FINAL

City of Mount Vernon Comprehensive Stormwater Management Plan Update

Prepared for

City of Mount Vernon, Washington

November 2004

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SECTION 1: INTRODUCTION

City of Mount Vernon Comprehensive Stormwater Management Plan Update

1. Introduction

1.1 Background

The purpose of the Comprehensive Stormwater Management Plan Update (Stormwater Plan Update) is to provide an update to the strategic framework for the management of stormwater within Mount Vernon. The Stormwater Plan Update is intended to be a flexible document that may be readily revised should the priorities and focus of the City change. It is also intended to act as a reference for other City departments whose activities may impact storm and surface water and could be affected by drainage.

Because this is an Update to an existing plan, the 1995 Comprehensive Surface Water Management Plan (1995 Surface Water Plan) will be referenced frequently and should be considered a companion document. As a general practice, only new material, findings, and recommendations will be included in this update. Occasionally material from the existing plan will be re-iterated in the interest of clearly communicating a point.

The role of surface water management in Mount Vernon is to:

1. Respect and preserve the City's watercourses
2. Minimize water quality degradation and control sedimentation of creeks, streams, ponds, lakes, and other water bodies
3. Protect the life, health, and property of the general public
4. Preserve and enhance the suitability of waters for contact recreation and fish habitat
5. Preserve and enhance the aesthetic quality of the waters
6. Maintain and protect valuable ground water quantities, locations, and flow patterns
7. Insure the safety of City roads and rights-of-way
8. Decrease drainage-related damages to public and private property

The City uses the following tools and regulations to manage stormwater:

- Mount Vernon Comprehensive Surface Water Management Plan, (R.W. Beck and Associates, November 1995) (1995 Surface Water Plan)
- Mount Vernon Comprehensive Plan (January 1995)
- Mount Vernon Municipal Code (Specifically, Chapter 2673, Chapter 16.32, and Chapter 15.36)

- Mount Vernon Development Code (Title 13, Sewers; Title 14, Land Use and Development; and Title 15, Buildings and Construction)
- Comprehensive Sewer and Combined Sewer Overflow Reduction Plans for the City of Mount Vernon (R.W. Beck and Associates, 1991)
- Critical Areas Ordinance #2482 (February, 1992)
- Section 4(d) of the Endangered Species Act (National Marine Fisheries Service)
- Shoreline Management Act (RCW Chapter 90.58, 1971) and the Skagit County Shoreline Master Program (developed in 1976 in accordance with the State Shorelines Management Act)
- State Hydraulic Code (RCW Chapter 75.20.100-140, 1949)
- State 402 (Water Quality) Certification
- Coastal Zone Management Determinations
- Floodplain Management Program
- State Environmental Policy Act (1971, with new implementation rules adopted in 1984, WAC Chapter 197-11)
- Puget Sound Water Quality Management Plan (Puget Sound Water Quality Authority, 1994)
- NPDES Phase II Minimum Control Measures (EPA, October 1990)
- Sections 401 and 404 of the Clean Water Act
- Section 10 of the River and Harbor Act of (1899)
- National Environmental Policy Act (1969)
- Coastal Zone Management Act of (1972)
- Forest Practices Act (RCW Chapter 76.09)
- State Floodplain Regulations (Chapter 86.16 RCW)
- National Flood Insurance Act of 1968 and Flood Disaster Protection Act of 1973 (FEMA)
- Model Wetlands Protection Ordinance (Ecology, September 1990)
- DRAFT Capital Improvements Plan for Surface Water for the Years 2005 – 2010 (Developed June 2004, Pending Council Approval)
- City Design Standards - MVMC Title 12 Streets, Sidewalks and Public Works, Title 13 Sewers, Title 14 Land Use and Development, Title 15 Buildings and Construction, Title 16 Subdivisions, Title 17 Zoning, and various ordinances.

The City of Mount Vernon Comprehensive Plan (Comp Plan) provides guidance to direct public and private decisions affecting future growth and development. The Surface Water

Plan gives the Public Works Department a guide to implement the policy impacting surface water set in the Comprehensive Plan and is intended to assist the City in meeting its surface-water-related legislated responsibilities as well as recommend improvements to operations and maintenance activities and the CIP. The Capital Improvements Plan (CIP) identifies and discusses program elements, project and funding. Brief descriptions of the other tools and regulations in this list can be found in the 1995 Surface Water Plan or in the Regulations and Policies portion (Section 4) of this Update.

This document is the first update since the first Surface Water Management Plan was prepared in 1995. It addresses changes that have taken place since 1995, including new federal regulations and changing surface water management techniques and strategies. The City has implemented many of the recommendations contained in the initial Surface Water Plan and has addressed its most pressing basic issues related to property damage from flooding. As the City moves through its hierarchy of needs, it is expected that the focus will shift from addressing these basic quantifiable needs to goals that relate more to the character of the City and the vision of its citizens and leaders.

1.2 Goals and Objectives

The objective of the Surface Water Plan is to provide a surface water management framework that will protect the public's safety, health and property, conserve and enhance natural systems within the City, and comply with local, state, and federal regulations. This update was developed using the following principles:

- The Surface Water Plan should be a "living" document that encompasses alternative solutions such as Low Impact Development and can be adapted to conditions and priorities.
- The recommendations should meet the current and anticipated requirements of federal regulations, particularly the Endangered Species Act (ESA) and Phase II of the National Pollution Discharge Elimination System (NPDES).

Specific goals and objectives for the City of Mount Vernon's Surface Water Management Program are articulated in Section II of the 1995 Surface Water Management Plan.

1.3 Report Organization

The body of this plan summarizes the general surface water conditions in the City. Technical conclusions are detailed in appendices. The Plan comprises the following:

- **Section 1:** Introduction to the City of Mount Vernon Comprehensive Surface Water Management Plan Update
- **Section 2:** Summary of the physical surface water, drainage, and drainage-related characteristics of the City
- **Section 3:** Description of the surface water storage and conveyance system analyses performed for this update. Discussion of results and potential solutions to surface water issues.

- **Section 4:** Review of the regulatory framework to assure the City's surface water management policies are in compliance with federal, state, and local regulations. Discussion of "Street Edge Alternatives" and criteria for potential candidate sites in Mount Vernon is included in Appendix B.
- **Section 5:** Identification of CIP recommendations and potential program funding sources.
- **Section 6:** Documentation of the existing O&M programs and recommendations to increase the efficiency and effectiveness of that program.
- **Section 7:** Stormwater rate analysis.
- **Section 8:** Recommendations.
- **Appendixes:** Provide surface water modeling analysis, regulations and policies, storm drainage capital improvement plan projects, and operations and maintenance.

SECTION 2: DRAINAGE BASIN CHARACTERISTICS

2. Drainage Basin Characteristics

Topography, land use, climate, soils, and other physical characteristics affect surface water runoff quantity and quality in the City. These characteristics, along with other watershed resources such as fish habitat, wildlife and wetlands are described in the 1995 Surface Water Plan. Because this is an Update to that plan, it will be referenced frequently and should be considered a companion document. Updated information about the characteristics of the drainage basins that was performed for this Update will be the focus of this chapter. Occasionally, material from the existing plan will be repeated in this chapter to provide clarity.

2.1 General Description

The study area includes the City of Mount Vernon's urban growth boundary, as shown in Figure 2-1. This area is similar to the study area described in the 1995 Surface Water Plan, with the exception that the corporate City Limits have expanded since that plan was prepared. The urban growth boundary has not changed.

The climate is typical of areas west of the Cascade Mountains and is strongly influenced by the Pacific Ocean. Winters are generally wet and mild with temperatures varying from 30°F to 50°F. Summers are usually relatively dry and cool with temperatures rarely exceeding 80°F. The average annual temperatures and precipitation are approximately 50 degrees Fahrenheit and 30 inches, respectively. Precipitation data used in the updated hydrologic modeling analyses performed for this Update were obtained from the National Oceanic and Atmospheric Administration (NOAA) station at Burlington (10/1/56 – 11/30/93) and from the Washington State University Cooperative Extension Public Agricultural Weather System (PAWS) station at Mount Vernon for the period of 12/2/1993 through 11/23/2002.

The topography is highly variable within the study area, comprising relatively steep slopes of the hillsides of the eastern portion of the City and flat floodplains of the Skagit River and Nookachamps Creek in the western and northern portions of the City, respectively. The study area slopes in all directions, with all the surface water eventually draining into the Skagit River and Nookachamps Creek. The highest elevation is approximately 910 feet above mean sea level. Slopes range from zero in the floodplain area to 96 percent around Little Mountain.

Soils categories in the study area are comprised of four types: glacial till, glacial outwash, flood plain, and wetland soils. A more detailed description of the soil types can be found in the 1995 Surface Water Plan.

2.2 Drainage Basins

The study area is comprised of seven separate drainage basins: Kulshan Creek (including the Freeway Drive subbasin system), Maddox Creek, Carpenter Creek, Nookachamps Creek, Trumpeter Creek (College Way), Britt Slough, and West Mount Vernon. There is an additional drainage basin not associated with a stream which includes the downtown Mount Vernon combined sewer system area. These basins were delineated as part of the 1995 Surface Water Plan. The basins were further divided into several smaller subbasins. The authors of the original plan used topographic maps and drainage system inventories to

Please contact City of Mount Vernon Staff for a copy of this page. It is a large format map.

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map the basins and subbasins. The original basin delineations are shown on maps and figures in the 1995 Surface Water Plan.

As part of this plan Update, one of the tasks was to develop GIS layers and prepare drainage maps of the City's storm drainage data inventory and associated drainage features. Drainage basins were then redelineated using detailed topography of the GIS, storm drainage network, and basin delineation features associated with the GIS software. Drainage basin delineations were field checked for two specific detailed modeling areas: Freeway Drive and Upper Maddox Creek (Little Mountain Estates area). All the original basins and subbasins are included in the Update, and no new basins were added to the system with one exception: one subbasin was added to the Kulshan Creek basin for modeling purposes (subbasin 8A). Figure 2-1 shows the revised drainage basins and subbasins, as well as the drainage inventory.

The following sections describe the updated basin delineations and available resources used to complete the task. For a complete description of each of the major streams and associated drainage basins, refer to the 1995 Surface Water Plan, Section III.

2.2.1 Available Resources

Several resources were used to prepare the drainage basemaps in accordance with the Scope of Work. These included existing GIS shapefiles, City storm drainage inventory, and AutoCAD basemap files. The City initially provided some of the GIS shapefiles from their existing data inventory, and the remaining shapefiles were prepared as a part of this Update. The City provided the following data sets: streets, parcels, City boundaries, water bodies, streams, wetlands, and stormwater management facilities (i.e., ponds). A subconsultant to the City had recently inventoried the wetlands, streams, fish habitat, and stormwater facilities. This information was incorporated into the City's GIS.

Several resources came from information that resided in the City's AutoCAD files. This included the 2-foot topographical contours within the City limits, and the drainage basin delineations from the 1995 Surface Water Plan. The AutoCAD files were converted to GIS format and then adjusted to align with the City's datum.

The storm drainage inventory (storm sewers and catch basins) came from the City's inventory. The City had been inventorying their storm sewer system for several years. Most of this information was collected by City staff on handwritten log books and field maps. Information such as pipe size, depth of the pipes, and pipe and catch basin type and material was collected by the staff. As part of the plan Update, CH2M HILL assisted the City staff with setting up the GIS storm drainage shape files and inputting the inventory into the database. Personnel from the City's GIS group digitized the locations of catch basins in GIS format and connected the catch basins with storm pipes. Pipe and catch basin information from the field books was added to the data set. CH2M HILL did not verify or field check the data inventory. As of the date of this plan Update, the City is still in the process of completing the data inventory. The GIS figure included in this section reflects the most up-to-date inventory of storm drains and catch basin at the time of writing of this report.

The original drainage basin delineations were hand-drawn on AutoCAD maps, and these were also used to refine the basins. These maps are included in Appendix C of the 1995 Surface Water Plan.

2.2.2 Updated Basin Delineations

As described in the previous subsection, the City provided the AutoCAD-converted drainage basin delineations from the 1995 Surface Water Plan. City staff digitized the shapefiles into GIS, using the hardcopy basemaps. Many of the basins required adjustment to reflect the detailed, topographic information (2-foot contours) that was recently incorporated into the City's GIS, and the drainage system inventory. An automatic delineation routine within the GIS program that uses digital elevation data was used to help refine the basin boundaries. Boundaries were checked against the drainage inventory (pipe flow directions) as well as the original AutoCAD drainage maps from the 1995 Surface Water Plan.

For several of the basins that are partially located within the study area, some of the basin outer boundaries were extended to reflect the new City Limits, thereby increasing the basin sizes. Also, some of the original basin boundaries were "cut off" at the study limits (i.e., the entire basin was not mapped), and these basins have been extended to accurately reflect the basin drainage area, even though some of these areas are outside the City Limits. The majority of the other basins that are contained within the City Limits were unchanged with respect to total drainage area.

Table 2-1 lists the basins and subbasins, drainage areas, and original drainage areas from the 1995 Surface Water Plan. The updated basins are shown in Figure 2-1.

TABLE 2-1
Drainage Basin Areas

Basin Name	Subbasin	Subbasin Area (acres)	Basin Area (acres)	Original Basin[1] Area (acres)
Britt Slough	SB-30	386	386	73
Carpenter Creek Basin		-	1760	3753
	SB-35	1519	-	-
	SB-36	241	-	-
Combined Sewer Area	SB-23	438	438	462
Kulshan Creek Basin		-	1396	1404
	SB-14	394	-	-
	SB-05	147	-	-
	SB-06	89	-	-
	SB-11	80	-	-
	SB-12	55	-	-
	SB-09	9	-	-
	SB-10	122	-	-

TABLE 2-1
Drainage Basin Areas

Basin Name	Subbasin	Subbasin Area (acres)	Basin Area (acres)	Original Basin[1] Area (acres)
	SB-08	21	-	-
	SB-13	303	-	-
	SB-08A	5	-	-
	SB-07	171	-	-
Maddox Creek Basin		-	2058	1984
	SB-22	477	-	-
	SB-37	633	-	-
	SB-19	177	-	-
	SB-51	383	-	-
	SB-34	388	-	-
Nookachamps Creek		-	1073	347
	SB-02	431	-	-
	SB-39	77	-	-
	SB-38	565	-	-
Skagit River Tributary		-	842	
	SB-01	191	-	-
	SB-03	651	-	-
Trumpeter Creek Basin		-	2046	2013
	SB-04	339	-	-
	SB-18	205	-	-
	SB-17	553	-	-
	SB-15	564	-	-
	SB-16	384	-	-
West Mount Vernon		-	350	450
	SB-26	114	-	-
	SB-25	80	-	-
	SB-24	156	-	-

[1]Basin areas were calculated and delineated as part of the 1995 Surface Water Plan. Subbasin areas were not included in the plan.

2.2.3 Freeway Drive Subbasin

The Freeway Drive subbasin is part of the Kulshan Creek basin. As part of the Stormwater Plan Update, CH2M HILL and its subconsultant Northwest Hydraulic Consultants (NHC) performed a detailed hydrologic and hydraulic modeling exercise to simulate existing and future conditions of this area. The area is flat with developing commercial properties, and the storm drainage is pumped via a pump station and force main to the Skagit River. The City requested that an analysis be performed to determine the existing capacity of the system and the current level of system performance, and to identify the system pump station improvements which would be needed for future build-out of the basin.

The detailed modeling task required a review of drainage basin areas for the Freeway Drive stormwater system so that the hydrologic model could be updated. The City provided information about the existing storm drainage system and the operation of the detention ponds in the area. As-built drawings, 2-foot topographical contours, and drainage inventory provided information about drainage basins. Field investigations were also performed to help in the delineation process.

The subbasins tributary to the Freeway Drive pump station were updated using the information described above. Three changes were made to the basin delineations that are different than the original plan. First, a new subbasin 8A was added to the system. This subbasin was originally part of the north section of subbasins 7 and 6 (See Figure III-5, 1995 Surface Water Plan). Subbasins 6 and 7 drain south to the Kulshan Creek pump station. It was determined through conversations with City Staff that a portion of those subbasins drain to the west and then to the Freeway Drive system. Therefore, subbasin 8A was delineated and included in the Freeway Drive system.

The second change to the system involved removing the tributary area of subbasin 9. During a meeting, City staff indicated drainage from subbasin 9 (previously assumed to be tributary to the Freeway Drive pump station) likely flows instead to the separate College Way system (Kulshan Creek).

The third change is an addition to the Freeway Drive system within the non-tributary subbasin 11. Part of subbasin 11 south of College Way (the area bounded by the centerlines of Interstate 5 to the east and Freeway Drive to the west) was determined to drain to the Freeway Drive pump station. The drainage corridor follows the alignment of the force main for the Freeway Drive pump station.

2.2.4 Upper Maddox Creek

The analysis of upper Maddox Creek and the Little Mountain Estates area was a detailed hydrologic and hydraulic modeling study to determine the performance of the Little Mountain Estates Regional detention facility and determine if there is unused capacity in the detention storage systems. As part of the analysis, a redelineation of the areas tributary to the facility was performed to more accurately reflect the conditions at the facility. A review of the subbasin delineation for the Little Mountain Estates detention facility showed this subbasin (51) to be nearly twice as large as previously estimated for the 1995 Surface Water Plan. For this reason, the tributary basin was redelineated based on the GIS 2-foot contour interval topographic mapping, recent drainage inventory, drainage reports, and visual field observations. This Little Mountain Estates subbasin was further subdivided into

5 separate subbasins to account for the routing effects of two upstream detention ponds tributary to Maddox Creek.

SECTION 3: SURFACE WATER MODELING AND ANALYSIS

3. Surface Water Modeling and Analysis

This section describes the surface water analyses performed for the surface water comprehensive plan update. The purpose of the analysis presented in this section is to provide updated surface water models to more accurately reflect land use and floodplain storage in the Maddox Creek basin. The information presented in this analysis will also be used to develop Capital Improvement Program (CIP) projects and may be used to support future stormwater planning efforts.

3.1 Maddox Creek HSPF Model Update

The hydrologic analysis of the Maddox Creek basin was performed using the Hydrologic Simulation Program – Fortran (HSPF) model. This model was selected because it uses historical rainfall records to generate a long-term series of surface water flows. This long-term flow record gives a more accurate estimate of flood-frequency at a given point than provided by single-event design storm analysis. A long-term flow record also allows analysis of flow duration, which is useful when studying the flow effects on channel erosion.

An HSPF model for the Maddox Creek basin was originally developed in 1993 to support the 1995 Surface Water Plan. For this plan update, the model was updated and recalibrated to include a longer meteorological record, changed land use, and a more accurate representation of storage volumes in the lower portion of the basin. The updated HSPF analysis is fully documented in Technical Memorandum No. 1 found in Appendix A.

The updated Maddox Creek HSPF model will be used for future analysis. The updated meteorological and calibrated input parameters developed for this model form the basis for HSPF models developed for detailed study areas described in Section 3.2.

3.1.1 Model Set-up

The Maddox Creek HSPF model continuously simulated streamflows for existing land use conditions at a one-four time step. The simulation was performed using a 46-year meteorological record extending from October 1956 to December 2002. This model was based on the original HSPF model developed to support the 1995 Surface Water Plan. Revisions to the model included:

- Extending the meteorological data set to include recent precipitation data
- Updating land-use to reflect current (2002) land use conditions
- Refining instream storage volume estimates

Meteorological Inputs

Meteorological inputs included 1-hour precipitation data from the NOAA precipitation station at Burlington and WSU Public Agricultural Weather Station (PAWS) precipitation station at Mount Vernon. Data from the Mount Vernon precipitation station were adjusted to represent the slightly higher rainfall amounts at the Burlington precipitation station. Daily pan evaporation data were obtained from the WSU PAWS Puyallup pan evaporation station.

Subbasin and Land Use

The 1995 Surface Water Plan divided the Maddox Creek basin into 5 separate subbasins. This analysis used the subbasin delineation developed for the 1995 Surface Water Plan (see Figure III-5 in the 1995 Plan).

Land segment parameter values were defined to represent the conditions that allow rainfall to infiltrate into the soil, cause rainfall to pond and evaporate, and produce runoff in the drainage systems and streams. These values are based on a combination of land use, surface vegetation, and soils.

A review of the 1992 and 2001 aerial photography of the basin showed that land development in the Maddox Creek basin is about midway between full buildout and the level of development that existed when the original HSPF model was created. Therefore, existing conditions land use (year 2002) was approximated as an average of the current (1991) and future build-out estimated in the 1995 Surface Water Plan. Future land use conditions were based on a recently completed land use analysis.

Land use is converted to HSPF land segment parameter values representing the amount of surface effective impervious areas (EIA), vegetation, and soils. Effective impervious area is the area that is directly connected to the conveyance system and does not infiltrate into the ground. Surface vegetation was classified into three general categories (forest, pasture, and grass) which affect how much rainfall is intercepted before reaching the ground. Finally, soils have a major impact on how much and how fast the rainfall can infiltrate into the ground before it begins to generate stormwater runoff. Four general soils categories were used: till, outwash, Custer-Norma, and saturated. Table 3-1 describes the HSPF land use parameters used in the analysis.

TABLE 3-1
2002 Existing Conditions HSPF Land Use Parameters (area in acres)

	SB 51	SB 19	SB 34	SB 22	SB 37	TOTAL
Till Forest	100.1	95.7	200.1	82.3	82.2	560.4
Till Pasture	102.1	77.2	51.1	57.5	62.3	350.1
Till Grass	53.8	123.1	20.1	146.9	15.9	359.8
Outwash Forest	--	--	--	--	23.7	
Outwash Pasture	6	12.1	--	--	13.7	31.8
Custer Norma Grass	--	--	--	27.5	301.9	329.4
Saturated	2	14.3	11.8	--	--	28.1
Impervious (EIA)	6.8	21.5	2.7	133.1	116.4	280.4
TOTAL	270.6	343.8	285.7	447.3	616.1	1963.6

Detention and Instream Storage

The original Maddox Creek models did not account for the significant amount of channel floodplain storage in the relatively flat lower basin areas. As a result, the original estimates

of peak flows at Hickox Road were overestimated. Additional analysis showed that approximately 120 acre-feet of floodplain storage exists at this location during peak flow conditions.

Existing detention facilities were generally not included in the model. These facilities likely provide little flow attenuation because they are small in size and were designed using ineffective flow control standards. The exception is the large regional detention facility at Little Mountain Estates.

The regional detention pond at Little Mountain Estates is an 8.7-acre-foot facility that provides critical control of peak flows from the upstream basin area. A side-flow weir located adjacent to Maddox Creek controls inflow to the facility. This weir, as originally designed, was intended to divert high streamflows into the detention facility while allowing relatively low flows to remain in the channel. However, this weir failed after a short period of service, causing a large portion of creek flow to be directed into the pond. Sandbags have been placed as a temporary measure to keep at least some flow in the main channel, but these are expected to be ineffective under high flow conditions. For this reason, the revised HSPF model was configured so that the Little Mountain Estates pond receives all streamflow from the upper basin flows to reflect the failed condition of the side-flow weir. The flow routing table for this facility was also updated to reflect a more accurate estimate of the outlet structure discharge rating. Additional analysis of the Little Mountain Estates regional detention facility and side-flow weir is presented in Section 3.2.2.

Calibration

This calibration effort focused on streamflow data collected at Hickox Road during the period December 2001 through February 2002. The largest peak flow event during this period occurred on December 13, 2001. The magnitude of this event was estimated to be equivalent to a 2-year recurrence interval peak flow event. The original Maddox Creek HSPF models were calibrated to streamflow data collected during the 1991-92 and 1992-93 wet weather seasons at a culvert located 1,200 feet upstream from Anderson Road. The largest flow during the original calibration period had a return period estimated as approximately a three-year event, resulting from a storm on January 11, 1992.

The revised model was unable to match measured streamflow during the initial calibration effort. Calibration was improved when two revisions were made to the original model. First, the original land segment parameter values were replaced with regional parameters develop by the USGS for basins in Western King and Snohomish Counties (Dinacola, 1990). The second revision routed groundwater from the upper basin directly to the lower basin, bypassing the stream channels in the upper basin.

3.1.2 Flood Frequency Analysis

Peak flood frequency is the probability that a given peak flood event will occur in any year. Flood frequency is commonly expressed as a return-period, which is the inverse of the probability, and represents the average interval between the occurrences of a specific magnitude flood. Peak flood-frequency was determined from the 46 peak annual discharge values computed with the updated HSPF model.

Tables 3-2 lists the peak flows for existing land use conditions determined with the updated Maddox Creek hydrologic model for the 2-, 10-, and 100-year recurrence intervals. Table 3-3 shows this information from the 1995 CSWMP.

TABLE 3-2
Existing Conditions Peak Flood Frequency Computed With Updated Maddox Creek HSPF Model

Subbasin	2-Year Peak Flow (cfs)	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
SB 51 - Maddox Creek Below Little Mountain Estates Pond	4	11	14
SB 19 - Maddox Creek at Blackbum Road	19	34	67
SB 34 - Maddox Creek above Anderson Road	28	61	105
SB 22 - Flowers Creek & I-5 Highway Corridor	46	77	100
SB 37 - Maddox Creek at Hickox Road	46	75	95

Note: Flow values reported in the table include contributions from upstream tributary subbasins.

TABLE 3-3
Existing Conditions Peak Flood Frequency Computed With 1993 CSWMP Maddox Creek HSPF Model

Source: City of Mount Vernon Comprehensive Surface Water Management Plan (R.W. Beck, 1995)

Subbasin	2-Year Peak Flow (cfs)	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
SB 51 - Maddox Creek Below Little Mountain Estates Pond	12	20	32
SB 19 - Maddox Creek at Blackburn Road	17	25	40
SB 34 - Maddox Creek above Anderson Road	28	45	70
SB 22 - Flowers Creek & I-5 Highway Corridor	40	65	107
SB 37 - Maddox Creek at Hickox Road	95	170	280

Note: Flow values reported in the table include contributions from upstream tributary subbasins.

The updated land use and revised HSPF parameter set used in the updated Maddox Creek HSPF model resulted in higher predicted peak flows for most upland subbasins in the Maddox Creek basin. Subbasin SB 51 is the exception where peak flows decreased due to the revised stage-discharge relationship used for Little Mountain Estates pond. However, the increase in peak flows from the upland subbasins (SB-19, SB-22, and SB-34) was offset by the floodplain storage added in lower Maddox Creek (SB 37). Including the floodplain storage in the lower reach of Maddox Creek (SB 37) resulted in a significant reduction in peak flow at this location and more closely represents the actual flood condition observed in this reach.

3.2 Detailed Study Area Investigation

Detailed technical analysis was performed for four separate study areas in the City of Mount Vernon. Three of these studies investigated stormwater flooding issues using detailed numerical analysis and information developed with the updated Maddox Creek HSPF model. The fourth study was more qualitative and investigated the use of Low Impact Development (LID) techniques to reduce stormwater impacts.

3.2.1 Maddox Creek Floodplain Encroachment

The current Mount Vernon Critical Areas Ordinance (CAO) requires 25- to 50-foot buffer widths for Maddox Creek. Because these buffer widths are substantially lower than recommended by current scientific research, the City is considering updating the CAO to require larger buffer widths. The Lower Maddox Creek floodplain area is under considerable development pressure to fill and otherwise encroach upon the floodplain. Because much of the floodplain area lies outside the stream buffer, current regulations would allow this area to be filled.

Output from the updated HSPF model described in Section 3.1 was used to analyze the hydrologic impacts of two encroachment scenarios. The two scenarios are:

- Scenario 1 - Allow the floodplain to be encroached upon up to the existing 25-foot buffer width (50-foot-wide corridor) for natural and constructed channels.
- Scenario 2 - Limit floodplain encroachment to the proposed 100-foot buffer width (200-foot-wide corridor) for natural channels and 25-foot buffer width (50-foot-wide corridor) for constructed channels.

A peak flow event occurring in November 1990 was selected as the design event for this analysis. The recurrence interval for this event is estimated to be roughly equivalent to a 100-year peak flow event. This hydrograph was routed through an unsteady flow hydraulic model to accurately compute the peak water surface elevation and peak flow impacts.

Table 3-4 shows the results of the floodplain encroachment analysis. This table shows that potential loss of floodplain storage in the lower basin could result in a 50 percent increase in the 100-year peak flow in Maddox Creek at the City's urban growth boundary (Hickox Road) for the existing buffer width requirement (Scenario 1). The floodplain analysis also showed that Maddox Creek flood water levels within the city limits could increase by up to 1.6 feet at some locations.

TABLE 3-4
Peak Flow Increase at Hickox Road for Floodplain Encroachment Scenarios

	Peak Flow (cfs)	Percent Increase[1]
Scenario 1 – 25-foot buffer	200	52
Scenario 2 – 100-foot buffer	182	38

Note:
[1]100-year peak flow is 132 cfs under future land use conditions.

The HSPF analysis for floodplain encroachment is fully documented in Technical Memorandum No. 1 found in Appendix A.

The floodplain encroachment analysis documented in this section demonstrates the effectiveness of floodplain storage in attenuating peak flows during large storm events. When fill is placed in the floodplain, the attenuating affects of storage are lost. This loss of attenuation usually results in higher peak flood stages and/or downstream increased peak flow rates. More flooding leads to the need for flood control projects that ultimately result in transferring stormwater management costs to the public.

3.2.2 Little Mountain Estates Regional Detention Facility Evaluation

The Little Mountain Estates detention facility is located in the southeastern part of the City (SB-51) of the Maddox Creek basin (see Technical Memorandum No. 3 in Appendix A). This pond was built in the 1990s to provide 8.7 acre-feet of stormwater detention for the Little Mountain Estates subdivision and to serve as a regional facility to attenuate peak streamflow rates caused by future development in the upper Maddox Creek basin. A concrete side-flow weir was constructed at the southeast corner of the pond to divert high streamflow in Maddox Creek into the facility. The weir has failed in recent years allowing a greater volume of streamflow into the pond.

Two detention ponds were constructed upstream of the Little Mountain Estates facility to provide stormwater control for all phases of the Maddox Creek Planned Urban Development (PUD). There may be unused storage capacity in these ponds because not all phases of the PUD were constructed as planned.

The hydrologic analysis of the Little Mountain Estates regional detention facility was performed using the HSPF model. This analysis used the land use parameters and meteorological inputs developed for the regional Maddox Creek HSPF model described in Section 3.1. This model was used to investigate:

- The potential to mitigate peak flow increases due to future land development,
- The availability of unused detention storage in the Maddox Creek PUD detention ponds, and
- Alternative diversion weir/outlet structure configurations for Little Mountain Estates Regional Detention Facility.

The HSPF analysis was performed for five scenarios assuming three land use conditions in combination with three routing scenarios. Table 3-5 describes the five scenarios.

TABLE 3-5
HSPF Modeling Scenarios

Scenario	Land Use Condition	Routing Scenario
1	Pre-Developed (forested)	No Ponds
2	Existing Condition	Damaged diversion weir and existing control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2

TABLE 3-5
HSPF Modeling Scenarios

Scenario	Land Use Condition	Routing Scenario
3	Existing Condition	Modified Diversion and control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2
4	Future Condition	Damaged diversion weir and existing control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2
5	Future Condition	Modified Diversion and control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2

A review of the subbasin delineation for the Little Mountain Estates detention facility (SB-51) showed this subbasin to be nearly twice as large as previously estimated for the 1995 CSWMP. For this reason, the tributary basin was redelineated based on new, 2-foot contour interval topographic mapping, recent drainage inventory, drainage reports, and visual observation. This Little Mountain Estates subbasin was further subdivided into 5 separate subbasins to account for the routing effects of two detention ponds serving the Maddox Creek PUD.

Predeveloped conditions were assumed to be forested except for wetland areas. Existing and future land use conditions were recomputed for this analysis to account for the larger tributary area. More precise techniques were used to determine land use because this analysis required a higher level of accuracy than was needed for the regional HSPF model. Existing conditions land use was updated to reflect current (2004) development conditions. The current development conditions were based on aerial photography, drainage reports for existing developments, and visual observations. Future conditions land use was updated based on current land use zoning with a few exceptions. Existing undeveloped, and low-density residential areas were assumed to be redeveloped to higher-density land use unless in a critical or protected area.

The existing and modified channel bypass and weir diversion configuration were explicitly modeled in this analysis. The characteristics of the existing weir were approximated based on actual site conditions observed in February 2004. The characteristics of the modified diversion weir were based on recommendations provided in the draft letter report on *Hydraulic Structure Modifications for Little Mountain Estates Detention Facility* (R.W. Beck, 1995).

Table 3-6 shows the peak flood frequency for Little Mountain Estates Regional Detention Facility. This table shows that for the existing land use condition, the Little Mountain Estates Regional Detention Facility with the current diversion weir and control structure configuration (Scenario 2) attenuates peak flows to predeveloped conditions peak flows for events less than or equal to the 10-year event. If the diversion weir and control structure are modified as proposed in the R.W. Beck report, peak flow rates will increase for events below the 2-year return frequency but decrease for less frequent return periods.

Table 3-6 shows that flows are predicted to significantly increase under future land use conditions (Scenario 4). The peak flow increase ranges from a doubling for the 2-year event to

about a 60 percent increase for events with a return period equal to or higher than the 100-year event. The diversion weir and control structure modifications (Scenario 5) mitigate the peak flows, but the increase will still be greater than peak flows under existing land use conditions.

TABLE 3-6
Peak Flood Frequency at Little Mountain Estates Regional Detention Facility

Scenario	Land Use Condition	Diversion and Control Structure Configuration	2-Year Peak Flow Rate (cfs)	10-Year Peak Flow Rate (cfs)	100-Year Peak Flow Rate (cfs)
1	Predeveloped (forested)	None	10.0	18.7	20.3
2	Existing	Existing	8.9	18.0	24.4
3	Existing	Modified	10.5	15.5	19.9
4	Future	Existing	20.0	32.5	39.1
5	Future	Modified	16.5	24.4	34.5

Table 3-7 shows the peak annual stage for the Little Mountain Estates Regional Detention Facility. This table shows that approximately 0.5 feet of unused storage depth (0.8 acre-feet) is available in the pond for Scenario 2. The storage volume will be fully utilized for Scenario 3 and Scenario 4. The storage volume will be 0.7 feet higher than the maximum allowable high water elevation for Scenario 5 (0.9 acre-feet over-utilized).

TABLE 3-7
Peak Stage Frequency at Little Mountain Estates Regional Detention Facility

Scenario	Land Use Condition	Diversion and Control Structure Configuration	2-Year Peak Elevation (feet)	10-Year Peak Elevation (feet)	100-Year Peak Elevation (feet)	Comparison to Maximum Pond Elevation (assuming 1-foot freeboard)
2	Existing	Existing	215.6	217.0	217.3	0.5 feet remain
3	Existing	Modified	216.6	216.1	217.8	Fully utilized
4	Future	Existing	217.0	217.5	217.8	Fully utilized
5	Future	Modified	215.8	218.3	218.5	Over-utilized

Note: Overflow elevation = 218.8 feet. Maximum pond elevation = 217.8 assuming 1 foot freeboard.

Flow duration analysis was performed for the reach downstream of Little Mountain Estates Regional Detention Facility. This reach was assumed to include the predicted outflow from the Little Mountain Estates pond with the predicted discharge in the bypass reach. Flow duration is the amount of time (generally expressed as a percent of total) in which a given flow is equaled or exceeded. Table 3-8 shows the results of this analysis. This table shows that the flow duration under Scenario 2 is slightly higher than the predeveloped condition

(Scenario 1) flow duration. This table also shows that flow duration will increase under future land use conditions.

TABLE 3-8
Flow Duration at Little Mountain Estates Regional Detention Facility

	Flow Duration (cfs)				
Percent Time Exceeded	Scenario 1 – Predeveloped Land Use, No Pond	Scenario 2 – Ex. Land Use, Ex. Structure Configuration	Scenario 3 – Ex. Land Use, Mod. Structure Configuration	Scenario 4 – Fu. Land Use, Ex. Structure Configuration	Scenario 5 – Fu. Land Use, Mod. Structure Configuration
0.01	14.3	16.6	14.9	26.3	21.9
0.05	10.1	11.6	11.2	18.4	16.4
0.1	8.4	9.2	10.0	14.9	14.3
0.2	6.9	7.5	8.9	11.4	12.1
0.5	4.9	5.6	7.0	7.7	9.5
1	3.4	4.3	5.2	6.0	8.0
5	1.2	2.2	2.0	3.2	3.5
10	0.6	1.4	1.2	2.2	1.8
30	0.1	0.3	0.3	0.4	0.4
90	0.01	0.02	0.02	0.02	0.02

The HSPF analysis showed that the Maddox Creek PUD ponds are fully utilized and have no excess capacity.

The Little Mountain Estates Regional Detention Facility in its current configuration is able to match predeveloped peak flow for the current land use condition. However, this facility is not large enough to mitigate the increase in peak flow rates predicted for future land use conditions.

3.2.3 Freeway Drive

The Freeway Drive subbasin is an internally drained, 46-acre basin located west of Interstate 5 within a meander loop of the Skagit River. Stormwater from this basin flows to a regional detention facility located west of Freeway Drive and is then pumped to the Skagit River. The current pond/pump configuration is adequately sized to convey stormwater for existing development but does not have the capacity to convey stormwater from future development.

The hydrologic analysis of the Freeway Drive basin was performed using an updated HSPF model. This analysis used the land use parameters and meteorological inputs developed for the regional Maddox Creek HSPF model described in Section 3.1.

The tributary subbasin area was revised to better reflect actual drainage conditions. More precise techniques were used to determine land use because this analysis required a higher level of accuracy than was needed for the regional HSPF model. Predeveloped conditions were assumed to be forested. Existing land use conditions were revised to reflect the current (2004) development conditions based on aerial photography, drainage reports for existing developments, and visual observations. Future land use conditions were based on the assumption that undeveloped parcels would develop as commercial property.

The routing elements of the model were updated to better include:

- Additional volume in the Freeway Drive Regional Stormwater Facility. The previous estimate of storage volume was based on the live storage level shown in the design plans. As-built drawings showed the live storage level to be 2 feet lower than assumed.
- Pump station improvements. Recent pump station improvements more than doubled the conveyance capacity of the system from 557 gpm to 1325 gpm.
- Storage in large ditch adjacent to Freeway. The previous analysis assumed this ditch would be replaced with a large diameter pipeline. According to City staff, this project is unlikely to occur.
- Additional detention storage due to construction of new facilities. The updated model includes a new facility constructed for the Riverside Bridge project and a composite detention pond that incorporates the cumulative storage routing characteristics for all detention facilities constructed since the time of the original analysis.

The performance standard used for this analysis assumed that the volume of overflow from the Freeway Drive facility should not be greater than the runoff volume that occurred under predevelopment conditions. This subbasin is a closed depression, so controlling peak flows is not necessary because there are no streams to protect. Because this subbasin is a closed depression, controlling the duration of inundation (or volume) is critical. For this analysis, the performance standard was to limit the volume of overflow from the Freeway Drive regional detention facility to 8 acre-feet. This value corresponds to the amount of runoff volume estimated to occur under predevelopment conditions.

Figure 3-1 shows the performance of the current Freeway Drive pump/pond configuration. This figure shows that the Freeway Drive pond has enough capacity to mitigate about 28 of the available 56 acres of new commercial development in the subbasin. This corresponds to 50 percent of the current development potential in the subbasin.

The HSPF analysis for the Freeway Drive Pump Station analysis is fully documented in Technical Memorandum No. 2 found in Appendix A.

To accommodate full buildout of the Freeway Drive basin north of College Way, the existing 10-inch force main should be replaced with an 18-inch diameter pipe. An 18-inch-diameter pipe will allow the existing pump to operate at a higher capacity. The recommended improvement will control buildout condition overflows from the regional stormwater pond to a runoff volume less than what occurred under predeveloped (forested basin) conditions. Construction of this improvement should be timed to occur before the development of the next 28 acres.

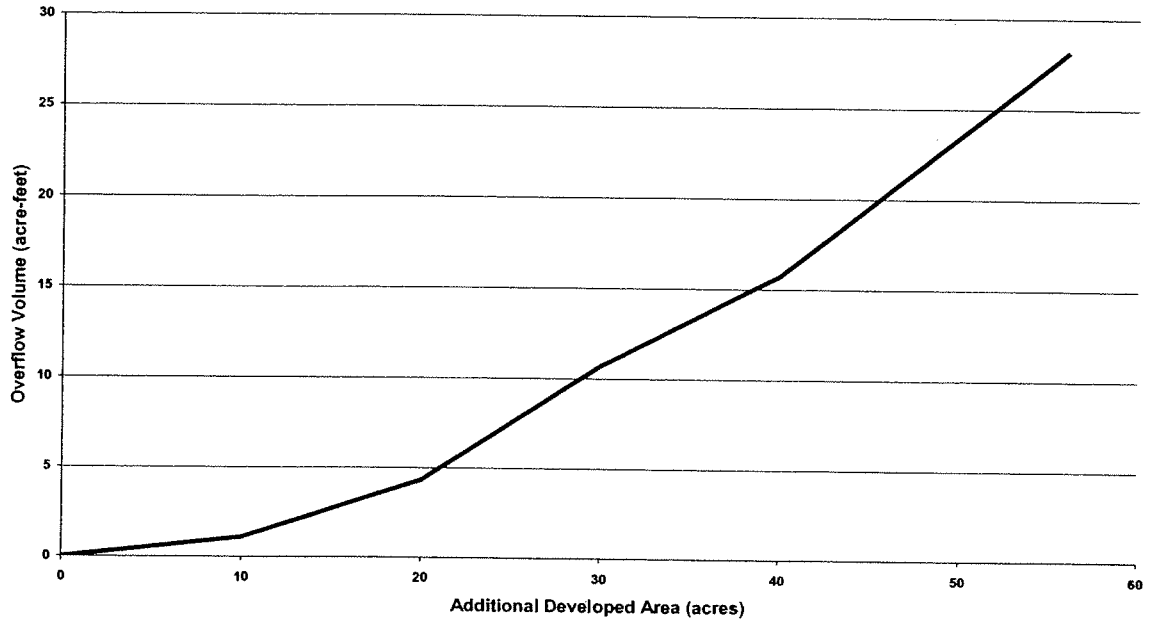

FIGURE 3-1
Development Potential in Freeway Drive Subbasin

Figure 3-2 shows the effect of pump capacity on overflow volume. This figure shows that a pump with a capacity of 2400 gpm (or greater) will limit overflow volume to less than 8 acre-feet.

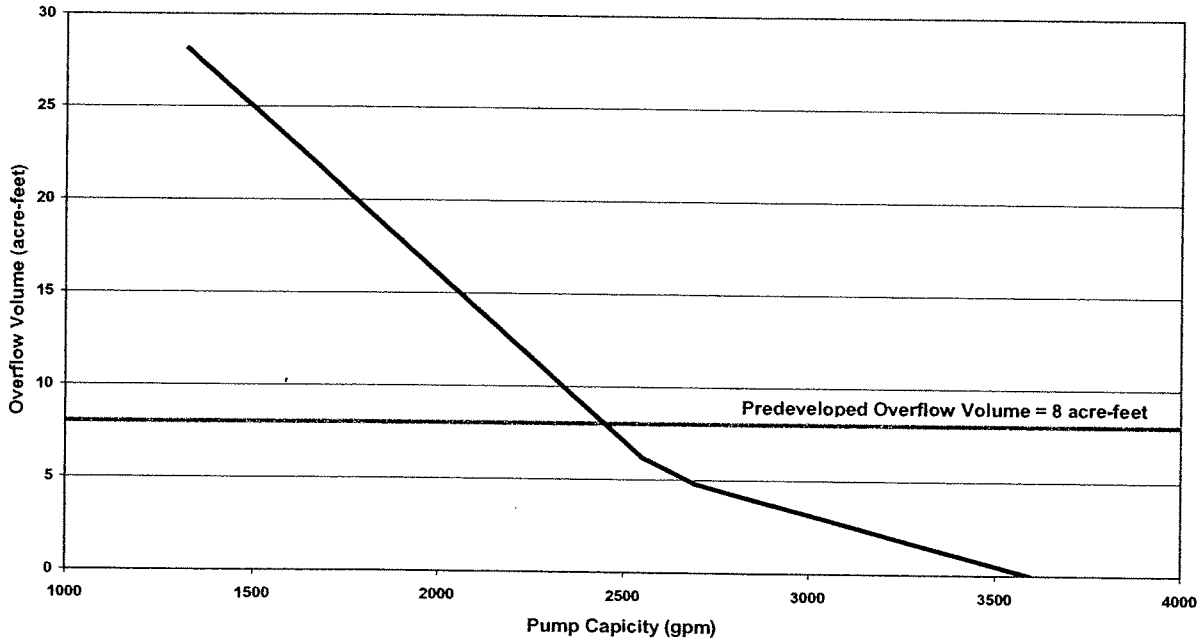

FIGURE 3-2
Effect of Pump Capacity on Overflow Volume

3.2.4 Stormwater Management at Cascade Christian Center Using Low Impact Development Techniques

Low Impact Development (LID) strategies are being introduced to the Western Washington area as a means of reducing impacts to aquatic systems by identifying development measures which promote natural hydrologic functions such as evaporation and infiltration and reduce or eliminate water quality impacts. The premise is that the natural hydrologic function cannot be achieved with conventional development and large end-of-the-pipe facilities. Rather, a new approach to site development is needed that creates less runoff and preserves more of the functions of the native forest. LID strategies allow natural infiltration to occur as close as possible to the original area. By engineering the terrain, vegetation, and soil features to perform this function, costly conveyance, treatment and detention systems can be avoided, and the landscape can retain more of its natural hydrological function.

The Cascade Christian Center of Skagit County development project was selected as the LID demonstration project. Alternative site designs were developed showing various LID techniques that can be included in the project.

Phase I of the Cascade Christian Center includes the construction of a new church building and parking lot and eight residential lots on an 8 acre site. This development will include about 5 acres of impervious area directly connected to the storm drain system. The impervious area consists of rooftops, parking areas, streets and sidewalks. The remaining area is landscaped or grass. Runoff control will be provided in a 2.1 acre-foot detention facility.

An alternative design was prepared that includes LID techniques such as biorentention cells, permeable pavers, forest retention and rainfall dispersion from impervious areas. The overall design promotes a decrease in impervious area and a more engineered landscape to facilitate storage and infiltration of stormwater runoff. This will decrease the required detention storage by 1.1 acre-feet. The result of the LID design was an overall reduction of total impervious area (primarily parking areas) of approximately 1.5 acres.

The LID approach reduced the effective impervious areas from 65 percent to 44 percent. In the process, the total volume of total stormwater runoff decreased from approximately 35% to approximately 3% with more effective water quality treatment.

The LID approach is fully documented in Technical Memorandum No. 4 found in Appendix A.

SECTION 4: REGULATIONS AND POLICIES

4. Regulations and Policies

4.1 Regulatory Compliance Gap Analysis Summary

4.1.1 Introduction

A variety of state and federal regulations affect City storm and surface water programs. These regulations include the Clean Water Act (CWA), National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater Program, the Endangered Species Act (ESA), and the Puget Sound Water Quality Management Plan (PSWQMP). Additionally, there are related guidance documents that recommend actions that are likely necessary to achieve compliance with the regulations. As an initial step in developing a comprehensive stormwater management plan update, Mount Vernon's existing regulatory compliance was evaluated to identify where potential "gaps" may lie between the City's existing policies, plans, codes, and practices and the regional and federal laws and guidance documents. Because they are enforceable federal laws, this analysis focuses on the CWA and ESA listings of salmon. The Washington State PSWQMP also specifies stormwater programs that jurisdictions must implement. This manual has not been enforced consistently, but the PSWQMP and the NOAA Fisheries Model ESA recommendation will be used by regulatory agencies to assess compliance. This section of the Surface Water Plan Update summarizes the major areas, where the City of Mount Vernon may not meet the requirements set forth by the above-mentioned programs, and identifies actions that are underway and future actions needed to fill existing gaps.

A detailed analysis of findings was prepared and a report was submitted previously to the City of Mount Vernon. The full report can be found in Appendix B of this Surface Water Plan Update. The discussion herein is a summary and update of that earlier report. The City has already initiated a number of actions to address potential gaps in regulatory compliance.

4.1.2 Methods

To identify potential "gaps" in Mount Vernon's regulations, policies, and practices, the following were reviewed:

- Mount Vernon Municipal Code
- Mount Vernon Comprehensive Plan
- Mount Vernon Comprehensive Surface Water Management Plan
- NPDES Phase II Minimum Control Measures
- NMFS 4(d) Municipal, Residential, Commercial, and Industrial (MRCI) Development Standards
- Tri-County Model 4(d) Proposal
- Puget Sound Water Quality Management Plan

A series of interviews related to regulatory compliance were also conducted with Mount Vernon Staff. These interviews contributed to the identification of potential "gaps." It was necessary to interview City staff from a variety of departments to understand the current level of enforcement and implementation of existing regulations and policies. In addition, staff members were able to identify particular areas of concern and desired outcomes associated with the Surface Water Plan Update.

4.1.3 Findings

4.1.3.1 NPDES Phase II Permit Requirements

EPA's Stormwater Phase II Final Rule requires Municipal Separate Storm Sewer Systems (MS4s) serving cities whose population is less than 100,000 to obtain an NPDES Phase II Municipal Stormwater Permit. Stormwater discharges are considered "point sources" of pollution, and the Clean Water Act requires all point source discharges to be covered by federally enforceable NPDES permits.

Mount Vernon complied with the regulatory requirements by submitting an application for coverage under a permit by the deadline of March 10, 2003. Ecology has not yet developed or issued a final permit for Phase II jurisdictions. Thus, the actual permit conditions are not yet known, and jurisdictions have no current mechanism to obtain a permit or permit coverage. In the interim, EPA has identified 6 minimum requirements that are discussed below. Ecology is likely to require more than the EPA 6 minimum requirements to provide consistency with the PSWQMP and the more stringent requirements of Phase I municipal stormwater permit jurisdictions. Mount Vernon does not yet meet the minimum requirements of 3 of the 6 EPA elements and only partially meets the minimum requirements of 1 of the 6 elements (Table 4-1):

TABLE 4-1
Mount Vernon and the NPDES Minimum Control Measure Requirements

Minimum Control Measure	Minimum Requirements Met
1. Public Education and Outreach on Stormwater Impacts	Yes[1]
2. Public Involvement/Participation	No
3. Illicit Discharge Detection and Elimination	No
4. Construction Site Stormwater Runoff Control	Yes[1]
5. Post-Construction Stormwater Management in New Development and Redevelopment	Partial[2]
6. Pollution Prevention/Good Housekeeping for Municipal Operations	No

[1]While the minimum requirements are currently met, the city will still need to set measurable goals to be in full compliance.
[2]Partial means that some of the minimum requirements have been implemented, but further additions are needed for compliance.

To meet the conditions of the NPDES permit, Mount Vernon will need to meet the minimum requirements of the 6 above listed measures. While some of the requirements include a substantial number of actions to implement them, others do not require a tremendous effort to achieve full compliance. Table 4-1 summarizes the 6 minimum control

measures. The complete list of NPDES Phase II Requirements and NMFS Municipal, Commercial, Residential and Industrial Development Standards for a "Take" Exemption are provided in Appendix B.

For example, Minimum Control Measure (MCM) 2, "Public Involvement/Participation," only requires a jurisdiction to comply with applicable state, tribal, and local public notice requirements. On the other hand, MCM 3 requires an operator of a regulated small MS4 to develop, implement, and enforce an illicit discharge detection and elimination program. The permit requires that the program include a number of components including completing a storm sewer system map, which shows the location of all outfalls, and the names and location of all waters of the United States that receive discharge from those outfalls. The measure also requires the City to develop a program to detect non-stormwater discharges and illegal dumping. Since a complete inventory of the storm sewer system in Mount Vernon still needs to be completed, and because there is not a program for the detection of illicit discharges to storm sewers, the minimum requirements set forth in MCM #3 have not been met.

