

**Assessing the Feasibility of Holistic Surface Water Management for
Municipalities in Oregon**

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June, 2013

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List of Acronyms

BiOp – Endangered Species Act Biological Opinion
BMP – Best Management Practices
CRS – Community Rating System
CWA – Clean Water Act
DEQ – Department of Environmental Quality
DLCD – Department of Land Conservation and Development
EPA – Environmental Protection Agency
ESA – Endangered Species Act
ESU – Equivalent Service Unit
FEMA – Federal Emergency Management Agency
GMA – Growth Management Act
LID – Low Impact Development
MS4 – Municipal Separate Storm Sewer System
NFIP – National Flood Insurance Program
NMFS – National Marine Fisheries Service
NPDES – National Pollutant Discharge Elimination System
OAR – Oregon Administrative Rule
OWEB – Oregon Watershed Enhancement Board
RHZ – Riparian Habitat Zone
SDC – Systems Development Charge
SGP – Small Grants Program
SGSD – Smart Growth and Site Design
SSWMCP – Storm and Surface Water Management Comprehensive Plan
SWCD – Soil and Water Conservation District
SWF – Surface Water Fee
SWMP – Surface Water Management Plan
SWUF – Stormwater Utility Fee
TDR – Transfer of Development Rights
TMDL – Total Maximum Daily Load
WAC – Washington Administrative Code
WPA – Watershed Planning Act
WQMP – Water Quality Management Plan

Introduction

Surface water issues have always been a concern for the US, but it wasn't until the late 1960's¹ and early 1970's² that serious consideration was given to how surface water resources should be managed. The passing of the Clean Water Act (CWA) and the National Flood Insurance Act (NFIA) set the stage for managing surface water issues locally. Both pieces of legislation were enacted to curtail the increasing burden that land use decisions were putting on ecologic and economic systems. The question then became: what is the best way to locally manage surface water issues? This paper attempts to answer this question.

The focus of this paper is to determine if communities in Oregon can address surface water issues holistically through comprehensive management efforts. In regards to this project, surface water issues include water quality, flooding, and habitat protection. Currently, some Oregon communities address these issues individually with the intention of meeting state and federal regulations. A surface water management plan (SWMP) represents a comprehensive effort to manage surface issues with potentially greater efficiency than would be possible through several individual plans. The feasibility of creating a SWMP is dependent on several factors including the requirements of state and federal regulations, the development of the plan, and the actual structure of the plan.

Current water quality regulations include standards from the National Pollutant Discharge Elimination System (NPDES) and Total Maximum Daily Load (TMDL) programs. Flood regulation stems from the National Flood Insurance Program (NFIP), but flood standards are likely to become more rigorous in the future as a result of a lawsuit from the National Marine Fisheries Service (NMFS). In 2003, NMFS filed a lawsuit against FEMA claiming that agency's insurance program was not doing enough to protect threatened and endangered species and their habitat.³ A similar lawsuit is currently taking place in Oregon, with a similar expected outcome: increased standards for protecting stream corridors. Traditionally, habitat protection regulation has been a product of the Endangered Species Act (ESA); however, this project focuses solely on the new ESA standards as they relate to the NFIP. Federal surface water regulations are augmented by Oregon's Statewide Planning Goals; specifically, Goals 5, 6, and 7, which address natural resource preservation, resource quality, and natural hazards respectively.

Surface water regulations help to inform the creation of a surface water management plan, but they do not specifically guide the development of a plan, or define the structure of a plan. For this project, plan development includes the steps that a community needs to take to involve the public and form

¹ Office of the General Council, All-Hazard Authorities of the Federal Emergency Management Agency, Doc. No. 42 (1997). <http://www.fema.gov/>

² Navigation and Navigable Waters, 33 U.S.C. § 1251. <http://uscode.house.gov/>

³ Federal Emergency Management Agency. *ESA and the NFIP Implementing a Salmon Friendly Program – FEMA Region 10 ESA and the National Flood Insurance Program*. <http://www.fema.gov/>

partnerships. Public involvement and agency representation are vital to plan development, because without them a community may find it difficult to implement land use policies or garner support for voluntary programs. Partnerships also play an important role in the success of a SWMP because partners can assist communities with funding and services that they might otherwise lack.

Plan structure consists of a variety of components, but this project is focused on three: funding, strategies, and monitoring. These components represent the core of a SWMP and were determined from a review of plans from Edmonds, Washington and West Linn, Oregon. These plans were chosen to inform this project because they address surface water issues holistically. Both communities focus primarily on meeting the standards of the NPDES, with some consideration given to TMDL standards. Nonetheless, they provide valuable insight into how a SWMP might function in Oregon.

Based on state and federal regulatory requirements, the findings from the case study analysis, and through a review of pertinent literature, this project aims to provide guidance to Oregon municipalities that wish to manage surface water issues holistically. The approaches mentioned in this project act as options that communities can choose to incorporate into their plans as they see fit. Communities may not be able to fulfill all of the state and federal surface water requirements by implementing a holistic management plan, but they can take steps towards meeting some regulatory requirements, and in the process create a healthier and safer environment for people and wildlife.

Methods

The methods for this project include a review of surface water policies, an analysis of two existing surface water management plans, and interviews conducted with representatives from two state agencies. Information gathered from this section was used to provide insight into the feasibility of addressing surface water issues holistically in Oregon.

A portion of the data for this project was gathered by reviewing current floodplain and water quality regulation and upcoming habitat protection regulation. Standards from all three areas were assessed based on the compliance requirements for communities in Oregon. This process involved working with state agents to determine what is required and how requirements are to be met. Water quantity laws were not assessed, because in reviewing surface water management plans in Washington and Oregon, water quantity was rarely mentioned.

In addition to reviewing flood and water quality standards, I performed a case study analysis of current surface water management plans in two cities. The cities that were selected for this project are West Linn, Oregon and Edmonds, Washington. The plans in these two cities are unique in that they aim to address water quality, flooding, and habitat protection issues holistically, using a combination of structural and non-structural approaches. West Linn was also selected because the City is located in Oregon, where this project aims to provide guidance. In reviewing these plans I identified strategies and processes that can, at least in part, be used by communities throughout Oregon.

I conducted two interviews with agents at the Department of Environmental Quality (DEQ) and the Department of Land Conservation and Development (DLCD) to determine if a surface water management plan would comply with water quality, flood, and future habitat protection standards. These interviews were also valuable for providing general insight into the feasibility of holistic surface water management in Oregon from the perspective of those who oversee policy compliance requirements and plan development.

The pre-development phase of creating an environmental plan can be just as important as the actual structure of a plan. Therefore, I conducted additional research into two key areas: public involvement and partnerships. Gaining the support of the public in making local plan decisions is the first step towards effective implementation of a plan. I gathered information about public involvement through the two case studies, interviews with city officials, and through researching journal articles. My research into this topic centered on the public's perception of stream corridors and watershed management; specifically, how a community can gain the support of its local population, and how information about environmental issues can best be distributed to that population. Lastly, communities – especially smaller communities – will likely need assistance in developing and implementing a holistic management plan. Local, regional, and state partnerships can help to alleviate resource constraints. In determining how effective partnerships operate in Oregon, I relied on the case study approaches and research from various journal articles and agency websites.

Regulatory Framework

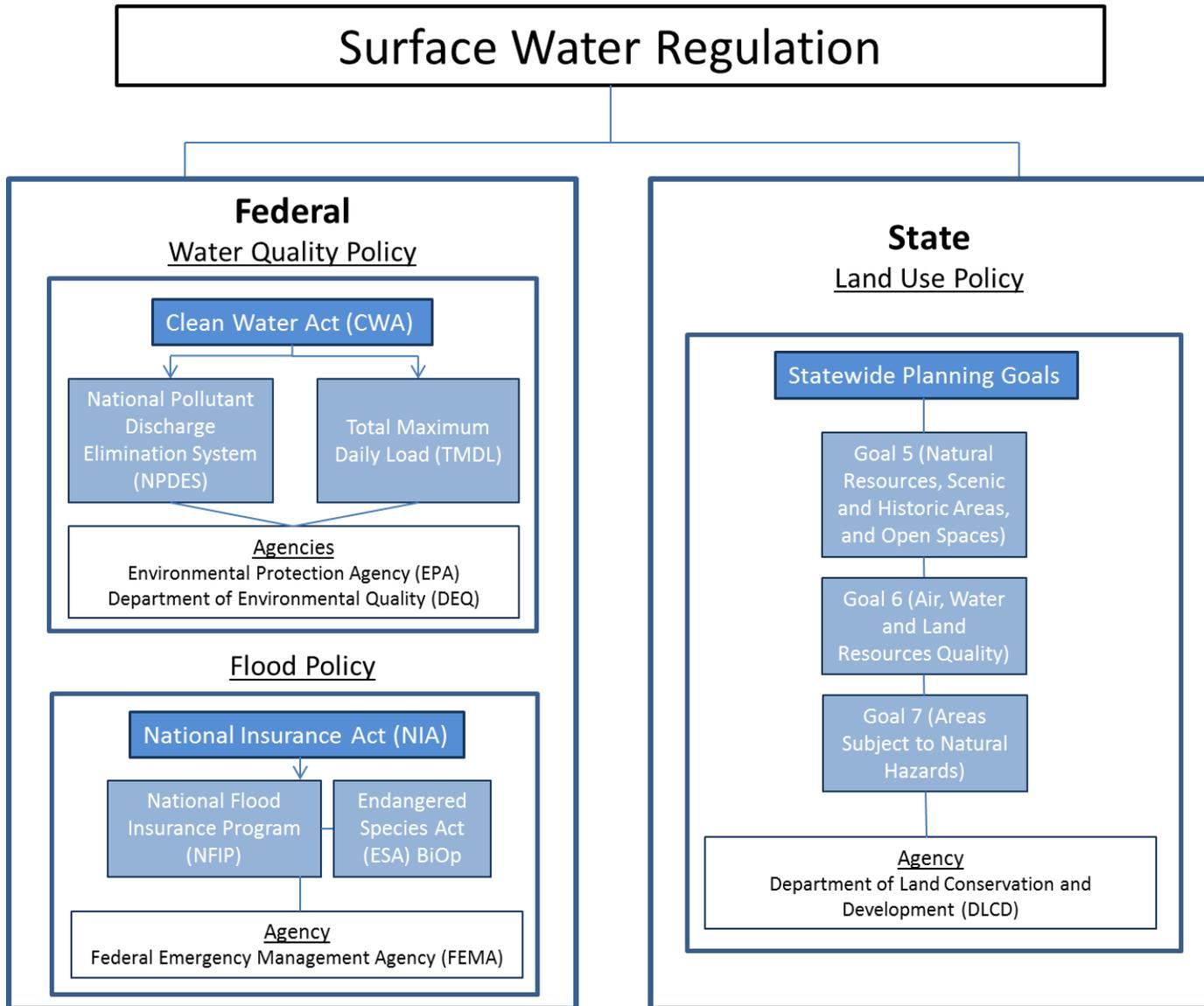
This section encompasses information gathered from reviewing state and federal surface water regulations. Regulatory information includes all state and federal water quality, flooding, and habitat protection policies that are relevant to Oregon.

Four regulatory agencies are directly relevant to this project: the Environmental Protection Agency (EPA), the Department of Environmental Quality (DEQ), the Federal Emergency Management Agency (FEMA), and the Department of Land Conservation and Development (DLCD). The EPA and the DEQ oversee the regulatory requirements of the Clean Water Act (CWA), specifically the NPDES and TMDL programs. FEMA oversees the National Flood Insurance Program (NFIP), including the upcoming ESA requirements. Lastly, DLCD is responsible for overseeing Oregon's Statewide Planning Goals. Urban communities in Oregon are obligated, through federal and state policies, to manage waterways in an effort to prevent water quality, flooding, and habitat protection issues.⁴⁵ Figure 1 consists of a diagram illustrating the state and federal surface water policies and the agencies that are responsible for administering them.

⁴ "Procedures and Requirements for Complying with Goal 5." *Oregon Administrative Rules*,
<http://arcweb.sos.state.or.us/>

⁵ "ASFPM - National Flood Insurance Program (NFIP)." *Association of State Floodplain Managers*,
<http://www.floods.org/>

Figure 1: Oregon Surface Water Regulation Diagram



Federal Water Quality Regulations

The Clean Water Act (CWA) of 1972 created the overarching framework for managing water quality in the United States.⁶ Through this act, Congress mandated the Environmental Protection Agency (EPA) to begin regulating pollutants in the nation's waterways⁷, and gave the agency the authority to set pollution standards and enforce them. It also made it unlawful for anyone to discharge pollution from a point source into navigable waters without a permit.

The National Pollutant Discharge Elimination System (NPDES) program was established through Section 402 of the CWA and serves as a regulatory measure to gain compliance with meeting water quality goals.⁸ Similarly, Total Maximum Daily Loads (TMDLs), which set water pollution standards for waterways, are also required through federal regulation.⁹ The EPA delegates some of the responsibilities of these programs to states and works with state agencies on implementation. To meet federal water quality standards, states are allowed to set their own regulations for the amounts of different pollutants allowed in water bodies.¹⁰ In Oregon, the Department of Environmental Quality (DEQ) works in conjunction with the EPA to administer water quality regulations, such as the NPDES and TMDL programs.

