

CHAPTER 9. ASSESSMENT OF BASIN PLAN RECOMMENDATIONS

This chapter presents an analysis of potential solutions for the flooding, water quality, and habitat degradation issues listed in Chapters 6, 7, and 8 and summarizes those that are recommended based on the analysis. The solutions selected for inclusion in the basin plan are those that best meet the goals and objectives of the plan and that best reflect the values and preferences of the stakeholders.

9.1 ANALYSIS OF POTENTIAL SOLUTIONS

Potential solutions were evaluated by analyzing and ranking alternatives based on the severity of the problem they address and how well they would resolve the problem. Solutions were categorized as follows:

- Regulatory/programmatic measures/BMPs
 - Flood Hazard Preventive Measures
 - Flood Hazard Program Compliance Assurance
 - Water Quality Preventive Measures
 - Water Quality Compliance Assurance
 - Habitat Program Preventive Measures
 - Effectiveness and Monitoring Program
 - Technical Assistance, Education and Outreach
 - Additional Studies
- Capital Improvement Projects
 - Flood Hazard Reduction
 - Water Quality and Habitat Improvement

Each of the potential capital improvement projects and programmatic recommendations were evaluated for their net natural resource management benefit and then prioritized based on cost to benefit considerations. In determining net benefit, each project and program was scored using ranking criteria that assigned points for the project or program's potential for various aspects of flood reduction (approximately 35% of total), water quality protection or improvement (approximately 30% of total), natural resource improvement (approximately 30% of total), and other factors such as multiple use, education, and recreation (approximately 5% of total). In total, each project and program was reviewed and scored for 40 specific criteria. Table 9-1 lists the selection criteria and the weighted value assigned to each. Programmatic measures were eligible for additional points in the rating system so as to implement Pierce County's policy for preference of "non-structural measures" over "structural measures." This preference policy was stated and adopted in the 1991 surface water management plan and again in the County's Comprehensive Plan.

A prioritization worksheet was prepared for each proposed project and each proposed programmatic measure. In addition, cost estimates were prepared for capital improvement projects. The prioritization worksheets and cost estimates are included in Appendix E and F,

respectively. Included with the cost estimate sheets are project schematics, (Figures F-1 through F-26), that indicate the specific locations of each of the proposed projects. These, in addition to the generalized project location maps, Figures 9-1 through 9-5, pinpoint and illustrate the capital improvement projects described in Chapters 9 and 10. Appendix G lists the page numbers in Chapter 6 where a description of each of the issues addressed by the recommendations can be referenced.

Recommended projects and programs were ranked based on total benefit points and were then categorized into high, medium, and low priority projects using the following prioritization scheme:

- High Priority Projects: 25 percent of total number of recommendations
- Medium Priority: 50 percent of total number of recommendations
- Low Priority: 25 percent of total number of recommendations.

After this order was established, projects and programs were ranked within their priority category from lowest cost to highest cost. This was done to direct County financial resources to projects that would have a greater return, in terms of net benefit, for the resources invested. In achieving this cost overlay, several methods were experimented with, listed as follows:

- Establishing a benefit point to cost ratio.
- Establishing a cost to benefit point ratio.
- Grouping projects into various cost ranges and reducing benefit point values proportionate to increased costs.
- Applying a percent penalty to benefit points, based on increased costs.

All of these different methods resulted in an excessive weighting to cost, which essentially negated the natural resource benefit rating for flood control, water quality, and habitat protection. These ranking methods resulted in disproportionate results where the least expensive projects always rated higher than the more expensive projects, even though the benefit gained through some of the more expensive projects could be much greater. These results aborted the purpose of benefit /cost considerations so were dropped. This led to the project/prioritization method used in the Basin Plan to group by benefit and rank by cost for each of the major categories.

A “low priority” project designation does not indicate that the project has “no benefit” for flood control, water quality protection, or natural resource protection. All of the recommendations in the Basin Plan provide a net benefit to these resources. “No benefit” proposals were screened out during the planning process. “Low Priority” means that the proposed project or program scored lower than other projects and programs, based on the degree of certainty that net environmental benefit would occur from the project or program. In some cases, it is likely that some “low priority” recommendations will be implemented which will result in a positive benefit, particularly those low priority recommendations that are relatively easy to implement and that have low costs.

| TABLE 9-1. PROGRAMMATIC MEASURES | |
|---|---|
| 1. FLOOD REDUCTION | |
| a. Level of Flooding (score all that apply) | |
| | Prevents/reduces inconvenience flooding (high = 5, medium = 3, low = 1) |

- Prevents/reduces hazard to public safety (high = 25, medium = 17, low = 8)
- Prevents/reduces risk to critical facilities (hospitals, etc.) (high = 20, medium = 13, low = 7)
- Prevents/reduces severe property damage (> \$100,000/year) (high = 15, medium = 10, low = 5)
- Prevents/reduces minor property damage (< \$100,000/year) (high = 10, medium = 7, low = 3)
- b. Frequency of Flooding – solves an existing problem (select & score one only)
 - Prevents/reduces annual flooding (high = 20, medium = 13, low = 7)
 - Prevents/reduces flooding every 1 to 5 years (high = 15, medium = 10, low = 5)
 - Prevents/reduces flooding every 5 to 25 years (high = 10, medium = 7, low = 3)
 - Prevents/reduces flooding less than one in 25 years (high = 5, medium = 3, low = 1)
- c. Required due to flooding liability (high = 20, medium = 13, low = 7)
- d. Increases capacity of flood plain (high = 20, medium = 13, low = 7)
- e. Corrects non-compliance with County design standard (H/D ratio < 1.5) (high = 20, medium = 13, low = 7)
- f. Future Flooding: level of increase in peak discharge that is expected due to land use changes within the project area - High = 15, Medium = 10, Low = 5
- g. Estimated benefit to doing the project now (in feasibility and cost benefit) versus waiting and doing project later - High = 15, Medium = 10, Low = 5
- h. Provides basin-wide flood reduction benefit (high = 15, medium = 10, low = 5)
- i. Provides county-wide flood reduction benefit (high = 25, medium = 17, low = 8)

TOTAL FLOODING SCORE (Maximum Score of 225)

2. WATER QUALITY IMPROVEMENT

- a. Reduces sources of or impacts from emission of fine sediments (high = 20, medium = 13, low = 7)
- b. Reduces sources of or impacts from emission of heavy metals (high = 20, medium = 13, low = 7)
- c. Reduces sources of or impacts from emission of excess nutrients (high = 20, medium = 13, low = 7)
- d. Reduces sources of or impacts from excess oxygen demanding conditions (high = 20, medium = 13, low = 7)
- e. Reduces sources of or impacts from emission of oil and grease (high = 20, medium = 13, low = 7)
- f. Reduces sources of emission of pathogens such as fecal coliform (high = 30, medium = 20, low = 10)
- g. Lowers water temperature, provides more shade (high = 30, medium = 20, low = 10)
- h. Provides basin-wide water quality benefits (high = 15, medium = 10, low = 5)
- i. Provides county-wide water quality benefits (high = 25, medium = 17, low = 8)
- j. Solves or substantially reduces an existing problem (high = 15, medium = 10, low = 5)

TOTAL WATER QUALITY SCORE (Maximum Score 215)

3. NATURAL RESOURCE IMPROVEMENT & PROTECTION

- a. Improves and/or protects habitat for aquatic species (high = 30, medium = 20, low = 10)
- b. Improves and/or protects habitat for terrestrial species (high = 20, medium = 13, low = 7)
- c. Increases proportion of native plant species (high = 10, medium = 7, low = 3)
- d. Improves flow regime and/or natural hydrology (high = 10, medium = 7, low = 3)
- e. Increases channel stability/reduces erosion (high = 5, medium = 3, low = 1)
- f. Increases extent of salmonid spawning habitat (high = 80, medium = 48, low = 25)
- Opens passage to long reach of habitat (>4000 ft)

- g. Salmonids other than cutthroat trout present;** Q = [Good (ft) + Fair (ft)] / [Total (ft)] (high = 5, medium = 3, low = 1)
- h. Provides basin-wide benefit (high = 15, medium = 10, low = 5)
- i. Provides county-wide benefit (high = 25, medium = 17, low = 8)

TABLE 9-1 (continued).
PROGRAMMATIC MEASURES

- j. Solves or substantially reduces an existing problem (high = 15, medium = 10, low = 5)
- TOTAL NATURAL RESOURCE IMPROVEMENT SCORE (Maximum Score 215)**

4. OTHER FACTORS

- a. Provides recreational or multiple use opportunities (high = 10, medium = 7, low = 3)
- b. Enhances visual aesthetic of area (high = 10, medium = 7, low = 3)
- c. Provides public education opportunities (high = 10, medium = 7, low = 3)
- d. Is a highly visible project or has been on the CIP needs list multiple years. (high = 10, medium = 7, low = 3)

TOTAL OTHER FACTORS SCORE (Maximum Score 40)

TOTAL PROJECT SCORE (Maximum Score 695)

TABLE 9-2.
PROJECT IDENTIFICATION CODE REFERENCE

| Codes Referencing Type of Action | |
|----------------------------------|---|
| Major Divisions | |
| REG | Regulatory Action |
| PRG | Programmatic Action |
| CIP | Capital Improvement Project |
| Minor Divisions | |
| FHPM | Flood Hazard Preventive Measures |
| FHCA | Flood Hazard Program Compliance Assurance |
| WQPM | Total Water Quality Preventive Measures |
| WQCA | Total Water Quality Compliance Assurance |
| HPM | Total Habitat Program Preventive Measures |
| MON | Total Effectiveness and Monitoring Program |
| ED | Develop and Administer a Technical Assistance, Education and Outreach Program |
| ST | Additional Studies |
| WQH | Water Quality and Habitat Improvement |
| FH | Flood Hazard Reduction |
| FL(XXX#) | Flood Hazard Reduction Project for a Specific Flooding Issue (e.g. FLLCC1 – Lower Clover Creek Subbasin Flood Hazard Reduction Project for Flooding Issue FLLCC1) |
| Geographic Divisions | |
| SP | Spanaway Creek Subbasin |
| WL | Wards Lake Subbasin |
| NF | North Fork Subbasin |
| LCC | Lower Clover Creek Subbasin |

| | |
|-----------------|--|
| UCC | Upper Clover Creek Subbasin |
| Examples | |
| PRG-FH1 | Programmatic Flood Hazard Reduction Action #1 |
| CIP-FLSP1-1,2,3 | Three Capital Improvement Projects Addressing Spanaway Creek Flooding Issue #1 |

The project costs for recommended capital improvement projects was estimated based on unit costs developed by Pierce County Water Programs, WSDOT Unit Bid Tabulations and on costs from recent construction projects in the Puget Sound region. Land values used to calculate the costs of property acquisition and drainage easements were based on estimates from the Pierce County assessor's database. Equivalent full time employee hours for regulatory and programmatic alternatives were developed by Pierce County Water Programs and through discussions with Water Programs staff.

9.2 PROGRAMMATIC RECOMMENDATIONS

Flood Hazard Preventive Measures (FHPM)

Rating Score **323**

PRM-FHPM 1 Require flood disclosure statements on property titles.

Require that a disclosure statement of flood hazard designation be placed on the titles of buildings located in SFHAs. Some measure of protection for buyers is provided through RCW 64.06.020 (1994), a state law that requires sellers of real property to disclose to buyers if a property is within a designated floodplain or designated flood hazard zone. Disclosure is based on the seller's actual knowledge of the flood hazard when the disclosure form is completed. Response options for floodplain disclosure include "yes," "no," and "don't know," with no further explanation or documentation required. Because the basis for this disclosure is the seller's knowledge of flood hazard rather than a determination based on scientific and historical evidence, this disclosure has limited effectiveness in informing potential buyers about flood hazard risk.

