CHAPTER NINE
Development of Basin Plan Recommendations

9.1 INTRODUCTION

Two kinds of improvements are necessary to correct current and potential future flooding and environmental problems in the Key Peninsula Island (KI) Basin: capital improvements and programmatic improvements. Capital improvements are improvements that require the investment of capital by public agencies or private parties. Programmatic improvements are improvements to the ongoing programs or new programs operated by the County related to the services they provide. Alternatives for capital and programmatic improvements are discussed separately below. A regulatory review was also performed and elements of ordinances discussed below.

9.2 CAPITAL IMPROVEMENTS

As discussed in *Chapters 6* and *8*, some flooding, and fish and wildlife habitat problems can be solved or lessened by capital improvements or investments. Water quality problems, discussed in *Chapter 7*, in rural areas such as the KI Basin do not lend themselves to solution solely by capital improvement. Programmatic solutions will be far more effective for water quality improvements, as discussed in the next section. The types of flooding problems encountered in the KI Basin can be corrected by culvert replacement projects. Fish passage problems can also be corrected by culvert replacement projects or by culvert modification. High quality aquatic and riparian fish and wildlife habitat can be acquired for the public and protected from development. Degraded aquatic habitat and riparian habitats can be restored by either public or private entities.

Existing high quality fish and wildlife habitat can be protected by acquisition on behalf of the public and by imposing and enforcing regulations that prevent its destruction by private parties. The most effective program is one that employs a combination of acquisition and enforcement. The development and evaluation of capital projects that are designed to protect fish and wildlife habitat by acquisition are described below.

Degraded fish and wildlife habitat can be improved by restoration on behalf of the public and by promoting habitat restoration by private parties. The development and evaluation of capital projects that are designed to improve degraded fish and wildlife habitat through restoration are described below. The relative merits of restoration by public entities and encouragement of restoration by private parties are discussed in *Chapter 10*. Acquisition associated with restoration are also described and discussed.

9.2.1 Development of Flooding and Fish Passage Capital Projects

Capital projects were developed for each of the identified flooding and fish passage problems. All fish passage barriers that were surveyed in the field, including fish passage barriers identified in the PCD, database are included in the CIP list. A complete list of fish passage barriers is contained in *Appendix L*.

A total of 33 projects are recommended as CIPs, including 30 culvert replacements and 3 fish passage projects. Of these, 15 culverts are identified as undersized and have the potential of causing road flooding during heavy storms. Culverts and fish passage projects on both public and private property are included in the CIP list. Of the 33 projects, 30 are culvert replacements and 3 are fish passage projects.

Undersized culverts were only included in the CIP if flooding occurred for storm events of 25-year return intervals, or less, unless these culverts were also fish passage barriers. The 100-year storm event occurs so infrequently that it is not an optimum use of resources to replace these culverts.

In cases where a culvert is expected to cause flooding at the 25-year storm or less, the preferred solution is replacement with a new culvert that both meets the drainage standards and provides unrestricted fish passage. Typically, this involves the installation of a culvert with an even larger cross-sectional area than that needed for flood flow conveyance alone. The Washington Department of Fish and Wildlife has published guidelines for "fish-friendly" culverts that limit the velocity of flow in culverts during the 2-year return-frequency flow event. In addition, new culverts must now span the width of the stream channel. The stream channel width requirement usually dictates the size of the culvert.

In the case of culverts that cause serious fish passage problems, the preferred solution is replacement with new culverts that both meet the drainage standards and provide unrestricted fish passage. Some culverts that cause serious fish passage problems may be modified to provide fish passage, rather than replaced. For example, a culvert with an impassable drop at the downstream end could be modified by the installation of a fish ladder, and a steeply sloping culvert could have baffles installed to slow and deepen flow. Generally, modifications of this sort are less effective than culvert replacement, but they may be justified when culvert replacement would be very costly or may not take place for some time. For analytical purposes, it was first assumed that any culverts that cause a serious fish passage problem should be replaced with "fish friendly" culverts.

For the purposes of estimating the cost of culvert replacements, a replacement culvert size was chosen for each culvert replacement project. The replacement culvert size chosen was generally either, the width of the streambank, or, one to three standard culvert sizes larger than the existing culvert (e.g. a 54-inch diameter culvert would replace a 36-inch diameter culvert), if the streambank width was not known.
It is important to note that prior to construction each culvert replacement project should undergo a site-specific engineering design process to ensure appropriate sizing, slope, and positioning to accommodate future flows and allow safe fish passage.

Capital improvements were developed to correct potential flooding problems caused by both publicly and privately owned culverts. Removal of fish barriers owned by public agencies without also removing privately owned barriers would not have provided fish with full access to available habitat. Water Programs would like to work with on repair of both public and private culverts, with willing landowners, to resolve fish passage barriers, as funding allows. A full list of fish passage barriers, and potential barriers, is contained in *Appendix L*.

9.2.2 Development of Land Acquisition Capital Projects

Lands that could be obtained by the County for protection or enhancement of important fish and wildlife habitat are identified. Land acquisition projects are identified for protection of existing reaches with good quality fish habitat and good riparian habitat. Stream reaches proposed for acquisition include consideration of continuous corridors to provide connectivity for wildlife. Another criteria for acquisition is the size of the drainage basin. The larger the basin, the greater the capacity of the system to absorb disturbances within the watershed and, therefore, some of the reaches in smaller basins are included.

An alternative to fee simple acquisition is to purchase an easement on the property. This has advantages in that the landowner is responsible for maintenance and liability for the property. However, landowners often view their property as a parcel that they may maintain in the manner they prefer, which is not always beneficial to water quality and wildlife. Easements are more protective than no easement, but not as protective as placing the property in public ownership. In the event the property owner is not willing to sell the stream reach, an easement is a good alternative to consider.

Stream reaches identified for land acquisition include those with associated wetland areas. Wetlands that could be protected include Vaughn Creek (Reach VA-03), and Rocky Creek (Reach RC-07). Additional wetlands, that require restoration, have been identified for acquisition. Restoration sites include Dutcher Creek (Reach DU-02), Anderson Island (AI-04), Whiteman Creek (Nearshore), and Vaughn Creek (Reaches VA-03, VA-04, and VA-05).

Land acquisition is an important tool for the County to protect riparian and aquatic habitats. While land regulations provide protection, they do not apply to properties with vested rights for development under older rules, nor do they address cumulative impacts. *Appendix J* provides a memo listing the advantages and disadvantages of land acquisition, purchasing of an easement, and a list of stream reaches the County could consider for protection. The areas targeted for acquisition typically include floodplains and areas that would be part of a set-back for new development.

9.2.3 Development of Stream Enhancement Projects

This plan includes projects developed for currently degraded reaches with potential for restoration. Data gathered in the characterization phase of the KI Basin plan indicated that, of the approximately 94,000 feet of stream corridor surveyed, 72 percent of in-stream fish habitat in the basin is in “Good” condition, 15 percent is in “Fair” condition, and 13 percent is in “Poor” condition. Seventy-three percent of the riparian habitat is in “Good” condition, 14 percent is in “Fair” condition, and 13 percent is in “Poor” condition.

