# CHAPTER 5

# COMMUNITY-WIDE STORMWATER PLANNING AND POLICIES

## 5.1 INTRODUCTION

The Stormwater Master Plan (SWMP) is a departure from historical methods of dealing with stormwater runoff. It integrates the broader watershed and its functional elements and processes into stormwater planning and implementation. Streams that were viewed solely as water conveyance systems are seen as an integral part of the community's ecological health. A watershed is defined as the land within a given area (or basin) that collects rainfall towards a stream system. It includes the area from the ridge top of elevated areas to the confluence (or discharge) of the receiving stream, and both surface and subsurface water. The watersheds included in the SWMP are shown in Figure 4-1.

Planning by watershed is intended to provide a unified stormwater management strategy that will address water quality, water quantity, uplands natural resource and wetlands management, cross-jurisdictional basin management, floodplain management, and stream-system management. Public participation and information outreach are also important components of a community-based management process.

This chapter identifies stormwater-relevant findings, including state and federal regulatory guidelines, current City practices, and community values. Based on these findings, it provides stormwater policy direction, and describes strategies and practices for managing local streams and watersheds. The chapter is organized into the following sections:

**Background** - Provides the context of Corvallis stormwater management, including streams and the way in which the community would like to address stormwater management today.

**Existing Planning Framework** - Summarizes other City documents related to stormwater planning, policy, and implementation.

**Stormwater Quality Management** - Addresses stormwater quality issues, including pollutants in surface and ground water, sediment transport, and water temperature.

**Water Quantity Management** - Addresses how stormwater volume is managed within the Corvallis urban landscape, from rainfall and other sources, to the stormwater's ultimate discharge.

**Uplands Natural Resource and Wetlands Management** - Addresses the stormwater management values of uplands natural features and wetlands, and the implications of activities in these areas.

**Cross-Jurisdictional Basin Stormwater Management** - Addresses watershed issues that cross-jurisdictional boundaries, including flow, water quality, wetlands, and stream vitality.

**Floodplain Management** - Addresses the functional value of floodplains and the implications of encroachment into them, and provides guidance for activities within floodplains.

**Stream System Management** - Addresses various techniques available for managing streams and riparian areas.

**Public Participation and Information Outreach** - Describes what can be done to involve and inform the community about individual and community-wide practices to improve stormwater management, including water quality, detention, and stream health.

**Process for Implementing Policy Recommendations** - Includes specific recommendations on implementation of this chapter's policy recommendations.

## 5.2 BACKGROUND

Like many northwest communities, Corvallis initially collected urban runoff and domestic sewage in the same piping system, called a combined sewer. The combined wastewater was then piped directly into the Willamette River. The City's first wastewater treatment system was constructed in 1952. The original facility had limited capacity and, by today's standards, the wastewater received little or no treatment, depending on rainfall intensity. As the river became increasingly polluted, the need for more intensive treatment of domestic and industrial wastes was met with sophisticated biochemical treatment. The cost per gallon of such treatment was expensive and it became economically prohibitive to continue treatment of storm runoff. Corvallis embarked on a program of sewer-storm separation, dedicating much of its combined sewer system exclusively to domestic waste, and routing stormwater to nearby drainageways or native streams.

When Corvallis introduced system development charges (SDCs) in the 1970s, stormwater conveyance was excluded. This decision marked the end of publicly funded stormwater pipes. Since that time, Corvallis has become increasingly dependent on its native streams and drainageways for conveyance of urban runoff. In 1981, Corvallis formally acknowledged that streams had, in fact, been transformed into the principal stormwater conveyance system, resulting in the City's first Stormwater Master Plan.

In the recent past, urban streams were managed solely as stormwater conveyance systems. This approach led to a decline in stream water quality, loss or decline in the diversity and abundance of aquatic and riparian species, and degradation of the physical condition of streams. It is now understood that, if managed appropriately, the streams passing through a city can provide numerous amenities to the community, including natural hydrological management such as the reduced potential for flooding, protected or restored habitat for aquatic and riparian species, improved water quality, green belts, open spaces, educational opportunities for citizens, and increased property values for abutting property owners.

In the early 1970s, the State and federal governments established regulations protecting wetlands and the water quality of streams. Although these regulations were responsible for a number of improvements, the health of local waterways continued to degrade. Recently, new federal regulations were adopted to help further protect and improve streams, rivers, wetlands, and other natural habitats of our community. These new regulations require that local governments take a more active role in protecting water quality and certain species of fish and wildlife, and their habitats.

The City determined that the community was interested in updating the Stormwater Master Plan. In response to this concern, the Mayor appointed a Stormwater Planning Committee (SWPC) to work with the citizens and public agencies to undertake this effort. A variety of citizens provided direction on issues related to local stormwater management during the development of the SWMP. An initial

random telephone survey (366 respondents) and stakeholder interviews (50 respondents) were conducted to assess citizen attitudes and values on elements of stormwater management. The respondents placed a high priority on improved stormwater management, such as better water quality, flood mitigation, wetland protection, and stream corridor vitality. The survey and interview questions, along with the results of both, are in Appendix A.

Additional citizen input was collected through a series of community public meetings and workshops hosted by the SWPC. The first three meetings focused on collecting citizens' issues, values, and objectives, and developing a set of stormwater evaluation criteria, which became the guiding principles for stormwater management. Citizen input was also collected for each basin within the Urban Growth Boundary (UGB) during a series of 10 meetings hosted by the SWPC. Two workshops were then held to collect citizen input specific to watershed management, including alternatives for floodplain regulations and stream corridor width, water quality, detention, and stormwater management from a watershed-wide perspective.

The comments and responses of citizens were reviewed by the SWPC to identify specific stormwater policy issues. The SWPC considered a range of policy alternatives to address these issues. The stormwater policy direction and suggested strategies and practices in the SWMP are a result of this community-wide process. The results of the public meetings and the policy alternatives considered by the SWPC are summarized in Appendix A.

To meet regulatory requirements and address citizen input, a watershed-based approach to stormwater management was used. This approach considers the diverse needs of the community, government regulations, and environmental implications. The City is in a unique position to provide watershed management leadership, since the City is responsible for numerous activities that affect the health of the watersheds. The City and the community acknowledge that this approach is necessary and, through the implementation of the SWMP, intend to preserve and restore these watershed functions for the benefit of current and future generations.

Community outreach efforts were conducted to develop a set of criteria by which the SWPC could evaluate the various options being considered. The following criteria were established and used in their evaluation of these options. Examples to aid in the clarification of these criteria are in Appendix A.

- Maintains and accommodates natural hydrological processes.
- Protects and improves water quality.
- Controls unwanted erosion.
- Protects and restores natural resources and ecosystem functions.
- Meets or exceeds current regulations and anticipated future regulations.
- Ensures that cost considerations are inclusive.
- Addresses maintenance requirements and allows for maintenance access.
- Incorporates community awareness and information exchange.
- Addresses cumulative effects and off-site effects.
- Is designed and managed to avoid public health and safety hazards.
- Incorporates community amenities.

- Explores and uses innovative and low-technology approaches.
- Implements urban and rural land use objectives.

A significant portion of development within the Corvallis UGB results from public activities such as infrastructure development and building construction. Through infrastructure planning and construction, the City influences the locations of other public and private developments. For example, when a road is planned and built within a floodplain, the City encourages other construction within that floodplain.

The City has the opportunity to provide leadership by using highly responsible standards for its municipal development activities. The City can use its partnerships with other public entities, such as the county and school district, to encourage these public bodies to exhibit the same responsible activities in their construction, operation, and maintenance tasks. Policies outlined in the SWMP will apply to municipal as well as residential, industrial, and commercial development. The City will use its facility plans to provide the framework to encourage appropriate development in locations so as to preserve or enhance the flow and quality of the stormwater in its local watersheds.

## 5.3 EXISTING PLANNING FRAMEWORK

The SWMP provides the guiding framework and policy recommendations for managing watersheds and their associated waterways. The City also has a number of existing planning and engineering tools available for managing stormwater runoff and natural resources within the community. These tools include:

- Comprehensive Plan,
- Master Plans,
- Land Development Code,
- Municipal Code,
- Council Policy,
- Design Criteria Manual, and
- Standard Construction Specifications.

The relationships among these documents are described in the next sections. Altogether, these documents provide the City with the framework for managing stormwater and watersheds.

### 5.3.1 Comprehensive Plan

The Comprehensive Plan contains the requirements of the Statewide Planning Goals and Guidelines and the community's vision on land use. It defines how land will be used and managed within the City.

Generally, the Comprehensive Plan is organized around the topic areas defined by the Statewide Planning Goals. Each topic area is in an article (chapter) that includes a background discussion followed by findings and policies in support of the goals. The findings provide statements of fact or

conclusions, while the policies provide guidance for actions required for meeting the community's vision. Master facility and area-specific plans for implementing the policies of the Comprehensive Plan are also included by reference as part of the Plan.

### 5.3.2 Master Plans

The City has developed master plans that address long-range planning within specific areas of service or interest. These master plans add greater detail to the policy direction provided by the Comprehensive Plan. For example, the *South Corvallis Drainage Master Plan* (SCDMP) was developed to address the specific drainage needs of that area of the City.

Other planning documents that influence stormwater and natural resource management include: South Corvallis Area Plan, West Corvallis/North Philomath Plan, Parks and Recreation Facilities Plan, Criteria and Process to Acquire or Protect Open Space, Water Master Plan, Wastewater Master Plan, and the Corvallis Transportation Plan. Since each of these documents was prepared with a different primary purpose, their effect on stormwater and natural resource management may not be consistent with contemporary watershed management.

### 5.3.3 Land Development Code

The Land Development Code (LDC) provides specific direction to implement the policies of the Comprehensive Plan and the associated Master Plans. It is one of several documents used by developers, interested citizens, and the City to ensure that new construction and redevelopment are consistent with the goals and policies of the City. It contains development standards for various land use designations, along with the legal framework, enforcement provisions, and administrative procedures for land development.

### 5.3.4 Municipal Code

The ordinances defined by the Municipal Code provide the legal framework for managing City operations and define procedures and responsibilities for many of the activities undertaken by City government. The Code contains sections on local improvements, utilities, traffic, public protection, and development regulations. Presently, the section on utilities focuses on the sanitary collection/treatment and water distribution systems. The Code is silent on stormwater management issues, except for title 2.09, which explains the financial charges for the stormwater utility.