The National Pollutant Discharge Elimination System (NPDES) program was created with the intention of limiting the discharge of pollutants from point sources. The most common point sources of pollution regulated under the NPDES program include treatment plants, industrial facilities, and urban runoff.¹¹ Pollution regulation from urban runoff is applicable to municipalities that contain a municipal separate storm sewer system (MS4).¹² There are two levels of regulatory requirements for MS4 compliance: Phase I and Phase II. Phase I is targeted at cities or counties with populations of 100,000 or greater. Phase II is targeted at municipalities within an urbanized area, or municipalities that reside outside of an urbanized area but are required to obtain an MS4 permit by a designated authority. Phase II MS4's, which are much more common than Phase I MS4s, are required to adhere to six minimum control measures. The six measures are:¹³

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination

⁶ Navigation and Navigable Waters, 33 U.S.C. § 1251. <http://uscode.house.gov/>

⁷ Protection of Environment, 40 U.S.C. § 130. <http://www.ecfr.gov/>

⁸ Navigation and Navigable Waters, 33 U.S.C. § 402. <http://water.epa.gov/>

⁹ Navigation and Navigable Waters, 33 U.S.C. § 303. <http://water.epa.gov/>

¹⁰ United States Environmental Protection Agency. "Clean Water Act Enforcement." United States Environmental Protection Agency. Last modified May 18, 2010. <http://www.epa.gov/>

¹¹ Office of Wastewater Management, Water Permitting 101, Doc. (). <http://www.epa.gov/>

¹² EPA. "Stormwater Discharges From Municipal Separate Storm Sewer Systems (MS4s)." United States Environmental Protection Agency. Last modified May 3, 2013. <http://cfpub.epa.gov/>

¹³ EPA. "Small MS4 Stormwater Program Requirements." United States Environmental Protection Agency. Last modified March 17, 2008. <http://cfpub.epa.gov/>

- Construction Site Runoff Control
- Post-Construction Runoff Control
- Pollution Prevention/Good Housekeeping

To meet these minimum measures, the EPA may require municipalities to develop a stormwater management plan.¹⁴ The plan should include a collection of best management practices (BMPs) that a municipality can implement to limit pollution from stormwater runoff.¹⁵

Total Maximum Daily Load (TMDL) refers to the maximum pollutant discharge that a waterway can carry while still adhering to water quality regulations set forth by the state.¹⁶ A TMDL represents a specific strategy for managing pollutant discharge, which typically includes a Water Quality Management Plan (WQMP). According to the Oregon Administrative Rules (OAR), “Water Quality Management Plan” means the element of a TMDL describing strategies to achieve allocations identified in the TMDL to attain water quality standards.¹⁷ The EPA assigns the responsibility of determining what shall go into a WQMP to state agencies. Furthermore, the Environmental Quality Commission sets pollution limits to TMDLs, which are met through permit requirements, which dictate that the permittee is responsible for implementing strategies to improve water quality.¹⁸

Federal Flood Regulations

Federal flood control measures have existed in the U.S. for nearly a century. Early flood management efforts concentrated almost solely on disaster relief from large scale flood events.¹⁹ However, in 1968, due to excessive cost expenditures, the federal government created the National Flood Insurance Program (NFIP) through the National Flood Insurance Act (Title 42 – The Public Health and Welfare, Chapter 50 – National Flood Insurance).²⁰ The objectives of the NFIP are threefold: provide individuals with monetary relief from flooding; reduce flood damage through floodplain management strategies; and, reduce federal flood relief costs.

Communities throughout the U.S. that are located in flood prone areas are eligible to participate in the NFIP. The program ensures that members are eligible to purchase flood insurance at a reduced rate.²¹ The NFIP is a voluntary program. However, communities that choose not to participate in the program

¹⁴ Office of Watershed Management, MS4 Program Evaluation Guidance, Doc. No. EPA-833-R-07-0 03 (2007). <http://www.epa.gov/>

¹⁵ Ibid.

¹⁶ "Water Quality Assessment." Oregon Department of Environmental Quality. <http://www.deq.state.or.us/>

¹⁷ Division 42 Total Maximum Daily Loads (TMDLS), Or. Rev. Stat. §§ 340-042-0025. <http://arcweb.sos.state.or.us/>

¹⁸ "About the Environmental Quality Commission." Oregon Department of Environmental Quality. <http://www.deq.state.or.us/>

¹⁹ Federal Emergency Management Agency, National Flood Insurance Program: Program Description, Doc. (2002). <http://www.fema.gov/>

²⁰ Office of the General Council, All-Hazard Authorities of the Federal Emergency Management Agency, Doc. No. 42 (1997). <http://www.fema.gov/>

²¹ Federal Emergency Management Agency, Fact Sheet: National Flood Insurance Program, Doc. (). <http://www.in.gov/>

may not receive federal funding or aid in the event of a disaster.²² In order for a community to participate and remain in the NFIP, the community needs to comply with the Federal Emergency Management Agency's (FEMA) standards.

The NFIP requires that communities "adopt and enforce floodplain management regulations" to comply with standards of the program, which typically means the adoption of a floodplain ordinance.²³ Program requirements are dictated through Chapter 44, Section 60.3 of the Code of Federal Regulations. At a minimum, communities that participate in the program shall.²⁴

- Require permits for proposed developments;
- Review permit applications to determine that flood prevention measures are being taken; and,
- Require the retrofitting of utility systems in flood prone areas.

It is more likely, however, that communities participating in the NFIP will face specialized requirements from data that has been collected by a Federal Insurance Administrator. The Flood Insurance Administrator is responsible for defining special flood hazard zones, called A Zones, based on a community's Flood Insurance Rate Map.²⁵ Specific standards may apply to different flood hazard zones based on the probability of a flood and the vulnerability of an area. What these standards amount to, in most communities, is the designation of a floodway and floodplain in which development is either prohibited outright or approved conditionally.

Communities that have met FEMA's flood management requirements and joined the NFIP are eligible to participate in the Community Rating System (CRS). The CRS is an incentive-based program that provides communities with lower insurance rate premiums in exchange for increased flood mitigation efforts.²⁶ Insurance rates are based on 10 CRS classes. Class 1 gives the greatest insurance rate reduction at 45 percent, while class 10 gives a zero percent reduction and class nine gives a 5 percent reduction. The class rating system is directly dependent on the mitigation efforts put forth by a community. According to FEMA, "The CRS recognizes 18 creditable activities, organized under four categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness."²⁷ Included in the four categories are activities such as preserving the natural state of the floodplain, adopting a floodplain management plan, and encouraging low density zoning, among others.

The NFIP compliance standards mentioned above are applicable to the U.S. as a whole; however, stricter standards through the NFIP have already been enacted in Washington, and Oregon will also face more

²² Federal Emergency Management Agency, Answers to Questions About the NFIP, Doc. No. F-084 (2011). <http://www.fema.gov/>

²³ Federal Emergency Management Agency, National Flood Insurance Program (NFIP) Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials, Doc., at 5-4 (2013). <http://www.fema.gov/>

²⁴ Title 44: Emergency Management and Assistance, 44 C.F.R. § 60.3 (1979). <http://www.ecfr.gov/>

²⁵ Ibid.

²⁶ Federal Emergency Management Agency, National Flood Insurance Program: Program Description.

²⁷ Ibid. P. 32

stringent standards in the coming years. In 2003, the effectiveness of the NFIP in protecting threatened and endangered species was called into question through a lawsuit by the National Marine Fisheries Services (NMFS).²⁸ The National Marine Fisheries Service undertook a biological opinion to determine how endangered species, as they are identified under the Endangered Species Act (ESA), are affected by the standards of the National Flood Insurance Program (NFIP). NMFS determined that FEMA was not doing enough through the NFIP to avoid impacting endangered riverine species.²⁹ FEMA is requiring communities in Washington that are part of the NFIP to develop approaches to protect fish species based on this new ruling.

The *Floodplain Management and the Endangered Species Act Checklist for Programmatic Compliance* document explains the background behind the upcoming changes to the NFIP and provides a checklist for communities to follow in adhering to these new changes. The requirements within the document are currently only applicable to Washington State, but may soon be applicable to Oregon as well. According to the document:³⁰

“FEMA offers two ways to meet this ESA requirement:

1. Prohibit all development in the floodway and other areas as specified by the RPA.
2. Enact regulations that allow development that meet the criteria specified in the Biological Opinion by either:
 - a. Adopting the Model Ordinance, or
 - b. Enforcing the same requirements in other ordinances, such as the growth management, zoning, or critical areas regulations.”

Additionally, “If a community chooses not to enact regulations under the two options described above, then a third option of showing compliance with ESA on a permit by permit basis will be required.”³¹ The permit by permit option would require developments in the special flood hazard zones to submit an additional permit to the NMFS, so that ESA compliance can be assessed.³² This third option is not recommended by FEMA and it is unlikely that many communities will choose this route.

Most Washington communities are likely to choose option 2a or 2b.³³ Regardless of the option chosen, a community must meet the ESA’s Biological Opinion (BiOp) Provisions, of which there are five.³⁴ The first

²⁸ Federal Emergency Management Agency. *ESA and the NFIP Implementing a Salmon Friendly Program – FEMA Region 10 ESA and the National Flood Insurance Program*. <http://www.fema.gov/>

²⁹ Federal Emergency Management Agency, *Endangered Species Act – Section 7 Consultation Final Biological Opinion*, Doc. (2012). <http://www.fema.gov/>

³⁰ Federal Emergency Management Agency, *Floodplain Management and the Endangered Species Act Checklist for Programmatic Compliance*, Doc. (2010). <http://www.fema.gov/>

³¹ *Ibid.*

³² *Ibid.*

³³ *Ibid.* P. 8

³⁴ Federal Emergency Management Agency, *Floodplain Management and the Endangered Species Act Checklist for Programmatic Compliance*.

provision is concerned with the definition of “development.” The BiOp has added the language, “removal of substantial amounts of vegetation, or alteration of natural site characteristics” to NFIPs definition of development.³⁵ The second provision adds to current FEMA mapping delineations; specifically, the BiOp adds a Riparian Habitat Zone (RHZ), in addition to the special flood hazard area. The RHZ is a buffer area where development is highly restricted. The RHZ can extend between 150 to 250 feet from the ordinary high water line, depending on the type of stream.³⁶ Provision three aims to enhance the permit process for developments by necessitating more stringent permit requirements. Provision four deals with development standards, including the incorporation of low impact development (LID) strategies. Provision five describes required habitat protection standards that communities must abide by. Habitat protection standards include: limiting native vegetation removal; requiring mitigation measures for all developments in the community; and using techniques to limit development density in protected areas, among other standards.

Currently, the provisions of the ESA’s BiOp are only applicable to communities in Washington, but these provisions, or ones like them, will soon be enacted in Oregon. According to a representative from Oregon’s Department of Land Conservation and Development, “door three (permit by permit) is not going to be available in Oregon, so everything will have to be dealt with either by a stand-alone modified flood ordinance or the program evaluation.”³⁷ This indicates that, like in Washington, communities in Oregon are likely to choose option 2 in meeting ESA requirements.

Oregon’s Regulatory Framework

In addition to the federal standards mentioned above, Oregon communities are obligated to consider the state’s 19 Statewide Planning Goals. These goals have had a strong influence on the state’s land use decisions and policy making since 1973.³⁸ The goals cover a range of topics, including citizen involvement (Goal 1), forest lands (Goal 4), economic development (Goal 9), etc. Local governments (e.g., cities and counties) are required to have comprehensive land use plans that adhere to the statewide planning goals.³⁹ Pertinent to this project are Goals 5, 6, and 7.

Applicable Statewide Planning Goals

Goal 5 is implemented through Oregon Administrative Rules (OARs) 660-023. These rules provide procedures for jurisdictions to follow when protecting natural resources. It is through Goal 5 that jurisdictions are obligated to provide protection for wetland and riparian resources.⁴⁰

³⁵ Ibid. P. 10

³⁶ Federal Emergency Management Agency, Floodplain Management and the Endangered Species Act: A Model Ordinance, Doc. (2012). <http://www.fema.gov/>

³⁷ Representative from the Department of Land Conservation and Development. April 26, 2013.

³⁸ Oregon Department of Land Conservation and Development. "Statewide Planning Goals." State of Oregon. <http://www.oregon.gov/>

³⁹ Ibid.

⁴⁰ Ibid.

Division 23 is that portion of the OARs that outlines the requirements that local jurisdictions must adhere to in complying with Goal 5. The OARs within Division 23 explain the obligations of local jurisdictions towards implementing riparian protection strategies, most notably the development of a riparian ordinance.⁴¹ It is important to note that these regulations only apply to jurisdictions who are conducting periodic review or amending comprehensive plans or other land use regulations. Jurisdictions with populations under 10,000 are not required to conduct periodic review and, as a result, are not responsible for meeting the requirements of Division 23.⁴²

Like Goal 5, Goal 6 also aims to protect the state's natural resources; specifically, air, water, and land resources. Goal 6 provides guidelines for cities to follow to ensure that these natural resources are protected. The guidelines suggest that a city should be mindful of land use decisions, collaborate with local and state organizations, and develop innovative strategies for reducing pollution.⁴³

In addition to these natural resource oriented goals, the state requires that jurisdictions follow statewide planning Goal 7, which aims to protect people and developments against natural hazards. Goal 7 follows many of the requirements that have been established by FEMA. The guidelines for Goal 7 include language about maintaining natural areas as a mitigation effort against natural hazards, collaborating with citizens and local agencies, using non-regulatory strategies, and ensuring that the public is well informed regarding natural hazards issues.⁴⁴ However, unlike Goal 5, there are no implementation rules associated with Goal 7.

Total Maximum Daily Loads (TMDLS)⁴⁵

While jurisdictions with populations under 10,000 are not obligated to comply with Division 23 requirements, they are obligated to comply with Division 42, which outlines the requirements for adhering to TMDL requirements. The requirements for Division 42 stem from the Federal Water Pollution Control Act Section 303 and are administered by the DEQ. Unlike the requirements for Goal 5, there are no overarching standards for complying with TMDLs. Each jurisdiction is given an agreed upon set of management strategies depending on the pollution parameters of the waterway needing protection. A collection of management strategies will often take the form of a Water Quality Management Plan (WQMP). The basic requirements for a WQMP are described in OAR 340-042-0080(3). According to the OAR, in developing a WQMP, a community must:⁴⁶

- “Identify management strategies to reduce pollutant loading;

⁴¹ Division 23 Procedures and Requirements for Complying with Goal 5, Or. Rev. Stat. §§ 660-023-0000. <http://arcweb.sos.state.or.us/>

⁴² Ibid.

