CHAPTER 4: MANAGEMENT APPROACHES

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Stormwater management activities include a broad range of approaches from regulations to public education to facilities construction and operation. Each activity has a unique set of costs and benefits, and most activities must be combined with others to work effectively. For instance, stormwater facility construction must be combined with on-going maintenance. Some approaches address a specific problem such as a flooded street, while other approaches, such as riparian revegetation, can resolve many problems simultaneously. Taken in total, these activities define the specific level of service the county provides to the watershed or basin. This chapter describes a variety of approaches to managing stormwater and explains the positive and negative aspects of each approach. Chapter 5 presents three alternative levels of service which combine each of these approaches. Chapter 6 contains the specific recommendations of the Recommended Plan, and Chapter 7 contains specific recommendations for a Minimum Service Alternative.

The management approaches are grouped into the following categories:

- Facilities construction, operation, and maintenance
- Regulations and acquisition
- Public involvement and education
- Riparian and in-stream restoration
- Monitoring

The chapter ends with a summary of the Regional Nonstructural Management Plan, which represents a regional approach to dealing with problems and solutions that cross basin boundaries.

Historically, surface water management in the McAllister/Eaton Creek basin included only ditch maintenance and complaint response to control flooding and protect public safety. Development in the basin resulted in ground water contamination, which the county addressed by designating the McAllister Geologically Sensitive Area (GSA) in 1988 (revised in 1990). The GSA represents a regulatory approach to managing water quality. Also, the city of Olympia protects McAllister Springs by owning the surrounding area, which demonstrates the acquisition approach to managing surface water.

4.1 FACILITIES CONSTRUCTION, OPERATION AND MAINTENANCE

4.1.1 Goals

Goals for stormwater facilities construction, operation and maintenance include:

- Convey stormwater runoff without flooding
- Provide maximum detention and infiltration in order to maintain natural hydrology

- Prevent ground and surface water contamination
- Protect natural drainages
- Maintain stormwater facilities so they work effectively and efficiently

4.1.2 Types of Facilities

Stormwater facilities are also called "structural solutions" because they rely on physical structures to rectify problems. Facilities for draining and treating stormwater runoff range from simple structures such as roadside ditches to elaborate underground vaults and oil/water separators. In the past, stormwater facilities were often designed and built without considering their impacts to other features of the environment or the watershed as a whole, which resulted in degraded water quality and fish habitat. However, current stormwater facility designs can improve water quality and habitat. "Regional" facilities are facilities designed to serve more than one subdivision or development.

Stormwater facilities include components to convey, store, and treat stormwater. Often, one component serves multiple purposes, such as a swale which conveys and treats runoff.

- <u>Conveyance Systems</u> Most conveyance systems in developed areas of the basin consist of catch basins and pipes leading to infiltration facilities. Catch basins are the containers directly beneath storm drains, which fill up with the oily sediments in runoff. Pipes then convey the runoff to ponds, trenches, or other stormwater facilities. Grassy swales are broad, shallow grass-lined channels which treat as well as convey stormwater.

  Open channel conveyance systems are preferred over pipes, because they offer more options than piped systems for treating and storing stormwater. Grass-lined swales provide good water quality treatment, but rock-lined or paved channels are preferred over pipes where site restraints prevent the use of swales. Installing catch basins in grassy swales instead of paved gutters can reduce the need for maintenance because the grass removes sediments which would otherwise fill the catch basins. Open conveyance systems in the basin include grassy swales that discharge to Little McAllister Creek. Road-side ditches in the basin also convey runoff and infiltrate it into the ground through the loose, gravelly soils in the area.

- <u>Storage Systems</u> Retention ponds are the most common types of storage facilities in the basin. These "dry" ponds hold water only during storm events and then infiltrate to ground water. They provide some treatment by settling out suspended solids. Retention ponds can be used for other purposes such as parks during dry weather. Yauger Park, in the Percival Creek Basin, is a retention pond.

  Other infiltration facilities, such as dry wells and infiltration trenches, also store runoff and discharge it to ground water. Dry wells are large, gravel-filled pits which store runoff. Infiltration trenches consist of perforated drain pipe buried in long, gravel-filled moats. Both of these facilities provide some treatment by removing suspended solids.

Detention ponds receive runoff during storm events, then treat and slowly release the runoff to surface water. Some are "wet" ponds, which retain water year-round. These ponds can function as natural ponds, providing fish and wildlife habitat and other recreational and aesthetic benefits, but they sometimes raise safety concerns in residential areas. Current design standards require gradual side slopes and shallow water depths to improve safety. They remove suspended solids and help remove nutrients like nitrates and phosphorous.

Spill control structures are storage vaults or ponds which are installed on the conveyance system. They are designed to divert and trap hazardous materials that run into the storm drains, and prevent the hazardous materials from being discharged to surface or ground water. Underground vaults use oil/water separators to divert petroleum spills from the conveyance systems. Spill traps must be maintained regularly to function properly.

- Treatment Systems Detention and retention systems can partially remove pollutants carried in stormwater by holding the water and allowing suspended particles to settle out. Constructed wetlands provide much better treatment of nutrients at greater costs. Oil/water separators are stormwater treatment devices that can be incorporated into any stormwater system to remove petroleum products. They range from simple baffled vaults to complex coalescing plates, and they are moderately to highly effective at removing oil and petroleum.

  Pre-treatment systems filter sediments and certain pollution out of runoff before it enters the primary treatment facility. Pre-treatment systems include sand filters similar to facilities used by various sewage treatment systems. Leaf-compost filter systems have shown promising results in recent studies.

