2011 Stormwater Comprehensive Plan Update

February 2011

Parametrix

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Prepared for

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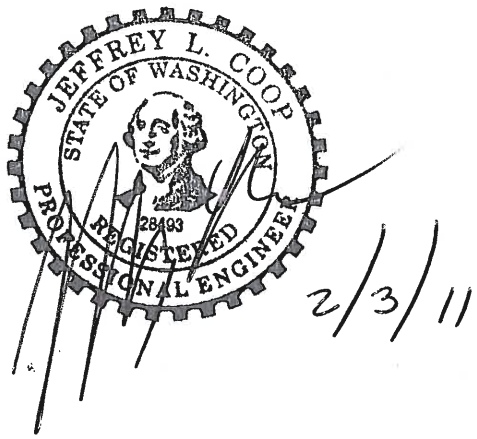
CERTIFICATION

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



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KEY TERMS

BFE	Base Flood Elevation
BiOp	biological opinion
BMP	best management practice
CFR	Code of Federal Regulations
CIPs	Capital Improvement Projects
City	City of Sumner
Comprehensive Plan Update	Stormwater Comprehensive Plan Update
CRS	Community Rating System
DU/AC	dwelling unit per acre
Ecology Manual	Stormwater Management Manual for Western Washington
Ecology	Washington State Department of Ecology
ERU	equivalent residential unity
ESA Program Guidelines	Regional Road Maintenance Endangered Species Act Program Guidelines
ESA	Endangered Species Act
ESU	equivalent service unit
FEMA	Federal Emergency Management Agency
FIRMs	Flood Insurance Rate Maps
GIS	Geographic Information System
GMA	Growth Management Act
HPA	Hydraulic Project Approval
IAC	Implementation Advisory Committee
IDDE	Illicit Discharge Detection and Elimination
KCRTS	King County Runoff Time Series
LDR	Low Density Residential
LID Manual	Low Impact Development Technical Guidance Manual for Puget Sound
LID	Low Impact Development
LWD	large woody debris
MDR	Medium Density Residential
MS4s	municipal separated storm sewer systems
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System

KEY TERMS (CONTINUED)

O&M	operation and maintenance
PSP	Puget Sound Partnership
RCW	Revised Code of Washington
ROE	Report of Examination
SBUH	Santa Barbara Unit Hydrograph
SDC	System Development Charge
SDWA	Safe Drinking Water Act
SEPA	State Environmental Policy Act
SFHAs	Special Flood Hazard Areas
SMA	Shoreline Management Act
SMC	Sumner Municipal Code
SMP	Shoreline Master Program
SWMP Plan	Stormwater Management Program Plan
SWPPPs	Stormwater Pollution Prevention Plans
SWRLID	Stormwater Retrofit and LID
TAC	Technical Advisory Committee
TMDLs	Total Maximum Daily Loads
UGA	Urban Growth Area
UIC	Underground Injection Control
USFWS	U.S. Fish and Wildlife Services
Utility	City of Sumner Storm and Surface Water Utility
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation
WWHM	Western Washington Hydrology Model

1. INTRODUCTION

This Stormwater Comprehensive Plan Update (Comprehensive Plan Update) has been developed to complement and amend the information presented in the *City of Sumner Stormwater Comprehensive Plan*, prepared by Parametrix, Inc. and adopted by the City of Sumner (City) in January 1992 (1992 Comprehensive Plan). In addition, this Comprehensive Plan Update includes the results of stormwater planning performed in 2004 where such results are still applicable.

Several stormwater and surface water plans have been prepared for the City of Sumner. Those plans are listed below.

- Design Technical Memorandum Salmon Creek Culvert Replacement Project (Cosmopolitan 1999).
- Draft Stormwater Quality Action Plan (KCM 1995).
- Stormwater Comprehensive Plan (1992 Comprehensive Plan) (Parametrix 1992).
- East Sumner Neighborhood Plan (City of Sumner 2001).
- Storm and Surface Water Utility Development (URS Corporation 1986).

The major focus of this Comprehensive Plan Update is to:

- Inform the City of the current regulatory programs that impact surface water management and land use as they relate to stormwater management decisions; and
- Identify Capital Improvement Projects (CIPs) and opinions of costs at time of construction so that these costs can be incorporated into a rate and System Development Charge (SDC) study being prepared by others. CIPs identified in this Comprehensive Plan Update are from the Stormwater Capital Improvement Plan published separately.

1.1 BACKGROUND

This document is being prepared as an update to the existing 1992 Comprehensive Plan and planning performed in 2004. Consequently, general City background information, such as soil conditions, vegetation, and topography will not be discussed. Information prepared in previous planning documents is available in those documents published separately from this Comprehensive Plan Update.

1.2 PREVIOUS PLANNING DOCUMENTS

The City of Sumner Storm and Surface Water Utility (Utility) was formed in 1986. The engineering document, which was the basis for forming the Utility, was titled *City of Sumner Storm and Surface Water Utility Development* (URS Corp. 1986). At the time of the preparation of the 1986 report, the equivalent service unit (ESU) was set at 2,400 square feet of impervious surface, and the number of ESUs throughout the City was as shown in Table 1-1. Changes in ESUs since 1986 are also shown in Table 1-1.

Table 1-1. City of Sumner Equivalent Service Units (ESUs)

Development Type	ESU – 1986	1992[a]	2003[a]	2010
Single-Family Residential Parcels	1,411		2,154	2,380
Non-Residential Parcels[b]	2,354		12,421	16,891
Subtotal:	**3,765**	**5,885 (assumed)**	**14,575**	**19,271**
Highways				
Highway 167	243	243	243	243
Highway 410	151	151	151	151
Railroads				
BNRR	58	58	58	58
UPRR	70	70	70	70
Total:	**4,287**	**6,407**	**15,097**	**19,793**

[a] Presented for comparison purposes. Development of ESU estimates, subsequent to 1986 calculation, is described in this Comprehensive Plan Update.

[b] Includes all development other than single-family residential (i.e. multi-family, apartments, etc.).

The 1992 Comprehensive Plan was prepared to establish a plan for the construction of improvements to the stormwater utility. Problems on the existing system were identified, and a program of 34 capital improvement projects, with a total estimated project cost of approximately $30 million, was described. The planning in 2004 identified which projects from the 1992 Comprehensive Plan had been completed, which ones were no longer needed, which ones needed to be carried forward, and additional CIPs that were needed. In 2004, 53 projects were identified for a total cost in 2004 dollars of $16,334,840. Chapter 4 of this Comprehensive Plan Update describes currently identified CIPs from the 1992 Comprehensive Plan and the 2004 planning. Some projects from the 1992 Comprehensive Plan or the 2004 planning are no longer carried forward because the projects were completed, it was determined they were no longer required, or the problems that the projects were intended to address were resolved by other means.

The 1992 Comprehensive Plan was developed using the assumption that CIPs would be paid for through revenue from rates (through bonds), local improvement districts, or state funding through grants and/or loans. The 1992 Comprehensive Plan estimated that monthly stormwater rates would need to increase to as much as $16.75 per month by the year 2000, depending on the number of projects completed and the type of funding mechanism used. The 1992 Comprehensive Plan did not propose the implementation of a system development charge to pay for capital projects.

Implementation of an SDC was recommended in a study for the Utility that was prepared in 1997 (EES 1997). The study recommended a system development charge of $1,840 per ESU. The calculation of the SDC presented in the cost study was based on historical patterns of development within the City, where the ESU density was approximately six ESUs per acre. Most recent development within the City has been at a density significantly higher than this. The SDC is currently being evaluated in a separate study and will be documented by The FCS Group.

The 1992 Comprehensive Plan identified the need for water quality monitoring to collect baseline data and to evaluate the need for water quality capital improvement projects. A *Stormwater Quality Action Plan* (Action Plan), which was prepared for the City in 1995, sought to identify and prioritize water quality problems within the City and develop a plan for monitoring and protecting water quality (KCM 1995).

A small amount of base flow sampling in ditches, stormwater outfalls, and Salmon Creek was performed as part of the Action Plan preparation, but an ongoing program was not implemented.

One of the main products of the 1995 Action Plan was an engineering report presenting a conceptual design for improvements to Salmon Creek. The goals for this project were as follows:

- Decrease the frequency and severity of flooding in the developed areas of the floodplain.
- Improve water quality in Salmon Creek.
- Restore the quality of fish and wildlife habitat, and increase the diversity and abundance of fish and wildlife using the stream and associated wetlands.
- Provide facilities for public access, recreation, and education.

A total of 15 potential projects to improve water quality in Salmon Creek were identified in the Action Plan. These 15 projects have been carried forward in this Comprehensive Plan Update.

In 1999, the *Stormwater Quality Plan* (Cosmopolitan 1999) was published. The *Stormwater Quality Plan* included design of 11 culvert replacements along Salmon Creek. The estimated construction cost for this project was approximately $790,000 (1999 dollars). These projects have not been constructed at the time this Comprehensive Plan Update was prepared. Consequently, these culvert replacement projects are included in the proposed CIP program described in Chapter 4 of this Comprehensive Plan Update.

The *East Sumner Neighborhood Plan,* prepared by the City of Sumner in 2001, included a *Stormwater Facilities Plan* (Berger-Abam 1997). The *Stormwater Facilities Plan* recommended the construction of wet ponds and wetland regional facilities as the neighborhood plan is implemented, with some of the facilities being incorporated into new park space. Where applicable, these proposed regional facilities are included in the CIP program described in Chapter 4 of this Comprehensive Plan Update.

1.3 STUDY AREA

The City of Sumner is located in north-central Pierce County, and is situated adjacent to and within the flood plains of the Puyallup and White Rivers and Salmon Creek. The study area and contributing basin delineation used in this Comprehensive Plan Update is the same as used in the 1992 Comprehensive Plan. However, this Comprehensive Plan Update only considers and evaluates stormwater infrastructure improvements within city limits or annexation areas. Subbasin and study area boundary locations in relation to the current city limits are presented in Figure 1-1.

Figure 1-2 presents a map of the existing City stormwater infrastructure. Figure 1-2 has been updated to reflect changes to the system that have been constructed since the preparation of the 1992 Comprehensive Plan. The City is in the process of cataloging the entire system in a Geographic Information System (GIS) database, and the map presented in this Comprehensive Plan Update reflects current mapping efforts, but is not complete. This map should be updated as the stormwater system mapping is completed.

The locations of known existing City-owned stormwater management facilities are presented in Figure 1-3.

1.4 EXISTING AND FUTURE LAND USE

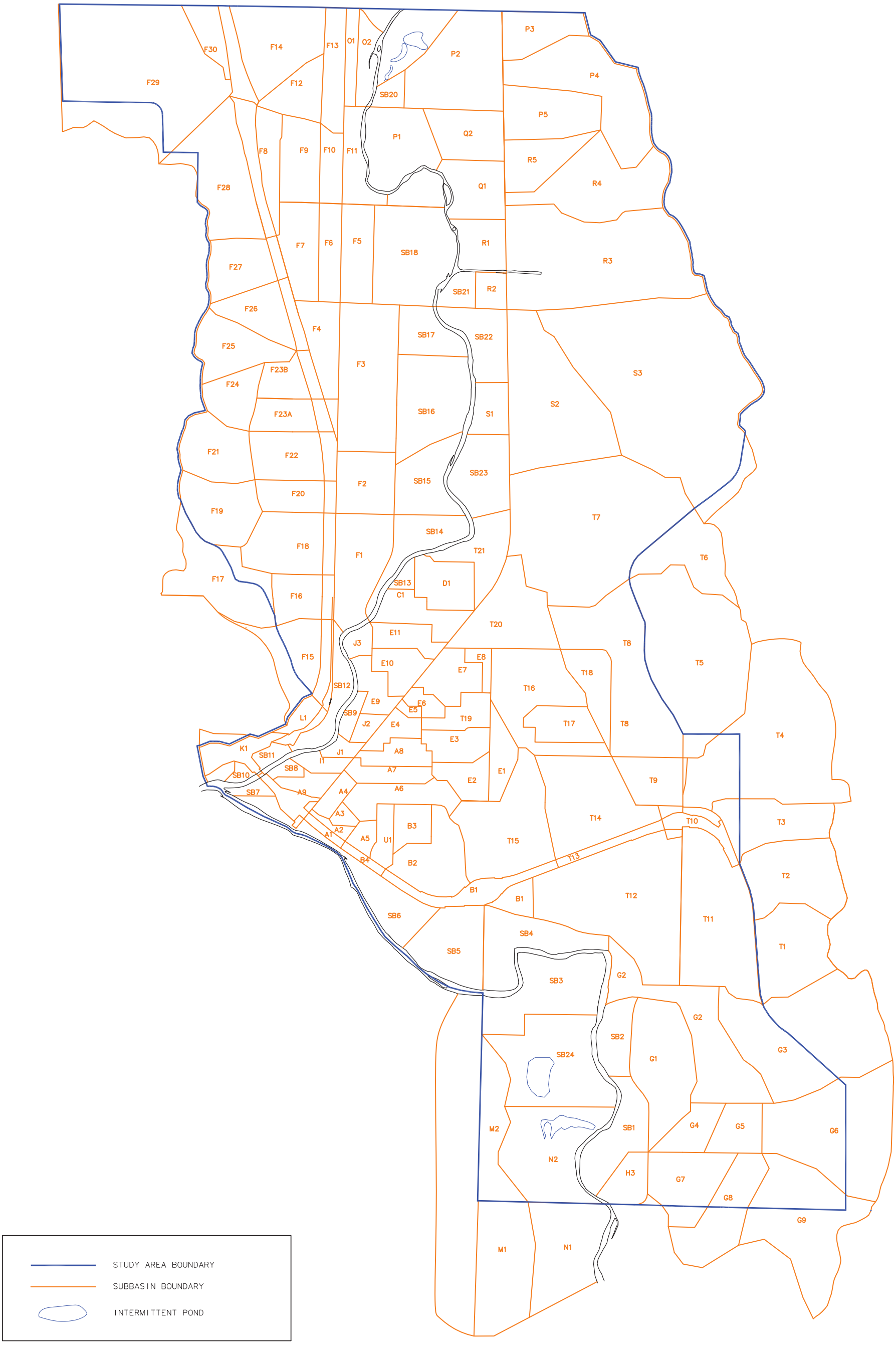
Per the 2000 census, the population within Sumner city limits is approximately 8,504. As was detailed in the 1992 Comprehensive Plan, the City of Sumner is still in a transition phase where agricultural land is being developed to residential, commercial, and industrial uses. The southern portion of Sumner, bounded by Sumner-Tapps Highway to the east, the White River to the west, Salmon Creek to the North, and the Puyallup River to the south, represents the "Old Town" portion of the city which, excluding some vacant parcels to the east and north, is essentially fully developed. Existing uses within this area consist mainly of business/commercial and single-family residential. Vacant parcels to the north and east of the "Old Town" area are expected to be developed as single-family residential and urban village, respectively. The area within city limits, north of the White River and Salmon Creek, was largely used for agricultural purposes in the past, and at this time is essentially undeveloped. A majority of this area is expected to be developed for light industrial and commercial activities.

Table 1-2 summarizes existing land use within the City. Figure 1-4 presents the current City of Sumner Land Use Map.

Table 1-2. Summary of Existing Land Use

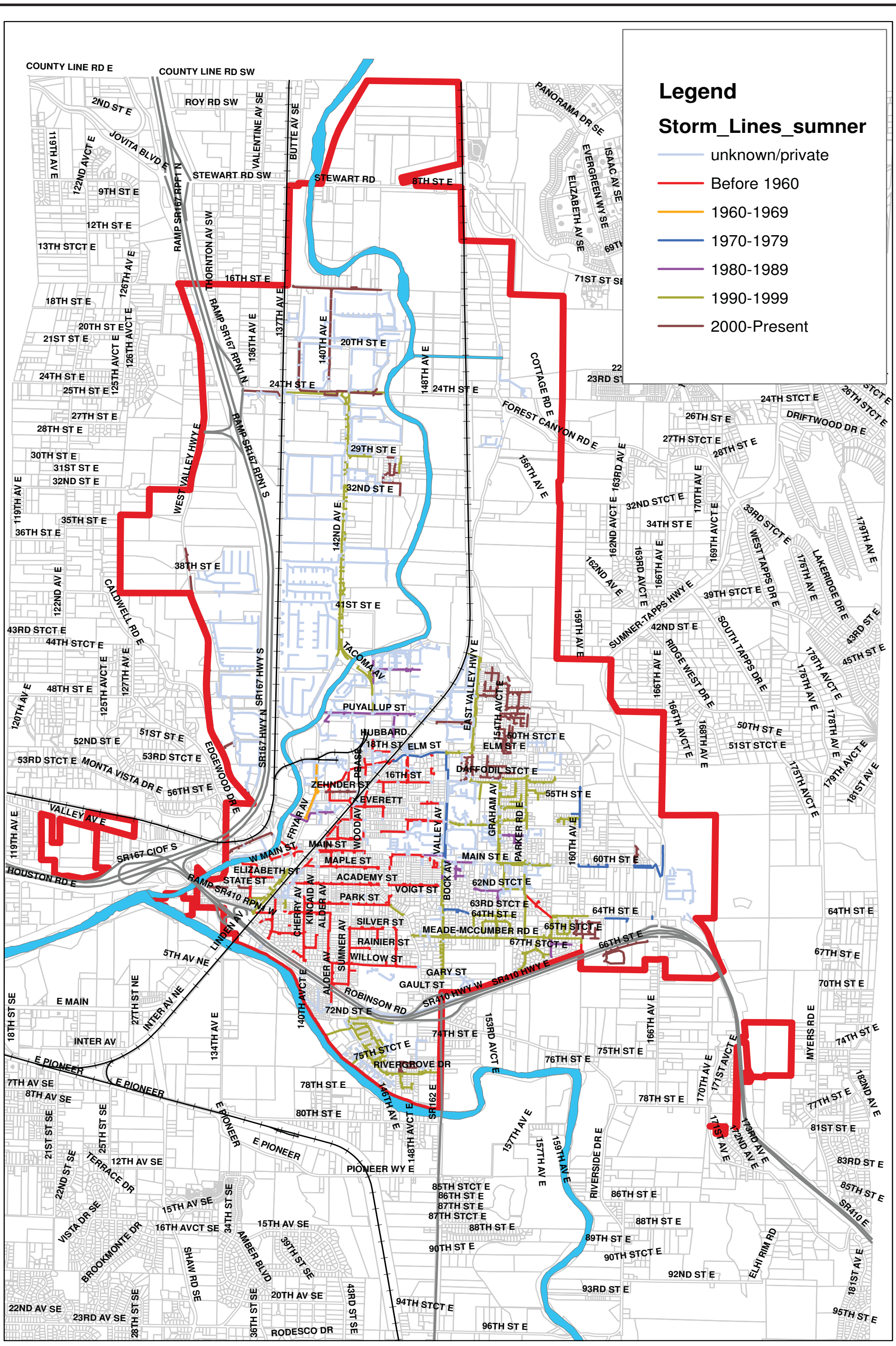
Existing Land Use	Area within current City Limits, acres	Percent	Area within the UGA but outside current City limits, acres	Percent	Total Area, acres	Percent
Single Family	727.28	18%	385.85	35%	1,113.13	21%
Multi-Family	157.83	4%	13.59	1%	171.42	3%
Commercial/Services	182.89	4%	14.94	1%	197.83	4%
Industrial	942.96	23%	17.79	2%	960.75	18%
Civic/Public	681.51	16%	355.48	32%	1,037.00	20%
Parks/Recreation	242.42	6%	19.67	2%	262.09	5%
Agriculture	383.52	9%	81.88	7%	465.40	9%
Vacant	825.10	20%	223.16	20%	1,048.25	20%
Total:	**4,143.51**	**100%**	**1,112.36**	**100%**	**5,255.87**	**100%**

Ultimate land use expected at buildout of current city limits and the UGA, based on the most current comprehensive plan map designations, is as follows: 44 percent commercial/ industrial, 27 percent single-family residential, 10 percent multi-family and medium to high density residential, and 20 percent civil-public utilities and facilities. Figure 1-5 presents the latest Sumner Comprehensive Plan land use designations.



Parametrix DATE: DEC 08, 2010 FILE: 216-1527-060 FIG1-1

Figure 1-1
Stormwater Comprehensive Plan
Study Area Boundary
and Subbasin Locations



Parametrix DATE: DEC 08, 2010 FILE: 216-1527-060 FIG1-2 NOTE: Graphic background prepared by the City of Sumner

Figure 1-2
Stormwater Comprehensive Plan
Existing Stormwater Infrastructure

Parametrix DATE: JAN 28, 2011 FILE: 216-1527-060 FIG1-3 NOTE: Graphic background prepared by the City of Sumner

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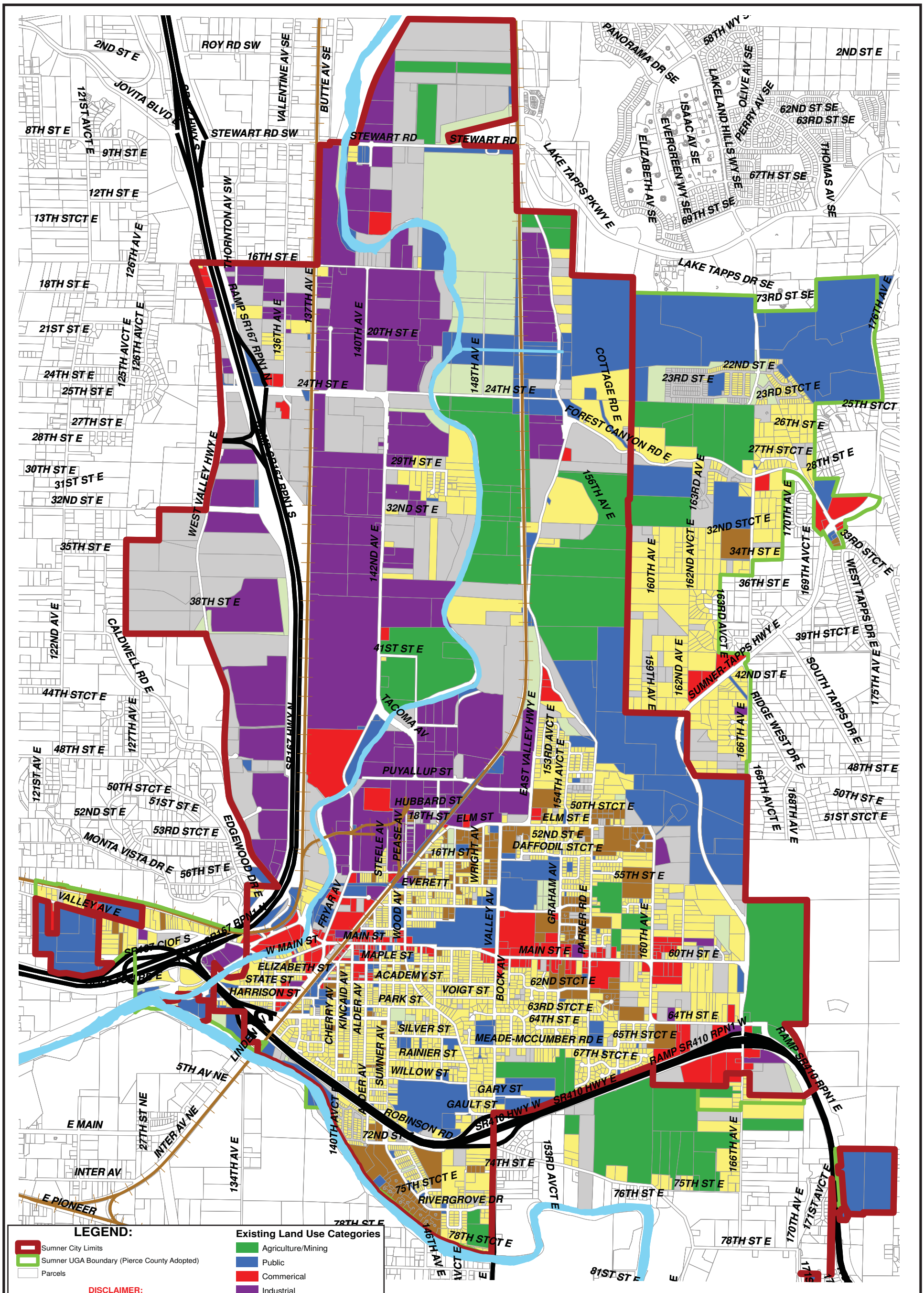
Figure 1-3
Stormwater Comprehensive Plan
City-owned Stormwater Management Facilities



Parametrix DATE: DEC 08, 2010 FILE: 216-1527-060 FIG1-4 NOTE: Graphic backround prepared by the City of Sumner

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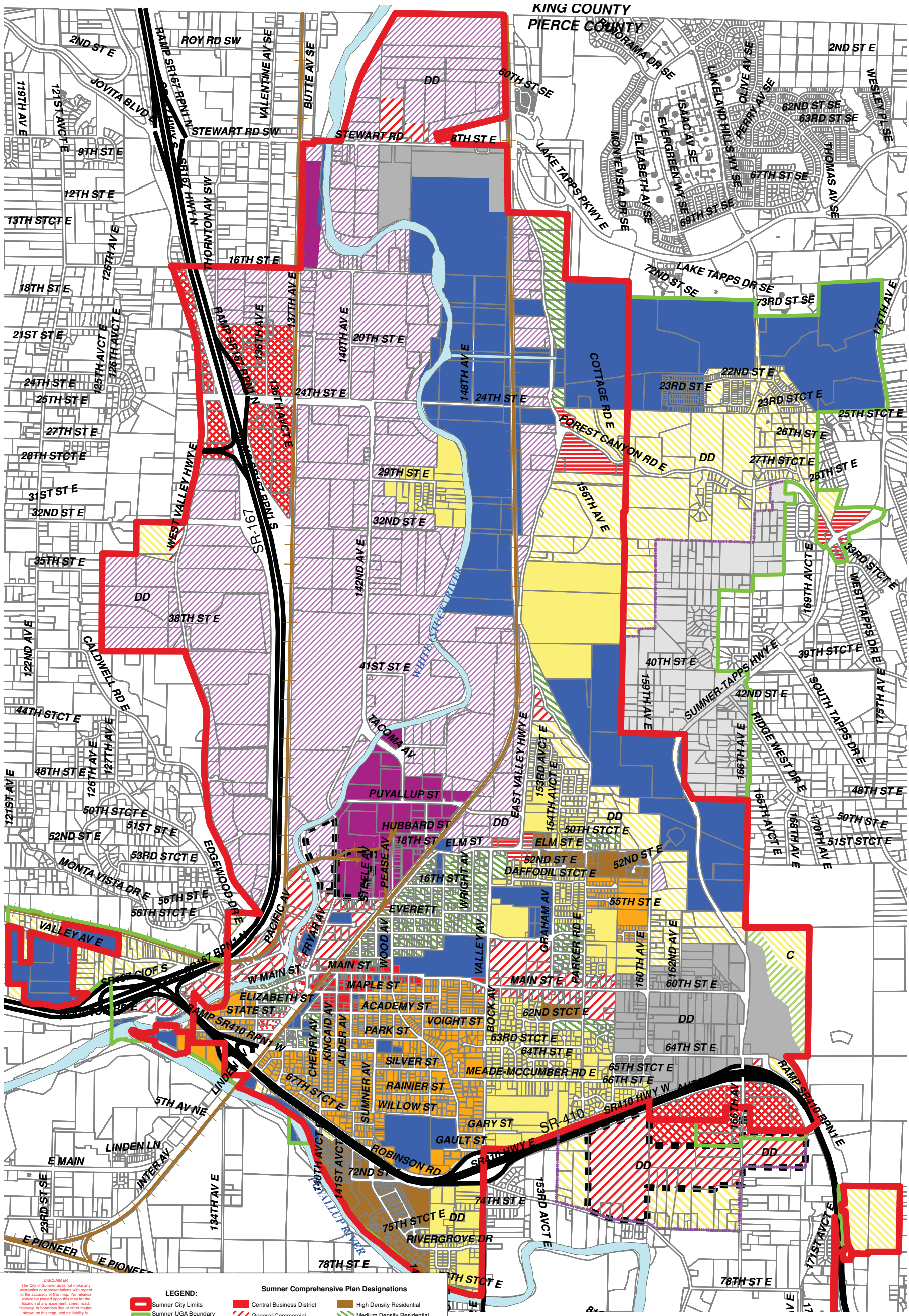
Figure 1-4
Stormwater Comprehensive Plan
Existing Land Use Map



Parametrix DATE: DEC 08, 2010 FILE: 216-1527-060 FIG1-5 NOTE: Graphic backround prepared by the City of Sumner

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Figure 1-5
Stormwater Comprehensive Plan
Comprehensive Plan Land Use Map

2. STORMWATER MODELING

The 1992 Stormwater Comprehensive Plan identified 44 individual stormwater basins in and around the City of Sumner that generate and affect stormwater flows within city limits. These basins were further divided into subbasins, for a total of 115 subbasins. A majority of these basins were hydrologically and hydraulically modeled in 1992 using the WaterWorks modeling program. WaterWorks uses the Santa Barbara Unit Hydrograph (SBUH) method to estimate peak runoff rates for specified design storms in each subbasin. The design storms chosen for the 1992 modeling effort were the 25-year, 24-hour event and the 100-year, 24-hour event using Type 1A precipitation distribution.

Hydrologic modeling data was subsequently used to complete hydraulic modeling of the existing Sumner stormwater infrastructure to help ascertain system deficiencies and identify potential capital improvement projects. The results for the basin modeling effort are presented in the 1992 Stormwater Comprehensive Plan Technical Appendix Sections 6 and 7. A discussion of the modeling results can be found in Section 5.0 of the 1992 Stormwater Comprehensive Plan.

The hydrologic modeling conducted in 1992 assumed average Low Density Residential (LDR) and Medium Density Residential (MDR) densities of one dwelling unit per acre (DU/AC) at approximately 15 percent impervious cover and four DU/AC at approximately 42 percent impervious cover, respectively. These density assumptions are too low for new development based on the minimum lot sizes allowed for LDR and MDR in the current Sumner Municipal Code (SMC). Based on the current allowable lot sizes, density assumptions of 30 percent for LDR and 48 percent for MDR are more appropriate.

Although the densities assumed for inputs in the 1992 hydrologic modeling are not suitable for current development trends, they were appropriate for development occurring before and at the time the modeling was conducted. A majority of the capital improvement projects proposing upsizing existing conveyance as part of the 2004 planning is in the "Old Town" portion of Sumner, so previous modeling is still applicable.

As stated above, the hydrologic modeling on which the 1992 hydraulic modeling was based was completed using the SBUH method. The SBUH method is a single-event model and is no longer considered a viable model for flow control Best Management Practice (BMP) design with the availability of continuous simulation models, such as the King County Runoff Time Series (KCRTS) model and the Western Washington Hydrology Model (WWHM). However, SBUH is still a viable model for conveyance design. Therefore, the flow data developed during the 1992 modeling effort, used to estimate replacement pipe sizing, should still be applicable.

Modeling conducted during preliminary regional facility sizing for the Capital Improvement Plan in Section 4.0 was completed using the WWHM utilizing the basin characteristics and model inputs presented in the 1992 Comprehensive Plan, with the exception that the LDR and MDR density assumptions were revised to more accurately represent current development trends. The results for modeling completed during preliminary regional facility sizing can be found in Appendix E.

3. STORMWATER AND SURFACE WATER REQUIREMENTS

3.1 INTRODUCTION

The City is impacted by stormwater regulations and policies from a variety of sources. This chapter of the Comprehensive Plan Update presents an overview of regulations that impact stormwater and surface water. Although the focus of this Comprehensive Plan Update is on stormwater, regulations related to surface water are interrelated with stormwater because of stormwater and surface water flows combine together in common systems.

3.2 FEDERAL REGULATIONS

3.2.1 Clean Water Act (CWA) Phase II NPDES Stormwater Permits

The federal government regulates stormwater through several different programs. The CWA requires all operators of municipal separated storm sewer systems (MS4s) with a population of 10,000 to 100,000 or those located in a federally designated urban area to obtain and comply with the National Pollutant Discharge Elimination System (NPDES) Phase II stormwater regulations that became effective March 10, 2003. The City is within a federally designated urban area and is subject to the requirements of the Phase II permit.

On January 17, 2007, the Washington State Department of Ecology (Ecology) issued the Western Washington Phase II Municipal Stormwater Permit promulgated under the NPDES and State Waste Discharge General Permit for Discharges. This permit is referred to as the NPDES Phase II Permit. The permit was modified in 2009 and the City is a permittee under the NPDES Phase II Permit. The City has filed its Notice of Intent for coverage under the permit and is proceeding with the requirements of the NPDES Phase II Permit. Triggers for coverage under the NPDES Phase II Permit include:

- Owning and operating a storm drain system.
- Discharging to surface waters or the ground.
- Being located within, or partially located within, a census-defined urbanized area.
- Have a population of more than 10,000.

The NPDES Phase II Permit provides detailed information regarding the permit requirements. The NPDES Phase II Permit and its appendices are available through Ecology's website at:

<http://www.ecy.wa.gov/programs/wq/stormwater/municipal/phaseIIww/wwphiipermit.html>

The following Ecology website with NPDES Phase II Permit information was in effect at the time this Comprehensive Plan Update was prepared:

<http://www.ecy.wa.gov/programs/wq/stormwater/municipal/index.html>

Prior to issuance of the NPDES Phase II Permit, stormwater management facilities and systems were designed based on criteria developed specifically for the City. However, the Sumner Municipal Code has been amended to reflect adoption of the Ecology *Stormwater Management Manual for Western Washington* (Ecology Manual), adoption of the minimum requirements in Appendix I of the NPDES Phase II Permit with some exceptions, and adoption of the Puget Sound Partnership (PSP) Low Impact Development Technical Guidance Manual for Puget Sound (LID Manual).

Section S5.A of the NPDES Phase II Permit requires the City to prepare a Stormwater Management Program Plan (SWMP Plan). The SWMP Plan documents how the City plans to implement the requirements of the NPDES Phase II Permit. The City has prepared the initial SWMP Plan and will need to update the SWMP Plan annually as required by Section S5.A.2 of the NPDES Phase II Permit.

Costs to develop and implement the SWMP and meet the other requirements of the NPDES Phase II Permit are part of the City's overall stormwater management costs. These costs are reflected in the overall stormwater management program and in the financial analysis included in the rate and SDC analyses by others.

The City's current SWMP document was prepared in February 2010 and is available through the City's website at:

<http://www.ci.sumner.wa.us/Documents/Public%20Works/Stormwater_03-05-2010.pdf>

Section S5.C of the NPDES Phase II Permit requires that the SWMP address the following components:

- Public Education and Outreach;
- Public Involvement and Participation;
- Illicit Discharge Detection and Elimination (IDDE);
- Controlling Runoff from New Development, Redevelopment, and Construction Sites; and
- Pollution Prevention and Operation and Maintenance for Municipal Operations. This is being addressed in part through the agreement executed by the City for maintenance of the City's Public Works Shop Building site. A copy of the agreement is included in Appendix C.

Section S9 of the NPDES Phase II Permit requires an Annual Report be submitted to Ecology. A copy of the City's 2009 Annual Report is available through the City's website at:

<http://www.ci.sumner.wa.us/Documents/Public%20Works/Stormwater/NPDES_2009_Report.pdf>

The SWMP document and Annual Report have been published separately from this Comprehensive Plan Update because of the requirement for annual updates. However, these two documents contain information relevant to comprehensive stormwater planning for the City. Based on the SWMP document, ongoing stormwater management elements to be implemented by the City are summarized in Table 3-1.

Table 3-1. Summary of Future SWMP Actions[a]

Element	Action
Public Education and Outreach	• River Clean-Up; scheduled for April 2010 • Paper Shredding; scheduled for April 2010
Public Involvement and Participation	• Ongoing participation in the Puyallup River Watershed Council • Continued involvement in the South Puget Sound Phase II Coordinator's Group • Ongoing catch basin stenciling for industrial and commercial sites • Ongoing availability of car wash kits for community car washes

(Table Continues)

Table 3-1. Summary of Future SWMP Actions[a] (Continued)

Element	Action
Public Involvement and Participation (Continued)	• On-line survey • Prepare annual SWMP updates and post to website
Illicit Discharge Detection and Elimination	• Ongoing update to storm system base map • Ongoing enforcement of agreements for maintenance of nonpublic stormwater facilities • Ongoing implementation of Stormwater Pollution Prevention Plans (SWPPPs) for City-owned facilities • Identify the location of illicit connections during ongoing storm system maintenance • Ongoing documentation of inspection activities • Include IDDE in public education and outreach activities • Ongoing staff training
Controlling Runoff from New Development, Redevelopment, and Construction Sites	• Ongoing maintenance of City-owned stormwater facilities • Ongoing enforcement of City codes and standards • Ongoing staff training
Pollution Prevention and Operation and Maintenance for Municipal Operations	• Cleaning the stormwater system bi-annually • Ongoing implementation of SWPPPs for City-owned facilities • Ongoing implementation of the inspection plan for inspecting catch basins, inlets, and stormwater facilities owned by the City

[a] Source: Stormwater Management Program (City of Sumner 2010)

The current NPDES Phase II Permit will expire on February 15, 2012. There are several efforts underway to issue an updated permit when the current permit expires. These efforts include:

- Implementation by Ecology of the Stormwater Work Group to provide recommendations regarding monitoring requirements;
- Implementation by Ecology of the Low Impact Development (LID) Technical Advisory Committee (TAC) and Implementation Advisory Committee (IAC) to provide recommendations regarding LID;
- Implementation by Ecology of 2012 Municipal Stormwater Permit Reissuance Listening Sessions to receive comments related to the draft 2012 permits and the reissuance process.

At the time this Comprehensive Plan Update was prepared, there is no firm understanding of what requirements will be contained in the 2012 permit. However, it is generally thought that the provisions summarized below will be required. The following is based on information from Ecology, attending LID TAC and IAC meetings, reviewing reports by the Stormwater Work Group, attending the Listening Sessions, and attending the bi-monthly American Public Works Association Stormwater Managers Meeting:

- Monitoring requirements have been more stringent for Phase I permittees rather than Phase II permittees. However, monitoring requirements may become more stringent for Phase II permittees in the 2012 permit. Monitoring requirements are unknown but

could include a buy-in option to support regional monitoring rather than monitoring by each individual permittee. Reports by the Stormwater Work Group are available through Ecology's website at:

<http://www.ecy.wa.gov/programs/wq/psmonitoring/swworkgroup.html>

- LID was required to be implemented by Phase I permittees where feasible. Phase II permittees were required to not prohibit the implementation of LID. The purpose of the LID TAC and IAC was to better determine the feasibility of LID and how LID could be implemented through the 2012 permit. Although LID implementation has focused on Phase I permittees, similar requirements may be passed on to Phase II permittees in the 2012 permit. Reports by the TAC and IAC are available through Ecology's website at:

  <http://www.ecy.wa.gov/programs/wq/stormwater/municipal/LIDstandards.html>

3.2.2 Total Maximum Daily Loads (TMDLs)

The assessment of water quality for waters of Washington State is required under Section 303(d) of the CWA. Under Section 303(d) of the CWA, all states are required to prepare a list of waterbodies that do not meet water quality standards.

Water quality for assessed waterbodies is categorized under the following designations:

- Category 5 – Polluted waters that require a TMDL.
- Category 4C – Polluted waters that are impaired by a non-pollutant but do not require a TMDL. Impairment can include physical factors such as low water flow, stream channelization, and dams.
- Category 4B – Polluted waters that do not require a TMDL because a pollution control program is already in place.
- Category 4A – Polluted waters that do not require a TMDL because a TMDL is already in place.
- Category 3 – Waters with insufficient data.
- Category 2 – Waters of concern where there is some evidence of a water quality problem but there is insufficient information to require a TMDL to be prepared.
- Category 1 – Waterbodies that have been tested and meet standards for clean waters.

Table 3-2 summarizes the 303(d) water quality assessment information for waterbodies within the City, the City's UGA, or in proximity to the city. Information from Ecology's website regarding TMDLs is included in Appendix B.

Table 3-2. Summary of 303(d) Water Quality Assessment Information

Water Body	General Location	303(d) Category	Ecology Listing ID	Pollutant	TMDL Prepared
White River	North (upstream) of Lake Tapps Tailrace	5	17515	Temperature	No
White River	North (upstream) of Lake Tapps Tailrace	5	7526	pH	No
White River	North (upstream) of Salmon Creek	5	21301	Temperature	No
White River	North (upstream) of Salmon Creek	5	17513	Temperature	No
White River	South (downstream) of Salmon Creek	5	17513	Temperature	No

(Table Continues)

Table 3-2. Summary of 303(d) Water Quality Assessment Information (Continued)

Water Body	General Location	303(d) Category	Ecology Listing ID	Pollutant	TMDL Prepared
White River	Near southwest portion of city limits	5	16709	Fecal Coliform	No
White River	Near southwest portion of city limits	5	21302	Temperature	No
Salmon Creek	East (upstream) of confluence with White River	5	45601	Fecal Coliform	No
White River	North (upstream) of Lake Tapps Tailrace	4C	6192	Instream Flow/Habitat	No

Water quality within receiving waterbodies is complex and is contingent upon a variety of factors. Pollutant levels that are not in conformance with water quality standards could be attributed to land uses with a direct or surface discharge to the waterbody, physical conditions of the stream, and/or chemical or biological processes within the waterbody.

Sources of fecal coliform can include discharges from septic tanks and drainfields, stormwater runoff from animal farms, and animal access to streams. The presence of fecal coliform can cause other water quality violations by reducing the levels of dissolved oxygen. In addition, dissolved oxygen levels can be impacted by temperature and flow. As the water temperature increases, the ability of water to retain oxygen decreases. As water levels decrease during the summer, prolonged exposure to warmer temperatures and/or sunlight can increase the temperature of the water which, in turn, can result in lower levels of dissolved oxygen.

There are several factors that impact the pH in receiving waterbodies. Excess nutrients, such as carbon, nitrogen, and phosphorus, can promote benthic algal growth on rocks or other debris in streambeds. The algae remove dissolved inorganic carbon, which is needed for photosynthesis, from water. Consequently, during daylight hours, algae can consume dissolved carbon dioxide which would cause the pH to increase. Another factor impacting the pH is the amount of carbon dioxide. If there are significant amounts of carbon dioxide, the amount of disassociated hydrogen ions can increase which would lower the pH.