### 5.3.5 Council Policy

As the City's governing body, the City Council uses numerous avenues to define policies. These avenues include special plans developed in response to specific needs, such as an Endangered Species Act (ESA) Response Plan, budget authority as exercised through the annual City budget and the Capital Improvement Plan, and agreements with other jurisdictions governing joint activities. The Council can also develop policies that provide direction for the day-to-day operations of City government, such as maintenance procedures, recycling, and chemical use in landscaping. Examples are the Drainageway Maintenance Plan and the Integrated Pest Management Plan.

### 5.3.6 Design Criteria Manual

The 1991 Design Criteria Manual defines minimum engineering criteria for the design of public infrastructure including streets, and water distribution, sanitary sewer collection, and stormwater collection systems. For example, it specifies that new storm drains shall be designed to handle a 10-year event storm.

The Design Criteria Manual discourages the use of detention facilities, although the City has required their use in recent years for private development projects. In addition, the manual does not specify the use or design of facilities to protect water quality. Currently, the manual states that inspection and maintenance of private stormwater detention and treatment facilities are the responsibility of the owner(s).

Brown and Caldwell wrote an Interim Technical Memorandum, *Recommendations to Development Standards*, June 15, 1999, that specifically addresses new stormwater design practices. The memorandum discusses the rationale for modifying sections of the Design Criteria Manual and provides recommended language that could be adopted for it. The recommendations include requirements for detention and water quality facilities. This technical memorandum is in Appendix F.

### 5.3.7 Standard Construction Specifications

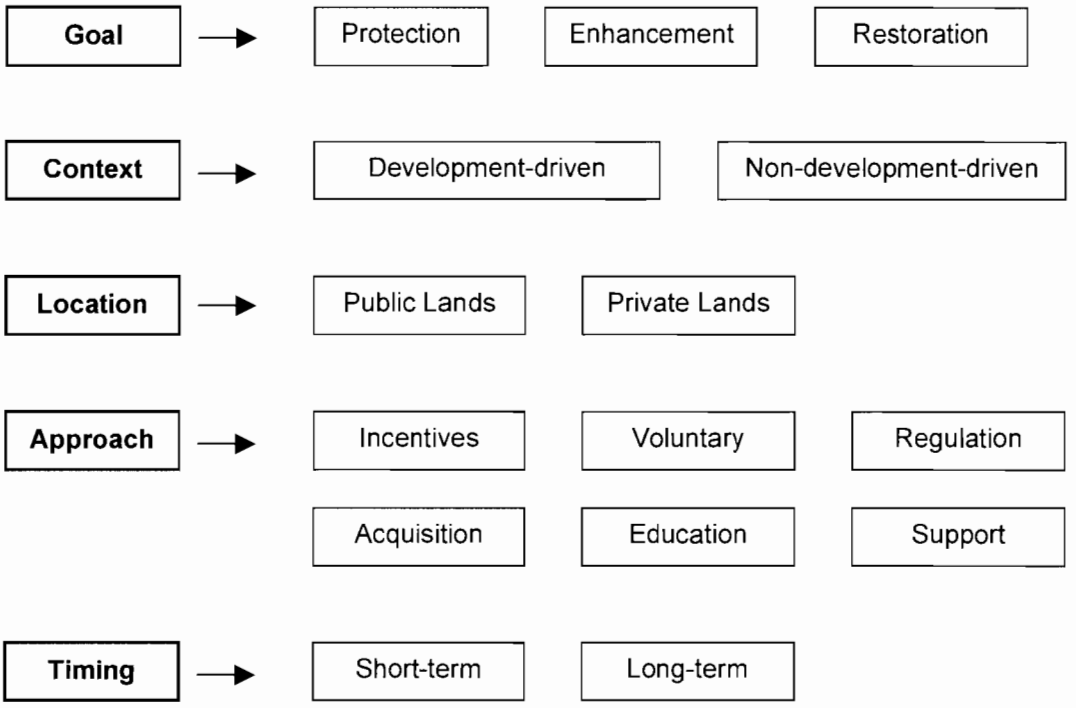
The Standard Construction Specifications (SCS) provide guidance on the design and construction of all public works projects within the City, including streets, sanitary sewers, water lines, and storm drainage systems.

## 5.4 WATERSHED AREA STORMWATER MANAGEMENT

In the following sections, each management issue is discussed in detail and includes background, issues, and citizen input that frame solutions to watershed management goals. These are followed by strategies to address the issues and specific policies and programs suggested to improve stream functions and stormwater management. This section also includes suggested follow-up actions that will be required to more fully address the issues.

Figure 5-1 summarizes the options and implementation strategies that were considered during development of the plan and the policies.

**Figure 5-1. Stormwater Policy and Implementation Strategies**




## 5.4.0 General Policies

**GP-1** The Corvallis stormwater utility shall incorporate existing natural features such as streams and wetlands as a means of managing urban runoff. When using these natural features for urban stormwater needs, stormwater management shall follow the guiding principle of minimizing harm to these natural systems, maintaining the natural functions and, over time, repairing any damage associated with past practices.

**GP-2** Implementation of the Corvallis Stormwater Master Plan shall be guided by the following evaluation criteria:

a. Maintains and accommodates natural hydrological processes.
b. Protects and improves water quality.
c. Controls unwanted erosion.
d. Protects and restores natural resources and ecosystem functions.
e. Meets or exceeds current regulations and anticipated future regulations.
f. Ensures that cost considerations are inclusive.
g. Addresses maintenance requirements and allows for maintenance access.
h. Incorporates community awareness and information exchange.
i. Is designed and managed to avoid public health and safety hazards.
j. Incorporates community amenities.

k. Minimizes cumulative effects and off-site effects.
l. Explores and uses innovative and low-technology approaches.
m. Implements urban and rural land use objectives.

**GP-3** Policies outlined in the SWMP shall apply to Municipal, Residential, Commercial, and Industrial (MRCI) development.

**GP-4** The City shall recognize and use both short-term (up to 10 years) and long-term (10-100 years) implementation strategies to meet community stormwater objectives.

**GP-5** The City shall develop a set of incentive mechanisms for potential use in implementing stormwater policies and encourage private property owners, non-profits, and other organizations to participate in their implementation.

**GP-6** The City shall determine "beneficial uses" relevant to local streams within the Urban Growth Boundary and monitor whether these streams are meeting their beneficial uses.

### 5.4.1 Stormwater Quality Management

#### 5.4.1.1 Background

Human activities can degrade water quality. Impervious surfaces such as roads and parking lots collect oils and other materials that are transported into streams during rainstorms. Farming and development activities disturb historical vegetative cover, often resulting in the transportation of sediments into waterways. The application of chemicals by farmers and homeowners has also affected the chemistry of the water in the streams.

Corvallis citizens highly value the health of the City's streams, wetlands, and groundwater. In addition, a number of State and federal regulations were developed to improve or protect the quality of stormwater runoff and receiving waters. The Oregon Department of Environmental Quality (DEQ) has conducted studies and analyses that identify elevated temperature levels or concentrations of bacteria and toxins in Oregon streams and rivers. The DEQ has determined that the Corvallis section of the Willamette River is "water-quality limited" for temperature, bacteria, and mercury. (Water-quality limited streams do not meet water quality standards for a particular parameter such as mercury.) The Marys River near the confluence of the Willamette is water-quality limited for temperature and bacteria.

There has been limited testing for contaminants in Corvallis streams, but City data have shown periodic elevated temperature and bacteria levels. For these reasons, stormwater quality is one of the important issues that must be addressed in the stormwater planning process. For example, a recent National Water Quality Assessment Program study (Anderson, 1997) showed high levels of pesticides in Dixon Creek.

The City does some stream monitoring that includes monthly sampling and testing for basic water quality parameters including bacteria, dissolved oxygen, pH, and temperature. The principal goal of the stream monitoring program is to identify sources of contamination in urban streams. When sources of contamination are located, City staff conducts follow-up activities to facilitate elimination.

A 3-square-mile area within the City limits has a combined sanitary and stormwater collection system that conveys stormwater runoff to the wastewater treatment plant. The combined system serves some of the more densely developed and impervious areas of the City, including the downtown area. The stormwater collected in this area is treated to remove oils, grease, and suspended solids, and is chlorinated and then de-chlorinated. This level of stormwater treatment exceeds all present state and federal regulations as well as the National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater Regulations.

The Oregon DEQ issues erosion control permits for construction activities on sites greater than 5 acres. The City also has regulations and requirements to control erosion from construction activities. City staff is responsible for review and approval of erosion control plans, issuance of permits, and monitoring and enforcement compliance. The objective of the erosion control permit program is to prevent construction activities from negatively affecting stormwater quality and natural resources.

The City has on-going maintenance activities that protect stormwater quality. All City streets are swept bi-weekly and catch basin sediments are removed yearly to help prevent pollutants and sediments from reaching streams.

#### 5.4.1.2 Issues

By the year 2006, existing State and federal regulations will require greater levels of stormwater pollution source-control and prevention for the area of the City that currently has separate sanitary and stormwater collection systems. The types and levels of pollutants in urban stormwater and streams were well documented by studies of urban areas in Oregon. The Association of Clean Water Agencies (ACWA) is an organization of municipalities that shares common water quality goals in Oregon; the City of Corvallis is a member. In 1996, ACWA surveyed member-agency stormwater quality monitoring data to develop a profile of "typical" urban stormwater pollutants. The results of this survey were incorporated in the DEQ stormwater quality management regulatory programs and recommendations of Best Management Practices (BMPs) to control stormwater pollutants.

The federal Clean Water Act is the basis for most water-quality related legislation, including the National Pollution Discharge Elimination System (NPDES) program and the State-implemented Total Maximum Daily Load (TMDL) requirements. The City is considering additional water-quality related requirements as part of the Endangered Species Act (ESA) to protect federally listed aquatic species in the Willamette Basin. Each of these regulations is discussed in detail in Chapter 3.

The City will be required to establish programs and resources to meet the NPDES Phase II Stormwater permit requirements on or before 2006. The NPDES Phase II program requires six minimum controls for Phase II permittees. Three of the controls directly affect stormwater quality: illicit discharge detection and elimination, construction site runoff control, and post-construction runoff control. As a Phase II permittee, the City is required to develop and implement BMPs that satisfy each of these minimum control measures.

The State TMDL requirements are specific to certain water-quality related parameters or criteria. For example, stream temperatures are elevated during the summer and exceed water quality standards in sections of the Willamette River and in the lower reaches of the Marys River. Bacteria in the Willamette River exceed standards, and elevated concentrations of mercury have been found in fish

tissue. Each of these parameters has made the DEQ 303(d) list. The 303(d) list is part of a national EPA program to identify water-quality limited waterways and the pollution components that affect water quality, such as phosphorus, ammonia, and nitrates. The City must work with the DEQ to develop and implement a plan to restore and protect the beneficial uses of local streams and rivers.