Additionally, the City will be required to keep records related to permit compliance and make them available for review for at least 3 years and prepare an annual report in years 2 and 4 of the permit.

4.1.3.2 Endangered Species Act 4(d) Rules for Incidental "take" Allowances

The ESA provides for the protection of endangered and threatened species. Two sections of the ESA directly affect local jurisdictions:

Section 4(d) relates to the listing of species as threatened or endangered. It allows the listing agency to publish rules that define conditions under which "incidental" take is permissible. The National Marine Fisheries Service (NMFS) issued the final 4(d) rules governing the conservation of steelhead and salmonids in the Northwest. To qualify for incidental take protection, municipalities must demonstrate compliance with the 4(d) rule. NMFS 4(d) rule allowing incidental take requires municipalities to conduct program actions and create and issue regulations which will provide for the conservation of threatened species.

Section 9 defines specific actions that are prohibited, which may result in a "take" of endangered species. A "take" could involve harming, harassing, pursuing, hunting, or killing a listed or endangered species. Destruction or changes to habitat (supporting listed and threatened species) is defined as a "harm" under the ESA, and Mount Vernon could be liable. However, the 4(d) rule for Northwest salmonids has an exemption for certain governmental activities if they meet the municipal, commercial, residential, and industrial (MRCI) development standards outlined in the final rules released in July 2000.

Recently NOAA Fisheries prepared a document that provides guidance for their staff when reviewing projects or evaluating municipal programs for ESA compliance. The guidance is based on the best science and commercial data available. The document lists best management practices (BMPs) to avoid and minimize the effects of stormwater on listed salmonids using natural watershed features. Furthermore, the document includes model terms and conditions that may be applied to programs that predict effects of hydrology and water quality as a result of stormwater runoff. It mentions that these terms and conditions can also be used to minimize impacts of programs being evaluated in the Section 4(d)

process. Two "Reasonable and Prudent Measures" define the basis for the terms and conditions that are presented in the document:

The (Federal action agency) shall:

1. Minimize incidental take from development or land conversions by avoiding or minimizing adverse effects to watershed processes, or riparian or aquatic systems through the protection of subwatershed or reach water quality and natural hydrology.
2. Complete a monitoring and reporting program to ensure the objective of this Opinion is met, to minimize the likelihood of take from activities that result in stormwater runoff with the potential to affect water quality and hydrology in streams with listed salmonids.

Table 4-2 below presents NOAA Fisheries Model Terms and Conditions to minimize "take" and to support the survival and recovery of listed salmonids, and how Mount Vernon plans to accomplish each of them.

TABLE 4-2
NOAA Fisheries Model Terms and Conditions[1] to Minimize "take" and to Support the Survival and Recovery of Listed Salmonids

To Implement Reasonable and Prudent Measure #1, Mount Vernon Shall:	**Will Be Accomplished By:**
1A. Use a subwatershed or landscape approach to look for opportunities to restore natural hydrology.	Critical Areas Ordinance Update in progress
1B. Develop and implement a Stormwater Management Plan.	Comprehensive Surface Water Management Plan Update in progress
2. During construction, prevent pollutants from entering stormwater runoff.	Staff working to clarify responsibilities and improve inter-departmental communication
3. Minimize alteration of natural soils and vegetation.	Critical Areas Ordinance Update in progress
4. If designated (i.e., engineered) facilities are needed to minimize or avoid effects to hydrology and water quality; continuous rainfall/runoff models must be used to calculate the design facility.	Adoption of New (August 2001) Ecology Manual
To Implement Reasonable and Prudent Measure #2, Mount Vernon Shall:	**Area to Be Addressed:**
1. Implementation monitoring. Ensure that a monitoring report is submitted within 120 days of program implementation describing the success of implementing and meeting permit conditions. This shall include review of the Stormwater Management Plan.	Underway, will be refined in Comprehensive Surface Water Management Plan Update
2. Effectiveness monitoring. Gather any other data or analyses deemed necessary or helpful to complete an assessment of habitat trends in hydrology and water quality as a result of the permitted actions. Monitoring must demonstrate that the facility is operating as designed.	To be defined in Comprehensive Surface Water Management Plan Update

[1]These are generalized terms and conditions, and, therefore, should not be applied *pro forma.*

Low impact development (LID) techniques can be effective BMPs to minimize stormwater impacts on listed species. A document titled "Identifying Sites for 'Street Edge Alternatives'" is included in Appendix B as one example of BMPs that may be applicable to the City of Mount Vernon.

4.1.3.3 Puget Sound Water Quality Management Plan

The Puget Sound Water Quality Management Plan lists the elements of a comprehensive stormwater program that are required for local jurisdictions. The elements are similar to EPA's 6 minimum measures, but include the following additional requirements:

- "Assurance of adequate 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."

The PSWQMP also requires jurisdictions to include a stormwater element in their land use plans.

4.1.3.4 Growth Management Act

The growth management act requires land use plans to address stormwater as described in the PSWQMP and to provide concurrency of stormwater facilities with growth.

The GMA also directs growth in cities, creating a challenge for cities to accommodate growth and protect water quality and aquatic resources.

SECTION 5: STORM DRAINAGE CAPITAL IMPROVEMENT PLAN PROJECTS

5. Storm Drainage Capital Improvement Plan Projects

5.1 Purpose

The Capital Improvement Program (CIP) is a list of priority projects showing the estimated costs and available funding for each capital project over a 20-year period (2005 – 2024). The CIP implements and is consistent with the policies contained in the *Capital Improvements Plan (2004-2009)*, a regularly updated component of the *City of Mount Vernon Comprehensive Plan (1995)*.

5.2 Identification of Proposed Projects and Prioritization

The 1995 Surface Water Plan identifies a number of CIP and non-CIP problems in Section VI "Problem Identification." Table X-1 in Section X of the 1995 Plan summarizes the suggested Surface Water CIPs and shows a proposed schedule for improvements. This table has been reproduced in Appendix C to show the recommended projects and their disposition. The 1995 Plan's methodology of developing a comprehensive summary of stormwater problems involved public input, interviews with City Staff, interviews with agencies and jurisdictions, field observations and the performance of hydrologic and hydraulic modeling for specific areas.

This Stormwater Plan Update includes the pending projects identified by City staff as a result of the 1995 Surface Water Plan's CIP. It also includes CIP recommendations from the Shannon and Wilson, Inc. report "Inventory and Evaluation of the Kulshan and Trumpeter Stream Systems, Mount Vernon, Washington" (March 2001). In addition, several specific problems were identified by City staff and included in modeling analyses for this Plan Update. Of these, one will be included in the CIP.

The Surface Water section of the City's latest overall CIP (2004 – 2009), and a more current, Draft Surface Water CIP (for 2005 – 2010), received from the City were also referenced in the development of this CIP Update. The Draft CIP will need to obtain Planning Commission and Council Approval before it becomes official; however, it is an important planning tool for the development of this CIP.

The City's overall CIP for the years 2003 - 2008 (prepared by the Finance Department) lists the following priorities for the City's projects:

1) A safe and livable community
2) Infrastructure that assists in economic development
3) Completing unfinished projects

The approach to developing the CIP list shown herein focuses on clearly identifiable local improvements, with emphasis later in the planning period on projects requiring considerable analysis, design, and/or larger amounts of funding.

The entire list of recommended Surface Water CIP Projects for the City of Mount Vernon is shown in Table 5-1. This table identifies the CIP projects for a 20-year planning period, beginning in 2005, and lists estimated project costs. Costs developed for the 1995 Surface Water Plan have been escalated to 2005 levels using a 1.422 multiplier (based on ENR indices between 1995 and 2005). Detailed CIP sheets have been developed for 8 projects

from the larger list. Table 5-2 lists these projects and Figure 5-1 shows their locations. The detailed CIP sheets are located in Appendix C.

TABLE 5-1
Surface Water Capital Improvement Projects – DRAFT, August 2004: Pending Council Approval

Project ID	Project Title	Project Cost in 2005 Dollars	Comments
D-01-01	Blackburn Road Culvert Replacement	~~$85,000~~ 194[2]	
D-01-02	Maddox Creek Restoration and Pond Retrofit	$50,000	
D-01-05	Park Street Pump Station	$30,000	Shared funding for this $60k total project: $30k Sewer Capital Reserve and $30k Surface Water Utility
D-05-01	Downtown Floodwall – Semi-Permanent	$180,000	Shared funding for this $250k total project: $70,000 Dike District, $180,000 Surface Water Utility
D-05-02	UGA Drainage Analysis	$80,000	
D-05-03	West MV Storm Force Main Upgrade	$35,000	
D-94-11	Erosion Problem Repairs	$12,000	
D-94-14	Log Weir Fish Structure	$12,500	
D-98-01	Downtown Floodwall – Permanent	$1,367,400	
D-06-01	Freeway Drive Force Main Replacement[1]	$765,000	
Regional System Problems[3]			
RS4b	Kulshan Creek Pump Station Phase II – Beyond 20 Years	$956,000	Not completed
RS6	Little Mountain Estates Detention Pond Modifications	Developer Build	Not completed. Included as analysis and recommendation element in the 2004 Surface Water Plan Update.
RS7	Erosion Control on Maddox Creek	$559,000	In progress (culvert removal). Project may incorporate with road improvements and become a County project. Centennial Grant obtained for stream enhancement, and Eaglemont development will fund culvert replacement.
Y	Maddox Creek Floodplain Encroachment – Future Channel Restoration[2]	[redacted]	

Local System Problems			
LS1	700-Foot-Long Berm along Hoag Road	$319,000	Not completed. City working with Wildlands, Inc.
LS6	Log Bed Control Weir Installation to Control Erosion North of Cedar Lane	$16,000	Not completed
LS7	MH Drop Structure and Pipe Extension on Kulshan Tributary Near Viewmount	$68,000	Not completed
LS11	Trashrack Installation at Storm Drain Inlet Near Kiowa and Nez Perce	$700	Not completed
LS12	Replacement of Storm Drain System in W. Mount Vernon along Memorial Highway	$792,000	Not completed
LS13	Additional Catchbasins Installation at Wall Street and Garfield Street	$20,000	Not completed
LS14	New Catchbasin Installation and Storm Drain Connection at Wall Street North of Memorial Hwy	$57,000	Not completed
LS15	Replacement of 16 Storm Drains Between E. Division and E. Fir Just West of N. LaVenture	$528,000	Not completed
LS16	Log Bed Control Weir Installation in Stream Between Mohawk and Apache	$16,000	Not completed
LS17	Culvert and Ditch Installation at Comanche Drive	$20,000	Not completed
LS18	Culvert Replacement at Shoshone East of Sioux	$34,000	Not completed
LS19	Armoured Spillway Installation in Two Detention Ponds Near Waugh and Division	$84,000	Not completed
LS20	Storm Drain Installation West of S 6th up to Lind and Connect to Maddox Tributary	$220,000	Not completed
LS24	*Drainage Improvement in Commercial Area on West Side of I-5 South of College Way.*	*Fix anticipated in conjunction w/RS1*	*Not completed*
LS25	Replacement of 3 Pipes Between Britt Slough and Blackburn Road	$404,000	In progress. Interlocal agreement with school district.
LS27	Replacement of 2 Pipes Along I-5 Between Blackburn and Anderson Road	$71,000	In progress

	Available Funds for Drainage Complaint Solutions	$600,000	$30,000 per year for 20-year planning period
Water Quality Problems			
WQ3	Installation of Oil/water separators	$466,000	Not completed
Environmental Resource Problems			
E2	Manhole Barrier Removal in Kulshan East of Railroad	$2,800	Not completed
E3	Log Weir Fish Structure Installation – Kulshan Creek North of Cedar Lane	$16,000	Not completed
E4	Restoration of Channel on Kulshan from Riverside to N 18th (2,200 feet)	$148,000	Not completed
E5	Restoration of Channel on Mainstem of Trumpeter (7,000 feet)	$466,000	Not completed
E11	Log Weir Fish Passage Structure Installation d/s of Culvert on Maddox Creek at Blackburn Road	$16,000	Not completed
	Conservation of Prime Headwater Habitats (Land Acquisition)[4]		
	Protection of Wetland Connections (Land Acquisition)[4]		
	Removal of Fish Passage Barriers in Trumpeter Creek System[4]		
	Protection of Remaining Riparian Conditions (Study/Policy Development)[4]		
	Restoration of In-Stream and Riparian Habitats[4]		
	Restoration of Wetland Connections[4]		

Total Project Costs $ 8,496,400

Footnotes:

[1] Upgrades will involve an optimization study; however, WSDOT has performed a regional study that may allow for a simplified look at Mount Vernon's specific issue. Results of the WSDOT study should be available in June 2004.

[2] There should be no filling of the original channel. While floodplain encroachment is a policy issue; ultimately, there is an opportunity for future restoration of the channel.

[3] See R.W. Beck Comprehensive Surface Water Management Plan, November 1995.

[4] See Shannon & Wilson Inventory and Evaluation of the Kulshan and Trumpeter Stream Systems, March 2001, for detailed list of projects under this category. Reference Appendix J "Review and Comment Letter from WDFW, Dated 9/25/02" for direction on completion of projects.

TABLE 5-2

Surface Water Capital Improvement Plan Project Funding by Source – DRAFT, June 2004: Pending Council Approval

Project ID	Project Title	Project Cost in 2005 Dollars
D-01-02	Maddox Creek Restoration and Pond Retrofit	$50,000
D-05-03	West Mount Vernon Storm Force Main Upgrade	$35,000
D-94-11	Erosion Problem Repairs	$12,000
D-94-14	Log Weir Fish Structure	$12,500
X	Freeway Drive Force Main Replacement	$765,000
LS1	700-Foot-Long Berm Along Hoag Road	$319,000
LS12	Replacement of Storm Drain System in W. Mount Vernon Along Memorial Highway	$792,000
LS15	Replacement of 16 Storm Drains Between E. Division and E. Fir, West of N. LaVenture	$528,000
	Total Cost	**$2,513,500**

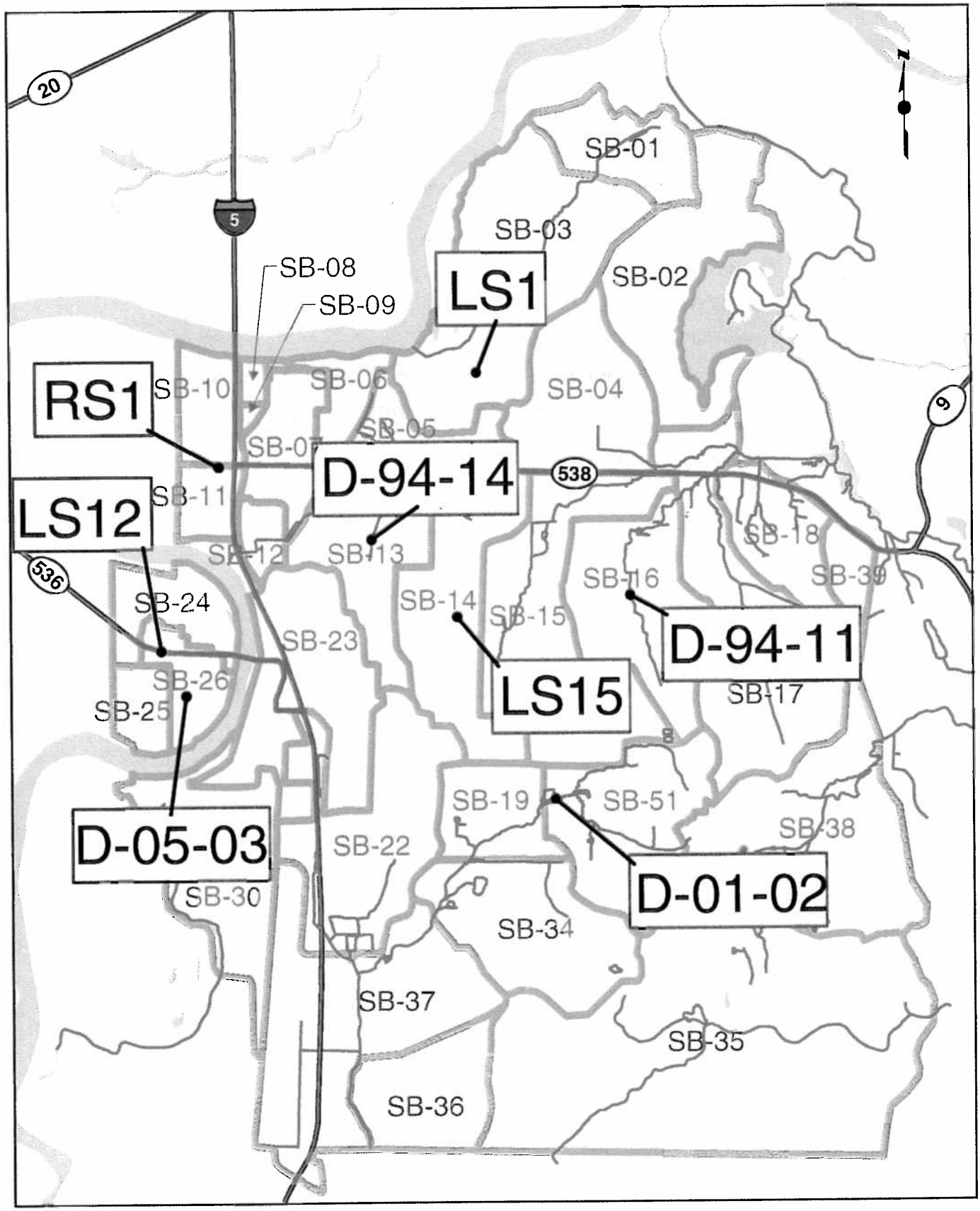

Figure 5-1
Detailed CIP Sheet
Location Map
See Sheets in Appendix C

SECTION 6: OPERATIONS AND MAINTENANCE

6. Operations and Maintenance

6.1 Purpose

The Washington State Growth Management Act requires the City of Mount Vernon to implement a stormwater facilities (public and private) maintenance program. This section provides an update to the 1995 Comprehensive Surface Water Management Plan's maintenance and operations section.

6.2 Current Level of Maintenance

6.2.1 Facilities Description/Inventory

Stormwater facilities include the storm sewer conveyance system (i.e., stormwater pipe, ditches, catch basins, and other structures) and retention/detention facilities. The City is currently working on a field update to their catch basin and stormwater conveyance inventory, with data being entered into the City's GIS Database. In the September 13, 2002, Pentec Environmental Report titled *Mount Vernon Stormwater Pond Inventory*, an inventory of the City's ____ retention/detention facilities is detailed. These facilities have been included in Figure 2-1, along with the City's most up-to-date GIS inventory of catch basins and stormwater conveyance facilities. Appendix D contains individual inventory sheets for the City's retention/detention facilities, as prepared by Pentec.

The City's stormwater facilities consist of the following system elements:*

_____ feet of stormwater conveyance pipe

_____ catch basins

_____ feet of open ditches

_____ residential retention/detention stormwater facilities

_____ commercial retention/detention stormwater facilities

_____ oil/water separators

_____ regional facilities (channels, pipes, enclosed drains)

** This information to be filled in with the final GIS inventory data (currently being compiled by the City of Mount Vernon).*

6.2.2 Existing Stormwater Facilities Maintenance Program

As detailed in the 1995 Surface Water Plan, the City of Mount Vernon has an effective operations and maintenance program for certain elements of its stormwater system; however, some systemic issues, such as water quality and quantity problems, are apparent during heavy storms. The 1995 Surface Water Plan (Section VIII, Maintenance and Operations) suggested improvements to the existing plan to ensure that a comprehensive maintenance program would be employed. Refer to "C. Recommendations" in the 1995 Plan for a complete list of these suggested improvements.

6.3 Recommended Level of Maintenance

6.3.1 Proposed Maintenance Type/Frequency

Refer to the recommendations in the 1995 Surface Water Plan. No updates are proposed at this time. Tables 6-1 and 6-2, provided herein, are updated versions of the Annual Maintenance Costs and the Recommended Surface Water Maintenance Program tables from the 1995 Plan, respectively. The costs associated with maintenance activities have been updated from 1995 dollars to 2005 dollars using a standard index multiplier of 1.422, based on *Engineering News Record*'s cost indices.

TABLE 6-1
Annual Maintenance Costs

Structure	Maintenance Cost[a]	Percent of Total Cost
Pipes	$53,300	19%
Catch Basins	$53,200	19%
Streets	$66,000	24%
Roadside Ditches	$31,400	11%
Manholes	$22,200	8%
Detention Basins	$28,000	10%
Pump Stations	$13,400	5%
Curb Inlets	$10,300	4%
Total	$277,700	**100%**

[a]A conversion factor of 1.422 was used to turn 1995 dollars into 2005 estimate.
Final inventory quantities may affect the total maintenance costs.

TABLE 6-2
City of Mount Vernon Recommended Surface Water Maintenance Program

Note that the "units to be maintained" column will need to be updated when the City completes its system inventory.

Item No.	Maintenance Activity	Units to be Maint.	Prod. Unit	Freq. (times/ year)	Daily Prod.	Crew Size	Equipment	Annual Crew Days	Full-time Equip. Equiv.	Annual Person Days	Full-time Labor Equiv.	Annual Labor Cost[a]	Annual Equipment Cost[a]	Total Cost[a]	Percent of Program
1	Clean Catch Basins	1,500	EA	1.50	30.00	2	1 Vactor	75.00	0.34	150.00	0.68	$40,474.26	$12,723.89	$53,198.15	19.15
2	Clean Manholes	250	EA	1.50	12.00	2	1 Vactor	31.25	0.14	62.50	0.28	$16864.28	$5,301.61	$22,165.89	7.98
3	Clean Curb Inlets	800	EA	2.00	266.00	6	3 Trucks	6.02	0.03	36.09	0.16	$9,738.17	$457.77	$10,195.94	3.67
4	Roadside Ditches Remove Sediments	70,400	LF	0.20	750.00	3	1 Backhoe 2 Dumptrucks	18.77	0.09	56.32	0.26	$15,196.73	$6,453.21	$21,649.94	7.79
5	Roadside Ditches Vegetation Control	35,200	LF	2.00	2,500.00	1	1 Mower	28.16	0.13	28.16	0.13	$7,598.37	$2,366.38	$9,964.75	3.59
6	Clean Pipes (18" dia. or less)	132,000	LF	.33	1,500.00	2	1 Vactor 1 Truck	29.04	0.13	58.08	0.26	$15,671.63	$5,663.39	$21,335.02	7.68
7	Clean Pipes (over 18" dia.)	132,000	LF	0.33	1,000.00	2	1 Vactor 1 Truck	43.56	0.20	87.12	0.40	$23,507.45	$8495.08	$32,002.53	11.52
8	Regional Detention Basins Veg. Control	5	EA	2.00	1.00	1	1 Mower	10.00	0.05	10.00	0.05	$2698.29	$840.33	$3,538.62	1.27
9	Regional Detention Basins Remove Sed.	5	EA	0.33	1.00	2	1 Backhoe 1 Dumptruck	1.65	0.01	3.30	0.02	$890.43	$346.37	$1,236.80	0.45

TABLE 6-2
City of Mount Vernon Recommended Surface Water Maintenance Program

Note that the "units to be maintained" column will need to be updated when the City completes its system inventory.

Item No.	Maintenance Activity	Units to be Maint.	Prod. Unit	Freq. (times/ year)	Daily Prod.	Crew Size	Equipment	Annual Crew Days	Full-time Equip. Equiv.	Annual Person Days	Full-time Labor Equiv.	Annual Labor Cost[a]	Annual Equipment Cost[a]	Total Cost[a]	Percent of Program
10	Clean Streets Downtown/ Arterials	16	MI	50.00	12.00	1	1 Street Sweeper	66.67	0.30	66.67	0.30	$17,988.56	$22,937.33	$40,925.89	14.73
11	Clean Streets Curb Residential	24	MI	15.00	14.00	1	1 Street Sweeper	25.71	0.12	25.71	0.12	$6,938.45	$8,847.26	$15,785.71	5.68
12	Clean Streets Non-Curb Residential	40	MI	6.00	16.00	1	1 Street Sweeper	15.00	0.07	15.00	0.07	$4,047.42	$5,160.91	$9,208.33	3.32
13	Clean Detention Pipes	25	RT	1.00	2.00	2	1 Vactor	12.50	0.06	25.00	0.11	$6,745.71	$2,120.64	$8,866.35	3.19
14	On-site Detention Basin Veg. Control	30	EA	2.00	2.00	1	1 Mower	30.00	0.14	30.00	0.14	$8,094.85	$2,520.99	$10,615.84	3.82
15	On-site Detention Basins Remove Sed.	30	EA	0.33	2.00	2	1 Backhoe 1 Dumptruck	4.95	0.02	9.90	0.05	$2,671.30	$1,039.13	$3,710.43	1.34
16	Pump Station Maintenance	5	EA	*	*	*	*	*	*	*	*	*	*	$13,366.80	4.81
17	Catch Basins Repair/Replace	1,500	EA	0.02	1.00	3	1 Dumptruck 1 Backhoe	0.00	0.00	0.00	0.00	$0.00	$0.00	$0.00	**
18	Manholes Repair/Replace	250	EA	0.02	3.00	3	1 Dumptruck 1 Backhoe	0.00	0.00	0.00	0.00	$0.00	$0.00	$0.00	**
19	Curb Inlets Repair/Replace	800	EA	0.02	3.00	3	1 Dumptruck 1 Backhoe	0.00	0.00	0.00	0.00	$0.00	$0.00	$0.00	**

TABLE 6-2
City of Mount Vernon Recommended Surface Water Maintenance Program

Note that the "units to be maintained" column will need to be updated when the City completes its system inventory.

Item No.	Maintenance Activity	Units to be Maint.	Prod. Unit	Freq. (times/ year)	Daily Prod.	Crew Size	Equipment	Annual Crew Days	Full-time Equip. Equiv.	Annual Person Days	Full-time Labor Equiv.	Annual Labor Cost[a]	Annual Equipment Cost[a]	Total Cost[a]	Percent of Program
20	Pipes Repair/ Replace	264,000	LF	0.02	50.00	3	1 Dumptruck 1 Backhoe	0.00	0.00	0.00	0.00	$0.00	$0.00	$0.00	**
								398.28	1.81	663.85	3.02	$179,125.90	$85,273.99	$277,766.99	100.00

[a]A conversion factor of 1.422 has been used to convert 1995 dollars into 2005 dollars.

*Pump stations are maintained by the Sewer Department

**These costs are typically covered in street replacement programs.

Assumptions			
Labor Costs (Maintenance Worker)		**Equipment Costs**	
Average cost per hour	$29.44	Vactor	$169.66/day
Regular Workday (hrs.)	8 hours	10 Yard Dump	$133.82/day
		Mower	$84.04/day
		Street Sweeper	$34.07/day
		1 Ton Truck	$25.37/day
		Backhoe	$76.11/day

SECTION 7: STORMWATER RATE ANALYSIS

7. Stormwater Rate Analysis

This section describes the results of a surface water utility rate study based on the proposed stormwater programs and capital projects. The rate study entailed projecting utility revenue needs, projecting revenue under current rates, and projecting revenue if rates are (a) reduced for commercial properties with on-site detention facilities, and (b) reduced temporarily for newly annexed areas. The expectation is that rates will meet the utility's objectives for revenue generation, equity among customers, rate defensibility, and administrative ease.

This report discusses the following:

- Surface water utility customer base and growth projections
- Existing surface water rates and revenue projections based on this rate structure
- Annual surface water system capital and operating cost projections, and 5-year revenue requirements (calendar year 2005-2009)
- Discussion of costs/savings associated with on-site detention facilities, policy issues, and implications for revenue generation of a rate reduction for these properties
- Discussion of costs/savings associated with the South Mount Vernon annexation area, policy issues, and implications for revenue generation of reducing rates for 5 years
- Pro forma projections of revenues, operating and maintenance expenses, with presentation of rates for three alternatives:
    1. A uniform rate per equivalent service unit (ESU), at the current rate level
    2. Same as #1, but with a reduced rate for property with on-site detention facilities
    3. Same as #2, but with a 5-year reduction in rates for the South Mount Vernon annexation area, under two rate reduction scenarios

Key findings include:

- The current rates are adequate to support the existing services and a small portion of the proposed CIP.
- Additional funding will be needed to fund the bulk of planned capital projects or to expand services.
- Discounts in rate for on-site detention facilities are defensible and would have a modest financial impact on the utility, but should be established only if these do not interfere with the utility's ability to fully fund operational and capital needs.
- Temporary rate reductions for newly annexed areas are defensible from an equity and financial perspective; the level of service could be proportional to revenue generated from rates in these areas.

7.1 Customer Base

Table 7-1 presents the customer base as of March 31, 2004. The table shows the number of accounts and ESUs for the different land uses in the system. An ESU, as defined in the Mount Vernon Municipal Code, is:

> ...a configuration of development, or impervious surfaces on a parcel, estimated to contribute an amount of runoff to the city's surface water management system which is approximately equal to that created by the average developed single-family residential parcel within Mount Vernon. One ESU is equal to 2,657 square feet of impervious surface area [Section 13.35.101 D].

The Code continues with a definition of "impervious surface" as:

> ... that hard surface that either prevents or retards the entry of water in the soil mantle and/or causes water to run off the surface in greater quantities or at an increased rate of flow from that present under natural conditions. Impervious surfaces may include, but are not limited to, rooftops, concrete or asphalt paving, walkways, patios, driveways, parking lots or storage areas, trafficked gravel, and oiled, macadam or other surfaces which similarly impede the natural infiltration or runoff of surface water [Section 13.35.101 E].

TABLE 7-1
Account Data (as of March 31, 2004)

Account Type	# Accounts	# ESUs
Single Family Residential	5,518	5,995
SFR Seniors*	335	335
Duplex	228	229
Restaurant	51	393
Commercial	517	5,791
Apartment	239	1,734
Government	126	2,897
Multiple Family Residential	4	23
Industrial	1	52
Total	**7,019**	**17,449**
Of Total – with Detention**	187	3,612
Detention as % if total	3%	21%
Seniors as % of total	5%	2%

* Assumes all senior accounts are single-family residential (SFR)

** On-site detention as of June 25, 2004

As Table 7-1 shows, in March 2004 there were a total of 7,019 accounts and 17,449 ESUs in the system. Industrial, government, and commercial accounts have the largest number of ESUs per account. While one ESU is equal to an average single-family account, it is assumed that there are more ESUs than single-family accounts due to some misclassification of customers into the single-family residential category. The table also notes that 187 accounts (excluding single-family residential, as discussed below) have on-site detention facilities, which contain 3,612 ESUs (21 percent of the system's total ESUs).

Table 7-2 presents the projected ESUs in the system through 2009, based on the existing service area, along with the projected surface water fee revenues, based on the utility's current rates (discussed below). It is assumed that the number of accounts and ESUs in the system will grow at a rate of 2 percent per year for all property types (based on information provided by the City). The table shows the number of ESUs in each year as of March 31 (the date of the base data provided by the City), the new/growth ESUs, and the mid-year/average ESUs for the year (as of July 31). The mid-year/average ESUs are used to project revenue.

7.2 Existing Rate Structure and Associated Revenue Projections

The existing surface water rates are designed to fund administration, planning, design, construction, water quality programming, operation, maintenance and repair of surface water system facilities, conveyance and program needs. The charges, which are per ESU, were established in 1994, to meet the needs identified in the Comprehensive Surface Water Management Plan.

The charges, per ESU, were set at $3.95 per month in 1994 through 1996, $5.35 per month in 1997 and 1998, and $6.05 per month in 1999 through 2003, and have not changed since. The charge for single-family residential customers is equal to one ESU per month; for duplexes it is equal to two ESUs per month; undeveloped parcels are not charged; all other parcels are charged based on the total amount of impervious surface area divided by the impervious area of one ESU (2,657 square feet), rounded to the nearest whole number, and multiplied by the rate per ESU. Low-income elderly persons are charged 75 percent of the otherwise applicable rate (currently $4.54 per ESU). The amount charged is included in the City's monthly utilities bill as a surface water line item.

Table 7-2 shows revenue projections through 2009, applying the current rate structure and the customer growth projections discussed above. It should be noted that the 2004 projection is approximately 3.7 percent below that projected by the City. The City's projection is based on cash inflows without receivables, and the prior year's revenue. Table 7-2 bases the projection on actual and projected new accounts/ESU data and the utility's current rates, which are used as the basis for projecting revenue under different rate structure scenarios. It is assumed that this modest discrepancy results from the timing of cash inflows and account growth (which is not evenly paced through the year). It should be noted that the revenue projection assumes that there are no unpaid accounts as, according to the City, unpaid accounts do not have an appreciable bearing on revenue generation.

TABLE 7-2
Projected ESUs and Surface Water Utility Revenues (2004 – 2009)

	March 31					
	2004	**2005**	**2006**	**2007**	**2008**	**2009**
Number of ESUs						
Single Family Residential	5,995	6,115	6,237	6,362	6,489	6,619
SFR Seniors	335	342	349	356	363	370
Duplex	229	234	238	243	248	253
Restaurant	393	401	409	417	425	434
Commercial	5,791	5,907	6,025	6,145	6,268	6,394
Apartment	1,734	1,769	1,804	1,840	1,877	1,914
Government	2,897	2,955	3,014	3,074	3,136	3,199
Multiple Family Residential	23	23	24	24	25	25
Industrial	52	53	54	55	56	57
Total	17,449	17,798	18,154	18,517	18,887	19,265
Growth Rate	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
New ESUs During Year						
Single Family Residential	118	120	122	125	127	130
SFR Seniors	7	7	7	7	7	7
Duplex	4	5	5	5	5	5
Restaurant	8	8	8	8	8	9
Commercial	114	116	118	120	123	125
Apartment	34	35	35	36	37	38
Government	57	58	59	60	61	63
Multiple Family Residential	0	0	0	0	0	0
Industrial	1	1	1	1	1	1
Total	342	349	356	363	370	378
ESUs at end of July (mid-year average)	17,535	17,885	18,243	18,608	18,980	19,360
Charge per ESU	$6.05	$6.05	$6.05	$6.05	$6.05	$6.05
Discounted Senior Charge	$4.54	$4.54	$4.54	$4.54	$4.54	$4.54
Projected Fee Revenues	$1,267,000	$1,292,000	$1,318,000	$1,344,000	$1,371,000	$1,399,000

7.3 Revenue Requirements

This section presents costs that the surface water system is projected to incur over the 5-year period 2005 through 2009. These costs must be recovered through surface water utility rates and other sources. The system revenue requirements for this calculation are based on the system's cash needs, and thus exclude non-cash expenses such as depreciation. The following categories of expenditure make up the revenue requirements: operation and maintenance expenses, CIP, and debt service requirements. No transfers out are anticipated.

7.3.1 Operation and Maintenance Expenses

The City's operation and maintenance (O&M) expenses include administration (primarily personnel and administrative overhead), maintenance, capital projects (non-CIP renewal and replacement), professional services, public education outreach, taxes, and miscellaneous expenses. The historical and projected operation and maintenance expenses of the surface water system are summarized in Table 7-3.

As Table 7-3 shows, operating expenses grew from 2001 to 2003, when they spiked upward; expenses are expected to decline precipitously in 2004, and then to increase gradually through 2009. The sharp increase in O&M costs in 2003 was due to one-time professional services and flood control costs. The projected 2004 O&M costs are based on the 2002 actual costs, adjusted by a 2 percent annual escalation factor for inflation. O&M costs are projected to continue to escalate at 2 percent per year from 2005 through 2009. Taxes are also projected to increase by 2 percent per year from 2005 through 2009. ("Taxes" refer to the business and occupation tax that the utility collects from its customers; it passes 85 percent of this revenue to the City's general fund and 15 percent to the state.) It is assumed that there will be no non-CIP capital costs included in operating expenses from 2005 through 2009.

TABLE 7-3
Actual and Projected Expenditures – 2001 through 2009

	Actual	Actual	Actual	*Estimated*	Projected				
	2001	2002	2003	2004	2005	2006	2007	2008	2009
Operations/ Maintenance	$796,927	$794,216	$1,230,240	$826,302	$842,828	$859,685	$876,879	$894,416	$912,305
Taxes	$99,248	$209,049	$102,310	$102,162	$104,205	$106,289	$108,415	$110,583	$112,795
Capital Expenses (non-CIP)	$454,108	$211,100	$192,858	$75,840	$0	$0	$0	$0	$0
Total Operating Expenses	$1,350,283	$1,214,365	$1,525,408	$1,004,304	$947,034	$965,974	$985,294	$1,005,000	$1,025,100

Source: City of Mount Vernon, Strategic Outlook, 2004 – modified with assumption that 2004 O&M is based on 2002 actual, adjusted by a 2% annual escalation factor for inflation (based on discussion with the City's Director of Finance).

7.3.2 Capital Improvement Program and Debt Service

The surface water system's 6-year CIP is presented in Section 5. The total known capital needs are $8,500,000. Of this total, $600,000 is expected to be funded by rates in 2005 through 2007. The remaining $7,900,000, which is 93 percent of the total, is currently unfunded. The City does not plan on issuing new debt during the forecast period to cover these CIP costs.

The utility obtained a Public Works Trust Fund loan of $3.1 million in 1997 to cover system capital improvement costs. This loan, which has a 3 percent interest rate, has a term of 20-years and thus is scheduled to be paid off in 2016. Debt service payments, comprised of principal and interest, are close to $230,000 in 2004. They will decline to approximately $200,000 in 2009, and to $170,000 in 2016, following which the loan will be retired. The loan covenants require the City to set aside funds each month to meet the July debt service payments.

Additional revenues will be needed to fund capital projects after the next three years.

7.3.3 Transfers Out

In the 4 years between 1998 and 2001, the utility transferred more than $1.0 million to other City departments. The utility has not transferred out funds since 2001, and no transfers are projected during the study period.

7.3.4 Potential Additional Revenues

Additional revenues would be needed to fund the recommended expansions in services and capital projects. There are several potential sources for additional revenue. The most common include:

- Increased SWM fee
- Grants
- Debt
- Capital facility fees
- Existing Taxes

A mixture of these sources should be considered. The most straight forward source is an increase in the SWM fee. However, this is unlikely to receive public support without an extensive public process to build understanding among the public and develop support for specific program elements and specific capital projects.

Grants are available from a variety of sources but are very competitive and largely focused on habitat or water quality projects. An exception is the Flood Control Assistance Account Program (FCAAP) created by Washington state. This program funds projects related to flooding but also gives priority to projects that provide a benefit to fish or water quality. The City has been successful in competing for and winning grants and should continue pursuit of grants for appropriate projects.

There are also a variety of sources for debt including some that provide low interest rates. Debt is not recommended at this time because the City already has a substantial debt payment and there is not adequate revenue to repay additional debt.

Capital facility fees are a potential source of funding for capital projects related to growth. Such fees are charged against new development to support necessary public drainage facilities or improvements. The analyses and the list of capital projects in this plan may provide an adequate basis to support a capital facility fee.

Existing tax revenues are fully allocated for other issues and there is far more demand than supply. This is a major reason that the Storm and Surface Water Utility was created. Thus, the use of existing tax revenues for surface water projects is unlikely.

Table 7-4 below illustrates a potential combination of funding sources for capital projects. The complete list of individual capital projects is found in Section 5.

TABLE 7-4
Illustration of Capital Project Funding Needs and Potential Revenue Needs

Total Identified Capital Project Needs	$8,496,400
Potential CIP Projects with Existing Revenues	$(584,500)
Potential FCAAP funding for flood wall @50% ($250,000 plus $1,367,000 for semi-permanent and permanent wall)	$(808,500)
Assume SRFB or other grants for habitat related projects	$(300,000)
Six Year Revenue Shortfall	$6,803,400
Annual Revenue Shortfall	$1,133,900
Annual Revenue Generated by $3.00 Rate Increase*	$648,000

* Based on approximately 18,000 ESUs

Revenue sources and the need for the projects should be evaluated during the annual budget processes.

7.4 Pro Forma Projections and Rate Adjustments

This section presents a 5-year pro forma projection of the surface water system's financial performance based on projected system growth and costs discussed above. The proposed adjustments in the City's monthly surface water rates are calculated to meet the system's policy goals, primarily associated with equity, along with financial commitments, including debt service coverage requirements.

Table 7-5 presents a pro forma projection of system revenues and expenses for 2005 through 2009. The top portion of the table shows the calculation of the system revenue requirements. Revenues from sources other than rates are then deducted to determine the amount of revenue that needs to be generated through surface water rates to cover the system costs in each year. These rate revenue requirements are then compared with projected revenues under existing rates – and, in addition, with a potential on-site detention discount, which is discussed below. Any revenue surplus or shortfall is then calculated, which is added to or deducted from the cash balance.

7.5 System Revenue Requirements From Rates and Projected Revenue Under Existing Rates

As Table 7-5 shows, the total system revenue requirements amount to about $1.4 million in 2005, and decline to about $1.2 million in 2009. Revenue requirements are projected to decline during the 5-year period as rate-funded improvements decline from $255,000 in 2005 to zero in 2008 and 2009.

Nonrate revenues, in the case of the City, consist of interest income. Interest income is projected to be 3 percent per year of the beginning cash balance (under the existing rates scenario). As the table shows, interest income would fluctuate over the 5-year period from a low of approximately $13,000 in 2007, to a high of $21,000 in 2009. Given the small contribution of nonrate revenue to cover the system's costs, the amount of revenue that is needed to be generated through surface water fees is close to the total system revenue requirements.

As Table 7-5 shows, under the current rate structure, the system would experience a deficit and dip into reserves in 2005 and 2006, when rate-funded CIP improvements are highest, but would experience an operating surplus for the last 3 years of the period, which would enable the utility to fully replenish its reserves. Rate revenue, under the current rate structure, would be adequate to meet the system's anticipated needs for the 5-year period.

7.5.1 Surface Water Rate Modifications and Projected Revenue

Two alternatives for stormwater rate reductions are under consideration by the City:

- Reduced rate for properties with on-site detention facilities
- Temporarily reduced rate for properties in newly annexed areas.

Apart from these two changes, the City would like to maintain the current rate structure and fee levels.

The following paragraphs identify and evaluate the implications of the two potential changes to the rate structure. The analysis explored how rate reductions would impact the utility's objectives for revenue generation, equity among customers, rate defensibility, and ease in rate administration.

Before delving into the specifics of the two potential rate reductions, it should be noted that if a class of properties has a reduced need for surface water services, a rate reduction is defensible. Other jurisdictions offer surface water rate reductions or credits for properties with inspected and approved on-site detention facilities and it is not uncommon for jurisdictions to provide a reduced rate for a particular sub-zone of the service area, where this can be justified. From a legal perspective, a nexus must exist between the rate and the demand for service.

TABLE 7-5
Surface Water Fee Revenue Requirement Calculations, 2005-2009

Revenue Requirements	2005	2006	2007	2008	2009
Operating Expenditures	$947,034	$965,974	$985,294	$1,005,000	$1,025,100
Debt Service	$224,505	$219,553	$214,601	$209,648	$204,696
Rate Funded Improvements	$255,000	$252,500	$77,000	$0	$0
Transfers Out	$0	$0	$0	$0	$0
Total Revenue Requirements	$1,426,539	$1,438,027	$1,276,895	$1,214,648	$1,229,796
Non-Rate Revenues					
Interest Income	$19,749	$16,305	$13,193	$15,602	$20,761
Other Non-Rate Revenues	$0	$0	$0	$0	$0
Total Non-Rate Revenues	$19,749	$16,305	$13,193	$15,602	$20,761
Surface Water Fee Revenue Requirements	$1,406,790	$1,421,722	$1,263,701	$1,199,045	$1,209,035
Projected Surface Water Fee Revenues					
1. Under Current Rate Structure	$1,292,000	$1,318,000	$1,344,000	$1,371,000	$1,399,000
Operating Surplus/(Deficit)	($114,790)	($103,722)	$80,299	$171,955	$189,965
Cash Carried Forward (beginning balance)	$658,292	$543,502	$439,780	$520,078	$692,033
2. With On-Site Detention Discount	$1,238,505	$1,263,435	$1,288,344	$1,314,231	$1,341,095
Operating Surplus/(Deficit)	($168,285)	($158,287)	$24,642	$115,185	$132,060
Cash Carried Forward (beginning balance)	$658,292	$490,007	$331,719	$356,362	$471,547

7.5.2 Rate Reduction for Properties with On-Site Detention Facilities

The question of whether properties with on-site detention and water quality treatment facilities should be given a credit against the surface water rate has public policy dimensions as well as revenue generation implications. A discussion of these issues follows.

7.5.2.1 Policy Considerations – On-Site Detention Discount

The concept of a rate reduction for properties with on-site detention and water quality treatment facilities is based on the premise that these properties do not create the same impacts and therefore do not require the same level of service as properties without such facilities. This assumes that the facilities were adequately designed and constructed, are adequately maintained and perform as intended. Where this is the case, these properties result in reduced need for public capital projects and related maintenance.

As on-site detention facilities only partially mitigate impacts to natural systems, there is still a need for publicly-funded capital projects to mitigate drainage impacts. In addition, these properties would not reduce the need for general storm/surface water services, such as planning, inspection, monitoring, administration and education.

The City's current surface water budget has a portion dedicated to maintenance of facilities on single-family developments, but no budget for maintenance of facilities on all other privately-owned or public properties. It is proposed that a rate reduction be extended only to non-single-family residential properties, in proportion to the ongoing cost savings to the City associated with facility maintenance. This savings represents 20 percent of the cost to provide service to these properties. Thus, a credit of 20 percent is proposed.

7.5.2.2 Revenue Projections – On-Site Detention Discount

As of June 25, 2004, 187 accounts (excluding single-family residential) in the existing service area, with a total of 3,612 ESUs, benefit from private on-site detention facilities. While this is only 3 percent of accounts, it represents 21 percent of the system's ESUs. It is assumed that the number of such accounts and ESUs will grow at a rate of 2 percent per year, which is the growth rate for the service area. Table 7-6 shows the financial implications of establishing a 20 percent discount for these customers. As the table indicates, a 20 percent discount would result in a 4 percent reduction in revenue (i.e., 20 percent of 21 percent of the ESUs). Over the 5-year period, this represents $278,391 in lost revenue.

TABLE 7-6
On-Site Detention Discount - Projected Revenues, 2005-2009

	2005	2006	2007	2008	2009	Total
Detention Discount per ESU	$4.84	$4.84	$4.84	$4.84	$4.84	
Number of ESUs with Detention	3,684	3,758	3,833	3,910	3,988	
Lost Revenue Due to Discount	$53,495	$54,565	$55,656	$56,769	$57,905	$278,391
Lost Revenue as % of Fee Revenue	4%	4%	4%	4%	4%	4%

Table 7-5 shows the total projected surface water fee revenues during the 5-year period, with an on-site detention discount. As the table shows, while the discount would detract from net revenue, its impact would not be large enough to create a deficit in 2007, 2008 or 2009. While the utility would meet its financial obligations during the period, reserves would decline by approximately $187,000 (from the beginning balance of 2005 to the beginning balance of 2009), due primarily to the on-site detention discount.

7.5.3 Temporary Rate Reduction for Properties in Newly Annexed Areas

Discussions are underway concerning the annexation of South Mount Vernon into the service area. It is anticipated that other areas may be annexed in the future. Policy considerations along with associated revenue projections follow.

7.5.3.1 Policy Considerations – Newly Annexed Areas

It is expected that, in the long run, the cost of providing surface water utility service to the South Mount Vernon annexation area – and any other annexation areas – will be comparable, per ESU, to the cost of providing service within the current service area. In the long-run, therefore, the monthly surface water fee, per ESU, should be uniform throughout the service area. However, a reduced monthly fee is suggested during a 5-year transition period, for the following reasons:

- Customers in the annexation area currently pay an annual fee to the Skagit County Surface Water Utility for services, at a level that is about one-third or less than that of the City's fee; the City's monthly fee of $6.05 per ESU would be a significant increase for these customers, many of whom would not have a chance to budget accordingly.
- Customers in the annexation area have contributed fees to the South Mount Vernon sub-flood control zone (SFCZ), although these fees were last assessed in 1987. Unspent resources associated with these fees amount to approximately $58,700, which should be earmarked for annexation area projects or services – offsetting, as appropriate, City fees in the short-term.
- The utility has not budgeted for or scheduled work for the annexation area, and would be unlikely to provide full service to this area immediately.
- The utility does not have available resources to initiate service to the annexation area (and that area has not yet paid for such service).
- The utility does not have a thorough understanding of the surface water system in the annexation area – its condition, maintenance needs and capital needs – and currently lacks resources to meet those needs.
- The annexation area is more rural than the existing service area, and surface water service costs may be lower in this area per ESU; within 5 to 6 years, the annexation area is expected to be significantly more built out and its surface water service costs then are expected to be comparable with those in the rest of the service area.
- Reduced rates were instituted for a 5-year transitional period, between 1994 and 1998, when the City introduced its surface water rate, as discussed above; a similar approach should be taken with newly annexed areas.
- Service in the annexation area could be scaled to equal revenue generated, during a transitional period.

The City considered rate alternatives that would transition annexation area customers from their existing County surface water rates to those charged by the City. Two transitional rate alternatives were considered – a 50 percent transitional rate, and a stepped increase. For both alternatives, a 5-year transitional period is proposed, as it is expected that in year 6 the service level and associated costs in the annexation area will be comparable with those in the existing service area. It should be noted that these alternatives are illustrative of many transitional rate schedules that the City might consider.

7.5.3.2 Existing Skagit County Surface Water Rate

Customers in the annexation area are currently subject to the surface water rates shown in Table 7-7. As the table indicates, the County charges an annual fee per parcel for residential properties excluding apartments, and a fee per impervious area for apartments, commercial and industrial properties. It also charges $.30 per acre for all parcels – developed and undeveloped. The City's fee is only applied to properties with impervious area (i.e., developed properties). The County also charges the surface water fee for County roads ($0.007 per impervious square foot) and State roads ($0.0021 per impervious square foot), which the City does not do.

TABLE 7-7
Annual Surface Water Rates, City of Mount Vernon and Skagit County

	Single Family Residential	Duplex	Multiple Family (assume fourplex)	Apts, Commercial, Industrial
City Rate per ESU	$72.60	$72.60	$72.60	$72.60
County Rate				
per Parcel	$25.80	$31.79	$31.79	
per Impervious Sq. Ft.				$0.007
per Acre	$0.30	$0.30	$0.30	$0.30
Total (w/o acreage fee)	$25.80	$15.90	$7.95	$18.60
	per dwelling	per dwelling	per dwelling	per City ESU
County as % of City	36%	22%	varies	26%

The majority of South Mount Vernon annexation area is nonresidential property. These customers' current rates are approximately 26 percent of what they would be under the City's existing rates, per ESU, excluding the County's acreage fee. (This is calculated by multiplying $0.007 per square feet x 2,657 square feet per ESU = $18.60 per ESU, which is 26 percent of $72.60.) The fee per acre is modest ($0.30) and results in limited revenue, as there are only 518 total acres in the annexation area (121 acres of state and county roads and 397 parcel-related acres); this fee component is therefore excluded from the analysis.

7.5.3.3 Stepped Transitional Rate

Customers in the annexation area would not be subject to the Skagit County Surface Water Utility fee when they join the Mount Vernon service area. It is therefore suggested that, following annexation, these customers continue to pay a "typical" County fee for their first year of service with the Mount Vernon Surface Water Utility. That fee would be $0.007 per impervious square foot, which is $18.60 per year per ESU (2,657 square feet), or $1.55 per month per ESU. This fee would cover the cost of maintaining the level of service performed by the County, for 1 additional year. The fee would then increase each year in equal steps of $10.80 per ESU, to arrive at $72.60 per year per ESU in year 6; on a monthly basis, the fee would increase $0.90 per year, to arrive at $6.05 per month in year 6. The gradual, step-wise rate increase would be commensurate with the step-wise expansion of service and increase in associated costs. This gradual approach would ease customers into the new/increased rates.

