Final Report

Roseburg Storm Drainage Master Plan

Prepared for

City of Roseburg

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Prepared by

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Introduction

The overall objective of the City of Roseburg Stormwater Master Plan is to recommend a series of improvements to the City's storm drainage system that manages the quantity and quality of stormwater runoff under current and future development conditions while providing general guidance for the development community as they add new storm drainage infrastructure to the City. In 1987, the City developed a city-wide drainage master plan to guide expansion of the system to serve current and future development within the Urban Growth Boundary (UGB). While this plan has been a useful tool, development has outpaced the recommended improvements and an update is now necessary. In addition, issues such as stormwater quality and the associated regulatory implications have also reinforced the need for a revised master plan.

The goal of the City of Roseburg Stormwater Master Plan (SWMP) is to proactively manage stormwater runoff to protect the water quality and aquatic habitat of the receiving waters and to minimize the affects of increased runoff from development within the storm drain conveyance system. These goals are met through the SWMP by identifying infrastructure and natural resource improvements for the collection, conveyance, and treatment of stormwater runoff generated within the city. The plan prioritizes storm drain improvements within the UGB and provides a 5-year implementation schedule for the construction of the highest priority projects. Lesser priority projects are also identified in order of importance, and are to be implemented as opportunities arise.

Major tasks undertaken in the development of the plan include the following:

- Development of a stormwater infrastructure plan that alleviates current capacity and flooding problems that can also manage additional runoff generated from future development.
- Implementable engineering solutions.
- Recommend improvements that are sustainable from an operations and maintenance perspective.
- Provide site specific project recommendations for conveyance and water quality system improvements.
- Address regulatory standards.

Study Area

Roseburg lies in the foothills of the South Umpqua River in Southern Oregon. The study area includes all areas within the Urban Growth Boundary (UGB) and portions beyond that contribute to the City's storm drain system. Areas outside the UGB were evaluated only for runoff amounts that would contribute to the system.

The study area is comprised of several drainage basins and waterways. The major waterway, the South Umpqua River, flows through the City from the south to the northwest and is the final destination for all of the City's stormwater runoff. The other major waterway is Deer Creek which flows from the high eastern peaks westwards into the Roseburg valley and ultimately into the South Umpqua River.

Smaller waterbodies in the basin include Newton Creek which flows from the northeastern peaks southwest through a large portion of the City. Newton Creek has several tributaries of its own and drains about a quarter of the City. Other smaller creeks include the tributaries to Deer Creek: Rifle Range Creek (north) and Ramp Creek (south). The last tributary is Parrot Creek which drains the most southern part of the City directly into the South Umpqua. Parrot Creek basin is quite small within the UGB, but has had many flooding issues in recent years.

Planning and Analysis Criteria

A master planning analysis was performed for Roseburg to identify potential stormwater and water quality improvements in the City. The evaluation was guided by a set of system analysis criteria used to identify potential improvements. These criteria include quantitative assessments of storm drain surcharging and flooding, culvert overtopping, channel flooding and pollutant loading. The planning and analysis section presents the various system analysis criteria used to identify conveyance and water quality problem areas and to evaluate potential improvements.

Hydrologic and Hydraulic Analysis

A critical piece of the stormwater system analysis is the selection of an appropriate set of predictive hydrologic, hydraulic and water quality models. The chosen modeling tool, XP-SWMM was selected because it is capable of predicting the quantity and quality of runoff, evaluating the hydraulic performance of existing facilities (channels, pipes, culverts, etc.) designing proposed facilities and analyzing Best Management Practices (BMP) strategies designed to target runoff and pollutant reduction.

Specific problem areas were identified by evaluating each system node (manhole or conveyance system junction) and link (pipe, channel, canal, etc.) using the hydraulic and water quality criteria. In most cases, a number of deficient nodes and links have been grouped together into a single problem area. For example, an undersized pipe segment may cause several upstream manholes to surcharge and flood; hence the problem area encompasses the undersized pipe as well as the flooded nodes and adjacent areas.

Water quality areas of concern highlight those portions of the city having comparatively higher pollutant concentrations and/or loads. For example, three transportation corridors (Interstate-5, Highway 99 and Highway 138) as well as the downtown area tend to have higher pollutant loadings than anywhere else in the city and consequently represent places where BMPs can be targeted to maximize the system-wide water quality benefit.

TMDL Implementation Plan

A TMDL Implementation Plan addresses water quality mitigation issues as detailed in the Umpqua Basin Total Maximum Daily Load (TMDL), 2006. This plan is designed to assist the City of Roseburg in reducing pollutant loading in the Umpqua River basin to help restore and protect water quality. The goal of the implementation plan is to assist the City in reducing pollution sources related to its land uses within city limits in order to prevent water quality excursions in dissolved oxygen, temperature, biological criteria, phosphorous, bacteria, and pH.

The plan also reviews the current water quality issues in the South Umpqua River and Deer Creek through the City of Roseburg and potential means to control pollutant loading. These measures are recommendations that can be implemented by the City depending on needs and funding. Some measures may already be in place as part of day-to-day operations and maintenance practices.

Urban Growth Expansion

The purpose of this section is to provide a general analysis of runoff and drainage in areas of the Urban Growth Boundary (UGB) that are expected to develop in the near future. A discussion of suggested policies regarding development areas is included rather than a quantification of runoff flows based on assumed development patterns. The UGB areas discussed include the South Troost Street/Airport (2a), North Troost Street (2b), Parrot Creek Drainage (6a), Ramp Creek Drainage (6b), and DaMotta Creek Drainage (9) Areas.

Alternative Analysis

Alternatives for the hydraulic and water quality system deficiencies were developed and evaluated using the project GIS and the XP-SWMM model. Each alternative can generally be described as either conveyance-oriented, water quality-oriented or multi-purpose. Conveyance alternatives include new or upsized storm drain pipes, culvert modifications, detention ponds and improved channels. Water quality improvements include swales or channel enhancements and structural pollution reduction facilities. Structural pollution reduction facilities are considered proprietary and non-proprietary water quality manholes and vaults using filtration and/or hydrodynamic separation as the pollutant removal mechanism. The following sections describe the alternative development process, the evaluation process and the recommended improvements.

Capital Improvement Plan

The recommended plan includes 29 individual CIP projects in addition to projects from the City's previous stormwater improvement list, Calkins Storm Drainage Report, and NPDES stormwater management plan, and is summarized in Tables 9.1-1 and in Figure 9.1-1. Collectively, the improvements include 38,000 feet of new or replaced storm drain pipe, approximately 250 feet of channel enhancement, 20 replaced culverts, 2 new detention ponds, 7 structural pollution reduction manholes, and 2 water quality swales. The total capitol cost for the improvements is just over 194 million dollars, which includes all construction activities, and land acquisition, with the exception of mitigation land acquisition (if required) and maintenance. From an implementation standpoint, a majority of the projects are located in public right-of-way, although in several cases, coordination with private landowners and ODOT may be required. Other implementation issues that are likely to be encountered include roadway closures and/or temporary traffic control, utility conflicts and relocations, limited site access and environmental permitting.

SECTION 1

Introduction

The overall objective of the City of Roseburg Stormwater Master Plan is to recommend a series of improvements to the City's storm drainage system that manages the quantity and quality of stormwater runoff under current and future development conditions while providing general guidance for the development community as they add new storm drainage infrastructure to the City. In 1987, the City developed a city-wide drainage master plan to guide expansion of the system to serve current and future development within the Urban Growth Boundary (UGB). While this plan has been a useful tool, development has outpaced the recommended improvements and an update is now necessary. In addition, issues such as stormwater quality and the associated regulatory implications have also reinforced the need for a revised master plan.

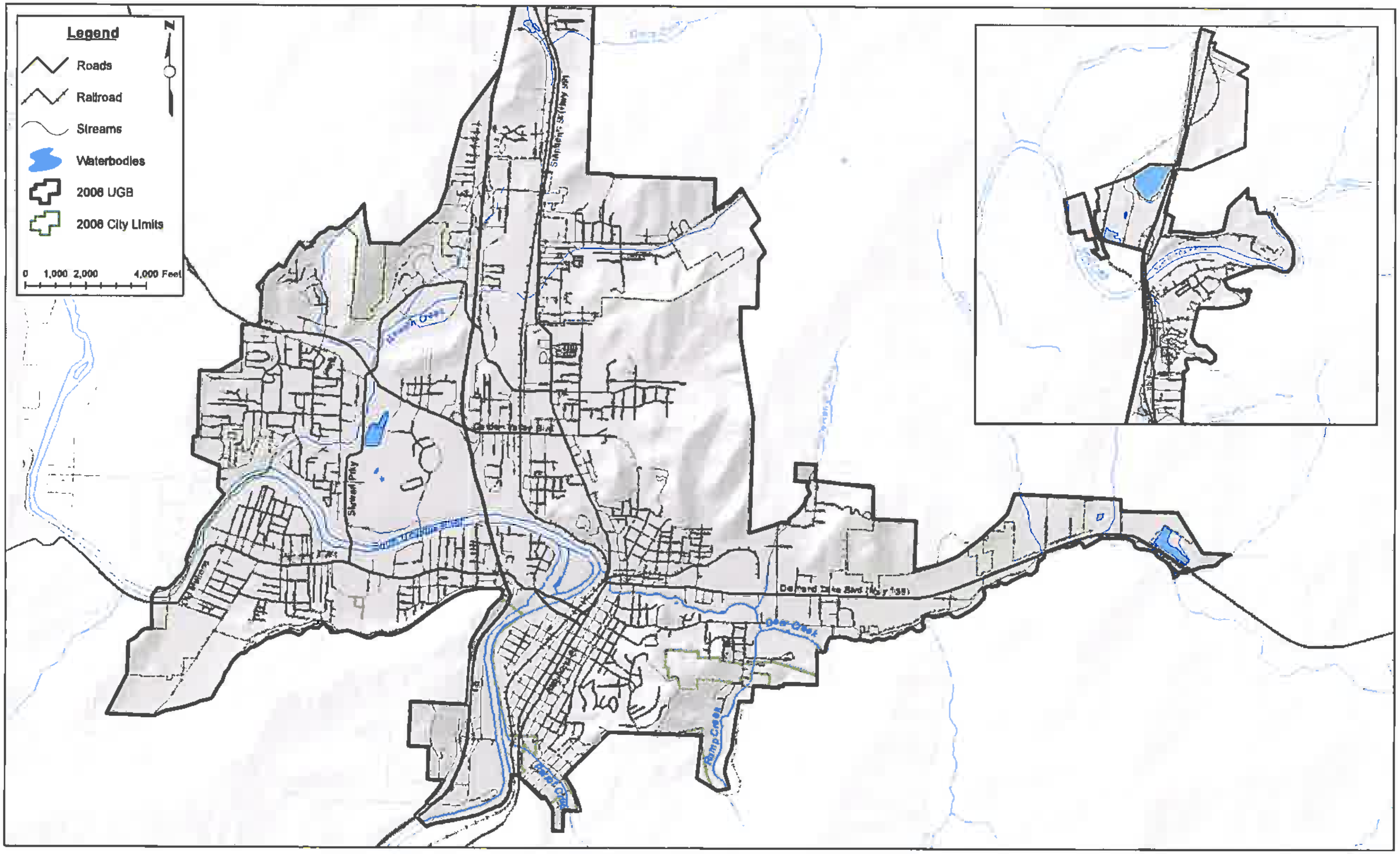
The goal of the City of Roseburg Stormwater Master Plan (SWMP) is to proactively manage stormwater runoff to protect the water quality and aquatic habitat of the receiving waters and to minimize the affects of increased runoff from development within the storm drain conveyance system. These goals are met through the SWMP by identifying infrastructure and natural resource improvements for the collection, conveyance, and treatment of stormwater runoff generated within the city. The plan prioritizes storm drain improvements within the UGB and provides a 5-year implementation schedule for the construction of the highest priority projects. Lesser priority projects are also identified in order of importance, and are to be implemented as opportunities arise.

Major tasks undertaken in the development of the plan include the following:

- Development of a stormwater infrastructure plan that alleviates current capacity and flooding problems that can also manage additional runoff generated from future development.
- Implementable engineering solutions.
- Recommend improvements that are sustainable from an operations and maintenance perspective.
- Provide site specific project recommendations for conveyance and water quality system improvements.
- Address regulatory standards.

1.1 Study Area

The City of Roseburg is located along the South Umpqua River in central Douglas County, in Southern Oregon. The study area for the SWMP is approximately 10,500 acres and includes six major drainage basins within the 2006 Urban Growth Boundary and several smaller areas that are directly connected to the South Umpqua River. The major basins are shown in Figure 1.1-1 and include Parrott Creek, Newton Creek, Deer Creek, Ramp Creek, Rifle Range Creek, and Davis Creek.



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Study Area
FIGURE 1.1-1
Stormwater Master Plan | City of Roseburg

1.2 Contents of Master Plan

This Master Plan is divided into the following chapters:

Stormwater Management Policies, Goals, and Regulations
This chapter presents the goals, policies, and regulatory considerations guiding the SWMP.

Study Area Characteristics
This chapter presents the study area and basin boundaries, the general topography, the local climatic conditions, the soils and the primary drainage features.

Planning, Analysis, and Improvement Design Criteria
This chapter presents the various system analysis criteria used to identify conveyance and water quality problem areas and to evaluate potential improvements.

Hydrologic and Hydraulic Analysis
This chapter presents the development and calibration of the XP-SWMM model used in the master plan. Included are a description of the XP-SWMM model, the data requirements, the data sources, the model setup and the model validation. The development of the water quality model is also discussed in this section. This section also characterizes the existing and future hydraulic and water quality problem areas that will be used as a baseline for the development of a stormwater CIP program.

TMDL Implementation Plan
This chapter presents a TMDL Implementation Plan to address water quality mitigation issues as detailed in the Umpqua Basin Total Maximum Daily Load (TMDL), 2006. This plan is designed to assist the City of Roseburg in reducing pollutant loading in the Umpqua River basin to help restore and protect water quality.

Urban Growth Expansion
This chapter describes the regional setting of the City of Roseburg with respect to the UGB Expansion Plan and includes a discussion of growths potential affect on stormwater management.

Alternative Analysis and Project Development
This chapter describes the development of the recommended stormwater improvement plan, including the alternative analysis and evaluation process. Fact sheets are provided for each project and include key design criteria for use in final design and implementation.

Capital Improvement Plan
This chapter outlines the recommended system improvements; identifies water quality, and flood control projects to be included in the City's CIP; presents estimated project costs; and provides an implementation plan by ranking the relative importance of each CIP project.

Financial Plan and SDC Analysis
This chapter presents the recommended financial plan and system development charge (SDC) update that will fund the capital improvements identified in this master plan.

SECTION 2

Stormwater Polices, Goals, and Regulations

This section summarizes the goals and policies that were used to define the stormwater master planning approach.

2.1 Stormwater Management Goals

The primary goal of the Stormwater Master Plan (SWMP) is to recommend a series of improvements to the City's storm drainage system that manage the quantity and quality of storm runoff under current and future development conditions while providing general guidance for the development community as they add new storm drainage infrastructure to the City. There are other policies and goals included in the City's Comprehensive Plan that complement the stormwater planning process but are not integral to achieving the primary goal of the SWMP. As such, these overarching policies and goals are not included in this summary.

2.2 Stormwater Policies

To achieve the previously mentioned goals, a series of policies are needed to shape how the City will manage stormwater quantity and quality within the Urban Growth Boundary (UGB). The following policies were established by the City and stakeholders to guide the master planning process.

1. Provide protection from periodic inundation which could result in loss of life and property.
2. Assure an orderly extension of the storm drainage system to serve existing and future development.
3. Construct stormwater infrastructure improvements that can be accessed and maintained by the city.
4. Maintain existing creeks and tributaries as natural open drainage channels.
5. Protect and enhance natural resources associated with the stream environment.
6. Prevent significant erosion resulting from stormwater runoff and adverse effects on water quality.
7. Provide a regional approach to stormwater management which is consistent with other community goals and plans.

2.3 Stormwater Regulations

Water quality treatment (i.e., pollutant removal) of stormwater is a relatively new practice, and is primarily a result of multiple regulatory programs. The water quality characteristics of stormwater are variable, and the pollutants found in stormwater do not necessarily equate with the in-stream and ground water quality standards, which are the driving forces behind stormwater quality management. As a result, developing a stormwater management strategy to minimize stormwater impacts and protect water quality is challenging.

The following discussion provides the general framework used in developing the SWMP as well as overall water quality treatment policy. Additional discussion specific to an implementation plan that addresses the National Pollutant Discharge Elimination System (NPDES) and Total Maximum Daily Loads (TMDL) is provided in Chapter 6.

2.3.1 Regulations

There are several federal and state laws and regulatory programs that affect stormwater management strategies. The primary goal of these laws is to protect and/or maintain the quality of surface and ground water. Below is a summary of the primary regulatory drivers that influence stormwater management.

2.3.1.1 Clean Water Act (CWA)

The 1972 Clean Water Act (CWA) set forth the legal framework for surface water protection. The CWA resulted in a series of programs including National Pollutant Discharge Elimination System (NPDES) discharge permits; Section 303(d) listings of impaired water bodies, and Total Maximum Daily Loads (TMDLs) to create watershed-based approaches to identify and minimize pollutant loadings. Within the State of Oregon, the Department of Environmental Quality (DEQ) implements the CWA programs listed below on behalf of the Environmental Protection Agency (EPA).

NPDES MS4

In 1987 the CWA was amended to create a comprehensive national program to address storm water discharges from municipalities called Municipal Separate Storm Sewer Systems (MS4s). This program was implemented in two phases. Phase I (1990) included larger municipalities and Phase II (1999) extended coverage of the NPDES stormwater program to small MS4s. Municipalities are "automatically" part of the NPDES Phase II program when the population reaches 50,000 persons with a density of 1,000 persons per square mile. The City of Roseburg is not currently considered a Phase II MS4, but this designation is expected to change in the near future.

NPDES MS4 program requires the development of a Stormwater Management Program to address stormwater quality and must include the development, implementation, and evaluation of best management practices (BMPs) within the following categories:

- Public Education and Outreach on Stormwater Impacts;
- Public Involvement/Participation;
- Illicit Discharge Detection and Elimination;
- Construction Site Stormwater Runoff Control;
- Post-Construction Stormwater Management for New and Redevelopment;
- Pollution Prevention for Municipal Operations.

Chapter 6 of this report provides additional discussion on how the City can address these six minimum measures.

Section 303 CWA

Section 303 of the CWA establishes a process to designate beneficial uses of water and establishes water quality standards to protect these uses. Water quality standards are developed by DEQ for a wide range of pollutants, including toxic chemicals, nutrients, and parameters such as dissolved oxygen and pH.

Under Section 303(d), DEQ is required to maintain a list of waterbodies that do not meet one or more of these water quality standards. Once a waterbody is included on the 303(d) List, DEQ develops a Total Maximum Daily Load (TMDL) for each pollutant. The TMDL is an estimate of the waterbody's ability to assimilate pollutants, while still meeting the designated beneficial uses. The end result of the TMDL process is an allocation of pollutant loading (i.e., allowable discharges) to various parties. Point source discharges are issued "waste load allocations" and non-point discharges (i.e., stormwater) are issued load allocations. Load allocations may be issued to a group of management agencies (e.g., Department of Agriculture) for collective implementation. TMDL loads also are reflected in the various NPDES permits (both point and non-point) that regulate discharges.

The South Umpqua River is listed on the 2002 303(d) List for several parameters within the City limits. Deer Creek is also 303(d) listed; the reasons for the listings are shown below in Table 2.3-1. A TMDL process to address these parameters has begun and the draft TMDLs are available from the Oregon Department of Environmental Quality. It is possible that additional listings could occur in the future even after the completion of these TMDLs.

TABLE 2.3-1
Roseburg 303(d) and TMDLs Regulated Waterbodies
Roseburg: SWMP

Waterbody	Parameter	Season	List Date	Draft TMDL
South Umpqua	Aq. weeds/algae	Summer	1998	Yes
South Umpqua	Chlorine	Year round	1998	Yes
South Umpqua	Cadmium	Year round	2002	Yes
South Umpqua	Arsenic	Year round	2002	Yes
South Umpqua	Temperature	Winter/summer/fall	1998, 2002	Yes
South Umpqua	Fecal coliform	Winter/spring/fall	1998	Yes
South Umpqua	Biological criteria		1998	Yes
South Umpqua	Phosphorus	Summer	1998	Yes
South Umpqua	pH	Summer/fall	1998	Yes
South Umpqua	Dissolved oxygen	Winter/spring/fall	2002	Yes
Deer Creek	Temperature	Year round	1998, 2002	Yes
Deer Creek	Fecal coliform	Year round	1998	Yes
Deer Creek	Dissolved oxygen	Year round	1998	Yes

Pollutants of Concern

As mentioned above, under section 303(d) of the CWA the South Umpqua River is designated as being impaired for temperature, pH, phosphorus, chlorine, arsenic, cadmium, dissolved oxygen, aquatic weeds or algae, and fecal coliform (i.e., bacteria) and other bacterial criteria. These listings are all for river reaches within the City limits. Urban stormwater runoff can contribute to these impairments; however the contribution can also vary by specific basin. Increased temperature is generally a result of removed riparian canopies, water/channel alterations (i.e., low flows), and dams or diversion structures that increase water residence time. However, a reduction in groundwater recharge and lower stream base flows is attributed to stormwater collection and conveyance.

Acidic or basic pH readings are generally attributed to industrial point-source discharges, algal growth, or the use of salts for de-icing. If the pH changes are linked to algal growth, then DEQ may even more closely regulate phosphorus in stormwater runoff as excess phosphorus can encourage algal growth.

Bacteria are found in urban stormwater runoff. Animal and pet wastes can contribute to high amounts of bacteria in urban stormwater. Specific water quality treatment measures (e.g., large extended wet ponds) can also increase bacteria counts by attracting wildlife. However, the larger contributing factors are typically considered failing septic systems, leaking sanitary infrastructure, and cross connections.

To date, pollutants typically associated with urban stormwater include total suspended solids, turbidity, heavy metals (e.g., lead, copper), oils and grease, and fertilizers (e.g., phosphorus, nitrogen). DEQ has "set standards" for toxics (i.e., metals, chemicals), sedimentation (i.e., total suspended solids), nutrients, and turbidity. The turbidity standard is currently being revised. Additionally, some pollutants (e.g., phosphorus) are regulated by DEQ as surrogates to address other standards. For example, there is a water quality standard for chlorophyll a, which was developed to protect aquatic life. Increased chlorophyll a is considered to be a result of increased phosphorus loading to waters that then promotes aquatic growth. Therefore DEQ will regulate phosphorus through TMDLs and discharge permits.

2.3.1.2 Endangered Species Act (ESA)

The federal ESA provides protection for plant, fish, and wildlife species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS). Because urban stormwater management has significant potential to impact the habitat for listed threatened and endangered species, several sections of the ESA provide additional context for the development of a stormwater management strategy.

Specifically, ESA Section 9 prohibits "take" of a listed species, which includes damage to habitat. NMFS recently adopted a definition of harm similar to that of USFWS which included spawning, rearing, and migrating to the list of essential behavioral patterns (64 FR 60727, November 8, 1999). The preamble to the rule states that the following activities could constitute a take:

- Operating or maintaining barriers that prevent or impede migration to or within a listed species' essential habitat;
- Discharges of pollutants into a listed species' essential habitat;
- Alteration of streamflows (such as diversion of water) that is likely to impair migration, spawning, or other essential functions;
- Conducting landuse activities and earthwork that may increase sediment loads; or

- Construction of bridges, roads, or trails along streams containing critical habitat.

Currently, there are no fish or aquatic species listed under the ESA within the South Umpqua River basin. However, there are a number of candidate and proposed species (e.g., Oregon spotted frog, sea-run Cutthroat Trout) that could eventually be protected under the ESA. Such listings could influence discharge water quality requirements.

2.3.1.3 Safe Drinking Water Act (SDWA)

The SDWA was established to protect the quality of drinking water in the U.S and is overseen by the EPA. This law focuses on all waters actually or potentially designated for drinking use, whether from above ground or underground sources. In Oregon, the program regulating the injection of surface water or contaminants into the subsurface Underground Injection Control (UIC) has been delegated to the DEQ. Stormwater injection systems (e.g, drywells) are examples of Class V UICs.

The UIC Program provisions include control of certain avenues for pollutants to enter groundwater aquifers, such as injection wells, dry wells, infiltration trenches, or other facilities which infiltrate surface water at a concentrated location to the subsurface. If municipalities opt to use Class V systems to discharge stormwater, they are required to register the Class V system with DEQ, and potentially collect water quality samples. Additionally, there are restrictions or considerations that DEQ can use for approval such as two-year travel times to drinking water wells and the potential for the drywell to receive hazardous materials or runoff.

Due to the soil characteristics in the Roseburg area, infiltration tends not to be a preferred stormwater disposal method. Consequently, meeting the SDWA requirements should not be a significant issue for the City as long as UICs are not allowed as a means of stormwater disposal.

2.3.1.4 Oregon Anti-Degradation Policy

In addition to the CWA, the State of Oregon DEQ has an administrative rule developed to eliminate the incremental degradation of water quality. This policy is termed the anti-degradation policy and is applicable to all waters. This policy not only requires that beneficial uses be met, but that existing water quality is maintained. This policy will be applied by DEQ in its review and issuance of MS4 permits. This anti-degradation policy may affect the City if regulated in the future through the NPDES MS4 permit.

2.3.1.5 Other Regulatory and Non-Regulatory Considerations

The regulatory programs previously addressed apply primarily to stormwater discharges. However, there are other components that may affect the overall stormwater management approach. These include land acquisition, other regulatory requirements (e.g., for construction), long term maintenance and Measure 37.

Certain approaches to stormwater management such as creating retention ponds within existing drainages may not be allowed without agency approvals such as Department of State Lands and U.S. Army Corps of Engineers permits for removal and/or fill of material. Retrofitting existing stormwater conveyance systems to provide water quality treatment can also be challenging due to land acquisition constraints and attempting to provide treatment within the hydraulic capacity of the system. Lastly, long-term maintenance of water quality facilities can be challenging for municipalities due to equipment and staff requirements.

Under Measure 37, which was enacted in 2004, private land owners are entitled to receive just compensation when a land use regulation is enacted after the owner or a family member became the owner of the property and if the regulation restricts the use of the property and reduces its fair market value. Although the true impact Measure 37 will have on stormwater is unknown, it is likely to result in new development and increased imperviousness for areas where zoning was not expected to change.

2.3.2 Recommended Water Quality Approach

To be proactive, the City should begin to address the quality of urban stormwater because of the draft South Umpqua River TMDLs, the state anti-degradation policy, and because in the future the City is likely to be considered a Phase II community when the population growth reaches 50,000 persons within the specified density.

The following is a recommended approach for improving the City's urban stormwater quality by potential pollutant. These recommendations complement the six minimum measures established for a stormwater management plan discussed in section 6.

Temperature
Stormwater runoff alone does not typically result in high thermal loads to water bodies. However, direct routing of runoff to surface waters does decrease groundwater recharge and base flows, which may result in higher summer temperatures. The City should consider the use of source control (minimize new impervious surfaces) as a primary option for stormwater management. Managing surface flows by matching existing hydraulic conditions will help maintain receiving water body characteristics and may aid in limiting future 303(d) listings (i.e., habitat modification).

Extended wet ponds for water quality treatment and in-line ponds for stock watering or flood control without proper shading can create high temperatures through long residence times. The SWMP process will recommend that the City not consider these options for surface water management without proper shading.

TMDLs that have been issued to date require non-point discharges to reach the shading potential, which in effect, is to plant riparian vegetation along creeks and rivers. The City should identify locations to plant vegetation and consideration should also be given to the protection of existing stream buffers.

Bacteria
The City should implement a program to identify cross connections, sanitary line leaking (near water bodies), and failing septic systems. Animal and pet wastes could be addressed through non-structural best management practices such as public education.

The SWMP will not use bacteria as a target pollutant when determining effective water quality treatment methods. As noted above, consideration should be given to any facility that may attract wildlife, especially if the facility is directly discharging into waters. If a water quality facility is identified to address other pollutants, retention facilities would also keep bacteria in stormwater from directly discharging into surface waters.

pH

As with bacteria, the SWMP will not consider this a target pollutant when identifying water quality treatment methods. It is recommended the City wait until the TMDL is finalized and identifies the cause of the pH violations.

Total Suspended Solids and Associated Pollutants

The removal of total suspended solids (TSS) is one of the most documented and tracked pollutants in stormwater treatment and many water quality facilities have completed studies to address the removal efficiency of TSS. The efficiency of TSS removal can vary significantly both seasonally and by individual facility. Removal of TSS will often result in the removal of other particulate pollutants which include a percentage of metals and phosphorus. TSS removal will not address dissolved pollutants which includes soluble phosphorus, nitrates, and metals in the dissolved state.

Regardless of the limitations, TSS is still the best parameter to compare and assess various water quality facilities. TSS should be a target pollutant for consideration in a water quality management approach. This includes water quality treatment stormwater flows as well as erosion control. For the SWMP, a land-use based, build-up/wash-off model was used to identify locations where pollution reduction facilities would best address TSS and the associated particulate pollutants (Section 5).

Nutrients

Nutrients including phosphorus and nitrogen are found in urban stormwater runoff. These nutrients are found in common fertilizers and phosphorus is often used as a cleaning agent. Typically these dissolved constituents are removed through biological uptake and filtration. The recommended approach is to use vegetated facilities where possible to provide the biological uptake. In addition, providing public information on fertilizer use, native plant selection, etc., will aid in reducing nutrient loads in stormwater.

Toxics and Turbidity

Toxics including pesticides and herbicides are found in urban stormwater runoff. These chemicals are often released as a result of agricultural practices and conversion of agricultural lands to urban development. Developing a blanket policy for treating toxics (in stormwater runoff) is challenging because the decay and treatment process varies by chemical.

The turbidity standard will likely only be addressed in regards to construction practices for sites greater than 1 acre through the state's 1200C permit program. Addressing erosion control and promoting vegetation protection especially around water courses is the recommended approach for both of these parameters.

2.3.3 Conclusions

As part of the stormwater master planning effort, stormwater quality facilities were identified and included in the improvement recommendations. Water quality treatment methods include vegetated treatment facilities and underground proprietary facilities as appropriate. These facilities will focus on the removal of TSS, phosphorus, and particulate metals. Facility types were selected based on: treatment area, pollutant load estimates, maintenance, land availability, and overall ability to meet the regulatory programs. Facility locations were identified through the system modeling and improvement recommendation process.

The City should consider implementation of non-structural practices and policies. It is likely that the City will eventually be included as a NPDES Phase II community and the South Umpqua River TMDL was finalized in the summer of 2007. Recommended policies include those similar to current Phase II and TMDL actions and are presented in detail in Section 6.

SECTION 3

Study Area Characteristics

This chapter presents the study area and basin boundaries, the general topography, the local climatic conditions, the soils and the primary drainage features.

3.1 Study Area

Roseburg lies in the foothills of the South Umpqua River in Southern Oregon. The study area includes all areas within the Urban Growth Boundary (UGB) and portions beyond that contribute to the City's storm drain system. Areas outside the UGB were evaluated only for runoff amounts that would contribute to the system. The study area is shown in Figure 1.1-1.

The study area is comprised of several drainage basins and waterways. The major waterway, the South Umpqua River, flows through the City from the south to the northwest and is the final destination for all of the City's stormwater runoff. The other major waterway is Deer Creek which flows from the high eastern peaks westwards into the Roseburg valley and ultimately into the South Umpqua River.

Smaller waterbodies in the basin include Newton Creek which flows from the northeastern peaks southwest through a large portion of the City. Newton Creek has several tributaries of its own and drains about a quarter of the City. Other smaller creeks include the tributaries to Deer Creek: Rifle Range Creek (north) and Ramp Creek (south). The last tributary is Parrot Creek which drains the most southern part of the City directly into the South Umpqua. Parrot Creek basin is quite small within the UGB, but has had many flooding issues in recent years.

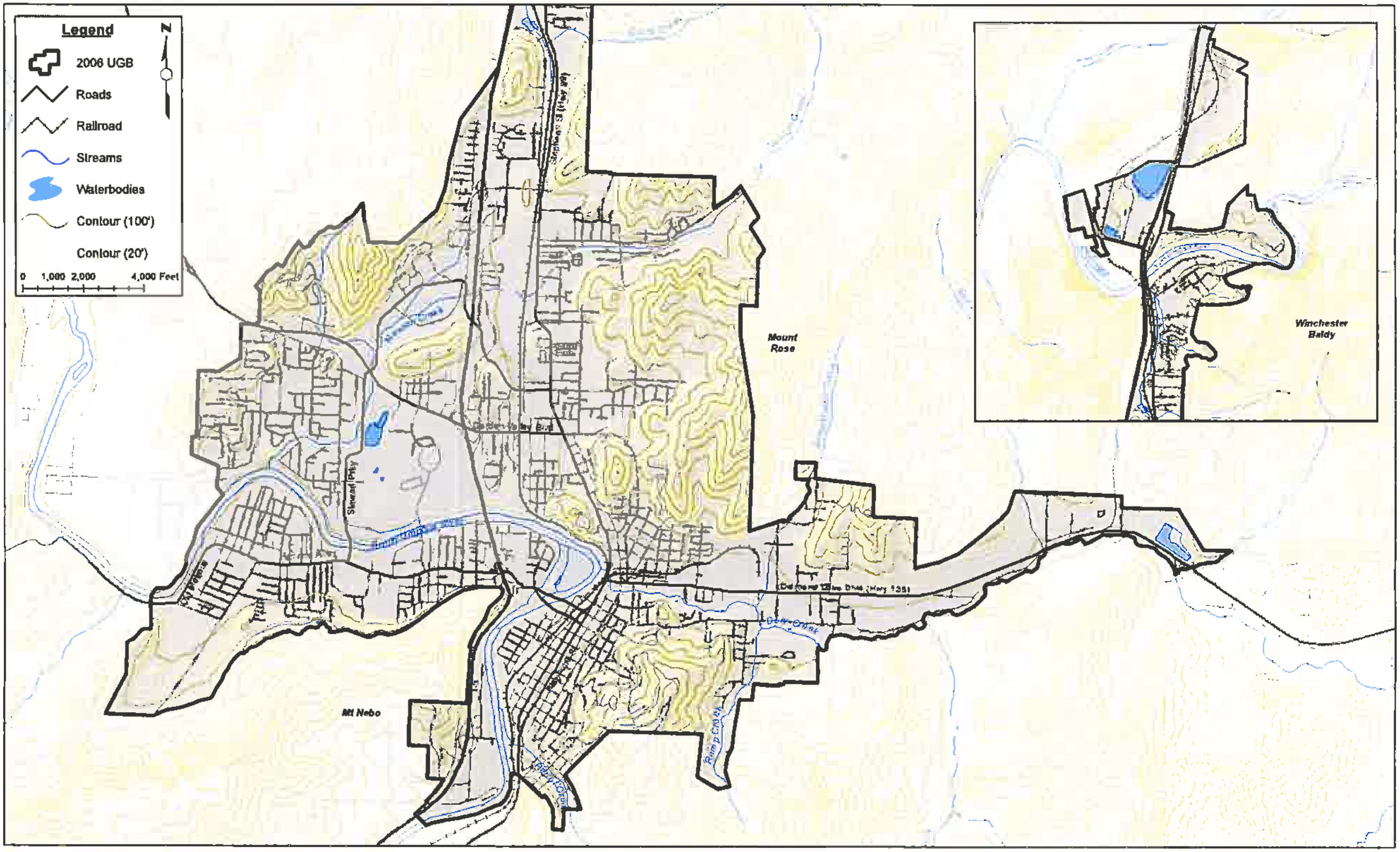
3.2 Climate

Roseburg lies in the Southwestern Interior of Oregon. This region is characterized by deep river valleys winding through the foothills of the Coast Range. The regional climate is affected by proximity to the Pacific Ocean, bringing warm, dry summers and cool, wet winters. While nearly 120 inches of precipitation can fall on the peaks of the Coastal Range, most valleys receive only a fraction of that. According to the Oregon Climate Service, the average annual precipitation in Roseburg is just over 33.5 inches per year. About 75% of this will fall during the five month period between November and March. Snowfall is rare on the valley bottoms, and generally only 4 to 5 inches will fall on the valleys, sticking for only a few days. Average temperatures range from 35 to 50°F in the winter and 55 to 85°F in the summer. (Oregon Climate Service)

Flooding in the area is generally caused by winter storm events that have been preceded by periods of prolonged rainfall. The most recent flooding event was December 31, 2005, when a relatively large precipitation event (less than 5-yr recurrence interval) followed many days of consistently wet weather. Generally the South Umpqua and Deer Creek, the major natural drainage ways through the city, have enough capacity to pass large storm events, but high flows paired with incessant rainfall can create flooding issues. Other large events in recent history include the February/March 1996 storms and the December 1964 event.

3.3 Topography

Roseburg is located in the widest valley in the Umpqua Basin, called the Hundred Valleys (Figure 3.3-1). The average elevation is 580 feet mean sea level (msl) but the local peaks are much higher, with many of them reaching to nearly 1500 feet msl. The highest points surrounding the city are located at the crest of the Parrot Creek and Newton Creek basins at roughly 1700 feet msl. Due to the varying topography, surface slopes within the UGB range from very flat (less than 1 percent) near the river to slopes greater than 1:1 in the upper basin and along the riverbank.



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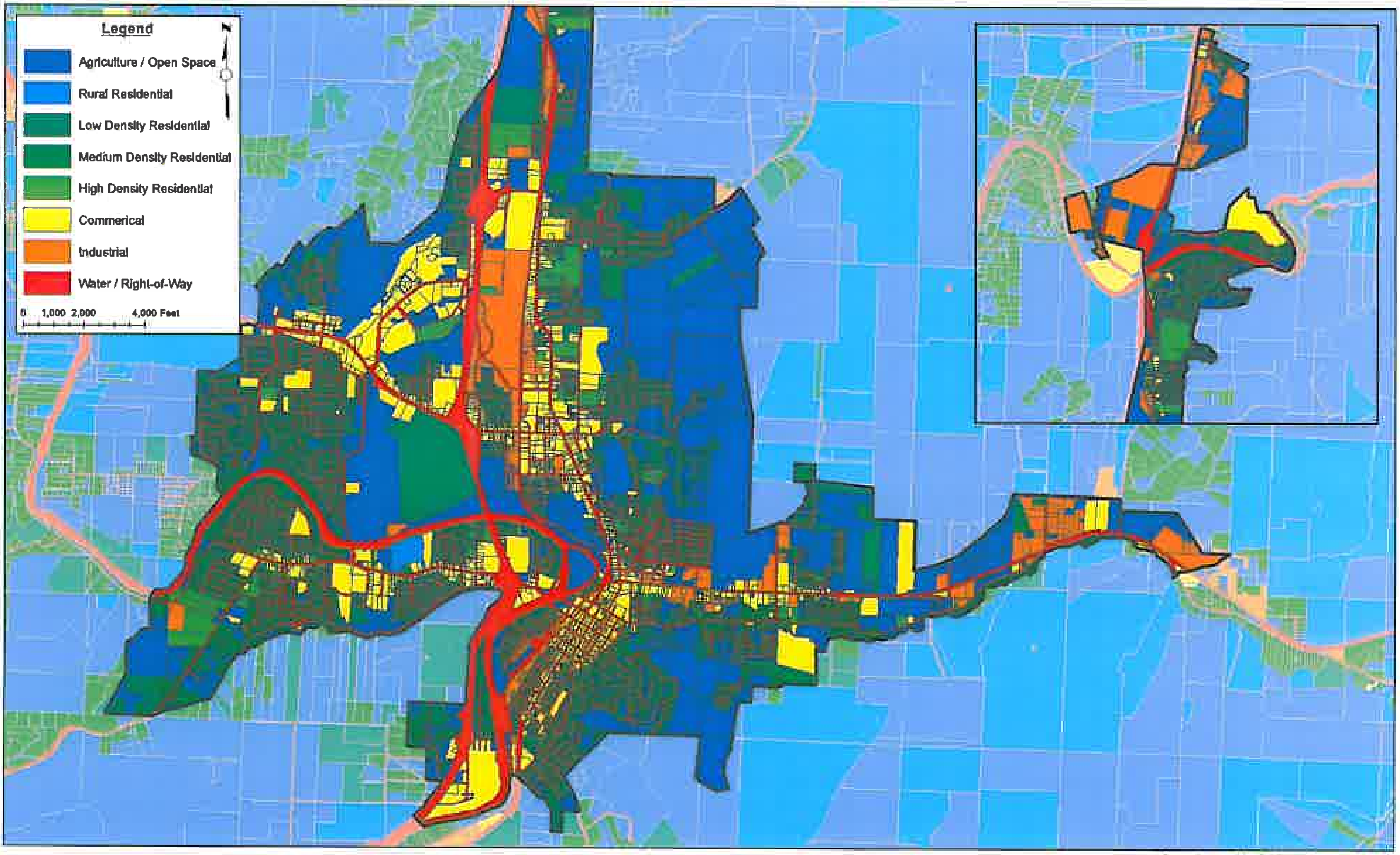
Topography
FIGURE 3.1-1
Stormwater Master Plan | City of Roseburg

3.4 Land Use

As of 2006, the City of Roseburg's Urban Growth Boundary (UGB) encompasses nearly 10,200 acres, of which approximately 3360, or 33%, is zoned as open space. Of the remaining 6,480 acres, the breakdown of landuse is distributed as follows: medium density residential (23%), transportation right-of-way (17%), commercial (12.6%), industrial (7.4%), high density and low density residential (3.2% respectively) and rural residential (0.7%). Figure 3.4-1 shows the existing land use in the City of Roseburg, and Figure 3.4-2 shows future land use in the City.

In geographic terms, the highest density areas are located in downtown and along Stephens St, Garden Valley Blvd, Diamond Lake Blvd and Stewart Prky. Conversely, the majority of the open space is located along the upper hillslopes to the east of town and in Stewart Park golf course and the adjacent VA hospital grounds.



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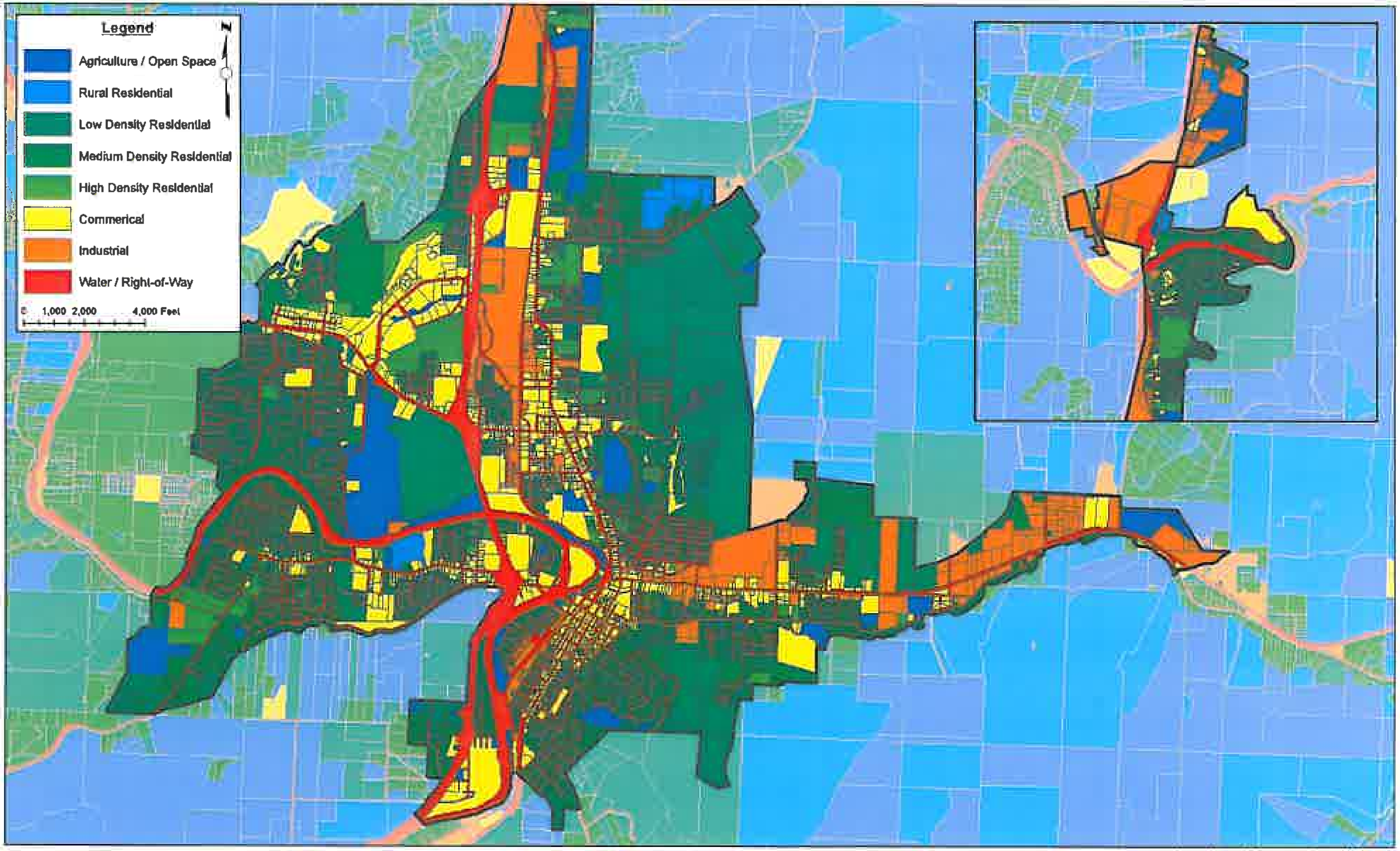
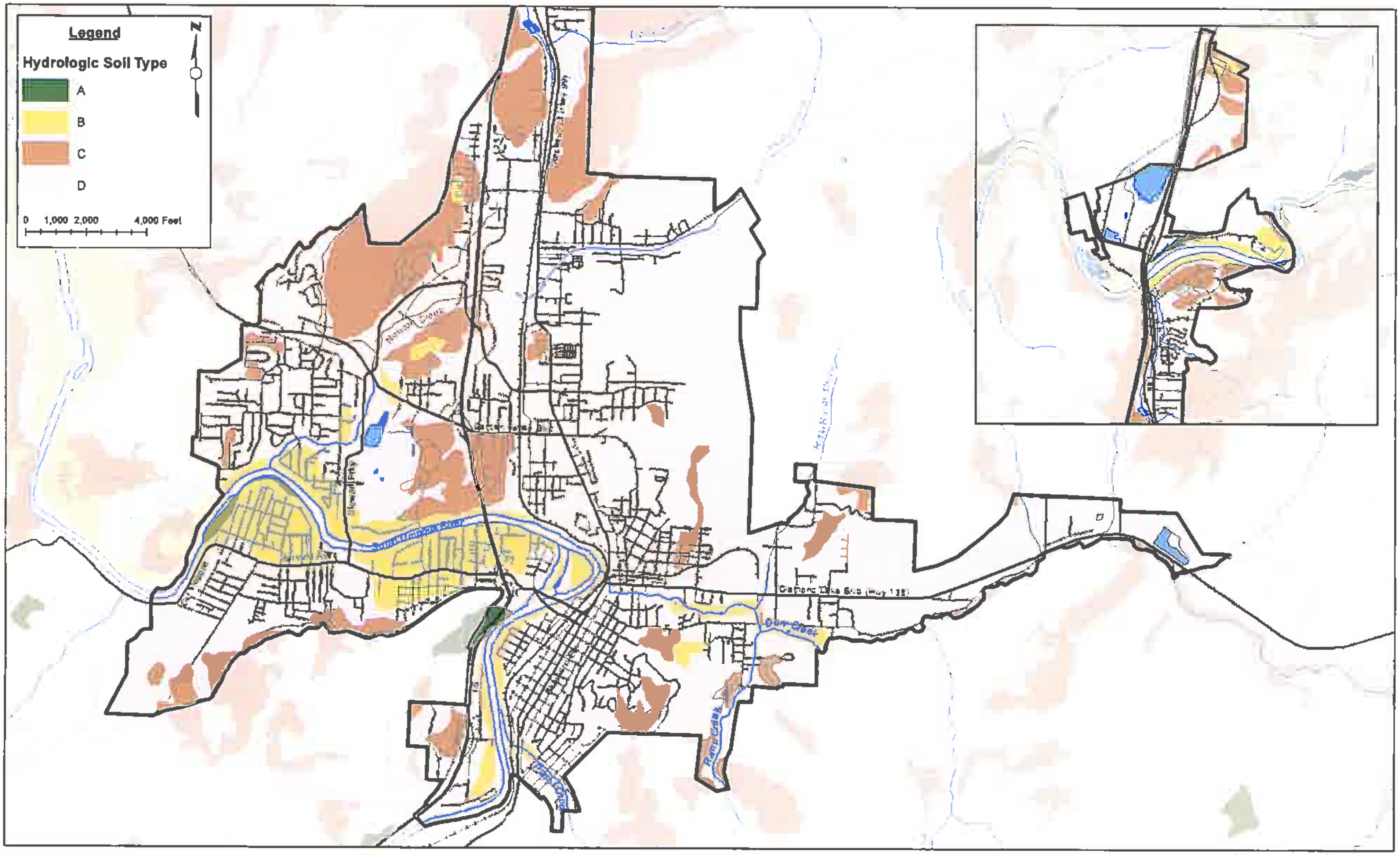
Landuse (Existing Conditions)
FIGURE 3.4-1
Stormwater Master Plan | City of Roseburg



Landuse (Future Conditions)
FIGURE 3.4-2

3.5 Soils and Geology

The primary soil type throughout Roseburg is clay. This soil is determined to have very low infiltration capabilities by the Natural Resource Conservation Service (NRCS) Soil Survey Geographic (SSURGO) for Douglas County. Hydrologically, clayey soils are labeled "type D" and have the lowest infiltration rates of any soil type. These impermeable soil types mean that much of the rain falling onto the basin will runoff instead of infiltrate. There are small patches of other soils in the valley, scattered areas of type C soil, with a slightly higher infiltration rate than type D, and many of the stream banks on both the north and south banks of the South Umpqua are a type B soil, with more infiltration capacity than the type C or D soils. See Figure 3.5-1.



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Hydrologic Soil Type

FIGURE 3.5-1

Stormwater Master Plan | City of Roseburg

3.6 Watersheds

There are 12 major drainage subbasins in the City of Roseburg (Figure 3.6-1). Upper and Lower Newton Creek and its tributary Sweetbriar Creek drain the entire northeastern portion of the City. Upper and Lower Deer Creek basin includes all the areas that drain to Deer Creek and includes the seasonal streams Rifle Range Creek to the north and Ramp Creek to the south. Parrot Creek drains the small residential area southwest of historic downtown. The downtown areas that drain directly to the river is in the Mt. Nebo Area. The Harvard Boulevard Area drains the north slopes of the Mt. Nebo ridge and areas both north and south of the river that do not enter Newton Creek. The North Channel Area drains a significant portion of Garden Valley Blvd and Stephens Street east of Interstate-5. North of the Newton Creek basin, the Davis Creek basin incorporates all areas in the Urban Growth Boundary (UGB) that drain to the North Umpqua River from the south.

A more detailed description of each drain subbasin is provided below.

3.6.1 Upper Newton Creek

The Upper Newton Creek basin is the third largest basin draining through the city at roughly 2,326 acres. Upper Newton Creek contains areas east of I-5, including a portion of the Roseburg Regional Airport. Within the city limits, the basin is almost completely built out, however very little development presently exists outside the urban growth boundary. Due to the limited development in Upper Newton Creek, most flooding issues are minor and can be attributed to developments encroachment on Newton Creek, not on the pipes and stream channel being undercapacity.

3.6.2 Lower Newton Creek

The Lower Newton Creek basin is contained entirely within the city limits and drains roughly 1236 acres of mainly commercial and residential areas. The commercial areas are primarily located along Stewart Parkway, between I-5 and Garden Valley Blvd and along Garden Valley Blvd west of I-5. The basin is almost completely built out with limited residential develop opportunities north of Garden Valley Blvd.

Two significant flooding issues are known to existing in this basin; 1) The duck pond area of Newton Creek produces severe flooding on a somewhat frequent basis across Stewart Parkway and into the surrounding residential areas; and 2) Storm drain flooding is common in the Calkins Road area due to a significantly undersized storm drain system.

3.6.3 Sweetbrier Creek

The Sweetbrier Creek basin is a northern tributary to Newton Creek and joins Newton Creek several thousand feet downstream of I-5. Sweetbrier Creek encompasses roughly 1078 acres and has developed and undeveloped areas on both sides of I-5. Within the city limits, the basin is almost completely built out, and includes a portion of the municipal airport and hospital. The upper portion of Sweetbrier Creek is presently undeveloped, however future residential development is being considered for this area. Due to the basin not being fully developed, most flooding issues are minor and can be attributed to developments encroachment on the Creek or moderately undersized culvert crossings.

3.6.4 Upper Deer Creek

With the exception of the South Umpqua River, the Upper Newton Creek basin is the largest catchment area that drains through the city at nearly 41,000 acres, of which, only 740 are located within the urban growth boundary. Very limited development exists in the basin (several industrial parcels along Diamond Lake Blvd) with most of the land zoned as agricultural. No significant flooding issues are known to exists, although Deer Creek is susceptible to minor flooding along Douglas Avenue during large events (100-year storm).

3.6.5 Lower Deer Creek

The Lower Deer Creek area is located in the central part of Roseburg and includes a majority of the downtown area. The South Umpqua River borders the basin to the west and it is bisected north-south by Deer Creek. Landuse on both sides of Deer Creek is mainly commercial, with residential higher up on the surrounding hill slopes.

Several areas within the basin are known to flood. 1) If the South Umpqua River is at or above flood stage, Deer Creek will also flood the surrounding areas. 2) The existing storm drain system along NE Jackson Street is old and undersized, resulting in street flooding during larger storm events. 3) The storm drain system along Fulton Street is known to flood the adjacent City maintenance yards.

3.6.6 North Channel Area

The North Channel area is located in the central part of Roseburg and is bounded by I-5 to the west, Upper Newton Creek to the north, Riffle Range Creek to the east and Lower Deer Creek to the south. This area contains roughly 1204 acres and is almost entirely located within the urban growth boundary. With the exception of the upper slopes on the eastern side of the basin, the area is heavily developed. Between I-5 and Stephens Street (Hwy 99), development is mainly commercial and east of Stephens Street, development is mainly residential. Flooding is not known to be severe in this basin, however where the storm drain system crosses or runs parallel to the railroad, minor flooding has been experienced.

3.6.7 Ramp Creek

The Ramp Creek basin is a tributary to Deer Creek and is the smallest drainage basin within the city. The basin, which is located east of the Mt. Nebo area and the Parrot Creek basin and encompasses approximately 755 acres, flows almost straight north to Deer Creek. Landuse in the basin is almost entirely residential, although presently much of the upper basin us undeveloped. Given the development pressures in Roseburg, this area is one of several that are experiencing the most significant levels of new residential development within the urban growth boundary.

