

October 15, 2004  
WP52758

Councilmember Shawn Bunney, Pierce County Council  
Brian Ziegler, P.E., Director, Public Works and Utilities Department

RE: SWMAB Recommended Technical Amendments to the Muck Creek Basin  
Plan

Dear Councilmember Bunney and Mr. Ziegler:

This letter contains the Storm Drainage and Surface Water Management Advisory Board (SWMAB) recommended revisions to the Muck Creek Basin Plan.

In my letter to you dated September 30, 2004, the SWMAB recommended that you adopt the Muck Creek Basin Plan dated April 2003 with our September revisions. The attachment provides those recommended revisions.

Sincerely,

Deborah Johnston  
Surface Water Advisory Board Chair

cc: Harold Smelt, Water Programs Manager  
Dan Wrye, Program Services Section Manager  
Heather Kibbey, Water Quality Section Supervisor  
file

## ATTACHMENT

### **Storm Drainage and Surface Water Management Advisory Board recommended changes to the Muck Creek Basin Plan (dated April, 2003):**

p S-3 Section S-4, 2<sup>nd</sup> para. The Draft Basin Plan and the accompanying Draft Supplemental Environmental Impact Statement ~~was~~were made ...

p S-4 Programmatic recommendations, 4<sup>th</sup> item "...acquisition program for riparian **and wetland habitat protection and flood hazard reduction.**"

Table S-1--**Insert new table S-1, attached.**

p. S-5, Section S.7, insert new language:

Implementation of the recommended actions will generally follow the prioritization groupings of high, medium, and low and a logical order of sequencing. To ensure that the full benefits of all projects are realized, implementation will not follow the exact sequence of the first project to the last project in the High category, followed by the first action in the Medium category, and so forth. Several factors exist that will result in implementation of actions that are not in the exact sequence as depicted in the projects and programs prioritized by the benefit and ranked by cost table. These factors include the following:

- Available funds;
- Contingent projects<sup>1</sup>;
- Available staff and professional service needs;
- Cooperation from private landowners;
- The best implementer may be an agency other than Pierce County Public Works and Utilities; and
- New information, regulations or emerging issues.

### **Economic Development Criteria**

Implementing projects and programs recommended in the Basin Plan is expected to reduce flood hazards, and preserve or protect water quality and floodplain habitat. Collectively and individually, these projects are aimed at protecting Pierce County's quality of life. Projects and programs in the Plan will afford resource protection as the community develops; preserve, enhance or protect natural floodplain functions; balance structural and nonstructural approaches; reduce potential County environmental

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<sup>1</sup> Contingent projects include projects such as stream restoration projects intended to reduce flood hazards and improve aquatic habitat, and culvert replacement projects intended to improve fish passage. These projects will provide their full benefit after all downstream fish passage barriers are removed, and should be sequenced accordingly.

liabilities; and help achieve environmental compliance and long-term sustainability. Collectively, these attributes help make Pierce County a liveable community where quality of life issues will provide indirect, passive economic development benefits to businesses and individuals looking to locate or stay in Pierce County.

In addition to the above, Water Programs will consider the following criteria in developing its annual proposed capital facilities plan updates:

- Is the project located in an employment center zone (or handle flow from those zones)?
- Is the project located in another type of commercial zone (or handle flow from those zones)?
- Will the project reduce permitting timelines for industrial/commercial projects?
- Will the project assure access to an employment center via road and /or rail?
- Will the project increase the supply of developable property?
- Will the project reduce overall development costs?
- Are there partners willing to contribute to the development costs of the project?
- Does the project allow/provide for land development?