Compliance with the ESA will affect many City activities, including public works projects and construction activities. Any activity that affects water quality and quantity, or the habitat of species listed under ESA, falls under the ESA requirements. Activities that result in erosion, use of chemicals (herbicides, pesticides, and fertilizers), and/or activities that affect riparian areas and wetlands must be scrutinized to determine the potential effects on listed species. Activities that have the potential to harm threatened or endangered species must be modified or eliminated. The City has initiated a separate work effort to determine the City's ESA Response Plan. Many elements of this SWMP were created with the ESA regulations in mind and will be an important component of the City's ESA Response Plan.

Although the City is responsible for complying with State and federal environmental regulations, private property owners are not always held to the same standards. Private property owners may affect streams or wetlands by encroachment, by removal of critical vegetation, or by the improper application of yard chemicals. These activities are often difficult to manage, as many citizens are not aware of the regulations that apply to their property, or are unaware of the detrimental effects that their activities have on a stream or wetland.

#### 5.4.1.3 Citizen Input

Public input on policy development was received through public meetings held by the SWPC, a random telephone survey of residents, and stakeholder interviews. A telephone survey of 366 residents established a baseline of public opinion and identified public sentiment toward the management of stormwater in Corvallis. (See Appendix A for detailed survey results.) With regard to water quality, Corvallis residents clearly understand the importance of managing stormwater to protect the environment. Controlling surface pollutants entering streams received the highest "very important" rating (62 percent) of all issues reviewed, and a combined "very important" / "important" rating of 93 percent. Additionally, 52 percent of those surveyed say improving stream water quality is "very important" for future stormwater management planning, with a combined "very important"/ "important" rating of 92 percent.

Residents also consistently rate stream habitat as "very important." Fifty-six percent of those surveyed rate loss of stream habitat as "very important" with a combined "very important" / "important" rating of 88 percent. Sixty percent of the survey respondents say protecting stream habitat is "very important" in planning for future community stormwater management, with a combined "very important" / "important" rating of 94 percent. The importance of water quality is also underscored as residents rate less highly the option of using streams to drain urban runoff.

During public workshops conducted by the SWPC to develop stormwater alternatives, participants were asked to rate their support for water quality alternatives. Attendees were supportive of all alternatives that improved water quality. Over 80 percent of the participants supported voluntary measures and 70 percent supported mandatory standards. Participants supported alternatives to:

- Develop public infrastructure to provide for Best Management Practices for stormwater quality,
- Provide incentives to private construction that maintain stormwater quality, and
- Provide incentives to protect wetlands and riparian areas for their water quality benefits.

#### 5.4.1.4 Strategies to Address Issues

The ACWA survey has been incorporated in the DEQ stormwater quality management programs and recommendations of Best Management Practices (BMPs) to control stormwater pollutants. BMPs include stormwater management techniques such as bioswales, surface detention ponds, and street sweeping. The City will be in compliance with NPDES Phase II regulations by applying the DEQ- recommended stormwater quality BMPs. The EPA has recommended BMPs for governing agencies to use for the control of stormwater quality issues for a range of contamination sources in the NPDES Phase II permit program. Additional, future water quality monitoring is recommended to confirm the success of stormwater quality BMPs.

Citizen interest in water quality and state and federal regulations suggest that the City would best meet the needs of the community by establishing policies to address state TMDL water quality standards for stream temperature and bacteria. Corvallis stream temperatures are monitored monthly, and exceed standards during the summer and fall when stream flows are low and ambient temperatures are hot. Direct sunlight on streams is a principal cause of increased stream temperatures and shading of the stream corridor is effective in controlling stream temperatures. Policies that support shading stream corridors are needed. Policies are also needed to support stream channel structure to create deeper pool habitat and provide cool refuge areas at times of low flows and warmer temperatures. Policies that promote groundwater contribution to base flows in streams and remove illicit stream flow diversions (typically for irrigation uses) will also help to control stream temperatures.

Bacterial contamination in streams can impair the safe use of the water body as a fishable and swimable stream. Policies that encourage BMPs for stormwater runoff that provide water quality treatment and reduced sedimentation will minimize bacteria in streams. Another common source of bacteria in streams is pet and other animal feces. Policies that control pet activities close to streams will address this source of bacteria. Policies should also address agricultural and other animal activities within or close to stream corridors. Controlling the sources of bacteria will reduce bacterial contamination of streams.

Another urban source of bacterial contamination is sanitary wastewater reaching streams via cross-connections between sanitary and storm systems. Operation and maintenance programs attempt to address elimination of cross-connections.

Compliance with NPDES Phase II and TMDL regulations will also assist the City in meeting ESA regulatory requirements. It is anticipated that the ESA Response Plan will require changes to City programs, operations and maintenance practices, maintenance standards, and development standards.

Protecting and improving the water quality of Corvallis streams represents an important value to the citizens of Corvallis. In response to the desires of the community, and as required by State and federal regulations, the SWMP establishes goals and policy recommendations to protect and improve stormwater quality. Also included are recommendations for follow-up actions.

#### 5.4.1.5 Goals

1. Minimize soil erosion and sediment in stormwater.
2. Lower instream water temperatures.
3. Minimize pollution within waterways, groundwater, and wetlands.
4. Inform the public of the value of a healthy watershed.

#### 5.4.1.6 Existing Policies

1. Where development of hillsides occurs, removal of vegetation will be minimized to control erosion. Vegetation disturbed during development shall be replaced or enhanced through landscaping (Comprehensive Plan Policy 4.6.9).
2. To minimize the negative impacts of development, stormwater runoff after development should be managed to produce no significant reduction of water quality than prior to development unless more appropriate provisions are identified in adopted comprehensive stormwater management plans (Comprehensive Plan Policy 4.10.6).
3. The City shall develop a program to minimize the conveyance of detrimental sediments and pollutants from public streets into streams and drainageways (Comprehensive Plan Policy 4.10.12).
4. The City shall attempt to protect groundwater resources from pollution and damage through education, regulation, and example (Comprehensive Plan Policy 4.12.1).
5. All development within the Corvallis Urban Growth Boundary shall comply with applicable State and federal water quality standards (Comprehensive Plan Policy 7.5.1).
6. The City shall work with the Oregon Water Resources Department to enforce illegal water withdrawals from streams (OWRD Regulation).

#### 5.4.1.7 New Policies

**QL-1** Sediment removal using Best Management Practices shall be used prior to discharge of all runoff from both public and private impervious areas.

**QL-2** Lands set aside for water quality improvement, such as vegetated swales, detention facilities, and open channels, shall be maintained for proper functioning. Responsibility for maintenance shall be determined at the time these facilities are reviewed by the City for approval.

**QL-3** To reduce the need for and costs associated with instream water quality monitoring, the City shall develop a program to monitor whether the stormwater quality policies are being implemented.

**QL-4** The City shall develop a biological component for its instream water-quality monitoring program.

**QL-5** The City shall work to ensure that harmful urban runoff is not discharged directly into streams.

**QL-6** The City shall work to preserve and enhance native stream corridor vegetation on both public and private lands.

**QL-7** The City shall work to limit stormwater pollutants from entering streams from sources such as agricultural waste, pet waste, vehicle wash water, household and business chemicals, and other community waste products.

**QL-8** Along with the NPDES requirements, the City shall:

a. Require an erosion control plan for all construction activity that can potentially cause erosion.
b. Provide erosion control guidance to the development community in the form of an erosion control handbook.
c. Require sediment removal (to the maximum extent practicable) from construction site runoff prior to discharge to stormwater systems or streams.
d. Enforce erosion control measures through an active enforcement program with fines for violations, and educate the public and building inspectors on the importance of erosion control.
e. Develop community-specific standards that limit sediment discharge into receiving water bodies.

**QL-9** The City shall develop guidelines for public agencies, private property owners, and landscape maintenance specialists that minimize the flow of chemical pesticides, herbicides, and fertilizers into the stream system.

**QL-10** The City shall develop standards for cleaning publicly accessible parking lots and private catch basins that drain into public streams.

**QL-11** The City shall continue cleaning public parking lots and catch basins.

**QL-12** The City shall promote the protection of key areas of exchange between ground and surface waters, such as springs, unconstrained reaches of streams, and upstream drainages.

**QL-13** The City shall prohibit new installations of overhead utility lines along streams where the utility is in conflict with management of vegetation that provides shading. However, utility lines may cross streams.

**QL-14** The City shall promote the protection and enhancement of the stream channel structure for deeper pool habitat that provides cooler water refuge areas at times of low stream flows.

**QL-15** The City shall continue to conduct cross-connection surveys to identify any sanitary or other illicit connections to the stormwater system.

**QL-16** The City shall continue to evaluate, design, and modify its facilities to minimize known sources of water quality impairment.

#### 5.4.1.8 Suggested Follow-Up Actions

1. The City shall investigate additional stormwater quality management techniques that are used by other agencies and implement them as appropriate.
2. The City shall retrofit catch basins to improve water quality.

### 5.4.2 Water Quantity Management

#### 5.4.2.1 Background

Water quantity management addresses how stormwater is stored and conveyed from where it falls to where it ultimately is discharged into a receiving water body downstream of the City. Typically, with the current urban infrastructure, precipitation is managed in one of three ways: (1) It can travel overland as sheet flow to open-channel drainages, wetlands, or piped systems; (2) it can soak into the ground and, as subsurface flow, be intercepted and collected by sump pumps, tiling, etc., or migrate to an open channel; or (3) it can be intercepted and stored by vegetation, roofs, or other surfaces until it evaporates.

The open-channel systems include the numerous natural streams and manmade channels and ditches found throughout the City. The piped system includes the inlets, catch basins, and piped drainage system used to convey stormwater runoff.

The City operates and maintains the stormwater collection and drainageway system, and responds to emergency flooding issues, including capital improvement projects that address flooding concerns.

#### 5.4.2.2 Issues

Flooding is a natural process that occurs in an open-channel system when the flow exceeds the hydraulic capacity of the channel and the floodplain is employed to temporarily store and transport this additional water. For flood policy and management purposes, this document distinguishes natural flooding from urban-created flooding. Natural flooding is typically the historical flooding patterns that occurred before the City was established. Natural flooding has many positive benefits, including creating and maintaining varied habitat for fish and wildlife, and transporting nutrients onto the floodplains.