Flooding in the Ramp Creek basin is not widespread, however the added development pressure has increased peak flows rates and erosion in the basin. Consequently, the most problematic flooding areas in the basin are where sediment has built up on culverts in lower Ramp Creek and reduced their conveyance capacity.

3.6.8 Riffle Range Creek

The Riffle Range Creek basin is a tributary to Deer Creek. The basin, which is located east of the North Channel and opposite of the Ramp Creek basin, encompasses approximately 953 acres. The creek itself, generally flows south beneath Diamond Lake Blvd before joining Deer Creek approximately 800 feet downstream of Ramp Creek confluence. Landuse in the basin is mainly open space/agricultural, however light industrial parcels are located along Diamond Lake Blvd and several pockets or low density residential also are located in the basin. Given the development pressures in Roseburg, portions of this basin are expected to experience significant growth over then next decade.

Flooding in the Riffle Range Creek basin is not significant. Minor flooding does occur at several culvert crossings, however routine maintenance by the county can probably address this issue. Although flooding is not significant today, additional development may create problems, because much of the infrastructure in the basin was not sized to manage higher peak flows.

3.6.9 Parrot Creek

The Parrot Creek basin is located east of the South Umpqua River on the south end of the City. The basin drains approximately 1711 acres, however only 145 acres are located within the urban growth boundary. Development within the city limits is primarily residential, with several acres of light industrial adjacent to the River. Outside of the city limits, development is almost entirely agricultural with several large residential lots on the upper slopes of the surrounding mountains.

Although flooding in the Parrot Creek basin is not widespread, nearly all of the street culverts between the South Umpqua River and Ichabod Lane are undersized and overtop during high flow events. The November 2005 flood actually washed out the Starmer Street culvert crossing, which has since been replaced with an open bottom box culvert with a capacity nearly 4 times its original capacity.

3.6.10 Mt. Nebo Area

The Mt. Nebo area encompasses the southern half of downtown Roseburg to the east of the river as well as the steep slopes up to Mt. Nebo to the west of the river. The basin comprises an area of approximately 761 acres, most of which is located within the urban growth boundary. Land use in the basin is mainly commercial to the east of the river and a mix of open space, right-of-way (I-5) and residential on the west side.

All areas in the basin drain to the South Umpqua River via piped storm drain systems. Originally, this part of Roseburg was served by a combined storm/sanitary system, however that was replaced with a separated system in the late 80's and early 90's. No major flooding problems are known to exist in this basin.

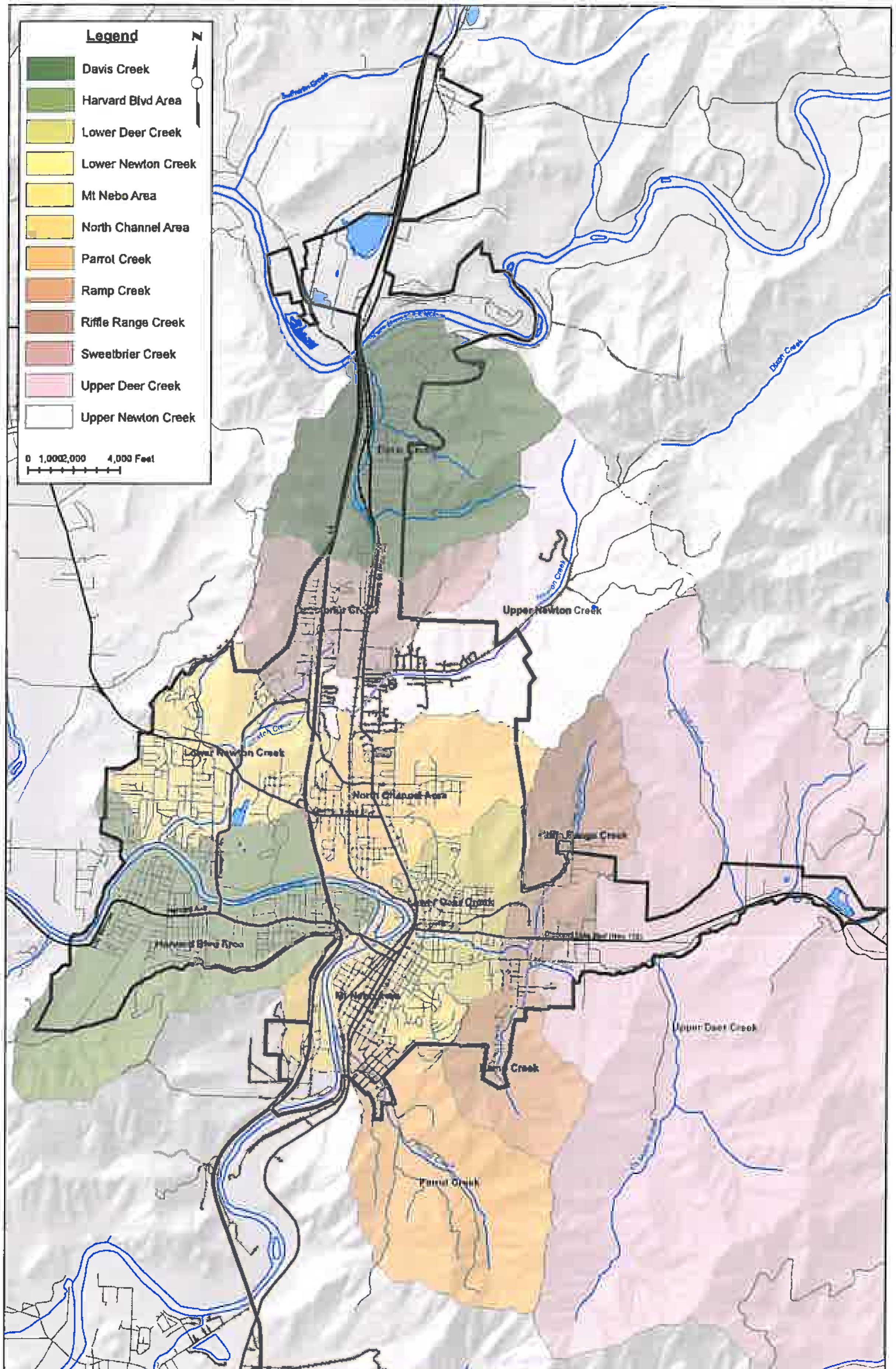
3.6.11 Harvard Ave Area

The Harvard Ave area is generally located south of the South Umpqua River and west of I-5, however a small portion of the basin is located to the North of the river. The Harvard area, which encompasses approximately 2352 acres, does not have a primary stream channel; rather all flows drain to the river via overland flow or a piped storm drain system. Landuse in the basin is primarily older residential, with some light commercial parcels along Harvard Avenue.

Flooding in this area can be significant and is generally related to four problems. 1) If the South Umpqua River is at or above flood stage, the existing stormwater outfalls will be submerged, reducing the system's capacity and potentially flooding areas via backflow. 2) The base of the hills to the south is lower than Harvard Avenue. That coupled together with several undersized storm drains leading north to the river can produce prolonged ponding and surface flooding in the basin. 3) Military Ave, which runs along the urban growth boundary on the hills to the south has very little drainage infrastructure. Consequently, the existing ditches and culverts are more likely to fail and erosion and sedimentation will continue to be a problem in the downstream storm drain system. 4). Overflows from the duck pond area adjacent to Newton Creek often flood the municipal golf course in the Harvard Basin and can even close Stewart Parkway if the event is severe enough.

3.6.12 Davis Creek

The Davis Creek basin is located in the northern portion of the urban growth boundary and encompasses approximately 2167 acres. This basin is the only drainage area within the UGB that discharges into the North Umpqua River, which occurs just east of I-5. No significant flooding issues are known to existing in this basin; however a series of private culverts and bridges along the creek may produce localized flooding if a significant amount of debris is in the channel. Other minor drainage problems in this area involve hillside erosion which may play a role in reducing the capacity of roadside ditches and cross culverts.



Major Watershed Boundaries

FIGURE 3.6-1

3.7 Storm Drain System

In terms of the actual storm drainage infrastructure, Roseburg has nearly 100 miles of storm drain pipe, hundreds of culverts, however very few detention facilities. Because much of the infrastructure was built without a comprehensive plan and without a consistent set of standards, portions of the system were not designed to meet future development and localized flooding resulted. The following assessment from the 1987 master plan is still true today: "The drainage system draining into the natural creeks and rivers is a combination of open ditches, closed conduits and major structures at road crossings. Most of it was constructed without a general view of the entire system and without a clear understanding of how each of the elements should work together, e.g. large pipes drain into smaller pipes, inadequately sized pipes serving developing areas."

3.8 Floodplains

Within the Roseburg UGB, there are FEMA-designated water bodies; the South Umpqua River, the North Umpqua River, Newton Creek and Deer Creek. Each are described below, with corresponding FEMA flood inundation maps provided in Appendix A of this report.

South Umpqua River
The 100-year floodplain boundary is generally contained within the riverbanks through the city, with the exception of at the western edge of the town along Hickory and Sharp Street and immediately downstream of I-5. This area west of I-5, in particular, is susceptible to flooding, with the FEMA 100-year floodplain extending south from the river to the base of Mt. Nebo. Due to the areas topography, flooding depths could be in excess of 5 feet during large events and would likely close Harvard Ave and the surrounding secondary streets.

North Umpqua River
Although expansive floodplains along the North Umpqua River are common, the 100-year flood is entirely contained within the main channel in the areas surrounding Winchester.

Newton Creek
Newton Creek has experienced significant flooding during events more frequent than the 100-year storm. Consequently, during a 100-year event, the floodplain boundaries are quite large. The FEMA Flood Insurance Rate Maps (FIRM) indicate the most severe flooding just upstream of I-5, along Stewart Parkway upstream of Garden Valley Boulevard and downstream of Garden Valley Boulevard, which is the worst area based on discussions with City staff. Large events would likely close Stewart Parkway and the surrounding secondary streets in this area due to backwatering.

Deer Creek
Within the city limits, the FEMA FIRM Maps indicates that severe flooding of Deer Creek would only occur near its confluence with the South Umpqua River. Large events would likely close portions of Diamond Lake Boulevard (Highway 138) and Jackson Street, however Stephens Street (Highway 99) would likely remain open.

SECTION 4

Planning, Analysis, and Improvement Design Criteria

A master planning analysis was performed for Roseburg to identify potential stormwater and water quality improvements in the City. The evaluation was guided by a set of system analysis criteria used to identify potential improvements. These criteria include quantitative assessments of storm drain surcharging and flooding, culvert overtopping, channel flooding and pollutant loading. This chapter presents the various system analysis criteria used to identify conveyance and water quality problem areas and to evaluate potential improvements.

4.1 Stormwater Modeling Criteria

Stormwater master planning was accomplished using a number of system analysis criteria. The following information summarizes the planning and design criteria, including design storms, modeling assumptions, water quality limits and other design criteria used in the master plan.

4.1.1 Design Storms

Foremost of the system analysis criteria is the design storm recurrence interval, which directly influences pipe capacity requirements, detention volumes and water quality treatment flows. Table 4.1-1 describes the four design storms used in the Roseburg Stormwater Master Plan.

TABLE 4.1-1
Design Storms
Roseburg: SWMP

Recurrence Interval (yrs)	Depth (In)	Distribution	Comments
100-yr	5.0	SCS Type 1A (24 hour)	To be used for design and analysis of infrastructure along FEMA-designated creeks and rivers
50-yr	4.5	SCS Type 1A (24 hour)	For analysis and design of major public infrastructure.
10-yr	3.5	SCS Type 1A (24 hour)	For analysis and design of minor public infrastructure.
Water Quality Storm	0.83	SCS Type 1A (24 hour)	For water quality analysis including regional water quality pond volume requirements and BMP sizing.

4.1.2 Water Quality

A water quality analysis was conducted using the XP-SWMM model (discussed in section 5) to identify potential pollutant "hot spots" within the City of Roseburg. The modeled constituents included Total Suspended Solids (TSS), Phosphorus, Lead, Copper and Zinc. Parameters including temperature, pH and bacteria were not modeled because these cannot be readily analyzed using land use-based methods. The presence of "hot spots" was identified as areas that exhibit comparatively higher pollutant loadings with respect to other areas within the city.

4.2 System Analysis Criteria

Hydraulic deficiencies are generally related to an undersized or poorly designed conveyance system; however they can also result from insufficient system storage, excessive runoff generated from highly impervious land covers or flooded backwater conditions from the major drainage ways. To identify these deficiencies, results from the hydraulic model will be incorporated into the project GIS and compared to a set of problem identification criteria, which are described below. Other problem areas will also be added to the system deficiency list if they are known flooding locations as provided by the City.

4.2.1 Known Flooding Locations

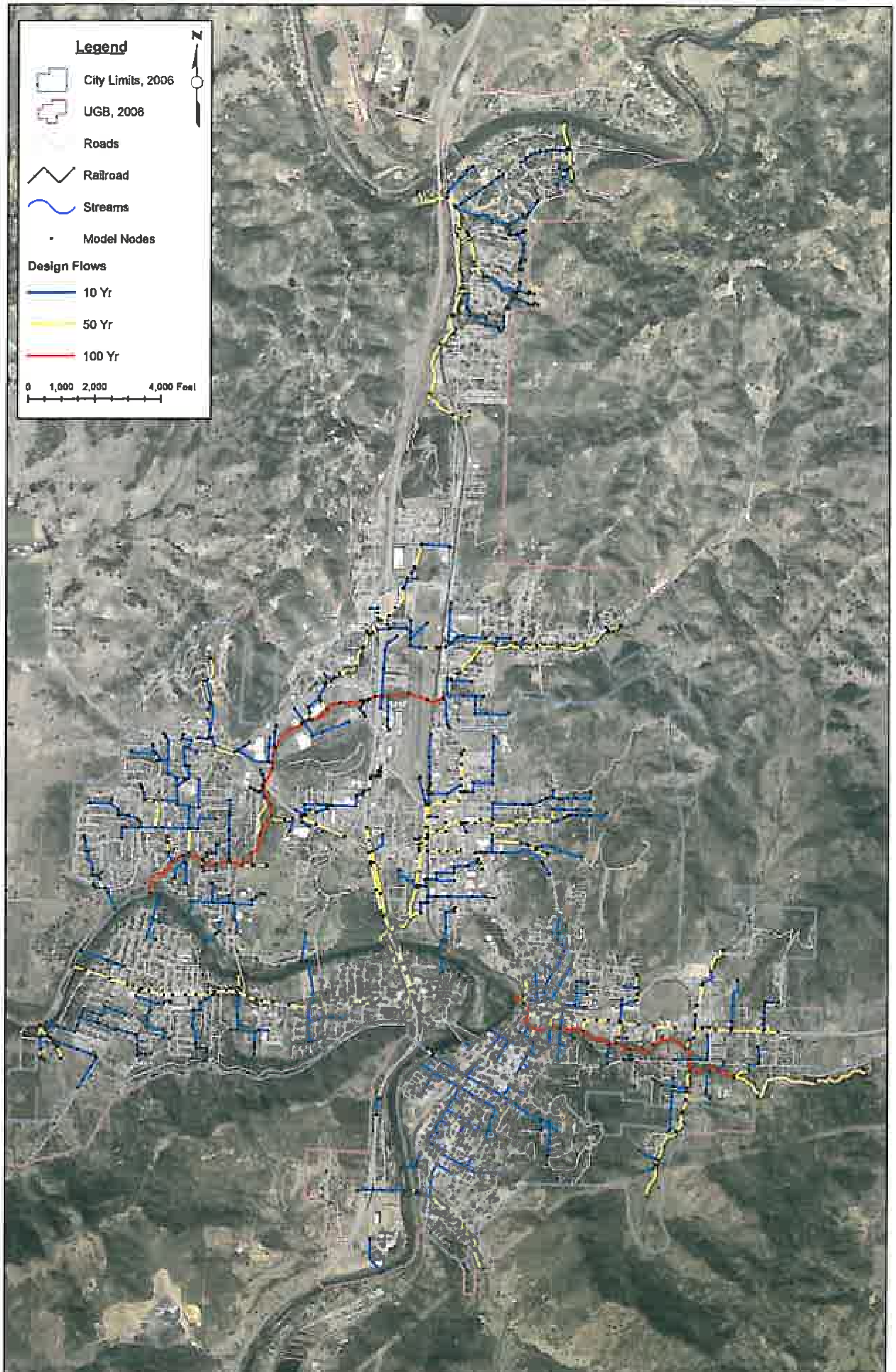
Areas within the city that experience localized flooding (e.g. undersized pipes (< 18" in diameter) or roadside ditches, clogged catch basins, etc.) will not be considered a system deficiency unless they have been identified by the City as known flooding locations.

4.2.2 Conveyance System Requirements

Depending on the type of the conveyance element being investigated, the following criteria will be used:

4.2.2.1 Storm Drains

Surcharge conditions for the piped system are acceptable only for demonstrating the adequacy of the conveyance system to convey the peak run-off for the corresponding design storms, provided that the hydraulic grade line (HGL) is 1-foot lower than the manhole rim elevation. If the HGL is over or within one foot of the manhole rim elevation, that particular section of pipe will be identified as undersized. Storm drains pipes will be evaluated to the 10-yr event for the minor drainage systems (contributing area < 250 acres) and the 50-yr event for the major drainage system (contributing area > 250 acres or along arterial streets). See Figure 4.2-1.



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System-Wide Design Flows

FIGURE 4.2-1

Stormwater Master Plan | City of Roseburg

4.2.2.2 Culverts

There are a number of locations within the city where open channel flow is conveyed through a culvert under a public roadway. Culverts at locations where the model predicts that the hydraulic grade line (HGL) will inundate the road sub-grade will be classified as undersized. The roadway sub-grade elevation will be determined by subtracting 1-foot from the roadway crown elevation as determined from the 2' contour coverage supplied by the City. Culverts will be evaluated to the 10-yr event for the minor drainage systems (contributing area < 250 acres) and the 50-yr event for the major drainage system (contributing area > 250 acres or arterial street crossings). See Figure 4.2-1.

4.2.2.3 Open Channels

Open channel conveyance elements, including the primary stream canals and ditches, will be added to the problem identification list if the corresponding design storm causes the channel to overtop its banks and flood the surrounding area. Open channel segments will also be added to the problem identification list if their average velocity is above the critical erosive threshold for the stream bed material.

4.2.3 Structure Flooding

Buildings or other structures that are within 100 feet of a flooded manhole and whose ground elevation is at or below the adjacent water surface elevation of that flooded manhole will be added to the problem identification list. Areas within the city that exhibit significant structural flooding will be considered high priority areas in terms of conveyance system improvements.

SECTION 5

Hydrologic and Hydraulic Analysis

This chapter presents the development and calibration of the XP-SWMM model used in the master plan. Included are a description of the XP-SWMM model, the data requirements, the data sources, the model setup and the model validation. The development of the water quality model is also discussed in this section. This section also characterizes the existing and future hydraulic and water quality problem areas that will be used as a baseline for the development of a stormwater CIP program.

5.1 Model Description

A critical piece of the stormwater system analysis is the selection of an appropriate set of predictive hydrologic, hydraulic and water quality models. The chosen modeling tool, XP-SWMM, which is a commercially enhanced version of the U.S. EPA SWMM model, was selected because it is capable of predicting the quantity and quality of runoff, evaluating the hydraulic performance of existing facilities (channels, pipes, culverts, etc.) designing proposed facilities and analyzing Best Management Practices (BMP) strategies designed to target runoff and pollutant reduction. Detailed tabular results and the model schematic are provided in Appendices B and C, respectively.

5.2 Model Setup and Calibration

The development of the stormwater model consisted of calculating individual input parameters in the project GIS for each subcatchment and conveyance element. Through GIS, each model parameter described below will be calculated and transferred to the SWMM model where the system analysis will be performed. The following discussion describes how each of the input parameters will be developed.

5.3 Hydrologic Parameters

5.3.1 Subcatchment Boundaries

One of the key tasks in building a hydrologic model is to allocate flows from individual subcatchments to their respective conveyance element (Figure 5.3-1). In addition, the spatial arrangement between these subcatchments in the model must represent actual ground conditions. Gridded elevation data, provided by the City as 2-foot contours, will be processed using GIS software to initially examine the topography of each catchment. For areas with significant relief, the GIS delineation will be used directly. For areas where topography alone can not accurately delineate the subcatchment boundary, aerial photos and the existing drainage network map will also be reviewed and the subcatchment boundaries will be adjusted manually.

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Model Subcatchment Map

FIGURE 5.3-1

5.3.2 Basin Width

Basin width, which represents the physical width of overland flow and essentially determines the time lag between peak precipitation and peak runoff, will be determined by dividing the length of the longest flow path by the subcatchment area. This length will be determined by measuring the distance from the upper-most point in the subcatchment, through the overland and stormwater conveyance path, to the most downstream point in the subcatchment.

5.3.3 Slope

Subcatchment slope also influences the runoff travel time and resulting hydrograph shape. Subcatchment slopes will be determined by intersecting the longest flow path noted above with the DTM data at the end points and dividing the total elevation difference by the flow length.

5.3.4 Infiltration

Infiltration is the process by which surface water percolates into the subsurface soil and groundwater column. Infiltration is an important hydrologic process because it governs groundwater recharge, soil moisture storage, and surface water runoff volume. As modeled in SWMM, infiltration is one of several processes that represent a withdrawal of a portion of total storm precipitation that could otherwise generate surface runoff. Each of the surface infiltration parameters will be calculated in GIS by co-analyzing soils, landuse (impervious area), topography and subcatchment characteristics as described below.

5.3.5 Soils

Information on soil types and characteristics within the city will be compiled and grouped from the NRCS SSURGO dataset. Using GIS, the predominant hydrologic soil type in each subcatchment will be identified. For each soil group, a set of Horton infiltration parameters including Max Infiltration Rate, Asymptotic Infiltration Rate and Decay Rate of Infiltration will be assigned (Table 5.3-1) based on literature. The Horton infiltration method will be used because parameters can be estimated from existing soil surveys without extensive field testing.

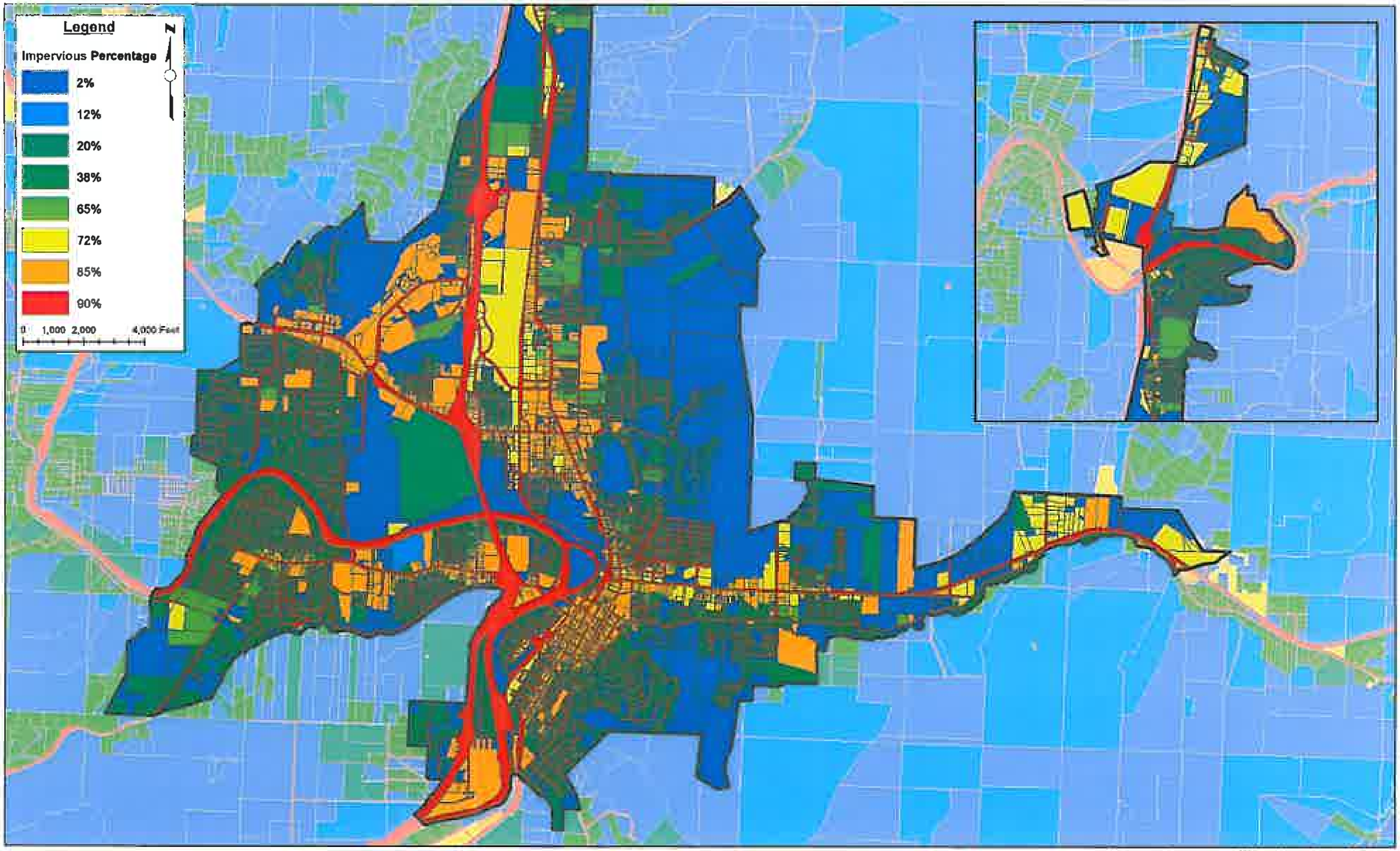
TABLE 5.3-1
Horton Infiltration Parameters
Roseburg: SWMP

NRCD Hydrologic Soil Group	Infiltration (in/hr)[1]		Decay Coefficient
	Initial	Final	
A	5.0	0.3	0.0007
B	4.5	0.224	0.0018
C	3.0	0.10	0.0018
D	3.0	0.026	0.0018

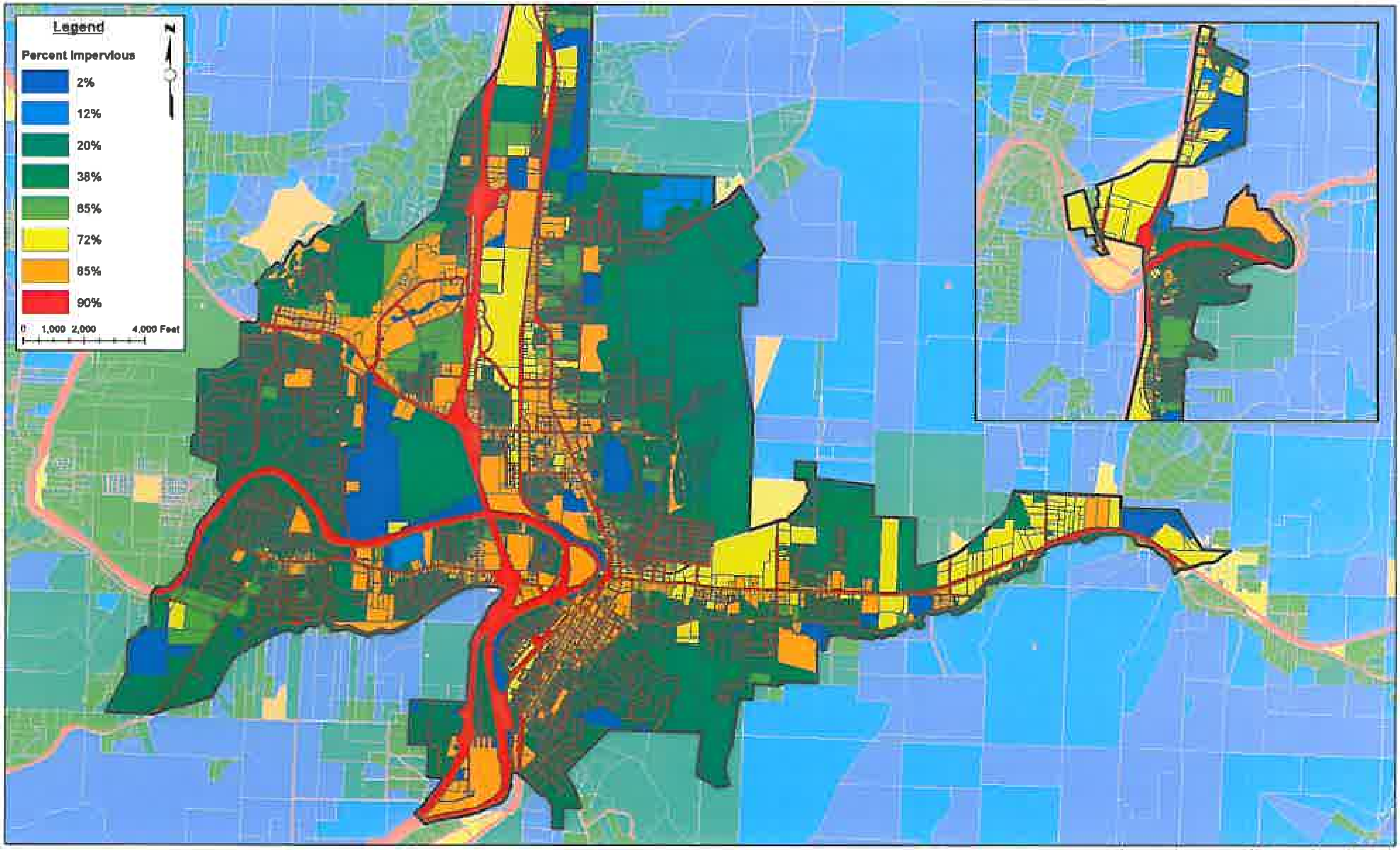
1. Handbook of Hydrology, 1992.

5.3.6 Land Use

Land use affects both the quantity (volume and peak) and quality of water being routed though the stormwater system and natural channels. The effect land use has on water quantity can be generally linked to the amount of impervious area for a particular land use category. The more impervious the area, the faster the water will be routed to the storm water collection system due to the lower surface roughness of the ground. It will also have an increase in volume since infiltration can not occur through impervious surfaces. Consequently, an area with a higher percentage of impervious surfaces will produce higher peak flows over a shorter period of time than will a similar area with a lower percentage of impervious surfaces. See Figure 5.3-2 and Figure 5.3-3 for existing and future impervious areas in the City of Roseburg.



Imperviousness (Existing Conditions)
FIGURE 5.3-2



Imperviousness (Future Conditions)

FIGURE 5.3-3

Stormwater Master Plan | City of Roseburg

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5.3.7 Other Hydrologic Parameters

In addition to the soil infiltration rates and subcatchment imperviousness, SWMM also requires surface parameters that control the amount of immediate runoff and the rate of runoff from overland areas. There are three parameters required: depression storage, zero detention and Manning's "n".

5.3.7.1 Depression Storage

Depression storage defines the amount of rain that must fall before runoff can occur in a subcatchment. These values will be assigned for pervious areas (0.1 inches) and impervious areas (0.05 inches) respectively, based on SWMM user's manual guidance.

5.3.7.2 Zero Detention

The zero detention parameter controls the amount (area) of a subcatchment that has immediate runoff, or the area that has no depression storage. Based on guidance in the XPSWMM users manual, this parameter will be uniformly set to 10%.

5.3.7.3 Manning's Roughness

Manning's roughness, or "n", is used to calculate the time it takes for precipitation to be transformed to runoff. Higher values of Manning's "n" represent rougher surfaces like grass where runoff times will be delayed. Low values represent impervious areas such as roads or parking lots and produce higher peak flows with little or no runoff delay. These values will be assigned for pervious areas (0.2) and impervious areas (0.03) respectively, based on guidance in the SWWM user's manual.

5.3.8 Existing Conditions (2006)

Existing impervious percentages for each subbasin within in the SWMM model will be established using a GIS analysis that combined the city's parcel database, the County Assessors' property classification database and the impervious percentages (by land use) listed in the SCS TR-55 manual. This process is outlined as follows:

- The county parcel maps will be joined with the Assessors' property classification database to spatially describe the existing land use within the watershed.
- The property classification categories in the Assessor's database will be refined down to seven general land use categories for stormwater modeling; Open/Agricultural (OPEN), Rural Residential (RR), Low Density Residential (LDR), Medium Density Residential (MDR), High Density Residential (HDR), Commercial (COM), Industrial (IND) and Transportation (TRANS).
- The impervious percentages for each land use category will be based on the (Allen Creek Drainage Master Plan.) The impervious percentages will be joined to the parcel dataset and intersected with the subbasin coverage to establish net impervious percentages for each subbasin.

TABLE 5.3-2
Land Use Categories and Associated Impervious Percentages
Roseburg: SWMP

Land Use Category	Assessor Property Classification[1]	Impervious Percentage (%)[2]
OPEN	400, 490, 491, 500, 540, 550, 580, 600, 640, 641, 800, 801, 940, 950, 960, 970	2
RR	501, 541, 551, 581, 941, 951, 961, 981	12
LDR	010, 100, 110, 401, 901, 910, 911	20
MDR	014, 101, 190, 191, 998	38
HDR	102, 112, 202, 700, 701, 707, 781, 917, 982, 987, 992, 997	65
COM	020, 021, 024, 025, 200, 201, 210, 290, 920, 921, 986, 996	85
IND	300, 301, 303, 931	72
TRANS	n/a (all right-of-way)	90

1. Douglas County Parcel GIS database.
2. SCS TR-55 manual.

5.3.9 Future Conditions (Comprehensive Plan, 2020)

The future conditions scenario being evaluated as part of this master plan will be represented by the City of Roseburg Comprehensive Plan. In a similar method to that outlined above, a unique impervious percentage will be assigned to each subcatchment.

5.3.10 Precipitation

Table 5.3-3 summarizes the 24-hr precipitation depths for the study area. Data was determined from the NOAA Atlas 2 Western U.S. Precipitation Frequency Maps.

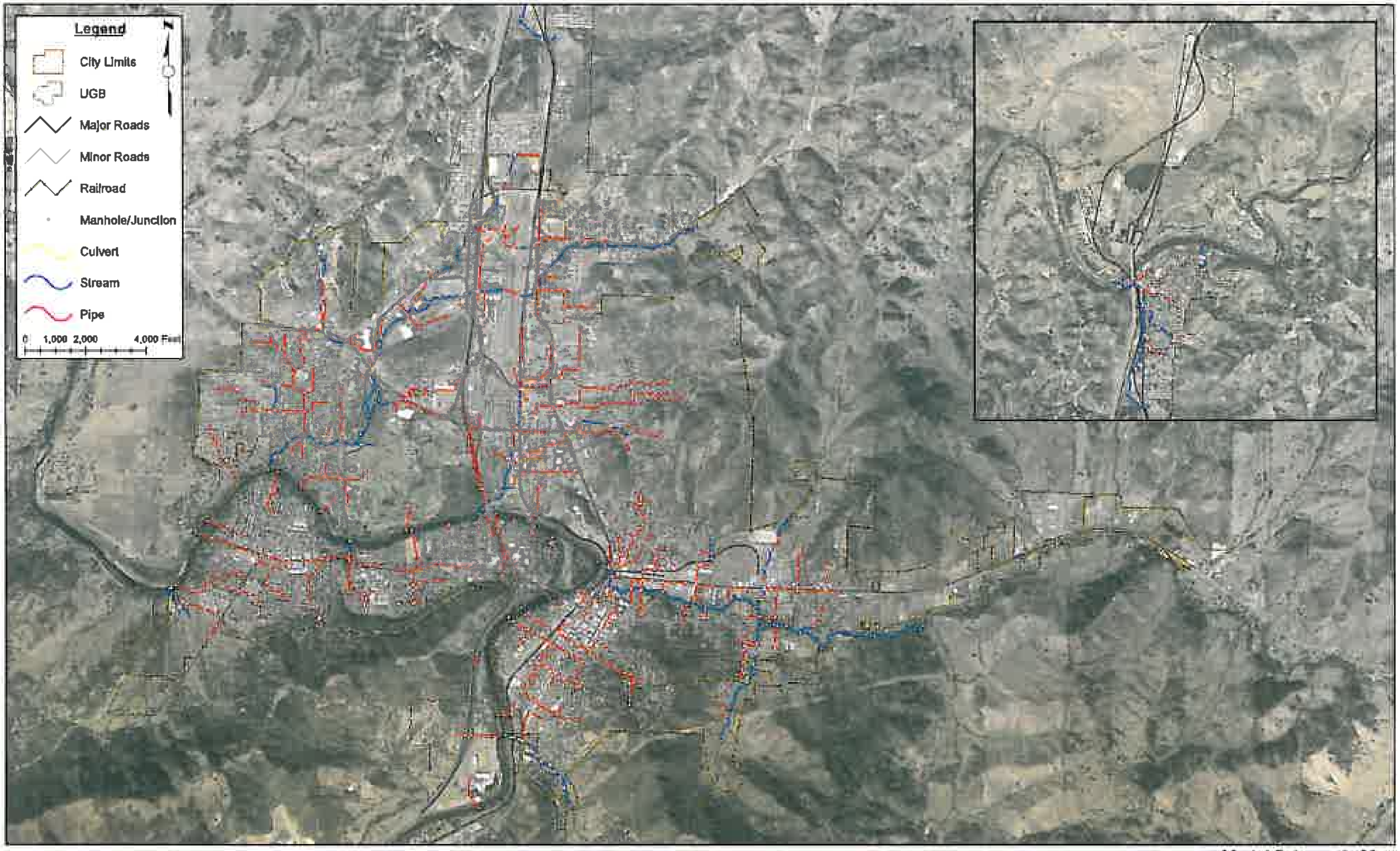
TABLE 5.3-3
Rainfall Depth-Duration-Frequency Values
Roseburg: SWMP

Return Frequency (yr)	24-Hour Precipitation (In)
10	3.5
50	4.5
100	5.0

5.4 Hydraulic Parameters

5.4.1 Storm Drain and Manhole Data

The storm drain pipe and manhole data used for model construction will be developed from two sources (Figure 5.4-1). At the planimetric level, the City's GIS storm drain and manhole data layers will be used to develop a system schematic map. Generally, pipes less than 18" in diameter will be excluded from the SWMM model in order to strike a balance between accurately representing the drainage system and model complexity. With this in hand, manhole rim and invert elevations will be established by combining the manhole depth attribute with the 2-foot resolutions contours provided by the City.



Model Schematic Map
FIGURE 5.4-1
Stormwater Master Plan | City of Roseburg

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5.4.2 Open Channels

Open channel data, including major roadside ditches and creek cross-sections will be extracted from the city's 2-foot resolution contour data. The data will be used to determine channel cross-sections as well as overall reach slopes. Roughness estimates for each open channel element will be derived from the city's high resolution aerial photograph and/or field observations. It should be noted that the stormwater model will include the major creeks for model connectivity and definition of outfall hydraulics only: 100-year flood capacities and floodplain extent will not to be analyzed in this study.

5.4.3 Roughness

Roughness characteristics for each model segment will be assigned based material and its' associated Manning's roughness coefficient, "n" according to the following table.

TABLE 5.4-1
Manning's Roughness Values
Roseburg: SWMP

ID	Description	Manning's "n"	Description
NAT	Natural Channel	Variable (0.02 - 0.07)	Field observations and aerial photography
RCP	Reinforced Concrete Pipe	0.015	Average of concrete values listed in Roseburg Design and Construction Standards
CMP	Corrugated Metal Pipe	0.024	Roseburg Design and Construction Standards
PVC	Polyvinyl Chloride Pipe	0.011	Roseburg Design and Construction Standards
BOX	Box Culvert	0.015	Same as concrete
ADS	Advanced Drainage System Pipe	0.011	Same as PVC

5.4.4 Boundary Conditions

Boundary conditions for the hydraulic analysis will be imposed at the downstream limit of the model where outfalls discharge to the South Umpqua River. These water surface elevation boundary conditions will be set to mean winter (Nov. through April) discharge for all return periods. Although flood flows in the South Umpqua River may impact the surface runoff and drainage immediately adjacent to the river, the relative elevation of the river with respect to the stormwater outfalls combined with the statistical likelihood of experiencing a 100-year flood event in the river at the same time as a 100-year rainfall event in the city make this condition appropriate.

5.4.5 Data Gaps

The following is a list of data that are not available, or have yet to be provided, for this stormwater master plan. All of the items listed below should be considered preferable data used to enhance the model results, but not critical to the overall master planning analysis and goals.

- The city's manhole database was missing invert or ground elevation measurements at a number of locations. Interpolation will be used to if this data can not be collected.

5.5 Water Quality Parameters

A second key element in the master planning process is the development of a representative water quality model for the storm drain system, that is capable of analyzing a variety of different water quality constituents, stormwater facilities, and best management practices. For these purposes, a water quality model was built to predict pollutant concentrations and loads for primary conveyance system in the City of Roseburg using a first-flush, or "water quality" design storm approach with a rainfall depth corresponding to 1/3 of the 2-year storm. The model simulation provides approximate concentrations throughout the system to identify potential pollutant "hot spots" within the basin where regional water quality improvements would be most beneficial.

5.5.1 Regulatory Background

Section 303 of the Clean Water Act (CWA) sets a process to designate beneficial uses of water and establishes water quality standards to protect these uses. Water quality standards are developed by the Oregon Department of Environmental Quality (DEQ) for a wide range of pollutants, including toxic chemicals, bacteria, and parameters such as dissolved oxygen and temperature.

Under Section 303(d), DEQ is required to maintain a list of water bodies that do not meet one or more of these water quality standards. Once a water body is included on the 303(d) List, DEQ develops a Total Maximum Daily Load (TMDL) for each pollutant. The TMDL is an estimate of the waterbodies ability to assimilate pollutants, while still meeting the designated beneficial uses. The end result of the TMDL process is an allocation of pollutant loading (i.e., allowable discharges) to various parties. Point source discharges are issued "waste load allocations" and non-point discharges (i.e., stormwater) are issued load allocations. Load allocations may be issued to a group of management agencies (e.g., Department of Agriculture) for collective implementation. TMDL loads also are reflected in the various NPDES permits (both point and non-point) that regulate discharges.

Roseburg, which is primarily located in the South Umpqua Basin, has a dissolved oxygen, temperature, bacteria, phosphorous, pH and Biological criteria draft TMDL.

5.5.2 Model Setup

The primary goal of the water quality model development and analysis was to identify areas within the basin having elevated pollutant concentrations and/or loads. The water quality model is not intended to determine numerical limits to be used in NPDES permitting activities. It is also important to note that a number of the pollutants on the Oregon Department of Environmental Quality's (DEQ) 303d list cannot be readily analyzed using standard stormwater modeling tools. For example, stream temperature is strongly related to shading and tree cover along the channel and bacteria can be influence by agricultural practices or septic tank leakage, both of which are difficult to quantify with standard modeling tools. The stormwater quality analysis modeled five water quality constituents: total suspended solids (TSS), phosphorus (P), and three metals - lead (Pb), copper (Cu) and zinc (Zn). A key reason for modeling the set of constituents listed above is their relationship to TSS. The concentration of phosphorus, lead, copper and zinc can all be estimated via potency factors, which provide a fractional estimate of the concentration of a given pollutant that is adsorbed to suspended sediments.

5.5.2.1 Stormwater Pollutants

<u>Total Suspended Solids</u>

Total Suspended Solids (TSS) represents the amount of suspended organic and inorganic matter in the runoff. It includes all sediments and other constituents that are attached to the sediments or suspended in the water column itself. TSS is also a frequently reported parameter as a surrogate for other stormwater pollutants including metals, nutrients, and various organic compounds.

<u>Phosphorus</u>

Phosphorus (P) is a relatively common element that is found fairly uniformly throughout land uses; it is widely used in fertilizer and pesticides and as a cleanser. Phosphorus is also found to occur naturally in soils and groundwater.

<u>Metals</u>

Metals such as Lead (Pb), Copper (Cu) and Zinc (Zn) are relatively common in urban storm runoff. Lead is often found in paints used on older homes; however, because of the relative sparseness of older residential land use currently in the Kelly Creek Area, lead concentration will not likely be excessive. Zinc is found on roadways due to its use as a galvanizing agent on automobiles and metal structures; it is also used in tires and oil. Copper also is a commonly used metal in electrical wires, paints, and in several automobile applications (such as brakes and wires).

5.5.2.2 Event Mean Concentration

Event mean concentrations (EMC) provide a method to model land use-based water quality constituents in XP-SWMM. For master planning, it is desirable to know specific EMC value associated with the watershed being studied. In practice, this would require significant data collection in Roseburg. Instead, because pollutants know no political boundaries, locally developed guidance could be used. EMC values were initially determined for residential, commercial, transportation, open space, and industrial land use categories by reviewing the Analysis of Oregon Urban Water Quality Monitoring Data (ACWA, 1997). To incorporate these parameters into XP-SWMM, the percentage of each land use category was determined using GIS for each individual subbasin. This breakdown, in addition to the above mentioned table, was then input into XP-SWMM and the model itself determined the corresponding net pollutant concentration for each subbasin.

5.6 Analysis Scenarios

Three analysis scenarios will be evaluated; existing conditions and future conditions.

5.6.1 Existing Conditions

The existing conditions scenario represents 2006 land use within the city limits and surrounding areas.

5.6.2 Future Conditions (within the Current UGB)

This future conditions scenario will represent the Roseburg Comprehensive Plan which forecasts landuse out to 2020. All areas outside the current UGB will remain unchanged.

5.6.3 Future Conditions (UGB Expansion)

This future conditions scenario will again represent the Roseburg Comprehensive Plan within the current UGB however the landuse changes associated with the potential UGB expansion areas will also be included in the analysis.

5.7 Model Verification

Validation of the hydrologic and hydraulic model was performed in a three tiered approach. First, peak flows were compared to regional regression equations at select locations to confirm general consistency with typical southern Oregon rainfall-runoff events. Next, the model results were compared to peak flow statistics at the Deer Creek and Parrot Creek USGS gauges to further confirm the models ability to predict peak flows. Lastly, the model results were compared to known flooding locations as an on-the-ground verification of the models ability to reproduce observed problems.

Overall, the results of this analysis confirmed the models ability to simulate the rainfall-runoff process within the Roseburg area. In terms of accuracy, comparison to regression flows and the USGS peak flow statistics produced maximum difference in peak flows of approximately 20%.

The primary limitation to this approach is data availability. That is, because continuous flow measurements (hourly) from actual storm events are not available, detailed calibration and verification can not be performed. Instead, the approach described above provides a viable and sufficiently accurate alternative for identifying the more significant stormwater conveyance problems and evaluating various alternative solutions.

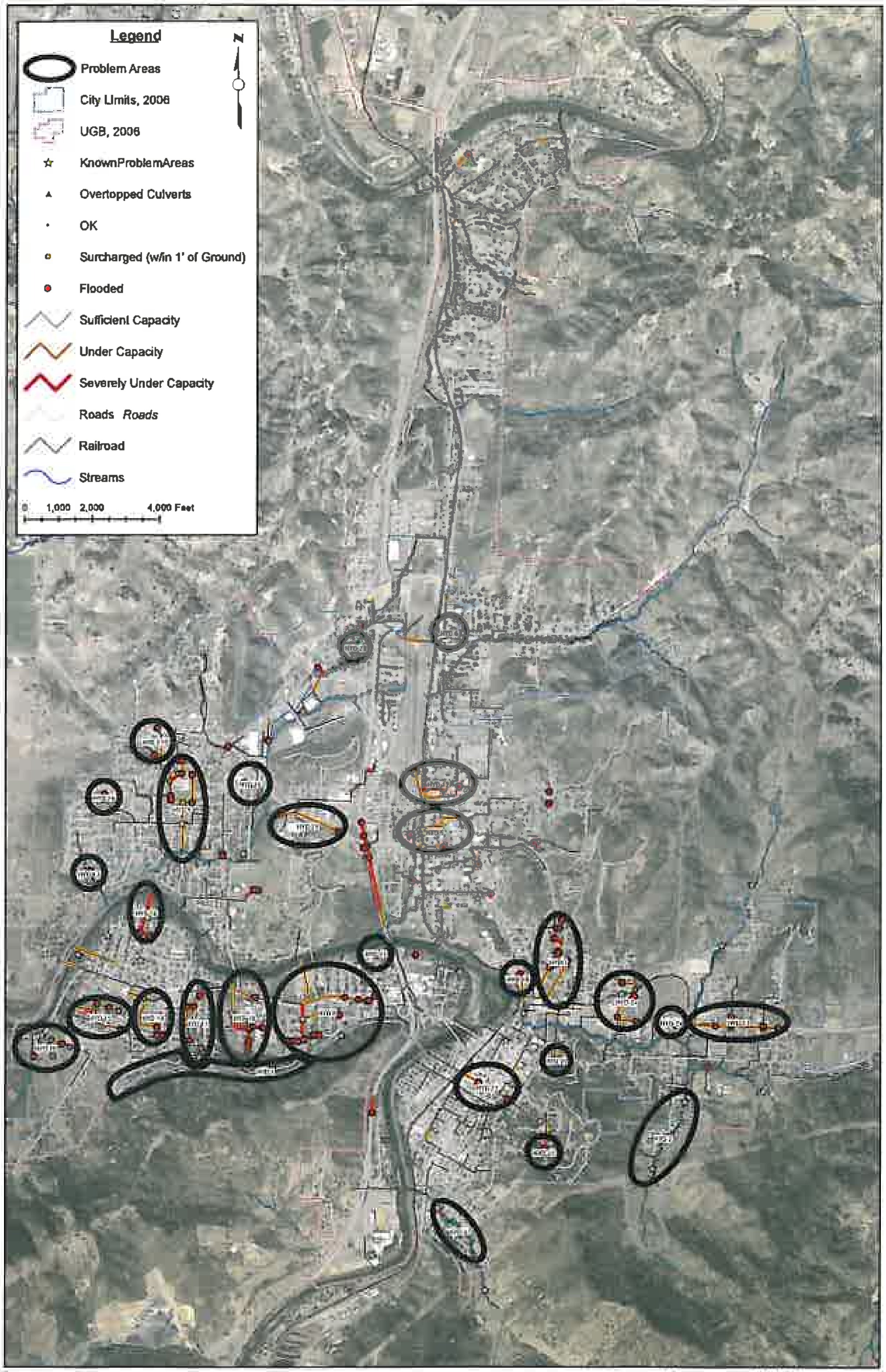
5.8 Model Results and Problem Identification Summary

Problem areas can be categorized as either water quantity or water quality related (Figure 5.8-1). Water quantity, or hydraulic, deficiencies are generally related to an undersized or poorly designed conveyance system. However, hydraulic deficiencies can also result from insufficient system storage or excessive runoff generated from highly impervious land cover. In addition to hydraulic deficiencies, areas with excessive pollutant concentrations and/or loads also can be classified as deficient from a water quality perspective.

To identify deficiencies for both categories, results from the XP-SWMM model, as well as known problem areas as indicated by City maintenance staff, were evaluated against the planning and analysis criteria, which are presented in TM 3.2. These criteria include:

- Storm Drain Surcharging
- Channel Flooding
- Culvert Crossings
- Water Quality Areas of Concern

Model results are shown in detail in Appendix C.



Summary of Problem Areas
FIGURE 5.8-1
Stormwater Master Plan | City of Roseburg

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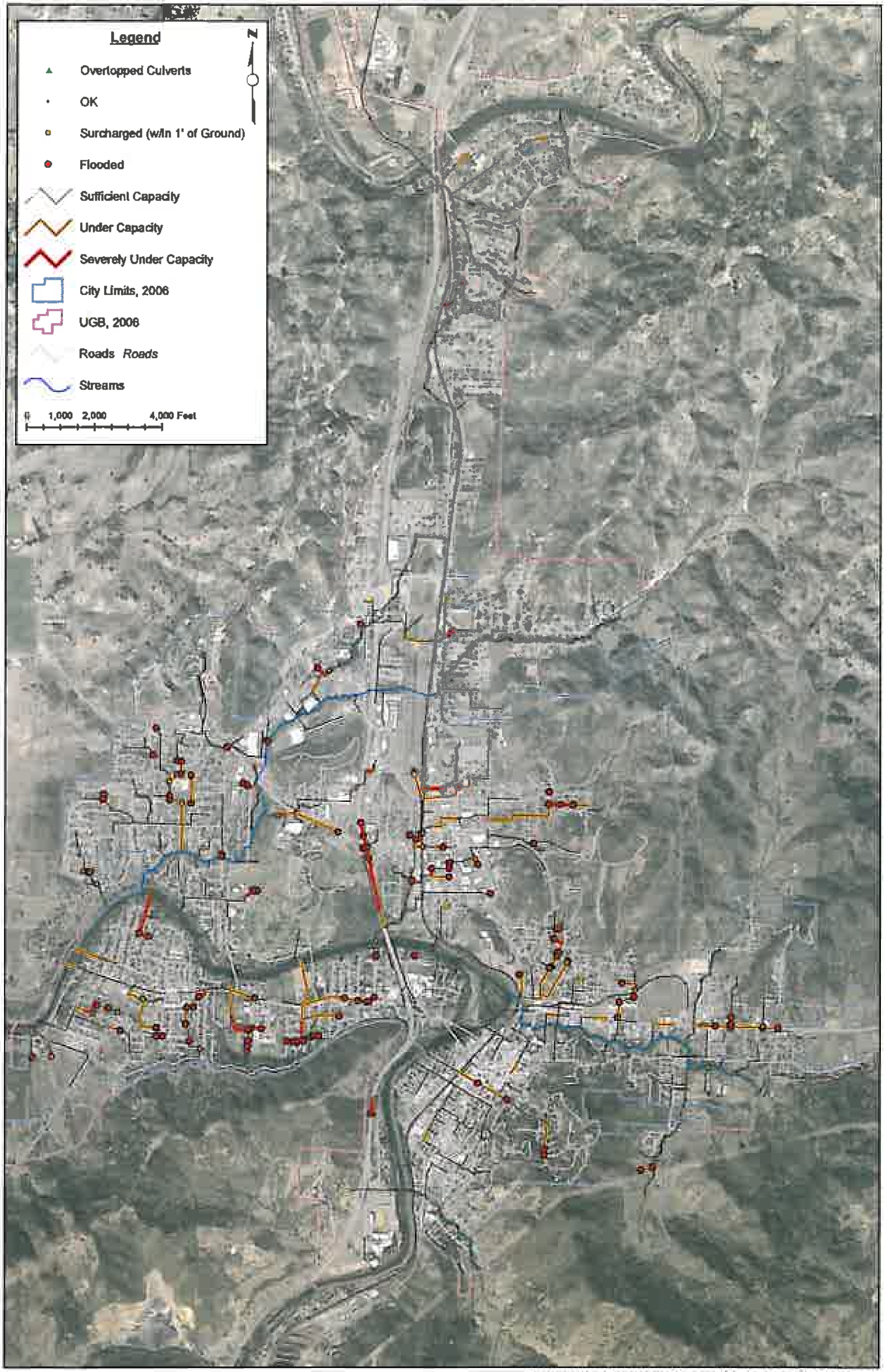
5.8.1 Hydraulic Problems

As previously mentioned, specific problem areas were identified by evaluating each system node (manhole or conveyance system junction) and link (pipe, channel, canal, etc.) using the noted hydraulic and water quality criteria. In most cases, a number of deficient nodes and links have been grouped together into a single problem area (Figure 5.8-1). For example, an undersized pipe segment may cause several upstream manholes to surcharge and flood; hence the problem area encompasses the undersized pipe as well as the flooded nodes and adjacent areas.