In light of these and other factors, following action on the Basin Plan, Pierce County will develop an implementation strategy designed to sequence, schedule and assign resources for the various recommended actions. This implementation strategy will be developed in collaboration and coordination with other potential implementers and in consideration with available financial and staff resources. The implementation strategy will include performance measurements and provide for periodic evaluation of progress.

p. 2-3, ~~2.2~~ **2.3 Other Programs....**

p. 2-1, after 2nd paragraph--insert "In 1988 the Pierce County Storm Drainage and Surface Water Management Advisory Board (SWMAB), a County-wide group of individuals representing each major watershed of the County was established to assist in the development of the Pierce County surface water utility plan and to assist in guiding the program. After the 1991 Plan was adopted, the Board dissolved. The County Council reestablished the SWMAB in 2004. There are nine board members, representing the major watershed basins within the County, who review the surface water utility program. SWMAB meetings are open to the public."

p. 3-2, Nisqually River Council, first line, "...coordinate the interests..."  
Washington State Department of Ecology, 5<sup>th</sup> sentence, delete "also"

p. 3-5, Insert **"Final" Basin Plan**

At the end of the Draft SEIS review a Final SEIS was prepared, and comments obtained were addressed, and where appropriate, incorporated into the text of the “Final” Basin Plan.

Planning Commission--April 23, 2003

The Muck Creek Basin Plan was presented at a public hearing before the Pierce County Planning Commission. Several members of the public attended and several commented. The Planning Commission recommended approval of the Plan.

Pierce County Storm Drainage and Surface Water Management Advisory Board (SWMAB)-August 2, 2004, September 1, 2004, September 16, 2004

In August, the SWMAB was briefed on the content of the Plan. A full presentation on the Plan was given on September 1, with a follow-up presentation on September 16. The SWMAB recommended approval of the Plan to the County Council.”

p. 4-4, 4.3 Soils, 1<sup>st</sup> para., first sentence: “...consist almost entirely of two associations **Kapowsin and Spanaway**.

p.4-5, Natural Drainage System, 3<sup>rd</sup> para, 3<sup>rd</sup> sentence. “The South Fork drainage **area is approximately 36.6 sq. miles in area** and...”

p. 4.6, 3<sup>rd</sup> para, 1<sup>st</sup> sentence, “...occurring along the Main Stem and the lower North Fork, between RM 11 **of the Mainstem and RM 1.5 of the North Fork** (Figure 4-1).”

p. 4-8, 3<sup>rd</sup> para, 3<sup>rd</sup> sentence, “...until mid-November and **it** then varied...”

p. 4-21, last para, 3<sup>rd</sup> sentence, “Coho salmon (*O. kisutch*) have not been **observed spawning** in Muck Creek since the 1980’s. However, **juveniles have been observed near Johnson Creek on Ft. Lewis as recently as 2002 and in the upper reaches of the South Fork in the late 1990s.**

p. 4-28, 4<sup>th</sup> full para, “**Three** other state sensitive...small flowered trillium.” **Delete info re: golden paintbrush.**

Last sentence, “Prairie habitat...cottontail rabbits.” **Delete “coyotes with occasional blacktail deer.”**

p. 4-30, Revise Table 4-10 to add:

Streaked Horned Lark ( <i>Eremophila alpestris</i> )	Federal/state candidate
Mardon Skipper Butterfly ( <i>Polites mardon</i> )	Federal candidate--State endangered
Puget Blue Butterfly ( <i>Plebejus icariodes blackmorei</i> )	State candidate
Taylor’s (Whulge) Checkerspot ( <i>Euphydras editha taylori</i> )	Federal/state candidate

Valley Silverspot <i>Speyeria zerene bremnerii</i> )	Federal species of concern/state candidate
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p. 5-5, 1<sup>st</sup> full para, 1<sup>st</sup> sentence, “**Salmonid** runs in Muck Creek occur relatively late (**delete**,”) compared to most (**delete**,”) in the Puget sound region.”

p. 6-8, Table 6.1, CIP12NF-RD01, delete “**10307**”, CIP12NF-CUL02 , delete “**6927**”, CIP12SFCUL04, delete “**9300**”.

p. 8-1, Fish Passage and Low Flow, first para,last sentence, “Spawning **coho have not** been seen in Muck Creek for several years.”

1<sup>st</sup> para, next to last sentence “...redside shiners (*Richardsonius balteatus*).”

p. 9-4, Implementation Strategy, insert new language and delete old.

