping of waste material or pollutants into storm drains.
• Develop and implement a Stormwater public education program aimed at residents, businesses, and industries in the urban area.</td><td>Develop a Public Education and Outreach Program on Stormwater Impacts that accomplishes the following:
• A public education program must be implemented to distribute educational materials to the community.
• The community should be made aware about the impacts of Stormwater discharges to waterbodies and the steps needed to decrease Stormwater pollution.
• Municipalities are encouraged to work with their state and Phase I communities to develop an education/ outreach program more efficiently.
Involve public participation by accomplishing the following:
• The public must be involved in developing the municipality's Stormwater program by following state, tribal, and local public notice requirements.
• All economic and ethnic groups should be included.
• Examples of public involvement/ participation that should be considered include public hearings, citizen advisory boards, and working citizen volunteers.</td><td></td><td></td><td>The Town currently conducts limited public education of citizens and businesses on stormwater quality.</td><td>The Town must implement a public education program that includes informing the public about the new stormwater management ordinance as well as the effect on water quality from human activities.</td></tr>
</table>

Stormwater Program Activity	Requirements				Town Status	Plan of Action
	Ecology's Basic and Comprehensive Stormwater Program [1]	NPDES Phase II Final Federal Rule [2]	Endangered Species Act 4(d) Rule [3]	Other Regulatory Programs		
D. Program Funding	• Assure adequate local funding for the Stormwater program through surface water utilities, sewer charges, fees, or other revenue-generating sources.				The Town currently funds its stormwater program through its Storm Drain Utility. The revenues from the utility may not be adequate to completely fund a program that meets regulatory requirements.	Evaluate adequacy of existing rate revenues to fund a regulatory compliant program. (This will be accomplished as part of this plan.)
E. Interlocal Coordination	• Complete local coordination arrangements such as interlocal agreements, joint programs, consistent standards, or regional boards or committees.				Does the Town have any interlocal agreements with Pierce County for stormwater management?	If there are elements of the City's stormwater program that could be accomplished more cost effectively on a County-wide basis, then agreements with the County should be pursued.
F. Implementation	• Implement inspection compliance, and enforcement measures. • Prepare an implementation schedule for the comprehensive stormwater program.				The Town currently has limited resources for inspection and enforcement.	The new ordinance should include responsibilities for inspection, compliance, and enforcement.

FOOTNOTES:

1. Basic program requirements from list of Ecology equivalency review criteria in "Guidance for local governments when submitting manuals and associated ordinances for equivalency review" (Ecology 1994) and "Stormwater Program Guidance Manual" (Ecology 1992). Comprehensive Program requirements from "Stormwater Program Guidance Manual for Puget Sound Basin" (Ecology 1992). Many of these requirements will likely get incorporated into Ecology's NPDES Phase II stormwater general permit.
2. Final Federal Rule and applicable State regulations will be the basis for the Regulations to be adopted by Ecology which is the NPDES Permitting Authority in Washington State. Ecology's regulations have not yet been promulgated and may differ from the Final Federal Rule. As mentioned in the above footnote, Ecology's regulations will most likely contain many of the same requirements as those in Ecology's Basic Comprehensive Stormwater Program.
3. Requirements summarized from "A Citizen's Guide to the 4(d) Rule For Threatened Salmon and Steelhead on the West Coast", prepared by the National Marine Fisheries Service, Northwest and Southwest Regions, June 20, 2000.
4. Ecology indicates the following advantages and disadvantages in the different approaches (Ecology 1994):

   If the entire manual (either Ecology's manual or one written by a local government) is incorporated into the ordinance by reference, all the information contained in the manual becomes part of the local government code. The advantage of this method is that there are no questions about what is and is not an enforceable part of the local government code. Once disadvantage is that if a local government wishes to change something, the ordinance may have to undergo revision as well. Additionally, the Plan requires that the ordinance and/or the manual adopted be revised within a year following any Ecology update of the manual.

   If only parts of the manual (or only the minimum requirements themselves) are adopted in an ordinance, those parts are then enforceable. The other parts of the manual serve as additional guidance. If this method is chosen, only revisions to those parts of the manual adopted in the ordinance require revision of the ordinance. Updates can easily be made to the parts of the manual not adopted in the ordinance.
5. Ecology recommends that the following activities be completed to assess water quality problems (Ecology 1992): a land use survey; general mapping of stormwater drainage systems; mapping of known outfalls to water bodies; mapping areas where stormwater is discharged to groundwater; mapping of public and private water supply wells, conveyance streams, wetlands, and other constructed conveyances, a visual assessment of water quality in water bodies in the vicinity of outfalls; a survey of Ecology and local government records or reported water quality problems, sediment impact zones or any historical water quality data collected in the vicinity of outfalls, natural systems used for stormwater conveyance or water supply wells; and interviews with maintenance crews or other field staff that are in a position to notice water quality problems.
6. Ecology recommends that investigative tools that may be applied to identify problem storm drains include collecting and analyzing water samples, identifying illicit connections to the storm drain system, surveying land uses, homes, and businesses, and water and sediment tracing in storm drains. Corrective actions include developing measures to correct or reduce the problem through application of BMPs described in an approved stormwater management manual or other water quality control measures. Basin planning to address the cumulative impacts from diverse sources of stormwater and sediment contamination should be strongly considered. Corrective actions shall include a program to eliminate illicit discharges.

Section 6

DRAINAGE PROBLEM IDENTIFICATION AND PROBLEM SOLUTIONS

Section 6
DRAINAGE PROBLEM IDENTIFICATION AND PROBLEM SOLUTIONS

6.1 Introduction

This section includes a summary of drainage system problems within the Town of Eatonville. Specific flooding problems are identified, and planning level solutions are summarized. Specific water quality problems were not identified given the scope of this project, but programmatic solutions to water quality problems are provided.

The local drainage system in the Town consists primarily of a piped system with some ditches. None of these systems are classified as streams that support aquatic habitat. Therefore, no habitat problems or solutions are discussed.

Estimated construction and implementation costs are identified for drainage system improvements to solve flooding problems. The solutions are prioritized and incorporated into a capital improvements program (CIP) based on input from the Town.

6.2 Flooding Problems and Solutions

6.2.1 Drainage System Water Quantity Problem Identification

Drainage system problem identification was based on input from Town staff and the results of hydraulic modeling of the trunk system. In addition, the 1986 Town of Eatonville Adopted Comprehensive Storm Drainage Report (Drainage Report) was reviewed for identification of other potential problems.

Most of the problems identified are localized flooding due to the lack of a collection system or an undersized system. Table 6-1 summarizes the problems including their location, and a description of the problem. The approximate location of each problem is shown on Figure 6-1.

6.2.2 Drainage Solution Analysis

Modifications were made to the SWMM model described in Section 4 in order to develop solutions to flooding problems. In general, to increase the capacity of the system, the pipe diameter was increased from downstream to upstream until flooding no longer occurred. In addition, any reverse grade problems were adjusted. Note that the solution analysis was performed assuming future land use conditions in the basin.

The XP-SWMM model developed for the existing system was modified to assess the impacts of potential drainage solutions. The improvement projects identified are listed in Table 6-2. See Figure 6-2 for improvement project locations.

Modeling of the 25-year flow revealed flooding issues along all major drainage pathways in the Eatonville system, and as a result the improvement projects involve replacing a substantial portion of the system. In order to prioritize the projects, the model was examined under 2-year, 5-year, and 10-year flow conditions. Table 6-3 shows a summary of the areas where the model shows flooding to occur under these flow conditions. The 2-year flow results indicate the most immediate problem areas. The progression of the problem areas can be seen in the 5-year, 10-year, and 25-year flow results. The prioritized improvement project list, Table 6-4, was developed based on this progression as well as implementing solutions on a downstream to upstream approach. This approach avoids introducing new problems by fixing upstream issues first, only to find that they cause further problems downstream.

Additional improvement projects identified by the Town of Eatonville staff in Table 6-1 but not identified through modeling, were given priority above the projects identified through the modeling. The remaining improvement projects identified through the 1986 Drainage Report but not identified through modeling, were given priority below those identified by either the staff or the modeling.

Table 6-5 lists peak flows with system improvements at the 25-year flow. The modeled water surface elevations with system improvements are listed in Table 6-6. The table shows that the water levels no longer surcharge above the grate elevation, and flooding during a 25-year event is eliminated.

6.2.3 Cost Estimates for Drainage System Improvements

A conceptual solution was developed for each of the identified problems based on the Drainage Report and the hydrologic/hydraulic modeling results. Table 6-2 summarizes the conceptual solutions for the identified drainage system problems along with their estimated construction costs. See Appendix C for the cost estimate worksheets for the individual improvement projects.

Much of the system to be replaced runs across private property where it is not known if easements exist. If easements do not exist for the improvement project of interest, they will need to be obtained before the project can proceed. The cost estimates do not include the cost to obtain these easements.

Table 6-1
Drainage System Problems
Eatonville, Washington

Drainage Problem No.	Information Source	Problem Location	Problem Type/Description
DP01 [1]	1986 Drainage Report	Intersection of Hill Top Area and Eatonville Highway West [2]	Flooding / No formal drainage system is located in this area
DP02	1986 Drainage Report	Intersection of Hill Top Area and Eatonville Highway West	Flooding / Collection system piping is undersized
DP03	1986 Drainage Report Hydrologic / Hydraulic Modeling	Center Street West between Eatonville Highway West and Washington Avenue South	Flooding at 25 year future land use event / Due to insufficient conveyance capacity and drainage system reverse grade
DP04	1986 Drainage Report	Antonie Avenue North between Williams Addition and Center Street West	Flooding / Collection system piping is undersized
DP05	1986 Drainage Report	Center Street West to Dow Addition	Flooding / Collection system piping is undersized
DP06	1986 Drainage Report	Intersection of Antonie Avenue South and Eatonville Highway West	Flooding / Collection system piping is undersized
DP07	1986 Drainage Report	Lynch Street	Flooding / No collection system
DP08	Town of Eatonville Staff	Eatonville Highway West near West Town Limits	Flooding / Private pond and undersized ditch
DP09	Town of Eatonville Staff Hydrologic / Hydraulic Modeling	Eatonville Highway West between Antonie Avenue North and Center Street West	Flooding at 25 year future land use event / Due to insufficient conveyance capacity and drainage system reverse grade

Table 6-1 (Continued)
Drainage System Problems
Eatonville, Washington

Drainage Problem No.	Information Source	Problem Location	Problem Type/Description
DP10	Town of Eatonville Staff Hydrologic / Hydraulic Modeling [3]	Center Street West near Jensen Lane North through Cedar Avenue North	Flooding at 25 year future land use event / Due to insufficient conveyance capacity and drainage system reverse grade
DP11	Town of Eatonville Staff	Penn Avenue North between Lynch Street West and Carter Street West	Standing water / No collection system
DP12	Town of Eatonville Staff	Washington Avenue between Larson Street West and Prospect Street East	Standing water / Town used old sanitary sewer to act as temporary underdrain, but standing water problem still exists
DP13	Town of Eatonville Staff	Adams Avenue South (south of Center and north of Prospect)	Standing water / No collection system
DP14	Hydrologic / Hydraulic Modeling	Center Street East between Bergeren Road North and Washington Avenue South	Flooding at 25 year future land use event / Due to insufficient conveyance capacity and drainage system reverse grade
DP15	Hydrologic / Hydraulic Modeling	36-Inch Main Trunk to Lynch Creek	Flooding at 25 year future land use event / Due to insufficient conveyance capacity and drainage system reverse grade

(1) DP = Drainage Problem
(2) Eatonville Highway West formerly Triangle Road
(3 Hydrologic/Hydraulic modeling performed using XP-SWMM

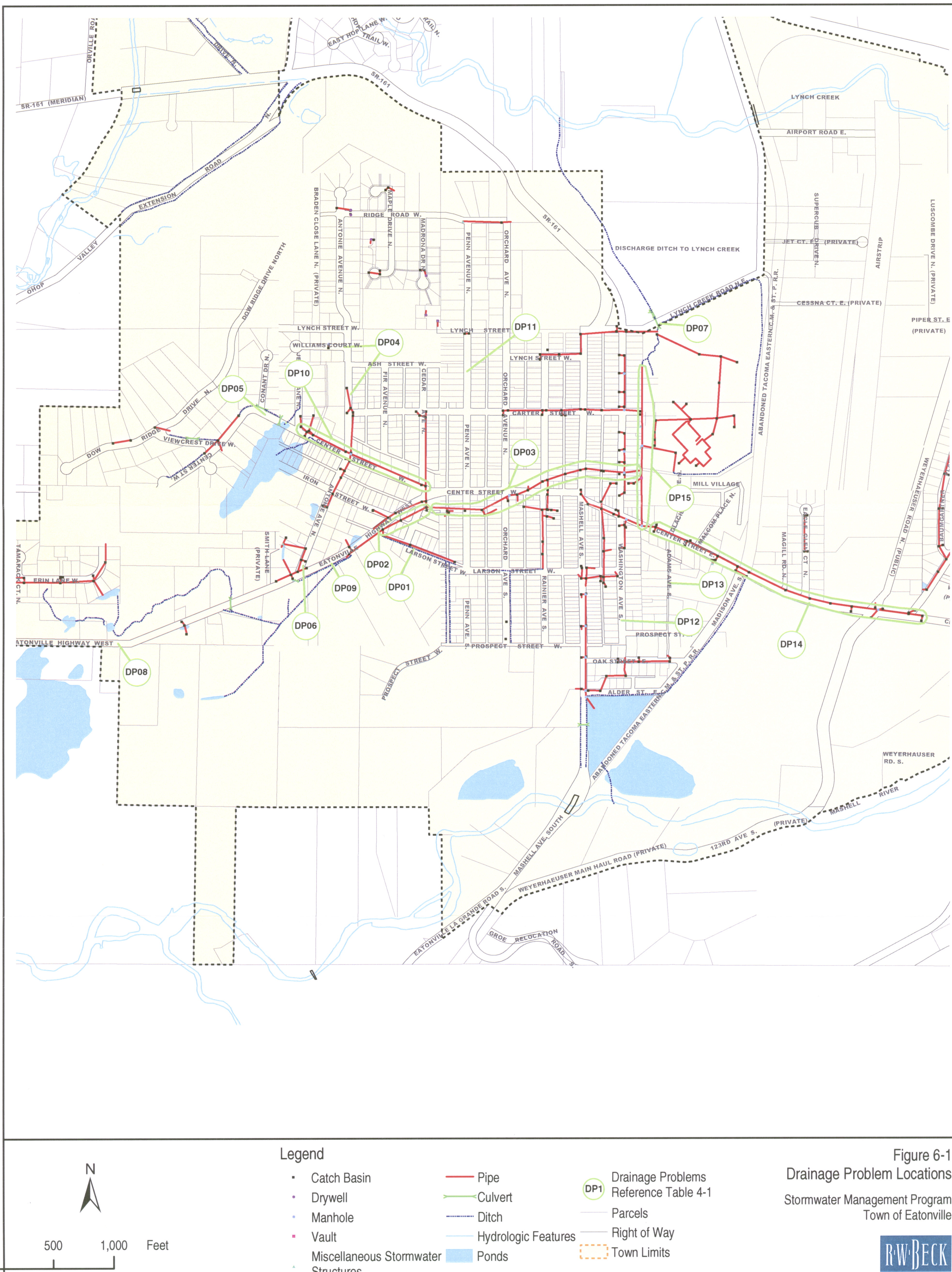

Figure 6-1
Drainage Problem Locations

Stormwater Management Program
Town of Eatonville

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Table 6-2
Stormwater Improvement Projects
and Estimated Implementation Costs

Improvement Project No.	Location	Project Description	Drainage Problem Addressed	Estimated Implementation Cost (Town)
IP01 (1)	N-S Main Trunk to Lynch Creek	• From CB993 through culvert past Lynch Creek Road, replace 1,450 LF of 36-inch pipe with 48-inch smooth walled Corrugated Polyethylene Pipe (CPEP). • Increase capacity of conveyance drainage ditch. • Adjust negative grade of pipe from CB1346 to CB1344 (2).	DP15 DP07	$ 907,800
IP02	Center Street West from Orchard Avenue South to Main Trunk	• From CB1328 to Main Trunk connection, replace 1,160 LF of 24-inch pipe with 36-inch smooth walled CPEP pipe. • Adjust negative grade of pipe from CB1328 to CB1331 (2). • Potential to realign stormwater drainage system along Center Street West.	Assumes IP01 has been implemented. DP03 DP15	$ 475,800
IP03	Center Street West from Jensen Lane North through Cedar Avenue North	• From CB1315 to CB1302, replace 1,300 LF of 12-inch with 30-inch smooth walled CPEP pipe.	Assumes IP01 and IP02 have been implemented. DP03 DP05 DP10	$ 475,300
IP04	Center Street West from Cedar Avenue North to Orchard Avenue South	• From CB1302 to CB1328, replace 720 LF of 24-inch with 36-inch smooth walled CPEP pipe.	Assumes IP01 through IP03 have been implemented. DP03	$ 336,400

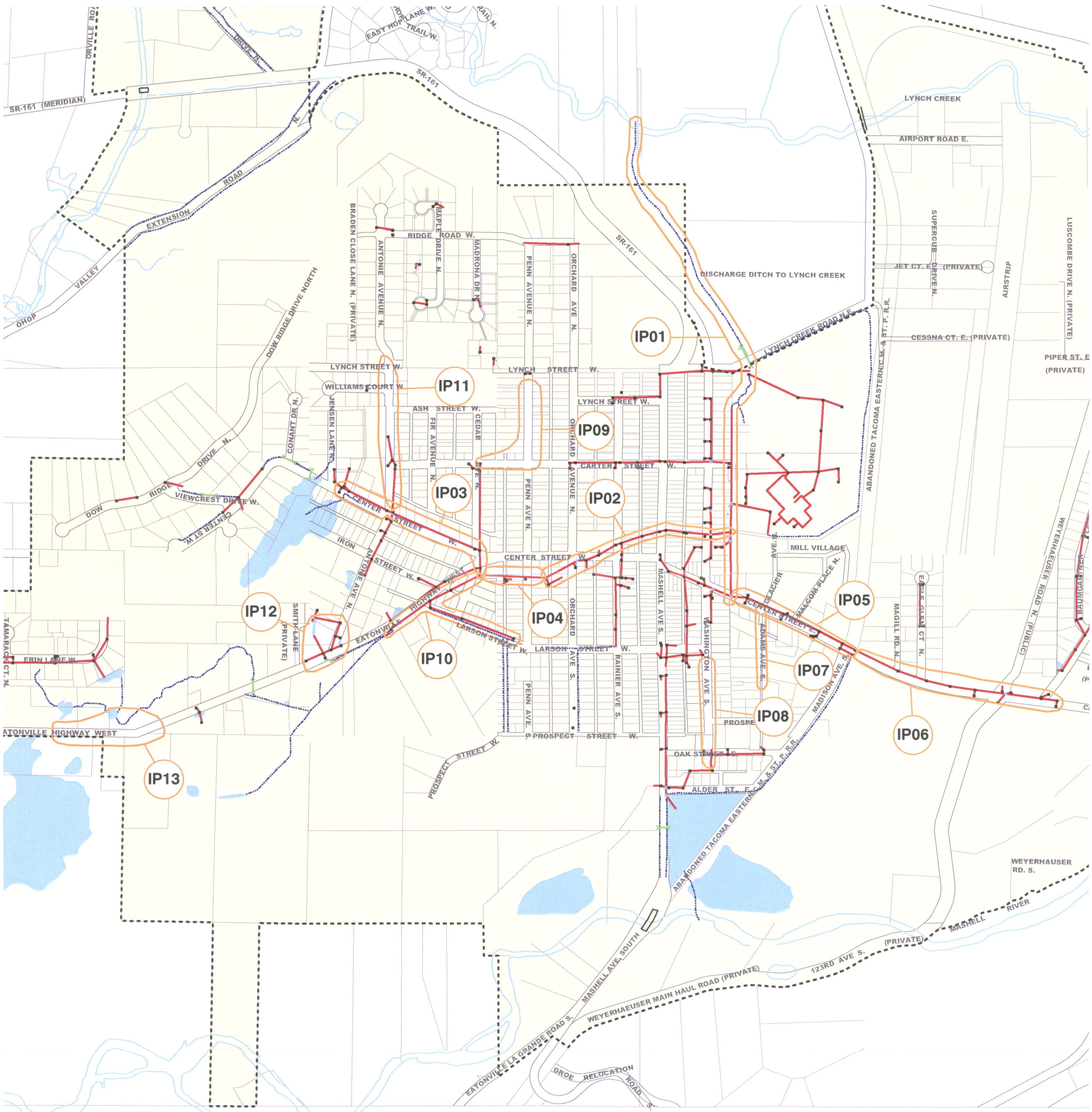
Table 6-2 (Continued)
Stormwater Improvement Projects
and Estimated Implementation Costs

Improvement Project No.	Location	Project Description	Drainage Problem Addressed	Estimated Implementation Cost (Town)
IP05	Center Street East from Madison Avenue South to Main Trunk	• From CB994 to CB993, replace 980 LF of 12-inch pipe with 24-inch smooth walled CPEP pipe.	Assumes IP01 through IP04 have been implemented. DP14	$ 335,500
IP06	Center Street East from Bergeren Road to Madison Avenue South	• From CB1100 to CB994, replace 1,500 LF of 12-inch pipe with 18-inch smooth walled CPEP pipe.	Assumes IP01 through IP05 have been implemented. DP14	$ 406,400
IP07	Adams Avenue South between Center Street West and Prospect Street East	• Install conveyance system of approximately 600 LF of 18-inch smooth walled CPEP pipe.	DP13	$ 213,500
IP08	Washington Avenue between Larson Street West and Prospect Street East	• Install conveyance system of approximately 650 LF of 12-inch smooth walled CPEP pipe to replace sanitary sewer pipe acting as underdrain.	DP12	$ 208,100
IP09	Penn Avenue North between Lynch Street West and Carter Street West	• Install conveyance system of approximately 725 LF of 8 to 12-inch (unknown diameter of connection pipe) smooth walled CPEP pipe. • Determine if infiltration system at this location is feasible.	DP11	$ 212,500

Table 6-2 (Continued)
Stormwater Improvement Projects
and Estimated Implementation Costs

Improvement Project No.	Location	Project Description	Drainage Problem Addressed	Estimated Implementation Cost (Town)
IP10	Intersection of Hill Top Area and Eatonville Highway West (3)	• From CB944 to CB1302, replace 750 LF of 24-inch pipe with 36-inch smooth walled CPEP pipe. • Adjust negative grade of pipe from CB944 to CB945 (2). • Regrade drainage ditch along Larson Street West to Eatonville Highway West to reduce flow velocity to provide for erosion control at Eatonville Highway West. • Please Note: Eatonville measure down information provided indicates 36-inch pipe, however 1986 Drainage Report indicates 24-inch pipe.	DP01 DP02 DP09	$ 335,800
IP11	Antonie Avenue North between Williams Addition and Center Street West	• Install conveyance system of approximately 400 LF of 18-inch smooth walled CPEP pipe. • From CB1026 to CB1041, replace 575 LF of 12-inch (assumed – pipe diameter information unavailable) pipe with 18-inch smooth walled CPEP pipe.	DP04	$ 260,300
IP12	Intersection of Antonie Avenue South and Eatonville Highway West	• May require increase in drainage pipe capacity. • Flooding issue may be resolved through implementation of IP10. • Need additional information before proposing solution. Unable to estimate cost for project at this time.	DP06	$ Unknown
IP13	Eatonville Highway West near West Town Limits	• Increase capacity of drainage ditch. Privately owned detention pond may require capacity increase. • Need additional information before proposing solution. Unable to estimate cost for project at this time.	DP08	$ Unknown
IP14	Drainage System	• Survey complete drainage system to assess stormwater drainage system.	Assessment	$ 10,000
			TOTAL:	$4,177,400

(1) IP = Improvement Project
(2) Negative grade indicated based on measure down information provided by the Town of Eatonville
(3) Eatonville Highway West formerly Triangle Road



Legend

- Catch Basin
- Drywell
- Manhole
- Vault
- Miscellaneous Stormwater Structures
- Pipe
- Culvert
- Ditch
- Hydrologic Features
- Ponds
- IP1 Improvement Projects
- Parcels
- Right of Way
- Town Limits

N

0 500 1,000 Feet

Figure 6-2
Improvement Problem Locations

Stormwater Management Program
Town of Eatonville

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Table 6-3
2-Year, 5-Year, and 10-Year Modeling Results – Existing System

SWMM Model Node ID	Location Description	Rim or Overflow Elevation (ft)	2-Year WSEL (ft) (3)	5-Year WSEL (ft) (3)	10-Year WSEL (ft) (3)	25-Year WSEL (ft) (3)	DP No (4)	IP No (5)
CENTER STREET WEST SYSTEM								
1315 (2)	Center St W. near Jensen Ln N.	814.27	813.51	813.93	814.37	814.78	DP05,	IP03
931 (2)	Center St W. near Jensen Ln N.	814.27	813.77	814.44	815.00	815.62	DP10	
1043	Center St W. at Antonie Av N.	818.44	814.10	815.16	816.19	817.36		
1041	Center St W. at Antonie Av N.	818.38	814.14	815.24	816.35	817.60		
1309	Center St W. at Cedar Av N.	811.97	812.35	812.51	812.56	812.60	DP10	IP03
1308	Center St W. at Cedar Av N.	812.10	812.16	812.48	812.53	812.57		
1300	Eatonville Hwy W. at Center St W.	811.54	809.10	811.69	811.78	811.81	DP02	IP10
N55 (2)	North side of Eatonville Hwy W. Southwest of Antonie Av N.	820	816.78	817.22	817.61	817.97		
N56	South side of Eatonville Hwy W. Southwest of Antonie Av N.	820	816.78	817.22	817.61	817.97		
N57 (2)	South side of Eatonville Hwy W. Southwest of Antonie Av N.	820	816.78	817.22	817.61	817.97		
N61	South side of Eatonville Hwy W. at intersection point of drainage ditch	820	816.78	817.22	817.61	817.97		
944	Eatonville Hwy W. between Antonie Av N. & Larson St W.	819.54	816.78	817.22	817.61	817.97		
945	Eatonville Hwy W. near Larson St W.	822.39	819.27	819.32	819.35	819.39		
1302	Cedar Av S. near Eatonville Hwy W.	810.11	807.40	809.54	810.27	810.42	DP02	IP10
1325	South of Center St W. near Penn Av N.	807.90	806.42	807.94	808.15	808.35	DP03	IP04
1328	Center St W. near Orchard Av N.	807.26	805.59	806.72	806.50	807.01		
1330	Center St W. near Orchard Av N.	806.52	805.33	806.33	806.09	806.28		
1331	Center St W. between Orchard Av N. & Rainier Av S.	806.63	804.46	804.54	804.99	805.30		
1331B	North of Center St W. near Rainier Av S.	804.85	800.61	802.40	803.50	803.82		
1331X (1)	North of Center St W. near Rainier Av S.	802.99	800.56	802.12	803.15	803.38	DP03	IP02
1331C	North of Center St W. between Rainier Av S. & Mashell Av S.	801.84	799.40	800.53	801.19	801.77		
986	Mashell Av S. North of Center St W.	799.39	797.93	799.24	799.50	799.59	DP03	IP02
987	Mashell Av S. North of Center St W.	798.63	797.43	798.78	798.91	798.95		
1001	North of Center St E. between Mashell Av S. & Washington Av S.	794.71	793.09	793.65	794.97	795.05		
970	Washington Av S. North of Center St E.	792.17	789.27	791.79	793.34	793.50		
D1 (1)	North of Center St E. near school property along 36-inch discharge pipe to Lynch Creek	792.99	786.67	789.68	792.53	793.35	DP15	IP01
1344	North of Center St E. at school property along 36-inch discharge pipe to Lynch Creek	792.13	786.13	788.85	791.49	792.46		
D2 (1)	North of Center St E. at Carter St W. near school property along 36-inch discharge pipe to Lynch Creek	790.99	783.90	786.81	788.94	789.93		
D3 (1)	East of Washington Av S. at Lynch Creek Rd N.E.	786.99	780.38	781.69	782.46	782.82		
D4 (1)	North of Lynch Creek Rd N.E.	791.99	778.60	778.91	779.06	779.14		
D5-A (1)	North of Lynch Creek Rd NE at 36-inch Box Culvert	780.40	778.41	778.72	778.89	778.97		
D5-B (1)	North of Lynch Creek Rd NE at 36-inch Box Culvert	780.35	778.13	778.38	778.50	778.55		
D6 (1)	North of Lynch Creek Rd NE along discharge ditch to Lynch Creek	730	727.32	727.40	727.44	727.46		
D7 (1)	North of Lynch Creek Rd NE along discharge ditch to Lynch Creek	700	697.93	698.08	698.16	698.19		
D8 (1)	North of Lynch Creek Rd NE along discharge ditch to Lynch Creek	635	632.93	633.08	633.15	633.19		
CENTER STREET EAST SYSTEM								
1100	Center St E. near Bergeren Rd N.	858.14	856.68	857.86	858.50	858.83	DP14	IP06
935	Center St E. at Bergeren Rd N.	861.55	856.68	857.86	858.50	858.83		
1096	Center St E. near Weyerhaeuser Rd N.	862.10	855.66	856.28	856.65	856.84		
1093	Center St E. between Weyerhaeuser Rd N. & Eagle Glen Ct N.	859.11	854.10	854.18	854.39	854.39		
1092	Center St E. between Weyerhaeuser Rd N. & Eagle Glen Ct N.	850.25	846.94	846.98	847.03	847.05		
1091	Center St E. at Eagle Glen Ct N.	840.15	836.96	837.03	837.45	840.26	DP14	IP06
1090	Center St E. at Magill Rd N.	826.41	823.48	823.66	823.89	826.73		
994	Center St E. at Madison Av S.	801.22	801.42	801.45	801.47	801.49		IP05
1089	Center St E. near Madison Av S.	799.21	799.43	799.48	799.51	799.53		
1170	Center St E. between Madison Av S. & Malcom Pl N.	796.73	796.98	797.03	797.08	797.12		
1166	Center St E. between Malcom Pl N. & Glacier Av N.	793.98	794.27	794.31	794.35	794.37		
1164	Center St E. near Glacier Av N.	791.49	792.81	792.93	793.03	793.44		
993	Center St E. between Glacier Av N. & Washington Av S.	792.12	792.80	792.93	793.02	793.43		
1346	North of Center St E. near school property	792.04	786.69	789.71	792.59	793.41	DP15	IP01

Notes:

(1) Note the rim/ground elevation is estimated/assumed NOT surveyed

(2) Storage node

(3) Existing conditions; no system improvements

Water elevation higher than rim/ground elevation; flooding occurs

(4) From Table 6-1

(5) From Table 6-2

Table 6-4
Prioritized Stormwater Improvement Projects and Estimated Implementation Costs

Priority No.	Improvement Project No. (1)	Location	Project Cost	Cumulative Cost
1	IP14	Survey Assessment (2)	$ 10,000	$ 10,000
2	IP07	Adams Av S between Center St W & Prospect St E (3)	$ 213,500	$ 223,500
3	IP08	Washington Av between Larson St W and Prospect St E	$ 208,100	$ 431,600
4	IP09	Penn Av N between Lynch Street W and Carter St W	$ 212,500	$ 644,100
5	IP03	Center St W from Jensen Ln N thru Cedar Av N	$ 475,300	$ 1,119,400
6	IP05	Center St E from Madison Av S to N-S Main Trunk	$ 335,500	$ 1,454,900
7	IP02	Center St W between Orchard Av S to N-S Main Trunk	$ 475,800	$ 1,930,700
8	IP04	Center St W from Cedar Av N to Orchard Av S	$ 336,400	$ 2,267,100
9	IP10	Intersection of Hill Top Area and Eatonville Hwy W	$ 335,800	$2,602,900
10	IP01	N-S Main Trunk to Lynch Creek	$907,800	$ 3,510,700
11	IP06	Center St E from Bergeren Rd to Madison Av S	$ 406,400	$ 3,917,100
12	IP11	Antonie Av N between Williams Addition and Center St W	$ 260,300	$ 4,177,400
13	IP12	Intersection of Antonie Av S and Eatonville Hwy W	$ Unknown	
14	IP13	Eatonville Hwy W near West Town Limits	$ Unknown	
		Total Stormwater Improvement Projects:	**$4,177,400**	

(1) From Table 6-2.
(2) Based on results from survey assessment, IP priorities and scope can be revised.
(3) Adams Ave S project listed in Eatonville Proposed 2003 Budget. Alder St was also identified as a capital project in the proposed budget, but was not identified as a problem area during the modeling analysis and was not identified by the Town during discussions of problem areas. This can be added as a prioritized improvement project pending Stormwater Management Program Report review.
(4) See Table 9-3 for value of improvement projects covered under varied ESU rate increases over a 20-year period.

Table 6-5
Computer Modeling Results – Pipes – With System Improvements

SWMM Model Link ID	Location Description	TOTAL 25-year Flow (cfs)
CENTER STREET WEST SYSTEM		
L54	Center St W. near Jensen Ln N.	14.6
L1	Center St W. near Jensen Ln N.	19.7
L2	Center St W. at Antonie Av N.	19.7
L3	Center St W. between Antonie Av N. & Cedar Av N.	25.5
L4	Center St W. at Cedar Av N.	30.4
L5	Intersection of Center St W. & Eatonville Hwy S.	32.1
L6	Cedar Av S. near Intersection of Center St W. & Eatonville Hwy S.	33.7
L51	N-S Across Eatonville Hwy W. Southwest of Antonie Av N.	26.5
L52	Ditch on South side of Eatonville Hwy W. Southwest of Antonie Av N.	22.4
L57	Ditch on South side of Eatonville Hwy W. Southwest of Antonie Av N.	19.2
L53	Ditch on South side of Eatonville Hwy W. Southwest of Antonie Av N.	5.1
L29	Eatonville Hwy W. between Antonie Av N. & Iron St W.	3.0
L30	From Eatonville Hwy W. near Iron St W. to Cedar Av S.	4.4
L7	From Cedar Av S. near Intersection of Center St W. & Eatonville Hwy S. to South of Center St W. near Penn Av N.	39.1
L8	From South of Center St W. near Penn Av N. to Center St W. at Orchard Av S.	43.7
L9	Center St W. near Orchard Av S.	45.7
L10	Center St W. between Orchard Av N. & Rainier Av S.	45.7
L11	From Center St W. between Orchard Av N. & Rainier Av S. to Rainier Av S.	45.8
L12	Rainier Av S. North of Center St W.	45.8
L13	North of Center St W. between Rainier Av S. & Mashell Av S.	52.3
L14	North of Center St W. between Rainier Av S. & Mashell Av S.	52.3
L15	North of Center St W. at Mashell Av S.	52.3
L16	North of Center St E. between Mashell Av S. & Washington Av S.	52.3
L17	North of Center St E. between Mashell Av S. & Washington Av S.	52.4
L22	North of Center St E. between Washington Av S. and school property	60.6
L23	North of Center St E. and East of Washington Av S. at school property along 36-inch discharge pipe to Lynch Creek	90.4
L24	North of Center St E. and East of Washington Av S. at school property along 36-inch discharge pipe to Lynch Creek	110.9
L25	North of Center St E. and East of Washington Av S. at school property along 36-inch discharge pipe to Lynch Creek	114.4
L26	CMP Culvert N-S across Lynch Creek Rd N.E.	116.0
L27	Ditch between CMP Culvert and 36-inch Concrete Box Culvert	119.9
L56	36-inch Concrete Box Culvert	119.9
L28	Discharge Ditch to Lynch Creek North of Lynch Creek Rd N.E.	119.8
L45	2 - 24-inch Concrete Culverts	119.8
L46	Discharge Ditch to Lynch Creek North of Lynch Creek Rd N.E.	119.8
CENTER STREET EAST SYSTEM		
L31	Center St E. at Bergeren Rd N.	0.02
L32	Center St E. between Bergeren Rd N. & Weyerhaeuser Rd N.	2.2
L33	Center St E. at Weyerhaeuser Rd N.	2.2
L34	Center St E. between Weyerhaeuser Rd N. & Eagle Glen Ct N.	2.2
L35	Center St E. between Weyerhaeuser Rd N. & Eagle Glen Ct N.	2.2
L36	Center St E. from Eagle Glen Ct N. to Magill Rd N.	6.3
L37	Center St E. from Magill Rd N. to Madison Av S.	6.2
L38	Center St E. at Madison Av S.	10.4
L39	Center St E. between Madison Av S. & Malcom Pl N.	13.9
L40	Center St E. between Madison Av S. & Malcom Pl N.	13.9
L41	Center St E. between Malcom Pl N. & Washington Av S.	13.9
L42	Center St E. between Malcom Pl N. & Washington Av S.	23.2
L43	North of Center St E. and East of Washington Av S. along 36-inch discharge pipe to Lynch Creek	30.3
L44	North of Center St E. and East of Washington Av S. along 36-inch discharge pipe to Lynch Creek	30.1

Table 6-6
Computer Modeling Results – Catch Basins – With System Improvements

SWMM Model Node ID	Location Description	Rim or Overflow Elevation (ft)	25-Year WSEL (ft)	Flooding (Y/N)	Freeboard (ft)
CENTER STREET WEST SYSTEM					
1315 [2]	Center St W. near Jensen Ln N.	814.27	813.39	N	0.9
931 [2]	Center St W. near Jensen Ln N.	814.27	811.60	N	2.7
1043	Center St W. at Antonie Av N.	818.44	810.80	N	7.6
1041	Center St W. at Antonie Av N.	818.38	810.67	N	7.7
1309	Center St W. at Cedar Av N.	811.97	808.34	N	3.6
1308	Center St W. at Cedar Av N.	812.10	808.24	N	3.9
1300	Eatonville Hwy W. at Center St W.	811.54	807.50	N	4.0
N55 [2]	North side of Eatonville Hwy W. Southwest of Antonie Av N.	820	818.03	N	2.0
N56	South side of Eatonville Hwy W. Southwest of Antonie Av N.	820	818.04	N	2.0
N57 [2]	South side of Eatonville Hwy W. Southwest of Antonie Av N.	820	818.04	N	2.0
N61	South side of Eatonville Hwy W. at intersection point of drainage ditch	820	818.04	N	2.0
944	Eatonville Hwy W. between Antonie Av N. & Larson St W.	819.54	818.04	N	1.5
945	Eatonville Hwy W. near Larson St W.	822.39	819.53	N	2.9
1302	Cedar Av S. near Eatonville Hwy W.	810.11	807.16	N	2.9
1325	South of Center St W. near Penn Av N.	807.90	804.69	N	3.2
1328	Center St W. near Orchard Av N.	807.26	803.08	N	4.2
1330	Center St W. near Orchard Av N.	806.52	802.75	N	3.8
1331	Center St W. between Orchard Av N. & Rainier Av S.	806.63	802.30	N	4.3
1331B	North of Center St W. near Rainier Av S.	804.85	801.51	N	3.3
1331X [1]	North of Center St W. near Rainier Av S.	802.99	801.32	N	1.7
1331C	North of Center St W. between Rainier Av S. & Mashell Av S.	801.84	800.05	N	1.8
986	Mashell Av S. North of Center St W.	799.39	798.43	N	1.0
987	Mashell Av S. North of Center St W.	798.63	797.37	N	1.3
1001	North of Center St E. between Mashell Av S. & Washington Av S.	794.71	793.67	N	1.0
970	Washington Av S. North of Center St E.	792.17	789.80	N	2.4
D1 [1]	North of Center St E. near school property along 36-inch discharge pipe to Lynch Creek	792.99	787.81	N	5.2
1344	North of Center St E. at school property along 36-inch discharge pipe to Lynch Creek	792.13	787.08	N	5.0
D2 [1]	North of Center St E. at Carter St W. near school property along 36-inch discharge pipe to Lynch Creek	790.99	785.53	N	5.5
D3 [1]	East of Washington Av S. at Lynch Creek Rd N.E.	786.99	781.83	N	5.2
D4 [1]	North of Lynch Creek Rd N.E.	791.99	779.53	N	12.5
D5-A [1]	North of Lynch Creek Rd N.E. at 36-inch Box Culvert	780.40	779.29	N	1.1
D5-B [1]	North of Lynch Creek Rd N.E. at 36-inch Box Culvert	780.35	778.98	N	1.4
D6 [1]	North of Lynch Creek Rd N.E. along discharge ditch to Lynch Creek	730	727.69	N	2.3
D7 [1]	North of Lynch Creek Rd N.E. along discharge ditch to Lynch Creek	700	698.47	N	1.5
D8 [1]	North of Lynch Creek Rd N.E. along discharge ditch to Lynch Creek	635	633.47	N	1.5
CENTER STREET EAST SYSTEM					
1100	Center St E. near Bergeren Rd N.	858.14	856.50	N	1.6
935	Center St E. at Bergeren Rd N.	861.55	856.50	N	5.0
1096	Center St E. near Weyerhaeuser Rd N.	862.10	855.76	N	6.3
1093	Center St E. between Weyerhaeuser Rd N. & Eagle Glen Ct N.	859.11	854.17	N	4.9
1092	Center St E. between Weyerhaeuser Rd N. & Eagle Glen Ct N.	850.25	847.08	N	3.2
1091	Center St E. at Eagle Glen Ct N.	840.15	837.02	N	3.1
1090	Center St E. at Magill Rd N.	826.41	823.67	N	2.7
994	Center St E. at Madison Av S.	801.22	798.09	N	3.1
1089	Center St E. near Madison Av S.	799.21	795.20	N	4.0
1170	Center St E. between Madison Av S. & Malcom Pl N.	796.73	792.57	N	4.2
1166	Center St E. between Malcom Pl N. & Glacier Av N.	793.98	790.38	N	3.6
1164	Center St E. near Glacier Av N.	791.49	789.40	N	2.1
993	Center St E. between Glacier Av N. & Washington Av S.	792.12	788.00	N	4.1
1346	North of Center St E. near school property	792.04	787.82	N	4.2

Notes:

1 Note the rim/ground elevation is estimated/assumed NOT surveyed

2 Storage node

6.3 EXISTING WATER QUALITY

The water quality assessment represents a limited evaluation of the existing water quality within the Town of Eatonville.

No specific water quality problems were identified in Eatonville in the 1986 Drainage Report. Neither Mashel River nor Lynch Creek are listed on the Washington Department of Ecology's section 303(d) list of impaired and threatened water bodies. If there were water bodies within the Town on Ecology's 303(d) list, they would be selected for further studies referred to as total maximum daily load (TMDL) determinations. These studies include a problem formulation and an analysis on how to control the discharge of particular pollutants to surface waters.

The Town is not currently on the state's list of proposed jurisdictions that need to comply with an NPDES Phase II stormwater permit. But even though the Town does not have to implement an NPDES compliant program yet, may still want to examine ways to improve the quality of the Town untreated runoff from roadways and other developed areas that discharge directly to water bodies, allowing sediment, oil and grease, and other roadway pollutants to drain into the neighboring creeks.

6.4 General Water Quality Problems

Urban development can lead to a wide range of water quality problems resulting from a variety of common development activities. Water quality problems in the vicinity of Eatonville are typical of problems encountered in other urban areas. Surface water in the Town generally flows overland, collecting in small roadside ditches and traveling to storm drain inlets, streams, or other waterways, which lead to either Mashel River or Lynch Creek. The quantity of runoff from rainfall, flooding, the erosion of soils and stream channels, and the transport of nonpoint source pollutants all are factors in the decline of water quality in an urban watershed. Nonpoint source pollution is pollution that is generated on the land surface area over a large area that washes off in storm events into the storm drainage system. Examples of nonpoint source pollutants include chemical contamination from automobiles and machinery operation (i.e., oil, grease, hydraulic fluids, heavy metals, etc.), erosion and sediment transport from disturbed soils (sediment and nutrient loading), and nutrient and biological pollution from livestock grazing (e.g., phosphorus and fecal coliform bacteria).

Although provisions for water quality treatment and protection facilities are now required as part of new developments, much of the existing development in the Town occurred before stormwater treatment requirements were established. Thus, runoff from most of the existing developed areas in the Town receives little or no treatment before it reaches the nearest waterway.

General water quality problems have been divided into the following five categories, each of which is discussed in detail below, followed by solutions for each problem:

- Non-point source pollution from impervious surfaces
- Nonexistent or inadequate stormwater treatment facilities

- Erosion and sediment transport from disturbed areas
- Pollutant inputs from residences
- Accidental or intentional discharge of chemical contaminants

6.4.1 Non-point Source Pollution from Impervious Surfaces

Development and urbanization inevitably result in increased impervious surface areas. At a minimum, impervious surfaces result in increased rates and volumes of stormwater runoff, resulting in the potential for increased erosion and scour in downstream waterways. In urban settings, impervious areas also provide a medium for the deposition and transport of common urban pollutants. Roadways collect tire fragments, oil and grease, heavy metals, sand and grit, and other contaminants generated from vehicular traffic. Parking lots and driveways also collect concentrated amounts of these pollutants as vehicles drip and deposit various automotive chemicals directly on to parking lot surfaces. Inevitably, stormwater runoff across roadways and parking lots entrains these pollutants and transports them to downstream receiving waters. To prevent water quality degradation, it is important that runoff from impervious surfaces receives some form of water quality treatment to remove pollutants to the maximum extent possible.

Most existing impervious areas within the Eatonville area are contributing to cumulative water quality problems in the area. Runoff from all but the most recent developments receives little or no water quality treatment before being routed to downstream waters. Thus, pollutants deposited in these impervious areas can be entrained by stormwater and transported to the receiving water systems without any treatment to remove the contaminants. In addition, because water quality treatment does not remove 100 percent of all pollutants, even treated runoff from impervious surfaces carries some level of pollutant loads to receiving waters. Thus, as the Eatonville area continues to grow and develop, associated pollutant loads to nearby waters will also increase. The challenge is to minimize the net pollutant increase by improving the existing treatment systems and maximizing the efficiency of future systems.

6.4.1.1 Solutions

Constructing water quality treatment and detention systems where possible, as well as implementing source control best management practices (BMPs) are effective methods of reducing the water quality impacts associated with impervious surfaces. Impervious surfaces are a necessary component of development, and many of the water quality problems associated with them can be mitigated with structural treatment measures and source controls to prevent pollutants from coming into contact with surface waters. Once the Town adopts a new Stormwater Management Ordinance, new developments would be required to adequately manage stormwater from their sites to reduce impacts in downstream systems.

Implementation of a public education program could also help to control stormwater pollution. Efforts to improve public awareness of existing problems may help to reduce the deposition of pollutants on impervious surfaces and reduce impacts on receiving waters. For example, improving public awareness of the detrimental effects of allowing automotive fluids to be deposited onto roadways and parking lots could help to reduce impacts on streams and rivers.

Maintenance of stormwater facilities is important for improving water quality. For example, regular maintenance of catch basins is an effective means of reducing stormwater pollution because it removes pollutants from these structures before they accumulate to the point of being washed into receiving waters. Maintaining water quality treatment and detention systems also keeps them functioning properly. Maintenance of the Town's drainage system is discussed in Section 7 of this stormwater plan. The Town should also institute a program to require private drainage systems to be maintained. In accordance with the Puget Sound Plan, the Town will be responsible for maintenance of the overall storm drain system. If the jurisdiction does not want to maintain all privately owned facilities themselves, then it must implement a program requiring private property owners to maintain private facilities. This requirement should be implemented with an inspection program to ensure that facilities do get maintained on a regular basis.

In addition, the Town should stay abreast of current technological advances that might reduce the adverse effects of impervious surfaces. For example, studies have been conducted on the feasibility of constructing semi-pervious parking lot surfaces to help reduce runoff through increased infiltration. These semi-pervious surfaces are more porous than concrete or asphalt and allow precipitation to infiltrate through them, thereby reducing runoff and pollutant transport. In addition, a variety of urban planning and design techniques are currently being explored that reduce the area of impervious surfaces in new developments, such as reduced street widths, landscaped cul-de-sacs, and placement of sidewalks on only one side of the street. Whenever feasible, these and other advances should be evaluated and included in development proposals that come before the Town.

Implementing public education programs will be a cost to the stormwater program. Other jurisdictions have already developed many types of educational materials and Eatonville should utilize this information whenever possible. The major cost to the program will be in staff time and is estimated to be 0.1 full-time equivalents (FTEs) for public education, as discussed in Section 8. The public education program should not only be focused on this problem, but other water quality problems as well.

6.4.2 Nonexistent or Inadequate Stormwater Treatment Facilities

Many areas within Eatonville were developed prior to the establishment of significant stormwater treatment requirements. These areas include roadways, parking lots, commercial areas, residential areas, and industrial areas that were constructed prior to when stormwater treatment facilities were required, which all typically generate pollutants that can adversely affect downstream receiving waters. Thus, runoff from these areas is not treated, and any contaminants present in the runoff are transported directly downstream. Similarly, some areas that were developed more recently may have incorporated treatment facilities that no longer function at the desired efficiency, due to lack of maintenance funds or out–of-date designs. If stormwater treatment systems are not functioning efficiently, pollutants present in runoff are not effectively removed from the runoff and may directly impact downstream waters.

The lack of stormwater treatment systems in existing urban areas is likely a contributor to surface water quality problems in the Eatonville area. The most common occurrence is roadway and parking lot runoff that is collected in catch basins and directly conveyed to receiving waters without water quality treatment. The majority of the existing developed areas convey stormwater runoff in this manner, thereby generating a pollutant load on downstream waters.

6.4.2.1 Solutions

The best solution for this problem is to retrofit the existing stormwater systems to include water quality treatment measures. Although retrofitting existing systems is generally costly and therefore may not be the preferred course of action, new development in Eatonville will present opportunities to retrofit existing drainage systems for water quality as part of larger development projects. As part of the mitigation requirements for new developments, the Town should require developers to improve stormwater management systems where they are needed. The Town should explore financial incentives with utility rate credits for those developments that exceed standards. An examples of a project that could be eligible for a rate credit is when a developer plans to convert a section of an existing ditch on the edge of their property into a biofiltration swale for water quality treatment. The swale retrofit could be expanded to a greater length beyond the property line to treat a greater amount of runoff. Similarly, new stormwater treatment ponds could be increased in size to effectively treat off-site flows in addition to on-site flows. These types of development projects could result in minor but significant improvements to the Town's existing stormwater system.

Structural BMPs that could be used to retrofit existing water quality controls include oil/water separators, oversized catch basins, biofiltration swales, vegetative filter strips, and wet ponds. For example, parking areas that currently have no water quality treatment facilities could incorporate oil/water separators. Roadways that receive sand and grit applications in the winter months should be fitted with oversized catch basins to help prevent these materials from being washed downstream. Roadside slopes and ditches could be retrofitted with vegetative filter strips and bioswales, respectively, to provide treatment for runoff that currently receives no treatment. These individual improvements are generally minor but cumulatively would result in significant improvements compared to existing conditions.

These types of structural BMPs could be implemented on a case by case basis where Town staff observe an opportunity to improve water quality. For systems within the public right-of-way, the improvements could be made using the system replacement budget identified in the proposed maintenance and operations budget. For systems on private property, the Town can work with the property owner first on a voluntary basis. If the water quality problem is very severe, the Town can take additional steps to require improvements.

Future developments are not expected to cause significant long-term impacts on water quality in the area. Following adoption of a new Stormwater Management Ordinance, many of the problems associated with new impervious surfaces will be addressed for new developments. Thus, the Town should focus on addressing water quality problems associated with older roadways and existing developments. Nonetheless, allocating additional funds and personnel for enhanced maintenance of stormwater systems would help to reduce the potential for future water quality problems in the area. Although the Town currently maintains its stormwater systems, additional resources could be dedicated to ensure that stormwater treatment systems are functioning properly.

Retrofitting stormwater facilities as a part of redevelopment projects would be done by the developer at no cost to the Town. The proposed Stormwater Management Ordinance includes requirements for retrofitting as a part of redevelopment. Retrofitting with oil/water separators, oversized catch basins, and biofiltration swales is also recommended to improve water quality from these areas. While the Town could institute a program for these types of retrofits by budgeting a certain dollar amount to be spent per year, it is recommended that the Town perform these types of upgrades at the time the Town's maintenance crews are performing regular system replacements. For example, if a pipe system is being replaced in the downtown area, it could be replaced with oversized catch basins and inverted elbows for oil/water separation. The recommended maintenance program, discussed in Section 7, includes only $1,000 per year for system replacements. Since a substantial portion of the Town's drainage system is listed as a future Improvement Project, this amount may not require an increase if the capital projects are a high priority. However, allocating a larger budget for system replacements and repair would be recommended so that portions of the drainage system could be improved concurrently with the capital improvement projects. The annual allowance for system replacement is $1,000 according to the Town's proposed 2003 budget.

6.4.3 Erosion and Sediment Transport from Disturbed Areas

Another common source of water quality impairment in Eatonville results from the erosion and transport of sediment from disturbed land. Excessive sediment loads can cause a variety of water quality and habitat problems, including turbidity violations, temperature increases, increased pollutant loads (i.e., pollutants bound to the sediments), and shifts in stream substrate composition with the potential for habitat impairment or losses. The primary cause of sediment transport in Eatonville is the disturbance of soils, usually for construction purposes, without effective measures to limit and control erosion of these disturbed soils.

The majority of Eatonville is zoned for single-family residential uses and has been developed. Every new development is accompanied by temporary land disturbance that can cause erosion and lead to water quality pollution. Each time land is disturbed to provide for a new development, the threat of erosion and sediment transport is introduced. Disturbed land can be exposed to wind and rain that can easily erode unprotected soils. Disturbed soils that are not properly covered and stabilized can result in significant sediment loads reaching downstream waters. Without the incorporation of settling basins or other measures to control the transport of these materials along the conveyance system, much of the eroded soil reaches downstream receiving waters, contributing to water quality and habitat impairment. Proper soil stabilization, combined with measures to limit the off-site transport of any eroded material, will greatly reduce the potential for erosion and water quality problems. In addition, construction activities can also generate other pollutants such as the chemicals from fertilizers and pesticides, petroleum products, construction chemicals, and various solid wastes.

6.4.3.1 Solutions

The best solution for erosion and sediment transport problems is to adopt and enforce stringent erosion control standards and BMPs. This will be accomplished in part with the adoption of a new Stormwater Management Ordinance. Implementation of the new ordinance will include development of a program to inform and educate area contractors about the erosion control requirements. It is suggested that the Town work on this program jointly with Pierce County. A coordinated joint program would likely be more effective in attracting area contractors. The enforcement of these standards is crucial. Town staff should diligently review all stormwater pollution prevention plans and temporary sedimentation and erosion control plans that are submitted with development applications, to ensure adequate water quality protection. In addition, the Town needs to ensure that erosion control facilities are frequently inspected and that developers are held responsible for any failure to adhere to the approved plans.

Controlling erosion from large development areas should not result in a significant increase in expenses to the Town. As noted earlier, the primary recommendation was to better enforce erosion control standards. The Town currently passes all costs for development review and inspection on to the developer. Therefore, while this will result in the need for additional resources, development fees will pay for these resources.

6.4.4 Pollutant Inputs from Residences

Residential parcels may be one of the most significant sources of water quality pollutants found within the waterways in Eatonville. Many small sources cumulatively contribute significant amounts of pollutants, including nutrients, oils and greases, sediments, organics, metals, pathogens, and bacteria. The main concerns associated with residential land result from chemical inputs from overfertilization, misuse of pesticides, domestic pet wastes, car washing, spills or improper disposal of hazardous wastes, and construction-related soil disturbance.

Many residential properties use fertilizers and pesticides in landscaping. When used properly, these chemicals should not contribute to significant water quality problems. However, problems can arise when excess chemicals that are not taken up by plants or pests are entrained into stormwater runoff and transported to downstream waters. These chemicals can be directly hazardous to aquatic organisms or may exacerbate existing water quality problems. Additional water quality problems can result from a lack of attention to domestic pet wastes on residential property. Pet wastes that are allowed to concentrate near a stormwater conveyance system or natural waterway can add bacteria and nutrients to runoff, thereby contributing to water quality degradation.

Residential additions or other property modifications that result in areas of disturbed ground can also result in considerable erosion and sediment transport to downstream waters. Small developments or landscaping on individual properties can often result in significant ground disturbance, sometimes for extended periods of time. During periods of frequent or heavy rainfall, any exposed soils can easily be eroded by stormwater runoff and transported to downstream waters. Many residents are not aware of the potential impacts and do little to control or improve erosion-related problems. These problems are of particular concern in the Eatonville area where several of the area open channel drainage systems pass directly through residential properties where water quality is easily affected by activities on adjacent properties.

Older, dense residential areas provide little roadside area for biofiltration in ditches, and the minimal filter strips or buffer widths provide little biofiltration between yards and drainage ways.

6.4.4.1 Solutions

Perhaps the best way to reduce water quality problems associated with private residences is to educate homeowners about water quality degradation by encouraging source control of stormwater pollution. For example, providing information on the environmental hazards associated with pesticides, fertilizers, and hazardous wastes would help to limit overapplication (and application preceding storm events) of chemicals used in landscaping activities. Information should also be provided on certified waste collection facilities where hazardous waste from these products can be disposed. Providing information on the wise use of pesticides and herbicides or alternative methods of pest control would also help to reduce their use. Implementation of an Integrated Pest Management Plan (IPMP) rather than using chemical treatment should be encouraged. Any efforts to inform property owners about how they can help to improve water quality just by altering their own land use practices would be beneficial.

Several Washington State municipalities and agencies have already developed excellent public education materials that could be used by Eatonville. Many of these materials are available on the Internet and are offered for use free of charge. Relevant information could be distributed in the form of flyers, town meetings, newspaper articles, and workshops.

Homeowners and developers should be encouraged to incorporate soil amendments such as compost into the top soil layer when creating lawn areas. These soil amendments in a lawn will increase runoff infiltration and reduce overland runoff. These lawns not only promote better surface water quality, but also reduce watering needs, reduce flooding, and recharge the groundwater system.

In addition, the Town should make efforts to ensure that catch basins in existing and new residential areas are labeled with warnings such as DO NOT DUMP; DRAINS TO SURFACE WATERS where appropriate.

Encouraging property owners to plant native vegetation along drainage ways through private property and reduce the physical disturbances to these systems would help to improve water quality. The use of recommended BMPs would reduce stormwater exposure.

6.4.5 Accidental or Intentional Discharge of Chemical Contaminants

As with most urbanized areas, the threat of accidental or intentional spills of chemicals in storm drainage systems increases with increasing human activity. Automobile use and repair, construction work, auto service stations, small manufacturing businesses, and chemical storage areas all present some risk of spills or contamination. Whether the discharge is intentional or accidental, the end result is generally the same: materials spilled on land can easily and readily be transported to a stormwater conveyance system and ultimately to a stream. Under the best-case scenario, any environmentally hazardous spills would be promptly and properly cleaned up, with minimal impacts on water quality. However, if cleanup equipment and procedures are lacking, the contaminants will likely find their way to a storm drain and ultimately to a waterway. Chemical contaminants are also sometimes directly discharged to a storm drain or ditch illegally.

Because there are no records of illegal dumping, it is difficult to determine how significant this problem might be in Eatonville. Some of the pollutants find their way into surface and groundwater resources. In addition, household hazardous wastes are often dumped in storm drains, ditches, or backyards, where they contribute to nonpoint pollution by directly entering the drainage ways, stream, and groundwater. Finally, household hazardous wastes are sometimes incinerated and can contaminate runoff through rainfall or through ash spread in yards, backyard pits, or even landfills.

Ideally, the affected stormwater system would include a spill containment mechanism (e.g., oil/water separator), and most of the spill would not be carried downstream. However, the more common situation throughout most urbanized areas, including Eatonville, is that stormwater conveyance systems do not include spill containment measures or water quality treatment capacity. As a consequence, spills flow directly to receiving waters without treatment. The impacts are highly dependent on the type and volume of chemical spilled, but clearly there is a potential for severe water quality impacts to occur. Although no records of significant spills of this nature have been recorded in Eatonville, other urbanized stream systems have been impacted by fuel spills. Therefore, measures to avoid these types of impacts should be considered.

6.4.5.1 Solutions

The best solutions to limit or prevent this type of pollution are prevention, structural barriers, and public education. New development that has areas prone to hazardous material spills (e.g., gas stations, auto repair lots, and industrial areas) should have cleanup mechanisms in place that are able to prevent a spill from reaching a storm drain. For existing development that does not have appropriate stormwater controls or programs, they can be achieved one of three ways. First, if an area is redeveloping, water quality capital facilities can be required as a part of the redevelopment. Second, if there is an observed water quality problem, the Town can enforce proper BMPs. Finally, the Town can encourage property owners through voluntary compliance. Structural or capital measures could greatly reduce the risk of surface water contamination. The preferred means of accomplishing this is to install some type of oil/water separator facility into the on-site drainage system. This could be as simple as an inverted elbow added to a catch basin, or a more elaborate oil/water separation system for larger sites. In either case, the end result is that oil and similar chemicals that drain to catch basins are separated from the water by gravity and are not allowed to drain to the receiving water. The chemicals can then be removed from the catch basin before they reach the downstream receiving waters.

Education regarding the water quality impacts of chemical contaminants and the ease with which these pollutants can enter a river or stream would also help to significantly reduce water quality pollution. Citizens and businesses alike should be made clearly aware of the connection between the storm drains and the nearby waterways. Likewise, they should be informed about the cumulative impacts a town can have on a waterway, from numerous seemingly insignificant chemical inputs to storm drains. The Town should encourage a neighborhood watch mentality to help enforce regulations regarding any illegal chemical dumping to storm drains. Clear labels on individual drains reading DO NOT DUMP; DRAINS TO SURFACE WATERS would also help to prevent illegal dumping. The Town has stenciled some of their catch basins and it is recommended that they stencil all other catch basins in the Town.

The 0.1 FTE is intended to cover public education for helping solve the following problems discussed above:

- Non-point source pollution from impervious surfaces
- Pollutant inputs from residences
- Accidental or intentional discharge of chemical contaminants

In addition, implementing a regular program for inspection of private stormwater facilities will also require additional staff time. It is estimated that this would involve approximately 0.1 FTE, as discussed in Section 8.

6.5 Anticipated Future Water Quality Problems

Anticipated future water quality problems will mostly relate to erosion and sediment transport from future construction sites and non-point source pollution from increased development and associated impervious surfaces. The solutions outlined for these problems under general water quality problems will help minimize these future water quality problems.

Section 7

OPERATION AND MAINTENANCE

Section 7
OPERATION AND MAINTENANCE

7.1 Introduction

The objective of a stormwater operation and maintenance program is to assure the reliability and dependability of the stormwater infrastructure. Such a program is designed to minimize life-cycle costs, protect the lives and property of the Town's residents and businesses, reduce local flooding and enhance water quality. An operations and maintenance program includes an analysis of the frequencies and levels of maintenance required to achieve water quality objectives, ensure reliability, and achieve the lowest life-cycle cost.

As part of this study, the current maintenance program was reviewed with Town staff and recommended changes to the program were identified. A summary of the current maintenance program is provided in this section, as well as a proposed operation and maintenance program. The proposed operations and maintenance program described in this section uses generally accepted maintenance practices and planning standards.

This section focuses on maintenance activities. Program management, public education, and engineering activities are described in Section 8.

7.2 Current Stormwater Maintenance Program

Table 7-1 describes current stormwater maintenance activities. Tables 7-2 and 7-3 show the supporting information for Table 7-1. This list of stormwater maintenance activities was developed from a system inventory provided by the Town, additional interviews with Town staff and review of the Town's 2003 budget.

<< Separate equipment costs are not identified in either Table 7-1 or Table 7-4 since much of the work is contracted out and therefore equipment costs are included. If the Town plans to purchase any major equipment that they would like to have funded through the storm drain fund, the items should be identified and can be added to Table 7-4. >>

Table 7-1
Current Stormwater Maintenance Program

Item No.	Maintenance Activity	Units to be Maintained	Production Unit	Freq. (times/yr)	Daily Production	Crew Size	Annual Crew Days	Annual Person Days	Full-time Labor Equiv.	Annual Labor Cost ($)	Annual Other Cost ($)	Total Annual Cost	Percent of Program
1	Clean Catch Basins, Drywells & Manholes	306	Each	NA	NA	NA	NA	NA	NA	NA	$3,000	$3,000	12%
2	Clean Roadside Ditches (remove sediments)	17,250	LF	1	2,000	3	9	26	0.12	$3,528	$0	$3,528	14%
3	Clean Roadside Ditches (vegetation control - string trimmer)	3,450	LF	6	1,000	1	21	21	0.09	$2,823	$0	$2,823	11%
4	Clean Roadside Ditches (vegetation control - mower)	13,800	LF	6	2,100	1	39	39	0.18	$5,377	$0	$5,377	22%
5	Clean Storm Drain Pipes (non-perforated)	25,625	LF	NA	NA	NA	NA	NA	NA	NA	$0	$0	0%
6	Clean Storm Drain Pipes (perforated)	3,375	LF	NA	NA	NA	NA	NA	NA	NA	$0	$0	0%
7	Clean Culverts	20	Each	1	10	2	2	4	0.02	$545	$0	$545	2%
8	Clean Detention Ponds (remove sediments)	0	Each	NA	NA	NA	NA	NA	NA	NA	$0	$0	0%
9	Clean Detention Ponds (vegetation control)	0	Each	NA	NA	NA	NA	NA	NA	NA	$0	$0	0%
10	Repair/Replace/Install New Catch Basins, Dry Wells, Manholes	306	Each	NA	NA	NA	NA	NA	NA	NA	$1,000	$1,000	4%
11	Street Sweeping	1	LS	NA	NA	NA	NA	NA	NA	NA	$0	$0	0%
12	Emergency Maintenance	1	Each	28	8	2	4	7	0.03	$955	$0	$955	4%
13	Drainage Complaints & Flood Response	1	Each	4	8	2	1	1	0.00	$136	$0	$136	1%
14	Disposal Costs (catch basin cleaning & street sweeping)	NA	NA	NA	NA	NA	NA	NA	NA	NA	$0	$0	0%
15	Other O&M	NA	NA	NA	NA	NA	NA	NA	NA	NA	$7,300	$7,300	30%
Total								98	0.45	$13,364	$11,300	$24,664	100%

Notes:
Refer to Table 7-2 and Table 7-3 for explanatory comments.

Table 7-2
Supporting Information: Current Stormwater Maintenance Program Labor

Table 7-1 Item No.	Maintenance Activity	Notes Regarding the Units to be Maintained	Notes Regarding the Frequency	Notes Regarding the Daily Production
1	Clean Catch Basins, Drywells, and Manholes	Contracted out.	4 days once per year.	Prioritized - (1) Key areas including Washington & Center Streets, Carter Street, Antony Street; (2) 1/3 of systems on six year rotation.
2	Clean Roadside Ditches (remove sediments)	Dump Truck and Backhoe used.	72 hours x 3 staff = 216 hours per year.	Approximately 1% of the total length of drainage ditches is actually drainage swales. No distinction is made in the program due to the minimal length of swales.
3 & 4	Clean Roadside Ditches (vegetation control)	Riding Mower, Brush Hog, and String Trimmer used.	20 hours per week for 6 months (April through October); Hilltop area & near maintenance bldg, View Crest once every two weeks.	Assumptions: Approximately 20% of the total length of ditches is mowed yearly using weedeaters; Approximately 80% of the ditches are mowed 3 times per year using a mower.
5 & 6	Clean Storm Drain Pipes (perforated and non-perforated)	Source: inventory based on information provided by the Town.	Assumption: Done on an as needed/emergency basis.	Assumption: Cost merged with other items.
7	Clean Culverts	Source: inventory based on information provided by the Town.		Assumption: Cost merged with other items.
8 & 9	Clean Detention Ponds (remove sediments and vegetation control)	Source: inventory based on information provided by the Town.	Detention ponds privately owned and maintained.	Line items 8 & 9 will be deleted in final version of Eatonville's Stormwater Management Program once maintenance items have been reviewed and confirmed.
10	Repair/Replace/Install New Catch Basins, Dry Wells, Manholes	Source: inventory based on information provided by the Town.	Assumption: Done on an as needed basis.	
11	Street Sweeping	Source: inventory based on information provided by the Town.	Curbed Streets - Commercial swept weekly; Curbed Streets - Residential swept twice per year; Uncurbed Streets - Residential 24 Hours per Year - special events only.	No current cost to Storm Drain Fund. Currently funded through Street Fund.
12	Emergency Maintenance	Source: Town staff	16 Hours x 32 Staff = 32 Hours per Year	
13	Drainage Complaints & Flood Response	Source: Town staff	12 Calls per Year. 4 Hours x 2 Staff = 8 Hours per Year	
14	Disposal Costs (catch basin cleaning and street sweeping)			Assumption: Cost merged with other items.
15	Other O&M	Source: Town of Eatonville 2003 Budget	Includes (1) operating supplies, (2) tools/minor equipment, (3) machinery and equipment, (4) communications, (5) miscellaneous.	

Table 7-3
Supporting Information: Current Stormwater Maintenance Program Costs

Table 7-1 Item No.	Maintenance Activity	Notes Regarding the Program Cost
1-13	Various	Labor costs are based on a fully burdened labor rate of $17.05 per hour and 220 working days per year. Source of labor cost: Town combined utilities personnel cost of $90,000 per year for 3 full time equivalents
14	Disposal Costs	Disposal costs are assumed to be merged with other expense items.
15	Other O&M	Source: Town of Eatonville 2003 Budget. Includes (1) operating supplies, (2) tools/minor equipment, (3) machinery and equipment, (4) communications, (5) miscellaneous.

7.3 Proposed Stormwater Maintenance Program

As discussed in Section 5 under the Puget Sound Plan, operating and maintaining the Town's stormwater system to preserve water quality is required. Tables 7-4 and 7-5 describe a proposed stormwater maintenance program with the maintenance frequencies generally accepted as the minimum for maintaining water quality. Table 7-4 shows proposed stormwater maintenance activities and Table 7-5 is supporting documentation that highlights the difference between the current program and the proposed program. Table 7-5 shows that accounting of actual costs to the storm drain fund, as well as increasing the level of maintenance for the storm drain pipes, catch basins, manholes, and culverts result in a higher cost for the program.

Table 7-4
Proposed Stormwater Maintenance Program

Item No.	Maintenance Activity	Units to be Maintained	Production Unit	Freq. (times/yr)	Daily Production	Crew Size	Annual Crew Days	Annual Person Days	Full-time Labor Equiv.	Annual Labor Cost	Annual Other Cost	Total Annual Cost	Percent of Program
1	Clean Catch Basins, Drywells & Manholes	306	Each	1	NA	NA	NA	NA	NA	NA	$6,000	$6,000	18%
2	Clean Roadside Ditches (remove sediments)	17,250	LF	1	2,000	3	9	26	0.12	$3,528	$0	$3,528	11%
3	Clean Roadside Ditches (vegetation control - string trimmer)	3,450	LF	6	1,000	1	21	21	0.09	$2,823	$0	$2,823	9%
4	Clean Roadside Ditches (vegetation control - mower)	13,800	LF	6	2,100	1	39	39	0.18	$5,377	$0	$5,377	16%
5	Clean Storm Drain Pipes (non-perforated)	25,625	LF	0.25	2,000	2	3	6	0.03	$874	$0	$874	3%
6	Clean Storm Drain Pipes (perforated)	3,375	LF	0.25	2,000	2	0	1	0.00	$115	$0	$115	0.3%
7	Clean Culverts	20	Each	1	10	2	2	4	0.02	$545	$0	$545	2%
8	Clean Detention Ponds (remove sediments)	0	Each	NA	NA	NA	NA	NA	NA	NA	$0	$0	0%
9	Clean Detention Ponds (vegetation control)	0	Each	NA	NA	NA	NA	NA	NA	NA	$0	$0	0%
10	Repair/Replace/Install New Catch Basins, Dry Wells, Manholes	306	Each	NA	NA	NA	NA	NA	NA	NA	$1,000	$1,000	3%
11	Street Sweeping	1	LS	52	NA	NA	NA	NA	NA	NA	$4,300	$4,300	13%
12	Emergency Maintenance	1	Each	28	8	2	4	7	0.03	$955	$0	$955	3%
13	Drainage Complaints & Flood Response	1	Each	4	8	2	1	1	0.005	$136	$0	$136	0%
14	Disposal Costs (catch basin cleaning & street sweeping)	NA	NA	NA	NA	NA	NA	NA	NA	NA	$0	$0	0%
15	Other O&M	NA	NA	NA	NA	NA	NA	NA	NA	NA	$7,300	$7,300	22%
Total								105	0.48	$14,353	$18,600	$32,953	100%

Table 7-5
Proposed Stormwater Maintenance Program: Changes From Current Program

Table 7-4 Item No.	Maintenance Activity	Changes From Current Program
1	Clean Catch Basins, Drywells & Manholes	All structures to be cleaned once a year.
2	Clean Roadside Ditches (remove sediments)	No change.
3	Clean Roadside Ditches (vegetation control - string trimmer)	No change.
4	Clean Roadside Ditches (vegetation control - mower)	No change.
5 & 6	Clean Storm Drain Pipes (non-perforated and perforated)	Pipes to be cleaned .25 times a year
7	Clean Culverts	All structures to be cleaned once a year.
8 & 9	Clean Detention Ponds (remove sediments & vegetation control)	Privately maintained; no change. Adoption of Ecology's Stormwater Manual will require standards for maintenance of private facilities. Increased cost for inspection and implementation of standards will be incurred. See Table 8-1.
10	Repair/Replace/Install New Catch Basins, Dry Wells, Manholes	No change. Capital improvement projects include replacement/repair of substantial portion of stormwater system.
11	Street Sweeping	No change. Proposed funding to come from Storm Drain Fund rather than Street Fund.
12	Emergency Maintenance	No change.
13	Drainage Complaints & Flood Response	No change.
14	Disposal Costs	To be included as a budget/cost item.
15	Other O&M	No change.

Ecology is expected, in the future, to publish a model stormwater ordinance that may contain operation and maintenance provisions. The Town should monitor any model ordinances developed by Ecology and reassess its maintenance program accordingly.

Section 8

PROGRAM MANAGEMENT, PUBLIC EDUCATION, AND ENGINEERING

Section 8
PROGRAM MANAGEMENT, PUBLIC EDUCATION, AND ENGINEERING

8.1 Introduction

This section describes the Town's program management, public education, and engineering activities related to stormwater management and provides estimates of staff resources needed for these activities. Table 8-1 provides a summary of current activities and the anticipated future program. Activities associated with the management of the stormwater program by maintenance personnel are not included in Table 8-1. Maintenance requirements are included in Section 7.

8.2 Existing and Anticipated Future Program Management, Public Education, and Engineering

8.2.1 Program Management

Stormwater program management includes budgeting stormwater-related projects and activities, staff work planning, regulatory compliance, resource allocation, and supervision. It also includes coordination between staff and elected officials regarding stormwater planning and policies. It was estimated, with input from Town staff, that the existing effort for these tasks is approximately 0.25 FTE.

Table 8-1
Stormwater Engineering, Public Education, and Program Management

Program Element	Current Program FTE	Current Program Annual Cost (1)	Recommended Future Program FTE	Recommended Future Program Annual Cost (1)	Reason for Increase	Current Funding Source
1 Surface Water Program Management - Budgeting - Funding development - Work planning - Resource allocation and staff supervision - Coordination with elected officials and resource agencies - Engineering plan review - Maintain drainage inventory - Stormwater planning	0.25	$13,200	0.30	$15,840	Additional engineering will be required for: - Increased plan review and inspection resulting from adoption of the Ecology manual (or equivalent) and enforcement	Storm Drain Fund
2 Professional Services (2)		$12,000		$12,000	No change	Storm Drain Fund
3 Insurance and Taxes		$7,100		$7,100	No change	Storm Drain Fund
4 Public Education	0.00	$0	0.10	$7,280	Public education is a Puget Sound Plan requirement. Cost includes $2,000 per year for materials.	None
Total	0.25	$32,300	0.40	$42,220		

Notes:
(1) Assumes 1 FTE to complete program management or engineering activities costs $30/hour including benefits.
(2) Primarily consulting services related to program management and engineering services.

8.2.2 Engineering

Engineering associated with stormwater management includes many current activities, including: plan review and inspection during construction, engineering for minor drainage problems, maintaining stormwater system data such as the Town's mapping and stormwater facilities inventory, stormwater system planning, development and administration of construction standards, response to drainage complaints, and engineering support for maintenance programs.

Based on conversations with Town staff, the engineering is integrated with the surface water program management responsibilities. The Town will need to initiate an inspection program for private drainage facilities and an illicit discharge prevention program in support of the new stormwater ordinance (Section 5).

8.2.3 Public Education

Providing public education related to improving stormwater quality has been limited within the Town. The Town will be required by the Puget Sound Plan to:

- Public Education/Outreach: implement a public education program to distribute educational materials to the community, or conduct equivalent outreach activities about the impacts of stormwater discharges on local waterbodies and the steps that can be taken to reduce stormwater pollution, as well as working with local businesses on implementing source controls. The Town will also be required to determine the appropriate Best Management Practices (BMPs) for public education and outreach.

Section 9

FUNDING ANALYSIS

Section 9
FUNDING ANALYSIS

9.1 Introduction

The City currently funds existing stormwater-related services through their stormwater utility. The goal of the financial analysis is to evaluate how the Town's current funding can meet the capital and operating needs detailed in this stormwater plan.

The scope of services for the funding analysis included the following major tasks:

Task 1 – Rate Basis Impervious Area Determination

Task 2 – Rate Analysis

9.2 Rate Basis—Impervious Area Determination

There are a number of potential bases for charging stormwater rates. These rate bases vary in terms of their defensibility, fairness, east of implementation/administration, and understandability.

The most common basis for charging stormwater fees throughout the United States is impervious surface area. This term refers to hard surface area that prevents for slows water infiltration into the ground. RCW 35.67, the authorization of the stormwater utility concept, allows the imposition of service rates based on contribution of runoff. Impervious surface area is most widely accepted as an appropriate measure of a property's contribution of runoff, providing a clear relationship to service received from a stormwater program.

To administer a rate structure based on impervious surface area, data quantifying the applicable area by parcel is required. To minimize administrative and data collection costs, stormwater utilities typically develop a uniform rate for single-family residential customers based on the estimated average amount of impervious area per developed single-family residential parcel – commonly referred to as an equivalent service unit or ESU. This approach also implies that each residence in the Town will be served equally by the presence of the utility. The value of one ESU as defined by the Town of Eatonville's Municipal Code 13.24.030E is 3,000 square feet.

The charge basis for all other customer types is generally the actual measured impervious surface area by parcel, expressed as the number of ESUs on the parcel. The rate itself is most commonly calculated as a dollars amount per ESU. For example, assuming an ESU value of 3,000 square feet of impervious surface area, a monthly fee of $8 per ESU per month would result in monthly charges of $8 to all single-family residences. A nonresidential customer with 15,000 square feet of impervious surface area would be charged $40 for five ESUs (15,000/3,000=5). All developed parcels would be charged for a minimum of one ESU.

The recommended rate approach is based on the amount of actual or assumed impervious surface area on the parcel. The rate is then expressed as a dollar amount per Equivalent Service Unit (ESU), with an ESU equal to the average amount of impervious surface area on the City's developed single-family residential parcels. Under this approach, the rate calculation is relatively simple. The total of annual unfunded program costs, or the rate revenue requirement, is divided by the total number of ESUs in the customer base (adjusted to account for likely credits granted). The result may be divided again by 12 to convert it to a monthly figure.

MONTHLY RATE	=	ANNUAL PROGRAM REVENUE REQUIREMENT	÷	TOTAL NUMBER OF ESUs	÷	TWELVE (MONTHS)

As part of the system mapping work, the impervious area per parcel for non single family residential parcels was identified from aerial photos (orthophotos) obtained from Triathlon Inc. in combination with tax parcel boundaries obtained from Pierce County. The tax parcel information was received on September 8, 2001 and the orthophotos were flown on April 19, 1999. The orthophotos have an accuracy of +/- 4 Feet.

Using Geographical Information System (GIS) analysis tools, including ArcMap and Arc/Info, parcels within the Town of Eatonville boundaries were identified as Single Family Residential (Code 1101), Vacant Land Residential (Code 9600), and Vacant Commercial Land (Code 9700) as designated by the Pierce County Land Use Code listing. These parcels were not included in the impervious area analysis as Single Family Residential (SFR) parcels already have an assumed impervious area of 3,000 square feet according to the Town of Eatonville Municipal Code 13.24.030E, and the vacant land parcels are assumed to be undeveloped. Impervious features such as buildings, pavement, concrete, or hard pack earth on the remaining parcels within the Town of Eatonville's boundaries were digitized. The data from this process was exported from GIS into an electronic spreadsheet. See Appendix D for the GIS data. The ESUs for the non-SFR parcels were then computed by taking the square footage of impervious area divided by the 3,000 square feet of impervious area designated as a single ESU. This analysis was performed only for the non-SFR parcels. Each SFR parcel was assumed equal to one (1) ESU.

According to the Town's municipal code EMC Ch13.24.060, billing is based on each parcel of developed real property within the Town. Under the current definition of ESU using the flat rate of $8 per ESU per month, the generated revenue is $109,500. The current number of ESUs is then derived by dividing that number by 12 months and by $8 per month resulting in approximately 1,140 ESUs. The number of ESUs calculated from the new impervious areas for non-SFR parcels is approximately 1,350. Table 9-1 summarizes these results.

Table 9-1
ESU Summary

No. of ESUs	Residential (SFR)	Non Residential (Non-SFR)	Total
Flat Rate	NA	NA	1140
Measured Commercial Impervious Area	579[1]	770	1349

1. Residential Equivalent Service Units (ESU) were not measured. Each single family residential property is defined as one ESU.

9.3 Rate Analysis

Total program costs were developed which are based on the regulatory compliance recommendations, capital improvements projects, operation and maintenance program, public education, engineering, plan reviews, inspection, enforcement, and administration costs.

Minimal costs are associated with passing ordinances to implement regulatory recommendations and the costs for enforcing these regulations are included as part of program management. When looking at all the needs identified for each of the other major program components (capital improvements, maintenance and operations, program management, public education, and engineering), the current utility service charge will be evaluated as to its ability to generate sufficient revenues to fund the costs estimated for implementing all the program needs. To resolve this issue, a prioritization process was initiated to determine which program elements should be funded and implemented by the Storm Drain Utility.

Using the new number of ESUs and the current $8/month rate, revenues would increase to $129,600. However with the proposed program costs including proposed capital improvement projects, the revenue generated would take 95 years to fund the proposed capital improvements, see Table 9-2.

The effect of raising the $8 per ESU per month rate by $1 generates an additional $16,080 per year and reduces the time to complete the complete CIP program to approximately 52 years from 65 years. See Table 9-3 for Projected Rate Increase Impacts on the stormwater improvement projects.

<< A specific rate increase recommendation is not made in this draft of the Stormwater Management Program. This is typically determined by the community through their board members once the CIP has been reviewed and approved. The recommended rate increase, if any, will be added to the final of this report once it has been determined by the Town. >>

Table 9-2
Projected Rate Impacts

	Annual Total: Existing ESU Definition (1)	Annual Total: Revised ESU Definition (2)	Description
SOURCES OF FUNDS			
Rate Revenue (existing rate structure)	$ 109,500	$ 129,600	
Other (3)	$ 9,900	$ 9,900	Source: 2001 Budget
TOTAL SOURCES OF FUNDS	$ 119,400	$ 139,500	
USES OF FUNDS			
O&M Expenses	$ 32,953	$ 32,953	Table 7-4 Proposed Maintenance Program
Program Management & Engineering	$ 42,220	$ 42,220	Table 8-1 Recommended Future Program
Debt Service	$ -	$ -	No existing storm drainage debt
Subtotal	$ 75,173	$ 75,173	
Revenues Available for Capital Expenditures (4)	$ 44,227	$ 64,327	
TOTAL USES OF FUNDS	$ 119,400	$ 139,500	
CAPITAL IMPROVEMENT PLAN FUNDING			
Total Capital Improvement Plan Cost	$ 4,177,400	$ 4,177,400	Table 6-2 Stormwater Improvement Projects and Estimated Implementation Costs in 2003 dollars
Years Required to Complete CIP (5)	94.5	64.9	

Notes:
(1) All costs in 2003 dollars.
(2) All costs in 2003 dollars. Using ESU number based on impervious surface area.
(3) Other revenues include late fees, permit fees, and other service charges.
(4) This line represents the amount of capital expenditures that can be funded using the existing rate structure without a rate increase. Capital projects are assumed to be funded on a pay-as-you-go basis without issuance of debt.
(5) Calculated by dividing the total CIP cost by the annual capital expenditure.

Table 9-3
Projected Rate Increase Impacts

	Annual Total: Revised ESU Definition @ $8 per month per ESU (1)	Annual Total: Revised ESU Definition @ $9 per month per ESU (1)	Annual Total: Revised ESU Definition @ $10 per month per ESU (1)	Annual Total: Revised ESU Definition @ $12 per month per ESU (1)	Description
SOURCES OF FUNDS					
Rate Revenue	$ 129,600	$ 145,800	$ 162,000	$ 194,400	
Other (2)	$ 9,900	$ 9,900	$ 9,900	$ 9,900	Source: 2001 Budget
TOTAL SOURCES OF FUNDS	$ 139,500	$ 155,700	$ 171,900	$ 204,300	
USES OF FUNDS					
O&M Expenses	$ 32,953	$ 32,953	$ 32,953	$ 32,953	Table 7-4 Proposed Maintenance Program
Program Management & Engineering	$ 42,220	$ 42,220	$ 42,220	$ 42,220	Table 8-1 Recommended Future Program
Debt Service	$ -	$ -	$ -	$ -	No existing storm drainage debt
Subtotal	$ 75,173	$ 75,173	$ 75,173	$ 75,173	
Revenues Available for Capital Expenditures (3)	$ 64,327	$ 80,527	$ 96,727	$ 129,127	
TOTAL USES OF FUNDS	$ 139,500	$ 155,700	$ 171,900	$ 204,300	
CAPITAL IMPROVEMENT PLAN FUNDING					
Total Capital Improvement Plan Cost	$ 4,177,400	$ 4,177,400	$ 4,177,400	$ 4,177,400	Table 6-2 Stormwater Improvement Projects and Estimated Implementation Costs in 2003 dollars
Years Required to Complete CIP (4)	64.9	51.9	43.2	32.4	
Prioritized Capital Improvement Plan Covered by Revenues (5)	$ 1,286,500	$ 1,610,500	$ 1,934,500	$ 2,582,500	Table 6-4 Prioritized Stormwater Improvement Projects and Estimated Implementation Costs in 2003 dollars
Available for Capital Expenditures for a 20-Year Period	20.0	20.0	20.0	20.0	

Notes:

(1) All costs in 2003 dollars. Using ESU number based on impervious surface area.

(2) Other revenues include late fees, permit fees, and other service charges.

(3) This line represents the amount of capital expenditures that can be funded per year. Capital projects are assumed to be funded on a pay-as-you-go basis without issuance of debt.

(4) Calculated by dividing the total CIP cost by the annual capital expenditure.

(5) Calculated by multiplying the revenues available for capital expenditures per year by 20 years. See Table 6-4 for prioritized improvement projects that can be completed.

Section 10

RECOMMENDED PLAN FOR IMPLEMENTATION

Section 10
RECOMMENDED PLAN FOR IMPLEMENTATION

10.1 Introduction

The recommended plan for implementation consists of elements of the total program needs identified in the previous sections and consists of the following four major program components:

- Regulatory recommendations
- Capital improvements
- Maintenance and operations program
- Program management, public education, and engineering

The highest priority elements of the total program needs will be implemented to help solve current and future water quality and flooding problems, preserve and enhance valuable environmental resources, and establish a comprehensive and long-term approach to surface water management.

The total program needs were identified in previous sections as follows:

- Existing local, state and federal regulations that affect the Town's stormwater program are described in Section 5.
- Proposed solutions to flooding and water quality problems are described in Section 6.
- Maintenance and operations program needs are described in Section 7.
- The staffing level needs for program management, public education, and engineering are discussed in Section 8.

10.2 Recommended Plan

Implementation of the recommended plan will require a rate increase of $x.00 per ESU per month. This results in a new monthly rate of $xx.00 per ESU. The implementation of the recommended plan will provide the Town with the program elements and financial resources necessary to comply with Department of Ecology requirements. Program elements not funded by the utility could be funded through the City's general fund or be deferred.

<< A specific rate increase recommendation is not made in this draft of the Stormwater Management Program. This is typically determined by the community through their board members once the CIP has been reviewed and approved. The

recommended rate increase, if any, will be added to the final of this report once it has been determined by the Town. >>

The rest of this section describes the elements of the recommended plan for implementation.

10.2.1 Regulatory Recommendations

It is recommended that the Town adopt a new Stormwater Management Ordinance which adopts the minimum requirements or Ecology Manual in its entirety. This ordinance should also include prohibition of illicit discharges and standards regarding the maintenance and operation of public and private facilities.

The Town should accompany adoption of this new ordinance with a public education program designed to inform and educate affected parties about the new requirements.

10.2.2 Recommended Capital Improvements Program

Capital improvements were developed to solve conveyance problems, which was the Town's primary problem with respect to flooding issues. Completion of these projects is not specifically required in order for the Town to meet existing and proposed regulatory requirements.

It is recommended that Town staff reconfirm the priorities of the capital projects as money becomes available. This should include consideration of factors such as any emergency situations that may develop and the fact that some projects on this list should be completed simultaneously with capital street improvement projects. In addition, it is recommended that the Town explore other options to obtain funding for capital projects over the next several years. Future rate increases may also increase the funds available for future capital projects. See Table 10-1 for recommended stormwater improvement projects.

Table 10-1
Recommended Stormwater Improvement Projects

Priority No.	Improvement Project No. (1)	Location	Project Cost	Cumulative Cost
1	IP14	Survey Assessment (2)	$ 10,000	$ 10,000
2	IP07	Adams Av S between Center St W & Prospect St E (3)	$ 213,500	$ 223,500
3	IP08	Washington Av between Larson St W and Prospect St E	$ 208,100	$ 431,600
4	IP09	Penn Av N between Lynch Street W and Carter St W	$ 212,500	$ 644,100
5	IP03	Center St W from Jensen Ln N thru Cedar Av N	$ 475,300	$ 1,119,400
6	IP05	Center St E from Madison Av S to N-S Main Trunk	$ 335,500	$ 1,454,900
7	IP02	Center St W between Orchard Av S to N-S Main Trunk	$ 475,800	$ 1,930,700
8	IP04	Center St W from Cedar Av N to Orchard Av S	$ 336,400	$ 2,267,100
9	IP10	Intersection of Hill Top Area and Eatonville Hwy W	$ 335,800	$2,602,900
10	IP01	N-S Main Trunk to Lynch Creek	$907,800	$ 3,510,700
11	IP06	Center St E from Bergeren Rd to Madison Av S	$ 406,400	$ 3,917,100
12	IP11	Antonie Av N between Williams Addition and Center St W	$ 260,300	$ 4,177,400
13	IP12	Intersection of Antonie Av S and Eatonville Hwy W	$ Unknown	
14	IP13	Eatonville Hwy W near West Town Limits	$ Unknown	
		Total Stormwater Improvement Projects:	**$4,177,400**	

(1) From Table 6-2.
(2) Based on results from survey assessment, IP priorities and scope can be revised.
(3) Adams Ave S project listed in Eatonville Proposed 2003 Budget. Alder St was also identified as a capital project in the proposed budget, but was not identified as a problem area during the modeling analysis and was not identified by the Town during discussions of problem areas. This can be added as a prioritized improvement project pending Stormwater Management Program Report review.
(4) See Table 9-3 for value of improvement projects covered under varied ESU rate increases over a 20-year period.

10.2.3 Recommended Maintenance and Operations Plan

The purpose of a Maintenance and Operations Program is to ensure system reliability, achieve the lowest life-cycle cost for facility replacement, and to use maintenance methods and standards that promote water quality. The recommended stormwater maintenance and operations program will require an annual budget of approximately $32,953, including the equivalent of approximately 0.48 FTE staff persons. This does not represent a significant FTE increase of maintenance personnel over the current maintenance program as described in Section 7. Specific increases in the maintenance and operations level of service for the recommended program include:

- Increase the catch basin cleaning to include all catch basins 1 time per year. Since this function is contracted out, it does not affect the FTE.
- Increase the cleaning of the pipes to 0.25 times per year.
- Track the expenditures related to implementing the stormwater program (eg, sediment disposal costs, street sweeping costs, etc)

The recommended stormwater maintenance program is shown on Table 10-2.

Table 10-2
Recommended Stormwater Maintenance Program

Item No.	Maintenance Activity	Units to be Maintained	Production Unit	Freq. (times/yr)	Daily Production	Crew Size	Annual Crew Days	Annual Person Days	Full-time Labor Equiv.	Annual Labor Cost	Annual Other Cost	Total Annual Cost	Percent of Program
1	Clean Catch Basins, Drywells & Manholes	306	Each	1	NA	NA	NA	NA	NA	NA	$6,000	$6,000	18%
2	Clean Roadside Ditches (remove sediments)	17,250	LF	1	2,000	3	9	26	0.12	$3,528	$0	$3,528	11%
3	Clean Roadside Ditches (vegetation control - string trimmer)	3,450	LF	6	1,000	1	21	21	0.09	$2,823	$0	$2,823	9%
4	Clean Roadside Ditches (vegetation control - mower)	13,800	LF	6	2,100	1	39	39	0.18	$5,377	$0	$5,377	16%
5	Clean Storm Drain Pipes (non-perforated)	25,625	LF	0.25	2,000	2	3	6	0.03	$874	$0	$874	3%
6	Clean Storm Drain Pipes (perforated)	3,375	LF	0.25	2,000	2	0	1	0.00	$115	$0	$115	0.3%
7	Clean Culverts	20	Each	1	10	2	2	4	0.02	$545	$0	$545	2%
8	Clean Detention Ponds (remove sediments)	0	Each	NA	NA	NA	NA	NA	NA	NA	$0	$0	0%
9	Clean Detention Ponds (vegetation control)	0	Each	NA	NA	NA	NA	NA	NA	NA	$0	$0	0%
10	Repair/Replace/Install New Catch Basins, Dry Wells, Manholes	306	Each	NA	NA	NA	NA	NA	NA	NA	$1,000	$1,000	3%
11	Street Sweeping	1	LS	52	NA	NA	NA	NA	NA	NA	$4,300	$4,300	13%
12	Emergency Maintenance	1	Each	28	8	2	4	7	0.03	$955	$0	$955	3%
13	Drainage Complaints & Flood Response	1	Each	4	8	2	1	1	0.005	$136	$0	$136	0%
14	Disposal Costs (catch basin cleaning & street sweeping)	NA	NA	NA	NA	NA	NA	NA	NA	NA	$0	$0	0%
15	Other O&M	NA	NA	NA	NA	NA	NA	NA	NA	NA	$7,300	$7,300	22%
Total								105	0.48	$14,353	$18,600	$32,953	100%

10.2.4 Recommended Program Management, Public Education, and Engineering

The recommended plan for implementation devotes 0.40 FTE to program management, public education, and engineering. This represents an overall increase from existing efforts of 0.25 FTE as described in Section 8.

Table 10-3
Recommended Program Management, Public Education, & Engineering Program

	Current Program		Recommended Future Program			
Program Element	FTE	Annual Cost (1)	FTE	Annual Cost (1)	Reason for Increase	Current Funding Source
1 Surface Water Program Management - Budgeting - Funding development - Work planning - Resource allocation and staff supervision - Coordination with elected officials and resource agencies - Engineering plan review - Maintain drainage inventory - Stormwater planning - Administer construction standards	0.25	$13,200	0.30	$15,840	Additional engineering will be required for: - Increased plan review and inspection resulting from adoption of the Ecology manual (or equivalent) and enforcement	Storm Drain Fund
2 Professional Services (2)		$12,000		$12,000	No change	Storm Drain Fund
3 Insurance and Taxes		$7,100		$7,100	No change	Storm Drain Fund
4 Public Education	0.00	$0	0.10	$7,280	Public education is a Puget Sound Plan requirement. Cost includes $2,000 per year for materials.	None
Total	0.25	$32,300	0.40	$42,220		

Notes:
(1) Assumes 1 FTE to complete program management or engineering activities costs $30/hour including benefits.
(2) Primarily consulting services related to program management and engineering services.

As development projects are submitted and reviewed, it is recommended that the Town use the opportunity to collect stormwater structure information as part of its ongoing inventory updating. The Town can require the use of a standard datum (e.g. Pierce County) so that the information regarding its stormwater system can be integrated with the data already gathered.

Section 11

REFERENCES

Section 11
REFERENCES

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Appendix A

STORMWATER STRUCTURE INVENTORY

Appendix A1

COMPLETE STORMWATER INVENTORY WORKSHEETS

R·W·BECK

		Missing/Incomplete Information				COUNT CB =	306											
	*	GPS related - not part of drainage system																
		NORTHING	EASTING	ELEV	MD	INVERT	DIRECTION	DIAMETER	MAT'L	MH DIAM.	CB LEN	CB WID	CB DEP		NOTES			
				(FT)	(IN)	(FT)	(N,S,E,W)	(IN)		(IN)	(IN)	(IN)	(IN)					
*	3	564257.1733	1198017.332	806.1		806.10			NO INFORMATION REQUIRED						SB			
*	4	564259.2355	1200368.426	820.85		820.85			NO INFORMATION REQUIRED						SB			
*	5	563121.264	1198687.795	796.39		796.39			NO INFORMATION REQUIRED						AXEL			
*	6	563104.2864	1201320.714	829.23		829.23			NO INFORMATION REQUIRED						ALUMON			
*	7	563153.1304	1193382.151	865.62		865.62			NO INFORMATION REQUIRED						CASEDMON			
*	8	565744.334	1201352.379	836.54		836.54			NO INFORMATION REQUIRED						STONE	MON		
*	9	568367.9491	1201302.792	881.59		881.59			NO INFORMATION REQUIRED						SB			
*	10	565067.4955	1198847.532	794.01		794.01			NO INFORMATION REQUIRED						SB			
*	11	565755.7687	1198845.477	797.16		797.16			NO INFORMATION REQUIRED						SB			
*	12	568665.1182	1196302.36	553.58		553.58			NO INFORMATION REQUIRED						SB			
*	13	568367.6311	1195824.29	546		546.00			NO INFORMATION REQUIRED						RB\NOCAP			
*	14	564403.3782	1197312.336	812.8		812.80			NO INFORMATION REQUIRED						SB			
*	20	570997.3625	1201281.451	-99999		-99999.00			NO INFORMATION REQUIRED						CALCED	E	4-Jan	S11
*	21	568365.1148	1198658.991	-99999		-99999.00			NO INFORMATION REQUIRED						CALCED	N	4-Jan	S14
*	22	568409.2438	1193386.638	-99999		-99999.00			NO INFORMATION REQUIRED						CALCED	N	4-Jan	S15
*	23	571042.2707	1196005.728	-99999		-99999.00			NO INFORMATION REQUIRED						CALCED	W	4-Jan	S11
*	24	565769.905	1196010.339	-99999		-99999.00			NO INFORMATION REQUIRED						CALCED	W	4-Jan	S14
*	30	563261.4729	1201217.554	-99999		-99999.00			NO INFORMATION REQUIRED						H&T			
*	31	563372.3928	1200993.909	-99999		-99999.00			NO INFORMATION REQUIRED						PK			
*	32	565466.4595	1201580.228	-99999		-99999.00			NO INFORMATION REQUIRED						H&T			
*	33	565597.8004	1201341.241	-99999		-99999.00			NO INFORMATION REQUIRED						H&T			
*	34	565745.0883	1201351.857	-99999		-99999.00			NO INFORMATION REQUIRED						2" IP			
*	35	568362.2804	1196015.189	-99999		-99999.00			NO INFORMATION REQUIRED						1 1/2" IP W\ALUMINUM CAP			
*	49	568371.1596	1196127.117	554.47		554.47			NO INFORMATION REQUIRED						FDPK W\FLASHER			
*	100	571020.5599	1198649.423	-99999		-99999.00			NO INFORMATION REQUIRED						CALCED	CENTER	S	11
*	101	573722.9311	1195995.486	-99999		-99999.00			NO INFORMATION REQUIRED						CALCED	NW	COR	S11
*	102	560483.0604	1198636.616	-99999		-99999.00			NO INFORMATION REQUIRED						CALCED	CENTER	S23	
*	103	560493.4226	1195964.556	-99999		-99999.00			NO INFORMATION REQUIRED						CALCED	W	4-Jan	S23
*	105	560472.763	1201255.153	-99999		-99999.00			NO INFORMATION REQUIRED						CALCED	E	4-Jan	S23
	873	564950.953	1199001.083	788.18		788.18									YD			
	897	563706.5005	1194209.399	869.9		869.90									CB			
	898	563706.1624	1194228.529	869.04		869.04									CB			
	899	563713.0431	1193830.274	884.79		884.79									CB			
	900	563707.9058	1193526.735	892.13		892.13									CB			
	901	563701.4548	1193531.34	891.63		891.63									CB1			
	902	563702.0234	1193602.172	890.28		890.28									CB2			
	903	563661.5395	1193601.679	890.15		890.15									CB3			
	904	563700.3077	1193833.216	884.55		884.55									CB4			
	905	563699.8983	1193909.531	882.35		882.35									CB5			
	906	563659.9884	1193909.802	882.09		882.09									CB6			
	907	563697.7408	1194209.414	869.78		869.78									CB7			
	908	563658.1226	1194209.811	869.66		869.66									CB8			
	909	563717.1784	1194479.404	855.44		855.44									CB9			
	910	563674.775	1194483.511	855.31		855.31									CB10			
	911	563827.4548	1194578.473	860.65		860.65									CB11			
	914	564205.7374	1200355.777	820.42		820.42									CB114			
	919	564205.6342	1200380.558	820.21		820.21									CB119			
	920	563905.7691	1200379.518	824.18		824.18									CB			
	921	563905.2987	1200354.433	824.17		824.17									CB			
	924	564290.9916	1201791.201	873.58		873.58									CBF			
	925	564482.6072	1202044.56	878.68		878.68									CB			
	926	564476.0824	1202042.087	879.14	50	874.97	N	12	PVC	48			108		DW7			
				879.14	56	874.47	E	12	PVC									

Missing/Incomplete Information

* GPS related - not part of drainage system

COUNT CB = 306

	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIAMETER (IN)	MAT'L	MH DIAM. (IN)	CB LEN (IN)	CB WID (IN)	CB DEP (IN)	NOTES	
927	564522.2668	1202058.993	879.1	70	873.27	E	12	PVC	48			103	DWF	
			879.1	38	875.93	S	12	PVC						
			879.1	70	873.27	W	12	PVC						
928	564331.672	1202477.301	878	81	871.25	N	12	PVC	48			134	DW8	
			878	79	871.42	E	12	PVC						TO DRYWELL
			878	81	871.25	W	12	PVC						
929	564311.3856	1202533.164	875.29		875.29								COIT10	
930	564916.9814	1196262.442	814.44		814.44								CB	
931	564949.5564	1196194.619	814.27		814.27								CB	
932	563335.7951	1195211.554	825.14	80	818.47	N	12	PVC		24	20	86	CBFFFF	
			825.14	80	818.47	S	12	PVC						
			825.14	53	820.72	W	12	PVC						
933	563306.8604	1195233.099	825.15	75	818.90	N	12	PVC		24	20	86	CBFFF	
			825.15	71	819.23	S	12	PVC						
934	563233.5381	1195250.599	822.9		822.90								CB66	
935	563387.5647	1201214.232	861.55		861.55								CB	
936	563397.9191	1201215.983	861.87		861.87								CB	
937	563904.3737	1201566.646	869.02		869.02								CB	
940	563680.6987	1196130.056	817.89		817.89								TOP12"CON1.06MD	
941	563668.8964	1195989.342	820.13		820.13								CB	
942	563950.9267	1196593.82	820.39	42	816.89	N	12	CONC		24	20	57	CB5AA	
			820.39	46	816.56	S	12	CONC						
943	563921.069	1196612.952	820.49	55	815.91	N	12	PVC		24	20	66	CB4AA	
			820.49	58	815.66	W	12	PVC						
944	563891.358	1196591.845	819.54	62	814.37	NE	12	CONC	48			74	CB6AA	
			819.54	74	813.37	E	36	CONC						
			819.54	72	813.54	W	36	CONC						
945	564093.2389	1196871.445	822.39	41.5	818.93	E	36	CONC	30			120	CBAA	
			822.39	39	819.14	S	12	ST						
			822.39	21.5	820.60	W	36	CONC						
946	564044.9361	1196874.478	827.66	35	824.74	NE	6	CONC		24	20	?	CBAAA	
			827.66	35	824.74	S	6	CONC						
947	564193.0664	1196916.517	818.83		818.83								CB	
948	564232.0883	1196977.247	817.42		817.42								CB	
949	563965.5971	1197098.26	850.12	24	848.12	E	8	CONC		?	?	24	CB2AA	
			850.12	24	848.12	W	8	CONC						
950	565602.9673	1196420.909	817.93		817.93								CB	
951	565627.3893	1196423.029	818.11		818.11								CB	
952	565635.071	1196422.935	818.9		818.90								STMH	
953	563825.1507	1197466.158	879.35	12	878.35	E	8	CONC		24	20	24	CB3AA	
			879.35	12	878.35	W	8	CONC						
954	564530.0572	1196525.562	815.73	58		N	12	PVC CORR	48			93	CBV36	
			815.73	52	811.40	S	12	PVC CORR						

	Missing/Incomplete Information				COUNT CB =	306							
*	GPS related - not part of drainage system												
	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIAMETER (IN)	MAT'L	MH DIAM. (IN)	CB LEN (IN)	CB WID (IN)	CB DEP (IN)	NOTES
955	565043.9933	1196300.473	812.06		812.06								CB
956	563937.2967	1196234.32	828.24	110	819.07	W	12	PVC	48			127	CBV32
			828.24	110	819.07	S	12	PVC CORR					
957	564028.2006	1196070.633	821.97		821.97								CB
958	563975.2958	1196045.087	819.39		819.39								TOP12"PL1.02MD
959	565061.1377	1196590.011	815.59		815.59	NO INFORMATION REQUIRED							MIC
960	566711.73	1196605.441	821.63		821.63								CB171A
961	566746.5858	1196605.479	820.89		820.89								DW2
962	566707.5183	1196605.438	820.62		820.62								DW1
963	566502.2087	1196774.181	824.81		824.81								DW5
964	566229.4307	1196797.794	825.55		825.55	NO INFORMATION REQUIRED							SB
965	564585.5733	1196555.399	814.6	48		N	12	PVC	48			76	CBV37
			814.6	51		S	10	PVC					
			814.6	35		W	8	DI					
966	566200.3267	1197227.873	831.21		831.21								DW6
967	566152.7659	1197198.078	831.39		831.39	NO INFORMATION REQUIRED							SB
968	565718.5567	1197546.96	831.63		831.63								CB
969	566915.4603	1196800.449	822.41		822.41	NO INFORMATION REQUIRED							SB
970	564563.7469	1198866.811	792.17	43	788.59	N	10	PVC		NA	NA	48	STMH4
			792.17	43	788.59	S	8	PVC					
			792.17	48	788.17	W	30	CONC					
971	564739.4018	1198865.203	792.27	32	789.60	S	10	PVC		NA	NA	38	STMH3
			792.27	32	789.60	W	8	PVC					
972	565085.2544	1198866.883	793.55	39		N	10	PVC	MH	NA	NA	?	STMH2
			793.55	39		W	12	CONC					
			793.55	39		E	8	CONC					
973	565719.7477	1197584.19	831.52		831.52								CB
974	564773.1435	1199001.099	790.38		790.38								YD
975	564713.3838	1198989.006	791.54		791.54								YD
976	564476.4878	1198903.874	792.03		792.03								CB
977	565384.5914	1198864.573	794.71		794.71								STMH1
978	565582.6716	1198233.805	811.92		811.92								CB
979	566639.8403	1197852.982	813.39		813.39								CB1.76
980	564303.6621	1198567.747	796.1	18	794.60	N	15	CONC		30	22	18	CBB
			796.1	18	794.60	E	8	CONC					
981	564387.656	1198510.822	798.96	33.6	796.16	N	15	CONC		30	22	33.6	CBA
			798.96	33.6	796.16	S	15	CONC					
982	564424.7547	1198509.951	799.1	25.2	797.00	S	15	CONC		30	22	25.2	CBM
983	564282.5598	1198037.366	804.59		804.59								CB
984	565089.6374	1198508.626	804.37	28	802.04	E	15	CONC		30	22	34	CBE
			804.37	25	802.29	W	14	CONC					
985	565088.2607	1198546.336	804.41	32	801.74	E	14	CONC		30	22	39	CBF
			804.41	32	801.74	W	14	CONC					

	Missing/Incomplete Information				COUNT CB =	306							
*	GPS related - not part of drainage system												
	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIAMETER (IN)	MAT'L	MH DIAM. (IN)	CB LEN (IN)	CB WID (IN)	CB DEP (IN)	NOTES
986	564588.7001	1198506.562	799.39	30	796.89	E	18	CONC		30	22	30	CBD
			799.39	30	796.89	W	24	CONC					
			799.39	28	797.06	E	18	CONC					
987	564598.5912	1198551.337	798.63	29	796.21	E	18	CONC		30	22	26	CBC
			798.63	31	796.05	W	18	CONC					
988	564476.2425	1198803.205	791.94		791.94								CB
989	564476.4405	1198753.455	792.51		792.51								CB
990	564325.2074	1198678.394	792.03		792.03								CB103A
991	563936.1442	1198872.981	793.4		793.40								DRAIN
992	564175.1692	1198883.846	793.18		793.18								STMH5
993	564118.4692	1199012.232	792.12	72	786.12	N	24	CONC	48			72	STMH6
			792.12	72	786.12	E	12	CONC					
			792.12	42	788.62	S	12	CONC					
994	563734.7474	1199895.274	801.22		801.22								CBVASC
995	562927.8305	1198866.13	787.18	17	785.76	E	8	PVC		24	20	36	DW
996	562881.9739	1198879.046	788.61	59	783.69	N	12	PVC		24	20	60	CBTTT
			788.61	51	784.36	N(NW)	6	PVC					
			788.61	60	783.61	W	12	PVC					
997	562880.0479	1198719.269	785.53	38	782.36	W	12	PVC		24	20	54	CBTT
			785.53	38	782.36	E	12	PVC					
998	562757.7188	1198670.844	788.68	38	785.51	E	12	PVC		24	20	49	CBTTTT
			788.68	38	785.51	S	12	PVC					
999	564248.5957	1198315.848	802.64		802.64								CB104
1000	564263.5469	1198679.562	792.09		792.09								CB102A
1001	564582.1317	1198680.066	794.71		794.71								CB
1002	566650.3473	1197533.788	817.98		817.98								TOP12"CON1.06MD
1003	566652.6776	1197588.454	816.48		816.48			NO INFORMATION REQUIRED					GD
1004	564882.4653	1196295.917	815.24		815.24								CB314
1007	565825.2494	1197324.725	830.29		830.29								CB=DW107
1008	565872.5664	1197226.384	828.88	25	826.80	E	6	PVC		24	18	45	CB=DW108
1013	566764.7899	1196490.965	822.72		822.72								CB13
1014	566911.8504	1196894.76	820.84		820.84								CB14
1015	566932.2136	1196918.131	820.67		820.67								CB15
1016	566228.5779	1196755.071	824.7		824.70								CB16
1017	566244.8459	1196847.476	826.1		826.10								CB17
1018	566214.3319	1196847.751	825.99		825.99								CB18
1019	566500.1964	1196797.13	824.29		824.29								CB19
1020	566248.9604	1197182.389	830.02		830.02								CB20
1021	566249.2679	1197212.877	830		830.00								CB21
1024	565039.049	1196192.236	813.28		813.28								CB24
1026	565270.6527	1196573.133	818.1		818.10								CB26
1027	563721.4206	1196111.648	820.55		820.55								CB27
1028	563745.2011	1196167.53	820.76		820.76								CB28
1029	563776.4779	1196240.619	820.99		820.99								CB29

	Missing/Incomplete Information				COUNT CB =	306								
*	GPS related - not part of drainage system													
	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIAMETER (IN)	MAT'L	MH DIAM. (IN)	CB LEN (IN)	CB WID (IN)	CB DEP (IN)	NOTES	
1030	563831.3443	1196231.436	824.82	21	823.07	W	8	CI		24	20	28	CB30	
1031	563844.8476	1196197.469	824.95	43	821.37	N	12	PVC CORR		24	20	58	CB31	
			824.95	37	821.87	E	8	CI						
1033	564296.3899	1196376.391	827.49	40	824.16	E	12	PVC		TYPE 1	TYPE 1	57	CB33	
1034	564282.1819	1196410.21	827.26	35	824.34	N	12	PVC CORR		24	20	53	CB34	
			827.26	37	824.18	W	12	PVC CORR						
1035	564397.2065	1196457.347	821.75	59	816.83	N	12	PVC CORR		24	20	74	CB35	
			821.75	59	816.83	S	12	PVC CORR						
1038	564602.5059	1196521.66	814.43	30	811.93	E	8	CI		24	20	30	CB38	
1039	564685.6547	1196564.675	816.78	62	811.61	E	12	PVC CORR		24	20	80	CB39	
1040	564668.0492	1196596.871	816.67	130	805.84	N	12	PVC CORR	MH			112	CB40	
			816.67	126	806.17	S	12	PVC						
			816.67	62	811.50	W	12	PVC						
			816.67	55	812.09	E	12	PVC CORR						
1041	564723.9893	1196604.655	818.38		818.38								STMH41	
1042	564733.6028	1196609.321	818.03		818.03								CB42	
1043	564745.0008	1196565.313	818.44		818.44								CB43	
1044	565042.0946	1196624.699	814.97		814.97								CB44	
1045	565069.0658	1196625.243	815.04		815.04								CB45	
1046	565105.1251	1196604.788	816.13		816.13								CB46	
1047	565063.6378	1196574.764	815.08		815.08								CB47	
1056	562705.1196	1198550.102	782.58	65.52	777.12	N	12	PVC CORR	48	NA	NA	103.2	STMHV56	
			782.58	60.48	777.54	S	12	PVC CORR						
1057	562760.4551	1198570.121	784.25	42.48	780.71	E	12	PVC		48	48	64.32	CB57	
			784.25	47.52	780.29	W	12	PVC						
1058	562760.3571	1198546.863	784.55	51.6	780.25	W	12	PVC CORR	?			105.6	STMHV58	
			784.55	52.32	780.19	E	12	PVC CORR						
			784.55	78.96	777.97	S	14	PVC CORR						
1059	562774.6237	1198514.108	784.94	32.4	782.24	E	14	PVC CORR		TYPE 1	TYPE 1	39.6	CB59	
			784.94	29.52	782.48	W	14	PVC CORR						
1060	563034.3818	1198546.759	794.78	58	789.95	N	12	PVC CORR	48	NA	NA		STMHV60	
			794.78	56.5	790.07	S	12	PVC CORR						
			794.78	44.75	791.05	NE	8	DI						
1061	563040.2641	1198552.654	794.83	19.2	793.23	W	8	PVC CORR		24	20	25.68	CB61	
1062	563033.824	1198513.431	794.5	28.5	792.13	E	8	DI		24	20	29.04	CB62	
1063	563292.9826	1198512.672	796.81	27.6	794.51	E	8	DI		24	20	27.6	CB63	
			796.81	27.6	794.51	S	8	PVC						
1064	563298.1562	1198552.052	796.78	22	794.95	SW	8	DI	48	NA	NA		CBV64	NO ACCESS
1065	563292.1075	1198546.888	796.94	21.6	795.14	W	8	PVC CORR		24	20	24.24	STMH65	

Missing/Incomplete Information (shaded)

* GPS related - not part of drainage system

COUNT CB = 306

	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIAMETER (IN)	MAT'L	MH DIAM. (IN)	CB LEN (IN)	CB WID (IN)	CB DEP (IN)	NOTES
1066	563559.3143	1198551.484	795.55	20.4	793.85	W	8	CI		24	20	22.56	CB66
1067	563554.3978	1198545.833	795.87	39.6	792.57	NE	8	DI	48	NA	NA	62.88	STMHV67
			795.87	40.8	792.47	S	12	PVC CORR					
			795.87	39.6	792.57	W	8	DI					
1070	563686.0222	1198511.932	795.15	35.04	792.23	W	12	PVC CORR		24	20	38.64	CB70
			795.15	35.52	792.19	N	12	PVC CORR					
			795.15	36.96	792.07	E	8	CI					
1071	563772.2315	1198518.609	795.13	24.72	793.07	S	8	CI		24	20	35.04	CB71
1073	563773.4983	1198555.456	794.1	37.2	791.00	E	12	PVC		24	20	42	CB73
			794.1	37.68	790.96	S	12	PVC					
1079	563936.1626	1198830.713	793.39		793.39								CB79
1080	563936.0961	1198870.671	793.44		793.44								CB80
1082	564106.0726	1198881.199	792.68	22	790.85	N	8	PVC		TYPE 1	TYPE 1	29	CB82
1083	564122.9564	1198828.708	792.46	22	790.63	E	8	PVC		30	22	23	CB83
			792.46	19	790.88	S	4	PVC					
1084	564127.4885	1198870.067	792.65		792.65								CB84
1085	564200.638	1198824.881	793.1		793.10								CB85
1086	563700.1733	1199876.922	801.29		801.29								CB86
1087	563685.6357	1198552.023	795.15	30.72	792.59	E	8	CI		24	20	30.7	CB87
1088	563554.2349	1198512.206	795.63	32	792.96	N	12	PVC CORR		22	20	49	CB88
1089	563782.7812	1199803.82	799.21	62	794.04	E	12	PVC		TYPE1	TYPE 1	73	CB89
			799.21	62	794.04	S	12	PVC					
			799.21	62	794.04	W	12	PVC					
1090	563586.0424	1200198.734	826.41	42	822.91	E	12	PVC CORR		22	20	59	CB90
			826.41	40.5	823.04	W	12	PVC CORR					
1091	563516.8084	1200398.887	840.15		840.15								CB91
1092	563476.8732	1200568.213	850.25	43	846.67	E	12	PVC CORR		22	20	53	CB92
			850.25	43	846.67	W	12	PVC CORR					
1093	563450.8844	1200743.45	859.11	66	853.61	E	12	PVC CORR		TYPE 1	TYPE 1	77	CB93
			859.11	64	853.78	S	12	PVC					
			859.11	66	853.61	W	12	PVC					
1094	563410.8453	1200737.927	859.29	62	854.12	N	12	PVC CORR		22	20	75	CB94
1095	563439.3903	1200937.521	862.24	39	858.99	N	4	PVC		TYPE 1	TYPE 1	57	CB95
			862.24	47	858.32	S	12	PVC					
1096	563358.3957	1200905.095	862.1	80	855.43	N (NW)	12	PVC		48	48	127	CB96
			862.1	78	855.60	E (NE)	?	PVC					
			862.1	95	854.18	E	?	PVC					
			862.1	81	855.35	W	12	PVC					

