CRESCENT SANITARY DISTRICT
PRELIMINARY ENGINEERING REPORT
FOR
WASTEWATER SYSTEM IMPROVEMENTS

Prepared for:
Crescent Sanitary District
PO Box 265
Crescent, OR 97733

Prepared by:
Anderson Engineering & Surveying
17681 Hwy 395
Lakeview, OR 97630
541-947-4407
www.andersonengineering.com

Funded by:
Business Oregon-IFA
775 Summer St. NE, Suite 200
Salem, OR 97301

REGISTERED PROFESSIONAL ENGINEER
12,359
OREGON
DEC. 2 1983
DARRYL J. ANDERSON

EXPIRES DEC. 31, 2015

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDIX

1.0 GENERAL

1.1 Introduction

The purpose of this Engineering Report is to provide guidance to the Crescent Sanitary District (District) in providing centralized wastewater collection and treatment services for currently taxed properties residing within the District's boundaries. The purpose also covers the potential consideration for expanding facilities to Ghilchrist and West Crescent if it is found financial feasible. Existing development in these areas is currently served by individual on-site sewage systems. This report has been prepared to conform with current Oregon Department of Environmental Quality (ODEQ) regulations and guidelines. As such, this Engineering Report has been written to meet the requirements of Oregon Administrative Rule (OAR) 123-043-000. In anticipation of the potential for requesting funding from either Oregon Business Development Department Infrastructure Finance Authority (IBDD-IFA), Oregon Department of Environmental Quality Clean Water State Revolving Fund (ODEQ-CWSRF) and the United States Department of Agriculture (USDA) Rural Utilities Service (RUS) Bulletin 1780-3: "Preliminary Engineering Report – Wastewater Facilities". This report may be used to process the funding request and should clearly describe the District's present situation, analyze alternatives and recommend a specific course of action. The depth of analysis within the report is expected to be proportional to the size and complexity of the proposed project.

Potential funding applicants are expected to perform an environmental review concurrently with the preliminary engineering report. The required environmental review pursuant to 7 CFR Part 1794, guidance in RUS Bulletin 1794A-602: "Guide for Preparing the Environmental Report for Water and Waste Projects" is not included in the scope of work for this report and will be completed as a separate project after an alternative is selected and an implementation plan is solidified.

A primary objective of the report is to ensure adequate conveyance and treatment capacity is provided to meet the needs of the District's service area, to ensure such facilities minimize adverse impacts on the environment, and to protect the health and safety of the affected community. An additional priority is to accomplish these goals in an economical and efficient manner. Minimum requirements for the collection system are design guidelines and standards developed by ODEQ .The approach taken in preparation of this report is to:

- Define environmental and physical conditions in the planning area.
- Develop flow and waste load projections.
- Describe existing facilities, capacity and constraints.
- Describe the need for the project.
- Evaluate alternatives to meet project needs.
- Describe the proposed project, costs and implementation plan.

This report utilizes information obtained from the District's archives, and previous planning and design-related documents. Information provided by District staff concerning various systems and loading characteristics has been considered and included in this report. It is anticipated that this report will be reviewed by the District, ODEQ, Stakeholders and applicable Funding Agencies.

RELATED DOCUMENTS, STANDARDS AND DESIGN CRITERIA
Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities Financed by:

- Infrastructure Finance Authority
- Oregon Department of Environmental Quality
- Rural Community Assistance Corporation
- United States Department of Agriculture

Crescent Sanitary District Wastewater Facilities Plan 1999, 2007 Update
HGE, Inc.

1.2 Background

The primary concern for the District according to the Wastewater Facilities Plan is wastewater pollution. Crescent, Oregon presently houses no city-wide wastewater facility, leaving all businesses and residents reliant on individual septic systems. Many of these systems are aged and failing resulting in pollution of the local groundwater and Wild and Scenic Little Deschutes River with high levels of nitrates. This has led the ODEQ to place the Crescent area on a moratorium prohibiting the installation of any new septic systems. Unfortunately, this means that Crescent can no longer bring in new businesses and/or residents.