For the existing land use scenario, the problem areas illustrated in Figure 5.8-2 represent current system deficiencies and are unrelated to future urbanization. Based on model results and input from city staff, the top 10 problem areas within the city are as follows:

1. Newton Creek and the neighboring duck ponds east of Stewart Parkway and South of Garden Valley Boulevard.
2. The entire length of Military Drive.
3. The Ramp Creek area.
4. Fulton Street near the City's maintenance shops.
5. The existing culverts on Parrot Creek between Ichabod Street and the South Umpqua River.
6. The storm drain system at Airport Road and Garden Valley Boulevard.
7. Sweetbrier Creek at Newton Creek Road
8. Jackson and Nash Street North of Highway 138
9. Harvard Avenue between Francis Street and Interstate 5
10. Eldorado Court north to Luth Court and Moore Avenue



Hydraulic Problem Areas (Existing Conditions)
FIGURE 5.8-2

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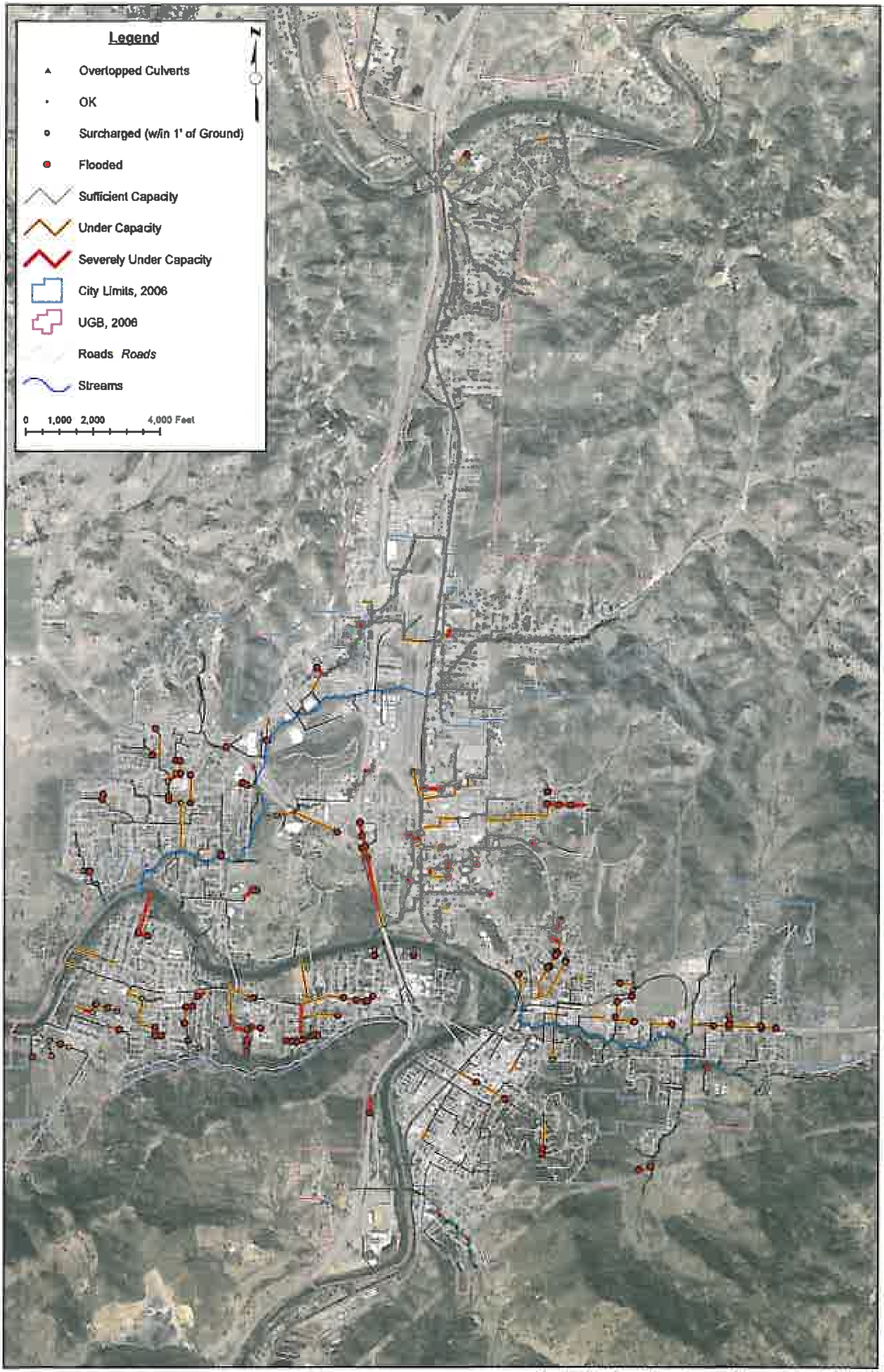
Future condition problems, as shown in Figure 5.8-3, are based on the City's zoning database, as well as several expected UGB expansion areas. Under future conditions, the additional (or expanded) problem areas represent locations where runoff from new development is likely to exceed the capacity of the existing system. Based on model results and a review of the proposed zoning maps, the top 5 areas that are predicted to be problems are as follows:

1. The Parrot Creek area
2. The Ramp Creek area
3. The Sweetbrier Creek area
4. The storm drain system at Airport Road and Garden valley Boulevard.
5. Military Drive



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Hydraulic Problem Areas (Future Conditions)

FIGURE 5.8-3

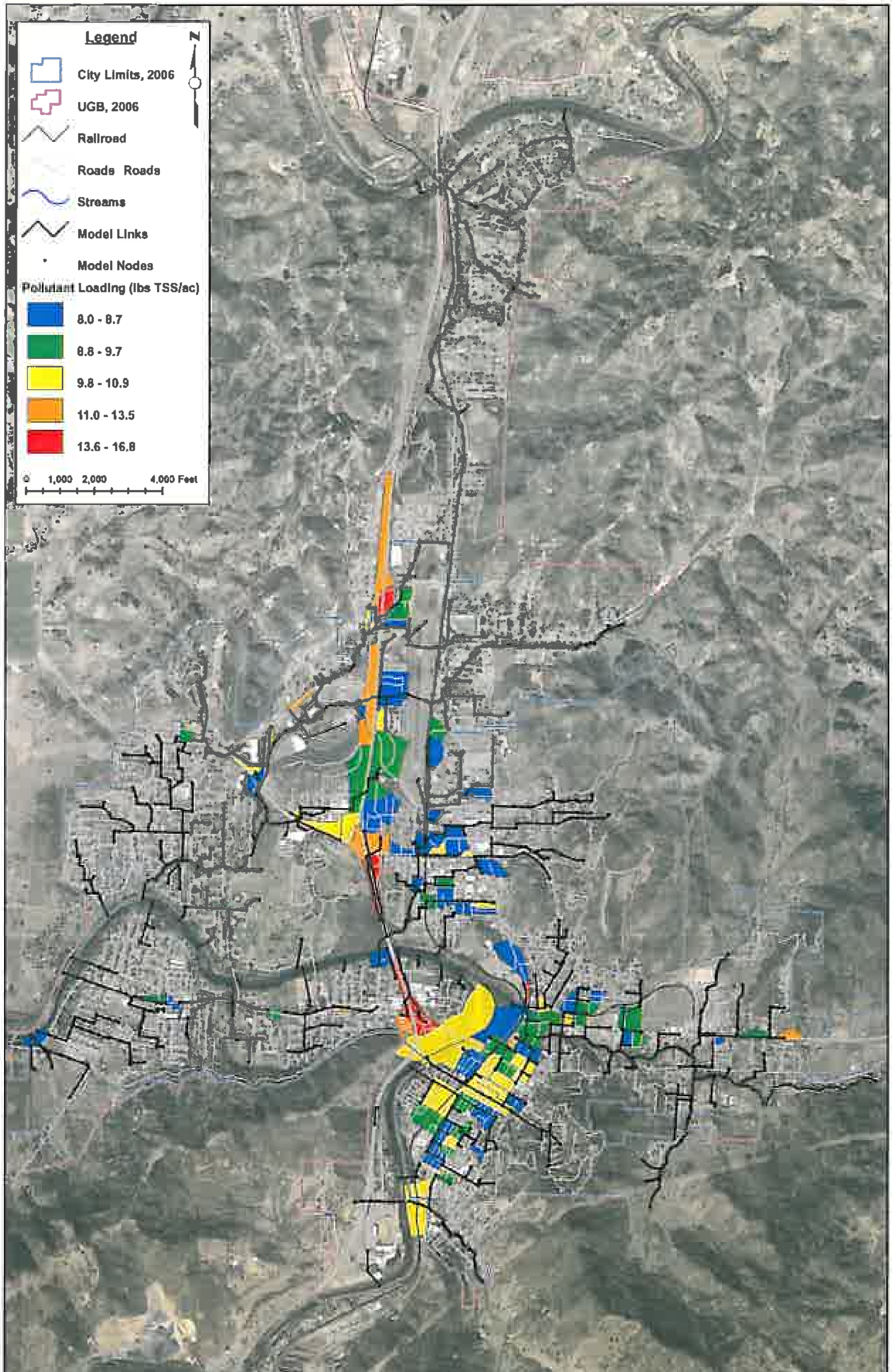
5.8.1.1 Ranking Hydraulic Problems

In order to rank the remaining problem areas with respect to one another, the predicted volume of flooding was used. The rank of each site was determined by how great the flooding volume was at each site; areas with greater flooding volumes were ranked higher (or more important) than areas with smaller flooding volumes.

The process of ranking each problem area was developed to identify the severe, major and minor problems within the City's storm drain system. This approach was necessitated due to the large number of problem locations, the anticipated high cost associated by addressing all problems and the limited budget available within the City's stormwater budget. It should be noted these problem categories do not address local drainage problems since this was outside the scope of this plan.

5.8.2 Water Quality Problems

Water quality areas of concern, shown in Figure 5.8-4, highlight those portions of the city having comparatively higher pollutant concentrations and/or loads. For example, three transportation corridors (Interstate-5, Highway 99 and Highway 138) as well as the downtown area tend to have higher pollutant loadings than anywhere else in the city and consequently represent places where BMPs can be targeted to maximize the system-wide water quality benefit.



Water Quality Areas of Concern

FIGURE 5.8-4

SECTION 6

TMDL Implementation Plan

This chapter presents a TMDL Implementation Plan to address water quality mitigation issues as detailed in the Umpqua Basin Total Maximum Daily Load (TMDL), 2006. This plan is designed to assist the City of Roseburg in reducing pollutant loading in the Umpqua River basin to help restore and protect water quality. The goal of this section is to assist the City in reducing pollution sources related to its land uses within city limits in order to prevent water quality excursions in dissolved oxygen, temperature, biological criteria, phosphorous, bacteria, and pH.

This plan also reviews the current water quality issues in the South Umpqua River and Deer Creek through the City of Roseburg and potential means to control pollutant loading. These measures are recommendations that can be implemented by the City depending on needs and funding. Some measures may already be in place as part of day-to-day operations and maintenance practices.

6.1 Condition Assessment and Problem Description

The Umpqua Basin has demonstrated water quality deficiencies in many categories considered in this plan: temperature, bacteria, dissolved oxygen, aquatic algae/weeds, pH, phosphorous, and biological criteria. Table 6-1 lists the 303(d) listed streams and the parameters exceeding Oregon water quality standards within the City of Roseburg.

The following parameters are addressed by this TMDL Implementation Plan:

- Dissolved oxygen
- Temperature
- Biological criteria
- Bacteria
- Phosphorous
- pH

TABLE 6-1
Roseburg 303(d) and TMDL Regulated Waterbodies
Roseburg: TMDL Implementation Plan

Waterbody	Parameter	Season	RM[1]	List Date [2]	TMDL[3]
South Umpqua	Aq. weeds/algae	Summer	0-15.9	1998	Yes
	Cadmium	Year round	0-15.9	2002	No
	Arsenic	Year round	0-15.9	2002	No
	Temperature	Year round	0-68.8	2004	Yes
	Fecal coliform	Summer	0-15.9	1998	Yes
	Biological criteria	Undefined	0-15.9	1998	Yes
	Phosphorus	Summer	0-15.9	1998	Yes
	pH	Year round	0-15.9	2004	Yes
	Dissolved oxygen	Year round	0-68.8	2004	Yes
Deer Creek	Temperature	Year round	0-9.6	1998, 2002	Yes
	Fecal coliform	Year round	0-9.6	1998	Yes
	E. Coli	Fall/winter/summer	0-9.6	2004	Yes
	Dissolved oxygen	Year round	0-9.6	1998	Yes

[1] RM = River miles

[2] 303(d) list date

[3] TMDLs approved April 2007

6.1.1 Beneficial Uses

Water quality standards are designed to protect the most sensitive of the beneficial uses of a water body. The beneficial uses occurring in the South Umpqua River within City limits include:

- Public domestic water supply
- Private domestic water supply
- Industrial water supply
- Irrigation
- Livestock watering
- Boating
- Hydropower
- Aesthetic quality
- Salmonid fish spawning
- Salmonid fish rearing
- Resident fish and aquatic life
- Anadromous fish passage
- Wildlife and hunting
- Fishing

- Water contact recreation
- Commercial navigation and transportation

6.1.2 Existing Sources of Water Pollution

There are many possible sources of water pollution, "point" sources such as temperature from wastewater treatment plants and "nonpoint" sources such as nutrient loadings from neighborhood landscaping chemicals. Both point and nonpoint pollution sources can be difficult to curtail and in some cases even difficult to identify. The following paragraphs describe some of the existing sources of water pollution in the City of Roseburg.

Temperature is greatly influenced by anthropogenic activities near the water body. While some human activities can help reduce stream temperatures (reservoir releases, riparian area replanting) most activities contribute to warming trends through direct or indirect action. The five most prevalent human effects are:

1. Disturbance of riparian vegetation, especially removal and thinning as these reduce stream shading, thereby increasing exposure to the sun,
2. Channel widening (increased width-to-depth ratio) is often caused by loss of riparian vegetation, this puts more stream surface in contact with solar radiation,
3. Increased withdrawals from and high temperature discharges to the water body, or
4. Reduction in groundwater recharge due to disconnected floodplains.

The most likely sources of dissolved oxygen depletion and nutrients (specifically phosphorous) in the Umpqua Basin within the City of Roseburg are:

- Wastewater treatment plants and sanitary sewer systems
- Discharges from permitted sites other than publicly owned treatment works (POTWs)
- Urban runoff
- Rural runoff including septic systems
- Instream and near-stream erosion caused by human activity contributes sediment-bound nutrients

There are many possible sources of bacteria in the Umpqua Basin; the following list contains some of the most probable sources within the City of Roseburg:

- Wastewater treatment plants and sanitary sewer systems
- Cross connections between sanitary and storm sewers
- Discharges from permitted sites other than wastewater treatment plants
- Direct deposition from pets, livestock, and wildlife
- Illegal dumping, especially of human waste
- Urban runoff

- Rural runoff including septic systems

As with the other pollutants, there are many possible sources for increased pH within the Umpqua Basin:

- Imbalances in dissolved oxygen and biochemical oxygen demand
- Phosphorus loading
- Discharges from permitted sites other than wastewater treatment plants
- Illegal dumping or discharges
- Urban or rural runoff

The two final TMDLs, for aquatic weeds and algae and biological criteria, are dependent upon meeting water quality goals outlined above. Aquatic weeds and algae growth result from high nutrient loading and warm, stagnant water. Controlling phosphorus is essential to controlling algal growth, which in turn contributes to dissolved oxygen and pH issues. Biological criteria, or biocriteria, are a measure of the health of a waterbody "to support aquatic species without detrimental changes in the resident biological communities" (OAR 340-041-0011). There are currently no numeric criteria for this TMDL and biological criteria should improve as stream water quality conditions improve through implementation of the remaining TMDLs.

6.2 Goals and Objectives

The overall goal of this TMDL Implementation Plan is to outline strategies to meet water quality standards for each of the 303(d) listed water bodies in the City of Roseburg. Specifically, this TMDL Implementation Plan is a guide for the City to select the programs and measures to be implemented within the City's jurisdiction that best protect water quality in the Umpqua Basin from the following pollutants:

- Dissolved oxygen
- Temperature
- Bacteria
- Phosphorous
- pH

Successful implementation of these TMDLs will improve the final two TMDLs parameters, which do not have numerical goals:

- Biological criteria
- Aquatic weeds and algae

6.3 Proposed Management Strategies

The expectation of this TMDL Implementation Plan is to propose Best Management Practices (BMPs) to meet load allocations for 303(d) listed water bodies in the City of Roseburg. (This discussion is organized by BMP category; to see BMPs for each pollutant, please see the Implementation Matrices at the end of the section.) The following BMPs address the primary pollutants of concern listed above:

- Public education and outreach - Develop and distribute educational materials and conduct public outreach workshops aimed at informing citizens about the impacts of activity in riparian zones and the importance of storm water in stream health.
- Public involvement and participation - Involve the public in developing and implementing the stormwater management program.
- Illicit discharge detection and elimination - Adopt an ordinance to develop and implement a program for detecting and eliminating illicit discharges to the storm drain system. This includes storm system mapping, dry weather sampling, TV pipe inspections, and citizen information activities.
- Construction site storm water runoff control - Management of this program has been returned to Oregon ODEQ for construction sites one acre or greater. For smaller sites, the City will investigate adding an erosion control checklist to their building permit package. Currently all construction inspection is performed by the county so an agreement would be necessary to coordinate this management strategy.
- Post-construction storm water management - Develop, implement, and enforce a program and standards to control the discharge of polluted runoff from new development and redeveloped sites. This can include structural treatment and detention systems as well as resource protection measures (wetland protection, habitat protection, etc.) and pollution prevention planning. This program will be supported by new construction design guidelines that incorporate stream offsets to preserve riparian areas which also may abate stream temperature increases.
- Pollution prevention in municipal operations - Develop, implement, and enforce a program to control the discharge of polluted runoff from municipal operations (road maintenance, vegetation management, storm drain maintenance, etc.).

A matrix of proposed management strategies is included in appendix D.

6.3.1 TMDL Implementation Plan Component Summaries

The TMDL proposed management strategies are detailed below. Some of the activities are continuations of existing City programs; others are new activities that will be needed to meet the future NPDES requirements. Many of them can be conducted regionally with other jurisdictions.

6.3.1.1 Public Education and Outreach

Both workshops and publications are beneficial forums for exposing the public to water quality protection information. The City of Roseburg will collaborate with other local agencies such as watershed councils, home builders associations, environmental groups, and the City's public works, community planning, and parks and recreation departments to conduct workshops educating streamside landowners about simple practices that improve water quality including:

- Managing and maintaining roads to reduce water quality impacts
- Managing riparian areas for water quality and wildlife habitat
- Water conservation
- Stream-friendly home site development
- Landscaping with native plants
- Septic system maintenance

Publications that could be prepared by the City include fact sheets and brochures that provide information to residential landowners, builders, and real estate agents regarding existing ordinances and permits as well as BMPs including the basic message that dumping anything in a storm drain is illegal as they drain to streams and not sewers. These publications would be similar to workshop topics and would be available online, in the city library, by mail to streamside landowners, realtors, and home builders groups. They could also be distributed in the city planning office and provided to real estate agency offices.

6.3.2 Public Involvement and Participation

Roseburg will investigate participation in a regional water quality public involvement and participation program with other stakeholders in the Umpqua Basin. The program would be a combination of regional efforts and activities at the local level. The following activities could be included:

- Public Review/Public Meetings – The City would work with other stakeholders to investigate ways to encourage the involvement of the public in water quality preservation or remediation activities. Interested individuals or groups could assist the City by performing restoration projects within the riparian zones and other sensitive areas, for example blackberry removal and native tree planting.
- Distribute News Releases – The distribution of news releases will be provided when the local press is available and interested in water quality topics. Opportunities would depend on the news agencies' interest in water quality activities.

6.3.3 Illicit Discharge Detection and Elimination

Development of a formal illicit discharge detection and elimination program for the City will be investigated. Currently the Roseburg Fire Department is haz-mat trained and handles all spills for Douglas County. The following elements of the program are outlined in the Stormwater Management Program (appended to the 2008 Stormwater Master Plan):

- Storm Sewer/Sanitary Sewer System Maps – Create maps of current infrastructure to assist local municipal and emergency agencies in spill prevention during maintenance and emergency activities, include water bodies and their 303(d) status.
- Ordinance to Prohibit Non-Stormwater Discharges – The existing ordinances will be revised as needed to comply with NPDES Phase II and local TMDLs.

- Detect and Address Non-Stormwater Discharges – An Illicit Discharge Plan will be prepared, with procedures for inspection and detection of illicit discharges: The following components will be included in the plan:

    1. Develop database of assessment information and complaint responses
    2. Identification of priority areas for assessment
    3. Field assessment activities
    4. Routine schedule for system inspection
    5. Characterization of any discharges found
    6. Procedures to trace an illicit discharge
    7. Procedures to remove an illicit discharge

- Conduct Field Inspections – The Illicit Discharge Plan will provide a schedule and reporting procedures for inspections. At a minimum each outfall will be inspected on a three-year rotation. Appropriate actions will be taken to determine the source of any illicit discharges found during the inspections.
- Spill Response Plan – The City would create a spill response plan that coordinates alerting the Oregon Emergency Network and efforts to protect water quality.
- Plan for Enforcement Actions – Enforcement action will be documented, and all records will be reported annually to the DEQ as a measure of progress on this initiative.
- Train Municipal Staff on Spill and Illicit Discharge BMPs – City of Roseburg fire department staff are trained in the proper BMPs to use for spill response and illicit discharge detection and removal through their hazardous materials program. Refresher training will update staff on changes to the procedures as needed.

6.3.4 Construction Site Stormwater Runoff Control

Erosion control permitting and inspection responsibilities have been granted to Oregon ODEQ under the NPDES 1200 process for all sites larger than one acre. For this reason, the City will no longer require erosion control plans to be submitted with construction documentation. Applicants must present proof the permit was acquired before beginning construction activities on sites larger than one acre.

For sites less than one acre, the City will investigate adding an erosion control checklist to their building permit package. This checklist could be combined with a brochure on erosion and sediment control methods to illustrate basic BMPs use. Currently developers submit their plans to the City for a land use compliance verification and if the documentation is in order, the City approves the plans and the developer can submit them to the County. In 2007, the City began contracting with the County for building permit services. In accordance with this agreement, the County performs all construction inspection so a modification would be necessary to coordinate this management strategy. The existing land use ordinance would need to be modified to require the use of the checklist, a 2-year process. The City will investigate coordination activities with the County to have sites less than one acre inspected for erosion and sediment control.

6.3.5 Post-Construction Stormwater Management

Design standards for the City of Roseburg are currently being updated, and preservation of habitat and water quality are addressed within the new standards. Additionally, ensuring long-term maintenance, operation, and enforcement of the new ordinances will be included in the design standards. In addition to developing design standards, the City will also consider the following activities: revising the existing setback ordinance, investigating developed areas that drain to streams instead of the City storm drains, and investigating a stormwater rate reduction incentive for landowners to reduce their contribution to stormwater flows.

An additional measure the City may consider is revisiting the current "setback ordinance" that requires developers and landowners to maintain a "buffer" or "setback" from the water body in order to maintain thickly vegetated riparian zones. These zones provide shade, which is most likely the largest factor increasing stream temperature in the City of Roseburg. Currently the setback for residential zones adjacent to the South Umpqua is 50 feet from top of bank and 25 feet from top of bank for Deer Creek. The setback for commercial zones is 50 feet from top of bank for both the South Umpqua and Deer Creek.

The City will investigate the following activities and determine if these actions will continue to be allowed under the current setback ordinance:

- Non-native vegetation may be removed and replaced with native plant species, subject to a landscape plan approved by the Oregon Department of Fish and Wildlife (ODFW)
- Vegetation may be removed if necessary for the development of water-related or water-dependent uses, subject to a landscape plan approved by ODFW and Oregon Department of State Lands
- Vegetation may be removed for forestry activities that have been granted a permit under the Forest Practices Act

It is recommended that inspections be performed in order to discover and address violations of the ordinance. The City will investigate revising the setback ordinance if necessary to proactively protect water quality.

Some developed areas within City limits do not drain to the City storm drain system. The City of Roseburg has previously allowed some small mixed-use areas to convey stormwater flows to adjacent creeks instead of the City storm drain system. These areas are exempt from stormwater utility fees. The City will investigate stormwater treatment in these areas to determine if they are providing any water quality or quantity treatment.

The City will consider creating an incentive program to encourage landowners to manage some stormwater onsite. Due to the clayey local soils and steep hillsides, this decision will require careful consideration as landowners will have few options for stormwater management.

6.3.6 Pollution Prevention in Municipal Operations

Most City operations already meet NPDES pollution-prevention requirements, but the City will develop a formal operations and maintenance (O&M) plan to document existing activities, with minor modifications to reduce pollutants. This plan will also reduce non-point discharges into local water bodies. The stormwater management program outlines the following activities:

- Operation and Maintenance Plan – The City of Roseburg will review existing public works O&M activities and document the activities in a plan that will include the following:

    1. Descriptions of required maintenance activities and procedures,
    2. Identification of the departments and personnel responsible for each activity,
    3. A schedule of activities, including maintenance, inspections and reports, and
    4. Rules for the use of herbicides and pesticide by the Public Works Department.

- Park and Open Space Maintenance – The Public Works Department Parks Division will work to implement BMPs such as reducing and monitoring fertilizer, herbicide and pesticide application (with the ultimate goal of eliminating their use); vegetation maintenance and disposal; and trash management.

- Vehicle and Equipment Washing – Roseburg will implement vehicle and equipment washing practices as outlined in the O&M Plan. All publicly owned vehicles are washed in a self-contained covered building or a designated wash area. The City constructed a vehicle and equipment washing facility during 2005 and a public safety facility for washing fire and police vehicles will be completed in 2009.

- New Construction and Land Disturbances – Roseburg currently requires that BMPs be followed for public construction projects. This practice will continue once the O&M Plan is developed. Public construction projects will be required to follow the same requirements and procedures as private development.

- Dust Control Practices – Erosion control and dust control are currently required for all public construction projects as part of the bid documents and specifications.

- Stormwater System Maintenance – Roseburg will continue its existing stormwater system maintenance schedule, which includes the following:

    1. Storm line cleaning – 5-year rotation,
    2. Culverts – 5-year rotation,
    3. Drainage ditches – as needed, some cleaned each year,
    4. Creeks – annual vegetation maintenance and debris removal (2 miles per year),
    5. Inlets – 5-year rotation and as needed,
    6. Trash racks – monthly in winter, and
    7. Manholes – 5-year rotation.

- Open Channels and Structural Stormwater Controls – Open channels and structural stormwater controls will be inspected and maintained regularly. Waste from the stormwater controls will be disposed of properly, and records of cleaning and maintenance will be kept. Roseburg currently conducts annual vegetation maintenance and debris removal in creeks.

- Road, Highway and Parking Lot Maintenance – The City's Road Department currently follows pollution prevention practices for sanding and street sweeping. Once the O&M Plan is adopted, the Road Department will continue to follow practices outlined in the Plan for snow removal. Roseburg purchases de-icing chemicals from the Oregon Department of Transportation for use in city equipment. De-icing occurs only on overpasses. All sanding materials are kept in a concrete bin specifically for that purpose. The City conducts street sweeping on all curb-and-gutter streets every three to four weeks with a regenerative street sweeper. Streets that have been sanded are swept when the sand is no longer needed.

- Flood Management Projects – The City will implement review procedures for flood management projects. All new flood management projects will include water quality considerations. Previously identified priority flood management projects will be reevaluated for water quality considerations. Low impact development (LID) techniques applicable to the City's terrain and soils will be investigated as a possible method of reducing flood flows and providing water quality treatment. Potential LID BMPs are described in the City of Roseburg Stormwater Master Plan.

- Employee Training on O&M Implementation – City staff will be trained on O&M procedures. The training will occur in combination with training for the illicit discharge and spill plan. Training will be general for all municipal employees, with more specific training for specific program areas. Refresher training will update staff on changes to the procedures as needed. Materials for several trainings are available from Oregon ODEQ and USEPA.

6.4 Summary

The following table of activities is recommended to address TMDLs within the City of Roseburg:

TABLE 6-1
Management Strategy Summary
Roseburg: TMDL Implementation Plan

	TMDL Parameter					
Management Measure/Source Category	Temperature	Biocriteria	Dissolved O_2	Phosphorous	pH	Bacteria
Public Education and Outreach						
Create and present stormwater workshops for streamside land owners and general public	X	X	X	X	X	X
Add stormwater quality information to city website	X	X	X	X	X	X
Develop a water quality news releases	X	X	X	X	X	X
Install stations with signage, ordinance for pet waste collection						X
Create water quality brochures for the general public	X	X	X	X	X	X
Develop a water quality traveling display	X	X	X	X	X	X
Targeted water quality brochures for streamside landowners	X	X	X	X	X	X
Public Involvement and Participation						
Hold public reviews/ meetings to encourage public water quality stewardship	X	X	X	X	X	X
Complete storm drain marking		X	X	X	X	X
Coordinate with watershed council for riparian vegetation restoration projects and incentive program for land owners	X	X	X	X		
Illicit Discharge Detection and Elimination						
Adopt ordinance to prohibit non-stormwater discharges	X	X	X	X	X	X
Create illicit discharge and spill response plans	X	X	X	X	X	X
Perform stream surveys to detect illicit discharges and illegal intakes	X	X	X	X	X	X
Construction Site Stormwater Runoff Control						
Sites one acre or larger - NPDES 1200-C through Oregon DEQ	X	X	X	X	X	
Sites less than one acre - erosion control checklist and inspections		X	X	X	X	
Post-Construction Stormwater Management						
Develop City's design standards to protect water quality, including landscaping with native plants	X	X	X	X		X
Refine setback ordinance to protect riparian areas	X	X	X	X		X
Stormwater retrofits in areas not connected to City storm drains		X	X	X	X	X
Incentives for decreasing stormwater flows to storm drains		X	X	X		
Pollution Prevention in Municipal Operations						
Develop formal public works O&M plan	X	X	X	X	X	X
Optimize park and open space maintenance to minimize fertilizing and watering, maximize use of native plants	X	X	X	X		X

6.5 TMDL Implementation Matrices

The TMDL Implementation Matrices at the end of this document in Appendix E summarize the text in terms of the six management strategies with checkboxes to indicate which TMDL parameters each activity addresses. The matrices are intended to facilitate tracking of individual implementation plan components at annual and 5-year reviews. The City of Roseburg can update the "status" column of the matrices and submit the tables to DEQ as evidence of progress on TMDL initiatives.

6.6 Performance Monitoring

Progress reports will be requested by ODEQ annually after this TMDL implementation plan is approved. ODEQ groups performance monitoring into two categories: implementation monitoring and effectiveness monitoring.

Implementation monitoring would include updating the TMDL implementation matrices' "status" column to gage completion and progress on those tasks and provide a description of progress on the different management strategies.

For effectiveness monitoring, a description of the effectiveness of the TMDL implementation efforts in reducing pollutant loads will be included in progress reports. The City of Roseburg is expected to coordinate with the watershed council, soil and water conservation district, and ODEQ to ensure that any monitoring and evaluation strategies do not duplicate other efforts or involve unnecessary data collection. The intent of effectiveness monitoring is to evaluate if the actions are stringent enough to produce reductions in pollutant loading in the watershed. Field measurements are essential to making this conclusion.

6.7 Plan Review, Revision, and Reporting Requirements

The City of Roseburg is required to establish a process by which the TMDL implementation plan is reviewed annually and progress evaluated. City staff will provide interim progress information in the annual report to ODEQ, including updating the "status" column in the implementation matrices. The annual report will include details on whether the plan is meeting pollution reduction goals and description of how the plan is to be modified if it is found lacking (adaptive management).

The City of Roseburg will review the plan every five years following ODEQ approval of the final version of the implementation plan. Revisions, restructuring, and additions will be coordinated with ODEQ at that time.

In addition, the City of Roseburg will review and revise this plan as needed following ODEQ reevaluation of the TMDL. According to the WQMP, "ODEQ will collect and review information for TMDL Implementation Plans on an annual basis and will periodically review available environmental data. However, an in-depth review of all data and information collected by all entities will be evaluated with the next Umpqua Basin TMDL cycle. Typically, the evaluation would be done on a 5-year schedule; the next overall review for the Umpqua is currently planned for 2011. In addition, the Technical Advisory Committee of the Partnership for Umpqua Rivers (formerly Partnership for the Umpqua Rivers) has compiled an inventory of all monitoring currently being conducted in the Umpqua Basin. Monitoring for TMDL implementation will build on existing monitoring programs."

6.8 Evidence of Compliance with Land Use Requirements

All of the strategies outlined here and listed in the implementation matrices are consistent with the City of Roseburg's land use plans. The City will evaluate and maintain consistency with local and statewide land use laws in any future actions related to TMDL implementation.

6.9 Program Funding

The City of Roseburg's stormwater program is part of the Street Division of the Public Works Department. This division is funded by Public Works budget and via the Storm Drainage Utility. The City may seek grant funding to offset costs for some of the most labor intensive implementation plan components such as stream surveying and water quality data collection. The City will also investigate opportunities to workshare with the watershed council to achieve goals common to both organizations.

The costs associated with this TMDL implementation plan are provided by task in the implementation matrices.

6.10 Conclusion

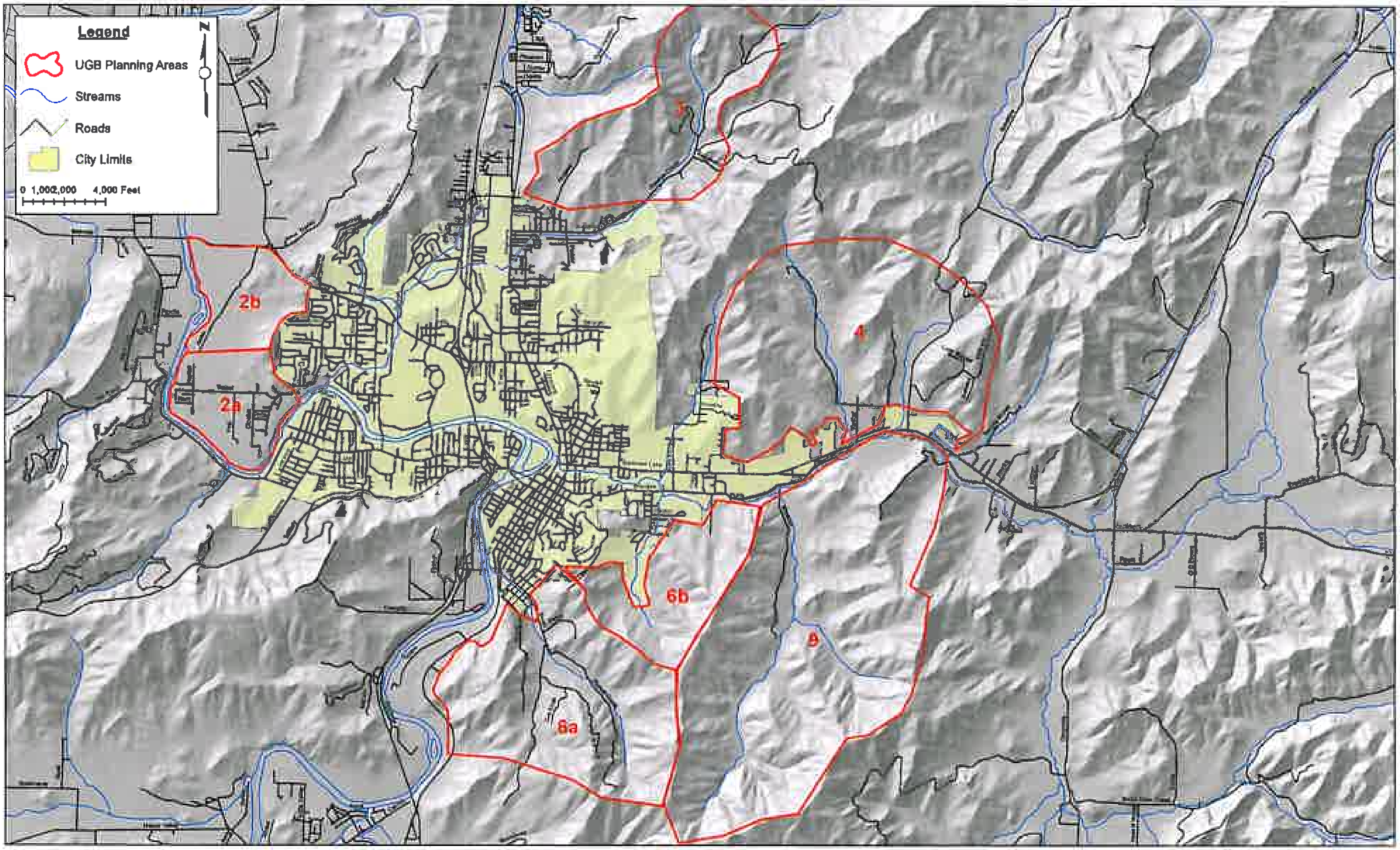
The content of this TMDL implementation plan and attached matrices are intended to meet the requirements for the TMDL implementation plan. All of the strategies outlined are consistent with City of Roseburg regulations. As was stated earlier in this report, the TMDL implementation plan is established to function in concert with the specifications of the stormwater management plan. The six minimum control measures addressed in that document are reflected in this plan and the attached implementation matrices. This document has been reviewed by management staff for accuracy. The City's stormwater utility and public works budget makes funding for proposed strategies possible.

SECTION 7

Urban Growth Expansion

7.1 Introduction

The purpose of this section is to provide a general analysis of runoff and drainage in areas of the Urban Growth Boundary (UGB) that are expected to develop in the near future. A discussion of suggested policies regarding development areas is included rather than a quantification of runoff flows based on assumed development patterns. The UGB areas discussed include the South Troost Street/Airport (2a), North Troost Street (2b), Parrot Creek Drainage (6a), Ramp Creek Drainage (6b), and DaMotta Creek Drainage (9) Areas (Figure 7.1-1).



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Future Planning Areas
FIGURE 7.1-1
Stormwater Master Plan | City of Roseburg

7.2 Analysis Areas

7.2.1 Planning Area 2a: Harlan Jones

This area is located immediately north of the South Umpqua River and immediately west of the existing City limits (Figure 7.1-1). The area is approximately 500 acres and encompasses everything south of Troost Street and includes the Felts Field Airport. Topographically, the area is generally flat, with an average ground slope of 1.1%. From a drainage perspective, these flat slopes make the area more susceptible to ponding and surface flooding. Presently, no significant storm drainage infrastructure exists in this area, with the exceptions of roadway culverts and ditches.

In planning for the future annexation and development of this area, several drainage opportunities and constraints exist. According to the FEMA Flood Insurance Study of the South Umpqua River, portions of the southwestern edge of this planning area are inundated during the 100-year event. As a result, development should be limited near the west end of Troost Street, including Hitchman, Doyle, Tillicum, and Kent Lane unless proper flood protection measures can be provided. Another constraint within this planning area is the presence of wetlands. According to the National Wetlands Inventory, several large wetlands covering roughly 50 acres of land are located in this area. These wetlands should be preserved, however mitigation for new development may be able to enhance or expand these wetlands.

A major east-west storm drain line (potentially along Troost Street) and a major south-flowing storm drain (potentially along Felt Street) should be constructed to provide drainage for new development. These primary drainage systems will convey runoff to the river whilst minimizing the number of new outfalls. As with any other annexed area, post-development runoff rates should be required to match pre-development rates and water quality treatment should be provided in this area. This is especially important since the South Umpqua River now has TMDL requirements.

7.2.2 Planning Area 2b: Charter Oaks

This area is located north of Troost Street and immediately west of the existing City limits (Figure 7.1-1). The area is approximately 690 acres and encompasses everything south of Melrose Road and north of Planning Area 2a. The area is also relatively flat with an average slope of approximately 1.0% that directs runoff westward to the South Umpqua River. Like planning area 2a, the flat topography of the area makes it susceptible to ponding and surface flooding. Presently, no significant storm drainage infrastructure exists in this area, with the exceptions of roadway culverts and ditches.

In planning for the future annexation and development of this area, several drainage opportunities and constraints exist. The FEMA Flood Insurance Study of the South Umpqua River indicates that a substantial portion of the planning area, totaling approximately 217 acres (41% of the total area) is within the 100-yr floodplain. This includes portions of Jones Road and Melrose Road and should only be developed with proper flood protection measures. Also, according to the National Wetlands Inventory, several large wetlands covering roughly 35 acres are located in this area. These wetlands should be preserved and mitigation for new development may provide an opportunity to enhance or expand these wetlands.

A major storm drain system leading west to the South Umpqua River should to be constructed to provide a single point of discharge for new development. The drainage system could be built along Melrose Road, Jones Road or other future streets. This new drainage systems will convey runoff to the river whilst minimizing the number of new outfalls. As with any other annexed area, post-development runoff rates should be required to match pre-development rates and water quality treatment should be provided in this area. This is especially important since the South Umpqua River now has TMDL requirements.

7.2.3 Planning Area 6a: Booth Street

This area is located at the southern end of the city and east of the South Umpqua River (Figure 7.1-1). The area is approximately 2,105 acres and encompasses the Parrott Creek drainage area and a smaller drainage area that flows west to the South Umpqua River. The area is surrounded by steep ridges but flattens substantially near Parrott Creek and the river. The steep topography of the area makes it susceptible to flashy runoff and sediment erosion/accumulation. Presently, no significant storm drainage infrastructure exists in this area, with the exceptions of culverts in the Parrott Creek channel.

In planning for the future annexation and development of this area, several drainage constraints and opportunities exist. Within the city limits, the existing culverts along Parrott Creek are currently undercapacity and will have to be replaced to handle an increase in runoff caused by future development. Each culvert will also have to be designed with to accommodate fish passage, which will likely require large buried, or open bottom, box or arch culverts.

As observed during recent flood events within the basin, significant flooding and ponding occurs along Parrot Creek immediately upstream of the city limits. Consequently, development in this area should be precluded unless adequate flood protection measures are constructed. In place of development, a large regional detention pond could be constructed at this location to provide flow control and water quality treatment for development within the basin.

As with any other annexed area, post-development runoff rates should be required to match pre-development rates and water quality treatment should be provided in this area. This is especially important since the South Umpqua River now has TMDL requirements. According to the National Wetlands Inventory, no wetlands exist in this planning area, however development along the steeper slopes of the basin should be managed to minimize erosion problems.

7.2.4 Planning Area 6b: Ramp Canyon

This area is located south of Deer Creek and is sandwiched between Planning Areas 6a and 9 (Figure 7.1-1). The area is approximately 1085 acres and encompasses Ramp Creek which flows beneath Waldon, Chinaberry, and Douglas Avenues before draining into Deer Creek. This planning area, in particular, is experiencing significant development with additional residential homes planned for construction over the next 10 years. Much of the immediate development is occurring along the flatter areas adjacent to Ramp Creek; however the surrounding steeper areas are also likely to experience significant development pressure.

In planning for the future annexation and continued development of this area, several drainage constraints and opportunities exist. Several of the culverts along Ramp Creek are currently undercapacity and will not be able to handle an increase in runoff caused by future development. Additionally, maintenance activities along the creek have observed significant sediment accumulation at the culvert crossings, further reducing their capacity. To provide adequate conveyance along Ramp Creek, the culverts should to be sufficiently upsized to not only convey flood flows, but to also allow for channel erosion and deposition to occur at each crossing without increasing flooding potential. Consequently, large buried, or open bottom, box or arch culverts should be constructed along the creek. Upstream detention, either as a series of individual ponds associated with each development or a single regional facility, should also be provided to extenuate the peak runoff in the basin. As with any other annexed area, post-development runoff rates should be required to match pre-development rates and water quality treatment should be provided in this area. This is especially important since the South Umpqua River and Deer Creek now has TMDL requirements. According to the National Wetlands Inventory, no wetlands exist in this planning area.

7.2.5 Planning Area 9: DaMotta Creek Drainage

This area is located south of Deer Creek and is east of Planning Areas 6a and 6b (Figure 7.1-1). The area is approximately 9744 acres and drains to Deer Creek near the city limits of Roseburg via DaMotta Creek. Because DeMotta Creek discharges to Deer Creek above the city limits, special consideration to stream temperatures will be required according to the proposed TMDL for the Umpqua Basin.

In planning for the future annexation and development of this area, several drainage constraints and opportunities exist. Because this area is currently undeveloped, a series of new storm drains will need to be constructed. To preserve DaMotta Creek, each new storm drain should be constructed with detention and water quality treatment prior to discharge to the creek. Additionally, a stream buffer should also be considered to lessen the impact from new developments immediately adjacent to the creek.

Although Deer Creek is a relatively large stream, flooding is not uncommon in the lower reaches of the creek when the stage of the South Umpqua River is high. This is supported by the Flood Insurance Study for Deer Creek, which shows significant flooding in downtown Roseburg. Consequently, development within the basin should be required to provide sufficient detention so that no net change in peak flows and runoff volumes are discharged from the basin (and from the development) as compared to existing conditions.

According to the National Wetlands Inventory, several large wetlands covering roughly 143 acres of land are located in this area. These wetlands should be preserved, however mitigation for new development may be able to enhance or expand these wetlands. As with any other annexed area, post-development runoff rates should be required to match pre-development rates and water quality treatment should be provided in this area.

7.2.6 Planning Area 3: Upper Newton Creek

This area is located north of the existing City limits and encompasses the upper reach of Newton Creek (Figure 7.1-1). The area is approximately 1460 acres and is surrounded by steep topography the makes it susceptible to flashy runoff. Presently, no significant storm drainage infrastructure exists in this area, with the exceptions of roadway culverts and ditches. However, from where Newton Creek enters the city to its confluence with the South Umpqua River, large storm drainage facilities (pipes, culverts, ponds, etc) exist.

In planning for the future annexation and development of this area, several drainage opportunities and constraints exist. Based on topography along, all runoff from this area flows into Newton Creek and eventually into the South Umpqua River. Severe flooding problems due to present development are already a significant issue downstream from this area, so any future development should include plans to limit runoff into Newton Creek as much as possible. This may involve over-detention at each development, construction of downstream infrastructure improvements or construction of large regional detention ponds in order to not make the existing flooding problems worse. Several sites exist within this planning area where large regional detention facilities might be located. These regional solutions may present a better option for managing stormwater within the basin as opposed to a series of site-specific stormwater ponds.

Another constraint within this planning area is the presence of wetlands. According to the National Wetlands Inventory, several large wetlands covering roughly 61 acres of land are located in this area. These wetlands should be preserved, however mitigation for new development may be able to enhance or expand these wetlands.

It is recommended that before development begins in the upper reach of Newton Creek, the flooding problems within the city limits should be addressed. To limit the amount of runoff from new development, efforts should be taken to maximize infiltration and construct large detention facilities upstream of the city limits. The runoff should be conveyed through current natural channels as much as possible to limit the amount of piping used in the drainage system, and a buffer around Newton Creek should be used to minimize encroachment along the creek. As with any other annexed area, post-development runoff rates should be required to match pre-development rates and water quality treatment should be provided in this area. This is especially important since the South Umpqua River now has TMDL requirements.

7.2.7 Planning Area 4: Diamond Lake Corridor

This area is located east of the existing City limits and north of Diamond Lake Boulevard. (Figure 7.1-1). The area is approximately 2480 acres and is surrounded by steep topography the makes it susceptible to flashy runoff and erosion. Presently, no significant storm drainage infrastructure exists in this area, with the exceptions of roadway culverts and ditches. However, large storm drainage infrastructure exists in the City limits downstream of this area, particularly along Diamond Lake Boulevard.

In planning for the future annexation and development of this area, several drainage opportunities and constraints exist. All runoff from this area flows south underneath Diamond Lake Boulevard to Deer Creek. Flooding problems due to present development are already an issue along Diamond Lake Boulevard and in Deer Creek so any future development should include plans to limit runoff as much as possible.

Additionally, new culverts will likely be needed beneath Diamond Lake Boulevard, which will require special coordination with ODOT (the owner of the road).

Another constraint within this planning area is the presence of wetlands. According to the National Wetlands Inventory, several large wetlands covering roughly 194 acres are located in this area. These wetlands should be preserved and mitigation for new development may provide an opportunity to enhance or expand these wetlands.

To limit the amount of runoff from new development, efforts should be taken to maximize infiltration and construct regional detention facilities where possible. Conveying runoff beneath Diamond Lake Boulevard is a large concern since the current drainage system is undercapacity in certain locations. As with any other annexed area, post-development runoff rates should be required to match pre-development rates and water quality treatment should be provided in this area. This is especially important since the South Umpqua River now has TMDL requirements

SECTION 8

Alternative Analysis and Project Development

Alternatives for the hydraulic and water quality system deficiencies were developed and evaluated using the project GIS and the XP-SWMM model. Each alternative can generally be described as either conveyance-oriented, water quality-oriented or multi-purpose. Conveyance alternatives include new or upsized storm drain pipes, culvert modifications, detention ponds and improved channels. Water quality improvements include swales or channel enhancements and structural pollution reduction facilities. Structural pollution reduction facilities are considered proprietary and non-proprietary water quality manholes and vaults using filtration and/or hydrodynamic separation as the pollutant removal mechanism. The following sections describe the alternative development process, the evaluation process and the recommended improvements.

8.1 Development and Evaluation Process

A number of alternatives were developed and evaluated for each critical problem area to arrive at a recommended or preferred alternative. Although in a number of cases, several alternatives resulted in a viable and constructible solution, the goal of improving system conveyance and water quality while minimizing land acquisition often became the deciding factor during the alternative selection process. The following section describes the alternative development and evaluation process and summarizes the recommended improvements.

8.2 Alternative Development

A number of factors were used in developing each alternative. Although each problem area had unique constraints and required a different set of improvements, a number of common themes were followed:

- To minimize capital expenditures, the existing infrastructure was used to the maximum extent possible.
- Multi-use facilities, such as regional detention facilities with a combined water quality cell were used where practical.
- Land acquisition, in terms of size and present ownership, were considered when locating system improvements.
- In developing alternatives, an attempt was made to provide water quality treatment facilities for the drainage sub-regions that have the highest pollutant loads or the land uses that are likely to generate the highest loads.
- If practical, non-structural water quality facilities (i.e. swales, etc) were considered preferable to structural pollution reduction facilities due to the maintenance requirements.

- Wetland mitigation and environmental permitting requirements were considered when locating system improvements alternatives.

8.3 Alternative Evaluation

In general, the identification of the recommended, or preferred, alternative was based on the need to provide flood protection and water quality treatment throughout the system. The general process used to evaluate the alternatives is detailed as follows:

- Is a pipe system the only viable alternative?
- Can the new or upsized pipes be eliminated by using detention or flow diversion facilities?
- Does the alternative provide water quality treatment? At a minimum, do the areas that generate the highest pollutant loads (i.e. commercial and industrial parcels) have water quality treatment?
- Is the water quality treatment structural or non-structural?
- Is environmental permitting/wetland mitigation likely?
- To what level is land acquisition required?
- To what level are regulatory limits (TMDLs) being addressed?
- To what level is the alternative addressing known system deficiencies (versus modeled deficiencies)?
- Will construction related implementation issues be significant? Roadway closures, large excavations, utility conflicts.
- Can the system be rearranged/modified to eliminate the need to replace existing infrastructure?
- Will the alternative be cost effective?
- Will the alternative be maintainable, both short term and long-term?
- Are the facilities accessible for maintenance?

8.4 Alternative Summary Tables

A summary of the problem area and preferred alternatives are included as fact sheets in Tables 8.4-1 and 8.4-2 in the following pages. Each summary also includes the following:

- **Problem Location.** Summarizes the location and extent of the problem with respect to city streets and other key landmarks.
- **Problem Summary**. Summarizes the system problems as developed using the problem identification criteria.
- **Potential Solutions.** Lists the solutions for the problem that may or may not be the recommended solution alternative.
- **Recommended Alternative.** Provides a narrative of the components for the recommended alternative developed.
- **Technical Data.** Summarizes the hydraulic data needed to evaluate the viability of the conceptual alternative. This includes design flows, pipe slopes, pipe diameters and lengths, and storage volumes.

- **Benefits.** Identifies if the problems are resolved. Also identifies the benefits relative to another alternative described for the same problem location.
- **Land Ownership.** Summarizes existing land ownership and any land acquisition required to implement the alternative.
- **Permitting.** Summarizes any permitting or mitigation issues likely to be associated with the alternative.
- **Implementation Issues.** Identifies issues that would affect construction and maintenance for each alternative. Examples include major utility relocations, high groundwater, significant roadway closures, etc. Also identifies special construction techniques necessary to implement the alternatives. Also identifies if the alternative does not alleviate deficiencies within a problem area.
- **Cost.** Identifies the total project cost including construction, land acquisition, engineering and administration for the recommended alternative. Basis of costs, assumptions, and the anticipated level of accuracy is described in Section 9. Detailed cost summaries are included in Appendix F.

TABLE 8.4-1

PROBLEM #1: MILITARY AVENUE

	Discussion
Problem Location:	Military Avenue between Fromdahl Drive and Altamont Street.
Problem Summary:	The culverts and storm drainage system along Military Avenue are inadequate to keep the roadway from flooding. The road is frequently overtopped with floodwater. The current storm drain system is minor and consists of small ditches, pipes, and culverts.
Technical Details:	Pipe sizes: 12" or less Peak flow: Variable (~ 20 cfs) Q_{ratio}: N/A Flooded volume: Variable

Potential Solutions:	• **Increase the culvert sizes underneath Military Avenue and improve the ditch system.** • Construct a new storm drain piping system along Military Avenue.