Stream enhancement alternatives were developed by identifying reaches with poor quality fish habitat or riparian habitat. In many cases, reaches are classified as poor for both riparian habitat and fish habitat because fish habitat often suffers when the riparian habitat is degraded. In these reaches, stream enhancement activities targeted toward both improving fish habitat and the riparian habitat are appropriate to implement.

However, there are a variety of causes for fish habitat degradation, and reaches also exist where fish habitat is in poor condition but the riparian habitat is in fair condition. In these reaches, it may be more cost effective to target stream enhancement activities solely toward improving fish habitat. There are also several reaches where the riparian habitat has degraded to poor condition, but fish habitat has only degraded to fair condition. In these reaches, in may be more cost effective to target enhancement activities solely toward improving the riparian habitat, which over time will also likely improve fish habitat.

Three wetlands areas have been identified for CIPs as wetlands restoration projects. These are also identified above for land acquisition, and include reaches on Anderson Island, Vaughn Creek, and Whiteman Creek.

Thirty-five stream reaches (including the three wetland restoration projects listed above), totaling 35,570 linear feet were identified as potential sites for stream enhancement or wetland restoration that would substantially benefit fish and wildlife. The cooperation of private landowners in reaches targeted for stream enhancement projects will be necessary for successful project implementation.

9.2.4 Evaluation of Capital Improvement Projects

Capital improvement projects were evaluated using a modified form of the procedure outlined in *Pierce County's Guidelines for Basin Planning*. The procedure was designed to provide a means for calculating the benefits and costs of capital projects, so that projects could be prioritized objectively and consistently across basins. The cost of capital projects can be readily estimated but the benefits are more difficult to calculate because they cannot be expressed in monetary terms. Therefore, the potential capital improvement projects were evaluated for their net surface water and natural resource management benefit.

In evaluating net benefit, each project was scored using a prioritization sheet that assigned points for the project's potential for various aspects natural resource management benefit. The scoring schedule is shown in *Table 9-1*. Points were assigned based on benefits related to flood reduction (approximately 35% of total), water quality protection or improvement (approximately 30% of total), natural resource protection or improvement (approximately 30% of total), and other factors such as multiple use, education, and recreation (approximately 5% of total). Each project was reviewed and scored using approximately 40 specific criteria.

The total number of benefit points awarded to a capital project are then divided by the estimated project cost to provide a benefit to cost ratio. Project costs were estimated using cost estimates shown in *Appendix I*. Guidelines for cost estimates were provided from current construction projects, Means Construction Cost Data, and "A Primer on Habitat Project Costs" developed by Puget Sound Shared Strategy.

The results of the evaluation are shown in *Tables 9-2*, *9-3*, and *9-4*. *Table 9-2* was developed assuming that fish passage problems created by culverts would be permanently corrected by replacing the existing culverts with "fish-friendly" culverts. Some of the fish passage problems could be temporarily solved by measures such as culvert cleaning, installation of baffles or installation of fish ladders. Capital projects are listed in descending order of score in *Tables 9-2*, *9-3*, and *9-4*. Detailed project score forms for each project are in *Appendix J* and cost estimates are contained in *Appendix I*.

9.3 REGULATORY PROGRAMS AND PROGRAMMATIC IMPROVEMENTS

As discussed in *Chapters 6*, *7*, and *8*, there are a number of potential flooding, water quality, and aquatic and wildlife habitat problems that may be prevented by regulatory and programmatic improvements. The overall relative increase of flooding hazards associated with increased development in a watershed can be reduced through development standards that require limits on post-development runoff rates and volumes. Increased pollutant loading associated with increased development may be reduced with regulations requiring the installation of water quality improvement facilities (structural BMPs) for new development and the prohibition of development on or near stream banks. Finally, regulations supporting the creation of vegetated buffers or the increase in vegetated buffer widths along stream banks can improve aquatic and wildlife habitat in areas with increased development.

Pierce County has recently enacted regulations and amended development standards to reduce the adverse impacts of human activities on surface water bodies. Initial regulations designed to help Pierce County meet the requirements of the Clean Water Act (CWA) and the Endangered Species Act (ESA) have been updated and incorporated into revised development guidelines and standards and stormwater and surface water management plans.

Before determining whether additional regulatory or programmatic measures are needed to protect surface water bodies in the Key Peninsula Basin, an initial review of the existing regulations and development plans was conducted.

9.3.1 Review and Evaluation of Existing Regulations

To control the potential impacts on stream health from new development in the Key Peninsula Basin, ordinances and regulations have been established at the regional level. Specifically, the current *Pierce County Code* updated in August 2001, including the "Directions for Protecting and Restoring Habitat" (effective as of March 1, 2005) regulatory package, provides the template for much of the regulatory guidelines regarding buffers, low impact development standards, stormwater management, and environmental protection.

The "Directions for Protecting and Restoring Habitat" regulatory package itself contains three ordinances related to critical area protection and amendments updating a large proportion of Title 17 and 18 county codes. The Key Peninsula-Islands Basin does not contain any incorporated areas so these codes apply to the entire Pierce County portion of the basin. The ordinances are described as follows:

Ordinance 2004-56s, Exhibit B, Amendments to the Pierce County Stormwater Management and Site Development Manual

Ordinance 2004-56s, Exhibit B, contains amendments to select chapters of the Pierce County Stormwater Management and Site Development Manual and the addition of an entirely new chapter (*Chapter 10*) which provides guidance on low-impact development (LID) standards and techniques. *Chapter 10* was created to encourage new development to: maintain pre-developed hydrologic conditions onsite, retain and restore native soils and vegetation, limit effective impervious surfaces, and utilize LID BMPs to manage stormwater quantity and quality.

Ordinance 2004-56s, Exhibit D, Amendments to Title 18E, Critical Areas

Pierce County complies with the Washington State Growth Management Act and the ESA by requiring protection of critical areas such as streams, wetlands, and landslide hazard areas. *Ordinance 2004-56s, Exhibit D*, includes amendments to specific sections of *Title 18E - Development Regulations for Critical Areas* of the Pierce County Code, which has recently (March 1, 2005) become effective. Under *Title 18E.40, Fish and Wildlife Habitat*, there are design standards in place for protection of streams and wetlands, specifically related to buffer requirements. Current regulations have a maximum required buffer width of 150 feet or a minimum buffer width of 65 feet, applicable depending on the water type classification. These revised Pierce County buffer requirements are based on the *Tri-County Salmon Recovery Plan* interim protection measures and standards, developed in 2001 to assist in the protection of salmon habitat in Pierce, King, and Snohomish Counties.

Pierce County's revised buffer requirements, like the Tri-County Plan, rely on the Washington Department of Natural Resources (DNR) water-typing scheme to determine the appropriate buffer for each critical fish and wildlife area. The water-typing system is described later in this Section under "Application of the County Buffer Requirements".