Wastewater in Crescent is disposed of through private, on-site septic tanks. Concern about pollution and health hazards resulting from wastewater disposal practices initiated the formation of the Crescent Sanitary District. In September 1979, a Wastewater Management Plan was developed for the District. The recommended option developed in the management plan included a gravity wastewater collection system with lagoon treatment and land disposal. A more detailed evaluation was conducted in the "Wastewater Treatment Facility Plan," completed in 1983. The selected alternative consisted of gravity collection, stabilization lagoon treatment, and rapid infiltration land application. Adequate funds were not available at that time for construction of public wastewater facilities. Wastewater disposal is still a major concern in Crescent. The community has an estimated residential population of 535 people within the present service boundary. High groundwater levels in the area increase the likelihood of groundwater contamination and failing septic systems. Well water is the principal source of water supply in the vicinity of Crescent, and protecting the quality of the groundwater resource is of high importance. Even after sources of contamination have been eliminated, it may take many years before nitrate concentrations drop to acceptable levels for safe drinking water. Similar conditions existed in La Pine (located approximately 16 miles north of Crescent), where it was found that private septic tanks were polluting the groundwater in that area. Since then, the La Pine Sanitary District has installed a public wastewater system.

The District currently provides no wastewater collection and conveyance to the residents within the District's boundary.

Most of the deficiencies identified in the wastewater system are related to increasing nitrate levels in the ground-water aquifer underlying the central Oregon city of La Pine and the surrounding area, due to contamination from residential septic systems. This contamination has public health implications because groundwater is the sole source of drinking water for area residents. A task force steering committee report entitled 'S. Deschutes/N. Klamath Groundwater Protection Project' states:

"DEQ, the US Geological Survey and Deschutes County have determined that the safety of the groundwater in southern Deschutes and northern Klamath counties is threatened by nitrate contamination from traditional on-site septic wastewater treatment systems."

The result of this imminent public health threat leads into the next phase of the engineering and environmental reports which will outline the wastewater system improvement project and will serve as the catalyst to prepare the final designs, specifications, and bidding documents for a wastewater treatment facility for the Crescent Sanitary District.

2.0 PROJECT PLANNING AREA

2.1 Location

The unincorporated area of Crescent is located along Highway 97 approximately 90 miles north of Klamath Falls in northern Klamath County, and approximately 60 miles south of Bend. Crescent borders the southern boundary of Gilchrist. Crescent currently has a post office with the zip code of 97733.

Drainage through the area is generally from south to north and towards the Little Deschutes River. A vicinity map is shown as Figure 2-1 below. Figure 2-2 shows the Project Study Area. The District is located in Township 39 South, Range 9 East, Section 34. (see Figures 2.1 and 2.2 below).

Figure 2.1-Vicinity Map

The planning area for this report is solely for the tax based lots included in the Crescent Sanitary District. Westside Crescent and Gilchrist are shown to provide a conceptual level of planning data for purposes of land requirements for the possibility of these areas to annex into the Crescent Sanitary District in the future. These established communities and possible future development of several land parcels could impact the ultimate capacity of the proposed Crescent wastewater facilities. As identified in the 1999 facilities plan, there is a 155 acre parcel with no existing dwellings and another 142 acre parcel also without dwellings. When these parcels develop and are annexed into the District they will pay for connection fees and system development charges based on established District Ordinances. New developments would also pay the cost of extending collection system main lines to serve the development with no cost to the District. Another development proposed in the area is a destination resort on forest land along Crescent Creek. Although this proposed destination resort development is not immediately adjacent to the Crescent Sanitary District, a development of the scope proposed will certainly create overflow development that will impact growth in the District for residential, commercial and retail services.

When considering these future developments, incorporating adequate wastewater system flexibility is the most important issue for the District. For example, planning for the treatment facilities and effluent disposal should include acquisition of adequate land to allow for expansion. Funding agencies will not provide funds for expanding wastewater facilities for future development. The future developments are expected to pay for the growth as explained above with connection fees and systems development charges.