Increasing the identification of flood hazards for all real property would increase the current state requirements for hazard disclosure and would reduce the incidence of "don't know" disclosure statements by sellers. This would increase awareness of flood hazard potential among floodplain residents and could increase the number of residents covered by flood insurance.

Cost Assumption include 0.25 FTE per year countywide over 10 year Lifecycle cost and then prorated for the Clover share of the Countywide cost (41.7%).

Cost: \$104,250

Application: County-wide

PRG-FHPM 2 Upgrade and Administer the County's Floodplain Regulations to Address Groundwater and Pothole Flooding

Large areas in Clover Creek Basin experienced extended flooding during the 1996 and 1997 flood events. Specific areas are in the Spanaway Lake and Upper Clover Creek subbasins. This flooding was from a combination of groundwater flooding and also runoff accumulating in closed depressions known as "Potholes" which have no surface outlets to a creek or river. Current FEMA floodplain mapping does not adequately capture the extent of

the areas of flooding or provide enough information in the form of Base Flood Elevations (BFE) to provide regulatory protection.

Upgrading the current floodplain mapping would delineate presently unmapped flood hazard areas. However these maps are typically used as a general guide by a property owner to determine if their property may be in a Flood Hazard Area. Typically, additional survey work and analysis by a trained professional is needed to identify BFEs for these new mapped zones. The survey also identifies where the lowest occupied building floor needs to be, with respect to the BFE, to meet County code. The flood hazard area regulation in the Critical Areas Ordinance is currently undergoing revisions. The regulations would require property owners to have a BFE determination made where groundwater flood hazard maps show that their property may be located in a flood hazard area. New mapped areas would be submitted to FEMA for a Physical Map Revision to the existing floodplain maps.

New regulations should require new developments that are in the vicinity of groundwater flood hazard areas to elevate the lowest point of their infiltration systems above the highest level of groundwater recorded in the pothole to ensure that their systems do not fail during periods of groundwater flooding.

Regulations of new septic sewers should be reviewed also to ensure placement of septic systems is above the BFE of groundwater and pothole flooding. Coordinate with the Pierce County Health Department to utilize information gathered in the Clover Creek Plan to identify and discourage development of new septic systems in inappropriate areas.

Cost Assumption include 1.0 FTE per year countywide over 10 year Lifecycle. Submittal to FEMA's are assumed cost \$5000 per year. Cost and then prorated for the Clover share of the Countywide cost (41.7%).

Cost: \$437,850

Application: Countywide

PRG-FHPM 3 Conduct A Low Impact Development Pilot.

A pilot should be conducted that incorporates low impact development techniques and tools. Pierce County should adopt low impact development guidelines and work with local property interests to implement those guidelines. The NF-2 and NF-3 subbasins, as well as the UCC-6 and UCC-7 areas, would be targeted for implementation of the pilot. Upon completion of the pilot, Pierce County would make recommendations on whether low impact development guidelines should be made mandatory. The pilot would be consistent with policies in the Parkland-Spanaway-Midland Community which promote aspects of low-impact development. The pilot project would be a one-time event.

Cost Assumption includes 0.5 FTE per year for two years in Basin only for pilot.

Cost: \$100,000

Application: Basin-wide

compliance.

The updated standards would also consider opportunities for basin-specific restrictions. For example, new regulations may prohibit the construction of stormwater conveyance systems which directly discharge to Spanaway Creek or Coffee Creek or to an existing conveyance system that discharges directly to these creeks or to Spanaway Lake.

Cost Assumption includes 0.25 FTE as one time one year cost. Prorated for the Clover share of the Countywide cost (41.7%).

Cost: \$10,425

Application: County-wide

Total Water Quality Compliance Assurance Recommendations (WQCA)

Rating Score **231**

PRG-WQCA 1 Increase Inspections For Compliance With Stormwater Requirements and NPDES Permit

Pierce County would increase the amount of inspection related to public and private stormwater facilities to ensure compliance with current regulations (including NPDES permits). Both existing and new stormwater facilities would be targeted for inspection to confirm that regular maintenance is occurring and that maintenance standards and agreements are being met. When a violation is identified, inspectors would offer education and technical assistance, but enforcement actions would be taken when necessary.

Cost Assumption includes 6.0 FTEs per year countywide. The estimated costs include funding to support additional inspection staff. Lifecycle cost then prorated for the Clover share of the Countywide cost (41.7%).

Cost: \$2,502,000

Application: County-wide

Total Habitat Program Preventive Measures Recommendations (HPM)

Rating Score **134**

PRG-HPM 1 Recommend Ecology take actions on illegal diversions

Steps that could be taken to meet this goal include the following:

- Identify and map all surface water diversions
- Determine the legality (possession of water rights) for diversions
- Educate the public as to the importance of maintaining in-stream flows.
- Work with landowners to find alternate options to meet their water needs. For ornamental ponds, this could be installation of recirculating pumps or sealing the pond bottoms.

Cost Assumption: Assumes ongoing referrals as negligible additional cost

Cost: \$0

Application: Basin Specific

PRG-HPM 2 Revise and administer the County's Critical Areas Ordinance to require all stream-related construction projects to protect the integrity of stream structures and to establish adequate buffer requirements.

This effort should focus on the following measures:

- Coordinating with the Washington Department of Fish and Wildlife through the Hydraulic Project Approval process to require construction restoration practices that would achieve the desired goal
- Providing input through SEPA review
- Extending the scope of the County's Critical Areas Ordinance to include in-stream construction practices.

Adopt adequate riparian buffer requirements to protect the remaining intact riparian zones in the Clower Creek basin. Adoption of buffer requirements would require a determination of appropriate buffer widths. The process for implementing riparian buffer requirements as follows:

- Conduct a biological survey of stream reaches in the Clower Creek subbasins.
- Involve affected landowners and stakeholders in a community process.
- Identify needed modifications to County regulations.
- Adopt modified regulations.
- Implement new buffer requirements.
- Train a County enforcement/inspection team.

Cost Assumption: Assumes 1.0 FTE countywide. Lifecycle cost over 10 years then prorated for the Clower share of the Countywide cost (41.7%).

Cost: \$417,000

Application: County-wide

Total Effectiveness and Monitoring Program Recommendations

Rating Score **233**

PRG-MON 1 Develop and Implement a Surface Water Management Monitoring

Program

The Monitoring Program would include the following aspects:

- **Water Quantity:** The water quantity element would monitor both base and flood flows on main stem creeks and selected tributaries. Groundwater and pothole flooding would also be tracked. Specific studies or modeling may be performed to accurately identify flood hazard areas.
- **Water Quality:** Many water quality monitoring aspects are already included in Pierce County's NPDES permit. However, water quality sampling for basin plan effectiveness should include temperature, solids, nutrients, pH, metals, oils and grease, and bacteria. Specific outfalls may be identified for regular sampling and additional sampling may be done to trace sources of contamination.
- **Biological Health:** Currently, Pierce County is participating in macroinvertebrate sampling which follows the protocols established for the Benthic-Index Biological Integrity (B-IBI) developed by Professor Carr at the University of Washington. This sampling program would continue unless a more effective protocol or methodology is identified for assessing biological health.
- **Waterbodies:** The sampling program will include methodologies for evaluating conditions in streams, wetlands, lakes, and surfacing groundwater.
- **Dissemination/Mapping:** Information collected under this monitoring program would be evaluated and shared with other appropriate agencies. Where feasible, data would be recorded in GIS systems and mapped. Pierce County would have a strategy for posting updated information on the internet.
- **Adaptive Management:** As the monitoring program generates data, that information would be shared and used to assess the effectiveness of current policies, programs, and procedures. In addition, effectiveness of the monitoring program would be evaluated as well as the potential role for volunteers in implementing the program.

Cost Assumption: Assumes 3.75 FTE countywide plus \$45k per year. Lifecycle cost over 10 years then prorated for the Clover share of the Countywide cost (41.7%).

Cost: \$1,751,400

Application: County-wide

Develop and Administer a Technical Assistance, Education and Outreach Program

Rating Score 328

PRG-ED 1 Develop and implement an education, outreach, and technical assistance program

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, 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 would 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. Pierce County may even consider offering financial support and assistance to other programs that support the goals and objectives of the basin plan.

Cost Assumption: Assumes total of 2.25 FTE countywide plus \$90k per year. Lifecycle cost over 10 years then prorated for the Clover share of the Countywide cost (41.7%). Plus a one time cost of \$75,000.

Cost: \$1,388,550

Application: County-wide

9.3 ADDITIONAL STUDIES

The following studies are recommended as desirable but not available information. Because of the speculative nature of the benefit of the studies which would require some future action to be taken with the information from the study they were not given a benefit score.

Conduct Additional Studies

- ST 1** **Review current filling and grading regulations and determine if changes to their administration are needed. If changes are needed, make recommendations and determine costs.**

These inquiries can be made simultaneously by sharing information and working with the Code Enforcement Divisions and Land Use Advisory Commissions to determine the extent of filling violations. Specific areas of concern include:

- Areas tributary to the E-1 and W1 Regional Stormwater Detention Facilities. If violations are significant, a hydrologic analysis may be required to establish their impact on peak flows and runoff volume.
- Evaluate whether code violations have occurred at Johns Road East site identified under problem FLUCC24.

Cost Assumption : 0.5 FTE for one year

Cost: \$50,000

Application: County-wide

ST 2

Determine habitat value of reaches NF2, NF3, T1, T2, T3, M1, MS10, MS11, and Coffee Creek

Habitat quality was not evaluated along these reaches because of natural or man made blockages which prevent the migration of salmon to upstream reaches. There is evidence of salmon and resident cutthroat trout inhabiting these drainage networks and this should be further evaluated. If it is identified as habitat for trout or other fish species of concern, this information should be transmitted to the Planning and Land Services Department for inclusion in the Critical Area Regulation Critical Fish and Wildlife Maps. These drainage areas are tributary to identified habitat areas downstream, so protection of riparian areas is important for ensuring water quality.

Cost Assumption : 0.5 FTE for two years

Cost: \$100,000

Application: Basin-wide

9.4 RECOMMENDED CAPITAL IMPROVEMENT PROJECTS

9.4.1 Basin-Wide Recommended Capital Improvement Projects

Water Quality/Stream and Riparian Habitat Improvements

CIP-WQH-1 Livestock Fencing

A livestock fencing program should be implemented in agricultural areas to eliminate the direct destruction of stream banks, riparian cover, and habitat features by livestock. Pastures bordering creeks were identified in Clover Creek (reach MS8), and the North Fork (reach NF7) during the stream habitat assessment. There may also be pastures further upstream of NF7 and in North Fork Tributary 5. The County could promote livestock fencing by implementing a cost-share program with land-owner's, or by implementing a property tax cut for property owner's that construct and maintain livestock fencing. The project cost shown below is annualized and includes construction costs and a cost contingency factor.

Issues Addressed: WQ-9,4; H-4,7
Cost: \$500,000/over 10 years
Rating Score: 140
Cost/Benefit Ratio: 3
Application: Basin-wide
Priority: High

CIP-WQH-2 Restore Riparian Buffers

Restore riparian buffers where riparian vegetation has been cut back or planted with grass to restore shading and stabilize embankments. Although this plan recommends complete stream restoration projects, on many of the creek's reaches, this recommendation can be used on some reaches as an interim measure where set-backs occur due to permitting for in-stream work or other reasons. Once established, buffer zones provide a long-term source of woody debris. Buffer management practices, such as selective tree cutting to reduce crowding, can be used to increase growth rates. Affected parties would include property owners adjacent to Clover Creek and its tributaries, and potentially community and non-profit environmental organizations that may wish to become involved.

The vegetated buffer was assumed to be 30 feet wide on either side of the stream, but will vary depending on the easement width. The project cost is annualized and includes the construction cost of installing two miles of fencing plus a contingency factor.