Implementation of the recommended actions will generally follow the prioritization groupings of high, medium, and low and a logical order of sequencing. To ensure that the full benefits of all projects are realized, implementation will not follow the exact sequence of the first project to the last project in the High category, followed by the first action in the Medium category, and so forth. Several factors exist that will result in implementation of actions that are not in the exact sequence as depicted in the projects and programs prioritized by the benefit and ranked by cost table. These factors include the following:

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community develops; preserve, enhance or protect natural floodplain functions; balance structural and nonstructural approaches; reduce potential County environmental liabilities; and help achieve environmental compliance and long-term sustainability. Collectively, these attributes help make Pierce County a liveable community where quality of life issues will provide indirect, passive economic development benefits to businesses and individuals looking to locate or stay in Pierce County.

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Table 9-1, after p. 9-3, insert new table 9-1

p. 9-2, Capital Improvement Project  
“There are a total of 21 CIP’s....”

p. 9-3, 2<sup>nd</sup> paragraph, third sentence, “The prioritized list of measures is shown on Table 9-1. Prioritized measures recommended in the Plan over a ten year period total \$10.5 million.”

p. 9-3, middle of page

- \$3.5 million is for projects identified as “High Priority”
- \$6.5 million is for projects identified as “Medium Priority”
- \$0.5 million is for projects identified as “Low Priority”

Information Gaps, end of first sentence, “4 basin specific studies are proposed as part of the Basin Plan (numbers 31-34 Table 9-1)

p. 9-11, 4<sup>th</sup> para, revise and combine 1<sup>st</sup> and 2<sup>nd</sup> sentences: “Patterson Springs is a critical area that is the major source of flow to the upper North Fork.....”

p. 9-17, 3<sup>rd</sup> complete para, 6<sup>th</sup> line, revise language. “As part of the monitoring program water samples could be collected...” Replace “Annually for the first three years”

Para at top of page next to last sentence, delete the comma between increases and somewhat.

p. 9-24, CIP12SF-CUL02: “Orting-Kapowsin Highway Conveyance Improvements”  
(288th St. E and Orting-Kapowsin Highway)  
Cost: \$10,000      Score: 85

**Problem:** Stormwater overtops 288th St E and floods the property owner on the southwest corner of the intersection of 288<sup>th</sup> St E and the Orting-Kapowsin Highway. In the winter, frozen water over the road and poor lighting presents a safety hazard.

**Solution:** Roadside ditch regrading and maintenance is needed in all ditches surrounding the intersection. Construct a 50-foot 18" culvert across 288<sup>th</sup> St E allowing drainage to the ditch on the north side ditch. It is also recommended that traffic accident records be reviewed to assess accident frequency; illumination of the intersection should be considered.

p. 9-25, CIP12SF-DIV01 In the solution section, third sentence, change “se” to “see”

p. 9-26, CIP12LC-CUL01: “Schudy Rd S Culvert Replacement”  
(311<sup>th</sup> St. S and Schudy Road)  
Cost: \$100,000      Score: 175

**Problem:** The lower-most Lacamas Creek culvert crossing of Schudy Rd S does not have sufficient capacity to pass the 100-year storm event and water from the creek overtops the road.

**Solution:** Replace the existing culverts with one 10'-11" wide by 6'-4" deep metal box culvert, 29 feet in length. The culvert is sized to allow for stream bed material in the bottom of the culvert. Install large woody debris upstream and downstream of culvert to increase stream habitat value.

p. 9-27, CIP12LC-CUL02 “Highway 507 Culvert Replacement”  
(Highway 507 and Lacamas Creek)  
Cost: \$345,000      Score: 215

**Problem:** Lacamas Creek crosses under Highway 507 through three 4-foot high arch culverts. On several past occasions, high flows have overflowed the highway at a low

spot in the road, south of the culverts. This has disrupted highway traffic and caused downstream flooding and creek damage.

**Solution:** Replace the existing triple arch culverts with a 20'x5' concrete box culvert convey the 100-year, 24-hour storm event and meet the current Pierce County design standards. The culvert is sized to allow for stream bed material in the bottom of the culvert. During detailed design, the low spot in the highway, south of the stream crossing, needs to be factored into the design.