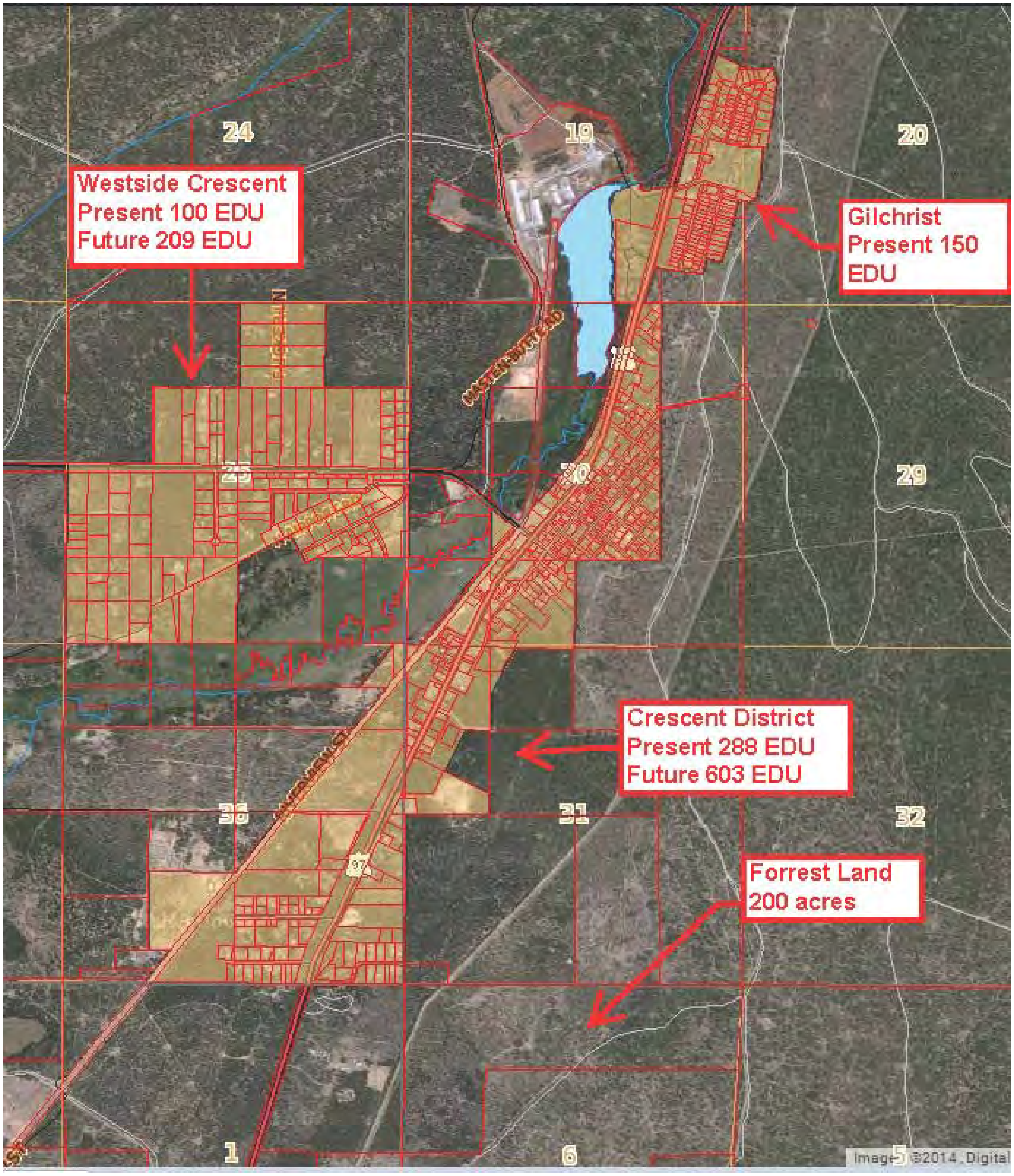


Figure 2.2-Planning Area

The land under consideration for the wastewater treatment facilities, and recycled water application is 1.5 miles south of the District's business core and adjacent to the southerly District boundary, more particularly described as Tax Lot 200, Township 25 South, Range 9 East, Section 6, W.M. Klamath County, Oregon. (See figure 2.3 below)

