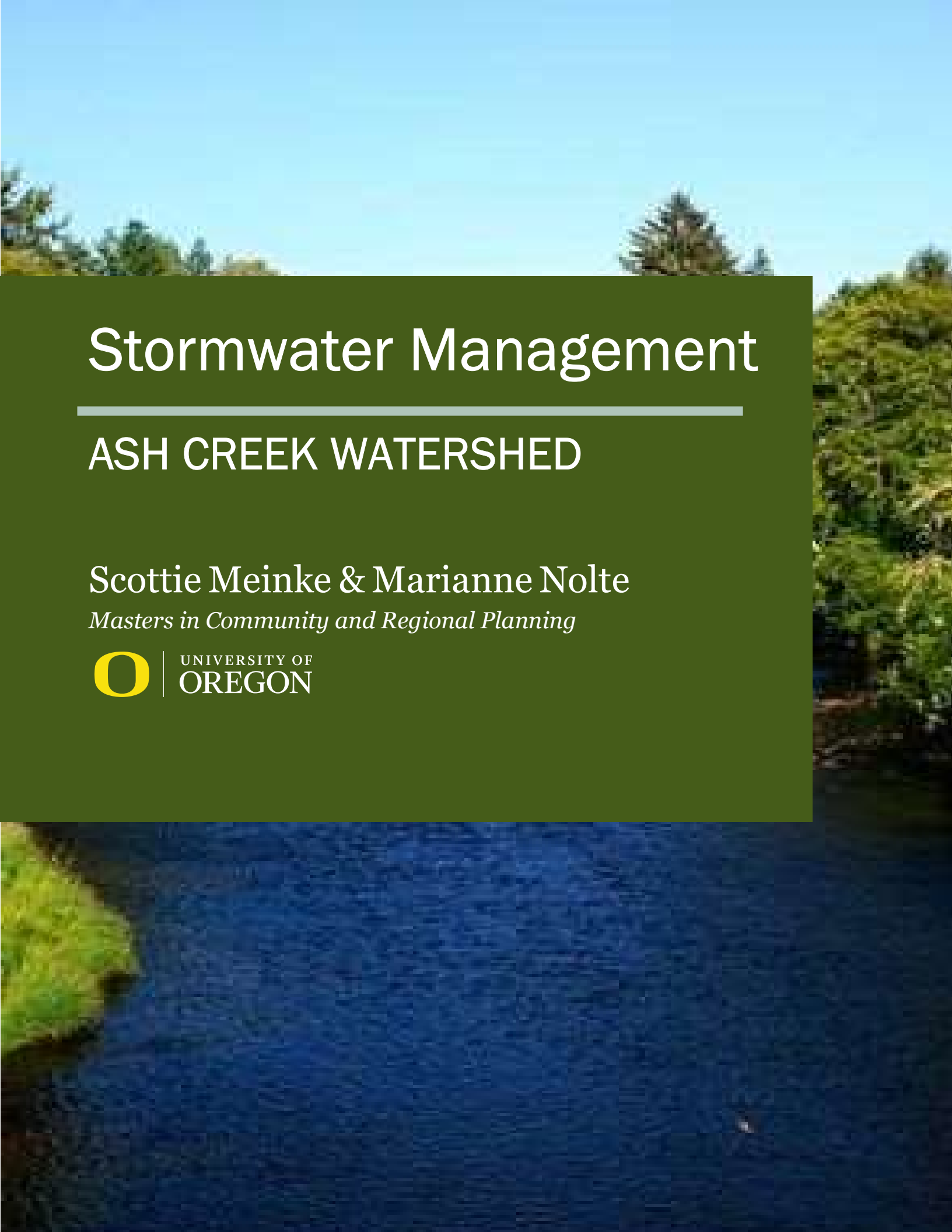

# Stormwater Management

## ASH CREEK WATERSHED

Scottie Meinke & Marianne Nolte
*Masters in Community and Regional Planning*
UNIVERSITY OF OREGON

# Acknowledgements

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Thank you all for the support, encouragement, and direction throughout this project

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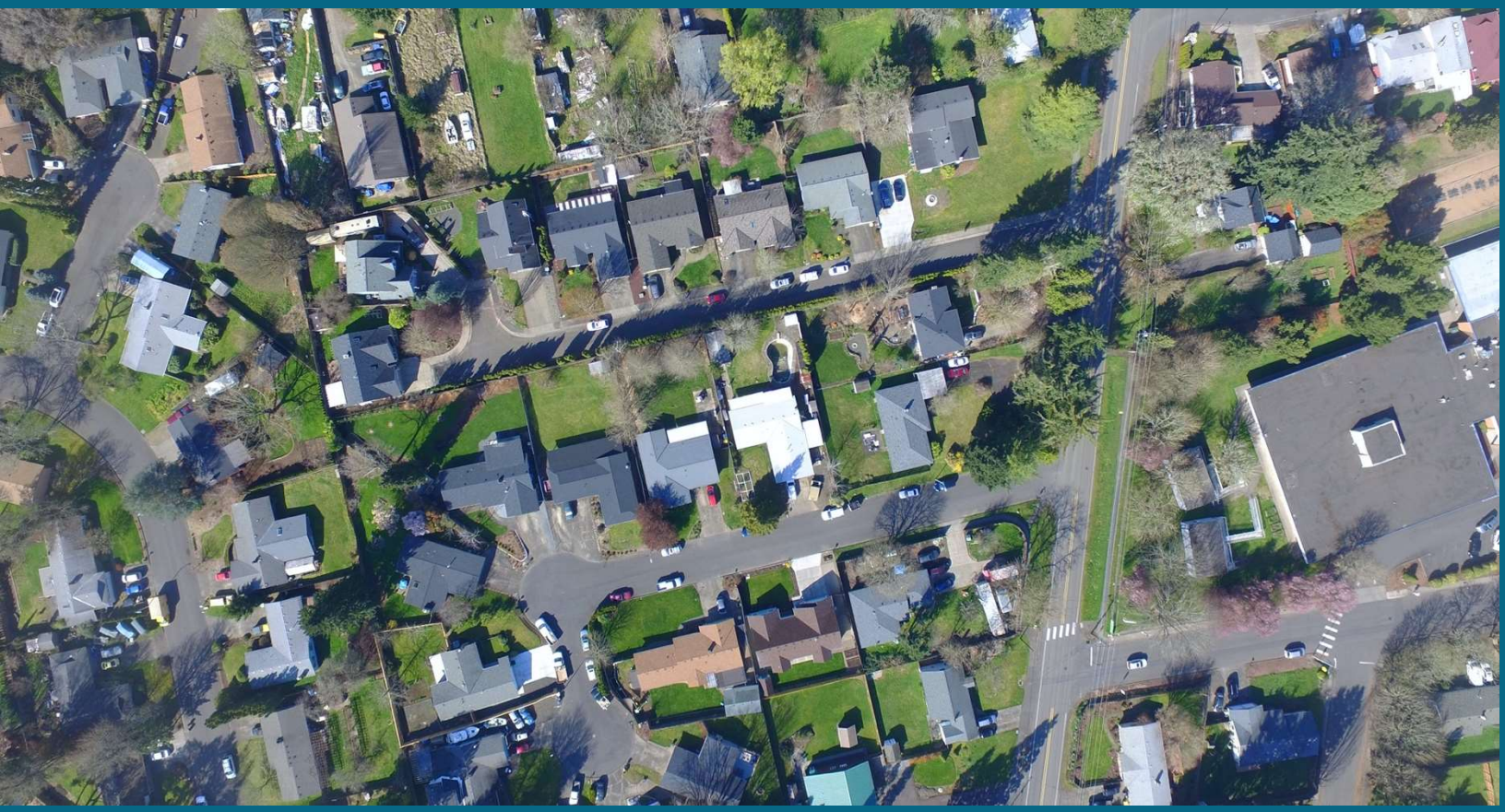


# Introduction

The Willamette Valley is known for its wet climate. In an average year, the Willamette Valley receives roughly 47 inches of precipitation, most of which falls as rain. In an undeveloped environment, plants and trees would take in the rain; soils would absorb the precipitation and re-charge groundwater; and surface water left over would flow to temporary and perennial streams. In urban environments, however, impervious surfaces such as streets, parking lots, sidewalks, driveways, and building rooftops prevent stormwater from reaching the soil or flowing into its natural channels. Instead, stormwater is collected in gutters and culverts and piped underground. The water then reaches drainage channels at a higher speed and often higher temperature than what would occur naturally. Additionally, urban stormwater often contains contaminants from motor vehicles, construction sites, and industrial sources.

Urban stormwater, then, poses several threats to natural watersheds: the higher flow rate of urban stormwater can erode streambanks and destroy natural vegetation and habitat. Higher temperatures can disrupt the chemistry of the stream and has a negative impact on salmon. And contaminants, such as sediment, bacteria, nutrients, and heavy metals lower the quality of the water.

These water quality issues are becoming more apparent in three communities in Oregon's Willamette Valley. The municipalities of Dallas, Monmouth, and Independence are located in Polk County, Oregon. These communities are small (the estimated population of Monmouth and Independence is near 10,000 people each, while Dallas is estimated at 15,000[1]), but they are increasingly serving as bedroom communities for Salem and Corvallis. As such, all three cities are experiencing rapid growth. This growth has led to several new residential development projects, which will impact the existing stormwater management system, and will also increase the amount of impervious surfaces present in each city.

This increased development has implications for the Ash Creek watershed, which portions of all three cities drain into. Ash Creek tends to flash flood, and increased surface coverage in Dallas, Monmouth, and Independence will increase that tendency. Additionally, new building developments may worsen water quality in Ash Creek by increasing pollutants and sediment created during and after construction.


**Figure 1** Stormwater
Source: City of Brighton Colorado

1 U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates

Ash Creek falls within the greater Luckiamute Watershed, which is monitored by the Luckiamute Watershed Council (LWC). "The goal of the Council is to promote broad and informed public participation in the ecologically and economically sound sustainability and improvement of natural resources and environmental quality in the Luckiamute watershed."[2] The LWC partners with local agencies, landowners and businesses within Polk County to improve water quality and habitat within the Luckiamute and Ash Creek Watersheds. Leaders of the Luckiamute Watershed Council are concerned that future development will compromise Ash Creek's water quality and streambank integrity.

This study is meant to help the LWC by identifying and analyzing stormwater management policies and practices in Dallas, Monmouth, and Independence. This study compares the stormwater management policies in each city and identifies areas of alignment amongst all three cities. This study also analyses case studies in three cities (two located in Oregon and one in Kansas) and explores the ways that other communities have implemented stormwater management practices that reduce the sediment, pollution, bacteria, and excess flow that degrades watersheds. Finally, this study makes recommendations about how the LWC might create partnerships with Dallas, Monmouth, and Independence; and prioritize strategies that better protect the watershed and improve water quality.

# Background

## The Role of the Watershed council

According to the Oregon Department of Fish and Wildlife, watershed councils are "locally organized, voluntary, non-regulatory groups established to improve the condition of natural resources in the state's watersheds." Watershed councils are meant to represent the diverse interests of any watershed basin, and are required to be balanced in their makeup.[3]

The primary purpose of a watershed council is to understand and address conditions in the entirety of the watershed. Councils plan and implement projects to protect or improve streambanks and habitat, educate the public about watershed issues, and monitor changes in the watershed. Watershed councils do not have the authority to regulate land use or water use. Instead, watershed councils work in an advisory capacity.[4] Watershed councils foster partnerships between residents and local, state, and federal agencies. Many watershed councils partner with cities and community members to identify and control urban impacts to the watershed.

Watershed councils are funded in part by the Oregon Watershed Enhancement Board (OWEB). This state agency is funded through lottery ticket sales and through the federal Pacific Coast Salmon Recovery Fund. OWEB provides individual watershed councils funding for operations, restoration projects, monitoring efforts, and outreach to landowners and local residents.[5]

2 Luckiamute Watershed Council–Luckiamute Watershed Council–Helping people help their watershed. (n.d.).
3 Oregon Department of Fish and Wildlife. Watershed Councils
4 Ibid
5 Network of Oregon Watershed Councils. About Watershed Councils.

## The Luckiamute Watershed

The Luckiamute Watershed drains 315 square miles, and contains hundreds of stream miles between all its tributaries. Within the watershed, 87% of the land is privately owned, and the predominant uses are forestry and agriculture.[6]

The Ash Creek watershed is a sub-watershed between the Rickreall Creek and Luckiamute River watersheds. (The Rickreall Watershed Council, established in 1997, acts as an advisory council for that watershed.[7]) Ash Creek is a perennial tributary to the Willamette River. Ash Creek has been altered throughout the years. Starting with development in the 1800's, residents have drained wetlands and riparian areas for agriculture, logging, homes, and cities.[8]

The Luckiamute Watershed Council is concerned about Ash Creek's ability to continue to provide floodwater storage and fish and wildlife habitat, particularly as nearby towns expand their development efforts. A 2004 study by the Wetland and Watershed Assessment Group notes that land use patterns in the watershed have changed over the last 50 years, which has reduced water quality, water storage capacity in floodplains, and has contributed to incision and instability along Ash Creek's banks.[9] To address this, Luckiamute Watershed Council has partnered with local landowners in Monmouth and Independence to control invasive weeds and improve the riparian zone along Ash Creek. The LWC also conducts stream temperature monitoring with residents of Monmouth, native planting days with a winery in Dallas, ivy weeding days in Independence, and adopt-a-road programs throughout Polk County.[10]

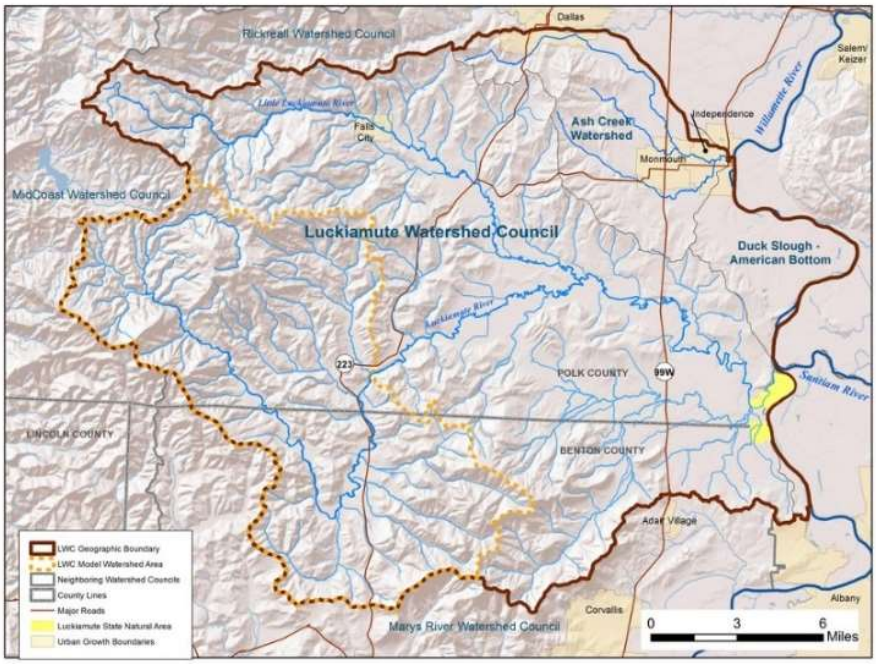



**Figure 2** Luckiamute Watershed Map

*Source: Luckiamute Watershed Council*

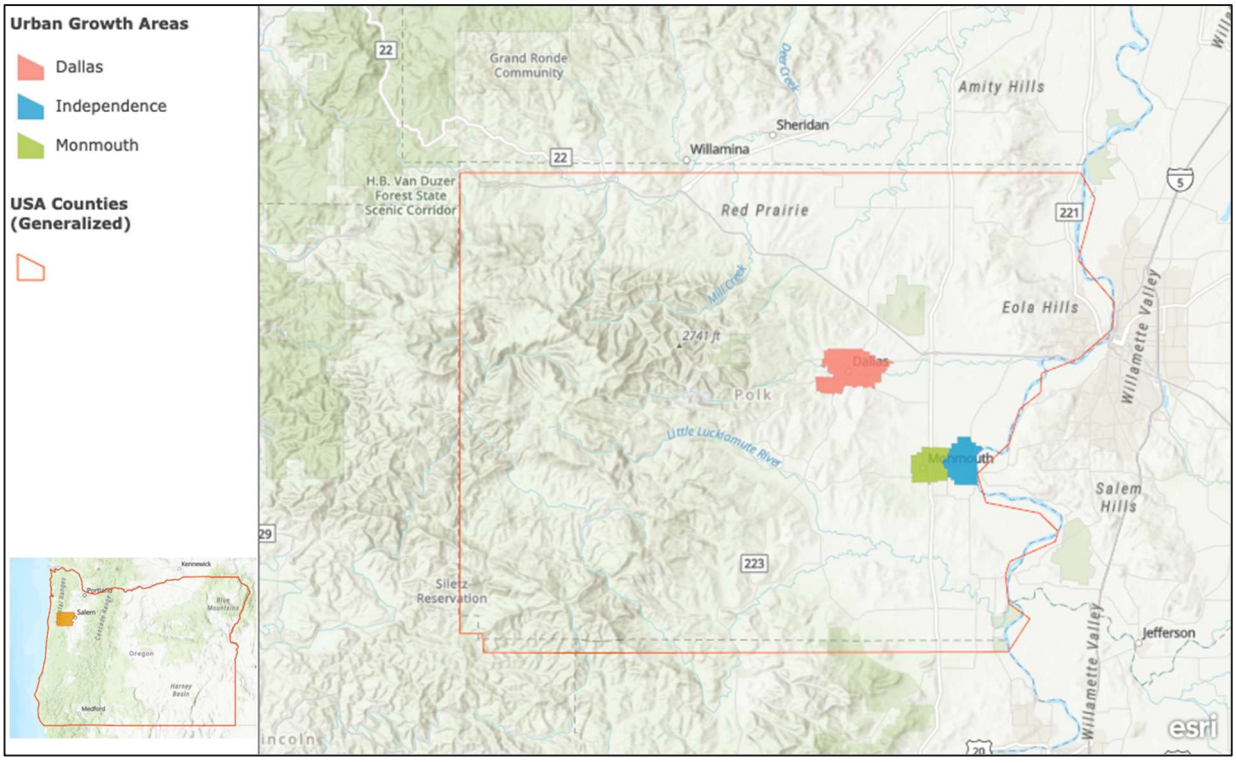
6 Luckiamute Watershed Council. About Our Watershed webpage.
7 Rickreall Watershed Council. About Us webpage
8 Ibid
9 Garono, et al. "Luckiamute / Ash Creek / American Bottom Watershed Assessment."
10 Luckiamute Watershed Council. Events Page

# Area Profile

## Polk County

Dallas, Independence, and Monmouth are located in Polk County. Polk County sits in the Willamette Valley and is part of the Salem Metropolitan Statistical Area. The City of Dallas, highlighted in red below, is the county seat.

**Figure 3:** Polk County, Oregon




Source: ArcGIS Online, ESRI

# The City of Dallas

The Town of Dallas was incorporated in 1874 and became the City of Dallas in 1901. Dallas is located 13 miles west of Salem, 50 miles east of the coast and 70 miles southwest of Portland. Dallas prides itself on its proximity to outdoor recreation, city parks and wineries, and other tourism activities. The city advertises as business friendly, offering development incentive packages, streamlined permitting and a supportive business environment.

## Relationship to Ash Creek

Rickreall Creek runs west-to-east through Dallas before draining into the Willamette River. The north fork of Ash Creek runs through the southern end of Dallas before connecting to Monmouth and draining into the Willamette River in Independence.

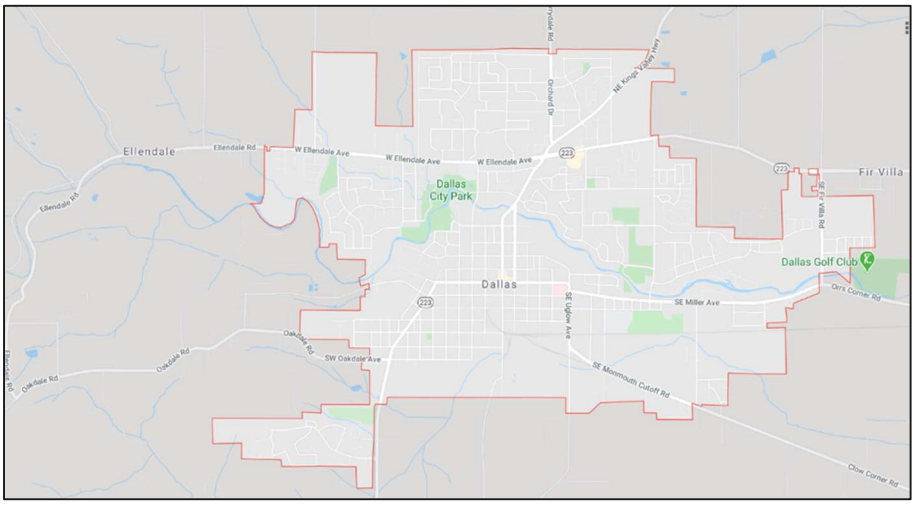



**Figure 4:** Area Map of Dallas, Oregon
Source: Google Maps

## Growth and Development

Dallas's population was 15,413 in 2017, up from 14,896 in 2015.[11] The city is expecting continued growth over the next decade or more, which will change the land use patterns in Dallas. The city completed a housing needs analysis in June of 2019 and identified 678 acres of buildable land within the Urban Growth Boundary.

These lands are located in the north part of town, along Rickreall Creek, and in the southwest part of town, along the north fork of Ash Creek. About half of this land is currently vacant, and the other half is noted as partially vacant.[12] Aerial imagery shows the land along the north fork of Ash Creek being occupied by small farms and associated buildings. Of the 678 acres of identified buildable lands, 577 acres are designated for low-density residential use.[13]

11 U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates
12 Ibid, 37
13 City of Dallas. Housing Needs Analysis. June, 2019. Page 36.

# The City of Monmouth

The City of Monmouth was incorporated in 1856 when Western Oregon University was established. The City of Monmouth is located 16 miles west of Salem, 55 Miles east of the coast and 60 miles south of Portland. Monmouth is surrounded by farmland and adjacent to Independence. Monmouth advertises excellent city services delivered by a fiscally sound, proactive government and an active and vibrant downtown with a small-town vibe.

## Relationship to Ash Creek

Monmouth contains two drainage basins: the first is located at the west end of the city and flows north to empty into the North and Middle forks of Ash Creek. The second drainage runs through the southeast quarter of the city and flows east, eventually emptying into the South Fork of Ash Creek near City of Independence.[14]

## Growth and Development

Monmouth's population was 9,983 in 2017, up from 9,869 in 2015.[15] Like Dallas, Monmouth is projecting continued growth over the next decade and beyond, but Monmouth's population is also affected by enrollment at Western Oregon University, which has dropped over the past decade.[16]

Monmouth is planning for continued growth and development, which will alter the current use of the land and its current runoff patterns. The city's housing needs analysis identified 370 acres of buildable land, 284 acres (roughly 70%) is slated for low-density residential construction.[17] The city notes that there is sufficient building capacity within the UGB to accommodate projected need.

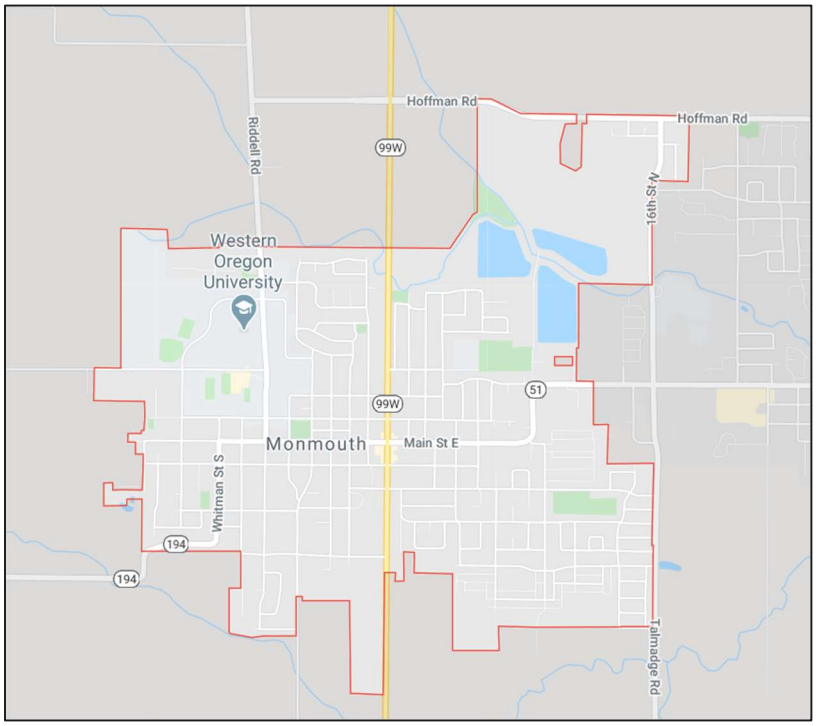



**Figure 5**: Area Map of Monmouth, Oregon
Source: Google Maps

[14] City of Monmouth. Comprehensive Plan, Public Facilities Element. 2007. Page 14
[15] U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates
[16] City of Monmouth. Housing Strategies Report. June, 2019. Pg 8
[17] City of Monmouth. Housing Needs Analysis. June, 2019. Pg 26

# The City of Independence

The City of Independence was incorporated in 1885 with the prosperity of cultivating and harvesting hops. Independence is located 12 miles west of Salem, 55 miles east of the coast and 60 miles south of Portland. The City prides itself as a small town with an extensive historic district. The city has made large efforts to return vitality into the downtown through redevelopment and historic restoration. The city advertises as solution-oriented and willing to facilitate new business development.