TABLE 8.4-1

PROBLEM #1: MILITARY AVENUE

	Discussion
Recommended Alternative:	• Increase the culvert sizes underneath Military Avenue and improve the ditch system.
Technical Data:	*<u>As shown below</u>* *Drainage area < 5 acres = 12" CMP* *5 < drainage area < 12 acres = 24" CMP*
Benefits:	• Located within public right-of-way and minimizes impacts to Military Dr. • Reduces flooding and erosion. • Low cost versus new storm drain construction along entire road length.
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permits anticipated.
Implementation Issues:	• Due to the road width, full closures may be required • Routine maintenance will be critical to maintenance adequate capacity given the amount of sediment that will likely wash into the culverts.
Cost	$ 18,800 (per crossing). x 9 crossing = <u>$169,200</u>

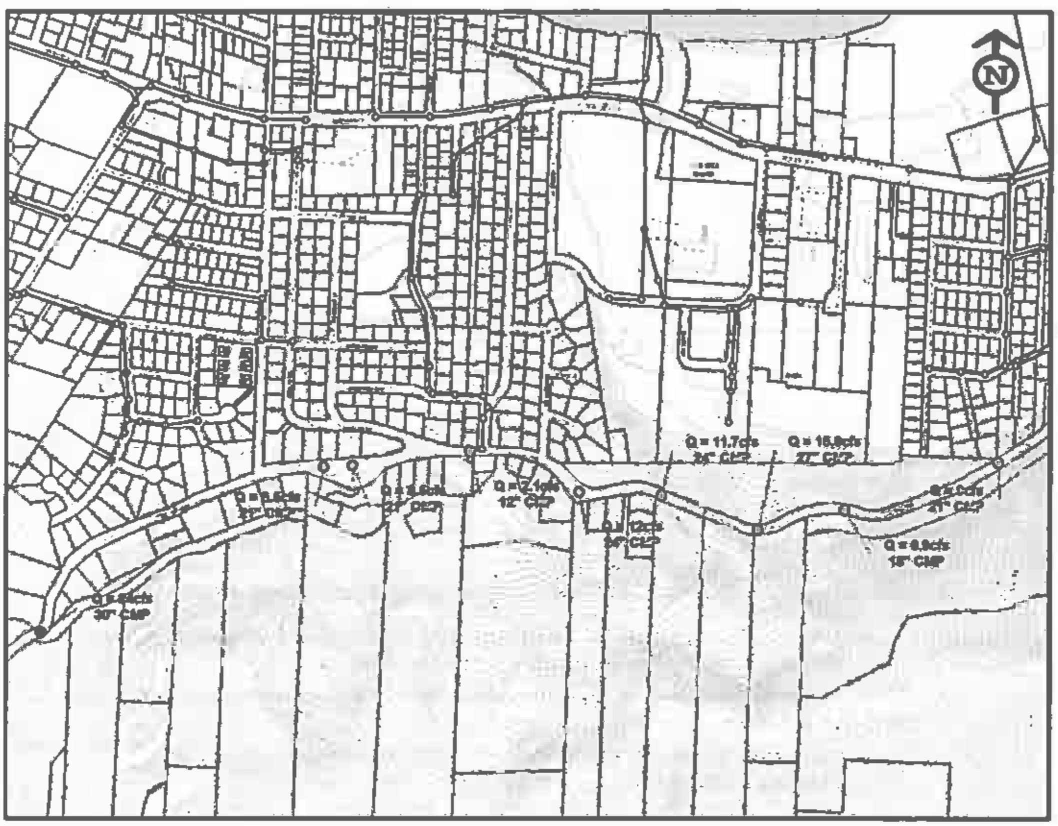
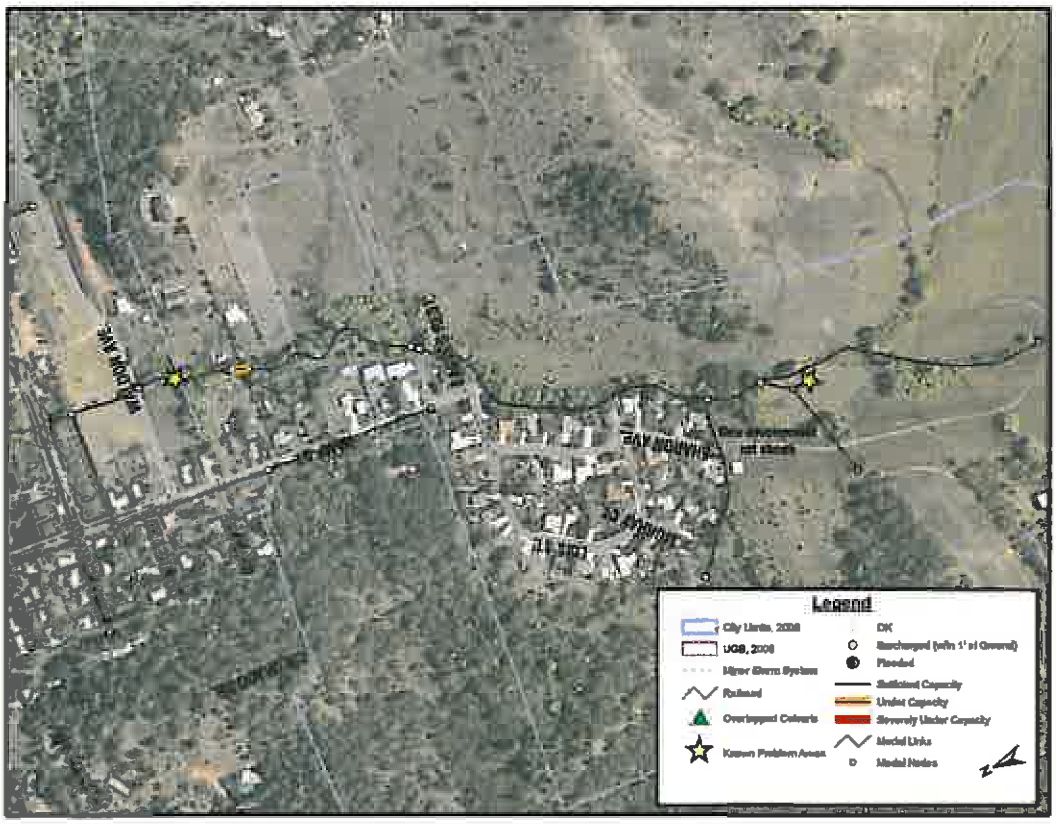


TABLE 8.4-1

PROBLEM #2: RAMP CREEK AREA

	Discussion
Problem Location:	Ramp Creek from Sharon Avenue to Deer Creek
Problem Summary:	Ramp Creek has experienced downstream flooding in the past. Culverts are also under capacity causing roadway overtopping. Velocities inside the channel are excessively high and cause extensive erosion. In addition, significant development pressure in this area will lead to an increase in future runoff, exacerbating the current problems in the creek.
Technical Details:	Pipe sizes: Culvert diameters range from 3' to 6'x6'7" pipe arches Peak flow: 145 cfs $Q_{P(EXISTING)}$ = 166 cfs $Q_{P(FUTURE)}$ = 199 cfs [50-year return period] Flooded volume: $V_{(EXISTING)}$ = 121 ac-ft $V_{(FUTURE)}$ = 135 ac-ft



Potential Solutions:

- **Construct a regional detention pond(s) at the upstream end of Ramp Creek to lower peak flow rates in the channel.**
- Increase the culvert sizes in the creek channel at each crossing down to Deer Creek.
- Increase the capacity of the channel via route maintenance including sediment removal and bank stabilization

TABLE 8.4-1

PROBLEM #2: RAMP CREEK AREA

	Discussion
Recommended Alternative:	• Construct a regional detention pond(s) at the upstream end of Ramp Creek to lower peak flow rates in the channel.
Technical Data:	Pipe sizes: Culvert diameters range from 3' to 6'x6'7" pipe arches Peak flow: 145 cfs $Q_{P(EXISTING)}$ = 166 cfs $Q_{P(FUTURE)}$ = 199 cfs [50-year return period] Flooded volume: $V_{(EXISTING)}$ = 121 ac-ft $V_{(FUTURE)}$ = 135 ac-ft
Benefits:	• Eliminates downstream flooding
Land Ownership:	• Land acquisition will be required
Permitting:	• Environmental permitting will be required
Implementation Issues:	• Land acquisition costs are high • Developable land will be used for detention pond(s)
Cost	Land Acquisition: $ 1,397,816 Capital Costs: $ 1,199,323 TOTAL: $ 2,597,139

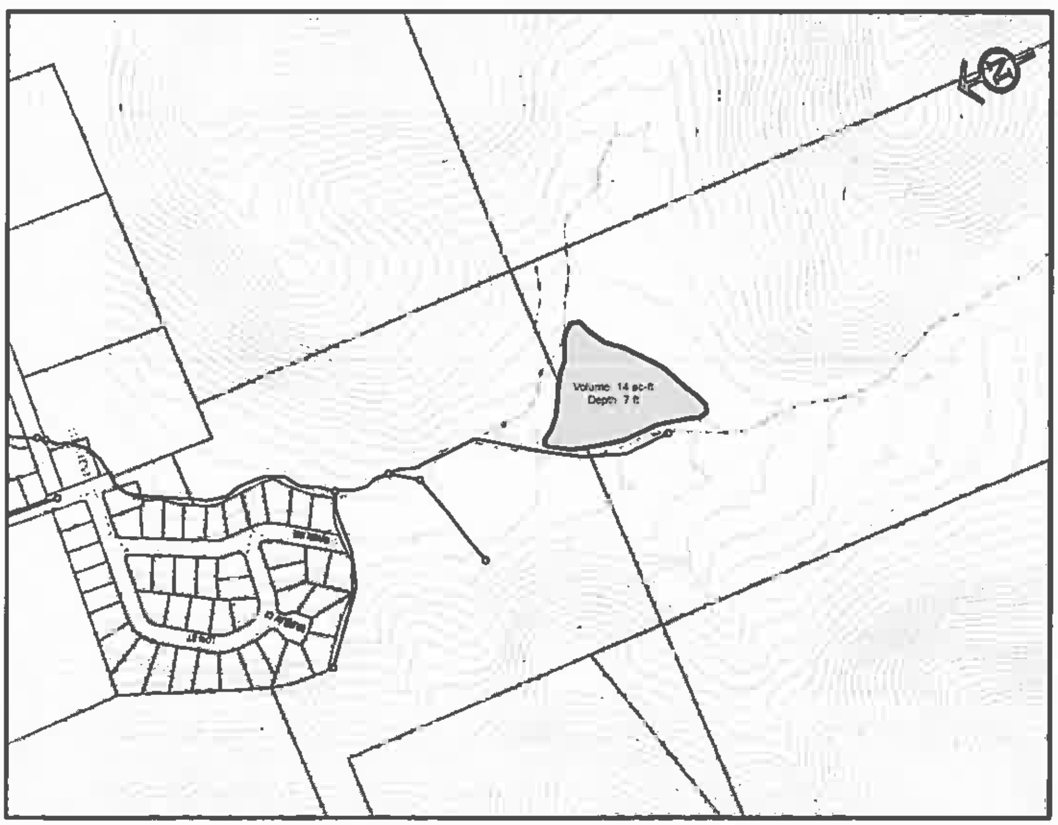
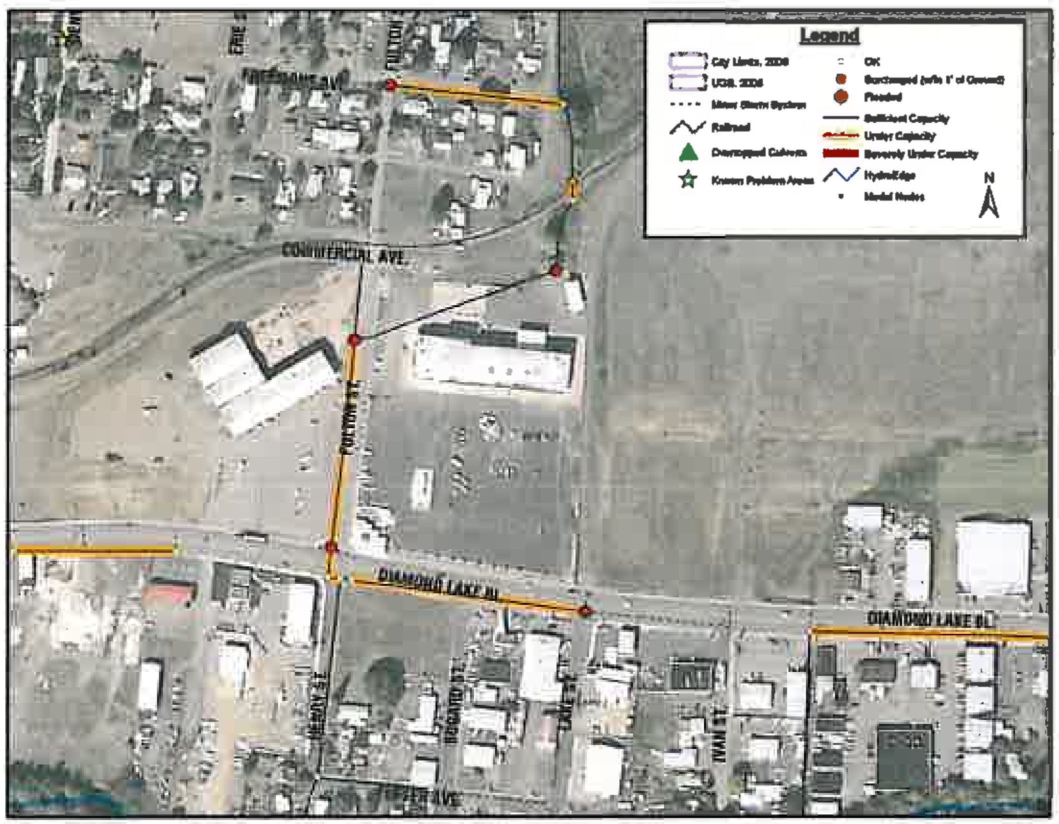


TABLE 8.4-1

PROBLEM #3: DIAMOND LAKE BOULEVARD AT FULTON ST

	Discussion
Problem Location:	Fulton Street, Diamond Lake Boulevard, and Freemont Avenue.
Problem Summary:	The existing 12" diameter storm drain pipe along Freemont Avenue empties into a ditch that connects into a 30" diameter pipe. The 30" diameter pipe crosses Diamond Lake Boulevard and continues south. The 12" diameter pipe along Freemont Avenue is under capacity, as well the 30" diameter pipe along Fulton Street. There is an 18" diameter storm drain pipe along Diamond Lake Boulevard that connects into the 30" diameter pipe along Fulton Street which is also under capacity.
Technical Details:	Pipe sizes: 12 – 30" Peak flow: 11.7 cfs Q_{ratio}: 1.3 – 2.8 Flooded volume: 26.0 ac-ft



Potential Solutions:	• **Upsize the storm drain pipes along Freemont Ave., Fulton St., and Diamond Lake Blvd.** • Construct a parallel pipe system along Fulton St. and Diamond Lake Blvd. to help carry excess flow.

TABLE 8.4-1 PROBLEM #3: DIAMOND LAKE BOULEVARD AT FULTON ST	
	Discussion
Recommended Alternative:	• Upsize the storm drain pipes along Freemont Ave., Fulton St., and Diamond Lake Blvd.
Technical Data:	*Freemont Ave.:* S (%): 1.44 D (in): 18 L (ft): 387 Q (cfs): 11 *Fulton St.:* S (%): 1.19 D (in): 42 L (ft): 457 Q (cfs): 95 *Diamond Lk.:* S (%): 0.59 D (in): 21 L (ft): 519 Q (cfs): 11 *Culvert Crossing:* S (%): 2.72 D (in): 42 L (ft): 42 Q (cfs): 144
Benefits:	• Primarily located within public right-of-way • Eliminates flooding and utilizes existing infrastructure
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• Environmental permitting may be required for in-water work at the culvert crossing
Implementation Issues:	• Construction along Diamond Lake Boulevard will require traffic control and short-term lane closures, and will require coordination with ODOT. • Deep pipe excavations near Fulton Street. • Coordination with Central Oregon and Pacific Railroad is required for the culvert crossing replacement
Cost	$ 733,576

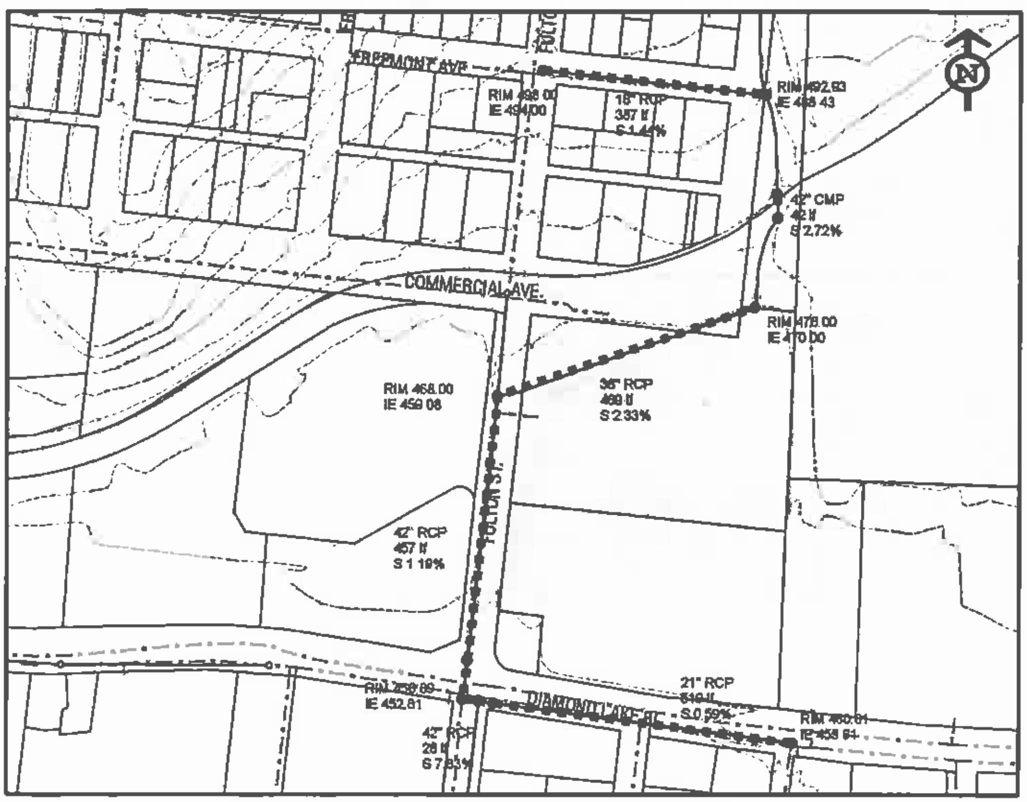
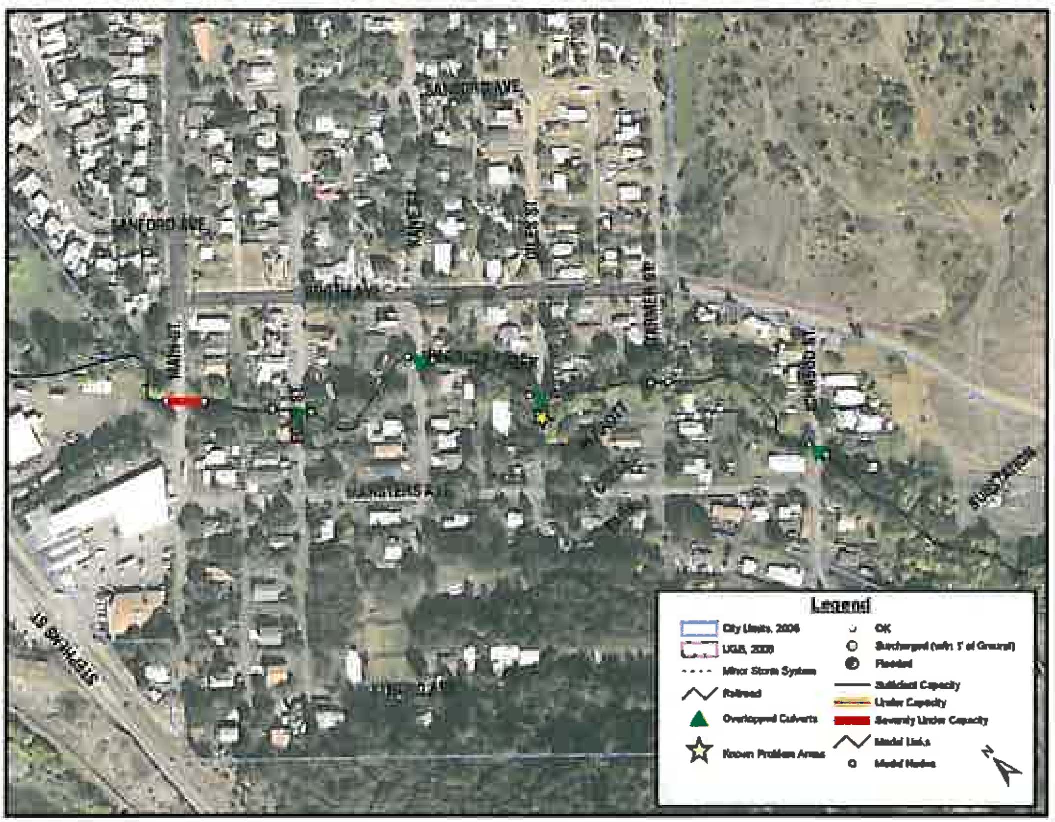


TABLE 8.4-1

PROBLEM #4: PARROT CREEK CULVERTS

	Discussion
Problem Location:	The culverts located within Parrot Creek between Main St. and Ichabod St.
Problem Summary:	There are four 5- and 6-foot diameter corrugated metal pipe (CMP) culverts along Parrot Creek within the city limits that are undersized and cause roadway flooding. The culverts are located at Ichabod, Giles, and Eddy Street. This is a known flooding area.
Technical Details:	Pipe sizes: Culvert diameters 5 – 6' Peak flow: 310 cfs Q_{ratio}: N/A Flooded volume: N/A



Potential Solutions:	• Replace existing culverts with buried box culverts or open bottom arch culverts with approximate dimensions of 18' x 6'. • Replace existing culverts with large bottomless arch culverts. • Construct a large regional detention system upstream of the UGB.

TABLE 8.4-1

PROBLEM #4: PARROT CREEK CULVERTS

	Discussion				
Recommended Alternative:	• Replace existing culverts with buried box culverts or open bottom arch culverts with approximate dimensions of 18' x 6'.				
Technical Data:	*Ichabod St. Culvert:*	S (%): 6.89	W (ft): 18	L (ft): 87	Q (cfs): 310
	Giles St. Culvert:	S (%): 7.02	W (ft): 18	L (ft): 57	Q (cfs): 310
	Kane St. Culvert:	S (%): 1.96	W (ft): 18	L (ft): 41	Q (cfs): 310
	Eddy St. Culvert:	S (%): 4.46	W (ft): 18	L (ft): 45	Q (cfs): 310
Benefits:	• Located within public right-of-way • Eliminates flooding				
Land Ownership:	• All property owned by the City of Roseburg				
Permitting:	• Environmental permitting will be required for in-water work				
Implementation Issues:	• Potential sanitary utility conflicts at each crossing • Relatively deep excavations at Eddy Street				
Cost	Ichabod St.: $ 281,866 Kane St.: $ 354,208		Giles St.: $ 281,866 Eddy St.: $ 531,798		

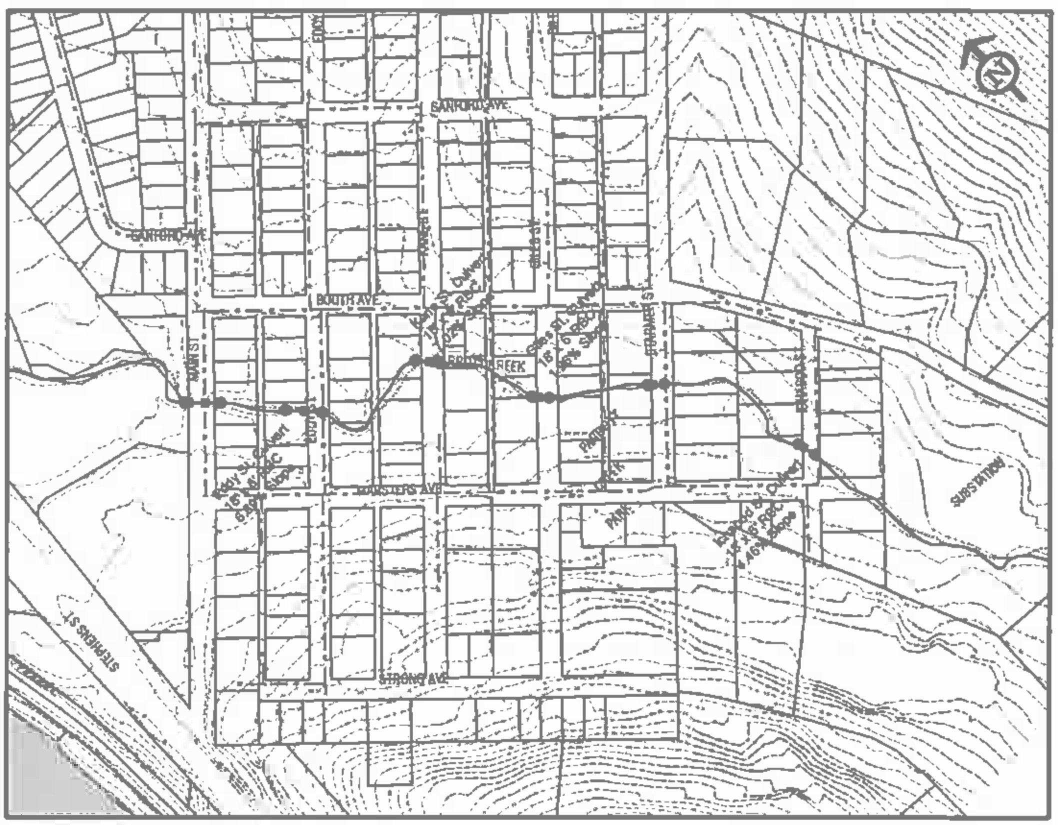
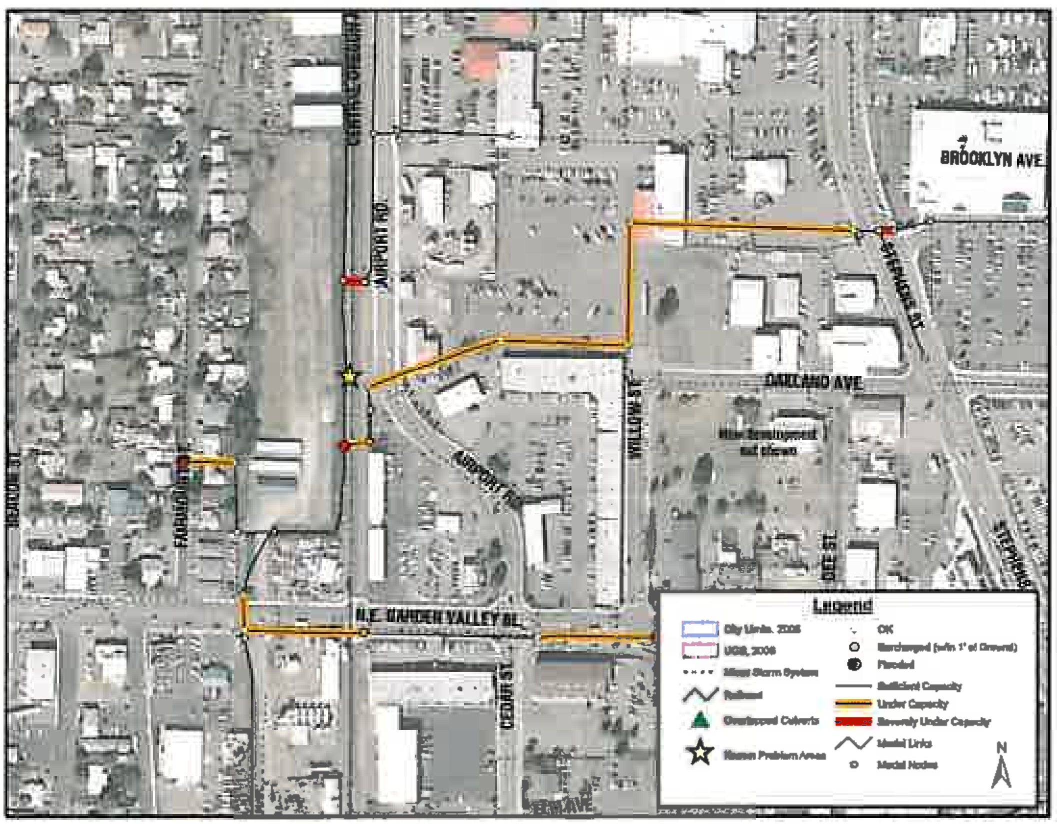


TABLE 8.4-1

PROBLEM #5: AIRPORT ROAD NORTH OF GARDEN VALLEY BLVD

	Discussion
Problem Location:	North of N.E. Garden Valley Boulevard and west of Airport Road.
Problem Summary:	The culvert west of Airport Road that spans underneath the railroad is under capacity and causes flooding of the surrounding area. The ditchs immediately upstream of the culvert are also under capacity which leads to further flooding. This area is known by the City to be a flooding problem area.
Technical Details:	Pipe sizes: 36 – 48" Peak flow: 114 cfs Q_{ratio}: 1.2 – 2.2 Flooded volume: 1.3 ac-ft



Potential Solutions:	• **Replace the existing surface channel system between Airport Rd and N.E. Garden Valley Boulevard with a new piped storm drain. Reroute storm drain along Fairmont St to N.E. Garden Valley Boulevard for accessibility.** • Construct a new pipe system along Airport Road to N.E. Garden Valley Boulevard.

TABLE 8.4-1 PROBLEM #5: AIRPORT ROAD NORTH OF GARDEN VALLEY BLVD	
	Discussion
Recommended Alternative:	• Replace the existing surface channel system between Airport Rd and N.E. Garden Valley Boulevard with a new piped storm drain. Reroute storm drain along Fairmont St to N.E. Garden Valley Boulevard for accessibility.
Technical Data:	*Fairmont St. 1:* S (%): 0.50 D (in): 18 L (ft): 343 Q (cfs): 21 *NE Garden 1:* S (%): 3.08 D (in): 24 L (ft): 248 Q (cfs): 34 *NE Garden 2:* S (%): 2.81 D (in): 24 L (ft): 358 Q (cfs): 33 *NE Garden 3:* S (%): 0.61 D (in): 24 L (ft): 248 Q (cfs): 15 *Box Culvert 1:* S (%): 0.67 D (ft): 7 W (ft): 7 L (ft): 147 Q (cfs): 461 Information on remainder of upsized pipes can be found in Appendix F.
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure • System connection reduces the lineal footage of pipe replacement
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• Environmental permitting may be required for in-water work
Implementation Issues:	• Traffic control will be necessary on N.E. Garden Valley Blvd.
Cost	**$ 839,844**

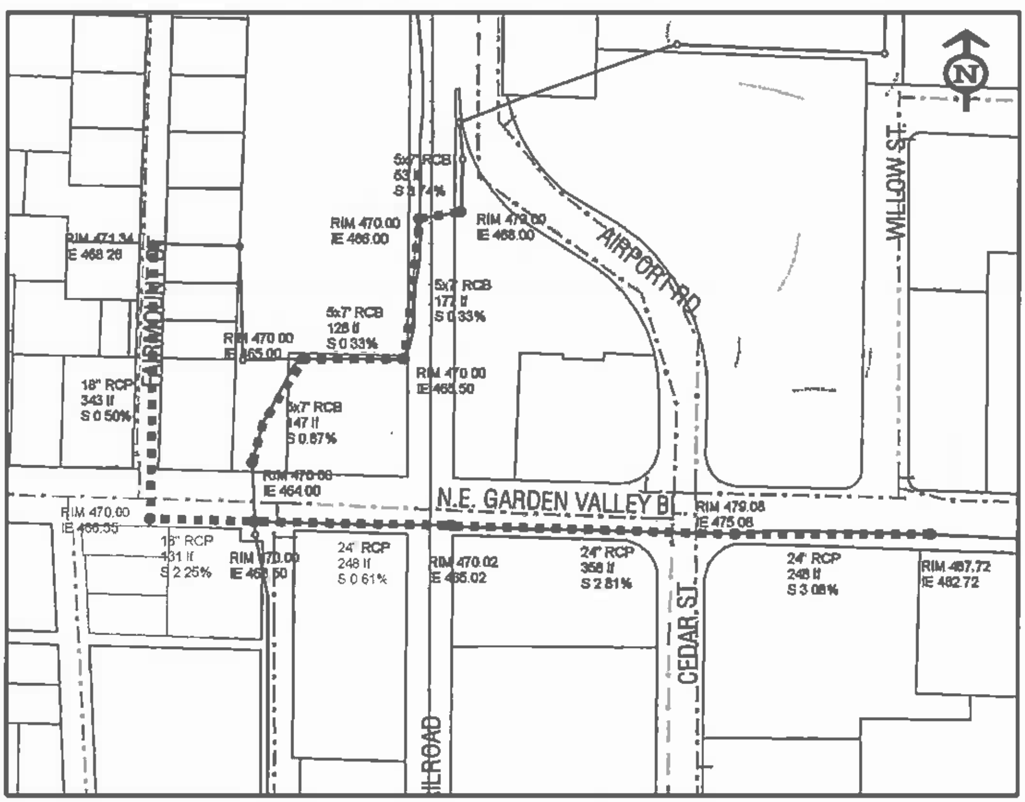
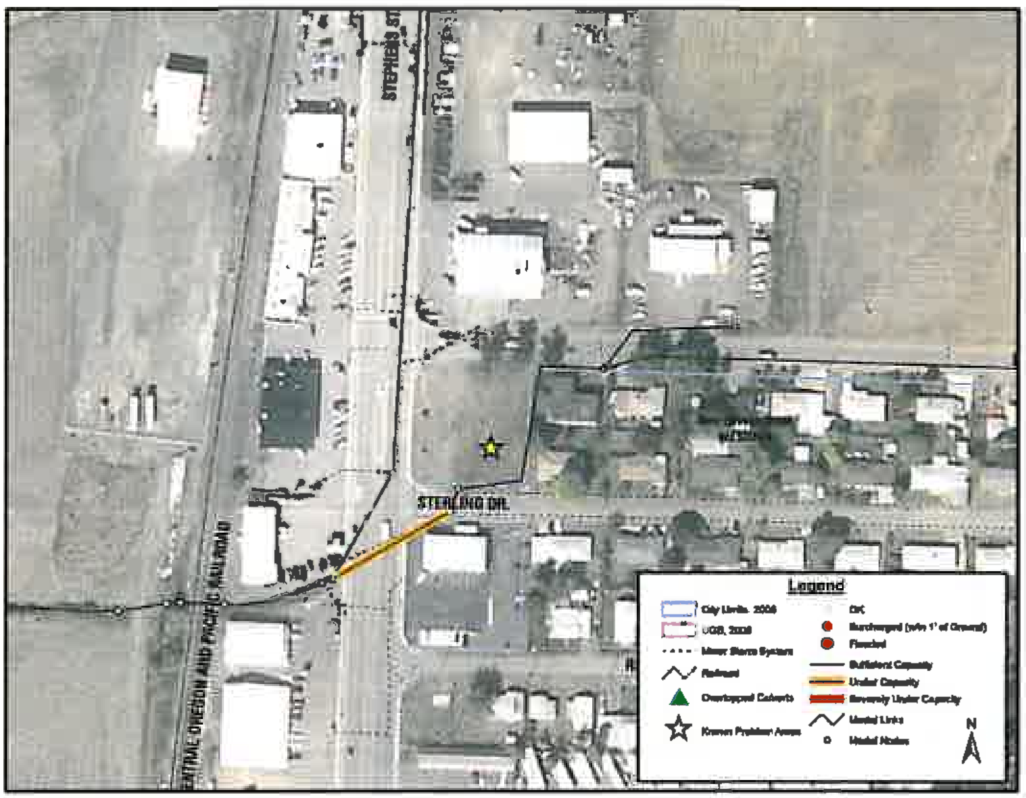


TABLE 8.4-1

PROBLEM #6: SWEETBRIER CREEK AT NEWTON CREEK AND STERLING ROADS

	Discussion
Problem Location:	The intersection of Sweetbrier Creek and Newton Creek Road
Problem Summary:	Water flowing down Sweetbrier Creek floods this area due to inlet constrictions at Newton Creek Road and an under capacity culvert between Newton Road and Sterling Drive. Poor channel maintenance may also contribute to this flooding problem. In addition, high development pressure in this area is likely to lead to an increase in future runoff, exacerbating the current problems in the creek. This area of flooding is known by the City.
Technical Details:	Pipe sizes: 48" Peak flow: 81.6 cfs Q_{ratio}: > 3 Flooded volume: 13.2 ac-ft



Potential Solutions:	• **Construct a detention pond north of Newton Road to lower peak flow rates in the channel.** • A regional detention pond constructed at the upstream end of Newton Creek will lower the peak discharge in the creek and lower downstream water surface elevations. • Upsize the storm drain system between Sterling Road and the Central Oregon & Pacific Railroad.

TABLE 8.4-1

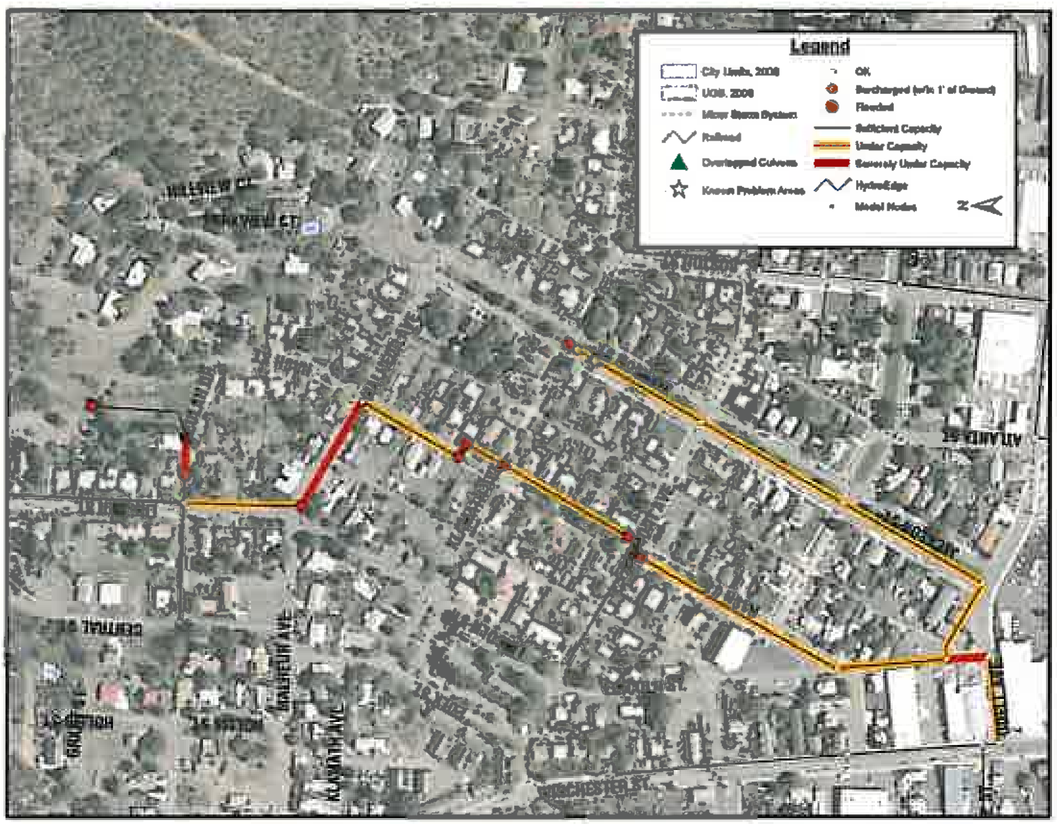
PROBLEM #6: SWEETBRIER CREEK AT NEWTON CREEK AND STERLING ROADS

	Discussion
Recommended Alternative:	• Construct a detention pond north of Newton Road to lower peak flow rates in the channel.
Technical Data:	Pipe sizes: 48" Peak flow: 81.6 cfs Q_{ratio}: > 3 Flooded volume: 13.2 ac-ft
Benefits:	• Eliminates downstream flooding
Land Ownership:	• Land acquisition will be required
Permitting:	• Environmental permitting will be required
Implementation Issues:	• Land acquisition costs are high • Developable land will be used for detention pond(s)
Cost	Land Acquisition: $ 1,620,000 Capital Costs: $ 1,173,887 TOTAL: $ 2,793,887

TABLE 8.4-1

PROBLEM #7: NASH STREET AND JACKSON STREET STORM DRAIN SYSTEM

	Discussion
Problem Location:	Nash and Jackson Street between Beulah Drive and Odell Avenue
Problem Summary:	The storm drain pipes connecting Beulah Drive to Odell Avenue via Nash Street range from 12" diameter at the upstream end to 30" diameter at the downstream end. All the pipes are under capacity, causing significant roadway flooding. The storm drain pipes along Jackson Street range from 12" to 15" diameter and are also under capacity, causing roadway flooding. This part of the city is relatively old and the storm drain infrastructure may need replacement from a condition standpoint as well. This area of flooding is known to be a problem area by the city.
Technical Details:	Pipe sizes: 12 – 30" Peak flow: 49.5 cfs Q_{ratio}: 1.2 – 3.0 Flooded volume: 11.7 ac-ft



Potential Solutions:	• **Upsize pipes along Jackson Street and add an additional pipe along Freemont Avenue to divert water from Nash Avenue.** • **Upsize pipes between Beulah Drive and Odell Avenue along Nash Street and pipes along Jackson Street.**

TABLE 8.4-1

PROBLEM #7: NASH STREET AND JACKSON STREET STORM DRAIN SYSTEM

	Discussion
Recommended Alternative:	• Upsize pipes along Jackson Street and add an additional pipe along Freemont Avenue to divert water from Nash Avenue.
Technical Data:	*Beulah Dr. 1:* S (%): 2.54 D (in): 21 L (ft): 95 Q (cfs): 22 *Beulah Dr. 2:* S (%): 2.56 D (in): 21 L (ft): 71 Q (cfs): 22 *Lincoln St.:* S (%): 5.58 D (in): 21 L (ft): 298 Q (cfs): 32 *Malheur Ave.:* S (%): 1.81 D (in): 30 L (ft): 305 Q (cfs): 48 *Nash St. 1:* S (%): 6.61 D (in): 30 L (ft): 283 Q (cfs): 91 *Nash St. 2:* S (%): 1.33 D (in): 36 L (ft): 39 Q (cfs): 67 Information on remainder of upsized pipes can be found in Appendix F.
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure • System connection reduces the lineal footage of pipe replacement
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permitting is anticipated
Implementation Issues:	• Traffic control and short-term closures in Lincoln St., Nash St., Malheur Ave., Freemont Ave., and Jackson St.
Cost	$ 1,210,920

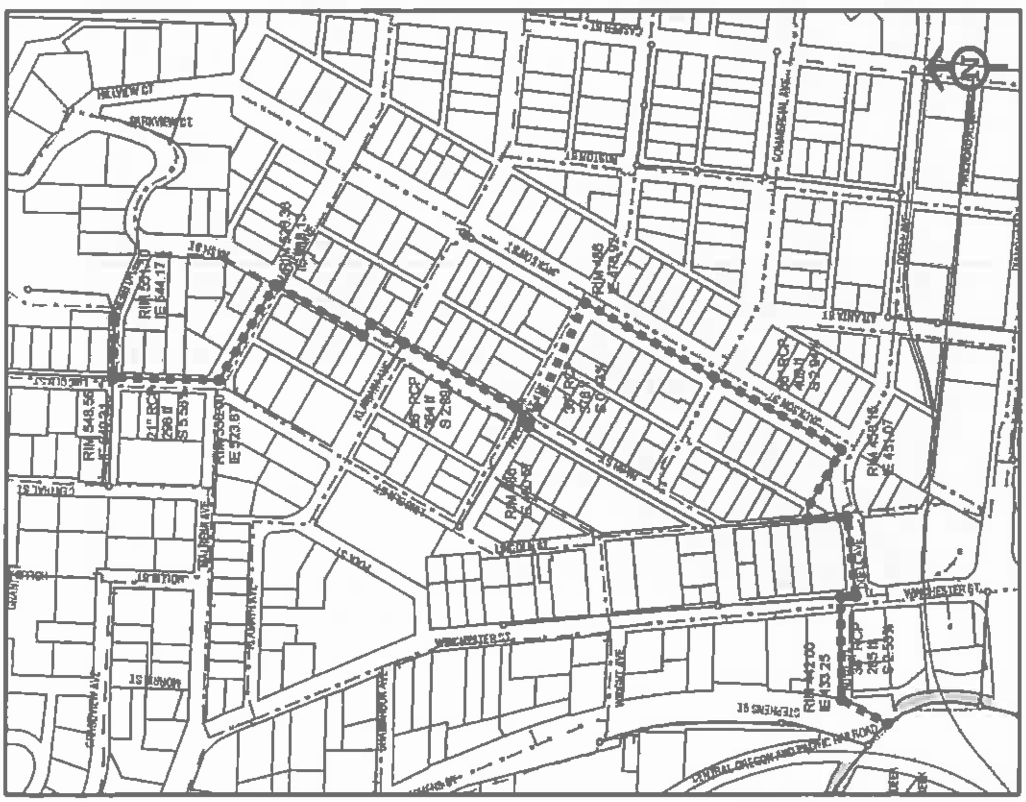
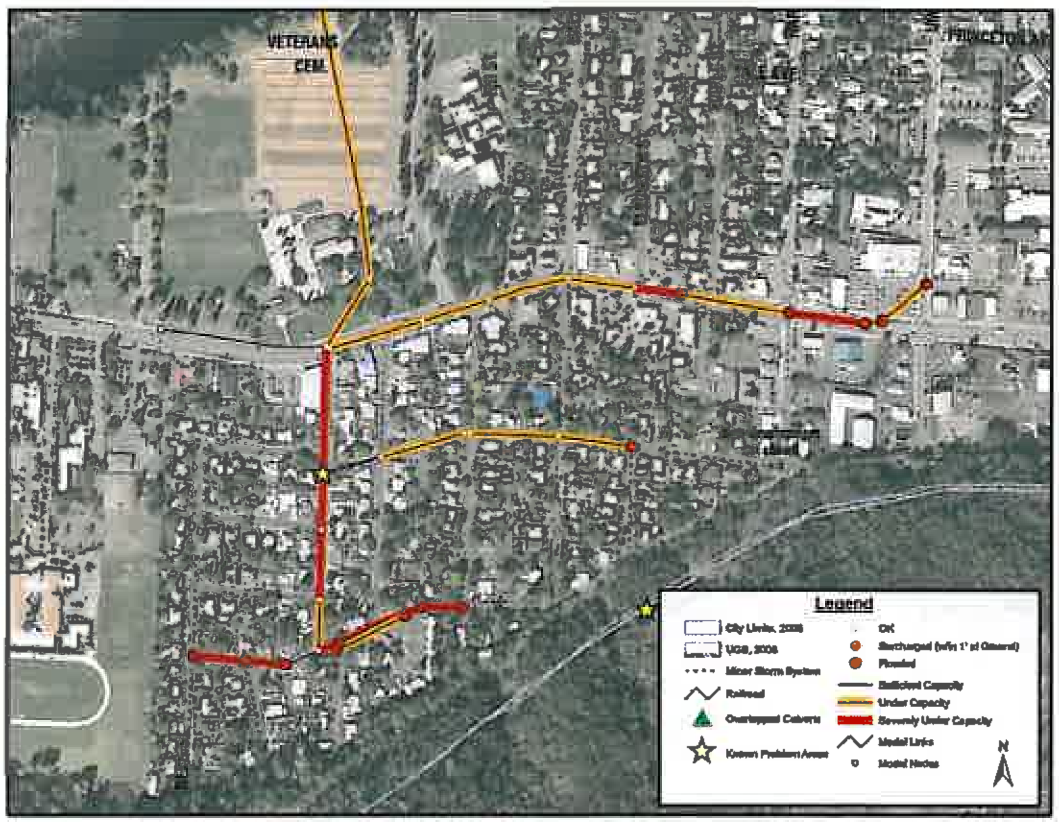


TABLE 8.4-1

PROBLEM #8: HARVARD AVENUE STORM DRAIN SYSTEM EAST OF I-5

	Discussion
Problem Location:	Harvard Avenue between Francis Street and Interstate 5
Problem Summary:	The storm drain system along Harvard Avenue and Nebo Street is severely under capacity, thereby creating flooding conditions during high flows. . The area south of Harvard Avenue is slightly lower in elevation that the area to the north creating a sink that collects water when flooding occurs. This area also experiences high water levels in the South Umpqua River which may compound the flood problem. This is a known flooding area by the City.
Technical Details:	Pipe sizes: 12 – 36" Peak flow: 144.4 cfs Q_{ratio}: 1.3 – >3 Flooded volume: 9.9 ac-ft



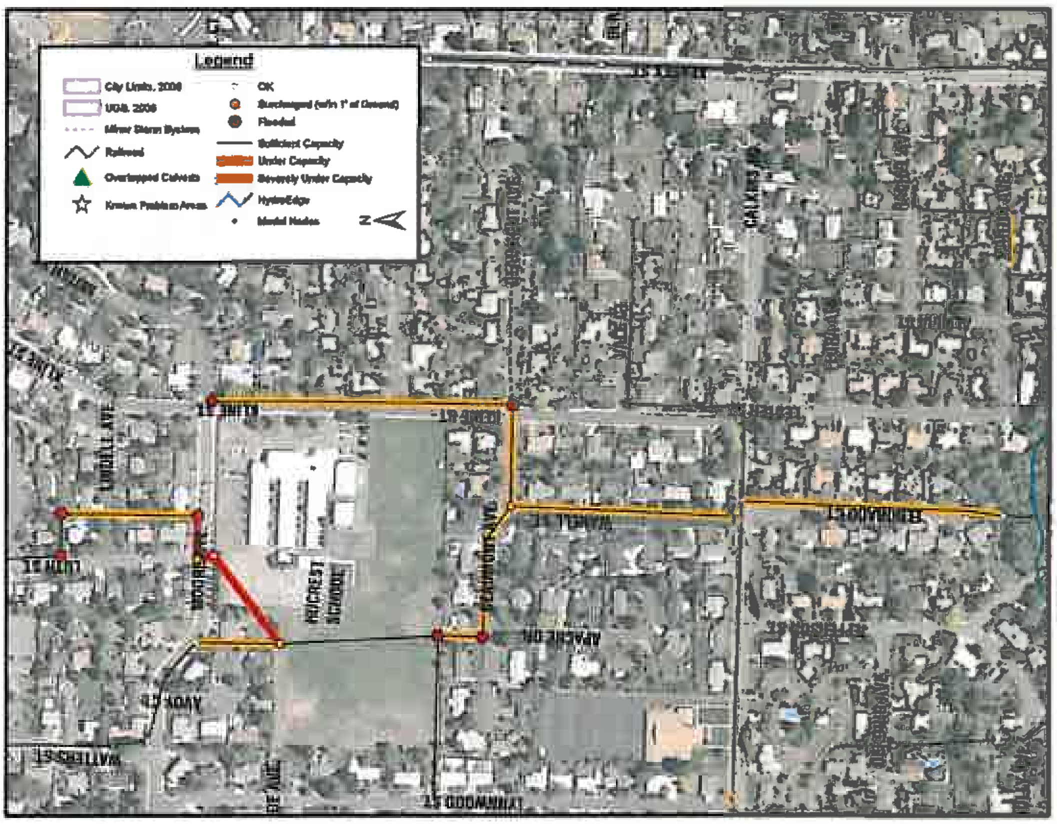
Potential Solutions:	• Construct new storm drain along BallF Street to the S. Umpqua River • Upsize the pipes along Harvard St, Fairhaven St and Myrtle Ave. • Construct a parallel pipe system along Harvard Ave and Fairhaven St. • Construct a new pipe system along Wharton Street to Harvard Avenue to divert flow away from the Fairhaven Street system.