Factors that impact temperature include loss of shading provided by riparian vegetation, low flows during the summer months during longer hours of sunlight and warmer air temperatures, and discharges of stormwater from dead storage water quality treatment BMPs, such as wet ponds.

The Category 4C listing for low instream flows appears to be based on documentation prepared between 1983 and 1993 in support of Puget Sound Energy's operation of the Lake Tapps hydroelectric facility. However, low flows could continue to be a problem based on stream flow data available from the United States Geological Survey (USGS) and Ecology's Report of Examination (ROE), issued September 15, 2010, for flow rate allocations to the Cascade Water Alliance. Based on Ecology's ROE, the minimum flow to the White River from August 7 through November 14 of each year is to be 500 cfs measured at USGS Gauge Station 12099200. Based on the report *Water Quantity and Water Quality Analyses for the Lake Tapps Water Right Applications* (Aspect Consulting 2010), minimum flows of 500 cfs during this time period is the same as approved under the interim agreement between Puget Sound Energy and the United States Army Corps of Engineers. Average daily flow rates are available from the USGS Gauge Station 12099200 from 2003 through 2010. Within the period from August 7 through November 14 of each year within this time frame, there would be 791 average daily flow records. Based on average daily flow records, there are 270 days,

or 34 percent of the records, with flow rates below the 500 cfs minimum required flow rate. Consequently, low in-stream flows will likely continue to be a problem for the White River. Although implementation of LID by the City within areas surrounding the White River may help with groundwater recharge of the river, stormwater infiltration will not likely significantly restore the flows to the required flow rates.

Currently, there are no approved TMDL plans or TMDL plans in process for the listings in Table 3-2. If the TMDLs include pollutant loading allocations for stormwater discharges, the allocations may be implemented through modifications or future revisions to the NPDES Phase II Permit. The City will need to comply with applicable allocations if any are identified for the City.

3.2.3 Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) is the main federal law that protects the quality of drinking water. Under the SDWA, the USEPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards. In Washington State, Ecology has received authority from the USEPA to administer the requirements of the SDWA. The SDWA requires many actions to protect drinking water and its sources, including rivers, lakes, reservoirs, springs, and groundwater wells.

There are two aspects of the SDWA related to stormwater management: wellhead protection and underground injection control. Construction of stormwater BMPs that rely on infiltration, such as infiltration ponds or rain gardens, will need to consider the location of wells, wellhead protection areas, and requirements for registering underground injection control wells. Information regarding the City's wellhead protection areas can be found in Appendix G of the *Water System Plan Update* (Parametrix 2009).

The Underground Injection Control (UIC) program was developed as one of the key programs to protect drinking water sources. Ecology received authority from USEPA in 1984 to regulate UIC wells in Washington State. The UIC rule is found in Chapter 173-218 Washington Administrative Code (WAC).

A UIC well is a constructed facility used to discharge fluids into the subsurface. Examples of UIC wells are dry wells, infiltration trenches with perforated pipe, and any structure deeper than the widest surface dimension. The majority of UIC wells in Washington are used to manage stormwater, sanitary waste, return water to the ground, and help clean up contaminated sites. A dry well is an example of a stormwater UIC well. A large on-site septic system is an example of a sanitary sewer UIC well. The potential for groundwater contamination from UIC wells depends upon well construction, well location, quality of the fluids injected, and the geographic and hydrologic settings in which the injection occurs.

Stormwater-related elements of the UIC program include the following:

- An understanding of if the proposed facility meets the definition of a Class V injection well. The USEPA has issued clarification on what types of stormwater management facilities may be classified as a UIC well. The clarification letter and its attachment are included in Appendix D.
- An understanding of if the UIC well meets the nonendangerment standard of Chapter 173-218-080 WAC. If the UIC well provides the required treatment and discharges will be in compliance with water quality standards for groundwater, the UIC well can be rule authorized. Otherwise, the UIC well must go through the demonstrative approach to document that groundwater quality standards will be maintained.

- Registering the UIC well with Ecology. As part of updating the Sumner Municipal Code for consistency with the NPDES Phase II Permit, the code has clarified that the City will register UIC wells with Ecology.

The following USEPA website with SDWA information was in effect at the time this Comprehensive Plan Update was prepared:

<http://www.epa.gov/safewater/sdwa/index.html>

The following Ecology website with UIC information was in effect at the time this Comprehensive Plan Update was prepared:

<http://www.ecy.wa.gov/programs/wq/grndwtr/uic/index.html>

3.2.4 Endangered Species Act (ESA)

The purpose of the ESA is to "provide a means whereby the ecosystems upon which endangered species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of treaties." The ultimate goal of the ESA is to return endangered and threatened species to the point where they no longer need the statute's protection. The ESA is administered through the U.S. Fish and Wildlife Services (USFWS) and the National Oceanic Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS). Table 3-3 lists threatened or endangered species that live in waterbodies of the Puget Sound Region.

Table 3-3. Summary of ESA Listed Species

Listed Species	Listed As	Federal Agency	Date of Listing
Bull Trout	Threatened	USFWS	11/1/07
Dolly Varden Trout	Proposed Similarity of Appearance (Threatened)	USFWS	5/11/05
Chinook Salmon	Threatened	NOAA NMFS	3/24/99
Steelhead Salmon	Threatened	NOAA NMFS	5/11/07
Southern Resident Killer Whale	Endangered	NOAA NMFS	11/18/05

The City is located in Water Resource Inventory Area (WRIA) 10 – Puyallup/White.

The following NOAA website with ESA recover information was in effect at the time this Comprehensive Plan Update was prepared:

<http://www.sharedsalmonstrategy.org/plan/>

<http://www.sharedsalmonstrategy.org/plan/vol2.htm>

The following Washington State Department of Transportation (WSDOT) website with ESA listing information was in effect at the time this Comprehensive Plan Update was prepared:

<http://www.wsdot.wa.gov/Environment/Biology/BA/default.htm>

Policies and regulations that are implemented as part of recovery plans of listed species can impact water quality treatment requirements for stormwater BMPs, maintenance procedures, and wastewater treatment plant effluent criteria. Major policy and regulatory documents related to ESA listed species that are being developed or implemented for the Puget Sound Region include:

- The NPDES Phase II Permit.
- The Tri-County Model 4(d) proposal developed through a partnership between King, Pierce, and Snohomish Counties; local cities; utilities; Native American tribes; business interests; and environmental groups.

- The Puget Sound Recovery Plan being developed by the Puget Sound Partnership. The City will need to remain aware of stormwater and surface water requirements as policies and regulations develop.

The following documents were reviewed to prepare this Comprehensive Plan Update. A brief summary of major findings relevant to the City's stormwater management is included:

- *Salmon Habitat Protection and Restoration Strategy* (Pierce County 2008). This plan was prepared both for WRIA 10 – Puyallup/White Watershed and WRIA 12 – Chambers/Clover Creek Watershed. The Restoration Strategy identifies high priority areas for restoration and protection within WRIA 10 and WRIA 12. The Restoration Strategy identifies and prioritizes near and long term actions. Based on the Restoration Strategy, the Lower White River is one of the high priority areas for restoration in WRIA 10 to address the low viable salmonid population parameters caused by river channelization. The Restoration Strategy identifies opening floodplain habitat and restoring riparian functions on the Lower white River as providing the greatest restoration benefits for Lower White River Chinook. Setback levees were identified as a means to opening floodplain habitat. The Restoration Strategy also includes acquisition of existing high quality habitat and habitat restoration as recommended actions.

  However, the Restoration Strategy also reports that flow modifications that have resulted from the Mud Mountain Dam and Lake Tapps diversion strongly limit White River spring Chinook performance. The Restoration Strategy states that "Restoration of more normative flows in the diversion reach and more normative flows from the flood control reservoir were projected to produce the greatest benefits to all White River salmonids by a substantial margin over the other actions, including Chinook produced in the upper and lower river." The Ecology ROE for Cascade Water Alliance allows up to 20 cfs to be diverted to the diversion channel regardless of flows in the White River. This is likely intended to restore or maintain beneficial flows in the diversion reach. However, restoration of normative flows from the Mud Mountain Dam is beyond the control of the City and may limit the benefit of future restoration efforts.

  The Restoration Strategy was available at Pierce County's website in effect at the time this Comprehensive Plan Update was prepared:

  <http://www.co.pierce.wa.us/xml/services/home/environ/water/PS/leadentity/2008/Strategy03-2008.pdf>

- *Salmon Habitat Limiting Factors Report for the Puyallup River Basin (Water Resource Inventory Area 10)* (Washington Conservation Commission 1999). The Habitat Report was prepared as part of the Puget Sound Recovery Plan. The Habitat Report contains several key findings and data gaps that could require the City's involvement to address. Those key findings and data gaps are summarized in Table 3-4. Salmon production and habitat impacts related to Mud Mountain Dam and Lake Tapps are not included in Table 3-4 since those facilities are beyond the control of the City. Additional data related to salmon recovery could be obtained in the future. Such data could result in additional requirements regarding land use and stormwater management. For example, future requirements may need to be addressed in future planning under the Growth Management Act (GMA), future requirements of the NPDES Phase II Permit, a project-specific permit through the Joint Aquatic Resource Permit Application, or floodplain management through Federal Emergency Management Agency (FEMA) requirements.

Table 3-4. Summary of White River Habitat Limiting Factors[a]

Element	Potential Impacts
Flood control practices have adversely impacted fish production throughout the basin. The removal of riparian vegetation, construction levees and revetments, and removal of large woody debris (LWD) pose significant adverse impacts on natural production of salmonids.	Future regional projects may include riparian restoration, installation of LWD, and construction of setback levees.
Data from the drainages studied in this subbasin on temperatures, spawning gravels, large woody debris and holding pools indicates the Chinook beneficial uses are currently poorly supported.	Future data acquisition may result in requirements to promote Chinook beneficial uses.
There exist numerous barriers to adult and juvenile salmonids on tributary streams throughout the basin.	City is addressing this in part through CIPs 33 through 40 on Salmon Creek and CIP 52 on the Number 9 Ditch in Forest Canyon.
Additional data on presence and distribution of anadromous salmonids and native char needs to be collected.	Future data acquisition may result in requirements to promote beneficial uses of identified species.
Freshwater life history data needs to be collected, including spawning run timing of all species of naturally produced salmonids.	Future data acquisition may result in requirements to support beneficial uses and run times.
A sediment budget for the White River needs to be prepared.	Ongoing sediment deposition in the White River can impact floodplain elevations and boundaries within the City.
Existing flood control facilities and opportunities to restore floodplain and off-channel salmonid habitat restoration opportunities need to be identified and mapped.	Future regional projects may include off-channel habitat restoration and setback levees.
Development of baseline data on habitat utilization by salmonid species in the basin needs to be addressed for effective management of the watershed.	Future data acquisition may result in requirements to support effective management.

[a] Summarized from the Salmon Habitat Limiting Factors Report for the Puyallup River Basin (Water Resource Inventory Area 10) (Washington Conservation Commission 1999).

The Habitat Report was available through the King County website in effect at the time this Comprehensive Plan Update was prepared:

<http://your.kingcounty.gov/dnrp/library/archive-documents/wlr/wrias/10/salmon-habitat-limiting-factors/pdf/wria-10-salmon-habitat-limiting-factors.pdf>

- *White River Basin Plan Characterization Report* (Pierce County 2007). Currently, Pierce County is in Phase I of a three-phase planning effort to update the *Storm Drainage and Surface Water Management Master Plan* (Montgomery 1991). Phase I includes the characterization of physical, hydrologic, and cultural aspects of the basin. Phase II includes analyzing alternatives and identification of preferred solutions. Phase III includes implementation and effectiveness monitoring. The White River Basin is one of the basins in Pierce County in the current basin planning efforts. The City has been identified as one of the stakeholders in the White River basin plan.

  The Characterization Report has identified characteristics of stream systems within the city as well as unincorporated areas of Pierce County. The stream characteristics and potential impacts to the City are summarized in Table 3-5. There were no fish barriers identified on the White River itself within the city. Table 3-5 is based on

information in the Characterization Report and does not reflect the improvements to Salmon Creek proposed in this Comprehensive Plan Update. There are more improvements to Salmon Creek proposed in this Comprehensive Plan Update than fish barriers in Salmon Creek identified by Pierce County.

The City, as a stakeholder in the White River basin planning process, should coordinate with Pierce County on a regular basis during Phase II to determine if regional projects are proposed for any of the stream reaches listed in Table 3-5.

The Characterization Report was available through the Pierce county website in effect at the time this Comprehensive Plan Update was prepared:

<http://www.co.pierce.wa.us/pc/services/home/environ/water/ps/watershed/whiterivermain.htm>

Table 3-5. Summary of Stream Reach Characterization[a]

Stream Reach – Section	Description, Downstream to Upstream	Aquatic Habitat Characterization[b]	Riparian Corridor Characterization[c]	Potential Impact to City[d]
JOVITA CREEK				
0032-01	Confluence with White River through parallel culverts under SR 167	Poor	Fair	Not likely; parallel culverts under SR 167 mainline and railroad parallel culverts are owned by others
0032-02	SR 167 culverts to ditch draining constructed wetlands	Poor	Poor	Not likely; culvert replaced with new ramp for 24th Interchange
0032-03	Ditch draining constructed wetland to 32nd Street off-ramp	Poor	Poor	Code enforcement
0032-04	32nd Street off-ramp through culvert under SR 167	Poor	Poor	Not likely; WSDOT culvert under SR 167 mainline; code enforcement; regional project
0032-05	SR 167 culvert to city limit	Poor	Fair	Code enforcement; regional project; Upper portion of this reach extends north into City of Pacific
SALMON CREEK[e]				
0035-01	Confluence with White River through culvert under sod farm	Fair	Fair	Addressed through CIP 33; Code enforcement
0035-02	Sod farm culvert to vegetation change	Fair	Fair	Code enforcement
0035-03	Vegetation change to culvert downstream of railroad	Fair	Fair	Code enforcement
0035-04	Culvert downstream of railroad to confluence with Stream 0037	Fair	Poor	Code enforcement; regional project

(Table Continues)

Table 3-5. Summary of Stream Reach Characterization[a] (Continued)

Stream Reach - Section	Description, Downstream to Upstream	Aquatic Habitat Characterization[b]	Riparian Corridor Characterization[c]	Potential Impact to City[f]
SALMON CREEK[e] (Continued)				
0035-05	Stream 0037 to East Valley Highway bridge	Good	Fair	Code enforcement
0035-06	East Valley Highway bridge to vegetation change	Fair	Poor	Code enforcement; regional project
0035-07	Vegetation change to confluence with Stream 0036	Fair	Poor	Code enforcement; regional project
0035-08	Stream 0036 to vegetation change	Fair	Fair	Code enforcement
0035-09	Vegetation change to vegetation change	Poor	Poor	Code enforcement; regional project
0035-10	Vegetation change through culvert under Parker Road	Poor	Poor	Partially addressed through CIP 34; code enforcement; regional project
0035-11	Parker Road culvert to dirt access road culvert	Poor	Poor	Code enforcement; regional project
0035-12	Dirt access road culvert to stream at intersection of 160th Avenue East and Elm Street	Poor	Poor	Code enforcement; regional project.
0035-13	Intersection of 160th Avenue East and Elm Street to culvert under 52nd Street East	Fair	Poor	Partially addressed through CIP 37; code enforcement; regional project
0035-14	52nd Street East culvert through culvert under meat packing plant and parking lot	Poor	Poor	Addressed through CIP 37; code enforcement; regional project
0035-15	Meat packing plant culvert through plant access road culvert	Poor	Poor	Addressed through CIP 37; code enforcement; regional project
0035-16	Plant access road culvert through culvert under 162nd Avenue East	Poor	Fair	Addressed through CIP 38; code enforcement; regional project
0035-17	162nd Avenue East culvert through culvert under 60th Street East	Poor	Poor	Addressed through CIP 39 and 40; code enforcement; regional project
0035-18	60th Street East culvert to stream source near intersection of 64th Street East and 166th Avenue East	Poor	Fair	Addressed through CIP 40 and 41; code enforcement; regional project

(Table Continues)

Table 3-5. Summary of Stream Reach Characterization[a] (Continued)

Stream Reach - Section	Description, Downstream to Upstream	Aquatic Habitat Characterization[b]	Riparian Corridor Characterization[c]	Potential Impact to City[f]
UNNAMED TRIBUTARY[f]				
0036-1	Confluence with Salmon Creek to gradient change	Good	Good	Code enforcement
0036-2	Gradient change to barrier cascade	Good	Good	Code enforcement
UNNAMED TRIBUTARY				
0037-01	Confluence with White River to East Valley Highway culvert	Fair	Poor	Code enforcement; regional project
UNNAMED TRIBUTARY				
0038-01	Confluence with White River through culvert under sod farm	Poor	Fair	Code enforcement; regional project
0038-02	Sod farm culvert through railroad culvert	Poor	Poor	Code enforcement; regional project
0038-03	Railroad culvert through culvert under dirt road adjacent to fiber optic cable alignment	Poor	Poor	Code enforcement; regional project
0038-04	Dirt road culvert through upstream end of channel	Fair	Poor	Code enforcement; regional project
0038-05	From channel through culvert under East Valley Highway	Poor	Poor	Code enforcement; regional project
0038-06	East Valley Highway culvert through culvert under Forest Canyon Road	Fair	Fair	Code enforcement
DIERINGER CANAL				
0039.5-01	Confluence of Dieringer Canal with White River to confluence with Stream 0039	Poor	Poor	Code enforcement; regional project
UNNAMED TRIBUTARY				
0039-01	Stream 0039.5 through culvert under East Valley Highway	Poor	Poor	Code enforcement; regional project
0039-02	Upstream of East Valley Highway	Poor	Poor	Code enforcement; regional project

Notes:

[a] From Tables 4-12 and 4-13 of the *White River Basin Plan Characterization Report* (Pierce County 2007). Listed stream reaches are based on Pierce County nomenclature and are tributary to the White River within the city limits.

[b] Based on rating process, factors, and results in Appendix E and Appendix F of the *White River Basin Plan Characterization Report* (Pierce County 2007). Aquatic habitat factors evaluated include:

- potential to recruit large woody debris
- substrate composition
- embeddedness
- bank condition
- pool frequency
- channel pattern/bedform
- large woody debris

Notes: (Continued)

[c] Based on rating process, factors, and results in Appendix E and Appendix F of the *White River Basin Plan Characterization Report* (Pierce County 2007). Aquatic habitat factors evaluated include:

- riparian buffer width
- riparian cover
- canopy cover
- structural diversity
- invasive species
- snags
- abundance and size of dead and down vegetation

[d] Code enforcement of critical areas code and stormwater management codes. Regional project assumed for poor ranking. Regional project could include City leading the project with partial funding by other agencies, or the City participating in the funding with other agencies leading. Other agencies could include WSDOT, Ecology, Pierce County, or Pierce Conservation District.

[e] Stream 0035 referred to as Strawberry Creek in the *White River Basin Plan Characterization Report* (Pierce County 2007).

[f] Stream 0036 referred to as Salmon Creek in the *White River Basin Plan Characterization Report* (Pierce County 2007). Stream 0036 is an unnamed tributary to Salmon Creek in City nomenclature.

Another element of ESA-related planning that is applicable to the City is the road maintenance standards developed by the Tri-County Road Maintenance ESA Technical Working Group (Tri-County Group). The Tri-County Group was formed "to develop a road maintenance program that would contribute to the conservation of salmonids and other fish species and would meet federal agencies' requirements under Section 4(d) of the ESA." Agencies that participated in the Tri-County Group include King County, Snohomish County, Pierce County, and WSDOT. The Tri-County Group developed the Regional Road Maintenance Endangered Species Act Program Guidelines (ESA Program Guidelines) to provide a consistent program that can be used by any agency in the region that wanted to limit, reduce, or eliminate the prohibition on take of threatened species under the 4(d) rule for species regulated by NOAA NMFS, the special 4(d) rule and/or a Section 7 take exemption for species regulated by the USFWS.

The City should review its current road maintenance standards for consistency with the ESA Program Guidelines and document its intent to implement the ESA Program Guidelines.

The following King County website with the ESA Program Guidelines was in effect at the time this Comprehensive Plan Update was prepared:

<http://www.kingcounty.gov/transportation/kcdot/Roads/environment/RegionalRoadMaintenanceESAGuidelines/ESAProgramGuidelines.aspx>

The following NOAA website with the Puget Sound Salmon Recovery Plan was in effect at the time this Comprehensive Plan Update was prepared:

<http://www.sharedsalmonstrategy.org/plan/>

3.2.5 Federal Emergency Management Agency

The Federal Emergency Management Agency originated in 1979 by executive order to consolidate federal responses to disasters. Prior to 1979, many of the federal responses to emergencies and disasters were fragmented. Although federal response to disasters can be traced back to the Congressional Act of 1803, it was not until 1974 when the Disaster Relief Act was enacted. The Disaster Relief Act, enacted after multiple hurricanes and earthquakes in the 1960s and 1970s, broadened the scope of existing disaster relief programs and provided federal assistance programs for both public and private losses sustained in disasters. The Disaster Relief Act was amended by the Robert T. Stafford Disaster Relief and Emergency Assistance Act in 1988. In 2003, FEMA was incorporated into the Department of Homeland Security.

Floodplains are regulated by FEMA through the National Flood Insurance Program (NFIP). To obtain flood insurance and participate in the NFIP, local agencies must adopt a floodplain management ordinance. Typically such ordinances are based on Chapter 173-158 WAC and Section 44 of the Code of Federal Regulations (CFR) Parts 59 and 60. The City regulates development within floodplains through the Chapter 16.58 SMC:

- Floodplains are shown on Flood Insurance Rate Maps (FIRMs) published by FEMA. Mapped floodplains can reflect a variety of conditions such as:
  - Flooding associated with closed depressions, such as lakes;
  - Flooding associated with rivers for which a hydraulic model has been created; or
  - Areas subject to frequent flooding but for which a hydraulic model has not been created.
- FEMA FIRMs related to areas within the current city limits and Urban Growth Area (UGA) include:
  - 53053C-0334E – the southwesterly portion of the City at the confluence of the White and Puyallup Rivers;
  - 53053C-0351E – the northerly portion of the City, including the Cities of Pacific and Auburn;
  - 53053C-0361E – the southerly portion of the City along the Puyallup River at SR 162;
  - 53053C-0213E – the northern-most portion of the City, including the Cities of Pacific and Auburn;
  - 53053C-0353E – the main portion of the City, including the large area between the White and Puyallup Rivers;
  - 53053C-0352 – the easterly portion of the City, including portions of the City of Auburn and unincorporated Pierce County;
  - 53053C-0332 – the westerly portion of the City, including portions of the City of Edgewood; and
  - 53053C-0354E – the southeasterly portion of the City, including Salmon Creek, SR 410 at 166th Avenue East, and portions of unincorporated Pierce County.

The floodplains noted above are based on Preliminary Digital FIRMs available through Pierce County's public access GIS website in effect at the time this Comprehensive Plan Update was prepared:

<http://matterhorn.co.pierce.wa.us/publicgis/presentation/map.cfm?Cmd=INIT>

Floodplain information shown on the FEMA FIRMs within the city and the City's UGA include:

- Special Flood Hazard Areas (SFHAs) subject to inundation by the 1-percent annual chance flood, commonly referred to as the "100-year flood;"
- SFHAs for which the Base Flood Elevation (BFE) has been determined, referred to as AE zones;
- SFHAs for which the BFE has not been determined, referred to as A zones;

- Floodway areas within AE zones; and
- Other areas that are either subject to inundation of the 0.2-percent annual chance flood, or areas of the 1-percent annual chance flood with average depths of less than 1-foot or with drainage areas less than 1 square mile. These are referred to as X zones. The 0.2-percent annual chance flood is commonly referred to as the "500-year flood."

Water bodies with SFHAs for the 1-percent annual chance flood for both AE and A zones include:

- The White River;
- The Puyallup River;
- Salmon Creek;
- Milwaukee Ditch; and
- Unnamed streams.

The FEMA FIRMs also include X zones at various locations within the city.

Note that waterbodies regulated as floodplains are not necessarily regulated through the state's Shoreline Management Act (SMA), which is discussed below. Floodplain areas may be significantly larger and include more waterbodies than shoreline management areas.

There are two major aspects in regulating development within floodplains: maintaining channel hydraulics and conveyance volume capacity, and minimizing the risk of water quality impacts. Maintaining channel hydraulics and conveyance volume capacity can be accomplished through a variety of ways such as limiting encroachments as regulated in Chapter 16.58.110 SMC. However, even in such cases where these factors are mitigated, development sites can still pose a risk to water quality especially during a flood event because materials can be stored on-site that enter into the floodway during a flood event. Although Chapter 16.16.130 SMC regulates floodplain development outside of floodways, this chapter applies only to those portions of floodplains within the City's shoreline jurisdiction and does not regulate the storage of materials within floodplains to prevent water quality degradation within floodplains and floodways. The City will need to address water quality protection through its stormwater permitting process so that project proponents will provide proper storage and covering of potential sources of pollutants. Storage and covering BMPs are identified in Ecology's Manual.

In September 2008, NOAA released a biological opinion (BiOp) regarding FEMA's ongoing administration of the NFIP. NOAA determined that the NFIP adversely affects or destroys critical habitat of several marine species listed under the ESA. The BiOp is for SFHAs, Channel Migration Zones plus 50-feet, and Riparian Buffer Zones. The Channel Migration Zones plus 50-feet and the Riparian Buffer Zones are referred to as the Protected Area. FEMA is required to provide guidance to local governments on how to avoid violating ESA when authorizing development within a floodplain. FEMA guidance regarding the BiOp includes:

- Updating regulations and codes based on adopting FEMA's Model Ordinance adapted to the communities' specific needs.
- Evaluating current regulations and codes for consistency with the requirements of the Model Ordinance based on a checklist provided by FEMA. Adopting FEMA's Model Ordinance would not be required if current regulations or codes are sufficient based on the results of the checklist evaluation.

- Requiring project proponents on a project-by-project basis to address ESA requirements. The intent of this option is to limit impacts to NFIP communities with limited financial resources and/or NFIP communities that may have limited areas to which the BiOp applies. This option would require each project proponent to prepare a Biological Assessment.

The City is a Tier 1 NFIP community in the BiOp and was originally required to meet the BiOp provisions by September 2010. However, a 1-year extension was granted. Compliance is now required by September 2011. At the time of this Comprehensive Plan Update, the City's intent was to prepare a new ordinance based on FEMA's Model Ordinance. However, this is contingent upon training that FEMA has indicated it would provide. Until the time that a new ordinance is prepared, the City is requiring that ESA issues be addressed on a case-by-case basis.

As a community that participates in the National Flood Insurance Program (NFIP), the City is required to adopt floodplain regulations and codes consistent with NFIP requirements. NFIP rates are contingent upon the level of protection provided by the City's regulations and codes. The NFIP does allows for credits to reduce rates depending on the level of protection provided through the City's regulations and codes. Projects within or adjacent to A or AE zones will need to conform to City codes and regulations. Project proponents within or adjacent to X zones will need to determine if the project is in the 1- or 0.2-percent annual chance flood and comply with applicable City regulations and codes.

Documentation regarding the BiOp and FEMA guidance was available through the following websites at the time this Comprehensive Plan Update was prepared:

- Biological Opinion on the Puget Sound National Flood Insurance Program:

  <https://pcts.nmfs.noaa.gov/pls/pcts-pub/pcts_upload.summary_list_biop?p_id=29082>

- Floodplain Management and the Endangered Species Act, A Model Ordinance:

  <http://www.fema.gov/pdf/about/regions/regionx/Draft_ESA_Model_Ordinance_v2.4.pdf>

- Floodplain Management and the Endangered Species Act Checklist for Programmatic Compliance:

  <http://www.fema.gov/pdf/about/regions/regionx/Biological_Opinion_Checklist8_12._10.pdf>

- Floodplain Habitat Assessment and Mitigation Regional Guidance:

  <http://www.fema.gov/pdf/about/regions/regionx/draft_mitigation_guide.pdf>

- Regional Guidance for Hydrologic and Hydraulic Studies in support of the Model Ordinance for Floodplain Management and the Endangered Species Act:

  <http://www.fema.gov/pdf/about/regions/regionx/draft_handh_guide.pdf>

- Community Rating System (CRS) Credit for Habitat Protection:

  <http://www.fema.gov/pdf/about/regions/regionx/draft_crs_credit_for_habitat_protection.pdf>

3.3 STATE REGULATIONS

3.3.1 PSP Action Agenda

The PSP published the Action Agenda on December 1, 2008. The Action Agenda "outlines how to solve the problems that threaten Puget Sound – which include pollutants in stormwater that washes off our city streets, suburban, and rural areas into the Sound, to the more than 21 species that have been listed as threatened or endangered, to massive fish kills in Hood Canal, to continued discharges of toxic substances into the Sound, to loss of habitat for living things throughout the region – whether on land or in fresh and marine waters."

The Action Agenda includes several stormwater-related elements. A brief overview of the stormwater-related elements includes:

- Control and manage stormwater runoff in an integrated way with protection of vegetated land cover and reduction of pollutants before they reach water.
- Use a watershed approach for protection and restoration efforts.
- Use Action Agenda-based watershed assessments to define areas that should be protected and those that are best suited for growth using Low Impact Development technologies, and to prioritize restoration opportunities including stormwater retrofits.
- Use development incentives to increase and improve redevelopment within urban growth areas, including those for stormwater management upgrades and restoration. Example incentives could include: flexible design standards such as setbacks, building height restrictions, parking lot and road design; use of transfer of development rights; and property tax incentives such as the Public Benefit Rating System program.
- Fix current barriers to the use and reuse of rainwater, gray water, stormwater, and wastewater.
- Ongoing analysis of potential benefits and impacts of alternative approaches for managing stormwater and land use collectively to understand better how to reduce impacts of runoff. This analysis would provide a key scientific basis for integrated land use and water resources planning.
- Use a comprehensive, integrated approach to managing urban stormwater and rural surface water runoff to reduce stormwater volumes and pollutant loadings.
- Conduct a focused outreach campaign for the public and businesses to reduce pollutants identified in toxic loading and other studies that are priority threats to Puget Sound. This effort will be focused on pharmaceuticals, personal care products, and pollutants in stormwater runoff.
- Integrate efforts to manage stormwater discharges with work to protect land cover and reduce pollutants at the watershed scale and across Puget Sound.
- Integrate stormwater management efforts into integrated watershed planning, such as the development of Watershed Management Plans and Water Quality Improvement Plans.
- Investigate, and if appropriate and feasible, establish watershed-scale stormwater permits through Section 208 of the Clean Water Act. Focus permits on the multitude of discharges that occur in logical geographic areas, rather than discharge-specific inputs or jurisdictional boundaries.

The City will need to track the Action Agenda as it is developed and implemented to determine if there are changes to how stormwater management facilities are designed, analyzed, constructed, operated and maintained, and if there are changes that impact land use regulations, such as critical area setbacks, buffers, management of shorelines, clearing restrictions, or requirements to use Low Impact Development practices.

Most of the elements related specifically to stormwater management in the Action Agenda are identified in Priority C.2, Use a Comprehensive, Integrated Approach to Managing Urban Stormwater and Rural Surface Water Runoff to Reduce Stormwater Volumes and Pollutant Loadings. An excerpt from the Action Agenda containing the elements of Priority C2 is included in Appendix A.

The following PSP website with Action Agenda information was in effect at the time this Comprehensive Plan Update was prepared:

<http://www.psp.wa.gov/aa_action_agenda.php>

3.3.2 Hydraulic Project Approval

The state Legislature gave the Washington Department of Fish and Wildlife (WDFW) the responsibility of preserving, protecting, and perpetuating all fish and shellfish resources of the state. To assist in this goal, the state Legislature enacted the Hydraulic Code, Chapter 77.55 RCW, in 1943. State waters include all marine waters and fresh waters but do not include watercourses that are entirely artificial, such as irrigation ditches, canals, and stormwater run-off devices. Projects that conduct any construction activity that will use, divert, obstruct, or change the natural flow or bed of state waters are regulated under the state's Hydraulic Code. Such projects must obtain a Hydraulic Project Approval (HPA) from WDFW.

There are streams located within the city and the City's UGA; however, large segments of the streams are located on private property outside of city right-of-way. Consequently, work might occur in or near a stream that could impact the water quality or flow regime that could go unnoticed by the City. Such projects could exacerbate existing water quality problems, create damage to adjacent or downstream properties, or violate Ecology water rights regulations. For projects in or near a stream where the project proponent submits an application to the City, permit review staff has the opportunity to provide notification to project proponents that they contact WDFW to determine if their project must obtain an HPA. The City could require the project proponent to provide documentation of contact with WDFW and/or a copy of the HPA prior to issuing the permit. For projects where permit applications are not submitted to or required by the City, the City may become aware of actions in or near a stream based on reports from neighbors or incidental observations by City staff. The City would then have an opportunity to provide notification to the property owners that they contact WDFW to determine if their project must obtain an HPA.

The City could also inform citizens and business about the requirements to obtain an HPA through the public education and outreach component of the SWMP plan developed under the NPDES Phase II Permit. Although an HPA is not specifically related to the NPDES Phase II Permit, nonauthorized activities that impact the water quality and/or flow regime of the stream could result in a violation of the NPDES Phase II Permit.

The City will need to obtain an HPA for any CIP located in a regulated stream during the design of the project.

Typical freshwater activities that may occur within the city or the City's UGA that are required to obtain an HPA include:

- Stream bank protection;
- Construction or repair of bridges, piers, and docks;
- Pile driving;
- Channel change or realignment;
- Conduit (pipeline) crossing;
- Culvert installation;
- Dredging;
- Gravel removal;
- Pond construction;
- Placement of outfall structures;
- Log, log jam, or debris removal;
- Installation or maintenance of water diversions; and
- Mineral prospecting.

The following WDFW website with HPA information was in effect at the time this Comprehensive Plan Update was prepared:

<http://wdfw.wa.gov/hab/hpapage.htm>

3.3.3 Shoreline Management Act

The Shoreline Management Act (SMA) was enacted by the state Legislature in 1971. The SMA is found in Chapter 90.58 Revised Code of Washington (RCW). The policy of Washington State as documented in the SMA is to "provide for the management of the shorelines of the state by planning for and fostering all reasonable and appropriate uses. This policy is designed to insure the development of these shorelines in a manner which, while allowing for limited reduction of rights of the public in the navigable waters, will promote and enhance the public interest." The SMA further states that "In the implementation of this policy the public's opportunity to enjoy the physical and aesthetic qualities of natural shorelines of the state shall be preserved to the greatest extent feasible consistent with the overall best interest of the state and the people generally. To this end uses shall be preferred which are consistent with control of pollution and prevention of damage to the natural environment, or are unique to or dependent upon use of the state's shoreline." Under the SMA, local government is to have the primary responsibility of initiating the planning required by the SMA and administering the regulatory program consistent with the policy and provisions of the SMA.

Generally, the shorelines of freshwater rivers and lakes are regulated under the SMA except for the following:

- Shorelines on segments of streams upstream of a point where the mean annual flow is twenty cubic feet per second or less and the wetlands associated with such upstream segments; and
- Shorelines on lakes less than 20 acres in size and wetlands associated with such small lakes.

The City adopted its first Shoreline Master Program (SMP) in 1973. The current SMP was adopted by Ecology in 2004. Based on the SMP, the City's shoreline jurisdiction includes both sides of the White River within the current city limits and the UGA, and the north side of the Puyallup River within the current city limits and the UGA.

Based on Chapter 7, Specific Shoreline Development Policies and Regulations, of the SMP, the following will likely need to be addressed during the next update:

- It is not clear if Item 17, Stormwater Management Facilities, is included as a separate project specifically for stormwater management or a facility required as mitigation for a proposed project. The SMP needs to specify that the requirements are applicable to all stormwater facilities whether they are a stand-alone project or mitigation for any of the other types of projects listed in Chapter 7.
- The discussion for Item 10, Parking, requires that parking facilities in shoreline areas should be located and designed to minimize adverse impacts including those related to stormwater runoff. However, adverse impacts related to stormwater runoff could be associated with other types of projects in Chapter 7. Consequently, Chapter 7 needs to add a requirement that all projects proposed in the shoreline jurisdictional areas be designed to meet the City's stormwater management codes and standards.
- Shoreline jurisdictional areas could likely be included in the Protected Areas associated with FEMA floodplain mapping through the City's implementation of NOAA's BiOp as discussed earlier. Chapter 7 needs to add a requirement that all projects in the shoreline jurisdictional areas be designed to meet the City's floodplain regulations and standards. This could likely require the use of Low Impact Development as required by the BiOp even if not required in the NPDES Phase II Permit when it is reissued.

The City's Shoreline Master Program was available through the City's website through the following site address in effect at the time this Comprehensive Plan Update was prepared:

<http://www.ci.sumner.wa.us/Living/Enviro_Shoreline.htm>

3.4 COUNTY REGULATIONS

3.4.1 Stream Team

Currently, the City participates in a regional stream program led by the Pierce Conservation District. The regional Stream Team Program includes Pierce County and the cities of Sumner, Tacoma, Lakewood, Puyallup, and Fife. The purposes of the program are to:

- Involve citizens in observing, monitoring, recording and reporting stream and lake conditions;
- Create a community information exchange that will increase awareness of how activities affect water resources;
- Improve water quality through direct citizen involvement;
- Motivate the public to change habits for fish and wildlife; and,
- Provide useful data to resource agencies.

The City participates by sharing in the cost. At its December 14, 2010, meeting, the Pierce County Council approved to continue funding of the Pierce Conservation District at $5.00 per parcel within unincorporated Pierce County and the cities of Sumner, Fircrest, Gig Harbor, Lakewood, Milton, Puyallup, Steilacoom, Tacoma, and University Place.

3.4.2 Flood Control Hazard District

On May 4, 2010, the Pierce County Council voted to form the Pierce County Flood Control Zone District. The purpose of this District is to address the risks and impacts associated with recurring flooding within Pierce County. Because the District has recently formed, it is not clear what policies and projects will be implemented by the District. However, the following types of policies and projects may be implemented:

- Maintaining existing levees.
- Constructing new flood hazard reduction structures.
- Purchasing flood-prone properties.
- Implementing land use regulations to keep people and structures out of flood danger areas.

The District has identified a budget of $1,450,000 for 2011 and is in the process of adopting the budget and funding mechanism.

3.5 LOCAL STORMWATER REGULATIONS

3.5.1 Surface Water Design

In 2010, the City adopted Ecology's 2005 Manual "…with reference to threshold standards of land-disturbing activities." Adoption of Ecology's Manual is found in Chapter 13.48.030 SMC. Several other changes to the SMC as required by the NPDES Phase II Permit, such as illicit discharge provisions and escalating enforcement actions, have been made.

The following Code Publishing Company website with the SMC was in effect at the time this Comprehensive Plan Update was prepared:

<http://www.codepublishing.com/wa/sumner/>

3.5.2 City of Sumner Comprehensive Plan

In accordance with the Growth Management Act, Chapter 36.70A RCW, the City has developed its comprehensive plan. The Comprehensive Plan prepared under the GMA was initially published in 1994; the updated Comprehensive Plan was published in 2009. Amendments to the comprehensive plan are currently in process. Implementation of the Comprehensive Plan is primarily through SMC Title 15, Zoning.

Stormwater-related references in the Comprehensive Plan that will likely need to be revised in future updates are summarized in Table 3-6.

Table 3-6. Summary of Stormwater-Related Comprehensive Plan Policies

Introduction	
Related Documents	Includes a reference to the 2004 Draft Stormwater Comprehensive Plan. The reference will need to be updated to the Final Stormwater Comprehensive Plan when it is adopted.
Environment Element	
1.4.6	"*The City of Sumner will continue to be a leader in developing and implementing state-of-the-art stormwater management techniques including low impact development (LID).*" The City is working towards achieving this through adoption of the LID Technical Guidance Manual for Puget Sound. The City is also currently working towards this through other code and design standards updates. Additional LID requirements may be included in the next cycle of the NPDES Phase II Permit.
2.2.4	"*Continue to implement wetland protection and stormwater management regulations to help mitigate flooding impacts to the community*." The City is working towards achieving this through adoption of Ecology's *Stormwater Management Manual for Western Washington* and the Minimum Requirements in Appendix 1 of the NPDES Phase II Permit.
Transportation Element	
6.5	"*Provide incentives for the use of low impact development techniques that will reduce impervious surfaces, provide for stormwater infiltration, and protect the natural environment and systems*." The City is working toward implementation of LID practices through adoption of the LID Technical Guidance Manual for Puget Sound. The City is also currently working towards this through other code and design standards updates. Additional LID requirements may be included in the next cycle of the NPDES Phase II Permit.
Capital Facilities and Public Services Element	
1.7.3	"*Seek broad funding for stormwater system improvements*." Funding through state or federal programs for projects related to conveyance elements is limited and difficult to obtain. However, projects that provide a water quality benefit may be eligible for funding through a variety of state and federal funding programs. Projects that improve water quality in the receiving waters can include monitoring projects, retrofitting an area to provide treatment by constructing LID BMPs or water quality treatment facilities, improving habitat, or repairing or removing failing septic systems. The City is working towards achieving this through application to Ecology through its Stormwater Retrofit and LID Competitive Grants Program and its Combined Funding Cycle for the Centennial, Section 319, and Revolving Fund Programs. In addition, the City has received funding from Ecology through its Municipal Stormwater Capacity Grants Program for implementation of the NPDES Phase II Permit.
1.7.4	"*Coordinate with Pierce County on stormwater matters of common interest such as protection and preservation of water quality and resources in watersheds shared by both the City and County*." The City is working towards achieving this by being a stakeholder in the White River Basin planning that Pierce County is leading.
1.7.5	"*Continue to implement storm drainage, erosion control and critical area ordinances to help reduce off-site impacts of development and protect stream channels, aquatic resources, habitat and wetlands. The regulations shall reflect the requirements and manuals of the Puget Sound Water Quality Authority and other agencies as appropriate*." The City is working towards achieving this by adopting the *LID Technical Guidance Manual for Puget Sound*, Ecology's *Stormwater Management Manual for Western Washington*, and the Minimum Requirements in Appendix 1 of the NPDES Phase II Permit.
1.7.6	"*Ensure that existing and future public and private stormwater and other water quality protection infrastructure is properly maintained and operated*." The City is working towards achieving this by requiring operations and maintenance agreements be executed by non-residential development. Operations and maintenance information is to be submitted to the City annually. The City provides operation and maintenance of City-owned stormwater BMPs including BMPs for City facilities and BMPs for residential developments.

