CITY OF FLORENCE
RESOLUTION NO. 9, SERIES 2019

A Resolution Approving the Florence Stormwater Master Plan Update, dated December 2018, including the Capital Improvement Plan in support of the Florence Realization 2020 Comprehensive Plan and Repealing Resolution No. 8, Series 2004.

RECITALS:

1. The Florence Stormwater Management Plan was adopted in 2004 and was intended to address City stormwater management needs over a twenty-year period.

2. The City Council appropriated funds for the preparation of an updated stormwater master plan.

3. The purpose of the Stormwater Master Plan Update, dated December 2018, details the vision, goals and implementation framework of the City's stormwater management systems.

4. It is intended that Table 7-1, CIP Prioritization Schedule, in the Stormwater Master Plan Update be used in conjunction with the Florence Realization 2020 Comprehensive Plan Policies and that the entire Stormwater Master Plan Update be adopted in support of the Comprehensive Plan but is not a part of that document.

Based on these findings,

THE CITY COUNCIL OF THE CITY OF FLORENCE RESOLVES AS FOLLOWS:

1. Florence Stormwater Master Plan Update, dated December 2018, is hereby adopted and City Council directs City staff to use the plan's goals, objectives, and projects when evaluating stormwater needs and improvements.

2. Table 7-1 "CIP Prioritization Schedule" contained in the Stormwater Master Plan, dated December 2018, will later be adopted as part of the Florence Comprehensive Plan in accordance with OAR 660-11-45 and the Stormwater Master Plan Update that includes Table 7-1 is incorporated in the Florence Public Facilities Plan.

3. Any further revisions, amendments, or modifications to the Stormwater Master Plan Update shall be by resolution of the Florence City Council.

4. Resolution No. 8, Series 2004 is hereby repealed.

5. This Resolution shall become effective immediately upon adoption.

ADOPTION:

This Resolution is passed and adopted on the 20th day of May, 2019.

Joe Henry, Mayor

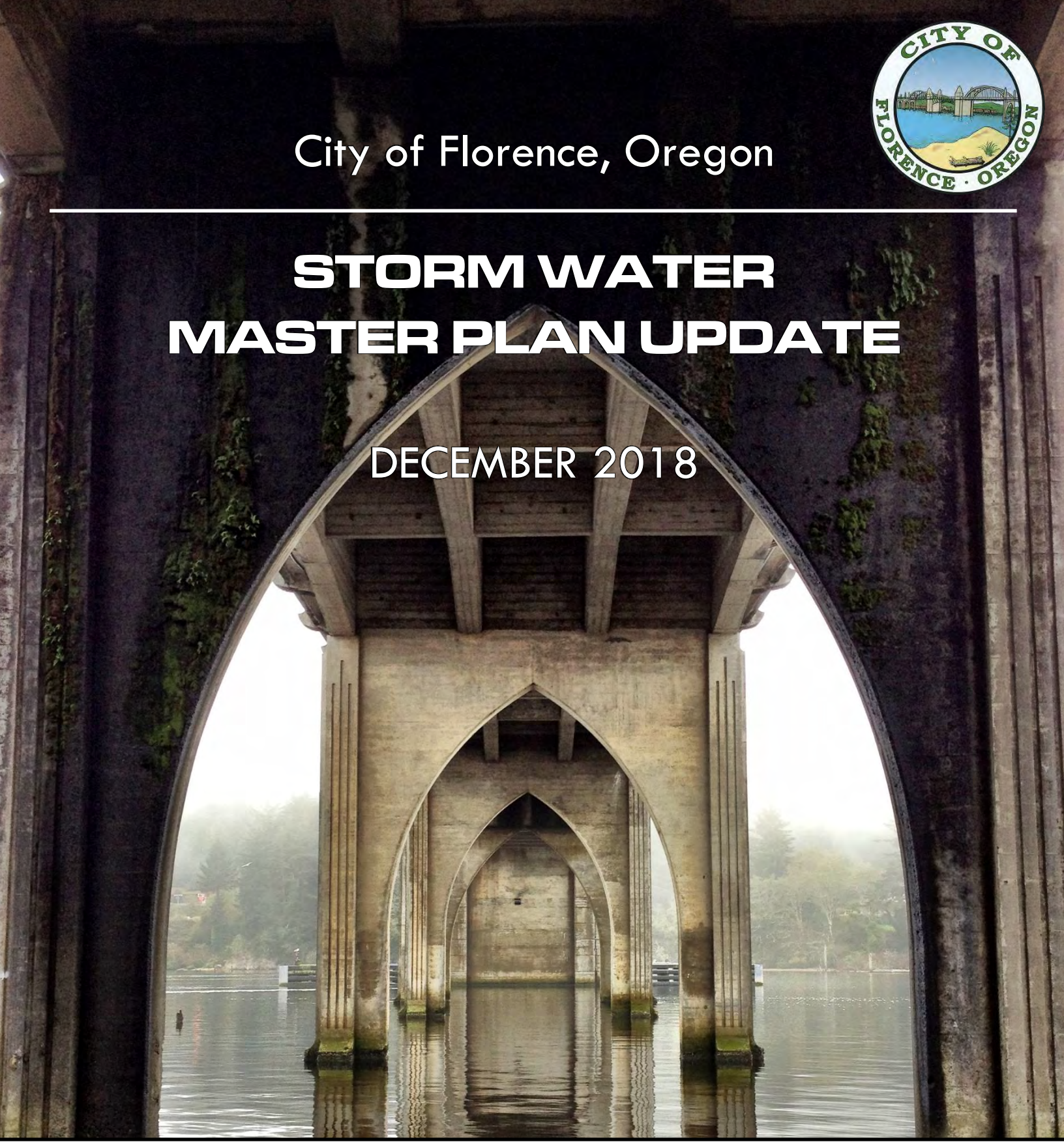
Attest:

Kelli Weese, City Recorder

City of Florence, Oregon

STORM WATER MASTER PLAN UPDATE

DECEMBER 2018



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Civil West Engineering Services, Inc.

Storm Water Master Plan Update

Prepared For:

City of Florence, Oregon

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Abbreviations

ADS	Advanced Drainage Systems Pipe (Corrugated Plastic)
BMP	Best Management Practice
CIP	Capital Improvement Project
CMP	Corrugated Metal Pipe
DEQ	Department of Environmental Quality
DSL	Department of State Lands
HOA	Home Owner's Association
PUD	Planned Urban Development
PVC	Poly-vinyl Chloride Pipe
RCP	Reinforced Concrete Pipe
R-O-W	Right-Of-Way
STEP	Salmon Trout Enhancement Program
SWMP 2000	Storm Water Management Plan (prepared by Brown & Caldwell in 2000)
UGB	Urban Growth Boundary

1.0 Executive Summary

Section 1

In October of 2000, Brown & Caldwell furnished the City with a Storm Water Management Plan (SWMP 2000) which makes recommendations for capital improvement projects to address flooding problems and protect the quantity and quality of water in the aquifer as well as other valuable natural resources (e.g. Wildlife habitat). SWMP 2000 was intended to guide upgrades and expansion of the storm water conveyance system for the planning area for a period of 20 years. As the end of that planning period approaches, it is prudent for the City to reevaluate their storm water management needs, to ensure that City storm water budgets are utilized in the best possible way.

In February of 2017, the City of Florence initiated an update to the City's existing Storm Water Management Plan. This update is intended to supplement the information and analyses provided in SWMP 2000, and establish a more current and relevant list of recommended priority capital improvement projects. These two planning documents may be used in tandem to assess the deficiencies and potential of the City's storm water infrastructure.

The study area of SWMP 2000 was determined by topography in and around the City's Urban Growth Boundary (UGB). The landscape defines an assortment of natural drainage basins which represent the full footprint of the storm water tributary area, which crosses city boundaries and extends into and beyond the UGB. This study will address priority improvements that are located within the UGB only.

Figure 1-1 - City of Florence, Urban Growth Boundary (UGB)

2.0 Introduction

Section 2

The City of Florence is located in Lane County, Oregon, on the coast along Highway 101 where the Siuslaw River meets the Pacific Ocean (43°58'05" N, 124°06'26" W). The City is home to approximately 8,500 people. The City owns and operates a number of storm water networks which are used to convey runoff and ground water surcharge safely through the community to ultimate points of discharge. The City's storm water management system is comprised of manholes, pipes, catch basins, curb inlets, ditches, swales, culverts, retention and detention basins, infiltration basins, wetlands, roadway conveyance infrastructure, streams, creeks, etc.

Figure 2-1 - Location Map

In addition to the City storm water system, the community also has a state-owned storm water system that collects and conveys water south along Highway 101, toward the Siuslaw River. Along with these two systems, there are also a handful of drainage systems within the City that are privately owned, and which are supposed to be maintained by planned urban developments (PUD) and/or HOAs. In some cases, these systems have been neglected, which has caused the infrastructure to deteriorate to the point where it is no longer operational.

The state of parts of the existing infrastructure, whether it be state-owned, city-owned, or privately owned, has caused some areas within the City to experience seasonal flooding. Recent flooding can be attributed to an increase in cumulative seasonal rainfall, the deteriorated state of parts of the existing storm water infrastructure, undersized facilities, and sections of the system that have been damaged. The goal of this study is to assess the deficiencies of the infrastructure in those locations, and to assist the City in establishing a plan for alleviating flooding and other drainage problems.

2.1 Need for Plan

The City's current storm water planning document was furnished in the year 2000, with a planning period of 20 years. Over the 18 years that have gone by since that document was furnished, the City has completed a host of storm water improvement projects to address the deficiencies that were identified in that document. With less than three years left in the planning period, and having addressed many of the priority issues that were identified in SWMP 2000, it is prudent for the City to reevaluate their storm water system, and to identify and prioritize the deficiencies that exist now. By revisiting the priority CIP list, the City will be able to utilize their utility funds more effectively for the remainder of the planning period and beyond.

2.2 Plan Authorization

In January of 2017, the City approached Civil West Engineering regarding an update to the City's Storm Water Management Plan. A preliminary kick-off meeting was held with City Public Works employees to initiate the planning work and begin the necessary data collection. The Engineering Services Agreement was signed by the City on February 15, 2017, authorizing Civil West to complete the desired master plan update.

2.3 Study Objective

The purpose of this report is to furnish the City of Florence with an updated planning document that supplements SWMP 2000. This updated document provides engineering assessment of system components and up-to-date guidance for future planning and development of the storm water system. It provides clear descriptions of existing conditions, recommendations, and preliminary cost estimates for improvements to the storm drainage infrastructure.

Principal plan objectives include:

- Description and mapping of existing storm water system
- Evaluation of the capability of existing storm water system components
- Identification and prioritization of major drainage issues
- Recommendations for improvements needed to meet future needs and/or address deficiencies

The ultimate purpose for these objectives is to protect private and public property from damage caused by storm water and ground water related issues, and to limit negative impact to the community's operations and livelihood. By prioritizing future capital improvement projects, the City will be able to focus its efforts to high-risk areas first, and thereby make strides toward protecting and improving the quality of life in those areas. The City's storm water infrastructure operates in tandem with State-owned and privately-owned drainage infrastructure, so it is important to recognize that the effectiveness of recommended drainage improvements herein hinges on the cooperative nature of the relationship between these multiple systems. Together these systems endeavor to meet the needs of all members of the community, without unfavorably impacting each other or the environment. At the conclusion of this report, recommended capital improvements are presented as projects with estimated costs to allow the City to plan and budget as needed.

2.3.1 Past Studies and Reports

The following plans, reports, and documents have been prepared for the City in the past and have been used as references for parts of the discussion within this report:

- *Pine Court Storm Drainage System Improvements – Evaluation of Alternatives,* January 2017, Civil West Engineering Services, Inc.
- *City of Florence Stormwater Design Manual*, September 2011, Branch Engineering, Inc.
- *City of Florence Storm Water Management Plan*, October 2000, Brown & Caldwell

2.4 Acknowledgments

Various members of the City staff have contributed time and effort to ensure accurate record keeping and proper planning of the City's infrastructure system needs. City Public Works Inspectors, GIS technicians, and others have all helped to complete this effort. We wish to acknowledge and thank the following persons in particular for their assistance as we prepared this report:

Mike Miller – Public Works Director
August Murphy – Water/Wastewater Treatment Plant Superintendent
Brenda Cervantes – GIS Specialist (retired)
Steve Hatler – Collections
Sean Selig – Public Works Inspector

2.5 Public Involvement

A public reception was held at the Florence Event Center on November 1st, 2017 to allow members of the community to share their knowledge and concerns regarding drainage problems within the City. Information from this survey was combined with data gathered through field investigation to more comprehensively assess the condition and deficiencies of the City's storm water infrastructure. For a full description of this public outreach program, see Appendix G.

3.0 Existing Conditions

Section 3

3.1 Drainage Management Techniques/Infrastructure

3.1.1 Infiltration

Soil conditions in the City of Florence are uniquely well-suited to allow surface storm water runoff to infiltrate into the ground. This mechanism is used throughout the City as a primary method of storm water management, particularly outside of the downtown area, where development is less dense and ground surfaces are generally more pervious.

In some cases, land development activities in Florence have relied on ground water infiltration as the sole drainage management technique, as underground infrastructure has never been introduced. In some cases, this has appeared to be sufficient inasmuch as rainfall levels each year do not exceed the average. However, some developments have experienced severe flooding, particularly during years with high rainfall.

3.1.2 Underground Piping / Surface Conveyance

The City is also equipped with an underground conveyance system made up of pipes, culverts, catch basins, curb inlets, and manholes. As seen in Figure 3-1, this system primarily exists in the southern part of the City, and along Highway 101. Drainage infrastructure in the highway right-of-way is state-owned, but there are a handful of locations where the City's system is connected to the State's.

The City's piping systems operate in conjunction with a series of surface conveyance systems including ditches, streams, creeks, ponds, and lakes. In many areas, runoff is conveyed a relatively short distance by pipe, and is then discharged into one of these larger surface conveyance systems. There are several locations where streams and creeks pass underneath city streets prior to reaching their ultimate discharge in the Siuslaw River. This has required the construction of storm water culverts.

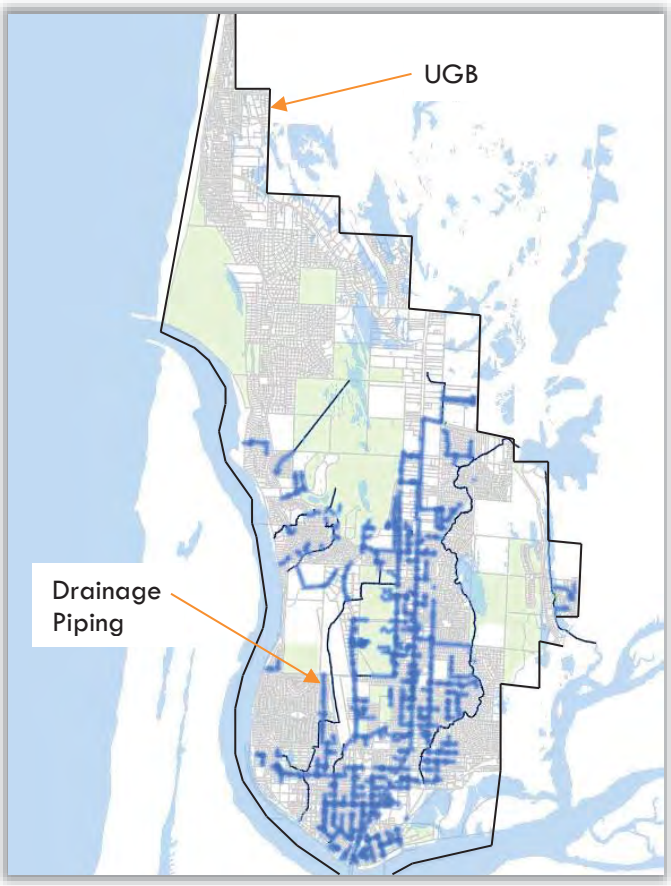


Figure 3-1 - Overall map of underground storm water pipe network

Each of these systems requires regular maintenance and proper engineering design to ensure adequate capacity for peak flows. Figure 3-1 provides a visual comparison of the underground storm water system's footprint to the size of the UGB. This comparison illustrates the amount of surface area within the city where infiltration is the sole storm water management technique.

3.2 Flooding

Condition #1 - When large amounts of surface water infiltrate into the ground, the water table rises, decreasing the remaining capacity for further infiltration. If wet weather continues, the water table may rise so much that ground water will begin to surcharge back out onto the surface.

This is especially problematic when the area receiving surcharge is topographically lower in elevation than its surroundings. The water is detained in an unintended basin with nowhere to go until the wet season ends and the water table drops down again. Section 4 identifies a few areas in Florence where this condition has been observed. This is perhaps the most common cause for flooding within the city.

> *"Florence has very unique hydrologic characteristics. Groundwater and surface runoff are inextricably related. Groundwater in the area fluctuates seasonally and annually. A majority of precipitation on pervious surfaces infiltrates the soil and contributes to the groundwater. During above average rainfall periods elevated groundwater levels near the ground surface greatly increase the rates of surface runoff. Low areas without constructed or natural drainage facilities are often inundated with water much of the year. These areas expose the high groundwater table and create seasonal wetlands."*
>
> • *Stormwater Design Manual, 2011, pg. 4*

Condition #2 - In some places, piping systems have been constructed but have not been connected to a larger surface conveyance system for discharge. Instead, these systems convey water from one landlocked location to another where it is expected to infiltrate. As in Condition #1, when wet weather causes the water table to rise, infiltration is disallowed which debilitates the system's effectiveness.

Condition #3 - There are many locations where storm water runoff is discharged from a development, street, or property in a way that impacts other properties downstream. Some individual property owners within the city have expressed concern when storm water from adjacent properties or streets has flowed towards, onto, or across their properties. In large amounts, this surplus flow may present a threat to property. Unfortunately, the finished floor of many residences in Florence was constructed at a significantly lower elevation than surrounding topography and adjacent streets, which naturally establishes the house as the downstream destination for surface flow.

On a global scale, storm water from outside the UGB may enter the city, forcing the City to develop a strategy for managing waters from outside its own jurisdiction. No existing or imminent threats to the City and its residents have been observed at this scale during this planning effort.

3.3 Rainfall Data

Figure 3-2 shows the amount of wet season rainfall received each month for the current planning period (2000-2020). Rainfall quantities were measured at the Florence Wastewater Treatment Plant. Data in the table is expressed in inches. Figure 3-2 is a clip from a larger table which contains data dating back to 1957. To view the entire table, see Appendix C.

As seen in the Table, the City of Florence experienced near record-setting precipitation in early 2017. From October of 2016 through April of 2017, the City recorded 94.12 inches of rainfall, which far exceeds the average precipitation for the wet season, and in fact, is the 2nd-wettest winter on record (going back to 1957).

Wet Season Rainfall Report

Rainfall units expressed in inches

	OCT	NOV	DEC		JAN	FEB	MAR	APR	TOTAL
2000	4.62	4.51	6.89	2001	3.04	4.09	5.06	3.74	31.95
2001	4.79	11.09	12.71	2002	15.26	4.15	6.76	5.31	60.07
2002	0.46	5.84	21.48	2003	14.50	3.41	10.58	8.54	64.81
2003	3.23	10.62	18.04	2004	14.82	7.78	4.62	4.37	63.48
2004	7.47	3.96	10.31	2005	8.07	2.85	6.22	5.02	43.90
2005	5.40	10.36	15.58	2006	21.88	4.64	10.82	3.59	72.27
2006	0.85	20.00	11.25	2007	6.72	11.11	6.42	3.58	59.93
2007	4.25	7.17	15.06	2008	13.14	4.91	6.46	5.24	56.23
2008	3.52	9.30	9.80	2009	6.72	5.00	7.78	2.62	44.74
2009	6.64	9.46	8.65	2010	10.93	7.30	10.02	8.40	61.40
2010	5.95	11.45	13.85	2011	7.95	7.05	13.60	6.78	66.63
2011	5.43	7.55	7.15	2012	11.66	7.83	20.02	7.40	67.04
2012	13.33	14.38	14.07	2013	6.35	5.75	3.64	3.82	61.34
2013	1.04	4.60	3.00	2014	4.68	10.46	7.80	4.59	36.17
2014	9.75	8.06	15.00	2015	3.68	10.86	6.52	2.93	56.80
2015	4.44	7.61	24.09	2016	12.58	6.33	10.62	2.55	68.22
2016	15.47	14.45	8.75	2017	10.31	20.18	16.92	8.04	94.12
2017	7.40	11.42	4.83	2018	11.41	5.56	6.82	5.83	53.27
				Average total during current planning period (2000-2020)					59.02

Figure 3-2 - Wet Season Rainfall Report

The City of Florence Stormwater Design Manual indicates that a 25-year storm event is to be used in hydrologic design of storm water facilities. Having recently experienced a 25-year event in 2016-2017, and as a result of its effort to respond to the consequences of that storm, the City is eminently aware of the areas where storm water management facilities are insufficient, or in need of repair.

In the Section that follows, major areas of concern are identified, with summaries of the conditions that exist at each location and which contribute to the drainage issues.

4.0 Observed Drainage Issues

Section 4

This section provides a list of locations where major drainage issues have been observed within the City. A summary of the conditions that exist at each location and which contribute to the drainage issues is included.

4.1 Spruce Street at 42nd St.

See Region 7 Map in Appendix A.

Spruce Street, just north of 42nd Street, was observed to be inundated with storm water during 2016-2017 wet season field inspections. As shown in Figures 4-1 and 4-2, the focal point of the flooding is located approximately 60-70 feet north of the intersection, near the driveways of 4220 and 4211 Spruce Street. The infiltration swales at the road's edge were overflowing, and the water level had risen to the point where the entire roadway was submerged and surface flood waters were approaching the homes on either side of the street.

Figure 4-1 - Spruce Street, looking SW

Figure 4-2 - Spruce Street, looking SE

Generally, water gathers at this location via ground water surcharge, local surface runoff, and spillover runoff from other nearby, overwhelmed storm water collection/ conveyance networks. At least two nearby systems contribute to this issue, including:

1. System A: The State-owned ditch and culvert network along Highway 101. This system, which originates near the Fred Meyer, crosses underneath Highway 101 in front of the Bi-Mart. At the southwest corner of Bi-Mart, the water enters a ditch and is conveyed to the east along the south side of the Bi-Mart property. Once it reaches the southeast corner, the water is supposed to enter an 18" culvert to flow underneath 42nd Street to another ditch which flows south along the eastern edge of Pacific Pines RV Park (Tax Lot #: 18121433200), eventually discharging into the existing system at 40th Street near the Presbyterian Church. It appears that these waters are not entirely contained in the 18-inch culvert by the Bi-Mart, so excess surface water is introduced at this location.

2. System B: There is a 36-inch CMP culvert near Spruce Street & Munsel Lake Road (see Section 4.3) which discharges water into the wetlands at the northwest corner of Florentine Estates. Some of

this water enters a pipe network that travels through Florentine Estates, then discharges into Munsel Creek near 45th Street (Tax Lot #: 181214243300). However, some of the water moves through a series of wetlands and ponds on undeveloped Tax Lot # 18121420700, eventually making its way along the eastern edge of the Bi-Mart property. It appears that these waters also contribute to the flooding problems at 42nd & Spruce.

Figure 4-3. Aerial Map of Stormwater Tributary Area

As shown on the Region 7 Map in Appendix A, this neighborhood does not have any existing underground storm water infrastructure. Instead, it relies solely on infiltration for storm water management. Historically however, this neighborhood was purportedly equipped with roadside ditches and swales. Some of these remain intact while others appear to have been filled in and do not exist anymore. One option for the City is to restore these ditches and reestablish roadside flow, to discharge into the ditch which is adjacent to the Pacific Pines RV Park.

See Section 6.1 for further detail regarding potential solutions to the drainage issues in this area.

4.2 46th Street by Fred Meyer

See Region 7 Map in Appendix A.

The City owns 42-inch drainage piping that flows south along the east side of Highway 101, across from Fred Meyer. However, drainage infrastructure on the Fred Meyer property, and in 46th Street to the south, does not connect to this 42-inch drainage pipe, nor does it discharge into the state-owned system that runs along the west side of Highway 101 at this location. Instead, 46th Street, and Fred Meyer drainage infrastructure, rely on local infiltration for discharge.

Figure 4-4 - 46th Street, looking East

Wet-season field inspection of this location revealed the shortcomings of the existing drainage system. 46th Street was completely unusable because it was inundated with 8-inches of ground water, as shown in Figure 4-4. Unfortunately, there does not appear to be a "quick fix" solution for these issues. Connecting the existing piping to the highway infrastructure is infeasible because 46th Street piping flows west, in the opposite direction of the highway. There is drainage infrastructure on Oak Street to the west, but it is higher in elevation than 46th Street, which disallows these systems from being connected. Caution should be exercised in any case, because adding flow to either of these systems would increase their demand, possibly exacerbating flooding issues in other parts of the city downstream.

Another challenge to the drainage of 46th Street is presented by the sand dune that exists immediately west of Fred Meyer (see Figure 4-5). The wind blows sand from the dunes onto 46th Street and Oak Street, with virtually no obstructions. This causes the drainage infrastructure to become silted in, thus decreasing its effectiveness.

Figure 4-5 - Sand dune west of Fred Meyer blows onto 46th Street

4.3 Spruce Street near 52nd St.

See Region 7 Map in Appendix A.

Real estate development activities on Spruce Street near 52nd Street were constructed with an underground pipe network that also connects to a series of ditches and concrete detention basins/ weirs. Water is collected from Spruce Street through curb inlets and catch basins along the west side of Spruce. The water is passed underneath Spruce Street through ADS plastic pipe, and then discharged into the detention basins, which line the east side of Spruce Street.

Before Spruce Street was constructed in this area, storm water travelled southeast from Highway 101 across Tax Lot #300, and then along its southern boundary in what has come to be known as the "Siefert Ditch" (see Lane County Assessor Map #18121420). After crossing the Spruce Street right-of-way, flow from the ditch turned south, joining storm waters that flow in from the north. The construction of Spruce Street interrupted this natural drainage channel and impacted wetlands in the area.

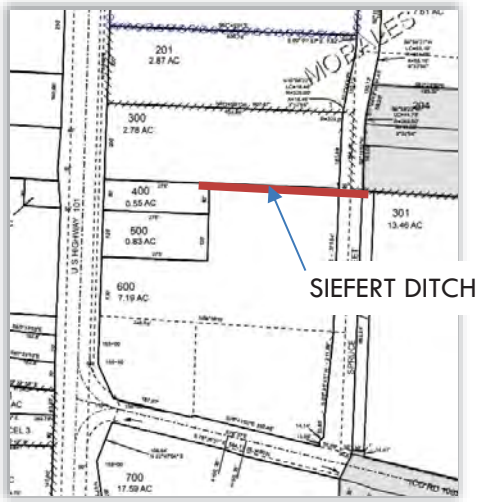


Figure 4-6 - Clip from Lane County Assessor Map #18121420

During construction of Spruce Street, the City was required to implement wetland mitigation strategies to prohibit possibly-contaminated groundwater in the area from entering Siefert Ditch, then crossing the street, and disturbing the wetlands. As part of that effort, the Siefert Ditch was converted from a conveyance channel to an infiltration swale, and flow across the Right-Of-Way was cut off.

However, the City did install a catch basin at the southeast corner of Tax Lot #300, with an ADS culvert to move *surface* runoff from that parcel to the detention basin on the east side of Spruce Street. The grate elevation of that catch basin is situated well above the hydraulic grade line of the ditch, and during the wet-season of 2016-2017, which saw more rainfall than any other year in the current planning period, water from the Siefert Ditch never rose high enough to crest the grate of the catch basin.

Figure 4-7 - Siefert Ditch with Catch Basin

After all these improvements were constructed, the City was involved in a lawsuit where it was argued that the construction of Spruce Street caused water to backup and flood nearby Tax Lot #500. The Siefert Ditch,

now an infiltration swale, did fill up with more water than beforehand, although runoff from Highway 101 is also a likely culprit for excess waters on those tax lots. In the end, the City acquired Tax Lots #400 and 500 in a settlement. It is sensible for the City to address any potential groundwater or surface runoff concerns which exist west of Spruce Street.

On the east side of Spruce Street, the existing concrete detention basins/ weirs are intended to combine storm water management with road-side aesthetics. These structures have been effective in controlling the flow and improving water quality in the swale toward Munsel Lake Road to the south. In the case of the weir directly east of the Siefert Ditch, City crews have cut a notch in the wall of the weir to lower the discharge elevation of that water quality basin below the grate elevation of the catch basin installed by the City on the southeast corner of Tax Lot #300 (see Figure 4-9).

Figure 4-8 - Detention Ponds/ Weirs

Figure 4-9 - Make-shift Orifice

At Munsel Lake Road, storm water splits in two directions. Some flow enters a ditch inlet that conveys water west into the pipe network that travels south along Highway 101. The remainder flows in a ditch east along Munsel Lake Road to a 36-inch CMP culvert which crosses underneath the road. Field inspection of this culvert suggests that it is adequately sized and in reasonably good condition. As shown on the Region 7 Map in the Appendix, after leaving the culvert, this flow travels south, where it splits again. Some of the flow is piped underneath Florentine Estates to Munsel Creek, and the rest of it flows into undeveloped Tax Lot #1812142000700, which contributes to the flooding problems on the east side of Bi-Mart near 42nd Street and Spruce Street (see Section 4.1).

Figure 4-10 - 36" CMP culvert at Munsel Lake Rd.

Figure 4-11 - 36" CMP Culvert at Munsel Lake Rd.

4.4 Spyglass Lane, Mariners Lane & Royal St. George Drive

See Region 6 Map in Appendix A.

At the north end of city limits, just south of Heceta Beach Road, a myriad of wetlands is situated on Lane County, City of Florence, and BLM lands, which together make up "Three Mile Prairie". Groundwater and surface runoff on these lands generally flows to the southwest toward Sand Pines Golf Course and the Mariner's Village Subdivision. Being entirely undeveloped, it is appropriate that these lands rely solely on groundwater infiltration for storm water management. Figure 4-12 below shows the general movement of surface and ground water in the vicinity of Mariner's Village and Sand Pines.

Figure 4-12 - Surface & ground water movement near Mariner's Village

As shown in the figure, storm water flow is concentrated at the northeast corner of the Mariner's Village subdivision. At that location, the water is collected and piped underneath the development, picking up water from a handful of contributing catch basins along the way. This pipe system then discharges into Tax Lot #4600 (see Lane County Assessor Map #18121532, Appendix B), where it is allowed to pond, forming a natural water body during the wet season. This seasonal wetland is used as a large infiltration basin, until ground water recedes during the summer months.

During the wet season of 2016-2017, ground water levels rose to a point where storm water could not be contained within Tax Lot #4600. In fact, flooding spilled out into Tax Lot #126 (labeled "Common Area 'C'"; see Figure 4-13), which is used as an RV parking lot. Ground water also surcharged back up out of the catch basins throughout the subdivision. Flooding was so excessive that City of Florence Public Works was forced to rent a large pump from Eugene to draw the water down so that flood conditions would not cause damage or loss for nearby residents.

Residents of Mariner's Village have expressed concern that storm water flow from Three Mile Prairie is not being sufficiently attenuated, and presents a threat to their property and livelihood.