TABLE 8.4-1 PROBLEM #8: HARVARD AVENUE STORM DRAIN SYSTEM EAST OF I-5	
	Discussion
Recommended Alternative:	• Construct new storm drain along Ballf Street to the S. Umpqua River
Technical Data:	*Ballf St. 1:* S (%): 1.60 D (in): 24 L (ft): 620 Q (cfs): 25 *Ballf St. 2:* S (%): 0.53 D (in): 36 L (ft): 570 Q (cfs): 42 *Ballf St. 3:* S (%): 0.37 D (in): 48 L (ft): 1050 Q (cfs): 76
Benefits:	• Primarily located within public right-of-way • Eliminates flooding
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• Environmental permitting may be required for the outfall retrofit
Implementation Issues:	• Construction along Ballf Street will require traffic control and short-term lane closures
Cost	$ 1,251,399

TABLE 8.4-1

PROBLEM #9: ELDORADO COURT AREA STORM DRAIN PIPE

	Discussion
Problem Location:	Eldorado Court north to Luth Court and Moore Avenue
Problem Summary:	The storm drain system from Eldorado Court north to Moore Avenue ranges from 12" to 30" diameter and is currently under capacity. Localized flooding occurs throughout this area during larger storm events.
Technical Details:	Pipe sizes: 12 – 30" Peak flow: 85.4 cfs Q_{ratio}: 1.2 – >3 Flooded volume: 2.8 ac-ft



Potential Solutions:	• **Add a new storm drain pipe along Luth St. to Moore Ave. Upsize the current drainage system that runs from Moore Ave. through the Hucrest School grounds and south along Wanell St. and Eldorado Ct. (This is a replacement for phase 3 of the Calkins Hydraulic Report)**

TABLE 8.4-1 PROBLEM #0: ELDORADO COURT AREA STORM DRAIN PIPE	
	Discussion
Recommended Alternative:	• Add a new storm drain pipe along Luth St. to Moore Ave. Upsize the current drainage system that runs from Moore Ave. through the Hucrest School grounds and south along Wanell St. and Eldorado Ct. (This is a replacement for phase 3 of the Calkins Hydraulic Report)
Technical Data:	*Luth St.:* S (%): 3.48 D (in): 36 L (ft): 376 Q (cfs): 115 *Moore Ave.:* S (%): 0.20 D (in): 36 L (ft): 47 Q (cfs): 26 *Hucrest 1:* S (%): 0.47 D (in): 36 L (ft): 301 Q (cfs): 40 *Hucrest 2:* S (%): 2.96 D (in): 36 L (ft): 435 Q (cfs): 100 *Beaumont 1:* S (%): 1.32 D (in): 36 L (ft): 122 Q (cfs): 85 Information on remainder of upsized pipes can be found in Appendix F.
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permitting is anticipated
Implementation Issues:	• Limited pipe cover along Beaumont Ave. and Luth Ave. • Traffic control along busy streets.
Cost	$ 766,201

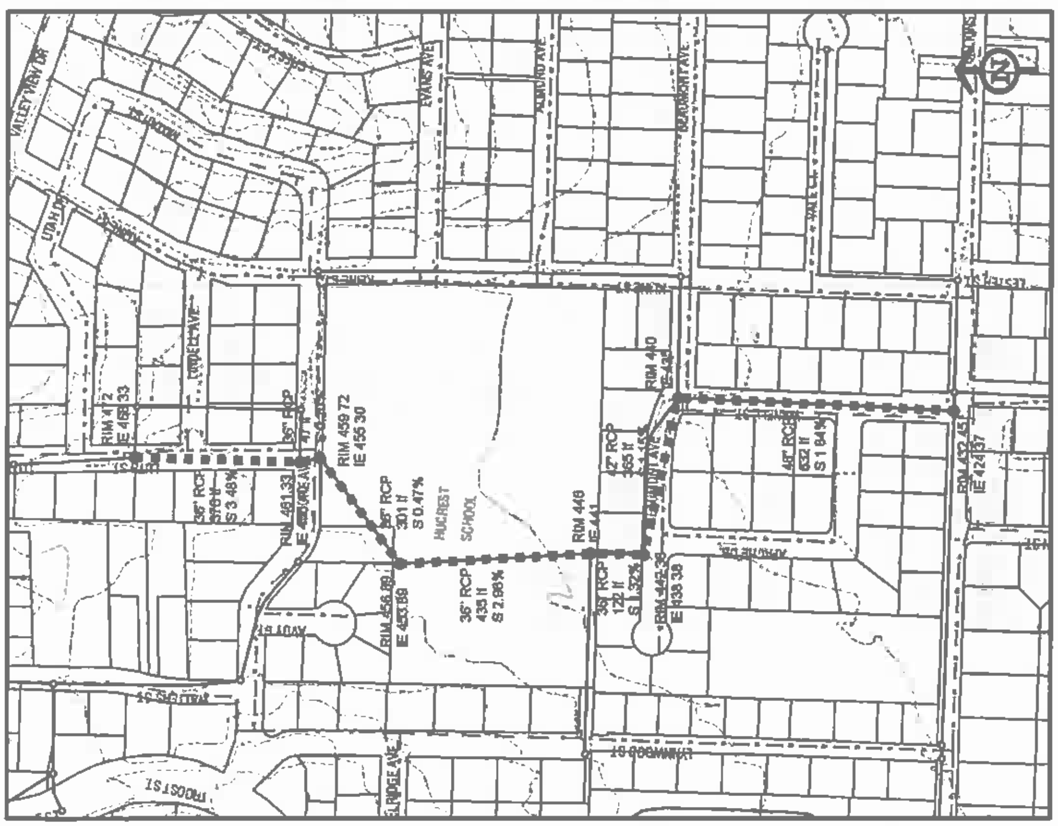
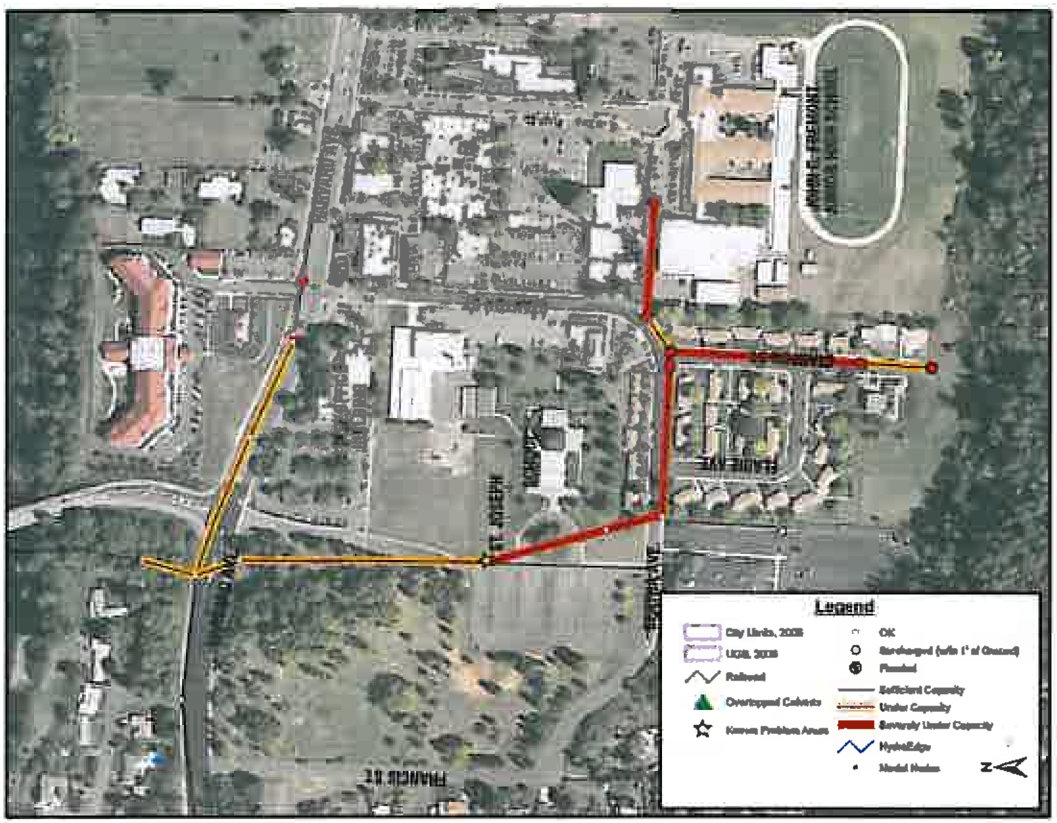


TABLE 8.4-1

PROBLEM #10: HARVARD STREET AT FRANCIS STREET AND BERTHA AVENUE

	Discussion
Problem Location:	Harvard Street at Francis Street and Bertha Avenue
Problem Summary:	The existing storm drain system between Harvard Street and the base of Mount Nebo is under capacity causing significant flooding along Bertha Street. The area surrounding Bertha Street is lower in elevation than Harvard Avenue creating a sink that collects water during flood events. This area also experiences high water levels in the South Umpqua River which may compound the flooding problem. This is a known flooding area.
Technical Details:	Pipe sizes: 18" - 42" Peak flow: 26 - 110 cfs Max Q_{ratio}: > 3 Flooded volume: ~7.9 ac-ft



Potential Solutions:	• **Construct a new storm drain system along School Road, Bertha Avenue, Stanton Street and Harvard Street.** • Construct a new parallel pipe system along Francis Street, Bertha Avenue and Stanton Street. • Incorporate a water quality manhole north of Harvard Street.

TABLE 8.4-1

PROBLEM #10: HARVARD STREET AT FRANCIS STREET AND BERTHA AVENUE

	Discussion
Recommended Alternative:	• Construct a new storm drain system along Francis Street, Bertha Avenue and Stanton Street.
Technical Data:	*North of Harvard:* S (%): 0.50 D (in): 60 L (ft): 144 Q (cfs): 160 *South of Harvard 1:* S (%): 0.51 D (in): 60 L (ft): 117 Q (cfs): 162 *South of Harvard 2:* S (%): 0.57 D (in): 60 L (ft): 624 Q (cfs): 171 *South of Harvard 3:* S (%): 0.13 D (in): 48 L (ft): 408 Q (cfs): 44 Information on remainder of upsized pipes can be found in Appendix F.
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permits anticipated.
Implementation Issues:	• Construction along Harvard Avenue will require traffic control and short-term lane closures. • Deep pipe excavations near Harvard Avenue
Cost	$ 1,165,620

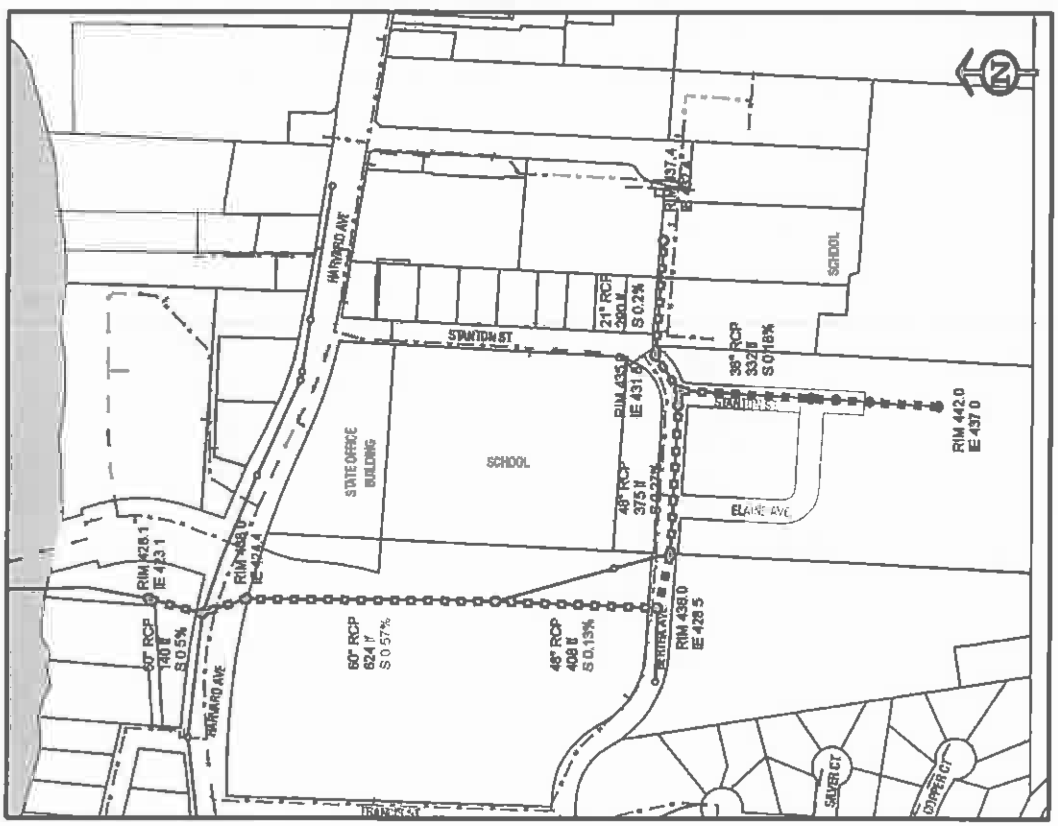
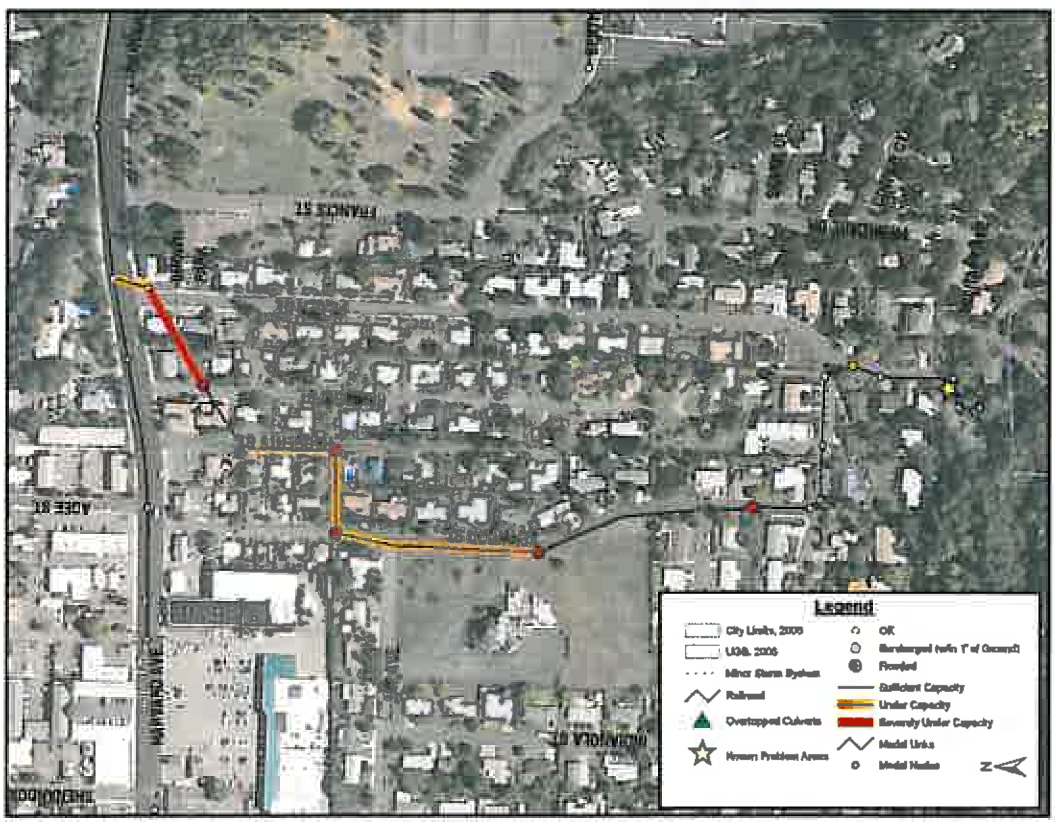


TABLE 8.4-1

PROBLEM #11: KENNWOOD AND HAGGERTY ST

	Discussion
Problem Location:	The existing storm drain system along Kennwood And Haggerty St between Harvard St and Military Ave.
Problem Summary:	The storm drain system between Harvard Ave and Haggerty St is severely undercapacity. The pipe system along Haggerty St and a portion of Kennwood St is also undercapacity creating flooding conditions during high flows. The area south of Harvard Avenue is slightly lower in elevation that the area to the north creating a sink that collects water when flooding occurs. This area also experiences high water levels in the S Umpqua River.
Technical Details:	Pipe sizes: 12 – 24" Peak flow: 12.0 – 26.6 cfs Q_{ratio}: 1.7 – >3 Flooded volume: 4.1 ac-ft



Potential Solutions:	• **Construct new storm drain systems along Kenwood and Pilger Streets north to Harvard Avenue and utilize available capacity in the system.** • Upsize the storm drain pipes between Haggerty Street and Harvard Avenue and along Kenwood and Haggerty Street.

TABLE 8.4-1

PROBLEM #11: KENWOOD AND HAGGERTY ST

	Discussion
Recommended Alternative:	• Construct new storm drain systems along Kenwood and Pilger Streets north to Harvard Avenue and utilize available capacity in the system.
Technical Data:	*Kenwood St.:* S (%): 1.38 D (in): 18 L (ft): 458 Q (cfs): 11 *Pilger St. 1:* S (%): 11.85 D (in): 18 L (ft): 142 Q (cfs): 31 *Pilger St. 2:* S (%): 10.45 D (in): 18 L (ft): 488 Q (cfs): 29 *Pilger St. 3:* S (%): 7.73 D (in): 18 L (ft): 457 Q (cfs): 25 *Pilger St. 4:* S (%): 2.30 D (in): 18 L (ft): 396 Q (cfs): 14 *Pilger St. 5:* S (%): 1.58 D (in): 24 L (ft): 226 Q (cfs): 26
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure • New pipe alignment reduces the total lineal footage of pipe necessary to solve the flooding problems
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permits anticipated.
Implementation Issues:	• No significant implementation issues anticipated
Cost	**$ 474,757**

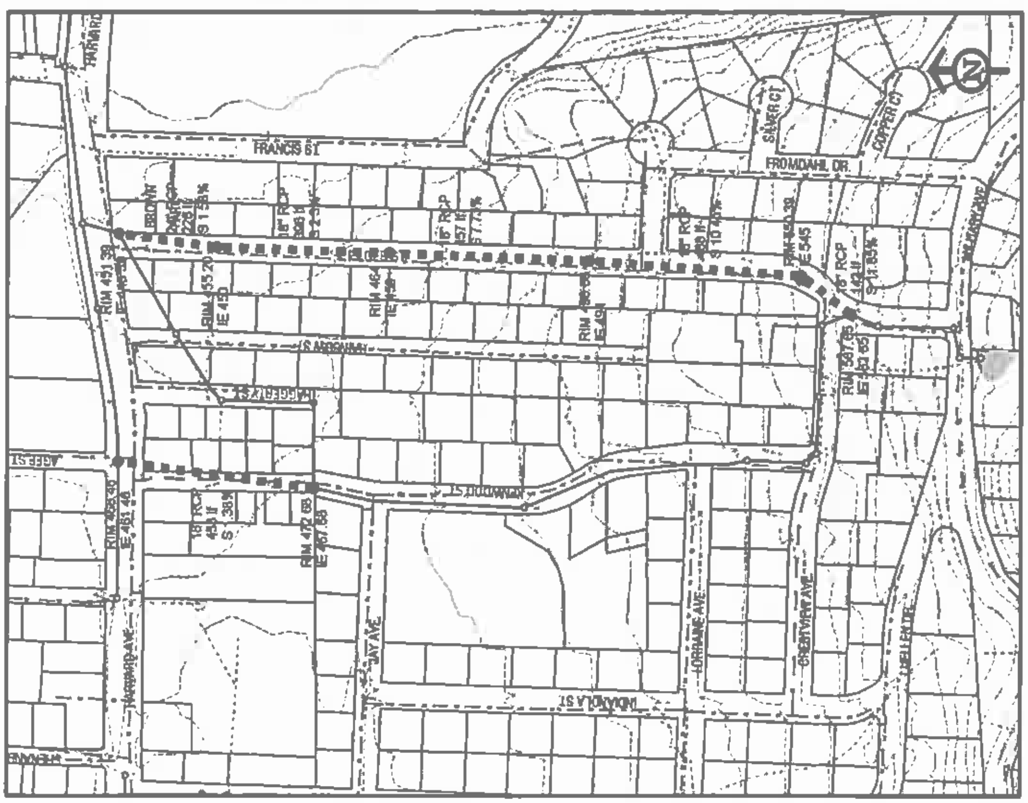
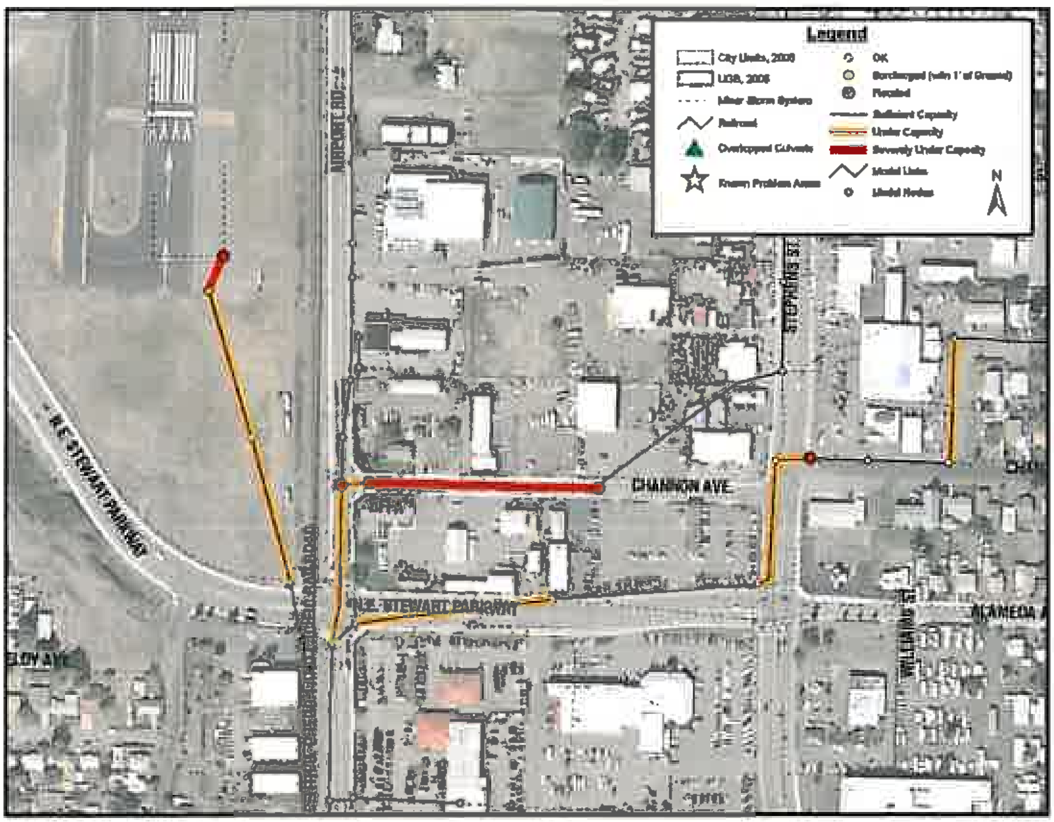


TABLE 8.4-1

PROBLEM #12: STEWART PRKWY AT AIRPORT RD

	Discussion
Problem Location:	The existing storm drain system along Stewart Prky and Stephens St, the existing storm drain system along Airport Rd and Channon Ave and the storm system drain the southeast portion of the Roseburg Municipal Airport.
Problem Summary:	Undersized pipe segments along Stewart Prky, Airport Rd, Channon Ave, Stephens St and in the airport cause localized flooding throughout the area. Only the pipe segment along Channon Ave is severely undercapacity (flows greater than 200% of the pipe capacity according to modeling)
Technical Details:	Pipe sizes: 18 – 42" Peak flow: 25 – 84.6 cfs Q_{ratio}: 1.1 – > 3 Flooded volume: 2.2 ac-ft



Potential Solutions:	• **Upsize the storm drain system along Airport Rd. and Channon Ave.** • Construct a parallel system along Channon Ave.

TABLE 8.4-1

PROBLEM #12: STEWART PRKWY AT AIRPORT RD

	Discussion
Recommended Alternative:	• Upsize the storm drain system along Airport Rd. and Channon Ave.
Technical Data:	*Channon Ave.:* S (%): 0.13 D (in): 36 L (ft): 499 Q (cfs): 28 *Airport Rd..:* S (%): 1.83 D (in): 36 L (ft): 345 Q (cfs): 76 If the pipe at the intersection of Channon Ave. and Stephens St. has an 18" diameter (as reported by the City), upsizing the pipe is recommended. Otherwise, monitoring of the pipe is advised.
Benefits:	• Located within public right-of-way • Improves water quality • Eliminates flooding and utilizes existing infrastructure
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permits anticipated.
Implementation Issues:	• No significant implementation issues anticipated • Traffic control may be required at Stewart Parkway
Cost	**$ 281,560**

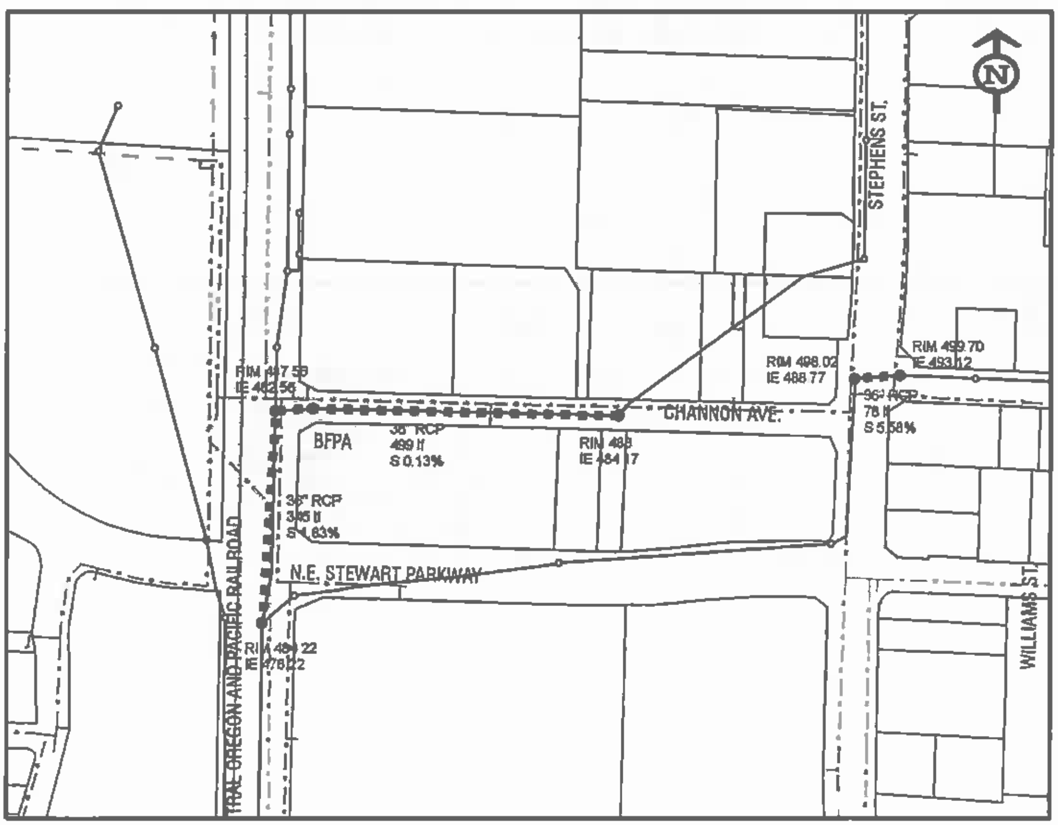
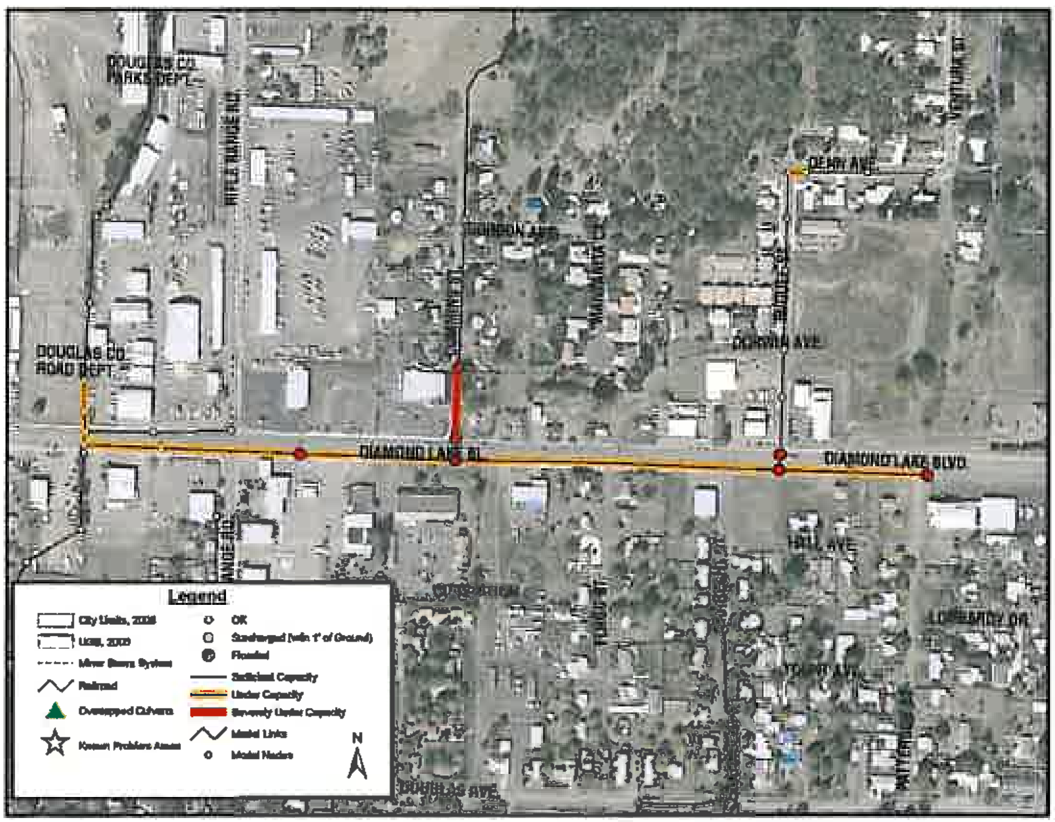


TABLE 8.4-1

PROBLEM #13: DIAMOND LAKE BLVD #1

	Discussion
Problem Location:	Storm drain at Diamond Lake Blvd between Riffle Range Rd and Patterson St.
Problem Summary:	The storm drain system along Diamond Lake Blvd. is under capacity and the system along Cummins St. is severely under capacity. The undersized pipes cause localized flooding.
Technical Details:	Pipe sizes: 12 – 24" Peak flow: 12.2 – 59.2 cfs Q_{ratio}: 1.9 – > 3 Flooded volume: 1.9 ac-ft



Potential Solutions:	• **Upsize the storm drain system along Diamond Lake Blvd. and Cummins St. (Although this system is mainly within the ODOT right-of-way, nearly all of the flow entering the system is runoff from within the city limits.)** • Construct a parallel system along Diamond Lake Blvd. • Investigate detention possibilities west of Miguel St.

TABLE 8.4-1

PROBLEM #13: DIAMOND LAKE BLVD #1

	Discussion
Recommended Alternative:	• Upsize the storm drain system along Diamond Lake Blvd. and Cummins St. (Although this system is mainly within the ODOT right-of-way, nearly all of the flow entering the system is runoff from within the city limits.)
Technical Data:	*Diamond Lk. 1:* S (%): 1.40 D (in): 15 L (ft): 488 Q (cfs): 7 *Diamond Lk. 2:* S (%): 1.66 D (in): 27 L (ft): 972 Q (cfs): 35 *Diamond Lk. 3:* S (%): 1.46 D (in): 36 L (ft): 1108 Q (cfs): 56 *Cummins St.:* S (%): 0.31 D (in): 24 L (ft): 210 Q (cfs): 11
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure
Land Ownership:	• Diamond Lake Boulevard owned by ODOT
Permitting:	• No special permits anticipated
Implementation Issues:	• Construction along Diamond Lake Boulevard should be coordinated with ODOT • Significant traffic control will be required
Cost	**$ 876,245**

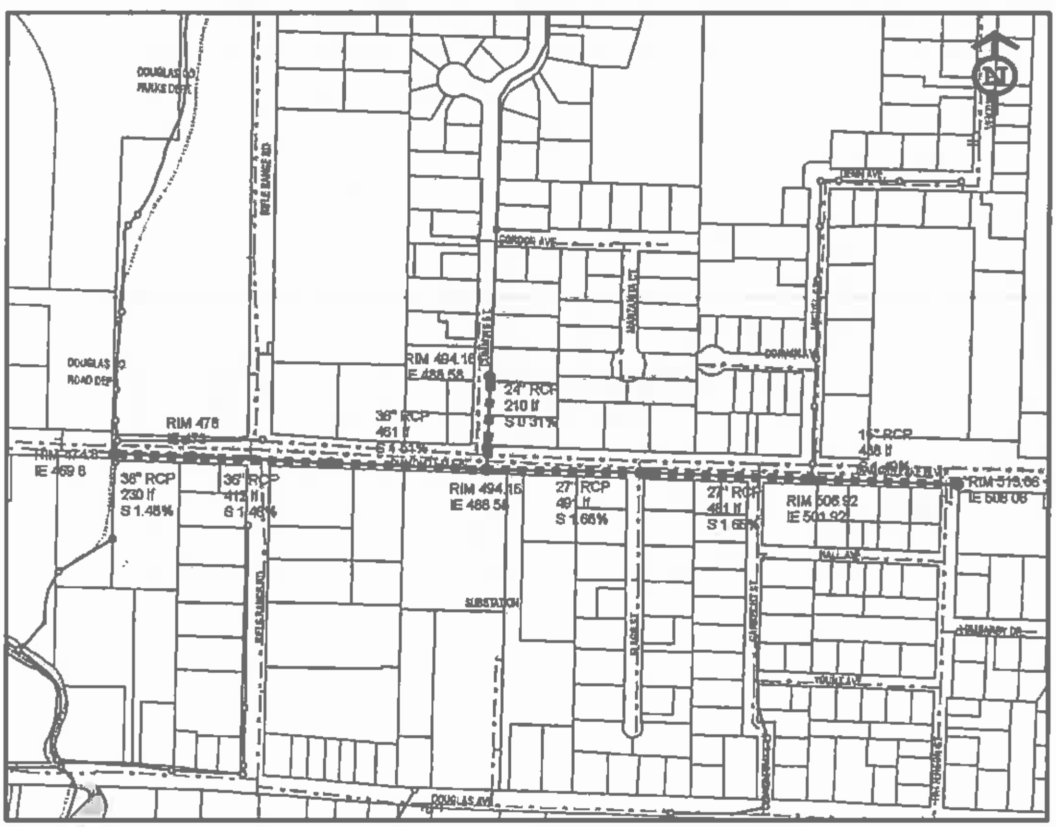
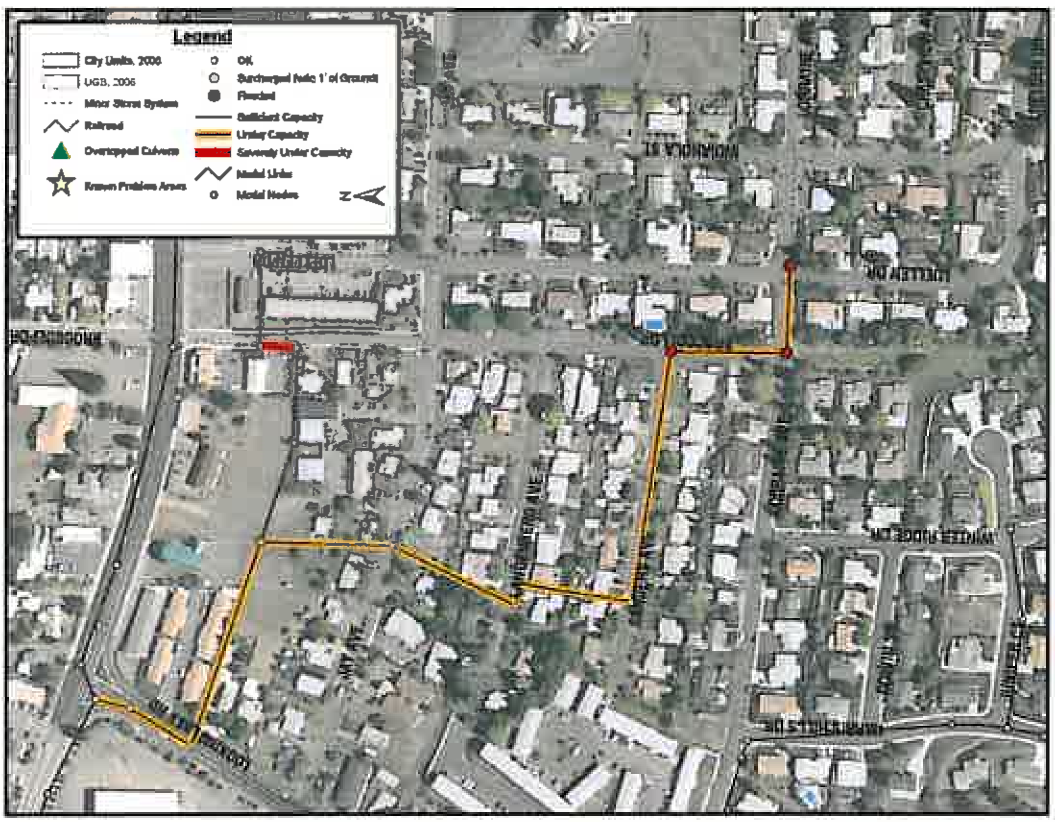


TABLE 8.4-1

PROBLEM #14: STORM DRAIN BETWEEN LOOKINGLASS RD AND LORRAINE AVE

	Discussion
Problem Location:	Storm drain system along Lorraine Ave., Broccoli Dr., Sanders Ave., and Lookinglass Rd.
Problem Summary:	The storm drain system in this area is under capacity, particularly the southern portions of the system between Sanders and Lorraine Ave., causing floods in the surrounding neighborhoods.
Technical Details:	Pipe sizes: 18 – 24" Peak flow: 23.3 – 51.0 cfs Q_{ratio}: 1.3 – > 3 Flooded volume: 1.1 ac-ft



Potential Solutions:	• **Construct a new storm drain between Jay Ave and Lorraine Ave. (This alignment is shorter and will have less property impacts)** • As a lower cost alternative, upsize the storm drain along Lorraine Ave., Broccoli Dr., and Sanders Ave. • Upsize the entire storm drain system in this area.

TABLE 8.4-1

PROBLEM #14: STORM DRAIN BETWEEN LOOKINGLASS RD AND LORRAINE AVE

	Discussion
Recommended Alternative:	• Construct a new storm drain between Jay Ave and Lorraine Ave. (This alignment is shorter and will have less property impacts)
Technical Data:	*Lorraine Ave.:* S (%): 2.73 D (in): 24 L (ft): 181 Q (cfs): 32 *Broccoli Dr. 1:* S (%): 5.36 D (in): 24 L (ft): 240 Q (cfs): 45 *Broccoli Dr. 2:* S (%): 2.68 D (in): 36 L (ft): 495 Q (cfs): 95 *Jay Ave. 1:* S (%): 1.36 D (in): 36 L (ft): 226 Q (cfs): 68 Information on remainder of upsized pipes can be found in Appendix F.
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure
Land Ownership:	• Nearly all property owned by the City of Roseburg
Permitting:	• No special permits anticipated
Implementation Issues:	• Significant traffic control will be required
Cost	**$ 721,591**

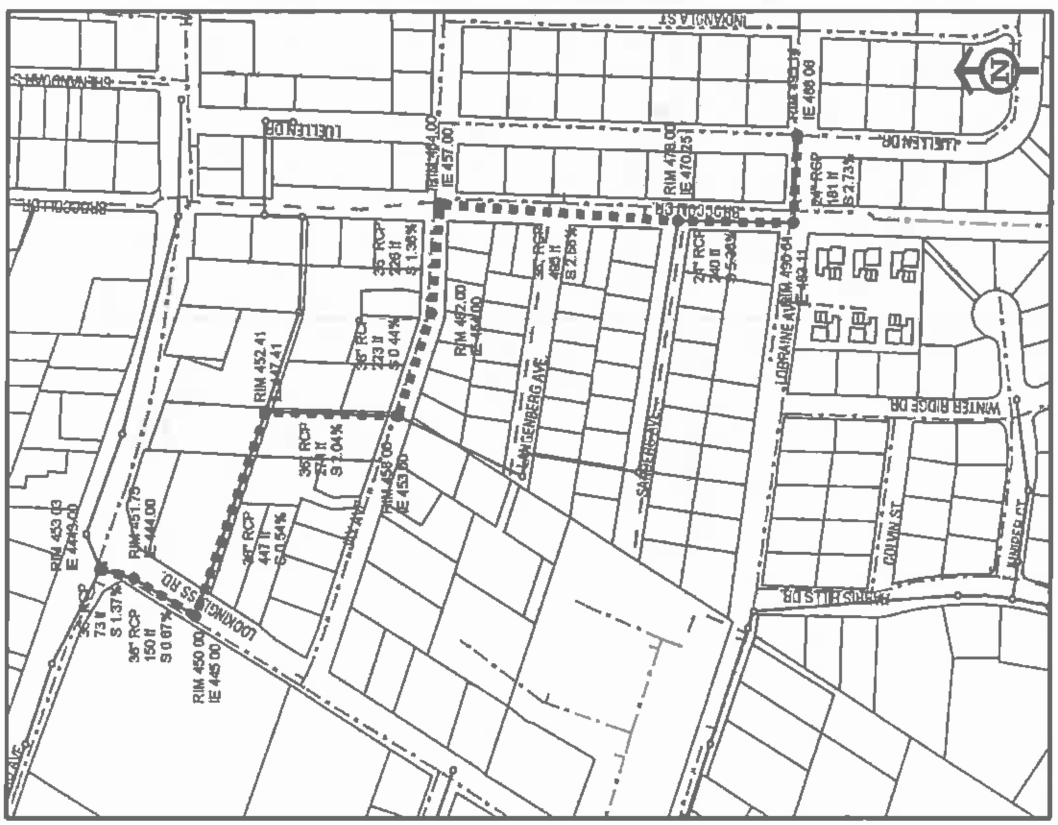
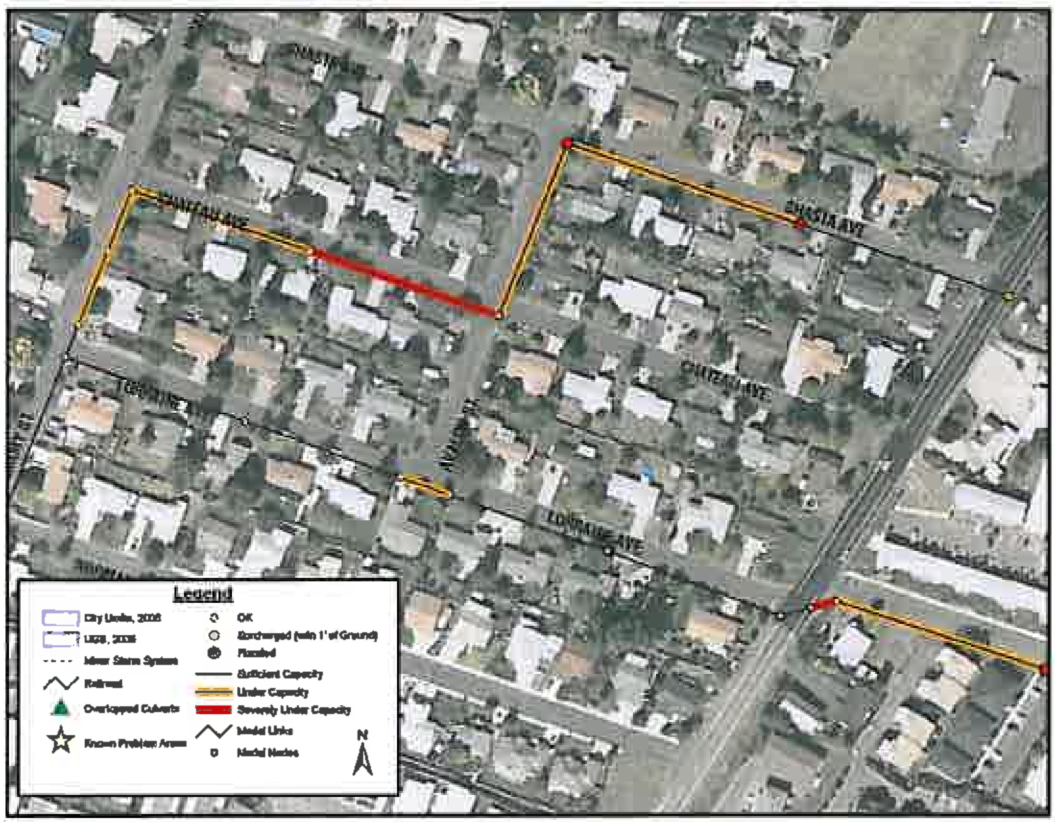


TABLE 8.4-1

PROBLEM #15: STORM DRAIN ALONG HICKORY ST, CHATEAU AVE AND SHASTA AVE

	Discussion
Problem Location:	Storm drain system along Shasta Ave., Chateau Ave., and Hickory St.
Problem Summary:	The storm drain system along Shasta Ave., Chateau Ave., and Hickory St. are under capacity causing localized floods in the surrounding neighborhoods.
Technical Details:	Pipe sizes: 12 – 18" Peak flow: 4.2 – 6.5 cfs Q_{ratio}: 1.3 – > 3 Flooded volume: 1.1 ac-ft



Potential Solutions:

- **Evaluate the potential to connect Chateau St to Lorrain St via Avalon St to utilize available capacity.**
- Upsize the storm drain system along Shasta Ave., Chateau Ave., and Hickory St.
- Construct a parallel pipe system along Shasta Ave., Chateau Ave., and Hickory St.

TABLE 8.4-1 PROBLEM #15: STORM DRAIN ALONG HICKORY ST, CHATEAU AVE AND SHASTA AVE					
	Discussion				
Recommended Alternative:	• Connect Chateau St to Lorrain St via Avalon St to utilize available capacity				
Technical Data:	*Shasta Ave. 1:*	S (%): 2.05	D (in): 18	L (ft): 316	Q (cfs): 13
	Shasta Ave. 2:	S (%): 1.00	D (in): 18	L (ft): 354	Q (cfs): 9
	Avalon St. 1:	S (%): 0.72	D (in): 18	L (ft): 265	Q (cfs): 8
	Avalon St. 2:	S (%): 0.78	D (in): 30	L (ft): 268	Q (cfs): 31
	Information on remainder of upsized pipes can be found in Appendix F.				
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure				
Land Ownership:	• All property owned by the City of Roseburg				
Permitting:	• No special permits anticipated				
Implementation Issues:	• Significant traffic control will be required				
Cost	**$ 404,066**				

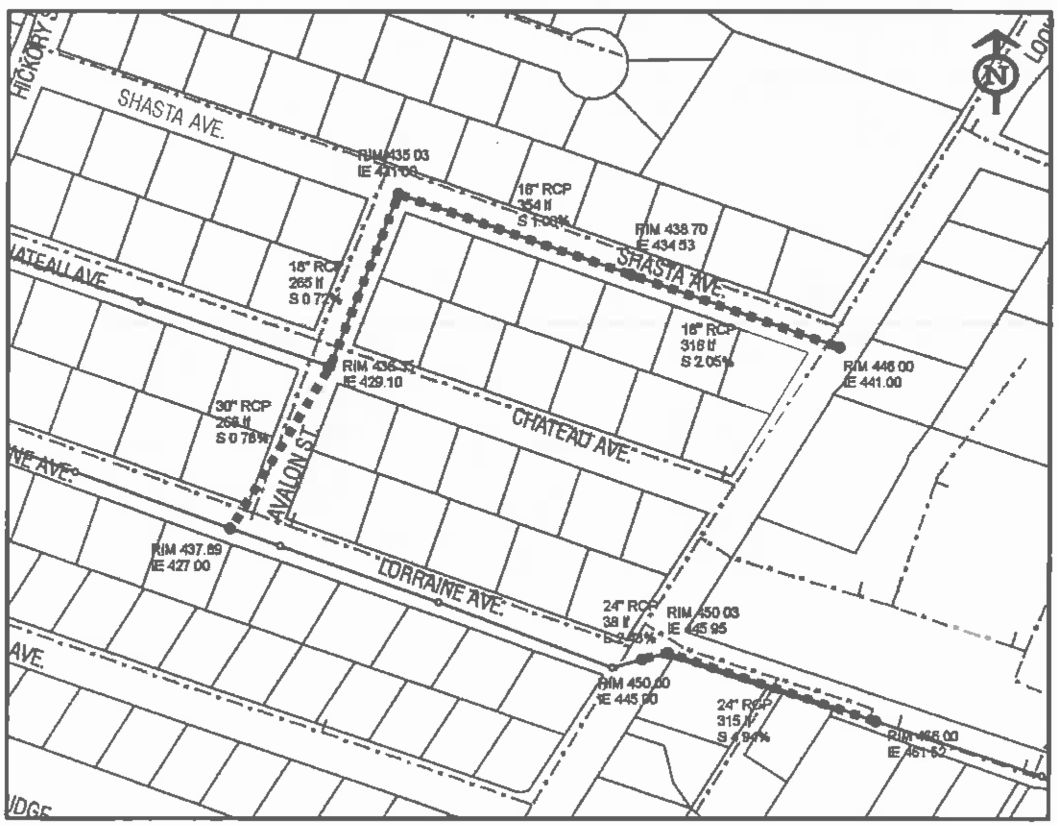
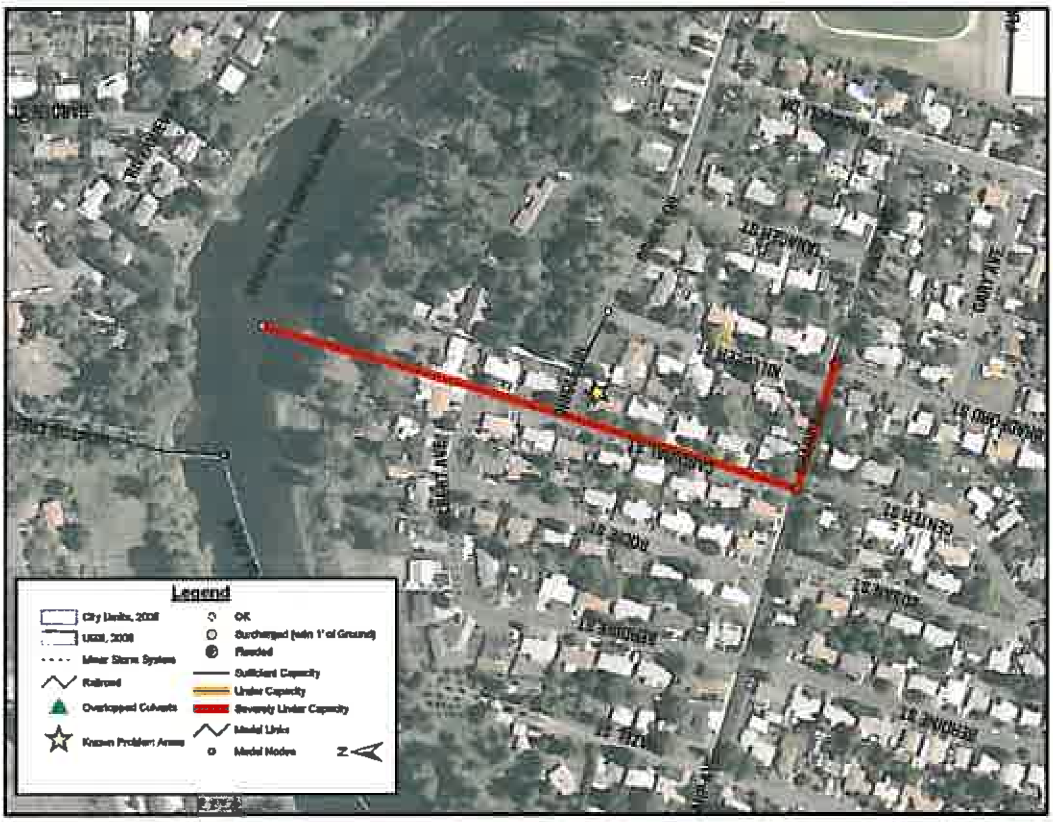


TABLE 8.4-1

PROBLEM #16: CARDINAL STREET

	Discussion
Problem Location:	Storm drain system along Cardinal St. between the S. Umpqua River and Sharp Ave.
Problem Summary:	The storm drain system along Sharp Ave and Cardinal St. is severely under capacity causing flooding in the surrounding neighborhoods. This is a known flooding area by the city.
Technical Details:	Pipe sizes: 12 – 15" Peak flow: 10.3 – 20.0 Q_{ratio}: > 3 Flooded volume: 0.71 ac-ft



Potential Solutions:

- Upsize the storm drain system along Sharp Ave. and Cardinal St
- Construct a parallel storm drain system along Sharp Ave. and Cardinal St.
- Evaluate a new storm drain system and outfall along Hazel St or Sharp St.