4.1.3 Facilities Maintenance

Stormwater facilities require periodic inspection and maintenance to function effectively. Unmaintained facilities often clog with sediment and debris, and fail to work. Inspection includes checking stormwater pond levels during rain events, checking the waste levels in oil/water separators, ensuring that ditches and swales are unclogged and mowed, and looking for signs of backwatering or clogged facilities. Facilities maintenance activities include mowing swales and ditches, cleaning out catch basins and oil/water separators, and brushing and removing sediments from ponds.

The Puget Sound Water Quality Management Plan orders local jurisdictions to adopt maintenance policy ordinances by July, 1994. The minimum requirements include inspection and maintenance of privately owned facilities, which includes most of the existing systems in the basin. Maintenance has been a thorny issue in the past because most facilities are owned and theoretically operated by homeowner associations or groups of lot owners. However, many of these groups either do not exist or do not realize that facilities maintenance is their responsibility. In addition, most of these groups do not collect dues and do not have the administrative structure needed to manage an ongoing maintenance program.

4.1.4 Benefits and Limitations

The US EPA has compiled the results of stormwater system effectiveness studies from all over the nation. The results indicate that well maintained stormwater facilities can be highly effective at removing sediments and associated heavy metals. The effectiveness of oil/water separators varies significantly. Most stormwater facilities do a poor job of removing soluble contaminants such as nitrates, phosphorous, and certain pesticides. Constructed wetlands show good potential for removing nutrients, but they are expensive and land-intensive. Stormwater infiltration facilities improve ground water recharge, reduce damaging flood flows in streams, and imitate the natural hydrology of the basin, but they also have the potential to contaminate ground water.

Even the best-designed stormwater facility will not function properly without regular maintenance. Catch basins must be cleaned out regularly or they will release pollutants every time it rains. Full catch basins also permit sediments to flow directly into the stormwater facilities at the receiving end of the pipe. Pre-treatment systems such as sand filters require even more frequent maintenance. Late summer or early fall cleaning is especially critical, because the first heavy storms of the fall wash all the contaminants that accumulated over the dry season into receiving waters. Swales must be mowed to prevent clogging and flooding, but they lose effectiveness if they are mowed too short. All ponds require periodic inspection and occasional cleaning to remove sediments.

Spill control traps depend on regular maintenance for their effectiveness. They can prevent hazardous spills from contaminating receiving waters only if they are empty when the spills reach them, so they must be pumped out periodically. Nevertheless, spill control structures represent the best defense against contamination, once a spill has occurred.

4.2 REGULATIONS AND ACQUISITION OF CRITICAL AREAS

4.2.1 Goals

The goals for regulations and acquisition of critical areas include:

- Require site and drainage designs that minimize runoff and maximize ground water recharge, and prevent erosion and runoff from construction activities.

- Protect natural drainage ways and encourage innovative land use planning which reduces runoff and increases ground water recharge.

- Protect critical areas such as streams, wetlands and floodplains, which provide important stormwater and habitat benefits.

- Enforce regulations and respond to complaints quickly and effectively.

4.2.2 Types of Regulation and Acquisition

Jurisdictions within the McAllister/Eaton Creek basin protect natural resources through various regulations and development controls, including drainage regulations, road design standards, building and zoning codes, and environmental regulations such as the critical areas ordinance. Acquisition provides the ultimate tool for protecting natural areas.

Drainage regulations govern the amount and quality of stormwater released from developments, and design standards affect runoff by influencing the amount of impervious area created by streets and buildings. Building regulations govern land clearing and construction activities which can cause significant erosion and runoff because they expose bare soil to rainfall. Regulations can help preserve vegetation, which is the most effective method for reducing erosion and runoff. Cleared land requires expensive techniques to control erosion.

Land use regulations have a profound effect on the basin-wide impacts of development. Previous regulations and planning have permitted large scale losses of natural drainage systems and forests, which are vital areas for reducing runoff and flooding problems. Changes in land use planning and regulation can prevent future problems on the landscape scale, such as flooding and widespread pollution.

Healthy streams, wetlands, and floodplains naturally cleanse polluted water and reduce flooding for minimal costs. Loss of these natural functions causes flooding and pollution problems which then require expensive and less effective artificial solutions. The most effective and sustainable method of protecting the natural functions of specific parcels is to acquire them and manage them as natural areas.

4.2.3 Regulatory Authority

Washington State has given local jurisdictions the authority to manage water resources, but specific regulations have not been developed in many cases. For instance, the Washington State Growth Management Act requires local governments to adopt regulations to protect critical areas including wetlands, flood areas, fish and wildlife habitat, and conservation areas, but does not specify guidelines to accomplish this goal.

Many state agencies have developed management guidelines that local jurisdictions can choose to uphold strictly or follow informally. The Puget Sound Water Quality Authority (PSWQA), Washington Department of Ecology (WDOE), and Washington Department of Fisheries (WDF) have all developed guidelines for stormwater, water resources, and/or habitat management. These guidelines can help, but may not adequately protect resources at the local level.

Local regulations and development controls intended to protect water resources include development review, environmentally sensitive (critical) areas ordinances, the nonpoint source pollution control ordinance, clearing and grading regulations, and the regional Drainage Design and Erosion Control Manual which has been adopted by Olympia, Lacey, Tumwater, and Thurston County.

A detailed discussion of federal, state, and local regulations concerning water resources is presented in Appendix D.

4.2.4 Benefits and Limitations

Governments have a long and controversial history of addressing problems with regulations. Regulations give local jurisdictions the ability to protect the public interest by setting acceptable community standards for practices that affect community resources. Local regulations are often designed to fill perceived gaps in state and federal regulations. Regulations give local government the authority to take punitive actions against individuals, such as fines, for degrading public resources. This acts as a negative incentive.