## Relationship to Ash Creek

Independence's downtown is located along the Willamette River. Ash creek runs west-to-east through Independence before meeting with Willamette. The south fork of Ash Creek runs through Independence's south end.


**Figure 6**: Area Map of Independence, Oregon
Source: Google Maps

## Growth and Development

Independence's population was 10,059 in 2017, up from 9,198 in 2015.[18] Like Dallas and Monmouth, Independence is planning for sustained growth over the next decade and beyond.

The city expanded its UGB in 2008, incorporating 270 acres of land in the southeast corner of town, along the south fork of Ash creek.[19] Land outside the current city limits is zoned for exclusive farm use. As the city expands, the city will annex that land and rezone for mixed residential use.[20]

[18] U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates
[19] City of Independence. Southwest Independence Concept Plan. June 2012. Pg. 8
[20] Ibid 13

# Stormwater Management

Dallas, Monmouth, and Independence are expecting continued growth over the next decade or more, which will change the land use patterns in the area. All three towns have identified buildable lands which are currently vacant or used at a low intensity. As these lands are developed, the increased impervious surface area will impact the Ash Creek watershed.

The cities need a unified plan to manage stormwater. All three cities are impacted by federal and state water quality mandates, which is one key reason to develop strong stormwater management practices. A second reason is to protect and the Ash Creek watershed itself. Dallas, Monmouth, and Independence pride themselves on offering high quality of life to their residents, with access to natural areas. Protecting and enhancing those areas should be a priority.

## Regulatory Environment

### National and State Context

Dallas, Monmouth, and Independence are impacted by federal and state requirements for water quality. The Endangered Species Act (ESA), passed in 1973, provides programs for the conservation of threatened and endangered plants and animals, and the habitats in which they are found.[21] The ESA requires federal agencies such as US Fish and Wildlife Service and the US Army Corps of Engineers, which is responsible for many dams in Oregon, to ensure that no actions taken by municipalities or individuals jeopardize any listed endangered species.

The Clean Water Act (CWA), a federal law passed in 1972, establishes the structure for regulating the discharge of pollutants into water bodies. The CWA also regulates certain quality standards for surface waters. These standards are administered by the federal Environmental Protection Agency and carried out by the individual states.[22]

Every two years, Oregon's Department of Environmental Quality (DEQ) is required to assess water quality and report to the US Environmental Protection Agency on the condition of Oregon's waters. The state must identify waters that do not meet water quality standards and where a Total Maximum Daily Load (TMDL) pollutant load limit needs to be developed. A TMDL defines the amount of a pollutant that can be present in a waterbody without causing water quality criteria to be exceeded.[23]

A Water Quality Management Plan (WQMP) is one of the twelve elements called for in the TMDL rule. The WQMP provides the framework of management strategies to attain and maintain water quality standards.[24]

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[21] United States Environmental Protection Agency. Endangered Species Act. 16 U.S.C. §1531 et seq. (1973)
[22] United States Environmental Protection Agency. Clean Water Act. 33 U.S.C. §1251 et seq. (1972).
[23] Oregon Department of Environmental Quality. Water Quality Assessment.
[24] Oregon Department of Environmental Quality. Willamette Basin TMDL, Water Quality Management Plan. September, 2006. Page 14-3.

Finally, the DEQ is responsible for issuing National Pollution Discharge Elimination System (NPDES) permits, which are mandated by the CWA. NPDES permits are required for point-source discharges of pollutants into water sources, which can include discharge from sewage treatment facilities, pulp and paper mills, other manufacturing plants, and stormwater discharge.[25]

## Local Context

Upper Willamette River Spring Chinook and Upper Willamette River Winter Steelhead are both listed under the ESA and documented in lower Ash Creek. These species do not spawn in the system but use it as refuge from the Willamette River during high flows for rearing and migration. The presence of these salmonids mandates that any development must be granted a permit for removal or fill activity near Ash Creek. Their presence also triggers additional permitting for certain activities that may disturb fish habitat, such as dewatering for a culvert or the construction of a bridge. These permits are obtained on a project-by-project basis. Last, the cities' existing TMDL plans account for water temperature in the Willamette basin, which is driven by requirements from the ESA.[26]

At the city level, Dallas, Independence, and Monmouth all have DEQ-accepted nonpoint source TMDL implementation plans for stormwater management.[27] These plans assess the extent of the problem related to stormwater, and the actions that will be taken to address it. The TMDL implementation plan also includes a timeline for implementing control measures, and must outline stormwater control measures, including pollution prevention in municipal operations, public outreach on stormwater impacts, public involvement, illicit discharge detection and elimination, construction site runoff control, and post-construction stormwater management in new development and redevelopment.[28]

Dallas and Monmouth also hold NPDES permits for their sewage treatment plants. Dallas's plant discharges into Rickreall Creek, and Monmouth's discharges into the Willamette River.[29] Both these water bodies fall below water quality standards and are regulated by the TMDL plans listed above.

## Watershed Protection

Dallas, Monmouth, and Independence are required by federal and state regulations to address water quality issues. Aside from complying with regulations, however, there are ecosystem, economic, and health reasons to protect the Ash Creek watershed.

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[25] Oregon Department of Environmental Quality. Water Quality Permits, Frequently Asked Questions.
[26] Gramlich, Nancy. Email exchange, May 20, 2020
[27] Gramlich, Nancy. Email exchange, February 2, 2020
[28] Oregon Department of Environmental Quality. Willamette Basin TMDL, Water Quality Management Plan. September, 2006. Page 14-22
[29] Oregon Department of Environmental Quality. Water Quality Permitting. Information Required for Industrial Wastewater NPDES Permit Readiness Review.

Healthy watersheds filter pollutants, help retain sediment, and promote nutrient cycling. Watersheds with natural soil resources and intact vegetation may help offset greenhouse gas emissions by sequestering carbon. This makes the area more resilient to climate change and extreme weather events. Further, intact vegetation reduces the risk for invasive species to colonize the watershed.[30]

The cities may also realize economic benefits from protecting the Ash Creek watershed. Natural landscapes can lower the cost to filter and treat drinking water, and, by acting as natural floodplains, can lower the amount (and therefore cost) of stormwater pipes and channels. Additionally, healthy watersheds can attract visitors to the area, and can increase property values around natural areas.[31]

Finally, thriving watersheds have health impacts on surrounding communities. Green spaces provide areas for recreation–fishing, walking, and biking–and areas for residents and visitors to relax, picnic, and watch birds and wildlife. These benefits can lower the risk of illness, and boost the quality of life in Dallas, Monmouth, and Independence.

## Plans and Policies

The cities each have comprehensive plans, stormwater management plans, and development codes that address stormwater management and the growth of the cities. Those plans, as will be discussed in detail later, largely rely on piped infrastructure to carry stormwater away from city surfaces and into drainages. As the cities grow, the conventional stormwater systems will have an increasingly negative impact on Ash Creek. The cities can invest now in policies to encourage smaller, site-based stormwater management techniques. These will allow cities to address water quality, and better protect the watershed.

[30] United States Environmental Protection Agency. Healthy Watersheds Protection, Benefits of Healthy Watersheds.
[31] Ibid

# Chapter II

# Literature Review

Throughout the last century, the world has seen a drastic increase in urbanization and the effect on water quality and watershed health due to a high volume of development, increased impervious surfaces, and damaging management practices. Too often, cities have a difficult time balancing the environmental impacts with new growth and development as residents, employment, and investment opportunities expand.[32] Although growth can fuel the enhancement of vibrant communities, the substantial increase in development has altered stream-channel geomorphology, increased pollutant exports, harmed riparian communities, and decreased biological diversity within most watersheds in the United States.[33] Impervious surfaces and stormwater pipelines are two of the major infrastructure developments that affect water quality within streams and rivers.[34] These management practices and infrastructure create quick-flow conveyor systems in which pollutants are routed directly to streams and waterways via runoff. Recognizing the issues with longstanding stormwater management, many cities have updated their best management practices to use Low Impact Development (also referred to as Green Infrastructure (GI)) in reducing negative impacts on the environment.

## Conventional Stormwater Management

The United States is projected to have 400 million people by 2040, adding to the demand for development within local communities.[35] This development, however, will make it difficult for communities to protect natural resources. Development affects the watershed by increasing impervious surfaces and compacting soils. Build infrastructure increases water runoff from developed land while decreasing water infiltration.[36] Due to the lack of infiltration and the increased risk of flooding, conventional management practices integrate pipeline networks to collect and remove water from the developed areas. This management practice was coined as stormwater management, but over time has proven to have negative impacts to watershed health.

The term *stormwater* was initially defined by the Clean Water Act in 1972 as "stormwater runoff, snowmelt runoff, and surface runoff and drainage."[37] Conventional stormwater management systems are highly engineered pipeline networks and storm drainage systems that reduce flooding hazards through control and treatment.[38] This streamlined system provides an effective conveyance for stormwater, but also delivers pollutants directly to water networks.[39] In addition to increased pollutants, stormwater systems can increase sediment loads as well as warm water temperatures from roofs, streets, parking lots and other developed surfaces.[40] Increased water temperature and high levels of

[32] Environmental Protection Agency, Water Quality Scorecard: Incorporating Green Infrastructure Practices
[33] Hopkins et. al, Comparison of Sediment and Nutrient Export and Runoff characteristics from Watersheds with Centralized Versus Distributed Stormwater Management, Page 287
[34] Ibid, Page 285
[35] United States Environmental Protection Agency, Water Quality Scorecard, Page 1
[36] Ibid, Page 2
[37] Franzetti Law Firm P.C. Background and History of Stormwater Regulations, Page, 1
[38] United States Environmental Protection Agency, Reducing Stormwater Costs through LID, Page 2
[39] Franzetti Law Firm P.C. Background and History of Stormwater Regulations, Page 1
[40] United States Environmental Protection Agency, Protecting Water Quality from Urban Runoff, Page 1

pollutants can harm fish and wildlife populations, create downstream dead zones, impair native vegetation, degrade drinking water, and adversely affect recreational sites.[41] Further, conventional stormwater systems allow water to move very quickly. When this water reaches waterways, it can erode streambanks, leading to structural damage of the stream and developed areas around it.[42] Recognizing these problems, many cities are integrating new and improved systems to address environmental effects of land development and stormwater management.

# Low impact Development

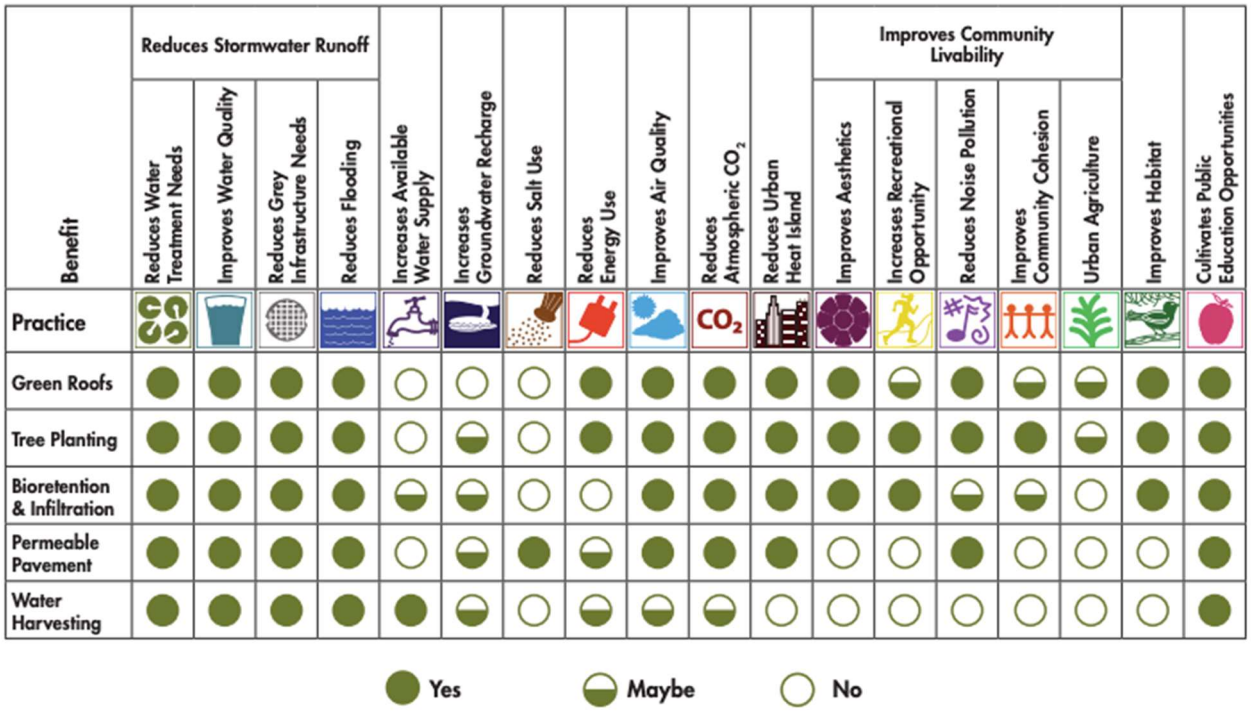
Green Infrastructure is a comprehensive network of decentralized stormwater management practices that reduces runoff and improve waterway health.[43] In addition to improved watershed health, GI can improve community livability, decrease carbon emissions, reduce energy consumption, and minimize long term costs. Low Impact Development is a type of GI that serves a similar purpose but centers on imitating natural systems within developed land. Over time, LID has become synonymous with GI and the two terms have become increasingly more difficult to differentiate. Due to this, we will be using LID as a blanket term to define all infrastructure practices within GI and LID. Examples of LID include bioretention ponds, permeable pavement, water harvesting, rain gardens, and vegetated surfaces.

## Environmental Benefits of LID

LID is a strategy some cities implement to reduce stormwater runoff and pollutant transport by managing runoff as close to the source as possible through multiple small-scale practices.[44] LID principles are designed to mimic natural systems and processes of infiltration, evapotranspiration, and harvesting.[45] These practices reduce the amount of runoff created during a storm event by holding water onsite and slowing water transport, thus alleviating downstream erosion and stream habitat damage. While runoff is held and transport is slowed, LID provides a system to filter pollutants through vegetation and soils which ultimately reduces pollutant loads into river networks.[46]

[41] Ibid, Page 2
[42] Alliance for the Chesapeake Bay. Erosion Informational Page.
[43] Center for Neighborhood Technology, The Value of Green Infrastructure, Page 7
[44] United States Environmental Protection Agency, Reducing Stormwater Costs through LID, Page 2
[45] United States Environmental Protection Agency, Polluted Runoff: Nonpoint Source Pollution
[46] United States Environmental Protection Agency, Effectiveness of LID, Page 1

**Figure 7:** Benefits of LID Practices




Source: *The Value of Green Infrastructure*, Page 3

Common LID designs include porous pavement, bio-retention cells and green roofs. These designs achieve the goals of reducing pollution and limiting the volume of stormwater that winds up in the watershed.[47]

Impervious pavement is a major source for runoff as it directly prevents water infiltration. Implementing porous pavement allows storm water to slowly seep into the soil beneath the pavement and recharge ground water. This practice reduces the need for water treatment and improves downstream water quality while reducing urban heat islands and providing an opportunity for public education.

Bio-retention cells are shallow, vegetated depressions in the ground meant to collect rainwater and allow runoff to slowly filter into the soil. Bioretention cells are constructed with mostly natural materials and mimic ponds and wetlands. This provides benefits of increased infiltration, reduction of flooding, air quality improvements, and recreational opportunities within natural habitats.

Green roofs are rooftops planted with a vegetative layer and soil medium. Green roofs are meant to absorb, filter, and slow rainwater before it hits the city's stormwater system. Implementing a green roof is most often a private landowner's responsibility; however, green roofs can have a high amount of community livability benefits.

[47] Yang and Chui, Integrated Hydro-Environmental Impact Assessment and Alternative Selection of Low Impact Development Practices in Small Urban Catchments, Page 329

The Oriental Sun Community, outside Beijing, utilized the LID disconnection strategies in which they disconnected roof downspouts, roadways, and impervious areas from the stormwater conveyer system.[48] The study determined the larger the infrastructure or the more widespread LID strategies were applied, the more impactful the LID system was at improving downstream water quality.[49] Effectiveness of LID was also directly correlated to system goals and motivations.

**Figure 8:** Green Infrastructure Types and Goals

| Infiltration | Transportation | Natural Systems | Stormwater Reuse | Buildings | Other |
|---|---|---|---|---|---|
| **Permeable Pavements** | Street bumpouts | Increased Tree Canopy | Cisterns | Green Roofs | Non-Structural Measures (Policy) |
| **Infiltration Planters** | Permeable Pavements | Constructed Wetlands | Rainwater Harvesting | Blue roofs | Solar Panels |
| **Bioretention Areas** | Traffic Calming Bioretention | Restoration of Wetlands | | Cisterns | |
| **Bioswales/ Biostrips** | | Creek daylighting | | | |
| **Vegetated Detention Strips** | | Abandoned lot Greening | | | |

Source: The Green Experiment: Cities, Green Stormwater Infrastructure, and Sustainability, Page 12

## Financial Benefits of LID

In addition to providing water quality improvements, LID systems may be more affordable than conventional infrastructure improvements. The United States EPA, in its report on reducing stormwater costs through LID, highlights several communities that have added LID infrastructure to municipal rights-of-way, subdivisions, parking lots, and commercial developments. The report displays the cost of LID improvements compared to conventional systems in twelve communities across the United States and Canada. Of those twelve, only one community's LID system was more expensive than conventional stormwater systems. LID systems in the other eleven communities were anywhere from 15% to 80% less expensive than greywater systems.[50]

The tables below illustrate these cost savings. Figure 8 outlines the cost comparison of a municipal project in Seattle, Washington, which used bioswales and street trees in place of curbs and gutters on a 660-foot-long city block. The total cost savings of using LID was $217,000.[51]

[48] Che et. al, Integral Stormwater Management Master Plan and Design in an Ecological Community, Page 1821
[49] Luan et. al, Evaluating Green Stormwater Infrastructure Strategies Efficiencies in a Rapidly Urbanizing Catchment using SWMM-Based Topics, Page 689
[50] United States Environmental Protection Agency, Reducing Stormwater Costs through LID, Page 12
[51] Ibid, 13

**Figure 9:** LID/Conventional Cost Comparison, Seattle

| Item | Conventional Development Cost | SEA Street Cost | Cost Savings* | Percent Savings* | Percent Total Savings* |
|---|---|---|---|---|---|
| Site Preparation | $ 65,084 | $ 88,173 | -$ 23,089 | - 35% | -11% |
| Stormwater Management | $ 372,988 | $ 264,212 | $108,776 | 29% | 50% |
| Site Paving and Sidewalks | $ 287,646 | $ 147,368 | $140,278 | 49% | 65% |
| Landscaping | $ 78,729 | $ 113,034 | -$ 34,305 | - 44% | -16% |
| Misc. (mobilization, etc.) | $ 64,356 | $ 38,761 | $ 25,595 | 40% | 12% |
| Total | $ 868,803 | $ 651,548 | $217,255 | --- | --- |

* Negative values denote increased cost for the LID design over conventional development

Source: Reducing Stormwater Costs Through Low Impact Development, Page 13

Figure 9 compares the costs for a residential subdivision in Auburn Hills, Wisconsin. The subdivision was designed with LID principles including open green space, bioswales and bioretention. The overall savings to use LID was $761,000.[52]

**Figure 10:** LID/Conventional Cost Comparison, Auburn Hills

| Item | Conventional Development Cost | Auburn Hills LID Cost | Cost Savings* | Percent Savings* | Percent Total Savings* |
|---|---|---|---|---|---|
| Site Preparation | $ 699,250 | $ 533,250 | $166,000 | 24% | 22% |
| Stormwater Management | $ 664,276 | $ 241,497 | $422,779 | 64% | 56% |
| Site Paving and Sidewalks | $ 771,859 | $ 584,242 | $187,617 | 24% | 25% |
| Landscaping | $ 225,000 | $ 240,000 | -$ 15,00 | - 7% | -2% |
| Total | $ 2,360,385 | $ 1,598,989 | $761,396 | --- | --- |

Source: Reducing Stormwater Costs Through Low Impact Development, Page 14

The EPA's report notes that LID infrastructure may be more expensive during the initial phases of a project due to increased site preparation and/or the cost of specific landscape plants. LID practices saved money during the construction phase of a project, due to reduced costs for site grading and preparation, site paving, and landscaping. In most cases, LID project costs were lower than the conventional stormwater systems.

[52] Ibid, 14

## Community Benefits of LID

In addition to water quality improvements, LID added value for communities. Design standards can improve aesthetics for communities and neighborhoods by implementing natural features into landscapes. When integrated, these features have the potential to create multiuse recreational and educational opportunities. Residential lots can become more desirable due to proximity to open space and these multiuse facilities.[53]

A major benefit for cities and municipalities to integrate LID principles into their system is the long-term reduction of cost and management. Conventional approaches utilize highly engineered hard surface infrastructure such as gutters, piping, and detention ponds that typically use large amount of materials to create and special machinery to maintain.[54] Implementing LID, however, has the potential to reduce costs through the integration of natural features and processes onto the landscape. Long term system infrastructure costs can be reduced through the reduction of curbs, gutters and impervious surfaces, thus reducing regular paving costs and maintenance.[55]

Another factor when considering costs between LID and conventional stormwater infrastructure is land requirements. Conventional stormwater management practices require additional land to house detention facilitates and pipe networks, increasing costs to the municipality. LID, however, can be incorporated at various scales into the landscaping of yards, along roadsides, adjacent to parking lots, and within open spaces.[56]

## Barriers to Low Impact Development

Although many municipalities recognize the importance and effectiveness of LID principles, there are barriers to implementing the infrastructure within local jurisdictions. Departmental specialization, existing regulations, and administrative complexities are some of the major restrictions to implementing LID strategies.[57] In addition, financial limitations throughout all levels of government are major challenges for cities to initially integrate LID strategies. Federal and state agencies rarely fund LID infrastructure, while local fee collection and tax leverage tend to be insufficient to pay for an integrated and comprehensive LID system.[58]

Community-wide ignorance and misunderstandings are common barriers to gain community buy-in for integrating a LID management system. For resident-specific adoption of LID, a study in Vermont determined most respondents felt there was “no need” for implementing LID on their properties. This “no need” response is correlated to perceptions within rural communities. However, the study argues that rural communities appear to experience more runoff-related issues such as flooding and erosion.[59]

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[53] United States Environmental Protection Agency, Costs of Low Impact Development, Page 2
[54] United States Environmental Protection Agency, Reducing Stormwater Costs through LID, Page 9
[55] Ibid
[56] United States Environmental Protection Agency, Reducing Stormwater Costs through LID, Page 10
[57] Berg, A Case Study of Form-Based Solutions for Watershed Protection, Page 448
[58] Keeley et al, Perspectives on the Use of Green Infrastructure for Stormwater Management in Cleveland and Milwaukee, Page 1099
[59] Coleman et. al, From the Household to the Watershed, Page 202

Finally, jurisdictional boundaries can be problematic when implementing LID strategies. Boundaries can help inform management practices, yet they also create administrative restrictions for LID. Relationships between local governments and residents can differ throughout communities within a watershed, making it difficult to create consistency.[60] Because LID is a comprehensive approach, misalignment across a municipality's vision, goals, and strategies can act as a barrier to initiating and implementing a LID approach.

# Integrating Best Management Practices

Municipal and residential investment in LID principles reflect community values through comprehensive alignment of codes, behaviors and collaboration within a community.[61] To be effective in implementing LID a city may invest time and resources toward collaborative planning initiatives and leadership, widespread code review, and community support.

## Leadership and Collaborative Planning

Collaborative planning is defined as "inclusive decision processes that bring together multiple stakeholders, help build networks and trust, and emphasize consensus decision procedures and voluntary compliance."[62] As cities continue to recognize the interdependence within and between jurisdictions, collaboration helps address impediments including institutional structures, regulatory inflexibility, departmental specialization, and administrative complexities.[63] Alignment between these entities is integral to the success of envisioning, designing, implementing, and advertising LID principles. A collaborative approach to stormwater management ensures that various entities are sharing resources–time, funding, and expertise–which lowers actual and administrative costs. A collaborative approach can protect natural resources: if municipalities have agreed with one another to protect water quality, then their individual actions and projects will likely be in better alignment with that goal. Finally, a collaborative approach can make stormwater a public and accessible topic. If local governments lead their communities by exposing stormwater systems and creating LID infrastructure on public land and rights of way, community members see and learn these techniques and are more likely to adopt and support them.[64]

## Code Review

Even with the best intentions to protect watershed health and improve water quality, little can be implemented until a code review occurs. Often existing codes can work against stormwater best management practices and create barriers to implementation.[65] Municipalities have the ability to change codes and regulations to reflect and require effective stormwater regulations and site design

[60] Ibid, Page 204
[61] Center for Neighborhood Technology, The Value of Green Infrastructure, Page 7
[62] Ananda and Proctor, Collaborative Approaches to Water Management and Planning: An Institutional Perspective, Page 97
[63] Ibid, Page 105 & Berg, A Case Study of Form-Based Solutions for Watershed Protection, Page 448
[64] United States Environmental Protection Agency, Enhancing Sustainable Communities with Green Infrastructure, Page 23
[65] United States Environmental Protection Agency, City of Neosho, Missouri, Page 17

standards.[66] These regulations and codes are the most direct means to achieving effective stormwater management goals.