TABLE 8.4-1 PROBLEM #16: CARDINAL STREET					
	Discussion				
Recommended Alternative:	• Upsize the storm drain system along Sharp Ave. and Cardinal St.				
Technical Data:	*Sharp Ave.:*	S (%): 0.91	D (in): 21	L (ft): 293	Q (cfs): 13
	Cardinal St. 1:	S (%): 0.56	D (in): 24	L (ft): 562	Q (cfs): 15
	Cardinal St. 2:	S (%): 0.51	D (in): 30	L (ft): 696	Q (cfs): 25
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure				
Land Ownership:	• All property owned by the City of Roseburg				
Permitting:	• Environmental permitting may be required for outfall modification into the South Umpqua River				
Implementation Issues:	• No significant implementation issues anticipated				
Cost	$ 448,560				

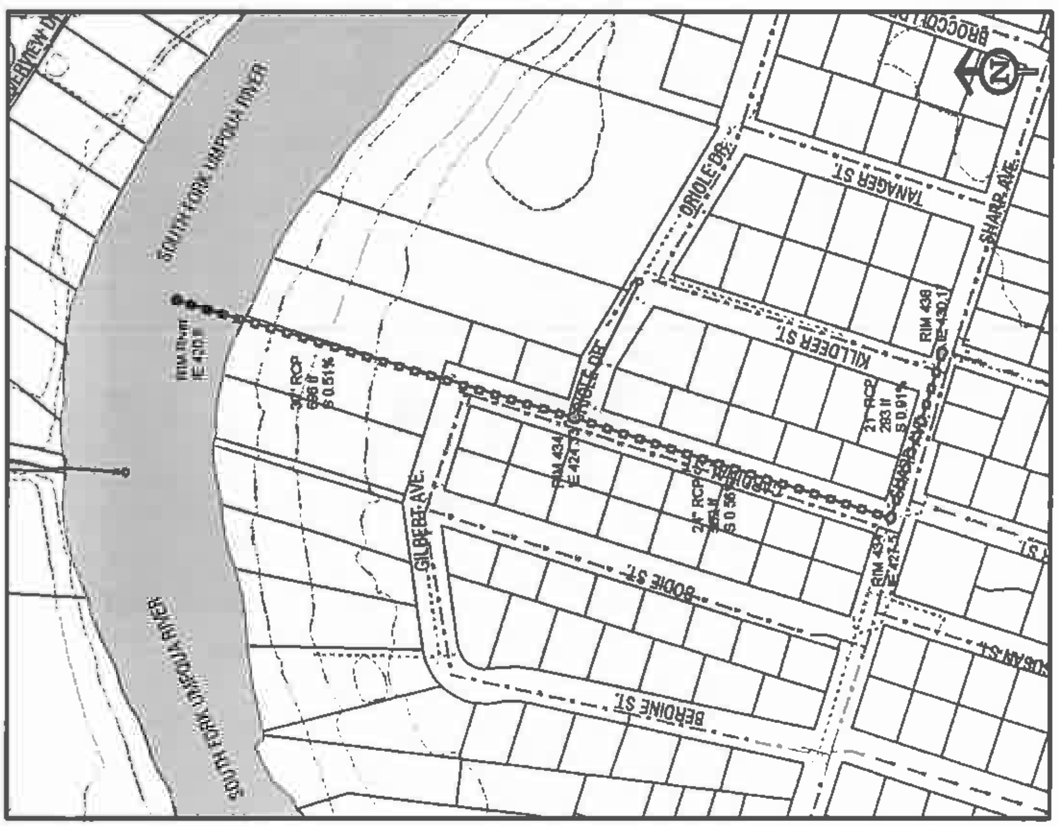
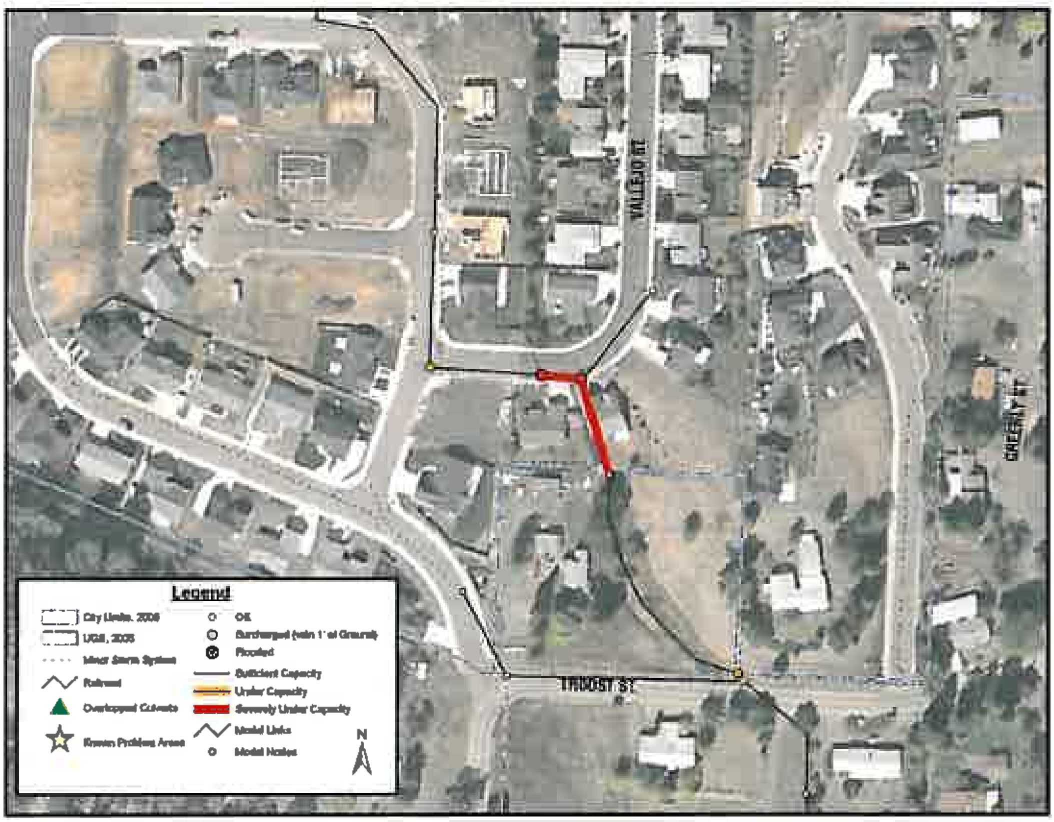


TABLE 8.4-1

PROBLEM #17: CULVERT AT VALLEJO ST

	Discussion
Problem Location:	Culvert between Vallejo St. and Troost St.
Problem Summary:	The culvert located south of Vallejo St. is under capacity and causes flooding of surrounding properties. In addition, significant development pressure in this area will lead to an increase in future runoff, exacerbating the current flooding problem.
Technical Details:	Pipe sizes: 18" Peak flow: 36.4 cfs Q_{ratio}: > 3 Flooded volume: 0.69 ac-ft



Potential Solutions:	• Construct a new pipe system from Vallejo St. to Troost St. • Investigate upstream detention

TABLE 8.4-1

PROBLEM #17: CULVERT AT VALLEJO ST

	Discussion				
Recommended Alternative:	• Construct a new pipe system from Vallejo St. to Troost St.				
Technical Data:	*Vallejo St. 1.:*	S (%): 3.91	D (in): 24	L (ft): 192	Q (cfs): 42
	Vallejo St. 2:	S (%): 2.56	D (in): 24	L (ft): 143	Q (cfs): 34
	Vallejo St. 3:	S (%): 1.42	D (in): 24	L (ft): 118	Q (cfs): 32
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure • System connection reduces the lineal footage of pipe replacement				
Land Ownership:	• All property owned by the City of Roseburg				
Permitting:	• No special permitting is anticipated				
Implementation Issues:	• No significant implementation issues anticipated				
Cost	$ 147,149				

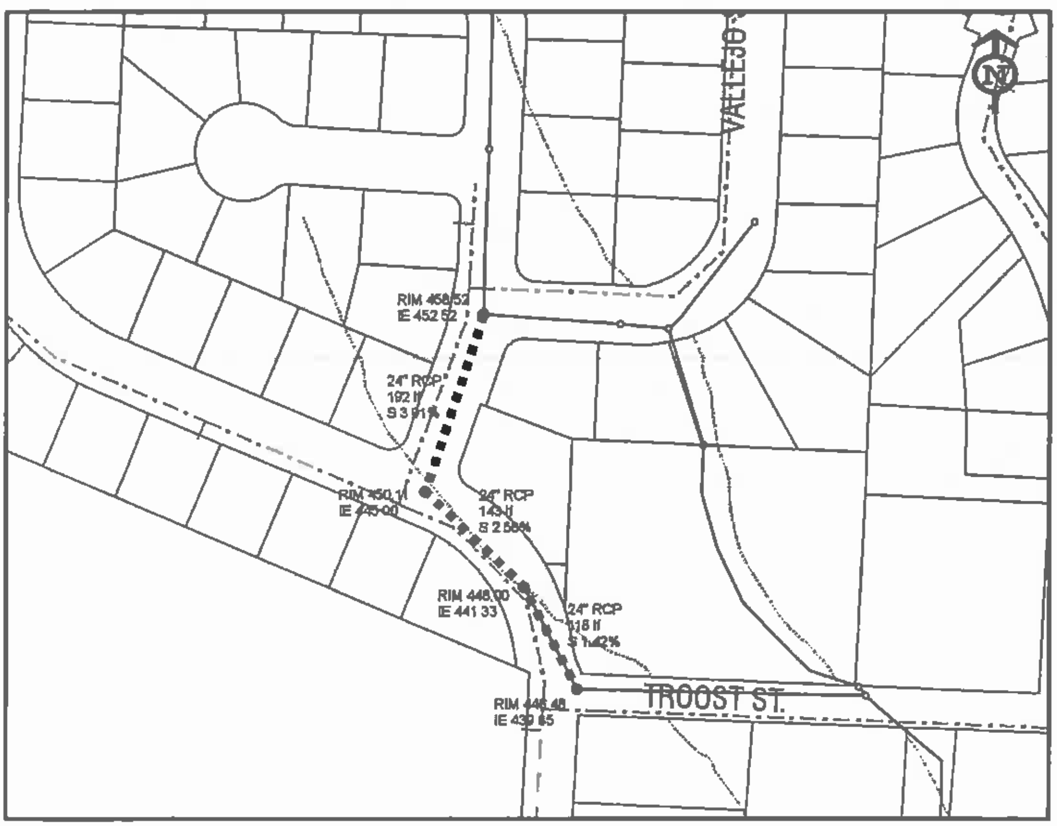
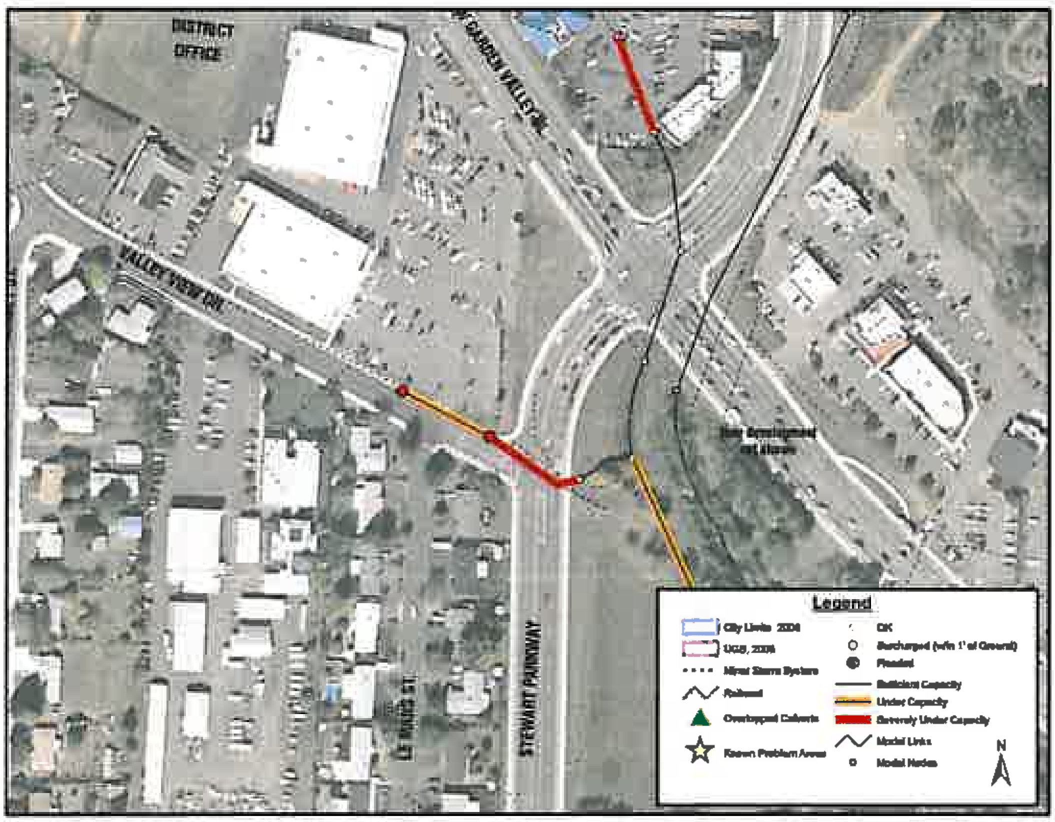


TABLE 8.4-1

PROBLEM #18: VALLEY VIEW DR AT STEWARD PRKWY

	Discussion
Problem Location:	The storm drain system at the intersection of Valley View Dr. and Stewart Prkwy.
Problem Summary:	The storm drain system along Valley View Dr. is under capacity causing localized flooding. The system is severely under capacity at the intersection of Valley View Dr. and Stewart Prkwy.
Technical Details:	Pipe sizes: 12 – 15" Peak flow: 14.9 cfs Q_{ratio}: 1.7 - > 3 Flooded volume: 0.57 ac-ft



Potential Solutions:

- **Upsize the storm drain system along Valley View Dr. at the intersection of Stewart Prkwy.**
- Construct local detention pond at southeast corner of parking lot.

TABLE 8.4-1 PROBLEM #18: VALLEY VIEW DR AT STEWARD PRKWY					
	Discussion				
Recommended Alternative:	• Upsize the storm drain system along Valley View Dr. at the intersection of Stewart Prkwy.				
Technical Data:	*Valley View 1.:*	S (%): 1.38	D (in): 21	L (ft): 149	Q (cfs): 22
	Valley View 2:	S (%): 0.64	D (in): 21	L (ft): 177	Q (cfs): 15
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure				
Land Ownership:	• All property owned by the City of Roseburg				
Permitting:	• No special permitting is anticipated				
Implementation Issues:	• No significant implementation issues anticipated				
Cost	**$ 86,038**				

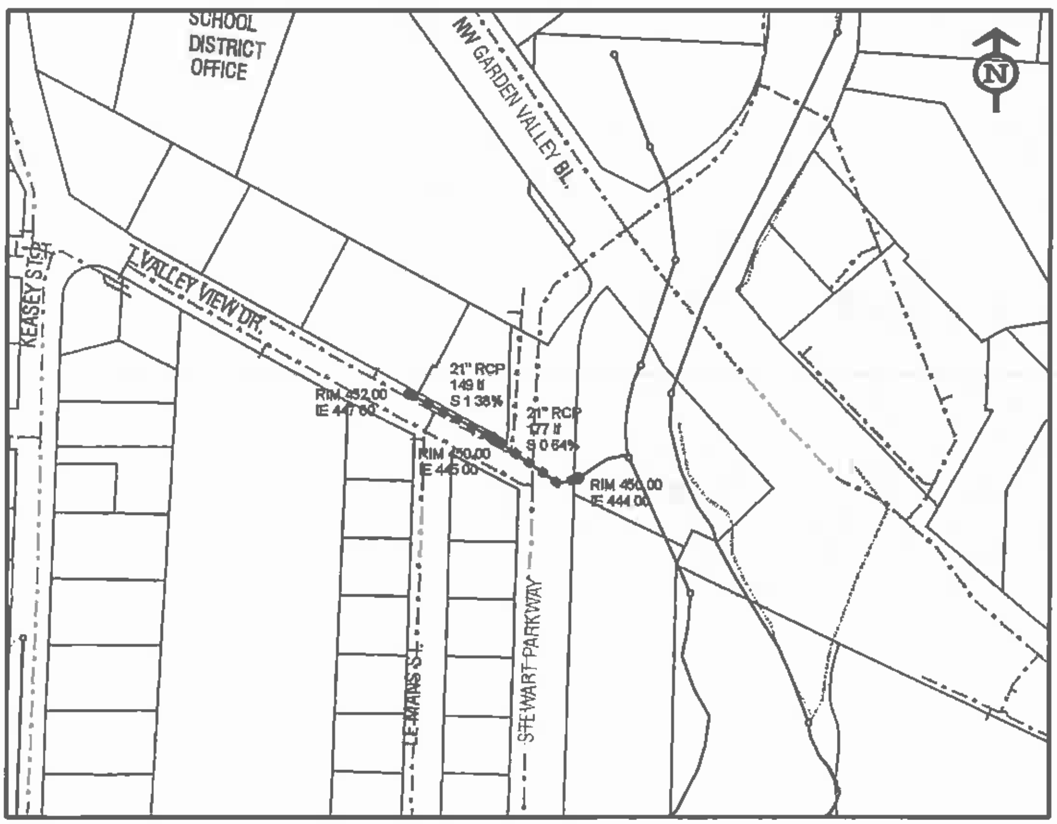
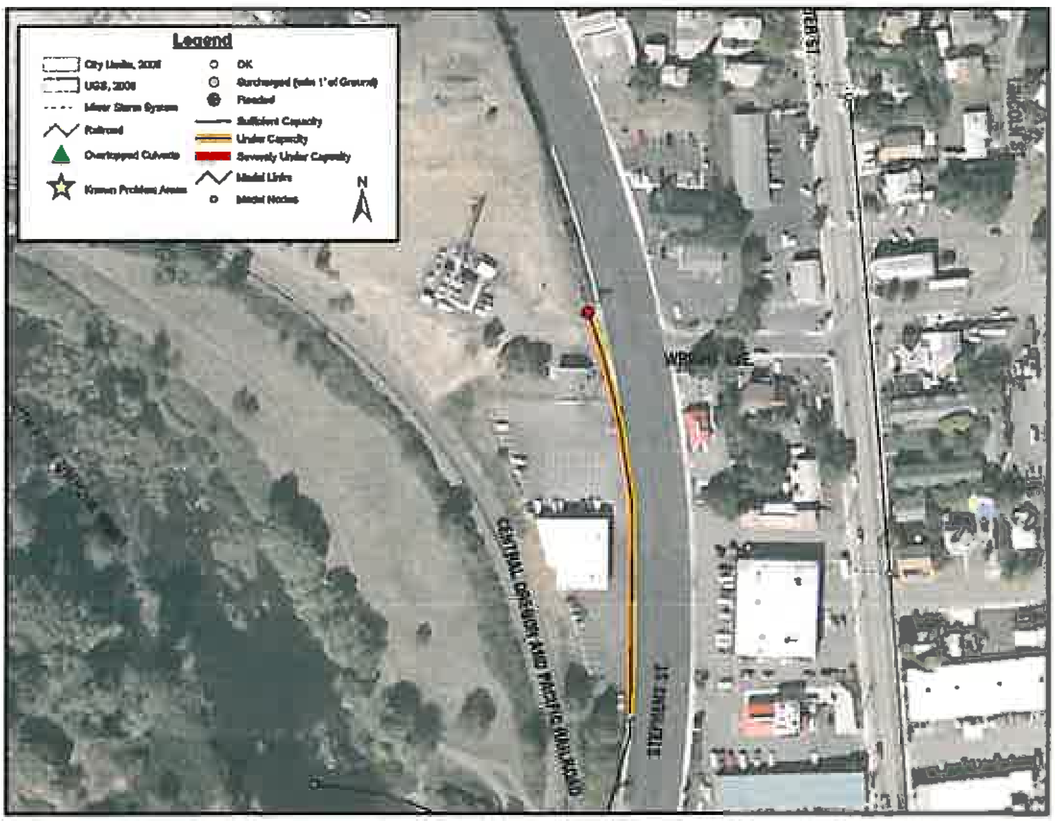


TABLE 8.4-1

PROBLEM #19: STEPHENS ST

	Discussion
Problem Location:	Stephens St. between Wright Ave and Rowe St.
Problem Summary:	The storm drain system along Stephens St. is under capacity causing localized flooding.
Technical Details:	Pipe sizes: 18" Peak flow: 34.7 cfs Q_{ratio}: 1.2 Flooded volume: 0.53 ac-ft



Potential Solutions:	• **Upsize the storm drain system along Stephens St. between Wright Ave and Rowe St.** • No local improvements recommended.

TABLE 8.4-1 PROBLEM #19: STEPHENS ST	
	Discussion
Recommended Alternative:	• Upsize the storm drain system along Stephens St. between Wright Ave and Rowe St.
Technical Data:	*Stephens St.:* S (%): 6.15 D (in): 21 L (ft): 510 Q (cfs): 34
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure
Land Ownership:	• All property is in public right-of-way
Permitting:	• No special permitting is anticipated
Implementation Issues:	• Traffic control will be required
Cost	**$ 126,601**

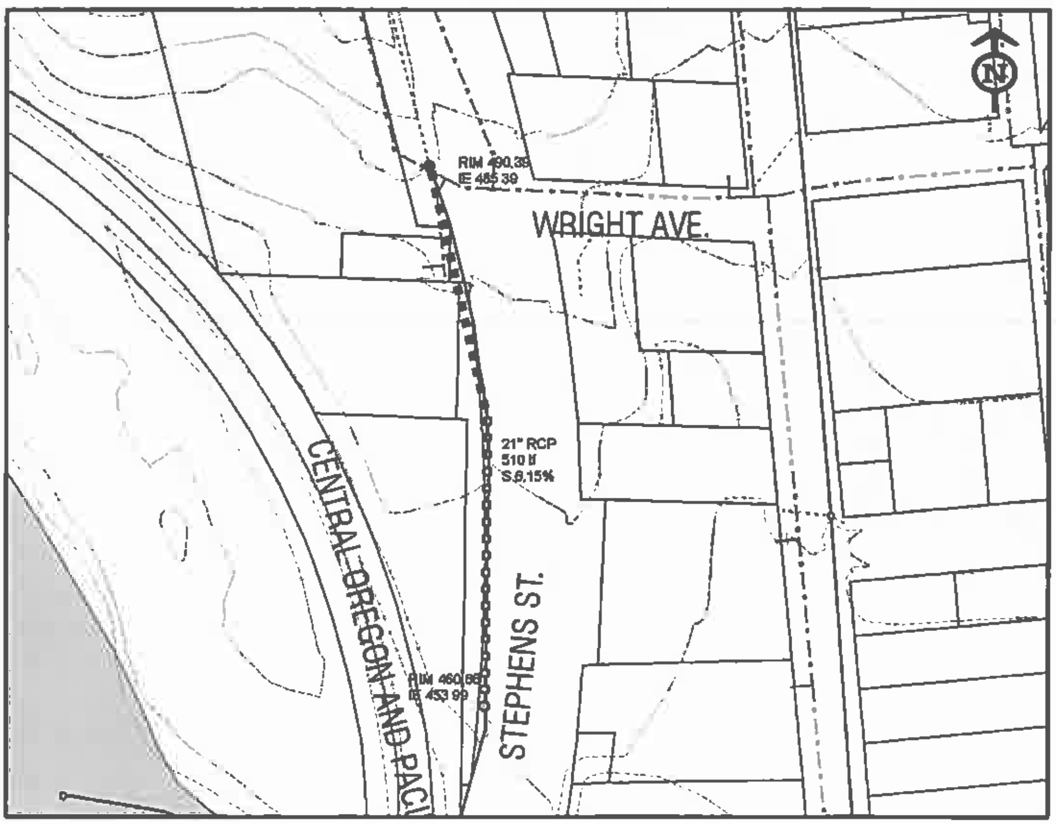
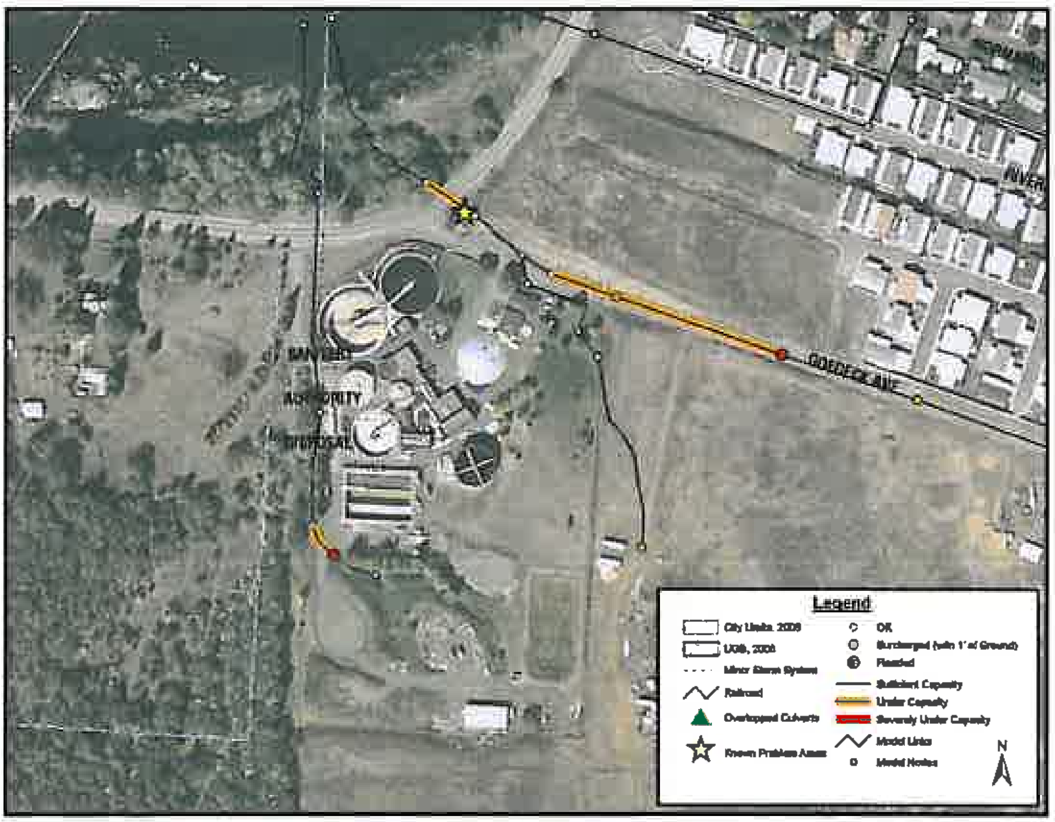


TABLE 8.4-1

PROBLEM #20: GOEDECK AVE

	Discussion
Problem Location:	Storm drain system along Goedeck Ave east of the wastewater treatment plant.
Problem Summary:	The storm drain system along Goedeck Ave is under capacity causing localized flooding. The City is aware of this problem area.
Technical Details:	Pipe sizes: 12 – 30" Peak flow: 81.8 – 104.1 cfs Q_{ratio}: 1.4 – 1.6 Flooded volume: 0.32 ac-ft



Potential Solutions:

- Upsize the storm drain system along Goedeck Ave.
- Construct a detention pond southeast of the treatment plant
- Construct a parallel storm drain system along Goedeck Ave.

TABLE 8.4-1 PROBLEM #20: GOEDECK AVE	
	Discussion
Recommended Alternative:	• Upsize the storm drain system along Goedeck Ave.
Technical Data:	*Goedeck Ave. 1:* S (%): 6.93 D (in): 36 L (ft): 327 Q (cfs): 207 *Goedeck Ave. 2:* S (%): 4.60 D (in): 36 L (ft): 129 Q (cfs): 169 *Goedeck Ave. 3:* S (%): 1.81 D (in): 36 L (ft): 111 Q (cfs): 106
Benefits:	• Located within public right-of-way • Eliminates flooding
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permitting is anticipated
Implementation Issues:	• No significant implementation issues anticipated
Cost	**$ 157,139**

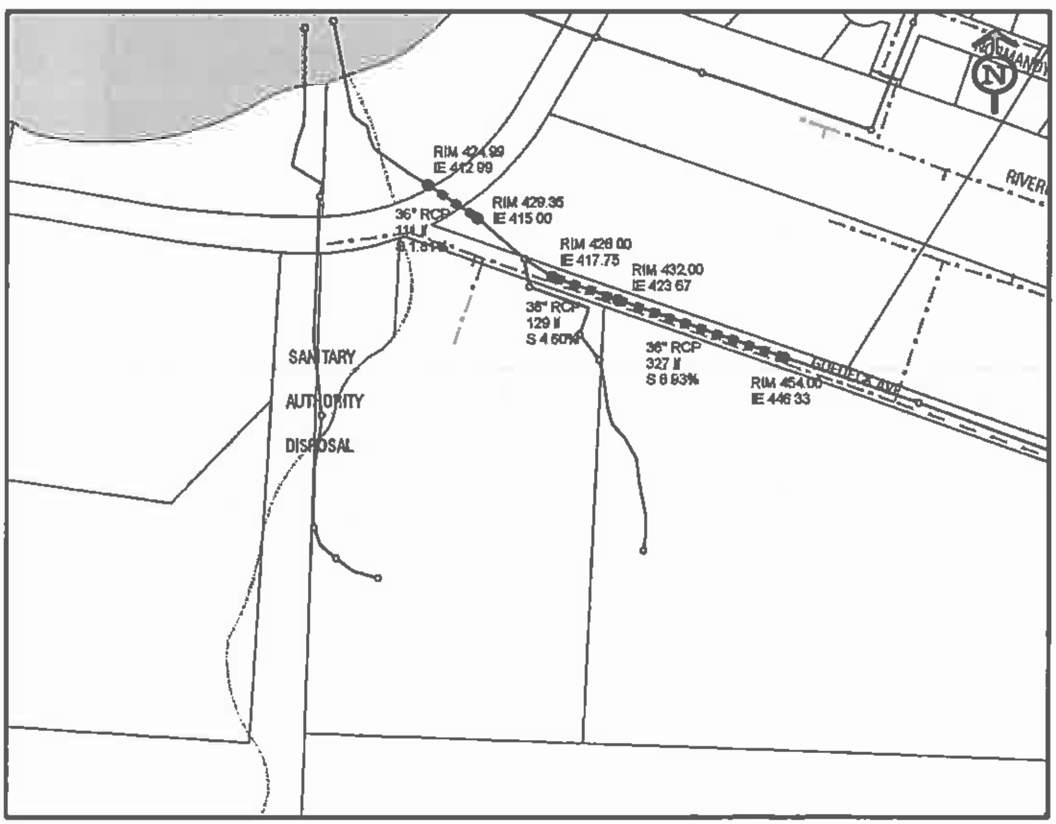
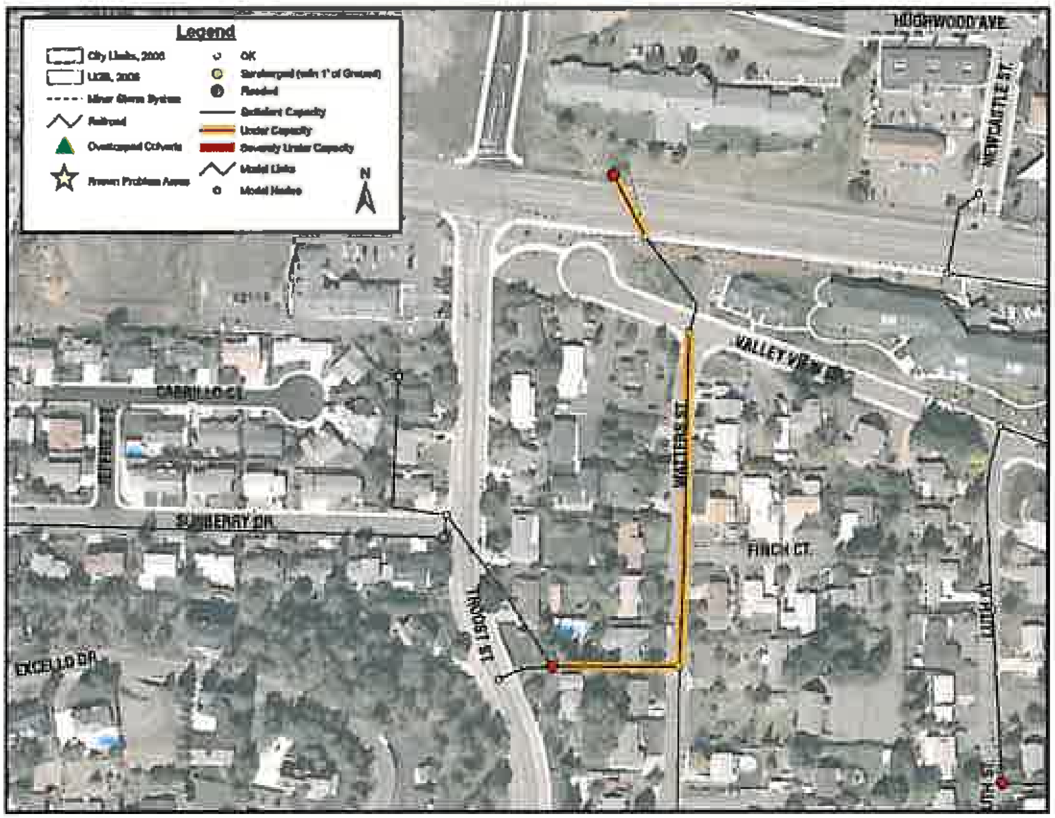


TABLE 8.4-1

PROBLEM #21: WATTERS ST

	Discussion
Problem Location:	Storm drain system along Watters St. south of Valley View Dr.
Problem Summary:	The storm drain system along Watters St. is under capacity causing floods in the surrounding neighborhoods.
Technical Details:	Pipe sizes: 18" Peak flow: 19.6 – 25.4 cfs Q_{ratio}: 1.4 – 2.4 Flooded volume: 0.27 ac-ft



Potential Solutions:	• **Upsize the storm drain system along Watters St.** • Construct a parallel system along Watters St.
Recommended Alternative:	• Upsize the storm drain system along Watters St.

TABLE 8.4-1 PROBLEM #21: WATTERS ST					
	Discussion				
Technical Data:	*Valley View 1:*	S (%): 1.35	D (in): 27	L (ft): 111	Q (cfs): 31
	Valley View 2:	S (%): 8.97	D (in): 27	L (ft): 181	Q (cfs): 110
	Watters St. 1:	S (%): 3.92	D (in): 27	L (ft): 530	Q (cfs): 53
	Watters St. 2:	S (%): 2.01	D (in): 24	L (ft): 202	Q (cfs): 28
Benefits:	• Eliminates flooding and utilizes existing infrastructure				
Land Ownership:	• Nearly all property owned by the City of Roseburg				
Permitting:	• No special permitting is anticipated				
Implementation Issues:	• Several pipe replacements are located on private property • Traffic control and lane closures will be required on Garden Valley Blvd.				
Cost	$ 379,648				

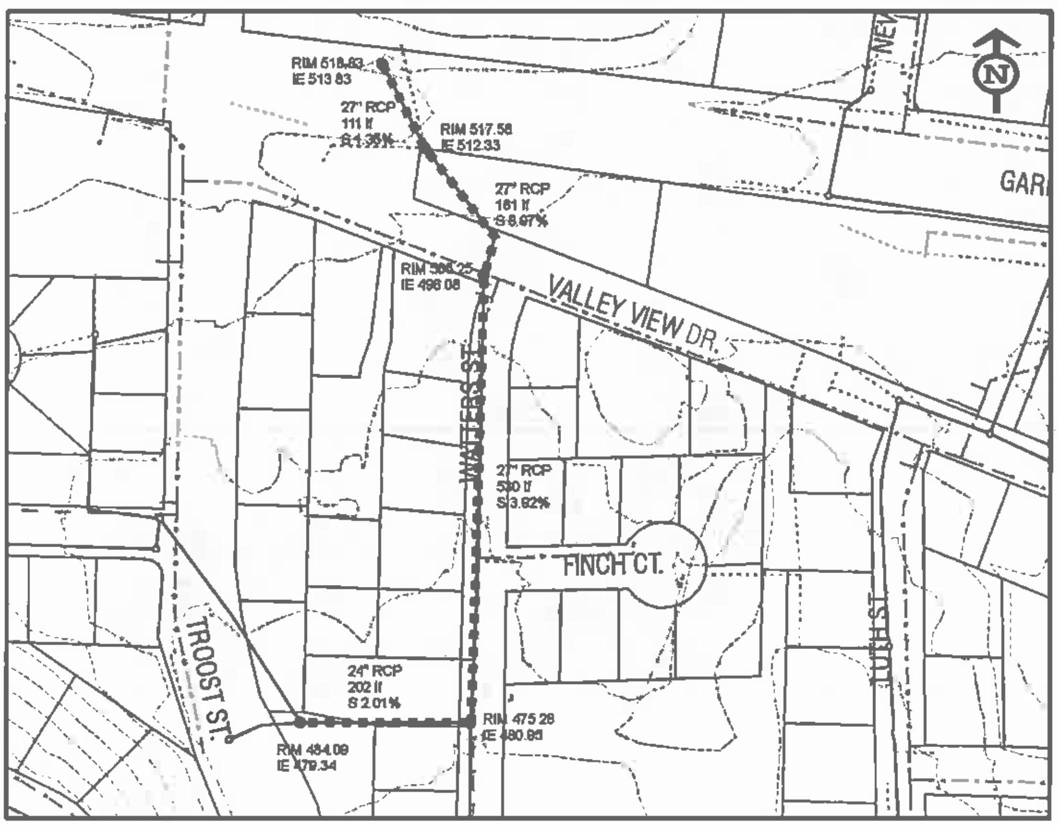
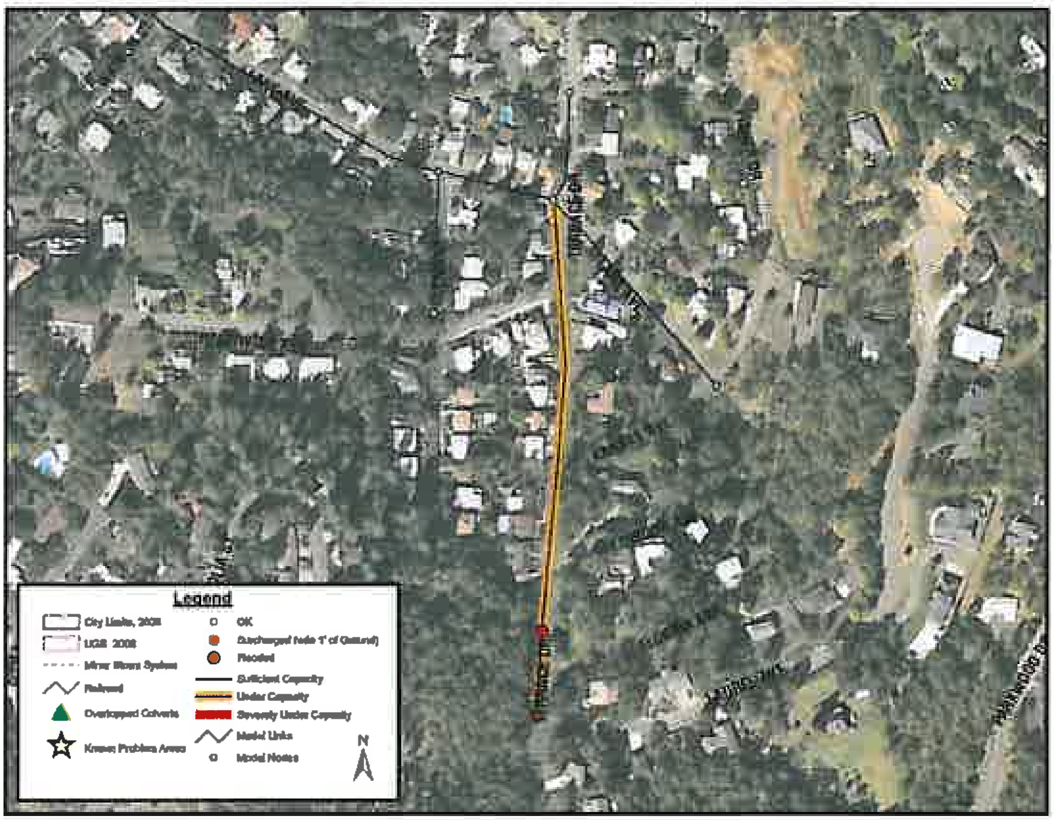


TABLE 8.4-1

PROBLEM #22: TERRACE DR BETWEEN LANE AVE AND LAURAL AVE

	Discussion
Problem Location:	Terrace Dr. between Lane Ave. and Laural Ave.
Problem Summary:	The storm drain system along Terrace Dr. is under capacity causing floods in the surrounding neighborhoods.
Technical Details:	Pipe sizes: 12" Peak flow: 17.5 cfs Q_{ratio}: 1.5 Flooded volume: 0.22 ac-ft



Potential Solutions:	• **Upsize the current storm drain system along Terrace Dr.** • Construct a parallel pipe system along Terrace Dr.

TABLE 8.4-1 PROBLEM #22: TERRACE DR BETWEEN LANE AVE AND LAURAL AVE					
	Discussion				
Recommended Alternative:	• Upsize the current storm drain system along Terrace Dr.				
Technical Data:	*Terrace Dr. 1:*	S (%): 14.1	D (in): 18	L (ft): 162	Q (cfs): 34
	Terrace Dr. 2:	S (%): 14.3	D (in): 18	L (ft): 840	Q (cfs): 34
Benefits:	• Eliminates flooding and utilizes existing infrastructure				
Land Ownership:	• All property owned by the City of Roseburg				
Permitting:	• No special permitting is anticipated				
Implementation Issues:	• Traffic control and lane closures will be required on Terrace Dr.				
Cost	**$ 235,827**				

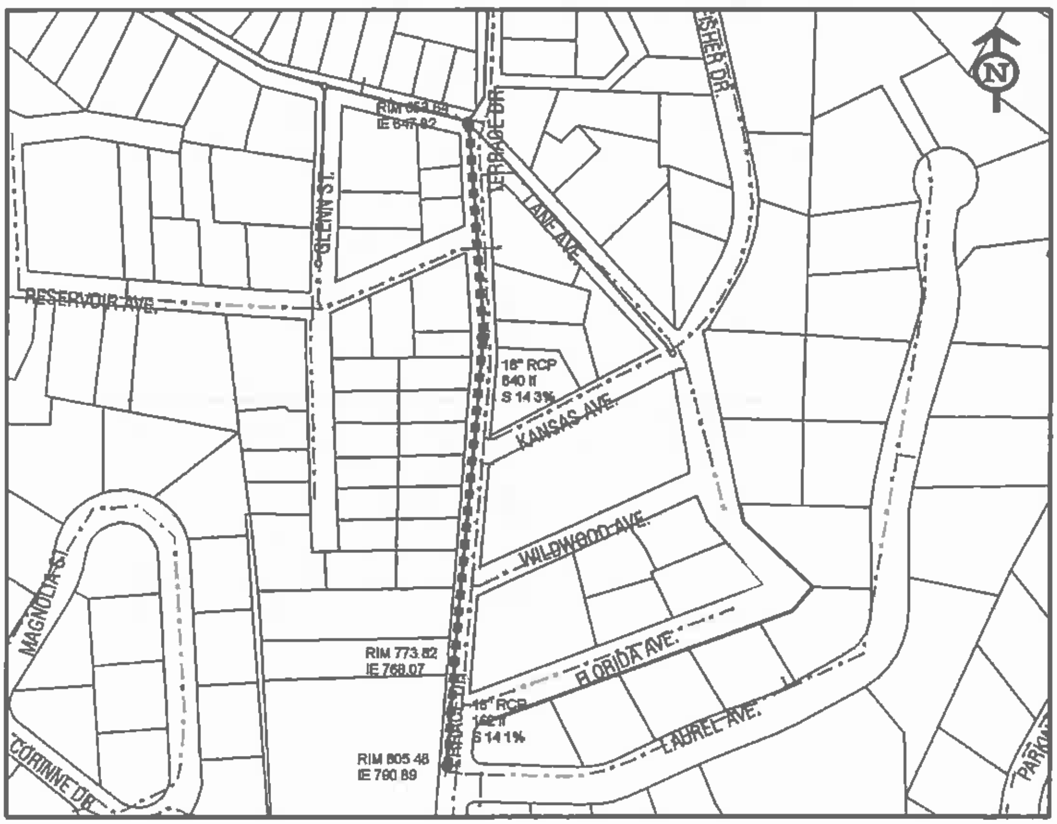
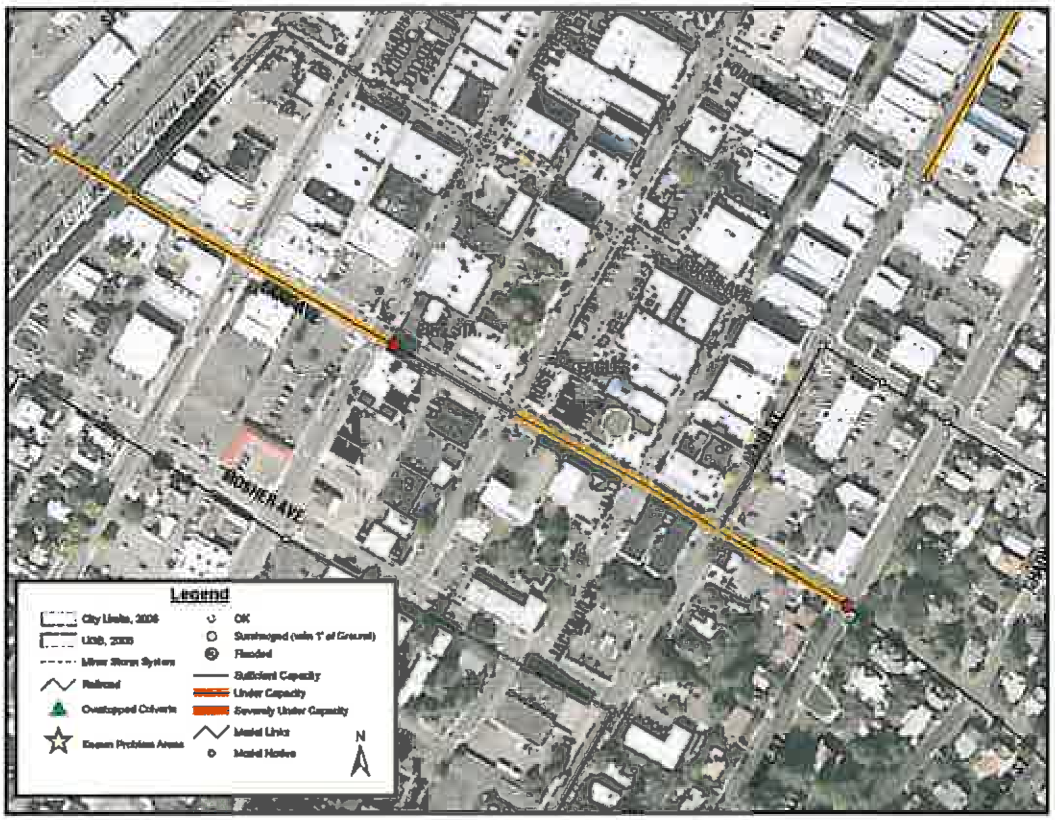


TABLE 8.4-1

PROBLEM #23: LANE AVE

	Discussion
Problem Location:	Lane Ave. between Kane St and the CO&P Railroad.
Problem Summary:	The storm drain system along Lane Ave. between Main St. and the CO&P Railroad is under capacity causing localized flooding.
Technical Details:	Pipe sizes: 24 – 36" Peak flow: 63.3 – 86.6 cfs Q_{ratio}: 1.2 Flooded volume: 0.12 ac-ft



Potential Solutions:	• **Upsize the storm drain system along Lane Ave.** • Construct a new pipe system along Cass St between Main St and Sheridan St to eliminate flooding along Lane St. • Construct a parallel pipe system along Lane Ave.
Recommended Alternative:	• Upsize the storm drain system along Lane Ave.

TABLE 8.4-1

PROBLEM #23: LANE AVE

	Discussion				
Technical Data:	*Lane Ave. 1:*	S (%): 7.05	D (in): 36	L (ft): 278	Q (cfs): 153
	Lane Ave. 2:	S (%): 3.45	D (in): 36	L (ft): 438	Q (cfs): 100
	Lane Ave. 3:	S (%): 2.30	D (in): 36	L (ft): 566	Q (cfs): 88
	Lane Ave. 4:	S (%): 3.58	D (in): 36	L (ft): 169	Q (cfs): 109
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure				
Land Ownership:	• All property owned by the City of Roseburg				
Permitting:	• No special permitting is anticipated				
Implementation Issues:	• Traffic control will be necessary along Lane Ave. • Coordination with railroad will be required				
Cost	$ 700,929				

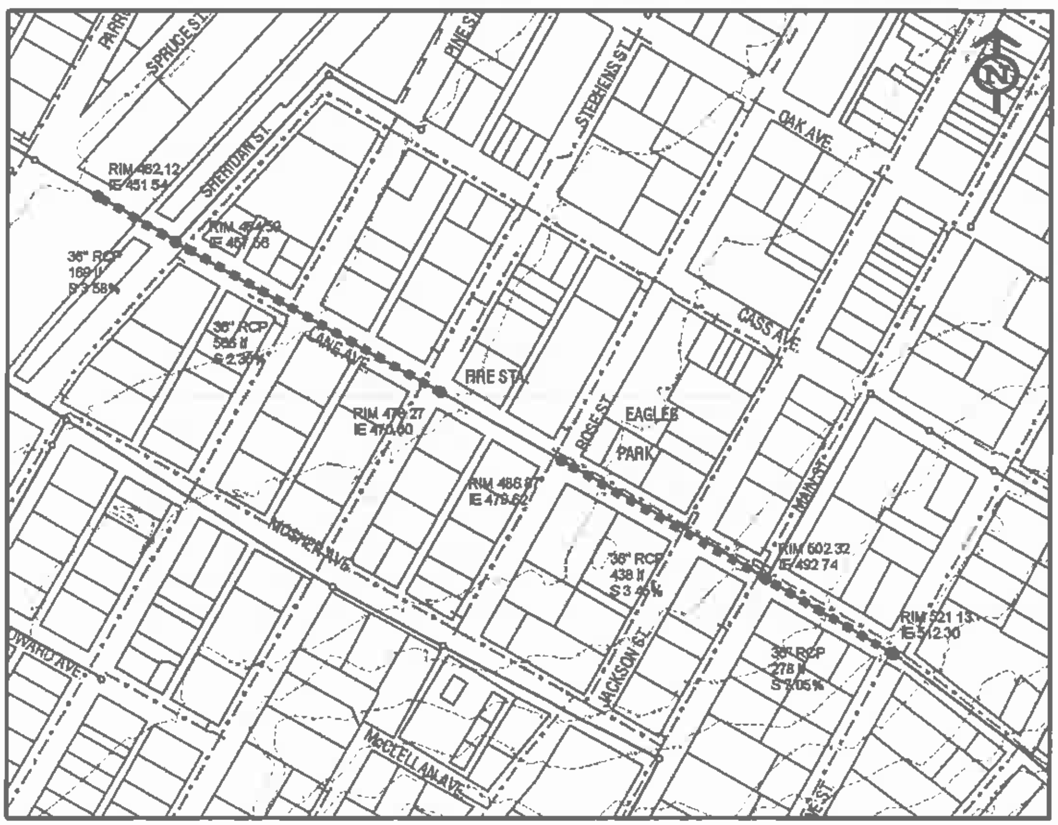
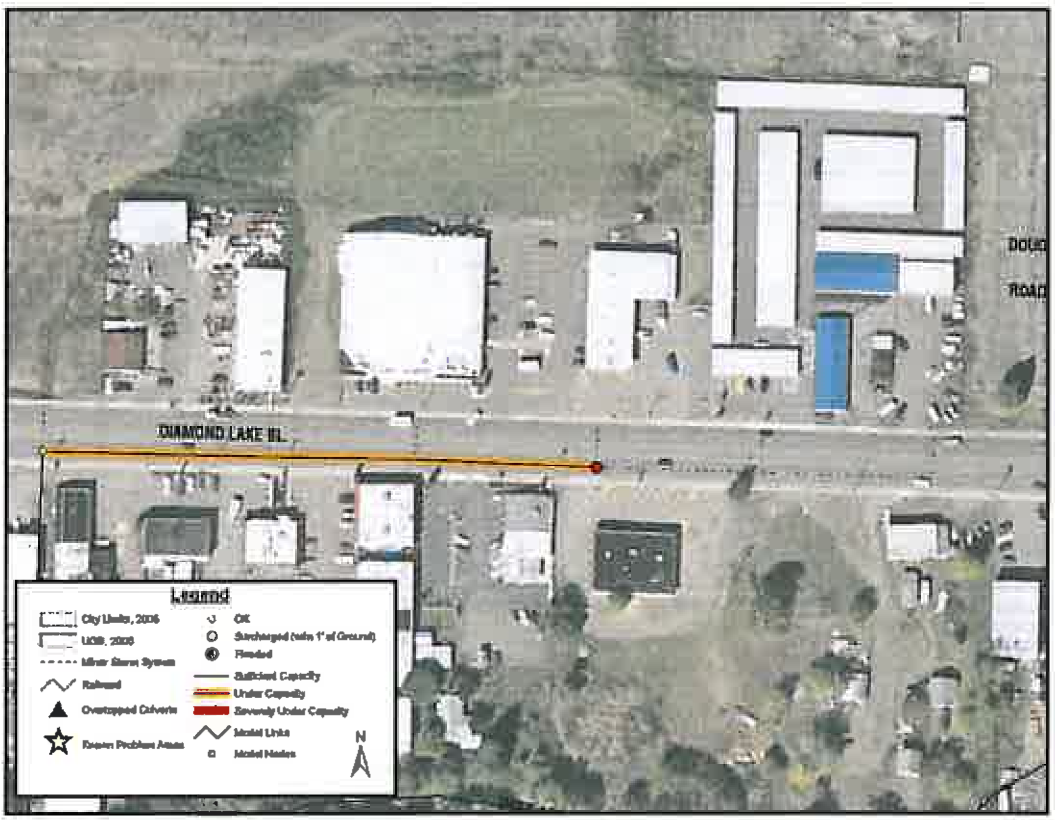


TABLE 8.4-1

PROBLEM #24: DIAMOND LAKE BLVD EAST OF DOUGLAS COUNTY ROAD DEPT SHOPS

	Discussion
Problem Location:	Diamond Lake Blvd. east of Douglas County Rd. and the Department Shops.
Problem Summary:	The storm drain system along Diamond Lake Blvd. is under capacity causing localized flooding.
Technical Details:	Pipe sizes: 18" Peak flow: 14.8 cfs Q_{ratio}: 1.3 Flooded volume: 0.10 ac-ft



Potential Solutions:

- **Upsize the storm drain system along Diamond Lake Blvd. (Although this system is mainly within the ODOT right-of-way, nearly all of the flow entering the system is runoff from within the city limits.)**
- **Construct a parallel pipe system along Diamond Lake Blvd.**

TABLE 8.4-1	
PROBLEM #24: DIAMOND LAKE BLVD EAST OF DOUGLAS COUNTY ROAD DEPT SHOPS	
	Discussion
Recommended Alternative:	• Upsize the storm drain system along Diamond Lake Blvd.
Technical Data:	*Diamond Lake Blvd.:* S (%): 0.91 D (in): 24 L (ft): 609 Q (cfs): 19
Benefits:	• Located within public right-of-way • Eliminates flooding
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permitting is anticipated
Implementation Issues:	• Traffic control will be necessary along Diamond Lake Boulevard • Construction along Diamond Lake Boulevard will require traffic control and short-term lane closures, and will require coordination with ODOT.
Cost	$ 185,445

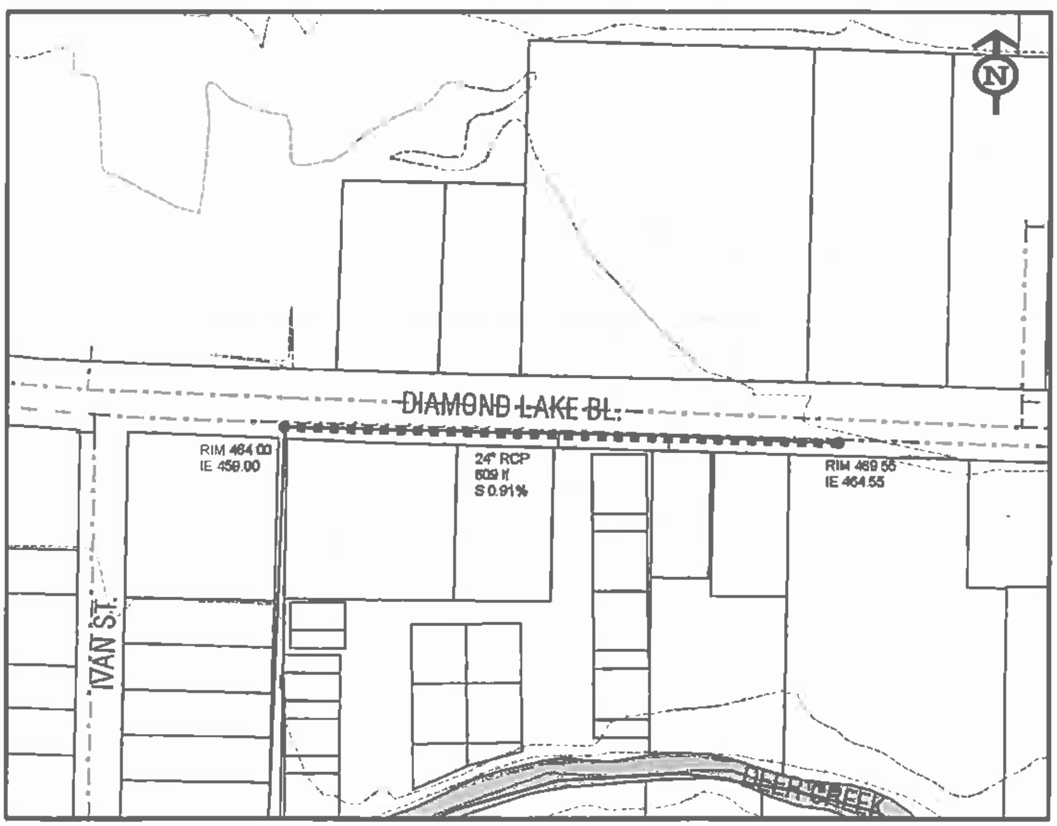
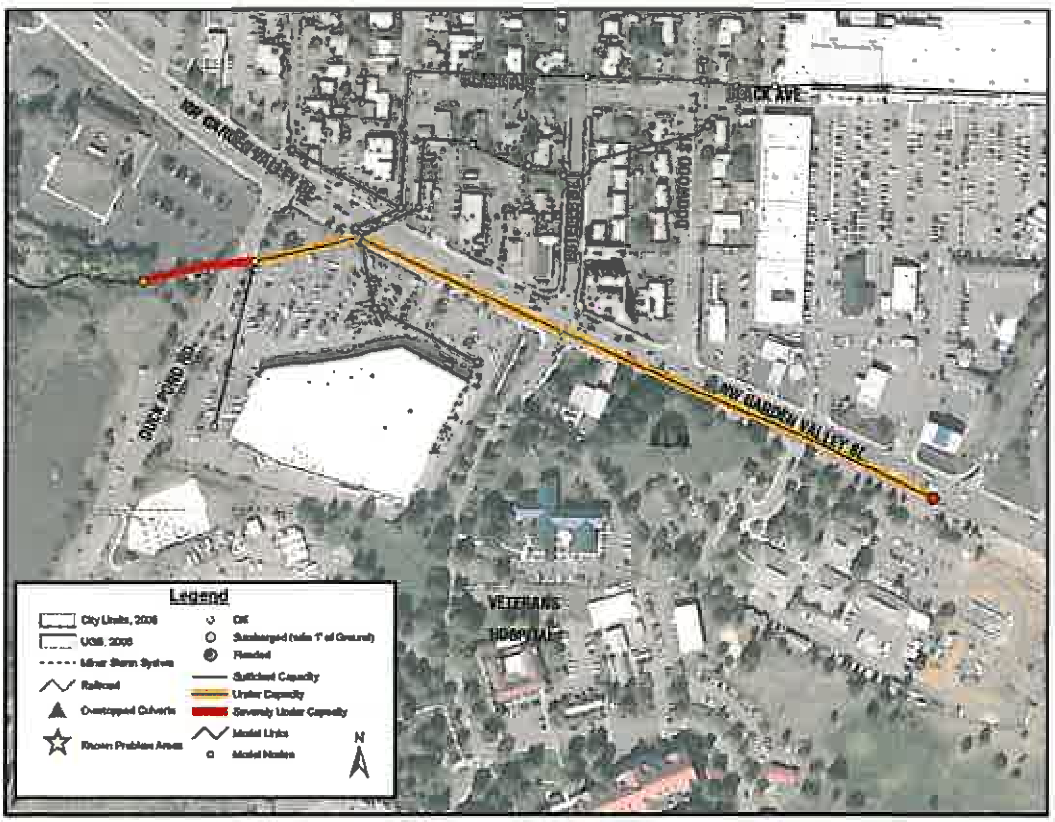


TABLE 8.4-1

PROBLEM #25: GARDEN VALLEY RD

	Discussion
Problem Location:	Garden Valley Rd. between Duck Pond Rd. and 1-5 Off Ramp.
Problem Summary:	High water elevations in Newton Creek backwater the storm drain pipes that empty into the creek from NW Garden Valley Rd.
Technical Details:	Pipe sizes: 12 – 60" Peak flow: 129.7 cfs Q_{ratio}: N/A Flooded volume: 0.075 ac-ft



Potential Solutions:	• Upsize the storm drain system along NW Garden Valley Blvd. • The Stewart Park diversion project considered by the City will help lower the upstream stage and reduce flooding. • A regional detention pond constructed at the upstream end of Newton Creek will lower the peak discharge in the creek and lower downstream water surface elevations. • Install a tide gate to eliminate backflow.