Missing/Incomplete Information

* GPS related - not part of drainage system

COUNT CB = 306

ID	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIAMETER (IN)	MAT'L	MH DIAM. (IN)	CB LEN (IN)	CB WID (IN)	CB DEP (IN)	NOTES	
1097	563430.0766	1200999.689	862.2	66	856.70	SW	12	PVC		22	20	76	CB97	
1098	563422.0242	1200960.204	862.98	73	856.90	N	12	PVC CORR		TYPE 1	TYPE 1	83	STMH98	
1099	563417.6524	1201267.893	860.12	21	858.37	W	12	PVC		22	20	42	CB99	
1100	563372.0122	1201327.487	858.14	29	855.72	S	12	PVC CORR		TYPE 1	TYPE 1	38	CB100	
			858.14	30	855.64	W	12	PVC						
1101	563332.3982	1201320.712	860.03	31	857.45	N	12	PVC		24	20	45	CB101	
1102	564425.2156	1198235.658	804.87	18	803.37	N	6	PVC		20	24	33	CB102	
			804.87	18	803.37	S	10	CONC						
1103	564386.1169	1198234.381	805.21		805.21								CB103	
1104	564253.8754	1198266.074	803.72	26	801.55	W	8	PVC		24	18	44	CBC04	
			803.72	26	801.55	E	8	PVC						
1105	564256.0654	1198237.613	804.75	12	803.75	N	8	PVC		24	20	41	CB105	
1106	564259.7614	1198230.813	804.29	19	802.71	E	8	PVC		24	20	47	CB106	
			804.29	15	803.04	S	8	PVC						
1107	564256.5057	1198190.587	803.85	24	801.85	W	6	PVC		28	24	43	CB107	
1108	564200.512	1198230.232	803.81		803.81								CB108	
1109	564183.4903	1198285.148	804.2		804.20								CBC09	
1110	565544.5601	1198330.549	809.68		809.68								CB104A	
1111	563990.6342	1198194.405	813.01		813.01								CB111	
1112	563887.459	1198191.832	816.29		816.29								CB112	
1113	565505.3613	1198171.876	818.11		818.11								CB105A	
1114	565544.8857	1198172.352	818.28		818.28								CB106A	
1118	563788.1449	1198511.869	794.54	46.32	790.68	S	12	PVC CORR		24	20	51.6	CB118 OR CBV72	
			794.54	45.36	790.76	W	12	PVC						
			794.54	40.32	791.18	N	8	CI						
			794.54	46.56	790.66	E	12	PVC						
1120	563689.3881	1196125.877	820.6		820.60								CB120	
1122	564471.6533	1201873.002	877.99	56	873.32	N	12	PVC		24	20	72	CB122	
			877.99	54	873.49	E	12	PVC						
			877.99	55	873.41	S	12	PVC						
1123	564461.206	1201905.854	878.17	52	873.84	W	12	PVC		24	20	69	CB123	
1124	564514.5446	1202056.778	878.68	50	874.51	S	12	PVC		24	20	57	CB124	CONNECTED TO DRY WELL
1125	564333.3745	1202472.368	877.54	72	871.54	E	12	PVC		24	20	80	CB125	
1126	566078.652	1198749.428	786.92	22	785.09	E	12	CONC		24	20	22	CB126	

	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIAMETER (IN)	MAT'L	MH DIAM. (IN)	CB LEN (IN)	CB WID (IN)	CB DEP (IN)	NOTES
	Missing/Incomplete Information				COUNT CB =	306							
*	GPS related - not part of drainage system												
1129	565712.2926	1198506.825	806.81	34	803.98	N	8	CONC		30	22	42	CB129
			806.81	32	804.14	S	8	CONC					
1130	565549.6159	1198507.279	805.98	19	804.40	N	8	CONC		30	22	19	CB130
			805.98	20	804.31	S	8	CONC					
1132	565777.0139	1198805.444	796.51	32	793.84	N	8	PVC		24	20	38	CB132
			796.51	31	793.93	E	8	PVC					
			796.51	29	794.09	W	8	PVC					
1133	565734.8822	1198804.554	796.34	24	794.34	S	8	PVC		24	20	24	CB133
1134	565731.5317	1198883.325	795.03		795.03								CB134
1136	565535.3877	1198867.191	795.14	33	792.39	S	8	PVC		24	20	33	CB136
			795.14	32	792.47	W	8	PVC					
1137	565538.1873	1198825.225	795.19	29	792.77	E	8	PVC		24	20	30	CB137
1138	565388.7772	1198867.745	794.55	33	791.80	N	8	PVC		24	20	35	CB138
			794.55	33	791.80	W	8	PVC					
1139	565388.8247	1198825.686	794.74	33	791.99	E	8	PVC		24	20	35	CB139
1140	565231.5988	1198868.055	794.08	35	791.16	N	10	PVC		24	20	35	CB140
			794.08	35	791.16	S	10	PVC					
			794.08	35	791.16	W	8	PVC					
1141	565232.0073	1198826.132	793.98	26.5	791.77	E	8	PVC		24	20	28	CB141
1142	565109.8736	1198868.422	793.56	37	790.48	N	10	PVC		24	20	42	CB142
			793.56	38	790.39	S	10	PVC					
			793.56	33	790.81	W	8	PVC					
1143	565110.3104	1198826.422	793.57	29	791.15	E	8	PVC		24	20	29	CB143
1144	564889.6524	1198869.078	792.8	28.5	790.43	S	8	PVC		24	20	28	CB144
			792.8	28	790.47	W	8	PVC					
1145	564899.4054	1198827.008	792.8	28	790.47	E	8	PVC		24	20	30	CB145
1146	564758.114	1198869.26	792.12	27	789.87	N	8	PVC		24	20	27	CB146
			792.12	27	789.87	S	8	PVC					
1147	564750.8503	1198827.427	792.1	24	790.10	E	8	PVC		TYPE 1	TYPE 1	24	CB147
1148	564649.7152	1198869.688	791.91	36	788.91	N	10	PVC		24	20	37	CB148
			791.91	37	788.83	S	10	PVC					
			791.91	36	788.91	W	8	PVC					
1149	564651.3763	1198827.748	791.88	29	789.46	E	8	PVC		TYPE 1	TYPE 1	30	CB149
1150	564550.7986	1198869.863	792.05	36	789.05	N	8	PVC		TYPE 1	TYPE 1	39	CB150
1151	564554.8763	1198827.914	792.05	32	789.38	N	8	PVC		24	20	34	CB151

	Missing/Incomplete Information				COUNT CB =	306							
*	GPS related - not part of drainage system												
	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIAMETER (IN)	MAT'L	MH DIAM. (IN)	CB LEN (IN)	CB WID (IN)	CB DEP (IN)	NOTES
1152	564400.9174	1198870.255	792.44	29	790.02	N	8	PVC		24	20	29	CB152
			792.44	29	790.02	W	8	PVC					
1153	564376.416	1198828.625	792.39	28	790.06	E	8	PVC		TYPE 1	TYPE 1	28	CB153
1154	564246.0465	1198820.775	792.69	14	791.52	E	8	PVC		24	20	16	CB154
1155	564254.5297	1198800.915	791.95	33	789.20	N	4	CONC		TYPE 2	TYPE 2	33	CB155
			791.95	30	789.45	S	12	CONC					
			791.95	25	789.87	W	8	PVC					
1156	564218.1219	1198782.127	792.15		792.15								CB156
1159	564072.7509	1199113.315	791.42	35	788.50	N	12	PVC		24	22	44	CB159
1161	563958.5719	1199370.255	793.97	30	791.47	N	12	PVC		22	20	40	CB161
1163	564130.7089	1199135.178	793.72	52	789.39	S	12	PVC		22	20	52	CB163
1164	564107.4289	1199128.909	791.49	52	787.16	N	12	PVC		TYPE 1	TYPE 1	52	CB164
			791.49	52	787.16	E	12	PVC					
			791.49	52	787.16	S	12	PVC					
			791.49	52	787.16	W	12	PVC					
1165	563997.0132	1199415.874	794.86		794.86								CB165
1166	563993.1737	1199385.906	793.98	72	787.98	N	12	PVC		?	?	78	CB166
			793.98	72	787.98	E	12	PVC					
			793.98	72	787.98	S	12	PVC					
			793.98	72	787.98	W	12	PVC					
1170	563868.8811	1199640.191	796.73	32	794.06	NE	6	PVC		TYPE 1	TYPE 1	63	CB170
			796.73	44	793.06	E	12	PVC					
			796.73	44	793.06	S	12	PVC					
			796.73	44	793.06	W	12	PVC					
1171	563835.275	1199622.513	796.76	37	793.68	N	12	PVC		22	20	47	CB171
			796.76	37	793.68	W	12	PVC					
1172	566742.2122	1196605.448	821.54		821.54								CB172
1173	563748.2479	1199787.28	799.25	38	796.08	N	12	PVC		22	20	49	CB173
			799.25	38	796.08	E	12	PVC					
1178	563022.6973	1198816.294	787.69		787.69								CB178
1179	562995.0205	1198816.139	787.62	27	785.37	E	8	ST		24	20	27	CB179
1180	562995.2052	1198872.924	787.83	46	784.00	N	12	PVC		24	20	50	CB180
			787.83	43	784.25	E	8	ST					
			787.83	40	784.50	W	8	ST					
1181	562997.1147	1198988.476	789.4		789.40								CB181
1182	563032.4757	1198988.164	789.69		789.69								CB182
1183	563000.0086	1199244.848	794.62		794.62								CB183
1184	563028.857	1199245.175	794.57		794.57								CB184

Missing/Incomplete Information
* GPS related - not part of drainage system

COUNT CB = 306

	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIAMETER (IN)	MAT'L	MH DIAM. (IN)	CB LEN (IN)	CB WID (IN)	CB DEP (IN)	NOTES	
1185	563588.8268	1201364.083	863.14	38	859.97	N	12	PVC		TYPE 1	TYPE 1	53	CB185	RETENTION POND TO WEST
			863.14	35	860.22	E	12	PVC						
			863.14	38	859.97	W	12	PVC						
1186	563735.3897	1201458.529	865.91	42	862.41	N	12	PVC		22	20	60	CB186	
			865.91	42	862.41	E	?	?						
			865.91	44	862.24	S	12	PVC CORR						
1187	563840.6297	1201525.809	867.97	56	863.30	W	12	PVC		24	20	70	CBV187	
			867.97	56	863.30	N	12	PVC						
			867.97	56	863.30	E	12	PVC						
			867.97	58	863.14	S	12	PVC						
1188	563946.6073	1201466.015	867.25	43	863.67	N	12	PVC		24	20	60	CB188	
			867.25	43	863.67	E	12	PVC						
			867.25	42	863.75	S	12	PVC						
1189	563955.7532	1201497.783	867.24	37	864.16	W	12	PVC		24	20	53	CB189	
1190	564259.2886	1201467.679	868.99	44	865.32	N	12	PVC		24	20	62	CB190	
			868.99	46	865.16	E	12	PVC						
			868.99	46	865.16	S	12	PVC						
1191	564259.5023	1201500.79	868.93	42	865.43	W	12	PVC		24	20	57	CB191	
1192	564549.7149	1201515.9	870.55	45	866.80	N	12	PVC		TYPE 1	TYPE 1	58	CB192	
			870.55	43	866.97	E	12	PVC						
			870.55	44	866.88	S	12	PVC						
1193	564539.7926	1201547.645	870.59	42	867.09	W	12	PVC		24	20	56	CB193	
1194	563904.3501	1201566.675	869.06	54	864.56	N	12	PVC		24	20	73	CB194	
			869.06	54	864.56	E	12	PVC						
			869.06	56	864.39	S	12	PVC						
1195	563913.4942	1201573.078	869.12	55	864.54	N	12	PVC		24	20	72	CB195	
			869.12	55	864.54	W	12	PVC						
1196	564030.3034	1201647.837	871.19	55	866.61	N	12	PVC		24	20	73	CB196	
			871.19	56	866.52	E	12	PVC						
			871.19	57	866.44	S	12	PVC						
1197	564157.8911	1201724.14	872.14	55	867.56	N	12	PVC		24	20	72	CB197	
			872.14	53	867.72	E	12	PVC						
			872.14	56	867.47	S	12	PVC						
1198	564701.193	1201611.72	871.28	32	868.61	N	12	PVC		24	20	45	CB198	
1199	564745.0439	1201625.063	871.53	38	868.36	N	12	PVC		24	20	56	CB199	
			871.53	39	868.28	S	12	PVC						
1200	564837.9	1201600.276	872.29	54	867.79	N	12	PVC		24	20	71	CB200	
			872.29	55	867.71	E	12	PVC						
			872.29	55	867.71	S	12	PVC						
1201	564828.3452	1201631.943	872.28	53	867.86	W	12	PVC		24	20	60	CB201	
			872.28	52	867.95	S	12	PVC						

	Missing/Incomplete Information				COUNT CB =	306							
•	GPS related - not part of drainage system												
	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIAMETER (IN)	MAT'L	MH DIAM. (IN)	CB LEN (IN)	CB WID (IN)	CB DEP (IN)	NOTES
1202	565141.3168	1201700.482	873.38	52	869.05	SE	12	PVC		22	20	56	CB202
1203	564706.2687	1201883.711	882.64	37	879.56	S	12	PVC		24	20	55	CB203
1300	564331.4915	1197229.834	811.54	67	805.96	N	12	CONC	?	24	18	77	CB300
			811.54	67	805.96	S	12	CONC	?				
			811.54	35	808.62	W	10	PVC					
1301	564327.8006	1197195.466	812.13	45	808.38	E	10	PVC		24	20	54	CB301
1302	564277.4161	1197231.349	810.11	?		N	15	CONC	MH			64	CB302 (vault)
			810.11	?		E	36	CONC					
			810.11	?		S	8	PVC					
			810.11	?		W	36	CONC					
1303	564254.2398	1197235.305	810.35	9	809.60	N	6	PVC		16	16	15	CB303
1304	564245.6887	1197404.31	809.66	24	807.66	N	12	PVC		18	24	42	CB304
			809.66	15	808.41	E(SE)	12	PVC					
			809.66	16	808.33	S	8	PVC					
1305	564235.2584	1197418.164	810.73	24	808.73	N	12	PVC		?	?	38	CB305
			810.73	20	809.06	W	12	PVC					
1306	564251.8014	1196789.902	815.21	10	814.38	S	8	CONC		24	18	10	CB306
1307	564256.4873	1196791.735	814.57	18	813.07	N	6	CONC		Type 1	Type 1	32	CB307
			814.57	19	812.99	E	12	CONC					
			814.57	21	812.82	S	10	CONC					
1308	564458.4753	1197225.368	812.1	73	806.02	N	8	PVC		Type 1	Type 1	77	CB308
			812.1	77	805.68	S	15	CONC					
			812.1	75	805.85	W	12	CONC					
1309	564468.6336	1197191.147	811.97	69	806.22	E	12	CONC		18	24	69	CB309
			811.97	69	806.22	W	12	CONC					
1310	565026.6513	1197226.121	820.62	34	817.79	N	6	PVC		18	24	49	CB310
			820.62	35	817.70	S	6	PVC					
			820.62	34	817.79	W	6	PVC					
1311	565075.3065	1197228.935	821.09	18	819.59	S	16	PVC		24	18	33	CB311
1312	565075.188	1197147.86	818.99	14	817.82	S	16	PVC		20	14	26	CB312
1313	565043.199	1197175.002	819.44	16	818.11	E	6	PVC		Type I	Type I	27	CB313
			819.44	15	818.19	W	6	PVC					
1314	564882.4921	1196295.886	815.22	84	808.22	N	12	PVC		24	20	109	CB314
			815.22	88	807.89	E	12	PVC					
			815.22	90	807.72	W	12	CONC					
1315	564875.2305	1196227.105	812.86	49	808.78	N	12	CONC		Type II	Type II	58	CB315

	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIAMETER (IN)	MAT'L	MH DIAM. (IN)	CB LEN (IN)	CB WID (IN)	CB DEP (IN)	NOTES
	Missing/Incomplete Information				COUNT CB =	306							
*	GPS related - not part of drainage system												
1316	564908.7079	1196244.446	814.12	35	811.20	N	12	PVC		18	24	52	CB316
			814.12	36	811.12	E	12	CONC					
			814.12	37	811.04	W	12	CONC					
1317	565043.4647	1195680.597	852.93	28	850.60	N	12	PVC		Type I	Type I	34	CB317
1318	564841.0839	1195511.342	869.46	72	863.46	E (SE)	12	PVC		24	20	?	CB318
			869.46	72	863.46	S	12	PVC					
1319	564734.2477	1195401.501	870.04	44	866.37	N	12	PVC		20	24	61	CB319
1320	564947.7918	1194991.912	934.34	22	932.51	E	12	PVC		Type I	Type I	31	CB320
1321	564841.4162	1194792.098	947.06	14	945.89	ES	4	PVC		18	24	39	CB321
			947.06	17	945.64	S	12	PVC					
1322	564818.438	1194645.992	950.42	20	948.75	N	12	PVC		24	18	20	CB322
			950.42	20	948.75	S	12	PVC					
1323	564250.1513	1197551.977	808.69	54	804.19	N	12	CONC		20	24	71	CB323
1324	564210.0523	1197716.016	809.87	76	803.54	N	10	CONC		24	20	76	CB324
			809.87	66	804.37	W	4	CONC					
1325	564255.2942	1197691.532	807.9	61	802.82	W	24	CONC	MH				CB325 (vault)
			807.9	60	802.90	E	10	PVC					
1326	563329.1465	1197894.835	935.56	30	933.06	N	12	CONC		Type I	Type I	43	CB326
			935.56	31	932.98	S	12	CONC					
			935.56	31	932.98	W	6	PVC					
1327	563187.6771	1197888.783	939.3	30	936.80	N	12	CONC		24	18	44	CB327
			939.3	30	936.80	S	12	CONC					
			939.3	30	936.80	W	6	PVC					
1328	564379.2682	1197914.909	807.26	76	800.93	E	24	CONC	MH			93	STMH328 (vault)
			807.26	79	800.68	S	24	CONC					
1329	564333.5156	1197907.015	805.1	30	802.60	SE	8	PVC		24	18	43	CB329
1330	564385.9358	1197984.171	806.52	20	804.85	S	8	PVC		24	18	32	CB330
1331	564421.6085	1198070.946	806.63	15	805.38	N	8	PVC		TYPE 1	TYPE 1	25	CB331
1332	565082.0282	1198350.716	805.96	26	803.79	E	12	CONC	MH			46	CB332 (vault)
			805.96	24	803.96	S	8	CONC					
			805.96	26	803.79	W	12	CONC					
1333	565045.2417	1198351.109	805.68	21	803.93	N	8	CONC	MH			47	CB333
			805.68	19	804.10	E	4	AC					
1334	565043.123	1198381.774	805.88	12	804.88	W	4	STEEL		TYPE 1	TYPE 1	27	CB334
1335	565082.021	1198224.161	812.98	24	810.98	E	12	CONC	MH			38	CB335
			812.98	24	810.98	W	12	CONC					

		Missing/Incomplete Information				COUNT CB =	306								
*		GPS related - not part of drainage system													
		NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIAMETER (IN)	MAT'L	MH DIAM. (IN)	CB LEN (IN)	CB WID (IN)	CB DEP (IN)	NOTES	
	1336	565081.4254	1198190.972	813.71	25	811.63	E	12	CONC	MH			45	CB336 (vault)	
				813.71	25	811.63	S	8	CONC						
				813.71	25	811.63	W	12	CONC						
	1337	565045.9003	1198189.769	814.35	25	812.27	N	8	CONC	MH			46	CB337 (vault)	
	1338	565081.5401	1197908.27	822.15	28	819.82	W	12	CONC	MH			46	CB338 (vault)	
				822.15	23	820.23	E	12	CONC						
	1339	565080.3279	1197865.369	822.24	26	820.07	E	12	CONC	MH			46	CB339 (vault)	
				822.24	28	819.91	S	8	CONC						
	1340	565044.615	1197867.464	822.26	22	820.43	N	8	CONC	?			45	CB340 (vault)	
	1341	565083.0559	1198681.418	798.63	21	796.88	N	6	CONC		TYPE 1	TYPE 1	44	CB341	
				798.63	37	795.55	E	12	CONC						
				798.63	35	795.71	W	12	CONC						
	1342	565073.2806	1199000.255	790.32	24	788.32	E	8	PVC		TYPE 1	TYPE 1	39	CB342	
	1343	565046.3801	1198998.593	790.37		790.37								CB343	
	1344	564785.4175	1199014.521	792.13		792.13								STMH344	
	1345	564476.8446	1198948.975	791.97	33	789.22	E	6	PVC		24	20	50	CB345	
				791.97	34	789.14	S	6	PVC						
	1346	564520.6748	1199007.406	792.04	96	784.04	N	36	CONC	?			96	STMVAULT	
				792.04	76	785.71	E	32	STEEL						
				792.04	96	784.04	S	36	CONC						
	2087	563833.5657	1199599.494	796.97		796.97								CB087	
	2088	563806.9908	1199596.46	796.65		796.65								DRAIN	
	2089	563836.4446	1199581.622	796.12		796.12								CBPL	
*	2620	563137.176	1196019.228	822.98		822.98			NO INFORMATION REQUIRED					GPS	4"X4" CONC MON W\BRASS CA
*	4214	562118.256	1198594.54	784.04		784.04			NO INFORMATION REQUIRED					GPS	SURFACE BRASSIE
		306	Total Number of Catch Basins (Not Including School Drainage System Elements)												
		AC	Asbestos Cement												
		CI	Cast Iron												
		CONC	Concrete												
		DI	Ductile Iron												
		PVC	Polyvinyl Chloride												
		PVC CORR	Polyvinyl Chloride Corrugated												
		ST	Steel												

Appendix A2

ABRIDGED STORMWATER INVENTORY WORKSHEETS

	ID	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIA. (IN)	MAT'L	CONNECTING PIPE LENGTH (FT)	NOTES
SYSTEM 1											
TRUNK 1											
	DITCH	-- NEED CHARACTERISTICS: AVG DEPTH, TOP WIDTH, BOTTOM WIDTH, SLOPE OF CHANNEL									
OK	1315	564875.2305	1196227.105	812.86	49	808.78	N(NE)	12	CONC		TO 931
										37.70	
	931	564949.5564	1196194.619	814.27	72.24	808.25	N	6	PVC		TO 930
				814.27	75.72	807.96	E	12	CONC		TO 1043
				814.27	73.68	808.13	S	12	CONC		TO 1315
				814.27	72.72	808.21	W	12	PVC		TO 1316
										360.22	
	1043	564745.0008	1196565.313	818.44	127.56	807.81	E(SE)	16	PVC		TO 1041
				818.44	128.16	807.76	W(NW)	12	CONC		TO 931
										44.60	
OK	1041	564723.9893	1196604.655	818.38	93.96	810.55	N	8	IP		TO 1044
				818.38	86.4	811.18	SW	12	ABS		TO 1040
				818.38	56.4	813.68	NE	12	ABS		TO 1042
				818.38	126.0	807.88	E	12	CONC		TO 1309
				818.38	132.24	807.36	W	12	ABS		TO 1043
										639.67	
OK	1309	564468.6336	1197191.147	811.97	69	806.22	E(SE)	12	CONC		TO 1308
				811.97	69	806.22	W(NW)	12	CONC		TO 1041
										35.70	
OK	1308	564458.4753	1197225.368	812.1	73	806.02	N	8	PVC		TO 1310
				812.1	77	805.68	S	15	CONC		TO 1300
				812.1	75	805.85	W(NW)	12	CONC		TO 1309
										127.06	
OK	1300	564331.4915	1197229.834	811.54	67	805.96	N	12	CONC		TO 1308
				811.54	67	805.96	S	12	CONC		TO 1302
				811.54	35	808.62	W	10	PVC		TO 1301
										54.10	
OK	1302	564277.4161	1197231.349	810.11	55.5	805.49	N	16	PVC		TO 1300
				810.11	62	804.94	E(SE)	24	CONC		TO 1325
				810.11	26.5	807.90	S	6	PVC		TO 1303
				810.11	62	804.94	W(SW)	24	CONC		TO 945
				810.11	29.5	807.65	E	3	PVC		? TO SURFACE ?
										460.71	
	1325	564255.2942	1197691.532	807.9	61	802.82	W	24	ST		TO 1302
				807.9	58.5	803.03	E(NE)	8	PVC		TO 1328
										255.47	

	ID	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIA. (IN)	MAT'L	CONNECTING PIPE LENGTH (FT)	NOTES
	1328	564379.2682	1197914.909	807.26	76	800.93	E	24	CONC		TO 1330
				807.26	79	800.68	S(SW)	24	CONC		TO 1325
										69.58	
	1330	564385.9358	1197984.171	806.52	20	804.85	S	8	PVC		TO ?
				806.52	36	803.52	NE	24	CONC		CONFIRM MD; TO 1331
				806.52	36	803.52	W	24	CONC		CONFIRM MD; TO 1328
										93.82	
	1331	564421.6085	1198070.946	806.63	15	805.38	N	8	CORR		TO ?
				806.63	36	803.63	NE	36	CONC		TO 1331B
				806.63	36	803.63	SW	36	CONC		TO 1330
										142.80	
OK	1331B	564493.44	1198194.36	804.85	67.08	799.26	NE	24	CONC		TO 1331X?
				804.85	67.08	799.26	SW	24	CONC		TO 1331
										42.11	
	1331X?				52.5		W(SW)	24	CONC		TO 1331B
					56.5		E(NE)	24	CONC		TO 1331C
					55		S	10	CONC		TO 1102
										155.93	
OK	1331C	564555.90	1198382.29	801.84	45.12	798.08	E	24	CONC		TO 986
				801.84	35	798.92	W	24	CONC		TO TO 1331X?
										128.53	
OK	986	564588.7001	1198506.562	799.39	32	796.72	NE	18	CONC		TO 987
				799.39	31.5	796.77	W(SW)	24	CONC		TO 1331C
				799.39	30.5	796.85	E	16	CONC		NOT SHOWN ON MAP: E & NE ???
											CLARIFY
										45.85	
OK	987	564598.5912	1198551.337	798.63	29	796.21	E(SE)	18	CONC		TO 1001
				798.63	31	796.05	W(SW)	18	CONC		TO 986
										129.78	
OK	1001	564582.1317	1198680.066	794.71	32	792.04	W(NW)	24	CONC		TO 987
				794.71	32	792.04	E	24	CONC		TO 1001B, 970
										187.65	
OK	970	564563.7469	1198866.811	792.17	47.5	788.21	N	10	PVC		TO 1148
				792.17	43	788.59	S	8	PVC		TO 1150
				792.17	48	788.17	W	24	CONC		TO 1001B, 1001
				792.17	48	788.17	E(NE)	24	CONC		TO TRUNK 4
										144.11	
	CONNECTION TO TRUNK 4										

	ID	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIA. (IN)	MAT'L	CONNECTING PIPE LENGTH (FT)	NOTES
TRUNK 2											
OK	1340	565044.615	1197867.464	822.26	22	820.43	N	8	CONC		TO 1339
										35.77	
OK	1339	565080.3279	1197865.369	822.24	26	820.07	E	12	CONC		TO 1338
				822.24	28	819.91	S	8	CONC		TO 1340
										42.92	
OK	1338	565081.5401	1197908.27	822.15	28	819.82	W	12	CONC		TO 1339
				822.15	23	820.23	E	12	CONC		TO 1336
										282.70	
OK	1336	565081.4254	1198190.972	813.71	25	811.63	E	12	CONC		TO 1335
				813.71	25	811.63	S	8	CONC		TO 1337
				813.71	25	811.63	W	12	CONC		TO 1336
										33.19	
OK	1335	565082.021	1198224.161	812.98	24	810.98	E	12	CONC		TO 1332
				812.98	24	810.98	W	12	CONC		TO 1336
										126.56	
OK	1332	565082.0282	1198350.716	805.96	26	803.79	E	12	CONC		TO 984
				805.96	24	803.96	S	8	CONC		TO 1333
				805.96	26	803.79	W	12	CONC		TO 1335
										158.09	
OK	984	565089.6374	1198508.626	804.37	28	802.04	E	15	CONC		TO 985
				804.37	25	802.29	W	14	CONC		TO 1332
										37.74	
OK	985	565088.2607	1198546.336	804.41	32	801.74	E	14	CONC		TO 1341
				804.41	32	801.74	W	14	CONC		TO 984
										135.18	
OK	1341	565083.0559	1198681.418	798.63	20	796.96	N	6	CONC		TO ?
				798.63	36	795.63	E	12	CONC		TO 972
				798.63	34	795.80	W	12	CONC		TO 985
										185.48	
OK	972	565085.2544	1198866.883	793.55	39	790.30	N	10	PVC		TO 1142
				793.55	39	790.30	W	12	CONC		TO 1341
				793.55	39	790.30	E	8	CONC		TO 1342
										133.91	
	1342	565073.2806	1199000.255	790.32	22.5	788.45	E	8	PVC		DOES PIPE FROM 972 CONNECT TO
											TRUNK 4 ? OR DOES IT CONNECT TO
											TO 1342 THEN TRUNK 4 ?
											CLARIFY
										13.08	
	CONNECTION TO TRUNK 4										

	ID	NORTHING	EASTING	ELEV	MD	INVERT	DIRECTION	DIA.	MAT'L	CONNECTING PIPE LENGTH	NOTES
				(FT)	(IN)	(FT)	(N,S,E,W)	(IN)		(FT)	
TRUNK 3											
OK	1113	565505.3613	1198171.876	818.11	13	817.03	NE	8	PVC		TO 1114
										39.53	
	1114	565544.8857	1198172.352	818.28	18	816.78	E	8	DI		TO 1110
				818.28	15	817.03	SW	8	PVC		TO 1113
										158.20	
OK	1110	565544.5601	1198330.549	809.68	25.5	807.56	E	8	PVC		TO 1130
				809.68	27	807.43	W	8	PVC		TO 1114
										176.80	
OK	1130	565549.6159	1198507.279	805.98	18.5	804.44	N	8	CONC		TO 1129
				805.98	19.5	804.36	W	8	CONC		TO 1110
										162.68	
OK	1129	565712.2926	1198506.825	806.81	34.5	803.94	N	10	CONC		TO ?
				806.81	33	804.06	S	10	CONC		TO 1130
				806.81	29	804.39	E	6	CONC		TO 1133
										298.58	
OK	1133	565734.8822	1198804.554	796.34	32	793.67	N	8	PVC		TO 1132
				796.34	31	793.76	E	8	PVC		TO 1134
				796.34	29	793.92	W	8	PVC		TO 1129
										78.84	
OK	1134	565731.5317	1198883.325	795.03	40	791.70	E	8	CONC		TO TRUNK 4
				795.03	38.5	791.82	W	12	CONC		TO 1133
										129.48	
	CONNECTION TO TRUNK 4										

	ID	NORTHING	EASTING	ELEV	MD	INVERT	DIRECTION	DIA.	MAT'L	CONNECTING PIPE LENGTH	NOTES
				(FT)	(IN)	(FT)	(N,S,E,W)	(IN)		(FT)	
TRUNK 4											
OK	993	564118.4692	1199012.232	792.12	50	787.95	N	12	CONC		TO 1346
				792.12	68	786.45	N	24	CONC		TO ? CLARIFY
				792.12	42	788.62	S	12	CONC		TO ? CLARIFY
				792.12	66	786.62	E	12	CONC		TO 1164
										402.23	
OK	1346	564520.6748	1199007.406	792.04	96	784.04	N	36	CONC		TO 1344
				792.04	76	785.71	SW	32	STEEL		TO 1345 ?
				792.04	96	784.04	S	36	CONC		TO 993
										264.09	
OK	1344	564785.4175	1199014.521	792.13	96	784.13	S	36	CONC		TO 1346
				792.13	94.5	784.26	N	36	CONC		TO LYNCH CREEK
				792.13	76	785.80	E	24	STEEL		TO SCHOOL; WHAT AREA DOES THIS DRAIN PIPE COLLECT ? DITCH ONLY ?
										1068.25	
INVERT AT DISCHARGE AT LYNCH CREEK					36		N	36	CONC		NEED INVERT AT PIPE DISCHARGE

	ID	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIA. (IN)	MAT'L	CONNECTING PIPE LENGTH (FT)	NOTES
TRUNK 5											
OK	982	564424.7547	1198509.951	799.1	25.2	797.00	S	15	CONC		TO 981
										37.11	
OK	981	564387.656	1198510.822	798.96	38.5	795.75	N	16	CONC		TO 982
				798.96	40	795.63	SE	16	CONC		TO 980
										101.47	
OK	980	564303.6621	1198567.747	796.1	19	794.52	N(NW)	14	CONC		TO 981
				796.1	18	794.60	E(SE)	4	CONC		TO 1000
										118.79	
OK	1000	564263.5469	1198679.562	792.09	30	789.59	N	8	CONC		TO ? 990 ?
				792.09	28	789.76	W(NW)	12	CONC		TO 980
				792.09	29	789.67	E(SE)	8	PVC		TO 1156
				792.09	31	789.51	S	12	CONC		TO 3004
										112.17	
OK	1156	564218.1219	1198782.127	792.15	28	789.82	SE	8	PVC		TO 1085
				792.15	27.75	789.84	NW	4	PVC		TO 1000
										46.19	
OK	1085	564200.638	1198824.881	793.1	41.5	789.64	N	12	CONC		TO 1154
				793.1	41.25	789.66	E(SE)	12	CONC		TO 992
				793.1	42.25	789.58	NW	12	CONC		TO 1156 ?
										64.23	
	992	564175.1692	1198883.846	793.18	54.36	788.65	E	12	CONC		TO 993
				793.18	51	788.93	S	12	CONC		TO 1084
				793.18	54.36	788.65	W	12	CONC		TO 992
										140.35	
	CONNECTION TO TRUNK 4 AT CB 993										
										117.20	
OK	1164	564107.4289	1199128.909	791.49	49	787.41	N	12	PVC		TO 1163
				791.49	52	787.16	E(SE)	12	PVC		TO 1166
				791.49	52.5	787.12	S	12	PVC		TO 1159
				791.49	51.75	787.18	W	12	PVC		TO 993
										281.25	

	ID	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIA. (IN)	MAT'L	CONNECTING PIPE LENGTH (FT)	NOTES
OK	1166	563993.1737	1199385.906	793.98	71.5	788.02	E(SE)	12	PVC		TO 1170
				793.98	71.5	788.02	S(SW)	12	PVC		TO 1161
				793.98	72	787.98	W(NW)	12	PVC		TO 1164
										283.04	
OK	1170	563868.8811	1199640.191	796.73	36	793.73	N	6	PVC		TO PROPERTY
				796.73	44.25	793.04	E(SE)	12	PVC		TO 1089
				796.73	46	792.90	S	12	PVC		TO 1171
				796.73	44.5	793.02	W(NW)	12	PVC		TO 1166
										184.90	
OK	1089	563782.7812	1199803.82	799.21	61.5	794.09	E(SE)	12	PVC		TO 994
				799.21	61	794.13	S	12	PVC		TO 1173
				799.21	62	794.04	W(NW)	12	PVC		TO 1170
										103.30	
OK	994	563734.7474	1199895.274	801.22	47	797.30	E(SE)	14	STEEL		TO 1090
				801.22	49	797.14	W(NW)	12	PVC		TO 1089
				801.22	44	797.55	S	12	PVC CORR		TO 1086
										337.94	
OK	1090	563586.0424	1200198.734	826.41	42	822.91	E(SE)	12	PVC CORR		TO 1091
				826.41	40.5	823.04	W(NW)	12	PVC CORR		TO 994
										211.79	
OK	1091	563516.8084	1200398.887	840.15	44	836.48	E(SE)	12	PVC CORR		TO 1092
				840.15	46	836.32	W(NW)	12	PVC CORR		TO 1090
										173.97	
OK	1092	563476.8732	1200568.213	850.25	43	846.67	E(SE)	12	PVC CORR		TO 1093
				850.25	43	846.67	W(NW)	12	PVC CORR		TO 1091
										177.15	
OK	1093	563450.8844	1200743.45	859.11	66	853.61	E(SE)	12	PVC CORR		TO 1096
				859.11	64	853.78	S	12	PVC		TO 1094
				859.11	66	853.61	W(NW)	12	PVC		TO 1092
										218.67	
OK	1096	563358.3957	1200905.095	862.1	85	855.02	SW	12	PVC CORR		TO 1097
				862.1	78.5	855.56	E(NE)	12	PVC CORR		TO 1098
				862.1	94.5	854.23	E	12	PVC CORR		TO 935
				862.1	87	854.85	W	12	PVC CORR		TO 1093
										256.35	
OK	935	563387.5647	1201214.232	861.55	67.5	855.93	W	12	PVC CORR		TO 1096
				861.55	60	856.55	N	12	PVC CORR		TO 936
				861.55	65.5	856.09	E	12	PVC CORR		TO 1100
										114.32	
OK	1100	563372.0122	1201327.487	858.14	29	855.72	S	12	PVC CORR		TO 1101

	ID	NORTHING	EASTING	ELEV	MD	INVERT	DIRECTION	DIA.	MAT'L	CONNECTING PIPE LENGTH	NOTES
				(FT)	(IN)	(FT)	(N,S,E,W)	(IN)		(FT)	
				858.14	30	855.64	W	12	PVC		TO 935
										40.19	
OK	1101	563332.3982	1201320.712	860.03	31	857.45	N	12	PVC		TO 1100

ASSUMPTION

1. storm drain system along Bergren Road, Baumgartner Place, and Kelsy Lane are NOT connected to main trunk system which ultimately discharges into Lynch Creek.

	ID	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIA. (IN)	MAT'L	CONNECTING PIPE LENGTH (FT)	NOTES
TRUNK 6											
	DITCH	-- NEED CHARACTERISTICS: AVG DEPTH, TOP WIDTH, BOTTOM WIDTH, SLOPE OF CHANNEL									
OK	944	563891.358	1196591.845	819.54	71.5	813.58	NE	36	ST		TO 945
				819.54	63	814.29	N(NE)	12	CONC		TO 943
				819.54	71.5	813.58	W	36	ST		TO DITCH
										344.87	
OK	945	564093.2389	1196871.445	822.39	41.5	818.93	E(NE)	36	CONC		TO 1302
				822.39	39	819.14	S	12	ST		TO 946
				822.39	21.5	820.60	W(SW)	36	CONC		TO 943
										404.29	
	CONNECTION TO TRUNK 1 AT 1302										

	ID	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIA. (IN)	MAT'L	CONNECTING PIPE LENGTH (FT)	NOTES
TRUNK 7											
OK	1118	563788.1449	1198511.869	794.54	24	792.54	NE	8	DI		TO 1071
										17.28	
OK	1071	563772.2315	1198518.609	795.13	24.72	793.07	S	8	CI		TO 1070
				795.13	24	793.13	NW	12	PVC CORR		TO 1118
										86.47	
OK	1070	563686.0222	1198511.932	795.15	36	792.15	N	12	PVC CORR		TO 1071
				795.15	34	792.32	W	12	PVC CORR		TO SURFACE ?
				795.15	36.5	792.11	E	8	DI		TO 1087
										40.09	
OK	1087	563685.6357	1198552.023	795.15	37	792.07	N	8	DI		TO 1073
				795.15	32.5	792.44	SW	12	PVC CORR		TO SURFACE ?
				795.15	36	792.15	NW	12	PVC CORR		DIRECTION ? W ?; TO 1070 ?
										87.93	
OK	1073	563773.4983	1198555.456	794.10	37.5	790.98	E	12	PVC CORR		TO 3006
				794.10	37.5	790.98	S	12	PVC CORR		TO 1087
										64.75	
	3006	563617.94	1198714.06	790.87	34	788.04	E	12	PVC CORR		TO 3002
				790.87	33	788.12	S	8	DI		TO 3005
				790.87	35	787.95	W	12	PVC CORR		TO 1073
										49.29	
	3002	563699.01	1198696.24	793.52			N				TO 3003
				793.52			E				TO 3007
				793.52			S				TO 3001
				793.52			W				TO 3006
										327.43	
	3003	563704.78	1198672.24	793.22	28.5	790.85	N	8	CONC		TO 3004
				793.22	33.36	790.44	S	8	CONC		TO 3002
				793.22	36	790.22	E	12	ABS		
				793.22	36.6	790.17	W	12	ABS		
										215.50	
	3004	563664.79	1198671.06		31		N	8	DI		TO 1000
					31		S	8	DI		TO 3003
					30.5		W	4	PVC		TO ?
										390.96	
	CONNECTION TO TRUNK 5 AT 1000										

	ID	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIA. (IN)	MAT'L	CONNECTING PIPE LENGTH (FT)	NOTES
SYSTEM 2											
TRUNK A											
	1088	563554.2349	1198512.206	795.63	25	793.55	E	8	PVC CORR		TO 1067
				795.63	28.5	793.26	S	6	PVC		TO ? SURFACE ?
										33.63	
OK	1067	563554.3978	1198545.833	795.87	38.5	792.66	NE	8	DI		TO 1066
				795.87	40	792.54	S	12	PVC CORR		TO 1065
				795.87	36	792.87	W	8	DI		TO 1088
										262.29	
OK	1065	563292.1075	1198546.888	796.94	51.5	792.65	W	8	DI		TO 1063
				796.94	67.5	791.32	N	12	PVC CORR		TO 1067
				796.94	67.5	791.32	S	12	PVC CORR		TO 1060
				796.94	53	792.52	NE	8	DI		TO 1064
										257.73	
OK	1060	563034.3818	1198546.759	794.78	57	790.03	N	12	PVC CORR		TO 1065
				794.78	57.5	789.99	S	12	PVC CORR		TO 1058
				794.78	34.5	791.91	NE	8	DI		TO 1061
				794.78	43	791.20	W	8	DI		TO 1062
										274.02	
OK	1058	562760.3571	1198546.863	784.55	51.5	780.26	W	12	PVC CORR		TO 1059
				784.55	80.5	777.84	S	12	PVC CORR		TO 1056
				784.55	36.5	781.51	N	12	PVC CORR		TO 1060
				784.55	36.5	781.51	E	12	PVC CORR		TO 1057
										55.33	
OK	1056	562705.1196	1198550.102	782.58	66.5	777.04	N	12	PVC CORR		TO 1058
				782.58	60.48	777.54	S(SE)	12	PVC CORR		TO BIOSWALE
	INVERT INTO BIOSWALE							12	PVC CORR		NEED INVERT OF PIPE INTO BIOSWALE

	ID	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIA. (IN)	MAT'L	CONNECTING PIPE LENGTH (FT)	NOTES
TRUNK B											
OK	1184	563028.857	1199245.175	794.57	58	789.74	S	12	PVC		TO 1183
				794.57	66.5	789.03	NW	12	PVC		TO ? SURFACE ?
										28.85	
OK	1183	563000.0086	1199244.848	794.62	63.25	789.35	W	12	PVC		TO 1181
				794.62	63.5	789.33	N	12	PVC		TO 1184
										256.39	
OK	1181	562997.1147	1198988.476	789.4	39	786.15	N	8	DI		TO 1182
				789.4	47	785.48	E	12	PVC		TO 1183
				789.4	47.5	785.44	W	12	PVC		TO 1180
										115.57	
OK	1180	562995.2052	1198872.924	787.83	46	784.00	N	12	PVC		TO ? SURFACE ?
				787.83	43	784.25	E	8	ST		TO 1181
				787.83	40	784.50	W	8	ST		TO 1179
				787.83	59.5	782.87	S	12	PVC		TO 996
										115.33	
OK	996	562881.9739	1198879.046	788.61	58	783.78	N	12	PVC		TO 1180
				788.61	59	783.69	W	12	PVC		TO 997
										159.79	
OK	997	562880.0479	1198719.269	785.53	38	782.36	SW	12	PVC		TO 998 ?
				785.53	38	782.36	E	12	PVC		TO 996
										131.57	
OK	998	562757.7188	1198670.844	788.68	38	785.51	NE	12	PVC		TO 997 ?
				788.68	38	785.51	W	12	PVC		TO 1057 ?
										100.76	
OK	1057	562760.4551	1198570.121	784.25	42.48	780.71	E	12	PVC		TO 998
				784.25	47.52	780.29	W	12	PVC		TO 1058
										23.26	
	CONNECTION TO TRUNK A AT 1058										

Appendix A3

STORMWATER INVENTORY MAP

R·W·BECK

Appendix B

CONVEYANCE ANALYSIS INFORMATION

Appendix B1

MODEL SCHEMATIC

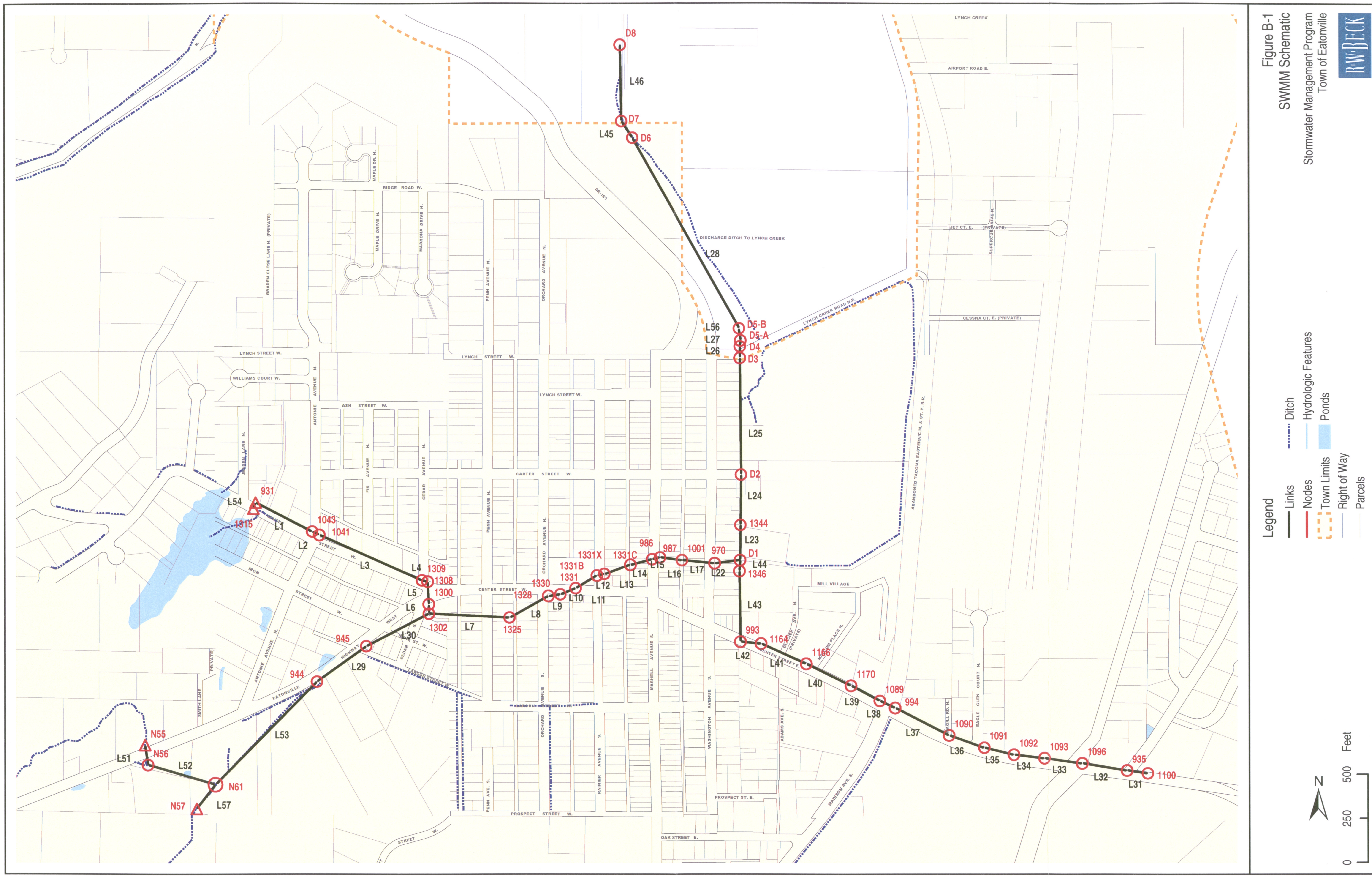

Figure B-1
SWMM Schematic
Stormwater Management Program
Town of Eatonville
R·W·BECK

Appendix B2

TIME OF CONCENTRATION WORKSHEETS

TOWN OF EATONVILLE
Project: Town of Eatonville Stormwater Mgmt Program
Subject: Development of Subbasin Time of Concentration Estimates

Date: 21-Dec-02
File Name: R:\Seattle\11-00616 Eatonville Stormwater\Working Documents\basin_data.xls
Reference: 1999 Pierce County Stormwater Management and Site Development Manual
& 1990 King County Stormwater Development Manual

Equations:

Sheet flow	T = 0.42*(n*L)^0.8/(P)^0.5*(s)^0.4, where
	n is sheet flow Mannings from Table 6.1 (Pierce County) L is length P is 2-year, 24-hour rainfall for this basin, P is 2 inches from Table E.1 (Pierce County) s is slope
Velocity	V = k(s)^0.5, where
	k is velocity factor from Table 6.1 (Pierce County) s is slope

Subbasin No. 1

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	150	0.030	Sheet Flow	0.8	0.0	55.6
	600	0.260	Velocity	3	1.5	6.5
	800	0.025	Velocity	15	2.4	5.6
	550	0.013	Velocity	42	4.8	1.9
total	2100			Tc (min) =		69.7

Subbasin No. 2

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	200	0.275	Sheet Flow	0.8	0.1	28.9
	800	0.119	Velocity	12	4.1	3.2
	170	0.013	Velocity	42	4.8	0.6
total	1000			Tc (min) =		32.1

Subbasin No. 3

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	200	0.175	Sheet Flow	0.15	0.4	9.1
	375	0.067	Velocity	12	3.1	2.0
	360	0.014	Velocity	17	2.0	3.0
	430	0.005	Velocity	42	3.0	2.4
	400	0.133	Velocity	17	6.2	1.1
	350	0.006	Velocity	12	0.9	6.3
	250	0.000	Velocity	17	0.2	24.5
total	2365			Tc (min) =		48.3

Subbasin No. 4

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	200	0.015	Sheet Flow	0.8	0.0	92.4
	500	0.030	Velocity	12	2.1	4.0
	200	0.046	Velocity	42	9.0	0.4
total	900			Tc (min) =		96.8

TOWN OF EATONVILLE
Project: Town of Eatonville Stormwater Mgmt Program
Subject: Development of Subbasin Time of Concentration Estimates

Subbasin No 5A

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	200	0.025	Sheet Flow	0.15	0.2	19.7
	230	0.043	Velocity	12	2.5	1.5
	480	0.009	Velocity	42	4.0	2.0
total	910			Tc (min) =		23.3

Subbasin No 5B

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	300	0.000	Sheet Flow	0.4	0.0	544.6
	1180	0.008	Velocity	12	1.1	18.3
	50	0.010	Velocity	42	4.2	0.2
total	1530			Tc (min) =		563.1

Subbasin No. 6

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	300	0.000	Sheet Flow	0.15	0.0	248.5
	410	0.024	Velocity	12	1.9	3.7
	600	0.006	Velocity	42	3.3	3.1
total	1310			Tc (min) =		255.2

Subbasin No. 7A

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	150	0.062	Sheet Flow	0.4	0.1	23.9
	330	0.025	Velocity	12	1.9	2.9
	230	0.061	Velocity	42	10.4	0.4
total	710			Tc (min) =		27.2

Subbasin No. 7B

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	130	0.062	Sheet Flow	0.15	0.2	9.7
	690	0.025	Velocity	12	1.9	6.1
total	820			Tc (min) =		15.8

Subbasin No. 8

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	300	0.100	Sheet Flow	0.15	0.3	15.7
	560	0.071	Velocity	12	3.2	2.9
	970	0.149	Velocity	17	6.6	2.5
	50	0.116	Velocity	42	14.3	0.1
total	1880			Tc (min) =		21.1

Subbasin No. 9

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	200	0.450	Sheet Flow	0.8	0.1	23.7
	200	0.350	Velocity	3	1.8	1.9
	550	0.073	Velocity	12	3.2	2.8
total	950			Tc (min) =		28.4

TOWN OF EATONVILLE
Project: Town of Eatonville Stormwater Mgmt Program
Subject: Development of Subbasin Time of Concentration Estimates

Subbasin No. 10

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	170	0.282	Sheet Flow	0.8	0.1	25.1
	150	0.213	Velocity	5	2.3	1.1
	110	0.000	Velocity	12	0.1	15.3
total	430			Tc (min) =		41.4

Subbasin No. 11

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	100	0.300	Sheet Flow	0.4	0.2	9.2
	480	0.219	Velocity	10	4.7	1.7
	150	0.008	Velocity	42	3.8	0.7
total	730			Tc (min) =		11.6

Subbasin No. 12/17

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	220	0.027	Sheet Flow	0.8	0.0	78.8
	450	0.087	Velocity	5	1.5	5.1
	300	0.117	Velocity	12	4.1	1.2
	280	0.268	Velocity	17	8.8	0.5
	750	0.104	Velocity	42	13.5	0.9
total	2000			Tc (min) =		86.6

Subbasin No. 13

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	170	0.029	Sheet Flow	0.15	0.2	16.3
	350	0.035	Velocity	12	2.2	2.6
total	520			Tc (min) =		18.9

Subbasin No. 14

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	250	0.000	Sheet Flow	0.15	0.0	214.8
	300	0.017	Velocity	12	1.6	3.2
	1010	0.025	Velocity	42	6.6	2.5
total	1560			Tc (min) =		220.5

Subbasin No. 15

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	200	0.000	Sheet Flow	0.15	0.0	179.7
	370	0.016	Velocity	12	1.5	4.1
	1150	0.027	Velocity	42	6.9	2.8
total	1720			Tc (min) =		186.5

TOWN OF EATONVILLE
Project: Town of Eatonville Stormwater Mgmt Program
Subject: Development of Subbasin Time of Concentration Estimates

Subbasin No. 16

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	200	0.025	Sheet Flow	0.15	0.2	19.7
	970	0.030	Velocity	12	2.1	7.8
	380	0.006	Velocity	42	3.3	1.9
total	1550			Tc (min) =		29.5

Subbasin No. 17 -- Combined with Subbasin No. 12

Subbasin No. 18

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	250	0.160	Sheet Flow	0.4	0.2	24.6
	210	0.381	Velocity	5	3.1	1.1
	170	0.153	Velocity	12	4.7	0.6
	1100	0.003	Velocity	42	2.3	8.0
total	1730			Tc (min) =		34.3

Subbasin No. 19

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	300	0.007	Sheet Flow	0.15	0.1	45.4
	410	0.007	Velocity	12	1.0	6.8
	360	0.000	Velocity	12	0.1	50.0
	850	0.018	Velocity	42	5.6	2.5
total	1920			Tc (min) =		104.7

Subbasin No. 20

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	280	0.014	Sheet Flow	0.15	0.1	32.6
	120	0.008	Velocity	12	1.1	1.9
	950	0.013	Velocity	42	4.8	3.3
total	1350			Tc (min) =		37.7

Subbasin No. 21

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	300	0.013	Sheet Flow	0.15	0.1	35.5
	530	0.008	Velocity	12	1.1	8.2
	180	0.011	Velocity	13	1.4	2.2
	30	0.026	Velocity	42	6.8	0.1
total	1040			Tc (min) =		46.0

Subbasin No. 22A

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	300	0.010	Sheet Flow	0.15	0.1	39.4
	380	0.076	Velocity	12	3.3	1.9
	470	0.002	Velocity	13	0.6	13.5
total	1150			Tc (min) =		54.8

TOWN OF EATONVILLE
Project: Town of Eatonville Stormwater Mgmt Program
Subject: Development of Subbasin Time of Concentration Estimates

Subbasin No. 22B

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	150	0.013	Sheet Flow	0.15	0.1	20.4
	660	0.023	Velocity	13	2.0	5.6
total	810			Tc (min) =		25.9

Subbasin No. 22C

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	300	0.013	Sheet Flow	0.15	0.1	35.5
	760	0.075	Velocity	12	3.3	3.9
	360	0.000	Velocity	17	0.2	35.3
total	1420			Tc (min) =		74.6

Subbasin No. 23

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	150	0.000	Sheet Flow	0.15	0.0	142.7
	50	0.025	Velocity	42	6.6	0.1
total	200			Tc (min) =		142.8

Subbasin No. 24

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	300	0.033	Sheet Flow	0.15	0.2	24.4
	1200	0.044	Velocity	12	2.5	7.9
	850	0.014	Velocity	17	2.0	7.0
total	2350			Tc (min) =		39.4

Subbasin No. 25A

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	300	0.023	Sheet Flow	0.15	0.2	28.2
	1200	0.026	Velocity	12	1.9	10.3
	710	0.003	Velocity	17	0.9	12.7
	440	0.000	Velocity	42	0.4	17.5
total	2650			Tc (min) =		68.7

Subbasin No. 25B

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	300	0.000	Sheet Flow	0.24	0.0	361.9
	1330	0.008	Velocity	42	3.8	5.9
total	1630			Tc (min) =		367.8

Subbasin No. 26

	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	250	0.040	Sheet Flow	0.011	1.7	2.4
	430	0.070	Velocity	5	1.3	5.4
	640	0.073	Velocity	11	3.0	3.6
	440	0.092	Velocity	42	12.7	0.6
	1770	0.006	Velocity	17	1.3	22.4
total	3530			Tc (min) =		34.4

TOWN OF EATONVILLE
Project: Town of Eatonville Stormwater Mgmt Program
Subject: Development of Subbasin Time of Concentration Estimates

Subbasin No. 27	Distance	Slope	Equation	n or K	Velocity (fps)	Travel Time (min)
	300	0.050	Sheet Flow	0.8	0.1	78.9
	430	0.221	Velocity	11	5.2	1.4
	610	0.008	Velocity	13	1.2	8.7
	1570	0.003	Velocity	17	0.9	28.1
total	2910			Tc (min) =		117.2

Appendix B3

SUBBASIN SUMMARY WORKSHEETS

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area Percent

Reference: 1999 Pierce County Stormwater Management and Site Development Manual, Table E.2

		Pierce County		Town of Eatonville					
		Area (Ac)	IMP	SF1 (Ac)	IMP (1)	SF2 (Ac)	IMP (1)	SF3 (Ac)	IMP (1)
Residential	1/8 Acre Lot	0.125	65%						
				0.22	42%	0.19	45%	0.14	58%
Residential	1/4 Acre Lot	0.25	38%						

Note

(1) % Impervious value interpolated

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program
Subject: Development of Subbasin Curve Numbers and Impervious Area Percent
Reference: 1999 Pierce County Stormwater Management and Site Development Manual, Table E.2

Hydrologic Soils Group B including 3 - Barneston gravelly coarse sandy loam

IMPERVIOUS	CN	PERVIOUS	CN		CN	Eatonville Zoning		
42%	98	58%	80	=	87.6	SF1 (1)	Single Family	9,600 SF per Dwelling Unit
45%	98	55%	80	=	88.1	SF2 (1)	Single Family	8,400 SF per Dwelling Unit
58%	98	42%	80	=	90.4	SF3 (1)	Single Family	6,000 SF per Dwelling Unit
85%				=	94	MF1 & MF2	Multi Family	(Pierce County Commerical Equivalent)
85%				=	94	C1 & C2	Commercial	
75%				=	92	I	Industrial	
75%				=	92	AP	Aerospace	(Pierce County Industrial Equivalent)
95%				=	98	ROW	Right of Way	(Pierce County Impervious Surface Equivalent)

Hydrologic Soils Group C including 19 - Kapowsin gravelly loam

IMPERVIOUS	CN	PERVIOUS	CN		CN	Eatonville Zoning		
42%	98	58%	86	=	91.0	SF1 (1)	Single Family	9,600 SF per Dwelling Unit
45%	98	55%	86	=	91.4	SF2 (1)	Single Family	8,400 SF per Dwelling Unit
58%	98	42%	86	=	93.0	SF3 (1)	Single Family	6,000 SF per Dwelling Unit
85%				=	95	MF1 & MF2	Multi Family	(Pierce County Commerical Equivalent)
85%				=	95	C1 & C2	Commercial	
75%				=	94	I	Industrial	
75%				=	94	AP	Aerospace	(Pierce County Industrial Equivalent)
95%				=	98	ROW	Right of Way	(Pierce County Impervious Surface Equivalent)

Hydrologic Soils Group D including 12 - Dupont muck and 36 - Scamman silt loam

IMPERVIOUS	CN	PERVIOUS	CN		CN	Eatonville Zoning		
42%	98	58%	90	=	93.4	SF1 (1)	Single Family	9,600 SF per Dwelling Unit
45%	98	55%	90	=	93.6	SF2 (1)	Single Family	8,400 SF per Dwelling Unit
58%	98	42%	90	=	94.6	SF3 (1)	Single Family	6,000 SF per Dwelling Unit
85%				=	96	MF1 & MF2	Multi Family	(Pierce County Commerical Equivalent)
85%				=	96	C1 & C2	Commercial	
75%				=	95	I	Industrial	
75%				=	95	AP	Aerospace	(Pierce County Industrial Equivalent)
95%				=	98	ROW	Right of Way	(Pierce County Impervious Surface Equivalent)

Note:

(1) Single Family curve numbers are weighted to correlate Town of Eatonville and Pierce County % impervious definitions

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Equations:

Runoff Curve Number per Subbasin	
	Weighted Average [Sum of (Subtotal of Area per Soil Type & Zone * Runoff Curve Number by Soil Type & Zone)] Total Subbasin Area
Percent Impervious Area per Subbasin	
	Weighted Average [Sum of (Subtotal of Area per Soil Type & Zone * % Impervious Area by Soil Type & Zone)] Total Subbasin Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
1		COMPOSITE				13.1	92	69.7	57%
1	3	ZONE-SF2	16,252	0.37	569,619	13.1			
1	3	ZONE-SF2	43,626	1.00	569,619	13.1			
1	3	ZONE-SF2	11,879	0.27	569,619	13.1			
1	3	ZONE-SF2	33,225	0.76	569,619	13.1			
				2.41			88.1		45%
1	3	ZONE-SF3	13,529	0.31	569,619	13.1			
1	3	ZONE-SF3	3,275	0.08	569,619	13.1			
1	3	ZONE-SF3	702	0.02	569,619	13.1			
1	3	ZONE-SF3	3,629	0.08	569,619	13.1			
1	3	ZONE-SF3	3,373	0.08	569,619	13.1			
				0.56			90.4		58%
1	3	ROW	89,040	**2.04**	569,619	13.1	98		95%
1	19	ZONE-SF1	203,064	**4.66**	569,619	13.1	91.0		42%
1	19	ZONE-SF2	9,769	0.22	569,619	13.1			
1	19	ZONE-SF2	82,541	1.89	569,619	13.1			
				2.12			91.4		45%
1	19	ROW	12,151	0.28	569,619	13.1			
1	19	ROW	24,374	0.56	569,619	13.1			
1	19	ROW	19,189	0.44	569,619	13.1			
				1.28			98		95%
				13.1					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
2		COMPOSITE				15.5	92	32.1	54%
2	3	ZONE-SF2	85,196	**1.96**	674,608	15.5	88.1		45%
2	3	ZONE-SF3	4,782	0.11	674,608	15.5			
2	3	ZONE-SF3	37,476	0.86	674,608	15.5			
				0.97			90.4		58%
2	3	ROW	5,475	0.13	674,608	15.5			
2	3	ROW	24,702	0.57	674,608	15.5			
				0.69			98		95%
2	19	ZONE-SF1	13,250	0.30	674,608	15.5			
2	19	ZONE-SF1	2	0.0001	674,608	15.5			
2	19	ZONE-SF1	29,278	0.67	674,608	15.5			
2	19	ZONE-SF1	7,330	0.17	674,608	15.5			
				1.14			91.0		42%
2	19	ZONE-SF2	373,813	**8.58**	674,608	15.5	91.4		45%
2	19	ZONE-SF3	1,789	0.04	674,608	15.5			
2	19	ZONE-SF3	8,791	0.20	674,608	15.5			
				0.24			93.0		58%
2	19	ROW	2,839	0.07	674,608	15.5			
2	19	ROW	14,813	0.34	674,608	15.5			
2	19	ROW	26,675	0.61	674,608	15.5			
2	19	ROW	38,396	0.88	674,608	15.5			
				1.90			98		95%
				15.5					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
3		COMPOSITE				31.9	93	48.3	51%
3	3	ZONE-SF3	274	0.01	1,387,945	31.9			
3	3	ZONE-SF3	1,230	0.03	1,387,945	31.9			
				0.03			90.4		58%
3	3	ROW	864	**0.02**	1,387,945	31.9	98		95%
3	19	ZONE-SF1	79,491	1.82	1,387,945	31.9			
3	19	ZONE-SF1	161,861	3.72	1,387,945	31.9			
3	19	ZONE-SF1	708,576	16.27	1,387,945	31.9			
				21.81			91.0		42%
3	19	ZONE-SF2	1,107	0.03	1,387,945	31.9			
3	19	ZONE-SF2	4,595	0.11	1,387,945	31.9			
3	19	ZONE-SF2	45,119	1.04	1,387,945	31.9			
				1.17			91.4		45%
3	19	ZONE-SF3	20,013	0.46	1,387,945	31.9			
3	19	ZONE-SF3	39,262	0.90	1,387,945	31.9			
				1.36			93.0		58%
3	19	ROW	3,500	0.08	1,387,945	31.9			
3	19	ROW	21,110	0.48	1,387,945	31.9			
3	19	ROW	194,573	4.47	1,387,945	31.9			
				5.03			98		95%
3	W	ZONE-SF1	103,685	**2.38**	1,387,945	31.9	100		42%
3	W	ZONE-SF3	647	0.01	1,387,945	31.9			
3	W	ZONE-SF3	1,622	0.04	1,387,945	31.9			
				0.05			100		58%
3	W	ROW	414	**0.01**	1,387,945	31.9	100		95%
				31.9					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
4		COMPOSITE				3.0	94	96.8	65%
4	3	ZONE-SF3	563	0.01	128,752	3.0			
4	3	ZONE-SF3	1,797	0.04	128,752	3.0			
4	3	ZONE-SF3	3,298	0.08	128,752	3.0			
4	3	ZONE-SF3	3,475	0.08	128,752	3.0			
				0.21			90.4		58%
4	3	ROW	17,619	**0.40**	128,752	3.0	98		95%
4	19	ZONE-SF1	2,247	**0.05**	128,752	3.0	91.0		42%
4	19	ZONE-SF2	6,539	0.15	128,752	3.0			
4	19	ZONE-SF2	57,087	1.31	128,752	3.0			
				1.46			91.4		45%
4	19	ZONE-SF3	892	0.02	128,752	3.0			
4	19	ZONE-SF3	4,311	0.10	128,752	3.0			
				0.12			93.0		58%
4	19	ROW	30,925	**0.71**	128,752	3.0	98		95%
				3.0					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
5A		COMPOSITE				14.9	93	563.1	60%
5A	3	ZONE-SF3	70,077	1.61	649,508	14.9			
5A	3	ZONE-SF3	60,304	1.38	649,508	14.9			
5A	3	ZONE-SF3	3,137	0.07	649,508	14.9			
5A	3	ZONE-SF3	3	0.0001	649,508	14.9			
5A	3	ZONE-SF3	36	0.001	649,508	14.9			
				3.07			90.4		58%
5A	3	ROW	58,111	**1.33**	649,508	14.9	98		95%
5A	12	ZONE-SF2	3,012	**0.07**	649,508	14.9	93.4		45%
5A	12	ROW	21,164	**0.49**	649,508	14.9	98		95%
5A	19	ZONE-MF1	11,190	**0.26**	649,508	14.9	95		85%
5A	19	ZONE-SF1	73,272	**1.68**	649,508	14.9	91.0		42%
5A	19	ZONE-SF2	124,915	2.87	649,508	14.9			
5A	19	ZONE-SF2	117,737	2.70	649,508	14.9			
				5.57			91.4		45%
5A	19	ZONE-SF3	212	0.005	649,508	14.9			
5A	19	ZONE-SF3	32,070	0.74	649,508	14.9			
5A	19	ZONE-SF3	20	0.0005	649,508	14.9			
				0.74			93.0		58%
5A	19	ROW	9,380	0.22	649,508	14.9			
5A	19	ROW	28,015	0.64	649,508	14.9			
5A	19	ROW	36,852	0.85	649,508	14.9			
				1.70			98		95%
				14.9					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
5B		COMPOSITE				10.3	93	23.3	69%
5B	3	ZONE-SF2	1,121	0.03	449,178	10.3			
5B	3	ZONE-SF2	463	0.01	449,178	10.3			
				0.04			88.1		45%
5B	3	ZONE-SF3	27,507	0.63	449,178	10.3			
5B	3	ZONE-SF3	37,400	0.86	449,178	10.3			
5B	3	ZONE-SF3	33,598	0.77	449,178	10.3			
5B	3	ZONE-SF3	18,843	0.43	449,178	10.3			
5B	3	ZONE-SF3	7,158	0.16	449,178	10.3			
5B	3	ZONE-SF3	35,604	0.82	449,178	10.3			
5B	3	ZONE-SF3	39,305	0.90	449,178	10.3			
5B	3	ZONE-SF3	27,940	0.64	449,178	10.3			
5B	3	ZONE-SF3	16,946	0.39	449,178	10.3			
5B	3	ZONE-SF3	67,147	1.54	449,178	10.3			
				7.15			90.4		58%
5B	3	ROW	135,867	3.12	449,178	10.3			
5B	3	ROW	280	0.01	449,178	10.3			
				3.13			98		95%
				10.31					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
6		COMPOSITE				8.7	93	255.2	73%
6	3	ZONE-MF2	3,330	**0.08**	378,676	8.7	94.0		85%
6	3	ZONE-SF3	4,057	0.09	378,676	8.7			
6	3	ZONE-SF3	8,437	0.19	378,676	8.7			
6	3	ZONE-SF3	8,615	0.20	378,676	8.7			
6	3	ZONE-SF3	10,546	0.24	378,676	8.7			
6	3	ZONE-SF3	13,449	0.31	378,676	8.7			
6	3	ZONE-SF3	42,347	0.97	378,676	8.7			
6	3	ZONE-SF3	42,930	0.99	378,676	8.7			
6	3	ZONE-SF3	46,148	1.06	378,676	8.7			
6	3	ZONE-SF3	51,038	1.17	378,676	8.7			
				5.22			90.4		58%
6	3	ROW	147,777	**3.39**	378,676	8.7	98		95%
				8.7					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
7A		COMPOSITE				1.5	94	27.2	70%
7A	3	ZONE-SF3	240	0.01	63,392	1.5			
7A	3	ZONE-SF3	3,955	0.09	63,392	1.5			
7A	3	ZONE-SF3	1,964	0.05	63,392	1.5			
				0.14			90.4		58%
7A	3	ROW	9,356	**0.21**	63,392	1.5	98		95%
7A	19	ZONE-SF3	16,120	0.37	63,392	1.5			
7A	19	ZONE-SF3	20,526	0.47	63,392	1.5			
7A	19	ZONE-SF3	4	0.0001	63,392	1.5			
				0.84			93.0		58%
7A	19	ROW	11,050	0.25	63,392	1.5			
7A	19	ROW	58	0.001	63,392	1.5			
7A	19	ROW	119	0.003	63,392	1.5			
				0.26			98		95%
				1.5					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
7B		COMPOSITE				5.3	94	15.8	82%
7B	3	ZONE-C1	11,385	0.26	231,095	5.3			
7B	3	ZONE-C1	17,129	0.39	231,095	5.3			
				0.65			94		85%
7B	3	ZONE-MF2	63,756	1.46	231,095	5.3			
7B	3	ZONE-MF2	12,122	0.28	231,095	5.3			
				1.74			94		85%
7B	3	ZONE-SF3	20,961	0.48	231,095	5.3			
7B	3	ZONE-SF3	16,675	0.38	231,095	5.3			
7B	3	ZONE-SF3	14,042	0.32	231,095	5.3			
7B	3	ZONE-SF3	63	0.001	231,095	5.3			
				1.19			90.4		58%
7B	3	ROW	84	0.002	231,095	5.3			
7B	3	ROW	72,735	1.67	231,095	5.3			
7B	3	ROW	748	0.02	231,095	5.3			
7B	3	ROW	1,396	0.03	231,095	5.3			
				1.72			98		95%
				5.3					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
8		COMPOSITE				12.6	92	21.1	51%
8	19	ZONE-SF1	2,522	0.06	548,471	12.6			
8	19	ZONE-SF1	28,378	0.65	548,471	12.6			
8	19	ZONE-SF1	67,352	1.55	548,471	12.6			
				2.26			91.0		42%
8	19	ZONE-SF2	29,995	0.69	548,471	12.6			
8	19	ZONE-SF2	345,404	7.93	548,471	12.6			
				8.62			91.4		45%
8	19	ZONE-SF3	224	0.01	548,471	12.6			
8	19	ZONE-SF3	476	0.01	548,471	12.6			
8	19	ZONE-SF3	707	0.02	548,471	12.6			
8	19	ZONE-SF3	2,661	0.06	548,471	12.6			
8	19	ZONE-SF3	2,855	0.07	548,471	12.6			
				0.16			93.0		58%
8	19	ROW	8,264	0.19	548,471	12.6			
8	19	ROW	59,633	1.37	548,471	12.6			
				1.56			98		95%
				12.6					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
9		COMPOSITE				6.0	91	28.4	45%
9	12	ZONE-SF2	796	0.02	262,735	6.0	93.6		45%
9	12	ROW	507	0.01	262,735	6.0	98		95%
9	19	ZONE-SF2	259,427	5.96	262,735	6.0	91.4		45%
9	19	ROW	2,004	0.05	262,735	6.0	98		95%
				6.0					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
10		COMPOSITE				1.6	94	41.4	68%
10	3	ZONE-SF3	15,377	**0.35**	68,344	1.6	90.4		58%
10	3	ROW	1,354	0.03	68,344	1.6			
10	3	ROW	2,295	0.05	68,344	1.6			
				0.08			98		95%
10	19	ZONE-SF3	82	0.002	68,344	1.6			
10	19	ZONE-SF3	33,687	0.77	68,344	1.6			
				0.78			93.0		58%
10	19	ROW	2,314	0.05	68,344	1.6			
10	19	ROW	13,233	0.30	68,344	1.6			
				0.36			98		95%
				1.6					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
11		COMPOSITE				2.5	94	11.6	71%
11	3	ZONE-C1	1,747	**0.04**	110,456	2.5	94		85%
11	3	ZONE-SF3	761	0.02	110,456	2.5			
11	3	ZONE-SF3	8,260	0.19	110,456	2.5			
				0.21			90.4		58%
11	3	ROW	1,651	0.04	110,456	2.5			
11	3	ROW	3,217	0.07	110,456	2.5			
				0.11			98		95%
11	19	ZONE-C1	3,009	**0.07**	110,456	2.5	95		85%
11	19	ZONE-SF1	1,152	0.03	110,456	2.5			
11	19	ZONE-SF1	10,146	0.23	110,456	2.5			
				0.26			91.0		42%
11	19	ZONE-SF3	85	0.002	110,456	2.5			
11	19	ZONE-SF3	347	0.01	110,456	2.5			
11	19	ZONE-SF3	4,754	0.11	110,456	2.5			
11	19	ZONE-SF3	41,405	0.95	110,456	2.5			
				1.07			93.0		58%
11	19	ROW	3,621	0.08	110,456	2.5			
11	19	ROW	30,304	0.70	110,456	2.5			
				0.78			98		95%
				2.5					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
12/17		COMPOSITE				17.7	94	86.6	68%
12/17	3	ZONE-C1	6,653	0.15	771,943	17.7			
12/17	3	ZONE-C1	521	0.01	771,943	17.7			
12/17	3	ZONE-C1	27,301	0.63	771,943	17.7			
12/17	3	ZONE-C1	22,022	0.51	771,943	17.7			
12/17	3	ZONE-C1	46,059	1.06	771,943	17.7			
12/17	3	ZONE-C1	8,307	0.19	771,943	17.7			
12/17	3	ZONE-C1	11,905	0.27	771,943	17.7			
12/17	3	ZONE-C1	2,835	0.07	771,943	17.7			
				2.88			94		85%
12/17	3	ZONE-MF2	31,945	**0.73**	771,943	17.7	94		85%
12/17	3	ZONE-SF1	267	0.01	771,943	17.7			
12/17	3	ZONE-SF1	8,477	0.19	771,943	17.7			
				0.20			87.6		42%
12/17	3	ROW	59,460	1.37	771,943	17.7			
12/17	3	ROW	11,054	0.25	771,943	17.7			
12/17	3	ROW	1,083	0.02	771,943	17.7			
				1.64			98		95%
12/17	19	ZONE-C1	5,280	0.12	771,943	17.7			
12/17	19	ZONE-C1	377	0.01	771,943	17.7			
12/17	19	ZONE-C1	897	0.02	771,943	17.7			
				0.15			95		85%
12/17	19	ZONE-MF2	16,506	**0.38**	771,943	17.7	95		85%

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
12/17	19	ZONE-SF1	47,732	1.10	771,943	17.7			
12/17	19	ZONE-SF1	34,545	0.79	771,943	17.7			
12/17	19	ZONE-SF1	20,011	0.46	771,943	17.7			
12/17	19	ZONE-SF1	50,463	1.16	771,943	17.7			
12/17	19	ZONE-SF1	74,841	1.72	771,943	17.7			
12/17	19	ZONE-SF1	68,966	1.58	771,943	17.7			
12/17	19	ZONE-SF1	16,462	0.38	771,943	17.7			
12/17	19	ZONE-SF1	6,281	0.14	771,943	17.7			
				7.33			91.0		42%
12/17	19	ZONE-SF2	26,910	**0.62**	771,943	17.7	91.4		45%
12/17	19	ZONE-SF3	7,330	**0.17**	771,943	17.7	93.0		58%
12/17	19	ROW	157,452	**3.61**	771,943	17.7	98		95%
				17.7					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
13		COMPOSITE				3.3	95	18.9	88%
13	3	ZONE-C1	333	0.01	143,681	3.3			
13	3	ZONE-C1	2,014	0.05	143,681	3.3			
13	3	ZONE-C1	19,837	0.46	143,681	3.3			
13	3	ZONE-C1	36,184	0.83	143,681	3.3			
				1.34			94		85%
13	3	ZONE-MF2	3,043	0.07	143,681	3.3			
13	3	ZONE-MF2	36,725	0.84	143,681	3.3			
				0.91			94		85%
13	3	ROW	163	0.004	143,681	3.3			
13	3	ROW	45,383	1.04	143,681	3.3			
				1.05			98		95%
				3.3					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
14		COMPOSITE				7.1	94	220.5	77%
14	3	ZONE-C1	4,709	0.11	307,714	7.1			
14	3	ZONE-C1	4,981	0.11	307,714	7.1			
14	3	ZONE-C1	9,386	0.22	307,714	7.1			
14	3	ZONE-C1	20,080	0.46	307,714	7.1			
14	3	ZONE-C1	28,643	0.66	307,714	7.1			
				1.56			94		85%
14	3	ZONE-SF1	12	**0.0003**	307,714	7.1	87.6		42%
14	3	ZONE-SF2	6,806	**0.16**	307,714	7.1	88.1		45%
14	3	ZONE-SF3	3,192	0.07	307,714	7.1			
14	3	ZONE-SF3	4,022	0.09	307,714	7.1			
14	3	ZONE-SF3	4,400	0.10	307,714	7.1			
14	3	ZONE-SF3	15,281	0.35	307,714	7.1			
14	3	ZONE-SF3	94,673	2.17	307,714	7.1			
				2.79			90.4		58%
14	3	ROW	1,693	0.04	307,714	7.1			
14	3	ROW	109,838	2.52	307,714	7.1			
				2.56			98		95%
				7.1					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
15		COMPOSITE				15.1	94	186.5	81%
15	3	ZONE-C1	164	0.00	656,974	15.1			
15	3	ZONE-C1	268	0.01	656,974	15.1			
15	3	ZONE-C1	391	0.01	656,974	15.1			
15	3	ZONE-C1	443	0.01	656,974	15.1			
15	3	ZONE-C1	463	0.01	656,974	15.1			
15	3	ZONE-C1	38,923	0.89	656,974	15.1			
15	3	ZONE-C1	42,059	0.97	656,974	15.1			
15	3	ZONE-C1	42,331	0.97	656,974	15.1			
15	3	ZONE-C1	46,431	1.07	656,974	15.1			
15	3	ZONE-C1	55,004	1.26	656,974	15.1			
				5.20			94		85%
15	3	ZONE-MF2	103	0.002	656,974	15.1			
15	3	ZONE-MF2	168	0.004	656,974	15.1			
				0.01			94		85%
15	3	ZONE-SF2	7	**0.0002**	656,974	15.1	88.1		45%
15	3	ZONE-SF3	42,643	0.98	656,974	15.1			
15	3	ZONE-SF3	43,848	1.01	656,974	15.1			
15	3	ZONE-SF3	47,847	1.10	656,974	15.1			
15	3	ZONE-SF3	48,069	1.10	656,974	15.1			
				4.19			90.4		58%
15	3	ROW	204,661	**4.70**	656,974	15.1	98		95%
15	36	ZONE-C1	216	0.005	656,974	15.1			
15	36	ZONE-C1	38,080	0.87	656,974	15.1			
				0.88			96		85%
15	36	ZONE-MF2	594	0.01	656,974	15.1	96		85%
15	36	ZONE-SF2	1,274	0.03	656,974	15.1			
15	36	ZONE-SF2	2	0.00005	656,974	15.1			
				0.03			93.6		45%
15	36	ROW	2,986	**0.07**	656,974	15.1	98		95%
				15.1					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
16		COMPOSITE				15.1	95	29.5	87%
16	3	ZONE-C1	273	0.01	658,998	15.1			
16	3	ZONE-C1	16,269	0.37	658,998	15.1			
16	3	ZONE-C1	32,432	0.74	658,998	15.1			
16	3	ZONE-C1	60,793	1.40	658,998	15.1			
16	3	ZONE-C1	66,052	1.52	658,998	15.1			
16	3	ZONE-C1	66,056	1.52	658,998	15.1			
16	3	ZONE-C1	74,625	1.71	658,998	15.1			
				7.27			94		85%
16	3	ZONE-MF2	4,916	0.11	658,998	15.1			
16	3	ZONE-MF2	23,152	0.53	658,998	15.1			
16	3	ZONE-MF2	32,857	0.75	658,998	15.1			
16	3	ZONE-MF2	35,965	0.83	658,998	15.1			
				2.22			94		85%
16	3	ROW	6,584	0.15	658,998	15.1			
16	3	ROW	10,759	0.25	658,998	15.1			
16	3	ROW	11,222	0.26	658,998	15.1			
16	3	ROW	18,455	0.42	658,998	15.1			
16	3	ROW	33,075	0.76	658,998	15.1			
16	3	ROW	33,832	0.78	658,998	15.1			
16	3	ROW	41,199	0.95	658,998	15.1			
				3.56			98		95%
16	36	ZONE-C1	78,707	**1.81**	658,998	15.1	96		85%
16	36	ZONE-C2	8,159	0.19	658,998	15.1			
16	36	ZONE-C2	5	0.0001	658,998	15.1			
				0.19			96		85%
16	36	ZONE-SF2	2,170	**0.05**	658,998	15.1	93.6		45%
16	36	ROW	321	0.01	658,998	15.1			
16	36	ROW	1,121	0.03	658,998	15.1			
				0.03			98		95%
				15.1					
17	Combined with Subbasin No 12								

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
18		COMPOSITE				13.6	96	34.3	87%
18	3	ZONE-C1	178	0.004	590,506	13.6			
18	3	ZONE-C1	4,456	0.10	590,506	13.6			
18	3	ZONE-C1	7,000	0.16	590,506	13.6			
18	3	ZONE-C1	16,949	0.39	590,506	13.6			
18	3	ZONE-C1	18,224	0.42	590,506	13.6			
18	3	ZONE-C1	23,606	0.54	590,506	13.6			
18	3	ZONE-C1	33,348	0.77	590,506	13.6			
18	3	ZONE-C1	63,733	1.46	590,506	13.6			
				3.85			94		85%
18	3	ZONE-MF2	90	0.002	590,506	13.6			
18	3	ZONE-MF2	5,528	0.13	590,506	13.6			
				0.13			94		85%
18	3	ROW	1,786	0.04	590,506	13.6			
18	3	ROW	15,967	0.37	590,506	13.6			
18	3	ROW	67,718	1.55	590,506	13.6			
				1.96			98		95%
18	19	ZONE-C1	1,838	**0.04**	590,506	13.6	95		85%
18	19	ZONE-MF2	2,526	0.06	590,506	13.6			
18	19	ZONE-MF2	21,213	0.49	590,506	13.6			
				0.54			95		85%
18	19	ZONE-SF1	1,803	0.04	590,506	13.6			
18	19	ZONE-SF1	14,017	0.32	590,506	13.6			
				0.36			91.0		42%
18	19	ROW	1,005	0.02	590,506	13.6			
18	19	ROW	2,501	0.06	590,506	13.6			
18	19	ROW	16,335	0.37	590,506	13.6			
				0.46			98		95%

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
18	36	ZONE-C1	27	0.001	590,506	13.6			
18	36	ZONE-C1	213	0.005	590,506	13.6			
18	36	ZONE-C1	8,623	0.20	590,506	13.6			
18	36	ZONE-C1	27,036	0.62	590,506	13.6			
18	36	ZONE-C1	48,285	1.11	590,506	13.6			
18	36	ZONE-C1	55,692	1.28	590,506	13.6			
				3.21			96		85%
18	36	ZONE-C2	22	0.001	590,506	13.6			
18	36	ZONE-C2	758	0.02	590,506	13.6			
				0.02			96		85%
18	36	ZONE-MF2	8,976	0.21	590,506	13.6			
18	36	ZONE-MF2	12,412	0.28	590,506	13.6			
18	36	ZONE-MF2	15,744	0.36	590,506	13.6			
				0.85			96		85%
18	36	ROW	92,895	**2.13**	590,506	13.6	98		95%
				13.6					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
19		COMPOSITE				15.7	96	104.7	77%
19	3	ZONE-I	1,057	**0.02**	685,139	15.7	92		75%
19	3	ZONE-SF3	27	0.001	685,139	15.7			
19	3	ZONE-SF3	197	0.005	685,139	15.7			
				0.01			90.4		58%
19	3	ROW	5,017	**0.12**	685,139	15.7	98		95%
19	19	ZONE-MF2	28,852	0.66	685,139	15.7			
19	19	ZONE-MF2	44,284	1.02	685,139	15.7			
19	19	ZONE-MF2	46,636	1.07	685,139	15.7			
				2.75			95		85%
19	19	ZONE-SF1	16,128	0.37	685,139	15.7			
19	19	ZONE-SF1	37,848	0.87	685,139	15.7			
				1.24			91.0		42%
19	19	ZONE-SF2	864	**0.02**	685,139	15.7	91.4		45%
19	19	ROW	46,133	**1.06**	685,139	15.7	98		95%
19	36	ZONE-C1	10,655	**0.24**	685,139	15.7	96		85%
19	36	ZONE-C2	5,668	**0.13**	685,139	15.7	96		85%
19	36	ZONE-I	583	**0.01**	685,139	15.7	95		75%
19	36	ZONE-MF2	16,225	0.37	685,139	15.7			
19	36	ZONE-MF2	22,065	0.51	685,139	15.7			
19	36	ZONE-MF2	52,416	1.20	685,139	15.7			
19	36	ZONE-MF2	55,263	1.27	685,139	15.7			
				3.35			96		85%
19	36	ZONE-SF3	1,106	0.03	685,139	15.7			
19	36	ZONE-SF3	31,022	0.71	685,139	15.7			
19	36	ZONE-SF3	38,100	0.87	685,139	15.7			
19	36	ZONE-SF3	110,537	2.54	685,139	15.7			
				4.15			94.6		58%
19	36	ROW	1,472	0.03	685,139	15.7			
19	36	ROW	112,983	2.59	685,139	15.7			
				2.63			98		95%
				15.7					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
20		COMPOSITE				7.1	95	37.7	69%
20	3	ZONE-SF3	28,938	0.66	309,690	7.1			
20	3	ZONE-SF3	29,327	0.67	309,690	7.1			
				1.34			90.4		58%
20	3	ROW	33,951	**0.78**	309,690	7.1	98		95%
20	36	ZONE-SF3	25,950	0.60	309,690	7.1			
20	36	ZONE-SF3	62,051	1.42	309,690	7.1			
20	36	ZONE-SF3	73,058	1.68	309,690	7.1			
				3.70			94.6		58%
20	36	ROW	325	0.01	309,690	7.1			
20	36	ROW	56,090	1.29	309,690	7.1			
				1.30			98		95%
				7.11					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
21		COMPOSITE				19.1	96	46.0	83%
21	3	ZONE-C2	10,710	0.25	829,922	19.1			
21	3	ZONE-C2	123,542	2.84	829,922	19.1			
				3.08			94		85%
21	3	ROW	22,512	**0.52**	829,922	19.1	98		95%
21	36	ZONE-C1	5,356	**0.12**	829,922	19.1	96		85%
21	36	ZONE-C2	58,767	1.35	829,922	19.1			
21	36	ZONE-C2	89,493	2.05	829,922	19.1			
21	36	ZONE-C2	169,539	3.89	829,922	19.1			
21	36	ZONE-C2	179,000	4.11	829,922	19.1			
				11.40			96		85%
21	36	ZONE-SF3	16,109	0.37	829,922	19.1			
21	36	ZONE-SF3	72,548	1.67	829,922	19.1			
				2.04			94.6		58%
21	36	ROW	15,117	0.35	829,922	19.1			
21	36	ROW	67,228	1.54	829,922	19.1			
				1.89			98		95%
				19.1					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
22A		COMPOSITE				9.2	93	54.8	76%
22A	3	ZONE-AP	65,036	**1.49**	401,935	9.2	92		75%
22A	3	ZONE-C2	188,659	**4.33**	401,935	9.2	94		85%
22A	3	ZONE-SF2	85,411	1.96	401,935	9.2			
22A	3	ZONE-SF2	199	0.005	401,935	9.2			
22A	3	ZONE-SF2	4,226	0.10	401,935	9.2			
22A	3	ZONE-SF2	3,137	0.07	401,935	9.2			
				2.13			88.1		45%
22A	3	ROW	47,189	1.08	401,935	9.2			
22A	3	ROW	8,079	0.19	401,935	9.2			
				1.27			98		95%
				9.2					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
22B		COMPOSITE				7.2	93	25.9	75%
22B	3	ZONE-C2	196,692	**4.52**	313,518	7.2	94		85%
22B	3	ZONE-SF2	83,208	**1.91**	313,518	7.2	88.1		45%
22B	3	ROW	33,448	0.77	313,518	7.2			
22B	3	ROW	169	0.004	313,518	7.2			
				0.77			98		95%
				7.2					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
22C		COMPOSITE				8.6	95	74.6	86%
22C	3	ZONE-C2	283,236	6.50	376,144	8.6	94		85%
22C	3	ROW	19,228	0.44	376,144	8.6			
22C	3	ROW	5,819	0.13	376,144	8.6			
				0.58			98		95%
22C	36	ZONE-C2	58,535	1.34	376,144	8.6	96		85%
22C	36	ZONE-MF1	251	0.01	376,144	8.6	96		85%
22C	36	ROW	9,075	0.21	376,144	8.6	98		95%
				8.6					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
23		COMPOSITE				7.5	95	142.8	85%
23	3	ZONE-C2	38,062	0.87	325,792	7.5			
23	3	ZONE-C2	38,158	0.88	325,792	7.5			
23	3	ZONE-C2	50,887	1.17	325,792	7.5			
23	3	ZONE-C2	58,849	1.35	325,792	7.5			
				4.27			94		85%
23	3	ZONE-SF2	6,942	0.16	325,792	7.5			
23	3	ZONE-SF2	7,851	0.18	325,792	7.5			
23	3	ZONE-SF2	14,548	0.33	325,792	7.5			
				0.67			88.1		45%
23	3	ROW	110,496	**2.54**	325,792	7.5	98		95%
				7.5					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
24		COMPOSITE				13.6	94	39.4	72%
24	3	ZONE-C2	24,482	**0.56**	591,767	13.6	94		85%
24	3	ZONE-MF1	44,102	**1.01**	591,767	13.6	94		85%
24	3	ZONE-SF2	133,987	**3.08**	591,767	13.6	88.1		45%
24	3	ZONE-SF3	5,076	**0.12**	591,767	13.6	90.4		58%
24	3	ROW	13,216	0.30	591,767	13.6			
24	3	ROW	20,314	0.47	591,767	13.6			
				0.77			98		95%
24	36	ZONE-C2	1,204	0.03	591,767	13.6			
24	36	ZONE-C2	14,790	0.34	591,767	13.6			
				0.37			96		85%
24	36	ZONE-MF1	257,126	**5.90**	591,767	13.6	96		85%
24	36	ZONE-SF2	67,405	**1.55**	591,767	13.6	93.6		45%
24	36	ROW	10,065	**0.23**	591,767	13.6	98		95%
				13.6					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
25A		COMPOSITE				50.7	93	68.7	77%
25A	3	ZONE-AP	1,332,496	30.59	2,210,492	50.7			
25A	3	ZONE-AP	93,967	2.16	2,210,492	50.7			
				32.75			92		75%
25A	3	ZONE-C2	97,085	**2.23**	2,210,492	50.7	96		85%
25A	3	ZONE-SF2	100,742	2.31	2,210,492	50.7			
25A	3	ZONE-SF2	37,483	0.86	2,210,492	50.7			
				3.17			88.1		45%
25A	3	ROW	1,909	0.04	2,210,492	50.7			
25A	3	ROW	31,361	0.72	2,210,492	50.7			
25A	3	ROW	301,947	6.93	2,210,492	50.7			
25A	3	ROW	48	0.001	2,210,492	50.7			
25A	3	ROW	209	0.005	2,210,492	50.7			
				7.70			98		95%
25A	36	ZONE-C1	48,193	**1.11**	2,210,492	50.7	96		85%
25A	36	ZONE-C2	142,524	**3.27**	2,210,492	50.7	96		85%
25A	36	ZONE-SF2	45	0.001	2,210,492	50.7			
25A	36	ZONE-SF2	19,481	0.45	2,210,492	50.7			
				0.45			93.6		45%
25A	36	ROW	1,057	0.02	2,210,492	50.7			
25A	36	ROW	1,946	0.04	2,210,492	50.7			
				0.07			98		95%
				50.7					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
25B		COMPOSITE				27.8	93	367.8	48%
25B	3	ZONE-C1	67	**0.002**	1,210,600	27.8	96		85%
25B	3	ZONE-SF2	126,690	2.91	1,210,600	27.8			
25B	3	ZONE-SF2	7,107	0.16	1,210,600	27.8			
				3.07			88.1		45%
25B	3	ROW	4,218	**0.10**	1,210,600	27.8	98		95%
25B	36	ZONE-MF2	31,031	**0.71**	1,210,600	27.8	96		85%
25B	36	ZONE-SF2	1,004,563	**23.06**	1,210,600	27.8	93.6		45%
25B	36	ROW	36,924	**0.85**	1,210,600	27.8	98		95%
				27.8					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
26		COMPOSITE				74.6	93	34.4	61%
26	12	ZONE-MF1	96,133	**2.21**	3,251,156	74.6	96		85%
26	19	ZONE-MF1	734,428	16.86	3,251,156	74.6			
26	19	ZONE-MF1	55,333	1.27	3,251,156	74.6			
26	19	ZONE-MF1	54,951	1.26	3,251,156	74.6			
				19.39			95		85%
26	19	ZONE-SF1	1,681,762	38.61	3,251,156	74.6			
26	19	ZONE-SF1	127,539	2.93	3,251,156	74.6			
26	19	ZONE-SF1	67,792	1.56	3,251,156	74.6			
				43.09			91.0		42%
26	19	ZONE-SF2	64,129	**1.47**	3,251,156	74.6	91.4		45%
26	19	ROW	26,590	0.61	3,251,156	74.6			
26	19	ROW	68,013	1.56	3,251,156	74.6			
26	19	ROW	100,868	2.32	3,251,156	74.6			
26	19	ROW	47,634	1.09	3,251,156	74.6			
26	19	ROW	125,986	2.89	3,251,156	74.6			
				8.47			98		95%
				74.6					

TOWN OF EATONVILLE

Project: Town of Eatonville Stormwater Mgmt Program

Subject: Development of Subbasin Curve Numbers and Impervious Area

Sub Basin Number	Soil Type	ZONING	AREA_new (SF)	AREA_new (Ac)	Sub Basin Area (SF)	Sub Basin Area (Ac)	Runoff Curve Number	Tc (min)	Impervious Area (%)
27		COMPOSITE				65.0	92	117.2	46%
27	12	ZONE-SF2	521,776	**11.98**	2,829,740	65.0	93.6		45%
27	12	ROW	9,296	**0.21**	2,829,740	65.0	98		95%
27	19	ZONE-MF1	7,540	**0.17**	2,829,740	65.0	95		85%
27	19	ZONE-SF2	2,161,727	49.63	2,829,740	65.0			
27	19	ZONE-SF2	101,015	2.32	2,829,740	65.0			
				51.95			91.4		45%
27	19	ROW	12,420	0.29	2,829,740	65.0			
27	19	ROW	154	0.004	2,829,740	65.0			
27	19	ROW	15,811	0.36	2,829,740	65.0			
				0.65			98		95%
				65.0					
		TOTAL OF SUBBASIN AREAS		505		505			

Appendix C

CAPITAL PROJECT COST ESTIMATE WORKSHEETS

PROJECT NO: IP01 | DATE: 02-Jan-03

LOCATION: N-S Trunk to Lynch Creek

DESCRIPTION: Eatonville, WA Improvement Project Order of Magnitude Cost Estimate

ITEM NO.	ITEM DESCRIPTION (In place)	QUANTITY	UNITS	UNIT COST	$/UNIT	COST
1	Mobilization	1	sum	0.07	% of sum	$28,856
2	Removal of Existing System	1,950	lf	$8	/lf	$14,625
3	Conflicts with Utilities (1)	1	ls	$2,000	/ls	$2,000
4	Sawcutting	3,902	lf	$4	/lf	$15,608
5	Pavement Removal	1,300	yd2	$6	/yd2	$7,800
6	Pavement Restoration (2)	1,300	yd2	$21	/yd2	$27,300
7	Dewatering	1	ls	$7,500	/ls	$7,500
8	48" Dia. CPEP (3)	1,950	lf	$130	/lf	$253,500
9	Increase Drainage Ditch Capacity (4)	2,500	lf	$10	/lf	$25,000
10	Catch Basin Type 2, 48"	10	each	$2,940	/each	$29,400
11	Erosion Control Measures (Filter fence, etc...)	1	ls	$15,000	/ls	$15,000
12	Traffic Control	1	ls	$7,500	/ls	$7,500
13	Landscaping	1	ls	$7,000	/ls	$7,000
				SUBTOTAL:		$441,089
				CONTINGENCY:	40%	$176,400
				SUBTOTAL:		$617,489
				SALES TAX (8.9%):	8.9%	$54,957
				CONSTRUCTION COST:		$672,446
				ENGINEERING, GEOTECHNICAL, LEGAL, ADMINISTRATION (35%):	35%	$235,356
				TOTAL:		$907,802 (5)
	GRAND TOTAL			TOTAL PROJECT COST:		$907,800

Notes

(1) Utility conflicts have not been researched.
(2) Includes 2" CSBC, 6" CSTC, & 3" ACP
(3) Pipe estimate includes: trench excavation, trench box, bedding, disposal of unsuitable materials, pipe, installation and backfill. Assumes native materials acceptable for backfill. Includes culvert length under Lynch Creek Rd NE.
(4) Includes length of discharge ditch to Lynch Creek
(5) Does not include land acquisition costs.

PROJECT NO: IP02 DATE: 02-Jan-03

LOCATION: Center Street West from Orchard Avenue South to Main Trunk

DESCRIPTION: Eatonville, WA Improvement Project Order of Magnitude Cost Estimate

ITEM NO.	ITEM DESCRIPTION (In place)	QUANTITY	UNITS	UNIT COST	$/UNIT	COST
1	Mobilization	1	sum	0.07	% of sum	$15,122
2	Removal of Existing System	1,160	l.f	$8	/l.f.	$8,700
3	Conflicts with Utilities (1)	1	ls	$2,000	/ls	$2,000
4	Sawcutting	2,322	l.f.	$4	/l.f.	$9,288
5	Pavement Removal	644	yd2	$6	/yd2	$3,867
6	Pavement Restoration (2)	644	yd2	$21	/yd2	$13,533
7	Dewatering	1	ls	$7,500	/ls	$7,500
8	36" Dia. CPEP (3)	1,160	l.f.	$100	/l.f.	$116,000
9	Catch Basin Type 2, 48"	6	each	$2,940	/each	$17,640
10	Erosion Control Measures (Filter fence, etc...)	1	ls	$15,000	/ls	$15,000
11	Traffic Control	1	ls	$15,000	/ls	$15,000
12	Landscaping	1	ls	$7,500	/ls	$7,500

SUBTOTAL:		$231,150
CONTINGENCY:	40%	$92,500
SUBTOTAL:		$323,650
SALES TAX (8.9%):	8.9%	$28,805
CONSTRUCTION COST:		$352,455
ENGINEERING, GEOTECHNICAL, LEGAL, ADMINISTRATION (35%):	35%	$123,359
TOTAL:		$475,814 (4)

GRAND TOTAL	TOTAL PROJECT COST:	$475,800

Notes

(1) Utility conflicts have not been researched.

(2) Includes 2" CSBC, 6" CSTC, & 3" ACP

(3) Pipe estimate includes: trench excavation, trench box, bedding, disposal of unsuitable materials, pipe, installation and backfill. Assumes native materials acceptable for backfill.

(4) Does not include land acquisition costs.

PROJECT NO: IP03 DATE: 02-Jan-03

LOCATION: Center Street West from Jensen Lane North through Cedar Avenue North

DESCRIPTION: Eatonville, WA Improvement Project Order of Magnitude Cost Estimate

ITEM NO.	ITEM DESCRIPTION (In place)	QUANTITY	UNITS	UNIT COST	$/UNIT	COST
1	Mobilization	1	sum	0.07	% of sum	$15,105
2	Removal of Existing System	1,300	l.f	$8	/l.f.	$9,750
3	Conflicts with Utilities (1)	1	ls	$2,000	/ls	$2,000
4	Sawcutting	2,602	l.f.	$4	/l.f.	$10,408
5	Pavement Removal	650	yd2	$6	/yd2	$3,900
6	Pavement Restoration (2)	650	yd2	$21	/yd2	$13,650
7	Dewatering	1	ls	$7,500	/ls	$7,500
8	30" Dia. CPEP (3)	1,300	l.f.	$85	/l.f.	$110,500
9	Catch Basin Type 2, 48"	7	each	$2,940	/each	$20,580
10	Erosion Control Measures (Filter fence, etc...)	1	ls	$15,000	/ls	$15,000
11	Traffic Control	1	ls	$15,000	/ls	$15,000
12	Landscaping	1	ls	$7,500	/ls	$7,500

SUBTOTAL:		$230,893
CONTINGENCY:	40%	$92,400
SUBTOTAL:		$323,293
SALES TAX (8.9%):	8.9%	$28,773
CONSTRUCTION COST:		$352,066
ENGINEERING, GEOTECHNICAL, LEGAL, ADMINISTRATION (35%):	35%	$123,223
TOTAL:		$475,289 (4)

GRAND TOTAL	TOTAL PROJECT COST:	$475,300

Notes

(1) Utility conflicts have not been researched.
(2) Includes 2" CSBC, 6" CSTC, & 3" ACP
(3) Pipe estimate includes: trench excavation, trench box, bedding, disposal of unsuitable materials, pipe, installation and backfill. Assumes native materials acceptable for backfill.
(4) Does not include land acquisition costs.

PROJECT NO: IP04 DATE: 02-Jan-03

LOCATION: Center Street West from Cedar Avenue North to Orchard Avenue South

DESCRIPTION: Eatonville, WA Improvement Project Order of Magnitude Cost Estimate

ITEM NO.	ITEM DESCRIPTION (In place)	QUANTITY	UNITS	UNIT COST	$/UNIT	COST
1	Mobilization	1	sum	0.07	% of sum	$10,691
2	Removal of Existing System	720	l.f	$8	/l.f.	$5,400
3	Conflicts with Utilities (1)	1	ls	$2,000	/ls	$2,000
4	Sawcutting	1,442	l.f.	$4	/l.f.	$5,768
5	Pavement Removal	400	yd2	$6	/yd2	$2,400
6	Pavement Restoration (2)	400	yd2	$21	/yd2	$8,400
7	Dewatering	1	ls	$7,500	/ls	$7,500
8	36" Dia. CPEP (3)	720	l.f.	$100	/l.f.	$72,000
9	Catch Basin Type 2, 48"	4	each	$2,940	/each	$11,760
10	Erosion Control Measures (Filter fence, etc...)	1	ls	$15,000	/ls	$15,000
11	Traffic Control	1	ls	$15,000	/ls	$15,000
12	Landscaping	1	ls	$7,500	/ls	$7,500
				SUBTOTAL:		$163,419
				CONTINGENCY:	40%	$65,400
				SUBTOTAL:		$228,819
				SALES TAX (8.9%):	8.9%	$20,365
				CONSTRUCTION COST:		$249,184
	ENGINEERING, GEOTECHNICAL, LEGAL, ADMINISTRATION (35%):				35%	$87,214
				TOTAL:		$336,398 (4)
	GRAND TOTAL			TOTAL PROJECT COST:		$336,400

Notes

(1) Utility conflicts have not been researched.

(2) Includes 2" CSBC, 6" CSTC, & 3" ACP

(3) Pipe estimate includes: trench excavation, trench box, bedding, disposal of unsuitable materials, pipe, installation and backfill. Assumes native materials acceptable for backfill.

(4) Does not include land acquisition costs.

PROJECT NO: IP05

DATE: 02-Jan-03

LOCATION: Center Street East from Madison Avenue South to Main Trunk

DESCRIPTION: Eatonville, WA Improvement Project Order of Magnitude Cost Estimate

ITEM NO.	ITEM DESCRIPTION (In place)	QUANTITY	UNITS	UNIT COST	$/UNIT	COST
1	Mobilization	1	sum	0.07	% of sum	$10,665
2	Removal of Existing System	980	l.f	$8	/l.f.	$7,350
3	Conflicts with Utilities (1)	1	ls	$2,000	/ls	$2,000
4	Sawcutting	1,962	l.f.	$4	/l.f.	$7,848
5	Pavement Removal	436	yd2	$6	/yd2	$2,613
6	Pavement Restoration (2)	436	yd2	$21	/yd2	$9,147
7	Dewatering	1	ls	$7,500	/ls	$7,500
8	24" Dia. CPEP (3)	980	l.f.	$65	/l.f.	$63,700
9	Catch Basin Type 2, 48"	5	each	$2,940	/each	$14,700
10	Erosion Control Measures (Filter fence, etc...)	1	ls	$15,000	/ls	$15,000
11	Traffic Control	1	ls	$15,000	/ls	$15,000
12	Landscaping	1	ls	$7,500	/ls	$7,500
				SUBTOTAL:		$163,023
				CONTINGENCY:	40%	$65,200
				SUBTOTAL:		$228,223
				SALES TAX (8.9%):	8.9%	$20,312
				CONSTRUCTION COST:		$248,535
				ENGINEERING, GEOTECHNICAL, LEGAL, ADMINISTRATION (35%):	35%	$86,987
				TOTAL:		$335,522 (4)
	GRAND TOTAL			TOTAL PROJECT COST:		$335,500

Notes

(1) Utility conflicts have not been researched.
(2) Includes 2" CSBC, 6" CSTC, & 3" ACP
(3) Pipe estimate includes: trench excavation, trench box, bedding, disposal of unsuitable materials, pipe, installation and backfill. Assumes native materials acceptable for backfill.
(4) Does not include land acquisition costs.

PROJECT NO: IP06 DATE: 02-Jan-03
LOCATION: Center Street East from Bergeren Road to Madison Avenue South
DESCRIPTION: Eatonville, WA Improvement Project Order of Magnitude Cost Estimate

ITEM NO.	ITEM DESCRIPTION (In place)	QUANTITY	UNITS	UNIT COST	$/UNIT	COST
1	Mobilization	1	sum	0.07	% of sum	$12,917
2	Removal of Existing System	1,500	l.f	$8	/l.f.	$11,250
3	Conflicts with Utilities (1)	1	ls	$2,000	/ls	$2,000
4	Sawcutting	3,002	l.f.	$4	/l.f.	$12,008
5	Pavement Removal	583	yd2	$6	/yd2	$3,500
6	Pavement Restoration (2)	583	yd2	$21	/yd2	$12,250
7	Dewatering	1	ls	$7,500	/ls	$7,500
8	18" Dia. CPEP (3)	1,500	l.f.	$50	/l.f.	$75,000
9	Catch Basin Type 2, 48"	8	each	$2,940	/each	$23,520
10	Erosion Control Measures (Filter fence, etc...)	1	ls	$15,000	/ls	$15,000
11	Traffic Control	1	ls	$15,000	/ls	$15,000
12	Landscaping	1	ls	$7,500	/ls	$7,500
				SUBTOTAL:		$197,445
				CONTINGENCY:	40%	$79,000
				SUBTOTAL:		$276,445
				SALES TAX (8.9%):	8.9%	$24,604
				CONSTRUCTION COST:		$301,049
				ENGINEERING, GEOTECHNICAL, LEGAL, ADMINISTRATION (35%):	35%	$105,367
				TOTAL:		$406,416 (4)
	GRAND TOTAL			TOTAL PROJECT COST:		$406,400

Notes

(1) Utility conflicts have not been researched.
(2) Includes 2" CSBC, 6" CSTC, & 3" ACP
(3) Pipe estimate includes: trench excavation, trench box, bedding, disposal of unsuitable materials, pipe, installation and backfill. Assumes native materials acceptable for backfill.
(4) Does not include land acquisition costs.

PROJECT NO: IP07 DATE: 02-Jan-03

LOCATION: Adams Avenue South between Center Street West and Prospect Street East

DESCRIPTION: Eatonville, WA Improvement Project Order of Magnitude Cost Estimate

ITEM NO.	ITEM DESCRIPTION (In place)	QUANTITY	UNITS	UNIT COST	$/UNIT	COST
1	Mobilization	1	sum	0.07	% of sum	$6,785
2	Conflicts with Utilities (1)	1	ls	$2,000	/ls	$2,000
3	Sawcutting	1,202	l.f.	$4	/l.f.	$4,808
4	Pavement Removal	233	yd2	$6	/yd2	$1,400
5	Pavement Restoration (2)	233	yd2	$21	/yd2	$4,900
6	Dewatering	1	ls	$7,500	/ls	$7,500
7	18" Dia. CPEP (3)	600	l.f.	$50	/l.f.	$30,000
8	Catch Basin Type 2, 48"	3	each	$2,940	/each	$8,820
9	Erosion Control Measures (Filter fence, etc...)	1	ls	$15,000	/ls	$15,000
10	Traffic Control	1	ls	$15,000	/ls	$15,000
11	Landscaping	1	ls	$7,500	/ls	$7,500
				SUBTOTAL:		$103,713
				CONTINGENCY:	40%	$41,500
				SUBTOTAL:		$145,213
				SALES TAX (8.9%):	8.9%	$12,924
				CONSTRUCTION COST:		$158,137
				ENGINEERING, GEOTECHNICAL, LEGAL, ADMINISTRATION (35%):	35%	$55,348
				TOTAL:		$213,485 (4)
	GRAND TOTAL			TOTAL PROJECT COST:		$213,500

Notes

(1) Utility conflicts have not been researched.
(2) Includes 2" CSBC, 6" CSTC, & 3" ACP
(3) Pipe estimate includes: trench excavation, trench box, bedding, disposal of unsuitable materials, pipe, installation and backfill. Assumes native materials acceptable for backfill.
(4) Does not include land acquisition costs.

PROJECT NO: IP08 DATE: 02-Jan-03

LOCATION: Washington Avenue between Larson Street West and Prospect Street East

DESCRIPTION: Eatonville, WA Improvement Project Order of Magnitude Cost Estimate

ITEM NO.	ITEM DESCRIPTION (In place)	QUANTITY	UNITS	UNIT COST	$/UNIT	COST
1	Mobilization	1	sum	0.07	% of sum	$6,615
2	Removal of Existing System	650	l.f	$8	/l.f.	$4,875
3	Conflicts with Utilities (1)	1	ls	$2,000	/ls	$2,000
4	Sawcutting	1,302	l.f.	$4	/l.f.	$5,208
5	Pavement Removal	217	yd2	$6	/yd2	$1,300
6	Pavement Restoration (2)	217	yd2	$21	/yd2	$4,550
7	Dewatering	1	ls	$7,500	/ls	$7,500
8	12" Dia. CPEP (3)	650	l.f.	$35	/l.f.	$22,750
9	Catch Basin Type 2, 48"	3	each	$2,940	/each	$8,820
10	Erosion Control Measures (Filter fence, etc...)	1	ls	$15,000	/ls	$15,000
11	Traffic Control	1	ls	$15,000	/ls	$15,000
12	Landscaping	1	ls	$7,500	/ls	$7,500
				SUBTOTAL:		$101,118
				CONTINGENCY:	40%	$40,400
				SUBTOTAL:		$141,518
				SALES TAX (8.9%):	8.9%	$12,595
				CONSTRUCTION COST:		$154,113
				ENGINEERING, GEOTECHNICAL, LEGAL, ADMINISTRATION (35%):	35%	$53,940
				TOTAL:		$208,053 (4)
	GRAND TOTAL			TOTAL PROJECT COST:		$208,100

Notes

(1) Utility conflicts have not been researched.

(2) Includes 2" CSBC, 6" CSTC, & 3" ACP

(3) Pipe estimate includes: trench excavation, trench box, bedding, disposal of unsuitable materials, pipe, installation and backfill. Assumes native materials acceptable for backfill.

(4) Does not include land acquisition costs.

PROJECT NO: IP09 DATE: 02-Jan-03

LOCATION: Penn Avenue North between Lynch Street West and Carter Street West

DESCRIPTION: Eatonville, WA Improvement Project Order of Magnitude Cost Estimate

ITEM NO.	ITEM DESCRIPTION (In place)	QUANTITY	UNITS	UNIT COST	$/UNIT	COST
1	Mobilization	1	sum	0.07	% of sum	$6,753
2	Conflicts with Utilities (1)	1	ls	$2,000	/ls	$2,000
3	Sawcutting	1,452	l.f.	$4	/l.f.	$5,808
4	Pavement Removal	242	yd2	$6	/yd2	$1,450
5	Pavement Restoration (2)	242	yd2	$21	/yd2	$5,075
6	Dewatering	1	ls	$7,500	/ls	$7,500
7	12" Dia. CPEP (3)	725	l.f.	$35	/l.f.	$25,375
8	Catch Basin Type 2, 48"	4	each	$2,940	/each	$11,760
9	Erosion Control Measures (Filter fence, etc...)	1	ls	$15,000	/ls	$15,000
10	Traffic Control	1	ls	$15,000	/ls	$15,000
11	Landscaping	1	ls	$7,500	/ls	$7,500
				SUBTOTAL:		$103,221
				CONTINGENCY:	40%	$41,300
				SUBTOTAL:		$144,521
				SALES TAX (8.9%):	8.9%	$12,862
				CONSTRUCTION COST:		$157,383
				ENGINEERING, GEOTECHNICAL, LEGAL, ADMINISTRATION (35%):	35%	$55,084
				TOTAL:		$212,467 (4)
	GRAND TOTAL			TOTAL PROJECT COST:		$212,500

Notes

(1) Utility conflicts have not been researched.

(2) Includes 2" CSBC, 6" CSTC, & 3" ACP

(3) Pipe estimate includes: trench excavation, trench box, bedding, disposal of unsuitable materials, pipe, installation and backfill. Assumes native materials acceptable for backfill.

(4) Does not include land acquisition costs.

PROJECT NO: IP10 | DATE: 02-Jan-03

LOCATION: Intersection of Hill Top Area and Eatonville Highway West

DESCRIPTION: Eatonville, WA Improvement Project Order of Magnitude Cost Estimate

ITEM NO.	ITEM DESCRIPTION (In place)	QUANTITY	UNITS	UNIT COST	$/UNIT	COST
1	Mobilization	1	sum	0.07	% of sum	$11,420
2	Removal of Existing System	750	l.f	$8	/l.f.	$5,625
3	Conflicts with Utilities (1)	1	ls	$2,000	/ls	$2,000
4	Sawcutting	1,502	l.f.	$4	/l.f.	$6,008
5	Pavement Removal	417	yd2	$6	/yd2	$2,500
6	Pavement Restoration (2)	417	yd2	$21	/yd2	$8,750
7	Dewatering	1	ls	$7,500	/ls	$7,500
8	36" Dia. CPEP (3)	750	l.f.	$100	/l.f.	$75,000
9	Improve Drainage Ditch Flow along Larson Street West	650	l.f	$10	/l.f.	$6,500
10	Catch Basin Type 2, 48"	4	each	$2,940	/each	$11,760
11	Erosion Control Measures (Filter fence, etc...)	1	ls	$15,000	/ls	$15,000
12	Traffic Control	1	ls	$15,000	/ls	$15,000
13	Landscaping	1	ls	$7,500	/ls	$7,500
				SUBTOTAL:		$163,143
				CONTINGENCY:	40%	$65,300
				SUBTOTAL:		$228,443
				SALES TAX (8.9%):	8.9%	$20,331
				CONSTRUCTION COST:		$248,774
	ENGINEERING, GEOTECHNICAL, LEGAL, ADMINISTRATION (35%):				35%	$87,071
				TOTAL:		$335,845 (4)
	GRAND TOTAL			TOTAL PROJECT COST:		$335,800

Notes

(1) Utility conflicts have not been researched.
(2) Includes 2" CSBC, 6" CSTC, & 3" ACP
(3) Pipe estimate includes: trench excavation, trench box, bedding, disposal of unsuitable materials, pipe, installation and backfill. Assumes native materials acceptable for backfill.
(4) Does not include land acquisition costs.

PROJECT NO: IP11 DATE: 02-Jan-03

LOCATION: Antonie Avenue North between Williams Addition and Center Street West

DESCRIPTION: Eatonville, WA Improvement Project Order of Magnitude Cost Estimate

ITEM NO.	ITEM DESCRIPTION (In place)	QUANTITY	UNITS	UNIT COST	$/UNIT	COST
1	Mobilization	1	sum	0.07	% of sum	$8,273
2	Removal of Existing System	575	l.f	$8	/l.f.	$4,313
3	Conflicts with Utilities (1)	1	ls	$2,000	/ls	$2,000
4	Sawcutting	1,952	l.f.	$4	/l.f.	$7,808
5	Pavement Removal	379	yd2	$6	/yd2	$2,275
6	Pavement Restoration (2)	379	yd2	$21	/yd2	$7,963
7	Dewatering	1	ls	$7,500	/ls	$7,500
8	18" Dia. CPEP (3)	975	l.f.	$35	/l.f.	$34,125
9	Catch Basin Type 2, 48"	5	each	$2,940	/each	$14,700
10	Erosion Control Measures (Filter fence, etc...)	1	ls	$15,000	/ls	$15,000
11	Traffic Control	1	ls	$15,000	/ls	$15,000
12	Landscaping	1	ls	$7,500	/ls	$7,500

SUBTOTAL:		$126,456
CONTINGENCY:	40%	$50,600
SUBTOTAL:		$177,056
SALES TAX (8.9%):	8.9%	$15,758
CONSTRUCTION COST:		$192,814
ENGINEERING, GEOTECHNICAL, LEGAL, ADMINISTRATION (35%):	35%	$67,485
TOTAL:		$260,299 (4)
GRAND TOTAL — TOTAL PROJECT COST:		$260,300

Notes

(1) Utility conflicts have not been researched.

(2) Includes 2" CSBC, 6" CSTC, & 3" ACP

(3) Pipe estimate includes: trench excavation, trench box, bedding, disposal of unsuitable materials, pipe, installation and backfill. Assumes native materials acceptable for backfill.

(4) Does not include land acquisition costs.

