City of Florence, Oregon

Storm Water Management Plan

Final Report

October 2000

BROWN AND CALDWELL

City of Florence

Storm Water Management Plan

October 2000

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Expires 6/30/01

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In association with:
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Pacific Habitat Services, Inc.

BROWN AND CALDWELL

This Master Plan was made possible through the dedication and support of the citizens of Florence and the Stakeholder Advisory Committee (SAC), working together with City of Florence staff.

Mayor:	Alan Burns
Councilor President:	Lonnie Iholts
Councilors:	Dave Braley Dianne Burch Della Weston
Public Works Director:	Ken Lanfear
Community Development Director:	Sandi Young

Stakeholder Advisory Committee

Chair:	Ron Latham[1], Mariners Village
Members:	Don Darby, Willow Dunes Darrell Fields, Sandpines Golf Course Lloyd Frach[2]/Joyce Phillips[2], Creekside Pines Dave Franzen, Wild Winds/City Planning Commission Robert (Bob) Friedman, Sea Watch Jay Goodwin, Old Town Tom Kartrude[1], Siuslaw Soil and Water Conservation District/Port of Siuslaw Ralph (Bud) Meyers, Idylewood Arolf Salo, Heceta South/City Planning Commission Ramon (Ray) Street, Greentrees Richard (Dick) Walker, Florentine Estates Rob Ward, Representative at Large Frank Williams, Shelter Cove

[1] Tom Kartrude was the SAC Chair from April 1999 through February 2000. Ron Latham assumed the Chair in March 2000.

[2] Joyce Phillips was added to the committee in November 1999 to replace Lloyd Frach who was no longer available to participate.

CITY OF FLORENCE
STORM WATER MANAGEMENT PLAN

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ABBREVIATIONS

BMP	Best Management Practice
B&W	Barney and Worth
cfs	Cubic Feet per Second
CNPCP	Coastal Nonpoint Pollution Control Program
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act of 1977
CZARA	Coastal Zone Act Reauthorization Amendments of 1990
CZMA	Coastal Zone Management Act of 1972
DEQ	Oregon Department of Environmental Quality
DLCD	Oregon Department of Land Conservation and Development
DSL	Oregon Division of State Lands
EIA	Effective Impervious Area
ENR	Engineering News Record
EPA	U.S. Environmental Protection Agency
EQC	Oregon Environmental Quality Commission
ESA	Endangered Species Act of 1973
ESU	Evolutionarily Significant Unit
F	Fahrenheit
FBFM	Flood Boundary and Floodway Map
FEMA	Federal Emergency Management Agency
FIA	Federal Insurance Administration
FIRM	Flood Insurance Rate Map
FR	Federal Register
HCP	Habitat Conservation Plan
ITP	Incidental Take Permit
LCOG	Lane County Council of Governments
LID	Local Improvement District
MEP	Maximum Extent Practicable
mg/L	Milligrams per liter
MIA	Mapped Impervious Area
mL	Milliliter
MODFLOW	Ground water model
MS4	Municipal Separate Storm Sewer System
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OAR	Oregon Administrative Rule
OCMP	Oregon Coastal Management Program
PUD	Planned Unit Development
RUNOFF	Hydrologic model
SAC	Stakeholder Advisory Committee
SCS	U.S. Soil Conservation Service
SDC	System Development Charge
SDWA	Safe Drinking Water Act
SSWCD	Siuslaw Soil and Water Conservation District
SWMP	Storm Water Management Plan
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
UGB	Urban Growth Boundary
UIC	Underground Injection Control

USDW	Underground Sources of Drinking Water
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WPCF	Water Pollution Control Facility
WRD	Oregon Water Resources Department
WWTP	Waste Water Treatment Plant
XP-SWMM	Hydrologic/hydraulic modeling package

EXECUTIVE SUMMARY

The City of Florence (City) worked with a 14-member Stakeholder Advisory Committee to develop the *City of Florence, Storm Water Management Plan (SWMP)*. The committee members were appointed by the mayor and met over an 18-month period to support preparation of the plan. The SWMP makes recommendations for addressing flooding problems, improving water quality, and protecting the quantity and quality of the aquifer and valuable natural resources (e.g., wildlife habitat). It is intended to guide upgrades and expansion of the storm water conveyance system to meet the area's needs over the next 20 years.

The recommendations will affect the City's capital improvement and operating programs, including the development of a storm water utility for collecting rates and fees as required to support the storm water program. In addition, new City code, ordinance, and development standards are recommended that will affect the way future development is conducted within the area.

The SWMP's study area is defined by the natural drainage basins within the area. The area crosses city boundaries and extends into, and in some locations, beyond the current Urban Growth Boundary (UGB), which represents the potential future boundary of the City, as shown in Figure EX-1. Recommended improvements for areas outside the current City limits will not be implemented until those areas are incorporated into the City.

The SWMP includes recommendations for reducing the potential for flooding in some privately owned and maintained urban developments; however, the City does not have the authority or responsibility for implementing them.

The City and its technical consultants (Brown and Caldwell) worked closely with citizens, Lane County, and relevant regulatory agencies to develop the SWMP. Implementation of the SWMP will require active involvement of all City departments, state and federal agencies, and local property owners.

PUBLIC INVOLVEMENT

The successful implementation of the SWMP requires community support for the overall program. A comprehensive public involvement program was included in the planning process to ensure the SWMP addresses community values and concerns. The public involvement program included the following elements:

- A **Stakeholder Advisory Committee (SAC)** to provide ongoing review and guidance. SAC members were appointed by the mayor to represent a broad range of community interests. They played an integral role in each aspect of the planning process. The recommendations in the SWMP have been endorsed by all SAC members.

- **Interviews with community leaders and key stakeholders** to determine the needs and values of the community. The stakeholders represented a wide spectrum of the community, including landowners, business owners, residents, neighborhood and community organizations, local government representatives, Planning Commission members, former mayors, and environmental concern groups.

- **Development of a public involvement plan** to identify the best approaches for reaching out and involving as much of the community as possible.

- **Public surveys,** available at the public library and City Hall. The public was invited to submit information about flooding problems in their neighborhoods through the completion of a *Problem Response Form.*

- A **newsletter** mailed to residents within the planning area to provide information and obtain feedback about the planning process.

- A **public workshop** to present study results and receive input on the draft recommended solutions. A **fact sheet** and maps were used to facilitate the discussion.

- **A community forum** held by a local radio station, where the SAC chair and consultant team project manager discussed the project and answered questions from the public.

OBJECTIVES

The following objectives were identified to guide the storm water management program. These objectives were developed early in the planning process by the SAC, selected community representatives, the public at large, City representatives, and a representative from the consultant team.

- Protect private and public property from storm water and groundwater related damage.

- Maintain public access to critical facilities at all times.

- Protect the quantity and quality of the aquifer.

- Provide improvements that will limit negative storm water related impacts to the community.

- Implement a storm water management program that will satisfy current, and, to the extent possible, future regulatory requirements.

- Develop a storm water management plan that defines the required improvements and associated costs.

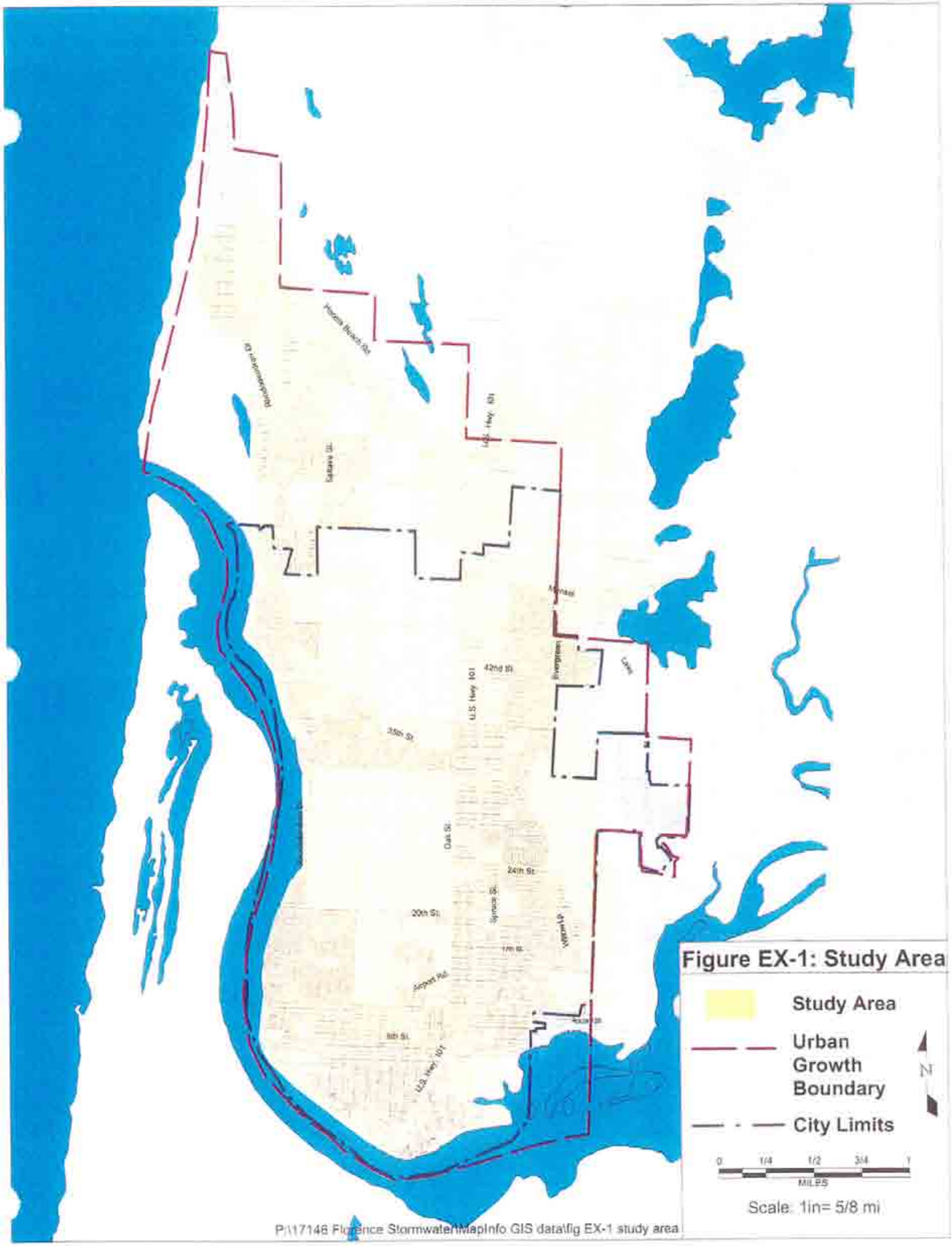


Figure EX-1: Study Area
Study Area
Urban Growth Boundary
City Limits
N
0 1/4 1/2 3/4 1
MILES
Scale: 1in= 5/8 mi
P:\17146 Florence Stormwater\MapInfo GIS data\fig EX-1 study area
Heceta Beach Rd
Sahara St
U.S. Hwy. 101
Munsel
Riverplace
Lane
42nd St
35th St
Oak St
24th St
Spruce St
20th St
Maple Dr
9th St
Rhododendron Dr

- Develop a storm water management plan that will not adversely affect wetlands, creeks, streams, and the river, while meeting the needs of the City.
- Protect or enhance the quality of life in the area.

In addition, the following technical objectives were defined:

- The recommendations of the storm water management plan must be able to be implemented from a physical, economic, and political perspective.
- The recommended improvements must be able to be maintained by the City within its current structure (personnel and equipment) or within a modified structure that can be funded.
- The plan shall include funding options to aid the City in financing the recommended improvements.

THE PLANNING PROCESS

The development of the SWMP involved a number of diverse activities spanning several technical disciplines and including the public involvement process. The following tasks were performed:

Description of planning area characteristics, including topography, geology and soils, vegetation, climate, population, and land use. These factors play an important role in determining the quantity and quality of storm water discharges. (See Chapter 2 for additional detail.)

Hydrologic/hydraulic modeling to analyze both existing conditions and projected future flows. The hydrologic models determined the quantity of storm water runoff that would have to be conveyed by the drainage systems. The hydraulic models determined if the capacity of the existing drainage system was adequate. (See Chapter 2 for additional detail.)

Groundwater modeling to develop a better understanding of the effect of groundwater on flooding in the area. (See Chapter 2 for additional detail.)

A regulatory analysis to identify and address state and federal regulations that affect storm water management and associated conveyance systems. (See Chapter 3 for additional detail.)

An analysis of system deficiencies, based on the modeling findings and on input from the public and City staff. The analysis identifies conditions and problems in each of five geographic regions within the planning area: Northwest, Northeast, Central, Southwest, and Southeast. (See Chapter 4 for additional detail.)

Project recommendations for each of the five regions. The recommended projects address the identified deficiencies and reflect the overall program objectives. (See Chapter 5 for additional detail.)

An implementation plan for the recommended projects. The SAC and consultant team used a priority ranking analysis to determine the order in which projects should be designed and constructed. The implementation plan also includes recommendations for funding, ordinance adoption, and future regulations. (See Chapter 6 for additional detail.)

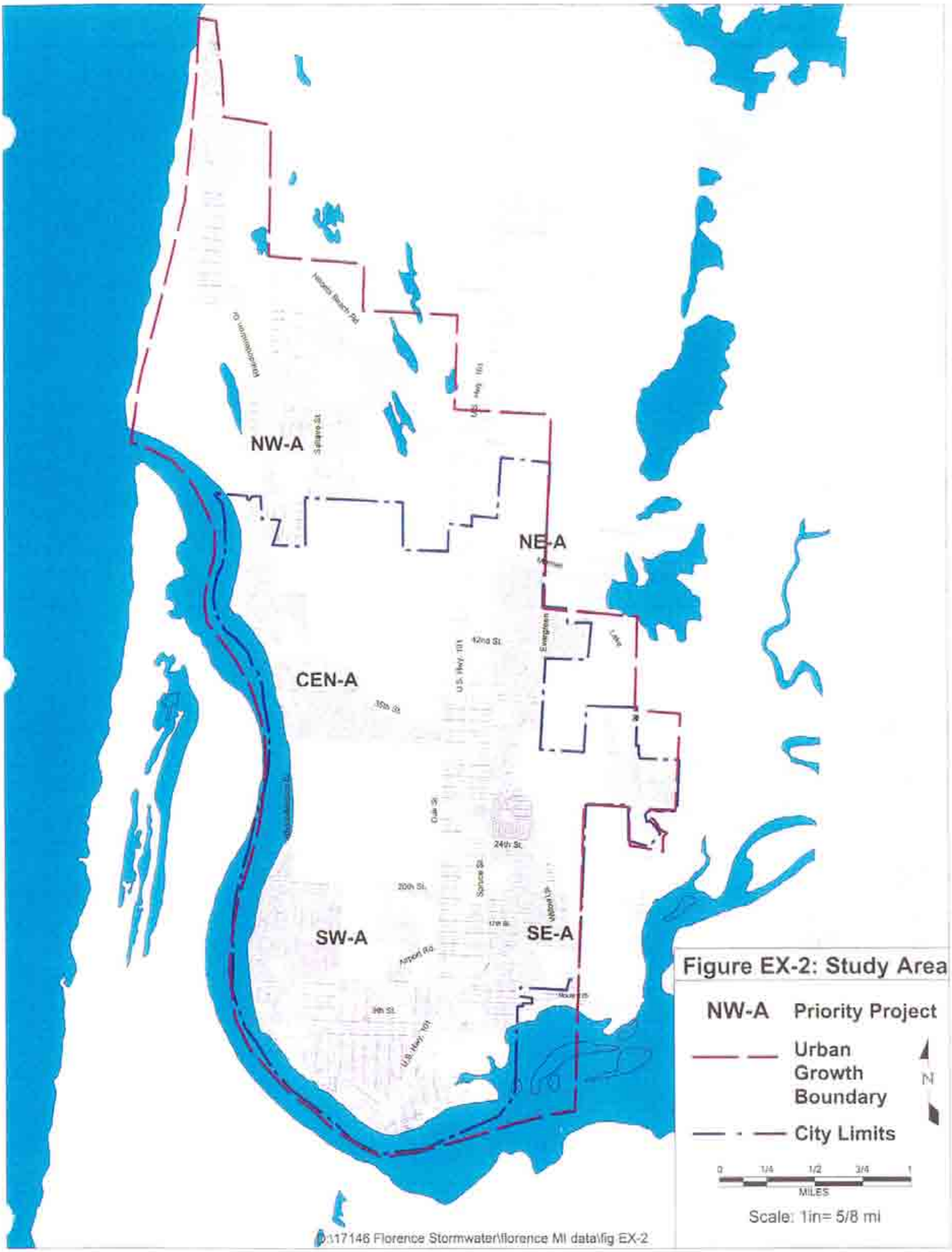
RECOMMENDED PROJECTS

The SWMP recommends 5 high priority projects at a total cost of nearly $1 million, and 8 unranked projects at a cost of approximately $3.6 million to address identified deficiencies. Although the City intends to ultimately implement all of the projects, funding and other resource limitations prohibit implementation all at one time. The project team and the SAC therefore ranked the projects in terms of their ability to meet both technical and value-based criteria. The five most critical projects are identified in Table EX-1 in order of priority, and the location of the projects are shown in Figure EX-2.

The recommended projects consist of structural improvements that will improve storm water runoff and surface water flooding conditions throughout the City. Several projects can be designed to provide additional benefits, such as water quality and riparian fish/wildlife habitat improvements.

Table EX-1. Priority Projects

Priority ranking	Project identifier/description	Study region	Estimated capital cost ($)
1	**CEN-A/Rhododendron channel:** Construction of permanent lined channel along Rhododendron Drive, terminating at 35th St.; flow then piped to large ravine to west. Would improve hydraulic capacity of collection system and lessen flooding potential.	Central	331,000
2	**NE-A/Munsel Lake Road drainage and diversion:** ~~Creation of vegetated swale along north side of Munsel Lake Road to divert flows to the east, culvert under road, pipe along portion of the route near junction with Munsel Creek.~~ *See Stormwater Design Report for Spruce Street LID*, July 2006, Florence Realization 2020 Comprehensive Plan Appendix 11.	Northeast	~~249,000~~ 800,000
3	**SE-A/Pine Court pump station:** Pump intake set at elevation to maintain health of existing wetlands. When groundwater level exceeds this elevation, pump activated and flow discharged into Munsel Creek.	Southeast	157,000
4	**SW-A/Greentrees ditch:** Construction of new channel to intercept runoff from property east of Greentrees development.	Southwest	37,000
5	**NW-A/Rhododendron Dr. and North Jetty Rd. improvements:** Pump station, pipe, and ditch improvements to protect property in flood area and downstream. (Project is outside City limits; implementation would require cooperative effort of developers, neighborhood associations, homeowners, and Lane County.)	Northwest	209,000
Subtotal			983,000


NW-A
NE-A
CEN-A
SW-A
SE-A
Figure EX-2: Study Area
NW-A Priority Project
Urban Growth Boundary
City Limits
0 1/4 1/2 3/4 1
MILES
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Scale: 1in= 5/8 mi
0:\17146 Florence Stormwater\florence MI data\fig EX-2

FUNDING

The City has historically funded storm water management through its Street Department. The revenue demands of the capital, operation, and maintenance recommendations made by the SWMP go well beyond what can be funded by the Street Department, and a separate funding source dedicated to storm water management is required. **The SWMP recommends that the City develop a storm water utility to manage, operate, and fund storm water management activities.**

The SWMP also recommends that the City initiate a rate study to determine the initial user fees to be charged by the utility and identify what costs can be funded by other revenue sources. The rate study should determine system development charges (SDCs) for funding growth-related storm water improvements; examine community participation in local improvement districts (LIDs) where relevant; and explore the range of alternative funding possibilities, including federal and state grant programs.

CODE, ORDINANCES, AND DEVELOPMENT STANDARDS

This comprehensive storm water management plan requires City codes, ordinances, and development standards to support overall stormwater management activities. **The SWMP recommends City adoption of a new storm water ordinance, including minimum development standards.** This local regulatory framework would provide clear direction to developers and contractors concerning the minimum standards and controls required for managing storm water quantity and quality. In addition, the code and ordinances would provide the City with the authority and responsibility for implementing and enforcing the required stormwater management activities. (Appendix D presents the recommended code, ordinance, and development standards.)

FUTURE REGULATIONS

New regulations will impact how storm water and surface water are managed. To address the new regulations, the City should **develop a formal response to the requirements of the Endangered Species Act (ESA)** by implementing a program to bring the City into complete compliance with the ESA. In addition, the City should **develop a wellhead protection plan to ensure the local aquifer remains a source of high-quality water.**

RECOMMENDATIONS

The City should initiate the following activities to support the SWMP:

- adopt the storm water ordinance presented in Appendix D,
- initiate a rate study to determine rate structure required for supporting program, and
- establish a storm water utility for managing and operating storm water management activities.

CHAPTER 1

INTRODUCTION

The Storm Water Management Plan (SWMP) for the City of Florence (City) identifies recommendations formulated to address flooding problems, improve water quality, protect the quantity and quality of the aquifer, and preserve valuable natural resources (e.g., wildlife habitat). The recommendations will affect the City's capital improvement and operating programs, including the development of a storm water utility for collecting rates and fees required to support storm water management activities. In addition, new City code, ordinance, and development standards have been recommended that will affect the way future development is conducted within the area. Implementation of the SWMP will require active involvement of all City departments, state and federal agencies, and local property owners.

AUTHORIZATION

In September 1998, the City entered into an agreement with Brown and Caldwell to prepare a SWMP for guiding upgrades and expansion of the storm water conveyance system to meet the area's needs over the next 20 years. The SWMP recommends improvements within the study area as defined by the shaded area shown in Figure 1-1. Some of the improvements lie outside the current city limits and will not be implemented until the unincorporated area is incorporated into the city.

The street and storm drainage systems in some of the planned urban developments within the study area are privately owned and maintained by the developments. The SWMP includes recommendations for reducing the potential for flooding in some of these areas, though the City does not have the authority or responsibility for implementing them.

OBJECTIVES

The City's long-term management of storm water related activities shall be guided by the overall objectives established for the SWMP. The objectives were developed early in the planning process to define the purpose and focus of the planning effort.

Meetings were held between spring and fall of 1999 with the Stakeholder Advisory Committee (SAC) to develop the objectives. The meetings included selected representatives from the community, the public at large, City representatives, and a representative from the consultant team. The specific objectives developed by this joint effort are defined as follows:

- Protect private and public property from storm water and groundwater related damage.
- Maintain public access to critical facilities at all times.

- Protect the quantity and quality of the aquifer.
- Provide improvements that will limit negative storm water related impacts to the community.
- Implement a storm water management program that will satisfy current, and, to the extent possible, future regulatory requirements.
- Develop a storm water management plan that defines the required improvements and associated costs.
- Develop a storm water management plan that will not adversely affect wetlands, creeks, streams, and the river, while meeting the needs of the City.
- Protect or enhance the quality of life in the area.

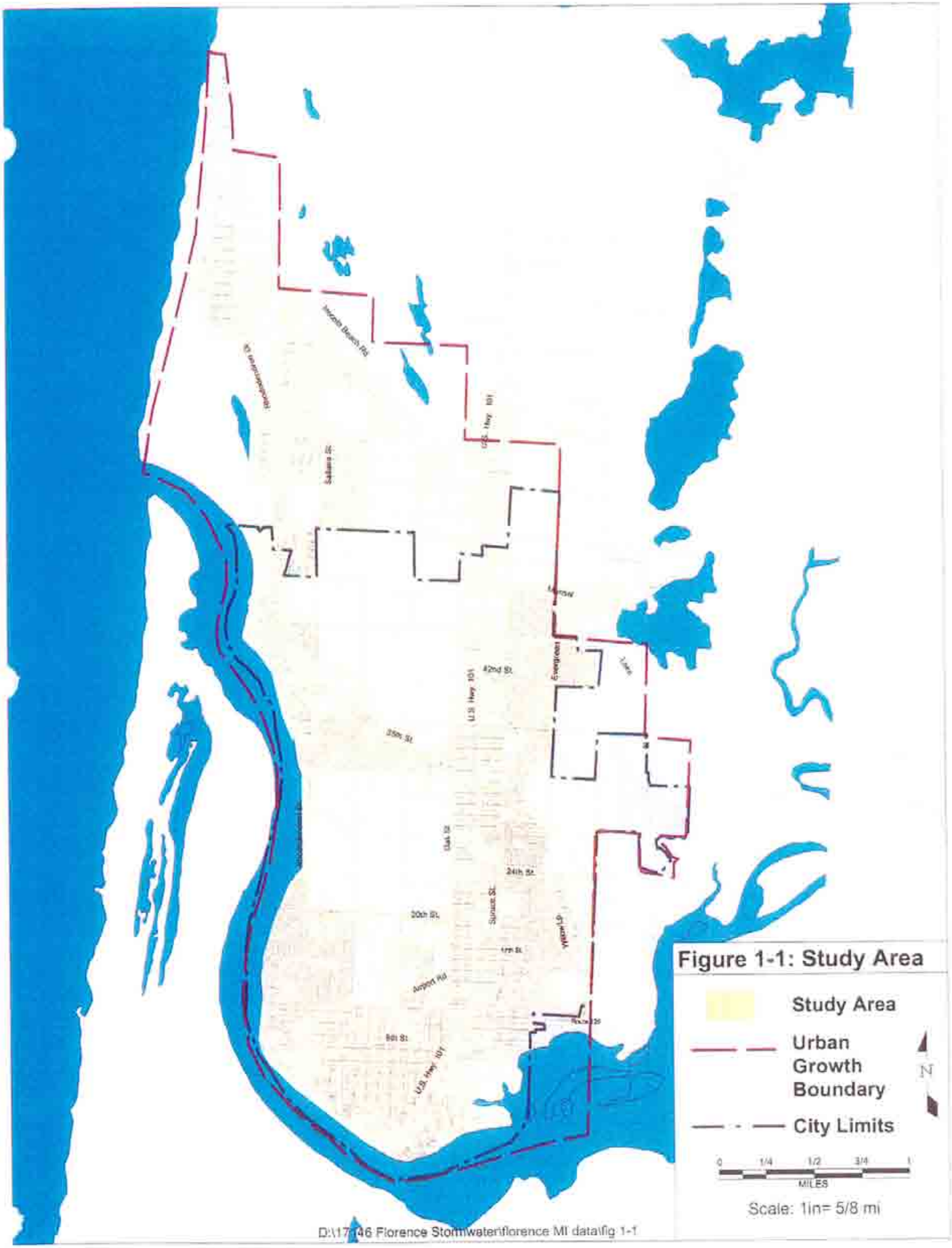
In addition, several technical objectives were defined to guide the storm water management program, including the following:

- The recommendations of the storm water management plan must be able to be implemented from a physical, economic, and political perspective.
- The recommended improvements must be able to be maintained by the City within its current structure (personnel and equipment) or within a modified structure that can be funded.
- The plan shall include funding options to aid the City in financing the recommended improvements.

The City should evaluate the effectiveness of the SWMP annually by reviewing it in terms of the above objectives. In this way, deficiencies in implementation can be identified and appropriate actions taken to improve overall direction of the plan. While the objectives should provide long-term guidance, they should not be considered inflexible. Instead, they should be regularly reviewed and modified as the long-term needs of the community change.

BACKGROUND

The surface water drainage system has developed as one of the necessary components of infrastructure required to support city growth. Throughout the City's history, the drainage system has been constructed to convey surface runoff and to help drain low areas as part of new development. Water quality and natural resource protection were not goals of early development activities.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0 1/4 1/2 3/4 1
MILES
Scale: 1in= 5/8 mi
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Due to the unique infiltration capacity of the soils in the area, the City has not had to construct an extensive piped collection system outside of downtown Florence. A system consisting mainly of pipes has been built downtown, along the southerly portion of the U.S. Highway 101 corridor, and in some residential developments. In many areas, runoff is conveyed a short distance by pipe or ditch prior to discharge to one of the larger surface water conveyance systems. Surface systems include Munsel Creek, some unnamed natural channels, and elements of a surface water conveyance system originally constructed in the early 1970s by the Siuslaw Soil and Water Conservation District (SSWCD). The SSWCD is a Special District under Oregon Department of Agriculture in cooperation with the federal Soil Conservation Service (now known as the Natural Resource Conservation Service). Although the exact history of these projects has not been determined, it is believed that these projects were completed by the SSWCD in cooperation with the City and Lane County. The City continues to maintain and operate the latter system since it provides drainage to a large area.

In most areas of the City, land developers have relied on infiltration as the primary technique for managing storm water. In some areas, infiltration has been used as the only method of storm water disposal. Unfortunately, this approach has had mixed results, particularly during high rainfall years. During periods of high rainfall, the area's groundwater table rises, thus reducing the effectiveness of infiltration techniques. The resulting abundance of surface water helps recharge the aquifer and provides a water source for the natural wetlands found throughout the study area.

Recently, concerns have been raised regarding the impact of growth on the quantity and quality of storm water runoff. Public testimony at SAC meetings and at a town hall meeting have provided insight into the nature of recent problems in the area. The frequency, areal extent, and duration of flooding events have increased in recent years, according to the public accounts. Issues have been raised regarding how storm water management in the area impacts water quality, including the quality of water that recharges the aquifer. Other concerns have been expressed regarding the way in which storm water is discharged from some developments, particularly the impacts on properties downstream of discharged water.

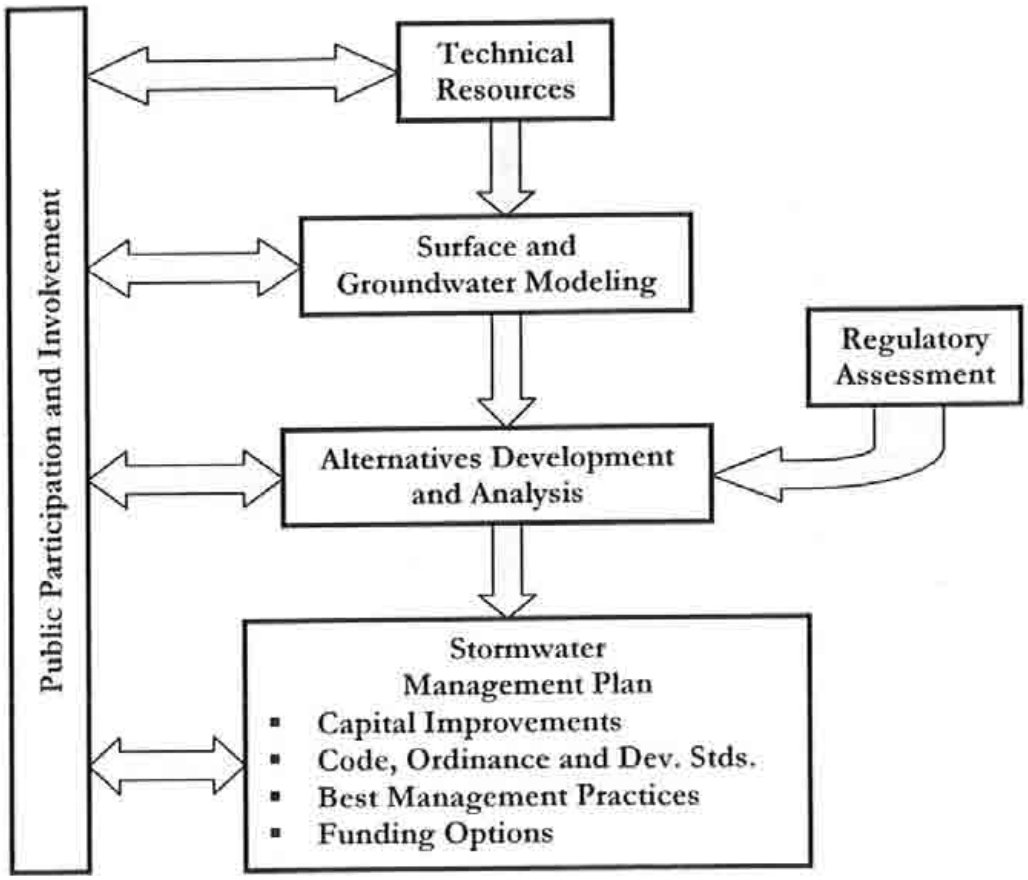
Not all of the study area included in the SWMP is under the City's jurisdiction, which compounds the problem of storm water management. This plan focuses on the area within the UGB, since it represents the potential future boundary of the city. Currently, the city boundary does not extend to the UGB. As a result, Lane County has jurisdiction and responsibility for a portion of the study area. In addition, regulatory agencies such as the U. S. Army Corps of Engineers (COE) and the Oregon Division of State Lands (DSL) have jurisdiction over the cutting and filling of material within wetlands and waters of the state which form a portion of the surface water drainage system.

The City and its technical consultant team worked closely with the SAC, Lane County, COE, and DSL to develop the SWMP. The activities and projects recommended herein have a technical foundation but are formulated to address the needs and concerns of the community. Upon adoption by the City, the SWMP will be implemented to ensure that the long-term storm water and surface water management needs of the community are met.

PROCESS FOR DEVELOPING THE MANAGEMENT PLAN

The development of the SWMP involved a number of diverse activities spanning several technical disciplines and including a public involvement process. The consultant team worked closely with the City and the SAC to ensure that the various components of the planning process came together in the SWMP. The various planning activities and sequence of events conducted during the SWMP planning process generally followed the flowchart shown as Figure 1-2.

Figure 1-2. Activity Flowchart



Technical Resource Management

The primary focus of the technical resource management task was to gather information to be used in a physical characterization of the study area. In a separate task, the physical data was used to develop the hydrologic/hydraulic model of the surface water system and the hydrogeologic (groundwater) model. The data collected included information on topography, hydrologic conditions (rainfall quantity, intensity, and duration in relation to the frequency of storm events), groundwater levels, land use and zoning, existing collection system data (pipe diameter, pipe length, depth to invert, and construction material), soil types, and locations of natural resources. This information was provided by a variety of sources including City as-built files; actual survey data as provided by the City and Lane County Council of Governments (LCOG); National Weather Service;

and numerous public and privately funded studies conducted in the area over the last 30 years. The accuracy and completeness of the data were evaluated to ensure that its use in the modeling process would be consistent with a planning level study. A complete listing of all the sources of information can be found in the reference section of this plan.

Public Involvement

The successful implementation of the SWMP requires community support for the plan. Barney and Worth, Incorporated (B&W), led the public involvement task as a subconsultant to Brown and Caldwell. B&W staff interviewed members of the community, including stakeholders and City officials, prepared the Public Involvement Plan, and assisted in facilitating the first several SAC meetings and a town hall meeting.

Community and Stakeholder Interviews. B&W conducted telephone and in-person interviews with a number of community leaders to determine the needs and values of the community prior to the development of the Public Involvement Plan. The stakeholders represented a broad spectrum of the community including:

- landowners
- business owners
- residents
- neighborhood and community organizations
- local government representatives
- Planning Commission members
- former mayors
- environmental concern group

Appendix A includes a technical memorandum summarizing the results of the interview process. The memorandum details many of the public's concerns and observations of City management, the storm water planning process, and the storm water management issues that have recently affected the area.

Public Involvement Plan. The information learned during the interview process provided the basis for the development of the Public Information Plan (PIP). The PIP was developed to ensure that the community, stakeholders, and local agencies provided input and feedback during the development of the SWMP. The PIP identifies an approach for reaching out and involving as much of the community as possible within the time and budget constraints allotted for this task. The PIP includes the following:

- community values
- goals of the (public) program
- objectives of the (public) program
- key issues
- target audiences
- public information and education: proposed techniques and tools
- public participation
- SAC

A copy of the PIP is included in Appendix A.

Stakeholder Involvement. The purpose of the SAC was to provide public input and feedback into the planning process. B&W recommended candidates for the SAC based on the results of interviews with community leaders. The mayor and City Council considered the recommendations and appointed the final roster for the committee. Table 1-1 lists the SAC membership and the communities or organizations that each person represents.

Table 1-1. SAC Membership

Name	Community/Organization
Don Darby	Willow Dunes
Darrell Fields	Sandpines Golf Course
Lloyd Frach[1]/Joyce Phillips	Creekside Pines
Dave Franzen	Wild Winds/City Planning Commission
Robert (Bob) Friedman	Sea Watch
Jay Goodwin	Old Town
Tom Kartrude – SAC Chair[2]	Siuslaw Soil and Water Conservation District/Port of Siuslaw
Ron Latham – SAC Chair[2]	Mariners Village
Ralph (Bud) Meyers	Idylewood
Arolf Salo	Heceta South/City Planning Commission
Ramon (Ray) Street	Greentrees
Richard (Dick) Walker	Florentine Estates
Rob Ward	Representative at Large
Frank Williams	Shelter Cove

[1] Joyce Phillips was added to the committee in November 1999 to replace Lloyd Frach who was no longer available to participate.

[2] Tom Kartrude was the SAC Chair from April 1999 through February 2000. Ron Latham assumed the Chair in March 2000.

The stakeholders who formed the SAC were selected to represent the community and to help guide the planning process. Specifically, the SAC was charged with the following tasks:

- Approve a work plan for the Committee, including a planned schedule of committee meetings.
- Review the City's storm water and drainage history, current status, and associated issues.
- Identify the need and benefits of a storm water management plan for the community.

- Monitor the technical study and receive progress reports.
- Assure implementation of a public involvement plan to keep community residents informed and educated about issues and progress on the storm water management planning process.
- Convene town hall meetings and at least one public workshop to facilitate public participation in the key decisions of the planning process.
- Review and comment on presentations and proposals by the City and its consultants regarding alternative approaches for managing the community's storm water problems.
- Review and comment on the draft storm water management plan as presented by the City and its consultants.
- Adopt a recommended storm water management plan for the City and forward the recommendation to the Florence Planning Commission.
- Carry out any other activities that may be required to fulfill this charge.

The SAC convened 17 times over the course of the project and facilitated two town hall meeting. The chronology of SAC activities is shown in Table 1-2.

Table 1-2. SAC Meeting Chronology

Date	Description
April 14, 1999	Kick-off meeting
May 27, 1999	Barney & Worth
July 15, 1999	Public involvement, supplemental scope
August 4, 1999	General project
September 1, 1999	Inputs, newsletter
October 5, 1999	Brown and Caldwell contract; problems map
October 13, 1999	Full project discussion
October 27, 1999	Recommendations on design criteria and code
November 18, 1999	Prepare for public workshop
December 9, 1999	Public workshop
April 12, 2000	Priority ranking system
April 19, 2000	Site tour
May 2, 2000	Reviewed and concurred in recommended corrective actions
June 6, 2000	Scored projects; reviewed proposed ordinance
June 28, 2000	Draft Program Plan approves; need well head protection
September 20, 2000	"Town Hall" review of plan
October 18, 2000	Acceptance of final form of SWMP; recommendation to Council

Public Surveys. Maps of known problem areas were displayed at the Public Library and at City Hall. The public was invited to submit information about flooding problems in their neighborhoods through the completion of a *Problem Response Form* which was available at each map display location. Information provided in the submitted forms was used to update the problem description maps.

In September 1999, a newsletter was prepared and distributed to residents within the study area through direct mail. The publication informed the public about the planning process, answered frequently asked questions, provided information on how to participate in the process, identified dates of upcoming SAC and Public Workshop meetings, and provided a *Problem Response Form* to be completed if the reader wished to identify a storm water related problem or remain on the mailing list.

A copy of the *Problem Response Form* and the newsletter are included in Appendix A. The public's response to the surveys and public meetings are tabulated in Appendix A.

Public Workshop. A Public Workshop was held in December 1999 to share the results of the modeling process with the community and to receive input on the draft recommended solutions. The SAC played a major role in this meeting by assisting in workshop facilitation. Committee members described to the public the work that had been completed and the nature of the proposed alternatives. Maps and a fact sheet were prepared showing each of the major drainage areas, along with associated problems, identified through modeling or by the public involvement process. The fact sheet explained the planning process and presented a "toolbox" of solutions that would be considered for managing storm water in the area. A copy of the fact sheet is included in Appendix A.

Other Activities. In June 1999, KCST radio station held a community forum to discuss the project and to answer questions from the public. Tom Kartrude, chair of the SAC, and James Hansen, project manager for the consultant team, represented the City's project team during the forum. In addition, Tom Kartrude and Ron Latham presented the major features and highlights of the SWMP to the Florence Rotary on July 25, 2000.

Hydrologic/Hydraulic Modeling and Analysis

Hydrologic/hydraulic models were constructed using the information collected during the technical resources management task. The hydrologic models determined the quantity of storm water runoff to be conveyed by the drainage systems. The hydraulic models determined if the capacity of the existing drainage system was adequate.

Hydrologic/hydraulic models were developed to analyze both existing conditions and future flows based on full build-out of the area as derived from land use as shown in Proposed Florence Comprehensive Plan Map (January 19, 2000). An understanding of the problems associated with both the existing and future conditions is necessary for developing funding mechanisms that require the differences between current system deficiencies and growth related deficiencies.

The models were run under a suite of design storms including the 2-, 10-, 25-, and 100-year return events. The modeled storm profile (hyetograph), defining rainfall intensity over time, was based on an actual storm that occurred on November 18, 1996. That storm was roughly equivalent to a 50-year return event and was used as the calibration event. The purpose of calibrating the models was to ensure that the model results were consistent with conditions observed in the field.

In addition, a groundwater model was constructed to develop a better understanding of the effect of groundwater on flooding in the area. EGR Consultants developed the original groundwater model of the area. Brown and Caldwell reviewed, updated, and calibrated the model for use in the planning process. Unlike the surface water model, the groundwater model was not used to predict a hydraulic response to individual storm events. Instead, the groundwater model was used to predict groundwater elevations based on yearly rainfall quantities. The results of the groundwater model were incorporated into the surface hydrologic and hydraulic model to predict surface water flows from both groundwater and storm water sources.

Alternatives Development and Analysis

The modeling results and public input were used to characterize the nature of flooding in the area. Alternatives were developed to mitigate flooding, improve water quality, recharge the water table, and preserve natural resources in the area. Recommendations were based on the consultant's experience and knowledge of Best Management Practices (BMPs) for reducing flooding and improving water quality. The alternatives were presented to the SAC and the merits discussed. The SWMP presents the preferred alternatives based on input from the SAC and the public.

A priority ranking analysis was completed to determine the order in which projects should be designed and constructed. The consultant team recommended an analysis process based on a number of criteria reflecting the values of the community. The SAC modified the priority ranking process and performed the analysis. The priority ranking of projects in the SWMP is a result of the SAC analysis. The approach and the results of the priority ranking process are presented in Appendix B.

Regulatory Impacts

The management of storm water, surface water, and the associated conveyance systems is affected by a number of regulations at the state and federal levels. The consultant team prepared a technical memorandum summarizing the impacts of such regulations. A copy of the technical memorandum is provided in Appendix C.

Local developers and the City are familiar with regulatory programs administered by the COE and the DSL. These agencies have jurisdiction over construction activities in wetlands and navigable rivers through the "cut and fill" permitting process. Currently, two federal programs are under development which will affect construction activities and the manner in which the storm water system is operated and maintained. These programs are the Endangered Species Act (ESA) and the National Pollutant Discharge Elimination System Phase II Stormwater Permits. Of these, the ESA will have the most immediate and far-reaching impacts to the City and the community. The technical memorandum provides insight as to expectations from these two federal programs.

Code, Ordinances, and Development Standards

City codes, ordinances, and development standards provide direction and support for the SWMP. A new storm water ordinance was developed for the City, including new minimum development standards. This local regulatory framework provides clear direction to developers and contractors concerning the minimum standards and controls required for managing storm water quantity and quality. In addition, the code and ordinances provide the City with the authority and responsibility for implementing and enforcing the program. The recommended code, ordinance, and development standards are described in a technical memorandum, provided in Appendix D.

Best Management Practices

The code, ordinance, and development standards recommended as part of the overall storm water program require that certain types of controls, or BMPs, be implemented to reduce flow rates and/or improve water quality. BMPs are available for controlling flow rate and water quality. Appendix E identifies a list of BMPs that are acceptable for use on projects within the study area. The list should be considered a toolbox that local developers and the City can use to meet the requirements of the SWMP.

Financial Assessment

A key element for implementing a successful storm water management plan is establishing the framework for funding the recommended activities. The consultant team has worked with the City to develop a list of potential funding sources for implementing all facets of the SWMP. In addition, advantages and disadvantages of the various sources were investigated. The technical memorandum in Appendix F summarizes the results of this task.

Storm Water Management Plan

The final task of the overall project was to prepare the SWMP. Development occurred in stages as described by the above text. A draft SWMP was prepared and submitted to the City and the SAC for review. Review comments were incorporated into the text, and a final SWMP prepared and submitted to the City.

ORGANIZATION OF THE SWMP

The SWMP is organized into the following chapters:

- Executive Summary – provides a brief summary of the SWMP in the form of a final project transmittal letter.
- Chapter 1: Introduction – describes the authorization, objectives, background, process for SWMP development, and organization of the SWMP.
- Chapter 2: Basis of Planning – describes the physical characteristics of the study area, the basis for hydrologic and hydraulic modeling, the relationship between surface water and groundwater, the standards to be used in developing alternatives, and the methods used for estimating the costs of improvements.
- Chapter 3: Regulatory Overview – provides an overview of the regulations affecting the construction, maintenance, and operation of the storm water drainage system.
- Chapter 4. Analysis Results – summarizes the reported problems and presents the results of the groundwater and surface water modeling.
- Chapter 5: Recommended Basin Plans – presents the recommended actions and costs for improving the City's storm water drainage system.
- Chapter 6: Implementation Plan – presents the ranking of projects for implementation and discusses funding options for the SWMP.
- References: Lists the technical resources used to prepare the plan.
- Technical Appendices – presents background and detailed information on the project, including public involvement process, priority ranking and analysis process, regulatory analyses technical memorandum, recommendations on ordinance, code and development standards, recommended BMPs, and a funding mechanism technical memorandum.

CHAPTER 2

BASIS OF PLANNING

This chapter describes the resources used to develop the Storm Water Management Plan (SWMP). The technical basis for the hydrologic and hydraulic modeling is defined, along with a discussion on the relationship between surface water and groundwater in the study area. The engineering standards used to develop recommendations are presented.

SERVICE AREA CHARACTERISTICS

The physical characteristics of a drainage basin establish the quantity and quality of storm water discharges. Topography, including man-made features such as raised roads, irrigation and drainage systems, and natural conveyance systems, determines the area drained by a basin. The runoff volume and rate are dependent on land use, soils, and existing vegetation within each basin. The slope of the drainage basin establishes the time of concentration—the period of time it takes for runoff from the most remote point in a drainage basin to flow to the outlet. All of these factors must be considered during the storm water management planning study.

Topography

The study area is determined by the local topography and often extends beyond political boundaries such as city limits and the urban growth boundaries.

Elevations were taken from maps showing 2-foot contour lines supplied by the City of Florence (City) or estimated from United States Geological Survey (USGS) maps where the city maps did not provide coverage. The City's contour lines were 20 years old, but they were verified with recently surveyed data points, where possible.

The study area includes roughly 7.6 square miles of drainage, as shown in Figure 2-1. The area was divided into four major drainage basins for modeling: Munsel Creek, the downtown area, a central basin that includes the airport and lands west of Highway 101, and a northwest basin that includes Sandpines Golf Course and Siuslaw Village. Each of the major basins consists of more than one hydrologically distinct drainage areas that were subdivided into smaller subbasins for more accurate modeling. The study area also included eight smaller basins (with no subbasins) along the western edge of the city that drain directly to the Siuslaw River. The smaller drainage basins were defined differently from the five geographic regions (Northwest, Northeast, Central, Southwest, and Southeast) that are discussed under Results (Chapter 4) and Recommendations (Chapter 5). The geographic regions may include more than one of the drainage basins shown in Figure 2-1.

Table 2-1 lists sizes and number of subbasins in each basin. In areas with more complex conveyance systems, smaller subbasins were delineated to improve model accuracy.

Table 2-1. Major Basins Included in This Study

Basin name	Area, acres	Number of subbasins	Average subbasin size, acres
Munsel Creek	1,957	10	196
Downtown	91	6	15
Central	586	19	31
Northwest	841	2	421
Other	1,431	8	179

The "other basins" category shown in Table 2-1 includes eight areas for which a hydrologic model was constructed and runoff flows calculated. These areas are shown in Figure 2-1 and include: Heceta, Iydlewood, Shelter Cove, Sea Watch, Rhododendron, Greentrees, Alder, and Old Town. Although not mentioned, many communities were included in the modeling of the four major basins.

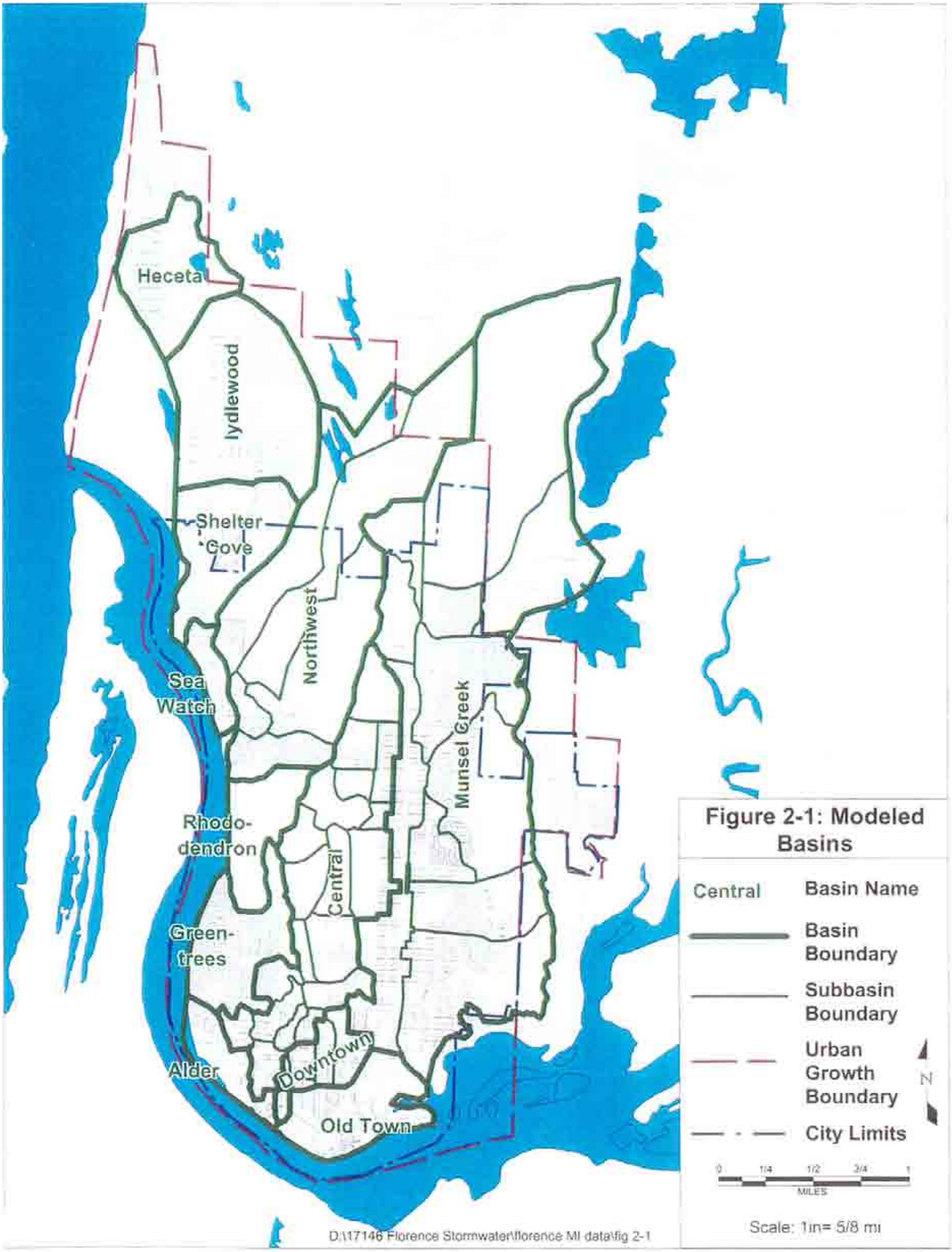
Geology and Soils

In addition to topography, the geology and soils of an area are major factors that determine the rate of storm water runoff. Generally, an area with steep slopes and clay soils will have larger volumes and more rapid runoff than a flat area with sandy soils.

According to the 1982 North Florence Dunal Aquifer Study prepared by Lane Council of Governments (LCOG, 1982), the Florence study area lies entirely within the coastal dunal sheet. The topology of the area is very complex, consisting of stabilized and unstabilized dunes formed by wind-deposited sands. The soils are generally deep and include loam, fine sand, and loamy fine sand (SCS, 1981). The sand is highly porous due to its relatively uniform grain size. High porosity increases the hydraulic conductivity and storage capacity of the soil. Infiltration rates range from extremely rapid in the higher dune areas to very slow in the low interdune areas.

The sands have accumulated on top of impermeable terrace clays. In a few areas, shallow sandstone bedrock, believed to be buried sea stacks, has been found at shallow depths, approximately 20 feet below grade.

The more stable sands are typically covered with an organic mat of detritus and grasses. The vertical uniformity of the sands includes old broken, buried organic layers. These buried layers are more impermeable than the surrounding sands, which creates an anisotropic hydraulic conductivity condition. That is, hydraulic conductivity in the horizontal direction tends to be much greater than in the vertical direction. The buried organic layers also produce organic acids, which make soil conditions acidic and corrosive.


Heceta
Lydlewood
Shelter Cove
Northwest
Sea Watch
Munsel Creek
Rhodo-dendron
Central
Green-trees
Alder
Downtown
Old Town
Figure 2-1: Modeled Basins
Central
Basin Name
Basin Boundary
Subbasin Boundary
Urban Growth Boundary
City Limits
N
0 1/4 1/2 3/4 1
MILES
Scale: 1in= 5/8 mi
D:\17146 Florence Stormwater\florence MI data\fig 2-1

Vegetation

Vegetation interacts with storm water in a number of different ways. Vegetative cover reduces the amount and force with which rainfall reaches the ground. Roots stabilize soils, allow increased infiltration, and draw water out of the soil and release it into the air through evapotranspiration. A healthy stand of vegetation generally moderates the hydrologic cycle.

In active dunes, vegetation is limited to scattered clumps of beachgrass (SCS, 1981), which has been planted near developed areas to reduce drifting. On stabilized dunes, and in low interdune areas, the native vegetation is more substantial. These areas contain Sitka spruce, shore pine, Pacific rhododendron, salal, and evergreen huckleberry.