Issues Addressed: WQ-9,4; H-3,7
Cost: \$2,400,000 over 10 years
Rating Score: 200
Cost/Benefit Ratio: 0.8
Application: Basin-wide

Priority: High

CIP-WQH-3 Enhance Wetland Areas

Enhance and restore wetland areas which store sediment and excess nutrients. Remove fill and replant areas with native vegetation. This project could be implemented as a component of property acquisition projects, through assisting community organizations with private wetland enhancement projects, such as the Nature Conservancy, or could be implemented independently by enhancing and restoring existing wetlands on public land. The cost of wetland restoration was estimated to be approximately \$50,000 per acre. With a construction budget of \$200,000 per fiscal year, 4 acres of wetland restoration could be completed each year, resulting in 40 acres of restored wetlands over the 10-year planning period. The project cost includes construction cost, a contingency factor, and engineering design and administrative costs.

Issues Addressed: WQ-9; H-2,7

Cost: \$5,760,000 over 10 years

Rating Score: 225

Cost/Benefit Ratio: 0.39

Application: Basin-wide

Priority: High

Spanaway Creek Restoration Projects (Figure 9-2)

CIP-WQH-4A Reach S1

Stream reach S1 is approximately 1,300 feet in length. The stream reconnaissance conducted during this project rated habitat conditions in the reach as “poor.” The vegetation is dominated by reed canary grass and bed material consists of fine organic material. A stream restoration project on this reach would include removal of the reed canary grass and restoration of native vegetation, plus dredging and removal of accumulated sediment where needed. There is a large wetland at the downstream end of the reach. Wetland restoration of an area within a 20-foot buffer on either edge of the stream was included in the cost of the project. Total project cost includes the purchase of drainage easements. (FLSP25)

Issues Addressed: H-1,3,5,7; WQ-7

Cost: Drainage Easements: \$5,248
Total Project Cost: \$459,000

Rating Score: 210

Cost/Benefit Ratio: 5

Application: Basin-wide

Priority: High

CIP-WQH-4B Reach S2

Stream reach S2 is approximately 1,000 feet in length. Residential properties

border the creek and riprap and concrete revetments have been installed to stabilize embankments. Numerous bridges and fences cross the creek. The stream reconnaissance found no pools or woody debris in the reach. Gravel and cobbles are the primary bed material. Most of the native vegetation has been replaced by ornamental vegetation or reed canary grass. The stream reconnaissance rated habitat conditions in the reach as "poor."

The stream restoration project would include the removal of reed canary grass and restoration of native vegetation. Neighborhood support for this project will be needed to establish native vegetation where ornamental shrubs and plantings are now. Replace hardened embankment with bioengineered bank stabilization measures and vegetation. Measures may also include placement of woody debris in the stream channel to increase geomorphic complexity. Total project cost includes the purchase of drainage easements.

Issues Addressed: H-1,3,5,7; WQ-7
Cost: Drainage Easements: \$4,217
Total Project Cost: \$304,300
Rating Score: 100
Cost/Benefit Ratio: 3
Application: Basin-wide
Priority: Medium

CIP-WQH-4C

Reach S3

Stream reach S3 is approximately 3,200 feet in length and flows through a large wetland. The upper half of the reach is vegetated with dense conifers and hardwoods, reed canary grass, yellow flag iris, and nightshade. Bed material in the upper half of the reach is organic material, sands and silts. Flooding (FLSP25) in this area is attributed partly to the accumulation of sediment and reed canary grass. The lower half of this reach is residential and most of the trees have been removed. The lower half is vegetated by reed canary grass and the bed material is primarily gravel. Some woody debris is present in the upper reach, but overall fewer than five pools were observed in the entire reach. The stream reconnaissance rated habitat conditions in the reach as "poor."

The stream restoration project would include dredging of accumulated sediment, removal of reed canary grass, and restoration of native vegetation. The focus of the project would be on flood hazard reduction and habitat improvement. Measures may also include the placement of woody debris in the stream to increase geomorphic channel complexity. Total project cost includes the purchase of drainage easements.

Issues Addressed: H-1,3,5,7; WQ-7,11,12,13
Cost: Drainage Easements: \$29,091
Total Project Cost: \$1,145,800
Rating Score: 275

Cost/Benefit Ratio: 2
Application: Basin-wide
Priority: High

CIP-WQH-4D Reach S5 and Removal of Concrete Weir

Stream reach S5 is approximately 1,630 feet in length. Habitat conditions observed during the stream reconnaissance in this reach were rated as “good.” Small to medium conifers and hardwoods border the creek. The bed material is gravel and cobbles. Connections to side-channels and wetlands were observed and wood debris was present. Riffles are the dominant morphology and no pools were found. The 6-foot-high concrete weir at the upstream end of this reach is a complete fish passage barrier. Removal of the weir would facilitate fish passage for resident cutthroat trout and increase Spanaway Creek’s potential for use by coho and other salmonid species of interest.

The removal of the concrete weir at the upstream end of this reach would require a section of this reach to be regraded. The weir is located in the Bresemann forest and Pierce County Parks and Recreation also owns a substantial length, 970 feet, of the creek downstream. This work could be completed within the boundaries of the County park. The stream restoration project would include flow diversion, removal of the concrete weir, regrading the stream and placement of erosion control measures such as in-stream weirs, boulders, and wood.

Issues Addressed: H-1,3,5,7; WQ-7
Cost: \$1,041,000
Rating Score: 259
Cost/Benefit Ratio: 2
Application: Basin-wide
Priority: High

CIP-WQH-4E Reach S6

Stream reach S6 is approximately 2,500 feet in length, from the outlet of Spanaway Lake to the concrete weir downstream. This reach is entirely within the Bressman forest owned by Pierce County Parks and Recreation. The riparian zone is vegetated by conifers and hardwoods, and grasses including yellow flag iris. Approximately 30 percent of the reach has riprap hardened banks. The bed material in the upper reach is gravel with very little woody debris and no pools. The lower part of the reach is a large pond created by weir. Residences with mown lawns are located adjacent to the pond. Habitat conditions observed during the stream reconnaissance in this reach were rated as “fair.”

The stream restoration project would be constructed in conjunction with the restoration and weir removal project on reach S5. This project would require channel regrading in the vicinity of the weir and channel/bank stabilization measures. Work would also include restoration of native vegetation to the reach and additional native riparian plantings upstream in the park area.

Measures may also include placement of woody debris in the stream channel.

Issues Addressed: H-1,3,5,7; WQ-7
Cost: \$785,500
Rating Score: 220
Cost/Benefit Ratio: 3
Application: Basin-wide
Priority: High

Clover Creek Main Stem Restoration Projects

CIP-WQH-5A Reach MS4

Stream reach MS4 is approximately 7,040 feet in length. This reach is completely lined with asphalt. The riparian vegetation consists of scotch broom, blackberries, and reed canary grass. Some willows and artificially placed boulder and cobble clusters are present. No natural aquatic habitats exist. Asphalt lining and shallow flow may make this a complete fish passage barrier during annual low flow periods. Habitat conditions observed during the stream reconnaissance in this reach were rated as “poor.”

The stream restoration project would include removal of the asphalt liner. To reduce flow loss through the channel, a clay liner or equal measure would be placed under the channel. Additional measures include removal of grass and non-native plants, planting of native riparian species, bank stabilization measures and in-stream habitat features. The total project cost includes the cost of drainage easements.

Issues Addressed: H-1,3,5,7; WQ-7
Cost: Drainage Easements: \$39,073
Total Project Cost: \$2,082,900
Rating Score: 209
Cost/Benefit Ratio: 1
Application: Basin-wide
Priority: High

CIP-WQH-5B Reach MS5

Stream reach MS5 is approximately 2,320 feet in length, and shares many of the same characteristics as reach MS4. This stream reach has also been lined with asphalt or concrete. Vegetation consists of non-native ornamentals, blackberries, and reed canary grass. Willows and artificially placed boulder and cobble clusters have been hand-placed. No natural aquatic habitats exist. The hardened liner and shallow flow may make this a complete fish passage during low flow. Habitat conditions observed during the stream reconnaissance in this reach were rated as “poor.”

The stream restoration project would include removal of the asphalt and concrete liner and placement of a clay liner or equal measure beneath the stream bed to reduce flow loss. Additional measures include removal of

grass and non-native plants, planting of native species, bank stabilization measures and in-stream habitat features. Drainage easements are included in the total project cost.

Issues Addressed: H-1,3,5,7; WQ-7
Cost: Drainage Easements: \$63,086
Total Project Cost: \$736,600
Rating Score: 324
Cost/Benefit Ratio: 4
Application: Basin-wide
Priority: High

CIP-WQH-5C

Reach MS6

Stream reach MS6 is approximately 1,480 feet in length. The lower 400 feet of this reach is asphalt lined. The middle reach has a gravel stream bed. The lower and middle reaches flow through former agricultural land intermixed with residential development. Reed canary grass and scotch broom are the predominant vegetation type, with some willows. The upper reach transitions between the alluvial characteristics of the middle reach and the wetland area in reach MS7. A narrow 25-foot strip of young Oregon ash, willows, blackberries and other shrubs are located in middle reach. Perennial vegetation is present along 50 percent of this section. Habitat conditions observed during the stream reconnaissance in this reach were rated as "fair."

The stream restoration project would include removal of the asphalt liner at the downstream end of the reach. Flow loss through the streambed would be minimized by placing a clay liner or equivalent measure under the channel. Additional measures would include removal of reed canary grass, restoration and enhancement of existing native vegetation, and possibly placement of woody debris in the stream channel to increase geomorphic complexity. Drainage easements are included in the total project cost.

Issues Addressed: H-1,3,5,7; WQ-7
Cost: Drainage Easements: \$14,425
Total Project Cost: \$478,700
Rating Score: 245
Cost/Benefit Ratio: 5
Application: Basin-wide
Priority: High

CIP-WQH-5D

Reach MS7

Stream reach MS7 is approximately 4,900 feet in length and flows through a large wetland. Some residential encroachment is located near the downstream end of the reach. The stream banks have been partially armored through this area. However, much of the wetland area has a wide floodplain and extensive channel braiding. This area was formerly agricultural, and reed canary grass and blackberries now dominate much of the site. Perennial

vegetation (young alders, willows, cottonwood, ash) exist along more than 50 percent of the banks. The Nature Conservancy owns most of the wetland area and has completed wetland mitigation on part of the site. Habitat conditions observed during the stream reconnaissance in this reach were rated as "fair."

The stream restoration project would include removal of reed canary grass and blackberries, and restoration and enhancement of native vegetation. The reconnaissance survey indicated it is unlikely the reach could be used for spawning due to low gradient and fine organic wetland sediments. However, rearing habitat could be created with undercut banks and denser riparian vegetation. Maintenance of the mitigation features in the Nature Conservancy wetland and additional wetland plantings would enhance the mitigation efforts made by the Conservancy. The County should work together with the Nature Conservancy to implement this project. Drainage easements are included in the total project cost.

Issues Addressed: H-2,5,7; WQ-7
Cost: Drainage Easements: \$75,281
Total Project Cost: \$1,734,500
Rating Score: 305
Cost/Benefit Ratio: 2
Application: Basin-wide
Priority: High

CIP-WQH-5E

Reach MS8

Stream reach MS7 is approximately 4,640 feet in length. The stream flows through former and current pastures with a few residential developments. The riparian zone is dominated by reed canary grass and blackberries, and sparse clumps of willows and young alders. Bank erosion has occurred in some areas, especially in the active pastures. The streambed material is sand and silt. No pools or woody debris are present. There are a few hydraulically connected wetlands with extensive reed canary grass. Habitat conditions observed during the stream reconnaissance in this reach were rated as "fair."