7.5.3.4 Fifty Percent Transitional Rate

This alternative would set the transitional rate at the mid-point between the typical customer's Skagit County rate ($18.60 per year per City ESU) and the City's existing rate ($72.60 per year per ESU) for 5 years, representing an increase of $27.00 per ESU and a 145 percent increase from the County's rates. On a monthly basis, the fee would be $3.80 per ESU. After the 5-year period, the annexation area rate would increase to match the City's rate of $6.05 per ESU. The higher rate in year 1, relative to the stepped alternative, recognizes initial/start-up costs associated with the annexation – such as developing an inventory of the annexed surface water system, a work-plan and budget – while maintaining service on par with that provided by the County. By providing more resources up-front, this averaged approach would give the utility slightly more flexibility in terms of timing projects in the annexation area during the initial 5-year period. From the customer's perspective, this approach would represent a larger initial jump than the stepped alternative, but the fee would then remain constant for 5 years, before it would jump again.

7.5.4 Revenue Projections – Newly Annexed Areas

Table 7-8 shows revenue projections for the South Mount Vernon annexation area under three scenarios, over the 5-year period:

- Full rates
- Fifty percent transitional rates
- Stepped transitional rates

The following parameters were used and assumptions made regarding the South Mount Vernon annexation area, for the revenue projections:

- There were an estimated 2,905 ESUs in the annexation area, based on aerial photography in May 2003, and it is assumed (per the City) that there have been minimal changes to date.
- There are 914 ESUs (per the City) that have benefited from on-site detention facilities and would be eligible for an on-site detention discount, which is about 31 percent of ESUs.
- There is almost no residential development in the annexation area, and therefore no accounts (or an unappreciable amount) would be eligible for a senior discount.
- Following annexation, a spurt in growth would occur at a rate of approximately 5 percent per year for 5 years; following that growth, the area's development would resemble that of the rest of Mount Vernon, and future growth would be at a relatively slower pace.

Table 7-8 shows the potential revenue generated under the three scenarios, with and without a discount for on-site detention. As the table indicates, if the discount is granted for on-site detention facilities, this would reduce annual revenue by 6 percent under all three scenarios (which is the 20 percent discount on 31 percent of ESUs). Assuming this discount is granted, revenue at full rates would be approximately $207,000 in 2005 and would increase to approximately $252,000 in 2009, with total revenue of $1.1 million over the 5-year period. Under the 50 percent transitional rate scenario, revenue would increase from

approximately $130,000 in 2005 to approximately $158,000 in 2009, with total revenue of $720,000 over the 5-year period. Under the stepped transitional rate scenario, revenue would increase from approximately $53,000 in 2005 to approximately $215,000 in 2009, with total revenue of $651,000 over the 5-year period. Over the 5-year period (assuming there is a discount for on-site detention facilities), revenue under the 50 percent transitional rate scenario would be $426,000 less than or 63 percent of that of the full fee, while revenue for the stepped transitional rate scenario would be $495,000 less than or 57 percent of that of the full fee.

TABLE 7-8
South Mount Vernon Annexation Area - Projected Revenues of Transitional Rate Scenarios, 2005-2009

	2005	2006	2007	2008	2009	
South Mt. Vernon ESUs	3,050	3,202	3,362	3,531	3,707	
Number of ESUs with Detention	960	1,008	1,058	1,111	1,167	
1. Revenue - Fee at 100%						
Monthly Fee per ESU	$6.05	$6.05	$6.05	$6.05	$6.05	
Potential Revenue	$221,417	$232,488	$244,113	$256,318	$269,134	
Lost revenue if Detention Discount	($13,935)	($14,632)	($15,363)	($16,131)	($16,938)	
2. Revenue - 50% (midpoint) Transitional Rate						
Monthly Fee per ESU	$3.80	$3.80	$3.80	$3.80	$3.80	
Potential Revenue	$139,070	$146,024	$153,325	$160,991	$169,041	
Lost revenue if Detention Discount	($8,752)	($9,190)	($9,649)	($10,132)	($10,639)	
3. Revenue - Stepped Transitional Rate						
Fee Steps (% of $6.05)	26%	40%	55%	70%	85%	
Monthly Fee per ESU	$1.55	$2.45	$3.35	$4.25	$5.15	
Potential Revenue	$56,724	$94,146	$135,168	$180,057	$229,097	
Lost Revenue if Detention Discount	($3,570)	($5,925)	($8,507)	($11,332)	($14,418)	
Total Revenue with Detention Discount						**Total**
1. Revenue - Fee at 100%	$207,482	$217,857	$228,749	$240,187	$252,196	$1,146,471
2. Revenue - 50% Transitional	$130,318	$136,834	$143,676	$150,860	$158,402	$720,090
3. Revenue - Stepped Transitional	$53,154	$88,221	$126,661	$168,725	$214,679	$651,439

7.5.5 Rate Reduction for Properties with On-Site Detention Facilities

CH2M HILL recognizes that a rate reduction for properties with on-site detention facilities is defensible from an equity and legal standpoint, and would be reasonably easy to implement from an administrative perspective. However, implementing this rate reduction

would, over the course of the coming 5-year period, cost the utility approximately $280,000, depleting reserves that could be used for needed capital improvements.

CH2M HILL recommends that the City establish a rate reduction for properties with on-site detention facilities only if this does not interfere with the ability to fully fund Surface Water Utility expenditure needs. Rates, coupled with other projected sources of revenue, should fully fund operational and capital needs. The policy decision should rest on carefully considered O&M projections. If the City is confident that O&M costs will reflect Table 7-5 projections (or be lower), and that other revenue sources will be identified to fund capital needs, the City should proceed with the rate reduction. If O&M costs are expected to be higher than those projected in Table 7-5, and/or if other revenue sources cannot be identified to fund capital needs, CH2M HILL recommends that the City consider coupling the rate reduction for properties with on-site detention facilities with an overall rate increase. This would serve both the City's equity objectives and revenue generation needs.

7.5.6 Temporary Rate Reduction for Properties in Newly Annexed Areas

CH2M HILL recommends that the City establish a temporary rate reduction for properties in newly annexed areas, with a 5-year timeframe. This timeframe would enable the City to inventory, budget and plan projects in the newly annexed area, and to scale up the level of service as resources become increasingly available. Of the two alternatives discussed, CH2M HILL recommends the transitional-stepped rate increase, as this approach would enable customers to budget for and get accustomed to higher rates, as their level of service increases in proportion to the rates they pay. The City might consider other transitional rate schedules, as the needs of the annexation area and associated costs become more apparent.

CH2M HILL recommends that if the City increases or otherwise modifies its surface water rates for existing service area customers during the 5-year transitional period, the rates of annexation area customers should be increased/modified proportionately, so that in year 6 the rates in the annexation area are the same as those in the City's larger service area.

If the City implements a rate reduction for on-site facilities in the existing service area, CH2M HILL recommends the same policy should apply to properties in newly annexed areas.

CH2M HILL also recommends that the unspent revenue that customers in the annexed areas have contributed to the South Mount Vernon sub-flood control zone ($58,700), should be transferred to the City's utility. If these funds were earmarked for capital projects – or if there are pressing capital needs in the annexed area – the funds should be spent on capital projects. If there are no pressing capital needs in the annexation area, these funds should offset annexation area surface water rates and be used for general operating expenses.

It is suggested that the customers in the annexation area be billed on a monthly basis, once they are integrated into the City's utilities billing system.

SECTION 8: RECOMMENDATIONS

8. Recommendations

The following recommendations have been synthesized from the information and analyses in the previous sections of this plan.

8.1 Regulations and Policies: Adopt Ecology "Stormwater Management Manual for Western Washington, August 2001"

The City should adopt the Ecology "Stormwater Management Manual for Western Washington" (as required by state law). The manual requires the use of a continuous simulation hydrologic model to evaluate impacts and determine the size of detention facilities. It will require the definition of pre-development conditions as forested for the purpose of hydrologic modeling. These two factors (continuous simulation and forested conditions) will result in larger detention ponds for most new developments which will provide better protection of stream resources and reduce future flooding and erosion in streams.

8.2 Enhance Education

The City should continue to contract with Skagit River non-profit groups to provide education related to stormwater. Additionally, the City should develop targeted educational information for commercial and industrial property owners regarding illicit discharges. Examples of printed information are available from other jurisdictions.

8.3 Implement Detection of Illicit Connections and Discharges

The City should develop a regular program for detection of illicit connections and illicit discharges to reduce pollutants within the City's stormwater conveyance system and the potential discharge of those pollutants to receiving waters. This is an action that is required by NPDES municipal stormwater permits. This is a relatively inexpensive activity that can be very effective. Stormwater systems in commercial and industrial areas should be visually inspected during the dry portions of the year. If there are flows, they are likely illicit discharges, particularly if they are not consistent flows (consistent flows could be groundwater).

Field screening of storm drain connections begins with a visual inspection, and consists of the following actions if the visual inspection indicates the potential for an illicit connection:

- Observe the physical conditions of the catch basin and the contributing pipes
- Photograph the catch basin rim and bottom (and incoming pipes if possible)
- Perform onsite water quality analysis of flows into the catch basin
- Estimate flow rate into the catch basin
- Repeat these water quality and flow analyses between 4 and 24 hours after completion of the first sample set at each site.

Storm drains should be inspected no sooner than 72 hours after the last measurable precipitation event to determine if there is flow in any of the incoming drainage pipes, or if

an incoming drainage pipe is aligned directly with a business or industry. If there is flow, the water coming from the pipe in question (or the catch basin itself when the pipe flow cannot be isolated) should be analyzed as described below. In cases where water quality sampling is performed, it is necessary to resample the site 4 to 24 hours after the completion of the first analysis.

It is recommended that City staff use a commercial storm drain kit to perform on-site evaluations of storm drains exhibiting flow after a 72-hour dry period. The parameters that should be monitored and their analysis methods are listed in Table 8-1.

TABLE 8-1
Illicit Storm Drain Connection Monitoring Parameters and Analysis Methods

Parameter	Analysis Method	Parameter	Analysis Method
Odor	Observation	Flow rate	Volume and time estimation
Color	Observation	PH	Field meter
Clarity	Observation	Phenol	Colorimetric test kit
Floatables	Observation	Total chlorine	Colorimetric test kit
Deposits/stains	Observation	Copper	Colorimetric test kit
Vegetation	Observation	Detergents	Colorimetric test kit
Structural condition	Observation	Turbidity	Colorimetric test kit
Biological growth	Observation	Color	Colorimetric test kit

In the event that a suspected illicit storm drain connection is confirmed by the results of field monitoring, the City's building official should be contacted for enforcement of building and drainage regulations. Enforcement may consist of physically disconnecting sources, educating site owners regarding proper disposal of pollutants, or making referrals to Ecology of other water quality agencies.

8.4 Improve and Document Enforcement Actions

Additional resources should be provided and inspections of new development should be increased. Native growth protection easements and aquatic resource setbacks should be field marked and inspected prior to construction . Regular inspection should document that these areas remain marked and are not violated during construction. Erosion control facilities should also be installed prior to construction, regularly inspected throughout construction, and removed and stabilized following construction. Drainage facilities such as swales, ditches, pipes, catch basins, and detention ponds should be inspected to assure that they are constructed in accordance with the design and are properly functioning at the completion of construction.

The responsibility among City departments for inspection should be clarified for each type and stage of permit review and construction. This will require an evaluation of the specific needs for inspection, training, staffing and assignments.

Additional training should be provided for all staff involved in permit review or inspection. Training should include the value of aquatic resources, potential impacts and methods to avoid, minimize, and compensate for impacts. Specific training is needed for marking and maintaining aquatic resource setbacks, and for erosion and sediment control.

8.5 Complete Inventories and GIS

The City is currently preparing inventories of the drainage system, streams, and wetlands. These inventory activities should be completed and periodically updated as appropriate. The information should be placed in the Geographical Information System for display on maps. The maps should be available at the City permit counters for use by property owners and developers.

8.6 Complete Capital Improvement Projects

Capital projects should be completed within available annual funding limits. Priorities for capital projects are listed in Section 5 of this plan. At the present funding levels and with the required annual debt payment for prior capital projects, new capital projects will be minimal. The capital improvement plan should be incorporated annually into the overall City capital improvement plan (normally completed as part of the budget process).

8.7 Evaluate the Need of Additional Funding to Complete Capital Improvement Projects

The demand for capital projects exceeds the available revenues for the stormwater utility. While this may not be unusual, there may be compelling reasons for some of the capital projects that warrant consideration of additional revenue (for example, a rate increase). The proposed capital improvement program should be reviewed by the Planning Commission or other public group to evaluate the demand for surface water capital projects and balance the demand against the desire to reduce or at least avoid increases in stormwater rates. The Planning Commission recommendations should be forwarded to the City Council for consideration.

There is no allowance in the budget for long-term replacement of the drainage infrastructure. Since much of the City is relatively new, this may not be critical at this time. But, it would be advantageous to start setting aside funding for eventual replacement before the issue becomes critical.

There are a number of grant programs available for capital projects that should be pursued aggressively. Most grants are for innovative projects, water quality, or habitat protection. There are very limited grant opportunities for typical stormwater projects to address local drainage problems as these are expected to be locally funded.

8.8 Rate Reductions

Rate reductions for on-site detention facilities and for newly annexed areas should be considered as discussed in Section 7 of this plan.

8.9 Update Plan in Five Years

Mount Vernon is growing rapidly, resulting in additional impervious surfaces and reduction in forests and open spaces and encroachment in riparian corridors. Changes will degrade streams and wetlands and increase flooding and erosion. This plan should be updated in 5 years to reflect changing regulatory requirements, growth, and changing public interests.

8.10 Maintenance

Continue maintenance activities as currently practiced. Develop documentation of tasks performed, the level of effort required, and known "hot spots," such as frequent drainage, erosion, or water quality problems. Use the documented level of effort to develop unit costs for each activity. This will allow appropriate budgets and billing for stormwater maintenance. Complete and regularly update the inventory of drainage facilities. Incorporate the inventory findings in the GIS system.

Develop and maintain a spill response program. Provide training for maintenance crews in containment and cleanup of spills.

8.11 Stormwater Pollution Prevention

Inspect existing facilities owned or operated by the Public Works and Parks Departments for stormwater pollution prevention. Identify and eliminate exposed sources of potential stormwater pollutants. Assure secondary containment of liquids that could become contaminants if spilled or leaked. Assure vehicle maintenance is performed in appropriate areas (either covered or in an areas that drains to the sanitary sewer or a separate treatment facility). Storage and transfer of potential pollutants should be under cover.

Review Integrated Pest Management Plans for the Department of Public Works and the Department of Parks. Update as appropriate.

8.12 LID

Continue to encourage and promote the use of Low Impact Development techniques. Suggest approaches to developers. Explore the potential to offer incentives to developers, such as reduced detention requirements or increased density. Allow flexibility in design standards to accommodate LID techniques. Amend design standards to specify pervious pavement for walkways and parking areas and allow narrow streets in residential areas if Low Impact Development features are implemented.

Review each City capital project for opportunities to incorporate LID techniques. Develop and adopt a City policy that directs inclusion of appropriate LID techniques. These projects can become examples for the development community to increase understanding and confidence in the approach.

Select a street upgrade project and fully incorporate LID techniques as a demonstration. Incorporate LID techniques in all road improvement projects as feasible.

8.13 Flood Protection

The original stormwater utility did not include actions to address flooding from the Skagit River since these actions are funded by various dike, drainage, and flood control districts. There are certain capital projects that would provide additional flood protection for the City that are not likely to be provided by the existing flood control districts. It would be beneficial if the City had a designated funding source for these activities. The potential to expand the use of the Storm and Surface Water Utility funds for this purpose should be evaluated by the City. This use of the funds would reduce funding available for other on-going stormwater actions. Thus, additional revenues may be necessary if river flood response actions are added.

8.14 Advocate

At the present time, there is no individual position that is dedicated or entirely available to manage the stormwater program. Therefore, there is no clear voice or advocate for surface water in the City.

Stormwater and related regulations are changing rapidly. As a relatively new field, the technology is also rapidly changing. With the amount of change, it is difficult to stay up to date. It would be helpful to have at least one staff dedicated (subject to budget constraints) to stormwater with primary responsibility in the City for monitoring changing regulatory conditions and technology.

Mount Vernon is blessed with an abundance of surrounding open space and productive aquatic resources. With the anticipated growth, this may change. If it does, citizens may become more outspoken about the need to protect or restore the City's aquatic resources. Having an advocate in the City now may prevent some of the loss of existing aquatic resources.

City staff should evaluate the departmental organizations and clarify responsibilities regarding surface water management. A position should be identified as the primary contact and representative for surface water issues.

APPENDICES

Appendix A
Surface Water Modeling and Analysis

- Technical Memorandum No. 1
- Technical Memorandum No. 2
- Technical Memorandum No. 3
- Technical Memorandum No. 4

TECHNICAL MEMORANDUM #1

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Subject: City of Mount Vernon Comprehensive Surface Water Management Plan Update; Maddox Creek HSPF Model and Lower Basin Channel Encroachment.

Date: June 30, 2004

Introduction

Hydrologic Simulation Program - Fortran (HSPF) hydrologic models for the Maddox Creek basin were originally developed in 1993 during preparation of the 1995 City of Mount Vernon Comprehensive Surface Water Management Plan (CSWMP). In the current work, the models were updated with meteorological data through December 2002 and modified to provide a more realistic representation of storage volumes in the lower portion of the basin. Model accuracy was reviewed by comparing the results of the updated HSPF simulations with Maddox Creek recorded streamflow data at Hickox Road for the period of May 2001 through September 2002. Finally, an assessment was made of potential lower-basin channel encroachments and loss of floodplain storage, and the effects of such encroachments on flood levels and peak discharges.

The Maddox Creek basin above the original calibration point, located 1,200 feet upstream from Anderson Road, is relatively steep-sloped and well-drained. The original Maddox Creek models did not include any channel storage in the relatively-flat lower basin areas below the calibration point. Because significant storage in the lower basin areas was neglected, model estimates of Maddox Creek peak flows at Hickox Road (the City's urban growth boundary and the downstream end of the HSPF model) were overestimated.

Model Update

Revisions to the Maddox Creek models included: 1) extending the meteorological data sets through mid-December 2002; 2) developing approximate land use data reflecting current (2002) land use conditions; 3) simulating the current (2002) performance of the regional detention pond at Little Mountain Estates; and 4) using a FEQ hydraulic model of the lower basin to estimate realistic lower-basin storage characteristics for HSPF simulations. Each of these updates is discussed below. The update work made use of available HSPF model sequences previously prepared by R.W. Beck and therefore relied upon the original soils mapping, the original land use mapping, and the original sub-basin delineations presented in

the 1995 CSWMP. Sub-basin delineations from the 1995 CSWMP are reproduced in Figure 1, with annotations to highlight locations of interest to the current work.

Meteorological Data Update

Precipitation data used in the updated hydrologic modeling were obtained from the National Oceanic and Atmospheric Administration (NOAA) station at Burlington for the period of October 1, 1956 through November 30, 1993, and from the Washington State University (WSU) Cooperative Extension Public Agricultural Weather System (PAWS) Mt. Vernon station for the period of December 1, 1993 through December 23, 2002. Data from the PAWS station were increased by 11% to represent the generally-higher rainfall amounts at Burlington and in the Maddox Creek basin. The NOAA Station at Burlington is located about 3 miles north of downtown Mount Vernon and has a reported station elevation of 30 feet. The Mount Vernon PAWS station is located about 3 miles west of downtown Mount Vernon, and has a reported station elevation of 10 feet. A comparison of monthly data for these two stations for 83 concurrent months between years 1991 and 1999 found that rainfall amounts at the NOAA (Burlington) gage are, on average, about 11% greater than at the PAWS gage. This variation is consistent with isopluvial mapping, which shows an eastward increase in rainfall amounts across the area.

Although the Burlington gage was assumed to best represent precipitation characteristics in the Maddox Creek basin based on isopluvial mapping, there are significant gaps in the records for that gage, and no concurrent rainfall records are available for either of the two documented high streamflow events in June 2001 and December 2001. Because of its relatively-complete record, the post-1993 rainfall data set was based exclusively on the PAWS data times a 1.11 multiplier. It should be noted that, on a monthly basis, total rainfall amounts at Burlington typically range from being about 10% lower to 20% higher than at the PAWS station. Similar monthly variability, and greater storm-specific variability, is expected between the PAWS rain gage and the Maddox Creek basin. Because of uncertainty over the actual rainfall in the Maddox Creek basin, HSPF validation results for individual storm events should be interpreted with caution.

Daily pan evaporation data were obtained from the Puyallup pan evaporation station, with winter months filled using the Jensen-Haise equation. The Puyallup station operated from water year 1960-1995. Daily values prior to 1960 (by others) and for 1996 and 1997 were assumed to have been copied from existing years. Evaporation values for water year 1998 and subsequent years were based on long term monthly averages. The latter assumption may not be appropriate for evaluating summer low flows but will have negligible impact on modeled storm flows.

Land Use Update for Current (Year 2002) Conditions

Land use characteristics representing current (year 2002) conditions were approximated as an average of estimates from the 1995 CSWMP of then-current (1991) and future buildout conditions for each sub-basin. This approach was based on a cursory visual inspection of basin aerial photographs showing the basin conditions in years 1992 and 2001. This was considered to be a reasonable and cost-effective approach.

Previous estimates of sub-basin land-use conditions were not tabulated in the 1995 CSWMP and had to be recovered from a combination of sources. Data sources included: 1) HSPF input sequences from 1993 of existing and future conditions, prior to the addition of sub-basin 51 above the Little Mountain Estates Pond; 2) a land-use breakdown (estimated in 1993) for sub-basin 51; and 3) an HSPF input sequence of future buildout land use conditions, based on a reanalysis of land-use by RW Beck in 2000. Table 1 summarizes the land-use conditions used for the current work, developed from the above sources.

Three irregularities were noted during the review of the previously-developed land-use data. First, the year 1993 and year 2000 estimates of the areas of sub-basins 19 and 52 differed by 24 acres or 4% of the combined total area of 614 acres. The reason for the difference is unclear, but may be due to use of different map products for the two analyses. The difference is small in relation to the total basin area and is felt to be inconsequential to model results. Second, in sub-basin 22 (which includes the Flowers Creek basin and about 1.3 miles of I-5 highway corridor) the year 2000 estimate of future impervious surface was 78 acres greater than the year 1993 estimate, even though both estimates were reportedly based on the same RW Beck land use mapping. The discrepancy was reduced, but not eliminated, by excluding 20 acres representing rooftop drainage in an area served by a combined sanitary-storm sewer. The third irregularity is in sub-basin 37 which includes lower Maddox Creek from Hickox Road to the confluence with Flowers Creek. The previous land use analysis for sub-basin 37 did not show any change in land use between the current (1991) and future buildout conditions. The "future" land use data based on the past work and recreated here is therefore believed to reflect outdated 1991 conditions rather than a future buildout scenario.

Note that the future land use data presented in Table 1 were used in the current study as a means to estimate the current land use, but were not used to develop a new future-conditions HSPF hydrologic model of the basin. The focus of the current study was to calibrate the HSPF model to flows recorded near the city urban growth boundary and, using an FEQ hydraulic model with previously-estimated future conditions flows, to assess the impacts of lower basin channel encroachment.

Table 1
Maddox Creek Soil and Land Use Data for HSPF Modeling
Land Use In Acres

1991 Existing Conditions (estimated in 1993)

	SB 51	SB 19	SB 34	SB 22	SB 37	TOTAL
Till Forest	174.0	146.5	218.0	82.2	76.4	697.1
Till Pasture	80.0	114.3	54.6	78.2	84.4	411.6
Till Grass	15.0	23.8	0.1	155.0	-	193.9
Outwash Forest	-	-	-	-	24.1	24.1
Outwash Pasture	5.0	24.2	-	-	13.4	42.6
Custer Norma Grass	-	-	-	28.5	303.0	331.5
Saturated	4.0	13.2	11.8	-	-	29.0
Impervious (EIA)	5.0	9.7	0.9	102.9	115.2	233.6
TOTAL	283.0	331.7	285.5	446.8	616.4	1963.3

2002 Existing Conditions (estimated in 2003)

	SB 51	SB 19	SB 34	SB 22	SB 37	TOTAL
Till Forest	100.1	95.7	200.1	82.3	82.2	560.4
Till Pasture	102.1	77.2	51.1	57.5	62.3	350.1
Till Grass	53.8	123.1	20.1	146.9	15.9	359.8
Outwash Forest	-	-	-	-	23.7	23.7
Outwash Pasture	6.0	12.1	-	-	13.7	31.8
Custer Norma Grass	-	-	-	27.5	301.9	329.4
Saturated	2.0	14.3	11.8	-	-	28.1
Impervious (EIA)	6.8	21.5	2.7	133.1	116.4	280.4
TOTAL	270.6	343.8	285.7	447.3	616.1	1963.6

Future Conditions (estimated in 2000, adjusted in 2003)

	SB 51	SB 19	SB 34	SB 22	SB 37	TOTAL
Till Forest	26.1	44.9	182.2	82.3	88.1	423.6
Till Pasture	124.1	40.0	47.6	36.8	40.1	288.6
Till Grass	92.5	222.4	40.0	138.9	31.9	525.7
Outwash Forest	-	-	-	-	23.3	23.3
Outwash Pasture	6.9	-	-	-	14.0	20.9
Custer Norma Grass	-	-	-	26.5	300.9	327.4
Saturated	-	15.3	11.7	-	-	27.1
Impervious (EIA)	8.6	33.2	4.4	163.3	117.6	327.2
TOTAL	258.2	355.8	286.0	447.9	615.9	1963.8

NOTE: Future conditions adjustment in 2003 was to reduce the SB 22 impervious area by 19.6 acres, which is the amount by which the total SB 22 area (estimated in 2000) exceeded the original SB 22 area (estimated in 1993). The increased total and impervious area in the year 2000 estimate is thought to have resulted from not deducting areas of roofs in SB 22, which drain to the sanitary sewer. Figure III-5 of the 1995 CSWMP shows that such areas exist.

Existing Detention Pond Update

The effects of existing detention ponds in the Maddox Creek basin were ignored in the existing conditions (2002) model, except for a large regional detention pond at Little Mountain Estates. This approach is the same as was adopted for the 1995 CSWMP. The rationale for ignoring other existing ponds is uncertainty over the historical ineffective design standards that regulated the design of these facilities, coupled with the expense of researching and modeling multiple discrete facilities which likely provide little peak flow control during major storm events. Consideration was given to modeling a new large detention pond in the Flowers Creek basin (part of model sub-basin 22), but this was not done in favor of putting more effort towards developing realistic channel storage characteristics for modeling the lower basin.

The regional detention pond at Little Mountain Estates is a significant facility which provides peak flow control for the entire basin (model sub-basin 51) upstream of the pond. As originally designed, a side weir on the main Maddox Creek channel was intended to split high streamflows into the detention facility while allowing relatively low flows to remain in the channel. However, the side weir failed after a short period of service, causing the entire creek flow to be directed into the pond. Sandbags have been placed as a temporary measure to keep at least some flow in the main channel, but these are expected to be ineffective under high flow conditions. Work is underway by the City to address the failed side weir.

For assessing current (year 2001-02) basin conditions, the HSPF model was configured to have the Little Mountain Estates pond receive 100% of the upper basin flows, reflecting the failed condition of the side weir during the validation period. Prior estimates of pond stage, area, and volume characteristics were retrieved from working files for the 1995 CSWMP. The outlet structure stage-discharge relationship was re-computed to accurately represent the hydraulic controls described in facility as-built drawings. Table 2 summarizes the hydraulic characteristics of the pond in its as-built configuration, assuming unobstructed orifices and no backwater effects from the outlet channel.

Table 2
Little Mountain Estates Detention Pond
As-Built Hydraulic Characteristics**

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow (cfs)
0.0	0.1	0.0	0.0
0.5	1.5	0.0	1.2
5.0	1.5	5.1	3.9
5.5	1.5	5.8	4.1
6.0	1.5	6.6	5.7
6.5	1.5	7.2	9.4
7.0	1.5	8.1	17.2
7.5	1.5	8.7	28.3
8.0	1.5	9.6	42.5
8.5	1.5	10.6	65.2
9.0	1.5	11.2	111.5

** The flows in Table 2 above reflect the discharges computed through four orifices at pond depths of 0.0 through 6.4 feet and a control structure overflow riser at a depth of 7.6 feet. The crest (overflow) elevation of the pond emergency spillway is at a pond depth of 8.4 feet.

Lower Basin Storage Update

Previous HSPF modeling of the Maddox Creek basin did not incorporate any channel storage below the original calibration point located about 1,200 feet upstream from Anderson Road. For the current work, lower basin channel storage was estimated by modifying an FEQ (Full Equations) hydraulic model developed for a separate project along lower Maddox Creek. This model[1] includes the lower reach of Maddox Creek from Hickox Road to the inlet side of a long culvert crossing I-5, and simulates hydraulic conditions for the month of November 1990 with inflows based on basin future conditions as estimated by RW Beck. November 1990 produced the highest peak flows in the hydrologic simulation period of January 1956 through February 1993. The original FEQ model was set up to route flows from the entire month of November 1990 because the large amount of flood storage along lower Maddox Creek would cause peak water levels to be the result of a prolonged large-volume event rather than a 24-hour peak flow event.

For the present work, the upstream limit of the original FEQ model for November 1990 was extended upstream about 1,600 feet to the confluence of Maddox Creek and Flowers Creek. Model output was processed at 12-hour increments to identify flows at Hickox Road and the

[1] The source (original) FEQ model is described in the July 2002 report "Maddox Creek Hydraulic and Hydrologic Analysis-Final," prepared by RW Beck for the City of Mount Vernon

corresponding total channel and floodplain storage between Hickox Road and the confluence with Flowers Creek. Figure 2 provides a sketch of the lower reach covered by this analysis and also a plot of the resulting volume-discharge data used in the HSPF model.

Analysis of the FEQ model results determined that nearly 120 acre-feet of water could be stored in the lower Maddox Creek channel and floodplain areas during a major flood such as occurred in November 1990. To put this in some context, the regional detention pond at Little Mountain Estates has a total storage volume of only about 11 acre-feet before overflow.

The HSPF model update work did not attempt to develop (and does not include) an accurate estimate of additional storage in model sub-basin 22, upstream of the confluence with Flowers Creek. This area consists of the Flowers Creek channel and roadway ditches along approximately 1.3 miles of I-5 highway corridor. From a cursory review, storage in this area is expected to be small relative to the lower basin storage shown in Figure 2.

Comparison of Maddox Creek Simulated and Recorded Flows at Hickox Road

Continuous water level and velocity data for Maddox Creek at Hickox Road have been collected since May 9, 2001 at a site known as the Carpenter School gage. Preliminary streamflow data from that gage through September 23, 2002, were provided to **nhc** for purposes of comparison with the simulation results from the updated HSPF model for current (year 2002) conditions.

A review of the preliminary streamflow data sets and comparison with available stream gaging measurements determined that reliable continuous streamflow data were available only for the months of December 2001 through February 2002. This period of reliable streamflow record includes an event on December 13, 2001 with a peak flow having about a 2-year recurrence interval, based on subsequent analysis.

Figure 3 presents HSPF simulation results, using USGS generalized parameters, for Maddox Creek at Hickox Road for water years 2001 and 2002 (October 2000 through September 2002). Figures 4, 5, and 6 compare the simulation results from the updated HSPF model with recorded flows at Hickox Road for the months of December 2001 through February 2002, for which the recorded streamflow data are reliable. Two versions of updated HSPF model results are presented to provide an assessment of the runoff parameters used in the HSPF modeling. The first set of HSPF simulation results uses the 1993 calibration parameters developed during preparation of the 1995 CSWMP. The second set of HSPF simulation results uses generalized parameters published by the USGS for basins in Western King and Snohomish Counties (Dinicola, 1990). It can be seen from Figures 4 through 6 that, of the two HSPF simulations, the flows produced with the USGS generalized parameters provide the best fit to the recorded data and a reasonably good reproduction of the recorded peak flows and volumes for these months. Subsequent HSPF simulations for the Maddox Creek basin are based exclusively on the USGS generalized parameters.

Comparison of Maddox Creek Simulated and Recorded Flows at Former Calibration Point above Anderson Road

The original Maddox Creek HSPF model was calibrated to streamflow data collected during the 1991-92 and 1992-93 wet weather seasons at a culvert located 1,200 feet upstream from Anderson Road, using concurrent 15-minute rainfall data collected at the Mount Vernon Waste Water Treatment Plant. The largest flow during the original calibration period had a return period estimated as approximately a three-year event, resulting from a storm on January 11, 1992.

The basin tributary to that original calibration point is relatively steep-sloped and well-drained. As a check on the revised parameter selection, an HSPF model input sequence was developed using the USGS generalized parameters and the 1991 land cover data from Table 1. The model was run to evaluate whether the use of USGS generalized parameters, in place of the calibration parameters developed for the 1995 CSWMP, would adversely affect model ability to simulate flows in the upper basin.

In the updated model for 1991 conditions, groundwater from the upper basin was assumed to bypass the original calibration gage site, emerging instead in the flat lands of the lower basin. This groundwater routing assumption is different from that in the earlier work; the change was made to improve model calibration while using the generalized parameters. The original model for the 1995 CSWMP assumed that upper basin groundwater would be measurable as streamflow at the original calibration gage site, and the model parameters had been adjusted to suppress groundwater flow.

Available results of the original calibration are limited to a single figure in the 1995 CSWMP showing simulated and recorded flows for a flood event in the period January 9-13, 1992. Figure 7 superimposes a plot of the updated simulation results onto an image of that figure. It can be seen from Figure 7 that the use of the USGS generalized parameters, together with updated groundwater routing assumptions, produces simulated flows which are in reasonable agreement with the recorded flows for the upper basin gage site and are at least as good as the original calibration results. This finding supports the use of the USGS generalized parameters for subsequent HSPF simulations in the Maddox Creek basin.

Maddox Creek Updated Flood Frequency Curves for Existing Conditions

Flood frequency curves for Maddox Creek were developed from the updated HSPF simulation results. Figure 8 plots the current-condition (year 2002) flood frequency curves for all five sub-basins represented in the updated Maddox Creek HSPF model.

Table 3 provides a summary of the flood quantiles for the basin, based on a visual evaluation of the frequency curve plots. Note that these curves reflect the current (failed) condition of the side weir at the Little Mountain Estates regional detention pond, and that land use in the lower basin (model sub-basin 37) reflects 1991 rather than 2002 conditions.

Table 3
Maddox Creek Peak Flows, Existing (2002) Conditions

Location (Cumulative flows to sub-basin outlet)	Flows (cfs) by Recurrence Interval			
	2-year	10-year	50-year	100-year
SB 51 - Maddox Creek Below Little Mountain Estates Pond	4	11	13	14
SB 19 - Maddox Creek at Blackburn Road	19	34	55	67
SB 34 - Maddox Creek 1200 ft above Anderson Road	28	61	90	105
SB 22 - Flowers Creek & I-5 Highway Corridor	46	77	95	100
SB 37 - Maddox Creek at Hickox Road	46	75	90	95

Lower Basin Channel Encroachment Assessment

The FEQ hydraulic model was used to assess the hydraulic impacts of possible channel encroachment in the lower basin. The FEQ model used for this purpose was the same model which was used to develop the stage-storage relationship presented in Figure 2 for the lower basin area.

Flood-prone areas in the lower Maddox Creek basin were identified from output of the FEQ model. As stated previously, this model computes flows and water levels for the month of November 1990 assuming future basin conditions as simulated by RW Beck. The peak flows and water levels determined from the model results reflect a major flood with a recurrence interval likely in the range 50 to 100 years.

Approximate inundation limits corresponding to the FEQ estimates of flood event peak water levels were estimated using City digital topographic mapping with two-foot contour intervals. Figure 9 presents the Maddox Creek inundation limits on a standard USGS base map. Included on Figure 9 are peak water levels and flows for the base condition of current channel conditions as well as for alternative encroachment scenarios discussed below.

Two encroachment scenarios were assessed. The first and most severe scenario assumed a 25-foot wide buffer from the centerline of channel, providing a total stream corridor width of 50 feet for both natural and ditched sections of channel. In the second scenario, the 25-foot buffer was retained for ditched sections of channel, and a 100-foot buffer (providing a 200-foot wide stream corridor) was assumed for the natural channel reaches. Figure 9 shows the locations of the ditched and natural sections of channel. The natural channel is located to the east of Interstate 5; the ditched reach of channel is located west of Interstate 5 and is connected to the natural channel by culverts beneath the highway. The modeling of these encroachment scenarios assumes that fill (eliminating floodplain storage) will be placed to the encroachment limits and that flow will be confined to the protected stream corridor.

Assessment results are summarized in Figure 9. The results show that both encroachment scenarios will result in noticeably higher peak water levels within the city as well as higher peak flows where Maddox Creek flows cross the city urban growth boundary at Hickox Road. The greatest water level increase of up to 1.6 feet will occur at the upper end of the ditched reach of channel, causing upstream backwater impacts of up to 1.3 feet in the natural channel. Very similar water level impacts will occur with both scenarios, presumably because the greatest impacts are associated with encroachment along the ditched section of channel where a constant 25-foot buffer (50-foot corridor) was assumed for both scenarios.

The combined peak flows at the ditch and channel crossings of Hickox Road (flow points 4 and 2 on Figure 9) would increase by up to 50%, from a base condition of 132 cfs to 200 cfs under the first encroachment scenario and 182 cfs under the second encroachment scenario. It should be noted that all of the modeled scenarios assume future buildout of the basin without effective onsite flow control and result in conservatively high estimates of peak flow. However, because the identical hydrology is assumed in each of the modeled scenarios, the estimated changes to peak flows and water levels provide a reasonable measure for comparison of the alternatives.

Summary

The HSPF model for Maddox Creek was updated with meteorological data through December 2002, realistic storage data for the flat lower basin, and land use data reflecting current (year 2002) conditions. Simulation results from two versions of the updated model—one version using calibrated parameters from the 1995 CSWMP and a revised version using USGS generalized parameters and alternative groundwater routing assumptions—were compared to available observed streamflow data for Maddox Creek at Hickox Road. Results from the revised model using USGS generalized parameters produced the best match to the observed flows. Simulation results using USGS generalized parameters and 1991 land use data were then compared to calibration results presented in the 1995 CSWMP for a site located upstream from Anderson Road. The results of the revised model are at least as good as those of the earlier work in matching observed streamflows at the original calibration site.

The updated HSPF model for Maddox Creek produces credible results based on comparisons of simulated and observed flows in the upper basin above Anderson Road and in the lower basin at Hickox Road. Conditions represented in the current-conditions (year 2002) model include the failed side weir at the Little Mountain Estates regional detention pond, and considerable channel and floodplain storage in the lower basin below the confluence of Flowers and Maddox Creeks. Application of the models, particularly for future land-use conditions, should be done with caution. The potential loss of storage, resulting from fill placement at flood-prone properties that would likely occur during development of the lower basin, could have a significant effect on peak flows at the City's urban growth boundary.

Potential loss of floodplain storage in the lower basin could result in Maddox Creek the future condition 100-year peak flows at the City's urban growth boundary (Hickox Road) being increased by as much as 50% above conditions without floodplain fill. Maddox Creek flood water levels within the city limits could be locally increased by up to 1.6 feet.

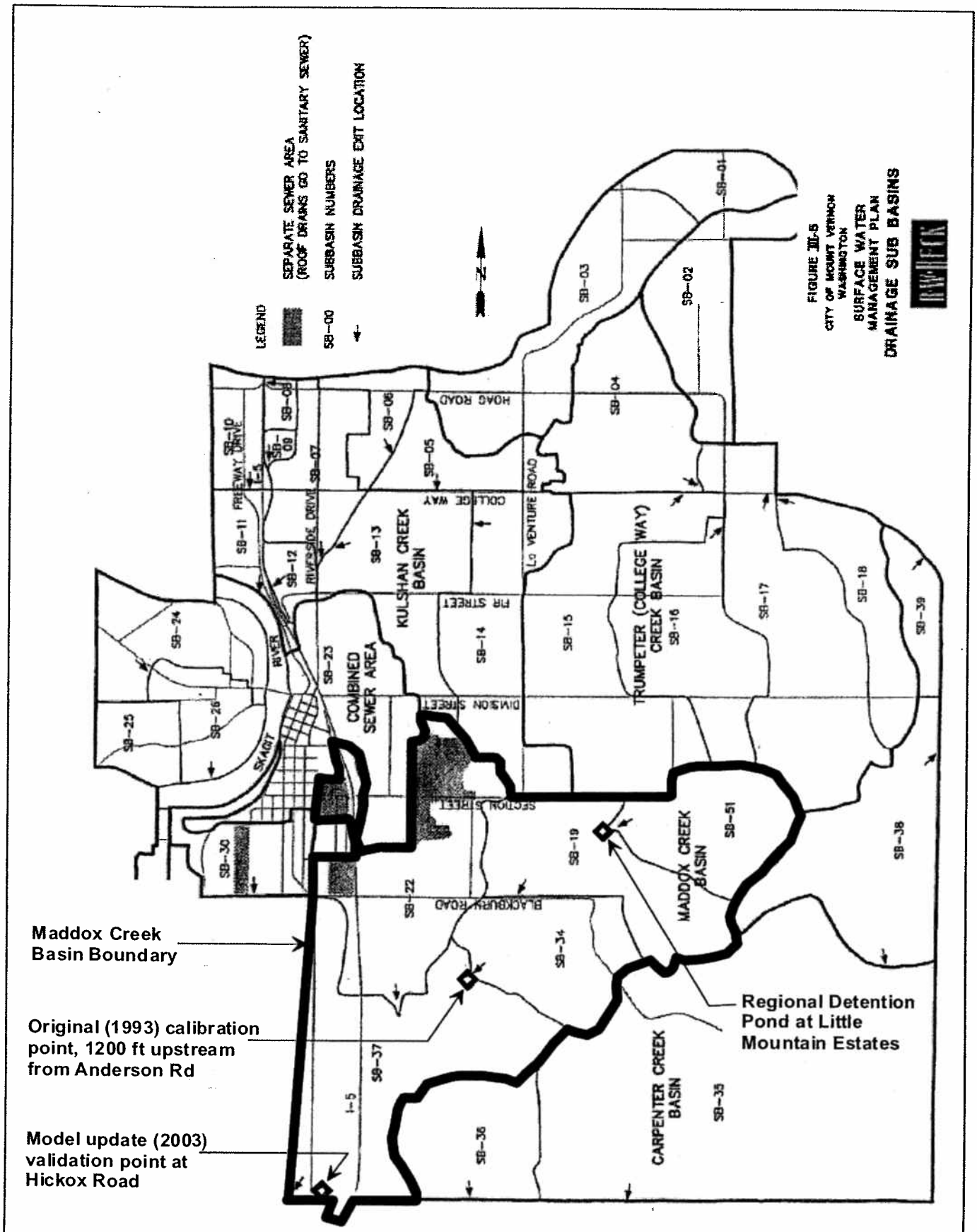

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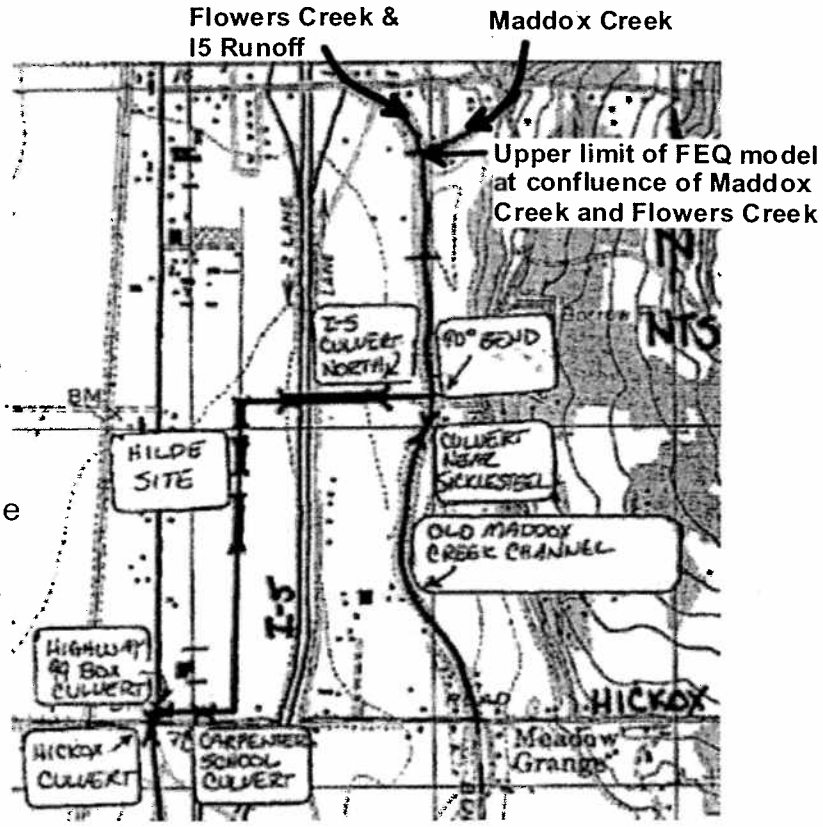
FIGURE 1
Sub-Basin Boundaries from 1995 CSWMP

Stage-storage points for the lower Maddox Creek basin determined by an FEQ hydraulic model of the reaches shown, beginning at the confluence of Maddox and Flowers Creeks and ending at Hickox Road.

The old Maddox Creek channel above Hickox road is included in the storage calculations, in addition to storage in the active ditched reach. Storage amounts are paired with FEQ-modeled discharges at "Hickox Culvert."