Municipal codes apply to large land use practices and can determine street design standards, zoning ordinances, and parking requirements. These codes are especially important to stormwater management as they often address impervious and paved surfaces.[67] For example, parking lots are known to have primary effects on watershed health through impervious surface cover, but they also can also have secondary effects as more parking is required. Oversupplying parking can discourage walking and increase vehicle transport which releases excess carbon, oils, and fluids onto pavement surfaces. These discharges then get transported to waterways and streams.[68] Executing an effective code review is not just encouraging stormwater infrastructure, but also diving into individual regulations and understanding the full effects on the environment and watershed health.

## Community Values

Community leaders and local government officials need to understand the values and identities of the communities they serve. Because conventional stormwater management has been subsurface and out of public eye, it is rare to see community members having an invested interest or a strong identity toward stormwater management. However, community members often value livability and community needs such as recreation, conservation, and watershed health. Natural features in the landscape such as native vegetation, forests, and wetlands can create and shape a regional identity that helps foster resources, tourism, and local economies. Community leaders must simultaneously educate and incorporate LID principles in order for community members to understand the connection between stormwater, their local environmental features, and community development.[69] Increasing knowledge will help integrate stormwater infrastructure above ground while producing a multiuse environment. Art, recreation, and placemaking increase visibility and community support, while ultimately reinforcing environmental protection.[70]

[66] United States Environmental Protection Agency, Enhancing Sustainable Communities with Green Infrastructure, Page 40
[67] Ibid, Page 41
[68] Ibid
[69] United States Environmental Protection Agency, Enhancing Sustainable Communities with Green Infrastructure, Page 41
[70] Ibid, Page 19

## Literature Review Synthesis

As watersheds continue to degrade due to increased development, there is a need for comprehensive implementation of LID principles. These techniques have proven effective at recharging soil layers, slowing the flow of water into creeks, and filtering pollutants from stormwater before it reaches the watershed. LID can be adapted to suit various location types, and several techniques can be linked together in order to provide the most benefit with minimal space requirements.

Environmental benefits result with the transition to LID, along with social benefits as cities preserve and maintain natural spaces. In order for these benefits to be realized, communities must view and plan for their impacts to the watershed. Collaborative planning, although time intensive, is a tool to help communities work across jurisdictional boundaries and create plans that protect their natural resources.

Most LID-based studies have focused on large municipalities: those with a population of over 500,000. Moreover, many of these studies have been conducted internationally. While these studies provide a useful look at whether LID is effective at managing stormwater, the regulatory environment is very different than it is in the United States, and in Oregon in particular. Many reports used case studies within urbanized locations on the east coast of the US and in China. There is a gap in knowledge for rural impacts on water quality and watershed management. A common link within the articles reviewed was that each location has opportunities and challenges to implementing effective stormwater management systems. In terms of the Ash Creek watershed, determining the opportunities and constraints will be integral in recommending best practices within this specific study area. Our hope is that our research will contribute to the body of knowledge focused on small, growing, and largely rural environments.

# Research Questions

What are the existing stormwater management policies and practices within the cities of the Ash Creek Watershed?

How do the stormwater management policies and practices differ and where do they align across jurisdictions?

What policies and practices can be adopted to protect the Ash Creek Watershed and allow cities to manage stormwater effectively and affordably?

# CHAPTER III

# Research Methods

To complete the research, we conducted two sets of interviews, examined case studies, and performed a plan analysis. This information was then synthesized into key findings and future implications.

## Interviews

The research team interviewed public works and planning staff in Dallas, Monmouth, and Independence. These interviews occurred twice throughout the project. The first interviews took place at the beginning of the project in February of 2020. These conversations were meant to provide project direction based on stormwater management priorities, jurisdictional responsibilities, and topics of interest specific to each city. Before the first interviews, the research team conducted a preliminary analysis of the goals and objectives of each city's comprehensive plans, stormwater master plans (if available), and development codes. Reading through each plan helped to inform and develop the interview structure. The first interviews helped the research team ensure that the project and its findings would be relevant to the needs of the communities. See Appendix I for the full set of interview questions.

The second interviews took place at the end of the project in May of 2020, once a full plan analysis and case study analysis were complete. This round of interviews built on findings from the plan analysis and the case studies, which suggested that cities wishing to create plans to better protect watershed health and water quality often formed partnerships across agencies in the community and worked towards goal alignment. For the second interviews, the research team spoke with the same people from the first round. The research team asked for opinions about existing relationships with various community entities and asked for participants' opinions about various goals related to watershed health. Appendix III contains the full list of second interview questions.

## Case Studies

Case studies provided expanded information and strategies about stormwater improvements and identified best practices to update city and development codes. This portion of the study took place between February and April, 2020. To identify relevant case studies, the research team used information gathered from the first interviews of staff in Dallas, Monmouth, and Independence, as well as the input from leaders of the Luckiamute Watershed Council. The LWC expressed interest in learning about communities that have invested in stormwater management systems that slow water flows, reduce pollutants, and protect streambank integrity. Staff from all three cities expressed an interest in smaller, local LID strategies; larger scale regional bioretention areas; managing flooding; and affordable options that are simple to maintain.

For our case studies, then, we identified three communities that have updated their stormwater management plans and systems to better protect their watersheds, manage flooding, and limit costs.

- Stayton, Oregon was recommended by staff from the Luckiamute Watershed Council as well as several city staff members during interviews. Stayton's plan is unique because it focuses on the design of LID strategies and specifically addresses operations and maintenance costs.
- Wilsonville, Oregon focuses on LID strategies and makes particular note of the city's role in investing in LID infrastructure.
- Lenexa, Kansas has focused on regional bioretention projects, as well as on strong local control over stormwater management.

In addition to reading the stormwater management plans and other relevant documents for each city, the research team conducted email and telephone interviews with Lenexa's Stormwater Engineer; Wilsonville's Natural Resource Director; and Stayton's Director of Public Works.

# Document Analysis

The purpose of document analysis was to review and analyze relevant city documents for similarities and differences. This provided an understanding of the opportunities and limitations within Dallas, Monmouth and Independence. This portion of the research was conducted between January 2020 and March 2020 and occurred simultaneously to the first round of interviews. The identified relevant plans include the following:

| Independence, OR | Dallas, OR | Monmouth, OR |
|---|---|---|
| • Independence Comprehensive Plan | • Dallas Comprehensive Plan | • Comprehensive Plan Goals and Policies |
| • 2005 Stormwater Master Plan 1 & 2 | • 2016 Stormwater Master Plan | • 1984 Title IX Zoning and Development: Monmouth Zoning Ordinance |
| • Independence Development Code | • 2019 Dallas Development Code | |

To identify the stormwater management strategies present in each city, the research team first read through each city's Comprehensive Plan and noted the sections that mentioned stormwater or stormwater management practices. The research team then created tables organizing these sections into broad subject categories. For instance, we noted that each city's plan mentioned stormwater in its sections on Economic Development, Natural Resources, Public Facilities, etc. In some cases, all three cities' plans noted the same topics; in other cases, only one city mentioned a specific topic.

This process was repeated for Stormwater Master Plans for Independence and Dallas (Monmouth does not yet have a stormwater master plan), and again for the Development Codes in all three cities. Appendix II contains the tables for each plan, sorted by subject area.

Once each plan was sorted by subject area, the research team read through each code in order to assess whether the cities' plans and codes agreed with one another. The document analysis chapter discusses each plan in greater detail and describes to what extent the plans and codes align with one another.

# Synthesis

With interviews, document analysis, and case studies complete, the research team created a findings document for the Luckiamute Watershed Council. This document, created in May of 2020, discusses the current realities in each city, including their stormwater management priorities and limitations; key takeaways from each case study community, including LID implementation and roll-out ideas; and the results of the second round of interviews, which identify projects that each city is most likely to commit to. The purpose of this document is to allow LWC staff to approach city staff with a better understanding of present issues and work successfully towards better outcomes for stormwater management and watershed health.

The research team sent initial ideas via email to the director of the LWC in order to ensure that they were useful and feasible. The initial ideas included a focus on partnerships, a focus on watershed health, and recommended that improving riparian vegetation, reducing stormwater runoff, and prioritizing LID principles were actions to support watershed health. The LWC responded that focusing on riparian vegetation is very much in the wheelhouse of the LWC, and they are interested in working with cities to discuss stormwater runoff and LID principles. The LWC would need the cities' buy-in to implement the latter two ideas, but they look forward to starting a discussion of all three ideas. Finally, the LWC enthusiastically supports a regional partnership on stormwater management. This would help the cities align better on development standards, as well as approach watershed health from a bigger-picture perspective.

The LWC will share the findings document, as well as a two-page information sheet with its board and city staff. From there, the LWC will be able to convene a meeting with key city staff and begin work on a partnership approach to watershed health.

# CHAPTER IV

# Interview Synthesis

Concurrent with content analysis, the research team interviewed public works and planning staff in Independence, Monmouth, and Dallas. These conversations took place February 10, February 14, and April 2 respectively, and were conducted via telephone and Zoom videoconferencing.

These interviews helped us better understand the administrative realities regarding stormwater in each city. Our questions focused on four broad topic areas:

- Stormwater management at the municipal level
- Public and governmental responsibility for stormwater
- Water quality and watershed health
- Collaboration across jurisdictions

In addition to discussing each city's priorities, development regulations for stormwater, and water quality concerns, we also discussed whether city staff were aware of any other municipalities that have updated stormwater plans, and whether those might serve as potential case study communities. See Appendix I for the full set of interview questions.

Public works staff in all three cities noted their top priority was to manage surface flooding. Interviewees mentioned that residents do not generally notice stormwater systems when they are working well, but they do notice when they have failed. As such, each city has created a list of frequently flooded sites and are working on widening pipes and culverts to address the flooding.

Additionally, interviewees in all three cities noted that a lack of funding makes it very difficult to keep up with repairs or implement new changes. Cities are on very tight budgets and must invest in strategies they know will meet their needs. Interviewees all expressed some interest in LID strategies, but they noted the difficulty in knowing which LID strategies to implement: cities need to know the installation cost, the cost to maintain, the environmental impact, and the impact on residents and developers. Given all the unknowns, interviewees were concerned about spending public money on LID strategies which may or may not meet their needs.

Each city funds stormwater improvements using System Development Charges (SDC's) for new developments. Dallas and Independence also have a stormwater utility fee for city residents. Both SDC's and stormwater utility fees are used to fund improvements to the existing greywater systems. (At the time of this writing, Monmouth plans to assess a stormwater utility fee. As of now, stormwater system improvements in Monmouth are made from the city's streets fund.)

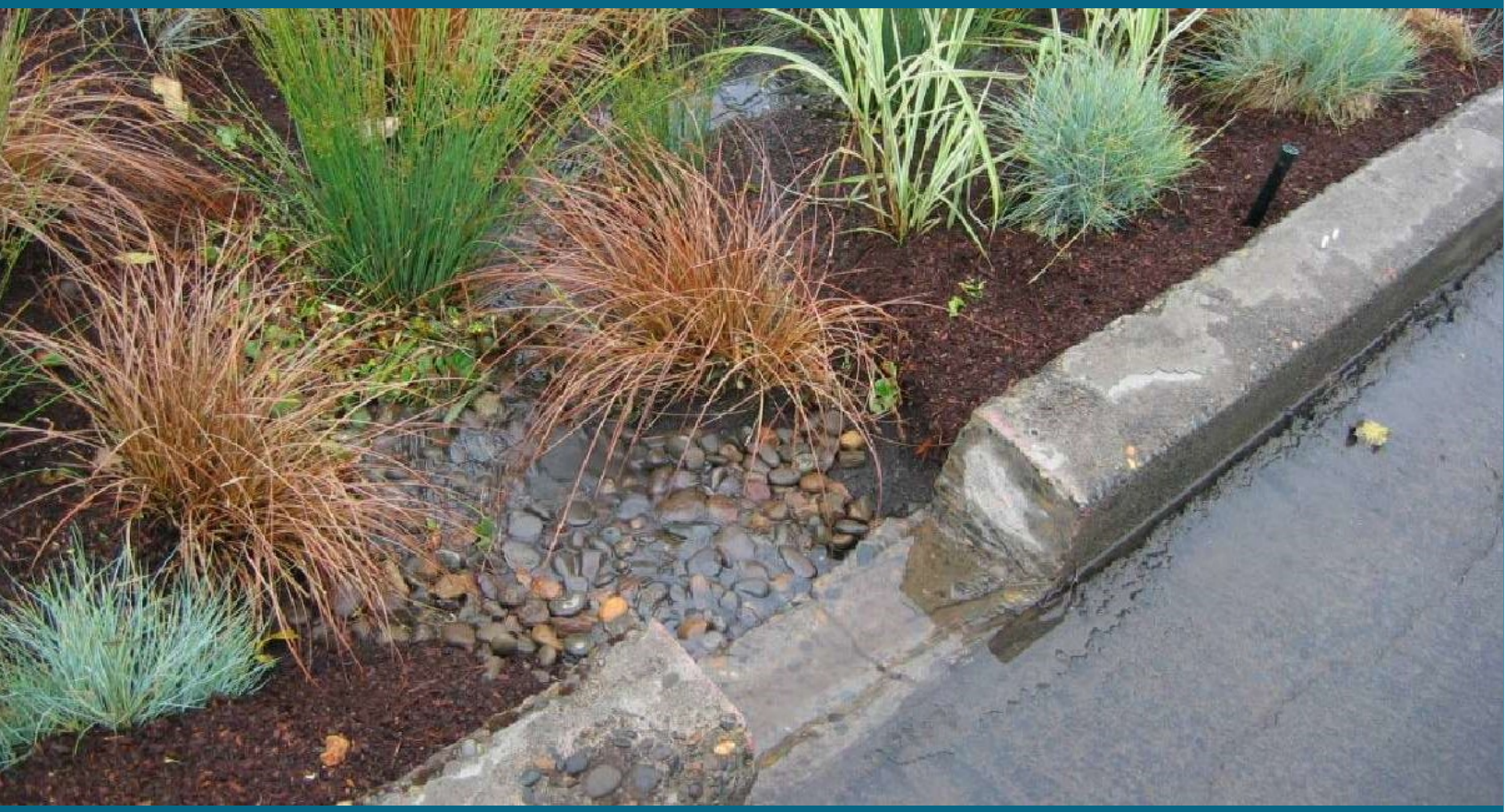
Interviewees from Dallas and Monmouth noted that watershed health is important and expressed a desire to ensure that the city's actions do not degrade the watershed. Dallas and Monmouth interviewees expressed an openness to collaborating with watershed councils in order to better protect and rehabilitate watersheds. Monmouth and Independence both work with the LWC currently on streambank projects such as invasive species removal, and interviewees from both communities noted they would like this relationship to continue. Interviewees from Independence noted that, while there is

an opportunity to improve stormwater systems to protect the watershed and address climate change, it is likely a low priority for City Council members and the public.

Interviewees from Dallas and Monmouth noted that they would be open to forming more collaborative relationships with the other cities and with the Luckiamute Watershed Council. Dallas interviewees noted that they are not very familiar with the other cities' policies, but would be open to more alignment, particularly if LWC coordinated that relationship. Independence interviewees expressed concern that, if LID strategies became a goal for all three cities, developing in Independence would become too expensive, and the city would lose its competitive edge with developers.

Finally, interviewees suggested cities for potential case studies, and expressed a desire to learn more about LID strategies, including bioretention and regional solutions. Given that feedback, our case studies, discussed in the following chapter, focus on cities that have invested in affordable LID strategies.

# CHAPTER V



# Case Studies

## Background and Context

Luckiamute Watershed Council is interested in stormwater management practices that Independence, Dallas, and Monmouth can adopt in order to protect the Ash Creek watershed. Our goal was to highlight practices that reduce sediment and chemical pollution that reaches Ash Creek from each city, as well as practices that reduce the speed of stormwater flows. These strategies include porous pavements, biofiltration, green roofs, and water capture. Collectively, these practices are considered LID.

Our final research question focused on the stormwater management strategies each city could afford to install and maintain. The cities are operating on limited budgets and have limited understanding and interest limited support from the public. In identifying case studies, the intent was to investigate other communities that have saved money and/or created additional community benefits by investing in LID practices. Two themes across the case studies emerged from the analysis as initial steps in converting from a conventional stormwater management system to a LID system.

# Stormwater Management Transition

The case studies share many of the same themes when updating their stormwater management systems. These themes were the initial steps to creating a foundation to implement new and improved infrastructure mitigating stormwater runoff. Two themes were consistent across all three cities:

## Create Partnerships

The first theme was to rely on and create partnerships and connections. This included collaboration between county, state, cities, and community members as an integral part of the outreach connecting stormwater to watershed health. Creating trusted partnerships allowed cities to disperse capacity and rely on one another when implanting new practices.

## Prioritize Watershed Health

The second theme was to make watershed health the top priority within stormwater management. Prioritizing this goal gave direction to help implement LID practices into the future stormwater management system.

Once the cities integrated the themes, they were able to implement LID stormwater management systems and policies. Beyond shared goals, each city shared many of the same approaches to implement LID infrastructure. The cities integrated these approaches within their updated stormwater management system and were able to use different aspects of each approach to address their stormwater needs. The strategies employed can be broken down into the following approaches.

# Low Impact Development Approaches

## Development Approach

The development approach is categorized as policies and practices that prioritize and require LID principles in new development. Requiring new development to implement LID practices and policies ensures stormwater infrastructure that minimizes the negative impacts from stormwater runoff. In addition to new development, the cities encourage private landowners to update and install LID stormwater infrastructure within their properties.

## Municipal Approach

The municipal approach to stormwater management requires municipalities to use LID systems on city property, within public spaces and open rights-of-way. In addition, cities are required to update and retrofit existing stormwater infrastructure on an as-needed basis.

## Regional Approach

The regional approach encourages cities to utilize local resources within a region to create and facilitate joint stormwater systems and management practices. The regional approach allows cities to increase capacity and reduce cost while supporting connections and partnerships.

# Stayton, Oregon

## Community and Plan Background

The City of Stayton Oregon is located in the Willamette Valley, approximately 12 miles southeast of Salem. The city is approximately 2.7 square miles. As of the 2018 PSU certified population estimates, Stayton's population was roughly 7,890. Stayton borders the Santiam Highway to the north and the Santiam River to the south. Most land within Stayton's UGB is residential with dispersed pockets of public/semipublic space, a central commercial district, and an industrial zone bordering the west side of the UGB.

The City of Stayton Storm Water Master Plan was adopted in 2009 and complies with Oregon's Total Maximum Daily Load Requirements for the Willamette River and tributaries. The intent and implementation of the adopted Stormwater Master Plan was to decrease peak discharges into the Salem Ditch and Stayton Power Canal while reducing contamination into the City's stormwater system. Stayton recognized effective stormwater management as an increasing concern and focused on developing practical solutions to their identified challenges. The primary objectives of the Storm Water Master Plan are as follows:

- Establish storm system design and planning criteria.
- Evaluate the existing storm system using computer hydraulic modeling.
- Summarize existing system deficiencies and propose improvements to enhance system serviceability.
- Recommend improvements needed to service further growth.
- Develop a Capital Improvement Plan and an appropriate System Implementation Strategy.

## Stormwater Management Plan Fundamentals

In 2010 Stayton implemented the City of Portland's Stormwater Management Plan as its official stormwater design standard. This adoption provided methods to reduce stormwater runoff within the city as well as improve water quality of the stormwater runoff before entering downstream ditches, creeks, and rivers. Stayton requires all new developments to meet the stormwater management requirements prior to any issuance of development permits. The Stormwater Management Plan provides requirements to help protect water resources through increasing permeability in an effort to minimize direct conveyance systems, increase groundwater recharge, and decrease pollution levels within the streams and rivers. The Stormwater Management Plan outlines city requirements and standards in three chapters.

## Chapter 1: Requirements and Policies

Chapter 1 explains the regulatory planning environment within Stayton and the relationship between the stormwater plan and the other city documents. This chapter provides regulation and policy requirements for the city to install stormwater infrastructure to newly developed or improved land.[71] The City's requirements are system-specific and based on a stormwater infiltration and discharge management hierarchy.

The City of Stayton provides a Stormwater Management Handout for single family residents and minor commercial improvements.[72] This handout assists community members and commercial developments in assembling a proposed onsite stormwater management plan. This is required for projects that develop or redevelop over 500 square feet of impervious surfaces and are required to comply with stormwater management requirements.[73]

## Chapter 2: Stormwater Facility and Conveyance Design

Chapter 2 provides information needed to select and design stormwater management facilities and conveyance features meeting the requirements and policies in Chapter 1. There are three major design goals detailed in Chapter 2.

- **Goal 1: Create an Informed Project Team.** Depending on the size of the proposed improvement or installation of a stormwater facility, the city states it is critical for the members of the project team to establish a clear understanding of the design process. The team must be prepared to integrate solutions that reduce impervious area, limit stormwater discharge, and protect and improve water quality.[74] To do this, the team must utilize the knowledge and resources from the various disciplines (architecture, geology, engineering) and encourages collaboration in order to minimize potential planning project setbacks and reviews.

- **Goal 2: Maximize Permeability and Minimize Offsite Discharge**. This design goal emphasizes the importance of impervious surfaces to reduce volumes of flow rates. This results in smaller stormwater management facilities and lesser downstream impacts. Maximizing permeability must be considered throughout the project from initial site planning to material selection.

- **Goal 3: Use Stormwater as a Design Element.** This design goal addresses stormwater in relation to the conceptual design. Unlike an underground piped system, stormwater can be designed to be aesthetically pleasing and provide connection to onsite natural features. Integrating stormwater design into the development plans can increase land values, provide additional recreation, improve wildlife habitat, and enhance environmental education opportunities throughout the community.

[71] City of Stayton, Oregon. Chapter 1. Requirements and Policies, Page 1-13
[72] City of Stayton, Stormwater Management Handout, Page 1
[73] City of Stayton, Stormwater Management Handout, Page 1
[74] City of Stayton, Oregon, Chapter 2. Stormwater Facility and Conveyance Design, Page 2-4

## Chapter 3: Operations and Maintenance

Chapter 3 provides a clear management plan to operate and maintain the stormwater facilities in order to function as intended and limit offsite environmental impacts. Stayton relies on property owners to perform routine inspections of the facilities to determine appropriate maintenance needs.[75] The city requires every private property owner who has a stormwater facility and/or conveyance system to submit an Operations and Maintenance (O&M) Form. This form outlines the site plan and information about the stormwater facility and is reviewed to determine the appropriate maintenance regime.

There are two approaches to creating a maintenance plan within Stayton: Simplified Plans and Presumptive Plans. The Simplified plans are provided by the city and detail maintenance plans based on a list of facilities installed. They also provide a tailored operations and maintenance log to track work performed. Property owners can implement stormwater facilities based on the designs manual while the simplified approach educates and incentivizes property owners to easily maintain the facilities installed.

The performance approach is developed as a site-specific O&M Plan. This approach outlines the requirements a property owner must determine in terms of operations and maintenance procedures, schedule, and persons responsible for implementing and documenting the O&M activities.[76] This approach is more tedious but provides an avenue for alternative stormwater management facilities to be considered by the city.

Once reviewed and accepted by the city, a public works employee will review the maintenance regime once a year. This keeps residents and private entities accountable to maintaining the stormwater infrastructure. Stayton has recently adopted this maintenance plan and has not seen much development to understand the full cost. Stayton recognizes that once more stormwater infrastructure is implemented, the cost will rise and need to be addressed.

# Implementing the Plan

Stayton had outside pressure from an impending lawsuit previous to adopting Portland's Stormwater Management Plan. The lawsuit originated from stormwater discharge in a set of private irrigation ditches. The ditches were used to water farmed crops. The private entity (Santiam Water Control District) threatened a lawsuit against the City due to this improper discharge. The city and the private entity settled out of court through a memorandum of understanding. This MOU stated that Stayton was required to adopt a more stringent stormwater management system and regulations. The MOU motivated the city to adopt Portland's Stormwater Management Plan quickly and word-for-word. In this case, the city was not the motivating factor toward watershed health but rather the community pushing the city to become more stringent in their regulations. This is important as it may not be the city's top priority, but there is potential for outside pressure initiating the process.