9.3.2 Review and Evaluation of Other Sources for Programmatic Improvement

A number of other sources of programmatic suggestions and improvements exist for the Key Peninsula-Islands basin. The *Key Peninsula Community Plan* update is currently in process after being initiated in September 2004, and is scheduled for completion in September 2006. Comprehensive information on the plan update is limited at this time, but the results of the community survey have been released. The survey results contain information regarding the community's views on a variety of topics ranging from quality of life, land use, the economy, and public facilities and services. The survey results can assist in making programmatic recommendations based on the communities regard for various environmental and financial topics.

Another document that was considered in making programmatic recommendations was the *Key Peninsula-Gig Harbor-Islands Watershed Characterization and Action Plan*. This document provides a number of education, outreach, and technical assistance recommendations that may be considered as programmatic improvements.

9.3.3 Review of County Buffer Requirements

Application of County Buffer Requirement

With the approval of the revised county buffer width requirements, the DNR Stream Typing Classification System, as amended by the Fish and Forest Report and adopted by the Washington State Legislature in March 2000, was used to classify streams in the Key Peninsula Basin as water types. The water types correspond to the buffer requirements in the County's regulations. The DNR method of classification is "habitat-driven" and replaces Type 1 through 5 water designations with geomorphic parameters, which help to classify water bodies as S, F, or N. These new water classifications are defined as follows:

- Type S: shorelines of the state.
- Type F: segments of natural waters other than Type S that contain fish or fish habitat.
- Type N: segments of natural waters other than Type S that do not contain fish or fish habitat

It is important to note that waters without fish due to fish passage barriers, but with fish supporting conditions, are considered Type F. The detailed definitions for these water types and the subcategories of each type are provided in WAC 222-16-030. It should be noted that streams within ravines may have associated landslide hazard areas which may require a buffer width greater than those widths listed. Pierce County has adopted the DNR water types, which are provided in the revised buffer requirements in the Pierce County Development Regulations, Section 18E.40.060 and Ordinance 2004-56s Exhibit D.

The water typing system is meant to rely on fish habitat water typing maps. These maps were developed based on a multi-parameter, field-verified geographic information system (GIS) logistic regression model and will be updated every five years. The multi-parameter model is designed to identify fish habitat by using geomorphic parameters such as basin size, gradient, elevation, and other indicators. The modeling process is designed to achieve a level of statistical accuracy of 95% in separating fish habitat streams and nonfish habitat streams.

The geomorphic model, including the water type map database, was released for public use in March 2005. To determine the stream typing classifications, the model and database was queried for each stream that was field inventoried in the Key Peninsula – Islands Basin (*Table 9-5*). Most reaches queried had either an F or N water type designation. A number of upstream reaches were identified as an N6 designation, which according to the data dictionary for the water type map database, indicates that the reach was formerly untyped or an unknown stream feature upstream of a modeled end point. The N6 designation does not have an accompanying buffer width requirement in the *WAC 222-16-030*. *Table 9-5* shows the resulting water type designation based on the query of the geomorphic model. The recommended buffers outlined in *Table 9-5* are based on the reach designations outlined in the *WAC 222-16-030*, and if an N6 designation is shown, the buffer width recommended is based on the adjacent downstream reach water type classification.

Field surveys in the Key Peninsula- Islands Basin confirm that there is a significant difference in stream conditions between those streams with adequate buffers between the water body and

development and those streams that have been encroached upon by agricultural and residential development, especially for streams with steep slopes.

Potential Barriers to Effective Implementation of the Buffer Requirements

Because the new buffer requirements would largely be applied to new development, the effectiveness of the requirements depends on the amount of vacant lands that would be subject to development restrictions in critical areas. All new development would be subject to the current critical areas and resource lands regulations (including increased buffer widths), unless a property is vested, meaning the date used to determine which development regulations apply to the permit application is prior to the date that the current regulations became effective.

Within the general provisions section of the development regulations in the Pierce County code, there is a section on vesting which is intended to "provide property owners, permit applicants, and the general public assurance that regulations for project development will remain consistent during the lifetime of the application". This section is applicable to use permits, preliminary plats, final plats, short plats, large subdivisions, binding site planes, shoreline development permits, and any other land use permit application that is determined by the Washington State Legislature to be subject to the Vested Rights Doctrine.

While this section of the development regulations provides protection for applicants and incorporates time limitations so as to avoid rendering new development regulations completely ineffective, this clause does create a barrier to effectively protecting riparian habitats with an increased buffer width ordinance. Therefore, it is important to determine the number of parcels of vacant land that are already platted or have the potential to subdivide under existing regulations that have vested rights requiring only a 35-foot buffer, so as to identify where the new buffer ordinances are rendered ineffective. This type of analysis was not undertaken as part of the Key Peninsula- Islands Watershed Plan, but it is recommended and would be feasible using existing data and information as described below.

As of yet, the county has not conducted any additional studies to aid in assessing the effectiveness of the buffer ordinance as pertaining to the Key Peninsula Basin. The *Key Peninsula Community Plan* is currently in progress and, through its development, additional resources and efforts are being considered. These efforts may be directed at a review of the county assessor's platting information in conjunction with a summary of those vacant lands that are subject to a vesting control to outline those parcels in which the previous buffer requirements (35 feet) may be permissible compared to those parcels subject to the revised buffer requirements. The total area with the potential for protection by the 150-foot buffer could then be calculated and used to qualitatively describe the effectiveness of these ordinances.

As discussed previously, the overall determination of the ordinance effectiveness as related to buffers is controlled by the amount of new development that occurs. Projected growth and development in the Key Peninsula Basin is relatively limited. Current population projections by the Puget Sound Regional Council indicate that the Key Peninsula - Islands area will experience a growth rate of approximately 12.6% from 2000 to 2010, 3.8% from 2010 to 2020, and 6.1% from 2020 to 2030 (1-include citation from Phase 1 report). These growth rates are significantly lower than the 44.9% population increase observed from 1990 to 2000. Therefore, future

development is projected to consume less land than development that has already occurred in the Key Peninsula-Islands area.

The primary land use categories in the Key Peninsula Basin are currently residential and vacant, which indicates that the basin is not currently built out and if the need for additional development does occur, there is land available. However, 96% of the basin is currently zoned R10, which means that if development generally follows the zoning designation, new residential development should consist of one dwelling per 10 acres. With new development maintaining relatively low-density, the new requirement for 150-foot buffers should be reasonable for existing lots to accommodate and still have buildable area.