⁴³ Oregon Department of Land Conservation and Development. *Goal 6: Air, Water and Land Resource Quality*. <http://www.oregon.gov/>

⁴⁴ Department of Land Conservation and Development. *Goal 7: Areas Subject to Natural Hazards*. <http://www.oregon.gov/>

⁴⁵ Division 42 Total Maximum Daily Loads (TMDLS), Or. Rev. Stat. §§ 340-042-0025. <http://arcweb.sos.state.or.us/>

⁴⁶ Department of Environmental Quality, TMDL Implementation Plan Guidance – for State and Local Government Designated Management Agencies, (Or. 2007). P. 6. <http://www.deq.state.or.us/>

- Provide a timeline for implementing management strategies and completing milestones;
- Provide performance monitoring for the plan;
- Provide evidence of compliance with applicable statewide land use requirements; and,
- Provide any other analyses or information specified in the WQMP.”

The DEQ may require communities to include additional information in a WQMP depending on the specific circumstances of a community.

Washington’s Regulatory Framework

Washington State has enacted several policies for managing growth and protecting surface water resources. The State’s Growth Management Act (GMA), for instance, aims to guide urban growth in a sustainable manner for all counties and cities throughout the state. The Shoreline Management Act (SMA) aims to protect and enhance the resources of a waterway, including water, vegetation, and wildlife. The State has also enacted water quality standards for surface water under Title 173, Chapter 201A of Washington’s Administrative Code (WAC), which set criteria for waterways in an effort to protect aquatic life and public health.

Growth Management Act (GMA)⁴⁷

The GMA includes thirteen goals for counties and communities to incorporate into their comprehensive plans and regulations that are intended to guide the overall growth of the state. Goals nine and ten are most relevant to this project. Goal nine aims to preserve open space and protect wildlife. Goal ten aims to protect the environment and improve water quality. The standards of the GMA dictate that cities are required to identify critical areas and incorporate those designated areas into their comprehensive plans as appropriate.⁴⁸ Critical areas include wetlands, wildlife habitat areas, and flood zones, among others. To protect these areas, the state requires that cities and counties adopt development regulations to mitigate potentially harmful impacts.⁴⁹

Shoreline Management Act (SMA)⁵⁰

The SMA aims to protect streams and riparian areas from pollution and degradation, while still allowing access to these areas by the public. According to the SMA, cities and counties are required to adopt a shoreline master program. The program must explain how shoreline areas will be managed over time and provide standards for developments and uses in shoreline areas. Washington’s Department of Ecology is the designated agency responsible for overseeing the standards of the SMA and providing assistance to jurisdictions.

⁴⁷ Growth Management Act, Wash. Rev. Code § Chapter 36.70A.

⁴⁸ Growth Management Act, Wash. Rev. Code § Section 36.70A.060. <http://apps.leg.wa.gov/>

⁴⁹ Ibid.

⁵⁰ Shoreline Management Act, Wash. Rev. Code § Chapter 90.58. <http://apps.leg.wa.gov/>

Water Quality Standards⁵¹

Chapter 173-201A of the WAC establishes water quality standards for the surface waters of the state. Water quality standards have been enacted to protect aquatic freshwater fish from various pollutant types. A complete list can be found in the WAC. The state’s water quality standards include an antidegradation policy that describes how water quality is to be managed, which includes mitigating impacts from human activities. According to the WAC, water quality standards are to be met by using a permitting system for point source discharges and best management practices for non-point source discharges. Like the SMA, water quality standards are administered by the Department of Ecology.

Regulatory Framework Summary

For the most part, surface water regulations in Oregon and Washington stem from federal policies. Federal water quality policies include the NPDES and TMDL programs, which are both overseen in Oregon by the Department of Environmental Quality, and in Washington by the Department of Ecology. Flood policies stem from the NFIP, which is administered by FEMA. And the primary federal habitat protection policy is the ESA; however, habitat protection is soon to be addressed through the NFIP as well. In addition to these federal policies, Oregon communities are required to adhere to the requirements of Statewide Planning Goals 5, and should consider the guidelines of Goals 6 and 7 as they relate to surface water management. Washington communities are required to address the Growth Management Act and the Shoreline Management Act, which function similarly to Oregon’s Statewide Planning Goals.

Figure 2 provides an overview of the relevant surface water policies for communities in Oregon and Washington.

Figure 2: Oregon Surface Water Policies

Policy	Purpose	Requirements	Regulatory Agency
<i>Federal</i>			
Clean Water Act	Improve the water quality of the nation’s waterways.	The EPA must set pollution standards for the impaired waterways of the nation.	EPA
National Pollutant Discharge Elimination System Program	Limit the discharge of pollutants from point sources.	Communities must develop a stormwater management plan to address a set of minimum control measures: <ul style="list-style-type: none"> • Public Education and Outreach • Public Participation/Involvement 	Federal: EPA State: DEQ

⁵¹ Water Quality Standards for Surface Waters of the State of Washington, Wash. Rev. Code §§ Chapter 173-201A. <https://fortress.wa.gov/>

Policy	Purpose	Requirements	Regulatory Agency
		<ul style="list-style-type: none"> • Illicit Discharge Detection and Elimination • Construction Site Runoff Control • Post-Construction Runoff Control • Pollution Prevention/Good Housekeeping <p>Communities must monitor their efforts to reduce pollution from their MS4s.</p>	
Total Maximum Daily Load Program	Limit the discharge of pollutants to specific waterways. The TMDL program targets both point sources and non-point sources.	<p>In Oregon, pollution limits for waterways are established by the DEQ. Pollution limits are set for specific pollutant types, such as temperature, bacteria, dissolved oxygen, etc.</p> <p>Communities are responsible for addressing pollutant limits for the waterways that flow through their jurisdictional boundaries by developing a Water Quality Management Plan. EPA designates the responsibility of determining what shall go into a WQMP to state agencies.</p> <p>Communities must monitor their efforts to improve the water quality of impaired waterways.</p>	Federal: EPA State: DEQ
National Flood Insurance Act	Provide nation-wide flood insurance.	See the National Flood Insurance Program requirements below.	FEMA
National Flood Insurance Program	Threefold: provide individuals with monetary relief; reduce flood damage through floodplain management strategies; and, reduce federal flood relief costs.	<p>Communities that participate in the NFIP shall adopt and enforce floodplain management regulations (usually an ordinance), and at a minimum, shall:</p> <ul style="list-style-type: none"> • Require permits for proposed developments; • Review permit applications to determine that flood prevention measures are being taken; And, 	FEMA

Policy	Purpose	Requirements	Regulatory Agency
		<ul style="list-style-type: none"> Require the retrofitting of utility systems in flood prone areas. <p>For most communities, these requirements will apply to FEMA designated A Zones, which typically encompass the floodway and floodplain.</p>	
Endangered Species Act Biological Opinion	Provide greater protection for threatened and endangered species under the NFIP.	<p>The compliance requirements for the ESA BiOp in Oregon cannot be stated with certainty, because the litigation process has not yet concluded. However, the requirements are likely to be very similar to those in Washington. Washington communities can choose between three options.</p> <ol style="list-style-type: none"> “Prohibit all development in the floodway and other protected areas (Riparian Habitat Zone). Enact regulations that allow development that meet the criteria specified in the BiOp by either. <ol style="list-style-type: none"> Adopting the Model ordinance, or Enforcing the same requirements in other ordinances, such as the growth management zoning, or critical areas regulations.” Evaluate compliance on a permit by permit basis. 	FEMA
State			
Statewide Planning Goals	Oregon’s Statewide Planning Goals guide land use and policy decisions throughout the state.	Communities must consider the Statewide Planning Goals in creating or modifying their comprehensive plans. However, most of the goals do not have specific requirements.	DLCD
Goal 5	Protect the state’s natural resources, scenic and historic	The requirements of Goal 5 can be found in Division 23 of the Oregon Administrative Rules. Division 23	DLCD

Policy	Purpose	Requirements	Regulatory Agency
	areas, and open spaces.	states that in order for communities to comply with Goal 5, they must adopt a riparian ordinance. These regulations only apply to jurisdictions who are conducting periodic review or amending comprehensive plans or other land use regulations. Jurisdictions with populations under 10,000 in population are not required to conduct periodic review and, as a result, are not responsible for meeting the requirements of Division 23.	
Goal 6	Protect the state's air, water, and land resources.	There is no implementation rule associated with this goal.	DLCD
Goal 7	Protect people and developments against natural hazards.	There is no implementation rule associated with this goal.	DLCD

Case Study Analysis

To gain insight into the feasibility of holistically addressing surface water issues, I have reviewed two surface water management plans; one in Edmonds, Washington and one in West Linn, Oregon. The scenarios in which the two plans were created are slightly different in that surface water management plans are required by law in Washington State⁵²; while in Oregon they are voluntary. Nevertheless, the main impetus for creating a surface water management plan for these two jurisdictions was to comply with NPDES Standards under the CWA. The surface water management plans in Edmonds and West Linn are relevant to this project because of their focus on integrating water quality, flood, and habitat protection strategies into one holistic plan.

This review is concerned primarily with five major plan components: funding, strategies, monitoring, public involvement, and partnerships. The strategies section is further broken down into water quality, flooding, habitat, and holistic to provide a clearer distinction between strategies. The five major components can be considered the core of a surface water management plan. Other components, while

⁵² "The Need for Storm and Surface Water Management: The Water Quality Issue." Municipal Research and Service Center of Washington. Last modified February 2011. <http://www.mrsc.org/>

vital to the effectiveness of a plan, are often very unique to a specific community and were not included in the review of the Edmonds and West Linn plans.

Edmonds, Washington

The City of Edmonds' plan, titled "Storm and Surface Water Management Comprehensive Plan," is largely dictated by the requirements of its NPDES Phase II permit. In Washington, NPDES compliance is controlled by the Department of Ecology, which requires that all Phase II communities create a stormwater program. Edmonds' SSWMCP was developed to meet this NPDES requirement. The city is also required to comply with TMDL requirements in meeting water quality standards. Waterbodies within the city's limits currently have TMDLs for phosphorous and fecal coliform bacteria. The NPDES and TMDL programs are primarily intended to protect water quality, but can also partially address flooding and habitat protection through the reduction of runoff and preservation of open space. The main flood prevention program for Edmonds is the NFIP and the main habitat protection regulation is the ESA, both of which are mentioned in more detail in the "Regulatory Framework" section above.

Funding

The City of Edmonds opted to fund surface water management strategies by enacting a stormwater utility fee (SWUF).⁵³ Edmonds rationalizes the use of a SWUF on the grounds that "Demand is placed on a stormwater utility whenever a vegetated area is converted to impervious since it generates increased runoff from private property and/or the public right of way."⁵⁴ The SWUF is thus used to offset this conversion and stabilize the stormwater system through the implementation of mitigation strategies.

The City of Edmonds uses a tiered equivalent service unit (ESU) method in determining fee rates by identifying a base equivalency ratio of one ESU to 3,000 square feet of impervious surface. Notably, impervious surface area calculations are only necessary for developments that are not designated as single family residential. All single family residential parcels are automatically equivalent to one ESU.⁵⁵ Edmonds estimates that the 2013 fee rate per ESU is approximately \$11.36.⁵⁶

Using a SWUF as its primary source of funding, the City of Edmonds has established a tiered funding allocation system to pay for the city's water management needs. The first funding tier, called tier 1, is established to meet essential water management needs such as permits, regulatory requirements, and to handle emergency events. Funding for tier 2 is allocated to more general capital improvement projects that help to augment the environmental capacity of the city.⁵⁷

⁵³ New England Environmental Finance Center. "Stormwater Utility Fees." University of Southern Maine. Last modified May 2005. <http://efc.muskie.usm.maine.edu/>

⁵⁴ City of Edmonds. *Storm and Surface Water Management Comprehensive Plan*. P. 14., 2010

⁵⁵ Ibid. P. 31

⁵⁶ Ibid. P. 13

⁵⁷ Ibid. P. 2

Surface Water Management Strategies

The strategies in Edmonds' plan focus heavily on stormwater mitigation to address water quality issues such as phosphorous, sediment loading, and bacteria pollution during runoff events. Flooding has also been a problem for the City as greater urbanization has led to increased impervious surface and exacerbated stormwater runoff.⁵⁸ Identification of problem areas is vital to implementing successful solutions. The City of Edmonds has recognized that water quality and flood concerns are a direct result of a poor drainage system, and have therefore concluded that restoring natural drainage systems is necessary to alleviate, at least in part, the problems mentioned above. The City's SSWMCP includes site specific projects as well as general focus areas for managing surface water issues. This paper is only concerned with the general focus areas because the majority of the site specific projects are dependent on the location and needs of Edmonds specifically.

Holistic

Holistic strategies are those strategies that address all three surface water issues mentioned in the City's SSWMCP. One such holistic strategy in Edmonds' plan is public outreach and education. Public outreach and education is stated as Goal C in the City's plan and encompasses water quality and flooding directly and habitat protection indirectly. Aside from the public education materials already on the City's website, the SSWMCP plan mentions the following education and outreach strategies:⁵⁹

- "Develop an outreach and inspection program to evaluate and enforce the maintenance of private stormwater facilities."
- "Provide citywide public education on pesticide and fertilizer use."
- "Perform business inspections and educate business owners and operators on proper source control BMPs."

In addition to the strategies above, the plan also includes a section specifically for public education and outreach, which contains a broad overview of current and future endeavors and is concerned primarily with stormwater management. Closely following the public education and outreach strategy, the city has taken measures to encourage the use of low impact development (LID) practices.