Climate

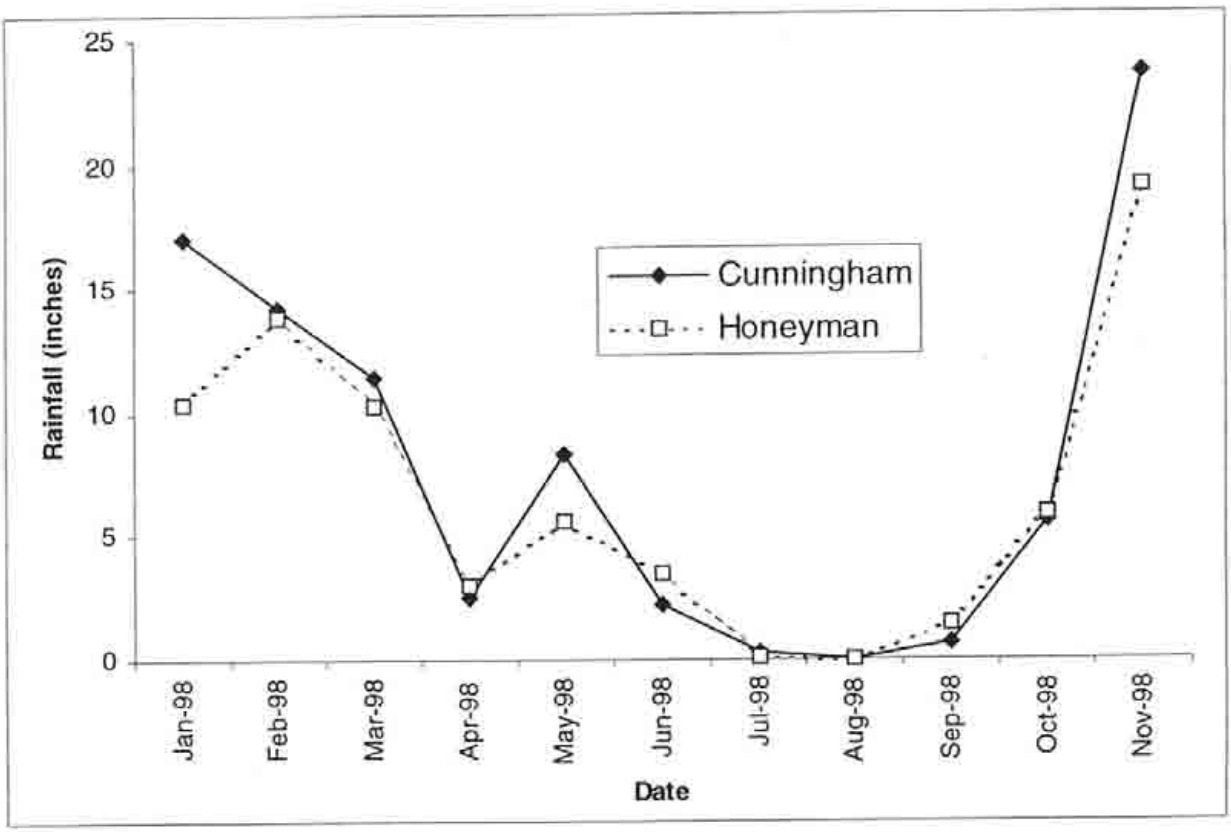
The climate in Florence is influenced by the Pacific Ocean. Temperatures are moderate, with average monthly fluctuations of less than 20 degrees F. The temperature ranges from a summer high of 61 degrees F to a low of 44.5 degrees F in the winter (LCOG, 1982). Rainfall data exist for three stations in the Florence area: Honeyman State Park, the Florence Wastewater Treatment Plant (WWTP), and a private gauge maintained by Roger Cunningham (Oregon Climate Service). Table 2-2 lists average annual rainfall for each station. Figure 2-2 shows monthly average rainfall from the Cunningham and Honeyman gauges. These two sources of rainfall information represent the most complete daily data sets available.

Monthly rainfall follows the temperate marine pattern typical of western Oregon in which the majority of precipitation occurs in winter. The data show a strong correlation between *monthly* averages at the two gauges for the time period shown. Differences between the average annual rainfall volumes recorded at the three stations is due in part to the different time periods of the records. There is no correlation, however, between the gauges for *daily* rainfall data for the winter months of January and August 1998, which suggests that winter storms are highly localized and that rainfall amounts display considerable geographic variability for short time scales.

Table 2-2. Average Annual Rainfall at Three Stations in Florence

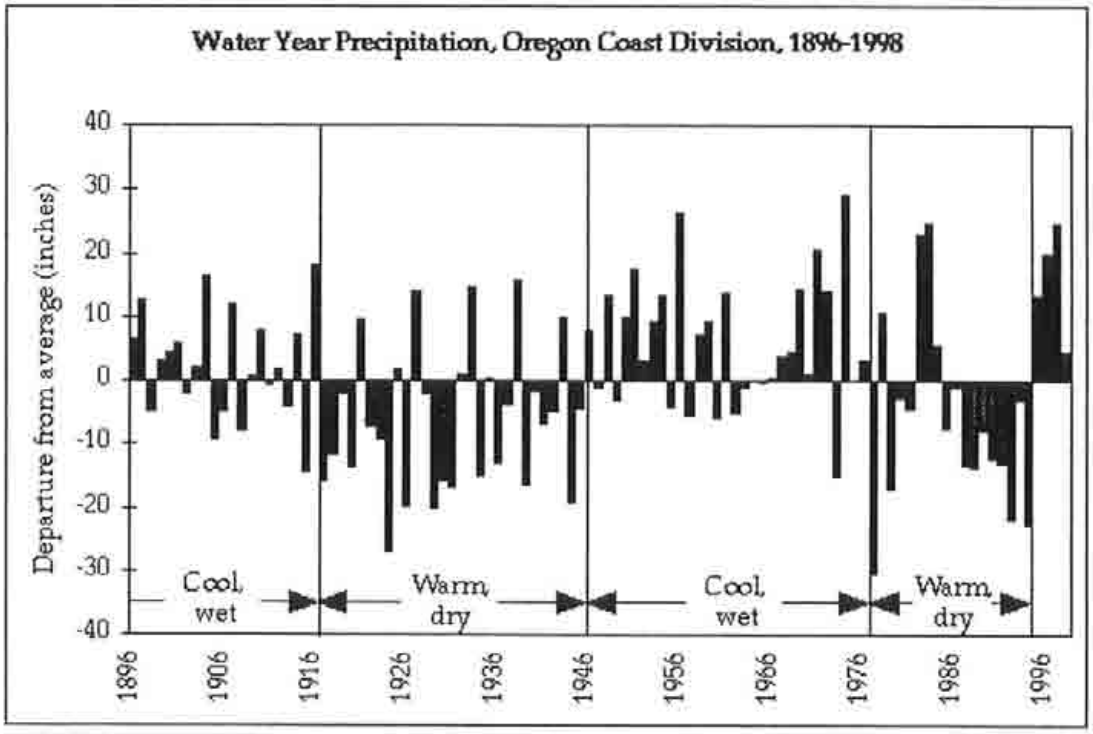
Station	Recent time period	Recent average annual rainfall, inches	Historical time period	Historical average annual rainfall, inches
Honeyman S.P.	1980 to 1998	71		
Florence WWTP	1980 to 1996	61	1941 to 1981	69
Cunningham	1993 to 1998	92		

Figure 2-2. Florence Monthly Average Rainfall



Precipitation on the Oregon coast appears to follow a 20-year cycle from cool/wet periods to warm/dry periods (*Long-Term Wet-Dry Cycles in Oregon*, George H. Taylor, March 1999, Oregon Climate Service). Figure 2-3 shows that the last warm/dry period may have ended with the floods of 1996, and a cooler, wetter cycle now predominates.

Figure 2-3. Long Term Wet-Dry Cycles in Oregon



Source: George H. Taylor, March 1999, Oregon Climate Service

Population and Land Use

Land use plays an important role in determining runoff water quantity and quality. In undeveloped and rural areas where the land is covered by forests and agricultural fields, rainfall has an opportunity to infiltrate the soil. The soil acts like a sponge that stores rainwater and releases it slowly during dry periods. In addition, the natural groundcover in rural areas tends to be rough, which slows the movement of water across the surface. Slow movement of water across vegetated land and through the soil allows time for some pollutants to be trapped and broken down. Within the city, open and undeveloped areas include the Munsel Creek Greenway and public property north of Sandpines Golf Course.

Urban land uses such as commercial, industrial, and densely populated residential areas, contain a high percentage of impervious surfaces. Roofs, sidewalks, roads, and parking lots prevent water from infiltrating the ground. Instead, water moves rapidly over these surfaces, picking up pollutants such as oils and metals. Increased frequency of flooding, higher flood peaks, decreased dry weather base flows, and higher pollutant concentrations are some of the major negative impacts associated with commercial, industrial, and higher density residential land uses.

Each major type of land use in the Florence area was assigned an impervious percentage typical of its classification. Land uses and associated imperviousness are shown in Table 2-3.

Table 2-3. Land Use Classifications and Impervious Percentages

Land use classification	Percent impervious area
Agricultural (AGR)	30
Commercial (COM)	75
Educational Facility (EDU)	50
Surface Water: Lake, stream, etc.(H_2O)	100
Industrial (IND)	90
Multi-Family Residential (MFR)	60
Parks/Open Space (POS)	5
Single Family Residential (SFR)	35
Utility (UTL)	90
Vacant (VAC)	5
Streets (STR)	100

Table 2-4 lists the number of acres of each land use designation assumed for this study. Present land uses were computed from a digital version of the Florence tax lot map, updated in February 1999. Lane County and City land use codes were consolidated into the 11 general categories shown above. Each of roughly 7,000 tax lots within the study area was assigned one of these categories, and the total area of each land use was computed for each of the drainage basins.

Future land uses were based on the latest available version of the Proposed Florence Comprehensive Plan Map (January 19, 2000). This map describes land uses on a coarser scale with fewer categories than the tax lot map. The Florence Comprehensive Plan did not include agricultural or utility land uses, and the scale was too broad to compute land reserved for streets. The scale also produced some unrealistic discrepancies between the present and future land uses, such as decreases in commercial land use in some of the basins. These problems were addressed during development of the models, as explained in the subsection titled "Effective Impervious Area."

Table 2-4. Present and Future Land Use by Basin (Acres)

Land use	Central Basin		Downtown		Munsel Creek		Northwest		Total	
	present	future	present	future	present	Future	present	future	present	future
AGR	1	0	0	0	1	0	3	0	4	0
COM	145	38	3	33	112	310	159	25	420	407
EDU	102	119	0	0	0	0	0	0	102	119
H_2O	0	0	0	0	1	1	0	0	1	1
IND	42	159	1	2	6	43	0	17	49	221
MFR	47	101	10	12	309	378	155	109	521	600
POS	2	57	0	0	0	150	0	301	2	508
SFR	95	113	38	44	510	662	215	344	858	1,162
UTL	21	0	1	0	65	0	13	0	99	0
VAC	63	0	5	0	771	413	278	45	1,117	457
STR	68	0	33	0	182	0	18	0	302	0

The population of Florence increased from 5,161 in 1990 to 6,185 in 1995, which translates to an annual growth rate of roughly 3.5 percent. Population is expected to continue to rise, with a corresponding increase in development and impervious surfaces. As the percentage of impervious surfaces increases, water quantity and quality will be impacted.

HYDROLOGY AND HYDRAULICS

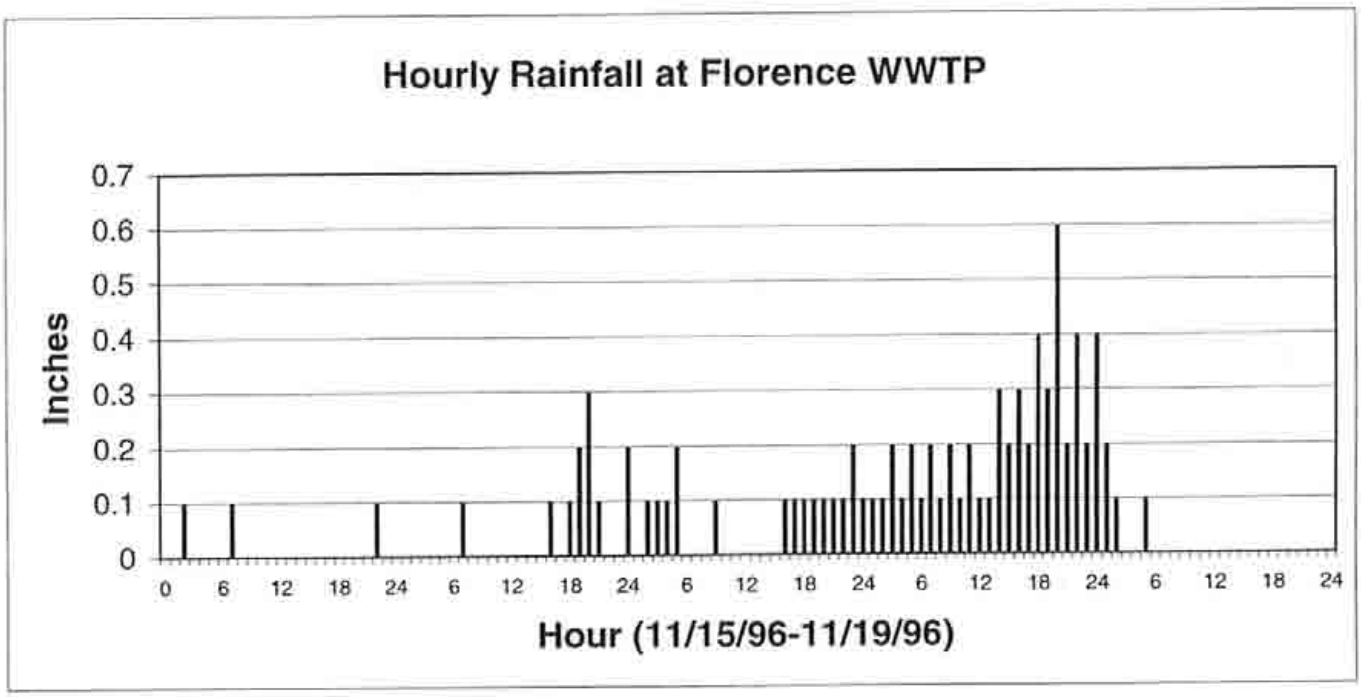
The hydrology and hydraulics portion of this study modeled the rainfall, runoff, and routing of flows through the storm water conveyance system.

Design Storm

The first step in hydrologic and hydraulic modeling is to decide upon an appropriate design storm. Until recently, most modeling used a synthetic storm that related rainfall depth over time. In Oregon, this storm is most often represented by the Soil Conservation Service Type IA storm distribution. This storm, with a quick buildup to a single, sharp peak followed by a smooth tailing off, does not fully represent natural conditions in Florence. However, it does provide reasonable guidance for designers concerned about flooding resulting from summertime thunderstorms, as is the case east of the Cascades. In Florence, flooding problems are associated with the longer duration winter storms that usually do not have a sharply defined peak. Consequently, a different type of design storm was recommended for the SWMP.

The event representing peak rainfall was chosen as November 18, 1996. The Florence WWTP recorded 5.4 inches of rain in that 24-hour period. While a storm of this volume has a return frequency of roughly 50 years, it was only part of a larger system that spanned longer than 24 hours. Consequently, to more accurately predict soil saturation and runoff conditions, the model included rainfall data from November 1, 1996, through November 19, 1996. Total rainfall during this 19-day design storm was 10.1 inches. Figure 2-4 shows the rainfall pattern (hyetograph) for the selected storm.

Figure 2-4. Design Storm Hyetograph



The total rainfall volume of the design storm was increased or decreased using the multipliers in Table 2-5 to simulate storms of different return frequencies. Storm volumes were obtained from the 1973 National Oceanic and Atmospheric Administration Precipitation - Frequency Atlas of the Western United States, Volume X – Oregon.

Table 2-5. Design Storm Multipliers

Return frequency, years	Storm volume, inches	Design storm multiplier percent of Nov. 1996 (5.4-inch storm)
2	3.46	64
10	4.48	83
25	5.06	94
100	5.95	110

Effective Impervious Area

The quantity and rate of storm water runoff depend not only on the rainfall volume but also on the slope of the ground, the types of vegetation, and the amount of impervious area. Each of the 11 land use categories in Table 2-3 was assigned an impervious percentage. The mapped impervious area (MIA) was computed by totaling the impervious acreage in each subbasin. Not all of the MIA runs off directly into inlets and pipes. Some streets, sidewalks, and rooftops drain across pervious areas, such as grassy lawns or sandy ditches, where some of the water infiltrates. To account for this, MIA values were converted to effective impervious areas (EIAs) for use in the models. EIAs were calculated using equations developed by Roger Sutherland (OTAK, 1987) for western Oregon urban areas. His equations have been calibrated and successfully used on numerous projects throughout western Oregon.

Due to differences in detail between the maps used to determine present and future land use, some subbasins showed a future decrease in EIA. The model was run with a conservative estimate using the maximum EIA (present or future) to calculate future runoff.

SURFACE/GROUNDWATER RELATIONSHIP

More than most communities, the groundwater and storm water in Florence are directly dependent on each other. The purpose of performing groundwater simulations was to assess the relationship between long term rainfall patterns and groundwater elevations. Groundwater level is affected by the amount of storm water that infiltrates, while the amount of storm water runoff depends largely on the level of soil saturation. However, the two operate on very different time cycles. The elevation of the groundwater table fluctuates on a seasonal, annual, or longer time frame. Storm water runoff varies based on rainfall intensity over minutes, hours, or days. Consequently, separate models were used to simulate storm water and groundwater conditions.

The water elevation within the aquifer has high points and low points similar to the ground surface, with groundwater flowing downgradient. In Florence, the highest water elevation within the aquifer is located north of town and east of U.S. Highway 101 near Collard Lake, as shown in Figure 2-5. An old sea stack, similar to others found off the Oregon coast, is thought to be buried here. Groundwater to the north of this point flows northward, while the area to the south flows southerly through Collard, Clear, and Munsel Lakes.

The groundwater simulations were performed using the USGS MODFLOW finite difference code. The model was originally developed by EGR and Associates and the results presented in the Quantitative Three Dimensional Groundwater Model of the Florence Dunal Aquifer, Lane County, Oregon (EGR and Associates, 1997). Brown and Caldwell reviewed the conceptual model, hydraulic parameters, calibrations and predictive simulations and concluded that it provides a relevant estimate of the effects of varied rainfall.

The quantity and quality of storm water available to recharge the Florence aquifer depend on a number of factors, one of which is the amount of impervious surface area directly connected to a piped collection system. Impervious areas provide little opportunity for infiltration. Storm water discharged to a stream or ditch may or may not infiltrate depending on the channel lining. Another factor is the area soils. Florence's soils are mostly sands, so most storm water that falls onto or runs over sandy areas will infiltrate. Lenses of organic material may significantly reduce the rate of infiltration, and saturated soil may reduce the infiltration rate during high rainfall and/or high groundwater conditions.

The model simulates the recharge due to precipitation by using a value for rainfall and recharge as well as a value for evapotranspiration. The values for rainfall were obtained from the 1982 North Florence Dunal Aquifer Study and estimates of evapotranspiration and runoff were based on vegetation type. Higher runoff/evapotranspiration values were used for urban and forested areas where runoff and higher evapotranspiration were more likely to occur, respectively. Lower values were used for open sand areas where infiltration would be the highest. The difference between the recharge/rainfall and runoff/evapotranspiration was the amount of water recharged to the aquifer.

Simulations were performed for dry, average, and wet years by varying the annual precipitation. The wet year was set at approximately 177 percent of the average year volume. Table 2-6 lists average rainfall for three different years, dry, average, and wet. The dry year was set at 68 percent of the average year. The simulations were performed for steady-state simulations to provide a conservative "worst case simulation." The year chosen to exemplify a wet year, 1996, contained the large storm event used in the storm water modeling.

Table 2-6. Annual Florence Precipitation

Type of year	Example	Rainfall inches
Dry	1988	47
Average	1987	69
Wet	1996	122

MODELING PARAMETERS AND ASSUMPTIONS

Construction of surface water and groundwater models requires the entry of a large amount of data to "set up" the model. Most of the data include physical parameters such as pipe size, channel slope, or land use, that have been measured from maps or in the field. The modeler establishes the remaining data, which are not directly measured. These parameters and assumptions are discussed in this section.

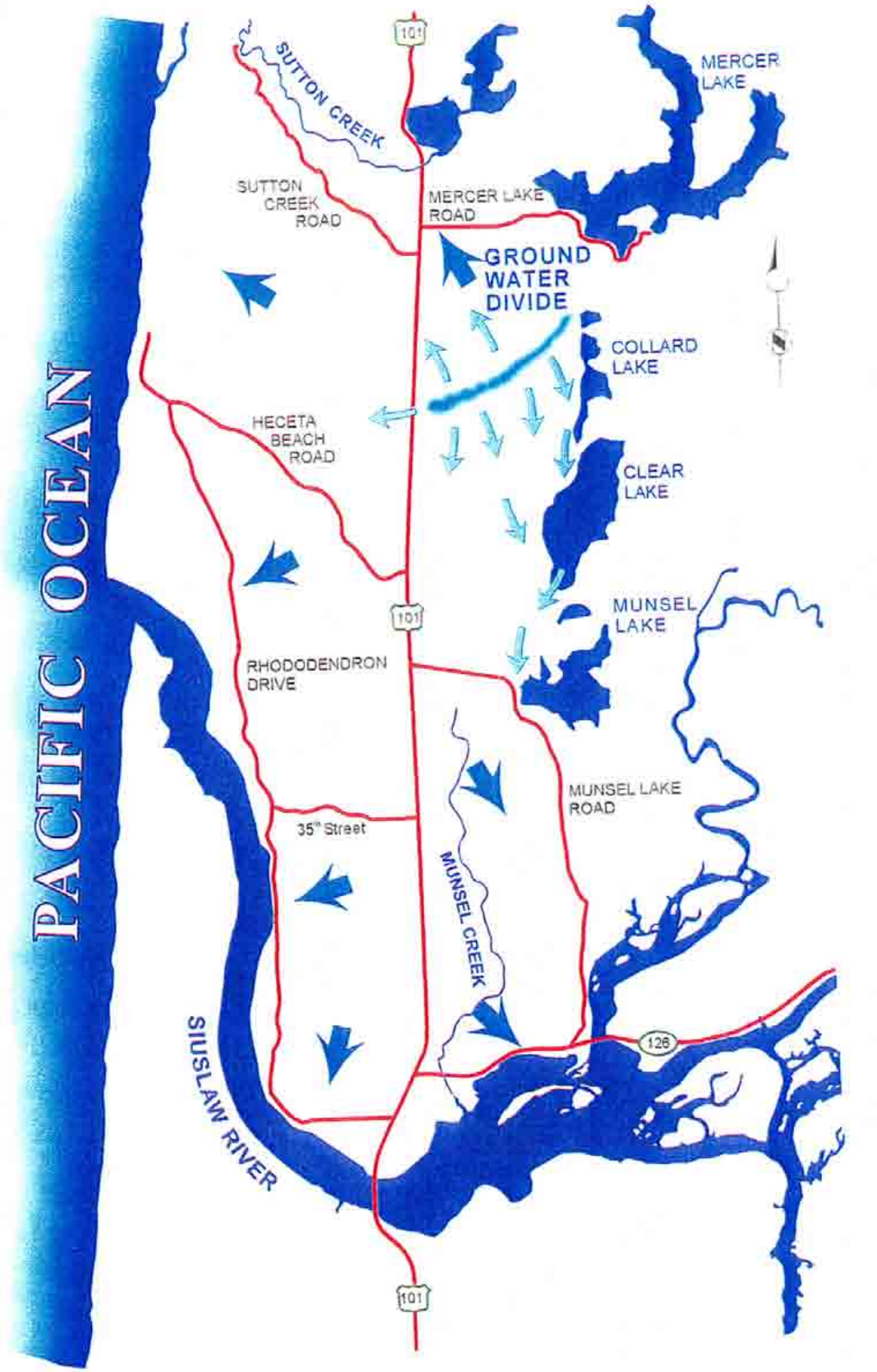


Figure 2.5 Florence Dunal Aquifer System

Runoff

The quantity of storm water runoff was modeled using the RUNOFF module of the XP-SWMM computer model. XP-SWMM is a graphical version of the Environmental Protection Agency's (EPA's) SWMM urban storm water model. Subbasin slope was calculated as the average slope of two to four flow lines, as measured against mapped contour lines. Subbasin width was assumed to be the subbasin area divided by the length of the longest flowline. Infiltration in the pervious portion of each subbasin was described using the Horton equation, which states that the infiltration rate approaches, but never quite reaches, a minimum value during the course of the storm. Maximum and minimum infiltration rates used in this study were 6 and 4 inches per 1 hour, respectively, and exponential decay was set to a low rate, 10^{-6}/sec.

Conveyance System

The modeled conveyance system contains 115 conduits (pipes, culverts, channels, etc.) with a total length of 10.5 miles. Table 2-7 lists the five types of conduits used in the model.

Table 2-7. Modeled Conduit Types

Conduit type	Number of conduits.	Total length	Manning's Roughness coefficient, "n"
Pipe	67	3.3 miles	0.013
Culvert	8	483 feet	0.025
Natural Channel	11	1.7 miles	0.03 in channel, 0.06 overbank
Trapezoidal Channel	28	5.4 miles	0.03 in channel, 0.06 overbank
Bridge	1	38 feet	0.03 in channel, 0.06 overbank

The roughness coefficient distinguishes conduit types within the hydraulic model. The rougher the lining of the conduit, the higher the roughness coefficient. For example, corrugated metal culverts are rougher than pipes with smooth linings. Natural channels with surfaces covered with rock and vegetation are rougher still. The banks of natural and man-made channels are usually more heavily vegetated than the main channel. Therefore, when a stream spills over the top of its banks, the overbank flow area is assigned a higher roughness. All things being equal, the higher the roughness coefficient, the lower the capacity of a conduit.

There are two types of channels listed in Table 2-7. Man-made channels are typically modeled as trapezoids with a flat bottom and constant side slopes. Natural channels have a more irregular cross section than man-made channels. Natural channels were modeled using actual cross sections where this topographic information existed. Lengths, diameters, and elevations of conduits were taken from the City of Florence Storm Drain Map, with updates provided by Ken Lanfear in the fall of 1999. Missing elevation data were estimated from topographic maps and surrounding survey points. City geographic information system topographic coverages were used to determine channel profiles. The model includes pipes and culverts 12 inches diameter and larger.

Calibration

No historical stream flow data were available for calibrating the models. Instead, a number of indirect sources were used to calibrate the groundwater and surface water models. Anecdotal reports collated from the advisory committee and public were used to confirm areas that routinely flooded. City maintenance personnel also added their observations and knowledge of the system. This anecdotal information was compared with model results. Model parameters were modified to provide good model representation of know problem areas.

Aerial photographs provided confirmation of flooded areas, especially in inaccessible locations. Some of the photographs were taken by local residents, including those showing water in the Southeast Region. A commercial photography firm took aerial photos during the February 1996 flooding. The commercial photos were used to determine the extent of standing water to the northeast of Mariners Village. The photos were less useful than expected, however, since they were taken under poor light conditions in the latter stages of the storm.

Early model simulations over-predicted the extent of flooding in the lower Munsel Creek area of Florence. Model parameters were modified to increase the conductivity of the creek to more accurately simulate the estimated discharge of Munsel Creek. The model was calibrated based on visual observations of Munsel Creek stage elevations during high precipitation events. To determine areas of flooding, model output was compared to ground surface elevations. The depth of flood-water was calculated by subtracting the water surface elevation from the ground elevation. Sections that showed negative values of depth to water indicate areas where the groundwater elevation is higher than the land surface elevation.

In addition, on August 4, 1999, flow was measured at the fish-rearing structure on Munsel Creek between 9th and 10th Streets behind the City Public Works building. The depth and width of flow across the concrete structure were measured, velocity estimated, and a flow rate calculated. The flow, approximately 5 cubic feet per second, was considered to be representative of base flow since there had not been rain for weeks prior to the measurement.

ENGINEERING STANDARDS TO BE EMPLOYED

This section describes the engineering standards used in developing the recommendations presented in this SWMP.

Culvert and Pipe Capacity

The capacity analysis distinguishes between surcharged pipes and flooding. By definition, sur-charged pipes lack the capacity to convey the design storm flow and cause water to back up in the system. Flooding will occur when the water backed up by the undersized conveyance system rises

above the local ground surface elevation. The extent and duration of flooding depends on the amount of available storage within the system. Surcharging is noted when it occurs in the modeling, but upgrading the conveyance system was not recommended except in these situations:

- Flooding is indicated by complaints or through modeling
- Surcharging is threatening the integrity of the system
- Increased flows from replacing a pipe/culvert upstream require replacing a downstream facility

Allowable Headwater for Culverts

Headwater depth is defined as the depth at which water backs up behind culverts. Many culverts in Florence are located behind deep roadfills. At these locations, if the culvert is undersized, a substantial amount of water can be detained upstream. If the roadway and adjacent property are not at risk from flooding or erosion, the facilities are not recommended for expansion or replacement. These situations are recognized as increasing water storage in the system. The storage provides downstream benefits, such as smaller peak flows and less erosion. It also allows the use of smaller and less expensive culverts and bridges.

Replacement Pipe/Culvert Parameters

If the open channel located above and below an undersized culvert is wide enough, installation of a parallel culvert is generally considered more desirable than replacement with a larger culvert, due to cost. If the open channel is too narrow to allow this, or if other concerns are present (buried utility lines, maintenance issues), the culvert may need to be replaced with a larger culvert or a bridge. For undersized pipes, only pipe replacement was considered, because utility lines and other sewers surrounding the pipe make it cost prohibitive to run a parallel pipe.

Detention Assumptions

Detention facilities in the Florence area not lined with an impermeable layer were considered to function as infiltration facilities.

Channel Velocities

The risk of water erosion of sandy soils in Florence is relatively small due to the rapid infiltration rate. However, erosion can occur in channels with good vegetative cover and channels without cover with flows in excess of 3 feet per second and 1.5 feet per second, respectively. The rills and fluvial fans found in areas throughout the City provide evidence of the erosive force of water on sandy soils. If erosive forces start to cut down a channel, the sand can be washed away quite rapidly.

CHAPTER 3

REGULATORY OVERVIEW

A number of state and federal regulations will influence or directly determine how the City of Florence (City) manages its surface and storm water collection system. These regulations impact nearly all facets of storm water management, including planning, design, construction, and maintenance activities. It is crucial that the City develops and implements storm water management activities in accordance with state and federal regulations. The purpose of this chapter is to provide a brief overview of the major requirements of the state and federal programs that affect storm water management within the study area. A technical memorandum that provides additional information on the impacts of the regulations is provided as Appendix C.

This chapter is divided into two major sections: general permitting requirements, and Endangered Species Act (ESA) requirements. The general permitting section describes state and federal permitting programs that affect storm water management. The ESA will also affect storm water management within the City, but it has much broader influence that will impact activities throughout all of City government. Therefore, a separate section is included that defines the requirements of ESA legislation and its affect upon the City.

GENERAL PERMITTING REQUIREMENTS

There are three types of permits which will have a direct impact on activities in Florence. They are state and federal "removal and fill" permits, National Pollutant Discharge Elimination System (NPDES) permits for construction activities, and the permits required for infiltration facilities. The purpose of and requirements for the three types of permits are described in the following sections. Other types of permits that may impact the management of the storm water system are defined and explained in Appendix C.

Removal/Fill Permits

Removal/fill permits were developed to protect the state's water resources. Permits are required for certain types of construction activities which involve the removal or fill of materials within "waters of the state". The State of Oregon (State) defines waters of the state as "natural waterways including all tidal and nontidal bays, intermittent streams, constantly flowing streams, lakes, wetlands and other bodies of water in this state, navigable and non-navigable, including that portion of the Pacific Ocean which is in the boundaries of this state". The State's jurisdiction covers any activity that proposes removing or altering 50 cubic yards or more of material within the bed or banks of the waters of the state. The Oregon Division of State Lands (DSL) administers the program for the State.

Federal jurisdiction covers "navigable waters" and includes all removal and fill activities located therein. The federal government's definition of navigable waters is at least as broad as the State's "waters" definition. In addition, the federal permitting program is not limited to activities involving

a specific volume of material, but applies to all removal and fill activities within navigable waters. The United States Army Corps of Engineers (COE) administers the permitting program for the federal government. Many of the public projects undertaken by the City or on behalf of the City, will fall under the requirements of one of the COE's nationwide general permits. These were developed to reduce the permitting effort for both the applicant and the federal reviewing agency while providing the required level of protection to the environment.

A joint state/federal permit application package has been developed by the agencies to help streamline the permitting process. A copy of the permit application package should be prepared and submitted to each agency since each has its own review and approval process. If the application is approved, DSL and the COE will each issue their own permits. Applicants should allow between 60 to 90 days for the permit process.

Many of the proposed projects defined by the Storm Water Master Plan (SWMP) will require removal and fill permits due to the projects' proximity to wetlands or other water bodies. A thorough field investigation by a state-approved wetland delineator should be conducted early in the design phase. Designs should be developed and sized to avoid or minimize impacts to wetlands and water bodies. Field work should be performed at an early stage of the design process to determine if removal and fill permits will be required. This will save time and money.

NPDES Permits

The national storm water permitting program was initiated by the NPDES Phase I requirements promulgated in 1990. Phase I requirements focused on cities greater than 100,000 population, industrial facilities, and construction sites disturbing five acres or more of land. The Phase II requirements, published in December 1999, extended the permitting program to include "small" cities and construction sites that disturb lands from one to five acres in size.

Phase II requirements significantly increase the number of municipalities participating in the permitting program. However, Florence is *not* directly impacted by this latest rulemaking. By EPA definition, small cities are areas with greater than 50,000 residents, and population densities of at least 1,000 people per square mile. Because Florence does not meet the criteria, the City will not require an NPDES permit for municipal storm water discharges at this time. The City could be brought into the permitting program if the Oregon Department of Environmental Quality (DEQ) or the Environmental Protection Agency (EPA) determine that the City's participation would be crucial for maintaining good water quality, or the health of natural resources in the area. The technical memorandum included as Appendix C defines the minimum activities that would be required to comply with the rule.

Construction site NPDES permits will impact both private development and City capital improvement projects. DEQ manages the permitting of construction sites without involving the City. Elements of the permit requirements will be consistent with the proposed new development standards recommended to augment this management plan.

Injection Well Permits

In many areas of the state, and in particular the Florence area, storm water is disposed using methods that allow infiltration into the soil. Federal regulations have been developed to address the pollution potential of this practice. The federal Underground Injection Control (UIC) program is being implemented by the DEQ. The State is currently developing rules for implementing the program that will be submitted to the EPA for approval. Implementation and enforcement of the program is expected to begin in 2001. The rules will effect Class V injection wells defined according to the DEQ as: "1) any bored, drilled or driven shaft; 2) a dug hole whose depth is greater than its largest surface dimension; 3) an improved sinkhole; or 4) a subsurface fluid distribution system (an assemblage of perforated pipes or drain tiles used to distribute fluids below the surface of the ground)."

Existing privately-owned Class V facilities were to have been registered with the state by December 31, 1999. Municipal agencies have until December 31, 2000 to register existing facilities, while new facilities will be expected to apply for DEQ Water Pollution Control Facilities (WPCF) permits. Although wells located in non-sensitive areas will be covered by a general WPCF permit, wells located in sensitive areas will require individual WPCF permits. Sensitive areas include land adjacent to wetlands, sites within 500 feet of domestic and/or public wells, delineated wellhead protection areas, delineated source water areas, sole source aquifers, groundwater management areas, areas adjacent to endangered species spawning grounds, areas adjacent to water quality limited water bodies or water bodies with set total maximum daily loads, flood plains, and DEQ listed cleanup sites. By the definition, most areas within the Urban Growth Boundary (UGB) will be considered sensitive. The individual permits will require: periodic monitoring, sampling and analysis of the discharge; an operation and maintenance plan; a spill contingency plan, and in many instances, pre-treatment requirements.

ENDANGERED SPECIES ACT REQUIREMENTS

The focus of this section is to review how the ESA regulations will impact City's storm water management activities, and to recommend a strategy for complying with the requirements.

ESA Background

The Endangered Species Act was enacted to prevent extinction of certain species of fish, wildlife, and plants that have seen significant declines in their populations within a defined geographic range, or Evolutionarily Significant Unit (ESU). The rules prohibit a "take", which the ESA defines as "harass, harm, pursue, hunt, shoot, wound, trap, capture, or collect, or attempt to engage in any such conduct". The rules go into effect immediately upon listing by the government. The term "harass" is further defined as any intentional or negligent act that creates the likelihood of injuring wildlife by disrupting normal behavior such as breeding, feeding, or sheltering, whereas "harm" is an act that either kills or injures a listed species. By definition, take and harm can include any habitat modification or degradation that significantly impairs the essential behavioral patterns of fish or wildlife.

The National Marine Fisheries Service (NMFS), a section within the National Oceanic and Atmospheric Administration has responsibility for administering the ESA rules as they apply to marine fish species. Freshwater fish and all other animal and plant species are protected by the U.S. Fish and Wildlife Service (USFWS).

The ESA requirements apply to any activity that could result in a take of an endangered species. According to NMFS, "Any government body authorizing an activity that specifically causes take may be found to be in violation of the Section 9 take prohibitions." State and City governments manage a number of activities that could potentially impact, directly or indirectly, endangered species, including:

- Planning and zoning
- Development permitting
- Erosion and sediment control
- Floodplain management
- Water use
- Storm water discharge
- Wastewater discharge
- Road and bridge construction and maintenance
- Pesticide, herbicide, fertilizer, and other chemical use
- Riparian area protection, alteration, or development
- Wetland protection, alteration, or development
- Estuarine shorelands protection, alteration, or development

In addition, NMFS and the USFWS have a policy to identify specific activities considered likely to result in take. As indicated in the Federal Register "Notice of Threatened Status for Two ESUs of Steelhead in Washington and Oregon" (64 FR 14517), such activities include, but are not limited to:

1. Destroying or altering the habitat of listed salmonids (through activities such as removal of large woody debris or riparian shade canopy, dredging, discharge of fill material, draining, ditching, diverting, blocking, or altering stream channels or surface or ground water flow).

2. Discharging or dumping toxic chemicals or other pollutants into waters or riparian areas supporting listed salmonids.

3. Violating federal or state Clean Water Act discharge permits.

4. Applying pesticides and herbicides in a manner that adversely affects the biological requirements of the species.

5. Introducing non-native species likely to prey on listed salmonid species or to displace them from their habitat.

ESA Enforcement

Enforcement of ESA rules will be by NMFS under Section 9 of ESA. Also, third parties may bring suit under Section 9 against the entity or person alleged to have committed a take. A take permit or a 4(d) take limit is not required if a take does not occur. However, an entity or person will be at risk of violating the rules unless a certainty of compliance is provided as offered under Section 4(d), Section 10 or the federal nexus.

Listed Wildlife and Plants

Four marine fish species have been listed for the Oregon coast from just north of Gold Beach to Astoria, and inland to the coastal range divide. Listings define the status of the species as being one of the following: endangered, threatened, or not warranted. Endangered is defined as, "in danger of extinction throughout all or a significant portion of its range", while threatened means, "likely to become endangered within the foreseeable future throughout all or a significant portion of its range." The candidate classification means the ESA listing status has not yet been determined. The four listed fish species, include:

- Coho Salmon: Threatened
- Cutthroat Trout: Candidate
- Steelhead: Candidate
- Chinook Salmon Not warranted

The USFWS has listed 28 species of plants and animals as endangered or threatened. According to the Oregon Natural Heritage Program records, none of these have been identified in the Florence area. Regardless, the determination of whether or not any of the listed species is present in the Florence area will be a responsibility of the owner/developer of the land. In addition, listings can change; therefore, it is imperative that the owner/developer of a property determine the applicable listings at the time of the proposed activity.

Complying with ESA

The final rules defining NMFS' requirements for conserving the listed steelhead and salmonid ESUs were adopted by NMFS in June 2000, and published in the *Federal Register* on July 10, 2000 (50CFR Part 223). The discussion presented in this document is based on the final rules and on information gathered through discussions with NMFS and others involved in the 4(d) exemption process. In general, three approaches are available to municipalities for complying with the proposed rules: federal nexus, development of a Habitat Conservation Plan (HCP), or qualification for a 4(d) exemption. These options are described in more detail below.

The final 4(d) rules for the different ESUs have different effective dates. The effective date for the steelhead ESU is September 8, 2000. The effective date for the salmon ESUs is January 8, 2001.

Federal Nexus. Activities requiring federal permits (Section 10/404 permits) or projects funded by federal monies require federal agency review and approval. The COE will consult with NMFS or USFWS, as appropriate, through an ESA Section 7 consultation when the project is

located within the geographic range of a listed species. Federal approval of the project provides a mechanism for limiting the local jurisdiction's exposure to the take provisions.

HCP. Section 10 of the ESA identifies a process that could result in the issuance of an Incidental Take Permit (ITP). The permit would authorize the incidental take of a listed species, but not authorize the activities that result in take. The value of the ITP is that it provides long-term coverage even if the rules are changed in the future.

To be considered for an ITP, an HCP must be prepared and submitted to either NMFS or USFWS, depending on the listed species. The HCP planning process helps ensure that any potential incidental take would be minimized and mitigated. The HCP process includes an assessment of a specified habitat and the identification of activities required to protect and restore that habitat. Most HCPs approved to date have been for projects that would impact less than 1,000 acres. However, the HCP process is evolving, such that it may be possible to use the HCP approach to provide coverage for broad-based planning and follow-on field and construction activities, while achieving the desired long-term biological and regulatory goals.

The applicant must decide whether to pursue an ITP. While service personnel provide detailed guidance and technical assistance throughout the process, the applicant drives the development of an HCP. The applicant is responsible for submitting a completed permit application, the necessary components of which include: a standard application form, an HCP, an implementation agreement (if required), and, if appropriate, a draft National Environmental Policy Act (NEPA) analysis.

4(d) Exemption

For species listed as threatened, Section 4(d) of the ESA provides that the appropriate service issue regulations deemed "necessary and advisable to provide for the conservation of the species." NMFS issued the proposed 4(d) rules for Oregon coast Coho among with other species in the January 3, 2000 Federal Register. Following public hearings and a public comment period, the final rule adopted in June 2000.

Limits have been established on the take prohibition for certain programs that NMFS has deemed adequate to help conserve the listed species. A 4(d) exemption may be used to allow certain activities to proceed without the additional protection of the federal "take" prohibitions if NMFS finds that the activities are adequately protective of the species. Thus, a local government can apply for a 4(d) limitation to the take prohibitions and once granted, individual activities to implement the plan would be exempt from the take rule. Activities would still need to be implemented in a way that minimizes impact; e.g., timing an activity to not affect spawning or passage during migration. The proposed 4(d) rule lists 13 activities or programs that NMFS considers protective enough to warrant an exception or a limit to the basic rule. These are listed as follows:

1. Activities conducted in accordance with ESA incidental take authorization under Section 10 or Section 7 of ESA.

2. Scientific research activities for a period of up to six months after final rule.

3. Emergency actions to rescue or salvage listed salmonids.

4. Approved fishery management activities.

5. Approved hatchery and genetic management programs.

6. Joint tribal/state resource management plans for tribal treaty fishing activities.

7. Approved state scientific research activities.

8. State, local and private habitat restoration activities as approved by NMFS.

9. Screened water diversion devices meeting NPFS criteria.

10. Road maintenance activities in Oregon conducted in accordance with Oregon Department of Transportation's (ODOT) Road Maintenance Guide.

11. City of Portland park activities in compliance with the Integrated Management Plan.

12. Certain development activities within urban areas meeting a "12-step" integrated urban development plan as approved by NMFS.

13. Forest management activities in Washington.

Several public agencies are negotiating with NMFS to define the programs that would be required to provide eligibility for the 4(d) exemption. For example as cited above, the City of Portland, Oregon, Parks and Recreation Department has received approval of its integrated pest management program, as has the road maintenance plan developed by ODOT. The goal of the City of Portland program is to reduce the use of herbicides and pesticides in routine park maintenance. Other agencies are working to develop programs that they hope will be accepted by NMFS.

In the Portland metropolitan area, the regional government Metro is working to develop an exception or limitation for development occurring within the area's Urban Growth Boundary. Metro is preparing an Urban Growth Management Functional Plan that will define plans and development activities for complying with ESA listings of salmon and steelhead. If approved by NMFS, take prohibitions will not apply to municipal, residential, commercial, and industrial development and redevelopment (MRCI) within the Metro regional area. NMFS will consider the following 12 evaluation criteria when evaluating if proposed MRCI development ordinances or plans adequately conserve the listed species:

1. Avoid inappropriate areas such as steep slopes, wetlands, and areas of high habitat value.

2. Avoid impacts to stream water quality and quantity, and maintain the historic hydrograph, including peak and base flows.

3. Require minimum width riparian buffers around all wetlands and streams.

4. Avoid stream crossings by roads, utilities, and other linear development.

5. Protect historic stream meander patterns, flood plains and channel migration zones.

6. Protect wetlands and wetland functions.

7. Preserve the hydrologic capacity of all intermittent and perennial streams to pass peak flows.

8. Landscape to reduce need for watering and application of herbicides, pesticides and fertilizer.

9. Prevent erosion and sediment runoff during and after construction to prevent discharge of sediment.

10. Assure that water supply demands for new development can be met without impacting flows needed for threatened salmonids.

11. Provide necessary enforcement, funding, and reporting to manage the plan.

12. Comply with all other state and federal environmental or natural resource laws.

While the Metro plan has not yet been approved by NMFS, the broad range of topics included in the plan provides insight to NMFS's expectations. All other cities and public agencies should expect that they will have to submit a comparable plan for NMFS approval.

Other agencies that are attempting to develop broad-based programs acceptable to NMFS include a joint effort by King, Pierce, and Snohomish counties in Washington. While progress has been made in defining a complete 4(d) exemption, the program has not yet been approved. While much of the Washington tri-county effort has been spent negotiating an agreement with NMFS that would be acceptable to the jurisdictions, there is still no indication as to whether NMFS will adopt any or all of the tri-county recommendations. As a result, prudent planning would stress program development consistent with the components described in the July 10, 2000 rule.

NMFS recommends a "plug and play" approach to meeting the 4(d) requirements. Jurisdictions would produce plans to be reviewed by NMFS. If approved, the plans would be published in the Federal Register and be available for others to adopt. While adoption in this manner would save new applicants considerable time and effort in developing compliance plan, the plan must still be "tailored" to meet the specific needs of the listed species within the applicant's jurisdiction. NMFS must review and approve the modified plan before it can provide protection against take.

While there is currently no prototype format for a storm water management plan to serve as a 4(d) limitation on the take prohibitions, NMFS is requesting cities meet with them to discuss ways in which their program can serve as an application for a 4(d) limitation on the take prohibitions. Other than applicable Section 7 consultation requirements, NMFS does not have authority to require review of a city's storm water management plan. However, receiving a limit on the take prohibitions under section 4(d) would provide legal assurance to the city that it would not be subject to a NMFS enforcement action or a third-party lawsuit.

Recommended Strategy

The City should perform a "gap analysis" to determine if, and where, the City may have exposure under the ESA rules. The scope and nature of follow-on activities would be based on the results of the gap analysis.

Where exposure is defined, the City should pursue the plug and play approach identified by NMFS to gain the 4(d) exemption. This approach will provide a certainty of compliance, while not requiring the level of City effort and cost that would be required to prepare a HCP. Projects that fall under the federal nexus would be covered through the federal permitting process.

A disadvantage of the plug and play approach is that the required plans have not been developed or approved by NMFS. The City should adopt the plug and play plans as they become available and if they are applicable to the area; however, the City would be exposed to liability if the plans are not made available in a timely manner. The City should coordinate with Lane County Council of Governments to see if coverage under a cooperative plan would be a possibility.

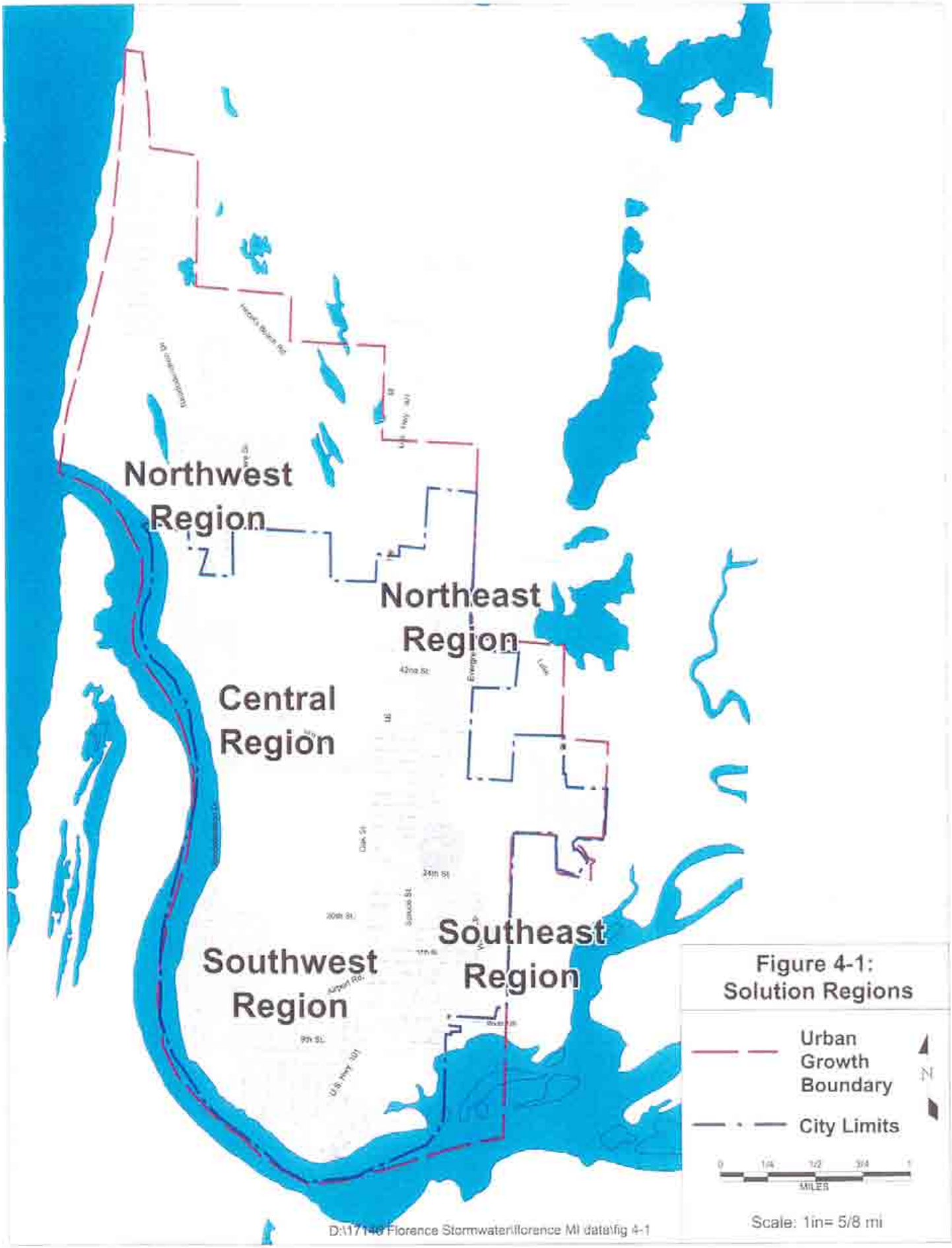


Figure 4-1: Solution Regions

CHAPTER 4

ANALYSIS RESULTS

This chapter presents the results of the analysis process, including a summary of the public information developed during the involvement process, the hydrologic and hydraulic modeling output, and the groundwater modeling findings. Chapter 5 presents the recommendations made to address the deficiencies identified during the analysis process.

REGION BY REGION SUMMARY

The Florence study area was divided into five regions for public presentation purposes. The regions are referred to by geographic location: Northwest, Northeast, Central, Southwest, and Southeast, as shown in Figure 4-1. For consistency, the same regions are used in discussing the results of the analysis in this chapter and the recommendations in Chapter 5. The regions may include portions of one or more of the hydrologically defined drainage basins presented in Chapter 2.

Problems reported by the public and City staff are presented for each region. The reported problems are derived from verbal and written input from the public, as detailed in Appendix A. City staff and Lane County personnel noted additional problems. Existing reports were examined and the applicable information was used in this study.

The surface water modeling and groundwater modeling were conducted as reported in Chapter 2. A complete listing of the hydrologic and hydraulic modeling results is provided at the end of this chapter for each of the modeled elements in the conveyance system. In addition, an oversized map at the end of this chapter, Figure 4-6, shows the modeled surface water elements and identified problem areas. An explanation of the overall groundwater modeling results follows the regional discussions.

Northwest Region

The Northwest Region lies outside the Florence city limits. It is made up of largely residential neighborhoods south of Heceta Beach Road. The region is characterized by small, rolling dunes that end in steep bluffs overlooking the North Jetty Recreation Area and Heceta Beach. Storm water runoff flows generally east to west in this area.

Natural resources of the region include a large number of wetlands. Most wetlands are found in depressions between the dunes that lie at or below the usual surface of the groundwater table. Many of the wetlands are obvious to the untrained eye and tend to be deep with open water. Shallow wetlands tend to be forested and are often not obvious.

Native vegetation in the area is mainly shore pine, Sitka spruce, salal, evergreen huckleberry, and Pacific rhododendron. In areas exposed to the ocean, high winds limit the size of trees.

Reported Problems

Problems reported in the Northwest Region mostly involve localized flooding of low-lying areas between the dunes. Gullsettle Court and Sandrift Street are low areas along the eastern edge of the Idylewood development, as shown in Figure 4-6. For years, flooding has been reported from this area. During the wetter than average winter of 1981, the intersection of Oceana Drive and Sandrift Street was under 2 feet of water.

Recently, the return to a wet climatic cycle and construction of new homes in low areas have increased the number of flooding complaints. During the past several years, local residents have pumped water out of their neighborhood to keep streets passable and prevent homes from flooding. Unfortunately, the pumped water has allegedly caused problems in neighborhoods surrounding Gullsettle Court and Sandrift Street. In response to this, residents along Saltaire Street at the west end of Sandrift Street have created a small, concrete-lined channel to convey the flow. The channel feeds into an existing 12-inch-diameter pipe running to the west between Seapine Drive and Saltaire Street. The pipe terminates at a short segment of roadside ditch along Rhododendron Drive, where it is joined by another 12-inch culvert running along Rhododendron Drive. The ditch runs to the south about 20 feet and appears to have experienced some erosion. Flows then enter a 12-inch corrugated metal pipe culvert running west under Rhododendron. This culvert appears to be in poor condition, and there is no obvious discharge point from the limited length of ditch along North Jetty Road.

Modeling Results

The storm water and groundwater modeling did not show storm water runoff or a high groundwater table to be a problem in the Idylewood development. However, since the neighborhood lies at a low elevation in relation to the lakes to the east, it is possible that seepage through the intervening sand dunes when lake levels are high is responsible for the flooding. Flooding at the lowest elevation in the area, Gullsettle Court, will continue to be a problem during years with high lake levels.

A number of areas in this region do not have clearly defined drainage paths, or they drain directly to the Pacific Ocean or Siuslaw River. Examples include the Driftwood Shores and Heceta South areas. Runoff quantities from the areas were calculated, but the absence of a defined conveyance system precluded the need for a hydraulic model. As a result, no conveyance facilities were evaluated.

Northeast Region

The Northeast Region covers an area extending from north of Munsel Lake Road to south of Florentine Estates to about 32nd Street, and from the ridge just to the west of Highway 101 to Munsel Creek to the east. The area contains commercial development along Highway 101 from 42nd Street north to Heceta Beach Road, the Florentine Estates residential development, an auto salvage yard north of Munsel Lake Road, and undeveloped property north of the salvage yard and west of Florentine Estates.

The property along Highway 101 drains into roadside ditches, where most of the water infiltrates before it can leave the basin. If large enough flows occur, the topography of the area would direct flow southeast toward Munsel Creek.

Most of the area north of Munsel Lake Road drains to the southwest, where it enters the northwest corner of Florentine Estates. It flows through a combination of ponds and pipes through the Florentine Estates development and joins Munsel Creek near 45th Court.