3.5.3 Critical Areas

There are several types of critical areas within the city. Table 3-7 lists the type of critical area and the related SMC section.

Table 3-7. Summary of Critical Areas and City Code Sections

Type of Critical Area	SMC Chapter
Flood Hazard Area	16.58
Landslide and Erosion Hazard Area	16.50
Seismic Hazard Area	16.52
Aquifer Recharge Areas	16.48
Wetlands	16.46
Fish and Wildlife Conservation Areas	16.56
Natural Resource Lands	16.40

Analysis, design, and construction of stormwater management systems and facilities will need to conform to the requirements of the NPDES Phase II Permit as well as provide stormwater-related environmental protection consistent with critical area regulations.

3.6 DEVELOPMENT REGULATIONS

Regulation of development within the City, in addition to the above SMC chapters, is regulated through the following code provisions:

- Title 12 – Streets, Sidewalks, and Public Places
- Title 13 – Public Services
- Title 15 – Buildings and Construction
- Title 17 – Subdivisions
- Title 18 – Zoning

4. CAPITAL IMPROVEMENTS

One of the primary goals of this Stormwater Comprehensive Plan Update is to develop capital improvement strategies to alleviate existing and future infrastructure deficiencies and to increase the water quality of stormwater discharged to receiving waters. This section presents a summary of capital improvement projects proposed to achieve these goals.

A detailed capital improvement plan, including project descriptions, construction cost estimates, and project scheduling is presented in a separate document titled: *2011 City of Sumner Stormwater Capital Improvement Plan*. City adoption of this Comprehensive Plan Update would include the adoption of this Capital Improvement Plan.

4.1 PREVIOUS CAPITAL IMPROVEMENT PROJECTS

The 1992 Stormwater Comprehensive Plan identified 34 capital improvement projects. Projects identified in the 1992 Comprehensive Plan have either been incorporated into a different project, have been completed, or are no longer necessary. Table 4-1 summarizes the status of the projects identified in the 1992 Comprehensive Plan. Table 4-1 was prepared based on coordination with City personnel. Note that there are no projects carried forward from the 1992 Comprehensive Plan with a 1992 project number.

Table 4-1. 1992 Stormwater Comprehensive Plan Capital Improvement Projects and Current Status

Project No.	Name	Status	Comment
92-1	Willow Street and Sumner Avenue Improvement	Included in new CIP 18.	
92-2	Puyallup Street Improvement	Included in new CIP 19.	
92-3	Zehnder Street Outfall System Improvements	Removed from list. Partially completed through completion of CIP 5.	CIP 5 and 21 eliminated the need for this project. CIP 5 has been completed.
92-4	Pacific Avenue Improvements	Completed through CIP 20.	CIP 20 has been completed.
92-5	Rivergrove Road Outfall	Constructed by development.	
92-6	East Sumner Trunk System with Diversion to Puyallup River	Completed.	
92-7	South SR 410 Diversion Interceptor	Included in new CIP 21.	
92-8	Meade McCumber Street/ Valley Avenue Improvement	Partially completed.	Remainder to be constructed in CIP 7 and 22.
92-9	Parker Avenue/Elm Street Interceptor	Partially completed.	Remainder to be constructed in CIP 13 and 15.
92-10	South Parker Road Improvements	Not constructed.	Project not required.
92-11	North Parker Connection	Included in new CIP 14.	
92-12	64th Street East Improvements	Included in new CIP 10 and 23.	CIP 23 has been completed.

(Table Continues)

Table 4-1. 1992 Stormwater Comprehensive Plan Capital Improvement Projects and Current Status (Continued)

Project No.	Name	Status	Comment
92-13	160th and Main Street Improvements	Included in new CIP 24.	
92-14	East Elm Street Outfall	Completed.	Remainder was constructed when CIP 16 was completed.
92-15	Van Tassel Road Outfall	Partially completed.	Remainder to be constructed in CIP 11 and 12.
92-16	East Main Street Outfall	Partially completed.	Remainder of project not required.
92-17	Poole Road Outfall	Included in new CIP 25.	
92-18	Wahl Road Interceptor	Included in new CIP 26.	
92-19	South Valley Avenue Outfall	Not constructed.	Project outside city limits, not included in new CIP.
92-20	Van Ogles Creek Outfall Pipe System Improvements	Not constructed.	Project outside city limits, not included in new CIP.
92-21	Van Ogles Creek Rehabilitation and Crossing Improvements	Not constructed.	Project outside city limits, not included in new CIP.
92-22	Alderton Pond Improvements	Not constructed.	Project outside city limits, not included in new CIP.
92-23	Alderton Creek Rehabilitation and Crossing Improvements	Not constructed.	Project outside city limits, not included in new CIP.
92-24	142nd Avenue Interceptor	Completed.	
92-25	24th Street Outfall to White River	Not constructed.	To be built as part of 24th Street Interchange project.
92-26	16th Street Outfall to White River	Partially completed.	Remainder of project not required.
92-27	139th Avenue East Ditch Improvements	Not constructed.	Project outside city limits, not included in new CIP.
92-28	136th Avenue East and 24th Street East Improvements	Partially completed.	Remainder to be constructed in CIP 28.
92-29	West NE 16th Outfall and System Improvements	Not constructed.	Project outside city limits, not included in new CIP.
92-30	West NE 8th Outfall and System Improvements	Not constructed.	Project outside city limits, not included in new CIP.
92-31	Culvert Crossing Railroad at NE 8th Street	Not constructed.	To be constructed as part of 8th Street corridor improvements.
92-32	Puget Power and Light Canal Drainage Improvements	Included in new CIP 29.	
92-33	Middle Creek Drainage Improvements	Not constructed	Not included in CIP, would require dredging Middle Creek.
92-34	Salmon Creek Improvements	Included in new CIP 33–39.	

4.2 RECOMMENDED CAPITAL IMPROVEMENT PROJECTS

The CIPs proposed in the *2011 City of Sumner Stormwater Capital Improvement Plan* include projects recommended in the 1992 Comprehensive Plan, projects subsequently identified by City staff, and projects identified through research into current stormwater infrastructure conditions and problem areas.

Project priority was determined by considering the surcharge/flooding potential indicated during hydraulic modeling conducted for the 1992 Comprehensive Plan, project conformance with City planning, recommendations by City staff, and availability of funding.

4.2.1 Recommended Capital Improvement Project Summary

Figure 4-1 (see page 4-9) presents a site map showing the locations of proposed capital improvement projects. Table 4-2 summarizes each project, listing priority, scheduled completion date, and estimated construction costs in 2010 dollars and at the expected time of completion. This table also identifies projects that are expected to be funded by developers as part of individual development projects.

There are a total of 46 capital improvement projects identified in the proposed capital improvement project list in Table 4-2. The projects have been scheduled based on a high, medium, or low priority. Projects prioritized as high, medium, and low are scheduled for completion in 0 to 5 years, 5 to 10 years, and 10 to 15 years, respectively. The total estimated cost for these projects at time of construction completion is $70,195,600, in 2010 dollars. The projects have been prioritized based on urgency and to balance the annual cost. The cost per year ranges from $440,700 to $13,243,600.

4.3 REGIONAL STORMWATER FACILITIES

Ten sites were previously identified within the Sumner city limits as potential sites for the construction of regional stormwater flow/water quality control facilities. The criteria used to objectively evaluate each site for its potential to provide regional stormwater control are discussed in the *2011 City of Sumner Stormwater Capital Improvement Plan*.

Table 4-3 summarizes the current status of each of the previously identified regional facility sites including site ID, site location, and recommended site use. The locations of each potential regional facility site are shown on Figure 4-2 (see page 4-11). The regional facility projects are described further in the *2011 City of Sumner Stormwater Capital Improvement Plan.*

Table 4-2. Capital Improvement Plan Schedule

Project No. – Description	Project Priority [a]	Funding Source Percentages [b]	Total Cost Year 2010 ($)	Year of Completion										
				2011 ($)	2012 ($)	2013 ($)	2014 ($)	2015 ($)	2016 ($)	2017 ($)	2018 ($)	2019 ($)	2020 ($)	2021–2030 ($)
Seattle Construction Cost Index – 4/14/03 (increases at 4.5%)			**7642**	**7642**	**7986**	**8345**	**8721**	**9113**	**9523**	**9952**	**10400**	**10868**	**11357**	**11868**
Capital Improvement Projects														
CIP No. 1 – Alder Avenue High Flow Bypass	LOW	80/20	$5,566,000											$7,483,400
CIP No. 2 – Gary Street Improvements	HIGH	30/70	$291,000				$322,900							
CIP No. 4 – Railroad Street Improvements	50/50	20/80	$80,000											$107,600
CIP No. 6 – River Street Improvements	LOW	20/80	179,000											$240,708
CIP No. 7 – 151st Avenue East and 152nd Avenue East Improvements; incorporates part of Project 92-8	HIGH	20/80	$408,000				$452,800							
CIP No. 8 – 63rd Street Court East Improvements	HIGH	20/80	$485,000					$548,100						
CIP No. 10 – 64th Street East Outfall Improvements; incorporates part of Project 92-12	HIGH	50/50	$196,000	$205,500										
CIP No. 11 – South 160th Avenue East Improvements; incorporates part of Project 92-15; TIP construction in 2014	HIGH	50/50	$107,000				$118,800							
CIP No. 12 – North 160th Avenue East Improvements; incorporates part of Project 92-15	HIGH	50/50	$293,000			$319,200								
CIP No. 13 – Elm Street Interceptor; incorporates part of Project 92-9; TIP construction in 2013	HIGH	40/60	$278,000			$302,800								
CIP No. 14 – North Parker Road Improvements; incorporates Project 92-11; TIP construction in 2014	HIGH	30/70	$184,000			$200,500								
CIP No. 15 – Parker Road Improvements; incorporates part of Project 92-9; TIP construction in 2013	HIGH	20/80	$335,000			$364,900								
CIP No. 17 – Main Street Improvements	LOW	10/90	$169,000											$227,300
CIP No. 18 – Willow Street Interceptor and Tributary Improvements; incorporates Project 92-1	HIGH	10/90	$1,155,000					$1,350,400						
CIP No. 19 – Puyallup Street Outfall Improvements; incorporates Project 92-2	HIGH	40/60	$1,803,000					$2,037,500						
CIP No. 21 – South SR-410 Diversion Interceptor; incorporates remainder of Project 92-3 and Project 92-7	LOW	80/20	$11,641,000											$15,651,800
CIP No. 22 – Meade-McCumber Street Improvements; incorporates part of Project 92-8	LOW	20/80	$146,000											$196,400
CIP No. 24 – East Main Street/160th Avenue East Improvements; incorporates Project 92-13; TIP construction in 2013	HIGH	80/20	$251,000			$273,400								
CIP No. 25 – Poole Road Outfall Improvements; incorporates Project 92-17	HIGH	60/40	$402,000		$429,700									
CIP No. 26 – Wahl Road Interceptor; incorporates Project 92-18	LOW	100/0	$1,424,000											$1,914,700
CIP No. 27 – South Parker Road Improvements; TIP construction in 2013	HIGH	20/80	$77,000			$83,900								
CIP No. 28 – 136th Avenue East Improvements	HIGH	70/30	$726,000		$776,000									

Table Continues

Table 4-2. Capital Improvement Plan Schedule (continued)

Project No. – Description	Project Priority [a]	Funding Source Percentages [b]	Total Cost Year 2010 ($)	Year of Completion										
				2011 ($)	2012 ($)	2013 ($)	2014 ($)	2015 ($)	2016 ($)	2017 ($)	2018 ($)	2019 ($)	2020 ($)	2021–2030 ($)
CIP No. 29 – Puget Sound Power and Light Canal Drainage; incorporates Project 92-32	LOW	50/50	$591,000											$794,700
CIP No. 31 – 62nd Street East; TIP construction in 2013	HIGH	100/0	$244,000			$265,800								
CIP No. 33 – REI/Railroad Culvert Improvements	LOW	50/50	$207,000											$278,400
CIP No. 34 – Parker Road Culvert Improvements	HIGH	30/70	$84,000	$88,100										
CIP No. 35 – Puyallup Watershed Access Culvert Improvements	HIGH	30/70	$76,000	$79,700										
CIP No. 36 – 47th Street Court East Culvert Improvements	HIGH	80/20	$75,000		$80,200									
CIP No. 37 – 160th Avenue East Culvert Improvements; TIP construction in 2014	HIGH	80/20	$667,000			$726,500								
CIP No. 38 – 162nd Avenue East Culvert Improvements	HIGH	80/20	$183,000				$203,100							
CIP No. 39 – East Main Street Culvert Improvements	HIGH	80/20	$28,000					$31,700						
CIP No. 40 – Salmon Creek Restoration; TIP construction in 2014	HIGH	60/40	$291,000				$322,900							
CIP No. 41 – 64th Street East Culvert Improvements	HIGH	50/50	$350,000			$381,300								
CIP No. 43 – East Valley Highway Improvements – Detention Pond with Bioswale; TIP construction in 2012/2013	HIGH	80/20	$2,063,000		$1,102,500	$1,123,500								
CIP No. 44 – East Valley Highway Improvements; TIP construction in 2012/2013	80/20	80/20	$934,000	$240,000	$370,900	$378,000								
CIP No. 45 – West Valley Highway Improvements – Detention Pond with Bioswale	LOW	50/50	$534,000											$718,000
CIP No. 46 – 16th Street East Improvements	LOW	70/30	$472,000											$634,700
CIP No. 47 – White River Levee Improvements	HIGH	40/60	$2,988,000			$3,254,500								
CIP No. 49 – Golf Course Culvert Improvements	HIGH	50/50	$247,000	$259,000										
CIP No. 50 – Development Rights Relinquished by City	HIGH	40/60	$1,524,600		$1,629,500									
CIP No. 51 – 24th Street Setback Levee	HIGH/LOW	100/0	$16,000,000			$450,000								$20,907,600
CIP No. 52 – Number 9 Ditch and Forest Canyon Class III Habitat Improvements	LOW	80/20	$651,000											$875,300
CIP No. 53 – Rivergrove Puyallup River Improvements	HIGH	100/0	$12,268,000	$3,215,300	$3,277,900	$3,340,600	$3,403,200							
SITE A.2 – 48-Inch Outfall Water Quality Facility	HIGH	30/70	$1,633,000			$1,778,700								
SITE D – Detention Pond with Water Quality Facility	HIGH	90/10	$1,466,000		$1,566,800				$440,700					$1,919,000
SITE J – Water Quality Treatment	MED	50/50	$383,000											
TOTAL – CAPITAL ASSET FUNDS (Includes inflation) (City-funded only – exclude developer or LID-funded projects)			**$70,195,600**	**$4,087,600**	**$9,233,500**	**$13,243,600**	**$4,823,700**	**$3,967,700**	**$440,700**	**0**	**0**	**0**	**0**	**$50,030,900**

[a] Project Priority Identification:
HIGH Completed within 0–5 years
MED Completed within 5–10 years
LOW Completed within 10–20 years

[b] Allocation between capital cost and replacement cost, respectively. Based on rate analysis provided by City.

Table 4-3. Summary of Potential Regional Facility Sites

Site ID	Site Location	Recommended Use
Site A.1	South Sumner	Constructed a water quality treatment BMP to service existing 48-inch outfall to the Puyallup River. Project completed.
Site A.2	South Sumner	Construct a water quality treatment BMP within the contributing area to provide a partial treatment retrofit prior to discharging through the existing 42-inch outfall to the Puyallup River.
Site B	South Sumner	Project removed from list. Sumner School District 320 owns this parcel. Construction of stormwater facility not feasible due to location in watershed and current land use.
Site C	Southeast Sumner	Project removed from list. Project proposed construction of stormwater flow/water quality treatment facility to service future development.
Site D	Southeast Sumner	Construct stormwater flow/water quality treatment facility to service future development and City roads.
Site E	East Central Sumner	Project removed from list. Project proposed construction of stormwater flow/water quality treatment facility to service future development OR construct water quality control facility to service existing streets.
Site F	Central Sumner	Project removed from list. Construction of stormwater facility at this location not feasible due to location in watershed and hydraulic complications.
Site G	East Central Sumner	Project removed from list. Construction of stormwater facility at this location not feasible due to location in watershed.
Site H	Southeast Sumner	Project removed from list. Project proposed construction of stormwater flow/water quality treatment facility to service future development.
Site I	Central Sumner	Project removed from list. Project proposed construction of stormwater flow/water quality treatment facility to service future development.

Figure 4-1. Proposed Capital Improvement Project Locations

Figure 4-2. Potential Regional Facility Locations

5. SYSTEM DEVELOPMENT CHARGE AND MONTHLY RATE REVIEW

Current stormwater monthly rates for 2010, including tax, are $9.97 per ESU. One ESU is equal to 2,400 square feet of impervious area. Current system development charges (SDCs) are $2,514.00 per equivalent residential unity (ERU). The SDC for a single family residence is for one ERU per unit. For multi-family residences, the SDC is for one ERU for the first unit and 0.8 ERU for each unit thereafter. SDCs for accessory dwelling units are for 0.8 ERU per unit.

The monthly rates are based on a rate study prepared by The FCS Group. Currently, The FCS Group is performing an SDC analysis. Current SDCs may change based on the results of the analysis. The rate and SDC studies will be published separately from this Stormwater Comprehensive Plan Update. The rate and SDC study will reflect stormwater CIP costs, operation and maintenance (O&M) costs, and NPDES Phase II Permit compliance costs.

6. GROUNDWATER AND STREAM-FLOW MONITORING

The City of Sumner is interested in collecting baseline data to evaluate the impacts of development on stream and groundwater flow within the northern portion of the city. Development of a groundwater and stream-flow monitoring plan is the initial step in this process.

A detailed monitoring plan has been developed and is available in a separate document entitled *Groundwater and Stream Low Flow Monitoring Plan*. This section presents an overview of the monitoring plan and its objectives, including capital improvements proposed to meet those objectives.

6.1 MONITORING PLAN OBJECTIVE

The objective of the monitoring plan is to collect stream flow and groundwater data in the White River Valley. Monitoring will be conducted year-round, with particular attention given during low-flow periods.

The data collected during stream and groundwater monitoring will be used for the following purposes:

- To determine the general groundwater gradients in the White River Valley. Groundwater flow patterns will be used to help ascertain whether development within a certain area will affect flow levels within nearby streams.
- To calibrate a hydrologic and/or hydrogeologic computer model. The model(s) could be used to simulate conditions under various development scenarios and to evaluate the effect of development on local stream flow.
- To evaluate the feasibility of using infiltration facilities and low-impact development techniques to provide developed stormwater attenuation in the White River Valley.

Data will be collected using a combination of stream gauges and groundwater monitoring wells. Stratigraphic and groundwater level information from well logs for existing wells within the White River Valley will also be utilized to assist in developing hydrologic cross-sections of the valley.

The data obtained by the City may be useful to Ecology, Pierce County, and other agencies as part of TMDL review and development, White River basin planning, and ESA salmon recovery planning and implementation. In addition, groundwater data may be useful to projects adjacent to the groundwater monitoring wells for design of LID BMPs.

No formal reporting of the data is currently planned.

6.2 STREAM GAUGES

The *Groundwater and Stream Low Flow Monitoring Plan* proposed installation of four stream gauges equipped with continuous recording devices to evaluate flow conditions in local tributaries to the White River. Stream monitoring sites are located at:

- 16th Street East.
- Ota Turf Farm.
- Salmon Creek at East Valley Highway.
- 48th Street East at Milwaukee Ditch.

The monitoring equipment has been purchased for the stream gauges, and the well points have been installed. Installation of the monitoring equipment is anticipated in early 2011. Equipment purchasing and well point installation represent the major costs associated with the stream

gauges. It is anticipated that the costs for City staff to install and maintain the equipment and review the data will not be significant. Consequently, there are no costs carried forward in this Comprehensive Plan Update or the Capital Improvement Plan Update for stream flow monitoring.

An existing USGS stream gauge located at the Williams Road Bridge will be used to evaluate flow in the White River.

6.3 GROUNDWATER MONITORING

The *Groundwater and Stream Low Flow Monitoring Plan* proposes constructing a total of 12 monitoring wells to develop groundwater gradients in the White River Valley and to record measurable changes in groundwater patterns and flows resulting from development within the valley. Monitoring wells should be equipped with pressure transducers and data loggers to measure and collect groundwater level at preprogrammed time intervals. The *Groundwater and Stream Low Flow Monitoring Plan* contains a map showing the proposed monitoring well locations.

Eight monitoring wells will be utilized to complement the data obtained from the stream gauging operations. Two wells should be constructed at each stream gauge location, one on each side of the tributary, within 5 to 30 feet of the stream bank.

Two monitoring wells should be constructed along Milwaukee Creek (north to south), and two monitoring wells should be constructed along 24th Street East (west to east). Data collected from these monitoring wells, in conjunction with data from existing wells in the valley and monitoring wells constructed at stream gauging locations, will be used to develop hydrologic cross-sections of the White River Valley from north to south and from west to east.

Groundwater monitoring sites are located at:

- 16th Street East;
- 24th Street East and 148th Avenue East;
- 24th Street East and 142nd Avenue East;
- the Ota Turf Farm;
- 24th Street East and West Valley Highway;
- Salmon Creek and East Valley Highway;
- 48th Street East and Milwaukee Ditch; and
- 42nd Street East and Milwaukee Ditch.

The monitoring wells have been constructed, and the monitoring equipment has been purchased and installed. Data is available from the monitoring equipment for review and analysis. Equipment purchasing and monitoring well installation represent the major costs associated with the groundwater monitoring gauges. It is anticipated that the costs for City staff to maintain the equipment and review the data will not be significant. Consequently, there are no costs carried forward in this Comprehensive Plan Update or the Capital Improvement Plan Update for groundwater monitoring.

7. FUNDING SOURCES

Historically, there have been various sources of funding for storm and surface water projects. The amount of funding varies among the funding cycles and is contingent upon federal and state budgets and objectives of the funding agency. This section presents a brief overview of the funding sources and the types of projects potentially funded to assist in future funding applications.

7.1 FUNDING SOURCES

Funding sources come from the United States Environmental Protection Agency, Ecology, and the Public Works Board. There are four basic funding groups:

- Stormwater Retrofit and LID (SWRLID) Competitive Grants Program. This grant is offered to winning applicants to provide stormwater treatment to retrofit untreated contributing areas and/or to construct a LID project. Funding award is contingent upon providing a measurable water quality benefit. The City applied for three different projects for the Fiscal Year 2011 program:
  - Site J Outfall Treatment Retrofit
  - CIP 19 Outfall Treatment Retrofit
  - Site A.2 Outfall Treatment Retrofit
- Municipal Stormwater Capacity Grants Program. This grant is offered to NPDES Phase I and II Permittees. There is not a competitive or application process to receive the funding; however, the amount of funding can vary among the permittees based on criteria developed by Ecology. The funding is provided by Ecology, and Ecology notifies permittees of the funding amount. If the permittee accepts the funding, a Grant Acceptance Intent Notice must be submitted. The funding is to be used by permittees to meet NPDES permit requirements.
- Water Quality Grants and Loans. This is the combined funding package that includes funding from USEPA and Ecology for the Centennial Clean Water Program, Federal Clean Water Action Section 319 Nonpoint Source Fund, and the Washington State Water Pollution Control Revolving Fund. The funding award could be grant or loan. Project applications could be for a nonpoint source activity, on-site septic systems, stormwater, or a wastewater facility. Similar to the SWRLID grant program, the funding application must demonstrate a measurable water quality benefit.
- Public Works Trust Fund. This loan source, administered through the Washington State Department of Commerce, receives funding through bonds or funds from federal or state agencies. Agencies that support the Public Works Trust Fund include the Department of Commerce, Department of Health, Transportation Improvement Board, Ecology, USDA – Rural Development, and the PSP. Funding can be used for critical public health, safety, and environmental infrastructure that support the economic vitality of Washington's communities. Loans can be for construction, repair, or replacement of storm sewer systems, water systems, sanitary sewer systems, roads, streets, solid waste and recycling facilities, and bridges. Loans can also be used for planning. Storm sewer projects can also be included with road projects.

Detailed information regarding the various loan programs is available through the websites listed below. The complexity of the applications vary. The SWRLID grant application requires a predesign report. Although the Water Quality Grants and Loans do not require a pre-design report for stormwater projects, a technical memorandum may be required to demonstrate the design basis and feasibility of the project.

- Municipal Stormwater Capacity Grants Program and Fiscal Year 2011 Stormwater Retrofit and LID Competitive Grants:

  <http://www.ecy.wa.gov/programs/wq/funding/FundingPrograms/OtherFundingPrograms/StWa12/FY12StWa.html>

- Fiscal Year 2012 Water Quality Grants and Loans, Combined Funding Cycle for the Centennial, Section 319, and Revolving Fund Programs:

  <http://www.ecy.wa.gov/programs/wq/funding/cycles/2012/index.html>

- Washington State Public Works Board Public Works Trust Fund Construction Loans, Fiscal Year 2012 Application Guidelines:

  <http://pwb.wa.gov/GuidelinesandInstructionManuals/PWTF%20Application%20Guidelines%202011-2012.doc>

The requirements and scoring for completion of cultural resources review, compliance with Growth Management Act, and completion of environmental review under the State Environmental Policy Act (SEPA) vary depending on the funding source pursued. Completing these items improves the application score because it demonstrates readiness to proceed.

Table 7-1 summarizes the various sources and types of surface and stormwater projects that could potentially be eligible. Typically, grants are preferred rather than loans. However, loans may be acceptable to the City because the interest rates are typically lower than general bank loans. The focus of Table 7-1 is on stormwater or surface water funding programs. Although the focus of Table 7-1 is on stormwater and surface water projects, on-site septic system projects are included because failing septic systems can lead to surface water quality degradation. This is discussed further in Section 7.2 below.

Table 7-1. Summary of Surface and Stormwater Project Funding Sources[a]

Program/Project Type	Funding Type	Sample Projects[b]
REVOLVING FUND		
Nonpoint Source Activity	Loan	Aquatic plant control related to water quality; BMP implementation; planning; education; farm planning; lake, stream, wetland and riparian restoration and enhancement; irrigation efficiency implementation; TMDL development and implementation; water quality monitoring; wellhead protection; NPDES permit activities. Forgivable principal not applicable to stormwater or surface water projects.
On-Site Septic System	Loan	Large on-site community wastewater systems; on-site septic repair/replacement program; education programs. Forgivable principal not applicable.
On-Site Septic System – Hardship[c]	Subsidized Loan	Similar to Revolving Fund On-Site Septic System Loan.
Stormwater	Loan	Projects required by or independent from a permit; planning (such as conveyance and treatment).

(Table Continues)

Table 7-1. Summary of Surface and Stormwater Project Funding Sources[a] (Continued)

Program/Project Type	Funding Type	Sample Projects[b]
Stormwater – Hardship	Subsidized Loan	Similar to Revolving Fund Stormwater Loan.
Green Project Reserves[d]	Loan or Forgivable Principal[e]	Green infrastructure (LID; street tree or urban forestry programs; establish/restore permanent riparian buffers; wetland management; land acquisition for water quality improvements); environmentally innovative activities (decentralized wastewater treatment solutions to existing deficient or failing on-site wastewater systems).
CENTENNIAL		
Nonpoint Source Activity	Loan	Similar to Revolving Fund Nonpoint Source Activity Loan.
Nonpoint Source Activity	Grant	Similar to Revolving Nonpoint Source Activity Loan. Irrigation efficiency and NPDES permit activities not eligible.
Stormwater[f]	Grant or Loan	Loan program similar to Revolving Fund Stormwater Loan. Stormwater projects not required by a permit are grant-eligible.
Stormwater – Hardship[g]	Grant or Loan	Similar to Centennial Stormwater Grant or Loan.
On-Site Septic System	Loan	Similar to Revolving Fund On-Site Septic System Loan.
On-Site Septic System[h]	Grant	On-site septic repair/replacement program; education.
SECTION 319		
Nonpoint Source Activity	Grant	Similar to Revolving Fund Nonpoint Source Activity Loan. Irrigation efficiency and NPDES permit activities not eligible. Stormwater projects not required by a permit.
PUBLIC WORKS TRUST FUND		
Construction	Loan	Municipal infrastructure, such as roads, stormwater, water and sanitary sewer. Stormwater components typically included in application for road projects.

[a] From Table 2, *Funding Guidelines SFY 2012-2013 Water Quality Financial Assistance Guidelines, Publication No. 10-10-049* (Ecology 2010). Does not reflect funding information regarding wastewater facilities. See Ecology publication for further details.

[b] Within the overall funding program. Not all projects within a program are eligible for all funding sources within an overall funding program. Summarized from Appendix C, *Funding Guidelines SFY 2012-2013 Water Quality Financial Assistance Guidelines, Publication No. 10-10-049* (Ecology 2010). See Ecology publication for further details.

[c] Requires completing a financial hardship analysis form. Contingent upon population, median household income, and other factors.

[d] Summarized from memorandum *Procedures for Implementing Certain Provisions of the Fiscal Year 2010 Appropriation Affecting the Clean Water and Safe Drinking Water Revolving Fund Programs* (USEPA April 2010). See EPA publication for further details.

[e] Must take Revolving Fund loan with Forgivable Principal loan.

[f] Stormwater facilities required as mitigation for new or redevelopment are permit-required stormwater facilities through the NPDES Phase II Permit. For example, constructing stormwater management facilities for new and redeveloped pavement for a road project are permit-required facilities if the new and redeveloped pavement exceed the thresholds and trigger stormwater facilities. Constructing stormwater facilities to retrofit existing roadway is not a permit-required facility if such facilities are constructed independent of a road widening or improvement project.

[g] Limited to education and outreach, monitoring, establishing a stormwater utility, or identification and mapping of pollution sources.

[h] Must have matching funds in loan or other funding and commit to implement a repair/replacement loan program.

7.2 POTENTIALLY ELIGIBLE PROJECTS

Table 7-2 identifies projects that could potentially receive funding assistance from Ecology contingent upon funding availability. Table 7-2 was prepared based on *Funding Guidelines SFY 2012-2013 Water Quality Financial Assistance Guidelines, Publication No. 10-10-049* (Ecology 2010). Eligibility of the projects in Table 7-2 is contingent upon eligibility requirements and funding levels of future funding programs. Based on funding criteria for the 2012-2013 funding

cycle, the projects in Table 7-2 may have been eligible for Revolving Fund Non-Point Source Activity Loan, Centennial Non-point Source Activity Loan or Grant, Section 319 grant, and/or Green Project Reserves.

Table 7-2. Summary of Projects Potentially Eligible for Ecology Funding[a]

CIP No.	Project	Potentially Eligible Components[b]	Total Cost Opinion[c] ($)
33	REI/Railroad Culvert Improvements	Replace existing culverts with two each 10-foot-wide by 8-foot-deep three-sided box culverts. Approximately 45 feet total length.	278,400
34	Parker Road Culvert Improvements	Replace existing culvert with 10-foot-wide by 5-foot-deep box culvert. Approximately 25 feet total length.	88,100
35	Puyallup Watershed Access Culvert Improvements	Replace existing culvert with 10-foot-wide by 5-foot-deep box culvert. Approximately 25 feet total length.	79,700
36	47th Street Court East Culvert Improvements	Replace existing culvert with 10-foot-wide by 5-foot-deep box culvert. Approximately 20 feet total length.	80,200
37	160th Avenue East Culvert Improvements	Replace existing culverts with two each 10-foot-wide by 5-foot-deep box culverts. Approximately 60-feet total length. Opens up and restores approximately 250 feet of Salmon Creek.	726,500
38	162nd Avenue East Culvert Improvements	Replace existing culverts with three each 10-foot-wide by 3-foot-deep box culverts. Approximately 75 feet total length.	203,100
39	East Main Street Culvert Improvements	Remove approximately 25 feet of existing culvert; restore stream channel.	31,700
40	Salmon Creek Restoration	Remove existing culvert; restore approximately 150 feet of stream channel.	322,900

a Contingent on requirements of future funding cycles and funding availability.

b Culverts to be based on Washington State Department of Fish and Wildlife criteria for fish passage. Includes stream bank restoration in vicinity of culvert construction.

c At year of construction. From Table 4-2.

Table 7-2 identifies the current cost opinion for the project; however, not all project costs are eligible for funding. The amount of funding requested for future funding applications would need to be based on eligible project costs consistent with Ecology guidelines for the year the funding is requested. Project costs that are generally not eligible for Ecology funding include:

- Indirect City-employee costs that are greater than 25 percent of salaries and benefits;
- Administration costs exceeding 15 percent of the total eligible costs; and
- Construction contingencies may be eligible but require approval by Ecology.

Detailed information regarding eligible project costs can be found in *Administrative Requirements for Recipients of Ecology Grants and Loans – Yellow Book, Publication No. 91-18* (Ecology 2005) available through Ecology's website at:

<http://www.ecy.wa.gov/pubs/9118.pdf>

A project that might be developed by the City not listed in Table 7-2 regards documented fecal coliform levels in Salmon Creek. Based on Ecology's TMDL website, a TMDL for fecal coliform for Salmon Creek is required but has not been prepared. The cause of the fecal coliform could be from failed septic systems and could extend to areas outside of the city. The City may wish to implement a planning project to identify the sources of the fecal coliform loading and coordinate with Pierce County to be a project partner since Pierce County may have sampling equipment and available staff. The planning, design, and construction of a solution could potentially be funded in part through the various programs identified in Table 7-1. A cost opinion for this project has not been prepared or reflected in this Comprehensive Plan Update.

Table 7-3 identifies projects that could potentially receive funding assistance from the Public Works Board contingent upon funding availability. The projects listed in Table 7-3 are stormwater projects that are part of road projects. The costs in Table 7-3 are for stormwater-related costs and do not include road construction costs. It is likely that the projects in Table 7-3 would be included in a funding application as part of a road project rather than a stand-alone stormwater project. However, the decision to include stormwater components within a road project would need to be determined based on how the application could be potentially ranked.

Table 7-3. Summary of Projects Potentially Eligible for Public Works Board Funding

CIP No.	Project	Potentially Eligible Components	Total Cost Opinion [a] ($)
11	South 160th Avenue East Improvements	975-feet of 12- and 18-inch-diameter storm drain pipe; catch basins	118,000
13	Elm Street Interceptor	1,350-feet of 12-, 18- and 24-inch-diameter storm drain pipe; catch basins; flow control facility; water quality treatment facility	302,800
14	North Parker Road Improvements	1,050-feet of 12-and 18-inch-diameter storm drain pipe; catch basins; flow control facility; water quality treatment facility	200,500
15	Parker Road Improvements	1,095-feet of 12- and 18-inch-diameter storm drain pipe; catch basins; flow control facility; water quality treatment facility	364,900
24	East Main Street/160th Avenue East Improvements	2,075-feet of 12-, 18- and 24-inch-diameter storm drain pipe; catch basins; water quality treatment facility	273,400
43	East Valley Highway Improvements – Detention Pond with Biofiltration Swale	7,550-feet of 12-, 18- and 24-inch-diameter storm drain pipe; catch basins; flow control facility; water quality treatment facility	2,226,000
44	East Valley Highway Improvements	7,550-feet of 12-, 18- and 24-inch-diameter storm drain pipe; catch basins	988,900

[a] At year of construction. From Table 4-2.

Funding applications are ranked in order of highest priority to lowest priority, as follows:

- Reduction of risk to public health and safety, such as repetitive flooding;
- Environmental benefits, such as providing treatment of roadway runoff prior to discharge to streams with ESA-listed species;

- Operational improvements, such as reduction of combined sewer overflows; and
- Growth or economic opportunity.

Additional factors that are considered in prioritizing funding applications include:

- Severity of the problem, such as facing fines, third party lawsuits, or impending danger;
- If the project will prevent a routine problem that occurs on a frequent basis; and
- If the project is beneficial to the future of the system.

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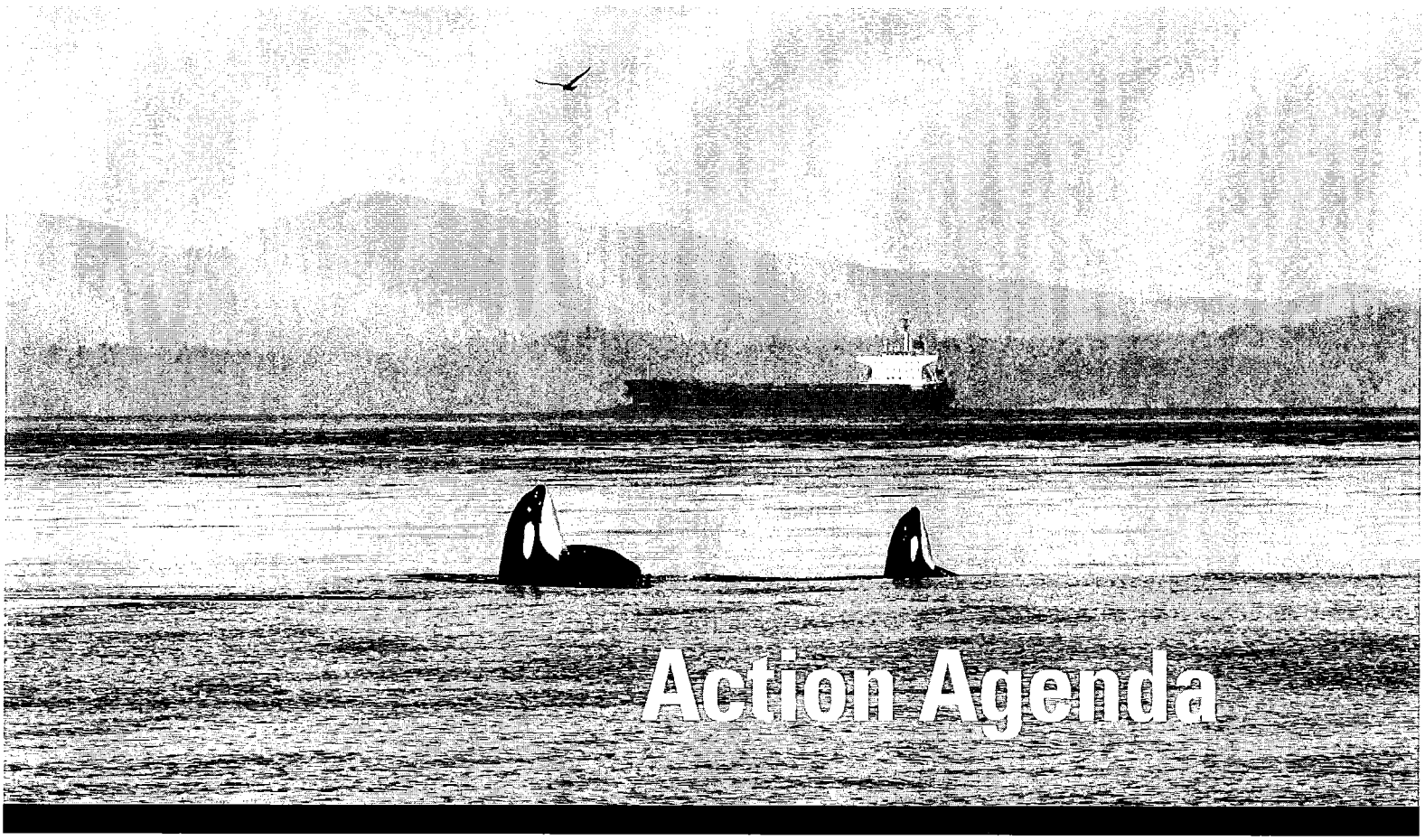
APPENDIX A

Excerpts from Puget Sound Partnership Action Agenda



Action Agenda

The Puget Sound Action Agenda is a strategy for cleaning up, restoring, and protecting Puget Sound by 2020

PugetSoundPartnership
our sound, our community, our chance

passed, seek and support one-year funding for fiscal year 2010 and pursue a dedicated state funding option.

4. Obtain delegated authority from the Coast Guard to expand and enhance the scope of authority of the Department of Ecology's vessel and facility inspections, marine incident investigations, and the agency's ability to augment Coast Guard prevention activities and review spill prevention and response plans on behalf of the Coast Guard. Delegated authority will streamline and strengthen spill prevention plans and operations manuals required by both agencies as well as stronger state enforcement.
5. Petition EPA to establish Puget Sound as a No Discharge Zone for commercial and/or recreational vessels to eliminate bacteria, nutrients, and pathogens from being discharged into Puget Sound. Prioritize areas of the Sound that have nutrient and/or pathogen problems, have high vessel use, are significant for shellfish production, and/or that are otherwise especially vulnerable.
6. Implement existing air management plans consistent with the Action Agenda.
7. Implement Shellfish Protection District plans, on-site sewage treatment plans in marine recovery areas, and related projects to restore water quality at tribal, commercial, and recreational shellfish areas that are degraded or threatened.
8. Implement immediate remediation actions to address Hood Canal's low dissolved oxygen concentrations through the Hood Canal Dissolved Oxygen Program.
9. Implement priority strategies and actions to address low dissolved oxygen in South Sound, targeted areas in the Whidbey Basin, and other vulnerable areas. This includes the Ecology-led South Sound Dissolved Oxygen Study.

C.2 Use a comprehensive, integrated approach to managing urban stormwater and rural surface water runoff to reduce stormwater volumes and pollutant loadings.

Surface water and stormwater runoff in urban and rural areas are the primary transporters of toxic, nutrient, and pathogen pollutants to surface and groundwater resources throughout the Puget Sound basin. Comprehensive approaches to reduce stormwater runoff volumes and pollutant loadings differ in urban and rural areas, but include maintaining and restoring natural hydrologic systems of forests and wetlands for infiltration, and managing surface water closer to its source when possible. The region needs to better implement the current programs and regulations now, as well as strengthen efforts moving forward. This work is particularly important as stormwater flows will likely become larger and more frequent with climate change.

C.2.1 *Integrate efforts to manage stormwater discharges with work to protect land cover and reduce pollutants at the watershed scale and across Puget Sound.* This means implementing the land use protection and restoration actions described in Priorities A, B, and D, as well as the loadings reduction strategy in C.1.