Regulations are undoubtedly necessary tools for maintaining natural resources, but they also have important drawbacks. Some regulations are reactive, not proactive; they respond to damage after it has been done. Changing regulations can cause both positive and negative economic impacts to individuals, and can create confusion and misunderstanding among the regulated parties. Recently, regulations which caused lowering of property values have been challenged in court, and currently pending cases will probably affect the future regulatory arena. If governments are required to compensate landowners for value losses, the expense could significantly raise the public costs for environmental protection.

Regulations are only effective if they are actively enforced, and complaint response must occur quickly to resolve problems effectively. Enforcement of regulations designed to protect the integrity of water resources and important habitat areas is a critical part of any management program. This requires that jurisdictions maintain an adequate enforcement staff. Unfortunately, staff must often cover large areas. State agencies have enforcement staff, but they are often unavailable for enforcement at the local level. Enforcement is often inconsistent, which raises questions of fairness and equity.

Land acquisition can offer an alternative to regulation for specific situations. By buying critical lands, governments can protect important resources and preserve future options for resolving existing and potential environmental problems, often at a reduced cost compared to postponing remediation to a future date. Acquired land often becomes available for a variety of public uses such as recreation and education. Unfortunately, the initial cost of acquisition is high, and acquired lands are still vulnerable to impacts from off-site.

4.3 PUBLIC INVOLVEMENT AND EDUCATION

4.3.1 Goals

The basic goals of public involvement and education are to increase basin residents' understanding of their impacts on local water resources, encourage practical changes which reduce nonpoint pollution, and increase public involvement in decision making and resource management. Public education is also an important feature of most regulatory programs.

4.3.2 Mandates for Public Involvement and Education

Careful stewardship of natural resources requires an understanding of how we interact with our environment. Informed residents have the knowledge needed to make good decisions and reduce environmental impacts. The Thurston County Comprehensive Plan, the Puget Sound Water Quality Management Plan, and the Washington State Legislature all recommend more extensive education programs focusing on the environment, growth, Puget Sound, and water resource related issues. The county recently adopted formal procedures for public involvement in decision making.

The Puget Sound Water Quality Management Plan defines public involvement as an ongoing dialogue between interested and affected parties and decision makers in all steps of the decision making process. Education is more broadly defined, involving more diverse audiences, materials and activities. The Regional Nonstructural Management Plan in Appendix K describes a wide range of approaches to public involvement and education.

4.3.3 Benefits and Limitations

Public involvement and education activities encourage individual basin residents to take personal responsibility for their actions in the basin. This is the only way to reduce many non-point impacts, which cannot be resolved through engineered solutions or regulations. For example, regulations will probably never be effective at preventing people from dumping used motor oil down storm drains, because there are too many potential offenders and too many storm drain locations. Engineered structures are fairly ineffectual at removing oil by-products. Education offers the best potential for resolving this problem.

Education focusses on prevention rather than remediation, which is always more effective and usually cheaper. Education and involvement also increase the likelihood that local government actions reflect the desires of the community, and reduce the potential of ill will between the government and the people. However, educational activities do nothing about solving existing problems that have resulted from past land use practices. Structural approaches must be combined with education to deal with those problems.

4.4 RIPARIAN AND IN-STREAM RESTORATION

4.4.1 Goals

The goals of riparian and in-stream restoration include:

- Restore native vegetation in degraded stream corridors in order to improve fish and wildlife habitat, reduce erosion and improve water quality

- Restore unrestricted passage for fish in streams with human-created barriers, and improve in-stream fish habitat

4.4.2 Riparian and Stream Restoration Techniques

The important functions of riparian vegetation are described in Chapter 3, Section 3.1.4. Stream restoration includes a variety of approaches from planting native vegetation to building elaborate structures. Past fish enhancement projects placed a strong emphasis on building pools and eddies, often without sufficient understanding of the stream's hydrologic and biological processes. The latest fish management techniques emphasize restoring riparian vegetation and natural hydrologic processes, and investigating the biological factors which limit fish production. For example, recent studies indicate that artificial structures should be constructed from native materials and mimic natural configurations, and streams should be allowed to move logs and stumps around during floods.

"Bioengineering", or using vegetation to structurally reinforce and stabilize eroding banks, has gained increased acceptance, and is now being used on stream banks, road cuts, and fill slopes. The bioengineering approach takes advantage of vegetation's natural ability to strengthen unstable soils and slow stream velocity. Bioengineering can utilize native plants such as willows and cottonwoods, which maintains the ecological integrity of the stream system.

Some culverts prevent fish from moving up and down streams, because they produce high water velocities or present physical barriers such as large waterfalls at the outfall points. The Departments of Fisheries and Wildlife recommend replacing or retrofitting these culverts according to detailed specifications designed to allow fish passage. Other structural changes include placing spawning gravels in streams, constructing wooden or rock weirs and sills to create pools, and placing large logs and stumps into streams to provide cover.

4.4.3 Benefits and Limitations

Stream restoration projects can produce a broad range of benefits beyond the potential for increased fish production and the related economic and recreational benefits. The water quality improvements from riparian revegetation benefit the economy particularly by reducing contamination to commercial shellfish harvesting areas, and also by protecting public health. Riparian restoration also improves wildlife habitat, which improves recreational opportunities and the quality of life. Riparian vegetation can reduce erosion, mitigate flooding, and prevent property damage.

Culvert replacement or upgrading can open new stretches of streams to migrating fish. A city of Olympia project to replace pipes with fish passage structures on Indian Creek has resulted in salmon reaching the upper reaches of the creek for the first time since the early part of the century. Improved fish passage allows access to more spawning and rearing habitat, which can increase a stream system's productivity.