By adopting the Stormwater Management Plan verbatim, Stayton cut costs and time. This allowed the city to adopt a plan quickly and settle the MOU efficiently. Although this was a resourceful process, the

[75] City of Stayton, Oregon. Chapter 3. Operations and Maintenance, Page 3-27
[76] Ibid

city has seen backlash in the adoption of a large city plan in a small city context. Specifically, developers struggle with the restrictive nature of the plan. The city often gets pushback and complaints from new developers who are not accustomed to the scale of this plan. Often developers will choose other neighboring cities with less intense regulations.

# Bottom Line

Stayton is notable because of its heavy emphasis on watershed health and the importance of managing stormwater responsibly. The city also emphasizes the design aspect of LID systems, ensuring that they are visible, attractive, and beneficial to property owners and the environment. Finally, the city is committed to properly operating and maintaining LID systems, providing maintenance plans to individuals, and offering residents clear and easy-to-follow guidance on LID management.

As a small city with limited capacity, Stayton was able to save on cost when adopting Portland's Stormwater Management Plan. Although there were cost benefits to adopt to plan verbatim from an already existing plan, Stayton advises to be prepared for pushback from developers. Some developers previously implementing the conventional system were unfamiliar and unwilling to work with the city on the new regulations. The complexity of projects changed and, in some cases, it was necessary for the developers to become more informed about LID implementation. The public works department often receives phone calls and complaints from developers and occasionally has developers move business to neighboring cities. With this consideration, creating collaborative stormwater management goals and systems has the potential to reduce this flight when the plans and regulations are standardized across jurisdictions.

# Wilsonville, Oregon:

## Community and Plan Background

The City of Wilsonville, Oregon is located in the Willamette Valley, at the southern edge of the Portland Metropolitan Area. As of the 2010 census, Wilsonville's population was roughly 19,500, and the city has been growing. As of 2018, Wilsonville's population was estimated at 24,000.[77] [78] Most land within Wilsonville's UGB is residential and industrial, followed by public open space and commercial uses.[79]

Wilsonville re-wrote its stormwater master plan in 2012 and chose to focus on LID strategies to help mitigate existing problem areas in its stormwater infrastructure. The city identified seventeen areas with undersized or deteriorating pipe, erosion, problems with flooding, and problems with water quality. The new stormwater management plan was meant to achieve the following objectives:[80]

- Improve the environment and protect water quality.
- Develop an efficient and effective Capital Improvement Program.
- Maintain continual capacity in the storm system.
- Meet regulatory requirements.
- Gain public support for the Master Plan document.

Wilsonville's new stormwater management plan emphasizes the use of LID strategies, noting that these strategies improve water quality, enhance Wilsonville's natural features, provide aesthetic value, and provide necessary wildlife habitat.[81]

## Stormwater Management Plan Fundamentals

Wilsonville's stormwater management plan prioritizes LID techniques for new development, redevelopment, and retrofitting existing development. The plan mandates that City staff create a list of approved LID measures and provide guidance to the development community for constructing LID features on a site. These features may pertain to engineering and design approaches, landscaping design, stormwater management facility design, and building design solutions. Figure 12 outlines a list of Wilsonville's suggested approaches.[82]

Wilsonville's plan also stipulates that the City prioritize LID strategies, rather than the conventional drainage system, to maintain its municipal stormwater systems. Wilsonville committed to using LID practices when making road improvements, investigating the effectiveness of alternative paving materials for parking lots, and allowing open drainage systems where practicable.[83] Further, Wilsonville changed its policies to allow LID systems on any public right of way. With this regulation, the city has

[77] U.S. Census Bureau, Census 2010 Summary File 1
[78] U.S. Census Bureau, Quick Facts, Wilsonville City, Oregon
[79] City of Wilsonville. Stormwater Master Plan. Page ES-2.
[80] Ibid, page ES-1
[81] Ibid
[82] City of Wilsonville. Stormwater Master Plan. Page 2-10
[83] Ibid, Page 2-11

been able to install LID infrastructure in more locations without encountering red tape. The increased number of LID systems has not only helped manage stormwater but has also created flyways for bees and other insects.[84]

Finally, the city developed incentives to encourage residents to retrofit their properties to include LID strategies.[85] Since the adoption of the plan, however, the city has stopped encouraging individual property owners to install LID systems. The city has found that, when homes change hands, LID infrastructure does not receive the maintenance it needs. Instead, the city has decided to pursue LID installations on its own property, where the systems can be properly maintained.[86]

**Figure 11:** Wilsonville's Suggested LID Strategies

| | |
|---|---|
| **Engineering and Design Approaches** | Minimizing land disturbance for new development |
| | Locating impervious surfaces on poorly drained soils as much as possible |
| | Minimizing impervious surfaces |
| | Consider promoting shared driveways that connect two or more homes |
| | Reducing residential street width, with city approval |
| | Incorporating pervious materials, where feasible, particularly in parking and pedestrian areas |
| | Minimizing clearing and grading of sites |
| | Reducing parking requirements where bus or train service is available, or developing shared parking arrangements |
| | Using open channels for conveyance and treatment for street drainage |
| | Minimizing soil compaction on new sites |
| **Landscaping Design** | Requiring the use of soil amendments to improve the permeability of soils within landscaped areas |
| | Requiring the preservation and replacement of topsoil |
| | Maximizing the use of landscaping areas and traffic islands for stormwater treatment with rain gardens and filter strips |
| | Infiltrating stormwater on site for the water quality storm, where feasible |
| | Disconnecting impervious surfaces (minimizing effective impervious surfaces) |
| **Stormwater Management Facility Design** | Integrating water quality and detention into natural features |
| | Mitigating impacts of impervious surfaces |
| | Encouraging all stormwater to be routed through vegetated areas prior to entering a storm drain |
| **Building Design** | Encourage the use of Green Roofs (eco-roofs) |
| | Disconnect downspouts where feasible as approved by the City's authorized representative |
| | Use rain barrel or cistern system |
| | Encourage the use of a purple pope system to reuse water |

Source: City of Wilsonville. Stormwater Master Plan. Page 2-10

[84] Rappold, Kerry. Interview, April 17, 2020.
[85] City of Wilsonville. Stormwater Master Plan. March, 2012, Page 2-12.
[86] Rappold, Kerry. Interview, April 17, 2020.

Wilsonville's stormwater management plan also identifies several capital improvement program (CIP) projects to maintain the functionality and capacity of the existing stormwater management system. According to Wilsonville's adopted budget for FY2019-2020, CIPs are funded either through inter-fund transfers from Operating Funds (including Stormwater, amongst others,); System Development Funds; intergovernmental revenue, which includes grants and intergovernmental agreements; and the use of Urban Renewal Funds.[87] Wilsonville requires developers to pay a stormwater system development charge before being issued a building permit. The City uses the revenues from this program to implement large-scale projects, such as stream restorations and street improvements like green curb extensions.[88] The city's budget document notes that the city is committed to both new LID investment, and maintaining the existing greywater system.[89] Wilsonville leaders have found room in the operating budget and CIP budget to allow for these goals.

# Bottom Line

Wilsonville has heavily emphasized using LID strategies at the municipal level, for new developments, and for retrofitting projects. The city is also committed to upgrading its existing stormwater management system by incorporating LID elements. The Environmental Protection Agency notes that Wilsonville's regulations are commendable for being, "achievable, transparent, and effective and complementing large-scale protections with site-level runoff mitigation and management."[90]

[87] City of Wilsonville. Adopted Budget, FY2019-2020. Page xi
[88] United States Environmental Protection Agency. "Green Infrastructure: Municipal Policies for Managing Stormwater with Green Infrastructure Case Studies." Page 68
[89] City of Wilsonville. Adopted Budget, FY2019-2020. Page 136.
[90] United States Environmental Protection Agency. "Green Infrastructure: Municipal Policies for Managing Stormwater with Green Infrastructure Case Studies." Page 68

# Lenexa, Kansas

## Community and Plan Background

The City of Lenexa, Kansas is located southwest of Kansas City, and within the metropolitan area of Kansas City. As of the 2010 census, Lenexa's population was roughly 48,000, and the area has been growing steadily since the late 1990's.[91]

In 1998 the city conducted an intensive planning effort to manage the city's growth. City staff created a comprehensive management plan meant to preserve and enhance the city's quality of life, protect the natural environment and the positive attributes it lends to residents, and manage the city's capital investments. This planning effort revealed, somewhat unexpectedly, that the general public supported responsible management of stormwater, were concerned with water quality, and were willing to use public funds to upgrade the stormwater system.[92]

In 2001, Lenexa overhauled its stormwater management plan and laid out the following objectives for the plan:[93]

- Manage storm water holistically as a complete watershed system.
- Provide a funding source to support a staff dedicated to the operation, maintenance, and management of the storm water system and provide the necessary public education.
- Mange the storm water runoff to preserve, and even enhance, water quality.
- Manage storm water runoff and have programs to meet the requirements of the Federal National Pollution Discharge Elimination System (NPDES) Phase II and the TMDL programs.
- Manage storm water to protect, and even restore, natural areas valued by the citizens of Lenexa.
- Develop a program with community participation and support.
- Cooperate and participate with surrounding communities for effective management of the watershed.

## Stormwater Management Plan Fundamentals

Lenexa's new stormwater plan sought to preserve the characteristics of the undeveloped western end of the city and stipulated that stormwater management in new developments consider existing streams, habitat areas, and recreational trail systems.[94]

[91] U.S. Census Bureau, Census 2000 Summary File 1
[92] City of Lenexa, Stormwater and Watershed Management Master Plan. Page 1-2
[93] City of Lenexa. Stormwater and Watershed Management Master Plan. Page 1-2
[94] City of Lenexa. Stormwater and Watershed Management Master Plan. Page 4-12

Lenexa's new plan called for the city to rely on open channels, source runoff control, and localized management of stormwater, rather than the conventional system of collection, transport, and discharge. Lenexa's new plan incorporated several LID elements:

- Detailed stormwater policies and practices for new development. These encouraged developers to use LID strategies.
- Joint use detention basins which contain peak flows from several areas in the wet season and serve as recreational areas during dry periods.
- Regional retention basins.[95]

# Implementing the Plan

Once Lenexa's new stormwater master plan was complete, the city implemented the plan largely through policies. City leadership recognized the value of Lenexa's growth, but also recognized the value of growing in a way that preserved the natural environment and the area's quality of life. Therefore, City leadership committed to creating and enforcing policies regulating stormwater and land uses.

The first of these policies dealt with new development. Lenexa's leaders overhauled the City's codes for new development, prioritizing designs that minimize impervious areas, increase green space, and use open channels instead of enclosed systems. The City stipulated that homes should be located closer to existing roadways, which preserves green space at the rear of properties. The development codes also prioritize sites that utilize vegetative buffers and natural drainage channels and preserve mature vegetation. Finally, developers were encouraged to intersperse open drainage swales amongst enclosed systems to allow water to recharge the soil.[96]

Next, Lenexa's leaders wrote policies encouraging the creation and use of joint-use retention basins. These are water retention areas that attenuate water flows from developed areas and help to remove sediment and debris. Additionally, these basins can provide recreation areas for Lenexa's residents. The City committed to constructing and maintaining these basins, which required detailed site analysis to determine the location of these facilities. Joint-use basins reduce the need for developers of new lots to construct stormwater facilities: therefore, the City charges developer system development fees to help pay for constructing joint-use basins.[97]

In addition to prioritizing joint-use basins, City leaders also created policies to build regional retention basins. These are large reservoirs (40 acres or greater) designed to attenuate flows, reduce the velocity of stormwater, allow for water quality enhancement, and allow for wildlife habitat and recreational use by area residents. The City stipulated that regional retention facilities should be fed by natural channels and established protected zones for waterways downstream of the retention basin. This helped the city protect habitat and natural space. Finally, Lenexa's leaders worked with Johnson County to create a formula for siting and paying for retention basins.[98] Criteria in this formula included a ranking system for

[95] City of Lenexa. Stormwater and Watershed Management Master Plan. 1-3
[96] Ibid 6-28
[97] Ibid 6-36
[98] Ibid 6-38

the potential site's development priority, its recreational value, its cost per single family equivalent, and its potential watershed impact—its potential for reducing flow and improving water quality.[99]

The above policies address the physical considerations of the new stormwater master plan, but City leaders also committed to funding stormwater management by establishing a stormwater utility fee, authorizing bonding, and implementing taxes and fees that would pay for programs and staff. The stormwater utility fee is based on the amount of surface runoff on each parcel of land. Each parcel is charged $5.50 (in 2008) per dwelling unit, and commercial properties are charged based on the amount of stormwater generated by the impervious surface area.[100] City leaders also enacted a one-mill levy in order to fund stormwater management planning, administration, and improvement.[101]

Finally, city leaders agreed to engage the community in conversations about the importance of stormwater management, and made clear the public's role and the city's role in reducing pollution.[102] Additionally, the City (in coordination with Johnson County) provides funding for individual property owners to plant rain gardens or native plantings, and to buy rain barrels, all of which help reduce the volume and velocity of stormwater that reaches municipal systems.[103]

# Bottom Line

Lenexa is notable because of its reliance on strong local control to require more rain gardens and other bioretention strategies on new development projects. Lenexa, in coordination with Johnson County, has also invested in large land preservation efforts that have the benefits of preserving existing stormwater channels while also providing recreation opportunities to residents. Finally, Lenexa has encouraged residents to become active participants in stormwater management and watershed health.

[99] Ibid 5-35
[100] United States Environmental Protection Agency. "Green Infrastructure: Municipal Policies for Managing Stormwater with Green Infrastructure Case Studies." Page 44
[101] City of Lenexa, Stormwater and Watershed Management Master Plan. Page 4-15
[102] City of Lenexa, Stormwater and Watershed Management Master Plan. Page 4-16
[103] City of Lenexa, Stormwater Management Plan. Page 9

# Case Study Key Takeaways

The three case studies discussed share many of the same goals. Each municipality identified stormwater management as a priority for the city, and set out to improve watershed health, improve water quality, and improve the serviceability of their stormwater systems. All three cities also identified funding for these projects as a priority and committed to listing stormwater improvements amongst the cities' Capital Improvement Projects. Finally, the cities discussed here identified that public support is crucial for any major stormwater change and committed to educating residents and local leaders about the importance and benefits of properly managed stormwater systems.

Beyond their shared goals, each of the cities shared many of the same approaches for implementing LID infrastructure. The strategies that each city employed can be broken down into three categories:

- **Development**: Stayton, Wilsonville, and Lenexa all adopted policies that impacted new development. The cities required new development projects to use LID systems; and also required LID systems for retrofitted projects, which may be the responsibility of developers or the cities.

- **Municipal**: Each city required municipalities use LID systems on the city's property and in public rights-of-way and encouraged private landowners to install their own LID systems. Cities also provided operations and maintenance information to residents.

- **Regional**: Lenexa in particular, together with Johnson County, purchased large tracts of land to use as regional detention facilities, which could double as recreation areas for residents.

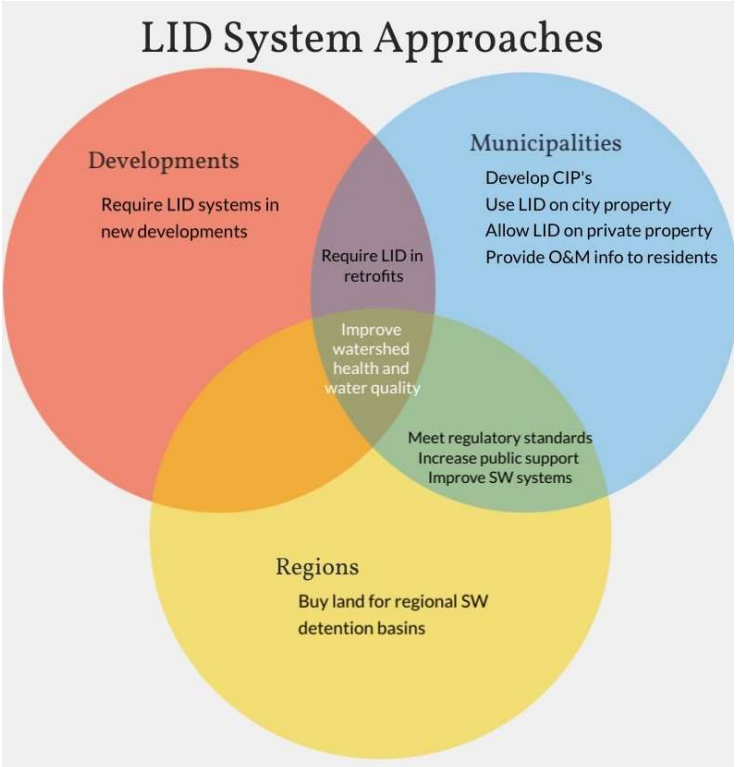



**Figure 12:** LID System Approaches

Source: Meinke and Nolte, 2020

Taken together, these LID strategies are meant to improve the health of the watershed, allow cities to extend the life of their existing conventional stormwater management systems, increase stormwater awareness and support from individual community members, and better plan for funding stormwater management systems in the future.

# CHAPTER VI

# PLAN ANALYSIS

## Background and Context

Our first two research questions focus on existing stormwater management standards within Independence, Dallas, and Monmouth. Our task was to identify the stormwater management strategies in each city and assess whether those strategies were different or similar across jurisdictions.

To do this, we focused on three major plans for each city: the Comprehensive Plan, the Stormwater Master Plan (which only Independence and Dallas have written at the time of this report), and the Development Code.

Comprehensive plans are controlling documents for city development within the Urban Growth Boundary and serve as a guide for urban development and implementation of land use regulations. Stormwater Master Plans are also comprehensive planning documents, meant to provide recommendations for current and future stormwater management strategies within the UGB. Development Codes contain land use and development regulations for properties within the UGB and are intended to implement the Comprehensive Plans in each city.

Within the Comprehensive Plan, mandatory language for policies was identified as *shall, must,* and *will* and is required to be followed while making quasi-judicial decisions. Permissive language states a preferred direction for cities but is not considered binding to city council decision making. Permissive language includes *should, may,* and *encourage*. Understanding this language difference provided a regulatory framework for the following plan analysis.

# Comprehensive Plans

## Plan Background

Comprehensive plans are the controlling document for jurisdictions within Oregon and must address and be consistent with Statewide Planning Goals. Comprehensive plans provide a legal framework for long-term implementation and land use regulations throughout the local jurisdiction. These plans must be reviewed and acknowledged by the Land Conservation and Development Commission (LCDC) and only then is it a controlling document for land use planning and development within the areas covered.

Comprehensive planning documents are comprised of goals and policies for Oregon communities. Goals set the general direction for cities and are not considered decision making criteria, while policies are utilized by city council to judge and decide on land use applications. The following section examines the similarities and differences within the current comprehensive plans.

# Comprehensive Plan Comparison

Major similarities and differences were interpreted based on the goals and policies presented within the comprehensive plans of Dallas, Monmouth, and Independence. The goals and corresponding policies were initially sorted by similar categorization and then classified based on policies addressing watershed health and those addressing land use and development. The policies were then analyzed based on the mandatory and permissive language structure or determined as not mentioned within the document. The information was examined, and the similarities and differences were determined.

## Land Use

The plan comparison determined most similarities emerge within the land use classification. These similarities are related to new development requirements, improved lands standards, and purpose of stormwater as a public facility.

## New Development

Dallas, Independence, and Monmouth recognize that increased and new development creates a demand for public facilities including water, sanitary sewers, parks, streets, schools, fire protection, and stormwater infrastructure. The cities acknowledge the importance of stormwater facilities as they mitigate hazards by removing water from developed lands and reducing flood events. Dallas, Independence, and Monmouth currently accept traditional stormwater infrastructure through the use of detention ponds and pipe networks as new developments are established.

All three cities require developers to install the necessary storm drainage facilities consistent with their comprehensive plans at the developer's own expense. Dallas mandates new developments to be consistent with the City's long-range stormwater management plans and programs. Similarly, Independence and Monmouth state that all new developments shall be installed, engineered and City-approved with drainage facilities connecting to the pipe network. Implementing stormwater infrastructure addresses the capacity of the growing communities.

## Improved Lands

Dallas, Monmouth, and Independence address policies for stormwater implementation through previously improved lands. Dallas states the city will continue to work with property owners and Polk County to ensure best management practices are applied to improved lands but does not specify how and in what capacity. Independence's and Monmouth's comprehensive plans state storm drainage improvements on already improved lands will be accomplished as the need arises using resources of bond issues or other funds depending upon the scope and expense of the project

## Public Facilities

Dallas, Monmouth, and Independence explain stormwater management as a public facility through their Public Facilities section within their Comprehensive Plans. The purpose of stormwater as a public facility in Dallas is to provide a timely, orderly and efficient arrangement of public facilities and services to serve

as a framework for community development.[104] Drainage basins within the city are divided into ten districts and are considered natural drainage networks into Rickreall and Ash Creek.

Independence and Monmouth state similar purposes for their public facilities, and it is clear that Monmouth, which updated its plan in 2007, based the public facilities section on Independence's Public Facility Element, which was updated in 2003. Both cities address stormwater as a public facility important to the general health and welfare of their community. The Comprehensive Plans differentiate between facilities that are necessary for sustaining life within the city and those that enhance the life of the community. Sewer and stormwater are considered necessary for life while parks, schools and recreational facilities greatly enhance the quality of their community.

## Watershed Health

The three cities address stormwater in relation to watershed health, however they do so in various ways. Although there are no goals or policies that directly align between the cities, the cities do recognize the importance of improving and sustaining their natural resources. The cities are aware of their connection to the watershed and how development can affect water quality, but the ways they go about protecting the watershed are all different.

## Natural Resources and Parks

The majority of mandatory policies addressing watershed health are concentrated in the Natural Resources and Parks classification. Independence and Dallas strive to protect riparian areas through the creation of buffer zones and the reduction of pollution and erosion, while also recognizing the need to conduct further studies. These riparian areas and open spaces help to retain stormwater, and also double as park and recreation spaces. Monmouth addresses watershed health through the mandated federal and state policies.

[104] Volume II Comprehensive Plan, Dallas OR 7.3.2

**Figure 13:** Comprehensive Plan Topics focused on Watershed Health

Watershed Health

| Category | Code | Mandatory | | | Permissive | | | Not Mentioned | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | IND | DAL | MON | IND | DAL | MON | IND | DAL | MON |
| *Natural Resources & Parks* | *Creating Open Space Buffers* | X | X | | | | | | | X |
| | *Maintain Riparian Open Space* | X | | X | | | | | X | |
| | *Preserve Riparian Vegitation* | X | | | | | | | X | X |
| | *Protecting wetlands* | | | X | | | | X | X | |
| | *Conduct further studies* | X | X | | | | | | | X |
| | *Preserve Wildlife habitat* | X | | | | | | | X | X |
| | *Reduce Erosion, Sedimentation & Flooding* | X | X | | | | | | | X |
| | *Reduce pollution* | X | X | | | | | | | X |
| | *Development adheres to federal, state and local air, land and water quality regulations* | | | X | | | | X | X | |
| | *Protect, enhance, restore and conserve natural resources* | | | X | | | | X | X | |
| | *City opperations use Best Management Practices* | | | X | | | | X | X | |
| | *Review and respond to State water quality improvement planning* | | | X | | | | X | X | |
| | *Implement TMDL plan* | | | X | | | | X | X | |
| *Economy* | *Encourage environmentally sound industry* | X | | | | X | | | | X |
| *Public Facilities & Services* | *New Development: protect wetlands and reduce erosion* | | X | | | | | X | | X |
| | *Participate in watershed council* | | X | | | | | X | | X |
| *Livable Neighborhoods* | *Limit Development to safe and non protected areas* | | X | | | | | X | | X |
| | *Development should not degrade river quality* | X | | | | | | | X | X |
| *Greenway ** | *Recognize importance of Ash creek* | | | | X | | | | X | X |
| | *Recognize importance of riparian vegetation* | | | | X | | | | X | X |
| | *Collaboration with other agencies to protect greenway* | X | | | | | | | X | X |
| *Natural Hazards & Disasters* | *Development in floodway limited to open space* | X | | | | | | | X | X |
| | *Prevent soil related damage using the ORS-I Soils Sheet* | X | | | | | | | X | X |

* Independence is the only city directly connecting to Ash Creek with a Greenway

Source: Meinke and Nolte, 2020

**Figure 14**: Comprehensive Plan Topics focused on Land Use

Landuse

| Category | Code | Mandatory | | | Permissive | | | Not Mentioned | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | IND | DAL | MON | IND | DAL | MON | IND | DAL | MON |
| *Natural Resources & Parks* | *Protect scenic/ historical sites in development code* | | X | | | | | X | | X |
| | *Collaborate and other agencies and plans* | X | | | | | X | | X | |
| *Economy* | *Locate Industry inside city limits* | X | X | X | | | | | | |
| | *Encourage commercial land uses develop standards* | | | X | | | | X | X | |
| | *Encourage ag activities* | | | | | X | | X | | X |
| | *Encourage waterfront development* | X | | | | | | | X | X |
| *Public Facilities & Services* | *City is service providor* | | X | | | | | X | | X |
| | *City shall develop and follow SWMP* | X | X | X | | | | | | |
| | *City to develop level of service standards* | | X | | | | | X | | X |
| | *Place stormwater drainage on public rights of way* | | X | | | | | X | | X |
| | *New Development: System capacity is addressed* | X | X | X | | | | | | |
| | *New Devlpt: developer pays* | X | X | X | | | | | | |
| | *Existing development: city issue bonds to fund improvements* | X | | X | | | | | X | |
| *Urban Growth Management* | *UGB annex requirements* | X | X | X | | | | | | |
| | *follow FEMA floodplain requirements* | | X | | | | | X | | X |
| *Residential Neighborhoods* | *Prioritize full range of urban services with denser landuse* | | X | | | | | X | | X |
| *Greenway* | *Encourage Agriculture activities in W. Greenway* | | | | X | | | | X | X |
| | *encourage recreational use within public land* | X | | | | | | | X | X |
| *Natural Hazards & Disasters* | *Adequately flood proofed development in floodway* | | | | X | | | | X | X |
| | *Participate in national flood insurance program* | | | X | | | | X | X | |
| | *Development limited to acceptable grades* | X | | | | | | | X | X |
| | *Adjust flood boundary* | X | | | | | | | X | X |

Source: Meinke and Nolte, 2020

# Stormwater Master Plans

## Plan Background

The stormwater master plans for Independence and Dallas are comprehensive planning documents that operate within each city's Urban Growth Boundary. The stormwater master plans (SWMP) are meant to provide recommendations for current and future needs of the cities and establish a schedule of work to be done and a financing plan for the work. Both Dallas's and Independence's stormwater master plans contain an analysis of existing stormwater collection and conveyance systems and identify various problem areas that need modifications to address current uses and future needs. At the time of this writing, Monmouth is in the process of completing a SWMP, which is expected to take effect in the summer of 2021. Thus, Monmouth is left out of the SWMP discussion, below.