- C.2.1.1 Integrate stormwater management efforts into integrated watershed planning. This would include actions identified in Sections A and D, as well as Watershed Management Plans and Water Quality Improvement Plans.
- C.2.1.2 Investigate, and if appropriate and feasible, establish watershed-scale stormwater permits through Section 208 of the Clean Water Act. Focus permits on the multitude of discharges that occur in logical geographic areas, rather than discharge-specific inputs or jurisdictional boundaries.

C.2.1.3 Establish priorities and resource needs for creating a coordinated water quality monitoring program under National Pollutant Discharge Elimination System (NPDES). This program would need to be coordinated with the overall regional monitoring program identified in E.3.

C.2.2 *Manage stormwater runoff in urban and urbanizing areas to reduce stormwater related impacts.*

C.2.2.1 Implement the municipal stormwater NPDES Phase I and II permits so that the discharges from municipal stormwater systems are reduced. Achieve overall water quality standards. Provide financial and technical assistance to permitted cities and counties.

C.2.2.2 Implement other NPDES permits including those for industrial discharges and the Washington State Department of Transportation.

C.2.2.3 Improve stormwater management in communities not currently covered by NPDES permits by providing financial and technical assistance to local governments to create local comprehensive stormwater control programs. Investigate expansion of NPDES permit coverage to include additional jurisdictions with municipal separated storm sewer systems (MS4). Initiate work in areas with documented stormwater-related problems and intact resources that are threatened by surface runoff.

C.2.2.4 Provide cities and counties with comprehensive guidance and standards regarding LID practices to incorporate into stormwater codes for development and redevelopment. Assist local governments with revisions to regulations so that all jurisdictions in Puget Sound require the use of LID where feasible, as soon as possible.

C.2.2.5 Advance the use of LID approaches to stormwater management. This includes, but is not limited to: a) resolve institutional barriers that limit use of LID for new development and redevelopment and road construction, including an update of stormwater flow control standards; b) implement, assess, and promote successful examples of LID techniques; c) develop incentives for using LID; d) develop focused training for contractors and developers and other stormwater professionals; and e) develop focused training for local government staff on areas best suited for LID and assist them in revising their regulations to allow LID.

C.2.2.6 Evaluate the technical and programmatic solutions for Combined Sewer Overflows (CSOs) in the context of improving water quality in fresh and marine water and preserving and recovering the health of Puget Sound. Continue efforts to eliminate discharge of raw sewage.

C.2.2.7 Prioritize and implement stormwater retrofits in urbanized areas, including roads. In the near term, develop high-level prioritization criteria for the selection of new projects. Over the long term, link retrofit priorities to coordinated watershed restoration and pollution prevention strategies.

C.2.2.8 Improve future, new, and updated NPDES permits by requiring sub-basin planning to better identify specific actions for water bodies, improving collaboration of effort for shared water bodies, incorporating climate change

projections related to stormwater runoff volumes, and meeting other requirements that will need to be identified.

C.2.3 *Manage surface water runoff in rural areas and on working resource lands to reduce pollutant loadings.*

C.2.3.1 Implement the Forest and Fish agreement, including road maintenance and abandonment plans on public and privately held working forests.

C.2.3.2 Fund and implement voluntary incentive, stewardship and technical assistance programs for rural unincorporated landowners, hobby farms, working farms, and nurseries.

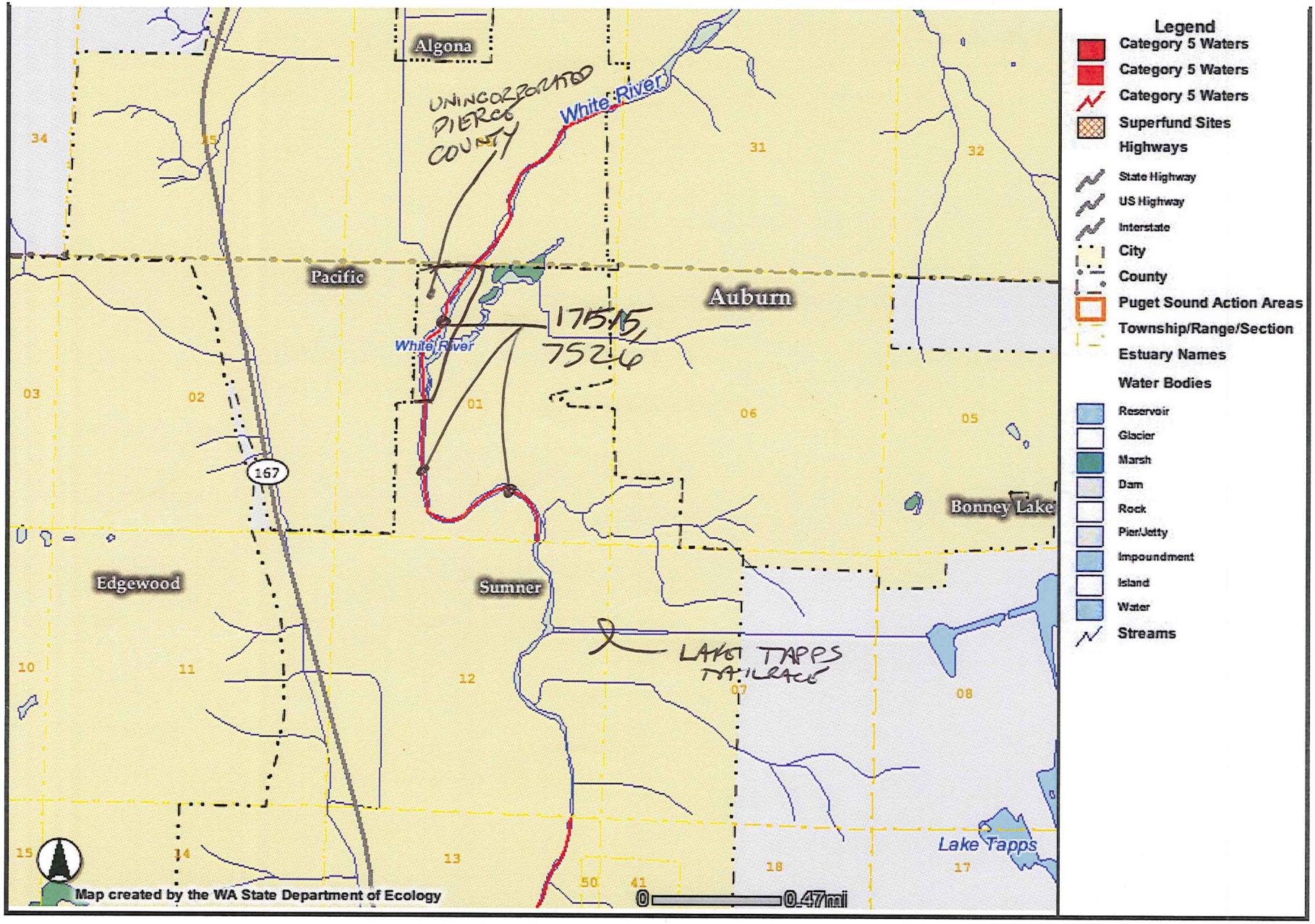
C.2.3.3 Implement and ensure compliance with Concentrated Animal Feeding Operations permits.

C.2 Near-term Actions

1. Establish a regional coordinated monitoring program for stormwater, working with the Monitoring Consortium of the Stormwater Work Group (see E.3).
2. Provide financial and technical assistance to cities and counties to implement NPDES Phase I and II permits, as well as Ecology for permit oversight and implementation.
3. Assist cities and counties in incorporating LID requirements for development and redevelopment into all stormwater codes.
4. Develop and implement LID incentives. Work with regional experts to develop and implement incentives and remove barriers to the use of low impact stormwater management techniques on development projects.
5. Convene a group of regulating agencies, implementers with key funding responsibilities, and other stakeholders as appropriate to evaluate the technical and programmatic solutions for CSOs to meet overall program goals of improving water quality in fresh and marine water. The integration of CSO solutions into the larger range of solutions to stormwater and other water quality problems may improve cost effectiveness of both programs in urban areas, notably Seattle and King County. This will require flexibility in implementation, timing, and scope of municipal wastewater NPDES program as applied to CSOs.
6. Retrofit existing stormwater systems by: a) developing high-level criteria that can be used in 2009 to determine the highest priority areas around the Sound for stormwater retrofits; and b) implementing stormwater retrofit projects in the highest priority areas based upon these criteria to bring areas into compliance with current stormwater regulations. Retrofits should include low impact stormwater management techniques to the greatest extent feasible. Monitor effectiveness of the techniques.
7. Continue to implement road maintenance and abandonment programs for federal, state (including trustlands), and private timber lands.
8. Implement private property stewardship, incentive, and technical assistance programs (e.g. Conservation Districts, WSU Extension, Washington Sea Grant, local government programs) that focus on reducing sources of water pollution, from commercial and non-commercial farms and other nonpoint pollution sources, particularly in priority areas.
9. Implement NPDES industrial permits and Washington State Department of Transportation permits, including Ecology for permit oversight and implementation.

APPENDIX B

Ecology TMDL Information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Bonney Lake
Edgewood
Sumner
LAKE TAPPS TAILRACE
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Category 5 Waters
Superfund Sites
Highways
State Highway
US Highway
Interstate
City
County
Puget Sound Action Areas
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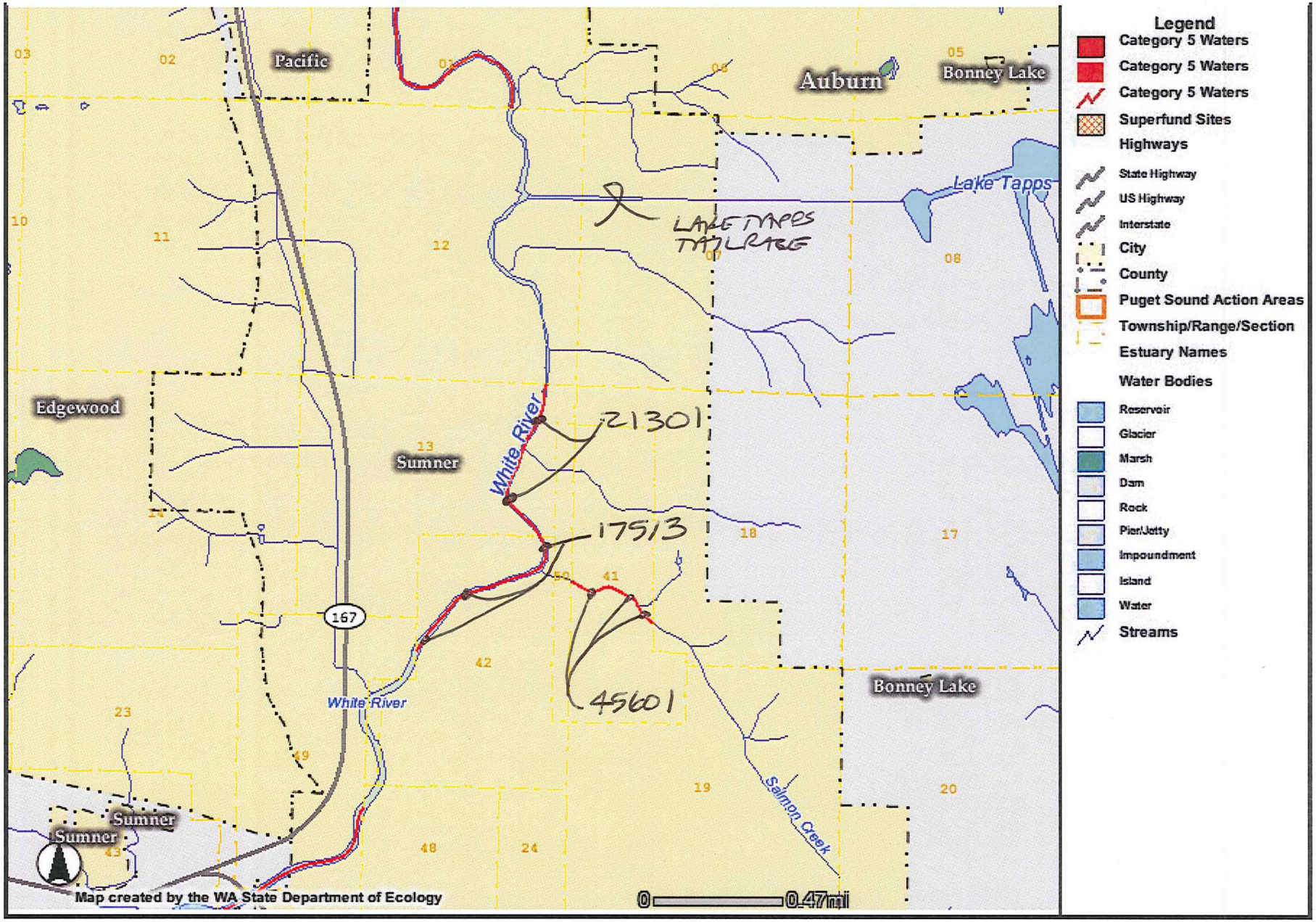
Estuary Names
Water Bodies
Reservoir
Glacier
Marsh
Dam
Rock
Pier/Jetty
Impoundment
Island
Water
Streams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Category 5 Waters
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Category 5 Waters
Superfund Sites
Highways
State Highway
US Highway
Interstate
City
County
Puget Sound Action Areas
Township/Range/Section
Estuary Names
Water Bodies
Reservoir
Glacier
Marsh
Dam
Rock
Pier/Jetty
Impoundment
Island
Water
Streams
Pacific
Auburn
Bonney Lake
Lake Tapps
LAKE TAPPS TAYLRAGE
Edgewood
Sumner
White River
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17513
45601
167
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Bonney Lake
Salmon Creek
Sumner
Sumner
Map created by the WA State Department of Ecology
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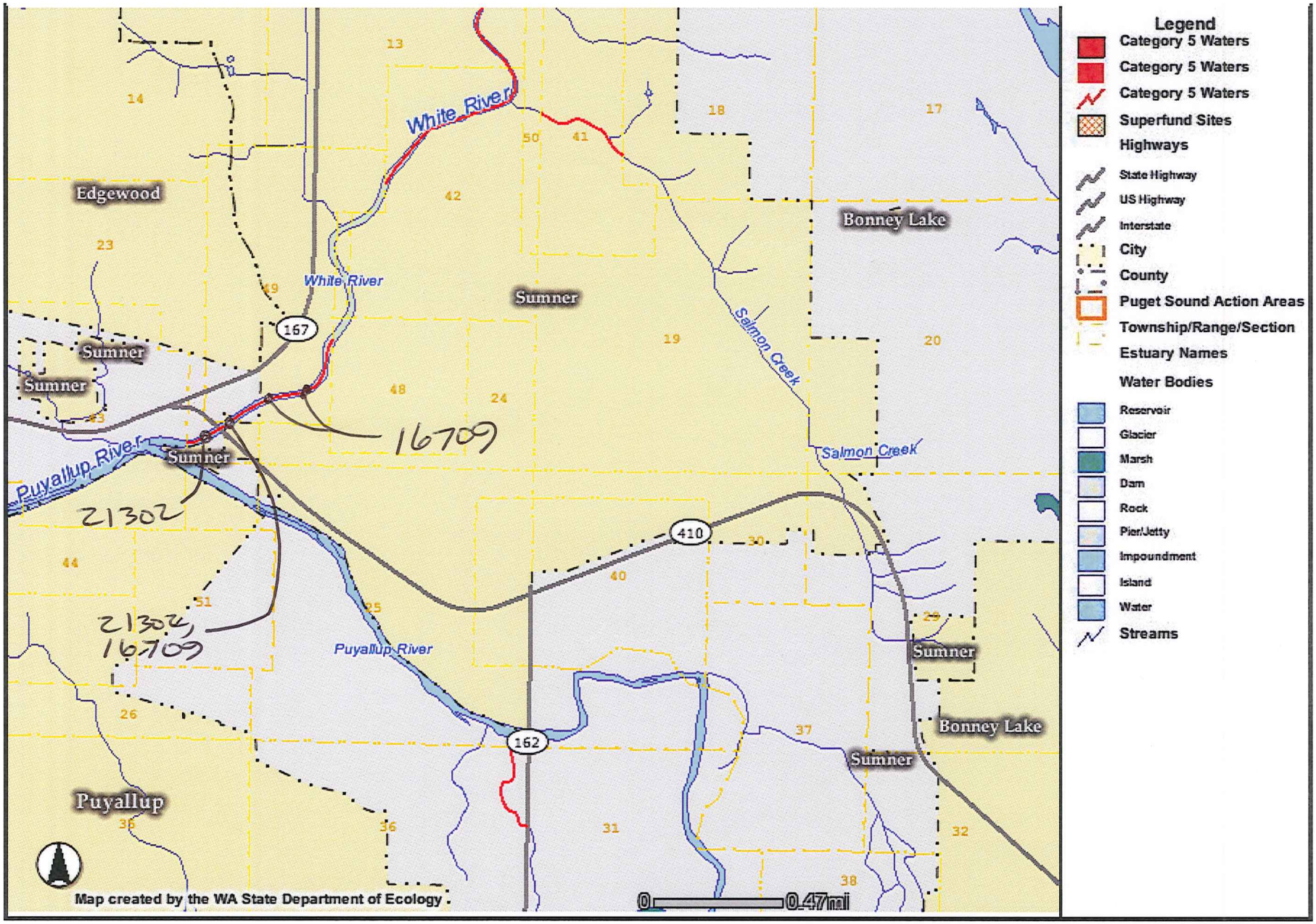
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Superfund Sites
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US Highway
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Impoundment
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Map created by the WA State Department of Ecology
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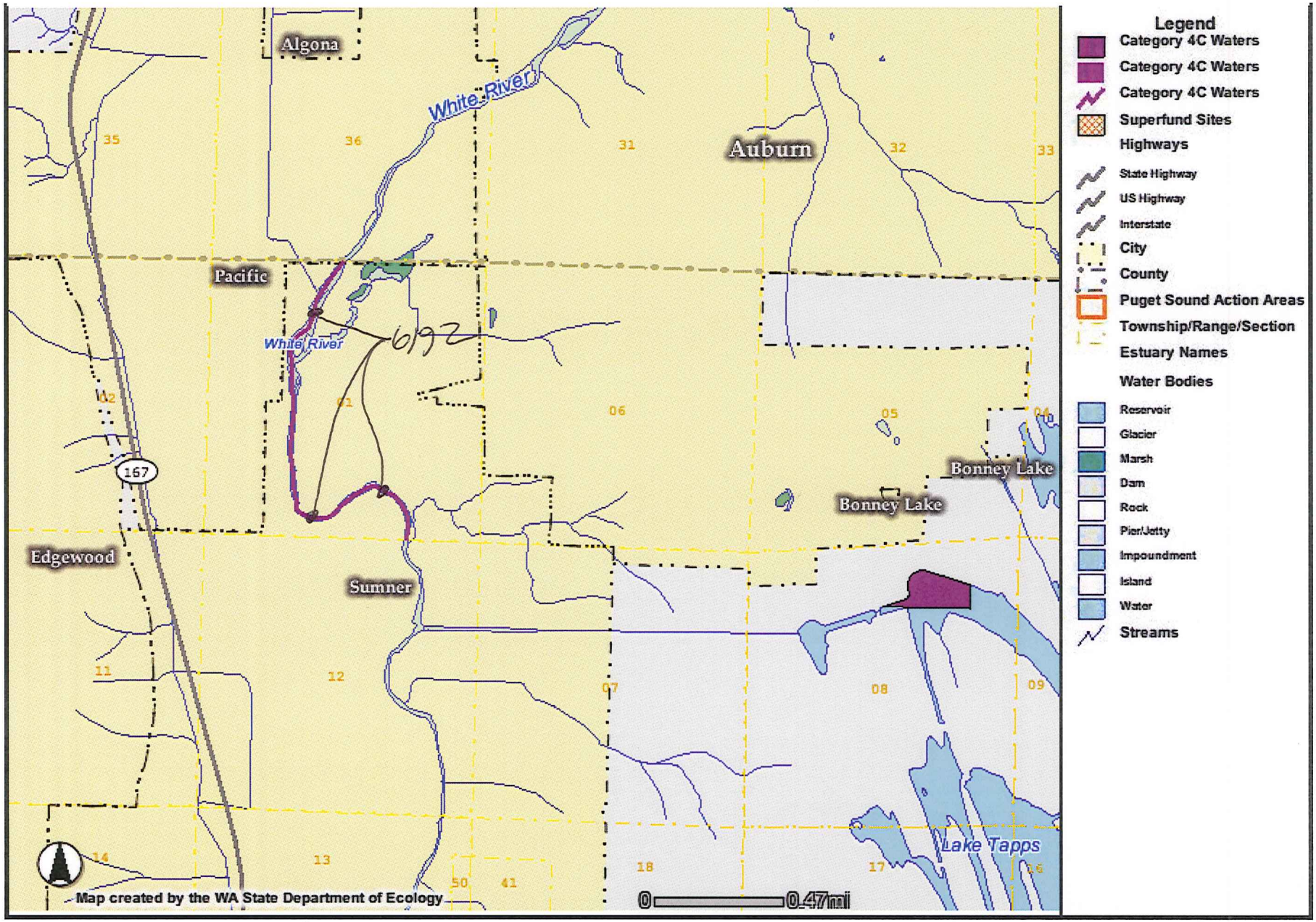
Algona
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Bonney Lake
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Lake Tapps
Map created by the WA State Department of Ecology
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Superfund Sites
Highways
State Highway
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Estuary Names
Water Bodies
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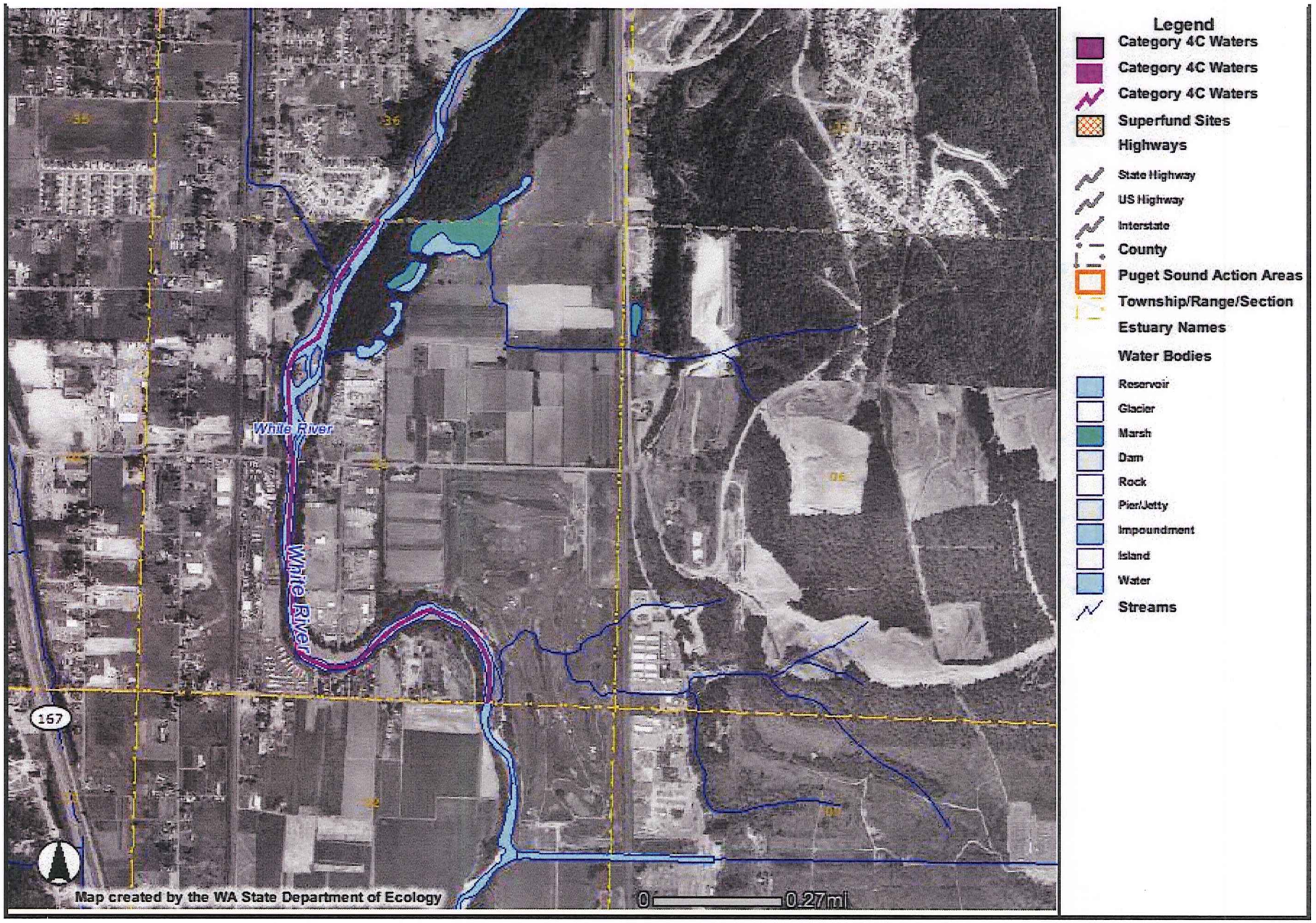
4/15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Estuary Names
Water Bodies
Reservoir
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Streams
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White River
167
Map created by the WA State Department of Ecology
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5/15

null
November 16, 2010

Pierce County
Geographic Information Services

Legend

- **Cities Boundary**
- **Ortho - AerialExpress 2009 (1 foot)**

Disclaimer: The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. **ALL DATA IS EXPRESSLY PROVIDED 'AS IS' AND 'WITH ALL FAULTS'.** The County makes no warranty of fitness for a particular purpose.

5/10

Listing ID:	17515		
Water Body Name:	WHITE RIVER		
Water Body Type:	River/Stream		
Parameter:	Temperature	**2008 CATEGORY:**	5
Sample Medium:	Water	**2004 Category:**	5
WRIA:	10 - Puyallup-White	**1998 303(d) List?:**	N
		1996 303(d) List?:	N
County:	Pierce		
Puget Sound Action Area:	South Central Puget Sound		
Township Range Section:	20.0N - 04.0E - 01		
LLID:	1222573471997		
Lower Rte:	6.487	**Upper Rte:**	9.008
WASWIS:	LY34GL		
Lower Rte:	6.487	**Upper Rte:**	9.004

EIM

User Study ID	User Location ID
AMS001	10C085
KERI0003	WHI04.9

2008 Basis

*** 2008 Basis Statement (carried forward from 2004) ***

Unpublished data from the Puyallup TMDL Effectiveness Monitoring Project shows a 7-day mean of maximum values of 18.9 for week ending 1 September 2002.

Dept. of Ecology unpublished data from ambient monitoring station 10C085 (White R. nr Sumner) shows a 7-day mean of daily maximum values of 21.3 for mid-week 21 July 2002

Ebbert, 2002. shows a 7-day mean of maximum values of 18.95 for week ending 31 August 2001.

Hallock (2001) Dept. of Ecology Ambient Monitoring Station 10C085 (White R nr Sumner) shows 1 excursions beyond the criterion out of 5 samples collected between 1993 - 2001 measured on this date: 96/07/24.

Erickson (1999) station WHI04.9 (White River (WHI04.9)) shows 3 excursions beyond the criterion out of 6 samples collected between 06/96 - 11/97.

Erickson (1999) shows multiple excursions beyond the criterion (RM 4.9) during 1996.

Remarks

In addition to the general temperature criteria the following critieria also apply to this waterbody: [Chapter, 173-201A WAC Table 200 (1)(c)] --Sept. 15-July 1, the temperature shall not exceed a 1-day maximum of 13°C.

7/15

Listing ID:	7526		
Water Body Name:	WHITE RIVER		
Water Body Type:	River/Stream		
Parameter:	pH	**2008 CATEGORY:**	5
Sample Medium:	Water	**2004 Category:**	5
WRIA:	10 - Puyallup-White	**1998 303(d) List?:**	Y
		1996 303(d) List?:	Y
County:	Pierce		
Puget Sound Action Area:	South Central Puget Sound		
Township Range Section:	20.0N - 04.0E - 01		
LLID:	1222573471997		
Lower Rte:	6.487	**Upper Rte:**	9.008
WASWIS:	LY34GL		
Lower Rte:	6.487	**Upper Rte:**	9.004
WBID:	WA-10-1030		

EIM

User Study ID	User Location ID
KERI0003	WHI04.9

2008 Basis

Location ID [WHI04.9] -- In 1997, 2 of 15 samples (13.3%) showed an excursion of the criteria for this waterbody: 2 high pH excursions.

*** 2004 Basis Statement Below ***

Ebbert, 2002, shows 15 excursions beyond the criterion from 55 daily maximum measurements collected in 2001.

Unpublished data from the Puyallup TMDL Effectiveness Monitoring Project shows 32 excursions beyond the criterion from 70 daily maximum measurements collected in 2001.

Hallock (2001) Dept. of Ecology Ambient Monitoring Station 10C085 (White R nr Sumner) shows 0 excursions beyond the criterion out of 5 samples collected between 1993 - 2001.

Erickson (1999) station WHI04.9 (White River (WHI04.9)) shows 3 excursions beyond the criterion out of 21 samples collected between 06/96 - 11/97.

Pelletier, 1993, 4 excursions beyond the criterion out of 10 samples at RM 4.9 on 9/18/90, 9/19/90, 10/2/90 and 10/3/90.

Remarks

8/15

At Least 10 percent of samples were excursion of the criteria in at least one year, however fewer than 3 excursions exist from all data considered.

High pH

9/15

Listing ID:	21301		
Water Body Name:	WHITE RIVER		
Water Body Type:	River/Stream		
Parameter:	Temperature	**2008 CATEGORY:**	5
Sample Medium:	Water	**2004 Category:**	5
WRIA:	10 - Puyallup-White	**1998 303(d) List?:**	N
		1996 303(d) List?:	N
County:	Pierce		
Puget Sound Action Area:	South Central Puget Sound		
Township Range Section:	20.0N - 04.0E - 13		
LLID:	1222573471997		
Lower Rte:	3.586	**Upper Rte:**	4.600
WASWIS:	LY34GL		
Lower Rte:	3.586	**Upper Rte:**	4.600

2008 Basis

*** 2008 Basis Statement (carried forward from 2004) ***

Continuous monitoring data from a study by Parametrix (2002 and 2004) indicates exceedances of the numeric temperature criteria at RM 1.8 in 2002 and 2003.

Remarks

Northwest Pulp and Paper Association presented rationale and a two year study performed by Parametrix (12/16/02 and 3/15/04) that temperatures higher than the numeric criteria are a natural condition and the segment meets the state water quality standard for temperature. Ecology required pulp mills on the Columbia and White/Stuck River to perform a two-year ambient water temperature monitoring study in accordance with Ecologys WQP 1-11 and quality assurance requirements. Ecology reviewed this study and the associated listing in 2003 for natural conditions, but has not yet made a determination of natural conditions for these rivers. EPA has the lead in a Temperature TMDL for the Columbia and Snake Rivers that is underway that may address this issue. The Parametrix study measured temperature data upstream and downstream of pulp mills along the rivers and found the mills did not have a measurable effect on temperatures (the associated discharges do not exceed 0.3 degrees). This study will be valuable for verifying that pulp mills do not contribute a significant increase in temperature when load allocations are being considered in the TMDL.

10/15

Listing ID:	17513		
Water Body Name:	WHITE RIVER		
Water Body Type:	River/Stream		
Parameter:	Temperature	**2008 CATEGORY:**	5
Sample Medium:	Water	**2004 Category:**	5
WRIA:	10 - Puyallup-White	**1998 303(d) List?:**	N
		1996 303(d) List?:	N
County:	Pierce		
Puget Sound Action Area:	South Central Puget Sound		
Township Range Section:	20.0N - 04.0E - 42		
LLID:	1222573471997		
Lower Rte:	2.468	**Upper Rte:**	3.586
WASWIS:	LY34GL		
Lower Rte:	2.468	**Upper Rte:**	3.586

2008 Basis

*** 2008 Basis Statement (carried forward from 2004) ***

Ebbert, 2002. shows a 7-day mean of maximum values of 20.0 for week ending 13 August 2001. Unpublished data from the Puyallup TMDL Effectiveness Monitoring Project shows a 7-day mean of maximum values of 19.6 for week ending 13 August 2002.

11/15

Listing ID:	16709		
Water Body Name:	WHITE RIVER		
Water Body Type:	River/Stream		
Parameter:	Fecal Coliform	**2008 CATEGORY:**	5
Sample Medium:	Water	**2004 Category:**	5
WRIA:	10 - Puyallup-White	**1998 303(d) List?:**	Y
		1996 303(d) List?:	Y
County:	Pierce		
Puget Sound Action Area:	South Central Puget Sound		
Township Range Section:	20.0N - 04.0E - 49		
LLID:	1222573471997		
Lower Rte:	0.504	**Upper Rte:**	1.361
WASWIS:	LY34GL		
Lower Rte:	0.505	**Upper Rte:**	1.361

2008 Basis

*** 2008 Basis Statement (carried forward from 2004) ***

Hallock (2001) Dept. of Ecology Ambient Monitoring Station 10C070 (White R. at Sumner) shows a geometric mean of 98 does not exceed the criterion and that 33% of the samples exceeds the percentile criterion from 3 samples collected during 1996.

Hallock (2001) Dept. of Ecology Ambient Monitoring Station 10C070 (White R. at Sumner) shows a geometric mean of 106 exceeds the criterion and that 33% of the samples exceeds the percentile criterion from 3 samples collected during 1995.

Hallock (2001) Dept. of Ecology Ambient Monitoring Station 10C070 (White R. at Sumner) shows a geometric mean of 152 exceeds the criterion and that 33% of the samples exceeds the percentile criterion from 9 samples collected during 1993.

Remarks

Was listed under the name White (Stuck) River in 1998. -kk

12/15

Listing ID:	21302		
Water Body Name:	WHITE RIVER		
Water Body Type:	River/Stream		
Parameter:	Temperature	**2008 CATEGORY:**	5
Sample Medium:	Water	**2004 Category:**	5
WRIA:	10 - Puyallup-White	**1998 303(d) List?:**	N
		1996 303(d) List?:	N
County:	Pierce		
Puget Sound Action Area:	South Central Puget Sound		
Township Range Section:	20.0N - 04.0E - 23		
LLID:	1222573471997		
Lower Rte:	0.221	**Upper Rte:**	0.504
WASWIS:	LY34GL		
Lower Rte:	0.221	**Upper Rte:**	0.505

2008 Basis

*** 2008 Basis Statement (carried forward from 2004) ***

Parametrix, 2002. shows a 7-day mean of daily maximum value of 18.09 deg. C at RM 0.3 in 2002.

Remarks

Parametrix, 2002. by comparison with upstream station shows the segment did not exceed the allowable 0.3 deg C rise in water temperature from the Sonoco Products discharge at Sumner when upstream temperature was greater that 18 deg C.

13/15

Listing ID:	45601		
Water Body Name:	SALMON CREEK		
Water Body Type:	River/Stream		
Parameter:	Fecal Coliform	**2008 CATEGORY:**	5
Sample Medium:	Water	**2004 Category:**	
WRIA:	10 - Puyallup-White	**1998 303(d) List?:**	N
		1996 303(d) List?:	N
County:	Pierce		
Puget Sound Action Area:	South Central Puget Sound		
Township Range Section:	20.0N - 05.0E - 41		
LLID:	1222308472188		
Lower Rte:	0.214	**Upper Rte:**	0.804

EIM

User Study ID	User Location ID
LSUL0001	10-SAL-0.2

2008 Basis

Location ID [10-SAL-0.2] -- 0 of 5 (0.0%) of samples collected in 2007 exceed the percent criterion (200 col/100mL)
Location ID [10-SAL-0.2] -- A geometric mean of 80.99 col/100mL calculated from 5 samples collected in 2007 does not exceed the geometric mean criterion (100 col/100mL)

Location ID [10-SAL-0.2] -- 2 of 5 (40.0%) of samples collected in 2006 exceed the percent criterion (200 col/100mL)
Location ID [10-SAL-0.2] -- A geometric mean of 119.66 col/100mL calculated from 5 samples collected in 2006 exceeds the geometric mean criterion (100 col/100mL)

Remarks

Category was determined by an exceedance of both fecal coliform criteria. [Data collection period(s) -- 2006: Location ID -- 10-SAL-0.2]. More recent data may not meet minimum data requirements of Ecology WQP Policy 1-11

14/15

Listing ID:	6192		
Water Body Name:	WHITE RIVER		
Water Body Type:	River/Stream		
Parameter:	Instream Flow	**2008 CATEGORY:**	4C
Sample Medium:	Habitat	**2004 Category:**	4C
WRIA:	10 - Puyallup-White	**1998 303(d) List?:**	Y
		1996 303(d) List?:	Y
County:	Pierce		
Puget Sound Action Area:	South Central Puget Sound		
Township Range Section:	20.0N - 04.0E - 01		
LLID:	1222573471997		
Lower Rte:	6.487	**Upper Rte:**	9.008
WASWIS:	LY34GL		
Lower Rte:	6.487	**Upper Rte:**	9.004
WBID:	WA-10-1030		

2008 Basis

*** 2008 Basis Statement (carried forward from 2004) ***

Inadequate instream flows in the bypass reach of Puget Power's White River Hydroelectric Project (RM 3.5 to 24.25): Puget Power. November 1983. Application for License, Major Project at Existing Dam (and additional information developed to supplement the application through 1992). Including IFIM study and data conducted by Puget Power and in consultation with Ecology, the National Marine Fisheries Service, U.S. Fish and Wildlife, Department of Fisheries and Wildlife; 11/13/89 Letter from Merritt Tuttle, National Marine Fisheries Service to W.J. Finnegan, Puget Power; April 1993 Letter from Bill Backous, Ecology to Puget Power issuing Water Quality Certification for the White River Hydroelectric Project; Federal Energy Regulatory Commission. 1992. Environmental assessment of the White River Hydroelectric Project; Washington Department of Fisheries. 1975. A Catalog of Washington Streams and Salmon Utilization. Volume 1.;SASSI, 1993., Spring Chinook are listed as a critical stock.

Remarks

This listing was on the 1998 303(d) list, but has been moved to the new Category 4C (impaired by a non-pollutant) based on EPA Guidance for preparing the 2004 Integrated Report.

15/15

APPENDIX C

City Shop Agreement to Maintain Stormwater Facilities and to Implement a Pollution Source Control Plan

200308131313 23 PGS
08-13-2003 04:44pm $41.00
PIERCE COUNTY. WASHINGTON

RETURN TO:

Public Works Department
City of Sumner
1104 Maple Street, STE 260
Sumner WA 98390-1423

Please make no mark in the margin space - Reserved for County Auditor's use only.

TYPE OF DOCUMENT:	Agreement to Maintain Stormwater Facilities
GRANTOR(S):	**City of Sumner**
GRANTEE:	City of Sumner, a Municipal Corporation
LEGAL DESCRIPTION:	Page 6, Exhibit 'A' of this document
ABBREVIATED LEGAL DESCRIPTION:	**042013 SW**
ASSESSOR TAXPARCEL I.D. No.:	**042013 3025 & 042013 3024**
NAME OF PROJECT	**City of Sumner – Public Works Shop Building**
ADDRESS OF PROJECT	**4711 – 142 AVE**
PROJECT No.:	**SWMA 00067**

AGREEMENT TO MAINTAIN STORMWATER FACILITIES AND TO IMPLEMENT A POLLUTION SOURCE CONTROL PLAN

THIS AGREEMENT made and entered into this 6th day of August, 2003, by and between the CITY OF SUMNER, a municipal corporation hereinafter referred to as "City", and **City of Sumner** (hereinafter referred to as "Owner").

WHEREAS, this agreement contains specific provisions with respect to maintenance of storm water facilities and use of pollution source control (BMPs). The authority to require maintenance and pollution source control is provided in Ordinance No. 1603; and

WHEREAS, Owner owns the following-described real property situated in Pierce County, State of Washington, as set forth in Exhibit 'A', which is attached hereto and made a part hereof; and

WHEREAS, Owner has constructed improvements including, but not limited to, building, pavement, and stormwater facilities on the above-described real property; now, therefore,

For and in consideration of the mutual benefits to be derived therefrom, it is mutually agreed as follows:

A. City and Owner enter into this agreement in order to further the goals of City to insure the protection and enhancement of City's water resources. The responsibilities of each party to this agreement are identified below:

1. Owner shall:

a. Implement the stormwater facility maintenance program included herein as Exhibit "1".

b. Implement the pollution source control program included herein as Exhibit "2".

c. Maintain a record (in the form of a log book) of steps taken to implement the programs referenced in "a" and "b" above. The log book shall be available for inspection by the City staff at Owner's business address: 1104 Maple ST, Suite 260 , Sumner WA 98390. The log book shall catalog the action taken, who took it, when it was done, how it was done, and any problems encountered or follow-up actions recommended. Maintenance items ("problems") listed in Exhibit "1" shall be inspected on a monthly or more frequent basis, as necessary. Owner is encouraged to photocopy the individual checklists in Exhibit "1" and use them to complete its monthly inspections. These completed checklists would then, in combination, comprise the monthly log book.

d. Submit an annual report to City regarding implementation of the programs referenced in "a" and "b" above. The report must be submitted on or before May 15th of each calendar year and shall contain, at a minimum, the following:

(1) Name, address and telephone number of the business, the person or the firm responsible for plan implementation, and the person completing the report.

(2) Time period covered by the report.

(3) A chronological summary of activities conducted to implement the programs referenced in "a" and "b" above. A photocopy of the applicable sections of the log book, with any additional explanation needed, shall normally suffice. For any activities conducted by paid parties not affiliated with Owner, include a copy of the invoice for services.

(4) An outline of planned activities for the next year.

2. *City shall:*

   a. Provide technical assistance to Owner in support of its operation and maintenance activities conducted pursuant to its maintenance and source control programs. Said assistance shall be provided upon request, and as City time and resources permit, at no charge to Owner.

   b. Review the annual report and conduct a minimum of one (1) site visit per year to discuss performance and problems with Owner.

   c. Review this agreement with Owner and if necessary consider reasonable modification hereto no more than once every three (3) years.