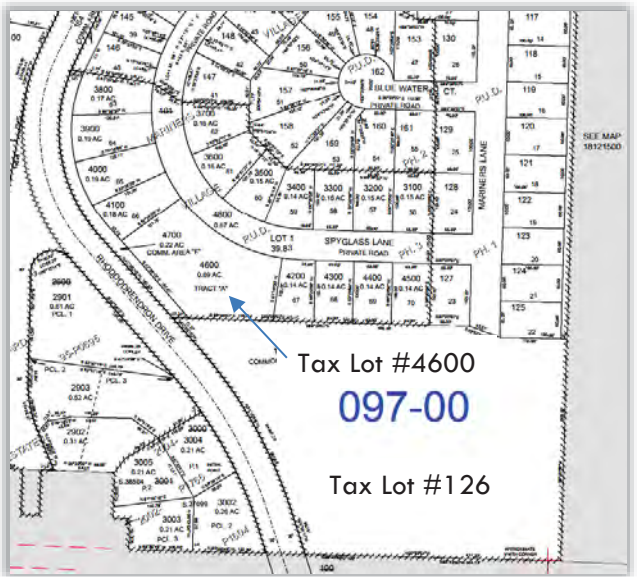


Figure 4-13 - Clip from Lane County Assessor Map #18121532

Figure 4-14 - Tax Lot #4600 used for infiltration becomes a seasonal wetland in winter months

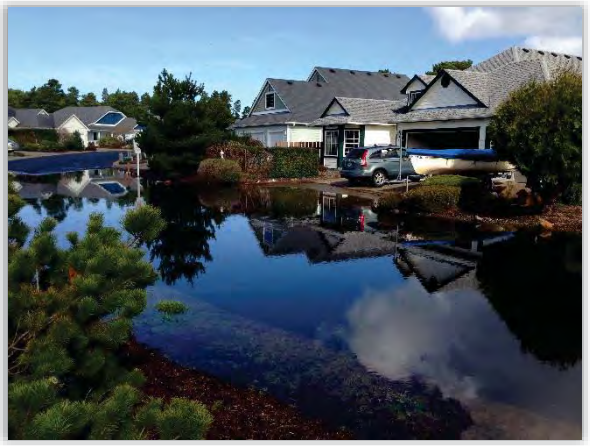


Figure 4-15 - Spyglass Lane flooded after water surcharged out of catch basins

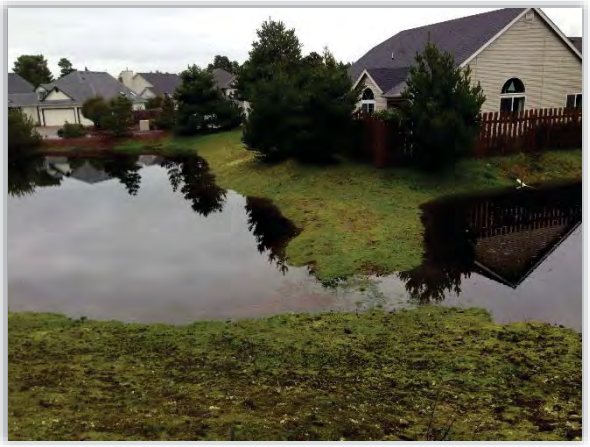


Figure 4-16 - Water overflows from Lot #4600 at this location

Figure 4-17 - Lot #4600 flooded. A car can be seen driving by on Rhododendron Drive.

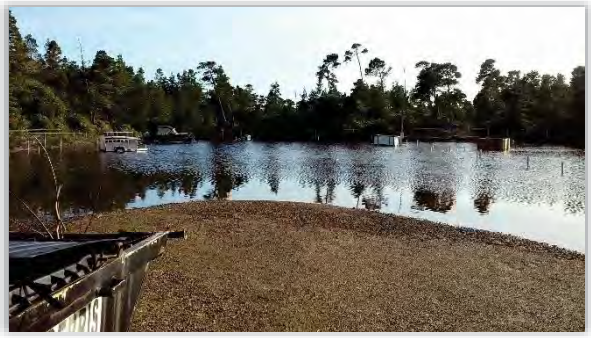


Figure 4-18 - Lot #126 (RV Parking) flooded after #4600 overflowed.

Photo credit: Eva Pinkavova,

- *Figure 4-15,*
- *Figure 4-16,*
- *Figure 4-17*

Photo credit: Jacquie Rwagenschutz,

- *Figure 4-18*

In November 2017, Civil West Engineering and the City of Florence hosted a public information meeting specifically for the residents of the Mariner's Village subdivision. During this session, a few residents suggested that the best solution to their drainage issues would be to restore the natural watercourse that existed prior to the construction of Rhododendron Drive by constructing a culvert across that road, from Tax Lot #4600, and discharging into the Siuslaw River. While that strategy does appear to be the most straightforward, it is unlikely that such an approach would succeed. Constructing additional outfalls into waters of the United States is regulated by the Department of Environmental Quality (DEQ), the Department of State Lands (DSL), and the United States Army Corps of Engineers (Army Corps). The Army Corps has historically prohibited additional outfalls into the Siuslaw River entirely, in an effort to protect the spawning ground of the endangered coho salmon. It is unlikely that the Army Corps will deviate from this path, even to restore a drainage path which likely did exist prior to the construction of Rhododendron Drive, so it would be prudent for the City to consider other discharge alternatives.

Real estate development activities have been occurring just north of Royal Saint George Drive, on the east and south sides of where flooding occurred. At the time of this report, this new development, known as Fairway Estates, does not have any streets or homes yet, but new drainage infrastructure has been installed. Underground piping flows to the southwest, and currently terminates at a manhole near the Rhododendron Drive right-of-way (see Figure 4-19). The manhole is a flow-control structure with a 4-inch orifice to reduce the discharge of this system to pre-development flow conditions. Storm pipes in this development are as large as 60-inches in diameter, which was a design strategy implemented to detain surface runoff underground, before it is attenuated and discharged.

Figure 4-19 – Flow control manhole w/ no outfall constructed yet

This storm system is currently inactive because it has not yet been connected to any discharge outfall downstream. City staff have indicated that the developer is planning to have a 15-inch storm drain line installed from the flow-control manhole to the south, ultimately connecting to the City's drainage outfall which was constructed in 2016 at 35th Street and Rhododendron Drive. This outfall discharges into what is known as "Bud's Ravine". The 4-inch flow-control orifice is an important feature of the Fairway Estates system, not only because it attenuates the rate of discharge flow from Fairway Estates, but also because it helps to prevent flows in Bud's Ravine from exceeding capacity. Presently, there is no connection between the Fairway Estates pipe system and the Mariner's Village infiltration system. Due to the unlikelihood of the Army Corps permitting an additional outfall to the Siuslaw River, the City may find a solution to the Mariner's Village drainage issues by installing an emergency overflow from that neighborhood into the Fairway Estates system.

See Appendix E for additional historical information regarding storm water management in this area.

4.5 Pine Street from 29th St to 28th St. to Highway 101

See Region 4 Map in Appendix A.

An existing underground pipe network collects water from 29th Street and Pine Street via two catch basins. Storm water is conveyed south through the undeveloped Pine Street right-of-way in a 10-inch transite pipe which connects to another catch basin located on 28th Street. Additional storm water is collected at this location. From here, the pipe network flows east toward Highway 101.

At the southwest corner of the 28th Street intersection with Highway 101, there is a storm manhole which is the end point of this system. All storm water that is conveyed underground to this location must either infiltrate or bubble-up out of the top of the manhole, as the manhole does not connect to the state-owned system, nor does it discharge into a larger surface conveyance system.

Figure 4-20 - Intentional break in 10" transite pipe for drainage

Because this pipe network is not allowed to discharge, the entire system has been observed to backup and overflow onto City streets. As a temporary fix, the 10-inch transite pipe between 29th Street and 28th Street has been exposed and broken open to allow water to drain into the undeveloped right-of-way (see Figure 4-20).

Figure 4-21 and Figure 4-22 show the flooding that has occurred in this area. Because the undeveloped right of way is topographically lower than the surrounding area, it is possible that high ground water is also contributing to the flooding of the right-of-way. The flooding shown in Figure 4-22 demonstrates that the flooding poses a threat to the businesses there.

Figure 4-21 - Pine Street, looking north from 28th Street

Figure 4-22 - North side of 28th Street, looking east from Pine Street

4.6 Rhododendron Drive (north of Wildwinds St.)

See Region 3 Map in Appendix A.

Flooding was observed on the east side of Rhododendron Drive, approximately 850 feet north of Wildwinds Street. This location likely receives runoff from the land to the east, but flooding in this location is also likely caused by high ground water. There is no catch basin at this location to pipe these waters into the river, so they rely on infiltration or evaporation for attenuation.

In the 2016-2017 wet season, flood waters had risen to a point where the north-bound lane of Rhododendron Drive was under water. This can be seen in Figure 4-23.

Figure 4-23 - Flooding on Rhododendron Drive

Figure 4-24 - Aerial Location Map

4.7 Kingwood Street from Airport Way to Airport Rd.

See Region 1 Map in Appendix A.

Civil West wet season field inspections of Kingwood Street did not produce any evidence of flooding problems between Airport Way and Airport Road. However, City staff have reported that the driveway entries for the Florence Senior Center (see Figure 4-25) have at times been rendered unusable because flood waters are too deep to allow normal passage.

Figure 4-25 - Florence Senior Center driveway entrance

As shown in Figure 4-26, there is a single catch basin on the west side of the street across from the Senior Center, and a curb inlet on the east side next to the driveway. These collection structures fill up with pine needles very quickly, due to the presence of tall coniferous trees lining the west side of the road. The pine needles drop from the trees into the gutter, and are pushed into the catch basin, causing the structure to become clogged, and causing the runoff to be trapped in the driveway area.

Figure 4-26 - Kingwood Street at Florence Senior Center, looking North

Figure 4-27 also shows that biorolls have been placed in the gutter surrounding the curb inlet. This is an erosion control measure that the City has used to slow the collection of pine needles in the curb inlet, but this solution has been shown to be temporary in nature and is insufficient, particularly during peak flow conditions.

Figure 4-27 - Biorolls placed by curb inlet

Figure 4-28 and Figure 4-29 show dry-season field inspection photographs of existing conditions at 18th Street and Laurel Way, just upstream of the catch basins in front of the Senior Center. These photographs document the presence of sinkholes in the roadway, located directly above storm water infrastructure. Sinkholes are an indicator that substantial deterioration has occurred in the underground pipe network. City records confirm that the 18-inch corrugated metal pipe (CMP) which is meant to convey storm water from 18th Street, Laurel Way, and 17th Place to the south along Kingwood Street, has indeed failed. As a result, storm water that would be contained within this pipe escapes, undermining the road above.

Figure 4-28 - Sinkhole on 18th St. caused by failed storm pipe

Figure 4-29 - Sinkhole on 18th St. caused by failed storm pipe

Once it has escaped the pipe, the storm water has the opportunity to infiltrate. However, this area experiences a very high water table during the wet season. Therefore, when the piped water is added to the excessive amounts of ground water, it exacerbates the flooding problem on Kingwood, particularly when the catch basins and curb inlets are clogged with pine needles.

In summary, the drainage difficulties at this location on Kingwood Street are three-fold:

1. The 18-inch CMP drainage main has deteriorated and needs to be replaced.
2. Deteriorated pipes have caused the roadway to be damaged, requiring repair of the storm water infrastructure, and restorative improvements to the roadway.
3. There is excessive debris (pine needles) entering the pipe network at this location. Preventative measures should be included in any improvements to the drainage network in this area.

Figure 4-30 - Airport & 12th Street right-of-way, looking NW

Storm water on Kingwood Street, north of Airport Road, is conveyed diagonally across the airport property to the southwest where it crosses underneath the 12th Street right-of-way. Prior to entering the 36-inch CMP inlet, the flow combines with surface runoff that collects at the topographic low point at the south end of the airport runways. As seen on the Region 1 Map in the Appendix, flooding has been reported at this location, and in fact, has been so severe that flood waters have risen high enough to spread out onto the asphalt runway. For this reason, it is possible that the 36-inch culvert is insufficiently sized. As stated, this culvert is CMP on the inlet side, but transitions to ADS before reaching the south side of the right-of-way.

Figure 4-31 - Airport drainage ditch & manhole @ 12th Street R-O-W, SW end of airport property

Figure 4-32 - 36" ADS culvert outlet for drainage under 12th Street right-of-way

4.8 9th Street from Ivy St. to Elm St.

See Region 1 Map in Appendix A.

After passing underneath the 12th Street right-of-way, storm water from the airport property meanders one block west and three blocks south, in a ditch towards the intersection of 9th Street and Ivy Street. While at 12th Street this ditch is relatively deep, by the time it reaches 9th Street, the ditch is much shallower.

Just prior to reaching the intersection, the ditch runs along the backside of Seabrook Townhomes, whose address is off of Jasper Lane. In 2016, with permission from the City, a resident of the Seabrook Townhomes made considerable efforts to improve the route and cross section of the ditch next to the townhomes, by digging the ditch wider and deeper with a shovel. The motivation for this endeavor was borne by the fact that Seabrook Townhomes were constructed at too low an elevation, and residents there are concerned that high water in the ditch could pose a threat to their townhomes. The modifications to the ditch were done to potentially improve the flow of the ditch, and hopefully relieve/reduce the drainage problems faced by the townhomes.

Figure 4-33 - Seabrook Townhomes & drainage ditch, view from 9th Street, looking North up Ivy Street right-of-way

Figure 4-34 - Hand-dug ditch adjacent to Seabrook Townhomes, dry-season field inspection photograph

It appears that storm water in the ditch is only a threat to these townhomes if it runs too high and floods on to the townhomes' property. The more imminent drainage threat for these citizens though, is that this area, like many others in Florence, is prone to extremely high ground water levels. With the finished floor elevation of the townhomes set as they are, high ground water could potentially surcharge and flood the units. While improving flow in the drainage ditch will help to confine those waters, it will not eliminate the threat that ground water poses to Seabrook Townhomes.

An existing 42-inch concrete culvert conveys water from the ditch into a storm drain manhole located in the intersection of 9th Street and Ivy Street. This manhole channels the flow to the west, where it combines with a few other tributary systems before discharging into a stream at 9th Street between Elm Street and Fir Street. Field inspection of the 42-inch culvert, both in wet-season and dry-season conditions, revealed that the culvert is heavily silted in, which obstructs the flow from the ditch. Figure 4-35 shows the culvert mostly full, and there is evidence that, at times, the water level rises to a point above the crown of

the culvert pipe. This is problematic considering the drainage issues we have just described for the Seabrook Townhomes. Lack of sufficient capacity in the culvert may cause the ditch to backup and overflow on to the property of the townhomes. However, with a thorough cleaning, and control of incoming sediment, it is likely that the culvert will perform as needed.

Figure 4-35 - 42-inch concrete culvert inlet, heavy sedimentation, evidence of exceeded capacity

City Public Works crews have reported that an unforeseen result of hand-digging the ditch is that the sand has been left exposed, subject to erosion. This has caused the culvert and other downstream piping to be significantly silted in, and the City has had to make extra efforts to clean out the piping in this area to maintain capacity. This condition will persist until vegetation grows back in the ditch, but in the meantime, the sedimentation of the system prevents it from flowing at full capacity. This has caused drainage issues everywhere from the Ivy Street ditch to the creek between Elm Street and Fir Street.

Figure 4-36 - Private drainage piping discharging into ditch. Efforts made by Seabrook Townhomes residents to alleviate flooding

Figure 4-37 - Dry-season field inspection photograph of 42-inch concrete culvert inlet, silted in

4.9 Ivy Street from 6th St. to 8th St.

See Region 1 Map in Appendix A.

Existing storm water infrastructure on Ivy Street north of 6th Street is connected to a larger network of underground piping, which gathers water from much of the Old Town area west of Highway 101. Flow in this network generally travels south, discharging into the Siuslaw River via the newly re-constructed outfall by the Ivy Street Wastewater Pump Station.

This location is at the upstream end of one of the branches of that system, which fortunately minimizes the impacts that may be caused by its deficiencies. Furthermore, all the storm water infrastructure downstream of this location is either brand new or is currently under design for improvement/ construction in the near future.

At the intersection of 6th Street and Ivy Street, a storm water manhole is connected to an influent 24-inch PVC pipe, from the north. Just upstream of the manhole connection, the PVC pipe is coupled to an older Concrete pipe of the same diameter. Upstream from here, at the intersection of 7th and Ivy, the pipe increases size to 30-inches. These two pipes, along with the connected catch basin and curb inlet runs have deteriorated to the point of failure. As shown in Figure 4-38, sinkholes have begun to form in the roadway, along the alignment of the storm water system.

Figure 4-38 - Sinkholes forming directly above drainage lines. Evidence of pipe failure.

No flooding has been observed by City crews or by Civil West engineers in this location, and there were no reports of flooding from the public either. Therefore, it is assumed that underground piping in this location is adequately sized. It simply needs to be repaired to protect the utility of the road.

The City is already under contract to complete storm water improvement designs on Hemlock Street and 6th Street, nearby. Issues and deficiencies in this system are similar to those on Ivy Street, as discussed

above, but the City has also observed and received reports of localized flooding occurring in this area when the existing storm infrastructure is overwhelmed.

In this "Old Town" region of Florence, there are many homes whose finished floor elevation is actually lower than the elevation of the adjacent street. This presents a problem because in the absence of a continuous curb and gutter, the runoff from the street will flow in the direction of the homes, and if it is not collected and removed, it may contribute to or cause flooding problems in those homes. Homes built at topographic low points will likely be at risk for flooding either via ground water surcharge, surface runoff concentration, or both.

To respond to this issue, the City can do its part by prohibiting street runoff from crossing onto private property. To accomplish this, the City's storm system must have sufficient capacity to handle the demand of a peak storm event. In this spirit, the City is actively working to up-size storm water piping in these neighborhoods, as shown in Figure 4-39 .

Figure 4-39 - Map of storm water improvements currently under design in the Old Town area.

4.10 8th Street from Highway 101 to Maple Street

See Region 2 Map in Appendix A.

Another branch of the storm water network described in Section 4.9 collects runoff from 8th Street between Highway 101 and Maple Street. The underground stormwater network at this location collects street runoff via two catch basins, with one on either side of the street. The water is conveyed to the west in an 8-inch diameter concrete pipe, which according to reports from City crews, is quick to clog up. This stormwater pipe also receives water from another catch basin located in the parking lot between Banner Bank and the Post Office. However, when the system is clogged, that water backs up and surcharges out of the catch basin in the parking lot, which causes flooding concerns particularly on the Banner Bank property.

The cause for the clogging of the pipe in 8th Street is unknown. It is possible that the pipe is disjointed or full of deleterious material, and it is also possible that the pipe is simply undersized for the tributary stormwater flow in this area. Any effort to correct this issue should include a hydrologic analysis to ensure adequately sized pipes are being used for the anticipated flows.

4.11 Juniper Street from Rhododendron Dr. to 2nd St.

See Region 1 Map in Appendix A.

Another branch of the storm water network described in Section 4.9 collects runoff from Juniper Street between 2nd Street and Rhododendron Drive. Piping for this two-block segment consists of 8-inch diameter concrete pipe. As shown in the Region 1 Map in the Appendix, there are no manholes to allow access to this section of piping, so the City cannot perform its usual maintenance and reconnaissance efforts on this infrastructure.

City crews have indicated that this pipe is old, cracked, and dislocated, but the City's push camera does not have enough length to investigate all the issues with this system, and the City's TVI camera is too large to travel through the smaller diameter pipe with its dislocations and other issues. These facts have prevented the City from being able to fully analyze the internal condition of the pipe. No flooding has been reported in this area, which suggests that drainage is still occurring, despite the damaged condition of the piping.

4.12 Nopal Street from 1st St. to 2nd St.

See Region 2 Map in Appendix A.

The Florence Old Town area, east of Highway 101 has two or three small storm water pipe networks which convey runoff a comparatively short distance before discharging into the Siuslaw River. For the most part, these small systems appear to be adequately sized for peak flow conditions. However, the infrastructure in Nopal Street between 1st Street and 2nd Street has experienced significant deterioration.

City Public Works crews reported that this section of 8-inch diameter concrete pipe is cracked and failing, causing obstructions within the pipe that prevent City crews from being able to clean and maintain the system in that area. The obstructions also decrease the flow capacity of the system, which in turn causes the system to get backed up, and flood onto City streets, primarily the intersection of 2nd Street and Nopal.

4.13 North Jetty Road, Windward Way, Oceana Drive, Saltaire Street, etc.

See Region 8 and Region 9 Maps in Appendix A.

Several residential neighborhoods have been developed outside of the City boundary at the northwest end of the UGB. Because these neighborhoods are outside of City limits, the City of Florence has not been responsible to manage stormwater in and around these subdivisions. Instead, it has been and continues to be the responsibility of individual Homeowners Associations and real estate developers. Nevertheless, the City of Florence is interested in protecting the safety and welfare of all its community members, so this brief analysis has been included to provide information useful to that end.

Figure 4-40 - Aerial view of neighborhoods outside of City boundary

SWMP2000 included an excellent description of this region, characterizing it as a collection of wetlands and small, rolling dunes that end in steep bluffs overlooking the North Jetty Recreation Area and Heceta Beach. Groundwater and surface runoff throughout this area generally flow to the west and is almost entirely reliant on infiltration for its mitigation.

Field inspection of these neighborhoods revealed the presence of roadside ditches and infiltration swales along virtually every street inspected. As shown in Figure 4-41 and Figure 4-42, this infrastructure appeared to be in good condition although it is unclear if the capacity of this system has been sufficient to handle peak flows.

Figure 4-41 - Roadside Ditch (Sandrift Street)

Figure 4-42 - Roadside infiltration swale (Saltaire Street)

SWMP2000 predicted widespread groundwater flooding throughout this region, citing the high number of wetlands that exist as evidence of the already-close proximity of the groundwater table to the surface. This assessment has proved to be valid as there are many neighborhood communities throughout Florence who have been impacted by excess groundwater surcharging out of infiltration ditches during events of high rainfall. At the time of SWMP2000, extensive flooding had been reported near the intersection of Oceana Drive and Sandrift Street. Local residents attempted to pump excess water out of the neighborhood, but these efforts reportedly intensified flooding problems in other nearby neighborhoods.

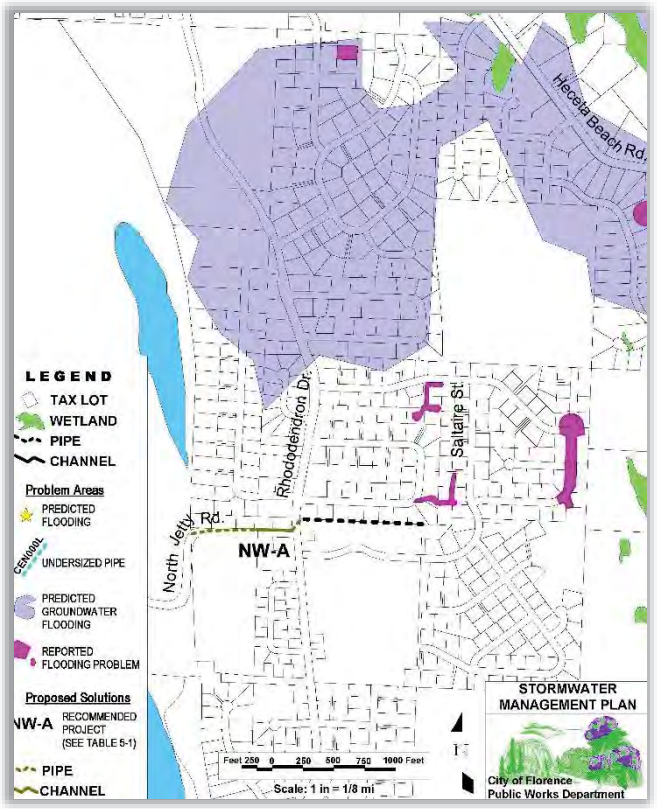


Figure 4-43 - Figure 5-1 from SWMP2000, shows existing drainage infrastructure and flooding problems in the neighborhoods northwest of the city boundary

Residents of these neighborhoods have also constructed a small amount of conveyance infrastructure to supplement their roadside ditches and infiltration swales. This infrastructure, which can be seen in Figure 4-43, consists of a concrete-lined channel and 12-inch pipe to move water from the south side of Sea Pines Drive, across Rhododendron Drive to North Jetty Road. (Figure 4-43 is borrowed from SWMP2000.)

From there, a ditch conveys water to the west along the north edge of North Jetty Road, until it reaches an 18" CMP culvert, which carries water over the edge of the steep bank, and down toward the North Jetty Recreation Area. This culvert, shown in Figure 4-44, has experienced extensive corrosion, and needs to be replaced. It is unclear where this pipe eventually discharges, as its terminus could not be located during field inspection.

Figure 4-44 - 18-inch CMP culvert at top of bluffs on North Jetty Road

SWMP 2000 recommended the addition of a pumping facility in Gullsettle Court, as well as replacement of the 12-inch culvert which passes underneath Rhododendron Drive. At the time of SWMP2000 the ditch along North Jetty Road was in poor condition and the 18-inch culvert at its west end did not exist. It was recommended that the 18-inch culvert be installed with large riprap at the bottom of the bluffs to dissipate energy at the base of the slope and prevent erosion. It has not been verified whether this recommendation was heeded.

As stated earlier, stormwater improvements in this region are the responsibility of HOAs and private developers. The City cannot implement any improvements as long as this region is outside of city limits. If this region is ever annexed in, the City may wish to complete further studies of stormwater behavior in this area, to assess the need for pump stations, pipe systems, and/or other infrastructure.

4.14 Coastal Highlands Development (18th Ct., Pine Ct., 16th St.)

See Region 2 Map in Appendix A.

The Coastal Highlands Development is a subdivision which relies entirely on ground water infiltration for storm water management. There is presently no underground pipe network to convey storm water away from the area. The development is topographically lower than its surroundings and is adjacent to a seasonal wetland located on properties owned by the Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians.

The development's proximity to this seasonal wetland has been problematic during times of high rainfall because the wetland does not have a discharge point. Instead, when the water table rises in the wetland, ground water surcharges back on to city streets, and remains until the water table recedes once again, or as in the winter of 2017, it is pumped out at the City's expense.

The City of Florence has already engaged in planning efforts to correct these issues. This summary has been provided, simply to collect and summarize all the City's major drainage issues in the same document. See Pine Court Storm Drainage System Improvements – Evaluation of Alternatives (2017) for more information.

Figure 4-45 - Driveway of 1720 Pine Court, pumping flood waters west across Willow Loop into Munsel Creek

Figure 4-46 - Pine Court, flooded with more than 12-inches of ground water

Figure 4-47 - 16th Street, flooded with more than 12-inches of ground water

5.0 Culvert Crossings

Section 5

5.1 Munsel Creek at Spruce St. & 12th St.

See Region 2 Map in Appendix A.

By the time Munsel Creek passes underneath Spruce Street at the 12th Street right-of-way, it has already received storm water discharge from most of the drainage systems that exist on the west side of Highway 101 within the City of Florence. This region covers roughly 500 acres and reaches at least as far north as 52nd Street.

Currently, the creek passes underneath Spruce Street via a single 84-inch corrugated metal culvert, which is shown in Figure 5-1. Field inspection of this culvert revealed that the corrugated metal pipe is severely dislocated in multiple locations (Figure 5-4), and the wall of the pipe has experienced significant corrosion (Figure 5-3). The factory treatment of coal-tar epoxy applied to the interior of the pipe wall has eroded away, leaving the pipe exposed to environmental degradation.

Figure 5-1 - 84-inch CMP culvert, outlet side, looking NE

Figure 5-4 also shows that the pipe has experienced deformation under the load of the road above. When combined with the evidence of severe corrosion and dramatic dislocations, this culvert should be considered unsafe for entry by maintenance personnel.

Figure 5-2 – Deteriorated factory coating

Figure 5-3 - Evidence of severe corrosion in pipe wall

Wet-season observation of this culvert suggests that it has adequate capacity but may experience flows of up to two-thirds its capacity. Any design to replace this culvert should include a formal capacity analysis to verify that flow is not impeded at this location, particularly due to the number of systems upstream which rely on this crossing.

Figure 5-4 - 84-inch CMP culvert; Severe dislocations and significant deformation of pipe under roadway load. The forefront dislocation shown in this photograph is the location where a repair was completed on this culvert in 2011.

There is a separate outfall pipe approximately 15 to 20 feet south of this 84-inch CMP culvert. It is a 24-inch concrete outfall pipe for the 12th Street underground drainage infrastructure. Field inspection of this outfall revealed that the concrete is cracked along the crown of the pipe (Figure 5-5), and the pipe is heavily silted in (Figure 5-6). The sedimentation of this pipe is a result of its slope, which goes uphill in the direction of drainage. In this way, the pipe acts as a filtration weir. After the water crests the discharge invert elevation, the water flows down a concrete chute into Munsel Creek (see Figure 5-7).

Figure 5-5 - 24-inch concrete outfall, cracking in the pipe crown

Figure 5-6 - Outfall pipe is sloped uphill in the direction of flow, causing sedimentation

Figure 5-7 - Concrete chute channeling flow down into Munsel Creek

5.2 Munsel Creek at 18th St.

See Region 4 Map in Appendix A.

Currently there are three, parallel, 42-inch corrugated metal culverts which allow Munsel Creek to flow underneath 18th Street. As shown in Figure 5-8, these culverts were flowing at full capacity during the wet season of 2016-2017. As shown in Figure 3-2, the 2016-2017 winter rains exceeded average wet season rainfall during the planning period by approximately 58%. Thus, these culverts appear to have sufficient capacity for typical storm events, but further analysis should be completed to verify that the culverts have sufficient capacity to handle the peak design storm. This location is of particular concern because Munsel Creek is used as a discharge point for several state, City, and privately-owned drainage systems which are upstream from this location. If flow is impeded by undersized culverts at this location, it could cause flooding at several other locations upstream.

Field inspection also revealed that these culverts have deteriorated and may be at the end of their useful life. The pipe cross section has been squashed, and the metal has experienced significant corrosion. Evidence of road-side erosion was also observed above the culverts.

These culverts are in close proximity to the Coastal Highlands Development and Pine Court, whose drainage issues were recently evaluated in another report furnished by Civil West. As described in that report, this region experiences flooding in part due to the surcharge of high ground water. It is likely that some of the flow through these culverts is influenced by ground water surcharge, which should be accounted for when performing future capacity analysis.

Figure 5-8 - Three 42-inch CMP culverts; insufficient capacity, roadside erosion

5.3 Munsel Creek at 23rd St. & Willow

See Region 4 Map in Appendix A.

Munsel Creek flows underneath city streets on 23rd Street just east of Willow Street, via a single 72-inch corrugated metal culvert. This culvert appears to have experienced significant corrosion and deformation. The deterioration of this culvert has caused large sinkholes to form in the street above, prompting City Public Works crews to take action to improve the longevity of this culvert and protect the road.

City crews began by digging out the backfill above the culvert and replacing it with CLSM backfill (concrete slurry), which has greater strength than typical trench backfill for this type of installation. The trench patch for this work can been seen in Figure 5-9. In an effort to strengthen the road and avoid future sinkholes, the City installed CLSM for the entire depth of the trench, from the top of the CMP culvert to the bottom of the asphalt concrete roadway surface. Since that time, the culvert has continued to deteriorate, however, which poses a threat to the road, and to the motorists who pass over this culvert crossing.

Figure 5-9 - Additional settlement has occurred after City trench patched with CLSM backfill

In addition to the CLSM cap, City crews have coated the inside of this culvert with an old coal-tar epoxy, which is common for increasing the longevity of corrugated metal pipe. In many places, the epoxy coating was observed to be peeling away, leaving the bare steel exposed, and increasing its susceptibility to future corrosion.

Field inspection of the inside of the culvert indicates that the pipe has sufficient capacity to handle the peak flows experienced at this location, and no reports have been filed by the City or the Public regarding flooding in this area. For a view of the inside of this culvert, see Figure 5-10.

Figure 5-10 - Inside of 72-inch culvert, level of water stains suggests sufficient capacity

Figure 5-11 - Coal-tar epoxy present on pipe wall

5.4 30th Street and 31st Street

See Region 5 Map in Appendix A.

One of the tributary branches of the Siuslaw River flows from Munsel Lake to the south, wrapping around the east side of Munsel Lake Road and North Fork Siuslaw Road. In that path, the creek passes underneath 31st Street, just to the east of Munsel Lake Road, via two 24-inch concrete culverts. During wet season inspection, only one of these culverts was observed to be functional, while the other did not allow any flow despite being partially submerged. The functional culvert was observed to be flowing at capacity, suggesting that it is dramatically undersized.

Figure 5-12 - Erosion at the roadway edge, steep slope, 31st Street, North side

The roadway above these culverts is decidedly narrow, and the slope of the banks on either side is noticeably steeper than 1:1 (horizontal: vertical). Asphalt at the roadway's edge was cracked and slipping down the bank towards the water.