Appendix D

EQUIVALENT SERVICE UNIT (ESU) WORKSHEETS

LAND USE CODES

The following standard four digit code system for identifying and coding LAND USE ACTIVITIES will be used in Pierce County.

For ready reference, GENERAL series category of codes are as follows:

1100 -- Lodging
1400 -- Mobile Home Parks
1900 -- Condominiums
2100 -- Food processing
2200 & 2300 -- Textiles
2400 -- Lumber
2600 -- Paper products
2700 -- Printing/Publishing
2800 -- Chemicals
2900 -- Petroleum
3100 -- Rubber products
3200 -- Concrete and clay products
3300 -- Smelting/Refining
3400 -- Metal products
4100 -- Railroads
4200 -- Motor vehicles (transportation)
4300 -- Aircraft
4400 -- Marine craft
4500 -- Highways
4500 -- Street Right-of-Way
4600 -- Parking
4700 -- Communications
4800 -- Utilities
4900 -- Freight and travel
5100 -- Wholesale
5200 -- Building materials
5300 -- Retail Trade
5300 -- Shopping centers
5500 -- Automobile retail sales
5600 -- Clothing sales
5700 -- Furniture sales
5800 -- Eating and Drinking places
5900 -- Stores (retail)
6100 -- Banks
6100 -- Insurance/Real Estate
6200 -- Laundry/Linen service
6200 -- Personal Services
6300 -- Advertising
6300 -- Business Services
6400 -- Repair services
6500 -- Professional
6600 -- Construction
6700 -- Government
6800 -- Educational activities
6900 -- Churches
7100 -- Libraries/Museums
7200 -- Arenas/Race tracks
7300 -- Amusement parks
7400 -- Recreational activities
7600 -- Parks
7700 -- Timberland
8100 -- Agriculture (Farms)
8300 -- Timber products
8400 -- Fishing activities
8500 -- Quarries
8500 -- Sand & Gravel
8600 -- Reforestation
8700 -- Designated Forest Land
9200 -- Wildlife
9300 -- Water area
9400 -- Floor space (vacant)

VACANT LAND CODES
9100 -- Acreage
9600 -- Residential
9700 -- Commercial
9800 -- Industrial

Appendix D1

RESIDENTIAL (SFR)

Town of Eatonville

SFR - SINGLE FAMILY RESIDENTIAL, VACANT RESIDENTIAL, & VACANT COMMERCIAL

1 ESU = 3000 Square Feet Impervious
Eatonville Municipal Code 13.24.030 E.

OBJECTID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	ESU
1	416104042	SMITH EDWARD F & P JEANNETTE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9640	1
2	416104042	SMITH EDWARD F & P JEANNETTE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	124922	1
3	416104043	KEYBANK USA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	72401	1
4	416108019	PLAAS MIKE & KATIE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	81687	1
5	416113034	NELSON CORA J LIVING TRUST	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	123454	1
6	416104006	FORD BETTY E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	44646	1
7	416108018	RABANG TYRONE J & RISA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	40150	1
8	416151041	SOBHANI ENAYATOLLAH & JUDITH A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	254293	1
9	416155005	SHOLIN MEREDITH A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	73053	1
10	416141055	BURLINGAME HAROLD W & ROSALIE ETAL	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	1710459	1
11	416151010	GOODWIN LEAH L & ALLEN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	53991	1
12	416142100	NARVAEZ THOMAS & HELEN D NEIGHBOR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	332203	1
13	416142100	NARVAEZ THOMAS & HELEN D NEIGHBOR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	2022	1
14	416151038	SELTUN MAE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	86035	1
15	416141048	BLANCHER HOWARD S JR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	211232	1
16	416141057	BURLINGAME HAROLD & ROSALIE ETAL	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	36074	1
17	416155001	SCIGLIANO MICHAEL J & BEVERLY M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	134283	1
18	416146018	ZACHARY DARREN W & KRISTINE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	57661	1
19	416141031	SWANSON DALE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	34269	1
20	416145001	POOLE CHRISTOPHER F	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	17051	1
21	416146017	BENNETT STEVEN E & DENISE R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	39957	1
22	416142035	KILDAHL FRANK & MARILYN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14679	1
23	416142094	BRADEN HOWARD & RUTH M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	376413	1
24	9660000150	MINOTT RICHARD G JR & MARGIT	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10192	1
25	9660000170	COLE BOBBY J & PATRICIA H	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12695	1
26	6021710260	CHIDESTER LOREN J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8512	1
27	6021710270	TRIGGS DAVID & ELIZABETH	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8755	1
28	6021710280	MILLER MICHAEL L & B Y CONANT	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8513	1
29	416142032	SWANSON ROY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	38400	1
30	416142024	LYNCH BRIAN T & DIANE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	57492	1
31	416142029	MC TEE CHARLES K JR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	79259	1
32	416142019	ROOT JOSEPH R & DIANA G	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	58483	1
33	6021710250	SUTHERLAND RONALD B & DINA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8580	1
34	416142021	HIGHTOWER JOHN D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	32516	1
35	9660000180	GUERTNER WILLIAM C & EVA R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10731	1
36	6021710230	PARKER SEBASTIAN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10555	1
37	6021710240	SMITH TOM D & LORI K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8525	1
38	8867100131	CLEVENGER DENNIS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12197	1
39	6021710290	SMITH TONY H JR II	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8557	1
40	9660000190	SCHAUB RONALD D & MELAINE J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12212	1
41	9660000120	ANDERSON STEPHEN D & MARTHA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13056	1
42	9660000110	BECKENDORF R W	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12985	1
43	9660000200	JUMPER WAYLAN B & DIANA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12759	1
44	6021710220	PERUSSE PHILIP C & DONNA K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11207	1
45	8867100100	LOFQUIST WARREN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12789	1
46	8867100070	ELSTON GEORGE G	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12784	1
47	8867100040	MARCHETTI ARLENE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12787	1
48	8867100010	BUTLER V R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14444	1
49	416142022	RADER WILLIAM F JR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14412	1
50	9660000100	ANDRADE HECTOR C ETAL	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12499	1
51	416142036	KRONES EARL R & ELIZABETH J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13017	1
52	416142057	HEFLEY HAROLD	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8898	1
53	9660000210	ZACHARY DARREN W & KRISTINE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12603	1
54	416145009	TILTON EDWARD K & VALERIE D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	65282	1

SFR - SINGLE FAMILY RESIDENTIAL, VACANT RESIDENTIAL, & VACANT COMMERCIAL

1 ESU = 3000 Square Feet Impervious
Eatonville Municipal Code 13.24.030 E.

OBJECTID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	ESU
55	416145010	SEVERSON ROBERT E & MARYA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	67045	1
56	416142026	DEAN JAMES L & CAROLE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	17569	1
57	8867100110	COX BRETT R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12781	1
58	8867100080	KILDAHL KENNETH F & LINDA K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12786	1
59	8867100050	BURGESS GENEVIEVE T	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12789	1
60	8867100020	RIDGWAY GREG N & KARIN L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14413	1
61	416142056	HEADLEE JACK R JR & MARY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7316	1
62	9660000090	KRAMBRINK JOHN A & JANET I	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12466	1
63	9660000220	SLUPIANEK BARBARA B	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12623	1
64	6021710210	STURDIVANT ANDREW J & AMY R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8654	1
65	416142044	DELAURANTI JOAN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13709	1
66	416142025	BERTRAM JAMES PATRICK	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	17265	1
67	416142055	MDP ACCOUNTS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10979	1
68	8867100120	SNIEZAK MICHAEL J & AMY M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12787	1
69	8867100090	OSTROM ROBERT A & SUZANNE C	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12788	1
70	8867100060	BERTRAM CHRIS D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12791	1
71	416145004	WORKMAN BRYAN K & LINDA S	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	66341	1
72	6021710200	BETSCHART LORRON A & SALLYANN J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8672	1
73	9660000080	WILLIAMS DAVID M & MONICA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12538	1
74	6021710010	RUISCH FRANK	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8375	1
75	9660000230	HOBBS ROBERT W & BELYNDA R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12872	1
76	416142041	MATOUSEK SAM C JR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	18011	1
77	416142049	GILBERTSON RONALD L & LORI M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8627	1
78	416142003	HENLEY GEORGE B & KIMBERLY K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6872	1
79	6021710190	DORN JOSEPH P & R I	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9213	1
80	6021710020	BILLDT LISA D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8366	1
81	6021710180	MOBLEY WILLIAM W & CHARLOTTE K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8866	1
82	416142102	DALY GREG P & JAMIE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12092	1
83	6021710110	SMITH CHARLES A & SUZANNE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8135	1
84	416142018	FISHER PAUL G & ELIZABETH A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6777	1
85	9660000240	SANCHEZ ANDRES	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12552	1
86	6021710100	LONN LESTER L & HELEN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8528	1
87	6021710170	STREICH WADE L & MARA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9482	1
88	416142062	METTLER JAMES R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	16204	1
89	6021710030	DOMSER ROBERT W & NORMA S	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8355	1
90	416141050	BERTRAM MICHAEL J & MARGARET	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	59158	1
91	416142092	PAINTER BRUCE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14823	1
92	9660000061	CLEVENGER OKEY & SHIRLEY M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	18624	1
93	6021710120	ESTEL CHARLES E & A EVELYN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9365	1
94	6021710090	STALLMAN JASON T & RACHEL L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9183	1
95	416151049	MORRISON BERT L & LINDA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	218705	1
96	9660000250	FLAMME ELAINE C	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12713	1
97	6021710040	HOLT ROBERT W JR & THERESA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8442	1
98	6021710160	MELTON JUSTIN R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10175	1
99	6021710130	ROOF RICHARD A & MICHELLE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9655	1
100	416142063	STRANIK SUSAN F	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	27809	1
101	6021710140	BECKETT ROBERT E & DEBORAH M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8762	1
102	6021710150	HATCH THAYNE E & TAMMIE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8771	1
103	6021710080	WOOD MICHAEL S	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9245	1
104	6021710050	STARKEL MARK J & JODY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7953	1
105	416146005	KNELLEKEN MICHAEL W & KATHY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11576	1
106	9660000260	GORDON GLORIA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12757	1
107	416145012	RICHARDS KEITH M & BARBARA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	179594	1
108	6021710060	ROBBINS CHARLES E & NORINE J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11055	1

SFR - SINGLE FAMILY RESIDENTIAL, VACANT RESIDENTIAL, & VACANT COMMERCIAL

1 ESU = 3000 Square Feet Impervious
Eatonville Municipal Code 13.24.030 E.

OBJECTID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	ESU
109	6021710070	JONES GREGG & DIANA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9625	1
110	416146009	OFSTAD BEVERLY A & RONALD B	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13091	1
111	416141051	ARNESTAD DONALD M & CAROL A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	62561	1
112	416146010	HUDSPETH ROBERT & NANCY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11352	1
113	416146006	HAYNES ELWIN T	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	17898	1
114	9660000270	DART KEN O & CHRISTINE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13045	1
115	416146008	WARD ROBERT L & CAROL J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13096	1
116	9660000030	CAILLIER KEVIN E & KIM B	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13309	1
117	416146011	HUDSPETH ROBERT & NANCY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11729	1
118	416146023	BRAITHWAITE KAY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8582	1
119	9660000280	BOETTCHER SETH & WENDY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13237	1
120	416146022	BRAITHWAITE KAY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11835	1
121	416145013	RICHARDS GEORGE T & ANNABELLE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	178185	1
122	416142096	WHITE JOHN A & SUSAN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	21191	1
123	416146007	PAINTER DAN B & PAMELA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15638	1
124	416146016	MEREDITH MARY M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11539	1
125	9660000020	KELLY RODNEY J & KAREN L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9068	1
126	9660000010	KELLY RODNEY J & KAREN L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10777	1
127	416146024	BRAITHWAITE KAY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9484	1
128	416146021	BRAITHWAITE KAY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12433	1
129	416142101	FRITH RICKY H & LINDA K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10722	1
130	3166000080	WALKINSHAW ERIC & CATHARINE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14969	1
131	3166000090	CARNEY RICHARD & JUNE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	18533	1
132	416147006	MATTHIESEN MICHAEL E & CHERYL A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9578	1
133	9660020060	GOETZ THOMAS & FAWN L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10216	1
134	9660020050	HALE CONNIE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7906	1
135	9660020040	TREYZ PAUL & GRACE E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8815	1
136	9660020030	CROSS PAUL J & JENNIE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8582	1
137	9660020020	ERICKSON EINER T & EDITH E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8501	1
138	9660020010	BARNETT MARGARET A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9466	1
139	3605000780	CHAPPELL CAROL L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15134	1
140	3605000690	MCCARTY CLIFFORD B	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11096	1
141	3605000600	HIGHTOWER DENNIS A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10506	1
142	3166000060	STRONG FAMILY TR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	33986	1
143	3605000180	MATTHEWS FRED & CAROL	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	3711	1
144	3605000100	BUTLER CHARLES H & LYNN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14860	1
145	416144142	GOOD PAUL & JOAN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	135490	1
146	416147007	VAN DEREN CLYDE W & HELEN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9709	1
147	6021670230	MURPHY WENDELL C & BRENDA P	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	26443	1
148	3537000370	HANNA EVELLYN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	61342	1
149	3605000610	THOMPSON BILLIE K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6376	1
150	9660020070	RODEWALD DEVIN R & MELANIE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9429	1
151	3605000200	BUTLER CHARLES H & LYNN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7709	1
152	3605000790	JUMPER BRANDON & DEBORAH	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10299	1
153	9660020090	POLLOCK BARBARA H	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8363	1
154	9660020101	FOUST FREDDA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13234	1
155	9660020111	RODRIGUEZ JOEL R & MARIA H	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9460	1
156	9660020120	ELDER BEATRICE V	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9448	1
157	9660020080	DRAKE VALERIE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8137	1
158	416147008	BUSH LEROY H & VIOLA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9708	1
159	3605000620	LARSON GERALD B & JOAN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6370	1
160	3166000100	ESTES ROBERT & CHARLENE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9679	1
161	3605000110	BUTLER CHARLES H & LYNN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5893	1
162	3605000030	LEE CHARLES L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7002	1

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OBJECTID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	ESU
163	3605000210	OSTERBERG DEBORAH G	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8164	1
164	3605000801	RYAN MICHAEL D & RHONDA D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14320	1
165	3605000720	MILLER DIXIE L ETAL	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9554	1
166	3537000350	BEACH PHILIP F & HARRIETT	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	82513	1
167	3605000120	BUTLER CHARLES H & LYNN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5896	1
168	3605000220	BOYD GENE L & CHARLENE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7219	1
169	3605000640	MILLER LOUIS L JR & CAROL J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6356	1
170	5543000090	JOHNSON KEITH R & L M MICHENER	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13491	1
171	5543000010	RICKETTS GARY R & RENEE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	21048	1
172	3605000810	HIGHTOWER JOHN D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10481	1
173	3605000730	WILLIAMS DAVID A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6459	1
174	6715000141	FORD PHILIP H & SONJIA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10096	1
175	3166000110	LA DOUX TED J & KATHY A M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11303	1
176	3605000230	HIGHTOWER JOHN D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	3608	1
177	3605000740	LILLOREN ARNOLD O & PEGGY R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7209	1
178	6021670240	PACKARD JAMES E & K I TUGEND	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10945	1
179	3605000320	POWELL WILLIAM D & MARJORIE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7260	1
180	3605000240	HIGHTOWER JOHN D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7212	1
181	3605000901	HIGHTOWER JOHN D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	3948	1
182	3605000820	HIGHTOWER JOHN D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6955	1
183	3605000460	DAVIS MILDRED & JAMES R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7720	1
184	3605000660	VAN CLEVE GEORGE P JR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12679	1
185	5543000080	BIRKETT JAMES A & HERMILINDA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14094	1
186	3605000550	EATONVILLE SCHOOL DIST #404	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5616	1
187	5543000020	HART BRET A & KAREN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	21319	1
188	3166000040	SCHAUB ROBERT E & GAIL C	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	20009	1
189	3605000750	FREDRICKSON REBECCA H	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9205	1
190	6715000142	BENNETT STEVEN E & DENISE R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10270	1
191	3605000330	WINTER DANA A & MICHAEL G	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7259	1
192	3605000831	RIVARD MICHAEL K & DEBRA K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8293	1
193	3605000250	HOLT ROBERT W SR & PAMELA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7207	1
194	3605000560	BLACKETT JAMES R & CHRISTINE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8447	1
195	3605000470	MC VAY MICHAEL E & ELIZABETH A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6212	1
196	3537000330	BOETTCHER CALEB & SARAH E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	39174	1
197	416158002	HANSEN ALEXANDER F & KAREN J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9429	1
198	6715000120	O NEIL MARTHA E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11962	1
199	6715000081	SOLAND BRIAN C L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10096	1
200	6715000051	BYERS WALTER E & MARY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9147	1
201	6715000020	SIMMONS JEFFREY S & ANGELA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10680	1
202	3605000841	HIGHTOWER DENNIS A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	19205	1
203	3605000760	HUNTER JASON E & ANN MARY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12949	1
204	3605000670	LUCHT DENNIS & KAY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12652	1
205	5543000070	OLSON GERALD F & DENISE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14230	1
206	3605000260	JOHNSON SHIRLEY K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7202	1
207	3605000480	RICHARDS GEORGE L & BERYL F	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6207	1
208	416147009	CHRISTIAN W HARRISON	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	16599	1
209	5543000030	BOWMAN GORDON B & KATHLEEN R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	20822	1
210	3605000080	EATONVILLE CHURCH OF CHRIST	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14008	1
211	6021670250	PRICE DIANE G	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9078	1
212	416158003	THOMPSON DALE C & HANNAH D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	18651	1
213	3605000570	MOOERS BETTY R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8178	1
214	6715000150	CARNEY JOHN W & DIANN K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15393	1
215	6021670220	ROEBUCK JAMES M & TONYA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11173	1
216	3537000260	SCARFO MICHAEL J & KARIN J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	18381	1

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217	6715000062	SMITH EUGENE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15389	1
218	6715000101	SMITH ROBERT C & CHERYL A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7695	1
219	416158001	DOLL DANIEL L & SUSAN I	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10009	1
220	3537000210	JENSEN ERIC K & PATRICIA W	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	20863	1
221	6715000132	HIGHTOWER DENNIS A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5965	1
222	6715000131	HIGHTOWER DENNIS A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6067	1
223	6715000090	HEERSINK GREGG A & AMY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5820	1
224	6715000030	BLACK DOUGLAS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10817	1
225	3605000930	HIGHTOWER JOHN D & LORRAINE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5346	1
226	3605000850	CHRISTIAN WILLIAM H	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14085	1
227	6021670260	POTTER SHAWN N	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8515	1
228	3605000770	WIENHOLZ WAYNE A II & KELLY S	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13038	1
229	3605000680	HEADLEE JACK R & MARY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12742	1
230	3605000580	ALLISON BOBBI	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5941	1
231	3537000280	DOW SIDNEY L & MARIE TTEE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	52761	1
232	3537000310	SCHMIDT THOMAS D & PATRICIA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	32824	1
233	3537000320	ROED KENNETH J & SHERRY H	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	39056	1
234	3605000090	HRVATIN ANTONIA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13968	1
235	416143062	MARSHALL LORAINE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	34290	1
236	3537000250	FREEMAN SCOTTY L & DEBORAH K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	17450	1
237	3605000510	MORRIS BRUCE J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8707	1
238	6021670270	SCALF RANDALL L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8646	1
239	3605000590	LARSON GERALD B & JOAN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5696	1
240	6021670210	MEADOWS DAVID S & LACEY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8155	1
241	3537000240	VIRGINIA BAKER WOOLF REV LIV TR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	31378	1
242	5543000042	MOORE TERRANCE W	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8443	1
243	416143044	MANUFACTURERS & TRADERS TR CO	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	18387	1
244	5543000041	O'NEAL RICKY R & KELLI M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8910	1
245	3537000230	SIMONS GLEN R & DEANNA R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	22650	1
246	6715000160	OLDEN DALE C JR & J J BOWERMAN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10318	1
247	6715000180	HAYNES ARNDON	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	24298	1
248	6715000201	LAMBERT CHRISTOPHER J & CAROL M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6206	1
249	6715000202	ERICKSON MARJORIE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5953	1
250	6715000220	O'NEILL D D & J A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7569	1
251	6021670280	STEPHENS TOD E & HEIDI K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9288	1
252	6715000270	MILLER HELENE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8132	1
253	3605000980	BERNOVICH JOHN W	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	19562	1
254	3605001050	BOETTCHER PAUL & CONNIE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12023	1
255	3605001140	COLLIS DONALD & JUDITH K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5921	1
256	3537000020	MCKAY BETTY J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	26786	1
257	3605001210	BICKFORD DOROTHY M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13732	1
258	6021670200	COVEY JONATHAN N	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7762	1
259	3605001260	JONES KEVIN E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13357	1
260	3605001670	SOBHANI ENAYATOLLAH & JUDY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5720	1
261	6715000340	KLUMP PATRICIA A & STEVEN J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	36631	1
262	6021670290	BAKER LARRY L SR & DONNA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14972	1
263	3605001150	MALCOM KEITH	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11661	1
264	3605001680	CHRISTENSEN RICHARD G & J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5910	1
265	6715000281	ALLISON BETTY J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8194	1
266	3537000030	JUDD ANTHONY D & GWENDOLYNN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	29532	1
267	6021670190	HAUSNER NICHOLAS J & MELANIE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8148	1
268	6715000170	OLDEN DALE N	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8314	1
269	3605001790	MURPHY CLIFFORD L & KERRI L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11841	1
270	6715000203	DAWKINS DANIEL J & DEANNA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6050	1

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271	3605001270	WINEBRENNER JAMES A & MARGARET M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6672	1
272	6021670300	KEENEY DARYL C & JO ANNE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13351	1
273	3605001220	HARPER RAYMOND N JR & PATRICIA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11401	1
274	3605001690	CHRISTENSEN RICHARD G	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5912	1
275	3605001070	HOFFMAN DANIAL A & THERESA H	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12224	1
276	6021670180	JUMPER JAMES A & VICKIE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8133	1
277	6715000211	MILLER JEAN ANN & RUTH A WILLIAMS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6048	1
278	6021670310	MAY RUTH L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8460	1
279	6715000240	URICH JOHN C	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5900	1
280	6715000282	MC GUIRE RODNEY L & MELANIE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10861	1
281	3537000040	RIDGWAY SCOTT M & SHEELAH M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	34362	1
282	3605000990	HIGHTOWER JOHN D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13063	1
283	3605001280	VAN EATON LOUISE & TOM	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6948	1
284	3605001340	VAN EATON ROBERT A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5839	1
285	6715000310	KNOX PATRICIA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5865	1
286	3537000140	ABRAHAMS M J & N L MAYS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	18617	1
287	3605001700	CHRISTENSEN RICHARD & JOAN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7558	1
288	6715000470	ROLAND MICHAEL R & CHERYL D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	44203	1
289	6715000351	WICKS SHEILA F	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7304	1
290	6715000321	CARLSON ANNA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12585	1
291	3537000100	DEKOFSKI STANLEY & LADONA K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	32478	1
292	6715000212	ANDERSON OLGA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15081	1
293	6715000250	JONES PATRICK S & JULIE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11747	1
294	6021670320	HOLT LARRY D & RUTH A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10956	1
295	6715000352	WICKS JOHN M & JUNE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7716	1
296	3537000180	AHLSTRAND GARY M & DEANNA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	22255	1
297	6021670330	VAN STEEN ALEX E & RUTH A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8778	1
298	3537000120	PETERSON EUGENE N & CATHERINE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	25222	1
299	3537000050	BOETTCHER DANIEL & MARIE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	22335	1
300	416143010	MC KASSON CHARLES G & JUDITH	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10930	1
301	6715000290	WING GARY L & DONNA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10875	1
302	6715000361	SMITH JOHN T & DARLENE J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5965	1
303	3605001000	ARNESON LYNN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6535	1
304	6021670340	THORSON JERRY & JENNIFER MILLER	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10157	1
305	416154033	ARNESON LYNN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	37153	1
306	3605001171	MADDEN GENEVA N	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11908	1
307	3605001300	VAN EATON THOMAS M & LOUISE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	20246	1
308	3537000190	PALMER HENRY J & JOANN J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	30444	1
309	6715000362	DYKE ROBERT C & LINDA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11870	1
310	6021670160	HELPING HAND HOUSE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8511	1
311	3537000130	MCALEXANDER WILLIAM C III & L E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	24742	1
312	416143012	LONN LOUIS & JEAN N	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11282	1
313	6715000260	HUSTED BRIAN L & THERESA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9209	1
314	6023050010	LEMON ROBERT J & SCHERILL A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9244	1
315	3605001001	ARNESON LYNN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6537	1
316	3537000200	FISHER VERNON & SYLVIA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	24949	1
317	416147003	MCKASSON CHARLES D & ROBECCA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7962	1
318	6021670150	DOWNS WILLIAM R & SUSANNA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9209	1
319	6715000300	CONLEY DAVID A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9951	1
320	3605000970	MCDANIEL BRENDA K & JIMMY D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10840	1
321	6715000372	PETERSEN DALLAS A & SANDRA C TTEE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5860	1
322	3605001010	MC BRIDE WM MRS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6539	1
323	3605001090	GUENTHER PATRICK H & KATHLEEN K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6009	1
324	3537000160	PATTERSON TIMOTHY R & YVONNE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	28537	1

SFR - SINGLE FAMILY RESIDENTIAL, VACANT RESIDENTIAL, & VACANT COMMERCIAL

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OBJECTID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	ESU
325	416147004	MCKASSON CHARLES G & JUDITH K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7984	1
326	3605001192	HESSLER JACK & MONA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8368	1
327	3537000080	IVERSON JOHN & ARLEEN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14203	1
328	6023050030	MILLER JON C & CHRISTY R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8697	1
329	6715000480	DEAL SHELLEY A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	18265	1
330	3537000170	ARMSTRONG BERNARD J & JUDITH A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	31695	1
331	416143005	HARMON JERRY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11594	1
332	6021670370	PETERS DAVID M & PATRICIA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9408	1
333	6715000380	DELL DARBY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5972	1
334	3605001020	GALLAGHER THOMAS M & J L JENNINGS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6541	1
335	6715000371	ESAREY JERROLD L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6010	1
336	3605001100	MEYER BRUCE F	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6006	1
337	3605001310	MORRISON BRUCE A ETAL	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6592	1
338	6021670140	TURNER PETER J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8699	1
339	6021670360	LINN DOUGLAS J & NE'SHA K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8197	1
340	3537000070	SEARCH ROGER L & KATHERINE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15193	1
341	6023050020	BOREN MICHAEL & HOLLY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8400	1
342	3605001200	HALE ELAM IVAN & MARY LOU	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	19989	1
343	6023050040	SUMMER LUCINDA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8457	1
344	6021670350	KING ADAM J & TERESA N	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9844	1
345	416143004	NOVAK VLADAMIR S & SVATAVA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8296	1
346	416143006	POTTS ELMER M & SHERRY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	18651	1
347	3605001030	LANIER TRAVIS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6544	1
348	3605001111	SCHWIND S D & R L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6003	1
349	6715000421	BURGESS JEFFREY A & JANIS L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12086	1
350	416143008	SMITH KIM K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6213	1
351	6023050050	GLOVER VICKIE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8461	1
352	6021670130	TIDBALL MARK D & C B WHITEHURST	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8632	1
353	6021670380	CLEVENGER JEFF R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10000	1
354	3605001041	SOLAND BRIAN L & JOSEPHINE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6546	1
355	6715000500	WALTER ROBERT J & DIXIE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	103832	1
356	3605001130	LUCHT BOBBY D & TANYA F	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6351	1
357	3605001112	SIENKIEWICH SCOTT C	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5577	1
358	416154072	CORP CHURCH OF LATTER-DAY SAINTS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	332318	1
359	416143014	PARKIN BRETT W & CHERRI E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11790	1
360	6023050060	HAWKINS JEFFREY L & SUSAN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8491	1
361	6715000422	CHAINEY JOYCE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15162	1
362	6021670510	IVERSON KIMBERLY A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11478	1
363	6715000492	SLATTEN TED	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13252	1
364	416143039	KOESEL DUANE & ELSA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8721	1
365	6021670120	WELLS KAREL A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9487	1
366	6023050070	HARVARD DALE & DEBRA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8468	1
367	6021670390	BRALLIER MICHAEL A & SHERYL L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9592	1
368	3605001042	SOLAND BRIAN L & JOSEPHINE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6419	1
369	6715000430	PREDMORE RONALD	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	36201	1
370	6022100010	MALOTT DANNY P & PAMELA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10184	1
371	6023050080	KURTH LAURIE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8473	1
372	416143040	HIBBARD ROSA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8764	1
373	6021670500	HELPING HAND HOUSE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10394	1
374	6023050090	OSTROM ALFRED R JR & SHAWN R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8441	1
375	6022100030	RICKETTS QUENT R & MARIN E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	18482	1
376	6021670400	CONGER STEVEN P & MAUREEN C	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9533	1
377	6021670110	METTLER JASON P	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8074	1
378	3581000100	WILLISTON RONALD E & SARA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10685	1

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OBJECTID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	ESU
379	6022100040	ABRAHAMSON RANDALL L & TERESA D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	19093	1
380	3581000110	BANKS ROBERT E & HELEN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8578	1
381	3581000120	MONROE JAMIE M & REBECCA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8139	1
382	3581000130	DUCKETT RICHARD & MARJORIE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12222	1
383	3605002840	WEAVER REBECCA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	4657	1
384	6021670490	BAKER LYNN N & MARIAN J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9664	1
385	416144098	CHRISTENSEN STEVEN R & SALLY M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12276	1
386	3605002350	DAWKINS MADORA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13115	1
387	6022100020	COSTA ROBERT	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9054	1
388	3605002410	WILCOX JUNE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	3982	1
389	3605002280	BAARDSON ARNOLD V & AUDREY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	22816	1
390	416143013	TOWN OF EATONVILLE TOWN CLERK TTEE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10840	1
391	6022100050	MCPHAIL DARIN & MICHELLE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8885	1
392	3605002790	WEAVER REBECCA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7122	1
393	6021670410	KEMPF CONAN A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9519	1
394	6021670100	GROSSI PHILIP & SANDRA K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8830	1
395	6022100060	TWEET PHILIP & SHAUNNA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13097	1
396	6023050110	MCCURTAIN MICHELLE S & CHRISTOPHER	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	45873	1
397	6022100070	SMITH GREGORY W & TERRI A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8468	1
398	6021670480	MILLER ANDREA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9053	1
399	3605002800	PALZER CHRIS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7001	1
400	6715000441	ZELMA SHARON V	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8398	1
401	6022100110	WINTER DONALD R & LISA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10344	1
402	6021670420	ESSELBACH FRANK W & BETTY J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9274	1
403	3581000090	IRWIN PEGGY J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9143	1
404	6022100080	HAUENSTEIN ANTHONY C & HEATHER L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10291	1
405	6021670090	MISNER THOMAS P & DEBORAH K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8607	1
406	3605002250	PIERCE COUNTY RURAL LIBRARY DIST	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11704	1
407	3605002170	EATONVILLE TOWN OF	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6091	1
408	6715000412	PETERS RODNEY J & LINDA C	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7683	1
409	6022100090	LAMOTHE LORI	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14436	1
410	6022100100	RICE ARLENE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12514	1
411	3581000140	LEIGH JULIE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8887	1
412	3605002373	VAN CLEVE ROSEMARIE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	19791	1
413	3605002426	MILLER TOMAS A & STACY A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10023	1
414	6996000031	CECCANTI EMILIO & CARMEN L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	21126	1
415	6715000391	BARLOW JOYCE J & NONA E WALCH	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11445	1
416	3605002180	LIND STEPHEN G	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12167	1
417	6021670430	HICKS GIL S & PENNY K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8817	1
418	6021670080	O'DOHERTY SEAN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8348	1
419	6715000512	GREEN DAVID R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	17401	1
420	3581000080	STEIN ROY J & MADALYN Y	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9276	1
421	3605002050	LA PLANTE ALICE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7843	1
422	6715000541	KING DENISE M F	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14217	1
423	6021670460	MOEBIUS ROBERT S	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9702	1
424	3581000150	KING JAMES J & DREITHA D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9480	1
425	3605002261	WIKANDER JOHN E & SANDRA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5867	1
426	416144104	DOHERTY ANNE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9728	1
427	6021670070	MILLER DANIEL L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8453	1
428	416154076	GONZALEZ CINDY LOU	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	43471	1
429	6996000081	LOVELL LEE & ANNETTE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	21772	1
430	3581000070	GRAIG JOELLEN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8745	1
431	6021670440	JACOBSEN ALFRED T & GLORIA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10219	1
432	416133022	VAN EATON JAMES P & EDWINNA F	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	214507	1

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433	6715000570	BRESTER ROBIN & KAREN FOLK	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	28985	1
434	3605002131	PATTERSON TIMOTHY R & YVONNE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	4102	1
435	3605002070	MARSHALL ROBERT L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7824	1
436	3581000160	MILES TED L & CAROL J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9049	1
437	6022090290	BENNETT EDWARD T & MICHELLE H	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14057	1
438	6022090220	LUBBESMEYER CONST INC	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13364	1
439	6715000513	LYDAY JOHN F & BETTE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	16677	1
440	416143026	BLOCK WALLACE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	59459	1
441	6996000020	SOULE EDWARD L JR & LARRAINE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13894	1
442	3605001940	RATH VICTOR B & PATRICIA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11898	1
443	6021670060	DALY JAMIE L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8619	1
444	416144105	KEMPF DALE C & SHERRI	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12189	1
445	6996000090	MC LANE PATRICK J & DONNA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12637	1
446	3581000060	BROWN DOUGLAS L & JUDY M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8987	1
447	3605002080	SJOBLOM ALLEN G & GINGER L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15699	1
448	6021670450	MIERKE DALE G & JODY M SHROYER	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12480	1
449	6022090230	MONEY RAYMOND J & BECKY C	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11940	1
450	3605002341	PETTERSON JAMES R JR & LIZA C	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	17833	1
451	6023200040	MOORE JASON C & YOLANDA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9445	1
452	416143064	CONANT ALBERT JR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9316	1
453	3581000170	SWICK SID A & VICKY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8880	1
454	6022090160	AMES BRAD C & JACQUELINE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11743	1
455	6022090150	KNAPP MICHAEL B & PAMELA E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12047	1
456	6021670050	COCHRAN TADGEL & COLLEEN C	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8572	1
457	416143063	CONANT ALBERT JR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10175	1
458	416154068	SMITH EUGENE LEE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	69344	1
459	416144026	FOSTER A D & R D SCHAFER-HEIYDT	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	4762	1
460	6715000514	TILLER MICHAEL W & PREMILA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	16316	1
461	3605002210	CONENT ALBERT & WANDA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12118	1
462	6996000010	HEACOCK CHARLES E & JEAN L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15019	1
463	3605001950	VAN HOOF SHARON L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5953	1
464	3581000050	HICKMAN WILLIAM D & CYNTHIA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9739	1
465	416144091	LA CHANCE VERDUN T & LAURA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15525	1
466	3605002404	JONES VICTOR M & ANGEL M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9814	1
467	3581000180	ROSS PETER JR & CAROL L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8921	1
468	6021670040	MORRIS ROBERT F & LOIS I	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9246	1
469	6023200010	JORDAN MICHAEL H & JOAN K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	24244	1
470	3605002020	CALDWELL FERN A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	17730	1
471	3605001960	NEUJAHR DEBRA R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11913	1
472	6022090140	WENNERLIND KARL J & APRIL M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13042	1
473	6022090320	CHRISTIE GREGORY L & DELMA K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13655	1
474	6022090180	TROUT DANIEL R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11693	1
475	6022090270	STANSBERRY SALLIE K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11712	1
476	6022090240	ZENTZ KENNETH C & AUTUMN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11727	1
477	416144132	WOOD CHRIS & REBECCA D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	17236	1
478	416144058	SKELLY SEAN & NORMELINDA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10374	1
479	3581000040	WARFIELD RONALD G & BECKIE A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8968	1
480	6022090190	GARVIDA DAVID JR & NOEMI	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11807	1
481	6021670030	RICHMOND WILLIAM D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14164	1
482	3605002342	KRONOFF SALLY E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11800	1
483	3581000190	MILLER NICHOLAS F & MARGARET E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9054	1
484	416144129	BURCH LANCE A & PAMELA H	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15859	1
485	416154019	REICHEL DUANE J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	253427	1
486	416154061	SNYDER JIM A & DORIS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	108531	1

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OBJECTID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	ESU
487	416144041	CHRISTENSEN RICHARD & JOAN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	2952	1
488	416154009	HOFFMAN MARK T & CHERYL L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	51744	1
489	6022090130	ABICHT DAVID M & KIM	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15889	1
490	6021670020	HOLM MARY ELLEN	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10217	1
491	3605002100	SMITH EDWARD K & MARLENE J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5143	1
492	3581000200	ELLIS DAVID E & NANCY E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8768	1
493	3581000030	BRYMER JUSTIN D & MANDY L LUCHT	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9283	1
494	416144049	COLLINS ETHEL E TTEE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	16356	1
495	6022090120	BASS ROBERT J & ALMA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15900	1
496	416144097	WINSLOW STEPHEN & CYNTHIA SPERLING	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	20402	1
497	6021670010	C & J CONSTRUCTION	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8514	1
498	6022090020	LUBBESMEYER CONSTRUCTION INC	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11920	1
499	6022090030	PAYNE WILLIAM E & NANCY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11953	1
500	6022090050	LUBBESMEYER CONSTRUCTION INC	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11953	1
501	6022090060	LUBBESMEYER CONSTRUCTION INC	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11953	1
502	3581000210	SAMORA BARBARA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8200	1
503	6022090080	PAUL PETER J & DIANE J WISLEY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11953	1
504	6022090110	PHIPPS MICHAEL A & CHERILYN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11310	1
505	3605002470	PARNELL HAROLD R SR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13769	1
506	6022090090	AMES RICHARD C & CYNTHIA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11953	1
507	6022090100	DUENAS JUANITA C	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14012	1
508	3605002570	DANIEL SHIRLEY M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13015	1
509	416137001	PEGG KEVIN T & CHARLENE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	81797	1
510	416144106	GEMMELL CHAD A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13367	1
511	3581000220	MATHEWS IRENE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9518	1
512	3581000010	UNITED METHODIST CHURCH OF	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11224	1
513	3605002480	PARNELL HAROLD R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	20379	1
514	3605002535	VAN CLEVE GEORGE S & PAULETTE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11239	1
515	416154082	JORDAN MICHAEL H & JOAN K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	194005	1
516	3605002580	DANIEL ALETA K & TIMOTHY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12943	1
517	3605002724	WARD ROBERT L & CAROL J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13927	1
518	416144045	PARRISH RAYMOND & CHERYL	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15324	1
519	416144122	HAMILTON JOSEPH B & JOAN R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	265775	1
520	3581000230	PREDMORE RICHARD E & DELORES N	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10304	1
521	416154084	HEERSINK STEVEN S & LINDA K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	104891	1
522	416144103	ROBERTSON CLAUDE K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7150	1
523	416144079	GUFFEY GARY H & CLAUDIA A	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	16984	1
524	3605002525	HANSON STEVEN L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15763	1
525	3605002541	PARANTO ARLEN E & JOHNNIE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13888	1
526	3605002725	KOPEC ANTHONY R & BARBARA O	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13990	1
527	416144080	BLEDSOE TERESA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	14177	1
528	416144016	ANDERSON OLGA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9772	1
529	416144034	HANY ELDON D & CINDY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	23145	1
530	416143033	KASTAMA STEVEN G & SHEILA R	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	37141	1
531	3605002503	EXLEY LARRY A & LANNA F	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6548	1
532	416144074	OLSON LELIA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12870	1
533	416158008	MCDONALD JAMES G & PHYLLIS M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	26586	1
534	3605002504	AMES JARED C & AMY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6550	1
535	3660000041	AKERVICK ROBERT & MELODE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10077	1
536	3660000051	JOHNSON OLEN J JR & DONNA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	13028	1
537	3605002533	COSSALMAN STEPHEN W & LINDA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	25908	1
538	3660000061	SNYDER DENNIS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12514	1
539	416144150	CYRUS KERRY P	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7301	1
540	416144063	FOUNTAIN DANIEL J & LUCILE G	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	11005	1

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541	3660000011	HIGHTOWER JOHN D & LORRAINE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12771	1
542	3660000070	WOODARD DANIEL J & DONNA D	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7208	1
543	416144025	JOHNSON OLEN J JR & DONNA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9528	1
544	416144087	TOMCZAK CHESTER J & MARY	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	9128	1
545	3605002660	SUMERALL RANDALL K & ANGELA B	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7061	1
546	3660000020	LAMBERT MICHELL M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6495	1
547	416144077	HOVELAND ARLENE S	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	12463	1
548	3660000110	WRIGHT EUGENE M & HILMA M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	15037	1
549	3605002621	MIERKE DALE G	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7018	1
550	416221011	LYTLE WALTER K	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	216013	1
551	3605002670	LOGSTON JESSE	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6525	1
552	3660000030	HORTON BRUCE D & BEVERLY B	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5586	1
553	3660000101	SHEETS THOMAS J & HELEN E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6112	1
554	3660000103	SAINT GARY M & DEBRA J	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	32096	1
555	416232045	CHRISTIAN WILLIAM	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	367594	1
556	416232020	UHLMAN WM F & JEAN E	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	457436	1
557	3660000080	FEDERAL NATIONAL MTG ASSOC	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	8193	1
558	3660000102	GALLAGHER THOMAS M & PATRICIA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6396	1
559	416232007	FUCHS J F & P L LEITH-FUCHS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	10700	1
560	416232029	CHRISTIAN SANDRA L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	39698	1
561	416242007	TOMCZAK CHESTER & MARY F	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	274575	1
562	416232008	DUNLAP EVERETT L & DOROTHY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7434	1
563	416232017	RANDOLPH MARGARET	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5920	1
564	3660000180	ISOM LINDA & DENNIS	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7441	1
565	3660000170	NOE SCOTT	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5812	1
566	3660000160	CYRUS KERRY P	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6337	1
567	3660000150	COCHRAN TADGE L & COLLEEN C	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6467	1
568	3660000140	TILLERY JANET M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6403	1
569	3660000130	GALLAGHER CATHARINE M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6579	1
570	3660000120	JOHNSON OLEN & DONNA JR	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	7380	1
571	416232030	HARTMAN BERNARD E & YAIKO	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	34282	1
572	3660000201	ARMOUR JOHN & MONICA	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	6783	1
573	3660000211	RIESAU DONALD B	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5317	1
574	3660000221	CYRUS KERRY P	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5757	1
575	3660000231	CYRUS KERRY P	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	5694	1
576	416232072	VAN BUSKIRK ROY L & KATHY L	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	139191	1
577	416236001	COLLINS RICHARD F	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	95778	1
578	416236005	COLLINS RICHARD F & MAUREEN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	105418	1
579	416236006	COLLINS RICHARD F & MAUREEN M	1101	DESIGNATES USE FOR SINGLE FAMILY DWELLING.	123935	1
580	416104032	PLAAS MIKE & KATIE	9600	VACANT LAND - RESIDENTIAL.	42167	0
581	416133023	CARRIAGE HOUSE INC	9600	VACANT LAND - RESIDENTIAL.	203664	0
582	416133024	CARRIAGE HOUSE INC	9600	VACANT LAND - RESIDENTIAL.	210827	0
583	416133026	SWANSON ROY L & KAREN S	9600	VACANT LAND - RESIDENTIAL.	87325	0
584	416141032	SWANSON DALE M	9600	VACANT LAND - RESIDENTIAL.	99699	0
585	416141032	SWANSON DALE M	9600	VACANT LAND - RESIDENTIAL.	3415	0
586	416141037	SWANSON DALE M	9600	VACANT LAND - RESIDENTIAL.	30076	0
587	416141044	VAN EATON ELSIE M TTEE	9600	VACANT LAND - RESIDENTIAL.	251807	0
588	416141054	MALMGREN WALTER W & MADELINE G	9600	VACANT LAND - RESIDENTIAL.	78199	0
589	416141056	BURLINGAME HAROLD & ROSALIE ETAL	9600	VACANT LAND - RESIDENTIAL.	26900	0
590	416141058	BURLINGAME HAROLD W & ROSALIE ETAL	9600	VACANT LAND - RESIDENTIAL.	192924	0
591	416142015	SMALLWOOD THOMAS H & KAREN M	9600	VACANT LAND - RESIDENTIAL.	15110	0
592	416142073	STRANIK DENNIS & SUSAN	9600	VACANT LAND - RESIDENTIAL.	40673	0
593	416142086	KNELLEKEN MICHAEL W & KATHY M	9600	VACANT LAND - RESIDENTIAL.	13440	0
594	416142103	KNELLEKEN MICHAEL W & KATHY M	9600	VACANT LAND - RESIDENTIAL.	9891	0

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595	416142104	TOWN OF EATONVILLE	9600	VACANT LAND - RESIDENTIAL.	303827	0
596	416142105	EATONVILLE SCH DIST 404	9600	VACANT LAND - RESIDENTIAL.	82600	0
597	416143007	HIBBARD ROSA	9600	VACANT LAND - RESIDENTIAL.	3087	0
598	416143011	POTTS AARON M	9600	VACANT LAND - RESIDENTIAL.	6216	0
599	416143061	DAVIS JACK & MARILYN	9600	VACANT LAND - RESIDENTIAL.	10370	0
600	416143066	JOHNSON KEITH R	9600	VACANT LAND - RESIDENTIAL.	4837	0
601	416143067	CECCANTI EMILIO & CARMEN L	9600	VACANT LAND - RESIDENTIAL.	10371	0
602	416143700	SMITH ROBERT T & DOROTHY	9600	VACANT LAND - RESIDENTIAL.	124867	0
603	416144005	PARRISH RAYMOND & CHERYL	9600	VACANT LAND - RESIDENTIAL.	29409	0
604	416144018	CHRISTENSEN RICHARD G & J	9600	VACANT LAND - RESIDENTIAL.	6992	0
605	416144023	CHRISTENSEN RICHARD G & J	9600	VACANT LAND - RESIDENTIAL.	3163	0
606	416144030	PAINTER DONALD & KAREN	9600	VACANT LAND - RESIDENTIAL.	51490	0
607	416144039	CHRISTENSEN RICHARD G & JOAN	9600	VACANT LAND - RESIDENTIAL.	13597	0
608	416144040	CHRISTENSEN RICHARD G & JOAN	9600	VACANT LAND - RESIDENTIAL.	1356	0
609	416144044	PAINTER DONALD & KAREN	9600	VACANT LAND - RESIDENTIAL.	11587	0
610	416144047	PAINTER DONALD & KAREN	9600	VACANT LAND - RESIDENTIAL.	42360	0
611	416144057	ANDERSON OLGA	9600	VACANT LAND - RESIDENTIAL.	2241	0
612	416144078	HOVELAND ARLENE S	9600	VACANT LAND - RESIDENTIAL.	10432	0
613	416144086	TOMCZAK CHESTER L	9600	VACANT LAND - RESIDENTIAL.	10684	0
614	416144117	HAMILTON JOSEPH B & JOAN R	9600	VACANT LAND - RESIDENTIAL.	144835	0
615	416144126	CHRISTIAN WILLIAM H	9600	VACANT LAND - RESIDENTIAL.	711843	0
616	416144133	PAINTER DONALD & KAREN	9600	VACANT LAND - RESIDENTIAL.	10577	0
617	416144136	CHRISTIAN WILLIAM H	9600	VACANT LAND - RESIDENTIAL.	99830	0
618	416144138	ARNESTAD DONALD M & CAROL A	9600	VACANT LAND - RESIDENTIAL.	283632	0
619	416144143	ARNESTAD DONALD M & CAROL A ETAL	9600	VACANT LAND - RESIDENTIAL.	334781	0
620	416144144	SLEAD CHARLES R & CATHERINE N	9600	VACANT LAND - RESIDENTIAL.	181980	0
621	416145005	BLANCHER CANDACE D	9600	VACANT LAND - RESIDENTIAL.	62531	0
622	416145006	METTLER JAMES T & SHAUN K	9600	VACANT LAND - RESIDENTIAL.	59146	0
623	416145008	TILTON EDWARD K & VALERIE D	9600	VACANT LAND - RESIDENTIAL.	58018	0
624	416146013	STRANIK DENNIS A & SUSAN F	9600	VACANT LAND - RESIDENTIAL.	15778	0
625	416146014	SMALLWOOD THOMAS H & KAREN M	9600	VACANT LAND - RESIDENTIAL.	15888	0
626	416146015	SMALLWOOD THOMAS H & KAREN	9600	VACANT LAND - RESIDENTIAL.	15773	0
627	416146019	FOUNTAIN DANIEL J & LUCILE G	9600	VACANT LAND - RESIDENTIAL.	40594	0
628	416146020	ROY TERRY G & MICHELE	9600	VACANT LAND - RESIDENTIAL.	545724	0
629	416147010	CHRISTIAN W HARRISON	9600	VACANT LAND - RESIDENTIAL.	10782	0
630	416147011	CHRISTIAN W HARRISON	9600	VACANT LAND - RESIDENTIAL.	10770	0
631	416147012	CHRISTIAN W HARRISON	9600	VACANT LAND - RESIDENTIAL.	10758	0
632	416151015	DANMARK LTD INC	9600	VACANT LAND - RESIDENTIAL.	56000	0
633	416151016	DANMARK LTD INC	9600	VACANT LAND - RESIDENTIAL.	66032	0
634	416151017	DANMARK LTD INC	9600	VACANT LAND - RESIDENTIAL.	85657	0
635	416151018	DANMARK LTD INC	9600	VACANT LAND - RESIDENTIAL.	65160	0
636	416151042	GOODWIN LEAH & ALLEN	9600	VACANT LAND - RESIDENTIAL.	7244	0
637	416151048	DOW SIDNEY & MARIE	9600	VACANT LAND - RESIDENTIAL.	1033771	0
638	416151051	MORRISON BERT & LINDA	9600	VACANT LAND - RESIDENTIAL.	59165	0
639	416151052	GAYDA MICHAEL L	9600	VACANT LAND - RESIDENTIAL.	213746	0
640	416154018	HOFFMAN MARK T & CHERYL L	9600	VACANT LAND - RESIDENTIAL.	22818	0
641	416154053	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	2957	0
642	416154064	DOW SIDNEY L	9600	VACANT LAND - RESIDENTIAL.	153265	0
643	416154065	ARNESON LYNN	9600	VACANT LAND - RESIDENTIAL.	60974	0
644	416154066	DOW SIDNEY L	9600	VACANT LAND - RESIDENTIAL.	159310	0
645	416154073	SMITH EUGENE LEE	9600	VACANT LAND - RESIDENTIAL.	253052	0
646	416154074	SMITH CAROL A	9600	VACANT LAND - RESIDENTIAL.	87017	0
647	416154075	GONZALEZ CINDY LOU	9600	VACANT LAND - RESIDENTIAL.	218332	0
648	416154077	SMITH EUGENE L & CAROL A	9600	VACANT LAND - RESIDENTIAL.	154341	0

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649	416154078	SMITH EUGENE L & CAROL A	9600	VACANT LAND - RESIDENTIAL.	32347	0
650	416154081	JORDAN MICHAEL H & JOAN K	9600	VACANT LAND - RESIDENTIAL.	127035	0
651	416155004	BRAMHALL THOMAS W & DIANA J	9600	VACANT LAND - RESIDENTIAL.	91368	0
652	416155006	GOODWIN ALLEN S & LEAH L	9600	VACANT LAND - RESIDENTIAL.	125546	0
653	416158010	SMITH ROBERT T & DOROTHY	9600	VACANT LAND - RESIDENTIAL.	143447	0
654	416231020	HAMILTON JOSEPH B & JOAN R	9600	VACANT LAND - RESIDENTIAL.	270038	0
655	416231021	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	67355	0
656	416231035	CITY OF EATONVILLE	9600	VACANT LAND - RESIDENTIAL.	218862	0
657	416231036	CITY OF EATONVILLE	9600	VACANT LAND - RESIDENTIAL.	216997	0
658	416232010	UHLMAN WM F & JEAN E	9600	VACANT LAND - RESIDENTIAL.	42553	0
659	416232019	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	28699	0
660	416232036	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	18529	0
661	416232039	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	23544	0
662	416232040	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	103391	0
663	416232041	CHRISTENSEN RICHARD & JOAN	9600	VACANT LAND - RESIDENTIAL.	202188	0
664	416232042	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	53836	0
665	416232058	MAGILL LARRY E & DONNA K	9600	VACANT LAND - RESIDENTIAL.	78888	0
666	416232071	VAN BUSKIRK ROY L & KATHY L	9600	VACANT LAND - RESIDENTIAL.	60999	0
667	416236002	COLLINS RICHARD F	9600	VACANT LAND - RESIDENTIAL.	45983	0
668	3166000052	BOETTCHER & SONS	9600	VACANT LAND - RESIDENTIAL.	21806	0
669	3166000070	BOETTCHER & SONS	9600	VACANT LAND - RESIDENTIAL.	19639	0
670	3537000010	STUTESMAN DALE M	9600	VACANT LAND - RESIDENTIAL.	39163	0
671	3537000060	BOETTCHER & SONS	9600	VACANT LAND - RESIDENTIAL.	32530	0
672	3537000090	WEINER DAVID B & JENNIFER M	9600	VACANT LAND - RESIDENTIAL.	21334	0
673	3537000110	ABRAHAMS MARK J & NANCY L MAYS	9600	VACANT LAND - RESIDENTIAL.	29414	0
674	3537000150	THOMPSON BILLIE K & GLORIA KUHRT	9600	VACANT LAND - RESIDENTIAL.	23227	0
675	3537000220	ANDERSON SUZANNE & JACK	9600	VACANT LAND - RESIDENTIAL.	19368	0
676	3537000270	SALTER TERESA	9600	VACANT LAND - RESIDENTIAL.	17648	0
677	3537000290	ISABELLA DEDITCH	9600	VACANT LAND - RESIDENTIAL.	43455	0
678	3537000300	HIGHTOWER JOHN D	9600	VACANT LAND - RESIDENTIAL.	39087	0
679	3537000340	SHELTON STEPHEN R & TERI L	9600	VACANT LAND - RESIDENTIAL.	51014	0
680	3537000360	SCOTT GEORGE B & KAREN H	9600	VACANT LAND - RESIDENTIAL.	64364	0
681	3537000380	MALCOM KEITH & DELORES	9600	VACANT LAND - RESIDENTIAL.	62865	0
682	3537000390	DOW DALE L & LYNN M	9600	VACANT LAND - RESIDENTIAL.	10783	0
683	3581000020	UNITED METHODIST CHURCH	9600	VACANT LAND - RESIDENTIAL.	9491	0
684	3605000020	LEE CHARLES L	9600	VACANT LAND - RESIDENTIAL.	7002	0
685	3605000050	ABRAHAMS M J & N L MAYS	9600	VACANT LAND - RESIDENTIAL.	7003	0
686	3605000190	MATTHEWS FRED & CAROL	9600	VACANT LAND - RESIDENTIAL.	5822	0
687	3605000630	MILLER DIXIE L ETAL	9600	VACANT LAND - RESIDENTIAL.	6363	0
688	3605000650	MILLER LOUIS L JR & CAROL J	9600	VACANT LAND - RESIDENTIAL.	6349	0
689	3605000710	LARSON GERALD B & JOAN M	9600	VACANT LAND - RESIDENTIAL.	6495	0
690	3605000860	CHAPPELL CAROL L	9600	VACANT LAND - RESIDENTIAL.	5796	0
691	3605000870	NOE DEBORAH J	9600	VACANT LAND - RESIDENTIAL.	3959	0
692	3605000890	HIGHTOWER JOHN D	9600	VACANT LAND - RESIDENTIAL.	3976	0
693	3605000940	BERNOVICH JOHN W	9600	VACANT LAND - RESIDENTIAL.	6462	0
694	3605000950	HIGHTOWER JOHN D	9600	VACANT LAND - RESIDENTIAL.	4333	0
695	3605000960	WING GARY L & DONNA M	9600	VACANT LAND - RESIDENTIAL.	4333	0
696	3605001060	BOETTCHER PAUL & CONNIE	9600	VACANT LAND - RESIDENTIAL.	2966	0
697	3605001081	HOFFMAN DANIAL A & THERESA H	9600	VACANT LAND - RESIDENTIAL.	2875	0
698	3605001240	MORRISON BRUCE A ETAL	9600	VACANT LAND - RESIDENTIAL.	6289	0
699	3605001290	VAN EATON THOMAS M & L A L	9600	VACANT LAND - RESIDENTIAL.	6456	0
700	3605001830	MILLER JEAN ANNE & RUTH A WILLIAMS	9600	VACANT LAND - RESIDENTIAL.	10443	0
701	3605001930	RATH VICTOR B & PATRICIA A	9600	VACANT LAND - RESIDENTIAL.	1432	0
702	3605002010	CALDWELL FERN A	9600	VACANT LAND - RESIDENTIAL.	6608	0

SFR - SINGLE FAMILY RESIDENTIAL, VACANT RESIDENTIAL, & VACANT COMMERCIAL

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Eatonville Municipal Code 13.24.030 E.

OBJECTID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	ESU
703	3605002060	LA PLANTE ALICE L	9600	VACANT LAND - RESIDENTIAL.	3921	0
704	3605002122	CHRISTENSEN RICHARD G JR	9600	VACANT LAND - RESIDENTIAL.	5326	0
705	3605002123	MARSHALL ROBERT & LORAINE	9600	VACANT LAND - RESIDENTIAL.	3601	0
706	3605002150	MASHELL INC	9600	VACANT LAND - RESIDENTIAL.	19225	0
707	3605002220	CONENT ALBERT & WANDA	9600	VACANT LAND - RESIDENTIAL.	12199	0
708	3605002262	CASCADE LAND INVESTMENTS INC	9600	VACANT LAND - RESIDENTIAL.	17663	0
709	3605002270	POST/CHRISTIAN LIVING TRUST	9600	VACANT LAND - RESIDENTIAL.	23662	0
710	3605002290	CASCADE LAND INVESTMENTS INC	9600	VACANT LAND - RESIDENTIAL.	45397	0
711	3605002310	TOWN OF EATONVILLE	9600	VACANT LAND - RESIDENTIAL.	3071	0
712	3605002322	TOWN OF EATONVILLE	9600	VACANT LAND - RESIDENTIAL.	8851	0
713	3605002331	BABCOCK DAVID & KIM	9600	VACANT LAND - RESIDENTIAL.	17860	0
714	3605002360	DAWKINS MADORA	9600	VACANT LAND - RESIDENTIAL.	3049	0
715	3605002383	BABCOCK DAVID L & KIM C	9600	VACANT LAND - RESIDENTIAL.	9823	0
716	3605002391	BABCOCK DAVID L & KIM C	9600	VACANT LAND - RESIDENTIAL.	9809	0
717	3605002403	TOWN OF EATONVILLE	9600	VACANT LAND - RESIDENTIAL.	13078	0
718	3605002421	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	1590	0
719	3605002423	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	1103	0
720	3605002425	BABCOCK DAVID L & KIM C	9600	VACANT LAND - RESIDENTIAL.	9732	0
721	3605002430	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	2164	0
722	3605002440	VAN HOOF SHARON L	9600	VACANT LAND - RESIDENTIAL.	2139	0
723	3605002450	VAN HOOF SHARON L	9600	VACANT LAND - RESIDENTIAL.	10768	0
724	3605002460	KASTAMA STEVEN G & SHEILA R	9600	VACANT LAND - RESIDENTIAL.	13042	0
725	3605002490	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	7604	0
726	3605002501	COSSALMAN STEPHEN W & LINDA J O	9600	VACANT LAND - RESIDENTIAL.	23423	0
727	3605002510	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	3203	0
728	3605002522	COSSALMAN STEPHEN W & LINDA J O	9600	VACANT LAND - RESIDENTIAL.	24073	0
729	3605002524	VAN EATON THOMAS F III & BETTY A	9600	VACANT LAND - RESIDENTIAL.	16880	0
730	3605002534	VAN CLEVE G STEVEN	9600	VACANT LAND - RESIDENTIAL.	11281	0
731	3605002550	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	67287	0
732	3605002560	EATONVILLE TOWN OF	9600	VACANT LAND - RESIDENTIAL.	67614	0
733	3605002590	D & K UNLIMITED INC	9600	VACANT LAND - RESIDENTIAL.	46801	0
734	3605002600	D & K UNLIMITED INC	9600	VACANT LAND - RESIDENTIAL.	15908	0
735	5543000060	TOMCZAK CHESTER	9600	VACANT LAND - RESIDENTIAL.	19488	0
736	6021670170	PAINTER DANNY B & PAMELA A	9600	VACANT LAND - RESIDENTIAL.	8533	0
737	6021670470	ESSELBACH FRANK W & BETTY J	9600	VACANT LAND - RESIDENTIAL.	9589	0
738	6022090010	JORDAN MICHAEL H & JOAN K	9600	VACANT LAND - RESIDENTIAL.	12852	0
739	6022090040	LUBBESMEYER CONSTRUCTION INC	9600	VACANT LAND - RESIDENTIAL.	11953	0
740	6022090070	EATONVILLE BAPTIST CHURCH	9600	VACANT LAND - RESIDENTIAL.	11953	0
741	6022090170	SWICK MAX G	9600	VACANT LAND - RESIDENTIAL.	12035	0
742	6022090200	BELL JAMES M & SANDRA L	9600	VACANT LAND - RESIDENTIAL.	15859	0
743	6022090210	BARNHART TIMOTHY S & TAMARA R	9600	VACANT LAND - RESIDENTIAL.	12739	0
744	6022090280	LUBBESMEYER CONST INC	9600	VACANT LAND - RESIDENTIAL.	11935	0
745	6022090300	JORDAN MICHAEL H & JOAN K	9600	VACANT LAND - RESIDENTIAL.	14104	0
746	6022090310	JORDAN MICHAEL H & JOAN K	9600	VACANT LAND - RESIDENTIAL.	11960	0
747	6023050100	LITZENBERGER ROWLAND D & RONDA S	9600	VACANT LAND - RESIDENTIAL.	68137	0
748	6023200020	JORDAN MICHAEL H & JOAN K	9600	VACANT LAND - RESIDENTIAL.	14560	0
749	6023200030	LUBBESMEYER CONST INC	9600	VACANT LAND - RESIDENTIAL.	11159	0
750	6023200050	LUBBESMEYER CONST INC	9600	VACANT LAND - RESIDENTIAL.	10429	0
751	6023200060	LUBBESMEYER CONST INC	9600	VACANT LAND - RESIDENTIAL.	15372	0
752	6715000083	PIERCE COUNTY PROPERTY MNGMT	9600	VACANT LAND - RESIDENTIAL.	1348	0
753	6715000190	HAYNES ARNDON	9600	VACANT LAND - RESIDENTIAL.	6058	0
754	6715000450	PREDMORE RONALD	9600	VACANT LAND - RESIDENTIAL.	2965	0
755	6715000511	MCKASSON CHARLES G & JUDITH K	9600	VACANT LAND - RESIDENTIAL.	10094	0
756	6715000560	KING JAMES J & DREITHA D	9600	VACANT LAND - RESIDENTIAL.	6546	0

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Eatonville Municipal Code 13.24.030 E.

OBJECTID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	ESU
757	6996000041	CECCANTI EMILIO & CARMEN L	9600	VACANT LAND - RESIDENTIAL.	10282	0
758	6996000051	CECCANTI EMILIO & CARMEN L	9600	VACANT LAND - RESIDENTIAL.	11279	0
759	6996000060	CECCANTI EMILIO & CARMEN L	9600	VACANT LAND - RESIDENTIAL.	14602	0
760	6996000070	CECCANTI EMILIO & CARMEN	9600	VACANT LAND - RESIDENTIAL.	11304	0
761	9660000041	MALCOM KEITH & DELORES J	9600	VACANT LAND - RESIDENTIAL.	18438	0
762	9660000070	WILLIAMS DAVID M & MONICA L	9600	VACANT LAND - RESIDENTIAL.	12472	0
763	9660000130	HECHT CRAIG & MYRNA	9600	VACANT LAND - RESIDENTIAL.	10664	0
764	9660000140	MINOTT RICHARD G JR & MARGIT	9600	VACANT LAND - RESIDENTIAL.	12418	0
765	9660000160	BENNETT STEVEN E & DENISE	9600	VACANT LAND - RESIDENTIAL.	9851	0
766	416143017	KNEIP I GRACE	9700	VACANT COMMERCIAL LAND.	3708	0
767	416144054	MILLER JEAN ANN & RUTH A WILLIAMS	9700	VACANT COMMERCIAL LAND.	44026	0
768	416144141	HAMILTON JOSEPH B & JOAN R	9700	VACANT COMMERCIAL LAND.	18710	0
769	416231008	JOHNSON OLEN J & DONNA M	9700	VACANT COMMERCIAL LAND.	5701	0
770	416231039	JOHNSON OLEN J & DONNA M	9700	VACANT COMMERCIAL LAND.	6873	0
771	3605000040	MOUNTAIN VIEW INVESTMENTS LLC	9700	VACANT COMMERCIAL LAND.	14006	0
772	3605000520	EATONVILLE SCH DIST #404	9700	VACANT COMMERCIAL LAND.	24467	0
773	3605000540	EATONVILLE SCH DIST #404	9700	VACANT COMMERCIAL LAND.	11168	0
774	3605001336	MELVIN W. & SYBIL J. COX	9700	VACANT COMMERCIAL LAND.	5834	0
775	3605001370	VAN EATON THOMAS M & LOUISE	9700	VACANT COMMERCIAL LAND.	5857	0
776	3605001380	VAN EATON THOMAS M & LOUISE	9700	VACANT COMMERCIAL LAND.	11728	0
777	3605001590	EATONVILLE FURNITURE INC	9700	VACANT COMMERCIAL LAND.	3598	0
778	3605001600	EATONVILLE FURNITURE INC	9700	VACANT COMMERCIAL LAND.	4244	0
779	3605001770	MASHELL TELEPHONE COMPANY	9700	VACANT COMMERCIAL LAND.	9378	0
780	3605001880	CHRISTENSEN RICHARD & JOAN	9700	VACANT COMMERCIAL LAND.	18110	0
781	3605002721	CHRISTENSEN RICHARD & JOAN	9700	VACANT COMMERCIAL LAND.	11213	0

Total Number of SFR ESUs 579

Appendix D2

NON RESIDENTIAL (NON-SFR)

R·W·BECK

NON SFR - NON SINGLE FAMILY RESIDENTIAL

1 ESU = 3000 Square Feet Impervious
Eatonville Municipal Code 13.24.030 E.

OBJECT ID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	IMPERV_ AREA (SF)	IMP_AREA (%)	ESU
782	416141019	VAN EATON ELSIE M TTEE	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	22487	2890	12.9	1
783	416141052	WILLIAMS DAVID M & MONICA L	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	65911	1978	3.0	1
784	416142070	LOFQUIST WARREN & KATHRINE	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	13404	1001	7.5	1
785	416144130	CHRISTIAN HARRISON & SANDRA L	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	131420	7598	5.8	2.5
786	416145002	POOLE CHAS L & CHRISTINE M	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	32319	607	1.9	1
787	416145003	POOLE CHAS L & CHRISTINE M	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	33064	703	2.1	1
788	416145007	VAN CLEVE GEORGE & ROSEMARIE	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	63944	2842	4.4	1
789	416145011	LOGSTON JESS B & BONNIE J	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	61609	2701	4.4	1
790	416154011	SMITH EUGENE L & CAROL A	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	12126	0	0.0	0
791	416231000	JOHNSON OLEN J & DONNA M	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	14447	7574	52.4	2.5
792	3605000700	THOMPSON BILLIE K	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	6498	790	12.2	1
793	3605001350	VAN EATON ROBERT A	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	5843	456	7.8	1
794	3605001920	RATH VICTOR B & PATRICIA A	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	1432	1432	100	1
795	3605002536	VAN CLEVE GEORGE JR & ROSEMARIE	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	11848	1143	9.6	1
796	6715000230	O'NEILL D D & J A	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	10214	4167	40.8	1.4
797	6715000491	WALLIN CHARLES E	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	29409	0	0.0	0
798	8867100133	SWANSON ROY & KAREN	1100	REAL PROPERTY NOT USED FOR HUMAN HABITATION. REF. MANUAL	7628	1388	18.2	1
799	416143025	HOLDEN DAROLD A ETAL	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	11350	0	0.0	0
800	416147001	JONES WILLIAM C & LINDA S	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	23782	2363	9.9	1
801	416232000	GONZALES ANTOINETTE	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	8616	1843	21.4	1
802	3605000340	FLESHMAN WILLIAM J JR	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	7259	2987	41.1	1
803	3605000491	MOORE THOMAS O & TERRI L	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	9844	3982	40.5	1.3
804	3605001082	CHRISTENSEN RICHARD & JOAN	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	12028	2510	20.9	1
805	3605001160	MALCOM KEITH J	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	11634	2955	25.4	1
806	3605002140	MC KASSON-DANIEL LLC	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	15829	5700	36.0	1.9
807	3605002191	MILLER FREDERICK A & SUSAN L	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	6076	1711	28.2	1
808	3605002192	ASHBY FRIEDA	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	6071	2789	45.9	1
809	3605002200	GAFFNEY THOMAS & FRIEDA ASHBY	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	6066	3641	60.0	1.2
810	3605002610	MC KASSON-DANIEL LLC	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	7866	2103	26.7	1
811	5543000043	WRIGHT HELEN & M V DEADMOND	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	8829	2731	30.9	1
812	5543000044	BRUNO DAN Q & DONNA	1102	DESIGNATES USE FOR DUPLEX (2 FAMILY UNITS).	12367	6843	55.3	2.3
813	416144069	DAKA INC	1105	FIVE (5) OR MORE FAMILY UNITS (NON-SUBSIDIZED) APPRAISED BY COMMERCIAL SECTION.	32297	21796	67.5	7.3
814	416148001	GLACIER VILLAGE LIMITED PTNSP	1105	FIVE (5) OR MORE FAMILY UNITS (NON-SUBSIDIZED) APPRAISED BY COMMERCIAL SECTION.	51843	40318	77.8	13.4
815	416154012	WESTWOOD PARK ASSOCIATES	1105	FIVE (5) OR MORE FAMILY UNITS (NON-SUBSIDIZED) APPRAISED BY COMMERCIAL SECTION.	67163	38769	57.7	12.9
816	416154013	BOETTCHER & SONS	1105	FIVE (5) OR MORE FAMILY UNITS (NON-SUBSIDIZED) APPRAISED BY COMMERCIAL SECTION.	37261	5721	15.4	1.9
817	3605000010	THURESON DAVID & NORA A	1105	FIVE (5) OR MORE FAMILY UNITS (NON-SUBSIDIZED) APPRAISED BY COMMERCIAL SECTION.	10594	5460	51.5	1.8
818	3605000140	CHRISTENSEN RICHARD G	1105	FIVE (5) OR MORE FAMILY UNITS (NON-SUBSIDIZED) APPRAISED BY COMMERCIAL SECTION.	11809	6299	53.3	2.1
819	3605000350	HEATH DOROTHY M	1105	FIVE (5) OR MORE FAMILY UNITS (NON-SUBSIDIZED) APPRAISED BY COMMERCIAL SECTION.	7258	2792	38.5	1
820	3605000420	CRESTVIEW APARTMENTS	1105	FIVE (5) OR MORE FAMILY UNITS (NON-SUBSIDIZED) APPRAISED BY COMMERCIAL SECTION.	22212	10816	48.7	3.6
821	3605001335	COX MELVIN W & SYBIL J	1105	FIVE (5) OR MORE FAMILY UNITS (NON-SUBSIDIZED) APPRAISED BY COMMERCIAL SECTION.	5830	397	6.8	1
822	3605002625	MASHELL SOUTH INC	1105	FIVE (5) OR MORE FAMILY UNITS (NON-SUBSIDIZED) APPRAISED BY COMMERCIAL SECTION.	43168	16336	37.8	5.4
823	3605002691	HIGHTOWER JOHN D	1105	FIVE (5) OR MORE FAMILY UNITS (NON-SUBSIDIZED) APPRAISED BY COMMERCIAL SECTION.	17899	8686	48.5	2.9
824	416104005	FORD BETTYE E	1152	MOBILE HOME(S) IF IT IS ASSESSED AS PERSONAL PROPERTY.	86563	1975	2.3	1
825	416104044	SMITH EDWARD F & P JEANNETTE	1152	MOBILE HOME(S) IF IT IS ASSESSED AS PERSONAL PROPERTY.	583982	4476	0.8	1.5
826	416113039	SMITH EDWARD F & P JEANNETTE	1152	MOBILE HOME(S) IF IT IS ASSESSED AS PERSONAL PROPERTY.	287841	3379	1.2	1.1
827	416143032	VAN HOOF SHARON L	1152	MOBILE HOME(S) IF IT IS ASSESSED AS PERSONAL PROPERTY.	165136	0	0.0	0
828	416144062	CLUPHF ROBERT	1152	MOBILE HOME(S) IF IT IS ASSESSED AS PERSONAL PROPERTY.	34351	0	0.0	0
829	416144065	STONEBURNER EVELYN M	1152	MOBILE HOME(S) IF IT IS ASSESSED AS PERSONAL PROPERTY.	13112	0	0.0	0
830	416144090	HEFLEY DOUGLAS R	1152	MOBILE HOME(S) IF IT IS ASSESSED AS PERSONAL PROPERTY.	17667	0	0.0	0
831	416147002	NEISTADT MIKE	1152	MOBILE HOME(S) IF IT IS ASSESSED AS PERSONAL PROPERTY.	39999	1387	3.5	1
832	416154035	MCLAUGHLIN JAMES D & DEBORAH	1152	MOBILE HOME(S) IF IT IS ASSESSED AS PERSONAL PROPERTY.	8082	3146	38.9	1.0
833	416137002	MALCOM GARY K	1155	MOBILE HOME(S) ELIMINATION OF TITLE	228997	4713	2.1	1.6
834	416104000	BARNES LYLE M	1199	LAND THAT FORMERLY HAD DWELLING OR MOBILE HOME ON IT.	123360	0	0.0	0
835	416144006	CHRISTENSEN RICHARD & JOAN	1199	LAND THAT FORMERLY HAD DWELLING OR MOBILE HOME ON IT.	4412	2198	49.8	1
836	3605001360	VAN EATON THOMAS M & LOUISE A	1199	LAND THAT FORMERLY HAD DWELLING OR MOBILE HOME ON IT.	11700	635	5.4	1
837	3605002090	MASHELL INC	1199	LAND THAT FORMERLY HAD DWELLING OR MOBILE HOME ON IT.	14456	1430	9.9	1
838	3660000090	HENLEY ENTERPRISES INC	1199	LAND THAT FORMERLY HAD DWELLING OR MOBILE HOME ON IT.	13048	0	0.0	0
839	416144004	NAKATA ANTHONY R & APRIL W	1400	MOBILE HOME PARK/COURT APPRAISED BY COMMERCIAL SECTION.	96920	59029	60.9	19.7
840	416148010	MILLER JAMES J & JEAN A	1400	MOBILE HOME PARK/COURT APPRAISED BY COMMERCIAL SECTION.	258171	164005	63.5	54.7
841	3605002630	MARAS P J & EDNA F	1400	MOBILE HOME PARK/COURT APPRAISED BY COMMERCIAL SECTION.	52845	16406	31.0	5.5

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OBJECT ID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	IMPERV_ AREA (SF)	IMP_AREA (%)	ESU
842	3605002630	MARAS P J & EDNA F	1400	MOBILE HOME PARK/COURT APPRAISED BY COMMERCIAL SECTION.	23857	8755	36.7	2.9
843	416148002	CHRISTIAN WILLIAM H & DEBORAH A	1510	HOTELS, TOURIST COURTS AND MOTELS.	32574	30227	92.8	10.1
844	3605001890	CHRISTENSEN RICHARD G & JOAN	2710	NEWSPAPERS: PUBLISHING, PUBLISHING AND PRINTING.	2778	1853	66.7	1
845	416141043	EATONVILLE TOWN OF	4311	AIRPORT AND FLYING FIELD LANDING/TAKEOFF FIELD.	265707	45810	17.2	15.3
846	416144131	BURLINGAME HAROLD W & ROSALIE	4311	AIRPORT AND FLYING FIELD LANDING/TAKEOFF FIELD.	291126	57042	19.6	19.0
847	416141015	EATONVILLE TOWN OF	4315	AIRCRAFT STORAGE AND EQUIPMENT MAINTENANCE.	124079	18345	14.8	6.1
848	416142053	EATONVILLE TOWN OF	4500	HIGHWAY AND STREET RIGHT-OF-WAY	4355	0	0.0	0
849	416142075	EATONVILLE TOWN OF	4500	HIGHWAY AND STREET RIGHT-OF-WAY	1516	0	0.0	0
850	416142082	EATONVILLE TOWN OF	4500	HIGHWAY AND STREET RIGHT-OF-WAY	9998	0	0.0	0
851	416142089	EATONVILLE TOWN OF	4500	HIGHWAY AND STREET RIGHT-OF-WAY	14447	0	0.0	0
852	416143049	EATONVILLE TOWN OF	4500	HIGHWAY AND STREET RIGHT-OF-WAY	3607	0	0.0	0
853	3605000070	EATONVILLE SCH DIST #404	4500	HIGHWAY AND STREET RIGHT-OF-WAY	7004	3427	48.9	1.1
854	3605001840	LUBKING PETROLEUM INC *****	4500	HIGHWAY AND STREET RIGHT-OF-WAY	3502	1987	56.7	1
855	416144148	TOWN OF EATONVILLE	4540	ARTERIAL STREETS.	10405	1580	15.2	1
856	416133046	WEYERHAEUSER COMPANY	4590	OTHER HIGHWAY AND STREET RIGHT-OF-WAY, NOT ELSEWHERE CODED.	136975	57924	42.3	19.3
857	416144009	RIDGWAY NOEL & JOANNE	4600	AUTOMOBILE PARKING.	21632	12792	59.1	4.3
858	416144028	VAN CLEVE GEORGE P JR & ROSEMARIE	4600	AUTOMOBILE PARKING.	5255	2367	45.0	1
859	416144037	VAN CLEVE GEORGE P JR & ROSEMARIE	4600	AUTOMOBILE PARKING.	2808	2808	100	1
860	416144043	VAN CLEVE GEORGE P JR & ROSEMARIE	4600	AUTOMOBILE PARKING.	3853	3853	100	1.3
861	416144046	VAN CLEVE G STEVEN & C M	4600	AUTOMOBILE PARKING.	3492	811	23.2	1
862	3605000390	EATONVILLE SCHOOL DISTRICT	4600	AUTOMOBILE PARKING.	11433	7164	62.7	2.4
863	3605001450	HEINZ KIRK F & TARA L	4600	AUTOMOBILE PARKING.	5639	5621	99.7	1.9
864	3605001710	VAN CLEVE CHRISTINE M	4600	AUTOMOBILE PARKING.	783	0	0.0	0
865	3605001720	VAN CLEVE GEORGE P JR & ROSEMARIE	4600	AUTOMOBILE PARKING.	1375	245	17.8	1
866	3605001730	VAN CLEVE GEORGE P JR & ROSEMARIE	4600	AUTOMOBILE PARKING.	1358	1023	75.3	1
867	3605001740	VAN CLEVE GEORGE P JR & ROSEMARIE	4600	AUTOMOBILE PARKING.	3117	2760	88.5	1
868	3605001750	VAN CLEVE GEORGE P & ROSEMARY	4600	AUTOMOBILE PARKING.	5927	5549	93.6	1.8
869	416143035	MASHELL TELEPHONE CO INC	4719	OTHER TELEPHONE COMMUNICATIONS, NOT ELSEWHERE CODED.	228187	8282	3.6	2.8
870	3605002780	MASHELL TELEPHONE CO INC	4719	OTHER TELEPHONE COMMUNICATIONS, NOT ELSEWHERE CODED.	2693	2693	100	1
871	3605002860	MASHELL TELEPHONE CO INC	4719	OTHER TELEPHONE COMMUNICATIONS, NOT ELSEWHERE CODED.	6151	5591	90.9	1.9
872	6021670520	TOWN OF EATONVILLE	4830	DRAINFIELDS/CATCH BASINS. IN RESIDENTIAL DEVELOPMENTS.	2658	0	0.0	0
873	6022090330	JORDAN MICHAEL H & JOAN K	4830	DRAINFIELDS/CATCH BASINS. IN RESIDENTIAL DEVELOPMENTS.	20051	0	0.0	0
874	416151050	EATONVILLE TOWN OF	4833	WATER STORAGE. REF. MANUAL	6676	0	0.0	0
875	416144101	LUBKING PETROLEUM INC *****	5192	PETROLEUM BULK STATIONS AND TERMINALS.	31746	26666	84.0	8.9
876	416144042	AL & BARNEY'S INVESTMENTS LLC	5211	LUMBER YARDS.	44355	44343	100	14.8
877	3605001760	VAN CLEVE GEORGE P JR & ROSEMARIE	5251	HARDWARE.	8483	7900	93.1	2.6
878	3605002750	CHRISTENSEN RICHARD G	5310	DEPARTMENT STORES.	7119	6720	94.4	2.2
879	416144017	FIRGROVE NODAK INC	5395	MISCELLANEOUS RETAIL AND OFFICE SPACE.	5096	3278	64.3	1.1
880	416144151	MALCOLM FAMILY LP	5395	MISCELLANEOUS RETAIL AND OFFICE SPACE.	24654	15696	63.7	5.2
881	416148007	MALCOM FAMILY LIMITED PARTNERSHIP	5395	MISCELLANEOUS RETAIL AND OFFICE SPACE.	55179	55179	100	18.4
882	3605001420	ANDERSON KURT A & MEGAN E	5395	MISCELLANEOUS RETAIL AND OFFICE SPACE.	3641	3573	98.2	1.2
883	3605001780	RHYMES MARY ANN	5395	MISCELLANEOUS RETAIL AND OFFICE SPACE.	8841	6408	72.5	2.1
884	3605001860	CHRISTENSEN RICHARD & JOAN	5395	MISCELLANEOUS RETAIL AND OFFICE SPACE.	14167	14167	100	4.7
885	3605002112	CHRISTENSEN RICHARD G JR	5395	MISCELLANEOUS RETAIL AND OFFICE SPACE.	6231	5516	88.5	1.8
886	3605001250	J & J BROTHERS LLC	5410	GROCERIES (WITH OR WITHOUT MEAT).	38489	27768	72.1	9.3
887	3605001870	RIDGWAY JAMES N	5410	GROCERIES (WITH OR WITHOUT MEAT).	35435	1916	5.4	1
888	3605001460	VAN EATON CHEVROLET INC	5511	MOTOR VEHICLES (NEW AND USED CARS).	6096	3972	65.2	1.3
889	416144147	MALCOM FAMILY LIMITED PARNTERSHIP	5536	AM-PM TYPE OF CONVENIENCE STORE WITH GAS AS PRIMARY FUNCTION	22574	22574	100	7.5
890	416143022	MUELLER PATRICK J & SANDRA A	5599	OTHER RETAIL TRADE, AUTOMOTIVE, MARINE CRAFT, AIRCRAFT AND ACCESSORIES, NOT ELSE	3438	2580	75.0	1
891	416144121	BARTHOLOMEW DAVID A	5599	OTHER RETAIL TRADE, AUTOMOTIVE, MARINE CRAFT, AIRCRAFT AND ACCESSORIES, NOT ELSE	117533	2620	2.2	1
892	3605000130	BUTLER CHARLES H & LYNN M	5810	COFFEE SHOP/CAFE.	11799	1980	16.8	1
893	3605001400	KENFIELD STEVEN G & STAR S	5810	COFFEE SHOP/CAFE.	3145	1623	51.6	1
894	3605001850	ASSOCIATED PETROLEUM PRODUCTS INC	5810	COFFEE SHOP/CAFE.	6800	6171	90.8	2.1
895	416143015	NASINEC STEVEN J & CHRISTINE L	5812	RESTAURANT WITH BAR.	4595	3526	76.7	1.2
896	416144115	BABCOCK DAVID & KIM	5813	FAST FOOD RESTAURANTS/CARRY-OUT.	25127	18642	74.2	6.2
897	416143016	BRECHEEN ROBERT B & NICOLE E	5820	DRINKING PLACES (TAVERNS - ALCOHOLIC BEVERAGES).	3795	3629	95.6	1.2
898	3605001410	HUGH CRAIG E & KATHLEEN M	5820	DRINKING PLACES (TAVERNS - ALCOHOLIC BEVERAGES).	3519	3443	97.8	1.1
899	3605002760	MASHELL INC	5931	ANTIQUES.	8801	7807	88.7	2.6
900	416143019	EATONVILLE MASONIC TEMPLE CORP	5999	OTHER RETAIL TRADE, NOT ELSEWHERE CODED.	3821	2877	75.3	1
901	416144013	CHRISTENSEN RICHARD G & J	5999	OTHER RETAIL TRADE, NOT ELSEWHERE CODED.	15995	12332	77.1	4.1

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OBJECT ID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	IMPERV_ AREA (SF)	IMP_AREA (%)	ESU
902	416154010	WOLF ERNST P & LUCIE E	5999	OTHER RETAIL TRADE, NOT ELSEWHERE CODED.	38441	6603	17.2	2.2
903	3605001650	PALMER G WILLETT & GENEAL I	5999	OTHER RETAIL TRADE, NOT ELSEWHERE CODED.	7165	6898	96.3	2.3
904	3605001800	IAMS NANCY A	5999	OTHER RETAIL TRADE, NOT ELSEWHERE CODED.	6941	2124	30.6	1
905	3605001820	MILLER JEAN ANN & RUTH A WILLIAMS	6111	BANKING SERVICES.	10381	7491	72.2	2.5
906	3605002041	PUGET SOUND NATL BANK EATONVILLE	6111	BANKING SERVICES.	6751	4181	61.9	1.4
907	3605001910	COOK THELMA H TTEE	6152	REAL ESTATE AGENTS, BROKERS AND MANAGEMENT SERVICES.	7812	4974	63.7	1.7
908	416144038	BRADEN HOWARD	6199	MISCELLANEOUS OFFICE SPACE.	7190	4064	56.5	1.4
909	3605000060	ABRAHAMS M J & N L MAYS	6199	MISCELLANEOUS OFFICE SPACE.	7003	847	12.1	1
910	3605001440	HEINZ KIRK F & TARA L	6231	BEAUTY SERVICES.	8925	8840	99.0	2.9
911	3605001510	DANIEL TIM	6231	BEAUTY SERVICES.	3641	3503	96.2	1.2
912	3605001430	BUDNICK JAMES M & MAUREEN M	6232	BARBER SERVICES.	3640	3585	98.5	1.2
913	416143001	EATONVILLE TOWN OF	6242	CEMETERIES.	172949	439	0.3	1
914	3605001580	BERTRAM JAMES P & JUDITH A	6290	OTHER PERSONAL SERVICES, NOT ELSEWHERE CODED.	3999	3539	88.5	1.2
915	3605001810	WULLER ANTONY D	6290	OTHER PERSONAL SERVICES, NOT ELSEWHERE CODED.	13882	3518	25.3	1.2
916	416133021	VAN EATON JAMES P & EDWINNA F	6376	GENERAL WAREHOUSING AND STORAGE.	212566	8	0.0	1
917	416144128	RIDGEWAY NOEL & JOANNE	6376	GENERAL WAREHOUSING AND STORAGE.	7390	4145	56.1	1.4
918	416148008	MALCOM BROTHERS INC	6380	MINI-WAREHOUSE	67161	57379	85.4	19.1
919	416151044	MCGINNIS FAMILY TR	6380	MINI-WAREHOUSE	174414	50929	29.2	17.0
920	416143018	KNEIP I GRACE	8397	AUTOMOBILE AND TRUCK RENTAL SERVICES.	3876	1389	35.8	1
921	416158007	BENNETT STEVE E & DENISE R	6399	OTHER BUSINESS SERVICES, NOT ELSEWHERE CODED.	10801	4142	38.4	1.4
922	3605000280	VAN EATON CHEV INC	6411	AUTOMOBILE REPAIR SERVICES.	10798	9950	92.1	3.3
923	3605001520	DANIEL TIM	6411	AUTOMOBILE REPAIR SERVICES.	7283	7042	96.7	2.3
924	3605001610	VANCLEVE GEORGE P & ROSEMARY	6411	AUTOMOBILE REPAIR SERVICES.	15599	14979	96.0	5.0
925	416148009	MALCOM FAMILY LIMITED PARTNERSHIP	6412	AUTOMOBILE WASH SERVICES.	12674	12674	100	4.2
926	3605000360	VAN EATON CHEVROLET INC	6412	AUTOMOBILE WASH SERVICES.	10839	3402	31.4	1.1
927	416155003	AMES KENNETH D & M W SWARTOUT	6499	OTHER REPAIR SERVICES, NOT ELSEWHERE CODED.	117297	13021	11.1	4.3
928	416242010	SWANSON ROY L & KAREN S	6499	OTHER REPAIR SERVICES, NOT ELSEWHERE CODED.	94905	3298	3.5	1.1
929	3605002722	MILLER JAMES J & JEAN ANN	6499	OTHER REPAIR SERVICES, NOT ELSEWHERE CODED.	6963	1394	20.0	1
930	3605001230	VAN EATON THOMAS M & 6OUISE	6511	PHYSICIANS' SERVICES.	25142	3840	15.3	1.3
931	416144019	ROBERTSON CLAUDE K	6512	DENTAL SERVICES.	8057	1605	19.9	1
932	3605001990	COSSALMAN STEPHEN W & LINDA J O	6512	DENTAL SERVICES.	10055	9211	91.6	3.1
933	3605002042	COOK DAVID H & BELINDA A	6516	SANITARIUMS, CONVALESCENT AND REST HOME SERVICES.	16812	7057	42.0	2.4
934	3605000160	SOBHANI ENAYATOLLAH & JUDITH	6519	OTHER MEDICAL AND HEALTH SERVICES, NOT ELSEWHERE CODED.	11756	2770	23.6	1
935	416104008	PIERCE COUNTY	6700	GOVERNMENTAL SERVICES	18508	0	0.0	0
936	416231011	EATONVILLE TOWN OF	6700	GOVERNMENTAL SERVICES	106836	7542	7.1	2.5
937	416231040	EATONVILLE CITY OF	6700	GOVERNMENTAL SERVICES	164065	4253	2.6	1.4
938	416232051	EATONVILLE TOWN OF	6700	GOVERNMENTAL SERVICES	39015	0	0.0	0
939	3605002160	EATONVILLE TOWN OF	6700	GOVERNMENTAL SERVICES	12244	9154	74.8	3.1
940	3605002111	ESTER LORRAINE & ROBERT N	6730	POSTAL SERVICES.	22369	19712	88.1	6.6
941	416144149	MILLER JOHN E & SHELLEY A	6811	NURSERY SCHOOLS.	39501	5900	14.9	2.0
942	416144001	EATONVILLE SCHOOL DIST #404	6812	PRIMARY (ELEMENTARY) SCHOOLS. (GRADE 1 THRU 6).	591629	102480	17.3	34.2
943	416144002	EATONVILLE S D # 404	6812	PRIMARY (ELEMENTARY) SCHOOLS. (GRADE 1 THRU 6).	439253	135477	30.8	45.2
944	416142106	EATONVILLE SCH DIST 404	6813	SECONDARY SCHOOLS. (GRADES 7 THRU 12).	441554	175726	39.8	58.6
945	416142107	TOWN OF EATONVILLE	6813	SECONDARY SCHOOLS. (GRADES 7 THRU 12).	9290	0	0.0	0
946	3605000310	EATONVILLE SCHOOL DISTRICT #404	6813	SECONDARY SCHOOLS. (GRADES 7 THRU 12).	8552	3236	37.8	1.1
947	3605000450	EATONVILLE SCHOOL DIST NO 404	6813	SECONDARY SCHOOLS. (GRADES 7 THRU 12).	10944	2661	24.3	1
948	416142039	ARCHDIOCESE OF SEATTLE	6911	CHURCHES, SYNAGOGUES AND TEMPLES.	151607	53063	35.0	17.7
949	3605000150	EATONVILLE CHURCH OF CHRIST	6911	CHURCHES, SYNAGOGUES AND TEMPLES.	11819	6027	51.0	2.0
950	3605000400	EATONVILLE SCHOOL DISTRICT	6911	CHURCHES, SYNAGOGUES AND TEMPLES.	5784	3232	55.9	1.1
951	3605001560	UNITED METH CHURCH OF EATON	6911	CHURCHES, SYNAGOGUES AND TEMPLES.	7318	3823	52.2	1.3
952	6715000530	EATONVILLE LIVING WORD	6911	CHURCHES, SYNAGOGUES AND TEMPLES.	25766	24875	96.5	8.3
953	416144139	EATONVILLE AERIE 3158 FOE	6994	CIVIC, SOCIAL AND FRATERNAL ASSOCIATIONS.	282375	46515	16.5	15.5
954	416144140	EATONVILLE TOWN OF	6994	CIVIC, SOCIAL AND FRATERNAL ASSOCIATIONS.	119421	2580	2.2	1
955	3605001333	AMERICAN LEGION POST #148	6994	CIVIC, SOCIAL AND FRATERNAL ASSOCIATIONS.	5785	1036	17.9	1
956	3605002240	PIERCE CO RURAL LIBRARY DIST	7111	LIBRARIES.	7836	4273	54.5	1.4
957	416143020	KERR KENDALL H ETAL	7212	MOTION PICTURE THEATERS.	4878	4566	93.6	1.5
958	3605002300	TOWN OF EATONVILLE	7424	RECREATION CENTER (GENERAL), CONTAINS AREAS FOR DIVERSIFIED ACTIVITIES.	11985	9837	82.1	3.3
959	416141005	EATONVILLE TOWN OF	7600	PARKS	2580	0	0.0	0
960	416141006	EATONVILLE TOWN OF	7600	PARKS	9039	0	0.0	0
961	416141016	EATONVILLE TOWN OF	7600	PARKS	2191	0	0.0	0

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962	6715000010	EATONVILLE TOWN OF	7610	PARKS - GENERAL RECREATION.	16177	0	0.0	0
963	6715000040	EATONVILLE TOWN OF	7610	PARKS - GENERAL RECREATION.	18076	0	0.0	0
964	6715000070	EATONVILLE TOWN OF	7610	PARKS - GENERAL RECREATION.	18052	0	0.0	0
965	6715000110	EATONVILLE TOWN OF	7610	PARKS - GENERAL RECREATION.	17864	0	0.0	0
966	416221005	SMITH ROBERT T & DOROTHY	7700	OPEN SPACE TIMBER LAND	437247	0	0.0	0
967	416143000	BENTON ROBERT H & LISA M	7701	OPEN SPACE LAND - FARM AND AGRICULTURE.	247952	7972	3.2	2.7
968	416143034	BENTON ROBERT H & LISA M	7701	OPEN SPACE LAND - FARM AND AGRICULTURE.	48695	0	0.0	0
969	416221010	RATH VICTOR B & PATRICIA A	7701	OPEN SPACE LAND - FARM AND AGRICULTURE.	864860	6147	0.7	2.0
970	416221700	VAN EATON JOHN J & ELSIE M	7701	OPEN SPACE LAND - FARM AND AGRICULTURE.	40344	0	0.0	0
971	416221703	EATONVILLE BAPTIST CHURCH	7701	OPEN SPACE LAND - FARM AND AGRICULTURE.	647603	12378	1.9	4.1
972	416232700	RATH VICTOR & PATRICIA	7701	OPEN SPACE LAND - FARM AND AGRICULTURE.	436182	16405	3.8	5.5
973	416232701	RATH VICTOR & PATRICIA	7701	OPEN SPACE LAND - FARM AND AGRICULTURE.	442318	187	0.0	1
974	416151033	BRUCKER A L & PHYLLIS J TTEE	8100	AGRICULTURE.	145213	0	0.0	0
975	416232033	CHRISTIAN WILLIAM H	8100	AGRICULTURE.	133340	0	0.0	0
976	3605001970	FARRIS RICHARD A & KATHY L	8221	VETERINARIAN SERVICES.	5637	3124	55.4	1.0
977	416231010	HAMILTON JOSEPH B & JOAN R	8223	POULTRY HATCHERY SERVICES.	1288755	19604	1.5	6.5
978	416231019	HAMILTON JOSEPH B & JOAN R	8223	POULTRY HATCHERY SERVICES.	586928	2740	0.5	1
979	416231004	WEYERHAEUSER COMPANY	8700	DESIGNATED FOREST LAND. NEVER CHANGE THIS USE CODE.	53788	0	0.0	0
980	416231023	WEYERHAEUSER COMPANY	8700	DESIGNATED FOREST LAND. NEVER CHANGE THIS USE CODE.	289955	0	0.0	0
981	416141008	EATONVILLE SCH DIST 404	9100	IDENTIFIES THOSE PARCELS OF LAND THAT ARE UNDEVELOPED.REF MANUAL	196764	3552	1.8	1.2
982	416151013	MC CLAIN MARVIN D & ELLEN M	9100	IDENTIFIES THOSE PARCELS OF LAND THAT ARE UNDEVELOPED.REF MANUAL	71337	0	0.0	0
983	416155002	SELTUN RANDY	9100	IDENTIFIES THOSE PARCELS OF LAND THAT ARE UNDEVELOPED.REF MANUAL	244822	0	0.0	0
984	416231003	ABLEMAN MAX & CAROL	9100	IDENTIFIES THOSE PARCELS OF LAND THAT ARE UNDEVELOPED.REF MANUAL	30656	0	0.0	0
985	416231018	BOETTCHER & SONS	9100	IDENTIFIES THOSE PARCELS OF LAND THAT ARE UNDEVELOPED.REF MANUAL	476771	0	0.0	0
986	416232032	EATONVILLE TOWN OF	9100	IDENTIFIES THOSE PARCELS OF LAND THAT ARE UNDEVELOPED.REF MANUAL	407880	0	0.0	0
987	416232046	CHRISTIAN WILLIAM ET AL *	9100	IDENTIFIES THOSE PARCELS OF LAND THAT ARE UNDEVELOPED.REF MANUAL	426560	3904	0.9	1.3
988	416232056	CITY OF EATONVILLE	9100	IDENTIFIES THOSE PARCELS OF LAND THAT ARE UNDEVELOPED.REF MANUAL	216798	0	0.0	0
989	416242005	BOETTCHER & SONS	9100.	IDENTIFIES THOSE PARCELS OF LAND THAT ARE UNDEVELOPED.REF MANUAL	15111	0	0.0	0
990	416242009	TOWN OF EATONVILLE	9100	IDENTIFIES THOSE PARCELS OF LAND THAT ARE UNDEVELOPED.REF MANUAL	927	0	0.0	0
991	416242011	TOWN OF EATONVILLE	9100	IDENTIFIES THOSE PARCELS OF LAND THAT ARE UNDEVELOPED.REF MANUAL	98244	0	0.0	0
992	416232082	EATONVILLE TOWN OF	9310	RIVERS, STREAMS OR CREEKS.	3684	0	0.0	0
993	416232063	EATONVILLE TOWN OF	9310	RIVERS, STREAMS OR CREEKS.	1423	0	0.0	0
994	3605001390	FITZER WILLIAM	9400	VACANT FLOOR AREA.	8748	1942	22.2	1
995	3605001540	CHOLAR RICK & LINDA CRERAR	9400	VACANT FLOOR AREA.	3707	3613	97.5	1.2
996	416142027	HIGHTOWER JOHN D	9601	VACANT RESIDENTIAL LAND THAT MUST HAVE AN ECOLOGY BAN DEPRECIATION OF 25%.	32478	0	0.0	0
997	3605002427	THOMAS HATTIE G	9610	VACANT LAND - CONSERVATION AREAS AND BUILDING RESTRICTIONS.	303	0	0.0	0
998	416142072	HOPE INTERNATIONAL	9666	RESIDENTIAL VACANT LAND THAT HAS A MAJOR FUNCTIONAL OR ECONOMIC PROBLEM	5118	0	0.0	0
999	416143065	TOWN OF EATONVILLE	9666	RESIDENTIAL VACANT LAND THAT HAS A MAJOR FUNCTIONAL OR ECONOMIC PROBLEM	1584	0	0.0	0
1000	416144135	SKELLY SEAN & NORMELINDA	9666	RESIDENTIAL VACANT LAND THAT HAS A MAJOR FUNCTIONAL OR ECONOMIC PROBLEM	2799	0	0.0	0
1001	416232012	DUNLAP EVERETT L & DOROTHY L	9666	RESIDENTIAL VACANT LAND THAT HAS A MAJOR FUNCTIONAL OR ECONOMIC PROBLEM	2193	0	0.0	0
1002	416232018	RANDOLPH MARGARET	9666	RESIDENTIAL VACANT LAND THAT HAS A MAJOR FUNCTIONAL OR ECONOMIC PROBLEM	1633	0	0.0	0
1003	3166000051	EATONVILLE TOWN OF	9666	RESIDENTIAL VACANT LAND THAT HAS A MAJOR FUNCTIONAL OR ECONOMIC PROBLEM	113	0	0.0	0
1004	3537000400	DOW SIDNEY L	9666	RESIDENTIAL VACANT LAND THAT HAS A MAJOR FUNCTIONAL OR ECONOMIC PROBLEM	78764	0	0.0	0
1005	6021710300	PIERCE COUNTY TAX TITLE	9666	RESIDENTIAL VACANT LAND THAT HAS A MAJOR FUNCTIONAL OR ECONOMIC PROBLEM	1197	0	0.0	0
1006	6021710310	CORP OF CATHOLIC ARCHBISHOP	9666	RESIDENTIAL VACANT LAND THAT HAS A MAJOR FUNCTIONAL OR ECONOMIC PROBLEM	3668	20	0.6	1
1007	6021710320	CORP OF CATHOLIC ARCHBISHOP	9666	RESIDENTIAL VACANT LAND THAT HAS A MAJOR FUNCTIONAL OR ECONOMIC PROBLEM	3472	466	13.4	1
1008	6021710330	CORP OF CATHOLIC ARCHBISHOP	9666	RESIDENTIAL VACANT LAND THAT HAS A MAJOR FUNCTIONAL OR ECONOMIC PROBLEM	1209	186	15.3	1
1009	8867100134	KILDAHL FRANK & MARILYN	9666	RESIDENTIAL VACANT LAND THAT HAS A MAJOR FUNCTIONAL OR ECONOMIC PROBLEM	1654	0	0.0	0
1010	416143021	MUELLER PATRICK J & SANDRA A	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	1111	1111	100	1
1011	416143023	MUELLER PATRICK J & SANDRA A	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	2994	1590	53.1	1
1012	416143028	VAN CLEVE GEORGE P & ROSEMARY	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	3682	3529	95.8	1.2
1013	416143029	MUELLER PATRICK J & SANDRA A	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	2084	1224	58.7	1
1014	416144110	AL & BARNEY'S INVESTMENTS LLC	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	46491	31390	67.5	10.5
1015	3605000270	VAN EATON CHEV INC	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	7197	3983	55.3	1.3
1016	3605000290	EATONVILLE SCH DIST #404	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	24872	0	0.0	0
1017	3605000370	EATONVILLE SCH DIST #404	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	30204	20671	68.4	6.9
1018	3605000410	EATONVILLE SCHOOL DISTRICT	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	6833	3441	50.4	1.1
1019	3605000430	EATONVILLE SCH DIST #404	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	33210	30128	90.7	10.0
1020	3605001470	VAN EATON CHEVROLET INC	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	4904	4622	94.3	1.5
1021	3605001480	VAN EATON CHEVROLET INC	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	7284	6902	94.7	2.3

NON SFR - NON SINGLE FAMILY RESIDENTIAL

1 ESU = 3000 Square Feet Impervious
Eatonville Municipal Code 13.24.030 E.

OBJECT ID	TAX_PARCEL	TAX_PAYER_	USE_CD	LAND_USE_D	AREA (SF)	IMPERV_ AREA (SF)	IMP_AREA (%)	ESU
1022	3605001490	VAN EATON CHEV INC	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	7284	6948	95.4	2.3
1023	3605001500	VAN EATON CHEV INC	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	3642	3492	95.9	1.2
1024	3605001530	DANIEL TIM	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	3641	3538	97.2	1.2
1025	3605001571	UNITED METHODIST CHURCH EATONVILLE	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	6804	4565	67.1	1.5
1026	3605001660	CHRISTENSEN RICHARD G	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	7062	6803	96.3	2.3
1027	3605001900	CHRISTENSEN RICHARD G & JOAN	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	3132	2190	69.9	1
1028	3605001980	KERR KENDALL H ETAL	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	950	893	94.0	1
1029	3605002000	COSSALMAN STEPHEN W & LINDA J O	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	5902	4816	81.6	1.6
1030	3605002230	PIERCE COUNTY RURAL LIBRARY DIST	9780	COMMERICAL LAND WHICH DOES NOT HAVE A BUILDING VALUE BUT DOES HAVE A BUILDING.	3893	1652	42.4	1
1031	6021670530	Please call ATR Operations at 798-3134 for more in			6234	0	0.0	0
1032	6022100120	Please call ATR Operations at 798-3134 for more in			61307	0	0.0	0
1033	no tax parcel no.				219220	0	0.0	0
1034	no tax parcel no.				240	0	0.0	0

Total Number of Non SFR ESUs 770

Appendix B

Quality Assurance Project Plan

Quality Assurance Project Plan

for:

Town of Eatonville Comprehensive Stormwater Plan Update

Town of Eatonville, WA

Prepared For:

United States Environmental Protection Agency Region 10
1200 6th Avenue
Seattle, WA 98101

Prepared By:

AHBL, Inc.
Wayne E. Carlson, AICP, LEED® AP
2215 North 30th Street, Suite 300
Tacoma, WA 98403-3350
(253) 383-2422
(253) 383-2572

QAPP Preparation Date:

11 / 20 / 2012

Estimated Project Dates:

Project Start Date: 11 / 01 / 2012
Project Completion Date: 06 / 30 / 2013

A PROJECT MANAGEMENT

A1. Approval Sheet

Sean M. Comfort	July 1, 2013
Sean M. Comfort, P.E. AHBL, Inc. Principal-in-Charge, Chief Investigator	Date
Wayne E. Carlson	July 1, 2013
Wayne E. Carlson, AICP, LEED® AP AHBL, Inc. Quality Assurance Officer	Date
Doug Beagle Town of Eatonville Town Administrator	Date

Contents

SECTION 1: PROJECT MANAGEMENT

1.1 Project Description and Background

The Town of Eatonville has received a grant from the Nisqually Tribe to assist with an update to its Comprehensive Stormwater Management Plan. Mashel River and Ohop Creek, which run on either side of the town, are classified as critical salmon habitat, and the Tribe has an interest in addressing adverse impacts to this habitat resulting from stormwater runoff that originates in Eatonville. The plan update will be focused on identification of opportunities to retrofit existing facilities and incorporate Low Impact Development (LID) techniques.

The LID techniques that will be explored are infiltration-based practices including bioretention and permeable pavements. Capture and reuse practices such as cisterns will not be evaluated because such practices will not serve to enhance low summertime flows in the Mashel River.

1.2 Project Team and Organization

The Town of Eatonville has retained AHBL, Inc. to prepare the updated Comprehensive Stormwater Management Plan, including an update to the Town's hydrologic and hydraulic stormwater computer model. AHBL staff will conduct the necessary modeling and data analysis, as well as writing the updated Comprehensive Stormwater Management Plan, under the direction of Town staff. An organizational chart of the project team is included in Figure 1, and a brief description of the team members and their responsibilities is included below:

Doug Beagle – Town Administrator (Town of Eatonville): Mr. Beagle will act as project manager for the Town and will have responsibility for client-side administration of the project and review of all deliverables produced by the consultant team.

Sean Comfort, PE – Principal (AHBL): Mr. Comfort will act as Principal-in-Charge and project manager for the consultant team. His responsibilities will include oversight of project deliverables and schedule, and he will ensure that all contractual issues are addressed and work is performed.

Wayne Carlson, AICP, LEED AP – Associate Principal (AHBL): Mr. Carlson will oversee the land use planning and policy components of the Comprehensive Stormwater Management Plan Update and will ensure that deliverables meet contractual obligations and are produced on-schedule.

Laura Grignon, PE – Project Engineer (AHBL): Ms. Grignon will oversee the update of the hydrologic and hydraulic computer models to provide the Town of Eatonville with a clear understanding of the existing stormwater system, including areas in need of improvement. Ms. Grignon will also oversee the testing and evaluation, based on the updated model, of various LID options.

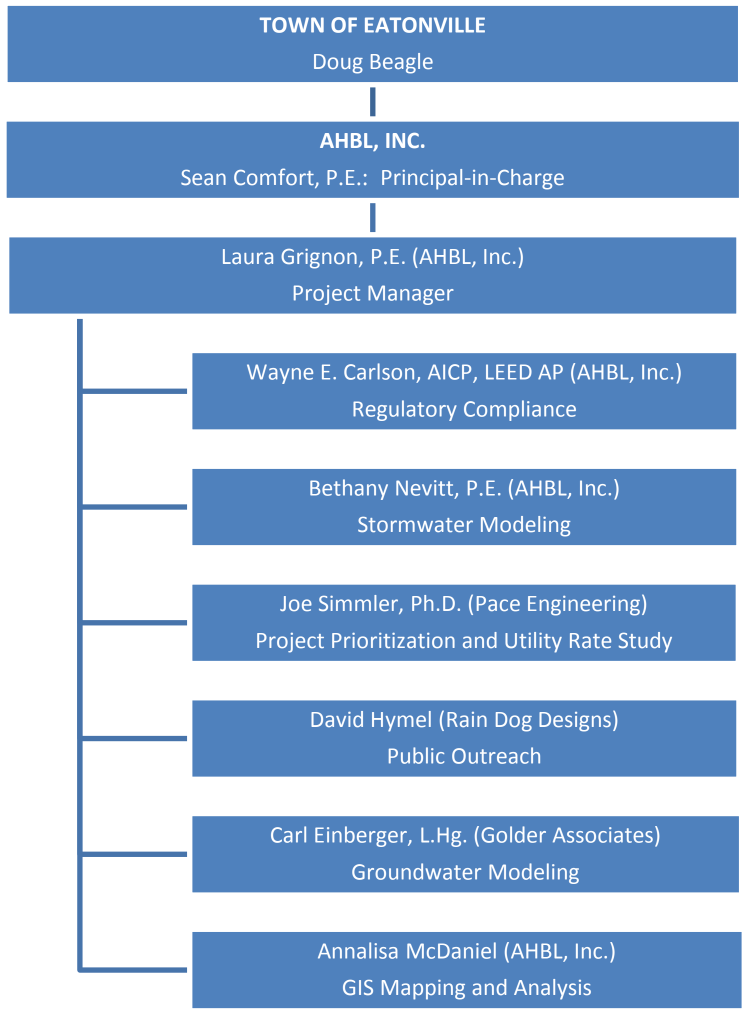
Bethany Nevitt, PE – Project Engineer (AHBL): Under the direction of Ms. Grignon, Ms. Nevitt will perform modeling of the Town's existing stormwater system.

Annalisa McDaniel – Project Planner (AHBL): Ms. McDaniel will provide technical assistance to the engineering team in the form of GIS analysis, data conversion, and mapping services. Ms. McDaniel will also formulate the policy components of the Comprehensive Stormwater Management Plan and be responsible for final synthesis of the plan document.

Carl Einberger, L.Hg. – Hydrogeologist (Golder Associates): Mr. Einberger will provide groundwater analysis and hydrogeology recommendations for the LID scenarios proposed for the plan.

Joe Simmler, Ph.D. – Water Resources (Pace Engineering): Mr. Simmler will review the Town's rate study and lead the project prioritization process.

Figure 1 – Organization Chart



1.3 Project Tasks Description and Schedule

The Comprehensive Stormwater Management Plan will involve the following tasks:

- Task 1: Quality Assurance Project Plan
- Task 2: GIS Stormwater System Data Mapping
- Task 3: GIS Impervious Surface Data Mapping
- Task 4: Hydraulic and Hydrologic Modeling
- Task 5: Code Compliance Review
- Task 6: Stormwater Drainage Problem Identification/LID Solutions List
- Task 7: Operations and Maintenance Program
- Task 8: Review and Update of Program Management/Funding Opportunities
- Task 9: Development of New Stormwater Rate System

- Task 10: Compilation and Presentation of SWCP Update

This QAPP will focus specifically on the tasks associated with modeling of the stormwater system (Tasks 2, 3, and 4), per the grant agreement between the Nisqually Tribe and the Town of Eatonville (Attachment A).

1.3.1 Task 2 – GIS Stormwater System Data Mapping

AHBL will acquire all available data on the Town's existing stormwater drainage system, including the locations of pipes, channels, catch basins, manholes, and outfalls, as well as associated sizing information (pipe and manhole diameters) and elevations (rims and inverts). This data will be reviewed internally for completeness and quality. Any data gaps identified will be documented and reported to the Town's project manager.

1.3.2 Task 3 – GIS Impervious Surface Data Mapping

AHBL will acquire the most recent infrared aerial imagery of the Town of Eatonville from the US Department of Agriculture's Aerial Photography Field Office as the basis for estimating impervious surface coverage within Town limits. After conversion to ESRI shapefile format, this data will be used to estimate impervious surface coverage for each tax parcel in the service area.

1.3.3 Task 4 – Hydraulic and Hydrologic Modeling

The hydraulic and hydrologic modeling task includes applying the Western Washington Hydrologic Model 3.0 (WWHM3) to the various land use categories within the Town, using extended precipitation data from Pierce County. Historic storm data closely representing a 25-year storm event will be inputted into the hydraulic model CivilStorm V8i, and the Town's conveyance system will be modeled under these conditions. The modeled conveyance system will reflect the system inventory completed in 2003 by RW Beck, subsequent as-built drawings prepared by the Town of Eatonville, and limited field verification performed by AHBL.

1.4 Quality Objectives and Criteria for Model Input/Output

Data used as input for the hydraulic and hydrologic modeling will be reviewed for completeness and integrity to ensure the greatest possible accuracy via the following provisions:

- Data sources will include information from the original model created RW Beck in 2003, which was subject to a QA process at that time.
- The original model will be updated with data from projects constructed subsequent to the completion of the original model to more closely represent current conditions. This data will be taken from as-built

documentation and construction plans furnished and certified by the Town of Eatonville.

- Where data is missing, incomplete, or of insufficient quality to produce accurate modeling results, limited field verification will occur to confirm or update the data in question.
- Hydrologic data is taken from the WWHM3 model using Pierce County precipitation information. Flow output will be judged for reasonableness based on staff experience working with the WWHM3.
- The hydraulic model produces a discrepancy table that identifies potentially invalid data elements, such as 0 slopes or reverse slopes. These elements will be back-checked against data sources to determine if correction is needed.
- The hydraulic model produces a hydraulic grade line (HGL) profile that provides a visual indication of how the system is behaving. Discrepancies and errors will be reflected in this profile, and the HGL provides another method to confirm model validity.
- Final QA/QC review is provided by a senior engineer who is not part of the project team.

1.5 Staff Training Requirements and Certifications

AHBL staff involved with this spatial analysis and modeling effort have considerable experience gained from previous similar projects. Laura Grignon, who will be leading the modeling effort, is a registered Professional Engineer with 15 years of experience designing stormwater solutions in Western Washington and has managed numerous hydrologic and hydraulic modeling projects in the past. Sean Comfort, who is the overall Principal-in-Charge, is also a registered Professional Engineer with more than 25 years of experience and will provide quality assurance review to ensure that modeling outputs meet industry standards. Project modeling staff have also received training on the use of the Western Washington Hydrologic Model, as well as advanced training in hydraulic modeling using CivilStorm V8i.

1.6 Documentation and Records

Documentation and records for this project will include the following:

- A tracking matrix documenting data requested by AHBL from various agencies to form the basis of the modeling and planning efforts. The matrix shall include a description of the requested data, the agency from whom it was requested, the date requested, and the date received.

SECTION 2: MODEL SELECTION AND CALIBRATION, INCLUDING DATA ACQUISITION AND MANAGEMENT

2.1 Model Selection

The hydrologic model selected for this modeling effort is the Western Washington Hydraulic Model 3.0 (WWHM3). WWHM3 is a continuous simulation hydrologic model developed by the Washington State Department of Ecology and based upon Hydrologic Simulation Program Fortran (HSPF). Pierce County has developed specific precipitation time series for use in modeling rainfall patterns within its jurisdiction.

Hydraulic modeling of the Town's stormwater conveyance system will be conducted using CivilStorm, a modeling program developed by Bentley, Inc. CivilStorm provides a backwater analysis of flows in the conveyance system using the hydrologic conditions from the WWHM3. It can predict locations of overtopping and calculate the capacity of the conveyance system versus expected flows.

These modeling systems were chosen because of their accuracy of modeling hydrologic conditions in the Town of Eatonville, the ease and accuracy of modeling LID Best Management Practices, and the stability of the hydraulic model in simulating disparate conveyance elements.

2.2 Model Calibration and Validation

The Pierce County Extended Rainfall Data will be used to calibrate the model. The Pierce County Mean Annual Precipitation map (included with the data), identifies Eatonville as being located within the 40-42 inch precipitation zone in East Pierce County. Thus, the 158 year, 15 minute precipitation time series and the 158 year, 24 hour evaporation time series for the "40 inch east basin" will be loaded into WWHM3.

2.3 Secondary Data Acquisition Requirements

To execute the appropriate modeling tasks, input data will be acquired from the following sources:

- Modeling inputs from the original modeling effort by RW Beck in 2003. This data was a combination of information from Town records and field measurements conducted by Town staff. The data potentially contains errors in elevations, sizes, pipe material, and catchment boundaries. Due to the limited time frame and scope of the project, this data will only be field-verified in limited circumstances where discrepancies are obvious.

- Data representing projects constructed subsequent to the RW Beck modeling effort and the associated effects on the existing conveyance system. This data will be taken from as-built documentation and construction plans provided by the Town. Data from as-built documents is expected to be accurate, assuming that as-built conditions were accurately surveyed and recorded. Construction plans are expected to be sufficiently precise for this modeling effort, though they may not exactly reflect what was ultimately constructed.
- Hydrologic data will be taken from the WWHM3, using Pierce County precipitation information. This data has undergone its own QA process, independent of this project, and is anticipated to be precise.

2.4 Data Management and Hardware/Software Configuration

The data for this project will consist of (1) raw data (e.g., GIS data sets, as-built surveys, rainfall data, etc.) consistent with QA/QC operations and (2) data from analytical runs sorted and stored in electronic format suitable for review.

All data sets will be filed in appropriate directory/subdirectory structures on computers that are backed up on a daily basis. All data files will be archived on DVD at the end of the project. Documentation of data will be saved in spreadsheet format.

Staff members who are responsible for receiving data (e.g., rainfall data, as-built surveys, GIS data sets, etc.), must be aware of and adhere to the procedures in this QAPP. Project data will be recorded directly, promptly, and legibly in standardized formats in compliance with SOPs. Changes or corrections to data will be indicated in a log. Staff members making changes will be identified and the date explanation for the change will be noted. As described earlier, standard good data analysis practices will be employed in each aspect of the analyses.

SECTION 3: ASSESSMENTS AND RESPONSE ACTIONS

3.1 Assessment and Response Actions

Due to the short duration of the project, no formal audits of procedures are planned. However, all modeling outputs and associated reports undergo an internal QA/QC review by senior project staff prior to publication or delivery to the client to ensure that industry standards have been followed appropriately during the modeling process.