In conclusion, it is difficult to predict the effectiveness of the buffer regulations, due to the limited amount of readily available information regarding current parcel platting, vesting constraints and the variability regarding new development in this area. There is concern that build-out conditions in the watershed, particularly on Ketron, Herron and Anderson Islands, would have harmful effects on water quality and fish and wildlife habitat. Implementation of programs and regulations described in this Basin Plan provide opportunities to mitigate the potential harmful effects of development on vested parcels of property. One effective tool to preserve the existing high quality habitat is for Pierce County Water Programs to implement a land acquisition program for wetlands and along stream corridors. These areas are typically non-buildable portions of properties and can be partitioned to separate out the buildable part of the property for future development.

9.3.4 Review of the County Low-Impact Development Standards

Ordinance 2004-56s, Exhibit B includes amendments to the Pierce County Stormwater Management and Site Development manual, including the addition of *Chapter 10* related to LID standards and guidance. LID techniques are designed to manage stormwater generated from new and redevelopment so that there will be no negative impacts to adjacent or downstream property owners and no degradation to groundwater or surface waters. The revised standards discuss the general process for incorporating LID practices into a project, beginning with site inventories through site design and LID BMP selection. Guidelines for site design include:

- Retain 65% of the site in open space or natural resource protection areas preferably in contiguous blocks or linear corridors when feasible.
- Orient residential lots to minimize site disturbance.
- Eliminate stream crossings with roads and conveyance systems.
- Minimize impervious surfaces by reducing building footprints, road length and width, parking areas, and driveways.
- Eliminate effective impervious surface by directing stormwater from impervious surfaces in swales or low velocity sheet flow to adjacent open space or bioretention areas.
- Utilize small, dispersed bioretention areas to capture, store, and infiltrate stormwater on-site.
- Maintain pre-developed flow path lengths.

- Layout roads and lots to follow topographic contours to minimize soil and vegetation disturbance.
- Utilize pervious paving surfaces such as porous pavement and pavers for roads, driveways, parking lots, or other types of drivable or walkable coverage.
- Direct rooftop runoff to infiltration areas or cisterns for non-potable reuse or utilize vegetative roof systems for evaporation and transpiration of stormwater.
- Limit development in natural resource protection areas.

The effectiveness of LID techniques increases when the concepts are applied at both the individual site scale and at the community and regional scale, especially where transportation infrastructure is considered. As the Key Peninsula-Islands Basin is not currently built out (based on the relatively high proportion of vacant lands present), they are in the unique position to apply these development standards on both the regional and individual site scale. However, with the relatively limited development expected over the next 20 years (based on population projections), it will be difficult to determine the effects any LID techniques are having on water quality and wildlife habitat improvements.

The County may consider the use of incentives to promote implementation of LID as comprehensively as possible on a site specific level, while focusing on LID techniques for redevelopment of transportation corridors, indirectly supporting any development which does occur, on a regional scale.

9.3.5 Other Environmental Protection Policies

The *Key Peninsula- Gig Harbor-Islands Watershed Characterization and Action Plan* includes a number of education, outreach, and technical assistance programs designed to reduce nonpoint source water pollution.

Many of these programs would improve Key Peninsula's residents' understanding of human impacts on streams and provide residents with tools to act as better watershed stewards. Some of the action items proposed in this plan are:

- Encourage riparian buffering by offering landowners technical and financial assistance (AF 7).
- Create and distribute generalized best management practice (BMP) guidebooks for farm and forestry activities (AF 20).
- Develop an education program on slope stability, shoreline armoring, and vegetation management for shoreline landowners (SH 3).
- Provide technical assistance to landowners concerning shoreline stewardship/management options and offer an incentives program guidebook to encourage shoreline property owners to improve habitat and maintain a naturally functioning shoreline (SH 4 and SH 12) [It is also recommended as a part of this Basin Plan that this action item be expanded to include streamside property owners].
- Develop showcase shoreline habitat restoration projects (SH 10).

- Support volunteer shoreline stewardship programs (SH 13).
- Provide assistance to property owners on reducing stormwater flows and implementing BMP's (SW 7).
- Assess streams and develop habitat improvement projects (SW 13).
- Initiate a public outreach program that targets illegal dumping of solid waste (OT 6).
- Implement a voucher system for disposal of "problem items" such as furniture, tires, used batteries and appliances (OT 7).
- Expand the master gardener programs to include public presentations on integrated pest management and other environmentally-friendly gardening practices (OT 9).
- Develop an education program for golf course grounds keepers on water quality, integrated pest management, and habitat enhancement on golf courses (OT 14).
- Pursue alternatives to roadside spraying of herbicides (OT 15).
- Establish a pet waste education program (GN 1).
- Create a buffer improvement program (GN 7).
- Support water conservation projects and encourage water recycling (GN 10 and 11).
- Establish a native plant salvage program and encourage use of native plants in public installations (GN 23 and GN 25).

Although a *Key Peninsula Community Plan* has not been completed, an initial community survey was distributed in September 2004 to help gauge the opinions of the general public with regards to the current quality of life, the natural environment, development, land-use planning, and public facilities and services.

Generally, residents in the Key-Peninsula Basin support protection of the natural environment including streams and wetlands, maintenance of open space and tree cover, and development designed to maintain the rural character of the community. These opinions support select objectives of LID development techniques. The survey also found that the current residents do not necessarily support additional commercial or residential growth on the peninsula, indicating that observed effects of additional buffer requirements and LID techniques may be limited. However, the community tends to support public improvements to transportation corridors (new and existing roads) and public acquisition of open space or shoreline property.

Evaluation of the effectiveness of the alternative (education, outreach, and technical assistance) programmatic measures may provide useful information related to water quality and habitat improvements, considering the limited anticipated development expected in the Key Peninsula - Islands Basin. Cost estimates, potential funding sources, and methods of implementation were developed for each of the action items in the *Key Peninsula-Gig Harbor-Islands Watershed Characterization and Action Plan*.

Pierce County, Kitsap County, and the City of Gig Harbor are the regulatory organizations identified in the Plan that will implement the action items in the plan. The KGI Watershed Council and Steering Committee will pursue implementation of the action plan with these

organizations. The KGI Watershed Council is responsible for coordination of plan implementation, monitoring, and public involvement.

9.3.6 Stormwater Management

Pierce County's stormwater management plan and development standards include a number of provisions designed to reduce the adverse effects of urban stormwater runoff on streams. They include the implementation of various best management practices (BMPs) that limit the discharge of pollutants in stormwater to surface waters from both existing and new development and limit the hydrologic change associated with new development. Some BMPs are incorporated into the new LID guidelines and standards.

Because urban runoff control technology is in its infancy, it is not yet known how effective the BMPs will be over the long run. BMPs for stormwater management have been in effect for less than ten years in the most urban areas, including Pierce County, and few attempts have been made to measure their effects on water quality and stream health. In addition, there has been limited recent development in the Key Peninsula - Islands Basin and it is unlikely that an inventory of existing BMPs is available for monitoring or tracking.

9.3.7 Possible Regulatory and Programmatic Improvements

Based upon review of the current Pierce County regulations designed to reduce development-related adverse effects on streams, it is clear that positive changes have been made in the regulatory structure regarding stream buffers, development regulations, and other environmental protection policies. The changes have resulted from a better understanding of the connection between development patterns and stream health and the placement of a greater emphasis on protecting water quality and fish and wildlife habitat.