Figure 5-13 - Two 24-inch concrete culverts, one inactive, insufficient capacity

5.5 Munsel Creek at Water Treatment Plant

See Region 4 Map in Appendix A.

Munsel Creek crosses underneath Willow Street on the northeast side of the Florence Water Treatment Plant via a single 60-inch CMP culvert. This culvert is in relatively good condition in comparison with other CMP culverts in the city. Field inspection revealed no dislocations, and only minimal amounts of corrosion were observed in the pipe wall.

Figure 5-14 - 60-inch CMP culvert at WTP

The pipe cross section is slightly deformed but does not appear to have caused any significant impact to the road above. This road, "Willow", is a gravel access road used only for Treatment Plant operations and presently does not experience heavy traffic loads. The culvert has somewhat less-than-average bury depth (between 12" and 18"), but this appears to be holding up well.

Field inspection indicates that this culvert appears to have adequate capacity, flowing at 50% to two-thirds capacity during peak flow conditions. There have been no reports of overflow or flooding at this location. As shown in Figure 5-15, sand bags were discovered on the inlet side of the culvert. These sand bags were not installed as a flood-prevention or sedimentation averting mechanism. City staff indicated that the sand bags were installed as part of the Salmon Trout Enhancement Program (STEP), to slow flow at this location, and make a settling pond of sorts, just prior to entering the culvert. Dry season inspection revealed that the sand bags do not appear to have impeded the flow through the culvert.

Figure 5-15 - Sand bags installed as part of STEP

Figure 5-16 - Inside of WTP culvert

5.6 Marine Manor (Rhododendron Drive)

See Region 3 Map in Appendix A.

Storm water in the region of 35th Street, Wecoma Loop, and Skookum Drive is mostly channeled into a stream which conveys water through the residential area toward the Siuslaw River. The stream receives additional flow from an existing underground pipe network in Pacific View Drive, and from the wetlands just northwest of Pacific View Drive.

Figure 5-17 - 10' x 8' box culvert crossing Rhododendron Drive

Ultimately, this stream crosses underneath Rhododendron Drive via a 10-foot wide by 8-foot tall box culvert, which is notably one of the largest storm water conveyance structures in Florence. However, once the water exits the box culvert on the west side, it is not permitted to maintain the same volume of space because the stream comes to a tee in the middle of the Marine Manor PUD where housing and landscaping have been constructed. There is a small berm on the outlet side of the culvert, and a stilling basin to dissipate the water's energy before it is channeled into a single 36-inch corrugated metal pipe which conveys water across the Marine Manor properties and discharges into the Siuslaw River through a sea wall discharge. Somewhere prior to reaching the sea wall, the CMP culvert transitions to 36-inch ADS pipe.

This dramatic reduction in cross-sectional area is not necessarily problematic, as long as the 36-inch culvert is adequately sized to convey storm water during peak flow conditions. During dry-season field inspections, a resident of the PUD expressed concern over the substantial amounts of flow that culminate at this location, but no other reports have been logged by Civil West engineers or the City.

Figure 5-18 - 36-inch CMP pipe from box culvert to river

Figure 5-19 - 36-inch outfall constructed of ADS

6.0 Capital Improvement Projects

Section 6

This section includes recommendations for capital improvement projects to address the City's major drainage issues, as described in the detailed analyses included Section 4 of this Master Plan update. The Capital Improvement Plan (CIP) consists of a variety of projects designed to enable the City to properly serve the community's needs and prepare for future storm events.

The information provided in this section may be used to plan for, prioritize, and implement the various recommended projects in a way that is harmonious with the City's other budgetary interests and timing constraints. As needs arise or as new deficiencies are identified, additional projects may be added to the CIP. Although each subsection includes only one cost estimate and accompanying project schematic, in some cases multiple project alternatives are discussed. Final design for each project will inevitably reveal detailed information which is not currently available. Such information should be used to determine the best possible engineering solution for each respective project.

The City should adopt this CIP and move forward in a deliberate manner to undertake high priority projects as soon as funding is available. Subsections in this chapter correspond to subsections in Sections 4 and 5 (e.g. Section 6.2 capital improvements correspond with Section 4.2 drainage issues).

6.1 Spruce Street at 42nd Street

As stated in Section 4.1, streets in the vicinity of Spruce Street and 42nd Street are not presently equipped with storm water management infrastructure. The proposed improvements at this location would include the installation of underground piping, catch basins, and ditches to collect storm water from the intersection of Spruce and 42nd and from the southeast corner of Bi-Mart, and convey those waters into the existing ditch which flows south along the eastern property boundary of the Pacific Pines RV park. See Figure 6-1 for a schematic diagram of these improvements.

The existing 18-inch culvert which currently collects water from the southeast corner of Bi-Mart lacks capacity, so this pipe would need to be removed and replaced with a larger diameter pipe. Additionally, since water flows to this location from two separate directions (from the west and from the north), it will be important to construct and orient the new culvert inlet in such a way that water enters the new pipe from both ditches without scouring or eroding away the adjacent private properties. To accomplish this, a concrete headwall structure is recommended at this location.

This system would alleviate flooding in the intersection, and it would also create a path for water in the ditch behind Bi-Mart to discharge, thus helping to alleviate the flooding in that location as well.

The figure below shows the footprint of the recommended improvements.

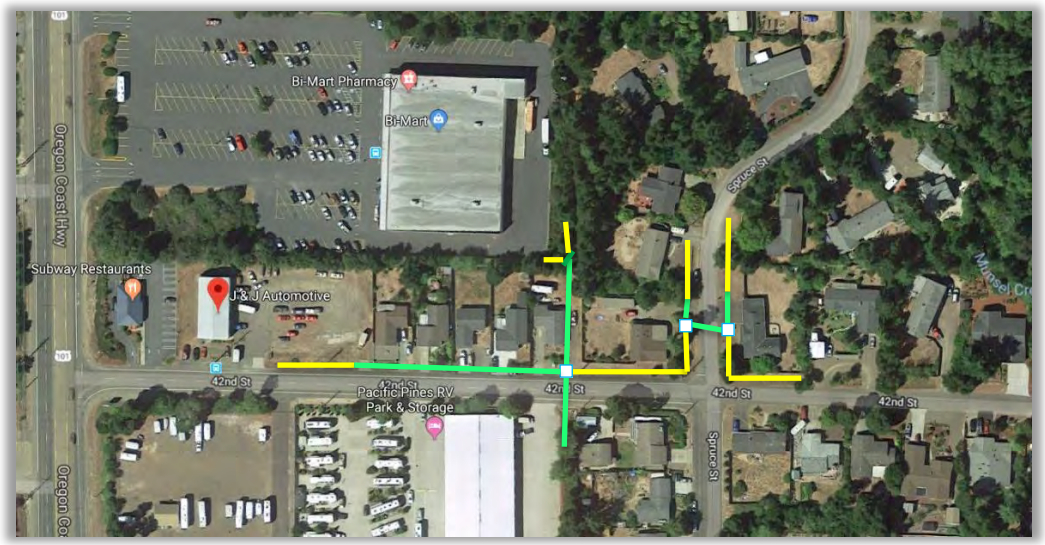


Figure 6-1 – CI Project Diagram (Spruce & 42nd)

The table below provides a preliminary cost estimate for this capital improvement project, based on average construction costs in the Florence region for 2017.

LEGEND
- Manhole
- Headwall
- Catch Basin / Curb Inlet
- Pipe
- Ditch

Note: This legend will be used for all Capital Improvement Project Diagrams in this section.

Table 6-1 - Preliminary cost estimate for Spruce St Storm Improvements

Spruce Street at 42nd Street					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 32,900.00	$ 32,900.00
2	Ditch Excavation	cy	185	$ 20.00	$ 3,700.00
3	Jute Mat, Seed, Riprap	sy	280	$ 10.00	$ 2,800.00
4	Catch Basin / Curb Inlet	ea	3	$ 2,500.00	$ 7,500.00
5	Headwall Structure	ea	1	$ 16,000.00	$ 16,000.00
6	SD PVC Piping (8"-24") & Fittings	lf	595	$ 150.00	$ 89,300.00
7	Asphalt Repair (Trench Patch)	lf	45	$ 52.00	$ 2,400.00
8	Landscape Restoration	ls	1	$ 9,800.00	$ 9,800.00
		Construction Total			$ 164,400.00
		Contingency (20%)			$ 32,900.00
		Subtotal			$ 197,300.00
		Engineering (16%)			$ 31,600.00
		Total Project Cost			**$ 228,900.00**

As an alternative to this design, the City could elect to install underground piping to transmit water directly into Munsel Creek. As shown in Figure 6-2, such a design would require the City to obtain multiple easements, and it would likely be more expensive, and more difficult to maintain than the ditch solution described above. This approach is not recommended.

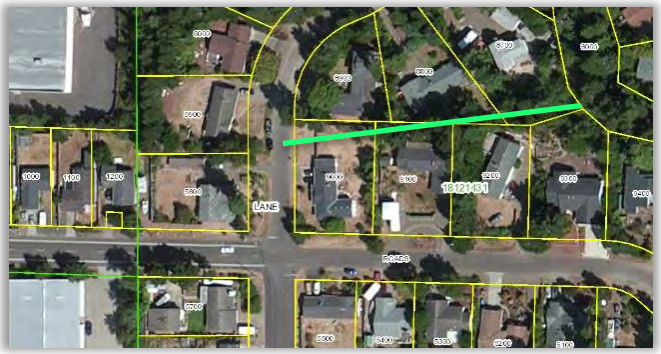


Figure 6-2 - Tax lots near 42nd and Spruce. Direct discharge into Munsel Creek would require easements

6.2 46th Street by Fred Meyer

Drainage issues for 46th Street on the south side of Fred Meyer are described in Section 4.2. As stated there, the direction of flow in the existing underground storm piping on 46th street is to the west. In order to provide a point of discharge for this network, it will be necessary to reverse the direction of flow by removing and replacing the existing pipe network such that storm water can be conveyed east toward the highway via gravity flow. The new system may be connected to either the City-owned 42-inch pipe on the east side of the highway, or to the State system which runs south along the west side of Highway 101. See Figure 6-3 for a potential project layout.

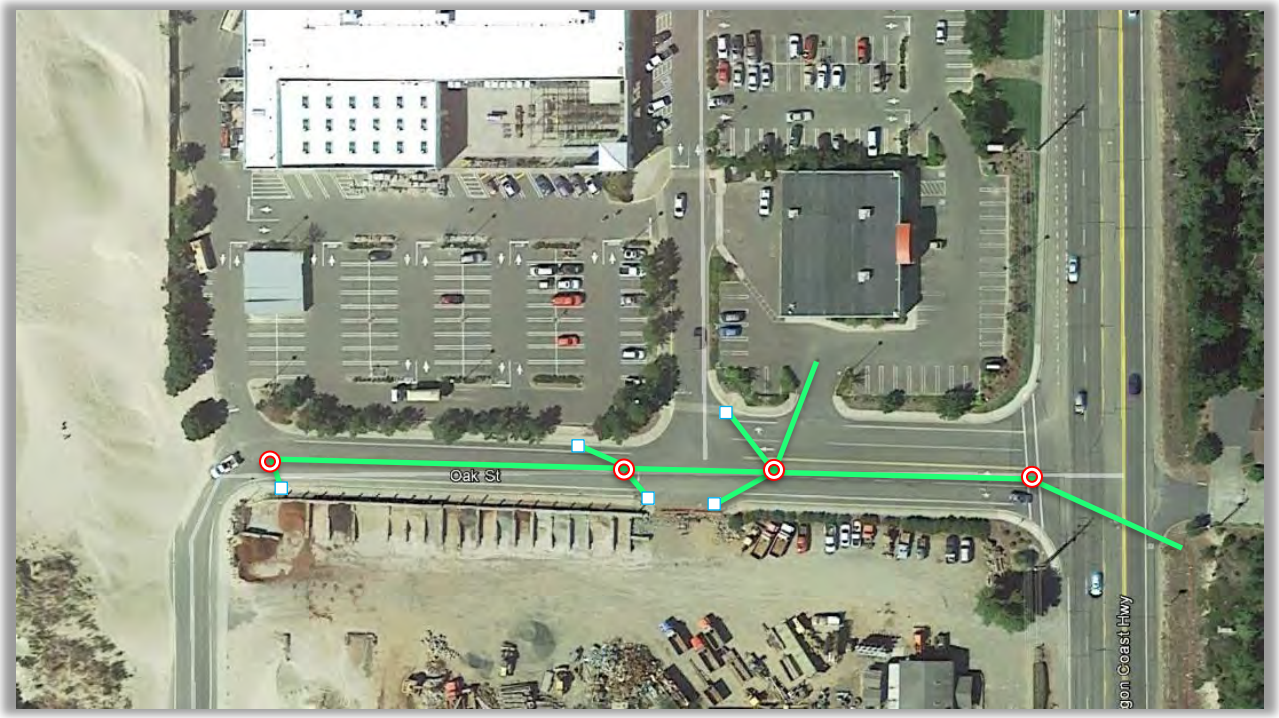


Figure 6-3 - CI Project Diagram (46th by Fred Meyer)

Table 6-2 summarizes the preliminary cost estimate for the improvements shown above.

Table 6-2 - Preliminary cost estimate for 46th Street improvements

46th Street by Fred Meyer					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 42,300.00	$ 42,300.00
2	Manhole	ea	4	$ 5,500.00	$ 22,000.00
3	Catch Basin / Curb Inlet	ea	5	$ 2,500.00	$ 12,500.00
4	Connect to Existing Manhole / Base Reconstruct	ea	1	$ 2,000.00	$ 2,000.00
5	SD PVC Piping (8"-15") & Fittings	lf	875	$ 115.00	$ 100,700.00
6	Asphalt Repair (Trench Patch)	lf	800	$ 52.00	$ 41,600.00
7	Landscape Restoration	ls	1	$ 5,000.00	$ 5,000.00
		Construction Total			$ 226,100.00
		Contingency (20%)			$ 45,300.00
		Subtotal			$ 271,400.00
		Engineering (16%)			$ 43,500.00
		Total Project Cost			**$ 314,900.00**

6.3 Spruce Street near 52nd St.

As described in Section 4.3, the Siefert Ditch is currently being used as an infiltration swale. During development of Spruce Street, the Army Corps of Engineers prohibited water in the ditch from crossing Spruce Street, due to water quality concerns related to the historic use of Tax Lot #300 as a wrecking yard. The Army Corps wishes to protect the wetland mitigation efforts on the east side of Spruce from being contaminated by ground water from Tax Lot #300. As a consequence, water in the ditch may get backed up during wet-weather months, spilling over into adjacent properties. To correct this issue, it is recommended that the City restore the Siefert Ditch as a conveyance channel, and further, extend the ditch to the south along the western edge of the Spruce Street right-of-way, and tie it in to the pipe network on Munsel Lake Road.

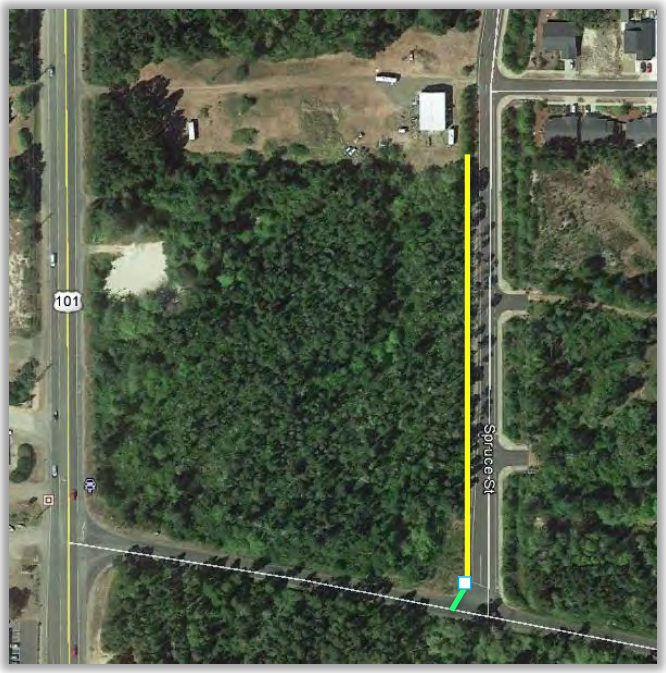


Figure 6-4 - CI Project Diagram (Spruce near 52nd)

Based on field inspection, the rest of the storm water infrastructure in this area appears to be adequately sized and in reasonably good condition. A preliminary cost estimate for the above described improvements/ modifications is provided in Table 6-3.

Table 6-3 - Preliminary Cost estimate for 52nd Street Improvements

Spruce Street near 52nd Street					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 5,300.00	$ 5,300.00
2	Ditch Inlet	ea	1	$ 2,500.00	$ 2,500.00
3	Ditch Excavation w/ Jute Mat & Seed	cy	100	$ 29.00	$ 2,900.00
4	SD PVC Piping (8"-15") & Fittings	lf	60	$ 100.00	$ 6,000.00
5	Rip-Rap	cy	10	$ 100.00	$ 1,000.00
6	Connect to Existing Manhole / Base Reconstruct	ea	1	$ 2,000.00	$ 2,000.00
7	Landscape Restoration (incl. Pavement Trench Patch)	ls	1	$ 3,000.00	$ 3,000.00
		Construction Total			$ 22,700.00
		Contingency (20%)			$ 4,600.00
		Subtotal			$ 27,300.00
		Engineering (35%)			$ 9,600.00
		Total Project Cost			**$ 36,900.00**

6.4 Spyglass Lane, Mariner's Lane & Royal St. George Drive

As evidenced by the flooding of Tax Lot #126 during the 2016-2017 wet season, the retention pond on Tax Lot #4600 is inadequate to store runoff from a significant storm event. In order to prevent future flooding, it is recommended that the City construct an emergency overflow to convey excess storm water from the retention pond to another basin or drainage system with adequate capacity. As shown on the Region 6 Map in the Appendix, there are three nearby storm systems to which the Mariner's Village outfall could theoretically be connected. These include Shelter Cove, Sea Watch Estates, and Bud's Ravine.

This sub-section will evaluate the feasibility of each of these discharge options, as well as two other potential drainage management strategies, which could be implemented to handle storm water in Mariner's Village. Each of these options has advantages and disadvantages. These alternatives are discussed herein to provide clarity and thoroughness of analysis for the benefit of the City and the residents of the Mariner's Village subdivision.

Alternative #1 – "Shelter Cove Outfall Connection": The Shelter Cove subdivision has stormwater infrastructure, including an outfall, near Tax Lot #1000. Connecting to this system would be expensive and comes with several hurdles: (1) The system is privately maintained, and not under the City's control, so to connect to it would require the City to take control of that system; (2) New piping to this location would require the City to obtain permanent easements across multiple private properties, and; (3) Existing topography rises 25 feet above the existing grade of Rhododendron Drive before coming back down to south cul-de-sac of Shoreline Drive. It is unlikely that sufficient fall exists between a future inlet on Tax Lot #4600 and the existing outfall on Shoreline Drive. Additionally, in order to install piping through such terrain, it would have to be accomplished via directional bore, which would drive up the cost of the project. This alternative is not recommended.

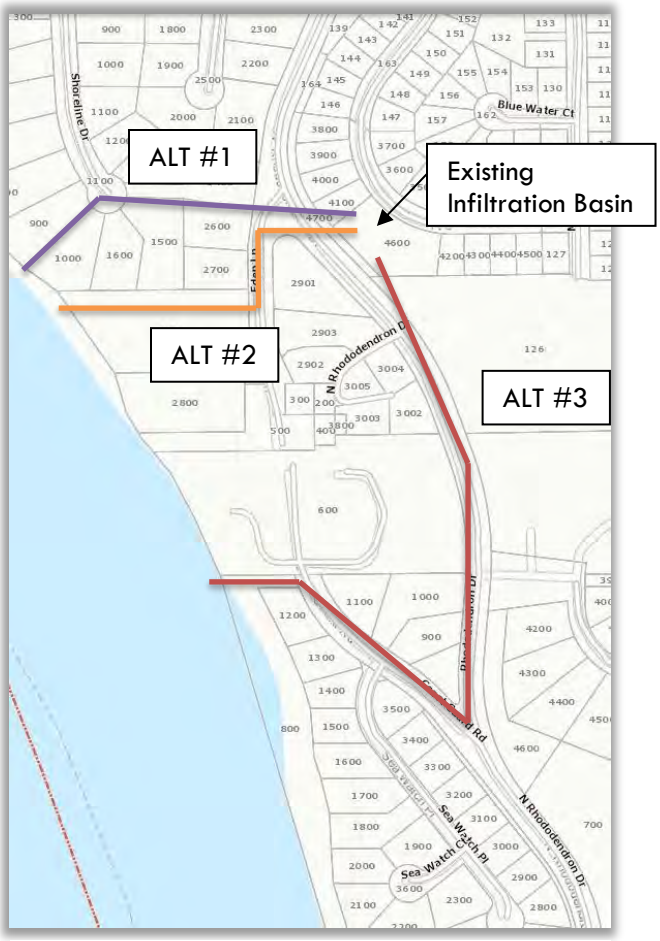


Figure 6-5 - Vicinity Map, showing Alternative #1 (purple), Alternative #2 (orange), and Alternative #3 (red)

Alternative #2 – "Eden Lane": The City of Florence owns Tax Lot #100 on the west side of Eden Lane. Some residents in the Mariner's Village community have suggested that the City should install a pipe from Tax Lot #4600 across Rhododendron Drive, south down Eden Lane, west across Tax Lot #100, to ultimately discharge directly into the Siuslaw River. This alternative would also require the directional boring pipe installation method as Tax Lot #100 exhibits complicated terrain with an 85-foot precipice at the edge of the river. If such a pipe were installed, the City would have to reduce the hydraulic head that would be generated by such a steeply-sloped pipe, to prevent scour of the river bottom, and erosion of the bank. This could be accomplished perhaps with large-diameter riprap, but as stated in Section 4.4, it is unlikely that the City will be permitted to construct a new outfall anyway, particularly in this volatile location. The Army Corps

of Engineers is restrictive of any construction which may impact the endangered coho salmon which use the Siuslaw River as a spawning ground. This alternative is not recommended.

Alternative #3 – "Sea Watch Estates": Some drainage infrastructure exists on Coast Guard Road. The City could potentially construct an overflow from Mariner's Village south along Rhododendron Drive to the intersection with Coast Guard Road. At that point, the City would need to redirect the flow approximately 300-degrees, to send it back to the northwest. This could be accomplished with two manholes, to help incrementally redirect flow. This new system would then join the existing infrastructure on Coast Guard Road. However, this existing City-owned system currently crosses into privately-owned Tax Lot #800, which is owned by the Seawatch Estates Homeowners Association, before discharging into the river. It is unclear whether the City possesses an easement for this infrastructure. See Appendix E for information regarding a lawsuit that occurred in 2006 over City-owned drainage infrastructure being operated on this property.

The "outfall" on Tax Lot #800 consists of a fabric sleeve which carries the water from the top of the embankment, approximately 50-feet down to the river. If this alternative was selected, this sleeve would need to be replaced with larger diameter rigid pipe, and the energy dissipation techniques described in Alternative #2 would apply here as well.

Alternative #4 – "Bud's Ravine": As described in Section 4.4, the new Fairway Estates development east of Mariner's Village is soon going to be connected to the drainage system which flows out via Bud's Ravine. It is possible to install an emergency overflow from Mariner's Village Tax Lot #4600 to discharge excess waters into the same flow control manhole being used for Fairway Estates, located at the edge of Rhododendron Drive, and shown in Figure 4-19. This would require that the existing orifice discharge being used for Fairway Estates' overflow be adequately sized to also handle Mariner's Village overflow. If not, that orifice will cause water to dam up and flooding problems will continue.

In 2004, Branch Engineering furnished a design report for the City which proposed drainage improvements specifically for the region in question, including Mariner's Village, Fairway Estates, Royal Saint George, and Siano Loop. This full report has been included in Appendix F.

Regarding Bud's Ravine, the report states: *"The existing ravine on the west side of Rhododendron Drive is proposed to be partially filled and piped to prevent erosion and bank scouring due to increases in flow that will be generated by the improvements. Armoring the outfall of the pipe at the Siuslaw River is also proposed for erosion prevention purposes."*

This recommendation was made long before the 2016 installation of the 42-inch culvert at Rhododendron Drive and 35th Street, which itself enables water from Tax Lot #3800 (and beyond) to enter Bud's Ravine. However, no erosion control measures or scour-prevention improvements have since been implemented. Bud's Ravine has not been piped, but it has been subjected to increased flows. Visual inspection of Bud's Ravine revealed that the ravine is so densely vegetated that it is mostly unnavigable by foot. Plants and trees in this area are very well established, and their presence provides natural slope stabilization and scour prevention.

Figure 6-6 - Dense vegetation in Bud's Ravine

Figure 6-7 - Approximate path of Bud's Ravine

The approximate path of Bud's Ravine is shown in Figure 6-7. As seen in the Figure, there are a handful of homes which are situated along the banks of the ravine. One of these homes, 3515 Rhododendron Drive has a detached 3-car garage/shop which is located in close proximity to the top of the sloped bank. As shown in Figure 6-8, the foundation of this shop has been completely exposed at its northwest corner due to unconfined, loose sand eroding away from the building's perimeter. The previous owners of this home had argued that this erosion was caused by increased flows in Bud's Ravine, introduced by the 42-inch culvert, but this claim is likely incorrect. The erosion seen here appears to be a localized issue, likely caused by rain, wind, lack of stabilizing vegetation at the top of the slope, and therefore appears to be unrelated to the stormwater flows in the ravine.

Figure 6-8 - 3515 Rhododendron Drive 3-car garage foundation exposed

This issue is addressed in this storm water master plan only to demonstrate that Bud's Ravine is indeed a stable stormwater conveyance channel, and that it is therefore eligible to receive additional flows from Mariner's Village. Prior to constructing any improvements associated with this alternative, a detailed regional drainage evaluation should be completed to determine peak potential flows, and validate the stability and capacity of Bud's Ravine.

Alternative #5 – "Pump Station": Mariner's Village Tax Lot #103 was at one time the discharge site of a storm water pumping station. Water from the subdivision was pumped to this location, and allowed to infiltrate into this Tax Lot, which reportedly had a great capacity for this purpose. However, pumping was eventually terminated, and the discharge site was filled with slurry because of threats of litigation by the developer of the Shelter Cove subdivision. It was alleged that the concentration of groundwater in the Mariner's Village subdivision had increased the hydrostatic pressure being applied against the embankment upon which sits Shelter Cove. As a result, it was further alleged that the increased pressure was causing erosion underground separating the embankment and threatening the perpetuity of the entire subdivision. No litigation ever took place, but there are still lingering echoes of these claims amongst residents of Shelters Cove and the Coast Guard Station.

It could be possible to rehabilitate the Tax Lot #103 pump station, and from there pump water directly into the Siuslaw River. This would require the installation of an underground pipe via directional bore, which would pass directly underneath Shelter Cove at a significant depth, to reach the toe of the embankment at the water's edge. Such a pipe would be approximately 1,200 feet long, horizontally, to the nearest location on the river. As was the case with other alternatives listed above, this strategy would require erosion control, bank stabilization, marine life migration prevention, and hydraulic energy dissipation.

Figure 6-9 - Mariner's Village vicinity map, showing possible path of directionally bored pipe from Tax Lot #300 to the Siuslaw River

Recommendation: As stated previously, each of these alternatives has inherent disadvantages. The City should carefully consider each alternative, and their impacts, prior to entering design phase. It is recommended that the City elect a plan which exhibits the following characteristics:

- Low cost – to efficiently utilize City funding
- Highest benefit – for Mariner's Village residents, the City, and other nearby neighborhoods
- Legal and Safe – to protect public and private stakeholders from loss
- Environmentally Low-Impact – to protect valuable natural resources
- Regulatorily feasible – to ensure successful implementation of the project

It has been made apparent that some of these alternatives have been, or in the future may be associated with litigation. It is recommended that the City adopt a plan which lessens or, preferably, eliminates any threat of future litigation.

With these factors in mind, our recommended is to implement Alternative #4 – "Bud's Ravine". As stated previously, visual inspection of Bud's Ravine indicates that the banks of the ravine are currently well stabilized by dense, mature vegetation. No evidence of bank scour or erosion has been observed during engineering inspections, which leads to the conclusion that the homes situated at the tops of the banks are not currently at risk. The depth of the channel also provides more than enough volumetric capacity to handle the proposed flows. At this point in time, we do not recommend piping any portion of Bud's Ravine because construction activities within the ravine would destroy the existing stabilizing vegetation, making way for bank scour and erosion. Figure 6-10 and Figure 6-11 below show images of the ravine's flowline. As previously stated, a more detailed evaluation should be completed to establish peak flow in Bud's Ravine and validate this recommendation, prior to implementing any of these improvements.

If this solution is selected and no piping occurs within Bud's Ravine, a maintenance and inspection plan should be implemented. This plan would call for routine inspection and re-evaluation of the stability of this ravine. If conditions change, and erosion or scour is observed, it may become necessary for the City to alter its approach and implement improvements to stabilize the banks. At the time of this report, such work appears to be unnecessary, but no guarantee is made that it will not become necessary in the future, with changing climatic conditions and/or alterations to the City's drainage network.

Figure 6-10 - Bud's Ravine flowline (approx. 80 ft from outfall)

Figure 6-11 - Bud's Ravine flowline (approx. 250 ft downstream from Rhododendron crossing)

Thus, it is recommended that the City connect an emergency overflow from Mariner's Village into the Fairway Estates system, so that excess water unable to infiltrate during peak storm events can be safely discharged to the river. This alternative preserves the utility of the Mariner's Village infiltration system and improves upon it by minimizing the threat posed during seasons of high rainfall. This alternative is also preferable in a regulatory sense, because it does not hinge on the Army Corps of Engineers issuing a permit for a new outfall.

In addition to the emergency overflow, it will be necessary to relieve the northeast corner of the Mariner's Village subdivision, where storm water flow from Three Mile Prairie is concentrated. As described in Section 4.4, water is currently collected at that location, and piped underneath Mariner's Village to Tax Lot #4600. However, homeowners in that northeast corner have still submitted complaints of storm water flooding their yards and threatening their homes. It is therefore recommended that the City install a perforated drain pipe / French drain along the entire eastern border of Mariner's Village, to convey water away from the homes and into the Fairway Estates system.

Implementing the above improvements may cause at least two specific impacts to downstream infrastructure. First, connecting new drainage piping in Mariner's Village to the Fairway Estates system will introduce flows which may exceed the capacity of that system and its orifice. It will be necessary to design this connection in such a way that water from both systems is handled appropriately, so that flooding is eliminated, and downstream flow is correctly attenuated.

Second, with the addition of flows from Mariner's Village and Fairway Estates to the 42-inch crossing at Rhododendron Drive, it is recommended to install additional armoring to the outfall on the west side of the street. That location, shown in Figure 6-12, requires water to make a 90-degree angle turn immediately after exiting the pipe. Energy dissipating rip rap is already in place but may need to be enhanced to prevent scour of the bank with the additional flow to the network.

Figure 6-12 - Inlet into Bud's Ravine (90-deg angle turn)

A preliminary estimate of the costs associated with this alternative is provided below.

Table 6-4 - Preliminary cost estimate for Mariner's Village improvements

Spyglass Lane, Mariner's Lane, & Royal Saint George Drive					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 58,000.00	$ 58,000.00
2	Perforated Drain Pipe (east Mariner's Village)	lf	1100	$ 100.00	$ 110,000.00
3	SD PVC Piping (12") & Fittings (not in roadway)	lf	900	$ 95.00	$ 85,500.00
4	Manhole / Orifice Control	ea	2	$ 5,500.00	$ 11,000.00
5	Connect to Existing Manhole / Base Reconstruct	ea	2	$ 2,000.00	$ 4,000.00
6	Armor Outfall of 42-inch crossing	ls	1	$ 2,500.00	$ 2,500.00
7	Landscape Restoration	ls	1	$ 10,000.00	$ 10,000.00
		Construction Total			$ 281,000.00
		Contingency (20%)			$ 56,200.00
		Subtotal			$ 337,200.00
		Engineering (16%)			$ 54,000.00
		Total Project Cost			**$ 391,200.00**

6.5 Pine Street from 29th St to 28th St. to Highway 101

Drainage issues for Pine Street from 29th Street to 28th and Highway 101 are described in Section 4.5. As stated there, the undeveloped right-of-way is currently being used to infiltrate overflowing water from the pipe system, which has no discharge. This has caused flooding at nearby businesses.