Restoration projects must be planned with care. The northwest has many examples of poorly planned projects which caused more erosion and property damage, rather than preventing it. In-stream structure designs in particular must account for the stream's dynamics. The best planned projects will not work if blockages prevent fish from reaching improved habitat, or if other factors such as lack of food or contaminated water limit fish production. Restoration projects must address the root causes of the original degradation in order to succeed, and fisheries enhancement must incorporate a comprehensive management strategy.

4.5 MONITORING

4.5.1 Goals

Goals of stream and habitat monitoring include:

- Determine the background (ambient) levels of various pollutants in surface water
- Describe the existing condition of the basin's water resources
- Improve understanding of the basin's water-related ecological processes and functions
- Identify problems and determine trends in water quality, flood flows, and habitat
- Evaluate the effectiveness of specific management actions

4.5.2 Monitoring Approaches

Monitoring covers a broad array of activities used to provide the baseline of information from which to identify problems, determine trends, and evaluate the effectiveness of solutions to water resource problems. Water quality monitoring approaches range from infrequent stream sampling by volunteers to intensive source tracking programs and detailed chemical analyses. Stream habitat monitoring approaches range from simple, qualitative descriptions of individual stream sites to intensive, end-to-end quantitative stream measurements. The appropriate monitoring techniques depend on the objectives of the program and the availability of funding. Monitoring the effectiveness of stormwater facilities involves measuring specific water quality parameters before and after construction. Monitoring stormwater projects is essential for measuring the success of the projects and improving future projects.

4.5.3 Benefits and Limitations

A well-designed water quality monitoring program which combines appropriate ambient and intensive monitoring techniques can pinpoint a source of pollution, differentiate between natural components and introduced contaminants, or increase our understanding of the processes which lead to a specific water quality condition. These desired results can provide the foundation for sound decisions on programs and construction proposals. The results of any water quality study depend to some extent on the timing and frequency of sampling. It is difficult for any monitoring program to catch every pollution event. Monitoring techniques that accurately identify problem sources can be prohibitively expensive, but less specific information can be misleading. Effective monitoring requires clear, realistic objectives.

Most stream habitat monitoring methods are based on essentially qualitative methods which rely largely on the judgement of individuals. This makes the results hard to replicate and reduces the value of the data gathered. Nevertheless, stream surveys can help to locate problem sites and evaluate overall stream conditions. They can also provide a picture of large-scale trends. Detailed, quantitative stream surveys provide replicable results, but are expensive and time-consuming. However, these surveys can link biological data with stream hydrology to create a powerful tool for predicting the effects of flows on fish habitat. The proper method will depend on the specific objectives of the monitoring program.

Monitoring individual stormwater projects provides extremely valuable information on their effectiveness, and these monitoring programs are relatively simple to design because they target very specific information. They require good baseline data on pre-project conditions, preferably for at least a few years.

Any monitoring program that utilizes volunteers provides the additional benefit of raising the understanding and awareness of the local citizens. Citizen monitoring programs require rigorous training and quality control measures to insure the reliability of the data. Most citizen monitoring programs will need to depend to some extent on the technical expertise of agency staff to provide interpretation of the data.

4.6 REGIONAL NONSTRUCTURAL MANAGEMENT PLAN

The Regional Nonstructural Management Plan applies consistent measures regionally to solve problems which cross basin boundaries. The plan was developed and adopted jointly by Thurston County and the cities of Olympia, Lacey, and Tumwater during the process of drafting and adopting the Indian/Moxlie, Percival, and Woodard/Woodland basin plans. Planners from the local jurisdiction came independently to the conclusion that certain measures should be implemented region-wide, rather than basin-by-basin. Consequently, the local jurisdictions formulated a set of joint recommendations and decided to include them as an element of all the basin plans in Thurston County. These recommendations are currently being implemented in the annual work plans of Lacey, Olympia, and Thurston County.

Examples of the regional recommendations include public education, which cannot realistically be limited to the residents of one particular basin, and drainage design standards, which should not differ from basin to basin throughout the county. The regional recommendations include many of the management approaches described above. The entire set of recommendations is integral to this basin plan, and may be found in Appendix K.

CHAPTER 5: LEVEL OF SERVICE ALTERNATIVES

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This chapter proposes a recommended level of service, and describes a minimum service alternative, as well as describing the results of no further action. Each level of service includes a specific set of activities to meet its goals and objectives. A discussion of the results follows the description of each service level. The chapter ends with a matrix that evaluates the results of each service level against six rating criteria. Chapters 6 and 7 provide details of the specific recommendations and costs associated with recommended plan and the minimum level-of-service, respectively.

- The Recommended Service Level would provide the maximum level of protection for water resources and public health and safety available with current knowledge and technology. These measures would protect McAllister Springs, reduce future flooding and increase preservation of the creek corridors. Public costs associated with the Recommended Service Level are higher than Minimum Service Alternative costs.

- The Minimum Service Alternative presents management approaches which would meet all state and federal requirements, protect McAllister Springs, reduce current flooding problems in the basin and reduce degradation to the creek corridor. It would require funding above current levels.

- No Action describes the existing level of service, which would decrease in the future as grant-funded activities, such as the business education and assistance program, expire.

5.1 RECOMMENDED SERVICE LEVEL

This section describes the Recommended Service Level, and ends with a summary of the anticipated results. Chapter 6 describes the specific measures of the Recommended Service Level in greater detail.