## Stormwater Master Plan Comparison

### Plan Goals

Independence's SWMP was written in 2005. The plan's stated purpose is to assess the condition of the existing stormwater system and guide the development of the stormwater conveyance network.[105]

Dallas's SWMP was written in 2016, and its goals are much the same: to assess the condition of the existing stormwater collection and conveyance system, locate deficiencies, and address future needs. Dallas's plan also seeks to identify capital improvement and staffing needs.[106]

Although the information contained in the two plans is quite similar, Independence focuses on the policy framework surrounding this plan. Independence discusses development codes for Polk County and the City of Independence, comprehensive plans from Polk County, and City Council policy. Dallas focuses on presenting findings about its existing system, and includes detailed discussion about modeling techniques used, including hydraulic analysis, soil retention properties, and runoff analyses. Overall, Dallas's plan is more site-specific and feels action-oriented. Independence's plan is oriented towards the planning and regulatory environment and focuses much less heavily on individual sites in the city boundaries.

### Watershed Health and Water Quality

Both plans address water quality issues, though Dallas's plan is more detailed and more current. Dallas's SWMP contains a large section on water quality which lists the types of contaminants, the observed levels of those contaminants, and possible methods of removal, including passive filtration.[107] Independence mentions water quality, but briefly, stating only that the city is not affected by the DEQ's requirements for water quality, but does enforce the DEQ's standards in new developments.[108]

[105] City of Independence. Stormwater Master Plan, 1-1
[106] City of Dallas. Stormwater Master Plan, ES-1
[107] City of Dallas, 6-4
[108] City of Independence, 5-5

Independence's plan recommends that the city enhance water quality by continuing to enforce standards in new development, identifying best management practices, preserving stream corridor vegetation, and barring property owners from discharging stormwater directly into streams.[109] Dallas recommends enhancing water quality by installing catch basins wherever practical, preserving open channel waterways, installing passive water filtration systems, identifying best management practices, and following the DEQ's six minimum control measures: educating the public about water quality, involving the public in stormwater management, eliminating illicit discharge, limiting stormwater runoff from construction sites, reducing stormwater flows when construction is complete, and conducting good municipal housekeeping.[110]

## Land Use

Both cities address stormwater in relation to land use and begin by analyzing the existing stormwater system and identifying system deficiencies. In Independence, most problems are related to flooding: either existing pipes are too narrow to handle the amount of water, or the slope conditions are unfavorable and cause negative pipe pressure.[111] The plan notes that flooding is a natural part of the area, but increased development will increase the likelihood of surface flooding. As of 2005, the city was using detention facilities to control flooding, but the SWMP recommends reconsidering that strategy because peak flows in the Willamette River back up detention facilities and cause surface flooding. Instead, the plan calls for piping stormwater, and using strategies like porous pavement that can recharge groundwater and reduce surface floods.[112]

Dallas's analysis of its existing system is broken into key areas: West Ellendale at Wyatt, Douglas Drainage, Rickreall/Uglow, Kings Valley Highway, and North Fork of Ash Creek. In the Ash Creek area, Dallas, like Independence, is focused on problems with flooding.[113] Dallas does note that the entire Ash Creek is piped underground, which creates different hydraulic characteristics upstream versus downstream.[114]

## Funding Sources

Finally, both plans conduct a funding analysis and identify potential funding sources, including cost sharing with Oregon Department of Transportation, Polk County, private developers, and the Ash Creek Water Control District. Both plans also mention grants, taxes, general obligation bonds, system development charges, and ratepayer fees as potential options for funding needed stormwater improvements.

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[109] Ibid
[110] City of Dallas, 6-7
[111] City of Independence, 6-2–6-7
[112] City of Independence, 5-7
[113] City of Dallas, 7-36
[114] Ibid 7-35

**Figure 15**: Stormwater Master Plan Topics Focused on Watershed Health

**Watershed Health**

| Category | Code | Mandatory | | Permissive | | Not Mentioned | |
|---|---|---|---|---|---|---|---|
| | | IND | DAL | IND | DAL | IND | DAL |
| *Monitor Contaminants* | *Nutrients* | | X | X | | | |
| | *Sediment* | | X | X | | | |
| | *Bacteria* | | X | | | X | |
| | *Organic compounds and solvents* | | X | X | | | |
| | *Metals* | | X | | | X | |
| | *Increased temperature* | | X | | | X | |
| *Removal Methods* | *Grassy swales, streambeds, detention ponds, wetponds* | | | | X | X | |
| | *Straw bales, silt fences, woven matting* | | | | X | X | |
| | *Siphon-type catch basins* | | | | X | X | |
| | *Sumped catch basins* | | | | X | X | |
| | *Spill prevention* | | | X | X | | |
| | *Cooling towers and chillers* | | | | X | X | |
| *Water Quality Enhancement* | *Identify Best Management Practices* | | | X | X | | |
| | *Set standards for new development* | X | X | | | | |
| | *Preserve stream corridor vegetation* | | | X | | | X |
| | *Bar private property owners from discharging into streams* | | | X | | | X |
| | *Install catch basins where practical* | | | | X | X | |
| | *Preserve open channel waterways* | | | | X | X | |
| | *Install passive water filtration* | | | | X | X | |

Source: Meinke and Nolte, 2020

**Figure 16**: Stormwater Master Plan Topics Focused on Land Use

**LAND USE**

| Category | Code | Mandatory | | Permissive | | Not Mentioned | |
|---|---|---|---|---|---|---|---|
| | | IND | DAL | IND | DAL | IND | DAL |
| *Existing System Deficiencies* | *Flooding: Stop use of detention facilities* | | | X | | | X |
| | *Flooding: Use porous pavement to address* | | | X | | | X |
| | *Flooding: Use pipes to address* | | | X | X | | |
| | *Flooding: Re-work slope conditions to address* | | | X | X | | |
| *Funding Sources* | *Cost sharing: Partner with ODOT* | | | X | X | | |
| | *Cost sharing: Partner with Polk County* | | | X | X | | |
| | *Cost sharing: Partner with Private Developers* | | | X | X | | |
| | *Cost sharing: Partner with Ash Creek Water Control District* | | | X | X | | |
| | *Apply for grants* | | | X | X | | |
| | *Propose GO bonds* | | | X | X | | |
| | *Charge System Development Fees* | X | X | | | | |
| | *Charge Stormwater Utility Fees* | X | X | | | | |
| | *Charge Stormwater Tax* | | | X | X | | |

Source: Meinke and Nolte, 2020

# Development Codes

## Plan Background

Development Codes contain land use and development regulations for properties within the UGB and are intended to implement the Comprehensive Plans in each city. The Development Codes for Dallas, Independence, and Monmouth address a variety of topics meant to protect the health, safety, and welfare of city residents. Given the broad scope of each development code, the research team identified those parts of the development code that specifically mentioned stormwater management practices and identified parts of the code that discussed the impact of development on the watershed, stream health, or stormwater facilities. The research team then organized that information into topic areas, which include new development requirements, site design standards, landscaping requirements, impervious surface standards, and floodplain protection.

## Plan Comparison

All three cities require new development to plan for and install stormwater facilities. Plans for new development must address storm water drainage, erosion control, stormwater treatment, and flood control.[115] [116] [117]

### Watershed Health

#### Impervious Surface Standards

All three cities set standards for drainage and impervious surfaces, noting that impervious surfaces speed water flow and increase the risk of flooding.[118] [119] [120] Dallas and Independence have set impervious surface standards and require drainage facilities to reduce the likelihood of flooding. Dallas goes a step further, encouraging the use of water treatment facilities by exempting areas with porous pavement or swales from the calculation of total lot coverage. Monmouth addresses drainage and impervious surfaces only in its Public Service College Zone, which applies to Western Oregon University.

Only Dallas notes that parking areas represent an opportunity for significant runoff. Dallas requires parking areas to be designed to minimize stormwater runoff.[121]

[115] City of Independence, Subchapter 90
[116] City of Dallas, Article 3
[117] City of Monmouth, Title 17
[118] City of Independence, Subchapter 55
[119] City of Dallas, Article 2
[120] City of Monmouth, Title 18
[121] City of Dallas, Article 3

## Floodplain and Wetland Protection

Dallas and Monmouth specifically note the potential impact of development on floodplains and wetlands. In order to protect these areas, Dallas only allows recreation paths and facilities to be built through floodplains.[122] Monmouth notes that protected wetland areas exist near the city, and bans building, excavating, removing vegetation, and storage of refuse in these areas.[123] Independence discusses developments adjacent to protected wetlands, but does not specifically ban or allow development in these areas.

# Land Use

## Site Design Standards

All three cities necessarily address land use issues in their development codes. This is evident in grading and drainage requirements in each city's site design standards. Grading must conform to city standards, and developers must submit grading and drainage plans that allow for the collection, treatment, and transmission of stormwater from the new development to existing city facilities.[124] [125] [126]

Dallas and Independence's site design standards are quite detailed. Dallas discusses the sizing of pipes and culverts, the impacts new development will have on downstream properties, and requires that plans address future uses of the site. Independence's site design standards address these concerns, as well as subsurface soils, house foundation drains, and street gutter requirements.

Finally, all three cities set standards for site design and review in mixed-use zones, and note that water management is a critical part of the overall design of these areas.[127] [128] [129] Monmouth's planning commission may allow developers to increase the density of an underlying zone if the water facilities are adequate, if the site does not interfere with natural resource areas, and if the site uses water conserving landscaping and stormwater diversion.[130]

[122] City of Dallas, Article 4
[123] City of Monmouth, Title 18
[124] City of Independence, Subchapter 55
[125] City of Dallas, Article 2
[126] City of Monmouth, Title 18
[127] City of Independence, Subchapter 23
[128] City of Dallas, Article 2
[129] City of Monmouth, Title 18
[130] City of Monmouth, Title 17

## Landscaping Requirements

All three cities have landscape requirements, noting that landscaped areas help address erosion, landslides, and stormwater flooding. All three cities require commercial and industrial areas to conform to landscaping standards. In Independence, these sites must dedicate 15% of the total property area to landscaping, while Dallas and Monmouth require 10%. Dallas's Commercial Neighborhood Districts must dedicate 15% of the area to landscaping.[131] [132] [133]

Additionally, all three cities set landscaping requirements in multifamily residential areas. Independence requires 20% of the area for multifamily sites be landscaped, while Dallas and Monmouth require 15%.[134] [135] [136]

Independence and Dallas specifically note that detention facilities for stormwater management should be incorporated into landscape designs wherever possible. [137]

**Figure 17:** Development Code Topics Focused on Watershed Health

**Watershed Health**

| Category | Code | Mandatory | | | Permissive | | | Not Mentioned | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | IND | DAL | MON | IND | DAL | MON | IND | DAL | MON |
| *Impervious Surface Standards* | *Cities Establish Maximum Lot Coverage Standards* | X | X | X* | | | | | | |
| | *Cities Establish Building Setback Requirements* | X | X | X* | | | | | | |
| | *Cities Deduct LID Areas from Lot Coverage Calculations* | | X | | | | | X | | X |
| | *Parking Areas Designed to Minimize Stormwater Runoff* | | X | | | | | X | | X |
| *Floodplain and Wetland Protection* | *City Allows Only Recreational Paths to be Built in Floodplains* | | X | | | | | X | | X |
| | *City Bans Building in Wetlands* | | X | X | | | | X | | |
| | *City Bans Excavation in Wetlands* | | | X | | | | X | X | |
| | *City Bans Removing Vegetation in Wetlands* | | | X | | | | X | X | |
| | *City Bans Storage of Refuse in Wetlands* | | | X | | | | X | X | |

*Monmouth's development codes contain these standards only in the PC—Public Service College Zone

Source: Meinke and Nolte, 2020

[131] City of Independence, Subchapter 54
[132] City of Dallas, Article 3
[133] City of Monmouth, Title 18
[134] City of Independence, Subchapter 54
[135] City of Dallas, Article 3
[136] City of Independence, Subchapter 54
[137] City of Independence, Subchapter 14

**Figure 18:** Development Code Topics Focused on Land Use

## LAND USE

| Category | Code | Mandatory | | | Permissive | | | Not Mentioned | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | IND | DAL | MON | IND | DAL | MON | IND | DAL | MON |
| *Standards for New Development* | *Developers must plan for and install stormwater facilities* | X | X | X | | | | | | |
| | *Developers must address stormwater drainage* | X | X | X | | | | | | |
| | *Developers must control erosion* | X | X | X | | | | | | |
| | *Developers must address stormwater treatment* | X | X | X | | | | | | |
| | *Developers must control flooding* | X | X | X | | | | | | |
| *Site Design Standards* | *Grading in new development conforms to city standards* | X | X | X | | | | | | |
| | *New developments collect and treat stormwater and transmit it to existing city facilities* | X | X | X | | | | | | |
| | *Development plans address future use of a site* | X | X | | | | | | | X |
| | *Development plans describe impacts to downstream neighbors* | X | X | | | | | | | X |
| | *Development plans describe impact on subsurface soils* | X | | | | | | | X | X |
| | *City allows increased density in new developments if stormwater is managed on-site* | | | X | | | | X | X | |
| | *City stipulates maximum length of street gutter* | X | | | | | | | X | X |
| | *City allows house foundation drains to connect to city system* | | | | X | | | | X | X |
| | *City stipulates minimum size for storm drainage pipe* | X | X | | | | | | | X |
| | *City stipulates minimum size for storm drainage culvert* | X | X | | | | | | | X |
| | *City applies stormwater management standards in mixed-use zones* | X | X | X | | | | | | |
| *Landscaping Requirements* | *Landscaped area minimums, commercial districts* | X | X | X | | | | | | |
| | *Landscaped area minimums, industiral districts* | X | X | X | | | | | | |
| | *Landscaped area minimums, multifamily districts* | X | X | X | | | | | | |
| | *Landscaped areas incorporate stormwater management elements* | | | | X | X | | | | X |

Source: Meinke and Nolte, 2020

# Plan Analysis Key Takeaways

The comprehensive plans, stormwater master plans, and development codes for each city differ slightly in their specific requirements but are largely aligned along several key elements. First, each city recognizes public facilities as a component of general welfare, and stresses that cities are responsible for proper stormwater management in order to provide for the public's safety, health, and ability to grow responsibly.

Second, each city notes that stormwater needs will grow as the cities do, and these plans and codes are meant to help cities manage stormwater properly in areas that are growing rapidly.

Third, given the rapid growth, all three cities have mandated that new developments install and maintain appropriate stormwater systems. There is some ambiguity about which stormwater management strategies the cities would prefer developers use. For instance, as discussed above, Monmouth will allow developers to increase their development's density if the site uses water conserving landscaping and stormwater diversion. That allowance certainly serves as an incentive for developers to adopt LID, but the allowance is permissive only—there is no requirement to use LID in new developments. In many cases, the cities default to requiring conventional systems, rather than requiring LID. For example, Dallas lays out standards for subdivisions and master planned developments, which would be a good place to require LID systems. In the development codes, however, Dallas only requires that that storm drains are installed before the roads are paved. In short, cities are inconsistent in acknowledging LID strategies which may be helpful. Additionally, the codes and plans largely focus on the installation and treatment of familiar conventional systems, which shows that cities will default to using the existing greywater infrastructure.

Finally, existing stormwater infrastructure improvements are made on an as-needed basis: when pipes fail, or when recurrent flooding has become a nuisance. None of the codes we analyzed required that cities implement LID strategies. Instead, any improvements made will likely match the existing stormwater system.

All three cities recognize that stormwater management is a critical part of a healthy and functional city and have solid plans in place to manage stormwater according to conventional standards. There is an opportunity for the cities to mandate the use of LID strategies both for new development and when making improvements to the existing system. For example, Dallas and Independence allow LID elements to be incorporated into landscaped areas, while this idea is not mentioned in Monmouth's development codes. All three cities could make this a requirement, rather than an option. Additionally, Dallas requires parking areas to be designed to minimize stormwater runoff. Independence and Monmouth may be able to make similar requirements when new parking areas are being proposed.

Each of the plans and codes analyzed here are reliant on the existing conventional system, and while there are nods to LID, its use in each city is inconsistent. The case study communities have shown that LID may help improve water quality and erosion, and they offer several examples of how Dallas, Monmouth, and Independence could adopt LID policies at the development, municipal, or regional level. This idea is discussed in detail in the next section.

# CHAPTER VII

# Findings

In order to create potential next steps for the Luckiamute Watershed Council, the research team synthesized findings from the plan analysis, key elements from the case study communities, and findings from the second round of interviews. Our findings focus on our initial three research questions:

1. What are the existing stormwater management policies and practices within the cities of the Ash Creek Watershed?

2. How do the stormwater management policies and practices differ and where do they align across jurisdictions?

3. What policies and practices can be adopted to protect the Ash Creek Watershed and allow cities to manage stormwater effectively and affordably?

**What are the existing stormwater management policies and practices within the cities of the Ash Creek Watershed?**

Question one focuses on the existing stormwater management policies and practices in Dallas, Monmouth, and Independence. Looking at each city's plans and codes line by line revealed that each city's stormwater management practices and policies were unique to that location. That said, while the specific policies might differ, the overall thrust is the same. For instance, Monmouth's comprehensive plan encourages the development of commercial land use standards, while Dallas and Independence do not mention that policy specifically. Dallas and Independence do, however, encourage environmentally sound industry. Both regulations are meant to spur environmentally responsible economic development. Figures 14-19, discussed in Chapter Six, provide a detailed look at the individual policies of each city. The cities' policies and practices, while different in their execution, have similar intent: to preserve natural resources as much as is feasible, support the local economy, find funding for stormwater management projects, and create standards for new development. Each city has solid plans to manage stormwater according to conventional standards. The plans of all three communities discuss LID infrastructure and acknowledge that LID helps with watershed health and water quality. However, no city requires LID for new developments and/or for municipal upgrades.

How do the stormwater management policies and practices differ and where do they align across jurisdictions?

Question two focuses on the similarities and differences in plans across all three towns. We found a great deal of alignment amongst the plans and codes in Dallas, Monmouth, and Independence, and this alignment relates to the broader concepts or ideas behind the plans. All three cities' comprehensive plans recognize that increased development creates a demand for public facilities. The cities acknowledge the importance of stormwater infrastructure and manage stormwater as a public facility. These concepts underlie each city's unique codes. Within the stormwater management plans, both Dallas's and Independence's goals are to assess the conditions of the stormwater system and locate deficiencies and areas of flooding. Both plans call for increased pipe size, and better slope angles in order to address flooding. (Monmouth does not yet have a stormwater master plan.) Finally, the development codes in all three cities address increased impervious surface and its impacts on stormwater management. Again, these broad concepts underlie the robust codes all three cities have for new development, including drainage and grading requirements, landscaping minimums, and impervious surface maximums.

There are differences between the three cities as well, though the differences appear in individual codes and policies. First, although all three cities' comprehensive plans recognize stormwater's impact on watershed health, few policies directly aligned across all three cities. For instance, Dallas and Independence call for creating open space buffers, but that idea is not used in Monmouth. Monmouth calls for protecting wetlands, which is not mentioned in Dallas's or Independence's plans. Second, within stormwater management plans, Dallas focuses on water quality standards, which are absent in Independence's plan. Dallas is required by the DEQ to address those elements, while Independence is not; however, those regulations do have an impact on the focus of Dallas's plan.

Overall, the cities are very much aligned in their ideas and conceptual understanding of stormwater, and their general treatment of stormwater. The cities use the same basic tools—comprehensive plans, stormwater master plans, and development codes—and within those tools the same basic ideas: pipes, culverts, new construction standards, and landscaping requirements. The individual execution of those ideas looks slightly different for each city, but the general concepts are the same.

What policies and practices can be adopted to protect the Ash Creek Watershed and allow cities to manage stormwater effectively and affordably?

Question three focuses on policies or practices that can be adopted to protect the Ash Creek Watershed and allow cities to manage stormwater effectively and affordably. To answer this question, we relied on case studies and a second round of interviews with city staff.

Each case study community, while focused on a different aspect of LID and stormwater management in general, overlapped on a few main elements: first, each case study community highlighted the importance of forming partnerships across related agencies, and educating community members and community leaders about the importance of improved stormwater management practices. Second, each case study community aligned their goals to focus on improved watershed health and improved water quality. Each case study community differed in the measures they took to address watershed health and water quality and focused to a greater or lesser extent on a regional, municipal, or a development-centered approach, but the underlying goals of all communities were the same.

Interview respondents from Dallas, Monmouth, and Independence noted that they would like to participate in collaborative efforts to protect the watershed and would be interested in a regional approach that includes LWC, all three cities, and potentially Polk County. Respondents noted that, if the LWC spearheads meetings or gatherings, they are likely to participate, but did note that a lack of time and funding are hindrances. Finally, interview respondents commented about their relationship with city councilors and the general public. Respondents agreed that stormwater management is not a top priority for either city council or the general public, and that both parties could use more information about the importance of the stormwater system.

Interviewees were asked to rank their top priorities for protecting watershed health, and their top priorities based on ease of implementation. Sustaining partnerships was a unanimous choice in both categories, and respondents also highlighted the importance of reducing stormwater runoff, utilizing LID principles, and preserving/enhancing native riparian vegetation. Appendix III contains the full list of interview questions, and Appendix IV contains the response sheets and codes for the second interviews.

Interview respondents diverged on a few themes as well. Respondents did not agree on who is responsible for informing city council and the public about the importance of stormwater management. This topic came up because staff in all three cities noted that, if the public and city councilors understand how stormwater is handled by the city and understand the impact of stormwater on the surrounding natural environment, they are more likely to support funding stormwater improvements. Some city staff felt the responsibility for public outreach fell outside the city's purview, while others felt that city staff are responsible for public outreach. Further, some cities had more interest and ability to boost their outreach efforts, while other respondents felt they lacked the necessary time and funding. Finally, one city mentioned that including recreational opportunities with stormwater management changes would likely get more support from city councilors.

Given these findings, we propose that the answer to question three, about policies or practices that can be adopted to protect the Ash Creek Watershed and allow cities to manage stormwater effectively, is to focus less on individual policies or practices. We suggest instead that the LWC focus instead on partnerships. We have seen that each city has different policies and practices for regulating stormwater, water quality, open space, and natural resources. We have also seen that all three cities wish to be better stewards of the watershed and are interested in working together to make that a reality.

# Where to go from here?

We recommend that the LWC focus on a regional approach to improved watershed health. Including all three cities and Polk County in a collaborative effort will allow cities with greater resources (which include funding, time, ideas, staff participation, and social connections) to support those cities with fewer resources. A regional approach will also allow each city to support the efforts it feels able to support, while knowing that it is participating in a greater effort. Further, cities may be able to learn from one another. For instance, Dallas, which is required by the DEQ to monitor water quality, may be able to offer support and guidance to Independence and Monmouth if all three cities agreed that water quality testing was a key goal. Monmouth and Independence, who have written the LWC into their budgets in past years, may be able to pool their resources cooperatively with Dallas to fund the LWC's efforts for streambank rehabilitation.