3.2 Reports to Management

Given the compressed project schedule, internal QA/QC review will occur as part of the regular workflow, rather than as a distinct task, and client QA/QC will occur at delivery of the draft modeling results. QA/QC will occur at the 30% and 90% draft phases of the development of the Comprehensive Stormwater Plan update. The Town of Eatonville will maintain copies of the original interim submittals as well as the revisions that occurred as a result of the comments made during review.

SECTION 4: OUTPUT ASSESSMENT AND MODEL USABILITY

Hydrology will be modeled using WWHM3 with extended data from Pierce County for both the existing conditions, future conventional, and future LID scenarios for the 25-year storm event. The WWHM3 modeling software will be used to generate runoff flows from each of the sub-basins, including both the existing conditions and the future build out conditions for the 25-year storm event. The following input parameters will be used:

- Pierce County Extended Rainfall Data
- Sub-basin Areas
- Land Classifications
- Impervious Area Coverage

Output from the model will represent an historic storm event with characteristics similar to the 25-year, 24-hr event with 15-minute peak flows identified in the 2003 RW Beck plan.

Hydraulic modeling will be modeled using CivilStorm V8i for AutoCAD Civil 3D 2012.

4.1 Pierce County Extended Rainfall Data

The Pierce County Extended Rainfall Data will be downloaded from the Pierce County website. Eatonville is located within the 40-42 inch precipitation zone in East Pierce County. Thus, the 158 year, 15 minute precipitation time series and the 158 year, 24 hour evaporation time series for the “40 inch east basin” will be loaded into WWHM3.

4.2 Land Classifications

Soil types, slopes and land coverage are required input parameters for WWHM. From the Pierce County Stormwater Management and Site Development Manual, the soils will be classified into the following Hydrologic Soil Groups: Barneston Gravelly Coarse Loamy Sand = B, Dupont Muck = D, Kapowsin Gravelly Loam = D and Scamman Silt Loam = D.

Slopes were approximated based on the topographic information generated by GIS. Slopes were generalized as Flat (0-5%), Moderate (5-15%) and Steep (>15%).

Pervious land coverage will be modeled as lawn while impervious areas will be modeled as roads. Impervious area classification does not affect the hydrologic calculation, so further subdivision of impervious areas into roof, parking, road, etc. will not be required.

4.3 Existing Conditions

The existing impervious surface coverage will be developed from GIS data obtained from Pierce County. This information will be subdivided and grouped based on sub-basin boundaries using ArcGIS software. The GIS data obtained from this analysis will provide the individual square-foot area of impervious surface cover.

The total impervious area will be summed for each sub-basin. From the total sub-basin area and the total impervious area, the total pervious area will be calculated. The 2003 report provided soil coverage areas in each basin. Using the percentage of soil coverage for each soil designation, we intend to assume that existing pervious surfaces will have the same percentage within each soil classification. On-site slopes in each classification will also be assumed to be equal. From this, soil and slope data will be generated for each basin.

4.4 Future Build-Out Conditions

The sub-basin delineation from the 2003 report provided future impervious percentages and was divided into land use zone and soils. This information will be further subdivided based on slope classification. Percent impervious and basin total area will be used to calculate areas in acres. Slopes were delineated based on maps provided by the 2003 Report and are not proposed to be modified.

4.5 Low Impact Development Scenario

In addition to modeling the existing and future conditions, an LID scenario will be developed based on assumptions for each sub-basin. This scenario will assume that new developments will provide LID to the maximum extent feasible for both private and public developments. This scenario will not include any improvements to the conveyance system.

In order to develop the hydrographs, a review of each sub-basin will be performed. A flow reduction factor will be assumed based on the review of the soils and development conditions in each sub-basin. Reduction factors will be 0% for areas with no infiltration and vary from 10% up to 75% for areas located within areas known to infiltrate. Reduction factors are also based on the percentage of the sub-basin located in the infiltrative area and also the extent of development in the basin in the existing conditions compared to the future build out conditions.

SECTION 5: REFERENCES CITED

Bentley Systems. (2010). CivilStorm V8i SELECT.

Clear Creek Solutions. (August 2006). Western Washington Hydrology Model (WWHM) Version 3.0.

Pierce County Extended Rainfall Data. (2012). Pierce County, WA.

Pierce County GIS Data. (2012). Data layers provided to the Town of Eatonville. Tacoma, WA.

R.W. Beck. (January 2003). Draft Report Stormwater Management Program. Eatonville, WA.

SECTION 6: DISTRIBUTION LIST

This document will be distributed to the following project participants once all approval signatures have been received:

- Christopher Ellings
  Salmon Recovery Program Manager
  Nisqually Indian Tribe Natural Resources
  12501 Yelm Highway SE
  Yelm, WA 98513
  (360) 438-8687 x1270
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- Melissa Buckingham
  Urban Conservation Program Coordinator
  Pierce Conservation District
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  Puyallup, WA 98371
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  melissab@piercecountycd.org

- Marsha Huebner
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  University Place, WA 98467
  (253) 798-4050
  mhuebne@co.pierce.wa.us

- Doug Beagle
  Town Administrator
  Town of Eatonville
  201 Center Street West
  Eatonville, WA 98328
  (360) 832-3361 x105
  dbeagle@eatonville-wa.gov

Appendix C

Golder Associates Soils Technical Memorandum

TECHNICAL MEMORANDUM

Date:	May 9, 2013	**Project No.:**	123-93162.001
To:	Laura Grignon, Sean Comfort, AHBL	**Company:**	AHBL
From:	Michael Klisch, LHg and Carl Einberger, LHg		
cc:		**Email:**	ceinberger@golder.com

RE: TOWN OF EATONVILLE – ASSESSMENT OF POTENTIAL INFILTRATION SUITABILITY AND SHALLOW GROUNDWATER FLOWPATHS

The Town of Eatonville (Town) is pursuing options for Low Impact Development (LID) to include in its Comprehensive Stormwater Management Plan. Improved infiltration of stormwater is one component under consideration to support the LID efforts. The ability to achieve effective and timely infiltration of stormwater is highly dependent on underlying soil conditions. This memorandum summarizes geologic and soil conditions in the Town and identifies geologic and soil units favorable for infiltration. It also provides a generalized interpretation of shallow groundwater flowpaths in the Eatonville area. The interpretations presented in this memorandum are based upon a review of available data, and no field investigations have been conducted as part of this work.

1.0 GEOLOGIC UNITS

The surficial geologic units mapped in the vicinity of Eatonville are shown in Figure 1. The geologic units include both unconsolidated alluvial and glacial deposits and semi-consolidated to consolidated bedrock (Walters and Kimmel 1968; Walsh et. al. 1987).

The unconsolidated geologic units include:

- **Alluvial materials** consisting of silt, sand, and gravel. The alluvial materials occur along the Mashel River, Ohop Creek, and in the eastern portion of Eatonville, east of Washington Avenue. The alluvium is from about 10 to 100 feet thick, with the thickest deposits found along the Mashel River at the Town wellfield, where it is about 50 to 100 feet thick.
- **Glacial materials** including:
  - **Continental Glacial Deposits.** Continental glacial deposits, including till, advance and recessional outwash deposits, and undifferentiated drift of Fraser and Pre-Fraser ages, associated with the advance and retreat of continental glaciations, occur in the areas west and northwest from central Eatonville. These deposits consist of up to 100 feet of fine-grained materials including till and fine-grained outwash, and up to about 60 feet of coarser-grained outwash materials.

    The Ohop Creek valley was eroded by glacial meltwater streams and outburst floods as the Puget Glacial Lobe receded (and prior to mudflow deposition). This suggests that outwash deposits may underlie the alluvial and lahar materials present at the surface of the valley. Some well logs in the Ohop Valley intersected sand and gravel below lahar deposits which may be glacial outwash.

Golder Associates Inc.
18300 NE Union Hill Road, Suite 200
Redmond, WA 98052 USA
Tel: (425) 883-0777 Fax: (425) 882-5498 www.golder.com

- **Alpine Glacial Deposits.** Till and undifferentiated drift deposits of Fraser and Pre-Fraser ages, associated with the advance and retreat of alpine glaciations, occur mantling the upland areas northeast and east of Eatonville. These materials range in thickness from about 50 to over 200 feet.

Consolidated or semi-consolidated bedrock underlies the glacial and non-glacial materials. The bedrock units include the Miocene Mashel Formation and un-named Miocene to Eocene andesite and basalts. The Mashel Formation consists of semi-consolidated, fluvially-deposited sands and gravels, with some pumice and tuffaceous material, and some fine-grained lacustrine deposits. The Mashel Formation can be subdivided into an upper fine-grained part and a lower coarse grained part. The Mashel Formation underlies the continental glacial deposits, and is exposed in the valleys of Ohop Creek and the lower portion of the Mashel River southwest of Eatonville. The Mashel Formation is about 60 to over 200 feet thick. The Mashel Formation is underlain by andesites and basalts.

The andesite and basalts are Oligocene to Eocene in age. These rocks include rocks of the Hatchet Mountain Formation and Northcraft Formation, and may be regionally correlated to the Goble Volcanics. The andesites and basalts are exposed east and south of Eatonville, including in the Mashel River in Boxcar Canyon and at the Town's wellfield. The basalts also occur between about 40 and 100 feet below ground in the Town's wellfield. The total thickness of these rocks is unknown. A water supply test well drilled in Eatonville in 1942 intersected 180 feet of glacial materials and Mashel Formation before being advanced to a depth of 750 feet in the volcanic rocks. The volcanic rocks likely overlie Eocene or older sedimentary rocks that may be correlative with Puget Group sedimentary rocks.

2.0 SOIL UNITS

A map of soils in the Eatonville area based on the Soil survey of Pierce County (Zulauf 1979) is shown in Figure 2, and soil units are summarized in Table 1. The soils in Eatonville can be subdivided into two primary categories. The first is soil derived from glacial tills. These include the Kapowsin and Scamman soils. These soils are characterized by a low saturated hydraulic conductivity (less than about 0.2 inches/hour [in/hr]). The depth to water in these soils ranges from about 11 to 30 inches below ground. Much of the area south and west of the center of Eatonville is covered with Kapowsin and Scamman soils.

The second group of soils is derived from glacial outwash materials. Soils in this group include the Barneston, Indianola, and Ragnar soils within the Town. The soils derived from outwash soils are characterized by high saturated hydraulic conductivity (1.98 to 5.95 in/hr) and a depth to water of greater than 80 inches. These soils are found between Washington Street and Antonie Avenue, in the area of the Eatonville Airport, and in the area of the Town's wellfield near the Mashel River.

3.0 AREAS FAVORABLE FOR STORMWATER INFILTRATION

Areas favorable for stormwater infiltration are those underlain by soils derived from glacial outwash (Barneston, Indianola, and Ragnar soils) within the Town (Figure 3). These areas are favorable because of the high hydraulic conductivity of the soils and suitable depth to the water table.

Briscot soils have a high hydraulic conductivity but relatively shallow depth to water (6 to 36 inches) making them less favorable. Chehalis soils have a high depth to water (greater than 80 inches) but low hydraulic conductivity (0.2 to 0.57 in/hr). These soils are less favorable for infiltration, but may be suitable for small-scale infiltration depending on site-specific conditions and infiltration rates and volumes.

Areas of till-derived soils (Kapowsin and Scamman) are generally unfavorable for infiltration because of the low hydraulic conductivity of the soil materials. They may be suitable for small-scale infiltration of low volumes at low rates depending on site-specific conditions and infiltration rates and volumes.

For all of the soil units, site-specific investigations are recommend to fully assess the suitability for infiltration of stormwater.

4.0 SHALLOW GROUNDWATER FLOW

Shallow groundwater flow (within 50 to 75 feet of ground surface) in Eatonville was evaluated using topography (Eatonville and Tanwax Lake USGS 7.5 minute quadrangles), the location of major surface water bodies (Lynch Creek, Ohop Creek, and the Mashel River), and well log information on file with the Washington Department of Ecology. There are few well logs within the Town, significantly limiting the ability to conclusively map groundwater flow directions, particularly in the north central portion of the Town.

In general, shallow groundwater discharges to Ohop Creek (primarily on the northwest side of Town), the Mashel River (primarily on the south side of Eatonville), or Lynch Creek (on the north and northeast side of Eatonville; Figure 4). The precise boundaries between areas with groundwater flowing to the each of the respective surface water bodies cannot be ascertained with currently available data. A shallow groundwater divide is present beneath the central portion of the Town; however, the location of the divide is uncertain because of the relatively flat topography in the central portion of Eatonville and the sparse well log information.

Site-specific subsurface investigations would be needed to more accurately definite groundwater subbasins in the Town, and the relative contributions to Lynch Creek, Ohop Creek, and the Mashel River flows of enhanced groundwater recharge associated with implementation of LID methods for handing stormwater.

5.0 REFERENCES

Walters, K.L., and G.E. Kimmel. 1968. Groundwater Occurrence and Stratigraphy of Unconsolidated Deposits, Central Pierce County, Washington, Water Supply Bulletin No. 22, Washington State Department of Water Resources.

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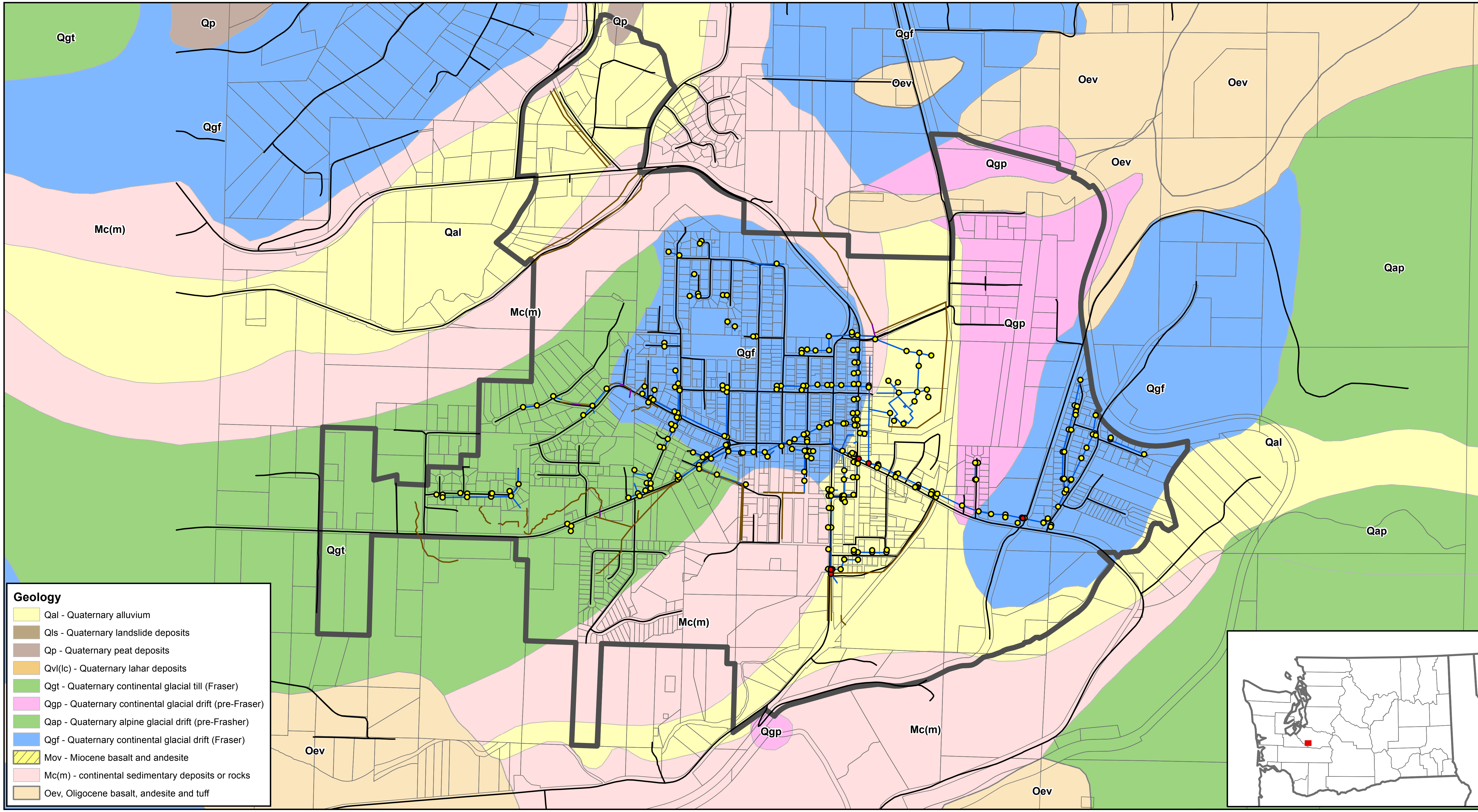
TABLE

Table 1: Soil Units in Eatonville

Map Unit Symbol	Map Unit Name	Parent Material	Saturated Hydraulic Conductivity (in/hr)	Depth to Water Table (inches)	Relative Infiltration Potential
2A	Aquic Xerofluvents, level	Stream Alluvium	0.57 to 1.98	1 to 10	Low
3B	Barneston gravelly coarse loamy sand, 0 to 6 percent slopes	Gravelly Glacial Outwash	1.98 to 5.95	More than 80	High
3C	Barneston gravelly coarse loamy sand, 6 to 15 percent slopes	Gravelly Glacial Outwash	1.98 to 5.95	More than 80	High
3E	Barneston gravelly coarse loamy sand, 30 to 45 percent slopes	Gravelly Glacial Outwash	1.98 to 5.95	More than 80	High
7A	Briscot loam, variant	Alluvium	1.98 to 5.95	6 to 36	Moderate-Low
9A	Chehalis silt loam	Alluvium derived from sandstone, shale, and basalt	0.20 to 0.57	More than 80	Moderate-Low
12A	Dupont muck	Decomposing Vegetation in Till Plain Depressions	0.0 to 0.06	0 to 12	Low
13B	Everett gravelly sandy loam, 0 to 6 percent slopes	Gravelly Glacial Outwash	1.98 to 5.95	More than 80	High
18B	Indianola loamy sand, 0 to 6 percent slopes	Sandy Glacial Outwash	1.98 to 5.95	More than 80	High
18C	Indianola loamy sand, 6 to 15 percent slopes	Sandy Glacial Outwash	1.98 to 5.95	More than 80	High
19B	Kapowsin gravelly loam, 0 to 6 percent slopes	Glacial Till Plains	0.0 to 0.06	18 to 30	Low
19C	Kapowsin gravelly loam, 6 to 15 percent slopes	Glacial Till Plains	0.0 to 0.06	18 to 30	Low
19D	Kapowsin gravelly loam, 15 to 30 percent slopes	Glacial Till Plains	0.0 to 0.06	18 to 30	Low
19E	Kapowsin gravelly loam, 30 to 50 percent slopes	Glacial Till Plains	0.0 to 0.06	18 to 30	Low
19F	Kapowsin gravelly loam, 50 to 70 percent slopes	Glacial Till Plains	0.0 to 0.06	18 to 30	Low
22A	McKenna gravelly loam 2.7	Glacial Till in Depressions/Drainageways	0.0 to 0.06	0	Low
32B	Ragnar sandy loam, 0 to 6 percent slopes	Alluvium and Glacial Outwash	1.98 to 5.95	More than 80	High
33A	Reed silty clay	Alluvium in Floodways	0.57 to 1.98	0	Low
34A	Riverwash	Coarse Sand and Gravelly Alluvium in Floodplains	No data	No data	Low
35F	Rock outcrop	Rock Outcrop	No data	No data	Low
36C	Scamman silt loam, 6 to 15 percent slopes	Clayey Glacial Till	0.06 to 0.20	11 to 16	Low
36D	Scamman silt loam, 15 to 30 percent slopes	Clayey Glacial Till	0.06 to 0.20	11 to 16	Low
44A	Tanwax muck	Sedimentary Peat in Ponded Basins	0.0 to 0.06	0 to 12	Low
PITS	Pits	Open Gravel and Sand Pits	No data	No data	Low
W	Water	Open Water	Not Applicable	0	Low

Notes:
From Soil Survey of Pierce County, Washington.

FIGURES



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

- Manhole
- Catch Basin
- Culvert
- Ditch
- Pipe
- Road
- Town Limits
- Parcel

0 1200
Scale in Feet

Map Projection:
Washington State Plane South,
NAD 1983, Feet

Source: USGS (geology),
Golder Associates Inc.

N

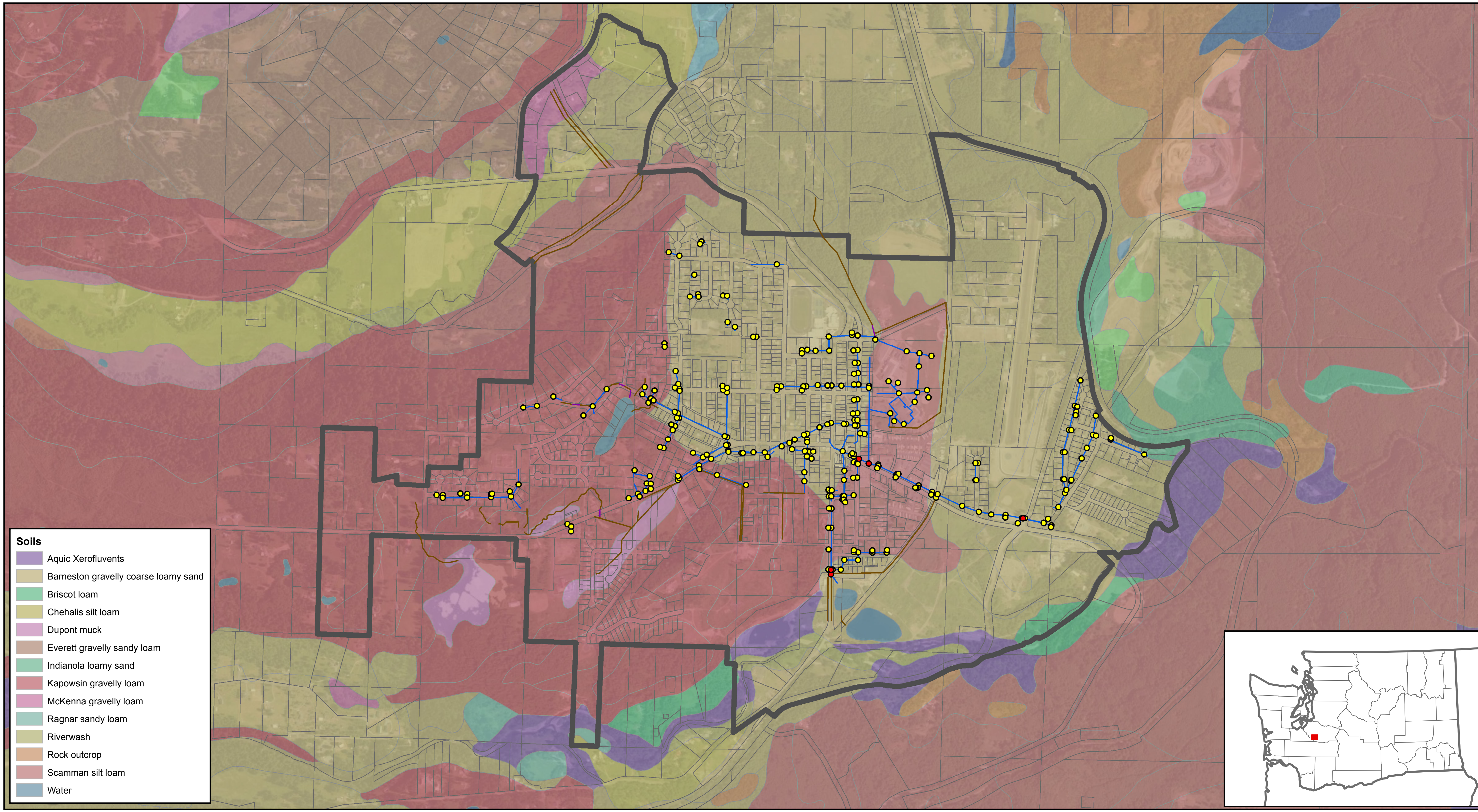
FIGURE 1

SURFICIAL GEOLOGY
EATONVILLE AND VICINITY

AHBL/EATONVILLE SW EVALUATION/WA

Path: M:\Projects\2012\12393162_Eatonville_SW_Evaluation\MXD\12393162_F01_Geology.mxd Date: 5/9/2013 User: THammond

Golder Associates



LEGEND

- Manhole
- Catch Basin
- Culvert
- Ditch
- Pipe
- Town Limits
- Parcel

0 1500
Scale in Feet

Map Projection:
Washington State Plane South,
NAD 1983, Feet

Source: NRCS (soils),
Golder Associates Inc.

N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

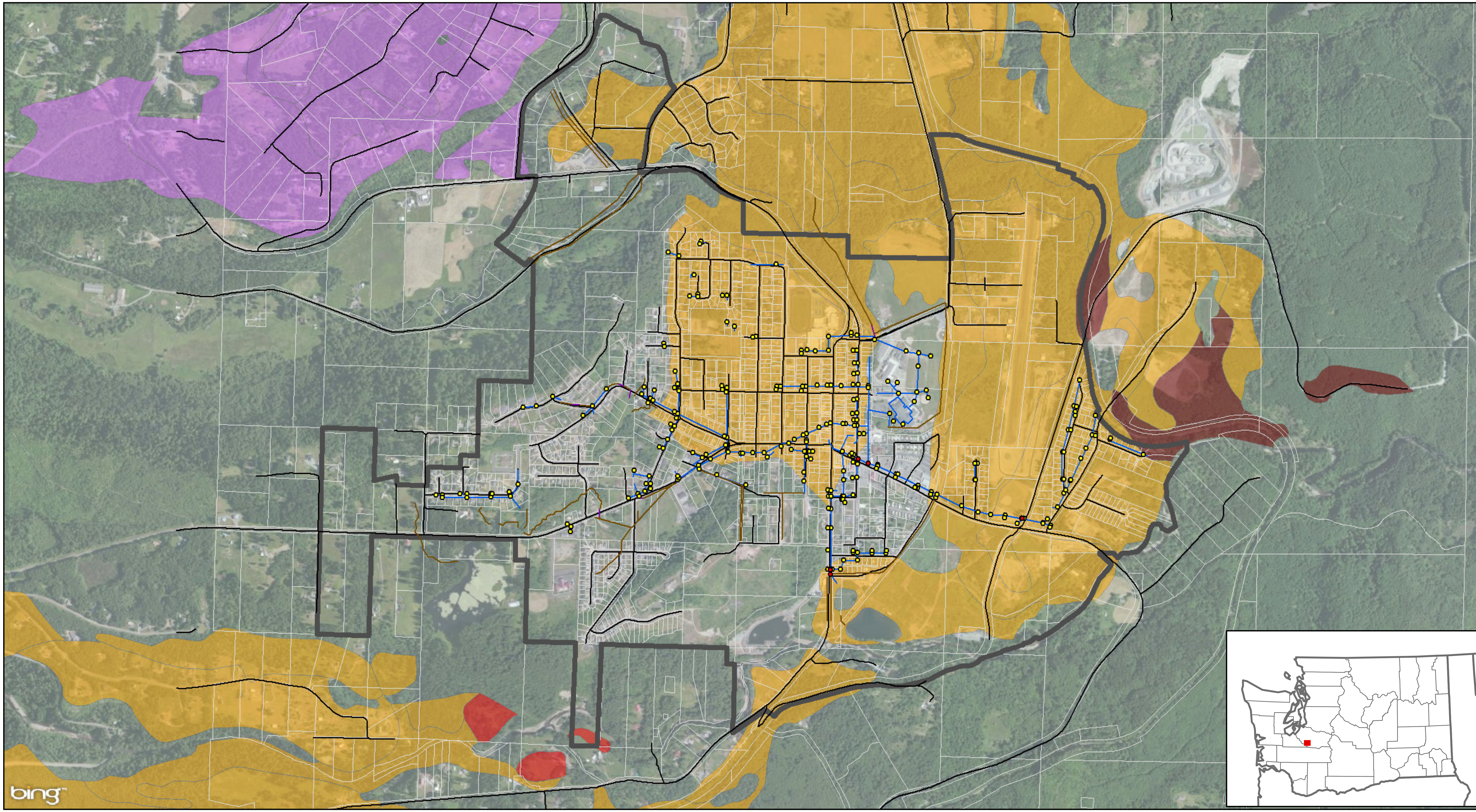
FIGURE **2**

SOILS MAP
EATONVILLE AND VICINITY

AHBL/EATONVILLE SW EVALUATION/WA

Path: M:\Projects\2012\12393162_Eatonville_SW_Evaluation\MXD\12393162_F02_Soils.mxd Date: 5/9/2013 User: THammond

Golder Associates



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

- Manhole
- Catch Basin
- Culvert
- Ditch
- Pipe
- Road
- Town Limits
- Parcel

Soils

- Barneston gravelly coarse loamy sand
- Everett gravelly sandy loam
- Indianola loamy sand
- Ragnar

0 1200
Scale in Feet

Map Projection:
Washington State Plane South,
NAD 1983, Feet

Source: NRCS (soils), Bing Maps (imagery)
Golder Associates Inc.

N

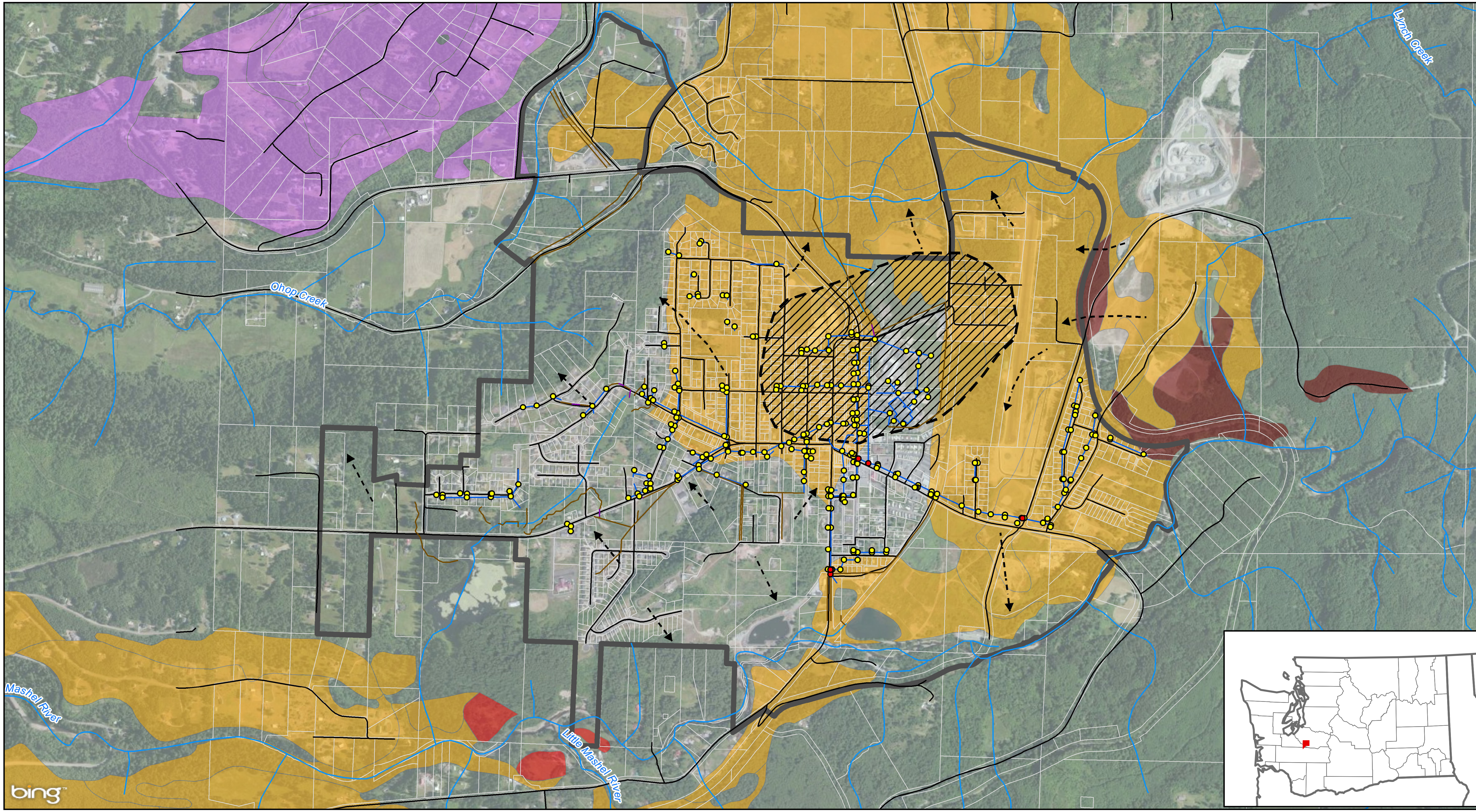
FIGURE 3

AREAS WITH HIGH INFILTRATION POTENTIAL
EATONVILLE AND VICINITY

AHBL/EATONVILLE SW EVALUATION/WA

Golder Associates

Path: M:\Projects\2012\12393162_Eatonville_SW_Evaluation\MXD\12393162_F03_HighInfiltrationAreas.mxd Date: 5/10/2013 User: THammond



This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

LEGEND

- Manhole
- Catch Basin
- Culvert
- Ditch
- Pipe
- Road
- Groundwater Flow Direction (Inferred)
- Stream/River
- Groundwater Divide (Location Uncertain)
- Town Limits
- Parcel

Soils

- Barneston gravelly coarse loamy sand
- Everett gravelly sandy loam
- Indianola loamy sand
- Ragnar

Note: Groundwater flow directions based on limited available well data and consideration of topography

0 1200
Scale in Feet

Map Projection:
Washington State Plane South,
NAD 1983, Feet

Source: NRCS (soils), Bing Maps (imagery), Golder Associates Inc.

N

FIGURE **4**

SHALLOW GROUNDWATER FLOW, EATONVILLE AND VICINITY

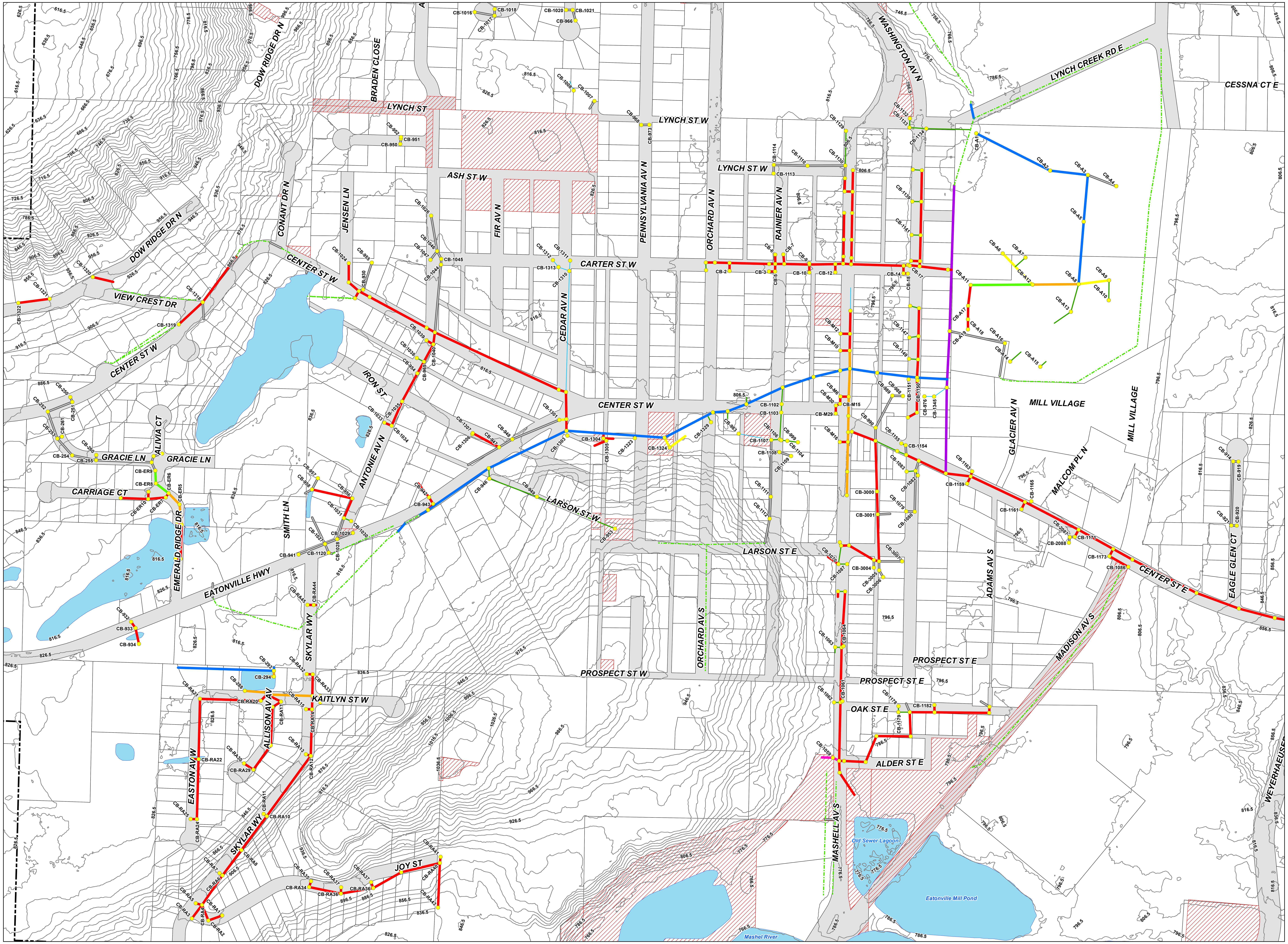
AHBL/EATONVILLE SW EVALUATION/WA

Golder Associates

Path: M:\Projects\2012\12393162_Eatonville_SW_Evaluation\MXD\R01\12393162R01_F04_ShallowGroundWaterFlow.mxd Date: 5/9/2013 User: THammond

Appendix D

Stormwater Inventory



Town of Eatonville

- Town Limits
- Tax Parcels
- Public Parcels
- Waterbodies
- Streams
- Channel
- Catch Basin

Conduit

Diameter in Inches

- No Data
- 6
- 8
- 10
- 12
- 14
- 15
- 18
- 24
- 36

N

0 205 410 Feet

AHBL

FIGURE 3-5
STORMWATER INVENTORY MAP

TRUNK	ID	NORTHING	EASTING	ELEV	MD	INVERT	DIRECTION	DIA.	MAT'L	CONNECTING PIPE LENGTH	PIPE CONNECTION TO	AHBL Notes
North Basin Stormwater Structure Inventory												
RW Beck information supplemented by Asbuilts and AHBL field measurements												
(MD = Measure Down - method by which data was collected in 2003 Program)												
Info Source				(FT)	(IN)	(FT)	(N,S,E,W)	(IN)		(FT)		
TRUNK 1 - Center Street West												
	DITCH	-- NEED CHARACTERISTICS: AVG DEPTH, TOP WIDTH, BOTTOM WIDTH, SLOPE OF CHANNEL										
RWB	1315	564875.2305	1196227.105	812.86	49	808.78	N(NE)	12	CONC		TO 931	
										37.70		
RWB	931	564908.7079	1196244.446	814.27	72.24	808.25	N	6	PVC		TO 930	Original N/E was switched with 1316. Updated location.
				814.27	75.72	807.96	E	12	CONC		TO 1043	
				814.27	73.68	808.13	S	12	CONC		TO 1315	
				814.27	72.72	808.21	W	12	PVC		TO 1316	
RWB	1314	564882.4921	1196295.886	815.22	84	808.22	N	12	PVC			Added CB into system
				815.22	88	807.89	E	12	PVC		TO 931	
				815.22	90	807.72	W	12	CONC		TO 1043	
RWB	1043	564745.0008	1196565.313	818.44	127.6	807.81	E(SE)	16	PVC		TO 1041	Assumed 12" PVC
				818.44	128.2	807.76	W(NW)	12	CONC		TO 1314	
										44.60		
RWB	1041	564723.9893	1196604.655	818.38	93.96	810.55	N	8	IP		TO 1044	
				818.38	86.4	811.18	SW	12	ABS		TO 1040	
				818.38	56.4	813.68	NE	12	ABS		TO 1042	
				818.38	126.0	807.88	E	12	CONC		TO 1309	Diameter out is larger than diameter in
				818.38	132.2	807.36	W	12	ABS		TO 1043	Diameter and material discrepancy. Assumed 12" PVC.
										639.67		
RWB	1309	564468.6336	1197191.147	811.97	69	806.22	E(SE)	12	CONC		TO 1308	
				811.97	69	806.22	W(NW)	12	CONC		TO 1041	
										35.70		
RWB	1308	564458.4753	1197225.368	812.1	73	806.02	N	8	PVC		TO 1310	
				812.1	77	805.68	S	15	CONC		TO 1300	Diameter discrepancy. Assumed 12".
				812.1	75	805.85	W(NW)	12	CONC		TO 1309	
										127.06		
RWB	1300	564331.4915	1197229.834	811.54	67	805.96	N	12	CONC		TO 1308	
				811.54	67	805.96	S	12	CONC		TO 1302	
				811.54	35	808.62	W	10	PVC		TO 1301	
										54.10		
RWB	1302	564277.4161	1197231.349	810.11	55.5	805.49	N	16	PVC		TO 1300	Diameter and material discrepancy. Assumed 12" Conc
				810.11	62	804.94	E(SE)	24	CONC		TO 1325	
				810.11	26.5	807.90	S	6	PVC		TO 1303	
				810.11	62	804.94	W(SW)	24	CONC		TO 945	
				810.11	29.5	807.65	E	3	PVC		? TO SURFACE ?	
										460.71		CB1325 - outlet higher than inlet
RWB	1325	564255.2942	1197691.532	807.9	61	802.82	W	24	ST		TO 1302	Material discrepancy. Assumed Concrete

North Basin Stormwater Structure Inventory

RW Beck information supplemented by Asbuilts and AHBL field measurements

(MD = Measure Down - method by which data was collected in 2003 Program)

TRUNK	ID	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIA. (IN)	MAT'L	CONNECTING PIPE LENGTH (FT)	PIPE CONNECTION TO	AHBL Notes
Info Source												
				807.9	58.5	803.03	E(NE)	8	PVC		TO 1328	Material and diameter discrepancy, assumed 24" Conc
										255.47		
RWB	1328	564379.2682	1197914.909	807.26	76	800.93	E	24	CONC		TO 1330	Outlet higher than inlet
				807.26	79	800.68	S(SW)	24	CONC		TO 1325	
										69.58		
RWB	1330	564385.9358	1197984.171	806.52	20	804.85	S	8	PVC		TO ?	AHBL confirmed 70" MD and 36" Diam for NE and 24"
AHBL				806.52	70	800.69	NE	36	CONC		TO 1331	for W
				806.52	70	800.69	W	24	CONC		TO 1328	
										93.82		
RWB	1331	564421.6085	1198070.946	806.63	15	805.38	S	8	CORR		TO CB in ROW	AHBL confirmed MD
AHBL				806.63	81	799.88	NE	24	CONC		TO 1331B	
				806.63	81	799.88	SW	36	CONC		TO 1330	
										142.80		
~~RWB~~	~~1331B~~	~~564493.44~~	~~1198194.36~~	~~804.85~~	~~67.08~~	~~799.26~~	~~NE~~	~~24~~	~~CONC~~		~~TO 1331X?~~	Not part of main line. Coud not find.
				~~804.85~~	~~67.08~~	~~799.26~~	~~SW~~	~~24~~	~~CONC~~		~~TO 1331~~	
										42.11		
RWB	1331X			804.85	72	798.85	W(SW)	24	CONC		TO 1331B	AHBL checked in field MD, routing and pipe diameter.
AHBL				804.85	72	798.85	E(NE)	24	CONC		TO 1331C	Assumed same rim elevation as 1331B.
				804.85	72	798.85	S	12	CONC		TO 1102	
										155.93		
RWB	1331C	564555.90	1198382.29	801.84	35	798.92	E	24	DI		TO 986	Assumed DI based on downstream CB
				801.84	35	798.92	W	24	CONC		TO TO 1331X	Couldn't open in field. MD through grate was 36" to bottom of CB.
										128.53		
RWB	~~986~~	~~564588.7001~~	~~1198506.562~~	~~799.39~~	~~32~~	~~796.72~~	~~NE~~	~~18~~	~~CONC~~		~~TO 987~~	Only saw a W and E pipe
WHP				~~799.39~~	~~35~~	~~796.47~~	~~W(SW)~~	~~24~~	~~DI~~		~~TO 1331C~~	Updated pipe size, material and MD
				~~799.39~~	~~35~~	~~796.47~~	~~E~~	~~24~~	~~DI~~		~~987~~	See Mashell Trunk for updated information
										45.85		
RWB	~~987~~	~~564598.5912~~	~~1198551.337~~	~~798.63~~	~~42~~	~~795.13~~	~~E(SE)~~	~~24~~	~~DI~~		~~TO 1001~~	Updated measuredown, diameter and material
AHBL				~~798.63~~	~~42~~	~~795.13~~	~~W(SW)~~	~~24~~	~~DI~~		~~TO 986~~	See Mashell Trunk for updated information
										129.78		
RWB	1001	564582.1317	1198680.066	794.71	32	792.04	W(NW)	24	DI		TO 987	Could not open
				794.71	32	792.04	E	24	CONC		TO 1001B, 970	
										187.65		
RWB	970	564563.7469	1198866.811	792.17	47.5	788.21	N	10	PVC		TO 1148	Confirmed MD, pipe size and material.
				792.17	43	788.59	S	8	PVC		TO 1150	
				792.17	48	788.17	W	24	CONC		TO 1001B, 1001	
				792.17	48	788.17	E(NE)	24	CONC		TO TRUNK 4	
										144.11		
	CONNECTION TO TRUNK 4											Could not find where connected

North Basin Stormwater Structure Inventory

RW Beck information supplemented by Asbuilts and AHBL field measurements
(MD = Measure Down - method by which data was collected in 2003 Program)

TRUNK	ID	NORTHING	EASTING	ELEV	MD	INVERT	DIRECTION	DIA.	MAT'L	CONNECTING PIPE LENGTH	PIPE CONNECTION TO	AHBL Notes
Info Source				(FT)	(IN)	(FT)	(N,S,E,W)	(IN)		(FT)		
TRUNK 2 - Carter Street												See Perteet Plans for Carter Street
RWB	1340	565044.615	1197867.464	822.26	22	820.43	N	8	CONC		TO 1339	Perteet asbuilts do not have pipe material for proprosed, nor any pipe info for existing on plans. Elevations on Perteets plans conflict with RWB's elevations.
										35.77		
RWB	1339	565080.3279	1197865.369	822.24	26	820.07	E	12	CONC		TO 1338	
				822.24	28	819.91	S	8	CONC		TO 1340	
										42.92		Perteet IEs conflict with RWB IEs
RWB	1338	565081.5401	1197908.27	822.15	28	819.82	W	12	CONC		TO 1339	
				~~822.15~~	~~23~~	~~820.23~~	~~E~~	~~12~~	~~CONC~~		~~TO 1336~~	
Perteet	CB#1			823.16		819.07	E,W	12			TO1338 AND 4	
		1.5-foot Adjusted Elevations		821.66		817.57						
Perteet	CB#4			818.31		813.88	E,W	12			To 1 and 1336	
		1.5-foot Adjusted Elevations		816.81		812.38						
										~~282.7~~		
RWB	1336	565081.4254	1198190.972	813.71	25	811.63	E	12	CONC		To CB#8	Revision per Perteet
		IE=812.85 assumed		813.71	25	811.63	W	12	CONC		To CB#4	Inverts don't reflect Pertee, assumed 812.85 per Perteet slopes
Perteet	CB#8			814.65		811.85		12			To 1336 and 1332	Conflicts with RWB
		1.5-foot Adjusted Elevations		813.15		810.35						
										~~33.19~~		
RWB	~~1335~~	~~565082.021~~	~~1198224.161~~	~~812.98~~	~~24~~	~~810.98~~	~~E~~	~~12~~	~~CONC~~		~~TO 1332~~	Demo'd per Perteet Plans
				~~812.98~~	~~24~~	~~810.98~~	~~W~~	~~12~~	~~CONC~~		~~TO 1336~~	
										~~126.56~~		
RWB	1332	565082.0282	1198350.716	805.96	26	803.79	E	12	CONC		TO CB#8	Perteet -> IE ~ 805.20 (used this number)
				805.96	24	803.96	S	8	CONC		TO CB#10	Latteral not modeled
		Perteet Rim = 808.87		805.96	26	803.79	W	12	CONC		TO CB#11	Perteet -> IE ~ 805.20 (used this number)
Perteet	CB#11			806.98		804.28		12			To 1332 and 984	Conflicts with RWB information
		1.5-foot Adjusted Elevations		805.48		802.78						
										~~158.09~~		
RWB	984	565089.6374	1198508.626	804.37	28	802.04	E	15	CONC		TO 985	Perteet shows all as 12"
				804.37	25	802.29	W	14	CONC		TO CB#11	Perteet shows all as 12"
										37.74		
RWB	985	565088.2607	1198546.336	804.41	32	801.74	E	12			TO CB#15	Replaced by CB#13 on Perteet Plans
Perteet	CB#13			804.41	32	801.74	W	14	CONC		TO 984	Rim=806.00 IE=801.64
												Perteet shows all as 12"
Perteet	CB#15			795.99		792.73		12			To 985 and 16	
		1.5-foot Adjusted Elevations		794.49		791.23						

North Basin Stormwater Structure Inventory												
RW Beck information supplemented by Asbuilts and AHBL field measurements												
(MD = Measure Down - method by which data was collected in 2003 Program)												
TRUNK	**ID**	**NORTHING**	**EASTING**	**ELEV**	**MD**	**INVERT**	**DIRECTION**	**DIA.**	**MAT'L**	**CONNECTING PIPE LENGTH**	**PIPE CONNECTION TO**	**AHBL Notes**
Info Source				**(FT)**	**(IN)**	**(FT)**	**(N,S,E,W)**	**(IN)**		**(FT)**		
												Assumed all new 12" is DI due to depth of cover
Perteet	CB#16			795.53		792.65		12			To 15 and 1143	
		1.5-foot Adjusted Elevations		794.03		791.15						
RWB	1143	565110.3104	1198826.422	793.57	29	791.15	E	8	PVC		To 1142 see WA Street Trunk	Perteet info shows CB#16 discharging to 1143
	CONNECTION TO 1143 in Washington Street (North)											
										~~135.18~~		
RWB	~~1341~~	~~565083.0559~~	~~1198681.418~~	~~798.63~~	~~20~~	~~796.96~~	~~N~~	~~6~~	~~CONC~~		~~TO ?~~	Demo'd per Perteet Plans
				~~798.63~~	~~36~~	~~795.63~~	~~E~~	~~12~~	~~CONC~~		~~TO 972~~	
				~~798.63~~	~~34~~	~~795.80~~	~~W~~	~~12~~	~~CONC~~		~~TO 985~~	
										185.48		
RWB	972	565085.2544	1198866.883	793.55	39	790.30	N	12	PVC		TO 1142	
				~~793.55~~	~~39~~	~~790.30~~	~~W~~	~~12~~	~~CONC~~		~~TO 1341~~	12" per KPG asbuits. KPG plans for Washington shows connection from 1142 to 972
				793.55	39	790.30	E	12	CONC		TO 1342	
										133.91		
RWB	1342	565073.2806	1199000.255	790.32	22.5	788.45	E	12	PVC		DOES PIPE FROM 972 CONNECT TO	Could not find in field
											TRUNK 4 ? OR DOES IT CONNECT TO	
											TO 1342 THEN TRUNK 4 ?	
											CLARIFY	
										13.08		
	CONNECTION TO TRUNK 4											
TRUNK ___ - Washington Street (North)												
RWB	1137	565538.1873	1198825.225	795.19	29	792.77	E	8	PVC		TO 1136	Data from RW Beck. Reviewed KPG asbuilts and seem to be consistent, but on diffferent vertical datums.
RWB	1136	565535.3877	1198867.191	795.14	33	792.39	S	8	PVC		TO 1138	12" per KPG asbuits, used 12" as makes sense with pipe drop
				795.14	32	792.47	W	8	PVC		TO 1137	
RWB	1138	565388.7772	1198867.745	794.55	33	791.80	N	8	PVC		TO 1136	12" per KPG asbuits, used 12"
				794.55	33	791.80	W	8	PVC		TO 1139	
							S				TO 1140	12" per KPG asbuits
RWB	1140	565231.5988	1198868.055	794.08	35	791.16	N	10	PVC		TO 1138	12" per KPG asbuits
				794.08	35	791.16	S	10	PVC		TO 1142	12" per KPG asbuits
				794.08	35	791.16	W	8	PVC		TO 1141	
RWB	1142	565109.8736	1198868.422	793.56	37	790.48	N	10	PVC		TO 1140	12" per KPG asbuits
				793.56	38	790.39	S	10	PVC		TO 972	12" per KPG asbuits
				793.56	33	790.81	W	8	PVC		TO 1143	

North Basin Stormwater Structure Inventory

RW Beck information supplemented by Asbuilts and AHBL field measurements

(MD = Measure Down - method by which data was collected in 2003 Program)

TRUNK	ID	NORTHING	EASTING	ELEV	MD	INVERT	DIRECTION	DIA.	MAT'L	CONNECTING PIPE LENGTH	PIPE CONNECTION TO	AHBL Notes
Info Source				(FT)	(IN)	(FT)	(N,S,E,W)	(IN)		(FT)		
CONNECTION TO TRUNK 2 - Carter Street at 972												
Trunk ___ - Washington Street (Central)												
RWB	1145	564899.4054	1198827.008	792.8	28	790.73	E	8	PVC		TO 1144	KPG shows 0.30 feet higher than downstream, so changed IE
RWB	1144	564889.6524	1198869.078	792.8	28.5	790.43	S	8	PVC		TO 1146	
				792.8	28	790.47	W	8	PVC		TO 1145	
RWB	1146	564758.114	1198869.26	792.12	27	789.87	N	8	PVC		TO 1144	
				792.12	27	789.87	S	8	PVC		TO 1148	
RWB	1148	564649.7152	1198869.688	791.91	36	788.91	N	10	PVC		TO 1146	
				791.91	37	788.83	S	10	PVC		TO 970	
				791.91	36	788.91	W	8	PVC		TO 1149	
CONNECTION TO TRUNK 1 - Center Street at 970												
RWB	1152	564400.9174	1198870.255	792.44	29	790.02	N	8	PVC		TO 970	
				792.44	29	790.02	W	8	PVC		TO 1153	
RWB	1153	564376.416	1198828.625	792.39	28	790.06	E	8	PVC		TO 1152	
TRUNK 3 - Lynch Street												
RWB	1113	565505.3613	1198171.876	818.11	13	817.03	NE	8	PVC		TO 1114	
										39.53		
	1114	565544.8857	1198172.352	818.28	18	816.78	E	8	DI		TO 1110	
				818.28	15	817.03	SW	8	PVC		TO 1113	
										158.20		
RWB	1110	565544.5601	1198330.549	809.68	25.5	807.56	E	8	PVC		TO 1130	
				809.68	27	807.43	W	8	PVC		TO 1114	
										176.80		
RWB	~~1130~~	~~565549.6159~~	~~1198507.279~~	~~805.98~~	~~18.5~~	~~804.44~~	~~N~~	~~8~~	~~CONC~~		~~TO 1129~~	Demo'd per WHP Mashell Asbuilts
				~~805.98~~	~~19.5~~	~~804.36~~	~~W~~	~~8~~	~~CONC~~		~~TO 1110~~	Not sure how this is still connected.
										162.68		Need to field confirm.
RWB	1129	565712.2926	1198506.825	~~806.81~~	~~34.5~~	~~803.94~~	~~N~~	~~10~~	~~CONC~~		~~TO ?~~	
AHBL				806.81	33	804.06	S	10	CONC		TO 1130	Only saw south connection in field
WHP				~~806.81~~	~~29~~	~~804.39~~	~~E~~	~~6~~	~~CONC~~		~~TO 1133~~	
CONNECTION TO TRUNK __ - Mashell at ____												

North Basin Stormwater Structure Inventory												
RW Beck information supplemented by Asbuilts and AHBL field measurements												
(MD = Measure Down - method by which data was collected in 2003 Program)												
TRUNK	**ID**	**NORTHING**	**EASTING**	**ELEV**	**MD**	**INVERT**	**DIRECTION**	**DIA.**	**MAT'L**	**CONNECTING PIPE LENGTH**	**PIPE CONNECTION TO**	**AHBL Notes**
Info Source				**(FT)**	**(IN)**	**(FT)**	**(N,S,E,W)**	**(IN)**		**(FT)**		
RWB	1133	565734.8822	1198804.554	796.34	32	793.67	N	8	PVC		TO 1132	
				796.34	31	793.76	E	8	PVC		TO 1134	
				796.34	29	793.92	W	8	PVC		~~TO 1129~~	
										78.84		
RWB	1134	565731.5317	1198883.325	795.03	40	791.70	E	8	CONC		TO TRUNK 4	
				795.03	38.5	791.82	W	12	CONC		TO 1133	
										129.48		
	CONNECTION TO TRUNK 4											
Trunk ___ - Mashell (North)												
												Entered based off Mashell plans. Converted from NAVD88 to
WHP	M24		~~NAVD88~~	~~809.5~~		~~807.11~~						NGVD29 to be on same datum as RW Beck Data
			NGVD29	806.04		803.65	S	12	DIP		To M22	
WHP	M23		~~NAVD88~~	~~809.44~~		~~806.69~~						
			NGVD29	805.98		803.23	S	12	DIP		To M21	
WHP	M22		~~NAVD88~~	~~809.19~~		~~806.80~~						
			NGVD29	805.73		803.34	N,E	12	DIP		To M24 (N) and To M21 (E)	
WHP	M21		~~NAVD88~~	~~808.99~~		~~806.49~~						
			NGVD29	805.53		803.03	N,S,E	12	DIP		To M23 (N), M22 (W), M19 (S)	
WHP	M20		~~NAVD88~~	~~808.71~~		~~806.39~~						
			NGVD29	805.25		802.93	N, S	12	DIP		To M22 (N), M17 (S)	
WHP	M19		~~NAVD88~~	~~808.49~~		~~806.29~~						
			NGVD29	805.03		802.83	N,S	12	DIP		To M21 (N), M18 (S)	
WHP	M18		~~NAVD88~~	~~808.62~~		~~806.04~~						
			NGVD29	805.16		802.58	N,S	12	DIP		To M19 (N), existing CB (S)	
WHP	M17		~~NAVD88~~	~~808.21~~		~~806.39~~						
			NGVD29	804.75		802.93	N,S	12	DIP		To M20 (N), existing CB (S)	
EX1			~~NAVD88~~	~~808.4~~		~~805.87~~						Estimated RIM from profile on WHP asbuilts
			NGVD29	804.94		802.41					To CB-985	
EX2			~~NAVD88~~	~~808.5~~		~~805.98~~						
			NGVD29	805.04		802.52					To CB984	

North Basin Stormwater Structure Inventory

RW Beck information supplemented by Asbuilts and AHBL field measurements
(MD = Measure Down - method by which data was collected in 2003 Program)

TRUNK	ID	NORTHING	EASTING	ELEV	MD	INVERT	DIRECTION	DIA.	MAT'L	CONNECTING PIPE LENGTH	PIPE CONNECTION TO	AHBL Notes
Info Source				(FT)	(IN)	(FT)	(N,S,E,W)	(IN)		(FT)		
CONNECTION TO TRUNK 2 - CARTER STREET												
Trunk ___ - Mashell (South)												
WHP	M13		~~NAVD88~~	~~804.25~~		~~799.77~~						
			NGVD29	800.79		796.31	S	12	PVC		To M11	Started model at M7 and M8 and south to Trunk 5
WHP	M11		~~NAVD88~~	~~803.1~~		~~799.23~~						
			NGVD29	799.64		795.77	N,W,S	12	PVC		To M13 (N), M12 (W), M9 (S)	
WHP	M9		~~NAVD88~~	~~802.67~~		~~799.03~~						
			NGVD29	799.21		795.57	N,W	12	PVC		To M11 (N), M10 (W)	
			~~NAVD88~~			~~798.57~~						
			NGVD29			795.11	S	18	PVC		To M7 (S)	
CONNECTION TO TRUNK 1 - CENTER STREET (WEST)												
WHP	M7		~~NAVD88~~	~~802.46~~		~~798.36~~						RWB Rim is 798.63 and IE=795.13, use WHP converted elevations
= RWB 987			NGVD29	799		794.90	N,S	18	PVC		To M9 (N), M5 (S)	
			~~NAVD88~~			~~799.80~~						
			NGVD29			796.34	E,W	24	DIP to M8		To M8 (W) = RWB 986, To 1001 (E)	
WHP	M8		~~NAVD88~~	~~802.95~~		~~800.30~~						RWB Rim is 799.39 and IE=796.47, use WHP converted elevations
= RWB 986			NGVD29	799.49		796.84	E,W	24	DIP to M7		To 1331C (W), M7 (E)	
WHP	M5		~~NAVD88~~	~~802.34~~		~~798.04~~						
			NGVD29	798.88		794.58	N,W,S	18	PVC		To M7 (N), M6 (W), M4 (S)	
WHP	M4		~~NAVD88~~	~~801.8~~		~~797.80~~						
			NGVD29	798.34		794.34	N,S	18	PVC		To M5 (N), M3 (S)	
WHP	M3		~~NAVD88~~	~~801.2~~		~~797.67~~						
			NGVD29	797.74		794.21	N,S	18	PVC(N), DI(S&E)		To M4 (N), M1 (S), 980 (E)	
CONNECTION TO TRUNK 5 - CENTER STREET (EAST)												
WHP	M1		~~NAVD88~~	~~800.17~~		~~796.93~~						
			NGVD29	796.71		793.47	N,S	18	DIP (N), PVC (S)		To M3 (N), M25 (S), M16 (E)	
WHP	M25		~~NAVD88~~	~~799.52~~		~~796.23~~						
			NGVD29	796.06		792.77	N,S	18	PVC		To M1 (N), M26 (S)	

North Basin Stormwater Structure Inventory

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(MD = Measure Down - method by which data was collected in 2003 Program)

TRUNK	ID	NORTHING	EASTING	ELEV (FT)	MD (IN)	INVERT (FT)	DIRECTION (N,S,E,W)	DIA. (IN)	MAT'L	CONNECTING PIPE LENGTH (FT)	PIPE CONNECTION TO	AHBL Notes
Info Source												
WHP	M26		~~NAVD88~~	~~798.64~~		~~795.56~~						
			NGVD29	795.18		792.10	N	18	PVC		To M1 (N), M26 (S)	
TRUNK 4 - Collector Main to Lynch Creek												
RWB	993	564118.4692	1199012.232	792.12	50	787.95	N	12	CONC		TO 1346	1346 lists 36" - invert out is higher than invert in? No West connection to 992? Assumed second north is actually to the west.
				792.12	68	786.45	N	24	CONC		TO ? CLARIFY	
				792.12	42	788.62	S	12	CONC		TO ? CLARIFY	
				792.12	66	786.62	E	12	CONC		TO 1164	1164 lists PVC
										402.23		
RWB	1346	564520.6748	1199007.406	792.04	96	784.04	N	36	CONC		TO 1344	Adverse slope to 1344
				792.04	76	785.71	SW	32	STEEL		TO 1345 ?	
				792.04	96	784.04	S	36	CONC		TO 993	993 lists 12"
										264.09		
RWB	1344	564785.4175	1199014.521	792.13	96	784.13	S	36	CONC		TO 1346	Adverse slope to 1346
				792.13	94.5	784.26	N	36	CONC		TO LYNCH CREEK	
				792.13	76	785.80	E	24	STEEL		TO SCHOOL; WHAT AREA DOES THIS DRAIN PIPE COLLECT ? DITCH ONLY ?	
										1068.25		
INVERT AT DISCHARGE AT LYNCH CREEK					36		N	36	CONC		NEED INVERT AT PIPE DISCHARGE	
TRUNK 5 - Center Street East												
RWB	982	564424.7547	1198509.951	799.1	25.2	797.00	S	15	CONC		TO 981	Diameter discrepancy
										37.11		
RWB	981	564387.656	1198510.822	798.96	38.5	795.75	N	16	CONC		TO 982	Diameter discrepancy
				798.96	40	795.63	SE	16	CONC		TO 980	Diameter discrepancy
										101.47		Assumed 16"
RWB	980	564303.6621	1198567.747	796.1	19	794.52	N(NW)	14	CONC		TO 981	Diameter discrepancy
				796.1	18	794.60	E(SE)	4	CONC		TO 1000	Diameter discrepancy
										118.79		Assumed 12" as 4" doesn't make sense
RWB	1000	564263.5469	1198679.562	792.09	30	789.59	N	8	CONC		TO ? 990 ?	
				792.09	28	789.76	W(NW)	12	CONC		TO 980	Diameter discrepancy
				792.09	29	789.67	E(SE)	8	PVC		TO 1156	Diameter discrepancy
				792.09	31	789.51	S	12	CONC		TO 3004	
										112.17		
RWB	1156	564218.1219	1198782.127	792.15	28	789.82	SE	8	PVC		TO 1085	Diameter and pipe material discrepancy
				792.15	27.75	789.84	NW	4	PVC		TO 1000	Diameter discrepancy
										46.19		Assumed 8" as 4" doesn't make sense
RWB	1085	564200.638	1198824.881	793.1	41.5	789.64	N	12	CONC		TO 1154	
				793.1	41.25	789.66	E(SE)	12	CONC		TO 992	
				793.1	42.25	789.58	NW	12	CONC		TO 1156 ?	Diameter and pipe material discrepancy

North Basin Stormwater Structure Inventory

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TRUNK	ID	NORTHING	EASTING	ELEV	MD	INVERT	DIRECTION	DIA.	MAT'L	CONNECTING PIPE LENGTH	PIPE CONNECTION TO	AHBL Notes
Info Source				(FT)	(IN)	(FT)	(N,S,E,W)	(IN)		(FT)		
										64.23		Assumed 8"
RWB	992	564175.1692	1198883.846	793.18	54.36	788.65	E	12	CONC		TO 993	
				793.18	51	788.93	S	12	CONC		TO 1084	
				793.18	54.36	788.65	W	12	CONC		TO 992	Assumed to 1085 per RWBeck map
										140.35		
CONNECTION TO TRUNK 4 AT CB 993				792.12		786.62					TO 1164	
										117.20		
RWB	1164	564107.4289	1199128.909	791.49	49	787.41	N	12	PVC		TO 1163	
				791.49	52	787.16	E(SE)	12	PVC		TO 1166	
				791.49	52.5	787.12	S	12	PVC		TO 1159	
				791.49	51.75	787.18	W	12	PVC		TO 993	993 lists concrete
										281.25		
RWB	1166	563993.1737	1199385.906	793.98	71.5	788.02	E(SE)	12	PVC		TO 1170	Assumed
				793.98	71.5	788.02	S(SW)	12	PVC		TO 1161	
				793.98	72	787.98	W(NW)	12	PVC		TO 1164	
										283.04		
RWB	1170	563868.8811	1199640.191	796.73	36	793.73	N	6	PVC		TO PROPERTY	
				796.73	44.25	793.04	E(SE)	12	PVC		TO 1089	
				796.73	46	792.90	S	12	PVC		TO 1171	
				796.73	44.5	793.02	W(NW)	12	PVC		TO 1166	
										184.90		
RWB	1089	563782.7812	1199803.82	799.21	61.5	794.09	E(SE)	12	PVC		TO 994	
				799.21	61	794.13	S	12	PVC		TO 1173	
				799.21	62	794.04	W(NW)	12	PVC		TO 1170	
										103.30		
RWB	994	563734.7474	1199895.274	801.22	47	797.30	E(SE)	14	STEEL		TO 1090	Below says PVC, not Steel. Assume PVC
				801.22	49	797.14	W(NW)	12	PVC		TO 1089	Assumed Type I
				801.22	44	797.55	S	12	PVC CORR		TO 1086	Assumed 14 is a typo, because it turns to 12
										337.94		
RWB	1090	563586.0424	1200198.734	826.41	42	822.91	E(SE)	12	PVC CORR		TO 1091	
				826.41	40.5	823.04	W(NW)	12	PVC CORR		TO 994	
										211.79		
RWB	1091	563516.8084	1200398.887	840.15	44	836.48	E(SE)	12	PVC CORR		TO 1092	Assumed Type 1
				840.15	46	836.32	W(NW)	12	PVC CORR		TO 1090	
										173.97		
RWB	1092	563476.8732	1200568.213	850.25	43	846.67	E(SE)	12	PVC CORR		TO 1093	
				850.25	43	846.67	W(NW)	12	PVC CORR		TO 1091	
										177.15		
RWB	1093	563450.8844	1200743.45	859.11	66	853.61	E(SE)	12	PVC CORR		TO 1096	
				859.11	64	853.78	S	12	PVC		TO 1094	
				859.11	66	853.61	W(NW)	12	PVC		TO 1092	
										218.67		
RWB	1096	563358.3957	1200905.095	862.1	85	855.02	SW	12	PVC CORR		TO 1097	Northing/Easting may have been switched with CB-1098. Lengths don't match AutoCAD, but they do for 1098 (1200960.2404, 563422.0242). Used 1098.
				862.1	78.5	855.56	E(NE)	12	PVC CORR		TO 1098	
				862.1	94.5	854.23	E	12	PVC CORR		TO 935	
				862.1	87	854.85	W	12	PVC CORR		TO 1093	

North Basin Stormwater Structure Inventory												
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TRUNK	**ID**	**NORTHING**	**EASTING**	**ELEV**	**MD**	**INVERT**	**DIRECTION**	**DIA.**	**MAT'L**	**CONNECTING PIPE LENGTH**	**PIPE CONNECTION TO**	**AHBL Notes**
Info Source				**(FT)**	**(IN)**	**(FT)**	**(N,S,E,W)**	**(IN)**		**(FT)**		
										256.35		
RWB	935	563387.5647	1201214.232	861.55	67.5	855.93	W	12	PVC CORR		TO 1096	Assumed
				861.55	60	856.55	N	12	PVC CORR		TO 936	
				861.55	65.5	856.09	E	12	PVC CORR		TO 1100	Adverse Slope to 1100
										114.32		
RWB	1100	563372.0122	1201327.487	858.14	29	855.72	S	12	PVC CORR		TO 1101	
				858.14	30	855.64	W	12	PVC		TO 935	Adverse Slope to 935
										40.19		
RWB	1101	563332.3982	1201320.712	860.03	31	857.45	N	12	PVC		TO 1100	
ASSUMPTION												
1.	storm drain system along Bergren Road, Baumgartner Place, and Kelsy Lane are NOT connected to main trunk system which ultimately discharges into Lynch Creek.											

South Basin Stormwater Structure Inventory												
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(MD = Measure Down - method by which data was collected in 2003 Program)												
TRUNK	**ID**	**NORTHING**	**EASTING**	**ELEV**	**MD**	**INVERT**	**DIRECTION**	**DIA.**	**MAT'L**	**CONNECTING PIPE LENGTH**	**PIPE CONNECTION TO**	**AHBL Notes**
Info Source				**(FT)**	**(IN)**	**(FT)**	**(N,S,E,W)**	**(IN)**		**(FT)**		
TRUNK A												
RWB	1088	563554.2349	1198512.206	795.63	25	793.55	E	8	PVC CORR		TO 1067	
				795.63	28.5	793.26	S	6	PVC		TO ? SURFACE ?	
										33.63		
RWB	1067	563554.3978	1198545.833	795.87	38.5	792.66	NE	8	DI		TO 1066	
				795.87	40	792.54	S	12	PVC CORR		TO 1065	
				795.87	36	792.87	W	8	DI		TO 1088	
										262.29		
RWB	1065	563292.1075	1198546.888	796.94	51.5	792.65	W	8	DI		TO 1063	
				796.94	67.5	791.32	N	12	PVC CORR		TO 1067	
				796.94	67.5	791.32	S	12	PVC CORR		TO 1060	
				796.94	53	792.52	NE	8	DI		TO 1064	
										257.73		
RWB	1060	563034.3818	1198546.759	794.78	57	790.03	N	12	PVC CORR		TO 1065	
				794.78	57.5	789.99	S	12	PVC CORR		TO 1058	
				794.78	34.5	791.91	NE	8	DI		TO 1061	
				794.78	43	791.20	W	8	DI		TO 1062	
										274.02		
RWB	1058	562760.3571	1198546.863	784.55	51.5	780.26	W	12	PVC CORR		TO 1059	
				784.55	80.5	777.84	S	12	PVC CORR		TO 1056	
				784.55	36.5	781.51	N	12	PVC CORR		TO 1060	
				784.55	36.5	781.51	E	12	PVC CORR		TO 1057	
										55.33		
RWB	1056	562705.1196	1198550.102	782.58	66.5	777.04	N	12	PVC CORR		TO 1058	
				782.58	60.48	777.54	S(SE)	12	PVC CORR		TO BIOSWALE	
	INVERT INTO BIOSWALE							12	PVC CORR		NEED INVERT OF PIPE INTO BIOSWALE	Assumed length and invert and set slope=1%
TRUNK B												
RWB	1184	563028.857	1199245.175	794.57	58	789.74	S	12	PVC		TO 1183	
				794.57	66.5	789.03	NW	12	PVC		TO ? SURFACE ?	
										28.85		
RWB	1183	563000.0086	1199244.848	794.62	63.25	789.35	W	12	PVC		TO 1181	
				794.62	63.5	789.33	N	12	PVC		TO 1184	
										256.39		
RWB	1181	562997.1147	1198988.476	789.4	39	786.15	N	8	DI		TO 1182	
				789.4	47	785.48	E	12	PVC		TO 1183	
				789.4	47.5	785.44	W	12	PVC		TO 1180	Diameter and material discrepancy
										115.57		
RWB	1180	562995.2052	1198872.924	787.83	46	784.00	N	12	PVC		TO ? SURFACE ?	
				787.83	43	784.25	E	8	ST		TO 1181	Diameter and material discrepancy
				787.83	40	784.50	W	8	ST		TO 1179	Assumed 12" PVC

South Basin Stormwater Structure Inventory												
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(MD = Measure Down - method by which data was collected in 2003 Program)												
TRUNK	**ID**	**NORTHING**	**EASTING**	**ELEV**	**MD**	**INVERT**	**DIRECTION**	**DIA.**	**MAT'L**	**CONNECTING PIPE LENGTH**	**PIPE CONNECTION TO**	**AHBL Notes**
Info Source				**(FT)**	**(IN)**	**(FT)**	**(N,S,E,W)**	**(IN)**		**(FT)**		
AHBL	Assumed IE=784.50			787.83	59.5	782.87	S	12	PVC		TO 996	Originally notes show the CB depth as 50", which is incompatible with 59.5". Assumed supposed to be 39.5". Need to field verify.
										115.33		
RWB	996	562881.9739	1198879.046	788.61	58	783.78	N	12	PVC		TO 1180	
				788.61	59	783.69	W	12	PVC		TO 997	AHBL confirmed MD.
										159.79		
RWB	997	562880.0479	1198719.269	785.53	38	782.36	SW	12	PVC		TO 998	
				785.53	38	782.36	E	12	PVC		TO 996	
										131.57		
RWB	998	562757.7188	1198670.844	788.68	78	782.18	NE	12	PVC		TO 997	RWB had 38" as measure down
AHBL				788.68	78	782.18	W	12	PVC		TO 1057	AHBL field measured 78".
										100.76		
RWB	1057	562760.4551	1198570.121	784.25	42.48	780.71	E	12	PVC		TO 998	
				784.25	47.52	780.29	W	12	PVC		TO 1058	
										23.26		
	CONNECTION TO TRUNK A AT 1058											

Appendix E

Hydrologic & Hydraulic Modeling

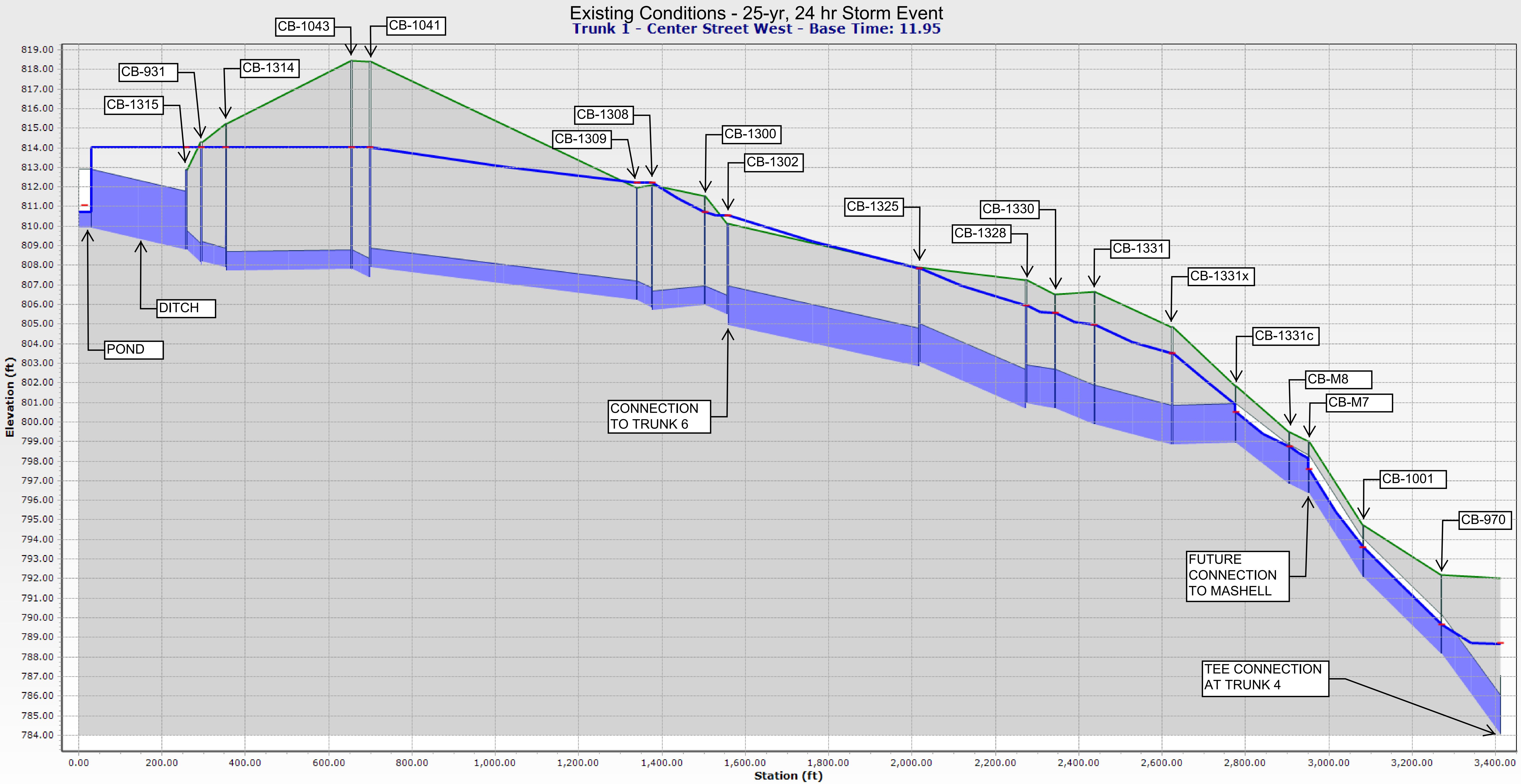
APPENDIX E
LID ASSUMPTIONS

Basin	Reasoning	Flow Reduction
1	Roughly 1/3 of basin in infiltrative area at the lower elevation of basin. Drains to Antonie Ave N, which has storm improvements in south ½ of street. Antonie has history of flooding, thus good candidate for storm improvements. Also drains to Center Street West, which is candidate for green street. Existing Impervious / Zoned Impervious = 33%/45%	20%
2	Not within infiltrative area.	0%
3	Not within infiltrative area.	0%
4	Not within infiltrative area.	0%
5a	Roughly 1/3 of basin within infiltrative area adjacent to Center Street West. Antonie Ave has street improvements, but also has a history of flooding. Existing impervious is 35% whereas future build out is roughly 50%.	0%
5b	Basin within infiltrative area. Good opportunities for green streets. Developed and no existing storm improvements. Existing Impervious / Zoned Impervious = 40%/69%	50%
6	Basin within infiltrative area. Good opportunities for green streets. Developed and no existing storm improvements. Existing Impervious / Zoned Impervious = 43%/73%	50%
7a	Less than ¼ of basin within infiltrative soils. May have some reduction with flows tributary to Center street.	0%
7b	Basin within infiltrative area. Good opportunities for green streets. Low development and no existing storm improvements. Existing Impervious / Zoned Impervious = 52%/82%	50%
8	Not within infiltrative area.	0%
9	Not within infiltrative area.	0%
10	Roughly ½ basin within infiltrative area and adjacent to Center Street. Steep slopes in half of the basin with no	30%

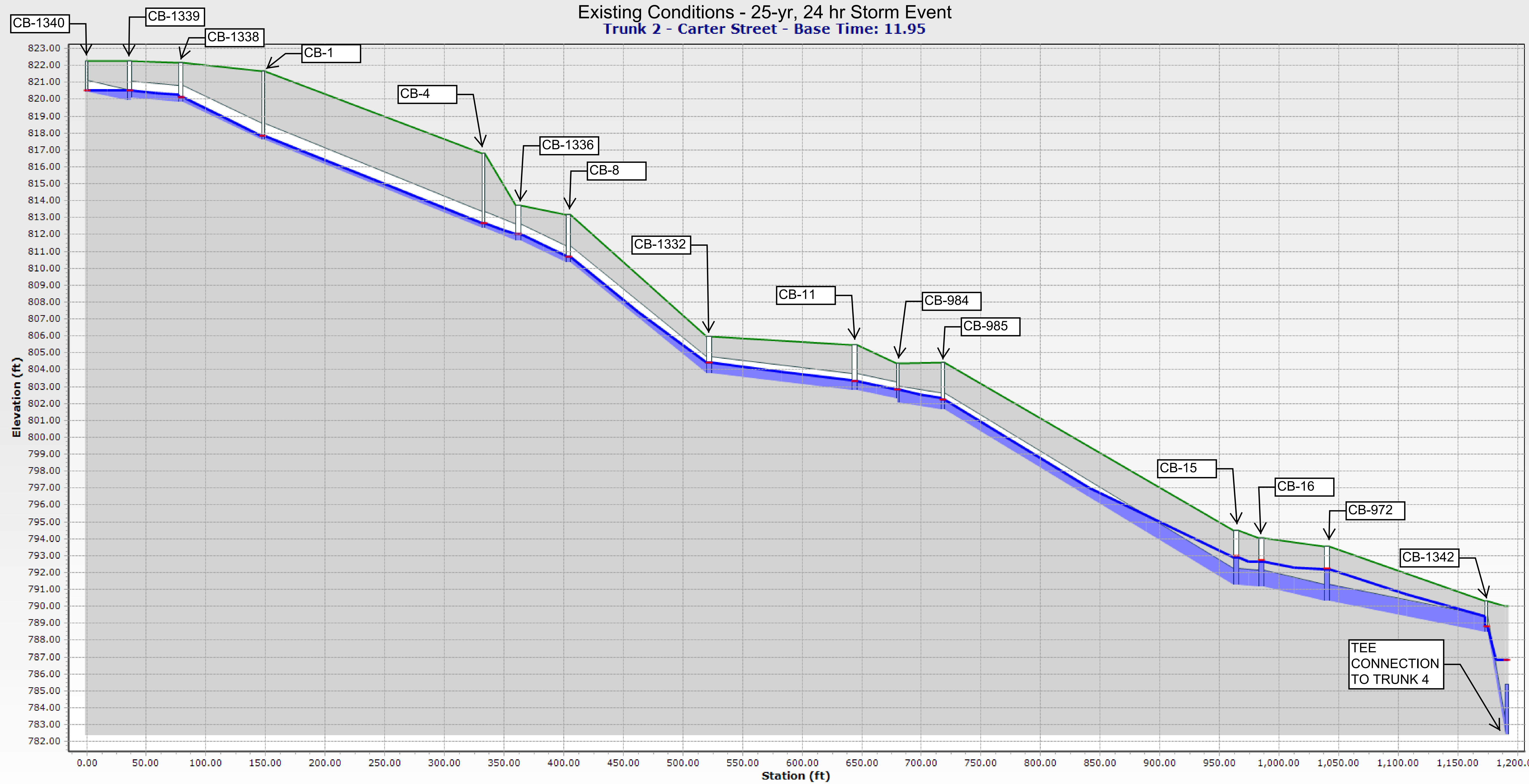
	infiltrative soils. Existing Impervious / Zoned Impervious = 16%/58%	
11	Less than ½ within infiltrative area. Steep slopes for area outside of infiltrative zone.	0%
12/17	Roughly 1/3 basin within infiltrative area. Infiltrative area adjacent to Center Street. Lots are larger and may have room to disconnect roof drains. Existing Impervious / Zoned Impervious = 30%/50%	15%
13	Basin within infiltrative area. Good opportunities for green streets. Developed but no existing storm improvements. Existing Impervious / Zoned Impervious = 60%/88%	30%
14a	Basin within infiltrative basin. Includes mostly the school. Existing storm improvements within ½ of street, which is the lower end of the basin. Existing Impervious / Zoned Impervious = 65%/58% (existing includes ROW which allows 95%)	20%
14b	Basin within infiltrative basin. Smaller lots, developed with existing storm improvements. May have room to disconnect roof drains and provide dry wells. Existing Impervious / Zoned Impervious = 49%/85%	30%
15a	Basin within infiltrative area. Good opportunities for green streets. Medium development and no existing storm improvements. Adjacent to Orchard Ave which may be candidate for green street. Existing Impervious / Zoned Impervious = 45%/81%	50%
15b	Basin within infiltrative area, smaller lots. Good opportunities for green streets. Medium development and no existing storm improvements. Adjacent to Rainier Ave which may be candidate for green street. Existing Impervious / Zoned Impervious = 64%/81%	30%
15c	Basin within infiltrative area, small lots, well developed, existing storm improvements. Existing Impervious / Zoned Impervious = 63%/81%	30%
15d	Basin within infiltrative area, small lots, well developed, existing storm improvements. Existing Impervious / Zoned Impervious = 52%/81%	30%
16a	Basin within infiltrative area. Good opportunities for green streets. Medium development and no existing storm improvements. Adjacent to Orchard and Rainer Ave which may be candidate for green street. Existing Impervious / Zoned Impervious = 55%/87%	50%

16b	Basin within infiltrative area. Small developed lots. Existing storm systems within street improvements. Existing Impervious / Zoned Impervious = 68%/87%	20%
16c	Basin within infiltrative area. Small developed lots. Existing storm systems within street improvements. Existing Impervious / Zoned Impervious = 78%/87%	20%
18a	Basin within infiltrative area. Center street and Mashell Ave intersection. Small developed lots. Center Street may include green street improvements. Existing Impervious / Zoned Impervious = 80%/87%	10%
18b	Roughly half within infiltrative area. Small developed lots. Existing storm improvements. Center Street may include green streets. Modeling indicates potential for flooding. Existing Impervious / Zoned Impervious = 86%/87%	10%
18c	No infiltration.	0%
18d	Roughly ½ within infiltrative area. Low development but existing storm improvements within the infiltrative area. Existing Impervious / Zoned Impervious = 36%/87%	30%
19a	No infiltration within basin.	0%
19b	No infiltration within basin.	0%
19c	No infiltration within basin.	0%
20a	Roughly 1/3 within infiltrative area. Existing Impervious / Zoned Impervious = 44%/60%	20%
20b	Roughly ½ within infiltrative area. Existing Impervious / Zoned Impervious = 38%/60%	20%
21	No infiltration within basin.	0%
22a	Basin within infiltrative area and adjacent to areas that have provided 100% infiltration. The developed areas may already include some infiltrative systems. Existing Impervious / Zoned Impervious = 23%/76%	75%
22b	Basin within infiltrative area and adjacent to areas that have provided 100% infiltration. Some of the developed areas may already include some infiltrative systems. Existing Impervious / Zoned Impervious = 44%/75%	60%
22c	Basin within infiltrative area. Large lots with low development. Existing Impervious / Zoned Impervious = 12.5%/85%	75%

23	Basin within infiltrative area. Large lots. Mostly includes ROW which has existing improvements. Existing Impervious / Zoned Impervious = 58%/85%	30%
24	Roughly 2/3 basin within infiltrative area. Large lots with low development. Existing Impervious / Zoned Impervious = 15%/85%	50%
25a	Roughly ¾ basin within infiltrative area. Currently 22% impervious whereas future condition is 77%. Large lots with low development. Existing Impervious / Zoned Impervious = 22%/77%	50%
25b	Not within infiltrative zone and includes school.	0%
26	Not within infiltrative zone.	0%
27	Not within infiltrative zone.	0%



Existing Conditions - 25-yr, 24 hr Storm Event
Trunk 1 - Center Street West - Base Time: 11.95
CB-1043
CB-1041
CB-931
CB-1314
CB-1315
CB-1308
CB-1309
CB-1300
CB-1302
CB-1325
CB-1330
CB-1328
CB-1331
CB-1331x
CB-1331c
CB-M8
CB-M7
CB-1001
CB-970
DITCH
POND
CONNECTION TO TRUNK 6
FUTURE CONNECTION TO MASHELL
TEE CONNECTION AT TRUNK 4
Elevation (ft)
Station (ft)



Existing Conditions - 25-yr, 24 hr Storm Event
Trunk 2 - Carter Street - Base Time: 11.95
CB-1340
CB-1339
CB-1338
CB-1
CB-4
CB-1336
CB-8
CB-1332
CB-11
CB-984
CB-985
CB-15
CB-16
CB-972
CB-1342
TEE CONNECTION TO TRUNK 4
Elevation (ft)
Station (ft)
823.00
822.00
821.00
820.00
819.00
818.00
817.00
816.00
815.00
814.00
813.00
812.00
811.00
810.00
809.00
808.00
807.00
806.00
805.00
804.00
803.00
802.00
801.00
800.00
799.00
798.00
797.00
796.00
795.00
794.00
793.00
792.00
791.00
790.00
789.00
788.00
787.00
786.00
785.00
784.00
783.00
782.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00
550.00
600.00
650.00
700.00
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850.00
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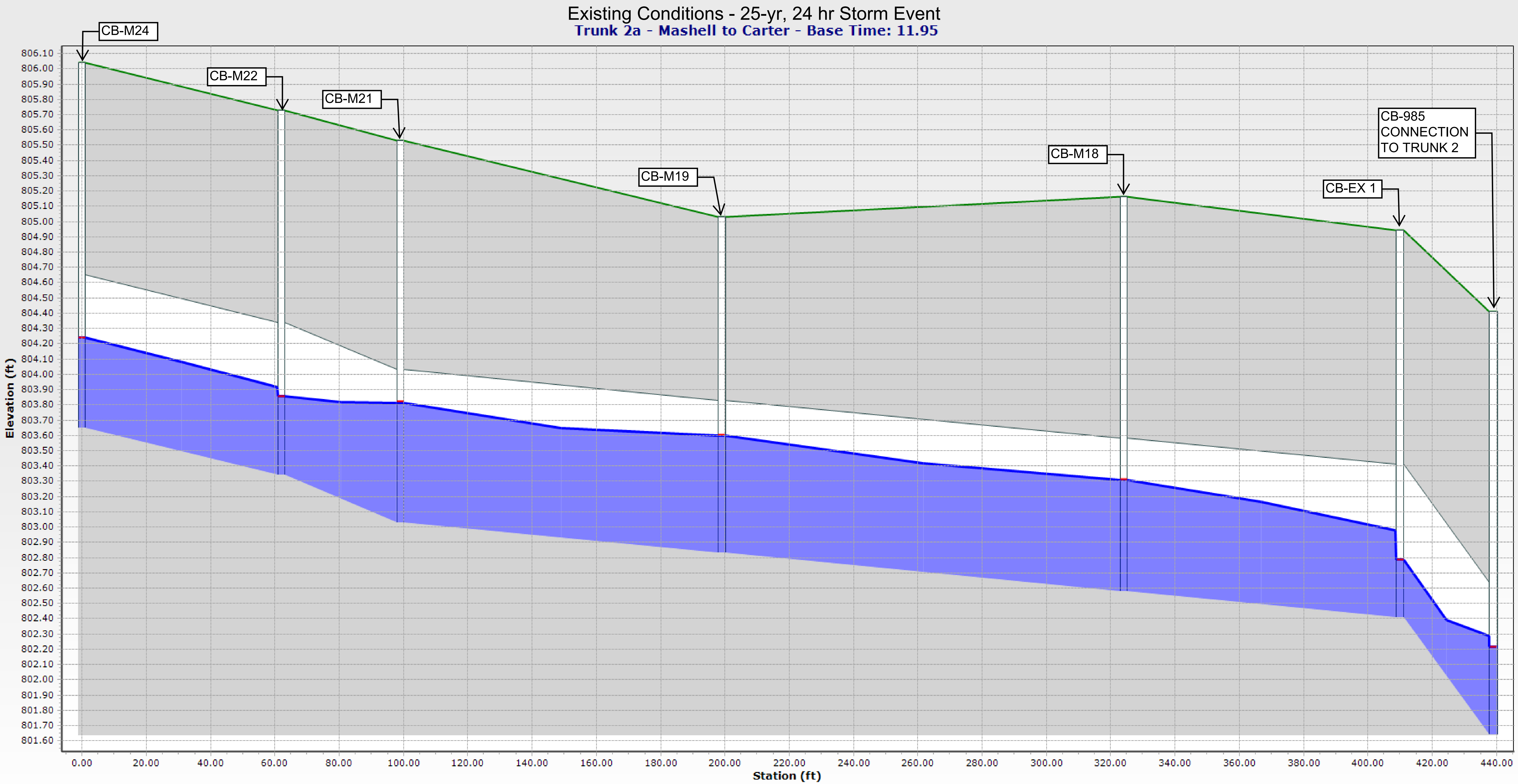
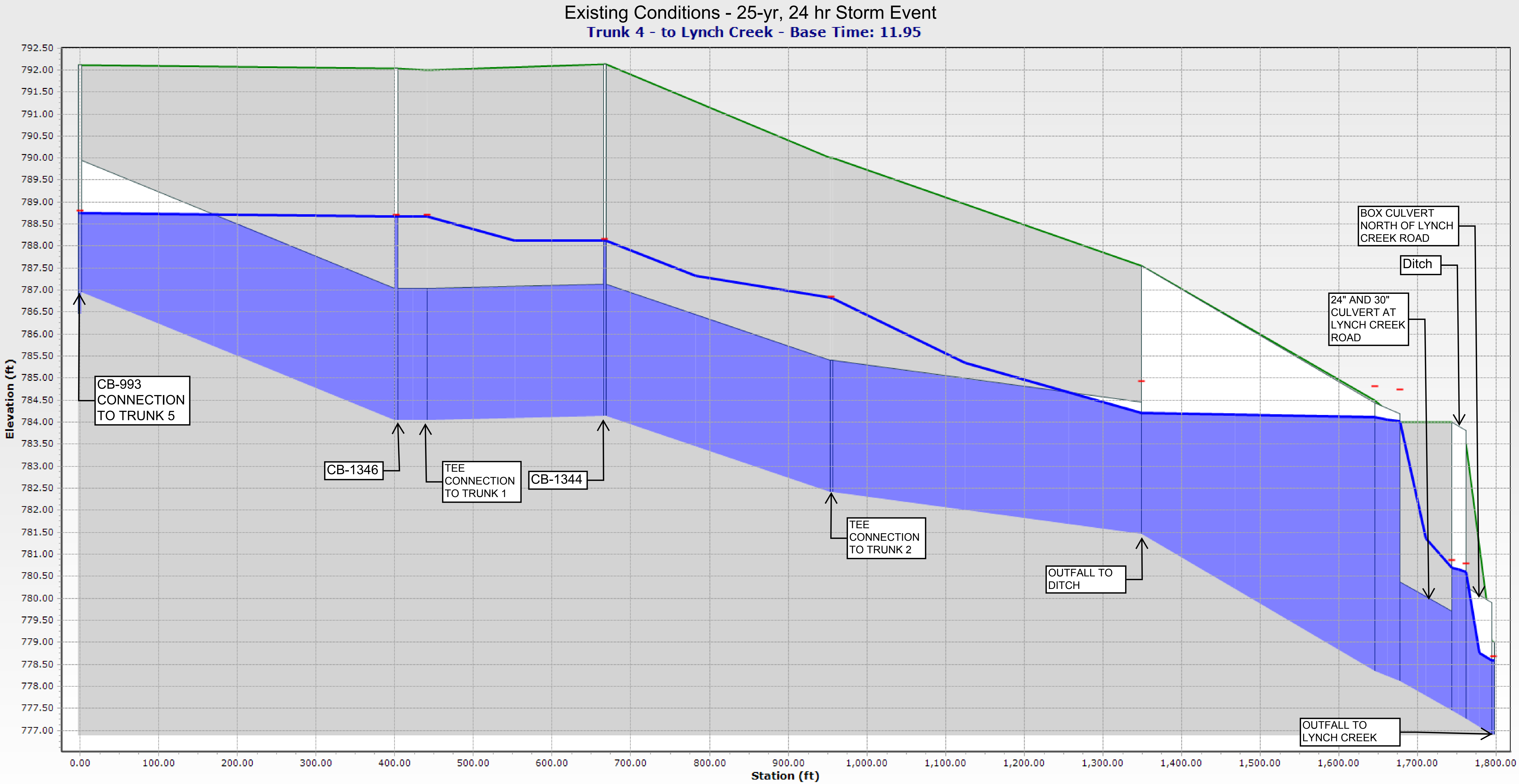
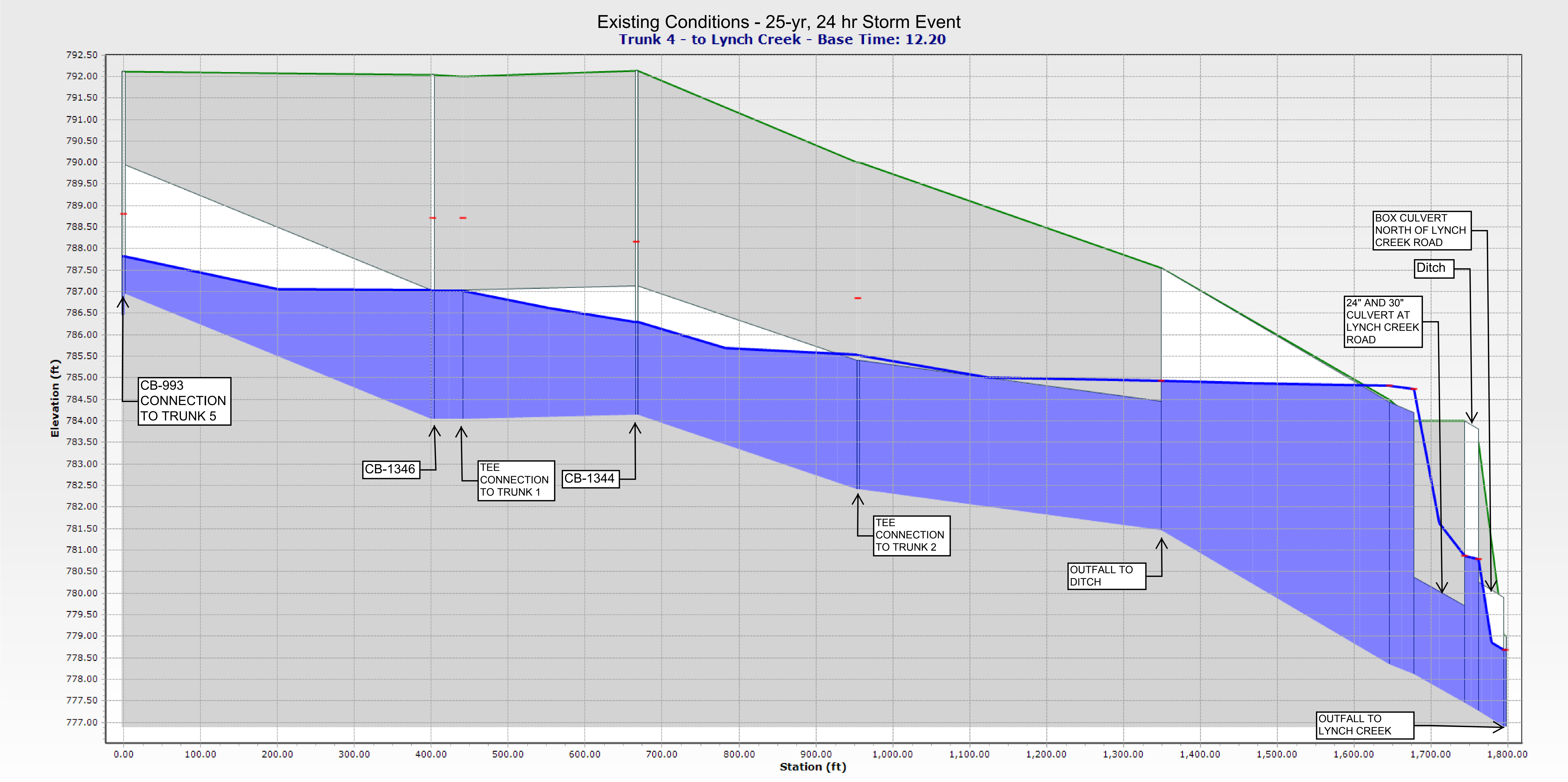
1,150.00
1,200.00



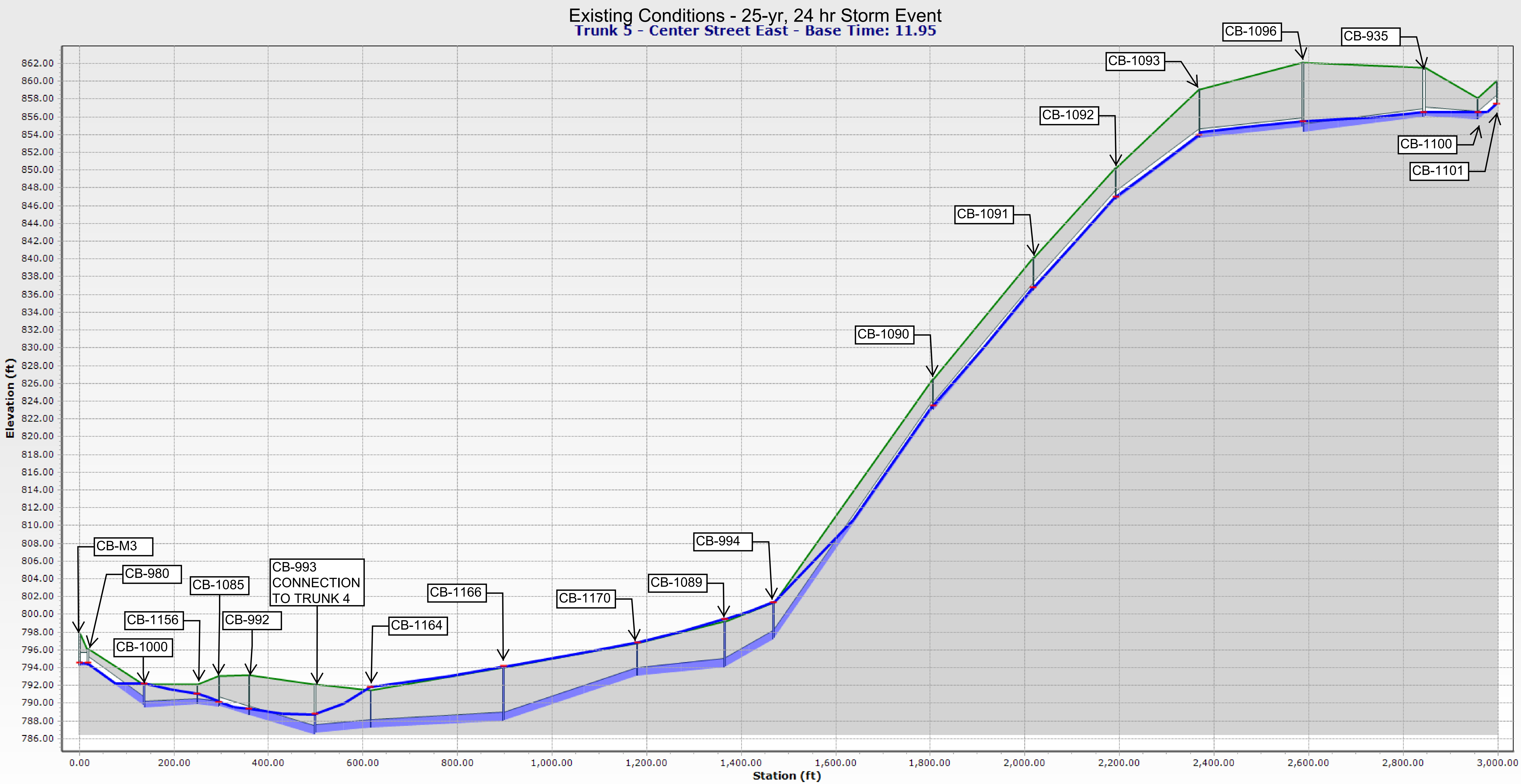
Existing Conditions - 25-yr, 24 hr Storm Event
Trunk 2a - Mashell to Carter - Base Time: 11.95
CB-M24
CB-M22
CB-M21
CB-M19
CB-M18
CB-EX 1
CB-985 CONNECTION TO TRUNK 2
Elevation (ft)
Station (ft)



Existing Conditions - 25-yr, 24 hr Storm Event
Trunk 4 - to Lynch Creek - Base Time: 11.95
Elevation (ft)
Station (ft)
792.50
792.00
791.50
791.00
790.50
790.00
789.50
789.00
788.50
788.00
787.50
787.00
786.50
786.00
785.50
785.00
784.50
784.00
783.50
783.00
782.50
782.00
781.50
781.00
780.50
780.00
779.50
779.00
778.50
778.00
777.50
777.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
900.00
1,000.00
1,100.00
1,200.00
1,300.00
1,400.00
1,500.00
1,600.00
1,700.00
1,800.00
CB-993 CONNECTION TO TRUNK 5
CB-1346
TEE CONNECTION TO TRUNK 1
CB-1344
TEE CONNECTION TO TRUNK 2
OUTFALL TO DITCH
BOX CULVERT NORTH OF LYNCH CREEK ROAD
Ditch
24" AND 30" CULVERT AT LYNCH CREEK ROAD
OUTFALL TO LYNCH CREEK



Existing Conditions - 25-yr, 24 hr Storm Event
Trunk 4 - to Lynch Creek - Base Time: 12.20
Elevation (ft)
Station (ft)
CB-993 CONNECTION TO TRUNK 5
CB-1346
TEE CONNECTION TO TRUNK 1
CB-1344
TEE CONNECTION TO TRUNK 2
OUTFALL TO DITCH
BOX CULVERT NORTH OF LYNCH CREEK ROAD
Ditch
24" AND 30" CULVERT AT LYNCH CREEK ROAD
OUTFALL TO LYNCH CREEK



Existing Conditions - 25-yr, 24 hr Storm Event
Trunk 5 - Center Street East - Base Time: 11.95
Elevation (ft)
Station (ft)
CB-M3
CB-980
CB-1156
CB-1000
CB-1085
CB-992
CB-993 CONNECTION TO TRUNK 4
CB-1164
CB-1166
CB-1170
CB-1089
CB-994
CB-1090
CB-1091
CB-1092
CB-1093
CB-1096
CB-935
CB-1100
CB-1101
862.00
860.00
858.00
856.00
854.00
852.00
850.00
848.00
846.00
844.00
842.00
840.00
838.00
836.00
834.00
832.00
830.00
828.00
826.00
824.00
822.00
820.00
818.00
816.00
814.00
812.00
810.00
808.00
806.00
804.00
802.00
800.00
798.00
796.00
794.00
792.00
790.00
788.00
786.00
0.00
200.00
400.00
600.00
800.00
1,000.00
1,200.00
1,400.00
1,600.00
1,800.00
2,000.00
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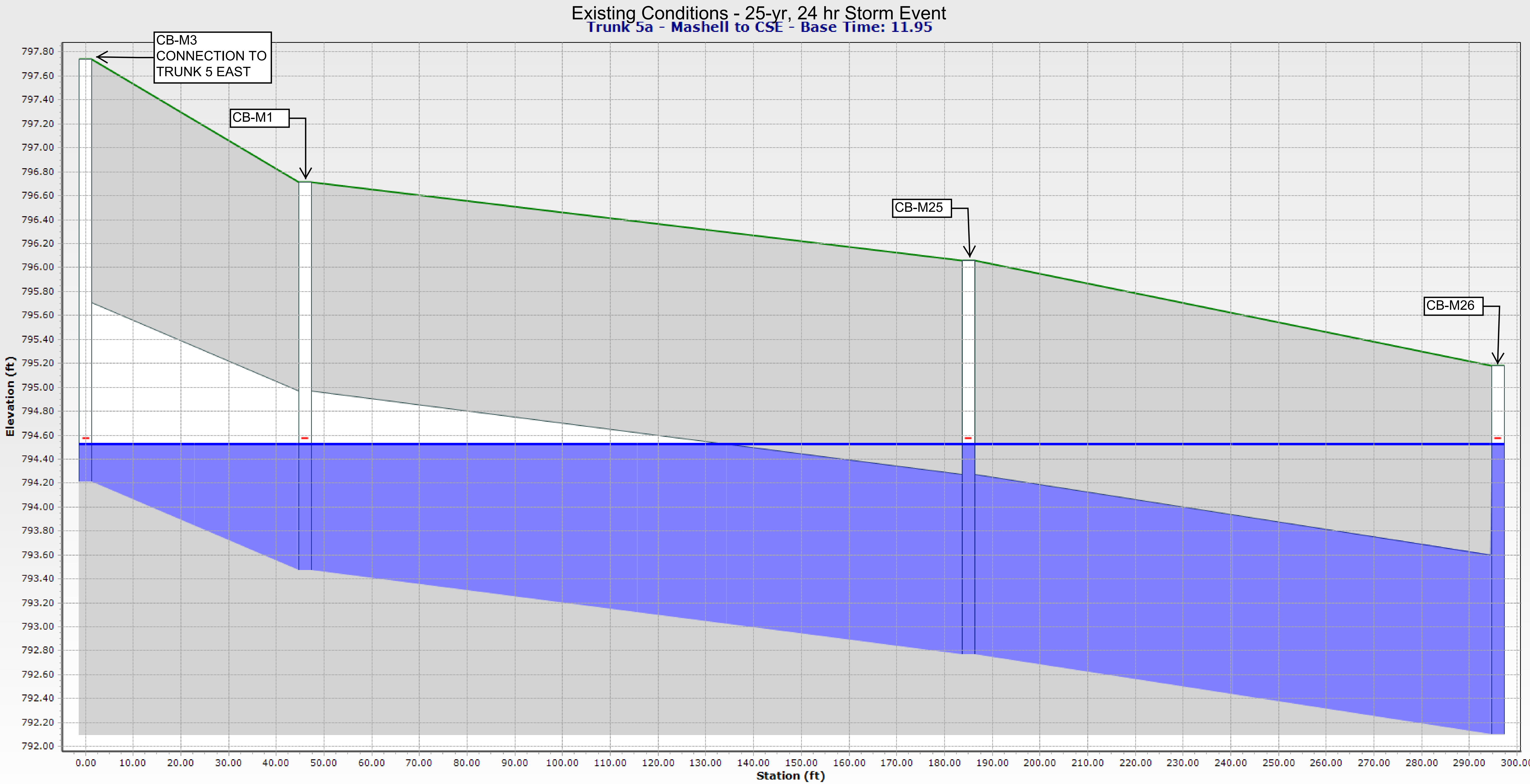
2,600.00
2,800.00
3,000.00



Existing Conditions - 25-yr, 24 hr Storm Event
Trunk 5a - Mashell to CSE - Base Time: 11.95
CB-M3 CONNECTION TO TRUNK 5 EAST
CB-M1
CB-M25
CB-M26
Elevation (ft)
Station (ft)
797.80
797.60
797.40
797.20
797.00
796.80
796.60
796.40
796.20
796.00
795.80
795.60
795.40
795.20
795.00
794.80
794.60
794.40
794.20
794.00
793.80
793.60
793.40
793.20
793.00
792.80
792.60
792.40
792.20
792.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
110.00
120.00
130.00
140.00
150.00
160.00
170.00
180.00
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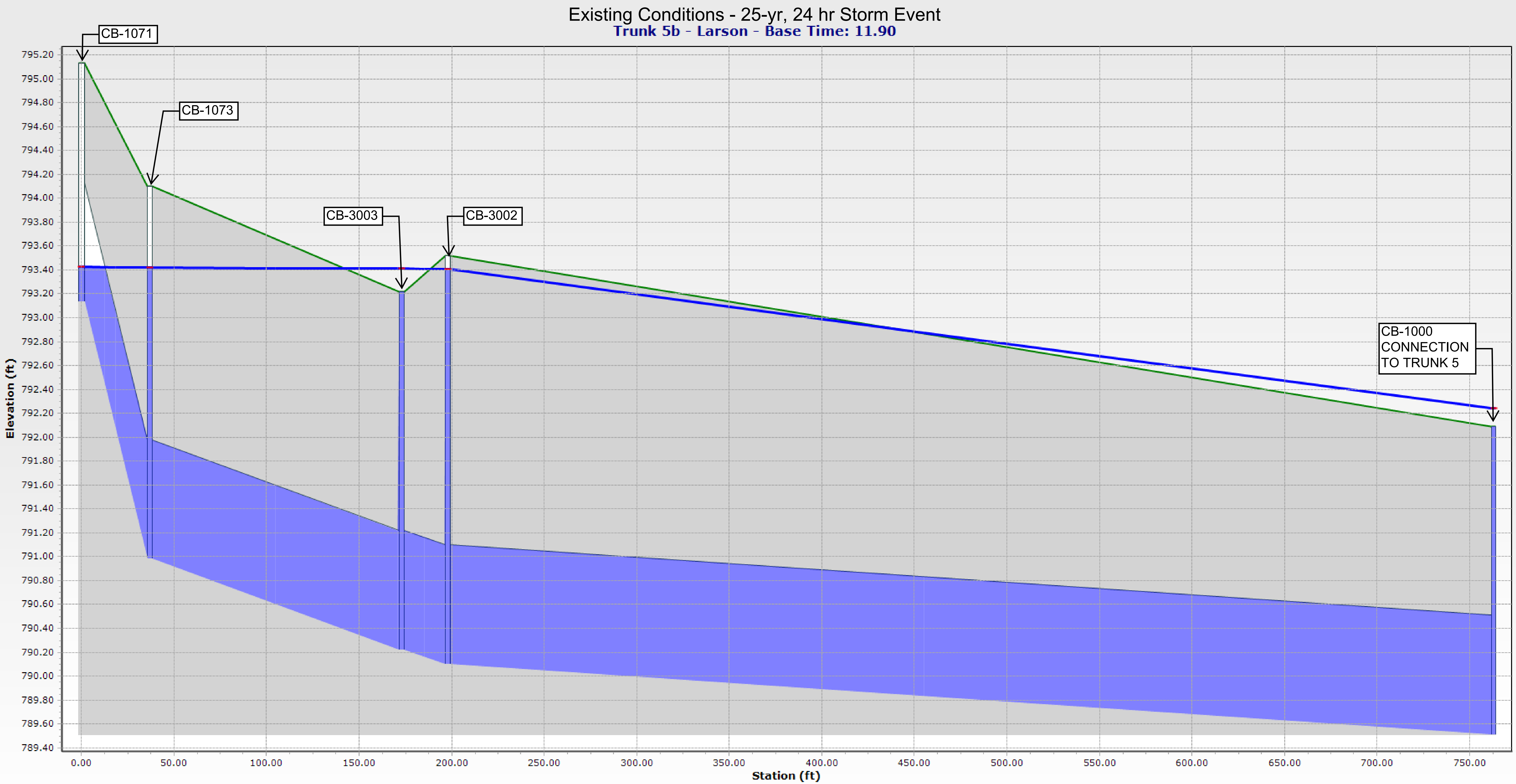
280.00
290.00
300.00



Existing Conditions - 25-yr, 24 hr Storm Event
Trunk 5b - Larson - Base Time: 11.90
CB-1071
CB-1073
CB-3003
CB-3002
CB-1000
CONNECTION
TO TRUNK 5
Elevation (ft)
Station (ft)
795.20
795.00
794.80
794.60
794.40
794.20
794.00
793.80
793.60
793.40
793.20
793.00
792.80
792.60
792.40
792.20
792.00
791.80
791.60
791.40
791.20
791.00
790.80
790.60
790.40
790.20
790.00
789.80
789.60
789.40
0.00
50.00
100.00
150.00
200.00
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300.00
350.00
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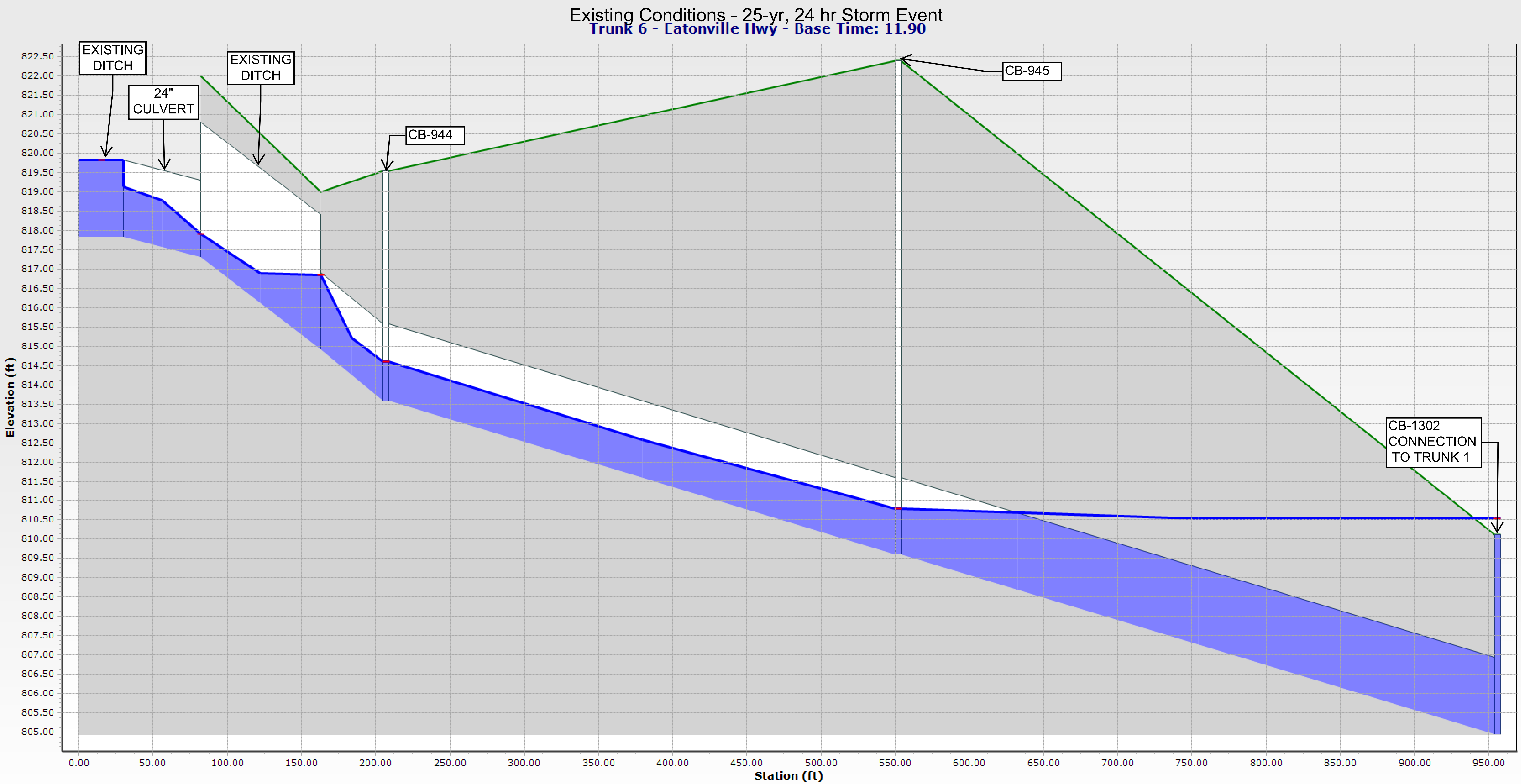
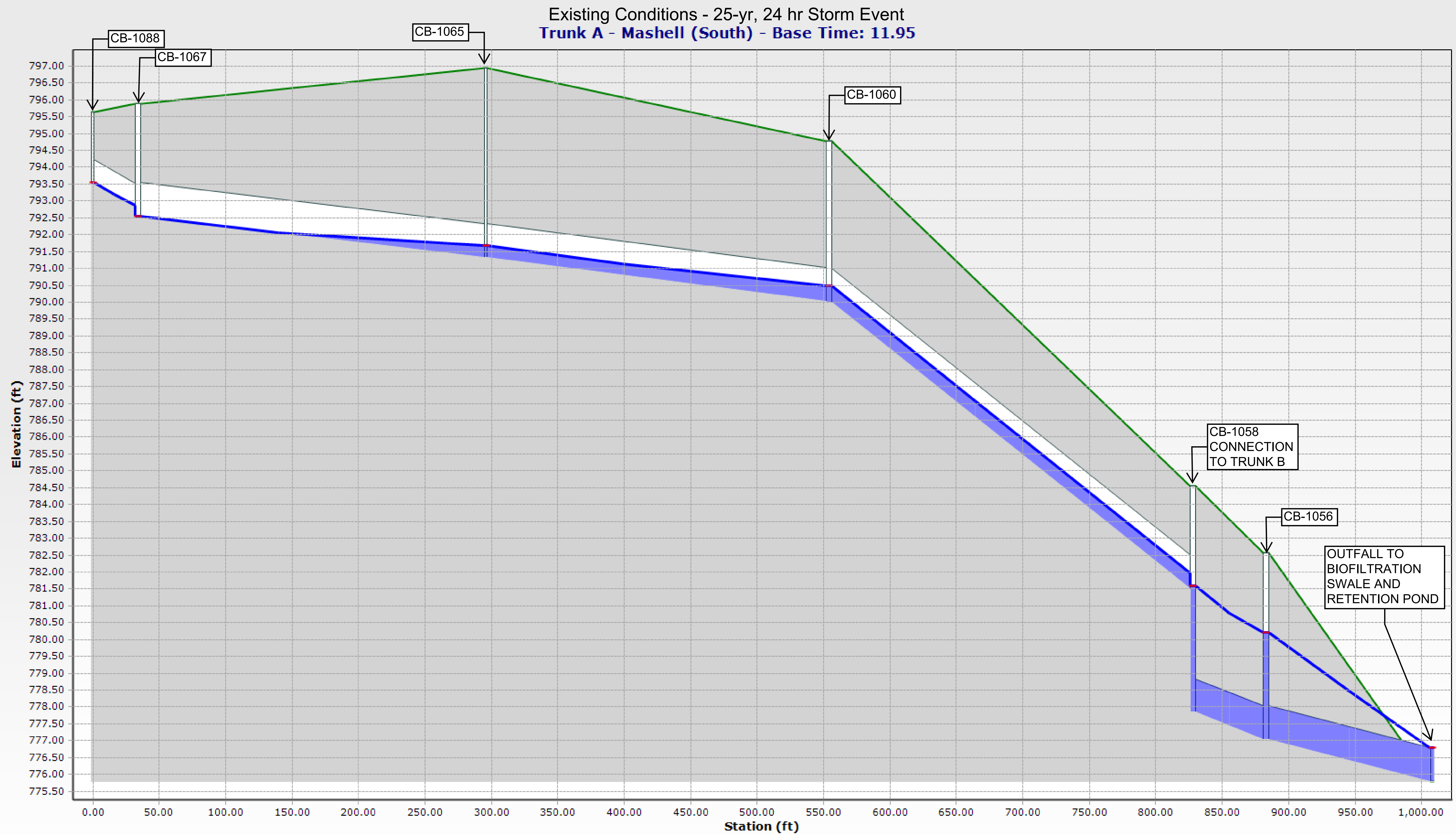
450.00
500.00
550.00
600.00
650.00
700.00
750.00



Existing Conditions - 25-yr, 24 hr Storm Event
Trunk 6 - Eatonville Hwy - Base Time: 11.90
EXISTING DITCH
24" CULVERT
EXISTING DITCH
CB-944
CB-945
CB-1302 CONNECTION TO TRUNK 1
Elevation (ft)
Station (ft)


Existing Conditions - 25-yr, 24 hr Storm Event
Trunk A - Mashell (South) - Base Time: 11.95
CB-1088
CB-1067
CB-1065
CB-1060
CB-1058
CONNECTION
TO TRUNK B
CB-1056
OUTFALL TO
BIOFILTRATION
SWALE AND
RETENTION POND
Elevation (ft)
Station (ft)
797.00
796.50
796.00
795.50
795.00
794.50
794.00
793.50
793.00
792.50
792.00
791.50
791.00
790.50
790.00
789.50
789.00
788.50
788.00
787.50
787.00
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779.50
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778.00
777.50
777.00
776.50
776.00
775.50
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00
550.00
600.00
650.00
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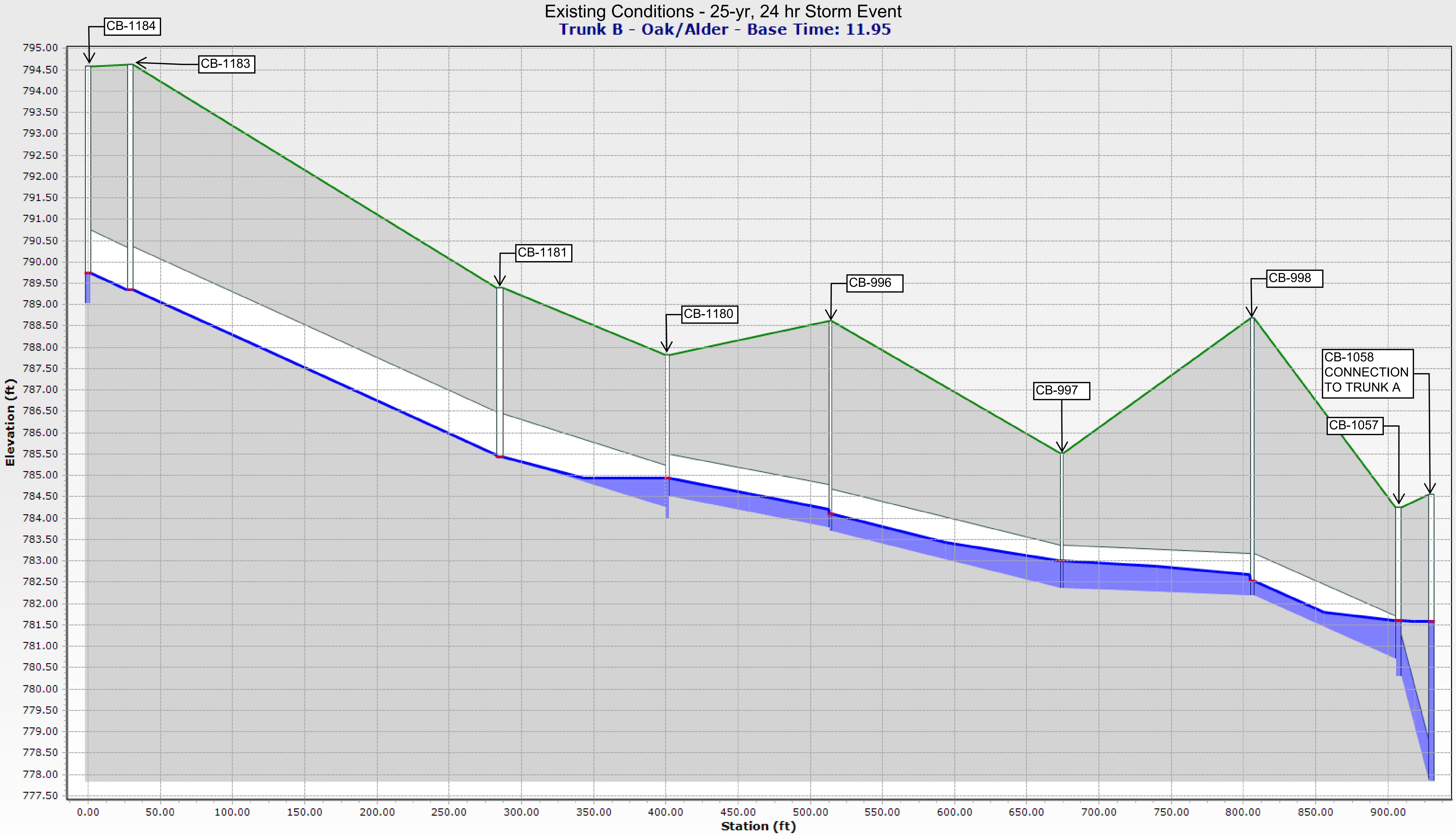
900.00
950.00
1,000.00



Existing Conditions - 25-yr, 24 hr Storm Event
Trunk B - Oak/Alder - Base Time: 11.95
CB-1184
CB-1183
CB-1181
CB-1180
CB-996
CB-998
CB-997
CB-1058 CONNECTION TO TRUNK A
CB-1057
Elevation (ft)
Station (ft)
795.00
794.50
794.00
793.50
793.00
792.50
792.00
791.50
791.00
790.50
790.00
789.50
789.00
788.50
788.00
787.50
787.00
786.50
786.00
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779.50
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778.50
778.00
777.50
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
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450.00
500.00
550.00
600.00
650.00
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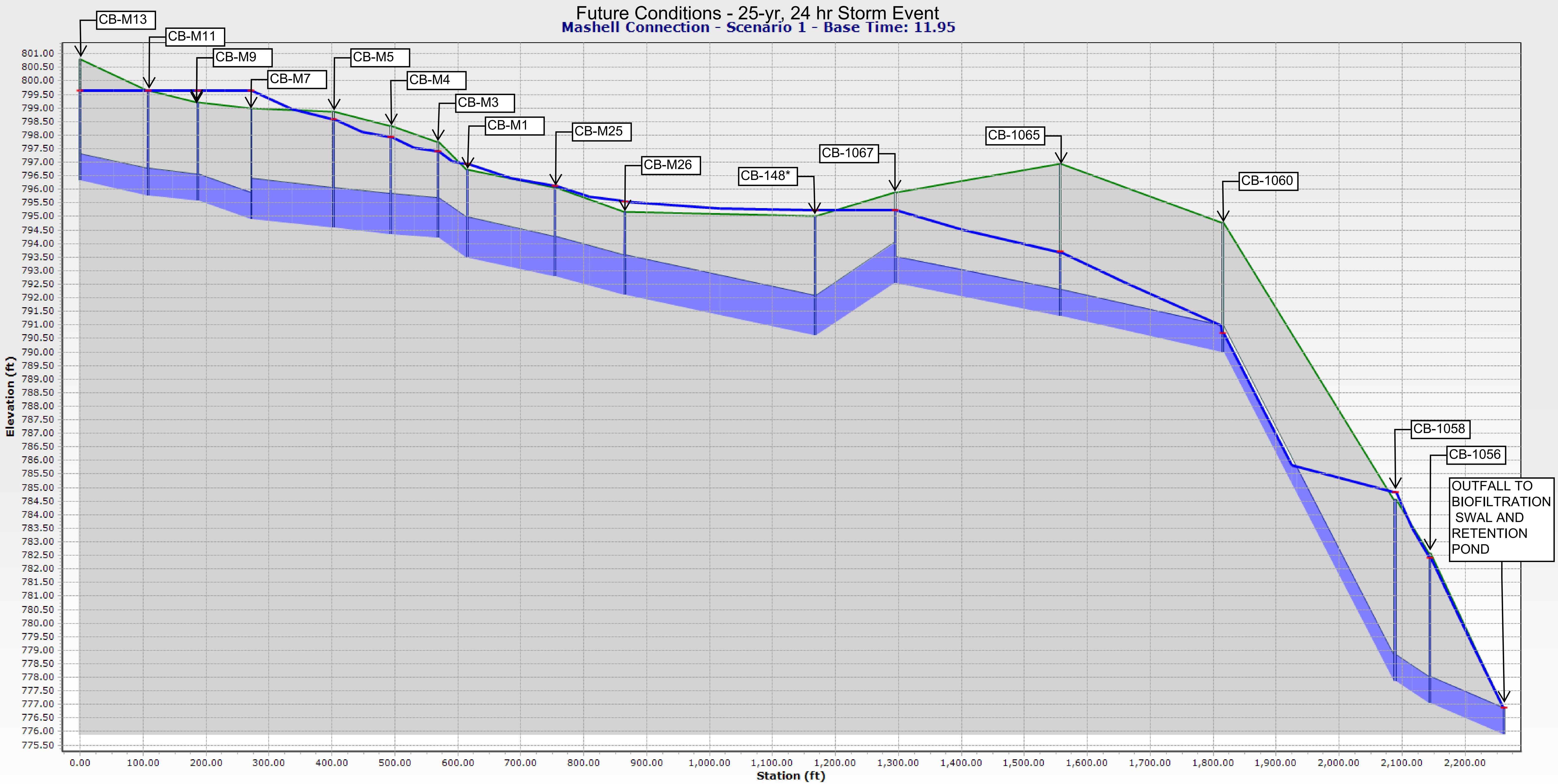
800.00
850.00
900.00

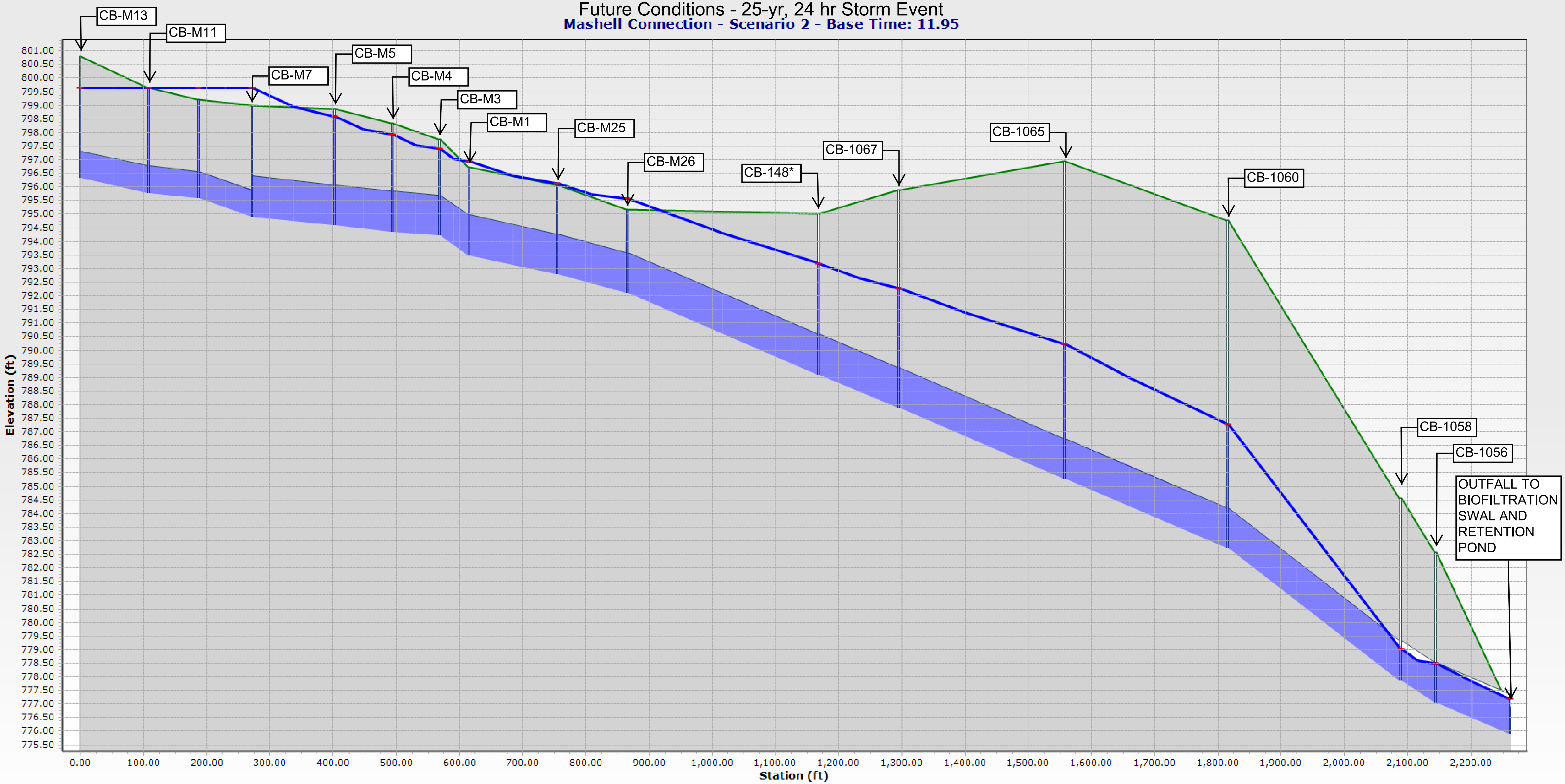


Notes:
This scenario connects the existing systems without changing the existing structures or pipes.