5.1.1 Stormwater Facilities

The Recommended Service Level proposes evaluating the potential for upgrading all inadequate stormwater facilities in the basin to include the best current technologies, in addition to implementing a maintenance program. Those facilities which meet cost and benefit criteria would then be upgraded. The basic philosophy behind the Recommended Service Level is to provide the maximum possible treatment for runoff from existing stormwater systems, before discharging it to surface or ground water. Increased treatment offers the greatest potential for preventing stormwater from contaminating drinking water supplies in aquifer-sensitive areas, and reduces the likelihood of failure in infiltration systems. Wherever practical, underground conveyances would be converted to grassy swales throughout the basin. Pretreatment would be installed on existing infiltration systems in the basin. Pretreatment alternatives would include wet vaults, sand filters, and leaf compost filters. Small ponds would be enlarged, and constructed wetlands would be the preferred treatment for all new development. Spill control structures would be installed to protect McAllister Springs, and a wetland at the head of Little McAllister Creek would be used for stormwater detention, to prevent downstream erosion and improve habitat and water quality.

The capital construction program would be combined with increased maintenance of existing facilities. The county would develop a program to insure the maintenance and operation of privately owned facilities. The county would inspect the facilities and maintain records of all work performed. Remedial maintenance would be performed on failing facilities as part of the initial maintenance program.

5.1.2 Regulations and Acquisition

The Recommended Service Level would triple the storage requirement of the 1991 Regional Drainage Manual, which is the level necessary to prevent cumulative impacts of future development on downstream flows (see Appendix M for the 1991 Drainage Manual requirements). New developments would retain and infiltrate a greater quantity of runoff on-site, which would preserve ground water recharge and prevent increases in winter flood flows. Standard drainage designs would be developed by the County so that single family homes and building remodels which increase impervious area meet the Drainage Manual minimum requirements for runoff detention/retention. Stormwater pretreatment designs for aquifer sensitive areas would be added to the Regional Drainage Design Manual. Enforcement of the Nonpoint Source Pollution Ordinance would increase. In addition, the Recommended Service Level would emphasize cluster zoning throughout the basin, which would reduce runoff and preserve forested areas. The county would negotiate a conservation easement along Eaton Creek, and in the Little McAllister Creek watershed. The conservation easements would be integrated with a program of tax incentives and land use guidelines to promote economically sustainable riparian activities which also improve water quality, such as planting harvestable, fast growing tree crops between agricultural fields and streams.

5.1.3 Public Involvement and Education

The Recommended Service Level would increase education and assistance opportunities for homeowners in the McAllister GSA, and develop information on least-toxic alternatives for distribution at points-of-purchase. The Recommended Service Level also supports implementing the regional PIE proposal included in the Regional Nonstructural Management Plan, which was adopted by the county in the Percival and Indian/Moxlie basin plans (see Appendix K). Those recommendations include community grants, Stream Team activities, youth and school education, business education, public outreach, interjurisdictional coordination, and management of volunteer data.

5.1.4 Riparian and In-stream Restoration

The Recommended Service Level would include a comprehensive watershed restoration program in partnership with the county and landowners, volunteer groups, the Conservation District, and other local, state and federal agencies in order to systematically restore healthy riparian corridors to both Eaton and McAllister creeks. Riparian restoration would offer numerous benefits beyond improved fish habitat, including reduced erosion and improved water quality. Sites would be prioritized according to the cost and benefits to habitat and water quality, and scheduled into a multi-year, comprehensive revegetation program. The Recommended Service Level would remove fish passage barriers by such measures as retrofitting impassable culverts and building fish ladders in order to open up additional stream reaches. It would also include creating new fish spawning habitat, and evaluating the potential for other in-stream structural improvements.

5.1.5 Monitoring

The Recommended Service Level would expand ambient monitoring of Eaton and McAllister creeks, and supplement it with additional site-specific monitoring to pinpoint pollution sources. Stream gauging would be expanded to include McAllister and Little McAllister Creeks. Stream habitat monitoring would be conducted by volunteers and county staff in cooperation with the Northwest Indian Fisheries Timber-Fish-Wildlife program, using the qualitative T-F-W method. Periodic, quantitative surveys of the stream channel would also be conducted. Fish population counts would be conducted on both streams. Pre- and post-monitoring would be included in all structural stormwater projects in order to evaluate their effectiveness.

5.1.6 Regional Nonstructural Management Plan

The Recommended Service Level would also implement the recommendations in the Regional Nonstructural Management Plan described in Appendix K.

5.1.7 Results of the Recommended Service Level

Flooding The Recommended Service Level would resolve all the known road and home flooding problems in the basin caused by inadequate drainage facilities. In addition, increased maintenance and upgrading of existing facilities and higher drainage design standards would probably prevent road and home flooding in the future which would occur otherwise. Clustering would preserve forested open space, which would also help reduce future flooding. The plan does not address flooding on private property caused by the actions of individual landowners.

Erosion The Recommended Service Level would virtually eliminate stream bank erosion on McAllister and Eaton Creeks caused by artificial removal of vegetation. Erosion in Little McAllister Creek caused by high runoff peaks would be sharply reduced. Erosion caused by channel straightening and modifications would decline. Some natural erosion would continue, especially in the steep ravines of Little McAllister Creek and lower Eaton Creek. However, natural erosion would not threaten private property or buildings because the creek corridors would be placed in protective easements where no building would occur.

Water Quality The Recommended Service Level would sharply reduce the risk that stormwater facilities will contaminate drinking water supplies, and would reduce the risk of a catastrophic accident contaminating McAllister Springs. Fecal coliform and nutrient contamination of Eaton Creek, Lake St. Clair, and McAllister Creek would decrease. Restored stream buffers would significantly improve the water quality of runoff from agricultural areas.