The buffer regulations, LID regulations, education programs, and water quality regulations implemented as a part of the local planning and regulatory efforts described above are expected to reduce degradation of water quality and habitat loss as a result of streamside development. Environmental policies proposed in the upcoming Key Peninsula Community Plan could further reduce the impacts of current land practices and new development activities within stream corridors if implemented consistently.

Additional programmatic and regulatory changes that could be made in the future to further protect stream health from the impacts of new development include:

- Promotion of incentive-based, voluntary landowner development practices that will protect streams adjacent to properties vested under less stringent stream protection regulations.
- Implementation of the education and outreach programs proposed in the Key Peninsula-Gig Harbor-Islands Watershed Characterization and Action Plan in an effort to help to reduce negative impacts to streams from future development in the basin.
- Incorporation of LID standards for new development and significant redevelopment, infrastructure expansion, and maintenance.

- Use of incentives to promote LID standards implementation as comprehensively as possible.

Most of the new development standards apply primarily to new development. Although the Key Peninsula - Islands Basin is not considered built out, minimal new development is projected to occur in the upcoming years. Therefore, to protect water quality and stream health it would be desirable to implement these measures on private and previously developed areas to the extent practicable, encouraged through the implementation of public education and outreach measures previously discussed.

Programmatic and regulatory measures that could be considered to protect stream health in already developed areas include the following:

- Education on limiting pesticide and fertilizer use in stream corridors.
- Limitations on domestic animal access to streams.
- Basin-specific stream protection measures.
- Implementation of the education and outreach programs proposed in the Key Peninsula-Gig Harbor-Islands Watershed Characterization and Action Plan in an effort to help to reduce negative impacts to streams from existing development in the basin.
- Financial incentives to property owners for revegetation of current stream buffer areas.

Each sub-basin in the Key Peninsula - Islands Basin has particular land uses that pose specific problems for stream health. For example, golf courses and significant residential developments in the headwater area of the Schoolhouse Creek-Islands sub-basin contribute pesticides, herbicides, and fertilizers to receiving waters. Limiting quantities and types of chemicals used in this and other comparable areas could control the water quality degradation occurring in these sub-basins.

Agricultural and pasture lands along a majority of streams in the upper Key Peninsula sub-basins contribute to excessive nutrient and bacteria levels. Encouraging buffers for existing developed and/or private lands may reduce the discharge of bacteria and chemicals, to streams, limiting the access of animals in streams, would also improve water quality. Implementation of education and outreach programs is likely to be more successful and better received by the public than using enforcement.

A combination of capital improvement programs and programmatic improvements discussed in this chapter, when implemented, will meet the County's goals of optimizing resources while reducing flooding, protect water quality and natural resources.

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Pierce County Development Regulation Amendments, Ordinance 2004-58s, Exhibit A – Amendments to Title 18, Development Regulations – General Provisions, Version March 1, 2005;

http://www.co.pierce.wa.us/pc/abtus/ourorg/council/habitat%20directions.htm.

Water Type Map Database Data Dictionary, Washington Department of Natural Resources – Forest Practices Application and Review System (FPARS), March 1, 2005. Provided by Pierce County Water Programs.

Table 9-1 Pierce County Capital Improvement Project Prioritization
EVALUATION OF PROJECT BENEFITS

Name:	
Location:	
Subbasin:	
Project:	

		Score	
	1. FLOOD REDUCTION (Maximum Score 185)	**Maximum**	**Assigned**
a	*Level of Flooding (score all that apply)*		
	Prevents inconvenience flooding	5	
	Prevents hazard to public safety	25	
	Prevents risk to critical facilities (hospitals, etc.)	20	
	Prevents severe property damage (> $100,000/year)	15	
	Prevents minor property damage (< $100,000/year)	10	
b	*Frequency of Flooding (score one)*		
	Prevents annual flooding	20	
	Prevents flooding every 1 to 5 years	15	
	Prevents flooding every 5 to 25 years	10	
	Prevents flooding less than one in 25 years	5	
c	Required due to flooding liability	20	
d	Increases capacity of flood plain	20	
e	Corrects non-compliance with County design standard (H/D ratio < 1.5)	20	
f	*Future Flooding: level of increase in peak discharge that is expected due to landuse changes within the project area (score one)*		
	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 (score one)*		
	High	15	
	Medium	10	
	Low	5	
*	**Total Flooding Score**	185	
	2. WATER QUALITY IMPROVEMENT (Maximum Score 160)		
a	Reduces sources of or impacts from emission of fine sediments	20	
b	Reduces sources of or impacts from emission of heavy metals	20	
c	Reduces sources of or impacts from emission of excess nutrients	20	
d	Reduces sources of or impacts from excess oxygen demanding conditions	20	
e	Reduces sources of or impacts from emission of oil and grease	20	
f	Reduces sources of emission of pathogens such as fecal coliform	30	
g	Lowers water temperature, provides more shade	30	
*	**Total Water Quality Score**	160	
	3. NATURAL RESOURCE IMPROVEMENT & PROTECTION (Maximum Score 160)		
a	Improves and/or protects habitat for aquatic species	30	
b	Improves and/or protects habitat for terrestrial species	20	
d	Increases proportion of native plant species	10	
f	Improves flow regime and/or natural hydrology	10	
g	Increases channel stability/reduces erosion	5	
h	*Increases extent of salmonid spawning habitat (score one - score weighted based on quality "Q"**)*		
	Opens passage to long reach of habitat (>4000 ft)	80*Q	
	Opens passage to medium reach of habitat (1000 - 4000 ft)	65*Q	
	Opens passage to short reach of habitat (<1000 ft)	50*Q	
i	Salmonids other than cutthroat trout present	5	
	** Q = [Good (ft) + Fair (ft)] / [Total (ft)]		
*	**Total Natural Resource Improvement Score**	160	
	4. OTHER FACTORS (Maximum Score 40)		
a	Provides recreational or multiple use opportunities	10	
b	Enhances visual aesthetic of area	10	
c	Provides public education opportunities	10	
d	Is a highly visible project or has been on the CIP needs list multiple years	10	
*	**Total Other Factors Score**	40	
***	**Total Project Score**	**545**	**0**