* CB-148 does not exist to date but is assumed as an intended structure once Mashell construction is continued.

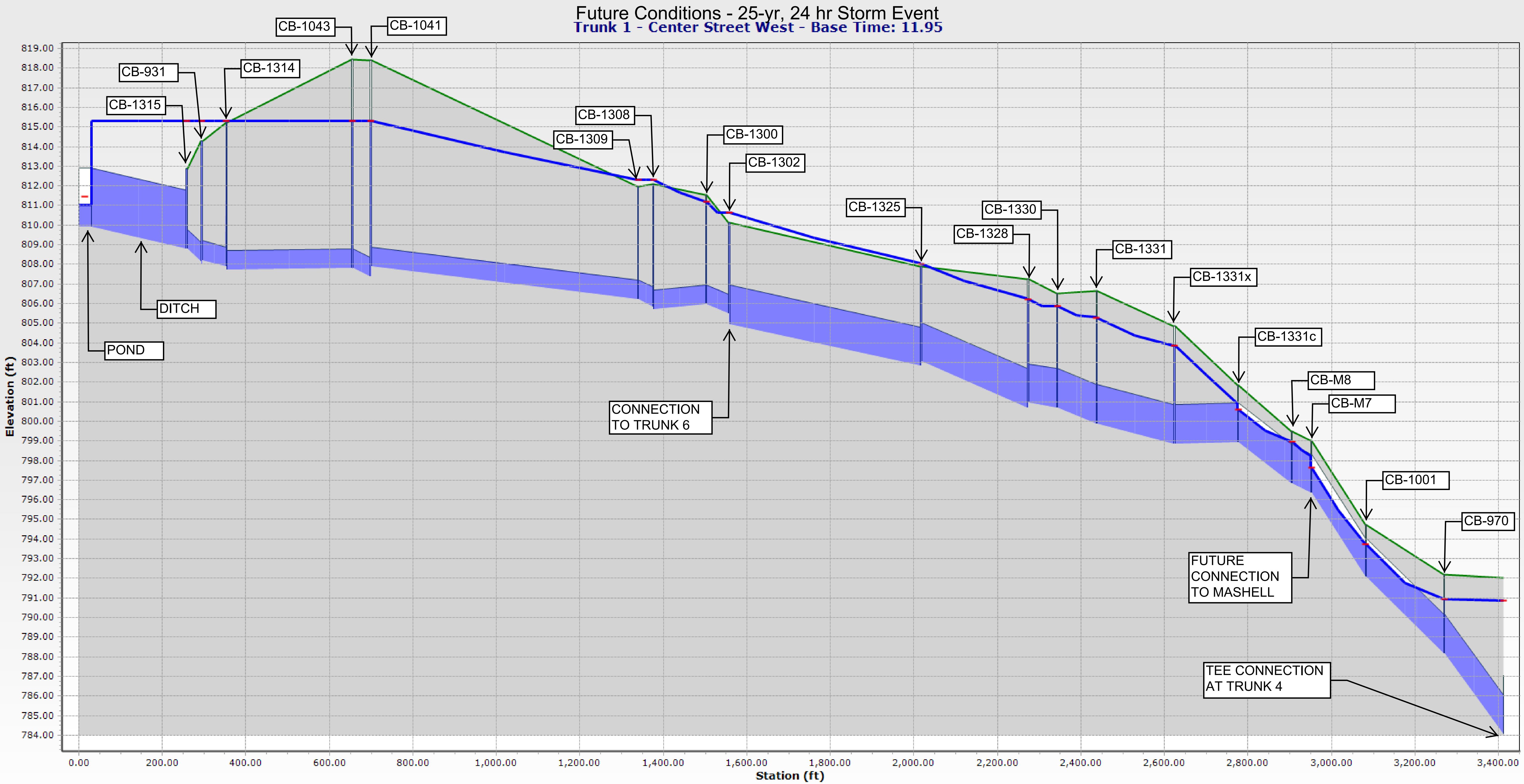
Future Conditions - 25-yr, 24 hr Storm Event

Mashell Connection - Scenario 2 - Base Time: 11.95

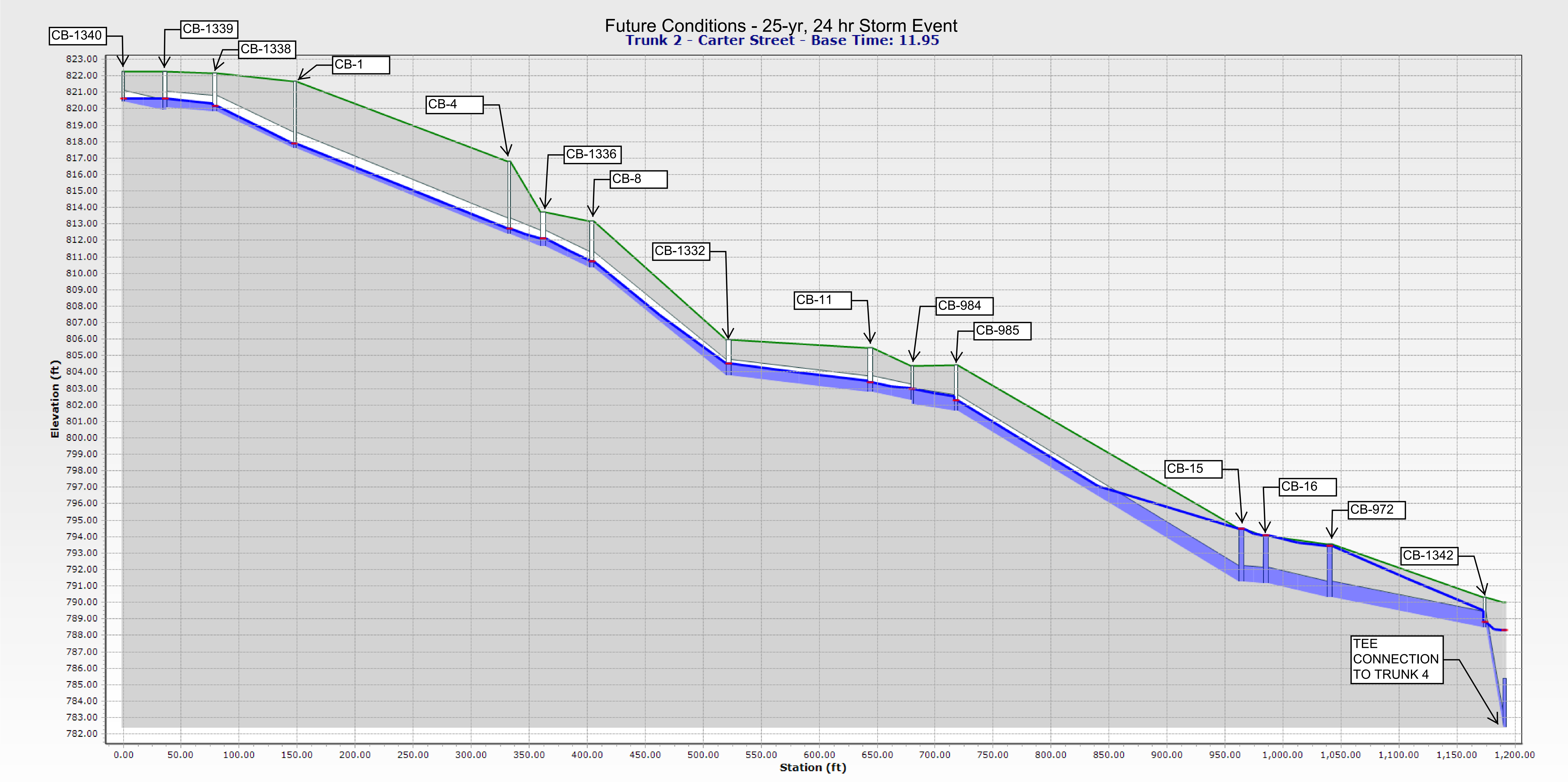


Notes:
This scenario continues the north system to the outfall, replacing downstream pipes with 18" pipe and 1% minimum slopes.

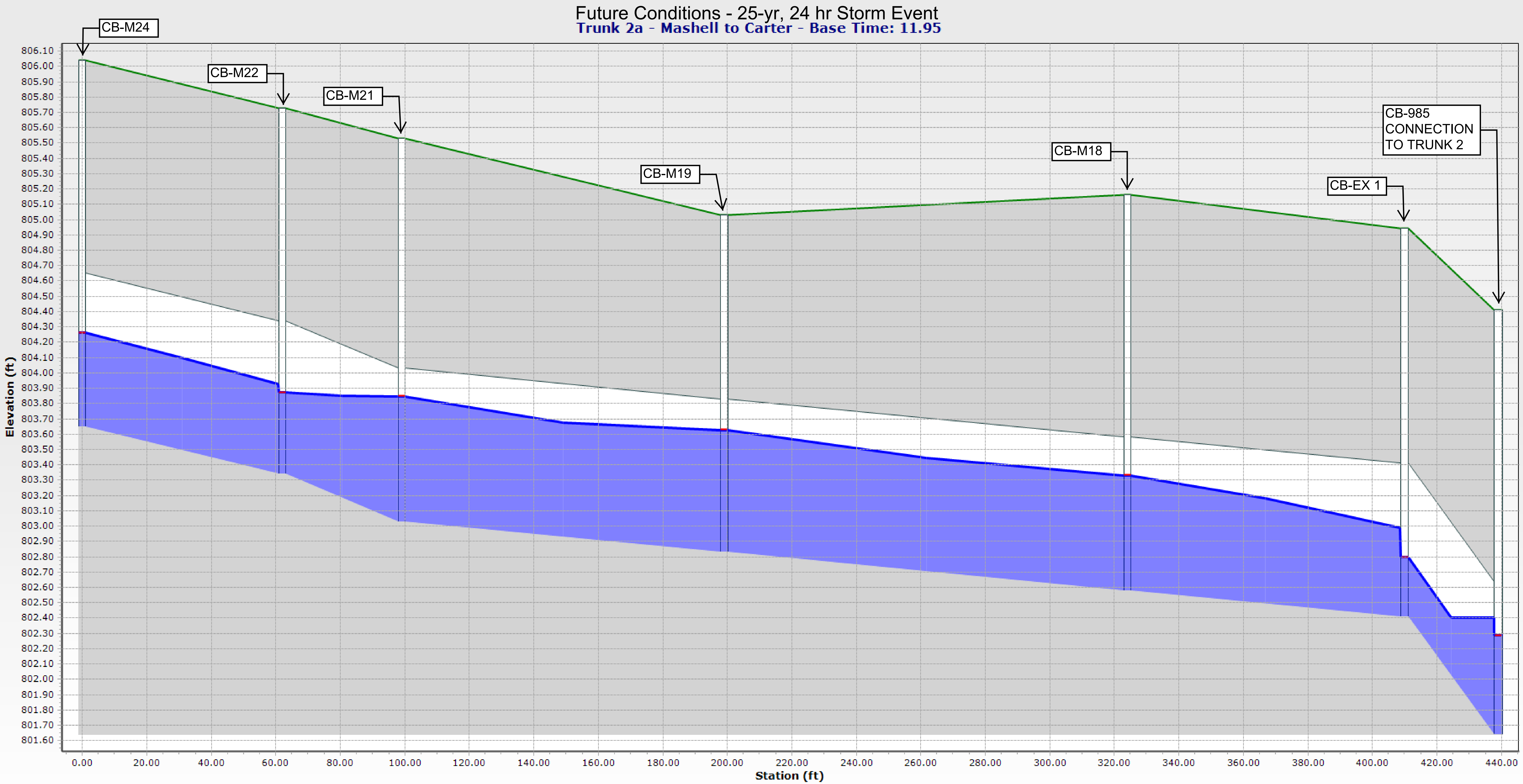
* CB-148 does not exist to date but is assumed as an intended structure once Mashell construction is continued.



Future Conditions - 25-yr, 24 hr Storm Event
Trunk 1 - Center Street West - Base Time: 11.95
CB-1043
CB-1041
CB-931
CB-1314
CB-1315
CB-1308
CB-1309
CB-1300
CB-1302
CB-1325
CB-1330
CB-1328
CB-1331
CB-1331x
CB-1331c
CB-M8
CB-M7
CB-1001
CB-970
DITCH
POND
CONNECTION TO TRUNK 6
FUTURE CONNECTION TO MASHELL
TEE CONNECTION AT TRUNK 4
Elevation (ft)
Station (ft)

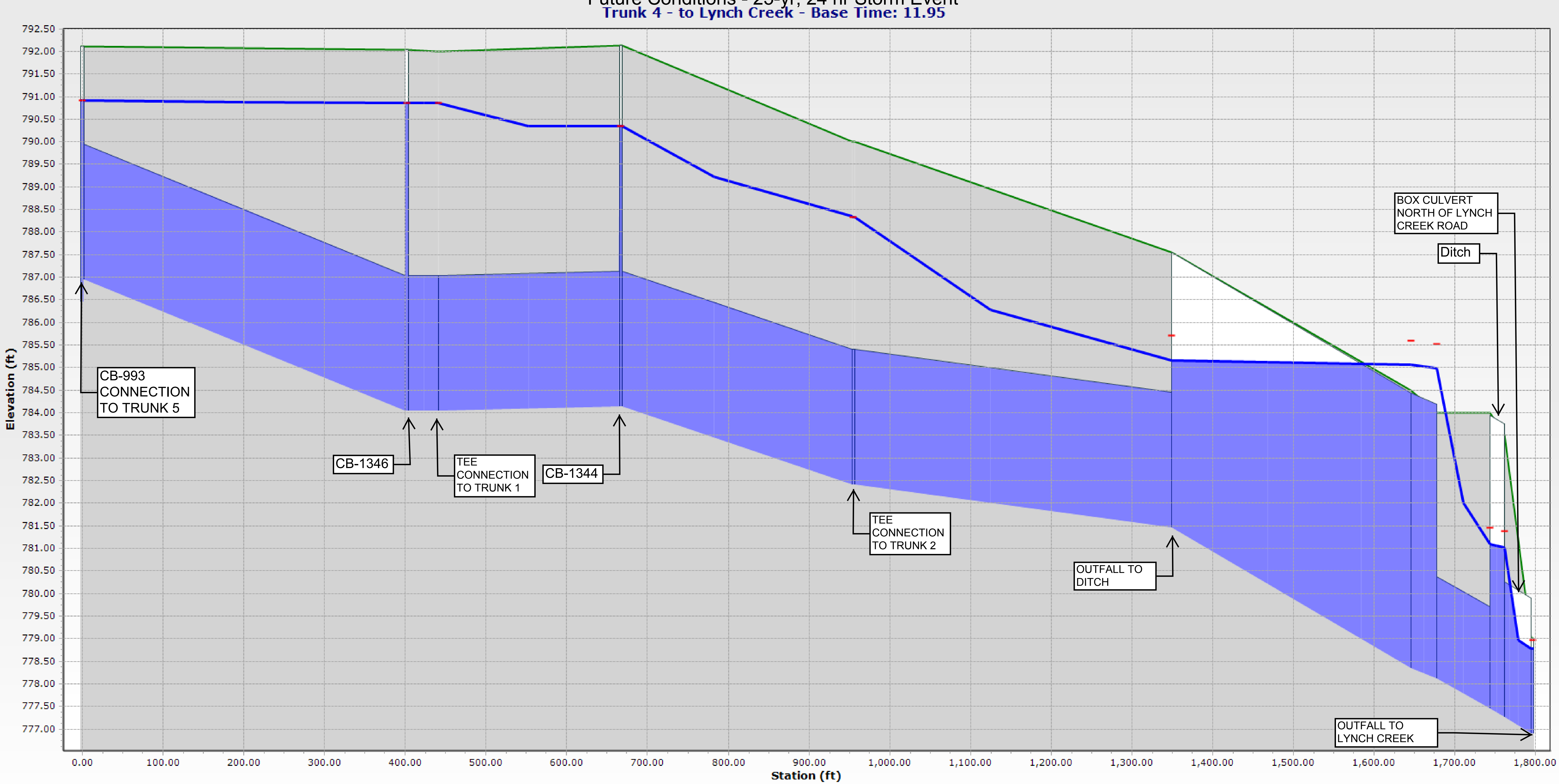


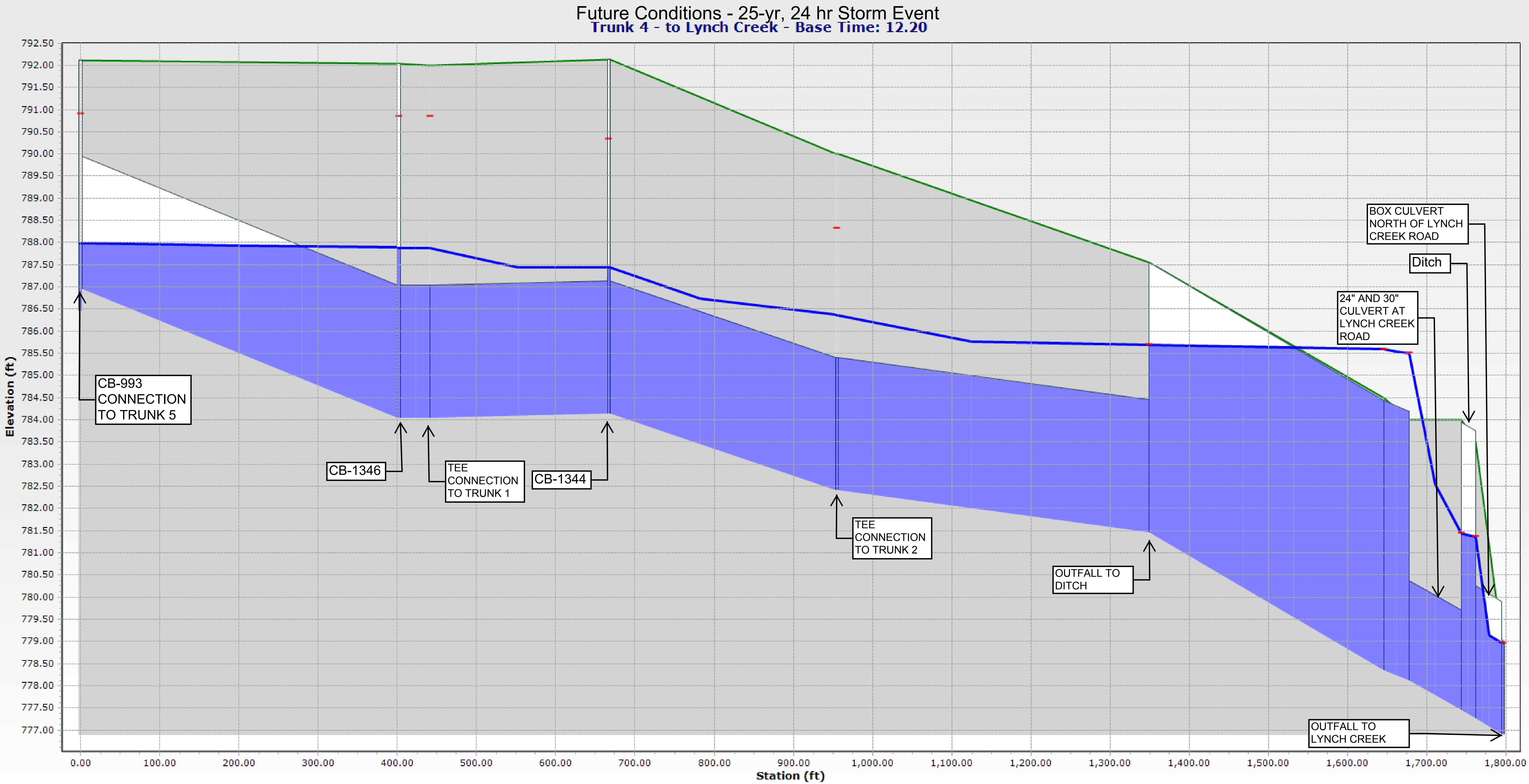
Future Conditions - 25-yr, 24 hr Storm Event
Trunk 2 - Carter Street - Base Time: 11.95
CB-1340
CB-1339
CB-1338
CB-1
CB-4
CB-1336
CB-8
CB-1332
CB-11
CB-984
CB-985
CB-15
CB-16
CB-972
CB-1342
TEE CONNECTION TO TRUNK 4
Elevation (ft)
Station (ft)



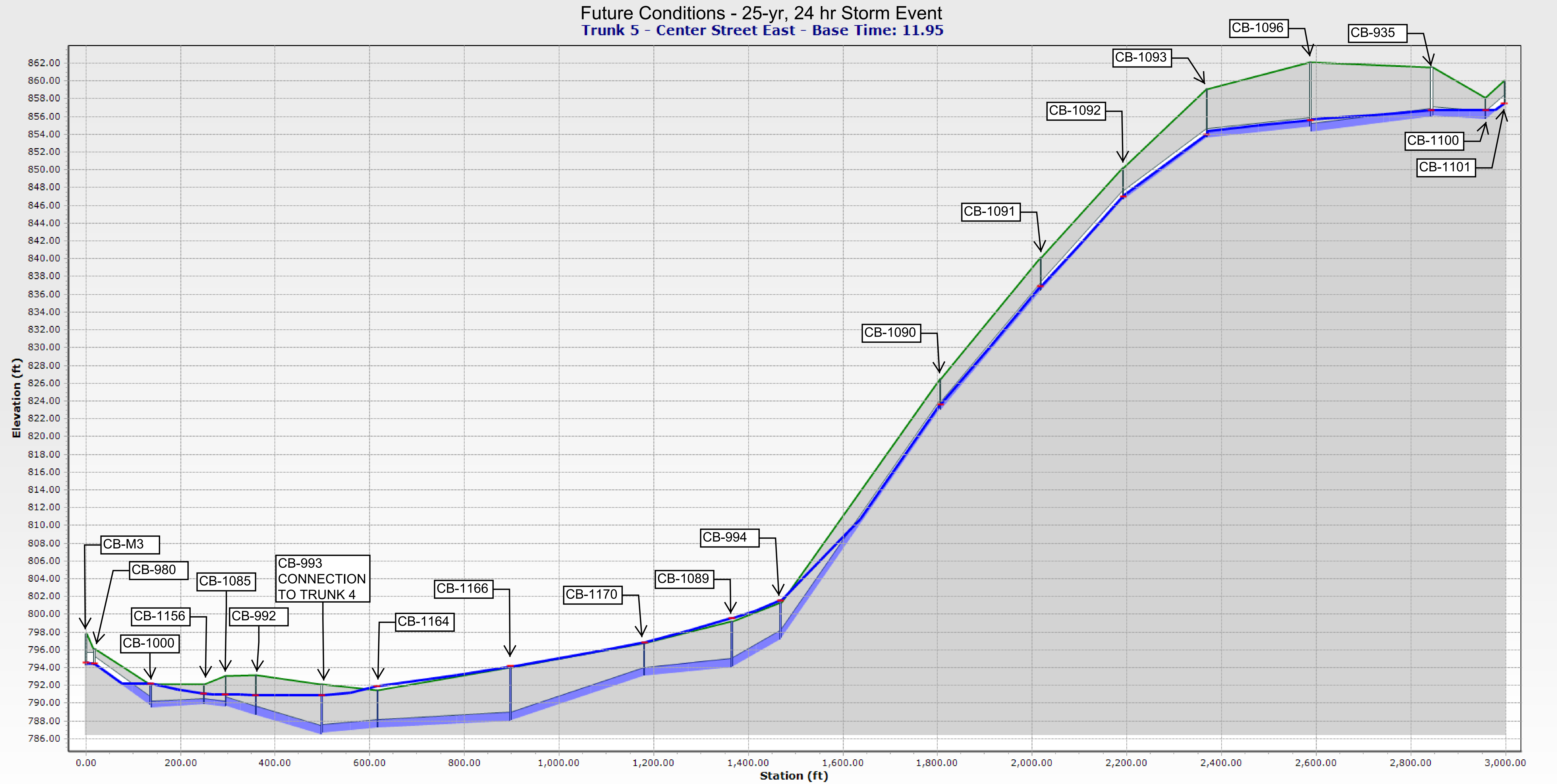
Future Conditions - 25-yr, 24 hr Storm Event
Trunk 2a - Mashell to Carter - Base Time: 11.95
CB-M24
CB-M22
CB-M21
CB-M19
CB-M18
CB-EX 1
CB-985 CONNECTION TO TRUNK 2
Elevation (ft)
Station (ft)

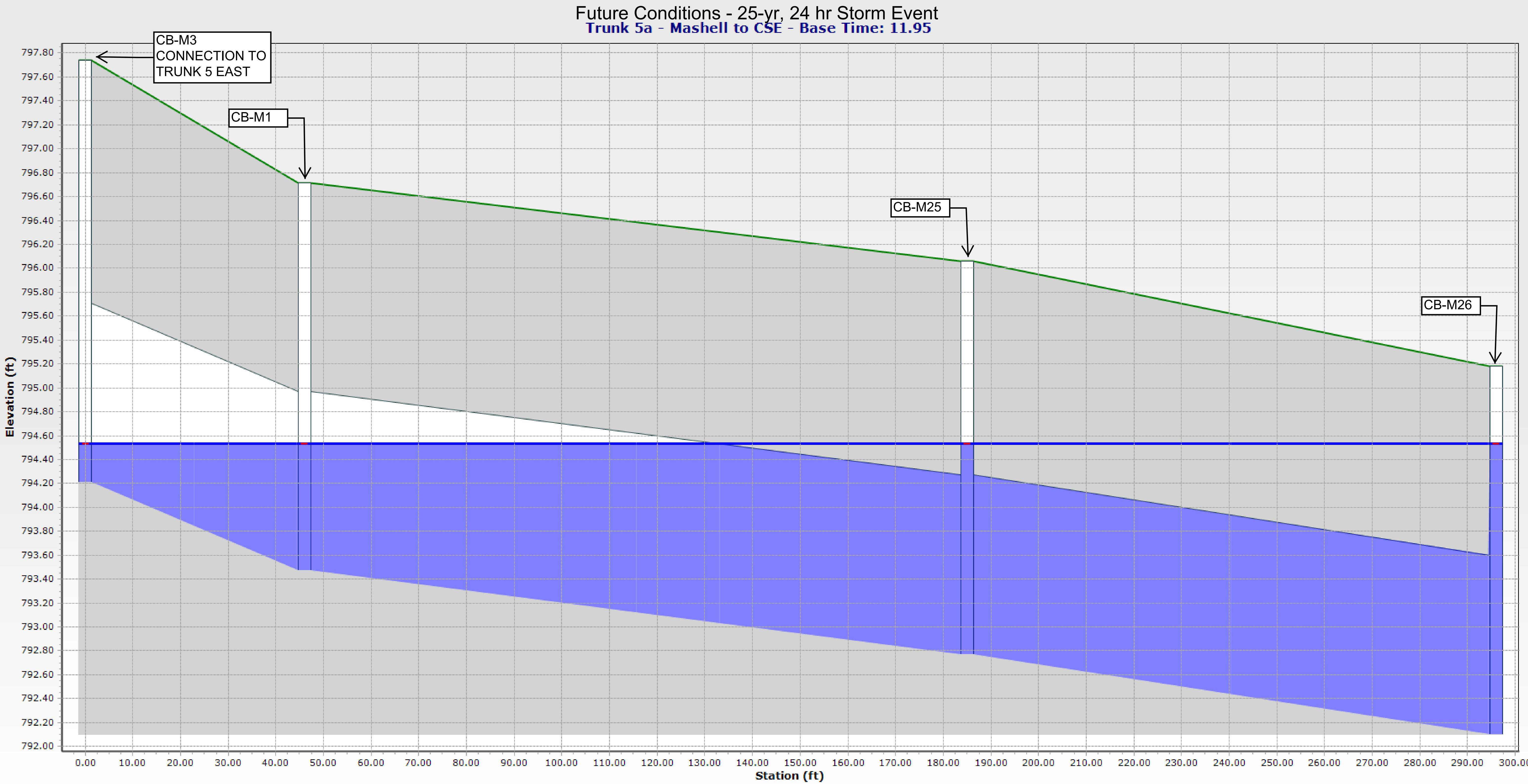
Future Conditions - 25-yr, 24 hr Storm Event

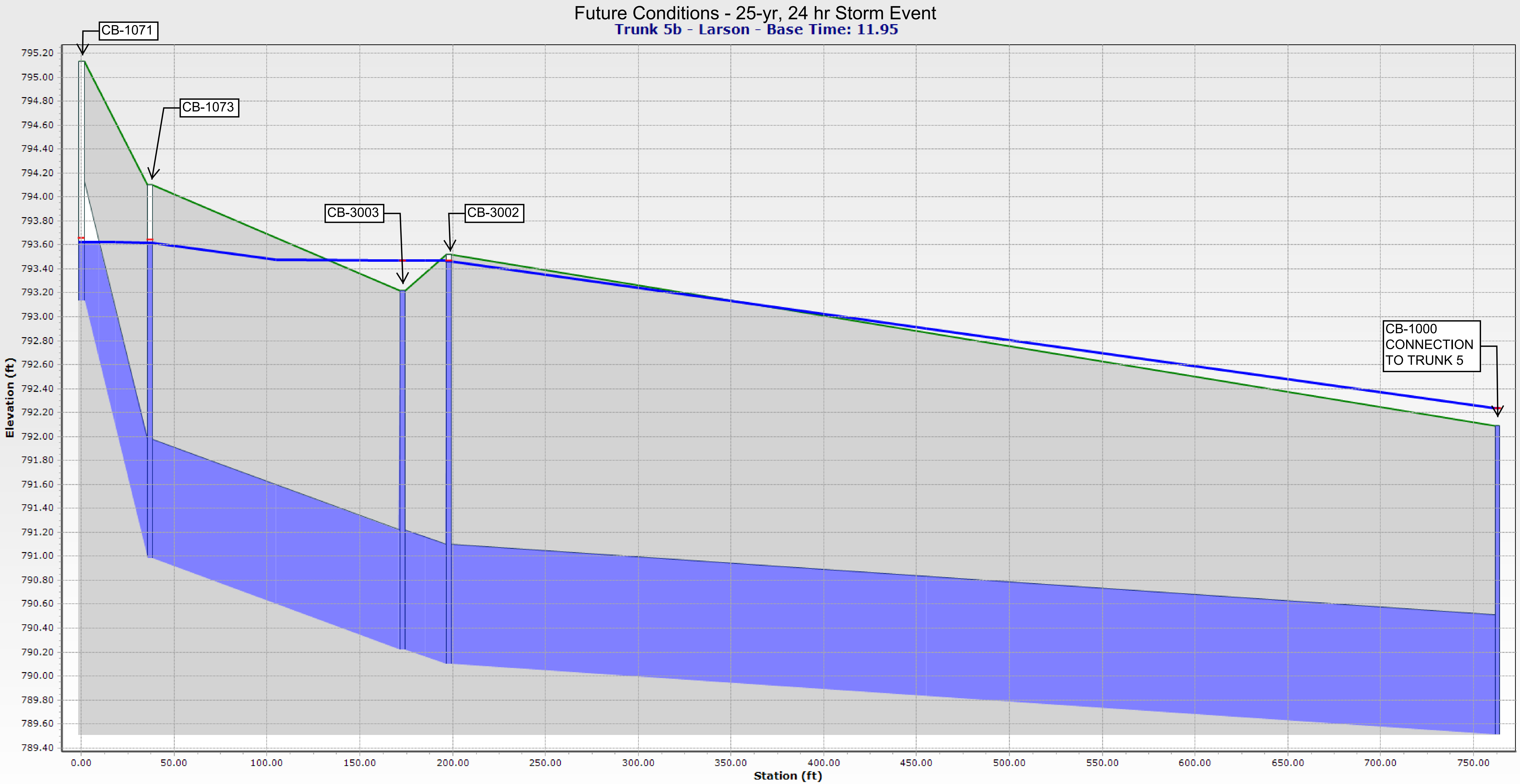




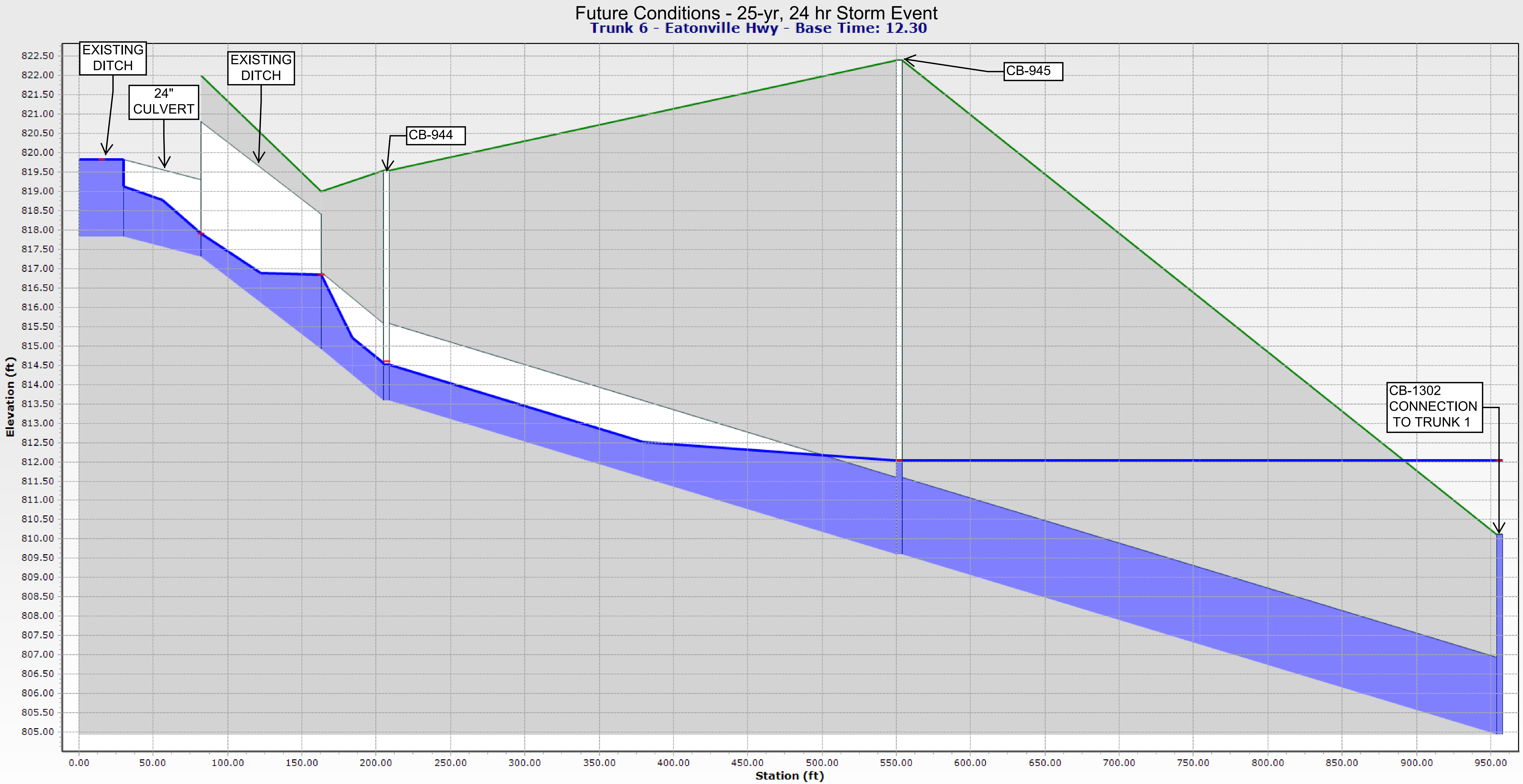
Future Conditions - 25-yr, 24 hr Storm Event
Trunk 4 - to Lynch Creek - Base Time: 12.20
Elevation (ft)
Station (ft)
CB-993 CONNECTION TO TRUNK 5
CB-1346
TEE CONNECTION TO TRUNK 1
CB-1344
TEE CONNECTION TO TRUNK 2
OUTFALL TO DITCH
BOX CULVERT NORTH OF LYNCH CREEK ROAD
Ditch
24" AND 30" CULVERT AT LYNCH CREEK ROAD
OUTFALL TO LYNCH CREEK

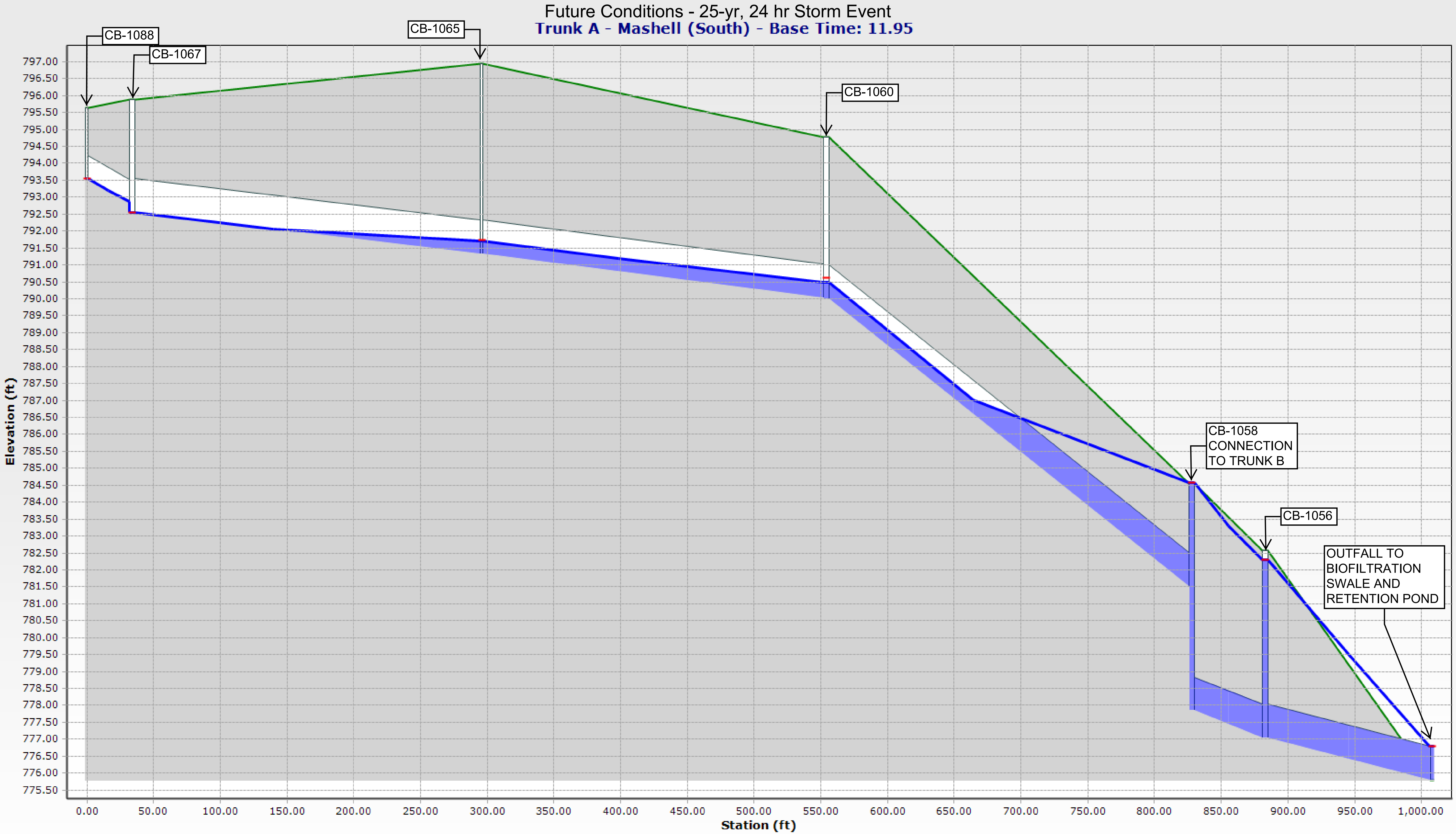

Future Conditions - 25-yr, 24 hr Storm Event
Trunk 5 - Center Street East - Base Time: 11.95
Elevation (ft)
Station (ft)
CB-M3
CB-980
CB-1000
CB-1156
CB-1085
CB-992
CB-993 CONNECTION TO TRUNK 4
CB-1164
CB-1166
CB-1170
CB-1089
CB-994
CB-1090
CB-1091
CB-1092
CB-1093
CB-1096
CB-935
CB-1100
CB-1101


Future Conditions - 25-yr, 24 hr Storm Event
Trunk 5a - Mashell to CSE - Base Time: 11.95
CB-M3 CONNECTION TO TRUNK 5 EAST
CB-M1
CB-M25
CB-M26
Elevation (ft)
Station (ft)
797.80
797.60
797.40
797.20
797.00
796.80
796.60
796.40
796.20
796.00
795.80
795.60
795.40
795.20
795.00
794.80
794.60
794.40
794.20
794.00
793.80
793.60
793.40
793.20
793.00
792.80
792.60
792.40
792.20
792.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
110.00
120.00
130.00
140.00
150.00
160.00
170.00
180.00
190.00
200.00
210.00
220.00
230.00
240.00
250.00
260.00
270.00
280.00
290.00
300.00

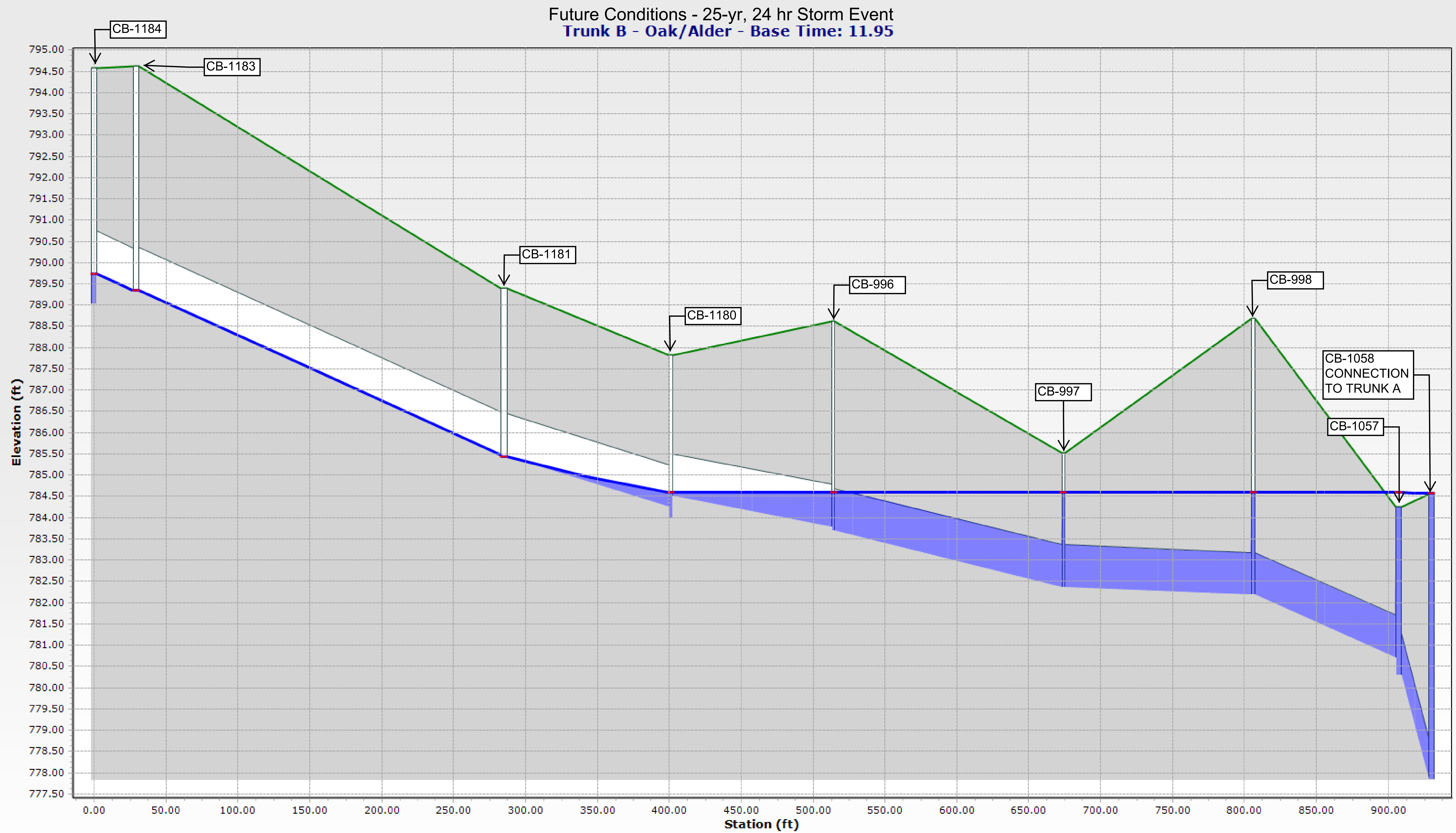


Future Conditions - 25-yr, 24 hr Storm Event
Trunk 5b - Larson - Base Time: 11.95
CB-1071
CB-1073
CB-3003
CB-3002
CB-1000
CONNECTION
TO TRUNK 5
Elevation (ft)
Station (ft)
795.20
795.00
794.80
794.60
794.40
794.20
794.00
793.80
793.60
793.40
793.20
793.00
792.80
792.60
792.40
792.20
792.00
791.80
791.60
791.40
791.20
791.00
790.80
790.60
790.40
790.20
790.00
789.80
789.60
789.40
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00
550.00
600.00
650.00
700.00
750.00

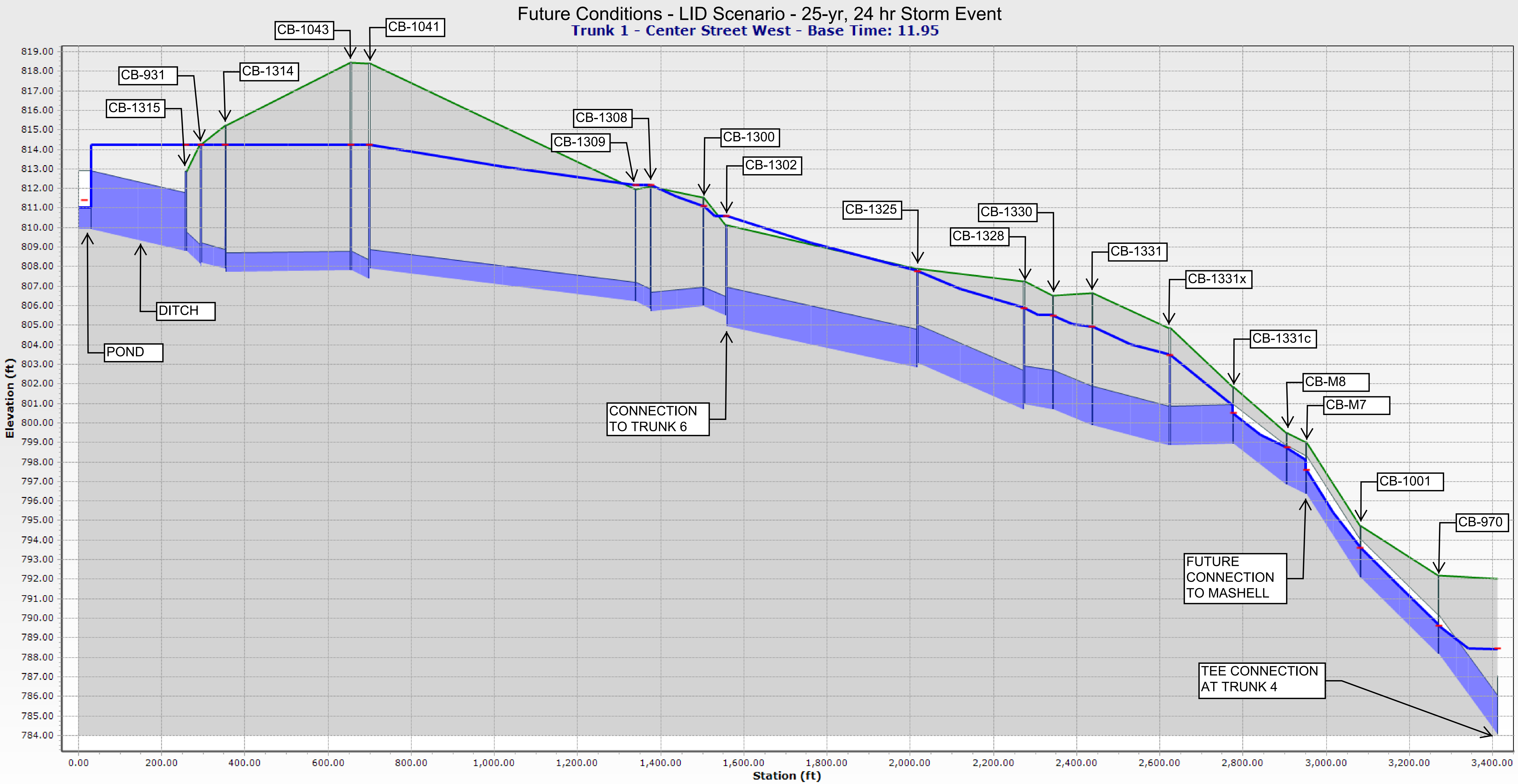

Future Conditions - 25-yr, 24 hr Storm Event
Trunk 6 - Eatonville Hwy - Base Time: 12.30
EXISTING DITCH
24" CULVERT
EXISTING DITCH
CB-944
CB-945
CB-1302 CONNECTION TO TRUNK 1
Elevation (ft)
Station (ft)
822.50
822.00
821.50
821.00
820.50
820.00
819.50
819.00
818.50
818.00
817.50
817.00
816.50
816.00
815.50
815.00
814.50
814.00
813.50
813.00
812.50
812.00
811.50
811.00
810.50
810.00
809.50
809.00
808.50
808.00
807.50
807.00
806.50
806.00
805.50
805.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00
550.00
600.00
650.00
700.00
750.00
800.00
850.00
900.00
950.00

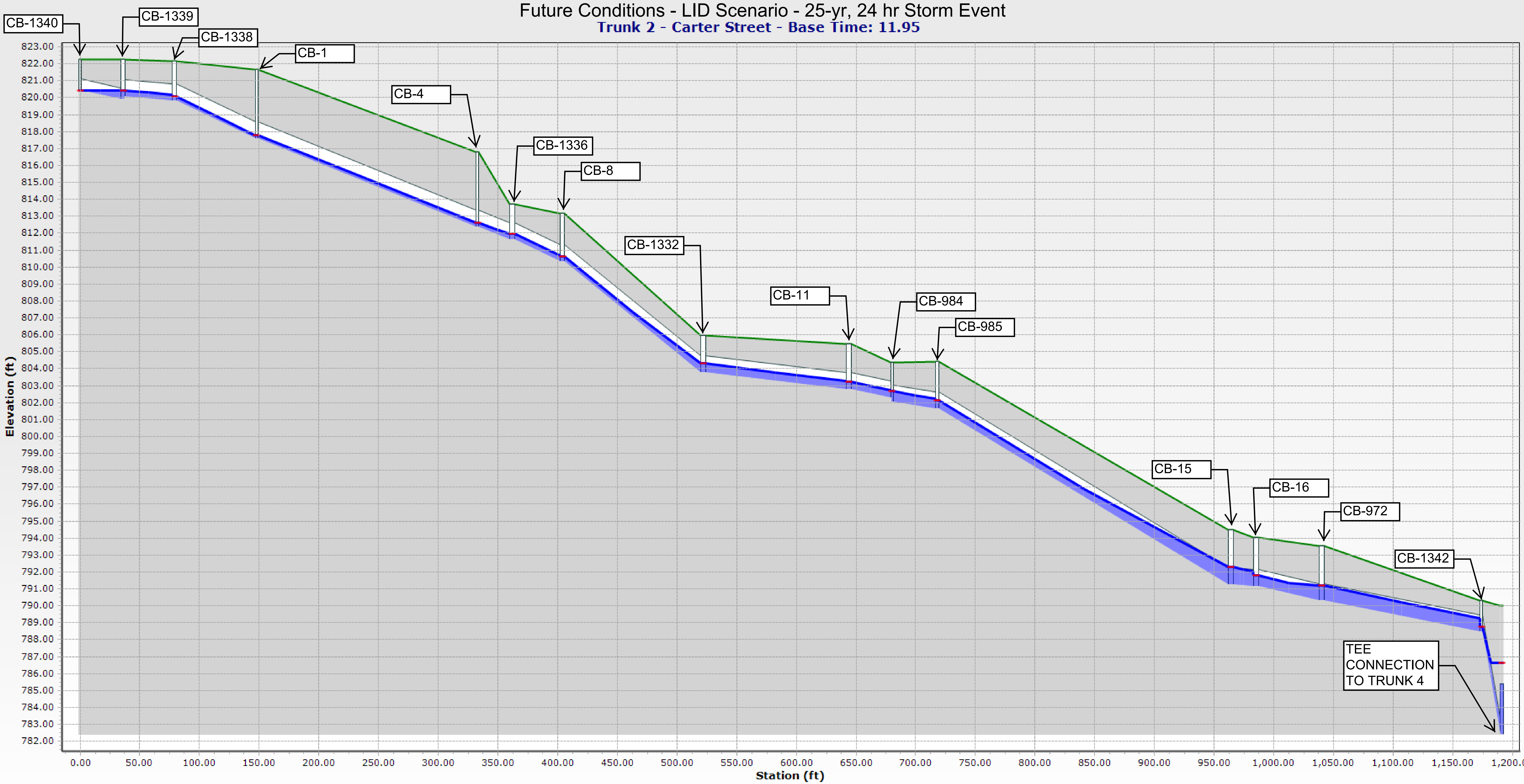


Future Conditions - 25-yr, 24 hr Storm Event
Trunk A - Mashell (South) - Base Time: 11.95
CB-1088
CB-1067
CB-1065
CB-1060
CB-1058 CONNECTION TO TRUNK B
CB-1056
OUTFALL TO BIOFILTRATION SWALE AND RETENTION POND
Elevation (ft)
Station (ft)



Future Conditions - 25-yr, 24 hr Storm Event
Trunk B - Oak/Alder - Base Time: 11.95
CB-1184
CB-1183
CB-1181
CB-1180
CB-996
CB-998
CB-997
CB-1058 CONNECTION TO TRUNK A
CB-1057
Elevation (ft)
Station (ft)
795.00
794.50
794.00
793.50
793.00
792.50
792.00
791.50
791.00
790.50
790.00
789.50
789.00
788.50
788.00
787.50
787.00
786.50
786.00
785.50
785.00
784.50
784.00
783.50
783.00
782.50
782.00
781.50
781.00
780.50
780.00
779.50
779.00
778.50
778.00
777.50
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00
550.00
600.00
650.00
700.00
750.00
800.00
850.00
900.00


Future Conditions - LID Scenario - 25-yr, 24 hr Storm Event
Trunk 1 - Center Street West - Base Time: 11.95
Elevation (ft)
Station (ft)
CB-1043
CB-1041
CB-931
CB-1314
CB-1315
CB-1308
CB-1309
CB-1300
CB-1302
CB-1325
CB-1330
CB-1328
CB-1331
CB-1331x
CB-1331c
CB-M8
CB-M7
CB-1001
CB-970
POND
DITCH
CONNECTION
TO TRUNK 6
FUTURE
CONNECTION
TO MASHELL
TEE CONNECTION
AT TRUNK 4
819.00
818.00
817.00
816.00
815.00
814.00
813.00
812.00
811.00
810.00
809.00
808.00
807.00
806.00
805.00
804.00
803.00
802.00
801.00
800.00
799.00
798.00
797.00
796.00
795.00
794.00
793.00
792.00
791.00
790.00
789.00
788.00
787.00
786.00
785.00
784.00
0.00
200.00
400.00
600.00
800.00
1,000.00
1,200.00
1,400.00
1,600.00
1,800.00
2,000.00
2,200.00
2,400.00
2,600.00
2,800.00
3,000.00
3,200.00
3,400.00


Future Conditions - LID Scenario - 25-yr, 24 hr Storm Event
Trunk 2 - Carter Street - Base Time: 11.95
CB-1340
CB-1339
CB-1338
CB-1
CB-4
CB-1336
CB-8
CB-1332
CB-11
CB-984
CB-985
CB-15
CB-16
CB-972
CB-1342
TEE CONNECTION TO TRUNK 4
Elevation (ft)
Station (ft)
823.00
822.00
821.00
820.00
819.00
818.00
817.00
816.00
815.00
814.00
813.00
812.00
811.00
810.00
809.00
808.00
807.00
806.00
805.00
804.00
803.00
802.00
801.00
800.00
799.00
798.00
797.00
796.00
795.00
794.00
793.00
792.00
791.00
790.00
789.00
788.00
787.00
786.00
785.00
784.00
783.00
782.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00
550.00
600.00
650.00
700.00
750.00
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900.00
950.00
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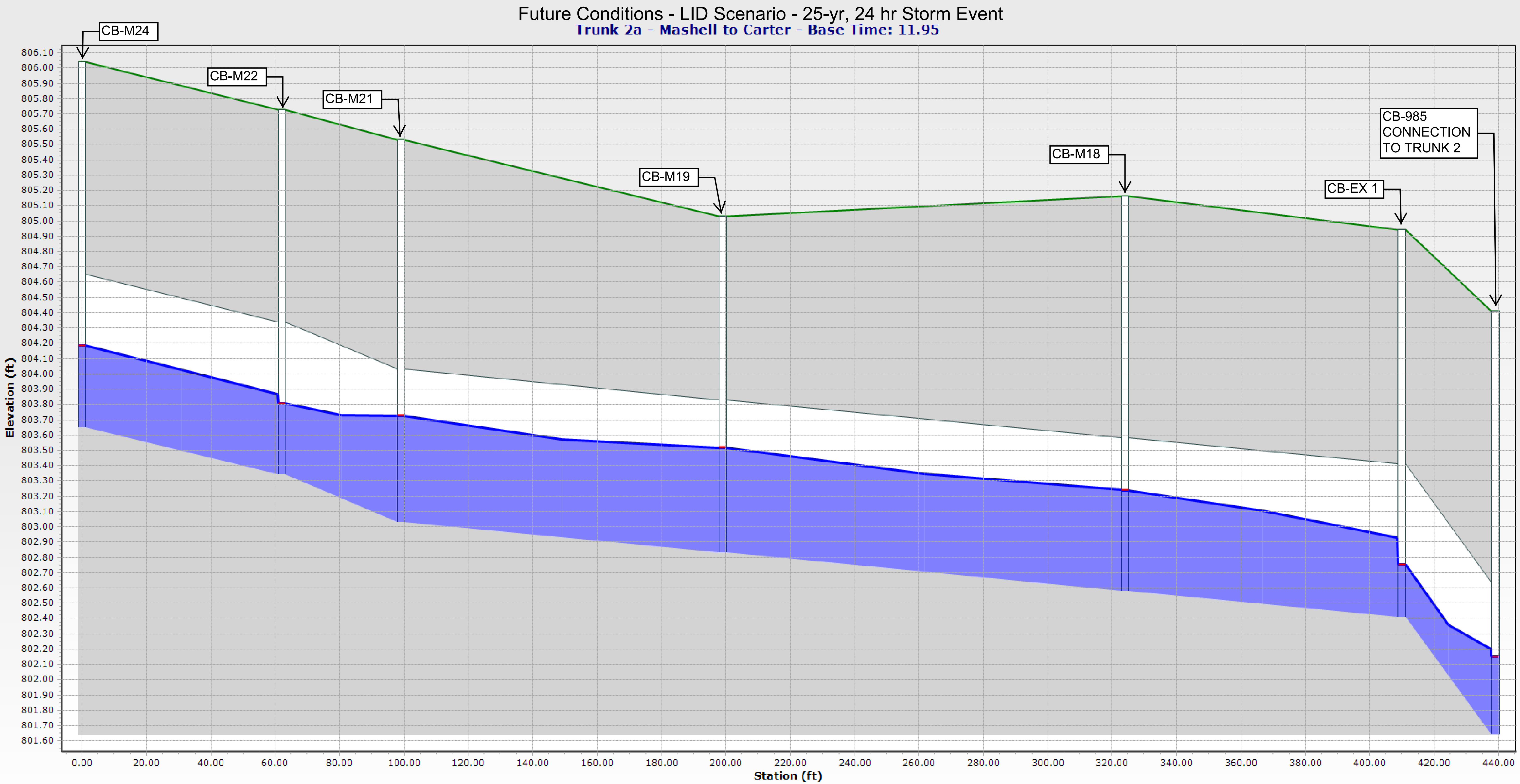
1,050.00
1,100.00
1,150.00
1,200.00



Future Conditions - LID Scenario - 25-yr, 24 hr Storm Event
Trunk 2a - Mashell to Carter - Base Time: 11.95
CB-M24
CB-M22
CB-M21
CB-M19
CB-M18
CB-EX 1
CB-985 CONNECTION TO TRUNK 2
Elevation (ft)
Station (ft)
806.10
806.00
805.90
805.80
805.70
805.60
805.50
805.40
805.30
805.20
805.10
805.00
804.90
804.80
804.70
804.60
804.50
804.40
804.30
804.20
804.10
804.00
803.90
803.80
803.70
803.60
803.50
803.40
803.30
803.20
803.10
803.00
802.90
802.80
802.70
802.60
802.50
802.40
802.30
802.20
802.10
802.00
801.90
801.80
801.70
801.60
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
220.00
240.00
260.00
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360.00
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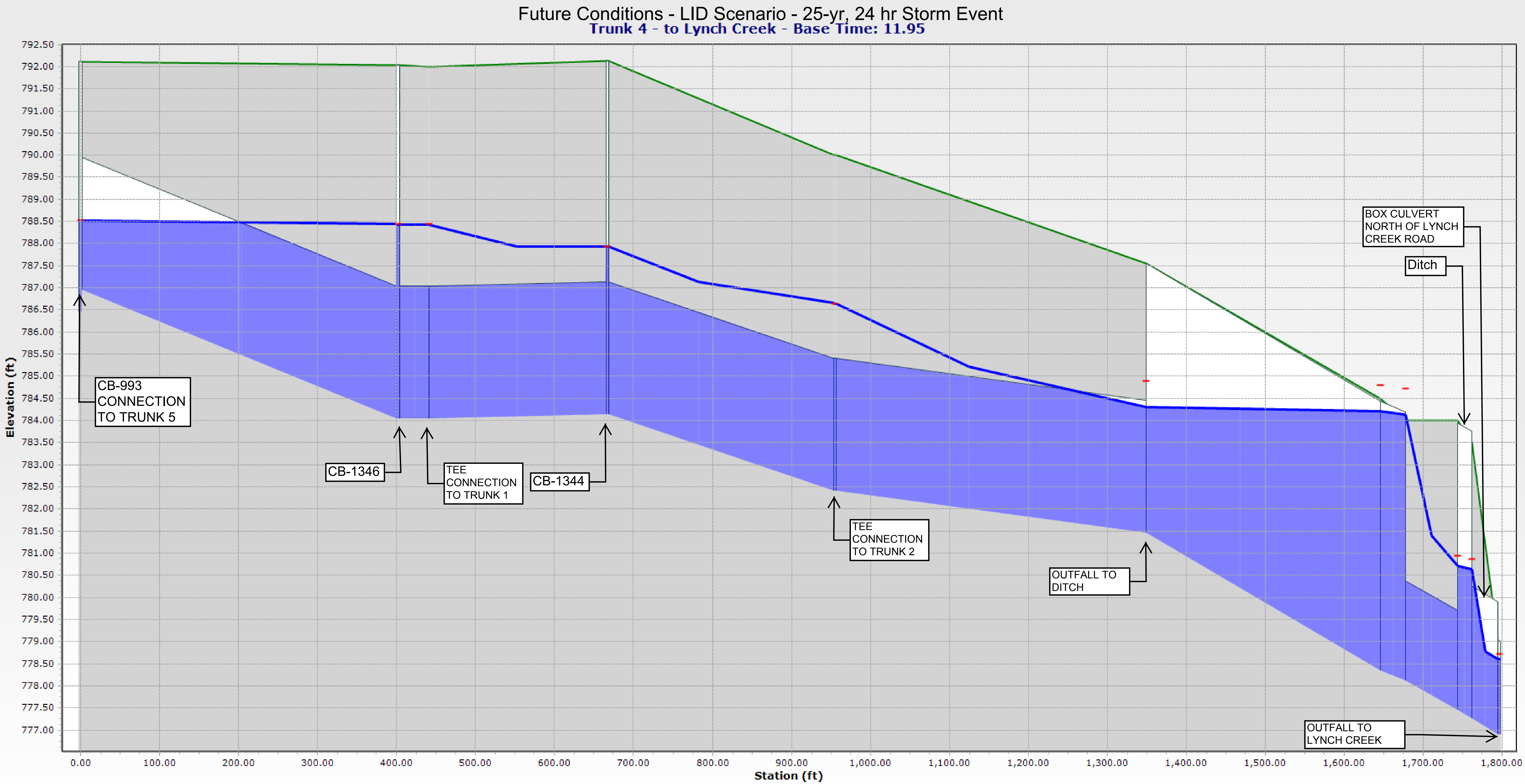
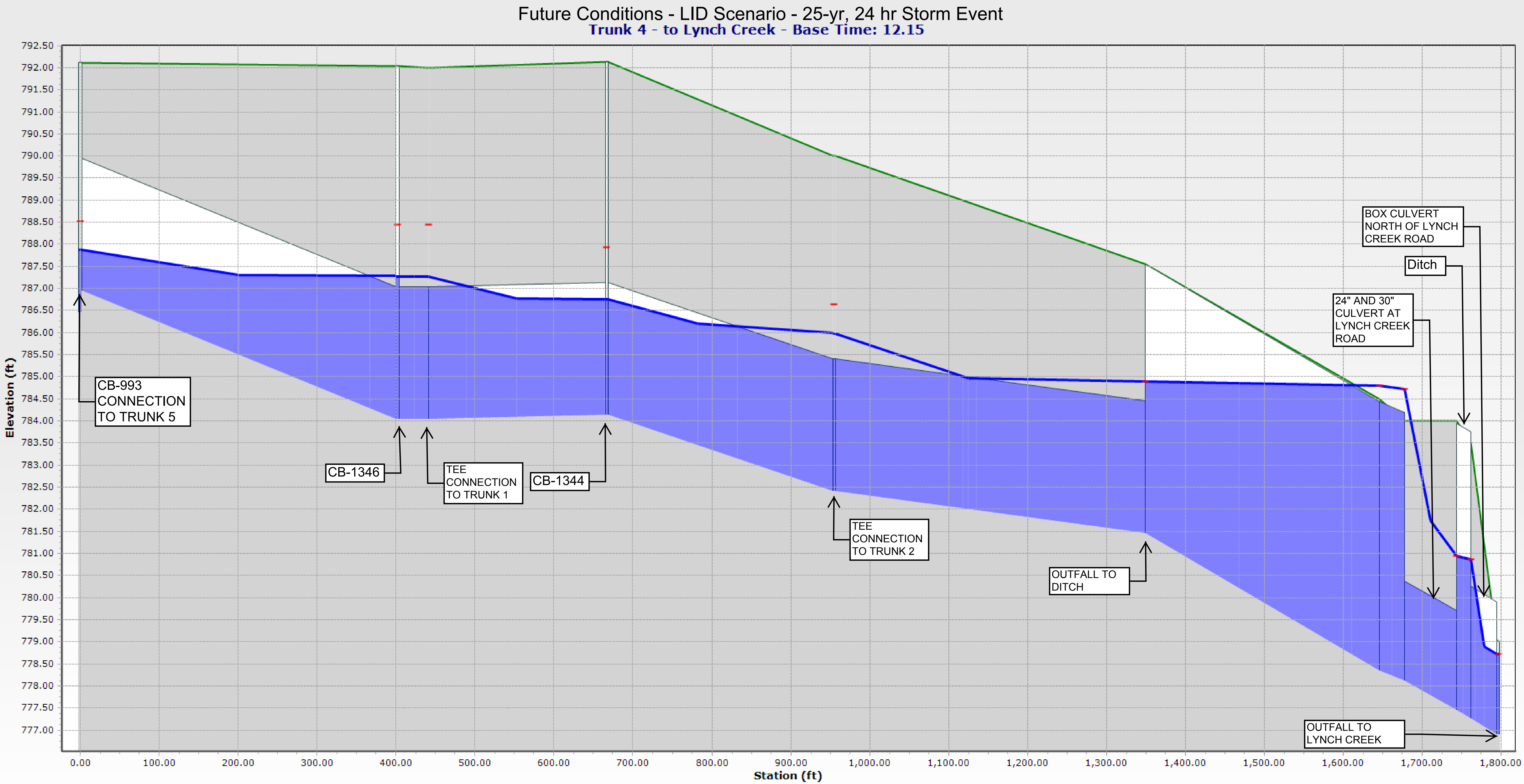
400.00
420.00
440.00

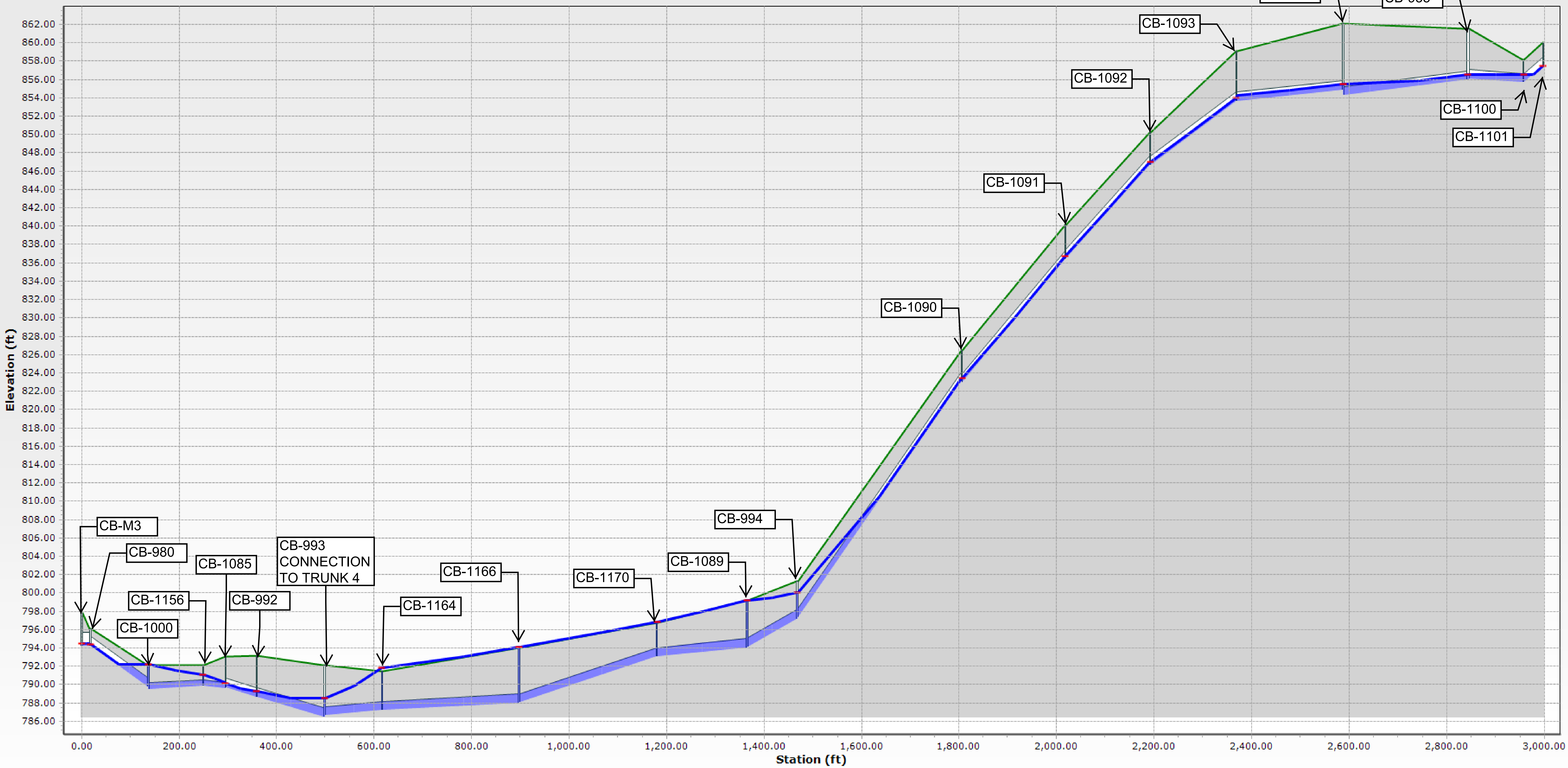


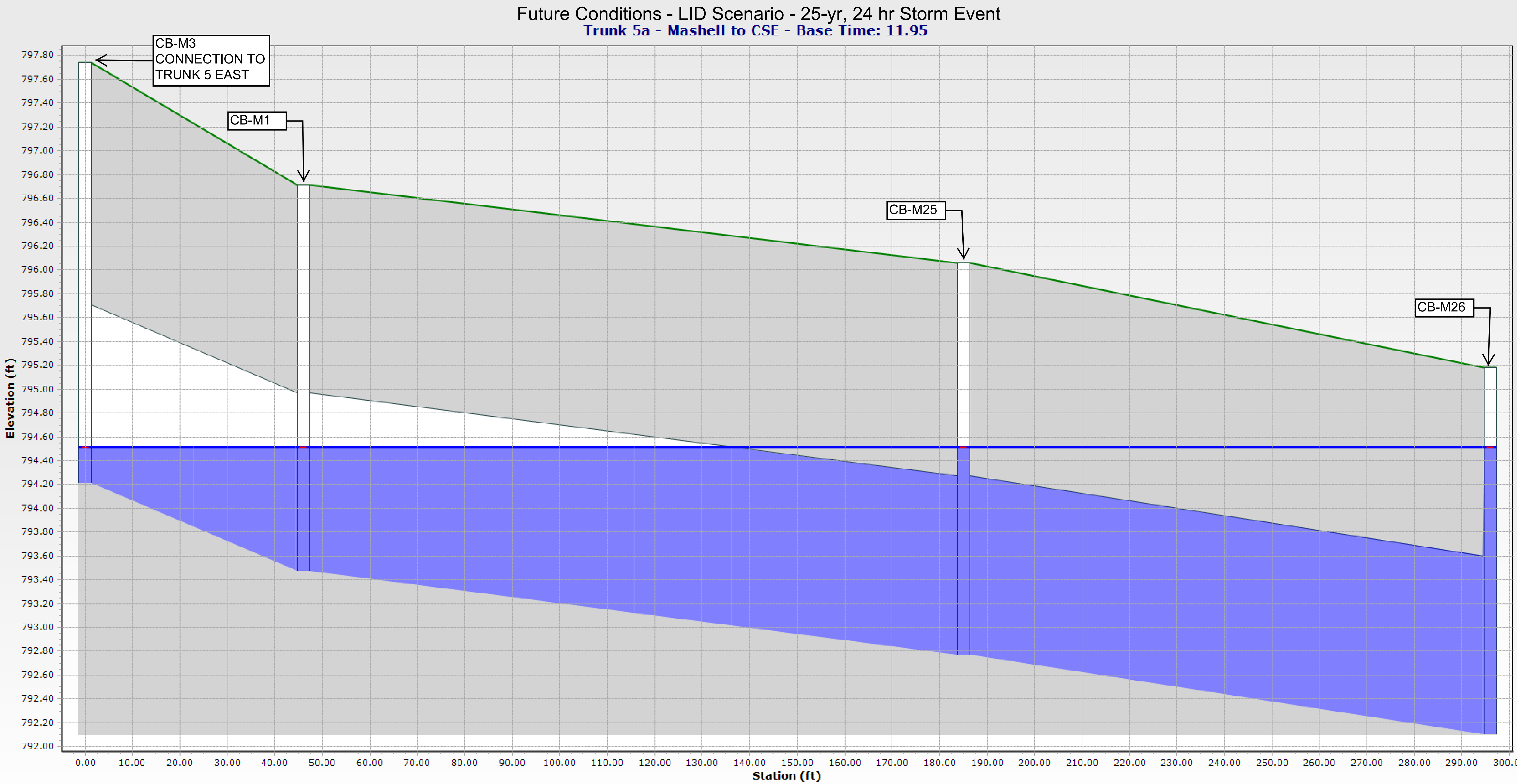
Future Conditions - LID Scenario - 25-yr, 24 hr Storm Event
Trunk 4 - to Lynch Creek - Base Time: 11.95
Elevation (ft)
Station (ft)
CB-993 CONNECTION TO TRUNK 5
CB-1346
TEE CONNECTION TO TRUNK 1
CB-1344
TEE CONNECTION TO TRUNK 2
OUTFALL TO DITCH
BOX CULVERT NORTH OF LYNCH CREEK ROAD
Ditch
OUTFALL TO LYNCH CREEK


Future Conditions - LID Scenario - 25-yr, 24 hr Storm Event
Trunk 4 - to Lynch Creek - Base Time: 12.15
Elevation (ft)
Station (ft)
CB-993 CONNECTION TO TRUNK 5
CB-1346
TEE CONNECTION TO TRUNK 1
CB-1344
TEE CONNECTION TO TRUNK 2
OUTFALL TO DITCH
BOX CULVERT NORTH OF LYNCH CREEK ROAD
Ditch
24" AND 30" CULVERT AT LYNCH CREEK ROAD
OUTFALL TO LYNCH CREEK

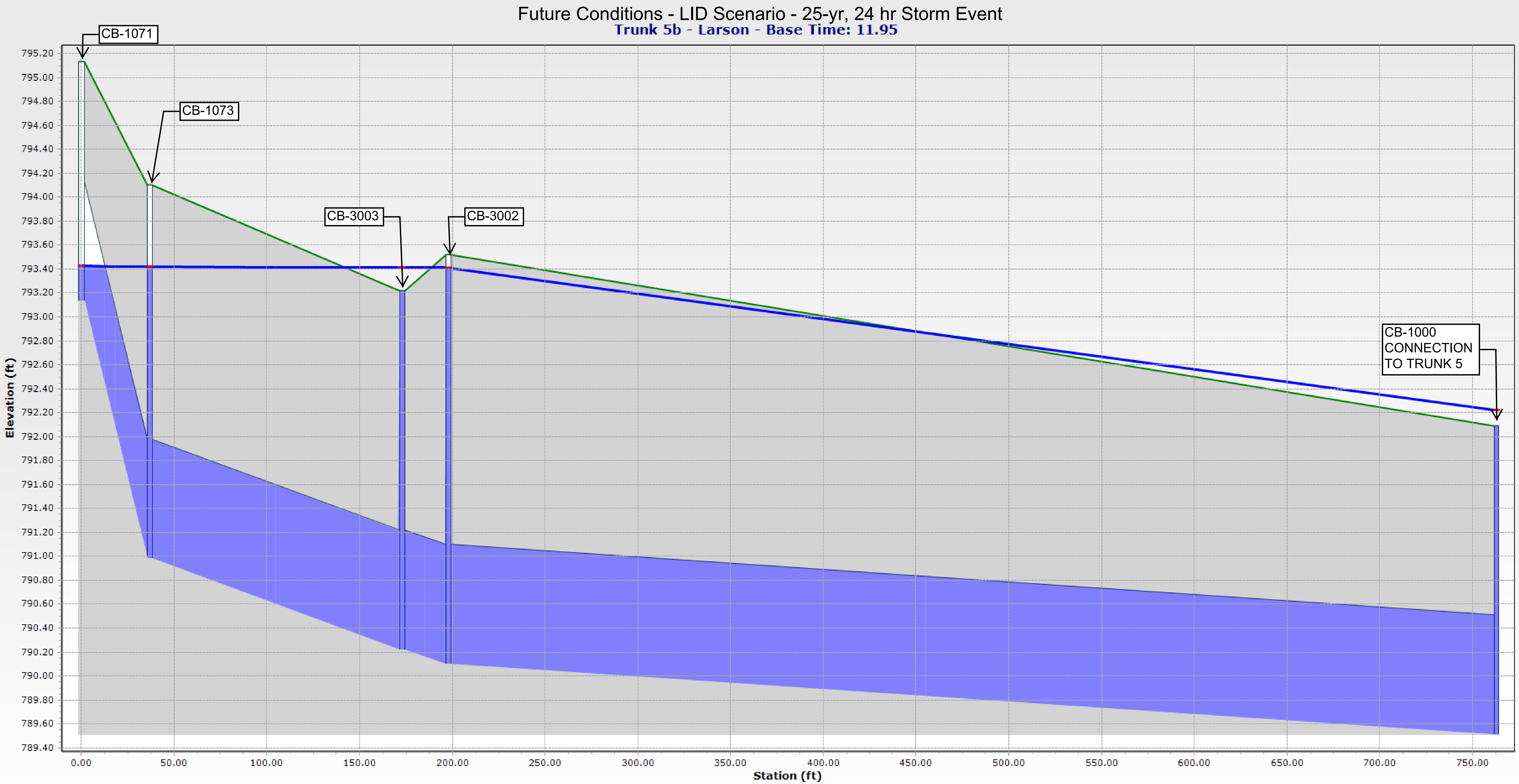
Future Conditions - LID Scenario - 25-yr, 24 hr Storm Event

Trunk 5 - Center Street East - Base Time: 11.95

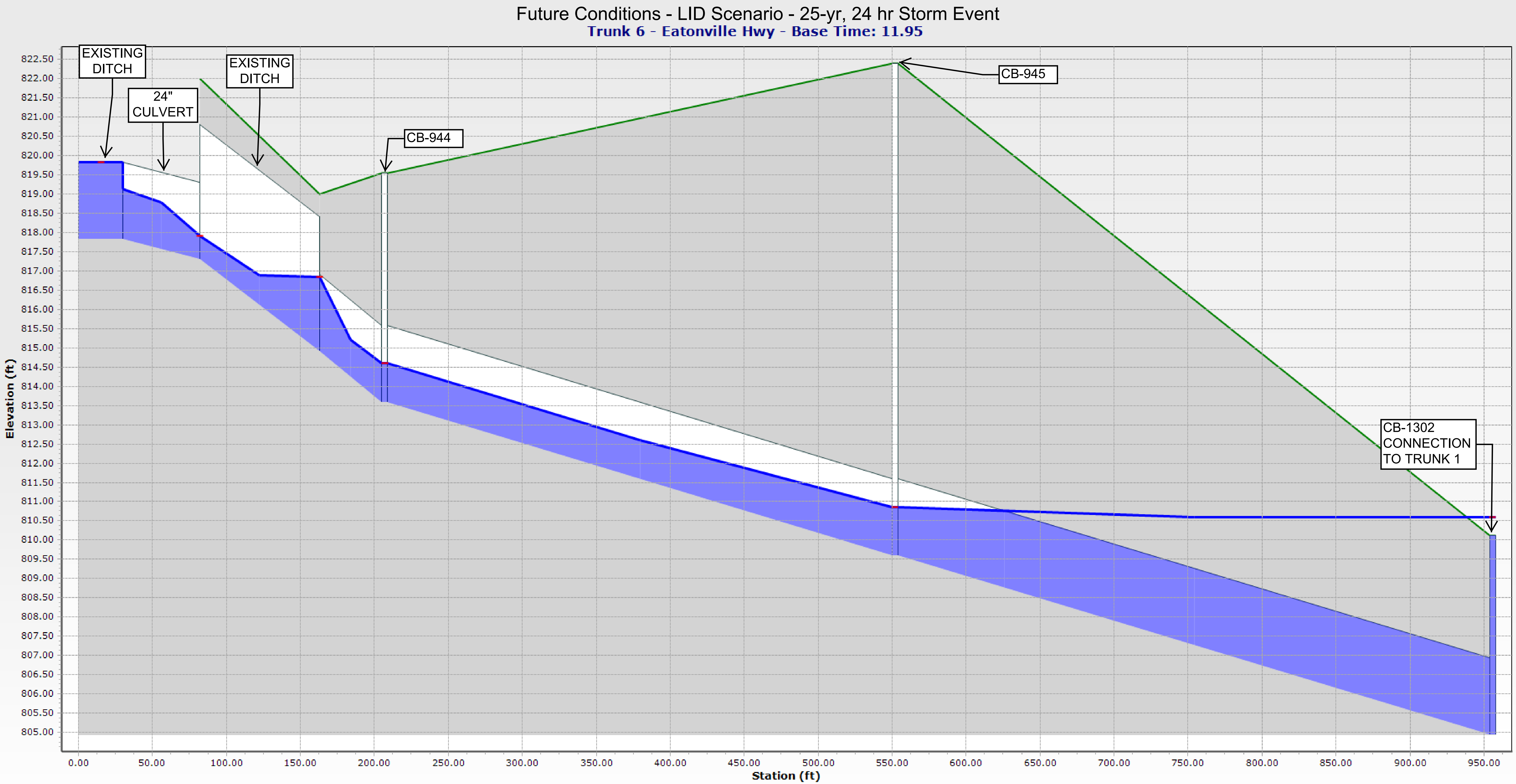




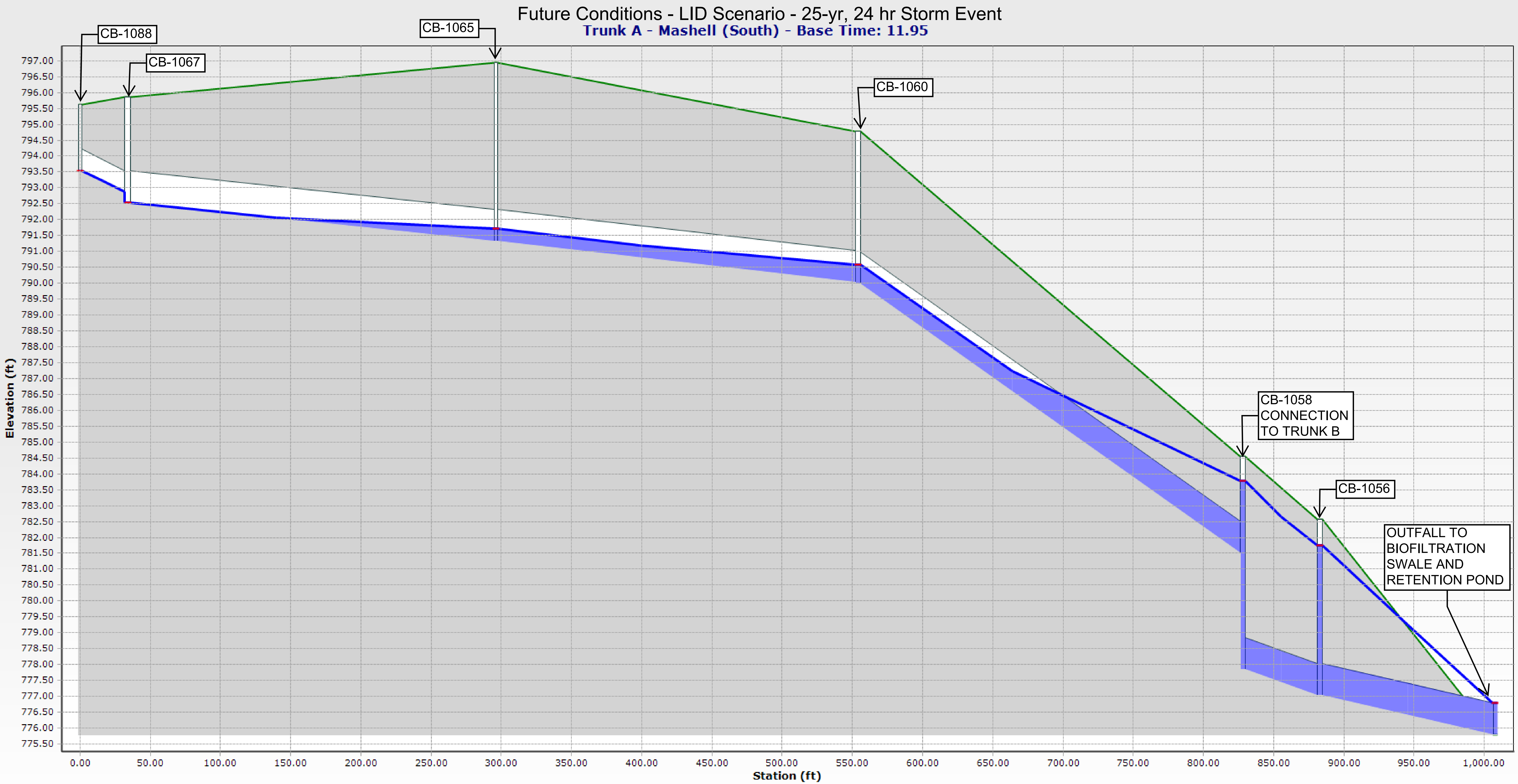
Future Conditions - LID Scenario - 25-yr, 24 hr Storm Event
Trunk 5a - Mashell to CSE - Base Time: 11.95
CB-M3 CONNECTION TO TRUNK 5 EAST
CB-M1
CB-M25
CB-M26
Elevation (ft)
Station (ft)



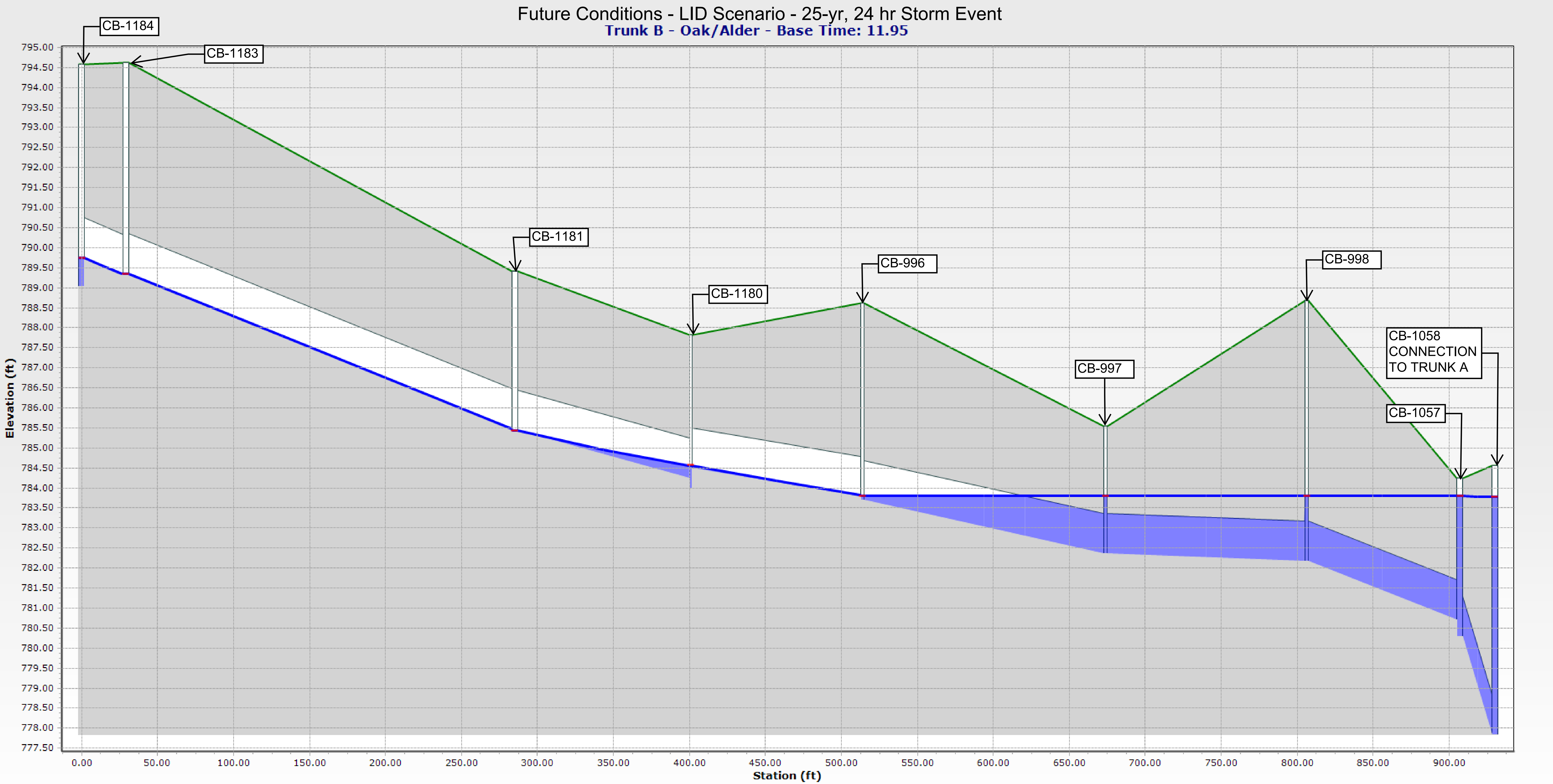
Future Conditions - LID Scenario - 25-yr, 24 hr Storm Event
Trunk 5b - Larson - Base Time: 11.95
CB-1071
CB-1073
CB-3003
CB-3002
CB-1000 CONNECTION TO TRUNK 5
Elevation (ft)
Station (ft)



Future Conditions - LID Scenario - 25-yr, 24 hr Storm Event
Trunk 6 - Eatonville Hwy - Base Time: 11.95
EXISTING DITCH
24" CULVERT
EXISTING DITCH
CB-944
CB-945
CB-1302 CONNECTION TO TRUNK 1
Elevation (ft)
Station (ft)



Future Conditions - LID Scenario - 25-yr, 24 hr Storm Event
Trunk A - Mashell (South) - Base Time: 11.95
CB-1088
CB-1067
CB-1065
CB-1060
CB-1058 CONNECTION TO TRUNK B
CB-1056
OUTFALL TO BIOFILTRATION SWALE AND RETENTION POND
Elevation (ft)
Station (ft)



Future Conditions - LID Scenario - 25-yr, 24 hr Storm Event
Trunk B - Oak/Alder - Base Time: 11.95
CB-1184
CB-1183
CB-1181
CB-1180
CB-996
CB-998
CB-997
CB-1058 CONNECTION TO TRUNK A
CB-1057
Elevation (ft)
Station (ft)

Catch Basin Table

North System - Existing Conditions - 25-yr, 24 hr

Id	Label	Rim Elevation (ft)	Invert Elevation (ft)	Structure Type	Diameter (ft)	Length (ft)	Width (ft)	Hydraulic Grade (Maximum) (ft)	Maximum Flooding Depth (ft)	Flow (Overflow Maximum) (ft³/s)	Flow (Out to Links Maximum) (ft³/s)	Time to Maximum Hydraulic Grade (hours)
19	CB-1164	791.49	787.12	Box Structure	3	2.17	1.83	791.79	0.3	3.82	8.47	11.95
20	CB-1166	793.98	787.98	Circular Structure	4	3	3	794.14	0.16	1.42	5.51	11.75
21	CB-1170	796.73	793.02	Box Structure	3	2.17	1.83	796.86	0.13	0.92	5.72	11.95
22	CB-1089	799.21	794.04	Box Structure	3	2.17	1.83	799.47	0.26	3.1	6	11.8
23	CB-994	801.22	797.14	Box Structure	3	2.17	1.83	801.35	0.13	0.92	6.76	11.85
24	CB-1090	826.41	822.91	Box Structure	3	2.17	1.83	823.47	0	0	4.93	12
25	CB-1091	840.15	836.32	Box Structure	3	2.17	1.83	836.78	0	0	4.93	11.95
26	CB-1092	850.25	846.67	Box Structure	3	2.17	1.83	847.01	0	0	2.64	12
27	CB-1093	859.11	853.61	Box Structure	3	2.17	1.83	853.99	0	0	2.64	12
28	CB-1096	862.1	854.23	Circular Structure	4	3	3	855.52	0	0	2.64	12
29	CB-935	861.55	855.93	Circular Structure	4	3	3	856.57	0	0	2.65	11.95
30	CB-1100	858.14	855.64	Box Structure	3	2.17	1.83	856.57	0	0	0	11.95
31	CB-1101	860.03	857.45	Box Structure	3	2.17	1.83	857.45	0	0	0	0
72	CB-993	792.12	786.45	Circular Structure	4	3	3	788.8	0	0	12.1	12
74	CB-1346	792.04	784.04	Circular Structure	4	3	3	788.71	0	0	13.85	12
75	CB-1344	792.13	784.13	Circular Structure	4	3	3	788.16	0	0	54.61	12
78	CB-992	793.18	788.65	Box Structure	3	2.17	1.83	789.37	0	0	3.78	11.95
80	CB-1085	793.1	789.58	Box Structure	3	2.17	1.83	790.08	0	0	1.59	11.85
82	CB-1156	792.15	789.82	Box Structure	3	2.17	1.83	791.1	0	0	1.59	11.95
85	CB-1000	792.09	789.51	Box Structure	3	2.17	1.83	792.23	0.14	1.04	1.59	11.95
86	CB-980	796.1	794.18	Box Structure	3	2.67	2.17	794.53	0	0	0.55	1.05
95	CB-931	814.27	807.96	Circular Structure	4	3	3	814.02	0	0	7.3	11.95
96	CB-1314	815.22	807.72	Box Structure	3	2.17	1.83	814.02	0	0	4.8	11.95
97	CB-1043	818.44	807.76	Circular Structure	4	3	3	814.02	0	0	5.04	11.95
98	CB-1041	818.38	807.36	Circular Structure	4	3	3	814.02	0	0	5.06	11.95
100	CB-1309	811.97	806.22	Box Structure	3	2.17	1.83	812.23	0.26	2.94	3.17	11.95
101	CB-1308	812.1	805.68	Box Structure	3	2.17	1.83	812.22	0.12	0.8	4.63	11.95
102	CB-1300	811.54	805.96	Box Structure	3	2.17	1.83	810.74	0	0	8.79	11.95
103	CB-1302	810.11	804.94	Circular Structure	4	3	3	810.54	0.43	7.51	19.54	12
104	CB-1325	807.9	802.82	Circular Structure	4	3	3	807.83	0	0	20.92	11.95
105	CB-1328	807.26	800.68	Circular Structure	4	3	3	805.94	0	0	21.96	11.95
106	CB-1330	806.52	800.69	Box Structure	3	2.17	1.83	805.56	0	0	21.96	11.95
107	CB-1331	806.63	799.88	Box Structure	3	2.17	1.83	804.97	0	0	21.97	11.95
109	CB-1331C	801.84	798.08	Box Structure	3	2.17	1.83	800.49	0	0	29.11	11.95
110	CB-M8	799.49	796.84	Box Structure	3	2.17	1.83	798.74	0	0	29.11	11.95
111	CB-M7	799	794.9	Box Structure	3	2.17	1.83	797.58	0	0	30.64	11.95

Catch Basin Table

North System - Existing Conditions - 25-yr, 24 hr

Id	Label	Rim Elevation (ft)	Invert Elevation (ft)	Structure Type	Diameter (ft)	Length (ft)	Width (ft)	Hydraulic Grade (Maximum) (ft)	Maximum Flooding Depth (ft)	Flow (Overflow Maximum) (ft³/s)	Flow (Out to Links Maximum) (ft³/s)	Time to Maximum Hydraulic Grade (hours)
112	CB-1001	794.71	792.04	Box Structure	3	2.17	1.83	793.62	0	0	30.64	11.95
113	CB-970	792.17	788.17	Box Structure	3	2.17	1.83	789.64	0	0	33.53	11.95
114	CB-1331X	804.85	798.85	Circular Structure	4	3	3	803.5	0	0	29.11	11.95
142	CB-1340	822.26	820.43	Box Structure	3	2.17	1.83	820.52	0	0	0	11.95
143	CB-1339	822.24	819.91	Circular Structure	4	3	3	820.52	0	0	1.06	11.95
144	CB-1338	822.15	819.82	Circular Structure	4	3	3	820.1	0	0	1.06	11.95
145	CB-1336	813.71	811.63	Circular Structure	4	3	3	812.05	0	0	2.19	11.95
147	CB-1332	805.96	803.79	Circular Structure	4	3	3	804.41	0	0	2.19	11.95
148	CB-984	804.37	802.04	Box Structure	3	2.17	1.83	802.81	0	0	3.13	11.95
149	CB-985	804.41	801.64	Box Structure	3	2.67	2.17	802.22	0	0	4.88	11.95
151	CB-972	793.55	790.3	Circular Structure	4	3	3	792.25	0	0	6.7	12
152	CB-1342	790.32	788.45	Box Structure	3	2.17	1.83	788.8	0	0	6.7	12
153	CB-1	821.66	817.57	Box Structure	3	2.17	1.83	817.86	0	0	1.06	11.95
154	CB-4	816.81	812.38	Box Structure	3	2.17	1.83	812.68	0	0	1.05	11.95
155	CB-8	813.15	810.35	Circular Structure	4	3	3	810.71	0	0	2.19	11.95
156	CB-11	805.48	802.78	Circular Structure	4	3	3	803.32	0	0	2.19	11.95
157	CB-15	794.49	791.23	Circular Structure	4	3	3	792.98	0	0	4.87	12
158	CB-16	794.03	791.15	Circular Structure	4	3	3	792.74	0	0	4.82	12
160	CB-1143	793.57	791.15	Box Structure	3	2.17	1.83	792.55	0	0	0.12	12
161	CB-1142	793.56	790.39	Box Structure	3	2.17	1.83	792.26	0	0	1.94	12
162	CB-1140	794.08	791.16	Box Structure	3	2.17	1.83	792.26	0	0	0.13	12
163	CB-1138	794.55	791.8	Box Structure	3	2.17	1.83	792.26	0	0	0	12
164	CB-1136	794.55	792.39	Box Structure	3	2.17	1.83	792.39	0	0	0	0
165	CB-1137	795.19	792.77	Box Structure	3	2.17	1.83	792.77	0	0	0	0
205	CB-1315	812.86	808.78	Circular Structure	4	3	3	814.02	1.16	0	7.26	11.95
215	CB-1145	792.8	790.47	Box Structure	3	2.17	1.83	790.73	0	0	0	0
216	CB-1144	792.8	790.43	Box Structure	3	2.17	1.83	790.43	0	0	0	0
217	CB-1146	792.12	789.87	Box Structure	3	2.17	1.83	789.87	0	0	0	0
218	CB-1148	791.91	788.83	Box Structure	3	2.17	1.83	789.68	0	0	0	11.95
219	CB-1152	792.44	790.02	Box Structure	3	2.17	1.83	790.02	0	0	0	0
220	CB-1153	792.39	790.06	Box Structure	3	2.17	1.83	790.06	0	0	0	0
230	CB-M24	806.04	803.65	Box Structure	3	2.17	1.83	804.24	0	0	1.78	11.95
231	CB-M22	805.73	803.34	Box Structure	3	2.17	1.83	803.86	0	0	1.78	11.95
232	CB-M23	805.98	803.23	Box Structure	3	2.17	1.83	803.82	0	0	0	12
233	CB-M21	805.53	803.03	Box Structure	3	2.17	1.83	803.82	0	0	1.79	12