Fish and Wildlife Habitat The Recommended Service Level would significantly improve fish and wildlife habitat. An almost continuous corridor of native vegetation from the mouth of McAllister Creek to upper Eaton Creek would improve wildlife travel routes, food and cover, and would reduce stream temperature fluctuations and increase food sources and cover for fish and aquatic insects. The reduced erosion would also improve spawning gravels and result in more overhanging vegetation for fish. Gravel enhancement projects would create new spawning habitat. Migratory fish would gain access to significant new stretches of stream because fish passage barriers would be removed on both creeks. The newly accessible stream reaches would contain high-quality habitat because of the revegetation and gravel enhancement projects. Eventually, increased streamside vegetation would add woody debris to the stream channel, which would enhance in-stream habitat diversity and value. Mandatory cluster zoning would also help preserve wildlife habitat.

Statutory Requirements The Recommended Service Level meets all state and federal mandates, including requirements for stormwater facilities design and maintenance, water quality protection, critical areas protection, and fish passage.

Cost The cost of the Recommended Service Level is estimated at $5.53 million. For more details on cost and funding options, see Chapter 6.

5.2 MINIMUM SERVICE ALTERNATIVE

This section describes the Minimum Service Alternative, explains its differences with the recommended service level, and ends with a summary of the anticipated results. Chapter 7 describes the specific measures of the Minimum Service Alternative in greater detail.

5.2.1 Stormwater Facilities

The main difference between the Minimum Service and Recommended Service approaches to stormwater facilities is that the Minimum Service Alternative would not upgrade existing facilities unless they are currently causing flooding or erosion. This would be less expensive, but it would provide less protection for ground water. The Minimum Service Alternative emphasizes an aggressive program of scheduled maintenance. The basic philosophy behind the Minimum Service Alternative is that existing facilities should be maintained better before attempting to solve historical problems by building new facilities. Generally, improved maintenance would be the preferred option, and additional construction would only occur in sites where maintenance proved ineffective.

However, some high priority problems cannot be solved through maintenance. The Minimum Service Alternative includes some new facilities to remedy the worst existing flooding problems in areas such as the Hidden Forest and Mountain Aire subdivisions. An artificial wetland would be constructed to reduce erosion, protect fish habitat, and improve water quality in Little McAllister Creek. Spill control structures would be installed at high-risk intersections to prevent hazardous materials spilled in traffic accidents from contaminating drinking water supplies in the McAllister GSA.

5.2.2 Regulations and Acquisition

The main regulatory features of the Minimum Service Alternative include new drainage standards which represent a middle ground between existing (1991) standards and those proposed in the Recommended Service Level; and new buffer requirements for Eaton Creek which would cost less than the conservation easement proposed in the Recommended Service Level (see Appendix M for the 1991 Drainage Manual requirements). The Minimum Service Level would include a conservation easement for part of the Little McAllister Creek watershed, but instead of including an easement along Eaton Creek as well, this alternative would increase Eaton Creek buffer requirements in the next update of the Critical Areas Ordinance. This approach gives less protection to the creek because existing areas with inadequate buffers would not be placed in an easement and restored. Tax incentives and guidelines would be developed to encourage environmentally sound, sustainable tree harvesting in the outer buffer areas. Stormwater pretreatment designs would be added to the Regional Drainage Design Manual. The Nonpoint Source Pollution Control Ordinance would be enforced. The Minimum Service Alternative also supports implementing the regulations recommended by the Regional Nonstructural Management Plan, adopted by the county in the Percival and Indian/Moxlie basin plans (see Appendix K for details).

5.2.3 Public Involvement and Education

The Minimum Service Alternative would include all the public education proposed in the

Recommended Service Level, because public education is essential for reducing nonpoint pollution, and it is relatively inexpensive compared to the cost of building capital facilities. The Minimum Service Alternative would increase education and assistance opportunities for homeowners in the McAllister GSA, and develop information on least-toxic alternatives for distribution at points-of-purchase. The Minimum Service Alternative also supports implementing the regional PIE proposal included in the Regional Nonstructural Management Plan, which was adopted by the county in the Percival and Indian/Moxlie basin plans (see Appendix K). Those recommendations include community grants, Stream Team activities, youth and school education, business education, public outreach, interjurisdictional coordination, and management of volunteer data.

5.2.4 Riparian and In-stream Restoration

The Minimum Service Alternative proposes targeting selected streambanks along McAllister and Eaton creeks for staff-assisted volunteer revegetation projects, rather then implementing the basin-wide watershed restoration program of the Recommended Service Level. This limited approach to riparian restoration would help solve some immediate erosion problems, but offers only minor water quality and habitat benefits. The revegetation of severely erosive and dangerous sites would not be undertaken. Streamside property owners would be encouraged to participate in the revegetation efforts. The Minimum Service Alternative would solve fish passage problems by such measures as retrofitting impassable culverts and building fish ladders in order to open up additional stream reaches. When possible, these projects would be planned to coincide with road upgrades.

5.2.5 Monitoring

The Minimum Service Alternative would include all the monitoring proposed in the Recommended Service Level except for calibrating the Lake St. Clair computer model, because monitoring is essential for identifying problems and addressing them before they get worse. Monitoring is also necessary for evaluating the effectiveness of individual projects. The Minimum Service Alternative would continue ambient monitoring of Eaton and McAllister creeks, and supplement it with additional site-specific monitoring to locate hot spots. Stream gauging would be expanded to include McAllister and Little McAllister Creeks. Stream habitat monitoring would be conducted by volunteers and county staff in cooperation with the Northwest Indian Fisheries Timber-Fish-Wildlife program, using the qualitative T-F-W method. Periodic, quantitative surveys of the stream channel would also be conducted. Fish population counts would be conducted on both streams. Pre- and post-monitoring would be included in all structural stormwater projects in order to evaluate their effectiveness.