Stream restoration in this reach should be coordinated with a livestock fencing project to protect the project and to prevent further degradation of the stream. The restoration project would include dredging accumulated sediment, removal of reed canary grass and establishment and enhancement of native vegetation. Care should be taken not to disturb the native gravel substrate which prevents flow loss through the streambed. The project could also incorporate enhancements to the existing wetlands, in the form of replacing reed canary grass with native wetland plantings. The cost of drainage easements is included in the total project cost.

Issues Addressed: H-3,5,7; WQ-7
Cost: Drainage Easements: \$14,926
Total Project Cost: \$1,351,300

Rating Score: 135
Cost/Benefit Ratio: 1
Application: Basin-wide
Priority: Medium

CIP-WQH-5F Reach MS9

Stream reach MS9 is approximately 11,890 feet in length. Vegetation in the reach includes dense medium sized hardwoods and conifers, and native shrubs, including salmonberry. The streambed material is gravel and sand. The stream flows next to a road, which narrows the riparian corridor and floodplain and creates several breaks in the riparian corridor. No woody debris or pools were observed during field reconnaissance. There are several hydraulically connected wetlands adjacent to the stream. The wetlands are fairly overgrown in reed canary grass. Habitat conditions observed during the stream reconnaissance in this reach were rated as “fair.”

Restoration of this reach would include placement of wood debris or boulders in the stream, adding additional plantings or widening the existing riparian corridor where the road does not encroach and restoration of the connected wetlands. The cost of drainage easements is included in the total project cost.

Issues Addressed: H-3,5,7; WQ-7

Cost: Drainage Easements: \$33,186
Total Project Cost: \$3,629,700

Rating Score: 215
Cost/Benefit Ratio: 1
Application: Basin-wide
Priority: High

North Fork Clover Creek Restoration Projects (Figure 9-1)

CIP-WQH-6A Reach NF4

Stream reach NF4 is approximately 1,900 feet in length and flows through Brookdale Golf Course. The riparian vegetation consists of manicured grass and reed canary grass. This reach has a relatively steep gradient, and the channel is incised. The channel is undermining several concrete bulkheads built into the embankments. The streambed is gravel and cobbles. Habitat conditions observed during the stream reconnaissance in this reach were rated as “poor.” No pools or woody debris were observed.

A stream restoration project on this reach would be designed to reduce erosion and continued channel incision by adding stepped weirs or other energy dissipation devices. The project may include removal of the concrete bulkheads and replacement with bioengineered materials. A vegetative buffer should be replanted to provide shade, cover and a future source of wood debris. The cost of drainage easements is included in the total project cost.

Issues Addressed: WQ-1,3,5,8,10
Cost: Drainage Easements: \$10,792
Total Project Cost: \$557,700
Rating Score: 160
Cost/Benefit Ratio: 3
Application: Basin-wide
Priority: Medium

CIP-WQH-6B

Reach NF5

Stream reach NF5 is approximately 2,400 feet in length and includes the stream reach between Brookdale Road and Waller Road. Habitat conditions observed during the stream reconnaissance in this reach were rated as "poor." The Brookdale Road culverts are a partial fish passage barrier to adult fish passage and a complete barrier to juveniles. The channel flows through a steep ravine that is prone to erosion. Some embankments have been armored with riprap. The streambed consists of gravel and cobbles. The lower half of the reach flows through a new subdivision where the riparian vegetation has been removed. The upper half flows through an older residential area with young native and non-native trees.

Restoration of this reach should be coordinated with replacement of the Brookdale and Waller Road culverts. Erosion can be reduced through the installation of energy dissipation devices such as log weirs to create step-pools. Restore armored banks with bioengineered bank stabilization measures and native vegetation. Restore native riparian vegetation in the lower half of the reach.

Issues Addressed: H-1,3,5,7; WQ-7
Cost: Drainage Easements: \$5,789
Total Project Cost: \$672,800
Rating Score: 155
Cost/Benefit Ratio: 2
Application: Basin-wide
Priority: Medium

CIP-WQH-6C

Reach NF6

Stream reach NF6 is approximately 1,600 feet in length. The reach has a fairly wide riparian corridor of medium sized native hardwoods and conifers (particularly cedar), with no residential encroachment except at the very upper end. All vegetation except for a few medium sized trees have been removed at a house at the upstream end of the reach. Habitat conditions observed during the stream reconnaissance in this reach were rated as "good." The streambed is predominantly gravel and cobbles. One pool was observed. Upstream of this reach the stream divides into ditches that flow through active pastures where animals have access to the stream.

The Waller Road culvert at the downstream end of this reach is perched and appears to be failing. The culvert appears to be perched 1 to 2 feet above the

stream, and a large scour pool has formed at the outlet of the culvert. This culvert is likely a fish passage barrier much of the year.

A stream restoration project on this reach would include placement of in-stream structures (root wads, boulders, etc.) to increase pool frequency and improve fish habitat. Native vegetation should be replanted at the upstream end of reach.

Issues Addressed: H-1,3,5,7; WQ-7
Cost: Drainage Easements: \$12,967
Total Project Cost: \$545,800
Rating Score: 210
Cost/Benefit Ratio: 4
Application: Basin-wide
Priority: High

Morey Creek Fish Ladder/Restoration Project

CIP-WQH-7 Reach M1

Morey Creek was not included in the detailed stream reconnaissance performed by Tetra Tech ISG in May 2000. Therefore existing habitat conditions were not documented. As construction of a fish ladder at the downstream weir is currently under consideration by the Pierce County Conservation District, an estimate for restoring Morey Creek was made.

A conservative planning level estimate for restoring the creek was made based on the assumption that the entire reach may need some form of restoration work. This estimate may greatly exceed the construction cost for what is actually required and should be refined with a formal stream assessment. The total project cost includes drainage easements, construction of the fish ladder (provided by the Pierce County Conservation District), wetland restoration, and stream restoration.

Issues Addressed: H-1,3,7; WQ-7
Cost: Drainage Easements: \$10,792
Total Project Cost: \$1,738,800
Rating Score: 130
Cost/Benefit Ratio: 0.75
Application: Basin-wide
Priority: Medium

Removal of Fish Passage Barriers

CIP-WQH-8 Steilacoom Lake Weirs

The series of weirs upstream of Steilacoom Lake is owned by the City of Lakewood. Three are at least 6 feet high. Currently there is a narrow fish ladder than smaller sized anadromous fish can traverse. Widening the fish ladders would allow larger salmonids to utilize upstream reaches. Permitting

and negotiating the removal of the weirs is likely to be a long process. It may be beneficial to work with the City to redesign the fish ladders at these weirs in the interim, until removal of the structures can be negotiated if possible. (H-1,2,6,8)

Issues Addressed: H-1
Cost: \$250,000
Rating Score: 45
Cost/Benefit Ratio: 2
Application: Basin-wide
Priority: Low

CIP-WQH-9 138th St. E. culvert on the main stem at upstream end of MS6

Issues Addressed: H-1
Cost: \$180,000
Rating Score: 173
Cost/Benefit Ratio: 10
Application: Basin-wide
Priority: High

CIP-WQH-10 Replace the Brookdale Road culverts.

The Brookdale Road culverts, shown in Figure 9-1, are a partial fish passage barrier to adult fish passage and a complete barrier to juveniles. Replacement of this culvert with a bottomless culverts meeting WDFW design criteria would provide coho and trout access to stream reach NF6, which has good habitat features and an intact riparian corridor. Replacement of this culvert and the Waller Road culvert (CIP-FL-2) should be coordinated with stream restoration projects on reaches NF4, NF5, and NF6 (projects CIP-WQH-6A, B, C) to increase the potential for fish usage.

Issues Addressed: H-1
Cost: \$171,000
Rating Score: 45
Cost/Benefit Ratio: 3
Application: Basin-wide
Priority: Low

CIP-WQH-11 Military Road Culvert
Issues Addressed: H-1
Cost: \$270,000
Rating Score: 45
Cost/Benefit Ratio: 2
Application: Basin-wide
Priority: Low

CIP-WQH-12 Retrofit McChord Air Force Base culverts.
Retrofit the 2,500-foot-long culvert under the McChord Air Force Base runways with grating or equivalent measure to provide light inside the culvert to enhance fish passage.
Issues Addressed: H-1
Cost: \$100,000
Rating Score: 115
Cost/Benefit Ratio: 12
Application: Basin-wide
Priority: Medium

Other Water Quality and Habitat Protection Measures

CIP-WQH-13 Maintain and retrofit existing detention facilities to reduce first-flush contaminants.
Issues Addressed: H-7; WQ-4,7
Cost: \$295,000 over 10 years
Rating Score: 180
Cost/Benefit Ratio: 6
Application: Basin-wide
Priority: High

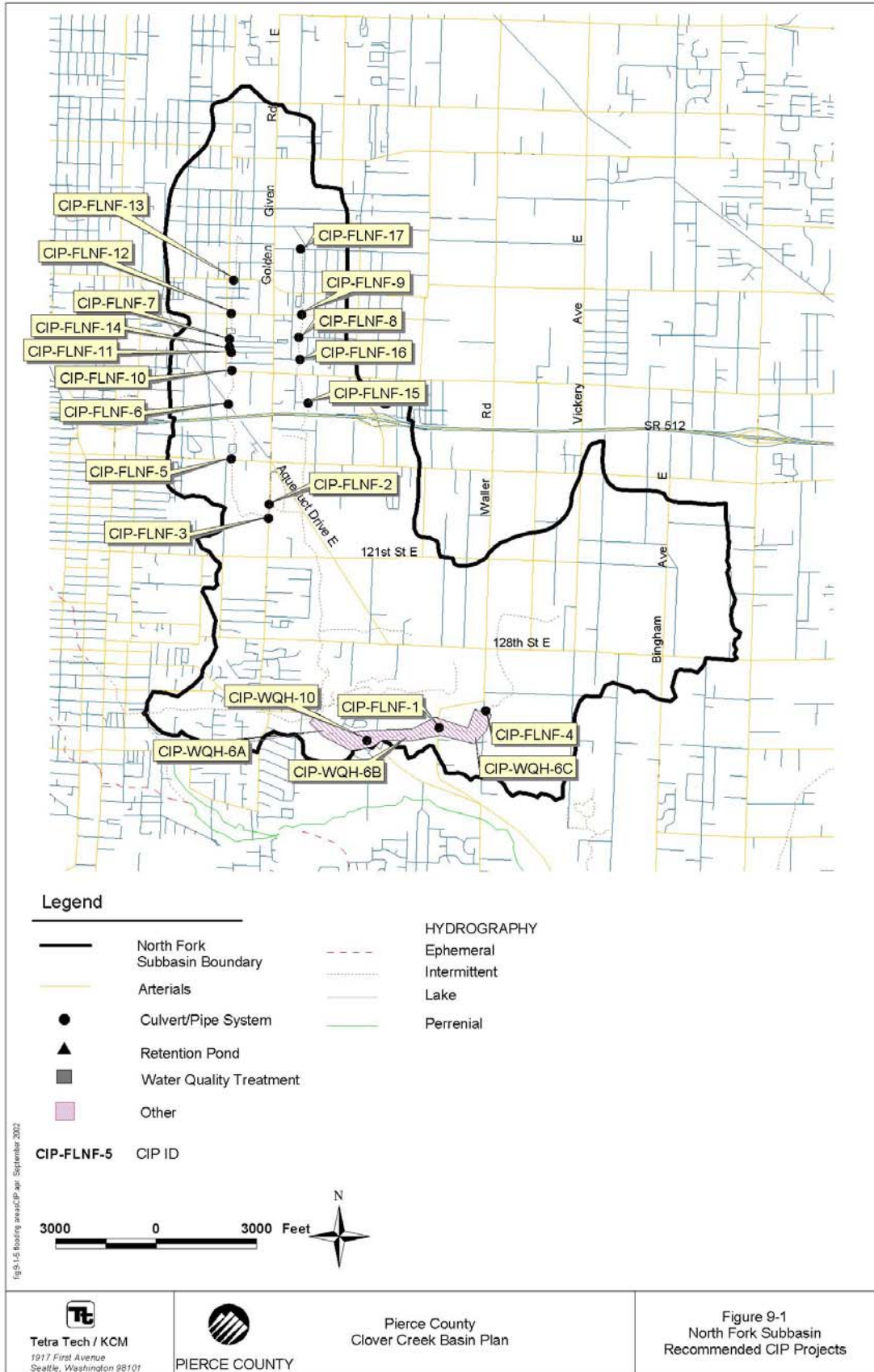
CIP-WQH-14 Continue to retrofit existing dry wells.
Continue to retrofit existing dry wells with the two-stage design that allows infiltration with minimum impact on beneficial uses of stormwater.
(WQ-1,2,5,6,8,10)
Issues Addressed: WQ-5,18
Cost: \$6,750,000 over 10 years
Rating Score: 165
Cost/Benefit Ratio: 0.24
Application: Basin-wide
Priority: Medium

CIP-FL-1

Install trash racks on culverts as needed

Install trash racks on culverts susceptible to debris collection as needed. Culverts should be prioritized based on input from drainage districts and on culvert location with respect to development and past maintenance problems. A local drainage district noted a need for the installation of trash racks on large culverts near developments, at the twin 40" culverts under Aqueduct Drive (CV-ML-6), the 54" culvert on 112th St.(CV-ML-5), and the 36" CMP on 06th St. E. by SR512 near B&O Evergreen.