Base Map of FEQ model components from RW Beck Report dated July 2002

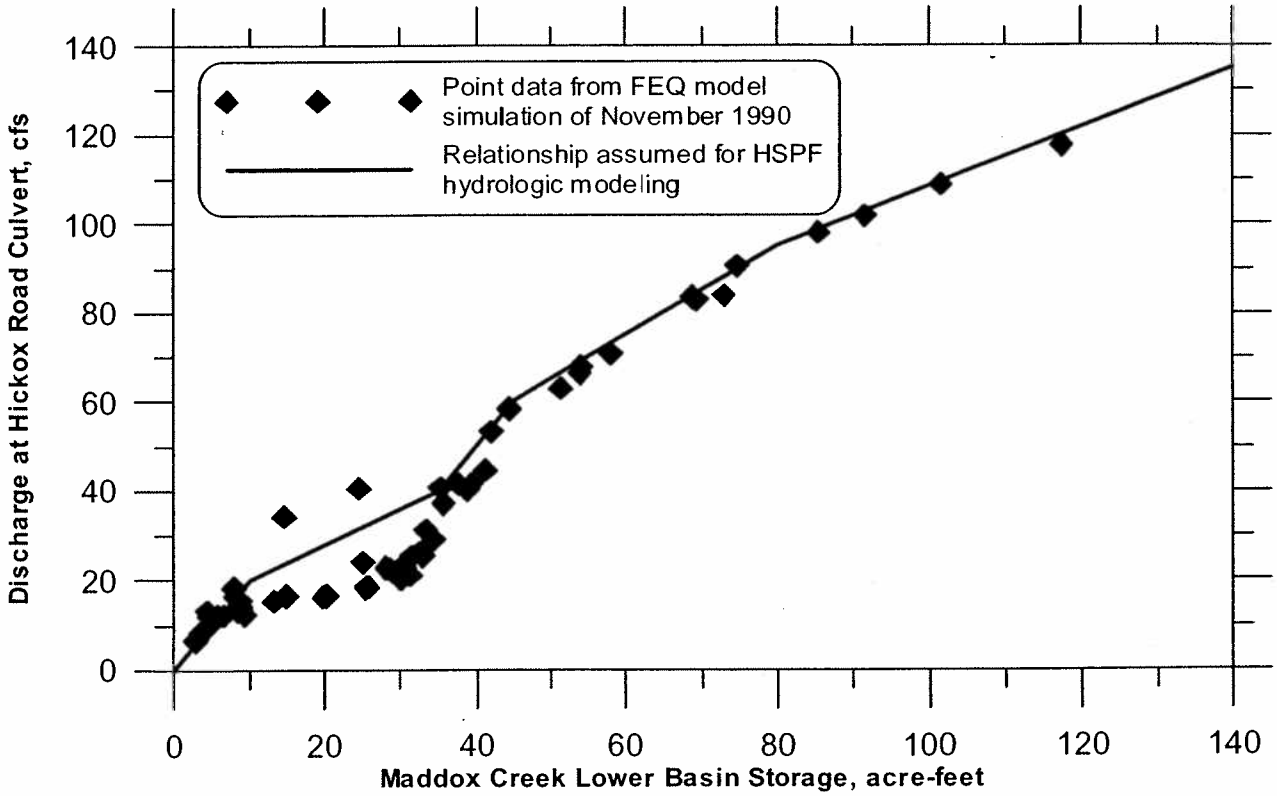


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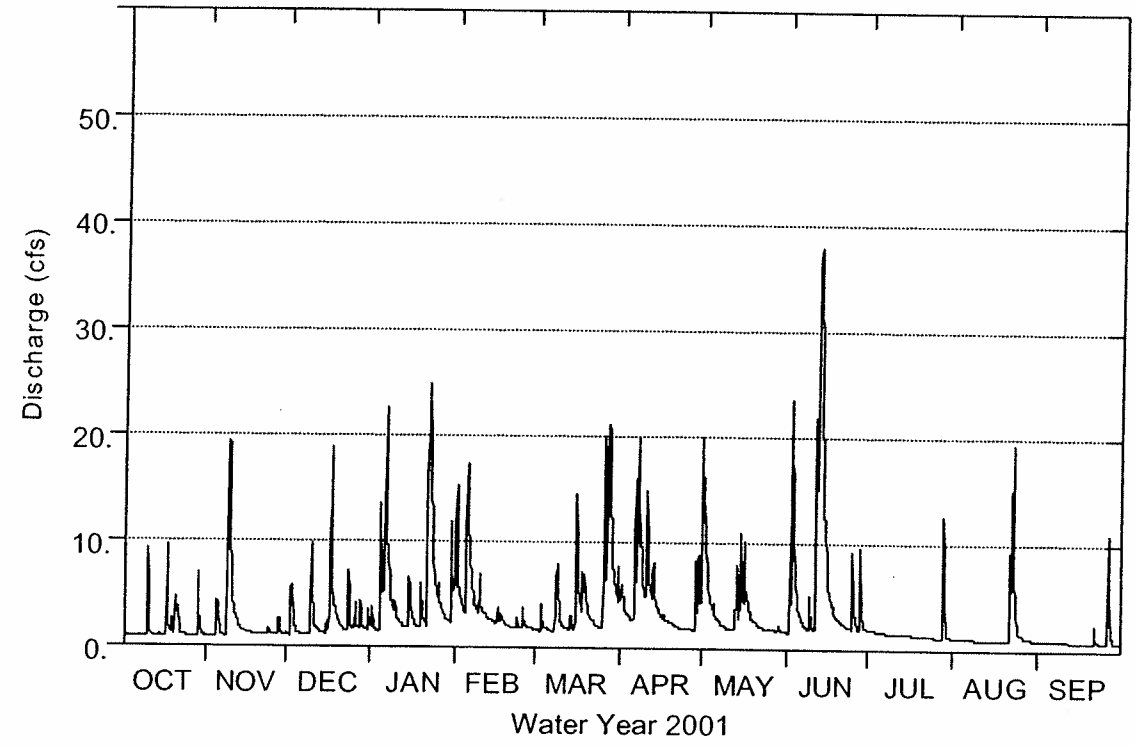
FIGURE 2
Maddox Creek Lower Basin Storage

Maddox Creek at Hickox Road
HSPF Simulated Flows With USGS Generalized Parameters



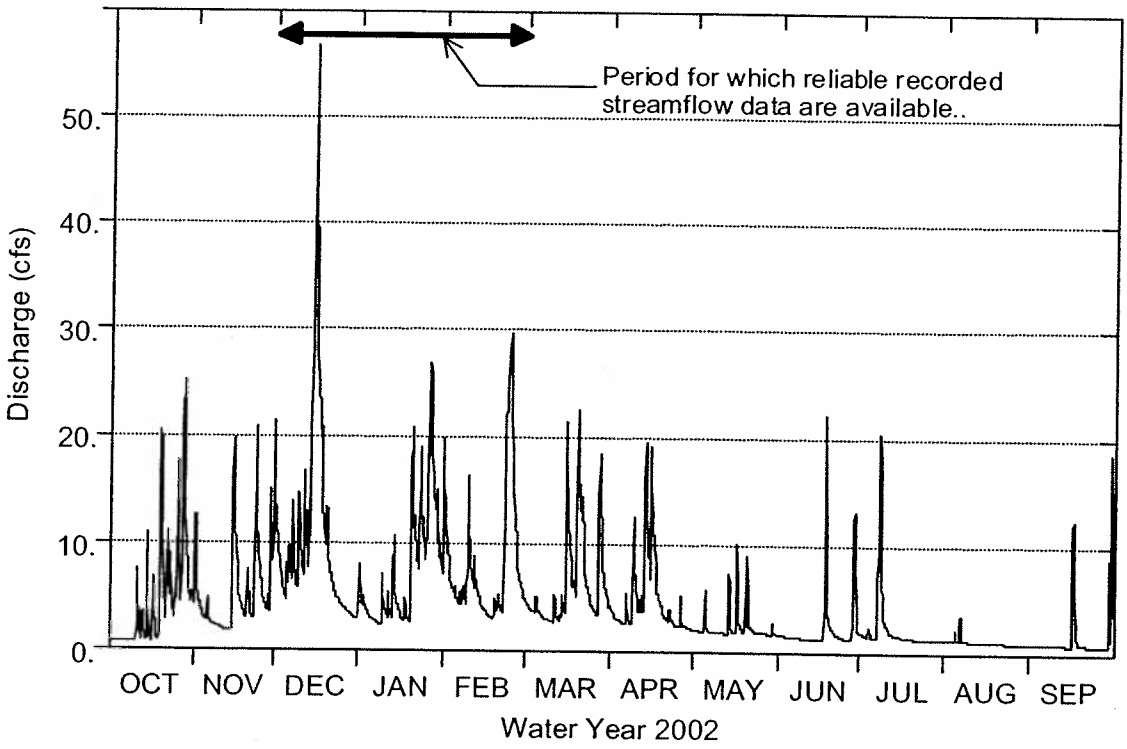


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FIGURE 3
Simulated Flows at Gage Site, 2001-02

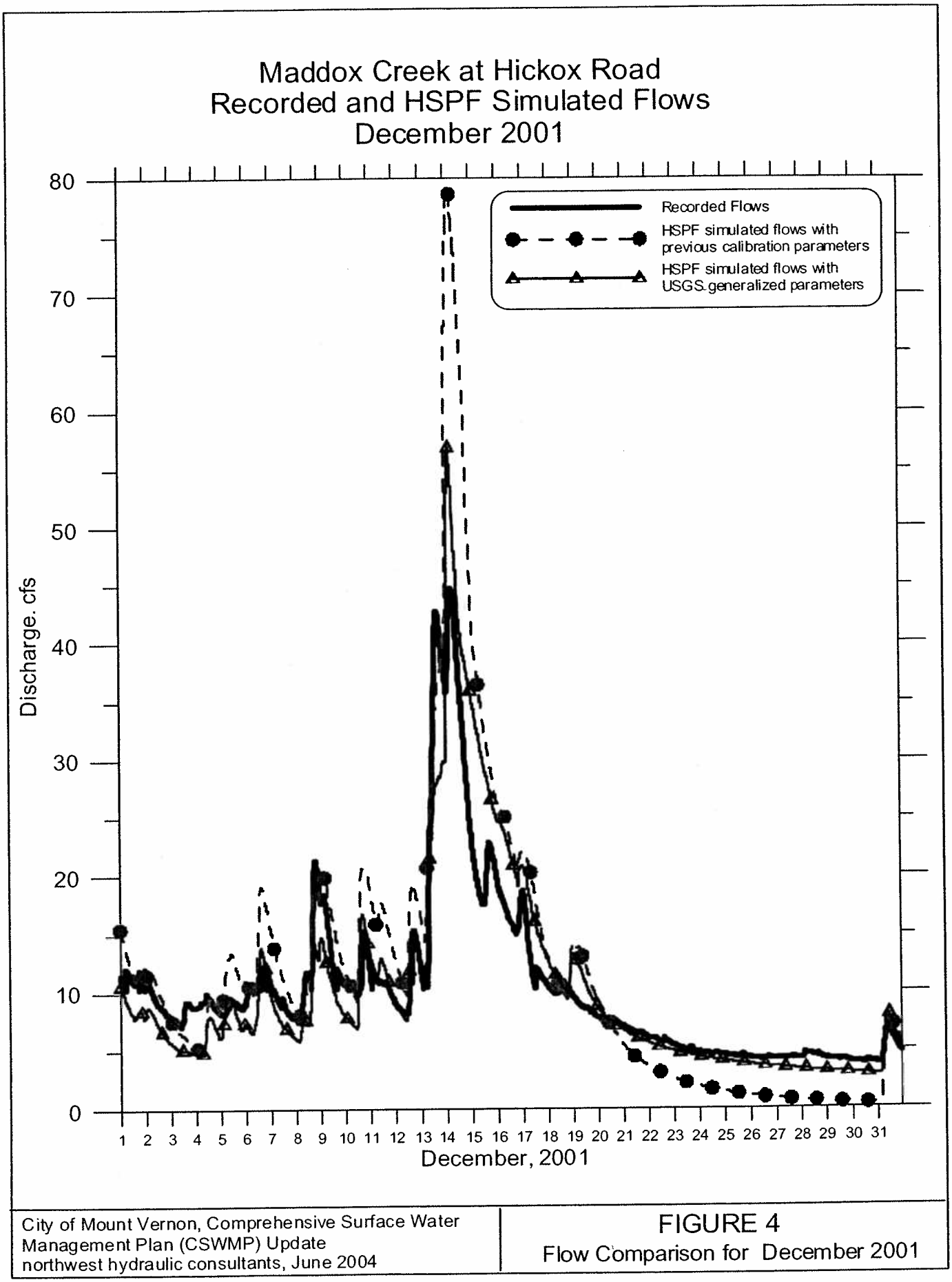

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FIGURE 4
Flow Comparison for December 2001

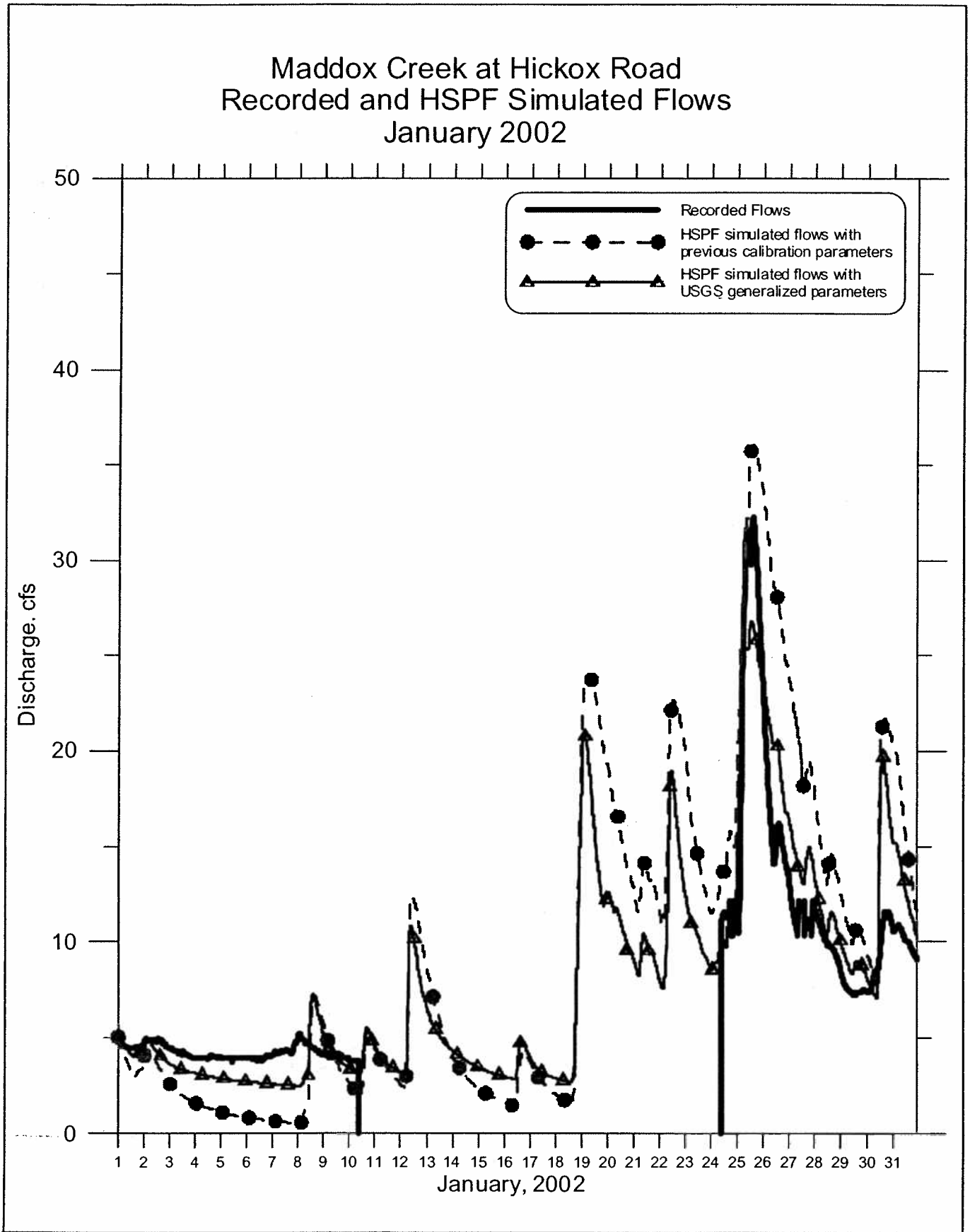

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FIGURE 5
Flow Comparison for January 2002

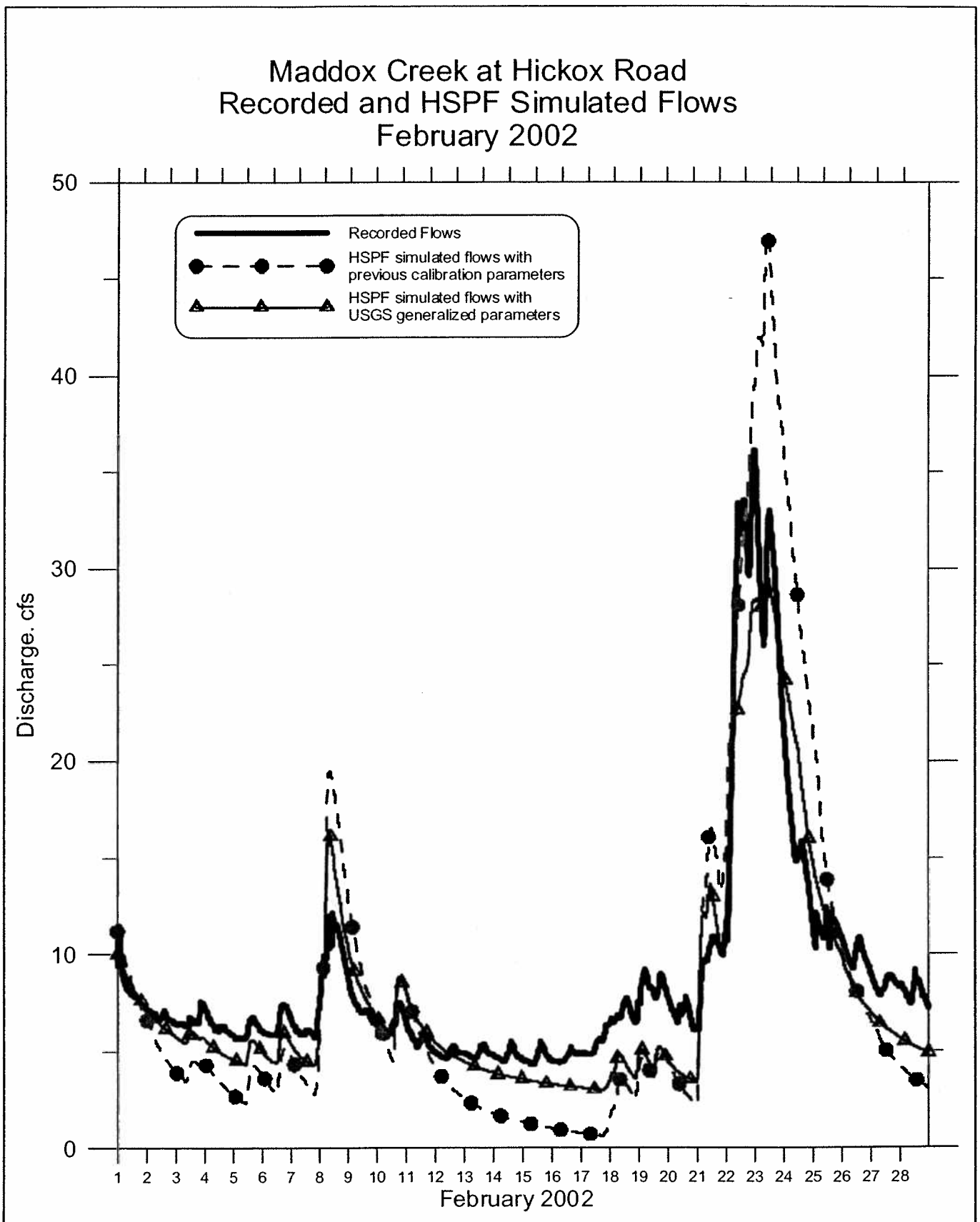

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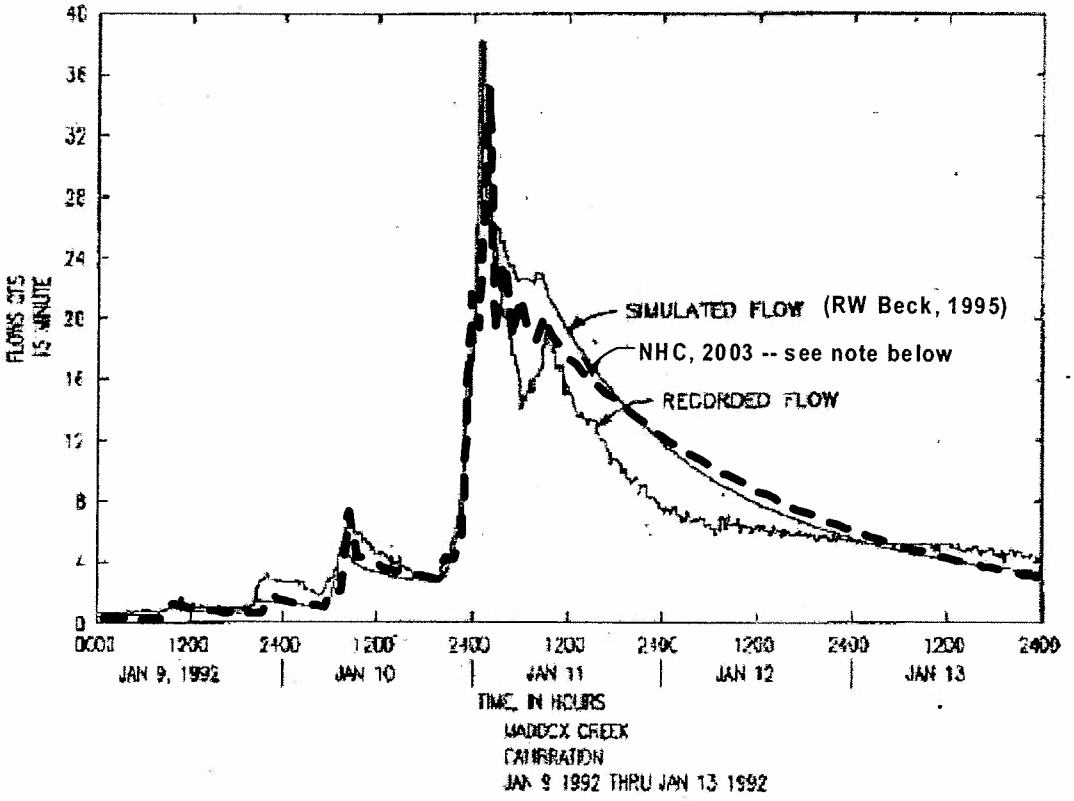
FIGURE 6
Flow Comparison for February 2002

Maddox Creek above Anderson Road
Recorded and HSPF Simulated Flows
January 1992 Event



Heavy dashed line shows HSPF hourly simulation results by NHC in 2003 using 1990 land use data, USGS generalized HSPF parameters for King and Snohomish Counties, and hourly rainfall data from the NOAA Burlington gage.

In the NHC simulations with USGS generalized parameters, groundwater in the upper basin is assumed to surface in the the lower basin, and does not contribute to streamflows at the calibration location represented in the above plot.

FIGURE IV-1
CITY OF MOUNT VERNON
SURFACE WATER MANAGEMENT PLAN
HSPF RESULTS FOR JANUARY 1992 EVENT ON MADDOX CREEK

R.W. BECK AND ASSOCIATES

City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update
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FIGURE 7
Flow Comparison for January 1992 Event

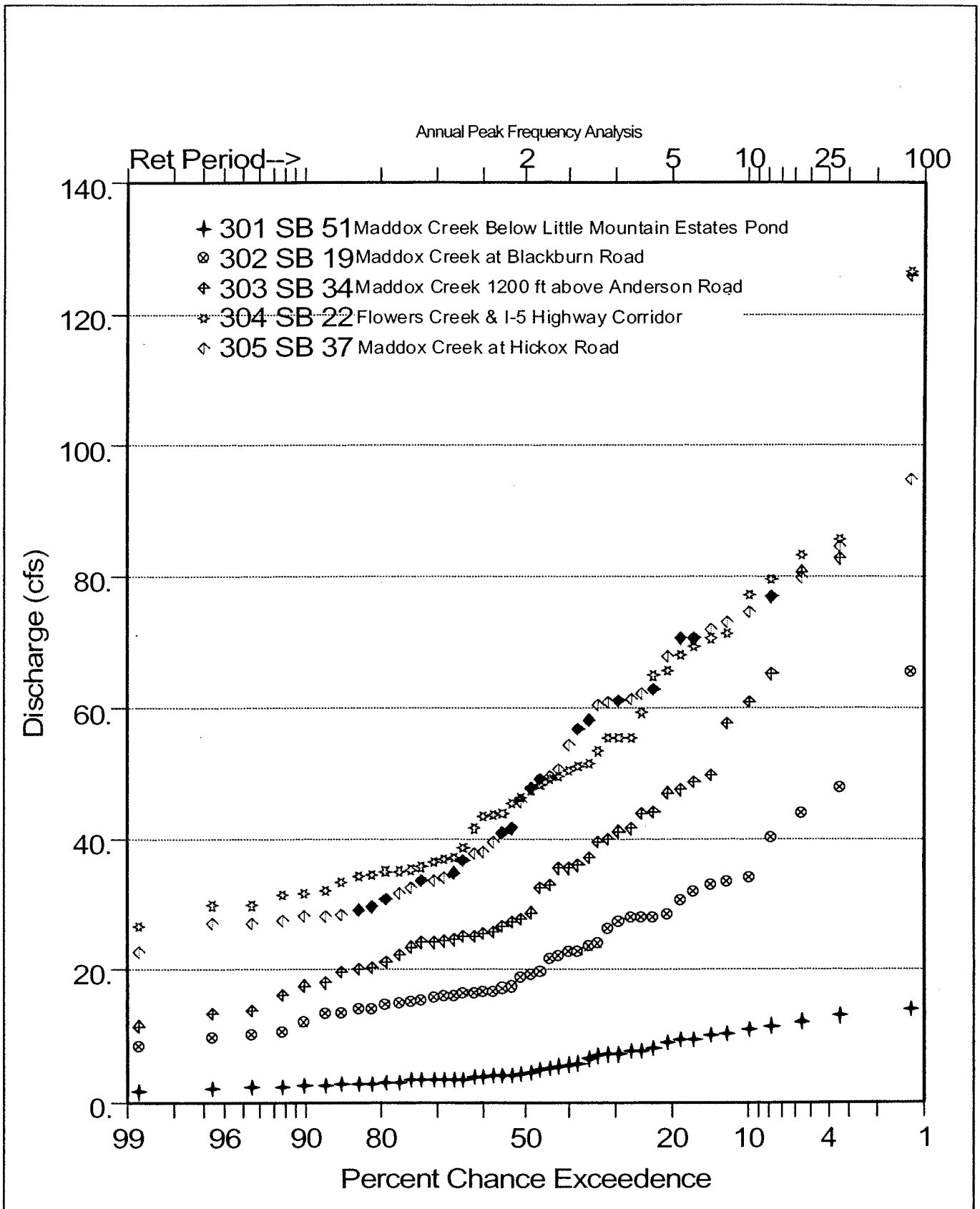

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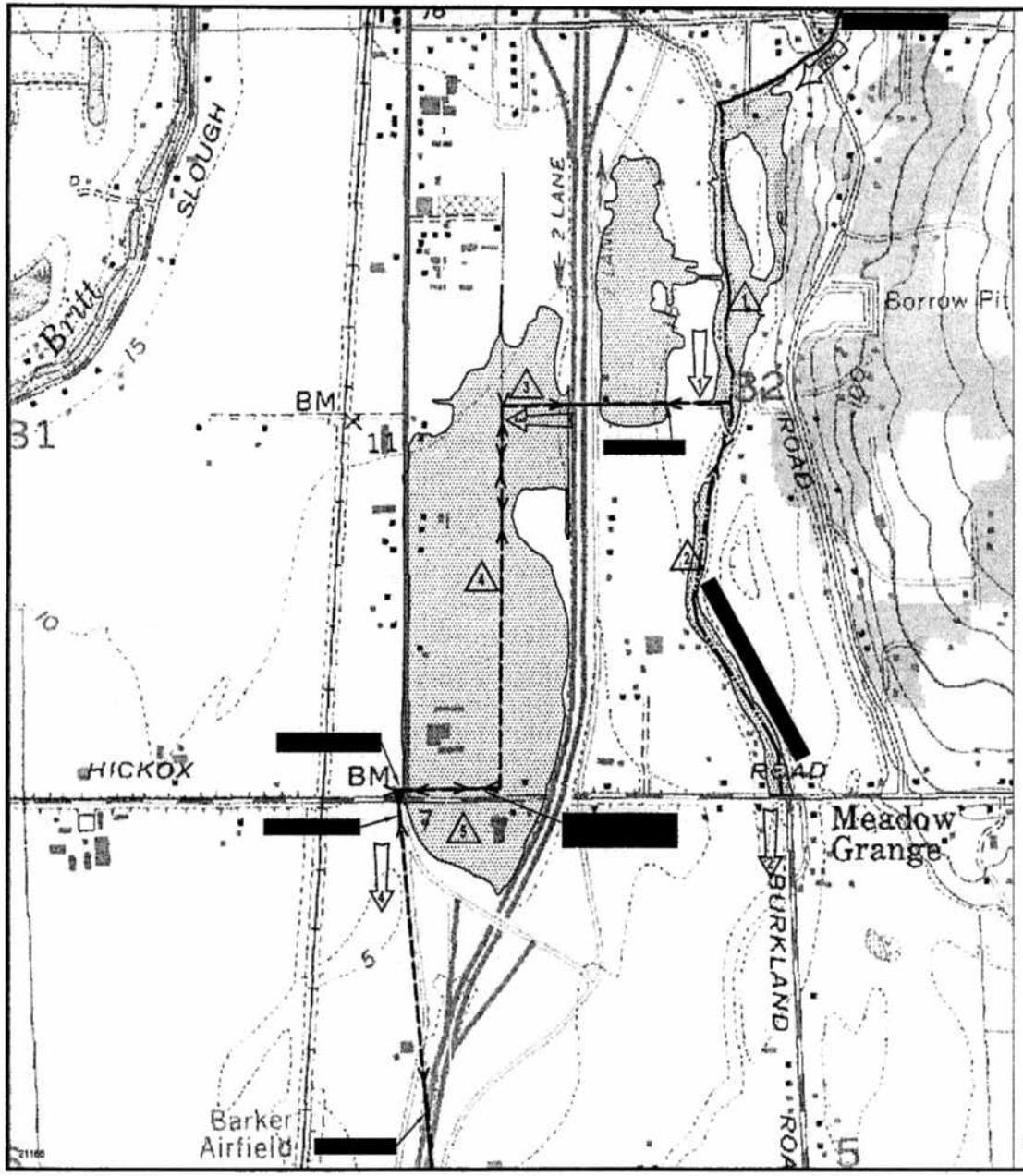
FIGURE 8
Peak Flows, Existing (Year 2002) Conditions



Legend

- Natural Channel
- Ditched Channel
- Base Condition Flood Innundation Limits
- Peak Water Levels Along Channel Reach
- Peak Flows

Base Condition Scenario:

Peak flows, peak water levels, and innundation limits derived from an FEQ model of Maddox Creek for the flood event of November 1990, developed by RW Beck for the City of Mount Vernon (July 2002). Hydrology for the base condition and all scenarios reflects future build-out of the tributary basin.

Alternative 1 Encroachment Scenario:

Establish a buffer (no fill) width of 25 feet from centerline of channel. This provides a stream corridor 50 feet wide for both natural and ditched sections of channel.

Alternative 2 Encroachment Scenario:

Establish a buffer (no fill) width of 25 feet from centerline of ditched reaches of channel, and of 100 feet from centerline of natural reaches of channel. This provides a stream corridor 200 feet wide for natural sections, including the now-abandoned segment of natural channel upstream from Hickox Road.

Peak Water Levels:

1. Base: 15.3'
   Alt 1: 16.6'
   Alt 2: 16.5'
2. Base: 12.0'
   Alt 1: 12.1' - 12.3'
   Alt 2: 12.1' - 12.2'
3. Base: 9.3' - 9.4'
   Alt 1: 10.9'
   Alt 2: 10.7'
4. Base: 9.2 - 9.3',
   Alt 1: 9.5 - 10.9'
   Alt 2: 9.4' - 10.7'
5. Base: 9.2'
   Alt 1: 9.3' - 9.4'
   Alt 2: 9.3'

Peak Flows:

- Base: 111cfs
  Alt 1: 186 cfs
  Alt 2: 162 cfs
- Base: 15 cfs
  Alt 1: 57 cfs
  Alt 2: 50 cfs
- Base: 123 cfs
  Alt 1: 151 cfs
  Alt 2: 136 cfs
- Base: 117 cfs
  Alt 1: 143 cfs
  Alt 2: 132 cfs

800 0 800 1600 feet

Lower Maddox Creek Flood Assessment

November 1990 Event Peak Flows & Water Levels

northwest hydraulic consultants inc.

Date: June 2004 | Figure 9

TECHNICAL MEMORANDUM #2

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Prepared For: CH2M HILL

Prepared By: Bill Rozeboom, P.E.

Subject: City of Mount Vernon Comprehensive Surface Water Management Plan Update; Freeway Drive Basin Update.

Date: June 30, 2004

Introduction

The Freeway Drive basin is a poorly drained area along the Freeway Drive commercial district in the northwest corner of the city of Mount Vernon. Basin boundaries are shown by Figure 1. The basin is confined by diked reaches of the Skagit River to the north and to the south, and by the city limits to the west. The eastern boundary to the basin generally follows the I-5 highway corridor and includes some additional area along the northern city limit adjacent to the Skagit River east of I-5. The natural drainage from the basin is by a combination of infiltration and unconcentrated surface flow to the agricultural lands west of the city. The area west of the city is contained within a meander loop of the Skagit River and includes Ledger Lake as a closed depression drainage feature and a surface expression of the local groundwater table.

College Way divides the Freeway Drive basin approximately in half. The area to the south of College Way, sub-basin 11 on Figure 1, presently lacks a defined drainage outlet, and most runoff from this area either infiltrates to groundwater or flows westward to Ledger Lake. The area to the north of College Way, including sub-basins 8, 8A, and 10, is served by a regional drainage system including a large stormwater detention pond adjacent to Lowe's Hardware and a stormwater pump station located near the intersection of College Way and Freeway Drive. The basin stormwater system does not have a gravity outlet; runoff either infiltrates as seepage from the stormwater system or is pumped to the Skagit River.

Hydrologic analysis was performed to investigate the performance of the Freeway Drive pump station for current and future conditions. The Hydrologic Simulation Program – Fortran (HSPF) was used for this analysis.

HSPF hydrologic models for the Freeway Drive basin were originally developed in 1993 during preparation of the 1995 City of Mount Vernon Comprehensive Surface Water Management Plan (CSWMP). In the current work, the models for current and future conditions were updated with meteorological data through December 2002, and modified to reflect updated estimates of pump station capacity, stormwater storage, and land use. The

updated models were used to determine the current level of system performance and to identify the system pump station improvements which would be needed for future build-out of the basin.

Model Update

The revisions to the Freeway Drive Basin models involved extending the simulation period through mid-December 2002 using meteorological data sets developed during the update of the HSPF models for Maddox Creek, and developing models for past, current, and future conditions as summarized below.

- Past-Conditions (Validation) Model. A past-conditions validation model was developed to represent the historical condition of the Freeway Drive stormwater system and pump station during the period of 1994 through 2001. The modeled tributary basin area was 46 acres, and the modeled pump capacity was 1.24 cfs, consistent with past conditions.

- Current Conditions Model. A current conditions model was developed to represent the condition of the Freeway Drive stormwater system as of early 2004. The modeled tributary basin area was 82.4 acres and the modeled pump capacity was 2.95 cfs, consistent with current conditions.

- Future Conditions Models. A series of future conditions models was developed to represent buildout of the Freeway Drive basin north of College Way. The modeled tributary basin area incrementally increased by up to 56 additional acres for a total tributary basin area of 138.4 acres, and various pump station capacities were evaluated. The analysis did not include potential development in the Freeway Drive basin south of College Way.

Past-Conditions (Validation) Model

The HSPF models previously developed for the Freeway Drive basin reflected a conservative assumption of a constantly-high groundwater table which limits the amount of live storage in the regional stormwater detention pond. Conservatism was warranted because of anecdotal reports of a high groundwater table, combined with uncertain rates of seepage inflow from the Skagit River during periods of high river flow. Because the original HSPF analysis (1993) preceded the pond construction (1994), there was no opportunity for model validation at the time of the earlier work. For this update, the original existing-conditions model was reconfigured to more accurately reflect conditions since the pond was constructed and model simulation results for 1994-2001 were compared with available information on actual system performance.

Previous land use analysis of existing conditions in 1994 determined that the Freeway Drive Pump Station and the Lowe's (formerly Eagle) Hardware Regional Stormwater Pond would receive runoff from 46 acres of effective impervious surface, including the surface area of the regional pond. All pervious area in the basin, at both developed and undeveloped sites, was

assumed to not have access to the storm drain system and to not contribute any flow to the pump station. The model conservatively assumed that a constantly high groundwater table would fill the regional pond to an elevation of 19 feet and that live storage would occur only above that elevation.

A review of basin areas for the Freeway Drive stormwater system found that two offsetting adjustments to the previously-mapped basin areas are indicated. The areas involved in these adjustments are identified on Figure 1. From a December 2003 meeting with City of Mount Vernon staff, it was determined that drainage from developed areas of sub-basin 9 (previously assumed to be tributary to the Freeway Drive pump station) likely drains instead to the separate College Way system. In the prior analysis, that sub-basin had been assumed to contribute runoff from 8.6 acres of impervious surface to the pump station, representing 22% of the inflow volume in 1995. The deduction is largely offset by an additional area south of College Way which had previously been included as part of (non-tributary) sub-basin 11. The offsetting area south of College Way consists of a north-sloping corridor bounded by the centerlines of Interstate 5 to the east and Freeway Drive. For the current work it is assumed that the year 1994 tributary area to the stormwater system and pump station is 46 acres of impervious surface, as described in the earlier analysis.

The modeled basin storage in the Freeway Drive stormwater system was adjusted to better reflect actual storage conditions in the regional facilities. Significant storage volumes exist at two locations: the regional stormwater pond behind Lowe's Hardware and in a large open ditch along the west side of Freeway Drive. In the updated analysis, pumped-outflow live storage in the regional pond begins at outlet elevation 17.4 feet, which corresponds to the top of existing stoplogs at the outlet structure as confirmed by a field inspection in late 2003. Low-rate seepage flow of 0.03 inches per hour is modeled as occurring from the dead storage pool and to draw the pond down to its bottom, elevation 15.2 feet. In the previous analysis, live storage was assumed to be available only above elevation 19 feet, which is the top of stoplogs as shown on the pond engineering plans. Higher stoplogs are believed to have been initially proposed due to concerns of a high groundwater table at the pond location.

The regional stormwater pond behind Lowe's Hardware is an unlined excavation in an area mapped as having Custer Norma soils. Actual infiltration rates from this pond are expected to be highly variable due to groundwater table effects and the amount of organics and silts found at the surface. The Custer Norma soil series has a limiting infiltration capacity in the upper soil layers in the range of 0.2 to 0.6 inches per hour. If the surface layers are removed (e.g., by pond excavation), the infiltration capacity at depth can be as great as 20 inches per hour. However, the pond will tend to seal over time as sediments are deposited from the stormwater runoff, and no infiltration will occur during periods of high river level and high groundwater of concern. As a simplifying assumption, the infiltration from the dead storage pool was modeled at a conservatively low rate of 0.03 inches per hour, which is representative of relatively fine-grained Alderwood soils. That rate corresponds to 0.044 cfs over the 1.5-acre area of the pond bottom. Modeled infiltration was furthermore set to zero during relatively wet periods, when the water level in the Freeway Drive Regional Pond is in the live storage range and when the system pump station is in operation. Subsequent evaluation of model

results determined that the modeled infiltration rate produced significant drawdowns (to below elevation 17 feet) only during the summer months.

Storage in the large ditch along Freeway Drive was ignored in the previous analysis with the conservative assumption that the ditch would be replaced by a pipe system in the future. However, the ditch exists under current conditions and is now considered likely to remain in the future. In discussions with city staff in November 2003, it was concluded that future development of the Freeway Drive basin would preserve the ditch and the stormwater storage that it provides.

For the model update, regional pond stage-storage data were computed from the pond as-built engineering plans[1]. Stage-storage data for the Freeway Drive ditch were computed from a representative measured ditch section having a bottom width of 6 feet at elevation 17 feet, side slopes of 1:1, and a length of 1800 feet. The resulting storage characteristics in the Freeway Drive basin are summarized in Table 1 below. Relative to the previous analysis, the storage below the spillway crest is increased by 6.5 acre-feet in the active storage (pumped-outflow) range from elevation 17.4 to 22.5 feet and by 3.7 acre-feet in the limited-use storage (seepage outflow) range below 17.4 feet.

Table 1
Freeway Drive Basin Regional System Stormwater Storage

Regional Pond Reference Point	Elevation Feet	Storage Volume, Acre-feet		
		Pond	Ditch	Combined
Bottom of pond	15.2	0.00	0.00	0.00
	15.3	0.15	0.00	0.15
Invert of outlet pipe	17.0	2.94	0.00	2.94
	17.1	3.13	0.03	3.15
Top of stoplog (actual)	17.4	3.68	0.11	3.79
	17.5	3.87	0.13	4.01
Top of stoplog (plans)	19.0	6.95	0.66	7.61
	20.0	9.25	1.12	10.36
Crest of spillway	22.5	15.91	2.61	18.52
	23.0	(17.40)*	(2.98)*	(20.38)*
Top of perimeter berm	23.5	(18.95)*	(3.36)*	(22.31)*

(*Values in parentheses are for an overflow condition which exceeds pond full supply level)

The other revision to the validation-period model was to reduce the pump capacity. The original report had estimated the capacity of the pump station to be 2.67 cfs, but subsequent pump tests by the city determined that the actual capacity was only 1.24 cfs. The lesser capacity corresponds to the then-existing10 hp pumps and 10" diameter PVC forcemain.

[1] Final dimensions shown as annotations on approved engineering plans for storm drainage system and detention pond for City of Mount Vernon, Eagle Hardware & Garden. Plans dated 04/30/93 by Bell Walker Engineers, Inc and approved 05/18/93 by the city of Mount Vernon..

Larger 25 hp motors were installed in 2002, which has increased the current pump capacity to 2.95 cfs (1325 gpm). For the purpose of model validation to conditions in 1994-2001, simulations were run with the original 1.24 cfs capacity.

Historical records of monthly total operating hours and estimated pumped volumes at the Freeway Drive Stormwater Pump Station are the only data available to describe system performance over the validation period, years 1994 through 2001. No records, photographs, or other anecdotal reports could be located by the city to describe maximum levels or water level fluctuations in the regional pond, and the city was unable to comment on the reasonableness of simulated pond stage hydrographs.

Model Validation

Evaluation of the validation model results focused on the period of November 1995 through January 1996 and which included a prolonged period of wet weather and high river levels. This period was also used by nhc to calibrate a previous water level model for the City of Mount Vernon of the Ledger Lake area immediately west of the Freeway Drive basin. The results of the previous Ledger Lake study showed that the maximum groundwater level (and Ledger Lake level) was 20.0 feet and occurred in November 1995. This groundwater level was the second-highest in the 40-year simulation period with an estimated recurrence interval between 25 and 50 years. The only higher groundwater level in the Ledger Lake study simulation period was 20.2 feet, occurring in November 1990.

The best available estimates of local groundwater levels over the validation event are from the prior Ledger Lake analysis, which considered the lake to be a surface expression of groundwater levels. Figure 2 presents the results of that earlier study for the period of the validation event. This figure shows that the local groundwater table at Ledger Lake immediately west of the Freeway Drive basin may have been in the live storage range for the regional stormwater pond (higher than 17.4 feet) for most of December 1995 and well below the live storage range for most of November as well as for all of January.

Table 2 compares the predicted basin outflow with the pump station records for the November 1995 to January 1996 validation event. Pump station inflow volumes were computed by multiplying monthly rainfall by the impervious tributary area of 46 acres. Predicted pump station outflow volumes were computed by adjusting the inflow volumes for the simulated changes in pond storage over each month, with an additional manual adjustment for refill of approximately 4 acre-feet of limited use storage below pond elevation 17 feet at the start of the period. The manual adjustment was made to correct for the discrepancy between actual conditions and the simulations results at the start of the validation event. The HSPF simulation results produced a water level of 17.1 feet on November 1, 1995; whereas, the estimated actual groundwater level on that date, based on the Ledger Lake analysis, was about 10 feet, indicating a dry pond. Values presented in Table 2 as actual pumped outflow volumes are based on data obtained from the City's Station Time Records for the Freeway Drive Storm Station. The station time records report total pumped volumes for each month as determined from pump operating hours and an assumed pump rate of 1.24 cfs.

Table 2
Validation Event Predicted and Pumped Outflow Volumes

Month	Rain (inches)	Pumped Outflow Volume (acre-feet)		
		Predicted	Actual	Difference
Nov 1995	11.1	30.5	6.6	+23.9 (362%)
Dec 1995	3.5	20.8	23.5	-2.7 (-11%)
Jan 1996	5.6	21.4	15.4	+6.0 (+39%)

Variations in seepage losses over the validation period are presumably responsible for the inconsistent match of predicted and actual outflows. The Freeway Drive stormwater system is mostly an open system, and seepage losses from the system can occur from the unlined ditches as well as from the bottom area (1.5 acres) of the unlined regional detention facility. During periods of low groundwater, infiltration losses from the pond bottom will occur at rates significantly greater than simulated in the model.

The validation period results show that the model greatly over-estimates pumped-outflow volumes during the high-rainfall month of November 1995, when groundwater levels were initially low. However, model predictions for the high-groundwater, low-rainfall condition in December 1995 are reasonably consistent with the actual pumped volumes. These results suggest that modeled pumped volumes are reasonable under conditions of a high groundwater table, such as occurred in December 1995 but will overestimate pumped outflows in other periods. The HSPF analysis assumed that high groundwater persists throughout all winter months.

A second finding from the validation exercise is that external (Skagit River) horizontal seepage inflows to the storm drain system appear to be minor relative to the existing pump capacity. As stated above, elevated groundwater conditions are thought to have been present for most of December 1995, with groundwater levels above elevation 17 feet for most of the month and a peak water level of nearly 20 feet. Seepage inputs to the stormwater system, if significant, should have shown up in the pump records for December 1995. Instead, the pump station records show pump operation for only 230 hours (or 31 % of the available hours in the month), and the pumped volumes are within 11% of the estimated stormwater runoff from the basin. For December 1995, the excess pumped volume of 2.7 acre feet is equivalent to an average seepage inflow 0.04 cfs over the month or 0.09 cfs if the seepage inflows occurred over the two week-period with the highest estimated local groundwater levels above 19 feet elevation.. While the estimated rates of seepage inflow are approximate, the point to be made is that the limited excess pumping during a prolonged period of high groundwater conditions suggests that seepage inputs from groundwater are small relative to the pump capacity and are not significant to the performance of the Freeway Drive stormwater system.

Updated Current Conditions Model (Year 2004)

The HSPF model of the Freeway Drive basin was configured to current conditions by setting the pump capacity to the upgraded station capacity of 2.95 cfs (1325 gpm) and by adjusting the tributary basin to reflect conditions as of early 2004. Tributary basin adjustments were

made to reflect areas of new commercial development within the basin service area north of College Way, and to include additional basin areas identified as sub-basin 8A on Figure 1 which will result from stormwater routing for the Riverside Bridge Replacement Project. New areas of commercial development over the period 1994-2003 were identified by comparing the basin land use mapping from the 1995 CSWMP with a current aerial image from the City GIS system. The basin areas to drain by gravity and pumped flows to a new detention pond for the Riverside Bridge Replacement Project[2] and thence to the Freeway Drive stormwater system, were confirmed by correspondence with the project drainage engineers, Leonard, Boudinot & Skodje, Inc.

Commercial properties which had been developed as of 1994 are assumed to have 80% effective impervious coverage, with only the impervious portion, totaling 46 acres, being directly tributary to the Freeway Drive storm drain system. That assumption is consistent with the prior analysis conducted in 1993 and also the current model validation run. New properties developed from 1994 to 2004 are assumed to have runoff from both impervious and pervious surfaces routed through an on-site stormwater detention facility, meeting the city's current stormwater standards, prior to discharge to the regional Freeway Drive system. Ponds constructed over this period have been at an elevation range which avoids backwater effects, with the consequence that local detention storage is independent of (rather than a part of) the live storage pool of the Freeway Drive regional pond and ditch system. The total acreage of new commercial development from 1994 to 2004, excluding the Riverside Bridge Replacement Project, is estimated to be 16.5 acres at 80% effective impervious cover. The bridge project, which first drains to its own on-site stormwater detention facility, adds an additional basin area of 19.9 acres at 55% effective impervious cover.

The HSPF model of current (year 2004) conditions includes three stormwater ponds. These are: 1) the Freeway Drive regional pond, described above, with pumped outflow at 2.95 cfs; 2) the Riverside Bridge Project stormwater detention pond with stage-storage-outflow characteristics as presented in the design report for that project; and 3) a composite detention pond reflecting the cumulative performance of on-site stormwater detention facilities assumed to have been constructed since 1994. Inflow to the Freeway Drive Regional Pond consists of the outflow from the other two ponds, plus direct runoff from the 46 acres of original tributary basin.

Hydraulic characteristics for the Riverside Bridge Project stormwater detention pond were determined from the project design report and are summarized in Table 3. Hydraulic characteristics for the Composite Detention Pond were determined by scaling the pond hydraulic data presented in the design report[3] by Semrau Engineering for a detention pond recently constructed for an 80% impervious, 4-acre site on Freeway Drive, about 1000 feet north of College Way. Pond hydraulic data of storage and discharge values were scaled to

[2] "Riverside Bridge Replacement Project Stormwater Drainage Analysis; City of Mount Vernon, Washington, City of Burlington, Washington" dated February 7, 2002 by Leonard, Boudinot & Skodje, Inc. for Harding Lawson Associates.

[3] "Drainage Report for W.L. and Kathleen M. Massey Fill and Grade Application; Section 18, T.34N, R.4E., W.M. City of Mount Vernon, Job NO. 91-045A" dated April 29, 1999 by Semrau Engineering & Surveying for W.L. and Kathleen M. Massey.

unit area values, representing a one-acre commercial site, by dividing the design report values by the basin area. For the composite pond, Table 4 presents stage-storage discharge data in both unit-area amounts as well as the composite values used in the model of current conditions.

Table 3
Detention Pond Hydraulic Characteristics
Riverside Bridge Replacement Project
19.9-Acre Basin at 55% Effective Impervious Area

Stage Ft	Depth ft	Storage ac-ft	Discharge Cfs
30.0	0.0	0	0
30.5	0.5	0.13	0.31
31.0	1.0	0.28	0.43
31.5	1.5	0.44	0.92
32.0	2.0	0.61	1.19
32.5	2.5	0.80	1.41
33.0	3.0	1.01	2.04
33.5	3.5	1.23	3.24
34.0	4.0	1.47	4.38

Table 4
Detention Pond Hydraulic Characteristics
Composite On-Site Stormwater Detention Pond
Developments at 80% Effective Impervious Area

		Unit Area Values 1-Acre-Increment		Composite Pond 16.5-Acres of Development	
Stage ft	Depth Ft	Storage ac-ft	Discharge cfs	Storage ac-ft	Discharge cfs
23.0	0.0	0.0000	0.0000	0.00	0.00
23.5	0.5	0.0057	0.0192	0.09	0.32
24.0	1.0	0.0140	0.0271	0.23	0.45
24.5	1.5	0.0252	0.0332	0.42	0.55
25.0	2.0	0.0393	0.0384	0.65	0.63
25.5	2.5	0.0566	0.0429	0.93	0.71
26.0	3.0	0.0772	0.1178	1.27	1.94
26.5	3.5	0.1014	0.4751	1.67	7.84
27.0	4.0	0.1293	1.5824	2.13	26.11

Key elements of the HSPF model of current (Year 2004) conditions are a total tributary basin area of 82.4 acres, two on-site detention ponds with a combined live storage of about 2.7 acre feet before overflow, a total of 14.7 acre-feet of pumped-outflow live storage in the regional detention pond and ditch system, and a regional system pump capacity of 2.95 cfs (1325 gpm). The HSPF simulation results for this condition showed that the level of protection against uncontrolled overflows from the regional pond is presently greater than once in 100 years.

Future Development Scenarios

The future development scenarios considered here address buildout of the Freeway Drive basin areas north of College Way, which have drainage access to the Freeway Drive regional detention pond and pump station. The assessment does not address existing or future development in those Freeway Drive basin areas located south of College Way (and west of Freeway Drive), which at present drain by percolation into the ground and by westward overland flow at the city limits. The 1995 CSWMP had explored scenarios which included a relocated pump station to serve the presently non-draining area. However, for the current work it was decided, in consultation with City of Mount Vernon staff, to evaluate scenarios which could be accomplished without relocation of the existing pump station. Evaluation of the non-draining area would be deferred for future study.

The remaining developable area in the tributary basin to the Freeway Drive regional storm drain system was determined from a recent aerial image from the City's GIS system. Four properties within the city limits, totaling approximately 56 acres, remain to be developed as follows: 1) a 40-acre property immediately north of Lowe's Hardware and the regional stormwater pond; 2) a 4.2-acre property adjacent to the Skagit River at the northwest corner of the city limits; 3) a 2.9-acre property adjacent to the Skagit River east of Interstate 5; and 4) an 8.9-acre property about 1,000 feet south of the river and east of Interstate 5. The land use assumption used in the model for the future build-out condition of these commercial-zoned properties is to have effective impervious coverage at 80% with runoff from both pervious and impervious surfaces being conveyed to the Freeway Drive regional storm drain system.

An initial simulation of basin buildout with the existing pump station determined that frequent overflows would occur from the emergency spillway of the regional (Lowe's Hardware) pond. Model results, which reflect the conservative assumption of a constantly high groundwater table and minimal seepage losses from the storm drain system, showed spillway overflow in nearly one half of the 46 years of the simulation. Table 5 presents the dates of the largest nine overflow events, ranked by both pond peak level and total overflow volume. Included in Table 5 are the estimated groundwater conditions for each event, based on the previously-identified water level model of the Ledger Lake area.

Table 5
Major Stormwater Events and Coincident Groundwater Conditions
Based on Preliminary Basin Buildout Modeling of Freeway Drive Stormwater System
(events ranked by total modeled volume of overflow at emergency spillway)

Overflow Volume (rank)	Event Period		Monthly Rainfall (inches)	Pond Peak Level (HSPF Model)		Est'd Actual GW Elev. (ft)	
	Month	Year		Date	(rank)	On Date of Pond Peak	Max in Next 7 days
1	Nov	1990	14.8	24-Nov-90	4	**19.0**	**20.2**
2	Nov	1989	10.7	10-Nov-79	2	13.6	16.4
3	Nov	1995	11.1	28-Nov-95	8	**18.1**	**20.0**
4	Jan	1971	12.3	26-Jan-71	5	14.0	15.9
5	Jan	1982	8.7	23-Jan-82	6	11.0	12.7
6	Dec	1979	8.6	14-Dec-79	1	12.8	17.2
7	Dec	1967	7.3	25-Dec-67	3	12.5	14.8
8	Jan	1974	7.6	24-Jan-74	9	15.0	15.8
9	Jan	1984	8.3	24-Jan-84	7	11.8	13.9

The information in Table 5 was compiled to assess the reliability of the simulation results given the findings of the model validation exercise. Table 5 shows that only two of the nine largest runoff (pond overflow) events in the simulation period had high coincident groundwater conditions as estimated by the prior analysis of the Ledger Lake area. It is likely that the modeled overflows in other events are overestimated because of the conservative assumption of high groundwater through the winter months, with infiltration at a correspondingly low rate. As discussed earlier, the findings of the validation exercise were that modeled pond outflows appeared to be reasonably accurate for periods of high groundwater conditions but could significantly overestimate pond outflow in other periods. The model is particularly likely to overestimate peak pond levels and outflow volumes for events in which the actual groundwater level is below the bottom of the regional pond at 15.2 feet.

Model results summarized below for future development scenarios include the peak rates and total volumes of overflow for the November 1990 event. The simulation results for the November 1990 event, during a period of high groundwater, are felt to be the most accurate and useful for quantifying system performance under design storm conditions. The modeled pond overflows for the other major events previously identified in Table 5 are not included in the future scenario results because the model is believed to significantly overestimate overflows for all but the November 1990 and November 1995 events. The November 1990 event is adopted here as a design storm because it is the most severe storm in the period of record. It has the highest simulated overflow volumes in the 46-year HSPF simulation period from 1957 to 2002 and also the highest estimated groundwater level in the 40-year Leger Lake analysis period from 1957 to 1996.