In order to provide a point of discharge for this network, eliminate flooding, and restore the utility of the right-of-way, it is recommended to remove and replace the existing pipe network in the region, and connect new piping to the existing drainage infrastructure on Oak Street to the west. This project will provide the City with an opportunity to complete street improvements on 28th Street at the same time. See Figure 6-3 for a potential project layout.

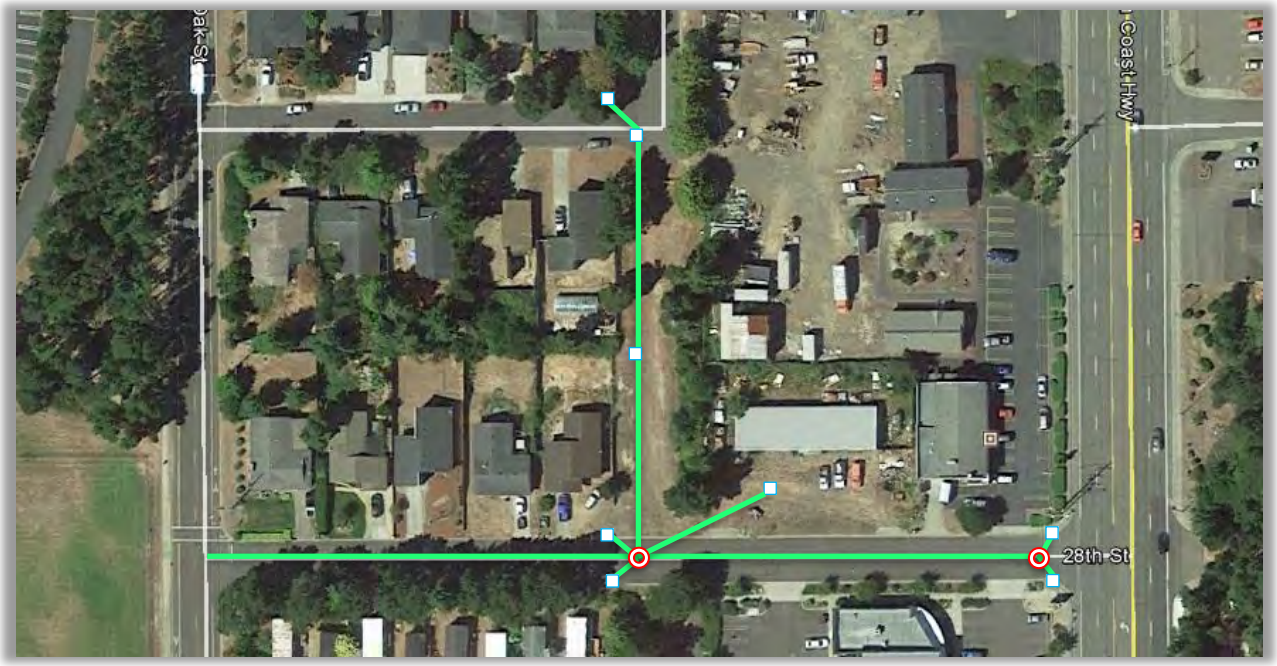


Figure 6-13 – CI Project Diagram (28th Street & Pine)

Table 6-5 summarizes the preliminary cost estimate for the improvements shown above.

Table 6-5 – Preliminary cost estimate for Pine Street Improvements

Pine Street from 29th St to 28th St to Highway 101					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 46,700.00	$ 46,700.00
2	Manhole	ea	2	$ 5,500.00	$ 11,000.00
3	Catch Basin / Curb Inlet	ea	8	$ 2,500.00	$ 20,000.00
4	Connect to Existing Manhole / Base Reconstruct	ea	1	$ 2,000.00	$ 2,000.00
5	SD PVC Piping (8"-15") & Fittings	lf	1100	$ 90.00	$ 99,000.00
6	Asphalt Repair (Trench Patch)	lf	725	$ 52.00	$ 37,700.00
7	Landscape Restoration	ls	1	$ 3,000.00	$ 3,000.00
		Construction Total			$ 219,400.00
		Contingency (20%)			$ 43,900.00
		Subtotal			$ 263,300.00
		Engineering (16%)			$ 42,200.00
		Total Project Cost			**$ 305,500.00**

6.6 Rhododendron Drive (north of Wildwinds St.)

As described in Section 4.6, flooding has been observed on the east side of Rhododendron Drive north of Wildwinds Street. It would seem that this issue could be easily resolved by simply installing a culvert to pass water underneath the roadway to discharge into the Siuslaw River. But, as has been described previously, it will be difficult for the City to obtain permission from the Army Corps of Engineers to construct an additional outfall on the river. City staff has indicated that there may be an existing storm water inlet on the west side of the street. If such a structure exists, the City could explore that as a discharge opportunity for a culvert across Rhododendron.

In the case that such an inlet is not available, it is recommended that the City install a catch basin with piping to convey water to the southeast, and discharge onto Tax Lot #702. This tax lot, which is the former site of a landfill, is owned by Lane County, so its use would require the City to come to an agreement with County officials. It is also recommended to install energy dissipating rip-rap at the discharge point, to prevent erosion of the embankment.

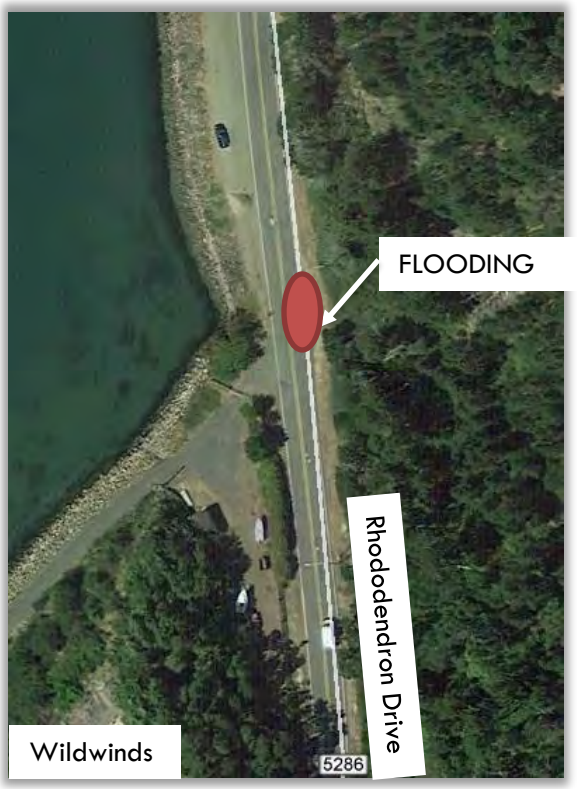


Figure 6-14 - CI Project Diagram (Rhododendron Drive, north of Wildwinds)

Table 6-6 summarizes the preliminary cost estimate for the recommended improvements, and a diagram of the improvements is shown in Figure 6-14 (right).

Table 6-6 - Preliminary cost estimate for Rhododendron Flood Relief Improvements

Rhododendron Drive (north of Wildwinds)					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 2,900.00	$ 2,900.00
2	Catch Basin / Curb Inlet	ea	1	$ 2,500.00	$ 2,500.00
3	Riprap	cy	5	$ 100.00	$ 500.00
4	SD PVC Piping (8"-15") & Fittings	lf	60	$ 90.00	$ 5,400.00
5	Landscape Restoration	ls	1	$ 2,000.00	$ 2,000.00
		Construction Total			$ 13,300.00
		Contingency (20%)			$ 2,700.00
		Subtotal			$ 16,000.00
		Engineering (32%)			$ 5,200.00
		Total Project Cost			**$ 21,200.00**

* It is recommended that the City complete this project with City Public Works crews, if possible.

6.7 Kingwood Street from Airport Way to Airport Rd.

A summary of the drainage problems for this area is provided in Section 4.7. It is recommended that the City remove and replace all existing drainage piping on Kingwood Street between 20th Street and 15th Street. It is also recommended to complete these improvements on 18th Street, Laurel Way, and 17th Place. These roads have experienced damage due to the failure of the existing CMP pipe network. Existing piping should be replaced with plastic pipe, and accompanying drainage structures.

Figure 6-15 - CI Project Diagram (Kingwood St.)

By removing and replacing the pipe in its existing location, trench patch operations for the drainage project will result in a repaired roadway surface as well. This dual-benefit approach is recommended, unless the City wishes to complete larger street improvements in this location. In that case, the City should weigh the costs of demolition to remove the existing piping versus sand/slurry filling the existing pipe and installing new piping in another location.

It is recommended that the City extend the proposed pipe network beyond 15th street to the southwest, diagonally across the airport property. Doing so will establish a more logical path for storm water flow, and waters from Kingwood Street will be connected to the surface conveyance system which discharges near the City's wastewater treatment plant.

It is recommended that the catch basin on the west side of Kingwood, across the street from the Senior Center (shown in Figure 4-26), be removed and replaced with a curb inlet. A curb inlet will be less susceptible to clogging from pine needles, especially if it is constructed with a deep sump. See Figure 6-15 for a potential project layout.

A preliminary cost estimate for these improvements is shown in Table 6-7, on the next page.

Table 6-7 - Preliminary cost estimate for Kingwood Street improvements

Kingwood Street from Airport Way to Airport Road					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$161,000.00	$ 161,000.00
2	Manhole	ea	9	$ 5,500.00	$ 49,500.00
3	Catch Basin / Curb Inlet	ea	19	$ 2,300.00	$ 43,700.00
4	SD PVC Piping (8"-24") & Fittings	lf	3720	$ 120.00	$ 446,400.00
5	Asphalt Repair (Trench Patch)	lf	3500	$ 52.00	$ 182,000.00
6	Landscape Restoration	ls	1	$ 10,000.00	$ 10,000.00
		Construction Total			$ 892,600.00
		Contingency (10%)			$ 89,300.00
		Subtotal			$ 981,900.00
		Engineering (15%)			$ 147,300.00
		Total Project Cost			**$ 1,129,200.00**

6.8 9th Street from Ivy St. to Elm St.

Drainage issues on 9th Street from Ivy to Elm are described in Section 4.8. As stated there, a majority of the drainage problems in this corridor appear to be caused by an excessive amount of sediments entering the system via the 42-inch concrete pipe on the west side of Seabrook Townhomes. Field inspections of the ditch took place after it was already hand dug by a local resident, and at the time of inspection, vegetation had not grown back to stabilize the walls of the ditch.

Figure 6-16 - CI Project Diagram (Ivy St. Ditch)

It is recommended that the City complete improvements to this ditch, to increase its capacity, and stabilize its banks. City Public Works crews have traditionally used a high-strength woven coir twine erosion control mat (Coir Mat 90) to preserve ditch banks until a root base can be established. This, or a similar product, is recommended for installation after excavating a new ditch with a more definitive flow path. It is recommended to complete this project in the early spring, to give grass seed ample opportunity to germinate.

Furthermore, it is recommended to install riprap or a geosynthetic cementitious composite mat along the bottom of the ditch. Doing so will reduce the erosion that may occur along the flow line, while still allowing ground water to enter the ditch through the vegetated banks. Rip rap or a concrete headwall should be installed around the entrance of the 42-inch pipe.

The 42-inch concrete pipe which transmits ditch water into the manhole on 9th Street is assumed to be of sufficient size. Construction operations in this area should include a thorough cleaning of the system downstream of this inlet, to ensure proper flow. No additional improvements to this pipe network appear to be necessary at this time. Table 6-8, below, shows a cost estimate for these improvements.

Table 6-8 - Preliminary cost estimate for 9th Street ditch

9th Street from Ivy to Elm Street					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 23,900.00	$ 23,900.00
2	Ditch Excavation	cy	270	$ 20.00	$ 5,400.00
3	Jute Mat, Seed, Riprap	sy	500	$ 10.00	$ 5,000.00
4	Riprap (or Headwall Alternative = +$15,000)	cy	25	$ 100.00	$ 2,500.00
5	Geosynthetic Cementitious Composite Mat	sy	250	$ 20.00	$ 5,000.00
6	Landscape Restoration	ls	1	$ 6,000.00	$ 6,000.00
		Construction Total			$ 47,800.00
		Contingency (20%)			$ 9,600.00
		Subtotal			$ 57,400.00
		Engineering (20%)			$ 11,500.00
		Total Project Cost			**$ 68,900.00**

6.9 Ivy Street from 6th St to 8th St.

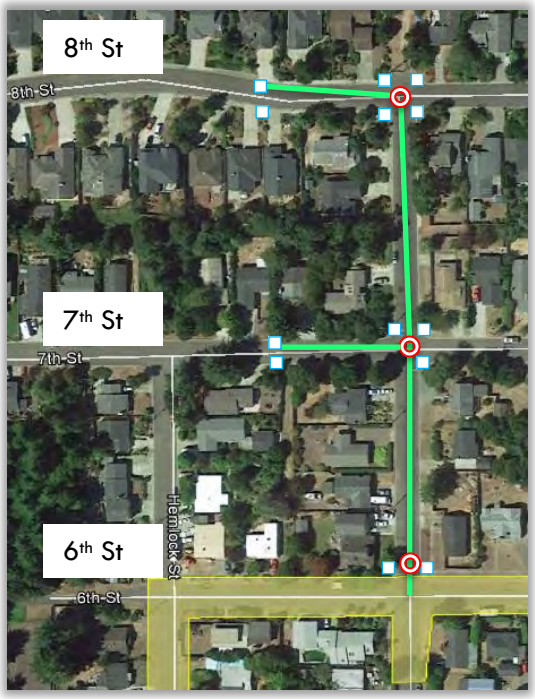


Figure 6-17 - CI Project Diagram (Ivy St. from 6th to 8th)

As described in Section 4.9, piping on Ivy Street between 6th and 8th needs to be removed and replaced due to deterioration of existing pipe, which has caused the formation of sinkholes in the roadway. If existing piping is removed and replaced in the same location, trench patch operations will result in a repaired roadway surface. However, the demolition cost to remove existing piping may exceed the cost to sand/slurry fill and abandon the existing pipe and install new piping elsewhere in the road. Final design should account for these considerations to ensure that City funding is used efficiently.

Figure 6-17 (left) shows a potential layout for the improvements described above. As noted in Section 4.9, the City is currently under contract to complete storm water improvement designs on 6th Street and Hemlock. The project area for these improvements is shown in the Figure, highlighted in yellow.

Table 6-9 (below) provides a preliminary cost estimate for these improvements.

Table 6-9 - Preliminary cost estimate for Ivy Street improvements

Ivy Street from 6th to 8th Street					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 64,200.00	$ 64,200.00
2	Manhole	ea	3	$ 5,500.00	$ 16,500.00
3	Catch Basin / Curb Inlet	ea	13	$ 2,500.00	$ 32,500.00
4	Connect to Existing Manhole / Base Reconstruct	ea	1	$ 2,000.00	$ 2,000.00
5	SD PVC Piping (12"-30") & Fittings	lf	1100	$ 165.00	$ 181,500.00
6	Asphalt Repair (Trench Patch)	lf	1100	$ 52.00	$ 57,200.00
7	Landscape Restoration	ls	1	$ 2,000.00	$ 2,000.00
		Construction Total			$ 355,900.00
		Contingency (20%)			$ 71,200.00
		Subtotal			$ 427,100.00
		Engineering (16%)			$ 68,400.00
		Total Project Cost			**$ 495,500.00**

6.10 8th Street from Highway 101 to Maple Street

As stated in Section 4.10, the City has observed flooding on 8th Street, and in the parking lot area between Banner Bank and the Post Office. It is believed that the cause of the flooding is an obstruction in the 8-inch diameter concrete pipe located in 8th Street. It is recommended that the City replace the pipe from Highway 101 to Maple Street. It is also recommended to remove the existing catch basins and replace them with curb inlets where possible.

These improvements should be preceded by a hydrologic analysis to determine and verify the minimum diameter required for stormwater piping in this area. Figure XX shows a schematic diagram of the recommended improvements.

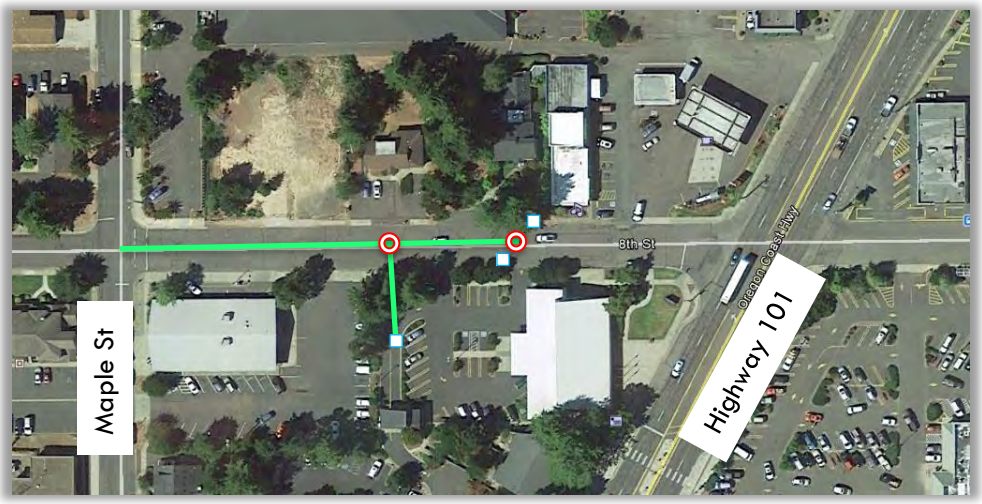


Figure 6-18 - CI Project Diagram (8th Street)

A preliminary cost estimate for these improvements is shown in the table below.

Table 6-10 - Preliminary cost estimate for 8th Street improvements

8th Street from HWY 101 to Maple Street					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 19,100.00	$ 19,100.00
2	Manhole	ea	2	$ 5,500.00	$ 11,000.00
3	Catch Basin / Curb Inlet	ea	3	$ 2,500.00	$ 7,500.00
4	Connect to Existing Manhole / Base Reconstruct	ea	1	$ 2,000.00	$ 2,000.00
5	SD PVC Piping (8"-15") & Fittings	lf	500	$ 86.00	$ 43,000.00
6	Asphalt Repair (Trench Patch)	lf	500	$ 52.00	$ 26,000.00
7	Landscape Restoration	ls	1	$ 1,000.00	$ 1,000.00
		Construction Total			$ 109,600.00
		Contingency (20%)			$ 22,000.00
		Subtotal			$ 131,600.00
		Engineering (16%)			$ 21,100.00
		Total Project Cost			**$ 152,700.00**

6.11 Juniper Street from Rhododendron Dr. to 2nd St.

Drainage issues in this area appear to be mostly focused on maintenance concerns. Flooding has not been observed here, but City crews have indicated that the pipes are cracked and dislocated. To enable the City's Public Works Department to perform maintenance and/or reconnaissance on this infrastructure, it would be necessary to at least install a manhole at one end of the pipe. However, it appears that there are 45-degree bends along this pipeline as well, which further complicates the use of push TVI cameras. It is recommended that the City construct new drainage infrastructure in this location, with plastic pipe and straight runs, so that City crews can perform their facility maintenance.

The City has already contracted to complete drainage improvements on 2nd Street (see Figure 6-19, shown in yellow), so the improvements recommended here would tie-in to this new construction, when completed.

Table 6-11 (below) shows a preliminary cost estimate for these improvements. Because of the small size of this project, it is anticipated that the City will receive bids with relatively high costs for mobilization. The City may wish to combine this capital improvement project with other small projects (e.g. CI Project from Sections 6.8, 6.10 and/or 6.12) to combine construction soft costs and engineering fees, and thus save money.

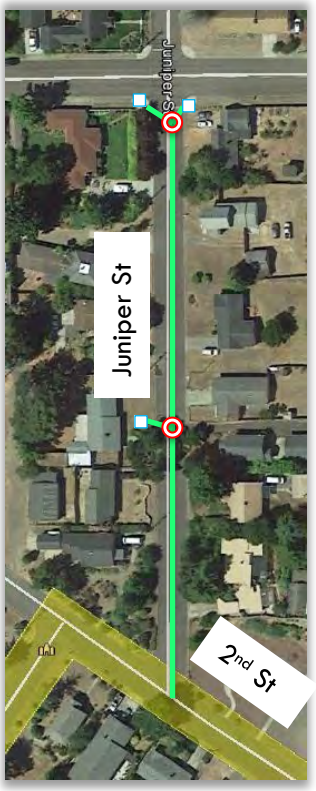


Figure 6-19 - CI Project Diagram (Juniper)

Table 6-11 - Preliminary cost estimate for Juniper Street improvements

Juniper Street from Rhododendron Drive to 2nd Street					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 24,900.00	$ 24,900.00
2	Manhole	ea	2	$ 5,500.00	$ 11,000.00
3	Catch Basin / Curb Inlet	ea	3	$ 2,500.00	$ 7,500.00
4	Connect to Existing Manhole / Base Reconstruct	ea	1	$ 2,000.00	$ 2,000.00
5	SD PVC Piping (8"-15") & Fittings	lf	700	$ 86.00	$ 60,200.00
6	Asphalt Repair (Trench Patch)	lf	700	$ 52.00	$ 36,400.00
7	Landscape Restoration	ls	1	$ 1,000.00	$ 1,000.00
		Construction Total			$ 143,000.00
		Contingency (20%)			$ 28,600.00
		Subtotal			$ 171,600.00
		Engineering (16%)			$ 27,500.00
		Total Project Cost			**$ 199,100.00**

6.12 Nopal Street from 1st St. to 2nd St.

As stated in Section 4.12, the City has observed flooding in this location due to cracked and failing concrete pipe. The pipe has become obstructed which causes water to backup and surcharge back onto the street. It is recommended that the City replace the pipe in between 1st Street and 2nd Street. It is also recommended to remove and relocate catch basins to new locations (as drainage conditions will allow), away from the path of pedestrian travel at the base of sidewalk ramps. A diagram for these improvements is shown in Figure 6-20.

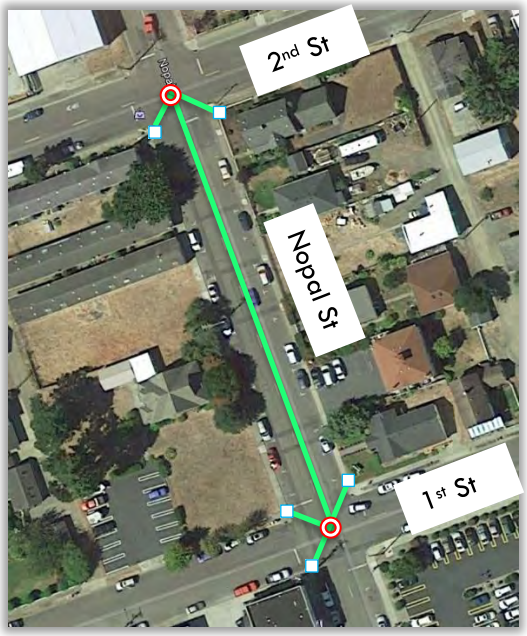


Figure 6-20 - CI Project Diagram (Nopal)

A preliminary cost estimate for these improvements is shown in Table 6-12. As with the project in Section 6.11, the small size of this project will likely result in relatively high costs for mobilization, if bid independently. The City may wish to combine this capital improvement project with other small projects (e.g. CI Project from Sections 6.8, 6.10 and/or 6.11) to combine construction soft costs and engineering fees, and thus save money. This project could also be completed as part of a street improvements project, if there are any planned for this area within the City's Transportation Master Plan).

Table 6-12 - Preliminary cost estimate for Nopal Street improvements

Nopal Street from 1st to 2nd Street					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 29,900.00	$ 29,900.00
2	Manhole	ea	2	$ 5,500.00	$ 11,000.00
3	Catch Basin / Curb Inlet	ea	5	$ 2,500.00	$ 12,500.00
4	SD PVC Piping (8"-12") & Fittings	lf	490	$ 73.00	$ 35,800.00
5	Asphalt Repair (Trench Patch)	lf	490	$ 52.00	$ 25,500.00
6	Landscape Restoration	ls	1	$ 500.00	$ 500.00
		Construction Total			$ 115,200.00
		Contingency (20%)			$ 23,100.00
		Subtotal			$ 138,300.00
		Engineering (16%)			$ 20,800.00
		Total Project Cost			**$ 159,100.00**

6.13 North Jetty Road, Windward Way, Oceana Drive, Saltaire Street, etc.

A summary of drainage issues for this area, outside of the City boundary, is provided in Section 4.13 as well as in SWMP2000. As stated there, storm water improvements for this region are the responsibility of HOAs and private developers because the City cannot complete storm water infrastructure projects outside of its jurisdiction.

For now, it is recommended that projects be completed through a collaborative effort involving developers, Homeowners Associations, individual home owners, and Lane County. If parts of this region are annexed into the City's boundary during the planning period, the City may choose to re-prioritize the capital improvement projects contained herein and include projects that would address drainage issues present in this area.

The annexation of the Driftwood Shores Surfside Inn included the annexation of the entire Rhododendron Drive right-of-way, as it extends to the north beyond the City's boundary. As a result, the City *does* have the right and responsibility to manage stormwater in that corridor. To relieve drainage issues thereabouts, it is recommended that City crews perform ditch restoration improvements along the east side of Rhododendron Drive, from North Jetty Road to Woodlands Drive. Stormwater culverts are already in place at both of those locations, so ditch flow would be diverted into those culverts. From there, stormwater would flow out into the North Jetty Recreation Area.

The extent of these ditch restoration improvements is shown in the figure shown (right).

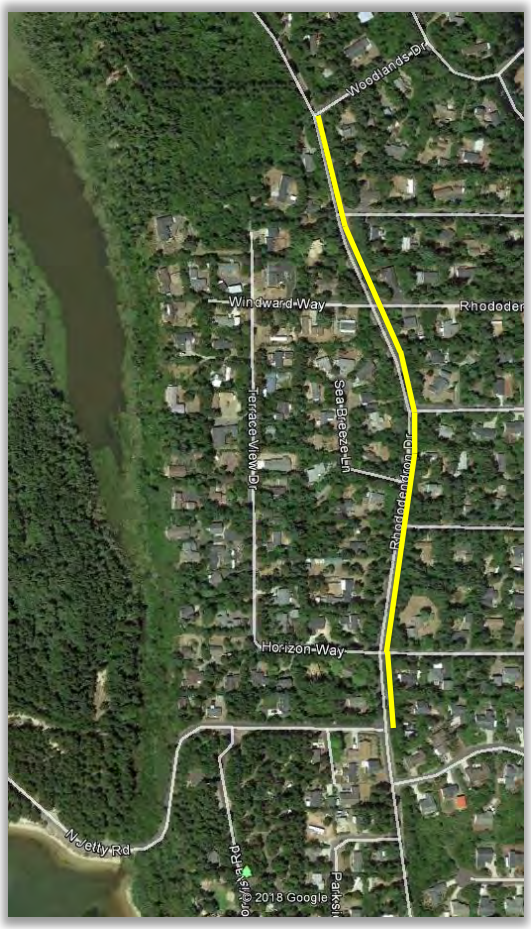


Figure 6-21 – Recommended ditch improvements to be performed by City crews

6.14 Coastal Highlands Development (18th Ct., Pine Ct., 16th St.)

In January 2017, Civil West Engineering furnished a report for the City, entitled: *Pine Court Storm Drainage System Improvements – Evaluation of Alternatives*. This report provided several detailed cost estimates for recommended capital improvement projects which should address the flooding problems in Pine Court and 18th Court. The two separate projects that were ultimately recommended to the City include:

1. Rehabilitate infiltration swales and install underdrains.
2. Construct a collection system to discharge into Munsel Creek.

These recommendations are still valid. In this master plan update, it is further recommended to extend these improvements to incorporate 16th Street as well. An updated potential project layout is provided in the Figure below. Please note that the topography of this region is extremely flat, so the schematic layout shown below may need to be altered during final design, to produce a design which will drain into Munsel Creek via gravity flow.

Figure 6-22 - CI Project Diagram (Pine Court)

A cost estimate for these improvements is shown in the Table below.

Table 6-13 - Preliminary cost estimate for Coastal Highlands Development improvements

Coastal Highlands Development (18th Ct, Pine Ct, 16th Street)					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$121,700.00	$ 121,700.00
2	Manhole	ea	10	$ 5,500.00	$ 55,000.00
3	Catch Basin / Curb Inlet	ea	14	$ 2,500.00	$ 35,000.00
4	Outfall	ls	1	$ 10,000.00	$ 10,000.00
5	SD PVC Piping (12"-24") & Fittings	lf	2300	$ 110.00	$ 253,000.00
6	6" Perforated ADS Piping	lf	3000	$ 50.00	$ 150,000.00
7	1-1/2" Drain Rock	ton	180	$ 40.00	$ 7,200.00
8	Fittings	ls	1	$ 10,500.00	$ 10,500.00
9	Landscape Restoration	ls	1	$ 8,000.00	$ 8,000.00
		Construction Total			$ 650,400.00
		Contingency (20%)			$ 130,100.00
		Subtotal			$ 780,500.00
		Engineering (15%)			$ 117,100.00
		Total Project Cost			**$ 897,600.00**

The remaining segments in this chapter correspond to the segments in Section 5 – "Culvert Crossings". Capital improvement project recommendations are made here, to correct deficiencies and rehabilitate deteriorating culverts.

6.15 Munsel Creek at Spruce Street & 12th St.

The existing culvert at this location is described in Section 5.1.

Failed culverts pose a threat to the safety of the public, particularly when located under roadways. When a culvert collapses, as it may due to corrosion and loss of structural strength, sink holes will likely form, and the entire road may collapse. In 2011, a segment of this existing culvert failed compelling the City to perform emergency repairs on the culvert. At that time, the City replaced a segment of pipe, but did not replace the entire culvert. Since then, the culvert has continued to corrode, and the dislocations in the pipe at the extents of the 2011 repair are especially susceptible to erosion.

It is recommended that the City remove the existing 84-inch CMP culvert in its entirety and replace it with an 8'x5' (min.) rectangular concrete box culvert. A concrete structure will be preferable to the existing metal pipe, as it is noncorrosive.

Figure 6-23 - Section of pre-cast concrete box culvert

Three-sided, open-bottom box culverts are the preferred choice of environmental regulatory agencies because they preserve the natural creek bottom. This condition has been proven to have a lesser impact on fish migration, and other environmental aspects.

The City may also elect to install concrete or eco-block retaining headwalls on either end of the new culvert. The function of these walls would be to support the banks of the road and dissipate hydraulic energy as water is funneled into the culvert. However, there did not appear to be any significant erosion at these banks during field inspection, and the location of the existing culvert inlet is adequately offset from the edge of the roadway to facilitate armoring the bank with riprap or some other method. Therefore, no recommendation is made for such structures at this time.

A preliminary cost estimate for these improvements is shown in the table below.

Table 6-14 - Preliminary cost estimate for 12th St. box culvert

Munsel Creek at Spruce Street & 12th					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 44,900.00	$ 44,900.00
2	8'x5' Box Culvert	lf	100	$ 1,800.00	$ 180,000.00
3	Asphalt Repair (Trench Patch)	lf	45	$ 90.00	$ 4,100.00
4	Riprap	cy	15	$ 100.00	$ 1,500.00
5	Standard Curb & Gutter	lf	60	$ 25.00	$ 1,500.00
6	Landscape Restoration	ls	1	$ 8,000.00	$ 8,000.00
		Construction Total			$ 240,000.00
		Contingency (20%)			$ 48,000.00
		Subtotal			$ 288,000.00
		Engineering (16%)			$ 46,100.00
		Total Project Cost			**$ 334,100.00**

6.16 Munsel Creek at 18th St.

As stated in Section 5.2, the three existing 42-inch CMP culverts at Munsel Creek and 18th Street appear to be undersized. Field inspection also revealed that these pipes have been squashed under the load of the roadway above.