Issues Addressed: FL-BW4
Cost: \$40,500 over one year
Rating Score: 95
Cost/Benefit Ratio: 23
Application: Basin-wide
Priority: Medium



9.4.2 Spanaway Creek Recommended Capital Improvement Projects

Flood Hazard Reduction (Figure 9-2)

CIP-FLSP1-1 8th Avenue East – Evaluate BFE and flood damage potential; implement appropriate measures (e.g. floodproofing, buy property)

Flooding depths on property may reach depths greater than 4 feet, based on the generalized flood maps for this area. Previous damage to structures on the property has not been reported. The base flood elevation and first floor elevation should be identified for the house to determine the degree of flood hazard. An appropriate level of action (elevate, floodproof, buy-out, or do nothing) should be selected based on the degree of flood hazard.

Issues Addressed: FL-SP1

Cost: Implement on an as needed basis

CIP-FLSP1-1B: Elevate and floodproof house—\$40,200

CIP-FLSP1-1A: Purchase property—\$87,200

Rating Score: CIP-FLSP1-1B: 25

CIP-FLSP1-1A: 95

Cost/Benefit Ratio: CIP-FLSP1-1B: 5

CIP-FLSP1-1A: 11

Priority: CIP-FLSP1-1B: Low

CIP-FLSP1-1A: Medium

CIP-FLSP1-2 203rd Street Court East

The maximum flood depth on the properties in this area is approximately 1 to 3 feet. There have been no reports of flood damage to these properties during previous flood events. The base flood elevation and first floor elevation should be identified for the house to determine the degree of flood hazard. An appropriate level of action (elevate, floodproof, buy-out, or do nothing) should be selected based on the degree of flood hazard. Flooding could also be contained off-site by construction of a berm. However, this solution would reduce floodplain capacity and may worsen flooding on adjacent properties.

Issues Addressed: FL-SP1

Cost: Implement on an as needed basis

CIP-FLSP1-2A: Purchase properties—\$209,200

CIP-FLSP1-2B: Construct berm—\$63,100

CIP-FLSP1-2C: Floodproof houses—\$62,400 per house

Rating Score: CIP-FLSP1-2A: 45

CIP-FLSP1-2B: 25

CIP-FLSP1-2C: 25

Cost/Benefit Ratio: CIP-FLSP1-2A: 2

CIP-FLSP1-2B: 4

CIP-FLSP1-2C: 2
Priority: CIP-FLSP1-2A: Low
 CIP-FLSP1-2B: Low
 CIP-FLSP1-2C: Low

CIP-FLSP1-3 Field Road Mobile Home Park—Buy property

This property is a vehicle storage yard and mobile home park. Several of the mobile homes on the property sustained damage during both the 1996 and 1997 floods. The maximum flood depth on the property, based on floodplain mapping for this area, is approximately 2 to 4 feet. Purchasing this property may be the most economical and effective solution. The property can be purchased and maintained as open space to eliminate future flood damage. Clearing the property would also increase floodplain storage.

Issues Addressed: FL-SP1, H-3
Cost: \$92,8000
Rating Score: 110
Cost/Benefit Ratio: 12
Application: Spanaway Creek
Priority: Medium

CIP-FLSP1-4 Field Road East Storage Units

Some of the storage units on this site were damaged in the groundwater flood events of 1996 and 1997. The maximum flood depth based on the floodplain mapping for this area is approximately 1 to 2 feet. Options for protecting the storage units from future damage include dry-floodproofing (acceptable for commercial buildings), or construction of a berm along the east edge of the property. Although a berm would protect the storage units, the loss of floodplain storage may adversely affect flooding on other properties. Dry-floodproofing would be the least expensive solution and likely preferable to constructing a berm, which would require hiring a consultant to assess impacts on adjacent properties. The base flood elevation and first floor elevations of the buildings need to be identified to determine the floodproofing height.

Recommended Project: CIP-FLSP1-4A: Dry-floodproof buildings
Alternative: CIP-FLSP1-4B: Construct levee
Issues Addressed: FL-SP1
Cost: CIP-FLSP1-4A: \$90,000
 CIP-FLSP1-4B: \$102,400
Rating Score: CIP-FLSP1-4A: 70
 CIP-FLSP1-4B: 50
Cost/Benefit Ratio: CIP-FLSP1-4A: 8
 CIP-FLSP1-4B: 5

Priority: CIP-FLSP1-4A: Medium
CIP-FLSP1-4B: Low

CIP-FLSP1-5 Field Road East mobile home parcel—Identify the BFE and flood damage potential; implement appropriate measures (e.g. elevate mobile home or buy property).

It is not known whether any structures on the property have been damaged in the past, however the property is in the floodplain and there have been previous reports of flood damage to the adjacent properties. This property could be purchased and maintained as open space. The maximum flood depth on the property is approximately 1 to 2 feet. The lot is zoned mobile home.

Issues Addressed: FL-SP1
Cost: \$43,400
Rating Score: 45
Cost/Benefit Ratio: 10
Application: Spanaway Creek
Priority: Low

CIP-FLSP1-6 Mountain Highway mobile home park—Elevate mobile homes

Four or five mobile homes on the property have been damaged during previous flood events. Flood depths appear to be 1 foot or less, based on floodplain mapping for this area. The BFE needs to be verified before implementing any floodproofing retrofits. Elevating the structures could be a feasible solution. Once elevated, each structure should be secured to the foundation for sufficient seismic support.

Issues Addressed: FL-SP1
Cost: \$81,000
Rating Score: 70
Cost/Benefit Ratio: 9
Application: Spanaway Creek
Priority: Medium

CIP-FLSP1-7 208th Street East properties—Evaluate BFE and flood damage potential; implement appropriate measures (e.g. floodproofing)

Although three properties in this area are within the floodplain, previous flood damage has not been reported. Two of the properties on the east side of the ditch are mobile homes, and the third property on the west side of the ditch is a single-family residence. The maximum flood depth based on floodplain maps for the area is approximately 1 foot or less. The base flood elevation and first floor elevations of the buildings need to be identified to determine if any structural measures are needed.

Issues Addressed: FL-SP1
Cost: \$6,400
Rating Score: 25
Cost/Benefit Ratio: 39
Application: Spanaway Creek
Priority: Medium

CIP-FLSP1-8 8th Avenue East— Evaluate BFE and flood damage potential; implement appropriate measures (e.g. floodproofing)

Damage to this property has not been reported during previous flood events. Based on floodplain mapping for the area, the maximum depth of flooding is approximately 1 foot or less. The base flood elevation and first floor elevations of the buildings need to be identified to determine if any structural measures are needed.

Issues Addressed: FL-SP1
Cost: \$3,200
Rating Score: 25
Cost/Benefit Ratio: 78
Application: Spanaway Creek
Priority: Low

CIP-FLSP1-9 Continue planned conveyance upgrades.

The proposed project includes constructing a piped conveyance system from approximately 1st Avenue Court East and 191st Street north along the east edge of the Spanaway Airport, turning west at 182nd Street, and connecting to the Pacific Avenue South conveyance system. The project includes the purchase of a 2.5 acre parcel to the north of the airport.

Issues Addressed: FL-SP1
Cost: \$500,000 for Construction
 \$200,000 for Land Acquisition
Rating Score: 95
Cost/Benefit Ratio: 1

Application: Spanaway Creek

Priority: Medium

CIP-FLSP3-1 44th Avenue Court East & 225th Street Court East

A new plat is located where stormwater infiltration used to naturally occur. The property owner to the south has reported off-site runoff draining onto his property and flooding his septic field. The stormwater originates from a residential development to the north and areas to the east. Although the development has a local detention pond at the northwest corner of the development, a portion of the stormwater discharges onto the infiltration site to the south via a 24-inch pipe. Drainage is conveyed to the infiltration site through roadside ditches in the development, and then into 24-inch ADS storm drains that cut across several properties. The capacity of the 24-inch storm drain and ditches appear to be adequate to pass the 25-year peak discharge. Although the ditches have several right angle bends, the ditches are large enough to provide adequate freeboard at the estimated 25-year and 100-year design flows.

The current owner of the infiltration site has expressed a willingness to grant the county an easement for construction of a retention pond. If the owner agrees, the County should buy the property and construct a retention pond. Easements have not been included in the cost of the project for the 24-inch pipes since they are public storm drains.

Issues Addressed: FL-SP-3

Cost: \$400,300

Rating Score: 95

Cost/Benefit Ratio: 2

Application: Spanaway Creek

Priority: Medium

CIP-FLSP4-1,2 50th Avenue Court East & 224th East

There have been numerous reports of surface flooding near this intersection during flood events in 1996 and 1997. The drainage appears to originate from a wetland to the east. In addition, the invert elevation of the culvert at the intersection appears to have been constructed too high. Lack of routine maintenance may also contribute to the problem. A formal drainage channel between the wetland and the culvert, in addition to regular maintenance of the culvert, would increase conveyance capacity and reduce debris congestion, which could lead to flooding.

Recommended projects:

CIP-FLSP4-1: Maintain culvert

CIP-FLSP4-2: Purchase drainage easements/construct ditch

Issues Addressed: FL-SP4

Cost: CIP-FLSP4-1: \$5000 over 10 years

CIP-FLSP4-2: \$11,800

Rating Score: CIP-FLSP4-1: 50
CIP-FLSP4-2: 70
Cost/Benefit Ratio: CIP-FLSP4-1: 100
CIP-FLSP4-2: 59
Priority: CIP-FLSP4-1: Low
CIP-FLSP4-2: Medium

CIP-FLSP5-1,2 51st Avenue East & 219th Street Court East

Three residential properties experience chronic flooding and mushy soil. It appears that the homes encroach into a wetland area, which results in flooding when the water level in the wetland is high. The homes' private drainage systems discharge water onto 218th Street Court East, which drains to a dry well at the intersection of 51st Avenue East and 219th Street Court East. When the properties flood, the excess drainage results in flooding of the dry well and of five adjacent properties.

Several alternatives were analyzed. One option included constructing an overflow pipeline from the dry well to an existing detention pond at the end of 219th Street Court East and either floodproofing or elevating the homes. The other alternative would be to purchase the properties and restore the wetland by increasing wetland storage capacity and revegetating the sites. The latter option may be cost prohibitive because the total cost of buying the properties could exceed \$400,000. However, the cost to benefit ratio appears to be comparable to the storm drainage improvement and floodproofing alternatives.