B. Remedies:

1. If City determines that maintenance or repair work is required to be done to the stormwater facility existing on Owner's property, the Director of the Department of Public Works shall give the owner of the property within which the drainage facility is located, and the person or agent in control of said property, notice of the specific maintenance and/or repair required. The Director shall set a reasonable time in which such work is to be completed by the persons who were given notice. If the above required maintenance and/or repair is not completed within the time set by the Director, written notice will be sent to the persons who were given notice stating City's intention to perform such maintenance and bill Owner for all incurred expenses.

2. If at any time City determines that the existing system creates any eminent threat to public health or welfare, the Director may take immediate measures to remedy said threat. Under such circumstances no notice to the persons listed in B.1 above shall be required, but the City shall give the Owner immediate notice of the remedial measures so taken

3. The persons listed in B.1 above shall assume all responsibility for the cost of any maintenance and for repairs to the stormwater facility. Such responsibility shall include reimbursement to City within thirty (30) days of the receipt of the invoice for any such work performed. Overdue payments will require payment of interest at the current legal rate for liquidated judgments. If legal action ensues, any costs or fees incurred by City will be borne by the parties responsible for said reimbursements.

4. In the event Owner of the property fails to pay City within thirty (30) days from the date that the costs were incurred, City shall have the right to file a lien against the real property for all charges and expenses incurred. A lien specifying the

CITY OF SUMNER

By: Barbara Skinner
Barbara Skinner Mayor

By: Andrew Neiditz
Andrew Neiditz City Administrator

STATE OF WASHINGTON)
) SS
COUNTY OF PIERCE)

On this 11 day of August, 2003, before me, the undersigned, a Notary Public in the State of Washington, duly commissioned and sworn, personally appeared Barbara Skinner, and Andrew Neiditz, representing themselves as Mayor and City Administrator, respectively, of the City of Sumner, the municipal corporation that executed the foregoing instrument, and acknowledged the instrument to be the free and voluntary act and deed of said municipal corporation for the uses and purposes therein mentioned, and on oath stated that they are authorized to execute the same.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal the day and year first above written.

VICKI L. PFAU NOTARY PUBLIC STATE OF WASHINGTON COMMISSION EXPIRES SEPT. 7, 2005

Vicki Pfau

Printed Name: Vicki Pfau

NOTARY PUBLIC in and for the State of Washington, residing at Puyallup

My Commission Expires: 9-7-05

Approved to Form:

By: Pat Bosmans
Patricia Bosmans City Attorney

ATTEST:

By: Susan B. Clary
Susan Clary City Clerk

Approved:

By: William Shoemaker
William Shoemaker Public Works Director

R:\Address Files\142nd Ave E\4711\Storm Water Maintenanc Agreement 2003.doc

EXHIBIT 'A' - STORMWATER MAINTENANCE AGREEMENT
Legal Description

0420133025

COM AT INTER OF N LI OF A MORRISON DLC & C/L OF SEC TH S 30 FT TH E 146 FT TO POB TH E 621.1 FT TO W LI OF CO RD TH S 581.7 FT TH W 400 FT TH S 322 FT TH W 339.60 FT TH S 410.92 FT TH W 149 FT TO ELY LI OF PACIFIC CITY CO RD TH N 05 DEG 55 MIN E ALG SD ELY LI TO A PT 682 FT S OF N LI SD DLC TH E 173 FT TH N 231 FT TH W 173 FT TH N 327 FT TH E 116 FT TH N 94 FT TO POB EXC THAT POR LY NLY OF S LI OF R/W CYD TO CY OF SUMNER PER ETN 976888 OUT OF 4-701 SEG K-0416 JU 1/11/99JU

0420133024

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EXHIBIT 1: MAINTENANCE PROGRAM - COVER SHEET

TYPE OF DOCUMENT:	Agreement to Maintain Stormwater Facilities
GRANTOR(S):	**City of Sumner**
GRANTEE:	City of Sumner, a Municipal Corporation
LEGAL DESCRIPTION:	Page 6, Exhibit 'A' of this document
ABBREVIATED LEGAL DESCRIPTION:	**042013 SW**
ASSESSOR TAXPARCEL I.D. No.:	**042013 3025 & 042013 3024**
NAME OF PROJECT	**City of Sumner – Public Works Shop Building**
ADDRESS OF PROJECT	**4711 – 142 AVE**
PROJECT No.:	**SWMA 00067**

Inspection Period: _____

Number of Sheets Attached: _____

Date Inspected: _____

Name of Inspector: _____

Inspector's Signature: _____

EXHIBIT 1: MAINTENANCE PROGRAM – COVER SHEET

TYPE OF DOCUMENT: Agreement to Maintain Stormwater Facilities
GRANTOR(S):
ABBREVIATED LEGAL DESCRIPTION:
ASSESSOR TAXPARCEL I.D. No.:
NAME OF PROJECT
ADDRESS OF PROJECT
PROJECT No.:
Recording No:

Inspection Period:	ANNUALLY by May 15
Number of Sheets Attached:	
Date Inspected:	
On-site Contact Name (print) (REQUIRED)	
Site Contact Mailing Address:	
Site Contact Telephone number: (REQUIRED)	
Site Contact email address:	
City inspection signature:	

SWMA # _____ Year: _____

EXHIBIT 1 MAINTENANCE PROGRAM

1. Maintenance checklist for Catch Basins and Inlets

Frequency	Drainage System Feature	Y	N	NA	Conditions to Check For	Problem	Conditions That Should Exist
M, S	General				Trash or debris in front of the catch basin opening. Is blocking capacity by more than 10%.	Trash, debris and sediment in or on basin	No trash or debris located immediately in front of catch basin opening. Grate is kept clean and allows water to enter.
M					Sediment or debris (in the basin) that exceeds 1/3 depth from the bottom of basin to invert of the lowest pipe into or out of the basin.		No sediment or debris in the catch basin. Catch basin is dug out and clean.
M, S					Trash or debris in any inlet or pipe blocking more than 1/3 of height.		Inlet and outlet pipes free of trash or debris.
M, S					Dead animals or vegetation that could generate odors that would cause complaints or dangerous gases (e.g., methane).		No dead animals or vegetation present within the catch basin.
M, S					Deposits of garbage exceeding 1 cubic foot in volume		No condition present which would attract or support the breeding of insects or rodents.
M					Corner of frame extends more than ¾ inch past curb face into the street (if applicable)	Structural damage to frame and/or top slab.	Frame is even with curb.
M					Top slab has holes larger than 2 square inches or cracks wider than ¼ inch (intent is to make sure all material is running into the basin)		Top slab is free of holes and cracks.
M					Frame is not sitting flush on top slab i.e., separation of more than ¾ inch of the frame from the top slab.		Frame is sitting flush on top slab.
A					Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks or maintenance person judges that structure is unsound.	Cracks in basin walls/bottom	Basin replaced or repaired to design standards. Contact a professional engineer for evaluation.
A					Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.		No cracks more than ¼-inch wide at the joint of inlet/outlet pipe.
A					Basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Settlement/ Misalignment	Basin replaced or repaired to design standards. Contact a professional engineer for evaluation.
M, S					Presence of chemicals such as natural gas, oil, or gasoline. Obnoxious color, odor, or sludge noted.	Fire hazard or other pollution	No color, odor, or sludge. Basin is dug out and clean.
M, S					Vegetation or roots growing in inlet/outlet pipe joints that are more than six inches tall and less than six inches apart.	Outlet pipe is clogged with vegetation.	No vegetation or root growth present.
M, S					Vegetation growing across and blocking more than 10% of the basin opening.	Vegetation	No vegetation blocking opening to basin.
M, S					Non-flammable chemicals of more than ½ cubic foot per three feet of basin length.	Pollution	No pollution present other than surface film.

Key:
A = Annual (March or April preferred)
M = Monthly
S = After major storms.

Comments:

1. Maintenance checklist for Catch Basins and Inlets (Continued)

Frequency	Drainage System Feature	Y	N	NA	Conditions to Check For	Problem	Conditions That Should Exist
M, S	Catch Basin Cover				Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover not in place	Catch basin cover is closed.
A					Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than ½ inch of thread.	Locking Mechanism Not Working	Mechanism opens with proper tools.
A					One maintenance person cannot remove lid after applying 80 lbs of lift; intent is to keep cover from sealing off access to maintenance.	Cover Difficult to Remove	Cover can be removed by one maintenance person.
A	Ladder				Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges.	Ladder Rungs Unsafe	Ladder meets design standards and allows maintenance person safe access.
M, S	Metal Grates (if applicable)				Trash and debris that is blocking more than 20% of grate surface.	Trash and Debris	Grate free of trash and debris.
M, S					Grate missing or broken member(s) of the grate.	Damaged or Missing	Grate is in place and meets design standards.

Key:
A = Annual (March or April preferred)
M = Monthly
S = After major storms.

Comments:

SWMA # _____ Year: _____

2. Maintenance Checklist for Conveyance Systems

Frequency	Drainage System Feature	Y	N	NA	Conditions to Check For	Problem	Conditions That Should Exist
M, S	Pipes				Accumulated sediment that exceeds 20% of the diameter of the pipe.	Sediment & debris	Pipe cleaned of all sediment and debris.
M					Vegetation that reduces free movement of water through pipes.	Vegetation	All vegetation removed so water flows freely through pipes.
A					Protective coating is damaged; rust is causing more than 50% deterioration to any part of pipe.	Damaged (rusted, bent, or crushed) Trash & debris Sediment buildup	Pipe repaired or replaced.
M					Any dent that significantly impedes flow (i.e., decreases the cross section area of pipe by more than 20%)		Pipe repaired or replaced.
M					Pipe has major cracks or tears allowing groundwater leakage.		Pipe repaired or replaced.
M, S	Open Ditches				Dumping of yard waste such as grass clippings and branches into basin. Unsightly accumulation of non-degradable materials such as glass, plastic, metal, foam, and coated paper.	Trash & debris	Remove trash and debris and dispose as prescribed by city Waste Management Section.
M					Accumulated sediment that exceeds 20% of the design depth	Sediment buildup	Ditch cleaned of all sediment and debris so that it matches design.
A					Vegetation (e.g., weedy shrubs or saplings) that reduces free movement of water through ditches.	Vegetation	Water flows freely through ditches. Grassy vegetation should be left alone.
M					See "Ponds" Checklist	Erosion damage to slopes	See “Ponds” Checklist.
A					Maintenance person can see native soil beneath the rock lining.	Rock lining out of place or missing (if applicable)	Replace rocks to design standard.
Varies	Catch Basins				See "Catch Basins" Checklist		See “Catch Basins” Checklist.
M, S	Swales				See above for "Ditches"	Trash & debris	See above for “Ditches”.
M					See above for "Ditches"	Sediment Buildup	Vegetation may need to be replanted after cleaning.
M					Grass cover is sparse and weedy or areas are overgrown with woody vegetation.	Vegetation not growing or overgrown.	Aerate soils and reseed and mulch bare areas. Maintain grass height at minimum of 6 inches for best stormwater treatment or a minimum of 2 inches above the design flow depth. Remove woody growths, recontour, and reseed as necessary.
M, S					See Ponds Checklist	Erosion damage to slopes	See Ponds Checklist.
M					Swale has been filled in or blocked by shed, woodpile, shrubbery, etc.	Conversion by homeowner to incompatible use	If possible, speak with homeowner and request that swale be restored. Contact City to report a problem if not rectified voluntarily.
A					Water stands in swale or flow velocity is very slow. Stagnation occurs.	Swale does not drain.	A survey may be needed to check grades. Grades need to be in 1-5% range if possible. If grade is less than 1% underdrains may need to be installed.

Key:
A = Annual (March or April preferred)
M = Monthly
S = After major storms.

Comments:

3. Maintenance checklist for Ponds.

Frequency	Drainage System Feature	Y	N	NA	Conditions to Check For	Problem	Conditions That Should Exist
M, S	General				Any trash and debris which exceeds 1 cubic foot per 1000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash & debris buildup in pond	Trash and debris cleared from site.
M, S					Bar screen over outlet more than 25% covered by debris or missing.	Trash rack plugged or missing	Replace screen. Remove trash and debris and dispose as prescribed by City Waste Management Section.
M					Any poisonous vegetation which may constitute a hazard to the public. Examples of poisonous vegetation include: tansy ragwort, poison oak, stinging nettles, devils club.	Poisonous Vegetation	Remove poisonous vegetation. Do not spray chemicals on vegetation without obtaining guidance from the Cooperative Extension Service and approval from the City.
M, S					Oil, gasoline, or other contaminants of one gallon or more or any amount found that could: 1) cause damage to plant, animal, or marine life; 2) constitute a fire hazard; or 3) be flushed downstream during rain storms. Presence of chemicals such as natural gas, obnoxious color, odor, or sludge noted.	Fire hazard or pollution	Find sources of pollution and eliminate them. Water is free from noticeable color, odor or contamination.
M					For grassy ponds, gross cover is sparse and weedy or is overgrown. For wetland ponds, plants are sparse or invasive species are present. Wetland ponds must be kept wet--water frequently in summer.	Vegetation not growing or is overgrown.	For grassy ponds, selectively thatch, aerate and reseed ponds. Grass cutting unnecessary unless dictated by aesthetics. For wetland ponds, hand-plant nursery-grown wetland plants in bare areas. Pond bottoms should have uniform dense coverage of desired plant species.
M					Any evidence of rodent holes if facility is acting as a dam or berm., or any evidence of water piping through dam or berm via rodent holes.	Rodent holes	Rodents destroyed and dam or berm repaired.
M					Dams resulting in a change or function of the facility	Beaver Dam	Rodents and dam/berm removed.
M					When insects such as wasps and hornets interfere with maintenance activities, or when mosquitoes become a nuisance.	Insects	Insects destroyed or removed from site.
A					Tree growth does not allow maintenance access or interfere with maintenance activity (i.e., slope mowing, silt removal, or equipment movements). If trees are not interfering with access, leave trees alone.	Tree growth	Trees do not hinder maintenance activities. Selectively cultivate trees such as alder for firewood.

Key:
A = Annual (March or April preferred)
M = Monthly
S = After major storms.

Comments:

3. Maintenance checklist for Ponds (Continued)

Frequency	Drainage System Feature	Y	N	NA	Conditions To Check For	Problem	Conditions That Should Exist
M	Side Slopes of Pond				Check around inlets and outlets for signs of erosion. Check berms for signs of sliding or settling. Action is needed where eroded damage over 2 inches deep and where there is potential for continued erosion.	Erosion on berms or at entrance/exit.	Find causes of erosion and eliminate them. Then slopes should be stabilized by using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
M	Storage Area				Accumulated sediment that exceeds 10% of the designed pond depth. Buried or partially buried outlet structure probably indicates significant sediment deposits.	Sediment buildup in pond.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
A	Pond Dikes				Any part of dike which has settled 4 inches lower than the design elevation.	Settlement	Dike should be built back to the design elevation.
A	Emergency overflow spillway				Only one layer of rock exists above native soil in area 5 square feet or larger, or any exposure of native soil.	Rock Missing	Replace rocks to design standards.

Key:
A = Annual (March or April preferred)
M = Monthly
S = After major storms.

Comments:

4. Maintenance Checklist for Infiltration Systems

Frequency	Drainage System Feature	Y	N	NA	Conditions to Check For	Problem	Conditions That Should Exist
M, S	General				See "Ponds" Standard No. 3	Trash & Debris	See "Ponds" Standard No. 3
M					See "Ponds" Standard No. 3	Poisonous Vegetation	See "Ponds" Standard No. 3
M, S					See "Ponds" Standard No. 3	Pollution	See "Ponds" Standard No. 3
M					See "Ponds" Standard No. 3	Unmowed Grass/ Ground Cover	See "Ponds" Standard No. 3
M					See "Ponds" Standard No. 3	Rodent Holes	See "Ponds" Standard No. 3
M					See "Ponds" Standard No. 3	Insects	See "Ponds" Standard No. 3
M	Storage Area				A percolation test-pit or test of facility indicates facility is only working at 90% of its designed capabilities.	Sediment	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
M					Sheet cover is visible and has more than three 1/4 – inch holes in it.	Sheet Cover (if applicable)	Sheet cover repaired or replaced.
M, S					Any sediment and debris filling vault to 10% of depth from sump bottom to bottom of outlet pipe or obstructing flow into the connector pipe.	Sump Filled with Sediment and Debris (if applicable)	Clean out sump to design depth.
M, S	Filter Bags				Sediment and debris fill bag more than ½ full.	Filled with Sediment and Debris	Replace filter bag or redesign system.
M, S	Rock Filters				By visual inspection, little or no water flows through the filter during heavy rain storms.	Sediment and Debris	Replace gravel in rock filter.

Key:
A = Annual (March or April preferred)
M = Monthly
S = After major storms.

Comments:

SWMA # _____ Year: _____

5. Access Roads/Easements

Frequency	Drainage System Feature	Y	N	NA	Conditions to Check For	Problem	Conditions That Should Exist
W	General				Road shall be swept weekly.	Trash and Debris	Trash and debris cleared from site.
W					Debris which could damage vehicle tires (glass or metal)	Blocked Roadway	Roadway free of debris which could damage tires.
M, S					Any obstructions which reduce clearance above road surface to less than 14 feet.		Roadway overhead clear to 14 feet high.
W, S					Any obstructions restricting the access to a 10-to-20 -foot width for a distance of more than 12 feet or any point restricting access to less than a 10-foot width.		Obstruction removed to allow at least a 12 foot access.
M	Road Surface				When any surface defect exceeds 6-inches in depth and 6 square feet in area. In general, any surface defect which hinders or prevents maintenance access.	Settlement, Potholes, Mush, Spots, Ruts	Road surface uniformly smooth with no evidence of settlement, potholes, mush spots or ruts.
					Weeds growing in the road surface that are more than 6 inches tall and less than 6 inches apart within a 400-square foot area.	Vegetation in Road Surface	Road surface free to weeds taller than 2 inches.
M, S	Shoulders and Ditches				Erosion within 1 foot of the roadway more than 8 inches wide and 6 inches deep.	Erosion Damage	Shoulder free of erosion and matching the surrounding road.
M					Weeds and brush exceed 18 inches in height or hinder maintenance access.	Weeds and Brush	Weeds and brush cut to 2 inches in height or cleared in such a way as to allow maintenance access.
SA	Pavement Markings				Pavement marks shall be painted yearly.	Faded Marks	All pavement markings to be obvious.

Key:

SA = Annual (March or April preferred)
M = Monthly
W = Weekly (see schedule)
S = After major storms.

Comments:

6. Maintenance Checklist for Closed Detention Systems (Pipes/Tanks)

Frequency	Drainage System Feature	Y	N	NA	Conditions to Check For	Problem	Conditions That Should Exist
M	Storage Area (Pipe/Tank)				One-half of the end area of a vent is blocked at any point with debris and sediment. Plugged vent can cause storage area to collapse.	Plugged air vents (small pipe that connects catch basin to storage pipe)	Vents free of debris and sediment.
M					Accumulated sediment depth exceeds 15% of diameter. Example: 72-inch storage tank would require cleaning when sediment reaches depth of 10 inches.	Debris and Sediment	All sediment and debris removed from storage area. Contact City Public Works for guidance on sediment removal and disposal.
A					Any crack allowing material to leak into facility.	Joints between tank/pipe sections.	All joints between tank/pipe sections are sealed.
A					Any part of tank/pipe is noticeably bent out of shape.	Tank/pipe bent out of shape.	Tank/pipe repaired or replaced to design. Contact a professional engineer for evaluation.
M, S	Manhole				Cover is missing or only partially in place. Any open manhole requires maintenance.	Cover not in place.	Manhole is closed.
A					Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than ½-inch of thread (may not apply to self-locking lids).	Locking mechanism not working	Mechanism opens with proper tools.
A					Control device is not working properly due to missing, out of place, or bent orifice plate.	Damaged or Missing	Plate is in place and works as designed.
A					One maintenance person cannot remove lid after applying 80 pounds of lift. Intent is to keep cover from sealing off access to maintenance.	Cover difficult to remove.	Cover can be removed and reinstalled by one maintenance person.
A					Maintenance person judges that ladder is unsafe due to missing rungs, misalignment, not securely attached to structure, rust, or cracks.	Ladder rungs unsafe	Ladder meets design standards and allows maintenance persons safe access.

Key:

A = Annual (March or April preferred)
M = Monthly
S = After major storms.

Comments:

SWMA # _____ Year: _____

7. Maintenance Checklist for Control Structure/Flow Restrictor (structure that controls rate at which water exits facility)

Frequency	Drainage System Feature	Y	N	NA	Conditions to Check For	Problem	Conditions That Should Exist
M	Structure				Distance between debris buildup and bottom of orifice plate is less than 1 ½ feet	Trash and debris (includes sediment)	All trash and debris removed.
A					Structure is not securely attached to manhole wall and outlet pipe structure should support at least 1,000 pounds of up or down pressure.	Structural damage	Structure securely attached to wall and outlet pipe.
A					Structure is not in upright position (allow up to 10% from plumb).		Structure in correct position.
A					Connections to outlet pipe are not watertight and show signs of rust.		Connections to outlet pipe are watertight; structure repaired or replaced and works as designed.
M					Any holes (other than designed holes) in the structure.		Structure has no holes other than designed holes.
M, S	Cleanout Gate				Cleanout gate is not watertight or is missing.	Damaged or missing	Gate is watertight and works as designed.
A					Gate cannot be moved up and down by one maintenance person.		Gates moves up and down easily and is watertight.
M, S					Chain leading to gate is missing or damaged.		Chain is in place and works as designed.
A					Gate is rusted over 50% of its surface.		Gate is repaired or replaced to meet design standards.
M, S					Any trash, debris, sediment, or vegetation blocking the plate.	Obstructions	Plate is free of all obstructions and works as designed.
M, S	Overflow Pipe				Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Obstructions	Pipe is free of all obstructions and works as designed.

Key:

A = Annual (March or April preferred)
M = Monthly
S = After major storms.

Comments:

7a. Maintenance Checklist for Pump System

Frequency	Drainage System Feature	Y	N	NA	Conditions To Check For	Problem	Conditions That Should Exist
M	Pump Wetwell				Probe for sediment and check for floating debris.	Trash & Debris Includes sediment	All trash, debris, and sediment to be removed.
M	Pump float switches				Are the floats caught-up or intertwined.	Red alarm light	Floats should hang freely and at the proper spacing.
M	Pumps				Check amp draw. If high, pull pump.	Pumps are kicking out	Full load amps should be less than 6.9 amps.
A	Pumps				Pull pump and check oil reservoir to see if there is water.	Pumps are not pumping as they should.	Replace oil annually and seals and/or bearing if necessary.

Key:

A = Annual (March or April preferred)
M = Monthly
S = After major storms.

Comments:

SWMA # _____ Year: _____

8. Maintenance Checklist for Energy Dissipaters

Frequency	Drainage System Feature	Y	N	NA	Conditions to Check For	Problem	Conditions That Should Exist
A	Rock Pad				Only one layer of rock exists above native soil in area 5 square feet or larger, or any exposure of native soil.	Missing or moved rock	Replace rocks to design standard.
A	Rock-filled trench for the discharge from pond				Trench is not full of rock.	Missing or moved rock	Add large rock (+30 lb. Each) so that rock is visible above edge of trench.
M	Dispersion Trench				Accumulated sediment that exceeds 20% of the design depth.	Pipe plugged with sediment	Pipe cleaned/flushed.
M					Over ½ of perforations in pipe are plugged with debris and sediment.	Perforations plugged	Clean or replace perforated pipe.
M, S					Visual evidence of water at concentrated points along trench (normal condition is a "sheet flow" of water along trench). Intent is to prevent erosion damage.	Not discharging water properly	Trench must be redesigned or rebuilt to standard. Elevation of lip of trench should be the same (flat) at all points.
M, S					Maintenance person observes water flowing out during any storm less than the design storm or it is causing or appears likely to cause damage.	Water flows out top of "distribution" catch basin	Facility must be rebuilt or redesigned to standards. Pipe is probably plugged or damaged and needs replacement.
M, S					Water in receiving area is causing or has potential of causing landslide.	Receiving area over-saturated.	Stabilize slope with grass or other vegetation, or rock if conditions is severe.

Comments:

9. Maintenance Checklist for Fencing/Shrubbery Screen/Other Landscaping

Frequency	Drainage System Feature	Y	N	NA	Conditions To Check For	Problem	Conditions That Should Exist
M	General				Any debris in the fence or screen that permits easy entry to a facility.	Missing or broken parts/dead shrubbery	Fence is mended or shrubs replaced to form a solid barrier to entry.
M, S					Erosion has resulted in an opening under a fence that allows entry by people or pets.	Erosion	Replace soil under fence so that no opening exceeds 4 inches in height.
M					Shrubbery is growing out of control or is infested with weeds.	Unruly vegetation	Shrubbery is trimmed and weeded to provide appealing aesthetics. Do not use chemicals to control weeds.
A	Wire Fences				Posts out of plumb more than 6 inches.	Damaged parts	Posts plumb to within 1 ½ inches of plumb.
A					Top rails bent more than 6 inches.		Top rail free of bends greater than 1 inch
A					Any part of fence (including posts, top rails, and fabric) more than 1 foot out of design alignment.		Fence is aligned and meets design standards.
A					Missing or loose tension wire.		Tension wire in place and holding fabric.
A					Missing or loose barbed wire that is sagging more than 2 ½ inches between posts.		Barbed wire in place with less than ¾-inch sag between posts.
A					Extension arm missing, broken, or bent out of shape more than 1 ½ inches.		Extension arm in place with no bends larger than ¾ inch.
A					Part or parts that have a rusting or scaling condition that has affected structural adequacy.	Deteriorated paint or protective coating.	Structurally adequate posts or parts with a uniform protective coating.
M					Openings in fabric are such that an 8-inch diameter ball could fit through.	Opening in fabric.	No openings in fabric.

Key:

A = Annual (March or April preferred)
M = Monthly
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Comments:

SWMA # _____ Year: _____

10. Maintenance Checklist for Grounds (Landscaping)

Frequency	Drainage System Feature	Y	N	NA	Conditions To Check For	Problem	Conditions That Should Exist
M	General				Weeds growing in more that 20% of the landscaped area (trees and shrubs only).	Weeds (nonpoisonous)	Weeds present in less than 5% of the landscaped area.
M					Any presence of poison ivy or other poisonous vegetation or insect nests.	Safety hazard	No poisonous vegetation or insect nests present in landscaped area.
M, S					See Ponds Checklist	Trash or litter	See Ponds Checklist
M, S					Noticeable rills are seen in landscaped areas.	Erosion of Ground Surface	Causes of erosion are identified and steps taken to slow down/spread out the water. Eroded areas are filled, contoured, and seeded.
A	Trees and shrubs				Limbs or parts of trees or shrubs that are split or broken which affect more than 25% of the total foliage of the tree or shrub.	Damage	Trim trees/shrubs to restore shape. Replace trees/shrubs with severe damage.
M					Trees or shrubs that have been blown down or knocked over.		Replant tree, inspecting for injury to stem or roots. Replace if severely damaged.
A					Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.		Place stakes and rubber-coated ties around young trees/shrubs for support.

Comments:

11. Maintenance Checklist for Bioretention Facilities

Frequency	Drainage System Feature	Y	N	NA	Conditions To Check For	Problem	Conditions That Should Exist
BA	General				Established vegetation with a minimum 80% survival rate.	Drought or drowning	Watering may be required during prolonged dry periods, even after plants are established. Replant vegetation for poor performing plants and/or barren soils.
BA, S					Maintain proper flow of stormwater from paved/impervious areas to bioretention facility.	Flow path blocked or detoured	Remove debris and re-direct water to inlet/entrance.
BA					Weeds growing in more that 20% of the landscaped area.	Evasive vegetation	Remove undesired weeds and vegetation.
A					Bare soils where mulch is missing.		Replace mulch to a depth of 2-3 inches.
BA					Any trash, debris, sediment, or vegetation blocking or clogging infrastructure.	Trash/debris	Remove all trash and debris from bioretention area.
A	Rock filled trench/pad				Vegetation clogging/blocking inlet and overflow infrastructures.		Remove vegetation within 1 foot of inlets and outfalls.
A					Sediment build up clogging infrastructure	Sediment	Remove sediment and replace soil, vegetation and mulch layer where erosion is visible.
A					Maintain proper infiltration rates and drainage. Check under-drains.		Clean/Jet under-drains.
BA					Check around inlets, outlets and sidewalls for signs of erosion. Check berms for signs of sliding or settling. Action is needed where eroded damage over 2 inches deep and where there is potential for continued erosion.		Remove sediment and re-grade side slopes. Replant and mulch where barren soils are exposed.

Key:

A = Annual (March or April preferred)
BA = Bi-Annual
M = Monthly
S = After major storms.

Comments:

12. Maintenance Checklist for Permeable Pavement

Frequency	Drainage System Feature	Y	N	NA	Conditions To Check For	Problem	Conditions That Should Exist
M	General				Accumulated sediment and debris deposits clogging pavement and reducing infiltration rate.	Sediment deposits	Plant vegetation or mulch on exposed soils. Use street sweeper with vacuum to clean surface or pressure washer.
M, S	Eco-Stone Pavers				Accumulated sediment and debris deposits clogging pavers and reducing infiltration rate.		Plant vegetation or mulch on exposed soils. Use street sweeper with vacuum to clean surface or pressure washer.
M					Pavers have cracks or are broken.	Damage	Replace individual broken pavers.
A					Weeds growing in between pavers	Weeds	Remove weeds manually. Do not apply herbicides.

Key:

A = Annual (March or April preferred)
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M = Monthly
S = After major storms.

Comments:

13. Maintenance Checklist for Vegetated Roof Surfaces

Frequency	Drainage System Feature	Y	N	NA	Conditions To Check For	Problem	Conditions That Should Exist
BA	Drainage				Accumulated sediment that exceeds 20% of the diameter of the pipe.	Trash and debris	Remove soil substrate, vegetation and debris.
BA					Vegetation that reduces free movement of water through pipes.		No vegetation blocking opening to basin. Remove all vegetation blocking flow.
BA	General				Inspect fire ventilation points for proper operation.	Fire & Safety	No damage to fire ventilation structures.
BA					Maintain easy access to ventilation points.		Access to ventilation and Fire & Safety structures is not blocked or damaged.
M					Presence of chemicals, fertilizers or contaminants from mechanical systems, weed control, or pet access.		Fix all damaged and leaking mechanisms and remove all pet waste.

Key:

A = Annual (March or April preferred)
BA = Bi-Annual
M = Monthly
S = After major storms.

Comments:

EXHIBIT 2

POLLUTION SOURCE CONTROL PROGRAM

WHAT ARE POLLUTION SOURCE CONTROLS, AND WHY ARE THEY NEEDED?

Pollution source controls are actions taken by a person or business to reduce the amount of pollution reaching surface and ground waters. Controls, also called "best management practices" (BMPs), include:

- Altering the activity (e.g., substitute non-toxic products, recycle used oil, reroute floor drains to sanitary sewer from storm sewer).
- Enclosing or covering the activity (e.g., building a roof)
- Segregating the activity (e.g., diverting runoff away from an area that is contaminated)
- Routing runoff from the activity to a treatment alternative (e.g., to a wastewater treatment facility, sanitary sewer, or stormwater treatment area).

Pollution source controls are needed because of the contamination found in runoff from commercial areas and the effect of this contamination on aquatic life and human health. Research on urban runoff in the Puget Sound area and elsewhere has found oil and grease, nutrients, organic substances, toxic metals, bacteria, viruses, and sediments at unacceptable levels. Effects of contaminated runoff include closure of shellfish harvesting areas and swimming areas, mortality of young fish and other aquatic organisms, tumors on fish, and impairment of fish reproduction.

PROFESSIONAL SERVICES

DESCRIPTION: Presented here are the remaining service businesses including theaters; hotels/motels; finance, banking, hospitals and medical services; nursing homes, schools and universities, and legal, financial and engineering services.

MATERIALS USED AND WASTES GENERATED: The primary concern is runoff from parking areas. Stormwater from parking lots will contain undesirable concentrations of oil and grease, suspended particulates, and metals such as lead, cadmium, and zinc. It will also contain the organic byproducts of engine combustion. Some also produce Dangerous Wastes, for example, hospitals, nursing homes, and other medical services. These materials are stored within the building until disposal.

REQUIRED ACTIONS: The following actions shall be taken to ensure that pollution generated on site shall be minimized:

1. Warning signs (e.g., "Dump No Waste--Drains to Stream") shall be painted or embossed on or adjacent to all storm drain inlets. They shall be repainted as needed.

2. Parking lots shall be swept when necessary to remove debris and, at a minimum, twice a year. Use of newer model high-velocity vacuum sweepers is recommended as they are more effective in removing the more harmful smaller particles from paved surfaces.

3. Sediment removed from ponds/catch basins shall be disposed of in a proper manner. Contact the City for instruction prior to completing this task.

4. No activities shall be conducted on site that is likely to result in short-term high-concentration discharge of pollution to the stormwater system. Such activities may include, but are not limited to; vehicle washing, vehicle maintenance, and cleaning of equipment used in the periodic maintenance of buildings and paved surfaces.

5. Employees shall receive basic instruction regarding the control of pollution from commercial operations. Contact the Public Works Department at (253) 863-8300.

6. Medical offices with high volume customer contacts have potential to influence individuals' water quality practices. Owners are encouraged to have informational brochures provided by the City (see Item 5 above) available in waiting rooms.

APPENDIX D

USEPA UIC Guidance Memorandum

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 13 2008

OFFICE OF
WATER

MEMORANDUM

SUBJECT: Clarification on which stormwater infiltration practices/technologies have the potential to be regulated as "Class V" wells by the Underground Injection Control Program

TO: Water Division Directors, Regions 1-10

FROM: Linda Boornazian, Director
Water Permits Division (MC 4203M)

Steve Heare, Director
Drinking Water Protection Division (MC 4606M)

Over the past several years stormwater infiltration has become an increasingly effective tool in the management of stormwater runoff. Although primary stormwater management responsibilities within EPA fall under the Clean Water Act (CWA), the infiltration of stormwater is, in some cases, regulated under the Safe Drinking Water Act (SDWA) with the goal of protecting underground sources of drinking water (USDWs). Surface and ground water protection requires effective integration between the overlapping programs. This memorandum is a step forward in that effort and is meant to provide clarification on stormwater implementation and green infrastructure, in particular under the CWA, which is consistent with the requirements of the SDWA's Underground Injection Control (UIC) Program.

In April 2007, EPA entered into a collaborative partnership with four national groups (the Association of State and Interstate Water Pollution Control Administrators, the Low Impact Development Center, the National Association of Clean Water Agencies, and the Natural Resources Defense Council) to promote green infrastructure as a cost-effective, sustainable, and environmentally friendly approach to stormwater management. The primary goals of this collaborative effort are to reduce runoff volumes and sewer overflow events through the use of green infrastructure wet weather management practices.

Within the context of this collaborative partnership, green infrastructure includes a suite of management practices that use soils and vegetation for infiltration, treatment, and evapotranspiration of stormwater. Rain gardens, vegetated swales, riparian buffers and porous pavements are all common examples of green infrastructure techniques that capture and treat stormwater runoff close to its source. Green infrastructure management practices typically do not include commercially manufactured or proprietary infiltration

devices or other infiltration practices such as simple drywells, which do not provide for pre-treatment prior to infiltration.

The partnership is promoting green infrastructure as an effective approach to stormwater management because these practices are associated with a number of environmental benefits. In addition to reducing and delaying runoff volumes, green infrastructure approaches can also reduce pollutant levels in stormwater, enhance ground water recharge, protect surface water from stormwater runoff, increase carbon sequestration, mitigate urban heat islands, and increase wildlife habitat.

Given the multiple benefits that green infrastructure can provide, EPA and its partners have increased efforts to incorporate green infrastructure techniques into stormwater management strategies nationwide. In recent years, public support for these practices has gradually increased. For more information on green infrastructure, please visit www.epa.gov/npdes/greeninfrastructure.

There are cases where stormwater infiltration practices are regulated as Class V wells under the UIC program, and State and local stormwater managers report that some developers are hesitant to incorporate green infrastructure practices because they fear regulatory approvals will slow the process and increase costs. EPA believes those fears are unfounded and notes that most green infrastructure practices do not meet the Class V well definition and can be installed without regulatory oversight by the UIC Program. However, EPA remains committed to the protection of USDWs and emphasizes the need for UIC program compliance (per 40 CFR 144).

To provide clarification on which stormwater infiltration techniques meet EPA's UIC Class V well definition, EPA's Office of Water has developed the attached "Class V Well Identification Guide." State or Regional stormwater and nonpoint source control programs, developers, and other interested parties are requested to contact the State or Regional UIC Program Director with primary authority for the UIC Class V program when considering the use of practices that have been identified, or potentially identified, as Class V wells. UIC program managers should consider the proximity to sensitive ground water areas when looking at the suitability of stormwater infiltration practices. Depending on local conditions, infiltration without pretreatment may not be appropriate in areas where ground waters are a source of drinking water or other areas identified by federal, state, or local governments as sensitive ground water areas, such as aquifers overlain with thin, porous soils.

Please share this memo and the attached guide with your State and Regional stormwater, nonpoint source control, UIC and other ground water managers, as well as with appropriate green infrastructure contacts. These programs are encouraged to coordinate on stormwater management efforts when sensitive ground water issues arise.

Attachment

Underground Injection Control (UIC) Program Class V Well Identification Guide

This reference guide can be used to determine which stormwater infiltration practices/technologies have the potential to be regulated as "Class V" wells. Class V wells are wells that are not included in Classes I through IV. Typically, Class V wells are shallow wells used to place a variety of fluids directly below the land surface. By definition, a well is "any bored, drilled, driven shaft, or dug hole that is deeper than its widest surface dimension, or an improved sinkhole, or a subsurface fluid distribution system" and an "injection well" is a "well" into which "fluids" are being injected (40 CFR §144.3). Federal regulations (40 CFR §144.83) require all owners/operators of Class V wells to submit information to the appropriate regulatory authorities including the following:

1. Facility name and location
2. Name and address of legal contact
3. Ownership of property
4. Nature and type of injection well(s)
5. Operating status of injection well(s)

For more information on Class V well requirements, please visit http://www.epa.gov/safewater/uic/class5/comply_minrequirements.html. For more information on green infrastructure, please visit http://www.epa.gov/npdes/greeninfrastructure.

The stormwater infiltration practices/technologies in rows A through I below are generally not considered to be wells as defined in 40 CFR §144.3 because typically they are not subsurface fluid distribution systems or holes deeper than their widest surface dimensions. If these practices/technologies are designed in an atypical manner to include subsurface fluid distribution systems and/or holes deeper than their widest surface dimensions, then they may be subject to the Class V UIC regulations. The stormwater infiltration practices/technologies in rows J through K however, depending upon their design and construction probably would be subject to UIC regulations.

	Infiltration Practice/Technology	Description	Is this Practice/Technology Generally Considered a Class V Well?
A	Rain Gardens & Bioretention Areas	Rain gardens and bioretention areas are landscaping features adapted to provide on-site infiltration and treatment of stormwater runoff using soils and vegetation. They are commonly located within small pockets of residential land where surface runoff is directed into shallow, landscaped depressions; or in landscaped areas around buildings; or, in more urbanized settings, to parking lot islands and green street applications.	No.
B	Vegetated Swales	Swales (e.g., grassed channels, dry swales, wet swales, or bioswales) are vegetated, open-channel management practices designed specifically to treat and attenuate stormwater runoff. As stormwater runoff flows along these channels, vegetation slows the water to allow sedimentation, filtering through a subsoil matrix, and/or infiltration into the underlying soils.	No.
C	Pocket Wetlands & Stormwater Wetlands	Pocket/Stormwater wetlands are structural practices similar to wet ponds that incorporate wetland plants into the design. As stormwater runoff flows through the wetland, pollutant removal is achieved through settling and biological uptake. Several design variations of the stormwater wetland exist, each design differing in the relative amounts of shallow and deep water, and dry storage above the wetland.	No.
D	Vegetated Landscaping	Self-Explanatory.	No.
E	Vegetated Buffers	Vegetated buffers are areas of natural or established vegetation maintained to protect the water quality of neighboring areas. Buffer zones slow stormwater runoff, provide an area where runoff can infiltrate the soil, contribute to ground water recharge, and filter sediment. Slowing runoff also helps to prevent soil and stream bank erosion.	No

	Infiltration Practice/Technology	Description	Is this Practice/Technology Generally Considered a Class V Well?
F	Tree Boxes & Planter Boxes	Tree boxes and planter boxes are generally found in the right-of-ways alongside city streets. These areas provide permeable areas where stormwater can infiltrate. The sizes of these boxes can vary considerably.	No.
G	Permeable Pavement	Permeable pavement is a porous or pervious pavement surface, often built with an underlying stone reservoir that temporarily stores surface runoff before it infiltrates into the subsoil. Permeable pavement is an environmentally preferable alternative to traditional pavement that allows stormwater to infiltrate into the subsoil. There are various types of permeable surfaces, including permeable asphalt, permeable concrete and even grass or permeable pavers.	No.
H	Reforestation	Reforestation can be used throughout a community to reestablish forested cover on a cleared site, establish a forested buffer to filter pollutants and reduce flood hazards along stream corridors, provide shade and improve aesthetics in neighborhoods or parks, and improve the appearance and pedestrian comfort along roadsides and in parking lots.	No.
I	Downspout Disconnection	A practice where downspouts are redirected from sewer inlets to permeable surfaces where runoff can infiltrate.	In certain circumstances, for example, when downspout runoff is directed towards vegetated/pervious areas or is captured in cisterns or rain-barrels for reuse, these practices generally would not be considered Class V wells.
J	Infiltration Trenches	An infiltration trench is a rock-filled trench designed to receive and infiltrate stormwater runoff. Runoff may or may not pass through one or more pretreatment measures, such as a swale, prior to entering the trench. Within the trench, runoff is stored in the void space between the stones and gradually infiltrates into the soil matrix. There are a number of different design variations.	In certain circumstances, for example, if an infiltration trench is “deeper than its widest surface dimension,” or includes an assemblage of perforated pipes, drain tiles, or other similar mechanisms intended to distribute fluids below the surface of the ground, it would probably be considered a Class V injection well.