It is recommended to remove the existing culverts in their entirety and replace them with a 9'x4' rectangular box culvert. Doing so will increase the capacity of the crossing and result in a reduced maintenance burden on City Public Works crews. The use of a concrete drainage structure here will also facilitate long life of the structure, being noncorrosive.

The next-best alternative to this recommendation would be to remove and replace the existing culverts with three side-by-side 48-inch PVC/ADS culverts. Plastic pipe is non-corrosive as well, but such a strategy does not reduce the maintenance burden and would likely be more expensive than the box culvert recommended above. Final design should include a cost comparison to determine the most cost-feasible approach. There may also be grant funds available for the culvert for Fish Passage.

Figure 6-24 - Photograph of open bottom concrete box culvert.

box

Figure 5-8 shows signs that the bank at the edge of the roadway has sluffed off. It is recommended that the City install large-diameter riprap to stabilize this bank and prevent future erosion.

Table 6-15 - Preliminary cost estimate for 18th St. box culvert

Munsel Creek at 18th Street					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 35,600.00	$ 35,600.00
2	9'x4' Box Culvert	lf	75	$ 1,900.00	$ 142,500.00
3	Asphalt Repair (Trench Patch)	lf	40	$ 90.00	$ 3,600.00
4	Riprap	cy	10	$ 100.00	$ 1,000.00
5	Standard Curb & Gutter	lf	60	$ 25.00	$ 1,500.00
6	Landscape Restoration	ls	1	$ 6,000.00	$ 6,000.00
		Construction Total			$ 190,200.00
		Contingency (20%)			$ 38,100.00
		Subtotal			$ 228,300.00
		Engineering (16%)			$ 36,600.00
		Total Project Cost			**$ 264,900.00**

6.17 Munsel Creek at 23rd St. & Willow

The existing culvert at this location is described in Section 5.3. As stated there, the 72-inch corrugated metal pipe appears to be in reasonably good condition, although some evidence of aging has been observed. The existing culvert pipe has experienced displacement/ slippage in the past, which on at least one occasion caused damage to the roadway above.

Therefore, the concern with this culvert crossing is not the pipe itself, but rather with the integrity of the roadway above and the bank stability on the upstream, and especially downstream ends. When the culvert slipped, the bank of the roadway on the discharge end experienced a significant loss of stability. This event prompted City crews to repair the road, and also to stabilize the bank by reinforcing it with pumped concrete and riprap. However, the slope of this bank is quite steep which has limited the effectiveness of the City's efforts. Further slippage and deterioration of the bank is possible but does not appear to have occurred within the last few years. For this reason, this culvert appears to be performing adequately at the moment, but in the future, it may require replacement. At that time, it may be beneficial to install a box culvert, or another structure with significant weight to reduce the likelihood of slippage.

Figure 6-25 – Example of open bottom box culvert. Potential future solution @ 23rd St crossing

Evidence of corrosion in the pipe wall was observed during field inspection of this culvert, and is shown in Figure 6-26. CMP culverts' first method of failure is often corrosion in the lower half of the pipe wall. In order to extend the lifetime of this culvert, the City may wish to line the bottom of the existing culvert with a geosynthetic cementitious composite mat, such as the one shown in Figure 6-27.

Figure 6-26 - Evidence of corrosion in existing pipe wall

Figure 6-27 - Geosynthetic cementitious composite mat applied to CMP culvert to extend lifetime of culvert (example)

The City has reported that approximately 150 feet south of this culvert crossing, Munsel Creek is causing erosion to the bank upon which sits Willow Street. It is recommended that the City reinforce the bank of the road at this location, to protect the utility of Willow Street. No further capital improvements appear to be imminently necessary.

It is recommended that the City establish a long-term plan to replace this culvert with a 7'x5' box culvert with energy dissipating, slope-stabilizing riprap or headwalls on each end. An initial cost estimate for these improvements is provided below.

Table 6-16 - Preliminary cost estimate for 23rd St. box culvert

Munsel Creek at 23rd & Willow					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 39,100.00	$ 39,100.00
2	7'x5' Box Culvert	lf	85	$ 1,800.00	$ 153,000.00
3	Asphalt Repair (Trench Patch)	lf	40	$ 90.00	$ 3,600.00
4	Riprap	cy	30	$ 100.00	$ 3,000.00
5	Standard Curb & Gutter	lf	80	$ 25.00	$ 2,000.00
6	Landscape Restoration	ls	1	$ 8,000.00	$ 8,000.00
		Construction Total			$ 208,700.00
		Contingency (20%)			$ 41,800.00
		Subtotal			$ 250,500.00
		Engineering (16%)			$ 40,100.00
		Total Project Cost			**$ 290,600.00**

6.18 30th Street and 31st Street

As stated in Section 5.4, the culverts at this location are under-performing either due to lack of capacity or obstructed flow conditions. It is recommended that the City first attempt to clean the western-most culvert, to eliminate any blockages if possible. If the City is unable to clear the culvert of obstructions and/or obstructed flow continues, it is recommended that the City install a new 36-inch PVC or ADS culvert to transmit stormwater underneath 31st Street.

It is recommended that this new culvert be installed with greater length than the existing culverts, so as to establish entry and discharge further away (horizontally) from the existing edge of pavement. Doing so will provide the room necessary to add fill material to decrease the slope at the roadway's edge, and even widen the road, if desired. A decreased slope will facilitate bank stability, which will preserve the life expectancy of the road.

As an alternative to the increased length of the culvert, the City could choose to install concrete headwalls, although it is anticipated that such an approach would be more expensive than the recommendation above.

Figure 6-28 - Eroded edge of pavement. Address by replacing/extending culvert and adding fill material

A preliminary cost estimate is shown in Table 6-17, below.

Table 6-17 - Preliminary cost estimate for 31st St. culvert improvements

30th and 31st Street					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Mob., Bonds, Insurance, OH, Temp. Facilities, Demo & Site Prep	ls	1	$ 9,500.00	$ 9,500.00
2	SD PVC Piping (36")	lf	60	$ 350.00	$ 21,000.00
3	Riprap	cy	30	$ 100.00	$ 3,000.00
4	Asphalt Repair (Trench Patch)	lf	30	$ 52.00	$ 1,600.00
5	Landscape Restoration	ls	1	$ 6,000.00	$ 6,000.00
		Construction Total			$ 41,100.00
		Contingency (20%)			$ 8,300.00
		Subtotal			$ 49,400.00
		Engineering (20%)			$ 9,900.00
		Total Project Cost			**$ 59,300.00**

6.19 Munsel Creek at Water Treatment Plant

The existing culvert at this location is described in Section 5.5. As stated there, the existing 60-inch CMP culvert appears to be in reasonably good condition, although some evidence of corrosion in the pipe wall was observed. The observed corrosion was present relatively high up on the wall of the pipe, so a cementitious mat such as the one in Figure 6-27, would likely not be effective here. Instead, the City should establish a long-term plan to replace the culvert. Until such time, this culvert appears to be performing adequately. Therefore, no recommendations for capital improvement projects are included for this location at this time. See Section 7 for a priority ranking of this culvert's replacement, as compared to other capital improvement projects listed herein.

The following two sub-sections discuss capital improvement projects that are already being designed. When funding becomes available, and the other more highly-prioritized projects are complete, these projects will be shovel ready.

6.20 6th & Hemlock Storm Water Improvements

As shown on the Region 1 Map in Appendix A, several of the City's underground stormwater pipe networks converge in the area of the City that lies west of Kingwood Street and south of Rhododendron Drive. Because so many areas rely on this convergence for successful stormwater management, it is critical that storm water infrastructure here operate smoothly. However, like the area discussed in Section 6.9, existing pipe in this area is deteriorating due to age, and in some cases, is undersized for the predicted flow rates.

In 2017, the City retained Civil West Engineering to complete storm water improvement designs for this area. At the time of this report, those designs were still underway. The figures here show the cover sheet for the engineering plans related to that project, as well as a map identifying the precise location of the project.

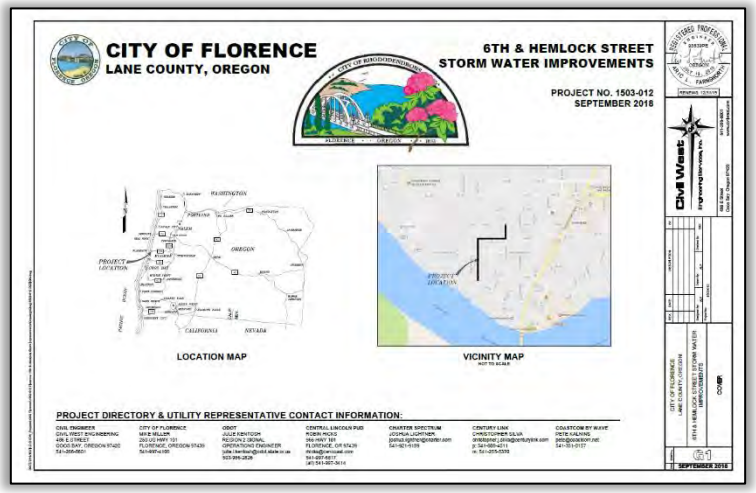


Figure 6-29 - Cover sheet for Engineering plans related to this project

Figure 6-30 - Location & extents of 6th & Hemlock Storm Water Improvements project

6.21 2nd & Ivy Storm Water Improvements

Within the past few years, the City has completed several storm water improvement projects, including one on 1st Street which extended from Greenwood Street to Ivy Street. The City also completed storm water improvements on Kingwood Street from Rhododendron Drive to 2nd Street. These two projects are both a part of the same underground pipe network, and in order to achieve full functionality, it is necessary to complete storm water improvements between the two of them.

In 2017, the City retained Civil West Engineering to complete those designs. At the time of this report, those designs were still underway. The figures here show the cover sheet for the engineering plans related to that project, as well as a map identifying the precise location of the project.

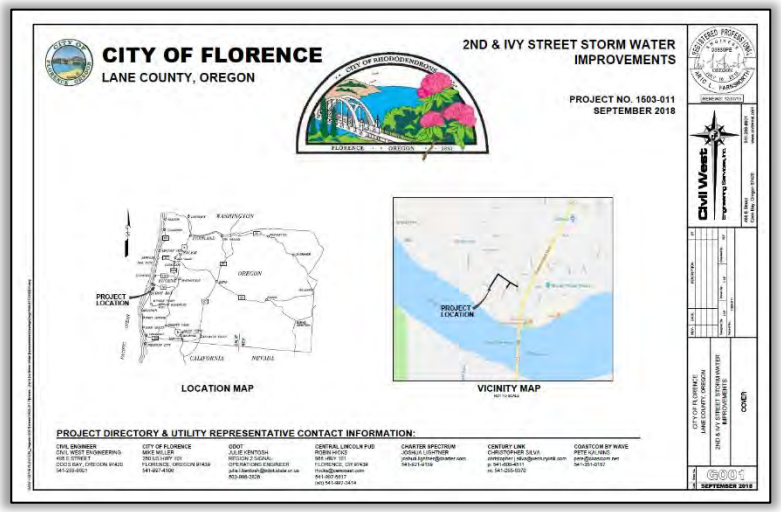


Figure 6-31 - Cover sheet for Engineering plans related to this project

Figure 6-32 - Location & extents of 2nd & Ivy Storm Water Improvements project

7.0 CIP Prioritization

Section 7

7.1 Background

Section 6 of this document presented several capital improvement projects that the City may complete to address drainage and flooding issues throughout the City. The estimated total cost to complete all these projects is significant, so it will be important for the City to prioritize them, or even take on individual projects in phases. Some of the projects discussed herein are interconnected, so the completion of one project may not produce the desired functionality in the storm water system without the completion of others on the list as well.

Topography is the major determinant of stormwater flow. Due to the topography in and around Florence, stormwater drainage in the City is affected by a larger hydraulic tributary region which extends beyond city boundaries, into and beyond the UGB. However, the City cannot legally spend taxpayer money on projects outside of its jurisdiction. Therefore, capital improvements outside of the current City boundary are not presently eligible for prioritization amongst other City projects. As those areas outside of the City are annexed, the City may choose to re-evaluate the prioritization ranking schedule shown below, to address urgent projects which become their responsibility through annexation.

7.2 Prioritization Criteria

In the paragraphs that follow, projects have been ranked based on their adherence to the following criteria:

- The project will provide flood protection for currently at-risk areas
- The project will benefit a maximum number of stakeholders
- The project responds to maintenance and public complaints
- The project will result in needed repairs to other existing failed infrastructure
- The project maintains/ restores public access to critical facilities
- The project addresses erosion and sedimentation concerns
- The project complies with regulatory requirements to protect the quality and quantity of water in the aquifer

7.3 CIP Prioritization Schedule

The following schedule, Table 7-1, outlines one approach for implementing the CIP list.

Table 7-1 - CIP Prioritization schedule

Priority Ranking	Section Heading	Project Description	Est. Total Project Cost
1	6.13	Coastal Highlands Development (18th Ct, Pine Ct, 16th St.)	$ 897,600.00
2	6.4	Spyglass Lane, Mariner's Lane & Royal St. George Drive	$ 391,200.00
3	6.14	Culvert - Munsel Creek at Spruce St. & 12th St.	$ 334,100.00
4	6.8	9th Street from Ivy St to Elm St.	$ 68,900.00
5	6.5	Pine Street from 29th St to 28th St to HWY 101	$ 305,500.00
6	6.2	46th Street by Fred Meyer	$ 314,900.00
7	6.1	Spruce Street at 42nd Street	$ 228,900.00
8	6.7	Kingwood Street from Airport Way to Airport Rd.	$ 1,129,200.00
9	6.20	6th & Hemlock Storm Water Improvements (underway)	$ 1,059,000.00
10	6.21	2nd & Ivy Storm Water Improvements (underway)	$ 394,000.00
11	6.15	Culvert - Munsel Creek at 18th St.	$ 264,900.00
12	6.3	Spruce Street near 52nd Street	$ 36,900.00
13	6.17	Culvert - 30th Street & 31st Street	$ 59,300.00
14	6.16	Culvert - Munsel Creek at 23rd St. & Willow	$ 290,600.00
15	6.9	Ivy Street from 6th St to 8th St.	$ 495,500.00
16	6.10	8th Street from Highway 101 to Maple St.	$ 152,700.00
17	6.11	Juniper Street from Rhododendron Dr to 2nd St.	$ 199,100.00
18	6.12	Nopal Street from 1st St to 2nd St.	$ 159,100.00
19	6.6	Rhododendron Drive (north of Wildwinds St.)	$ 391,200.00

No CIP Recommendations Made			
-	6.13	North Jetty Road, Windward Way, Oceana Dr, Saltaire St, etc.	$ -
-	6.19	Culvert - Munsel Creek at Water Treatment Plant	$ -
-	6.22	Culvert - Marine Manor (Rhododendron Drive)	$ -

The prioritization schedule shown above is only a recommendation meant to acts as a guide in assisting the City to carry out these improvements in a very methodical and logical order. It is possible to break these projects up into phases if the City should wish to do so. The City should classify these projects into their own list of priorities as City resources become available or as needs dictate. No prior approval is needed from the State or regulating authorities to re-order, combine, or eliminate projects as the City sees fit. For example, if the City wishes to complete the projects in Sections 6.8, 6.10, 6.11, and 6.12 simultaneously under a single contract, it would be prudent for the City to do that. As stated in those sections, potential savings are available to the City by consolidating projects to minimize duplicate mobilization charges. The City should carefully consider such options and alternatives prior to commencing final design.

7.3.1 CIP Updates

Periodically, the Capital Improvement Plan should be updated and evaluated. It is suggested the every three to five years, the CIP be evaluated and modified as necessary to reflect current development trends, system needs, and prior accomplishments. The City may modify the CIP at any time under ORS 223.309(2).

7.4 Conclusion

This Storm Water Master Plan Update has been furnished for the City of Florence to provide guidance to the City as they seek to solve drainage issues in their region. Chapter 3 of this study delivers a summary of the City's existing storm water management infrastructure, their approach to drainage management, and the conditions which currently cause flooding within the City. Chapter 3 also includes a rainfall data report to illustrate the amount of rain being handled by the City's infrastructure.

Chapter 4 of this master plan offers detailed analyses of specific locations throughout the City where drainage issues have been identified. Civil West engineers have visited these locations one-by-one, both during dry season and wet season months, to evaluate the behavior of ground water and surface runoff at each location. The analyses performed at each location also document the condition and apparent effectiveness of drainage infrastructure in each area, whether natural or man-made. Chapter 5 of this study includes similar evaluations specifically for storm water culverts.

Chapter 6 of this Storm Water Master Plan Update builds upon the information provided in Chapters 4 and 5 by providing recommendations for capital improvement projects that could be implemented to address drainage issues. The recommendations made in this section pinpoint one of many viable solutions for each drainage issue. Civil West did not complete hydraulic calculations to size any piping, swales, or culverts (etc.) discussed in this report, so conveyance structure sizes listed in this report are approximate only. Hydraulic design should be included in final design work for each respective project.

In some cases, Chapter 6 provides discrete evaluations for several different capital improvement options at any one location. These evaluations are intended to assist the City and its constituents in understanding that there are many factors which influence these recommendations, and that therefore, the most obvious solution may not necessarily be the best option. The projects recommended herein seek to exhibit the following characteristics:

- Low cost – to efficiently utilize City funding
- Highest benefit – for the City, the community, businesses, HOAs, homeowners, etc.
- Legal and Safe – to protect public and private stakeholders from loss
- Environmentally Low-Impact – to protect valuable natural resources
- Regulatorily feasible – to ensure successful implementation of the project

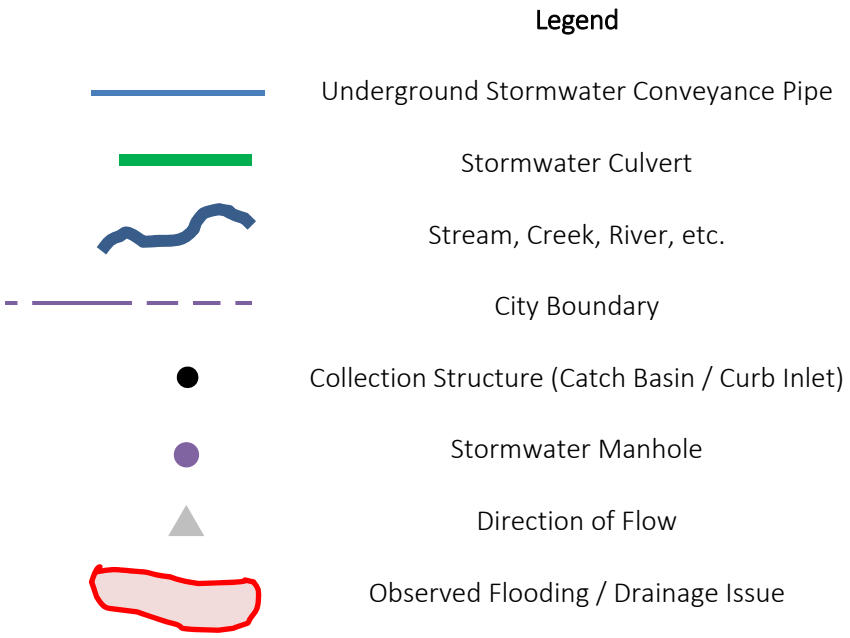
Chapter 7 provides a prioritization schedule for the projects recommended in Chapter 6. The intent of this prioritization activity is to assist the City in planning for the implementation of these projects, in accordance with the City's other time and budget constraints.

This document also contains some historical information relative to drainage infrastructure at certain locations. This information has been researched and included herein so as to provide valuable context to the City regarding the recommended capital improvements.

APPENDIX

Appendix A – Stormwater Infrastructure & Observed Flooding Maps
Appendix B – Lane County Tax Assessor Maps
Appendix C – Wet Season Rainfall Report
Appendix D – Florence Public Works Yearly Rainfall Report
Appendix E – Description of 2006 Lawsuit at Sea Watch Estates
Appendix F – Branch Engineering Design Report for North Rhododendron Drive Vicinity
Appendix G – Public Involvement Program

APPENDIX A
Stormwater Infrastructure & Observed Flooding Maps



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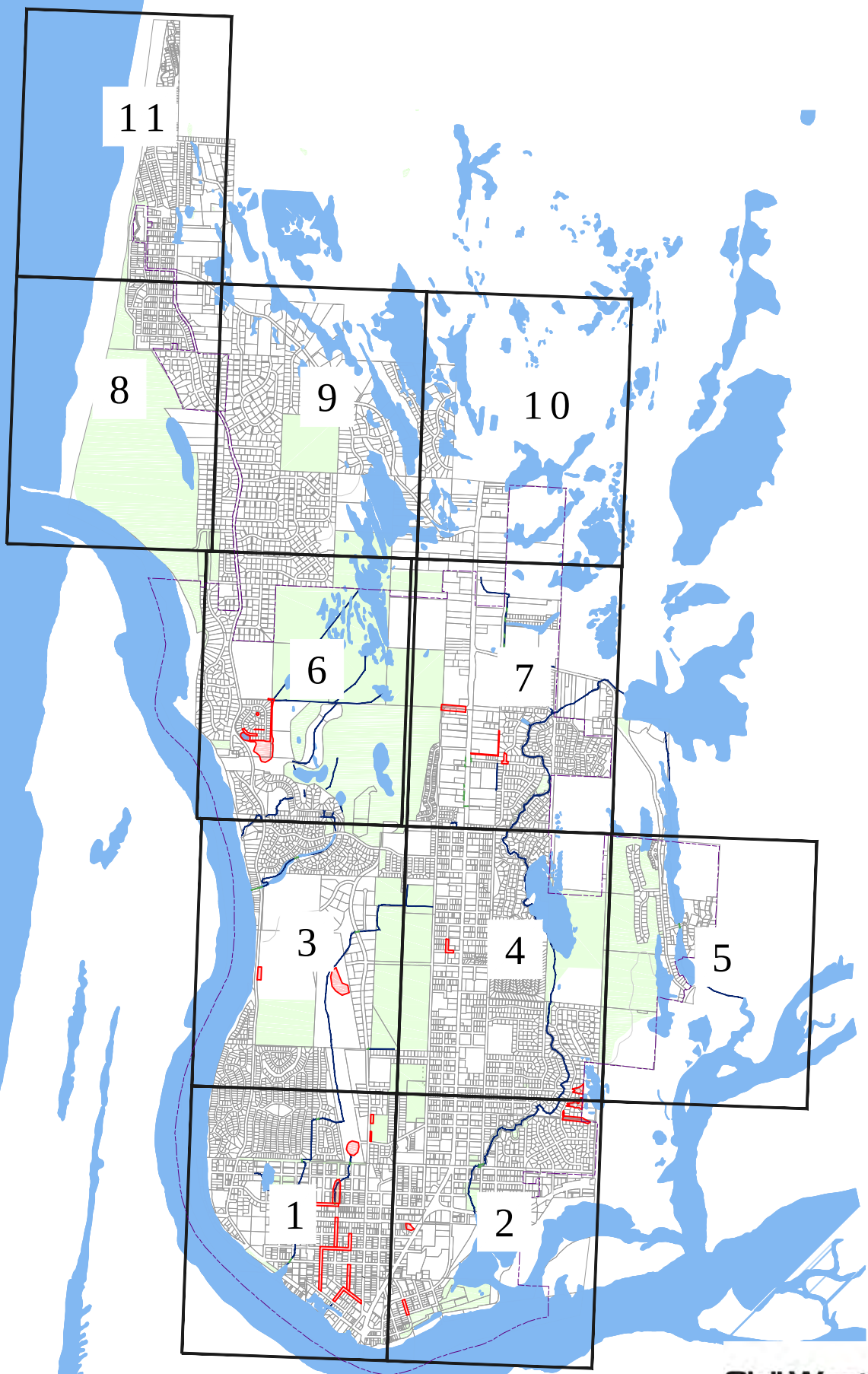

Civil West
Engineering Services, Inc.

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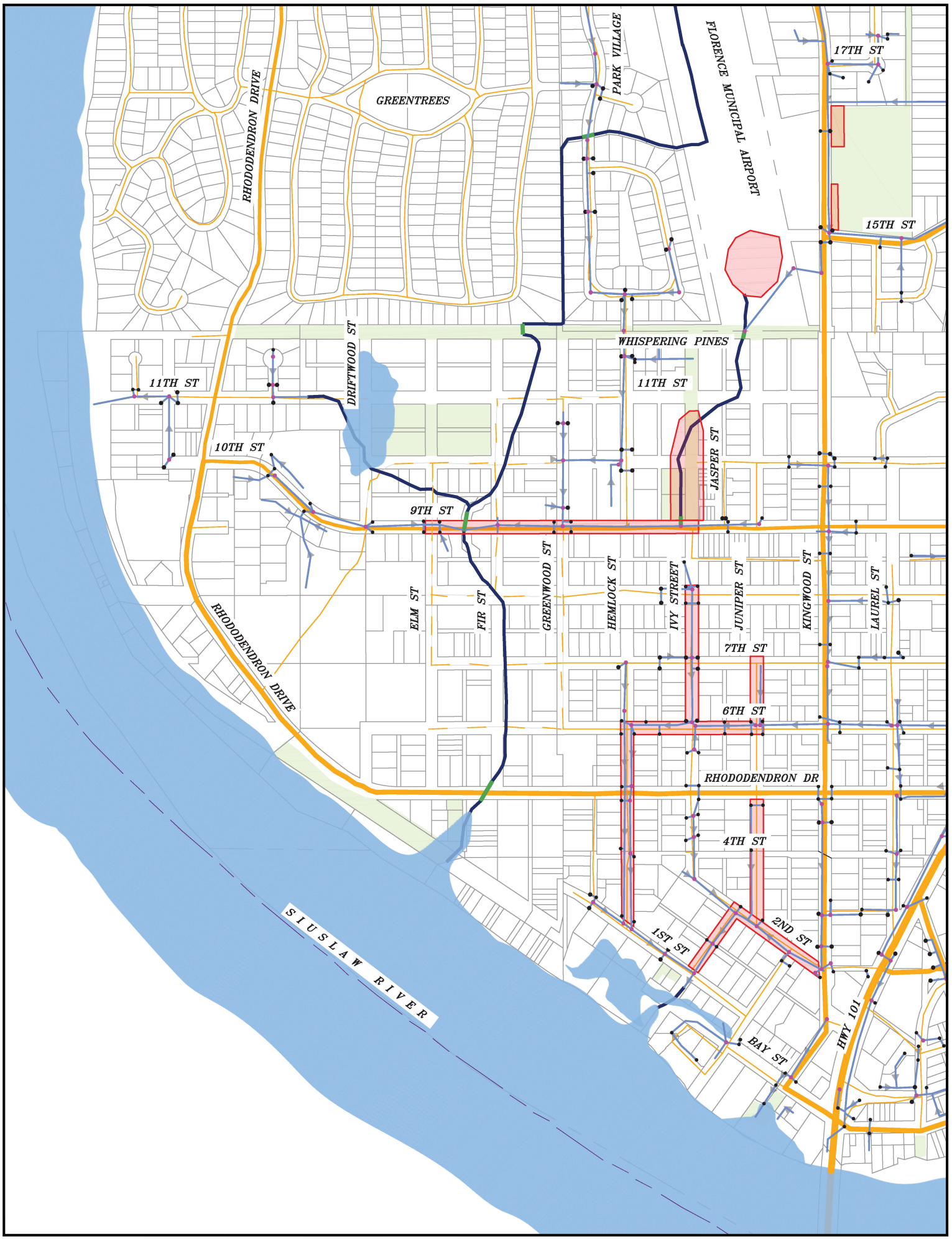

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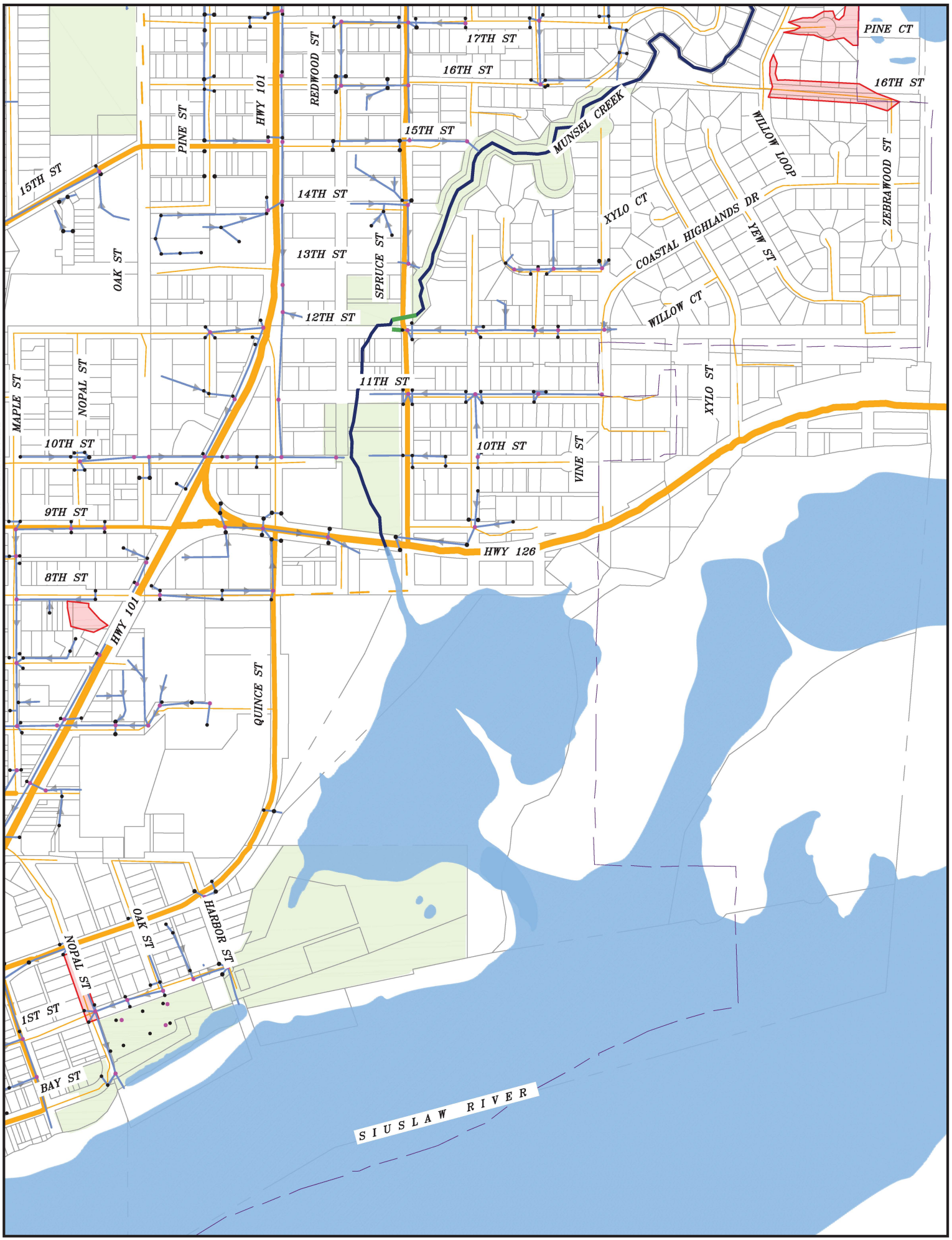