Flooding can occur at natural and manmade constrictions, or be the consequence of higher flows associated with increased development and intensified by land uses that fill or isolate portions of the floodplain. Natural constrictions that can lead to site-specific flooding include debris jams, low channel gradients, and loss of channel cross-sections due to sediment buildup. However, channel structures such as wood jams create opportunities for temporary water storage within the stream corridor. Manmade constrictions within the natural channel systems are usually a result of under-

sized culverts or bridges, although other manmade structures such as utility piping and dams (for water extraction) can lead to backups and flooding. Shallow watercourses that have been channelized in low gradient areas can fill with sediment. For more discussion on flooding in natural channels, see Section 5.4.5, Floodplain Management, in this chapter.

Water quantity management in the piped system focuses on conveying and storing stormwater runoff with limited pipe surcharging and flooding. Surcharging is defined as water flowing under pressure and exceeding the normal carrying capacity of the pipe. Flooding occurs when surcharged water reaches ground level. Both surcharging and flooding occur when the flow exceeds the hydraulic capacity of the conduit due to undersized pipes, low gradients (pipe slope), downstream backwater effects, or a combination of these factors.

The primary regulations influencing water quantity management are the Endangered Species Act (ESA) and the National Flood Insurance Program (NFIP). For a complete overview of the applicable regulations, consult Chapter 3.

The ESA influences how stormwater is managed from a quantity perspective. To protect an endangered species, ESA requires that properly functioning conditions be maintained within the geographical range of the listed species. The National Marine Fisheries Service advises jurisdictions to evaluate how development will affect base and peak flows and to manage that development to avoid changing the natural stormwater runoff hydrograph.

Nationwide, the NFIP has a major influence on how water quantity and flooding are managed within urban areas. When Congress initiated the NFIP in 1968, its objectives were generally limited to controlling costs to all levels of government due to flood disaster relief. The NFIP did not (and does not currently) factor in erosion and sedimentation, hydrologic energy modifications, habitat implications, and isolation of citizens living in floodplain developments during an event. The NFIP is administered by the Federal Insurance Administration as part of the Federal Emergency Management Agency (FEMA). The NFIP insurance coverage is available only in communities that implement regulations to reduce the likelihood of future flood damage. Current building codes and development regulations conform to NFIP standards by restricting new construction within flood-prone areas to the floodway fringe (a subset of the floodplain).

To enter the NFIP program, a community must complete a detailed technical study of flood hazards. A floodplain study determines the elevations of floods of varying intensity and the floodway boundaries. This information is presented on a Flood Insurance Rate Map and Flood Boundary and Floodway Map. The community adopts and enforces regulatory standards based on these maps. Currently, the City's Comprehensive Plan and Land Development Code support the FEMA program.

The City's stormwater collection systems were designed to collect and convey runoff for up to the 10-year return, 24-hour storm event. This is the amount of precipitation that occurs in a 24-hour storm event that has a 10 percent chance of occurrence in any given year.

The Corvallis area open drainageways, including streams and rivers, have been modified extensively by human activities over the last 150 years. Historical descriptions of the Corvallis landscape in the *1850s Federal Land Office Original Survey Notes* and historical aerial photos of the Corvallis watersheds from the 1930s demonstrate that significant modifications and relocation of the natural watercourse system have occurred. Most channel modifications (channel relocation, piping intermittent watercourses, and floodplain and adjacent wetland filling) for many of the last 40 years were made to accommodate urban development and agricultural practices, and worked against accommodating and managing larger flood events.

The total peak runoff flow that results from a storm event is directly related to (1) the soil's capacity to infiltrate water (soil saturation will affect this); (2) the elevation of ground water relative to the surface elevation; (3) the amount of impervious area (roofs, pavement); and (4) the amount of landscape storage capacity, including basin-wide vegetative cover, channel-floodplain connections, and detention pocket areas such as wetlands, depressions, and swales. Typical urban development results in an increase in impervious area that also increases the peak flow from a given storm event. Impervious areas on steeper terrain result in more rapid runoff and greater peak flow than impervious areas on flatter terrain.

The City currently requires new private developments to use detention to keep development runoff equivalent to pre-development levels for up to the 10-year storm event. Infrastructure designed to manage water quantity can be achieved at different scales, ranging from large detention basins that serve entire developments to single-residential-lot methods.

Urban-related modifications to the peak runoff that enters area streams and rivers can have an adverse effect on the health of the receiving stream. Increased peak flows or frequency of peak flows can increase bank erosion, sediment transport, and downstream flood potential. Detention of runoff is an important tool to minimize the negative effects of peak flows from urban areas. However, there are areas within the lower reaches of the Corvallis area watersheds where improperly designed detention can actually accentuate downstream peak flows and flooding. Discharge strategies are therefore important in controlling effects on streams.

### 5.4.2.3 Citizen Input

Public input on water quantity management was provided through public meetings held by the SWPC, a random telephone survey of residents, and stakeholder interviews. Based on the telephone survey of 366 residents, a large number have first-hand experience with flooding. (See Appendix A for detailed survey results.) Over one-third of survey participants (37 percent) say they are affected by flooding, and for most of these it has become a routine occurrence. Over three-quarters (78 percent) reported that they are affected by one or more flood events during wet years. Twenty-two percent of respondents who have experienced flooding report damage to their homes, basements, or garages.

During the public workshops conducted by the SWPC, participants were asked to rate their support for water quantity alternatives. Attendees were supportive of all alternatives that addressed water quantity issues. Participants supported alternatives to:

- Develop public infrastructure to provide for Best Management Practices for stormwater quantity,
- Identify and acquire significant areas for natural detention,
- Protect upland vegetation to maintain stormwater function, and
- Develop guidelines to reduce impervious area for parking.

### 5.4.2.4 Strategies to Address Issues

Basin characteristics have a significant effect on water storage and on the timing and amount of runoff that enters the streams. Most important is the amount of rainfall, impervious area, vegetation, the rate of conversion of groundwater to surface flows, and runoff that exists in the watershed. Drainages that support proper stream functions typically require a minimum amount of water during specific times of the year. This amount of water is called the base flow, which is the water necessary to support healthy stream functions. Although base flows and groundwater recharge are critical elements of stream functions, saturated soils associated with building foundations can create structural challenges for developers. Engineering practices encourage the removal of groundwater beneath buildings and roads in order to provide a stable base. Compaction of soils and de-watering methods such as foundation drains discourage groundwater recharge. To address these issues, the City should encourage a range of design options that meet the detention and groundwater recharge objectives.

Existing policies and new policies are intended to reduce the effect of urban-influenced peak runoff and reduce the potential for urban-related downstream flooding. In response to the desires of the community, and as required by federal and State regulations, the SWMP provides program and policy recommendations to protect and improve stormwater quantity. In addition, recommendations are identified for activities that require further follow-up actions before implementation.

### 5.4.2.5 Goals

1. Maintain and accommodate natural hydrological processes, from base to peak flows.
2. Encourage percolation of rainfall into the ground.
3. Increase vegetative cover to retain and slow stormwater release.
4. Protect downstream properties from urban flooding.
5. Minimize urban-related erosion.

### 5.4.2.6 Existing Policies

1. To minimize the negative impacts of development, stormwater runoff after development should be managed to produce no significantly greater peak flow rates than prior to development, unless more appropriate provisions are identified in adopted comprehensive stormwater management plans (Comprehensive Plan Policy 4.10.5).

### 5.4.2.7 New Policies

**QN-1** Through engineering analysis, the City shall establish stormwater detention and release standards for new development and redevelopment that preserve or restore the properly functioning conditions of the receiving waters.

**QN-2** The City shall develop guidelines and evaluate the need for public infrastructure that provides for temporary detention in areas primarily dedicated to other uses, such as parks and open space, parking, and streets.

**QN-3** The City shall develop standards for detention facilities. These facilities shall be located outside of stream channels unless it can be demonstrated that the properly functioning condition of the streams is maintained.

**QN-4** The City shall consider the amount of impervious surface when evaluating detention requirements and develop a policy to encourage groundwater recharge opportunities.

**QN-5** The City shall consider incorporating detention capacity when replacing or retrofitting the storm drainage system.

**QN-6** The City shall consider acquisition of land and easements for future detention facilities.

**QN-7** The City shall require the use of appropriate detention to control peak flows and reduce the potential for downstream erosion, flooding, and impairment of natural stream functions.

**QN-8** To reduce peak runoff from impervious areas and maintain pre-development flow regimes, the City shall work to adopt standards such as the following:

a. Minimize the proportion of each development site allocated to surface parking and circulation.
b. Minimize the average dimensions of parking stalls.
c. Use pervious materials and alternative designs where applicable, such as infiltration systems.
d. Modify setback requirements to reduce the lengths of driveways.
e. Promote the use of shared driveways to reduce impervious surfaces in residential development.
f. Promote disconnection of roof downspouts to reduce runoff into a piped collection system or the street and encourage storage for reuse.
g. Retain a larger percentage of vegetated area within all types of development to increase rainfall interception.
h. Pursue the use of retention and infiltration facilities where the soils are suitable to control runoff volume, peak flow, and to promote dry-season base flows in streams.
i. Develop subsurface storage as well as surface detention facilities.
j. Evaluate additional restrictions on cuts in hillsides, especially in areas with near-surface groundwater.

**QN-9** The City shall modify standards for managing urban runoff to allow for innovative building/landscape designs if it can be demonstrated that the resulting performance is comparable to existing building standards.

**QN-10** The City shall encourage practices that enhance groundwater recharge to maintain or increase stream flow during dry periods.

**QN-11** The City shall differentiate between natural flooding and urban-created flooding regimes and allow for natural flooding to occur while minimizing urban-created flooding (see FP-1).

**QN-12** The City shall develop water quantity maintenance practices that protect, enhance, and restore the vegetative canopy along drainageways.

**QN-13** The City shall use maintenance policies that enhance the natural detention capacity and upstream storage capacity of urban streams, such as retaining vegetation and wood, and allowing beaver dams to remain instream.

**QN-14** The City shall provide incentives to developers for incorporating existing vegetation and open spaces into permanent stormwater facilities.

**QN-15** The City shall develop standards to manage surface flows on developed sites to increase the time it takes for the water to reach the stream, where applicable.

**QN-16** The City shall incorporate detention and water quality features into public street and municipal parking lot rehabilitation projects.

**QN-17** To manage stormwater drainage and provide direction for developing standards, the City shall establish parameters and/or objectives for allowing new development to use vegetated swales or open channels.