Natural resources of the northeast region include Munsel Lake, Munsel Creek, wetlands, and undeveloped upland areas. Munsel Lake covers over 100 acres, and is deeper than most coastal lakes with depths reaching more than 70 feet. The lake is used for recreation, including fishing for trout and warm-water gamefish. Munsel Creek provides good riparian habitat, especially in undeveloped areas such as Greenway Park.

Native vegetation in the area is mainly shore pine, scattered Sitka spruce, Pacific rhododendron, salal, and evergreen huckleberry. The soil surface in undeveloped areas is covered with a thin mat of grass, sedges, needles, and twigs.

Reported Problems. Reported problems include extensive flooding of streets throughout the western third of Florentine Estates, as shown in Figure 4-6. There are also citizen concerns about the impact of storm water infiltration from commercial properties along Highway 101. The concern focuses on the potential for degradation of the aquifer from pollutants discharged from commercial areas.

Modeling Results. Modeling did not show groundwater to be a major factor within Florentine Estates, although extensive areas of high groundwater are located to the north and to the south. The ponds and wetlands resulting from the high groundwater to the north of Munsel Lake Road overflow into Florentine Estates during large storm events. Modeling indicates that the existing conveyance system through Florentine Estates is undersized for the 25-year storm. This causes flooding along streets from the small pond in the northwest corner of Florentine Estates through the twin 18-inch-diameter pipes running along the west edge, to the pond at the junction with Munsel Creek, as shown in Table 4-1.

Table 4-1. Northeast Region Pipes Identified as Undersized

Name	Location	Existing capacity (cfs)	Present flow (cfs)				Future flow (cfs)			
			2	10	25	100	2	10	25	100
MUN330L	Florentine Estates	3.5	**4.6**	**5.9**	**6.7**	**7.7**	**8.0**	**8.9**	**8.9**	**8.9**
MUN350L	Sherwood Loop to 45th Ct.	6.1	4.6	5.9	**6.7**	**7.7**	**8.0**	**8.9**	**8.9**	**8.9**
MUN410L	Spruce St. to Munsel Creek	23.0	6.7	9.0	10.2	12.1	20.0	**26.0**	**28.5**	**29.5**
MUN420L	Spruce St. from 40th St.	24.0	6.8	9.0	10.2	12.1	19.9	**26.0**	**28.5**	**29.5**

Note: Numbers shown in bold font indicate flows exceed the capacity of the existing conveyance system.

Modeling also revealed that culverts along Spruce Street south of Florentine Estates may be slightly undersized under future conditions, due to reported negative pipe slopes (the end-to-end slope of the pipe is in the wrong direction) and increases in commercial development along Highway 101. The existing culverts are 36-inch diameter and should be increased to 42-inch diameter culverts in order to pass the 25-year future flows without surcharging. See Figure 4-6 for location of undersized facilities.

Central Region

The Central Region extends from 32nd Street to approximately the city limits to the north and is bounded to the east by the ridge of dunes just west of Highway 101. The region contains large expanses of undeveloped property to the north (most of it publicly owned), a golf course to the south and east, and partially developed, single-family residential development to the south and west. Surface water flows are generally from the northeast to southwest in this area, in part through a chain of lakes located south of Heceta Beach Road. In addition, a culvert under Highway 101 near Heceta Beach Road adds some flows from east of the highway.

Native vegetation in the area includes shore pine, Sitka spruce, salal, Pacific rhododendron, evergreen huckleberry, and a limited amount of Douglas fir and western hemlock in areas sheltered from high winds. Many of the dunes in the area have been planted with beach grass, which stabilizes the sand. Scotch broom has become established near Mariners Village. This European native is an ornamental shrub that likes sun, tolerates drought, and fixes nitrogen. It is considered invasive and can outcompete native vegetation in disturbed areas.

Reported Problems. Problems reported in the Central Region include flooding in Mariners Village, the Sandpines Golf Course area, and along portions of Royal Saint Georges Drive, as shown in Figure 4-6. There are also concerns about the potential groundwater effects on erosion along the bluffs overlooking the Siuslaw River to the west in the Shelter Cove and Sea Watch developments.

A number of investigations have shown that erosion has been occurring for decades at the river bluff. The investigations have concluded that erosion is causing a variety of factors, including runoff at the top of the bluff, wave action at the base of the bluff, and groundwater seepage. The rate seems to vary over time, but no clear cause has emerged that allows prediction of erosion rates.

Modeling Results. Investigation and modeling indicated that an old powerline service road through a relatively flat area to the northeast conveys excess runoff to Mariners Village. Mariners Village has constructed an internal drainage system to carry flows from the northeast corner of the development to a retention facility in the southern corner of the development. The arrangement is a temporary one and has no defined outlet from the pond.

The Sandpines Golf Course receives surface water flows from the northeast. Two large ponds have been constructed on the golf course which provide some detention. Some of the flow across the golf course is routed to the east end of Royal Saint Georges Drive, then south to a culvert and ditch system connecting with Rhododendron Creek. The remainder of the flow travels through a ditch along the west edge of the Sandpines Golf Course property to an area behind the houses along Siano Loop. At that point, the flow enters a long culvert that runs southwest, then northwest to

connect to a deep ravine leading to the Siuslaw River. The problems in the area of the golf course include general flooding on the course, and water flowing through properties along Royal Saint Georges Drive.

A number of previous studies have focused on the erosion occurring along the Siuslaw River. This study did not attempt to replicate that work. Due to the concerns of local residents, however, additional infiltration was not considered as a viable alternative for the Central Region.

The modeling also indicated the presence of several surcharged pipes along Oak Street between 25th and 20th Streets. The undersized pipes are listed in Table 4-2.

Table 4-2. Central Region Pipes Identified as Undersized

Name	Location	Existing capacity (cfs)	Present flow (cfs)				Future flow (cfs)			
			2	10	25	100	2	10	25	100
CEN510L	Oak Street from 36th St. to 35th St.	4.6	**8.5**	**9.1**	**9.1**	**9.1**	**8.5**	**9.1**	**9.1**	**9.1**
NRW005L	Rhododendron Dr. to Siuslaw River	25.0	**35.3**	**35.3**	**35.3**	**35.3**	**35.3**	**35.3**	**35.3**	**35.3**
NRW030L	35th Street between Wecoma and Siano	21.0	**29.5**	**29.5**	**29.5**	**29.5**	**29.5**	**29.5**	**29.5**	**29.5**

Note: Numbers shown in bold font indicate flows exceed the capacity of the existing conveyance system.

Southwest Region

The Southwest Region stretches from 32nd Street to the north, to the Siuslaw River to the south and west, and to Highway 101 to the east. It includes the Florence Airport and the Greentrees development. The central portion of this study area drains directly to a ditch that runs south between the airport and the Greentrees development with approximately 700 feet of the ditch in an easement with Greentrees. The ditch continues south of 9th Street past the Florence Wastewater Treatment Plant to the Siuslaw River. The other major drainage system in this region is a series of pipes that run along Kingwood Street, cross the airport south of the runway, reemerge as a channel running south from the runway, and then are piped along 9th Street to the drainage ditch south of the Greentrees development. The Greentrees development lacks an internal drainage system.

Native vegetation in the Southwest Region is mainly shore pine, scattered Sitka spruce, Pacific rhododendron, salal, and evergreen huckleberry. The soil surface in undeveloped areas is covered with a thin mat of grass, sedges, needles, and twigs.

Reported Problems. Reported problems include flooding along Kingwood Street, flooding at a pipe/bubbler link south of the runway, and flooded property and roads in the Greentrees development, as shown in Figure 4-6. Although residents feel most of the latter problems result from the lack of an internal drainage system within the Greentrees development, there have been some complaints about the runoff entering into the Greentrees development from an adjoining, undeveloped property to the east. A few roads in the downtown area also undergo flooding, notably near the Public Library.

Modeling Results. The modeling results showed undersized pipes along Kingwood and Oak Streets. It confirmed that the pipe/bubbler link south of the airport runway is a source of problems. Modeling was not done on smaller downtown pipes, such as those by the library, but larger pipes in the area appeared to be surcharging.

Surcharging along Kingwood Street results from water backing up in a relatively flat section of pipe (CEN230) south of Airport Road. Flat pipes cannot pass the same amount of water as pipes with a steeper slope such as those just upstream; therefore, water backs up. Although the pipes are surcharging, surface flooding does not appear to be a significant issue.

Along Oak Street, the model showed that surcharging occurs from 29th to 21st Streets during storms, but the undersized pipes do not appear to be causing flooding problems.

Subsequent to the modeling the City replaced the pipe/bubbler line south of the airport runway with a larger pipe section. No further action is recommended at this location.

Modeling indicated a number of surcharged pipes in the downtown system. These included pipes along Hemlock Street between 1st and 6th Streets (DTN20L, DTN30L, DTN40L), and along 6th Street between Kingwood and Maple Streets (DTN90L and DTN100L). The larger pipes appeared to surcharge even during the 10-year storm, and smaller tributary pipes have been reported as causing flooding problems; however, the smaller pipes were not modeled. The undersized pipes for the Southwest Region are listed in Table 4-3.

Table 4-3. Southwest Regional Pipes Identified as Undersized

Name	Location	Existing capacity (cfs)	Present flow (cfs)				Future flow (cfs)			
			2	10	25	100	2	10	25	100
CEN040L	Pipe under 9th St.	82.0	69.0	**85.8**	**94.4**	**108.0**	76.4	**93.4**	**105.0**	**119.0**
CEN080L	N Kingwood St.	30.0	22.2	28.3	**31.2**	**35.4**	25.8	**32.9**	**36.4**	**41.5**
CEN230L	SE Airport Rd.	10.0	**15.0**	**15.7**	**16.0**	**16.4**	**15.0**	**15.7**	**16.0**	**16.4**
CEN250L	Intersection Kingwood St. and Airport Rd.	12.0	**15.0**	**15.7**	**16.0**	**16.4**	**15.0**	**15.7**	**16.0**	**16.4**
CEN260L	Kingwood St. from 17th Pl. to Airport Rd	9.5	8.5	**10.8**	**10.6**	**10.3**	8.5	**10.8**	**10.6**	**10.3**
CEN270L	Airport Wy. from 18th St. to 17th Pl.	9.8	8.4	**11.0**	**12.5**	**14.6**	8.4	**11.0**	**12.5**	**14.6**
CEN290L	N of Airport	7.6	**11.7**	**14.2**	**16.0**	**18.1**	**11.6**	**14.4**	**15.8**	**18.3**
CEN310L	N of Airport	5.9	**12.4**	**15.0**	**16.1**	**18.1**	**11.9**	**14.4**	**15.6**	**18.1**
CEN340L	Oak St. from 21st St. to midblock	15.0	10.9	14.2	**16.0**	**18.8**	10.9	14.2	**16.0**	**18.8**
CEN380L	Oak St. from N of 23rd St. to 23rd St.	14.0	10.9	**14.2**	**16.0**	**18.8**	10.9	**14.3**	**16.1**	**18.9**
CEN390L	Oak St. from midblock to N of 23rd St.	14.0	10.9	**14.2**	**16.0**	**18.8**	10.9	**14.3**	**16.1**	**18.9**
CEN400L	Oak St. from 25th St. to midblock	15.0	10.9	14.2	**16.1**	**18.8**	10.9	14.3	**16.1**	**18.9**

Table 4-3. Southwest Regional Pipes Identified as Undersized (continued)

Name	Location	Existing capacity (cfs)	Present flow (cfs)				Future flow (cfs)			
			2	10	25	100	2	10	25	100
DTN020L	Hemlock St. from 4th St. to 1st St.	15.0	**16.9**	**19.0**	**19.3**	**19.7**	**18.5**	**19.5**	**19.7**	**20.0**
DTN030L	Hemlock St. from Rhododendron to 4th	14.0	**15.4**	**17.1**	**17.1**	**17.6**	**16.9**	**17.6**	**16.9**	**17.6**
DTN040L	Hemlock St. from 6th St. to Rhododendron	12.0	**15.3**	**17.2**	**17.1**	**17.5**	**16.9**	**17.6**	**17.6**	**17.6**
DTN090L	6th St. from Laurel St. to Kingwood St.	6.5	6.5	**9.1**	**9.2**	**9.9**	**7.8**	**11.0**	**10.9**	**10.5**
DTN100L	6th St. from Maple St. to Laurel St.	8.1	6.5	**8.5**	**9.3**	**9.8**	7.82	**9.1**	**9.6**	**9.2**

Note: Numbers shown in bold font indicate flows exceed the capacity of the existing conveyance system.

Southeast Region

The Southeast Region lies between 32nd Street to the north, the Siuslaw River to the south, Highway 101 to the west, and the hills to the east. Munsel Creek is its most defining feature, along with the large wetland area between the hills and the creek. The wetland has formed in a deflation plain, where the sand was scoured away by the wind. There is no natural drainage outlet for the area.

Native vegetation in the area is mainly shore pine, scattered Sitka spruce, Pacific rhododendron, salal, and evergreen huckleberry. The soil surface in undeveloped areas is covered with a thin mat of grass, sedges, needles, and twigs. Many of the young shore pines to the north of the delineated wetland areas became established during the relatively dry 1980s, and will probably not survive the current wet cycle and elevated groundwater table.

Reported Problems. Local residents and City staff have reported flooding problems on streets and around home foundations in low-lying areas next to the wetlands, as shown in Figure 4-6. The problems are widespread and often persist for weeks at a time.

Modeling Results. Modeling confirmed that a high groundwater table exists in the area. During the past several years, the water table has been exceptionally high, exacerbating the flooding problem. Lowering surface water elevations to more normal levels should solve most of the reported problems.

Modeling also indicated that the Siuslaw River causes about 3 feet of water to back up Munsel Creek. This extends as far as 10th Street, but the surcharging occurs only at the culvert under State Highway 126. Table 4-4 lists undersized pipes for the Southeast Region.

Table 4-4. Southeast Region Pipes Identified as Undersized

Name	Location	Existing capacity (cfs)	Present flow (cfs)				Future flow (cfs)			
			2	10	25	100	2	10	25	100
MUN020L	Highway 126	1.9	**27.9**	**33.5**	**38.5**	**43.8**	**33.8**	**41.9**	**43.6**	**44**

Note: Numbers shown in bold font indicate flows exceed the capacity of the existing conveyance system.

GROUNDWATER MODELING

The modeling used to predict groundwater elevations for dry, average and wet scenarios is shown in Table 4-5.

Table 4-5. Annual Rainfall Scenarios

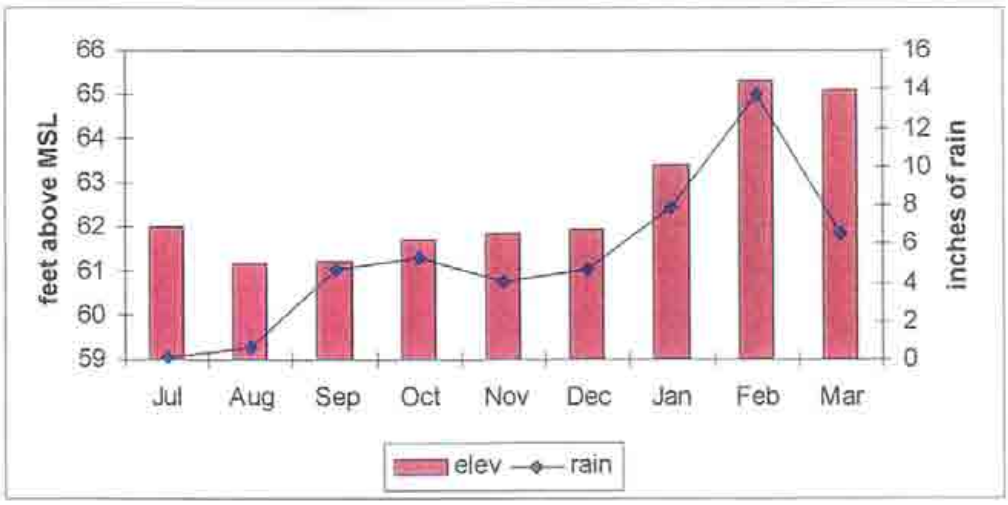
Type of year	Example	Rainfall (inches)
Dry	1988	47
Average	1987	69
Wet	1996	122

The results of the modeling are shown as Figures 4-2 through 4-4. The groundwater elevation increased by roughly 15 feet between dry and average years and between average and wet years. By superimposing groundwater elevations with maps of ground contours, the results showed that during dry years, very few areas contained emergent groundwater, manifested as lakes or wetlands. A moderate number of these areas are present during years of average rainfall. During wet years, such as 1996-1998 or the early 1980s, large areas of Florence undergo flooding from the high groundwater table.

Plotting monthly groundwater elevations during the modeled time period, July 1996 through March 1997, showed that the month with the highest groundwater elevation was February, which is also when the most rain fell, as shown in Figure 4-5. Groundwater elevations in March were almost as high, even though the rainfall volume was substantially less. July showed relatively high groundwater levels, even though rainfall was almost nonexistent. Although rainfall increased sharply in September, the effect on groundwater was not seen for several more months.

Groundwater elevations are affected by rainfall. The relationship between rainfall volume, groundwater elevations, and the extent and duration of flooding in the area can be explained by the rate at which water moves through the soil. Water moves both horizontally and vertically through the soil at a significantly lower rate than water movement on the ground surface. As a result, groundwater conditions always lag behind the rainfall events to the extent that single rainfall events have little effect on the groundwater elevations. Instead, rainfall volume that is accumulated over the course of months or years affects groundwater elevations. For this reason, the flooding due to high groundwater conditions in Florence lasts for extended periods of time, unlike the flooding associated with undersize pipes or culverts. It also indicates that groundwater solutions need to be designed based on the long-term conditions.

Figure 4-5. Monthly Groundwater Elevations



HYDROLOGIC AND HYDRAULIC MODELING FINDINGS

The results of the hydrologic and hydraulic modeling of the surface storm water system are shown in Table 4-6. The model segments identified in the table correspond to the elements shown in Figure 4-6. The results are shown for existing (present) and future conditions for the full range of design storms (2-, 10-, 25-, and 100-year return events).

EROSIVE VELOCITIES IN CHANNELS

The flow velocities in open channels were compared to the criteria listed in Chapter 2 to determine areas of potential erosion. Only five modeled segments exceeded 3 feet per second. Four of the segments, MUN060L, MUN110L, MUN120L, and MUN190L, along Munsel Creek had velocities between 3 and 4.5 feet per second during the 2 year storm. This is probably not enough to warrant further action at this point. The fifth segment, NWR015L, is the section of Rhododendron Creek downstream of Skookum Drive. The velocity here was reported as 6.7 feet per second and the area should be inspected to see if bank stabilization measures are needed. Table 4-7 lists channel velocities for the 2-year storm for both the existing and future flow scenarios.

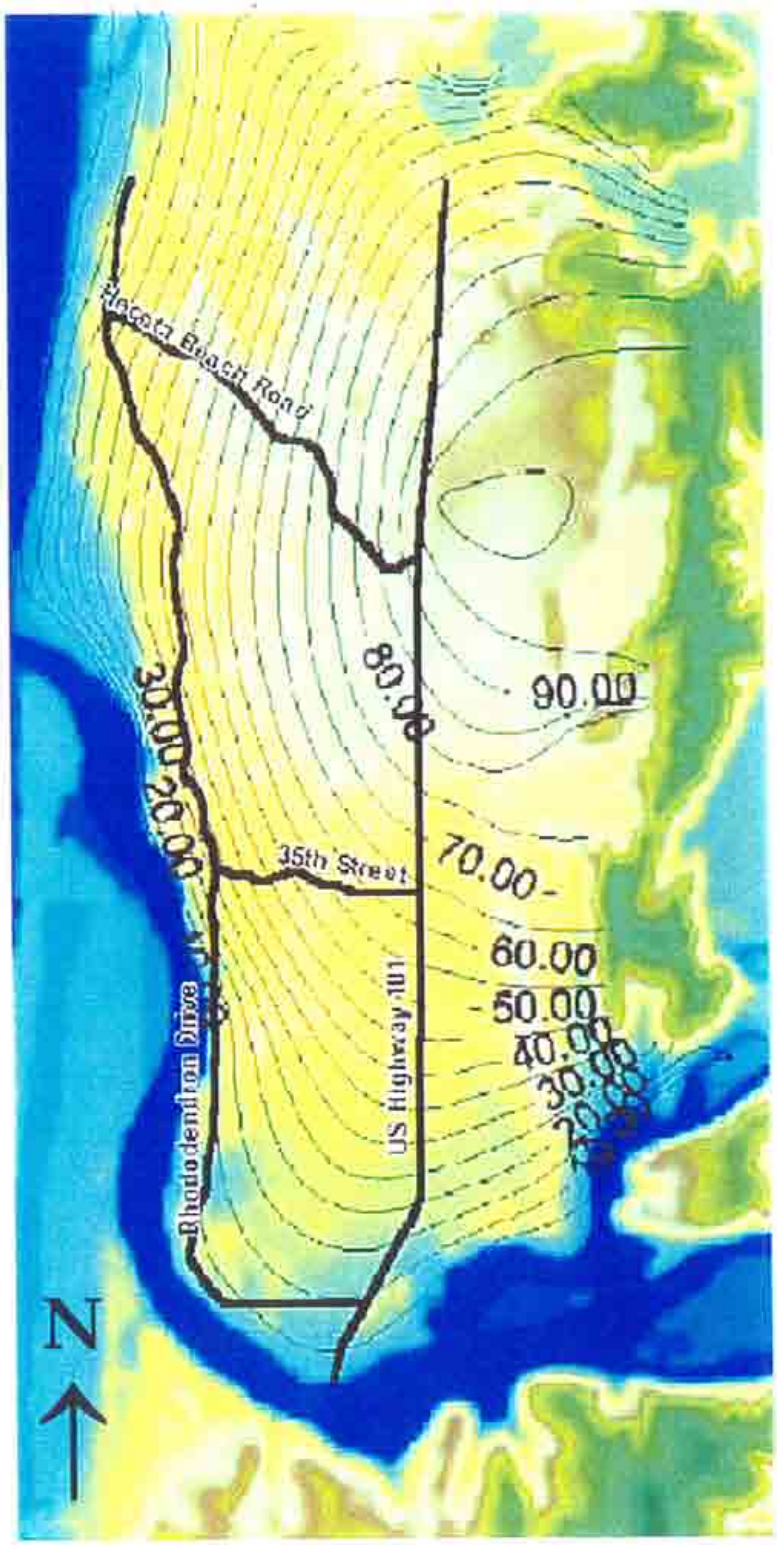


Figure 4-2. Groundwater Elevation, Dry Year

Note: Water elevations shown are above mean sea level.

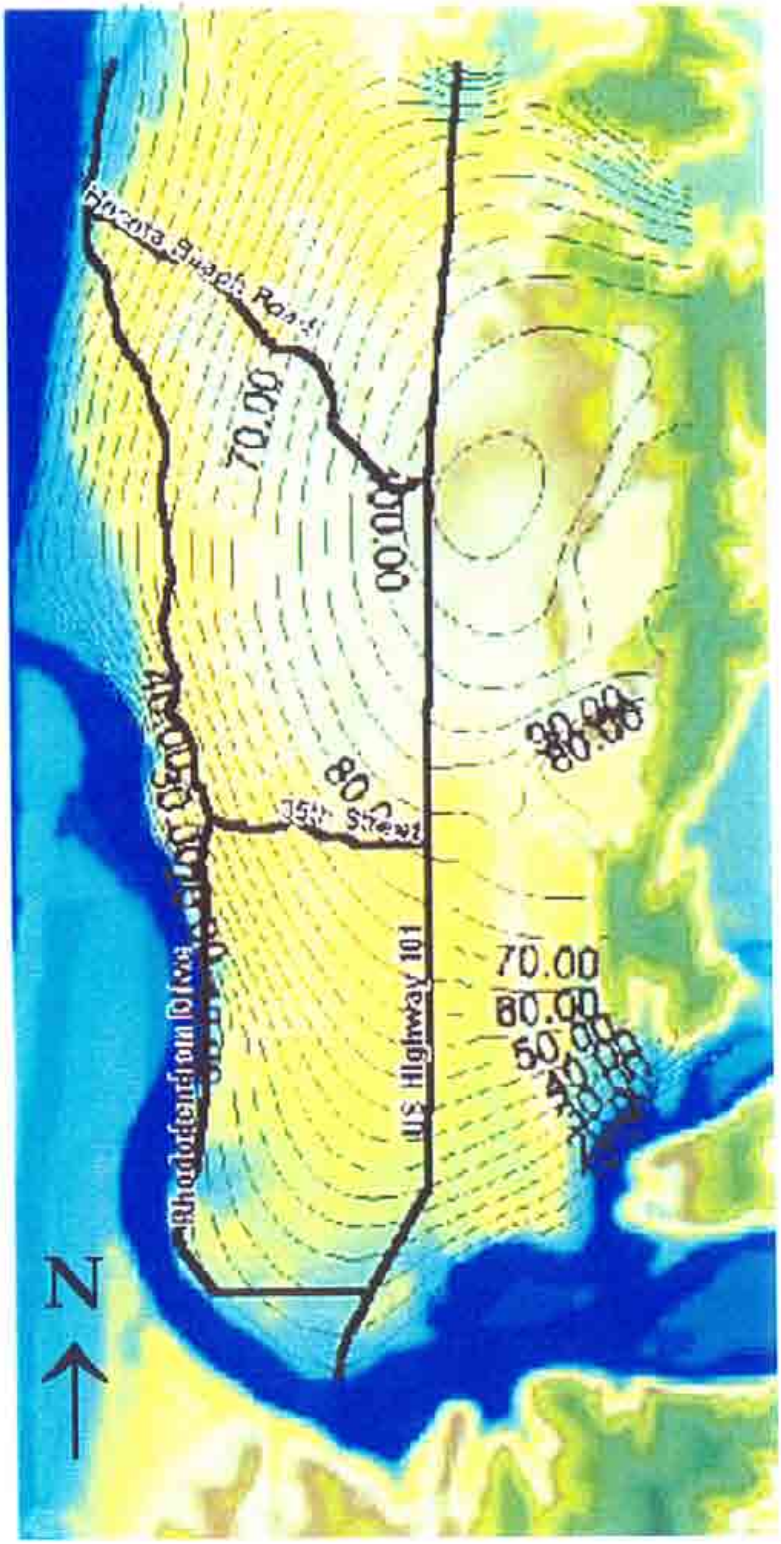


Figure 4-3. Groundwater Elevation, Normal Year

Note: Water elevations shown are above mean sea level.

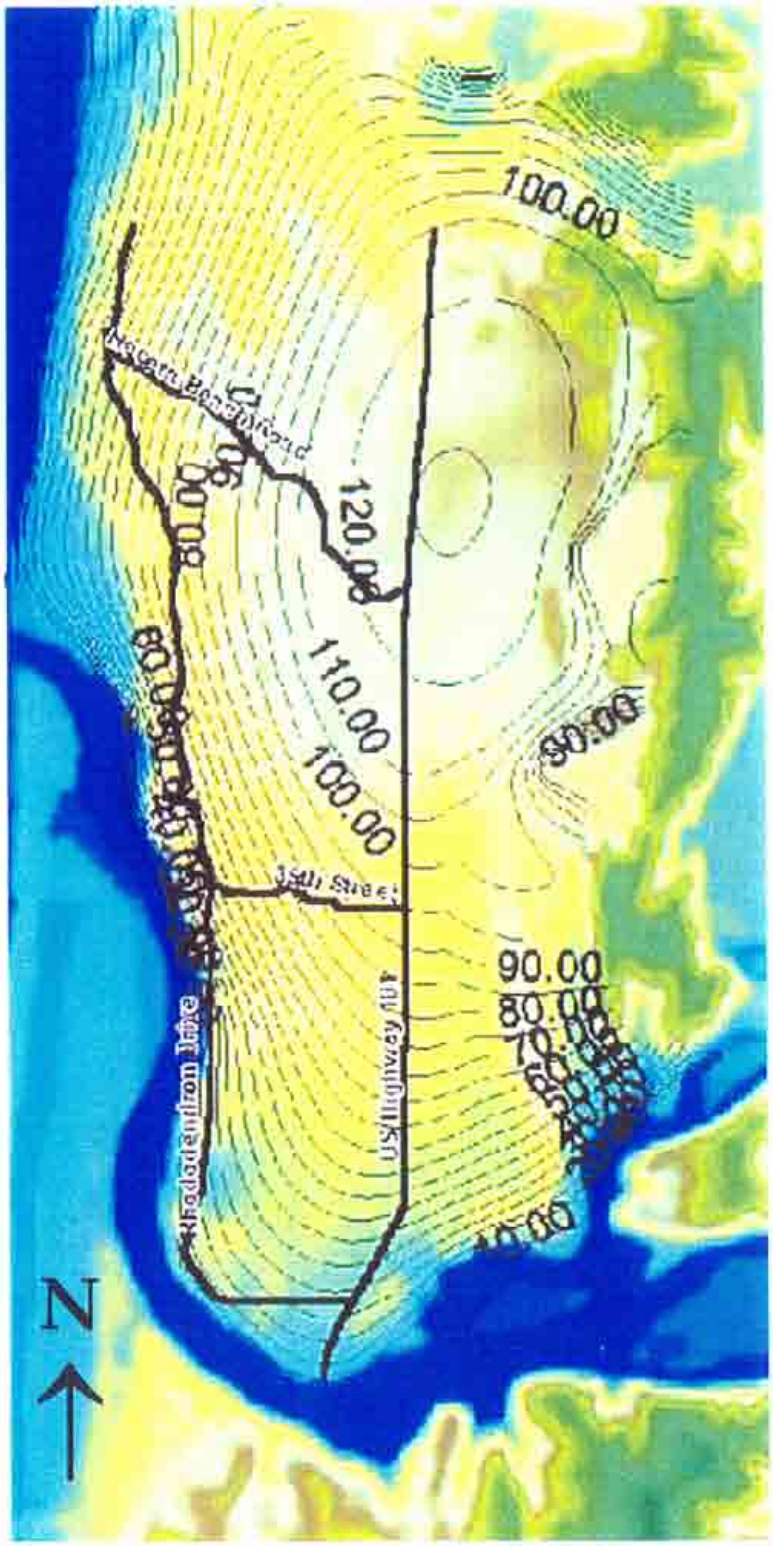


Figure 4-4. Groundwater Elevation, Wet Year

Note: Water elevations shown are above mean sea level.

Table 4-6. Conveyance Modeling Elements

(See Figure 4-6 for model segment locations)

Name	Location	Length (ft)	Diameter (in)	Slope	Design flow (cfs)	Present Flow (cfs)				Future Flow (cfs)				Freeboard (feet)
						2	10	25	100	2	10	25	100	
CEN010L	Rhododendron Dr. to Siuslaw River W of downtown	268	TC	0.00687	650	70.0	87.5	93.3	106.0	77.2	93.2	102.0	117.0	2.2
CEN020L	Pipe under Rhododendron Dr.	114	36	0.02158	98	70.0	87.5	93.3	***106.0***	77.2	93.0	*102.0*	***117.0***	1.6
CEN030L	Channel from 9th St S to Rhododendron Dr.	1398	TC	0.00837	581	68.8	85.6	94.2	108.0	76.3	93.3	104.0	119.0	7.6
CEN040L	Pipe under 9th St	69	60	0.00362	82	69.0	***85.8***	***94.4***	***108.0***	76.4	***93.4***	***105.0***	***119.0***	5.6
CEN050L	Channel from Greentrees to 9th St.	1334	TC	0.01115	149	64.5	64.7	72.4	84.7	63.9	72.4	83.0	96.2	6.3
CEN053L	Channel SE of Greentrees	833	TC	0.00224	91	47.9	59.9	67.3	78.6	54.8	68.9	78.9	90.7	4.2
CEN056L	Channel between Airport and Greentrees	799	TC	0.00234	203	43.7	57.6	65.4	76.4	51.7	68.1	77.7	89.2	4.4
CEN060L	Channel W of Airport	1511	NC	0.00207	313	41.4	53.6	60.4	70.1	49.6	64.5	73.2	87.8	2.4
CEN065L	Channel along N Kingwood Dr.	2329	TC	0.00442	410	26.9	35.1	39.2	45.1	32.7	42.6	47.8	55.1	6.2
CEN070L	Channel along N Kingwood Dr.	733	NC	0.00266	512	22.1	28.1	31.0	35.3	25.6	32.7	36.3	41.3	5.4
CEN080L	N Kingwood Dr.	96	48	0.00156	30	22.2	28.3	***31.2***	***35.4***	25.8	***32.9***	***36.4***	***41.5***	2.1
CEN090L	Channel NW of LCC	1684	NC	0.00433	142	16.3	20.0	21.6	23.9	18.4	22.6	24.6	27.5	1.8
CEN100L	Channel N of LCC	623	TC	0.00140	259	13.0	15.1	15.9	17.1	13.4	15.6	16.5	17.8	3.3
CEN110L	Oak St. from 32nd St. to discharge point	158	30	0.00696	34	13.3	15.2	16.0	17.2	13.6	15.7	16.6	17.9	2.8
CEN120L	Oak St. from midblock to 32nd St.	265	27	0.00445	21	13.3	15.2	16.0	17.2	13.6	15.7	16.6	17.9	2.5
CEN130L	Oak St. from 34th St. to midblock	340	27	0.00438	21	13.3	15.2	16.0	17.2	13.6	15.7	16.6	17.9	3.0
CEN140L	Oak St. from 35th St. to 34th St.	242	24	0.00227	11	8.5	9.1	9.1	9.2	8.5	9.1	9.1	9.2	3.4
CEN150L	Intersection of 35th St. and Oak St.	59	24	0.03034	39	8.5	9.1	9.1	9.1	8.5	9.1	9.1	9.1	2.0
CEN180L	9th St. from Driftwood St.	512	18	0.00555	8	3.0	3.5	3.9	4.6	2.9	3.5	3.9	4.6	9.0
CEN190L	9th St. from Greenwood	493	42	0.00160	40	16.5	19.0	19.9	20.5	17.0	19.6	20.2	21.0	7.2
CEN200L	9th St. from Ivy St. to Greenwood St.	668	42	0.00219	47	15.5	17.5	18.2	18.5	16.1	18.1	18.4	19.0	13.7
CEN210L	Channel from Airport to 9th St.	1028	TC	0.01089	5510	16.6	17.8	18.4	19.2	17.1	18.5	19.1	20.1	9.9
CEN220L	12th St. S of Airport	54	33.96	0.03333	104	15.0	15.7	16.0	16.4	15.0	15.7	16.0	16.4	7.5

Abbreviations: TC = trapezoidal channel
NC = natural channel

Table 4-6. Conveyance Modeling Elements (continued)

(See Figure 4-6 for model segment locations)

Name	Location	Length (ft)	Diameter (in)	Slope	Design flow (cfs)	Present Flow (cfs)				Future Flow (cfs)				Freeboard (feet)
						2	10	25	100	2	10	25	100	
CEN230L	SE Airport	431	24	0.00195	10	***15.0***	***15.7***	***16.0***	***16.4***	***15.0***	***15.7***	***16.0***	***16.4***	2.3
CEN240L	SE Airport	84	24	0.00786	20	15.0	15.7	16.0	16.4	15.0	15.7	16.0	16.4	6.4
CEN250L	Intersection of Airport Wy and Airport Rd	180	24	0.00267	12	***15.0***	***15.7***	***16.0***	***16.4***	***15.0***	***15.7***	***16.0***	***16.4***	1.8
CEN260L	Airport St. from 17th Pl to Airport Rd	828	24	0.00178	10	8.5	***10.8***	***10.6***	***10.3***	8.5	***10.8***	***10.6***	***10.3***	***0.0***
CEN270L	Airport Wy from 18th St. to 17th Pl	411	24	0.00187	10	8.4	***11.0***	***12.5***	***14.6***	8.4	***11.0***	***12.5***	***14.6***	1.2
CEN290L	N of Airport	179	24	0.00112	8	***11.7***	***14.2***	***16.0***	***18.1***	***11.6***	***14.4***	***15.8***	***18.3***	2.7
CEN300L	N of Airport	382	TC	0.00079	173	11.8	14.1	15.3	17.2	11.1	13.6	14.9	17.5	5.7
CEN310L	N of Airport	148	24	0.00068	6	***12.4***	***15.0***	***16.1***	***18.1***	***11.9***	***14.4***	***15.6***	***18.1***	5.1
CEN320L	Channel N of 20th St.	752	TC	0.00093	387	9.7	11.9	13.0	14.8	9.4	11.6	12.8	14.9	7.1
CEN330L	Oak Street west to discharge	675	36	0.00080	19	10.9	14.1	15.8	18.4	10.9	14.1	15.8	18.5	4.2
CEN340L	Oak St. from 21st St. to midblock	71	30	0.00141	15	10.9	14.2	***16.0***	***18.8***	10.9	14.2	***16.0***	***18.8***	3.9
CEN350L	Oak St. at 21st St.	63	30	0.00159	16	10.9	14.2	16.0	***18.8***	10.9	14.2	16.0	***18.8***	4.0
CEN360L	Oak St. from 22nd St. to 21st St.	275	30	0.01513	50	10.9	14.2	16.0	18.8	10.9	14.2	16.1	18.9	3.8
CEN370L	Oak St. from 23rd St. to 22nd St.	320	30	0.00172	17	10.9	14.2	16.0	***18.8***	10.9	14.3	16.1	***18.9***	4.3
CEN380L	Oak St. from N of 23rd St. to 23rd St.	132	24	0.00371	14	10.9	***14.2***	***16.0***	***18.8***	10.9	***14.3***	***16.1***	***18.9***	3.9
CEN390L	Oak St. from midblock to N of 23rd St.	215	24	0.00377	14	10.9	***14.2***	***16.0***	***18.8***	10.9	***14.3***	***16.1***	***18.9***	3.9
CEN400L	Oak St. from 25th St. to midblock	275	24	0.00451	15	10.9	14.2	***16.1***	***18.8***	10.9	14.3	***16.1***	***18.9***	3.8
CEN410L	Oak St. from 26th St. to 25th St.	330	21	0.00458	11	1.6	2.1	2.9	4.3	1.6	2.1	2.9	4.3	5.5
CEN420L	Oak St. from 27th St. to 26th St.	288	21	0.00455	11	1.6	2.1	2.3	3.4	1.6	2.1	2.3	3.5	6.1
CEN430L	Oak St. from 28th St. to 27th St.	313	18	0.00447	7	1.6	2.1	2.3	2.8	1.6	2.1	2.3	2.8	6.1
CEN440L	Oak St. from 29th St. to 28th St.	313	18	0.00476	7	1.6	2.1	2.3	2.7	1.6	2.1	2.3	2.7	5.8
CEN450L	Oak St. from 30th St. to 29th St.	282	15	0.00287	4	1.6	2.1	2.3	2.7	1.6	2.1	2.3	2.7	3.7
CEN455L	S of Laurelwood Ln.	402	TC	0.00694	634	2.3	3.0	3.4	3.9	4.0	5.2	5.9	6.9	4.3
CEN460L	Between Laurelwood Ln and Myrtle Lp.	287	42	0.00160	40	2.3	3.0	3.4	3.9	4.0	5.2	5.9	6.9	3.8

Abbreviations: TC = trapezoidal channel
NC = natural channel

Table 4-6. Conveyance Modeling Elements (continued)

(See Figure 4-6 for model segment locations)

Name	Location	Length (ft)	Diameter (in)	Slope	Design flow (cfs)	Present Flow (cfs)				Future Flow (cfs)				Freeboard (feet)
						2	10	25	100	2	10	25	100	
CEN470I.	34th Pl. to Myrtle Ln.	157	42	0.00064	25	2.3	3.0	3.4	3.9	4.0	5.2	5.9	6.9	3.3
CEN480I.	Laurelwood St. from 35th St. to 35th Pl.	349	36	0.00544	49	2.3	3.0	3.4	3.9	4.0	5.2	5.9	6.9	3.8
CEN490I.	35th St. at Laurelwood	68	36	0.00529	49	2.3	3.0	3.4	3.9	4.0	5.2	5.9	6.9	3.3
CEN500I.	35th St. at Laurelwood	64	36	0.00297	36	2.3	3.0	3.4	3.9	4.0	5.2	5.9	6.9	2.7
CEN510I.	Oak St. from 36th St. to 35th St.	319	18	0.00194	5	***8.5***	***9.1***	***9.1***	***9.1***	***8.5***	***9.1***	***9.1***	***9.1***	***0.0***
DTN010I.	1st St. to Siuslaw River	273	24	0.02388	35	16.9	19.0	19.2	19.7	18.5	19.5	19.7	20.0	1.6
DTN020I.	Hemlock St. from 4th St. to 1st St.	365	24	0.00433	15	***16.9***	***19.0***	***19.3***	***19.7***	***18.5***	***19.5***	***19.7***	***20.0***	3.5
DTN030I.	Hemlock St. from Rhododendron Dr. to 4th St.	355	24	0.00377	14	***15.4***	***17.1***	***17.1***	***17.6***	***16.9***	***17.6***	***17.6***	***17.6***	5.2
DTN040I.	Hemlock St. from 6th St. to Rhododendron Dr.	304	24	0.00286	12	***15.3***	***17.2***	***17.1***	***17.5***	***16.9***	***17.6***	***17.6***	***17.6***	1.1
DTN050I.	6th St. from Ivy St. to Hemlock St.	282	24	0.00649	18	14.2	16.1	16.0	16.3	15.5	17.0	16.9	16.8	***0.0***
DTN060I.	6th St. from Juniper St. to Ivy St.	357	24	0.00504	16	10.3	13.0	13.2	13.6	11.6	12.9	12.9	13.5	0.1
DTN070I.	6th St. from Kingwood St. to Juniper St.	346	24	0.00465	15	10.3	13.0	13.2	13.7	11.6	12.8	13.7	13.5	0.5
DTN080I.	Ivy St. from 7th St. to 6th St.	320	24	0.00403	14	3.1	4.2	4.6	5.4	3.2	4.2	4.7	5.4	0.7
DTN090I.	6th St. from Laurel St. to Kingwood St.	390	18	0.00382	7	***6.5***	***9.1***	***9.2***	***9.9***	***7.8***	***11.0***	***10.9***	***10.5***	***0.0***
DTN100I.	6th St. from Maple St. to Laurel St.	320	18	0.00594	8	6.5	***8.5***	***9.3***	***9.8***	7.8	***9.1***	***9.6***	***9.6***	***0.0***
MUN010I.	Hwy 126 to Siuslaw River	949	TC	***-0.00062***	85	83.5	***101.0***	***115.0***	***131.0***	***101.0***	***126.0***	***131.0***	***131.0***	10.5
MUN020I.	Hwy 126	126	30	0.00008	2	***27.9***	***33.5***	***38.5***	***43.8***	***33.8***	***41.9***	***43.6***	***44.0***	5.3
MUN030I.	10th St. to Hwy 126	292	NC	0.00712	235	67.2	86.8	101.0	112.0	87.0	110.0	113.0	114.0	***0.0***
MUN040I.	Spruce St. to 10th St.	882	TC	0.00724	115	69.0	88.5	98.9	108.0	86.5	108.0	106.0	112.0	***0.0***
MUN050I.	Spruce St. downtown	121	84	0.00760	290	69.9	91.4	100.0	127.0	87.8	119.0	129.0	149.0	0.9
MUN060I.	15th Pl. to Spruce St.	1003	TC	0.00527	532	56.8	81.3	90.9	108.0	80.2	107.0	116.0	124.0	7.5
MUN090I.	18th St. to 15th Pl.	2794	TC	0.00304	404	57.6	82.5	91.8	109.0	81.3	108.0	116.0	125.0	2.8
MUN100I.	18th St.	60	54	0.01000	102	19.2	28.1	30.6	36.9	26.9	36.1	38.7	42.1	7.3
MUN110I.	E of Park Dr. to 18th St.	821	NC	0.00542	1630	55.6	75.4	85.4	102.0	78.8	102.0	109.0	117.0	13.9

Abbreviations: TC = trapezoidal channel
NC = natural channel

Table 4-6. Conveyance Modeling Elements (continued)

(See Figure 4-6 for model segment locations)

Name	Location	Length (ft)	Diameter (in)	Slope	Design flow (cfs)	Present Flow (cfs)				Future Flow (cfs)				Freeboard (feet)
						2	10	25	100	2	10	25	100	
MUN120L	23rd St. to E of Park Dr.	961	NC	0.00349	5140	55.7	74.7	85.7	102.0	78.8	102.0	110.0	118.0	14.0
MUN130L	23rd St.	68	72	0.00147	162	55.7	74.7	85.8	102.0	78.9	102.0	110.0	118.0	2.6
MUN140L	Outer Dr. to 23rd St.	457	NC	0.00635	678	55.8	74.8	85.9	102.0	79.0	102.0	110.0	118.0	2.7
MUN150L	Munsel Ck Greenway Pk	224	NC	***-0.00402***	560	53.3	71.5	82.0	97.6	76.4	98.4	105.0	112.0	4.2
MUN160L	Munsel Ck Greenway Pk	40	84	***-0.02000***	470	53.3	71.5	82.0	97.6	76.4	98.4	105.0	112.0	3.4
MUN170L	Munsel Ck Lp. to Munsel Ck Greenway Pk	3715	TC	0.00585	1270	38.7	51.6	59.0	69.9	62.2	77.9	81.1	81.1	5.5
MUN180L	Munsel Ck Lp. bridge	38	0	0.02737	424	40.1	53.3	60.9	71.9	64.1	78.6	81.2	81.3	3.4
MUN190L	Munsel Ck Lp.	999	TC	0.00461	130	40.1	53.4	60.9	72.0	64.1	78.7	81.3	81.3	***0.0***
MUN200L	Munsel Ck E of Munsel Ck Dr.	1508	TC	0.00460	175	35.0	46.1	52.4	61.5	46.0	58.3	63.9	78.6	2.9
MUN210L	Culvert under 42nd St.	40	60	0.01450	163	35.5	46.6	53.0	62.0	46.5	58.7	64.4	72.7	2.9
MUN220L	Florentine Estates to 42nd St.	1308	TC	0.00142	275	18.8	24.7	27.9	32.6	25.5	31.1	32.8	35.9	5.1
MUN230L	Munsel Ck SE of Sherwood Lp.	694	NC	0.00810	534	10.3	13.4	15.2	17.8	10.3	13.4	15.2	17.8	7.2
MUN240L	Florentine Estates	39	60	0.01538	168	10.3	13.4	15.2	17.8	10.3	13.4	15.2	17.8	5.9
MUN250L	Florentine Estates	675	NC	0.00443	868	10.3	13.5	15.2	17.8	10.3	13.5	15.2	17.8	5.3
MUN260L	Florentine Estates	36	60	0.02000	192	10.3	13.4	15.2	17.8	10.3	13.4	15.2	17.8	5.0
MUN270L	Munsel Lk Rd to Florentine Estates Rd.	802	TC	0.00582	321	10.4	13.5	15.3	17.9	10.4	13.5	15.3	17.9	7.5
MUN280L	Culvert under Munsel Lk Rd.	107	60	0.01131	277	10.4	13.5	15.3	17.9	10.4	13.5	15.3	17.9	7.9
MUN290L	Nordahl Rd to Munsel Lk Rd.	785	TC	0.00414	196	10.4	13.5	15.3	17.9	10.4	13.5	15.3	17.9	6.6
MUN300L	Outlet of Munsel Lk	21	36	***-0.00143***	13	10.4	***13.5***	***15.3***	***17.9***	10.4	***13.5***	***15.3***	***17.9***	6.0
MUN320L	Discharge from Florentine Estates pond 2	48	18	0.11458	36	3.0	3.9	4.5	5.1	5.4	5.9	5.9	6.0	3.1
MUN330L	Florentine Estates	155	18	0.00110	4	***4.6***	***5.9***	***6.7***	***7.7***	***8.0***	***8.9***	***8.9***	***8.9***	1.2
MUN340L	N of 45th Ct	48	18	0.00917	10	4.6	5.9	6.7	7.7	8.0	8.9	8.9	8.9	1.3
MUN350L	Sherwood Lp. to 45th Ct.	326	18	0.00337	6	4.6	5.9	***6.7***	***7.7***	***8.0***	***8.9***	***8.9***	***8.9***	***0.0***
MUN360L	SW part of Sherwood Lp.	579	18	0.00475	7	2.1	2.7	3.1	4.2	4.9	5.8	5.8	5.6	5.2

Abbreviations: TC = trapezoidal channel

NC = natural channel

Table 4-6. Conveyance Modeling Elements (continued)

(See Figure 4-6 for model segment locations)

Name	Location	Length (ft)	Diameter (in)	Slope	Design flow (cfs)	Present Flow (cfs)				Future Flow (cfs)				Freeboard (feet)
						2	10	25	100	2	10	25	100	
MUN370I.	W of Florentine Estates	838	18	0.00451	7	2.1	2.7	3.1	4.0	4.5	5.2	5.3	5.2	1.9
MUN380I.	NW of Florentine Estates	76	TC	***-0.02513***	504	4.2	5.5	6.2	7.8	9.0	10.8	11.2	11.6	***0.0***
MUN390I.	NW of Florentine Estates	207	TC	0.00676	360	4.2	5.5	6.2	7.5	9.0	12.2	13.9	16.3	1.8
MUN400I.	Culvert under Munsel Lk Rd.	53	24	0.03283	41	4.2	5.4	6.2	7.2	9.0	11.6	13.2	15.4	3.2
MUN410I.	Spruce St. to Munsel Ck.	324	36	0.00123	23	6.7	9.0	10.2	12.1	20.0	***26.0***	***28.5***	***29.5***	4.4
MUN420I.	Spruce St. from 40th St.	682	36	0.00132	24	6.8	9.0	10.2	12.1	19.9	***26.0***	***28.5***	***29.5***	3.2
MUN430I.	40th St.	186	36	0.01871	91	7.0	9.1	10.3	12.1	20.0	26.0	28.5	29.5	2.9
MUN440I.	W end of 40th St.	44	24	0.02545	36	7.0	9.1	10.3	12.1	20.0	26.1	28.5	29.5	0.2
MUN450I.	42nd St. to 40th St.	607	TC	0.01255	59	7.0	9.1	10.3	12.1	20.0	26.3	38.2	39.8	0.4
MUN470I.	Willow St. to Munsel Ck	93	TC	0.05516	75	6.8	8.8	9.9	11.6	7.0	9.1	15.2	20.5	1.5
MUN480I.	Willow St. and Outer Dr.	55	24	0.04182	46	6.8	8.8	9.9	11.6	7.0	9.1	10.4	12.2	1.6
NRW005I.	Rhodo. Dr. to Siuslaw River S of Siuslaw Village	100	24	0.01270	25	***35.3***	***35.3***	***35.3***	***35.3***	***35.3***	***35.3***	***35.3***	***35.3***	***0.0***
NRW010I.	Rhododendron Dr. S of Siuslaw Village	69	36	0.02014	95	39.5	41.9	43.6	46.0	39.5	41.9	43.6	46.0	1.3
NRW015I.	Channel from Skookum Dr. to Rhododendron Dr.	1075	TC	0.02719	50	40.0	42.0	43.6	46.1	40.0	42.0	43.6	46.1	2.9
NRW020I.	Skookum Dr.	153	36	0.03209	119	39.7	42.0	43.7	46.2	39.7	42.0	43.7	46.2	3.9
NRW025I.	Channel from 35th to Skookum Dr. at Siuslaw Village	1023	NC	0.01719	1660	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	4.7
NRW030I.	35th St. between Weeoma Dr. and Siano Lp.	79	24	0.00873	21	***29.5***	***29.5***	***29.5***	***29.5***	***29.5***	***29.5***	***29.5***	***29.5***	***0.0***

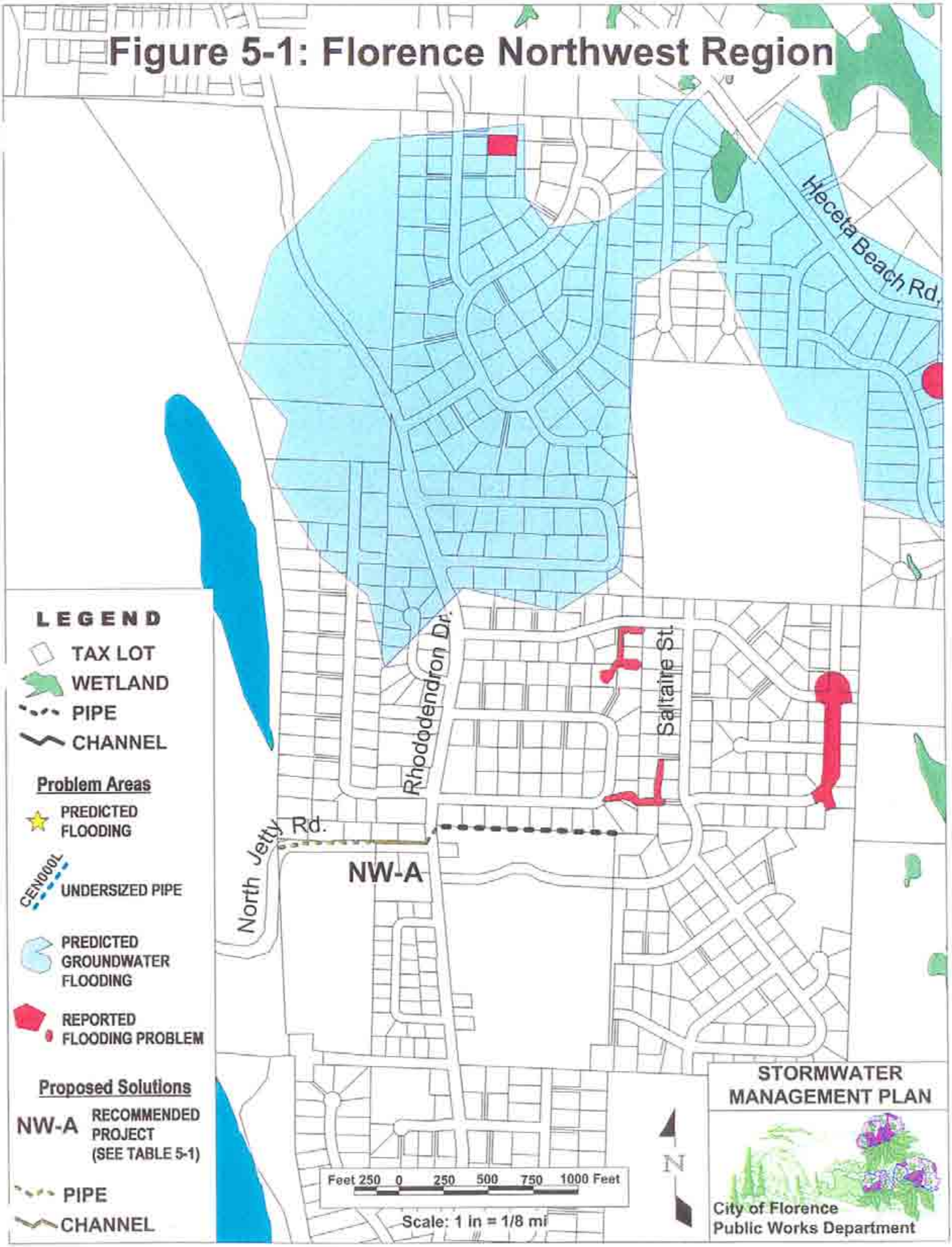
Abbreviations: TC = trapezoidal channel

NC = natural channel

Table 4-7. Channel Velocities

Segment name	Location	Velocity, feet per second	
		Present	Future
CEN010L	Rhododendron Drive to Siuslaw River west of downtown	1.54	1.69
CEN030L	Channel from 9th Street south to Rhododendron Drive	2.90	2.96
CEN050L	Channel from Greentrees to 9th Street	***3.67***	***3.66***
CEN053L	Channel southeast of Greentrees	2.57	2.69
CEN056L	Channel between Airport and Greentrees	2.31	2.48
CEN060L	Channel west of Airport	2.91	***3.06***
CEN065L	Channel along north Kingwood Drive	0.74	0.85
CEN070L	Channel along north Kingwood Drive	2.70	2.84
CEN090L	Channel northwest of Lane Community College	1.64	1.65
CEN100L	Channel north of Lane Community College	0.63	0.61
CEN210L	Channel from Airport to 9th Street	1.04	1.06
CEN300L	North of Airport	0.32	0.29
CEN320L	Channel north of 20th Street	0.29	0.27
CEN455L	South of Laurelwood Lane	0.36	0.36
MUN010L	Highway 126 to Siuslaw River	-2.07	-2.49
MUN030L	10th Street to Highway 126	1.85	2.40
MUN040L	Spruce Street to 10th Street	***3.53***	***3.89***
MUN060L	15th Place to Spruce Street	***4.37***	***4.82***
MUN090L	18th Street to 15th Place	***3.61***	***3.94***
MUN110L	East of Park Drive to 18th Street	***4.13***	***4.45***
MUN120L	23rd Street to east of Park Drive	***3.19***	***3.61***
MUN140L	Outer Drive to 23rd Street	2.92	***3.23***
MUN150L	Munsel Creek Greenway Park	-1.94	-2.32
MUN170L	Munsel Creek Loop to Munsel Creek Greenway Park	1.11	1.55
MUN190L	To Munsel Creek Loop	***4.16***	***4.77***
MUN200L	Munsel Creek east of Munsel Creek Drive	1.89	2.19
MUN220L	Florentine Estates to 42nd Street	1.76	1.94
MUN230L	Munsel Creek southeast of Sherwood Loop	2.53	2.09
MUN250L	Florentine Estates	2.39	2.39
MUN270L	Munsel Lake Road to Florentine Estates Road	1.30	1.30
MUN290L	Nordahl Road to Munsel Lake Road	1.71	1.71
MUN310L	Highway 101 to Munsel Creek (not used)	0.00	0.00
MUN380L	Northwest of Florentine Estates	0.35	-0.44
MUN390L	Northwest of Florentine Estates	0.42	0.48
MUN450L	42nd Street to 40th Street	2.01	2.99
MUN470L	Willow Street to Munsel Creek	2.83	2.18
NRW015L	Channel from Skookum Drive to Rhododendron Drive	***6.70***	***6.70***
NRW025L	Channel from 35th to Skookum Drive at Siuslaw Village	1.82	1.82

Figure 5-1: Florence Northwest Region



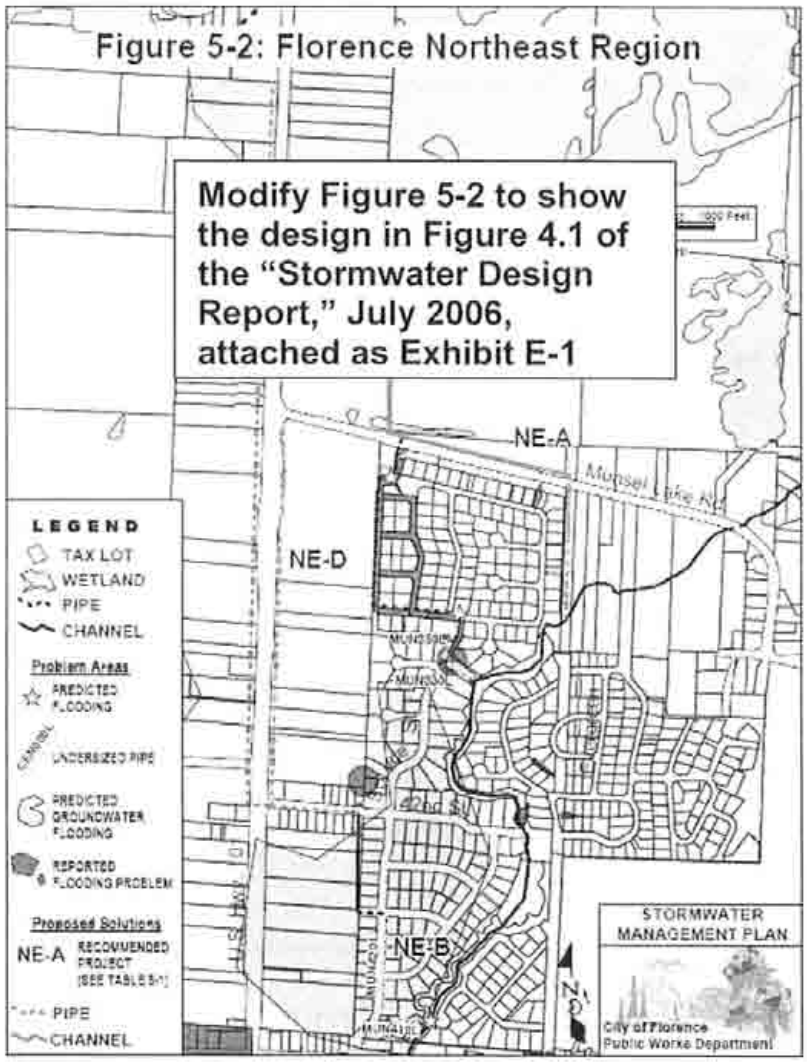


Figure 5-2: Florence Northeast Region
Modify Figure 5-2 to show the design in Figure 4.1 of the "Stormwater Design Report," July 2006, attached as Exhibit E-1
NE-A
NE-D
NE-B
Munsel Lake Rd
LEGEND
TAX LOT
WETLAND
PIPE
CHANNEL
Problem Areas
PREDICTED FLOODING
UNDERSIZED PIPE
PREDICTED GROUNDWATER FLOODING
REPORTED FLOODING PROBLEM
Proposed Solutions
NE-A RECOMMENDED PROJECT (SEE TABLE 5-1)
PIPE
CHANNEL
STORMWATER MANAGEMENT PLAN
City of Florence
Public Works Department

Exhibit E-1: Proposed Stormwater Design, Spruce Street Local Improvement District

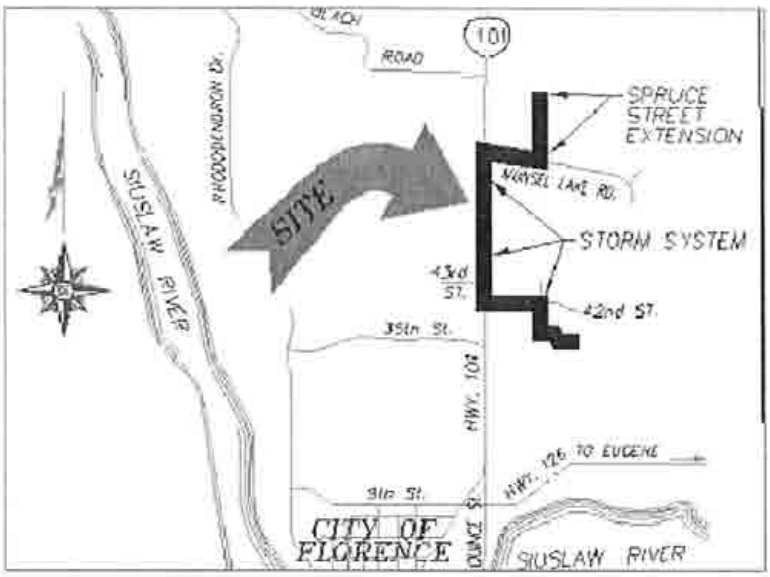


Figure 4.1: Overview of Path of New Stormwater System.