TABLE 8.4-1

PROBLEM #25: GARDEN VALLEY RD

	Discussion
Recommended Alternative:	• Upsize the storm drain system along NW Garden Valley Blvd.
Technical Data:	_NW Garden Valley 1:_ S (%): 2.28 D (in): 15 L (ft): 918 Q (cfs): 8 _NW Garden Valley 2:_ S (%): 2.86 D (in): 15 L (ft): 503 Q (cfs): 9
Benefits:	• Located within public right-of-way • Eliminates flooding
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permitting is anticipated
Implementation Issues:	• Traffic control will be necessary along NW Garden Valley Blvd.
Cost	**$ 314,896**

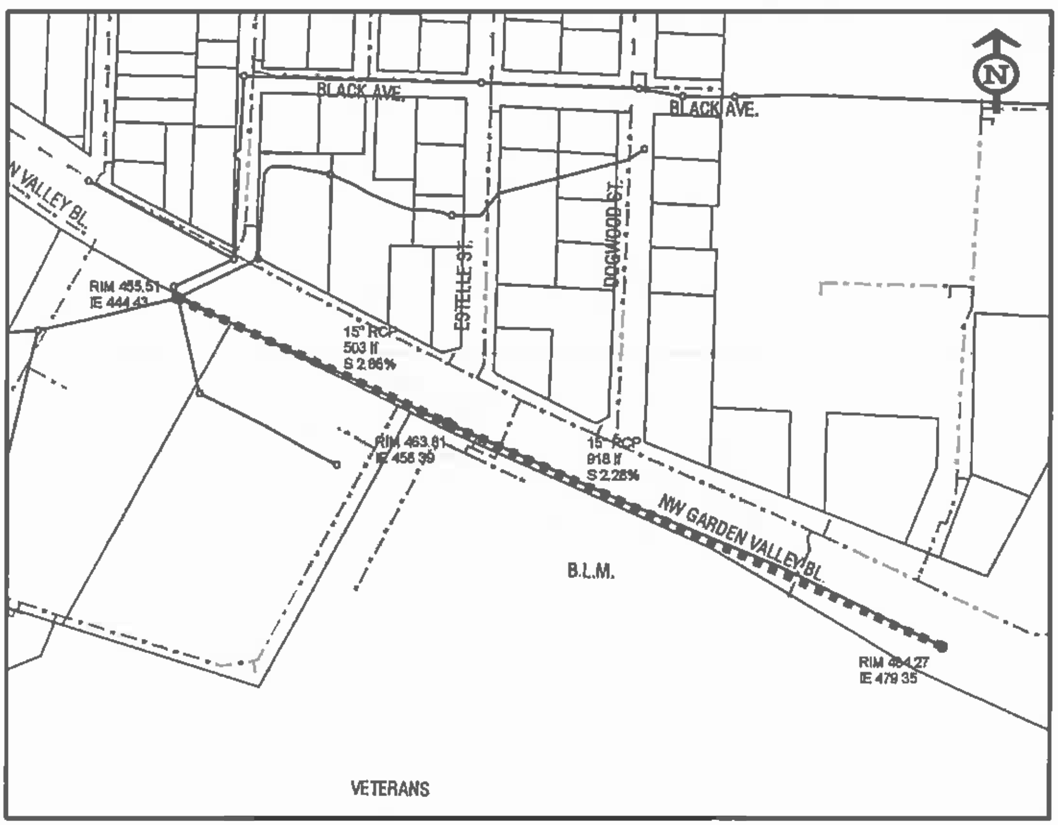


TABLE 8.4-1

PROBLEM #20: ESQUIRE DR

	Discussion
Problem Location:	Esquire Dr. north of Canterbury Dr.
Problem Summary:	The storm drain system along Esquire Dr. is under capacity causing localized flooding.
Technical Details:	Pipe sizes: 12 – 18" Peak flow: 9.9 – 19.1 cfs Q_{ratio}: 1.3 Flooded volume: 0.069 ac-ft

Potential Solutions:	• **Upsize the storm drain system along Esquire Dr.** • Construct a parallel pipe system along Esquire Dr.
Recommended Alternative:	• Upsize the storm drain system along Esquire Dr.

TABLE 8.4-1 PROBLEM #26: ESQUIRE DR					
	Discussion				
Technical Data:	*Esquire Dr., 1:*	S (%): 8.83	D (in): 15	L (ft): 152	Q (cfs): 17
	Esquire Dr. 2:	S (%): 2.64	D (in): 24	L (ft): 290	Q (cfs): 32
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure				
Land Ownership:	• All property owned by the City of Roseburg				
Permitting:	• No special permitting is anticipated				
Implementation Issues:	• No significant implentation issues anticipated				
Cost	**$ 128,040**				

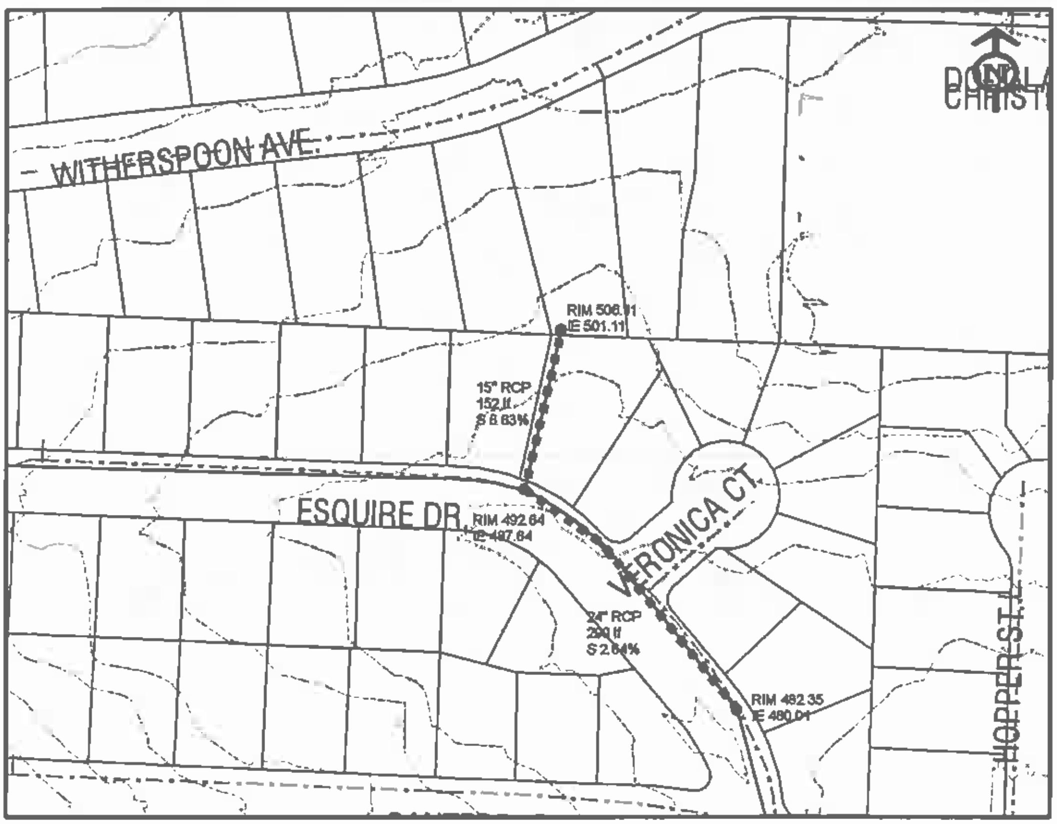
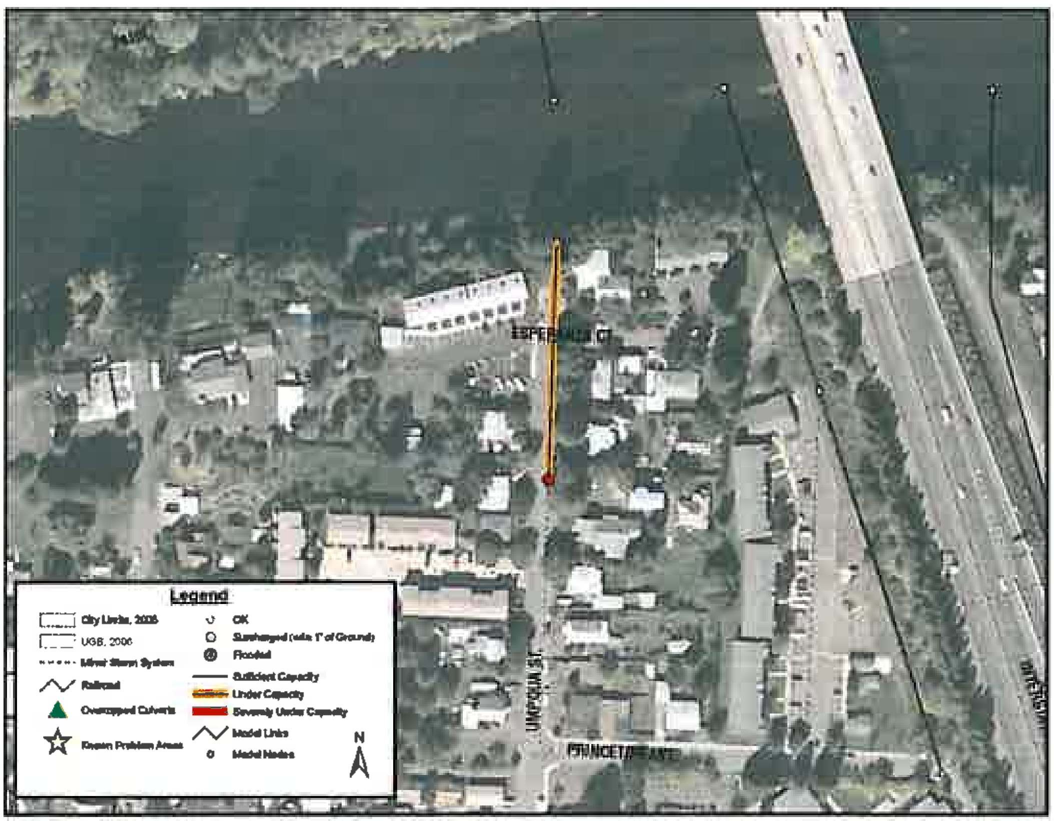


TABLE 8.4-1

PROBLEM #27: UMPQUA ST

	Discussion
Problem Location:	Umpqua St. north of Princeton Ave.
Problem Summary:	The storm drain system along Umpqua St. is under capacity causing flooding in the surrounding neighborhoods.
Technical Details:	Pipe sizes: 8" Peak flow: 3.1 cfs Q_{ratio}: 1.6 Flooded volume: 0.037 ac-ft



Potential Solutions:	• **Upsize the current storm drain system along Umpqua St.** • Construct a parallel pipe system along Umpqua St.
Recommended Alternative:	• Upsize the current storm drain system along Umpqua St.

TABLE 8.4-1 PROBLEM #27: UMPQUA ST					
	Discussion				
Technical Data:	*Umpqua St. 1:*	S (%): 3.39	D (in): 12	L (ft): 177	Q (cfs): 6
	Umpqua St. 2:	S (%): 1.06	D (in): 12	L (ft): 120	Q (cfs): 3
Benefits:	• Located within public right-of-way • Eliminates flooding				
Land Ownership:	• All property owned by the City of Roseburg				
Permitting:	• Environmental permitting may be required since stormwater is discharged into the South Umpqua River				
Implementation Issues:	• No significant implentation issues anticipated				
Cost	$ 94,595				

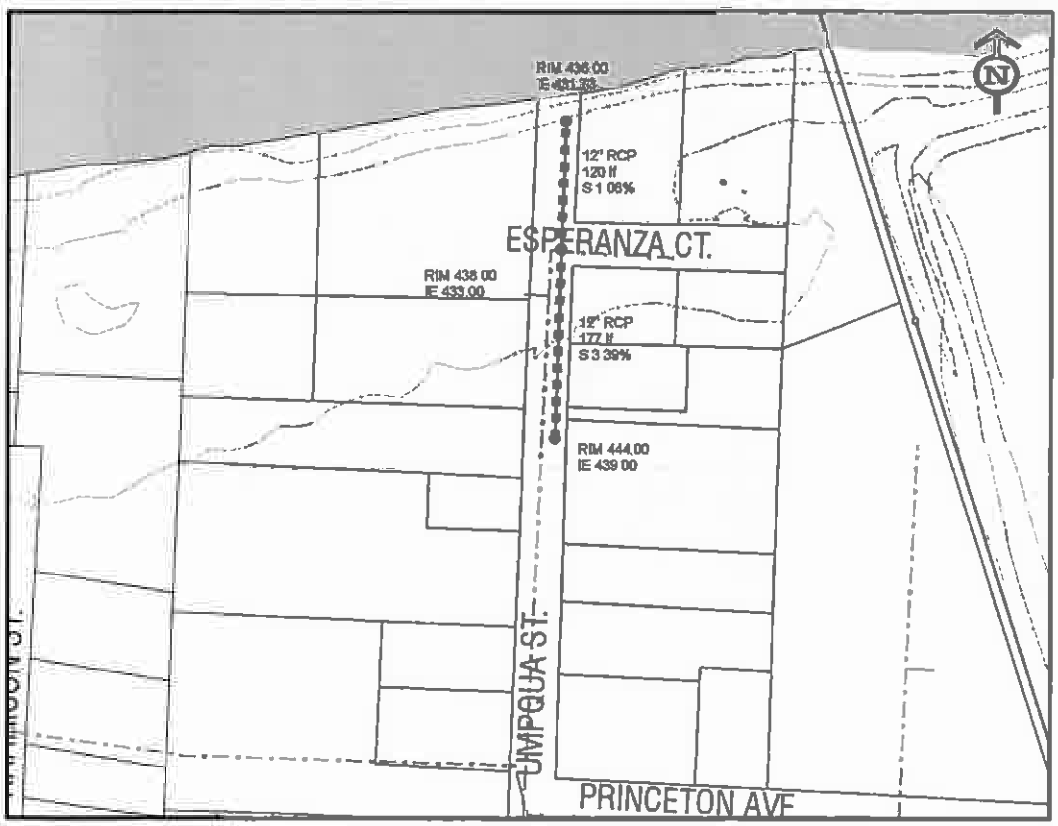


TABLE 8.4-1

PROBLEM #28: NEWTON CREEK CULVERT

	Discussion
Problem Location:	Newton Creek culvert at Plateau Dr.
Problem Summary:	The culvert beneath Plateau Dr. in Newton Creek is under capacity causing localized flooding and roadway overtopping.
Technical Details:	Pipe sizes: Culvert diameter 5.5' Peak flow: 425 cfs Q_{ratio}: N/A Flooded volume: N/A

Potential Solutions:	• **Upsize the current culvert beneath Plateau Dr.** • A regional **detention pond constructed at the upstream end of Newton** Creek **will lower the** peak **discharge in the creek and lower downstream water surface** elevations.
Recommended Alternative:	• Upsize the current culvert beneath Plateau Dr.

TABLE 8.4-1

PROBLEM #28: NEWTON CREEK CULVERT

	Discussion				
Technical Data:	*Plateau Dr.:*	S (%): 3.39 Q (cfs): 425	W (ft): 12	D: (ft): 6 buried 1'	L (ft): 63
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure				
Land Ownership:	• All property owned by the City of Roseburg				
Permitting:	• Environmental permitting may be required when replacing the culvert				
Implementation Issues:	• No significant implementation issues anticipated				
Cost	**$ 120,384**				

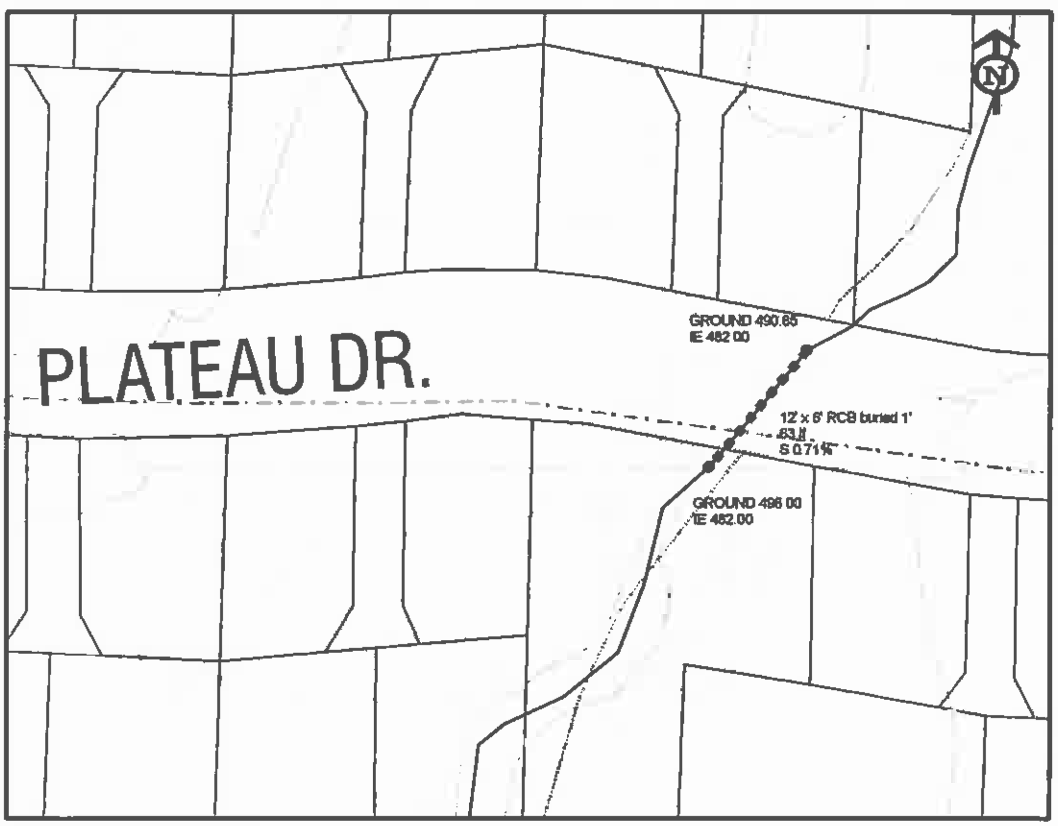
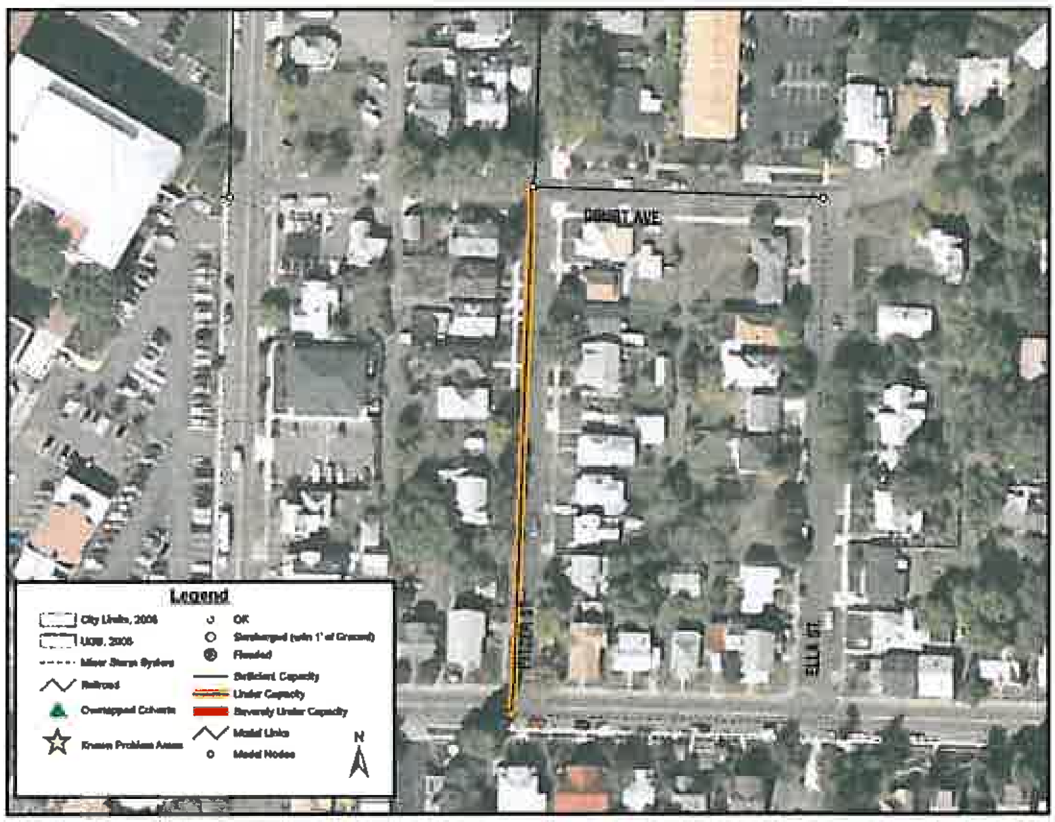


TABLE 8.4-1

PROBLEM #29: SOUTH END OF PITZER ST

	Discussion
Problem Location:	Pitzer St. between Court Ave. and Douglas Ave.
Problem Summary:	The storm drain system along Pitzer St. is under capacity causing localized flooding.
Technical Details:	Pipe sizes: 12" Peak flow: 8.9 cfs Q_{ratio}: 1.1 Flooded volume: N/A



Potential Solutions:	• Upsize the current storm drain system along Pitzer St. • Construct a parallel pipe system along Pitzer St.

TABLE 8.4-1 PROBLEM #29: SOUTH END OF PITZER ST	
	Discussion
Recommended Alternative:	• Upsize the current storm drain system along Pitzer St.
Technical Data:	*Pitzer St.:* S (%): 6.72 D (in): 15 L (ft): 510 Q (cfs): 15
Benefits:	• Located within public right-of-way • Eliminates flooding and utilizes existing infrastructure
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permitting is anticipated
Implementation Issues:	• No significant implementation issues anticipated
Cost	$ 142,702

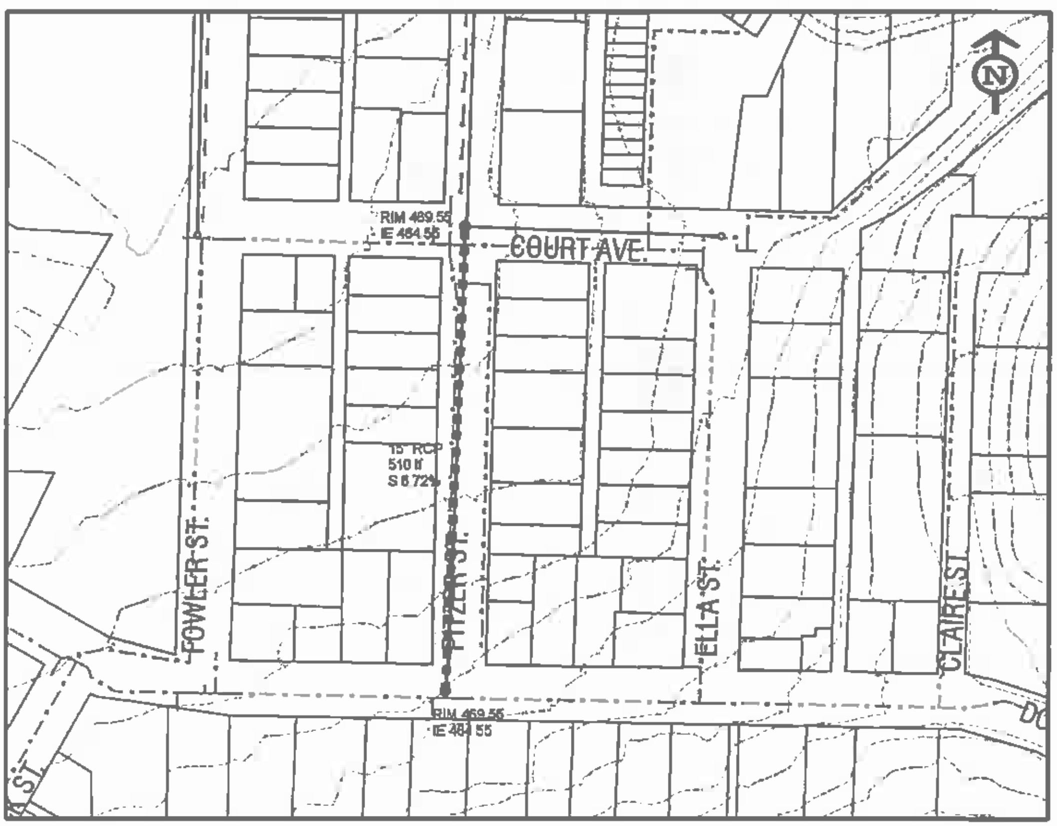
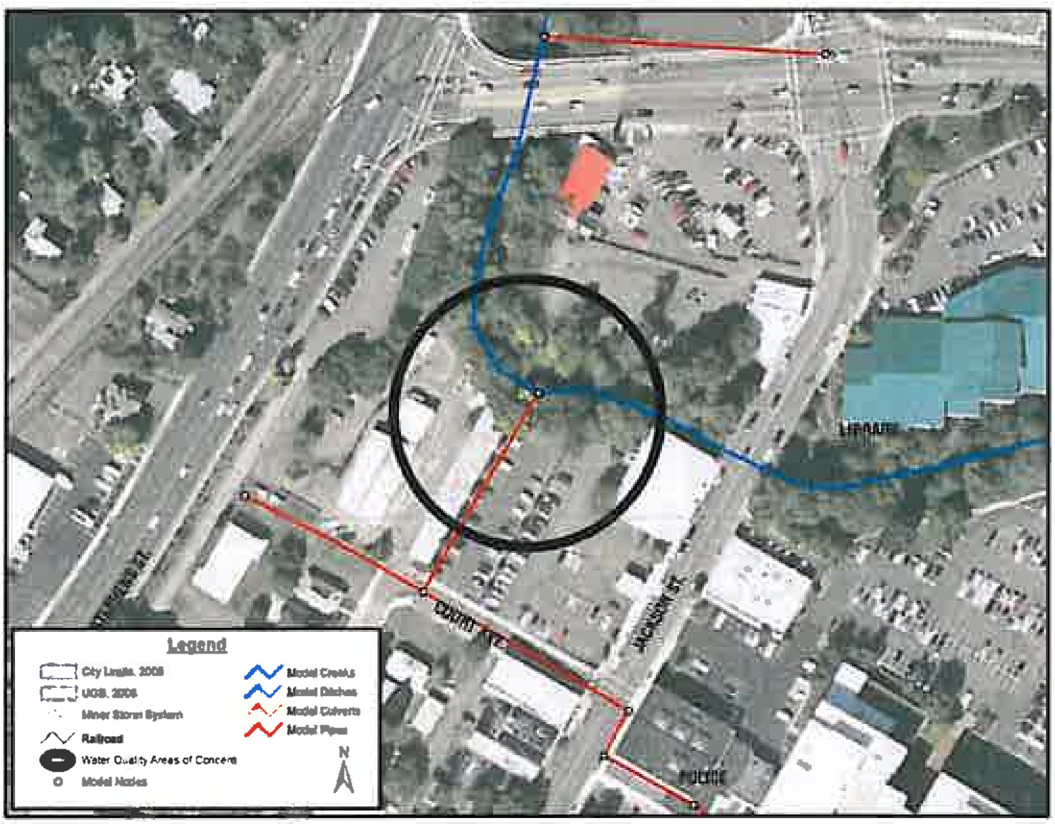


TABLE 8.4-2

WQ AREA OF CONCERN #1 DOWNTOWN

	Discussion
Problem Location:	The existing storm drain system in the northern portion of downtown discharging to Deer Creek between Jackson St and Stephens St
Problem Summary:	This area encompasses the central downtown commercial corridor and does not have any water quality treatment prior to its discharge to Deer Creek. The outfall is located on public property behind the City parking lot.
Technical Details:	Outfall Diameter: 30" Drainage Area: 42.3 acre WQ Flow: 4.7 cfs WQ Volume: 1.6 ac-ft



Potential Solutions:

- **Proprietary Water Quality Manhole**
- Source control through low impact development methods.

TABLE 8.4-2

WQ AREA OF CONCERN #1 DOWNTOWN

	Discussion
Preferred Alternative:	• Construct a proprietary water quality manhole in the City parking lot adjacent to Deer Creek
Technical Data:	*WQ Manhole Size: 8' Diameter* *To be constructed off-line*
Benefits:	• Located within city parking lot • Easy access for maintenance • Improves water quality for downtown area.
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permits anticipated.
Implementation Issues:	• Routine maintenance will be critical to the success of this facility.
Cost	**$ 61,594**

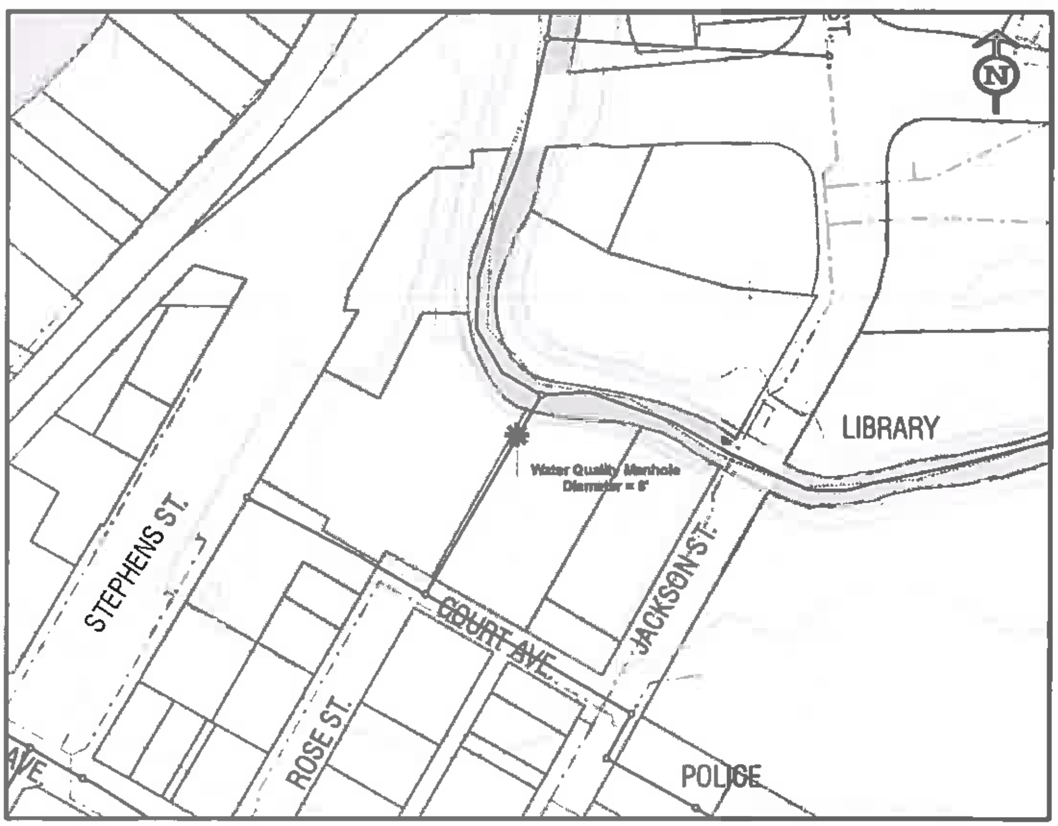
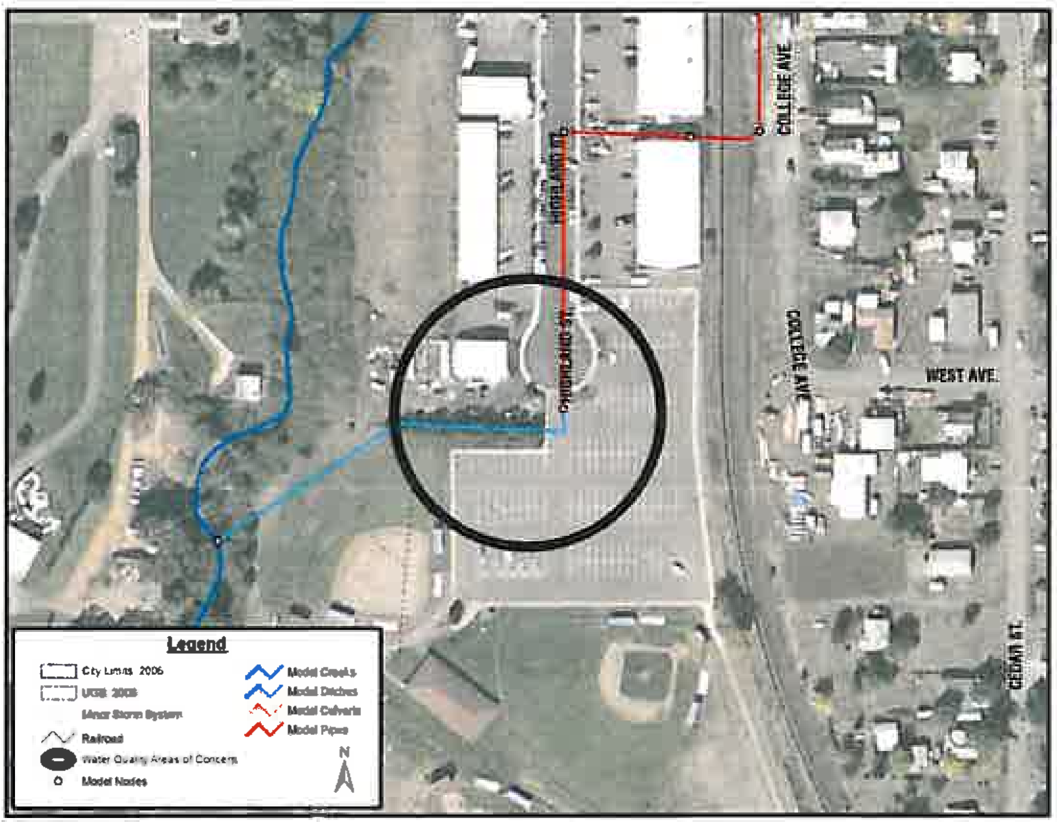


TABLE 8.4-2

WQ AREA OF CONCERN #2 CHESTNUT AVE STORM DRAIN

	Discussion
Problem Location:	The storm drain system along Chestnut Ave discharge to the unnamed channel at Highland St.
Problem Summary:	The area along Chestnut St is primarily commercial and the areas between Highland St and the CO&P railroad are primarily industrial. This area has no water quality treatment prior to its discharge to the unnamed channel and ultimately to the S. Umpqua River.
Technical Details:	Outfall Diameter: 36" Drainage Area: 63.6 acres WQ Flow: 3.6 cfs WQ Volume: 1.3 ac-ft



Potential Solutions:	• Water Quality Swale • Proprietary Water Quality Manhole • Source control through low impact development methods.

TABLE 8.4-2
WQ AREA OF CONCERN #2 CHESTNUT AVE STORM DRAIN

	Discussion
Preferred Alternative:	• Construct a water quality swale southwest of the Highland St cul-de-sac to provide treatment for the surrounding commercial and industrial areas.
Technical Data:	*Approximate swale dimensions:* *Length = 300', Bottom width = 12', Slope = 2%, Depth = 6", Side slopes 3:1*
Benefits:	• Located within existing drainage channel. • Easy access for maintenance. • Improves water quality for surround areas.
Land Ownership:	• If not already present, drainage easements will be required.
Permitting:	• No special permits anticipated.
Implementation Issues:	• Routine maintenance will be critical to the success of this facility.
Cost	**$ 15,509**

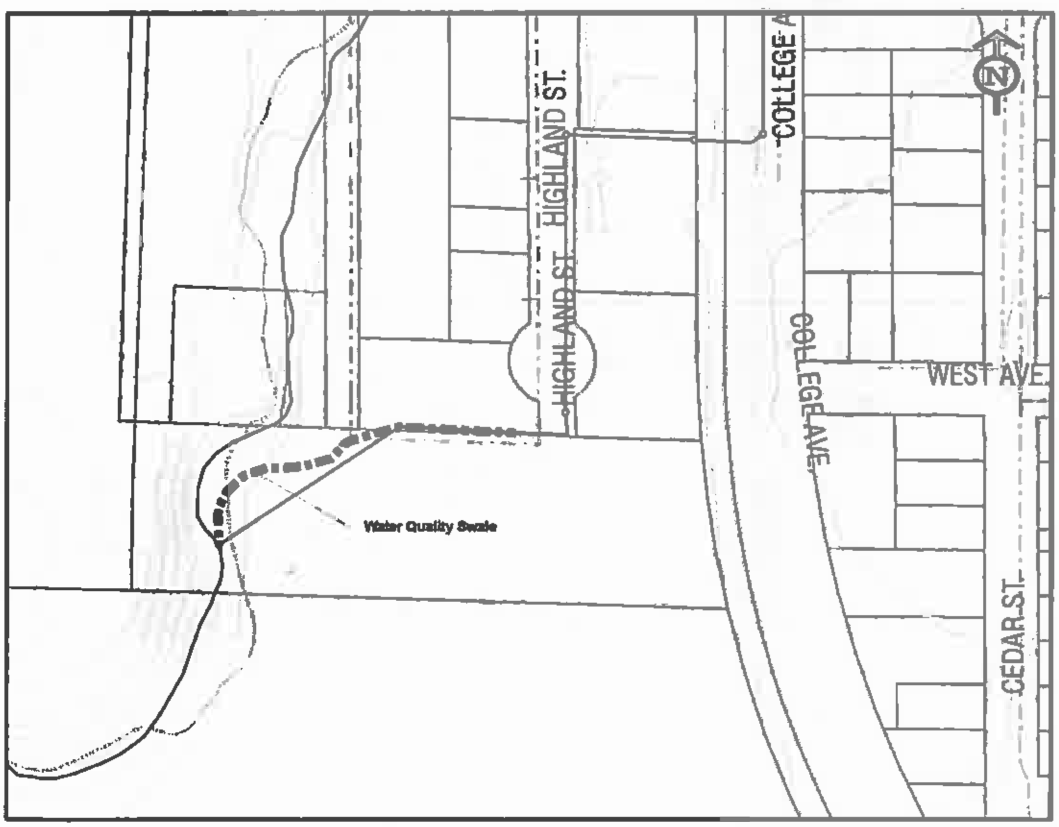
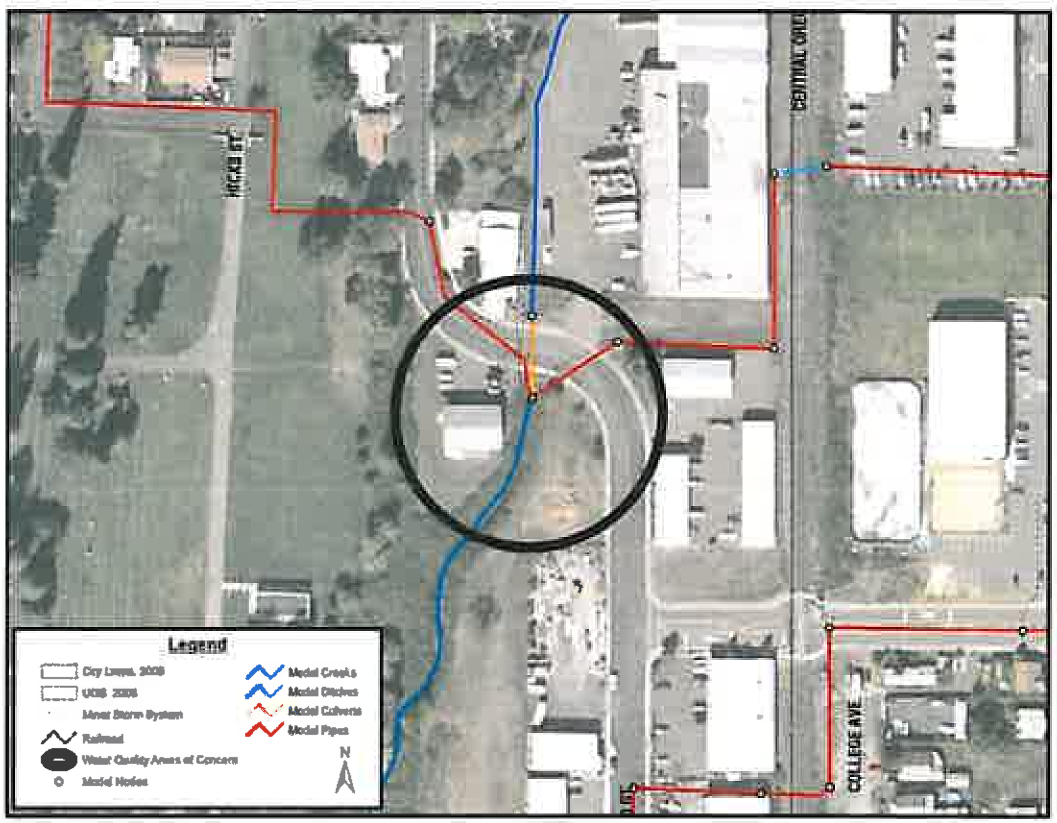


TABLE 8.4-2

WQ AREA OF CONCERN #3 CENTRAL NE COMMERCIAL AREAS

	Discussion
Problem Location:	The Central NE Commercial area between CO&P Railroad and the Vine St. (east-west) and Chestnut Ave and Meadow St (north-south).
Problem Summary:	This area encompasses approximately 250 acres of primarily commercial and industrial landuse and discharges at a single point to an unnamed channel adjacent to the CO&P Railroad prior to discharging to the S. Umpqua River. Presently, this area has no water quality treatment.
Technical Details:	Outfall Diameter: 24", 48", and 60" Drainage Area: 882.9 acre WQ Flow: 62.3 cfs WQ Volume: 26.2 ac-ft



Potential Solutions:	• **Proprietary Water Quality Manhole(s)** • Water Quality Swale • Water Quality Treatment Pond • Source control through low impact development methods.

TABLE 8.4-2

WQ AREA OF CONCERN #3 CENTRAL NE COMMERCIAL AREAS

	Discussion
Preferred Alternative:	• Construct a proprietary water quality manhole in public right-of-way on Highland Street.
Technical Data:	*WQ Manhole Size: 10' Diameter* *To be constructed off-line*
Benefits:	• Located in public right-of-way • Easy access for maintenance • Improves water quality for downtown area.
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permits anticipated.
Implementation Issues:	• Routine maintenance will be critical to the success of this facility. • Due to the size of the upstream basin, this facility will only provide treatment for a portion of the runoff.
Cost	$ 85,103

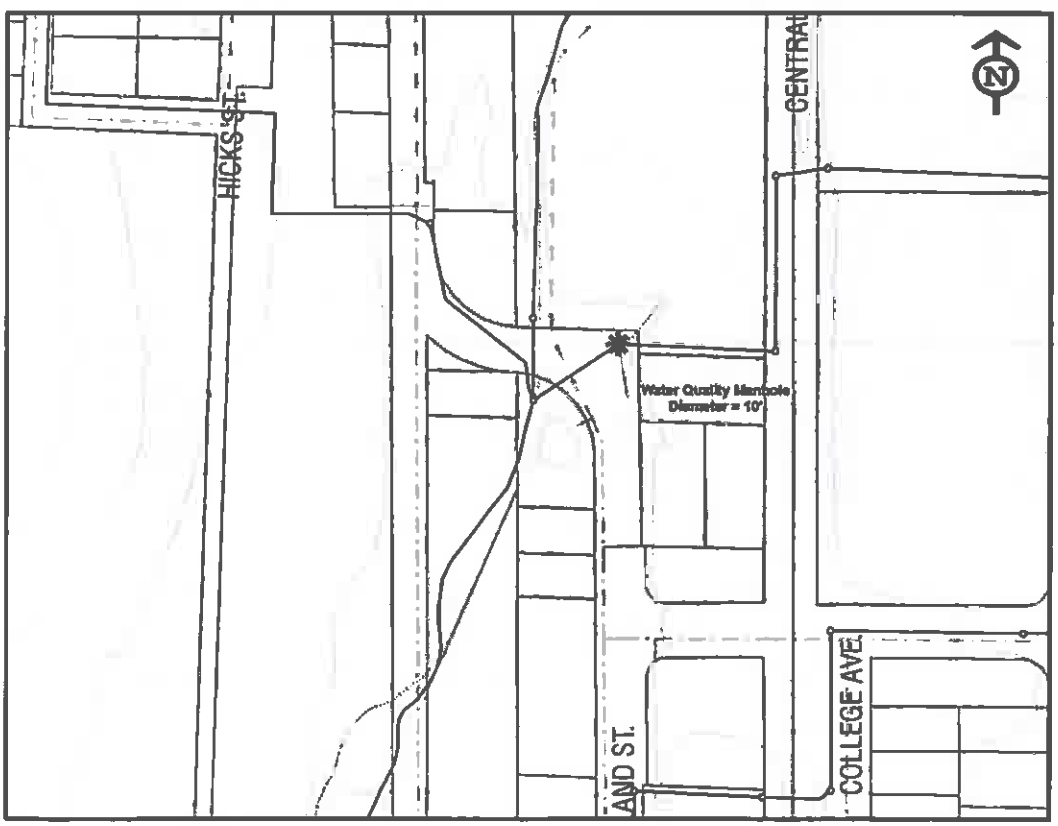
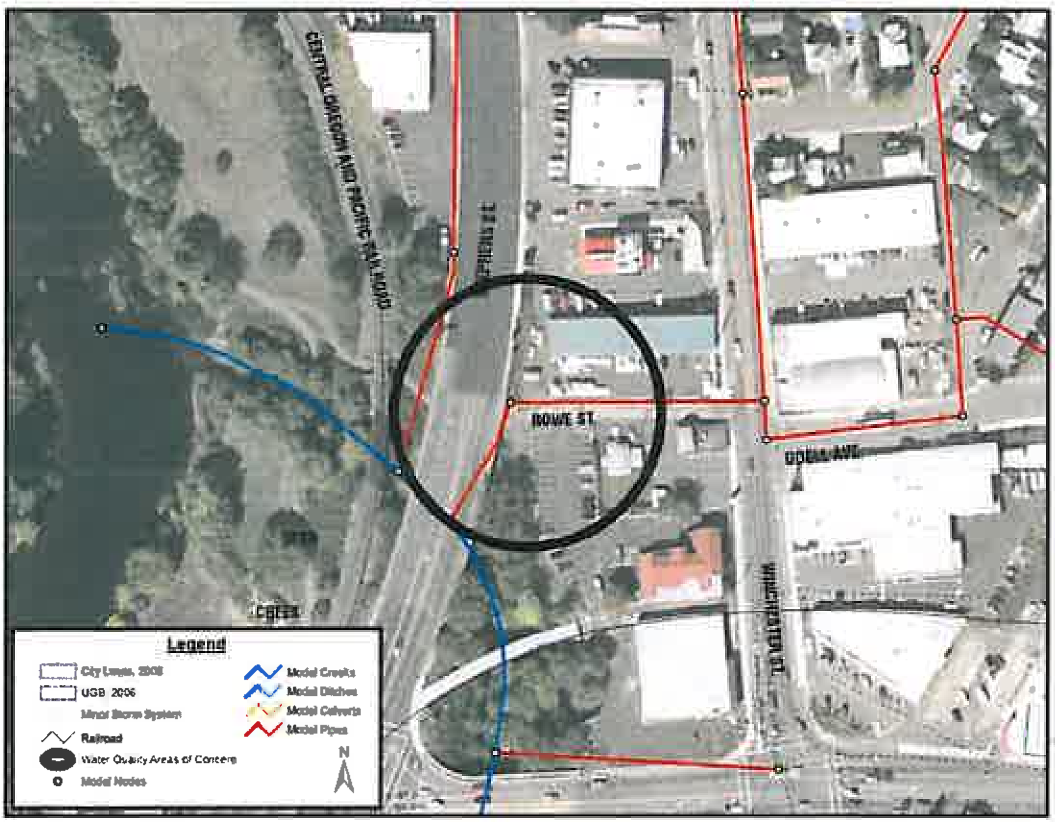


TABLE 8.4-2

WQ AREA OF CONCERN #4 INNER NE COMMERCIAL AREA

	Discussion
Problem Location:	The existing storm drain outfall between Deer Creek and the S. Umpqua River to the south, Jackson and Winchester St to the east-west and Grandview St to the north.
Problem Summary:	This area encompasses approximately 15 acres of primarily commercial and industrial landuse in the lower basin and nearly 65 acres of older residential properties above in the hills. The existing storm drain system discharges directly to Deer Creek at the mouth of the S. Umpqua River along Rowe St and presently this area has no water quality treatment.
Technical Details:	Outfall Diameter: 36" Drainage Area: 139.8 acres WQ Flow: 13.8 cfs WQ Volume: 4.8 ac-ft



Potential Solutions:	• **Proprietary Water Quality Manhole** • Water Quality Swale • Source control through low impact development methods.

TABLE 8.4-2

WQ AREA OF CONCERN #4 INNER NE COMMERCIAL AREA

	Discussion
Preferred Alternative:	• Construct a proprietary water quality manhole in public right-of-way on Rowe St just east of Stephens St.
Technical Data:	*WQ Manhole Size: 10' Diameter* *To be constructed off-line*
Benefits:	• Located within in alley • Easy access for maintenance • Improves water quality for downtown area.
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permits anticipated.
Implementation Issues:	• Routine maintenance will be critical to the success of this facility.
Cost	**$ 82,463**

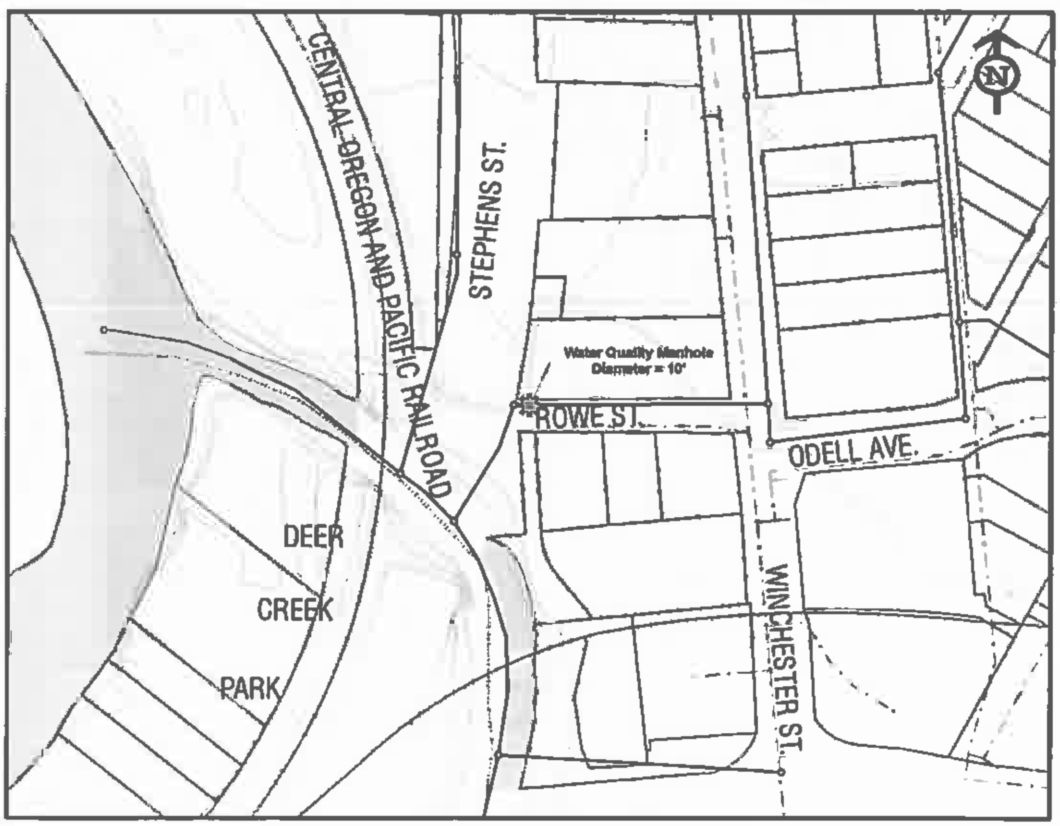
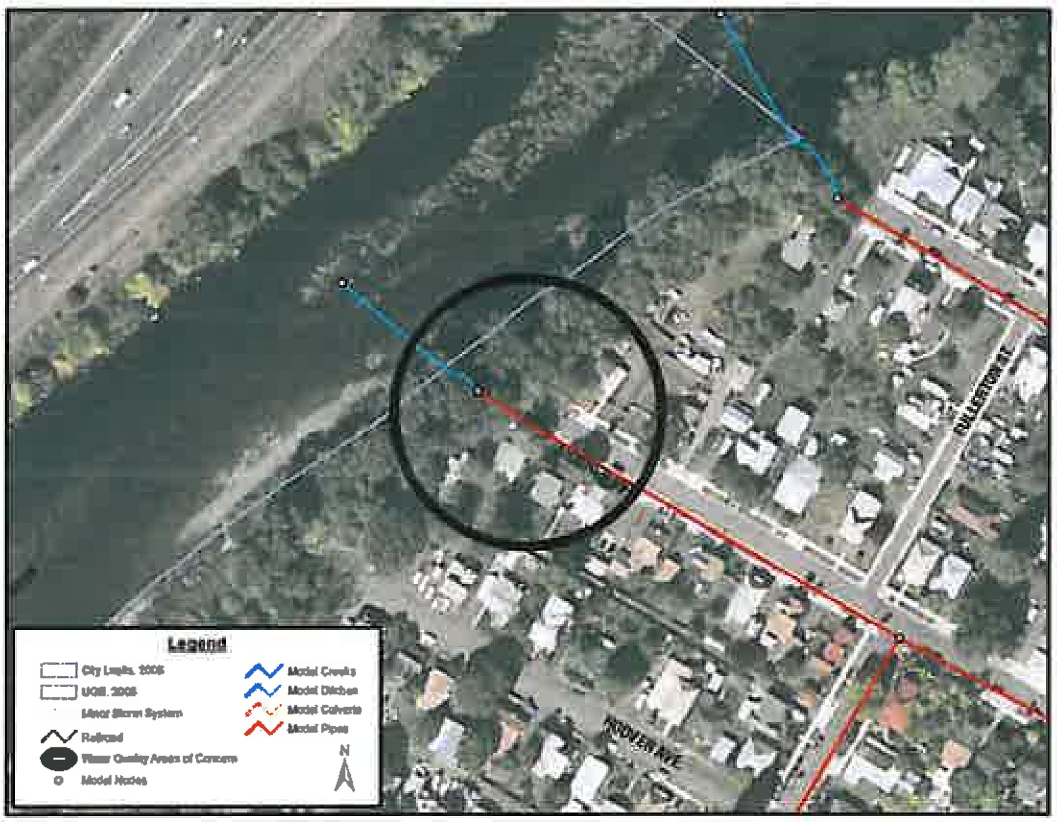


TABLE 8.4-2

WQ AREA OF CONCERN #5 SOUTH DOWNTOWN 1

	Discussion
Problem Location:	The existing storm drain system east of the S. Umpqua River and between Mosher Ave and Roberts Ave (north-south).
Problem Summary:	This area includes a large portion of the area on the south side of downtown and includes commercial, industrial and residential landuse. The outfall is located on in City right-of-way at the northwest end of Mosher Ave and does not have any water quality treatment prior to its discharge to the S. Umpqua River.
Technical Details:	Outfall Diameter: 48" Drainage Area: 163.6 acres WQ Flow: 16.1 cfs WQ Volume: 5.8 ac-ft



Potential Solutions:	• **Proprietary Water Quality Manhole** • Source control through low impact development methods.