**QN-18** The City shall encourage parking lots to be constructed of stable pervious surfaces that do not degrade groundwater quality.

#### 5.4.2.8 Suggested Follow-Up Actions

1. Recognize that the best efforts to mimic natural peak flood volumes and frequencies will probably not entirely maintain pre-development flooding regimes. Therefore, the City should design appropriate stormwater infrastructure, such as stream corridor widths, to accommodate those changes, including destabilized and widening channels, changes in the erosion and deposition patterns, etc.
2. The City shall identify steep terrain and consider implementing development standards for reducing impervious surfaces in these areas.
3. The City shall identify the runoff from impervious upland areas that is necessary to protect hydrological and habitat functions of areas downstream and consider development standards that maintain appropriate flows.

### 5.4.3 Uplands Natural Resource and Wetlands Management

#### 5.4.3.1 Background

Upland natural resources and wetlands are an integral component of the stormwater functions within the overall watershed. Upland natural resources are the natural features and areas outside of the stream corridor and the 100-year floodplain that influence stormwater function and management. They include uplands, wetlands, vegetation, swales, and groundwater zones. Natural and human activities in these areas have a significant influence on stormwater, including the downstream

channel and riparian areas. The Division of State Lands and the Army Corps of Engineers are responsible for the review and enforcement of the laws that govern wetlands in Oregon. In the landscape, wetlands provide water filtration and storage, and they support a unique habitat for aquatic and terrestrial creatures.

### 5.4.3.2 Issues

Land-disturbing activities in upland and wetland areas affect the natural storage and flow of stormwater, including both surface and subsurface flows. Development alters the natural process of stormwater infiltration into the ground and the recharge of the water table. The reduced quantity of infiltrated water can affect water supply to streams and wetlands, particularly to base stream flows during summer low-flow periods.

Vegetative management in upland and wetland areas influences water quantity and quality. Vegetation, including shrubs and trees, intercepts and stores precipitation until it is evaporated, while ground cover reduces soil erosion and slows overland flow. Improperly designed or sited urban development, poor construction practices, and forest or agricultural practices can alter hydrologic processes, resulting in increased flows, erosion, instream sedimentation, water quality degradation, and habitat loss.

Disturbances to wetlands and natural swales also influence water quantity and quality. Changes to surface flows, including an increase or a decrease in water volumes, can alter the form and ecological functions of natural features.

Existing local regulations governing upland natural resource and wetland management are in City and County codes and policies. The NPDES Phase II Stormwater Regulations and the ESA requirements also influence a number of activities within this category, as do the State and federal cut and fill programs. The Division of State Lands and Army Corps of Engineers currently enforce wetland regulations in the City and County. Citizens in the community have expressed concern that the Division of State Lands has not consistently implemented State and federal wetland regulations, and feel that strengthening these regulations through local policy might help to promote and encourage their more effective implementation. See Chapter 3 for more details on these regulations.

### 5.4.3.3 Citizen Input

Public input on upland natural resources and wetland management was provided through public meetings held by the SWPC, a random telephone survey of residents, and stakeholder interviews. Respondents to the telephone survey stated that protection of wetlands is an important issue. (See Appendix A for detailed survey results.) Eighty-eight percent rated protection of wetlands as "important" or "very important." Stakeholders who were interviewed also rated protection of wetlands as an important value. This was one of the key issues included as part of the "community livability" value expressed by those interviewed.

### 5.4.3.4 Strategies to Address Issues

Management of upland natural resources and wetlands in urban areas can protect or improve the stormwater-related functioning of these areas and can protect the health of the downstream systems.

In particular, this includes upland wetlands and natural swales, vegetation, and groundwater. These features provide for surface and subsurface runoff storage and transport, water quality protection, and natural habitat connectivity. Maximizing the tree canopy in upland areas reduces the downstream effect of rainfall runoff by providing interception of rainfall.

In response to community values, and as required by federal and State regulations, the SWMP provides programs and policy recommendations for the upland areas to protect and improve stormwater quality and quantity. Also included are recommendations for follow-up actions.

#### 5.4.3.5 Goals

1. Protect and enhance upland natural resources in order to maintain and re-establish hydrological functions and improve water quality.
2. Preserve and enhance biological functions of existing wetlands.
3. Maintain and accommodate natural hydrological processes.

#### 5.4.3.6 Existing Policies

1. Consistent with State and federal policy, the City adopts the goal of no-net-loss of significant wetlands in terms of both acreage and function. The City shall comply with at least the minimum protection requirements of applicable State and federal wetland laws as interpreted by the State and federal agencies charged with enforcing these laws (Comprehensive Plan Policy 4.11.1).
2. Wetlands within the Urban Growth Boundary shall be identified and inventoried by the City or through the development process (federal regulation implemented through the DSL).

#### 5.4.3.7 New Policies

**UP-1** The City shall ensure that operation and maintenance practices protect, enhance, and restore upland natural areas and their functions and processes.

**UP-2** The City shall identify upland natural areas and natural swales within the Corvallis Urban Growth Boundary (UGB) that provide important hydrological and habitat functions.

**UP-3** The City shall develop stewardship guidelines that protect natural stormwater functions and processes associated with wetlands, natural swales, and vegetation.

**UP-4** The City shall encourage the Division of State Lands to fully implement and enforce wetland protection goals and regulations within the City and the UGB to maintain hydrological and natural resource functions.

**UP-5** The City shall develop and implement incentives for developers and property owners to protect, enhance, and re-establish wetlands, natural swales, vegetation, and groundwater for stormwater functions.

**UP-6** The City shall explore opportunities to acquire lands to preserve stormwater functions through outright purchase, conservation easements, and partnerships.

**UP-7** The City shall encourage wetland mitigation to occur in the same basin.

**UP-8** Wetland mitigation should not compromise the existing stormwater functions of the land being used for the mitigation.

**UP-9** New development and redevelopment shall not significantly impair the quantity and quality of water reaching wetlands.

**UP-10** The City shall place a high level of significance on wetlands that are adjacent to streams.

**UP-11** The City shall continue to inventory significant habitat and natural resource areas.

**UP-12** The City shall continue to maximize preservation and restoration of existing upland natural resource areas and wetlands by use of development standards in the Land Development Code.

#### 5.4.3.7 Suggested Follow-Up Actions

1. The City shall consider exceeding existing state and federal requirements for wetland protection.

### 5.4.4 Cross-Jurisdictional Basin Stormwater Management

#### 5.4.4.1 Background

Most of the City's stream basins extend beyond existing City limits and the Urban Growth Boundary (UGB). In addition, all of the streams passing through the City originate within Benton County, outside the City limits. Some of the streams leave the City and pass back into the County before joining the Willamette River. To achieve many of the objectives presented in the SWMP, coordination is required between the City and Benton County. The City has an agreement with Benton County known as the Corvallis Urban Fringe Management Agreement (CUFMA), which outlines jurisdictional responsibilities within the urban fringe area (outside the City limits and within the UGB).

#### 5.4.4.2 Issues

The flow, water quality, and vitality of the streams are influenced by activities conducted within the County, since the headwaters for many of the streams and wetlands lie outside the City. In particular, the City and Benton County should revise the plan for managing development within the urban fringe to incorporate the objectives of the SWMP.

#### 5.4.4.3 Citizen Input

Public input concerning cross-jurisdictional basin stormwater management was provided through public meetings held by the SWPC. (See Appendix A for detailed public meeting results.) Many citizens recognized the need for coordination between government agencies to meet stormwater management objectives. Citizens, including those who live along watercourses downstream of Corvallis, also expressed concerns regarding water quality, water quantity, and stream health downstream of the UGB. A strong preference was shown for development of City and County agreements for stormwater management in the urban fringe. Citizen input also supported using a watershed-wide outreach approach to increase awareness regarding stormwater issues.

#### 5.4.4.4 Strategies to Address Issues

A coordinated watershed approach to address stormwater management issues will include cooperative participation of the City and surrounding jurisdictions. In response to the desires of the community, and as required by state and federal regulations, the SWMP provides program recommendations to protect and improve stormwater quality. In addition, recommendations are suggested that require further follow-up actions before implementation.

#### 5.4.4.5 Goals

1. Create and adopt a stormwater management program coordinated between the City and County.
2. Maximize citizen participation and understanding of cross-jurisdictional stormwater issues.
3. Identify stormwater objectives that are shared by the City, County, and public agencies.
4. Seek to manage watershed basins for stormwater functions, regardless of boundary lines.

#### 5.4.4.6 Existing Policies

1. The City and County shall pursue the completion of mapping of floodplain and floodway (including the City's 0.2-foot floodway) within the UGB, or require this mapping through the development process (Comprehensive Plan Policy 4.8.4).
2. The City shall work with Benton County to adopt a cooperative program that implements standards for management of vegetation, such as removal of detrimental vegetation and preservation of beneficial vegetation along significant drainageways within the city limits and UGB (Comprehensive Plan Policy 4.10.10).

#### 5.4.4.7 New Policies

**CJ-1** The City shall work with other governing agencies to develop a basin-wide stormwater management approach with common goals and objectives.

**CJ-2** The City shall develop cooperative agreements, watershed assessment tools, and mutually beneficial funding mechanisms with surrounding jurisdictions to protect streams, wetlands, and habitat throughout the entire watershed.

**CJ-3** The City shall work with Benton County to update the Corvallis Urban Fringe Management Agreement to adequately address stormwater management issues. Surrounding counties may also be part of the basin-wide management strategy.

**CJ-4** The City shall work with Benton County to encourage public participation and information outreach activities for all citizens within the watershed to further the objectives of the SWMP.

#### 5.4.4.8 Suggested Follow-Up Actions

1. The City and County shall identify watershed protection and restoration opportunities that involve multiple agency and/or property owner partnerships.

### 5.4.5 Floodplain Management

#### 5.4.5.1 Background

Flooding is a natural stream and river process that occurred before urbanization altered the landscape and drainage patterns. Floodplains accommodate and manage flows at times when water volume exceeds stream or river watercourse channel capacity. The City's Comprehensive Plan includes floodplains as a significant natural feature, and recommends that significant natural features be preserved or have their losses mitigated and/or reclaimed.