Low impact development strategies aim to incorporate natural systems into the growth of urban environments in an effort to control stormwater runoff. The preservation of the natural landscape is a key principle of LID. Strategies that encompass LID principles include: detention and retention ponds, rain gardens, vegetated swales, and permeable pavements, among others.⁶⁰ A detailed description of these strategies is provided in the "Surface Water Management Plan Structure" section. Edmonds intends to incorporate LID techniques by encouraging natural drainage systems to slow stormwater runoff and encouraging the use of infiltration systems to hold and filter stormwater before it drains into the waterways of the city.

⁵⁸ Ibid.

⁵⁹ Ibid. P.3-2

⁶⁰ United States Environmental Protection Agency. "Low Impact Development (LID)." United States Environmental Protection Agency. <http://water.epa.gov/>

Water Quality

Edmonds' plan focuses on two distinct water quality issues: nonpoint source pollution and illicit discharges. The City is concerned primarily with chemical, bacteria, and sediment based pollution as is required through the City's NPDES Phase II permit and TMDL implementation plan. The City's nonpoint source water quality management strategies can be classified into three unique areas. Area one focuses on restricting the use of fertilizers and pesticides containing phosphorus. Area two includes strategies to maintain stormwater facilities, both public and private, throughout the city. Area three focuses on preventing erosion by monitoring the transportation of sediment at construction sites and enhancing riparian vegetation. Strategies to alleviate pollution from illicit discharges are targeted at businesses and collectively involve the development of an inspection program.

Flooding

Like the water quality strategies mentioned in the previous section, many of the strategies that Edmonds has proposed to mitigate flood hazards will also have a positive impact on alleviating water quality and habitat concerns. The City proposes the incorporation of LID that would encourage the use of natural drainage systems, thereby increasing infiltration and slowing runoff. Other flood mitigation strategies aim to control stormwater flow rates through the following means:

- Enforcing flow control measures for new development and redevelopment projects;
- Replacing drainage pipes; and,
- Incorporating dry wells into the City's storm drain system.

Integrating natural drainage systems, as the city proposes, can have the added benefit of improving water quality and aquatic habitat.

Habitat Protection

Habitat protection strategies are, for the most part, referenced in Edmonds' plan in relation to water quality and flood strategies. For instance, many of the water quality and flood strategies aim to limit runoff and filter pollutants, which are important approaches to habitat protection as well. However, specific habitat protection actions are mentioned in the City's list of capital improvement projects. Habitat protection necessarily involves the preservation of streams and streamside resources, explicitly native vegetation. Edmonds intends to preserve streamside resources by stabilizing riparian areas to reduce sedimentation and restore and enhance riparian areas on private and public land to increase the overall density of streamside vegetation.⁶¹

Monitoring⁶²

Edmonds' SSWMCP includes a monitoring component to address NPDES and TMDL requirements. NPDES monitoring shall be conducted to determine the overall effectiveness of the city's stormwater management plan. Targeted monitoring efforts will also be performed to assess the efficiency of the

⁶¹ City of Edmonds. *Storm and Surface Water Management Comprehensive Plan Appendix A*. Pg. 3-2. 2010

⁶² Department of Ecology. *Western Washington Phase II Municipal Stormwater Permit.*, 2009.
<http://www.edmondswa.gov/>

city's BMPs.⁶³ The SSWMCP does not yet include specific monitoring strategies for meeting NPDES requirements, though there is a monitoring section in development. However, a representative from the public works department of the city has commented that pollution sampling efforts are currently underway.⁶⁴

Unlike the NPDES monitoring portion of Edmonds' plan, which is still largely in development, TMDL monitoring requirements are included with specific strategies for compliance. Monitoring requirements for TMDL compliance are represented in Appendix 2 of Edmonds' SSWMCP, and are concerned solely with fecal coliform bacteria pollution. Washington's Department of Ecology provides communities with two monitoring strategies.⁶⁵ The first monitoring strategy, titled Strategy A, requires the development of a Quality Assurance Project Plan and a Bacterial Pollution Control Plan. Quality Assurance Project Plans should include stream and stormwater conveyance sampling with the objective of locating high pollution areas. The Bacterial Pollution Control Plan is much broader in scope than the Quality Assurance Project Plan and requires that communities consider the following methods: waste ordinances; water pollution control enforcement; evaluation of critical areas; educational programs; BMP implementation; and water quality sampling. The second monitoring strategy, titled Strategy B, requires the development of an Early Action BMP plan in addition to the two plans under Strategy A. The requirements for the Early Action plan are identical to those in the Bacterial Pollution Control Plan, but with a shorter overall timeframe.

Public Involvement

To meet part of the requirements under the NPDES program, Edmonds has undertaken a public involvement process in creating its SSWMCP. The city provided opportunities for public involvement through three distinct avenues: the city's website, public hearings, and council meetings.⁶⁶ Aside from general public involvement opportunities, the city has encouraged public input during the development and update phases of the plan. In regards to the latest update phase, which took place in 2010, the city held several public hearings and conducted work sessions to help determine possible amendments to the plan.⁶⁷ According to Edmonds' plan, the city will continue to encourage public involvement on a routine basis, but only in regards to NPDES requirements. There is no mention in the city's plan of conducting public involvement efforts for other purposes.

Partnerships

The City of Edmonds resides in the Puget Sound, and is therefore part of the Puget Sound Partnership, which is an alliance consisting of citizens, municipal governments, tribes, organizations, and businesses. The goal of the Puget Sound Partnership is to foster collaborative action in conserving the natural resources of the Puget Sound. To meet this broad goal, the Partnership created an Action Agenda, which

⁶³ Ibid. P. 32

⁶⁴ A Representative from Edmonds' Public Works Department. City of Edmonds, Washington. April 5, 2013

⁶⁵ City of Edmonds. *Storm and Surface Water Management Comprehensive Plan* Pg. 3-5. 2010

⁶⁶ Ibid. P 4-2

⁶⁷ Ibid.

includes many of the same objectives as Edmonds` SSWMCP.⁶⁸ As a result, there is increased opportunity for grant funding and technical assistance for things like water quality monitoring.

In addition to partnership opportunities through the Puget Sound Partnership, Edmonds is working closely with the Snohomish County Conservation district to provide assistance with conservation strategies for community members. The city is also working with adjacent municipalities to monitor water quality for shared waterways.⁶⁹

West Linn, Oregon

In West Linn, the NPDES program is the driving regulatory force behind controlling water quality pollution, with some consideration given to meeting TMDL requirements as well.⁷⁰ The city is a Phase I NPDES permit holder for its MS4 system. Even though the city has a population under 100,000 and does not require a Phase I permit, they felt it was in their best interest to take a proactive approach to managing water quality. The city complied with the NPDES program by developing a Storm Water Management Plan.

West Linn is responsible for adhering to TMDL standards for the Willamette and Tualatin Rivers. TMDLs for the Willamette River are still being established, however the Tualatin River has TMDLs for temperature, bacteria, volatile solids, ammonia, and phosphorous.

Like Edmonds, West Linn is a participating member of the NFIP. The city is also responsible for habitat protection under the ESA. Both the NFIP and the ESA are mentioned in more detail in the general “Regulatory Framework” section above.

Additionally, the city is required to abide by state land use regulations, specifically, Statewide Planning Goal 5. West Linn complied with Goal 5 by conducting an inventory of the city’s natural resources, which includes riparian corridors, wetlands, and wildlife habitat.⁷¹ The city’s Goal 5 assessment provides the basis for guiding restoration efforts throughout the city.

Funding

Funding mechanisms are not directly mentioned in the City’s “Surface Water Management Plan” (SWMP). However, based on the City’s “Master Fees and Charges Document”⁷² and the City’s “Six Year Capital Improvement Plan”⁷³ several funding options are available. Surface water management projects appear to be funded through a monthly fee-based system, as well as from system development charges.

⁶⁸ City of Edmonds. *Storm and Surface Water Management Comprehensive Plan Appendix D*. Pg. D-3. 2010

⁶⁹ A Representative from Edmonds` Public Works Department. City of Edmonds, Washington. April 5, 2013

⁷⁰ City of West Linn Public Works Department. *West Linn Surface Water Management Plan*. By West Linn Public Works Department., 2006.

⁷¹ Ibid. P. 6-1

⁷² City of West Linn. "Master Fees and Charges Document." City of West Linn. Last modified June 11, 2012. Accessed March 4, 2013. <http://westlinnoregon.gov/>

⁷³ City of West Linn. "Six Year Capital Improvement Plan." City of West Linn. Last modified 2012. Accessed March 4, 2013. <http://westlinnoregon.gov/>

West Linn uses a similar fee-based system to that of Edmonds to pay for Surface Water Management strategies. In the case of West Linn, a monthly fee of \$5.31 is applied to single family residential units, with a higher fee applied to non-residential developments and developments with greater impervious area.⁷⁴

In addition to monthly fees, the City also uses a one-time charge, also known as a system development charge (SDC), to fund city projects. In West Linn, SDCs are automatically applied after the City issues a development or building permit or when a facility is joined to existing infrastructure. The expenditure of SDC funds is tracked through City plans, such as the water system master plan, which dictate how SDC funds are to be allocated to specific projects.

Surface Water Management Strategies

The surface water management strategies in West Linn's plan are guided by several overall goals and objectives identified by the City. Many of the goals and objectives are holistic in nature, including an emphasis on stormwater control measures and the greater management of natural areas.⁷⁵ The plan stresses the importance of not only incorporating structural strategies, but non-structural strategies as well. An analytical approach to determining effective strategies was employed by West Linn through the examination of current storm and surface water systems. Specifically, the City recognized insufficiencies in stormwater conveyance and natural resource preservation.⁷⁶ The strategies listed in the subsections below are remedies that the City has pursued to address the identified insufficiencies.

Holistic

Many of the strategies found in surface water management plans are inherently holistic given the close relationship of surface water issues, and the strategies in West Linn's plan fit this pattern. The category of "Natural Resource Enhancements" in West Linn's plan represents an all-inclusive set of strategies that center on the overall enrichment of streamside vegetation and improved bank stabilization. The augmentation of streamside vegetation has the added benefit of slowing floodwaters and allowing for improved infiltration potential.⁷⁷ Also included in West Linn's plan are strategies to increase overall infiltration and filtration rates throughout the city, which includes techniques such as bioswales, detention ponds, created wetlands, and the reduction of impervious surfaces where possible.⁷⁸

Decreasing the amount of impervious surface throughout a city can be a large and potentially costly undertaking. West Linn approaches impervious surface reduction through the various strategies above, but those strategies are often site-specific. To address resource protection on a broader scale, the city

⁷⁴ Ibid.

⁷⁵ City of West Linn Public Works Department. *West Linn Surface Water Management Plan*. By West Linn Public Works Department. P. 2-1., 2006.

⁷⁶ City of West Linn Public Works Department. *West Linn Surface Water Management Plan*. P. 5-1 to 7-2.

⁷⁷ Cohen, Russell. "Fact Sheet #1: Functions of Riparian Areas for Flood Control." Commonwealth of Massachusetts. Last modified January 8, 1997. <http://www.mass.gov/>

⁷⁸ City of West Linn Public Works Department. *West Linn Surface Water Management Plan*.

has incorporated LID language into its municipal code.⁷⁹ LID techniques attempt to mitigate the effects of development by recreating natural systems, which includes the management of stormwater.

Water Quality

Aside from the holistic strategies mentioned above, stream bank stabilization and filtration techniques are the primary strategies being used by the city to manage water quality. Natural bank stabilization techniques involve the careful placement of vegetation along the banks of a stream and are often used to prevent erosion, limit sedimentation, and decrease nutrient deposition. Filtration techniques can either involve the use of natural areas, such as a wetland, or can involve more complex devices, as in the case of West Linn. West Linn filters sedimentation through depressions or inlets that are designed to capture sediments as water flows over a surface or through drainage systems.⁸⁰

Flooding

Flood mitigation is a diverse subject that encompasses both non-structural strategies and structural strategies. Non-structural strategies, as they pertain to flood mitigation, are ones that focus on enhancing the capabilities of natural systems. Structural strategies can also be nature-oriented, but are often distinguished from non-structural methods because they rely on construction techniques. In most circumstances, a combination of both methods is preferable.⁸¹ West Linn's plan proposes the utilization of both methods due to the size and topographical nature of the city.

The prioritization of structural methods in West Linn's plan is based largely on the cost of a particular strategy in relation to its effectiveness in mitigating flood hazards. Initial consideration for structural strategies was also based on the inefficiencies of current water systems within the city. The technique that West Linn uses in prioritizing projects involves ranking strategies "by their lowest cost per cfs of expected conveyance improvement and then further evaluate(ing) them based on a deficiency index."⁸² It was determined that upgrading existing piping and culverts would provide the most benefit. Specific structural projects that were chosen are combined to constitute the City's Capital Improvement Plan.

Non-structural strategies mentioned in West Linn's plan include, detention, acquisition of properties, and the reduction of impervious area.⁸³ However, the plan does not reference specific examples detailing how these strategies are applied.

Habitat Protection

Many of the habitat protection benefits that would be gained from West Linn's plan have already been mentioned in the holistic subsection above. The plan does, however, discuss a specific strategy related to the protection of riverine species, called the "Fish Safe Culvert Inventory", which aims to retrofit existing culverts to make them fish friendly.⁸⁴

⁷⁹ Ibid. P. 5-6

⁸⁰ City of West Linn Public Works Department. *West Linn Surface Water Management Plan*. P. 5-3 to 5-4.