	Infiltration Practice/Technology	Description	Is this Practice/Technology Generally Considered a Class V Well?
K	Commercially Manufactured Stormwater Infiltration Devices	Includes a variety of pre-cast or pre-built proprietary subsurface detention vaults, chambers or other devices designed to capture and infiltrate stormwater runoff.	These devices are generally considered Class V wells since their designs often meet the Class V definition of subsurface fluid distribution system.
L	Drywells, Seepage Pits, Improved Sinkholes.	Includes any bored, drilled, driven, or dug shaft or naturally occurring hole where stormwater is infiltrated.	These devices are generally considered Class V wells if stormwater is directed to any bored, drilled, driven shaft, or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system.

APPENDIX E

2004 Modeling Results

WESTERN WASHINGTON HYDROLOGY MODEL V2
PROJECT REPORT

Project Name: Sumner Site A.2
Site Address:
City : Sumner
Report Date : 1/21/2004
Gage : McMillian
Data Start : 1948
Data End : 1996
Precip Scale: 1.00

PREDEVELOPED LAND USE

Basin : Combo Basin B1-B4
Flows To : Outflow
GroundWater: No

Land Use	Acres
TILL FOREST:	13.01
OUTWASH FOREST:	145.99

DEVELOPED LAND USE
Basin : Combo Basin B1-B4
Flows To : Outflow
GroundWater: No

Land Use	Acres
TILL GRASS:	3.78
OUTWASH GRASS:	50.63
IMPERVIOUS:	104.59

MITIGATED (POND) INFORMATION

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped

Return Period	Flow(cfs)
2 year	0.295
year	0.491
0 year	0.645
25 year	0.867
0 year	1.052
00 year	1.254

Flow Frequency Return Periods for Developed Unmitigated

Return Period	Flow(cfs)
year	30.555
5 year	41.092
10 year	48.604
5 year	58.725
0 year	66.733
100 year	75.152

Flow Frequency Return Periods for Developed Mitigated

Return Period	Flow(cfs)

2 year	30.555
5 year	41.092
10 year	48.604
25 year	58.725
50 year	66.733
100 year	75.152

Yearly Peaks for Pre and Post Developed

Year	Predeveloped	Developed
1949	0.394	23.961
1950	0.338	32.034
1951	0.904	43.066
1952	0.186	18.540
1953	0.209	34.311
1954	0.255	30.418
1955	0.243	22.296
1956	0.461	28.218
1957	0.177	65.795
1958	0.199	25.163
1959	0.258	26.235
1960	1.280	80.482
1961	0.388	25.325
1962	0.121	22.376
1963	0.860	54.826
1964	0.334	26.656
1965	0.323	41.956
1966	0.810	42.343
1967	0.385	27.706
1968	0.196	37.412
1969	0.253	53.904
1970	0.174	23.849
1971	0.274	25.785
1972	0.455	25.833
1973	0.169	32.622
1974	0.564	44.164
1975	0.330	22.697
1976	0.351	29.812
1977	0.068	18.448
1978	0.674	42.831
1979	0.354	41.022
1980	0.480	28.392
1981	0.262	42.417
1982	0.393	31.373
1983	0.208	43.665
1984	0.102	28.284
1985	0.155	17.812
1986	0.319	28.245
1987	0.734	41.178
1988	0.231	32.236
1989	0.185	30.938
1990	0.402	20.914
1991	0.353	37.744
1992	0.211	25.034
1993	0.415	22.078
1994	0.136	18.465
1995	0.122	40.707
1996	0.390	30.604

Ranked Yearly Peaks for Pre and Post Developed

Rank	Predeveloped	Developed
1	0.9042	65.7948
2	0.8603	54.8262
3	0.8102	53.9042
4	0.7338	44.1641
5	0.6739	43.6652
6	0.5637	43.0657
7	0.4798	42.8314
8	0.4606	42.4169
9	0.4552	42.3432

10	0.4147	41.9557
11	0.4024	41.1781
12	0.3937	41.0215
13	0.3928	40.7067
14	0.3897	37.7441
15	0.3878	37.4115
16	0.3846	34.3109
17	0.3542	32.6216
18	0.3534	32.2357
19	0.3506	32.0343
20	0.3378	31.3730
21	0.3340	30.9375
22	0.3299	30.6043
23	0.3231	30.4177
24	0.3192	29.8116
25	0.2738	28.3916
26	0.2618	28.2844
27	0.2584	28.2449
28	0.2553	28.2184
29	0.2529	27.7056
30	0.2430	26.6559
31	0.2309	26.2345
32	0.2112	25.8326
33	0.2095	25.7847
34	0.2081	25.3246
35	0.1991	25.1629
36	0.1960	25.0340
37	0.1857	23.9612
38	0.1850	23.8491
39	0.1765	22.6967
40	0.1742	22.3763
41	0.1694	22.2955
42	0.1551	22.0784
43	0.1363	20.9137
44	0.1215	18.5401
45	0.1212	18.4647
46	0.1018	18.4480
47	0.0681	17.8124

1/2 2 year to 50 year

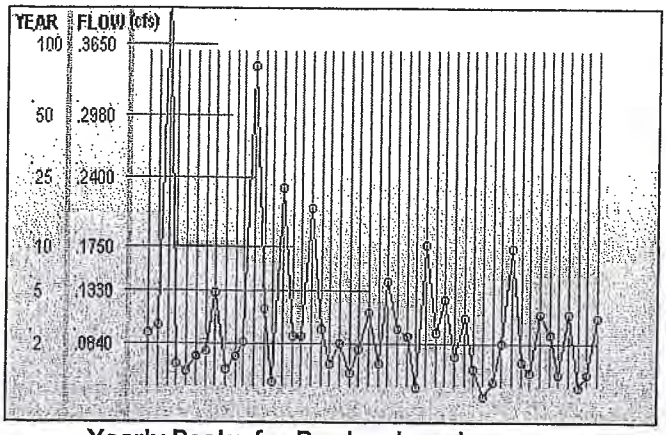
Flow(CFS)	Predev	Final	Percentage	Pass/Fail
.1475	4066	67786	1667.0	Fail
.1566	3505	66650	1901.0	Fail
0.1658	3053	65514	2145.0	Fail
0.1749	2665	64546	2421.0	Fail
.1840	2323	63494	2733.0	Fail
.1932	2084	62568	3002.0	Fail
0.2023	1873	61685	3293.0	Fail
0.2115	1678	60843	3625.0	Fail
.2206	1504	60128	3997.0	Fail
0.2297	1354	59370	4384.0	Fail
0.2389	1197	58697	4903.0	Fail
0.2480	1057	57940	5481.0	Fail
.2571	932	57267	6144.0	Fail
0.2663	830	56635	6823.0	Fail
0.2754	731	56004	7661.0	Fail
.2845	655	55415	8460.0	Fail
.2937	587	54868	9347.0	Fail
0.3028	519	54363	10474.0	Fail
0.3120	462	53900	11666.0	Fail
.3211	404	53269	13185.0	Fail
.3302	350	52806	15087.0	Fail
0.3394	308	52301	16980.0	Fail
0.3485	273	51839	18988.0	Fail
.3576	243	51376	21142.0	Fail
.3668	217	50913	23462.0	Fail
0.3759	193	50450	26139.0	Fail
0.3850	178	49987	28082.0	Fail
.3942	156	49566	31773.0	Fail
.4033	141	49146	34855.0	Fail
0.4125	137	48767	35596.0	Fail

0.4216	123	48388	39339.0	Fail
0.4307	112	48052	42903.0	Fail
0.4399	100	47715	47715.0	Fail
0.4490	95	47378	49871.0	Fail
0.4581	85	47000	55294.0	Fail
0.4673	75	46663	62217.0	Fail
0.4764	67	46327	69144.0	Fail
0.4855	60	45990	76650.0	Fail
0.4947	55	45695	83081.0	Fail
0.5038	51	45359	88939.0	Fail
0.5130	48	45022	93795.0	Fail
0.5221	47	44686	95076.0	Fail
0.5312	43	44391	103234.0	Fail
0.5404	37	44096	119178.0	Fail
0.5495	37	43802	118383.0	Fail
0.5586	35	43507	124305.0	Fail
0.5678	32	43255	135171.0	Fail
0.5769	30	42960	143200.0	Fail
0.5860	26	42666	164100.0	Fail
0.5952	25	42371	169484.0	Fail
0.6043	24	42077	175320.0	Fail
0.6135	20	41833	209164.0	Fail
0.6226	17	41597	244688.0	Fail
0.6317	17	41340	243176.0	Fail
0.6409	15	41105	274033.0	Fail
0.6500	14	40836	291685.0	Fail
0.6591	12	40613	338441.0	Fail
0.6683	11	40402	367290.0	Fail
0.6774	10	40200	402000.0	Fail
0.6865	9	39998	444422.0	Fail
0.6957	8	39792	497400.0	Fail
0.7048	7	39611	565871.0	Fail
0.7140	7	39426	563228.0	Fail
0.7231	7	39190	559857.0	Fail
0.7322	6	38980	649666.0	Fail
0.7414	5	38795	775900.0	Fail
0.7505	5	38597	771940.0	Fail
0.7596	5	38395	767900.0	Fail
0.7688	5	38147	762940.0	Fail
0.7779	5	37945	758900.0	Fail
0.7870	5	37734	754680.0	Fail
0.7962	4	37541	938525.0	Fail
0.8053	4	37339	933475.0	Fail
0.8145	3	37133	1237766.0	Fail
0.8236	3	36943	1231433.0	Fail
0.8327	3	36754	1225133.0	Fail
0.8419	3	36590	1219666.0	Fail
0.8510	3	36363	1212100.0	Fail
0.8601	3	36220	1207333.0	Fail
0.8693	2	36026	1801300.0	Fail
0.8784	2	35862	1793100.0	Fail
0.8875	2	35719	1785950.0	Fail
0.8967	2	35538	1776900.0	Fail
0.9058	1	35370	3537000.0	Fail
0.9150	1	35197	3519700.0	Fail
0.9241	1	35008	3500800.0	Fail
0.9332	1	34840	3484000.0	Fail
0.9424	1	34684	3468400.0	Fail
0.9515	1	34516	3451600.0	Fail
0.9606	1	34343	3434300.0	Fail
0.9698	1	34179	3417900.0	Fail
0.9789	1	34023	3402300.0	Fail
0.9880	1	33863	3386300.0	Fail
0.9972	1	33699	3369900.0	Fail
1.0063	1	33518	3351800.0	Fail
1.0155	1	33396	3339600.0	Fail
1.0246	1	33249	3324900.0	Fail
1.0337	1	33102	3310200.0	Fail
1.0429	1	32938	3293800.0	Fail
1.0520	1	32769	3276900.0	Fail

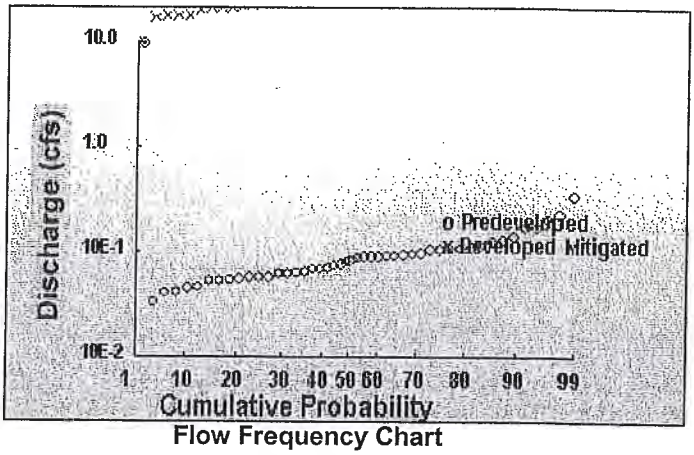
The development has an increase in flow durations from 1/2 predeveloped 2 year flow to the 2 year flow

or more than a 10% increase from the 2 year to the 50 year flow.
The Development Has an increase in flow durations for more than 50% of the flows from the 2 year to the 50 year flow.

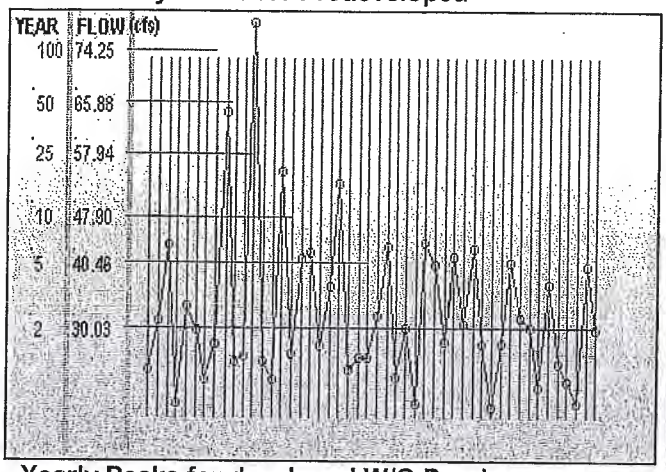
Water Quality BMP Flow and Volume.
On-line facility volume: 11.65 acre-feet
On-line facility target flow: 14.3 cfs.
Adjusted for 15 min: 18.2 cfs.
Off-line facility volume: 16.6 acre-feet
On-line facility target flow: 8.37 cfs.
Adjusted for 15 min: 10.6 cfs.



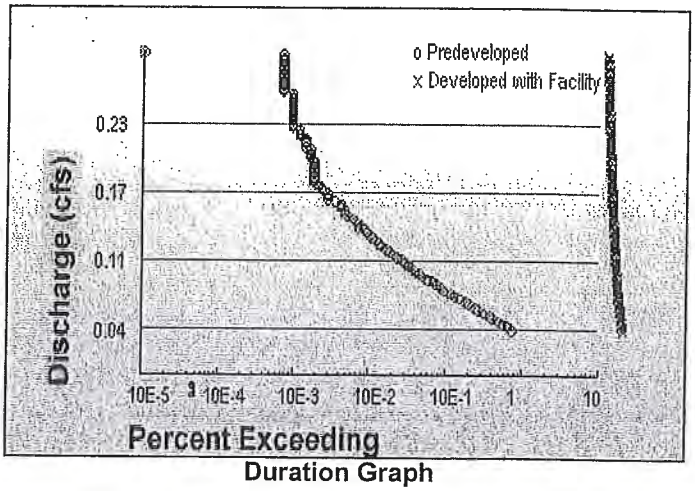
Yearly Peaks for Predeveloped



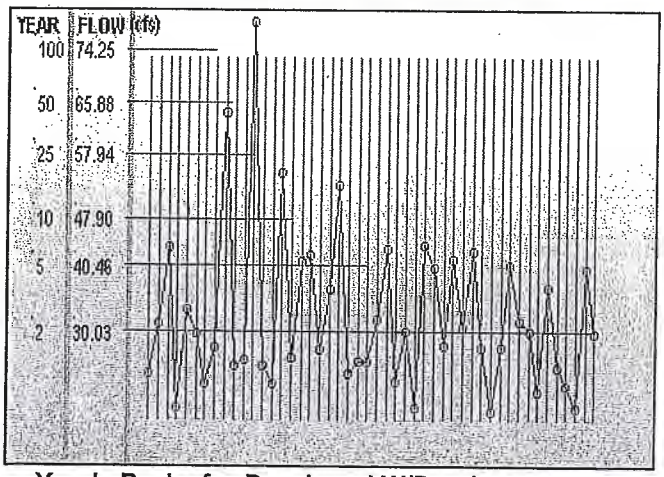
Flow Frequency Chart



Yearly Peaks for developed W/O Pond



Duration Graph



Yearly Peaks for Developed W/Pond

BASIN B TOTAL - FOR REGIONAL FACILITY SITE A.2 HYDROLOGIC CALCULATIONS

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	85.97	51.58	34.39
Medium Density Residential	0.00	0.00	0.00
High Density Residential/Commercial/Industrial	28.32	2.83	25.49
Industrial/Agricultural	0.00	0.00	0.00
Impervious	44.71	0.00	44.71
TOTAL AREA	**159.00**	**54.41**	**104.59**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	81.02	40%	48.61	32.41	77
Low Density Residential	C	4.95	40%	2.97	1.98	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	0.00	50%	0.00	0.00	80
Medium Density Residential	C	0.00	50%	0.00	0.00	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	20.26	90%	2.03	18.23	85
High Density Residential/Commercial/Industrial	C	8.06	90%	0.81	7.25	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	44.71	100%	0.00	44.71	-
TOTALS		**159.00**		**54.41**	**104.59**	

WEIGHTED PERVIOUS CN **78**

SITE B MODEL PARAMETERS:

LAND USE	SOIL GRP	ACRES
Landscaping - Pervious	A/B	50.64
Landscaping - Pervious	C/D	3.78
Roofs - Impervious	A/B	47.676
Roofs - Impervious	C/D	4.617
Roads, Etc - Impervious	A/B	47.676
Roads, Etc - Impervious	C/D	4.617
		159

SUBBASIN B1

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	17.79	10.67	7.12
Medium Density Residential	0.00	0.00	0.00
High Density Residential/Commercial/Industrial	0.00	0.00	0.00
Industrial/Agricultural	0.00	0.00	0.00
Impervious	37.95	0.00	37.95
TOTAL AREA	**55.74**	**10.67**	**45.07**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	12.84	40%	7.70	5.14	77
Low Density Residential	C	4.95	40%	2.97	1.98	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	0.00	50%	0.00	0.00	80
Medium Density Residential	C	0.00	50%	0.00	0.00	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	0.00	90%	0.00	0.00	85
High Density Residential/Commercial/Industrial	C	0.00	90%	0.00	0.00	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	37.95	100%	0.00	37.95	-
TOTALS		**55.74**		**10.67**	**45.07**	

WEIGHTED PERVIOUS CN **78**

SUBBASIN B2

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	42.50	25.50	17.00
Medium Density Residential	0.00	0.00	0.00
High Density Residential/Commercial/Industrial	28.32	2.83	25.49
Industrial/Agricultural	0.00	0.00	0.00
Impervious	0.00	0.00	0.00
TOTAL AREA	**70.82**	**28.33**	**42.49**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	42.50	40%	25.50	17.00	77
Low Density Residential	C	0.00	40%	0.00	0.00	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	0.00	50%	0.00	0.00	80
Medium Density Residential	C	0.00	50%	0.00	0.00	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	20.26	90%	2.03	18.23	85
High Density Residential/Commercial/Industrial	C	8.06	90%	0.81	7.25	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	0.00	100%	0.00	0.00	-
TOTALS		**70.82**		**28.33**	**42.49**	

WEIGHTED PERVIOUS CN **78**

SUBBASIN B3

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	25.68	15.41	10.27
Medium Density Residential	0.00	0.00	0.00
High Density Residential/Commercial/Industrial	0.00	0.00	0.00
Industrial/Agricultural	0.00	0.00	0.00
Impervious	0.00	0.00	0.00
TOTAL AREA	**25.68**	**15.41**	**10.27**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	25.68	40%	15.41	10.27	77
Low Density Residential	C	0.00	40%	0.00	0.00	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	0.00	50%	0.00	0.00	80
Medium Density Residential	C	0.00	50%	0.00	0.00	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	0.00	90%	0.00	0.00	85
High Density Residential/Commercial/Industrial	C	0.00	90%	0.00	0.00	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	0.00	100%	0.00	0.00	-
TOTALS		**25.68**		**15.41**	**10.27**	

WEIGHTED PERVIOUS CN **77**

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SUBBASIN B4

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	0.00	0.00	0.00
Medium Density Residential	0.00	0.00	0.00
High Density Residential/Commercial/Industrial	0.00	0.00	0.00
Industrial/Agricultural	0.00	0.00	0.00
Impervious	6.76	0.00	6.76
TOTAL AREA	**6.76**	**0.00**	**6.76**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	0.00	40%	0.00	0.00	77
Low Density Residential	C	0.00	40%	0.00	0.00	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	0.00	50%	0.00	0.00	80
Medium Density Residential	C	0.00	50%	0.00	0.00	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	0.00	90%	0.00	0.00	85
High Density Residential/Commercial/Industrial	C	0.00	90%	0.00	0.00	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	6.76	100%	0.00	6.76	-
TOTALS		**6.76**		**0.00**	**6.76**	

WEIGHTED PERVIOUS CN **#DIV/0!**

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WESTERN WASHINGTON HYDROLOGY MODEL V2
PROJECT REPORT

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roject Name: Site D (East Neighborhood)
Site Address:
City : Sumner
eport Date : 1/21/2004
age : McMillian
Data Start : 1948
Data End : 1996
recip Scale: 1.00

REDEVELOPED LAND USE

asin : Basin 1
lows To : Outflow
GroundWater: No

and Use	Acres
ILL PASTURE:	41.24
OUTWASH PASTURE:	13.26

EVELOPED LAND USE
asin : Basin 1
Flows To : Pond 1
roundWater: No

Land Use	Acres
TILL GRASS:	23.22
UTWASH GRASS:	6.31
MPERVIOUS:	24.97

CHRES (POND) INFORMATION
ond Name: Pond 1
ond Type: Trapezoidal Pond
Pond Flows to : Outflow
imensions
epth: 5ft.
Bottom Length: 531ft.
Bottom Width : 270.33ft.
ide slope 1: 3 To 1
ide slope 2: 3 To 1
Side slope 3: 3 To 1
ide slope 4: 3 To 1
olume at Riser Head: 14.082 acre-ft.
Discharge Structure
Riser Height: 4 ft.
iser Diameter: 18 ft.
rifice 1 Diameter: 3.91 in. Elevation: 0 ft.
Orifice 2 Diameter: 12.19 in. Elevation: 3.83697467889908 ft.
Orifice 3 Diameter: 53.59 in. Elevation: 4.19663853211009 ft.

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Pond Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
.000	3.295	0.000	0.000	0.000
.056	3.301	0.183	0.095	0.000
.111	3.308	0.367	0.134	0.000

0.167	3.314	0.551	0.164	0.000
0.222	3.320	0.735	0.189	0.000
0.278	3.326	0.920	0.212	0.000
0.333	3.332	1.105	0.232	0.000
0.389	3.338	1.290	0.250	0.000
0.444	3.345	1.476	0.268	0.000
0.500	3.351	1.662	0.284	0.000
0.556	3.357	1.848	0.299	0.000
0.611	3.363	2.034	0.314	0.000
0.667	3.369	2.222	0.328	0.000
0.722	3.375	2.409	0.341	0.000
0.778	3.382	2.597	0.354	0.000
0.833	3.388	2.785	0.367	0.000
0.889	3.394	2.973	0.379	0.000
0.944	3.400	3.162	0.390	0.000
1.000	3.407	3.351	0.402	0.000
1.056	3.413	3.540	0.413	0.000
1.111	3.419	3.730	0.423	0.000
1.167	3.425	3.920	0.434	0.000
1.222	3.431	4.111	0.444	0.000
1.278	3.438	4.301	0.454	0.000
1.333	3.444	4.493	0.464	0.000
1.389	3.450	4.684	0.473	0.000
1.444	3.457	4.876	0.483	0.000
1.500	3.463	5.068	0.492	0.000
1.556	3.469	5.261	0.501	0.000
1.611	3.475	5.454	0.510	0.000
1.667	3.482	5.647	0.518	0.000
1.722	3.488	5.840	0.527	0.000
1.778	3.494	6.034	0.535	0.000
1.833	3.500	6.229	0.544	0.000
1.889	3.507	6.423	0.552	0.000
1.944	3.513	6.618	0.560	0.000
2.000	3.519	6.814	0.568	0.000
2.056	3.526	7.009	0.576	0.000
2.111	3.532	7.205	0.583	0.000
2.167	3.538	7.402	0.591	0.000
2.222	3.545	7.599	0.599	0.000
2.278	3.551	7.796	0.606	0.000
2.333	3.557	7.993	0.613	0.000
2.389	3.564	8.191	0.621	0.000
2.444	3.570	8.389	0.628	0.000
2.500	3.576	8.588	0.635	0.000
2.556	3.583	8.786	0.642	0.000
2.611	3.589	8.986	0.649	0.000
2.667	3.596	9.185	0.656	0.000
2.722	3.602	9.385	0.662	0.000
2.778	3.608	9.585	0.669	0.000
2.833	3.615	9.786	0.676	0.000
2.889	3.621	9.987	0.682	0.000
2.944	3.628	10.19	0.689	0.000
3.000	3.634	10.39	0.695	0.000
3.056	3.640	10.59	0.702	0.000
3.111	3.647	10.79	0.708	0.000
3.167	3.653	11.00	0.715	0.000
3.222	3.660	11.20	0.721	0.000
3.278	3.666	11.40	0.727	0.000
3.333	3.672	11.61	0.733	0.000
3.389	3.679	11.81	0.739	0.000
3.444	3.685	12.02	0.745	0.000
3.500	3.692	12.22	0.751	0.000
3.556	3.698	12.43	0.757	0.000
3.611	3.705	12.63	0.763	0.000
3.667	3.711	12.84	0.769	0.000
3.722	3.718	13.04	0.775	0.000
3.778	3.724	13.25	0.780	0.000
3.833	3.731	13.46	0.786	0.000
3.889	3.737	13.67	1.681	0.000
3.944	3.744	13.87	2.077	0.000
4.000	3.750	14.08	2.379	0.000
4.056	3.757	14.29	2.825	0.000
4.111	3.763	14.50	3.399	0.000

.167	3.770	14.71	4.054	0.000
.222	3.776	14.92	16.84	0.000
4.278	3.783	15.13	27.05	0.000
.333	3.789	15.34	34.28	0.000
.389	3.796	15.55	40.36	0.000
.444	3.802	15.76	45.76	0.000
4.500	3.809	15.97	50.74	0.000
.556	3.815	16.18	55.40	0.000
.611	3.822	16.40	59.83	0.000
4.667	3.828	16.61	64.09	0.000
4.722	3.835	16.82	68.19	0.000
.778	3.842	17.03	72.18	0.000
.833	3.848	17.25	76.08	0.000
4.889	3.855	17.46	79.89	0.000
4.944	3.861	17.68	83.63	0.000
.000	3.868	17.89	87.32	0.000

ANALYSIS RESULTS

low Frequency Return Periods for Predeveloped

eturn Period	Flow(cfs)
year	1.227
5 year	2.068
0 year	2.765
5 year	3.819
50 year	4.739
100 year	5.785

low Frequency Return Periods for Developed Unmitigated

Return Period	Flow(cfs)
2 year	8.523
year	11.91
0 year	14.397
25 year	17.826
0 year	20.595
00 year	23.552

Flow Frequency Return Periods for Developed Mitigated

eturn Period	Flow(cfs)
year	0.608
5 year	0.841
10 year	1.021
5 year	1.28
0 year	1.498
100 year	1.739

early Peaks for Pre and Post Developed

Year	Predeveloped	Developed
949	1.424	0.566
950	1.338	0.598
1951	3.004	2.099
1952	0.650	0.397
953	1.171	0.706
954	0.979	0.541
1955	0.900	0.427
1956	1.621	0.700
957	0.741	0.514
958	0.746	0.456
1959	0.918	0.587
1960	6.221	0.749
961	1.371	1.697
962	0.555	0.456
1963	4.700	0.624
1964	1.265	0.600
965	1.134	0.621
966	4.072	0.531

1967	1.555	0.540
1968	0.756	0.520
1969	0.928	0.579
1970	0.665	0.628
1971	1.002	0.608
1972	1.680	0.718
1973	1.016	0.641
1974	3.076	0.556
1975	1.190	0.604
1976	1.792	0.611
1977	0.320	0.581
1978	3.400	0.611
1979	1.638	0.543
1980	1.725	0.780
1981	1.820	0.644
1982	1.460	0.771
1983	0.903	0.486
1984	0.579	0.571
1985	0.606	0.594
1986	1.302	0.555
1987	2.905	2.853
1988	1.086	0.586
1989	1.184	0.568
1990	1.433	0.780
1991	1.446	0.558
1992	0.968	0.599
1993	1.547	0.519
1994	0.525	0.457
1995	0.726	0.599
1996	1.543	0.699

Ranked Yearly Peaks for Pre and Post Developed

Rank	Predeveloped	Developed
1	4.7003	2.0985
2	4.0722	1.6966
3	3.4002	0.7804
4	3.0758	0.7803
5	3.0035	0.7713
6	2.9050	0.7486
7	1.8203	0.7181
8	1.7925	0.7058
9	1.7247	0.6995
10	1.6804	0.6993
11	1.6378	0.6436
12	1.6207	0.6406
13	1.5555	0.6281
14	1.5467	0.6241
15	1.5433	0.6212
16	1.4600	0.6111
17	1.4460	0.6109
18	1.4330	0.6085
19	1.4240	0.6037
20	1.3708	0.6005
21	1.3383	0.5995
22	1.3015	0.5988
23	1.2653	0.5981
24	1.1899	0.5940
25	1.1841	0.5871
26	1.1705	0.5864
27	1.1340	0.5815
28	1.0860	0.5787
29	1.0161	0.5713
30	1.0024	0.5684
31	0.9791	0.5655
32	0.9679	0.5584
33	0.9283	0.5558
34	0.9176	0.5545
35	0.9030	0.5426
36	0.9004	0.5407
37	0.7564	0.5399
38	0.7457	0.5313

39	0.7410	0.5204
40	0.7262	0.5194
41	0.6654	0.5142
42	0.6504	0.4865
43	0.6056	0.4575
44	0.5793	0.4560
45	0.5550	0.4558
46	0.5255	0.4268
47	0.3202	0.3970

1/2 2 year to 50 year

Flow(CFS)	Predev	Final	Percentage	Pass/Fail
0.6135	3369	3278	97.0	Pass
0.6552	2800	1921	68.0	Pass
0.6968	2385	1197	50.0	Pass
0.7385	2051	651	31.0	Pass
0.7802	1764	275	15.0	Pass
0.8219	1505	141	9.0	Pass
0.8635	1287	130	10.0	Pass
0.9052	1100	122	11.0	Pass
0.9469	928	111	11.0	Pass
0.9885	794	102	12.0	Pass
1.0302	681	96	14.0	Pass
1.0719	580	88	15.0	Pass
1.1136	488	82	16.0	Pass
1.1552	418	78	18.0	Pass
1.1969	352	75	21.0	Pass
1.2386	291	71	24.0	Pass
1.2802	237	68	28.0	Pass
1.3219	210	64	30.0	Pass
1.3636	185	62	33.0	Pass
1.4053	167	60	35.0	Pass
1.4469	153	56	36.0	Pass
1.4886	139	54	38.0	Pass
1.5303	126	50	39.0	Pass
1.5719	109	49	44.0	Pass
1.6136	104	48	46.0	Pass
1.6553	90	44	48.0	Pass
1.6970	78	40	51.0	Pass
1.7386	70	39	55.0	Pass
1.7803	64	38	59.0	Pass
1.8220	55	37	67.0	Pass
1.8637	51	36	70.0	Pass
1.9053	45	33	73.0	Pass
1.9470	40	33	82.0	Pass
1.9887	35	30	85.0	Pass
2.0303	34	29	85.0	Pass
2.0720	29	27	93.0	Pass
2.1137	25	26	104.0	Pass
2.1554	24	22	91.0	Pass
2.1970	21	20	95.0	Pass
2.2387	20	20	100.0	Pass
2.2804	17	18	105.0	Pass
2.3220	15	16	106.0	Pass
2.3637	15	14	93.0	Pass
2.4054	13	13	100.0	Pass
2.4471	12	12	100.0	Pass
2.4887	11	12	109.0	Pass
2.5304	10	11	110.0	Pass
2.5721	10	9	90.0	Pass
2.6137	9	9	100.0	Pass
2.6554	9	8	88.0	Pass
2.6971	9	7	77.0	Pass
2.7388	9	7	77.0	Pass
2.7804	9	6	66.0	Pass
2.8221	9	5	55.0	Pass
2.8638	8	5	62.0	Pass
2.9054	8	5	62.0	Pass
2.9471	6	5	83.0	Pass
2.9888	6	5	83.0	Pass
3.0305	5	4	80.0	Pass

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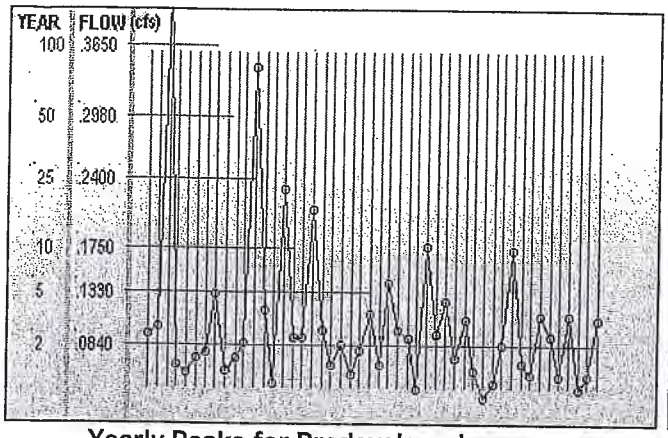
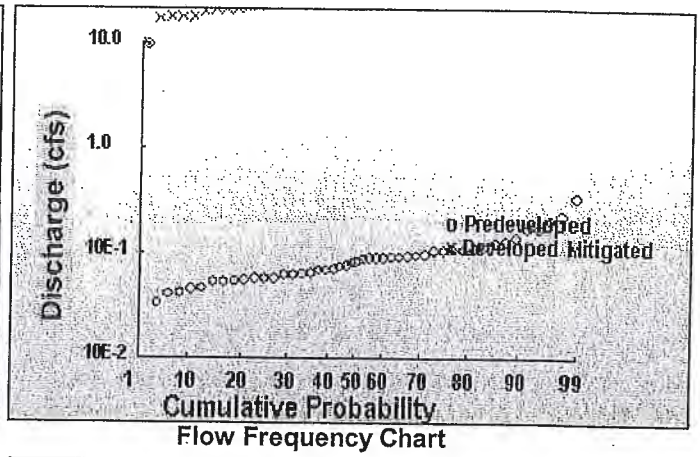
3.0721	5	4	80.0	Pass
3.1138	4	4	100.0	Pass
3.1555	4	4	100.0	Pass
3.1971	4	4	100.0	Pass
3.2388	4	4	100.0	Pass
3.2805	4	4	100.0	Pass
3.3222	4	3	75.0	Pass
3.3638	4	3	75.0	Pass
3.4055	3	3	100.0	Pass
3.4472	3	3	100.0	Pass
3.4888	3	3	100.0	Pass
3.5305	3	3	100.0	Pass
3.5722	3	3	100.0	Pass
3.6139	3	3	100.0	Pass
3.6555	3	2	66.0	Pass
3.6972	3	2	66.0	Pass
3.7389	3	2	66.0	Pass
3.7806	3	2	66.0	Pass
3.8222	3	2	66.0	Pass
3.8639	3	2	66.0	Pass
3.9056	3	2	66.0	Pass
3.9472	3	2	66.0	Pass
3.9889	3	2	66.0	Pass
4.0306	3	2	66.0	Pass
4.0723	3	2	66.0	Pass
4.1139	2	2	100.0	Pass
4.1556	2	2	100.0	Pass
4.1973	2	2	100.0	Pass
4.2389	2	2	100.0	Pass
4.2806	2	2	100.0	Pass
4.3223	2	2	100.0	Pass
4.3640	2	2	100.0	Pass
4.4056	2	2	100.0	Pass
4.4473	2	2	100.0	Pass
4.4890	2	2	100.0	Pass
4.5306	2	2	100.0	Pass
4.5723	2	2	100.0	Pass
4.6140	2	2	100.0	Pass
4.6557	2	2	100.0	Pass
4.6973	2	2	100.0	Pass
4.7390	1	1	100.0	Pass

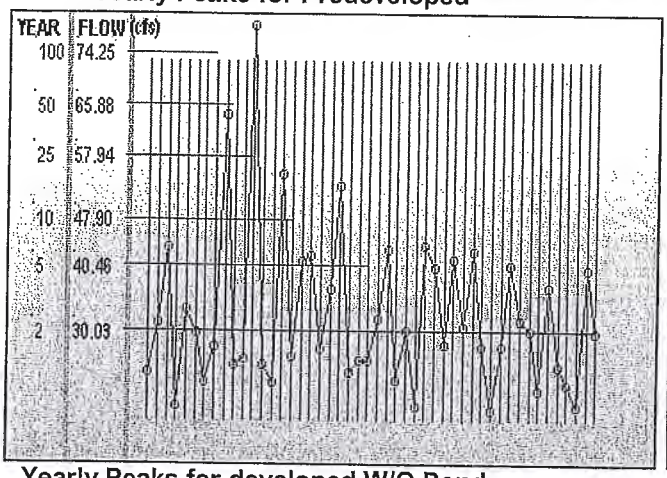
Water Quality BMP Flow and Volume.
On-line facility volume: 3.422 acre-feet
On-line facility target flow: 3.51 cfs.
Adjusted for 15 min: 4.18 cfs.
Off-line facility volume: 3.98 acre-feet
On-line facility target flow: 2 cfs.
Adjusted for 15 min: 2.38 cfs.