Figure 5-2: Florence Northeast Region

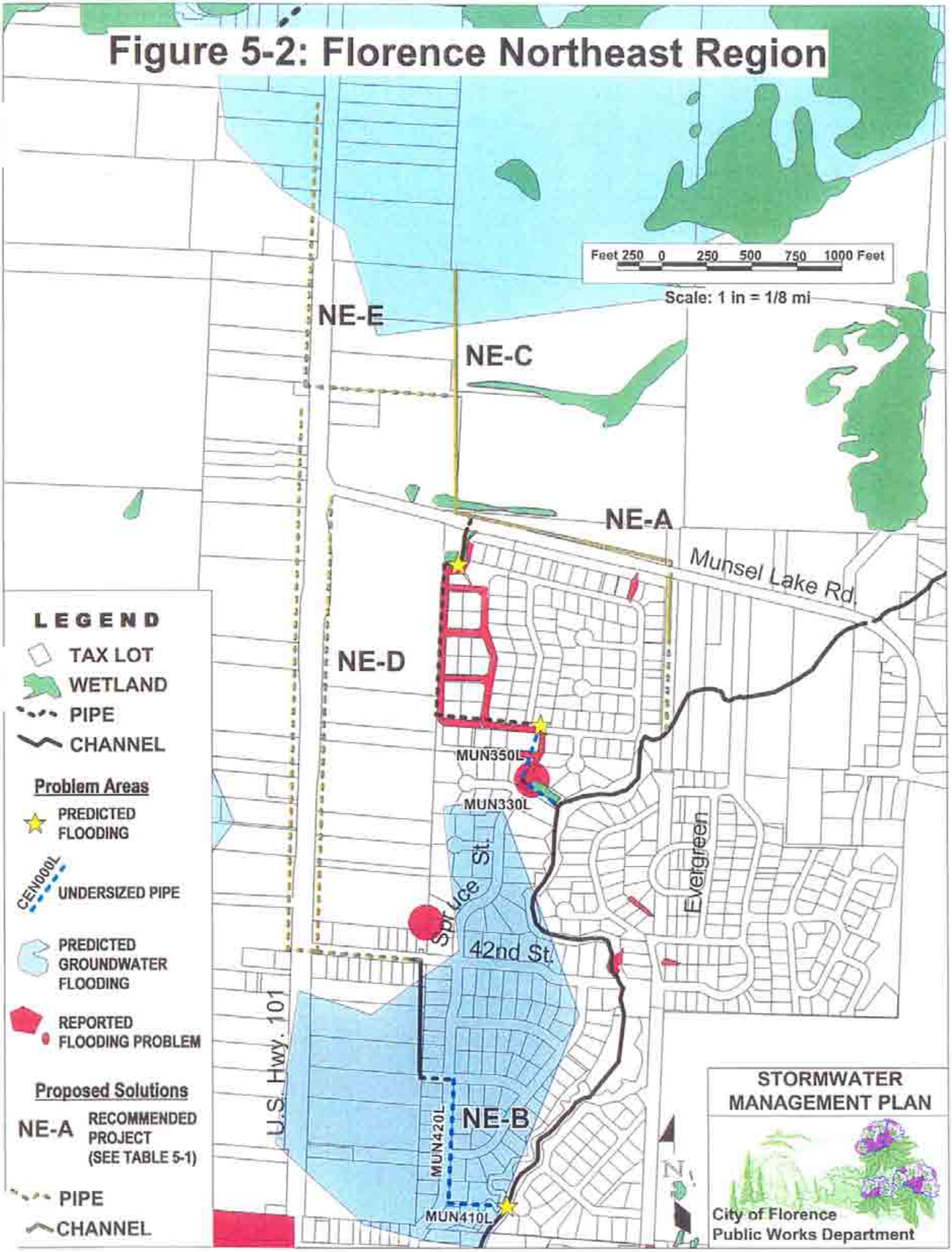
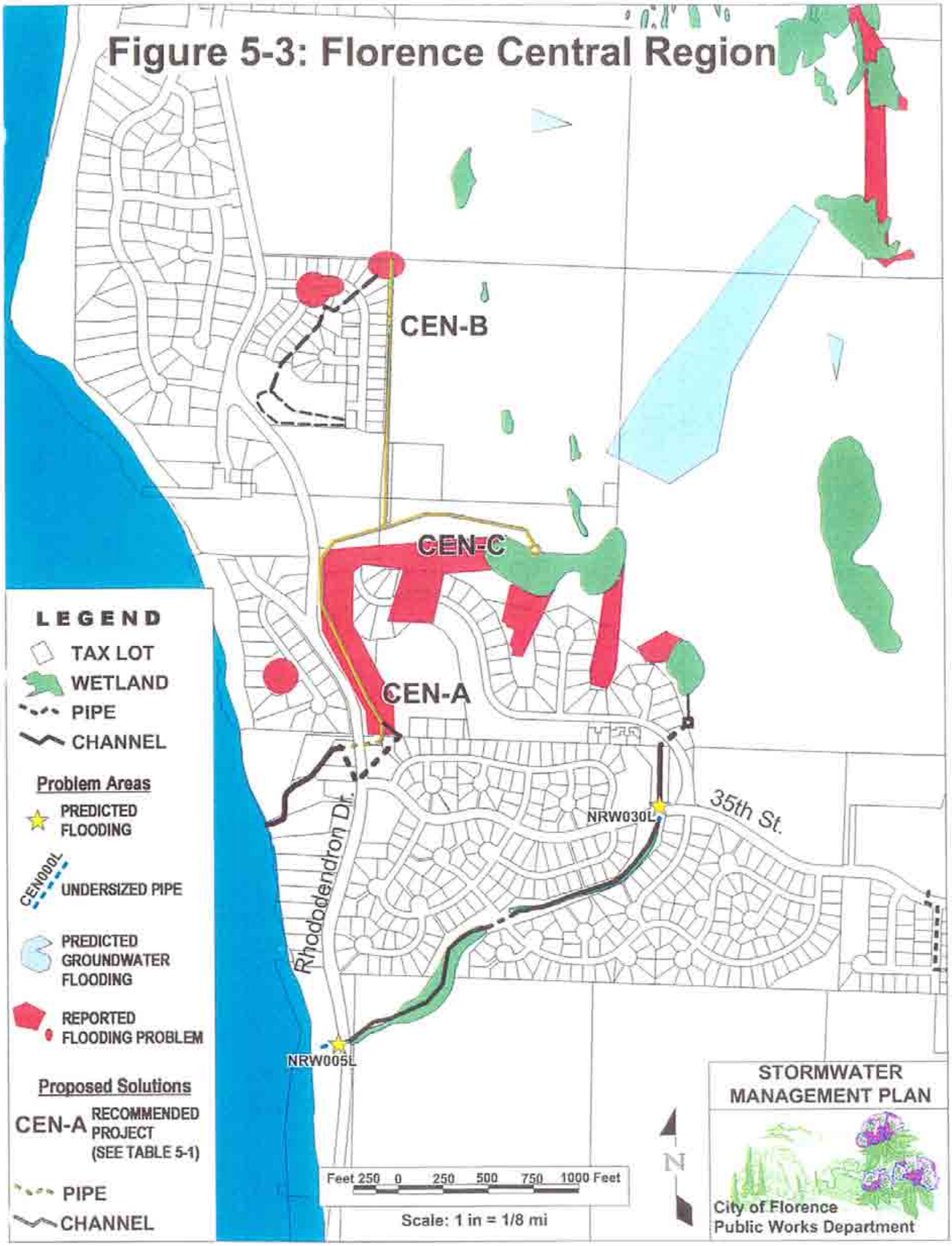


Figure 5-3: Florence Central Region



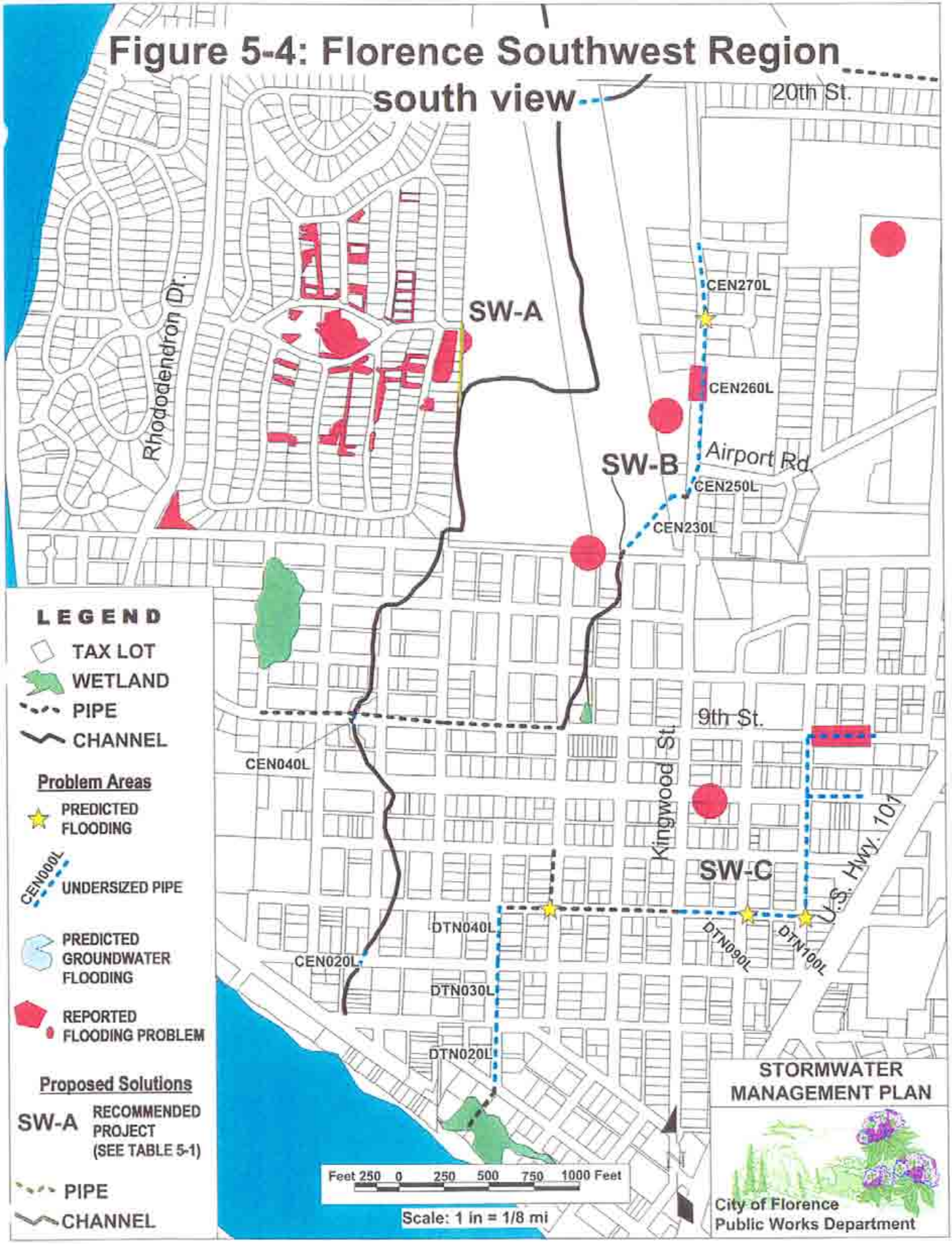
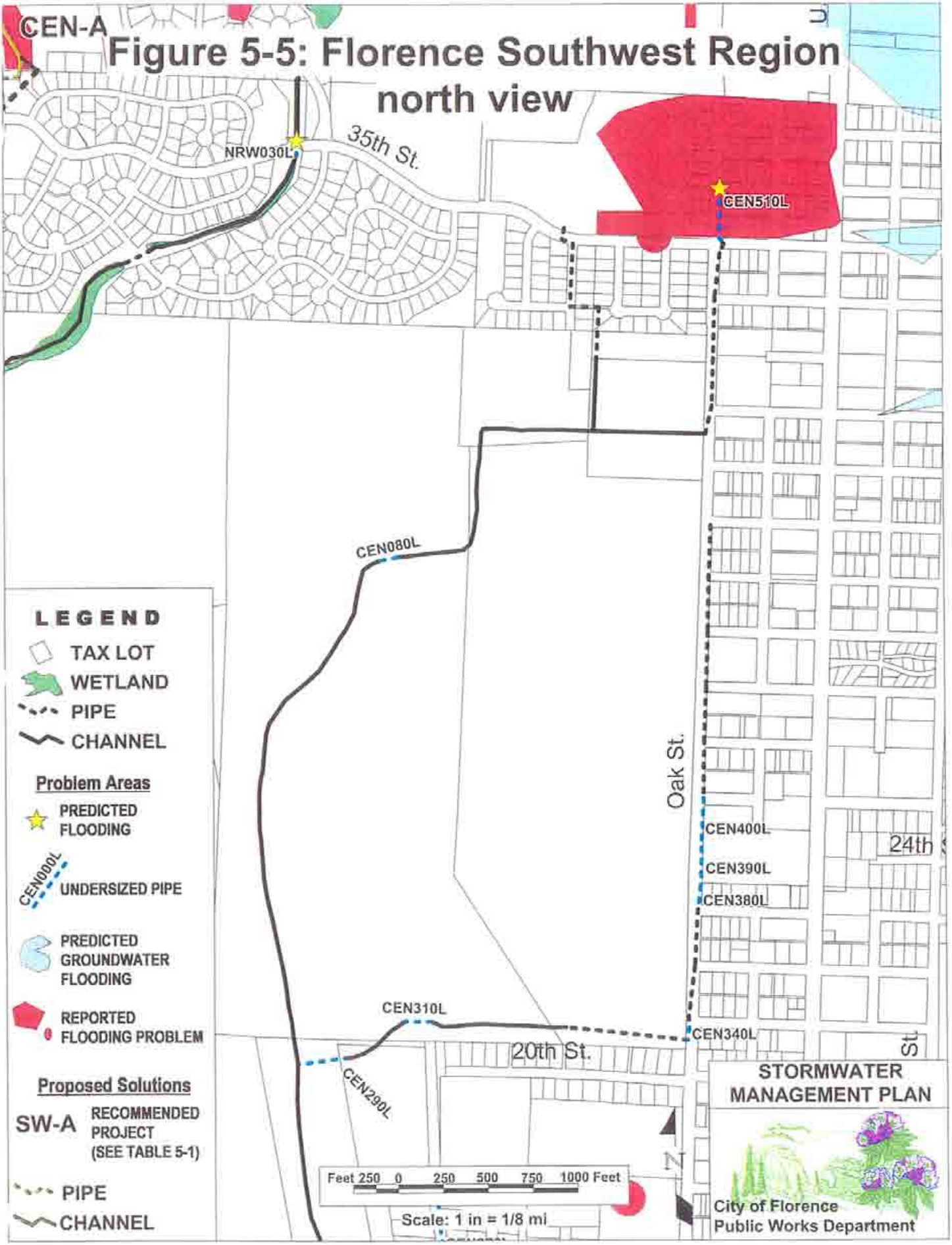


Figure 5-4: Florence Southwest Region
south view
20th St.
Rhododendron Dr.
SW-A
CEN270L
CEN260L
SW-B
Airport Rd
CEN250L
CEN230L
9th St.
Kingwood St.
CEN040L
SW-C
U.S. Hwy. 101
DTN040L
DTN090L
DTN100L
CEN020L
DTN030L
DTN020L
LEGEND
TAX LOT
WETLAND
PIPE
CHANNEL
Problem Areas
PREDICTED FLOODING
CEN000L
UNDERSIZED PIPE
PREDICTED GROUNDWATER FLOODING
REPORTED FLOODING PROBLEM
Proposed Solutions
SW-A
RECOMMENDED PROJECT (SEE TABLE 5-1)
PIPE
CHANNEL
Feet 250 0 250 500 750 1000 Feet
Scale: 1 in = 1/8 mi
STORMWATER MANAGEMENT PLAN
City of Florence
Public Works Department

CEN-A

Figure 5-5: Florence Southwest Region north view



CHAPTER 5

PROJECT RECOMMENDATIONS

Recommended projects were formulated based on the analysis results discussed in Chapter 4. The recommendations are presented by geographic region: Northwest, Northeast, Central, Southwest, and Southeast. They include maps of each region, as shown in Figures 5-1 through 5-6, and include both the recommendations and specific steps that should be undertaken for implementation. Within each region, the recommendations have been divided into projects. Each region may have one or more projects. The projects are named using a naming convention consisting of the initials for the region, followed by a letter, e.g., NW-A. Table 5-1, at the end of this chapter, contains brief descriptions and costs for all of the recommendations within the study area. Figure 5-7 shows the recommendations for the entire project area.

NORTHWEST REGION

The Northwest Region lies outside of the Florence city limits. It is made up of largely residential neighborhoods south of Heceta Beach Road. The region is characterized by small, rolling dunes that end in steep bluffs overlooking the North Jetty Recreation Area and Heceta Beach. Stormwater flows generally east to west in this area.

Recommendations

The main objective in this region is to protect private and public property in both the immediate flooding area and along the downstream conveyance route. Recommendations for the NW-A project, shown in Figure 5-1, include the addition of a pumping facility to evacuate water from the Gullsettle Court area. This will be required for the long-term solution, however, it is not the City of Florence's (City's) responsibility to design and construct a pump station in this area. The 12-inch-diameter culvert under Rhododendron Drive should be replaced with a box culvert that connects to a channel that receives the two incoming 12-inch diameter pipes. This improvement would lessen maintenance problems and increase hydraulic capacity in this area. The ditch, which leads west from Rhododendron Drive along the North Jetty Road, needs to be improved, and should be extended to the west. A pipe will be required at the west end of the ditch to provide a positive grade to the edge and down the face of the bluffs. A flow dissipater (large riprap) should be placed at the bottom end of this pipe to prevent erosion.

Table 5-1 lists the details of the improvements recommended for the Northwest Region conveyance system. The capital cost of Project NW-A is estimated at $209,000. Currently, the City cannot implement these improvements since the study area lies outside of the city limits. The City recommends that the improvements be made through a cooperative effort involving local developers, neighborhood associations, individual homeowners, and Lane County.

Next Steps

Planning is underway to develop a large parcel of property south of Saltaire Street within the next few years. The developer needs to work with Lane County and the City to determine where to discharge the resulting runoff in order to ensure compatibility with the overall plan for the area.

NORTHEAST REGION

The Northeast Region covers an area extending from north of Munsel Lake Road to south of Florentine Estates, and from the ridge just to the west of Highway 101 to Munsel Creek to the east. Its southern boundary ends at approximately 35th Street. The area contains the Florentine Estates residential development, an auto salvage yard north of Munsel Lake Road, and undeveloped property north of the salvage yard and west of Florentine Estates.

Most of the area north of Munsel Lake Road drains to the southwest, where it enters the northwest corner of Florentine Estates. It flows through a combination of ponds and pipes through the Florentine Estates development and joins Munsel Creek near 45th Court.

STORMWATER DESIGN

For the design of the stormwater system in this region, refer to the Stormwater Design Report for Spuce Street LID, Florence OR. July 2006, and Appendices A through C, Approved by the Florence City Council on September 5, 2006 and incorporated into Appendix 11 of The Florence Realization 2020 Comprehensive Plan in March 2008.

CENTRAL REGION

The Central Region extends from the northern city limits to approximately 35th Street. It is bounded to the west by the Siuslaw River and to the east by the ridge of dunes that lie west of Highway 101. It contains large expanses of undeveloped property to the north (most of it publicly owned), Sandpines Golf Course to the south and east, and partially developed, single-family residential development to the south and west. Surface water flows are generally from the northeast to southwest in this area.

Recommendations

The recommended plan for the Central Region consists of two projects, as shown in Figure 5-3. The first project, CEN-A, consists of construction of a permanent channel to the west of the Sandpines Golf Course. The channel should be lined to limit the infiltration of stormwater into the ground. The channel would run along Rhododendron Drive in an easement acquired by the City, and would terminate at the corner of 35th Street and Rhododendron Drive. At that point, flows would enter a pipe passing underneath Rhododendron Drive and connect with the large ravine to the west. The ravine's side slopes should be reinforced, as necessary, to stabilize the natural slopes and prevent erosion. This recommendation would improve the hydraulic capacity of the collection system, which will help lessen the potential for flooding. The system should be sized to include flows carried in the channel described as Project CEN-B.

Project CEN-B is a concrete-lined channel extending along the east side of Mariners Village to the northeast corner of the development. Construction of this channel is recommended to provide a pathway for flows originating from public land to the northeast. Project CEN-B should be undertaken only after the downstream improvements are completed. The existing temporary detention pond should be removed from service and flows routed to this new channel.

Project CEN-C is a concrete-lined channel extending from Project CEN-A eastward across the Sandpines Golf Course. This channel would intercept flows before they cause flooding along Royal Saint Georges Drive. Project CEN-C should be undertaken only after the downstream improvements in Project CEN-A are completed.

Table 5-1 lists the details of the improvements recommended for the Central Region conveyance system. The estimated capital costs are $331,000 for Project CEN-A, $171,000 for Project CEN-B, and $115,000 for Project CEN-C

Next Steps

A predesign investigation is required to better define the most cost-effective solutions available for the Central Region. Specifically, additional survey information is required along the route of the Project CEN-A channel, as well as information regarding the condition of the ravine near the downstream end. During the predesign phase, opportunities for detention/wetland facilities north of Sandpines Golf Course and Mariners Village should be investigated. Such facilities could decrease flooding and improve water quality downstream. Much of the land is public, so land acquisition costs are not a barrier. Emphasis should be placed on restoring or enhancing degraded habitat. However, wetlands should not be created at the expense of upland habitat that is in good condition.

Another opportunity may exist for a detention facility in the vacant lot at the corner of 35th Street and Rhododendron Drive that could enhance water quality or moderate peak flows downstream in the ravine.

SOUTHWEST REGION

The Southwest Region stretches from 35th Street to the north, to the Siuslaw River to the south and west, and to Highway 101 to the east. It includes the Florence Airport and the Greentrees development. The central portion of this region drains directly to a ditch that runs south between the Florence airport and the Greentrees development. The ditch continues south of 9th Street past the Florence Wastewater Treatment Plant to the Siuslaw River. The other major drainage system in this region is a series of pipes that run along Kingwood Street, cross the airport south of the runway, reemerge as a channel running south from the runway, and then are piped along 9th Street to the drainage ditch south of the Greentrees development. The Greentrees development lacks an internal drainage system.

Recommendations

Two projects are recommended for the Southwest Region, as shown in Figures 5-4 and 5-5. Project SW-A involves construction of a new channel to intercept runoff from the property to the east of the Greentrees development. The channel would be located near the point where the drainage ditch turns and runs south along the Greentrees development property line

Project SW-B requires upsizing of the pipes along Kingwood Street to accommodate both existing and projected flows from the 25-year storm.

Project SW-C is proposed to alleviate frequent flooding that has been reported. The project includes the replacement of a number of pipes along the main drainage pipe and several smaller pipes located near the library. The pipes should be replaced from downstream to upstream to avoid causing flooding. (Pipes DTN020L, DTN030L, and DTNO40L are at a lesser risk for flooding than pipes further upstream. Depending on pipe condition and the amount of surcharging that the City will allow, these pipes could probably be left as is to lessen the total project cost.

Table 5-1 lists the details of the improvements recommended for the Southwest Region conveyance system. The capital cost of Project SW-A is estimated at $37,000. The estimated capital cost of Project SW-B is $448,000, and the estimated capital cost of Project SW-C is $779,000 ($564,000 if downstream pipes are not upsized).

Next Steps

The pipes in the downtown area should be inspected for signs of surcharging, but they do not need to be replaced unless they are in poor condition or the surcharging results in flooding. Coordination with regulatory agencies should be encouraged to ensure that regular maintenance of the drainage ditch continues.

The pipes along Oak Street, CEN400L, CEN390L, CEN380L, and CEN340L should be inspected for signs of surcharging and replaced, as necessary.

SOUTHEAST REGION

The Southeast Region lies between 35th Street to the north, the Siuslaw River to the south, Highway 101 to the west, and the hills to the east. Munsel Creek is the most dominant physical feature within the region. There is also a large wetland area between the hills and the creek. The wetland has formed in a deflation plain, where sand was scoured away by the wind. There is no natural drainage outlet for the area.

Recommendations

The Southeast Region contains one recommended project, SE-A, as shown in Figure 5-6. Project SE-A recommends a pump station installation at the east end of Pine Court. The pump intake would be set at an elevation to maintain the health and vitality of the existing wetlands. When the groundwater level exceeds this elevation, the pump would be activated and discharge the flow into Munsel Creek.

Table 5-1 lists the details of the improvements recommended for the Southeast Region conveyance system. The capital cost of Project SE-A is estimated at $158,000.

Next Steps

The delineated wetlands that exist in the Southeast Region are somewhat degraded. Opportunities to work with local residents to enhance or restore the wetlands should be pursued.

The area along Munsel Creek upstream of Highway 126 should be investigated for damage due to backwater conditions created by the undersized culvert at the intersection of Munsel Creek and Highway 126.

Recommendations

The Southeast Region contains one recommended project, SE-A, as shown in Figure 5-6. Project SE-A recommends a pump station installation at the east end of Pine Court. The pump intake would be set at an elevation to maintain the health and vitality of the existing wetlands. When the groundwater level exceeds this elevation, the pump would be activated and discharge the flow into Munsel Creek.

Table 5-1 lists the details of the improvements recommended for the Southeast Region conveyance system. The capital cost of Project SE-A is estimated at $158,000.

Next Steps

The delineated wetlands that exist in the Southeast Region are somewhat degraded. Opportunities to work with local residents to enhance or restore the wetlands should be pursued.

The area along Munsel Creek upstream of Highway 126 should be investigated for damage due to backwater conditions created by the undersized culvert at the intersection of Munsel Creek and Highway 126.

Table 5-1. Cost Estimates for Recommended Projects

	Description	Pipe diameter (in)	Channel: Flow depth (ft)	Channel: Width (ft)	Channel: Side slope V/H	Cost: Amount	Cost: Unit	Cost: Unit cost ($)	Cost: Capital cost ($)	Cost: Total cost[2,3] ($)
NW Region										
A	**Jetty Road and Rhododendron Drive Improvements[1]**									
	Box culvert under drive		1	4	vert.	61	CY	600	36,307	50,800
	8 ft-wide pavement patch					480	SF	4	1,920	2,700
	Ditch		2	2.5	0.5	677	CY	20	13,533	18,900
	Pipe	30				392	LF	150	58,800	82,300
	Slope drain	30				129	LF	300	38,700	54,200
	Flow dissipator (riprap)					5	CY	50	250	400
	TOTAL								**149,510**	**209,300**
NE Region										
A	**Wetland along Munsel Creek Road and drainage south to Munsel Creek**									
	Swale or wetland excavation		1	10	0.5	1,892	CY	20	37,831	53,000
	Plant native vegetation					17,024	SF	1	17,024	23,800
	Geotextile lining					17,598	SF	1	17,598	24,600
	Culvert under Munsel Ck Rd	36				113	LF	180	20,340	28,500
	5 ft-wide pavement patch					200	SF	4	800	1,100
	Ditch south of Munsel Ck Rd		1	5	0.5	296	CY	20	5,920	8,300
	Pipe to Munsel Ck	30				522	LF	150	78,300	109,600
	Flow dissipator (riprap)					3	CY	50	150	200
	TOTAL								**177,963**	**249,100**
B	**Upsize culverts along Spruce Street south of Florentine Estates**									
	Upsize MUN410L	42				324	LF	210	68,040	95,300
	Upsize MUN420L	42				682	LF	210	143,220	200,500
	TOTAL								**211,260**	**295,800**
C	**Extend drainage to undeveloped area north of Munsel Lake Road**									
	Swale or wetland		2	6	0.5	4,175	CY	20	83,502	116,900
	Plant native vegetation					18,788	SF	1	18,788	26,300
	Geotextile lining					20,055	SF	1	20,055	28,100
	TOTAL								**122,345**	**171,300**

[1] Costs are not shown for pump station improvements required at Gullsettle Court.
[2] Total cost includes capital costs and provisions for engineering, administration, and contingency that represent a 1.4 multiplier on the capital cost.
[3] Costs do not include land acquisition or easement costs.

Table 5-1. Cost Estimates for Recommended Projects (continued)

	Description	Pipe diameter (in)	Channel: Flow depth (ft)	Channel: Width (ft)	Channel: Side slope V/H	Cost: Amount	Cost: Unit	Cost: Unit cost ($)	Cost: Capital cost ($)	Cost: Total cost[2,3] ($)
D	**Drainage along U.S. Highway 101 Munsel Lake Road to 42nd St.**									
	Pipe along west side and under Hwy 101	24				3,160	LF	120	379,200	530,900
	Pipe along east side of Hwy 101	24				2,521	LF	120	302,520	423,500
	Pipe from Hwy 101 to Spruce	30				526	LF	150	78,900	110,500
	5 ft-wide pavement patch (10% of pipe length)					1,193	SF	4	4,770	6,700
	TOTAL								**765,390**	**1,071,600**
E	**Drainage along U.S. Highway 101 north of Munsel Lake Road**									
	Pipe draining north portion of Hwy 101	30				2,385	LF	150	357,750	500,900
	5 ft-wide pavement patch (10% of pipe length)					1,193	SF	4	4,770	6,700
	TOTAL								**362,520**	**507,600**
CEN region										
A	**Rhododendron Diversion**									
	Plug existing culvert					1	EA	50	50	100
	Culvert under drive	36				179	LF	180	32,220	45,100
	Excavate ditch along drive		1.5	2	0.5	2,109	CY	20	42,187	59,100
	Line ditch w/4 in. of concrete					505	CY	320	161,643	226,300
	TOTAL								**236,100**	**330,600**
B	**Ditch from Mariner's Village**									
	Excavate ditch from Mariner's Village		1	1.5	0.5	907	CY	20	18,138	25,400
	Line ditch w/4 in. of concrete					325	CY	320	103,988	145,600
	TOTAL								**122,126**	**171,000**
C	**Golf Course Flow Bypass**									
	Excavate ditch from Golf Course		1	2	0.5	611	CY	20	12,227	17,100
	Line ditch w/4 in. of concrete					218	CY	320	69,637	97,500
	TOTAL								**81,863**	**114,600**

[1] Costs are not shown for pump station improvements required at Gullsettle Court.

[2] Total cost includes capital costs and provisions for engineering, administration, and contingency that represent a 1.4 multiplier on the capital cost.

[3] Costs do not include land acquisition or easement costs.

Table 5-1. Cost Estimates for Recommended Projects (continued)

	Description	Pipe diameter (in)	Channel: Flow depth (ft)	Channel: Width (ft)	Channel: Side slope V/H	Cost: Amount	Cost: Unit	Cost: Unit cost ($)	Cost: Capital cost ($)	Cost: Total cost[2,3] ($)
SW Region										
A	**Greentrees**									
	Ditch		2	5	0.5	1,309	CY	20	26,173	36,600
	TOTAL								**26,173**	**36,600**
B	**Upsize Pipes East of Airport**									
	Upsize CEN270L	30				179	LF	150	26,850	37,600
	Upsize CEN260L	30				411	LF	150	61,650	86,300
	Upsize CEN250L	48				828	LF	240	198,720	278,200
	Upsize CEN230L	36				180	LF	180	32,400	45,400
	TOTAL								**319,620**	**447,500**
C	**Upsize Pipes in Downtown Area**									
	Upsize 8-inch pipe in 9th St. (library)	12				360	LF	60	21,600	30,200
	Upsize 8-inch pipe in 8th St.	12				318	LF	60	19,080	26,700
	Upsize 8-inch pipe in Maple St.	12				1,014	LF	60	60,840	85,200
	Upsize DTN100L	21				320	LF	105	33,600	47,000
	Upsize DTN090L	24				390	LF	120	46,800	65,500
	Upsize DTN070L	27				346	LF	135	46,710	65,400
	Upsize DTN060L	27				357	LF	135	48,195	67,500
	Upsize DTN050L	27				282	LF	135	38,070	53,300
	Upsize DTN040L	30				304	LF	150	45,600	63,800
	Upsize DTN030L	30				355	LF	150	53,250	74,600
	Upsize DTN020L	30				365	LF	150	54,750	76,700
	5-ft pavement patch for above work					22,055	SF	4	88,220	123,500
	TOTAL								**556,715**	**779,400**
SE Region										
A	**Pine Court Pump Station**									
	PS (413 gpm @ 50 ft)					1	EA	100,000	100,000	140,000
	Force main	4				412	LF	20	8,240	11,500
	Pine Ct. pavement patch (3 ft. x 300 ft)					900	SF	4	3,600	5,000
	Flow dissipator (riprap)					3	CY	50	150	200
	TOTAL								**111,990**	**156,700**
GRAND TOTAL (ALL AREAS)										

[1] Costs are not shown for pump station improvements required at Gullsettle Court.

[2] Total cost includes capital costs and provisions for engineering, administration, and contingency that represent a 1.4 multiplier on the capital cost.

[3] Costs do not include land acquisition or easement costs.

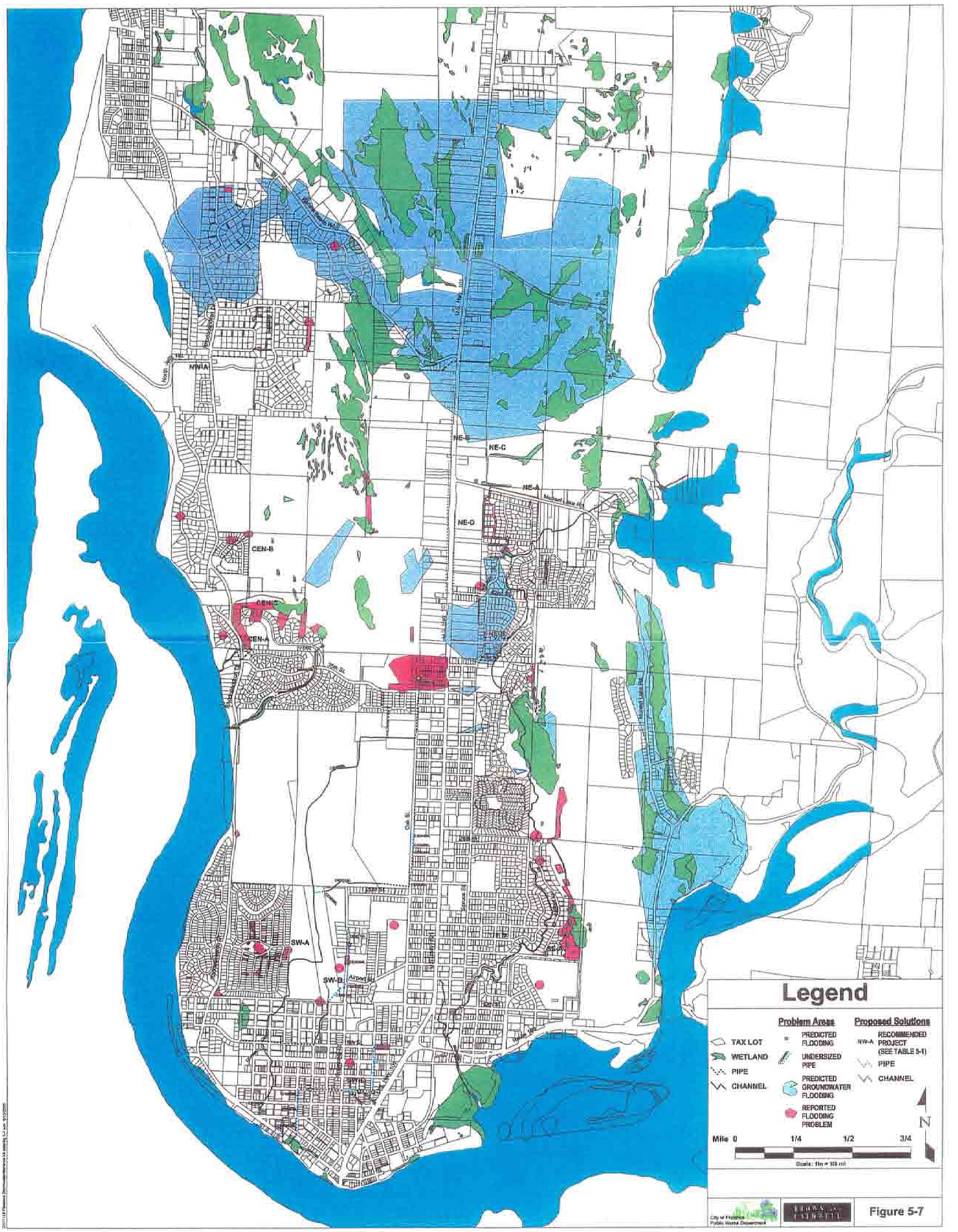

NW-A
NE-B
NE-C
NE-A
NE-D
CEN-B
CEN-C
CEN-A
SW-A
SW-B
Legend
Problem Areas
Proposed Solutions
TAX LOT
WETLAND
PIPE
CHANNEL
PREDICTED FLOODING
UNDERSIZED PIPE
PREDICTED GROUNDWATER FLOODING
REPORTED FLOODING PROBLEM
RECOMMENDED PROJECT (SEE TABLE 5-1)
PIPE
CHANNEL
N
Mile 0
1/4
1/2
3/4

Figure 5-7

CHAPTER 6

IMPLEMENTATION PLAN

Over $4.5 million in capital improvement projects is recommended by this Storm Water Management Plan (SWMP). Implementation of the projects is subject to funding limitations, and is influenced by future development and current and future state and federal regulations. This chapter describes how the projects were prioritized for implementation, presents the results of the prioritization process, and recommends additional activities required for successful storm water and surface water management in Florence.

PROJECT PRIORITIZATION

Brown and Caldwell in conjunction with the City of Florence (City) and the Stakeholder Advisory Committee (SAC), developed projects to protect property, maintain public access to essential facilities, protect the quantity and quality of the aquifer, limit impacts to the community, and satisfy federal and state regulations. Thirteen projects were defined to address deficiencies identified by the modeling and public involvement process. They consist of groups of recommendations required to address each specific deficiency. A priority ranking of the projects is required, since funding and other resource limitations prohibit implementation of all projects at one time, though the City intends to ultimately implement all of the projects. The 13 projects defined in Chapter 5 were evaluated by the SAC to determine a priority ranking for implementation.

Project Ranking Process

Prior to the SAC evaluation, Brown and Caldwell provided descriptions of each of the proposed projects. The descriptions along with oral and visual presentations made at SAC meetings and the December 9, 1999 Public Workshop, explained the need for the projects and presented the options available for addressing the problems. To develop a further understanding of the projects, members of the SAC visited each of the project sites.

The SAC evaluated the projects with respect to each project's ability to meet both technical and value-based criteria established by the consultant team and the SAC. The criteria are summarized below.

- Provides flood protection
- Maintains public access to critical facilities
- Protects aquifer (quantity and quality)
- Limits impacts to community
- Satisfies regulatory requirements
- Provides water quality benefits
- Enhances or protects natural habitat
- Responds to maintenance and public complaints

For each criterion, weights and point scales were determined which are described in detail in Appendix B.

Projects Not Ranked

Not all of the projects were prioritized for implementation. Issues such as available funding, the timing of new development proposals, available land or easements, and government regulations (i.e., permitting and prohibitions) have a major impact on the order in which projects are implemented. As a result, the SAC and the City decided that too many variables were involved to prioritize all of the projects at this time. Instead, the top five most critical projects identified by the SAC and consultant team were included in the initial priority ranking process. As the ranked projects are constructed, it is expected that the current unranked projects will be prioritized and their implementation scheduled.

The priority ranking of projects is subject to change due to the factors identified above. The City reserves the right to modify the order of implementation based on these and any other factors that may arise.

Project Ranking Results

All members of the SAC participated in the evaluation during a special meeting. The numerical results of the evaluation process are presented in Appendix B. The recommended priority of the top five projects is listed in Table 6-1, along with the associated capital costs. Unranked projects are also listed in the table.

Table 6-1. Priority Ranking of Projects

Priority ranking	Project description/Identifier	Study region	Estimated capital cost ($)
1	Rhododendron channel/CEN-A	Central	331,000
2	Munsel Lake Rd. drainage and diversion/NE-A	Northeast	249,000
3	Pine Court Pump station/SE-A	Southeast	157,000
4	Greentrees ditch/SW-A	Southwest	37,000
5	Rhododendron Dr. and North Jetty Rd. Improvements/ NW-A	Northwest	209,000
Subtotal			983,000
Unranked projects	Spruce Street/NE-B	Northeast	296,000
	Undeveloped area north of Munsel Lake Road/NE-C	Northeast	171,000
	Highway 101 drainage south of Munsel Lake Road/NE-D	Northeast	1,072,000
	Highway 101 drainage north of Munsel Lake Road/NE-E	Northeast	508,000
	Mariner's Village drainage/CEN-B	Central	171,000
	Golf Course bypass/CEN-C	Central	115,000
	Drainage east of airport/SW-B	Southwest	448,000
	Downtown area/SW-C	Southwest	779,000
Subtotal			3,560,000
Total all projects			4,543,000

Some of the projects provide benefits to a very specific area, rather than providing general benefit to the overall community. In these areas, the City will explore with the impacted community the idea of forming a Local Improvement District (LID). The LID would provide a mechanism for sharing the costs of capital and operational improvements with the citizens receiving the benefit.

PROJECT IMPLEMENTATION

The recommended capital improvement actions identified by the SWMP consist of structural improvements that will improve storm water runoff and surface water flooding conditions throughout the City. Several projects can be designed to provide additional benefits, such as water quality and riparian fish/wildlife habitat improvements. Where possible, additional benefits should be designed into the projects. This approach will help the City comply with federal and state regulations, i.e., Endangered Species Act (ESA), the National Pollution Discharge Elimination System (NPDES) Phase II storm water permitting program, and Total Maximum Daily Loads (TMDL)

Though a comprehensive hydrologic and hydraulic assessment of the area was conducted, it does not preclude the need for additional technical analysis and potential re-evaluation of project recommendations and prioritization in the future. New regulations, changes in development plans, and updated information on the science of storm water management should be factored into the decisions about the priority or appropriateness of a given project prior to implementation.

Predesign

The recommended projects are based on limited data or assumed field conditions. For this reason, more detailed data collection and pre-design on project elements that involve structural improvements should be conducted prior to implementation. Predesign assessment activities may include the following, as appropriate:

- Wetland determination
- ESA survey
- In-stream and riparian habitat assessment
- Geomorphic assessment
- Stream and culvert survey
- Photo points and water quality monitoring

Following site assessment, detailed design criteria should be developed to guide design activities. The design criteria will dictate project design needs and provide a benchmark of design/ construction success. Design activities for a structural project may include the following, as appropriate:

- Wetland delineation and tree survey
- Hydraulic analysis
- Geomorphic/sediment transport analysis
- Vegetative replacement determination
- Habitat replacement determination
- Plan and specification development

Physical, chemical and/or photo monitoring should also be conducted upstream and downstream of all major projects before the project is constructed, and over the life of the project, if possible. Monitoring, along with the design criteria, will allow for an evaluation of the effectiveness of the project over time and estimate the benefits to the watershed. The costs for monitoring are not included in the estimated costs.

Property Acquisitions/Easements

The SWMP identifies projects that will benefit developed and undeveloped areas in need of flood protection, protect the aquifer, and improve water quality and riparian fish/wildlife habitat. In order to implement many of these projects, the City will need to acquire properties or easements on which the proposed projects are located.

The cost of purchasing property or acquiring easements is not included in the estimate shown in this chapter. Land costs can be quite variable and are dependent upon a number of factors. Land acquisition costs must be estimated and included in a rate or funding analysis study.

There are no proposed buy-outs of existing homes that are prone to flooding. However, owners of homes that flood should be advised to floodproof their homes. The Federal Emergency Management Agency can provide guidance information on how to floodproof homes.

Costs

Project costs vary depending on the specific conditions of the project site. Therefore, the accuracy of the cost estimate is dependent on the amount of site information available.

Type of Estimate. Generally, a cost estimate is prepared for each phase of public works planning and design projects. As a project moves through the different phases—planning to predesign; predesign to design—the level of confidence in the specifics of the design increases, as does the certainty in the cost estimate. A description of the three major cost estimate categories is provided as follows:

Order-of-Magnitude Estimate. This type of estimate is approximate, and is made without detailed engineering data. Techniques such as cost-capacity curves, scale-up or scale-down factors, and ratios are used in developing such an estimate. Typically an order-of-magnitude estimate is considered accurate within a range of +50 percent or -30 percent. That is, the final cost may be as much as 50 percent more or 30 percent less than the estimated amount.

Budget Estimate. In this case, budget applies to the owner's budget and not to the budget as a project control document. This estimate is prepared based on field observations, or using process flow sheets, layouts, and equipment details. A budget estimate is normally accurate within +30 percent or -15 percent.

Definitive Estimate. As the name implies, this is an estimate prepared from well-defined engineering data, such as construction plans and specifications. At a minimum, the data must include fairly comprehensive plot plans and elevations, piping and instrument dia-

grams, one-line electrical diagrams, equipment data sheets and quotations, structural drawings, soil data and drawings, and a complete set of specifications. The most accurate estimate would be made from approved for construction drawings and specifications. The accuracy of a definitive estimate would fall within +15 percent or -5 percent.

The cost estimates developed for the SWMP are planning level estimates or order-of-magnitude estimates, not budget estimates or definitive estimates. Watershed planning is not an exact science and cost realities typically force planners to make subjective decisions based on limited data and assumed knowledge. Many assumptions were used to prepare the planning-level cost estimates for the SWMP. The cost assumptions were consistent with planning studies completed for Unified Sewerage Agency of Washington County for the Beaverton Creek Watershed Study (USA, 1999), the City of Portland for the Fanno Creek watershed (BES, 1997), and actual construction costs from projects in the Willamette Valley. The costs do not reflect internal staff time or monitoring (construction management) necessary to implement the capital projects. The costs for acquisition of land or easements were not included for any of the proposed projects.

During the predesign effort, detailed survey data on pipe and channel slopes, channel cross-sections, and topography at the project location will be developed. Also, a definitive decision on the design details will be made. At that time, a budget or definitive cost estimate will be developed.

Provisions for Engineering, Administration, and Contingencies. Other project costs have been assumed to be equal to 40 percent of the construction costs of the project. This includes 15 percent for engineering, 5 percent for administration, and 20 percent for contingency.

Cost Index. All costs were developed in June 2000, therefore, the future updating of these costs should be based on an Engineering News Record (ENR) Construction Cost Index of 6300.

Maintenance Costs. For maintenance activities, a 1 to 5 percent markup on the estimated construction costs were applied, as listed in Table 6-2.

Table 6-2. Annual Maintenance Costs by Facility

Type of facility	Annual maintenance as percent of construction cost
Pipe systems	0.5
Detention/water quality ponds	1
Constructed wetlands	3-6
Vegetated swales/manmade channels	5-7
Infiltration facilities	5-20
Sand filter	11-13

Table adapted from EPA, 1999.

Based on the assumptions shown above, the estimated annual maintenance costs for the projects recommended by this SWMP are listed in Table 6-3.

Table 6-3. Estimated Annual Maintenance Costs

Project Description/Identifier	Study region	Estimated annual maintenance cost ($)
Rhododendron channel/CEN-A	Central	9,900
Munsel Lake road drainage and diversion/NE-A	Northeast	12,500
Pine Court pump station/SE-A	Southeast	4,000
Greentrees ditch/SW-A	Southwest	1,800
Rhododendron Dr. and North Jetty Rd. improvements/NW-A	Northwest	10,500
Spruce St./NE-B	Northeast	800
Undeveloped area north of Munsel Lake Rd./NE-C	Northeast	8,600
Highway 101 drainage south of Munsel Lake Rd./NE-D	Northeast	5,400
Highway 101 drainage north of Munsel Lake Rd./NE-E	Northeast	2,500
Mariner's Village drainage/CEN-B	Central	5,100
Golf course bypass/CEN-C	Central	3,400
Drainage east of airport/SW-B	Southwest	2,200
Downtown area/SW-C	Southwest	3,900
Total all projects		70,600

In areas where the proposed project benefits only a very localized area, the idea of forming a Local Improvement District will be considered as a mechanism for sharing the costs of the activity with those receiving the benefit.