⁸¹ Stormwater PA. "PA BMP Manual." Stormwater PA. <http://www.stormwaterpa.org/>

⁸² City of West Linn Public Works Department. *West Linn Surface Water Management Plan*. P. 7-8

⁸³ Ibid. P. 7-4

⁸⁴ Ibid. P. 6-1

Monitoring

West Linn's SWMP does not address monitoring directly. However, several of the city's other plans that do address monitoring are associated with the objectives of the SWMP. In general, West Linn's monitoring efforts have been directed entirely at meeting NPDES MS4 requirements, with TMDL obligations being indirectly considered as well. In relation to NPDES monitoring requirements, the city is under obligation to conduct both programmatic monitoring and environmental monitoring.⁸⁵ Programmatic monitoring entails tracking implemented strategies, such as BMPs, to ensure that they are functioning as intended. Environmental monitoring consists of gathering water quality samples and extracting data from those samples to determine if water quality is improving.

In conducting environmental monitoring efforts, the city has partnered with seven other jurisdictions that all have similar NPDES requirements. Together, these jurisdictions developed the *Comprehensive Clackamas County Stormwater Monitoring Plan*. The plan includes instream, outfall, field screening, and BMP monitoring efforts.⁸⁶ Instream efforts involve the collection of water quality data from polluted water bodies at several points. The water quality data is then analyzed and compared to determine the effectiveness of the city's water quality improvement strategies. Outfall monitoring efforts function similarly to instream efforts, except that samples are taken from specific locations within a city's stormwater conveyance system. Field screening is another location specific sampling method that targets illicit discharge facilities to ensure that they are complying with MS4 requirements. Lastly, BMP monitoring efforts entail the inspection of structural BMPs, such as rain gardens and swales, to determine if they are functionally effectively.

While programmatic monitoring efforts are not mentioned in the multi-jurisdictional monitoring plan, they are mentioned in West Linn's *National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit & TMDL Implementation Plan*. This plan contains qualitative monitoring strategies for the NPDES and TMDL programs.⁸⁷ NPDES monitoring strategies include: reviewing and updating the city's code, tracking public education efforts, and inspecting and maintaining the city's stormwater conveyance system, among many others. TMDL monitoring strategies are concerned primarily with temperature pollution and include: tracking the distribution of educational information, recording changes in the city's development standards to encourage LID and BMP strategies, and tracking vegetation planting activities.

Public Involvement

West Linn carried out an extensive public involvement process during the development phase of the SWMP. To oversee the drafting of the document, the City created a Citizens Advisory Committee. The committee was responsible for providing recommendations to the City Council regarding the type,

⁸⁵ URS Corporation. *Comprehensive Clackamas County Stormwater Monitoring Plan.*, 2008. <http://westlinnoregon.gov/>

⁸⁶ Ibid.

⁸⁷ Oregon Department of Environmental Quality. *National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit & TMDL Implementation Plan.*, 2012. <http://www.clackamas.us/>

location, and prioritization of enhancement projects that would be included in the plan.⁸⁸ In total, the committee held thirteen meetings to discuss the creation of the plan. An open house was held following the initial plan development phase. During the open house the public was encouraged to express any concerns they had about the plan.⁸⁹ These concerns were then incorporated into the draft document.

Partnerships

The City's plan mentions that partnerships were established to meet three distinct objectives. First, partnerships with municipal agencies were developed to conduct regional public education efforts.⁹⁰ Second, the City partnered with the Oregon Department of Fish and Wildlife to examine the existence and type of fish communities in several streams within the city.⁹¹ The third partnership mentioned in the plan revolves around the need to provide water quality monitoring to meet NPDES requirements. To conduct water quality monitoring, the City partnered with seven other jurisdictions in the region, all of which were responsible for meeting the same NPDES requirements.⁹² The seven jurisdictions are currently working in conjunction with the USGS to address annual water quality monitoring requirements.⁹³

Case Study Comparison

The Edmonds and West Linn cases provide insight into the development and structure of a surface water management plan (see Figure 3). Both cases focused heavily on meeting NPDES program requirements, with some consideration given to meeting TMDL requirements. Wildlife and habitat protection was also mentioned in both plans in relation to the requirements of the ESA. Flooding is a concern for both communities, but only West Linn mentioned the NFIP as a reason for addressing flood issues. Furthermore, West Linn's plan includes consideration of Statewide Planning Goals 5, 6, and 7.

To fund surface water management strategies, both communities are using revenue from a monthly fee-based system. In Edmonds the monthly fee for a single family residence is approximately \$11.36, while in West Linn it is about \$5.31. West Linn also uses a one-time fee for new developments called a systems development charge, which generates \$1,056 per single family residence.⁹⁴

Specific water quality, flooding, and habitat protection strategies were mentioned in both plans. However, this project is concerned primarily with the holistic strategies in each plan. The holistic strategies used in Edmonds include public outreach and education and the integration of low impact

⁸⁸ City of West Linn Public Works Department. *West Linn Surface Water Management Plan*. P. 8-1

⁸⁹ Ibid.

⁹⁰ Ibid. P. 9-4

⁹¹ Ibid. P. 9-1

⁹² URS Corporation. *Comprehensive Clackamas County Stormwater Monitoring Plan*. P. 32, 2008.
<http://westlinnoregon.gov/>

⁹³ Ibid.

⁹⁴ City of West Linn. *Systems Development Charges (SDCs)*. http://westlinnoregon.gov/sites/default/files/fileattachments/systems_development_charges_sdcs_eff._7-1-12.pdf.

development strategies. West Linn’s plan also references low impact development, but in regards to municipal code changes. Holistic strategies in West Linn’s plan also include enriching streamside vegetation, improving stream bank stability, and integrating stormwater mitigation techniques.

A monitoring component was included in both plans, but they varied slightly in scope. Edmond’s monitoring approach concentrated heavily on NPDES monitoring requirements such as pollution sampling and developing a Quality Assurance Project Plan and Bacterial Pollution Control Plan. West Linn’s monitoring approach was more programmatic and included tracking BMPS, performing water quality sampling, reviewing and updating the city’s code, tracking public education efforts, and tracking vegetation planting activities.

The public involvement objectives of each city differed considerably. In Edmonds, public involvement centered solely on the requirements of the City’s NPDES permit. However, it is possible that other public involvement efforts were undertaken, but were not mentioned in the City’s plan. In West Linn, public involvement focused on the development of the actual plan, and not just on its individual components.

Partnerships played an important role in each community. Both Edmonds and West Linn relied on collaborative efforts with other municipalities. These municipal partnerships were formed with the primary intention of meeting NPDES requirements relating to water quality monitoring. Additionally, Edmonds relied on regional partnerships through the Puget Sound Partnerships and the Snohomish County Conservation District. West Linn relied less on regional partners and more on state partners such as the Oregon Department of Fish and Wildlife.

Figure 3: Case Study Comparison

Component	Case	
	Edmonds, Washington	West Linn, Oregon
<i>Funding</i>	<ul style="list-style-type: none"> Apply a Stormwater Utility Fee using a tiered equivalent service unit (ESU) system. 	<ul style="list-style-type: none"> Apply a Surface Water Management Fee using an ESU system. Apply a system development charge (SDC) system.
<i>Strategies</i>	↓	↓
<i>Holistic</i>	<ul style="list-style-type: none"> Perform public outreach and education. Integrate low impact development (LID) principles. 	<ul style="list-style-type: none"> Enrich streamside vegetation. Improve stream bank stability. Integrate LID principles. Acquire properties.
<i>Water Quality</i>	<ul style="list-style-type: none"> Restrict fertilizer and pesticide use. Maintain stormwater facilities. Prevent erosion from construction sites and through enhancing riparian vegetation. 	<ul style="list-style-type: none"> Plant vegetation along stream banks. Incorporate vegetated depressions/inlets.

	<ul style="list-style-type: none"> • Implement illicit discharge inspection program. 	
<i>Flood</i>	<ul style="list-style-type: none"> • Implement infiltration LIDs. • Enforce flow control measures for new development and redevelopment projects. • Replace drainage pipes. • Incorporate dry wells throughout the city. 	<ul style="list-style-type: none"> • Upgrade existing piping and culverts. • Use detention techniques. • Acquire properties in the floodplain. • Reduce overall impervious surface area.
<i>Habitat Protection</i>	<ul style="list-style-type: none"> • Stabilize, restore, and enhance riparian areas. 	<ul style="list-style-type: none"> • Retrofit existing culverts.
<i>Monitoring</i>	<ul style="list-style-type: none"> • Perform pollution sampling. • Develop Quality Assurance Project Plan. • Develop Bacteria Pollution Control Plan. 	<ul style="list-style-type: none"> • Perform water quality sampling in streams, conveyance systems, and discharge facilities. • Review and update city code. • Track public education efforts, vegetation planting activities, and BMPs.
<i>Public Involvement</i>	<ul style="list-style-type: none"> • Meet NPDES requirements. 	<ul style="list-style-type: none"> • Gather public input during plan development and refinement.
<i>Partnerships</i>	<ul style="list-style-type: none"> • Puget Sound Partnership. • Neighboring municipalities. • Snohomish Conservation District. 	<ul style="list-style-type: none"> • Neighboring municipalities. • USGS and ODFW.

Recommendations

This section provides recommendations for addressing surface water requirements and determining effective approaches to surface water management as they are described in the Edmonds and West Linn case studies. Surface water requirements, while specific to each policy, have varying degrees of overlap, thus incentivizing a holistic approach to managing surface water issues. The Edmonds and West Linn case studies provide insight into what a holistic surface water management might look like and how a similar plan might function for communities in Oregon. Supplementary literature reviews were conducted to augment the findings from the two case studies and to provide alternatives that were not mentioned in the two cases.

Addressing Regulatory Requirements

Every community in Oregon that contains a waterbody within its city limits is affected in some way by state and federal surface water regulation. For many communities, water quality standards from the TMDL program, and to a lesser degree the NPDES program, are likely to be a predominant concern. The same can be said of flood hazard standards. According to FEMA, there are 206 communities

participating in the NFIP, with only two communities not participating in the program.⁹⁵ A significant portion of the participating communities may also soon be regulated under the upcoming Endangered Species Act Biological Opinion (ESA BiOp). Given the inherent overlap between water quality, flooding, and habitat protection standards, a case can be made for addressing portions of all three surface water policy areas holistically.

For the purpose of this paper, only the major regulatory requirements of each policy will be discussed. The major water quality requirements include the development of a Water Quality Management Plan and Stormwater Management Plan for the TMDL and NPDES programs respectively. The major flooding and habitat protection requirements include a floodplain ordinance and two riparian ordinances, one through the ESA BiOp standards and one through the standards of Statewide Planning Goal 5. Many of the smaller component requirements from the TMDL and NPDES programs were excluded because they are often unique to a specific community. This is especially true of the TMDL program where pollutant parameters, such as bacteria or temperature, dictate the strategies that a community would implement.

To demonstrate how the various surface water policies overlap, I have created several maps showing the requirements of each policy and how those requirements might overlap in an average city. For the purpose of this project, the river that transects the city can be considered a class one stream. The first map (Map 1) shows the regulatory requirements of the individual policies. Figure 4 provides a brief summary of these requirements.

Figure 4: Regulatory Requirements Summary

Regulation	Requirements	Implemented Measure
Goal 5	Riparian Ordinance	75ft. Riparian Buffer
NFIP and ESA BiOp	Floodplain Ordinance & Riparian Habitat Zone	Development Restrictions & 200ft. Riparian Buffer
NPDES	Stormwater Management Plan	City-wide BMPs
TMDL	Water Quality Management Plan	City-wide BMPs & Riparian Ordinance (same as Goal 5)

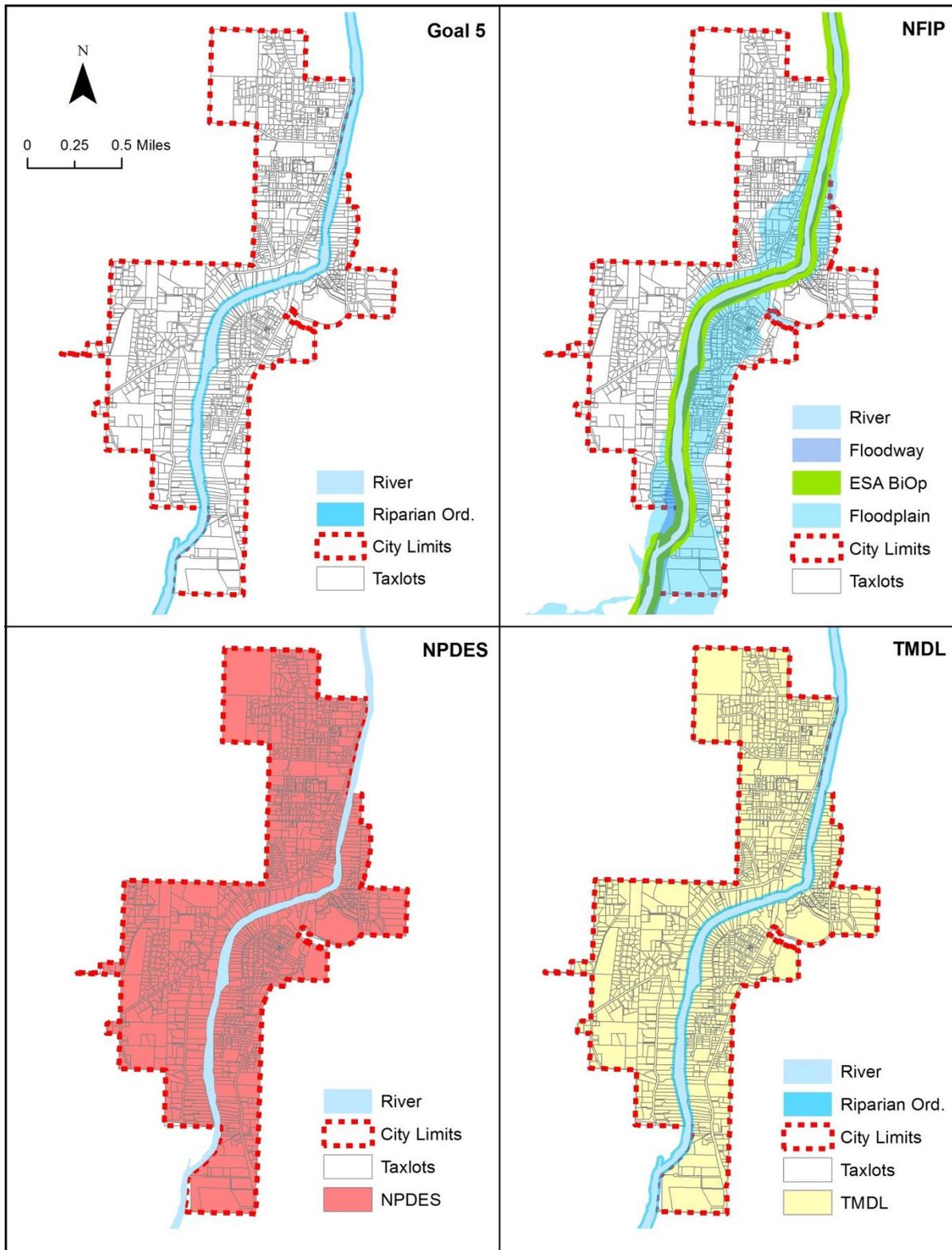
The second map (Map 2) provides a composite visual that demonstrates how all of the policy requirements overlay. It becomes clear in this second map that the requirements can be divided into two distinct categories: city-wide management and stream corridor management.