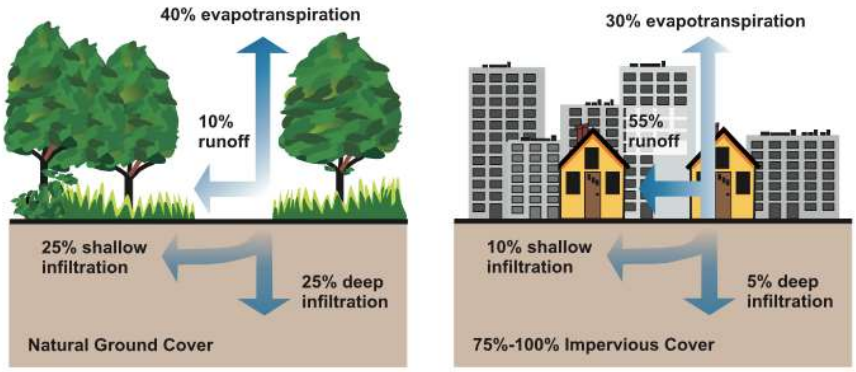
We suggest the LWC convenes a meeting with Public Works and Planning staff from Dallas, Monmouth, and Independence. Because sustaining partnerships was the top priority of all city staff we interviewed, we suggest that the purpose of this first meeting is for participants to meet one another, discuss their reasons for participating, and their desired outcomes from any collaborative effort.

After this initial meeting, we suggest that the LWC schedule further meetings that align around the cities' next priorities: enhancing riparian vegetation, prioritizing LID principles, and reducing stormwater runoff. Interview respondents noted that each of these priorities also touch on other aspects of watershed health. Enhancing riparian vegetation, for example, has the effect of enhancing streambanks as a whole and better protecting fish by shading the water. Reducing overall runoff enhances streambanks and creates opportunities to show the public how stormwater can be managed effectively. We believe that, by focusing on these topics, the LWC will help generate lasting partnerships in the region, tackle the cities' desired issues, and will create positive future changes for the watershed.

# STORMWATER MANAGEMENT
# ASH CREEK WATERSHED

## WATERSHED HEALTH

Conventional stormwater management implements underground pipe networks that remove excess surface water from developed lands. This system is detrimental to watershed health due to decreased infiltration, ground water storage reduction, increased water temperatures and elevated pollutant loads within waterbodies. Alternative management systems such as Low Impact Development (LID) are emerging as proactive ways to improve watershed health, enhance community livability and reduce stormwater runoff.




*Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface ruunoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.*

Source: EPA, Protecting Water Quality from Urban Runoff

## CURRENT STANDARDS

Dallas, Monmouth and Independence understand the importance of stormwater management to public safety, health and well-being. The cities rely on conventional stormwater standards that generally align across the three jurisdictions. Although the cities recognize the importance of LID principles for watershed health, the documents do not require LID infrastructure.

## PARTNERSHIPS

The case study communities highlight the importance of sustaining partnerships across agencies as well as informing community members and leaders on the significance of stormwater management practices.

## ALIGN GOALS

When implementing stormwater management, goal alignment is important in order to establish future direction and clarity for all partners. Goals must be clear and universal to improve regional watershed health and water quality.

## RESEARCH PROCESS

- Plan Analysis
- Stakeholder Interviews
- Case Studies

## COLLABORATE

It is recommended that LWC focus on a regional approach to improve watershed health. This includes collaborating with Dallas, Monmouth, Independence and Polk County to form lasting relationships and shared resources. A regional approach will allow the cities to support one another and create shared goals for long term watershed health.

To initiate the collaborative process, it is recommended that LWC convene a meeting with the Public Works and Planning Staff from Dallas, Monmouth and Independence. This meeting will begin a conversation toward a healthier Ash Creek Watershed.

Luckiamute WATERSHED COUNCIL

# Ash Creek Partnership

## Luckiamute Watershed Council

*invites the Public Works and Planning Staff from Dallas, Monmouth and Independence to collaborate on a regional approach to stormwater management in the Ash Creek watershed.*

*A regional approach encourages resource and knowledge sharing, support and flexibility toward a healthier Ash Creek Watershed. The priorities of the partnership are to establish and sustain partnerships and focus on watershed health.*

## Sustain Partnerships

Building & sustaining partnerships was determined to be the most important and easiest goal to accomplish in order to conserve the watershed. Sustaining partnerships help disperse resources, generate ideas and provide a broad network toward a common goal. This theme emerged across the case study communities, and it encompassed relationships between:

- The Watershed Council
- Community Organizations
- City Staff
- City Councils
- Polk County Public Works
- DEQ

*Dallas*

*Monmouth*

*Independence*

## Prioritize Watershed

Before updating stormwater plans and policies, it is recommended that the cities prioritize watershed health and water quality in stormwater strategies. Within that theme, our interview respondents noted that they wanted to focus on enhancing riparian vegetation, prioritizing LID principles and reducing stormwater runoff.

*Enhance Riparian Vegetation*

*Prioritize LID Principles*

*Reduce Stormwater Runoff*

*Meinke & Nolte*

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# CHAPTER VII

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# Report Appendix

# Appendix I: Interview Guide I

## Introduce Ourselves

Point of the research: We have been asked by the Luckiamute Watershed Council to look at the stormwater management standards and development standards in Independence, Monmouth, and Dallas, and see where there are similarities and opportunities to align. Our goal is to identify practices that the cities can adopt to better protect the watershed, and potentially preserve or enhance economic opportunities for the cities.
Verbal Consent: We want to state that your participation in this interview is voluntary, and you can stop and any time. We are taking notes from our conversation, but your responses will be anonymous, and we will not quote you directly in our written report. We would also like to put this call on speaker, and take an audio recording of the interview. Can we confirm that you agree to participate? Can we confirm that you agree to be recorded?

## Questions about Stormwater management

What are the city's priorities in terms of stormwater management? (infrastructure, physical design and implementation? Public support and buy in? Cost?)
Are there any stormwater projects or plans that the city is implementing currently?
Are there elements of stormwater management that you or the city would like to learn more about?
What are the barriers to implementing stormwater management in your Monmouth?

## Questions about jurisdiction

What are the public and private responsibilities to implementing stormwater infrastructure? (For example, do you use system development charges? Are property owners responsible for stormwater management? What is the city's responsibility in stormwater management?)

## Questions about water quality

What are you interested in terms of watershed health? (meeting standards? Watershed health? Recreation? Mercury? Fish?)
How do you, if at all, view the relationship between public infrastructure and watershed health?
Is your community taking steps or planning to take steps to address watershed health? And if so, how?

## Questions about Collaboration

When it comes to collaboration with the cities in the Ash Creek Watershed, what aspects of stormwater management do you see as imperative to (Dallas/Independence/Monmouth)? What regulations would you be unable to implement?

## Final questions

Our goal is to suggest ways to align the codes across the cities, and better protect the watershed. Throughout this process are there ways we can help you with your efforts to ____ (whatever their priority is)?
We'll be conducting a few case studies to help us identify what is working in other communities. Do you know of other communities that have been successful with stormwater management or watershed protection?

Is there anything you would like to add that we did not discuss here?

Do you have any questions?

## Next Steps

We will finish our comparison of plans, then complete case studies about other cities and towns that have changed their stormwater management practices. From there we are hoping to have some best practices in mind and recommendations for how your cities can align. We'd then like to run a focus group with people from Independence, Monmouth and Dallas to get your feedback on what is feasible and sensible before we finalize any recommendations.

# Appendix II: Plans and Codes

This appendix shows the research team's conceptual re-ordering of the Comprehensive Plans, the Stormwater Master Plans, and the Development Codes in Dallas, Monmouth, and Independence. We identified each section of the plans that was relevant to stormwater management, and then arranged the plans according to comparable topics.

# Comprehensive Plans

| Independence Comp Plan | | | Dallas Comp Plan | | | Monmouth Comp Plan TOC | |
|---|---|---|---|---|---|---|---|
| **Econony** | | | **Sustainable Economy** | | | **Economic Development** | |
| GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES |
| To provide for and maintain a viable and diverse economy while preserving the present sense of community and high level of environmental quality. | The City of Independence shall key any overall downtown redevelopment plan to emphasize the waterfront and existing historic structures | 29 | The City's overall economic goal is to continue as a sustainable community in order to enhance the quality of life for all Dallas citizens. This goal is best achieved by increasing economic opportunities without threatening environmental quality or eroding the region's natural resource base. | Encourage the future development of industrial facilities, primarily ones that would have a limited environmental effect upon the community and which do not place excessive demands on the City's infrastructure | Page 5 | To foster commercial and/or industrial activities to meet the expressed needs of the residents. | Commercial development in areas outside of downtown and Highway 99W shall be oriented to serve neighborhood needs. |
| | The City of Independence shall encourage non-polluting labor-intensive industries to locate within the City | 29 | | Require all existing and future industries to locate within the City Limits and to conform to existing federal and state environmental laws | Page 5 | | The City will develop neighborhood commercial standards. |
| | The City of Independence shall coordinate planning activities with Polk County in order that lands suitable for industrial use, but not needed within the planning period, are zoned in a manner which retains these lands for future industrial use. | 30 | | Encourage the development of an industrial or business park within the Dallas City Limits | Page 5 | | Industries shall be required to adhere to applicable Federal and State air, land and water quality standards. |
| | | | | Encourage the development of agriculture-related activities | Page 6 | | The City shall designate additional industrial land after the majority of the existing supply is developed. |
| | | | | | | | The City will work to place one or more industrial properties on the list of Oregon Certified Industrial Sites. |
| | | | | | | | The City will structure the standards and criteria of the Zoning Ordinance to assist commercial and industrial developers in determining the feasibility of a potential project. The City will emphasize the importance of a rapid review process, avoiding unnecessary delays in processing applications for developments. |

| Independence Comp Plan | | | Dallas Comp Plan | | | Monmouth Comp Plan | |
|---|---|---|---|---|---|---|---|
| **Natural Resources** | | | **Parks and Open Space** | | | **Natural Resources, Scenic and Historic Areas, and Open Spaces** | |
| GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES |
| To preserve and encourage wise use of available natural resources. | Independence shall encourage a buffer of open space where feasible between Monmouth city limits and shall encourage and coordinate with Monmouth to do the same. | 20 | To conserve and protect the community's natural and scenic resources and to ensure that new development helps to provide for the outdoor recreational needs of its residents. | A riparian buffer shall be established and protected along Rickreall and Ash Creeks, as prescribed in the Dallas Development Code. This undisturbed area shall be surveyed and protected through deed restrictions or other appropriate means, prior to development approval. | 12 | Protect natural resources and conserve scenic and historic areas, and open spaces. | Monmouth will protect significant wetlands through a safe harbor ordinance that contains restrictions on placement of fill material, grading, excavation, and vegetation removal. |
| | Independence shall maintain the Ash Creek and Willamette River floodway as open space. | 20 | | Rickreall and Ash Creeks shall be protected from pollution. | 12 | | Monmouth will provide notice to the Division of State Lands as specified in the Monmouth City Code for any development request on a property containing, or within 25 feet of, a wetland mapped on the City of Monmouth Local Wetland Inventory. |
| | Independence shall preserve the riparian vegetation along the Willamette River and Ash Creek. | 20 | | Steeply-sloped areas shall be preserved in their natural state to the maximum extent possible through hillside development standards in the Dallas Development Code. | 12 | | Monmouth will protect significant riparian corridors through a safe harbor ordinance that contains restrictions on placement of new structures and impervious surfaces, grading, and vegetation removal within riparian buffer sites. |
| | Independence shall seek available funding to study the feasibility of development of the Ash Creek floodplain as a nature center, park and wildlife sanctuary. | 20 | | Identified scenic, recreational, or historic sites shall be protected to the maximum extent possible through clear and objective standards in the Dallas Development Code. | 12 | | |
| | Independence shall encourage other agencies and responsible private groups in any effort to improve wildlife habitat along the Willamette River and Ash Creek. | 20 | | The City shall seek state funding to conduct a "Local Wetlands Inventory." Wetlands identified on that inventory shall be fully protected unless the economic, environmental, social and energy consequences of allowing conflicting uses have been fully examined in accordance with OAR Division 23, and incorporated into the Dallas Comprehensive Plan. | 12 | | |
| | Independence shall preserve present riparian vegetation along the Willamette through setback requirements. | 21 | | | | | |
| | Independence will support the water-quality management plans and programs of governmental agencies by regulating land uses, encouraging improved treatment of point sources of pollution, and the controlling of non-point sources of pollution. | 21 | | | | | |
| | Independence will encourage development of water management systems to effectively reduce the problems of erosion, sedimentation, flooding, and soil wetness. | 21 | | | | | |
| | Independence will cooperate with designated agencies to develop erosion and sediment control standards and specifications for use by Independence in connection with land development plans and the Federal Water Pollution Control Act and Amendments. | 22 | | | | | |

| Independence Comp Plan | | | Dallas Comp Plan | | | Monmouth Comp Plan | |
|---|---|---|---|---|---|---|---|
| **Public Facilities and Services** | | | **Public Facilities and Services** | | | **Public Facilities and Services** | |
| GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES |
| It shall be the policy of the City of Independence to investigate the feasibility of cooperation and coordination with other government and quasi-governmental agencies in planning and providing public facilities and services. Wherever feasible, cooperative projects should be promoted to insure the most economic and efficient provision of services to the citizens of the City of Independence.<br><br>The sizing and location of sewer, water and storm drainage lines is to reflect the requirements of desired land use arrangements and densities of the service area.<br><br>The installation, repair or resizing of municipal service lines should be done prior to, or concurrent with, street improvements. | The City shall develop a stormwater master plan for the Independence urban area | 27 | To provide a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for community development. | As a general purpose government, the City of Dallas shall be the principal provider of key urban services (i.e., sanitary sewer, potable water, storm drainage, transportation, parks and general government services) within the Dallas Urban Growth Boundary. | 19 | It shall be the policy of the City of Monmouth to investigate the feasibility of cooperation and coordination with other government and quasi-governmental agencies in planning and providing public facilities and services. Wherever feasible, cooperative projects should be promoted to insure the most economic and efficient provision of services to the citizens of the City of Independence.<br><br>The sizing and location of sewer, water and storm drainage lines is to reflect the requirements of desired land use arrangements and densities of the service area.<br><br>The installation, repair or resizing of municipal service lines should be done prior to, or concurrent with, street improvements. | The City shall develop a stormwater master plan for the Monmouth urban area |
| | All storm drainage is to be channeled into an effective storm drainage system | 27 | | The City shall develop levels of service standards for sanitary sewer, transportation, storm drainage and domestic water facilities serving new development within the Dallas UGB. | 19 | | All storm drainage is to be channeled into an effective storm drainage system |
| | All new developments shall install engineered and City-approved storm drainage facilities along with other improvements | 27 | | Wherever possible, public sewer, storm drainage and water facilities shall be placed within the public right-of-way to simplify maintenance and minimize impacts on private property owners. | 19 | | All new developments shall install engineered and City-approved storm drainage facilities along with other improvements |
| | Drainage facilities shall be provided in subdivisions and developments and shall connect to drainage ways and storm sewers outside the subdivision at developers' expense. The design shall consider the capacity and grade necessary to maintain unrestricted flow from areas draining through the subdivision. | 27 | | Subdivisions shall be prohibited on unincorporated land within the Dallas UGB and Individual residences on lots existing at the time of plan approval shall be sited to avoid planned streets, utilities and open space. | 20 | | Drainage facilities shall be provided in subdivisions and developments and shall connect to drainage ways and storm sewers outside the subdivision at developers' expense. The design shall consider the capacity and grade necessary to maintain unrestricted flow from areas draining through the subdivision. |
| | Storm drainage improvements through already improved lands will be accomplished as the need arises using resources of bond issues or other funds depending upon the scope and expense of the project | 27 | | All new development shall be designed consistent with the City's long-range storm water management plans and programs, and shall only occur consistent with the following provisions: Off-site drainage impacts shall be controlled through appropriate design; Stream channels and wetlands shall be protected through setbacks and other appropriate mechanisms; Erosion and sediment controls for excavation, new development and re-development projects shall be required. | 21 | | Storm drainage improvements through already improved lands will be accomplished as the need arises using resources of bond issues or other funds depending upon the scope and expense of the project |
| | | | | The City shall continue to participate in a Watershed Council and coordinate with Polk County, the Water Resources Department and affected property owners in the development and implementation of the Rickreall Creek Basin Plan. | 21 | | |
| | | | | The City shall continue to work with property owners and Polk County to ensure that best management practices are applied within the Mercer Reservoir watershed, to minimize impacts of development, forestry and agricultural on the City's water supply. | 21 | | |

| Independence Comp Plan | | | Dallas Comp Plan | | | Monmouth Comp Plan | |
|---|---|---|---|---|---|---|---|
| **Urbanization** | | | **Urban Growth Management** | | | **Urbanization** | |
| GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES |
| To provide for an orderly and efficient transition from rural to urban land. | Independence shall not extend urban services beyond city boundaries. | 34 | Through the Periodic Review process, the City of Dallas shall coordinate with Polk County to maintain a 20-year Urban Growth Boundary (UGB), to ensure sufficient buildable land to accommodate residential, commercial, industrial, open space and institutional land use needs.<br><br>Urban land uses, extension of urban services and annexation of land to the City shall not be permitted outside the UGB, unless concurrent amendments to both the City and County Comprehensive Plan are approved consistent with the Statewide Planning Goals. | Only lands that can be provided with the full range of urban facilities will be considered for annexation or rezoning. | 17 | To provide for an orderly and efficient transition from rural to urban land. | The City of Monmouth shall not extend urban services beyond city boundaries unless waivers for future annexation are obtained. |
| | | | | To promote an orderly, efficient and economic pattern of growth, urban services, including water and sewer facilities, will be extended to urbanizable lands only upon annexation to the City. | 17 | | Annexation to the city will be permitted if:The city is able to provide adequate sewer, water, storm drainage, administration and fire protection services to the area; and the new area will meet city standards for all public improvements. |
| | | | | Interim development on future urban land shall be supported by public facilities and services constructed to City standards. | 17 | | Changes to expand or reduce the Urban Growth Boundary will be based upon consideration of orderly and economical provision of public facilities and services |
| | | | | "Shadow plats" (future development plans) shall be provided prior to development approval or issuance of building permits, to ensure that interim development on land outside the City Limits does not interfere with future urban-level development or the efficient provision of City sanitary sewer, water and street facilities. | 17 | | |
| | | | | The City shall ensure against flood damage to persons and property through the effective implementation of flood plain regulations, consistent with Federal Emergency Management Act (FEMA) standards. | 18 | | |

| Independence Comp Plan | | | Dallas Comp Plan | | | Monmouth Comp Plan | |
|---|---|---|---|---|---|---|---|
| **Housing** | | | **Livable Residential Neighborhoods** | | | **N/A** | |
| GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES |
| To insure everyone the opportunity to live in safe and healthy housing and to provide a choice of housing types and densities. | Independence shall ensure that residential development in the vicinity of Ash Creek and the Willamette River does not adversely impact riparian areas and water quality. | 24 | Encourage the development of a variety of housing types and densities to meet the needs and desires of the community, and assure that existing and future residents of the community have the opportunity to acquire safe and sanitary housing at reasonable cost. | Identified river and stream corridors, wetlands, flood hazard, steep hillsides and slide hazard areas where building would be hazardous shall be considered unbuildable, and shall be used to define neighborhood boundaries. | 9 | | |
| | | | | Residential development shall be phased and provided with adequate sanitary sewer, water, storm drainage, transportation and park and recreational facilities, as prescribed in Chapter 7, Public Facilities Plan. | 10 | | |
| | | | | The development of close-in vacant land, readily serviceable by a full range of urban services shall have a higher priority than development of peripheral land that cannot be provided, efficiently, with a full range of urban services. | 10 | | |

| Independence Comp Plan | | | Dallas Comp Plan | | | Monmouth Comp Plan | |
|---|---|---|---|---|---|---|---|
| **Natural Hazards and Disasters** | | | **N/A** | | | **Natural Hazards** | |
| GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES |
| To protect life and property from natural disasters and hazards. | Independence will not permit development other than open-space park uses within the floodway. | 19 | | | | To protect life and property in Monmouth from natural hazards and disasters. | Monmouth will continue to participate in the National Flood Insurance Program. Monmouth will apply the floodplain overlay zone standards to development that occurs within designated 100-year floodplains. |
| | Independence may allow development in the floodway fringe provided the development is adequately flood-proofed. | 19 | | | | | |
| | Independence shall not allow subdivision development in any area containing soils with a severe rating for the intended use, (according to the ORS-I soils sheets) without first requiring a soils engineer's report detailing the necessary protective measures to prevent possible soils related damage. | 19 | | | | | |
| | Independence shall not allow subdivision development in any area with a poor drainage class (according to the ORS-I soils sheets) unless a site grading plan is included with the building plans that show run off and grading away from the structure. | 19 | | | | | |
| | Independence shall consider adjustments to the flood hazard boundary when the HUD study become available. | 19 | | | | | |

| Independence Comp Plan | | | Dallas Comp Plan | | | Monmouth Comp Plan |
|---|---|---|---|---|---|---|
| **Greenway Policies** | | | **N/A** | | | **N/A** |
| GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES | PAGE NUMBER | GOALS |
| To protect, conserve, enhance, and maintain the scenic, historical, agricultural, economic and recreational quality of land along the Willamette River. | Independence will cooperate with governmental agencies and special districts to protect all Willamette Greenway lands and resources. | 23 | | | | |
| | Independence encourages agricultural uses within the Willamette River Greenway | 23 | | | | |
| | Independence considers publicly owned land in the Greenway to have recreational value and will encourage its use as such. | 23 | | | | |
| | Independence recognizes the confluence of Ash Creek as an archaeologically significant area, as wildlife habitat, as a potential park expansion area, as a scenic area, as a flood prone area and protect it with Greenway implementation tools. | 23 | | | | |
| | Independence recognizes the importance of vegetation to the resource quality along the river and will encourage the preservation of it within the Greenway. | 23 | | | | |

| Independence Comp Plan | | | Dallas Comp Plan | | | Monmouth Comp Plan |
|---|---|---|---|---|---|---|
| **N/A** | | | **N/A** | | | **Land Use** |
| GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES | PAGE NUMBER | GOALS |
| | | | | | | To encourage efficient land use, meet future land needs to the year 2020, and to maintain land use designations appropriate for the character of the city of Monmouth. |

| Independence Comp Plan | | | Dallas Comp Plan | | | Monmouth Comp Plan |
|---|---|---|---|---|---|---|
| **N/A** | | | **N/A** | | | **Air, Land, and Water Resources** |
| GOALS | OBJECTIVES | PAGE NUMBER | GOALS | OBJECTIVES | PAGE NUMBER | GOALS |
| | | | | | | To maintain and improve the quality of air, water, and land resources in Monmouth. |