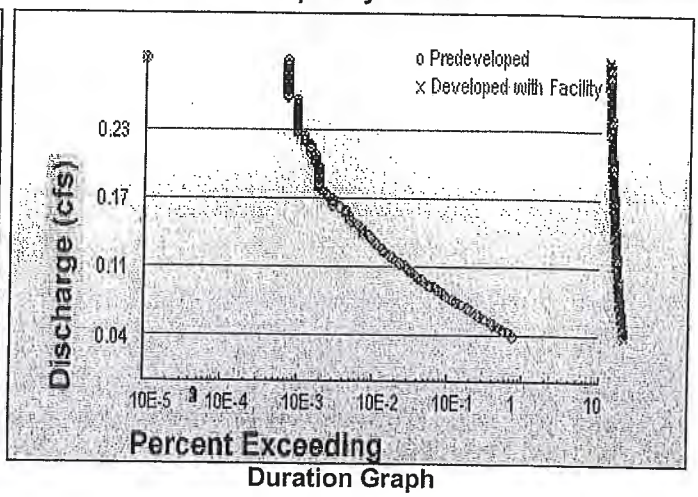
Yearly Peaks for Predeveloped



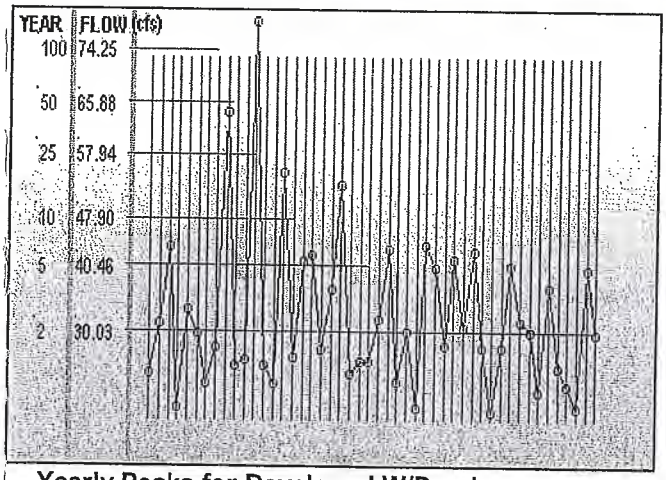
Flow Frequency Chart



Yearly Peaks for developed W/O Pond



Duration Graph



Yearly Peaks for Developed W/Pond

SITE D

Given: Project = POTENTIAL SUMNER REGIONAL FACILITY (SITE D)

Area =	54.5 acres		
Pt =	1.4 inches	(72% of 2-year, 24-hour precipitation)	
dt =	10 min.		
Tc =	6.6 min.	(Assumed: Minimum allowed per guidance)	
PERVIOUS Parcel		IMPERVIOUS Parcel	
Area =	29.53 acres	Area =	24.97 acres
CN =	83	CN =	98
S =	2.05	S =	0.20
0.2S =	0.41	0.2S =	0.04

Compute: Developed Conditions Runoff hydrograph

Column (3) = SCS Type IA Rainfall Distribution
Column (4) = Col. (3) x Pt = 10 year - 24 Hour Hyetograph at this location.
Column (5) = Accumulated Sum of Col. (4)
Column (6) = [If P <= 0.2S] = 0; Note, use PERVIOUS Area "S" value.
[If P > 0.2S] = (Col.(5) - 0.2S)^2/(Col.(5) + 0.8S); Using the PERVIOUS Area "S" value.
Column (7) = Col.(6) of Present Time Step - Col.(6) of Previous Time Step
Column (8) = Same method as for Col.(6), except use the IMPERVIOUS Area "S" value.
Column (9) = Col.(8) of the present time step - Col.(8) of the previous time step.
Column (10) = ((PERVIOUS area / Total area) x Col.(7)) + ((IMPERVIOUS area / Total area) x Col.(9))
Column (11) = (60.5 x Col.(10) x Total Area) / 10 (dt = 10 minutes)
Routing Constant, w = dt / (2Tc + dt) = 0.4310
Column (12) = Col.(12) of Previous Time Step + (w x [Col.(11) of Previous Time Step + Col.(11) of Present Time Step - (2 x Col.(12) of Previous Time Step)])

(1) Time Increment	(2) Time min.	(3) Rainfall distribution % of Pt	(4) Incremental Rainfall in.	(5) Accumulated Rainfall in.	Pervious Area (6) Accumulated Runoff in.	Pervious Area (7) Incremental Runoff in.	Impervious Area (8) Accumulated Runoff in.	Impervious Area (9) Incremental Runoff in.	(10) Total Runoff in.	(11) Instant hydrograph cfs	(12) design hydrograph cfs	
1	10	0.0040	0.0056	0.0056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.0	
2	20	0.0040	0.0056	0.0112	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.0	
3	30	0.0040	0.0056	0.0168	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.0	
4	40	0.0040	0.0056	0.0224	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.0	
5	50	0.0040	0.0056	0.0280	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.0	
6	60	0.0040	0.0056	0.0336	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.0	
7	70	0.0040	0.0056	0.0392	0.0000	0.0000	0.0000	0.0000	0.0000	0.0	0.0	
8	80	0.0040	0.0056	0.0448	0.0000	0.0000	0.0001	0.0001	0.0000	0.0	0.0	
9	90	0.0040	0.0056	0.0504	0.0000	0.0000	0.0004	0.0004	0.0002	0.1	0.0	
10	100	0.0040	0.0056	0.0560	0.0000	0.0000	0.0011	0.0008	0.0003	0.1	0.1	
11	110	0.0050	0.0070	0.0630	0.0000	0.0000	0.0022	0.0011	0.0005	0.2	0.1	
12	120	0.0050	0.0070	0.0700	0.0000	0.0000	0.0037	0.0015	0.0007	0.2	0.2	
13	130	0.0050	0.0070	0.0770	0.0000	0.0000	0.0054	0.0018	0.0008	0.3	0.2	
14	140	0.0050	0.0070	0.0840	0.0000	0.0000	0.0075	0.0021	0.0010	0.3	0.3	
15	150	0.0050	0.0070	0.0910	0.0000	0.0000	0.0099	0.0024	0.0011	0.4	0.3	
16	160	0.0050	0.0070	0.0980	0.0000	0.0000	0.0125	0.0026	0.0012	0.4	0.4	
17	170	0.0060	0.0084	0.1064	0.0000	0.0000	0.0160	0.0034	0.0016	0.5	0.4	
18	180	0.0060	0.0084	0.1148	0.0000	0.0000	0.0197	0.0037	0.0017	0.6	0.5	
19	190	0.0060	0.0084	0.1232	0.0000	0.0000	0.0237	0.0040	0.0018	0.6	0.6	
20	200	0.0060	0.0084	0.1316	0.0000	0.0000	0.0280	0.0043	0.0020	0.6	0.6	
21	210	0.0060	0.0084	0.1400	0.0000	0.0000	0.0324	0.0045	0.0021	0.7	0.7	
22	220	0.0060	0.0084	0.1484	0.0000	0.0000	0.0371	0.0047	0.0022	0.7	0.7	
23	230	0.0070	0.0098	0.1582	0.0000	0.0000	0.0429	0.0057	0.0026	0.9	0.8	
24	240	0.0070	0.0098	0.1680	0.0000	0.0000	0.0488	0.0060	0.0027	0.9	0.9	
25	250	0.0070	0.0098	0.1778	0.0000	0.0000	0.0550	0.0062	0.0028	0.9	0.9	
26	260	0.0070	0.0098	0.1876	0.0000	0.0000	0.0614	0.0064	0.0029	1.0	0.9	
27	270	0.0070	0.0098	0.1974	0.0000	0.0000	0.0680	0.0066	0.0030	1.0	1.0	
28	280	0.0070	0.0098	0.2072	0.0000	0.0000	0.0747	0.0067	0.0031	1.0	1.0	
29	290	0.0082	0.0115	0.2187	0.0000	0.0000	0.0828	0.0081	0.0037	1.2	1.1	
30	300	0.0082	0.0115	0.2302	0.0000	0.0000	0.0911	0.0083	0.0038	1.3	1.2	
31	310	0.0082	0.0115	0.2416	0.0000	0.0000	0.0996	0.0085	0.0039	1.3	1.3	
32	320	0.0082	0.0115	0.2531	0.0000	0.0000	0.1082	0.0086	0.0040	1.3	1.3	
33	330	0.0082	0.0115	0.2646	0.0000	0.0000	0.1170	0.0088	0.0040	1.3	1.3	
34	340	0.0082	0.0115	0.2761	0.0000	0.0000	0.1260	0.0089	0.0041	1.4	1.3	
35	350	0.0095	0.0133	0.2894	0.0000	0.0000	0.1365	0.0105	0.0048	1.6	1.5	
36	360	0.0095	0.0133	0.3027	0.0000	0.0000	0.1472	0.0107	0.0049	1.6	1.6	
37	370	0.0095	0.0133	0.3160	0.0000	0.0000	0.1580	0.0108	0.0050	1.6	1.6	
38	380	0.0095	0.0133	0.3293	0.0000	0.0000	0.1689	0.0110	0.0050	1.7	1.6	
39	390	0.0095	0.0133	0.3426	0.0000	0.0000	0.1800	0.0111	0.0051	1.7	1.7	
40	400	0.0095	0.0133	0.3559	0.0000	0.0000	0.1912	0.0112	0.0051	1.7	1.7	
41	410	0.0134	0.0188	0.3746	0.0000	0.0000	0.2072	0.0160	0.0073	2.4	2.0	
42	420	0.0134	0.0188	0.3934	0.0000	0.0000	0.2233	0.0162	0.0074	2.4	2.4	
43	430	0.0134	0.0188	0.4122	0.0000	0.0000	0.2396	0.0163	0.0075	2.5	2.4	
44	440	0.0180	0.0252	0.4374	0.0004	0.0004	0.2618	0.0222	0.0104	3.4	2.9	
45	450	0.0180	0.0252	0.4626	0.0013	0.0010	0.2842	0.0224	0.0108	3.6	3.4	
46	460	0.0340	0.0476	0.5102	0.0047	0.0034	0.3271	0.0429	0.0215	7.1	5.1	
47	470	0.0540	0.0756	0.5858	0.0139	0.0092	0.3965	0.0694	0.0368	12.1	9.0	
48	480	0.0270	0.0378	0.6236	0.0202	0.0063	0.4316	0.0351	0.0195	6.4	9.2	Q peak
49	490	0.0180	0.0252	0.6488	0.0250	0.0048	0.4552	0.0236	0.0134	4.4	5.9	
50	500	0.0134	0.0188	0.6675	0.0288	0.0038	0.4728	0.0176	0.0101	3.3	4.2	
51	510	0.0134	0.0188	0.6863	0.0329	0.0041	0.4904	0.0177	0.0103	3.4	3.5	

					Pervious Area		Impervious Area				
(1) Time Increment	(2) Time	(3) Rainfall distri-bution	(4) Incre-mental Rainfall	(5) Accumu-lated Rainfall	(6) Accumu-lated Runoff	(7) Incre-mental Runoff	(8) Accumu-lated Runoff	(9) Incre-mental Runoff	(10) Total Runoff	(11) Instant hydro-graph	(12) design hydro-graph
	min.	% of Pt	in.	in.	in.	in.	in.	in.	in.	cfs	cfs
52	520	0.0134	0.0188	0.7050	0.0372	0.0043	0.5081	0.0177	0.0104	3.4	3.4
53	530	0.0088	0.0123	0.7174	0.0402	0.0030	0.5198	0.0116	0.0069	2.3	2.9
54	540	0.0088	0.0123	0.7297	0.0433	0.0031	0.5314	0.0117	0.0070	2.3	2.4
55	550	0.0088	0.0123	0.7420	0.0464	0.0032	0.5431	0.0117	0.0071	2.3	2.3
56	560	0.0088	0.0123	0.7543	0.0496	0.0032	0.5548	0.0117	0.0071	2.3	2.3
57	570	0.0088	0.0123	0.7666	0.0530	0.0033	0.5665	0.0117	0.0072	2.4	2.4
58	580	0.0088	0.0123	0.7790	0.0564	0.0034	0.5783	0.0117	0.0072	2.4	2.4
59	590	0.0088	0.0123	0.7913	0.0599	0.0035	0.5900	0.0117	0.0073	2.4	2.4
60	600	0.0088	0.0123	0.8036	0.0636	0.0036	0.6018	0.0118	0.0073	2.4	2.4
61	610	0.0088	0.0123	0.8159	0.0673	0.0037	0.6136	0.0118	0.0074	2.4	2.4
62	620	0.0088	0.0123	0.8282	0.0710	0.0038	0.6253	0.0118	0.0075	2.5	2.4
63	630	0.0088	0.0123	0.8406	0.0749	0.0039	0.6372	0.0118	0.0075	2.5	2.5
64	640	0.0088	0.0123	0.8529	0.0789	0.0040	0.6490	0.0118	0.0076	2.5	2.5
65	650	0.0072	0.0101	0.8630	0.0822	0.0033	0.6586	0.0097	0.0062	2.1	2.3
66	660	0.0072	0.0101	0.8730	0.0855	0.0033	0.6683	0.0097	0.0063	2.1	2.1
67	670	0.0072	0.0101	0.8831	0.0889	0.0034	0.6780	0.0097	0.0063	2.1	2.1
68	680	0.0072	0.0101	0.8932	0.0924	0.0035	0.6877	0.0097	0.0063	2.1	2.1
69	690	0.0072	0.0101	0.9033	0.0959	0.0035	0.6974	0.0097	0.0063	2.1	2.1
70	700	0.0072	0.0101	0.9134	0.0994	0.0036	0.7071	0.0097	0.0064	2.1	2.1
71	710	0.0072	0.0101	0.9234	0.1030	0.0036	0.7169	0.0097	0.0064	2.1	2.1
72	720	0.0072	0.0101	0.9335	0.1067	0.0037	0.7266	0.0097	0.0064	2.1	2.1
73	730	0.0072	0.0101	0.9436	0.1104	0.0037	0.7363	0.0097	0.0065	2.1	2.1
74	740	0.0072	0.0101	0.9537	0.1142	0.0038	0.7461	0.0097	0.0065	2.1	2.1
75	750	0.0072	0.0101	0.9638	0.1180	0.0038	0.7558	0.0097	0.0065	2.2	2.1
76	760	0.0072	0.0101	0.9738	0.1219	0.0039	0.7656	0.0098	0.0066	2.2	2.2
77	770	0.0057	0.0080	0.9818	0.1249	0.0031	0.7733	0.0077	0.0052	1.7	2.0
78	780	0.0057	0.0080	0.9898	0.1281	0.0031	0.7810	0.0077	0.0052	1.7	1.8
79	790	0.0057	0.0080	0.9978	0.1312	0.0031	0.7888	0.0077	0.0052	1.7	1.7
80	800	0.0057	0.0080	1.0058	0.1344	0.0032	0.7965	0.0077	0.0053	1.7	1.7
81	810	0.0057	0.0080	1.0137	0.1376	0.0032	0.8042	0.0077	0.0053	1.7	1.7
82	820	0.0057	0.0080	1.0217	0.1408	0.0032	0.8120	0.0077	0.0053	1.7	1.7
83	830	0.0057	0.0080	1.0297	0.1441	0.0033	0.8197	0.0077	0.0053	1.8	1.7
84	840	0.0057	0.0080	1.0377	0.1474	0.0033	0.8275	0.0077	0.0053	1.8	1.8
85	850	0.0057	0.0080	1.0457	0.1507	0.0033	0.8352	0.0078	0.0054	1.8	1.8
86	860	0.0057	0.0080	1.0536	0.1541	0.0033	0.8430	0.0078	0.0054	1.8	1.8
87	870	0.0057	0.0080	1.0616	0.1574	0.0034	0.8507	0.0078	0.0054	1.8	1.8
88	880	0.0057	0.0080	1.0696	0.1608	0.0034	0.8585	0.0078	0.0054	1.8	1.8
89	890	0.0050	0.0070	1.0766	0.1638	0.0030	0.8653	0.0068	0.0047	1.6	1.7
90	900	0.0050	0.0070	1.0836	0.1669	0.0030	0.8721	0.0068	0.0048	1.6	1.6
91	910	0.0050	0.0070	1.0906	0.1699	0.0030	0.8789	0.0068	0.0048	1.6	1.6
92	920	0.0050	0.0070	1.0976	0.1730	0.0031	0.8857	0.0068	0.0048	1.6	1.6
93	930	0.0050	0.0070	1.1046	0.1761	0.0031	0.8926	0.0068	0.0048	1.6	1.6
94	940	0.0050	0.0070	1.1116	0.1792	0.0031	0.8994	0.0068	0.0048	1.6	1.6
95	950	0.0050	0.0070	1.1186	0.1823	0.0031	0.9062	0.0068	0.0048	1.6	1.6
96	960	0.0050	0.0070	1.1256	0.1854	0.0031	0.9130	0.0068	0.0048	1.6	1.6
97	970	0.0050	0.0070	1.1326	0.1886	0.0032	0.9198	0.0068	0.0048	1.6	1.6
98	980	0.0050	0.0070	1.1396	0.1918	0.0032	0.9267	0.0068	0.0049	1.6	1.6
99	990	0.0050	0.0070	1.1466	0.1950	0.0032	0.9335	0.0068	0.0049	1.6	1.6
100	1000	0.0050	0.0070	1.1536	0.1982	0.0032	0.9403	0.0068	0.0049	1.6	1.6
101	1010	0.0040	0.0056	1.1592	0.2008	0.0026	0.9458	0.0055	0.0039	1.3	1.5
102	1020	0.0040	0.0056	1.1648	0.2034	0.0026	0.9513	0.0055	0.0039	1.3	1.3
103	1030	0.0040	0.0056	1.1704	0.2060	0.0026	0.9567	0.0055	0.0039	1.3	1.3
104	1040	0.0040	0.0056	1.1760	0.2087	0.0026	0.9622	0.0055	0.0039	1.3	1.3
105	1050	0.0040	0.0056	1.1816	0.2113	0.0026	0.9677	0.0055	0.0039	1.3	1.3
106	1060	0.0040	0.0056	1.1872	0.2140	0.0027	0.9731	0.0055	0.0039	1.3	1.3
107	1070	0.0040	0.0056	1.1928	0.2166	0.0027	0.9786	0.0055	0.0040	1.3	1.3
108	1080	0.0040	0.0056	1.1984	0.2193	0.0027	0.9841	0.0055	0.0040	1.3	1.3
109	1090	0.0040	0.0056	1.2040	0.2220	0.0027	0.9896	0.0055	0.0040	1.3	1.3
110	1100	0.0040	0.0056	1.2096	0.2247	0.0027	0.9950	0.0055	0.0040	1.3	1.3
111	1110	0.0040	0.0056	1.2152	0.2274	0.0027	1.0005	0.0055	0.0040	1.3	1.3
112	1120	0.0040	0.0056	1.2208	0.2301	0.0027	1.0060	0.0055	0.0040	1.3	1.3
113	1130	0.0040	0.0056	1.2264	0.2328	0.0027	1.0115	0.0055	0.0040	1.3	1.3
114	1140	0.0040	0.0056	1.2320	0.2356	0.0027	1.0170	0.0055	0.0040	1.3	1.3
115	1150	0.0040	0.0056	1.2376	0.2383	0.0028	1.0224	0.0055	0.0040	1.3	1.3
116	1160	0.0040	0.0056	1.2432	0.2411	0.0028	1.0279	0.0055	0.0040	1.3	1.3
117	1170	0.0040	0.0056	1.2488	0.2439	0.0028	1.0334	0.0055	0.0040	1.3	1.3
118	1180	0.0040	0.0056	1.2544	0.2467	0.0028	1.0389	0.0055	0.0040	1.3	1.3

					Pervious Area		Impervious Area				
(1) Time Increment	(2) Time	(3) Rainfall distri-bution	(4) Incre-mental Rainfall	(5) Accumu-lated Rainfall	(6) Accumu-lated Runoff	(7) Incre-mental Runoff	(8) Accumu-lated Runoff	(9) Incre-mental Runoff	(10) Total Runoff	(11) Instant hydro-graph	(12) design hydro-graph
	min.	% of Pt	in.	in.	in.	in.	in.	in.	in.	cfs	cfs
119	1190	0.0040	0.0056	1.2600	0.2495	0.0028	1.0444	0.0055	0.0040	1.3	1.3
120	1200	0.0040	0.0056	1.2656	0.2523	0.0028	1.0499	0.0055	0.0040	1.3	1.3
121	1210	0.0040	0.0056	1.2712	0.2551	0.0028	1.0553	0.0055	0.0040	1.3	1.3
122	1220	0.0040	0.0056	1.2768	0.2579	0.0028	1.0608	0.0055	0.0040	1.3	1.3
123	1230	0.0040	0.0056	1.2824	0.2608	0.0028	1.0663	0.0055	0.0041	1.3	1.3
124	1240	0.0040	0.0056	1.2880	0.2636	0.0029	1.0718	0.0055	0.0041	1.3	1.3
125	1250	0.0040	0.0056	1.2936	0.2665	0.0029	1.0773	0.0055	0.0041	1.3	1.3
126	1260	0.0040	0.0056	1.2992	0.2694	0.0029	1.0828	0.0055	0.0041	1.3	1.3
127	1270	0.0040	0.0056	1.3048	0.2722	0.0029	1.0883	0.0055	0.0041	1.3	1.3
128	1280	0.0040	0.0056	1.3104	0.2751	0.0029	1.0938	0.0055	0.0041	1.3	1.3
129	1290	0.0040	0.0056	1.3160	0.2780	0.0029	1.0993	0.0055	0.0041	1.3	1.3
130	1300	0.0040	0.0056	1.3216	0.2810	0.0029	1.1048	0.0055	0.0041	1.4	1.3
131	1310	0.0040	0.0056	1.3272	0.2839	0.0029	1.1102	0.0055	0.0041	1.4	1.4
132	1320	0.0040	0.0056	1.3328	0.2868	0.0029	1.1157	0.0055	0.0041	1.4	1.4
133	1330	0.0040	0.0056	1.3384	0.2898	0.0029	1.1212	0.0055	0.0041	1.4	1.4
134	1340	0.0040	0.0056	1.3440	0.2927	0.0030	1.1267	0.0055	0.0041	1.4	1.4
135	1350	0.0040	0.0056	1.3496	0.2957	0.0030	1.1322	0.0055	0.0041	1.4	1.4
136	1360	0.0040	0.0056	1.3552	0.2987	0.0030	1.1377	0.0055	0.0041	1.4	1.4
137	1370	0.0040	0.0056	1.3608	0.3016	0.0030	1.1432	0.0055	0.0041	1.4	1.4
138	1380	0.0040	0.0056	1.3664	0.3046	0.0030	1.1487	0.0055	0.0041	1.4	1.4
139	1390	0.0040	0.0056	1.3720	0.3076	0.0030	1.1542	0.0055	0.0041	1.4	1.4
140	1400	0.0040	0.0056	1.3776	0.3106	0.0030	1.1597	0.0055	0.0042	1.4	1.4
141	1410	0.0040	0.0056	1.3832	0.3137	0.0030	1.1652	0.0055	0.0042	1.4	1.4
142	1420	0.0040	0.0056	1.3888	0.3167	0.0030	1.1707	0.0055	0.0042	1.4	1.4
143	1430	0.0040	0.0056	1.3944	0.3197	0.0030	1.1762	0.0055	0.0042	1.4	1.4
144	1440	0.0040	0.0056	1.4000	0.3228	0.0031	1.1817	0.0055	0.0042	1.4	1.4

Total Volume of Runoff = 141,171 cu. ft.
(Found by summing this column and multiplying by 600. 600 is the conversion required to convert SUM(Q) in cfs to total volume in cubic feet as follows:

V = SUM(Q) x dt
(cu.ft.) = (cu.ft/s) x (10 min.) x (60 s/min.)

Required Wet Pond Volume

Bottom Length	335	ft	3:1 length to width ratio
Bottom Width	115	ft	
Sideslope	3	:1	
Depth	5	ft	First cell 4 ft minimum depth
Bottom Area	38,525	SF	
Top Area	52,925	SF	
Available Storage	228,625	CF	Assume "Large" wetpond providing 1.5X the 6-month, 24-hour event volume.
Required Storage	225,870	CF	Includes 50% increase for "Large" wetpond and 10% increase to account for internal berm and sediment storage in first pond cell.

NOTES:
Top of berm set 1.7 feet above design water surface. Therefore total pond depth equals 7.7 feet.
Add 10% to volume during cost est to account for internal berm and 1-foot sediment storage in first wetpond cell.
Assume pond berm set 2 feet above existing grade. Therefore, total pond excavation equal 5.7 feet.

BASIN TOTAL FOR EAST SUMNER NEIGHBORHOOD HYDROLOGIC CALCULATIONS (SITE D)

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	12.02	12.02	0.00
Low Density Residential	15.78	9.47	6.31
Medium Density Residential	13.42	6.71	6.71
High Density Residential/Commercial/Industrial	13.28	1.33	11.95
Industrial/Agricultural	0.00	0.00	0.00
Impervious	0.00	0.00	0.00
TOTAL AREA	**54.50**	**29.53**	**24.97**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	1.43	0%	1.43	0.00	78
Open-Fields	C	10.59	0%	10.59	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	6.33	40%	3.80	2.53	77
Low Density Residential	C	9.45	40%	5.67	3.78	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	1.32	50%	0.66	0.66	80
Medium Density Residential	C	12.10	50%	6.05	6.05	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	4.18	90%	0.42	3.76	85
High Density Residential/Commercial/Industrial	C	9.10	90%	0.91	8.19	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	0.00	100%	0.00	0.00	-
TOTALS		**54.50**		**29.53**	**24.97**	

WEIGHTED PERVIOUS CN **83**

SITE D MODEL PARAMETERS:

LAND USE	SOIL GRP	ACRES
Landscaping - Pervious	A/B	6.31
Landscaping - Pervious	C/D	23.22
Roofs - Impervious	A/B	3.477
Roofs - Impervious	C/D	9.01
Roads, Etc - Impervious	A/B	3.477
Roads, Etc - Impervious	C/D	9.01
		54.5

WESTERN WASHINGTON HYDROLOGY MODEL V2
PROJECT REPORT

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roject Name: Sumner Site J (Dist. 11)
Site Address:
City : Sumner
eport Date : 1/21/2004
age : McMillian
Data Start : 1948
ata End : 1996
recip Scale: 1.00

PREDEVELOPED LAND USE

asin : Combo Basin T13 - T20
lows To : Outflow
GroundWater: No

and Use	Acres
ILL FOREST:	489.15
OUTWASH FOREST:	68.27

EVELOPED LAND USE
Basin : Combo Basin T13 - T20
Flows To : Outflow
roundWater: No

Land Use	Acres
TILL GRASS:	208.93
UTWASH GRASS:	34.51
MPERVIOUS:	313.98

CHRES (POND) INFORMATION

ANALYSIS RESULTS

low Frequency Return Periods for Predeveloped

Return Period	Flow(cfs)
? year	10.769
year	18.068
0 year	23.543
25 year	31.085
0 year	37.108
00 year	43.448

Flow Frequency Return Periods for Developed Unmitigated

eturn Period	Flow(cfs)
year	102.232
5 year	141.046
0 year	169.266
5 year	207.878
0 year	238.845
100 year	271.75

low Frequency Return Periods for Developed Mitigated

eturn Period	Flow(cfs)

2 year	102.232
5 year	141.046
10 year	169.266
25 year	207.878
50 year	238.845
100 year	271.75

Yearly Peaks for Pre and Post Developed

Year	Predeveloped	Developed
1949	14.772	83.390
1950	12.662	109.377
1951	26.040	153.708
1952	6.277	56.779
1953	7.795	119.035
1954	9.307	107.152
1955	8.520	67.003
1956	16.668	85.434
1957	6.501	208.455
1958	7.009	84.001
1959	9.324	87.934
1960	46.398	305.598
1961	13.634	87.470
1962	4.027	76.359
1963	31.244	205.702
1964	12.372	89.791
1965	11.680	127.837
1966	29.661	164.530
1967	14.412	91.012
1968	7.238	122.776
1969	9.007	164.562
1970	6.323	78.774
1971	9.944	88.192
1972	16.873	85.281
1973	6.334	98.497
1974	20.815	172.832
1975	11.984	68.928
1976	12.876	105.681
1977	1.835	55.396
1978	24.629	154.161
1979	13.286	129.042
1980	17.556	99.608
1981	9.431	155.952
1982	14.726	103.460
1983	7.462	144.951
1984	3.562	91.586
1985	5.504	56.738
1986	11.639	96.896
1987	27.562	134.849
1988	8.200	108.651
1989	6.957	109.873
1990	14.605	72.853
1991	13.123	129.148
1992	7.911	83.208
1993	15.532	74.715
1994	4.741	59.603
1995	3.743	125.079
1996	14.058	106.176

Ranked Yearly Peaks for Pre and Post Developed

Rank	Predeveloped	Developed
1	31.2438	208.4550
2	29.6609	205.7020
3	27.5618	172.8320
4	26.0402	164.5620
5	24.6294	164.5300
6	20.8146	155.9520
7	17.5559	154.1610
8	16.8731	153.7080
9	16.6677	144.9510

10	15.5316	134.8490
11	14.7723	129.1480
12	14.7260	129.0420
13	14.6047	127.8370
14	14.4123	125.0790
15	14.0581	122.7760
16	13.6335	119.0350
17	13.2859	109.8730
18	13.1226	109.3770
19	12.8762	108.6510
20	12.6615	107.1520
21	12.3718	106.1760
22	11.9840	105.6810
23	11.6797	103.4600
24	11.6393	99.6080
25	9.9443	98.4972
26	9.4313	96.8960
27	9.3244	91.5864
28	9.3072	91.0115
29	9.0073	89.7912
30	8.5204	88.1922
31	8.2002	87.9342
32	7.9110	87.4702
33	7.7954	85.4340
34	7.4622	85.2813
35	7.2380	84.0014
36	7.0086	83.3903
37	6.9568	83.2077
38	6.5014	78.7741
39	6.3341	76.3589
40	6.3230	74.7147
41	6.2775	72.8532
42	5.5038	68.9281
43	4.7406	67.0028
44	4.0268	59.6027
45	3.7434	56.7785
46	3.5624	56.7383
47	1.8355	55.3962

1/2 2 year to 50 year

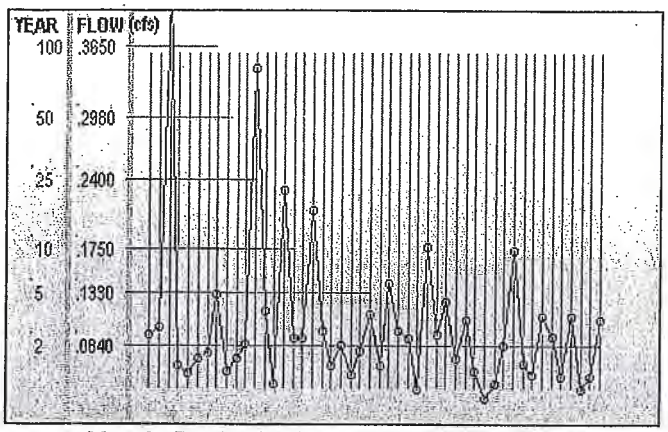
Flow(CFS)	Predev	Final	Percentage	Pass/Fail
5.3845	4170	28436	681.0	Fail
5.7049	3627	27224	750.0	Fail
6.0254	3164	26071	823.0	Fail
6.3458	2775	25036	902.0	Fail
6.6663	2463	23980	973.0	Fail
6.9867	2198	23062	1049.0	Fail
7.3071	1991	22200	1115.0	Fail
7.6276	1803	21371	1185.0	Fail
7.9480	1613	20563	1274.0	Fail
8.2685	1457	19890	1365.0	Fail
8.5889	1310	19204	1465.0	Fail
8.9093	1172	18560	1583.0	Fail
9.2298	1053	17912	1701.0	Fail
9.5502	936	17323	1850.0	Fail
9.8707	840	16776	1997.0	Fail
10.1911	746	16157	2165.0	Fail
10.5115	667	15598	2338.0	Fail
10.8320	601	15038	2502.0	Fail
11.1524	543	14470	2664.0	Fail
11.4728	479	13948	2911.0	Fail
11.7933	431	13486	3129.0	Fail
12.1137	378	13061	3455.0	Fail
12.4342	332	12661	3813.0	Fail
12.7546	293	12257	4183.0	Fail
13.0750	261	11853	4541.0	Fail
13.3955	236	11504	4874.0	Fail
13.7159	209	11159	5339.0	Fail
14.0364	184	10818	5879.0	Fail
14.3568	171	10490	6134.0	Fail
14.6772	157	10170	6477.0	Fail

14.9977	143	9880	6909.0	Fail
15.3181	129	9594	7437.0	Fail
15.6386	120	9320	7766.0	Fail
15.9590	114	9076	7961.0	Fail
16.2794	105	8840	8419.0	Fail
16.5999	95	8579	9030.0	Fail
16.9203	89	8344	9375.0	Fail
17.2408	80	8117	10146.0	Fail
17.5612	71	7885	11105.0	Fail
17.8816	65	7654	11775.0	Fail
18.2021	60	7397	12328.0	Fail
18.5225	56	7195	12848.0	Fail
18.8430	50	7014	14028.0	Fail
19.1634	47	6829	14529.0	Fail
19.4838	46	6652	14460.0	Fail
19.8043	42	6450	15357.0	Fail
20.1247	39	6286	16117.0	Fail
20.4452	37	6114	16524.0	Fail
20.7656	34	5937	17461.0	Fail
21.0860	31	5807	18732.0	Fail
21.4065	29	5634	19427.0	Fail
21.7269	26	5483	21088.0	Fail
22.0473	23	5327	23160.0	Fail
22.3678	23	5180	22521.0	Fail
22.6882	22	5041	22913.0	Fail
23.0087	18	4902	27233.0	Fail
23.3291	17	4772	28070.0	Fail
23.6495	15	4641	30940.0	Fail
23.9700	12	4515	37625.0	Fail
24.2904	10	4380	43800.0	Fail
24.6109	10	4271	42710.0	Fail
24.9313	8	4159	51987.0	Fail
25.2517	8	4029	50362.0	Fail
25.5722	7	3940	56285.0	Fail
25.8926	7	3855	55071.0	Fail
26.2131	6	3769	62816.0	Fail
26.5335	5	3666	73320.0	Fail
26.8539	5	3592	71840.0	Fail
27.1744	4	3508	87700.0	Fail
27.4948	4	3418	85450.0	Fail
27.8153	3	3348	111600.0	Fail
28.1357	3	3280	109333.0	Fail
28.4561	3	3185	106166.0	Fail
28.7766	3	3095	103166.0	Fail
29.0970	3	3014	100466.0	Fail
29.4175	3	2936	97866.0	Fail
29.7379	2	2844	142200.0	Fail
30.0583	2	2770	138500.0	Fail
30.3788	2	2702	135100.0	Fail
30.6992	2	2621	131050.0	Fail
31.0197	2	2539	126950.0	Fail
31.3401	1	2456	245600.0	Fail
31.6605	1	2386	238600.0	Fail
31.9810	1	2306	230600.0	Fail
32.3014	1	2238	223800.0	Fail
32.6218	1	2171	217100.0	Fail
32.9423	1	2111	211100.0	Fail
33.2627	1	2037	203700.0	Fail
33.5832	1	1988	198800.0	Fail
33.9036	1	1926	192600.0	Fail
34.2240	1	1869	186900.0	Fail
34.5445	1	1813	181300.0	Fail
34.8649	1	1762	176200.0	Fail
35.1854	1	1716	171600.0	Fail
35.5058	1	1678	167800.0	Fail
35.8262	1	1627	162700.0	Fail
36.1467	1	1573	157300.0	Fail
36.4671	1	1530	153000.0	Fail
36.7876	1	1495	149500.0	Fail
37.1080	1	1454	145400.0	Fail

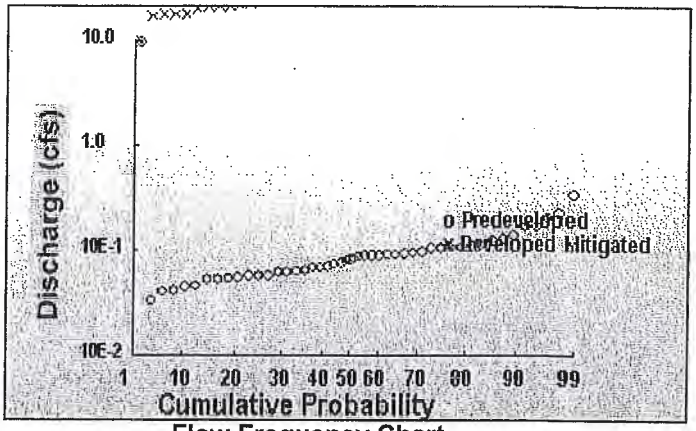
The development has an increase in flow durations from 1/2 predeveloped 2 year flow to the 2 year flow

r more than a 10% increase from the 2 year to the 50 ear flow.
The Development Has an increase in flow durations for more than 50% of the flows from the 2 year to the 0 year flow.

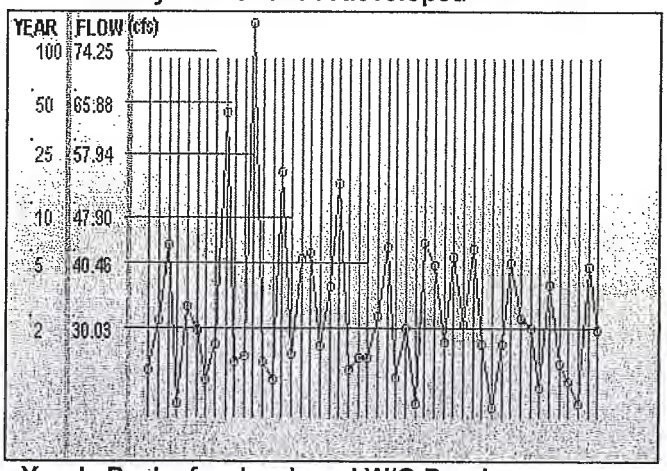
Water Quality BMP Flow and Volume.
n-line facility volume: 40.21 acre-feet
n-line facility target flow: 43.6 cfs.
djusted for 15 min: 53.8 cfs.
Off-line facility volume: 49.82 acre-feet
n-line facility target flow: 25.1 cfs.
djusted for 15 min: 30.9 cfs.



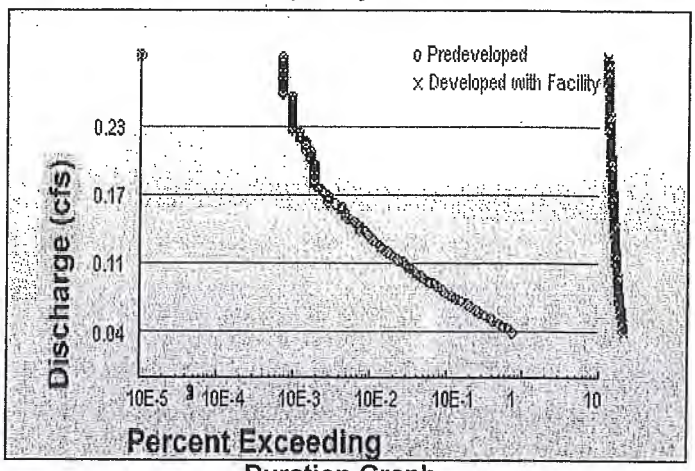
Yearly Peaks for Predeveloped



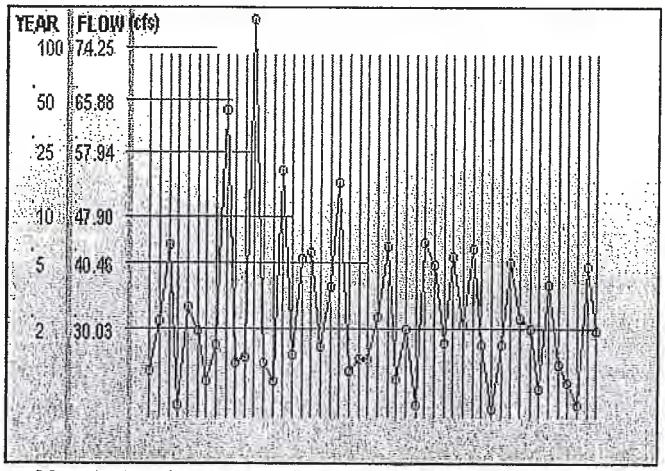
Flow Frequency Chart



Yearly Peaks for developed W/O Pond



Duration Graph



Yearly Peaks for Developed W/Pond

28/51

BASIN TOTAL FOR DISTRICT 11 OUTFALL WQ FACILITY HYDROLOGIC CALCULATIONS (SITE J)

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	185.38	111.23	74.15
Medium Density Residential	178.09	89.05	89.05
High Density Residential/Commercial/Industrial	114.62	11.46	103.16
Industrial/Agricultural	63.40	31.70	31.70
Impervious	15.93	0.00	15.93
TOTAL AREA	**557.42**	**243.44**	**313.99**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	44.04	40%	26.42	17.62	77
Low Density Residential	C	141.34	40%	84.80	56.54	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	14.13	50%	7.07	7.07	80
Medium Density Residential	C	163.96	50%	81.98	81.98	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	10.10	90%	1.01	9.09	85
High Density Residential/Commercial/Industrial	C	104.52	90%	10.45	94.07	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	61.60	50%	30.80	30.80	87
Industrial/Agricultural	D	1.80	50%	0.90	0.90	90
Impervious	-	15.93	100%	0.00	15.93	-
TOTALS		**557.42**		**243.44**	**313.99**	

WEIGHTED PERVIOUS CN **83**

SITE J MODEL PARAMETERS:

LAND USE	SOIL GRP	ACRES
Landscaping - Pervious	A/B	34.50
Landscaping - Pervious	C/D	208.94
Roofs - Impervious	A/B	24.8505
Roofs - Impervious	C/D	132.142
Roads, Etc - Impervious	A/B	24.8505
Roads, Etc - Impervious	C/D	132.142
		557.42

SUBBASIN T13

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	0.00	0.00	0.00
Medium Density Residential	0.00	0.00	0.00
High Density Residential/Commercial/Industrial	0.00	0.00	0.00
Industrial/Agricultural	0.00	0.00	0.00
Impervious	15.93	0.00	15.93
TOTAL AREA	**15.93**	**0.00**	**15.93**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	0.00	40%	0.00	0.00	77
Low Density Residential	C	0.00	40%	0.00	0.00	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	0.00	50%	0.00	0.00	80
Medium Density Residential	C	0.00	50%	0.00	0.00	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	0.00	90%	0.00	0.00	85
High Density Residential/Commercial/Industrial	C	0.00	90%	0.00	0.00	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	15.93	100%	0.00	15.93	-
TOTALS		**15.93**		**0.00**	**15.93**	

WEIGHTED PERVIOUS CN **#DIV/0!**

SITE C MODEL PARAMETERS:

LAND USE	SOIL GRP	ACRES
Forest - Previous	A/B	
Landscaping - Pervious	A/B	
Landscaping - Pervious	C/D	
Roofs - Impervious	A/B	
Roofs - Impervious	C/D	7.96
Roads, Etc - Impervious	A/B	
Roads, Etc - Impervious	C/D	7.97
		15.93

SUBBASIN T14

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	63.90	38.34	25.56
Medium Density Residential	30.73	15.37	15.37
High Density Residential/Commercial/Industrial	37.57	3.76	33.81
Industrial/Agricultural	0.00	0.00	0.00
Impervious	0.00	0.00	0.00
TOTAL AREA	**132.20**	**57.46**	**74.74**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	21.32	40%	12.79	8.53	77
Low Density Residential	C	42.58	40%	25.55	17.03	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	3.99	50%	2.00	2.00	80
Medium Density Residential	C	26.74	50%	13.37	13.37	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	7.91	90%	0.79	7.12	85
High Density Residential/Commercial/Industrial	C	29.66	90%	2.97	26.69	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	0.00	100%	0.00	0.00	-
TOTALS		**132.20**		**57.46**	**74.74**	

WEIGHTED PERVIOUS CN **82**

SITE I MODEL PARAMETERS:

LAND USE	SOIL GRP	ACRES
Forest - Previous	A/B	
Landscaping - Pervious	A/B	
Landscaping - Pervious	C/D	4.2
Roofs - Impervious	A/B	
Roofs - Impervious	C/D	4.9
Roads, Etc - Impervious	A/B	
Roads, Etc - Impervious	C/D	4.9
		14

SUBBASIN T15

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	121.48	72.89	48.59
Medium Density Residential	0.00	0.00	0.00
High Density Residential/Commercial/Industrial	11.83	1.18	10.65
Industrial/Agricultural	0.00	0.00	0.00
Impervious	0.00	0.00	0.00
TOTAL AREA	**133.31**	**74.07**	**59.24**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	22.72	40%	13.63	9.09	77
Low Density Residential	C	98.76	40%	59.26	39.50	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	0.00	50%	0.00	0.00	80
Medium Density Residential	C	0.00	50%	0.00	0.00	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	0.00	90%	0.00	0.00	85
High Density Residential/Commercial/Industrial	C	11.83	90%	1.18	10.65	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	0.00	100%	0.00	0.00	-
TOTALS		**133.31**		**74.07**	**59.24**	

WEIGHTED PERVIOUS CN **80**

SUBBASIN T16

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	0.00	0.00	0.00
Medium Density Residential	76.98	38.49	38.49
High Density Residential/Commercial/Industrial	35.32	3.53	31.79
Industrial/Agricultural	0.00	0.00	0.00
Impervious	0.00	0.00	0.00
TOTAL AREA	**112.30**	**42.02**	**70.28**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	0.00	40%	0.00	0.00	77
Low Density Residential	C	0.00	40%	0.00	0.00	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	0.00	50%	0.00	0.00	80
Medium Density Residential	C	76.98	50%	38.49	38.49	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	0.00	90%	0.00	0.00	85
High Density Residential/Commercial/Industrial	C	35.32	90%	3.53	31.79	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	0.00	100%	0.00	0.00	-
TOTALS		**112.30**		**42.02**	**70.28**	

WEIGHTED PERVIOUS CN **86**

SUBBASIN T17

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	0.00	0.00	0.00
Medium Density Residential	23.96	11.98	11.98
High Density Residential/Commercial/Industrial	15.25	1.53	13.73
Industrial/Agricultural	0.00	0.00	0.00
Impervious	0.00	0.00	0.00
TOTAL AREA	**39.21**	**13.51**	**25.71**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	0.00	40%	0.00	0.00	77
Low Density Residential	C	0.00	40%	0.00	0.00	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	0.00	50%	0.00	0.00	80
Medium Density Residential	C	23.96	50%	11.98	11.98	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	0.00	90%	0.00	0.00	85
High Density Residential/Commercial/Industrial	C	15.25	90%	1.53	13.73	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	0.00	100%	0.00	0.00	-
TOTALS		**39.21**		**13.51**	**25.71**	

WEIGHTED PERVIOUS CN **86**

SUBBASIN T18

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	0.00	0.00	0.00
Medium Density Residential	43.67	21.84	21.84
High Density Residential/Commercial/Industrial	0.00	0.00	0.00
Industrial/Agricultural	0.00	0.00	0.00
Impervious	0.00	0.00	0.00
TOTAL AREA	**43.67**	**21.84**	**21.84**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	0.00	40%	0.00	0.00	77
Low Density Residential	C	0.00	40%	0.00	0.00	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	0.00	50%	0.00	0.00	80
Medium Density Residential	C	40.33	50%	20.17	20.17	86
Medium Density Residential	D	3.34	50%	1.67	1.67	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	0.00	90%	0.00	0.00	85
High Density Residential/Commercial/Industrial	C	0.00	90%	0.00	0.00	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	0.00	100%	0.00	0.00	
TOTALS		**43.67**		**21.84**	**21.84**	

WEIGHTED PERVIOUS CN **86**

SITE E MODEL PARAMETERS:

LAND USE	SOIL GRP	ACRES
Forest - Previous	A/B	
Landscaping - Pervious	A/B	
Landscaping - Pervious	C/D	21.84
Roofs - Impervious	A/B	
Roofs - Impervious	C/D	10.92
Roads, Etc - Impervious	A/B	
Roads, Etc - Impervious	C/D	10.92
		43.68

SUBBASIN T19

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	0.00	0.00	0.00
Medium Density Residential	14.65	7.33	7.33
High Density Residential/Commercial/Industrial	13.81	1.38	12.43
Industrial/Agricultural	0.00	0.00	0.00
Impervious	0.00	0.00	0.00
TOTAL AREA	**28.46**	**8.71**	**19.75**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	0.00	40%	0.00	0.00	77
Low Density Residential	C	0.00	40%	0.00	0.00	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	10.14	50%	5.07	5.07	80
Medium Density Residential	C	4.51	50%	2.26	2.26	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	2.19	90%	0.22	1.97	85
High Density Residential/Commercial/Industrial	C	11.62	90%	1.16	10.46	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	0.00	50%	0.00	0.00	87
Industrial/Agricultural	D	0.00	50%	0.00	0.00	90
Impervious	-	0.00	100%	0.00	0.00	-
TOTALS		**28.46**		**8.71**	**19.75**	

WEIGHTED PERVIOUS CN **83**

SUBBASIN T20

FUTURE LAND USE	Total Area (Acres)	Pervious Area (Acres)	Imperv. Area (Acres)
Open Space - Forest	0.00	0.00	0.00
Open Space - Meadows/Fields	0.00	0.00	0.00
Low Density Residential	0.00	0.00	0.00
Medium Density Residential	31.77	15.89	15.89
High Density Residential/Commercial/Industrial	0.84	0.08	0.76
Industrial/Agricultural	63.40	31.70	31.70
Impervious	0.00	0.00	0.00
TOTAL AREA	**96.01**	**47.67**	**48.34**

Land Use	Soil Group	Total Area (Acres)	Percent Imperv.	Pervious Area (Acres)	Imperv. Area (Acres)	Pervious CN
Open-Forest	A	0.00	0%	0.00	0.00	48
Open-Forest	B	0.00	0%	0.00	0.00	67
Open-Forest	C	0.00	0%	0.00	0.00	78
Open-Forest	D	0.00	0%	0.00	0.00	83
Open-Fields	A	0.00	0%	0.00	0.00	65
Open-Fields	B	0.00	0%	0.00	0.00	78
Open-Fields	C	0.00	0%	0.00	0.00	85
Open-Fields	D	0.00	0%	0.00	0.00	89
Low Density Residential	A	0.00	40%	0.00	0.00	65
Low Density Residential	B	0.00	40%	0.00	0.00	77
Low Density Residential	C	0.00	40%	0.00	0.00	81
Low Density Residential	D	0.00	40%	0.00	0.00	87
Medium Density Residential	A	0.00	50%	0.00	0.00	68
Medium Density Residential	B	0.00	50%	0.00	0.00	80
Medium Density Residential	C	31.77	50%	15.89	15.89	86
Medium Density Residential	D	0.00	50%	0.00	0.00	90
High Density Residential/Commercial/Industrial	A	0.00	90%	0.00	0.00	76
High Density Residential/Commercial/Industrial	B	0.00	90%	0.00	0.00	85
High Density Residential/Commercial/Industrial	C	0.84	90%	0.08	0.76	89
High Density Residential/Commercial/Industrial	D	0.00	90%	0.00	0.00	91
Industrial/Agricultural	A	0.00	50%	0.00	0.00	71
Industrial/Agricultural	B	0.00	50%	0.00	0.00	82
Industrial/Agricultural	C	61.60	50%	30.80	30.80	87
Industrial/Agricultural	D	1.80	50%	0.90	0.90	90
Impervious	-	0.00	100%	0.00	0.00	-
TOTALS		**96.01**		**47.67**	**48.34**	

WEIGHTED PERVIOUS CN **87**

WESTERN WASHINGTON HYDROLOGY MODEL V2
PROJECT REPORT

Project Name: Sumner W Valley Hwy
Site Address:
City : Sumner
Report Date : 1/21/2004
Gage : McMillian
Data Start : 1948
Data End : 1996
Precip Scale: 1.00

PREDEVELOPED LAND USE

Basin : Basin 1
Flows To : Outflow
GroundWater: No

Land Use	Acres
TILL PASTURE:	2.99

DEVELOPED LAND USE

Basin : Basin 1
Flows To : Pond 1
GroundWater: No

Land Use	Acres
TILL GRASS:	0.46
IMPERVIOUS:	2.53

PRECHRES (POND) INFORMATION
Pond Name: Pond 1
Pond Type: Trapezoidal Pond
Pond Flows to : Outflow
Dimensions
Depth: 6ft.
Bottom Length: 137.13ft.
Bottom Width : 45.71ft.
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Volume at Riser Head: 1.069 acre-ft.
Discharge Structure
Riser Height: 5 ft.
Riser Diameter: 18 ft.
NotchType : Rectangular
Notch Width : 0.016 ft.
Notch Height: 2.201 ft.
Orifice 1 Diameter: 0.996 in. Elevation: 0 ft.