⁹⁵ Federal Emergency Management Agency, Federal Emergency Management Agency Community Status Book Report, Doc. <http://www.fema.gov/>

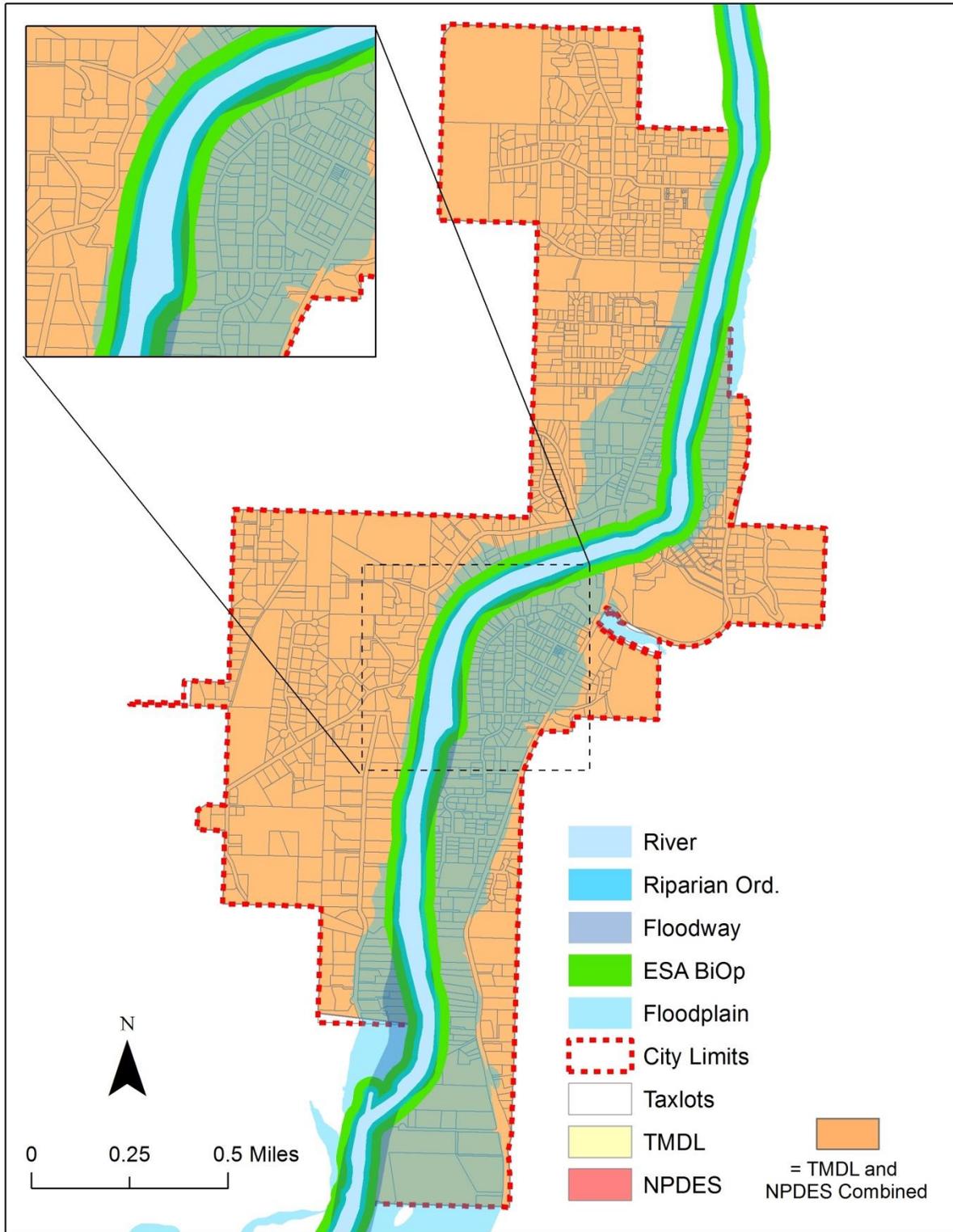
The NPDES and TMDL requirements take a broad approach to managing surface water issues – specifically water quality – by requiring the implementation of management strategies, both within and outside of the stream corridor. In essence, these policies aim to improve the quality of water from the urban conveyance system before the water reaches a natural stream. On the other hand, the requirements of the NFIP and Goal 5 are specific to the stream corridor. In the case of the two riparian ordinances, the stream corridor is protected through a narrow zone in which development is highly restricted and vegetation is preserved. The floodplain ordinance also protects the stream corridor, but with the primary objective of preventing economic loss. Nevertheless, a floodplain ordinance is usually designed to limit the construction of developments in the floodway and floodplain, and thus also has the added benefit of protecting environmental resources.

Even though the policy requirements mentioned above can be separated into two distinct categories, they are nonetheless intrinsically connected and are, in fact, complimentary. The NPDES and TMDL programs provide protection outside of the stream corridor and can be thought of as the first line of defense, and not just in terms of water quality. Best management practices and low impact development strategies can be designed throughout a city’s conveyance system to offer filtration and infiltration benefits. The second line of defense is provided through a floodplain and riparian ordinance. The implementation of these ordinances creates regulatory zones that are meant to protect the stream corridor and provide further filtration and infiltration potential, and in a potentially much more restrictive fashion. Given the complimentary nature of surface water policies, the holistic management of surface water issues to meet various regulatory objectives seems feasible. However, regulatory cohesiveness is not the only factor dictating the success of a holistic management approach. There are many other components that must work in unison for a community to effectively manage surface water issues.

Map 1: Separated Regulatory Overlay



Map 2: Combined Regulatory Overlay



Surface Water Management Approaches

This project aims to examine the potential effectiveness of managing surface water issues holistically in Oregon. Part of this examination was conducted through an analysis of current surface water requirements. However, an analysis of surface water requirements alone is not sufficient in determining the feasibility of a holistic management approach. To provide further insight, I have reviewed surface water management plans in Edmonds, Washington and West Linn, Oregon and conducted research from various literary sources. This section applies the findings from those plans, as well as findings from journal articles and government reports, to the current land use and regulatory systems in Oregon.

Funding

Funding plays an integral part in sustaining a holistic management approaches over time. Without a steady source of funding, it is unlikely that a municipality will be able to implement surface water management strategies on a regular basis, which may be necessary to meet state and federal standards. There are numerous funding streams available to municipalities including utility fees, grants, and fundraisers. However, this project will concentrate solely on the utility fee option for two reasons. First, a utility fee system is used by both of the case studies in this paper, indicating that it is likely a dependable method. Second, unlike grants and fundraisers, a utility fee provides jurisdictions with a reliable and constant source of funding, which ensures that mitigation measures can be implemented and maintained routinely.

As mentioned above in the case study analysis section, both Edmonds and West Linn use a utility fee system as a steady source of funding for their plans. There are slight variations between the two cases, but the overall premise remains the same. The Edmonds plan relies on a stormwater utility fee, which is a fee that is collected from residences and businesses to pay for stormwater mitigation activities. West Linn's plan uses a similar system, but allocates revenue more broadly to mitigate surface water issues in general. Both cities base their fee rates on equivalent service units. Equivalent service units and utility fee systems are discussed in more detail below.

Stormwater utility fees (SWUFs), and to a lesser extent, surface water fees (SWFs) are well established and highly utilized systems to fund pollution and flood issues.⁹⁶ SWUFs can be used to offset the costs of developing and maintaining a stormwater system and to meet the requirements of an NDPES permit, as shown in the case of Edmonds and West Linn. Smaller municipalities that do not have a stormwater system, but still need to meet surface water requirements such as a TMDL should consider using a SWF instead of a stormwater-based funding scheme. Due to the ease with which they can be established, and the revenue that they can generate, SWUFs and SWFs are often paramount to the success of water quality programs in communities throughout the United States. Their popularity can largely be attributed to the emergence of federal and state regulations requiring the mitigation of surface water pollution.⁹⁷ Two major benefits are gained from using SWUFs compared to other funding mechanisms: a

⁹⁶ New England Environmental Finance Center. "Stormwater Utility Fees." University of Southern Maine. Last modified May 2005. <http://efc.muskie.usm.maine.edu/>.

⁹⁷ Ibid.

stable source of revenue and an evenhanded distribution of responsibilities to the community.⁹⁸ However, implementing a SWUF or SWF program is not without its challenges. Many communities may find it difficult to garner public approval for an additional fee mechanism, particularly if they are already in place for other objectives.⁹⁹

The rate associated with a SWUF is typically established by using an equivalent service unit (ESU) measurement. ESUs are determined based on the total amount of impervious service contained on one parcel of land.¹⁰⁰ Using this technique to determine SWUF rates requires that the city determine the average impervious surface area of residential properties in the city. The average area can then be considered comparable to one ESU.¹⁰¹

Strategies

The strategy component can be considered the heart of a SWMP, with the other components providing an ancillary role. Strategies demonstrate how a local jurisdiction intends to accomplish its surface water goals. For the purpose of this project, only those strategies that address water quality, flooding, and habitat protection holistically will be discussed as possible approaches to incorporate into a holistic management plan. The approaches described below are recommendations and should not be considered the only options for managing surface water issues. A community's unique circumstance may dictate the need for alternatives.

Public Education

Public education serves an important role in creating an effective surface water management plan. In fact, public education is required for jurisdictions that have an NPDES Phase II permit,¹⁰² and the DEQ will usually incorporate a public education component into a community's TMDL Implementation Plan. FEMA recommends that communities provide educational information to the public, but it is not required as part of the NFIP program.¹⁰³ Regardless of regulatory requirements, it is in a community's best interest to educate the public about potentially contentious issues. Municipalities should clearly explain the importance of mitigating surface water issues, alternatives to traditional land use practices, and the compliance standards that the community is obligated to adhere to.

Edmonds' plan provides examples of public education approaches, specifically relating to water quality, that municipalities can pursue. The public education portion of the city's plan not only targets community members, but businesses as well. In educating the public, the city is trying to provide information about the harmfulness of specific activities, such as the use of fertilizers and pesticides.

⁹⁸Ibid. P. 2

⁹⁹Ibid. P. 2

¹⁰⁰ City of Edmonds. *Storm and Surface Water Management Comprehensive Plan*. P. 1-9., 2010

¹⁰¹ United States Environmental Protection Agency. "Funding Stormwater Programs." United States Environmental Protection Agency. Last modified January 2008. <http://water.epa.gov/>

¹⁰² United States Environmental Management Agency, Stormwater Phase II Final Rule Small MS4 Stormwater Program Overview, Doc. (2005). <http://www.epa.gov/>

¹⁰³ Association of State Floodplain Managers. *Floodplain Management Requirements A Study Guide and Desk Reference for Local Officials*. Report no. FEMA 480., 2005. <http://www.floods.org/>

Public education efforts to businesses, on the other hand, are aimed at encouraging the use of BMPs as an alternative to more traditional stormwater mitigation techniques. However, what Edmonds` plan does not describe is how public education efforts, such as the ones mentioned in the city`s plan, can be implemented effectively.

Before educating the public about surface water issues, a community must understand the most efficient means with which to disseminate information. Unfortunately, for smaller communities, methods for distributing information may be limited. Highly populated facilities or events, such as schools, churches, or communal gatherings, should be targeted as key areas for an educational campaign. Providing educational materials to local schools can be especially effective because not only are local children informed about water resource issues, but their parents will subsequently be informed as well.¹⁰⁴ A more costly, but comprehensive method for distributing educational information is through a community`s monthly newsletter. A survey conducted by Vivek Shandas regarding streamside landowner`s perception of riparian areas found that newsletters were the most preferred method for obtaining information, followed by information from friends, family, and neighbors.¹⁰⁵ Workshops and informal neighborhood meetings offer a more direct method for disseminating information and discovering community perspectives, which may be especially appropriate for discussing flood hazards.¹⁰⁶ Targeted meetings also offer a way for local officials to communicate with community leaders who may have the power to persuade other members of the community.¹⁰⁷ A local jurisdiction should also consider using modern approaches to reach community members, such as a city webpage or Facebook page.

After determining effective methods for distributing educational information, a local jurisdiction should prioritize the surface water information that is most pertinent to the community. Most communities will want to begin an educational campaign by starting with surface water basics, which includes the benefits of clean water, hazard mitigation, and habitat protection. Communities should also clearly articulate why the management of surface water issues is required and the relevant regulations involved.