Table 6 summarizes the results of future scenario model runs to assess system performance with incremental levels of additional basin development, with increased pump station capacity, and with optional on-site detention storage. Basin development is increased in regular increments up to the buildout condition of 56 acres more than existing conditions. Simulated pump capacities of 2.95 cfs and 5.68 cfs, respectively, represent the existing capacity of the Freeway Drive Stormwater Pump Station and the capacity which, per a concurrent CH2M Hill analysis, would be achieved by replacing the existing 10" diameter forcemain with a larger 18" diameter pipe. Other simulated pump capacities are arbitrary. Most of the simulations assume that new development will not be required to follow the city's current detention standards for stream bank erosion control, with the belief that those standards may be inappropriate in the context of the pumped-outflow Freeway Drive system, and that existing standards are likely to be relaxed. The issue of alternative detention standards in the Freeway Drive basin was deferred for future study. In those scenarios where additional detention is modeled, the composite on-site stormwater facility for recent development under the current city regulations (Table 4) was scaled up to reflect the additional development.

Table 6
Future Conditions Scenario Analysis
Freeway Drive Regional Stormwater System

Additional Development (acres)	Pump Capacity (cfs)	Additional on-site detention?	Stormwater Pond Overflows	
			Overflow in Nov 1990 design event	
			volume (ac-ft)	peak Q (cfs)
+ 0 ac	2.95	No	0	0
+ 10 ac	2.95	No	1.1	1.4
+ 20 ac	2.95	No	4.3	3.1
+ 30 ac	2.95	No	10.7	6.9
+ 40 ac	2.95	No	15.7	11.5
+ 56 ac	2.95	No	28.1	16.5
+ 56 ac	2.95	Yes	24.8	12.8
+ 30 ac	5.68	No	0	0
+ 40 ac	5.68	No	0.7	1.3
+ 56 ac	5.68	No	6.2	6.2
+ 56 ac	5.68	Yes	1.7	2
+ 56 ac	6.0	No	4.8	5.5
+ 56 ac	8.0	No	0	0

Table 6 quantifies how the volume and peak rate of overflow for the design event increase with increasing basin development and are diminished by increasing pump size. The presence of additional on-site stormwater ponds per the city's existing regulations does not

appreciably affect buildout development impacts on overflow volumes unless the pump station capacity is also increased.

A well-defined performance standard does not exist for the Freeway Drive regional stormwater system. The issue is discussed here because some definition of "acceptable" performance is essential to designing stormwater facilities and interpreting performance results. Guidelines adopted by the Department of Ecology and other jurisdictions would suggest that a suitable performance standard would generally be to preserve discharges to the natural location (e.g. maintain the flow pathways which exist prior to basin development), without adversely increasing the rates or volumes of flow at the point of discharge. Determination of a reasonable performance standard for the Freeway Drive system therefore requires consideration of the natural discharges which would occur without development, the condition of the downstream flow path, and the potential damage which could result from development-related increases to flow rates and flow volumes.

One reasonable performance standard for the Freeway Drive regional stormwater system would be to limit the design event outflow volume to an amount which does not exceed the estimated runoff volume to the overflow point under natural conditions. Peak flows are not felt to be an issue because any overflow from the stormwater facility would discharge to a shallow closed depression.

The Freeway Drive regional stormwater pond is located in a very broad swale which discharges to a closed depression located west of the city limits. At an elevation of 20 feet, representing the level of flooding which occurred during the November 1990 event, the closed depression has a surface area of about 60 acres and is separated from the adjacent Ledger Lake area by a low ridge. The depressional area was described in the prior Ledger Lake analysis as "the eastern fields." The natural-conditions tributary basin from city lands to the eastern fields includes approximately 80 acres north of College Way and west of Interstate 5. Under buildout development conditions, those areas will drain to the Freeway Drive storm drain system and will normally be pumped to the Skagit River rather than discharging to their natural location. During major storm events, water in excess of the system capacity will spill to the eastern fields, which is the natural discharge point. The area of the eastern fields closed depression is used for agricultural production.

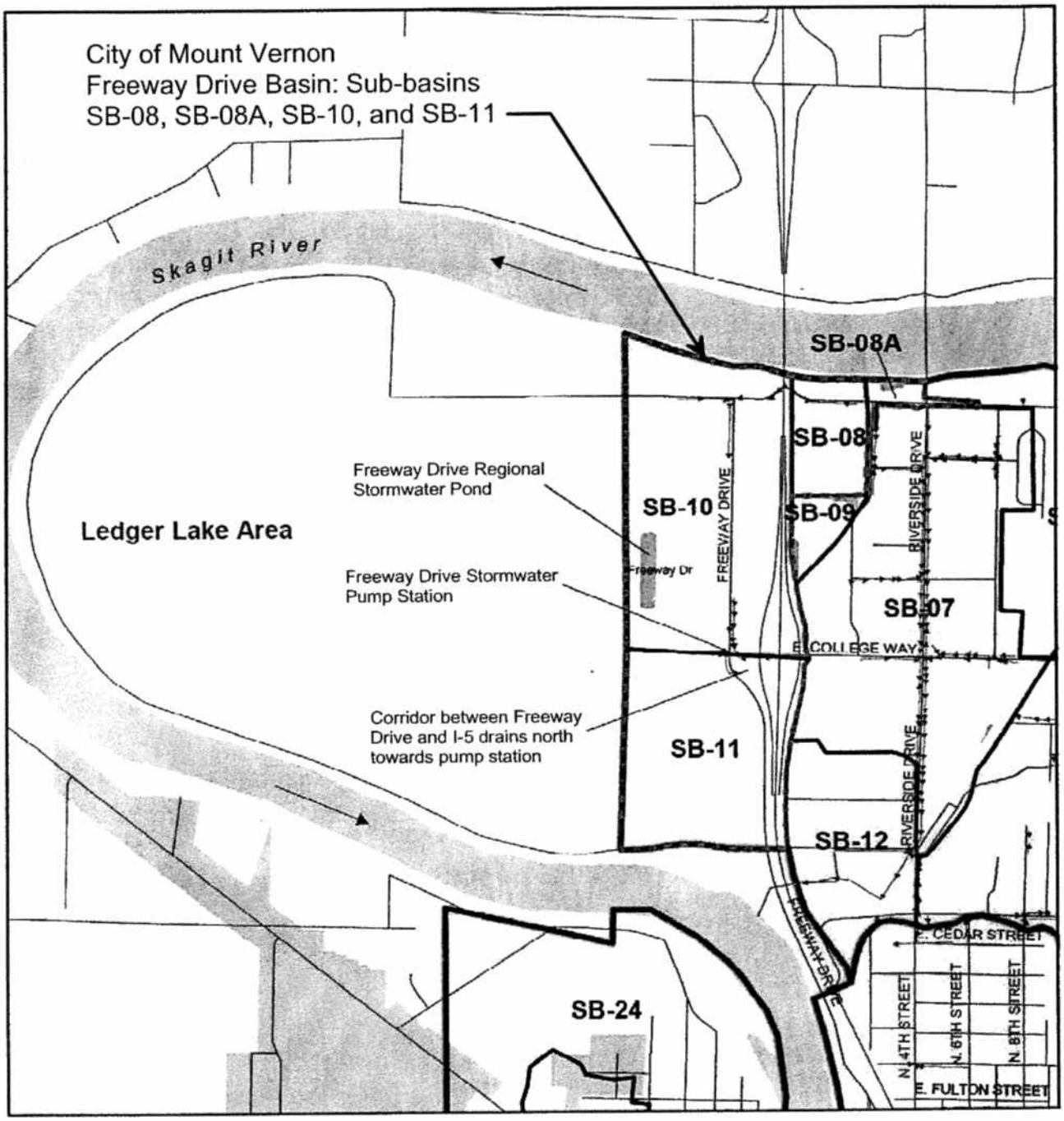
A simple HSPF model was developed to estimate the volume of runoff which, under natural conditions, would have flowed to the eastern fields closed depression during the month of November 1990. The model assumed a basin condition of 80 acres of forested land on Custer Norma soils as shown on soils mapping for the area. Generalized parameters developed by the USGS were used to characterize the basin runoff response for this combination of soil and land cover. Runoff volumes were determined by summing the modeled surface flows plus interflow runoff (SURO plus IFWO); modeled groundwater flows (AGWO) were not counted in the runoff total. The model results showed that under natural forested conditions, the tributary basin within the city limits would have contributed approximately 8 acre-feet of runoff to the eastern fields in the month of November 1990. An additional 6 acre-feet of runoff would have flowed into the eastern fields the following month. The peak discharge was approximately 0.5 cfs, occurring on November 24, 1990.

The proposed performance standard for the stormwater system is to limit the modeled overflow volume for November 1990 to no more than 8 acre feet, which is the same as the monthly runoff volume under the pre-development (forested) basin condition.

Recommendation

It our recommendation that, to accommodate full buildout of the Freeway Drive basin north of College Way, the capacity of the existing Freeway Drive stormwater pump station should be increased from 2.95 cfs to 5.68 cfs. According to a concurrent analysis by CH2M Hill, this increased capacity can be achieved by replacing the existing 10" forcemain with an 18" diameter pipe. The recommended pump station improvements will control buildout condition overflows from the regional stormwater pond to amounts less than runoff from pre-development (forested basin) city lands to the same discharge point.

The natural discharge point for the Freeway Drive basin under both predevelopment and developed conditions is a closed depression in an agricultural area west of the city. The regional stormwater pond behind Lowe's Hardware is expected to overflow to the natural discharge point during major events which occur coincident with high groundwater conditions such as those that occurred in November 1990 and November 1995. The pond overflow volume during the most severe event on record, November 1990, is equivalent to less than 2" of water over an already-flooded depressional area and is less than the runoff volume to the area which would have occurred with the city basins in a forested condition.

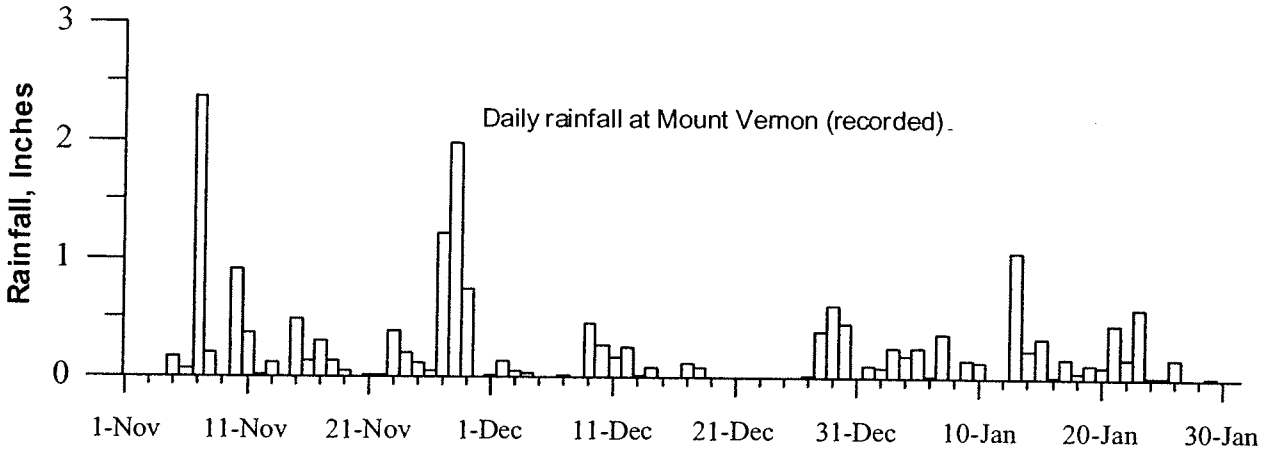


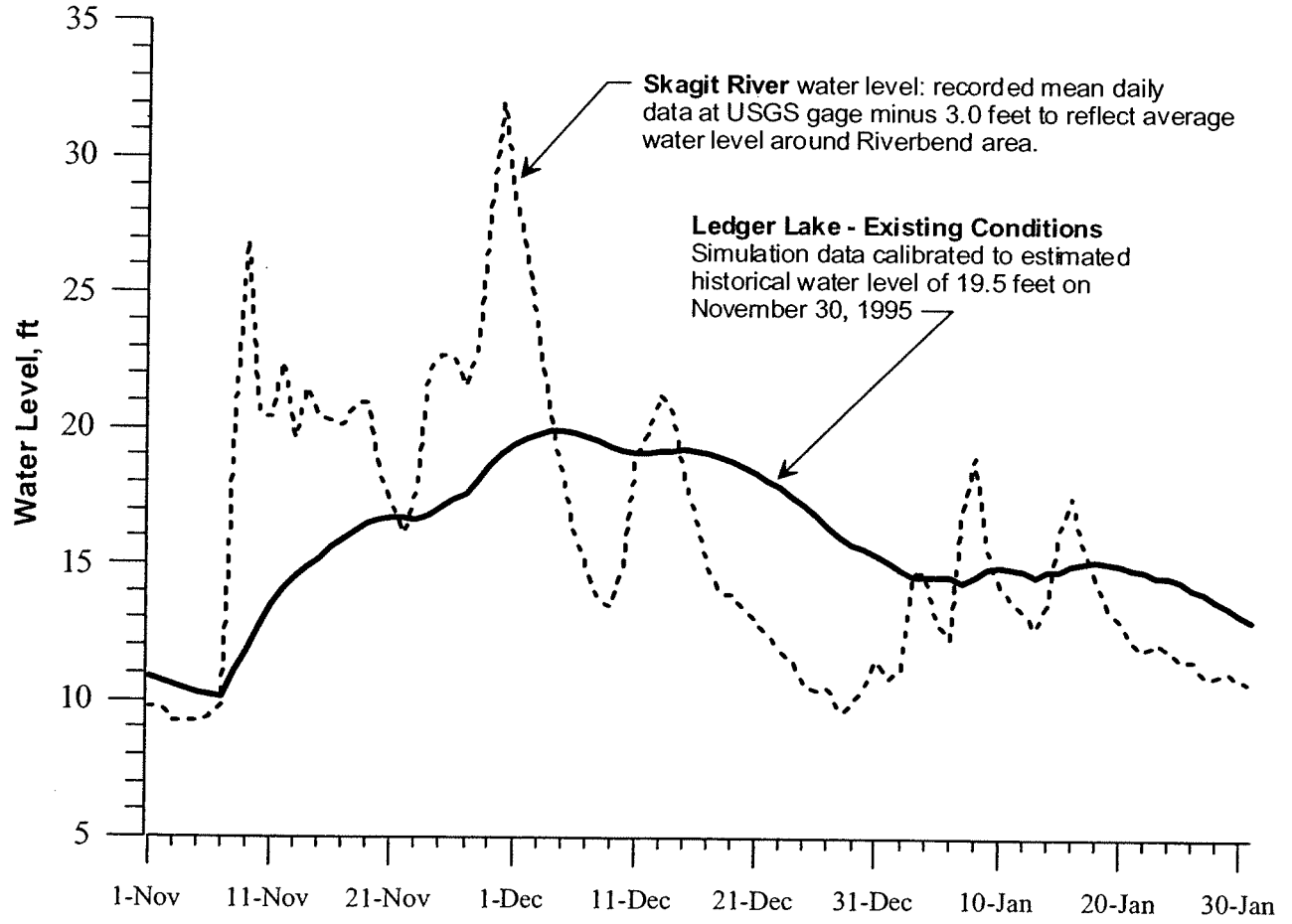
City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update
northwest hydraulic consultants, June 2004

FIGURE 1
Freeway Drive Basin Location Map

Mount Vernon Riverbend Analysis
Ledger Lake Simulated Water Levels
Flood of November-December 1995

Model Results for November 1, 1995 to January 31, 1996





City of Mount Vernon, Comprehensive Surface Water Management Plan (CSWMP) Update
northwest hydraulic consultants, June 2004

FIGURE 2
Ledger Lake Regional Groundwater, Nov 1995

Hydrologic Analysis of Little Mountain Estates Regional Detention Facility

PREPARED FOR: City of Mount Vernon, Washington

PREPARED BY: Jerry Scheller/CH2M HILL

COPIES: Bill Derry/CH2M HILL

DATE: March 31, 2004

1.0 Introduction

This technical memorandum documents the hydrologic analysis performed to evaluate the effectiveness of the Little Mountain Estates regional detention facility located in the upper reach of the Maddox Creek basin.

The purpose of this study was to:

1. Analyze the performance of the Little Mountain Estates detention facility to facilitate development of a project.
2. Analyze the performance alternative structure modification developed in previous study efforts.
3. Determine if there is unused capacity in the Maddox Creek PUD Ponds 1 and 2.

2.0 Description of the Study Area

The Little Mountain Estates detention facility is located in the southeast part of the City in the Maddox Creek basin. This pond was built in the 1990's to provide 8.7 acre-feet of stormwater detention for the Little Mountain Estates subdivision and to also serve as a regional facility to attenuate peak streamflow rates in Maddox Creek. A concrete side-flow weir was constructed at the southeast corner of the pond to divert high streamflow in Maddox Creek into the facility. The weir has failed in recent years allowing a greater volume of streamflow into the pond.

The area tributary to the Little Mountain Estates pond is about 380 acres. The topography of the basin is flat to moderately sloped in the vicinity of the pond but relatively steep in the upland areas. Existing land use in the northern half of the basin is characterized as primarily medium density residential development with pockets of low- and high-density mixed in. Land use in the southern half of the basin is primarily low-density residential with some undeveloped pasture and forested areas. A large wetland area exists immediately to the east of the Little Mountain Estates subdivision (between S 36th Street and Maddox Creek Road). There are two additional stormwater detention ponds, PUD Ponds 1 and 2, upstream of the

Maddox Creek Pond, that collect and store runoff from some of the residential development in the upper part of the basin.

3.0 Hydrologic Model Development

The hydrologic analysis of the Little Mountain Estates pond was performed using the Hydrologic Simulation Program – Fortran (HSPF) model. This model was selected because it uses historical rainfall records to generate a long-term series of surface water flows. This long-term flow record gives a more accurate estimate of flood-frequency at a given point than provided by single-event design storm analysis. A long term flow record also allows analysis of flow duration which is useful when studying the flow effects on channel erosion.

This analysis builds on previous analyses in support of the 1993 City of Mt. Vernon Comprehensive Surface Water Management Plan (CSWMP), (RW Beck, 1993). This analysis also uses information recently developed by Northwest Hydraulic Consultants (nhc) for the update to the Maddox Creek HSPF model.

The HSPF analysis was performed for five scenarios assuming three land use conditions in combination with three routing scenarios. Table 1 describes the five scenarios.

TABLE 1
HSPF Modeling Scenarios

Scenario	Land Use Condition	Routing Scenario
1	Pre-Developed (forested)	No Ponds
2	Existing Condition	Damaged diversion weir and existing control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2
3	Existing Condition	Modified Diversion and control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2
4	Future Condition	Damaged diversion weir and existing control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2
5	Future Condition	Modified Diversion and control structure at Little Mountain Estates Detention Facility, Maddox Creek PUD Ponds 1 and 2

3.1 Meteorological Data Inputs

This analysis used the updated precipitation data set developed by nhc for the Maddox Creek HSPF model. This data set was developed by combining rainfall data from the National Oceanic and Atmospheric Administration (NOAA) station at Burlington, Washington, with rainfall data collected at Washington State University Cooperative Extension station at Mt. Vernon.

Daily pan evaporation data were obtained from the Washington State University Cooperative Extension station at Puyallup, Washington.

The rainfall and evaporation data sets include the period from October 1956 through December 2002. The development of these data sets are fully documented in the nhc Maddox Creek Model Update report.

3.2 Subbasin Delineation

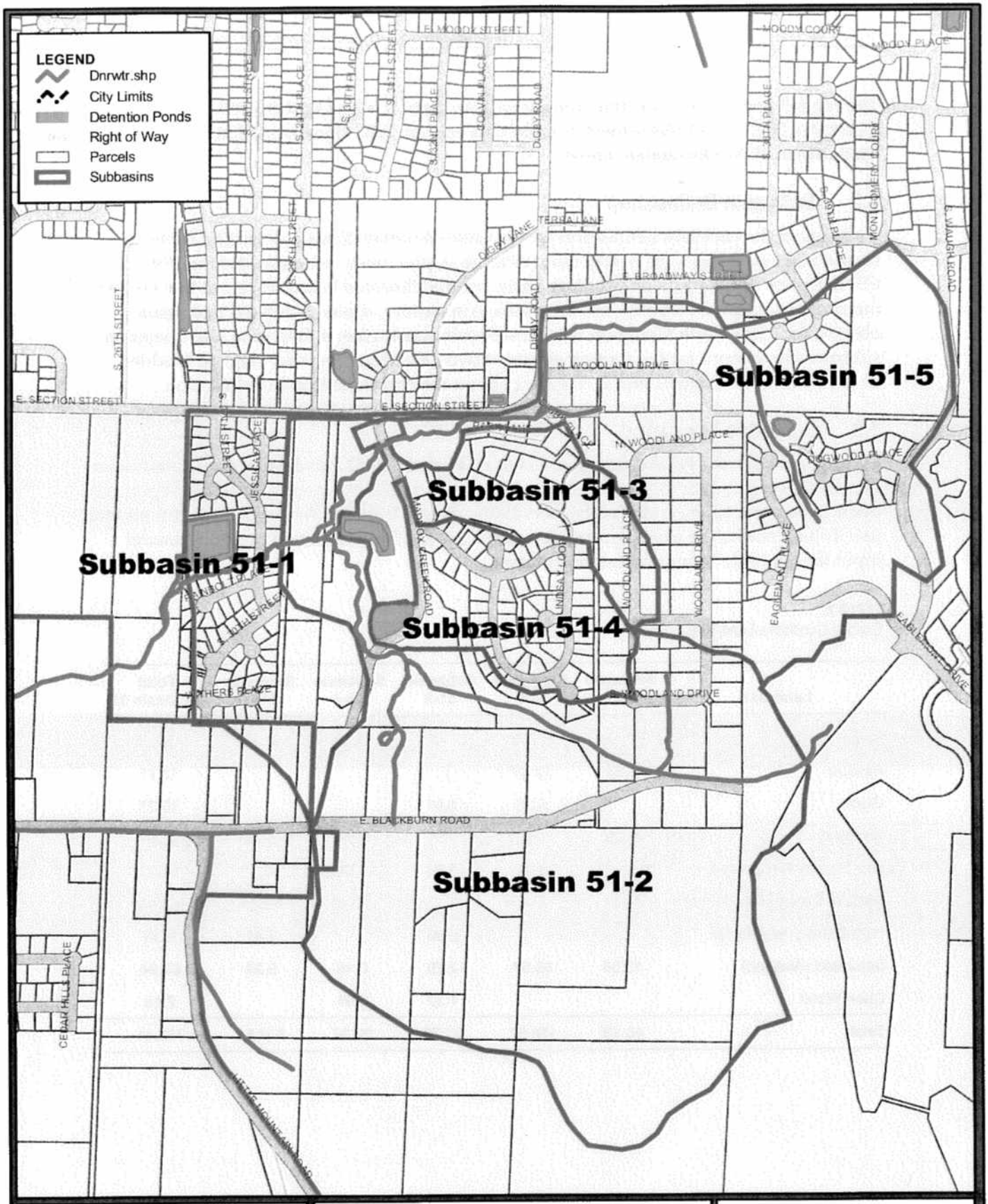
A review of the subbasin delineation for the Little Mountain Estates detention facility showed this subbasin to be nearly twice as large as previously estimated for the 1993 CSWMP. For this reason, the tributary basin was redelineated based on new 2-foot contour interval topographic mapping, recent drainage inventory, drainage reports and visual observation. This Little Mountain Estates subbasin was further subdivided into 5 separate subbasins to account for the routing effects of two detention ponds serving the Maddox Creek PUD (PUD Ponds 1 and 2). Figure 1 shows the revised subbasin delineation.

3.3 Land Use Scenarios

Existing conditions land use was updated to reflect current (2004) development conditions. The current development conditions was based on aerial photography, drainage reports for existing developments, and visual observations. Figure 2 shows the existing conditions land use. Table 2 shows the existing conditions land use and Table 3 shows the HSPF model input for the Little Mountain Estate subbasin.

TABLE 2
Existing Conditions Land-Use

Land Use	Subbasin 51-1	Subbasin 51-2	Subbasin 51-3	Subbasin 51-4	Subbasin 51-5	Total Subbasin 51
Forest		113.80	7.09	3.38	34.98	159.26
Pasture	1.63	12.07				13.71
Grass		5.26	5.01			10.27
Roadway	0.85			1.64	6.38	8.87
Low Density Residential		9.64	5.63	2.84	36.11	54.23
Medium Density Residential	24.11	2.23		19.40	19.35	65.09
High Density Residential			6.55		2.44	8.99
Saturated (Wetland)	13.54	35.57	2.29	0.16	9.29	60.84
Open Water			1.22	0.94		2.16
Total	40.13	178.57	27.79	28.37	108.55	383.41



HYDROLOGIC ANALYSIS
LITTLE MOUNTAIN ESTATES
REGIONAL DETENTION FACILITY
CITY OF MT. VERNON, WA

CH2MHILL

FIGURE 1
Revised Subbasin Delineation

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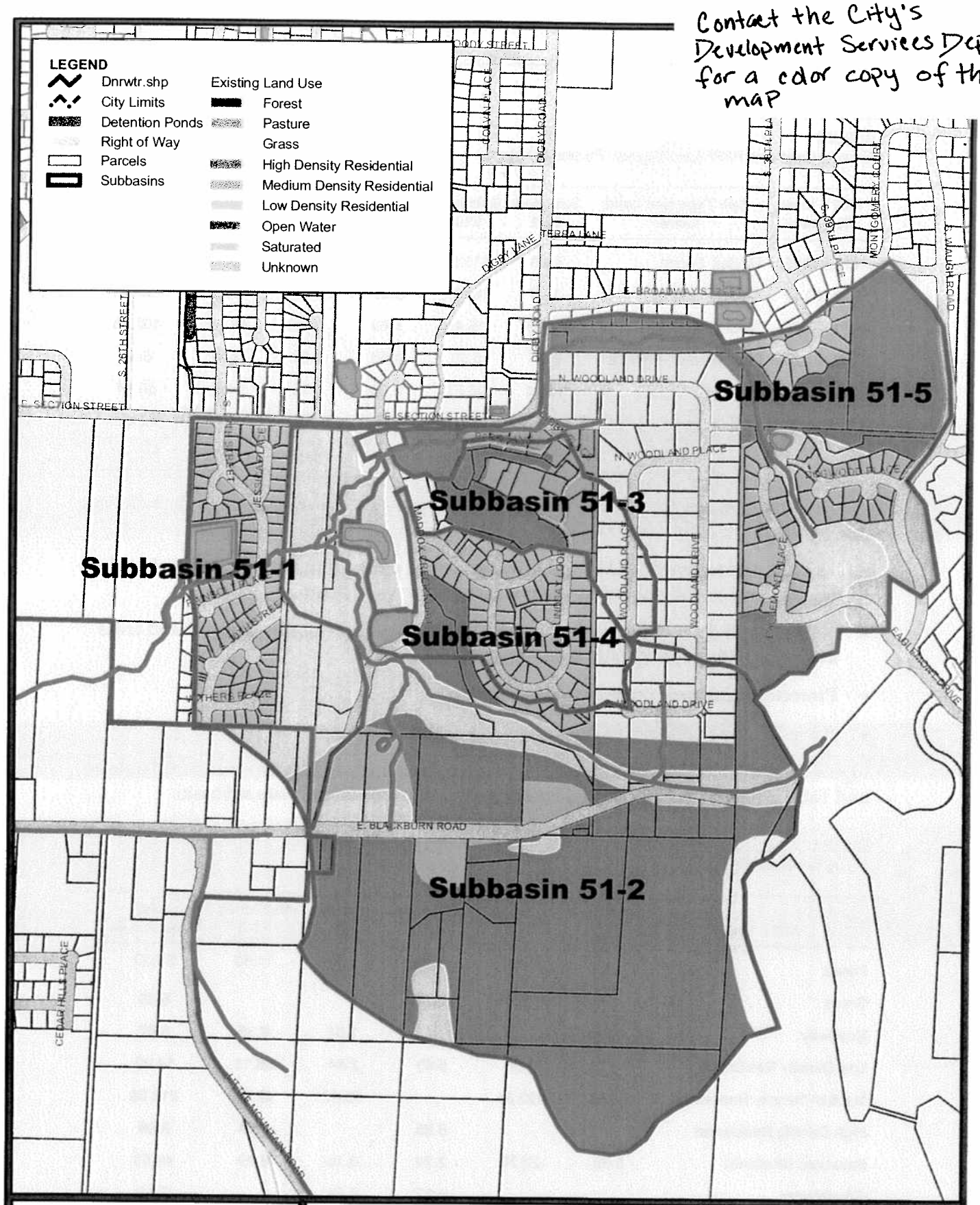
Contact the City's Development Services Dept. for a color copy of this map



HYDROLOGIC ANALYSIS
LITTLE MOUNTAIN ESTATES
REGIONAL DETENTION FACILITY
CITY OF MT. VERNON, WA
CH2MHILL

FIGURE 2
Existing Conditions
Land Use

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TABLE 3
Existing Conditions HSPF Land Segment Parameter Values

HSPF Land Segment	Soil Type and Land Cover	Subbasin 51-1	Subbasin 51-2	Subbasin 51-3	Subbasin 51-4	Subbasin 51-5	Total Subbasin 51
PERLND 15	Till Soil, Forest	0.00	113.80	7.09	3.38	34.98	159.26
PERLND 17	Till Soil, Pasture	1.63	6.07	0.00	0.00	0.00	7.71
PERLND 25	Till Soil, Grass	14.46	15.41	8.69	15.69	48.28	102.53
PERLND 27	Outwash Soil, Pasture	0.00	6.00	0.00	0.00	0.00	6.00
PERLND 51	Wetland	13.54	35.57	2.29	0.16	9.29	60.84
IMPLND 11	Impervious	10.49	1.72	9.72	9.13	16.01	47.07
Total		40.13	178.57	27.79	28.37	108.55	383.41

Future conditions land use was updated based on current land use zoning and the following assumptions:

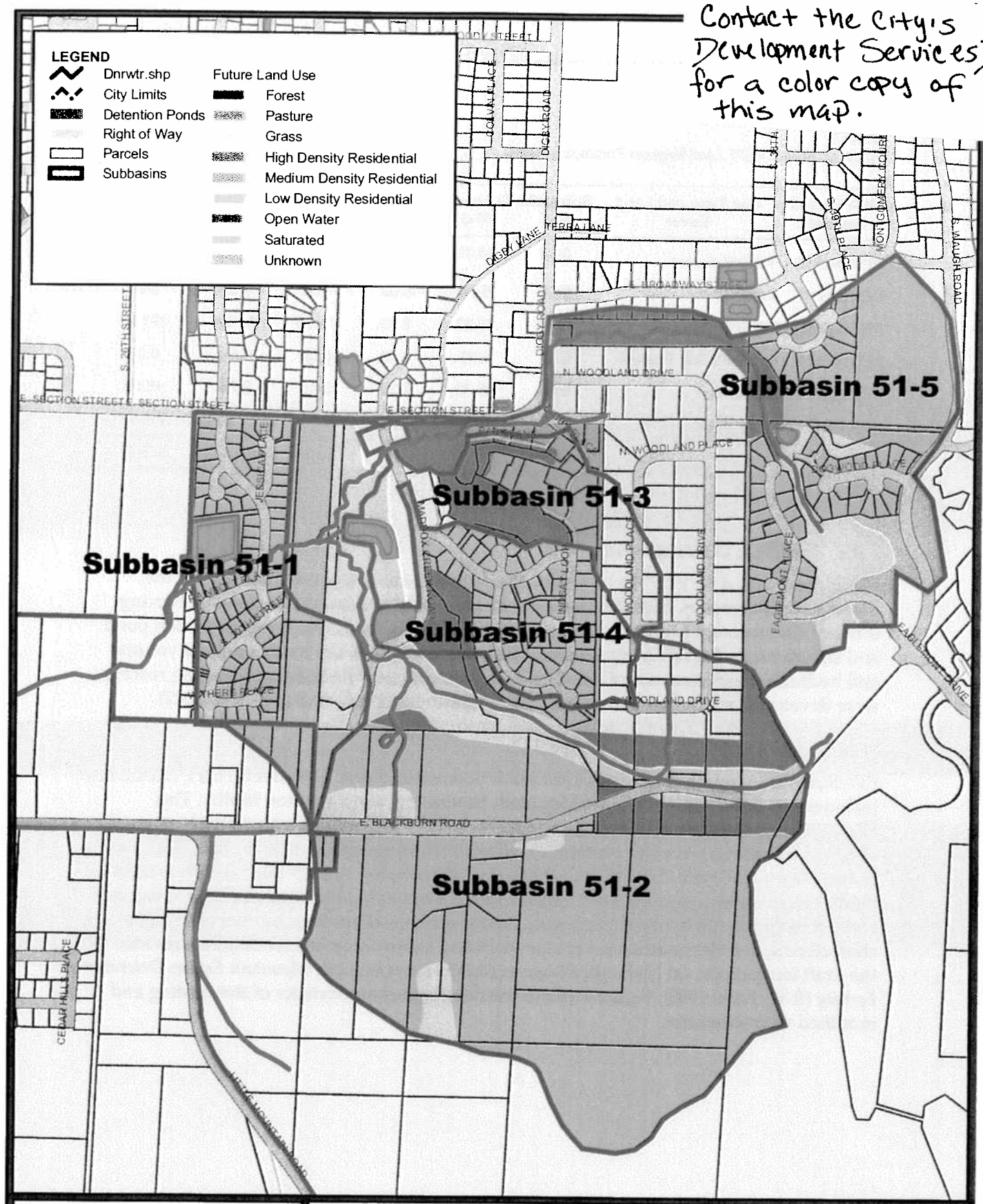
- Existing undeveloped, and low-density residential areas are assumed to redeveloped to higher density land use unless in a critical areas as noted below.
- No development will occur in critical areas. Critical areas are defined as wetland areas and areas with slopes greater than 40 percent.
- Protected areas were not assumed to develop.
- No redevelopment to a lower density will occur.

Figure 3 shows the future conditions land use. Table 4 shows the future conditions land use and Table 5 shows the HSPF model input for the Little Mountain Estate subbasin.

TABLE 4
Future Conditions Land-Use

Land Use	Subbasin 51-1	Subbasin 51-2	Subbasin 51-3	Subbasin 51-4	Subbasin 51-5	Total Subbasin 51
Forest		16.26	7.09	3.38	11.60	38.33
Grass		0.63	5.01			5.65
Roadway	0.85			1.64	6.38	8.87
Low Density Residential		9.64	5.63	2.84	36.11	54.23
Medium Density Residential	33.18	123.34		19.40	42.73	218.66
High Density Residential			6.55		2.44	8.99
Saturated (Wetland)	6.09	28.70	2.29	0.16	9.29	46.53
Open Water			1.22	0.94		2.16
Total	40.13	178.57	27.79	28.37	108.55	383.41

Contact the City's Development Services Dept. for a color copy of this map.



HYDROLOGIC ANALYSIS
LITTLE MOUNTAIN ESTATES
REGIONAL DETENTION FACILITY
CITY OF MT. VERNON, WA
CH2MHILL

FIGURE 3
Future Conditions
Land Use

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TABLE 5
Future Conditions HSPF Land Segment Parameter Values

HSPF Land Segment	Soil Type and Land Cover	Subbasin 51-1	Subbasin 51-2	Subbasin 51-3	Subbasin 51-4	Subbasin 51-5	Total Subbasin 51
PERLND 15	Till Soil, Forest	0.00	16.26	7.09	3.38	11.60	38.33
PERLND 17	Till Soil, Pasture	0.00	0.00	0.00	0.00	0.00	0.00
PERLND 25	Till Soil, Grass	19.91	83.32	8.69	15.69	64.02	191.63
PERLND 27	Outwash Soil, Pasture	0.00	0.00	0.00	0.00	0.00	0.00
PERLND 51	Wetland	6.09	28.70	2.29	0.16	9.29	46.53
IMPLND 11	Impervious	14.12	50.30	9.72	9.13	23.65	106.93
Total		40.13	178.57	27.79	28.37	108.55	383.41

3.4 FTABLE Development

FTABLEs are used by HSPF to represent stage-storage-discharge relationships for the Maddox Creek reaches. FTABLEs are used by the model to simulate stormwater routing through the system. FTABLEs generated for this analysis are of two types: detention pond and stream reach. FTABLEs representing detention facilities were based on pond volume and hydraulic characteristics of the flow control structures. FTABLEs representing reaches were developed using the open channel hydraulic model HEC-RAS (US COE, 2002).

FTABLE 510

FTABLE 510 represents Maddox Creek reach downstream of S. 27th Street. This FTABLE also includes the diversion to the Little Mountain Estates regional detention facility. This FTABLE for this reach was developed using the HEC-RAS model. Cross sections were obtained from the draft letter report on *Hydraulic Structure Modifications for Little Mountain Estates Detention Facility* (R.W. Beck, 1995). The lateral weir option in HEC-RAS was used to model the existing and modified diversion weir. The physical characteristics of the existing weir were approximated based on actual site conditions observed in February 2004. The characteristics of the modified diversion weir were based on recommendations provided in the draft letter report on *Hydraulic Structure Modifications for Little Mountain Estates Detention Facility* (R.W. Beck, 1995). Figure 4 shows the discharge characteristics of the existing and modified weir structure.

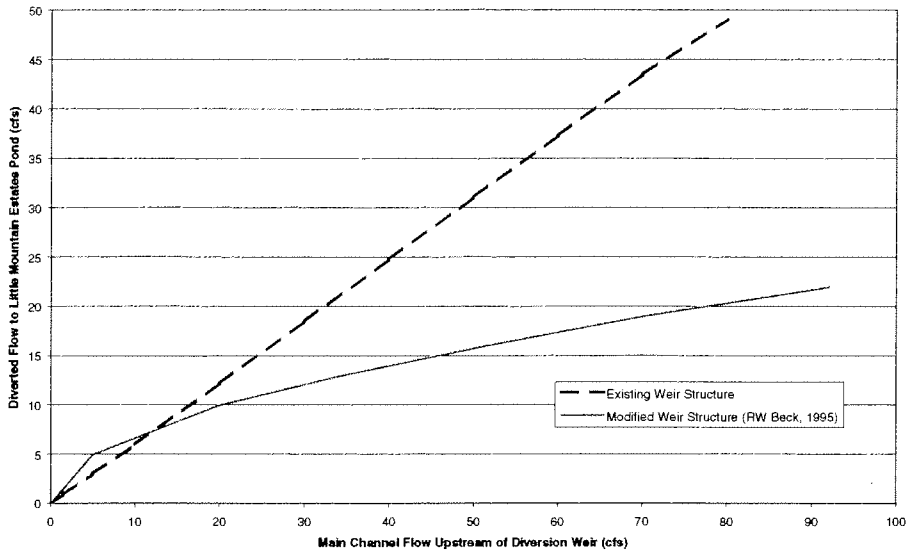

FIGURE 4
Diversion Weir Discharge Rating

FTABLE 511

FTABLE 511 represents the Little Mountain Estates regional detention facility. Stage-storage discharge characteristics for the existing pond and control structure were obtained from the draft Maddox Creek HSPF Model Update (nhc, 2003). Control structure modifications were based on recommendations provided in the draft letter report on *Hydraulic Structure Modifications for Little Mountain Estates Detention Facility* (R.W. Beck, 1995). Figure 5 shows the storage volume and Figure 6 shows the control structure stage discharge rating for the Little Mountain Estates regional detention facility.

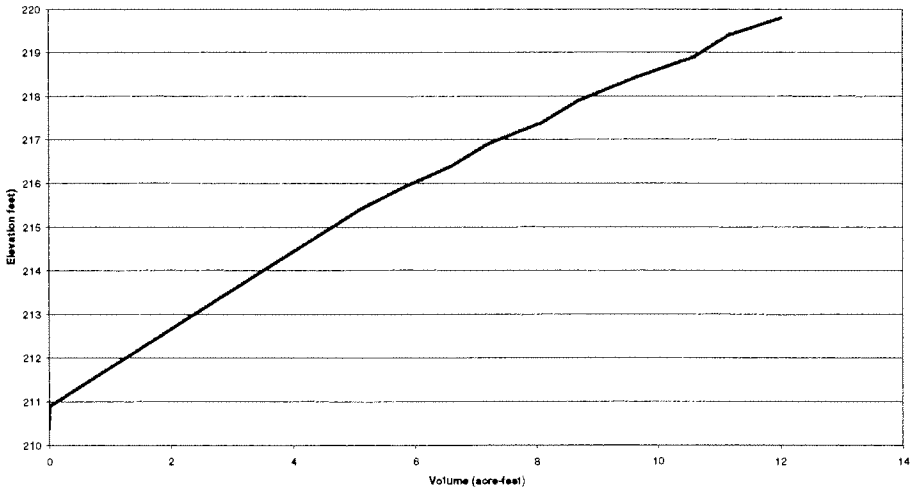

FIGURE 5
Storage Volume in Little Mountain Estates Regional Detention Facility

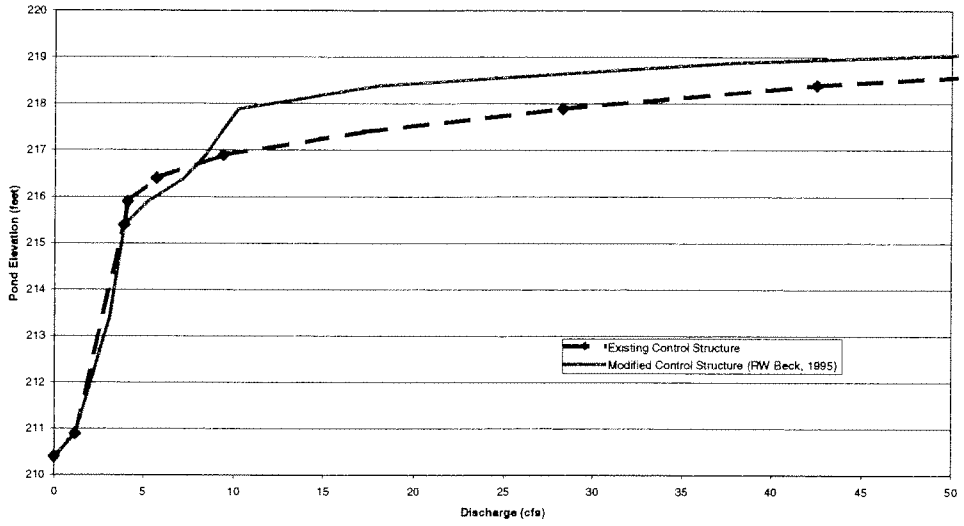

FIGURE 6
Discharge Rating for Little Mountain Estates Regional Detention Facility

FTABLE 512

FTABLE 512 represents the 1,200 foot reach between S. 27th Street and Maddox Creek Road. This FTABLE also includes a 2,400 foot reach of a tributary ditch extending from E. Blackburn Road to the confluence with Maddox Creek. HEC-RAS was used to develop the FTABLE for this reach. HEC-RAS cross sections were based on existing 2-foot topographic mapping.

FTABLE 513

FTABLE 513 represents the Maddox Creek PUD detention facility POND 1. Stage-storage discharge characteristics were obtained from existing drainage reports (Semrau and Lisser, 1995 and 1999). Figure 7 shows the storage volume for this detention pond.

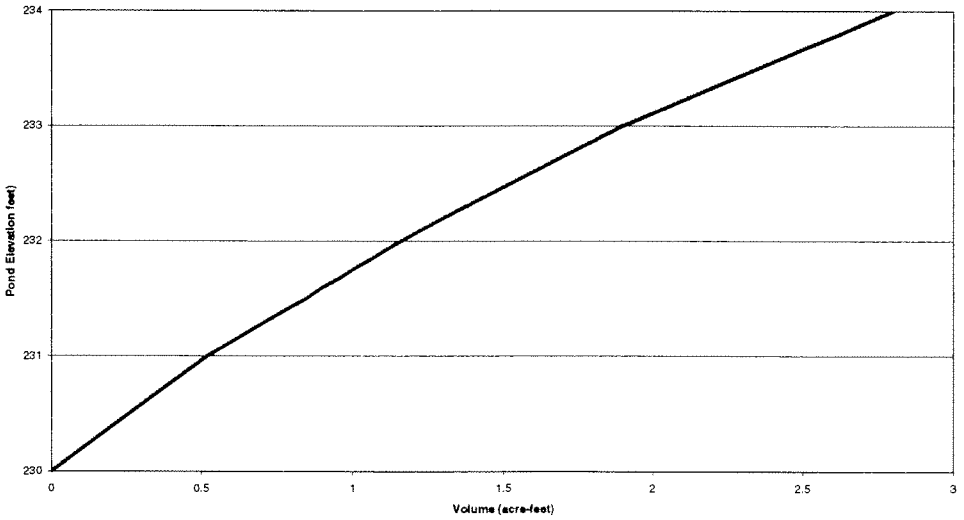

FIGURE 7
Storage Volume in Maddox Creek PUD Pond 1

FTABLE 514

FTABLE 514 represents the Maddox Creek PUD detention facility POND 2. Stage-storage discharge characteristics were obtained from existing drainage reports (Semrau and Lisser, 1995 and 1999). Figure 8 shows the storage volume for this detention pond.

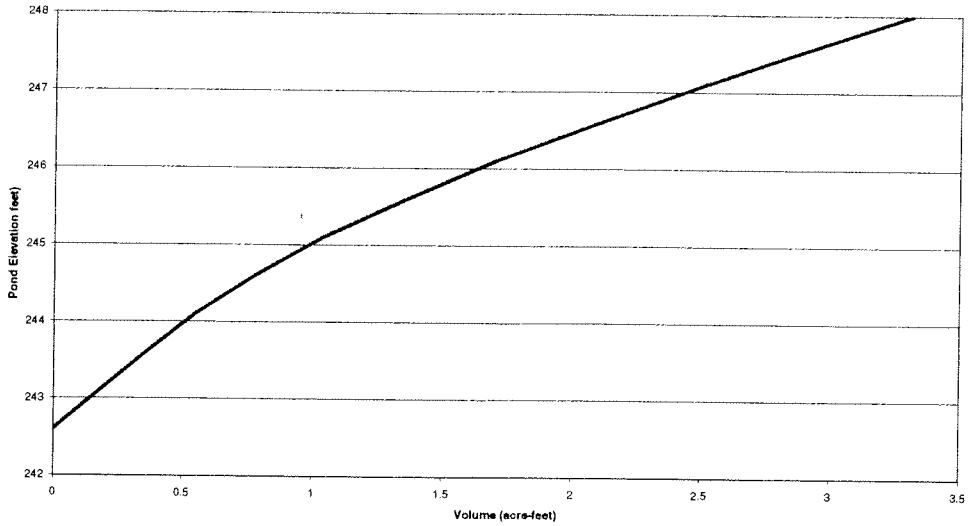

FIGURE 8
Storage Volume in Maddox Creek PUD Pond 2

FTABLE 515

FTABLE 515 represents the 4,200 foot reach upstream of Maddox Creek Road adjacent to E. Section Street. HEC-RAS was used to develop the FTABLE for this reach. HEC-RAS cross section were based on existing 2-foot topographic mapping.

3.5 HSPF Model Schematic

Figure 9 shows the HSPF model schematic used in this analysis.

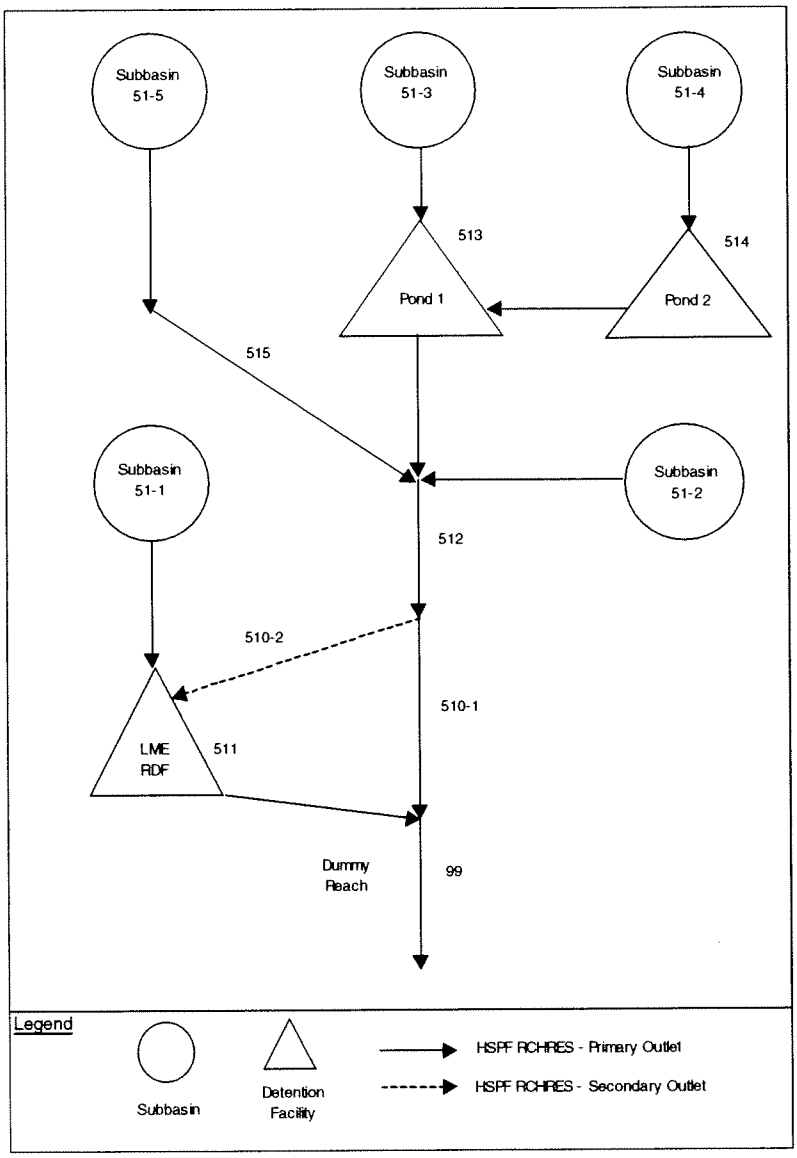

FIGURE 9
HSPF Model Schematic

4.0 Results of the Analysis

4.1 Peak Flood and Stage Frequency

Peak flood frequency is the probability that a given peak flood event will occur in any year. Flood frequency is commonly expressed as a return-period which is the inverse of the probability, and represents the average interval between the occurrence of a specific magnitude flood. For instance, a peak flood with a 50 percent probability of occurring in any given year is equivalent to a 2-year return period (1/0.5 = 2).

Table 3 shows the results of the HSPF analysis. Flood frequency was computed using the standard Log-Person Type III distribution (USGS, 1982).