Table 9-2: Evaluation of Culvert Replacements and Fish Passage Projects

Row #	Subbasin	CIP name	Location	Problem Addressed				Owner-ship	Down stream fish passage barriers	Estimated Cost ($)	Score
				Future flood hazard	Fish passage barrier	Potential fish passage barrier (Level B)	Not in compliance with County Design Standard				
1	Purdy Creek	PR-CR02	144th	X	X		X	Public		718,272	280
3	Schoolhouse Ck. (AI)	AI-CR03	Oro Bay Road	X	X		X	Public		35,070	240
2	Schoolhouse Ck. (AI)	AI-CR02	Eckenstam Johnson Road, Near Oro Bay Road	X		X	X	Public		43,837	235
4	Huge Creek	HG-CR06	160th St.	X			X	Public		60,837	160
5	Dutcher Creek	DU-CR04	Lackey Road	X	X			Public	X	142,158	155
6	Whiteman Creek	WH-CRNS1	Bay Road		X			Public		125,518	145
7	Whiteman Creek	WH-CRNS2	Bay Road		X			Public		125,518	145
8	Rocky West Creek	RW-CR01	Driveway off 144th St.	X	X		X	Private	X	32,951	145
9	Dutcher Creek	DU-CR06	Driveway east of 70th Avenue	X	X			Private	X	18,672	140
10	Dutcher Creek	DU-FP01	Driveway west of Lackey Rd.		X			Private		81,000	140
16	Schoolhouse Ck. (AI)	AI-CR08	Eckenstam Johnson Road and 108th St.		X		X	Public		190,452	135
11	Purdy Creek	PR-CR07	160th St.	X	X			Public		66,198	130
14	Filucy Bay	FBT-CR02	South of 56th St.	X	X			Public		82,377	125
12	Rocky Creek	RC-CR03	144th St.	X	X			Public		143,388	120
13	Purdy Creek	PR-CR04	Driveway on 62nd Ave.		X			Private	X	85,108	120
15	Knackstedt Creek	HE-CR01	Driveway off 21st St.		X			Private		52,099	120
17	Filucy Bay	FBT-CR01	Erickson Road		X			Public		91,692	115
18	Schoolhouse Ck. (KP)	SC-CR01	East of KP Hwy, west of 148th Ave, on Reeves Rd.		X			Public		98,825	110
19	Vaughn Creek	VAT-CR01	Hall Road		X			Public		316,755	105
20	Whiteman Creek	WH-CR03	Whiteman Road		X			Public	X	154,200	100
21	Schoolhouse Ck. (KP)	SCT-CR01	Mahnke Rd, East of the Reeves Rd./158th Ave. Intersection		X			Public		122,974	95
22	Schoolhouse Ck. (KP)	SCT-CR02	Mahnke Rd,SE of the Reeves Rd./158th Ave. Intersection	X	X			Public		54,822	90
23	Schoolhouse Ck. (AI)	AI-CR09	Driveway North of 108th St. Crossing		X			Private	X	5,000	90
24	Devil's Head	DHT-CR01	88th Street	X	X			Public		54,369	80
25	Glen Cove	GCT-CR01	Thomas Road		X			Public		81,672	70

Table 9-2: Evaluation of Culvert Replacements and Fish Passage Projects

Row #	Subbasin	CIP name	Location	Problem Addressed				Owner-ship	Down stream fish passage barriers	Estimated Cost ($)	Score
				Future flood hazard	Fish passage barrier	Potential fish passage barrier (Level B)	Not in compliance with County Design Standard				
26	Glen Cove	GCT-CR02	Thomas Road		X			Public		69,336	70
27	Whiteman Creek	WH-CR02	Whiteman Cove Road		X			Public	X	119,188	70
28	Herron Lake	HL-FP01	South of Herron Rd., mouth of Herron Lake Creek		X			Private		150,000	70
29	Vaughn Creek	VAT-FP02	Driveway off Wright-Bliss Rd. south of 104th St. Ct.		X			Private		150,000	70
30	Dutcher Creek	DU-CR05	Driveway west of Lackey Road		X			Private	X	5,000	65
									Total	**3,477,288**	

Note:

Table 9-2 was developed assuming that fish passage problems created by culverts would be permanently corrected by replacing the existing culverts with “fish-friendly” culverts. Some of the fish passage problems could be temporarily solved by measures such as culvert cleaning, installation of baffles or installation of fish ladders. Capital projects are listed in descending order of benefit score. The benefit to cost ratio of each project is also shown. A summary of the evaluation of each potential capital improvement project and detailed evaluation forms and cost estimates are contained in Appendix I.

Table 9-3 Property Acquisition Capital Improvement Projects

Row #	Stream	CIP Name	Aquatic Habitat	Riparian Corridor	Length of Reach (ft)	Acquire Land to **Improve** Reach	Acquire Land to **Protect** Reach	Zoning[1]	Cost / acre[2]	Estimated acreage to acquire[3]	Estimated acq. Cost	Score[4]	Score/ Cost (points/ $10,000
1	Huge Creek	HG-AC01	"Good"	"Fair"	2,435	X			$ 60,000	17	$ 1,006,198	285	2.8
2	Huge Creek	HG-AC02	"Good"	"Good"	2,820		X		$ 60,000	19	$ 1,165,289	280	2.4
3	Rocky Creek	RC-AC04	"Good"	"Good"	3,780		X		$ 60,000	26	$ 1,561,983	275	1.8
4	Vaughn Creek	VA-AC05	"Good"	"Good"	1,500		X		$ 60,000	10	$ 619,835	270	4.4
5	East Fork Rocky	EF-AC04			1,452		X		$ 60,000	10	$ 600,000	265	4.4
6	Huge Creek	HG-AC03	"Good"	"Good"	1,000		X		$ 60,000	7	$ 413,223	265	6.4
7	Rocky Creek	RC-AC01	"Good"	"Good"	1,430		X		$ 60,000	10	$ 590,909	265	4.5
8	Rocky Creek	RC-AC06	"Fair"	"Fair"	700		X		$ 60,000	5	$ 289,256	265	9.2
9	Rocky Creek	RC-AC02	"Good"	"Good"	4,875		X		$ 60,000	34	$ 2,014,463	260	1.3
10	Rocky Creek	RC-AC03	"Good"	"Good"	4,195		X		$ 60,000	29	$ 1,733,471	260	1.5
11	Rocky Creek	RC-AC05	"Good"	"Good"	2,100		X		$ 60,000	14	$ 867,769	260	3.0
12	Rocky Creek	RC-AC07	"Good"	"Good"	2,000		X		$ 60,000	14	$ 826,446	260	3.1
13	Vaughn Creek	VA-AC03	"Good"	"Good"	700		X	Resource	$ 60,000	5	$ 289,256	260	9.0
14	East Fork Rocky	EF-AC01	"Good"	"Good"	1,720		X		$ 60,000	12	$ 710,744	255	3.6
15	East Fork Rocky	EF-AC02	"Good"	"Good"	1,250		X		$ 60,000	9	$ 516,529	255	4.9
16	Huge Creek	HG-AC04	"Good"	"Good"	880		X		$ 60,000	6	$ 363,636	255	7.0
17	East Fork Rocky	EF-AC03	"Good"	"Good"	1,515		X		$ 60,000	10	$ 626,033	245	3.9
	TOTAL										**$ 14,195,041**		

Property Acquisition Capital Improvement Projects

NOTES:

[1] "Residential" zoning (Res) includes High Density Residential, Moderate Density Single Family, Master Planned Community, Rural Seperator, Rural and Reserve residential designations

[2] Cost/acre based on Pierce County Cost Estimating Guidance (high value residential land = $60,000/acre)

[3] Estimated acquistion area based on the following assumptions: average width of land acquisition a total of 300 ft, with stream in middle at 150 ft. length of land acquisition would be "estimated % of reach bordered by vacant land" multiplied by "length of reach".