In addition, buying the properties will benefit aquatic and terrestrial habitat in addition to eliminating flooding, whereas the other projects will focus only on flood damage prevention.

Recommended Project:

CIP-FLSP5-1: Purchase properties/restore wetlands

Alternatives:

CIP-FLSP5-2A: Install overflow pipe from dry well and floodproof houses

CIP-FLSP5-2B: Install overflow pipe from dry well; elevate and floodproof houses

Issues Addressed: FL-SP5; H-3,5,7
Cost: CIP-FLSP5-1: \$430,200
CIP-FLSP5-2A: \$168,000
CIP-FLSP5-2B: \$282,800
Rating Score: CIP-FLSP5-1: 195
CIP-FLSP5-2A: 90
CIP-FLSP5-2B: 90
Cost/Benefit Ratio: CIP-FLSP5-1: 5

CIP-FLSP5-2A: 5

CIP-FLSP5-2B: 3

Priority:

CIP-FLSP5-1: High

CIP-FLSP5-1: Medium

CIP-FLSP5-1: Medium

CIP-FLSP12-1 Purchase property/construct retention pond.

Runoff from the ditch along 14th Avenue East currently discharges onto a private property southwest of the intersection of 176th Street East and 14th Avenue East. The pervious soils at the site and the fact that stormwater is currently routed to the property makes this an ideal location for a regional retention facility. There are currently no documented flooding problems in the basin, however the future zoning (a combination of moderate single family residential and employment center) in the tributary basin is likely to have a significant impact on runoff volumes. The overall effective percent impervious for the area tributary to the property is expected to increase from 22 percent to 71 percent. The soils in the tributary basin are HSG Type D, which are less pervious and will typically generate larger volumes of surface runoff. The property should be purchased in the near future before increased development raises property costs.

The ditch along 14th Avenue East appears to have adequate capacity where the ditch slopes are greater than 2 percent. The terrain is flatter and the ditch slope is less than 2 percent near the pond, and the ditch does not appear to have adequate capacity to pass the 25-year design flow. Of more concern are several 12-inch concrete culverts which would create a severe backwater affect and cause the ditch to flood. The culverts should be upgraded to box or arch culverts to reduce backwater effects in the ditch. The ditch should be widened in areas along the north end of 14th Avenue East where the gradient flattens out.

Issues Addressed: FL-SP12

Cost: \$1,965,100

Rating Score: 85

Cost/Benefit Ratio: 0.43

Application: Spanaway Creek

Priority: Medium

CIP-FLSP20-1 Lakeside Drive South and 169th Street South

Flooding of several residences and Lakeside Drive adjacent to Spanaway Lake appears to be caused by high groundwater. The extent of flooding and total number of properties that could be affected is unknown at this time. This groundwater flood hazard area needs to be mapped to determine the number of properties within the flood hazard area. Following mapping, base flood elevations should be determined for each affected property for flood insurance purposes and also to determine if structural retrofits (e.g. floodproofing or elevation) are needed.

- Issues Addressed:** FL-SP20
- Cost:** CIP-FLSP20-1A Floodproofing—\$13,500 3 houses
CIP FLSP20-1B Floodproofing and elevation—\$138,600 3 houses
- Rating Score:** CIP-FLSP20-1A Floodproofing—55
CIP FLSP20-1B Floodproofing and elevation—55
- Cost/Benefit Ratio:** CIP-FLSP20-1A Floodproofing—41
CIP FLSP20-1B Floodproofing and elevation—4
- Priority:** CIP FLSP20-1A: Medium
CIP FLSP20-1B: Medium

CIP-FLSP21-1 8th Avenue Court South and 173rd Street South

This flooding problem is very similar to flooding problem FLSP21. Flooding of residences and 173rd Street South, adjacent to Spanaway Lake, occurs during extreme periods of high groundwater. 173rd Street South has two access points, and therefore access is not cut off to properties other than those in the immediate area of flooding. This groundwater flood hazard area needs to be mapped to determine the number of properties within the flood hazard area. Following mapping, base flood elevations should be determined for each affected property for flood insurance purposes and also to determine if structural retrofits (e.g. floodproofing or elevation) are needed.

- Issues Addressed:** FL-SP21
- Cost:** CIP-FLSP21-1A Floodproofing—\$13,500 3 houses
CIP-FLSP21-1B Floodproofing and elevation—\$138,600 3 houses
- Rating Score:** CIP-FLSP21-1A Floodproofing—55
CIP-FLSP21-1B Floodproofing and elevation—55
- Cost/Benefit Ratio:** CIP-FLSP21-1A Floodproofing—41
CIP-FLSP21-1B Floodproofing and elevation—4
- Priority:** CIP-FLSP21-1A Low
CIP-FLSP21-1B Low

**CIP-FLSP24-1, Creso Road
2 and 3**

High lake levels and high levels in a wetland immediately south of Creso

Road result in roadway and property flooding in a low lying area along the road. Approximately 400 feet of Creso Road was under 1.5 feet of water in 1997. Flooding also occurred during the previous two years as well. Four houses are affected, and access to a development of 10 to 15 homes is blocked when the roadway is flooded. New homes continue to be built in the development, increasing the number of residents affected.

Three alternatives were analyzed, including raising Creso Road in the depression and either buying or elevating and floodproofing the four houses, and placing a "Watch for Water Over Roadway" sign at the depression to help alert new residents and potential home-buyers. Buying the properties, although a permanent solution, may be cost prohibitive since all four are lakefront property. Although not a permanent solution (the houses would still need to be evacuated during floods), elevating the roadway, houses and their driveways would protect the houses and maintain emergency access to the subdivision.

Recommended Projects:

CIP-FLSP24-1: Elevate/floodproof houses and raise road

CIP-FLSP24-3: Add signage to Creso Road

Alternative:

CIP-FLSP24-2: Purchase properties and raise road

Issues Addressed: FL-SP24; H-3,5,7

Cost: CIP-FLSP24-1: \$291,800
CIP-FLSP24-2: \$899,200
CIP-FLSP24-3: \$500

Rating Score: CIP-FLSP24-1: 90
CIP-FLSP24-2: 150
CIP-FLSP24-3: 85

Cost/Benefit Ratio: CIP-FLSP24-1: 3
CIP-FLSP24-2: 2
CIP-FLSP24-3: 1,700

Priority: CIP-FLSP24-1: Medium
CIP-FLSP24-2: Medium
CIP-FLSP24-3: Medium

CIP-FLSP25-1 Inspect and Maintain County Infiltration Pond.

Flooding occurs from backwater conditions in Spanaway Creek and Tule Lake and from the overtopping of a County infiltration facility southwest of the intersection of 138th Street and Spanaway Loop Road. Increase inspection and maintenance of the County infiltration pond and outlet structure southwest of the intersection of 138th Street and Spanaway Loop Road. The pond should be periodically inspected to ensure that the outlet control structure is properly functioning and is kept free of debris. (FL-SP25)