5.2.6 Regional Nonstructural Management Plan

The Minimum Service Alternative supports implementing recommendations in the Regional Nonstructural Management Plan described in Appendix K.

5.2.7 Results of the Minimum Service Alternative

Flooding The Minimum Service Alternative would resolve all the known road and home flooding problems in the basin caused by inadequate drainage facilities. Improved maintenance might reduce the number of system failures which cause flooding. Future flooding from the cumulative impacts of new developments would probably increase during severe storms. The plan does not address flooding on private property caused by the actions of individual landowners.

Erosion The Minimum Service Alternative would reduce stream bank erosion caused by artificial removal of vegetation at a few sites on Eaton Creek, but erosion would continue at most other known problem areas. This alternative would have little effect on erosion caused by channel straightening and modifications. Erosion in Little McAllister Creek caused by high runoff peaks would be sharply reduced. Some natural erosion would continue, especially in the steep ravines of Little McAllister Creek and lower Eaton Creek. Eventually, the cumulative effects of new developments would probably increase stream bank erosion during heavy storms.

Water Quality The Minimum Service Alternative would reduce the risk of a catastrophic accident contaminating McAllister Springs, but it would not reduce the risk that existing stormwater facilities will contaminate drinking water supplies. Fecal coliform and nutrient contamination of Eaton Creek and Lake St. Clair would be reduced somewhat by addressing flooding on Raymond Ditch. Limited stream buffer restoration would have little or no effect on the water quality of runoff from agricultural areas.

Fish and Wildlife Habitat The Minimum Service Alternative would create small improvements in fish and wildlife habitat at a few sites on Eaton Creek. These small revegetation projects would not significantly improve travel routes, food and cover for wildlife, or improve stream temperatures for fish. Erosion would continue to harm spawning gravels. The net effect of revegetation would be improved fish habitat at a few isolated sites. Migratory fish would gain access to significant new stretches of stream because fish passage barriers would be removed. However, the fish habitat value of the newly accessible stream reaches would be highly variable because of the limited number of restoration sites.

Statutory Requirements The Minimum Service Alternative meets all state and federal mandates, including requirements for stormwater facilities design and maintenance, water quality protection, critical areas protection, and fish passage.

Cost The cost of the Minimum Service Alternative is estimated at $2.9 million. For more details on cost and funding options, see Chapter 7.

5.3 NO ACTION

5.3.1 Stormwater Facilities

No Action would rely on the existing storage and treatment facilities, which are mostly privately-owned. Project proponents would build facilities to mitigate the impacts of new developments and roads as required by the Drainage Design and Erosion Control Manual, but no new facilities would be constructed to solve existing problems. Maintenance would be limited to cleaning ditches and responding to flooding complaints. Most existing privately owned facilities would not be maintained. New facilities would still be required to file maintenance plans with the county, but no enforcement mechanism would be developed.

5.3.2 Regulations and Acquisition

No Action would rely on the current requirements of the Drainage Design and Erosion Control Manual to mitigate the impacts of new development, and would rely on existing building codes, erosion control requirements, and clearing and grading ordinances to minimize the impacts of construction. Development in floodplains and forests would continue. No Action would not add any staff or training for enforcing the nonpoint source pollution ordinance. The county Building Department recently hired additional staff to enforce drainage manual requirements. Technical assistance would be provided on a limited request basis. No Action would rely on existing ordinances to regulate critical areas, while private land trusts pursue open space acquisitions and conservation easements as available.

5.3.3 Public Involvement and Education

No Action would rely on current programs for public involvement and education, many of which are grant-funded and will be discontinued in the future. The activities which currently have limited on-going funding include Stream Team volunteer support, classroom presentations on stormwater, and monthly coordination meetings.

5.3.4 Riparian and In-stream Restoration

No Action would continue revegetation projects at the current small scale of volunteer efforts through the Stream Team program. Conservation District assistance might be available for a few revegetation projects in the basin. Projects would be limited by availability of volunteers and funds, and the accessibility of the sites. No Action does not include any fish barrier removals or habitat improvements.

5.3.5 Monitoring

No Action would continue the current comprehensive ambient water quality monitoring program which includes six samples per year from one site on Eaton Creek and one site on McAllister Creek. Monitoring to identify sources of fecal coliform contamination at Nisqually Reach would be limited to two existing grant-funded projects. Eaton Creek stream flow monitoring would continue, but McAllister flows would not be monitored. Stream habitat would not be monitored.

5.3.6 Regional Nonstructural Management Plan

No Action would continue activities recommended by the Regional Nonstructural Management Plan which have already been implemented. Examples include the Nonpoint Source Pollution Control Ordinance, the ambient monitoring program, and some of the public involvement activities. No new activities would be started, so recommendations such as stream habitat monitoring, improved stormwater facilities maintenance, and uniform vegetation protection regulations would not be implemented.

5.3.7 Results of No Action

Flooding No Action would result in increased flooding of roads and homes; known flooding sites would persist and new areas would flood as existing systems fail. Future flooding from the cumulative impacts of new developments would increase during severe storms.

Erosion No Action would result in increased stream bank erosion at numerous existing sites where vegetation has been removed. Erosion caused by channel straightening and modifications would continue. Erosion in Little McAllister Creek caused by high runoff peaks would continue. The cumulative effects of new developments would increase stream bank erosion during heavy storms. Resulting property damage would increase.

Water Quality No Action would not reduce the risk of a catastrophic accident contaminating McAllister Springs, nor would it reduce the risk that existing stormwater facilities will contaminate drinking water supplies. Fecal coliform and nutrient contamination of Eaton Creek and Lake St. Clair would continue. Agricultural runoff would continue to contaminate surface water. Additional drinking water wells would probably become contaminated and unusable.