Operations and maintenance costs used in a rate study should include consideration of the above noted costs and the planned implementation of the projects. Existing maintenance program costs will also be required in such a study.

COUNTY INVOLVEMENT

Several of the capital projects identified by the SWMP are located outside of the city limits, but within the Urban Growth Boundary (UGB). Lane County (County) is the responsible government entity for managing development and other land use activities in this area. Primarily, the County's focus for managing storm water and surface water is to provide adequate drainage for the county road system. The recommended improvements located outside of city limits will have to be coordinated and permitted by the County.

The City and County should develop a working agreement for approving new development and redevelopment within the unincorporated area inside the UGB. Since this area may eventually be brought into the city, the City and County should cooperate to ensure that the areas are developed in accordance with design and engineering standards acceptable to the City.

FUNDING

Historically, the City has funded storm water management through its Street Department. The revenue demands of the capital, operation, and maintenance recommendations made by the SWMP go well beyond what can be funded by the Street Department. In addition, the use of street funds for storm water management activities is not an equitable utilization of that revenue, since only a portion of all storm water runoff originates from city streets. A separate funding source dedicated to storm water management is required to ensure that other City services are not negatively impacted, to provide equitable utilization of the funding, and to develop adequate revenue sources providing for the timely implementation of the storm water recommendations. This section describes the next steps required for successful implementation of this SWMP. A summary of funding options available to the City is provided in Appendix F.

Storm Water Utility

The concept of a storm water utility was started in the early 1970s as an alternative for funding storm water related services. At that time, most municipal storm water programs were funded through general funds or taxation. Historically, these revenue sources have not provided adequate or reliable funding. Today, storm water utilities have gained acceptance throughout the country as a stable and equitable way of funding municipal storm water programs.

Storm water utilities are more than just a mechanism for funding storm water related services. A utility is an organizational structure, created by the City, with the sole purpose and function of implementing storm water management activities. This focus raises the importance of storm water management within the city and the community, thus helping to provide financial and political support for the planned improvements. In addition, a utility can be established as its own legal entity with the authority to manage and operate the storm water collection system and to assess fees to support the program financially.

A storm water utility would provide the City with stable and equitable funding sources to meet the capital, operation, and maintenance needs of the program. The funding mechanisms used by utilities are based on the "user pays" principle. User fees that relate directly to services provide a funding mechanism that is often more acceptable to the public than systems based on general taxes.

There are several funding options available to utilities, including user fees, system development charges (SDCs), and special improvement districts. Revenue from storm water user fees is flexible in that it can be used to pay for both the capital, and operation and maintenance needs of the system. It also allows the City to secure debt funding (through bonds and loans) of major capital projects, because there is a dedicated source for repayment. SDCs are used to fund growth related projects and are paid for by the properties being developed. Special improvement districts or LIDs used to levy assessments to a community for which a special benefit has been provided. Other funding options are available, including different types of grants offered by federal and state governments that could be applied to elements of the storm water program.

The City should create a storm water utility to manage, operate, and fund the storm water management program.

Rate Study

The City should proceed with a rate study to determine the initial user fees to be charged by the utility and to determine what costs can be funded by other revenue sources. The rate study should include a determination of System Development Charges for funding the growth related storm water improvements. Where applicable, community participation in LIDs should be examined with the cost sharing responsibilities defined for the participating residents. In addition, the rate study should explore the range of alternative funding possibilities, including, federal and state grant programs. For example, the Oregon Watershed Enhancement Board provides grants for public and private watershed enhancement projects through the use of state lottery funds. Projects that enhance watershed function and quality may be eligible to participate in the program.

OTHER RECOMMENDATIONS

Over the last four years, the citizens of Florence and the surrounding area have experienced a number of problems associated with high water levels found throughout the city. Adoption of the SWMP and the creation of a storm water utility will initiate activities that will address the causes of many of the flooding problems. Other activities required for successful implementation of the storm water program include the adoption of storm water ordinances and the establishment of a program to address the City's responsibility under the ESA.

Ordinance Adoption

The City should immediately adopt the storm water ordinances developed for the SWMP. The recommended ordinances shown in Appendix D will address many of the water quantity and water quality issues associated with new development. The new ordinances will help prevent many of the problems associated with past development from occurring again with new development. In addition, the new ordinances were developed with an understanding of the federal and state regulations facing the City at this time: ESA, NPDES Phase II, and TMDL. While the new ordinances alone will not address all of the regulatory requirements, they were developed to help meet the intent of the regulations.

Future Regulations

The ESA will have the most immediate and far-reaching impact on the City and its citizens in the future. The City should develop a formal response to ESA requirements by implementing a program to bring it into complete compliance. The first activity implemented under the program should be a risk evaluation. A risk evaluation would determine the City's exposure to ESA enforcement for each activity. Then, an ESA response should be developed in areas where the City is deemed to be at risk. Such a program would be consistent with programs implemented in other Oregon cities for ESA compliance, and it would help the City determine modifications to its current activities that could help save a species.

The City should proceed with developing a wellhead protection plan to ensure that the local aquifer remains a source of high quality water. The SWMP and the supporting ordinance recommendations support the use of infiltration as a means of recharging the aquifer and managing storm water. The use of infiltration facilities is broadly supported throughout the Pacific Northwest as one way of maintaining historic base flows in streams, which is a requirement of ESA. However, infiltration facilities must be used with consideration of the risks. They should not be used where there is a potential for groundwater contamination. In addition, the Oregon Department of Environmental Quality now requires permits for most types of infiltration facilities under the federal Safe Drinking Water Act of 1984.

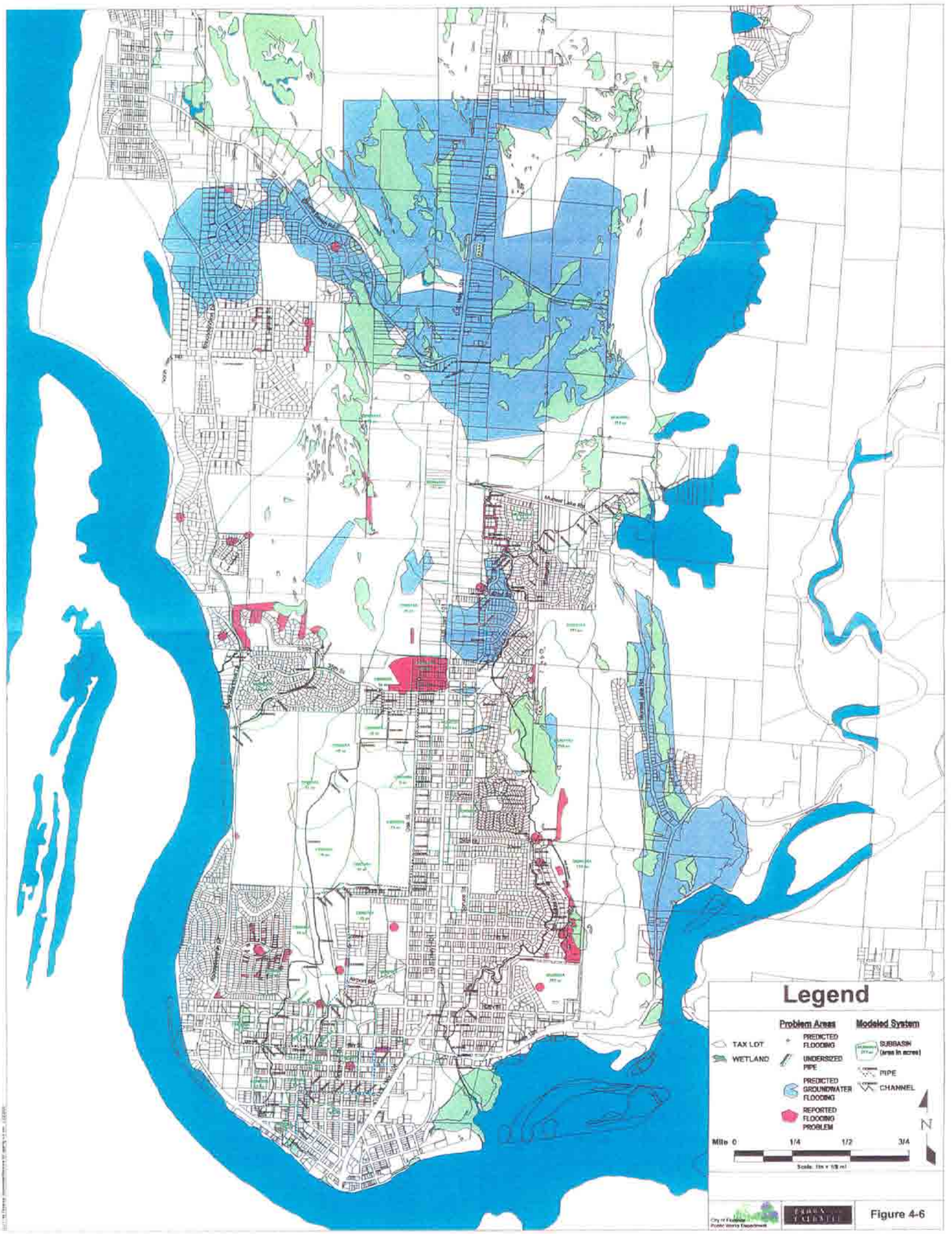

Legend
Problem Areas
TAX LOT
WETLAND
PREDICTED FLOODING
UNDERSIZED PIPE
PREDICTED GROUNDWATER FLOODING
REPORTED FLOODING PROBLEM
Modeled System
SUBBASIN (area in acres)
PIPE
CHANNEL
N
Mile 0
1/4
1/2
3/4

Figure 4-6

APPENDIX A
PUBLIC INVOLVEMENT PROCESS

Stakeholder Survey Results Technical Memorandum
Proposed Public Involvement Program
Problem Response Form
Stormwater Newsletter, September 1999
Work Shop Materials
Public Responses

TECHNICAL MEMORANDUM, STAKEHOLDER SURVEY RESULTS

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March 3, 1999

TECHNICAL MEMORANDUM

To: Ken Lanfear, City of Florence

Fm: Don Barney

Re: City of Florence, Stormwater Management Plan: Stakeholder survey results

Introduction

This memorandum summarizes the results of two rounds of interviews with a sampling of community stakeholders in Florence. The interviews, conducted over the past month, represents qualitative research to help determine issues and concerns, and gather opinions and ideas about the development of a Stormwater Management Plan for the City of Florence.

In the first round, those interviewed included City officials, civic leaders and activists, and representatives of the local business and development sectors. In the second round, those interviewed are members appointed to a stakeholders advisory committee to be involved in the Stormwater Management Plan development.

The list of all who were interviewed is attached. The memorandum is organized in two sections, separately providing the findings from each round of interviews.

Those interviewed paint a picture of two key constituencies representing most Florence residents. They are: (1) long-time residents living in older sections of town, either seeking new economic development opportunities and family-wage jobs or retired and living on limited fixed incomes; and, (2) recent emigrants to the community during the 90's, most of whom are retired, relatively affluent, and likely to be living in newer , subdivisions ringing the central area of the city. These groups appear to have substantially differing views on how to address growth and the issues it raises.

Common themes that emerge from the two round of interviews are:

- Stormwater management is a high priority for the City, for residential and business stakeholders experiencing periodic drainage problems, and for special interests concerned either about economic development or environmental issues. Community leaders believe public investment in stormwater management may be a lower priority for many in the community not confronted with significant drainage problems, or who are living on tight

budgets.

- Public education will be important to raise awareness and understanding about the need for stormwater management, and the connections and differences between stormwater management and wastewater treatment. Construction of a new wastewater treatment facility over the next two years is a top public priority in the community, with major public investment involved.

- Primary community values associated with development of a stormwater master plan are maintaining a high quality of living, managing growth, protecting and sustaining natural resources and natural systems, delivering public investments cost-effectively, allowing for adequate development of jobs, housing and other economic development, and assuring an open, participatory process in public decision making.

- Key issues most likely to generate public discussion during the plan development are:
  - drainage problems
  - the cost of solving those drainage and other stormwater-driven problems, and who pays
  - the relationship of stormwater to the City's aquifer and long-term water supply issues
  - growth management
  - trust in public process

- The process for developing a stormwater management plan, as these stakeholders see it, should include:
  - a clear statement of the need for and benefits of a stormwater solution
  - a summary at the outset of what is known about the stormwater problem, what is not known, and what research will be conducted
  - a set of options for solving the problem, with an evaluation of each option
  - a recommended solution that is both cost-effective and comprehensive in its scope
  - public information that helps the community understand the issues and keeps it aware of progress on the plan
  - opportunities for the public to provide input at key decision making points during the plan's development

Incorporating views and advice gathered during these interviews, the consultant will prepare within the month a public involvement plan for the stormwater management plan process for review by the City and the stakeholder advisory committee.

1. FINDINGS: Round One of Interviews

A. *The importance of stormwater management.*

- **The problem of stormwater drainage, or standing water as some perceive it, is a high priority issue for those who have experienced adverse impacts of flooding, or are knowledgeable about drainage issues in Florence.**

  A majority of those surveyed place stormwater near the top of infrastructure problems that Florence faces, alongside or just below wastewater treatment. "This is going to be more of a problem as time goes on," says one observer. "The more development in the north of the city, the more trouble down below," he says, noting drainage patterns in the community. Another says drainage problems in Florence haven't been comprehensively addressed since the 1960's, and "there's potential for serious property damage during winter storms."

  Solving the problem is important to the future economic development of the community, says one community leader. "We need to upgrade the infrastructure to support the next level of expansion and job development in the community," he says. Several others see stormwater management as an important part of broader growth management and a key to effective long-term planning for the community.

  The stormwater issue is expanding thanks to rapid development in the area, some in environmentally sensitive areas, says one observer. There's serious flooding in a number of areas, but not broad planning to treat the problem or consider impacts on natural, ecological systems, he adds.

  The present system, or lack of it, doesn't work, says another. "Half the airport was flooded in the last big problem period. As more blacktop is added, the problem grows significantly. There's some flooding in new subdivisions because they were improperly developed for drainage," this community leader notes. Another concurs: "We're living with the effects of poor planning for drainage for residential and commercial development in the eighties and early nineties, when we experienced a relative drought. Now we see the evidence of those mistakes."

- **Other residents in the community may not attach a high priority to the stormwater problem, however, viewing it as seasonal or not directly affecting them, several observers believe. Some may feel it is a problem requiring solutions by individual property owners rather than the community at large, they say.**

  Florence faces a lot of "10's", or top priority issues, while dealing with limited resources and other budget problems, some of the stakeholders comment. Along with wastewater treatment, public safety, schools development, street and parks maintenance compete with, and in the opinion of some, exceed concerns about stormwater management.

- **There's some confusion in the community, evidenced by several of those interviewed, about the relationship of local efforts to treat wastewater and to address stormwater problems. Some believe that the City's planned new wastewater treatment facility will help reduce stormwater problems.**

A business owner says the City's sewage plant has overflowed in the past because it can't handle the water it receives at certain times of the year. For this observer, there's a direct tie between sewage and stormwater management.

While the majority of those interviewed understand that wastewater and stormwater treatment systems will be separate, they also acknowledge that "most people don't understand the difference", as one City official puts it. "They assume it's all the same system. There's an important public education challenge here," he adds.

A community leader doesn't feel there's great confusion about the relationship, but says it will be important to be clear, "in ten words or less", about the purpose of the Stormwater Management Plan.

B. *Community values, concerns.*

- **Community values cited in this initial survey include:**
  - **improving livability;**
  - **good, long-term comprehensive planning to address such**
  - **problems as standing water;**
  - **protecting and sustaining natural resources and natural systems, including drainage;**
  - **cost-effectiveness in making public investments;**
  - **allowing for adequate development of jobs, housing, economic activity;**
  - **assuring open, participatory process in public decision making.**

"Recognize there's a certain schizophrenia about Florence," says one community leader commenting on values attached to livability and growth management. His take: Some old-timers in this community have lived through the decline of industry (timber) and jobs, and desire new growth. Recently arrived residents, many being retirees, have come to escape growth, and want to keep growth controlled while they also want public services to meet their needs. There's more than one Florence: what's on Highway 101 and what's off road. there's a perception around that the two Florence's can't co-exist successfully." Sustenance and protection of natural systems needs to be balanced with the right to develop property and maximize its potential, another observer comments There needs to be fairness in exercising development rights while not undercutting ecological systems, he feels. Another says "preserve vegetation as much as possible, but keep its value within reason, recognizing there is other open space in Florence besides the drainage ways."

"We need to protect the natural beauty of the area, and of nature, including fish and wildlife," yet another observer emphasizes.

Regarding public process, observers look for a participatory approach that informs and offers early opportunities to influence key decisions, "not one that delivers a solution with the expectation that the community will buy it," as one puts it.

- **Some issues that have gathered around the development of a new wastewater treatment facility may attach to development of a stormwater management plan**

and solutions, it's felt. Key among those issues are concerns about growth in Florence and low public trust of the City in handling environmentally sensitive projects, several observers indicate.

Managing growth is an issue that many people in the community don't want to deal with, says one observer. A visioning project done a couple of years ago, it's noted, produced some good ideas for the future, but the direction set has not been pursued out of a lack of energy or enthusiasm, it's felt. The pro's and con's of growth and no-growth are discussed but conclusions not reached, says another observer.

Concern, "angst" and even distrust around public infrastructure planning has emerged as a result of the process to develop a new wastewater treatment facility in Florence, several of those interviewed feel. "The process wasn't seen as open," says one. It got off on the wrong foot because "there wasn't a lot of information conveyed about wastewater spills. People were left to find out about them. They did, got angry and raised hell." Another observer feels issues the planning process was rocky because information gathered wasn't shared readily.

The sewer plant, about to be bid for construction, is now seen as absolutely needed, but at least one observer believes there are still questions in the community about the project: "Will it be done 'right'"? Will it work effectively and do its job well? Will the costs be kept down?"

C. *Key Issues, considerations for stormwater management planning.*

- **Growth management:**

Managing growth and maintaining quality of living in the community is critical, observers say. Livability is why many of Florence's newcomers of recent years are now here, it's noted. It's also the foundation for the community's future economic health and development.

Proponents of continuing growth include a community leader who says "the majority of the community wants to see greater shopping opportunities come to town, and more job opportunities, more housing development. Storm water drainage is a factor in that development. Even the no-growth' advocates recognize the need for a storm water management system."

A business executive says, "We need a sound full buildout' plan, at least for central Florence, that identifies long-term stormwater management needs." And another adds, "Expect greater density with development of vacant properties within the urban growth boundary" to further impact drainage problems."

- Flooding:

This is the continuing problem that's driving interest in stormwater management in areas of the community seeing excessive water standing in their yards, running down driveways, overflowing roadside ditches, backing up in parking lots.

There's a sense of the drainage patterns moving north to south in the community, or arising from developments not capable of handling heavy rains, including golf courses, but not a clear picture of how to address the problem comprehensively. concern is expressed that systems installed, such as in Kingwood Industrial District, will be adequate as occupancy expands. "We can't have water where it shouldn't be, and developers can't be expected to come up with individual solutions," says one community leader.

"Make sure the plan solves stormwater problems in all areas of the community," cautions another. "Don't propose a solution that simply move the problem from one area of the community to another."

- **Protection of the aquifer and wellhead system:**

With the aquifer cited repeatedly as the community's source of drinking water, worries surface about protecting it from runoff contamination and assuring that this supply is recharged adequately and safely to meet long-term needs.

On maintaining quality drinking water, one observer says, "We can't afford another Fred Meyer solution", noting there's a large paved, impervious area producing a concern about what's going into the aquifer when there's overflow, even with a drainage system included in the development. The individual development system doesn't work to prevent overflow and leaves open questions about contamination of the aquifer, this observer believes.

Aquifer quality concerns also arise around potential contaminants spawned by subdivisions and other housing developments where lawn fertilizers, for example, may be a significant source of trouble.

"We have to be careful what goes on top of the aquifer, and where the runoff goes," says a City official. "The environmental debate is about how extensive is the impact on the aquifer."

Bottom line on this key issue of the aquifer for several of those interviewed. The stormwater management plan should communicate that Florence will have clean drinking water in its future.

The long-term supply of the aquifer is also a legitimate issue, say several community leaders. If the solution to the stormwater problem is a system of pipes that moves rainwater out to ocean, speculates one observer, Florence could face inadequate recharging of its aquifer. The existing system of dry wells to assist in the recharging may not be adequate under such a scenario, he and others worry. "Quality recharging of the aquifer is a key issue," one City official emphasizes.

This last view doesn't appear to be unanimous, however. As another community leader puts it: "The future water supply is not a major problem right now." In his view, the majority of land in and around Florence is not paved over, and rain is still a generous supplier and recharger of the aquifer.

- **Cost and cost-effectiveness:**

  "What will it cost me?" is the first question many in Florence will ask, predict several observers. Florence's current local tax rates are lowest in Lane County, and the City has informed residents of this fact. But there's still resistance to any proposals for increasing taxes, observers report.

  Retirees, representing a large block of residents, take this view while seeking higher levels of service, say City officials. The retired population is not monolithic from an economic viewpoint, it's noted, with many living truly on social security and small pensions, while others who have emigrated in the past decade from California, seemingly are well off. The working population is largely occupied in lower wage, service industry jobs.

  The wastewater treatment solution is seen as a big bite at $11-13-million. On top of this, solving the stormwater problem "will be expensive," one community leader expects, as do several others. A cost to the residential ratepayer in the range of $2-4 per month for stormwater management might be acceptable to ratepayers, several of those interviewed speculate.

  There's expectation that system development charges will be part of the solution to pay for stormwater management. Some observers believe business should carry a substantial part of the cost through such charges; business people interviewed say cost distribution should be spread fairly with ratepayers throughout the community participating. One business person says costs of infrastructure in Florence seem proportionately higher for business compared to residential users.

  Regarding cost-effectiveness, while there appears to be acceptance at least among community leaders that some type of community stormwater solution is necessary, there's discussion and potentially debate around what's appropriate. Options and the costs attached to them will need to made clear, and the public will need to be involved in making choices, it's said. Several observers see City decision makers as fiscally very conservative, and say the case for recommended solutions will be eyed sharply, as to need and anticipated benefits as well as cost.

D. Anticipated benefits, outcomes of the Plan

- In addition to those already cited above, there are other specific expectations around development of a stormwater management plan that emerge from the interviews. They include:
  - a plan that "lets everyone know how drainage will be handled over the next 20 years, and how much its implementation will cost."
  - inclusion of a hydrology study that identifies where the aquifer is
  - (several say that's not clear) and provides a better basis for recharging and assuring high water quality. A desired product is a map of the aquifer, its capacity; facts and figures.
  - a clear cost/benefit ratio that supports recommendations for
  - implementing the plan.

- written guidelines in the plan or as an outcome that each developer will have to live with. Rules that stick, and are not subject to constant appeal efforts.

APPENDIX 1:

Stakeholders of the Plan: Groups and individuals

Groups identified include:

- Public utility residential and business ratepayers in Florence
- Residents, homeowners assns. of subdivisions in and around
- Florence
- Citizen activist groups (such as Citizens for Florence*)
- Developers, builders, contractors, realtors, bankers
- Florence Chamber of Commerce, Downtown Assn.

** Citizens for Florence is described by one account as a loose-knit group representing a fairly broad cross-section of the community; bright folks; some prominent citizens involved; more growth management interests than narrow environmental concerns, though environmental issues often are presented for openers; history of weekly meetings with 25-30 people in attendance and a list of 200-300 financial supporters in the community; "growing support for their positions".*

Individuals* identified for involvement, further contact include:

- Craig Daniels: lots of knowledge about Munsel Creek
- Dick Walker: a retired engineer
- Mr. Van Heeter: former Planning Commission member
- Rob Ward
- Del Phelps*, realtor
- Wilbur Ternyik : wetlands consultant

- Nola Huntington: Clear Lakes watershed
- Vic Vacarro (sp?): building contractor
- Mike Cociollo: Prudential realtor
- Rich Albright: Western Bank

- Ron Edelman: realtor
- Steve Lenhouse (sp?): Coast to Coast store owner
- Dennis Shepard: plumbing business, 997-1122
- Jenny Velenty (sp?): Florentine Estates resident, civic activist, 997-7573

- Tom Kartrude: Port of Siletz
- Brian Cole: BJ's ice cream owner
- Ken Carter: Carter Bros. Construction
- Porter Leighton, Elmer Vermillyea (sp?): Leisure Excavating
- David Gruez (sp?), Hospital Administration

Suggestions for added SAC members:

Interviewed:

- Phil Brubaker
- Stu Johnston
- Kathleen Sullivan: Friends for Florence
- Lisa Sedlacek

Not interviewed or talked with, but suggested in the interviews:

- Tom Grove, Oregon Pacific Bank
- Rick Luykens (sp?): middle school science teacher; flooding impacted
- Dan Parker: engineer, 902-0339
- Ron Holmquist: Viking Concrete

Suggestions for Chair:

- Don Darby
- Arolf Salo
- Tom Kartrude

PROPOSED PUBLIC INVOLVEMENT PROGRAM

City of Florence
Stormwater Management Plan

Proposed Public Involvement Program

1. Community Values

The public involvement program for the Plan is responsive to these community values held by citizens of Florence:

- Managing growth to maintain a positive quality of life for residents and businesses of the community
- Allowing for family-wage job development
- Protecting and maintaining natural resources and natural systems
- Developing efficient, cost-effective solutions to problems requiring public investment
- Assuring an open, participatory process in public decision making

2. Goals of the program.

- Attain credibility in the public process
- Communicate openly, effectively
- Listen and respond to ideas, concerns and opinions of the public
- Instill confidence in the product (the Plan)

3. Objectives of the program.

- To distribute public information early and continuously during the planning process to the general public and Plan stakeholders, informing them of the key issues and options for solutions, and keeping them aware of progress in the technical work, cost estimation and opportunities to participate in the public decision making process.

- To offer public education about the need and anticipated benefits of the Plan, and the relationship of the stormwater management issue to other community priorities, including wastewater treatment.

- To provide regular opportunities for public participation and input at key steps and in pivotal decisions of the planning process.

4. Key Issues.

The public involvement program will address key issues associated with the development of the Stormwater Management Plan, including:

- drainage problems on residential, commercial, industrial and undeveloped

properties in the Florence area.
- the cost of solving drainage and other stormwater-driven problems in the community, and funding options
- the relationship of stormwater management to the City's aquifer, long-term water supply
- the relationship of stormwater management to the City's program for wastewater treatment.
- trust in public process

5. Target audiences

The public involvement program will be designed to reach City of Florence ratepayers and other stakeholders of the stormwater management plan, including:

- Stakeholders Advisory Committee, appointed by the City to guide the stormwater management planning process
- homeowners associations
- local businesses and business community groups
- major public and private sector property owners
- relevant local and state public agencies
- environmental interests
- growth and land use issue interests
- development industry representatives, including land developers, construction and landscaping contractors, realtors.
- Citizens of Florence who will be asked to participate in the implementation of the stormwater management plan.

6. Public information and education: proposed techniques and tools

The following public outreach approaches and tools are proposed to keep the public informed of the stormwater management planning process and its progress, and to educate on the key issues involved:

a. Project newsletter	Quarterly progress report to stakeholders, interested parties. Send first edition citywide (in 6/99), with a feedback form that includes request to remain or be taken off the mailing list for future issues. Continue to send to key stakeholders and interested parties. (Responsibility: Consultant prepare first issue; City prepare subsequent issues; City print and mail all issues)
b. Newsletter reprint in local paper, The Siuslaw	Place all or part of newsletter copy as an ad in the paper.

News	(Responsibility: City place ads)
c. Water bill stuffer	At least twice during the first year of the planning process, place item in the water bill describing planning progress. (Responsibility: Consultant prepare copy for first stuffer. City prepare subsequent snuffers and distribute all stuffers)
d. Speakers Bureau	Presentations by City officials (Mayor, Council members, Lanfear) and SAC members to key civic groups – Chamber, Rotary, Lions, Friends for Florence, Kiwanis, Homebuilders assn., homeowners assn. meetings – at least once during process. (Responsibility: Consultant prepares key speaking points for first round of presentations; City supports continuation of the Speakers Bureau, including arrangements, information materials)
e. Public education pack	(1) Video clips/still photos of drainage problem areas in winter; (2) drainage basin map; (3) several fact sheets describing nature and background on key issues – drainage, aquifer relationship, wastewater relationships, etc. (Responsibility: City prepares pack except consultant prepares initial set (4) of fact sheets
f. Winter tour(s)	Of drainage problem areas for community leaders, interested parties (Responsibility: City staff; SAC members to participate in leading tours)
g. WEB page	Of factual material presented with graphics support, and interactive feedback tool, such as questionnaire or even a simple video game (Responsibility: City with possible assist on graphics from technical consultant)
h. Media relations	(1) Newspaper: press releases; educate a reporter to the story; solicit feature stories on impact of the problem and on relationship to associated issues with local paper and Oregonian. (2) Radio: use of monthly forum at

least three times during next year if possible, including at least one Town Hall meeting. (3) Cable: at least reruns of Town Hall meeting; possible use of videos of problem areas. (Responsibility: consultant prepare copy for first two press releases. City responsibility for rest of media relations.

i. Schools piece — For use in school classes, and for taking home to parents by all students. (City responsibility)

j. Information distribution — Shared booth at local events and in city gathering places (coffee shops, banks), copies of fact sheets and/or bill snuffers for distribution points (info "kiosks"), along with feedback forms on technical solutions. (Responsibility: City)

k. Information partnerships — Help with information development and distribution from potential partners for public education, such as OSU Extension Service, LCC, Chamber, homeowners assns. (Responsibility: City)

7. Public participation.

The following opportunities for public input and participation in the planning process are proposed:

a. Town Hall meetings (3) — Open workshops hosted jointly by the City Council, the Planning Commission and the Stormwater Management Stakeholders' Advisory Committee (SAC) at key decision points:

- Orientation: the need, what we know, what we need to study, anticipated benefits
- Options: proposed choices to solve the problem
- Recommendations: draft proposal from the SAC to the City

(Hold these meetings at Event Center for targeted/invited stakeholders and the general public)
(Responsibility: P.I. Consultant assist in

preparation and facilitate first two workshops; City has remaining responsibilities for preparation and outreach; technical consultant to make presentation at each meeting)

b. ***Public workshop/ charrette*** — SAC hosts;
Invited stakeholders and general public to review and respond to range of draft solutions proposed by consultants
(Responsibility: technical consultant to make presentation and work with participants; City responsible for arrangements, organization)

c. ***Five other SAC meetings*** — As proposed on the next two pages, SAC would have a total of nine meetings, each one an opportunity for public input. Four of those meetings are covered in (a) and (b) above.

d. ***Feedback form in newsletter*** — (Responsibility: consultant prepare first of the series; City takes responsibility after that)

e. ***WEB page feedback form*** — (Responsibility: City)

f. ***Radio talk shows*** — (once a quarter, if possible)
(Responsibility: City)

8. **Stakeholders' Advisory Committee**

a. ***City's Charge to the Committee*** — First draft prepared by consultant

b. ***Meetings (9), agendas***

Meeting 1 (April) — Agenda includes:

- Need and potential benefits re the study
- Results of community leader survey, including issues to be addressed
- Presentation of proposed public involvement program for the study
- Technical program: what's known; what needs to be studied

Meeting 2 (May) SAC members only. Agenda includes:

- Approval of p.i. plan
- Approval of technical study program
- Initial technical background report (?)

Meeting 3 (summer) SAC members with TAC members. Agenda:

- Technical backgrounding

Meeting 4 (Sept/early Oct) Agenda:

- Presentation by technical consultant of alternatives for solution and initial analysis (pro's and con's of each)

Meeting 5 (Jan., 2000) SAC only. Agenda:

- Project ranking. Technical consultant presentation and TAC input.

Meeting 6 (Feb/Mar) Agenda:

- Presentation by City PW, consultants of draft Stormwater Management Plan

Meeting 7 (Mar) SAC only

- SAC review and discuss draft Stormwater Management Plan

Meeting 8 (Mar/Apr) SAC hosts public workshop for invited participants and general public.

- Discussion of draft Plan

Meeting 9 (April) SAC only. Agenda:

- Review and discussion of draft Plan

Meeting 10 (May/early June) SAC only. Agenda:

- SAC acts on recommended Plan, forwarded to City for action.

(Responsibility for SAC meetings as follows:

- P.I. consultant responsible for organization and facilitation of first two Town Hall meetings (meetings 1 and 4), and for two other SAC meetings (meetings 2 and 5). Consultant responsible for meeting minutes and evaluation of meetings.

- City responsible for arrangements for all SAC meetings, including

location, notifications. In addition, City responsible for organization and recording of meeting 3 (with assistance of technical consultant) and for all aspects of meetings 6-9.)

Charge to the Stakeholders Advisory Committee,
City of Florence Stormwater Management Plan

The Mayor and City Council of Florence have appointed a Stakeholders Advisory Committee to assist in the development of a Stormwater Management Plan for the City of Florence.

The Committee is charged to complete the following tasks:

- Approve a work plan for the Committee, including a planned schedule of meetings of the Committee.
- Review the City's stormwater and drainage history, current status, and associated issues.
- Identify the need and benefits of a stormwater management plan for the community.
- Monitor the technical study conducted during the study and receive progress reports.
- Assure implementation of a public involvement plan to keep community residents informed and educated about issues and progress on the stormwater management planning process.
- Convene Town Hall meetings and at least one public workshop to facilitate public participation in the key decisions of the planning process.
- Review and comment on presentations and proposals of the City and its consultants about alternative approaches for managing the community's stormwater problems.
- Review and comment on the draft stormwater management plan as presented by the City and its consultants.
- Adopt a recommended stormwater management plan for the City of Florence, and forward this recommendation to the Florence Planning Commission.
- Carry out any other activities that may be required to fulfill this charge.

PROBLEM RESPONSE FORM

Problem Response Form

Use this number to mark your location on the map **1**

Name_____

Address_____

Telephone _____(day) _____(evening)

Description of problem:_____

_____

_____

_____

_____

NEWSLETTER
September 1999

Stormwater UPDATE

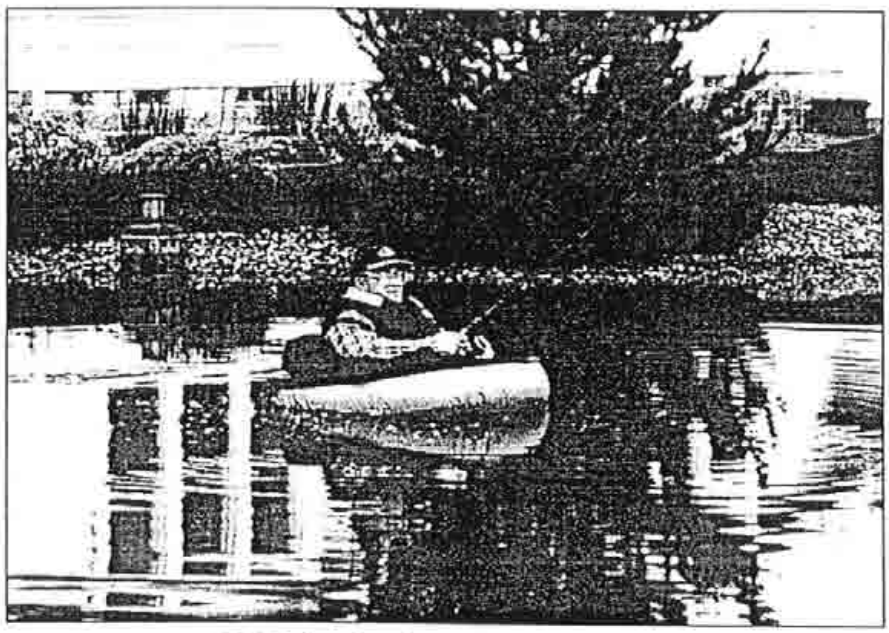
News about Florence's Stormwater Management Planning Process

September 1999

WE HAVE A PROBLEM

Water quality concerns . . . erosion and sedimentation . . . flooding in streets and neighborhoods . . . .

. . . do these issues sound familiar to you? Chances are, you or someone you know in the Flo- ıce area has been olved with one or more of them during winter and spring rainy seasons these last few years. While each issue comes with its own set of challenges, collectively, they pose two serious questions for Florence area residents: How do we solve problems caused by stormwater? And, how will we pay for the solutions?



If this looks familiar, see page 3.

To answer these questions, the City has initiated a comprehensive stormwater management planning ɔcess. Led by a local citizen Ad- ry Committee, the process is intended to provide direction for decision making over the next twenty years. It will recommend options for resolving Florence area stormwater problems and establish a framework for any new city codes, development standards and regulations that may be necessary to support a stormwater management program.

The purpose of a stormwater plan is:

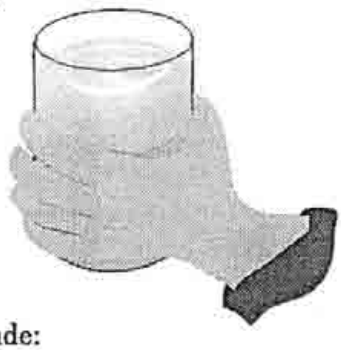
- To provide the City a tool for addressing flooding;
- To protect surface and ground water quality and quantity; and
- To prepare for and manage the impacts of growth in a cost-effective and physically efficient manner over time.

The planning process also includes a public outreach component to ensure the plan reflects community values. The advisory committee needs and values your input.

Frequently Asked Questions

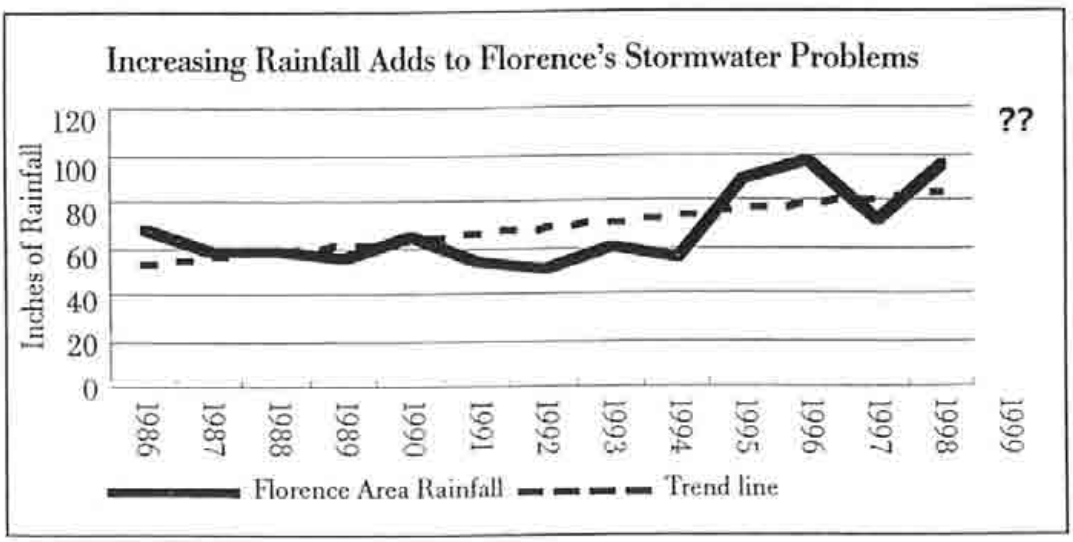
1. Why does the City of Florence need a stormwater management plan?

Rainfall levels vary from year to year. In Florence, a dry year (1992) may only produce 51 inches of rain, while a wet year (1996, 1998) may yield nearly 100 inches! An average rainfall year in Florence is approximately 70 inches. As shown in the graph below, rainfall levels have been increasing over the last decade. Because the Florence area is marked by steep slopes and low-lying areas, run-off from heavy storms can lead to localized flooding of homes, businesses and streets. Flood problems are compounded by rising water tables and increasing amounts of impervious surface which reduce the rate and available area for infiltration processes. If not properly managed, stormwater can pollute local streams and aquifers – the source of the City's drinking water.



Specific project objectives include:

- Drainage and flood control;
- Water quality protection;
- Land resource management;
- Wellhead (aquifer) protection; and
- Erosion and sedimentation control.



2. What has been done so far? What happens next?

To date, the Advisory Committee has met several times to review preliminary flood and ground water modeling results and to develop a public involvement strategy. Upcoming work will include: review of stormwater system alternatives; assessment of current regulations; and preparation of appropriate code, ordinance and development standards. Future work will identify the best alternatives and examine funding mechanisms.

3. How do I know if my flood problem has been identified?

A preliminary map of flood zones and known problem areas is being developed and will be on display at both the public library and City Hall. Maps will also be available at each of the Advisory Committee meetings and public workshops. If you know of flood problems not identified on the preliminary maps, please contact Ken Lanfear at: PO Box 340 (250 Hwy. 101), (541) 997-2141.

4. How much will a stormwater system cost and how will it be paid for?

Stormwater systems vary by type and cost. In Florence, cost will be based on the alternatives adopted by City Council after reviewing available options and receiving input from the technical team, Advisory Committee and local citizens. Financing alternatives will be analyzed as part of the planning process.

How Can I Help?

1. Plan to attend meetings of the Advisory Committee on stormwater management. The Mayor and City Council of Florence have appointed 14 people to an Advisory Committee to assist in the development of a Stormwater Management Plan. The Advisory Committee is charged to:

   - Review the City's stormwater and drainage history, current status and associated issues;
   - Identify the needs and benefits of a stormwater management plan for the community;
   - Monitor the technical work conducted during the study and receive progress reports;
   - Assure implementation of a public involvement plan to keep residents informed about the process;
   - Convene public meetings and a public workshop to facilitate citizen participation in decisions;
   - Review presentations and proposals of City and consultants about alternatives;
   - Review a draft stormwater management plan presented by City and consultants; and
   - Recommend a stormwater management plan and forward to the City and Planning Commission.

   The Advisory Committee meets in the City Council Chambers, City Hall. Upcoming meeting dates are listed in this Update issue. At each session, the Advisory Committee makes time to hear public comment. Also plan to attend a public workshop on options for resolving stormwater issues, to be held in December. Look for details in the next Update.

2. Follow the progress on stormwater planning through issues of Update by completing the form provided in this issue and returning it to remain on the mailing list.

3. Watch for public presentations on the stormwater planning process to be made to community organizations in the coming months. Dates, places and times will be posted in advance in the newspaper and advertised on radio.

4. Complete the feedback forms in future issues of Update. This will give you a chance to register your interests and concerns about the plan as it develops.

5. Contact Ken Lanfear, Public Works Director
   City of Florence
   PO Box 340 (250 Hwy. 101)
   Florence, OR 97439
   (541) 997-2141

Upcoming Activity in the Stormwater Planning Process

Event	Date & Place
Advisory Committee Meeting	*Wednesday, October 13, 1999 City Council Chambers, 7:00 - 9:00 p.m.*
Public Workshop	*Thursday, December 9, 1999 City Council Chambers, 7:00 - 9:00 p.m.*

Reply Form

☐ Yes, I would like to receive future issues of *Update*.

Please return by October 1 to:

Ken Lanfear
Public Works Director
City of Florence
P.O. Box 340 (250 Hwy. 101)
Florence, OR. 97439

Name: _____

Address: _____

City/State: _____

ZIP: _____

Comments: _____

WORK SHOP MATERIALS
(December 9, 1999)
Fact Sheet
Drainage Area Descriptions

"Program Fact Sheet"

* * *

City of Florence Stormwater Management Plan

The stormwater planning process is intended to:

- Identify existing/potential problem areas & recommend mitigation or preventative measures.
- Ensure a community role in establishing project goals & planning infrastructure improvements.
- Establish framework for new city codes, development standards, & design criteria as necessary.
- Provide a plan for stormwater management in the Florence area that will provide technical direction for decision making over the next 20 years.

Specifically, the project will address:

- Drainage & flood control
- Water quality protection
- Natural resource protection
- Aquifer protection
- Erosion & sedimentation control

A Stakeholder Advisory Committee has been established to:

- Review the City's stormwater drainage history & current status
- Identify the needs & benefits of a stormwater management plan for the community
- Monitor the technical work conducted during the study
- Assure implementation of a public involvement plan to keep residents informed
- Convene public meetings to facilitate citizen participation in decisions
- Review presentations by City & consultants on stormwater management techniques
- Review a draft stormwater management plan presented by City & consultants
- Recommend a stormwater management plan to City & Planning Commission

Opportunities for public participation include:

- Attending meetings of the stakeholder advisory committee
- Following progress through issues of the City's project newsletter, *Stormwater Update*
- Provide feedback via Problem Response Forms available at City Library & City Hall
- Participating in public workshops & forums (i.e. radio)

Upcoming Work:

- Current: Consultant/City continue dialogue with regulatory agencies to ensure proposed stormwater management alternatives are consistent with state & federal regulatory requirements
- Draft development standards & Best Management Practices available for review January - 2000
- Draft Stormwater Management Plan scheduled for completion early February - 2000
- Final plan presented to City Council near June – 2000

12/08/99

Key Findings:

- Most flooding in Florence area related to *high groundwater* & not directly due to storm problems.
- High groundwater problem has become more evident with *end of 20-year dry period* (1976-1995).
- Higher than normal rainfall years have produced flooding situations in some low areas & in some areas *relying upon infiltration* into the underlying sands to dispose of stormwater.
- Citizens want to *protect aquifer from contamination* by stormwater infiltration, but recognize some recharge of the aquifer is necessary to replenish it.
- The listing of salmon as an endangered species & new wetlands *regulations limit the range of alternatives* that can be used to fix existing problems. Solutions proposed for Florence are designed to solve the flooding problems, while also preserving water quality & habitat.

Description of Solution Types – The "Tool Box":

Some stormwater problems will be addressed through changes in City code, development standards, & design criteria. Others will be solved by constructing the following stormwater facility types:

Pipe: Some flooding problems are caused by systems constructed with undersized pipes. New or replacement pipe will be installed to help prevent flooding in some areas. Pipe materials include: concrete, reinforced concrete, polyvinyl chloride pipe (PVC), cast iron, corrugated steel & aluminum.

Detention ponds: One of the oldest & most effective methods of solving both flooding & water quality problems. They work on most types of pollutants, are relatively simple to design, & require little maintenance. Water is stored in an excavated or walled basin with discharge controlled through an outlet pipe or orifice. Detention for flood control allows water to be impounded for much shorter periods of time & does not require a permanent pool of water. If water quality treatment is also desired, detention between 48 to 72 hours allows most particulate pollutants to settle without running into low oxygen conditions from the decomposition of organic substances in the stormwater.

Constructed wetlands: Wetlands & ponds operate in much the same manner. Wetlands are designed more for improving water quality, than for flooding. Like ponds, they require more space than other techniques, which limits their application in fully-developed areas. Increases in temperature are also a concern with impounded water. Wetlands are shallower, allowing much more vegetation to grow. Their pollutant removal effectiveness may be slightly greater than in ponds, but they are less tolerant of fluctuations in water depth. Wetlands provide greater habitat benefits.

Vegetated swales: Vegetated swales are vegetated channels with a slope similar to that of standard storm drains channels (less than six percent), but wider & shallower to maximize flow residence time & promote pollutant removal. These facilities may be planted as grassy swales or contain shrubs & other ground covers. Swales are quite often used to retrofit in road medians. Maintenance is an essential component of swales to protect against erosion or invasion by weeds.

Culverts: A culvert is a short section of pipe or concrete structure that is usually constructed to allow water to pass under a roadway. Culverts are less expensive than bridges, but are not as good for fish passage. Open-bottomed culverts, such as arches, are better for fish than circular ones.

Infiltration facilities: Infiltration facilities may take the form of ponds or unlined channels on the surface or underground trenches & dry wells. Runoff enters the facility & drains to underlying soil. Sandy soils allow rapid drainage, but do not provide as much treatment other soils. To protect Florence's aquifer, infiltration is encouraged only for areas with little pollution (residential/open areas). Infiltration for runoff from commercial/industrial areas is not encouraged without treatment.

Florence Southwest Drainage Area (Greentrees)

Problem Understanding

Greentrees Village was developed as a PUD in 1973. The development does not have a curb and gutter drainage system. During the 1973 rainy season, the area around the clubhouse became very wet. As a result, several drainage pipes were installed to drain this area to the river.

During the last two winters, a large number of lots in Greentrees East were flooded during and after heavy storms. One home has been elevated to help prevent it from flooding. Other lots experience flooding, but solutions have not yet surfaced to address the problem.

A mapping of the problem areas as reported from residents indicates that most of the flooding is from the lack of an internal collection system. The severity of the problem appears to have worsened over the years as the percentage of impervious area has increased as undeveloped lots have been built up.

Greentrees' residents report that some stormwater flow enters several Greentrees lots from the property to the east.

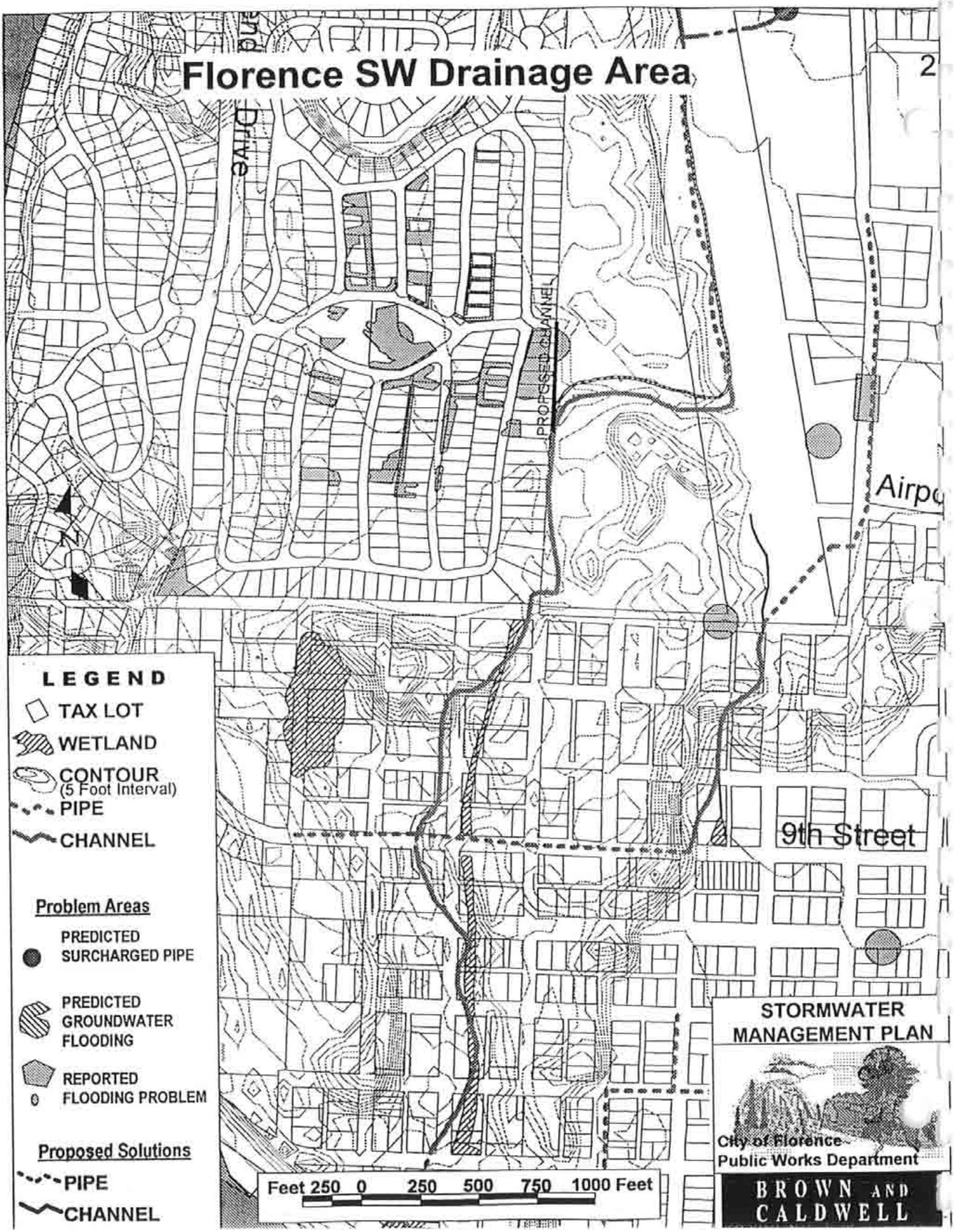
Potential Solution

The following solution is proposed:

- infiltration should be restored to a more natural state where possible within Greentrees,
- an internal stormwater pipe system should be extended to serve the entire development, and
- a ditch should be extended north from the airport ditch to intercept flows originating from off-site

Other Considerations

The proposed solution requires cooperation of private property owner to the east.


Florence SW Drainage Area
Drive
PROPOSED CHANNEL
Airpo
9th Street
N
LEGEND
TAX LOT
WETLAND
CONTOUR
(5 Foot Interval)
PIPE
CHANNEL
Problem Areas
PREDICTED
SURCHARGED PIPE
PREDICTED
GROUNDWATER
FLOODING
REPORTED
FLOODING PROBLEM
Proposed Solutions
PIPE
CHANNEL
Feet 250 0 250 500 750 1000 Feet
STORMWATER
MANAGEMENT PLAN
City of Florence
Public Works Department
BROWN AND
CALDWELL

Florence Southeast Drainage Area
(Willow Dunes, Creekside Pines, Coastal Highlands)

Problem Understanding

The developments in southeast Florence lie in a low area between Munsel Creek and the higher elevations of the hills to the east and south. A natural drainage route is not available for removing excess water from this area, as shown by the number of existing wetlands. In addition, the topography will not permit non-pumped gravity flow from the area. Modeling shows that during years of higher than average rainfall, the groundwater level rises between 5 and 10 feet, leading to flooding of streets and homes. It is estimated that about 400 gallons per minute may needed to remove the excess water from this area.