As urban areas expand, flooding typically occurs more frequently and with greater consequences. The floodplain must accommodate these hydrological modifications. The current City Land Development Code allows development within a portion of the floodplain, called the floodway fringe. The National Flood Insurance Program (NFIP) guidelines allow construction of new occupiable buildings in the floodway fringe provided they are elevated 1 foot above the base flood level. The guidelines also allow fill and/or flood proofing, depending on the type of structure. However, NFIP objectives do not factor in erosion and sedimentation, hydraulic energy modifications, habitat implications, and possible citizen isolation from services that can be associated with floodplain development. The February 2001 Draft Oregon State Goal 7 (Natural Hazards) suggests that local governments adopt floodplain measures that exceed the NFIP, including limiting placement of fill in the floodplain.

The City's Land Development Code implements NFIP and FEMA regulations by defining two flood zones:

> **Floodway** - Channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than 0.2 feet.
>
> **Floodway Fringe** - Portion of the 100-year floodplain outside of the floodway. This area may be developed under current policies.

#### 5.4.5.2 Issues

Floodplains play a significant role within stream and river basins. Floodplains provide additional storage and transport capacity during larger storm events, reduce instream velocities and bank erosion, collect sediment, provide refuge and feeding areas for fish during floods, and increase the recharge of groundwater. The public is more commonly aware of the negative aspects of floodplain flooding, including property damage, effects on business and transportation, and health and safety risks. The City desires to implement a floodplain management strategy that will avoid placing development at flood risk, lessen land-use conflicts between floodplain hydrological function and urban development, protect floodplain hydrological function, and reduce the threat of urban-created flood damage to private property while maintaining many of the hydrological and other benefits associated with natural flooding. The placing of public infrastructure in or through a floodplain often encourages development within the floodplain. SWMP policies to address floodplain management are focused on preventing additional urban-created flooding while allowing for natural flooding.

Small stream systems are affected to a greater degree by local actions (floodplain modifications) than are the Marys and Willamette Rivers. However, fill in any floodplain can potentially create some risk of affecting adjacent and downstream properties.

For communities that wish to qualify for flood insurance, NFIP regulations require their local governments to implement measures to reduce the potential of property damage due to flooding. The federal government has also developed regulations to implement measures to protect and restore the viability of endangered species, to protect water quality, and to protect wetlands and waters of the State from the effects of dredging and filling. Each of these regulations will influence, at a minimum, how the City manages floodplains. For a discussion on current floodplain regulations, endangered species requirements, and NPDES Phase II Stormwater Regulations, see Section 5.4.2 or Chapter 3.

### 5.4.5.3 Citizen Input

Public input on floodplain management was received through a random telephone survey of residents and through public meetings held by the SWPC. (See Appendix A for detailed survey and public meeting results.)

In the telephone survey, many residents noted that they have had some experience with flooding, but most have not experienced property damage. A majority (84 percent) recognizes the importance of controlling development in floodplains. Recent citizen flooding experiences included not only localized floodplain inundation, but also flooded streets and other areas when surcharged stormwater pipes were not able to dispose of water to the receiving water bodies. Citizens also requested City action after residential yards in the floodplain were inundated during recent storm events.

During the public meetings, a number of citizens noted that it is not possible to eliminate flooding from the landscape. Many were concerned that averting flooding in one part of the watershed increases flooding in other areas. They also noted that many types of urban development in the floodplain could directly conflict with a primary function of floodplains: to accommodate and manage stormwater. The public also raised the issue of the cost to current landowners of restricting development in the floodplain. Some noted that the community should share these costs.

The SWPC also reviewed a range of floodplain development alternatives with the attendees at the public meetings. Feedback received from the workshops shows strong support for more restrictive standards for floodplain development. The following alternatives were presented to the participants:

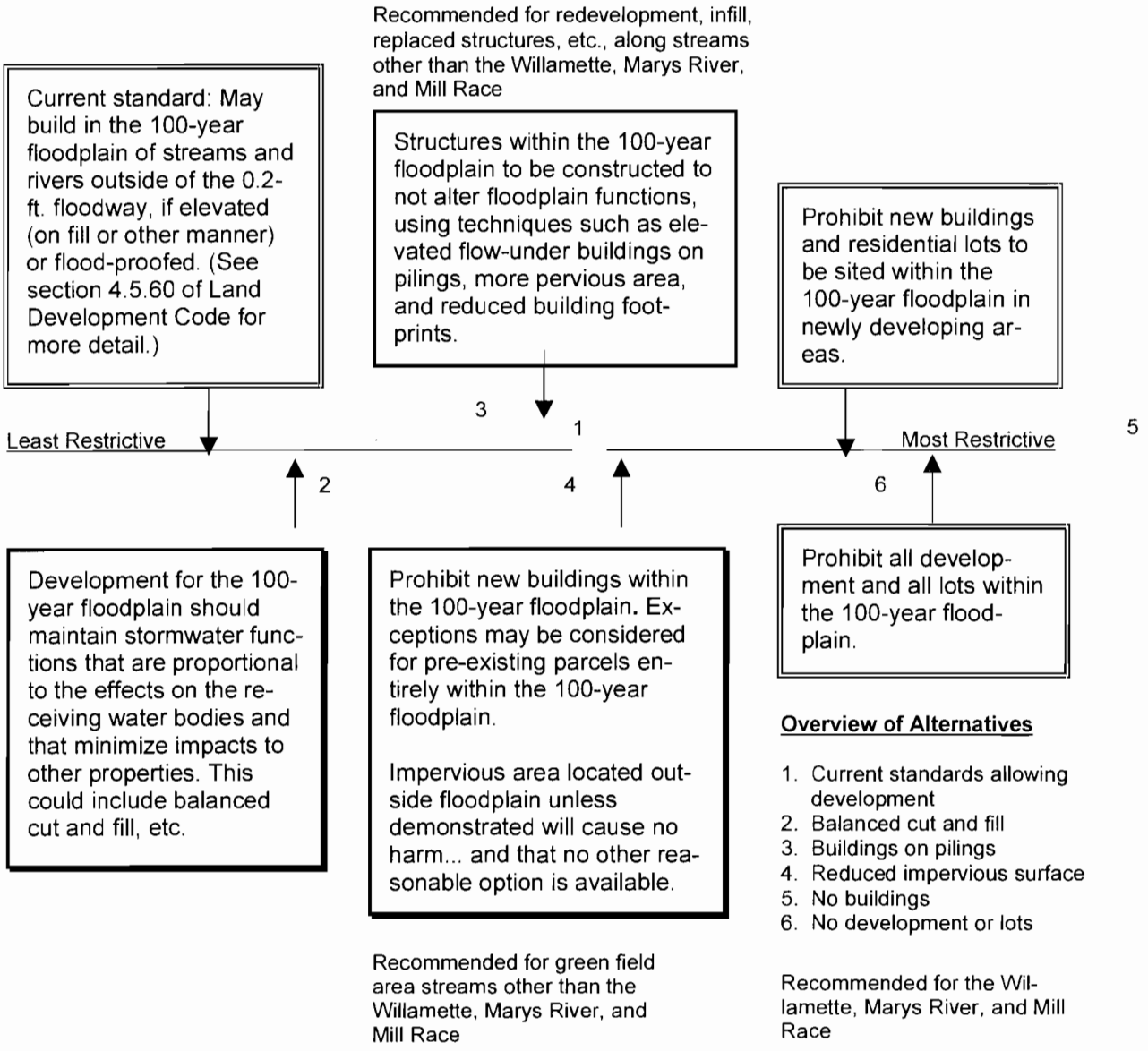
> **Alternative A** - Keep existing development standards. Development is allowed in the 100-year floodplain outside of the floodway, if elevated (on fill or without restricting flow), or flood-proofed.
>
> **Alternative B** - No net fill in the 100-year floodplain outside of the floodway. Allows development, but filling must be offset with excavation at the site to maintain flood storage capacity.
>
> **Alternative C** - Allow construction in the 100-year floodplain outside of the floodway, but structures must be elevated to not restrict flow, i.e., without fill or other water-displacing design.

**Alternative D** - No structural development within the 100-year floodplain. Use density transfer to offset floodplain development constraints for residential areas.

Thirty participants rated these alternatives and indicated strong support for the more restrictive alternatives (B, C, and D).

Figure 5-2 shows the range of development alternatives that the SWPC considered, along with highlighting some of the recommended policies.

**Figure 5-2. Development Alternatives**



### 5.4.5.4 Strategies to Address Issues

Developing accurate mapping of the floodways and 100-year floodplains in the UGB will help determine which areas are at risk of flooding. This data will provide decision makers with a clear understanding of the flood potential and the threat to existing structures.

In response to the desires of the community, and as required by State and federal regulations, the SWMP provides policy recommendations to protect and improve the floodplain function and processes, including both the 100-year floodway and floodway fringe. In addition, recommendations are suggested that require further follow-up actions before implementation.

### 5.4.5.5 Goals

1. Manage the 100-year floodplain for floodwater storage and transport.
2. Discourage activities in the 100-year floodplain that jeopardize floodplain functions.
3. Protect and enhance water quality and habitat by maintaining natural processes and functions.
4. Restore natural flooding capacity along urbanized streams.

### 5.4.5.6 Existing Policies

1. The City shall conduct further studies on methods to protect natural resources from the negative effects of development, such as transfer of development rights, Open Space - Conservation districts, or other useful measures (Comprehensive Plan Policy 4.5.5).
2. Development shall be prohibited within the floodway, except for bridges, public utilities, and seasonal and other temporary water-related uses that do not significantly alter the patterns of floodwater flows (Comprehensive Plan Policy 4.8.3).
3. Significant natural features within the UGB shall be identified and inventoried by the City or through the development process. These shall include:
   a. Seasonal and perennial streams and other natural drainageways, wetlands, and floodplains;
   b. Lands abutting the Willamette and Marys Rivers;
   c. Land with significant native vegetation as defined in the *Oregon Natural Heritage Plan (1998)*, which may include certain woodlands, grasslands, wetlands, riparian vegetation, and plant species;
   d. Ecologically and scientifically significant natural areas;
   e. Significant hillsides;
   f. Outstanding scenic views and sites; and
   g. Lands that provide community identity and act as gateways and buffers (Comprehensive Plan Policy 4.2.1).
4. Natural features and areas determined to be significant shall be preserved, or have their losses mitigated and/or reclaimed. The City may use conditions placed upon development of such lands, private nonprofit efforts, and City, State, and federal government programs to achieve this objective (Comprehensive Plan Policy 4.2.2).
5. The City and County shall pursue the completion of mapping of floodplains and floodway (including the City's 0.2-foot floodway) within the UGB, or require this mapping through the development process (Comprehensive Plan Policy 4.8.4).

### 5.4.5.7 New Policies

**FP-1** The City shall acknowledge and accommodate natural flooding within the floodplain, and avoid or minimize urban-created flooding patterns.