[4] Stream restoration project benefits were evaluated using the Capital Improvement Project benefit score sheets, shown in Appendix I.

Table 9-4 Stream Restoration and Wetland Restoration Capital Improvement Program Projects

Row #	Stream	CIP Name	Fish Habitat	Riparian Habitat	**Improve** Aquatic Habitat	**Improve** Riparian Habitat	Also Identified for **Land Acquisition**	Wetland Restor-at ion	Length (ft)	Cost/ ft.1	Total	Score[2]	Score/ Cost (points/$ 10,000)
1	East Fork Rocky	EF-RST04			X	X	X		1,575	$400	$ 630,000	270	4.3
2	Purdy Creek	PR-RST01	"Fair"	"Poor"		X			300	$200	$ 60,000	255	42.5
31	Purdy Creek	PR-RST02	"Fair"	"Fair"	X	X			320	$400	$ 128,000	230	18.0
3	Huge Creek	HG-RST01	"Good"	"Fair"	X	X	X		2,435	$200	$ 487,000	225	4.6
23	Schoolhouse AI	AI-WTRST04[3]						X	640	$460	$ 294,400	225	7.6
28	Vaughn Creek	VA-WTRST04						X	500	$460	$ 230,000	225	9.8
17	Whiteman Crk.	WH-WTRST01						X	595	$460	$ 273,700	220	8.0
4	Little Minter	LM-RST01	"Poor"	"Poor"	X	X			1,860	$400	$ 744,000	190	2.6
5	Minter Creek	MN-RST07	"Good"	"Poor"		X			1,027	$200	$ 205,400	190	9.3
6	Rocky West	RW-RST02	"Poor"	"Poor"		X			840	$200	$ 168,000	190	11.3
7	Little Minter	LM-RST02	"Poor"	"Poor"	X	X			1,120	$400	$ 448,000	185	4.1
8	Minter Creek	MN-RST01	"Poor"	"Poor"	X	X			1,200	$400	$ 480,000	185	3.9
9	Purdy Creek	PR-RST05	"Poor"	"Poor"		X			690	$200	$ 138,000	185	13.4
10	Purdy Creek	PR-RST07	"Fair"	"Good"	X	X			770	$200	$ 154,000	185	12.0
11	Minter Creek	MN-RST09	"Poor"	"Poor"	X	X			2,900	$400	$ 1,160,000	180	1.6
12	Purdy Creek	PR-RST06	"Fair"	"Poor"	X	X			1,070	$400	$ 428,000	180	4.2
13	Vaughn Creek	VA-RST02	"Poor"	"Poor"	X	X			1,100	$400	$ 440,000	175	4.0
14	Minter Creek	MN-RST05	"Good"	"Poor"		X			1,000	$200	$ 200,000	170	8.5
16	Whiteman Crk.	WH-RST01	"Poor"	"Poor"					595	$200	$ 119,000	170	14.3
15	Taylor Bay	TB-RST01	"Fair"	"Good"	X	X			2,100	$200	$ 420,000	165	3.9
18	Schoolhouse KPI	SC-RST03	"Poor"	"Poor"		X			550	$200	$ 110,000	165	15.0
19	Little Minter	LM-RST08	"Poor"	"Poor"		X			750	$200	$ 150,000	150	10.0
20	Minter Creek	MN-RST08	"Fair"	"Poor"		X			703	$200	$ 140,600	150	10.7
21	Minter Creek	MN-RST11	"Fair"	"Poor"		X			200	$200	$ 40,000	150	37.5
24	Herron Lake	HL-RST01	"Poor"	"Fair"	X				2,100	$200	$ 420,000	135	3.2
22	Schoolhouse AI	AI-RST04	"Poor"	"Poor"	X	X			640	$200	$ 128,000	130	10.2
25	Home Creek - #150044	HM-RST01				X			1,000	$200	$ 200,000	130	6.5
26	Vaughn Creek	VA-RST01	"Fair"	"Fair"	X				300	$200	$ 60,000	125	20.8
27	Vaughn Creek	VA-RST04	"Fair"	"Fair"	X				500	$200	$ 100,000	120	12.0
29	Home Creek - #150043	HM-RST02				X			600	$200	$ 120,000	120	10.0
30	Little Minter	LM-RST03	"Fair"	"Good"	X				1,350	$200	$ 270,000	115	4.3
32	Huge Creek	HG-RST06	"Poor"	"Poor"	X				950	$200	$ 190,000	105	5.5

33	Huge Creek	HG-RST05	"Fair"	"Fair"	X				530	$200	$ 106,000	95	9.0
	Total								**32,810**		**$ 9,242,100**		

NOTES:

[1] Stream restoration costs can vary significantly depending on the level of work necessary at a given site. These cost estimates are based on per lineal foot of stream, 10 foot wide. Cost estimates are $200/ft for riparian corridor improvements (streambank stabilization, riparian area planting, etc.) and $200/ft. for instream aquatic habitat improvements (placement of large woody debris, improving channel substrate, etc.). Costs are based two sources: "A Primer on Habitat Project Costs" Prepared for the Puget Sound Shared Strategy by Evergreen Funding Consultants, Spring 2003, and review of bid documents for three recent restoration projects in the State of Washington. These costs include a contingency. If both in-stream aquatic habitat improvements and riparian corridor improvements are needed, the cost estimate is $400/ft.

[2] Stream restoration project benefits were evaluated using the Capital Improvement Project benefit score sheets, shown in Appendix I.

[3] Wetland Restoration (WTRST) costs can vary considerably. These estimates assume $100,000/acre.