Community members should be given educational information based on their location and role within the community. Streamside property owners have the largest stake in surface water management efforts and will be most affected by, for instance, flood hazard mitigation efforts. Property owners who live along a stream also have the greatest potential to improve the surface water conditions of the community. However, general property owners and developers should not be excluded from campaigns to educate the public about surface water management. Community members, and to a lesser degree developers within the community, still have a stake in surface water issues, even if they do not live

¹⁰⁴ United States Environmental Protection Agency, National Management Measures to Control Nonpoint Source Pollution from Urban Areas, Doc. (2005). P. 9-26. <http://www.epa.gov/>

¹⁰⁵ Shandas, Vivek. 2007. "An Empirical Study of Streamside Landowners' Interest in Riparian Conservation." *Journal Of The American Planning Association* 73, no. 2: 173-184. P. 177.

¹⁰⁶ United States Environmental Protection Agency, Community Culture and the Environment A Guide to Understanding a Sense of Place, Doc. (2002). P. 135. <http://www.epa.gov/>

¹⁰⁷ Ibid. P. 168

adjacent to a stream. These individuals can benefit from surface water information, as well as information about mitigating stormwater runoff, decreasing flow rates, and limiting pollutant loads.

Stream Corridor Preservation

Stream corridor preservation can be one of the most effective non-structural strategies for managing surface water issues. Stream corridors comprise the stream channel and the land directly adjacent to the stream, known as the riparian area, or more inclusively, the floodplain area. Vegetation within riparian and floodplain areas serve to filter pollutants from runoff, decrease temperature pollution through canopy cover, slow flood waters to allow for greater infiltration, and provide habitat for wildlife.¹⁰⁸ These areas can also provide economic and social benefits to a community from streamside businesses and water-related recreation. Unfortunately, stream corridors are easily susceptible to degradation from development, decreasing their beneficial qualities.¹⁰⁹ As a result, state and federal regulations have been enacted to attempt to protect stream corridors and mitigate negative impacts.

Regulation around stream corridor preservation is common practice for FEMA and the DEQ. Specifically, FEMA requires that participants in the NFIP program adopt a floodplain ordinance¹¹⁰, while the DEQ may recommend that small communities address Goal 5 and TMDL compliance by adopting a riparian ordinance. From the standpoint of FEMA, the goal of implementing a floodplain ordinance centers on building protection and not environmental protection, but it can serve both purposes. The requirements of a floodplain ordinance involve strictly limiting development in the floodway and mediating development in the 100 year floodplain. A riparian ordinance, at least in Oregon, involves establishing a standard setback from a stream in which vegetation removal and new development is prohibited. The adoption of stream corridor regulation allows a local jurisdiction to cheaply manage surface water issues, but it may not be a very popular method in the eyes of the public because an inherent degree of restriction is involved.

Municipalities that have had trouble passing environmental regulations may want to consider pursuing incentive-based or market-based methods for preserving and restoring stream corridors. A non-regulatory approach to managing stream corridors is likely to require more time and funding compared to a blanket ordinance, but it can also be more favorable politically.¹¹¹ In West Linn, for example, the city is implementing vegetation planting activities along streams. These activities are dependent on regional partnerships, such as conservation districts, and participation from streamside landowners.

Landowners have a desire to protect streams and riparian vegetation, but may not be aware of the best methods to do so, or may have resource limitations.¹¹² Before developing a non-regulatory program to protect and enhance stream corridors, municipalities should ensure that landowners are properly

¹⁰⁸ Wenger, Seth J., and Laurie Fowler. *Protecting Stream and River Corridors*.: Public Policy Research Series, <http://www.rivercenter.uga.edu/>

¹⁰⁹ Indiana Department of Transportation, Stream Corridor Protection, (Ind.). <http://www.in.gov/indot/>

¹¹⁰ Federal Emergency Management Agency, Unit 5: The NFIP Floodplain Management Requirements, Doc. (2013). <http://www.fema.gov/>

¹¹¹ Dutcher, Daniel D., James C. Finley, A. E. Johnson, and J. Luloff. "Landowner Perceptions of Protecting and Establishing Riparian Forests: A Qualitative Analysis." P. 327

¹¹² Ibid.

educated about the functions and benefits of waterways. It is also important for municipalities to develop close partnerships with regional organizations, such as soil and water conservation districts and watershed groups, which have the capability of mitigating some of the costs of restoration programs.

Examples of non-regulatory stream corridor preservation and restoration strategies include: transfer of development rights (TDRs), density transfers, conservation easements, and cost share programs. Transfers of development rights involve assigning specific areas within the city as low-density development areas, or sending areas, while other areas are considered higher-density, or receiving areas.¹¹³ Developers may then purchase rights from landowners in the sending areas and construct higher density developments in the receiving areas. Municipalities that choose to use this strategy should be very precise in how they allocate TDR designated areas to make certain that land use actions correlate with the city's comprehensive plan.¹¹⁴ Density transfers resemble TDRs, but are restricted to a single parcel of land. For example, a landowner can use a density transfer to create a high density development further inland if he agrees not to development within the stream corridor.¹¹⁵ A conservation easement represents another preservation strategy that a municipality can incentivize. A conservation easement entails the permanent preservation of a parcel of land through a land donation. Landowners may choose to pursue this strategy if they want to prevent development, reduce their property taxes, or preserve the land for family members at a reduced cost.¹¹⁶

Small municipalities may find it difficult to gain enough support for strategies that require permanent preservation, such as the ones mentioned above. An alternative to the above strategies is the creation of a cost share program. Cost share programs are typically sponsored by environmental organizations or agencies such as soil and water conservation districts and watershed associations. These organizations/agencies provide a certain percentage of funding or in-kind services to landowners who wish to undertake restoration projects on their property. An example of a cost share program in Oregon is the Conservation Reserve Enhancement Program created by the Yamhill Soil and Water Conservation District. The Conservation Reserve Enhancement Program provides 75 percent of the costs for conservation programs, as well as guidance on how to properly develop a restoration project.¹¹⁷ Collaboration with regional and state entities is vital to the success of a cost share program. Jurisdictions should ensure that these types of partnerships are available for landowners that are interested in undertaking restoration projects.

¹¹³Capitol Region Council of Governments. *Transfer of Development Rights Fact Sheet*. 2002.
<http://www.crcog.org/>

¹¹⁴Capitol Region Council of Governments. *Transfer of Development Rights Fact Sheet*.

¹¹⁵Wenger, Seth J., and Laurie Fowler. *Protecting Stream and River Corridors*.

¹¹⁶US Fish and Wildlife Service. "Conservation Easements . . . Private Rights and Public Benefits."
<http://www.fws.gov/>

¹¹⁷Yamhill County Soil and Water Conservation District. *Establishing a Riparian Forest Buffer*.
<http://www.yamhillswcd.org/>

Low Impact Development (LID) Principles

The overall objectives of LID principles are to maintain open space, decrease impervious surface, and reduce development costs.¹¹⁸ Municipal governments, developers, and community members can all directly benefit from LID measures. From a surface water protection standpoint, LID allows for improved water quality and decreased stormwater runoff. The objectives of LID can be accomplished through a coordinated comprehensive planning effort facilitated by a municipal government. For instance, in Edmonds` plan, the city created a flood objective (FP-5) to incorporate LID techniques at a site scale throughout the city. The city has accomplished this objective, in part, by partnering with the Snohomish County Conservation District to install rain gardens on private properties. However, in most cases, potential obstacles towards realizing the benefits of LID first need to be eliminated. Eliminating obstacles can be accomplished through zoning code revisions that allow for clustered development and encourage low impact development strategies.¹¹⁹ Code revision is a tactic that West Linn has incorporated into their plan, although the city`s plan does not provide a detailed example of how this might be accomplished. Examples of LID strategies that municipalities should consider using to mitigate surface water issues are mentioned below.

Cluster development is a strategy that encourages the concentration of impervious surface onto a portion of a site, with the rest of the site remaining open space. Clustering works best when combined with other development practices such as reduced lot requirements and flexible construction standards.¹²⁰ When these strategies are combined, cluster development has the potential to “reduce impervious cover by 50 percent or more”¹²¹, when compared to some traditional developments. The collective reduction of impervious surface can greatly improve water quality, with specific regard to total suspended solids, total phosphorous, and nitrates.¹²² Flooding issues are also mitigated through reduced runoff rates and higher rates of absorption from the open space surrounding cluster developments.¹²³ The strategy also offers incentives in the form of reduced infrastructure, road, and stormwater management costs.¹²⁴ Furthermore, residential properties in cluster developments tend to be valued higher compared to properties in traditional developments.¹²⁵ Municipalities should consider incentivizing cluster developments by allowing developers to build at higher densities at designated sites.

Cluster development is closely associated with flexible development standards. Municipalities should consider adopting standards that encourage the following:

¹¹⁸ Department of Environmental Conservation, *Better Site Design*, (N.Y. 2008). P. 3. <http://www.dec.ny.gov/>

¹¹⁹ *Ibid.*

¹²⁰ Delaware Department of Natural Resources and Environmental Control, *Conservation Design for Stormwater Management: A Design Approach to Reduce Stormwater Impacts from Land Development and Achieve Multiple Objectives Related to Land Use*, (Del. 1997). <http://www.dnrec.state.de.us/>

¹²¹ *Ibid.* P. 3-PB (3-20)

¹²² Department of Environmental Protection, *Pennsylvania Stormwater Best Management Practices Manual*, 363-0300-002 (Pa. 2006). <http://www.elibrary.dep.state.pa.us/dsweb>

¹²³ *Ibid.* P. 32

¹²⁴ Department of Environmental Conservation, *Better Site Design*, (N.Y. 2008). <http://www.dec.ny.gov/>

¹²⁵ *Ibid.*

- Reduced setbacks;
- Reduced road widths and length;
- Flexible turnaround designs;
- Reduce parking requirements;
- Reduced driveway widths; and,
- Flexible sidewalk requirements.

In most cities, streets and parking lots tend to be the lead contributors of overall impervious surface. Current design standards unnecessarily encourage increased imperviousness by allowing for large street and parking stall widths.¹²⁶ Likewise, the allowable widths for driveways and setbacks are excessive and merely serve to take up space and increase stormwater runoff. To further limit impervious cover, municipalities should encourage the use of shared parking for neighboring businesses with opposing peak hours.¹²⁷ Similarly, developers and homeowners can use shared driveways to limit surface cover in residential areas. Municipalities do not have to mandate the use of conservation-oriented design standards. However, they should be encouraged as a potential option in the city's code. Delaware's *Conservation Design for Stormwater Management* document is a good reference for municipalities looking for specific design standards.

Property Acquisition

West Linn's plan mentions the acquisition of properties as a way to prevent economic loss during a flood event. Typically, only those properties that are most vulnerable to flood damage are targeted as potential candidates for property acquisition. Essentially, this approach involves the purchasing of developments with a floodplain with the intent of removing or relocating them. Acquiring properties that are adjacent to waterways is typically used as a flood mitigation measure by FEMA, but it can also provide benefits towards improving water quality and wildlife habitat.¹²⁸ FEMA offers monetary assistance to communities that wish to acquire vulnerable properties through the Hazard Mitigation Grant Program.¹²⁹ The grant program is only available to communities that are part of the NFIP. Furthermore, the program is only intended to pay up to 75 percent of the buyout, with the community covering the other 25 percent and any relevant real estate transaction costs.¹³⁰ Property acquisition is a voluntary process and should be considered carefully by homeowners and municipalities alike.

Best Management Practices

Structural strategies for managing surface water issues include site-specific low impact development measures that can be categorized into three groups: filtration, infiltration, and detention/retention.

¹²⁶ AHBL. *Integrating LID into Local Codes: A Guidebook for Local Governments.*, 2011. P. 29

<http://www.psp.wa.gov/>

¹²⁷ Governor's Office of Smart Growth. *Driving Urban Environments: Smart Growth Parking Best Practices*. P. 6

<http://contextsensitivesolutions.org/>

¹²⁸ Governor's Office of Homeland Security and Emergency Preparedness, *Property Acquisition Handbook for Local Communities*, (La. 1998). <http://www.gohsep.la.gov/>

¹²⁹ "Hazard Mitigation Assistance - Property Acquisition (Buyouts)." Federal Emergency Management Agency. <http://www.fema.gov/>

¹³⁰ Ibid.

Structural BMPs are more costly than their non-structural counterparts¹³¹ and, unless heavily incorporated, do not favor a systems approach to managing surface water. It is often most effective for a community to incorporate a combination of non-structural and structural BMPs.¹³² Both FEMA¹³³ and the EPA¹³⁴ recognize the importance integrating both types of approaches for mitigating flood and water quality issues. There are many other structural BMPs that a community may choose to include in their SWMP. Information on additional BMPs may be found at the websites of FEMA and the EPA.

Infiltration

Structural infiltration systems work by slowing or absorbing stormwater runoff, thereby allowing water to permeate into the soil.¹³⁵ While infiltration strategies are primarily used to reduce stormwater runoff flow rates, some natural or vegetated infiltration systems can also provide water quality benefits.¹³⁶ Overall, natural systems have been found to be less costly than conventional flow reduction systems. Municipalities that wish to incorporate flood mitigation measure throughout a community should consider educating homeowners and developers about the cost effectiveness of natural infiltration systems. Edmonds and West Linn have incorporated infiltration approaches into their SWMPs by using techniques such as porous pavement, dry wells, and vegetated swales.

Filtration

Filtration strategies are designed for the purpose of removing pollutants from stormwater over a relatively short period of time. While the primary objective of a filtration system is to remove pollutants, they can also be designed to reduce flow rates through infiltration or detention.¹³⁷ The water quality improvement benefits that filtration systems provide make them ideal for municipalities that are trying to meet the standards of an NPDES permit. The Edmonds and West Linn case studies reference bioretention techniques, such as rain gardens as the primary means with which they address water quality through LID strategies.