TABLE 6
Flood Frequency for HSPF Analysis – Peak Flow in cfs

RCHRES	Location	2-year	10-year	25-year	100-year
Scenario 1 - Pre-Developed Condition (Forested)					
511[1]	Little Mountain Estates Pond Outlet	10.0	18.7	19.6	20.3
512	S. 24th Street	8.9	16.3	17.3	18.1
515	Maddox Creek Road	2.4	4.5	4.9	5.0
Scenario 2 - Existing Land Use Condition, Existing Diversion and Control Structure Configuration					
99[1]	Little Mountain Estates Pond Outlet	8.9	18.0	23.3	24.4
512	S. 24th Street	13.8	24.7	28.9	35.6
513	Maddox Creek PUD Pond 1	2.6	4.4	5.1	6.1
514	Maddox Creek PUD Pond 2	1.0	2.2	2.7	3.4
515	Maddox Creek Road	6.9	11.8	14.9	20.3
Scenario 3 - Existing Land Use Condition, Modified Diversion and Control Structure Configuration					
99	Little Mountain Estates Pond Outlet	10.5	15.5	18.6	19.9
512	S. 24th Street	13.8	24.7	28.9	35.6
513	Maddox Creek PUD Pond 1	2.6	4.4	5.1	6.1
514	Maddox Creek PUD Pond 2	1.0	2.2	2.7	3.4
515	Maddox Creek Road	6.9	11.8	14.9	20.3
Scenario 4 - Future Land Use Condition, Existing Diversion and Control Structure Configuration					
99	Little Mountain Estates Pond Outlet	20.0	32.5	37.9	39.1
512	S. 24th Street	29.8	50.0	62.3	83.5
513	Maddox Creek PUD Pond 1	2.6	4.4	5.1	6.1
514	Maddox Creek PUD Pond 2	1.0	2.2	2.7	3.4
515	Maddox Creek Road	9.3	15.6	19.4	26.0
Scenario 5 - Future Land Use Condition, Modified Diversion and Control Structure Configuration					
99	Little Mountain Estates Pond Outlet	16.5	24.4	28.4	34.5
512	S. 24th Street	29.5	49.6	60.7	78.5
513	Maddox Creek PUD Pond 1	2.6	4.4	5.1	6.1
514	Maddox Creek PUD Pond 2	1.0	2.2	2.7	3.4
515	Maddox Creek Road	9.3	15.6	19.4	26.0

1. Flood-frequency estimated from a graphical fit of the data plotted using the Gringorton plotting position

Figure 10 shows the peak flood frequency for Little Mountain Estates pond. This figure shows that for the existing land use condition, the Little Mountain Estates regional

detention facility with the current diversions weir and controls structure configuration (Scenario 2) attenuates peak flows to predeveloped conditions (Scenario 1) peak flows for events less than or equal to the 10-year event. If the diversion weir and control structure are modified as proposed in the RW Beck report, peak flow rates will increase for events below the 2-year return frequency but decrease for less frequent return periods.

Figure 10 shows that flows are predicted to significantly increase under future land use conditions (Scenario 4). The peak flow increase ranges from a doubling for the 2-year event to about a 65 percent increase for events with a return period higher than the 25-year. The diversion weir and control structure modifications (Scenario 5) mitigate the peak flow increase will still be greater than peak flows under existing land use conditions.

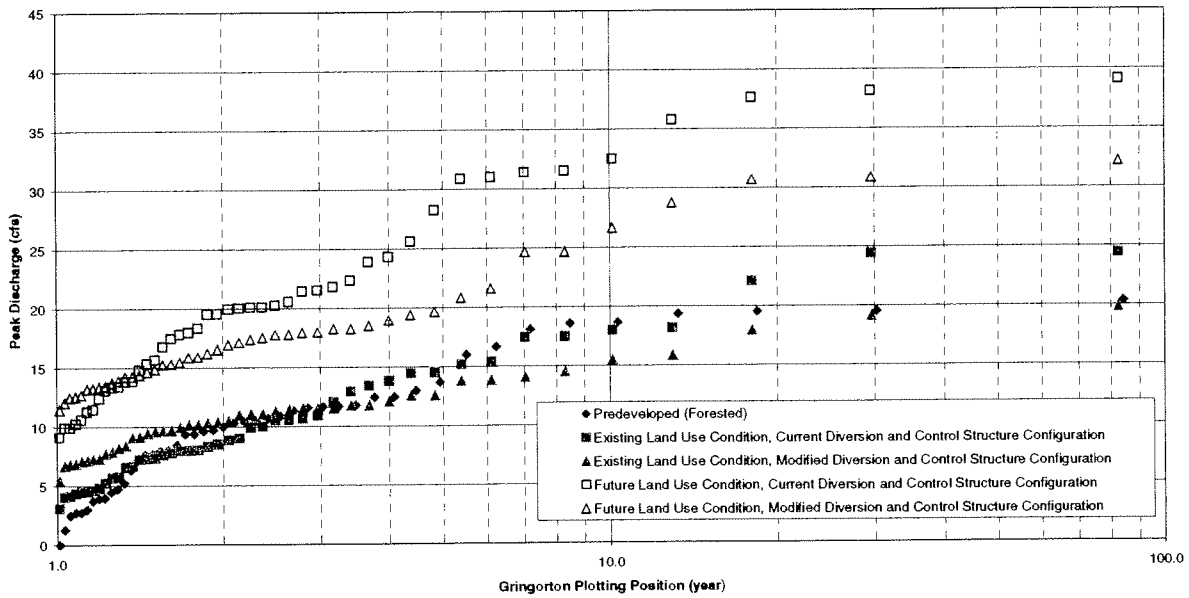

FIGURE 10
Peak Flood Frequency at Little Mountain Estates Pond
Plot shows creek flow for predeveloped condition and combined bypass and pond outflow for existing and future land use condition

Figure 11 shows the peak annual stage for Little Mountain Estates pond. This figure shows that:

- Approximately 0.8 acre-feet of unused storage volume is available in the pond for the existing land use condition and the current diversion weir and control structure configuration (Scenario 2).
- The storage volume will be fully utilized for the existing land use condition and the modified diversion weir and control structure configuration (Scenario 3) and future land use conditions the current diversion weir and control structure configuration (Scenario 4).

- The storage volume will be over utilized by 0.9 acre-feet for the future land use conditions and modified current diversion weir and control structure configuration (Scenario 5).

These conclusions are based on the assumption that there is 8.7 acre-feet of useable storage volume in the facility at the maximum allowable high water level of 217.8 feet (overflow elevation – 1 foot freeboard).

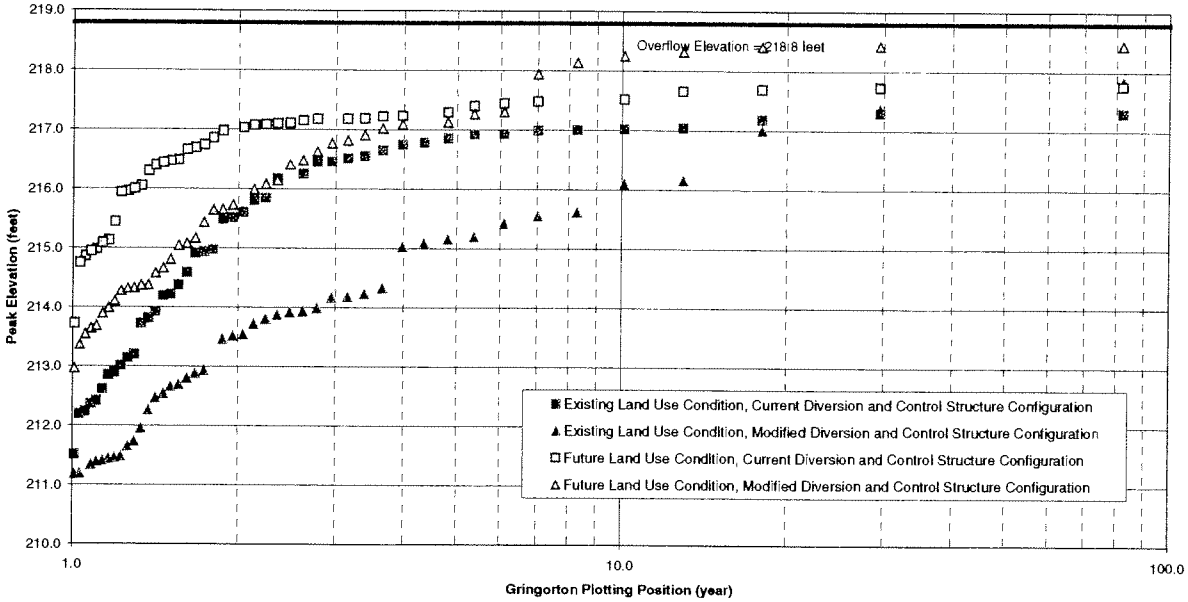

FIGURE 11
Ranked Peak Annual Stage at Little Mountain Estates Pond

Figures 12 and 13 show the peak annual flow for the Maddox Creek PUD Ponds 1 and 2 respectively. These figures show that the detention volume in these ponds is fully utilized (based on the 1 foot freeboard assumption).

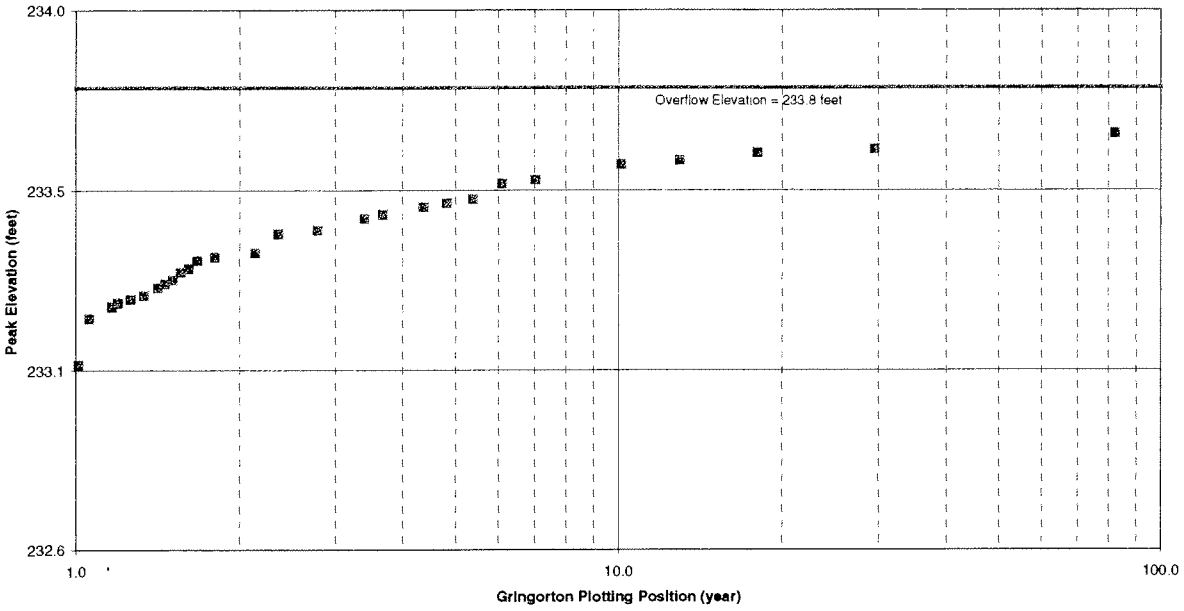

FIGURE 12
Ranked Peak Annual Stage at Maddox Creek PUD Pond 1

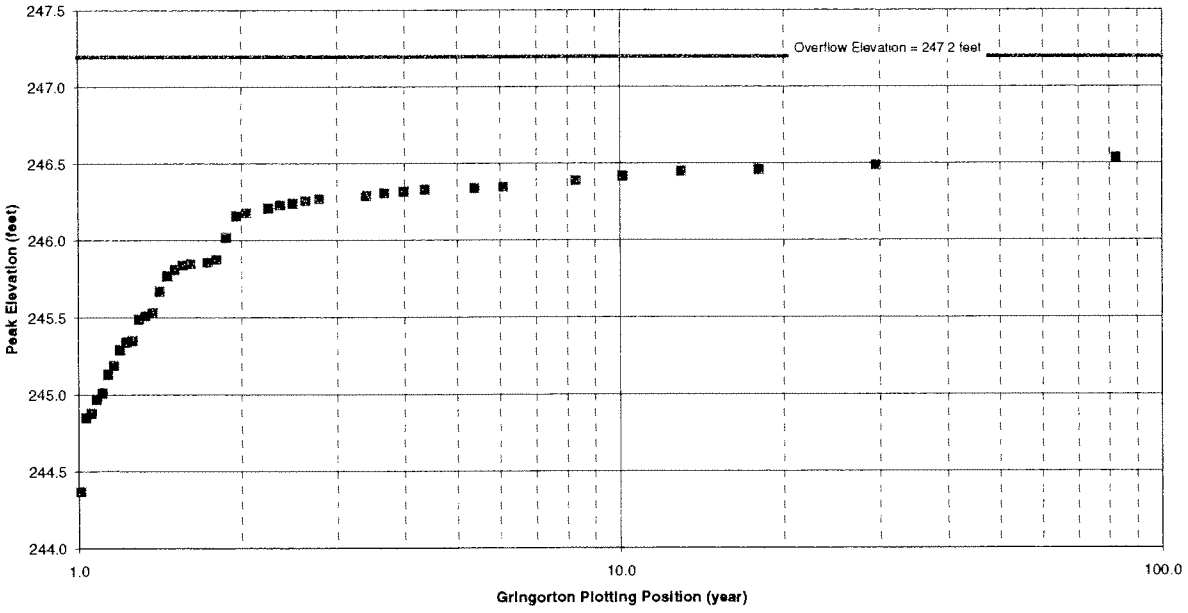

FIGURE 13
Ranked Peak Annual Stage at Maddox Creek PUD Pond 2

4.2 Duration Analysis

Flow duration analysis was performed for reach downstream of Little Mountain Estates pond. This reach was assumed to include the predicted outflow from the Little Mountain Estates pond with the predicted discharge in the bypass reach. Flow duration is the amount

of time (generally expressed as a percent of total) in which a given flow, is equaled or exceeded. Figure 14 shows the results of this analysis. This figure shows that the flow duration under the existing land use condition and the current diversion weir and control structure configuration (Scenario 2) is slightly higher than the predeveloped condition (Scenario 1) flow duration. This figure also shows that flow duration will increase under future land use conditions.

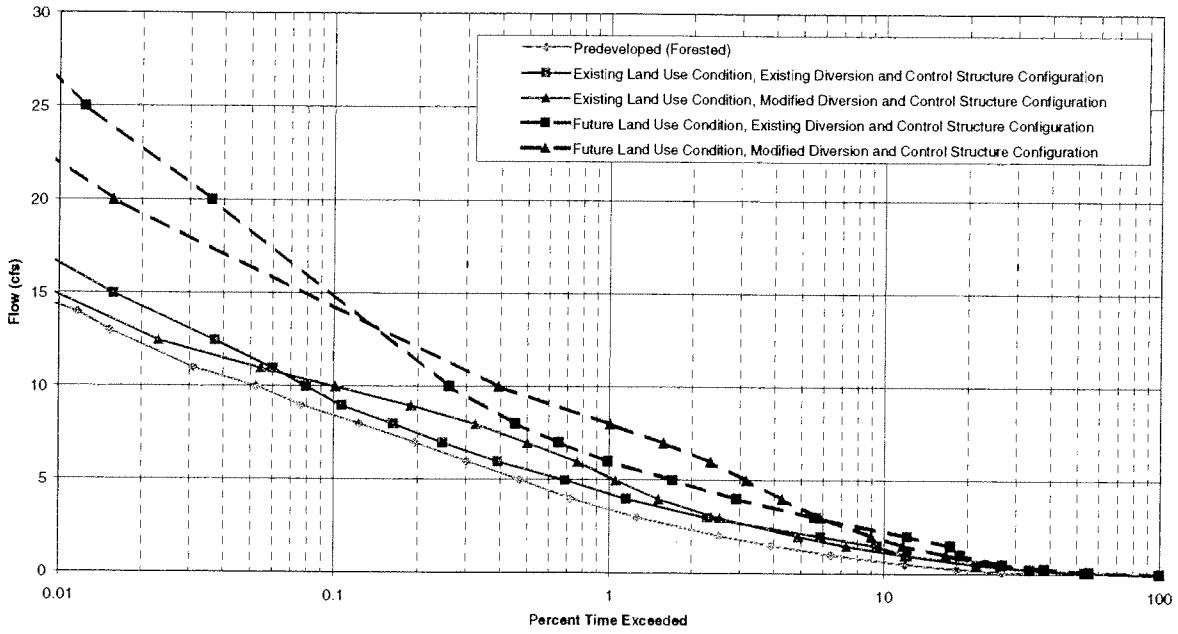

FIGURE 14
Flow Duration at Little Mountain Estates Pond
Plot shows creek flow for predeveloped condition and combined bypass and pond outflow for existing and future land use condition

5.0 References

R.W. Beck, 1993 City of Mt. Vernon Comprehensive Surface Water Management Plan, Seattle, Washington.

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Appendix B
Regulations and Policies

- Regulatory Compliance Gap Analysis - Full Report
- NPDES Phase II Requirements
- NMFS Municipal, Commercial, Residential, and Industrial Development Standards for a "Take" Exemption
- Tri-County Proposal - Model Planning Policies
- Identifying Sites for "Street Edge Alternatives"

1.0 Introduction

1.1 Purpose

A variety of state and federal regulations affect City storm and surface water programs. These regulations include the Clean Water Act (CWA) National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater Program, the Endangered Species Act (ESA), and the Puget Sound Water Quality Management Plan (PSWQMP). Additionally, there are related guidance documents that recommend actions that are likely necessary to achieve compliance with the regulations. As an initial step in developing a comprehensive stormwater management plan (CSMP) update, Mount Vernon asked CH2M HILL to identify where potential "gaps" may exist between the City's existing policies, plans, codes, and practices and the regional and federal laws and guidance documents. Because they are enforceable Federal laws, this analysis focuses on the CWA and ESA listings of salmon. The Washington State PSWQMP also specifies stormwater programs that jurisdictions most implement. This manual has not been enforced consistently, but the PSWQMP and the Tri-County ESA recommendation will be used by regulatory agencies to assess compliance. While this paper emphasizes the Federal laws and guidance, it also identifies areas where there are substantial differences between the Federal guidance and State or regional guidance documents.

1.2 Methods

To identify potential "gaps" in Mount Vernon's regulations, policies, and practices, the following were reviewed:

- Mount Vernon Municipal Code
- Mount Vernon Comprehensive Plan
- Mount Vernon Comprehensive Surface Water Management Plan
- Mount Vernon Staff Interviews
- NPDES Phase II Minimum Control Measures
- NMFS 4(d) Municipal, Residential, Commercial, and Industrial (MRCI) Development Standards
- Tri-County Model 4(d) Proposal
- Puget Sound Water Quality Management Plan

It was necessary to interview city staff from a variety of departments to understand the current level of enforcement and implementation of existing regulations and policies. In addition, staff members were able to identify particular areas of concern and desired outcomes associated with the surface water plan update. The following City staff members were interviewed:

- Skye Richendrfer, Mayor
- Jennifer Aylor, Manager, Surface Water Utility
- Dan Eises, Capital Projects Manager
- Walt Enquist, Supervisor, Wastewater Utility
- Andrew Denham, Sewer, Drainage Maintenance Foreman

- Fred Buckenmeyer, Engineering Director
- Roxanne Michael, Planning Director
- Gloria Rivera, Senior Planner.

A list of the pre-prepared questions for each is attached in Attachment A. A detailed list of responses was previously provided.

This analysis will be used to identify the need for new or expanded City regulations and policies, program modifications, and/or management activities, which may be required for compliance with relevant state and federal regulations.

2.0 Tri-County Proposal

2.1 Tri-County Proposal Response Background

Although Mount Vernon was not part of the Tri-County ESA response effort, the Tri-County proposal provides the best guidance available regarding what is needed to qualify for a 4(d) take limitation. The current 4(d) rule (see ESA discussion below) allows local jurisdictions to receive an exemption for certain governmental activities like park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and stormwater maintenance. Rather than each jurisdiction having to get approval, NMFS encouraged regional responses to the rule.

The Tri-County Proposal is an attempt to create a set of regulations that will meet the MRCI standards set forth by NMFS, in order to qualify for the 4(d) take limitation. While no elements of the Tri-County Proposal have been approved yet by NMFS and the USFWS, if is important to see if Mount Vernon's existing policies and code are consistent with the model regulations set forth in the Tri-County Proposal.

2.2 The Tri-County Model Response Proposal

The Tri-County Model 4(d) Rule Response Proposal consists of three regulatory and programmatic components:

- Regional Road Maintenance
- Stormwater
- Land Management

For the purposes of this report, the main focus of this analysis will look at the stormwater and land management components of the Tri-County Proposal. Since Mount Vernon is not located within the boundaries of the Tri-County proposal area, it is not required to adopt or comply with the Tri-County Model Response Proposal. However, if Mount Vernon wants to be sure it's going to be eligible for "take" protection, the City must have adequate policies and regulations in place to protect habitat functions.

2.2.1 Stormwater

The Tri-County Proposal includes a Stormwater Management Checklist that lists mandatory program elements, which can then be applied to Mount Vernon's existing programs, to identify areas lacking regulatory components. The following six areas of stormwater regulations were reviewed:

- Technical Standards

- Erosion Control
- Inspection and Enforcement
- Maintenance
- Source Control
- Discharge Reduction

Each of the requirements set forth in the Stormwater Management Checklist corresponds to a particular MRCI Standard and/or NPDES Phase II Minimum Control Measure. To prevent repetition, only the Tri-County Standards that were not previously addressed/considered have been included in Sections 4.0 and 5.0 under the headings "Minimum Requirements" or "Regulatory Guidance" respectively. Due to time and budget constraints, Mount Vernon's Programs, Policies, and Regulations were not analyzed in regard to the Tri-County proposed standards/checklist.

2.2.2 Land Management

The land management component consists of two parts:

Model Planning Policies (MPPs)
MPPs provide the policy basis to conserve salmonids listed under the ESA. These could include countywide planning policies or policies adopted through individual comprehensive plans. These model land management goals and policies act as the foundation for development regulations. The Tri-County Model suggests MPPs that adequately address issues related to salmonids; these have been included in Section 5.4 of this report.

Development Regulations
Model development regulations that apply to activities in the aquatic and adjacent near-shore areas that either provide salmonid habitat or are connected to waters that supply salmonid habitat. The Tri-County program provides three options for local governments, who can choose one or any combination of the following:

- Fixed Regulations – development proposals must comply with a standard set of prescribed development regulations without deviation. Regulations include inner and outer Management Zones (MZ) with specific provisions for each zone, designed to protect habitat functions from adverse project impacts.
- Site-Specific Habitat Evaluations – proposals for development are required to complete a Habitat Evaluation (HE), which will look at the habitat functions that are likely to be impacted as a result of the project. The HE requires the applicant provide conservation measures that are consistent with the program's habitat goals and objectives, in addition to mitigating for impacts to key habitat functions.
- Programmatic Regulations – conduct a HE on a specific geographic area or specific type or category of development activity. Based on the results of the HE, the jurisdiction will identify allowable activities and appropriate protection and mitigation measures that are consistent with the habitat goals and objectives of the Tri-County Program.

Of the three options, the Fixed Regulations option is the only option that sets default-buffer widths for streams and wetlands. Mount Vernon currently has fixed regulations regarding buffer widths. Therefore, the Tri-County development regulation standards for the Fixed Regulations option looked at in the following sections:

5.4 *MRCI #1 – Ensure that Development Avoids Critical Areas*

5.6 *MRCI #3 - Protect Riparian Areas*

3.0 Puget Sound Water Quality Management Plan

The Puget Sound Water Quality Management Plan (PSWQMP) is Washington's long-term strategy for protecting and restoring Puget Sound. The management plan takes a proactive approach towards pollution prevention, and recognizes that it will cost us far more to clean up pollution later than to prevent it now.

The recently adopted 2000 PSWQMP consists of 21 programs that address major concerns about Puget Sound and its resources. These programs aim to coordinate the roles and responsibilities of federal, state, tribal, and local governments. While almost all of the programs will ultimately have some effect on Mount Vernon, the following programs require direct action on the part of local governments:

- Marine and Freshwater Habitat Protection
- Municipal and Industrial Discharges
- Non-point Source Pollution
- Agricultural Practices
- Forest Practices
- Local Watershed Action
- On-Site Sewage Systems
- Stormwater and Combined Sewer Overflows
- Education and Public Involvement

Each of these programs includes various requirements and recommendations for local governments that will most likely require revisions and additions to comprehensive plans, municipal code sections, and city programs.

4.0 NPDES Phase II Stormwater Program

4.1 Background

Published in the Federal Register (64 FR 68722) in December, 1999, EPAs Stormwater Phase II Final Rule requires Municipal Separate Storm Sewer Systems (MS4s) serving cities whose population is less than 100,000, to obtain an NPDES Phase II Municipal Stormwater Permit. Stormwater discharges are considered "point sources" of pollution, and the Clean Water Act requires all point source discharges to be covered by federally enforceable NPDES permits. The NPDES Phase II Rule states the regulated jurisdiction must:

- Specify best management practices (BMPs) for six Minimum Control Measures (MCMs)
- Identify measurable goals
- Show an implementation schedule, and
- Define the entity responsible for implementation.

EPA provides very specific regulatory guidance (40 CFR 122.34(b)), for stormwater management BMPs, in regard to each of the six MCM requirements. This guidance is what Mount Vernon's existing regulations and practices were evaluated against, and therefore it has been included in Attachment B. BMPs, when implemented together, are

expected reduce pollutants discharged into receiving water bodies to the Maximum Extent Practicable (MEP).

4.2 Organization and Level of Analysis

The following sections analyze each of the six MCMs and their minimum BMP requirements in relation to what was learned through staff interviews and from the review of Mount Vernon's existing regulations and policies. In order to identify potential gaps, the following had to be looked at and evaluated for each MCM:

- Minimum control measure requirements set forth in the Code of Federal Regulations
- Regulatory guidance and potential BMPs suggested by the EPA
- Applicable Mount Vernon Municipal Code (MVMC) sections
- Applicable goals, policies, and objectives of the Mount Vernon Comprehensive Plan
- Information from staff interviews

Table 1 provides an overview of the NPDES Phase II minimum control measure requirements in regard to Mount Vernon's existing programs, policies, and practices.

Table 2 provides an in-depth look at the specific requirements of each MCM in regard to Mount Vernon's programs, policies, and regulations. Gaps were identified, where they existed, and potential actions were recommended to fill those gaps.

Table 1
Mount Vernon's Regulations and Policies and the NPDES Minimum Control Measure Requirements*

Minimum Control Measure	Minimum Requirements Met	Current Implementation	Extent of Enforcement	Comprehensive Plan Coverage	Municial Code Coverage
1) Public Education & Outreach on Stormwater Impacts	Yes	Yes	Adequate	Adequate	Inadequate
2) Public Involvement/Participation	No	Partial	Inadequate	Inadequate	Inadequate
3) Illicit Discharge Detection & Elimination	No	No	Inadequate	Inadequate	Inadequate
4) Construction Site Stormwater Runoff Control	Yes	Partial	Partial	N/A	Adequate
5) Post-Construction Stormwater Management in New Development & Redevelopment	Partial	Partial	Partial	Partial	Adequate
6) Pollution Prevention/Good Housekeeping for Municipal Operations	No	No	Inadequate	N/A	Inadequate

*Preliminary draft

Notes:

Partial = Means that some of the minimum requirements have been implemented, but further additions are needed for compliance.
Adequate = Means that the provisions set forth within the MCM are adequately being enforced and or covered within the City's code or comprehensive plan.
Inadequate = Means that the provisions set forth within the MCM are not adequately being enforced and or covered within the City's code or comprehensive plan.

Table 2 (11x17) NPDES Phase II Requirements and Mount Vernon's Policies and Regulations (5 Pages)

4.3 MCM #1 - Public Education and Outreach on Stormwater Impacts

4.3.1 Minimum Requirements

"Implement a public education program to distribute materials to the community or conduct equivalent outreach activities about the impacts of stormwater discharges on water bodies and the steps that the public can take to reduce pollutants in stormwater runoff."

4.3.2 Regulatory Guidance

The public education program should inform individuals and households about different ways to reduce stormwater pollution, such as:

- Proper septic system maintenance
- Proper use and disposal of landscape and garden chemicals including fertilizers and pesticides
- Protecting and restoring riparian vegetation
- Properly disposing of used motor oil and household hazardous wastes

In addition, the program should be tailored, using a mix of strategies, to target specific audiences and communities. Examples of strategies include:

- Distribute brochures or fact sheets
- Sponsoring speaking engagements before community groups
- Providing public service announcements
- Implementing educational programs targeted at school age children
- Conducting community-based projects such as storm drain stenciling and watershed cleanups

EPA recommends that some of the materials be directed towards targeted groups of commercial, industrial, and institutional entities likely to have significant stormwater impacts.

4.3.3 Mount Vernon Municipal Code

This section is not applicable to MCM Standard #1.

4.3.4 Mount Vernon Comprehensive Plan

The plan recommends a comprehensive, surface water management program that relies on a combination of education, regulations, operation and maintenance, and capital projects to protect surface water resources.

A major comprehensive plan element, within Chapter 6, *Utilities,* supports the requirements of MCM #1. The element includes, "Development of public education programs to increase the understanding and awareness of citizens and business owners about flood control and how their actions can affect water quality and environmental resources".

In addition, Chapter 6 identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 2 is to maintain good water quality.

Objective "d" of this goal reads, "Implement public education programs to reduce the source of pollutants entering surface waters".

4.3.5 City Staff Interviews

The following are highlights of the information and opinions obtained during individual staff interviews.

- The general public doesn't understand how their utility bill is divided, and what their money pays for or whom it benefits. One bill is sent out for wastewater, water, SWM, and solid waste, and the bills don't show a breakdown of costs.
- There is concern about how the public would perceive another rate increase on the utility bill because Mount Vernon already has one of the highest property tax rates in the County because of the low commercial tax base.
- The average resident is quite conservative and not open to the idea of paying extra money to restore habitat while potentially loosing property rights due to buffer increases. The City should improve communication regarding the benefits to salmon protection.
- The City should complete a couple projects such as walking and bike paths so the public can see the results and enjoy the restoration they pay for (ex. watching salmon spawn, interpretive trails, school field trips, etc.).
- More money could be spent on the implementation side rather than the regulatory side to ensure that results can clearly be seen.
- Explore more volunteer programs to aid in policy implementation and help save money.

4.3.6 Positive Aspects of the City's Current Programs

The City teams up with the Skagit Fisheries Enhancement Group (SFEG) to engage communities in habitat restoration and watershed stewardship. This program, called the Stormwater Education Program, has been implemented as a result of the Mount Vernon Comprehensive Stormwater Management Plan developed in 1994. The education program is aimed at teaching residents how to prevent stormwater pollution. Recently, 4th through 12th grade students participated in a storm drain stenciling program while being educated about the problem of pollution in local creeks, streams and rivers. Also, a television channel, Mount Vernon Television (MVTV), occasionally features segments regarding stormwater education. The City has a brochure showing "Home Tips for Healthy Streams" which has a variety of good ways to reduce pollution to stormwater and limit runoff.

4.3.7 Gaps or Deficiencies Identified

The City meets the minimum requirements of MCM #1 because the City has a contract with SFEG to develop and implement a stormwater education program. However, it should also target adults, homeowners, and businesses. The City should:

- Develop a program to educate business owners, especially those thought to have significant stormwater impacts (developers, etc.).

- Sponsor speaking engagements and slide shows before community groups and homeowners living along streams and rivers.
- Hold demonstrations showing the things people can do to reduce runoff and stormwater pollution, such as planting native vegetation.
- Create a series of fact sheets that expand on each of the tips suggested in the existing brochure.

4.4 MCM #2 - Public Involvement/Participation

4.4.1 Minimum Requirements

The public must be involved in developing the SWM program, complying with state, tribal, and local public notice requirements when implementing a public involvement/participation program.

4.4.2 Regulatory Guidance

The public shall be included in creating, implementing, and updating the storm/surface water management program. Municipalities should make efforts to reach out and engage all economic and ethnic groups. Opportunities for public involvement include:

- Serving as citizen representatives on a local stormwater management panel
- Attending public hearings
- Serving as citizen volunteers to educate other individuals about the program
- Assisting in program coordination with other pre-existing programs
- Participating in volunteer monitoring efforts

4.4.3 Mount Vernon Municipal Code

No sections within the Mount Vernon Municipal Code (MVMC) currently address MCM #2.

4.4.4 Mount Vernon Comprehensive Plan

A major comprehensive plan element, within Chapter 6, *Utilities,* supports the requirements of MCM #2. The element includes, "Establishment of a Citizen Advisory Committee (CAC) and a series of several meetings in which public input was collected".

4.4.5 City Staff Interviews

The City currently has a Citizens Advisory Committee, which comprises elected members. However, a collaboration needs to be developed between the CAC and the general public to make them feel as though they were part of the process. A coalition may reduce the number of complaints received if utility rates are increased. It may help to get the public focused on the issues and not on the government. The CAC should report to the Mayor not the City Council. There should be diversity in public involvement, not just interest groups. Utilize MVTV and the stormwater education program to target all income levels and ethnicity's.

4.4.6 Positive Aspects of the City's Current Programs

The City currently has a CAC. The City currently has a TV channel that can help engage the community and notify them about upcoming public hearings or workshops. The City used a CAC to develop the initial CSMP.

4.4.7 Gaps or Deficiencies Identified

Additional effort is needed to engage the public and create a local stormwater CAC. The general public should be engaged in the process of updating the stormwater plan. Page 6-6 of the Comprehensive Plan mentions a comprehensive, surface water management program that relies on a combination of education, regulations, operation and maintenance, and capitol projects to protect surface water resources. It appears that the City is lacking involvement between the public and the CAC. Since the CAC comprises elected citizens, it is important to encourage the general public to work with the CAC, so they can convey information directly to the mayor.

4.5 MCM #3 - Illicit Discharge Detection and Elimination

4.5.1 Minimum Requirements

Develop, implement, and enforce a program to detect and eliminate illicit discharges into the city's MS4. This includes:

- complete a storm sewer system map, showing the location of all outfalls and the names and location of all waters of the United States that receive discharge from those outfalls,
- effectively prohibit, through ordinance, or appropriate enforcement procedures and actions, non-stormwater discharges into your system, including illegal dumping to your system,
- inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste.

Tri-County standards for source control requires local jurisdictions to:

- compile a list of existing commercial, multifamily, industrial, and government sites to assist in a monitoring and inspection program.
- fund site inspections and enforcement of source control BMP's,
- establish source control program policies and procedures and provide appropriate staff training to implement a six-year inspection schedule/plan.

In addition to source control requirements, the Tri-County Proposal sets standards for the reduction of illicit discharges. The proposed standards require jurisdictions to adopt ordinances, to make it illegal to dump or spill contaminants into the storm drainage system, or have connections to the storm drainage system that discharge contaminants. Jurisdictions must allocate funding for investigation, referral, and enforcement as needed for illicit discharges identified from complaints, inspections, or other monitoring information. Investigation or referral to an appropriate agency of complaints/reports (indicating a potential illicit discharge) shall occur within 7 days on average.

4.5.2 Regulatory Guidance

Illicit discharge detection programs should include the following four components:

- Procedures for locating priority areas likely to have illicit discharges
- Procedures for tracing the source of an illicit discharge
- Procedures for removing the discharge
- Procedures for program evaluation and assessment.

EPA recommends that the program also promotes, publicizes, and facilitates public reporting of illicit connections or discharges and distributes outreach materials.

4.5.3 Mount Vernon Municipal Code

MVMC 13.33.050 (parts B and C) address part (ii) B of MCM requirement #3 as the section prohibits illicit discharges to public drainage control systems, in addition to defining "illicit discharges" and providing a list of common substances considered to be "illicit".

Chapter 13.33.050 (part F) partially addresses part (ii) C of MCM #3, mentioning that an engineer can hire someone to sample and analyze a discharge thought to be illicit. The code however only allows for sampling when an engineer has reason to believe a discharge is illicit.

4.5.4 Mount Vernon Comprehensive Plan

A major comprehensive plan element, within Chapter 6, *Utilities,* supports the requirements of MCM #3. The element includes, "Development of public education programs to increase the understanding and awareness of citizens and business owners about flood control and how their actions can affect water quality and environmental resources".

In addition, Chapter 6 identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 2 is to maintain good water quality. Objective "d" of this goal reads, "Implement public education programs to reduce the source of pollutants entering surface waters".

4.5.5 City Staff Interviews

Currently, surfacewater staff do not monitor water quality/pollution levels, and have expressed that they don't want to. Ecology has sampled Kulshan Creek in the past for dissolved oxygen and fecal coliform. Mount Vernon currently monitors for illicit discharges to sanitary systems, but not stormwater systems.

4.5.6 Positive Aspects of the City's Current Programs

The City already has its own television station named MVTV, which can be utilized to inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste. The program could display a phone number that people could call if they happened to know of violators or locations where illegal dumping occurs. The City has already signed a contract with SFEG to develop and implement a stormwater education program. SFEG could work with volunteers to detect illicit discharges.

4.5.7 Gaps or Deficiencies Identified

The minimum requirements include completing a storm sewer system map which shows the location of all outfalls and the names and location of all waters of the United States that receive discharge from those outfalls. Since a complete inventory of the storm sewer system in Mount Vernon, still needs to be completed, and because there is not a program for the detection of illicit discharges to storm sewers, the minimum requirements set forth in MCM #3 have not been met.

The code does not currently include provisions for illicit discharge detection and elimination program to be created. The comprehensive plan does not mention the hazards associated with illicit discharges and illegal dumping.

4.5.8 Recommendations for Compliance

To comply with the minimum requirements, Mount Vernon must develop a program to detect non-stormwater discharges and illegal dumping, unless these are not significant contributors of pollutants to their MS4. It is also recommended that the City create and distribute a pamphlet to inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper waste disposal and provide a telephone number they can call to report violators. Chapter six of the Comprehensive Plan should have another Objective added to Goal #2 – Maintain Good Water Quality. The Objective should read, "Implement an illicit discharge detection and elimination program to keep harmful substances from entering surface waters."

4.6 MCM #4 - Construction Site Runoff Control

4.6.1 Minimum Requirements

Develop, implement, and enforce a program to reduce pollutants in any stormwater runoff to the MS4 from construction activities that result in a land disturbance of greater than or equal to one acre. At a minimum your program must include:

(A) An ordinance or other regulatory mechanism to require erosion and sediment controls (ESC), as well as sanctions to ensure compliance to the extent allowable under State, Tribal, or local law.

(B) Requirements for construction site operators to implement appropriate ESC BMPs

(C) Requirements for construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality.

(D) Procedures for site plan review which incorporate consideration of potential water impacts

(E) Procedures for receipt and consideration of information submitted by the public

(F) Procedures for site inspection and enforcement of control measures

Tri-County standards prevent the transport of sediment from development sites during and after construction. The standards also require the application of various erosion and sedimentation control BMP's. In addition, projects that add or replace 2,000 square feet or more of impervious surface or clear more than 7,000 square feet must prepare a Construction SWPPP (Stormwater Pollution Prevention Plan).

4.6.2 Regulatory Guidance

EPA encourages municipalities to provide appropriate education and training measures to ensure that construction site operators implement ESC measures correctly. Procedures for site plan review should include the review of individual pre-construction site plans to ensure consistency with local ESC requirements. Procedures for site inspections and enforcement could include steps to identify priority sites based on the nature of the construction activity, topography, characteristics of soils, and receiving water quality. Examples of sanctions to ensure compliance include non-monetary penalties, fines, bonding requirements, and/or permit denials for non-compliance.

4.6.3 Mount Vernon Municipal Code

MVMC13.33.090, lists eleven Large Parcel Minimum Requirements (LPRs) aimed at controlling erosion and sediment movement to protect water quality during construction. LPRs apply to new development that includes the creation or addition of 5,000 square feet, or greater, of new impervious area or any land-disturbing activity of one acre or greater. The language within this section directly relates to MCM #4, part (A).

LPR #1 – Erosion and Sediment Control Plan. Requires developers to create a large parcel stormwater plan showing how a variety of BMPs will be accomplished. This requirement addresses MCM #4, part (B).

LPR #3 – Source Control of Pollution. Requires source control BMPs to be applied to all projects to the maximum extent possible. This requirement addresses MCM #4, part (C).

MVMC 13.33.120, provides the enforcement to make sure ESC measures get implemented properly, by requiring site inspections at various stages of work. It is necessary that the city develops a prioritization plan and supplies sufficient staff to carry out this provision, especially as development increases. This directly relates to MCM #4, part (F).

4.6.4 Mount Vernon Comprehensive Plan

Chapter 6, *Utilities,* identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 2 is to maintain good water quality, Objective b of this goal reads, "Require adequate erosion and sedimentation controls from new construction sites". Objective "c" reads, "Require adequate water controls for new development. Both objectives support, and are consistent with MCM #4.

4.6.5 City Staff Interviews

Regulations are not adequate to protect aquatic resources because the existing regulations are not properly enforced. The responsibility for, who is supposed to do enforcement, is not clear. Staff is limited, which also makes enforcement and site inspections hard. Mount Vernon has adopted both the DOE and King County manuals for its current drainage coded and ECS code. The ESC code includes provisions for turbidity monitoring, and if it's too high, a letter of non-compliance will be issued. If turbidity levels don't drop, then a stop-work order will be issued. Two stop-work orders were issued in 2002. A few developers cause the majority of Mount Vernon's erosion issues associated with development. It is unclear to the Planning Department how to enforce provisions set forth within the critical areas code which require buffers along streams and wetlands. They expect engineers to do this when in theory, they need to have trained people visiting large parcel construction sites on a regular basis to ensure code compliance.

4.6.6 Positive Aspects of the City's Current Programs

The City's regulations show consistency with the requirements set forth in MCM #4. These regulations act as the cornerstone for Mount Vernon's ability to comply with state and federal regulations. Implementation and enforcement of the code could enhance compliance.

4.6.7 Gaps or Deficiencies Identified

Interviews with City staff reveal that there is a deficiency in the amount of staff available to inspect large parcel sites for adequate ESC measures during construction. In addition, existing regulations are not being enforced because the responsibility for enforcement is not clear, as previously mentioned, staff is limited. There is a lack of good resource inventory maps and materials available to planners to ensure development is not occurring within a critical area. No training for site inspections and monitoring has been provided for the Planning Department. For more information, see MRCI #1 in Section 5.4 of this report.

Language supporting the following minimum requirement of MCM #4 could not be found within the MVMC or Mount Vernon Comprehensive Plan:

(E) Procedures for receipt and consideration of information submitted by the public.

4.6.8 Recommendations for Compliance

For the most part, the language of the code does not need revision, as it supports the requirements set forth in MCM #4. What is needed is the addition of staff members, who can read, understand, and adequately implement and enforce the existing code. If budget is limited, it is recommended that a site inspection prioritization plan be developed, based on the nature of the construction activity, topography, characteristics of soils, and receiving water quality . This would give priority to construction activities thought to pose the greatest risk to water quality, etc.

4.7 MCM #5 - Post-Construction Stormwater Management in New Development and Redevelopment

4.7.1 Minimum Requirements

Develop, implement, and enforce a program to address stormwater runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger plan of development. The program must ensure that controls are in place that would prevent or minimize water quality impacts. At a minimum, the program must:

(A) Develop and implement strategies which include a combination of structural and non-structural BMPs best suited for the community.

(B) Use an ordinance or regulatory mechanism to address post-construction runoff.

(C) Ensure adequate long-term operation and maintenance of BMPs.

Tri-County technical stormwater standards require water quality treatment facilities/BMPs that treat 90% of the annual runoff from new and redeveloped pollution-generating surfaces using the following thresholds:

Threshold 1 – All projects that add 5,000 square feet or more of new impervious surface or create 35,000 square feet or more of new cleared area.

Threshold 2 – All transportation redevelopment projects, in which new impervious surface is 5,000 square feet or more and equal to 50% or more of the existing impervious surface within the project limits.

Threshold 3 – All non-transportation redevelopment projects, in which the total of new plus replaced impervious surface is 5,000 square feet or more, and for which the

valuation of proposed improvements exceeds 50% of the assessed value of the existing site improvements.

Proposed Tri-County inspection/enforcement standards require an inspection schedule/plan for all private flow control and water quality facilities that ensures the inspection of each facility at least once in the first six years after the start date. Furthermore, inspection of all new flow control and water quality treatment facilities in subdivisions is required every six months during the period of heaviest house construction (1-2 years after approval).

4.7.2 Regulatory Guidance

The guidance provided within 40 CFR 122.34(b)(5)iii recommends that the City take a proactive approach towards reducing water quality impacts associated with new development and redevelopment. A good mixture of structural BMPs and non-structural BMPs will lead to the most successful stormwater management program. Non-Structural BMPs are preventative actions that involve management and source controls such as:

- Policies and ordinances that provide requirements and standards to direct growth to identified areas
- Protect sensitive areas such as wetlands and riparian areas
- Maintain and/or increase open space (dedicate a funding source just for acquisition)
- Provide buffers along sensitive water bodies
- Minimization of percent impervious area after development
- Minimize disturbance of soils and vegetation
- Encourage infill development in higher density urban areas with policies or ordinances
- Provide education programs for developers and the public about designs that minimize water quality impacts

For more guidance from the EPA and a list of structural BMPs, see Attachment A.

4.7.3 Mount Vernon Municipal Code

MVMC 17.69, establishes a Planned Unit Development (PUD) district which provides for innovative land use management techniques aimed at proactively dealing with storm water impacts. This non-structural BMP can help to encourage infill while rewarding developers who choose to avoid critical areas. This chapter of the MVMC follows the regulatory guidance provided under MCM #5, and meets the minimum requirement (A).

MVMC 17.119, establishes a Transfer or Purchase of Development Rights (TDRs) program. This is another example of a non-structural BMP that deals with stormwater impacts proactively. This chapter of the MVMC follows the regulatory guidance provided under MCM #5, and meets the minimum requirement (A).

MVMC 13.33.090, requires a permanent stormwater quality control plan (PSQCP) to be completed as part of the submittal requirements set forth in LPR #11. This regulation addresses the minimum requirements set forth in MCM #5, part (B).

MVMC 13.33.090, requires an operation and maintenance schedule for all proposed stormwater facilities and BMPs as part of LPR #10, including identifying the party or parties responsible for maintenance and operation. This regulation meets the minimum requirements set forth under MCM #5, part (C).

4.7.4 Mount Vernon Comprehensive Plan

Chapter 1, *Background Analysis*, discusses various "implications for the plan", which are like goals and objectives, but they are not numbered. One of the implications says, "Development regulations should support retention of natural areas and include design criteria to achieve subdivision and site layouts which will be sensitive to the environmental constraints and optimize open space and views." This is consistent with the regulatory guidance provided under MCM #5, and meets the minimum requirement (A).

Chapter 6, *Utilities,* identifies various objectives to be met in order to accomplish the goals set forth in the water management program. Goal 2 is to maintain good water quality, Objective "c" reads, "Require adequate water controls for new development". The objective supports, and is consistent with MCM #4.

4.7.5 City Staff Interviews

Ordinances, which support non-structural BMPs, such as the ones mentioned above provide a proactive way to reduce stormwater impacts. According to the interviews, there is a significant lack of knowledge among staff, regarding how to implement the provisions currently set forth in the code. Developers have been allowed to construct projects, in which they negatively impact sensitive areas, such as cutting down trees which are located within a streamside buffer. Developers have not mitigated for adverse impacts to water quality in the past. In an extreme example, Stonebridge developers ended up violating federal regulations and federal and state agencies jumped in to stop the development. This sends a bad message to agencies about Mount Vernon's ability to comply with state and federal regulations. In addition, it has drawn the attention of the agencies to keep a closer watch on the City.

4.7.6 Positive Aspects of the City's Current Programs

The City currently has a variety of good non-structural BMP programs in place, which encourage preservation of critical areas and infill in already developed areas with existing infrastructure. Unfortunately, there is inadequate enforcement to support the regulations.

4.7.7 Gaps or Deficiencies Identified

There is a lack of understanding among staff, regarding how to identify critical areas, and how to review development proposals for compliance with the municipal code. Furthermore, responsibility and a plan for enforcement of BMPs and mitigation measures is unclear between departments, most noticeably planning and engineering. It appears that from interviews, certain staff are unfamiliar with enforcement procedures and requirements set forth in the development code.

While the City's code currently addresses the minimum requirements set forth under MCM #5, the comprehensive plan could include more objectives, goals, and policies directed towards proactive thinking and land use management. The use of non-structural BMPs (mentioned above) should be encouraged and included as a goal of the comprehensive plan.

4.8 MCM #6 - Pollution Prevention/Good Housekeeping for Municipal Operations

4.8.1 Minimum Requirements

Develop and implement an operation and maintenance program that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations. The program must include employee training to prevent and reduce stormwater pollution from activities such as:

- Park and open space maintenance
- Fleet and building maintenance
- New construction and land disturbances
- Stormwater maintenance

Tri-County maintenance standards/programs require local jurisdictions to "Adopt the regulatory authority necessary to enforce adopted maintenance standards and allocate funding for inspection and maintenance of stormwater facilities. The following inspection requirements apply to public/municipal facilities:

- Inspection of all public flow control and water quality facilities annually except where a lesser or greater frequency is appropriate to ensure compliance with standards.
- Inspection of all public flow control and water quality facilities after major storm events.
- Require inspection of all public culverts that have a history of maintenance-related fish passage problems once in spring and once in summer.
- Take appropriate maintenance actions based on the findings of the inspections.

4.8.2 Regulatory Guidance

At a minimum, EPA recommends the following is considered when developing an operation and maintenance program for municipal operations:

- Maintenance activities, schedules, and long-term inspection procedures for structural and nonstructural stormwater controls to reduce floatables and other pollutants discharged from the MS4.
- Controls for reducing or eliminating the discharge of pollutants from streets, roads, highways, municipal parking lots, maintenance and storage yards, and waste transfer stations.
- Procedures for properly disposing of waste removed from the separate storm sewers and areas listed above (such as dredge spoil, accumulated sediments, floatables, and other debris).

Operation and maintenance programs can reduce the risk of water quality problems when they are developed and implemented properly. This measure is intended to improve the efficiency of these programs, which should be an integral component of all stormwater management programs

4.8.3 Mount Vernon Municipal Code

No language regarding an operation and maintenance program for municipal activities was found within Chapter 13.33, *Drainage Utility* or Chapter 13.34, *Surface Water Utility*.

4.8.4 Mount Vernon Comprehensive Plan

A major comprehensive plan element, within Chapter 6, *Utilities,* is consistent with the requirements of MCM #6. The element includes, "Development of a Maintenance and Operations Plan".

The comprehensive plan goes on to mention that 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.

4.8.5 City Staff Interviews

An inventory of the drainage system is needed to establish a maintenance schedule so crews can react and update/revise the inventory and data regarding routine maintenance schedules. Jennifer Aylor is waiting for an intern to help out with doing the inventory and to transfer existing data into digital format. The following facilities have not yet been inventoried: pipes, catch basins, roadside ditches, manholes, and curb inlets. Detention ponds and pump stations have already been inventoried. There is a need to identify methods to prevent fish from accessing the closed conduit system. Salmon have been "vactored" up in the past by maintenance staff. Need to identify stormwater discharge locations that currently have no source control or treatment prior to discharge. Present treatment options to meet water quality standards.

4.8.6 Positive Aspects of the City's Current Programs

Existing wastewater utility staff are already aware of improvements that are needed to the operations and maintenance program. In addition, the wastewater utility staff understands what updates need to occur to comply with NPDES Phase II requirements. The City has dramatically reduced the number of annual overflow events by completing an interceptor project and by making improvements to its WWTP. The utility has met Ecology's requirements ahead of schedule.

4.8.7 Gaps or Deficiencies Identified

There is no benchmark/frequency for all maintenance activities. Inventory and mapping of the existing storm sewer system is not complete. Software and survey crews are needed to complete the inventory, to begin tracking service requests, maintenance, and street sweeping schedules.

There is no language within the *Drainage Utility* or *Surface Water Utility* Chapters of the code that mentions an operations and maintenance plan for municipal activities. The Goals at the end of Chapter 6 of the comprehensive plan, could include a statement that a good maintenance and operations program is an objective of Goal #2 – Maintain Good Water Quality.