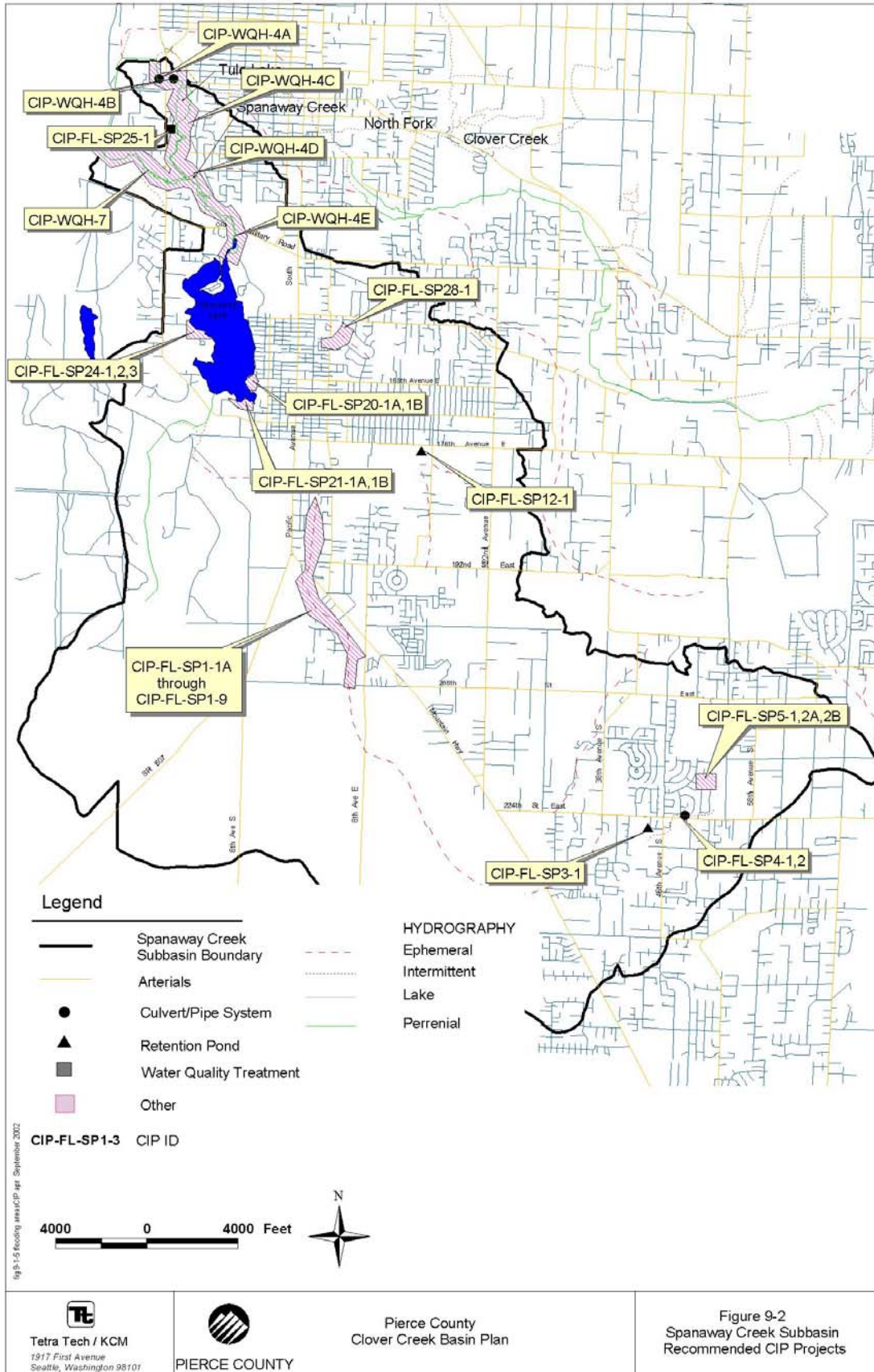
Issues Addressed: FL-SP25

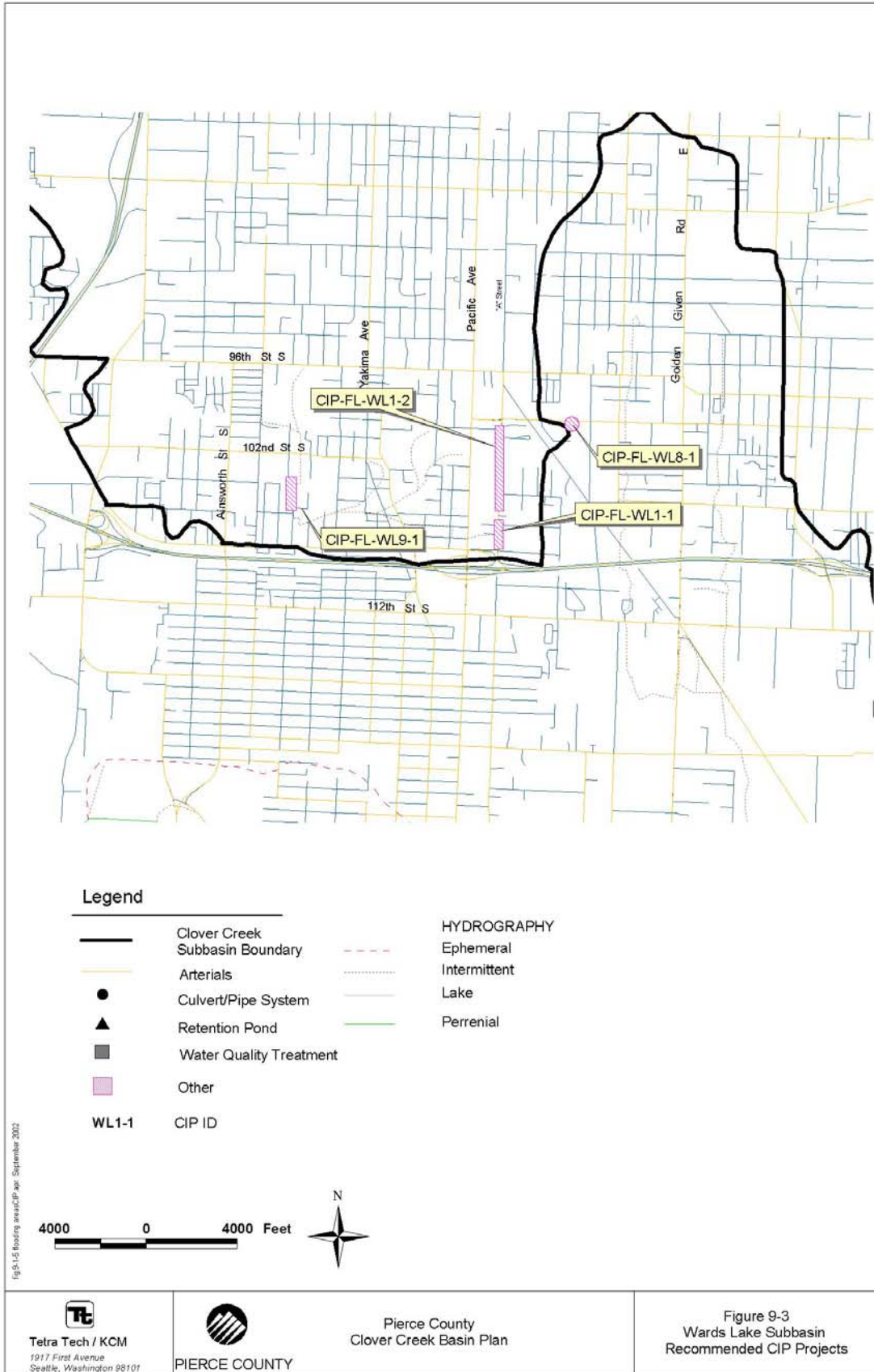
Cost: \$40,500 over 10 years
Rating Score: 190
Cost/Benefit Ratio: 47
Priority: High

CIP-FLSP28-1 3rd Avenue Court East & 161st Street Court East

Drainage complaints in this residential cul-de-sac have included complaints of property flooding, flooding of backyards, and water over the road (occurred twice in 1997). It is unknown whether any houses were damaged during these events or if the flooding was limited to the yards and road. Catch basins collect runoff and convey it onto an undeveloped parcel to the northwest. Lack of maintenance or undersized pipes may be contributing to the problem. Before considering a structural solution, the area should be monitored to determine the severity and extent of flooding. In addition, maintenance of the catch basins should be increased since it is believed lack of maintenance may be contributing to the problem. If the problem is a conveyance or capacity issue, other options can be pursued, such as upgrading the storm drains or purchasing the property that collects the drainage.

Issues Addressed: FL-SP28
Cost: \$2,500 over 5 years
Rating Score: 70
Cost/Benefit Ratio: 280
Priority: Medium





9.4.3 Wards Lake Recommended Capital Improvement Projects

Flood Hazard Reduction (Figure 9-3)

CIP-FLWL1-1,2 Flooding along “A” Street

Flooding occurs at a low spot in the roadway. The cause of flooding appears to be a combination of lack of capacity in an adjacent drainage ditch, the elevation of the roadway, and lack of maintenance of the roadside ditches. Drainage can be improved by tying in the “A” Street ditches with the recently completed storm drainage improvement project on Pacific Avenue.

Recommended Projects:

CIP –FLWL1-1: Raise “A” Street at the depression near the drainage ditch where water collects.

CIP-FLWL1-2: Increased maintenance of the roadside ditches on “A” Street.

Issues Addressed: FL-WL1

Cost: CIP-FLWL1-1: \$69,000
CIP-FLWL1-2: \$5,000 over 10 years

Rating Score: CIP-FLWL1-1: 75
CIP-FLWL1-2: 100

Cost/Benefit Ratio: CIP-FLWL1-1: 11
CIP-FLWL1-2: 200

Priority: Medium

CIP-FLWL8-1,2 300 through 500 block of 99th Street East, east of Larchmont Estates

Annual surface flooding of yards, basements, and first floors of two private residences has been reported by residents along 99th Street East. The source of the flooding appears to be a combination of backwater from the Larchmont Estates conveyance system, overtopping of the development’s private detention pond, and an inadequately defined drainage channel that the developer originally planned to replace one that was filled during construction of Larchmont Estates.

Potential solutions to this problem include either elevating and floodproofing both residences or purchasing the properties and maintaining the land as open space. Since purchasing the properties is a permanent solution and these houses are frequently flooded, this was chosen as the recommended solution. If the cost of buying these properties is prohibitive the alternative is to elevate and floodproof the houses.

Basements that are not walk-out-on-grade should not be wet-floodproofed since basement walls on residential structures are typically not designed to withstand high hydrostatic pressure. Therefore, retrofitting the homes will likely require that the basements be filled in. A determination of the base flood elevation should be conducted to determine the elevation and floodproofing height.

Recommended Project:

CIP –FLWL8-1: Purchase Properties

Alternative Project:

CIP-FLWL8-2: Floodproof houses

Issues Addressed: FL-WL8

Cost: CIP-FLWL8-1: \$266,000/2 houses
CIP-FLWL8-2: \$85,500

Rating Score: CIP-FLWL8-1: 115
CIP-FLWL8-2: 75

Cost/Benefit Ratio: CIP-FLWL8-1: 4
CIP-FLWL8-2: 9

Priority: Medium

CIP-FLWL9-1 11th Avenue Court at Parkland Ditch—Purchase drainage easements and construct flood walls

Parkland Ditch has several right-angle bends in a reach that flows through a residential neighborhood. During high flow periods, water spills out of the ditch and floods the surrounding properties. Although current Pierce County regulations require drainage easements along drainage channels across all properties, this requirement has not been consistently applied to residential properties bordering the ditch. The estimated 100-year flow through the ditch is approximately 75 cfs. The inventory shows the ditch dimensions to be 40-inches deep by 144-inches wide, which is adequate to convey this flow. The 48-inch CMP culvert at the first right angle bend on 11th Avenue, assuming a 0.01 ft/ft slope, is at or near capacity during the 25-year event. Velocities in the range of 6 to 7 fps would be discharging from the culvert at the right angle bend. Since the ditch is only 40-inches deep, water could overtop the embankment and flood the road and adjacent properties. Low flood walls at these right angle bends would contain flows within the ditch.

Low flood walls should be constructed at each right angle bend. In addition, drainage easements would need to be purchased from the properties where the walls would be constructed.

Issues Addressed: FL-WL9

Cost: \$185,900

Rating Score: 70

Cost/Benefit Ratio: 4

Application: Wards Lake

Priority: Medium

9.4.4 North Fork Clower Creek Recommended Capital Improvement Projects
Flood Hazard Reduction

The recommended flood hazard reduction measures focus on revisions to the culvert replacements recommended in the 1991 Plan, in addition to new culverts and items added in the interim. Each of the culverts recommended in the 1991 Plan were reprioritized using the current ranking criteria which assigns more points to projects that also have positive impacts on habitat. Based on the new ranking criteria, most of the culvert replacement projects are now ranked medium to low priority. Those that cross major arterials and were ranked high to medium in the 1991 Plan ranked higher in the current plan. The Waller Road and 30th Avenue culverts also ranked higher since they would both improve habitat, however not as high as other fish passage barrier improvement projects since the upstream reaches either have no potential spawning habitat or poor habitat conditions. In addition, current culvert problems and drainage needs that were identified during the current planning process were ranked higher. Figure 9-1 shows the culvert locations.

So far, several of the culvert projects have been completed but there are still many on the North Fork system to be implemented. Most have not caused flooding problems in the last decade, and are therefore not seen as high priority projects. However, as development continues in the North Fork subbasins where most of the undersized culverts are located, the importance of replacing these culverts will likely increase as will construction costs. Therefore the County should replace culverts using the current prioritization scheme as funding becomes available.

| <u>Project</u> | <u>Description</u> | <u>Estimated Cost</u> | <u>Points</u> | <u>Priority/ Cost Ratio</u> | <u>Priority</u> |
|-------------------|---|-----------------------|---------------|---------------------------------|-----------------|
| CIP-FLNF-1 | CV-CV-19N: Install box culvert to replace Waller Rd. 36" RCP | \$171,000 | 150 | 9 | Medium |
| CIP-FLNF-2 | CV-ML: Install box culvert to replace 36" RCP at 11520 Golden Given Rd. | \$85,050 | 110 | 13 | Medium |
| CIP-FLNF-3 | Install box culvert to replace Golden Given Road 30" CP | \$195,750 | 110 | 6 | Medium |
| CIP-FLNF-4 | CV-CV-20N: Install box culvert to replace 30th Ave. 42" CMP | \$57,348 | 150 | 26 | Medium |
| CIP-FLNF-5 | CV-ML-5: Install box culvert to replace McKinley and 112th 54" RCP | \$32,562 | 85 | 26 | Medium |
| CIP-FLNF-6 | CV-ML-6: Install box culvert to replace Aqueduct Dr. Twin 40" RCP's | \$153,252 | 95 | 6 | Medium |
| CIP-FLNF-7 | CV-ML-9: Install box culvert to replace 101st St. Ct. E. 54" RCP | \$35,964 | 70 | 19 | Medium |
| CIP-FLNF-8 | CV-ML-3A6: Install box culvert to replace 97th & | \$71,928 | 70 | 10 | Medium |

| <u>Project</u> | <u>Description</u> | <u>Estimated Cost</u> | <u>Points</u> | <u>Priority/ Cost Ratio</u> | <u>Priority</u> |
|--------------------|--|-----------------------|---------------|---------------------------------|-----------------|
| | 13th: 30" RCP | | | | |
| CIP-FLNF-9 | CV-ML-3A7: Install box culvert to replace 99th & 13th: 30" RCP | \$69,984 | 70 | 10 | Medium |
| CIP-FLNF-10 | CV-ML-7: Install box culvert to replace 104th St. E. 2-36" RCP's | \$32,100 | 65 | 20 | Medium |
| CIP-FLNF-11 | CV-ML-8: Install box culvert to replace 102nd St. E. 54" culvert | \$26,730 | 5 | 2 | Low |
| CIP-FLNF-12 | CV-ML-10: Install box culvert to replace 54" RCP culvert | \$45,684 | 75 | 16 | Medium |
| CIP-FLNF-13 | CV-ML-11: Install box culvert to replace 54" RCP | \$34,020 | 75 | 22 | Medium |
| CIP-FLNF-14 | 96th St. E. Install box culvert to replace 36" culvert | \$34,020 | 75 | 22 | Medium |
| CIP-FLNF-15 | CV-ML-3A3: Install box culvert to replace 104th St. E. 30" CMP | \$67,068 | 50 | 7 | Low |
| CIP-FLNF-16 | CV-ML-3A5: Install box culvert to replace 103rd/104th & 12th 36" RCP | \$67,068 | 50 | 7 | Low |
| CIP-FLNF-17 | CV-ML-3A9: Install box culvert to replace 95th St. E. & 13th 30" RCP | \$67,068 | 50 | 7 | Low |
| CIP-FLNF-18 | Planned Future Detention Pond - Part of the 6-Year Capital Facilities Plan | \$6,250,000 | 235 | 0.44 | High |