**FP-2** Development of new buildings on undeveloped lands (where such development does not fall within the definition of infill contained in Article 50 of the Corvallis Comprehensive Plan) shall be prohibited in the 100-year floodplain of Corvallis streams, with the exception of the Willamette River, the Marys River, and the Mill Race. If pre-existing parcels are entirely within the 100-year floodplain or if this policy renders an otherwise buildable parcel unbuildable, exceptions may be considered to allow limited development.

**FP-3** Streets, alleys, driveways, and parking lots on undeveloped lands, with the exception of the Willamette River, the Marys River, and the Mill Race, should be located outside the 100-year floodplain and wetlands unless it can be demonstrated that they are constructed in a manner that does not restrict or otherwise alter proper floodplain functions, will cause no harm to the properly functioning condition of the stream, and that no other reasonable option is available.

**FP-4** Infill and redevelopment in the 100-year floodplain of Corvallis streams, with the exception of the Willamette River, the Marys River, and the Mill Race, shall maintain or improve stormwater functions and floodplain functions existing prior to the proposed infill or redevelopment, using techniques such as flow-through designs, more pervious surface area, and reduced building footprints. Development standards shall be created to allow additions to existing structures consistent with those structures' design, provided the additions fall below the threshold of "substantial improvement" contained in the Land Development Code and are constructed consistent with FEMA standards.

**FP-5** Area-specific development standards for the 100-year floodplain of the Marys River, the Willamette River, and the Mill Race shall be instituted to maintain stormwater functions, be proportional to the impact of the development on the receiving water bodies, and minimize impacts to other properties.

**FP-6** The City shall develop a program to acquire land and easements that become available over time within the 100-year floodplain that are cost effective and provide opportunities that best remediate existing, or prevent future, flooding loss or damage.

**FP-7** The City shall work to protect hydrological processes associated with the 100-year floodplain to support self-sustaining levels of native fish, aquatic species, and wildlife populations.

**FP-8** New City infrastructure, including streets and sanitary sewers, should be located outside the 100-year floodplain and wetlands unless it can be demonstrated that they will cause no harm to the properly functioning condition of the stream and that no other reasonable option is available.

**FP-9** The City shall develop and implement incentives for floodplain protection, enhancement, and restoration as part of the development process.

**FP-10** The City shall allow for a variety of low-impact uses on publicly and privately owned floodplain lands provided it can be demonstrated that they do not harm floodplain functions.

**FP-11** The City shall work to accommodate housing and other development opportunities that are displaced by floodplain protection measures to ensure a compact development pattern.

#### 5.4.5.8 Suggested Follow-Up Actions

1. The City shall investigate the feasibility of constructing bridges to span the 100-year floodplain or a portion of the 100-year floodplain of permanent stream corridors or otherwise maintain connections in the floodplain (such as multiple culverts). The investigation should consider different stream-crossing standards for stream floodplains and the Willamette and Marys Rivers' floodplain and backwater areas.

### 5.4.6 Stream System Management

#### 5.4.6.1 Background

Stream systems in the Corvallis area include intermittent streams and stream reaches, perennial streams, and major rivers. Some of these streams and their watersheds are entirely within the Urban Growth Boundary (UGB), while others extend beyond the UGB into agricultural and forest resource lands.

For the purposes of the SWMP, a stream system is defined to include the channel, banks, and a corridor of land along the channel. However, this SWMP recognizes that a more complete description of a stream system would also include headwater swales, the floodplain, and streamside wetlands. Swales, floodplains, and wetlands were primarily addressed in the earlier sections of this chapter.

A stream's form and behavior can vary significantly from reach to reach and between different systems. These different forms can require different management strategies. The following list gives some examples, illustrating the variety of stream forms in the Corvallis stormwater management area:

- Stream confluences into the Marys and Willamette Rivers, with associated low gradients, and floodplain backwaters.
- Narrow, channelized, and sometimes incised stream reaches with development near or at the top of the bank. This development is often placed on fill in the floodplain.
- Widely meandering streams with a primarily native vegetative canopy and understory.
- Ditched stream reaches through agricultural lands, with a narrow, immature vegetative canopy. These ditches are sometimes modified natural swales and wetland corridors.
- Heavily wooded stream corridors with forested watershed.
- Narrow, low-flow and intermittent streams that are landscaped, mowed, and used by property owners.

Management of stream systems for stormwater includes proper design of stream corridor infrastructure such as bridges, ongoing best management practices, and the designation of appropriate stream corridors. The stream corridors provide for stormwater functions that do not degrade or conflict with other ecological functions.

The City provides stream system management to reduce the flood potential resulting from blockages, to control erosion from urban runoff, to lower stream water temperature, and to improve water quality and habitat through vegetation management. Future management can also provide stormwater benefits including improvement and protection of water quality, allowance for natural channel movement and bank erosion, accommodation for natural flooding and protection of floodplains, protection of adjacent wetlands, protection of biological resources, reduction of drainageway maintenance costs, and minimization of conflicts with abutting land uses.

The City's Land Development Code requires a drainageway dedication or easement along stream corridors at the time of development. The dedication or easement is of variable width based on one of two formulas and determined by several factors:

- Channel width;
- Presence of streamside vegetation;
- Additional width if channel is incised; and
- Includes the entire 0.2-foot floodway, or the floodplain up to 50 feet, whichever is greater.

### 5.4.6.2 Issues

Stream system management has changed significantly in the last 40 years. Previous stream management efforts focused on quickly draining urban areas and maximizing available land for development. As a result, stream sections in older areas of Corvallis were altered (narrowed, straightened, and developed close to the top of the bank with little or no vegetative canopy). In many cases the floodplain and streamside wetlands were filled. Groundwater supplies that feed streams are gone or no longer reach the stream channel, while small feeder streams were piped. This type of stream channel and corridor does not allow for proper stormwater functions or support additional stream functions such as maintaining water quality, moderating flow peaks, and protecting fish and wildlife habitat.

Typically, the health of a stream system is inversely related to the degree of urbanization. To discourage this historical trend from continuing, special measures are required to protect the health and vitality of the streams. The regulations relating to stream system management are addressed through several state and federal programs, including the flood insurance program, Endangered Species Act, and the Clean Water Act. For more details about these regulations, see Chapter 3.

Additional issues were identified during the SWMP process, which include:

1. The historical use of stream corridors for above- and below-ground utilities paralleling the stream created conflicts with proper stream functions (sewer lines were most common);
2. The need to maintain the historical connectivity between streams and groundwater, and the supplies of groundwater to feed streams;

3. Possible use of an outer zone along stream corridors for enhanced stormwater functions, such as bioswales;
4. Concern over recent proposals to build instream structures for in-channel detention and past problems associated with existing structures;
5. Ownership of stream corridors (public versus private);
6. Allowing streams and stream corridors to provide for stormwater functions without degrading these systems;
7. Replacement of native or other suitable plants with grass up to the stream bank, and placement of outbuildings within dedicated drainageway corridors;
8. With objectives such as stream system enhancement and restoration, both short-term and long-term approaches will be needed to achieve goals. Protection is often less costly than restoration; and
9. Contamination of waterways (e.g., animal waste, trash) resulting from trails along stream corridors and disrupted natural drainage patterns from impervious surfaces.

### 5.4.6.3 Citizen Input

Public input into stream system management was provided through a random telephone survey, interviews, and public meetings held by the SWPC. (See Appendix A for detailed survey and public meeting results.) Almost half of the 366 residents surveyed live within six blocks of a stream. These residents expressed strong support for protection of stream habitat, with 94 percent stating that this is an "important" or "very important" value. Likewise, they indicated that loss of stream habitat is an important issue.

The results of the stakeholder interviews indicate strong support for stream system management. Included as an important value was public access to streams. Citizens expressed a preference for solutions that provide multiple benefits, such as improving habitat and providing recreational opportunities.

In the public workshops, the SWPC provided the following range of alternatives for setting stream corridor widths:

- Maintain existing standards of 7 feet to 77 feet on each side of the channel, depending on stream channel width (or floodway width, or riparian vegetation width, whichever is greatest).

- Vary stream corridor widths to address stream corridor functions, with a minimum 50-foot width on each side of the stream, and a maximum width of 100 feet on each side of the channel, (or floodway width, or riparian vegetation width, whichever is greatest).

- Vary stream corridor widths to address stream corridor functions, with a minimum 50-foot width on each side of the stream, and a maximum width of 150 feet on each side of the channel, (or floodway width, or riparian vegetation width, whichever is greatest).

- Vary stream corridor widths to address stream corridor functions, with a minimum 50-foot width on each side of the stream, and a maximum width of 200 feet on each side of the channel, (or floodway width, or riparian vegetation width, whichever is greatest).

- Set stream corridor width based on location along the length, with each stream divided into three segments: upstream, midstream, and lower.

The majority of the attendees (62.5 percent) were opposed to the existing stream corridor widths. Of the 24 attendees, 63 percent supported a variable stream corridor width on each side of the channel of up to 200 feet.

### 5.4.6.4 Strategies to Address Issues

Stream system management will require a comprehensive strategy that acknowledges the existing and future urban development patterns and the need for stormwater infrastructure, yet provides support for protection and restoration of the natural functions of streams and riparian areas. A unified approach that balances the conflicting objectives will best meet the community needs and regulatory issues.

A key element of stream system management is establishing appropriate land uses within the stream corridor. City programs and policies for stream corridor management are encouraged to protect and restore stormwater functions without degrading or conflicting with other stream functions. Many of the policy recommendations in this section provide new stream system features that are directly related to the width of the stream corridor.

The stream corridor width required to adequately protect or restore a properly functioning stream will require follow-up study and planning activities. It is anticipated that the City will develop a new stream corridor width formula and definition that will address several objectives:

- Stormwater management;
- Endangered Species Act; and
- Significant Natural Features under Goal 5, of the Oregon Statewide Planning Goals

In response to the desires of the community, and as required by State and federal regulations, the SWMP provides programs and policy recommendations to protect and improve stream system management. In addition, recommendations are identified for activities that require further follow-up actions before implementation.

### 5.4.6.5 Goals

1. Map and inventory all streams.
2. Maintain and accommodate natural hydrological processes.
3. Protect and restore natural resources and ecosystem functions.

### 5.4.6.6 Existing Policies

1. Significant watercourses, lakes, and wetlands shall be preserved, or have their losses mitigated, in order to maintain clean water, support natural vegetation, protect the aquatic habitat, retain existing significant public vistas, and provide wildlife habitat and recreation sites. Site-specific

buffering and setback requirements may be required, as necessary, to achieve protection (Comprehensive Plan Policy 4.9.1).