5.0 Section 4(d) of the Endangered Species Act

5.1 Background

The ESA provides for the protection of endangered and threatened species. Two sections of the ESA directly affect local jurisdictions:

Section 4(d) relates to the listing of species as threatened or endangered. It allows the listing agency to publish rules that define conditions under which "incidental" take is permissible. The National Marine Fisheries Service (NMFS) issued the final 4(d) rules governing the conservation of steelhead and salmonids in the Northwest. To qualify for incidental take protection, municipalities must demonstrate compliance with the 4(d) rule. NMFS 4(d) rule allowing incidental take requires municipalities to conduct program actions and create and issue regulations which will provide for the conservation of threatened species.

Section 9 defines specific actions that are prohibited, which may result in a "take" of endangered species. A "take" could involve harming, harassing, pursuing, hunting, or killing a listed or endangered species. Destruction or changes to habitat (supporting listed and threatened species) is defined as a "harm" under the ESA, and Mount Vernon could be liable. However, the 4(d) rule for Northwest salmonids, has an exemption, for certain governmental activities, if they meet the municipal, commercial, residential, and industrial (MRCI) development standards outlined in the final rules, released in July 2000.

5.2 MRCI Standards /Evaluation Considerations

There are a total of twelve evaluation considerations when NMFS reviews a local jurisdiction's comprehensive plan and development regulations when determining a city's ability to conserve listed species, by protecting and restoring their habitat. These MRCI Standards have been taken directly from the 4(d) rule, and are provided in Attachment B. If NMFS approves Mount Vernon's policies and regulations, the city will be granted an exemption under the MRCI standards to a "take". Mount Vernon would be protected from action from NMFS and would have their support in the event of any third party lawsuits against the jurisdiction for action under the MRCI standards.

Some of the MRCI standards are very similar to the NPDES Phase II Minimum Control Measure Requirements. Therefore, in order to reduce repetition, the analysis will not go into detail regarding the following MRCI Standards:

- MRCI #2 – *Avoid Stormwater Discharge Impacts*, is covered under MCM #5 - Post-Construction Stormwater Management in New Development and Redevelopment
- MRCI #9 - *Prevent Erosion and Sediment Run-off During Construction,* is covered under MCM #4 - Construction Site Runoff Control.

5.3 Organization and Level of Analysis

The following sections analyze each of the twelve evaluation considerations in relation to what was learned through staff interviews and review of Mount Vernon's existing regulations and policies. In order to identify potential gaps, the following had to be looked at and evaluated for each MRCI:

- Regulatory guidance and suggested actions by NMFS
- Sections of the Mount Vernon Municipal Code, relating to the MRCI requirements
- Applicable goals, policies, and objectives of the Mount Vernon Comprehensive Plan
- Information from staff interviews

Table 3 provides an overview of the MRCI standards and the extent of Mount Vernon's existing programs, policies, and practices.

Table 3 Mount Vernon's Regulations and Policies and the NMFS 4(d) MRCI Standards*				
MRCI Standard	**Current Implementation**	**Extent of Enforcement**	**Comprehensive Plan Coverage**	**Municial Code Coverage**
#1) Ensure that Development Avoids Critical Areas	No	Inadequate	Inadequate	Inadequate
#2) Avoid Stormwater Discharge Impacts	Partial	Partial	Partial	Adequate
#3) Protect Riparian Areas	Partial	Inadequate	Inadequate	Inadequate
#4) Avoid Stream Crossings	No	N/A	N/A	Inadequate
#5) Protect Channel Migration Zones	Partial	N/A	N/A	Inadequate
#6) Protect Wetlands and Wetland Functions	No	Inadequate	Inadequate	Inadequate
#7) Preserve Hydrologic Capacities of Streams	Partial	N/A	N/A	Adequate
#8) Include Provisions for Native Vegetation	No	N/A	Inadequate	Inadequate
#9) Prevent Erosion and Sediment Run-off During Construction	Partial	Partial	N/A	Adequate
#10) Ensure Water Supply Diversions Don't Harm Salmon	No	Inadequate	N/A	Inadequate
#11) Enforcement, Funding, and Implementation Mechanisms	Yes	N/A	Adequate	Adequate
#12) Compliance w/ State and Federal Laws/Permits	Partial	Inadequate	Adequate	Adequate

*Preliminary draft

Notes:

Partial = Means that some of the standards have been met, but further actions are needed for compliance.
Adequate = Means that the provisions set forth within the MRCI Development Standards are adequately being enforced and or covered within the City's code or comprehensive plan.
Inadequate = Means that the provisions set forth within the MRCI Development Standards are not adequately being enforced and or covered within the City's code or comprehensive plan.

5.4 MRCI #1 - Ensure that Development Avoids Critical Areas

5.4.1 Regulatory Guidance

Ensuring that development will avoid inappropriate areas such as unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites. Activities such as development, timber harvest, or other soil disturbance should be sited in appropriate areas--avoiding unstable slopes, wetlands, areas already in a proper functioning condition, areas that are more functional than neighboring sites, and areas with the potential to be fully restored.

The Tri-County Proposal fixed regulations option requires the creation of Inner and Outer "Management Zones" along with a separate set of regulations for each. Management Zones (MZs) are just like buffers in the sense that they restrict development on property, which lies immediately adjacent to a defined water body that either provides salmonid habitat or contributes to the proper functioning of salmonid habitat. Tri-County requirements for MZ widths for streams are provided in Section 5.6, which discusses the protection of riparian areas.

5.4.2 Mount Vernon Municipal Code

MVMC Chapter 15.40, *Additional SEPA Guidelines*, consists of a variety of regulations aimed at protecting critical areas such as wetlands, streams, fish and wildlife habitat, and steep hillsides. This chapter would be reviewed when evaluating MCRI Standard #1.

5.4.3 Mount Vernon Comprehensive Plan

Chapter 1, *Background Analysis,* page 1-19 of the comprehensive plan does not identify threatened and endangered species within the City of Mount Vernon.

Chapter 1, *Background Analysis*, also discuses various "implications for the plan", which are like goals and objectives, but they are not numbered. One of the implications says, "Development regulations should support retention of natural areas and include design criteria to achieve subdivision and site layouts which will be sensitive to the environmental constraints and optimize open space and views." This is consistent with the regulatory guidance provided under MRCI #1

Another implication for the plan states that, "Wildlife habitat should be created or enhanced along riparian areas as part of wildlife protection and enhancement". This is consistent and supports MRCI #1.

The following Tri-County MPPs are good examples of comprehensive plan policies that Mount Vernon could adopt, to acknowledge and comply with the listing of Puget Sound Chinook under the ESA. Additional guidance regarding the implementation of each MPP is provided in Attachment C. The following policies address MRCI Standard #1 by providing framework for the creation, implementation, and enforcement of development regulations:

Model Policy No. 2: The city should preserve, protect, and where possible, restore natural habitat critical for the conservation of salmonid species listed under the federal ESA, through the adoption of comprehensive plan policies that seek to protect, maintain

or restore aquatic ecosystems, associated habitats and aquifers through the use of management zones, development regulations, incentives for voluntary efforts of private landowners and developers, land use classifications or designations, habitat acquisition programs or habitat restoration projects.

Model Policy No. 4: All jurisdictions shall work together to identify and protect natural habitat networks that cross jurisdictional boundaries.

Model Policy No. 6: All jurisdictions shall cooperatively work together to create and adopt modifications to their Critical Areas Regulations that include the best available science for the protection of existing habitat, wetlands, estuaries, riparian areas by avoiding negative impacts.

Model Policy No. 7: Upon adoption of a state classification system, the cities and the county shall work together to establish a single system for stream typing.

Model Policy No. 9: All jurisdictions shall establish a monitoring and evaluation method, which is designed to determine the effectiveness of restoration, enhancement, and recovery strategies for listed species.

Model Policy No. 10: All jurisdictions shall recognize that the best available science, to address listed species recovery issues, is evolving. Each jurisdiction shall apply an adaptive management strategy to determine how well the objectives of listed species recovery and critical habitat preservation/restoration are being achieved.

5.4.4 City Staff Interviews

As previously mentioned, a critical areas code exists, but it is hard to locate because it is titled, "Additional SEPA Guidelines". Wetland buffers set forth within the code are inadequate. Wetlands types are not classified or considered when impacts are mitigated. Enforcement through site visits is lacking.

5.4.5 Positive Aspects of the City's Current Programs

The City has a stream and wetlands inventory that shows the presence or absence of fish in streams. The "Shannon and Wilson" report is a reconnaissance level report, which includes maps of streams and wetlands in Mount Vernon.

5.4.6 Gaps or Deficiencies Identified

There may be a lack of understanding regarding how to identify critical areas, and how to review development proposals for compliance with the critical areas code. Furthermore, responsibility and a plan for enforcement appears unclear between departments. There were two "stop work" orders issued to developers in 2002, who failed to comply with the MVMC, resulting in state and federal agency involvement.

The current code, "Additional SEPA Guidelines" should be renamed "Critical Areas Ordinances" so it will be easier to find/stand out.

The City doesn't have geologic hazards (steep hillsides) critical areas mapped out as critical areas to avoid.

The Planning Department should revise the way they average buffer widths.

The City currently has a wetland setback/buffer that is a standard 25 feet. There are no increases in wetland buffer width depending on the rating or overall function of a

wetland. Furthermore there are no compensatory requirements or replacement ratios provided for impacts to or filling of wetlands.

The comprehensive plan does not have an "environmental" chapter/element with specific goals and policies for salmon protection. It is recommended that the City adopt comprehensive policies and goals similar to the Tri-County MPPs mentioned above.

5.5 MRCI #2 - Avoid Stormwater Discharge Impacts

5.5.1 Regulatory Guidance

Adequately preventing stormwater discharge impacts on water quality and quantity and stream flow patterns in the watershed--including peak and base flows in perennial streams. Stormwater management programs must require development activities to avoid impairing water quality and quantity.

This evaluation consideration is identical to the NPDES Phase II minimum control measure #5, which requires the development, implementation, and enforcement of a stormwater runoff program. See page 10 for a complete analysis.

5.6 MRCI #3 - Protect Riparian Areas

5.6.1 Regulatory Guidance

Protecting riparian areas well enough to attain or maintain Properly Functioning Conditions (PFC) around all rivers, estuaries, streams, lakes, deepwater habitats, and intermittent streams. Compensatory mitigation shall be provided, where necessary to offset unavoidable damage to PFC in riparian management areas. Activities should be quite limited in areas adjacent to all perennial and intermittent streams and waters supporting listed salmon and steelhead in order to avoid soil disturbance and maintain vegetated riparian corridors.

As previously mentioned the Tri-County Proposal Fixed Regulations Option requires the creation of Inner and Outer "Management Zones", along with a set of restrictions for each zone. Management Zones (MZs) are basically stream buffers, which aim to protect salmonid habitat, or areas that contribute to the proper functioning of salmonid habitat. The minimum prescribed widths of MZs are determined by water types, as established by the Washington *Forest and Fish Report*. This method of classification is "habitat-driven" instead of designating streams according to geomorphic parameters. The following MZ widths are recommended for the adequate protection of threatened salmonids:

Water Type S: 200 feet

Water Type F: 200 feet

Water Type F – Steep Ravine: 100 feet or 25 feet from the top of the bank

Water Type N – Within a ¼ mile upstream of a Type S or F stream: 115 feet

Water Type N – More than ¼ mile upstream of a Type S or F stream: 65 feet

5.6.2 Mount Vernon Municipal Code

MVMC 15.40.010, *Purpose,* includes goals which are applicable/address MRCI Standard #3:

C. Preserve and protect environmentally sensitive areas by regulating development within and adjacent to them.

E. Prevent adverse cumulative impacts to the water quality, wetlands, streams, stream corridors, and fish and wildlife habitat.

MVMC 15.40.080, *Buffers and Setbacks,* mentions that a 10-foot building setback from the edge of all critical area buffers may be required to prevent encroachment into the buffer.

The section of the code should be revised to say that a 10-foot setback is required.

In addition, this section needs to refer back to MVMC 15.40.050, *Regulated and Allowed Activities*, because that section mentions what activities are allowed and what activities are prohibited in buffers.

MVMC 15.40.050.C, *Wetland and Buffer Alteration*, starts off by mentioning that, "Wetlands and associated buffers may be altered provided that..."

This language could be changed to say, "Alterations to wetlands and buffers is

MVMC 15.40.120, *Stream Buffer Requirements,* provides stream ratings, which place streams into three different categories pursuant to WAC 222-16-030, Forest Practice Regulations.

MVMC 15.40.120 provides stream buffer requirements for minimum buffer widths:

Category I – Determined by the Skagit County Shoreline Master Program

Category II – 100 total width centered on the stream (i.e., 50 feet on each side of the centerline of the stream)

Category III – 50 total width centered on the stream (i.e., 25 feet on each side of the centerline of the stream)

MVMC 15.40.130, *Stream Preservation/Alternatives and Mitigation*, addresses stream mitigation, but fails to mention mitigation requirements for Category II and III streams. It mentions that "All Category I streams shall be preserved in accordance with the Shoreline Management Master Program". The previous sentence should mention the actual name of the shoreline program (i.e. Skagit County Shoreline Master Plan).

MVMC 15.40.140, *Fish and Wildlife Habitat Conservation Areas,* mentions that certain areas within the City shall be named Priority Habitat. In order for an area to be classified as priority habitat, it must meet one of the following:

1. Presence of a species federally or state listed or proposed for listing as threatened, endangered, sensitive, or as priority species, or outstanding potential habitat for those species.
2. Areas contiguous with large blocks of habitat extending outside the city limits and providing a travel corridor to a significant resource.
3. Areas adjacent to or contiguous with wetlands and streams which enhance the value of those areas for fish and wildlife.

If a development is proposed within or adjacent to a priority habitat area, the applicant shall provide a wildlife habitat assessment prepared by a professional.

The existing code only mentions that the habitat assessment shall include recommendations for protection of the identified habitat areas and species of concern. It is recommended that the code include more stipulations for the assessment.

The Tri-County Proposal provides a habitat evaluation outline, which requires the developer to look at habitat goals and objectives, inherent site potential, and conservation measures to mitigate for impacts.

5.6.3 Mount Vernon Comprehensive Plan

Chapter 1, *Background Analysis,* page 1-11 of the comprehensive plan mentions that the City of Mount Vernon's current development and future growth are controlled largely by it's existing physical features:

"The Skagit River defines the edge of the City to the north and west, except adjacent to downtown. A number of streams, some salmon bearing, provide natural corridors which should be protected from development by adequate buffers".

This is consistent with MRCI Standard #3, protect riparian areas.

Chapter 1, *Background Analysis*, page 1-22, also discuses various "implications for the plan", which are like goals and objectives, but they are not numbered. One of the implications says, "Wildlife habitat should be created or enhanced along riparian areas as part of wildlife protection and enhancement". This goal or policy is consistent with MRCI #3.

Page 1-18 of the plan, *Riparian Habitat,* also mentions that riparian habitat along streams usually supports diverse and productive wildlife communities.

5.6.4 City Staff Interviews

It is currently unclear who is responsible for enforcing the City's Critical Area Ordinances each time a project comes up for review. The City has a Problem Enforcement Team (PET) that comprises policy, fire, public works and planning staff. The Kulshan Ridge development was approved, and then a "stop work" order had to be issued because the developer did not obey stream buffer ordinances. Construction staging inspections and buffer inspections are lacking due to staffing issues. The way that the planning department averages buffers should be clarified and strengthened.

5.6.5 Positive Aspects of the City's Current Programs

The current comprehensive plan supports the protection and enhancement of riparian areas. The city already has a transfer of development rights program and other density credit programs in place to protect sensitive areas such as riparian corridors.

5.6.6 Gaps or Deficiencies Identified

The EPA mentions that streamside activities, carried out within a distance equal to the height of the tallest tree that can grow on that site (site potential tree height), can significantly affect essential habitat functions. This science-based method allows stream buffers to vary, depending on the type of habitat the stream supports.

Based on a comparison the existing Mount Vernon requirements for riparian/stream buffer widths and the requirements set forth within the Tri-County Proposal, it appears that the required widths of stream buffers may not be wide enough for Category II and III streams.

Staff lacks knowledge of how to apply the current "Shannon and Wilson Report" or utilize it when reviewing a project proposal. The planning department does not do many site visits/inspections to make sure trees are not getting cut down or that riparian areas/buffers are being preserved. Mount Vernons' Municipal Code should have more strict enforcement; it should be clarified who is responsible for enforcing which provisions.

Induce more penalties for developers who have deliberately and repeatedly broken sensitive area ordinances.

5.7 MRCI #4 - Avoid Stream Crossings

5.7.1 Regulatory Guidance

Avoiding stream crossings--whether by roads, utilities, or other linear development--wherever possible and, where crossings must be provided, minimize impacts. One method of minimizing stream crossings and their associated disturbances is to optimize transit opportunities to and within newly developing urban areas.

Where a crossing is unavoidable, the plan or ordinance should minimize its affect by preferring bridges over culverts; sizing bridges to a minimum width; designing bridges and culverts to pass at least the 100-year flood (and associated debris).

5.7.2 Mount Vernon Municipal Code

MVMC 15.40.130.B.2 address road stream crossings and states, "Culverting within a stream shall only be permitted to provide access to a lot when no other feasible means of access exists. Use of common access points shall be required for abutting lots which have no other feasible means of access. Culverting shall be limited to the minimum number of stream crossing required to permit reasonable access.

This section should mention that where crossings are unavoidable, bridges are preferred over culverts, and widths should be minimized. It should apply to City streets in addition to private roads or driveways.

MVMC 13.33.90.D.1, part i, *Underground Utility Construction,* includes guidance for developers regarding the construction of underground utilities. A section (4) should be added which urges the avoidance of stream crossing wherever possible, and if a utility must cross a stream, than underground boring is preferred over open trench construction.

5.7.3 Mount Vernon Comprehensive Plan

Polices, goals, and objectives within comprehensive plans are generally to broad to apply to MRCI Standard #4, Avoiding Stream Crossings.

5.7.4 Gaps or Deficiencies Identified

It is clear in the municipal code that new stream crossings are not recommended and should be avoided. Development standards should be more specific, and mention that stream crossings, if absolutely necessary, should be bridges, not culverts, and widths should be minimized. Also, the code should mention that installing cable underground should avoid stream crossings if at all possible. The code should encourage utilization of existing utility crossing corridors where streams or riparian buffers are present, and must be crossed.

5.8 MRCI #5 - Protect Channel Migration Zones

5.8.1 Regulatory Guidance

Adequately protecting historic stream meander patterns and channel migration zones (CMZs) and avoiding hardening of stream banks and shorelines. Any MRCI development should be designed to allow streams to meander in historic patterns of channel migration. Activities on the landscape must protect conditions that allow gradual bank erosion, flooding, and channel meandering in the zone within which it would naturally occur. This natural channel migration promotes gravel recruitment, geomorphic diversity, and habitat development.

If unusual circumstances require bank erosion to be controlled, it should be accomplished through vegetation or carefully bioengineered solutions. Rip-rap blankets or similar hardening techniques would not be allowed, unless particular site constraints made bioengineered solutions impossible.

"Management Zones", as prescribed within the Tri-County Proposal Fixed Regulations Option, seek to protect meander patterns and historic flow patterns of streams by encompassing CMZs and their associated wetlands. The Tri-County Proposal requires jurisdictions to conduct a jurisdiction-wide study, to set initial CMZ boundaries for all stream reaches where stream power, soil conditions, and valley-floor widths are sufficient enough to cause channel migration.

5.8.2 Mount Vernon Municipal Code

MVMC Chapter 15.36, *Floodplain Management Standards*, is the most applicable section of the code in regard to MRCI #5.

MVMC 15.36.020, *Methods of Reducing Flood Losses,* includes methods and provisions for reducing flood losses:

C. Controlling the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel floodwaters.

"Channel Migration Zones" should be added to this provision.

MVMC Chapter 15.36 should have a special section that discuses the protection of historic stream meander patterns and channel migration zones. A section adequately addressing the regulatory guidance set forth in MRCI #5 could not be found.

MVMC 15.36.030, *Definitions*. A definition for "Channel Migration Zones" should be added.

MVMC 15.40.010, includes one goals which is applicable and addresses MRCI Standard #5:

F. Protect the public and public resources and facilities from injury, loss of life, property damage, or financial losses due to flooding, erosion, land uses, soil subsidence or steep slopes failure.

MVMC 15.40.130, *Stream Preservation/Alternations and Mitigation,* should include a section that provides for the protection of historic stream meander patterns and channel migration zones. It should require that development, near streams, must allow for gradual bank erosion, flooding, and channel meandering in the zone where it would normally occur.

5.8.3 Mount Vernon Comprehensive Plan

The comprehensive plan mentions that a surface water management program will aid in preventing future flooding as a result of new development. It doesn't mention any specifics regarding the protection of channel migration zones and meander patterns. This is too specific for a comprehensive plan.

5.8.4 Gaps or Deficiencies Identified

The code does not discuss and define "channel migration zones". The planning department may not review maps showing channel migration areas and historic stream flow patterns when signing off on a development proposal.

5.9 MRCI #6 - Protect Wetlands and Wetland Functions

5.9.1 Regulatory Guidance

Adequately protecting wetlands, wetland buffers, and wetland function--including isolated wetlands. Activities on the landscape must protect wetlands and the vegetation surrounding them to avoid disturbing soils, vegetation, and local hydrology. Such conditions on the landscape contribute to the natural succession of wetlands and protect wetland functions needed to meet salmonid habitat requirements such as food chain support, shoreline protection, water purification, storm and flood water storage, and groundwater recharge. These conditions are also needed to protect the freshwater, marine, and estuarine wetland systems that provide vital habitat for rearing and migrating salmon and steelhead.

5.9.2 Mount Vernon Municipal Code

MVMC 15.40.010, includes goals which are applicable/address MRCI Standard #6:

C. Preserve and protect environmentally sensitive areas by regulating development within and adjacent to them.

E. Prevent adverse cumulative impacts to the water quality, wetlands, streams, stream corridors, and fish and wildlife habitat.

MVMC 15.40.050 discusses activities that are regulated and allowed (with a permit) within environmentally sensitive areas, such as wetlands.

D. Compensatory Mitigation. As a condition of any permit allowing alteration of wetlands and associated buffers the applicant may propose to restore, create, or enhance wetlands and their associated buffers.

This provision is inadequate because it says developers "may" propose not "will". This section should include more guidance for developers such as off-site and out-of-kind opportunities such as a wetland mitigation-banking program or financial contributions to an established water quality program.

E. Mitigation Plan. The city shall approve a mitigation plan before issuing any permits for development activity on a lot upon which a wetland alteration, restoration, creation, or enhancement is proposed.

This provision is inadequate because it fails to include "wetland buffers" as areas that require a mitigation plan if they are impacted.

In addition, the mitigation section provides no ratios or standards for the amount of wetland creation/replacement that would need to occur when a developer fills wetlands.

MVMC 15.40.080, *Buffers and Setbacks*, includes a provision under section (C) Fencing and Signage, that requires, "a split rail fence to be installed along the boundaries of all critical area buffers and, in a prominent location, one wetland/stream sign shall be posted per lot, or every 150 feet of buffer." This provision supports MRCI #6.

MVMC 15.40.090, *Wetland Delineation*, mentions that "wetlands shall be identified and delineated in accordance with the 1987 Corps of Engineers Wetlands Delineation Manual".

MVMC 15.40.100, *Wetland Buffers*, requires a buffer zone of 25 feet for all regulated activities adjacent to regulated wetlands. According to the Tri-County Proposal, this buffer width requirement is not adequate to protect wetland functions, and therefore does not address or meet MRCI Standard #6. The Tri-County standards require a minimum buffer of 100 feet around wetlands.

5.9.3 Mount Vernon Comprehensive Plan

Environmentally Sensitive Areas, Page 1-13 of the comprehensive plan addresses the need and objective of a wetland inventory:

"The objective of a wetland inventory is to assist the city with identifying the approximate location and extent of wetlands within the existing City limits and proposed urban growth area."

The section goes on to mention that the accuracy of the current wetland inventory is limited by a number of factors (i.e. age of photographs reviewed, limited time spent in the field verifying, etc.). In addition, it mentions that it is possible that additional wetlands are present, that were not located during the inventory.

Fish and Wildlife Priority Habitat and Species, Page 1-18 of the comprehensive plan briefly mentions that wetlands are an important type of wildlife habitat, but it does not make the link that wetlands act as filters and detention areas for run off, and that protecting wetlands will significantly improve water quality. There is no mention of threatened salmon, and how wetland protection will play a role in their recovery.

Chapter 6, *Utilities,* identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 2 is to maintain good water quality, but there is no objective that relates to the preservation of wetlands and their associated buffers.

Chapter 6, *Utilities,* identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 3 is to preserve sensitive resources and maintain varied use. Objective "b" of this goal reads, "Preserve wetlands and implement a wetlands management strategy." This objective supports, and is consistent with MCM #6.

5.9.4 City Staff Interviews

Mount Vernon does have a stream and wetlands inventory that shows the presence or absence of fish in streams. Referred to as the, "Shannon and Wilson Report," this report is a reconnaissance level report, which includes maps of streams and wetlands in Mount Vernon. It appears that the planning department does not look at this report when reviewing a project proposal. A hot issue is the City's wetland setback buffer that is a

standard 25 feet. Interviews with staff suggested that this was not adequate and that it is not based on the function of a wetland. Certain tribes tell the City that the setbacks are not adequate, and that they should be equal or greater to the setbacks required by Skagit County.

5.9.5 Gaps or Deficiencies Identified

The Mount Vernon Municipal Code has one standard buffer width for wetland protection, regardless of the type and/or function of the wetland. The standard buffer width of 25 feet is inadequate and does not comply with state and federal regulations and requirements. There is no wetland overlay/map layer to show the location of all the regulated wetlands within the City. Language within the code prohibiting impacts to wetlands is weak and is not adequate for the protection of wetlands and wetland buffers. The comprehensive plan should include more goals, policies, and objectives that address how important wetland protection is, especially when it comes to water quality and salmon recovery.

5.10 MRCI #7 - Preserve Hydrologic Capacities of Streams

5.10.1 Regulatory Guidance

Adequately preserving a permanent and intermittent streams' ability to pass peak flows. Activities that decrease a stream's hydrologic capacity by filling in its channel for road crossings or other development will increase water velocities, flood potential, and channel erosion, as well as degrade water quality, disturb soils and groundwater flows, and harm vegetation adjacent to the stream.

Minimum Tri-County flow control standards for new impervious surfaces/cleared areas include matching discharge durations ranging from 50% of the 2-year rate to 100% of the 50-year rate for the site condition that existed prior to any development in the region. For existing and incremental new impervious surfaces/ cleared areas require site-specific flow control facilities to mitigate for runoff from these surfaces in accordance with specific thresholds and design information specified within the Tri-County Proposal.

5.10.2 Mount Vernon Municipal Code

MVMC 13.33.90.D.2, *LPR #2 - Preservation of Natural Drainage Systems,* requires that natural drainage patterns shall be maintained in conformance with general design and construction standards. It goes on to mention that surface water entering the subject property shall be received at the naturally occurring locations and surface water exiting the subject property shall be discharged into the naturally occurring drainage basin.

MVMC 13.33.90.D.8, *LPR #8 - Off-Site Analysis and Mitigation,* requires all large parcel development projects to conduct a downstream analysis of water quality and quantity impacts resulting from the project. MRCI Standard #7 requires the following impacts to be evaluated and mitigated:

b. Stream bank and stream bed erosion

f. Inadequate storm water conveyance capacities

g. Excessive stormwater velocities

MVMC 13.33.190.A, also addresses MRCI #7, "Development which would increase the volume or rate of discharge due to any storm from the subject property shall not be permitted in areas designated by the engineer.

5.10.3 Mount Vernon Comprehensive Plan

Chapter 6, *Utilities,* identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 1 is to prevent property damage from flooding. Objective b of this goal reads, "Require adequate peak flow controls for new development". This objective supports, and is consistent with MCM #7.

5.10.4 City Staff Interviews

The engineering director felt that infiltration would be a good thing to work into the development code. Water quality credits for developers who implement rain gardens, vegetated roofs, or place houses on pins to allow for greater infiltration may improve water quality and preserve hydrologic capabilities of streams. However, infiltration does not work well everywhere. The City could develop a map of potential sites where infiltration would work well, and then these would be the only areas where developers could receive water quality credits.

5.10.5 Gaps or Deficiencies Identified

Adequate regulations in the MVMC appear to be in place to comply with these requirements. The City should require continuous simulation modeling for sizing new facilities. Cumulative impacts and imperfect enforcement should be addressed and a method of compensation should be developed through the CSMP update process. A gap may exist when it comes to reviewing drainage plans for development proposals. Additional staff may be required to adequately enforce the existing municipal code, in regard to downstream drainage concerns and preservation of hydrologic stream capacities.

5.11 MRCI #8 - Include Provisions for Native Vegetation

5.11.1 Regulatory Guidance

Providing adequate provisions for landscaping with native vegetation to reduce the need to water and apply herbicides, pesticides, and fertilizer. Plans must describe the techniques that local govemments will use to encourage planting with native vegetation, reducing lawn area, and lowering water use. These provisions will maintain essential habitat processes by helping conserve water and reduce flow demands that compete with fish needs. They will also reduce the amount of chemicals contributing to water pollution.

One of the minimum technical standards that the Tri-County Proposal sets forth, requires rural single-family residential developments to use runoff dispersion techniques. Dispersion BMPs, wherever possible, shall minimize effective impervious surface to less than 10% of the development site or be used for "fully dispersing" runoff from impervious surfaces and cleared areas of development sites that protect at least 65% of the site in a forest or native condition. This is known as the "65/10 Standard".

5.11.2 Mount Vernon Municipal Code

MVMC 13.33.090, requires a permanent stormwater quality control plan (PSQCP) to be completed as part of the submittal requirements set forth in LPR #11. The PSQCP is required to show the existing and proposed vegetative cover, soil types including trees, shrubs, and grasses shall be depicted on a map of the site. Measures for controlling runoff after construction are required in accordance with the Ecology and King County Manuals, but there is no mention of required vegetation to be planted.

MVMC Title 16, *Subdivisions*, fails to include any sections relating to a vegetation management plan, or retention of significant trees. Chapter 16.16, *Design Standards*, mentions nothing about tree retention or minimum vegetation requirements.

MVMC 16.32.032, *Design of short plats – Standards,* mentions nothing in regard to native vegetation requirements or tree retention.

5.11.3 Mount Vernon Comprehensive Plan

Chapter 6, *Utilities,* identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 2 is to maintain good water quality. Objective "d" of this goal reads, "Implement public education programs to reduce the source of pollutants entering surface waters." This objective supports the regulatory guidance provided above, and is therefore consistent with MCM #6.

5.11.4 City Staff Interviews

Interviews revealed that the average Mount Vernon resident is unaware of things they can do to reduce impacts to stormwater runoff. Residents tend to be conservative in nature, and may be unaware of the importance of planting native vegetation to help reduce runoff.

5.11.5 Gaps or Deficiencies Identified

The current development code for subdivision development has no regulations for a vegetation plan or minimum standards for tree retention. The municipal code is inadequate in regard to MRCI Standard #8.

Plans must describe the techniques that local governments will use to encourage planting with native vegetation, reducing lawn area, and lowering water use. It appears that this element is lacking from the current surface water program in Mount Vernon.

The stormwater education program should focus more on educating homeowners (living adjacent to critical streams/buffers) about specific alternatives to using harmful pesticides and fertilizers and changing the type of plants they have in their back yard. Interactive displays or workshops may be necessary to fully engage the public.

More programs should be developed that are aimed at teaching developers and businesses new ways of reducing runoff and ways to limit impacts to water quality.

5.12 MRCI #9 - Prevent Erosion and Sediment Run-off During Construction

5.12.1 Regulatory Guidance

Preventing erosion and sediment run-off during (and after) construction, which thus prevents sediment and pollutant discharge to streams, wetlands, and other water bodies

that support listed salmonids. These provisions, at a minimum, should include detaining flows, stabilizing soils, protecting slopes, stabilizing channels and outlets, protecting drain inlets, maintaining Best Management Practices (BMPs), and controlling pollutants.

This evaluation consideration is identical to the NPDES Phase II minimum control measure #4, which requires jurisdictions to develop, implement, and enforce a program to reduce pollutants in any stormwater runoff to the MS4 from construction activities. See page 8 for a complete analysis.

5.13 MRCI #10 - Ensure Water Supply Diversions Don't Harm Salmon

The City of Mount Vernon currently contracts with the Skagit PUD to provide drinking water. MRCI Standard #10 applies to the PUD and not the Mount Vernon Surface Water Division. Therefore, an analysis of this standard is not included in the scope of this report.

5.13.1 Regulatory Guidance

Ensuring that water supply demands can be met without affecting–either directly or through groundwater withdrawals--the flows that threatened salmonids need. A plan must ensure that any new water diversions are positioned and screened in a way that prevents salmonid injury or death.

5.13.2 Mount Vernon Municipal Code

Not covered within the existing municipal code

5.13.3 Mount Vernon Comprehensive Plan

Not covered within the existing comprehensive plan.

5.13.4 City Staff Interviews

Not discussed during interviews.

5.13.5 Gaps or Deficiencies Identified

The existing municipal code is lacking regulations that protect threatened salmon from new water diversions and diversion facilities. The comprehensive plan fails to include a policy or objective that mentions the importance of water conservation and salmon protection.

5.14 MRCI #11 – Enforcement, Funding, and Implementation Mechanisms

5.14.1 Regulatory Guidance

Providing mechanisms for monitoring, enforcing, funding, reporting, and implementing a program. Formal plan evaluations should take place at least once every five years. The plan should make a commitment to (and assign responsibility for) regular monitoring and maintenance activities for any detention basins, erosion and sediment control measures, and other management tools over the long term.

Practices should be adapted, as needed, based on monitoring results. In addition, to ensure that development activities comply with the ordinance or plan and that PFC is attained or maintained, commitments must be made for regular funding, enforcement, reporting, implementation, and plan evaluations.

A proposed Tri-County standard, regarding inspection/enforcement, requires the establishment of policies and procedures along with staff training/certification, to ensure that the following activities are carried out:

- Review all stormwater design plans required to be submitted for proposed development activities.
- Inspect all development sites that are hydraulically near a sediment/erosion sensitive site prior to clearing and construction.
- Inspect all development sites during construction to ensure proper installation and maintenance of erosion and sediment controls.
- Inspect all development sites upon completion of construction and prior to final approval/occupancy to ensure proper installation of permanent erosion controls and stormwater facilities/BMP's.
- Investigate reported water quantity/quality problems and potential violations within 7 days on average.

5.14.2 Mount Vernon Municipal Code

The code includes many sections that provide language for enforcement of regulations:

MVMC

5.14.3 Mount Vernon Comprehensive Plan

The following comprehensive plan element, located on page 6-6 of the *Utilities* section, is consistent with MRCI #11:

"Development of a financial strategy and funding mechanism to support the recommended surface water management program"

The comprehensive plan recommends a comprehensive stromwater management program that relies on a combination of the following, to protect surface water resources:

- Education
- Regulations
- Operation and Maintenance
- Capitol Projects

For this to be consistent with the MRCI Standards, "Public Input" should be added to this list.

Chapter 6, *Utilities,* identifies various objectives to be met to accomplish the goals set forth in the water management program. Goal 4 is to develop a continuous and comprehensive program for managing surface water. Objective a of this goal reads, "Ensure a funding source for program implementation" This objective is directly consistent with MCM #11.

5.14.4 City Staff Interviews

As previously mentioned, interviews with staff members has revealed that certain regulations are unknown to some city staff. Without having a good knowledge of where regulations/ordinances exist and what they mean, enforcement will be difficult.

Implementation will require additional revenues. Unfortunately, residential property rates in Mount Vernon are currently high. City staff are worried about discouraging new residents and commercial development because property taxes are high. Enforcement of environmental regulations may further discourage new development. Burlington (which lies just to the north) has a large amount of commercial development because it has no salmon bearing streams and development regulations are less strict. Mount Vernon may continue to lose commercial businesses to Burlington. There is a perception among developers that Mount Vernon already has strict development regulations.

5.14.5 Gaps or Deficiencies Identified

Enforcement, enforcement, enforcement...Also, a financial plan for program implementation should be developed with as much public knowledge and input as possible. More training is needed for the staff to adequately implement provisions set forth with the MVMC.

5.15 MRCI #12 - Compliance with State and Federal Laws and Permits

5.15.1 Regulatory Guidance

Complying with all other state and Federal environmental and natural resource laws and permits.

This standard, unlike the others, is too broad to be applied to individual regulations, policies, and programs identified within the City code and Comprehensive Plan. However, this gap analysis report will help Mount Vernon significantly, to identify the areas where they are lacking policies or regulations, which are needed for them to comply with State and Federal regulations

ATTACHMENT A

NPDES Phase II Minimum Control Measure Requirements and Regulatory Guidance

(Source: 40 CFR 122.34(b))

(1) Public Education and Outreach on Stormwater Impacts

Minimum Requirements – *40 CFR 122.34(b)(1)(i)*
You must implement a public education program to distribute educational materials to the community or conduct equivalent outreach activities about the impacts of storm water discharges on water bodies and the steps that the public can take to reduce pollutants in storm water runoff.

Regulatory Guidance – *40 CFR 122.34(b)(1)(ii)*
You may use storm water educational materials provided by your State, Tribe, EPA, environmental, public interest or trade organizations, or other MS4s. The public education program should inform individuals and households about the steps they can take to reduce storm water pollution, such as ensuring proper septic system maintenance, ensuring the proper use and disposal of landscape and garden chemicals including fertilizers and pesticides, protecting and restoring riparian vegetation, and properly disposing of used motor oil or household hazardous wastes. EPA recommends that the program inform individuals and groups how to become involved in local stream and beach restoration activities as well as activities that are coordinated by youth service and conservation corps or other citizen groups. EPA recommends that the public education program be tailored, using a mix of locally appropriate strategies, to target specific audiences and communities. Examples of strategies include distributing brochures or fact sheets, sponsoring speaking engagements before community groups, providing public service announcements, implementing educational programs targeted at school age children, and conducting community-based projects such as storm drain stenciling, and watershed and beach cleanups. In addition, EPA recommends that some of the materials or outreach programs be directed toward targeted groups of commercial, industrial, and institutional entities likely to have significant storm water impacts. For example, providing information to restaurants on the impact of grease clogging storm drains and to garages on the impact of oil discharges. You are encouraged to tailor your outreach program to address the viewpoints and concerns of all communities, particularly minority and disadvantaged communities, as well as any special concerns relating to children.

(2) Public Involvement/Participation

Minimum Requirements – *40 CFR 122.34(b)(2)(i)*
You must, at a minimum, comply with State, Tribal and local public notice requirements when implementing a public involvement/ participation program.

Regulatory Guidance – *40 CFR 122.34(b)(2)(ii)*

EPA recommends that the public be included in developing, implementing, and reviewing your storm water management program and that the public participation process should make efforts to reach out and engage all economic and ethnic groups. Opportunities for members of the public to participate in program development and implementation include serving as citizen representatives on a local storm water management panel, attending public hearings, working as citizen volunteers to educate other individuals about the program, assisting in program coordination with other pre-existing programs, or participating in volunteer monitoring efforts. (Citizens should obtain approval where necessary for lawful access to monitoring sites.)

(3) Illicit Discharge Detection and Elimination

Minimum Requirements – *40 CFR 122.34(b)(3)(i-iii)*
(i) You must develop, implement and enforce a program to detect and eliminate illicit discharges (as defined at § 122.26(b)(2)) into your small MS4.

(ii) You must:

> (A) Develop, if not already completed, a storm sewer system map, showing the location of all outfalls and the names and location of all waters of the United States that receive discharges from those outfalls;
> (B) To the extent allowable under State, Tribal or local law, effectively prohibit, through ordinance, or other regulatory mechanism, non-storm water discharges into your storm sewer system and implement appropriate enforcement procedures and actions;
> (C) Develop and implement a plan to detect and address non-storm water discharges, including illegal dumping, to your system; and
> (D) Inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste.

(iii) You need address the following categories of non-storm water discharges or flows (i.e., illicit discharges) only if you identify them as significant contributors of pollutants to your small MS4: water line flushing, landscape irrigation, diverted stream flows, rising ground waters, uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)), uncontaminated pumped ground water, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, dechlorinated swimming pool discharges, and street wash water (discharges or flows from fire fighting activities are excluded from the effective prohibition against non-storm water and need only be addressed where they are identified as significant sources of pollutants to waters of the United States).

Regulatory Guidance – *40 CFR 122.34(b)(3)(iv)*
EPA recommends that the plan to detect and address illicit discharges include the following four components: procedures for locating priority areas likely to have illicit discharges; procedures for tracing the source of an illicit discharge; procedures for removing the source of the discharge; and procedures for program evaluation and assessment. EPA recommends visually screening outfalls during dry weather and

conducting field tests of selected pollutants as part of the procedures for locating priority areas. Illicit discharge education actions may include storm drain stenciling, a program to promote, publicize, and facilitate public reporting of illicit connections or discharges, and distribution of outreach materials.

(4) Construction Site Stormwater Runoff Control

Minimum Requirements – *40 CFR 122.34(b)(4)(i)*
You must develop, implement, and enforce a program to reduce pollutants in any storm water runoff to your small MS4 from construction activities that result in a land disturbance of greater than or equal to one acre. Reduction of storm water discharges from construction activity disturbing less than one acre must be included in your program if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more. If the NPDES permitting authority waives requirements for storm water discharges associated with small construction activity in accordance with § 122.26(b)(15)(i), you are not required to develop, implement, and/or enforce a program to reduce pollutant discharges from such sites.

(ii) Your program must include the development and implementation of, at a minimum:

(A) An ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under State, Tribal, or local law;
(B) Requirements for construction site operators to implement appropriate erosion and sediment control best management practices;
(C) Requirements for construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality;
(D) Procedures for site plan review which incorporate consideration of potential water quality impacts;
(E) Procedures for receipt and consideration of information submitted by the public, and
(F) Procedures for site inspection and enforcement of control measures.

Regulatory Guidance – *40 CFR 122.34(b)(4)(iii)*
Examples of sanctions to ensure compliance include non-monetary penalties, fines, bonding requirements and/or permit denials for non-compliance. EPA recommends that procedures for site plan review include the review of individual pre-construction site plans to ensure consistency with local sediment and erosion control requirements. Procedures for site inspections and enforcement of control measures could include steps to identify priority sites for inspection and enforcement based on the nature of the construction activity, topography, and the characteristics of soils and receiving water quality. You are encouraged to provide appropriate educational and training measures for construction site operators. You may wish to require a storm water pollution prevention plan for construction sites within your jurisdiction that discharge into your system. See § 122.44(s) (NPDES permitting authorities' option to incorporate qualifying State, Tribal and local erosion and sediment control programs into NPDES permits for storm water

discharges from construction sites). Also see § 122.35(b) (The NPDES permitting authority may recognize that another government entity, including the permitting authority, may be responsible for implementing one or more of the minimum measures on your behalf.)

(5) Post-Construction Stormwater Management in New Development and Redevelopment

Minimum Requirements – *40 CFR 122.34(b)(5)(i)*
You must develop, implement, and enforce a program to address storm water runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, that discharge into your small MS4. Your program must ensure that controls are in place that would prevent or minimize water quality impacts.

(ii) You must:

(A) Develop and implement strategies which include a combination of structural and/or non-structural best management practices (BMPs) appropriate for your community;
(B) Use an ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under State, Tribal or local law; and
(C) Ensure adequate long-term operation and maintenance of BMPs.

Regulatory Guidance – *40 CFR 122.34(b)(5)(iii)*
If water quality impacts are considered from the beginning stages of a project, new development and potentially redevelopment provide more opportunities for water quality protection. EPA recommends that the BMPs chosen: be appropriate for the local community; minimize water quality impacts; and attempt to maintain pre-development runoff conditions. In choosing appropriate BMPs, EPA encourages you to participate in locally-based watershed planning efforts which attempt to involve a diverse group of stakeholders including interested citizens. When developing a program that is consistent with this measure's intent, EPA recommends that you adopt a planning process that identifies the municipality's program goals (*e.g.,* minimize water quality impacts resulting from post-construction runoff from new development and redevelopment), implementation strategies (e.g., adopt a combination of structural and/or non-structural BMPs), operation and maintenance policies and procedures, and enforcement procedures. In developing your program, you should consider assessing existing ordinances, policies, programs and studies that address storm water runoff quality. In addition to assessing these existing documents and programs, you should provide opportunities to the public to participate in the development of the program. Non-structural BMPs are preventative actions that involve management and source controls such as: policies and ordinances that provide requirements and standards to direct growth to identified areas, protect sensitive areas such as wetlands and riparian areas, maintain and/or increase open space (including a dedicated funding source for open space acquisition), provide buffers along sensitive water bodies, minimize impervious surfaces, and minimize disturbance of soils and vegetation; policies or ordinances that encourage infill development in higher density urban areas, and areas with existing infrastructure; education programs for developers

and the public about project designs that minimize water quality impacts; and measures such as minimization of percent impervious area after development and minimization of directly connected impervious areas. Structural BMPs include: storage practices such as wet ponds and extended-detention outlet structures; filtration practices such as grassed swales, sand filters and filter strips; and infiltration practices such as infiltration basins and infiltration trenches. EPA recommends that you ensure the appropriate implementation of the structural BMPs by considering some or all of the following: pre-construction review of BMP designs; inspections during construction to verify BMPs are built as designed; post-construction inspection and maintenance of BMPs; and penalty provisions for the noncompliance with design, construction or operation and maintenance. Storm water technologies are constantly being improved, and EPA recommends that your requirements be responsive to these changes, developments or improvements in control technologies.

(6) Pollution Prevention/Good Housekeeping for Municipal Operations

Minimum Requirements – *40 CFR 122.34(b)(6)(i)*
You must develop and implement an operation and maintenance program that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations. Using training materials that are available from EPA, your State, Tribe, or other organizations, your program must include employee training to prevent and reduce storm water pollution from activities such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and storm water system maintenance.

Regulatory Guidance – *40 CFR 122.34(b)(6)(ii)*
EPA recommends that, at a minimum, you consider the following in developing your program: maintenance activities, maintenance schedules, and long-term inspection procedures for structural and non-structural storm water controls to reduce floatables and other pollutants discharged from your separate storm sewers; controls for reducing or eliminating the discharge of pollutants from streets, roads, highways, municipal parking lots, maintenance and storage yards, fleet or maintenance shops with outdoor storage areas, salt/sand storage locations and snow disposal areas operated by you, and waste transfer stations; procedures for properly disposing of waste removed from the separate storm sewers and areas listed above (such as dredge spoil, accumulated sediments, floatables, and other debris); and ways to ensure that new flood management projects assess the impacts on water quality and examine existing projects for incorporating additional water quality protection devices or practices. Operation and maintenance should be an integral component of all storm water management programs. This measure is intended to improve the efficiency of these programs and require new programs where necessary. Properly developed and implemented operation and maintenance programs reduce the risk of water quality problems.

ATTACHMENT B

National Marine Fisheries Service Municipal, Commercial, Residential, and Industrial (MRCI) Development Standards for a "Take" Exemption

(Source: 50 CFR 223.203(b)(12))

"...The prohibitions of paragraph (a) of this section relating to threatened species of salmonids listed in Sec. 223.102 (a)(5) through (a)(10), and (a)(12) through (a)(19) do not apply to municipal, residential, commercial and industrial (MRCI) development (including redevelopment) activities provided that:

(i) Such development occurs pursuant to city, county, or regional government ordinances or plans that NMFS has determined are adequately protective of listed species; or within the jurisdiction of the Metro regional government in Oregon and pursuant to ordinances that Metro has found comply with its Urban Growth Management Functional Plan (Functional Plan) following a determination by NMFS that the Functional Plan is adequately protective. NMFS approval or determinations about any MRCI development ordinances or plans, including the Functional Plan, shall be a written approval by NMFS Northwest or Southwest Regional Administrator, whichever is appropriate. NMFS will apply the following 12 evaluation considerations when reviewing MRCI development ordinances or plans to assess whether they adequately conserve listed salmonids by maintaining and restoring properly functioning habitat conditions:

(A) MRCI development ordinance or plan ensures that development will avoid inappropriate areas such as unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites.

(B) MRCI development ordinance or plan adequately avoids stormwater discharge impacts to water quality and quantity, or to the hydrograph of the watershed, including peak and base flows of perennial streams.

(C) MRCI development ordinance or plan provides adequately protective riparian area management requirements to attain or maintain PFC around all rivers, estuaries, streams, lakes, deepwater habitats, and intermittent streams. Compensatory mitigation is provided, where necessary, to offset unavoidable damage to PFC due to MRCI development impacts to riparian management areas.

(D) MRCI development ordinance or plan avoids stream crossings by roads, utilities, and other linear development wherever possible, and where crossings must be provided, minimize impacts through choice of mode, sizing, and placement.

(E) MRCI development ordinance or plan adequately protects historic stream meander patterns and channel migration zones and avoids hardening of stream banks and shorelines.

(F) MRCI development ordinance or plan adequately protects wetlands and wetland functions, including isolated wetlands.

(G) MRCI development ordinance or plan adequately preserves the hydrologic capacity of permanent and intermittent streams to pass peak flows.

(H) MRCI development ordinance or plan includes adequate provisions for landscaping with native vegetation to reduce need for watering and application of herbicides, pesticides and fertilizer.

(I) MRCI development ordinance or plan includes adequate provisions to prevent erosion and sediment run-off during construction.

(J) MRCI development ordinance or plan ensures that water supply demands can be met without impacting flows needed for threatened salmonids either directly or through groundwater withdrawals and that any new water diversions are positioned and screened in a way that prevents injury or death of salmonids.

(K) MRCI development ordinance or plan provides necessary enforcement, funding, reporting, and implementation mechanisms and formal plan evaluations at intervals that do not exceed five years.

(L) MRCI development ordinance and plan complies with all other state and Federal environmental and natural resource laws and permits.

(ii) The city, county or regional government provides NMFS with annual reports regarding implementation and effectiveness of the ordinances, including: any water quality monitoring information the jurisdiction has available; aerial photography (or some other graphic display) of each MRCI development or MRCI expansion area at sufficient detail to demonstrate the width and vegetation condition of riparian set-backs; information to demonstrate the success of stormwater management and other conservation measures; and a summary of any flood damage, maintenance problems, or other issues.

(iii) NMFS finds the MRCI development activity to be consistent with the conservation of listed salmonids' habitat when it contributes to the attainment and maintenance of PFC. NMFS defines PFC as the sustained presence of a watershed's habitat-forming processes that are necessary for the long-term survival of salmonids through the full range of environmental variation. Actions that affect salmonid habitat must not impair properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of impaired habitat toward PFC. Periodically, NMFS will evaluate an approved program for its effectiveness in maintaining and achieving habitat function that provides for conservation of the listed salmonids. Whenever warranted, NMFS will identify to the jurisdiction ways in which the program needs to be altered or strengthened. Changes may be identified if the program is not protecting desired habitat functions, or where even with the habitat characteristics and functions originally targeted, habitat is not supporting population productivity levels needed to conserve the ESU. If any jurisdiction within the limit does not make changes to respond adequately to the new information in the shortest amount of time feasible, but not longer than one year, NMFS

will publish notification in the Federal Register announcing its intention to withdraw the limit so that take prohibitions would then apply to the program as to all other activity not within a limit. Such an announcement will provide for a comment period of not less than 30 days, after which NMFS will make a final determination whether to subject the activities to the ESA section 9(a)(1) prohibitions.

(iv) Prior to approving any city, county, or regional government ordinances or plans as within this limit, or approving any substantive change in an ordinance or plan within this limit, NMFS will publish notification in the Federal Register announcing the availability of the ordinance or plan or the draft changes for public review and comment. Such an announcement will provide for a comment period of no less than 30 days."