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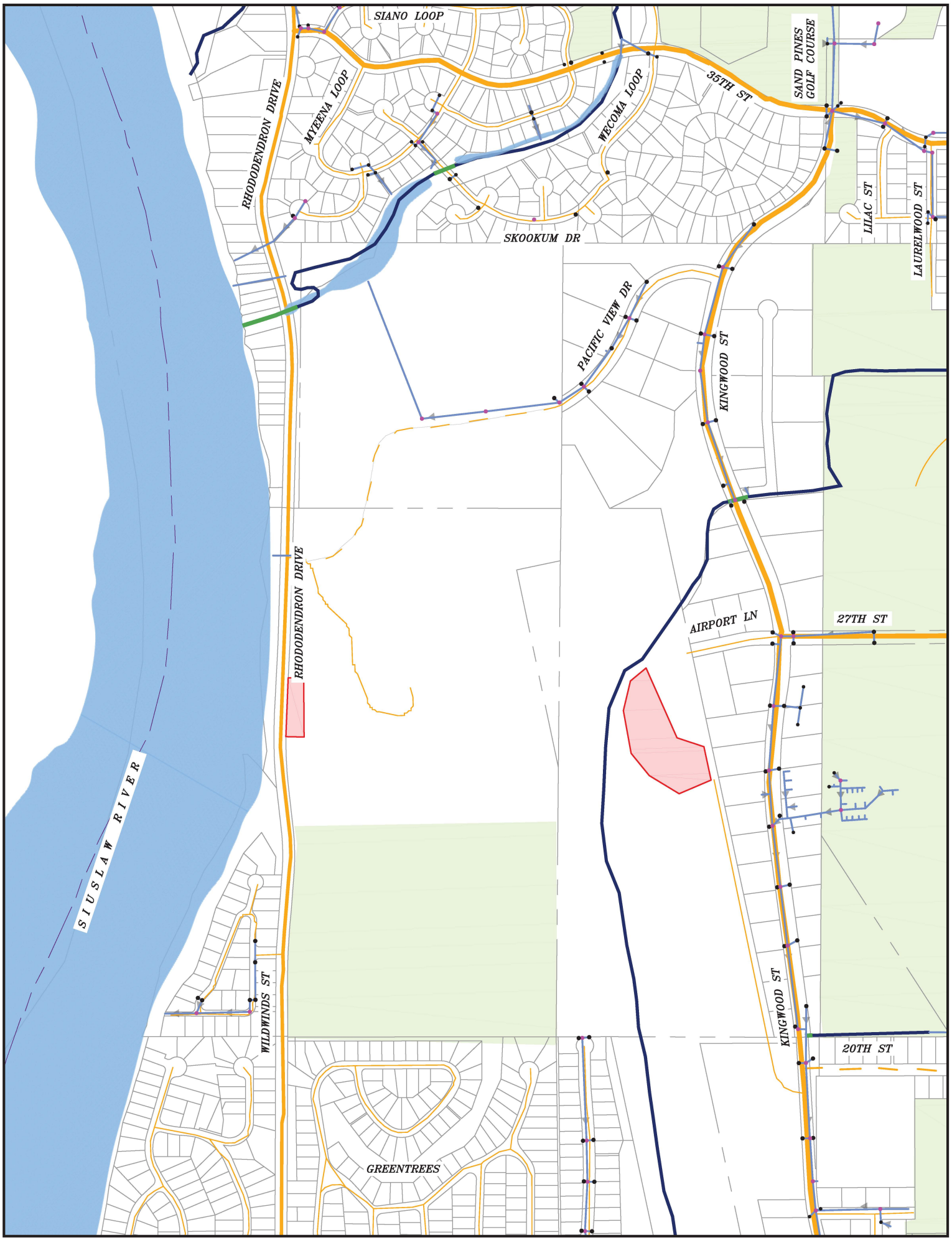
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WECOMA LOOP
35TH ST
SAND PINES GOLF COURSE
LILAC ST
LAURELWOOD ST
SKOOKUM DR
PACIFIC VIEW DR
KINGWOOD ST
RHODODENDRON DRIVE
AIRPORT LN
27TH ST
SEE REGION 4 MAP
SIUSLAW RIVER
WILDWINDS ST
KINGWOOD ST
20TH ST
GREENTREES
SEE REGION 1 MAP
REGION 3 MAP
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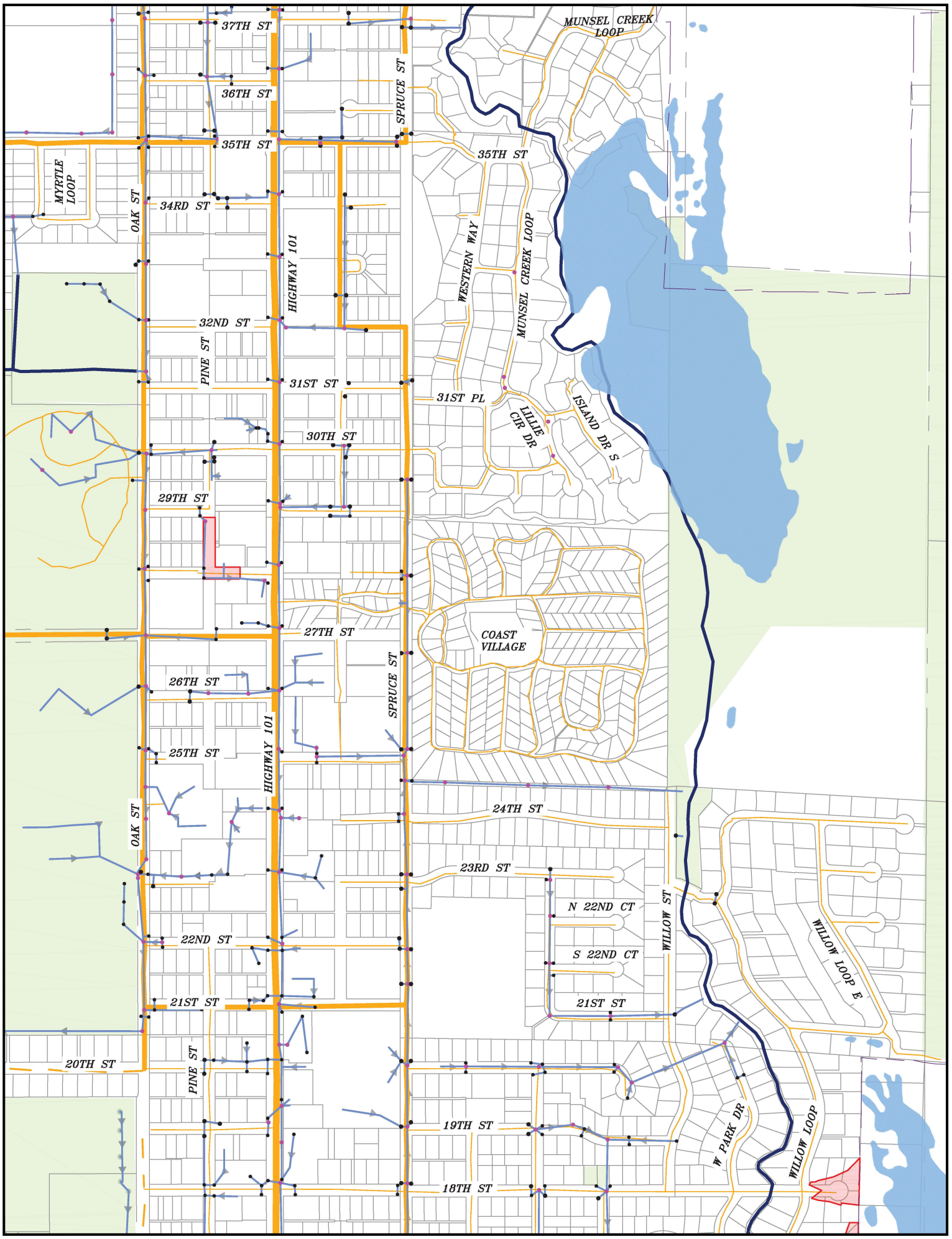

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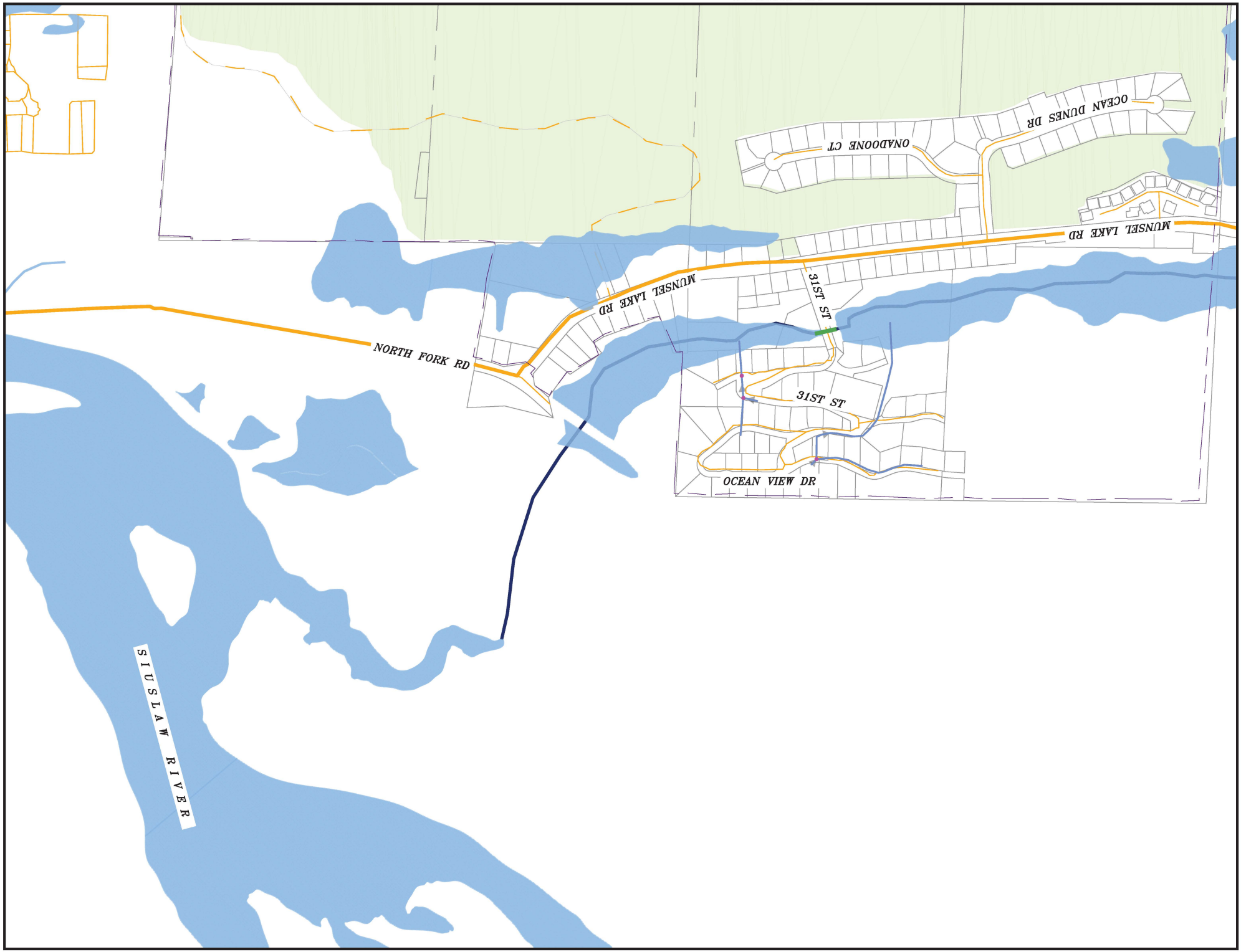

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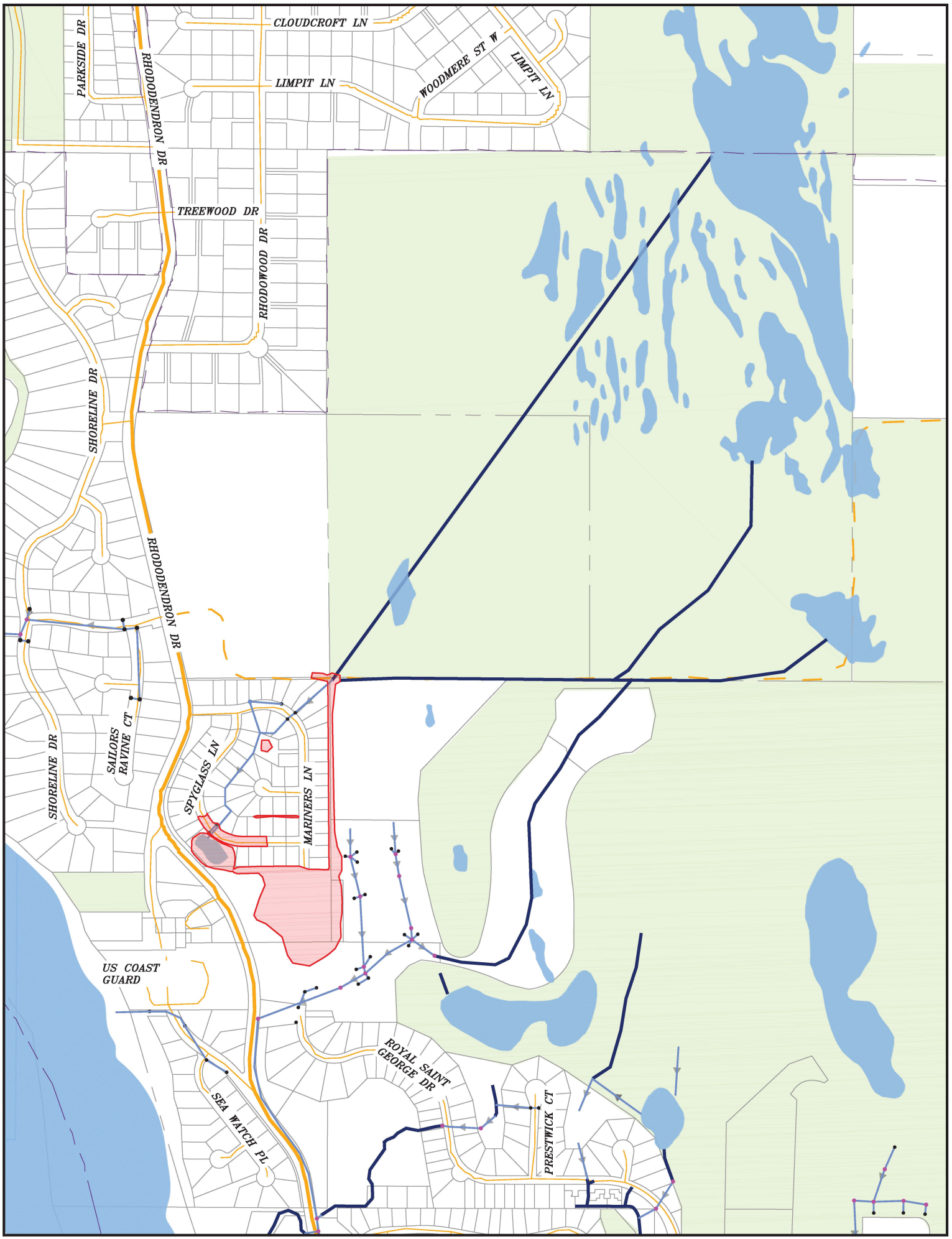

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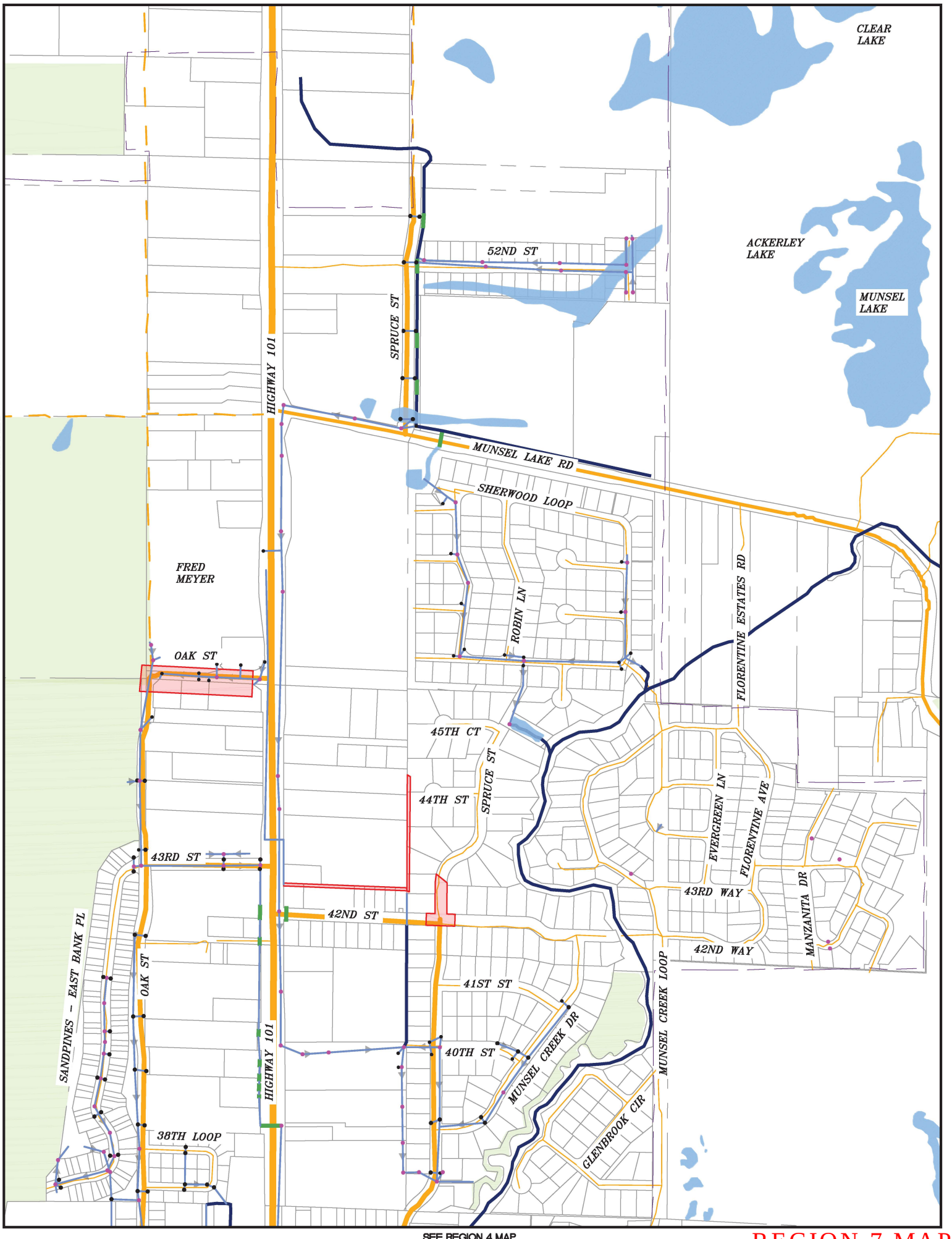

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REGION 7 MAP

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REGION 8 MAP

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REGION 9 MAP

SEE REGION 9 MAP

SEE REGION 7 MAP

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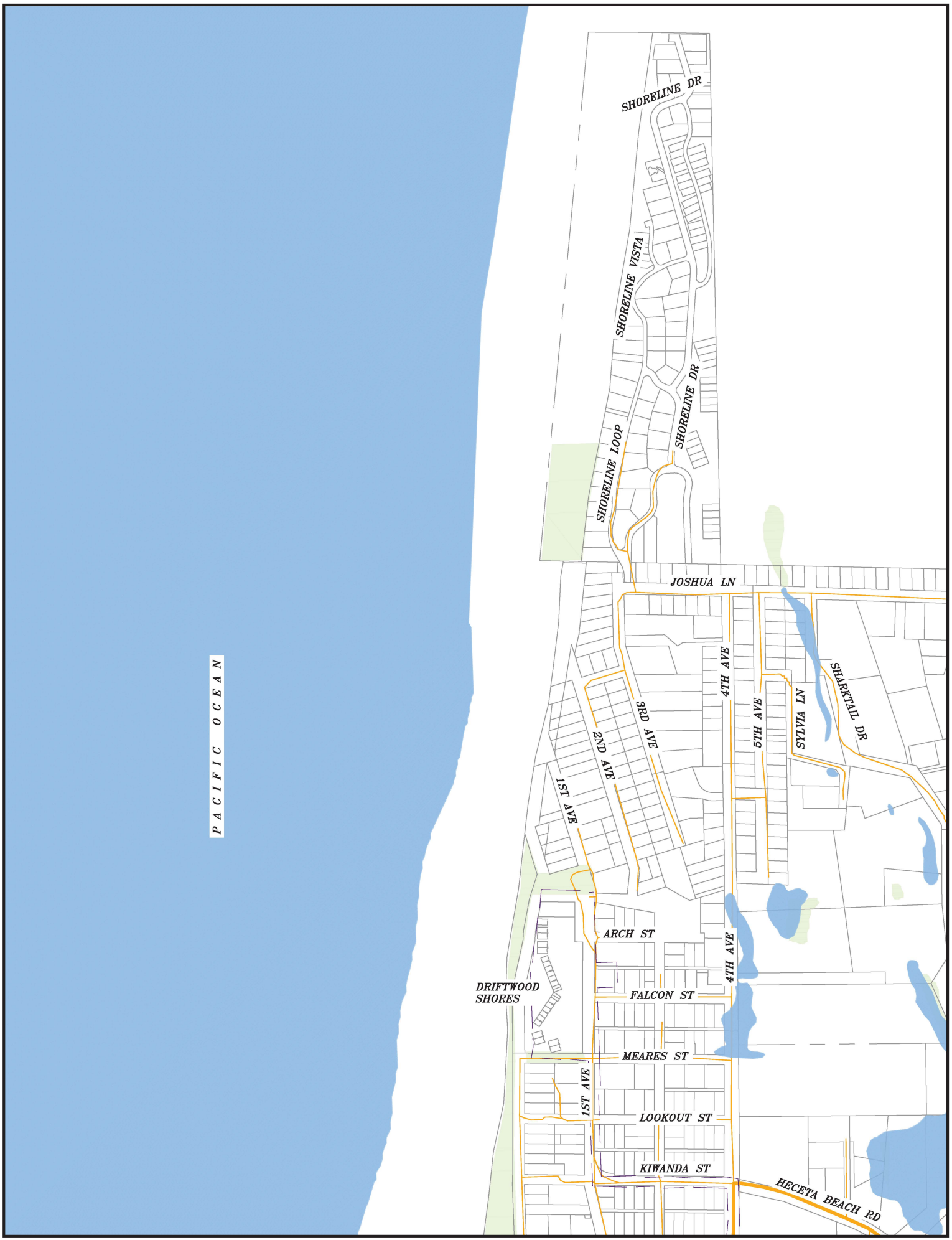

SEE REGION 8 MAP

REGION 11 MAP

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APPENDIX B
Lane County Tax Assessor's Maps

FOR ASSESSMENT AND TAXATION ONLY

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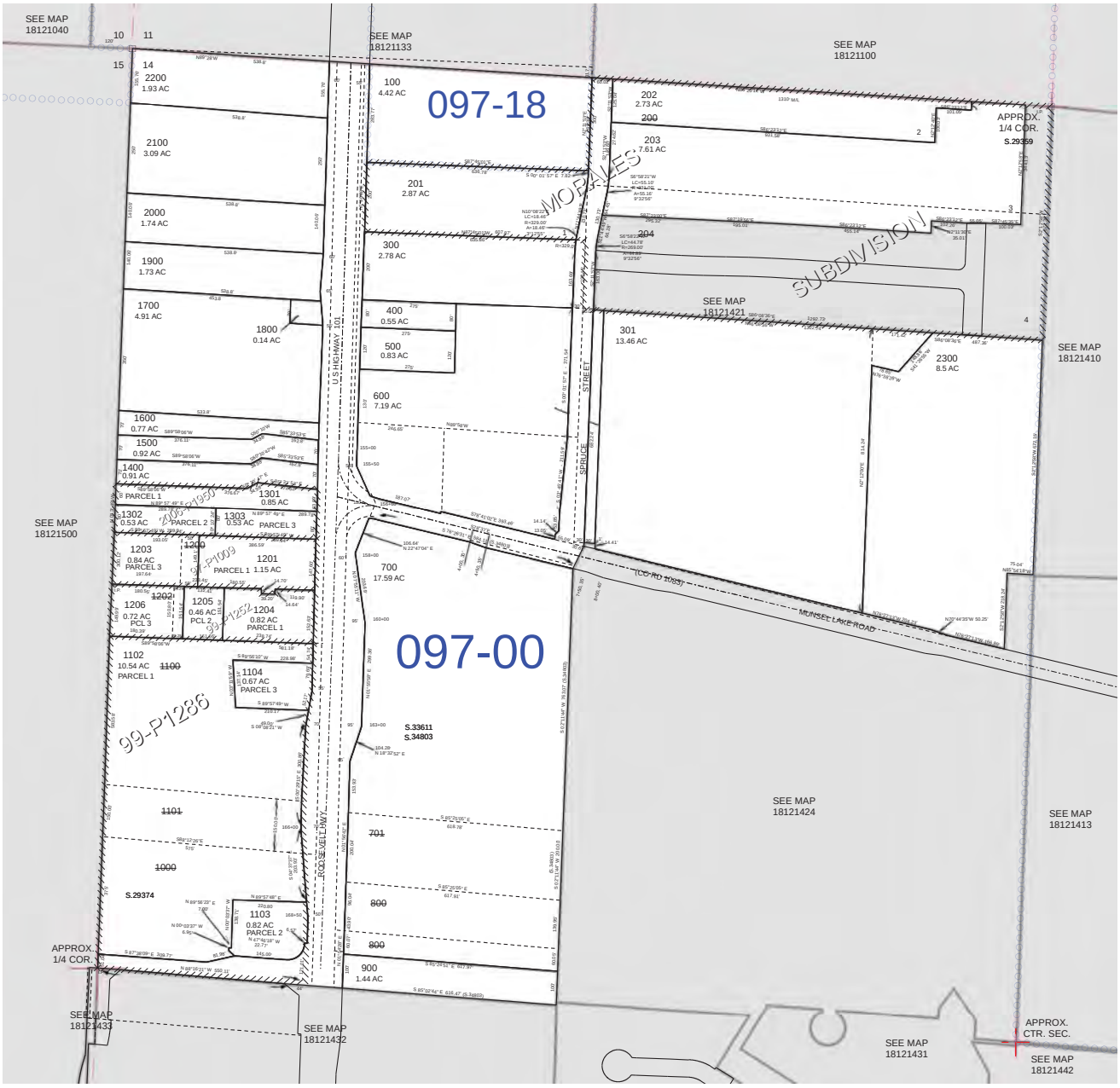

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07/15/2008 - LCAT155 - CANC. 204 INTO SPRUCE VILLAGE PHASE 1
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05/28/2010 - LCAT167 - LLA BETWEEN TL 1205/1206
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FOR ASSESSMENT AND TAXATION ONLY

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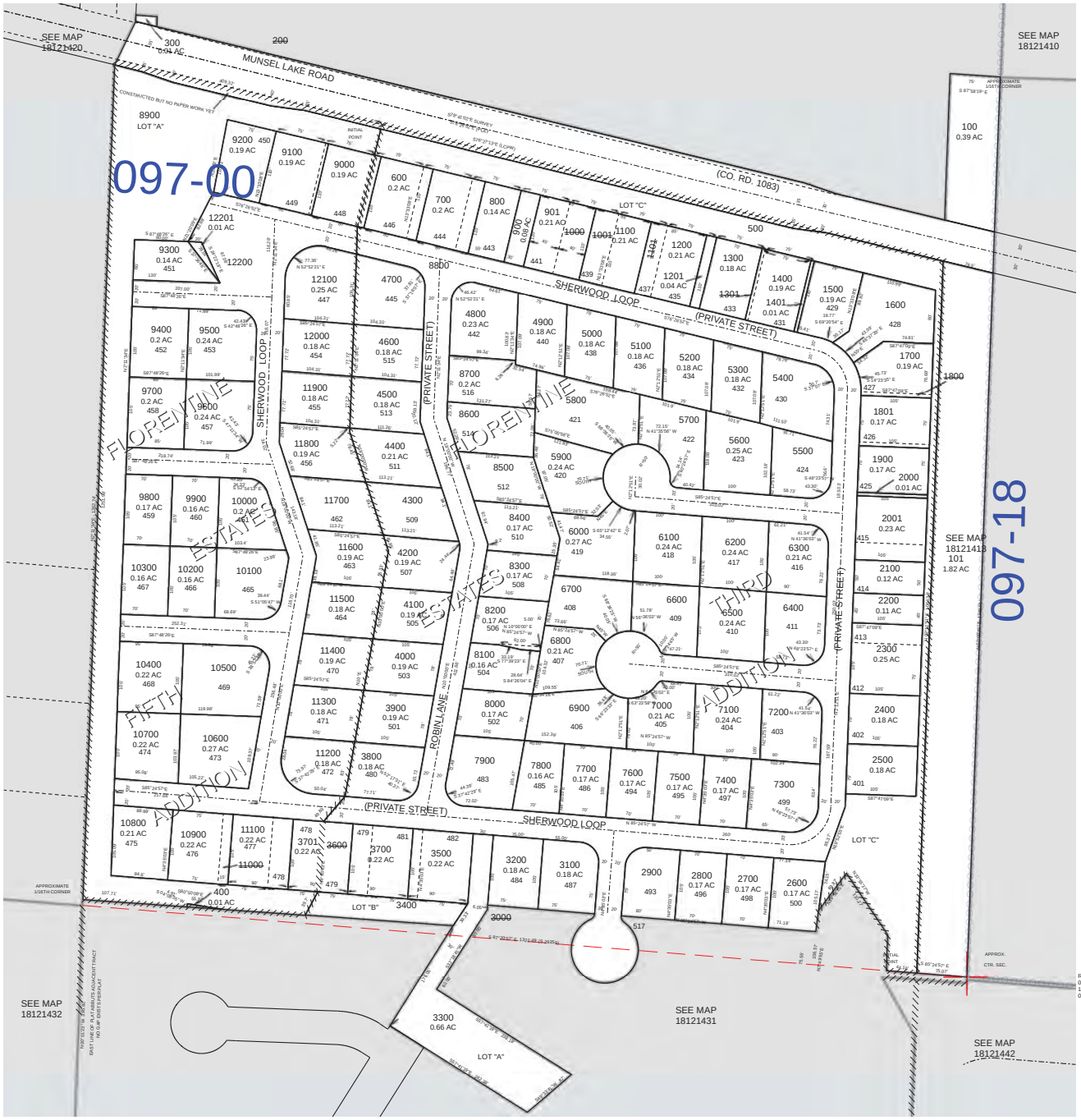