Potential Solution

The following is proposed:

- identify normal ground water elevations,
- install pump facility at end of Pine Court, above the normal water elevations, and
- pump excess water to Munsel Creek when water elevation exceeds normal elevation

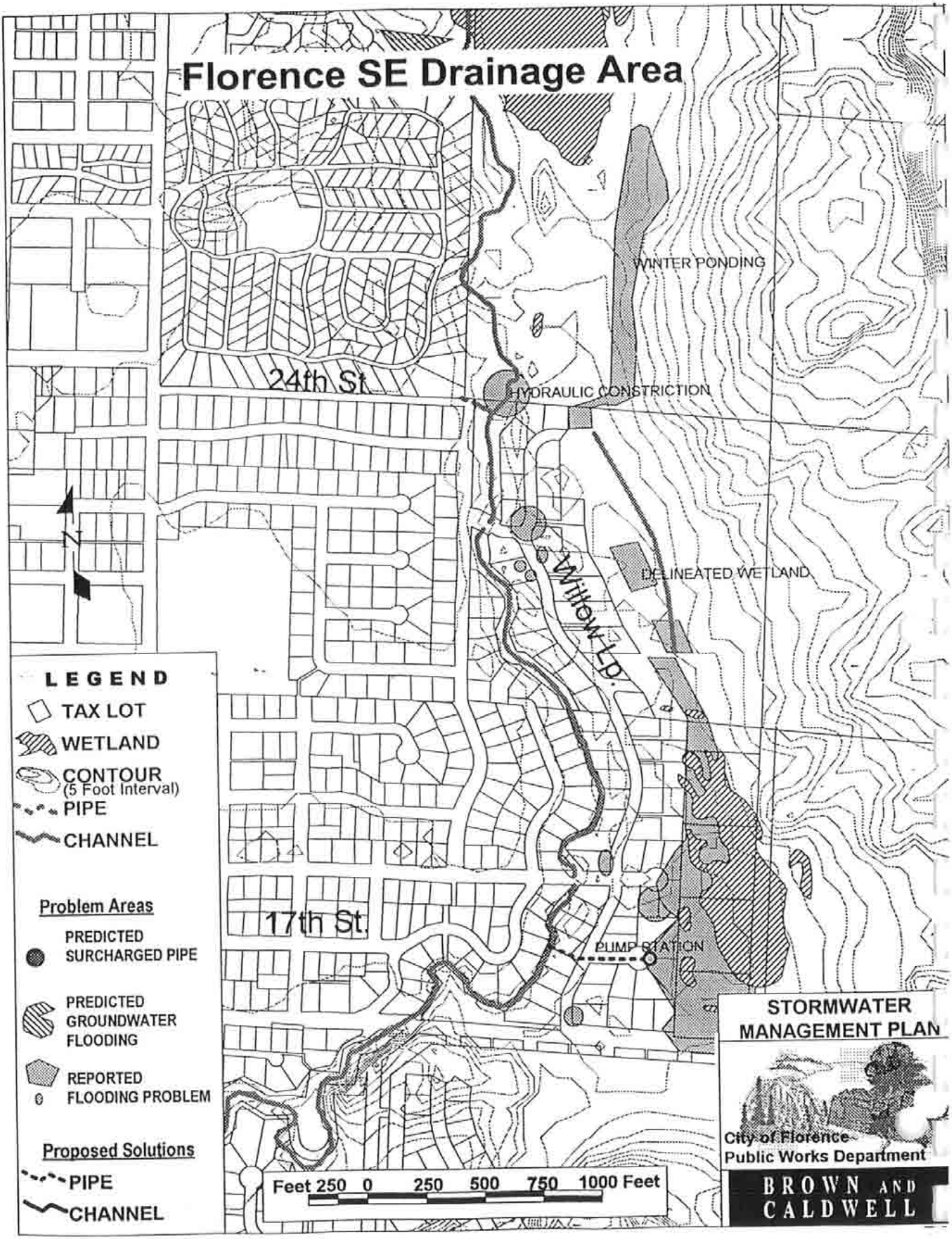
Other Considerations

Most of the pump facility would be underground, with only the field inlet (grate) and electrical box aboveground.

The city would need to acquire easements from residents to install and service the pump station.

Close coordination with regulatory agencies will be necessary because of the wetlands proximity.

Building restrictions may be required in certain low areas depending on the allowable water elevations.


Florence SE Drainage Area
WINTER PONDING
24th St.
HYDRAULIC CONSTRICTION
N
Willow Lp.
DELINEATED WETLAND
17th St.
PUMP STATION
LEGEND
TAX LOT
WETLAND
CONTOUR
(5 Foot Interval)
PIPE
CHANNEL
Problem Areas
PREDICTED SURCHARGED PIPE
PREDICTED GROUNDWATER FLOODING
REPORTED FLOODING PROBLEM
Proposed Solutions
PIPE
CHANNEL
Feet 250 0 250 500 750 1000 Feet
STORMWATER MANAGEMENT PLAN
City of Florence
Public Works Department
BROWN AND CALDWELL

Florence Northeast Drainage Area
(Florentine Estates)

Problem Understanding

There are numerous reports of flooding in Florentine during the large storm events of the past several winters, with most of the flooding occurring in the streets.

Rainfall analysis and modeling estimates show that during the past few high rainfall years, the groundwater levels north of Munsel Lake Road have been about 10 feet higher than normal. The high groundwater coupled with storm events creates flooding problems as the water is routed down through Florentine Estates. Florentine's internal stormwater collection system is not capable of handling these large flows.

Potential Solution

The following steps are proposed:

- allow low flows to continue under the road and into Florentine Estates to replenish the ponds, and
- capture high flows at Munsel Lake Road and route in a swale along north side of road to the east, then
- route flows through culvert under road and through pipe running along east edge of Florentine Estates to tie-in to Munsel Creek to east of Florentine Estates

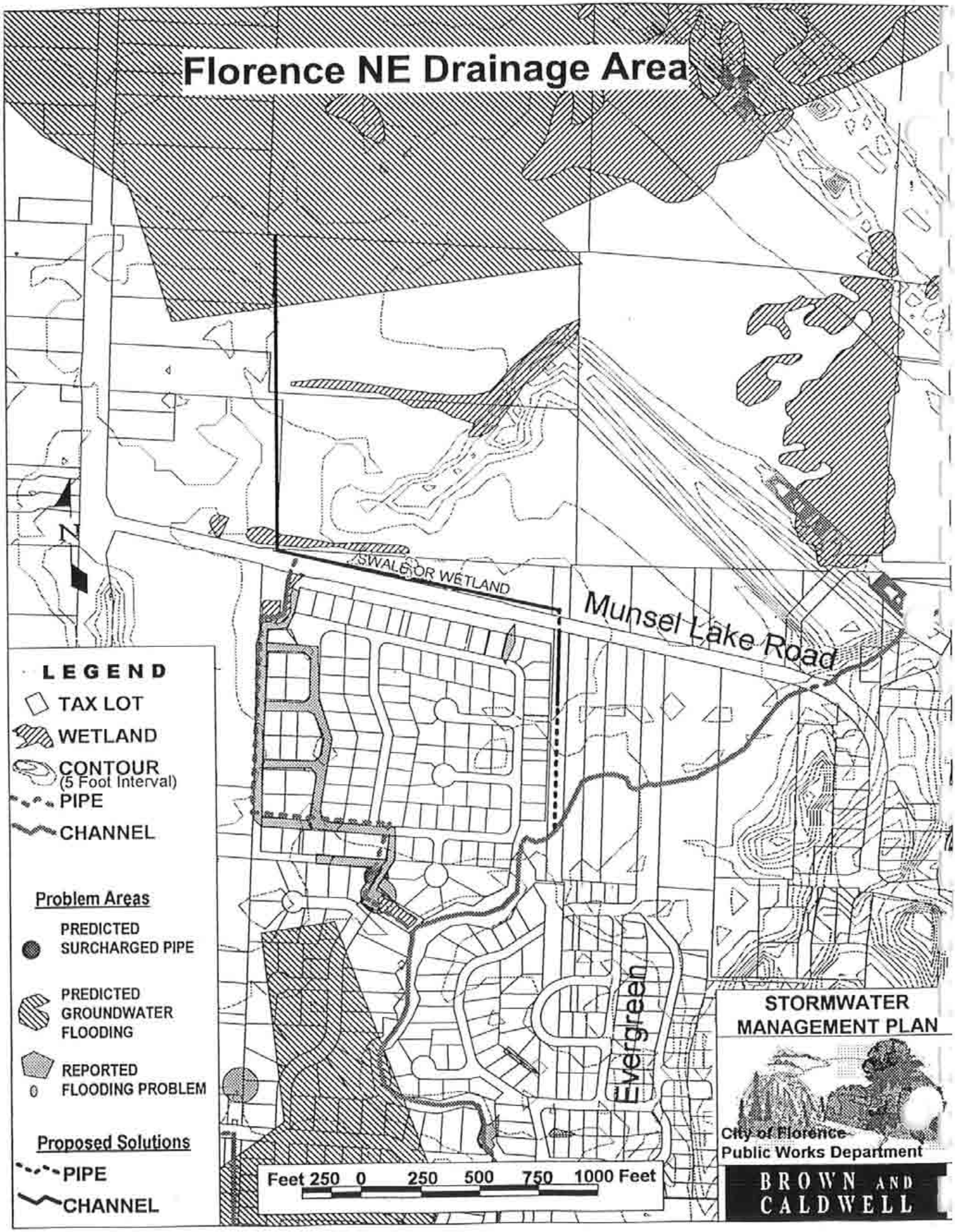
Other Considerations

Coordination with the regulatory and resource agencies will be necessary, especially concerning the proposed outfall to Munsel Creek. Allowances must be made for any flow dissipaters necessary to minimize potential erosion at the outfall.

Storage capacity should be maximized in the swale along Munsel Lake Road. This will lessen potential impacts on discharging into Munsel Creek and could be designed to improve water quality and habitat.

The proposed improvements will be sized to accommodate flows from future development occurring to the north of Munsel Lake Road.

As new development occurs to the north of Munsel Lake Road, opportunities to preserve and provide for habitat should be identified and implemented.


Florence NE Drainage Area
N
SWALE OR WETLAND
Munsel Lake Road
Evergreen
LEGEND
TAX LOT
WETLAND
CONTOUR
(5 Foot Interval)
PIPE
CHANNEL
Problem Areas
PREDICTED
SURCHARGED PIPE
PREDICTED
GROUNDWATER
FLOODING
REPORTED
FLOODING PROBLEM
0
Proposed Solutions
PIPE
CHANNEL
Feet 250 0 250 500 750 1000 Feet
STORMWATER
MANAGEMENT PLAN
City of Florence
Public Works Department
BROWN AND
CALDWELL

Florence Northwest Drainage Area
(Idylewood, Heceta South)

Problem Understanding

Northwest Florence, including Heceta South and Idylewood experience numerous flooding episodes each winter. These problems appear to be due to low areas in the topography which expose the groundwater table.

The Heceta South area has numerous such low areas which make construction of a piped drainage system difficult and expensive. The groundwater modeling effort has identified likely water level elevations in the area.

The low area in Idylewood near Gullsettle Court has no natural outlet and may be affected by the high groundwater elevations during years of high rainfall. Water is currently pumped to the west, but has no clearly defined path to a receiving water body, causing problems on other properties. Rainfall analysis and modeling estimates show that 300 gallons per minute may need to be removed from this area to prevent localized flooding.

Potential Solution

Due to its widespread nature, some building restrictions in Heceta South may be the most cost-effective method of dealing with flooding in this area.

The Idylewood problem appears more localized and the following steps are proposed:

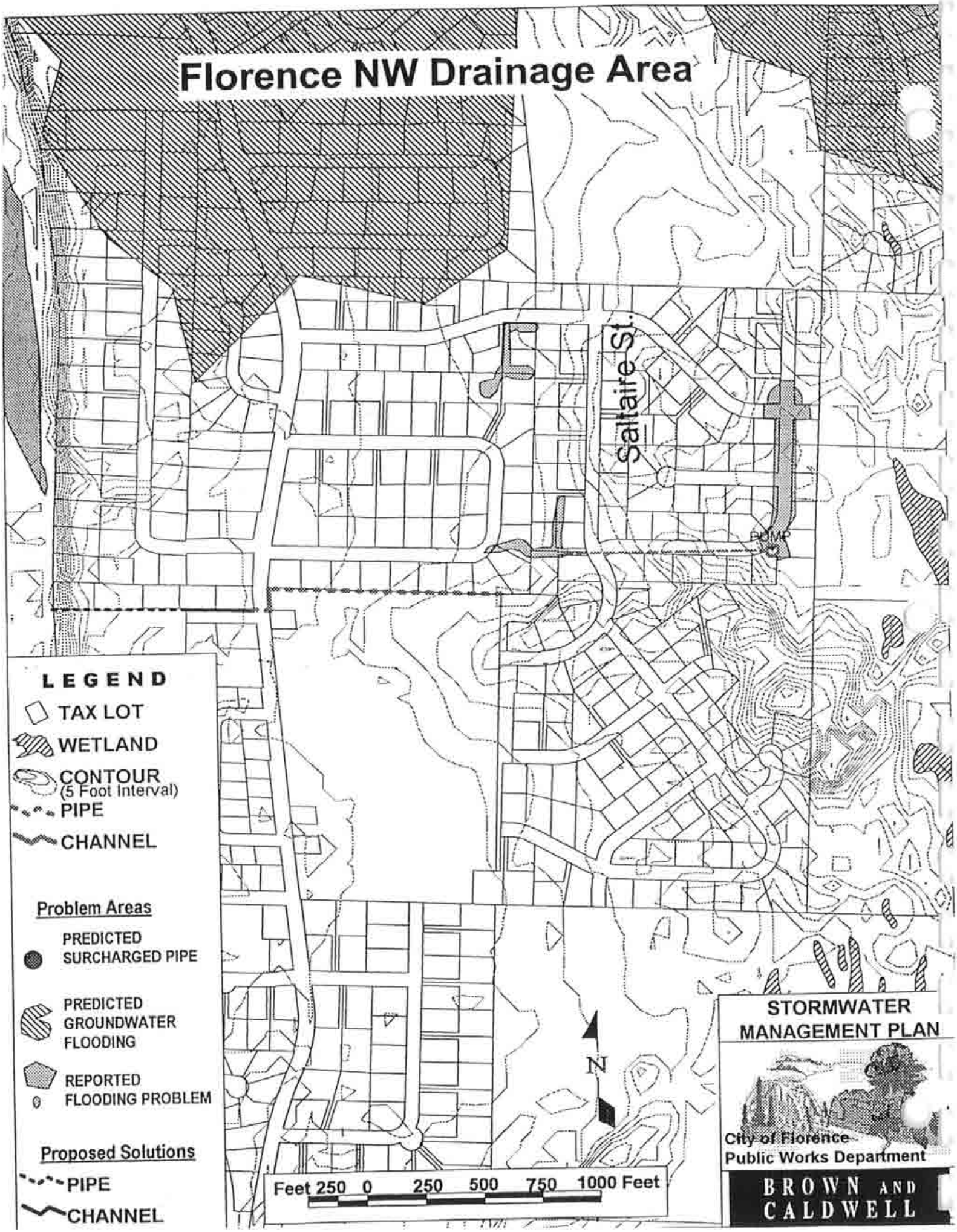
- replace the 12-inch culvert under Rhododendron Drive with larger pipe, and
- extend ditch along North Jetty Road to point of uphill slope, and
- install pipe to receive flow and convey it over crest of hill and the downslope

Other Considerations

These solutions require the cooperation of county and developers since they are outside city limits.

Regulatory and resource agencies must approve the creation of a new drainage outfall along the west end of the North Jetty Road.

If future development is permitted in the Idylewood area, it must have adequate drainage via the North Jetty route.


Florence NW Drainage Area
Saltaire St.
PUMP
LEGEND
TAX LOT
WETLAND
CONTOUR
(5 Foot Interval)
PIPE
CHANNEL
Problem Areas
PREDICTED
SURCHARGED PIPE
PREDICTED
GROUNDWATER
FLOODING
REPORTED
FLOODING PROBLEM
Proposed Solutions
PIPE
CHANNEL
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Feet 250 0 250 500 750 1000 Feet
STORMWATER
MANAGEMENT PLAN
City of Florence
Public Works Department
BROWN AND
CALDWELL

Florence Central Drainage Area
(Sandpines West, Mariners Village, Shelter Cove, Seawatch)

Problem Understanding

The relatively large area to the northeast of Sandpines Golf Course consists of seasonal lakes located on Lane County property north and south of Heceta Beach Road. The seasonal rainfall affects the groundwater elevations in the area along with the water surface elevations of the lakes. As the water elevations rise, the lakes become interconnected and a general south to southwesterly flow of surface water occurs. Sandpines has developed an Interim Drainage Plan (IDP) to address the drainage issues within Sandpines. The actual problems in Sandpines West consist of a high groundwater table that have impacted several houses.

The groundwater table in and around Mariners Village is influenced by the seasonal rainfall quantities. During high rainfall years, the groundwater has risen to negatively impact residents. Mariners Village is installing a piping system and temporary retention pond to alleviate flooding problems occurring largely on the northeast corner of their development.

Shelter Cove and Seawatch are experiencing erosion of the cliffs along the Siuslaw River apparently due to a number of factors.

Potential Solution

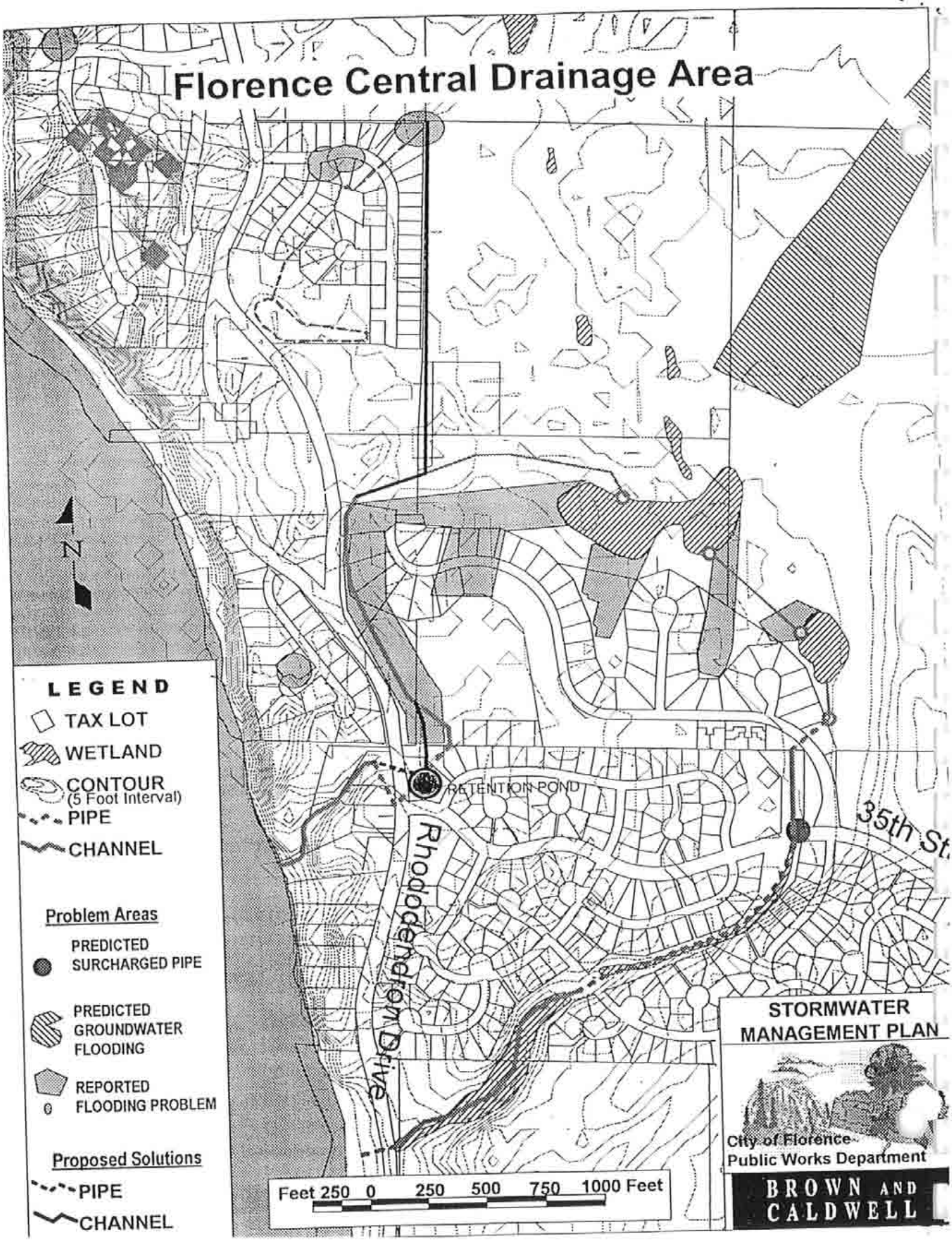
The following steps are proposed for the Central Drainage area:

- replace the existing berm along Rhododendron with more permanent and appropriately sized conveyance system, either a pipe or a lined channel (both would minimize the amount of infiltration occurring in this area), and
- discharge flows from the conveyance system to a pond at the intersection of 35th Street and Rhododendron Drive (the pond will help lessen downstream peak flows), and
- replace existing collection system near Rhododendron Drive with a culvert connected to the proposed pond and crossing Rhododendron Drive to the existing natural channel, and
- reinforce channel side slopes of the existing natural channel, as necessary, to prevent erosion

Other Considerations

In addition, the following measures will help broaden the flood relief:

- construct a ditch along the east side of Mariners Village to intercept and route flows southward, and
- coordinate the City proposed improvements with the efforts undertaken by Sandpines to maximize the benefit to the entire area, and
- investigate potential sites for wetland construction to the north of the Sandpines, and
- give additional consideration to creating a drainageway along Eden Way


Florence Central Drainage Area
N
LEGEND
TAX LOT
WETLAND
CONTOUR
(5 Foot Interval)
PIPE
CHANNEL
Problem Areas
PREDICTED
SURCHARGED PIPE
PREDICTED
GROUNDWATER
FLOODING
REPORTED
FLOODING PROBLEM
Proposed Solutions
PIPE
CHANNEL
RETENTION POND
Rhododendron Drive
35th St
Feet 250 0 250 500 750 1000 Feet
STORMWATER
MANAGEMENT PLAN
City of Florence
Public Works Department
BROWN AND
CALDWELL

PUBLIC RESPONSES

Information Centers

Newsletter

Public Workshop

Response to Information Centers			
Name	Address/Neighborhood	City, State	Comments
Jan Kinslow	87772 Sandrift St./Idylewood	Florence, OR	Heceta Lakes drain into this area and there is no draining outlets from this street. The water has to be pumped out. Water often covers the street and yards. Water also drains down from surrounding hills. This street is low.
Richard & Rosemary Ishii	87757 Sandrift St/Idylewood	Florence, OR	Sandrift Street is a very low (probably the lowest) street in Idylewood with no drainage at all. The storm water has to be pumped out. If it is not pumped out the street is covered with water and impassable and we have water covering our yards. Heceta Lakes drains toward our street instead of following the intended route through Sand Pines and out to the culvert under 35th Street. Something has to be done to provide drainage on this street.
L. Jack Evans	87810 Sandrift St/Idylewood	Florence, OR	We have water (up to 2 ft.) standing in the ditch in front of and on the south side of our house most of the winter and rainy months. The problem appears to be the lakes just to the east. These should be drained off to the ocean. This land should have been left as wetlands and permits to build should not have been issued by the County.
Ken and Leita Kent	467 Sherwood Loop/ Florentine Estates	Florence, OR	Flooding by the "Phelps" River. 8" of water in street during monsoon season.
Angelo Corso	4120 Munsel Creek Drive/ Florentine Estates	Florence, OR	Water under the home. Also, homes across and around and down the street total of eight.
Charles Lange	3866 Spruce Street/ Mariners Village	Florence, OR	Lot 9 Mariners Village experience. Significant flooding this last winter following the grading and fill which took place on Lot 8 without the required permits.
Glenn Gugelman	2033 24th Street	Florence, OR	Since the developing of our back alley we now have 6 - 8" of water in our back yard. We now have a stream that runs from the back out to the street at the property line between us and the house east of us. This drainage was bad enough that everyone walking by thought there was a broken pipe.
Mr. And Mrs. Marvin Knapton	2065 E. 24th Street	Florence, OR	Last winter, we had severe flooding in our yard the water ran through our yard into the street. There was over a foot in some places, covered half of our patio. We've been there 20 years never before like that since the drainage ditch was removed. Hope there is a remedy.
Marvin Ryall	05460 Friendly Acres Road	Florence, OR	Excess storm water (from property 5055 and 5071) drains very slowly. Historical drainage to south has been blocked by sand dunes and filling of property. Today ESW must perk or drain east under 101 then to Munsel Creek.
Robert Mulen	3409 E. Myrtle Loop	Florence, OR	Water collecting under my house up to 30" until we installed pump. We believe it comes from the property north of 35th that's always a lake - pity the guy that is buying it. Did the realtor tell the buyer about that.

Response to Information Centers			
Name	**Address/Neighborhood**	**City, State**	**Comments**
Mark Christian	2831 28th Place	Florence, OR	Entire lot floods including up under house. Last year water came within 6" of flooding house. Just bought house and am shocked that this happens - is new house. Water depth up to 18" around house.
Mr. and Mrs. A5Charles R. Miler	04807 Seapines Drive	Florence, OR	Water is being directed onto North Seapines Drive from Idylewood housing development. There are 2 (may be) points at which water is directed onto Seapines Drive.
John C. Heitman	3945 Munsel Creek Drive	Florence, OR	Poor drainage on Munsel Creek Drive causing high water table in rainy season.
Pat Malagruba	87836 Sandrift Street	Florence, OR	Lack of a proper groundwater drainage system has compromised my septic system; caused standing water to accumulate on my property; and has caused flooding at the intersection of Ocean and Sandrift Street which limited access to my home. Lane County failed to require or provide the proper infrastructure prior to issuing building permits for this area.
Gene Benedick	Gulsettle Court	Florence, OR	No drainage - water has to be pumped pout from yard and street. Overflow from Heceta Lakes comes in wrong direction, instead of flowing to the river it flows here.
Ralph Nelson	04946 Sandrift Court	Florence, OR	High water at intersections of Sandrift and Oceana And Sandrift and Sandrift Court where water is too deep to drive through. It seems water comes from a lake east of Sandrift behind Lots 27, 19, 18, 17 & 16.
John K. Pearce	87746 Saltaire Street	Florence, OR	We get flooding in the NW corner of our property, an area of 20'x30' up to 7" deep, most of which drains from our neighbor's property to the north of us, Lot 93, which gets up to 12" of water beneath the house. The two ditches on the east and south of our property fill to over flowing as 5 other drainage ditches drain into our ditches. See diagram on back.
Melvin Mullins	4939 Sandrift Court	Florence, OR	Lack of mail and paper delivery. Impossible on occasion to make it to the grocery store, contaminated water and damage to my car from driving through the water. Some sewers flooded and unusable.
Paul and Sandy Lee	4930 Sandrift Court	Florence, OR	During the rainy season, water accumulates at the intersections of Sandrift Street and Sandrift Court, and Sandrift Street and Oceana Drive. Sometimes water is too deep to drive through. It seems water comes from lakes east of Sandrift Street (i.e. ground water of above lakes).
Arthur Dalby	4924 Sandrift Court	Florence, OR	We have high water we have to drive through during the rainy season to get to our property. We are very concerned about the septic systems that do not function when this is the problem.

Response to Information Centers			
Name	Address/Neighborhood	City, State	Comments
Kenneth Chipps	4936 Sandrift Court	Florence, OR	We are concerned for the welfare of our two grandchildren that live with us. With the water that builds up at the Sandrift Street and Sandrift Court intersection there are odors, and possible septic overflows that could cause health problems for the neighborhood. The water has been deep enough where vehicles had problems, a person cannot walk without getting wet. The only way to get into our area is through this area that gets flooded. I have been told that this water comes from the "Wood" Lake east of Idlyewood, the same area that the City of Florence were proposing to dump more run-off water from the new developments that are proposed north of BiMart. More water in this low area is not what we need.
Charles and Jeanne Kimball	04862 Oceana Drive	Florence, OR	Please refer to letter sent to Ken Lanfear with pictures and descriptions of water problems down our panhandle drive, in our yard under our house and the running water that goes from our yard on into Seapines (your map is not accurate and does not correspond to the one we have from county. If you cannot locate packet sent to your office please call us so that we can show you the problems.
Loretta Woods	P.O. Box 2867, 4065 Munsel Creek Drive	Florence, OR	Rain water goes over sidewalks (occurred 98-99 winter) water has been excessive in yards occasionally under homes. Area obviously needs better drainage system.
Gary D. Krett	1512 Myrtle Loop	Florence, OR	Standing water southeast corner of Myrtle Loop (no storm drain) and water under homes (when water table is high) and why isn't drainage ditch on map east to west that is existing.
Marilyn V. Miller	2165 East 20th	Florence, OR	During heavy rains, the backyard fills and becomes a lake about 12" deep, and takes 2 - 3 weeks to go down. It also causes an underground stream that has undermined the driveway necessitating repair work after every heavy rain. It also floods the driveway because the city drains can't handle the heavy runoff.
Robert J. Douglass	4960 Oceana Drive	Florence, OR	Street overflow - 6" deep all the way under house we were pumping from 7 a.m. to 10 o'clock p.m. filling pumps with gas every 2 hours water from over flow and backup of lots 6 and 7.
Claude T. Silva	87740 Sandrift Street	Florence, OR	Water up to driveway - as much as 14" of depth from my home to intersection of Oceana and Sandrift. If we had not pumped we would have had water present for five months - three years in a row.
Marilyn V. Miller	2185 East 20th	Florence, OR	During heavy rains, the backyard floods to 12" and stays flooded for 2 - 3 weeks after rain stops. While the driveway hasn't undermined like next door, it is a concern that it could happen in future.

Response to Information Centers			
Name	Address/Neighborhood	City, State	Comments
Randall and Susan Pilcher	87842 Sandrift Street	Florence, OR	During the flood of 1996 corner of Oceana & Sandrift under water. Water was in front of our home (even though we pumped day & night) for over 2 months.
Lee Geiss	87767 Sandrift Street	Florence, OR	No water drainage between Oceana and Gullsettle. In a heavy rain we get between 2 inches and 12 inches of water on the street. It floods the front and back yards of our house. The lakes behind our house also add to the problem.
Donna Fariss	4105 Munsel Creek Drive	Florence, OR	Our house is at corner of 41st Street and Munsel Creek Drive - storm water runs down 41st and 42nd and into storm drain at our corner (not just down streets, but also on our property). Have had 4" - 5" on some occasions.
Richard Larsen	87791 Sandrift	Florence, OR	Water over street and yard. Water in crawl space under house. During heavy rains, water has no place to drain and builds up in the area like a bowl.
Don Gutmann	1620 17th Street	Florence, OR	The runoff form Miller Park now forms a lake just south of the end of 17th Street covering the bike path and last year was 6' from my foundation. H_2O bubbles out of the top of the new manhole in the park (30' west of above location). Last winter the manhole was bubbling H_2O out to the surface for many weeks. At times last winter this lake was wide enough that it spread from the dense vegetation on the west side of the bike path to my fence on the east side of the path, thereby completely blocking the path for school kids. They had to re-route up to Pine Street.

Reply to September 1999 Newsletter

Update	Name	Address	City, State	Comments
X	Ed Stivers	1549 N. Siano Loop	Florence, OR	Doing something about flood control prevents unnecessary expense (repairs, restoration, etc) in the future
X	Charles Lange	3866 Spruce Street	Florence, OR	How do I get specific information regarding the plans for Mariner's Village?
X	Richard & Rosemary Ishii	87757 Sandrift St	Florence, OR	We are in a bad flood area on Sandrift St. Please help us. We will attend all meetings and give out input. Thank you
X	Quentin T Woods	132 Evergreen Lane	Florence, OR	I believe many of the current plans are too short sighted. Problems are pushed into the future which generate increased future problems & expenditures
X	J.W. Hollinhurst	87698 Saltaire	Florence, OR	Florence deserves a more appealing newsletter than this. It is a graphical atrocity! This kind of image will negate any attempt to attract commerce
	Darlene Beane	PO Box 2619	Florence, OR	Great idea. Needs work, especially Coastal Highland's Willow Dunes Creekside 400 section of Florentine flooding excessive
	Tom & Donna Burke	PO Box 1238	Florence, OR	As water drains south from the Fred Meyers site, it backed up behind the Spiderweb store in a wide ditch (the past 20 years). There is a 30" drain pipe through the U-Store site, the pipe is reduced to 18" across Woodsmans Nursery, which then drains in a 10" pipe at the south end of Woodsman's, out to the HWY 101 ditch. This joins Hwy 101pavement drainage along the Les Schwab site. Thus collection of water then drains under Hwy 101 and eventually to Munsel Creek. Since there's obviously no drainage system planned or required for this area to obtain a building permit vis-a-vi Fred Meyers, I would suggest this be given a high priority. Because of the topography, it would be feasible to drain all these properties to the highway, with ODOT's cooperation. If not, good luck.
X	Louie & Evva Bonds	404 Sherwood Loop	Florence, OR	We are on the edge of previous periods of high water in the Florentine Estates. Until water north of Munsel Lake road is channeled elsewhere such as the lake south of Havata Road we will continue to have a problem. The Factory Outlet Mall will compound the problem
X	Jon Herring	PO Box 92	Florence, OR	My street floods every year and it needs to be fixed. I live at 2056 E 10th Street. I have water front property in the winter
X	Floyd H. Edmiston	1657 Elanco Lane	Eugene, OR	We are no longer own property in the City of Florence. Is this a city project or a Florence Project? Please define the term- community

Reply to September 1999 Newsletter

Update	Name	Address	City, State	Comments
X	Marybeth Stevenson	PO Box 1655	Florence, OR	I have a concern that the rocks along the sides of the roads in Coastal Highlands will not be adequate in times of downpours or flash floods.
X	Melvin Brown	457 Sherwood Lane	Florence, OR	You are right! We have a problem and will continue to have one if we continue developing the natural drainage areas.
X	Henry/Lois Wielders	5 Mariner Lane	Florence, OR	A good general overview of the problem. Now, what are you going to do? How are you going to do it? When are you going to do it? Need target dates for completion. How about draining the 7 lakes north of Sandpines. Was there ever any type of drainage plan formulated? If so, could some of it be useful now?
X	Diane & Lee Geiss	87767 Sandrift Street	Florence, OR	We live in Idlewood and still have water problems. The pump has been disconnected. If we have a wet winter we are worried about a flood.
X	Donna Fariss	4105 Munsel Creek Dr.	Florence, OR	Would like to see some action taken soon- before this winter's rains & flooding does damage to peoples' homes!
X	Charles & Mary Jo Betts	87708 Sandrift St	Florence, OR	Here in Idlewood subdivision, neither developer nor county officials have prepared any solutions to our continuing wastewater runoff problem!
	Milo Anderson	459 Sherwood Loop	Florence, OR	We are very concerned about storm water management living in Florentine Estates.
X	L. Jack Evans	87810 Sandrift St	Florence, OR	We live in Idlewood and we do indeed have a water problem.
X	John W. Taylor	412 Sherwood Loop	Florence, OR	Extend storm drain trunk on US 101 North from its northern terminus to N. city limit on US 101 so that US 101 & Munsel Creek Rd are not draining their overflow through the streets of Florentine Estates
X	Ralph E. Nelson	04946 Sandrift Ct	Florence, OR	I am very concerned as I have had to drive through 2 feet of water to get to my house.
X	Averill & Steen Gray	88039 Leeward Dr	Florence, OR	We actually live in the county, but have had flooding problems the last few winters. The county has been informed, but so far, has chosen to do nothing.

Reply to September 1999 Newsletter

Update	Name	Address	City, State	Comments
	Gene Benedick	27962 Ward Lane	Eugene, OR	I am the developer of the Idylewood sub-division and still own lot # 116 (4985 Gullsettle) which is off Sandrift street. The water table comes up much earlier these past 4 rainy seasons primarily due to seasonal lakes to the east of us filling up to 87 feet of elevation by mid to late December. More drainage is flowing from the east side of 101 near Hecta Beach Road and causing the lakes to fill much earlier than normal. If the lake was allowed to fill to only 83 feet of elevation by maintaining the clogged outlet caused by erosion over the years our area along Sandrift Street could absorb the above normal rain falls. The flood control pump installed 2 years ago cycles off and on for weeks even though it has not rained due to the water migrating from the lakes and will continue till the lake level drops to around 83/84 feet elevation level. Idylewood and 1st addition roads is part of the Lane county road system and should provide some relief to the residents of this area in keeping the water off the street. Since the flood control pump is pumping mostly the water coming from the lakes we should be allowed to pump it back to the lakes or somehow move this water more directly to the Siuslaw River. Bud Meyers is representing Idylewood on the committee and has all of my old maps and research files. Please feel free to contact me if I can be of any assistance.
X	Kathleen Jo Copenhaver	4627 W. Hwy 126	Redmond, OR	I own a rental in Florence at 4602 Foulweather. I have contacted the County on numerous occasions about the water run-off onto my property. The house sits down lower than the other houses on the street. My property gets all the run-off from Rhododendron and Foulweather and has caused dryrot. I have called the city and I have contacted the county several times by my effort was of no avail. If a berm was placed on the south side of Foulweather it would help the problem and since the other houses sit up higher than mine I don't believe it would cause a problem for them. Whenever I come to Florence I have dug ditches to try and keep the water from running under the house but it doesn't last long before it is filled with sand. The city was very nice but said there was nothing they could do as it was a county problem. I would like to receive future issues of Update and would appreciate any help or suggestions on
X	Harold Stanley	1882 E 18th	Florence, OR	Thanks for keeping us updated on this. We also have a house in Portland, don't get anything like this there. Since we aren't here all the time this is a good way to keep up.

Reply to September 1999 Newsletter

Update	Name	Address	City, State	Comments
X	Charles and Jeanne Kimball	04862 Ocean Drive	Florence, OR	We still want a response on whether you received and still have the pictures and text on flooding in 1999. It was taken to your office on June 23.
X	Nbill Sibbett	88708 Shorline Loop	Florence, OR	Am in urban growth area, but interest in your good work and planning
X	James E Elkins	1401 Zebrawood St	Florence, OR	I take sincere interest in civic affairs. This project is a definite must and start of service should be now.
X	R.H./ Betty Goldfinch	466 Sherwood Loop	Florence, OR	More meetings? We first were flooded in '96 (Three years ago)
X	Lucille E Long	1290 Ninth Street, PO Box 3096	Florence, OR	I would be pleased to attend meetings and get reports of what is needed and what can and will be done to control these flood conditions.
X	Virginia L Murche	1789 N. Siano Loop	Florence, OR	I am not able to attend meetings at night time. Also understand I am not in flood area. I am concerned about my drinking water. Would want to be notified if drinking water was not good. Thank you.
X	Marjorie Parsons Wazeka	234 Munsel Creek Loop	Florence, OR	I think it is great that you are putting out such an update about the chronic problem we all share.
X	Ed Stanfill	380 Leelo Court	Florence, OR	Drainage off city streets. Some of us help keep drains open- if private & city employees work together some of this can be alleviated- thus some drainage lines are not complete!
X	Robert G Miller	3409 E Myrtle Loop	Florence, OR	With up to 30" of water under my house every winter, I wonder why I wasn't notified of flooding before I purchased this home- Realtor goofed up I think- The acreage north of us is a lake hidden by brush and growth.
X	Lavell Cattam	2187 E 17th St	Florence, OR	Is this the same problem that two council members raised and brought about recall?
X	Charles W. Selden III	2194 13th St	Florence, OR	Why are lots still for sale in the obvious flood zones east of Munsel Creek and south of the water plant?
X	Mary E Craig	2070 Willow St	Florence, OR	Local residents of many, many years have informed me that every winter the Willow Dunes East area was under water. I cannot understand how lots were allowed to be sold, and built on, when the city knew of the problem- was the problem storm water or poor planning?
X	Mr. & Mrs. Ben Blazer	PMB # 1750 Highway 126	Florence, OR	We are not residents of the city of Florence. Reside in Heceta Beach area. Hope this includes this area as we have flood problems.

Reply to September 1999 Newsletter

Update	Name	Address	City, State	Comments
X	Marvin & Glenda Ryall	05460 Friendly Areas Rd	Florence, OR	We own property at 5071 & 5055 Hwy 101 and are very concerned about storm water drainage
X	Keith Muenchau	2055 W. Park Dr	Florence, OR	Everyone wants a handout from the government for their own good. They should go to the people that sold the land, contractors, the people involved in the construction and not the tax payers.
X	Maeta Henrikson	87511 Rhodowood Dr	Florence, OR	How about dry wells for storm water. They are used in Eugene at times or does sand make that not feasible? Thank you for keeping us all informed and updated.
X	Angelo Corso	4120 Munsel Creek Dr	Florence, OR	Problem on our street is water under our homes all winter long. Also the road is cracked and water comes across the street.
X	Loretta L. Woods	P.O. Box 2867	Florence, OR	Hope something can be done to area west of 42nd street to east of Hwy 101 this year.

City of Florence - Stormwater Management Plan

Response at Public Workshop

Name	Address/Neighborhood	Comments
Birgitt Lyon		40+ acres of City-owned wetlands overflowing every rainy season. These lands are being fed by runoff from northeast. Development was allowed by City without enforcing mandatory storm drainage plan submission by developer. I have several volumes of photos documenting the flow of this. How are we going to protect ourselves from being intimidated from the wetland overflow runoff?
Charles W. King		Areas south of Kelsie Court have major problems just south of Heceta South. Lot north of Kelsie Court has a major problem.
Marilyn Miller	P.O. Box 3288	My two lots (2165 & 2185 East 20th) and the area in back flood up to 6 inches every heavy rain. There is a large undeveloped area in back that also floods. It is so bad that it has undermined the driveway at 2165 East 20th and backs up city drainage in front of the house.
Robert Palmer	04842 Gloria Gayle	Standing water on lot 164 and adjoining lot to a depth of 2 feet. 10 inches of water under the house. Problem started when idle wood pumped water north onto the Winkie's 40 acre track behind our property. Water from idle wood should have been pumped west over the hill so it could move to the ocean.
Jerry & Lura Wauen	87816 Saltaire	Water coming from Ocean are affecting four adjoining lots accumulating in the back yard of the lot on the west side. The water forms a small creek through this lot and forms under their house.
Gary Zankiewicz	88005 Windleaf Way	Heceta South subdivision. Flooding on Windleaf Way--water flow from Wel land to Wetland east to west.
Gary Zankiewicz	88005 Windleaf Way	Heceta South subdivision. Several lots adjacent to Heceta Bush Road are continually under water. From Windleaf Way entrance to Heceta Park Way entrance.
Names were not included with the following responses.		
		42nd Street culvert or Munsel Creek has been at capacity on several flood events with water backing into yards north of 42nd Street. 42nd Street fenced for Florentine Estates so trafffic load is very low. Easy to fix.
		Bridge over Munsel Creek near 35th Street on Munsel Creek Loop has been near capacity. Culvert is a concrete box which is part of the bridge structure. Bypass is possible solution. Difficult since traffic volume is very heavy.

City of Florence - Stormwater Management Plan Response at Public Workshop		
Name	Address/Neighborhood	Comments
		Excess storm water runoff. 101 Highway drainage ditches don't drain properly. Suggestion 101 Highway drainage as #1.
		Excess storm water runoff. 101 Highway drainage ditches don't drain properly. Suggestion: Inlays or continue proposed swale along Munsel Lake Road to 101.
		Standing water on property east of Greentrees if source of Greentree problem.
		You are suggesting a channel where I put the sticker. This is a major source of blowout at Sea Watch. There is a cease and desist order on this.
		Munsel Creek behind #2400 on 175th Creek in last 4 years has widened 5 feet on both sides of creek causing erosion in yards from Park Drive West to Upas Street. Watch the salmon run. I hope you don't put any water into Munsel Creek from Coastal Creekside on Willow Dues.
		Two lots (lot 39--80 percent 37--50%) underwater. Consider pumping into sewer 18th Street/Willow Street. Will also address street problem at WL & 18th or consider extending sewer to end of 18th street.
		Major wetland pond 7-9 months of year. This area is north of City water treatment. Water flows from green area (wetlands) to north and then back across low areas on bike path to Munsel Creek.
		Munsel Creek - STEP folds who have taken fish out below Public Works report the amount of water coming down creek last couple years is much higher than in past--higher peak flows.
		Water over half of driveway back half.
		Formerly an outlet from large pond. City filled in at bikepath 10 years ago. Can we open up and use as surge pond? Berm on SE broke and now feeding water south.

APPENDIX B
PROJECT RANKING METHODOLOGY

CITY OF FLORENCE
COMPREHENSIVE STORMWATER MANAGEMENT PLAN
PROJECT RANKING METHODOLOGY

Background

During the summer and fall of 1999, Brown and Caldwell, in conjunction with the City of Florence (City), and the Stakeholder Advisory Committee (SAC), developed 13 projects to protect property, maintain public access to essential facilities, protect the quality and quantity of the aquifer, limit impacts to the community, and satisfy regulations. The projects were identified for the study area as defined by the limits of the Urban Growth Boundary (UGB), including several projects outside of the current city boundary.

The next step in the process toward completion of the City of Florence Comprehensive Storm Water Management Plan (CSWMP) was to evaluate the projects with respect to their ability to meet both technical and value-based criteria established by the consultant team and the SAC. Although the City intends to implement all of the projects, the objective of this effort was to prioritize implementation based on the evaluation criteria.

Due to the topography of Florence and the surrounding lands, the study area extended beyond the city's current boundaries. In addition, the CSWMP makes recommendations for several improvements located outside the city limits. Legally, the City cannot spend taxpayer money on projects outside of its jurisdiction. As areas outside of the city are annexed, the improvements in these areas should be re-evaluated relative to implementation priority.

Evaluation Criteria

The SAC developed some of the criteria while the remaining criteria were recommended by the consultant team. The recommended criteria, weights, and point scales are shown in Table B-1. Each project received an overall score based on the merits of its component actions.

Table B-1. Recommended Criteria, Point Scales and Weighting

Technical criteria	Maximum points	Weight	Maximum weighted score
1. Provides flood protection	4	5	20
2. Maintains public access to critical facilities	4	4	16
3. Protects aquifer (quantity and quality)	4	5	20
4. Limits impacts to community	4	3	12
5. Satisfies regulatory requirements	4	2	8
6. Provides water quality benefits	4	1	4
7. Enhances or protects natural habitat	4	2	8
8. Responds to maintenance and public complaints	4	3	12
Maximum weighted total score			100

The SAC chose to vary slightly the criteria, weights, and point scales that were originally recommended by the consultant team in order to achieve the overall objectives established for the project and as shown in Chapter 1. The weight assigned to each criterion was based on its perceived relative importance by the SAC.

The points assigned are based on the descriptive scales shown in Tables B-2 through B-9. In rating the projects, scores were assigned based on a range from 0 to 4 for each criterion. The scales minimize subjective bias and provide a measure of objectivity during the scoring process. A weighted total of 100 points was possible based on the assigned weighting.

Table B-2. Criteria Definition No. 1– Provides Flood Protection (weight = 5)
(Project impact on frequency, areal extent, and duration of flooding)

Points	Description
0	Project **does not address flooding issues.**
1	Project **reduces flood impacts to local roads** (no protection to outbuildings or homes).
2	Project **reduces flood impacts to collector streets and/or ≤3 homes/commercial structures.**
3	Project **reduces flood impacts to arterial streets and/or >3 and ≤10 homes/commercial structures.**
4	Project **reduces flood impacts to >10 homes/commercial structures or to public facilities: hospitals, health clinics, fire and police stations, schools, water treatment and wastewater treatment facilities.**

Note: Ranking for this criterion will not be based on detailed hydraulic or photogrammetric analyses.

Table B-3. Criteria Definition No. 2– Maintains Public Access To Critical Facilities (weight = 4)
(Project impact on providing access to facilities)

Points	Description
0	Project **does not provide protection of public access to critical facilities (as noted below).**
1	Project provides public access to **commercial and retail establishments.**
2	Project provides public access to **schools and public transportation links.**
3	Project provides public access to **water and wastewater treatment facilities.**
4	Project provides public access to **hospitals, health clinics, fire stations, and police stations.**

Table B-4. Criteria Definition No. 3– Protects Aquifer (weight = 5)
(Project impacts to the quality of the aquifer)

Points	Description
0	Project **does not provide any protection of aquifer.**
1	Project **protects quality of aquifer within UGB.**
2	Project **protects quality of aquifer within aquifer recharge area (up gradient from existing or proposed city wellfields or surface water sources).**
3	Project **protects quality of aquifer within 2,500 feet of existing or proposed city wellfields or surface water sources.**
4	Project **protects quality of aquifer within 1,000 feet of existing or proposed city wellfields or surface water sources.**

Table B-5. Criteria Definition No. 4– Limits Impacts to Community (weight = 3)
(Project impact on the community from construction activities, the operation and maintenance of the facility, or the required easement)

Points	Description
0	Construction, maintenance, and easement acquisition for the project will **provide a moderate or severe impact to the entire community.**
1	Construction, maintenance, and easement acquisition will **provide a severe disruption to traffic or commerce in a localized area.**
2	Construction, maintenance, and easement acquisition will **provide a moderate disruption to traffic or commerce in a localized area.**
3	Maintenance needs of the project are minimal; construction does not require specialized equipment. Construction, maintenance, and easement acquisition activities will **provide minor, short-term disruption to traffic or commerce in a localized area.**
4	Construction and maintenance of project will not impact community. Construction, maintenance, and easement acquisition activities **do not impact traffic or commerce.**

Table B-6. Criteria Definition No. 5– Satisfies Regulatory Requirements (weight = 2)
(Impact of Regulations on Project)

Points	Description
0	**None.** Project does not satisfy any existing or potential state/federal regulations (ESA, CWA, and TMDL).
1	**Low.** Project presents limited opportunity to achieve or advance regulatory compliance goals.
2	**Good**. Project presents opportunity to achieve compliance for at least one regulatory goal.
3	**Very Good.** Project presents significant opportunity to achieve compliance for both CWA and ESA regulatory goals.
4	**Excellent.** Project maximizes opportunities to achieve compliance for current and future regulatory goals.

Table B-7. Criteria Definition No. 6– Water Quality Benefits (weight = 1)
(Project Impacts on Surface Water Quality)

Points	Description
0	**None.** Project does not provide any improvement to water quality of receiving waters.
1	**Low.** Project provides improvement for one of the six key water quality parameters. [1]
2	**Good.** Project provides improvement for two of the six key water quality parameters. [1]
3	**Very Good.** Project provides improvement for three of the six key water quality parameters. [1]
4	**Excellent.** Project provides improvement for four or more of the six key water quality parameters. [1]

[1] Temperature, bacteria, dissolved oxygen, total suspended solids, total phosphorus, and metals.

Table B-8. Criteria Definition No. 7– Enhances of Protects Natural Habitat (weight = 2)
(Project Impacts on Natural Habitat)

Points	Description
0	Project actions will have **no impact on riparian, instream, or wetland habitat** connectivity, or channel characteristics such that fish or wildlife habitat is not improved.
1	Project actions will have **little impact on riparian, instream or wetland habitat** (<50 linear feet or ≤1/3 acre wetland), connectivity, or channel characteristics such that fish or wildlife habitat is not measurably improved.
2	Project actions **slightly improve riparian, instream, or wetland habitat** (>50 linear feet riparian area or >1/3 acre wetland), connectivity or channel characteristics such that fish or wildlife habitat is likely to be improved.
3	Project actions will **measurably improve riparian, instream, or wetland habitat** (>100 linear feet riparian area or >1 acre wetland) such that fish or wildlife habitat is improved.
4	Project **substantially improves riparian, instream, or wetland habitat** (e.g., >500 linear feet riparian area or >5 acres wetland), connectivity or channel characteristics, such that fish or wildlife habitat is substantially improved.

Table B-9. Criteria Definition No. 8– Responds to Maintenance and Public Complaints (weight = 3)
(Project Response to Complaint Sources)

Points	Description
0	Project **does not respond to reported drainage or flooding problems.**
1	Project responds to **minor maintenance problems, and/or few if any public complaints.**
2	Project responds to **one or more moderate priority maintenance problems, and/or few but infrequently reported public complaints.**
3	Project responds to **several moderate priority maintenance problems, and/or frequently reported public complaints.**
4	Project responds to **numerous moderate or high priority maintenance problems, and/or consistently reported flooding and/or drainage related problems.**

Project Evaluation Process

At a special meeting of the SAC, members evaluated the projects according to the criteria, scoring, and weighting described above. Each member evaluated the projects using a scoring table, as shown in Figure B-1. Upon completion of the scoring, the results were tallied. For each scoring criterion, the weighted scores from the SAC were summed, project by project.

Evaluation Results

The results of the SAC project evaluation process are shown in Figure B-2. Two values are shown for each criterion by project: the first score is the sum of all the SAC member's scores, the second number is the average score.

Figure B-1. Project Ranking Scoring Table

Scoring criteria	Weight	Projects				
		CEN-A	NE-A	SE-A	SW-A	NW-A
1. Provides flood protection	6					
2. Maintains public access to critical facilities	3					
3. Protects aquifer	5					
4. Limits impact to community	3					
5. Satisfies regulatory requirements	2					
6. Provides water quality benefits	1					
7. Enhances or protects natural habitat	2					
8. Responds to maintenance and public comments	3					
Totals						

Figure B-2. Project Ranking Process Scores by Project

Scoring criteria	Weight	Projects				
		CEN-A	NE-A	SE-A	SW-A	NW-A
1. Provides flood protection	6	288 / 22.15	288 / 22.15	264 / 20.31	264 / 20.31	240 / 18.46
2. Maintains public access to critical facilities	3	102 / 7.85	87 / 6.69	69 / 5.31	78 / 6.00	60 / 4.62
3. Protects aquifer	5	135 / 10.38	115 / 8.85	130 / 10.00	125 / 9.62	110 / 8.46
4. Limits impact to community	3	99 / 7.62	99 / 7.62	108 / 8.31	102 / 7.85	87 / 6.69
5. Satisfies regulatory requirements	2	74 / 5.69	66 / 5.08	62 / 4.77	62 / 4.77	40 / 3.08
6. Provides water quality benefits	1	34 / 2.62	37 / 2.85	25 / 1.92	20 / 1.54	20 / 1.54
7. Enhances or protects natural habitat	2	34 / 2.62	50 / 3.85	54 / 4.15	32 / 2.46	24 / 1.85
8. Responds to maintenance and public comments	3	135 / 10.38	129 / 9.92	129 / 9.92	93 / 7.15	105 / 8.08
Totals		901 / 69.31	871 / 67.0	841 / 64.69	776 / 59.69	686 / 52.76

Note: Top number equals sum of all weighted scores, bottom number equals average weighted score, with 13 stakeholder advisory committee members voting.

APPENDIX C
REGULATORY IMPACTS TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM

TO: Ken Lanfear, City of Florence
Public Works Director

FROM: James R. Hansen, P.E., Brown and Caldwell
Project Manager

DATE: December 10, 1999

PREPARED BY: Claudia L. Zahorcak, P.E./Brown and Caldwell

REVIEWED BY: David R. Felstul/Brown and Caldwell

SUBJECT: Task 5 Technical Memorandum: Regulatory Impacts

PROJECT: 17146: City of Florence Comprehensive Stormwater Management Plan

CONTENTS

SUMMARY

Management of urban stormwater will require careful coordination with agencies that are responsible for environmental management. Federal and state mandates require careful evaluation of recommended stormwater management practices to ensure they:

- Conform with general principles of environmental management
- Are consistent with other programs that aim to protect natural and biological resources
- Are appropriately registered and/or permitted
- Do not transfer an environmental problem from one medium to another (specifically, surface runoff to groundwater)

Several agencies are interested in reviewing Florence's stormwater master plan prior to its approval by City Council. None currently have authority to require review and formal comment. However, review of the plan could be mutually beneficial, as Florence's proposed actions could assist those agencies in meeting their goals.

After the National Marine Fisheries Service (NMFS) issues its regulations protecting the listed Coho salmon, Florence will want to review the regulations and determine if its plan is consistent. Further, it may wish to submit the plan as part of an application for a limitation on the take prohibitions under Section 4(d) of the Endangered Species Act (ESA). The advantage of having a 4(d) limitation is that it protects the city from third party suits.

BACKGROUND AND PURPOSE

Currently, the management of the City of Florence's storm water drainage system is impacted by a number of existing regulations at the state and federal levels. Agencies such as the U.S. Army Corps of Engineers (COE), the U.S. Environmental Protection Agency (EPA), National Marine Fisheries Service (NMFS) within the National Oceanic and Atmospheric Administration (NOAA), and the Federal Emergency Management Agency (FEMA) all manage programs and enforce federal laws or regulations that may affect the types of stormwater management techniques available to the City. Further, state agencies such as the Department of Environmental Quality (DEQ) and Division of State Lands (DSL) also have regulatory requirements that will affect the City's plan.