Table 9-5
SUMMARY OF KEY PENINSULA SUBBASIN WATER TYPES AND BUFFER WIDTHS

Basin	Subbasin	Water Characteristics	Pierce County Water Type	Pierce County Buffer Width	Fish Passage Barriers?	Flood Problems?	Water Quality Limited?	Predominant Land Use	Current Impermeable Surface
Key Peninsula	Dutcher (DU)	Drainage area - 3.2 square miles; Gradient - moderate; Discharge - to Dutcher Cove; Contains Fish - supports coho, steelhead presence is also reported.	Primarily F1	150 feet	Yes	Yes	No	space; 26% in low density residential	8%
Key Peninsula	Herron/ Knackstedt (HE)	Drainage area - 1.9 square miles; Gradient - moderate to shallow; Discharge - to Case Inlet; Contains Fish - supports coho and chum and cutthroat distribution is presumed.	N1 and N6 for select upstream tributaries; F1 for downstream reaches	115 feet for N1 and N6 reaches; 150 feet for F1 reaches	Partial	No	No	30% in low-density residential; 30% in open space	9%
Key Peninsula	Kingsman (KG)	Drainage area - 2.0 square miles, includes Herron Lake tributary area; Gradient - moderate to shallow, Discharge - to lake before presumably discharging to Case Inlet; Contains Fish - supports coho and chum and chinook are released annually.	Primarily F1	150 feet	Yes	No	No	53% in open space; 15% in resource land	8%
Key Peninsula	Lackey (LA)	Drainage area - 2.8 square miles; Gradient - shallow; Discharge - to Glen Cove; Contains Fish - supports coho and cutthroat distribution is presumed.	N2 and N6 for select upstream tributaries; F1 for downstream reaches	65 feet for N2 and N6 reaches; 150 feet for F1 reaches	No	No	No	43% in open space; 37% in low density residential	10%
Key Peninsula	East Fork Rocky (Fork Muck) (EF)	Drainage area - 12.2 square miles; Gradient - moderate; Discharge - to Rocky Creek before entering Rocky Bay; Contains Fish - supports coho and chum.	N2 and N6 for select upstream tributaries; F1 for downstream reaches	65 feet for N2 and N6 reaches; 150 feet for F1 reaches	No	No	No	45% in resource land; 28% in open space	9%
Key Peninsula	Rocky (RC)	Drainage area - 6.3 square miles, includes Rocky West tributary area; Gradient - moderate; Discharge - to Rocky Bay; Contains Fish - Rocky Creek supports coho, chum, Chinook, steelhead, and cutthroat salmon and Rocky West supports coho and cutthroat.	Primarily F1	150 feet	Partial	Yes	Yes - dissolved oxygen	62% in resource land; 17% in open space	9%
Key Peninsula	Schoolhouse-Key Peninsula (SC)	Drainage area - 1.8 square miles; Gradient - variable- shallow (<1%) to steep (8%) to shallow(1%); Discharge - to Filucy Bay; Contains Fish - supports coho, cutthroat, and chum salmon.	N1 and N6 for select upstream tributaries; F1 for downstream reaches	115 feet for N1 and N6 reaches; 150 feet for F1 reaches	Yes	No	No	42% in open space; 25% in low density residential	7%
Key Peninsula	Taylor Bay (TB)	Drainage area - 1.2 square miles; Gradient - moderate; Discharge - to Taylor Bay; Contains Fish - supports coho and cutthroat salmon.	F1	150 feet	Unknown		No	31% in open space; 24% in low density residential	9%
Key Peninsula	Vaughn (VA)	Drainage area - 6.1 square miles; Gradient - shallow; Discharge - to Vaughn Bay; Contains Fish - supports coho and chum, cutthroat trout are present.	Primarily F1	150 feet	Yes	No	No	35% in open space; 25% in low density residential	8%
Key Peninsula	Whiteman (WH)	Drainage area - 4.6 square miles; Gradient - shallow; Discharge - to Whiteman Cove; Salmonid fish passage barrier at mouth precludes use of Creek by andromous fish.	N1 for upstream tributaries; F1 for downstream reaches	115 feet for N1 reach; 150 feet for F1 reaches	Yes	No	No	50% in open space; 16% in low density residential	7%

Table 9-5
SUMMARY OF KEY PENINSULA SUBBASIN WATER TYPES AND BUFFER WIDTHS

Basin	Subbasin	Water Characteristics	Pierce County Water Type	Pierce County Buffer Width	Fish Passage Barriers?	Flood Problems?	Water Quality Limited?	Predominant Land Use	Current Impermeable Surface
Islands	Schoolhouse - Anderson Island (AI)	Drainage area - 1.9 square miles; Gradient - shallow; Discharge - to Oro Bay; Contains Fish - supports anadromous salmonids.	Primarily F1	150 feet	Unknown	Yes	No	58% in open space; 20% in low density residential	6%
Burley-Minter	Huge (HG)	Drainage area - 7.3 square miles; Gradient - shallow; Discharge - to Minter Creek, eventually into Minter Bay and Case Inlet; Contains Fish - coho and cutthroat to headwaters, steelhead for a portion.	N6 for upstream tributaries; F1 for downstream reaches	150 feet for F1 reaches (upstream to N6 designations if applicable)	Yes	Yes	Yes - dissolved oxygen, fecal coliform	28% in low density residential; 24% in open space	9%
Burley-Minter	Minter (MN)	Drainage area - 10.4 square miles, includes Little Minter tributary area; Gradient - shallow to moderate; Discharge - to Minter Bay and Case Inlet; Contains Fish - Minter Creek supports coho, cutthroat, Chinook, chum, and steelhead and releases of chum and coho; Little Minter supports coho, cutthroat, and chum.	F1 for upstream reaches; S1 downstream of confluence with Huge Creek	150 feet	Yes	Yes	Yes - dissolved oxygen, fecal coliform	37% in open space; 32% in low-density residential	9%
Burley-Minter	Purdy (PR)	Drainage area - 3.4 square miles; Gradient - shallow; Discharge - to Burley Lagoon; Contains Fish - supports Chinook, coho, chum, and steelhead, and cutthroat trout present.	Primarily F1	150 feet	Yes	Yes	Yes - dissolved oxygen, fecal coliform	30% in open space; 30% in low-density residential	9%

Table 9-6: Evaluation of Programmatic Recommendations

Row #	Prog. Number	Programmatic Name	Cost Estimate				Estimated Cost ($)	Score
			One-time	10-year	Countywide	Basin-specific		
1	PG-01	Implement Low Impact Development Program		x	x		100,000	351
2	PG-02	Increase Inspections for Compliance with Stormwater Requirements and NPDES Permit		x	x		208,800	403
3	PG-03	Develop & Implement a Land Management Program		x	x		9,570	407
4	PG-04	Develop & Implement Program to Enhance Degraded Riparian Habitat & Water Quality		x	x		34,500	310
5	PG-05	Develop & Implement an Education, Outreach & Technical Assistance Program		x	x		104,000	388
6	PG-06	Develop & Implement Surface Water Quality Monitoring Program		x	x		162,000	154
7	PG-07	Develop & Implement Stormwater Education Program for Shoreline Property Owners		x		x	600,000	281
8	PG-08	Develop & Implement BMP Manual for Water Programs Maintenance Activities	x		x		71,000	426
9	PG-09	Provide Technical Assistance to Nonprofit Groups Installing Fish-Friendly Culverts		x	x		8,700	294
10	PG-10	Develop & Implement Habitat Monitoring Program		x	x		7,750	194
11	PG-11	Encourage Installation of Permanent Buffer Markings and/or Signage	x		x		7,750	193
12	PG-12	Establish a Wetlands Banking or Advanced Mitigation Program	x		x		50,000	298
13	PG-13	Develop & Implement an Invasive Species Management Program		x	x		7,000	285
14	PG-14	Implement Elements of Shellfish Protection Program		x		x	6,200,000	368
							7,571,070	