Catch Basin Table

North System - Existing Conditions - 25-yr, 24 hr

Id	Label	Rim Elevation (ft)	Invert Elevation (ft)	Structure Type	Diameter (ft)	Length (ft)	Width (ft)	Hydraulic Grade (Maximum) (ft)	Maximum Flooding Depth (ft)	Flow (Overflow Maximum) (ft³/s)	Flow (Out to Links Maximum) (ft³/s)	Time to Maximum Hydraulic Grade (hours)
234	CB-M19	805.03	802.83	Box Structure	3	2.17	1.83	803.6	0	0	1.78	12
235	CB-M20	805.25	802.93	Circular Structure	3	3	3	802.93	0	0	0	0
236	CB-M17	804.75	802.93	Box Structure	3	2.17	1.83	802.93	0	0	0	0
237	CB-M18	805.16	802.58	Box Structure	3	2.17	1.83	803.31	0	0	1.78	12
238	CB-EX2	805.04	802.52	Circular Structure	3	3	3	802.81	0	0	0	11.95
239	CB-EX1	804.94	802.41	Box Structure	3	2.17	1.83	802.79	0	0	1.78	12
277	CB-944	819.54	813.58	Circular Structure	4	3	3	814.59	0	0	12.08	11.95
278	CB-945	822.39	809.6	Circular Structure	4	3	3	810.8	0	0	15.81	11.95
296	CB-M13	800.79	796.31	Circular Structure	3	3	3	797.86	0	0	0	11.95
297	CB-M11	799.64	795.77	Circular Structure	3	3	3	797.86	0	0	0	11.95
301	CB-M9	799.21	795.57	Circular Structure	3	3	3	797.86	0	0	0	11.95
314	CB-M3	797.74	794.21	Box Structure	3	2.67	2.17	794.58	0	0	0.55	0.35
316	CB-M1	796.71	793.47	Box Structure	3	2.67	2.17	794.58	0	0	0.18	0.35
318	CB-M25	796.06	792.77	Box Structure	3	2.67	2.17	794.58	0	0	0.09	0.35
320	CB-M26	795.18	792.1	Box Structure	3	2.67	2.17	794.58	0	0	0	0.35
356	CB-1118	794.54	792.54	Circular Structure	3	3	3	793.43	0	0	0	11.95
357	CB-1071	795.13	793.13	Circular Structure	3	3	3	793.43	0	0	1.81	11.95
359	CB-1073	794.1	790.98	Circular Structure	3	3	3	793.42	0	0	1.81	11.95
361	CB-3003	793.22	790.22	Circular Structure	3	3	3	793.41	0.19	0.61	1.5	11.95
363	CB-3002	793.52	790.1	Circular Structure	3	3	3	793.41	0	0	2.17	11.95

Catch Basin Table

South System - Existing Conditions - 25-yr, 24 hr

Id	Label	Rim Elevation (ft)	Invert Elevation (ft)	Structure Type	Diameter (ft)	Length (ft)	Width (ft)	Maximum Hydraulic Grade (ft)	Maximum Flooding Depth (ft)	Overflow Maximum (ft³/s)	Flow Out to Links Maximum (ft³/s)	Time to Maximum Hydraulic Grade (hours)
19	CB-1067	795.87	792.54	Circular Structure	4	3	3	792.54	0	0	0	0
20	CB-1065	796.94	791.32	Box Structure	3	2.17	1.83	791.67	0	0	0.82	11.75
21	CB-1060	794.78	789.99	Circular Structure	4	3	3	790.47	0	0	3.7	11.95
22	CB-1058	784.55	777.84	Circular Structure	4	3	3	781.59	0	0	7.57	11.95
23	CB-1056	782.58	777.04	Circular Structure	4	3	3	780.21	0	0	7.57	11.95
24	CB-1088	795.63	793.55	Box Structure	3	2.17	1.83	793.55	0	0	0	0
34	CB-1184	794.57	789.03	Circular Structure	4	3	3	789.74	0	0	0	0
35	CB-1183	794.62	789.33	Circular Structure	4	3	3	789.35	0	0	0	0
36	CB-1181	789.4	785.44	Circular Structure	4	3	3	785.44	0	0	0	0
37	CB-1180	787.83	784	Box Structure	3	2.17	1.83	784.94	0	0	1.41	11.95
38	CB-996	788.61	783.69	Box Structure	3	2.17	1.83	784.1	0	0	1.41	11.95
39	CB-997	785.53	782.36	Box Structure	3	2.17	1.83	783	0	0	1.41	12
40	CB-998	788.68	782.18	Box Structure	3	2.17	1.83	782.53	0	0	1.41	12
41	CB-1057	784.25	780.29	Circular Structure	4	3	3	781.6	0	0	2.32	11.95

Catch Basin Table

North System - Future Conventional - 25-yr, 24 hr

Id	Label	Rim Elevation (ft)	Invert Elevation (ft)	Drainage Problem # Assigned	Diameter (ft)	Length (ft)	Width (ft)	Hydraulic Grade (Maximum) (ft)	Maximum Flooding Depth (ft)	Flow (Overflow Maximum) (ft³/s)	Flow (Out to Links Maximum) (ft³/s)	Time to Maximum Hydraulic Grade (hours)
19	CB-1164	791.49	787.12	DP14	3	2.17	1.83	791.92	0.43	7.34	8.47	11.95
20	CB-1166	793.98	787.98	DP14	4	3	3	794.18	0.2	1.86	4.73	11.6
21	CB-1170	796.73	793.02	DP14	3	2.17	1.83	796.86	0.13	1.01	6.93	11.7
22	CB-1089	799.21	794.04	DP14	3	2.17	1.83	799.6	0.39	6.02	7.29	11.75
23	CB-994	801.22	797.14	DP14	3	2.17	1.83	801.5	0.28	3.38	8.05	11.95
24	CB-1090	826.41	822.91		3	2.17	1.83	823.57	0	0	6.98	11.95
25	CB-1091	840.15	836.32		3	2.17	1.83	836.88	0	0	6.98	11.95
26	CB-1092	850.25	846.67		3	2.17	1.83	847.04	0	0	3.24	12
27	CB-1093	859.11	853.61		3	2.17	1.83	854.03	0	0	3.24	12
28	CB-1096	862.1	854.23		4	3	3	855.64	0	0	3.24	11.95
29	CB-935	861.55	855.93		4	3	3	856.77	0	0	3.25	11.95
30	CB-1100	858.14	855.64		3	2.17	1.83	856.77	0	0	0	11.95
31	CB-1101	860.03	857.45		3	2.17	1.83	857.45	0	0	0	0
72	CB-993	792.12	786.45		4	3	3	790.92	0	0	10.8	11.95
74	CB-1346	792.04	784.04		4	3	3	790.85	0	0	13.77	11.95
75	CB-1344	792.13	784.13		4	3	3	790.35	0	0	64.77	11.95
78	CB-992	793.18	788.65		3	2.17	1.83	790.93	0	0	3.03	11.95
80	CB-1085	793.1	789.58		3	2.17	1.83	790.93	0	0	1.59	11.95
82	CB-1156	792.15	789.82		3	2.17	1.83	791.1	0	0	1.59	11.95
85	CB-1000	792.09	789.51	2013-2	3	2.17	1.83	792.23	0.14	1.11	1.59	11.95
86	CB-980	796.1	794.18		3	2.67	2.17	794.44	0	0	0.93	23.05
95	CB-931	814.27	807.96	DP11	4	3	3	815.31	1.04	0	3.81	11.95
96	CB-1314	815.22	807.72	DP11	3	2.17	1.83	815.31	0.09	0	3.82	11.95
97	CB-1043	818.44	807.76		4	3	3	815.31	0	0	3.82	11.95
98	CB-1041	818.38	807.36		4	3	3	815.31	0	0	6.24	11.95
100	CB-1309	811.97	806.22	DP10	3	2.17	1.83	812.3	0.33	4.48	3.04	11.95
101	CB-1308	812.1	805.68	DP10	3	2.17	1.83	812.3	0.2	1.94	4.61	11.95
102	CB-1300	811.54	805.96		3	2.17	1.83	811.18	0	0	9.25	11.95
103	CB-1302	810.11	804.94	DP09	4	3	3	810.62	0.51	9.87	19.49	11.9
104	CB-1325	807.9	802.82	DP03	4	3	3	808.02	0.12	0.87	20.93	11.9
105	CB-1328	807.26	800.68		4	3	3	806.23	0	0	21.99	11.85
106	CB-1330	806.52	800.69		3	2.17	1.83	805.85	0	0	21.99	11.85
107	CB-1331	806.63	799.88		3	2.17	1.83	805.28	0	0	22	11.85
109	CB-1331C	801.84	798.08		3	2.17	1.83	800.61	0	0	31.02	11.8
110	CB-M8	799.49	796.84		3	2.17	1.83	798.96	0	0	31.02	11.85
111	CB-M7	799	794.9		3	2.17	1.83	797.64	0	0	32.74	11.85
112	CB-1001	794.71	792.04		3	2.17	1.83	793.74	0	0	32.73	11.85

Catch Basin Table

North System - Future Conventional - 25-yr, 24 hr

Id	Label	Rim Elevation (ft)	Invert Elevation (ft)	Drainage Problem # Assigned	Diameter (ft)	Length (ft)	Width (ft)	Hydraulic Grade (Maximum) (ft)	Maximum Flooding Depth (ft)	Flow (Overflow Maximum) (ft³/s)	Flow (Out to Links Maximum) (ft³/s)	Time to Maximum Hydraulic Grade (hours)
113	CB-970	792.17	788.17		3	2.17	1.83	790.93	0	0	35.8	11.95
114	CB-1331X	804.85	798.85		4	3	3	803.85	0	0	31.05	11.8
142	CB-1340	822.26	820.43		3	2.17	1.83	820.6	0	0	0	11.95
143	CB-1339	822.24	819.91		4	3	3	820.6	0	0	1.43	11.95
144	CB-1338	822.15	819.82		4	3	3	820.15	0	0	1.43	11.95
145	CB-1336	813.71	811.63		4	3	3	812.1	0	0	2.73	11.95
147	CB-1332	805.96	803.79		4	3	3	804.51	0	0	2.72	11.95
148	CB-984	804.37	802.04		3	2.17	1.83	803	0	0	4.01	11.95
149	CB-985	804.41	801.64		3	2.67	2.17	802.29	0	0	5.85	11.95
151	CB-972	793.55	790.3		4	3	3	793.43	0	0	7.8	12
152	CB-1342	790.32	788.45		3	2.17	1.83	788.83	0	0	7.8	11.95
153	CB-1	821.66	817.57		3	2.17	1.83	817.91	0	0	1.43	11.95
154	CB-4	816.81	812.38		3	2.17	1.83	812.73	0	0	1.43	11.95
155	CB-8	813.15	810.35		4	3	3	810.75	0	0	2.73	11.95
156	CB-11	805.48	802.78		4	3	3	803.4	0	0	2.72	11.95
157	CB-15	794.49	791.23		4	3	3	794.48	0	0.01	5.86	12
158	CB-16	794.03	791.15	2013-3	4	3	3	794.11	0.08	0.45	5.54	12
160	CB-1143	793.57	791.15		3	2.17	1.83	793.44	0	0	0	12
161	CB-1142	793.56	790.39		3	2.17	1.83	793.44	0	0	2.37	12
162	CB-1140	794.08	791.16		3	2.17	1.83	793.44	0	0	0.34	12
163	CB-1138	794.55	791.8		3	2.17	1.83	793.44	0	0	0.03	12
164	CB-1136	794.55	792.39		3	2.17	1.83	793.44	0	0	0	12
165	CB-1137	795.19	792.77		3	2.17	1.83	793.44	0	0	0	12
205	CB-1315	812.86	808.78	DP10	4	3	3	815.31	2.45	0	3.33	11.95
215	CB-1145	792.8	790.47		3	2.17	1.83	790.93	0	0	0	11.95
216	CB-1144	792.8	790.43		3	2.17	1.83	790.93	0	0	0	11.95
217	CB-1146	792.12	789.87		3	2.17	1.83	790.93	0	0	0	11.95
218	CB-1148	791.91	788.83		3	2.17	1.83	790.93	0	0	0	11.95
219	CB-1152	792.44	790.02		3	2.17	1.83	790.93	0	0	0	11.95
220	CB-1153	792.39	790.06		3	2.17	1.83	790.93	0	0	0	11.95
230	CB-M24	806.04	803.65		3	2.17	1.83	804.26	0	0	1.88	11.95
231	CB-M22	805.73	803.34		3	2.17	1.83	803.87	0	0	1.88	11.95
232	CB-M23	805.98	803.23		3	2.17	1.83	803.85	0	0	0	12
233	CB-M21	805.53	803.03		3	2.17	1.83	803.85	0	0	1.88	12
234	CB-M19	805.03	802.83		3	2.17	1.83	803.63	0	0	1.88	12
235	CB-M20	805.25	802.93		3	3	3	803	0	0	0	11.95
236	CB-M17	804.75	802.93		3	2.17	1.83	803	0	0	0	11.95

Catch Basin Table

North System - Future Conventional - 25-yr, 24 hr

Id	Label	Rim Elevation (ft)	Invert Elevation (ft)	Drainage Problem # Assigned	Diameter (ft)	Length (ft)	Width (ft)	Hydraulic Grade (Maximum) (ft)	Maximum Flooding Depth (ft)	Flow (Overflow Maximum) (ft³/s)	Flow (Out to Links Maximum) (ft³/s)	Time to Maximum Hydraulic Grade (hours)
237	CB-M18	805.16	802.58		3	2.17	1.83	803.34	0	0	1.87	12
238	CB-EX2	805.04	802.52		3	3	3	803	0	0	0	11.95
239	CB-EX1	804.94	802.41		3	2.17	1.83	802.8	0	0	1.87	12
277	CB-944	819.54	813.58		4	3	3	814.61	0	0	12.37	11.85
278	CB-945	822.39	809.6		4	3	3	810.86	0	0	17.2	11.85
296	CB-M13	800.79	796.31		3	3	3	797.94	0	0	0	11.8
297	CB-M11	799.64	795.77		3	3	3	797.94	0	0	0	11.8
301	CB-M9	799.21	795.57		3	3	3	797.94	0	0	0	11.8
314	CB-M3	797.74	794.21		3	2.67	2.17	794.53	0	0	0.58	11.95
316	CB-M1	796.71	793.47		3	2.67	2.17	794.53	0	0	0.12	11.95
318	CB-M25	796.06	792.77		3	2.67	2.17	794.53	0	0	0.03	11.95
320	CB-M26	795.18	792.1		3	2.67	2.17	794.53	0	0	0	11.95
356	CB-1118	794.54	792.54		3	3	3	793.66	0	0	0	11.75
357	CB-1071	795.13	793.13		3	3	3	793.66	0	0	2.42	11.75
359	CB-1073	794.1	790.98		3	3	3	793.65	0	0	2.42	11.75
361	CB-3003	793.22	790.22	2013-4	3	3	3	793.47	0.25	1.4	1.41	11.8
363	CB-3002	793.52	790.1		3	3	3	793.47	0	0	2.12	11.8

Catch Basin Table

South System - Future Conventional - 25-yr, 24 hr

Id	Label	Rim Elevation (ft)	Invert Elevation (ft)	Structure Type	Diameter (ft)	Length (ft)	Width (ft)	Maximum Hydraulic Grade (ft)	Maximum Flooding Depth (ft)	Overflow Maximum (ft³/s)	Flow Out to Links Maximum (ft³/s)	Time to Maximum Hydraulic Grade (hours)
19	CB-1067	795.87	792.54		4	3	3	792.54	0	0	0	0
20	CB-1065	796.94	791.32		3	2.17	1.83	791.73	0	0	1.09	11.75
21	CB-1060	794.78	789.99		4	3	3	790.62	0	0	4.65	11.85
22	CB-1058	784.55	777.84	2013-1	4	3	3	784.57	0.02	0.06	9.68	11.95
23	CB-1056	782.58	777.04		4	3	3	782.29	0	0	9.64	11.95
24	CB-1088	795.63	793.55		3	2.17	1.83	793.55	0	0	0	0
34	CB-1184	794.57	789.03		4	3	3	789.74	0	0	0	0
35	CB-1183	794.62	789.33		4	3	3	789.35	0	0	0	0
36	CB-1181	789.4	785.44		4	3	3	785.44	0	0	0	0
37	CB-1180	787.83	784		3	2.17	1.83	784.59	0	0	0.03	11.95
38	CB-996	788.61	783.69		3	2.17	1.83	784.59	0	0	0.02	11.95
39	CB-997	785.53	782.36		3	2.17	1.83	784.59	0	0	0.02	11.95
40	CB-998	788.68	782.18		3	2.17	1.83	784.58	0	0	0.02	11.95
41	CB-1057	784.25	780.29	20-13-1	4	3	3	784.58	0.33	0	2.9	11.95

Catch Basin Table

North System - Future Conditions - LID - 25-yr, 24 hr

Id	Label	Rim Elevation (ft)	Invert Elevation (ft)	Structure Type	Diameter (ft)	Length (ft)	Width (ft)	Hydraulic Grade (Maximum) (ft)	Maximum Flooding Depth (ft)	Flow (Out to Links Maximum) (ft³/s)	Flow (Overflow Maximum) (ft³/s)	Time to Maximum Hydraulic Grade (hours)
19	CB-1164	791.49	787.12	Box Structure	3	2.17	1.83	791.81	0.32	8.54	4.34	11.95
20	CB-1166	793.98	787.98	Circular Structure	4	3	3	794.06	0.08	4.24	0.46	11.95
21	CB-1170	796.73	793.02	Box Structure	3	2.17	1.83	796.83	0.1	4.64	0.7	11.95
22	CB-1089	799.21	794.04	Box Structure	3	2.17	1.83	799.19	0	5.31	0	11.95
23	CB-994	801.22	797.14	Box Structure	3	2.17	1.83	799.99	0	4.37	0	11.95
24	CB-1090	826.41	822.91	Box Structure	3	2.17	1.83	823.38	0	3.2	0	11.95
25	CB-1091	840.15	836.32	Box Structure	3	2.17	1.83	836.68	0	3.2	0	11.95
26	CB-1092	850.25	846.67	Box Structure	3	2.17	1.83	846.98	0	2.27	0	12
27	CB-1093	859.11	853.61	Box Structure	3	2.17	1.83	853.96	0	2.27	0	11.95
28	CB-1096	862.1	854.23	Circular Structure	4	3	3	855.45	0	2.27	0	11.95
29	CB-935	861.55	855.93	Circular Structure	4	3	3	856.51	0	2.28	0	11.95
30	CB-1100	858.14	855.64	Box Structure	3	2.17	1.83	856.51	0	0	0	11.95
31	CB-1101	860.03	857.45	Box Structure	3	2.17	1.83	857.45	0	0	0	0
72	CB-993	792.12	786.45	Circular Structure	4	3	3	788.53	0	11.22	0	12
74	CB-1346	792.04	784.04	Circular Structure	4	3	3	788.44	0	13.12	0	12
75	CB-1344	792.13	784.13	Circular Structure	4	3	3	787.93	0	54.22	0	11.95
78	CB-992	793.18	788.65	Box Structure	3	2.17	1.83	789.25	0	2.88	0	11.95
80	CB-1085	793.1	789.58	Box Structure	3	2.17	1.83	790.08	0	1.59	0	11.85
82	CB-1156	792.15	789.82	Box Structure	3	2.17	1.83	791.1	0	1.59	0	11.95
85	CB-1000	792.09	789.51	Box Structure	3	2.17	1.83	792.22	0.13	1.59	1.04	11.95
86	CB-980	796.1	794.18	Box Structure	3	2.67	2.17	794.38	0	0.52	0	11.35
95	CB-931	814.27	807.96	Circular Structure	4	3	3	814.23	0	3.22	0	11.95
96	CB-1314	815.22	807.72	Box Structure	3	2.17	1.83	814.23	0	3.23	0	11.95
97	CB-1043	818.44	807.76	Circular Structure	4	3	3	814.23	0	3.24	0	11.95
98	CB-1041	818.38	807.36	Circular Structure	4	3	3	814.23	0	5.23	0	11.95
100	CB-1309	811.97	806.22	Box Structure	3	2.17	1.83	812.17	0.2	2.81	2	11.95
101	CB-1308	812.1	805.68	Box Structure	3	2.17	1.83	812.17	0.07	3.85	0.36	11.95
102	CB-1300	811.54	805.96	Box Structure	3	2.17	1.83	811.11	0	9.18	0	11.95
103	CB-1302	810.11	804.94	Circular Structure	4	3	3	810.59	0.48	19.7	9.27	11.95
104	CB-1325	807.9	802.82	Circular Structure	4	3	3	807.77	0	20.91	0	11.9
105	CB-1328	807.26	800.68	Circular Structure	4	3	3	805.88	0	21.81	0	11.9
106	CB-1330	806.52	800.69	Box Structure	3	2.17	1.83	805.51	0	21.81	0	11.85
107	CB-1331	806.63	799.88	Box Structure	3	2.17	1.83	804.93	0	21.81	0	11.85
109	CB-1331C	801.84	798.08	Box Structure	3	2.17	1.83	800.49	0	29.04	0	11.8
110	CB-M8	799.49	796.84	Box Structure	3	2.17	1.83	798.73	0	29.03	0	11.85
111	CB-M7	799	794.9	Box Structure	3	2.17	1.83	797.58	0	30.4	0	11.8
112	CB-1001	794.71	792.04	Box Structure	3	2.17	1.83	793.61	0	30.4	0	11.8

Catch Basin Table

North System - Future Conditions - LID - 25-yr, 24 hr

Id	Label	Rim Elevation (ft)	Invert Elevation (ft)	Structure Type	Diameter (ft)	Length (ft)	Width (ft)	Hydraulic Grade (Maximum) (ft)	Maximum Flooding Depth (ft)	Flow (Out to Links Maximum) (ft³/s)	Flow (Overflow Maximum) (ft³/s)	Time to Maximum Hydraulic Grade (hours)
113	CB-970	792.17	788.17	Box Structure	3	2.17	1.83	789.62	0	32.84	0	11.95
114	CB-1331X	804.85	798.85	Circular Structure	4	3	3	803.49	0	29.04	0	11.85
142	CB-1340	822.26	820.43	Box Structure	3	2.17	1.83	820.43	0	0	0	11.95
143	CB-1339	822.24	819.91	Circular Structure	4	3	3	820.43	0	0.72	0	11.95
144	CB-1338	822.15	819.82	Circular Structure	4	3	3	820.05	0	0.72	0	11.95
145	CB-1336	813.71	811.63	Circular Structure	4	3	3	811.98	0	1.62	0	11.95
147	CB-1332	805.96	803.79	Circular Structure	4	3	3	804.3	0	1.62	0	11.95
148	CB-984	804.37	802.04	Box Structure	3	2.17	1.83	802.7	0	2.52	0	11.95
149	CB-985	804.41	801.64	Box Structure	3	2.67	2.17	802.15	0	3.99	0	11.95
151	CB-972	793.55	790.3	Circular Structure	4	3	3	791.21	0	5.65	0	12
152	CB-1342	790.32	788.45	Box Structure	3	2.17	1.83	788.77	0	5.65	0	11.95
153	CB-1	821.66	817.57	Box Structure	3	2.17	1.83	817.81	0	0.72	0	11.95
154	CB-4	816.81	812.38	Box Structure	3	2.17	1.83	812.63	0	0.71	0	11.95
155	CB-8	813.15	810.35	Circular Structure	4	3	3	810.66	0	1.62	0	11.95
156	CB-11	805.48	802.78	Circular Structure	4	3	3	803.23	0	1.62	0	11.95
157	CB-15	794.49	791.23	Circular Structure	4	3	3	792.3	0	3.99	0	12
158	CB-16	794.03	791.15	Circular Structure	4	3	3	791.81	0	3.99	0	11.95
160	CB-1143	793.57	791.15	Box Structure	3	2.17	1.83	791.22	0	0	0	12
161	CB-1142	793.56	790.39	Box Structure	3	2.17	1.83	791.22	0	1.65	0	12
162	CB-1140	794.08	791.16	Box Structure	3	2.17	1.83	791.22	0	0	0	12
163	CB-1138	794.55	791.8	Box Structure	3	2.17	1.83	791.8	0	0	0	0
164	CB-1136	794.55	792.39	Box Structure	3	2.17	1.83	792.39	0	0	0	0
165	CB-1137	795.19	792.77	Box Structure	3	2.17	1.83	792.77	0	0	0	0
205	CB-1315	812.86	808.78	Circular Structure	4	3	3	814.23	1.37	2.64	0	11.95
215	CB-1145	792.8	790.47	Box Structure	3	2.17	1.83	790.73	0	0	0	0
216	CB-1144	792.8	790.43	Box Structure	3	2.17	1.83	790.43	0	0	0	0
217	CB-1146	792.12	789.87	Box Structure	3	2.17	1.83	789.87	0	0	0	0
218	CB-1148	791.91	788.83	Box Structure	3	2.17	1.83	789.66	0	0	0	11.9
219	CB-1152	792.44	790.02	Box Structure	3	2.17	1.83	790.02	0	0	0	0
220	CB-1153	792.39	790.06	Box Structure	3	2.17	1.83	790.06	0	0	0	0
230	CB-M24	806.04	803.65	Box Structure	3	2.17	1.83	804.18	0	1.5	0	11.95
231	CB-M22	805.73	803.34	Box Structure	3	2.17	1.83	803.81	0	1.5	0	11.95
232	CB-M23	805.98	803.23	Box Structure	3	2.17	1.83	803.73	0	0	0	12
233	CB-M21	805.53	803.03	Box Structure	3	2.17	1.83	803.73	0	1.5	0	12
234	CB-M19	805.03	802.83	Box Structure	3	2.17	1.83	803.52	0	1.5	0	12
235	CB-M20	805.25	802.93	Circular Structure	3	3	3	802.93	0	0	0	0
236	CB-M17	804.75	802.93	Box Structure	3	2.17	1.83	802.93	0	0	0	0

Catch Basin Table

North System - Future Conditions - LID - 25-yr, 24 hr

Id	Label	Rim Elevation (ft)	Invert Elevation (ft)	Structure Type	Diameter (ft)	Length (ft)	Width (ft)	Hydraulic Grade (Maximum) (ft)	Maximum Flooding Depth (ft)	Flow (Out to Links Maximum) (ft³/s)	Flow (Overflow Maximum) (ft³/s)	Time to Maximum Hydraulic Grade (hours)
237	CB-M18	805.16	802.58	Box Structure	3	2.17	1.83	803.24	0	1.5	0	12
238	CB-EX2	805.04	802.52	Circular Structure	3	3	3	802.72	0	0	0	11.95
239	CB-EX1	804.94	802.41	Box Structure	3	2.17	1.83	802.75	0	1.49	0	12
277	CB-944	819.54	813.58	Circular Structure	4	3	3	814.61	0	12.38	0	11.85
278	CB-945	822.39	809.6	Circular Structure	4	3	3	810.86	0	17.2	0	11.85
296	CB-M13	800.79	796.31	Circular Structure	3	3	3	797.85	0	0	0	11.85
297	CB-M11	799.64	795.77	Circular Structure	3	3	3	797.85	0	0	0	11.85
301	CB-M9	799.21	795.57	Circular Structure	3	3	3	797.85	0	0	0	11.85
314	CB-M3	797.74	794.21	Box Structure	3	2.67	2.17	794.51	0	0.52	0	11.95
316	CB-M1	796.71	793.47	Box Structure	3	2.67	2.17	794.51	0	0.13	0	11.95
318	CB-M25	796.06	792.77	Box Structure	3	2.67	2.17	794.51	0	0.07	0	11.95
320	CB-M26	795.18	792.1	Box Structure	3	2.67	2.17	794.51	0	0	0	11.95
356	CB-1118	794.54	792.54	Circular Structure	3	3	3	793.43	0	0	0	11.8
357	CB-1071	795.13	793.13	Circular Structure	3	3	3	793.43	0	1.7	0	11.8
359	CB-1073	794.1	790.98	Circular Structure	3	3	3	793.42	0	1.69	0	11.8
361	CB-3003	793.22	790.22	Circular Structure	3	3	3	793.41	0.19	1.21	0.64	11.8
363	CB-3002	793.52	790.1	Circular Structure	3	3	3	793.41	0	2.08	0	11.8

Catch Basin Table

South System - Future Conditions - LID - 25-yr, 24 hr

Id	Label	Rim Elevation (ft)	Invert Elevation (ft)	Structure Type	Diameter (ft)	Length (ft)	Width (ft)	Hydraulic Grade (Maximum) (ft)	Maximum Flooding Depth (ft)	Flow (Overflow Maximum) (ft³/s)	Flow (Out to Links Maximum) (ft³/s)	Time to Maximum Hydraulic Grade (hours)
19	CB-1067	795.87	792.54	Circular Structure	4	3	3	792.54	0	0	0	0
20	CB-1065	796.94	791.32	Box Structure	3	2.17	1.83	791.73	0	0	1.09	11.75
21	CB-1060	794.78	789.99	Circular Structure	4	3	3	790.59	0	0	4.65	11.95
22	CB-1058	784.55	777.84	Circular Structure	4	3	3	783.79	0	0	9.15	11.95
23	CB-1056	782.58	777.04	Circular Structure	4	3	3	781.74	0	0	9.14	11.95
24	CB-1088	795.63	793.55	Box Structure	3	2.17	1.83	793.55	0	0	0	0
34	CB-1184	794.57	789.03	Circular Structure	4	3	3	789.74	0	0	0	0
35	CB-1183	794.62	789.33	Circular Structure	4	3	3	789.35	0	0	0	0
36	CB-1181	789.4	785.44	Circular Structure	4	3	3	785.44	0	0	0	0
37	CB-1180	787.83	784	Box Structure	3	2.17	1.83	784.57	0	0	0.03	0.15
38	CB-996	788.61	783.69	Box Structure	3	2.17	1.83	783.8	0	0	0.02	11.95
39	CB-997	785.53	782.36	Box Structure	3	2.17	1.83	783.8	0	0	0.02	11.95
40	CB-998	788.68	782.18	Box Structure	3	2.17	1.83	783.8	0	0	0.02	11.95
41	CB-1057	784.25	780.29	Circular Structure	4	3	3	783.8	0	0	2.33	11.95

Channel Cross Sections

North System - Existing Conditions - 25-yr, 24 hr

Id	Label	Section Type	Invert Elevation (ft)	Bottom Width (ft)	Height (ft)	Left Side Slope (H:V)	Right Side Slope (H:V)	Material	Manning's n	Hydraulic Grade (Maximum) (ft)	Overtopping Depth (ft)	Time to Maximum Hydraulic Grade (hours)
342	CS-E1	Trapezoidal Cross Section	814.9	4	3.5	1.5	1.5	Natural stream, weedy	0.045	816.84	0	11.95
345	CS-E2	Trapezoidal Cross Section	817.3	4	3.5	1.5	1.5	Natural stream, weedy	0.045	817.91	0	11.95
372	CS-5	Irregular Channel	781.45	0	6.1			Natural stream, weedy	0.045	784.93	0	12.2
374	CS-6	Trapezoidal Cross Section	778.11	4	10	3	3	Natural stream, weedy	0.045	784.74	0	12.2
376	CS-7	Trapezoidal Cross Section	777.45	4	11	3	3	Natural stream, weedy	0.045	780.87	0	12.2
378	CS-8	Trapezoidal Cross Section	777.26	4	11	3	3	Natural stream, weedy	0.045	780.79	0	12.2
413	CS-11	Irregular Channel	778.34	0	6.09			Natural stream, weedy	0.045	784.82	0.39	12.2

Channel Lengths

North System - Existing Conditions - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Start) (ft)	Stop-node Id	Invert (Stop) (ft)	Length (ft)	Constructed Slope (ft/ft)	Flow (Maximum) (ft³/s)	Velocity (Maximum) (ft/s)	Hydraulic Grade (Maximum) (ft)	Time to Maximum Hydraulic Grade (hours)
379	CH-6	CS-7	777.45	CS-8	777.26	18	0.01	53.83	1.08	780.83	12.2
407	E1-E2	CS-E2	817.3	CS-E1	814.9	81	0.03	10.16	2.51	816.88	11.95
414	CH-9	CS-5	781.45	CS-11	778.34	296	0.01	56.26	0.82	784.89	12.2
415	CH-10	CS-11	778.34	CS-6	778.11	32	0.007	50.68	0.3	784.78	12.2

Channel Cross Sections Table

North System - Future Conventional - 25-yr, 24 hr

Id	Label	Section Type	Invert Elevation (ft)	Bottom Width (ft)	Height (ft)	Left Side Slope (H:V)	Right Side Slope (H:V)	Material	Manning's n	Hydraulic Grade (Maximum) (ft)	Overtopping Depth (ft)	Time to Maximum Hydraulic Grade (hours)
342	CS-E1	Trapezoidal Cross Section	814.9	4	3.5	1.5	1.5	None	0.013	816.84	0	11.9
345	CS-E2	Trapezoidal Cross Section	817.3	4	3.5	1.5	1.5	Natural stream, weedy	0.045	817.91	0	11.85
372	CS-5	Irregular Channel	781.45	0	6.1	-	-	Natural stream, weedy	0.045	785.7	0	12.15
374	CS-6	Trapezoidal Cross Section	776.5	4	10	3	3	Natural stream, weedy	0.045	785.52	0	12.15
376	CS-7	Trapezoidal Cross Section	775.84	4	11	3	3	Natural stream, weedy	0.045	781.46	0	12.15
378	CS-8	Trapezoidal Cross Section	775.65	4	11	3	3	Natural stream, weedy	0.045	781.38	0	12.15
411	CS-11	Irregular Channel	778.34	0	6.09	-	-	Natural stream, weedy	0.045	785.6	1.17	12.15

Channels Lengths Table

North System - Future Conventional - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Start) (ft)	Stop-node Id	Invert (Stop) (ft)	Length (ft)	Constructed Slope (ft/ft)	Flow (Maximum) (ft^3/s)	Velocity (Maximum) (ft/s)	Hydraulic Grade (Maximum) (ft)	Time to Maximum Hydraulic Grade (hours)
379	CH-6	CS-7	777.45	CS-8	777.26	18	0.01	65.21	0.99	781.42	12.15
407	E1-E2	CS-E2	817.3	CS-E1	814.9	81	0.03	10.16	2.51	816.88	11.85
412	CH-9	CS-5	781.45	CS-11	778.34	296	0.01	66.25	0.59	785.66	12.15
413	CH-10	CS-11	778.34	CS-6	778.11	32	0.007	60.41	0.28	785.56	12.15

Channel Cross Sections Table

North System - Future Conditions - LID - 25-yr, 24 hr

Id	Label	Section Type	Invert Elevation (ft)	Bottom Width (ft)	Height (ft)	Left Side Slope (H:V)	Right Side Slope (H:V)	Material	Manning's n	Hydraulic Grade (Maximum) (ft)	Overtopping Depth (ft)	Time to Maximum Hydraulic Grade (hours)
342	CS-E1	Trapezoidal Cross Section	814.9	4	3.5	1.5	1.5	None	0.013	816.84	0	11.9
345	CS-E2	Trapezoidal Cross Section	817.3	4	3.5	1.5	1.5	Natural stream, weedy	0.045	817.91	0	11.8
372	CS-5	Irregular Channel	781.45	0	6.1	0	0	Natural stream, weedy	0.045	784.9	0	12.15
374	CS-6	Trapezoidal Cross Section	776.5	4	10	3	3	Natural stream, weedy	0.045	784.72	0	12.15
376	CS-7	Trapezoidal Cross Section	775.84	4	11	3	3	Natural stream, weedy	0.045	780.95	0	12.15
378	CS-8	Trapezoidal Cross Section	775.65	4	11	3	3	Natural stream, weedy	0.045	780.87	0	12.15
411	CS-11	Irregular Channel	778.34	0	6.09	0	0	Natural stream, weedy	0.045	784.8	0.37	12.15

Channel Lengths Table

North System - Future Conditions - LID - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Start) (ft)	Stop-node Id	Invert (Stop) (ft)	Length (ft)	Constructed Slope (ft/ft)	Flow (Maximum) (ft^3/s)	Velocity (Maximum) (ft/s)	Hydraulic Grade (Maximum) (ft)	Time to Maximum Hydraulic Grade (hours)
379	CH-6	CS-7	777.45	CS-8	777.26	18	0.01	55.38	1.06	780.91	12.15
407	E1-E2	CS-E2	817.3	CS-E1	814.9	81	0.03	10.16	2.51	816.88	11.9
412	CH-9	CS-5	781.45	CS-11	778.34	296	0.01	55.3	0.77	784.86	12.15
413	CH-10	CS-11	778.34	CS-6	778.11	32	0.007	51.13	0.3	784.76	12.15

Pipe Table

North System - Existing Conditions - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Upstream) (ft)	Stop-node Id	Invert (Downstream) (ft)	Length (ft)	Constructed Slope (ft/ft)	Diameter (in)	Material	Manning's n	Full Capacity (ft³/s)	Flow (Maximum) (ft³/s)	Flow / Full Flow Capacity (%)	Velocity (Maximum) (ft/s)	Time to Maximum Flow (hours)
33	1100-1101	CB-1101	857.45	CB-1100	855.64	40	0.045	12	PVC	0.01	9.83	0	0.0	0	0
34	935-1100	CB-1100	855.64	CB-935	856.09	114	-0.004	12	PVC	0.01	2.91	0.02	0.7	0.04	12.05
35	1096-935	CB-935	855.93	CB-1096	854.23	256	0.007	12	PVC	0.01	3.77	2.64	70.0	4.64	11.95
36	1093-1096	CB-1096	854.85	CB-1093	853.61	219	0.006	12	PVC	0.01	3.49	2.64	75.6	4.81	12
37	1092-1093	CB-1093	853.61	CB-1092	846.67	177	0.039	12	PVC	0.01	9.17	2.64	28.8	10.03	12
38	1091-1092	CB-1092	846.67	CB-1091	836.48	174	0.059	12	PVC	0.01	11.21	2.64	23.6	11.58	12
39	1090-1091	CB-1091	836.32	CB-1090	822.91	212	0.063	12	PVC	0.01	11.65	4.93	42.3	14.24	11.95
40	994-1090	CB-1090	823.04	CB-994	797.3	338	0.076	12	PVC	0.01	12.78	4.93	38.6	15.02	11.95
41	1089-994	CB-994	797.14	CB-1089	794.09	103	0.03	12	PVC	0.01	7.96	6.76	84.9	8.61	11.8
42	1170-1089	CB-1089	794.04	CB-1170	793.04	185	0.005	12	PVC	0.01	3.41	5.99	175.7	7.63	11.7
43	1166-1170	CB-1170	793.02	CB-1166	788.02	283	0.018	12	PVC	0.01	6.16	5.98	97.1	7.61	11.7
44	1164-1166	CB-1166	787.98	CB-1164	787.16	281	0.003	12	PVC	0.01	2.5	5.5	220.0	7	11.7
73	993-1164	CB-1164	787.18	CB-993	786.62	117	0.005	12	PVC	0.01	3.2	8.47	264.7	10.78	11.7
76	1346-993	CB-993	786.95	CB-1346	784.04	402	0.007	36	Concrete	0.013	56.73	13.18	23.2	2.05	12.1
79	993-992	CB-992	788.65	CB-993	786.45	140	0.016	12	Concrete	0.013	4.46	3.77	84.5	4.81	11.95
81	992-1085	CB-1085	789.66	CB-992	788.65	64	0.016	12	Concrete	0.013	4.47	1.59	35.6	5.11	11.95
83	1085-1156	CB-1156	789.82	CB-1085	789.58	46	0.005	8	Concrete	0.013	0.87	1.59	182.8	4.55	11.95
91	1000-980	CB-980	794.18	CB-1000	789.76	119	0.037	12	Concrete	0.013	6.87	0.55	8.0	3.41	11.9
92	1156-1000	CB-1000	789.51	CB-1156	789.82	112	-0.003	8	PVC	0.01	0.83	1.59	191.6	4.55	11.95
116	Tee-1346	CB-1346	784.04	Tee Conne	784.04	39	0	36	Concrete	0.013	0	13.85	∞	1.96	12.15
117	1344-Tee	Tee Conne	784.04	CB-1344	784.13	226	0	36	Concrete	0.013	13.32	45.55	342.0	6.44	12.05
118	Tee-970	CB-970	788.17	Tee Conne	784.04	142	0.029	24	Concrete	0.013	38.62	33.53	86.8	10.67	11.95
119	970-1001	CB-970	788.17	CB-1001	792.04	188	0.021	24	Concrete	0.013	32.49	30.64	94.3	11.75	11.95
120	1001-M7	CB-1001	792.04	CB-M7	796.34	130	0.033	24	Ductile Iro	0.012	44.61	30.64	68.7	15.29	11.95
121	M7-M8	CB-M7	796.34	CB-M8	796.84	46	0.011	24	Ductile Iro	0.012	25.59	29.11	113.8	9.67	11.95
122	M8-1331C	CB-M8	796.84	CB-1331C	798.92	129	-0.007	24	Ductile Iro	0.012	31.17	29.11	93.4	11.27	11.95
123	1331C-133	CB-1331C	798.92	CB-1331X	798.85	153	0	24	Concrete	0.013	4.85	29.11	600.2	9.27	11.95
126	1331-1330	CB-1331	799.88	CB-1330	800.69	94	0.009	24	Concrete	0.013	21.02	21.96	104.5	6.99	12
127	1330-1328	CB-1330	800.69	CB-1328	800.93	70	-0.003	24	Concrete	0.013	13.29	21.96	165.2	6.99	12
128	1328-1325	CB-1328	800.68	CB-1325	803.03	255	0.009	24	Concrete	0.013	21.7	20.92	96.4	6.66	12.1
129	1325-1302	CB-1325	802.82	CB-1302	804.94	461	0.005	24	Concrete	0.013	15.34	19.54	127.4	6.22	12.15
130	1302-1300	CB-1302	805.49	CB-1300	805.96	54	0.009	12	Concrete	0.013	3.32	8.79	264.8	11.19	11.95
131	1300-1308	CB-1300	805.96	CB-1308	805.68	127	-0.002	12	Concrete	0.013	1.67	4.63	277.2	5.89	11.65
132	1308-1309	CB-1308	805.85	CB-1309	806.22	36	0.01	12	Concrete	0.013	3.63	3.17	87.3	4.04	12.4
133	1309-1041	CB-1309	806.22	CB-1041	807.88	640	-0.001	12	Concrete	0.013	1.81	3.01	166.3	3.84	12.4
139	1041-1043	CB-1041	807.36	CB-1043	807.81	45	-0.001	12	PVC	0.01	4.65	5.05	108.6	6.43	12.4
140	1043-1314	CB-1043	807.81	CB-1314	807.72	302	0	12	PVC	0.01	0.8	7.77	971.3	9.89	12.45
141	1314-931	CB-1314	807.89	CB-931	808.21	58	0.006	12	Concrete	0.013	2.65	7.31	275.8	9.31	12.45
166	1342-972	CB-1342	788.45	CB-972	790.3	134	0.014	12	PVC	0.01	5.44	6.7	123.2	8.53	12

Pipe Table

North System - Existing Conditions - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Upstream) (ft)	Stop-node Id	Invert (Downstream) (ft)	Length (ft)	Constructed Slope (ft/ft)	Diameter (in)	Material	Manning's n	Full Capacity (ft³/s)	Flow (Maximum) (ft³/s)	Flow / Full Flow Capacity (%)	Velocity (Maximum) (ft/s)	Time to Maximum Flow (hours)
167	972-1142	CB-972	790.3	CB-1142	790.39	25	0.004	12	PVC	0.01	2.8	1.87	66.8	2.38	12
168	1142-1143	CB-1142	790.81	CB-1143	791.15	42	0.008	12	PVC	0.01	4.17	0.12	2.9	0.15	12
169	1143-16	CB-16	791.15	CB-1143	791.15	24	0	12	PVC	0.01	0	0.12	∞	0.15	12
170	16-15	CB-16	791.15	CB-15	791.23	21	0.004	12	Ductile Iro	0.012	2.4	4.87	202.9	6.2	12
171	15-985	CB-15	791.23	CB-985	801.64	246	0.042	12	Ductile Iro	0.012	7.94	4.88	61.5	10.6	11.95
172	985-984	CB-984	802.04	CB-985	801.64	38	0.011	12	Concrete	0.013	3.67	3.13	85.3	5.19	11.95
173	984-11	CB-984	802.29	CB-11	802.78	36	0.013	12	Concrete	0.013	4.13	2.19	53.0	5.28	11.95
174	11-1332	CB-11	802.78	CB-1332	803.79	122	0.008	12	Concrete	0.013	3.25	2.19	67.4	4.38	11.95
175	1332-8	CB-1332	803.79	CB-8	810.35	118	0.056	12	Concrete (	0.013	8.41	2.19	26.0	8.93	11.95
176	8-1336	CB-8	810.35	CB-1336	811.63	42	0.031	12	Ductile Iro	0.012	6.75	2.19	32.4	7.58	11.95
177	1336-4	CB-1336	811.63	CB-4	812.38	29	0.026	12	Concrete	0.013	5.75	1.05	18.3	5.44	11.95
178	1-4	CB-4	812.38	CB-1	817.57	185	0.028	12	Concrete	0.013	5.96	1.05	17.6	5.59	11.95
179	1-1338	CB-1	817.57	CB-1338	819.82	69	0.033	12	Concrete	0.013	6.46	1.06	16.4	5.92	11.95
180	1338-1339	CB-1339	820.07	CB-1338	819.82	43	0.006	12	Concrete	0.013	2.72	1.06	39.0	3.18	11.95
181	1339-1340	CB-1340	820.43	CB-1339	819.91	36	0.015	8	Concrete	0.013	1.46	0	0.0	0	0
184	1142-1140	CB-1140	791.16	CB-1142	790.48	122	0.006	12	PVC	0.01	3.46	0.28	8.1	0.42	12.1
185	1140-1138	CB-1138	791.8	CB-1140	791.16	157	0.004	12	PVC	0.01	2.96	0.04	1.4	0.07	12.05
186	1138-1136	CB-1138	791.8	CB-1136	792.39	147	0.004	12	PVC	0.01	2.94	0	0.0	0	0
187	1136-1137	CB-1137	792.77	CB-1136	792.47	42	0.007	8	PVC	0.01	1.33	0	0.0	0	0
204	1331X-133	CB-1331	799.88	CB-1331X	798.85	187	0.006	24	Concrete	0.013	16.79	21.97	130.9	6.99	12
206	931-1315	CB-931	808.13	CB-1315	808.78	38	0.017	12	Concrete	0.013	4.68	7.04	150.4	8.97	12.45
221	1144-1145	CB-1145	790.73	CB-1144	790.43	43	0.007	8	PVC	0.01	1.31	0	0.0	0	0
222	1146-1144	CB-1144	790.43	CB-1146	789.87	132	0.004	12	PVC	0.01	3.02	0	0.0	0	0
223	CO-81	CB-1146	789.87	CB-1148	788.83	108	0.01	12	PVC	0.01	4.54	0	0.0	0	0
224	CO-82	CB-1148	788.83	CB-970	788.17	86	0.008	12	PVC	0.01	4.06	0	0.0	0	0
225	CO-83	CB-970	788.17	CB-1152	790.02	163	0.011	12	PVC	0.01	4.94	0	0.0	0	0
226	CO-84	CB-1152	790.02	CB-1153	790.06	48	0.001	12	PVC	0.01	1.33	0	0.0	0	0
240	M22-M24	CB-M24	803.65	CB-M22	803.34	62	0.005	12	Ductile Iro	0.012	2.73	1.78	65.2	3.72	11.95
241	M21-M22	CB-M22	803.34	CB-M21	803.03	37	0.008	12	Ductile Iro	0.012	3.54	1.78	50.3	3.4	11.95
242	M21-M23	CB-M23	803.23	CB-M21	803.03	100	0.002	12	Ductile Iro	0.012	1.72	0.02	1.2	0.1	12.25
243	M19-M21	CB-M21	803.03	CB-M19	802.83	100	0.002	12	Ductile Iro	0.012	1.72	1.79	104.1	2.93	12
244	M18-M19	CB-M19	802.83	CB-M18	802.58	125	0.002	12	Ductile Iro	0.012	1.72	1.78	103.5	2.95	12
246	M17-M20	CB-M20	802.93	CB-M17	802.93	125	0	12	Ductile Iro	0.012	0	0	∞	0	0
247	EX2-M17	CB-M17	802.93	CB-EX2	802.52	79	0.005	12	Ductile Iro	0.012	2.77	0	0.0	0	0
248	984-EX2	CB-EX2	802.52	CB-984	802.04	34	0.014	12	Ductile Iro	0.012	4.59	0	0.0	0	0
249	EX1-M18	CB-M18	802.58	CB-EX1	802.41	86	0.002	12	Ductile Iro	0.012	1.72	1.78	103.5	3.15	12
250	985-EX1	CB-EX1	802.41	CB-985	801.64	29	0.027	12	Ductile Iro	0.012	6.28	1.78	28.3	6.79	12
279	945-944	CB-944	813.58	CB-945	809.6	345	0.012	24	Concrete	0.013	24.3	12.08	49.7	7.71	11.95
280	1302-945	CB-945	809.6	CB-1302	804.94	404	0.012	24	Concrete	0.013	24.29	15.81	65.1	5.03	11.95
298	CO-108	CB-M13	796.31	CB-M11	795.77	108	0.005	12	PVC	0.01	3.28	0	0.0	0	0

Pipe Table

North System - Existing Conditions - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Upstream) (ft)	Stop-node Id	Invert (Downstream) (ft)	Length (ft)	Constructed Slope (ft/ft)	Diameter (in)	Material	Manning's n	Full Capacity (ft³/s)	Flow (Maximum) (ft³/s)	Flow / Full Flow Capacity (%)	Velocity (Maximum) (ft/s)	Time to Maximum Flow (hours)
302	CO-110	CB-M11	795.77	CB-M9	795.57	79	0.003	12	PVC	0.01	2.33	0	0.0	0	0
303	CO-111	CB-M9	795.57	CB-M7	794.9	85	0.008	12	PVC	0.01	4.12	0	0.0	0	0
317	M1-M3	CB-M3	794.21	CB-M1	793.47	46	0.016	18	Ductile Iro	0.012	14.49	0.17	1.2	0.3	4.05
319	M25-M1	CB-M1	793.47	CB-M25	792.77	139	0.005	18	PVC	0.01	9.69	0.05	0.5	0.03	4.05
321	M26-M25	CB-M25	792.77	CB-M26	792.1	111	0.006	18	PVC	0.01	10.62	0	0.0	0	4.05
322	980-M3	CB-M3	794.21	CB-980	794.18	18	0.002	18	Ductile Iro	0.012	5.04	0.55	10.9	2.21	11.9
344	944-E1	CS-E1	814.9	CB-944	813.58	44	0.03	24	CMP	0.024	21.28	10.16	47.7	6.68	12
358	CO-125	CB-1118	792.54	CB-1071	793.13	17	-0.034	12	PVC	0.01	8.56	0	0.0	0.01	12.15
360	CO-126	CB-1071	793.13	CB-1073	790.98	37	0.058	12	PVC	0.01	11.18	1.81	16.2	2.31	11.95
362	CO-127	CB-1073	790.98	CB-3003	790.22	136	0.006	12	PVC	0.01	3.47	1.81	52.2	2.31	11.95
364	CO-128	CB-3003	790.22	CB-3002	790.1	25	0.005	12	PVC	0.01	3.23	1.5	46.4	1.91	11.7
365	CO-129	CB-3002	790.1	CB-1000	789.51	565	0.001	12	PVC	0.01	1.5	2.17	144.7	2.76	11.7
377	CO-131	CS-6	776.5	CS-7	775.84	66	0.01	24	CMP	0.024	12.26	53.83	439.1	6.67	12.15
387	CO-134	CB-1344	784.13	Tee Conne	782.41	288	0.006	36	Concrete	0.013	51.57	54.61	105.9	7.73	12
388	CO-135	Tee Conne	782.41	CS-5	780.5	394	0.005	36	Concrete	0.013	46.41	61.22	131.9	8.66	12
389	CO-136	CB-1342	788.45	Tee Conne	782.41	17	0.363	12	PVC	0.01	27.89	6.7	24.0	8.53	12
391	CO-137	CS-8	775.65	OF-4	775.29	35	0.01		Concrete	0.013	29.11	53.85	185.0	10.06	12.2
400	1315-C1	OS-C1	809.92	CB-1315	808.78	227	0.005		Natural str	0.045	87.79	5.67	6.5	0.57	12.45
405	E2-E3	OS-E3	817.83	CS-E2	817.3	52	0.01	24	CMP	0.024	12.31	10.16	82.5	5.11	12.15
411	CO-140	CB-16	791.15	CB-972	790.3	55	0.015	12	PVC	0.01	5.76	4.69	81.4	5.98	12

Pipe Table

South System - Existing Conditions - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Upstream) (ft)	Stop-node Id	Invert (Downstream) (ft)	Length (ft)	Constructed Slope (ft/ft)	Diameter (in)	Material	Manning's n	Full Capacity (ft³/s)	Flow (Maximum) (ft³/s)	Flow / Full Flow Capacity (%)	Velocity (Maximum) (ft/s)	Time to Maximum Flow (hours)
25	CO-1	CB-1088	793.55	CB-1067	792.87	34	0.02	8	PVC	0.01	2.23	0	0.0	0	0
26	CO-2	CB-1067	792.54	CB-1065	791.32	262	0.005	12	PVC	0.01	3.16	0	0.0	0	0
27	CO-3	CB-1065	791.32	CB-1060	790.03	258	0.005	12	PVC	0.01	3.28	0.82	25.0	3.36	11.8
28	CO-4	CB-1060	789.99	CB-1058	781.51	274	0.031	12	PVC	0.01	8.15	3.69	45.3	10.02	11.95
29	CO-5	CB-1058	777.84	CB-1056	777.04	55	0.014	12	PVC	0.01	5.57	7.57	135.9	9.64	11.95
33	CO-7	CB-1056	777.04	OF-2	775.79	125	0.01	12	PVC	0.01	4.64	7.57	163.1	9.63	11.95
42	CO-8	CB-1184	789.74	CB-1183	789.33	29	0.014	12	PVC	0.01	5.52	0	0.0	0	0
43	CO-9	CB-1183	789.35	CB-1181	785.48	256	0.015	12	PVC	0.01	5.69	0	0.0	0	0
44	CO-10	CB-1181	785.44	CB-1180	784.25	116	0.01	12	PVC	0.01	4.7	0.02	0.4	0.48	8.9
45	CO-11	CB-1180	784.5	CB-996	783.78	113	0.006	12	PVC	0.01	3.69	1.41	38.2	4.31	11.95
46	CO-12	CB-996	783.69	CB-997	782.36	160	0.008	12	PVC	0.01	4.23	1.41	33.3	4.74	11.95
47	CO-13	CB-997	782.36	CB-998	782.18	132	0.001	12	PVC	0.01	1.71	1.41	82.5	2.86	12
48	CO-14	CB-998	782.18	CB-1057	780.71	101	0.015	12	PVC	0.01	5.59	1.41	25.2	5.83	12
49	CO-15	CB-1057	780.29	CB-1058	777.84	23	0.105	12	PVC	0.01	15.03	2.32	15.4	2.95	11.95

Pipe Table

North System - Future Conventional - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Upstream) (ft)	Stop-node Id	Invert (Downstream) (ft)	Length (ft)	Constructed Slope (ft/ft)	Diameter (in)	Material	Manning's n	Full Capacity (ft^3/s)	Flow (Maximum) (ft^3/s)	Flow / Full Flow Capacity (%)	Velocity (Maximum) (ft/s)	Time to Maximum Flow (hours)
33	1100-1101	CB-1101	857.45	CB-1100	855.64	40	0.045	12	PVC	0.01	9.83	0	0.0	0	0
34	935-1100	CB-1100	855.64	CB-935	856.09	114	-0.004	12	PVC	0.01	2.91	0.04	1.4	0.06	12.05
35	1096-935	CB-935	855.93	CB-1096	854.23	256	0.007	12	PVC	0.01	3.77	3.24	85.9	4.13	11.95
36	1093-1096	CB-1096	854.85	CB-1093	853.61	219	0.006	12	PVC	0.01	3.49	3.24	92.8	4.97	11.95
37	1092-1093	CB-1093	853.61	CB-1092	846.67	177	0.039	12	PVC	0.01	9.17	3.24	35.3	10.62	12
38	1091-1092	CB-1092	846.67	CB-1091	836.48	174	0.059	12	PVC	0.01	11.21	3.24	28.9	12.29	12
39	1090-1091	CB-1091	836.32	CB-1090	822.91	212	0.063	12	PVC	0.01	11.65	6.98	59.9	15.48	11.95
40	994-1090	CB-1090	823.04	CB-994	797.3	338	0.076	12	PVC	0.01	12.78	6.97	54.5	16.52	11.95
41	1089-994	CB-994	797.14	CB-1089	794.09	103	0.03	12	PVC	0.01	7.96	8.06	101.3	10.26	11.7
42	1170-1089	CB-1089	794.04	CB-1170	793.04	185	0.005	12	PVC	0.01	3.41	7.28	213.5	9.27	11.65
43	1166-1170	CB-1170	793.02	CB-1166	788.02	283	0.018	12	PVC	0.01	6.16	6.92	112.3	8.81	11.65
44	1164-1166	CB-1166	787.98	CB-1164	787.16	281	0.003	12	PVC	0.01	2.5	4.73	189.2	6.03	12.25
73	993-1164	CB-1164	787.18	CB-993	786.62	117	0.005	12	PVC	0.01	3.2	8.47	264.7	10.78	11.65
76	1346-993	CB-993	786.95	CB-1346	784.04	402	0.007	36	Concrete	0.013	56.73	12.56	22.1	2.04	12.2
79	993-992	CB-992	788.65	CB-993	786.45	140	0.016	12	Concrete	0.013	4.46	3.03	67.9	3.85	11.95
81	992-1085	CB-1085	789.66	CB-992	788.65	64	0.016	12	Concrete	0.013	4.47	1.59	35.6	2.02	11.95
83	1085-1156	CB-1156	789.82	CB-1085	789.58	46	0.005	8	Concrete	0.013	0.87	1.59	182.8	4.55	11.95
91	1000-980	CB-980	794.18	CB-1000	789.76	119	0.037	12	Concrete	0.013	6.87	0.92	13.4	6.11	15.55
92	1156-1000	CB-1000	789.51	CB-1156	789.82	112	-0.003	8	PVC	0.01	0.83	1.59	191.6	4.55	11.6
116	Tee-1346	CB-1346	784.04	Tee Conne	784.04	39	0	36	Concrete	0.013	0	13.77	∞	1.95	12.2
117	1344-Tee	Tee Conne	784.04	CB-1344	784.13	226	0	36	Concrete	0.013	13.32	44.16	331.5	6.25	12
118	Tee-970	CB-970	788.17	Tee Conne	784.04	142	0.029	24	Concrete	0.013	38.62	35.8	92.7	11.4	11.95
119	970-1001	CB-970	788.17	CB-1001	792.04	188	-0.021	24	Concrete	0.013	32.49	32.73	100.7	11.79	11.85
120	1001-M7	CB-1001	792.04	CB-M7	796.34	130	-0.033	24	Ductile Iro	0.012	44.61	32.73	73.4	15.5	11.85
121	M7-M8	CB-M7	796.34	CB-M8	796.84	46	-0.011	24	Ductile Iro	0.012	25.59	31.02	121.2	9.93	11.8
122	M8-1331C	CB-M8	796.84	CB-1331C	798.92	129	-0.016	24	Ductile Iro	0.012	31.17	31.03	99.6	11.2	11.75
123	1331C-133	CB-1331C	798.92	CB-1331X	798.85	153	0	24	Concrete	0.013	4.85	31.05	640.2	9.88	11.75
126	1331-1330	CB-1331	799.88	CB-1330	800.69	94	-0.009	24	Concrete	0.013	21.02	21.99	104.6	7	12.05
127	1330-1328	CB-1330	800.69	CB-1328	800.93	70	-0.003	24	Concrete	0.013	13.29	21.99	165.5	7	12.05
128	1328-1325	CB-1328	800.68	CB-1325	803.03	255	-0.009	24	Concrete	0.013	21.7	20.93	96.5	6.66	12.15
129	1325-1302	CB-1325	802.82	CB-1302	804.94	461	-0.005	24	Concrete	0.013	15.34	19.49	127.1	6.2	12.2
130	1302-1300	CB-1302	805.49	CB-1300	805.96	54	-0.009	12	Concrete	0.013	3.32	9.25	278.6	11.78	11.95
131	1300-1308	CB-1300	805.96	CB-1308	805.68	127	0.002	12	Concrete	0.013	1.67	4.61	276.0	5.87	11.6
132	1308-1309	CB-1308	805.85	CB-1309	806.22	36	-0.01	12	Concrete	0.013	3.63	3.04	83.7	3.87	12.35
133	1309-1041	CB-1309	806.22	CB-1041	807.88	640	-0.003	12	Concrete	0.013	1.81	2.51	138.7	3.19	14.65
139	1041-1043	CB-1041	807.36	CB-1043	807.81	45	-0.01	12	PVC	0.01	4.65	2.31	49.7	2.95	16.95
140	1043-1314	CB-1043	807.81	CB-1314	807.72	302	0	12	PVC	0.01	0.8	2.31	288.8	2.95	16.95
141	1314-931	CB-1314	807.89	CB-931	808.21	58	-0.006	12	Concrete	0.013	2.65	2.31	87.2	2.95	16.95
166	1342-972	CB-1342	788.45	CB-972	790.3	134	-0.014	12	PVC	0.01	5.44	7.8	143.4	9.93	12
167	972-1142	CB-972	790.3	CB-1142	790.39	25	-0.004	12	PVC	0.01	2.8	2.33	83.2	2.97	11.95
168	1142-1143	CB-1142	790.81	CB-1143	791.15	42	-0.008	12	PVC	0.01	4.17	0	0.0	0	0
170	16-15	CB-16	791.15	CB-15	791.23	21	-0.004	12	Ductile Iro	0.012	2.4	5.87	244.6	7.47	11.9
171	15-985	CB-15	791.23	CB-985	801.64	246	-0.042	12	Ductile Iro	0.012	7.94	5.85	73.7	11.04	11.95
172	985-984	CB-984	802.04	CB-985	801.64	38	0.011	12	Concrete	0.013	3.67	4	109.0	5.42	11.95
173	984-11	CB-984	802.29	CB-11	802.78	36	-0.013	12	Concrete	0.013	4.13	2.72	65.9	5.57	11.95
174	11-1332	CB-11	802.78	CB-1332	803.79	122	-0.008	12	Concrete	0.013	3.25	2.72	83.7	4.58	11.95

Pipe Table

North System - Future Conventional - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Upstream) (ft)	Stop-node Id	Invert (Downstream) (ft)	Length (ft)	Constructed Slope (ft/ft)	Diameter (in)	Material	Manning's n	Full Capacity (ft³/s)	Flow (Maximum) (ft³/s)	Flow / Full Flow Capacity (%)	Velocity (Maximum) (ft/s)	Time to Maximum Flow (hours)
175	1332-8	CB-1332	803.79	CB-8	810.35	118	-0.056	12	Concrete (	0.013	8.41	2.73	32.5	9.51	11.95
176	8-1336	CB-8	810.35	CB-1336	811.63	42	-0.031	12	Ductile Iron	0.012	6.75	2.73	40.4	8.06	11.95
177	1336-4	CB-1336	811.63	CB-4	812.38	29	-0.026	12	Concrete	0.013	5.75	1.43	24.9	5.97	11.95
178	1-Apr	CB-4	812.38	CB-1	817.57	185	-0.028	12	Concrete	0.013	5.96	1.43	24.0	6.14	11.95
179	1-1338	CB-1	817.57	CB-1338	819.82	69	-0.033	12	Concrete	0.013	6.46	1.43	22.1	6.5	11.95
180	1338-1339	CB-1339	820.07	CB-1338	819.82	43	0.006	12	Concrete	0.013	2.72	1.43	52.6	3.49	11.95
181	1339-1340	CB-1340	820.43	CB-1339	819.91	36	0.015	8	Concrete	0.013	1.46	0	0.0	0	12
184	1142-1140	CB-1140	791.16	CB-1142	790.48	122	0.006	12	PVC	0.01	3.46	0.51	14.7	0.7	12.15
185	1140-1138	CB-1138	791.8	CB-1140	791.16	157	0.004	12	PVC	0.01	2.96	0.15	5.1	0.2	12.1
186	1138-1136	CB-1138	791.8	CB-1136	792.39	147	-0.004	12	PVC	0.01	2.94	0	0.0	0	0
187	1136-1137	CB-1137	792.77	CB-1136	792.47	42	0.007	8	PVC	0.01	1.33	0	0.0	0	0
204	1331X-133	CB-1331	799.88	CB-1331X	798.85	187	0.006	24	Concrete	0.013	16.79	22	131.0	7	12.05
206	931-1315	CB-931	808.13	CB-1315	808.78	38	-0.017	12	Concrete	0.013	4.68	2.31	49.4	2.95	16.95
221	1144-1145	CB-1145	790.73	CB-1144	790.43	43	0.007	8	PVC	0.01	1.31	0	0.0	0	0
222	1146-1144	CB-1144	790.43	CB-1146	789.87	132	0.004	12	PVC	0.01	3.02	0	0.0	0	0
223	CO-81	CB-1146	789.87	CB-1148	788.83	108	0.01	12	PVC	0.01	4.54	0	0.0	0	0
224	CO-82	CB-1148	788.83	CB-970	788.17	86	0.008	12	PVC	0.01	4.06	0	0.0	0	0
225	CO-83	CB-970	788.17	CB-1152	790.02	163	-0.011	12	PVC	0.01	4.94	0	0.0	0	0
226	CO-84	CB-1152	790.02	CB-1153	790.06	48	-0.001	12	PVC	0.01	1.33	0	0.0	0	0
240	M22-M24	CB-M24	803.65	CB-M22	803.34	62	0.005	12	Ductile Iron	0.012	2.73	1.88	68.9	3.78	11.95
241	M21-M22	CB-M22	803.34	CB-M21	803.03	37	0.008	12	Ductile Iron	0.012	3.54	1.88	53.1	3.39	11.95
242	M21-M23	CB-M23	803.23	CB-M21	803.03	100	0.002	12	Ductile Iron	0.012	1.72	0.02	1.2	0.05	12.1
243	M19-M21	CB-M21	803.03	CB-M19	802.83	100	0.002	12	Ductile Iron	0.012	1.72	1.88	109.3	2.96	12
244	M18-M19	CB-M19	802.83	CB-M18	802.58	125	0.002	12	Ductile Iron	0.012	1.72	1.87	108.7	2.99	12
246	M17-M20	CB-M20	802.93	CB-M17	802.93	125	0	12	Ductile Iron	0.012	0	0	∞	0	0
247	EX2-M17	CB-M17	802.93	CB-EX2	802.52	79	0.005	12	Ductile Iron	0.012	2.77	0	0.0	0	0
248	984-EX2	CB-EX2	802.52	CB-984	802.04	34	0.014	12	Ductile Iron	0.012	4.59	0	0.0	0	0
249	EX1-M18	CB-M18	802.58	CB-EX1	802.41	86	0.002	12	Ductile Iron	0.012	1.72	1.87	108.7	3.21	12
250	985-EX1	CB-EX1	802.41	CB-985	801.64	29	0.027	12	Ductile Iron	0.012	6.28	1.87	29.8	6.88	12
279	945-944	CB-944	813.58	CB-945	809.6	345	0.012	24	Concrete	0.013	24.3	12.38	50.9	7.75	11.9
280	1302-945	CB-945	809.6	CB-1302	804.94	404	0.012	24	Concrete	0.013	24.29	17.2	70.8	5.48	11.85
298	CO-108	CB-M13	796.31	CB-M11	795.77	108	0.005	12	PVC	0.01	3.28	0	0.0	0	0
302	CO-110	CB-M11	795.77	CB-M9	795.57	79	0.003	12	PVC	0.01	2.33	0	0.0	0	0
303	CO-111	CB-M9	795.57	CB-M7	794.9	85	0.008	12	PVC	0.01	4.12	0	0.0	0	0
317	M1-M3	CB-M3	794.21	CB-M1	793.47	46	0.016	18	Ductile Iron	0.012	14.49	0.05	0.3	0.09	20.65
319	M25-M1	CB-M1	793.47	CB-M25	792.77	139	0.005	18	PVC	0.01	9.69	0.02	0.2	0.01	18.25
321	M26-M25	CB-M25	792.77	CB-M26	792.1	111	0.006	18	PVC	0.01	10.62	0	0.0	0	15.65
322	980-M3	CB-M3	794.21	CB-980	794.18	18	0.002	18	Ductile Iron	0.012	5.04	0.89	17.7	5.88	15.55
344	944-E1	CS-E1	814.9	CB-944	813.58	44	0.03	24	CMP	0.024	21.28	10.16	47.7	6.68	11.9
358	CO-125	CB-1118	792.54	CB-1071	793.13	17	-0.034	12	PVC	0.01	8.56	0	0.0	0.01	12.2
360	CO-126	CB-1071	793.13	CB-1073	790.98	37	0.058	12	PVC	0.01	11.18	2.42	21.6	3.09	11.75
362	CO-127	CB-1073	790.98	CB-3003	790.22	136	0.006	12	PVC	0.01	3.47	2.42	69.7	3.08	11.75
364	CO-128	CB-3003	790.22	CB-3002	790.1	25	0.005	12	PVC	0.01	3.23	1.41	43.7	1.79	11.6
365	CO-129	CB-3002	790.1	CB-1000	789.51	565	0.001	12	PVC	0.01	1.5	2.12	141.3	2.7	11.75
377	CO-131	CS-6	776.5	CS-7	775.84	66	0.01	24	CMP	0.024	12.26	65.12	531.2	8.07	12.15
387	CO-134	CB-1344	784.13	Tee Conne	782.41	288	0.006	36	Concrete	0.013	51.57	64.77	125.6	9.16	11.95

Pipe Table

North System - Future Conventional - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Upstream) (ft)	Stop-node Id	Invert (Downstream) (ft)	Length (ft)	Constructed Slope (ft/ft)	Diameter (in)	Material	Manning's n	Full Capacity (ft³/s)	Flow (Maximum) (ft³/s)	Flow / Full Flow Capacity (%)	Velocity (Maximum) (ft/s)	Time to Maximum Flow (hours)
388	CO-135	Tee Conne	782.41	CS-5	780.5	394	0.005	36	Concrete	0.013	46.41	72.55	156.3	10.26	11.95
389	CO-136	CB-1342	788.45	Tee Conne	782.41	17	0.363	12	PVC	0.01	27.89	7.8	28.0	9.93	12
391	CO-137	CS-8	775.65	OF-4	775.29	35	0.01		Concrete	0.013	29.11	65.18	223.9	10.52	12.15
400	1315-C1	OS-C1	809.92	CB-1315	808.78	227	0.005		Natural str	0.045	87.79	2.27	2.6	0.17	16.5
405	E2-E3	OS-E3	817.83	CS-E2	817.3	52	0.01	24	CMP	0.024	12.31	10.16	82.5	5.09	11.85
409	CO-140	CB-16	791.15	CB-972	790.3	55	0.015	12	PVC	0.01	5.76	5.54	96.2	7.05	12.05

Pipe Table

South System - Future Conventional - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Upstream) (ft)	Stop-node Id	Invert (Downstream) (ft)	Length (ft)	Constructed Slope (ft/ft)	Diameter (in)	Material	Manning's n	Full Capacity (ft³/s)	Flow (Maximum) (ft³/s)	Flow / Full Flow Capacity (%)	Velocity (Maximum) (ft/s)	Time to Maximum Flow (hours)
25	CO-1	CB-1088	793.55	CB-1067	792.87	34	0.02	8	PVC	0.01	2.23	0	0.0	0	0
26	CO-2	CB-1067	792.54	CB-1065	791.32	262	0.005	12	PVC	0.01	3.16	0	0.0	0	0
27	CO-3	CB-1065	791.32	CB-1060	790.03	258	0.005	12	PVC	0.01	3.28	1.08	32.9	3.66	11.75
28	CO-4	CB-1060	789.99	CB-1058	781.51	274	0.031	12	PVC	0.01	8.15	4.64	56.9	14.56	11.95
29	CO-5	CB-1058	777.84	CB-1056	777.04	55	0.014	12	PVC	0.01	5.57	9.69	174.0	12.34	11.9
33	CO-7	CB-1056	777.04	OF-2	775.79	125	0.01	12	PVC	0.01	4.64	9.64	207.8	12.27	11.95
42	CO-8	CB-1184	789.74	CB-1183	789.33	29	0.014	12	PVC	0.01	5.52	0	0.0	0	0
43	CO-9	CB-1183	789.35	CB-1181	785.48	256	0.015	12	PVC	0.01	5.69	0	0.0	0	0
44	CO-10	CB-1181	785.44	CB-1180	784.25	116	0.01	12	PVC	0.01	4.7	0.02	0.4	0.39	9.05
45	CO-11	CB-1180	784.5	CB-996	783.78	113	0.006	12	PVC	0.01	3.69	0.02	0.5	0.9	0.15
46	CO-12	CB-996	783.69	CB-997	782.36	160	0.008	12	PVC	0.01	4.23	0.02	0.5	0.81	0
47	CO-13	CB-997	782.36	CB-998	782.18	132	0.001	12	PVC	0.01	1.71	0.02	1.2	0.87	0
48	CO-14	CB-998	782.18	CB-1057	780.71	101	0.015	12	PVC	0.01	5.59	0.02	0.4	0.72	0
49	CO-15	CB-1057	780.29	CB-1058	777.84	23	0.105	12	PVC	0.01	15.03	2.9	19.3	3.7	11.95

Pipe Table

North System - Future Conditions - LID - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Upstream) (ft)	Stop-node Id	Invert (Downstream) (ft)	Length (ft)	Constructed Slope (ft/ft)	Diameter (in)	Material	Manning's n	Full Capacity (ft³/s)	Flow (Maximum) (ft³/s)	Flow / Full Flow Capacity (%)	Velocity (Maximum) (ft/s)	Time to Maximum Flow (hours)
33	1100-1101	CB-1101	857.45	CB-1100	855.64	40	0.045	12	PVC	0.01	9.83	0	0.0	0	0
34	935-1100	CB-1100	855.64	CB-935	856.09	114	-0.004	12	PVC	0.01	2.91	0.02	0.7	0.03	12.05
35	1096-935	CB-935	855.93	CB-1096	854.23	256	0.007	12	PVC	0.01	3.77	2.28	60.5	4.77	11.95
36	1093-1096	CB-1096	854.85	CB-1093	853.61	219	0.006	12	PVC	0.01	3.49	2.27	65.0	4.66	11.95
37	1092-1093	CB-1093	853.61	CB-1092	846.67	177	0.039	12	PVC	0.01	9.17	2.27	24.8	9.6	11.95
38	1091-1092	CB-1092	846.67	CB-1091	836.48	174	0.059	12	PVC	0.01	11.21	2.27	20.2	11.05	12
39	1090-1091	CB-1091	836.32	CB-1090	822.91	212	0.063	12	PVC	0.01	11.65	3.2	27.5	12.63	11.95
40	994-1090	CB-1090	823.04	CB-994	797.3	338	0.076	12	PVC	0.01	12.78	3.2	25.0	13.37	11.95
41	1089-994	CB-994	797.14	CB-1089	794.09	103	0.03	12	PVC	0.01	7.96	4.37	54.9	5.56	11.95
42	1170-1089	CB-1089	794.04	CB-1170	793.04	185	0.005	12	PVC	0.01	3.41	5.31	155.7	6.76	11.95
43	1166-1170	CB-1170	793.02	CB-1166	788.02	283	0.018	12	PVC	0.01	6.16	4.64	75.3	5.91	11.95
44	1164-1166	CB-1166	787.98	CB-1164	787.16	281	0.003	12	PVC	0.01	2.5	4.24	169.6	5.39	12.05
73	993-1164	CB-1164	787.18	CB-993	786.62	117	0.005	12	PVC	0.01	3.2	8.54	266.9	10.87	11.75
76	1346-993	CB-993	786.95	CB-1346	784.04	402	0.007	36	Concrete	0.013	56.73	12.2	21.5	2.06	12.1
79	993-992	CB-992	788.65	CB-993	786.45	140	0.016	12	Concrete	0.013	4.46	2.88	64.6	3.69	11.95
81	992-1085	CB-1085	789.66	CB-992	788.65	64	0.016	12	Concrete	0.013	4.47	1.59	35.6	5.12	11.95
83	1085-1156	CB-1156	789.82	CB-1085	789.58	46	0.005	8	Concrete	0.013	0.87	1.59	182.8	4.54	11.95
91	1000-980	CB-980	794.18	CB-1000	789.76	119	0.037	12	Concrete	0.013	6.87	0.52	7.6	3.27	11.95
92	1156-1000	CB-1000	789.51	CB-1156	789.82	112	-0.003	8	PVC	0.01	0.83	1.59	191.6	4.54	11.95
116	Tee-1346	CB-1346	784.04	Tee Conne	784.04	39	0	36	Concrete	0.013	0	13.12	∞	1.86	12.1
117	1344-Tee	Tee Conne	784.04	CB-1344	784.13	226	0	36	Concrete	0.013	13.32	44.32	332.7	6.27	12.05
118	Tee-970	CB-970	788.17	Tee Conne	784.04	142	0.029	24	Concrete	0.013	38.62	32.84	85.0	10.45	11.95
119	970-1001	CB-970	788.17	CB-1001	792.04	188	-0.021	24	Concrete	0.013	32.49	30.4	93.6	11.74	11.85
120	1001-M7	CB-1001	792.04	CB-M7	796.34	130	-0.033	24	Ductile Iroi	0.012	44.61	30.4	68.1	15.26	11.8
121	M7-M8	CB-M7	796.34	CB-M8	796.84	46	-0.011	24	Ductile Iroi	0.012	25.59	29.03	113.4	9.67	11.8
122	M8-1331C	CB-M8	796.84	CB-1331C	798.92	129	-0.016	24	Ductile Iroi	0.012	31.17	29.04	93.2	11.26	11.8
123	1331C-133	CB-1331C	798.92	CB-1331X	798.85	153	0	24	Concrete	0.013	4.85	29.04	598.8	9.24	11.8
126	1331-1330	CB-1331	799.88	CB-1330	800.69	94	-0.009	24	Concrete	0.013	21.02	21.81	103.8	6.94	12
127	1330-1328	CB-1330	800.69	CB-1328	800.93	70	-0.003	24	Concrete	0.013	13.29	21.81	164.1	6.94	12
128	1328-1325	CB-1328	800.68	CB-1325	803.03	255	-0.009	24	Concrete	0.013	21.7	20.91	96.4	6.66	12.1
129	1325-1302	CB-1325	802.82	CB-1302	804.94	461	-0.005	24	Concrete	0.013	15.34	19.7	128.4	6.27	12.15
130	1302-1300	CB-1302	805.49	CB-1300	805.96	54	-0.009	12	Concrete	0.013	3.32	9.18	276.5	11.68	11.95
131	1300-1308	CB-1300	805.96	CB-1308	805.68	127	0.002	12	Concrete	0.013	1.67	3.85	230.5	4.9	11.7
132	1308-1309	CB-1308	805.85	CB-1309	806.22	36	-0.01	12	Concrete	0.013	3.63	2.81	77.4	3.57	12.35
133	1309-1041	CB-1309	806.22	CB-1041	807.88	640	-0.003	12	Concrete	0.013	1.81	2.53	139.8	3.22	14.5
139	1041-1043	CB-1041	807.36	CB-1043	807.81	45	-0.01	12	PVC	0.01	4.65	2.32	49.9	2.95	16.45
140	1043-1314	CB-1043	807.81	CB-1314	807.72	302	0	12	PVC	0.01	0.8	2.32	290.0	2.95	16.5
141	1314-931	CB-1314	807.89	CB-931	808.21	58	-0.006	12	Concrete	0.013	2.65	2.32	87.5	2.95	16.5
166	1342-972	CB-1342	788.45	CB-972	790.3	134	-0.014	12	PVC	0.01	5.44	5.65	103.9	7.86	12
167	972-1142	CB-972	790.3	CB-1142	790.39	25	-0.004	12	PVC	0.01	2.8	1.65	58.9	2.29	11.95
168	1142-1143	CB-1142	790.81	CB-1143	791.15	42	-0.008	12	PVC	0.01	4.17	0	0.0	0	0
170	16-15	CB-16	791.15	CB-15	791.23	21	-0.004	12	Ductile Iroi	0.012	2.4	3.99	166.3	5.13	11.95
171	15-985	CB-15	791.23	CB-985	801.64	246	-0.042	12	Ductile Iroi	0.012	7.94	3.99	50.3	10.08	11.95
172	985-984	CB-984	802.04	CB-985	801.64	38	0.011	12	Concrete	0.013	3.67	2.52	68.7	4.99	11.95
173	984-11	CB-984	802.29	CB-11	802.78	36	-0.013	12	Concrete	0.013	4.13	1.62	39.2	4.87	11.95
174	11-1332	CB-11	802.78	CB-1332	803.79	122	-0.008	12	Concrete	0.013	3.25	1.62	49.8	4.06	11.95

Pipe Table

North System - Future Conditions - LID - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Upstream) (ft)	Stop-node Id	Invert (Downstream) (ft)	Length (ft)	Constructed Slope (ft/ft)	Diameter (in)	Material	Manning's n	Full Capacity (ft^3/s)	Flow (Maximum) (ft^3/s)	Flow / Full Flow Capacity (%)	Velocity (Maximum) (ft/s)	Time to Maximum Flow (hours)
175	1332-8	CB-1332	803.79	CB-8	810.35	118	-0.056	12	Concrete (	0.013	8.41	1.62	19.3	8.15	11.95
176	8-1336	CB-8	810.35	CB-1336	811.63	42	-0.031	12	Ductile Iroi	0.012	6.75	1.62	24.0	6.95	11.95
177	1336-4	CB-1336	811.63	CB-4	812.38	29	-0.026	12	Concrete	0.013	5.75	0.71	12.3	4.81	11.95
178	1-Apr	CB-4	812.38	CB-1	817.57	185	-0.028	12	Concrete	0.013	5.96	0.72	12.1	4.96	11.95
179	1-1338	CB-1	817.57	CB-1338	819.82	69	-0.033	12	Concrete	0.013	6.46	0.72	11.1	5.23	11.95
180	1338-1339	CB-1339	820.07	CB-1338	819.82	43	0.006	12	Concrete	0.013	2.72	0.72	26.5	2.83	11.95
181	1339-1340	CB-1340	820.43	CB-1339	819.91	36	0.015	8	Concrete	0.013	1.46	0	0.0	0	0
184	1142-1140	CB-1140	791.16	CB-1142	790.48	122	0.006	12	PVC	0.01	3.46	0.01	0.3	0.03	12.05
185	1140-1138	CB-1138	791.8	CB-1140	791.16	157	0.004	12	PVC	0.01	2.96	0	0.0	0	0
186	1138-1136	CB-1138	791.8	CB-1136	792.39	147	-0.004	12	PVC	0.01	2.94	0	0.0	0	0
187	1136-1137	CB-1137	792.77	CB-1136	792.47	42	0.007	8	PVC	0.01	1.33	0	0.0	0	0
204	1331X-133	CB-1331	799.88	CB-1331X	798.85	187	0.006	24	Concrete	0.013	16.79	21.81	129.9	6.94	12
206	931-1315	CB-931	808.13	CB-1315	808.78	38	-0.017	12	Concrete	0.013	4.68	2.32	49.6	2.95	16.5
221	1144-1145	CB-1145	790.73	CB-1144	790.43	43	0.007	8	PVC	0.01	1.31	0	0.0	0	0
222	1146-1144	CB-1144	790.43	CB-1146	789.87	132	0.004	12	PVC	0.01	3.02	0	0.0	0	0
223	CO-81	CB-1146	789.87	CB-1148	788.83	108	0.01	12	PVC	0.01	4.54	0	0.0	0	0
224	CO-82	CB-1148	788.83	CB-970	788.17	86	0.008	12	PVC	0.01	4.06	0	0.0	0	0
225	CO-83	CB-970	788.17	CB-1152	790.02	163	-0.011	12	PVC	0.01	4.94	0	0.0	0	0
226	CO-84	CB-1152	790.02	CB-1153	790.06	48	-0.001	12	PVC	0.01	1.33	0	0.0	0	0
240	M22-M24	CB-M24	803.65	CB-M22	803.34	62	0.005	12	Ductile Iroi	0.012	2.73	1.5	54.9	3.52	11.95
241	M21-M22	CB-M22	803.34	CB-M21	803.03	37	0.008	12	Ductile Iroi	0.012	3.54	1.5	42.4	3.43	11.95
242	M21-M23	CB-M23	803.23	CB-M21	803.03	100	0.002	12	Ductile Iroi	0.012	1.72	0.02	1.2	0.04	12.1
243	M19-M21	CB-M21	803.03	CB-M19	802.83	100	0.002	12	Ductile Iroi	0.012	1.72	1.5	87.2	2.81	12
244	M18-M19	CB-M19	802.83	CB-M18	802.58	125	0.002	12	Ductile Iroi	0.012	1.72	1.5	87.2	2.8	12
246	M17-M20	CB-M20	802.93	CB-M17	802.93	125	0	12	Ductile Iroi	0.012	0	0	∞	0	0
247	EX2-M17	CB-M17	802.93	CB-EX2	802.52	79	0.005	12	Ductile Iroi	0.012	2.77	0	0.0	0	0
248	984-EX2	CB-EX2	802.52	CB-984	802.04	34	0.014	12	Ductile Iroi	0.012	4.59	0	0.0	0	0
249	EX1-M18	CB-M18	802.58	CB-EX1	802.41	86	0.002	12	Ductile Iroi	0.012	1.72	1.5	87.2	2.95	12
250	985-EX1	CB-EX1	802.41	CB-985	801.64	29	0.027	12	Ductile Iroi	0.012	6.28	1.49	23.7	6.44	12
279	945-944	CB-944	813.58	CB-945	809.6	345	0.012	24	Concrete	0.013	24.3	12.38	50.9	7.75	11.9
280	1302-945	CB-945	809.6	CB-1302	804.94	404	0.012	24	Concrete	0.013	24.29	17.2	70.8	5.47	11.85
298	CO-108	CB-M13	796.31	CB-M11	795.77	108	0.005	12	PVC	0.01	3.28	0	0.0	0	0
302	CO-110	CB-M11	795.77	CB-M9	795.57	79	0.003	12	PVC	0.01	2.33	0	0.0	0	0
303	CO-111	CB-M9	795.57	CB-M7	794.9	85	0.008	12	PVC	0.01	4.12	0	0.0	0	0
317	M1-M3	CB-M3	794.21	CB-M1	793.47	46	0.016	18	Ductile Iroi	0.012	14.49	0.12	0.8	0.22	3.95
319	M25-M1	CB-M1	793.47	CB-M25	792.77	139	0.005	18	PVC	0.01	9.69	0.05	0.5	0.03	3.95
321	M26-M25	CB-M25	792.77	CB-M26	792.1	111	0.006	18	PVC	0.01	10.62	0	0.0	0	3.95
322	980-M3	CB-M3	794.21	CB-980	794.18	18	0.002	18	Ductile Iroi	0.012	5.04	0.52	10.3	2.16	11.95
344	944-E1	CS-E1	814.9	CB-944	813.58	44	0.03	24	CMP	0.024	21.28	10.16	47.7	6.68	12
358	CO-125	CB-1118	792.54	CB-1071	793.13	17	-0.034	12	PVC	0.01	8.56	0	0.0	0.01	12.15
360	CO-126	CB-1071	793.13	CB-1073	790.98	37	0.058	12	PVC	0.01	11.18	1.7	15.2	2.16	11.75
362	CO-127	CB-1073	790.98	CB-3003	790.22	136	0.006	12	PVC	0.01	3.47	1.69	48.7	2.16	11.75
364	CO-128	CB-3003	790.22	CB-3002	790.1	25	0.005	12	PVC	0.01	3.23	1.21	37.5	1.55	11.65
365	CO-129	CB-3002	790.1	CB-1000	789.51	565	0.001	12	PVC	0.01	1.5	2.08	138.7	2.65	11.75
377	CO-131	CS-6	776.5	CS-7	775.84	66	0.01	24	CMP	0.024	17.12	55.41	323.7	6.87	12.15
387	CO-134	CB-1344	784.13	Tee Conne	782.41	288	0.006	36	Concrete	0.013	51.57	54.22	105.1	7.67	11.95

Pipe Table

North System - Future Conditions - LID - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Upstream) (ft)	Stop-node Id	Invert (Downstream) (ft)	Length (ft)	Constructed Slope (ft/ft)	Diameter (in)	Material	Manning's n	Full Capacity (ft³/s)	Flow (Maximum) (ft³/s)	Flow / Full Flow Capacity (%)	Velocity (Maximum) (ft/s)	Time to Maximum Flow (hours)
388	CO-135	Tee Conne	782.41	CS-5	780.5	394	0.005	36	Concrete	0.013	32.9	59.84	181.9	8.46	12
389	CO-136	CB-1342	788.45	Tee Conne	782.41	17	0.363	12	PVC	0.01	27.89	5.65	20.3	7.19	12
391	CO-137	CS-8	775.65	OF-4	775.29	35	0.01		Concrete	0.013	85.81	55.35	64.5	10.14	12.15
400	1315-C1	OS-C1	809.92	CB-1315	808.78	227	0.005		Natural str	0.045	87.79	2.28	2.6	0.19	16.55
405	E2-E3	OS-E3	817.83	CS-E2	817.3	52	0.01	24	CMP	0.024	12.31	10.16	82.5	5.1	11.85
409	CO-140	CB-16	791.15	CB-972	790.3	55	0.015	12	PVC	0.01	5.76	3.99	69.3	7.44	11.95

Pipe Table

South System - Future Conditions - LID - 25-yr, 24 hr

Id	Label	Start-node Id	Invert (Upstream) (ft)	Stop-node Id	Invert (Downstream) (ft)	Length (ft)	Constructed Slope (ft/ft)	Diameter (in)	Material	Manning's n	Full Capacity (ft³/s)	Flow (Maximum) (ft³/s)	Flow / Full Flow Capacity (%)	Velocity (Maximum) (ft/s)	Time to Maximum Flow (hours)
25	CO-1	CB-1088	793.55	CB-1067	792.87	34	0.02	8	PVC	0.01	2.23	0	0.0	0	0
26	CO-2	CB-1067	792.54	CB-1065	791.32	262	0.005	12	PVC	0.01	3.16	0	0.0	0	0
27	CO-3	CB-1065	791.32	CB-1060	790.03	258	0.005	12	PVC	0.01	3.28	1.08	32.9	3.66	11.75
28	CO-4	CB-1060	789.99	CB-1058	781.51	274	0.031	12	PVC	0.01	8.15	4.65	57.1	8.7	11.95
29	CO-5	CB-1058	777.84	CB-1056	777.04	55	0.014	12	PVC	0.01	5.57	9.15	164.3	11.64	11.95
33	CO-7	CB-1056	777.04	OF-2	775.79	125	0.01	12	PVC	0.01	4.64	9.14	197.0	11.64	11.95
42	CO-8	CB-1184	789.74	CB-1183	789.33	29	0.014	12	PVC	0.01	5.52	0	0.0	0	0
43	CO-9	CB-1183	789.35	CB-1181	785.48	256	0.015	12	PVC	0.01	5.69	0	0.0	0	0
44	CO-10	CB-1181	785.44	CB-1180	784.25	116	0.01	12	PVC	0.01	4.7	0.02	0.4	0.39	14.3
45	CO-11	CB-1180	784.5	CB-996	783.78	113	0.006	12	PVC	0.01	3.69	0.02	0.5	0.9	0.15
46	CO-12	CB-996	783.69	CB-997	782.36	160	0.008	12	PVC	0.01	4.23	0.02	0.5	0.81	0
47	CO-13	CB-997	782.36	CB-998	782.18	132	0.001	12	PVC	0.01	1.71	0.02	1.2	0.87	0
48	CO-14	CB-998	782.18	CB-1057	780.71	101	0.015	12	PVC	0.01	5.59	0.02	0.4	0.72	0
49	CO-15	CB-1057	780.29	CB-1058	777.84	23	0.105	12	PVC	0.01	15.03	2.33	15.5	2.96	11.95

Stormwater Ponds

North System - Existing Conditions - 25-yr, 24 hr

Id	Label	Hydraulic Grade (Maximum) (ft)	Storage (Maximum) (gal)	Time to Maximum Hydraulic Grade (hours)	Elevation (ft)	Area (acres)	Percent Void Space (%)	Outlet Structure Type	Outlet Details	Outfall Link
398	PO-4	811.05	321,062.00	12.35	809.92	0.7	100	Weir	Rectangular	1315-C1
					810.92	0.99	100		Length 2-ft	
					811.92	1.685	100			
					812.92	1.555	100			
402	PO-E4	819.83	278,114.20	11.85	817.83	0.05	100	Culvert	CMP - Projecting	E2-E3
					818.83	0.1	100			
					819.83	1.457	100			

Eatonville Comprehensive Stormwater Plan
Sub-Basin Existing Conditions

	Summed GIS Data			Calc'd		RWB
Basin	Total Impervious Area (SF)	Total Impervious Area (Ac)		Total Pervious (Ac)	% Impervious	Total Area (Ac)
1	190870.22	4.3818		8.6882	33.53%	13.0700
2	169314.49	3.8869		11.5931	25.11%	15.4800
3	333247.12	7.6503		24.2097	24.01%	31.8600
4	33751.42	0.7748		2.1752	26.27%	2.9500
5a	224756.07	5.1597		9.7503	34.61%	14.9100
5b	180095.91	4.1344		6.1656	40.14%	10.3000
6	162176.58	3.7231		4.9769	42.79%	8.7000
7a	16442.51	0.3775		1.0725	26.03%	1.4500
7b	119383.98	2.7407		2.5593	51.71%	5.3000
8	60256.12	1.3833		11.2167	10.98%	12.6000
9	57897.57	1.3291		4.6709	22.15%	6.0000
10	10369.65	0.2381		1.3319	15.16%	1.5700
11	16813.27	0.3860		2.1540	15.20%	2.5400
1217	228115.46	5.2368		12.4732	29.57%	17.7100
13	85897.48	1.9719		1.3281	59.76%	3.3000
14a	135023.34	3.0997		1.6403	65.39%	4.7400
14b	50090.18	1.1499		1.1801	49.35%	2.3300
15a	66206.91	1.5199		1.8201	45.51%	3.3400
15b	85127.30	1.9543		1.1157	63.66%	3.0700
15c	83869.84	1.9254		1.1146	63.34%	3.0400
15d	127960.61	2.9376		2.6824	52.27%	5.6200
16a	99274.43	2.2790		1.8510	55.18%	4.1300
16b	118504.42	2.7205		1.2595	68.35%	3.9800
16c	238243.94	5.4693		1.5407	78.02%	7.0100
18a	45800.36	1.0514		0.2586	80.26%	1.3100
18b	182252.59	4.1839		0.6961	85.74%	4.8800
18c	52173.90	1.1977		1.0423	53.47%	2.2400
18d	79953.04	1.8355		3.2845	35.85%	5.1200
19a	27598.81	0.6336		1.7064	27.08%	2.3400
19b	32873.43	0.7547		4.2253	15.15%	4.9800
19c	131480.54	3.0184		5.3916	35.89%	8.4100
20a	54754.21	1.2570		1.6130	43.80%	2.8700
20b	69682.48	1.5997		2.6403	37.73%	4.2400
21	542938.90	12.4642		6.5858	65.43%	19.0500
22a	92427.42	2.1218		7.0782	23.06%	9.2000
22b	139151.64	3.1945		4.0055	44.37%	7.2000
22c	47122.68	1.0818		7.5582	12.52%	8.6400
23	188827.00	4.3349		3.1651	57.80%	7.5000
24	91129.46	2.0920		11.4980	15.39%	13.5900
25a	495794.01	11.3819		39.3181	22.45%	50.7000
25b	466939.50	10.7195		17.0805	38.56%	27.8000
26	838949.33	19.2596		55.3404	25.82%	74.6000
27	572737.19	13.1482		51.8518	20.23%	65.0000

	Existing Conditions WWHM Inputs									
Basin	% B	B, Lawn	Slope	%D	D, Lawn	Slope	Impervious Flat	Impervious Mod	Impervious Steep	Water
1	38.33%	3.3302	Flat	61.67%	5.3580	Steep	1.6795		2.7022	
2	23.39%	2.7116	Flat	76.61%	8.8815	Steep	0.9092		2.9778	
3	0.16%	0.0387	Mod	99.28%	24.0354	Mod		5.3459		2.4400
4	20.68%	0.4498	Flat	79.32%	1.7253	Flat	0.7748			
5a	29.51%	2.8773	Flat	70.49%	6.8730	Flat	5.1597			
5b	100%	6.1656	Flat	0%	0.0000		4.1344			
6	100%	4.9769	Flat		0.0000		3.7231			
7a	24.14%	0.2589	Steep	75.86%	0.8136	Steep			0.3775	
7b	100%	2.5593	Flat		0.0000		2.7407			
8		0.0000		100%	11.2167	Mod		1.3833		
9		0.0000		100%	4.6709	Mod		1.3291		
10	27.39%	0.3648	Steep	72.61%	0.9671	Steep			0.2381	
11	14.17%	0.3052	Steep	85.83%	1.8488	Steep			0.3860	
1217	30.77%	3.8380	Flat	69.23%	8.6352	Steep	1.6114		3.6254	
13	100%	1.3281	Flat		0.0000		1.9719			
14a	100%	1.6403	Flat		0.0000		3.0997			
14b	100%	1.1801	Flat		0.0000		1.1499			
15a	100%	1.8201	Flat		0.0000		1.5199			
15b	100%	1.1157	Flat		0.0000		1.9543			
15c	100%	1.1146	Flat		0.0000		1.9254			
15d	100%	2.6824	Flat		0.0000		2.9376			
16a	100%	1.8510	Flat		0.0000		2.2790			
16b	100%	1.2595	Flat		0.0000		2.7205			
16c	100%	1.5407	Flat		0.0000		5.4693			
18a	100%	0.2586	Flat		0.0000		1.0514			
18b		0.0000		100%	0.6961	Flat	4.1839			
18c		0.0000		100%	1.0423	Flat	1.1977			
18d	35.16%	1.1548	Flat, D	64.84%	2.1297	Steep	0.6454		1.1901	
19a		0.0000		100%	1.7064	Steep			0.6336	
19b		0.0000		100%	4.2253	Steep			0.7547	
19c		0.0000		100%	5.3916	Flat	3.0184			
20a	29.78%	0.4804	Flat	70.22%	1.1327	Flat	1.2570			
20b	29.78%	0.7863	Flat	70.22%	1.8540	Flat	1.5997			
21	18.90%	1.2447	Flat	81.10%	5.3411	Flat	12.4642			
22a	100%	7.0782	Flat		0.0000		2.1218			
22b	100%	4.0055	Flat		0.0000		3.1945			
22c	81.94%	6.1932	Flat	18.06%	1.3650	Flat	1.0818			
23	100%	3.1651	Flat		0.0000		4.3349			
24	40.77%	4.6877	Flat	59.23%	6.8102	Flat	2.0920			
25a	100%	39.3181	Flat		0.0000		11.3819			
25b	11.41%	1.9489	Flat	88.59%	15.1317	Flat	10.7195			
26		0.0000		100%	55.3404	Mod		19.2596		
27		0.0000		100%	51.8518	Flat	13.1482			

Appendix F

Project Descriptions & Cost Estimates

Town of Eatonville SWM Plan Update
CIP Analysis Write-Up
PACE Engineers, Inc.
10-Jan 13 Updated 2-1-13
Prepared by C. Rhinehart
Reviewed by J. Christofferson

This brief memo provides the background information on the development of Tasks 6.1 and 6.2 of PACE Engineers Inc, scope of work for the Eatonville SWM Plan Update. The purposes of these two tasks are to identify projects to resolve historic drainage issues and improve water quality with Low Impact Development (LID) technics, as feasible.

Table 6.2.1

The 2003 Stormwater Plan (2003 Plan) by RW Beck was reviewed to determine how 2003 drainage problems could be mitigated with Low Impact Development Best Management Practices (BMPs) to facilitate the Town's goal of infiltrating stormwater where feasible to address drainage problems. Hydraulic modeling completed by AHBL in 2013 confirmed most of these problems identified in the 2003 Plan and uncovered several additional flooding and conveyance capacity problems. This analysis and corresponding general opportunities for LID is captured in Table 6.1. Each column of the table is summarized below.

2003 DP # and Location lists the number and location per the 2003 Plan.

Flood or Conveyance Problem Per 2013 Model: Comparison was made to 2013 storm water modeling by ABHL for the future 25-year 24-hour storm at future built out condition. Flooding at catchbasins and inadequate pipe capacity are noted as 'Y' in those respective columns.

Undersized Ditch notes where ditch capacity is inadequate to convey flows without overtopping.

No Existing Conveyance is noted where no formal drainage infrastructure exists. (Such subbasin areas contribute to downstream flows, but have no conveyance modeling results.)

CB # and **Flood Depth at CB** lists the severity of flooding at the catchbasin noted by depth (less than 3 inches; 3 to 6 inches; more than 6 inches) by on the results of the AHBL 2013 modeling

Soil Type/Depth to GW or Impervious Layer: Two soil types are found within the study area and are identified for each problem. K, 18-30 represents Kapowsin gravelly loam, a soil with minimal infiltration potential and depth to groundwater of only 18 to 30 inches (insufficient for LID BMPs). B>80 is Barneston gravelly coarse loamy sand, a soil with high infiltration potential and depth exceeding 80 inches, hence ideal for LID BMPs. S, 11-16 represents Skamman silt loam, a shallow soil with low infiltration potential and no LID opportunity.

Potential LID BMPs and **Up Basin Opportunities for Dispersed LID** Typical locations for LID BMPs were sought to address the drainage problems based on subbasin boundaries, existing infrastructure, flows, and soils information provided by others. Locations in the upper reaches of each subbasin are preferable in order to manage runoff close to where rain falls. Dispersed LID is problematic where soils are Kapowsin on some slopes. Where feasible, potential LID BMPS are listed, as well as comments on dispersed LID in the subbasin, based on factors such as contributing subbasin size, soils and slopes.

Proximity to Public Site The proximity of problem areas and the conveyance system to public property is noted. These include linear right of way, a traffic island, and several small to large sized parcels.

Road Type The adjacent road is identified as residential or arterial, as a potential indicator of relative public safety hazard.

Relative Infiltration Potential The relative volume of stormwater which could be infiltrated in a problem subbasin is noted, based on soil type, available areas, and size of subbasin (size of subbasin is assume to represent relative runoff volume, given that the ratio of pervious to impervious surfaces is fairly consistent in the subbasins studied.

Conventional Solution Where LID solutions are not feasible, a conventional engineering solution such as a pipe to downstream conveyance is listed.

2013 Capital Improvement Program (CIP) Project to Mitigate DP lists the projects with potential to mitigate the drainage problem because the project involves dispersed LID BMP opportunities within the basin, or the project is located up stream of a problem area.

Summary of Analysis of Table 6.1: The 2003 Plan's CIP project list includes 15 drainage problems which were proposed to be addressed as 14 capital projects. This review indicates that at least nine of those problems can be resolved with LID BMPs, and that eight are proposed to be resolved with conventional engineering solutions. Two have the potential to benefit from a combination, such as increasing ditch capacity by widening and/or bioinfiltration.

Background on development of Task 6.3: Analysis to maximize stormwater infiltration through use of LID BMPs
Based on analysis including existing subbasin flows, the presence of soils conducive to infiltration, slopes, and available public space, thirteen potential new LID projects were identified. The projects were identified with the goal of maximizing stormwater infiltration within the project area, with the long term goal of increasing groundwater flow and stream flows in the Mashel River. This analysis is tabulated in Table 6.3. The LID solutions are relatively easly to maintainBMPs: dry wells, infiltration trenches, bioinfiltration swales, and rain gardens. Where the public aesthetic has more importance, bioinfiltration swales or rain gardens can provide an added aesthetic amenity.

Table 6.2.2
Contributing Basins are the upstream basins which can physically be routed to the LID BMP based on topography.

Location is the approximate location of the BMP.

Associated CBs are those closest to the BMP inlet, or otherwise proposed for modification.

Drainage Problem Mitigated are the drainage problems identified in the 2003 Plan or the 2013 AHBL modeling which could be relieved by the LID project. Although flood relief is not a specific driver of this analysis, reducing demand on conveyance capacity will provide some local flood relief.

Public Property identifies right of way or Town facility occupying the property, where known.

LID Options are selected based largely on available space, such as the small footprint required for wetwells. Bioinfiltration swales are shown where available space is narrow, such as right of way, and aesthetics may be important. Other favorable right of way BMPs include infiltration trenches.

The **Relative infiltration volume** is a qualitative assessment of how much stormwater could be infiltrated in a problem subbasin, based on soil type, available areas, and size of subbasin (size of subbasin is assumed to represent relative runoff volume, given that the ratio of pervious to impervious surfaces is fairly consistent in the subbasins studied). Potential is rated Low, Medium, or High.

Description of BMP provides an estimated quantity to describe the BMP for cost comparison purposes.

Shallow Groundwater Destination per Golder Assoc. Figure 4 of the Golder Report provides the location of the CIP per the identified watershed on this map figure. Where further research is needed in the Town Center to confirm the watershed boundary, “groundwater divide” is noted.

With the opportunities presented by infiltrative soils, right of way available, favorable slopes, and existing infrastructure, thirteen potential LID projects were developed with potential to significantly increase groundwater flows. These projects range from very small, such as a drywell which could resolve a localized flooding issue, to major project infrastructure opportunities associated with street reconstruction, which could include relocating stormwater trunk lines and providing a streetscape dominated by LID BMPs.

Summary of CIP Cost

Project Number	Project Name	Opinion of Cost Total
CIP #1 - LID Project B	Bioinfiltration Trench East of Madison Ave S.	$ 120,000
CIP #2 - LID Project I	Inflitration Pond at Sewage Lagoon	$ 690,000
CIP #3 - LID Project E	Green Street and Bioinfiltration Trench at Center St. #1	$ 540,000
CIP #4 - LID Project J	Green Street and Bioinfiltration Trench at Center St. #2	$ 1,780,000
CIP #5 - LID Project H	Drywell at Rainier Ave S	$ 90,000
CIP #6 - LID Project M	Green Street and Bioinfiltration Trench at Pennsylvania Ave N	$ 530,000
TOTAL		**$ 3,750,000**

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Eatonville SWM Plan - Bioinfiltration Trench East of Madison Ave S.
CHECK BY: JC of PACE Engineers
Project ID: CIP #1 - LID Project B
BY: CR of PACE Engineers
DATE: 4/24/2013

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Construction Elements					
1	Pavement Removal	320	SF	$ 7.00	$ 2,240
2	Pavement Restoration	320	SF	$ 25.00	$ 8,000
3	12" LCPE	80	LF	$ 45.00	$ 3,600
4	Type 1 Catch Basin	2	EA	$ 1,500.00	$ 3,000
5	Bioinfiltration swale earthwork	400	LF	$ 40.00	$ 16,000
6	Bioinfiltration amended soil	60	CY	$ 40.00	$ 2,400
7	Mulch, 3"	135	CY	$ 12.00	$ 1,620
8	Bioinfiltration swale plantings	3,600	SF	$ 2.00	$ 7,200
9	Overflow	2	EA	$ 200.00	$ 400
				Subtotal Construction Elements	**$ 44,460**
Required Ancillary Items					
10	DEWATERING		10%		$ 4,446
11	EROSION & SEDIMENTATION CONTROL		5%	(see note 3)	$ 2,223
12	TRAFFIC CONTROL		5%	(see note 4)	$ 2,223
13	CONTINGENCY		30%		$ 13,338
				Subtotal Ancillary	$ 22,230
				Subtotal Construction + Ancillary	**$ 66,690**
Mobilization					
14	MOBILIZATION		10%		$ 6,669
				Subtotal Construction + Ancillary	**$ 73,359**
Tax/Engineering/Management/Permitting					
15	EATONVILLE SALES TAX		7.9%		$ 5,795
16	ENGINEERING/LEGAL/ADMIN/UTILITY COORDINATION		25%	(see note 7)	$ 18,340
17	CONSTRUCTION MANAGEMENT		20%		$ 14,672
18	PERMITTING		10%		$ 7,336
19	LAND AND RIGHT OF WAY		0%	(see note 6)	$ -
				Subtotal	$ 46,143
				Subtotal Construction + Ancillary + Mobilization + Tax/Engineering/Management/Permitting	**$ 119,502**
2013 Dollars				**Total Planning Level Construction Cost Opinion (Rounded)**	**$ 120,000**

Notes:

1. The above cost opinion is in 2013 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material
3. Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
4. Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
5. Pipe costs includes excavation and bedding.
6. Right of way acquisition is assumed to not be required.
7. Utility Conflicts have not been researched.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Eatonville SWM Plan - Infiltration Pond at Sewage Lagoon
CHECK BY: JC of PACE Engineers
Project ID: CIP #2 - LID Project I
BY: CR of PACE Engineers
DATE: 4/24/2013

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Construction Elements					
1	18" LCPE	100	LF	$ 55.00	$ 5,500
2	Type 2 Catch Basin	4	EA	$ 2,200.00	$ 8,800
3	Bioinfiltration swale earthwork	200	LF	$ 40.00	$ 8,000
4	Bioinfiltration amended soil	30	CY	$ 40.00	$ 1,200
5	Mulch, 3"	75	CY	$ 12.00	$ 900
6	Bioinfiltration swale plantings	1,800	SF	$ 2.00	$ 3,600
7	Connection to existing structures	2	EA	$ 1,000.00	$ 2,000
8	Existing lagoon maintenance: removal of sediments	1	LS	$ 200,000.00	$ 200,000
9	Manhole Diversion/control structures	1	LS	$ 20,000.00	$ 20,000
				Subtotal Construction Elements	**$ 250,000**
Required Ancillary Items					
10	DEWATERING		10%		$ 25,000
11	EROSION & SEDIMENTATION CONTROL		10%	(see note 3)	$ 25,000
12	TRAFFIC CONTROL		2%	(see note 4)	$ 5,000
13	CONTINGENCY		30%		$ 75,000
				Subtotal Ancillary	$ 130,000
				Subtotal Construction + Ancillary	**$ 380,000**
Mobilization					
14	MOBILIZATION		10%		$ 38,000
				Subtotal Construction + Ancillary	**$ 418,000**
Tax/Engineering/Management/Permitting					
15	EATONVILLE SALES TAX		7.9%		$ 33,022
16	ENGINEERING/LEGAL/ADMIN/UTILITY COORDINATION		25%	(see note 7)	$ 104,500
17	CONSTRUCTION MANAGEMENT		20%		$ 83,600
18	PERMITTING		10%		$ 41,800
19	LAND AND RIGHT OF WAY		0%	(see note 6)	$ -
				Subtotal	$ 262,922
				Subtotal Construction + Ancillary + Mobilization + Tax/Engineering/Management/Permitting	**$ 680,922**
2013 Dollars				**Total Planning Level Construction Cost Opinion (Rounded)**	**$ 690,000**

Notes:

1. The above cost opinion is in 2013 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material
3. Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions. The Erosion & Sediment Control contingency was increased to 10% due to the close proximity of this project to the Mashel River.
4. Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
5. Pipe costs includes excavation and bedding.
6. Right of way acquisition is assumed to not be required.
7. Utility Conflicts have not been researched.
8. Management and disposal of hazardous materials may be needed and is not included.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: **Eatonville SWM Plan - Green Street and Bioinfiltration Trench at Center St. #1**
CHECK BY: **JC of PACE Engineers**
Project ID: **CIP #3 - LID Project E**
BY: **CR of PACE Engineers**
DATE: **4/24/2013**

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Construction Elements					
1	Pavement Removal	2,170	SY	$ 7.00	$ 15,190
2	Portland Cement Curb and gutter	1,200	LF	$ 23.00	$ 27,600
3	Portland Cement Sidewalk	670	SY	$ 30.00	$ 20,100
4	Portland Cement ADA Ramp	4	EA	$ 1,000.00	$ 4,000
5	Pavement Restoration	2,170	SY	$ 40.00	$ 86,800
6	12" LCPE	100	LF	$ 45.00	$ 4,500
7	Type 1 Catch Basin	4	EA	$ 1,500.00	$ 6,000
8	Bioinfiltration swale earthwork	400	LF	$ 40.00	$ 16,000
9	Bioinfiltration amended soil	60	CY	$ 40.00	$ 2,400
10	Mulch, 3"	135	CY	$ 12.00	$ 1,620
11	Bioinfiltration swale plantings	3,600	SF	$ 2.00	$ 7,200
12	Overflow	3	EA	$ 200.00	$ 600
13	Connection to existing structures	2	EA	$ 1,000.00	$ 2,000
				Subtotal Construction Elements	**$ 194,010**
Required Ancillary Items					
14	DEWATERING		10%		$ 19,401
15	EROSION & SEDIMENTATION CONTROL		5%	(see note 3)	$ 9,701
16	TRAFFIC CONTROL		10%	(see note 4)	$ 19,401
17	CONTINGENCY		30%		$ 58,203
				Subtotal Ancillary	$ 106,706
				Subtotal Construction + Ancillary	**$ 300,716**
Mobilization					
18	MOBILIZATION		10%		$ 30,072
				Subtotal Construction + Ancillary	**$ 330,787**
Tax/Engineering/Management/Permitting					
19	EATONVILLE SALES TAX		7.9%		$ 26,132
20	ENGINEERING/LEGAL/ADMIN/UTILITY COORDINATION		25%	(see note 7)	$ 82,697
21	CONSTRUCTION MANAGEMENT		20%		$ 66,157
22	PERMITTING		10%		$ 33,079
23	LAND AND RIGHT OF WAY		0%	(see note 8)	$ -
				Subtotal	$ 208,065
				Subtotal Construction + Ancillary + Mobilization + Tax/Engineering/Management/Permitting	**$ 538,852**
2013 Dollars				**Total Planning Level Construction Cost Opinion (Rounded)**	**$ 540,000**

Notes:

1. The above cost opinion is in 2013 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material
3. Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
4. Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
5. Pipe costs includes excavation and bedding.
6. Pavement restoration includes 2" CSTC, 6" CSBC, and 3 " ACP
7. Utility Conflicts have not been researched.
8. Right of way acquisition is assumed to not be required.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Eatonville SWM Plan - Green Street and Bioinfiltration Trench on Center St. #2**	**CHECK BY:**	**JC of PACE Engineers**		
Project ID:	**CIP #4 - LID Project J**				
BY:	**CR of PACE Engineers**	**DATE:**	**4/24/2013**		

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Construction Elements					
1	Pavement Removal	5,000	SY	$ 7.00	$ 35,000
2	Portland Cement Curb and gutter	3,000	LF	$ 23.00	$ 69,000
3	Portland Cement Sidewalk	1,670	SY	$ 30.00	$ 50,100
4	Portland Cement ADA Ramp	20	EA	$ 1,000.00	$ 20,000
5	Pavement Restoration	5,000	SY	$ 40.00	$ 200,000
6	12" LCPE	300	LF	$ 45.00	$ 13,500
7	36" LCPE	1,000	LF	$ 150.00	$ 150,000
8	Type 1 Catch Basin	12	EA	$ 1,500.00	$ 18,000
9	Type 2 Catch Basin, 54 inch	7	EA	$ 2,800.00	$ 19,600
10	Bioinfiltration swale earthwork	800	LF	$ 40.00	$ 32,000
11	Bioinfiltration amended soil	120	CY	$ 40.00	$ 4,800
12	Mulch, 3"	270	CY	$ 12.00	$ 3,240
13	Bioinfiltration swale plantings	7,200	SF	$ 2.00	$ 14,400
14	Overflow	12	EA	$ 200.00	$ 2,400
15	Connection to existing structures	8	EA	$ 1,000.00	$ 8,000
					$ 640,040
Required Ancillary Items					
16	DEWATERING		10%		$ 64,004
17	EROSION & SEDIMENTATION CONTROL		5%	(see note 3)	$ 32,002
18	TRAFFIC CONTROL		10%	(see note 4)	$ 64,004
19	CONTINGENCY		30%		$ 192,012
				Subtotal Ancillary	$ 352,022
				Subtotal Construction + Ancillary	**$ 992,062**
Mobilization					
20	MOBILIZATION		10%		$ 99,206
				Subtotal Construction + Ancillary	**$ 1,091,268**
Tax/Engineering/Management/Permitting					
21	EATONVILLE SALES TAX		7.9%		$ 86,210
22	ENGINEERING/LEGAL/ADMIN/UTILITY COORDINATION		25%	(see note 7)	$ 272,817
23	CONSTRUCTION MANAGEMENT		20%		$ 218,254
24	PERMITTING		10%		$ 109,127
25	LAND AND RIGHT OF WAY		0%	(see note 8)	$ -
				Subtotal	$ 686,408
				Subtotal Construction + Ancillary + Mobilization + Tax/Engineering/Management/Permitting	**$ 1,777,676**
2013 Dollars				**Total Planning Level Construction Cost Opinion (Rounded)**	**$ 1,780,000**

Notes:

1. The above cost opinion is in 2013 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material
3. Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
4. Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
5. Pipe costs includes excavation and bedding.
6. Pavement restoration includes 2" CSTC, 6" CSBC, and 3 " ACP
7. Utility Conflicts have not been researched.
8. Right of way acquisition is assumed to not be required.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Eatonville SWM Plan - Drywell at Rainier Ave S
Project ID: CIP #5 - LID Project H
BY: CR of PACE Engineers
CHECK BY: JC of PACE Engineers
DATE: 4/24/2013

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Construction Elements					
1	Pavement Removal	300	SF	$ 7.00	$ 2,100
2	Pavement Restoration	300	SF	$ 25.00	$ 7,500
3	12" LCPE	80	LF	$ 45.00	$ 3,600
4	Type 1 Catch Basin	3	EA	$ 1,500.00	$ 4,500
5	72" Diameter Dry Well, 6 feet deep	6	VF	$ 1,500.00	$ 9,000
6	Shoring	1	LS	$ 2,000.00	$ 2,000
7	Overflow	1	EA	$ 1,500.00	$ 1,500
				Subtotal Construction Elements	**$ 30,200**
Required Ancillary Items					
8	DEWATERING		10%	(see note 9)	$ 3,020
9	EROSION & SEDIMENTATION CONTROL		5%	(see note 3)	$ 1,510
10	TRAFFIC CONTROL		5%	(see note 4)	$ 1,510
11	CONTINGENCY		30%		$ 9,060
				Subtotal Ancillary	$ 15,100
				Subtotal Construction + Ancillary	**$ 45,300**
Mobilization					
12	MOBILIZATION		10%		$ 4,530
				Subtotal Construction + Ancillary	**$ 49,830**
Tax/Engineering/Management/Permitting					
13	EATONVILLE SALES TAX		7.9%		$ 3,937
14	ENGINEERING/LEGAL/ADMIN/UTILITY COORDINATION		25%	(see note 7)	$ 12,458
15	CONSTRUCTION MANAGEMENT		20%		$ 9,966
16	PERMITTING		10%		$ 4,983
17	LAND AND RIGHT OF WAY		0%	(see note 8)	$ -
				Subtotal	$ 31,343
				Subtotal Construction + Ancillary + Mobilization + Tax/Engineering/Management/Permitting	**$ 81,173**
2013 Dollars				**Total Planning Level Construction Cost Opinion (Rounded)**	**$ 90,000**

Notes:

1. The above cost opinion is in 2013 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material
3. Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
4. Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
5. Pipe costs includes excavation and bedding.
6. Pavement restoration includes 2" CSTC, 6" CSBC, and 3 " ACP
7. Utility Conflicts have not been researched.
8. Right of way acquisition is assumed to not be required.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Eatonville SWM Plan - Green Street and Bioinfiltration Trench at Pennsylvania Ave N**	**CHECK BY:**	**JC of PACE Engineers**		
Project ID:	**CIP #6 - LID Project M**				
BY:	**CR of PACE Engineers**	**DATE:**	**4/24/2013**		

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Construction Elements					
1	Pavement Removal	2,000	SY	$ 7.00	$ 14,000
2	Portland Cement Curb and gutter	1,200	LF	$ 23.00	$ 27,600
3	Portland Cement Sidewalk	670	SY	$ 30.00	$ 20,100
4	Portland Cement ADA Ramp	4	EA	$ 1,000.00	$ 4,000
5	Pavement Restoration	2,000	SY	$ 40.00	$ 80,000
6	12" LCPE	100	LF	$ 45.00	$ 4,500
7	Type 1 Catch Basin	4	EA	$ 1,500.00	$ 6,000
8	Bioinfiltration swale earthwork	400	LF	$ 40.00	$ 16,000
9	Bioinfiltration amended soil	60	CY	$ 40.00	$ 2,400
10	Mulch, 3"	135	CY	$ 12.00	$ 1,620
11	Bioinfiltration swale plantings	3,600	SF	$ 2.00	$ 7,200
12	Overflow	4	EA	$ 200.00	$ 800
13	Connection to existing structures	4	EA	$ 1,000.00	$ 4,000
					$ 188,220
Required Ancillary Items					
14	DEWATERING		10%		$ 18,822
15	EROSION & SEDIMENTATION CONTROL		5%	(see note 3)	$ 9,411
16	TRAFFIC CONTROL		10%	(see note 4)	$ 18,822
17	CONTINGENCY		30%		$ 56,466
				Subtotal Ancillary	$ 103,521
				Subtotal Construction + Ancillary	**$ 291,741**
Mobilization					
18	MOBILIZATION		10%		$ 29,174
				Subtotal Construction + Ancillary	**$ 320,915**
Tax/Engineering/Management/Permitting					
19	EATONVILLE SALES TAX		7.9%		$ 25,352
20	ENGINEERING/LEGAL/ADMIN/UTILITY COORDINATION		25%	(see note 7)	$ 80,229
21	CONSTRUCTION MANAGEMENT		20%		$ 64,183
22	PERMITTING		10%		$ 32,092
23	LAND AND RIGHT OF WAY		0%	(see note 8)	$ -
				Subtotal	$ 201,856
				Subtotal Construction + Ancillary + Mobilization + Tax/Engineering/Management/Permitting	**$ 522,771**
2013 Dollars				**Total Planning Level Construction Cost Opinion (Rounded)**	**$ 530,000**

Notes:

1. The above cost opinion is in 2013 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material
3. Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
4. Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
5. Pipe costs includes excavation and bedding.
6. Pavement restoration includes 2" CSTC, 6" CSBC, and 3 " ACP
7. Utility Conflicts have not been researched.
8. Right of way acquisition is assumed to not be required.