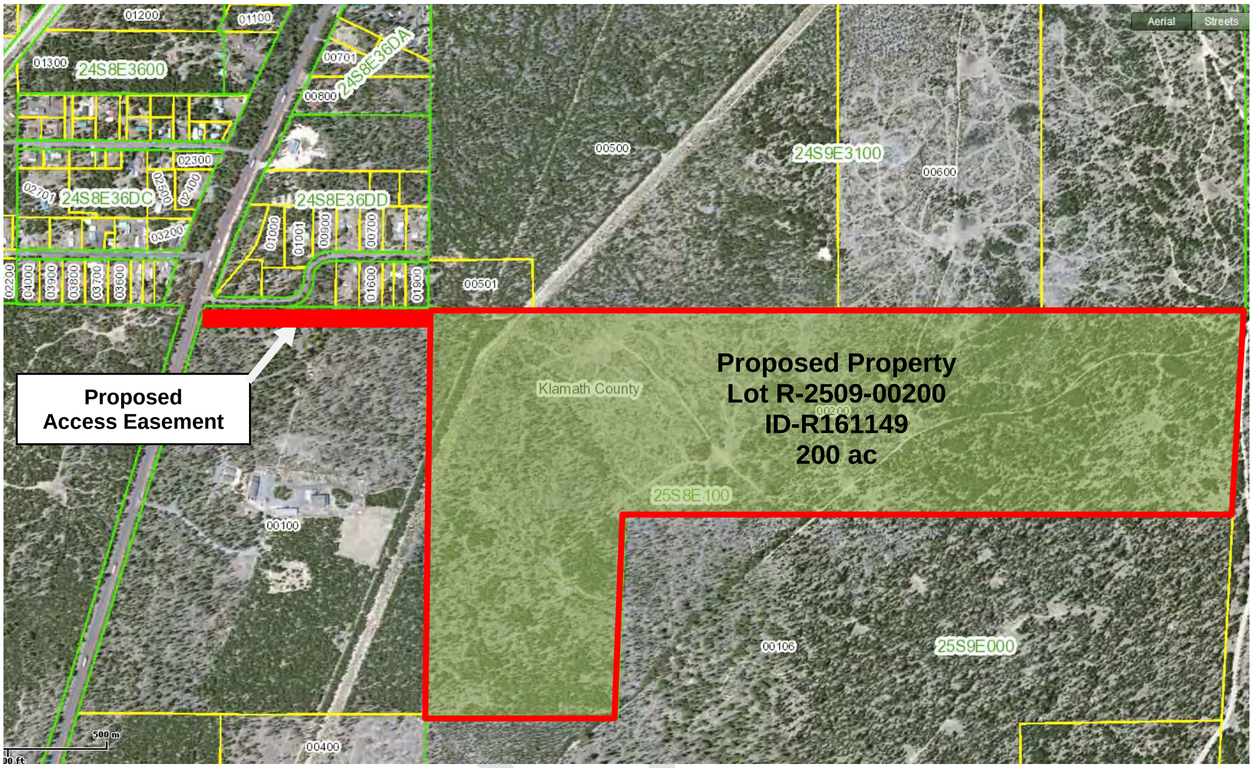


Figure 2.3-Proposed Wastewater Facilities Site

The District will need to negotiate a 30 ft wide access easement from the property currently owned by the US government located on Tax Lot R-2508-00100 which is shown in figure 2.3 above. The site topography gently slopes from east to west at a one-percent slope and is surrounded by forest land on the north, south and east and the US government property to the west. The Department of State Forestry owns the property and does not currently use the land to raise timber due to the poor soil conditions to grow ponderosa pines.

Land-use zoning within the planning area is shown on Figure 2.4. Existing land use consists of R1-Rural Residential, RUC-I-Rural Community Industrial, RUC-C-Rural Community Commercial, and F-Forest. The proposed wastewater treatment site is zoned F-Forest. Additional land required for a wastewater treatment plant will need to be annexed into the District's service boundary. A Conditional Use Permit and Land Use Compatibility Statement (LUCS) will need to be obtained from Klamath County planning for a wastewater treatment facility. Klamath County Comprehensive Plan polices for Goal 11 indicate that the proposed development of a community sewer system is appropriate in the unincorporated Crescent area due to the potential for groundwater contamination from septic systems and no plan amendment is required.