9.4.5 Lower Clover Creek Recommended Capital Improvement Projects

Flood Hazard Reduction

CIP-FLLCC6-1, 2 Confluence of the North Fork Clover Creek with the Main Stem

Flooding has been an ongoing problem near the confluence for many years. Projects by the County to reduce flood damage have included raising 136th Street South, buying repetitive loss properties, construction of two regional detention ponds, and annual channel maintenance. Additional capital improvement projects (area shown in Figure 9-4) to be

implemented include the following:

Recommended Projects:

CIP-FLLCC6-1: Maintain channel capacity

CIP-FLLCC6-2: Purchase four repetitive loss properties

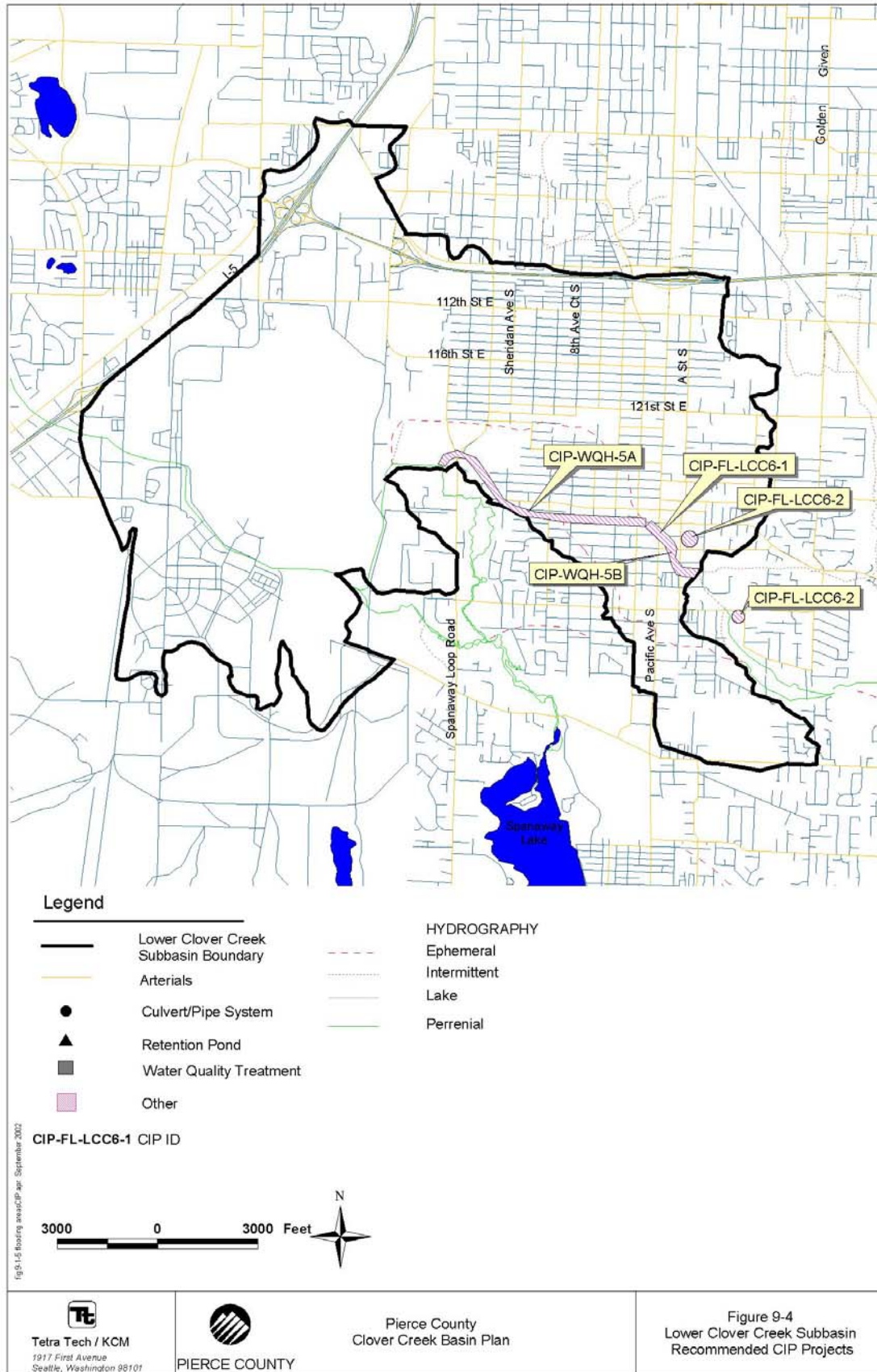
Issues Addressed: FL-LCC6; WQ-9

Cost: CIP-FLLCC6-1: \$100,000 over 10 years
CIP-FLLCC6-2: \$467,100 4 houses

Rating Score: CIP-FLLCC6-1: 210
CIP-FLLCC6-2: 170

Cost/Benefit Ratio: CIP-FLLCC6-1: 21
CIP-FLLCC6-2: 4

Priority: High



9.4.6 Upper Clover Creek Recommended Capital Improvement Projects

Flood Hazard Reduction (Figure 9-5)

CIP-FLUCC1-1 Willow Tree Estates

A portion of this development appears to encroach upon a wetland. During periods of high groundwater the development's private infiltration system and community septic drain field floods. In addition private roadways become inundated. The depth of flooding and the number of private roads that are flooded are unknown. The County currently does not have a formal conveyance system to route stormwater out of the area to a regional detention facility such as Afdem Pond or the pond at Rogers High School.

Several structural alternatives were analyzed to mitigate this flooding problem, including constructing a storm drain to Afdem Pond, and buying or retrofitting properties at risk. The Afdem Pond storm drain alternative was analyzed as a potential solution for both the Willow Tree and Wellington Estates flooding problems since the developments are both located in the same area. Although this alternative can be applied to both problem areas, it comes with a very high cost to benefit ratio. The more feasible solution for the Willow Tree Estates would be to limit growth in the subbasin using land use and development restrictions (REG-UCC-LU4, LU5). The base flood elevation in the vicinity of the flooded roads should be established to determine the severity of roadway flooding and the need to elevate any to maintain primary access routes to homes during flooding.

Recommended Projects: Non-structural recommendations REG-UCC-LU4, REG-UCC-LU5, and PRG-UCC-FH3

Alternative: CIP-FLUCC1-1: Construct storm drain to Afdem Pond.

Issues Addressed: FL-UCC1
Cost: CIP-FLUCC1-1: \$1,952,500
Rating Score: CIP-FLUCC1-1: 50
Cost/Benefit Ratio: CIP-FLUCC1-1: 0.26
Priority: Low

CIP-FLUCC2-1 Wellington Estates

Flooding occurs downgradient from the subdivision's detention pond dispersion galleries. The ponds were deeded to Pierce County after completion of the subdivision. One residential and two mobile home properties are located downstream of the pond and adjacent to a large wetland.

Proposed solutions include constructing a storm drain to Afdem Pond (same as CIP-FLUCC1-1), or purchasing the floodprone property for use as an infiltration facility. As described above, construction of a storm drain to Afdem Pond would be very costly for the benefit returned. With the other option, the dispersion galleries can be rerouted to discharge directly to the retention pond. Some wetland restoration would likely be needed since wetland is partly on the property and the pond would contribute subsurface drainage.

Recommended Project:

CIP-FLUCC2-1: Purchase property and construct retention pond

Alternative:

CIP-FLUCC1-1: Construct a storm drain to Afdem Pond—\$1,952,400

Issues Addressed: FL-UCC2
Cost: CIP-FLUCC2-1: \$272,800
 CIP-FLUCC1-1: \$1,952,500
Rating Score: CIP-FLUCC2-1: 45
 CIP-FLUCC1-1: 50
Cost/Benefit Ratio: CIP-FLUCC2-1: 2
 CIP-FLUCC1-1: .026

Priority: Low

CIP-FLUCC11-1A,1B
 CIP-FLUCC18-2A,2B

FLUCC11—Groundwater Flooding in the vicinity of Stoney Lake

FLUCC18—Groundwater flooding near 160th Street East and 22nd Avenue East

Stoney Lake discharges surface and subsurface flow along a swale that extends north from the lake to midway between Old Military Road and 176th Street East. Subsurface flows continue in a northwesterly direction along an ephemeral channel. Both flooding problems FLUCC11 and FLUCC18 are generated by subsurface flows along the ephemeral channel. During periods of high groundwater, properties along the swale and channel become inundated. The groundwater flood hazard area for Stoney Lake, the swale, and the ephemeral channel should be mapped to determine the extent of the groundwater flood hazard area (PRG-FH1). In addition to notifying affected properties in the groundwater flood hazard area, homeowner's have the option of floodproofing or elevating the house if it could be severely damaged during a flood.

Recommended Project: Floodproofing as needed

Issues Addressed: FL-UCC11
 FL-UCC18
Cost: FLUCC11 Floodproofing (1A)—\$9,800 (2 houses)
 FLUCC11 Floodproofing and elevation (1B)—\$92,400 (2 houses)
 FLUCC18-1 – 4,900 (1 house)
 FLUCC18-2 – 46,200 (1 house)

Rating Score: CIP-FLUCC11-1A,1B: 45
 CIP-FLUCC18-2A,2B: 50

Cost/Benefit Ratio: CIP-FLUCC11-1A, 1B: 46
 CIP-FLUCC18-2A, 2B: 5

Priority: FLUCC11-1: Low
 FLUCC18-1: Low

of dry wells. There are no nearby storm drainage conveyance systems that could be tied into from the cul-de-sac.

The most reasonable solution would be to elevate 139th Street East and floodproof the two houses. Since flooding over the road appears to be relatively shallow, the road could be elevated 4 to 6 inches at the low spot using additional layers of asphalt. This would provide adequate access to properties in the cul-de-sac during periods of high groundwater. The estimated base flood elevation will need to be determined for the two flooded properties to assess which floodproofing method would be most appropriate. The total project cost includes the cost of elevating and wet-floodproofing both houses and the cost of raising the road by applying an additional layer of asphalt. The floodproofing costs are conservative, as the houses may not need to be elevated depending on the base flood elevation and the type of foundation each house is on.

Recommended Projects: Floodproof and/or elevate two flood-prone houses and raise 139th Street East.

(elevate road + Floodproof and elevate two houses)

| | |
|----------------------------|--------------------|
| Issues Addressed: | FL-UCC25 |
| Cost: | \$112,100 |
| Rating Score: | 95 |
| Cost/Benefit Ratio: | 8 |
| Application: | Upper Clower Creek |
| Priority: | Medium |

CIP-FLUCC33-1 Repetitive loss property near 38th Avenue East and 152nd Street East

This property, located within Clover Creek's 100-year floodplain, was identified as a repetitive loss site in the Pierce County Repetitive Loss Plan (Tetra Tech/KCM 2001). The parcel is 2.4 acres and can either be maintained as open space or could be converted to a neighborhood pocket park, as the site is located next to Clover Creek.

Recommended Project: Purchase repetitive loss property

Issues Addressed: FL-UCC33, WQ-7,9,38

Cost: \$180,000

Rating Score: 350

Cost/Benefit Ratio: 19

Application: Upper Clover Creek

Priority: High