**After p. 9-28, replace figure 9-3 with the corrected figure 3 that shows all the projects.**

**p. 9-34, PG00-05 Develop and Implement Program to Enhance Riparian and Wetland Habitat, Water Quality and Provide Flood Hazard Attenuation**

Pierce County Water Programs would develop and implement projects in riparian and wetland areas that require restoration or enhancement to improve the ecosystem function, where property owners have given permission. Property owners could grant an easement to Pierce County covering all or part of their lands for habitat enhancement purposes or sell the land outright to the County. The primary function of the program would be to manage the restoration sites contained in the Basin Plan. Duties would include identifying potential projects, obtaining access, developing restoration plans, identifying resources to help in the restoration including recruiting volunteers where appropriate or hiring contractors, ordering supplies, and publicizing planting events or completed projects. The County could form partnerships with volunteer groups and other organizations such as the Pierce Conservation District, Pierce Stream Team, Muck Creek Council, the Nisqually Indian Tribe, and Fort Lewis to restore or enhance riparian and estuarine areas.

**Cost Assumption:** Includes 1 FTE to establish and run the program for a 10-year period. Prorated for the Muck Creek share of the County-wide cost (3.4%). The actual site restoration costs are included in the CIP element.

<b>Cost:</b>	<b>\$34,000</b>
<b>Application:</b>	<b>County-wide</b>
<b>Score:</b>	<b>325</b>

**p. 9-35, PG00-06 Develop and Implement an Education, Outreach, and Technical Assistance Program**

Pierce County Water Programs would develop a comprehensive education, outreach, and technical assistance program that includes the following elements:

- **Awareness:** Activities under this element include public notification of department activities, availability of data such as updated floodplain and

groundwater information and mapping, and Basin Plan-related information as it is developed.

- **Topics:** Topics may address specific pollutants such as pathogens, metals, nutrients; or issues such as flooding, lawn and garden chemicals, native plant landscaping, or small farm management. Generally, increasing public awareness of best management practices that they can implement to reduce water quality, flooding, and habitat impacts in their Basin will be the focus of each educational effort. Emergency information related to flooding needs to be well-coordinated and easily accessible.
- **Target audiences:** Audiences would include Basin residents but may also specifically target specific stakeholders such as floodplain residents, business owners, real estate professionals, or homebuyers. Coordination with other education providers such as schools and non-governmental organizations would be addressed.
- **Methods:** Methods to distribute information may include a variety of techniques such as posting information on the internet, use of libraries and public bulletin boards, speakers, news releases, newsletters, utility bill inserts, targeted mailings, fair booth displays, billboards, Pierce County Speaks segments, and other options. These methods will be utilized based on the information to be distributed and the target audience.
- **Direct Technical/Financial Assistance:** In addition to basic awareness, Pierce County’s education program could include an assistance program to directly aid residents in taking desired actions. This may include supporting volunteer monitoring programs, offering technical and financial assistance to floodplain residents, offering incentives for establishing buffers, and coordinating with other agencies that provide technical support such as the Conservation District. Additional incentives might come in the form of free native plants, discounts at local stores, free workshops, tax breaks, or other methods.
- **Coordination:** In order to efficiently communicate Water Programs messages, the education, outreach and technical assistance program will include a coordination element with other agencies, groups and jurisdictions. Coordination efforts will include other education providers but also technical staff.

**Cost Assumption:** Includes 1 FTE to establish and run the program for a 10-year period. Prorated for the Muck Creek share of the County-wide cost (3.4%). The actual site restoration costs are included in the CIP element.

<b>Cost:</b>	<b>\$111,000</b>
<b>Application:</b>	<b>County-wide</b>
<b>Score:</b>	<b>397</b>

p. 10-9, Table, section 6), Objectives, insert missing language

“Planning and design/construction of stormwater management measures should include opportunity for **comment by the general public and interested agencies. The Master Plan and its updates shall provide opportunity for** identification of acceptable storm water management measures.

The Citizens.....”

p. 10-15, second full para, first sentence, **delete extra periods.**

Appendix J--The two tables of impervious surface area information have been retitled to clarify the content. See attachment.

Appendix K--Insert the following text preceding the table:

## **Appendix K**

### **Drainage Complaint Summary**

This appendix presents a summary log of the investigations performed by the consultant on drainage and flooding problems in the Muck Creek Basin. The first section is a spreadsheet developed from a review of the drainage complaint files and GIS flood problem maps maintained at the Water Programs office. The second section presents, in narrative form, additional flooding problems identified during Phase 1 of the Basin Plan Study.