Identifying Sites for "Street Edge Alternatives"

The City of Mount Vernon is interested in identifying sites for "street edge alternatives" to promote infiltration along city streets. Street edge alternatives incorporate strategic site planning with micro-management techniques to achieve environmental protection, while allowing for development or infrastructure rehabilitation to occur. There are budgetary and environmental limitations that affect where the types of street edge alternative facilities discussed in this report are most applicable. Therefore it is necessary first to identify areas where the approach is feasible and second, areas with highest priority for implementation. This section describes the criteria, methodology, results and conclusions from an analysis of feasible and high priority locations for application of street edge alternative facilities.

Street Edge Alternative Concept

Street Edge Alternatives are also referred to as low impact development (LID) and natural drainage systems (NDS). LID involves practices such as incorporating existing land contours, native vegetation, native soil, longer time of concentration, natural drainage systems, raingardens, less effective impervious area and clumping (to name a few) in the initial development of the land, that result in less stormwater runoff.

Level of Service

Prioritization of street edge alternatives projects will require information on the selected level of service associated with each potential project site. Levels of service generally include:

- Traditional drainage system (curb and gutter, pipe and detain)
- Natural drainage system without sidewalks or curved streets
- Natural drainage system with sidewalks and curved streets

The City of Seattle implemented several variations of street edge alternatives projects. The SEA Streets model includes full re-development of a residential street right-of-way, including vegetated swales, a curvilinear street, and a sidewalk on one side of the street. The 110th Cascade model includes a series of stair-stepped natural pools, with extensive tree and shrub cover on one side of the roadway and a sidewalk on the opposite side. The High Point re-development incorporates street edge alternatives into a 129-acre housing development. This project differs from other street edge alternatives projects in that it integrates natural drainage elements into a traditional curb, gutter, and sidewalk approach throughout a highly dense area.

The City of Mount Vernon will need to prioritize which of these street edge alternatives variations is most appropriate for each project selected. Implementation decisions will be based on site characteristics, cost/benefit analysis, and community input. The SEA Streets model can be very costly, if it includes full re-development of the street and sidewalk within the right-of-way. The Cascade model is most appropriate for steep residential streets. Incorporating sidewalks and curvilinear streets adds cost to street edge alternatives projects,

but also provides safety and aesthetic benefits to the immediate neighborhood surrounding the project. The City of Mount Vernon must work with the neighborhood residents to determine the correct level of service (size and scale) for each individual street edge alternatives project.

Criteria for Candidate Project Sites

The following criteria were used to identify potential project sites for street edge alternative drainage implementation. These criteria include:

- Areas of the City not served by a combined sewer system
- Roadway grade from 1 percent to 4 percent
- Areas without clay soils
- Residential streets only (no arterials)
- Sites with existing flooding problems or known drainage problems

Methodology

Geographic information systems (GIS) technology was used to screen and map candidate street edge alternatives project sites. GIS allows one or more criteria to be applied to a specific geographic area to produce a map of potential street edge alternatives project sites.

The areas in the City of Mount Vernon that meet the basic criteria described above were identified using GIS. Areas were excluded that have roadway slopes greater than 8 percent, steep slopes and 300-foot buffers around those steep slopes, clay soils, arterial streets, or combined sewer systems. This analysis provided an initial sense of which areas are potentially suitable for a street edge alternatives, based on physical characteristics (slope, soils, and drainage system).

Once the areas with inadequate physical characteristics were excluded, an analysis of the existing flooding and drainage problems throughout the City were reviewed. These areas were identified by consulting with the City of Mount Vernon Public Works staff and the Comprehensive Surface Water Management Plan, 1995. The resulting sites were identified as high priority for street edge alternatives, based on their physical characteristics and the community issues surrounding them (see Figure 1).

The GIS analysis identified potential candidate sites for street edge alternatives implementation, based on an objective set of established screening criteria. The general topography in the City has slopes that range from zero in the lower areas to 96 percent around Little Mountain. The upper reaches of Maddox Creek, Flower Creek, and Carpenter Creek are situated in ravines with sideslopes of 35 to 45 percent.

The cumulative results of this screening process identify high-priority sites that meet all of the screening criteria. These sites have the appropriate roadway slopes and soil conditions, have existing drainage problems, are not on arterial roadways and are located in traditional ditch and culvert drainage areas for street edge alternatives implementation.

Site Visit

Additional analysis will be necessary to make final selections of sites. Field investigations may provide additional information regarding feasibility. Although the GIS results are useful for initial planning, selection of individual project sites requires a much more detailed process that includes site visits to verify physical characteristics and a detailed community involvement process conducted to gain buy-in from residents that would be affected by project implementation.

Community Involvement

A comprehensive community involvement strategy is required to select final candidate sites for street edge alternatives implementation. This strategy will include:

- A survey of neighborhood residents to determine their willingness to participate in a street edge alternatives project
- Community meetings to explain street edge alternatives concepts, costs/benefits, and risks, and to solicit feedback and design considerations from potential affected neighbors
- City-resident partnership agreements once final site locations are determined
- Ongoing communication with residents (e.g., newsletters, meetings) during site design and construction phases

Final street edge alternatives project sites should be selected with the approval of the affected neighbors. Residents should agree to the location and design of the project, as well as to any financial and/or maintenance agreements with the City related to the project.

Project Selection Policy Decisions

The City of Mount Vernon will need to address several challenging policy issues when prioritizing and selecting street edge alternatives project sites, including:

- How will project sites be distributed geographically throughout the City?
- How will environmental issues (flooding, water quality, habitat) be prioritized in the selection of project sites? Is protecting salmon in one watershed more important than preventing flooding in another watershed?
- How will the appropriate scale and level of service for individual projects be determined?
- What maintenance agreements with residents will be needed at project sites?
- Will residents be asked to contribute financially to street edge alternatives projects?

These policy issues are summarized in Figure 5-8.

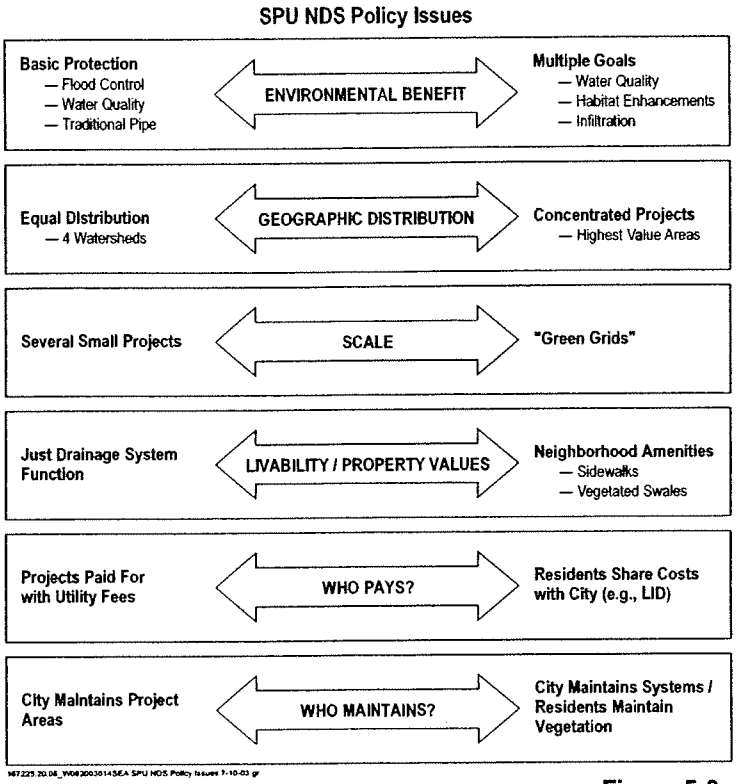

Figure 5-8

Maintenance Agreements

The City of Mount Vernon should make a policy decision regarding the maintenance practices required for various street edge alternatives projects. Residents might be expected to maintain the landscaping and vegetation associated with individual street edge alternative installations. This maintenance agreement should be described in all communications with neighbors in a potential project site area. Residents must agree to support the level of maintenance required for the selected street edge alternatives level of service.

Financial Assistance

The City of Mount Vernon could pursue an option for creating financial partnerships with neighborhood residents in areas that receive street edge alternative projects. This option could be included in community outreach surveys to potential candidate project site recipients. A financial partnership could include a Local Improvement District (LID) or some other form of short-term arrangement between the City and neighborhood residents for project development.

Considerations for the Future

In the future, it might be appropriate to revisit the issue of excluding areas with combined sewers. Applying street edge alternatives would reduce the amount of water entering the combined system, thus reducing the costs of conveyance and treatment of the combined sewage. Proper application of a street edge alternatives approach should eliminate the need for treatment of stormwater runoff.

Expanding the concept to private properties as they are rebuilt could provide further advantages in all areas, including areas with combined sewers. If homeowners collected rooftop runoff, which is relatively clean, and used it to flush toilets, wash clothes, or irrigate, there would be substantial benefits to the City's natural resources and infrastructure costs. In a residential area, approximately one-third of the impervious area is rooftops. If this source of runoff were eliminated, there would be a corresponding reduction of runoff entering either the stormwater system or the combined sewer system during peak flows.

Toilet flushing and clothes washing are responsible for nearly half the water consumption year round in residences. In the summer, peak demand for water is driven largely by

landscape irrigation. If an alternate source, such as rooftop runoff could be used for these tasks, there could be a reduction of as much as half the demand for domestic water in residential areas. This would in turn reduce the public cost of infrastructure for the water system and would allow more water to be left in the rivers that supply the City's water. These rivers are productive salmon habitat, and reducing the water demand would benefit that habitat. In terms of abundance and diversity of fish, habitat improvements in these rivers would far outweigh improvements in urban streams.

ATTACHMENT C

Tri-County Proposal – Model Planning Policies

Overview:
It is the intent of the Tri-County proposal to use the process established under the Growth Management Act ("GMA") (Ch. 36.70A RCW), to have individual jurisdictions ensure their planning policies and thus their implementing regulations, adequately address issues related to salmonids. With the adoption of the GMA, the seemingly logical step of a direct link between policies and implementing regulations and programs became mandated. For the purpose of this Model program, local jurisdictions that don't already have the requisite policy basis to provide protection for listed species should adopt relevant and appropriate model planning policies, either through the regional process of adopting countywide planning policies and/or through the adoption of planning elements of individual comprehensive plans.

The following is a list of proposed Model Planning Policies (MPPs) which jurisdictions planning under GMA that need to adopt policies may consider in order to provide the policy basis to conserve salmonids listed under the Endangered Species Act. While the Tri-County Model suggests the use of the county-wide planning policy process, it also recognizes the same end can be achieved by local jurisdictions individually adopting comprehensive plan policies covering the same topics.

General:

Model Policy No. 1: The county and cities should protect and enhance the natural ecosystems through comprehensive plan policies and development regulations that reflect natural constraints and protect sensitive features.

Discussion:

Regulate land use and development in a manner which respects fish and wildlife habitat in conjunction with natural features and functions (water quality, hydrologic and hydraulic functions, vegetation retention, etc.).

Manage natural resources and the built environment to protect, improve and sustain environmental quality while minimizing public and private costs.

Adopt an ecological approach to improving in-stream habitat including the establishment of water quality and quantity parameters to address impacts to critical fish species.

Work towards reducing the total effective impervious surface area within individual development sites and also within watershed[1] basins or larger geographic boundaries.

[1] A "watershed" is a geographic area that drains toward or contributes flow to the stream or river of interest. The geographic limits of the watershed are defined by the points at which the topography breaks to drain surface water into the tributaries which feed the stream or river system.

Model Policy No. 2: The county and cities should preserve, protect and, where possible, restore natural habitat critical for the conservation of salmonid species listed under the federal Endangered Species Act, through the adoption of comprehensive plan policies that seek to protect, maintain or restore aquatic ecosystems, associated habitats and aquifers through the use of management zones, development regulations, incentives for voluntary efforts of private landowners and developers, land use classifications or designations, habitat acquisition programs or habitat restoration projects.

Discussion:

Designate fish and wildlife habitat conservation areas[2] as a priority for acquisition programs such as Conservation Futures and Floodplain Buyout programs

Utilize incentive programs to encourage the preservation and/or restoration of critical habitat areas.

- *Counties should adopt a Public Benefit Rating System under the Current Use Assessment Program (RCW 84.34) that includes a higher priority for fish and wildlife habitat conservation areas.*

- *All jurisdictions should provide other types of incentive programs such as Transfer of Development Rights (TDR) and Purchase of Development Rights programs.*

Consider fish and wildlife habitat conservation areas when designating land use designations and companion zoning regulations.

Amend existing critical area regulations, as necessary, to protect fish and wildlife habitat conservation areas from development impacts.

Coordination of Watershed Planning and Land Use Planning:

Model Policy No. 3: The county and cities should protect the natural habitat critical for the conservation of salmonid species listed under the federal Endangered Species Act, through the adoption of comprehensive plan policies which encourage the use of planning activities or study techniques that are capable of determining changes in stream hydrology and water quality under different land use scenarios at full build-out of designated land use classifications.

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[2] The term "fish and wildlife habitat conservation area" is defined in RCW 36.70A.030(5).

Inter-jurisdictional Cooperation:

Model Policy No. 4: All jurisdictions shall work together to identify and protect natural habitat networks that cross jurisdictional boundaries.

Discussion:

Networks shall link large protected or significant blocks of fish and wildlife habitats within and between jurisdictions to achieve a continuous countywide network.

Networks shall be mapped and displayed in comprehensive plans and may be incorporated into open space/greenbelt corridor maps.

Establish informational sharing workshops or present information at established coordinating committees.

Whenever possible, utilize watershed boundaries instead of jurisdictional boundaries for plans and studies.

Model Policy No. 5: All jurisdictions shall coordinate watershed/aquatic restoration planning and implementation activities within a watershed.

Discussion:

Consider the implications of planning and implementation activities not only within jurisdictional boundaries, but also the implications of decisions and activities on habitat for critical fish species that is located outside jurisdictional boundaries but within the shared watershed.

Model Policy No. 6: All jurisdictions shall cooperatively work together to create and adopt modifications to their Critical Areas Regulations that include the best available science for the protection of existing habitat, wetlands, estuaries, riparian areas by avoiding negative impacts.

Discussion:

Provide for the removal of invasive species and the replanting of natural vegetation.

Support local community groups in critical habitat restoration and enhancement efforts through reduced or waiver of permit fees and streamlined permitting procedures.

Provide incentives to encourage landowners to retain, enhance, or restore critical habitat.

Development Standards:
Model Policy No. 7: Upon adoption of a state classification system, the cities and the county shall work together to establish a single system for stream typing.

Model Policy No. 8: All jurisdictions shall maintain or enhance water quality through control of runoff and best management practices to maintain natural aquatic communities and beneficial uses.

Monitoring, Best Available Science and Adaptive Management:
Model Policy No. 9: All jurisdictions shall establish a monitoring and evaluation method, which is designed to determine the effectiveness of restoration, enhancement, and recovery strategies for listed species.

Discussion:

Monitoring and evaluation strategies should be linked to future policy choices and management actions.

Adoption of local plans, which include Conservation Plans or watershed basin plans, and regulations, should include monitoring and evaluation criteria and timelines for conducting such activities.

Fish and wildlife habitat preservation or restoration plans, prepared by applicants who are proposing developments within critical habitat areas designated under Critical Area Regulations adopted pursuant to GMA and/or identified under SEPA, should include monitoring and evaluation criteria and timelines for conducting such activities.

At a minimum, monitoring and evaluation techniques should address:

- *Pre-development conditions including data on species viability and habitat, and when appropriate, watershed quality.*
- *A discussion of the limiting factors related to the proposal and suggested methods to eliminate a potential "take" of the species as a result of the proposal.*
- *A commitment to change conservation approaches if monitoring data indicates a potential degradation of the listed species.*

Develop complementary, coordinated, integrated, and flexible approaches for the collection, analysis, and sharing of monitoring information (e.g., GIS data, hydrologic and hydraulic analysis, etc.).

Model Policy No. 10: All jurisdictions shall recognize that the best available science to address listed species recovery issues is evolving. Each jurisdiction shall apply an adaptive management strategy to determine how well the objectives of listed species recovery and critical habitat preservation/restoration are being achieved.

Discussion:

Incorporate the results of pilot developments into land use regulations, zoning, and technical standards.

Model Policy No. 11: The counties and the cities shall ensure that any proposal to consider moving the current[3] UGA boundary provide at least the same level of protection afforded salmonid species habitat pursuant to the area's previous rural or resource designation. If the UGA is expanded prior to the completion of WRIA conservation plans, rural or resource standards previously applied to the areas will be maintained UNLESS a biological assessment has been conducted and demonstrates that revised standards are justifiable.

Discussion:

Continue the use of the rural standards in areas later designated to be within the urban growth area unless a study has been done to identify other protective measures that will be equal to those previously in plac

[3] The "current" UGA boundary refers to the boundary adopted as of the date the jurisdiction receives a take limit from the NMFS or USFWS.

Appendix C
Storm Drainage Capital Improvement Plan Projects

- 1995 Plan Projects and Disposition
- Detailed CIP Sheets for Select Projects

TABLE X-1
City of Mount Vernon Capital Improvement Plan from 1995 RW Beck Comprehensive Surface Water Management Plan

Problem Number	Location	1995 Cost	Disposition
Regional System Problems			
RS1	Construct new Riverbend Road (Freeway Drive) System	$1,750,000	Not yet completed
RS1	Design new Riverbend Road (Freeway Drive) System	$242,000	Not yet completed
RS2	Install two additional 36-inch culverts at Parker Way	$13,000	Completed or not needed
RS3	Culvert replacement at College Way update price	$109,000	Completed or not needed
RS4a	Kulshan Creek Pump Station Phase I (1)	$3,339,000	Completed or not needed
RS4b	Kulshan Creek Pump Station Phase II – Beyond 20 Years	$672,000	Not yet completed
RS6	Little Mountain Estates Detention Pond modifications	Developer Build	Not yet completed
RS7	Erosion control on Maddox Creek	$393,000	In progress. Shared funding.
RS8	Maddox Creek-Drainage District 17 Study	$44,000	?
Local System Problems			
LS6	Install log bed control weir to control erosion north of Cedar Lane	$11,000	Not yet completed
LS7	MH drop structure and pipe extension on Kulshan tributary near Viewmount	$48,000	Not yet completed
LS8	Culvert replacement along N 16th north of Florence	$29,000	Completed or not needed
LS9	Park Village Mobile Home Park	$53,000	Completed or not needed
LS10	Culvert replacement at Kiowa and Seneca	$22,000	Completed or not needed
LS11	Install trashrack at storm drain inlet near Kiowa and Nez Perce	$500	Not yet completed
LS12	Replace storm drain system in W. Mount Vernon along Memorial Highway	$557,000	Not yet completed
LS13	Install additional catchbasins at Wall Street and Garfield Street	$14,000	?

TABLE X-1
City of Mount Vernon Capital Improvement Plan from 1995 RW Beck Comprehensive Surface Water Management Plan

Problem Number	Location	1995 Cost	Disposition
LS14	Install new catchbasin and storm drain connection at Wall Street north of Memorial Hwy	$40,000	Not yet completed
LS15	Replace 16 of the storm drains between Division and Fir just west of LaVenture	$371,000	Not yet completed
LS16	Install log bed control weir in stream between Mohawk and Apache	$11,000	Not yet completed
LS17	Install culvert and ditch at Comanche Drive	$14,000	Not yet completed
LS18	Culvert replacement at Shoshone east of Sioux	$24,000	Not yet completed
LS19	Install armoured spillway in two detention ponds near Waugh and Division	$59,000	Not yet completed
LS20	Install storm drain west of S 6th up to Lind and connect to Maddox tributary	$155,000	Not yet completed
LS22	Install catchbasin and storm drain connection for the NW corner of Riverside and Fir	$100,000	Completed or not needed
LS23	Install storm drain connection along I-5 between Cameron and Kulshan Pump Station	$73,000	Completed or not needed
LS25	Replace 3 pipes between Britt Slough and Blackburn Road	$284,000	Completed or not needed
LS26a	Upgrade drainage system on Fox Hill Street – Replace Pipes in Street	$235,000	Completed or not needed
LS26b	Upgrade drainage system on Fox Hill Street – Install Pipe in Deep Ditch	$66,000	Completed or not needed
LS27	Replace 2 pipes along I-5 between Blackburn and Anderson Road	$50,000	In progress
Water Quality Problems			
WQ1	Water Quality Monitoring Program	$39,000	Completed or not needed
WQ3	Oil/water separators	$328,000	Not yet completed

TABLE X-1
City of Mount Vernon Capital Improvement Plan from 1995 RW Beck Comprehensive Surface Water Management Plan

Problem Number	Location	1995 Cost	Disposition
Environmental Resource Problems			
E1	Kulshan Creek Pump Station – Fish ladder	Included in RS4	Completed or not needed
E2	Manhole barrier in Kulshan east of Railroad	$2,000	Not yet completed
E3	Log weir fish structure – Kulshan Creek north of Cedar Lane	$11,000	Not yet completed
E4	Restore channel on Kulshan from Riverside to N 18th (2,200 feet)	$104,000	Not yet completed
E5	Restore channel on mainstem of Trumpeter (7,000 feet)	$328,000	Not yet completed
E10	Remove Culvert and restore stream channel on Maddox near Anderson	$40,000	Completed or not needed (Centennial grant through Skagit County to be used??)
E11	Log weir fish passage structure d/s of culvert on Maddox Creek at Blackburn Road	$11,000	
E13	Add riparian vegetation on Flowers Creek between Maddox and Blodgett (1,500 feet)	$38,000	Not yet completed
E14	Log weir fish passage structure on Flowers Creek at Blodget Road	$11,000	Not yet completed
E15	Restore channel on Carpenter Creek along Bacon Road (1,600 feet – one side)	$21,000	Not yet completed

Mount Vernon **Comprehensive Stormwater Management Plan Update**

CIP ITEM # D-01-02: Maddox Creek Restoration and Pond Retrofit

Location

Maddox Creek at S. 27th and Section ____

Concerns

- Failed detention pond causing drainage and water quality treatment problems

Proposed Action

- Retrofit failed detention pond
- Re-channelize Maddox Creek
- Re-plant site

Benefits

- Improved drainage and water quality treatment
- Separation of Maddox Creek from failed detention pond
- Elimination of jurisdictional wetlands from detention pond

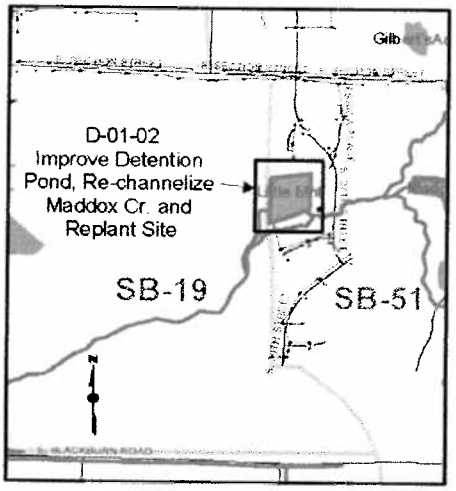
Costs

Engineering: $10,000
Construction: $40,000

$50,000

Revenue Source

City Surface Water Utility Fund



Linkage to Other Projects

CFP #	Project
D-99-05	Digby Road and Woodland Drive Stream Enhancement
T-00-04	Digby Road Improvements and Maddox Creek Relocation

☒ In Prior Plan and in Progress
☒ In Prior Plan and Appropriated
☐ In Prior Plan but not Appropriated
☐ New Project
☒ Consistent with Comprehensive Plan

Mount Vernon Comprehensive Stormwater Management Plan Update

CIP ITEM # D-05-03: West Mount Vernon Storm Surface Main Upgrade

Location

West Mount Vernon Storm Station

Concerns

- Storm sewer surcharges
- Localized flooding

Proposed Action

- Construct 75 feet of 18-inch ductile pipe from pump discharge through dike

Benefits

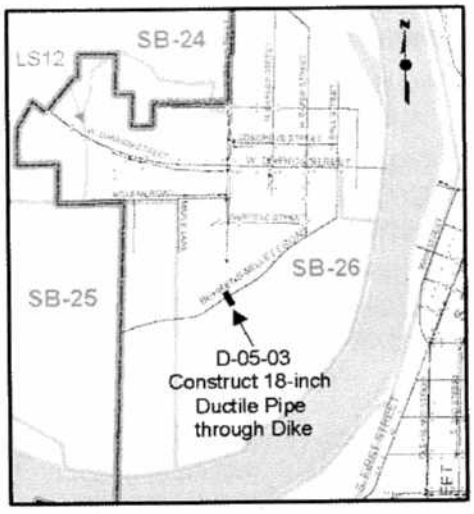
- Surcharging and flood reduction and consequent liability reduction for damages

Costs

Engineering:	$10,000
Construction:	$25,000
	$35,000

Revenue Source

City Surface Water Utility Fund



Linkage to Other Projects

CFP #	Project

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☐ In Prior Plan but not Appropriated
- ☒ New Project
- ☒ Consistent with Comprehensive Plan

Mount Vernon **Comprehensive Stormwater Management Plan Update**

CIP ITEM # D-94-11: Erosion Problem Repairs

Location

Trumpeter Creek between Mowhawk and Apache, east of Comanche

Concerns

- Erosion along portion of Southwest Fork of Trumpeter Creek
- Sedimentation

Proposed Action

- Install bed control weirs
- Restore stream channel between Mowhawk and Apache

Benefits

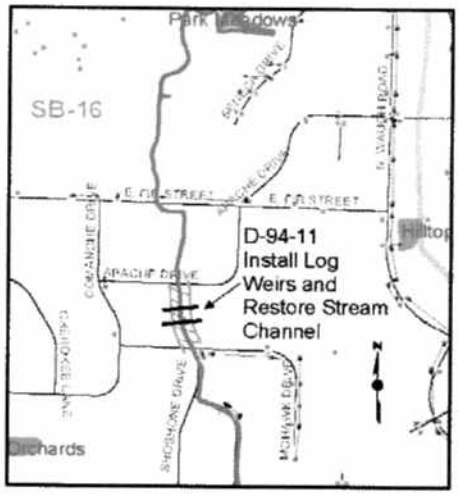
- Control and prevention of erosion and sedimentation

Costs

Engineering:	$2,100
Construction	$9,900
	$12,000

Revenue Source

City Surface Water Utility Fund



Linkage to Other Projects

CFP #	Project

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☒ In Prior Plan but not Appropriated
- ☐ New Project
- ☒ Consistent with Comprehensive Plan

Mount Vernon **Comprehensive Stormwater Management Plan Update**

CIP ITEM # D-94-14: Log Fish Weir Structure

Location

Tributary to Kulshan Creek near Cedar Lane

Concerns

- Partial fish barrier created by 1-foot drop in culvert outlet

Proposed Action

- Place log weirs at culvert outlet to facilitate fish passage

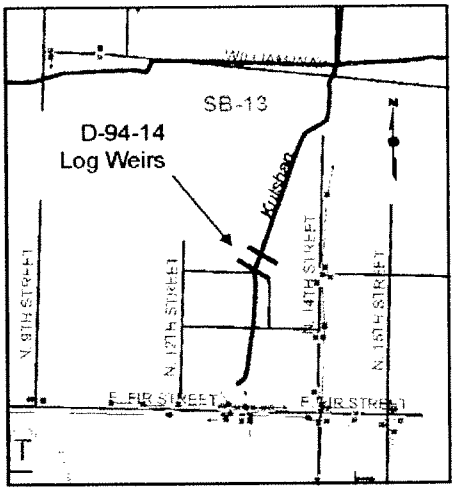
Benefits

- Improved fish habitat
- Increased fish population and survival rate

Costs

Engineering:	$2,100
Construction:	$10,400
	$12,500

Revenue Source



Linkage to Other Projects

CFP #	Project
D-94-07	Cedar Lane Erosion Control

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☒ In Prior Plan but not Appropriated
- ☐ New Project
- ☒ Consistent with Comprehensive Plan

Mount Vernon

Comprehensive Stormwater Management Plan Update

CIP ITEM # LS1: 700-Foot Long Berm along Hoag Road

Location

Hoag Road west of LaVenture Road

Concerns

- Flooding during high water events in the Skagit River

Proposed Action

- Construct 700-foot-long berm along the north side of Hoag Road to an elevation of 385 feet

Benefits

- Flood reduction and consequent liability reduction for damages

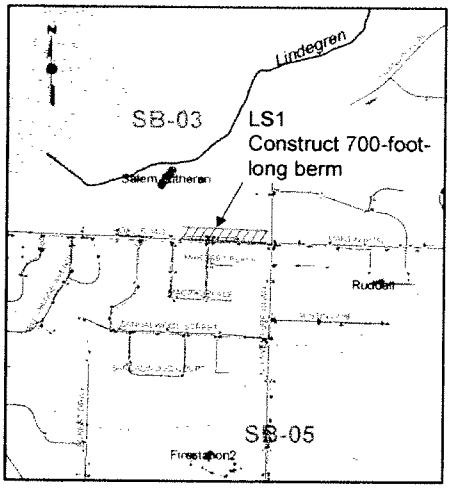
Costs

Engineering: $29,000
Construction: $290,000

$319,000

Revenue Source

City Surface Water Utility Fund



Linkage to Other Projects

CFP #	Project

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☒ In Prior Plan but not Appropriated
- ☐ New Project
- ☒ Consistent with Comprehensive Plan

Mount Vernon

Comprehensive Stormwater Management Plan Update

CIP ITEM # LS12: Replacement of Storm Drain System in W. Mount Vernon along Memorial Highway

Location

Memorial Highway west of S. Wall Street

Concerns

- Localized flooding along Memorial Highway (SR 536) due to insufficient capacity in storm drain system

Proposed Action

- Replace 1,700 feet of 12-inch storm drainage pipe with 30-inch pipe

Benefits

- Flood reduction and consequent liability reduction for damages

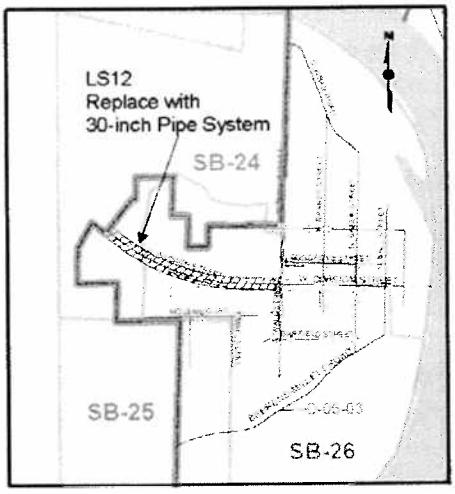
Costs

Engineering: $118,800
Construction: $673,200

$792,000

Revenue Source

City Surface Water Utility Fund



Linkage to Other Projects

CFP #	Project

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☒ In Prior Plan but not Appropriated
- ☐ New Project
- ☒ Consistent with Comprehensive Plan

Mount Vernon **Comprehensive Stormwater Management Plan Update**

CIP ITEM # X: Freeway Drive Force Main Replacement

Location

Along Freeway Drive, north of College Way, detention pond and pump station near Lowe's Hardware

Concerns

- Inadequate conveyance capacity for predicted future development flows

Proposed Action

- Replace 2,600 linear feet of existing 12-inch stormwater conveyance pipe with 18-inch ductile iron pipe (DIP)

Benefits

- Capacity to convey stormwater flows from predicted future development

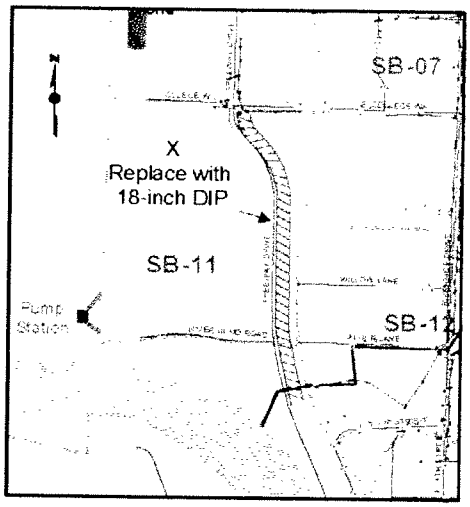
Costs

Engineering: $80,000
Construction: $685,000

$765,000

Revenue Source

City Surface Water Utility Fund



Linkage to Other Projects

CFP #	Project

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☒ In Prior Plan but not Appropriated
- ☐ New Project
- ☒ Consistent with Comprehensive Plan

Mount Vernon **Comprehensive Stormwater Management Plan Update**

CIP ITEM # LS15: Replacement of 16 Storm Drains between E. Division and E. Fir, West of N. LaVenture

Location

Between E. Division Street and E. Fir Street, West of N. LaVenture Road, including portions of Stanford Drive, Streeter Place, N. 21st Street and Fir Street

Concerns

- Localized flooding affecting several homes at the intersection of Division Street and South 20th Street
- Insufficient capacity in conveyance system north of Division Street for 10-year design flows

Proposed Action

- Replace 2,350 feet of undersized 15-inch to 24-inch CMP/CP storm drainage pipes with 24-inch to 36-inch CP and HDPE pipes along portions of streets identified in location description above

Benefits

- Flood reduction and consequent liability reduction for damages

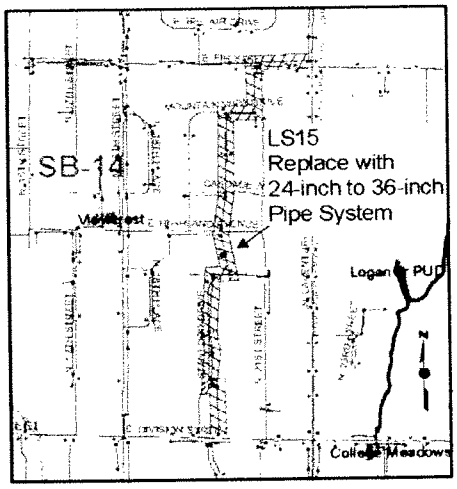
Costs

Engineering: $79,200
Construction: $448,800

$528,000

Revenue Source

City Surface Water Utility Fund



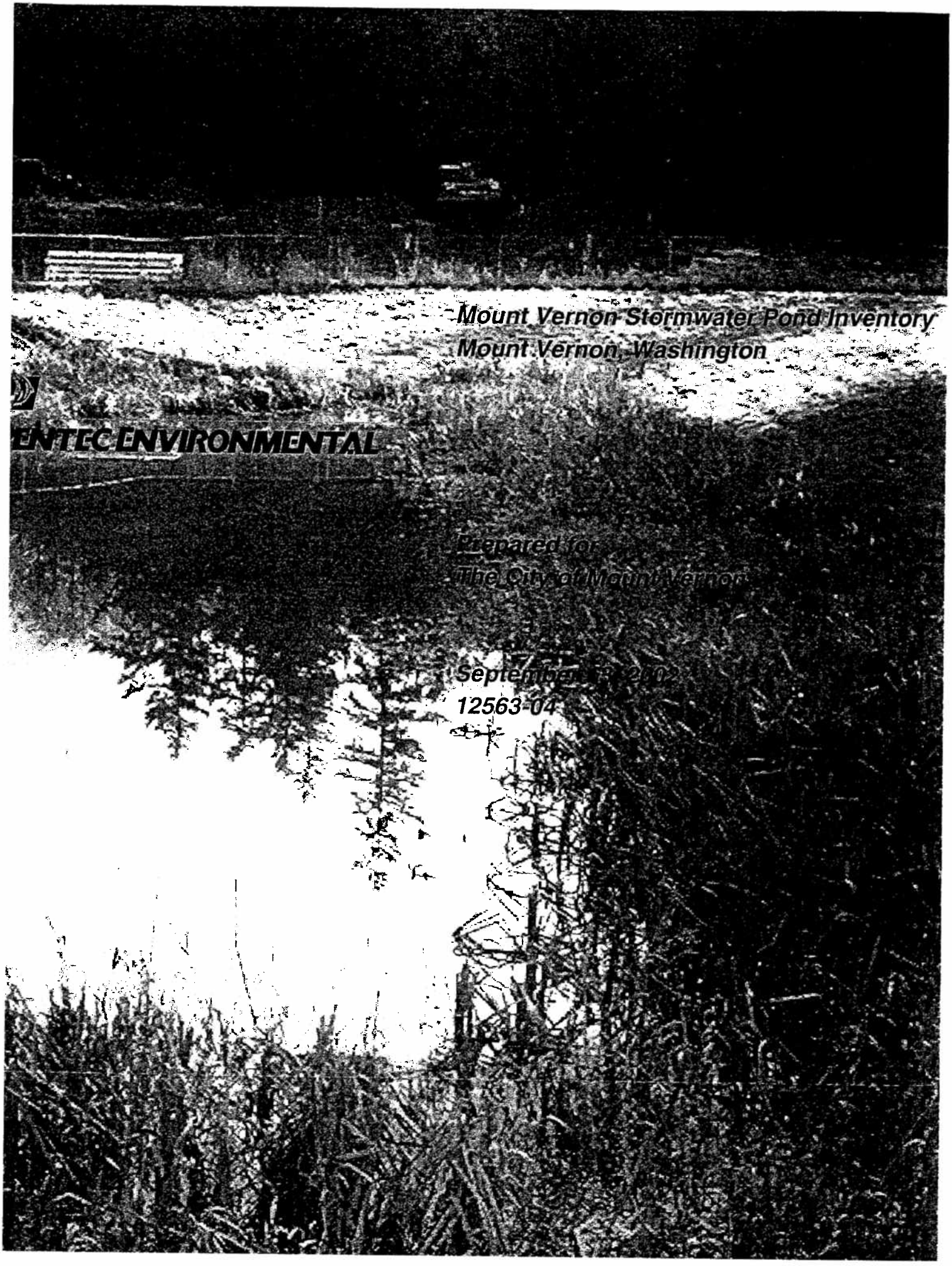
Linkage to Other Projects

CFP #	Project

- ☐ In Prior Plan and in Progress
- ☐ In Prior Plan and Appropriated
- ☒ In Prior Plan but not Appropriated
- ☐ New Project
- ☒ Consistent with Comprehensive Plan

Appendix D
Operations and Maintenance

- Pentec Environmental's Mount Vernon Stormwater Pond Inventory



Mount Vernon Stormwater Pond Inventory
Mount Vernon, Washington

ENTEC ENVIRONMENTAL

Prepared for
The City of Mount Vernon

September [illegible], 2002
12563-04

Mount Vernon Stormwater Pond Inventory
Mount Vernon, Washington

Prepared for
The City of Mount Vernon

September 13, 2002
12563-04

Prepared by
Pentec Environmental

Michael J. Muscari
Wetland Ecologist

Mary Lear
Water Resources Engineer

CONTENTS

MOUNT VERNON STORMWATER INVENTORY

INTRODUCTION

The City of Mount Vernon (City) contracted with Pentec Environmental (Pentec) to conduct an inventory of the City's stormwater detention facilities. This report documents the findings of the inventory of all stormwater ponds that are known by City staff to be the responsibility of the City. The report will be used by the City to form the basis of an ongoing maintenance program and cost estimates for the stormwater ponds for which the City is responsible.

This report includes information collected from the City's files, information collected during site visits to each pond, and detailed knowledge of the stormwater system conferred by City Wastewater Utility staff.

METHODS

The stormwater pond inventory was conducted by Michael Muscari and Mary Lear of Pentec, and John Dilley, lead operator for the City's Wastewater Utility. The field survey was completed between February 20 and April 11, 2002.

At each pond a Trimble Pathfinder Pro XRS global positioning system (GPS) was used to map the boundaries of the pond. The Trimble GPS has a horizontal precision to less than 1 meter (m), and at most ponds the precision was to less than 0.5 m. A level scope mounted on a tripod and staff gage were used to take relative elevation measurements. At a minimum, relative elevations were taken at the invert of the outlet, at the top of berm, and at the emergency overflow. The area of each pond, derived from the GPS data, and the relative elevations were used to calculate an approximate live storage volume for each of the ponds that have a flow control structure (FCS). The few ponds and swales without flow control structures were assumed to have little if any detention and so were not included in the calculations. These volume estimates are approximations only. An accurate measurement of volume would require a detailed topographic survey because of the varying slopes at most of the ponds. A detailed topographic study was not within the scope of this project.

Digital photographs were taken of each pond. Rough sketches were made at each site to document features such as inlet pipes, outlet pipes, FCS, spillways, etc. Sketches and photographs of each pond are included on the summary sheets. The lids were removed at every FCS to inspect the design and condition of standpipes and other flow restricting devices. It was not in the scope of this

project to enter the subterranean FCS vaults, so only information readily seen or measured from outside the hole was collected. A staff gage was used at each FCS to take approximate measurements of sediments in the vaults.

The information collected on the condition and function of the ponds was used to assign a maintenance priority rating. The purpose of the priority rating is to provide the City with a decision-making tool for scheduling improvements, repairs, and maintenance. Rating scores of High, Medium, and Low were given based on the conditions seen on the day of the site visit. Ponds were given a rating score based on the following scale.

- **High**—In need of immediate maintenance or repairs (sediment clogging FCS, berm erosion, sediment in pond or swale restricting flow, etc.);
- **Medium**—Repairs or maintenance needed but not urgent to function of detention pond (sediment in FCS but not clogging orifice, access road needs improvements or maintenance, remove small amount of vegetation from outlet); or
- **Low**—No repairs needed, maintain on regular schedule (mow to prevent invasive plant growth, check FCS for sediment, check outlet and inlet).

In consultation with City staff a cost estimate was made for recommended repairs and maintenance at each pond. The cost estimates are provided in Table 2.

DEFINITIONS AND ACRONYMS

Wet pond—Ponds constructed with the invert of the outlet pipe at a higher elevation than the bottom of the pond, resulting in permanent standing water at least 1 foot deep, but generally greater than 2 feet deep.

Dry pond—Ponds constructed with the invert of the outlet pipe at the same, or at only a slightly higher, elevation than the bottom of the pond. Dry ponds typically do not retain water more than a few days following a storm, but can have standing water up to 1 foot deep during the winter and into early spring.

Wetland Pond—Ponds with permanent standing water greater than 2 feet deep that do not have a flow control structure and usually do not provide a significant amount of live storage.

Swale—Linear shaped basins that are constructed to slow and treat road runoff, but do not have a flow control structure and therefore do not detain a significant amount of stormwater.

Detention Swale—Linear-shaped basins that have a flow control structure and are constructed to slow, treat, and detain stormwater. These swales do not receive a significant amount of water and likely detain stormwater only during the peak of large storm events.

Siltation Pond—Shallow ponds constructed to slow water flow and settle out suspended solids. There is no regulated flow control structure therefore there is no significant amount of stormwater detention.

FCS—Flow control structure.

CB—Catch basin.

PVC pipe—Polyvinyl chloride pipe.

CMP—Corrugated metal pipe.

HDPE pipe—High-density polyethylene pipe.

RESULTS

The results of the compilation of background information and the field survey are summarized for all of the ponds in the sections below. Detailed results for each of the ponds are provided on the attached data sheets. Figure 1 shows the approximate location of each pond on a map of the City.

General Conditions

A total of 69 stormwater treatment facilities were surveyed for this inventory. Four of the facilities were later determined to be private ponds, and so are not included in the following summaries or maintenance recommendations, but are included in a list of known private ponds in Appendix A. The 11 ponds (Eaglemont-56 to Eaglemont-66) on Eaglemont golf course will be discussed in a separate section from the ponds in the rest of the City, but six are maintained by the city and are included in the summary sheets. Of the 54 facilities within the city limits, there are 31 dry detention ponds, 14 wet detention ponds, 5 swales, 1 detention swale, 2 wetland ponds, and 1 siltation pond.

Seven ponds received a high maintenance rating, 23 ponds received a medium rating, and 26 ponds received a low rating (Table 1 and Data Sheets).

Of the 69 ponds included in the inventory 35 are owned by the City of Mount Vernon, and were mostly acquired through dedication. Four files are silent on ownership (older ponds), but are assumed to be the City's. The ownership of one pond is still to be determined. The remaining 29 ponds are privately owned and are typically part of a lot. Responsibility for maintenance of the ponds generally follows the guideline that if the pond filters city street water, then maintenance is assumed to be the City's responsibility. Forty-nine of the ponds are wholly the responsibility of the City. The City maintains an additional four ponds, although the older files do not address ongoing maintenance. Maintenance is shared for six of the ponds, the City being responsible for structural maintenance and homeowners' associations being responsible for aesthetic maintenance. Maintenance responsibility is still to be determined for one pond. Nine of the ponds are wholly private. Ownership and maintenance are reported for each pond on the data sheets.

Maintenance Recommendations

Maintenance recommendations vary for each pond and are discussed on each of the data sheets. Routine maintenance includes mowing of berm slopes, inspection of FCS, cleanout (vactor) of FCS, and cleanout of vegetation from around inlet and outlet pipes.

Mowing of berm slopes is recommended for most of the ponds in order to prevent the spread of invasive woody plant species such as Himalayan blackberry (*Rubus discolor*) and Scot's broom (*Cytisus scoparius*). Some of the berms have been planted with native trees and shrubs. Mowing is not recommended at these ponds. Weeding around the planted trees and shrubs is often necessary to promote healthy growth. Most of these plantings are assumed to have been done by local residents and homeowners associations and appear to be weeded and maintained by them. Generally, mowing once in the early summer and once in the late summer should be sufficient. Some of the dry ponds (Loveless-23) are used as parks and are mowed frequently to maintain a lawn.

Although in the early stages of growth woody plants (e.g., willows, alder, cottonwood, dogwood, etc.) provide additional functions at the detention ponds, removal of woody vegetation is recommended for a few of the ponds. Dense woody vegetation can slow the flow of water through the ponds and aid in removal of sediments, and provide wildlife habitat. Growth of non-woody plants (specifically cattail) can also aid in sediment removal and is also known to

remove toxins from the water. Cattail should be retained when not interfering with the inlet or outlet pipes. At some point the growth of trees within the detention area could begin to remove a significant amount of storage capacity from the pond. It is recommended that large trees be removed from the detention ponds before they become so large that the trunks start to take up detention volume, and before they are so large that removing the trees becomes difficult and requires heavy equipment. Most of the trees and shrubs that grow in the detention ponds will regenerate from the remaining roots within the next growing season, and so water quality and wildlife habitat functions will only be temporarily affected. It is recommended that trees be cut and removed from detention ponds when they have a diameter at breast height (dbh) of greater than 6 inches.

Dredging of detention ponds and drainage ditches is recommended at some of the sites. It is difficult to assign a schedule for dredging of ponds because of the variety of factors influencing the input and deposition of sediments to the ponds. In general it is recommended that each facility be inspected annually to assess the sediment deposition in the ponds and in the inlet and outlet pipes.

It is also difficult to assign a schedule for removal of sediments from the FCS because of the varied and changing factors affecting input of sediments to the system. Annual inspection of all FCS is recommended to avoid problems with clogging of the orifices in the FCS. Sediment build-up greater than 4 inches deep should be removed.

Improvement and Repair Recommendations

Improvements recommended are minor and include installing trash racks on outlet pipes, flap gates on inlet pipes, safety bars on large pipe openings, and woody plants on erosion-prone slopes. Specific improvement recommendations are included on the summary sheets.

Repairs are specified on the summary sheets and include repair of an erosion-damaged berm, reattachment of standpipe to vault wall, and replacement of a vandalized emergency overflow pipe.

Although not in the scope of this inventory, sites were evaluated for their potential for wildlife habitat enhancement. Native shrub and tree plantings can add wildlife habitat functions to many of the ponds without interfering with the detention function. Trees and shrubs planted along the slopes of the berms, outside of access ramps and paths, can provide habitat for birds, amphibians, and small mammals while providing shade for the pond. Shade on the pond can help reduce water temperature, which could be beneficial for fish downstream

of the pond. Because funding for wildlife habitat enhancement can be tight, plantings should be directed at sites where the most benefit would be received and where the highest probability of success can be assured. To control costs, tree and shrub plantings can often be accomplished with the help of volunteers and civic groups. Relatively small planting effort at some of these ponds could result in relatively large increases in wildlife habitat.

At one pond (Thunderbird-07), enhancement of wildlife habitat could be accomplished with little or no cost. There is a double-celled pond at this location with a low area between the two cells. This low area is connected to a wetland to the east and is likely partially wetland itself. The low area appears to be mowed on a regular basis along with the berm slopes. Ceasing mowing in the low area would not affect the detention functions of the ponds. If mowing were to continue along the berm slopes, but were discontinued in the low area between the pond cells, it is assumed that native shrubs would grow. Many native shrub stumps were seen in this area that are regularly mowed, but appear to be alive. Additional plantings of native trees in this area would speed the establishment of native vegetation.

Cost Estimates

Cost estimates for improvements, repairs, and maintenance are in Table 2. Cost estimates are based on information provided by the City on material and labor costs for tasks related to maintenance and repairs. Site-specific maintenance and repair cost estimates were made by giving consideration to the specific repairs or maintenance needed as well as the site conditions and access. These estimates provide an approximate cost only and are therefore most useful for relative comparison between different maintenance and repair needs.

The following rates were provided by the City and were used in the estimates of repair and maintenance costs.

- Vactor—$195 per hour including two operators.
- Dump Truck—$70 per hour including operator.
- Back hoe—$65 per hour including operator.
- Tractor mower—$65 per hour including operator.
- Operator—$25 per hour.

Routine maintenance of detention ponds includes periodic inspection of FCS and outlet/inlet pipes for sediment and debris accumulation, minor shovel work to clear plants and debris from inlet and outlet pipes, vactor sediment from FCS, and mowing of berm slopes and access roads. It is assumed that mowing at most of the detention ponds can be accomplished by one operator with tractor mower in under 2 hours. It is assumed that inspection of FCS and minor shovel work to clear debris from inlet and outlet pipes can be accomplished by one staff member in under two hours. It is assumed that at most ponds removing small amounts of sediment from FCS can be accomplished by two staff members is less than 2 hours.

Eaglemont Golf Course Ponds

Based on the detention pond index map (November 24, 1999) provided by the City, it is estimated that there are 31 detention ponds on the Eaglemont Golf Course property. There are four types of ponds described on the map and in the stormwater operation manual (June, 1994): 1 residential detention pond, 4 wet/detention ponds, 11 golf course detention ponds with underdrains, and 15 wetland/weir wall detention ponds.

Eleven ponds were inventoried on the Eaglemont property. Six of these ponds were determined to be maintained by the City. The remaining five ponds do not receive runoff from City streets, and are included in the list of private ponds in Appendix A.

Some of the golf course detention ponds and one of the wet/detention ponds could not be located. The detention pond index map shows a different configuration of fairways and greens than was constructed, and it appears that the location and number of ponds constructed is also different than shown on the map.

Rating of the 11 ponds for maintenance and repair needs resulted in 3 high, 6 medium, and 2 low scores. Ratings for each pond are shown on 11 data sheets titled Eaglemont 56 to Eaglemont 66 (6 data sheets in Sheets; 5 data sheets in Appendix A). Problems requiring maintenance or repairs include large amounts of sediment in FCS, clogged underdrains, nonfunctional charcoal filter units, insufficient berm height, erosion damage to berms, trees and shrubs growing on emergency overflow spillway, and trees and shrubs blocking access road to FCS. Although not included in the inventory, it was observed that several of the wetland/weir detention ponds had clogged outlets and remained filled to capacity more than 48 hours after the most recent storm.

LIMITATIONS

Work for this project was performed, and this report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of the City of Mount Vernon for specific application to the referenced property. This report is not meant to represent a legal opinion. No other warranty, express or implied, is made.

Any questions regarding our work and this report, the presentation of the information, and the interpretation of the data are welcome and should be referred to the authors of this document.

We trust that this report meets your needs.

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