Detention/Retention

Detention strategies typically involve an area or structure that is capable of retaining stormwater for an extended period of time until the water can be released to a surface water source. Retention is similar to detention, except that the collection areas are constantly inundated with water to give pollutants time to settle.¹³⁸ Both the Edmonds and West Linn case studies discuss the use of ponds as a way to retain and detain flood waters.

¹³¹ Wenger, Seth J., and Laurie Fowler. *Protecting Stream and River Corridors*

¹³² United States Environmental Protection Agency, *National Management Measures to Control Nonpoint Source Pollution from Urban Areas*.

¹³³ Department of Land Conservation and Development, *Planning for Natural Hazards: Flood TRG*

¹³⁴ Environmental Protection Agency, *Using Smart Growth Techniques as Stormwater Best Management Practices*

¹³⁵ Ibid.

¹³⁶ U.S. Department of Housing and Urban Development, *The Practice of Low Impact Development*, Doc. (2003). <http://www.huduser.org/>

¹³⁷ Department of Environmental Protection, *Volume III BMPs Technical Design Manual*, (Me. 2009). <http://www.maine.gov/dep/>

¹³⁸ "Stormwater 101: Detention and Retention Basins." Sustainable Stormwater Management. <http://sustainablestormwater.org/>

Monitoring

Jurisdictions can implement numerous strategies to address surface water issues, but unless the strategies are monitored or measured in some quantifiable way, jurisdictions cannot ensure that surface water issues are being mitigated effectively. However, state and federal agencies realize that smaller municipalities often lack the resources to perform highly technical water quality monitoring. These agencies will perform surface water measurements themselves, or rely on larger regional entities to monitor pollutants loads and flow rates within a particular watershed.

Municipalities should consider undertaking costly monitoring efforts by collaborating with neighboring municipalities, as in the case of Edmonds and West Linn. These two cities were successful in meeting their monitoring objectives because they established alliances with other jurisdictions that faced similar obligations. Unfortunately, the Edmonds and West Linn plans concentrated primarily on NPDES monitoring activities and only briefly discuss other monitoring activities.

Monitoring approaches will vary depending on a municipality's regulatory and environmental objectives. For instance, if a community is required to comply with TMDL standards for temperature pollution, they will want to monitor riparian restoration efforts. Likewise, if a community is under obligation to comply with NFIP standards, they will want to ensure that they are not permitting development within the floodplain. Measuring the effectiveness of surface water management strategies can be time intensive, which can strain under-resourced municipalities. To alleviate some of the burden inherent in surface water monitoring, municipalities should reach out to regional partners, such as watershed associations, soil and water conservation districts, and neighboring municipalities.

Public Involvement

Like any other planning process, the development of a surface water management plan requires the involvement and cooperation of the people who would be affected by the implementation of the plan. Edmonds and West Linn both incorporate a public involvement component into their plans, but they differ significantly. Municipalities in Oregon that are interested in addressing surface water issues holistically should consider the tactics from both plans. For instance, it may be beneficial for a municipality to consider holding public hearings or work sessions around the management of surface water issues. A more direct approach, such as the creation of a community advisory group should also be considered because it gives the public the opportunity to directly influence the planning process.

To supplement the information provided in the two case studies and to offer greater insight into how public involvement can be achieved, I have conducted research into the public's perception of water related issues. For example, it can be difficult to gain the interest and trust of the general public when making land use decisions, especially if they are skeptical about a topic, which is often the case with environmental issues.¹³⁹ Matters relating to water quality and habitat protection can be especially

¹³⁹ Shandas, Vivek. 2007. "An Empirical Study of Streamside Landowners' Interest in Riparian Conservation." *Journal Of The American Planning Association* 73, no. 2: 173-184. *Business Source Complete*, EBSCOhost (accessed April 4, 2013).

contentious due to the perceived burdens they place on landowners.¹⁴⁰ Topics relating to flooding, on the other hand, can gain wide community support because people living near waterways are often directly affected by flood hazards.¹⁴¹ Regardless of the issue, public involvement is an integral part of developing a SWMP.

Due to the volatile nature of surface water issues, establishing a healthy rapport with community members is crucial for municipalities. Unfortunately, trust building can often be a long and arduous process, and one that is not always completely effective.¹⁴² Understanding the perception of community members is one of the first steps in building trust and successfully addressing surface water issues. Kweit and Kweit conducted a survey based on the perceived trust of community members towards local government actions following a flood event. They observed that the most important element affecting the public's view of government decisions was based on whether the public had an opportunity to voice their opinion about how flood mitigation should be conducted. In this scenario, it made little difference in the eyes of the public whether the actions of the municipality differed from their view, so long as their voice was heard during the process.

Establishing trust with individuals to address a planning objective is closely tied to how receptive an individual is to information about that objective. The public relies on reputable networks to better inform their decisions about an issue, and it is rarely the case that local governments fill this role. For most people, informal networks, such as friends, family, and neighbors act as the primary source from which they acquire new information.¹⁴³ Universities and local or regional organizations that focus on environmental conservation also play a large role in influencing public perception around environmental issues.¹⁴⁴ Therefore, it would be beneficial for municipal governments to target these groups as potential partners in disseminating information.

The perception of an individual in regards to surface water issues is not based purely on trust. Other factors that affect perception can include the personal beliefs of an individual, as well as potential obstacles to surface water management. Personal beliefs can impact how someone views the need for conservation and the role of the local government in managing water resources. Obstacles might include limitations in time and funding to allocate to surface water management. Understanding the perceptions of the general public can aid local municipalities in disseminating information more effectively and can help to guide the development of a holistic surface water management approach.

¹⁴⁰ Dutcher, Daniel D., James C. Finley, A. E. Johnson, and J. Luloff. "Landowner Perceptions of Protecting and Establishing Riparian Forests: A Qualitative Analysis." *Society & Natural Resources* 17, no. 4 (2004): 319-32.

¹⁴¹ Kweit, Mary Grisez, and Robert W. Kweit. "Participation, Perception of Participation, and Citizen Support." *American Politics Research* 35, no. 3 (April 20, 2007): 407-25.

¹⁴² Ibid.

¹⁴³ Rosenberg, Stacy, and Richard D. Margerum. "Landowner motivations for watershed restoration: lessons from five watersheds." *Journal of Environmental Planning and Management* 51, no. 4 (July 2008): 477-96.

¹⁴⁴ Shandas, Vivek. "An Empirical Study of Streamside Landowners' Interest in Riparian Conservation."

Partnerships

Small municipalities may find it difficult to implement the strategies in a SWMP without reliable partnerships. Partnerships are available at the local, regional, state, and federal level. Local and regional partners are usually able to provide municipalities with more services than state or federal partners, but also have less funding to distribute. Services typically come in the form of funding or in-kind aid. Municipalities that need assistance developing a holistic plan should establish partnerships as early in the process as possible.

The Edmonds and West Linn cases provide a good example of the potential partnerships that are available to municipalities that are trying to address surface water issues. Both cities collaborate with neighboring municipalities for the purpose of conducting water quality sampling. Oregon municipalities may also find it beneficial to partner with neighboring municipalities to meet water quality monitoring objectives, especially in more urban areas where municipalities are closer together. Edmonds has the good fortune of being involved with the Puget Sound Partnerships, which connects the city with other regional partners. Regional partners are also available for Oregon municipalities, but they come in the form of soil and water conservation districts and watershed councils. Examples of other local, regional, and state partners in Oregon are examined below.

Local Partners

Landowners, local businesses, and developers represent some of the most basic partnerships for municipalities. Municipalities should ensure that potential local partners are aware of the surface water issues in the community and the projects that the city is trying to implement. Local partners, especially land owners and local businesses, can best serve a city through voluntary efforts by assisting with city-wide fundraising efforts and restoration projects. Developers should be considered a possible partner in implementing low impact development strategies that can help to mitigate stormwater runoff. Regardless of the potential partners involved, municipalities should make a concentrated effort to streamline the volunteer process, making it as easy as possible for those interested to get involved.

Regional Partners

For the purpose of this paper, regional partners are those entities located within the watershed or county of a municipality. In addition to the volunteer services available from local partners, regional entities can also provide municipalities with funding for strategies. Municipalities should be proactive in reaching out to potential partners. Regional partners should be made aware of a municipality's SWMP objectives, as well as the projects that may require assistance. In Oregon, regional partnerships around surface water issues are likely to be formed with watershed councils, soil and water conservation districts, and environmental groups or organizations.

The Oregon Watershed Enhancement Board (OWEB) describes watershed councils as "locally organized, voluntary, non-regulatory groups established to improve the condition of watershed in their local area."¹⁴⁵ Ideally, watershed councils are formed with the intention of representing the varying interests

¹⁴⁵ OWEB. "An Overview of Oregon Watershed Councils." Oregon Watershed Enhancement Board. <http://www.oregon.gov>

within a watershed, which not only includes jurisdictions but individual landowners as well.¹⁴⁶ Watershed councils focus heavily on public education ventures, but will also provide assistance with environmental enhancement projects.¹⁴⁷ The resources required for these endeavors come primarily from OWEB grants, and funding is often limited.¹⁴⁸ An effort should be made to include watershed councils in the development of a SWMP, so that municipalities are aware of the assistance that they are willing to provide.

In Oregon, watershed councils often partner with other regional entities, such as Soil and Water Conservation Districts (SWCDs).¹⁴⁹ In some cases, a SWCD may even oversee the monetary expenditures of a watershed council.¹⁵⁰ However, the actual purpose of SWCDs is much broader. They are tasked with establishing partnerships with the aim of conserving Oregon's natural resources, preventing flood hazards, and enriching wildlife habitat, among other objectives.¹⁵¹ SWCDs can provide many of the same opportunities that watershed councils can, including working with individual landowners on streamside projects, or municipalities on public education campaigns.¹⁵² It can be beneficial for municipalities to partner with SWCDs in hosting educational events for the public. These types of events inform the public about the need for environmental conservation, and can serve to teach the public about SWCD projects in the area.

State Partners

State agencies like the Oregon Watershed Enhancement Board (OWEB), the Department of Environmental Quality (DEQ), and the Oregon Department of Fish and Wildlife can provide municipalities with valuable direct and indirect assistance. Like the regional partners mentioned above, state agencies offer grant funding and in-kind services for restoration projects. They also offer a wealth of knowledge and information about surface water issues, which municipalities can use in developing their SWMPs. For instance, OWEB's website contains information about grant opportunities, current restoration projects, and how to effectively monitor riparian plantings.¹⁵³ The DEQ and Oregon Department of Fish and Wildlife offer similar services, but tailored towards water quality and habitat protection respectively. Municipalities should consider including state agencies in their SWMP

¹⁴⁶ Ibid.

¹⁴⁷ Lurie, Susan, and Michael Hibbard. "Community-Based Natural Resource Management: Ideals and Realities for Oregon Watershed Councils." *Society & Natural Resources: An International Journal* 21, no. 5 (May 19, 2008): 430-40. <http://www.tandfonline.com/doi/abs/10.1080/08941920801898085#tabModule>.

¹⁴⁸ Ibid.

¹⁴⁹ Bidwell, Ryan D., and Clare M. Ryan. "Collaborative Partnership Design: The Implications of Organizational Affiliation for Watershed Partnerships." *Society & Natural Resources: An International Journal* 19, no. 9 (September 22, 2006): 827-43. <http://www.tandfonline.com/doi/abs/10.1080/08941920600835585>.

¹⁵⁰ Lurie, Susan, and Michael Hibbard. "Community-Based Natural Resource Management: Ideals and Realities for Oregon Watershed Councils"

¹⁵¹ OACD. "Our Purpose." Oregon Association of Conservation Districts. <http://www.oacd.org/>

¹⁵² "About Us." Douglas Soil and Water Conservation District. <http://www.douglasswcd.org/>.

¹⁵³ OWEB. "Resources." Oregon Watershed Enhancement Board. <http://www.oregon.gov/>

development process as early as possible to take advantage of the opportunities and the knowledge that they have to offer.

Conclusion

The main compliance standards associated with surface water regulations are administered by state and federal authorities in two different ways: through the development of plans and through the implementation of ordinances. The compliance standards of the NPDES and TMDL programs involve the creation of community-specific plans that describe how a community intends to meet water quality standards. Flood and habitat protection standards, on the other hand, require that communities implement floodplain or riparian ordinances respectively. However, the flood standards of the NFIP are also augmented by the CRS, which provides an economic incentive for communities to develop flood management plans. Given the divergent surface water management requirements, it is unlikely that a community will be able to meet all of its regulatory requirements under a single plan. However, many of the approaches for adhering to surface water regulations do overlap.

The West Linn and Edmonds surface water management plans, while somewhat narrow in scope regarding regulatory compliance, describe how a multi-objective surface water management plan might function. These plans, augmented with information from government reports and peer-review journal articles, provide guidance for the development of a holistic surface water management plan for municipalities in Oregon. The process by which a municipality develops a holistic plan is dependent on the overall objectives that the municipality is trying to meet. State and federal surface water regulations are likely to have the greatest influence on the decisions of a municipality due to the necessity of compliance. However, municipalities may also choose to develop a surface water management plan to manage economic resources and protect environmental assets, among other incentives.

While communities are not required to develop a holistic plan, I believe they will find it beneficial to do so for three reasons. First, many surface water policy objectives do overlap, and a holistic plan allows communities to consolidate their efforts in meeting these objectives. Second, through the development of a holistic plan, the health and economic vitality of a community can be sustained. Third, the creation of a plan now has the benefit of preparing a community for the stern requirements of the reformed NFIP, which is likely to be a contentious issue among the public.