## Stormwater Master Plans

| INTRODUCTION | | | |
|---|---|---|---|
| Independence | | Dallas | |
| **Introduction** | Introduction | **Introduction** | Purpose and Need |
| | Authorization | | Goals and Objectives |
| | Master Plan Purpose | | Risks of Inaction |
| | Master Plan Scope | | Project Selection and Prioritization Criteria |
| | Previous Plans | | Intended Readers |

| PUBLIC INVOLVEMENT | | | |
|---|---|---|---|
| Independence | | Dallas | |
| **Public Involvement** | Objectives and goals | | |
| | Public Involvement process | | |
| | Public feedback | | |
| | Evaluation criteria | | |

| STUDY AREA | | | |
|---|---|---|---|
| Independence | | Dallas | |
| **Study Area** | General characteristics | **Watershed Characteristics** | Location and Waterways |
| | Land use | | Study Area Delineation |
| | Topography | | Climate: precip and temperature, precip depth |
| | Climate | | Soils |
| | Soils | | Topographical Features |
| | Drainage basins | | Groundwater |
| | | | Existing Drainage System |
| | | | Land Use: residential, industrial, commercial, parks, ag/forest, floodplain |
| | | | Land Cover |

| MODELING AND TECHNICAL STUDIES | | | |
|---|---|---|---|
| Independence | | Dallas | |
| **Modeling and Technical Studies** | Modeling data, parameters and assumptions | | Analysis Approach |
| | Design storm considerations | | Basic Assumptions |

| ANALYSIS AND RECOMMENDATIONS | | | |
|---|---|---|---|
| Independence | | Dallas | |
| **Stormwater Analysis** | Existing Stormwater System | **Analysis Results and Recommended Improvements** | West Ellendale at Wyatt: description of problem and existing system, hydrologic analysis, hydraulic analysis, propsed CIP's, recommended next steps |
| | System Inventory | | Douglas Drainage: description of problem and existing system, hydrologic analysis, hydraulic analysis, propsed CIP's, recommended next steps |
| | System Maps | | Rickreal/Uglow, Orchard: description of problem and existing system, hydrologic analysis, hydraulic analysis, propsed CIP's, recommended next steps |
| | Modeling Results | | Kings Valley Highway/Highway 223 at Cemetery: description of problem and existing system, hydrologic analysis, hydraulic analysis, propsed CIP's, recommended next steps |
| | System Deficiencies | | North Fork Ash Creek: description of problem and existing system, hydrologic analysis, hydraulic analysis, propsed CIP's, recommended next steps |
| | Existing Deficiencies | | Hunter Street: description of problem and existing system, hydrologic analysis, hydraulic analysis, propsed CIP's |
| | Existing Deficiencies-Independence | | |
| | Existing Deficiciencies-ODOT | | |
| | UGB build-out deficiencies | | |
| | UG Buildout Deficiencies-Independence | | |
| | UGB buildout Deficiencies- ODOT | | |
| | Improvement Cost Estimates | | |
| | Existing Deficiencies Estimates | | |
| | Existing deficiencies estimates- Independence | | |
| | Existing Deficiencies Estimate-ODOT | | |
| | UGB Buildout deficiencies Estimate | **Staffing Analysis** | Existing Facilities and Structures |
| | UGB Buildout deficiencies Estimates-Independence | | Current Staffing and Activities |
| | UGB buildout deficiencies Estimates-ODOT | | Future Staffing and Activities: admin, O and M, Staffing Recommendations, additional staffing implementation schedule |
| | Managment and Maintenance Analysis | **Additional Recommendations and Considerations** | Private Development Drainage Facilities |
| | Current Management Organization | | Stormwater Detention Considerations |
| | Current Maintenancne Effort | | Future Service for Growth Nodes: Wyatt, La Creole, Barberry |
| | Organizational Recommendations | | Data Collection |
| | Maintenance Requirements | | Condition Assessment |
| | Staffing recommendations | | Pipe Rehabilitation and Replacement |

| WATER QUALITY | | | |
|---|---|---|---|
| Independence | | Dallas | |
| **Stormwater Management** | Stormwater Quality Control | **Water Quality** | Regulatory Climate |
| | Quality Issues | | Topographical and Climate Information Relevant to Stormwater Quality |
| | Strategies to Address Quality Issues | | Types of Contaminants |
| | Quality Policies | | Observed Levels of Contamination |
| | Stormwater Quantity Management | | Methods of Removal: nutrient, sediment, bacteria, organic compounds and solvents, trace metals, temperature |
| | Quantity Issues | | Recommendations: catch basin types, open channel waterways, passive water quality treatment facilities, best management practices, potential BMP's for water quality treatment |
| | Strategies to Address Quantity Issues | | |
| | Quantity Policies | | |
| | Uplands Natural Resource & Wetlands Management | | |
| | Uplands and Wetlands Issues | | |
| | Strategies to address uplands and wetlands issues | | |
| | uplands and wetlands policies | | |
| | Floodplain Management | | |
| | Floodplain Issues | | |
| | Strategies to address Floodplain Issues | | |
| | Flodplain Policies | | |
| | Stream System Management | | |
| | Stream System Issues | | |
| | Strategies to Address Stream System Issues | | |
| | Stream System Policies | | |
| | Cross-Jurisdictional Basin Stromwater Management | | |
| | City of Monmouth | | |
| | Polk County | | |
| | Oregon Department of Transportation | | |
| | Watershed Councilc and Conservation District | | |

| FINANCIAL ANALYSIS | | | |
|---|---|---|---|
| Independence | | Dallas | |
| | Strategy for infrastructure Improvements | **Capital Cost Estimate** | |
| | Existing System Needs | **Capital Plan** | Schedule |
| | System Growth Requirements | | Cost Sharing and Grant Funding |
| | Funding | **Rate Study** | Introduction: Existing SWM infrastructure conditions |
| | Funding ALternatives | | Existing SWM financial Conditions |
| | General Obligation Bonds | | |
| | Advalorem Tax | | |
| | Revenue Bonds | | |
| | Local Improvesment District | | |
| | Capital Construction )sinking Fund) | | |
| **Financial Analysis** | System Development Charges | | |
| | Assessments | | |
| | Utility Fees | | |
| | Grants and Loans | | |
| | Funding Reccomendations | | |
| | Funding Plan | | |
| | Funding Plan | | |
| | Existing Deficiencies Funding | | |
| | UGB Build out Deficiencies Funding | | |
| | Implementation Plan | | |
| | Existing Deficiencies Implementation | | |
| | UGB Buildout Deficiencies Implementation | | |

Development Codes

| DEFINITIONS | | | | | | | | |
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| Independence | | | Dallas | | | Monmouth | | |
| SubChapter 13 Definitions | Defintions | Curb Lines: means the line indicating the edge of the vehicular roadway within the overall right-of-way on improved streets. The curb line is the face of the curb at the storm water gutter line. | Article 6: Definitions and Rules of Measurement | 6.1: Definitions | Stormwater Facility. A facility designed to manage the quantity of stormwater runoff and may contain features that are designed to improve the quality of runoff. Stormwater quality facilities may include vegetated swales and sand filters, wet or dry ponds, marshes, infiltration facilities, and structural storm sewer devices such as oil-water separators. Stormwater quality facilities do not include conveyance systems that are meant only for conveying the stormwater from one place to another and do not affect the quality of the stormwater. | Title 13: Utilities | 13.15: Sewer Utility<br>13.15.010: Definitions | "Sewage" shall mean a combination of the water-carried wastes from residences, business buildings, institutions, and industrial establishments, together with such ground, surface, and stormwaters as may be present. "Storm drain" (sometimes termed "storm sewer") shall mean a sewer which carries storm and surface waters and drainage, but excludes sewage and industrial wastes, other than unpolluted cooling water. |
| | | Grasscrete: means a structural vehicular paver that consists of pores or holes that are typically infilled with grass or some other type of ground cover that helps to reduce storm water runoff by treating the water on site. | | | Swale. A type of storm water facility. Usually a broad, shallow depression with plants that filter and process contaminants. | | 13.40: Utility License Code<br>13.40.004: Definitions | "Public utility easement" means an easement conveyed, granted or dedicated to the City or the public and acquired, established, dedicated or devoted to utility purposes, whether designated as a public easement, utility easement, general utility easement, public utility easement or similar term. Easements acquired for use by the City's public stormwater, wastewater, or water systems shall not be considered public utility easements or public rights-of-way. "Utility" means any person, or its lessees or trustees of record, that owns, operates, manages or controls all or a part of any utility facility in the City for the production, transmission, delivery, conveyance, distribution or function of gas, heat, steam, light, wastewater, stormwater, water, power, electricity, or communications service. Includes any affiliate of a utility, or any other entity controlled or managed by a utility or its affiliate, that uses utility facilities in the City to provide any utility service; utilities owned or operated by a municipality or special district; and electricity service supplier as defined by ORS 757.600; and a private communications network. "Utility service" means the provision of gas, heat, steam, light, wastewater, stormwater, water, power, electricity or communications service through utility facilities located in the public rights-of-way. (Ord. 1377 § 1, December 5, 2017.) |
| Subchapter 55: Stormwater Management Requirements | 55.010: Definitions | A. "Development" shall mean any property altered in appearance by removal of vegetation, grading or filling of the existing ground surface or construction of a structure or any other impervious surface. | | | Local Improvement District (LID). A small public district formed for the purpose of financing local improvements (paving of streets, construction of sidewalks, street lighting, water mains, storm sewers, parks, etc.) within a zone of benefit, usually assessed against abutting properties. Property owners within the LID are assessed for the cost of the improvements in accordance with ORS 223.387-223.485. | Title 18: Zoning | 18.165: Significant Riparian Corridors<br>18.165.020: Definitions | "Impervious surface" means any material that reduces and prevents absorption of storm water. |
| | | B. "Drainage management" means the handling of storm water runoff so as to minimize its adverse impacts upon the public health, safety and welfare; upon property, public or private; upon local economy and aesthetics; | | | Surface Water Management. Storm drainage facilities or practices conforming to an adopted surface or storm water management plan, or evironmental/engineering best practices. | | | |
| | | C. "Drainage management plan" means a plan drawn by a registered professional engineer showing ditches, culverts, easements and other proposed improvements with a statement in writing showing how the development will not create erosion, drainage, runoff or flooding problems either in the development, in adjacent or downstream properties. The plan shall also contain a soil erosion and sediment control plan. | | | | | | |
| | | D. "Impervious surface" are those hard-surface areas located upon real property which either prevent or retard saturation of water into the land surface, as existed under natural conditions pre-existent to development, and/or cause water to run off the land surface in greater quantities or at an increased rate of flow from that present under natural conditions pre-existent to development. Common impervious surfaces include, but are not limited to, roof tops, concrete or asphalt sidewalks, walkways, patio areas, driveways, parking lots or storage areas, streets, roads, and graveled, oiled, macadam or other surfaces which similarly impact the natural saturation or runoff patterns which existed prior to development. | | | | | | |
| | | E. "Improved premises" means any area which has been altered such that the runoff from the site is greater than that which could historically have been expected, or any alteration of the historic alignment and/or direction of the runoff. Such a condition shall be determined by the city. | | | | | | |
| | | F. "Open drainage way" means a natural or man-made path which has the specific function of transmitting natural stream water or storm runoff water from a point of higher evaluation to a point of lower evaluation. | | | | | | |
| | | G. "Runoff control" is any means approved by the city by which the peak rate of storm water runoff from developed land surfaces is reduced. | | | | | | |
| | | H. "Storm water management plan" is a comprehensive plan required for all development applications for projects which will expose more than 60,000 square feet of soil at one time or which will produce more than 10,000 square feet of additional impervious surface. | | | | | | |

| TYPES OF ZONES/ZONING | | | | | | | | |
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| Independence | | | Dallas | | | Monmouth | | |
| SubChapter 23: Mixed Density Residential (MX Zone) | 23.010 Density | To achieve balance and integration of a range of housing types, sizes, and densities,the Mixed Density Residential (MX) Zone relies on two criteria.<br><br>A. The intent of the MX Zone is to achieve a minimum average density of nine (9) dwelling units per net acre of residential land, while allowing a mix of lot sizes and densities. Net acres of residential land means the total site area devoted to residential uses, not including the area of streets, other rights-of-way to be dedicated to the public, or protected wetland or riparian areas. Net acres does include any area to be devoted to the trail/stormwater/drainage corridors located along the edges of the planning area and adjacent to riparian and wetland areas or corridors. | Article 2: Land Use Districts | 2.6: Mixed-Use Master Planning District<br><br>2.6.010: Purpose | Master planning also facilitates City review of the impacts resulting from development of individual parcels on remaining parcels within a Mixed Use Node, in terms of land use, transportation and public facilities (sewer, water, storm drainage, schools, parks). | Title 18: Zoning | 18.65: Mixed Density Residential (MX) Zone<br><br>18.65.120: Special Standards for Certain Uses | Street Access Developments: Townhomes, duplexes and triplexes receiving access directly from a public or private street shall comply with all of the following standards, in order to minimize interruption of adjacent sidewalks by driveway entrances, slow traffic, improve appearance of the streets, and minimize paved surfaces for better storm water management. (i) When garages face the street, they shall be recessed behind the front elevation (i.e., living area or covered front porch) by a minimum of four feet. (ii) The maximum allowable driveway width facing the street is 24 feet per dwelling unit. The maximum combined garage width per unit is 50 percent of the total building width. For example, a 24-foot-wide unit may have one 12-foot-wide recessed garaged facing the street. (iii) Two adjacent garages shall share one driveway when individual driveways would otherwise be separated by less than 20 feet (i.e., the width of one on-street parking space). When a driveway serves more than one lot, the developer shall record an access and maintenance easement/agreement to benefit each lot before building permit issuance. |
| | 23.050 Special Standards for Certain Uses | Street Access Developments. Townhomes, rowhouses and duplexes receiving access directly from a public or private street shall comply with all of the following standards, in order to minimize interruption of adjacent sidewalks by driveway entrances, slow traffic, improve appearance of the streets, and minimize paved surfaces for better storm water management. | | 2.9: Manufactured Dwelling Park Regulations<br>2.9.100: Site Development and Design Standards | Public and Private Facilities. Each manufactured dwelling park space shall be provided with water, sanitary sewer, storm drainage, street facilities, natural gas services, underground electrical power, telecommunication, and cable television in accordance with the requirements of Chapter 3.4. | | | |
| SUBCHAPTER 34 DOWNTOWN RIVERFRONT ZONE | 34.050 Townhomes, Rowhouses and Multifamily Standards | Street Access Developments. Townhomes, rowhouses and duplexes receiving access directly from a public or private street shall comply with all of the following standards, in order to minimize interruption of adjacent sidewalks by driveway entrances, slow traffic, improve appearance of the streets, and minimize paved surfaces for better stormwater management. a. When garages face the street, they shall be recessed behind the front elevation (i.e., living area or covered front porch) by a minimum of 4 feet. b. The maximum allowable driveway width facing the street is 24 feet per dwelling unit. The maximum combined garage width per unit is 50 percent of the total building width. For example, a 24-foot wide unit may have one 12-foot wide recessed garaged facing the street. c. Two adjacent garages shall share one driveway when individual driveways would otherwise be separated by less than 20 feet (i.e., the width of one on-street parking space). When a driveway serves more than one lot, the developer shall record an access and maintenance easement/agreement to benefit each lot, before building permit issuance. | | | | Title 18: Zoning | 18.115: Public Service College (PSC) Zone<br><br>18.115.080: Campus Planning Criteria | Within the boundaries of WOU, the Campus Development Plan shall conform to the following general planning criteria: (2) Maximum building area coverage: 50 percent of the total gross area of the campus. (3) Maximum building area: no maximum. (4) Building Setbacks. (6) Off-Street Parking. (a) Provide and maintain a minimum of one off-street parking space for each two and one-half full-time-equivalent students, faculty and staff. (b) Parking areas shall generally conform to the requirements of CC 18.130.020, 18.130.030, 18.130.050, 18.130.070 and 18.130.100. Other sections of this chapter do not apply to the PSC zone. (9) Utilities shall be underground. (10) Storm drainage shall conform to City of Monmouth Storm Drain Design Standards for a 10-year return period storm. (Amended by Ord. 1305, § 1 (Exh. A), November 6, 2012. Code 1983 § 94.140.) |
| | 34.055 Additional Development Standards | E. Design Standards and Guidelines.<br>1. Building Divisions Note: Roof gardens represent a unique and beneficial approach to treating the top of the building. Beyond their aesthetic benefits, rooftop gardens help manage stormwater run-off that would otherwise go into storm sewers, aquifers, and streams. In addition, rooftop gardens help mitigate the heat island effect by reducing the temperature and, therefore, providing energy savings and air quality. Green roofs can also provide a food source. | | | | | | |

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| **LOT COVERAGE STANDARDS/IMPERVIOUS SURFACES** | | | | | | | | |
| Subchapter 55: Stormwater Management Requirements | 55.015: Drainage Management Plans Required | B. Storm Water Management Plans. In addition to the drainage management plan described above, developers for projects which will expose more than 60,000 square feet of soil or which will produce more than 10,000 square feet of additional impervious surface must submit a comprehensive storm water management plan to the Planning Commission for its review and approval. | Article 2: Land Use Districts | 2.2: Residential Districts<br><br>2.2.030: General Development Standards<br><br>2.2.050: Housing Density<br><br>2.2.060: Lot Coverage and Impervious Surfaces | Lot Coverage (Impervious Surfaces): Max. Lot Coverage by Impervious Surfaces draining into a public right-of-way or draining off-site. Areas covered with pervious surfaces (e.g., planted areas, porous paving systems, etc.) and allowing on-site infiltration of stormwater, are not counted toward lot coverage, provided such areas are designed to City standards. Adjustments are limited to 10% (e.g., up to 55% in RL), except as approved through a Master Plan under Chapter 4.5.<br><br>Areas reserved for private access, stormwater treatment, and open space are counted for the purpose of calculating allowable density. Areas conveyed or dedicated to the public for stormwater treatment or open space, exclusive of public street rights-of-way, are counted for the purpose of calculating allowable density.<br><br>The purpose of the lot coverage standard is to provide flexibility in development design while encouraging developments that minimize stormwater runoff and incorporate water quality treatment. Therefore, lot coverage is calculated as the percentage of a lot or parcel covered by impervious surfaces (e.g., asphalt, concrete, and similar non-porous paving). It does not include areas that function as water quality treatment facilities and those allowing infiltration of treated surface water; such exempt areas may include porous paving systems, swales, landscape areas and other water quality treatment facilities conforming to City standards and as approved by the Public Works Director. | Title 18: Zoning | 18.115: Public Service College (PSC) Zone<br><br>18.115.080: Campus Planning Criteria | Within the boundaries of WOU, the Campus Development Plan shall conform to the following general planning criteria: (2) Maximum building area coverage: 50 percent of the total gross area of the campus. (3) Maximum building area: no maximum. (4) Building Setbacks. (6) Off-Street Parking. (a) Provide and maintain a minimum of one off-street parking space for each two and one-half full-time-equivalent students, faculty and staff. (b) Parking areas shall generally conform to the requirements of CC 18.130.020, 18.130.030, 18.130.050, 18.130.070 and 18.130.100. Other sections of this chapter do not apply to the PSC zone. (9) Utilities shall be underground. (10) Storm drainage shall conform to City of Monmouth Storm Drain Design Standards for a 10-year return period storm. (Amended by Ord. 1305, § 1 (Exh. A), November 6, 2012. Code 1983 § 94.140.) |
| **LANDSCAPING/STREET TREE REQUIREMENTS** | | | | | | | | |
| **Subchapter 54 BUFFERING, SCREENING, LANDSCAPE, and ASH CREEK SETBACK REQUIREMENTS** | 54.205 Landscaping Requirements | A minimum of 15% of the site for commercial, industrial and mixed-use developments should be landscaped. A minimum of 20% of the site for multi-family developments should be landscaped. [2] Up to one-third of the landscape may be hardscape such as a walkway, plaza, or small gathering area [3] Whenever possible, stormwater detention and retention facilities should be incorporated into the landscape. | Article 3: Community Design Standards | 3.2: Landscaping, Street Trees, Fences, and Walls<br><br>3.2.020: Landscape Conservation<br><br>3.2.030: Landscaping | Significant trees and shrubs identified as meeting the criteria in Section B, above, shall be retained to the extent practicable to minimize the risk of erosion, landslide, and stormwater runoff. Where protection is impracticable because it would prevent reasonable development of public streets, utilities, or land uses permitted by the applicable land use district, the City may allow removal of significant vegetation to provide for a reasonable building envelope (area exclusive of required yard setbacks), and areas for access and utilities.<br><br>"Hardscape features: In meeting the landscape area requirements of this Chapter, and where soil and drainage conditions allow, areas covered by unenclosed patios, decks, plazas, and similar hardscape features may count toward up to fifty percent (50%) of the required landscape area, provided that such surfaces allow for stormwater infiltration to the aquifer. Swimming pools, sports courts, and similar active recreation facilities may not be counted toward fulfilling the landscape requirement. Non-plant Ground Covers: Bark dust, chips, or similar mulch shall be used to cover all landscape surfaces not otherwise planted or covered with hardscape surfaces. Stone, aggregate and similar materials may be used as ground cover, but shall cover no more than fifty percent (50%) of the area to be landscaped and shall be limited to footpaths, landscape bed borders, or structures providing erosion control or stormwater management. Non-plant ground covers cannot be a substitute for ground cover plants. Storm Water Facilities. Surface storm water treatment facilities (e.g., detention/retention ponds and swales designed for water quality treatment), when required under Section 3.4.040, shall be landscaped with water tolerant, native plants." | Title 18: Zoning | 18.145: Landscaping and Street Trees<br><br>18.145.060: Minimum Area Requirements<br><br>18.145.100: Required Tree Plantings | Landscaped areas may include landscaping around buildings, in open spaces and outdoor recreation areas; in islands and perimeter planting areas in parking and loading areas; and in areas devoted to buffering and screening as required in this section and elsewhere in this chapter. The following area requirements shall be the minimum areas devoted to landscaping: (1) Multifamily Developments. In the medium density residential and high density residential zones, a minimum of 15 percent of the gross land area shall be devoted to landscaping in multifamily developments. Interior courtyards, atriums, solar greenhouses, roof gardens and storm drainage retention areas may be included with general landscaped areas in the calculation of this percentage. (2) Commercial Developments. In all commercial zones, except the Main Street district, a minimum of 10 percent of the gross land area shall be devoted to landscaping in commercial developments. (3) Industrial Developments. In all industrial zones, a minimum of 10 percent of the gross land area shall be devoted to landscaping in industrial developments. (4) For expansion of existing developments and parking lots, the required landscape minimum percentage shall be maintained. (Amended by Ord. 1305, § 1 (Exh. A), November 6, 2012. Code 1983 § 96.322.)<br><br>Tree plantings in accordance with this section are required for all landscape areas, including, but not limited to, parking lots for 10 or more cars and public street frontages. (1) Street Trees. (2) Parking Lot Trees. The intent of requiring parking lot trees is to provide a canopy effect to shade and soften the visual impact of the parking lot. (3) Areas Where Trees May Not Be Planted. Unless approved otherwise by the City Manager, trees may not be planted: (g) Within 10 feet of a public sanitary sewer, storm drainage, or water line; |
| | | | | | | Title 18: Zoning | 18.155: Heritage Trees<br><br>18.155.040: Heritage Tree Nomination | The nomination of a tree as a heritage tree or a group of trees as a heritage grove may be submitted by any person on a form provided by the City. No trees shall be designated as a heritage tree or a heritage grove without the voluntary consent of the owner. No trees located in areas identified in the Monmouth Comprehensive Plan or in adopted master plans as areas for public improvements to road, water, sanitary sewer, or storm sewer systems, or identified as locations for public buildings, shall be nominated. (Code 1983 § 96.515.) |

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| **FLOODPLAINS/RIPARIAN CORRIDORS/WETLANDS** | | | | | | | | |
| | | | Article 4: Administration of Land Use and Development | 4.3: Land Divisions and Property Line Adjustments<br><br>4.3.020: General Requirements<br><br>4.3.090: Final Plan Submission Requirements and Approval Criteria | Floodplain, Park, and Open Space Dedications. Where land filling and/or development is allowed within or adjacent to regulatory flood plain and the Comprehensive Plan designates the subject flood plain for park, open space, or trail use, the City may require the dedication of sufficient open land area for a greenway and/or trail adjoining or within the flood plain for transportation, storm drainage/water quality, or park purposes in the public interest. When practicable, this area shall include portions at a suitable elevation for the construction of a multi-use pathway in accordance with the City's adopted trails plan or pedestrian and bikeway plans, as applicable. The City shall evaluate individual development proposals and determine whether the dedication of land is justified based on the development's impact to the park and/or trail system, or as may be required for stormwater management.<br><br>Approval Process and Criteria. By means of a Type I procedure, the City Planning Official and City Engineer, or the Planning Commission, shall review the final plat and shall approve or deny it based on findings regarding compliance with the following criteria: The plat and deed contain a dedication to the public of all public improvements, including but not limited to streets, public pathways and trails, access reserve strips, parks, sewage disposal storm drainage and water supply systems | Title 18: Zoning | 18.170: Wetland Protection Areas<br><br>18.170.070: Prohibited activities within wetland protection areas | Except as allowed in MCC 18.170.060, Allowed activities within wetland protection areas, the following activities are prohibited within a wetland protection area: (1) Placement of new structures or impervious surfaces. (2) Excavation, drainage, grading, fill, or removal of vegetation except for fire protection purposes or removing hazardous trees. (3) Expansion of areas of landscaping with nonnative species, such as a lawn or garden, into the wetland protection area. (4) Disposal or temporary storage of refuse, yard debris, or other material. (5) Discharge or direct runoff of untreated stormwater. (6) Uses not allowed in the list of permitted uses for the underlying zone. (7) Any use not specifically allowed in CC 18.170.060. (Ord. 1380 § 4 (Exh. 3), 2018.) |
| **STREETS/SIDEWALKS/PARKING** | | | | | | | | |
| Subchapter 80: Site Design Review Requirements | 80.40 REVIEW CRITERIA AND STANDARDS | B. Site Development Plan - drawn to scale, indicating the following information:<br><br>9. Other site elements which will assist in the evaluation of site development; including (1) existing and proposed water, sewer and storm drain connections to the existing public utility system, (2) final building, parking area, and lot corner elevations, (3) drainage patterns. | Article 3: Community Design Standards | 3.3: Parking and Loading<br><br>3.3.010: Purpose<br><br>3.3.030: Automobile Parking Standards | Because vehicle parking facilities occupy large amounts of land, they must be planned and designed carefully to use the land efficiently, minimize stormwater runoff, and maintain the visual character of the community. This Chapter recognizes that each development has unique parking needs and provides a flexible approach for determining parking space requirements (i.e., "minimum" and "performance-based" standards).<br><br>All off-street parking spaces shall be improved to conform to City standards for surfacing, stormwater management, and striping. Standard parking spaces shall conform to the following standards and the dimensions in Figures 3.3.030F(1) through (3), and Table 3.3.030F: | Title 12: Streets, Sidewalks, and Public Properties | 12.18: Permits for Work in Rights of Way | Issuance of Permit. (a) If satisfied that the application, plans and documents submitted comply with all requirements of this chapter, the City shall issue a permit authorizing construction of the facilities subject to such further conditions, restrictions or regulations affecting the time, place and manner of performing the work as the City may deem necessary or appropriate… (f) No permit shall be issued to locate private water, stormwater, or wastewater facilities in the public right-of-way unless the applicant establishes it is in the public interest to do so. |