Fish and Wildlife Habitat No Action would result in continued loss of fish and wildlife habitat. The cumulative conversion of forests and open space to development would probably cause significant declines in wildlife population, and the additional runoff would degrade fish habitat. Erosion and siltation would continue to harm spawning gravels. Migratory fish would continue to be hampered by barriers to passage.

Statutory Requirements No Action would fail to meet a number of legal requirements, including the Department of Ecology's stormwater facilities maintenance requirements and drainage design and erosion control requirements, issued under the authority of the Puget Sound Management Plan (authorized under RCW 90.70.060); the Washington State Water Quality Standards (WAC 173-201); the Washington State Hydraulic Code (RCW 75.20.100 and WAC 220-110-110); and the federal Clean Water Act (33 U.S.C. 1330).

Cost No Action would not result in any immediate new costs to the county. However, the long-term cost of No Action would probably be considerably higher than the cost of the Recommended Service Level or the Minimum Service Alternative. Those costs would include flood damage, declining fisheries revenues, declining shellfish harvesting revenues, contaminated wells, and condemned land. Contamination at McAllister Springs would threaten the livelihood of thousands of businesses and families, and would practically halt the functioning of state offices, which would cause major losses to the local economy. The cost of developing alternative drinking water sources and cleaning up contamination at McAllister Springs would run in the millions of dollars. Other economic consequences would include lost jobs and increased insurance costs.

5.4 EVALUATION OF THE ALTERNATIVE SERVICE LEVELS' RESULTS

This section summarizes the results of the Recommended Service Level, the Minimum Service Alternative, and No Action, in a matrix which provides side-by-side comparisons.

5.4.1 Evaluation Criteria

Table 5-1 evaluates the results of each level-of-service against the following criteria:

1. Effectiveness in solving and preventing flooding problems.
2. Effectiveness at protecting and improving water quality.
3. Effectiveness at protecting and improving fish and wildlife habitat.
4. Effectiveness at reducing and preventing erosion.
5. Compatibility with law and adopted policy
6. Cost

To a large extent, the condition of the fish and aquatic insects reflects all other impacts of urbanization and indicates overall stream health. Increased flood levels sweep away spawning gravels and fish eggs. Degraded water quality reduces fish stocks. Increased erosion and sedimentation buries spawning gravels and smothers fish eggs. Loss of overhanging vegetation in the stream corridor raises water temperatures, reduces aquatic insect populations, replaces native plants with weedy non-natives, and therefore causes fisheries to decline. Domestic livestock walking in streams destroys habitat, increases erosion, and increases bacteria and nutrient levels. Viable fish populations often indicate that other criteria are within acceptable limits.

Table 5-1: Evaluation of level of service alternatives' results

Criteria	Recommended Service Level	Minimum Service Alternative	No Action
Flooding	Excellent - Existing problems would decrease as in Minimum Service Alternative, and other existing infiltration systems would be protected against failure by pretreatment structures.	Good - Existing flooding problems would be solved, and public health and safety would improve. Other areas may develop flooding problems as more infiltration systems fail in the future.	Poor - Existing flooding problems would continue and new areas would experience flooding due to increased development and lack of maintenance.
Water Quality	Good - PIE would help prevent future pollution problems. Treatment would be added to all existing systems where possible. Maximum maintenance would further improve water quality.	Fair - PIE efforts would help prevent major pollution increases. Treatment would be added to failing systems only. Increased maintenance would improve water quality. Threats to McAllister Springs would decrease.	Poor - Pollution problems identified by water quality monitoring would increase. Known pollution sites would persist. PIE efforts may help reduce some nonpoint pollution.
Habitat	Excellent - Migration barriers would be removed, all known erosion problems would be solved, large stretches of stream corridor would be revegetated, and in-stream habitat would improve.	Good - Fish migration barriers would be removed. Erosion controls and stormwater ponds would reduce siltation in some areas, but erosion would continue in other areas. Some riparian vegetation would be restored.	Poor - Flooding and erosion would continue to harm stream habitat, and the biological integrity of the stream systems would be threatened. Siltation and loss of streamside plants would increase. Fisheries could fail.

Criteria	Recommended Service Level	Minimum Service Alternative	No Action
Erosion	Excellent - Eroding sites would be systematically revegetated, peak flows would decrease, and cumulative increases in flows from new developments would be eliminated.	Fair - A few eroding sites would be revegetated, peak stream flows would be reduced, and cumulative increase in flows from new developments would be reduced.	Poor - Very little revegetation would be attempted and peak stream flows would increase with development.
Statutory Requirements	Excellent - Complies with all known federal, state and local laws and policies.	Excellent - Complies with all known federal, state and local laws and policies.	Poor - Would not comply with the Federal Clean Water Act, the Co. Comprehensive Plan, the Growth Mgmt Act, and the Puget Sound Water Quality Mgmt Plan. This could result in fines, litigation, and withholding of grant money.
Cost	High initial costs for building stormwater facilities will help to prevent expensive remedial actions in the future. Sustained fishery resource and potential for reopening closed commercial shellfish beds may help offset initial costs. This alternative goes the farthest toward avoiding future social, environmental, and financial costs.	Moderate to high initial costs for building stormwater facilities may be more than offset by the avoided costs described in No Action. These costs are difficult to estimate. Economic losses due to degraded fisheries may add to the cost of this alternative.	Low initial costs would probably lead to high cost to the community, because problems that are currently inexpensive to repair will be much more expensive to repair after the basin develops, and land will be less available for regional stormwater facilities in the densest areas with the greatest need. Economic losses from fish and shellfish declines are likely