Appendix G

Financial Information

Town of Eatonville - SWM Plan Update
Project #12521
Updated April 3, 2013
Prepared by J. Christofferson of PACE Engineers, Inc.

Sample Stormwater Management Program Elements	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
SWM Element #1 - Public Education and Outreach (4)	**$1,910**	**$2,197**	**$2,514**	**$2,847**	**$3,197**	**$3,564**	**$3,950**	**$4,355**	**$4,780**	**$5,226**
Develop a Public Outreach Brochure on the Low Impact Development										
SWM Element #2 - Public Involvement and Participation										
Develop and Maintain a Stormwater Program Website										
SWM Element #3 - Illicit Discharge Detection and Elimination	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Establish a Spill Response Hotline										
SWM Element #4 - Controlling Runoff from New Development, Redevelopment, and Construction Sites	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Conduct Stormwater Facility Construction Inspections										
SWM Element #5 - Municipal Operations and Maintenance (4)	**$61,024**	**$70,144**	**$80,219**	**$90,797**	**$101,904**	**$113,567**	**$125,812**	**$138,670**	**$152,171**	**$166,347**
Storm Drain Tools/Minor Equipment (2013 Budget Expenditure, Budget Line Item)	$50	$53	$55	$58	$61	$64	$67	$70	$74	$78
Storm Drain Repairs & Maintenance (2013 Budget Expenditure, Budget Line Item)	$500	$525	$551	$579	$608	$638	$670	$704	$739	$776
Funding Available for Equipment (to buy or rent)	*$1,474*	*$7,617*	*$14,565*	*$21,860*	*$29,521*	*$37,564*	*$46,010*	*$54,878*	*$64,189*	*$73,966*
New O&M Staff Person Salary and Benefits (1 FTE)	*$59,000*	*$61,950*	*$65,048*	*$68,300*	*$71,715*	*$75,301*	*$79,066*	*$83,019*	*$87,170*	*$91,528*
Funds avaiable for additional O&M Activities (excluding previously budgeted items) (7)	*$60,474*	*$69,567*	*$79,612*	*$90,160*	*$101,236*	*$112,865*	*$125,075*	*$137,897*	*$151,359*	*$165,494*
SWM Element #6 - Total Maximum Daily Load Allocations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Not applicable at this time										
SWM Element #7 - Monitoring	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Perform BMP Effectiveness Monitoring on LID Facilities										
SWM Element #8 - Reporting	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Maintain Records of all SWM Program Activities each Year										
SWM Element #9 - Capital Improvement Program										
Storm Drain Improvements (Budget Expenditure)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Design and Construction Stormwater CIP Projects identified in the SWM Plan Update	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SWM Element #10 - Additional Activities	**$48,535**	**$51,590**	**$54,282**	**$57,110**	**$60,079**	**$63,196**	**$66,469**	**$69,905**	**$73,514**	**$77,303**
New/Additional Program Overhead Costs (4)	$1,273	$1,465	$1,676	$1,898	$2,131	$2,376	$2,633	$2,903	$3,186	$3,484
Storm Legal Fees (2013 Budget Expenditure, Budget Line Item)	$1,786	$1,875	$1,969	$2,068	$2,171	$2,279	$2,393	$2,513	$2,639	$2,771
Storm Audit Costs (2013 Budget Expenditure, Budget Line Item)	$470	$494	$518	$544	$571	$600	$630	$661	$694	$729
Storm Drainage Utility Services (2013 Budget Expenditure, Budget Line Item)	$656	$689	$723	$759	$797	$837	$879	$923	$969	$1,018
Storm Drain Salaries and Wages (2013 Budget Expenditure, Budget Line Item)	$18,000	$18,900	$19,845	$20,837	$21,879	$22,973	$24,122	$25,328	$26,594	$27,924
Storm Drain Personnel Benefits (2013 Budget Expenditure, Budget Line Item)	$6,650	$6,983	$7,332	$7,698	$8,083	$8,487	$8,912	$9,357	$9,825	$10,316
Storm Drain Operation Supplies (2013 Budget Expenditure, Budget Line Item)	$1,000	$1,050	$1,103	$1,158	$1,216	$1,276	$1,340	$1,407	$1,477	$1,551
Storm Drain Professional Services (2013 Budget Expenditure, Budget Line Item)	$3,000	$3,150	$3,308	$3,473	$3,647	$3,829	$4,020	$4,221	$4,432	$4,654
Storm Drain Communications (2013 Budget Expenditure, Budget Line Item)	$3,000	$3,150	$3,308	$3,473	$3,647	$3,829	$4,020	$4,221	$4,432	$4,654
Storm Drain Insurance (2013 Budget Expenditure, Budget Line Item)	$9,000	$9,450	$9,923	$10,419	$10,940	$11,487	$12,061	$12,664	$13,297	$13,962
Storm Drain Miscellaneous (2013 Budget Expenditure, Budget Line Item)	$500	$525	$551	$579	$608	$638	$670	$704	$739	$776
Storm Excise Tax (2013 Budget Expenditure, Budget Line Item)	$3,200	$3,360	$3,528	$3,704	$3,890	$4,084	$4,288	$4,503	$4,728	$4,964
Storm Training (2013 Budget Expenditure, Budget Line Item)	$0	$500	$500	$500	$500	$500	$500	$500	$500	$500
Total Budgeted Expenditures (2) = Sum of Budget Line Items	**$47,812**	**$50,703**	**$53,213**	**$55,848**	**$58,616**	**$61,522**	**$64,573**	**$67,776**	**$71,140**	**$74,672**
Remaining Available Revenue = Total Budgeted Expenditures(3) - Total Proposed Revenue	**$63,657**	**$73,228**	**$83,802**	**$94,906**	**$106,564**	**$118,805**	**$131,658**	**$145,154**	**$159,325**	**$174,204**
Total Proposed SWM Program Expenditures (8)	**$111,469**	**$123,931**	**$137,015**	**$150,754**	**$165,180**	**$180,327**	**$196,231**	**$212,931**	**$230,465**	**$248,876**

Customer Classes Proposed Monthly Rates (6)										
Large Commercial (52 Users)	$22.80	$24.44	$26.16	$27.97	$29.87	$31.86	$33.96	$36.15	$38.46	$40.88
Medium Commercial (23 Users)	$15.30	$16.57	$17.89	$19.29	$20.75	$22.29	$23.90	$25.60	$27.38	$29.25
Apartments (100 Users)	$4.00	$4.70	$5.44	$6.21	$7.02	$7.87	$8.76	$9.70	$10.68	$11.72
Small Commercial (89 Users)	$7.60	$8.48	$9.40	$10.37	$11.39	$12.46	$13.59	$14.76	$16.00	$17.30
Residential (872 Users)	$7.60	$8.48	$9.40	$10.37	$11.39	$12.46	$13.59	$14.76	$16.00	$17.30
Low Income (12 Users)	$4.00	$4.70	$5.44	$6.21	$7.02	$7.87	$8.76	$9.70	$10.68	$11.72
Total Proposed Revenue (1)	**$111,469**	**$123,931**	**$137,015**	**$150,754**	**$165,180**	**$180,327**	**$196,231**	**$212,931**	**$230,465**	**$248,876**

	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
SDP Element #5 - Municipal Operations and Maintenance FTE Table										
Adopt Maintenance Standards, Staffing Training, Keep Maintenance Records	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
Annual Inspections/Cleaning of Water Quality, Flow Control Facilities and Catch Basins	*0.40*	*0.40*	*0.40*	*0.40*	*0.40*	*0.40*	*0.40*	*0.40*	*0.40*	*0.40*
Spot Checks after Major Storm Events of Known Problem Areas	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*
Road Maintenance including street sweeping, roadside ditch mowing, and catch basin cleaning	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*
Non-Roadway Maintenance including stormwater facilities in parks and public buildings	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*
Develop and implement a SWPPP for the Maintenance Yard	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*	*0.10*
O&M FTE Total	***1.00***	***1.00***	***1.00***	***1.00***	***1.00***	***1.00***	***1.00***	***1.00***	***1.00***	***1.00***

Notes

(1) Total Proposed Revenue is the dollar amount that would be generated based on the new Proposed Monthly Rate.

(2) Total Budgeted Expenditures is the total sum of the elements in the existing budget. They are noted as an Budget Expenditure.

(3) The Remaining Revenue is calculated by the Proposed Revenue (see note 1) minus the Budgeted Expenditures (see note 2). This dollar amount is the remaining funds available to fund new program activities (see note 4).

(4) Assumed 95% of the program is spent on O&M, 3% on public education, outreach and involvement, and 2% is spent on program overhead with the 'Remaining Revenue'.

(5) Assumed a 5% increase each year over the cost identified in the 2013 Budget to account for cost of living increases. A 5% was also applied to the salary and benefits costs of the new O&M Staff person.

(6) Assumed Rate Increase of 5% + 0.50/yr. and No New Users

(7) This number was calculated based on 93% of the Remaining Revenue (see note 3) that could be used for O&M Activities.

(8) Total Proposed SWM Program Expenditures = Total Budgeted Expenditures (see note 2) + Remaining Revenue (see note 3)

Town of Eatonville - SWM Plan Update
Project #12521
Updated April 3, 2013
Prepared by J. Christofferson of PACE Engineers, Inc.
Summary Table

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
SWM Element #1 - Public Education and Outreach **SWM Element #2 - Public Involvement and Participation**	$1,910	$2,197	$2,514	$2,847	$3,197	$3,564	$3,950	$4,355	$4,780	$5,226
SWM Element #3 - Illicit Discharge Detection and Elimination	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SWM Element #4 - Controlling Runoff from New Development, Redevelopment, and Construction Sites	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SWM Element #5 - Municipal Operations and Maintenance	$61,024	$70,144	$80,219	$90,797	$101,904	$113,567	$125,812	$138,670	$152,171	$166,347
SWM Element #6 - Total Maximum Daily Load Allocations	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SWM Element #7 - Monitoring	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SWM Element #8 - Reporting	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SWM Element #9 - Capital Improvement Program	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SWM Element #10 - Additional Activities	$48,535	$51,590	$54,282	$57,110	$60,079	$63,196	$66,469	$69,905	$73,514	$77,303
Total SWM Program Expenditures	**$111,469**	**$123,931**	**$137,015**	**$150,754**	**$165,180**	**$180,327**	**$196,231**	**$212,931**	**$230,465**	**$248,876**
Total Proposed Revenue	**$111,469**	**$123,931**	**$137,015**	**$150,754**	**$165,180**	**$180,327**	**$196,231**	**$212,931**	**$230,465**	**$248,876**
Remaining	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Appendix H

Operations & Maintenance Guidance

Maintenance Checklists for
Low Impact Development Facilities
January 2013

Source: City of Santa Barbara Storm Water BMP Guidance Manual (June 2008)

1. Bioretention Inspection and Maintenance Checklist

Date: ______________________ Work Order #: ______________________

Type of Inspection: ☐ post-storm ☐ annual ☐ routine ☐ post-wet season ☐ pre-wet season

Facility: ______________________ Inspector(s): ______________________

Defect	Conditions When Maintenance is Needed	Inspection Result (0, 1, or 2)*	Date Maintenance Performed	Comments of Action(s) Taken to Resolve Issue
Appearance	Untidy			
Trash and Debris Accumulation	Trash, plant litter and dead leaves accumulated on surface.			
Vegetation	Unhealthy plants and appearance.			
Irrigation	Functioning incorrectly (if applicable).			
Inlet	Inlet pipe blocked or impeded.			
Splash Blocks	Blocks or pads correctly positioned to prevent erosion.			
Overflow	Overflow pipe blocked or broken.			
Filter media	Infiltration design rate is met (e.g., drains 36-48 hours after moderate - large storm event).			

* Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed (include WO#). Enter 2 if maintenance was performed same day.

Source: City of Santa Barbara Storm Water BMP Guidance Manual (June 2008)

2. Vegetated Swale Inspection and Maintenance Checklist

Date: ______________________ Work Order #: ______________________

Type of Inspection: ☐ post-storm ☐ annual ☐ routine ☐ post-wet season ☐ pre-wet season

Facility: ______________________ Inspector(s): ______________________

Defect	Conditions When Maintenance is Needed	Inspection Result (0, 1, or 2)*	Date Maintenance Performed	Comments of Action(s) Taken to Resolve Issue
Appearance	Untidy			
Trash and Debris Accumulation	Trash and debris accumulated in the swale.			
Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation start to take over.			
Excessive Shading	Vegetation growth is poor because sunlight does not reach swale. Evaluate vegetation suitability.			
Poor Vegetation Coverage	When vegetation is sparse or bare or eroded patches occur in more than 10% of the swale bottom. Evaluate vegetation suitability.			
Sediment Accumulation	Sediment depth exceeds 2 inches or covers more than 10% of design area.			
Standing Water	When water stands in the swale between storms and does not drain freely.			
Flow spreader or Check Dams	Flow spreader or check dams uneven or clogged so that flows are not uniformly distributed through entire swale width.			
Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks and an eroded, muddy channel has formed in the swale bottom.			
Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.			
Erosion/ Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows. Eroded or rilled side slopes.			
	Eroded or undercut inlet/outlet structures			

* Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed (include WO#). Enter 2 if maintenance was performed same day.

Source: City of Santa Barbara Storm Water BMP Guidance Manual (June 2008)

3. Vegetated Filter Strip Inspection and Maintenance Checklist

Date: ______________________ Work Order #: ______________________

Type of Inspection: ☐ post-storm ☐ annual ☐ routine ☐ post-wet season ☐ pre-wet season

Facility: ______________________ Inspector(s): ______________________

Defect	Conditions When Maintenance is Needed	Inspection Result (0, 1, or 2)†	Date Maintenance Performed	Comments of Action(s) Taken to Resolve Issue
Appearance	Untidy			
Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.			
Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.			
Excessive Shading	Grass growth is poor because sunlight does not reach swale. Evaluate grass species suitability.			
Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom. Evaluate grass species suitability.			
Erosion/Scouring	Eroded or scoured areas due to flow channelization, or higher flows.			
Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.			
Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.			

† Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed (include WO#). Enter 2 if maintenance was performed same day.

Source: City of Santa Barbara Storm Water BMP Guidance Manual (June 2008)

4. Infiltration BMP Inspection and Maintenance Checklist

Date: ______________________________ Work Order #: ______________________________

Type of Inspection: ☐ post-storm ☐ annual ☐ routine ☐ post-wet season ☐ pre-wet season

Facility: ______________________________ Inspector(s): ______________________________

Defect	Conditions When Maintenance is Needed	Inspection Result (0, 1, or 2)*	Date Maintenance Performed	Comments of Action(s) Taken to Resolve Issue
Appearance, vegetative health	Mowing and trimming vegetation is needed to prevent establishment of woody vegetation, and for aesthetic and vector reasons.			
Vegetation	Poisonous or nuisance vegetation or noxious weeds.			
	Excessive loss of turf or ground cover (if applicable).			
Trash & Debris	Trash and debris > 5 cf/1,000 sf (one standard size garbage can).			
Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.			
Erosion	Undercut or eroded areas at inlet or outlet structures.			
Sediment and Debris	Accumulation of sediment, debris, and oil/grease on surface, inflow, outlet or overflow structures.			
	Accumulation of sediment and debris, in sediment forebay and pretreatment devices.			
Water drainage rate	Standing water, or by visual inspection of wells (if available), indicates design drain times are not being achieved (i.e., within 72 hours).			
Media clogging surface layer	Lift surface layer (and filter fabric if installed) and check for media clogging with sediment (function may be able to be restored by replacing surface aggregate/filter cloth).			
Media clogging	Lift surface layer (and filter fabric if installed) and check for media clogging with sediment (partial or complete clogging which may require full replacement).			

* Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed (include WO#). Enter 2 if maintenance was performed same day.

Source: City of Santa Barbara Storm Water BMP Guidance Manual (June 2008)

5. Permeable Pavement Inspection and Maintenance Checklist

Date: ______________________ Work Order #: ______________________

Type of Inspection: ☐ post-storm ☐ annual ☐ routine ☐ post-wet season ☐ pre-wet season

Facility: ______________________ Inspector(s): ______________________

Defect	Conditions When Maintenance is Needed	Inspection Result (0, 1, or 2)*	Date Maintenance Performed	Comments of Action(s) Taken to Resolve Issue
Sediment Accumulation	Sediment is visible			
Missing gravel/sand fill	There are noticeable gaps in between pavers			
Weeds/mosses filling voids	Vegetation is growing in/on permeable pavement			
Trash and Debris Accumulation	Trash and debris accumulated on the permeable pavement.			
Dead or dying vegetation in adjacent landscaping	Vegetation is dead or dying leaving bare soil prone to erosion			
Surface clog	Clogging is evidenced by ponding on the surface			
Overflow clog	Excessive buildup of water accompanied by observation of low flow in observation well (connected to underdrain system)			
	If a surface overflow system is used, observation of an obvious clog			
Visual contaminants and pollution	Any visual evidence of oil, gasoline, contaminants or other pollutants.			
Erosion	Tributary area exhibits signs of erosion or is noticeably not completely stabilized.			
Deterioration/ Roughening	Integrity of pavement is compromised (i.e., cracks, depressions, crumbling, etc.)			
Subsurface Clog	Clogging is evidenced by ponding on the surface and is not remedied by addressing surface clogging.			

* Maintenance: Enter 0 if satisfactory, 1 if maintenance is needed (include WO#). Enter 2 if maintenance was performed same day.

Source: City of Santa Barbara Storm Water BMP Guidance Manual (June 2008)

Source: City of Santa Barbara Storm Water BMP Guidance Manual (June 2008)

Green Stormwater Operations and Maintenance Manual

Seattle Public Utilities

August 2009

Table of Contents

List of Tables

I. Overview

This manual is a summary of *routine* maintenance activities for the design of Natural Drainage System (NDS) Projects. Several *non-routine* maintenance activities are also included within this chart. The manual is divided into four service levels for the vegetation section and three service levels for the hardscape and Infrastructure section. For some design elements, the service levels are very similar.

This chart is intended to be a Maintenance Manual for scheduling and performing maintenance activities. The manual features images and descriptions for vegetation, hardscape, infrastructure, and infiltration rates. It includes NDS sites used currently in Seattle and several images from NDS projects in other municipalities. It is important to realize that *no single project includes every design element*. (That is, all the NDS portrayed in this chart will *NOT* be found within a given NDS project.) Maintenance crew coordinators need to use the relevant maintenance categories for a given project per the NDS Service Agreement.

II. How to Use This Manual

The successful use of this manual hinges on the inspection of project features, which in turn triggers the appropriate maintenance activities. To use this chart first select the desired Service Level for maintenance on an existing NDS project, then maintenance crews will inspect the system for the conditions listed in the left-hand column of the chart. Note that the desired service level may vary from project to project, based on the NDS goals, the project location, the project age (i.e. whether or not the plants have successfully established), and economic considerations. The descriptions and images for each service level may be used to help determine by visual inspection whether recommended maintenance activities, in the right-hand column, will need to be performed.

III. Contacts

Name	Phone Number	Title
Drena Donofrio	206-571-1566	GSI O&M Asset Manager
Deb Heiden	206-386-1802	Urban Ecosystems Asset Manager
Tracy Tackett	206-386-0052	GSI Program Manager

Table I. Landscape and Vegetation Manual

Service Category	Service Level A (Excellent Effort)	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service D (Poor Effort)
Aesthetics (vegetation and trash)	• **Vegetation** • Healthy and attractive • No bare spots • Plant palette is working for facility • At least 95% survival of establishing plants • **Weeds -** Little or no weeds are present • **Asthetics** • Clean, distinct edges • Vegetation confined to planted areas • No overgrown appearance/dead growth • **Mulch** • Evenly distributed & approximately 4" of arborist woodchip mulch. No evidence of erosion (stabilized surfaces) • Limited shoulder compaction • Homeowner is fully maintaining (where applicable)	• **Vegetation** • Healthy with a good appearance • Occasional bare spots • Plant palette is mostly working for facility (At least 75%) • **Weeds -** Small quantities of weeds are present • **Asthetics** • Loose edges: grass/mulch encroaching on swale or vice versa • Some vegetation overlapping into pedestrian areas • Overgrown in isolated areas with some dead material • **Mulch** • 2"-4" layer of mulch is present • Erosion likely unless maintenance improved • Some shoulder compaction • Homeowner is providing some maintenance (where applicable) • Able to achieve Level A without complete retrofit	• **Vegetation** • Poor vegetation health and appearance • Bare spots are frequent • Plant palette is not working for facility (75%-50%) • **Weeds -** Weeds common • **Asthetics** • No edges; • Surrounding vegetation spills into swale and pedestrian areas • **Mulch** • Mulch is less than 2" • Substantial eroded areas • Shoulder compaction • Homeowner is not maintaining swale (where applicable) • Unable to achieve higher service levels without complete retrofit	• **Vegetation** • Poor Planted vegetation health and appearance • Bare spots are common • Plant palette has failed Less than 50% • **Weeds** - Weeds dominant • **Asthetics** • No edges; surrounding vegetation spills into swale or vice versa • **Mulch** • Mulch is absent • Substantial eroded areas • Shoulder compaction • Homeowner is not maintaining swale (where applicable) • Unable to achieve higher service levels without complete retrofit

Service Category	Service Level A (Excellent Effort)	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service D (Poor Effort)
Special Considerations for Noxious Weeds	Zero tolerance of Class A, B, C and non-designated noxious weeds	Zero tolerance of Class A and B. Class C weeds are controlled or absent. Non-designated weeds are controlled or absent.	Zero tolerance of Class A weeds. Class B and C are controlled. Non-designated are present (Control Prog. Is minimal)	Zero tolerance of Class A weeds. Class B, C, and Non-Designated are largely uncontrolled except for public safety reasons (illegal dumping, obstructs vision)
	Link to King County Noxious Weed List			
Vegetation	Lush vegetation; excellent appearance 	Mostly healthy vegetation with good appearance 	Mostly healthy vegetation with neglected appearance 	Poorly planted vegetation health and neglected appearance 

Service Category	Service Level A (Excellent Effort)	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service D (Poor Effort)
Aesthetics	Healthy, well-maintained vegetation; excellent appearance 	Appearance is good 	Moderate appearance 	Poorly maintained appearance 
Mulch	Deep mulch layer(4"-6"), clean edges, limited compaction 	Some mulch(2"-4"), loose edges, some compaction 	Little mulch(Less than 2"), no defined edge, shoulder compaction 	No mulch present, no defined edge, shoulder compaction 

Service Category	Service Level A (Excellent Effort)	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service D (Poor Effort)
Weeds	No weedy species present 	Occasional weedy species (5-10%) 	Lots of Weedy species (10-20%) 	Weedy species predominant (More than 20%) 
Erosion and bare spots	No erosion or bare spots 	Some erosion and bare spots (0-5%) 	Substantial erosion and bare spots (5-10%) 	Completely eroded and bare spots(More than 10%) 

Table II. System Functionality

Service Category	Service Level A (Excellent Effort)	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Poor Effort)
SYSTEM FUNCTIONALITY				
Bioretention (vegetation & soils/substrate)	• **Vegetation** • 100% of swale bottom is covered with healthy, wetland vegetation • No bare spots • **Infiltration** • Soil is well aerated, no evidence of compaction • Water drains within 48 hours • **Maintenance** • No erosion, channelization or scouring • No significant sediment or debris accumulation	• **Vegetation** • At least 80% of swale bottom is covered with healthy, wetland vegetation • Minimal bare spots 10% • **Infiltration** • Some evidence of compaction (2" of mulch) • Most water drains within 24 hours, minimal long-term ponding • **Maintenance** • Some erosion, channelization or scouring • Sediment or debris accumulation does not affect the function of the facility.	• **Vegetation** • Between 60-80%of swale bottom is covered with healthy, wetland vegetation • A few bare spots 10-20% • **Infiltration** • Compacted soils (Lack of Mulch) • The presence of long-term ponding (> 72 hours) • **Maintenance** • Erosion, channelization or scouring • Sediment and debris accumulations inhibit the water quality function of the facility without affecting conveyance	• **Vegetation** • Less than 60% of swale bottom is covered with healthy, wetland vegetation • Many bare spots • **Infiltration** • Compacted soils (Lack of Mulch) • The presence of long-term ponding (> 72 hours) • **Maintenance** • Erosion, channelization or scouring • Sediment and debris accumulations inhibit the water quality and conveyance of the system
Biofiltration (vegetation & soils/substrate)	• **Vegetation** • At least 80% of swale bottom covered with healthy, uniformed fine-stemmed vegetation at least 18 - 24 inches high • No bare spots • **Maintenance** • No erosion, channelization or scouring • No ponding • No significant sediment or debris accumulation	• **Vegetation** • Between 60-80% of swale bottom covered with healthy, uniformed fine-stemmed vegetation at least 18 - 24 inches high • A few bare spots 10% • **Maintenance** • Some erosion, channelization or scouring • No ponding • Sediment and debris does not affect the function of the facility.	• **Vegetation** • Between 60-40% of swale bottom covered with healthy, uniformed fine-stemmed vegetation, of at least 18 -24 inches high • Many bare spots 10-30% • **Maintenance** • Erosion, channelization or scouring • The presence of ponding • Sediment and debris affect the water quality function of the facility with out affecting conveyance.	• **Vegetation** • Less than 40% of swale bottom covered with healthy, uniformed fine-stemmed vegetation, of at least 18 -24 inches high • Many bare spots • Maintenance • Erosion, channelization or scouring • The presence of ponding Sediment and debris accumulations inhibit the water quality and conveyance of the system

Service Category	Service Level A (Excellent Effort)	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Poor Effort)
Bioretention + biofiltration (vegetation & soils/substrate)	• At least 100% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least 18 - 24 inches high • Soil is well aerated, no evidence of vehicle compaction • No erosion, channelization or scouring • Water drains within 24 hours • No visible bare spots • Acceptable level of sediment or debris accumulation	• 80% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least 18 - 24 inches high • Some evidence of vehicle compaction (lack of mulch) • Some erosion, channelization or scouring • Most water drains within 24 hours, minimal long-term ponding • A few bare spots 10-20% • Acceptable level of sediment or debris accumulation	• Less than 80-50% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least 18 - 24 inches high • Compacted soils • Erosion, channelization or scouring • The presence of long-term ponding (> 72 hours) • Many bare spots • Significant build up of sediment or debris	• Less than 50% of swale bottom is covered with healthy, uniformed fine-stemmed wetland vegetation at least 18 - 24 inches high • Compacted soils • Erosion, channelization or scouring • The presence of long-term ponding (> 72 hours) • Many bare spots or noxious weeds/grass • Significant build up of sediment or debris
Swale bottom vegetation				

Service Category	Service Level A (Excellent Effort)	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Poor Effort)
Sediment or debris accumulation				
Conveyance (vegetation & soils/substrate)	• Healthy vegetation • No erosion, channelization or scouring • No bare spots • No build up of sediment or debris • No non-designed obstructions to flow	• Mostly healthy vegetation • Some erosion, channelization or scouring • Minimal bare spots 10-20% • Some build up of sediment or debris • Minimal non-designed obstructions to flow (over-grown vegetation, trash rack blockages)	• Some vegetation • Erosion, channelization or scouring • Many bare spots 20-40% • Significant build up of sediment or debris • Significant non-designed obstructions to flow (over-grown vegetation, trash rack blockage)	• Poor or no vegetation • Erosion, channelization or scouring • Many bare spots 40% or more • Significant build up of sediment or debris • Significant non-designed obstructions to flow (over-grown vegetation, trash rack blockage)

Table III. Hardscape Manual

Service Category	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)	Recommended Maintenance Activities
HARDSCAPE & INFRA-STRUCTURE	**Summary** • sediment Is minimal • infrastructure is always accessible • no competition between roots(/dense plant material?) and pipes • no trash is present • small accumulation of organic debris on grates or screens • limited buildup of sediment behind check dams or log weirs • no erosion or undercutting surrounding weir walls • rockery and walls are stable and secure • stormwater sedimentation structures less than ½ full (NPDES)	**Summary** • some sediment is present • infrastructure is usually accessible • some competition between roots(/dense plant material?) and pipes • small amounts of trash are present • moderate accumulation of organic debris on grates or screens • occasional large sediment deposits behind check dams or log weirs • minimal erosion and/or undercutting surrounding weir walls • occasional loose rocks; walls are secure • stormwater sedimentation structures less than ½ full (NPDES)	**Summary** • Lots of sediment buildup is observed • infrastructure is mostly inaccessible • Significant competition between roots(/dense plant material?) and pipes • Trash is present • Heavy accumulations of organic debris on grates or screens • frequent large sediment deposits behind check dams or log weirs • Erosion and/or undercutting surrounding weir walls • Loose rocks; walls are not secure • stormwater sedimentation structures less than ½ full (NPDES)	
Sedimentation structures— TYPE 2	Sediment is blocking 10% of structure 	Sediment is blocking 30% of structure 	Sediment is blocking 50% of structure 	□ if sediment present, remove trash and unwanted organic debris □ muck out / vactor structure and dispose of waste properly

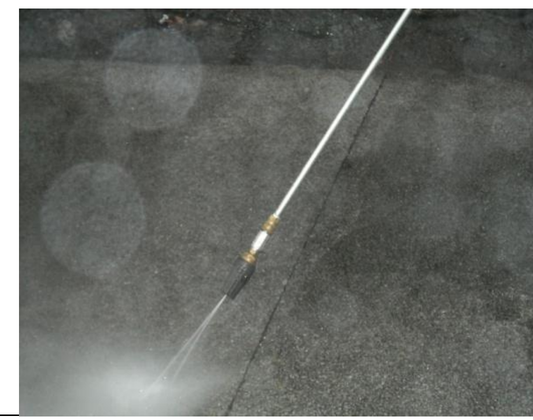
Service Category	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)	Recommended Maintenance Activities
Grates and debris screens on catch basins (CBs)	Accumulation of organic debris covers 10% of structure 	Accumulation of organic debris covers 30% of structure 	Accumulation of organic debris covers 50% of structure 	□ if present, muck out / vactor catch basins and dispose of waste properly. Clear debris and vegetation growth around intakes.
□ Outlet structures—TYPE 2	Accumulation of organic debris covers 10% of structure 	Accumulation of organic debris covers 30% of structure 	Accumulation of organic debris covers 50% of structure 	□ remove debris and dispose of waste properly

Service Category	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)	Recommended Maintenance Activities
Flow control structures and overflow structures or pipes	Accumulation of organic debris covers 10% of structure 	Accumulation of organic debris covers 30% of structure 	Accumulation of organic debris covers 50% of structure 	Remove debris and vegetation growth and dispose of waste properly
□ Log weirs and check dams	Sediment deposit of check dams or log weirs is about 10% 	Sediment deposits of check dams or log weirs is about 30% 	Sediment deposits of check dams or log weirs is about 50% or more 	□ add splash-pool (rocks) to reduce scouring of swale-bottom for undercutting or eroding □ remove sediment, debris, and trash if ponding upstream of check-dam

Service Category	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)	Recommended Maintenance Activities
Weir walls w/ flow control notch	Sediment deposit downstream of check dams or log weirs is about 10% 	Sediment deposit downstream of check dams or log weirs is about 30% 	Sediment deposit downstream of check dams or log weirs is about 50% or more 	add rocks to splash-pool to prevent scouring reinforce weir wall *(non-routine)*if leakage occurs at structure edges
Rockery / boulders PHOTOS TO BE UPDATED (shown here with little vegetative cover, but rocks may become covered in plant growth in well-established projects)	10% of rocks or walls are unsecured 	30% of rocks or walls are unsecured 	50% of rocks or walls are unsecured 	□ ensure large rocks and boulders are stable

Service Category	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)	Recommended Maintenance Activities
Manufactured block sidewalls	10% of rocks or walls are unsecured 	30% of rocks or walls are unsecured 	50% of rocks or walls are unsecured 	ensure blocks and bricks are stable
Soil-wrap walls ("green walls")	Erosion or undercutting of 10% is walls visible around rockery, walls and weirs 	Erosion or undercutting of 30% is visible around rockery, walls and weirs 	Erosion or undercutting of 50% is walls visible around rockery, walls and weirs 	□ repair as needed stabilize loose soil-bricks, notify vegetation crew if weeds present, water needed, or re-planting required

Table IV. Porous Pavement Manual

Level of Service	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)	Recommended Maintenance Activities
Street	Infiltration rate of 20 +in/hr	Infiltration rate of 10 in/hr	Infiltration rate of 3 in/hr	based on peak flows for 100yr design storm 3 in/hr and excess capacity for localized failure
Sidewalk	Infiltration rate of 20 +in/hr	Infiltration rate of 10 in/hr	Infiltration rate of 1 in/hr	
				Test infiltration rates per SPU Materials Lab procedure.
	Pressure wash @2500 psi bi-annually	Pressure wash @ 2500 psi annually	Pressure wash @ 2500 psi annually	
				Pressure wash pavement with an industrial machine

Level of Service	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)	Recommended Maintenance Activities
	Remove 100% of Garbage	Remove 75% of Garbage	Remove 20% of Garbage	
				Remove all garbage and debris as required with wire brush, broom, or pressure washer. Dispose of debris and garbage off site.
	Remove 100% vegetation growth (moss/creeping plants) adjacent to pavement	Remove 75% vegetation growth (moss/creeping plants) adjacent to pavement	Remove 40% vegetation growth (moss/creeping plants) adjacent to pavement	
				Vegetated, landscaped, eroded, or soiled areas need to be maintained to prevent growth on to porous pavement, debris clogging, and lateral transport of adjacent materials. Keep joints free of material mechanically, with a weed burner, or pressure washer.

Level of Service	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)	Recommended Maintenance Activities
Infiltration Failure	Any evidence ponding water needs to be reported to USM Green Stormwater Infrastructure O&M Asset Manager for monitoring and restoration. Contact: Drena Donofrio at 206-571-1566			
Misc.	Inspect pavement for spalling, cracking edges, pot holes, depressions, large cracks, skid resistance, and raveling concrete 2X per year.	Inspect pavement for spalling, cracking edges, pot holes, depressions, large cracks, skid resistance, and raveling concrete 1X per year.	Inspect pavement for spalling, cracking edges, pot holes, depressions, large cracks, skid resistance, and raveling concrete every other year.	*SPU Materials lab (to quantify variability in field testing)*
	Pavement condition survey every 2 years	Pavement condition survey every 3 years	Pavement condition survey every 7 years	SDOT - contact Ben Hansen or current manager
	Address all safety issue to SDOT			Contact 684-ROAD for repair.

Table V. Other Elements

Service Category	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)	Recommended Maintenance Activities
OTHER ELEMENTS	• up to 10% blockage caused by organic matter, sediment, debris or trash • irrigation system functions properly with no blockages or breaks in drip system • ponding only to intended depth (varies by location) • pond capacity is maintained • no liner leakages reported	• between 10-30% blockage caused by organic matter, sediment, debris or trash • irrigation system functions properly with no blockages or breaks in drip system • ponding only to intended depth (varies by location) • some sediment may reduce pond capacity • no liner leakages reported	• more than 30% blockage caused by organic matter, sediment, debris or trash • irrigation system has occasional blockages or breaks in drip lines • ponding only to intended depth (varies by location) • sediment buildup causes reduced pond capacity • no leakages reported	
□ Curb cuts	Curb is up to 10% blocked 	Curb is between 10-40% blocked 	Curb is above 40% blocked 	□ remove trash and organic debris and dispose properly

Service Category	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)	Recommended Maintenance Activities
Culverts	Culvert is up to 10% blocked 	Culvert is between 10-40% blocked 	Culvert is more than 40% blocked 	remove trash and organic debris and dispose properly
□ Irrigation systems (for establishing vegetation)	holes in drip irrigation correspond with plant locations; nozzles have no breaks, leaks, or blocks 	plants and drip holes mostly aligned minimal seeping of water when system is off; no breaks or blockages 	system has breaks or leaks; vegetation is not being adequately watered; complaints of ponding 	repair as needed (for establishing vegetation 0-3 years old)

Service Category	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)	Recommended Maintenance Activities
Porous/pervious pavers	water infiltrates well, pavers are up to 10% clogged or minimal ponding is observed 	water infiltrates well, pavers are between 10-40% clogged and minimal ponding is observed 	water does not infiltrate well, pavers are more than 40% clogged 	vactor debris, weed burn as required

Table VI. Infiltration

Infiltration Failure	Any evidence of a cell holding water for more than 24 hours needs to be reported to USM Green Stormwater Operations and Maintenance Asset Manager for monitoring or retrofitting. Contact: Drena Donofrio at 206-571-1566

Table VII. Safety, Spill Prevention and Response, and Pest Control

Service Category	Service Level A (Excellent Effort)	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)
SAFETY, MOBILITY, ACCESS	• Vegetation causes no visibility (line of sight) or driver safety issues • Infrastructure is always accessible and has clear access path • Vegetation around infrastructure is maintained at height to prevent damage during routine maintenance • Fire hydrant access clearly visible and accessible • Vegetation does not impede pedestrian access	• Vegetation causes minimal visibility (line of sight) or driver safety issues • Infrastructure is mostly accessible and has access path • Most vegetation around infrastructure is maintained at height to prevent damage during routine maintenance • Fire hydrant access clearly visible and accessible • Vegetation does not impede pedestrian access	• Vegetation causes visibility (line of sight) or driver safety issues • Infrastructure is not accessible and has clear access path • Vegetation around infrastructure is will be damaged during routine maintenance • Fire hydrant access clearly visible and accessible • Vegetation does not impede pedestrian access	• Vegetation causes visibility (line of sight) or driver safety issues • Infrastructure is not accessible and has clear access path • Vegetation around infrastructure is will be damaged during routine maintenance • Fire hydrant access clearly visible and accessible • Vegetation does not impede pedestrian access
				
SPILL PREVENTION	• Exercise spill prevention measures whenever handling or storing potential contaminants. • Fertilizers, Herbicides, Fungicides and Insecticides are prohibited in GSI.			

SPILL RESPONSE	• Clean up spills as soon as possible to prevent contamination of stormwater.
PEST CONTROL	Insects: • Standing water remains in the basin for time periods suitable to insect development. • Identify the cause of the standing water and take appropriate actions to address the problem. Rodents: • Rodent holes are present near the facility. • Fill and compact soil around the holes.

Seattle
Public
Utilities

Seattle Public Utilities
Seattle Municipal Tower
700 Fifth Avenue
Suite 4900
PO Box 34018
Seattle, WA 98124-4018

Appendix I

LID Codes

Project Memo

TO: Gary Armstrong, Town Administrator
Nick Bond, Town Planner, Planning Department

FROM: Wayne E. Carlson, Brad Medrud, & Natasha Ali-Khan

CC: Bruce Wulkan (Puget Sound Partnership) and Duane Fagergren (Puget Sound Partnership)

DATE: April 18, 2008

PROJECT: Puget Sound Partnership - Eatonville

PROJECT #: 207700.30

SUBJECT: Municipal Code Review

AHBL has reviewed those portions of your code we discussed in our teleconference on February 20, 2008, to determine if there are any challenges to implementing low impact development (LID) techniques. This review has helped us gain a better understanding of how your Municipal Code functions and identify areas to integrate LID techniques. We intend to discuss these findings at our first meeting with you on April 22, 2008.

The sections we reviewed were:

- 16.53 BMPs for Construction and Site Development
- 16.54 Stormwater Management and Erosion Control
- 17.17 Planned Unit Development
- 17.18 General Design for All Land Subdivision
- 18.04 District Regulations
- 18.05 Off Street Parking and Loading Requirements
- 18.07 Landscaping Regulations
- Engineering and Design Standards and Drawings (EDDS)
- Stormwater Management Program, Draft Report dated January 2003

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Below are our findings as well as a general synopsis on each of the different areas of the Municipal Code and their relationship to LID.

1. Best Management Practices for Construction and Site Development

Section 16.53

While this section does not hold any clear impediments to LID, the implementation of LID best management practices (BMPs) could be included as part of these general standards. We could either embellish this section of the code to include specific LID BMPs or we could incorporate an LID Chapter in the Town's code which would include a list of specific construction BMPs that will afford protections for LID projects appropriate to the Town including vegetation and soil protection, construction phasing and staging, soil stock piling and BMP management. The LID BMPs incorporated into the code would be tailored to the Town's requirements taking into account the limitations or any potential conflicts with existing Town policies, codes or regulations.

2. Stormwater Management and Erosion Control

Section 16.54

Eatonville's Stormwater Management and Erosion Control Chapter is already fairly LID compatible, with provisions to preserve, replace or enhance existing native vegetation as well as allowing for experimental BMP's. While the purpose statement is consistent with LID practices, there are not specific regulations to in this section of the code to support the intention. As noted above in Section 16.54, we recommend incorporating an LID Chapter in the Town's code which would include a list of specific LID BMPs appropriate to Eatonville. Later, in Section 18.07, we will discuss recommendations to implement LID practices within the landscape code.

3. Planned Unit Development

Section 17.17

Since this section is very brief and only includes a statement of the intention, Planned Unit Development standards will be more fully discussed in Section 18.04 District Regulations.

4. General Design Standards for All Land Subdivisions

a. Subdivisions, Generally

Reducing impervious surface coverage in site development is one important component of LID design. The *LID Technical Guidance Manual for Puget Sound* (January 2005) identifies LID as a stormwater management strategy that emphasizes conservation and use of natural site features with distributed, small-scale stormwater controls to more closely mimic hydrologic patterns in residential, commercial, and industrial settings. For the most part, subdivision codes tend to have little content that would inherently conflict with LID. However, in most communities, transportation facilities such as roads, associated curbs and gutters, sidewalks, and parking lots comprise the largest percentage of impervious surface. These transportation related standards and improvements, which are often directly referenced in subdivision regulations, usually pose the greatest challenge to implementing LID techniques.

b. Eatonville Subdivision

General Design Standards for all Land Subdivisions - Section 17.18

After reviewing this chapter, we found that this section of the code does not have much in the way of impediments to LID, however existing standards could be adjusted to further encourage the use of LID practices. The language regarding clearing and grading could be embellished (Section 12.18.070) to not only minimize clearing and grading where possible, but to actively preserve existing trees and vegetation. Recommendations for tree retention and preservation standards will be more fully described in Section 18.07 Landscaping Regulations.

Section 17.18.100 Streets, includes the street right-of-way width for standard street types within the Town. We will recommend that Eatonville consider reducing the width of the paved drive surface within the street right-of-way where appropriate. We will discuss potential street standard revisions under Engineering and Design Standards and Drawings (EDDS). We will primarily address the smaller, local roads as opposed to larger arterials.

Again, in section 17.18.140 Topography, we would recommend language that more strongly recommends minimizing alterations to the site's natural topography.

5. District Regulations

<u>Section 18.04</u>

Eatonville's District Regulations are already fairly LID compatible, with maximum site coverage standards included for each of the residential types. As mentioned in Section 16.53, we recommend incorporating a separate LID Chapter in the Town's code which would provide more detail regarding techniques.

In C-1 Downtown Commercial District, the site coverage is currently 100 percent. Since one of the primary impediments to LID is lot coverage standards that don't stipulate minimizing lot coverage, we recommend reducing the lot coverage in this zone, recommending options to reduce effective imperviousness, and exploring providing additional open space on a neighborhood level.

Planned Unit Development - Section 18.04.190

Within the Planned Unit Development, the flexibility in site design is more amenable to LID techniques and practices. We suggest adding language to the PUD purpose statement encouraging the use of LID design techniques and LID projects. Additionally, the inclusion of a standard for maximum lot coverage within the development standards section would further allow for the implementation of LID practices. Under the open space provision for PUD's, we recommend adding language regarding tree preservation and retention, which would be further detailed in Sections 18.07 – landscaping and in the chapter on construction site controls, Chapter 16.53. Regarding standards for minimum private street pavement widths, we will recommend that Eatonville consider reducing the width of the paved drive surface within the street right-of-way where appropriate. There is already existing language that these standards may be modified upon review and approval of the Town fire chief and the Town public works director providing they are sufficient to maintain emergency access and traffic safety.

While the PUD Chapter (Section 18.04.190), includes provisions for stormwater drainage that is accomplished using natural on-site drainage features for a density bonus of 2 percent, this section could be further embellished with additional requirements or recommendations for other LID techniques such as rain gardens and bioretention facilities. We would recommend including these standards in the landscape standards, Section 18.07. Additionally, a 4 percent density bonus is provided in the PUD code for a minimum of 15 percent native vegetation retention within the site design. We would suggest increasing the amount of native vegetation retention required and including a provision for native soils protections.

6. Off Street Parking and Loading Requirements

In many communities, parking lots are second only to roads as a source of impervious surface coverage. Reducing impervious surfaces associated with parking can be achieved in a variety of ways such as:

- Reduce the minimum number of parking stalls
- Specify a maximum number of parking stalls that cannot be exceeded
- Reduce parking space dimensions and circulation corridors and/or provide for higher percentage of compact stalls
- Limit the amount of impervious surface coverage and provide direction for the use of pervious pavement and other materials

Reducing the effective impervious surface area of parking is equally important, and can be mitigated by interrupting massive sheet run-off through landscaping and planting islands. Originally, the main purpose behind most planting islands was aesthetic. However, slight modifications to planting details and plant selection can allow planting islands to fulfill stormwater functions as well as provide an aesthetic benefit.

<u>Section 18.05</u>
We recommend adding provisions to the code that directly address reducing the overall size of impervious surfaces in parking lots as well as provisions for the use of pervious paving, as specifically described in the items bulleted above. Our recommended revisions will be based on the *LID Technical Guidance Manual for Puget Sound* (January 2005) and previous comparisons of impervious surface coverage in various codes. These code revisions will include detail drawings for LID parking lot design, and refer to the landscaping and stormwater drainage details, so that the incorporation of LID is consistent throughout various sections.

7. Landscaping Regulations

<u>Section 18.07</u>
Landscaping and the retention of native vegetation are two LID tools that can play a key role in reducing stormwater runoff, providing ecological habitat, and preserving natural drainage patterns.

After reviewing the chapter, we found the existing landscape code could be modified to encourage the implementation of LID practices and techniques. Some of these practices could include provisions for native tree retention, encouraging the use of native Pacific northwest and drought-tolerant plant materials, inclusion of bioretention swales and other surface water/water quality structures incorporated into landscape areas, mulching standards and the protection of significant/special trees.

We recommend the inclusion of an LID option in the landscape standards which would discuss standards for soil preparation techniques, mulching and the use of native, drought-tolerant species. In addition, low impact incentives by way of offering increased plant spacing in exchange for implementation of LID practices and techniques could be implemented.

We also recommend the inclusion of tree retention standards. While “special trees” are currently defined in the zoning code, as trees significant due to their size, age, species or variety or historical importance, there are not currently standards for special tree retention. A standard could be established for special trees such as all deciduous trees over 12-inches diameter-at-breast-height (DBH) and all coniferous trees 18-inches DBH. The standards could establish retention standards for special trees and replacement ratios for the removal of special trees. The requirement for submittal of a Tree Preservation Plan that identifies trees to be preserved, as well as those to be removed could be made necessary for Preliminary Plats, PUD's and commercial projects.

Alternately, some communities address vegetation retention through a tree count per acre or canopy cover where canopy coverage is expressed as a percentage of site area. We could introduce the concept of "Tree Canopy Cover" which would enhance the existing special tree retention requirements through establishing a system of tree unit credit requirements. The Tree Canopy Cover would provide further guidance on the relationship between tree maturity, canopy coverage, and corresponding tree credits as well as potential hazards.

We also recommend that landscape standards for stormwater facilities be included in this section. This would involve provisions for curvilinear-type stormwater facilities to mimic natural ponds or wetlands containing appropriate native or engineered soils and planted with appropriate native plant species. Design considerations for stormwater facilities including reducing the need for fencing by designing safe ponds with gentle side slopes and other options that allow stormwater facilities to double as landscape amenities would be proposed.

Finally, we will recommend including an appendix with detailed descriptions of species native to the Pacific Northwest.

8. Engineering and Design Standards and Drawings (EDDS)

With respect to the road sections and other improvements described in the Eatonville Road and Storm Standards, the primary impediments to LID that we noticed are that the Town's requirements for traditional street design with curb, gutter, and sidewalks, specifically the primary use of vertical curb. Curb and gutter requirements in street construction can limit opportunities for LID stormwater management techniques such as roadside bioretention swales. Therefore, we will recommend alternative cross-sections that reflect the following LID road design principles:

- Roads that are canted or pitched to a bioretention swale
- Curbs and gutters with "breaks" to allow surface water to enter the bioretention facility
- Sections consistent with manufacturer recommendations for alternative surfacing materials for sidewalks, parking, and vehicular travel.

We will also recommend that Eatonville consider reducing the width of the paved drive surface within a right-of-way. Currently, there is some variability in the required widths for right-of-ways (ROW's), paved travel lanes and sidewalks. The flexibility between various ROW widths and travel lanes affords the opportunity for bioretention swales or other onsite infiltration techniques as an alternative to traditional curb and gutter. Anticipated revisions will likely target lower traffic local roads as opposed to highways or larger roads.

As far as sidewalk maintenance and construction, we can provide a chapter that covers proper construction/installation, and maintenance for LID projects that would include sidewalks.

9. Stormwater Management Program Draft Report – Prepared by RW Beck, January 2003

Section 5.2.1.1- 5.2.1.3; 5.2.1.7 (Stormwater Regulations) and Section 7 (Operation & Maintenance)

Best Management Practices (Section 16.53) and Stormwater Management and Erosion Control (Section 16.54) were previously discussed in this memo. Since, this report incorporates much of the existing Municipal Code that was discussed in these sections, our recommendations remain the same.

Chapter 16.53
BEST MANAGEMENT PRACTICES FOR CONSTRUCTION AND SITE DEVELOPMENT

~~16.53.010 Protection for storm sewer inlets.~~
~~Storm sewer inlets receiving water from a project site during construction or site development shall be protected so that sediment-laden water will be filtered before entering the conveyance system. (Ord. 2005-20 § 1, 2005).~~

~~16.53.020 Dust control.~~
~~As necessary in the event that sediment is being visibly transported from a construction or development site across property boundaries, or by order of the administrator or designee, the proponent shall spray soil with water or approved dust palliative.~~
~~(Ord. 2005-20 § 1, 2005).~~

~~16.53.030 Stockpile management.~~
~~Soil stockpiles shall be set back at least 50 feet from down gradient drainage features (e.g., channels, catch basins, detention ponds, pavement, stream banks, and environmentally sensitive areas). No material shall be stockpiled on pavement without authorization from the administrator or designee which will be conditional on implementation of a procedure to prevent sediment transport.~~
~~(Ord. 2005-20 § 1, 2005).~~

~~16.53.040 Construction entrances.~~
~~Construction site entrances are egress points for vehicles onto paved roadways. All projects which have vehicular traffic shall have a means to prevent vehicles from tracking soils from the site. The administrator or designee may require that access points, roads, tire washing areas, and parking areas be constructed and maintained to keep sediment confined to the construction or development site. Vehicles shall only use designated access points to access a construction or development site. The access point(s) shall be maintained to prevent the transport of sediment onto public streets and rights-of-way. Should sediment be tracked off-site, sediment shall, on a daily basis, be shoveled and swept from the paved surface before washing. (Ord. 2005-20 § 1, 2005).~~

~~16.53.050 Erosion control facilities must be maintained.~~
~~Erosion control facilities shall not be allowed to fall into disrepair. The proponent or designee shall inspect facilities during and after rainfall events to ensure that they continue to function effectively. Repairs shall be made as soon as possible during rainfall events. (Ord. 2005-20 § 1, 2005).~~

16.53.010 Definitions.

A. "Best Management or Development Practices (BM/DPs), Best Management Practice (BMP)" shall mean the schedules of activities, prohibitions of practices, maintenance procedures, and structural and/or managerial practices, that when used singly or in combination, prevent or reduce the release of pollutants and other adverse impacts to waters of Washington state.
B. "Buffer or Buffer Zone" shall mean the zone contiguous with a sensitive area that is required for the continued maintenance, function, and structural stability of the sensitive area. The critical functions of a riparian buffer (those associated with an aquatic system) include shading, input of organic debris and coarse sediments, uptake of nutrients, stabilization of banks, interception of line sediments, overflow during high water events, protection from disturbance by humans and domestic animals, maintenance of wildlife habitat, and room for variation of aquatic system boundaries over time due to hydrologic or climatic effects. The critical functions of terrestrial buffers include protection of slope stability, attenuation of surface water flows from stormwater runoff and precipitation, and erosion control.
C. "Caliper" shall mean the diameter of any tree trunk as measured at a height of four feet above the ground on the upslope side of the tree.
D. "Creek" shall mean those areas where surface waters flow sufficiently to produce a defined channel or bed. A defined channel or bed is indicated by hydraulically sorted sediments or the removal of vegetative litter or loosely rooted vegetation by the action of moving water. The channel or bed need not contain water year around. This definition is not meant to include storm water runoff devices or other entirely artificial watercourses unless they are used to store and/or convey pass-through stream flows naturally occurring prior to construction.
E. "Clearing" shall mean the act of cutting and/or removing vegetation. This definition shall include grubbing vegetation.
F. "Clearing and Grading Permit" shall mean the written approval of the Town of Eatonville Town Planner or designee to proceed with the act of clearing property within the town limits of Eatonville. The Clearing and Grading Permit includes the associated approved plans and any conditions of approval as well as the permit form itself.
G. "Critical Area" shall mean any area designated as a critical area pursuant to RCW 36.70A.170 and Chapter 15.16 EMC.
H. "Degradation" shall mean degradation of an area includes, but is not limited to, impacts such as sedimentation, erosion, and loss of shading, light, and noise.
I. "Developed lot" shall mean a lot or parcel of land upon which a structure(s) is located, which cannot be more intensively developed pursuant to the town zoning code, and which cannot be further subdivided pursuant to town subdivision regulations.
J. "Development" shall mean any activity that requires federal, state, or local approval for the use or modification of land or its resource. These activities include, but are not limited to, subdivision and short subdivisions; binding site plans; planned unit developments; variances; shoreline substantial development; clearing activity; excavation; embankment; fill and grade work; converting fallow land or undeveloped land to agricultural purposes; activity conditionally allowed; building or construction; revocable encroachment permits; and septic approval.
K. "Development Area" shall mean an area where the movement of earth, or a change in the existing soil cover (both vegetative and nonvegetative) and/or the existing soil topography occurs as a result of an applicant's development plans.
L. "Drainage Plan" shall mean a plan for receiving, handling, and transporting surface water or groundwater runoff within the site.
M. "Drip line" of a tree shall be described by a line projected to the ground delineating the outermost extent of foliage in all directions.
N. "Dry Season" shall mean the period of May 1 through September 30.

O. “Ecology” shall mean Washington State Department of Ecology.
P. “Engineered Fill” shall mean soil fill, which is wetted or dried to near its optimum moisture content, placed in lifts of 12 inches or less and each lift compacted to a minimum percent compaction as specified by a geotechnical engineer.
Q. “Erosion” shall mean the wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. Also, the detachment and movement of soil or rock fragments by water, wind, ice, or gravity. The following terms are used to describe different types of water erosion:

  1. Accelerated erosion – Erosion much more rapid than normal or geologic erosion, primarily as a result of the influence of the activities of humans or, in some cases, of the animals or natural catastrophes that expose bare surfaces (e.g., fires).
  2. Geological erosion – The normal or natural erosion caused by geological processes acting over long geologic periods and resulting in the wearing away of mountains, building up of floodplains, coastal plains, etc. Synonymous with natural erosion.
  3. Gully erosion – The erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, ranging from one (1) to two (2) feet to as much as seventy-five (75) to one hundred (100) feet.
  4. Natural erosion – Wearing away of the earth’s surface by water, ice, or other natural agents under natural environmental conditions of climate, vegetation, etc., undisturbed by humans. Synonymous with geological erosion.
  5. Normal erosion – The gradual erosion of land used by humans, which does not greatly exceed natural erosion.
  6. Rill erosion – Erosion processes in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed and exposed soils.
  7. Sheet erosion – The removal of a fairly uniform layer of soil from the land surface by runoff.
  8. Splash erosion – The spattering of small soil particles caused by the impact of raindrops on wet soils. The loosened and spattered particles may or may not be subsequently removed by surface runoff.

R. “Excavation” shall mean the removal of material such as earth, sand, gravel, rock, or asphalt.
S. “Fill” shall mean earth, sand, gravel, rock, asphalt, or other solid material used to increase the ground surface elevation or to replace excavated material.
T. “Filling” shall mean the act of placing fill material (earth, sand, gravel, rock, asphalt, or other solid material) on any soil surface, natural vegetative covering, or other fill material to raise the ground elevation or to replace excavated material.
U. “Geotechnical Engineer” shall mean a professional engineer currently registered in the state of Washington, qualified by reason of experience and education in the practice of geotechnical engineering, and designated by the owner as the geotechnical engineer of record for the project.
V. “Grading” shall mean the movement of earth material through mechanical or other means to create the finished surface and contour of a project site.
W. “Grubbing” shall mean the act of removing vegetation by the roots.
X. “Ground cover” as defined in 18.02.172, shall mean low-growing vegetative materials with a mound or spreading manner of growth that provides solid cover within two years after planting. Examples include sod or seed lawn, ivy, junipers, cotoneaster, etc. (Ord. 94-06 § 2,1994).
Y. “Impervious Area” shall mean a hard surface area (e.g., parking lot or rooftop) that prevents or impedes the entry of water into the soil, thus causing water to run off the surface in greater quantities or at an increased rate of flow.

Z. “Lakes” shall mean natural or artificial bodies of water of two or more acres and/or where the deepest part of the basin at low water exceeds two meters (6.6 feet). Artificial bodies of water with a recirculation system approved by the public works department are not included in this definition.

AA. “Land development permit” shall mean a preliminary or final plat for a single-family residential development; a building permit; site plan; preliminary or final planned unit development plan.

BB. “Land Disturbance Activity” shall mean any activity that results in movement of earth, or a change in the existing soil cover and/or the existing soil topography. Land disturbing activities include, but are not limited to, clearing, grading, filling, and excavation.

CC. “Low Impact Development (LID)” shall mean a stormwater management strategy that emphasizes conservation and use of existing natural site features integrated with distributed, small-scale stormwater controls to more closely mimic natural hydrologic patterns in residential, commercial, and industrial settings.

DD. “Mechanical equipment” shall mean all motorized equipment used for earth moving, trenching, excavation, gardening, landscaping, and general property maintenance and shall be commercial grade equipment or greater.

EE. “Native growth area” shall mean a restrictive area where all native, predevelopment vegetation shall not be disturbed or removed except for removal pursuant to an enhancement program approved pursuant to this chapter or to remove dead or diseased vegetation. The purpose of the area is to protect steep slopes, slopes with erosion potential, landslide and seismic hazards, creeks, wetlands and/or riparian corridors, wildlife, and areas shown on the environmentally sensitive areas map. This area shall be defined during the development review process and shown on the recorded plat, short plat or approved site plan.

FF. “Open Space” shall mean land set aside for public or private use within a development that is not built upon.

GG. “Partially developed lot” shall mean a lot or parcel of land upon which a structure (refer to 18.02.510 EMC for the definition of a structure) is located and which is of sufficient area so as to be capable of accommodating additional development pursuant to the Town of Eatonville zoning code; or which may be subdivided in accordance with the Town of Eatonville subdivision chapter.

HH. “Permeable” shall mean soil or other material that allows the infiltration or passage of water or other liquids.

II. “Permit” shall mean, unless otherwise noted, the Clearing and Grading Permit; see Clearing and Grading Permit.

JJ. “Removal” shall mean the actual destruction or causing the effective destruction through damaging, poisoning or other direct or indirect actions resulting in the death of a tree or groundcover species.

KK. “Rockery or Rock Wall” shall mean one or more courses of large rocks stacked near vertical in front of an exposed soil face to protect the soil face from erosion and sloughing.

LL. “Routine landscape maintenance” shall mean pruning, weeding, planting annuals, mowing turf lands and groundcover species management which is undertaken by a person in connection with the normal maintenance and repair of property. This definition does not include felling or topping of trees or removal of invasive plants resulting from lack of regular maintenance.

MM. “Runoff” shall mean water from rain, melted snow, or irrigation that flows over the land surface.

NN. “Sedimentation” shall mean the process of gravity-induced settling and deposition of fragmented rock, soil, or organic particles displaced, transported, and deposited by erosive water-based processes.

OO. “Stormwater Pollution Prevention Plan” shall mean a report containing a narrative and drawings used to explain and justify the pollution prevention decisions made for a particular project. The narrative contains concise information concerning existing site conditions, construction schedules, and other pertinent items that are not contained on the drawings. The drawings and notes describe where and when the various BMPs should be installed, the performance the BMPs are expected to achieve, and actions to be taken if the performance goals are not achieved.

PP. “Stormwater Site Plan” shall mean a comprehensive report containing all of the technical information and analysis necessary for the Town of Eatonville to evaluate a proposed new development or redevelopment project for compliance with stormwater requirements. Contents of the stormwater site plan will vary with the type and size of the project, and individual site characteristics.

QQ. “Tree” shall mean any living woody plant characterized by one main stem or trunk and many branches and having a caliper of six inches or greater, or a multi-stemmed trunk system with a definitely formed crown.

RR. “Undeveloped lot” shall mean a platted lot or parcel of land upon which no structure (refer to 18.02.510 EMC for the definition of a structure) exists.

SS. “Wetlands” shall mean those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar area.

TT. “Wetponds” shall mean drainage facilities for water quality treatment that contain permanent pools of water that are filled during the initial runoff from a storm event. They are designed to optimize water quality by providing retention time in order to settle out particles of fine sediment to which pollutants such as heavy metals absorb. They also allow biologic activity to occur that metabolizes nutrients and organic pollutants.

UU. “Wet Season” shall mean the period of the year between October 1 and April 30.

16.53.020 Performance standards.

All of the performance standards in this section are required unless an exemption from a particular standard is clearly justified in the narrative of the construction SWPPP.

A. Minimize Potential Impacts. All grading and clearing activities shall be conducted so as to minimize potential adverse effects of these activities on forested lands, surface water quality and quantity, groundwater recharge, fish and wildlife habitat, adjacent properties, and downstream drainage channels. The applicant shall attempt to prevent impacts and minimize the clearing of naturally occurring vegetation, retain existing soils, and maintain the existing natural hydrological functions of the site.

B. Stormwater Consistency of Standards. All standards under this code will be consistent with the latest adopted version of the *Stormwater Management Manual for Western Washington*, pursuant of Title 16.54 EMC.

C. Clearing and Grading and Land Disturbance Limits. Clearing and grading activities for developments shall be permitted only if conducted pursuant to an approved site development plan (e.g., subdivision approval, site plan approval, etc.) that establishes permitted areas of clearing, grading, cutting, and filling. When establishing permitted clearing and grading areas, consideration should be given to minimizing removal of existing trees and minimizing disturbance/compaction of native soils except as needed for building purposes. Permitted clearing and grading areas and any other areas required to preserve critical or sensitive areas, buffers, native growth protection easements, or tree retention areas as may be required by local jurisdictions, shall be delineated on the site plans and the development site.

Prior to beginning land disturbing activities, including clearing and grading, all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area shall be clearly marked, both in the field and on the plans, to prevent damage and offsite impacts.

D. Natural Features and Vegetation Retention. Vegetation, drainage, duff layer, native top soil, and other natural features of the site should be preserved, and the grading and clearing be performed in a manner that attempts to limit areas of impact to the development area (e.g., structures, roads, utilities, sidewalks, parking, landscaping, etc.). Groundcover and tree disturbance shall be minimized, and root zones be protected. Land disturbance activities shall be conducted so as to expose the smallest practical area to erosion for the least possible time. Non Exempt Projects shall be phased to the maximum degree practical and shall take into account seasonal work limitations, to decrease exposed soils and minimize adverse impacts to natural features and vegetation resulting from land disturbance activities. No groundcover species or trees which are within a minimum of fifteen (15) feet of the annual high water mark of creeks, streams, lakes, and other shoreline areas or within ten (10) feet of the top of the bank of the same shall be removed, nor shall any mechanical equipment operate in such areas, provided that conditions deemed by the Town Planner or Designee to constitute a public nuisance may be removed, and provided that a property owner shall not be prohibited from making landscaping improvements where such improvements are consistent with the aims of this section, and where the owner can convincingly demonstrate such consistency to the Town Planner or Designee.

E. Aesthetics. Land disturbance activity shall be undertaken in such a manner so as to preserve and enhance the Town of Eatonville's aesthetic character. Important landscape characteristics that define the aesthetic character, such as large landmark trees, important vegetation species, and unique landforms or other natural features shall be preserved to every extent practical.

F. Site Containment. Erosion, sediment, and other impacts resulting from any clearing and grading activity shall be contained on the site. Containment of such impacts may require temporary erosion/ sedimentation control measures during and immediately following clearing and grading activities. The faces of slopes shall be prepared and maintained to control erosion. Check dams, riprap, plantings, terraces, diversion ditches, sedimentation ponds, straw bales, or other devices or methods shall be employed where necessary to control erosion and provide safety. Devices or procedures for erosion protection shall be initiated or installed as soon as possible during grading operations and shall be maintained in operable condition by the owner.

G. Protection of Adjacent and Downstream Properties and Waterways. Downstream properties and waterways shall be protected from erosion during construction due to temporary increases in the volume, velocity, and peak flow rate of runoff from the site. Downstream analysis is necessary if changes in flows could impair or alter conveyance systems, stream banks, bed sediments or aquatic habitat. Where necessary to protect waterways and properties, stormwater retention or detention facilities shall be constructed as one of the first steps in grading. Detention facilities shall be functional prior to construction of site improvements (e.g., impervious surfaces). If permanent infiltration ponds are used for flow control during construction, these facilities should be protected from siltation during the construction phase.

H. Install Sediment Controls. Stormwater runoff from disturbed areas shall pass through a sediment pond, or other appropriate sediment removal BMP prior to entering a storm drain inlet, leaving a construction site, or discharging to an infiltration facility. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but shall meet the applicable flow control performance standards. Sediment removal BMPs (sediment ponds, traps, filters, etc) shall be constructed as one of the first steps in grading. These BMPs shall be functional before other land disturbing activities take place. BMP's intended to trap sediment on-site shall be located in a manner to avoid interference with the movement of juvenile salmonids attempting to

enter off-channel areas or drainages. If protection is inadequate and deposition occurs on the adjoining property, public right-of-way, or drainage system, the contractor shall immediately remove the deposited sediment and restore the affected area to its original condition.
I. Construction Access. Construction vehicle access shall be, whenever feasible, limited to one route. A temporary access road shall be provided at all sites. Access surfaces shall be stabilized to minimize the tracking of sediment onto adjacent roads by utilizing quarry spalls, crushed rock or other equivalent BMPs. Other measures may be required at the discretion of the Town Planner or Designee in order to ensure that sediment is not tracked onto public streets by construction vehicles, or washed into storm drains. All approach roads shall be kept clean. Wheel wash or tire baths shall be located on site if the stabilized construction entrance is not effective in preventing sediment from being tracked onto public roads. Sediment shall be removed from roads by shoveling or pickup sweeping and shall be transported to a controlled sediment disposal area. Street washing will be allowed only after sediment is removed in this manner. If sediment is tracked off site, public roads shall be cleaned thoroughly at the end of each day, or more frequently during wet weather. Street wash wastewater shall be controlled by pumping back on-site or otherwise be prevented from discharging into systems tributary to state surface waters.
J. Stabilization of Disturbed Areas. All exposed soil shall be stabilized by application of suitable BMPs and soil stabilization measures, including but not limited to sod or other vegetation, plastic covering, mulching, or application of base course(s) on areas to be paved. Soil stabilization measures selected should be appropriate for the time of year, site conditions, estimated duration of use, and potential water quality impacts that stabilization agents may have on downstream waters or ground water. Soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast. All BMPs shall be selected, designed, and maintained according to the approved manual by the Town Planner or Designee. From October 1 through April 30, no disturbed soil shall remain exposed for more than two days. From May 1 through September 30, no disturbed soil shall remain exposed for more than seven days. Soil stockpiles must be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways and drainage channels. Linear construction activities, including right-of-way and easement clearing, roadway development, pipelines, and trenching for utilities, shall be conducted to meet the soil stabilization requirement.
K. Dust Suppression. Dust from clearing, grading, and other construction activities shall be minimized at all times. Impervious surfaces on or near the construction area shall be swept, vacuumed, or otherwise maintained to suppress dust entrainment. Any dust suppressants used shall be approved by the Town Planner or Designee. Petrochemical dust suppressants are prohibited. Watering the site to suppress dust is also prohibited unless it can be done in a way that keeps sediment out of the drainage system.
L. Erosion and Sedimentation Control. Erosion and sedimentation control BMPs shall be designed and implemented appropriate to the scale of the project and necessary to prevent sediment from leaving the project site, including but not limited to, the standards and requirements described in this chapter, and in the latest adopted version of the *Stormwater Management Manual for Western Washington.*

1. In addition to the measures in this and other codes and ordinances, the Town Planner or Designee may impose the following erosion control measures, or other additional measures, as appropriate for the project:
    a. Performance monitoring to determine compliance with state water quality standards, or more stringent standards if adopted by the town.
    b. Funding additional town inspection time, up to a full-time inspector.
    c. Stopping work if necessary to control erosion and sedimentation.

d. Construction of additional siltation/sedimentation ponds.
e. Use of erosion control blankets, nets, or mats in addition to or in conjunction with straw mulch.

2. If the initially implemented erosion and sedimentation BMPs do not adequately control erosion and sedimentation, additional BMPs shall be installed, including but not limited to the extraordinary BMPs described in subsection (1) of this section. It is the contractor's responsibility to ensure sediment does not leave the site in an amount that would violate applicable state, county, or town water quality standards. The Town of Eatonville has the authority to enforce state water quality standards, or, if adopted by the Town of Eatonville, more stringent water quality standards.

3. The timing/sequencing requirements for implementing/removing erosion and sedimentation control measures are as follows:

a. The contractor must install sediment removal BMPs prior to all other clearing, grading, or construction. These BMPs must be functional before other land disturbing activities take place.
b. The contractor must remove all temporary erosion and sediment control BMPs within thirty (30) days after final site stabilization or after the BMP is no longer needed, per agreement of the Town Planner or Designee. Before removing such BMPs, the contractor must remove trapped sediment or stabilize on-site. Any soils disturbed during sediment removal must be permanently stabilized by the contractor.
c. The contractor must complete the required permanent erosion control within seven (7) days of completed grading unless the weather is unsuitable for transplanting. In that case, the contractor must maintain temporary erosion control until permanent restoration can be completed. The period between work completion and final planting shall not exceed one year without written authorization from the Town Planner or Designee.

4. Stabilize Channels and Outlets

a. Temporary on-site stormwater conveyance systems shall be designed, constructed, and stabilized to prevent erosion from leaving the site and impacting properties, streams, and wetlands downstream of the clearing and grading activity. Stabilization measures shall be provided which comply with adopted BMPs at stormwater conveyance system outlets to prevent erosion of outlets, adjacent streambanks, slopes, and downstream reaches or properties.
b. All temporary on-site conveyance channels shall be designed, constructed and stabilized to prevent erosion from the expected peak 10 minute velocity of flow from a Type 1A, 10- year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate indicated by an approved continuous runoff model, increased by a factor of 1.6, may be used.
c. Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream reaches shall be provided at the outlets of all conveyance systems.

5. Protection of Critical Areas. The function and values of all critical areas, including all stream types, geologically unstable areas, critical aquifer recharge areas, frequently flooded areas, wetlands, and fish and wildlife conservation areas or habitats, and their critical areas buffers located on or adjacent to the site shall be protected from clearing

and grading activities that result in sedimentation, erosion, and degradation. Such impacts shall be avoided by appropriate use of setbacks, erosion, and sediment control measures and other appropriate best development and management practices consistent with Title 15.16.

6. Avoidance of Hazards. Land disturbance activities shall not result in off-site physical damage, nor pose a danger or hazard to life or property. Neither shall such activities contribute to or create landslides, accelerated soil creep, or settlement of soils.

7. Cut and Fill Slopes. Cut and fill slopes shall be designed and constructed in a manner that will minimize erosion. In addition, slopes shall be stabilized in accordance with the requirements of this section. The applicant shall:

a. Submit a geotechnical report, prepared by a geotechnical engineer, when required pursuant to the Town of Eatonville's Land Use Code including Critical Area Ordinance provisions for qualified professional reports or clearing and grading development standards set forth in Chapter 15.16 EMC. The clearing and grading development standards specify when a subsurface investigation is required and the level of investigation and information required in the report.
b. Minimize clearing and grading on slopes fifteen (15) percent or greater and meet any sensitive earth conditions performance standards.
c. Comply with the Land Use Code restrictions applicable to slopes forty (40) percent or greater and to areas of colluvial or landslide deposit on slopes of fifteen (15) percent or greater.
d. Limit the maximum gradient of artificial slopes to no steeper than 2:1 [two (2) feet of horizontal run to one (1) foot of vertical fall] unless a geotechnical engineering report and slope stability analysis is provided and shows that a factor of safety of at least 1.5 for static loads and 1.1 for pseudostatic loads can be met, as demonstrated per the methodology in the clearing and grading development standards.
e. Do no clearing, excavation, stockpiling, or filling on the potential slide block of an unstable or potentially unstable slope unless it is demonstrated to the Town Planner or Designee's satisfaction that the activity would not increase the load, drainage, or erosion on the slope.
f. Do no clearing, excavation, stockpiling, or filling on any unstable or potentially unstable areas (such as landslide deposits) unless it is demonstrated to the Town Planner or Designee's satisfaction that the activity would not increase the risk of damage to adjacent property or natural resources or injury to persons.
g. Intercept any ground water, subsurface water, or surface water drainage encountered on a cut slope and discharge it at a location approved by the Town Planner or Designee. Off-site stormwater (run-on) or groundwater shall be diverted away from slopes and undisturbed areas with interceptor dikes, pipes and/or swales. Off-site stormwater should be managed separately from stormwater generated on the site.
h. Follow the procedures and standards in the clearing and grading development standards related to slopes.
i. Design and protect cut and fill slopes to minimize erosion.
j. Excavated material shall be placed on the uphill side of trenches, consistent with safety and space considerations.

k. Check dams shall be placed at regular intervals within constructed channels that are cut down a slope.

l. At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion. Temporary pipe slope drains shall handle the expected peak 10-minute flow velocity from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis shall use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis shall use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. Bare soil areas should be modeled as "landscaped area."

8. Rockeries. Rockeries may be used for erosion protection of cut or fill slopes. The primary function of a rockery is to protect the slope face from soil erosion and sloughing.

a. Rockeries used to protect uncontrolled fill slopes may be no higher than four (4) feet, as measured from the bottom of the base rock.

b. Rockeries used to protect cut slopes or reinforced or engineered fill slopes may be up to a maximum height of twelve (12) feet, as measured from the bottom of the base rock, with the approval of the Town Planner or designee. Any rockery that is over four (4) feet high, as measured from the bottom of the base rock (cut slopes and reinforced or engineered fill slopes only) shall be designed by a geotechnical engineer.

c. A wall drain must be provided for all rockeries greater than four (4) feet in height as measured from the bottom of the base rock, or when the Public Works Department determines that a drain is necessary. The drains shall be installed in accordance with applicable standards from the latest adopted version of the *Stormwater Management Manual for Western Washington* or approved equivalent.

d. The geotechnical engineer must provide construction monitoring and/or testing as required by the permit conditions, and submit construction inspection reports to the department for all rockeries that require design by a geotechnical engineer. For each project, or phase of a project, the geotechnical engineer must provide a final letter or report summarizing the results of the construction monitoring for each rockery, verifying that the rockery construction meets the geotechnical recommendations and design guidelines. The final letter or report must be submitted to the department prior to the final clearing and grading inspection.

9. Control of Other Pollutants. Construction site operators must properly handle and dispose of other pollutants that are on-site during construction so as to avoid possible health risks or environmental contamination. Direct and indirect discharge of pollutants to the drainage system, critical areas, wetlands, streams, or any other adjacent properties is prohibited.

a. All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater.

b. Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. On-site fueling tanks shall include secondary containment.

c. Maintenance, fueling and repair of heavy equipment and vehicles shall be conducted using spill prevention and control measures. Contaminated surfaces shall be cleaned immediately following any spill incident.
d. Wheel wash or tire bath wastewater shall be discharged to a separate on-site treatment system or to the Town of Eatonville.
e. Application of fertilizers and pesticides shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' label requirements for application rates and procedures shall be followed.
f. BMPs shall be used to prevent or treat contamination of stormwater runoff by pH modifying sources. These sources include, but are not limited to: bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters. Construction site operators shall adjust the pH of stormwater if necessary to prevent violations of water quality standards.
g. Construction sites with significant concrete work shall adjust the pH of stormwater if necessary to prevent violations of water quality standards. Construction site operators obtain written approval from the Department of Ecology prior to using chemical treatment other than CO2 or dry ice to adjust pH.

10. Dewatering Devices

a. Foundation, vault, and trench dewatering water which have similar characteristics to stormwater runoff at the site shall be discharged into a controlled conveyance system prior to discharge to a sediment pond. Channels must be stabilized (as specified in Element #8 of Ecology's *Stormwater Management Manual for Western Washington*, Volume 2 or as amended).
b. Clean, non-turbid dewatering water, such as well-point ground water, can be discharged to systems tributary to state surface waters, provided the dewatering flow does not cause erosion or flooding of receiving waters. These clean waters should not be routed through stormwater sediment ponds.
c. Highly turbid or contaminated dewatering water shall be handled separately from stormwater.
d. Other disposal options, depending on site constraints, may include:
   i. Infiltration.
   ii. Transport off site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.
   iii. On-site treatment using chemical treatment or other suitable treatment technologies.
   iv. Sanitary sewer discharge with local sewer district approval.
   v. Use of a sedimentation bag with outfall to a ditch or swale for small volumes of localized dewatering.

11. Slash Removal. Slash from clearing shall be chipped and spread across the site within one (1) year of project completion.

12. Revegetation. The site shall be revegetated and landscaped as soon as practical, in accordance with a revegetation plan, approved by the Town Planner or Designee.

a. A permanent revegetation plan, utilizing vegetation that is known to have a high natural survival rate, shall be implemented consistent with the Town of Eatonville landscaping, tree protection and replacement, and permanent revegetation regulations in Chapter 18.07 EMC.

b. Where permanent revegetation measures are not in place within seven (7) days in the dry season and two (2) days in the wet season,(October 1 through April 30) the applicant shall provide temporary revegetation or stabilization measures in accordance with the recommendations of the latest edition of Ecology's *Stormwater Management Manual for Western Washington,* and maintain such measures in good condition until the permanent revegetation measures are installed and inspected by the Town of Eatonville.

   i. Temporary revegetation during the dry season for all disturbed areas of the site (exposed and unworked) that are not covered by permanent improvements such as buildings, parking lots, and decks shall be hydro-seeded and irrigated within seven (7) days until vegetation has been successfully established or the site otherwise revegetated or stabilized using straw mulch, or other approved methods on an interim basis.

   ii. Temporary revegetation during the wet season for disturbed areas of the site (exposed and unworked) that are not covered by permanent improvements such as buildings, parking lots, and decks shall be hydro-seeded, otherwise revegetated, or stabilized using plastic sheeting or other approved methods, on a temporary basis within two (2) days until vegetation has been successfully established.

13. Construction Phasing. Staged construction is allowed only if each phase complies with the code, and if the Town Planner or designee approves a phasing plan.

14. Seasonality – Temporary Restrictions. Seasonality refers to the wet season (defined as the period from October 1 through April 30). Clearing, grading, and other land disturbing activities may be approved by the Town Planner or Designee for proposals that have minimal disturbance of soils and are on sites with predominant soils that have low runoff potential, and are not hydraulically connected to sediment/erosion-sensitive features. The following criteria also apply:

a. Wet season clearing, grading, and other land disturbing activities may be approved provided an erosion and sediment control plan is prepared by a professional engineer that specifically identifies methods of erosion control for wet weather conditions to control erosion/sedimentation, surface water run off, and safeguard slope stability. In a situation where erosion or sediment is not contained on site, construction activity shall cease immediately and notification of the Town Planner or designee shall be made within twenty-four (24) hours.

b. When approval is issued in the dry season (defined as May 1 through September 30), and work is allowed to continue in the wet season, the Town of Eatonville may require additional measures to limit erosion/sedimentation for slope stability. The Town Planner or designee may prohibit land-disturbing activities during certain days of the wet season. Determinations shall be made on a site-specific basis and evaluation of the following:

   i. Average existing slope on the site.

ii. Quantity of proposed cut and/or fill.
iii. Classification of the predominant soils and their erosion and runoff potential.
iv. Hydraulic connection of the site to features that are sensitive to erosion impacts.
v. Storm events and periods of heavy precipitation.

c. If a clearing and grading approval is issued for work during the wet season (October 1 through April 30) and the Town Planner or Designee subsequently issues a "Stop Work" order or correction notice for insufficient erosion and sedimentation control, the approval will be suspended until the dry season (May 1 through September 30), or until the Town Planner or Designee determines that weather conditions are favorable and effective erosion and sedimentation control is in place.
d. Certain activities are exempted from seasonal restrictions (For a list of exemptions, see *Stormwater Management Manual for Western Washington-2005*, Construction SWPPP, Vol. 2 or as amended).
e. The following activities are exempt from the seasonal clearing and grading limitations:
   i. Routine maintenance and necessary repair of erosion and sediment control BMPs;
   ii. Routine maintenance of public facilities or existing utility structures that do not expose the soil or result in the removal of the vegetative cover to soil; and
   iii. Activities where there is one hundred percent infiltration of surface water runoff within the site in approved and installed erosion and sediment control facilities.

15. Maintenance. All temporary and permanent erosion and sediment control devices shall be maintained and repaired as needed. Erosion and sediment control devices that are damaged or not working properly shall be returned to operating condition within twenty-four (24) hours of identifying they are not working properly or receiving notice from the Town of Eatonville, or as otherwise directed by the Town Planner or Designee. The contractor shall:

a. Regularly inspect (weekly and within 24 hours after any runoff producing storm event during the dry season, (May 1 through September 30) and daily including on weekends during the wet season) all temporary and permanent erosion and sedimentation BMPs and maintain them per the development standards so that they function as intended until the site has been permanently stabilized, and the potential for on-site erosion has passed. Inlets should be inspected weekly at a minimum and daily during storm events. Inlet protection devices should be cleaned or removed and replaced when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).
b. Return any BMPs that are damaged or not working properly to normal operating conditions as directed by the town or within twenty-four (24) hours of receiving notice from the Town Planner or Designee. BMPs that must be addressed include: stream buffers/setbacks, stormwater/pollutant protection, natural feature preservation/vegetation retention, critical area protection, setbacks/buffers, wetlands, fish habitat, avoidance of hazards, revegetation, erosion and sediment control, and permanent retention/detention facilities.

The responsibility for maintaining site stability and maintenance objectives for buffer vegetation and permanent erosion, sedimentation, and runoff control structures for the original permit requirements is the responsibility of the property owner once the work is complete and final restoration measures have been installed as per the plans or approved permit requirements.

16. Ponds and Reservoirs. Grading and excavation to construct ponds and reservoirs shall:

a. Meet all applicable setbacks specified in this code, except for stormwater detention facilities authorized by the Town Planner or Designee.
b. Maintain in-stream flows of natural drainage courses.
c. Protect adjacent property from damage.

17. Site-Specific Requirements. Additional, site-specific requirements may be established after a site visit by the town. These requirements shall be based on specific site conditions and are limited to additional temporary erosion and sedimentation control and the mitigation of hazardous or potentially hazardous conditions that pose a threat off site or habitat preservation.

18. Project Management.

a. Construction site operators shall maintain, update and implement their Stormwater Pollution Prevention Plan (SWPPP). Construction site operators shall modify their SWPPP whenever 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.
b. For construction sites one acre or larger that discharge stormwater to surface waters of the state, a Certified Erosion and Sediment Control Specialist shall be identified in the Construction SWPPP and shall be on-site or on-call at all times. Certification may be obtained through an approved training program that meets the erosion and sediment control training standards established by Ecology. For sites disturbing more than one acre, site inspections shall be conducted by a Certified Erosion and Sediment Control Lead who shall be identified in the SWPPP and shall be present on-site or on-call at all times.
c. Maintaining an Updated Construction SWPPP - The Construction SWPPP shall be retained on-site or within reasonable access to the site.
d. The SWPPP shall be modified whenever there is a significant change in the 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.
e. The SWPPP shall be modified, if during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven (7) calendar days following the inspection.

19. Tree Retention. Trees shall be retained to the maximum extent feasible.

a. Clearing should not occur outside of the areas designated on the clearing plan.

b. No tree(s) or groundcover as defined in section 16.53.030.X shall be removed from a native vegetation area or environmentally sensitive site unless that plot plan and other submitted materials can demonstrate that the removal will enhance the area as discussed in 18.07.090. An exception for the installation of roads and utilities may be approved if it can be demonstrated that alternative access is not practical or would be more damaging and is developed pursuant to an approved development plan.
c. Enhancement may include non-mechanical removal of noxious or intrusive species or dead or diseased plants and replanting of appropriate native species.

20. Protection During Construction. Where the drip line of a tree overlaps a construction line, this shall be indicated on the survey and the following tree protection measures shall be employed:

a. The applicant may not fill, excavate, stack or store any equipment, or compact the earth in any way within the area defined by the drip line of any tree to be retained.
b. The applicant shall erect and maintain rope barriers on the drip line or place bales of hay to protect roots. In addition, the applicant shall provide supervision whenever equipment or trucks are moving near trees.
c. If the grade level adjoining a retaining tree is to be raised or lowered, the applicant shall construct a dry rock wall or rock well around the tree. The diameter of this wall or well must be equal to the tree's drip line.
d. The applicant may not install ground level impervious surface material within the area defined by the drip line of any tree to be retained.
e. The grade level around any tree to be retained may not be lowered within the greater of the following areas: (1) the area defined by the drip line of the tree, or (2) an area around the tree equal to one foot in diameter for each one-inch of tree caliper.
f. The applicant may prune branches and roots, fertilize and water as horticulturally appropriate for any trees and groundcover species which are to be retained.

The Town Planner or designee may approve the use of alternative tree protection techniques if those techniques provide an equal or greater degree of protection than the techniques listed above.

M. Native Soil Protection and Amendment.

1. The duff layer and native topsoil should be retained in an undisturbed state to the maximum extent practicable. In areas requiring grading, remove and stockpile the duff layer and topsoil on site in a designated, controlled area, not adjacent to public resources and critical areas, to be reapplied to other portions of the site where feasible.
2. Soil quality and depth. All areas subject to clearing and grading that have not been covered by impervious surface, incorporated into a drainage facility or engineered as structural fill or slope shall, at project completion, shall demonstrate compliance with the Guidelines for Implementing Soil Quality and Depth (BMP T5.13 in the *Stormwater Management Manual for Western Washington-2005* or as amended).

16.53.060 Failure to comply.

A. Failure to comply with the requirements of this chapter or an order from the administrator or designee regarding best management practices at a construction or site development project shall be subject to a stop work order and/or a civil infraction citation <u>and/or a misdemeanor subject to the penalties of RCW 9A.20.010(2). The civil infraction citation would be</u> in the amount of:

1. Fifty dollars for the first ~~offence~~ <u>offense</u>;
2. One hundred dollars for the second ~~offence~~ <u>offense</u>;
3. Two hundred fifty dollars for each additional ~~offence~~ <u>offense</u>.

B. Each additional day that the failure to comply continues shall constitute a distinct, separate offence. If the administrator or designee determines that any construction or site development practices on private property violate a provision of this chapter or are likely to create a hazard to the public safety, health or welfare, the environment, or public or private property, the administrator or designee may declare such condition a public nuisance and may direct the property owner or persons causing or contributing to the hazardous condition to abate the hazard within a specified period, or the administrator or designee may take action to abate the hazard and recover all costs incurred from the responsible parties. Payments shall be made within 90 days of the day the town submits a bill for costs and any stop work order issued will not be lifted prior to payment. In the event of nonpayment, the town may bring suit to recover such costs, including its attorney's fees, and upon obtaining a judgment, such amount shall become a lien against the property of the owner. A requirement or action to abate the hazard which is appealed pursuant to this or any other title of this code shall not be subject to a stay. (Ord. 2005-20 § 1, 2005).

Chapter 16.54
STORMWATER MANAGEMENT AND EROSION CONTROL

Sections:

16.54.010 Purpose.
It is the purpose of this chapter to guide and direct development or redevelopment within the town of Eatonville to control the adverse effects of erosion and sedimentation. The provisions of this chapter establish the minimum level of compliance that must be met to permit a property to be developed or redeveloped within the town of Eatonville.

Specifically, this chapter includes provisions to:
A. Protect property owners from increased runoff rates and from erosion, sedimentation, and other damage caused thereby;
B. Minimize water quality degradation and sedimentation in streams, ponds, lakes, wetlands, and other water bodies;
C. Maintain and protect groundwater resources;
D. Minimize adverse impacts of alterations of ground and surface water quantities, locations, and flow patterns;
E. Decrease potential landslide, flood, and erosion damage to public and private property;
F. Preserve and enhance the suitability of waters for contact recreation, fishing, and other beneficial uses;
G. Maintain and protect the town of Eatonville's stormwater management infrastructure, and downstream stormwater management infrastructure;
H. Provide a means of regulating clearing and grading of private and public land, to control water quality impacts, in order to protect public health and safety;
I. Provide minimum development regulations that will preserve, replace, or enhance existing native vegetation in order to preserve and enhance the valuable qualities of land and water bodies; and
J. Protect the health, safety, and welfare of the citizens of the town of Eatonville. (Ord. 98-16 § 1,
1998).

16.54.020 Stormwater Management and Site Development Manual adopted.
The Pierce County Stormwater Management and Site Development Manual, ~~effective November 3, 1997~~, latest edition is adopted and made a part hereof as though fully set forth in this chapter. (Ord. 98-16 §2, 1998).
The LID Technical Guidance Manual for Puget Sound (latest edition), is adopted and made a part hereof as though fully set forth in this chapter.

16.54.030 Definitions.
For the purposes of this chapter, definitions in the adopted manual shall apply except where different definitions are included herein. Words set out in this section shall have the following meanings:
A. “Approval” means a statement, by the director, that the proposed or completed work conforms to this chapter.
B. “Civil engineer” means an engineer licensed in civil engineering in the state of Washington.
C. “Civil engineering” means the application of the knowledge of the forces of nature, principles of mechanics, and the properties of materials to the evaluation, design, and construction of civil works for the beneficial use of mankind.
D. “Commercial agriculture” means those activities conducted on lands defined in RCW 84.34.020(2), and activities involved in the production of crops or livestock for wholesale trade. An activity ceases to be considered commercial agriculture when the area on which it is conducted is proposed for conversion to a nonagricultural use or has lain idle for more than five years, unless the idle land is registered in a federal or state soils conservation program, or unless the activity is maintenance of irrigation ditches, laterals, canals, or drainage ditches related to an existing and ongoing agricultural activity.
E. “Critical areas” means “sensitive areas,” as defined and governed by Chapter 15.20 EMC.
F. “Director” means the Eatonville public works director.
G. “Ecology” means the Washington State Department of Ecology.
H. “Excavation” means the mechanical removal of earth material.
I. “Fill” means a deposit of earth material by artificial means.
J. “Frequently flooded areas” means areas as defined and regulated in Chapter 15.20 EMC.
K. “Geologically hazardous areas” means areas as defined and regulated in Chapter 15.20 EMC.
L. “Grade” means the slope of a road, channel, or natural ground; the finished surface of a canal bed, roadbed, top of embankment, or bottom of excavation; or any surface prepared for the support of construction such as paving or the laying of conduit.
M. “Large parcel” means:
   1. A multifamily residential structure of three units or more;
   2. Creation or addition of 5,000 or more square feet of impervious surface area; or
   3. Land disturbing, activities totalling one acre or more, including all project phases.
N. “Large parcel erosion and sediment control plan” or “large parcel ESC plan” means a plan to implement BMPs to control pollution generated during land disturbing activity. Components of a large parcel ESC plan are defined in the manual under the heading “Drainage and Erosion/Sediment Control Plan Components.”
O. “Low Impact Development (LID)” means a stormwater management strategy that emphasizes conservation and use of existing natural site features integrated with distributed, small-scale stormwater controls to more closely mimic natural hydrologic patterns in residential, commercial, and industrial settings.
~~O.~~P “Manual” means the manual adopted by the town of Eatonville.
~~P.~~Q. “Mitigation” means, in the following order of preference:
   1. Avoiding the impact altogether by not taking a certain action or part of an action.
   2. Minimizing impacts by limiting the degree or magnitude of an action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts.
   3. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.

4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

5. Compensation for the impact by replacing, enhancing, or providing substitute resources or environments.

~~Q~~.R. “Permanent stormwater quality control (PSQC) plan” means a plan which includes permanent BMPs for the control of pollution from stormwater runoff after construction and/or land disturbing activity has been completed. For small sites, this requirement is met by implementing a small parcel erosion and sediment control plan. Guidance on preparing a PSQC plan is included in the manual under the heading “Design Standards Quality.”

~~R~~.S. “Pollution” means contamination or other alteration of the physical, chemical, or biological properties of waters of the state. Pollution may include changes in temperature, taste, color, turbidity, or odor of the waters. Pollution also includes such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious. Pollution may impact the public health, safety, or welfare; domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or livestock, wild animals, birds, fish, or other aquatic life.

~~S~~.T. “Regional detention and/or retention facility” means a stormwater quantity control structure designed to control surface water runoff from a basin or sub-basin containing a number of different businesses, developments, or areas. Regional detention and/or retention facilities may be designed to correct existing surface water problems, to provide or future growth, or both. Regional detention and/or retention facilities may be publicly or privately conceived, designed, and built, but they will typically be publicly owned and maintained after completion.

~~T~~.U. “Slope” means the degree of deviation of a surface from the horizontal, measured as a numerical ratio, a percentage, or in degrees. Expressed as a ratio, the first number is the horizontal distance (run) and the second number is the vertical distance (rise). Expressed as a percentage, the numerator is the rise and the denominator is the run. Expressed in degrees, 0 degrees is horizontal (minimum) and 90 degrees is vertical (maximum); the degree of slope is the arctangent of the rise divided by the run. A 1:1 slope is a 100 percent slope is a 45 degree slope; a 4:1 slope is a 25 percent slope is a 14 degree slope.

~~U~~.V. “Small parcel” means:

1. An individual detached single-family residence;
2. A duplex; or
3. Land disturbing activities of less than one acre and involving the creation or addition of less than 5,000 square feet of impervious surface area.

~~V~~.W. “Small parcel erosion and sediment control plan” or “small parcel ESC plan” means a plan for
small sites to implement temporary BMPs to control pollution generated during the construction phase only. Guidance for preparing a small parcel ESC plan is contained in the manual. Components of a small parcel ESC plan are defined in the manual under the heading “Requirements for Drainage and Erosion/Sediment Control for Construction of Single-Family and Duplex Residences and Other Small Projects.”

~~W~~.X. “Soil” means the unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

~~X~~.Y. “Source control BMP” means a BMP that is intended to prevent pollutants from entering stormwater. A few examples of source control BMPs are erosion control practices, maintenance of stormwater control facilities, constructing roofs over storage and working areas, and directing wash water and similar discharges to the sanitary sewer or a dead end sump.

~~Y.~~Z “Stormwater drainage system” means constructed and natural features which function together as a system to collect, convey, channel, hold, inhibit, retain, detain, infiltrate, divert, treat, or filter stormwater.

~~Z~~.AA “Stormwater facility” means a constructed component of a stormwater drainage system. A stormwater facility may be designed or build to perform a particular function or a combination of functions. Stormwater facilities include, but are not limited to, pipes, swales, ditches, culverts, street gutters, detention basins, retention basins, constructed wetlands, infiltration devices, catch basins, oil/water separators, sediment basins, and porous pavements.
~~AA~~.BB. “Stormwater management manual” means the manual adopted by the town of Eatonville.
~~BB~~.CC. “Stormwater site plan” means a plan which includes an erosion and sediment control (ESC)
plan and/or a permanent stormwater quality control (PSQC) plan. For small sites, this plan is the equivalent of a small parcel erosion and sediment control plan. Guidance on preparing a stormwater site plan is included in the manual.
~~CC~~.DD. “Technical deviations” means use of methods, dimensions, facilities, or sequences which differ from those described in the manual; technical deviations may be approved only to achieve the purposes of this chapter.
~~DD~~.EE. “Unstable slopes” means “landslide hazard areas” as defined and regulated under Chapter 15.20 EMC.
~~EE~~.FF. “Vegetation” means any or all plant life growing on the surface of the earth.
~~FF~~.GG. “Wetland” means an area as defined and regulated under Chapter 15.16 EMC. (Ord. 98-16 § 3, 1998).

Chapter 17.18
GENERAL DESIGN STANDARDS FOR ALL LAND SUBDIVISIONS

Sections:

17.18.010 Design standards required.
All divisions of land shall comply with all ordinances of the town of Eatonville, the development and construction standards of the town of Eatonville, laws of the state of Washington, and standards for public works construction set forth or referenced in the town standards and/or ordinances.(Ord. 92-9 § 3, 1992).

17.18.020 Future subdivision and access.
All land divisions shall be designed to accommodate the future land divisions of adjoining lands

by providing for adequate future access and utility service. Pedestrian and bicycle access to schools, parks, shorelines, recreation areas and open space shall be provided by walkway where street access is unsafe or inadequate. (Ord. 92-9 § 3, 1992).

17.18.030 Blocks – Nonresidential zone dimensions.
Blocks in nonresidential zones shall be dimensioned to accommodate the intended purpose of the land use. (Ord. 92-9 § 3, 1992).

17.18.040 Minimum lot size.
Lots or tracts shall be not less than the minimum size required in the zoning district unless dedicated or restricted by covenant for open space, park, recreational or other community or public use or unless lot size averaging or planned development criteria and/or procedures are used. (Ord. 2000-05 § 3, 2000; Ord. 92-9 § 3, 1992).

17.18.050 Lot size averaging.
The size of lots in land divisions may be reduced below the minimum lot size of the zone district provided:

A. The mean average lot size shall not be less than that required in the zone district. In computing the average lot size:

1. No lot shall be credited with more than 1.1 times the minimum lot size.
2. No lot shall be less than 0.95 times the minimum lot size.
3. No credit shall be granted for any lot areas subject to an existing or proposed access, stormwater management, surface drainage, or other easement or restriction substantially reducing the usability of the ground surface. Underground utility easement areas may be included in lot size average calculations.
4. No credit shall be granted for any “flagpole” or “panhandle” areas.

B. No less than four-fifths (80 percent) of the proposed lots shall have lot areas equal to or larger than the minimum lot size.

C. No corner lot shall have an area less than the minimum lot size.

D. If the land division is submitted in phases/divisions of development, each phase/division submitted for approval shall meet all provisions of this section. (Ord. 2000-05 § 4, 2000; Ord. 92-9 § 3, 1992).

17.18.060 Residential lot building sites.
Each residential lot in low-density residential zones shall have a building site within it no less than 1,600 square feet in area within which a suitable building can be built and served by utilities and vehicular access unless dedicated or restricted by covenant for open space, park, recreation or other public use. The building site area herein required shall not include any very severe development limitation areas. Such building sites with limited use shall be indicated on the face of the preliminary land division. (Ord. 92-9 § 3, 1992).

17.18.070 Clearing and grading.
Proposed clearing and grading should be minimized if possible by the use of shared-access driveways and careful location of streets and building sites. (Ord. 92-9 § 3, 1992).

17.18.080 Wetlands and drainage.
Wetlands and natural drainageways shall be subject to review under the Wetlands and Critical/Sensitive Area Ordinance. (Ord. 92-9 § 3,1992).

17.18.090 Hazards.
Where land division and development of land may pose a hazard to the land division and nearby properties because of steep slopes, unstable soils, excessive stormwater runoff or soil erosion, seismic areas and similar hazards set forth in the Critical/ Sensitive Area Ordinance, the land divider shall have the burden of presenting evidence satisfactory to the town for hazard mitigation per the Critical/Sensitive Area Ordinance. (Ord. 92-9 § 3,1992).

17.18.100 Streets.
A. All streets shall be in accordance with this section and the Road and Storm Standards for the town of Eatonville which is on file at the Town Hall. The size of streets and their associated rights of- way shall be as shown on the street/road standards for the class of street which is appropriate to serve the land division and anticipated community traffic, existing and potential as set forth in the Eatonville Road and Storm Standards. In areas where the division is adjacent to an existing street right-of-way, dedications shall be made to the existing street centerline in order to make the street right-of-way comply with the town standards.
B. In addition, streets must meet the following:
1. Relation to Adjoining Street Systems.
The layout of streets shall provide for the continuation of streets existing in adjoining property. The layout shall also provide for future projection of streets;
2. Intersections. Street intersections shall be as nearly at right angles as is practicable;
3. Jogs at Intersections. Streets jogs with centerline offset of less than 125 feet for access streets and 200 feet for arterials shall be avoided unless practical alternatives are not available;
4. Dead-End Streets. For any street temporarily dedicated, the developer shall provide a temporary turnaround facility as approved by the director;
5. Width. Street right-of-way widths shall meet the following minimum standards:

a. Major arterial streets: 80 feet,
b. Secondary arterial streets: 60 feet,
c. Collector arterial streets: 60 feet,
d. Access streets: 60 feet,
e. Cul-de-sac streets: 50 feet.
f. LID Cul-de-sac streets: 50 feet.
g. Alleys: 20 feet
h. LID Access streets: 60 feet

C. A street lying along the boundary of a subdivision may be dedicated one-half width when the adjoining property is unsubdivided; and, whenever there exists a dedicated half-street of an adjoining plat, the other half shall be dedicated on the proposed plat to make the street complete. (Ord. 92-9§ 3, 1992).

17.18.110 Driving surface and rights-of-way.
All roads shall be designed and constructed in accordance with the adopted Eatonville Road and Storm Drainage Standards for the town of Eatonville in effect at the date of acceptance of the land division. (Ord. 92-9 § 3, 1992).

17.18.120 Cul-de-sacs.
A. Cul-de-sacs shall have an improved turnaround with a minimum outside radius of 38 feet.
B. A “T” or “Y” or “hammerhead” configuration may be approved for private roads instead of a turning circle, if warranted by special conditions and approved by the public works director.
C. Use of the LID Cul-de-Sac option is encouraged.
~~C~~. D. Cul-de-sacs generally should not exceed 1,000 feet in length.

~~D~~. E. Parking is prohibited in a cul-de-sac turnaround and shall be posted. (Ord. 92-9 § 3, 1992).

Chapter 18.02
DEFINITIONS

Sections:

18.02.097-A Deciduous
"Deciduous" means trees that shed or loose their foliage at the end of the growing season.

18.02.106 Diameter at breast height (DBH).
"Diameter at breast height (DBH)" means the diameter of the tree when measured at 4 feet above ground.

18.02.132-A Evergreen.
"Evergreen" means trees that retain their leaves for more than one growing season.

18.02.255A Low Impact Development (LID).
"Low impact development" means a stormwater management strategy that emphasizes conservation and use of existing features integrated with distributed, small-scale stormwater controls to more closely mimic natural hydrologic patterns in residential, commercial, and industrial settings (*LID Technical Guidance Manual for Puget Sound-January 2005 or as amended*).

18.02.275-A Native vegetation.
"Native vegetation" includes native, undisturbed areas or rehabilitation of previously disturbed areas that consist of trees, plants, forest litter, and understory indigenous to the Pacific Northwest or near natives that are suitable for the Pacific Northwest climate. Invasive species, such as Himalayan Blackberry or Scotch Broom, are not native species. For the purposes of this chapter, native vegetation is defined by a tree density of no less than one tree unit per 600 square feet."

18.02.485-A Significant Tree
"Significant Trees" means trees 12" DBH or greater.

Chapter 18.04.190
PLANNED UNIT DEVELOPMENT – PUD

The intent of the PUD is to create a process to promote diversity and creativity in site design, and protect and enhance natural and community features. The process is provided to encourage unique developments which may combine a mixture of residential, commercial and industrial uses. <u>Low Impact Development (LID) projects and best management practices are an encouraged option and shall be designed in accordance with 18.04.200 Low Impact Development</u>. By using flexibility in the application of the development standards, this process will promote developments that will benefit citizens that live and work in the town.

A. Zoning Districts Where Permitted. PUDs are permitted in all zoning districts.

B. Permitted Uses.
1. Principally Permitted Uses. The principally permitted uses in PUDs shall be the same as those permitted in the underlying zoning classifications.
2. Conditional Uses. The conditional uses in PUDs shall be the same as those permitted in the underlying zoning classification. The conditional use permit review process may be consolidated with that of the PUD pursuant to the procedures specified in subsection (F) of this section.
3. Accessory Uses. Accessory uses and buildings which are customarily incidental and subordinate to a principally permitted use are also permitted.
4. Exceptions. In the residential PUDs of 10 acres or more, commercial uses may be permitted. Commercial uses shall be limited to those uses permitted in the neighborhood convenience district.

C. Development Standards. The following development standards are minimum requirements for a planned unit development:
1. Minimum Lot Size Exclusion. The minimum lot size requirements of the districts outlined in this title shall not apply to PUDs.
2. Minimum Site Acreage. Minimum site acreage for a PUD is established according to the zoning district in which the PUD is located.
3. Minimum Perimeter Building Setback. The minimum perimeter building setback of the underlying zone shall apply. Multifamily area requirements shall apply to any multifamily developments. The board of adjustment may reduce building separation requirements to the minimum required by the building and fire departments, according with the criteria set forth in subsection (F)(1) of this section. If an adjacent property is undevelopable under this title, the planning commission may also reduce the perimeter setback requirement to the minimum standards in the town building and fire codes.
4. Maximum Height of Structures. The maximum height of structures of the underlying zone shall apply. The planning commission may authorize additional height in C and I zones where pro posed development in the PUD is compatible with the scale and character of adjacent existing developments.
5. Open Space.
    a. The standard set forth in this subsection shall apply to PUD residential developments only. Each PUD shall reserve a maximum of 35 percent of the area denoted for residential use as open space.
    b. For the purpose of this section, open space shall be defined as land which is not used for buildings, dedicated public rights-of-way, traffic circulation and roads, parking areas or any kind of storage. Open space includes, but is not limited to, privately owned woodlands, open fields, streams, wetlands, severe hazard areas, sidewalks, walkways,

landscaped areas, gardens, courtyards or lawns. Common open space may provide for either active or passive recreation.

c. Open space within a PUD shall be available for common use by the residents, tenants or the general public, depending on the type of project.

6. Streets. If streets within the development are required to be dedicated to the town for public use, such streets shall be designed in accordance with the standards outlined in the town subdivision code and other appropriate town standards. If the streets within the development are to remain in private ownership and remain as private streets, then the following standards shall apply:

a. Minimum Private Street Pavement
Widths. Minimum private street pavement widths for parallel parking in residential planned unit developments are as follows:

	No Parking (feet)	**Parking One Side (feet)**	**Parking Both Sides (feet)**
One-way streets:	~~20~~ 16	~~29~~ 24	~~38~~ 32
Two-way streets:	~~22~~ 20	~~31~~ 28	~~40~~ 36

The minimum widths set out in this subsection (6) may be modified upon review and approval of the town fire chief and the town public works director providing they are sufficient to maintain emergency access and traffic safety. A maintenance agreement for private streets within a PUD shall be required by the planning commission as a condition of PUD approval.

b. Vehicle Parking Areas. Adequate vehicular parking areas shall be provided. The required number of parking spaces may vary from the requirements of Chapter 18.05 EMC and shall be approved by the planning commission based upon a parking need assessment study submitted by the applicant and approved by the planning director. Vehicular parking areas may be provided by on-street or off-street parking lots. The design of such parking areas shall be in accordance with the standards outlined in Chapter 18.05 EMC.

c. One-Way Streets. One-way loop streets shall be no more than 1,500 feet long.

d. On-Street Parking. On-street parking shall be permitted. Privately owned and maintained "no parking" and "fire lane" signs may be required as determined by the town public works director and town fire department chief.

7. Pedestrian Walkways. Pedestrian walkways shall be constructed of material deemed to be an all-weather surface by the public works director;

8. Landscaping and Tree Retention Requirements.

a. Minimum perimeter landscaping of the underlying zone shall apply. Additional landscaping shall be required as provided in Chapter 18.07 EMC.

b. Native vegetation requirements for PUD's shall comply with the requirements set forth in Chapter 18.07.065 Tree Retention and Conservation.

~~b~~. c. All PUD developments shall ensure that parking areas are integrated with the landscaping system and provide screening of vehicles from view from public streets. Parking areas shall be conveniently located to buildings and streets while providing for landscaping adjacent to buildings and pedestrian access.

~~c~~.d. Solid waste collection areas and waste reduction or recycling areas shall be conveniently and safely located for on-site use and collection, and attractively site screened.

9. Signs. The sign regulations of Chapter 18.06 EMC shall apply.

10. If portions of the PUD are to be subdivided for sale or lease, the procedures of the town

subdivision code, as amended, shall apply. Specific development standards such as lot size, street design, etc. shall be provided as outlined in EMC 18.04.190(C).

11. Shoreline Master Program. Any development located within 200 feet of the Mashell River shall adhere to the town shoreline master program regulations.

TOWN OF EATONVILLE

DRAFT TITLE 18.04.200
PLANNED LOW IMPACT DEVELOPMENTS (PLID)

Sections:

18.04A.200 Purpose.

It is the intent of this chapter to:

A. Manage stormwater through a land development strategy that emphasizes conservation and use of on-site natural features integrated with engineered, small-scale hydrologic controls to more closely mimic predevelopment hydrologic conditions.
B. Encourage creative and coordinated site planning, the conservation of natural conditions and features, the use of appropriate new technologies and techniques, and the efficient layout of streets, utility networks and other public improvements.
C. Minimize impervious surfaces and effective impervious surfaces.
D. Encourage the creation or preservation of permanent forested open space.
E. Encourage development of residential environments that are harmonious with on-site and off-site natural and built environments.
F. Further the goals and the implementation of the policies of the comprehensive land use plan.

18.04A.210 LID Design Criteria.

Conformance to the following criteria is required for all development reviewed under the provisions of this chapter:

A. LID projects shall meet the minimum peak and duration flow control standards per the *Stormwater Management Manual for Western Washington*, current edition.
B. Flow control facilities may be reduced in size through the standards contained in the *LID Technical Guidance Manual for Puget Sound* (January 2005, Section 7.2.2 or as amended) - full dispersion for all or part of the development site.
C. Water quality treatment BMPs shall be provided to treat 91 percent of the annual runoff volume per the Department of Ecology standards.
D. All site soils disturbed during construction shall be rehabilitated to the specifications and guidance of the most current version of the *LID Technical Guidance Manual for Puget Sound*.
E. After the certificate of occupancy is issued, there shall be no net increase in effective impervious surfaces for all PLID projects.

F. All projects shall provide a maintenance plan/program that has been approved by the town, including source control BMPs.

G. LID projects shall reduce the size of conventional detention facilities (e.g., ponds, vaults, etc.) as follows:

1. Calculate the volume of a conventional project by using the conventional modeling assumptions in Table 18.08A.20-2: Impervious Surface Maximum Limits and Modeling Assumptions.
2. Reduce the conventional volume by the percentage shown in Table 18.08A.20-1: Volume Reduction and Native Vegetation Requirements to find the allowed LID project volume.
3. Apply sufficient LID techniques to the project so that when the techniques are modeled using guidance from Chapter 7 of the *LID Technical Guidance Manual for Puget Sound* (January 2005 or as amended) the conventional volume is reduced to the required volume reduction percentage found in Table 18.08A.20-1. LID projects shall preserve native vegetation area according to the percentages shown in Table 18.08A.20-1. If the site has already been disturbed, the site shall be revegetated to meet the percentages shown in Table 18.08A.20-1.

TABLE 18.08A.20-1: Volume Reduction and Native Vegetation Requirements	Minimum Volume Reduction (Infiltration < 0.30 in/hr) [1,2]	Minimum Volume Reduction (Infiltration of ≥ 0.30 in/hr) [1,2]	Minimum Native Vegetation Area[3]	Maximum Impervious Surface
Non-Multifamily Residential ≤1.4 du/ac	50%	60%	35%	15%
Non-Multifamily Residential 1.5-2.4 du/ac	50%	60%	35%	15%
Non-Multifamily Residential 2.5-3.4 du/ac	50%	60%	35%	20%
Non-Multifamily Residential 3.5-4.9 du/ac	50%	60%	35%	30%
Non-Multifamily Residential 5.0-6.9 du/ac	50%	60%	20%	35%
Non-Multifamily Residential 7.0-9.9 du/ac	50%	60%	20%	40%
Non-Multifamily Residential ≥10.0 du/ac	50%	60%	20%	60%
Multi-Family[4,5]	40%	80%	20%	70%
Commercial[5]	40%	80%	10%	70%

[1] The volume reduction in the table represents a reduction as compared to the volume needed for a detention volume serving a standard development.

[2] Infiltration rates are as measured in the field at the proposed LID location using techniques recommended in the most current edition of the *Stormwater Management Manual for Western Washington* and the *Low Impact Technical Guidance Manual for Puget Sound*.

[3] Native vegetation area includes native, undisturbed areas or rehabilitation of previously disturbed areas. Native vegetation areas may integrate passive recreation facilities. Active recreation areas shall not count towards native vegetation areas total.

[4] Impervious area includes all hard surfaces that impede infiltration of rainfall into the underlying soil profile. These surfaces include but are not limited to compacted soil, asphalt concrete pavement, cement concrete pavement, roofs, and gravel paved areas. Green roofs and minimal excavation foundations, subject to conformance with applicable Department of Ecology BMPs, are not included in the total impervious area. Rainwater harvesting systems based on documented water balance may be used to reduce the calculated total impervious area. Permeable pavement systems such as modular grid pavement or pervious concrete count against the impervious surface totals only to the

extent indicated by Section 7.1.1 of the *LID Technical Guidance Manual for Puget Sound* (January 2005 or as amended).

[5] Multi-family projects are those projects containing more than four dwelling units attached in a single structure, regardless of ownership mechanism.

Table 18.08A.20-2: Impervious Surface Maximum Limits and Modeling Assumptions[1]

Dwelling Units Per Acre[2]	Conventional % Impervious: *Modeling Assumption*	Conventional % Turf: *Modeling Assumption*
Non-Multifamily Residential ≤1.4 du/ac	15%	85%
Non-Multifamily Residential 1.5-2.4 du/ac	25%	75%
Non-Multifamily Residential 2.5-3.4 du/ac	35%	65%
Non-Multifamily Residential 3.5-4.9 du/ac	40%	60%
Non-Multifamily Residential 5.0-6.9 du/ac	50%	50%
Non-Multifamily Residential 7.0-9.9 du/ac	60%	40%
Non-Multifamily Residential ≥10.0 du/ac	80%	20%
Multifamily Residential	90%	10%
Commercial	90%	10%

[1] Impervious area includes all hard surfaces that impede infiltration of rainfall into the underlying soil profile. Many LID Techniques improve the ability of water to infiltrate into the soil. These techniques count against the impervious surface totals only to the extent indicated by Chapter 7 of the *LID Technical Guidance Manual for Puget Sound* (January 2005 or as amended).

[2] Dwelling units per acre is based on gross density.

18.04A.220 Permitted uses.

Uses allowed in a low impact development shall include permitted, accessory and conditional uses allowed in and subject to the conditions of the underlying zone district(s).

18.08A.40 Conformance.

All uses and development shall conform to all relevant requirements and standards of:

A. The zone district(s) within which the low impact development is located, except as may be modified by this chapter;
B. The International Building and Fire Codes;
C. All applicable density requirements of the Eatonville Development Regulations; and
D. Other applicable official controls.

18.08A.50 General design criteria.

A. The location of all streets, buildings, parking areas, pedestrian, bicycle and vehicular ways, and utility easements shall be designed to promote public safety, compatibility of uses, minimize effective impervious surface, preserve forested open space, and complement predevelopment site characteristics such as topography, soils, hydrology, and other natural features.
B. Low impact developments shall record an easement or covenant against the land title to ensure that the low impact development features are protected.