| SITE DESIGN STANDARDS<br>Independence | | | Dallas | | | Monmouth | | |
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| CHAPTER 80 SITE DESIGN REVIEW REQUIREMENTS | 80.40 REVIEW CRITERIA AND STANDARDS | B. Site Development Plan - drawn to scale, indicating the following information:<br><br>9. Other site elements which will assist in the evaluation of site development; including (1) existing and proposed water, sewer and storm drain connections to the existing public utility system, (2) final building, parking area, and lot corner elevations, (3) drainage patterns. | Article 3: Community Design Standards | 3.4.060: Easements | Recordation. As determined by the City Engineer, all easements for sewers, storm drainage and water quality facilities, water mains, electric lines, or other public utilities shall be recorded with the final plat. See Chapter 4.2, Site Design Review, and Chapter 4.3, Land Divisions. | Title 17: Subdivisions and Partitions | 17.25: Improvements, Design and Development Standards<br><br>17.25.010: Improvement Requirements | Drainage. Such grading shall be performed and drainage facilities installed conforming to City specifications as is necessary to provide proper drainage within the subdivision and other affected areas in order to assure healthful, convenient conditions for the residents of the subdivision and for the general public. Drainage facilities in the subdivision shall be connected to drainage ways or storm sewers outside the subdivision. Dikes and pumping systems shall be connected to drainage ways or storm sewers outside the subdivision. Dikes and pumping systems shall be installed if necessary to protect the subdivision against flooding or other inundation. |
| | 80.30.005. Submission of docume | C. Landscape Plan - drawn to scale, indicating the following information:<br>4. The size and location of all storm water facilities intended to fulfill the requirements of Subchapter 55. | | 3.4.070: Construction Plan Approval and Permits | Construction Plan Approval and Permit: No public improvements, including sanitary sewers, storm sewers, streets, sidewalks, curbs, lighting, parks, or other requirements shall be undertaken until after the plans have been approved by the City, permit fee paid, and permit issued. | | | |
| | 80.40 REVIEW CRITERIA AND STA | F. Surface Water Drainage. Special attention shall be given to proper grading and contouring of the site, on-site surface drainage and on-site storage of surface water facilities, when necessary, so that removal of surface waters will not adversely affect neighboring properties, public rights-of-way or the public storm drainage system. All storm water facilities shall comply with the requirements of Subchapter 55. | | | | | | |
| | 80.70 ADDITIONAL REQUIREMEN | 80.70.005 To the extent necessary to meet the criteria for site design review contained in this subchapter, the City may impose the following additional requirements on a development subject to advising the applicant of the reason in writing.<br><br>B. Obtain approval of a grading and drainage plan for the collection, treatment and transmission of storm or ground water, from an engineer licensed to practice in the State of Oregon. | | | | | | |
| SubChapter 55 Stormwater Management Requirements | 55.020 Design Standards | A. All storm water systems within the development shall be designed to meet the criteria of the performance standards based on run off curves complied by the soil conservation services. Flows shall be computed by appropriate professional methods with design computations being submitted for approval. | | | | | | |
| | | B. Upstream drainage shall be accommodated by an adequate sized system through the proposed development for existing conditions and future potential development in the upstream drainage area or areas tributary to the proposed development, as determined by the Planning Commission. | | | | | | |
| | | C. Existing downstream drainage facilities shall be studied to determine the effect of the proposed development's drainage. The developer shall demonstrate to the satisfaction of the Planning Commission that the storm drainage from the proposed development will not, in any way, overload or damage existing storm drainage systems downstream from the proposed development. | | | | | | |
| | | D. Three hundred (300) feet shall be considered as the maximum length for carrying open storm water in a street gutter prior to intake at a catch basin for all zones. No storm water will be permitted to drain across a street or across an intersection. | | | | | | |
| | | E. Minimum pipe size for any storm drainage pipe shall be 12 inches. The minimum cover over storm drainage pipe shall be 36 inches. | | | | | | |
| | | F. Where open ditches, channels, streams or natural drainage courses are used, either to collect or discharge storm water, adequately sized perpetual easements shall be provided. Minimum width shall be 20 feet. Approval of the Planning Commission shall be required for any open storm drainage system. A minimum bottom flow line slope of two (2) percent is required, unless otherwise approved by the City. | | | | | | |
| | | G. Where subsurface soils are of the nature requiring an under-drainage system, underdrains shall be installed so that they are discharged by gravity. | | | | | | |
| | | H. House foundation drains may be connected to the storm drainage system upon approval by and under the direction of the City of Independence. | | | | | | |
| | | I. Storm drain system inlet and outlet aprons to shall be rip-rapped with appropriate sized rock material. | | | | | | |
| | | J. Proposed open detention facilities shall be fenced around the perimeter with chain link fence (6-feet high) and gated when required by the Planning Commission. | | | | | | |
| | | K. Storm drainage construction methods, materials, and testing requirements shall meet the latest A.P.W.A. standards and shall be approved by the City prior to installation. | | | | | | |

| UTILITIES | | | | | | | | |
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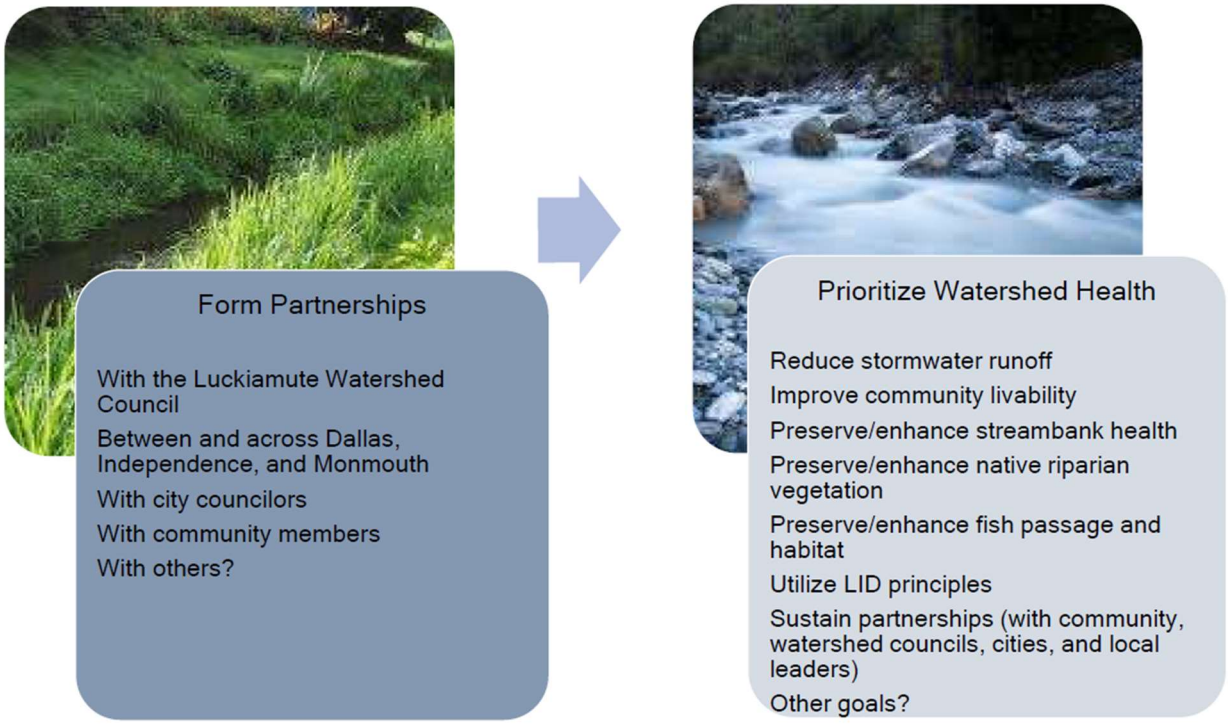
| Independence | | | Dallas | | | Monmouth | | |
| | | | Article 1: General Provisions | 1.3: Land Use Categories<br><br>1.3.400: Basic Utilities, Private and Public | Characteristics. Basic Utilities are infrastructure services, which need to be located in or near the area where the service is provided. Examples include water and sewer pump stations; sewage disposal and conveyance systems; electrical substations; water towers and reservoirs; water quality and flow control facilities; water conveyance systems; stormwater facilities and conveyance systems; telephone exchanges; bus stops or turnarounds, suspended cable transportation systems, and public safety facilities district heating and cooling systems; solar, wind, or geothermal power generation facilities that are not accessory to a primary structure but serve a single development, subdivision, or subarea of the City; and emergency communication broadcast facilities. Larger-scale utility facilities, and those that do not conform to the above definition (e.g., biomass power generation), may be classified as Industrial uses or "Other" uses (e.g., Utility Corridor) as applicable. | Title 13: Utilities | 13.15.040: Use of Public Sewers | No person shall discharge or cause to be discharged any stormwater, surface water, groundwater, roof run-off, subsurface drainage, uncontaminated cooling water, or unpolluted industrial process waters to any sanitary sewer. (2) Stormwater and all other unpolluted drainage shall e discharged to such sewers as are specifically designated as combined sewers or storm sewers, or to a natural outlet approved by the Director. Industrial cooling water or unpolluted process waters may be discharged, on approval of the Director, to a storm sewer, combined sewer, or natural outlet. |
| | | | Article 3: Community Design Standards | 3.4: Public Facilities<br><br>3.4.030: Sanitary Sewer and Water Service Improvements | Over-Sizing. The City may require as a condition of development approval that sewer, water, and/or storm drainage systems serving new development be sized to accommodate future development within the area as projected by the applicable Water, Sewer, and/or Storm Drainage Master Plan, provided that the City may grant the developer credit toward any required system development charge for the same, or the City may authorize other cost recovery or cost-sharing methods, in conformance with Section 3.4.010D.<br><br>Accommodation of Upstream Drainage. Culverts and other drainage facilities shall be large enough to accommodate existing and potential future runoff from the entire upstream drainage area, whether inside or outside the development. Such facilities shall be subject to review and approval by the City Engineer. C. Effect on Downstream Drainage. The rate of stormwater runoff leaving a development site during and after development (post-development) shall not exceed the rate of stormwater runoff leaving the site before development (pre-development). D. Storm Drainage Analysis and Mitigation Required. The City Engineer may require an applicant for development to provide a storm drainage analysis prepared by a qualified professional engineer registered in the State of Oregon to examine pre- and post-development stormwater runoff conditions and any required mitigation consistent with the City of Dallas Stormwater Master Plan. Such analysis, at a minimum, shall quantify pre- and postdevelopment runoff volumes and rates and propose mitigation based on stormwater management best practices, as specified by the City Engineer. Such mitigation shall ensure that post-development runoff rates do not exceed pre-development rates and necessary facilities are provided to protect public health, safety, and welfare. If upon reviewing the applicant's storm drainage analysis, the City Engineer determines that the stormwater runoff resulting from the development will overload any existing and/or proposed drainage facility, the City shall withhold | | | |

| SUBDIVISIONS/PARTITIONS/PROPERTY LINES<br>Independence | | | Dallas | | | Monmouth | | |
|---|---|---|---|---|---|---|---|---|
| | 90.60.030 Tentative Plat, Information. The following information shall be shown on the tentative plat: | P. Proposals for sewage disposal, storm water drainage, erosion control, storm water treatment, and flood control, including profiles of proposed drainage ways. | Article 3: Community Design Standards | 3.4.040: Storm Drainage Improvements | Subdivisions and Master Planned Developments. The following additional standards apply to all new subdivisions, including those within Master Planned Developments, in order to facilitate underground placement of utilities. All underground utilities, including sanitary sewers and storm drains installed in streets by the developer, shall be constructed prior to the surfacing of the streets. | | 17.15: Major Partition and Subdivision Procedure<br><br>17.15.050: Tentative Plat Information | The following information shall be shown on the tentative plat: (12) A vicinity map, showing existing subdivisions and unsubdivided land ownerships adjacent to the proposed subdivision, and showing how proposed streets, bikeways, pedestrian facilities, and utilities may be extended to connect to existing and proposed streets and utilities. (16) Proposals for sewage disposal, storm water drainage and flood control, including profiles of proposed drainage way. (17) If lot areas are to be graded, a plan showing the nature of cuts and fills and information on the character of the soil. (18) Proposals for other improvements such as electric utilities, street lighting, and landscape plans. (19) A complete service utility plan for the subdivision to be made, which plan shall require easements adequate to meet the underground service utility requirements of the subdivision but not to exceed the preliminary requirements. The final plat of the subdivision as provided shall contain a dedication to the public of easements in accordance with the service utility plan as adopted by the Planning Commission. (20) The location within the subdivision and in the adjoining streets and property of existing sewers, water mains, culverts, drain pipes and electric lines. (25) Soils Report. (Amended by Ord. 1275, June 16, 2009. Code 1983 § 97.130.) |
| **SUBCHAPTER 90 SUBDIVISION REGULATIONS** | | Y. If located within the Southwest Independence Concept Plan area, the location and widths of streets, pedestrian and bicycle facilities, and the trail/stormwater/riparian corridor along Ash Creek consistent with the Southwest Independence Concept Plan. | | | | Title 17: Subdivisions and Partitions | 17.30: Planned Unit Development<br><br>17.30.075: Density Exceptions | The Planning Commission may grant an exception to allow an increase from the maximum density of the underlying zone, up to a maximum of 120 percent of the underlying density, upon findings that: (2) Existing and proposed water, sanitary sewer and storm drainage facilities within and connecting to the development are adequate to support the proposed density; (3) The increase does not necessitate unnecessary topographic alterations or impact inventoried significant natural resource areas, including required buffer areas; (6) The development demonstrates a high level of compliance with recognized practices for sustainable development, including but not limited to the following: (e) Use of water conserving landscaping; (f) Use of storm water harvesting or diversion for irrigation; (g) Enhanced tree plantings; and (h) Use of green roofs; and (7) The development complies with all other requirements of the Zoning and Development Ordinance. (Ord. 1352, § 1 (Exh. A), December 2, 2014. Code 1983 § 97.537.) |
| | 90.60.075 Information Required on Final Applications. The application provided for in 90.60.070 of the proposed subdivision plat or the major partition must contain the following information with respect to the subject area: | L. Certificates. The following, which may be combined where appropriate, must be included:<br>1. A certificate that the subdivider has entered into agreement with the city relating to completion of improvements, public lands payments, monumentation or any other elements deemed relevant to the purpose of this or any other city ordinance, state statue, or federal law. The subdivider is responsible for the cost of an independent third party inspector for all public improvements including, but not limited to sewer, water, storm drainage and road construction, said inspection fees will be paid to the city before construction begins. Inspection fees will be set by the City Council. The subdivider shall be responsible for payment of any inspection fee costs that exceed the fee amount set by the City Council. All unused inspection fees shall be refunded to the subdivider upon satisfactory completion of all inspections. | | | | | 17.25: Improvements, Design and Development Standards<br><br>17.25.010: Improvement Requirements | Drainage. Such grading shall be performed and drainage facilities installed conforming to City specifications as is necessary to provide proper drainage within the subdivision and other affected areas in order to assure healthful, convenient conditions for the residents of the subdivision and for the general public. Drainage facilities in the subdivision shall be connected to drainage ways or storm sewers outside the subdivision. Dikes and pumping systems shall be connected to drainage ways or storm sewers outside the subdivision. Dikes and pumping systems shall be installed if necessary to protect the subdivision against flooding or other inundation. |
| | Subchapter 90.80 IMPROVEMENTS | 90.80.005 Improvement Requirements. The following improvements are summarily required in subdivision and major partitions, and may be applied to minor partitions as conditions for approval and shall be installed at the expense of the subdivider.<br><br>C. Drainage. Such grading shall be performed and drainage facilities installed conforming to city specifications as is necessary to provide property drainage within the subdivision and other affected areas in order to assure healthful, convenient conditions for the residents of the subdivision and for the general public. Drainage facilities in the subdivision shall be connected to drainage ways or storm sewers outside the subdivision. Dikes and pumping systems shall be installed if necessary to protect the subdivision against flooding or other inundation. All drainage improvements must conform to Subchapter 80, Storm Water Management Requirements and applicable State and Federal laws. | | | | | 17.25.020: Improvement Procedures | Underground utilities, television cables, telephone lines, sanitary sewers and storm drains installed in streets by the applicant shall be constructed prior to the surfacing of the streets. Stubs for service connections for underground utilities; television cable, telephone line, and sanitary sewers shall be placed to lengths that will avoid the need to disturb street improvements when service connections are made. |
| | | 90.80.010 Improvement Procedures. In addition to other requirements, improvements shall conform to the requirements of this ordinance and improvement standards or specifications adopted by the City and shall be installed in accordance with the following procedure:<br><br>D. Underground utilities, television cables, telephone lines, sanitary sewers and storm drains installed in streets by the subdivider shall be constructed prior to the surfacing of the streets. Stubs for service connections for underground utilities, television cable, telephone lines, and sanitary sewers shall be placed to lengths that will avoid the need to disturb street improvements when service connections are made. | | | | | 17.25.050: Blocks | Easements for Utilities. Dedication of easements for storm water sewers, and for access thereto for maintenance, in order to safeguard the public against flood damage and the accumulation of surface water, and maintenance and dedication of easements for other public utilities, may be required of the land divider at sufficient widths for their intended uses, by the Planning Commission along lot or parcel rear lines or side lines, or elsewhere as necessary to provide needed facilities for present or future development of the area in accordance with the purpose of this title. Such easements shall be dedicated to the public as a public utility easement for the underground installation and maintenance of all service utilities that may be required. |
| | 90.90.015 Blocks. | D. Easements for Utilities. Dedication of easements for storm water sewers, and for access thereto for maintenance, in order to safeguard the public against flood damage and the accumulation of surface water, and maintenance, and dedication of easements for other public utilities, may be required of the land divider at sufficient widths for their intended uses, by the Planning Commission along lot or parcel rear lines or side lines, or elsewhere as necessary to provide needed facilities for present or future development of the area in accordance with the purpose of this chapter. Such easements shall be dedicated to the City for the underground installation and maintenance of all service utilities that may be required. | | | | | 17.25.190: Improvements: Land and surface drainage | Such grading shall be done and drainage facilities shall be constructed by the land divider as are adequate for the purpose of proper drainage of the partition or subdivision, of areas affected thereby, and for the preservation of healthful and convenient surroundings and conditions for residents of the subdivision or partition, and for the general public, in accordance with specifications adopted by the City Council. |
| | | 90.90.045 Platting and Mapping Standards - Drainage. Where land in subdivision or partition is or will be periodically subject to accumulations of surface water, or is traversed by any water course channel, stream, or creek, the Planning Commission may require the applicant to provide for adequate unrestricted drainage over drainage land by dedicating drainage easements. Drainage easements approved by the Planning Commission are established | | | | | | |

# Appendix III: Interview Guide II

The following was distributed to interviewees before the interview so that they could see our interview topics ahead of time:

FRAMEWORK FOR IMPROVED WATERSHED HEALTH




## Introduction

Point of the research: We have been asked by the Luckiamute Watershed Council to look at the stormwater management standards and development standards in Independence, Monmouth, and Dallas, and see where there are similarities in each cities codes, and where there might be opportunities for the cities' codes to align with one another in order to better protect the Ash Creek watershed.

Part of our research has been looking at several case study communities, and most of them have pointed to two important factors when cities change their stormwater management plans to focus on watershed health and water quality. The first factor is partnerships, and the second factor is goals and priority alignment. Today we want to ask you some questions about these two elements.

Verbal Consent: Before we get started, we want to state that your participation in this interview is voluntary, and you can stop and any time. We are taking notes from our conversation, but your responses will be anonymous, and we will not quote you directly in our written report. We would also like to take an audio recording of the interview. Can we confirm that you agree to participate? Can we confirm that you agree to be recorded?

## Questions about Cooperation

Through our research, we've found that forming relationships with watershed councils, with residents, and across the region is an important part of implementing any stormwater changes. For this first section, we'll ask you about your relationships with four different entities in the community.

## Luckiamute Watershed Council

Do you have a relationship already?
How would you characterize that relationship?
What would LWC need to provide to make a relationship successful?
What would the city need to provide to make the relationship functional?

## Between and Across Dallas, Independence, and Monmouth

Do you have a relationship across cities already?
How would you characterize that relationship?
What would the other cities need to provide to make a relationship successful?
What would your city need to provide to make the relationship functional?

## City Councilors

Describe the relationship you have with city council.
How well-informed about stormwater issues do you feel city council is?
Do you feel you have a responsibility/obligation to educate city council on stormwater management?

## General Community

How well-informed about stormwater issues do you feel community members are?
Do you think it matters if the community is informed about stormwater management?
What is the city's responsibility for informing the community?

## Other

Are there any other communities that you think it is important to form partnerships with?

## Questions about Goal Alignment

Through our research, we've found that communities often start new stormwater management programs by agreeing on some goals and priorities which focus on water quality and watershed health, while also keeping cost, maintenance, and community support in mind. For this section of the interview, we will ask you to rank seven priorities according to two criteria.
Please take a look at the slide that I emailed you earlier this week. On the right-hand side, you'll see a list of potential priorities for watershed health. Please take a minute to silently identify the top three items that would be most beneficial for improving watershed health in your city.

- Reduce stormwater runoff
- Improve community livability
- Preserve/enhance streambank health
- Preserve/enhance native riparian vegetation
- Preserve/enhance fish passage and habitat
- Utilize Low-Impact Development principles
- Sustain partnerships (with community, watershed councils, cities, and local leaders)
- Other goals?  Please define

Now that you have had a chance to think, please tell me which three options you picked. (Note them) Why did you choose those options?

Next, we'll look at those same options again, but this time I would like you to silently identify the top three that would be easiest for your city to implement.

- Reduce stormwater runoff
- Improve community livability
- Preserve/enhance streambank health
- Preserve/enhance native riparian vegetation
- Preserve/enhance fish passage and habitat
- Utilize LID principles
- Sustain partnerships (with community, watershed councils, cities, and local leaders)
- Other goals?  Please define

Now that you have had a chance to think, please tell me which three options you picked. (Note them) Why did you choose those options?

## Wrap Up

Thank you very much for taking the time to talk with us. This helps us tell the Luckiamute Watershed Council a little more about your city's priorities and where there might be opportunities to build relationships and work on ideas to improving water quality. None of what you said is binding–this is just a place for the watershed council to know what your thoughts and limitations are, so they can start to build a plan that works for everyone.

From here, we'll summarize your responses for the watershed council, and we are also working on some Low-Impact Development options that all three cities and the watershed council may be able to work on at some future date.

Is there anything you would like to add that we have not discussed?

Do you have any questions before we sign off?

# Appendix IV: Interview Analysis

| Relationship with Luckiamute Watershed Council | Number of Mentions |
|---|---|
| We would be interested in collaborating if LWC spearheads efforts | 3 |
| We have a good existing partnership with LWC | 2 |
| We are interested in a collaboration with LWC plus Dallas, Monmouth, Independence, and Polk County | 2 |
| We have coordinated with LWC, but lack formal partnership | 1 |
| Our participation with LWC may be limited due to time constraints | 1 |
| | |
| **Relationship across Dallas, Monmouth, and Independence** | **Number of Mentions** |
| Public Works departments work together and share resources | 2 |
| Planning Departments have little contact across cities | 2 |
| Dallas is removed geographically, less resource sharing occurs with Dallas | 2 |
| We would like to collaborate more | 2 |
| Better collaboration would require more money and staff time, which are lacking | 1 |
| | |
| **Relationship with City Councils in Dallas, Monmouth, and Independence** | **Number of Mentions** |
| Stormwater management is not the top priority of city councilors | 3 |
| City staff is responsible for educating city councilors about stormwater management | 2 |
| City councilors' knowledge of stormwater management is uneven—some councilors are well-versed, some are not | 2 |
| City councilors trust city staff | 1 |
| Including recreation opportunities in stormwater management plans would get city councilors' attention | 1 |
| | |
| **Relationship with the General Public in Dallas, Monmouth, and Independence** | **Number of Mentions** |
| Community only notices stormwater facilities when they are not working properly | 3 |
| The City is responsible for educating the public about stormwater management practices | 2 |
| The City could do more to educate the public | 2 |
| We have no staffing for increased education or outreach efforts | 1 |
| We would be willing to increase education and outreach efforts | 1 |

The calculations were based on the respondents first, second and third choice answers and matched with a 3-2-1 scale analysis. The first choices were assigned a 3 value, second choice a 2 value and 3rd choice a 1 value. The responses were summed across all jurisdictions and the highest values were deemed most important and easiest.

| **Top Priorities for Watershed Health** | | | | |
|---|---|---|---|---|
| | 1st | 2nd | 3rd | |
| **Reduce Stormwater Runoff** | 2 | 1 | 1 | **9** |
| Improve Community Livability | | 1 | | **2** |
| **Preserve/ enhance streambank health** | | 2 | 1 | **5** |
| Preserve/enhance native riparian vegetation | | 1 | 2 | **4** |
| Preserve/enhance fish passage and habitat | | | 1 | **1** |
| **Utilize LID principles** | 1 | 1 | 1 | **6** |
| **Sustain partnerships** | 3 | | | **9** |
| | **3** | **2** | **1** | |
| | | | | |
| **Top Priorities for Ease of Implementation** | | | | |
| | 1st | 2nd | 3rd | |
| **Reduce Stormwater Runoff** | | | 2 | 2 |
| Improve Community Livability | | 1 | | 2 |
| Preserve/ enhance streambank health | | | | 0 |
| **Preserve/enhance native riparian vegetation** | | | 4 | 4 |
| Preserve/enhance fish passage and habitat | | | | 0 |
| **Utilize LID principles** | | 5 | | 10 |
| **Sustain partnerships** | 6 | | | **18** |
| | 3 | 2 | 1 | |