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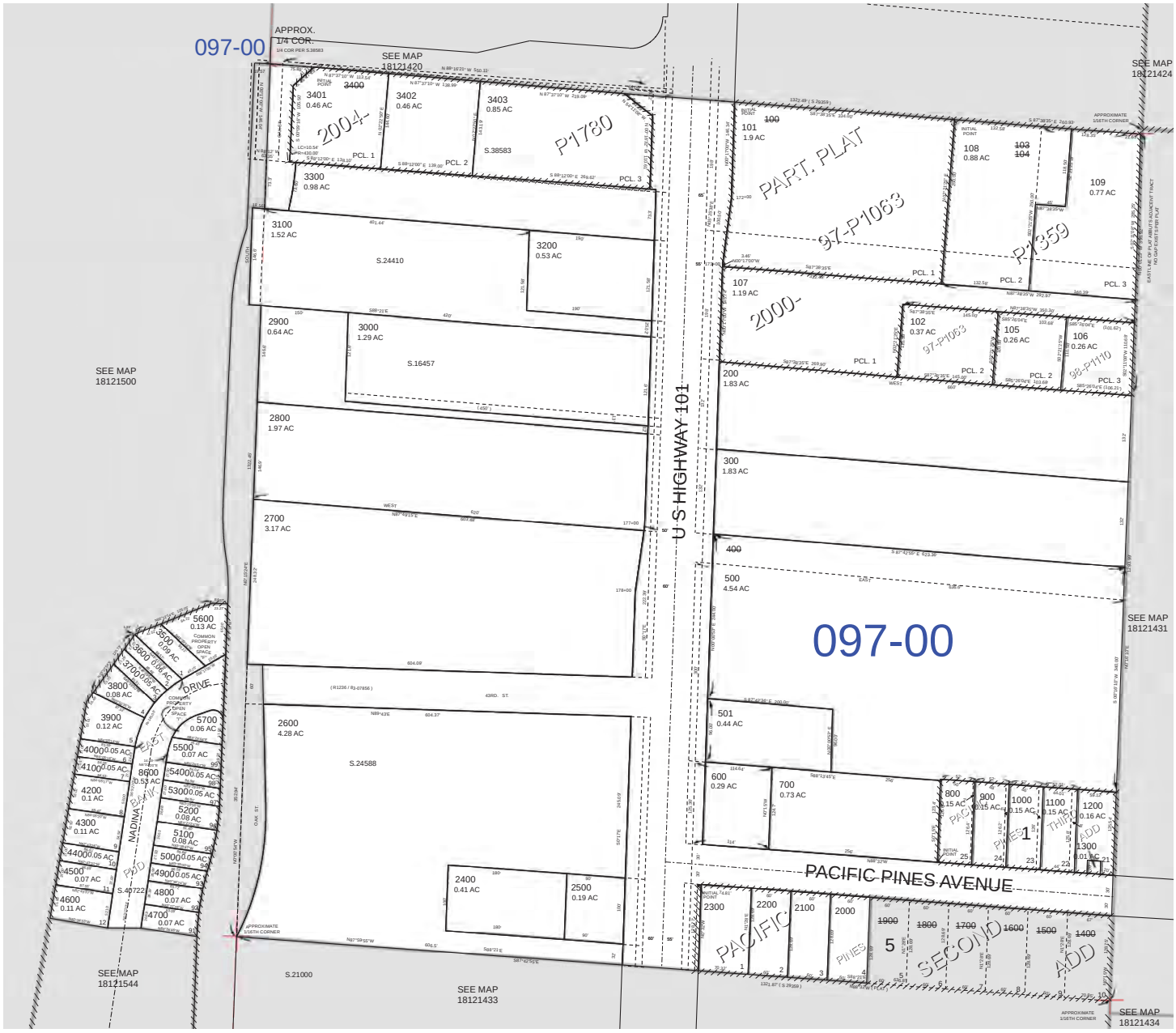

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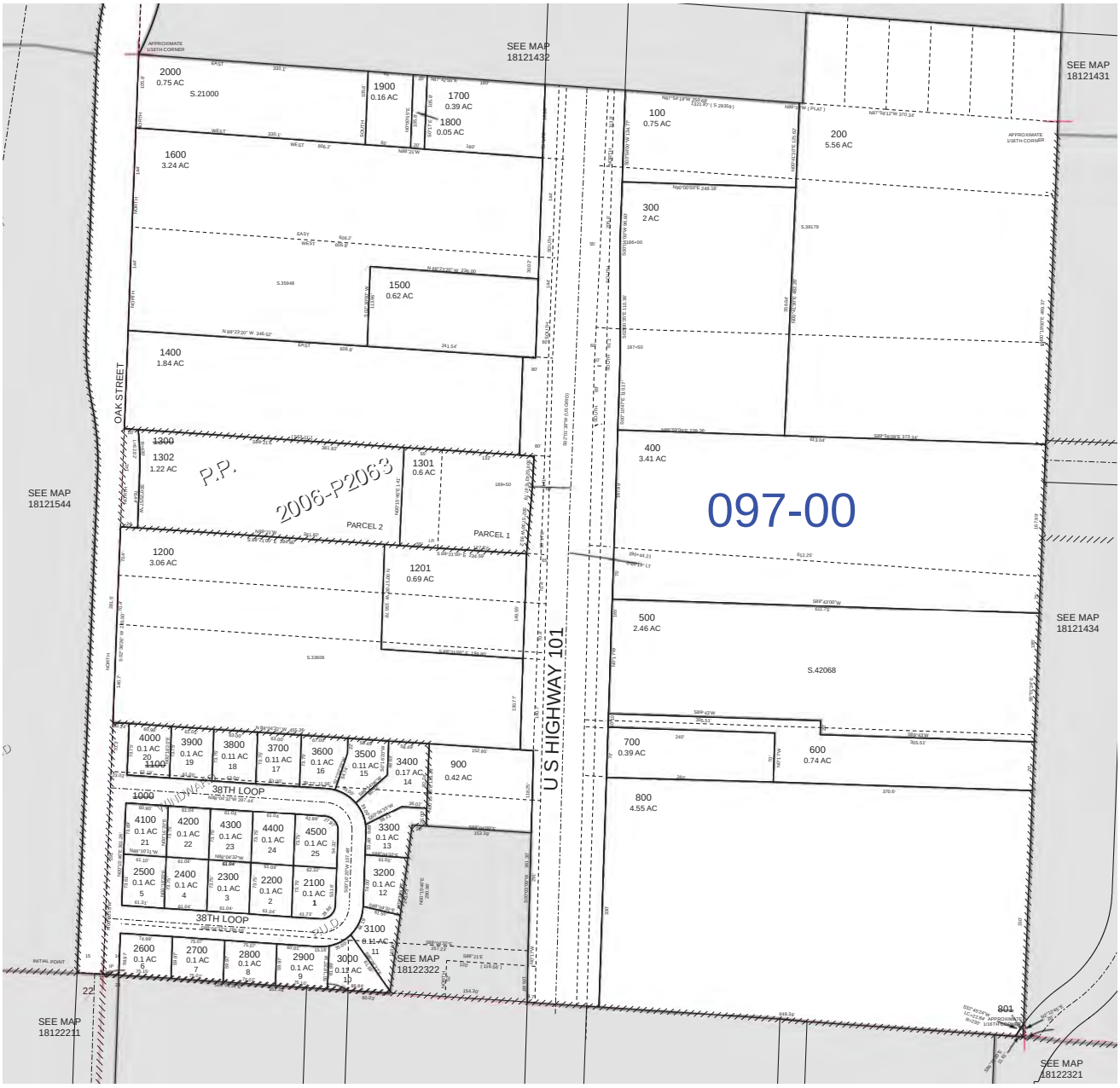

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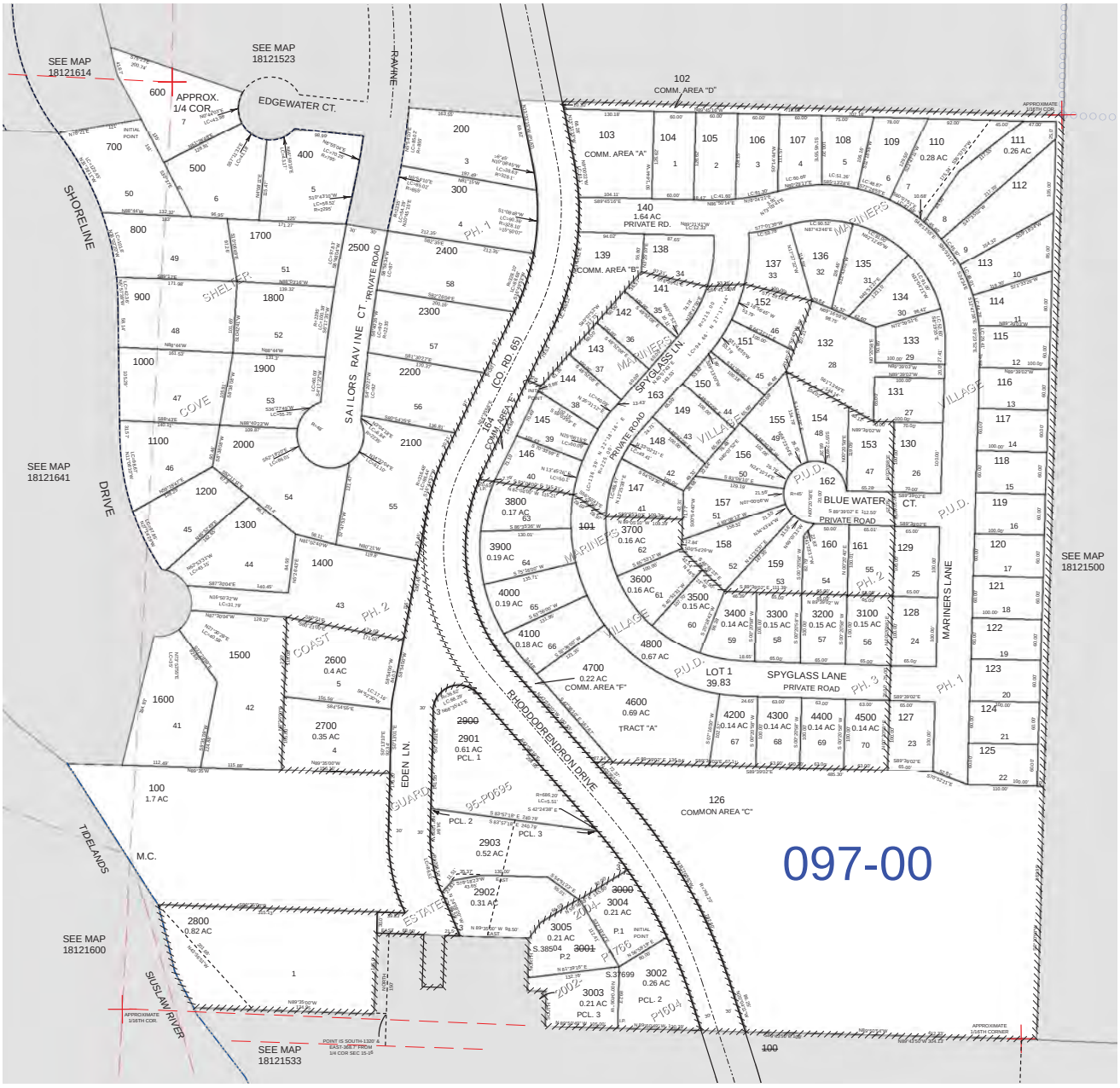

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FLORENCE
18121532

APPENDIX C
Wet Season Rainfall Report

Wet Season Rainfall Report

Rainfall units are expressed in inches.

	October	November	December		January	February	March	TOTAL
2017	7.40	11.42	4.83	2018	11.41			35.06
2016	15.47	14.45	8.75	2017	10.31	20.18	16.92	86.08
2015	4.44	7.61	24.09	2016	12.58	6.33	10.62	65.67
2014	9.75	8.06	15.00	2015	3.68	10.86	6.52	53.87
2013	1.04	4.60	3.00	2014	4.68	10.46	7.80	31.58
2012	13.33	14.38	14.07	2013	6.35	5.75	3.64	57.52
2011	5.43	7.55	7.15	2012	11.66	7.83	20.02	59.64
2010	5.95	11.45	13.85	2011	7.95	7.05	13.60	59.85
2009	6.64	9.46	8.65	2010	10.93	7.30	10.02	53.00
2008	3.52	9.30	9.80	2009	6.72	5.00	7.78	42.12
2007	4.25	7.17	15.06	2008	13.14	4.91	6.46	50.99
2006	0.85	20.00	11.25	2007	6.72	11.11	6.42	56.35
2005	5.40	10.36	15.58	2006	21.88	4.64	10.82	68.68
2004	7.47	3.96	10.31	2005	8.07	2.85	6.22	38.88
2003	3.23	10.62	18.04	2004	14.82	7.78	4.62	59.11
2002	0.46	5.84	21.48	2003	14.50	3.41	10.58	56.27
2001	4.79	11.09	12.71	2002	15.26	4.15	6.76	54.76
2000	4.62	4.54	6.89	2001	3.04	4.09	5.06	28.24
1999	4.30	17.31	11.20	2000	14.70	11.46	4.49	63.46
1998	4.90	22.04	18.26	1999	13.92	18.99	8.72	86.83
1997	7.91	7.55	7.80	1998	14.73	14.56	10.43	62.98
1996	7.92	15.62	23.07	1997	14.35	3.46	10.32	74.74
1995	4.94	13.36	16.03	1996	11.75	17.85	4.53	68.46
1994	2.23	13.77	10.14	1995	19.98	4.94	12.31	63.37
1993	1.60	3.09	12.06	1994	6.56	8.20	5.38	36.89
1992	5.15	7.70	11.82	1993	7.62	4.15	9.77	46.21
1991	3.06	11.53	6.30	1992	7.80	6.45	1.89	37.03
1990	8.17	9.23	4.96	1991	5.06	5.64	8.47	41.53
1989	5.30	5.22	3.58	1990	13.90	9.20	4.20	41.40
1988	0.80	14.51	7.30	1989	9.95	5.11	14.73	52.40
1987	0.78	6.85	17.14	1988	12.91	2.31	6.12	46.11
1986	2.93	10.21	5.05	1987	11.59	5.36	10.26	45.40
1985	7.37	6.40	4.93	1986	8.28	16.55	9.09	52.62
1984	8.22	19.00	6.02	1985	0.77	5.95	6.80	46.76
1983	2.40	15.11	13.90	1984	3.79	10.81	9.10	55.11
1982	4.63	8.61	14.38	1983	10.03	14.20	11.00	62.85
1981	7.03	13.77	16.81	1982	13.79	10.41	8.37	70.18
1980	3.15	6.73	14.72	1981	3.88	7.30	7.41	43.19
1979	11.84	9.08	13.13	1980	6.96	7.30	7.03	55.34
1978	0.85	7.10	5.70	1979	5.20	14.90	4.87	38.62
1977	4.10	10.60	13.75	1978	15.80	7.35	2.20	53.80

1976	2.10	2.05	2.30	1977	1.70	5.90	7.10	21.15
1975	9.80	15.10	8.95	1976	10.95	9.65	6.00	60.45
1974	1.15	10.23	14.64	1975	11.84	11.50	8.43	57.79
1973	5.14	26.03	20.47	1974	14.35	13.69	17.08	96.76
1972	1.05	5.18	12.45	1973	9.10	3.90	9.00	40.68
1971	4.25	12.85	18.85	1972	13.30	7.85	11.65	68.75
1970	5.00	8.05	14.05	1971	13.65	6.40	9.70	56.85
1969	7.35	5.55	13.72	1970	16.75	9.56	3.50	56.43
1968	9.79	14.35	23.25	1969	15.59	8.36	3.77	75.11
1967	5.24	8.90	9.61	1968	10.80	11.53	8.04	54.12
1966	4.40	9.35	13.14	1967	17.34	14.41	9.94	68.58
1965	1.63	15.07	12.63	1966	13.81	7.95	7.03	58.12
1964	2.00	12.43	17.89	1965	20.80	3.51	1.29	57.92
1963	5.02	13.64	9.10	1964	16.23	3.31	9.21	56.51
1962	6.48	13.12	5.62	1963	4.83	8.52	7.34	45.91
1961	9.24	11.15	9.24	1962	2.99	10.47	10.54	53.63
1960	5.39	16.97	5.11	1961	10.00	18.31	12.97	68.75
1959	5.35	4.01	5.38	1960	10.49	13.47	8.25	46.95
1958	3.63	12.29	10.60	1959	20.17	11.61	5.95	64.25
1957	7.24	3.95	16.58	1958	11.91	14.19	5.38	59.25
				1957	12.85	10.66	9.90	33.41

APPENDIX D
Florence Public Works Yearly Rainfall Report

City of Florence, Oregon – Public Works

2675 Kingwood St., Florence OR 97439 – 541-997-4106 – www.ci.florence.or.us

Yearly Rainfall Report

Rainfall units are expressed in inches with the current year listed first. Average rainfall for all years is listed at the end of the report.

Updated: February 14, 2018

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
2018	11.41												11.41
2017	10.31	20.18	16.92	8.04	4.38	2.92	0.06	0.25	0.96	7.40	11.42	4.83	87.67
2016	12.58	6.33	10.62	2.55	0.84	1.86	1.55	0.23	3.03	15.47	14.45	8.75	78.26
2015	3.68	10.86	6.52	2.93	1.37	0.41	0.10	0.93	0.77	4.44	7.61	24.09	63.71
2014	4.68	10.46	7.80	4.59	3.66	1.65	0.95	0.24	2.18	9.75	8.06	15.00	69.02
2013	6.35	5.75	3.64	3.82	4.39	2.00	0.03	0.94	7.91	1.04	4.60	3.00	43.47
2012	11.66	7.83	20.02	7.40	3.85	4.18	0.59	0.25	0.05	13.33	14.38	14.07	97.61
2011	7.95	7.05	13.60	6.78	4.32	1.95	0.52	0.02	0.95	5.43	7.55	7.15	63.27
2010	10.93	7.30	10.02	8.40	5.85	5.62	0.16	1.40	2.45	5.95	11.45	13.85	83.38
2009	6.72	5.00	7.78	2.62	3.84	0.85	0.22	0.56	2.35	6.64	9.46	8.65	54.69
2008	13.14	4.91	6.46	5.24	0.85	1.81	0.35	2.56	0.51	3.52	9.30	9.80	58.45
2007	6.72	11.11	6.42	3.58	1.58	1.71	1.11	0.60	3.01	4.25	7.17	15.06	62.32
2006	21.88	4.64	10.82	3.59	2.38	2.55	0.31	0.00	1.15	0.85	20.00	11.25	79.42
2005	8.07	2.85	6.22	5.02	5.86	3.31	1.00	0.03	2.72	5.40	10.36	15.58	66.42
2004	14.82	7.78	4.62	4.37	1.52	1.55	0.00	2.48	4.11	7.47	3.96	10.31	62.99
2003	14.50	3.41	10.58	8.54	1.51	0.40	0.00	0.45	1.93	3.23	10.62	18.04	73.21
2002	15.26	4.15	6.76	5.31	2.61	2.60	0.12	0.12	1.22	0.46	5.84	21.48	65.93
2001	3.04	4.09	5.06	3.74	1.68	3.02	0.37	1.51	0.43	4.79	11.09	12.71	51.53
2000	14.70	11.46	4.49	2.65	3.84	3.15	0.45	0.02	1.25	4.62	4.51	6.89	58.03
1999	13.92	18.99	8.72	3.61	5.57	1.88	0.25	1.35	0.05	4.30	17.31	11.20	87.15
1998	14.73	14.56	10.43	2.30	6.83	1.76	0.13	0.00	0.47	4.90	22.04	18.26	96.41
1997	14.35	3.46	10.32	5.98	3.77	3.28	0.93	1.25	4.87	7.91	7.55	7.80	71.47
1996	11.75	17.85	4.53	7.63	3.83	1.22	0.79	0.17	2.54	7.92	15.62	23.07	96.92
1995	19.98	4.94	12.31	7.45	2.89	3.26	0.16	0.55	3.71	4.94	13.36	16.03	89.58
1994	6.56	8.20	5.38	3.36	2.28	2.06	0.15	0.08	1.67	2.23	13.77	10.14	55.88
1993	7.62	4.15	9.77	8.65	6.22	5.15	2.70	0.25	0.04	1.60	3.09	12.06	61.30
1992	7.80	6.45	1.89	7.28	0.05	0.40	0.43	0.77	0.14	5.15	7.70	11.82	49.88
1991	5.06	5.64	8.47	5.46	5.07	0.50	0.34	2.47	0.14	3.06	11.53	6.30	54.04
1990	13.90	9.20	4.20	6.28	4.47	3.01	0.50	0.95	0.11	8.17	9.23	4.96	64.98
1989	9.95	5.11	14.73	2.33	4.33	1.61	0.86	2.10	0.40	5.30	5.22	3.58	55.52
1988	12.91	2.31	6.12	3.08	7.68	1.87	0.60	0.12	1.63	0.80	14.51	7.30	58.93
1987	11.59	5.36	10.26	3.10	2.21	0.38	1.47	0.20	0.40	0.78	6.85	17.14	59.74
1986	8.28	16.55	9.09	4.06	3.89	1.11	2.69	0.08	4.71	2.93	10.21	5.05	68.65
1985	0.77	5.95	6.80	1.48	2.07	5.01	0.55	0.23	3.31	7.37	6.40	4.93	44.87
1984	3.79	10.81	9.10	6.71	4.05	4.56	0.02	0.10	1.29	8.22	19.00	6.02	73.67
1983	10.03	14.20	11.00	4.80	3.23	4.82	2.09	2.05	0.22	2.40	15.11	13.90	83.85
1982	13.79	10.41	8.37	6.75	0.19	1.72	0.95	0.90	2.89	4.63	8.61	14.38	73.59
1981	3.88	7.30	7.41	2.65	4.39	3.33	0.13	0.38	2.71	7.03	13.77	16.81	69.79
1980	6.96	7.30	7.03	6.65	2.30	3.02	0.33	0.52	1.20	3.15	6.73	14.72	59.91
1979	5.20	14.90	4.87	5.30	4.43	1.25	0.40	1.90	2.84	11.84	9.08	13.13	75.14
1978	15.80	7.35	2.20	10.75	5.80	1.85	0.78	2.60	3.43	0.85	7.10	5.70	64.21
1977	1.70	5.90	7.10	0.85	4.25	0.70	0.05	2.00	5.40	4.10	10.60	13.75	56.40
1976	10.95	9.65	6.00	3.30	1.55	0.65	1.20	2.95	1.05	2.10	2.05	2.30	43.75
1975	11.84	11.50	8.43	6.15	3.08	0.80	0.20	2.30	0.00	9.80	15.10	8.95	78.15
1974	14.35	13.69	17.08	3.65	2.72	1.83	3.07	0.09	0.40	1.15	10.23	14.64	82.90
1973	9.10	3.90	9.00	1.50	3.00	3.20	0.04	0.75	4.70	5.14	26.03	20.47	86.83
1972	13.30	7.85	11.65	7.90	2.55	0.90	0.20	0.50	1.85	1.05	5.18	12.45	65.38
1971	13.65	6.40	9.70	8.30	1.90	3.55	0.30	1.20	4.40	4.25	12.85	18.85	85.35

City of Florence, Oregon – Public Works

2675 Kingwood St., Florence OR 97439 – 541-997-4106 – www.ci.florence.or.us

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
1970	16.75	9.56	3.50	5.15	2.35	0.85	0.05	0.30	1.70	5.00	8.05	14.05	67.31
1969	15.59	8.36	3.77	4.48	3.65	3.03	0.20	0.32	3.90	7.35	5.55	13.72	69.92
1968	10.80	11.53	8.04	3.26	4.41	3.38	0.44	5.89	2.97	9.79	14.35	23.25	98.11
1967	17.34	14.41	9.94	7.85	0.99	0.72	0.00	0.00	0.76	5.24	8.90	9.61	75.76
1966	13.81	7.95	7.03	0.42	0.78	1.22	0.78	0.00	1.46	4.40	9.35	13.14	60.34
1965	20.80	3.51	1.29	5.12	2.07	0.59	0.30	0.56	0.00	1.63	15.07	12.63	63.57
1964	16.23	3.31	9.21	2.65	1.63	2.23	0.56	1.31	0.92	2.00	12.43	17.89	70.37
1963	4.83	8.52	7.34	13.08	3.92	1.96	1.60	0.08	3.57	5.02	13.64	9.10	72.66
1962	2.99	10.47	10.54	4.70	4.22	0.50	0.24	0.86	3.63	6.48	13.12	5.62	63.37
1961	10.00	18.31	12.97	5.79	7.35	0.81	0.10	1.23	0.70	9.24	11.15	9.24	86.89
1960	10.49	13.47	8.25	6.68	10.13	0.34	0.02	1.45	0.76	5.39	16.97	5.11	79.06
1959	20.17	11.61	5.95	2.98	3.86	3.25	0.76	0.32	4.94	5.35	4.01	5.38	68.58
1958	11.91	14.19	5.38	9.85	1.37	1.19	0.01	0.40	2.82	3.63	12.29	10.60	73.64
1957	12.85	10.66	9.90	4.92	3.54	1.36	0.51	1.14	2.33	7.24	3.95	16.58	74.98

AVG:	**10.91**	**8.87**	**8.25**	**5.14**	**3.43**	**2.09**	**0.59**	**0.91**	**2.03**	**5.16**	**10.60**	**11.84**	**68.86**

APPENDIX E
Description of 2006 Lawsuit at Sea Watch Estates

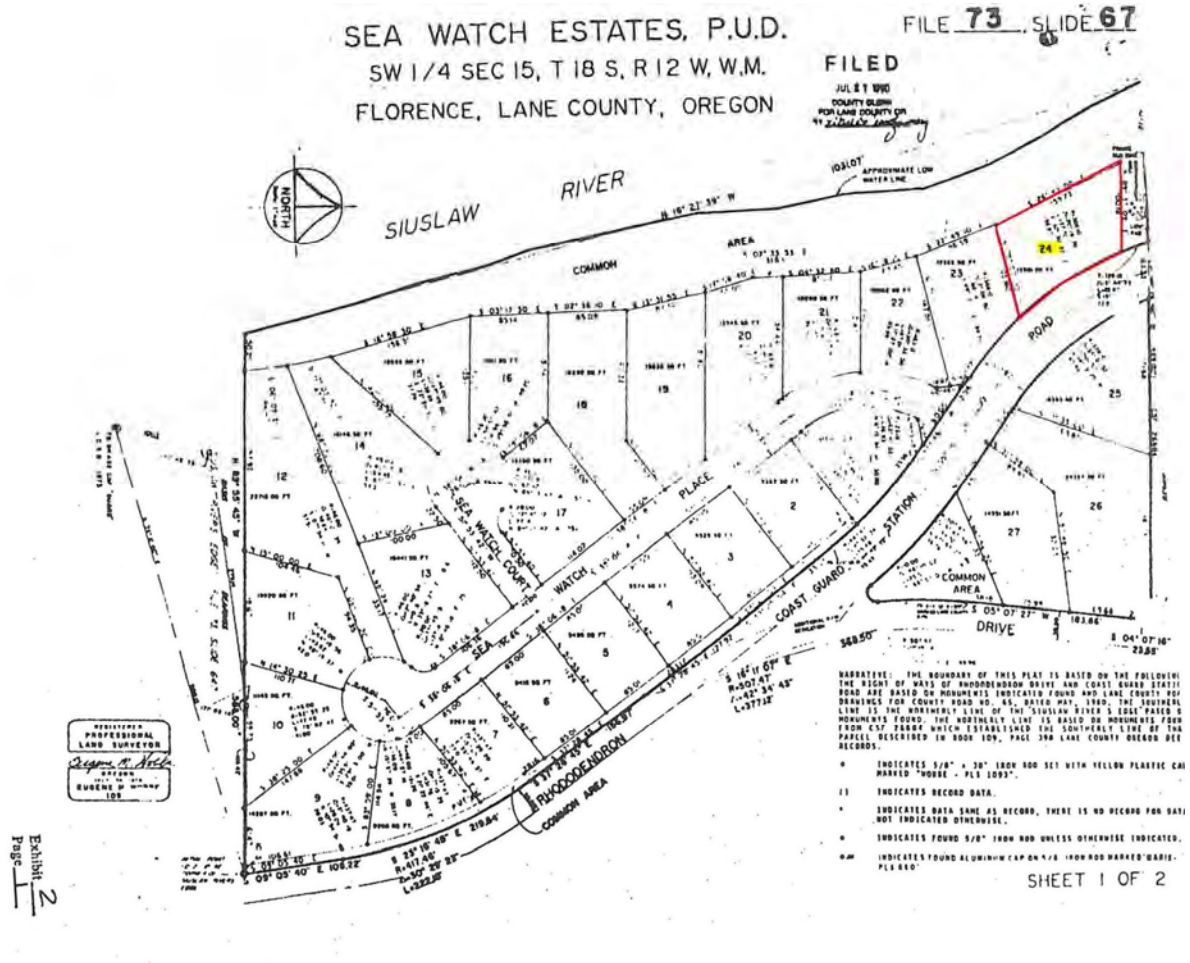
APPENDIX E

In 2006, the City was involved in a lawsuit where a resident of Sea Watch Estates (south of the Coast Guard Station) sued the City, alleging that the City had caused soils in the subdivision to destabilize, resulting in erosion along the Siuslaw River bank as well as damage to properties and property values throughout the subdivision.

This information is included here because it is relevant and useful for the City as they strive to educate members of the public who may be impacted by the existing drainage issues near the Mariner's Village subdivision. This information is supportive of the City's desire to not install drainage piping from Mariner's Village to the Siuslaw River.

The full court documents from this case have been provided separately to Mr. Mike Miller, Public Works Director, and are not included in this report.

Case No.: 16-05-21635 (Lane County Circuit Court)
Plaintiffs: Gabriele Meiringer, Daniel Douma, Meringer-Douma Revocable Trust, and Sea Watch Estates Home Owners Association
Defendant: City of Florence
Date: October 30, 2006



The plaintiff claimed that:

- The City installed drainage pipe and an outfall on private property without obtaining and recording an easement.
- The installation of this pipe was not done properly in that it discharged and channeled increased water flow on to private property, rather than extending down to the edge of the river.
- The City had received an engineering report from Foundation Engineering, Inc. which stated that "no water should be allowed to run down the common area slope." With this report in hand, the City knew that diverting surface water runoff to this outfall would cause river bank erosion and slope failure.
- Because the City directed water to this location, they were responsible for destabilized soil nearby, severe bank erosion, the physical loss of property, slope failure, and imminent threats of additional permanent physical damage to the house on the Plaintiff's property.
- The City substantially interfered with interests and caused a material decrease in value of the Plaintiff's property.

The lawsuit included counts of Inverse Condemnation, Negligence, and Trespassing. The City and the Plaintiff went through two rounds of responses and amended claims before a final judgement was stipulated.

In the end, judgments made which are relevant to the City's storm water infrastructure system include the following:

- The City did not have an easement for the drainage infrastructure.
- The City did not have a prescriptive right to use the pipe crossing the Plaintiff's property, and therefore was required to terminate its use.
- The City did not have permission to use the private properties in the area for drainage purposes.
- The drainage infrastructure did not comply with engineering recommendations.

APPENDIX F

Branch Engineering Design Report for North Rhododendron Drive Vicinity

CITY OF FLORENCE

DESIGN REPORT

May 12, 2004

RHODODENDRON DRIVE & 35TH STREET VICINITY LOCAL IMPROVEMENT DISTRICT FOR STORM DRAINAGE IMPROVEMENTS

CITY OF FLORENCE
DEPARTMENT OF PUBLIC WORKS
250 Highway 101
Florence, Oregon 97439

DESIGN REPORT

RHODODENDRON DRIVE & 35TH STREET VICINITY
Local Improvement District
for
Storm Drainage Improvements
Florence, Oregon

Date: May 12, 2004
Prepared by Branch Engineering, Inc.
for the City of Florence

RENEWS 12/31/05

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LIST OF FIGURES

INTRODUCTION

The Rhododendron Drive area north of 35th Street has been developing over the past several years with limited storm drainage infrastructure in the area. This has resulted in storm water facilities dominated with infiltration systems. The absence of large storm water facilities has also limited the ability to adequately convey surface runoff from undeveloped properties to the northeast near Highway 101. During extreme flood events, high water tables in the area exacerbate the flooding problems by adversely affecting the infiltration capacity of the soil. Also, several property owners on or near the banks of the Siuslaw River attribute some bank erosion to groundwater aquifers that the infiltration systems contribute to.

The purpose of this report is to provide a preliminary assessment of the required infrastructure necessary to convey surface runoff from the developed and undeveloped areas east of Rhododendron Drive. A cost estimate for the improvements and a cost distribution to the benefited property owners are also included in this report.

L.I.D.

The City is experiencing demand for drainage facilities in the 35th and Rhododendron Drive area and anticipates the formation of a Local Improvement District (LID) to share the costs of the improvements. The area under consideration contains property on the east and west sides of Rhododendron Drive from 35th Street to approximately 4,000 feet to the north. The proposed District contains about 266 acres and is shown in the Figure 1 Vicinity Map. Figure 2 further illustrates area with Tax Map and Tax Lot information.

PROJECT FUNDING

The project is proposed to be funded through assessments levied to the benefited properties within the District. At this time, no grant opportunities that might be applicable to this project are known. Should new funding sources become available for this project, they would most likely be utilized to reduce the assessable costs.

PROJECT SCHEDULE

The improvements in the area should be completed within a year of establishing the LID. Since this infrastructure will solve existing flooding problems, it is not recommended to time the improvements to a particular development.