TABLE 8.4-2

WQ AREA OF CONCERN #5 SOUTH DOWNTOWN 1

	Discussion
Preferred Alternative:	• Construct a proprietary water quality manhole in public right-of-way on Mosher Ave prior to discharge to the S. Umpqua River.
Technical Data:	*WQ Manhole Size: 10' Diameter* *To be constructed off-line*
Benefits:	• Located within public right-of-way with limited traffic. • Easy access for maintenance. • Improves water quality for downtown area.
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permits anticipated.
Implementation Issues:	• Routine maintenance will be critical to the success of this facility.
Cost	**$ 82,463**

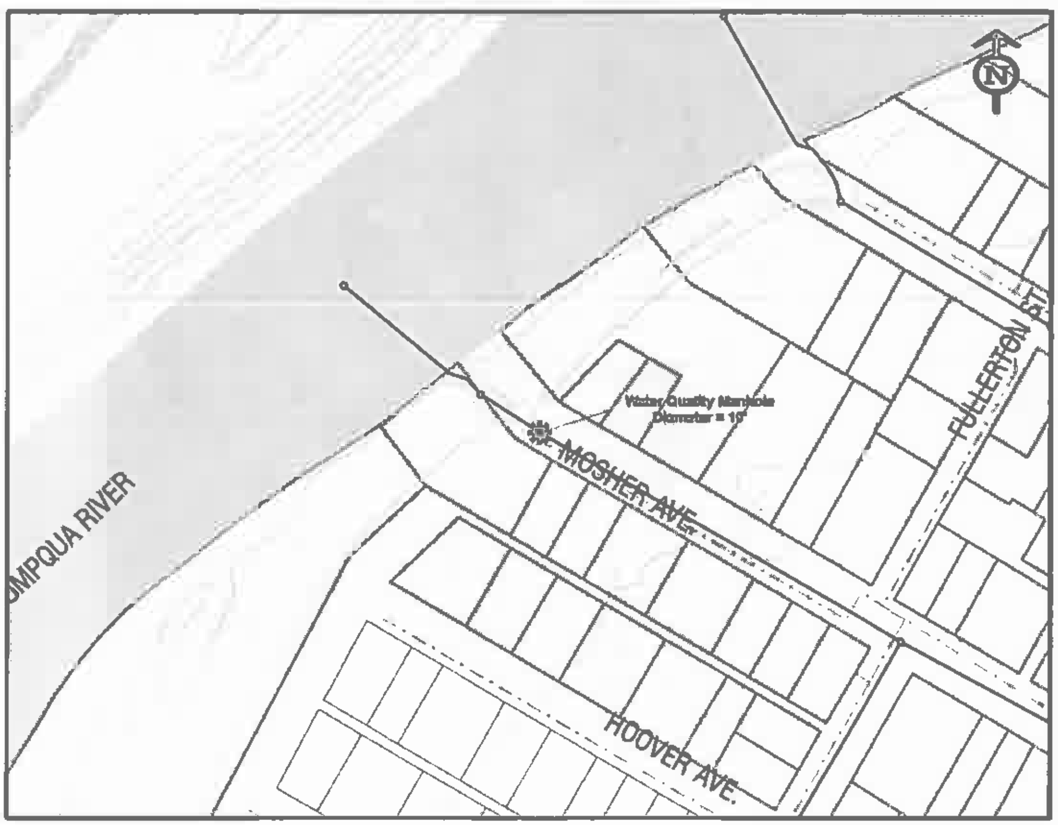
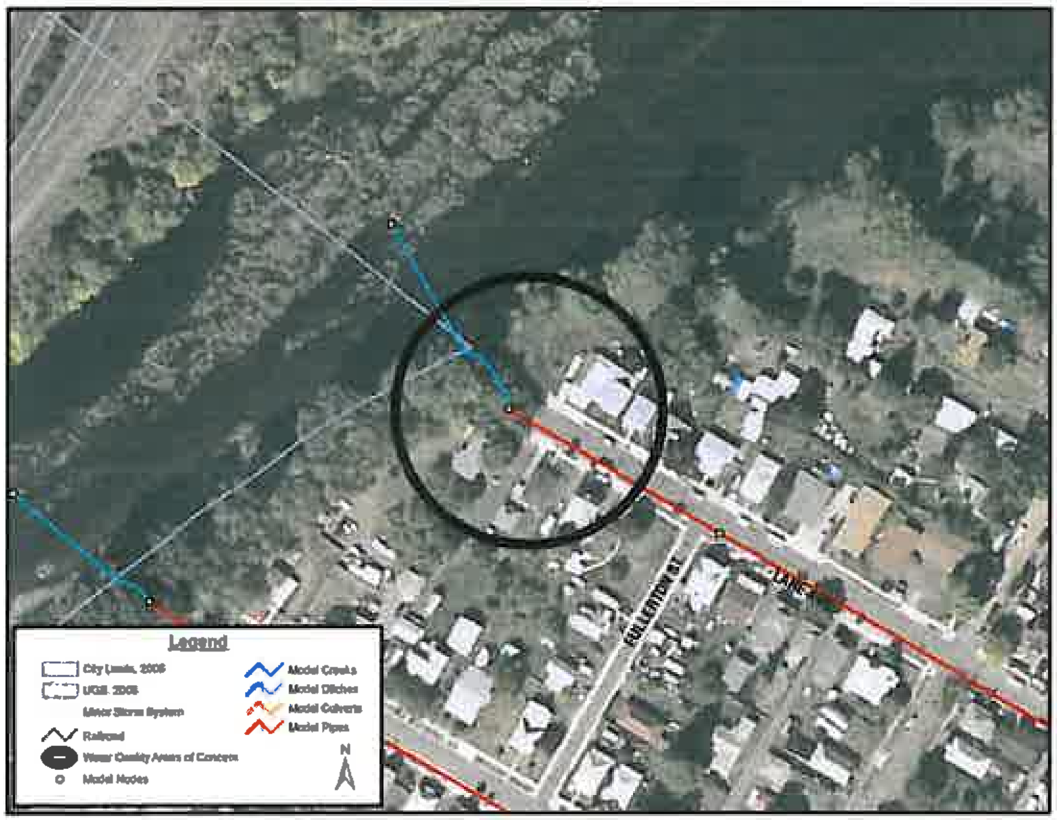


TABLE 8.4-2

WQ AREA OF CONCERN #6 SOUTH DOWNTOWN 2

	Discussion
Problem Location:	The existing storm drain system east of the S. Umpqua River along Lane Ave
Problem Summary:	This area includes a portion of the commercial district on the south side of downtown as well as residential areas near the S. Umpqua River and in the surrounding foothills to the east. The outfall is located on in City right-of-way at the northwest end of Lane Ave and does not have any water quality treatment prior to its discharge to the S. Umpqua River.
Technical Details:	Outfall Diameter: 42" Drainage Area: 149.8 acres WQ Flow: 11.7 cfs WQ Volume: 3.9 ac-ft



Potential Solutions:	• **Proprietary Water Quality Manhole** • Source control through low impact development methods.

TABLE 8.4-2

WQ AREA OF CONCERN #6 SOUTH DOWNTOWN 2

	Discussion
Preferred Alternative:	• Construct a proprietary water quality manhole in public right-of-way on Lane Ave prior to discharge to the S. Umpqua River.
Technical Data:	*WQ Manhole Size: 10' Diameter* *To be constructed off-line*
Benefits:	• Located within public right-of-way with limited traffic. • Easy access for maintenance. • Improves water quality for downtown area.
Land Ownership:	• All property owned by the City of Roseburg
Permitting:	• No special permits anticipated.
Implementation Issues:	• Routine maintenance will be critical to the success of this facility.
Cost	**$ 82,463**

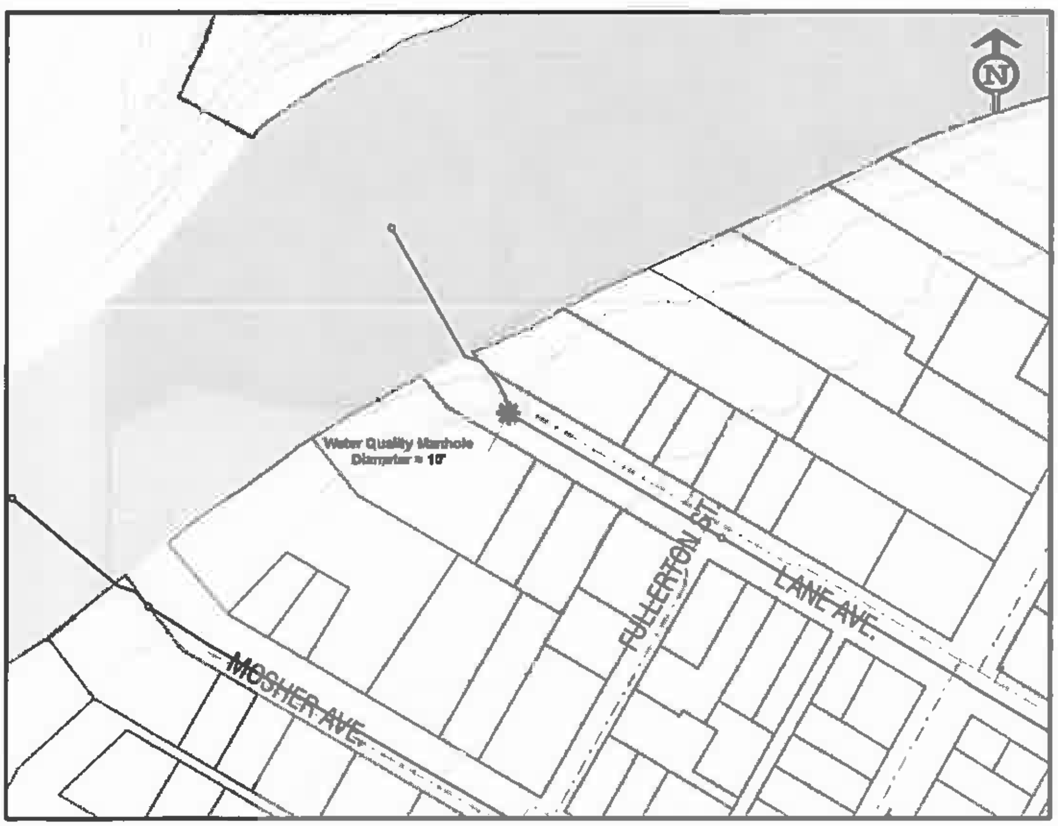
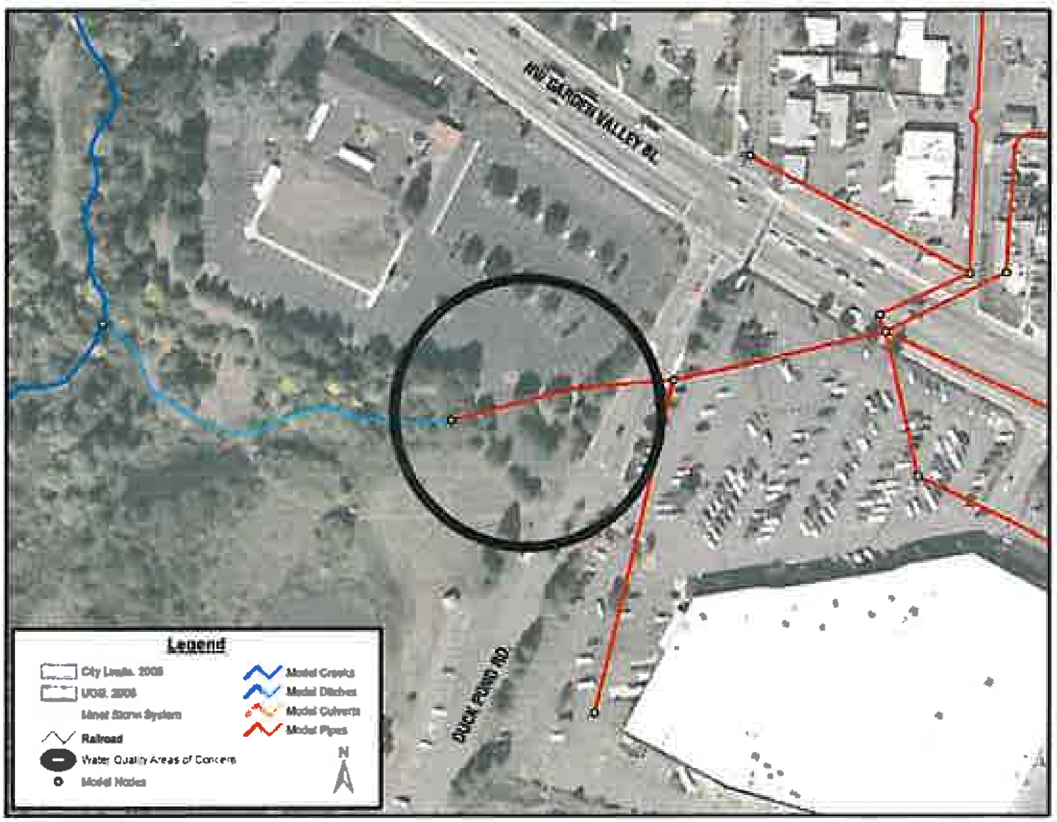


TABLE 8.4-2

W AREA OF CONCERN #7 GARDEN VALLEY BLVD AT I-5

	Discussion
Problem Location:	The existing storm drain system along Garden Valley Road west of Interstate-5 that discharges into Newton Creek at Duck Pond Rd.
Problem Summary:	This area includes a portion of the Interstate-5 corridor as well as the commercial areas to the north of Garden Valley Blvd. The outfall is located on in on City property on the northeast corner or the existing duck ponds. No water quality treatment currently exists within the basin prior to discharge to Newton Creek.
Technical Details:	Outfall Diameter: 60" Drainage Area: 156.5 acres WQ Flow: 14.0 cfs WQ Volume: 6.0 ac-ft



Potential Solutions:

- Proprietary Water Quality Manhole
- Water Quality Swale
- Water Quality Treatment Pond
- Source control through low impact development methods.

TABLE 8.4-2

W AREA OF CONCERN #7 GARDEN VALLEY BLVD AT I-5

	Discussion
Preferred Alternative:	• Construct a proprietary water quality manhole in public right-of-way on Duck Pond Road.
Technical Data:	*WQ Manhole Size: 10' Diameter* *To be constructed off-line*
Benefits:	• Located within public right-of-way with limited traffic. • Easy access for maintenance. • Improves water quality for the Garden Valley commercial areas.
Land Ownership:	• If not already present, drainage easements will be required.
Permitting:	• No special permits anticipated.
Implementation Issues:	• Routine maintenance will be critical to the success of this facility.
Cost	$ 85,103

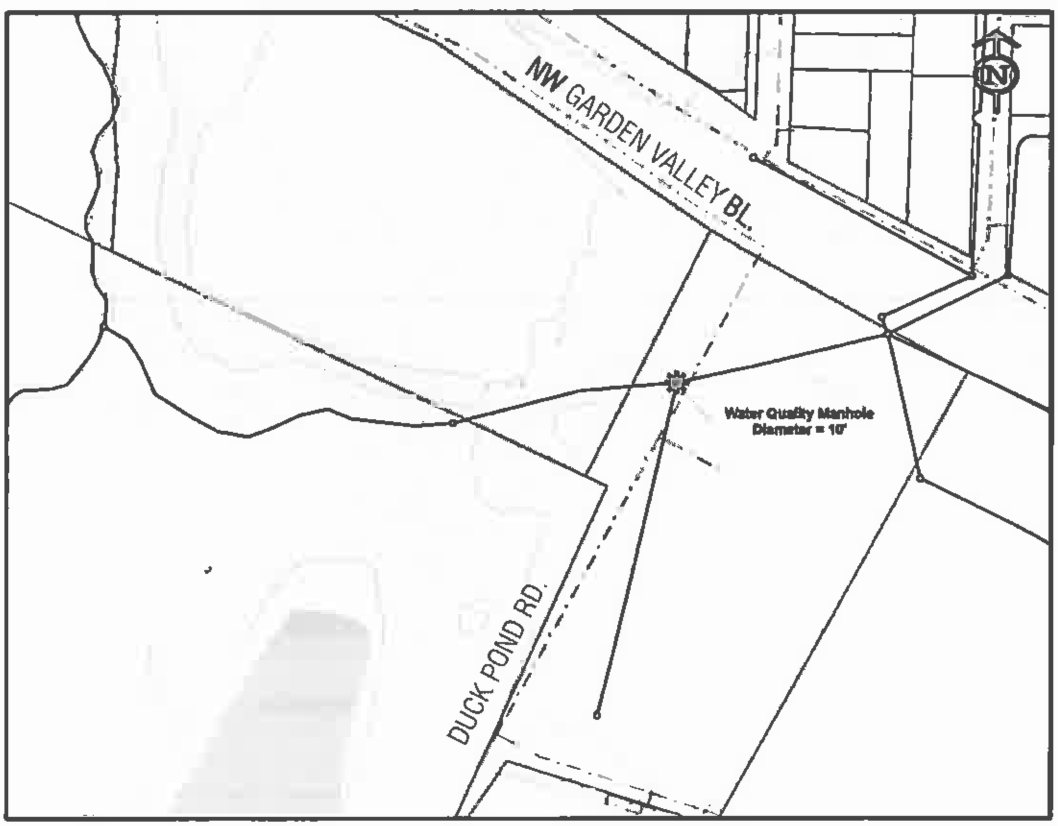
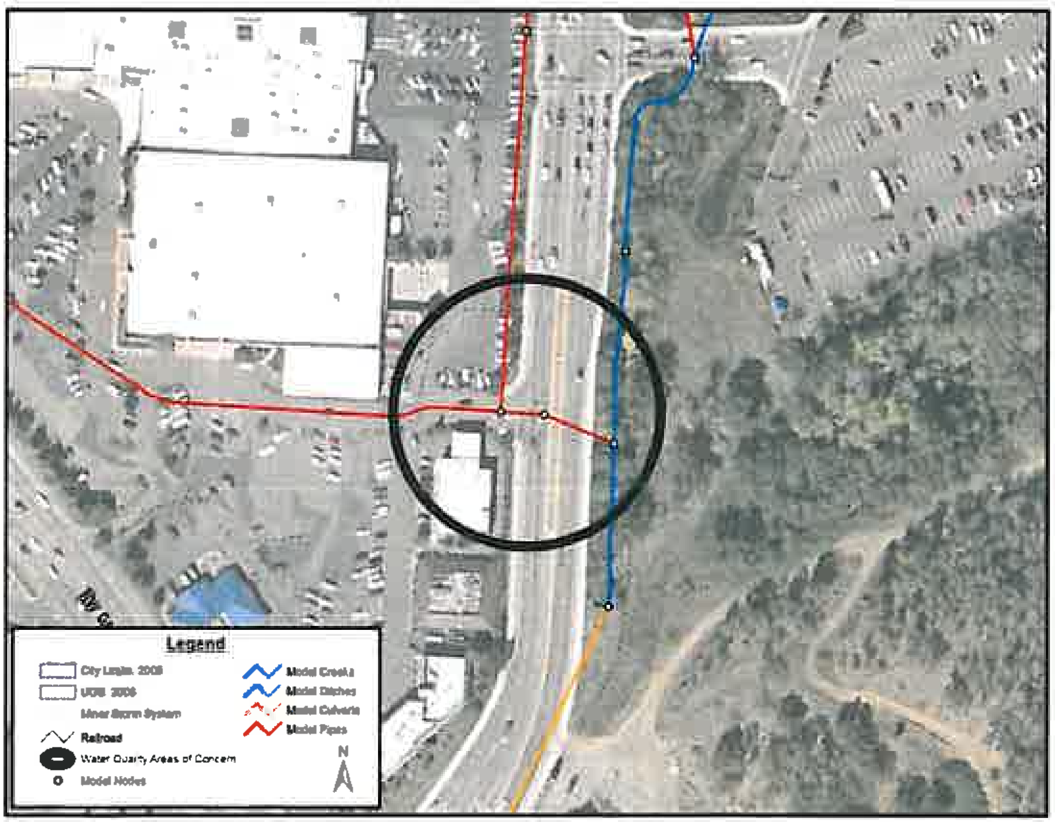


TABLE 8.4-2

WQ AREA OF CONCERN #8 GARDEN VALLEY BLVD AT STEWART PRKY

	Discussion
Problem Location:	The existing storm drain system along Stewart Prky, Garden Valley Rd and Kline St.
Problem Summary:	This area includes the commercial areas along Garden Valley Rd and Stewart Prky west of Newton Creek. The outfall is located east of Stewart Prky on public right-of-way across from the mall. No water quality treatment currently exists within the basin prior to discharge to Newton Creek.
Technical Details:	Outfall Diameter: 72" Drainage Area: 35.2 acres WQ Flow: 18.6 cfs WQ Volume: 7.3 ac-ft



Potential Solutions:	• **Proprietary Water Quality Manhole** • Source control through low impact development methods.

TABLE 8.4-2

WQ AREA OF CONCERN #8 GARDEN VALLEY BLVD AT STEWART PRKY

	Discussion
Preferred Alternative:	• Construct a proprietary water quality manhole in public right-of-way on Stewart Parkway.
Technical Data:	*WQ Manhole Size: 10' Diameter* *To be constructed off-line*
Benefits:	• Located within public right-of-way with limited traffic. • Easy access for maintenance. • Improves water quality in Garden Valley/Stewart Prky commercial areas.
Land Ownership:	• If not already present, drainage easements will be required.
Permitting:	• No special permits anticipated.
Implementation Issues:	• Routine maintenance will be critical to the success of this facility.
Cost	**$ 85,103**

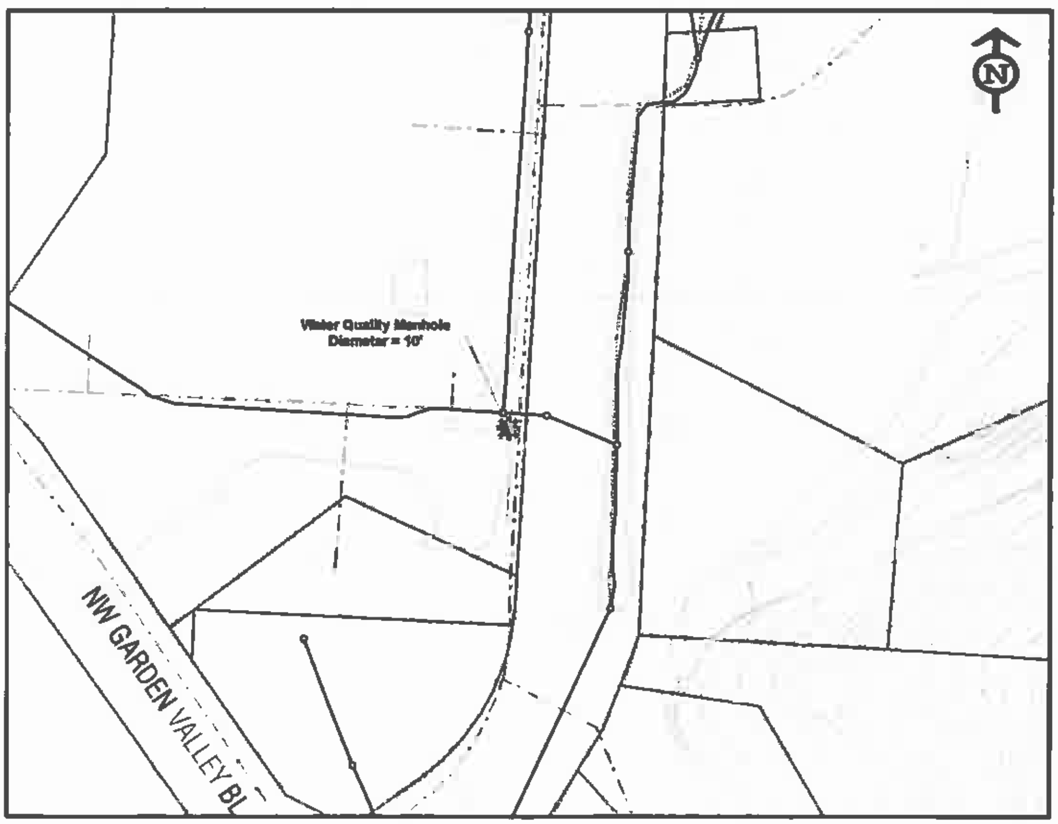
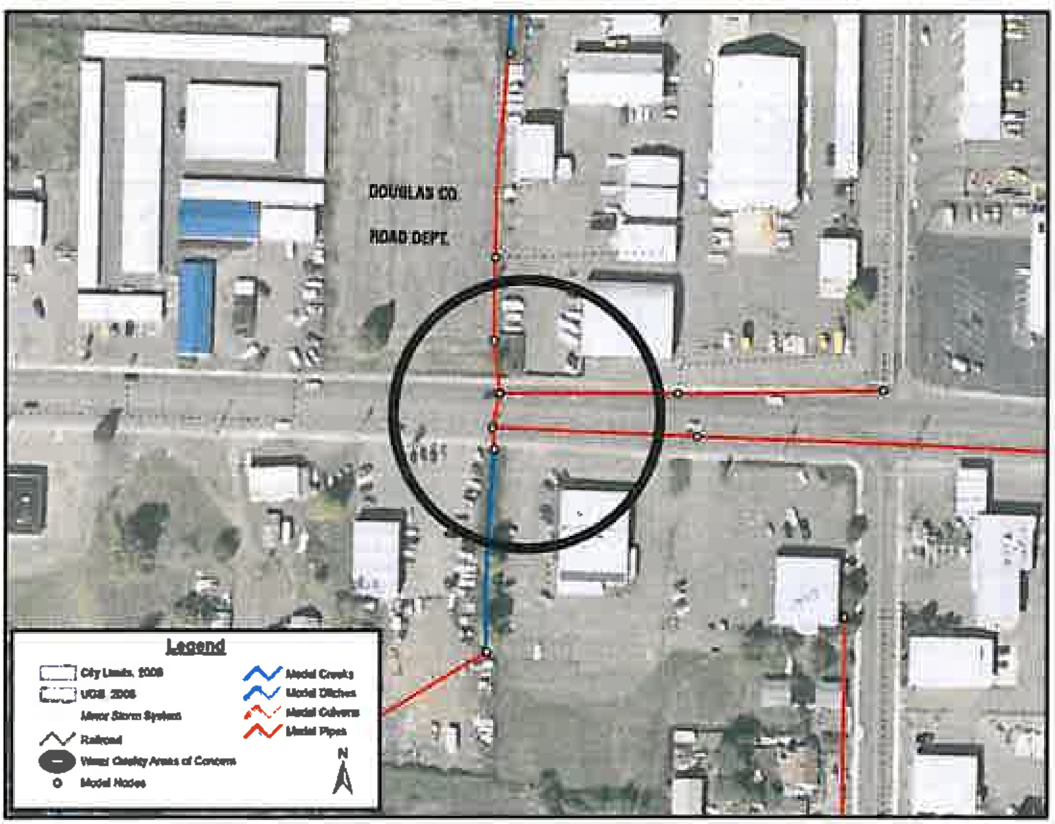


TABLE 8.4-2

WQ AREA OF CONCERN #9 DIAMOND LAKE BLVD

	Discussion
Problem Location:	The existing storm drain system along Diamond Lake Blvd discharging into the unnamed at the Douglas County Road Department shops.
Problem Summary:	This area includes the commercial and industrial areas along Diamond Lake Blvd, Riffle Range Rd and Miguel St. The outfall is on Diamond Lake Blvd immediately south of the Douglas County Road Department shops. No water quality treatment currently exists within the basin prior to discharge to Deer Creek.
Technical Details:	Outfall Diameter: 24" Drainage Area: 85.0 acres WQ Flow: 6.3 cfs WQ Volume: 2.1 ac-ft



Potential Solutions:	• Water Quality Swale • Proprietary Water Quality Manhole • Source control through low impact development methods.

TABLE 8.4-2

WQ AREA OF CONCERN #9 DIAMOND LAKE BLVD

	Discussion
Preferred Alternative:	• Construct a water quality swale in the existing open channel system south of Diamond Lake Boulevard.
Technical Data:	*Approximate swale dimensions:* *Length = 225', Bottom width = 12', Slope = 2%, Depth = 6", Side slopes 3:1*
Benefits:	• Located within existing drainage channel. • Easy access for maintenance. • Improves water quality for surround areas.
Land Ownership:	• If not already present, drainage easements will be required.
Permitting:	• No special permits anticipated.
Implementation Issues:	• Routine maintenance will be critical to the success of this facility.
Cost	**$ 16,477**

8.5 Other CIP Projects

In addition to the recommended alternatives discussed in the previous section of this report, the City also has several supplemental lists of improvements to the existing drainage system. These include the 2007-2011 Stormwater Capital Improvement Plan (CIP) (Table 8.5-1) and the 2005 Calkins Storm Drainage Report, which are summarized below.

In some cases, stormwater improvements were addressed in both the current master plan and one or both of the supplemental lists of improvements. In each of these cases, the cost estimates from the current master plan were assumed to supersede the older estimates and are therefore are listed as not available (*n/a*) in the following tables. Additional project information for each of these improvements, including a project description and a detailed breakdown of capital and O&M cost, can be found in the appendix of this report

TABLE 8.5-1
Previous 2007-2011 Drainage CIP
Roseburg: SWMP

ID	Description	Cost
SUP-1	Storm Drainage master Plan & Design Standards	$ 250,000
SUP-2	Charter Oaks Master Plan	$ 25,000
SUP-3	UGB Expansion, Infrastructure Evaluation	$ 25,000
SUP-4	Parrot Creek Crossing – Mitigation Project – Study	$ 25,000
SUP-5	Hillside Development Ordinance	$ 25,000
SUP-6	Stewart Parkway Drainage Bypass – Design	$ 50,000
SUP-7	Stewart Parkway Drainage Bypass – Construction	$ 800,000
SUP-8	Kline/Calkins Drainage – Phase 1 & 2 Design	n/a
SUP-9	Kline/Calkins Drainage – Phase 1 & 2 Construction	n/a
SUP-10	Kline/Calkins Drainage – Phase 3 & 4	n/a
SUP-11	Kline/Calkins Drainage – Phase 5 & 6	n/a
SUP-12	Fulton/Gardiner Drainage Improvements – Study	$ 25,000
SUP-13	Fulton/Gardiner Drainage Improvements – Construction	$ 1,000,000
SUP-14	Garden valley Sidewalks, Kline to Stewart Parkway (LID)	$ 25,000
SUP-15	Garden valley Sidewalks, Kline to Stewart Parkway (LID)	$ 200,000
SUP-16	Luellen Storm Pipe Relocation	$ 60,000
SUP-17	Starmer – Parrot Creek Crossing Bridge	$ 150,000
SUP-18	GIS Mapping	$ 100,000
SUP-19	Survey Base Maps – Roseburg	$ 50,000
SUP-20	Update Aerial Orthophotos	$ 50,000
SUP-21	Property Acquisition – Drainage	$ 250,000
SUP-22	Buildings & Structures – Admin & Maintenance Facility Improvements	$ 100,000
	Total:	**$ 3,210,000**

TABLE 8.5-2
Calkins Storm Drainage Report
Roseburg: SWMP

ID	Description		Cost
CALK-1	Phase 1 – El Dorado Court		$ 260,700
CALK-2	Phase 2 – Calkins Road from Troost St to El Dorado Ct		$ 332,700
CALK-3	Phase 2A – Canterbury Ave/Troost St to Calkins St/Troost St.		$ 71,800
CALK-4	Phase 3 – See figure		cost updated in master plan
CALK-5	Phase 4 – Witherspoon Ave to Calkins Rd		$ 199,300
CALK-6	Phase 5 – Watters Street – Valley View Dr to Finch Ct		$ 132,300
CALK-7	Phase 5A – Lynnwod St – Hucrest School to Calkins Rd		$ 79,100
CALK-8	Phase 6 – Roseburg Junior Academy		$ 138,300
CALK-9	Phase 7 – Sunberry Dr – Andrea Dr. to Troost Dr.		$ 134,500
		Total:	**$ 2,064,400**

SECTION 9

Capital Improvement Plan

This chapter outlines the recommended system improvements, identifies water quality and flood control projects to be included in the City's CIP, presents estimated project costs, and provides an implementation plan by ranking the relative importance of each CIP project.

9.1 System Improvement Recommendations

9.1.1 Recommended Plan Components

The goal of this master plan is to give the City a tool to proactively address stormwater capacity and water quality issues. With this in mind, the master plan was developed to identify infrastructure requirements for the collection, conveyance and treatment of stormwater runoff and the overall improvement of the City of Roseburg. The stormwater system analysis identified and evaluated 29 individual CIP projects related to flood control and 9 water quality improvements. Additionally, other planning studies within the City identified 26 projects that are included in this CIP.

Each CIP project is divided into the following general improvement categories:

- **Storm drain (SD) improvements** including pipe replacement/up-sizing and outfall modification for increased conveyance and reduced erosion
- **Open channel (OC) improvements** including channel conveyance modifications to reduce flooding risk to surrounding structures or roadways.
- **Culvert (CU) improvements** including culvert replacements improvements to reduce flooding risk to surrounding structures or roadways.
- **Detention pond (DP) improvements** including detention pond construction to reduce peak discharge rates and decrease downstream flooding risk.
- **Water quality (WQ) improvements** including water quality ponds and structural pollution reduction facilities (PRF) for reducing target pollutants concentrations and loads throughout the basin.
- **Stormwater management (SM) requirements** including NPDES activities, development of a stormwater ordinance and new maintenance and inspection activities.

9.1.2 Cost Estimates

Cost estimates were developed for each CIP project and are summarized in Table 9.1-1. CIP costs are considered order-of-magnitude estimates; they have an anticipated level of accuracy of +50% to -30%. The cost estimates include all capital construction cost plus a 20% contingency, a 5% allowance for permitting (if necessary), 25% for design and construction administration, 15% for utility relocations, and various other costs as required for mobilization, survey, traffic control, etc. All unit costs factors were obtained from recent data, including 2004-2005 ODOT bid tabs (Region 3 and Statewide), equipment suppliers, communication with City staff, and other recent projects in the area. All estimates are in 2007 dollars. Costs associated with NPDES activities are also in 2007 dollars; however they are primarily associated with increased staffing rather than specific improvement projects. Detailed cost sheets are provided in Appendix F.

9.1.3 Recommended Plan

The recommended plan includes 29 individual CIP projects in addition to projects from the City's previous stormwater improvement list, Calkins Storm Drainage Report, and NPDES stormwater management plan, and is summarized in Tables 9.1-1 and in Figure 9.1-1. Collectively, the improvements include 38,000 feet of new or replaced storm drain pipe, approximately 250 feet of channel enhancement, 20 replaced culverts, 2 new detention ponds, 7 structural pollution reduction manholes, and 2 water quality swales. The total capitol cost for the improvements is just over 194 million dollars, which includes all construction activities, and land acquisition, with the exception of mitigation land acquisition (if required) and maintenance. From an implementation standpoint, a majority of the projects are located in public right-of-way, although in several cases, coordination with private landowners and ODOT may be required. Other implementation issues that are likely to be encountered include roadway closures and/or temporary traffic control, utility conflicts and relocations, limited site access and environmental permitting.

TABLE 9.1-1
Recommended Plan Summary
Roseburg: SWMP

ID	Project Name	Category	Capitol Cost ($)
HYD 1	Military Avenue	SD, CU	$ 169,200
HYD 2	Ramp Creek Area	DP	$ 2,597,139
HYD 3	Diamond Lake Boulevard at Fulton Street	SD, CU	$ 733,576
HYD 4	Parrot Creek Culverts	CU, OC	$ 1,449,738
HYD 5	Airport Road North of Garden Valley Boulevard	SD, CU	$ 839,844
HYD 6	Sweetbrier Creek at Newton and Sterling Roads	DP	$ 2,793,887
HYD 7	Nash Street and Jackson Street	SD	$ 1,210,920
HYD 8	Harvard Avenue East of I-5	SD	$ 1,251,399
HYD 9	El Dorado Court Area	SD	$ 766,201
HYD 10	Harvard Street at Francis Street and Bertha Avenue	SD	$ 1,165,620
HYD 11	Kennwood and Haggerty Street	SD	$ 474,757
HYD 12	Stewart Parkway at Airport Road	SD	$ 281,561
HYD 13	Diamond Lake Boulevard #1	SD	$ 876,245
HYD 14	Lookinglass Road and Lorraine Avenue	SD	$ 721,591
HYD 15	Hickory Street, Chateau Avenue, and Shasta Avenue	SD	$ 404,066
HYD 16	Cardinal Street	SD	$ 448,560

TABLE 9.1-1
Recommended Plan Summary
Roseburg: SWMP

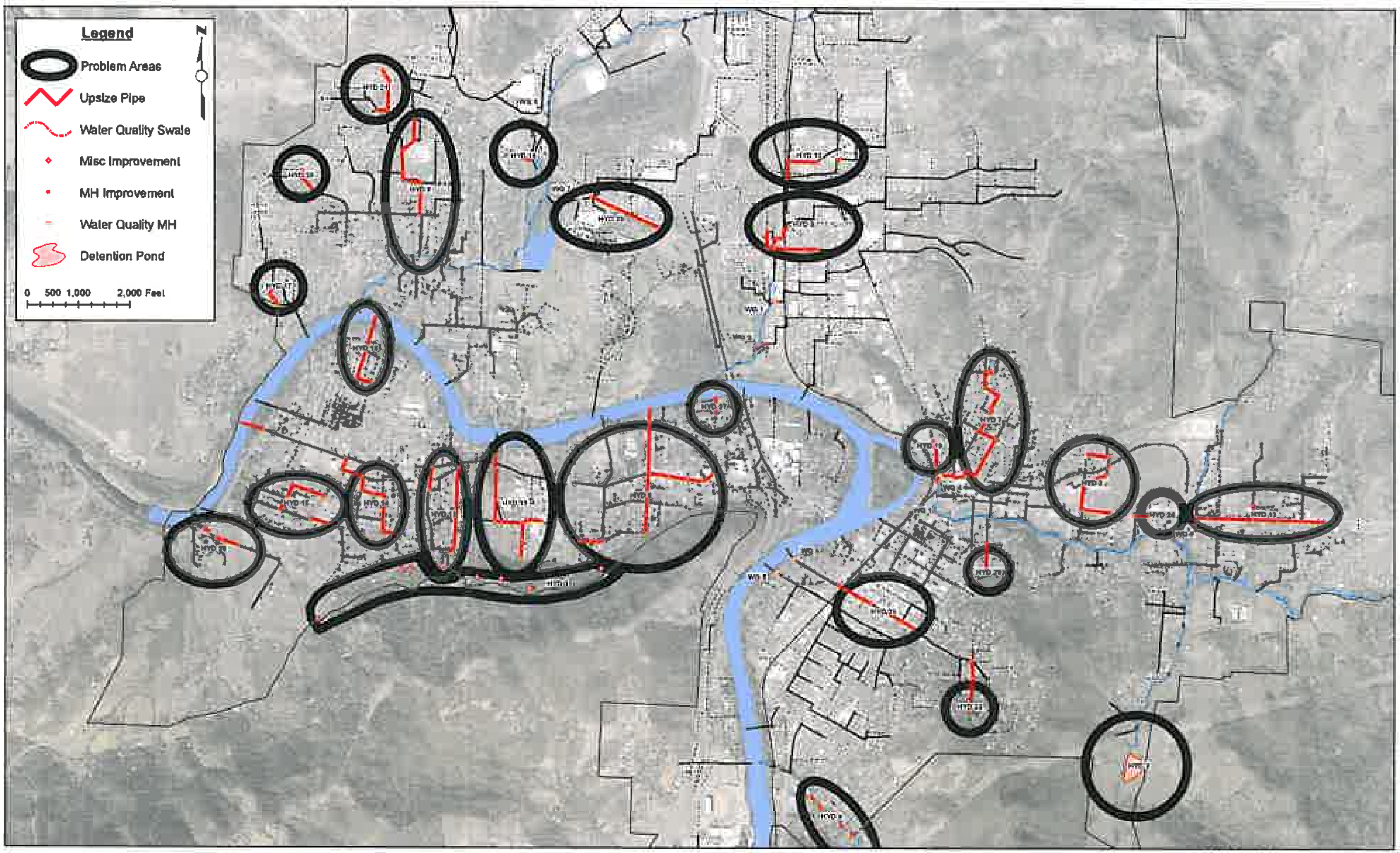
ID	Project Name	Category	Capitol Cost ($)
HYD 17	Culvert at Vallejo Street	SD	$ 147,149
HYD 18	Valley View Drive at Steward Parkway	SD	$ 86,038
HYD 19	Stephens Street	SD	$ 126,601
HYD 20	Goedeck Avenue	SD	$ 157,139
HYD 21	Watters Street	SD	$ 379,648
HYD 22	Terrace Drive between Lane and Laural Avenues	SD	$ 232,527
HYD 23	Lane Avenue	SD	$ 700,929
HYD 24	Diamond Lake Boulevard East of Douglas County Road Department Shops	SD	$ 185,445
HYD 25	Garden Valley Road between Duck Pond Road and I-5	SD	$ 314,896
HYD 26	Esquire Drive	SD	$ 128,040
HYD 27	Umpqua Street	SD	$ 94,595
HYD 28	Newton Creek Culvert	CU, OC	$ 120,384
HYD 29	South End of Pitzer Street	SD	$ 142,702
		Subtotal	***$ 18,849,986***
WQ 1	Downtown	WQ	$ 61,594
WQ 2	Chestnut Avenue Storm Drain	WQ	$ 15,509
WQ 3	Central NE Commercial Areas	WQ	$ 85,103
WQ 4	Inner NE Commercial Area	WQ	$ 82,463
WQ 5	South Downtown 1	WQ	$ 82,463
WQ 6	South Downtown 2	WQ	$ 82,463
WQ 7	Garden Valley Boulevard at I-5	WQ	$ 85,103
WQ 8	Garden Valley Boulevard at Stewart Parkway	WQ	$ 85,103
WQ 9	Diamond Lake Boulevard	WQ	$ 16,477
		Subtotal	***$ 596,278***
SUP-1	Storm Drainage Master Plan & Design Standards	n/a	$ 250,000
SUP-2	Charter Oaks Master Plan	n/a	$ 25,000
SUP-3	UGB Expansion, Infrastructure Evaluation	n/a	$ 25,000
SUP-4	Parrot Creek Crossing Mitigation Project—Study	n/a	$ 25,000
SUP-5	Hillside Development Ordinance	n/a	$ 25,000
SUP-6	Stewart Parkway Drainage Bypass—Design	n/a	$ 50,000
SUP-7	Stewart Parkway Drainage Bypass—Construction	n/a	$ 800,000
SUP-8	Kline/Calkins Drainage—Phase 1 & 2 Design	n/a	n/a

TABLE 9.1-1
Recommended Plan Summary
Roseburg: SWMP

ID	Project Name	Category	Capitol Cost ($)
SUP-9	Kline/Calkins Drainage—Phase 1 & 2 Construction	n/a	n/a
SUP-10	Kline/Calkins Drainage—Phase 3 & 4	n/a	n/a
SUP-11	Kline/Calkins Drainage—Phase 5 & 6	n/a	n/a
SUP-12	Fulton/Gardiner Drainage Improvements—Study	n/a	$ 25,000
SUP-13	Fulton/Gardiner Drainage Improvements—Construction	n/a	$ 1,000,000
SUP-14	Garden Valley Sidewalks, Kline to Stewart Parkway (LID)	n/a	$ 25,000
SUP-15	Garden Valley Sidewalks, Kline to Stewart Parkway (LID)	n/a	$ 200,000
SUP-16	Luellen Storm Pipe Relocation	n/a	$ 60,000
SUP-17	Starmer-Parrot Creek Crossing Bridge	n/a	$ 150,000
SUP-18	GIS Mapping	n/a	$ 100,000
SUP-19	Survey Base Maps–Roseburg	n/a	$ 50,000
SUP-20	Update Aerial Orthophotos	n/a	$ 50,000
SUP-21	Property Acquisition—Drainage	n/a	$ 250,000
SUP-22	Buildings & Structures—Admin & Maintenance Facility Improvements	n/a	$ 100,000
		Subtotal	***$ 3,210,000***
CALK-1	Phase 1—El Dorado Court	SD	$ 260,700
CALK-2	Phase 2—Calkins Road from Troost Street to El Dorado Court	SD	$ 332,700
CALK-3	Phase 2A—Canterbury Avenue/Troost Street to Calkins Street/Troost Street	SD	$ 71,800
CALK-4	Phase 3	SD	cost updated in master plan
CALK-5	Phase 4—Witherspoon Avenue to Calkins Road	SD	$ 199,300
CALK-6	Phase 5—Watters Street—Valley View Drive to Finch Court	SD	$ 132,300
CALK-7	Phase 5A—Lynnwood Street—Hucrest School to Calkins Road	SD	$ 79,100
CALK-8	Phase 6—Roseburg Junior Academy	SD	$ 138,300
CALK-9	Phase 7—Sunberry Drive—Andrea Drive to Troost Drive	SD	$ 134,500
		Subtotal	***$ 2,064,400***
NPDES-1	Stormwater Ordinance	WQ	
NPDES-2	Public Education and Outreach	WQ	
NPDES-3	Public Involvement and Participation	WQ	

TABLE 9.1-1
Recommended Plan Summary
Roseburg: SWMP

ID	Project Name	Category	Capitol Cost ($)
NPDES-4	Illicit Discharge Detection and Elimination	WQ	
NPDES-5	Construction Site Runoff Control	WQ	
NPDES-6	Post-Construction Runoff Control	WQ	
NPDES-7	Pollution Prevention in Municipal Operations	WQ	
		Subtotal	$
		Total	$



Recommended Capital Improvements
FIGURE 9.1-1

9.2 Project Prioritization

The recommended stormwater improvements for the City of Roseburg were prioritized according to a point-based implementation matrix. This matrix, which was completed by the project team and reviewed by City staff, includes a weighting for cost, available funding, regulatory mandate, safety/liability, complexity, impact, environmental benefit, permitting, and concurrence with other city improvements.

The process of prioritizing the order of the recommended CIP projects included developing a point-based implementation matrix and working with City staff to enter data in the matrix and evaluate prioritization results. The implementation matrix is based on other recently completed stormwater master plans in Southern Oregon and adapted to the City of Roseburg. These modifications were developed so that the criteria and weighting were relevant to the issues and problems within the City. The matrix includes the project identifier, itemized evaluation criteria, and a weighting for each criterion. The project evaluation criteria and their definitions are summarized in Table 9.2-1.

The process also included a score definition that assigned points based on the application of the criteria. Scores of 1, 5, or 10 were assigned to each criterion based on the score definitions shown in Table 9.2-2.

TABLE 9.2-1
Prioritization Evaluation Criteria and Definition
Roseburg: SWMP

Criterion	Definition
Cost	Total estimated cost of CIP.
Viability	Are there significant adverse consequences of not doing this project? Relates to non-construction projects, such as MPs, Rate Studies, etc.
Safety/Liability	What potential safety and/or liability issues are involved?
Complexity	How quickly can the solution be implemented and with what level of effort?
Impact	How large an area and/or how many people does the problem impact?
Concurrence	Does the work coincide with other City work or another jurisdiction's scheduled work? Is this work required prior to implementing other improvements (hydraulic dependence)?
Longevity	How long has this CIP existed? Is it a high visibility problem?
Immanence	Are there significant adverse physical consequences if this project is not completed?
Environmental Benefit	Are there direct environmental benefits associated with the projects (e.g., water quality, fish or habitat improvements)?
Permitting	In the current permitting environment, will this project pose difficulties in obtaining local, federal or state permits?
Known Problem	Is this a known problem area?

Based on the criteria and score definition, points were assigned for each CIP project and entered into the implementation matrix. A point total was then calculated based on the criteria score and relative weight. The result of this process is shown in Tables 9.2-3 and 9.2-4.

The CIP project with the highest rating (highest number of points) is the highest priority project for this basin. Projects were also classified as large (> $500,000) and small (< 500,000) and short- and long-term CIP projects: short-term CIP projects are anticipated to occur with in the next 5 years. The resulting implementation order short- and long-term CIP cost summary is shown in Tables 9.2-3 and 9.2-4.

TABLE 9.2-2
Summary of Scoring Definition
Roseburg: SWMP

Criterion	Weight	10	5	1
Cost	0.5	Less than $100,000.	Between $100,000 and $500,000.	Greater than $500,000.
Safety/ Liability	1	Significant hazard. Threat to life and limb and/or to property.	Moderate safety hazard.	No safety hazard.
Complexity	0.5	May be performed by a small crew in less than a month.	Typical or moderate level of difficulty.	Requires significant design, contract documents, or complex construction.
Impact	1	Has effects region-wide, with significant downstream and/or upstream impacts.	Affects small sub-basin.	Affects only one or two individual properties.
Concurrence	0.5	Pre-requisite project for other CIP projects or for inter-jurisdictional projects.	Related work within two to three fiscal years.	No related work.
Environmental Benefit	0.3	Significantly improves water quality and wildlife habitat.	Moderately improves water quality and wildlife habitat.	None.
Permitting	0.3	No permitting issues.	Potential permitting issues.	Significant issues. Possibly not permittable.
Known Problem	1	Known and recurrent problem area	Known but non-recurrent problem area	Unknown problem area

TABLE 9.2-3
Summary of Large CIP Projects
Roseburg: SWMP

ID	Project Name	Rating	Performance Criteria Scores								0-5 Year CIP	Long Term CIP
			Cost	Safety/ Liability	Complexity	Impact	Concurrence	Environmental Benefit	Permitting	Known Problem		
			0.5	*1*	*0.5*	*1*	*0.5*	*0.3*	*0.3*	*1*		
HYD 4	Parrot Creek Culverts	36.5	1	10	5	10	1	5	5	10	✓	
HYD 9	Eldora Court Area	31.3	1	5	5	5	10	1	10	10	✓	
HYD 10	Harvard Street at Francis Street and Bertha Avenue	28.8	1	5	5	5	5	1	10	10		✓
HYD 8	Harvard Avenue East of I-5	28.3	1	5	1	10	1	1	5	10		✓
HYD 2	Ramp Creek Area	26.5	1	5	1	10	5	5	5	5		✓
HYD 5	Airport Road North of Garden Valley Boulevard	25.3	1	5	1	5	5	1	5	10		✓
HYD 7	Nash Street and Jackson Street	23.8	1	5	5	5	5	1	10	5		✓
HYD 3	Diamond Lake Boulevard at Fulton Street	23.3	1	5	1	5	1	1	5	10		✓
HYD 6	Sweetbrier Creek at Newton and Sterling Roads	22.5	1	5	1	10	5	5	5	1		✓
HYD 14	Lookinglass Road and Lorraine Avenue	17.8	1	5	5	5	1	1	10	1		✓
HYD 23	Lane Avenue	17.8	1	5	5	5	1	1	10	1		✓
HYD 13	Diamond Lake Boulevard #1	13.8	1	1	5	5	1	1	10	1		✓

TABLE 9.2-4
Summary of Small CIP Projects
Roseburg: SWMP

ID	Project Name	Rating	Performance Criteria Scores Cost	Safety/ Liability	Complexity	Impact	Concurrence	Environmental Benefit	Permitting	Known Problem	0-5 Year CIP	Long Term CIP
			0.5	*1*	*0.5*	*1*	*0.5*	*0.3*	*0.3*	*1*		
HYD 1	Military Avenue	28.8	5	5	5.0	5	1	1	10	10	✓	
HYD 18	Valley View Drive at Stewart Parkway	22.3	10	5	5.0	5	1	1	10	1	✓	
HYD 25	Garden Valley Road between Duck Pond Road and I-5	26.8	5	5	10.0	5	10	1	10	1	✓	
HYD 11	Kennwood and Haggerty Street	19.8	5	5	5.0	5	1	1	10	1	✓	
HYD 15	Hickory Street, Chateau Avenue, and Shasta Avenue	19.8	5	5	5.0	5	1	1	10	1	✓	
HYD 21	Watters Street	19.8	5	5	5.0	5	1	1	10	1		✓
HYD 16	Cardinal Street	19.5	5	1	5.0	5	1	5	5	5		✓
HYD 12	Stewart Parkway at Airport Road	18.8	5	1	19.0	1	1	1	10	1		✓
HYD 20	Goedeck Avenue	18.8	5	1	1.0	10	1	1	10	1		✓
HYD 17	Culvert at Vallejo Street	18.3	5	1	10.0	5	1	1	10	1		✓
HYD 22	Terrace Drive between Lane and Laural Avenues	18.3	5	1	10.0	5	1	1	10	1		✓
HYD 29	South End of Pitzer Street	18.3	5	1	10.0	5	1	1	10	1		✓
HYD 28	Newton Creek Culvert	18	5	5	10.0	1	1	5	5	1		✓
HYD 27	Umpqua Street	16.8	10	1	10.0	1	1	1	10	1		✓
HYD 24	Diamond Lake Boulevard East of Douglas County Road Department Shops	14.3	5	1	10.0	1	1	1	10	1		✓
HYD 26	Esquire Drive	14.3	5	1	10.0	1	1	1	10	1		✓
HYD 19	Stephens Street	11.8	5	1	5.0	1	1	1	10	1		✓