There are two major mechanisms that will affect the City's planning process:

- Laws and regulations will prohibit some activities.
- Permits will be required to allow some activities.

The purpose of this Technical Memorandum (TM) is to summarize the key permitting requirements and key program elements and briefly indicate how these requirements might affect the development and implementation of the City's plan.

GENERAL PERMITTING REQUIREMENTS

Some activities can be included in the City's plan but will require permits from the controlling federal and/or state agency. Table 5-1 summarizes the permitting agencies, the type of activity that must be permitted, and in some cases a brief narrative of the permitting issues. Table 5-2 summarizes the permitting or review functions for each type of stormwater control activity.

The application process can vary according to the agency, the program, and the individual project seeking a permit.

FEDERAL PROGRAMS

There are several federal programs that affect stormwater management. These are briefly described below. Where the programs have been delegated to the state of Oregon, the program is introduced in this section and further described in the corresponding state section.

Clean Water Act

The federal Water Pollution Control Act amendments of 1972 established the framework to attain the national goals of having streams, rivers, and lakes be fishable and swimmable. As amended in 1977 and 1987, the act is now referred to as the Clean Water Act (CWA).

The CWA sets out required wastewater treatment requirements, and established the National Pollutant Discharge Elimination System (NPDES) to regulate the discharge of point sources of pollutants. This permitting system affected municipal and industrial point sources of wastewater discharged to the waters of the U.S. The issuing and enforcement of the NPDES program was delegated to the State of Oregon.

The CWA also requires states to define designated beneficial uses for all named stream segments, and to develop numerical and narrative stream water quality standards necessary to attain those beneficial uses. The Oregon Water Resources Department (WRD) defines the streams' beneficial uses and the Oregon DEQ establishes and enforces the water quality standards to attain those uses, establishes total maximum daily loads (TMDLs), and issues NPDES permits to point source dischargers.

The water quality standards for the waterways near Florence are discussed below under the State Programs Section.

Table 5-1. Potential State and Federal Permitting Requirements for Stormwater Management Facilities

Agency	Level of Government	Permit	Action Requiring Permit	Contact	Comments
U.S. Army Corps of Engineers (COE)	Federal			District Engineer, Portland District	Will not issue permit if local or state permit denied.
		§ 10 Rivers & Harbors Act	In-water structures (outfalls) (reviewed by ODF&W & USFWS)		For construction up to mean high water line; requires public hearing
		§ 404 Clean Water Act	Fill in wetlands or waters of the U.S.		For construction up to mean high water line and in wetlands; requires public hearing
		§ 404 Nationwide permit	Activities impacting wetlands		For construction impacting less than 1 acre of wetlands; requires public hearing
U.S. Fish and Wildlife Service (USFWS)	Federal				Consultation through Fish & Wildlife Coordination Act on §10 and §404 permits; recommends mitigation
National Marine Fisheries Service (NMFS)	Federal				Consultation on marine resources
Environmental Protection Agency (EPA)	Federal				Water Quality Standards; NPDES rules; veto power on Corps permits; veto power on DEQ permits
U.S. Coast Guard	Federal				Jurisdiction over navigational hazards
Bureau of Land Management (BLM)	Federal				Planned improvements passing through BLM property will require BLM approval.
Oregon Division of State Lands (DSL)	State			DSL Permit Office in Salem	Coordinates state agency review; must have project approval by local planning office
		Removal/Fill Permit	> 50 cubic yards of material; riprap for bank protection; dredge, fill, or alteration of stream; fill or structures within 25 feet of bank top; filling, removal, or alteration in waters and wetlands	DSL Permitting Section	Joint application with Corps; includes wetlands; permit usually issued with conditions
		Submerged Land Lease	Construction of facility occupying state-owned submerged lands; sand & gravel removal	DSL Resources Management Section	State-owned land and waterway, up to high water
		Easements/license	Pipeline in or over waterway; easements and rights-of-way on or over state-owned lands for pipeline construction	DSL Resource Management Section	
Oregon Department of Fish & Wildlife (ODF&W)	State				Reviews Joint Removal/Fill permit applications
Oregon Water Resources Department (WRD)	State				Water rights jurisdiction
Parks and Recreation Department	State				Reviews proposed actions for effects on recreation and scenery; State Historic Preservation; greenway review

Table 5-1. Potential State and Federal Permitting Requirements for Stormwater Management Facilities

Agency	Level of Government	Permit	Action Requiring Permit	Contact	Comments
Department of Environmental Quality (DEQ)	State				Corps permit approval requires DEQ water quality certification
		NPDES permits	Wastewater discharge	Municipal Waste Section	DEQ must review and approve facility plans prior to construction; may require water quality impact evaluation; requires public notice; hearing may be requested
		NPDES Storm Water Discharge (MS4)	Ph I regs apply to cities >100, 000 Ph II regs apply to Bureau of Census-defined urbanized areas: population >50,000 and an overall population density > 1,000 cap/sq mi.; other areas if determined to have potential adverse impact by state agency [a].		Potential eligibility for general permit
		NPDES Storm Water Discharge (Construction Activities)	Ph I regs apply to disturbance of > 5 acres of land with clearing, grading, excavation, or construction activities Ph II regs apply to > 1acre and <5acres.	Industrial & On-Site Waste Section	Application may be part of the process required to obtain building permit
		Temporary modifications of water quality standards	Construction activities that will impair water quality		
		§401 certification for Corps §404 permit	Federal permit to discharge into surface water		Certifies that federal permit and project will not violate water quality
State Marine Board	State				Reviews effects on recreational boating
Port of Siuslaw	State	Port permit for waterfront development			Commercial navigation jurisdiction

Note: Other county and local codes, ordinances, and permitting requirements may also apply.

Abbreviations: MS4, municipal separate storm sewer system; NPDES, National Pollutant Discharge Elimination System

[a] At this time, Florence is not subject to these regulations.

Table 5-2. Potential State and Federal Regulatory Coordination for Stormwater Practices

Type of Practice	Activity by Agency									Comments
	COE	USFWS	NMFS	DEQ	DSL	DWR	ODFW	County	City	
Uplands										
Constructed wetlands	P				P			P	P	
Infiltration				P				P	P	
Offline detention ponds								P	P	
Pipes								P	P	
Swales								P	P	
Streams										
Channel improvements	P	R	R		P		R			
Culverts	P	R	R		P		R			
Inline detention ponds	P	R	R		P	P	R			
Outfalls	P	R	R	P	P		R			
Wetlands										
Channel/piping	P	R			P		R			
Restoration	P	R			P		R			

Abbreviations: COE, Corps of Engineers; DEQ, Department of Environmental Quality; DSL, Division of State Lands; DWR, Department of Water Resources; NMFS, National Marine Fisheries Service; ODF&W, Oregon Department of Fish and Wildlife; USFWS, US Fish and Wildlife Service.
Activities: P = permit, registration, or certification required; R = review required; C = coordination recommended.

NPDES Stormwater Permit

The authorizing legislation for municipal stormwater management is the 1987 CWA amendments. They provide for municipal discharge permits to be issued on a system-wide basis. Through this legislation, the NPDES program was expanded to include the regulation of stormwater discharges. Cities discharging treated wastewater currently operate their wastewater treatment facilities under an NPDES discharge permit. Industrial stormwater dischargers are also permitted under this program. Agricultural stormwater is not currently managed by the NPDES system. Operation of a municipal separate storm sewer system (MS4) requires a separate permit from that for the wastewater treatment plant. There are currently four classes of cities: large, medium, small, and other. The first three categories require a permit; the last does not as of this time. Florence is in the other category.

Regulations issued to implement the MS4 permitting system prohibit non-stormwater discharges to storm drains and require controls to reduce the discharge of pollutants from storm drains to the maximum extent practicable (MEP). Rather than setting numerical effluent limits, the regulations encourage the management of stormwater by the implementation of best management practices (BMPs). This largely urban nonpoint source problem is to be addressed by structural and non-structural improvements and activities. These BMPs aim to reduce erosion, manage chemicals, remove pollutants through maintenance practices such as street sweeping, and educate the public regarding behaviors that put meeting water quality goals at risk.

This permitting process is discussed in more detail under the State Programs Section.

Endangered Species Act

The Endangered Species Act (ESA) of 1973 authorizes the federal government to list a species or "distinct population segment" of a species as threatened or endangered. Endangered is defined as "in danger of extinction throughout all or a significant portion of its range" (ESA §3[6]) and threatened is defined as "likely to become endangered within the foreseeable future throughout all or a significant portion of its range" (ESA §3[19]). A candidate species is "any species being considered by the secretary for listing as an endangered or a threatened species, but not yet the subject of a proposed rule" (ESA).

NMFS, a section within NOAA, has responsibility for administering the ESA with regard to anadromous fish species, whereas freshwater fish and all other organisms are protected by the U.S. Fish and Wildlife Service (USFWS). NMFS defines a "distinct population segment" as an Evolutionarily Significant Unit (ESU), i.e., a distinctive group of organisms contained within a defined geographic range, reproductively isolated form other population units and representing an important component in the evolutionary legacy of the species.

Oregon Listed Anadromous Fish. Three anadromous fish species in the Oregon Coast area (includes Florence) have been either listed as threatened or are currently a candidate for listing as of September 9, 1999 (refer to the cited webpage for more information):

- Coho Salmon: Threatened
  (http://www.nwr.noaa.gov/1salmon/salmesa/cohoesum.htm)

- Cutthroat Trout: Candidate
  (http://www.nwr.noaa.gov/1salmon/salmesa/cuttesum.htm)

- Steelhead: Candidate
  (http://www.nwr.noaa.gov/1salmon/salmesa/stlhesum.htm)

Umpqua cutthroat trout are now proposed for de-listing (see Federal Register, Vol. 64, No. 79, April 26, 1999, p. 20248 and Federal Register, Vol. 64, No. 64, April 5, 1999, p. 16397 as found at http://www.nwr.noaa.gov/1fedregn/notices1.htm).

Oregon Listed Plants and Animals. The USFWS has listed 28 species of Oregon plants and animals as threatened (T) or endangered (E) (http://www.fws.gov/r9endspp/statl-r1.html#LnkOR). According to the Oregon Natural Heritage Program records, none of these has been identified in the Florence area. A state-listed sensitive animal species, the American marten, was sighted in the coastal dunes in 1982.

Preventing Impacts on Listed Species. ESA Section 9 prohibits a "take," killing or harming the species. For endangered species, these prohibitions go into effect immediately upon listing. For species listed as threatened, Section 4(d) of the ESA provides that the appropriate Service issue regulations deemed "necessary and advisable to provide for the conservation of the species." NMFS will issue the proposed 4(d) rules, which will cover Oregon coast coho among

other species, on December 15, 1999 (appearing in Federal Register shortly thereafter); public hearings will be held in January; public comment period will be 60 days; the final rule will be issued in June 2000.

The term take is defined in the ESA as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." The term "harass" is further defined as any intentional or negligent act that creates the likelihood of injuring wildlife by disrupting normal behavior such as breeding, feeding, or sheltering (50 CFR 17.3), whereas "harm" is an act that either kills or injures a listed species. "Take" and "harm" can include significant habitat modification or degradation that significantly impairs essential behavioral patterns of fish or wildlife.

Since coho salmon have been listed as threatened, any activity included in the City's stormwater plan that involves direct federal activity, federal funding, or federal permitting, is subject to ESA section 7 consultation requirements. Section 7 requires federal agencies to consult with NMFS or USFWS to ensure that any action they authorize, fund, or carry out does not jeopardize the continued existence of any listed species. In practice, the burden of data gathering and application preparation falls to the local entity requesting the funding or permit.

The 4(d) rule can also be used to allow certain activities to proceed without the additional protection of the federal "take" prohibitions, if NMFS finds that the activities are adequately protective of the species. That is, a local government can apply for a 4(d) limitation to the take prohibitions. Once granted, individual activities to implement the plan would be exempt from the take rule. However, the activities would still need to be implemented in a way that minimizes impact, e.g., timing an activity to not affect spawning or passage during migration. While there is currently no prototype format for a stormwater master plan to serve as a 4(d) limitation on the take prohibitions, NMFS is requesting cities meet with them to discuss ways in which their program can avoid takes and perhaps serve as an application for a 4(d) limitation on the take prohibitions. Other than any applicable section 7 consultation requirements, NMFS does not have authority to require the review of a city's stormwater master plan. However, receiving a limit on the take prohibitions under section 4(d) would provide legal assurance to the city that they would not be subject to a NMFS enforcement action or a third-party lawsuit.

NMFS and the USFWS have a policy to identify specific activities considered likely to result in take. As indicated in the Federal Register "Notice of Threatened Status for Two ESUs of Steelhead in Washington and Oregon" (64 FR 14517), such activities include, but are not limited to:

1. Destroying or altering the habitat of listed salmonids (through activities such as removal of large woody debris or riparian shade canopy, dredging, discharge of fill material, draining, ditching, diverting, blocking, or altering stream channels or surface or ground water flow).

2. Discharging or dumping toxic chemicals or other pollutants into waters or riparian areas supporting listed salmonids.

3. Violating federal or state Clean Water Act discharge permits.

4. Applying pesticides and herbicides in a manner that adversely affects the biological requirements of the species.

5. Introducing non-native species likely to prey on listed salmonid species or to displace them from their habitat.

A second, generally more time-consuming, mechanism besides the 4(d) limitation on the take prohibitions is found in Section 10. An applicant can submit a Habitat Conservation Plan (HCP) that could result in NMFS or USFWS issuing an Incidental Take Permit (ITP). The purpose of the habitat conservation planning process associated with the permit is to ensure there is adequate minimizing and mitigating of the effects of the authorized incidental take. The purpose of the incidental take permit is to authorize the incidental take of a listed species, not to authorize the activities that result in take. By its nature, the HCP would be broader in scope than a traditional stormwater master plan. It would include the assessment of habitat and the identification of activities required to protect and restore that habitat. The value of the ITP is that it is long-term and provides a shield, even if the rules are changed.

Most of the earlier HCPs approved were for planning areas of less than 1,000 acres. However, HCPs are evolving from a process adopted primarily to address single projects to broad-based, landscape-level planning, utilized to achieve long-term biological and regulatory goals.

The applicant is in charge of deciding whether to pursue an ITP. While Service personnel provide detailed guidance and technical assistance throughout the process, the applicant drives the development of an HCP. The applicant is responsible for submitting a completed permit application. The necessary components of a completed permit application are: a standard application form, an HCP, an Implementation Agreement (if required), and, if appropriate, a draft National Environmental Policy Act (NEPA) analysis.

While processing the permit application, the Service will prepare an intra-Service biological opinion under Section 7 of the ESA and the ITP, and finalize the NEPA analysis documents. Consequently, ITPs have a number of associated documents besides the HCP. "Low Effect" HCPs are those involving (1) minor effects on federally listed, proposed, or candidate species and their habitats covered under the HCP; and (2) minor effects on other environmental values or resources. These HCPs do not require a NEPA document, and the target permit processing time is 3 months (USFWS, 1999).

Role of Local Governments. According to NMFS (NMFS, May 1999):

> "Any government body authorizing an activity that specifically causes take may be found to be in violation of the section 9 take prohibitions. For example, authorizing the use of an herbicide that is directly linked to mortality of a listed species, dewatering a stream in a manner or at a time that has the effect of preventing migration, or permitting construction to occur in such a way and at such a time that sedimentation significantly impairs salmon survival might be construed as take."

Some of the activities carried out or authorized by local governments that have a high likelihood of affecting salmonid habitat include the following:

- Planning, zoning, and development permitting

- Erosion and sediment control
- Floodplain management
- NPDES permit implementation
- Water use
- Stormwater discharge
- Wastewater discharge
- Road and bridge construction and maintenance
- Pesticide, herbicide, fertilizer, and other chemical use
- Riparian area protection, alternation, or development
- Wetland protection, alternation, or development
- Estuarine shorelands protection, alteration, or development

The NMFS notes that many of these activities could have either adverse or beneficial effects on listed species. Therefore, it is important for NMFS to comprehensively assess local government activities to identify how the activity could affect the listed species, the relative likelihood of the effect, and the potential for the local government to influence those effects. NMFS will review a program to determine if it in fact is beneficial (exempt under 4[d]) if the following information is provided:

1. A description of the activity or program, geographic area, and responsible jurisdiction.

2. A description of the listed species and habitat, including fish distribution and habitat identification.

3. A description of the short-term and long-term impacts of the action on the species and its habitat and how adverse impacts will be mitigated.

4. A description of the certainty of implementation of the program.

5. A program for monitoring both the implementation and effectiveness of the program, including timeframes.

6. An adaptive management approach that uses monitoring information as needed to modify the program.

NMFS considers the following factors in evaluating proposed exceptions:

- Will the action or program degrade existing habitat processes or functions?

- Will the action or program contribute to the restoration of degraded habitat processes or functions?

Impact on Florence's Stormwater Program. It would appear that the goals of the ESA (protection of habitat, minimization of erosion, management of stormwater quantity and quality) are generally consistent with and will likely be addressed in a general sense by Florence's Stormwater

Master Plan. A 4(d) limitation on the take prohibitions could be applied for by submitting the master plan if the document is constructed to address the six items above. A consultation with NMFS prior to the development of the recommended action plan would be a beneficial step in ensuring the plan qualifies for a 4(d) limitation on the take prohibitions.

Suggestions NMFS makes with regard to activities local governments manage include:

- *Stormwater discharge*: adverse effects can be mitigated by reducing hardened surfaces, detaining runoff, and preventing sediment and other pollutants from reaching any watercourse.

- *Riparian protection areas*: Riparian areas with adequate amounts of mature, native vegetation are essential for controlling temperature, maintaining bank stability, filtering pollutants and providing habitat.

- *Stream crossings*. Minimize stream crossings or at least their associated disturbances. Direct development to certain locations. Use bridges instead of culverts.

- *Stream meander patterns and channel migration zones*. Design development to allow streams to meander in historic patterns. Provide adequate riparian zones linked to the channel migration zone. Do not remove habitat elements. Minimize modification of channels through road construction, filling of wetlands, encroachment on riparian areas and floodplains, relocation of channels, and construction of ditches, dikes, and levees.

- *Wetlands and wetland functions*. Maintain existing wetlands.

- *Landscaping*. Plan landscaping to conserve water and reduce demands for flow that compete with fish needs. Minimize use of fertilizers, pesticides, and herbicides.

- *Erosion control*. Manage construction of buildings and roads to prevent sediment loadings to streams that can have long-term, significant impact on fish habitat.

- *Implementation, monitoring, maintenance, enforcement, and reporting*. Mechanisms for these functions need to be adequate to ensure that development will comply with approved policies, ordinances, and permitting procedures.

Coastal Zone Management

The U.S. Congress passed the Coastal Zone Management Act (CZMA) in 1972 to address competing uses and resource impacts occurring in the nation's coastal areas. To receive federal approval and implementation funding, states were required to have programs with enforceable policies that could regulate land uses, water uses, and coastal development. States' programs must protect and manage important coastal resources, including wetlands, estuaries, beaches, dunes, barrier islands, coral reefs, and fish and wildlife and their habitats (EPA, 1993). The Coastal Zone Act Reauthorization Amendments (CZARA) of 1990 specifically charged state coastal programs and

state nonpoint source programs with addressing nonpoint source pollution affecting coastal water quality.

The Act included several incentives to encourage coastal states to develop coastal management programs. One incentive was a legal authority called federal consistency that was granted to coastal states with federally approved coastal management programs. The federal consistency provisions of the CZMA require that any federal actions occurring in or outside of Oregon's coastal zone which affect coastal land or water uses or natural resources must be consistent with the Oregon Coastal Management Program (OCMP). The federal consistency requirement is a very unique concept in federal law as it declares that federal preemption does not apply to state authorities for coastal management (DLCD, 1999).

A requirement of the 1990 amendments was the development of a Coastal Nonpoint Pollution Control Program (CNPCP). EPA and the National Oceanic and Atmospheric Administration (NOAA) review and approve states' CNPCPs.

The OCMP and the CNPCP are discussed further under State Programs.

Wetlands Protection

Section 10 of the Rivers and Harbors Act of 1899 requires approval prior to the accomplishment of any work in or over "navigable waters" of the United States, or which affects the course, location, condition or capacity of such waters. The COE is responsible for administering the Act. The lower Siuslaw River would be considered navigable waters. Typical activities requiring Section 10 permits are:

- Construction of piers, wharves, bulkheads, dolphins, marinas, ramps, floats intake structures, and cable or pipeline crossings.
- Dredging and excavation.

Section 404 of the Clean Water Act requires approval prior to discharging dredged or fill material into the "waters of the United States." The COE is also responsible to administering Section 404 of the CWA. "Waters of the United States" includes essentially all surface waters such as all navigable waters and their tributaries, all interstate waters and their tributaries, all "wetlands adjacent" to these waters, and all impoundments of these waters. The lower Siuslaw River, Munsel Creek, and the numerous designated wetlands in the Florence area would qualify as "waters of the United States." Typical activities requiring Section 404 permits are:

- Depositing of fill or dredged material in waters of the U.S. or adjacent wetlands.
- Site development fill for residential, commercial, or recreational developments.

The landward regulatory limit for non-tidal waters (in the absence of adjacent wetlands) is the "ordinary high water mark." The ordinary high water mark is the line on the shores established by the fluctuations of water and indicated by physical characteristics.

As defined in Section 404, wetlands are:

> Those areas that are inundated or saturated with surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

The 1987 COE manual further clarifies that jurisdictional wetlands, i.e., those that are subject to regulation under the CWA, are those that exhibit all three of the following features: hydrophytes (wetland plants), hydric soils, and saturated or inundated substrate. This manual is currently the basis for regulating and enforcing the wetlands provisions of the CWA.

General permits of interest to Florence in the implementation of its stormwater plan are:

- Activities in headwater streams (average annual flow of 5 cubic feet per second [cfs])
- Minor dredging and filling (less than 25 cubic yards)
- Stormwater outfall and intake structures
- Minor road crossings
- Minor utility line crossings
- Bank stabilization
- Maintenance

Activities that involve placement of less than 10 acres of fill in headwaters streams are the subject of a general permit.

In April 1995 the COE's Portland District issued a regional General Permit for Wetland Restoration and Enhancement Projects. This permit authorizes specific types of wetland restoration and enhancement work anywhere in the state. Prior to initiating the restoration work, a description of the proposed work must be submitted to the Oregon DSL, the state agency responsible for protecting wetlands. DSL will review the information and confirm that the proposed activity qualifies for both the COE general permit and the DSL general authorization.

Floodplain Management

The National Flood Insurance Program (NFIP) was initiated by Congress in 1968 to control costs to all levels of government due to flood disaster relief. NFIP is administered by the Federal Insurance Administration (FIA), part of the FEMA. NFIP insurance coverage is available only in communities that implement regulations to reduce the likelihood of future flood damage. Zoning laws, building codes, and development regulations serve to manage the floodplain by restricting new construction within flood-prone areas.

Congress modified NFIP in 1973. Funds related to federal programs that involve structures within the 100-year floodplain can only be granted if the structure is covered under a flood insurance policy and the community participates in the NFIP.

The National Flood Mitigation Fund was set up by FEMA as the result of 1994 legislative reforms. FEMA can fund planning and actual projects on a cost-sharing basis of 25 percent state and local and 75 percent federal funding, contingent on a flood mitigation plan being developed.

Current FEMA regulations define two flood zones:

- Floodway—the part of the 100-year flood plain which must be kept clear of fill or other obstructions in order to convey the 100-year flood without an excessive increase in flood elevations.

- Floodway fringe—the portion of the 100-year floodplain outside of the floodway. This may be developed if the fill does not cause the 100-year flood elevation in the floodway to rise more than one foot.

To enter the regular 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 (FIRM) and Flood Boundary and Floodway Map (FBFM). The community adopts and enforces regulatory standards based on these maps.

Physical data developed as part of the stormwater master plan's hydrologic/hydraulic modeling could be utilized to update or develop FEMA maps. However, most master planning efforts do not provide the level of technical analysis required to satisfy the FEMA requirements. As part of a FEMA update, maps could be developed that account for planned improvements to the stormwater drainage system. This could be advantageous to the community if the actual 100-year floodplain is less extensive than currently shown on FEMA maps.

Safe Drinking Water Act

Almost all fresh ground waters within the United States are defined as Underground Sources of Drinking Water (USDWs) by EPA's Underground Injection Control (UIC) regulations. These regulations were promulgated in response to Part C of the federal Safe Drinking Water Act (SDWA). Stormwater disposal wells which inject above or into a USDW are defined as a type of Class V injection well. At this time, under federal regulations Class V injection wells are rule authorized; no permits are required for their construction, operation, maintenance, or abandonment (EPA, June 1998). Although no operating permit is required, registration and inventory is required. Oregon has primacy over the implementation of the program. Their requirements are discussed further under the next section.

STATE PROGRAMS

The State of Oregon has primacy on several federal programs. In addition, there are several programs the state has initiated. This section summarizes the potential interfaces between Florence's stormwater master plan and key state (or state-delegated federal) programs.

Water Quality Standards and TMDLs

The Oregon Environmental Quality Commission (EQC) is the rule-making body that sets policy, promulgates water quality standards, and approves discharge permits. It instructs the Oregon Department of Environmental Quality in the implementation of these policies and the enforcement of the permits. The principal named water body with the City of Florence jurisdiction is the main stem of the Siuslaw River, from its mouth to the confluence with the North Fork Siuslaw River. The designated beneficial uses of estuaries and adjacent marine waters in the South Coast Basin include:

- Industrial water supply
- Anadromous fish passage
- Salmonid fish rearing
- Salmonid fish spawning
- Resident fish and aquatic life
- Wildlife and hunting
- Fishing
- Boating
- Water contact recreation
- Aesthetic quality
- Commercial navigation and transportation

All but the last use also apply to all streams and tributaries in the South Coast Basin. In addition to these uses, streams and tributaries also have the following designated beneficial uses:

- Public domestic water supply
- Private domestic water supply
- Irrigation
- Livestock watering
- Hydro power

Numerical standards have been set for the Siuslaw River (Table 5-3). DEQ commonly uses the Turbidity Rule (340 Division 41) to enforce stormwater controls.

DEQ staff also develop draft Total Maximum Daily Loads (TMDLs) for streams in order to ensure that water quality standards are met. DEQ biennially issues a list of streams requiring water quality improvements. This 303(d) list states the water body and the parameter that is out of compliance or suspected of being out of compliance. Thus, activities undertaken by the community should attempt to minimize further violations of these parameters.

The DEQ has been delegated the authority to manage and enforce the NPDES program in Oregon. The national stormwater permitting program is being implemented in phases, with cities falling into different phases according to their size. Phase I was implemented in 1990 and targeted cities in large and medium cities (greater than 250,000 and greater than 100,000, respectively). The final Phase II rule was expected in November 1999, and will regulate small cities—those areas designated as urbanized areas by the U.S. Census Bureau. These are areas with over 50,000 residents and

population densities at least 1,000 capita/sq mi. Small cities have 3 years following final rulemaking to submit their plans, i.e., November 2002.

Table 5-3. Water Quality Standards for the Suislaw River

Parameter	Numerical standard[a]	Narrative standard[a]	Comment[b]
Dissolved oxygen	Estuarine waters: Not less than 6.5 mg/L		Several occurrences of values less than 6.5 mg/L recorded since 1968
Temperature	Not greater than 64 degrees C	No significant increase above natural background temperatures Cannot create an adverse effect on fish or other aquatic life	Peak of the mean recorded temperatures at 8 sites was 57 degrees F
pH	Estuarine and fresh waters: must range between 6.5 and 8.5		A value less than 6.5 has been recorded at each of 3 stations
Bacteria	Marine Waters and Estuarine Shellfish Growing Waters: A fecal coliform median concentration of 14 organisms per 100 milliliters, with not more than ten percent of the samples exceeding 43 organisms per 100 mL.		No violations
Ammonia	Criteria are pH and temperature dependent (see EPA guidance)		
Turbidity	No more than a ten percent cumulative increase in natural stream turbidities		

[a] Source: Oregon Administrative Rules 340-41-245
[b] DEQ data (1968 through 1983) and USGS data (1977 through 1992).

The current 303(d) list identifies several parameters of concern (Table 5-4).

Table 5-4. 1998 303(d) Listed Parameters for Reaches of the Siuslaw River

Waterbody name	Boundaries	Parameter
Siuslaw River	Mouth to headwaters	Temperature
Siuslaw River, North Fork	Mouth to headwaters	Habitat modification
Siuslaw River, North Fork	Mouth to headwaters	Sedimentation
Siuslaw River, North Fork	Mouth to headwaters	Temperature

Source: DEQ, October 1999 (http://waterquality.deq.state.or.us/wq/303dlist/303dpage.htm).

Florence is currently smaller than the requirement for the proposed Phase II program and therefore at this time does not require a stormwater permit. However, under the federal rules, DEQ can make a determination that a small city's system should be permitted under Phase II rules. In addition, citizens or groups can petition for the city's system to be permitted. Therefore, the key elements of the regulatory program should be acknowledged and incorporated into Florence's plan where possible.

The Phase II Stormwater Program requires implementation of six minimum control measures. The proposed rule would require the permittee (i.e., the City of Florence) "to choose appropriate best management practices (BMPs) for each minimum control measure. In other words, EPA would expect Phase II permittees to tailor their storm water management plans and their BMPs to fit the particular characteristics and needs of the permittee..." (EPA, April 1999). The six minimum controls with examples of appropriate BMPs are:

1. **Public education and outreach**: Distribute brochures, flyers, or bill inserts to educate homeowners and business operators about the problems associated with storm water runoff and the steps they can take to reduce pollutants in storm water discharges.

2. **Public participation/involvement**: Provide notice of storm water management plan development and hold meetings at which citizens and business operators are encouraged to communicate ideas. Include citizen and business representatives in a Citizens' Advisory Group.

3. **Illicit discharge detection and elimination**: Inventory and map the storm water system and test for the possible cross-connections of sanitary wastewater to the storm water conveyance system. Modify system to eliminate illicit discharges.

4. **Construction site runoff control**: Require the implementation of erosion and sediment controls, and control other waste. Review site plans and perform periodic inspections. Establish penalties for non-compliance.

5. **Post-construction runoff control**: Require the consideration and implementation of post-construction storm water controls for any new construction. This might include on-site detention, pollutant reduction, or both.

6. **Pollution prevention/good housekeeping**: City activities should include training maintenance staff to employ pollution prevention techniques and to maintain and operate public facilities to ensure the most efficient pollutant reduction. Materials handling, fleet vehicle maintenance, and application of chemicals in public areas (parks, roadways) should be managed to reduce impact on storm water quality.

Oregon Administrative Rule (OAR) 340-041-0120 (16) states that:

> Storm Sewers Systems Not Subject to Municipal NPDES Storm Water Permits: A collection system evaluation shall be performed of non-permitted storm sewers by January 1, 2005, unless the Department determines that an evaluation is not necessary because illicit and cross connections are unlikely to exist. Illicit and cross-connections shall be removed upon identification.

This activity can be expected to be required as a means to ensure there are no public health impacts due to release of untreated wastewater through the storm system.

DEQ requires, as part of the wastewater NPDES permit renewal process, the preparation of an Emergency Spill Response Plan. This document is intended to identify the appropriate actions by

the city operations and maintenance staff if there is an emergency spill of untreated wastewater. The plan includes activities to protect human health and to minimize impact on the storm drain system and ultimately the receiving waters.

Underground Injection Control Program

Oregon has primacy for the implementation of the Underground Injection Control Program required by federal regulation under the Safe Drinking Water Act. Further, the state agency can require more stringent requirements that set out in the federal regulations in order to protect certain resources. Currently, Oregon's administrative rules are being revised to align with current federal statute and regulation. Therefore, there is some uncertainty about the preferred techniques for local governments to manage rule authorized, Class V stormwater wells. Florence may be required to obtain an area or individual permit for municipally funded projects or for projects on private property.

The state does not consider natural infiltration of stormwater through pervious surfaces as underground injection. Injection generally involves the direct conveyance to a near-groundwater zone by piping or a well casing. Directly piping flow prevents the natural filtration process provided by shallow soil horizons. Infiltration swales would not be considered injection wells, whereas infiltration sumps, dry wells, or trenches would.

The state prefers cities to use existing storm sewers or surface disposal rather than groundwater disposal if possible. However, this may be in conflict with the need to protect degraded stream channels by reducing the volume and peak flow of urban stormwater discharge during winter and enhancement of low flows during summer. A balance will need to be found between storm sewers and injection wells. This is likely to be natural infiltration to the capacity of local soils, with overflow to an existing storm sewer. Dialogue with DEQ and EPA staff will assist planners and designers in choosing infiltration designs that avoid being classified as underground injection. Or, if underground injection is required, regulators can assist in well registration and permitting (if required).

Wetlands Impact and Restoration

The primary state regulation that affects development activities in and near wetlands is the Removal-Fill Permit Program, ORS 196.800 through 196.990, administered by DSL. The DSL uses the 1987 COE manual to delineate wetlands.

The Removal-Fill Permit Program regulates:

- The removal of 50 cubic yards or more of material from one location in any calendar year.
- The filling of a waterway with 50 cubic yards or more of material at one location at any time.

DSL also regulates irrigation ditches and intermittent streams if they are considered a source of food for wildlife or provide habitat for game fish. Further, DSL regulates intermittent streams if they meet federal wetlands criteria.

Any project, public or private, that involves filling or removing fill from wetlands included in the Florence wetland inventory will require a DSL permit if the quantities exceed 50 cubic yards. The absence of wetlands as shown in the inventory, or of streams and drainage channels does not automatically relieve the owner or developer of getting permits. Wetlands could be present on a site and not be shown on an inventory map. The owner or developer must determine if wetlands are present, and therefore, if a DSL permit is or is not required.

Oregon Coastal Management Program

The Oregon Coastal Management Program (OCMP) is a state and local partnership whose purpose is to protect, conserve, and -- where appropriate -- develop natural and cultural resources within Oregon's Coastal Zone. Oregon's Coastal Zone is an officially-designated area which encompasses most of the lands west of the crest of the Coast Range Mountains.

The OCMP is administered by the Oregon Department of Land Conservation and Development (DLCD). The federal Coastal Zone Management Act includes a concept called federal consistency. This means that Oregon's Coastal Management Program takes precedent and any federal actions occurring in or outside of Oregon's coastal zone which affect coastal land or water uses or natural resources must be consistent with the OCMP. Federal consistency potentially applies to any project having effects on land and water uses or natural resources of the Oregon coastal zone, but DLCD reviews are generally only required for projects west of the eastern coastal zone boundary.

City activities that might initiate federal actions that are subject to consistency review include:

- Federal permits and licenses (e.g., Corps of Engineers wetlands fill and navigable waterway permits, EPA pollution discharge permits)

- Federal financial assistance to state and local governments or related public entity (e.g., Rural Economic & Community Development, Housing and Urban Development, and U.S. Forest Service grants)

DLCD is the state's designated coastal management agency and is responsible for reviewing projects for consistency with the OCMP and issuing coastal management decisions. Federal permits, licenses, and financial assistance grants cannot be issued if the State objects based on project inconsistency with the OCMP. Essentially, the OCMP is a state and local partnership for the management of coastal lands, waters, and resources. A project is consistent if it will be in compliance with applicable local and state requirements. Reviews generally take 45 to 90 days but can take longer (up to 6 months) if significant management issues are raised or if a permit applicant has failed to apply for required local and state permits.

An element of the overall OCMP is Oregon's CNPCP, called for by the CZARA. The purpose of the program is to protect coastal waters from nonpoint source pollution. With the CNPCP,

Congress directed states with approved coastal programs to implement nonpoint source pollution control measures to protect coastal waters.

There are three important features of the CNPCP:

- First, the program is the shared responsibility of the state's coastal program and water quality agency.
- Second, the CNPCP is based on nonpoint source control management measures for virtually every land use activity in the coastal zone.
- And third, the CNPCP must be implemented through "enforceable policies and programs."

The state is required to implement an extensive set of nonpoint source control management measures published in federal guidance documents (EPA, 1993). There are 56 measures addressing forestry and agricultural activities, marinas, urban-type activities, hydromodification, and wetland protection. Once these measures are implemented, the state must implement additional measures where necessary to meet water quality standards. Federal approval of the state program requires the measures be implemented along with prove of their enforcement.

While many of the listed measures were being implemented in Oregon through other initiatives and programs, some areas were identified are requiring additional emphasis:

- Most of the agricultural management measures
- A measure for on-site septic system maintenance
- Measures for construction site erosion controls on small sites
- Measures for operation and maintenance of roads, highways, and bridges
- Riparian area protection

Measures that are likely to affect local governments include:

- Construction site erosion controls
- Land development requirements for reducing total suspended solids loading
- Road, highway, and bridge operation and maintenance
- Riparian and wetland area management

These measures, which will be the coastal program's predominant focus, highlight the need to address water quality in many planning and maintenance activities and decisions at the local level.

ABBREVIATIONS

BMP	Best management practice
cfs	Cubic feet per second
CNPCP	Coastal Nonpoint Pollution Control Program
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act of 1977
CZARA	Coastal Zone Act Reauthorization Amendments of 1990
CZMA	Coastal Zone Management Act of 1972
DEQ	Oregon Department of Environmental Quality
DLCD	Oregon Department of Land Conservation and Development
DSL	Oregon Division of State Lands
EPA	U.S. Environmental Protection Agency
EQC	Oregon Environmental Quality Commission
ESA	Endangered Species Act of 1973
ESU	Evolutionarily significant unit
FBFM	Flood Boundary and Floodway Map
FEMA	Federal Emergency Management Agency
FIA	Federal Insurance Administration
FIRM	Flood Insurance Rate Map
HCP	Habitat Conservation Plan
ITP	Incidental Take Permit
MEP	Maximum extent practicable
mg/L	Milligrams per liter
mL	Milliliter
MS4	Municipal separate storm sewer system
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OAR	Oregon administrative rule
OCMP	Oregon Coastal Management Program
SDWA	Safe Drinking Water Act
TM	Technical memorandum
TMDL	Total Maximum Daily Load
UIC	Underground Injection Control
USDW	Underground Sources of Drinking Water
USFWS	U.S. Fish and Wildlife Service
WRD	Oregon Water Resources Department

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APPENDIX D
ORDINANCE, CODE AND DEVELOPMENT STANDARDS

TECHNICAL MEMORANDUM

TO:	Ken Lanfear, City of Florence Public Works Director
FROM:	James R. Hansen, P.E., Brown and Caldwell Project Manager
DATE:	October 3, 2000
PREPARED BY:	James R. Hansen, P.E., Brown and Caldwell
REVIEWED BY:	Paul Bucich/Brown and Caldwell
SUBJECT:	Task 6 Technical Memorandum: Ordinance, Code and Development Standards
PROJECT:	BC #17146: City of Florence Comprehensive Storm Water Management Plan

CONTENTS

INTRODUCTION

This technical memorandum includes a recommended storm water ordinance for supporting the City's Storm Water Management Plan. As appropriate, a commentary is provided for each major section of the ordinance that explains the purpose and benefits of the recommendations.

A single storm water ordinance is recommended for guiding the City's development, operation, and maintenance of the public and private storm water collection system. The ordinance addresses a number of issues, including: city wide storm water management, flood protection from storm water and groundwater sources, guidance for future development, water quality protection, aquifer recharge development submittal requirements, environmental protection, operation and maintenance requirements, construction and inspection requirements, and a number of miscellaneous provisions. Within the ordinance, there are a number of policy statements and development standards that define specific requirements for the development, construction, and maintenance of the storm water collection system.

OBJECTIVES

Storm water ordinances should be tailored to meet the specific needs of a community. We do not recommend adopting a storm water ordinance from another jurisdiction since no two communities are exactly alike in their topography, climate, demographic distribution, types of storm water problems, economic resources, politics, and municipal structure. Instead, the storm water ordinance for the City of Florence should be structured as to define a storm water management program that will satisfy community and city objectives for the program.

A number of Stakeholders Advisory Committee meetings were held between spring through fall of 1999. These meetings included selected representatives from the community, the public at-large, City representatives, and the engineering consultant. As a result of these meetings, a number of objectives were formulated that define the overriding purpose of the storm water management planning effort. The specific objectives are defined as follows:

- Protect private and public property from storm water and groundwater related damage.
- Maintain public access to critical facilities at all times.
- Protect the quantity and quality of the aquifer.
- Provide improvements that will limit negative storm water related impacts on the community.
- Implement a storm water management program that will satisfy the current, and to the extent possible, the future regulatory requirements.

- Develop a storm water management plan that defines the required improvements and their associated costs.
- Develop a storm water management plan that will not adversely impact wetlands, creeks, streams and the river while meeting the needs of the City.
- Protect or enhance the quality of life of the area.

In addition, several technical objectives were defined that will also guide the storm water management program, including:

- The recommendations of the storm water management plan must be implementable from a physical, economic, and political perspective.
- The recommended improvements must be maintainable by the City within its current structure (personnel and equipment), or within a modified structure that can be funded.
- The recommended plan shall identify funding options that the City can explore to help finance the recommended program.

The recommended storm water ordinance has been structured to help achieve these objectives.

RECOMMENDED STORM WATER ORDINANCE

The recommended ordinance is included at the end of this technical memorandum.

RECOMMENDATIONS

The recommended storm water ordinance contains a number of requirements that will be new to the City and to the community. Therefore, it is important that there be agreement between all parties that the final language of the ordinance is for the common good of the community. Since these requirements will impact the community in a variety of ways, we recommend that the City and the public participate in the review and comment process.

We recommend a multi-phased review process for the Ordinance. First, the enclosed draft Ordinance should be provided to all the major divisions of the City for their review and comment. For example, the Ordinance will directly impact planning, community development, engineering, operations and maintenance, real estate, finance, and general counsel. For successful implementation, an

agreed upon overall approach to storm water management is required. Based on comments from these various groups, the draft Ordinance should be modified to reflect the City's collective approach to managing storm water.

Next, the Stakeholders Advisory Committee (SAC) should be given the opportunity to review the Ordinance. Their comments should be considered and be included in a revised version of the Ordinance, as appropriate. Simultaneous with the SAC review, major stakeholders in the community, including: developers, builders, engineers, special interest groups, and others as determined by the City should be given the opportunity to provide input into the ordinance adoption process.

The final version of the ordinance should include input from a cross-section of the community. While the process will take time, it attempts to include all parties in the development of the ordinance, thus improving the potential for successful Council adoption of the Ordinance. Also, the review and input process will be concurrent with the review and input process of the Storm Water Management Plan.

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CITY OF FLORENCE
STORM WATER ORDINANCE

TABLE OF CONTENTS

SECTION 1 – GENERAL PROVISIONS

A. PURPOSE

1. The purpose of this Ordinance is to protect, maintain, and enhance the public health, safety, and general welfare by establishing minimum requirements and procedures to control the adverse effects of storm water runoff associated with existing and future land development within the City. Proper management of storm water runoff will minimize damage to public and private property, ensure a functional drainage system, reduce the negative effects of development on the existing stream channels, assist in the attainment of water quality standards, help protect the quantity and quality of the water in the aquifer, enhance and protect the natural environment associated with the drainage system, and facilitate economic development while mitigating the associated impacts of development.

2. This Ordinance defines the minimum requirements that shall be provided. Additional requirements may be required by the City if the minimum requirements will not satisfy the overall purpose of this Ordinance.

3. Where the term "City" is referenced in this Ordinance such that an action or activity is required by a City of Florence official, the reference is to either the Community Development Director or the Public Works Director depending on the action or activity that is required. The division of responsibility between the Community Development Director and the Public Works Director is defined as follows:

   a) The Community Development Director is responsible for ensuring that the intent of this Ordinance is implemented as it applies to private development projects. The Community Development Director shall consult with the Public Works Director on private development projects that include facilities that will become publicly owned and maintained and on any private project that may have an impact on publicly owned facilities.

   b) The Community Development Director is responsible for ensuring that the submittal, review and approval process defined by this Ordinance is adhered to for all projects.

   c) The Public Works Director is responsible for ensuring that the intent of this Ordinance is implemented as it applies to public works projects."

B. DEFINITIONS

1. Backwater – Areas of water where the water surface elevation is raised as a result of down gradient activities or constrictions.

2. Best Management Practices (BMPs) – Includes a wide range of storm water management procedures to effectively control the quantity and quality of storm water runoff. Loosely interpreted, BMPs include the wide range of storm water management facilities available for quantity and quality control (e.g. detention ponds, water quality ponds, water quality manholes, vegetated swales, infiltration systems, etc.).

3. Buffer zone – A physical setback from a sensitive area used to protect the water quality, the aquatic and riparian wildlife communities, and the habitat value within the sensitive area. The start of the buffer starts at the edge of the defined channel (bank full stage) for streams/rivers, delineated wetland boundary, delineated spring boundary, or average high water for lakes.

4. Detention facility – A permanent storm water management structure that temporarily stores runoff by controlling the release rate from the facility to prevent down gradient flooding and high velocities.

5. Development – The division of land into two (2) or more lots, tracts or parcels, or the clearing, grubbing, stripping, grading, excavating, and filling of land.

6. Division of Land – The creation of lots or parcels.

7. Drainage Facility – Any of a number of types of storm water conveyance facilities, including: pipes, culverts, ditches, natural drainageways, streams, catch basins, inlets, trash racks, and other types of open-channel systems.

8. Easement – A grant or interest in land owned by another that entitles its holder a specific limited use.

9. HEC-1 – This is the first in a series of models developed by the Hydrologic Engineering Center, which is a division of the U.S. Army Corps of Engineers. HEC-1 a hydrologic model. It is available at: http://www.wrc-hec.usace.army.mil.

10. HECRAS – This is another model developed by the Hydrologic Engineering Center. RAS stands for River Analysis System. This is a hydraulic model and is an update to the older HEC-2 model. It is also available at: http://www.wrc-hec.usace.army.mil.

11. HSPF – This is a Hydrological Simulation Program translated into Fortran. It is a hydrologic model. It is an EPA/USGS program and can be found at: http://water.usgs.gov/software/hspf.html.

12. HYDRA – A commercial program from Pizer which is both hydrologic and hydraulic. More information can be found at: http://www.pizer.com/hydra.htm.

13. Impervious surfaces – Buildings, roofs, sidewalks, streets, paved parking areas, gravel streets and parking areas, and other types of paved or hard surfaces that severely limit the infiltration of storm water into the soil. Surfaces with a Rational Method runoff coefficient of 0.8 or higher shall be considered impervious.

14. Land Disturbing Activities – Any use of the land by any person that results in a change in the natural cover or topography that may cause erosion and alter the quality and/or quantity of storm water runoff.

15. Lot – A unit of land that is created by a subdivision of land.

16. Major Partition – A partition which includes the creation of a road or street and which does not result in the creation of more than two (2) or three (3) lots within a calendar year.

17. Minor Partition -- A partition which does not include the creation of a road or street, and which does not result in the creation of more than two (2) or three (3) lots within a calendar year.

18. Owner – An individual, association, partnership or corporation having legal or equitable title to land sought to be divided, other than legal title held for purposes of security only.

19. Partition Land – Division of an area or tract of land into two (2) or three (3) parcels within a calendar year when such area or tract of land exists as a unit or contiguous units of land under a single ownership at the beginning of such year.

20. Post-Developed Conditions – The conditions that exist following the completion of the land disturbing activity in terms of topography, vegetation, land use and rate, volume or direction of storm water runoff.

21. Pollution Generating Impervious Surface – Impervious surfaces subject to regular vehicular use, including: roads, unvegetated road shoulders, driveways, parking lots, diesel equipment storage yards, and airport runways; storage areas of erodable or leachable materials, wastes, or chemicals; and metal roofs that are not treated to prevent leaching.

22. Pollution Generating Pervious Surface – Any non-impervious surface with vegetative ground cover subject to the use of pesticides and fertilizers, including: lawns and landscaping of commercial sites, golf courses, parks and sports fields.

23. Pre-Developed Conditions – The conditions of the land prior to the initiation of the land disturbing activity in terms of topography, vegetation, land use and rate, volume or direction of storm water runoff.

24. Preliminary Development Plan – The minimum submittal requirement for all projects except those specifically exempt from the submittal process or subject to the modified requirements. The plan helps to identify the major impact of the proposed development on the quality and quantity of storm water and the proposed activities to limit negative impacts.

25. Public Storm Water Facility – Drainage and storm water management facilities located within the public right-of-way or easements dedicated to the City and that are owned and maintained by the City.

26. Retention Facility – Similar to a detention facility, except the retention facility is designed with a permanent pool of water that may have a detention storage volume above the permanent pool. Many of these facilities use infiltration and evaporation to discharge the retained volume of water.

27. Right-of-Way – The area between boundary lines of a street or other easement.

28. Sensitive Areas – Natural streams (perennial or intermittent), rivers, lakes, or wetlands hydraulically connected by surface water to streams, rivers, or lakes and areas defined by the City's Water Resource Overlay Zone, Florence City Code Title 10, Chapter 7. Also, includes all areas that are protected for species as per areas designated by Oregon Department of Fish and Wildlife, Oregon Division of State Lands, National Marine Fisheries Service, United States Fish and Wildlife Service and Oregon Department of Transportation.

29. Storm Water Management Facilities – Facilities or structures that control the quantity or quality of storm water, including: detention ponds, water quality ponds, vegetated swales, water quality manholes, treatment wetlands, infiltration systems, etc.

30. Storm Water Management Plan – A plan submitted to the City for review and approval prior to the major development of land. The Storm Water Management Plan is more detailed than the Preliminary Development Plan and is intended to help prevent negative impacts to storm water quality and quantity associated with major land disturbing activities.

31. Storm Water System – All of the structures and facilities that are designed for the collection, conveyance, storage, treatment, and disposal of storm water runoff and surface water, including both man made and natural drainage systems.

32. Subdivide Land – The division of an area or tract of land into four (4) or more lots within a calendar year when such area or tract of land exists as a unit or continuous units of land under single ownership at the beginning of such year.

33. Subdivision – Either an act of subdividing land, or an area or tract of land subdivided as defined in Section 11 of the City Code.

34. SWMM– This is a hydrologic and hydraulic storm water management model and it is an official EPA model. It was originally developed and maintained by Wayne Huber of Oregon State University. It is available at: http://www.ccee.orst.edu/swmm.

35. Zone of Contribution – The upgradient boundary of a wellhead protection area as defined by the 10-year time of travel.

C. SCOPE OF ORDINANCE

1. No person shall develop any land without having provided for appropriate storm water management measures that control or manage runoff in compliance with this Ordinance.

2. The current City Code and Comprehensive Plan shall be in effect and be adhered to by all projects affected by this Ordinance.

D. EXEMPTION AND MODIFIED REQUIREMENTS

1. Certain categories of projects are either exempt from this Ordinance or are required to follow a modified version of the Ordinance requirements.

   a) Projects exempt from the requirements of this Ordinance include:

      1) Projects with site development applications submitted for City review and approval prior to the effective date of this Ordinance.

      2) Emergency projects which if not performed immediately would substantially endanger life or property.

      3) Public works and private utility projects completely within easements adjacent to the public right-of-way which do not add impervious surface (not to include trenching activities) or impact water quality, wetlands, streams, open space buffers, park and recreation lands, or natural resource lands.

      4) Grading and working of land for agricultural purposes, provided the activity does not affect water quality, wetlands, streams, open space buffers, park and recreation lands, or natural resource lands.

      5) Maintenance of public roads or utilities when performed by a public agency and the project has been reviewed and approved for compliance with applicable State, Federal and City regulations, and the work is in an existing right-of-way or easement dedicated to or on property owned by the City.

      6) Public Works maintenance activities for routine repetitive activities, provided that erosion and sediment control measures are implemented as required.

      7) All utility trenching and installation where said utility has filed a plan with the City that addresses sediment and erosion control methods to be implemented as part of the work.

   b) For the types of projects described below, the requirements identified in the "Erosion Prevention and Sediment Control Practices for Single Family Residences and Small Projects" brochure available from the City shall be followed.

      1) Single family residential construction projects that are separate from the development (partitioning or subdividing) of the land.

      2) Non-residential construction projects adding less than 500 square feet of impervious surface to the area.

      3) Land clearing and grading activities disturbing less than 10,000 square feet of land and involving less than 50 cubic yards of excavated or fill material.

2. In accordance with Section 1.A, the Community Development Director and/or the Public Works Director will determine if a proposed project meets the criteria defined by Section 1.D. The City reserves the right to require additional protection measures if a project is deemed to present a risk to the community.

E. PUBLIC STORM WATER SYSTEM

1. All storm water drainage and management facilities shall be privately owned and maintained unless the City has specifically identified the facilities as being public facilities.

2. The City Public Works Director may require that a storm water facility that serves more than one property be a public facility provided the easement and maintenance requirements of this Ordinance are satisfied.

3. Planned Unit Developments (PUD) may or may not have a public storm water system. Generally, if the City owns and maintains the roads and there is free ingress and egress from the community (not gated), then the City may own and maintain the storm water system provided the easement and maintenance requirements of this Ordinance are satisfied. Ownership of the PUD storm water system shall be established prior to the issuance of construction permits.

4. Natural streams and drainageways are not owned and maintained by the City.

5. The storm water facilities identified in the City of Florence Storm Water Management Plan shall be publicly owned (See easement requirements in Section 5).

6. The City may accept ownership of the major components of the existing storm water drainage and management system located outside of the current City boundary after the area is annexed into the City. In general, the storm water drainage system owned and maintained by Lane County (prior to annexation) will be accepted by the City. The City's Public Works Director shall consider the following factors prior to recommending to City Council the acceptance of any facilities into the public drainage system:

   - standards used in the design,
   - the location of the system relative to the public right-of-way,
   - functionality of the system,
   - associated flooding problems,
   - maintenance requirements,
   - ability to access facilities,
   - pending or potential lawsuits, and
   - any other factors pertinent to the decision.

F. EXTENSION OF PUBLIC STORM WATER SYSTEM

The public storm water system shall be extended to the most distant up gradient parcel boundary(ies) to accommodate current and future flows entering the property, unless otherwise approved by the City. Except as otherwise provided, the extension of the public storm

water drainage system to serve any parcel or tract of land shall be done by and at the expense of the property owner(s) or applicant. The City may require that a storm water system that serves more than one property be a public system.

SECTION 2 – PLAN SUBMITTAL REQUIREMENTS

A. GENERAL

The Preliminary Development Plan and the Storm Water Management Plan are required to prevent or mitigate the potentially negative impacts associated with larger site disturbance and development activities.

B. PRELIMINARY DEVELOPMENT PLAN

1. A Preliminary Development Plan is required for all projects not specifically identified as being exempt or subject to the modified requirements. The plan shall include as a minimum the following:

    a) A general description of the proposed improvements.

    b) A general description of the topography, soil, storm water drainage and management system (include how surface runoff or flow enters and leaves the project site), and natural resource conditions of the site. If the area is subject to flooding from a high groundwater table, show how this water is managed to prevent flooding of existing or proposed structures.

    c) A general description of the proposed project property and a description of existing structures, buildings, and other fixed improvements located on the property and surrounding properties.

    d) A Site Plan that identifies the following features:

        1) The site location of the proposed project, indicating the location of the proposed project in relation to roadways, jurisdictional boundaries, streams, wetlands, and rivers.

        2) The boundary lines of the project site.

        3) All areas of the site that will be disturbed by construction activities and the total disturbed area calculated.