Insert the following text following the table:

#### **Preliminary Review of Flooding and Drainage Problems Identified during Phase 1 of the Muck Creek Basin Plan**

**#101** – Twin 36” culverts at lower-most Lacamas Creek crossing of Schudy Road, 0.5 miles south of 304<sup>th</sup> Street S.

The 1991 Stormwater Management Plan identified this crossing as insufficient to pass the 25-year flow – High Priority.

Observed this site in the field. The upstream portion of the culvert was partially block by woody debris and a large piece of concrete. It is recommended that maintenance be performed in the near future to remove this debris. There is a home in the vicinity of the culvert that could be damaged by an over-topping event along this rural road. There was no sign of any recent flood damage.

Status: Recommended CIP; re-analyze the culvert to verify its capacity and needed upgrade.

**#102** – Triple 36” culverts along the South Fork crossing at 288<sup>th</sup> Street E, 1.4 miles east of Meridian.

The 1991 Stormwater Management Plan identified this crossing as insufficient to pass the 25-year flow – High Priority. The County has verified that flooding commonly occurs at this crossing.

During a field visit, we met a resident who lived next to this crossing. He stated that until he raised his driveway, it used to flood, periodically. He confirmed that this crossing floods fairly regularly with 8” to 10” over the road.

Status: Recommended CIP; re-analyze the culvert to verify its capacity and needed upgrade.

**#102A** – 36” RCP along a branch of the South Fork crossing 288<sup>th</sup> Street E, 0.7 miles east of Meridian .

The top of this pipe is within 18” of the top of the road. Despite relatively little flow, the downstream end of the culvert was back-watered to within 3” of the top of the pipe at the time of the site visit. There are no homes or other high-value property that would be damaged by an over-topping event along this road.

Status: Recommended CIP; re-analyze the culvert to verify its capacity and needed upgrade.

**#103** – Twin 24” culverts along a branch of the South Fork crossing 288<sup>th</sup> Street E. 0.4 miles west of Meridian. The 1991 Stormwater Management Plan identified this crossing as insufficient to pass the 25-year flow – High Priority.

This appears to be a small drainage area consisting of grassy fields. The channel is quite shallow and can readily over-top its banks, flooding the surrounding field. However, there are no homes or other high-value property that would be damaged, should this occur.

Status: Recommended CIP; re-analyze the culvert to verify its capacity and needed upgrade.

**#104** – 36” culvert crossing of Meridian by a branch of the South Fork, 0.7 miles north of 288<sup>th</sup> Street E.

The 1991 Stormwater Management Plan identified this crossing as insufficient to pass the 25-year flow – High Priority.

Several homes are located in the vicinity of the culvert that might be damaged by a road over-topping event. Meridian is a state highway and an important road in the area. Flooding at this location would be a major problem for traffic.

Status: Recommended CIP; re-analyze the culvert to verify its capacity and needed upgrade.

**#105** – 4,000-foot length of Lacamas Creek upstream of 40<sup>th</sup> Avenue S

The 1991 Stormwater Management Plan identified this portion of Lacamas Creek as overgrown and filled with sediment. There was a recommendation to dredge the channel to add hydraulic capacity.

The creek lies behind a series of homes, entirely on private property and difficult to access from 40<sup>th</sup> Avenue S, which runs parallel. During the field visit, we did find one private access road which crossed the creek in this location. We confirmed that the channel is overgrown with the nuisance species, reed canarygrass. There is some brush, but no trees within the riparian zone. The stream channel is shallow and appears capable of rising out of its banks at moderate flows. However, there are no homes or other high value structures near the creek. There does not appear to be any substantial potential for damage or other serious consequences from the shallow flooding that apparently occurs along this stretch.

Status: This does not a substantial flood problem. However, it does pose a fish passage problem and provides poor stream habitat. It should be studied further for a possible Habitat CIP.

**#106** – 48” CMP conveying local runoff under 288<sup>th</sup> Street S, 0.3 miles west of 8<sup>th</sup> Avenue S.

This was identified as a flood problem at a public meeting.