18.08A.60 Native Vegetation Areas.

A. For the purposes of calculating required area, inundated lands shall not be included; however, other sensitive areas and their buffers may be included within the Native Vegetation Area boundaries. Land below an ordinary high water mark shall not be counted towards the required native vegetation.
B. Native Vegetation Areas shall be forested or reforested.
    1. Native Vegetation Areas that do not contain sufficient tree canopy coverage shall be planted with native or near native trees with a minimum of one native tree for every 600 square feet to be replanted, in accordance with the requirements of Chapter 18.07.65

2. Native Vegetation Areas shall be planted with vegetation that is indigenous to the Pacific Northwest or suitable for the Pacific Northwest climate. See Chapter 18.07.65 for a list of appropriate tree species.
3. Native Vegetation Areas that do not contain sufficient native vegetation, forest litter and understory shall be replanted. Reforested areas shall be replanted in accordance with Chapter 18.07.65

C. Existing native vegetation, forest litter and understory shall be preserved to the extent possible in the Native Vegetation Areas in order to reduce flow velocities and encourage sheet flow on the site. Runoff discharged into native vegetation areas shall be dispersed in accordance with BMP T5.30, Volume V, of the *Stormwater Management Manual for Western Washington-2005* or as amended. Further guidance on full or partial dispersion of stormwater runoff is provided in Section 7.2.2 and 7.2.3 of the *LID Technical Guidance Manual for Puget Sound* (January 2005 or as amended).

D. Development within Native Vegetation Areas shall be limited to stormwater dispersion facilities, pervious pedestrian trails, and approved surface water restoration projects. Activities within the Native Vegetation Areas shall be limited to passive recreation, removal of invasive species, amendment of disturbed soils consistent with all applicable regulations, and planting of native vegetation. Development shall be consistent with critical areas requirements and restrictions in Title 15.16 EMC.

E. A permanent protective mechanism shall be legally established to ensure that the required Native Vegetation Area is preserved and protected in perpetuity in a form that is acceptable to both the applicant and the Town and filed with the Town auditor's office. A permanent Native Vegetation Area shall be established using one of the following mechanisms.
   1. Placement in a separate non-building tract owned in common by all lots within the subdivision;
   2. Covered by a protective easement or public or private land trust dedication;
   3. Preserved through an appropriate permanent protective mechanism that provides the same level of permanent protection as subsection (a) of this section as determined by the approval authority.

F. Restrictions on the future use of the Protective Native Growth Area shall be recorded on the face of the final plat, short plat or large lot subdivision.

18.08A.70 Native soil protection and amendment.

A. The duff layer and native topsoils shall be retained in an undisturbed state to the maximum extent practicable. Any duff layer or topsoil removed during grading shall be stockpiled on-site in a designated, controlled area not adjacent to public resources and critical areas. The material shall be reapplied to other portions of the site where feasible.

B. Except as otherwise provided in subsection (3), areas that have been cleared and graded or subject to prior disturbance shall be amended. Prior disturbance shall include soil compaction or removal of some or all of the duff layer or underlying topsoil. The amendment shall take place between May 1 and October 1. Replaced topsoil shall be a minimum of 8 inch depth, unless the applicant demonstrates that a different thickness will provide conditions equivalent to the soil moisture holding capacity native to the site. Replaced topsoil shall have an organic content of 10 percent dry weight and a pH between 5.5 and 7.0. The intent of amending disturbed soils is to restore the moisture holding capacity of the original undisturbed native soil to the maximum extent practicable.

C. This section does not apply to areas would harm existing trees proposed for retention, or that, at project completion, are covered by an impervious surface, incorporated into a drainage facility or engineered as structural fill or slope.

18.08A.80 Clustering.

A. To achieve the goals of low impact development, residential lots shall be clustered within the designated development area of the site. Clustering is intended to preserve open space, reduce total impervious surface area, and minimize development impacts on critical areas and associated buffers (Title 15.16 EMC). Preservation of open space reduces potential stormwater runoff and associated impacts and provides area for dispersion, filtration and infiltration of stormwater.

B. The arrangement of clustered building lots shall be designed to avoid development forms commonly known as linear, straight-line or highway strip patterns.

18.08A.90 Residential densities.

Base densities shall be consistent with the underlying zoning. A bonus density of up to 20 percent is authorized for projects complying with this chapter.

18.08A.100 Lot size, lot width, building height, impervious coverage.

A. Lot size. Design objective: Minimize area of site disturbance. The minimum lot size of the underlying zone district may be reduced to achieve the goals in Section 18.08A.010 EMC.

B. Lot width. Design objective: Minimize street length. The minimum lot width of the underlying zone district may be reduced to achieve the goals in Section 18.08A.010 EMC.

C. Building setbacks. Design objective: Minimize impervious surfaces. The setbacks of the zone may be reduced to achieve the goals in Section 18.08A.010 EMC.

18.08A.110 Circulation and access.

Circulation and access provisions shall be appropriate to the scale of the project and to anticipated traffic characteristics, and consistent with the requirements of the Town road standards. Deviations from these standards may be granted where a bioretention swale with compost amended soils shall be provided within the right-of-way or easement dedicated to Eatonville adjacent to the public right-of-way or in islands created by loop roadways.

18.08A.120 Parking.

Parking shall conform to the requirements of Chapter 18.05 EMC.

18.08A.130 Alternative surfacing methods.

Alternative surfacing including, but not limited to: paving blocks, turf block, pervious concrete, porous asphalt, and other similar approved materials are encouraged. Alternative surfacing methods may be approved for parking areas, emergency parking areas, private roads, fire lanes, road shoulders, bike paths, walkways, patios, driveways, and easement service roads unless site constraints make use of such materials detrimental to water quality. Utilization of alternative surfacing methods shall be subject to review and approval by the Town's Public Works Director and Fire Marshal for compliance with other applicable regulations and development standards. Surfaces that comply with this section shall not be considered impervious surfaces under Section 13.24.070 EMC.

18.08A.140 Drainage and land alteration.

A. Land alteration may commence when in compliance with the Town of Eatonville site development regulations.

B. Drainage plans and improvements shall be in compliance with the Town of Eatonville drainage standards. Alternative BMPs not specifically referenced in the Eatonville standards may be considered subject to approval by the Public Works Director.

18.08A.150 Site assessment.

Low impact development site design is intended to complement the predevelopment conditions on the site. The development context shall be established by an initial site assessment consistent with the requirements of this section. The initial inventory and assessment process will provide the baseline information necessary to design strategies that preserve natural resources, preserve areas most appropriate to evaporate, transpire, and infiltrate stormwater, and achieve the goal of maintaining pre-development natural hydrologic conditions on the site. The assessment will result in a series of maps identifying streams, lakes, wetlands, and buffers; steep slopes, and other hazard areas; significant wildlife habitat areas; and permeable soils offering the best available infiltration potential. Maps can be combined as hard copies or as GIS layers to delineate the best areas to direct development. Designated development areas, which will contain all impervious surfaces and landscaped areas on the site, should be configured to minimize soil and vegetation disturbance, buffer critical areas, and take advantage of a site's natural stormwater processing capabilities. Designated development area boundaries shall be delineated on site plans and identified on the site during site preparation and construction. Areas outside of the designated development area envelope shall be designated Native Vegetation Areas or reserve areas.

The site assessment shall be a component of the project submittal. The site assessment shall include, at a minimum, the following:

A. A survey prepared by a registered land surveyor or registered civil engineer showing existing public and private development, including utility infrastructure, on and adjacent to the site, major and minor hydrologic features, including seeps, springs, closed depression areas, drainage swales, and contours as follows:
   1. Up to 10 percent slopes, two-foot contours.
   2. Over 10 percent to less than 20 percent slopes, five-foot contours.
   3. Twenty percent or greater slopes, 10-foot contours.
   4. Spot elevations shall be at 25 foot intervals.

B. Location of all existing lot lines, lease areas and easements, and the location of all proposed lot lines, lease areas, and easements.

C. A soils report prepared by a licensed geotechnical engineer or licensed engineering geologist. The report shall identify:
   1. Underlying soils on the site utilizing soil pits and soil grain analysis to assess infiltration capability on site. The frequency and distribution of soil pits shall be adequate to direct placement of the roads and structures away from soils that can most effectively infiltrate stormwater.
   2. Topologic features that may act as natural stormwater storage or conveyance and underlying soils that provide opportunities for storage and partial infiltration.
   3. Depth to groundwater.
   4. Geologic hazard areas and associated buffer requirements as defined in Title 15.16 EMC.

D. A survey of existing native vegetation cover by a licensed landscape architect, arborist, qualified biologist identifying any forest areas on the site, species and condition of ground cover and shrub layer, and tree species, and canopy cover.

E. A survey of wildlife habitat by a qualified biologist.

F. A streams, wetland, and water body survey and classification report by a qualified biologist showing wetland and buffer boundaries consistent with the requirements of Title 15.16 EMC, if present.

G. Flood hazard areas on or adjacent to the site, if present.

H. Aquifer and wellhead protection areas on or adjacent to the site, if present.

I. Any known historic, archaeological, and cultural features located on or adjacent to the site, if present.

18.08A.160 Textual information required.

The applicant must respond to each of the items below but the response may include estimates or approximations where exact figures are not known at the time of submittal. All estimates should be based on the applicant's best knowledge and intent of the proposal. When estimates or approximations are used they must be identified as such. The applicant should be aware that any estimates or approximations provided may be used to set development conditions or thresholds.

A. Title Report (issued no more than 30 days prior to formal application) for all land located within the boundaries of the proposed LID project. The title report shall show all persons having an ownership interest in the property included in the LID project and a legal description that describes the exterior boundary of the LID project and lists all encumbrances affecting land within the LID project.

B. A statement that confirms the ownership or control of the land within the boundaries of the proposed LID project and the nature of the applicant's interest in the same and the owners. If the development area has multiple owners, then all owners of record shall consented in writing to the LID project review process.

C. Description of the proposed LID project including:

1. Total gross area of the site;
2. Total area of reserve area;
3. Total project area (total gross site area minus total reserve area);
4. Total area of designated development area;
5. Total area of Native Vegetation Area;
6. Total units proposed;
7. Proposed number of dwelling units by type;
8. Lot sizes and dimensions;
9. Total area of impervious surfacing;
10. Proposed ownership of land areas within the LID project both during and after construction;
11. Gross density of dwelling units;
12. Requested dimensional modifications;
13. Development schedule indicating the approximate date when construction of the LID project or stages of the LID project can be expected to begin and be completed.

D. Projected population and analysis of anticipated impact of the development upon existing utilities and community facilities and services including but not limited to water, electricity, sewer and solid waste disposal, schools, parks, open space, trails, and police and fire protection. The analysis shall include how and when these impacts are being addressed by the LID project.
E. Report assessing adequacy of water supply to serve the proposed development.
F. Traffic impacts, including projected trip generation for the entire development and by phase.

18.08A.170 Site plan and supporting maps and graphics.

An initial site plan and any supporting graphics, narrative descriptions and maps to show existing conditions and major details of the proposed LID project. The initial site plan and supporting graphics and maps in combination shall provide a level of detail appropriate to the scale of the project and sufficient to demonstrate how the project complies with the provisions of this chapter.

A. Proposed name of the development, north point, scale, date and address, and telephone number of the preparer of the site plan/supporting maps.
B. All information included in the site assessment should be provided at a legible scale appropriate to the area covered by the proposal at the discretion of the administrator.
C. Designated development areas.
D. Native Vegetation Areas.
E. Reserve areas.
F. Areas of disturbed soils to be amended.
G. The existing and proposed circulation system of arterial, collector and/or local streets, including right-of-way street widths, off-street parking areas, and major points of access to public rights-of-way (including major point of ingress and egress to the development). Notations of proposed ownership, public or private, shall be included where appropriate.
H. Location and width of existing and proposed sidewalks and trails.
I. Proposed lots and dimensions.
J. For residential structures, provide the types and number of residential units in each structure or the range of residential structures proposed together with the range of the type and number of units per structure.
K. For nonresidential buildings, the gross floor area of each building.
L. The location and square footage or approximate location and square footage or acreage of all areas of all areas to be conveyed, dedicated or reserved as common open spaces, public parks, recreational areas, school sites, and similar public and semi-public uses with notations of proposed ownership included where appropriate.
M. Landscaping and open space improvements plan or concept.
N. The proposed treatment of the perimeter of the LID project, including materials and techniques used such as screens, fences and walls.
O. The location of existing and proposed utilities including sanitary sewers, water lines and storm drainage facilities intended to serve the development.
P. Existing zoning and Comprehensive Plan boundaries for the site and adjacent property.
Q. Information of contiguous properties within 300 feet of the proposed LID project including:
   1. Existing and, if known, proposed land use and streets; and

2. Existing structures excluding accessory buildings, ownership tracts and unique natural features of the landscape, if readily accessible.

R. A vicinity map showing the location of the site and its relationship to surrounding areas, including existing streets, major physiographic and cultural features such as railroads, lakes, streams, shorelines, schools, parks or other prominent features.

S. Landscape plan including a tree planting plan for Native Vegetation Areas.

18.08A.180 LID project entitlement

A. Non-residential projects conforming to the design criteria of this chapter shall be approved consistent with the land use entitlement procedures for the use within the underlying zone. For instance, a use that would require a conditional use permit, shall still require a conditional use permit.

B. Residential subdivisions conforming to this chapter shall be processed as Planned Unit Developments. The planning commission shall use the following review criteria in place of the required findings found under EMC 18.04.190.F:

1. The proposal meets the requirements of this title;
2. The perimeter of the project shall be compatible with the land use of adjoining properties. Compatibility includes, but is not limited to, size, scale, mass and architectural design;
3. The proposal shall not be detrimental to existing or potential surrounding land uses as defined by the Eatonville comprehensive plan;
4. The proposal conforms with the design criteria of this chapter.

18.08A.190 Modifications to the plan.

Requests for modifications of preliminary or final development plans shall be made in writing and shall be submitted to the planning department in the manner and form prescribed by the planning director.

A. Modifications shall be deemed minor if the proposal remains consistent with the purpose and design criteria of this chapter and does not change any of the following:

1. Land use;
2. Density, number of dwelling units or lots;
3. General location or number of access points;
4. The amount of open space;
5. The amount of parking;
6. The total square footage of structures;
7. The general height of structures.
8. The amount of impervious surfaces, unless reduced; and
9. The amount of native vegetation.

Examples of minor modifications include but are not limited to lot line adjustments, minor relocations of buildings or landscaped areas, minor changes in phasing and timing, minor changes in building design, and minor changes in elevations of buildings. Minor modifications may be approved by the Town Planner or designee.

B. Major modifications are those which, as determined by the Town Planner or designee, substantially change the basic design, density, open space or other similar requirements or provisions. Major adjustments to the development plans shall be reviewed under the same process as the original approval.

Chapter 18.05
OFF-STREET PARKING AND LOADING REQUIREMENTS

Sections:

18.05.010 Purpose.
It is the purpose of this chapter to specify the off-street parking and loading requirements for all uses permitted in this title, and to describe design standards and other required improvements. (Ord. 94-06 § 2, 1994).

18.05.020 Categories of uses and conditions of uses covered by chapter.
A. New Construction. New construction is covered by this chapter as follows:
1. Buildings constructed or enlarged;
2. Other structures or use areas constructed or enlarged;
3. Parking lots constructed or enlarged as follows:
    a. If new or adding the equivalent of 50 percent or more of the existing parking lot area, the entire parking facility must meet the standards of this title;
    b. If adding less than 50 percent of the existing parking lot area only the new portion must meet the standards of this title.

B. Change in Use. When the occupancy of any land use, structure or building, or any part of a building, structure or land use, is changed to another use, parking shall be provided to meet the requirements of the new use. (Ord. 94-06 § 2, 1994).

18.05.030 Location of off-street parking.
A. Single-Family Dwellings. Required parking for a single-family dwelling shall be located on the same lot as the building it is to serve.
B. Multifamily Dwellings. Required parking for multifamily dwellings may be on a contiguous lot if located within 500 feet of the dwelling units. The lot shall be legally encumbered by an easement or other appropriate means to ensure continuous use of the parking facilities. Documentation shall require review and approval of the town attorney.
C. Other Uses. For uses other than those described in subsections (A) and (B) of this section, required parking may be in areas other than on the premises if the required amount of parking area is set aside for a particular use in such a lot and such area is not located more than 500 feet from the premises. The lot or area to be utilized shall be legally encumbered by an easement or other appropriate means to ensure continuous use of the parking facilities. Documentation shall require review and approval of the town attorney. (Ord. 94-06 § 2, 1994).

18.05.040 Parking standards for specific activities.
The requirement of one space per dwelling unit may be reduced to no less than one space for every two dwelling units plus employee parking as determined by the planning director. The planning director shall base his decision on the following:

1. Availability for private, convenient, regular transportation services to meet the needs of the tenants;
2. Accessibility to and frequency of public transportation;
3. Pedestrian access to health, medical and shopping facilities;
4. Minimum age requirement to reside in subject apartments;
5. Special support services offered by the facility. Special parking for recreational vehicles will not be required as long as the facility does not permit recreational vehicles other than campers or vehicles that fit into a regular-sized parking stall. If recreational vehicles are to be permitted on the development, they must be screened and fenced. Compact stalls will not be permitted except for one-third of the required employee parking. Parking standards for specific activities are as follows:

ACTIVITY	NUMBER OF PARKING SPACES
A. Living Activities.	
1. Dwellings.	
a. Single family.	Two parking spaces per single
b. Two family.	Two parking spaces per dwelling unit.
c. Multifamily and apartment.	One parking space per unit for apartments of 400 square feet or less of floor area in all sized developments; two parking spaces for each dwelling unit for developments with 49 or less dwelling units; one and eight-tenths parking spaces per dwelling unit for developments of 50 or more dwelling units. For developments of 50 or more dwelling units, one parking space for each 15 dwelling units for recreational vehicles. Recreational vehicle parking shall be in defined, fenced and screened areas with a minimum of six foot- high sight-obscuring fences or landscaping as determined by the planning director, or the developer may provide areas of usable open space equal to that area that would be required for recreational vehicle parking. A vehicle less than 20 feet long that is used as primary transportation is not subject to recreational vehicle parking regulations. If open space in lieu of recreational vehicle parking is provided, its appropriateness will be determined at the time of development plan review by the planning director. Only garages which are accessed by driveways 18 feet in length shall meet the definition of parking space, as required by this title. Garages without the driveway of required length are permitted, but shall not be counted toward the parking space requirements of this title.

d. Multiple dwellings for low income elderly	One parking space for each four dwelling units.
e. Exceptions for senior citizen apartments in multifamily and apartment houses.	Approved building plans must show one and eight-tenths spaces per dwelling unit. The additional spaces, plus any required landscaping, shall be installed if at any time the structure is not used for senior citizen apartments.
2. Boarding houses and lodging.	One parking space for the proprietor, plus one space per sleeping room for boarders or lodging use, plus one additional space for each four persons employed on the premises.
3. Mobile homes.	Two parking spaces for each mobile home site, plus one screened space for each 10 lots for recreational vehicles.
4. Travel trailers.	One parking space for each trailer site.
5. Hotels.	One parking space for each guest rooms, plus two parking spaces for each three employees.
B. Commercial Activities.	
1. Banks.	One parking space for each 200 square feet of gross floor area, except when part of a shopping center.
2. Professional and business offices.	One parking space for each 250 square feet of gross floor area, except when part of a shopping center.
3. Shopping centers.	Four and one-half spaces per 1,000 square feet of gross leasable area (GLA) for centers having GLA of less than 400,000 square feet, and five spaces per 1,000 square feet of GLA for centers having a GLA of over 400,000 square feet.
4. Restaurants, nightclubs, taverns and lounges.	One parking space for each 100 feet of gross floor area, except when part of a shopping center.
5. Retail stores, supermarkets, department stores and personal service shops	One parking space for each 200 square feet of gross floor area, except when located in a shopping center.
6. Other retail establishments, furniture, appliance, hardware stores, household equipment service shops, clothing or shoe repair shops.	One parking space for each 500 square feet of gross floor area, except when located in a shopping center.
7. Drive-in business.	One parking space for each 100 square feet of gross floor area, except when located in a shopping center.
8. Uncovered commercial area, new and used car lots, plant nursery.	One parking space for each 5,000 square feet of retail sales area in addition to any parking requirements for buildings, except when located in a shopping center.
9. Motor vehicle repair and services.	One parking space for each 400 square feet of gross floor area, except when part of a shopping center.
10. Industrial showroom and display.	One parking space for each 500 square feet of display area.
C. Industrial Activities.	

1. Manufacturing, research and testing laboratories, creameries, bottling establishments, bakeries, canneries, printing and engraving shops.	One parking space for each 1,000 square feet of gross floor area. For parking requirements for associated office area, see professional and business offices.
2. Warehouses and storage buildings.	One parking space for each 2,000 square feet of gross floor area of office area may be included without additional parking requirements.
3. Speculative warehouse and industrial buildings with multiple use or tenant potential.	One parking space for each 1,000 square feet of gross floor area if building size is less than 100,000 square feet, or one parking space for each 2,000 square feet of gross floor area for buildings which exceed 100,000 square feet gross of floor area, this is a minimum requirement and valid for construction permit purposes only. Final parking requirements will be based upon actual occupancy.
D. Recreation Amusement Activities.	
1. Auditoriums, theaters, places of public assembly, stadiums and outdoor sports arenas.	One parking space for each four fixed seats, or one parking space for each 100 square feet of floor area of main auditorium or of principal place of assembly not containing fixed seats, whichever is greater.
2. Bowling alleys.	Five spaces for each alley, except when located in a shopping center.
3. Dance halls and skating rinks.	One parking space for each 200 square feet of gross floor area, except when located in a shopping center.
4. Golf driving ranges.	One parking space for each driving station.
5. Miniature golf courses.	One parking space for each 200 square feet of gross floor area. Such spaces shall be located adjacent to the building and shall be designated for visitors by signing or other special markings.
6. Recreational buildings, whether independent or associated with a multifamily complex.	One parking space for each 200 feet of gross floor area. Such spaces shall be located adjacent to the building and shall be designated for visitors by signing or other special markings.
E. Educational Activities.	
1. Senior high schools, public, parochial and private.	One space for each employee plus one space for each 10 students enrolled. In addition, if buses for the transportation of children are kept at the school, one off-street parking space shall be provided for each bus of a size sufficient to park each bus. Two and one-half parking spaces for each employee, plus one space for each three students residing on campus, plus one space for each five day student not residing on campus. In addition, if buses for transportation of students are kept at the school, one offstreet parking space shall be provided for each bus, of a size sufficient to park each bus. One additional parking space for each 100 students shall be provided for visitors in the vicinity of or adjacent to the administration portion of the building or complex. Such parking spaces shall be so designated by signing or other similar

	marking as approved by the public works director.
2. Colleges and universities and business and vocational schools.	Two and one-half parking spaces for each employee, plus one space for each three students residing on campus, plus one space for each five day student not residing on campus. In addition, if buses for transportation of students are kept at the school, one offstreet parking space shall be provided for each bus, of a size sufficient to park each bus. One additional parking space for each 100 students shall be provided for visitors in the vicinity of or adjacent to the administration portion of the building or complex. Such parking spaces shall be so designated by signing or other similar marking as approved by the public works director.
3. Elementary, middle and junior high.	Two and one-half parking spaces for each employee. In addition, if buses for transportation of students are kept at the school, one off-street parking space shall be provided for each bus, of a size sufficient to park each bus. One additional parking space for each 100 students shall be provided for visitors in the vicinity of or adjacent to the administration portion of the building or complex. Such parking spaces shall be so designated by signing or other special marking as approved by the public works director.
4. Libraries and museums.	One parking space for each 250 square feet in office and public use.
5. Nursery schools and day care centers.	One parking space for each employee, plus loading and unloading areas.
F. Medical Activities.	
1. Medical and dental offices.	One parking space for each 200 square feet of gross floor area, except when located in a shopping center.
2. Convalescent, nursing and health institutions.	One parking space for each two beds, plus one parking space for each staff doctor, plus one parking space for each three employees.
3. Hospitals.	One parking space for each three beds, plus one parking space for each staff doctor, plus one parking space for each three employees.
G. Religious Activities.	

1. Churches.	One space for each five seats in the main auditorium, provided that the spaces for any church shall not be less than ten. For all existing churches enlarging the seating capacity of their auditoriums, one additional parking space shall be provided for each five additional seats provided by the new construction. For all existing churches making structural alterations or additions which do not increase the capacity of the auditorium, no additional parking need be provided.
2. Mortuaries or funeral homes.	One parking space for each 100 square feet of floor area of assembly rooms.

H. Other Uses. For uses not specifically identified in this section, the amount of parking required shall be determined by the planning director, based on parking required for similar uses, and, if appropriate, documentation provided by the applicant.

I. Mixed Occupancies or Mixed Use if One Occupancy. In the case of two or more uses in the same building, the total requirements for off-street parking facilities shall be the sum of the requirements for the several uses computed separately, except in shopping centers. Off-street parking facilities for one use shall not be considered as providing required parking facilities for any other use, except as permitted in subsection (J) of this section pertaining to joint use.

J. Joint Use. The joint use of parking facilities may be authorized only for those uses which have dissimilar peak hour parking demands or parking facilities in excess of the requirements set out in this title. The following conditions must be fulfilled before a joint use facility is allowed:

1. The facility must be located within a radius of 500 feet of the buildings or use areas it is intended to serve;
2. Documentation of dissimilar peak hour parking demands must be provided by the applicant; and
3. The subject property shall be legally encumbered by an easement or other appropriate means which provides for continuous joint use of the parking facilities. Documentation shall require review and approval of the town attorney.

K. Employee Parking. Where employee parking will be maintained separately and in addition to parking for the general public, the regulations of this subsection shall apply:

1. Minimum parking stall sizes, aisle widths and percentage of compact car stall shall be as per other requirements in this chapter.
2. Employee parking must be clearly identified as such and not become parking for the general public.
3. If the employee parking is changed to parking for the general public, the normal regulations for off-street parking shall be in force.
4. Employee parking shall not be in lieu of parking requirements per activity as stated in this section.

L. Temporary Parking Facilities. Temporary parking facilities may be permitted by the planning director when it has been shown that:

1. The existing use of the subject property adequate legal nonconforming parking or that existing parking conforms to the applicable standards of this title;
2. The temporary parking facility is primarily intended to serve the public at large and not the existing use on the property;
3. The temporary parking facility serves a public need;
4. The temporary facility meets the following minimum standards:
    a. There shall be a minimum of 285 square feet gross area per stall.

b. The pavement section shall be a minimum of four inches of five-eighths inch minus C.R. crushed rock with bituminous surface treatment, subject to public works director review.

c. On-site drainage control and detention shall be provided per the drainage ordinance.

d. Ingress and egress and interior circulation and perimeter control shall be subject to public works director approval.

M. Compact Car Parking.

1. Parking stall size shall be a minimum of eight feet by 17 feet. Aisle width shall be per the requirements of EMC 18.05.080 and Table 18.05.2 following this chapter.

2. Compact car parking spaces shall be clearly identified by signing or other marking as approved by the public works director.

3. Compact car parking spaces shall not exceed 30 percent of the total required parking, and shall not be interspersed equally throughout the entire parking area.

4. See EMC 18.05.080 and Table 18.05.2 following this chapter for typical compact car stall arrangements.

5. No more than four compact car parking stalls shall be placed side-by-side, or eight head-to-head. (Ord. 94-06 § 2, 1994).

18.05.050 Drive-through businesses.

All banks, savings and loan associations, cleaning establishments, restaurants, and other businesses that maintain drive-through facilities or are designed in such a manner that customers must leave their automobiles temporarily in a driving line located adjacent to the facility shall be governed as follows:

A. The following number of stacking automobile spaces shall be provided in the following circumstances:

1. Drop boxes shall be provided with a minimum of two stacking spaces;

2. Banks, savings and loan associations, utility companies, and other businesses conducting financial transactions, not typically involving the on-site delivery of goods, shall provide a minimum of three stacking spaces per drive-through window or automatic teller machine;

3. Espresso stands, pharmacies, dry cleaners, or other businesses for which the typical transaction consists of the transfer of a pre-ordered or sorted quantity of goods, or the preparation or assembly of no more than two items per vehicle, shall provide a minimum of three stacking spaces per drive-through window;

4. Full service or fast food restaurants, or other businesses for which the typical transaction includes the preparation or assembly of three or more items per vehicle, shall provide a minimum of six stacking spaces per drive-through window;

5. For those businesses that provide two or more windows in series, for example one window for payments and one window for delivery of goods, the requirement of six stacking spaces per drive-through window shall be additive. Two windows shall require twelve spaces, etc.

B. Layout.

1. Size shall be a minimum of nine feet wide by 18 feet long.

2. Count shall be separate from required parking spaces.

3. Location shall be such that stacked vehicles do not interfere with access to or from any required parking or loading spaces or with pedestrian access to or from building entrances or exits.

4. Location shall not extend into the public right-of-way. (Ord. 99-06 § 7, 1999; Ord. 94-06 § 2, 1994).

18.05.055 Loading spaces.

Loading spaces shall be provided as follows:

A. Loading spaces shall be located not closer than 50 feet from any residential district, unless wholly enclosed within a building, or unless screened from such residential area by a wall or uniformly painted fence not less than six feet in height, plus any other screening or buffering required at the applicable zone boundary.

B. Space for loading berths may occupy all or any part of any required setback, except any required landscape buffer, as long as the loading space is uncovered. A covered loading area shall comply with the minimum setback requirements for the district.

C. Loading spaces shall be provided for the following types of buildings or businesses: warehouses, supermarkets, department stores, office buildings with a floor space in excess of 20,000 square feet, industrial or manufacturing establishments, freight terminals, railroad yards, mortuaries, and such other commercial and industrial buildings which, in the judgment of the planning director, are similar in nature in regard to loading space requirements.

D. Buildings with dock-high loading doors shall be provided with a minimum of 100 feet of clear maneuvering area in front of each door.

E. Buildings with ground level loading doors shall be provided with a minimum of 100 feet of clear maneuvering area in front of each door. (Ord.99-06 § 8, 1999).

18.05.060 Driveways.

Ingress and egress points from public rights-of ways shall be designed and located to preclude offsite or on-street maneuvering of vehicles, except:

A. In single-family residential districts, for single- family dwellings or individual driveways serving a single unit of a duplex, driveways may be designed to require backing into or out of the public right-of-way; and

B. In multifamily, commercial, industrial, or aerospace districts, or for conditional or special permit uses in residential districts, driveways may be configured to require backing into the public rights-of-way of designated alleys with the approval of the planning director. (Ord. 99-06 § 9, 1999).

18.05.070 Off-street parking regulations downtown commercial district C-1.

It is the purpose of this section to recognize the pedestrian-oriented nature of downtown activities while also recognizing the need for off-street parking facilities to eliminate traffic congestion. No off-street parking shall be required in this district, excepting that one parking space per unit is required for multifamily residential development.
(Ord. 94-06 § 2, 1994).

18.05.080 Size and design standards.

A. Parking Stall Size. Parking stall size shall be as follows:
Standard 9 feet by 19 feet *1,*3
Compact 8 feet by 17 feet *2,*3
Employee 8 1/2 feet by 18 feet *3
Parallel 9 feet by 23 feet

Notes:
*1. Dimensions may include overhang. See EMC 18.05.090 for exceptions.
*2. See Table 18.05.2 following this chapter for typical compact placement with required landscape area.

*3. Parking stall length may be reduced by a maximum of two feet with corresponding increases in aisle width.
B. Minimum Design Standards and Typical Parking Stall Arrangements. For minimum design standards and typical parking stall arrangements, see Tables 18.05.1 and 18.05.2 following this chapter.
C. Units of Measurement.
1. Benches. In stadiums, sports arenas, churches and other places of assembly in which patrons or spectators occupy benches, pews or other similar seating facilities, each 20 inches of width of such seating facilities shall be counted as one seat for the purpose of determining requirements for off-street parking facilities under this title.

2. Fractions. When a unit of measurement determining the number of required parking spaces results in the requirement of a fractional space, any fraction up to but not including one-half shall be disregarded and fractions one-half and over shall require one parking space. (Ord. 94-06 § 2, 1994). 18.05.090 Overhang exception, landscaping, paving, wheel stops, drainage, lighting and curbing.

18.05.090 Overhang exception, ~~landscaping,~~ paving, wheel stops, drainage, lighting and curbing.
~~A. Landscaping Generally. The landscaping requirements of Chapter 18.07 EMC and Table 18.05.2 following this chapter shall apply with respect to off-street parking facilities.~~
~~B. Landscape Islands. Landscape islands with a minimum size of 100 square feet shall be located in the following areas to protect vehicles and to enhance the appearance of parking areas~~:
~~1. At the ends of all parking rows;~~
~~2. Where loading doors or maneuvering areas are in close proximity to parking areas or stalls~~.
~~C~~. A. Paving. All vehicular maneuvering areas, including but not limited to off-street parking areas,
truck and mobile equipment loading, unloading, storage and maneuvering areas, and related access to and from public right-of-way shall be paved with asphalt or equivalent material, to be approved by the public works director.
~~D~~.B. Wheel Stops. Wheel stops, a minimum of two feet from any obstruction or the end of the parking stall, shall be required in the following locations:
1. Where the parking stall abuts a building or where vehicles may overhang a property line;
2. Where the parking stall abuts a pedestrian walkway of less than six feet in width, or a walkway which is not raised creating its own barrier;
3. Where a parking stall abuts any physical object which may be impacted (i.e., light standards, fire hydrants, fences, power vaults, utility poles, etc.);
4. Where a hazardous grade difference exists between the parking area and the abutting property;
5. Where other hazardous situations may exist as determined by the public works director.
~~E~~.C. Lighting. Any lighting of a parking lot or storage area shall illuminate only the parking lot or storage area. All lighting shall be designed located so as to avoid undue glare or reflection of light onto adjoining properties or public rights-of-way. Light standards shall not be located so as to interfere with parking stalls, maneuvering areas, or ingress and
egress areas.
~~F~~.D. Vehicle Overhang Exception. Where sufficient area is available to allow safe and efficient overhang of a vehicle, the planning director may permit the standard parking stall length to be reduced by two feet with corresponding increase in adjacent walkway or landscaping width.
~~G~~.E. Concrete Curb Placement. In addition to wheel stop requirements as provided in subsection

(D) of this section, all landscape areas within or abutting parking areas shall be separated from the paved area by concrete curbing or other acceptable method as approved by the planning director and the public works director. (Ord. 94-06 § 2, 1994).

18.05.095 Parking lot landscaping.

A. Landscaping Generally. The landscaping requirements of Chapter 18.07 EMC and Table 18.05.2 following this chapter shall apply with respect to off-street parking facilities.

B. Landscape Islands. ~~Landscape islands with a minimum size of 100 square feet shall be located in the following areas to protect vehicles and to enhance the appearance of parking areas~~:

1. Landscape islands shall be planted in accordance with the requirements of Type V – Open Area Landscaping requirements per Section 18.07.060.E EMC, except where low impact plant materials including drought-tolerant and/or native species have been selected, where the spacing between plants may be increased per EMC 18.07.050.O.
2. Landscape islands shall cover a minimum area of 160 square feet, and shall have a minimum dimension of six feet. They shall be located in the following areas to protect vehicles and to enhance the appearance of parking areas:
    a) At the ends of all parking rows;
    b) Where loading doors or maneuvering areas are in close proximity to parking areas or stalls.
3. Parking lot landscaping islands will also serve as on-site stormwater infiltration facilities, unless such techniques are adequately demonstrated to be infeasible. LID stormwater infiltration facilities shall be designed and constructed in accordance with *LID Technical Guidance Manual for Puget Sound (latest edition)*. Maintenance of stormwater infiltration facilities shall also be completed in accordance with the Technical Manual.
4. Clustering of parking lot landscape beds is encouraged for the health and vitality of the planting material, as compared with smaller planting beds at more regular intervals.
5. Landscaping islands placed at the terminus of driving aisles are encouraged. Landscape islands must have a minimum dimension of 6 feet.

18.05.100 Off-street parking plans.

A. Off-street parking plans shall be subject to review and approval by the planning director and public works director. Approval shall be based upon the following criteria:

1. Compliance with the requirements of this title;
2. Safety and efficiency of interior circulation;
3. Safety of ingress and egress points;
4. Effects of access on public streets with regard to capacity, congestion and delay.

B. All plans must be complete with the information as requested by the planning director. (Ord. 94-06 § 2, 1994).

Chapter 18.07
LANDSCAPING REGULATIONS

Sections:

18.07.010 Purpose.
A. The provisions of this chapter are to provide minimum standards for landscaping in order to maintain and protect property values and enhance the general appearance of the town in all zoning districts except single-family districts.
B. The intent of this chapter is also to encourage low-impact techniques including the use of native or drought-tolerant plants.
~~B.~~ C.The planning director shall have the authority to waive specific requirements or impose additional requirements in unique or special circumstances to ensure the fulfillment of the stated purpose of this chapter and to allow for flexibility and innovation of design. Special circumstances or unique conditions shall be reviewed with the planning director prior to submittal of a landscape plan.
Examples of special conditions might include:
1. Preservation of unique wildlife habitat;
2. Preservation of natural or native areas;
3. Compliance with special easements;
4. Renovation of existing landscaping;
5. Unique site uses. (Ord. 94-06 § 2, 1994).

18.07.020 Landscape plan approval.
A. A building permit shall not be issued until the landscaping plan has been approved;
B. At the time of development plan review, the planning director shall review specific landscape requirements with the owner or his representative.(Ord. 94-06 § 2, 1994).

18.07.025 Landscape, Irrigation and Tree Plan Submittal Requirements.
The applicant shall submit the appropriate number of landscape and irrigation plans for review, as determined by the Town Planner or designee. The landscape and irrigation plan may be provided separately or incorporated into plans submitted for site plan review. Landscaping and irrigation may be shown on the same plan. No permit for use which is subject to the requirements of this section shall be issued until the landscape and irrigation plan for such use has been approved by the Town Planner or designee.

A. Landscape Plans
1. Persons Qualified to Prepare Landscape Plan. The Landscape plan shall be prepared by a landscape architect licensed in the State of Washington, a nursery professional certified pursuant to the Washington Certified Nursery Professional program, or a Washington State certified landscape technician.

2. The landscape plan shall be prepared to an appropriate scale, not less than 1-inch to equal 40 feet, necessary to depict the following:

a. Name and address or location of project;
b. Vicinity Map;
c. Scale, north arrow and date of plan;
d. All property lines, impervious surfaces (including the total, paved impervious surface), vehicular drives, parking lots, existing and proposed structures (including the square footage of such structures), natural or manmade water features or bodies, above ground stormwater detention and treatment areas, existing or proposed fences and retaining walls, critical lands and associated buffers, and designated recreational open space areas;
e. All existing and proposed landscape areas showing existing vegetation or significant trees to be retained and vegetation to be removed and proposed plants to be installed. The area of all existing and proposed landscaping shall be calculated and shown on the plan;
f. A plant schedule containing the botanical and common names of the new plant material, existing plant material proposed to be retained, typical spacing for that species, the planting size of the material, the quantity of each plant, and any special planting instructions;
g. All topographic features of the area to be landscaped such as swales. A contour map detailing intervals at two feet shall be provided; and
h. All existing and proposed drainage and watering facilities.

B. Irrigation Plans. Where a landscape plan is required, as determined above, an irrigation plan must also be prepared to ensure that the planting will receive sufficient water for survival and growth.

1. Persons Qualified to Prepare Plans. The irrigation plan shall be prepared by a Washington State registered landscape architect or irrigation designer certified by the Irrigation Association.

2. Where automatic irrigation is required, a subsurface irrigation or drip irrigation system shall be provided in accordance with all State and local rules, regulations and ordinances including approved backflow devices. The tap, service, and meter shall be coordinated with the Town's Public Works Director. The system shall completely cover all planting areas.

3. The spacing of sprinkler heads shall not exceed the spacing recommended by the manufacturer of the head. Where an area may be utilized by pedestrians, pop-up heads are preferred. The system shall be designed to achieve maximum water efficiency and overthrow onto public sidewalks or streets shall be kept to a minimum.

C.Tree Survey and Plan.

1. Persons Qualified to Prepare Tree Plan. The Landscape plan shall be prepared by a landscape architect licensed in the State of Washington, a nursery professional certified pursuant to the Washington Certified Nursery Professional program, or a Washington State certified landscape technician.

2. The applicant shall submit a tree retention plan concurrently with the other permit applications for the project.

3.The tree survey/plan shall be prepared to an appropriate scale, not less than 1-inch to equal 40 feet, necessary to depict the following.

a. Name and address or location of project;
b. Vicinity Map;
c. Scale, north arrow and date of plan;
d. A tree survey that identifies the location, approximate size, species and number of significant trees on the site.

e. The following information may be included on the tree survey or on a separate plan. The applicant must indicate the trees to be retained, removed, transplanted or replaced, in addition to providing a final calculation of the percentage of significant trees that will be retained.

D. Review of landscape, irrigation and tree plans. Where a landscape and irrigation plan are required in concert with other site development permit applications, the plans shall be reviewed by the Town Planner or designee or the Town's consultant, as determined by the Town Planner or designee. If the Town Planner or designee designates the plans be reviewed by the Town's consultant, the applicant shall cover the cost of the third party review as required in accordance with the Town's fee ordinance. All fees shall be set by resolution of the Town Council.

18.07.030 Failure to complete required landscaping – Inspection.
A. Failure to complete all of the required landscaping or any part of it within six months of the building occupancy, issuance of the certificate of occupancy or the building directors final inspection shall constitute a zoning violation.
B. It shall be the responsibility of the project manager or business owner to contact the planning director upon completion of the landscaping work and request an inspection.
C. The planning director may inspect the landscaping upon request of the project manager or business owner or at any time after the six-month expiration date. (Ord. 94-06 § 2, 1994).

18.07.040 General landscape requirements for all zones.
A. All parking areas of over 20,000 square feet shall have a minimum of 10 percent of the parking area, maneuvering area and loading space landscaped as a means to reduce the barren appearance of the lot and to reduce the amount of stormwater runoff. Fifty percent of the perimeter landscaping, required adjacent to property lines, may be calculated as part of the 10 percent figure.
B. All ingress or egress easements which provide corridors to the subject lot, not adjacent to a public right-of-way, shall be considered the same as a public right-of-way. Landscape requirements for easement corridors shall be the same as those required adjacent to public rights-of-way.
C. All outside storage areas shall be screened by fencing and landscaping a minimum of five feet in depth unless it is determined by development plan review that such screening is not necessary because stored materials are not visually obtrusive. The five-foot deep landscaped area can occur within the street right-of-way abutting the property line.
D. All portions of a lot not devoted to building, future building, parking, storage or accessory uses shall be landscaped in a manner appropriate, to the stated purpose of this chapter.
E. All required landscaping areas shall extend to the curbline or the street edge. A crushed rock path in lieu of landscaping may be required where appropriate as determined by the planning director.
F. Required landscape areas which are inappropriate to landscape due to the existence of rail lines or other features shall be relocated, first, to another lot line, or second, to an equal-sized area in another portion of the lot, to be determined by the planning director upon review with the owner or developer.
G. Bark mulch, gravel or other nonvegetative material shall only be used in conjunction with landscaping to assist vegetative growth and maintenance or to visually complement plant material. Nonvegetative material is not a substitute for plant material.
H. Required landscape areas shall be provided with adequate drainage.
I. Slopes shall not exceed a three to one ratio (width to height), in order to decrease erosion potential and assist in ease of maintenance.

J. The perimeter of all parking areas which abut residential zones or uses shall be landscaped to a minimum depth of three feet with type II landscaping unless otherwise provided by this chapter. A six-foot high solid wood or equivalent fence is also required. Substitute fencing, including but not limited to, chainlink fence with slats, may be approved by the planning director upon application of the developer and adjacent residential property owners when such fencing shall provide buffering consistent with the purpose and intent of this chapter. The term "adjacent residential property," for purposes of this section, shall mean abutting property, and lots immediately adjacent to abutting property, and shall not mean property across a public road.
K. Landscaping shall not conflict with the safety of those using adjacent sidewalks or with traffic safety. Safety features of landscaping shall be discussed at the time of development plan review, if necessary. Quantity, arrangement and types of plants installed shall be appropriate to the size of the required landscape area and purpose of planting area as noted in EMC 18.07.050 pertaining to types of landscaping.
L. All trash containers shall be screened from abutting properties and streets by a 100 percent sight-obscuring fence or wall and appropriate landscaping.
M. Landscaping shall be placed outside of sight-obscuring or 100 percent sight-obscuring fences unless it is determined by the planning director that such arrangement would be detrimental to the stated purpose of this chapter.
N. A minimum of one tree shall be provided for each 100 square feet of required landscape area. (Ord. 99-11 § 8, 1999; Ord. 94-06 § 2, 1994).
O. Low Impact Development Option
1. Low Impact Planting Design and Technology. The following low-impact planting standards are provided to assist the applicant in the reduction of maintenance costs associated with development, to enhance the health and vitality of plant material, and to reduce watering costs, thus conserving water resources.

a. Water conservation.

i. Purpose. To take advantage of natural watering in order to reduce the amount of water that is required to maintain healthy plant material during the dry season to increase deep water penetration and soil oxygenation.

ii. Standards.

1) Soil Preparation.

a. Planting beds should be deep tilled to a depth of at least 12-inches. Soils will be greatly enhanced through the addition of the following materials; organic matter such as composted yard waste, and forestry by-products. Benefits include improved water drainage, moisture penetration, soil oxygenation, and/or water holding capacity.
b. For all newly landscaped areas, three to four cubic yards of composted organic matter per 1,000 square feet of landscape area should be added to a depth of four to six inches.
c. On project sites where topsoil is limited or nonexistent, a minimum of 6-inches of sandy loam topsoil should be tilled into the soil to a depth of 12 inches though all planting and turf areas.

2) Mulching.

a. Mulch should be applied regularly, and maintained in all planting areas to assist soils in retaining moisture, reducing weed growth, and minimizing erosion.
b. Mulches include organic materials such as wood chips and shredded bark.
c. Non-porous materials, such as plastic sheeting, are not recommended for use in any area of the landscape because of

down- slope erosion and potential soil contamination from herbicide washing.
d. Mulches should be applied to the following depths: a minimum three inches over bare soil, and two inches where plant materials will cover.

3) Compatible Water Use Design.

a. Trees and plant species should be selected based on having similar climatic, water, soil, and maintenance requirements.
b. Plants should be selected and grouped as determined by natural site conditions and be coordinated with the irrigation plan.

4) Plant Material.

a. Plants should be incorporated into landscape designs that are native to the Pacific Northwest or are introduced plants that are common to the Pacific Northwest in order to better reflect and complement the natural surroundings.
b. Drought-tolerant plants should be incorporated into designs in order to reduce irrigation requirements.

2. Low Impact Incentives. If all low impact practices and techniques noted in 18.07.040.O. are implemented, the following reductions in quantity and spacing of planting materials may be permitted as approved by the Town Planner or designee.
A. Standard.
The spacing requirement for trees and shrubs may be increased by up to 30 percent.
The spacing requirements for groundcover planting material may be increased by up to 40 percent. The minimum shrub size of planting material shall be reduced to a 1-gallon container.
B. Modification of Landscape Requirements. At the discretion of the Town Planner or designee, these landscape standards may be modified depending on the plant species proposed.

18.07.050 Types of landscaping.
A. Type I: Solid Screen.
1. Purpose. Type I landscaping is intended to provide a solid sight barrier to totally separate incompatible uses.
2. Description. Type I landscaping shall consist of evergreen trees or tall shrubs with a minimum height of six feet at planting, which will provide a 100 percent sight-obscuring screen within two years from the time of planting; or a combination of evergreen and deciduous trees and shrubs backed by 100 percent sight-obscuring fence.
B. Type II: Visual Screen.
1. Purpose. Type II landscaping is intended to create a visual separation that is not necessarily 100 percent sight-obscuring between incompatible uses.
2. Description.

a. Type II landscaping shall be evergreen or a mixture of evergreen and deciduous trees with large shrubs and ground cover interspersed with the trees. A sight-obscuring fence will be required unless it is determined by development plan review that such a fence is not necessary. The plantings and fence must not violate the sight area safety requirements at street intersections.
b. Evergreen trees shall be an average height of six feet at planting. Deciduous trees shall be the following sizes based on their spacing:

i. One-inch caliper: 10 feet on center;
ii. Two-inch caliper: 20 feet on center;
iii. Three-inch caliper: 30 feet on center;
iv. Three-and-one-half to five-inch caliper: 40 feet on center.

c. Ground cover shall be of sufficient size and spacing to form a solid cover within two years from the time of planting.

C. Type III: Visual Buffer.

1. Purpose. Type III landscaping is intended to provide visual separation of uses from streets and main arterials and between compatible uses so as to soften the appearance of streets, parking lots and building facades.

2. Description.

a. Type III landscaping shall be evergreen and deciduous trees planted not more than 30 feet on center interspersed with shrubs and ground cover. Where used to separate parking from streets, plantings must create a visual barrier of at least 36 inches in height at a time of planting and form a solid screen two years after planting. The planting shall not violate the sight area safety requirements at street intersections or driveways.

b. Evergreen trees shall be an average height of six feet at planting. Deciduous trees shall be the following sizes based on their spacing:

i. One-inch caliper: 10 feet on center;

ii. Two-inch caliper: 20 feet on center;

iii. Three-inch caliper: 30 feet on center;

iv. Three-and-one-half to five-inch caliper: 40 feet on center.

c. Ground cover shall be of sufficient size and spacing to form a solid cover within two years after the time of planting.

D. Type IV: Low Cover.

1. Purpose. Type IV landscaping is intended to provide visual relief where clear sight is desired or as a complement to larger, more predominant planting materials.

2. Description. Type IV landscaping shall consist of a mixture of evergreen and deciduous shrubs and ground cover, to provide solid covering of the entire landscaping area within two years of planting and to be held to a maximum height of three and one-half feet (see definition of ground cover).

E. Type V: Open Area Landscaping.

1. Purpose. Type V landscaping is primarily intended to visually interrupt large open spaces of parking areas.

2. Description.

a. Type V landscaping shall consist of trees planted with supporting shrubs or ground cover. Each landscape area shall be of sufficient size to promote and protect growth of plantings, with a ~~100~~ 160 square-foot minimum and a minimum dimension of six feet (see EMC 18.07.040(A)).

b. Parking lot landscaping will also serve as on-site stormwater infiltration facilities, unless such techniques are adequately demonstrated to be infeasible. LID stormwater infiltration facilities shall be designed and constructed in accordance with the most current version of the *LID Technical Guidance Manual for Puget Sound*. Parking lot landscaping shall also serve as stormwater infiltration facilities where on-site infiltration rates are 0.25 inches per hour or greater.

~~b.~~c. Evergreen trees shall be an average height of six feet at planting. Deciduous trees shall be the following sizes based on their spacing:

i. One-inch caliper: 10 feet on center;

ii. Two-inch caliper: 20 feet on center;

iii. Three-inch caliper: 30 feet on center;

iv. Three-and-one-half to five-inch caliper: 40 feet on center.

~~c~~.d. Ground cover shall be of sufficient size and spacing to form a solid cover within two years from the time of planting.
~~d~~.e. Grass is an acceptable ground cover for all areas. (Ord. 94-06 § 2, 1994).

18.07.060 Regulations for specific districts.
Landscaping regulations for specific zoning districts are as follows:
A. Single-Family Residential, SF-1 and SF-2.
None.
B. Medium- and High-Density multifamily Residential, MF-1 and MF-2.
1. A minimum of 10 feet of landscaping shall be provided abutting a public right-of-way;
2. Open green area shall occupy no less than 25 percent of the area of the lot;
3. The side and rear perimeters of properties shall be landscaped to a minimum depth of 10 feet;
4. A minimum of five feet of foundation landscaping shall be placed along the perimeter of any multifamily structure. Foundation landscaping consists of shrubbery or some other combination of landscape materials that helps to reduce the visual bulk of structures and buffer dwelling units from light, glare and other environmental intrusions.
C. Downtown Commercial District, C-1.
1. A minimum of three feet of landscaping to screen off-street parking areas, placement of which shall be reviewed by the planning director.
2. Street trees may be required in accordance with the downtown beautification plan.
D. General Commercial, C-2.
1. The side perimeter of property abutting a residential district shall be landscaped to a minimum width of 10 feet.
2. A planting strip not less than three feet in depth shall be provided along all property abutting public rights-of-way.
3. A minimum of three feet of landscaping to mask street and parking area shall be provided.
4. Street trees may be required as specified by the planning director.
E. Industrial District, I.
1. Front Yard. The front 10 feet shall be improved with appropriate permanently maintained landscaping.
2. Side Yard. At least five feet of the side yard shall be landscaped with permanently maintained landscaping. (Ord. 94-06 § 2, 1994).

18.07.65 Tree Retention and Conservation
A. Purpose. The retention of trees throughout the Town of Eatonville is necessary to preserve and enhance the visual appearance throughout the town, to preserve the natural wooded character of the Town, to promote utilization of natural systems, to reduce the impacts of site development on the storm drainage system and water resources, and to provide a better transition between the various permitted land uses. The retention of trees shall be accomplished through preserving existing trees, whenever feasible, and the planting of new trees.
B. All development proposals and land clearing applications shall use the standards set forth in this section for tree conservation and retention, which promotes tree conservation by establishing minimum tree density requirements, expressed as tree units per acre, for new uses proposed on vacant or redeveloping parcels. The only exceptions shall be developments located within the Downtown Commercial District (C-1), and the Aerospace District (AP).
1. Minimum Tree Density - New Uses on Vacant or Redeveloping Parcels. The tree density requirements will be met primarily through the conservation of existing trees. However, in order to provide for continued flexibility in the design of new development, in those situations where a development's design would preclude the retention of the required number of trees, the use of

replacement or supplemental tree planting is authorized. The minimum tree density for each land use designation is specified in Table 18.07.080.A.
2. Sites with Insufficient Tree Cover. It is recognized that some sites may not contain a sufficient number of existing trees to meet the tree density standards set forth in Table 18.07.080.A. In those situations, additional trees are to be planted as necessary to achieve the minimum tree density requirements of this Section.
3. Exemptions. Diseased or dangerous trees shall not be credited towards satisfying the minimum tree density requirements for a particular property. For trees that are deemed to be unhealthy and proposed to be removed from the site, the condition should be certified by a professional aborist or landscape architect at the applicant's expense. A tree removal permit must be obtained from the Town of Eatonville prior to the removal of dangerous and diseased trees. There is no fee associated with the removal of a dangerous or diseased tree as certified by a professional aborist or landscape architect.
4. Tree Density Requirements. All regulated activity shall ensure that the following tree densities shall be achieved and maintained during and after development:

Minimum Tree Density Requirements for Vacant or Redeveloping Parcels
(Table 18.07.065A)
Undeveloped or Redeveloping Properties

Land Use Designation	**Required Tree Unit Density(1)(2)**
MU, C-2, I	25 tree units/acre
MF-1, MF-2, SF-1, SF-2, SF-3, PUD	30 tree units/acre

5. Calculation of the Total Tree Units Required. The total number of tree units required to be provided by a regulated activity shall be calculated by multiplying gross site acreage, minus any public or private streets and regulated critical areas (excluding buffers) determined by Eatonville to be undesirable for tree planting (e.g., certain wildlife habitat and wetlands), by the required tree density (in tree units per acre) set forth in Table 18.07.080.A. The result of the calculation will be the total number of tree units required for the activity. If the calculation results in a fractional quantity, it shall be rounded to the nearest whole number (greater than or equal to .5 is rounded up, less than .5 is rounded down).
6. Tree Unit Credits. The number of tree unit credits given for retaining existing trees or the planting of new trees varies in order to encourage the retention of large existing trees and the planting of replacement trees that provide greater canopy areas at maturity. Tree unit credits for the retention of existing trees, significant trees, and the planting of new trees shall be awarded as follows:

Tree Unit Credits (Table 18.07.065.B.)	
Tree Category	**Tree Unit Credit**
Existing Tree 1" to 6" d.b.h.	1.0 tree units per tree
Existing Tree >6" to 12" d.b.h.	1.5 tree units per tree
Existing Tree >12" to 18" d.b.h.	2.0 tree units per tree
Existing Tree >18" to 24" d.b.h.	2.5 tree units per tree
Existing Tree > 24" d.b.h.	3.0 tree units per tree
Significant Tree < 24" d.b.h.	2.5 tree units per tree
Significant Tree >24" d.b.h.	3.0 tree units per tree
Replacement Tree, Small Canopy Species (Mature canopy area < 450 SF) feet)	.50 tree units per tree
Replacement Tree, Medium Canopy Species (Mature canopy area 450 to 1,250 SF)	1.0 tree units per tree
Replacement Tree, Large Canopy Species (Mature canopy area > 1,250 SF)	1.5 tree units per tree

a. Damaged or diseased trees shall not be credited towards satisfying the tree units per acre requirement. Provided, at the discretion of the Town Planner or designee, damaged or diseased or standing dead trees may be retained and counted toward the tree requirement, if it is demonstrated that such trees will provide important wildlife habitat and are not classified as dangerous trees.

b. Trees located within critical area buffers shall be credited towards satisfying the tree units per acre requirement and the acreage of any such areas be included when calculating the number of trees required for purposes of compliance with the tree units per acre requirement. Critical area buffers shall comply with the requirements set forth in Title 15.16.

7. Tree Conservation Requirements - Expansions of Existing Uses. Expansions of existing commercial, industrial, and multi-family properties which do not conform to the tree density requirements of this Chapter shall be subject to the following tree conservation requirements whenever such expansion would result in a greater than a 10 percent increase in the size of the existing building footprint or associated impervious areas (parking lots, storage areas, etc.):

a. A minimum of one tree unit shall be provided for each 500 square feet of building expansion or new construction; and

b. A minimum of three tree units shall be provided for each tree unit removed, up to a maximum of 25 tree units per acre.

c. No clearing, grading, or other approvals for vegetation removal at a site shall be approved until such time as the Town of Eatonville has approved any associated landscaping or tree preservation plans.

d. Tree retention areas and significant trees shall be protected during the construction phase through application of the following standards:

i. Reduce soil compaction during construction phase by protecting critical tree root zones that usually extends beyond the trees canopy or drip line. The critical tree root zone should be factored using the trees DBH (6" DBH = 6' radius, 10" DBH = 10' radius, 30" DBH = 45' radius).

ii. Prohibit any excavation within the critical tree root zone.

iii. Prohibit the stockpiling or disposal of excavated or construction materials in the vegetation retention areas.

iv. Avoid changing the grade near trees that have been designated for protection. If the grade level around a tree is to be raised, a dry rock wall or rock well shall be constructed around the tree. The diameter of this wall or well should be at least equal to the diameter of the tree spread plus five feet.

v. Restrict trenching in critical tree root zone areas.

    vi. Prevent wounds to tree trunks and limbs during the construction phase. Construction fencing should be installed to allow movement of construction equipment while maintaining free clearance around tree trunks and limbs.
    vii. Prohibit the installation of any impervious surfaces in critical root zone areas. Where road or sidewalk surfaces are needed under a tree canopy, unmortared porous pavers or flagstone (rather than concrete or asphalt) can be used. Boardwalks or bridging can span root zones without harming the tree roots.
    viii. Prep tree conservation areas to better withstand the stresses of the construction phase by, if necessary, fertilizing, pruning and mulching around them well in advance of beginning any construction activities.
    ix. Install brightly colored construction fencing to alert construction workers of the limits of vegetation retention areas to prevent accidental damage to these resources during construction activities.

e. Tree retention areas and significant trees shall be protected after development as follows:
    i. Tree retention areas shall be protected post development through the use of fencing, signage, homeowners' covenants, deed restrictions, and/or easements as determined necessary by the Town Planner or Designee.
    ii. If any significant tree that has been specifically designated to be retained in the tree preservation plan dies within five years of the development of the site, then the significant tree shall be replaced by the planting of a minimum of three trees of the same or similar species. Any required planting shall be monitored for a minimum of three years following installation to ensure plant survival and success. Planting which fail to survive during this three-year period shall be replaced at the expense of the developer, owner, or homeowners association as specified in the landscaping plan for the proposal.

18.07.070 Installation and Maintenance of landscaping.

A. Required. Whenever landscaping is or has been required in accordance with the provisions of this title or any addition or amendments to this title, or in accordance with the provisions of any previous code or ordinance of the town, the landscaping shall be permanently maintained in such a manner as to accomplish the purpose for which it was initially required.

B. All landscaping areas shall be provided with a permanent irrigation system.

C. Where landscaping is required under the provision of this chapter, trees, shrubs and planting areas shall be maintained in a healthy state to include mowing, watering, insect control, fertilizing and pruning by the owner of the lot or tract.

D. Plant material that has died shall be replaced at the beginning of the next appropriate planting season and planting areas shall be kept reasonably free of noxious weeds and trash.

E. Trees and/or shrubs shall be pruned to avoid potential safety hazards or nuisances created through overhanging branches or excessive shading.

F. All required landscaping that is located within the public right-of-way shall be maintained by the abutting property owner.

~~B.~~ G. Notice of Violation. The planning director or his designated representative is hereby authorized and empowered to notify the owner of any property required to be landscaped, or the agent, tenant, lessee or assignee of any such owner, that the landscaping is not being adequately maintained and the specific nature of such failure to maintain. The notice shall specify the date by which the maintenance must be accomplished, and shall be sent by certified mail, addressed to the owner at his last known address.

~~C~~. H. Action Upon Noncompliance.

1. Upon the failure, neglect or refusal of any owner or agent so notified to perform the required maintenance within the time specified in the written notice, or within 15 days after the date of such notice if the notice is returned to the town by the post office department because of inability to make delivery thereof, provided the notice was properly addressed to the last known address of the owner or agent, the planning director or his designated representative is hereby authorized and empowered to cause the required maintenance to be done and provide for payment of the cost thereof, with the cost to be collected or taxed against the property affected as provided in this section.

2. Nothing in this section shall prevent the planning director or a designated representative from taking action as provided in EMC 18.09.070.

~~D~~. I. Charge for Maintenance by Town to Be Included in Tax Bill. When the town has performed landscape maintenance or has paid for such maintenance, the actual cost thereof, plus accrued interest at the rate of eight percent per annum from the date of the completion of work, if not paid by such owner prior thereto, may be charged to the owner of such property on the next regular tax bill forwarded to such owner by the town, and if so charged shall be due and payable by the owner at the time of payment of such bill.

~~E~~.J. Lien for Payment of Charges. If the full amount due the town is not paid by such owner within 30 days after performance of the maintenance as provided for in subsection (C) of this section, then, in that case, the planning director (or the director's designated representative) may cause to be recorded in the office of the town clerk a sworn statement showing the cost and expense incurred for the work, the date the work was done, and the legal description of the property on which the work was done. The recording of such sworn statement shall constitute a lien and privilege on the property, and shall remain in full force and effect for the amount due in principal and interest, plus court costs, if any, until final payment has been made. The costs and expenses shall be collected in the manner fixed by law for the collection of taxes and further shall be subject to a delinquent penalty of eight percent per annum if the costs and expenses are not paid in full on or before the date the tax bill upon which the charge appears become delinquent. Sworn statements recorded in accordance with the provisions of this subsection shall be prima facie evidence that all legal formalities have been complied with and that the work has been done properly and satisfactorily, and shall be full notice to every person concerned that the amount of the statement plus interest constitutes a charge against the property designated or described in the statement and that the charge is due and collectible as provided by law.

~~F~~. K. Alternative Methods of Collection of Charges. In addition to or in lieu of the provision of subsections (D) and (E) of this section, the town may, at its option, commence a civil action in any court of competent jurisdiction to collect for any charges incurred by the town for performance of maintenance as provided in subsection (C) of this section. (Ord. 94-06 § 2, 1994).

EATONVILLE LID INCENTIVES-DRAFT

Increased Densities
- Allow greater residential densities with the implementation of LID techniques.
- With more sensitive design the land is able to manage more units.
- Potentially greater impacts needing mitigation.

Reduced Review Time / Expedited Review
- Commit to a priority status on LID projects with a maximum time between receipt and review.
- LID projects may need special studies and reviews that must be identified early.
- Impacts to staffing resources and other project review schedules. Outside consultants could also be used to expedite.

Property Tax Reduction
- Reduce or waive property taxes on an LID project for a given number of years.
- Lower service requirements result from lower impacts.
- Reduced revenues.

Reduced Application Fees
- Waive all or a portion of the submittal fees on LID projects.
- Due to lesser impacts to the community, lower fees are charged.
- Impacts to jurisdiction resources. May be offset by reduced habitat restoration and environmental costs

Public Recognition
- Emphasize LID projects on website, at Council meetings and in utility mailers.
- Highlight the great development projects going on throughout the area & create public awareness.
- Staff resource impacts.

Dedicated Review Team
- Create an LID review team that is familiar with and dedicated to LID projects.
- Specialized team with technical expertise is necessary and more efficient assistance and review.
- Initial training of team members in LID techniques will be required in any event. Outside consultants could also be used - charged to applicant or paid for by jurisdiction.

Flexibility in Bulk, Dimensional & Height Restrictions
- Allow greater building heights and floor area ratios as well as reduced setbacks.
- Provides flexibility in overall site design. Allows reduction in building footprint. Addresses clustering needs.
- Consistency/compatibility with existing development and urban design goals.

Adjustments to the Required Parking
- Reduce parking requirements.

- Reducing parking is both an LID technique for reducing impervious surfaces as well as a way to encourage more projects.
- May conflict with other community objectives.

Lower Stormwater System Development Fees

- Reduce charges when development meets thresholds.
- Lower impacts to system capacity, so lower fees are appropriate.
- Reduced capital funds. Compensate by raising charges for conventional developments.

Fee structure

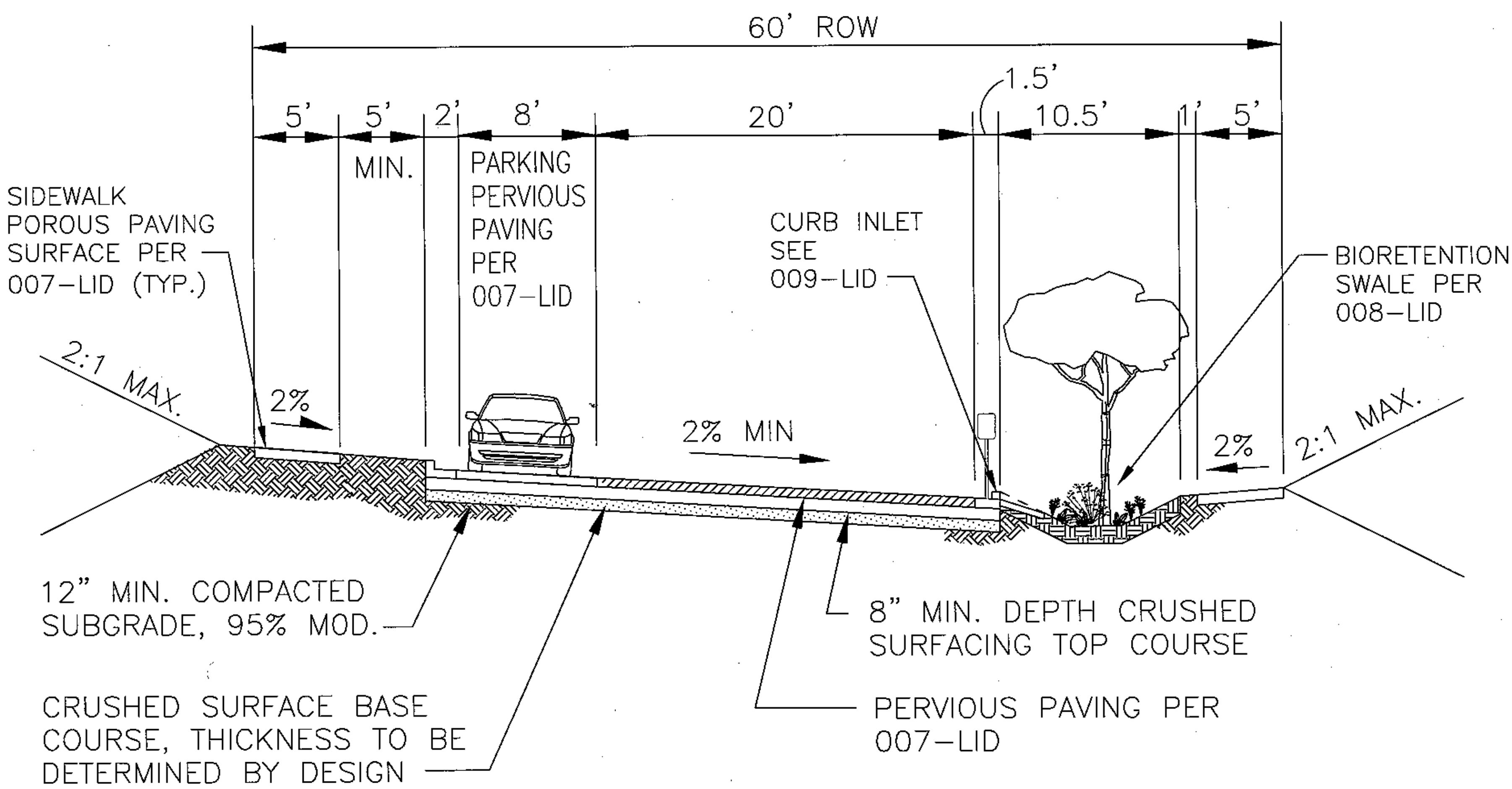
- Develop a new fee structure that is based on impervious surface. Fee reduction will be awarded based on LID implementation thresholds

Reduced requirements for conventional SW Mgt or reduced fee for tying into existing SW system.

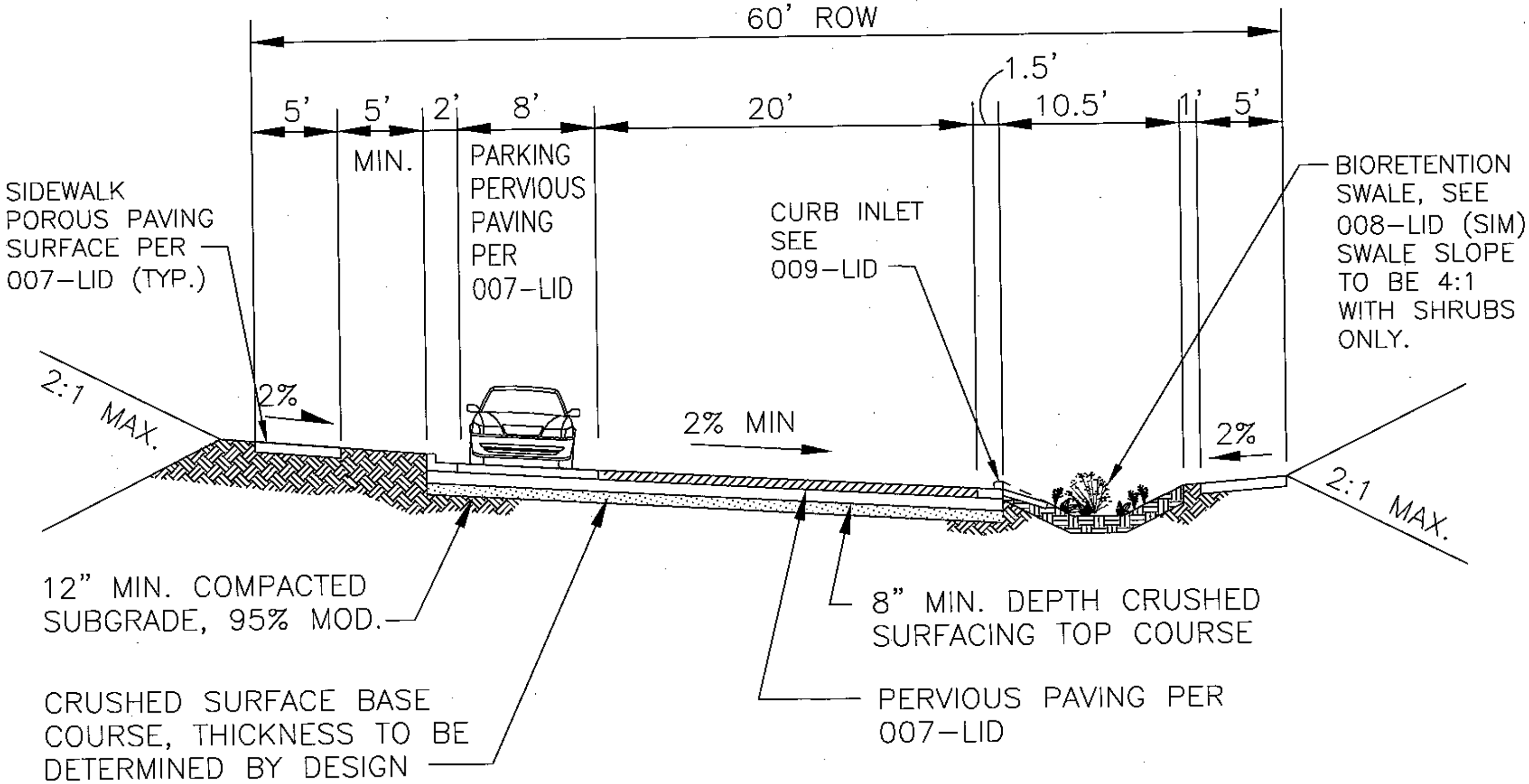
- Allow developers to reduce the amount of conventional stormwater management when they implement LID or LID techniques. Example, if roof runoff is re-used onsite, or infiltrated on-site, the development can remove the roof square footage in the calculations for determining detention pond size.

Town-furnished LID materials

- Town will supply materials (pervious concrete, plants, soil, mulch, compost, etc) to offset development costs on LID projects.



TOWN OF EATONVILLE, WA DEPARTMENT OF PUBLIC WORKS		
LID TYPICAL VERTICAL CURB **60' ROW ROADWAY**		
STANDARD PLANS		DRAWING No. 001-LID
REVISION: JUNE 2008	NOT TO SCALE	BY: ELR



NOTE: NO STREET SIGNS WILL BE PERMITTED IN THE AEROSPACE ZONE.

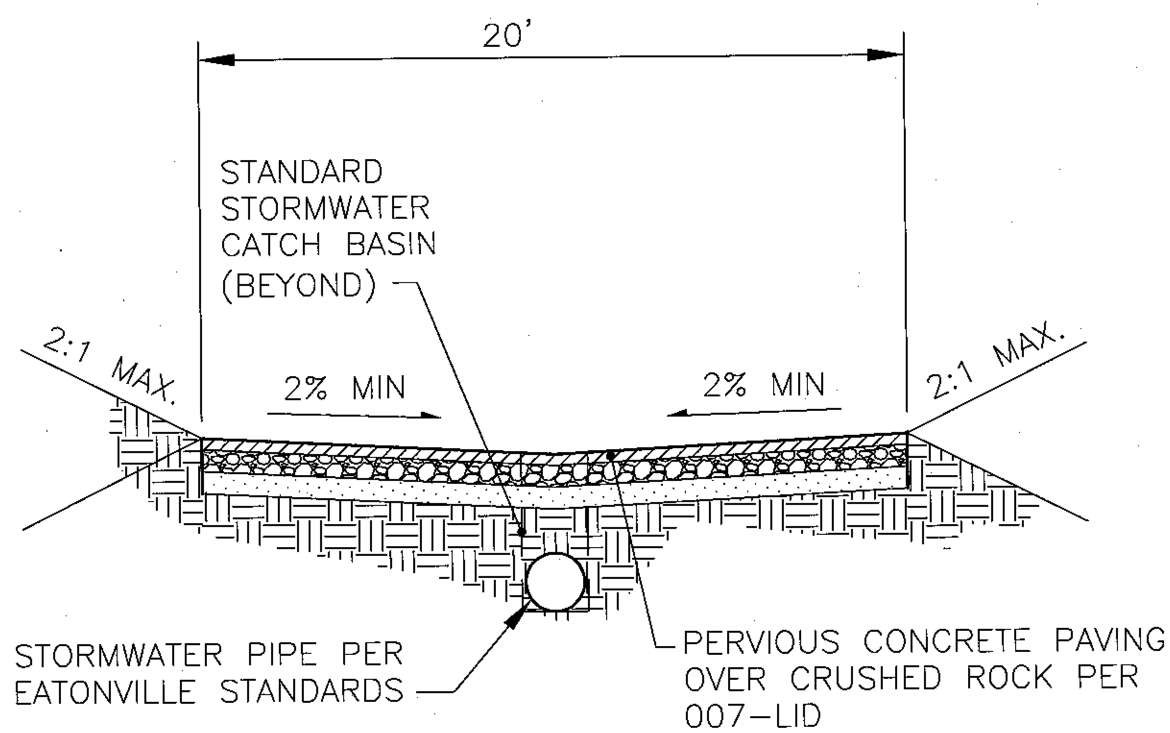
TOWN OF EATONVILLE, WA
DEPARTMENT OF PUBLIC WORKS

LID AEROSPACE ZONE
60' ROW - TAXIWAY

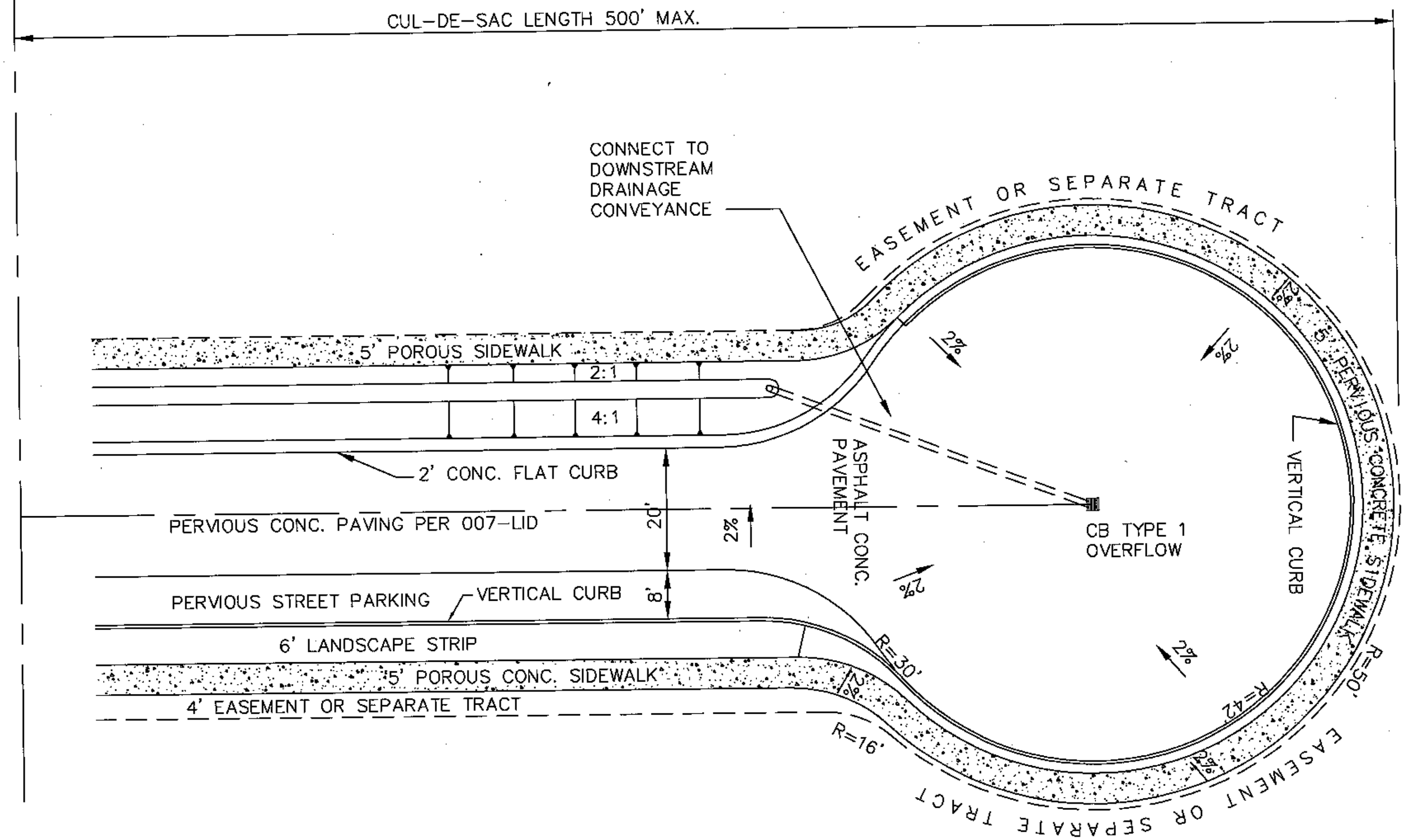
STANDARD PLANS

DRAWING No. 002-LID

REVISION: JUNE 2008 | NOT TO SCALE | BY: ELR



TOWN OF EATONVILLE, WA DEPARTMENT OF PUBLIC WORKS		
LID TYPICAL **20' ALLEY ROW** STANDARD PLANS		DRAWING No. 003-LID
REVISION: JUNE 2008	NOT TO SCALE	BY: ELR



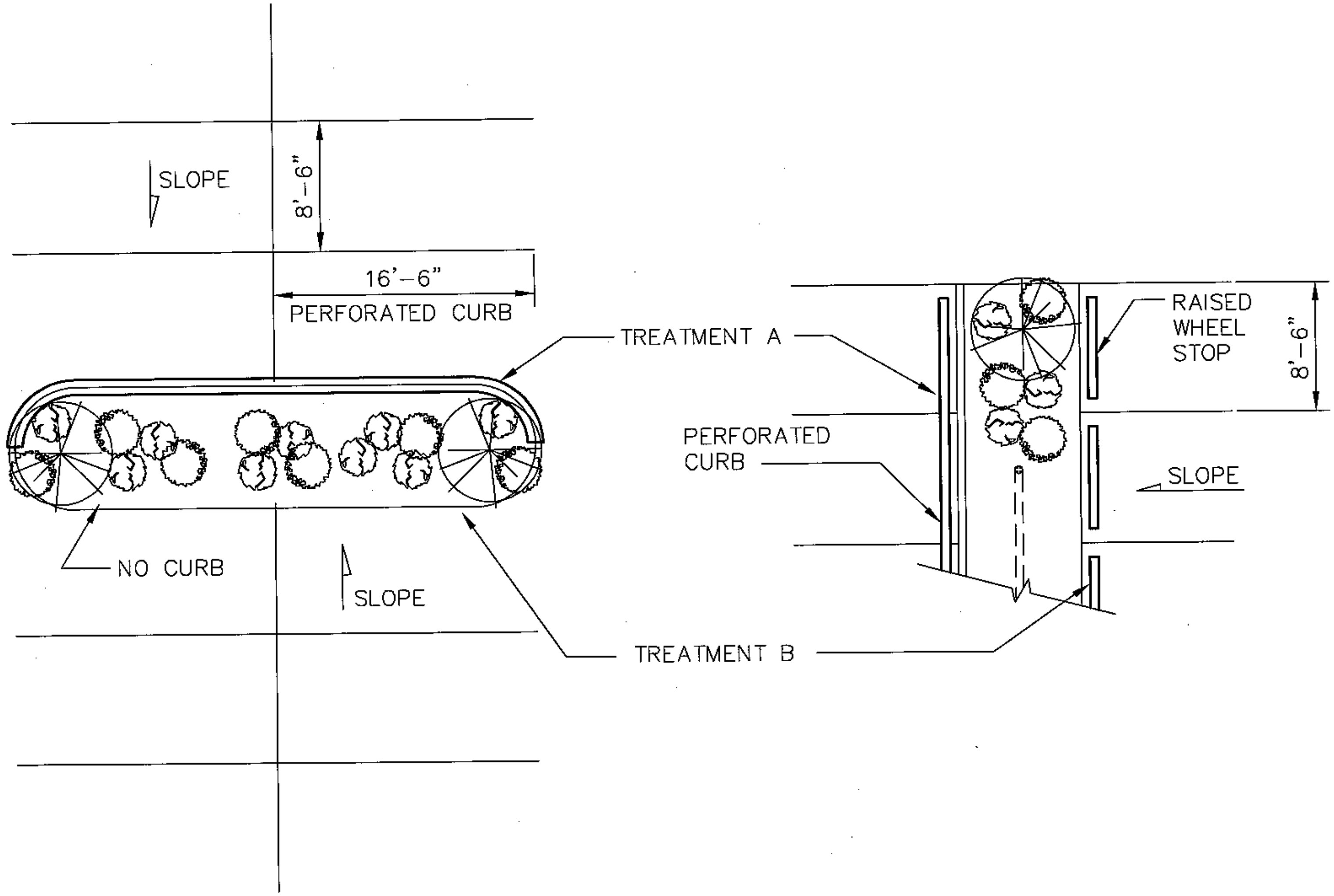
TOWN OF EATONVILLE, WA
DEPARTMENT OF PUBLIC WORKS

LID CUL-DE-SAC PLAN - 50' RADIUS

STANDARD PLANS

DRAWING No. 004A-LID

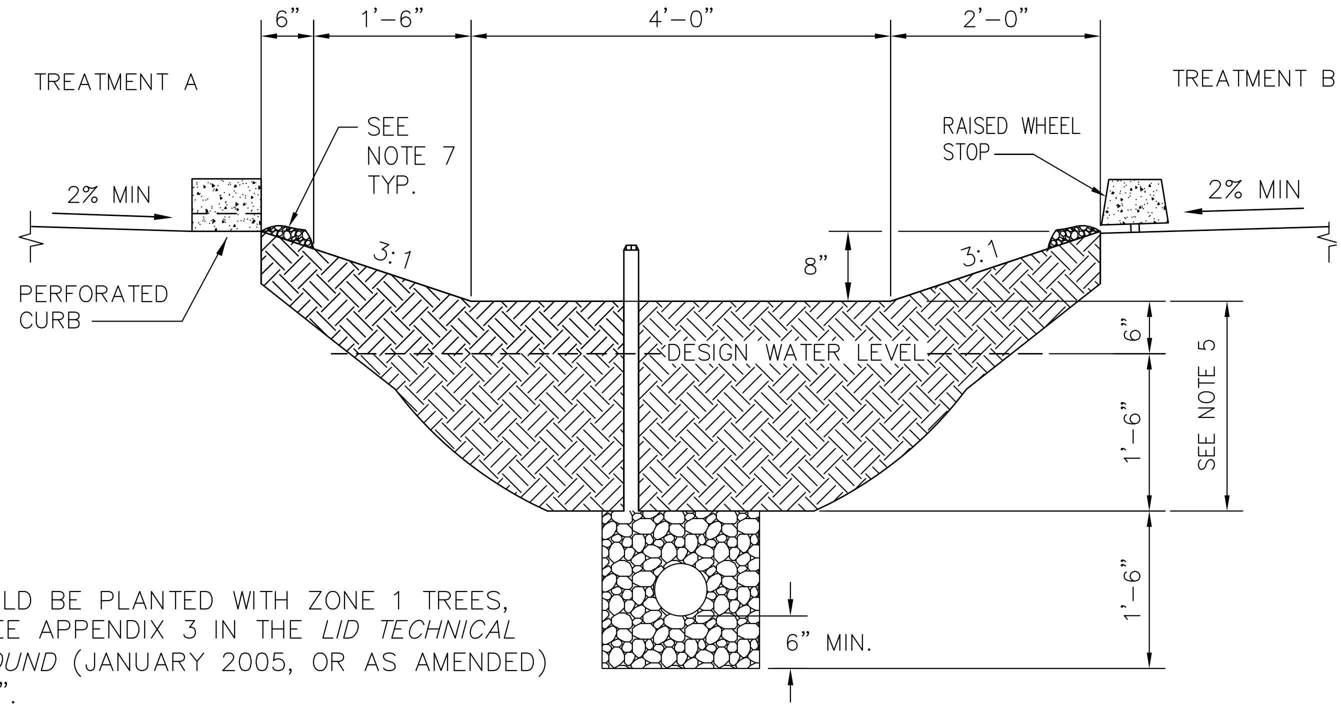
REVISION: JUNE 2008 | NOT TO SCALE | BY: ELR



NOTES:
1. UNDERDRAINS ARE ONLY PERMITTED IN SOILS WITH INFILTRATION RATES INADEQUATE TO MEET MAXIMUM POOL AND SYSTEM DEWATER RATES.

2. WHERE PERFORATED CURBS, OR WHEEL STOPS FLUSH WITH THE PAVEMENT, ARE USED, APPROXIMATELY 6 INCHES OF ROCK OR OTHER EROSION PROTECTION MATERIAL SHOULD BE USED TO DISSIPATE ENERGY AND/OR FLOW DISPERSION. SEE PLAN NO. LID 8

TOWN OF EATONVILLE, WA DEPARTMENT OF PUBLIC WORKS	
LID PARKING ISLAND TREATEMENT PLAN A & B	
STANDARD PLANS	DRAWING No. 005A-LID
REVISION: JUNE 2008	NOT TO SCALE
BY:	ELR



NOTES:

1. FLOOR OF PLANTING ISLAND SHOULD BE PLANTED WITH ZONE 1 TREES, SHRUBS AND GROUND COVER. SEE APPENDIX 3 IN THE *LID TECHNICAL GUIDANCE MANUAL FOR PUGET SOUND* (JANUARY 2005, OR AS AMENDED) FOR A "BIORETENTION PLANT LIST".

2. SIDE SLOPES SHOULD BE PLANTED WITH ZONE 1 OR 2 GROUND COVERS.

3. BIORETENTION SOIL, COMPOSITION AND pH LEVELS SHALL MEET THE STANDARDS SET FORTH IN THE *LID TECHNICAL GUIDANCE MANUAL FOR PUGET SOUND* (CURRENT EDITION).

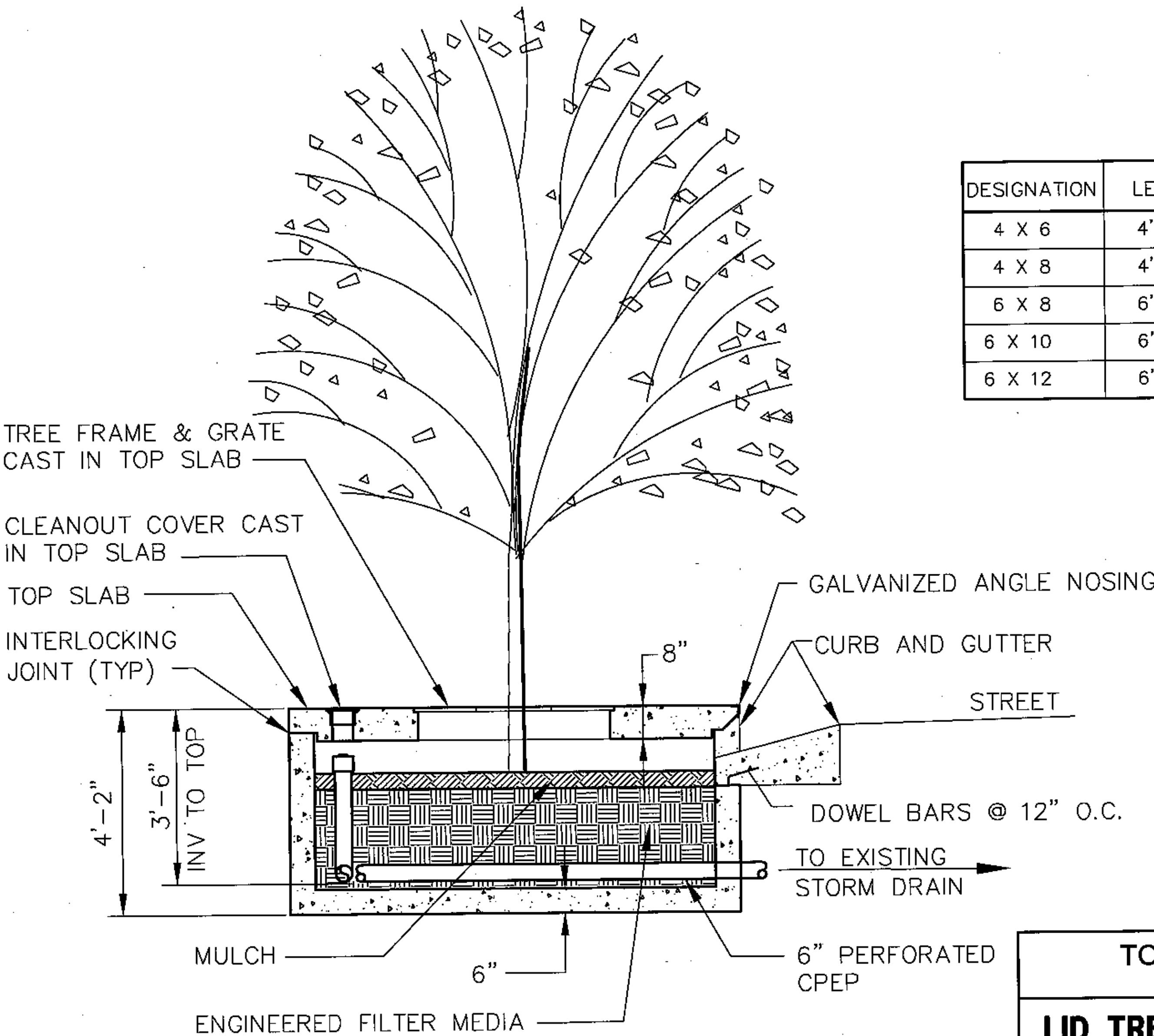
4. PLANTING SHALL CONSIST OF NATIVE SPECIES ABLE TO TOLERATE VARIABLE SOIL MOISTURE CONDITIONS, PONDING WATER FLUCTUATIONS, AND VARIABLE SOIL MOISTURE CONTENT.

5. AT LEAST 18 INCHES OF BIORETENTION SOIL MIX IS REQUIRED BELOW THE DESIGN WATER ELEVATION. ABOVE THIS ELEVATION AT LEAST 6 INCHES OF BIORETENTION SOIL MIX IS REQUIRED. COMPACT SUBSOILS MUST BE SCARIFIED AT 4 INCHES BELOW THE AMENDED LAYER.

6. UNDERDRAINS ARE ONLY PERMITTED IN SOILS WITH INFILTRATION RATES INADEQUATE TO MEET MAXIMUM POOL AND SYSTEM DEWATER RATES.

7. WHERE PERFORATED CURBS, OR WHEEL STOPS FLUSH WITH THE PAVEMENT, ARE USED, APPROXIMATELY 6 INCHES OF ROCK OR OTHER EROSION PROTECTION MATERIAL SHOULD BE USED TO DISSIPATE ENERGY AND/OR FLOW DISPERSION.

TOWN OF EATONVILLE, WA DEPARTMENT OF PUBLIC WORKS		
LID PARKING ISLAND BIORETENTION SWALE SECTION		
STANDARD PLANS	DRAWING No. 005B-LID	
REVISION: DEC. 2008	NOT TO SCALE	BY: ELR



DESIGNATION	LENGTH	WIDTH	TREE GRATE QTY & SIZE
4 X 6	4'–0"	6'–0"	(1) 3X3
4 X 8	4'–0"	8'–0"	(1) 3X3
6 X 8	6'–0"	8'–0"	(1) 4X4
6 X 10	6'–0"	10'–0"	(1) 4X4
6 X 12	6'–0"	12'–0"	(2) 4X4

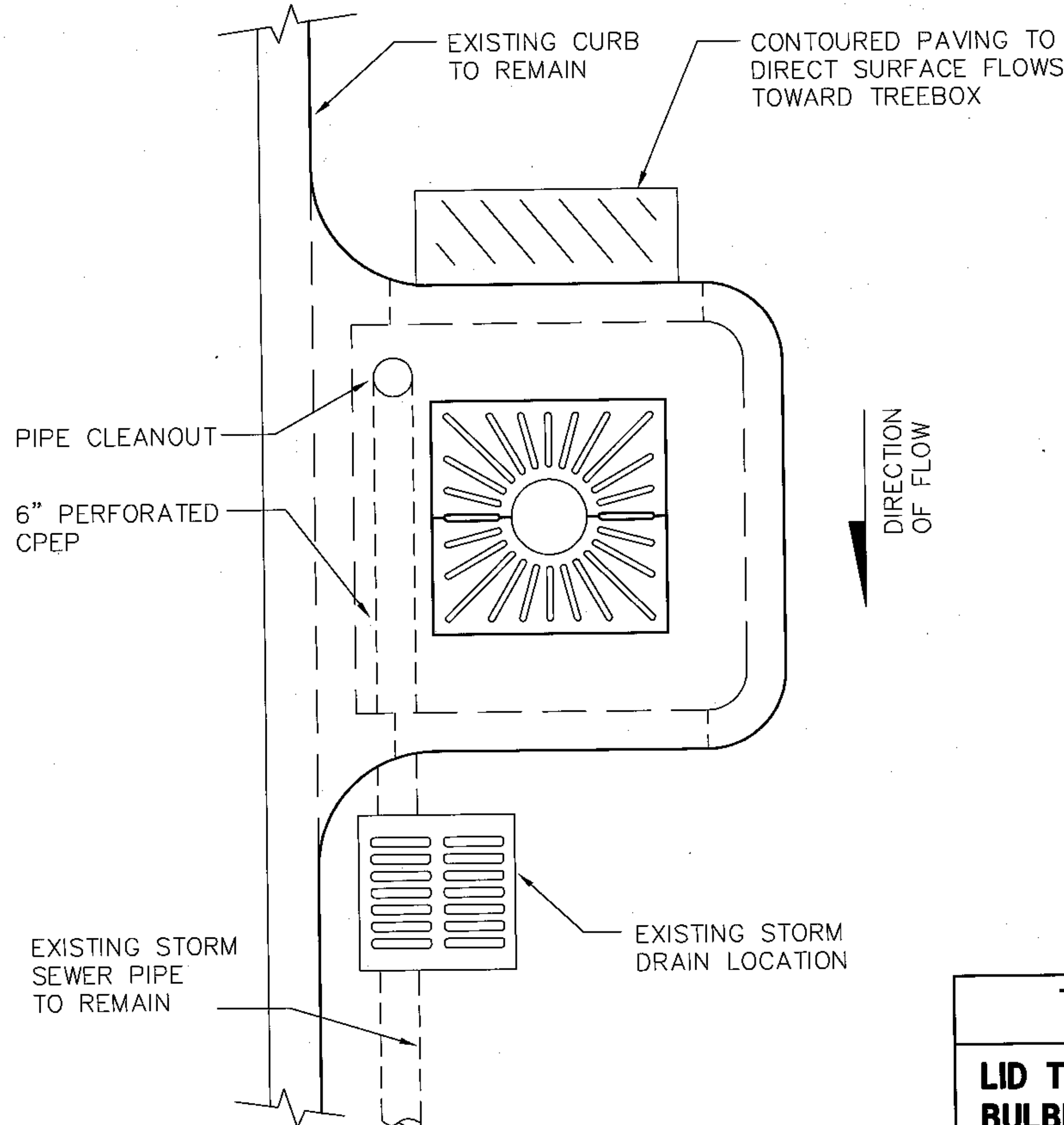
TOWN OF EATONVILLE, WA
DEPARTMENT OF PUBLIC WORKS

LID TREE BOX TYPICAL SECTION

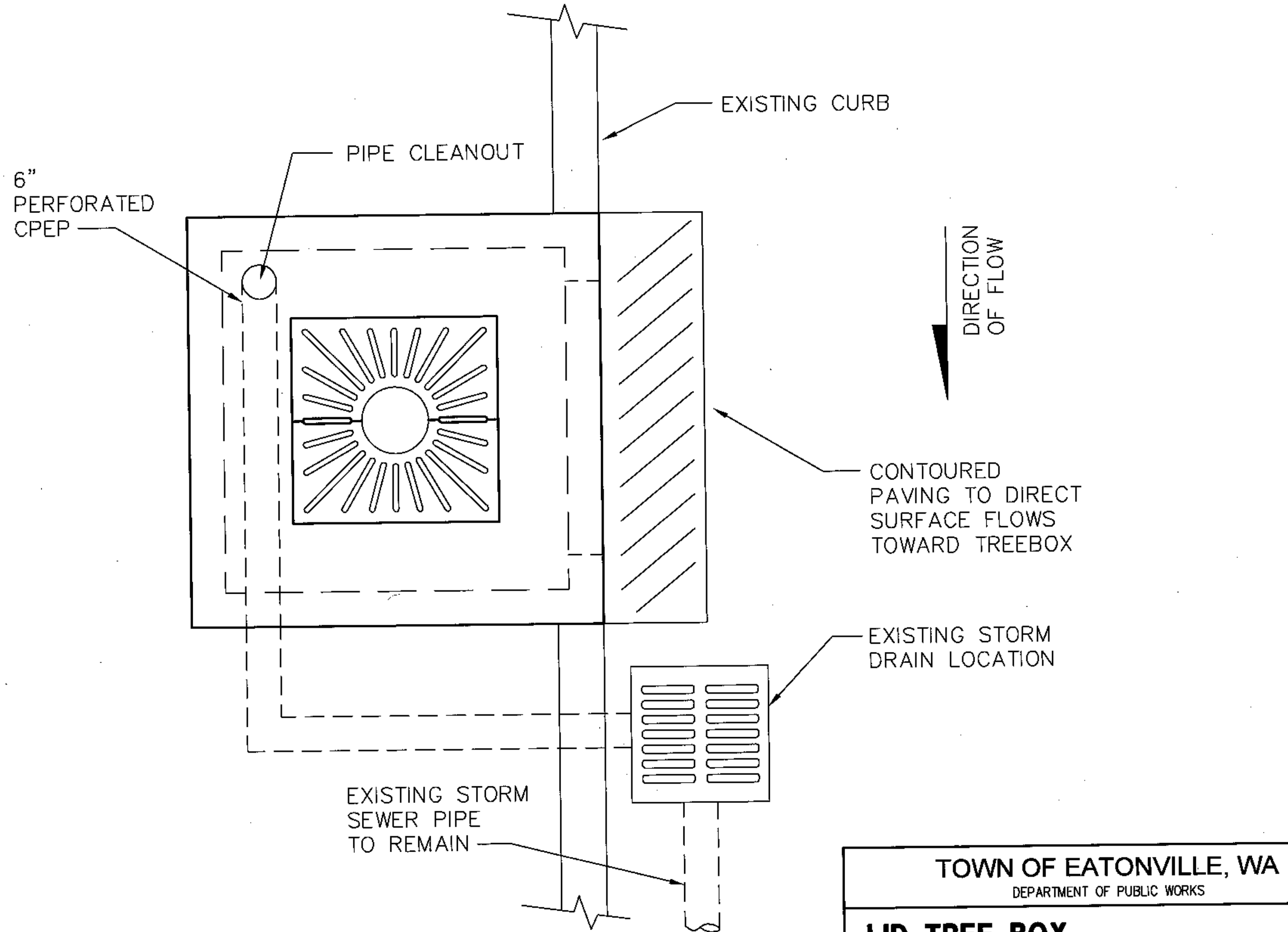
STANDARD PLANS

DRAWING No. 006A-LID

REVISION: JUNE 2008 | NOT TO SCALE | BY: ELR



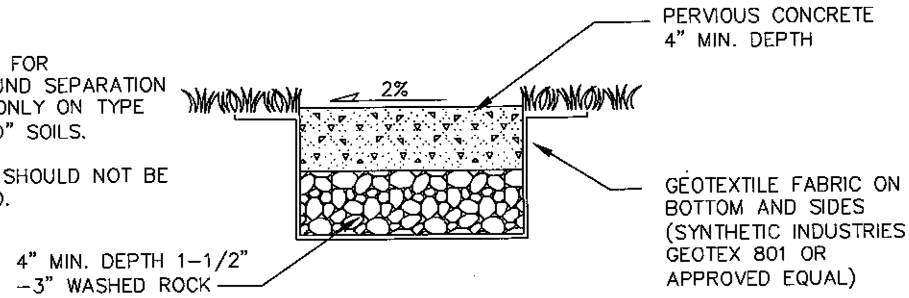
TOWN OF EATONVILLE, WA DEPARTMENT OF PUBLIC WORKS		
LID TREE BOX **BULBED - PLAN** STANDARD PLANS		DRAWING No. 006B-LID
REVISION: JUNE 2008	NOT TO SCALE	BY: ELR



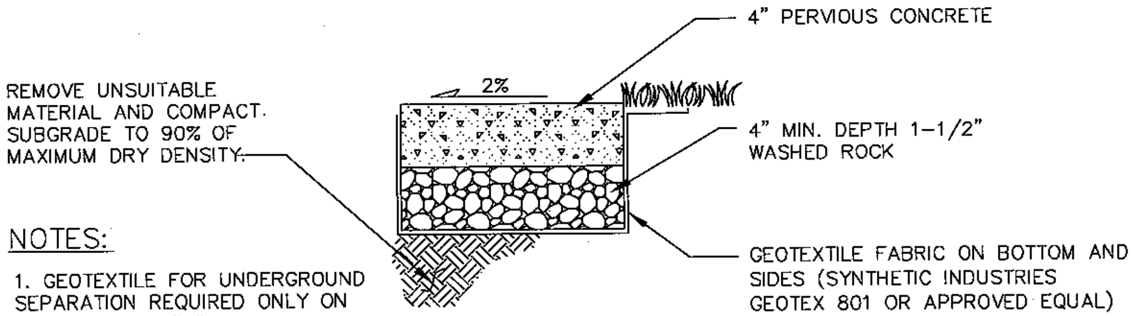
TOWN OF EATONVILLE, WA DEPARTMENT OF PUBLIC WORKS		
LID TREE BOX RECESSED - PLAN STANDARD PLANS		DRAWING No. 006C-LID
REVISION: JUNE 2008	NOT TO SCALE	BY: ELR

NOTES:

1. GEOTEXTILE FOR UNDERGROUND SEPARATION REQUIRED ONLY ON TYPE "C" AND "D" SOILS.
2. SUBGRADE SHOULD NOT BE COMPACTED.



PERVIOUS CONCRETE SIDEWALK

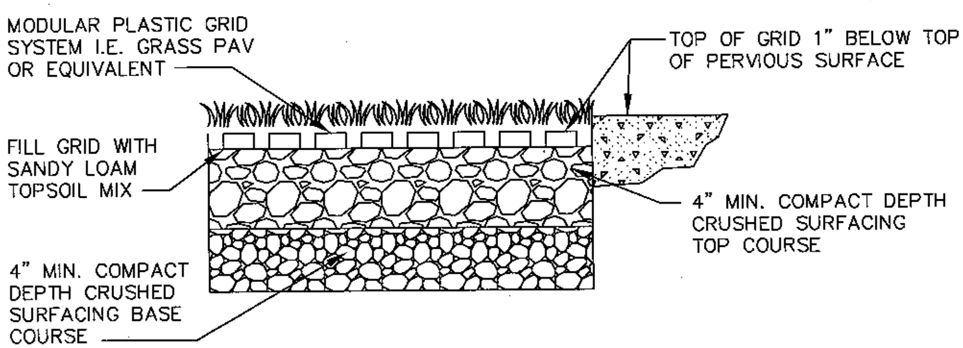


NOTES:

1. GEOTEXTILE FOR UNDERGROUND SEPARATION REQUIRED ONLY ON TYPE "C" AND "D" SOILS.

PERVIOUS CONCRETE SURFACING

DRIVABLE PERVIOUS SURFACING:
DRIVE LANE, SHOULDERS, ON-STREET PARKING



PERVIOUS GRASS PAVING

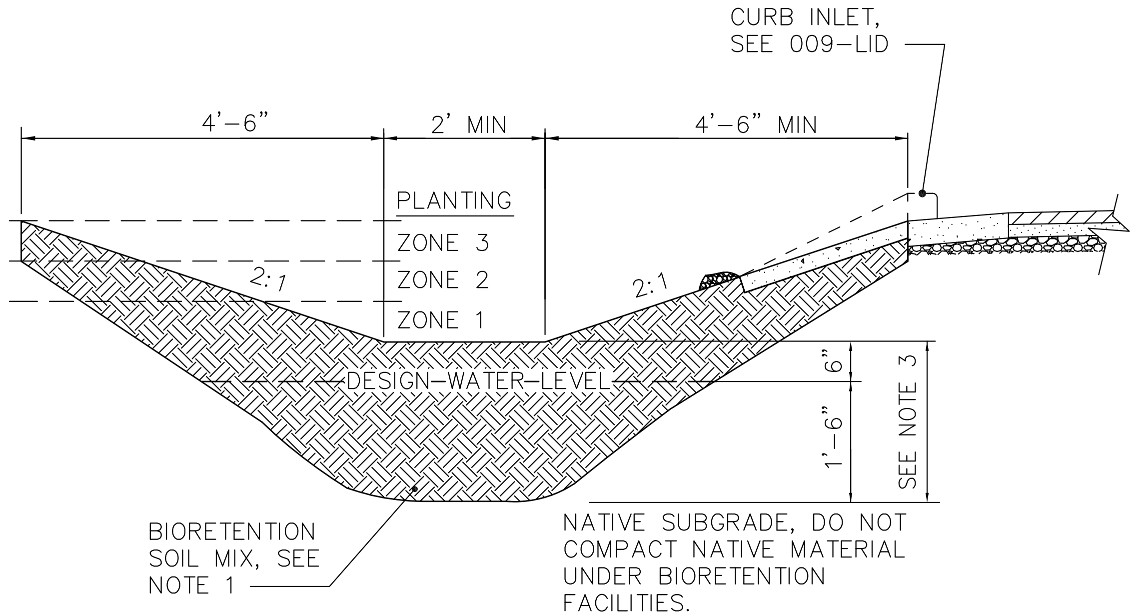
TOWN OF EATONVILLE, WA
DEPARTMENT OF PUBLIC WORKS

LID TYPICAL DETAIL
PERVIOUS PAVING

STANDARD PLANS

DRAWING No.
007-LID

REVISION: JUNE 2008	NOT TO SCALE	BY: ELR



NOTES:

1. BIORETENTION SOIL, COMPOSITION AND pH LEVELS SHALL MEET THE STANDARDS SET FORTH IN THE *LID TECHNICAL GUIDANCE MANUAL FOR PUGET SOUND* (CURRENT EDITION).

2. PLANTING SHALL CONSIST OF NATIVE SPECIES ABLE TO TOLERATE VARIABLE SOIL MOISTURE CONDITIONS, PONDING WATER FLUCTUATIONS, AND VARIABLE SOIL MOISTURE CONTENT. SEE APPENDIX 3 IN THE *LID TECHNICAL GUIDANCE MANUAL FOR PUGET SOUND* (JANUARY 2005, OR AS AMENDED) FOR A "BIORETENTION PLANT LIST".

3. AT LEAST 18 INCHES OF BIORETENTION SOIL MIX IS REQUIRED BELOW THE DESIGN WATER ELEVATION. ABOVE THIS ELEVATION AT LEAST 6 INCHES OF BIORETENTION SOIL MIX IS REQUIRED. COMPACT SUBSOILS MUST BE SCARIFIED AT 4 INCHES BELOW THE AMENDED LAYER.

4. UNDERDRAINS ARE REQUIRED IN SOILS WITH INFILTRATION RATES INADEQUATE TO MEET MAXIMUM POOL AND SYSTEM DEWATER RATES.

5. SEE 009–LID FOR CURB INLETS.

6. ZONE 1 PLANTINGS SHOULD BE USED BELOW THE DESIGN WATER ELEVATION.

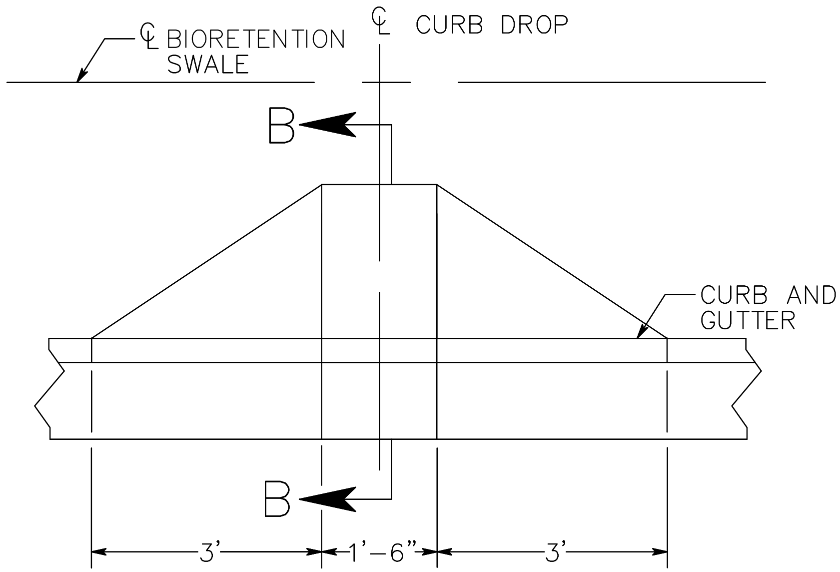
TOWN OF EATONVILLE, WA
DEPARTMENT OF PUBLIC WORKS

LID TYPICAL DETAIL
BIORETENTION SWALE

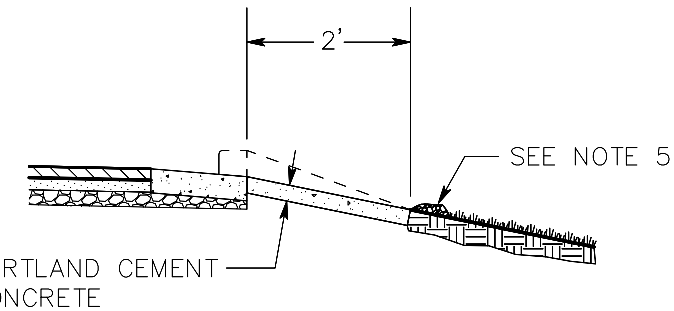
STANDARD PLANS

DRAWING No. 008-LID

REVISION: DEC. 2008	NOT TO SCALE	BY: ELR



CURB INLET TYPE 1



SECTION B–B

GENERAL NOTES

1. CURB INLET SHALL BE CONSTRUCTED IN ACCORDANCE WITH ASTM C 478 (AASHTO M 199) & ASTM C 890 UNLESS OTHERWISE SHOWN ON PLANS OR NOTED IN THE PROJECT SPECIAL PROVISIONS.
2. TOP SURFACE TO BE BROOM FINISHED.
3. ALL EXTERNAL EDGES NOT LABELED SHALL BE TROWELED WITH 1/4" RADIUS EDGER.
4. INLETS SHOULD BE SPACED CONSISTENT WITH CATCH BASIN SPACING REQUIRED IN THE STORM WATER MANUAL.
5. WHERE CURB INLETS ARE USED, APPROX. 6 INCHES OF ROCK OR OTHER EROSION PROTECTION MATERIAL SHOULD BE USED TO DISSIPATE ENERGY AND/OR FLOW DISPERSION.
6. PERVIOUS PAVING MAY BE USED FOR INLET WITH TOWN APPROVAL.

TOWN OF EATONVILLE, WA
DEPARTMENT OF PUBLIC WORKS

LID TYPICAL DETAIL
CURB INLET

STANDARD PLANS

DRAWING No. 009-LID

REVISION: DEC. 2008	NOT TO SCALE	BY: ELR

Appendix J

Pierce Conservation District - Steps to Join

Appendix J - Pierce Conservation District. Steps to join the Conservation District.

1. The Town of Eatonville passes a Resolution similar to the draft attached beginning page 16, giving authority to their Mayor/Council and staff to sign the "Petition for Inclusion" and requesting the PCD Board include Eatonville tax parcels in the "Resource Conservation Fee" or new Rate or Charge System.
2. Eatonville representatives sign the "Petition for Inclusion", beginning page 17
3. PCD Board approves a Resolution to do likewise and signs the "Petition for Inclusion"
4. The Petition gets forwarded to the WA State Conservation Commission
5. PCD forwards a request to the Pierce County Council to amend the PCD Rate or Charge ordinance in early August, PCD ensures Eatonville is included in that and the tax parcels that get forwarded for inclusion to the Assessor Treasurer's Office data set for 2014 collections and beyond
6. We then work with the Assessor-Treasurer's Office to ensure inclusion of Eatonville for the new rate or charge. The attached resolution and "Petition for Inclusion" will serve as the formal request and OK from the Town

Town of Eatonville
WASHINGTON
Resolution NO. ____________

A RESOLUTION OF THE TOWN OF EATONVILLE TOWN COUNCIL REQUESTING THAT THE PIERCE COUNTY COUNCIL ENACT A RESOURCE CONSERVATION FEE WITHIN THE CORPORATE BOUNDARIES OF EATONVILLE

WHEREAS, various Federal and State government laws and regulations mandate local governmental action relative to protection and enhancement of natural resources; and

WHEREAS, the Town of Eatonville is required to plan and implement programs and projects in response to these Federal and State mandates and the Endangered Species Act (ESA); and

WHEREAS, outside funding for said programs and projects is often insufficient to meet the needs of local government or local governments are faced with “unfunded mandates”; and

WHEREAS, the Pierce Conservation District, a locally-led agency of Washington State government offers significant assistance to local governments and private citizens in response to said Federal and State mandates; and

WHEREAS, the Town of Eatonville has significant natural resources such as prime agricultural soils, forest lands and river corridors important for endangered species recovery and the quality of life of the region; and

WHEREAS, the Town of Eatonville wishes to take advantage of the Pierce Conservation programs for water quality improvement, river bank stabilization, rain garden and rain barrel program development and agricultural land support;

WHEREAS, the Pierce County Council possesses the authority under RCW Chapter 89.08.400 to enhance the ability of the Pierce Conservation District to assist local governments by enacting an annual Resource Conservation Fee or Rate or Charge of up to Five Dollars ($5.00) per parcel within the Pierce Conservation District’s boundaries for a period of not greater than ten (10) years; and

NOW THEREFORE, BE IT RESOVED that the Town of Eatonville hereby requests to become included within the service territory of the Pierce Conservation District and is authorized to submit appropriate forms to the Pierce Conservation District and Washington State Conservation Commission; and

BE IT FURTHER RESOLVED that the Town of Eatonville requests the Pierce Conservation District Board of Supervisors include the eligible properties within the city limits to be included in the Resource Conservation Fee or Rate or Charge to fund said programs in accordance with RCW Chapter 89.08.400.

ADOPTED BY THE TOWN COUNCIL AT A REGULAR MEETING THEREOF ON THE _____ DAY OF _____, 2012

Washington State Conservation Commission
Olympia, Washington 98504

PETITION FOR INCLUSION OF ADDITIONAL TERRITORY
WITHIN THE
PIERCE CONSERVATION DISTRICT

TO: The Washington State Conservation Commission

Pursuant to the Conservation Districts Law (Chapter 89.08 RCW) the undersigning government authorities of the Town of Eatonville and the Pierce Conservation District, respectfully represent:

First: That heretofore the Pierce Conservation District was duly organized as a governmental subdivision of this state, and a public body corporate and politic.

Second: That there is need, in the interest of the public health, safety, and welfare, for the inclusion of the territory hereinafter described within the said Pierce Conservation District.

Third: That the territory proposed for inclusion within the said district includes substantially the following:

Incorporated Town of Eatonville

WHEREFORE, the undersigned petitioners respectfully request that the State Conservation Commission duly define the boundaries of the additional territory; and that the State Conservation Commission determine that such additional territory be so included and made a part of the Pierce Conservation District.

Pierce Conservation District	Town of Eatonville
______________________________	______________________________
Chair	Mayor
______________________________	______________________________
Vice Chair, Auditor	Council Member
______________________________	______________________________
Member	Council Member
______________________________	______________________________
Member	Council Member
______________________________	______________________________
Member	Council Member
	______________________________
	Council Member
	______________________________
	Council Member
	______________________________
	Council Member

Date: ______________________________