        4) The total quantity of impervious surface added by the project.

        5) The existing and proposed topography of the project site.

        6) The general location and identification of natural vegetation.

7) The location and identification of the existing and proposed storm water drainage system, including natural and man-made features.

8) The location of buffers and regulatory setbacks from streams and wetlands.

9) The required easements for all public facilities.

10) A description and plan of erosion prevention and sediment control practices to be implemented during construction and prior to landscaping becoming established.

e) The Preliminary Development Plan shall contain certification by the person(s) responsible for the land disturbing activity that the proposed activities will be accomplished pursuant to the plan. In addition to this certification, a registered Professional Engineer licensed by the State of Oregon shall prepare, certify, and stamp/seal documents as required by City and state law. The engineer must follow the standards of practice for the engineering community.

2. The Preliminary Development Plan shall be submitted and approved prior to the submittal of the construction plans for the project. The Storm Water Management Plan, where required, shall be submitted along with the construction drawings.

3. If the City approves the Preliminary Development Plan, no further submittal, review and approval of the storm water system shall be required unless changes are made to the design, a Storm Water Management Plan as described in Section 2.C.1 is required, or the project presents a unique threat to the public health, safety, and general welfare as determined by the City.

C. STORM WATER MANAGEMENT PLANS

1. Storm Water Management Plans are required for larger development projects: major partitions, subdivisions, land disturbing activities affecting over one (1) acre, projects involving the construction or extension of the public storm water system, or where the project is deemed by the City to present a special risk to the public health, safety, and general welfare.

2. The plan shall include as a minimum the following:

a) A vicinity map indicating a north arrow, scale, boundary lines of the site, and other information necessary to locate the project site.

b) The existing and proposed topography of the development site except for individual lot grading associated with the construction of each single family residence, unless the single family residence construction is a part of the overall development of the subdivision.

c) Physical improvements on the site, including existing and proposed development.

d) Location, dimensions, elevations, and characteristics of existing and proposed storm water drainage and management facilities.

e) All areas within the site that will be included in the land disturbing activities shall be identified and the total disturbed area calculated.

f) The total quantity of impervious surface added by the project.

g) The location and dimensions of stream and wetlands buffers and regulatory setbacks shall be shown.

h) A determination that no occupied first floor elevation of any structure is below the 100-year plus one foot flood elevation. The 100-year flood elevation to be used in this determination is as established by the Federal Emergency Management Agency (FEMA).

i) The required easements shall be shown for all public facilities along with all dedicated tracts of land for storm water management facilities.

j) A landscaping plan shall be provided in accordance with the City of Florence Site Design Policies and Standards (Adopted 4-24-90 and as amended 1992).

k) The Storm Water Management Plan shall include all engineering calculations needed to design the drainage system and associated structures including the pre- and post-development flow rates and velocities, peak rates of discharge at all existing and proposed points of discharge from the site, and the up gradient and down gradient analysis as required by Section 3.B.10. Storage volumes and infiltration rates shall be shown for the applicable facilities.

l) Description or site conditions at the existing and proposed discharge points form the development site.

m) Construction and design details for all storm water drainage and management facilities.

n) A description and plan of erosion prevention and sediment control practices to be implemented during construction and prior to landscaping becoming established.

o) A schedule showing the construction timing of the major components of the storm water system.

p) The Storm Water Management Plan shall contain certification by the persons responsible for the land disturbing activity that the proposed activities will be accomplished pursuant to the plan. The certification shall include an assurance that impacts to wetlands, streams, or their buffers will be mitigated in accordance with the requirements of all the applicable regulatory agencies.

q) An Operations and Maintenance Plan shall be submitted for all storm water quantity control and treatment facilities.

3. Storm Water Management Plans shall be prepared, certified, and stamped/sealed by a qualified registered Professional Engineer licensed by the State of Oregon. The engineer must follow the standards of practice for the engineering community and verify that the plans have been designed in accordance with this ordinance, along with all standards and criteria stated or referred to in this ordinance.

SECTION 3 - STORM WATER DESIGN CRITERIA

A. GENERAL

The criteria within this section shall be used in the design of public and private storm water drainage and management systems.

B. STORM WATER QUANTITY

1. A 25-year, 24-hour, Soil Conservation Service (SCS) Type 1A return period storm shall be used for the design of all private and public storm water drainage systems.

2. The Rational Method shall be used to design drainage facilities for projects draining less than or equal to 50 acres and having a time of concentration of less than 30 minutes. A hydrograph technique shall be used to design drainage facilities not meeting the above criteria. In addition, a hydrograph technique shall be used to design all storm water management facilities.

3. Acceptable hydrograph techniques include the Soil Conservation Service (SCS) unit hydrograph methods and the Santa Barbara Urban Hydrograph Method. For larger developments, use of HEC-1, HECRAS, HSPF, HYDRA, SWMM and other hydrologic/hydraulic models may be used if prior approval is provided by the City.

4. Structures for proposed pipe systems must be demonstrated to provide a minimum of 12-inches of freeboard between the hydraulic grade line and the top of the structure or finished grade above the pipe for the 25-year post-developed conditions. Surcharging of the piped system shall not be allowed if it will cause flooding in buildings including crawl spaces.

5. Open channel systems shall be designed with a minimum 6-inch freeboard for systems conveying up to 10 cubic feet per second and a minimum 12-inch freeboard for flows over 10 cubic feet per second. Under no conditions shall public or private buildings or structures be impacted by the design water elevation.

6. The 25-year, 24-hour storm design criteria shall be supplemented with an overland conveyance component demonstrating how flows from a 100-year, 24-hour SCS Type 1A return period event will be accommodated. This overland component shall not be allowed to flow through or inundate existing or proposed buildings. Public and private streets may be utilized to convey the 100-year, 24-hour flow provided the maximum depth does not exceed 4-inches and a full traffic lane remains available for use without being inundated.

7. A secondary outlet or emergency spillway is required for all storm water storage facilities. The secondary outlet or emergency spillway shall be designed to safely pass without danger to the public, property, or the facility the 100-year, 24-hour storm while assuming that the normal outlet structure is plugged.

8. Onsite storm water management facilities shall be required to prevent the post-development runoff rates from a project site from exceeding the pre-development runoff rates from the site, based on a 2 through 25-year, 24-hour return storm. Specifically the post-development runoff rates shall not exceed the pre-development runoff rates from the site, based on 2, 10, and 25-year, 24-hour return storms, respectively. Certain areas of the City as defined in the City of Florence Storm Water Management Plan are exempt or partially exempt from this requirement. Other exemptions may be made if the City determines that a more effective solution is available.

9. Each new development project is responsible for mitigating its impacts on the storm water system. This mitigation requirement can be satisfied through the use of any of the following techniques, subject to the other limitations identified by this Ordinance:

    a) Construction of onsite facilities to limit the flow rate of storm water runoff leaving the development site.

    b) Enlargement or improvement of the down gradient conveyance system in accordance with the requirements of this Ordinance and the City of Florence Storm Water Management Plan or as approved by the City.

    c) Payment of a Storm Water Management System Development Charge (SDC) as approved by the City Public Works Director. Approval of this option by the City Public Works Director shall require that the applicant verify the down gradient capacity of the storm water conveyance system and its appurtenances are adequate for safely conveying the increased flow and that no damage will occur to public facilities, private property, or habitat. A minimum distance of 1/4-mile down gradient will be investigated and the City reserves the right to require the applicant to investigate down to the ultimate point of discharge to a major water body.

10. The development of any land requiring a Storm Water Management Plan shall address onsite and off-site drainage concerns, both up gradient and down gradient (a minimum of 1/4-mile) of the project, including:

    a) Modifications to the existing onsite storm water drainage and management facilities and drainage patterns shall not restrict or redirect flows creating backwater or direct discharge onto off-site property to levels greater than the existing condition unless approved by the affected off-site property owners and the City. Proof of off-site property owners approval shall be provided by having the affected property owner(s) sign an easement identifying the location of the backwater storage or impoundment area. This area shall be clearly shown on the submitted Storm Water Management Plan site sheet(s). The easement shall be in a form approved by the City and recorded with the Lane County Deeds and Records Office.

b) Storm water facilities shall be designed and constructed to accommodate all flows generated from the project property in accordance with the land use zoning as shown in the most recent approved City Code.

11. The types of storm water management controls presented in the appendix of the City of Florence Storm Water Management Plan are available for owners and developers to use in satisfying the pre-developed and post-development runoff requirement. More than one of these types of controls may be needed to satisfy the runoff requirement. In areas where the runoff requirement in Section 3.B.6 are exempt or partially exempt, the City may require improvements to the down gradient conveyance system and/or SDC charges.

C. STORM WATER QUALITY

1. Storm water management facilities to treat storm water are required for certain types of projects. These water quality facilities shall be designed and constructed for all projects requiring a Storm Water Management Plan and for other projects as required by this section. Acceptable storm water management facilities, or combination of facilities must be capable of achieving a 70 percent removal rate of Total Suspended Solids (TSS) from the water quality design flow.

2. Water quality facilities shall be designed and constructed for all projects requiring a Storm Water Management Plan or certain types of projects located in districts zoned: multiple family residential, neighborhood commercial, commercial, limited industrial, highway, waterfront, marine, limited industrial, airport, and waterfront/marine. In these districts, the 70 percent TSS removal rate applies to projects involving the following:

   a) Greater than 5,000 square feet of new impervious surfaces.

   b) Greater than 5,000 square feet of any combination of new and/or replaced impervious surfaces as part of a redevelopment project.

   c) Greater than 43,560 square feet (1 acre) of contiguous pollution generating pervious surface that will be added and/or modified unless a landscape management plan to minimize the use of pesticides and fertilizers has been approved by the City.

3. Oil control facilities are required in high-use areas. High-use areas are defined as follows:

   a) Commercial or industrial sites subject to an expected average daily traffic count equal to or greater than 50 vehicles per day.

   b) Commercial or industrial sites subject to petroleum storage and transfer in excess of 1,500 gallon per year, not including routinely delivered heating oil.

   c) Commercial or industrial sites subject to use, storage, or maintenance of a fleet of 10 or more vehicles.

Oil control facilities that will limit the quality of the storm water discharge to less than 10 mg/L total petroleum hydrocarbons are required. High-use areas requiring oil control facilities shall not use infiltration facilities to satisfy the water quality treatment requirement.

4. Projects located within the aquifer's Zone of Contribution shall meet, at a minimum, the above requirements (Section 3.C.1 through 3.C.3), as applicable, and any additional requirements as identified in the City of Florence Storm Water Management Plan. Projects located in the Zone of Contribution shall not use infiltration facilities to meet the water quality requirement. When a wellhead protection plan is developed and adopted by the City, this specific requirement may be rescinded or modified by the City.

5. The water quality design storm shall be based on the 6-month, 24-hour SCS Type 1A rainfall return event.

6. Water quality facilities must be designed to prevent damage to the facility for flows exceeding the water quality design storm and to ensure no re-suspension of pollutants. The applicant is strongly advised to consider bypass facilities for any flows above the water quality design storm.

7. Sensitive areas shall be protected by a buffer zone of native, undisturbed vegetation. The outer boundary of the buffer shall be determined by a minimum 50-feet setback from the edge of the sensitive area, or wider if required by other City requirements (See Florence City Code Title 10, Chapter 7.) The width and nature of protection required within the buffer may change as the Endangered Species Act and other state and federal regulations are promulgated. The City requires that the buffer width meet all state and federal requirements. No land disturbing activities, structures, development and construction activities, gardens, lawns, application of chemicals, pet wastes, dumping of any kind of materials shall be permitted within the buffer zone, except as noted below:

   a) Roads, pedestrian, or bike paths crossing the buffer from one side to the other in order to provide access to or across the sensitive area.

   b) A pedestrian or bike path constructed within a buffer and parallel to a sensitive area shall have the buffer widened by the width of the path if the path is constructed of impervious material.

   c) Pedestrian or bike paths shall not exceed 10-feet in width.

   d) Utility/service infrastructure construction (i.e., storm, sanitary sewer, water, phone, gas, cable, etc.) if approved by the City Public Works Director.

   e) Measures to remove or abate hazards, nuisance, or fire and life safety violations as approved by the City.

   f) Enhancement of the riparian corridor for water quality or quantity benefits, fish, or wildlife habitat as approved by the City and other appropriate regulatory authorities.

g) Water quality facilities planted with appropriate native vegetation may encroach into the buffer area as approved by the City and other appropriate authorities.

8. The types of storm water management facilities presented in the appendix of the City of Florence Storm Water Management Plan are available for owners and developers to use in satisfying the storm water quality requirement. More than one of these types of facilities may be required to satisfy this requirement.

SECTION 4 – MAINTENANCE RESPONSIBILITY

A. PUBLIC FACILITIES

The City's Public Works Department will maintain and operate the public storm water drainage system and storm water management facilities that receive storm water within a public right-of-way, on land owned by the City, or within easements dedicated to the City.

B. PRIVATE FACILITIES

1. Privately owned storm water facilities must be maintained in accordance with the Operations and Maintenance Plan approved as part of the Storm Water Management Plan. A log of all maintenance activity shall be kept by the owner and made available to the City upon request. The City may, at its option, inspect the facilities for compliance with these requirements. If a property owner fails to maintain their facilities to the acceptable standards, the City may issue a written notice specifying the required actions. If these actions are not performed in a timely manner, the City will pursue legal action to enforce the provisions of the Operations and Maintenance Plan. The City will only enter the property to perform the required actions if the public's health and public property are in imminent danger. In this situation, reasonable attempts will be made to contact the property owner(s), but a written notice may not be required. The property owner(s) will be billed for the cost of the action.

2. A Maintenance Agreement shall be established that defines the maintenance responsibility. Acceptable arrangements for this maintenance responsibility include the following:

   a) Private maintenance by homeowner association,

   b) Private maintenance by development owner(s),

   c) Homeowner association or owner(s) arrange to pay City for maintenance, or

   d) Homeowner association or owner(s) arrange contract with a private maintenance company.

3. The Maintenance Agreement shall provide that the City shall notify the owner of the facility of any violation, deficiency or failure to comply with this Ordinance. The agreement shall also provide that upon a failure to correct violations requiring maintenance work, within ten (10) days after notice thereof, the City will pursue legal action against the responsible party to enforce the provisions of the agreement. In an emer-

gency situation, the City may provide for all necessary work to place the facility in proper working conditions. The owner of the facility shall be assessed the costs of the work performed by the City or its agents.

C. CITY ACCEPTANCE OF NEW STORM WATER FACILITIES

The City may accept for maintenance those new residential storm water facilities constructed under approved permits that meet the following conditions:

a) Improvements in residential platts/PUDs have been completed on at least 80 percent of the lots.

b) All drainage and storm water management facilities have been inspected and have been satisfactory operation for at least one (1) year.

c) Any storm water system improvements made during the one-year maintenance period have been accepted by the City.

SECTION 5 – EASEMENTS

A. PUBLIC FACILITIES

Public facilities must have an easement, tract, or right-of-way granted to the City to provide for the inspection and maintenance of the drainage system and storm water management facilities. A minimum of 7-1/2 feet is required along each side of the centerline of storm water pipes and culverts. A fifteen-(15) foot wide access is required around the perimeter of storm water management facilities (ponds, wetlands, infiltration facilities, etc). A fifteen-(15) foot wide access road shall be provided when the public facility does not front a public road.

B. PRIVATE FACILITIES

1. Privately owned facilities must be placed in an easement, tract, or right-of-way that allows for the maintenance of these facilities by the owners, homeowner's association, or developer.

2. The City may determine that certain privately owned facilities are critical components of the overall storm water system. In these situations, the City shall be granted perpetual, non-exclusive access that allows for public inspection. The access shall be defined in accordance with the requirements for a public easement, tract, or right-of-way.

SECTION 6 – CONSTRUCTION AND INSPECTION

A. CONSTRUCTION

Prior to the construction of, or modification to any public storm water facility, a letter of commitment along with a performance bond or cash deposit in form and substance satisfactory to the City shall be submitted by the owner or his agent as a performance assurance

for such work. The amount of the performance assurance shall be the sum necessary to construct the public storm water facility improvements. The performance assurance shall remain in effect until released by the City. A final inspection shall be conducted by the City upon completion of the work included in the approved Storm Water Management Plan to determine if the completed work is constructed in accordance with the plan(s). At a minimum, all of the following criteria must be met prior to release of the performance assurance:

a) Construction is completed on all public improvements required for the storm water drainage and management system to operate. Each component of the storm water system must have been inspected and accepted by the City, including all compaction, pipeline video inspections, and plastic pipe mandrelling.

b) The City has inspected and accepted the public improvements and the owner has submitted a maintenance assurance (letter of commitment, maintenance bond, or cash deposit, as approved by the City Public Works Director). The amount of the maintenance assurance shall be for ten (10) percent of the cost of construction of the public improvements, excluding the cost of landscaping. The assurance shall be for a period of not less than one year from the date of completion of construction.

c) For projects with landscaping, the landscaping has been installed and accepted by the City. A two-year landscaping maintenance assurance has been submitted and accepted by the City. The amount of the assurance shall be fifty (50) percent of the cost of construction of the landscaping features.

d) All onsite and off-site easements as required by the City are granted to the City and recorded with the Lane County Deeds and Records Office.

(a) The post construction erosion control is completed.
(b) All required record drawings are submitted.

B. INSPECTION

A City representative shall inspect the storm water project as necessary and shall check materials, equipment, and the construction of the project to determine whether the work is proceeding in accordance with the approved plans and the requirements of this Ordinance. The purpose of these inspections is to monitor compliance with City construction standards and the inspections are for the benefit of the City. The City does not provide the primary inspection for the project, and only provides a level of inspection necessary to monitor the quality of work being performed by others. The City's role in making inspections is not supervisory and the City has no responsibility, by virtue of such inspections, for any construction means or methods or compliance with safety requirements that remain the responsibility of the Contractor.

SECTION 7 – MISCELLANEOUS PROVISIONS

A. TECHNICAL EQUIVALENCY

1. The City may grant a technical deviation from the requirements of this Ordinance if there are exceptional circumstances applicable to the project such that the provisions of the Ordinance will result in unnecessary hardship and not fulfill the intent and objectives of the Ordinance. The cost to fulfill the requirements of this ordinance cannot be used as justification for a technical equivalency.

2. To be approved, the proposed technical equivalency shall meet the following conditions:

   a) The technical equivalency will not violate the development conditions imposed on the project.

   b) The granting of a technical equivalency will produce compensating or comparable results that are in the public interest.

   c) The granting of a technical equivalency will meet the objectives of safety, function, appearance, environmental protection, and maintainability based on sound engineering judgment.

   d) The City or designee shall make written finding supporting the determination of technical equivalency.

3. A written request for a technical equivalency shall be required and shall state the specific equivalency sought and the reasons, with supporting data, for their granting. The request shall include descriptions, drawings, calculations and any other information that is necessary to evaluate the proposed equivalency. A technical equivalency shall only be granted when the applicant can show that an unnecessary hardship exists that is unique to the project or the property.

4. The City may have the technical equivalency proposal reviewed by an engineer licensed by the State of Oregon. The City reserves the right to select the engineer to perform the evaluation. The City will take the recommendation of the engineer under consideration as part of the technical equivalency review process. The applicant will pay for the cost of the engineering review.

B. PENALTIES

1. Upon determination that a violation of this ordinance has occurred the owner shall be given a written notice of the violations and the time in which to correct the deficiencies.

2. If construction violations of the approved plan are occurring, an immediate stop work order may be issued by the City. If the City issues a stop work order, the City must show cause within forty-eight (48) hours.

3. Any person violating this ordinance or any part thereof, including failing to stop work upon order, shall upon conviction thereof, be fined not more than one thousand dollars or imprisoned not more than thirty (30) days for each offense. Each separate interval of 24 hours, or every day, such violations shall be continued, committed or existing, shall constitute a new and separate offense and be punished for each separate period of violation.

4. The City Attorney will institute appropriate actions or proceedings at law or equity for the enforcement of this Ordinance or to correct violations of this Ordinance.

C. CONFLICT WITH OTHER LAWS

Whenever the provisions of this ordinance potentially conflict with any other ordinance, the requirements of the more restrictive ordinance shall prevail.

D. SEVERABILITY

If any term, requirement or provision of this Ordinance or the application of this Ordinance to any person or circumstance shall, to any extent, be invalid or unenforceable, the reminder of this Ordinance shall be valid and be enforced to the fullest extent permitted by law.

E. AMENDMENTS

This Ordinance may be amended in accordance with the procedures and laws of the City.

F. LIABILITY

Neither the approval of a plan under the provisions of this ordinance nor the compliance with the provisions of this ordinance shall relieve any person from the responsibility for damage to any person or property otherwise imposed by law nor shall it impose any liability upon the City for damage to any person or property.

APPENDIX E
BEST MANAGEMENT PRACTICES

APPENDIX E

BEST MANAGEMENT PRACTICES

Stormwater Best Management Practices (BMPs) are activities or facilities used to control storm water quantity, quality, or both. BMPs are required to prevent or mitigate the negative impacts associated with growth and to respond to new regulations, especially the National Pollutant Discharge Elimination System (NPDES), the Total Maximum Daily Load (TMDL) limits, and the Endangered Species Act (ESA). The development standards adopted as part of the City of Florence's Comprehensive Storm Water Management Plan identify flow control and water quality criteria that most likely will require the implementation of certain types of BMPs for compliance with these requirements.

The purpose of this document is to provide guidance on the appropriate selection and design of storm water BMPs by reference. By itself, this document is not a design manual for BMPs. Instead, it provides guidance to the broad range of resources available for selecting and designing these facilities.

There are many manuals available that provide guidance for the selection, installation, and maintenance of BMPS. The development of one of these documents for the City of Florence would be prohibitively expensive and not be a wise use of City resources. Instead, the adoption and use of an existing document is recommended. Of course, the unconditional adoption of another city's or agency's manual may not be prudent since the document was prepared for an area with topography, soils, rainfall, vegetation, land use, and political structure that may be quite different from the City of Florence.

This appendix provides general guidance for the application of storm water BMPs and recommends a BMP manual for adoption by the City of Florence, along with modifications and exceptions to tailor the manual to the needs of the Florence area.

General BMP Guidelines

Stormwater BMPs can be divided into two main categories, preventative and treatment. Preventative BMPs are designed to decrease the volume of runoff or prevent pollutants from mixing with the storm water. In other words, they take care of the storm water before it enters the public conveyance system. In general, preventative BMPs are mostly activities rather than facilities. They rely on actions to reduce flow, prevent erosion or reduce the exposure of construction materials and other potential pollutants to storm water runoff. Also known as source control BMPs, these types of BMPs include limiting impervious area, preventing erosion, cleaning up work sites, and the covering or containing of chemicals and exposed construction materials. Preventative BMPs tend to be less expensive and more effective than treatment BMPs at reducing pollutants in runoff.

Treatment BMPs affect storm water after it enters the conveyance system. BMPs for treatment are mostly structural facilities rather than activities. Examples include detention/retention ponds, water quality ponds, constructed wetlands, vegetated swales, infiltration facilities, and other similar measures including a number of commercially designed units. These structural measures are more expensive and less effective than preventative BMPs at reducing pollutants in runoff.

Treatment BMPs can be further distinguished in terms of the size of the facility, either regional or on-site. Regional facilities are designed to treat runoff from more than a single site. Typically, a public agency will construct a regional facility to provide coverage for multiple users. In this case, those that discharge to the regional facility would usually pay an in-lieu-of fee. Regional facilities have a number of advantages, including: greater reliability, longer life span, and more reliable maintenance—particularly if it is provided by the municipality. Their disadvantages include requiring more land, costing more to construct, and requiring maintenance by a public entity.

On-site facilities are smaller, treating runoff from just that property or sub-division. Advantages of on-site facilities include costs that are borne directly by the property contributing the runoff, less infrastructure required to transport storm water, and BMP types that can be closely tailored to the site requirements. On-site disadvantages are difficulties in ensuring proper maintenance, less reliability, and a lack of available space for installation.

Considering the relative merits of BMP types, it is recommended that the emphasis in Florence be on implementing preventative BMPs. On-site facilities should be encouraged where adequate space exists for installation and clear responsibility for maintenance can be established.

In addition to these general considerations, the Florence area has several relatively unique features that must be considered for storm water management:

1. Virtually all of the soils within the city limits are dunal sands, with high rates of infiltration. Infiltration is desirable to minimize the amount of infrastructure required to transport storm water flows, increase base stream flow in the summer months, and recharge the aquifer. The City of Florence has traditionally relied heavily on infiltration to dispose of storm water and this practice should be encouraged in areas that do not threaten the quality of the aquifer.

2. Currently, the existing City well field and Clear Lake are the source of drinking water for the entire Florence area. Planning projections identify the need for additional wells and well fields to meet the future water requirements of the area. The wells draw water from the aquifer that lies beneath the entire area. Consequently, it is very important that the quantity and quality of the water infiltrating into the ground (and the aquifer) is well managed. Industrial and commercial land uses are more likely to generate hazardous pollutants than residential, parks and open space areas. As a result, areas up gradient from existing and future well field sites should be managed carefully to protect the quality of the groundwater. In these areas, land uses with a high pollution potential should not be allowed to infiltrate unless certain types of BMPs are implemented to treat the surface water prior to infiltration. As an alternative, a piped collection system should be considered in these high risk areas to reduce the likelihood of aquifer contamination.

3. Much of the flooding within the City limits is due to high groundwater tables, rather than surface runoff. This, rather than impermeable soils, limits the use of infiltration in Florence.

BMP Manual Comparison

A number of factors must be considered when deciding upon the most appropriate BMP manual for Florence to adopt. The manual should meet the following requirements:

- be simple to use,
- address quantity control,
- address quality control,
- be applicable to the soils, climate, vegetation, relevant to Florence,
- allow adjustments for different size rain events,
- provide a selection matrix for BMPs,
- be readily accessible to the engineering and development community,
- be relatively recent (mid to late 1990s),
- contain design details, and
- be a final version, not a draft.

The results of a comparison of ten manuals considered for use in Florence are shown in Table E-1.

Table E-1. BMP Manual Comparison

	Portland SW Quality 1995	Portland SW Mgmt 1999	USA Sewer Design	Tech Guidance Handbook 1991	Valley County, Idaho 1997	King County	WDOE SW Mgmt Draft 1999	ODOT Hydraulics Manual 1990	Coastal Zone Act 1993	Maryland 1998
Characteristics										
Simple to use	X	X	X	X	X			X		
Quantity control		X	X		X	X	X	X		X
Quality control	X	X		X		X	X		X	X
Relevant soils, climate, vegetation	X	X	X	X		X	X	X	X	
Customized rainfall						X	X	X		
Selection matrix for BMPs	X				X				X	X
Commonly available manual	X	X	X	X	X		X			X
Relatively recent (1990's)	X	X	X	X	X	X	X	X	X	X
Contains design details	X	X	X	X	X	X	X	X		X
Final, not draft	X	X	X	X	X	X			X	X

Recommended BMP Manual

Upon review of Table E-1, it is recommended that Florence adopt the 1999 version of the Portland Stormwater Management Manual as the City's BMP Manual with the following caveats:

1) The City of Florence Comprehensive Plan, Zoning Codes, Ordinance, Code and Development Standards are not superceded or replaced by the BMP Manual. The BMP Manual is to be used as a guide for the selection and design of appropriate BMPs. Many of the references throughout the Portland Stormwater Management Manual are specific to the regulatory and physical requirements of the City of Portland. Therefore, the user of the BMP Manual will have to use professional engineering judgement to determine the applicability of an approach or technique to the City of Florence.

2) The City of Florence has not adopted Chapters 1 through 5.5 of the Portland Stormwater Management Manual. The City has adopted Chapters 5.6 through 9 to be used as guidance for selecting and designing BMPs for use in the Florence area. The use of equations (based on Portland rainfall and soils), the forms and other submittals identified in the BMP Manual are not to be used unless specifically requested by the City Public Works Director or as required by City Ordinance, Code or Development Standards.

3) Exhibit 5-8, Grass Seed Mix should be adjusted in conjunction for local conditions as per the characteristics listed.

4) The rainfall depths shown in Table A-1 shall not be used.

5) The Simplified Approach discussed throughout the BMP Manual shall not be used.

6) The flow control requirements and techniques defined in Chapter 6.4 through 6.6 shall not be used.

7) The use of sumps and sedimentation manholes as defined in Chapter 6.7.5 shall not be allowed.

8) Appendices 6-A and 6-B shall not be used.

APPENDIX F
FUNDING MECHANISMS TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM

TO: Ken Lanfear, City of Florence
Public Works Director

FROM: James R. Hansen, P.E., Brown and Caldwell
Project Manager

DATE: September 28, 2000

PREPARED BY: Debbie Galardi, Galardi Consulting

SUBJECT: Technical Memorandum: Funding Mechanisms

PROJECT: City of Florence Storm Water Management Plan
BC Project No. 17146

CONTENTS

SUMMARY

The City of Florence's recently completed storm water management plan identifies capital improvement costs totaling $4.5 million (2000 dollars) in the next 20 years. These costs will place unprecedented demands on the City's resources, and are in addition to necessary operation and maintenance expenses. Accordingly, storm water system requirements will have significant financial implications for the City and its customers. Their nature will depend largely on the funding approach selected by the City. This plan will reflect an evaluation of the various options available for both raising capital financing resources and providing for the ongoing operation and maintenance of the system.

A major trend in storm water management has been to develop storm water utility user fees to provide a stable, dedicated revenue source for both capital improvement costs and ongoing operation and maintenance. System development charges are also becoming a common method of funding growth-related capital improvements. Debt financing is often required for major capital improvements, in order to spread out costs over a longer period of time and distribute them among current and future users of the system. Although the availability of federal and state assistance is limited, the City may be able to secure some grant funding for individual projects to help mitigate the financial impacts on the local community.

BACKGROUND AND PURPOSE

Storm water management is currently a function within the City's Street Department. Storm sewer maintenance is budgeted at $22,000 for Fiscal Year 1999-00. As a function within the Street Department, storm water management does not have a designated funding source: it is funded with street fund revenues that mainly consist of state gas tax revenues, as well as some federal funding. The City currently has a transportation system development charge (SDC) which is used to fund growth-related capital projects.

Implementation of the recommended storm water management plan will result in significant capital, operation, and maintenance costs to the City. These additional costs are necessary to enhance the drainage system and provide flood protection. The annual operation and maintenance needs of the proposed improvements are estimated to be $71,000. In addition, $4.5 million in capital improvements are projected over the next 20 years.

To meet the requirements of the system, it will be necessary for the City to secure additional funding sources for the capital and O&M costs, so as not to negatively impact other City services.

EVALUATION OF FUNDING OPTIONS

Historically, municipalities across the country have funded storm water infrastructure requirements through general property taxes or other utility funding (wastewater or streets). However, relatively recent legislation requiring substantial infrastructure expenditures coupled with the severe financial constraints facing local governments make these traditional financing strategies less feasible. Furthermore, cost-of-service principles argue that storm water charges should be based on factors related to the costs incurred for storm water management (i.e., control of runoff quantity and quality.) For these reasons, a major new trend in storm water funding is the development of storm water utilities, and the implementation of storm water rates and charges to support the utility functions and programs.

Legal Environment

Challenges to storm water rates over the last decade have generally focused on differentiating between user fees and taxes. Case law has generally upheld storm water user fees in cases where the following could be shown:

1. Revenues collected from the charges are used for specific storm water management program functions, including capital construction, operations and maintenance, and program administration; and

2. There is a rational relationship between the user fees and the public services provided

Selection of an equitable rate structure approach is important in demonstrating this latter point. For example, in *Long Run Baptist Association, Inc., et al., v. Louisville and Jefferson County Metropolitan Sewer District, et al.* (Case No. 87-CI-8061), the court upheld the District's drainage fee as a valid service charge (as opposed to a tax) in part because the fees were assessed based on impervious area. The court recognized impervious area as a valid, albeit indirect, measure of storm water contribution.[1]

In Oregon, storm water user fees have also been determined by the courts to be valid user fees, as opposed to property taxes subject to the limitations of Ballot Measure 5.[2] Under Measure 5, a tax is defined as:

> "...any charge imposed by a governmental unit upon property or upon a property owner as a direct consequence of ownership of that property except incurred charges and assessments for local improvements."

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[1] User-Fee-Funded Storm water Utilities, Water Environment Federation, 1994

[2] Article XI, section 11b, of the Oregon Constitution, adopted in 1990 by an initiative petition commonly known as "Ballot Measure 5"

In the case *Roseburg School District v. City of Roseburg*, filed May 21, 1993, the Oregon Supreme Court upheld the storm water user fees charged by the City of Roseburg. The Court's decision included the following points:

- The storm water fees were not necessarily charged to property owners; the person responsible for paying the storm water fee was the person responsible for paying the water bill, or the person(s) having the right to occupy the property if no water service was provided.
- The City's fees for storm water services were not imposed upon real property. There was no provision in the City's ordinance for attaching a lien against the property for nonpayment of charges.
- The fees were avoidable. Responsible persons could seek reductions or elimination of the charges by demonstrating the service was not being used.

Evaluation Criteria

In selecting an overall funding approach for storm water management, it is necessary to consider the advantages, as well as the potential limitations, of each funding method. Consideration of multiple evaluation criteria can ensure that the overall funding approach is financially sound, as well as politically feasible. Standard evaluation criteria include, but are not necessarily limited to:

- Equity
- Revenue adequacy and stability
- Legality
- Administrative feasibility
- Public understanding and acceptance

The central **equity** consideration is whether storm water costs are recovered in a fair, reasonable, and non-discriminatory manner consistent with community values.

Revenue adequacy and stability is a major consideration because of the inherent importance of maintaining reliable cash flows to support capital spending and utility operations. Some funding options are limited to particular types of costs. For example, systems development charges may only be used for capital improvements. Therefore, the overall funding approach will likely consist of a number of different methods.

Legality is of particular importance in storm water funding because of the challenges that have been brought against utilities over the last decade. As discussed previously, the charges to system users must bear some relationship to the services provided.

Administrative feasibility is likewise a perennial consideration, but is of particular importance in storm water funding, where the development of new rates and charges will likely require additional administrative support. Therefore, each option must also be evaluated on the basis of the availability of necessary data and on the administrative requirements imposed.

Foremost among administrative requirements is a plan for achieving **public understanding and acceptance** of the funding approach. Though a particular funding method may yield revenue adequacy or stability benefits, these benefits will be unlikely to yield customer satisfaction if there exists the impression that the funding practices are arbitrary and capricious.

DIRECT FUNDING OPTIONS

Property (and other) Taxes

Fewer and fewer communities are relying on *ad valorem* property taxes or other taxes to fund a portion of the utility system revenue requirements. Although taxes generally create a stable, known level of revenues, current public sentiment against raising taxes and tax limitation measures tend to limit most communities' ability to use property taxes as a funding option, except in unique circumstances. In addition, because property values (and other means of taxation assessment) are generally not related to storm water system use, taxes are viewed as a less equitable means of financing utility system improvements than charges related to usage.

Storm Water User Charges

As mentioned previously, storm water user charges are being used more and more by municipalities across the country as a means of providing a dedicated, stable source of revenue to fund the increasing needs of storm water management. A user charge approach to funding storm water management services is based on the premise that developed property generates a need for public services, and therefore should be charged in proportion to that need for services. There are many factors that affect the extent to which storm water runs off a particular property. These include the amount of impervious, semi-impervious, and total area. Storm water rate structures are generally based on one or more of these variables.

Because there is a link between the charges assessed and the services provided, user charges are viewed as a more equitable means of funding storm water programs than a system based on general taxes. User charges provide a level of revenue stability and adequacy. Also, reliance on user charges to fund storm water expenditures provides a strong and direct price signal with respect to the relative cost of storm water services.

In general, current revenue or "pay as you go" financing through user charges is particularly appropriate for funding ongoing operation and maintenance, as well as rehabilitation and selected replacement cost components. In contrast to system development charges that are legally restricted to recovering growth-related capital improvements[3], the benefits of system rehabilitation and replacement capital expenditures are generally distributed to all system users.

There is generally a limit, however, to how much user charges, or other "pay as you go" sources can be relied upon for funding major capital expenditure. Using user charges for financing such capital expenditures can have direct and potentially unstable impacts on user rates. High user charges to support capital spending creates severe political pressure to limit cost; roll back rate increases, or defer or eliminate system improvements or maintenance. Without some diversification of capital funding sources, fluctuating capital improvement costs over time can result in highly variable user charges. Also, some capital requirements are simply too large to be funded from user charges without borrowing or severe rate adjustments.[4]

Current revenue financing of capital expenditures presents a fundamental question of equity in distribution of cost responsibility. To the extent that current users pay for long-lived utility assets, future users are subsidized by current revenue financing of system assets. Accordingly, changes in the extent of current revenue support of capital spending will affect the distribution of cost responsibility between current and future users.

Some communities utilize user charge credits for on-site detention to enhance the equity of the user charge system. Credits against user charges have the added advantage of demonstrating that the fees are in fact charges for services (as opposed to taxes), because they are avoidable (see discussion under Legal Environment above). Credits against user charges are often predicated on the on-site improvements meeting established design standards, and the system user's continued compliance with established operating standards.

The primary disadvantage of a storm water utility supported by a user charge system is the additional administration costs it is likely to impose on the City. Up-front costs for billing system and database development, in addition to on-going billing system and customer service costs are required. Savings can be realized if the storm water utility administration can be coupled with an existing system, such as that used for processing sewer bills.

Plan Review and Inspection Fees

User charges are most appropriately used to recover costs that are incurred to provide general system services. To the extent that the storm water program also provides specific services to a limited number of customers, direct charges for these services may also be appropriate. The most common example of this type of charge is for plan review and inspection services. Separate charges

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[3] In Oregon, an SDC may consist of an improvement fee, a reimbursement fee, or a combined fee. Revenues from improvement fees are limited to funding growth-related capital costs.

[4] This potential instability may be addressed through some form of long-term averaging of rate increases in which funds for large capital expenditures are accumulated in years in which rate increases would not be otherwise required.

are sometimes levied on developers for the costs incurred by the City to review development plans and provide inspection of private facilities. To the extent that these costs can be discretely separated from the other operation and maintenance costs of the system and charged directly to those benefiting from the services, the equity of the funding system is enhanced.

System Development Charges

One of the principal sources of revenue for financing new storm water facilities, or expansions to existing facilities, is a one-time charge imposed at the time of connection to the system. This charge is generally referred to as a system development charge (SDC), impact fee, or capital contribution fee. These charges are designed to recover all, or a portion, of the capital investment made (or planned to be made) by a local government to provide sufficient capacity in a utility system to serve new users. Because SDC improvement fees are to pay for new development's proportionate share of capacity requirements, these SDC funds can not be used for O&M costs or for rehabilitation or replacement improvements. In Oregon, statutes restrict the use of SDC funds to the types of expenditures for which they were collected.

For some communities that utilize SDCs to fund storm water programs, credits are provided for system users who provide on-site storm water controls and activities. SDC credits may be provided for two types of privately-constructed improvements: 1) off-site improvements constructed by developers that provide capacity beyond the individual development's need, and 2) on-site improvements that reduce the capacity requirements of the individual development. Oregon SDC law requires that credits be provided for certain offsite improvements constructed by developers that provide excess system capacity. Credits for on-site improvements are not mandated by law, but are used in some communities to enhance the equity of the charges.

In terms of financial planning, SDCs have the advantage of matching specific improvements with a "dedicated" specific funding source. Public acceptance of system development charges tends to be relatively high among existing ratepayers in communities where the general sentiment is for "growth to pay for itself". As a consequence, SDCs are becoming an increasingly important funding mechanism to meet revenue needs and mitigate rate increases.

The major challenge of SDCs from a financial planning perspective is that of timing or cash flow. Because many of the improvements required to meet growth must be operational before the new connections can occur, the costs of the improvements are incurred before the revenues are received. Therefore, some interim financing method may be needed. Because the revenues from SDCs tend to fluctuate with the business or construction cycle, this instability may mean that SDC revenues are not reliable to meet system financial needs in certain circumstances. Finally, public opposition may result if SDC levels are perceived to be so high as to generate adverse economic development consequences. The validity of these concerns depends on the specific circumstances.

Contributions

There are a number of less commonly used capital funding options that may be appropriate for localized improvements. Developer contributions can secure system assets without impacting general system customers. Contributions are most often provided by developers seeking service extensions and generally do not require payment by the utility. Typically, they relate to the cost of physical facilities required to extend service rather than to a facility providing general system benefits.

While contributions allow for a utility to expand its revenue base with limited rate impacts from capital financing, they may impose future costs. In some instances, contributed facilities do not meet a utility's construction standards, resulting in greater rehabilitation or repair costs. In other cases, past contributors may require recognition of the value of their contributions when being assessed prospective charges. System development charges, for example, require credits to developers for construction of qualified public improvements (built to utility standards).

Local Improvement Districts

Another form of funding local improvements is through the establishment of Local Improvement Districts (LIDs). Each property in a LID is assessed a portion of the cost of the required improvements. Individual assessments are based on the estimated benefits received by each property owner. The City may use special assessment bonds as a means of financing the improvements up-front, and then use revenue from the assessments to pay the associated debt service. In Oregon, the Bancroft Bonding Act (ORS 223.205-295) addresses the means by which local governments may finance public improvements in LIDs.

This form of capital financing is used for funding facilities that will serve a small number of customers, therefore, LIDs are restricted to funding relatively small, localized system components. As such, LIDs alone do not represent a viable funding option for the city-wide capital improvement program. However, used in conjunction with other system-wide revenue sources, LIDs can enhance the equity of the overall funding system by requiring system users to pay directly for facilities that will serve them exclusively.

DEBT FINANCING

Because most storm water facilities are designed to last for more than 20 years, long-term debt is a popular method of financing capital improvements. Long-term debt allows the City to pledge future payments in exchange for current revenue to fund capital improvements. By using long-term debt to finance improvements, the costs of the proposed facilities will be shared between current and future beneficiaries of the improvements. In a sense, long-term financing provides a convenient method of matching the capital costs of an improvement to the ultimate user by spreading the

payment into the future. Additionally, most cities do not possess the necessary reserve funds to pay for all of their needed improvements.

Revenue Bonds

Revenue bonds are long-term debt instruments payable from the operating revenues of the utility (e.g., user charge and SDC revenues). Originally issued to finance canals and turnpikes, revenue bond financing is now used to fund a variety of capital improvements. Especially common uses of revenue bonds include utility improvements for enterprise funds such as water, wastewater, and storm water funds.

As with other forms of long-term financing, revenue bonds allow a utility to fund capital improvements greater than existing cash reserves. Because revenue bonds are generally paid off over a 15 to 20 year period, the costs of capital improvements are spread among current and future customers. Because revenue bonds are paid from the utility's revenues the system users, not local taxpayers, pay the costs of the improvements.

Revenue bonds generally do not require voter approval.[5] Normally, a local government authorizes the issuance of revenue bond debt by approving a bond ordinance or a resolution, where the issuer pledges to pay the bond principal and interest from revenues. In a sense, this pledge acts as a lien on revenues. Specified in the ordinance is the bondholders' lien position with respect to the revenue stream. Typically, the bondholders have a lien against the net revenues of the system (i.e., those revenues remaining after all operation and maintenance costs are paid).

In addition to the pledge of revenues to meet debt service requirements, the bond ordinance normally contains a rate covenant. The rate covenant requires the utility to charge adequate rates to generate the revenues pledged as debt service, pay O&M costs, and contribute to the replacement of facilities. Typically, the rate covenant contains a debt coverage requirement that requires the utility to charge rates that produce net revenues in excess of debt service by a stated percentage. Typical coverage requirements for utilities are net revenues equal to between 120 and 150 percent of the annual debt service requirement. Coverage requirements vary widely from resolution to resolution.

The principal disadvantage of all forms of debt financing, including revenue bonds, are the costs of borrowing – specifically, interest charges and transaction costs. Like a home mortgage, interest payments over the life of a long-term debt issue will well exceed the principal amount borrowed. The longer the term of the debt, the proportionally greater amount of interest charged. Transaction costs for underwriting services, marketing, legal review and so on mean that actual proceeds available for capital projects are reduced by one to three percent of the principal borrowed. Interest costs may be reduced significantly by securing strong credit ratings and issuing debt during favorable market conditions.

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[5] However, in Oregon such bonds must be "rational" and are subject to a petition requiring voter approval.

Some communities reduce interest costs on debt issues by purchasing bond insurance that secures bondholders from default. In some cases, the purchase of insurance results in higher credit ratings on debt issues, thereby minimizing interest costs on borrowings.

General Obligation Bonds

General Obligation (G.O.) bonds are another popular method of financing municipal infrastructure systems. Unlike revenue bonds, G.O. bonds are backed by the full taxing power of the issuer. Because this pledge is more secure than a pledge of revenues, G.O. bonds generally carry a lower interest rate than revenue bonds. However, unlike revenue bonds, G.O. bonds require voter approval. Additionally, because G.O. bonds are an obligation of the issuer, the bonds are included in the calculation of municipal debt limitations. For these reasons, revenue bonds are often used instead of G.O. bonds in financing infrastructure.

A variant of the G.O. bond is the "double-barreled" bond. These bonds are G.O. bonds that are paid either partly or entirely from the revenues of the system. If the revenues of the system fail to cover the required debt service, then the taxing authority of the issuer is used to pay debt service. Double-barreled bonds that are retired solely by the revenues of the utility are called self-supporting or self-liquidating.

Special Assessment Bonds

Special assessment (or Bancroft) bonds may be used by governments to finance local water, wastewater, street, and storm drainage improvements. Assessments are made on the properties that benefit from the improvements, and debt service is paid from these assessments. Governments may pledge general taxing authority in the event that assessments are unable to meet debt service requirements. If the bonds are voter-approved, the issuer may make a general obligation levy not subject to property tax limitations. However, if the bonds are not voter-approved, payments from property tax receipts are subject to tax limitations.

Special assessment bonds (without a general obligation pledge) are viewed as high-risk compared to G.O. or revenue bonds, and therefore, carry a higher interest rate than other debt instruments.

FEDERAL AND STATE ASSISTANCE

One of the most desirable methods of financing planned system improvements is to obtain grants and/or low-interest loans from federal or state agencies. The obvious reason is that these sources minimize the costs to the local community, thereby enabling improvements to be constructed with little or no impact on local residents. Although there can be some indirect costs associated with grants, such as record-keeping and administration, in general the benefits of these financial sources outweigh the costs. The limited availability of such funding is its major drawback. However, there

are a number of different programs that the City may want to pursue in establishing an overall funding plan. These are described in the following paragraphs.

Clean Water State Revolving Loan Funds

In the 1970's and 1980's, federal grants were available for certain major utility system improvements, particularly wastewater treatment facilities, through the Environmental Protection Agency (EPA) Construction Grants Program. However, in the early 1990's, this program was replaced with State Water Pollution Control Revolving Funds (SRFs). Under the new program, states were given federal grants to fund loans to communities for water pollution control projects. Communities that receive SRF loans then repay them to the state to create "revolving" sources of assistance for other communities. In most states, the demand far exceeds the available pool of SRF funds.

In Oregon, the Clean Water SRF program is administered by the Department of Environmental Quality (DEQ). Storm water capital improvement projects are considered eligible for SRF funding; however, historically the majority of funding has gone for wastewater system improvements. In allocating SRF funds, the DEQ considers the following eligibility criteria:

- **Receiving water body sensitivity** – Those projects that will enhance water quality in sensitive waterways are given highest priority. Waterway sensitivity may be established by total maximum daily loads (TMDLs), or by a number of different waterway designations, including Wild and Scenic river, State Scenic Waterway, or Outstanding Resource Waters designations;

- **Enforcement activities and water quality violations** – Those projects that are required to address Environmental Quality Commission (EQC) orders, or to carry out mutual agreements and orders, are given the highest priorities;

- **Affordability** – Priority is given to projects where the resulting user fees would exceed 1.75 percent of median household income in the community.

In order to secure SRF funding, it is necessary for the community to demonstrate that it has a stable, reliable revenue source for repaying the loans. Therefore, this funding source would need to be used in conjunction with some other method, like user charges or taxes.

Rural Utilities Service Funding

The U. S. Department of Agriculture Rural Development agency administers grant and loan programs for water, wastewater, and storm water capital facility construction (with the exception of combined storm and sanitary sewer facilities). To be eligible for funding from Rural Development, communities must have a population less than 10,000 and a median household income less than $27,756. To qualify for maximum funding, the community's median household income must be less than $22,205. Based on 1990 Census data, the City of Florence has a median household income of

approximately $18,000, and therefore, may qualify for loan and grant funding under this program. Grants may be made in some instances up to 75 percent of eligible project costs.

Rural Development is one of the funding agencies in Oregon that coordinate at a county level to prioritize needs and allocate funding for individual communities within a particular county. In Lane County, the Lane County Council of Governments (LCOG) manages this process. The City of Florence may pursue Rural Utilities Service funding either through Rural Development directly, or through LCOG.

Oregon Watershed Enhancement Board Grants

The Oregon Watershed Enhancement Board (OWEB) provides grants for public and private watershed enhancement projects through state lottery funds. Storm water projects that enhance watershed function and quality may be eligible for OWEB funding. One of the primary objectives of the program is to encourage coordination of public and private organizations involved in watershed planning and protection. Therefore, funding through OWEB should be pursued in a coordinated manner with the regional watershed council and the Oregon Department of Fish and Wildlife.

Grant applications are accepted by OWEB twice a year, in February and September.

State Economic Development Funding

Limited federal grant and loan funds are still available through programs administered by the Oregon Economic Development Department (OEDD). These include the Community Development Block Grant (CDBG) Program, the Water and Wastewater Financing Program, and the Special Public Works Fund Program.

Eligibility for most of these programs is limited to projects that: 1) benefit low- and moderate-income persons; 2) serve small, rural communities (i.e., up to 10,000 people); or 3) create jobs in economically disadvantaged communities. The Water and Wastewater Financing Program gives highest priorities to projects that are needed to address public health hazards.

OTHER COMMUNITIES' FUNDING APPROACHES

As mentioned previously, a major trend in storm water management has been the implementation of storm water user charges. There are a number of communities in Oregon that rely on storm water user charges as the primary funding source for storm water system management. Table 1 provides a sample list of Oregon communities that have implemented storm water user charges.

Table 1. Community Comparison of Storm Water Monthly Charges

Community	Monthly Bill*
Eugene	$7.08
Springfield	4.75
Ashland	1.93
Corvallis	4.48
Medford	3.10
Unified Sewerage Agency	4.00
Lake Oswego	5.58
Woodburn	NA
Roseburg	NA
Gresham	NA
Portland	10.01

*Per Single Family Dwelling Unit, >1,000 sq. ft. and < 3,000 sq. ft.
NA – Not available

In addition, Table 2 provides a sample list of Oregon communities charging storm water SDCs. The fee levels are based on 1999 information.

Table 2. Community Comparison of Storm Water SDCs

Community	SDC*
Eugene	$476
Springfield	715
Ashland	441
Corvallis	78
Medford	400
Unified Sewerage Agency	500
Lake Oswego	107
Woodburn	220
Roseburg	400
Gresham	1,012
Portland	310

*Per Single Family Dwelling Unit

For some communities that rely on user charges and SDCs to fund storm water programs, credits are provided for system users who provide on-site storm water controls and activities. Such credits, where employed, are intended to recognize the reduction in costs incurred by the utility as a result of the on-site measures. Specifically, on-site detention may reduce storm water runoff—both peak flows and total volume—and may also have an impact on water quality. A few examples of how SDC credits are used by other communities are provided below.

City of Portland. The City divides its SDC and facilities into on-site and off-site categories. On-site facilities handle storm water flows from individual properties and are recovered through SDCs based on impervious square footage. Off-site facilities handle storm water flows from rights-of-way are recovered through the SDCs based on linear feet site frontage and net new site vehicle trips.

The City grants a 100 percent credit of the on-site portion for developments draining directly to rivers, provided that no city facilities are used and that the discharge meets water quality standards. An 80 percent on-site credit is provided for facilities providing on-site retention of 1,000 cubic feet/acre (in addition to on-site facilities required to meet development standards). Smaller credits are provided for intermediate additional retention capacity.

The City does not grant an SDC credit associated with the off-site portion of the SDC.

City of Eugene. For single-family and duplex developments, the City provides a 100 percent SDC credit for complete elimination and management of runoff from the site entering the system or discharging into an area which ultimately enters the system. A 50 percent SDC credit is provided for partial reduction and management of runoff from the site entering the public system regardless of the amount of reduction.

For nonresidential customers, SDCs are reduced proportionate to reduction in total storm water runoff entering the public storm water system from the fully developed site.

Unified Sewerage Agency of Washington County. The SDC is comprised of a water quality portion and a water quantity portion. A credit against the water quality portion of the charges is offered for the construction of on-site water quality facilities. Similarly, a credit against the water quantity portion of the charge is offered if on-site retention is provided, along with documentation of its effectiveness.

A number of other communities, like the City of Salem, are in the process of evaluating their storm water funding programs. Historically, Salem has funded storm water management through wastewater rates. The City is currently looking into the development of user rates and SDCs.

RECOMMENDATIONS

To successfully implement the solutions identified in the recently completed storm water management plan, the City must secure adequate, stable funding sources to meet the capital, operation, and maintenance needs of the system. The program's success is also dependent on the level of public support for the management plan and associated funding system. A funding system that is based on the "user pays" principle is often more acceptable to the public, than a system based on general taxes. Therefore, the following funding sources should be considered by the City of Florence for supporting the storm water system:

- **User Charges** – The most stable and reliable, and often most equitable source of revenue for storm water management is user fees. Revenue from user fees is flexible in that it can be used to pay for both the capital and operation and maintenance needs of the system. A user fee system also allows the City to secure debt funding (through bonds and loans) for major capital projects, because there is a dedicated source for repayment. A user fee based on some measure of storm water contribution (e.g., impervious area) with credits provided where appropriate is generally more equitable than recovering costs through wastewater user fees that are based on wastewater volumes. Therefore, to the extent feasible, the City should consider the development of a separate storm water charge.

- **Systems Development Charges** – Many of the capital improvements identified in the master plan are needed wholly or partially to meet the demands of growth. SDCs are a common and equitable means for funding growth-related storm water system capital improvement costs. The SDC fee structure should include provisions SDC credits for certain types of on-site improvements.

- **Low-Interest Loans and Grants** – It appears from preliminary discussions with funding agencies that the City may be eligible for some combination of grants and loans from one or more sources. The City should begin to investigate these funding programs individually, and in collaboration with the County, and other stakeholders (e.g., regional watershed council).

- **Other Debt Funding** – If the City is unable to get sufficient funding from state and federal agencies, revenue bond funding may be appropriate for large blocks of capital spending.

- **Contributions and Assessments** – As appropriate, consider developer contributions and LIDs as a means for funding localized improvements.

In evaluating the feasibility of a storm water charge, the City should assess the following:

- Existing utility billing system capabilities/constraints
- Data collection and maintenance requirements
- On-going customer service requirements

In addition to these administrative considerations, it is also recommended that the City explore the public support for user charges and SDCs. If these options meet the City's objectives, a cost of service rate and SDC study should be conducted to establish fee levels and structure.

ABBREVIATIONS

CDBG	Community Development Block Grant
DEQ	Oregon Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
EQC	Oregon Environmental Quality Commission
GO	General Obligation
LCOG	Lane County Council of Governments
OEDD	Oregon Economic Development Department
O&M	Operation and Maintenance
OWEB	Oregon Watershed Enhancement Board
SDC	System Development Charge
SRF	State Revolving Fund
TMDL	Total Maximum Daily Load