At the time of the field visit, there was no flow along this drainage, yet the culvert was completely submerged. Fort Lewis lies immediately downstream and the channel has lots of debris. Several homes lie in the immediate vicinity. A local resident verified that this crossing floods nearly every winter and at least one garage suffers flood damage. The resident claimed that the Fort had done some grading work a short distance downstream that had blocked or diverted this drainage, causing it to back up to 288<sup>th</sup>, upstream of the Fort.

Status: Recommended CIP; contact the Fort regarding this problem. Arrange for a visit to the Fort portion of the drainage and determine if conditions on the Fort are causing a hydraulic capacity problem, offsite. May conduct localized hydrologic modeling.

**#107** – 24” and 36” CMPs along the 8<sup>th</sup> Avenue S crossing of the same local drainage as discussed for Site #106 (above), but located one-quarter mile upstream.

This was identified as a flood problem at a public meeting.

This crossing was dry and there is no high-value property in the immediate vicinity. Ponded water backed up from Site #106 was visible about 200 yards downstream.

Status: See #106.

**#108** – Sand Pit off of Webster Road, one mile south of 260<sup>th</sup> Street E.

This was identified as a possible erosion and water quality problem at a public meeting.

During a field visit, we walked up an access road off of Webster to the sand pit, which was closed. The pit is dug into a hill and drains to a small settling pond. The overflow structure appears to be damaged. An examination of the small outflow downstream of the settling pond showed no indication of excessive situation or sediment deposition. The overflow pipe within the settling pond has been damaged. This may allow short-circuiting of silty water during higher runoff conditions to the pond. Due to dense vegetation, no attempt was made to view conditions further down the slope or within the nearby valley below the sand pit.

Status: Recommended closure; this operation is on private property and poses no downstream flood or water quality problem. The County should contact the pit operator regarding replacement of the overflow pipe.

**#109** (not shown on Figure 6-1) – Reported chemical dump site at South 72<sup>nd</sup> Street and 297<sup>th</sup> Street S.

This problem was reported at a public meeting.

Status: This site lies outside of the Muck Creek Basin. The County may wish to investigate to determine if this warrants further action.

**#110** – Flooding near 48<sup>th</sup> Avenue E and 247<sup>th</sup> Street E

This problem was reported at a public meeting.

This reported flood location lies in the middle of a subdivision which is quite flat. There are two catch basins across the street from each other. There was no obvious sign of flood problem, however. We talked with a local resident who had lived near the site for 7 years. The resident stated that she was unaware of any flood problem at that location.

Status: Recommended Closure.

**#11** – Flooding at the intersection of 260<sup>th</sup> Street E and 50<sup>th</sup> Avenue S.

This problem was reported at a public meeting.

The intersection of these two streets is very flat. There is no storm pipe system. There is a small, depressed area in the NE corner. We talked with the owner of the house on the northwest corner, Chuck Whitson. He stated that the street has never flooded in the

10+ years that he has lived there. Ponded water does occasionally form in the small, depressed area mentioned.

Status: Recommended Closure.

**#112** – Flooding at Mathias Road and 54<sup>th</sup> Ave. E  
This problem was reported at a public meeting.

260<sup>th</sup> Street E is quite flat. However, there was no obvious sign of flood problems where it turns into Mathias Road. During the field visit, we walked through a subdivision located 0.1 miles to the south. A 7-year resident there told us that he had observed no flooding problems along that street. He did show us recent County repair work done on two catch basins in the next street over: 247<sup>th</sup> Street E. A small kettle lake lies within the subdivision between these two streets.

Status: Recommended Closure.

**#113** - A total of three 48” culverts convey the North Fork under 252<sup>nd</sup> Street E (east of 70<sup>th</sup> Avenue E.

This road is reported to periodically flood.

This is a one-half mile crossing of a very flat wetland area in the upper end of the North Fork. Two of the culverts are on the west side of the wetland and one culvert lies on the east side. All of the pipes were back-watered to the top, or nearly the top, of the pipes. The flat gradient in the area may act as a downstream control. A local resident confirmed that this road frequently overtops during rainy periods. At the time of the field visit, there was one short stretch of road where recent erosion due to flow over the road was visible. This road serves a limited number of local residences and has very little traffic.

Status: Recommended CIP; analyze the culverts to verify their capacity and determine the need for an upgrade.