Pond Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
0.000	0.144	0.000	0.000	0.000
0.067	0.146	0.010	0.007	0.000
0.133	0.147	0.019	0.010	0.000
0.200	0.149	0.029	0.012	0.000

0.267	0.151	0.039	0.013	0.000
0.333	0.152	0.049	0.015	0.000
0.400	0.154	0.060	0.016	0.000
0.467	0.156	0.070	0.018	0.000
0.533	0.158	0.080	0.019	0.000
0.600	0.159	0.091	0.020	0.000
0.667	0.161	0.102	0.021	0.000
0.733	0.163	0.112	0.022	0.000
0.800	0.165	0.123	0.023	0.000
0.867	0.166	0.134	0.024	0.000
0.933	0.168	0.145	0.025	0.000
1.000	0.170	0.157	0.026	0.000
1.067	0.172	0.168	0.027	0.000
1.133	0.174	0.180	0.028	0.000
1.200	0.175	0.191	0.029	0.000
1.267	0.177	0.203	0.029	0.000
1.333	0.179	0.215	0.030	0.000
1.400	0.181	0.227	0.031	0.000
1.467	0.183	0.239	0.032	0.000
1.533	0.184	0.251	0.032	0.000
1.600	0.186	0.264	0.033	0.000
1.667	0.188	0.276	0.034	0.000
1.733	0.190	0.289	0.034	0.000
1.800	0.192	0.301	0.035	0.000
1.867	0.194	0.314	0.036	0.000
1.933	0.196	0.327	0.036	0.000
2.000	0.198	0.340	0.037	0.000
2.067	0.199	0.354	0.037	0.000
2.133	0.201	0.367	0.038	0.000
2.200	0.203	0.380	0.039	0.000
2.267	0.205	0.394	0.039	0.000
2.333	0.207	0.408	0.040	0.000
2.400	0.209	0.422	0.040	0.000
2.467	0.211	0.436	0.041	0.000
2.533	0.213	0.450	0.041	0.000
2.600	0.215	0.464	0.042	0.000
2.667	0.217	0.478	0.043	0.000
2.733	0.219	0.493	0.043	0.000
2.800	0.221	0.508	0.044	0.000
2.867	0.223	0.522	0.045	0.000
2.933	0.225	0.537	0.047	0.000
3.000	0.227	0.552	0.050	0.000
3.067	0.229	0.568	0.053	0.000
3.133	0.231	0.583	0.056	0.000
3.200	0.233	0.598	0.059	0.000
3.267	0.235	0.614	0.063	0.000
3.333	0.237	0.630	0.066	0.000
3.400	0.239	0.646	0.070	0.000
3.467	0.241	0.662	0.074	0.000
3.533	0.243	0.678	0.078	0.000
3.600	0.245	0.694	0.082	0.000
3.667	0.247	0.711	0.085	0.000
3.733	0.249	0.727	0.089	0.000
3.800	0.252	0.744	0.093	0.000
3.867	0.254	0.761	0.098	0.000
3.933	0.256	0.778	0.103	0.000
4.000	0.258	0.795	0.108	0.000
4.067	0.260	0.812	0.113	0.000
4.133	0.262	0.829	0.119	0.000
4.200	0.264	0.847	0.124	0.000
4.267	0.266	0.865	0.130	0.000
4.333	0.269	0.882	0.135	0.000
4.400	0.271	0.900	0.141	0.000
4.467	0.273	0.919	0.147	0.000
4.533	0.275	0.937	0.153	0.000
4.600	0.277	0.955	0.159	0.000
4.667	0.279	0.974	0.165	0.000
4.733	0.282	0.992	0.171	0.000
4.800	0.284	1.011	0.178	0.000
4.867	0.286	1.030	0.184	0.000
4.933	0.288	1.049	0.191	0.000
5.000	0.290	1.069	0.197	0.000

5.067	0.293	1.088	0.449	0.000
5.133	0.295	1.108	0.909	0.000
5.200	0.297	1.128	1.505	0.000
5.267	0.299	1.147	2.211	0.000
5.333	0.302	1.167	3.011	0.000
5.400	0.304	1.188	3.895	0.000
5.467	0.306	1.208	4.857	0.000
5.533	0.309	1.228	5.890	0.000
5.600	0.311	1.249	6.990	0.000
5.667	0.313	1.270	8.153	0.000
5.733	0.315	1.291	9.376	0.000
5.800	0.318	1.312	10.65	0.000
5.867	0.320	1.333	11.99	0.000
5.933	0.322	1.355	13.37	0.000
6.000	0.325	1.376	14.81	0.000

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped

Return Period	Flow(cfs)
year	0.089
5 year	0.15
10 year	0.2
25 year	0.276
50 year	0.342
100 year	0.417

Flow Frequency Return Periods for Developed Unmitigated

Return Period	Flow(cfs)
2 year	0.753
5 year	1.015
10 year	1.201
25 year	1.452
50 year	1.651
100 year	1.86

Flow Frequency Return Periods for Developed Mitigated

Return Period	Flow(cfs)
year	0.057
year	0.085
10 year	0.109
25 year	0.146
50 year	0.178
100 year	0.214

Yearly Peaks for Pre and Post Developed

Year	Predeveloped	Developed
1949	0.103	0.043
1950	0.097	0.046
1951	0.212	0.133
1952	0.047	0.037
1953	0.085	0.076
1954	0.071	0.043
1955	0.065	0.036
1956	0.117	0.087
1957	0.054	0.039
1958	0.054	0.036
1959	0.066	0.052
1960	0.449	0.123
1961	0.099	0.128
1962	0.040	0.037
1963	0.340	0.059
1964	0.092	0.054
1965	0.082	0.061
1966	0.295	0.041
1967	0.113	0.042

1968	0.055	0.042
1969	0.067	0.050
1970	0.048	0.058
1971	0.073	0.060
1972	0.121	0.096
1973	0.074	0.064
1974	0.223	0.043
1975	0.086	0.058
1976	0.130	0.056
1977	0.023	0.072
1978	0.243	0.048
1979	0.119	0.045
1980	0.125	0.106
1981	0.132	0.075
1982	0.106	0.089
1983	0.065	0.040
1984	0.042	0.049
1985	0.044	0.069
1986	0.094	0.048
1987	0.211	0.376
1988	0.079	0.060
1989	0.086	0.045
1990	0.104	0.108
1991	0.105	0.047
1992	0.070	0.062
1993	0.112	0.042
1994	0.038	0.035
1995	0.053	0.075
1996	0.112	0.085

Ranked Yearly Peaks for Pre and Post Developed

Rank	Predeveloped	Developed
1	0.3398	0.1333
2	0.2949	0.1282
3	0.2431	0.1235
4	0.2228	0.1081
5	0.2122	0.1055
6	0.2106	0.0957
7	0.1319	0.0891
8	0.1298	0.0868
9	0.1249	0.0848
10	0.1213	0.0764
11	0.1187	0.0754
12	0.1175	0.0754
13	0.1128	0.0716
14	0.1121	0.0692
15	0.1119	0.0638
16	0.1058	0.0618
17	0.1048	0.0607
18	0.1039	0.0600
19	0.1032	0.0597
20	0.0994	0.0588
21	0.0970	0.0583
22	0.0943	0.0575
23	0.0917	0.0561
24	0.0862	0.0536
25	0.0858	0.0521
26	0.0848	0.0503
27	0.0822	0.0495
28	0.0787	0.0485
29	0.0737	0.0476
30	0.0726	0.0472
31	0.0709	0.0465
32	0.0702	0.0451
33	0.0673	0.0446
34	0.0664	0.0431
35	0.0654	0.0428
36	0.0651	0.0426
37	0.0548	0.0422
38	0.0540	0.0417
39	0.0536	0.0415

40	0.0527	0.0410
41	0.0482	0.0404
42	0.0470	0.0393
43	0.0439	0.0370
44	0.0419	0.0368
45	0.0402	0.0359
46	0.0380	0.0357
47	0.0232	0.0354

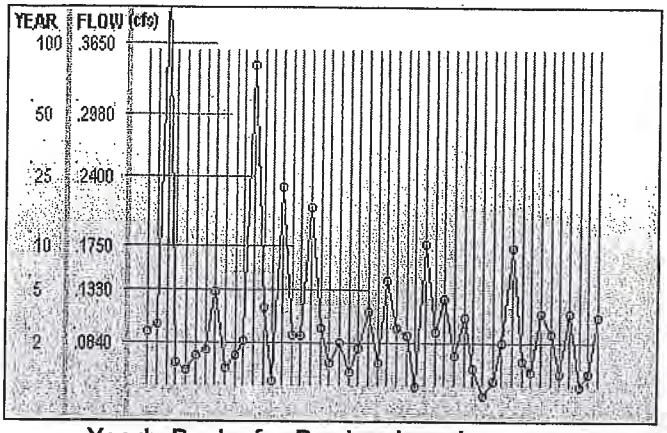
1/2 2 year to 50 year

Flow(CFS)	Predev	Final	Percentage	Pass/Fail
0.0445	3461	3372	97.0	Pass
0.0475	2886	2513	87.0	Pass
0.0505	2432	2018	82.0	Pass
0.0535	2095	1674	79.0	Pass
0.0565	1808	1457	80.0	Pass
0.0595	1547	1244	80.0	Pass
0.0625	1327	1100	82.0	Pass
0.0655	1135	984	86.0	Pass
0.0685	952	861	90.0	Pass
0.0715	816	736	90.0	Pass
0.0746	698	623	89.0	Pass
0.0776	598	534	89.0	Pass
0.0806	509	459	90.0	Pass
0.0836	431	386	89.0	Pass
0.0866	373	324	86.0	Pass
0.0896	302	246	81.0	Pass
0.0926	248	214	86.0	Pass
0.0956	213	183	85.0	Pass
0.0986	190	162	85.0	Pass
0.1016	172	141	81.0	Pass
0.1046	156	119	76.0	Pass
0.1076	143	97	67.0	Pass
0.1106	131	82	62.0	Pass
0.1136	115	72	62.0	Pass
0.1166	105	66	62.0	Pass
0.1196	94	56	59.0	Pass
0.1226	81	48	59.0	Pass
0.1256	71	41	57.0	Pass
0.1286	65	36	55.0	Pass
0.1316	58	30	51.0	Pass
0.1347	51	26	50.0	Pass
0.1377	46	25	54.0	Pass
0.1407	43	24	55.0	Pass
0.1437	37	22	59.0	Pass
0.1467	34	21	61.0	Pass
0.1497	31	20	64.0	Pass
0.1527	26	18	69.0	Pass
0.1557	24	18	75.0	Pass
0.1587	21	17	80.0	Pass
0.1617	18	15	83.0	Pass
0.1647	16	14	87.0	Pass
0.1677	15	12	80.0	Pass
0.1707	14	12	85.0	Pass
0.1737	13	11	84.0	Pass
0.1767	13	10	76.0	Pass
0.1797	11	8	72.0	Pass
0.1827	11	8	72.0	Pass
0.1857	10	7	70.0	Pass
0.1887	9	6	66.0	Pass
0.1917	9	4	44.0	Pass
0.1948	9	4	44.0	Pass
0.1978	9	3	33.0	Pass
0.2008	9	3	33.0	Pass
0.2038	9	3	33.0	Pass
0.2068	7	3	42.0	Pass
0.2098	7	3	42.0	Pass
0.2128	6	3	50.0	Pass
0.2158	5	3	60.0	Pass
0.2188	5	3	60.0	Pass
0.2218	5	3	60.0	Pass

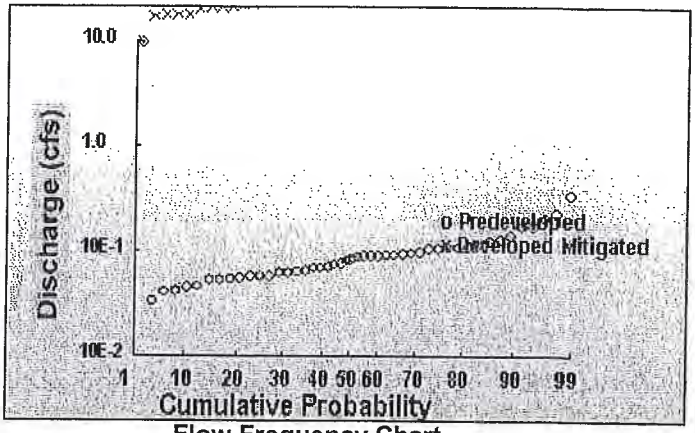
42/51

0.2248	4	3	75.0	Pass
0.2278	4	3	75.0	Pass
0.2308	4	3	75.0	Pass
0.2338	4	3	75.0	Pass
0.2368	4	3	75.0	Pass
0.2398	4	3	75.0	Pass
0.2428	4	2	50.0	Pass
0.2458	3	2	66.0	Pass
0.2488	3	2	66.0	Pass
0.2518	3	2	66.0	Pass
0.2549	3	2	66.0	Pass
0.2579	3	2	66.0	Pass
0.2609	3	2	66.0	Pass
0.2639	3	2	66.0	Pass
0.2669	3	2	66.0	Pass
0.2699	3	2	66.0	Pass
0.2729	3	2	66.0	Pass
0.2759	3	2	66.0	Pass
0.2789	3	2	66.0	Pass
0.2819	3	2	66.0	Pass
0.2849	3	2	66.0	Pass
0.2879	3	2	66.0	Pass
0.2909	3	2	66.0	Pass
0.2939	3	2	66.0	Pass
0.2969	2	2	100.0	Pass
0.2999	2	2	100.0	Pass
0.3029	2	2	100.0	Pass
0.3059	2	2	100.0	Pass
0.3089	2	2	100.0	Pass
0.3119	2	2	100.0	Pass
0.3150	2	2	100.0	Pass
0.3180	2	2	100.0	Pass
0.3210	2	2	100.0	Pass
0.3240	2	2	100.0	Pass
0.3270	2	2	100.0	Pass
0.3300	2	2	100.0	Pass
0.3330	2	1	50.0	Pass
0.3360	2	1	50.0	Pass
0.3390	2	1	50.0	Pass
0.3420	1	1	100.0	Pass

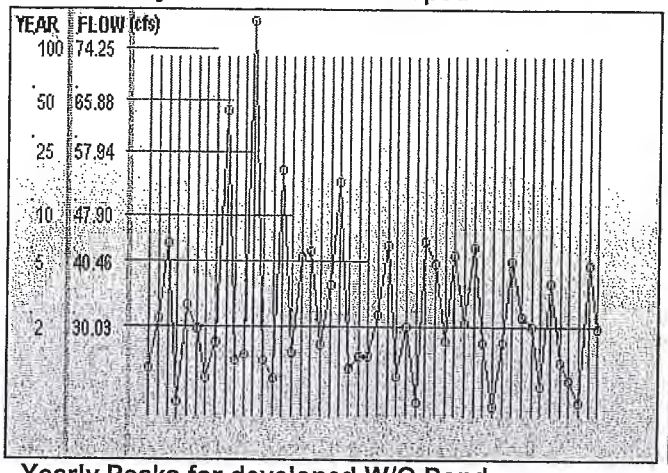
Water Quality BMP Flow and Volume.
On-line facility volume: 0.287 acre-feet
On-line facility target flow: 0.34 cfs.
Adjusted for 15 min: 0.45 cfs.
Off-line facility volume: 0.4 acre-feet
On-line facility target flow: 0.2 cfs.
Adjusted for 15 min: 0.26 cfs.



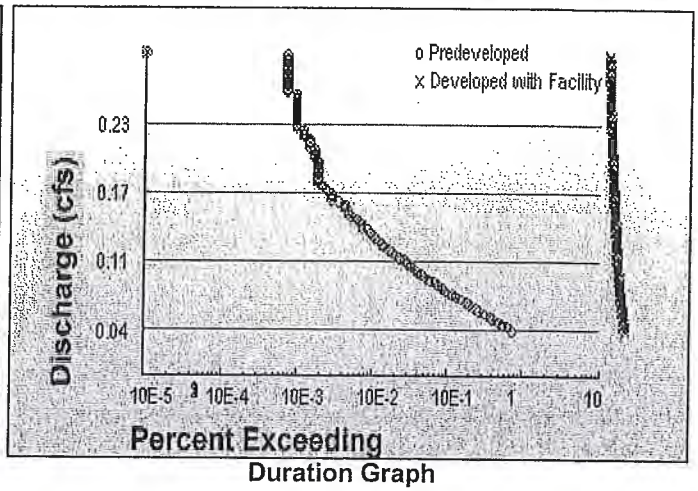
Yearly Peaks for Predeveloped



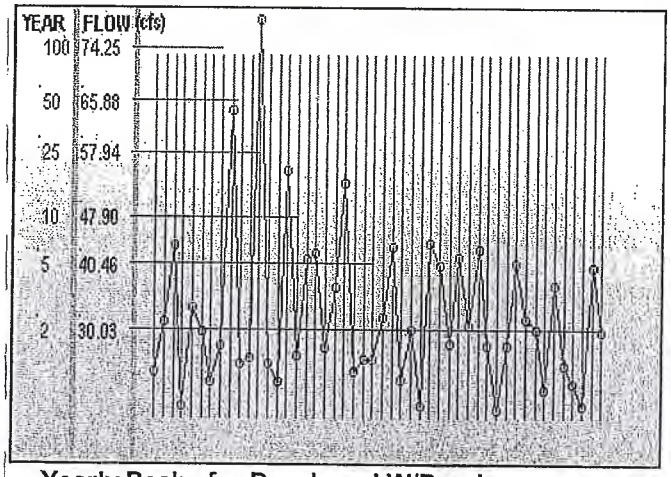
Flow Frequency Chart



Yearly Peaks for developed W/O Pond



Duration Graph



Yearly Peaks for Developed W/Pond

WESTERN WASHINGTON HYDROLOGY MODEL V2
PROJECT REPORT

Project Name: Sumner E Valley Hwy
Site Address:
City : Sumner
Report Date : 1/21/2004
Gage : McMillian
Data Start : 1948
Data End : 1996
Precip Scale: 1.00

PREDEVELOPED LAND USE

Basin : Basin 1
Flows To : Outflow
GroundWater: No

Land Use	Acres
TILL PASTURE:	18

DEVELOPED LAND USE
Basin : Basin 1
Flows To : Pond 1
GroundWater: No

Land Use	Acres
TILL GRASS:	2.8
IMPERVIOUS:	15.2

ARCHRES (POND) INFORMATION
Pond Name: Pond 1
Pond Type: Trapezoidal Pond
Pond Flows to : Outflow
Dimensions
Depth: 6ft.
Bottom Length: 377.69ft.
Bottom Width : 125.9ft.
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Volume at Riser Head: 6.360 acre-ft.
Discharge Structure
Riser Height: 5 ft.
Riser Diameter: 18 ft.
NotchType : Rectangular
Notch Width : 0.096 ft.
Notch Height: 2.224 ft.
Orifice 1 Diameter: 2.472 in. Elevation: 0 ft.

Pond Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
0.000	1.092	0.000	0.000	0.000
0.067	1.096	0.073	0.041	0.000
0.133	1.101	0.146	0.059	0.000
0.200	1.106	0.220	0.072	0.000

0.267	1.110	0.294	0.083	0.000
0.333	1.115	0.368	0.093	0.000
0.400	1.120	0.442	0.102	0.000
0.467	1.124	0.517	0.110	0.000
0.533	1.129	0.592	0.117	0.000
0.600	1.134	0.668	0.124	0.000
0.667	1.138	0.743	0.131	0.000
0.733	1.143	0.819	0.137	0.000
0.800	1.148	0.896	0.144	0.000
0.867	1.152	0.972	0.149	0.000
0.933	1.157	1.049	0.155	0.000
1.000	1.162	1.127	0.160	0.000
1.067	1.167	1.204	0.166	0.000
1.133	1.171	1.282	0.171	0.000
1.200	1.176	1.360	0.176	0.000
1.267	1.181	1.439	0.181	0.000
1.333	1.186	1.518	0.185	0.000
1.400	1.190	1.597	0.190	0.000
1.467	1.195	1.677	0.194	0.000
1.533	1.200	1.756	0.199	0.000
1.600	1.205	1.837	0.203	0.000
1.667	1.210	1.917	0.207	0.000
1.733	1.214	1.998	0.211	0.000
1.800	1.219	2.079	0.215	0.000
1.867	1.224	2.160	0.219	0.000
1.933	1.229	2.242	0.223	0.000
2.000	1.234	2.324	0.227	0.000
2.067	1.239	2.407	0.231	0.000
2.133	1.243	2.489	0.234	0.000
2.200	1.248	2.572	0.238	0.000
2.267	1.253	2.656	0.242	0.000
2.333	1.258	2.739	0.245	0.000
2.400	1.263	2.823	0.249	0.000
2.467	1.268	2.908	0.252	0.000
2.533	1.273	2.993	0.255	0.000
2.600	1.278	3.078	0.259	0.000
2.667	1.282	3.163	0.262	0.000
2.733	1.287	3.249	0.265	0.000
2.800	1.292	3.335	0.270	0.000
2.867	1.297	3.421	0.280	0.000
2.933	1.302	3.507	0.294	0.000
3.000	1.307	3.594	0.310	0.000
3.067	1.312	3.682	0.328	0.000
3.133	1.317	3.769	0.347	0.000
3.200	1.322	3.857	0.368	0.000
3.267	1.327	3.946	0.389	0.000
3.333	1.332	4.034	0.411	0.000
3.400	1.337	4.123	0.434	0.000
3.467	1.342	4.213	0.457	0.000
3.533	1.347	4.302	0.480	0.000
3.600	1.352	4.392	0.504	0.000
3.667	1.357	4.482	0.528	0.000
3.733	1.362	4.573	0.552	0.000
3.800	1.367	4.664	0.578	0.000
3.867	1.372	4.755	0.607	0.000
3.933	1.377	4.847	0.637	0.000
4.000	1.382	4.939	0.667	0.000
4.067	1.387	5.031	0.698	0.000
4.133	1.392	5.124	0.731	0.000
4.200	1.398	5.217	0.763	0.000
4.267	1.403	5.310	0.797	0.000
4.333	1.408	5.404	0.831	0.000
4.400	1.413	5.498	0.866	0.000
4.467	1.418	5.592	0.901	0.000
4.533	1.423	5.687	0.937	0.000
4.600	1.428	5.782	0.974	0.000
4.667	1.433	5.878	1.011	0.000
4.733	1.438	5.973	1.049	0.000
4.800	1.444	6.069	1.088	0.000
4.867	1.449	6.166	1.127	0.000
4.933	1.454	6.263	1.167	0.000
5.000	1.459	6.360	1.207	0.000

5.067	1.464	6.457	1.461	0.000
5.133	1.469	6.555	1.923	0.000
5.200	1.475	6.653	2.521	0.000
5.267	1.480	6.751	3.228	0.000
5.333	1.485	6.850	4.030	0.000
5.400	1.490	6.949	4.917	0.000
5.467	1.496	7.049	5.880	0.000
5.533	1.501	7.149	6.915	0.000
5.600	1.506	7.249	8.017	0.000
5.667	1.511	7.350	9.182	0.000
5.733	1.516	7.451	10.41	0.000
5.800	1.522	7.552	11.69	0.000
5.867	1.527	7.654	13.02	0.000
5.933	1.532	7.755	14.41	0.000
6.000	1.538	7.858	15.85	0.000

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped

Return Period	Flow(cfs)
2 year	0.535
5 year	0.9
10 year	1.202
25 year	1.659
50 year	2.058
100 year	2.511

Flow Frequency Return Periods for Developed Unmitigated

Return Period	Flow(cfs)
2 year	4.529
5 year	6.099
10 year	7.219
25 year	8.729
50 year	9.925
100 year	11.183

Flow Frequency Return Periods for Developed Mitigated

Return Period	Flow(cfs)
2 year	0.331
5 year	0.501
10 year	0.643
25 year	0.859
50 year	1.051
100 year	1.272

Yearly Peaks for Pre and Post Developed

Year	Predeveloped	Developed
1949	0.621	0.260
1950	0.584	0.269
1951	1.278	0.828
1952	0.283	0.217
1953	0.511	0.463
1954	0.427	0.256
1955	0.392	0.210
1956	0.707	0.521
1957	0.322	0.233
1958	0.325	0.210
1959	0.400	0.297
1960	2.701	0.740
1961	0.598	0.803
1962	0.242	0.218
1963	2.046	0.335
1964	0.552	0.307
1965	0.495	0.345
1966	1.775	0.246
1967	0.679	0.250

1968	0.330	0.249
1969	0.405	0.282
1970	0.290	0.331
1971	0.437	0.341
1972	0.730	0.579
1973	0.443	0.372
1974	1.341	0.255
1975	0.519	0.322
1976	0.782	0.316
1977	0.140	0.401
1978	1.464	0.276
1979	0.714	0.262
1980	0.752	0.645
1981	0.794	0.434
1982	0.637	0.544
1983	0.394	0.238
1984	0.253	0.272
1985	0.264	0.397
1986	0.568	0.269
1987	1.268	2.110
1988	0.474	0.339
1989	0.517	0.267
1990	0.625	0.655
1991	0.631	0.267
1992	0.422	0.349
1993	0.675	0.246
1994	0.229	0.210
1995	0.317	0.424
1996	0.673	0.510

Ranked Yearly Peaks for Pre and Post Developed

Rank	Predeveloped	Developed
1	2.0455	0.8281
2	1.7753	0.8035
3	1.4638	0.7399
4	1.3414	0.6546
5	1.2777	0.6455
6	1.2678	0.5792
7	0.7941	0.5435
8	0.7815	0.5206
9	0.7521	0.5097
10	0.7302	0.4626
11	0.7144	0.4343
12	0.7073	0.4235
13	0.6788	0.4011
14	0.6750	0.3974
15	0.6734	0.3718
16	0.6371	0.3493
17	0.6310	0.3453
18	0.6254	0.3411
19	0.6214	0.3388
20	0.5983	0.3347
21	0.5840	0.3306
22	0.5680	0.3218
23	0.5522	0.3158
24	0.5188	0.3066
25	0.5165	0.2967
26	0.5107	0.2825
27	0.4947	0.2764
28	0.4736	0.2724
29	0.4434	0.2695
30	0.4369	0.2685
31	0.4269	0.2671
32	0.4224	0.2670
33	0.4049	0.2615
34	0.4000	0.2600
35	0.3936	0.2564
36	0.3920	0.2550
37	0.3301	0.2495
38	0.3252	0.2492
39	0.3224	0.2462

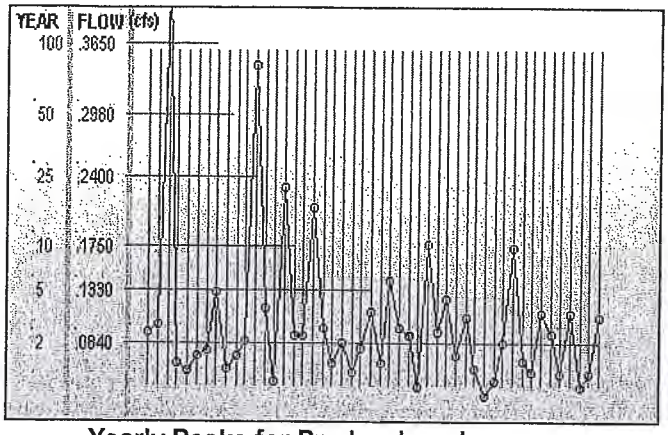
40	0.3170	0.2459
41	0.2903	0.2376
42	0.2829	0.2332
43	0.2643	0.2182
44	0.2525	0.2171
45	0.2421	0.2102
46	0.2288	0.2099
47	0.1397	0.2097

1/2 2 year to 50 year

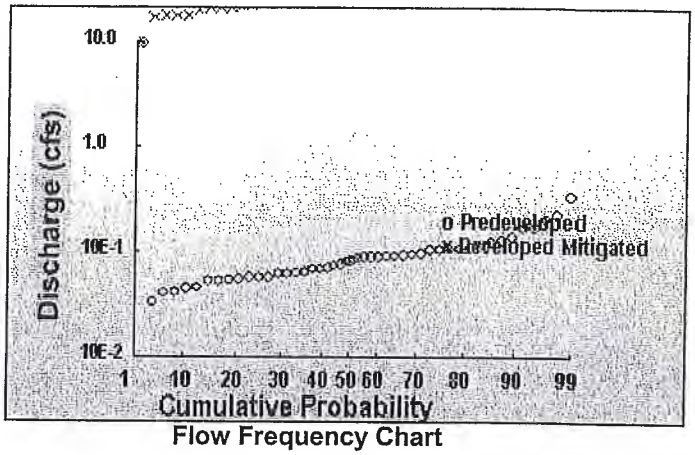
Flow(CFS)	Predev	Final	Percentage	Pass/Fail
0.2675	3386	2921	86.0	Pass
0.2856	2823	2046	72.0	Pass
0.3037	2393	1702	71.0	Pass
0.3218	2064	1459	70.0	Pass
0.3398	1785	1270	71.0	Pass
0.3579	1521	1113	73.0	Pass
0.3760	1291	998	77.0	Pass
0.3941	1107	878	79.0	Pass
0.4122	933	765	81.0	Pass
0.4303	799	651	81.0	Pass
0.4484	692	561	81.0	Pass
0.4664	588	485	82.0	Pass
0.4845	494	417	84.0	Pass
0.5026	424	354	83.0	Pass
0.5207	358	276	77.0	Pass
0.5388	296	232	78.0	Pass
0.5569	241	202	83.0	Pass
0.5750	211	174	82.0	Pass
0.5930	186	153	82.0	Pass
0.6111	169	136	80.0	Pass
0.6292	154	118	76.0	Pass
0.6473	140	92	65.0	Pass
0.6654	127	77	60.0	Pass
0.6835	112	70	62.0	Pass
0.7016	105	64	60.0	Pass
0.7196	92	58	63.0	Pass
0.7377	79	49	62.0	Pass
0.7558	70	44	62.0	Pass
0.7739	65	39	60.0	Pass
0.7920	57	36	63.0	Pass
0.8101	51	28	54.0	Pass
0.8282	45	25	55.0	Pass
0.8462	42	24	57.0	Pass
0.8643	36	23	63.0	Pass
0.8824	34	21	61.0	Pass
0.9005	31	20	64.0	Pass
0.9186	26	20	76.0	Pass
0.9367	24	19	79.0	Pass
0.9548	20	17	85.0	Pass
0.9728	18	16	88.0	Pass
0.9909	16	16	100.0	Pass
1.0090	14	14	100.0	Pass
1.0271	14	13	92.0	Pass
1.0452	13	13	100.0	Pass
1.0633	13	11	84.0	Pass
1.0814	11	10	90.0	Pass
1.0994	10	10	100.0	Pass
1.1175	10	8	80.0	Pass
1.1356	9	8	88.0	Pass
1.1537	9	7	77.0	Pass
1.1718	9	6	66.0	Pass
1.1899	9	6	66.0	Pass
1.2080	9	6	66.0	Pass
1.2261	9	6	66.0	Pass
1.2441	7	5	71.0	Pass
1.2622	7	5	71.0	Pass
1.2803	5	5	100.0	Pass
1.2984	5	5	100.0	Pass
1.3165	5	5	100.0	Pass
1.3346	5	5	100.0	Pass

1.3527	4	4	100.0	Pass
1.3707	4	4	100.0	Pass
1.3888	4	3	75.0	Pass
1.4069	4	3	75.0	Pass
1.4250	4	3	75.0	Pass
1.4431	4	3	75.0	Pass
1.4612	4	3	75.0	Pass
1.4793	3	3	100.0	Pass
1.4973	3	3	100.0	Pass
1.5154	3	3	100.0	Pass
1.5335	3	3	100.0	Pass
1.5516	3	3	100.0	Pass
1.5697	3	3	100.0	Pass
1.5878	3	3	100.0	Pass
1.6059	3	3	100.0	Pass
1.6239	3	3	100.0	Pass
1.6420	3	3	100.0	Pass
1.6601	3	3	100.0	Pass
1.6782	3	3	100.0	Pass
1.6963	3	3	100.0	Pass
1.7144	3	2	66.0	Pass
1.7325	3	2	66.0	Pass
1.7505	3	2	66.0	Pass
1.7686	3	2	66.0	Pass
1.7867	2	2	100.0	Pass
1.8048	2	2	100.0	Pass
1.8229	2	2	100.0	Pass
1.8410	2	2	100.0	Pass
1.8591	2	2	100.0	Pass
1.8771	2	2	100.0	Pass
1.8952	2	2	100.0	Pass
1.9133	2	2	100.0	Pass
1.9314	2	1	50.0	Pass
1.9495	2	1	50.0	Pass
1.9676	2	1	50.0	Pass
1.9857	2	1	50.0	Pass
2.0037	2	1	50.0	Pass
2.0218	2	1	50.0	Pass
2.0399	2	1	50.0	Pass
2.0580	1	1	100.0	Pass

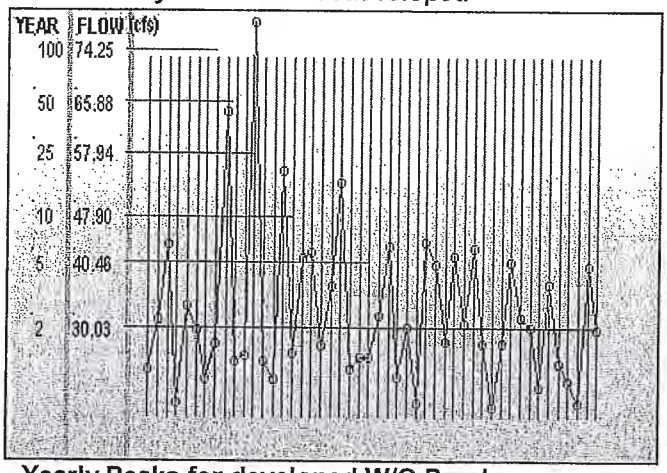
Water Quality BMP Flow and Volume.
On-line facility volume: 1.317 acre-feet
On-line facility target flow: 1.58 cfs.
Adjusted for 15 min: 2.09 cfs.
Off-line facility volume: 1.834 acre-feet
On-line facility target flow: 0.92 cfs.
Adjusted for 15 min: 1.22 cfs.



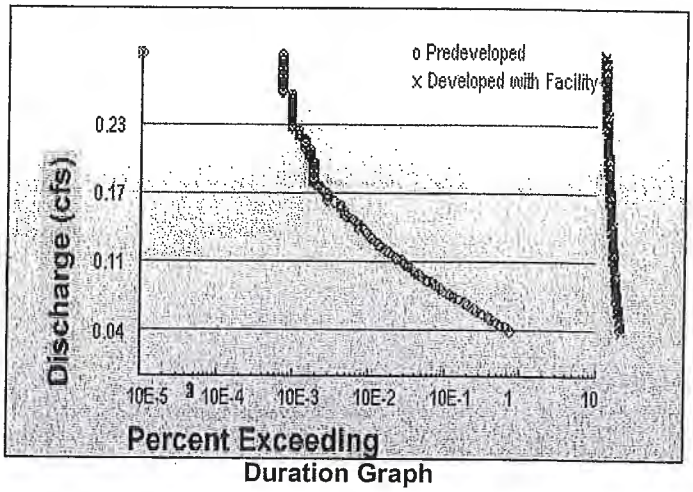
Yearly Peaks for Predeveloped



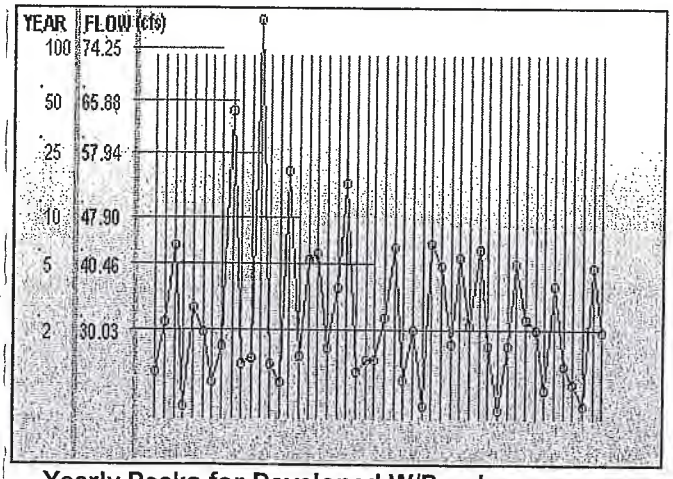
Flow Frequency Chart



Yearly Peaks for developed W/O Pond



Duration Graph



Yearly Peaks for Developed W/Pond

SUMNER CITY LIMITS

PROPOSED CIP, NOT YET CONSTRUCTED

REGIONAL SITE FOR STORMWATER MANAGEMENT FACILITIES

Figure 4.1
City of Sumner
Proposed Capital Improvement Project (CIP) Locations

SCALE IN FEET

0 800 1600

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SUMNER CITY LIMITS

EXISTING STORMWATER INFRASTRUCTURE

REGIONAL SITE FOR STORMWATER MANAGEMENT FACILITIES

Figure 4.2
City of Sumner
Potential Regional Facility Locations

N

SCALE IN FEET

0 800 1600

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