STORM WATER MASTER PLAN

The Storm Water Management Plan (SWMP), dated October 2000, developed for the City of Florence by Brown and Caldwell identifies the 35th Street and Rhododendron Drive area as the Florence Central Region. Within this region several reported flooding problems were documented including the northeast side of the Mariners Village Subdivision, the central part of Sea Watch Estates, and the northerly and westerly boundaries of Sandpines West Phase 1.

The SWMP lists several necessary improvement projects throughout the city and developed a priority list ranking for the improvements. One of the proposed improvements includes drainage infrastructure extending north from the 35th Street/Rhododendron Drive intersection for approximately 1000 feet. This improvement was identified as the #1 priority drainage improvement project for the City of Florence.

The SWMP recommends a concrete lined open channel design for the majority of the proposed improvements. This design report proposes an alternate design by replacing the concrete lined open channel with an underground pipe system. Underground pipes conserve space for future development and minimize impact to the vegetation in the area. Generally, the other aspects of the design outlined in this report follow the recommendations of the SWMP.

PROPOSED IMPROVEMENTS

The Rhododendron Drive area north of 35th Street will be provided with storm water drainage improvements consisting of approximately 5,000 lineal feet of a closed pipe system, manholes, inlet structures, and armoring an existing ravine outfall. The proposed improvements were separated into three segments (Improvements A, B, and C) for the purposes of describing the system.

Improvement A

Improvement A consists of a 36-inch diameter pipe extending from the northeast corner of Mariners Village south approximately 1,650 feet. Manholes will be provided approximately every 400 feet for access, and an inlet structure connected to the storm pipe will be constructed at the upstream terminus of the pipe to collect surface runoff. Stubs will be placed along this line for connection to the Mariners Village development and the future Sandpines development. It is proposed the pipe be centered in a 14-feet wide public drainage easement abutting the western property line of the future Sandpines development (Tax Lot 1500) for approximately the most northern 1,000 feet (see Figure 5). The southern 650 feet is proposed to follow the same bearing through a 14-feet wide easement on Tax Lots 200, 1200, and a portion of 100. The easements for placing the proposed line have not been dedicated.

Improvement B

This section of the improvements includes 2,050 feet of 60-inch pipe, an inlet structure, and an armored outfall to the Siuslaw River. This portion of the system begins at the southern terminus of Improvement A and will convey storm water southwest of the Rhododendron Drive/35th Street intersection to the outfall into the Siuslaw River. A 14-feet wide drainage easement will be required for the entire length of the pipe with exception to the Rhododendron Drive crossing.

A concrete lined open channel alternative may be used in lieu of the 60-inch diameter pipe along the Rhododendron Drive right-of-way. A 6-feet deep channel with concrete lining for the bottom 1.5 feet will prevent infiltration of storm water during normal rainfall events. This design would also allow groundwater to enter the channel in the upper 4.5 feet to intercept some groundwater flow through the area. A drainage easement in the order of 40-feet in width would be needed for the channel.

The existing ravine on the west side of the Rhododendron Drive is proposed to be partially filled and piped to prevent erosion and bank scouring due increases in flow that will be generated by the improvements. Armoring the outfall of the pipe at the Siuslaw River is also proposed for erosion prevention purposes.

Improvement C

Improvement C includes constructing approximately 750 feet of 24-inch pipe and 570 feet of 15-inch pipe. The alignment of the pipe is proposed to follow the south boundary of Tax Lots 3800, 3900, 4000, 4100, and 4200 to the proposed Wysteria subdivision (Tax Lot 3500). Within the proposed Wysteria subdivision, the alignment of the pipe will follow the south and west property lines of the subdivision.

PROJECTED STORM WATER INFRASTRUCTURE COSTS

The storm water infrastructure costs were developed for Improvements A, B, and C described above. The estimated total costs for design, construction, and easement purchase is approximately $1.2 million. The engineer's estimate detailing a breakdown of the costs is shown on Figure 5.

ALLOCATION OF ASSESSMENTS

As discussed previously in this report, the City anticipates the formation of a Local Improvement District to fund the costs of the improvements. The property owners benefited by the proposed improvements have been included within the assessment boundary as illustrated in Figure 2.

The proposed assessments are based on the cost of the improvements, the developed or undeveloped nature of the property, and the size of the parcel. Developed lots (lots within a platted subdivision) are proposed to be assessed at half of the rate as undeveloped parcels. This proposal is based upon the increase in land value and development potential of the undeveloped properties, and the previous improvements constructed in conjunction with the developed subdivisions.

The developed lots within the subdivisions identified on Figure 2 are indirectly assessed as to the size of the parcel. Since each of the developed lots have, or will have, a single family dwelling, and will have no opportunity for further development, the individual size of the platted lot has little bearing on the benefit received. As a result, the assessable area for each buildable lot[1] was determined by the area of the entire platted subdivision within the assessment boundary (including common areas) divided by the number of lots. Using this criteria, each lot within the subdivision will be assessed an equal amount for the improvements. The platted subdivisions within the assessment boundary include Mariners Village (all phases), Sandpines West Phase 1, Sea Watch Estates, and Shelter Cove Phases I, II, and III.

Lots within the assessment boundary that are just south of Shelter Cove and west of Rhododendron Drive were reviewed on a case-by-case basis as to the developed or undeveloped nature of the property. The lots are proposed to be assessed based on the area of the parcel and the developed or undeveloped nature of the lot.

Properties east of Rhododendron Drive within the assessment boundary will be piped to the proposed improvements. Properties west of Rhododendron Drive are benefited by the improvements due to the reduction in storm water infiltration that will occur east of Rhododendron Drive. Groundwater mapping by LCOG indicates the groundwater gradient slopes from east to west in the area. Based

[1] A buildable lot is defined as a lot that a single family house can legally be built on (does not include common areas for the subdivision).

on this information, surface infiltration of storm water east of Rhododendron Drive contributes to the groundwater aquifer at properties west of Rhododendron Drive, which is believed to have contributed to bank erosion and surface ponding problems.

Figures 6A and 6B outline the proposed assessments for each of the benefited properties comprising the Local Improvement District.

Figures

VICINITY MAP

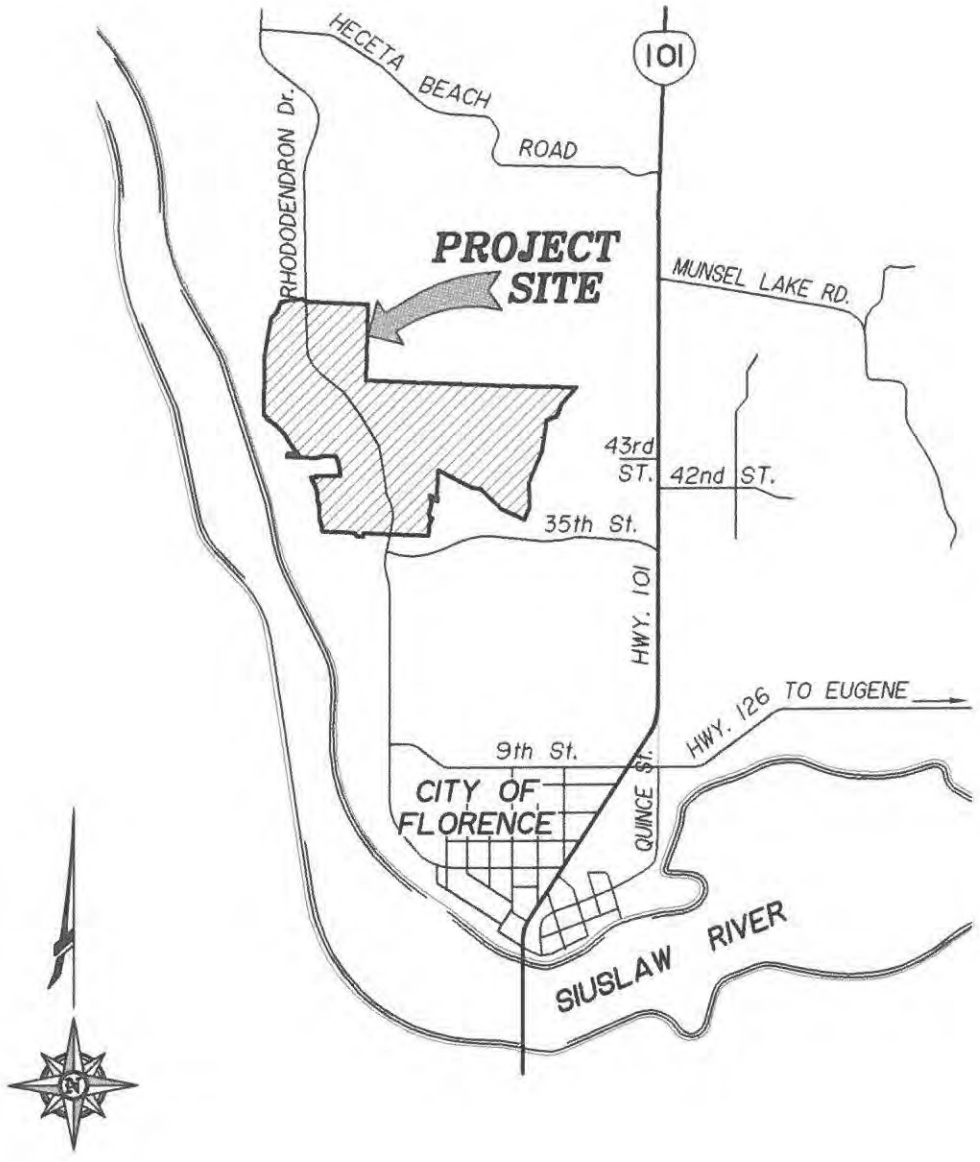


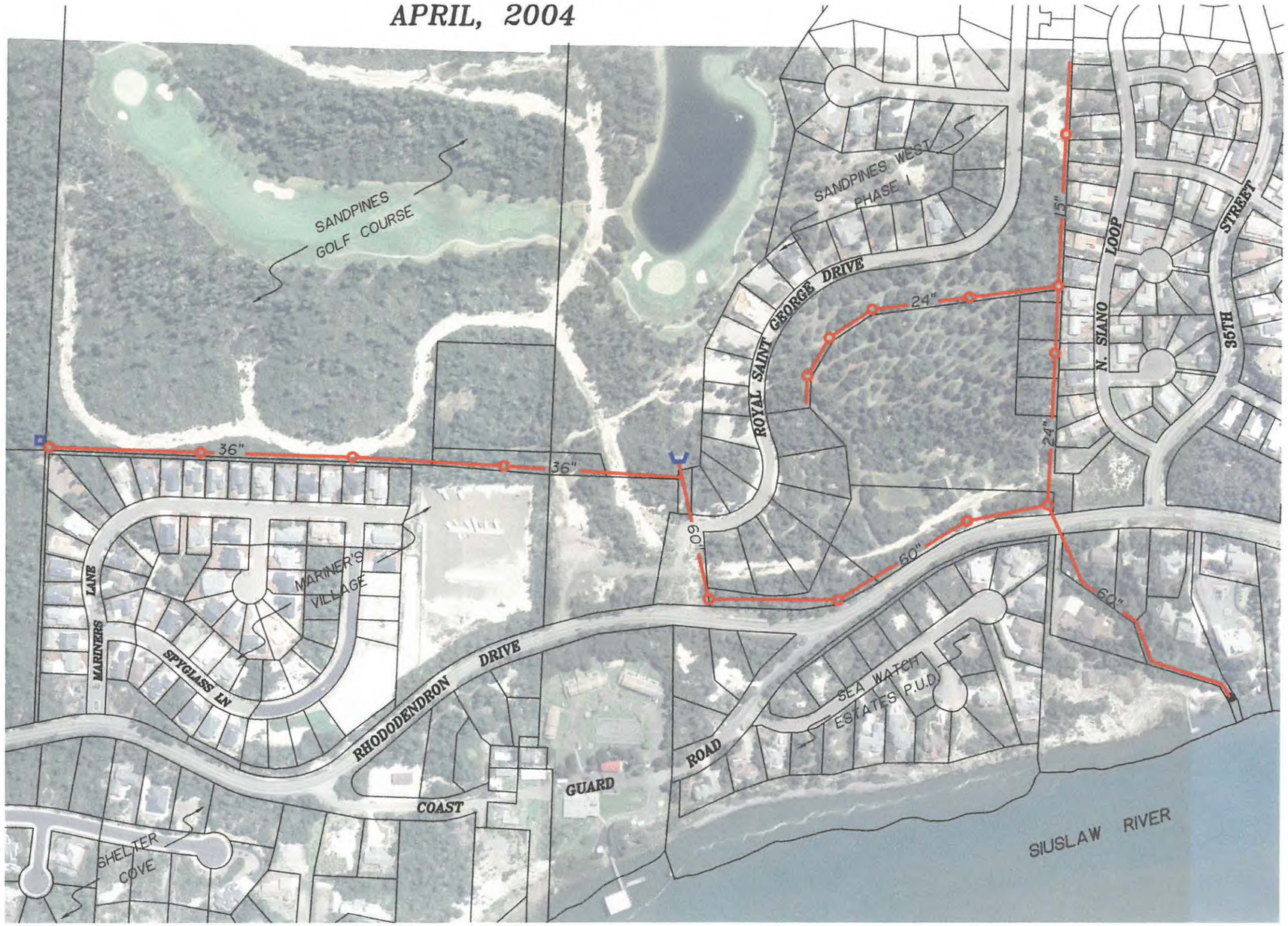
FIGURE 1

Branch Engineering, Inc.

DRAINAGE IMPROVEMENTS
RHODODENDRON DRIVE AND 35TH STREET VICINITY
FLORENCE, OREGON
APRIL, 2004

LEGEND

- PROPOSED PIPE
- PROPOSED MANHOLE
- PROPOSED INLET STRUCTURE
- PROPOSED HEADWALL
- PROPOSED RIP-RAP



GRAPHIC SCALE

300 0 150 300 600

(IN FEET)

Branch Engineering, Inc.
310 Fifth Street
Springfield, Oregon 97477
(541)746-0637 FAX (541)746-0389
branchadmin@branchengineering.com
Civil • Structures • Transportation • Surveying

FIGURE 3

PROJECT NO. 04-001C

TYPICAL TRENCH SECTION FOR IMPROVEMENT A

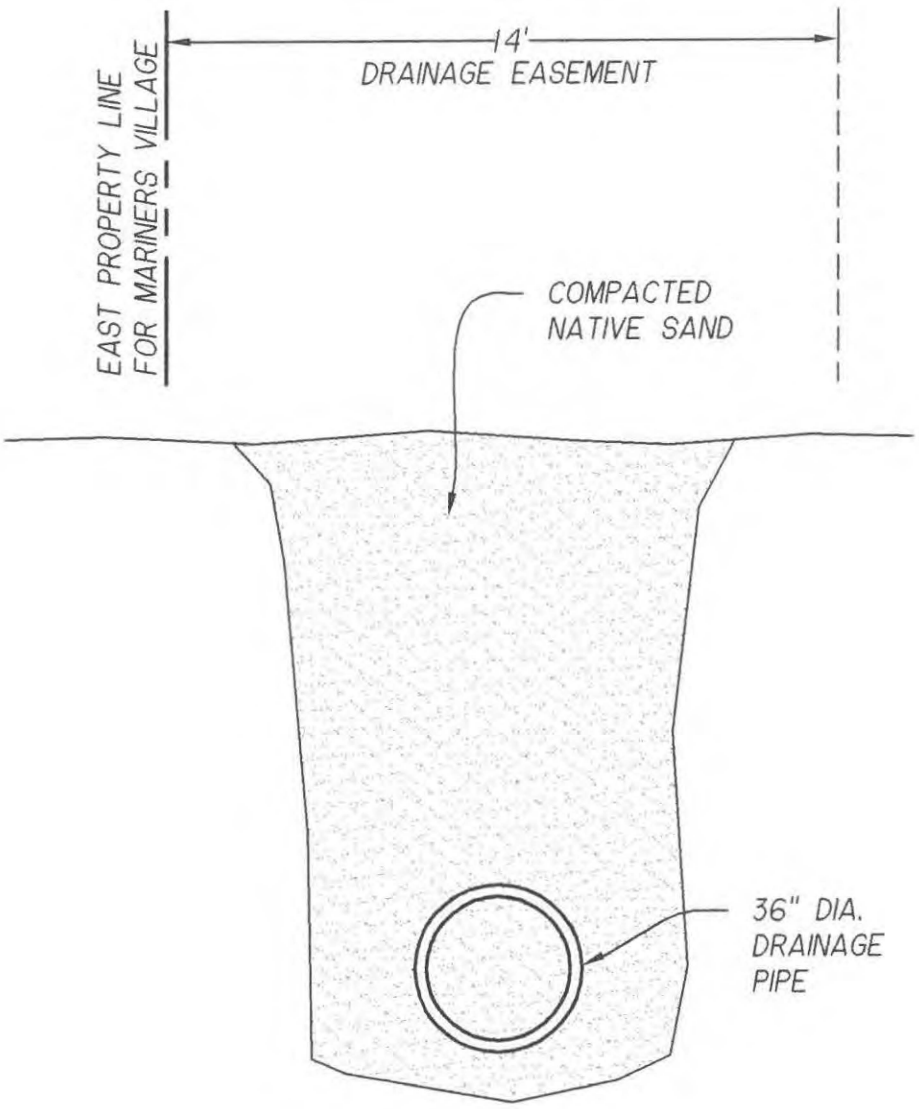


FIGURE 4

Branch Engineering, Inc.

APPENDIX G
Public Involvement Program

APPENDIX G

Public Involvement Program

Preparation of this report was supported by significant investigations of drainage conditions throughout the City. To supplement the information obtained through these investigations, the City of Florence Public Works Department and Civil West Engineering hosted a public reception at the Florence Events Center on Wednesday, November 1st, 2017. The purpose of the reception was to invite the public to participate in the discussion, and share their knowledge of existing drainage and flooding problems in and around the City. The reception was broken down into three sessions, each dedicated to a specific demographic:

- Session #1 – Coastal Highlands Development (Pine Court, 18th Court, Willow Loop)
- Session #2 – Mariner's Village Subdivision (Fairway Estates, Royal Saint George Drive)
- Session #3 – General Public

These meetings were well attended, and several members of the community engaged in our discussion of priority drainage issues.

Goals of the Public Outreach Program:

1. Attain credibility with the public by demonstrating expertise in infrastructure management and planning.
2. Distribute information during the planning process to the general public and CIP stakeholders, informing them of key issues and options for solutions.
3. Offer public education about the cause of drainage issues in specific locations, and describe the technical work that goes into solving them.
4. Listen and respond to ideas, concerns, and opinions of the public. Discuss the feasibility, history, and impacts of specific ideas.
5. Instill confidence in the City's plan to address specific drainage issues

Prior to the meeting, Civil West prepared maps to hang on the wall to facilitate discussions with the public. Members of the community were encouraged to draw on these maps to mark locations where they had observed flooding. Community members were also encouraged to fill out a Public Comment Form (see next page), describing known drainage issues and making recommendations for how to approach solving each problem. This form was also provided electronically on the City's website. In this way, the public was invited to have a voice during the master planning process, and the City was given an opportunity to provide public education about the feasibility of specific drainage strategies for specific locations in the City.

PUBLIC INPUT FORM

for the City of Florence Storm Water Master Plan Update

Name: _____

Address: _____

Phone: _____

E-Mail: _____

May we contact you to ask questions? (Circle one) YES NO

Where have you observed flooding?

_____

_____

_____

_____

_____

_____

In your opinion, which drainage issues are a top priority to solve?

_____

_____

_____

_____

_____

_____

CITY NEWSLETTER – FOCUS ON FLORENCE – OCTOBER 2017

Stormwater Management Plan Open House

The current Stormwater Management Plan was developed in the late 1990's, completed in 2000, and adopted by the City of Florence in 2004. The function of the plan is to make recommendations for stormwater capital improvement projects to address flooding problems and protect the quantity and quality of water in the aquifer, Munsel Creek, and the Siuslaw River, as well as other valuable natural resources.

The 2000 Stormwater Management Plan has been used to guide and direct the planning and development efforts, including upgrades and expansion of the stormwater conveyance system for a period of 20 years. As the end of that planning period approaches, and most of the projects contained in the current Stormwater Management Plan have been completed, now is the time for the City to reevaluate stormwater management needs of the community. This reevaluation will identify and prioritize the deficiencies that exist now, so that City stormwater funds are utilized in the best possible way.

In February 2017, the City retained Civil West Engineering Services, Inc. to complete an update to the current Stormwater Master Plan. A critical aspect to the success of that effort is to engage the community in conversation, and collect as much information as possible regarding existing drainage problems and flooding issues around the City. The City, together with its consultants from Civil West, will be holding a public reception at the Florence Events Center on Wednesday, November 1, 2017, from 5:30 pm to 7:00 pm. We invite you to stop by and share your knowledge and concerns with us.

In addition to the general public reception, we have scheduled two sessions to discuss the recent flooding issues that the community experienced during the winter 2017. The first session is scheduled for November 1st from 3:00 pm to 4:00 pm for concerned citizens living in the area of Coastal Highlands between 18th and 16th streets. The second session is scheduled for November 1st from 4:00 pm to 5:00 pm for concerned citizens living within the Mariners Village development.

Please stop by and become informed on our preliminary list of proposed improvements to address stormwater management now and into the future.

CITY NEWSLETTER – FOCUS ON FLORENCE – NOVEMBER 2017

Stormwater Management Plan Open House

On Wednesday, November 1st, the City held a public open house to discuss existing drainage and flooding problems in and around the City. We had great attendance at our two stakeholder meetings to discuss the flooding that occurred in two neighborhoods during 2017. We appreciated the feedback.

City staff and our consultant team have worked hard to identify all of the problem areas. However, we may not have captured all of the locations. If you were unable to attend the stakeholder meetings or the general open house event and would like to provide input, we would welcome it.

During the open house we provided a simple form for community members to share their observations. We encourage those individuals that could not attend the open house to fill out the form, drop them off at City Hall, or email them to Nilda Taylor at: nilda.taylor@ci.florence.or.us.

The forms can be downloaded from the City website at: www.ci.florence.or.us/publicworks/stormwater-management-plan-update

The information from the Stakeholder meetings, open house and these forms will help guide the development of our priority projects and list of proposed improvements to address stormwater management now and into the future.

For additional background information relating to our current Stormwater Management Plan, Public Works Director Mike Miller provided the City Council an in-depth presentation on:

- How it was developed
- The priority projects that were identified in 2000
- What projects have been completed
- Why stormwater management is important to the community
- Areas of concern, including how the system performed in February 2017.

You can watch the Vimeo presentation from the February 6, 2017 City Council meeting at:https://vimeo.com/202993032 The presentation starts approximately **58 minutes** into the Council meeting.

afarnsworth@civilwest.com

From: Eva Pinkavova <eva.pinkavova@gmail.com>
Sent: Thursday, November 9, 2017 4:07 PM
To: afarnsworth@civilwest.com
Subject: RE: Mariners Village Stormwater

Thanks Aric, I'll be happy to let you have JPGs of any of the photos.
Eva

From: afarnsworth@civilwest.com [mailto:afarnsworth@civilwest.com]
Sent: Thursday, November 9, 2017 08:33
To: 'Eva Pinkavova' <eva.pinkavova@gmail.com>; 'Mike Miller' <mike.miller@ci.florence.or.us>
Subject: RE: {possible Spam} Mariners Village Stormwater

Eva,

Thank you very much for your input. I am grateful to you for typing out your concerns so that we can study them while we plan for the future of the stormwater management system in Florence. If it's alright with you, I may reach out to you to ask for JPG copies of some of your photographs, for inclusion in our master planning document.

The City Public Works department is committed to professionally maintaining and improving current infrastructure. They do strive to protect all public and private property from being negatively impacted. If you would like more information about your Public Works department, you can visit their website at http://www.ci.florence.or.us/publicworks and they also provide regular updates through the City newsletter and the City of Florence facebook page (https://www.facebook.com/CityofFlorenceOregon/).

Thank you again for attending the meeting, and for sharing your insight with us. If you have any other information that you feel may be pertinent to this project, please don't hesitate to contact me.

Aric Farnsworth **– E.I.T., Architect**
541-266-8601 • Fax 541-266-8681
ALBANY • **COOS BAY** • MISSOULA • NEWPORT • ROGUE VALLEY
afarnsworth@civilwest.com
www.civilwest.com

From: Eva Pinkavova [mailto:eva.pinkavova@gmail.com]
Sent: Wednesday, November 8, 2017 4:38 PM
To: afarnsworth@civilwest.com; 'Mike Miller' <mike.miller@ci.florence.or.us>
Subject: {possible Spam} Mariners Village Stormwater

Dear Aric and Mike,

Firstly, thank you both for holding the Stormwater Management Plan meeting on Nov 1st 2017, and for the presentation which was very informative. I appreciate the way you listened to the concerns of the Mariners Village residents and the way you handled our questions.

My home is 60 Spyglass Lane, TL3500, directly opposite the stormwater 'pond' in TL4600, so I had plenty of opportunity to watch the water rising in the first few months of 2017. The document attached has all the pictures I took with the date and time and my comments. I hope they will be of use to you. I would be very happy to answer any questions you may have about the pictures or anything else concerning this issue.

You briefly explained the difficulties with the legal position concerning diverting water flow. As you consider what needs to be done I would like to suggest the following could be some useful considerations:

- Natural water flow will of course vary in heavy rainfall years. There is a case to be made that much higher than average rainfall years, such at the 2016/2017 winter, would typically create higher than usual natural run off. Logic suggests that this could be a legal argument that a route for such excessive run-off could and should be built into any stormwater management plans to be used only for such unusual events.
- Since the City of Florence presumably gave planning permits to the developer who built MV, the City must logically have some responsibility for dealing with the stormwater flood. I was very happy to see the City taking that on, when they began to pump the water out of the MV TL126 (RV Lot). It made a huge difference. I trust the City will continue to take appropriate action in such circumstances.
- Looking at TL4600 (the 'pond') and the land on the other side of Rhododendron Drive opposite the lowest point of TL4600, it seems to me that the construction of Rhododendron Drive has created a dam which prevents the natural runoff of water SW from TL4600. If the construction of the road was allowed despite laws about not diverting natural water flow, could a case not be made for re-instating that natural water flow by providing for a pipe to take excessive rainfall directly to the river in exceptional rainfall years?

I appreciate that this is a complex and difficult issue which I hope the city can resolve in a way which is fair and equitable for all its citizens and property owners, as well as being within the law. As I said at the meeting, moving the water around to resolve a problem in one area, while disadvantaging some else in another area does not seem to me to be a fair and equitable long term solution. I would prefer a solution in which we all behave as one community. I will look forward to your recommendations in due course.

In the meantime, now that the November rains have set in, we can only hope that you were right when you pointed out that last winter was unusual.

I would appreciate it, if you could confirm you have received this
Regards and thanks
Eva

Eva Pinkavova
60 Spyglass Lane
Florence, OR 97439
541-991-7187

PUBLIC COMMENT FORM RESPONDENTS

Last Name	First Name	Address	Tax Lot	Phone	Email	May we contact you to ask questions?	Where have you observed flooding?	In your opinion, which drainage issues are a top priority to solve?	Attachments?
Ryall	Marvin	05460 Friendly Acres Rd	1812023000904	541-997-5946	-	-	5055 Highway 101		
Rwagenschutz	Jacquie	68 Spyglass Lane	1812153204300	541-603-0068	j.misc.68@charter.net	YES	Rhody at River. Oak St at Fred Meyer / side street. Mariner's Village - enclosed as discussed w/ Aric are the pictures of my flooding over several months.	Along Rhody to County line - main traffic corridor. Mariner's Village because of its impact w/ Sandpines & Rhody. The design is badly flawed when there is a definite channeling of water around the village meeting back up w/ the rest of the water as it flows south and NO outlet for it. If no pumping would have occurred then a minimum of 12 homes would have been inundated with water. As is with the design lateral absorption and deterioration of the swale is putting several homes at risk. Sink holes: slides, etc.	Thumb Drive
Pinkavova	Eva	60 Spyglass Lane	1812153203500	541-991-7187	eva.pinkavova@gmail.com	YES	See email.	See emails.	Emails
Holmes	Brian	7 Mariners Lane	1812153200110	541-997-2449 (541-999-0537)	drbri64@yahoo.com	YES	In my backyard and under my house (Jan-May)	Water from upstream not being maintained on that property	
Sabado	Diane	22 Mariners Lane	1812153200125	541-590-3271	ddsabado49@gmail.com	-	Along Mariner's Lane behind the houses to the east flowing south forming two lakes in addition to flowing into the RV lot of Mariner's Village. Flooding from the western swales also occurred going into the RV lot.	If the flow from the NE corner could be contained, it would slow the flooding.	
Ryan	Paula	58 Spyglass Lane	1812153203300	541-902-8000	paula.ryan@q.com	YES	My backyard - lake (April 2017). Across the street / Spyglass Lane. Our retention pond was full and almost over the berm onto the road. Our RV parking lot was 3' deep.	A lot of water flows south from behind Fred Meyer into Sand Pines and by Mariner's Village. I have hiked back there and have documented this. We need a drainage ditch under Rhododendron - perhaps down Eden Lane to the river… I heard that the Mariner's Village area was once a swampy area that was filled in to build/ develop the area. It probably drained naturally over into the river. All natural drainage was probably filled in when Rhododendron was built, making a dam. The ditch coming down 35th Street just went in last year! It is not large enough to handle all the water we had last year!	
Hanson (Rhodes)	Nancy	9 Mariners Lane	1812153200112	415-497-4083	banjogirl57@gmail.com	YES	Southeast side yard area - w/in 10" from my house. Some water in my crawlspace. Trench (catch space) on W side filled completely.	Water coming in from the North East corner directed out before it hits Mariner's Village.	
Jones	Larry & Catherine	67 Spyglass Lane	1812153204200	541-272-9789	ptch229@q.com	-	Behind house in ditch. Beside house in pond. RV lot.	-	
Shook	Jim & Barbara	70 Spyglass Lane	1812153204500	775-296-1800	bjshook2@gmail.com	-	Behind our house and under our house.	Connect Mariner's Village to the public stormwater system for drainage and stop it from collecting in our neighborhood.	
Giles	Barbara	61 Spyglass Lane	1812153203600	541-902-7934	beejgiles@gmail.com	YES	My driveway - water flooded up out of drain when lake across the way filled & water had no where else to go.	Water coming in from northeast corner needs to be diverted.	
Baylis	Glen	1780 Willow Loop	1812261201900	541-997-8772	reggaec@charter.net	YES	Front yard - constantly. Swale fills and flood into yard even with light rain		
Gibson	Jackie & Gerry	1760 18th Court	1812261202100	541-997-9423	actazzif@yahoo.com	YES	In the cul-de-sac at 18th Courth - bottom of 18th Street	All the ones mentioned during the meeting today. Wetlands???	
Woodford	Jack & Janice	2000 Willow Loop	1812261203300	541-902-8521	jansart8@gmail.com	YES	Ground water came up under our house. Standing water area behind our property is normally a seasonal stream, but last winter it was a seasonal lake! Driveway became a lake.	Better drainage.	
Smith	Susan & Timothy	1710 Pine Court	1812261201600	541-590-0582	suzensmith420@yahoo.com	YES	Our lot 1700 was near 100% covered. Lot 1710 was 75% covered.	Yes.	
		1700 Pine Court	1812261201500	541-590-0582	suzensmith420@yahoo.com	YES	Our lot 1700 was near 100% covered. Lot 1710 was 75% covered.	Yes.	
Petersen	Fred A	1740 Willow Loop	1812261201800	541-997-3728	-	YES	Back yard of 1740 Willow Loop 8" high before city began pumping water down winter of 2016-2017. Had to pump (sump pump) to get water out from under house for several weeks until City pumped water table down.	Above.	
French	Cathy	B&E Wayside Space #19		775-240-3375	referralsunleashed@gmail.com		Space #19 B&E Wayside North fo 37th Street.		
	Diana	88556 3rd Ave		530-329-2825	dmclavel@gmail.com		Heceta Beach Road	Flooding on Heceta Beach. This should be a viable tsunami excape route for those of us living in Heceta Beach area.	