**#114** – Outflow from 48” stormwater pipe discharging west of the Graham Shopping Center and south of 224<sup>th</sup> Street E and 0.4miles west of Meridian.

This was reported as a possible flood problem at a public meeting.

During the initial visit, the pipe was observed to be discharging about 1 cfs. The flow travels northwest in a well-defined channel flowing through an open area. A residential area lies further to the west but we were unable to follow the stream due to dense vegetation and very wet conditions. We drove further west and then north along existing roads. We never encountered any substantial channel crossing nor any flowing water further down-gradient.

A second visit was made following a substantial rain event. A wooded area one-quarter of a mile east of the pipe discharge had water ponded 2-6 inches deep across an area of several acres. This water appeared to pond and infiltrate into the ground. There was no sign of outflow to the nearby residential area.

Status: Recommended CIP; conduct a study for a possible regional infiltration pond.

**#115** – Flooding east of Highway 7, south of Christenson Road.

Flood problems along Christenson Road were identified by County personnel on a previous field visit.

The area along Christensen Road, lying one-half mile west of Highway 7, was examined, this area is very flat conditions and standing water was observed in the ditch. County staff has reported that the area occasionally floods.

Status: Recommended CIP; examine the feasibility of a flow diversion and a ditch/pipe along the east side of Highway 7 to convey high flows directly to the South Fork.

Prior		Project Name	CIP Number	Score	Est. Cost	Priority Ranking	Total Costs
	1	Adopt updated stormwater mgt. standards	PG00-02	380	\$ 1,000	High	
	2	Maintenance BMP Manual	PG00-08	427	\$ 7,000	High	
	3	Invasive Species Management	PG00-09	420	\$ 7,000	High	
	4	Implement riparian land acquisition pgm.	PG00-04	389	\$ 9,000	High	
	5	Implement education/tech. assistance pgm.	PG00-06	397	\$ 111,000	High	
	6	Increased inspections	PG00-03	398	\$ 204,000	High	
	7	Lacamas Creek Habitat Restoration	CIP12LC-STR01	375	\$ 1,444,000	High	
	8	North Fork Habitat Restoration	CIP12NF-STR01	380	\$ 1,748,000	High	
Subtotal							\$3,531,000
	9	Implement riparian & WQ enhancement pgm.	PG00-05	325	\$ 34,000	Medium	
	10	288th St E Culvert Replacement II	CIP12SF-CUL03	165	\$ 41,000	Medium	
	11	Meridian E Culvert Replacement	CIP12SF-CUL05	195	\$ 46,000	Medium	
14	12	Conduct a low impact development pilot	PG12-01	346	\$ 100,000	Medium	
12	13	Schudy Rd S Culvert Replacement	CIP12LC-CUL01	175	\$ 100,000	Medium	
15	14	288th St E Culvert Replacement I	CIP12SF-CUL01	180	\$ 128,000	Medium	
16	15	288th St E Culvert Replacement III	CIP12SF-CUL04	170	\$ 133,000	Medium	
17	16	Implement surface water monitoring pgm.	PG00-07	244	\$ 158,000	Medium	
13	17	252nd St E Conveyance Improvements	CIP12NF-CUL03	155	\$ 179,000	Medium	
19	18	288th St S Infiltration Pond	CIP12MS-INF01	115	\$ 297,000	Medium	
20	19	336th St S Grade Change	CIP12LC-RD01	150	\$ 303,000	Medium	
18	20	Highway 507 Culvert Replacement	CIPLC-CUL02	215	\$ 345,000	Medium	
	21	South Fork Habitat Restoration	CIP12SF-STR01	365	\$ 608,000	Medium	
	22	Patterson Springs Acquisitions	CIP12NF-ACQ01	265	\$ 1,500,000	Medium	
	23	Graham Regional Stormwater Facility	CIP12NF-XXX	200	\$ 2,500,000	Medium	
Subtotal							\$6,472,000
	24	238th St E Conveyance Improvements	CIP12NF-RD01	45	\$ 2,000	Low	
	25	216th St Conveyance Improvements	CIP12NF-CUL01	45	\$ 4,000	Low	
	26	Kapowsin Highway Conveyance Improvements	CIP12SF-CUL02	85	\$ 10,000	Low	
	27	47th Ave E Conveyance Improvements	CIP12SF-PIP01	60	\$ 34,000	Low	
	28	70th Ave E Culvert Improvements	CIP12NF-CUL02	100	\$ 39,000	Low	
	29	242nd St E Infiltration Pond	CIP12NF-INF01	85	\$ 136,000	Low	
	30	Mountain Highway Conveyance Improvements	CIP12SF-DIV01	95	\$ 319,000	Low	
Subtotal							\$544,000
	31	Graham Groundwater Flow	ST12-01		\$ 205,000	Not Prioritized	
	32	Identification of Potholes	ST12-02		\$ 90,000	Not Prioritized	
	33	South Fork Flood Study	ST12-03		\$ 60,000	Not Prioritized	
	34	Wetland Site Identification	ST12-04		\$ 70,000	Not Prioritized	
Subtotal							\$425,000