2. Within the UGB, drainageway dedications adequate for flood protection, conveyance of stormwater, channel access and maintenance protection of riparian environment, and channel migration shall be secured along all open drainageways needed for public conveyance of stormwater, prior to or at the time of development. In already developed areas where dedications may not be possible, an easement may be pursued in lieu of a dedication (Comprehensive Plan Policy 4.10.4).
3. Significant natural plant communities and significant habitats for fish and wildlife within the UGB shall be identified and inventoried by the City or through the development process (Comprehensive Plan Policy 4.13.1).

### 5.4.6.7 New Policies

**SS-1** The City shall inventory and identify natural intermittent streams within the City's Urban Growth Boundary (UGB) that provide important hydrological, water quality, and aquatic habitat functions. Those streams used for stormwater functions shall be protected using mechanisms such as drainageway dedications and easements.

**SS-2** The City shall employ urban stormwater management practices that use a stream's natural features and processes and minimize conflicts with or degradation of the stream system's other ecological functions.

**SS-3** On public projects, the City shall incorporate stream habitat improvement and shading.

**SS-4** The City shall inventory all its land, including dedicated stream corridors, parks, and open space, to prioritize opportunities for stream and riparian habitat improvement.

**SS-5** The City shall develop stream corridor widths and other standards and programs that preserve the properly functioning conditions of streams. These standards can vary by reach or basin and shall be determined based on functional objectives such as:

a. Preservation of the hydrologic conveyance and storage capacity.
b. Allowance for natural channel lateral migration and bank failure.
c. Allowance for channel widening and other channel modifications that result from changes in hydrology from future urban development.
d. Proper shading of the stream to maintain or improve water quality.
e. Allowance for a vegetative management strategy that encourages native riparian species.
f. Provision of a pollutant-filtering zone for surface runoff.
g. Allowance for natural stream processes to minimize stream channel, bank, and corridor maintenance needs.
h. Buffering of urban uses from stream processes.
i. Provision of a source and delivery of large wood.
j. Preservation of the 0.2-foot floodway.
k. Preservation or enhancement of habitat.

**SS-6** The City shall develop standards and allowable uses within stream corridors. Consideration should be given to at least two levels of protection. Greater protection is necessary in the core-protected area to ensure that stormwater and other riparian and stream system functions and processes can occur. Protection is also necessary in the transition area, although there is a greater opportunity for other uses such as bikeways, detention facilities, and bioswales, as long as they do not significantly interfere with the stormwater functions outlined in SS-5 above. The transition area would also serve as a stream system buffer from more intensive urban development.

**SS-7** Where stream shading is not adequate, development shall include planting of trees and/or other vegetation to provide adequate shading.

**SS-8** The City shall work to enhance or restore degraded channels, riparian areas, and floodplains.

**SS-9** The City shall inventory and prioritize possible replacement of culverts with bridges to improve stream function and fish passage.

**SS-10** The City shall work to protect and restore native riparian vegetation along drainageways.

**SS-11** The City shall minimize stream crossings of roads, utilities, and other development activities.

**SS-12** Public access shall be allowed along stream corridors only if it does not impact the properly functioning condition of the streams.

**SS-13** The City shall develop a program that encourages individuals, neighborhoods, and organizations to participate in stream corridor stewardship.

**SS-14** The City shall work to develop maintenance practices that enhance and protect stream conditions.

**SS-15** To provide improved shading and other stream functions, the City shall work to obtain additional easements or dedications as development occurs along streams.

**SS-16** The City shall continue to develop policies to protect wetlands adjacent to stream corridors.

### 5.4.6.8 Suggested Follow-Up Actions

1. The City shall investigate ways to restore natural stream habitat functions and mitigate high stream temperatures.
2. The City shall investigate ways to protect existing stream systems, including channels, riparian areas, and floodplains for both permanent and intermittent streams.
3. The City shall identify intermittent streams within the UGB that provide important environmental functions.
4. As part of the current Land Development Code update, the City shall revise stream-width dedication formula to meet identified stormwater management needs.

## 5.4.7 Public Participation and Information Outreach

### 5.4.7.1 Background

The City encourages community participation in the management of local streams and natural resources. The City also provides stormwater management information and outreach related to household waste management, flood mitigation, and stormwater quality. Information outreach activities should communicate the goals and needs of the community's stormwater management program. In addition, public participation should be sought for a variety of activities, including stream stewardship programs and stream buffer planting events.

### 5.4.7.2 Issues

Many citizens are interested in learning how they can participate in programs that will protect, enhance, and restore the natural environment. To address this need, public education should be incorporated into the City's information outreach program. The education program should educate and inform the public on the importance of proper stormwater management techniques.

Stewardship programs for streams, wetlands, and other significant natural areas would allow community members to participate in and complement City activities. In addition, there are many types of demonstration projects that could be completed by the public or with public cooperation. These projects include stream restoration and protection, and can often be done with minimal cost, providing measurable benefit to the stream systems.

### 5.4.7.3 Citizen Input

Public input into the policy development task was provided through public meetings held by the SWPC. (See Appendix A for detailed public meeting results.) Public meetings showed citizen preference for a combined City staff and community volunteer approach to accomplish information outreach programs. Citizens also expressed a preference for outreach programs that target individual personal responsibility for control of stormwater pollution sources. Based on public input and regulatory requirements, the SWPC and the City developed policy objectives to provide a framework for creating the new policies.

### 5.4.7.4 Strategies to Address Issues

Most education programs that have proven effective in other Pacific Northwest communities are focused on improving and protecting water quality and the natural habitat of the streams. These efforts can include catch basin castings and stenciling, information on waste or materials management techniques, and general information on the importance of stormwater management. Other efforts such as flyers, newsletters, adopt-a-stream and stream-watch programs, educational signage, recognition and awards, and incentives help to educate and inform citizens about stormwater issues. Programs prepared for the grade schools and middle schools have proven effective. Citizen participation in stormwater issues can be facilitated through neighborhood associations, non-profit organizations, and community organizations.

#### 5.4.7.5 New Policies

**PP-1** The City shall establish information outreach programs that clarify personal responsibility for controlling sources of stormwater pollution and the health of streams.

**PP-2** The City shall assume a proactive role by providing stream stewardship guidelines for streamside property owners.

**PP-3** The City shall develop and support stewardship programs such as "Adopt-a-Stream" and neighborhood association "Stream Watch" to monitor and enhance stream and riparian habitat.

## 5.5 PROCESS FOR IMPLEMENTING POLICY RECOMMENDATIONS

This chapter of the SWMP discusses new policy recommendations that will be implemented following SWMP adoption. There are also recommendations for additional modifications to other City planning documents. Many of the recommendations will affect a number of City departments and may have economic, social, legal, and environmental impacts on the community. As a result, these additional modifications should be adopted only after careful consideration of all the impacts and after the recommendations are thoroughly reviewed by the public and the City. It is hoped that either all or a portion of this document will be adopted by Benton County, given that the same stormwater flows through both jurisdictions.

### 5.5.1 Programs and Procedures

Following City Council adoption of the SWMP, the City will determine how and when to implement the policies and recommendations. The City will consider the following forums for implementing the policy recommendations:

1. Budget Commission
2. Land Development Code
3. Capital Improvement Program
4. System development charges
5. Utility rate setting

Before any of the policies are implemented, they will be evaluated and forwarded to the appropriate forum for consideration. All of the forums noted above allow public input and require public hearings before final decisions are made.

### 5.5.2 Financing

The implementation of new stormwater management policies identified in this chapter will carry financial implications. There are currently short- and long-term costs to the City and others involved in managing current stormwater practices. The City will assess the cost and timing of implementing policy recommendations through the Capital Improvement Program, the budget process, system development charges, and rate setting. City financial resources and a schedule for implementation should be identified to appropriately fund what the City determines to be a priority.

Many of the policy recommendations included in the SWMP will require significant changes to existing City services and programs. The costs associated with the increased level of services will need to be evaluated and prioritized before implementation.

### 5.5.3 Early Action Items

Many of the policy recommendations in this chapter target existing regulatory issues that require short-term actions and changes to City programs. It should be noted that the City is currently conducting a Natural Resources Scoping Project to determine which natural resources in the community should be protected and preserved. In addition, regulatory implications resulting from the Endangered Species Act are also being evaluated to determine actions that may be necessary to preserve threatened and endangered species, and their habitats. Both of these efforts could result in actions that affect stormwater policies.

Implementation of policy recommendations that relate to floodplains, uplands natural resources, wetlands, and stream system management will require background work to identify certain parameters before being fully implemented. The floodplain management policies will require that the 100-year floodplain boundaries be updated for each basin within the City's UGB. The upland natural resources, wetlands, and stream system management policies will require resource inventories. This work is currently programmed under Statewide Planning Goal 5 and related natural resource inventory work. The early action and identification of the significant natural resources should be prioritized in the natural resources inventory process.

The upland natural resources, wetlands, and stream system management policies will also require a method of assessing the properly functioning conditions of the resources within each area to meet stormwater objectives. The City will need to identify a method to evaluate the properly functioning conditions and the protection, restoration, and enhancement requirements to meet policy recommendations. Identifying the methodology for properly functioning conditions and conducting a natural resource evaluation will be an extensive work effort that will require early action to fully implement related policies.

To effectively implement the policies, it will be important for the City and County to work together on stormwater issues. Developing an agreement between the City and the County will be an important step in properly managing the watersheds.

### 5.5.4 Protection and Restoration Programs

Many of the policy recommendations included in this chapter require protection and restoration of natural resources within the City's UGB. Implementation of policies may require changes to current land management practices, both for public and privately owned lands. A process of evaluating current land use and management practices to identify the changes required to best implement the policy recommendations is recommended. In some cases, a required change to land use will require public purchase of properties. A program of incentives for private property owners to manage properties to meet stormwater management goals should also be developed. In addition, open-space land use guidelines should be evaluated for opportunities to implement restoration and protection policies.

### 5.5.5 Policy Implementation Within Each Basin

The recommendations for each basin within the City's UGB include implementation of policy recommendations. Water quality features, restoration, protection activities, and mitigation of flood effects were identified for each basin in an effort to support policy recommendations.

### 5.5.6 City Appointed Stormwater Planning Commission

The Stormwater Planning Committee recommends the City consider appointing a Stormwater Planning Commission. This group could help track implementation of the recommended policies and facilitate citizen input on issues that are of significant concern to the community.