**Total Estimated Cost of Plan Implementation**

(Cost changes reflect rounding) **\$10,972,000**

Appendix J

Muck Creek Basin

Existing Impervious Area by Reach (Includes existing development)

REACH ID	Total Acres	Impervious Area	% Impervious
L10	2,427	158	6.5
L15	171	15	8.6
L20	598	39	6.6
L25	1,072	58	5.4
L30	674	40	5.9
L35	4,199	243	5.8
L40	218	17	7.8
L5	351	43	12.2
M15	476	26	5.5
M20	1,099	59	5.4
M25	1,119	56	5.0
M30	2,364	118	5.0
M35	5,407	295	5.5
M40	246	12	5.0
ML10	2,040	237	11.6
ML5	420	21	5.0
MN10	2,013	180	9.0
MN15	939	79	8.4
MN20	3,155	413	13.1
MN25	780	79	10.1
MN30	5,345	544	10.2
MN5	903	47	5.2
MS10	1,089	73	6.7
MS15	1,743	105	6.0
MS20	3,455	256	7.4
MS25	496	37	7.5
MS30	1,478	107	7.3
MS35	762	44	5.8
MS5	721	43	5.9
MSN10	1,638	115	7.0
MSN15	529	37	7.0
MSN20	2,107	175	8.3
MSN5	447	26	5.7
MSS10	2,751	143	5.2
MSS15	1,389	113	8.2
MSS20	1,166	71	6.1
MSS25	1,180	75	6.3
MSS30	1,105	80	7.2
MSS5	1,377	85	6.2
<b>TOTALS</b>	<b>59,450</b>	<b>4,364</b>	<b>7.3%</b>

Appendix J

Muck Creek Basin

Area Summary

Future Conditions

Future Impervious Area by Reach (Zoning only - does not include existing development)

REACH ID	Total Acres	Impervious Acres	% Impervious
L5	351	30	8.6
L10	2,422	133	5.5
L15	171	10	5.8
L20	598	33	5.5
L25	1,072	57	5.3
L30	674	40	5.9
L35	4,199	242	5.8
L40	218	13	5.8
ML5	420	21	5.0
ML10	2,034	171	8.4
M15	464	24	5.1
M20	1,097	55	5.2
M25	1,119	56	5.0
M30	2,364	118	5.0
M35	5,407	277	5.1
M40	246	12	5.0
MN5	902	45	5.0
MN10	1,971	113	5.7
MN15	936	64	6.8
MN20	3,155	193	6.1
MN25	780	47	6.0
MN30	5,345	492	9.2
MS5	721	38	5.3
MS10	1,089	64	5.9
MS15	1,743	103	5.9
MS20	3,455	208	6.0
MS25	496	28	5.6
MS30	1,478	90	6.1
MS35	762	46	6.0
MSN5	447	26	5.9
MSN10	1,638	102	6.2
MSN15	529	30	5.7
MSN20	2,107	124	5.9
MSS5	1,377	98	7.1
MSS10	2,751	173	6.3
MSS15	1,389	83	6.0
MSS20	1,166	68	5.9
MSS25	1,180	68	5.7
MSS30	1,105	65	5.9
<b>TOTALS</b>	<b>59,378</b>	<b>3,659</b>	<b>6.2</b>