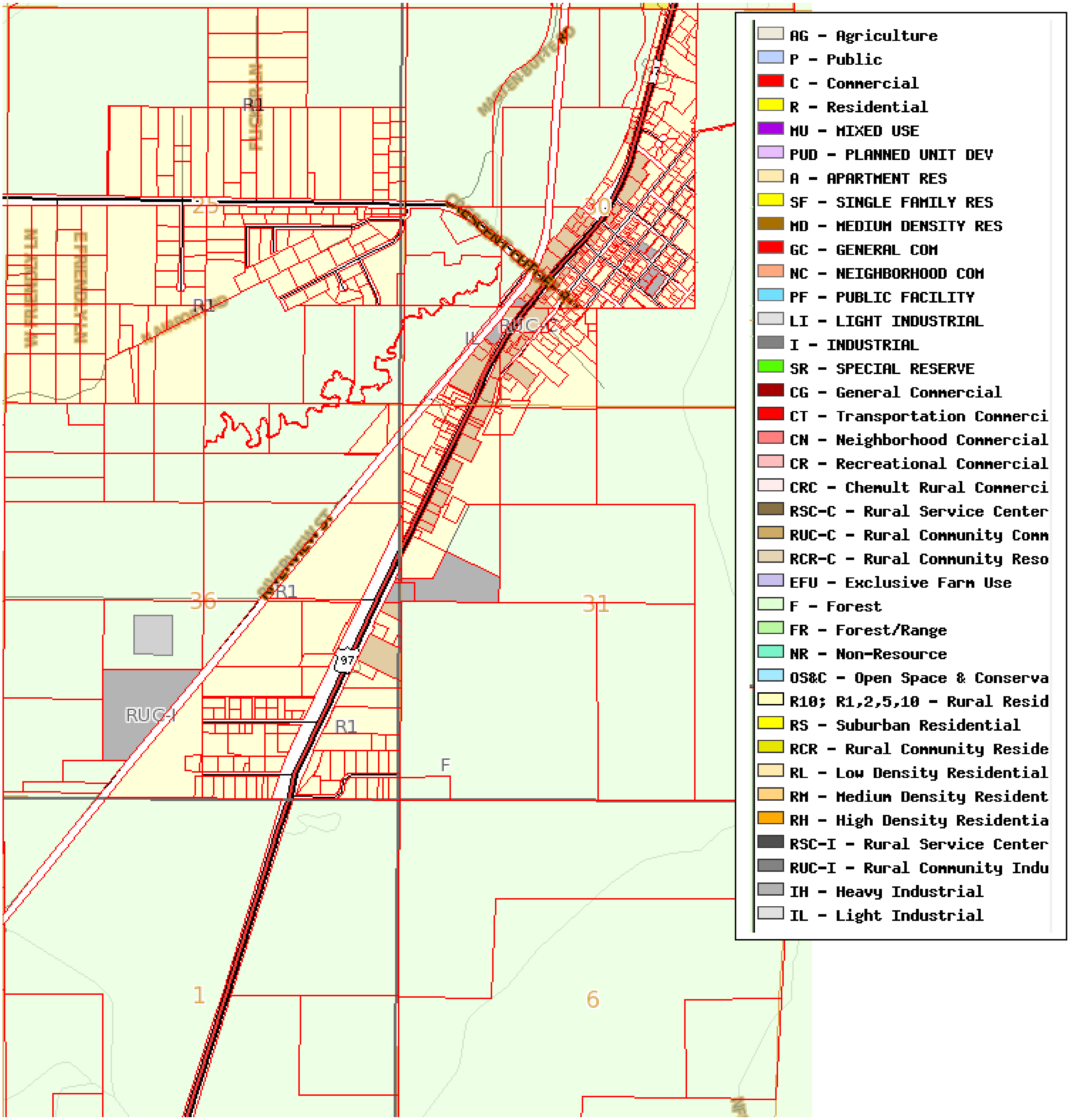


Figure 2.4-Klamath County Zoning-Crescent Oregon

The following is a discussion of the physical conditions within the planning area. This report provides a significant amount of information that will be used for environmental review. Environmental review will be completed as a separate project after an alternative is selected and an implementation plan is solidified.

Topography
The planning area gently slopes from the east to the west towards Little Deschutes River Meadow area. The core commercial area of Crescent at the intersection of the Crescent Cutoff Road and Highway 97 is the approximate low point in the planning area. The low point elevation is 4,460’ and the proposed treatment plan property elevation to the south is at an elevation of 4,478’.

Geology and Soils
The soils descriptions in the 1983 facilities plan do a good job summarizing the soil conditions that were field verified by Anderson Engineering & Surveying, Inc. (AES) and described as follows:

> *Surface soils of the area consist of coarse to fine pumice which resulted from the Volcanic eruption of Mount Mazama. Soils are coarse textured pumice soils and are unsuited for cultivation of crops and are used almost entirely for the production of Ponderosa pine, grazing, and Wildlife habitat. In the Crescent vicinity, the permeable pumice soil is underlain at a depth of 6 to 7 feet by a black and impervious layer of soil believed to be the remains of a former marshy area adjacent to the original position of the Deschutes River and below the present level of the river. The high permeability of the pumice soil underlain by the impervious layer creates a shallow basin for the accumulation of surface water adjacent to the Little Deschutes River. Water level during late spring at the Crescent Administrative Center is approximately two to three feet below the ground surface. In late August or early September, this water level has dropped to 6 feet or more below the ground surface. This phenomena is believed to result from the accumulation of surface originating water such as snow and rain along the natural slope toward the Little Deschutes River. As the ' water surface of the Little Deschutes River rises during spring runoffs, groundwater level in the adjacent soils rises correspondingly.*

According to the USDA NRCS Soil Survey of Crescent, Oregon the soils present in the developed areas within the planning area are primarily pumice and ash (Map Unit 73 and 75). The map unit is described by Natural Resource Conservation Service (NRCS) as soils relatively high in pumice and ash which do not make good fertile growing soil for woodlands. The photograph below shows the existing site conditions. Vegetation consists of sparsely underdeveloped ponderosa pines, antelope bitterbrush, and needle grasses. The predominate soil is Lapine gravelly loamy coarse sand (pumice and ash). The predominate soil are highly permeable and rapid draining. Unless the site is properly prepared and maintained undesirable plants may compete with reforestation. Because the coarse textured soil has insufficient anchoring capability trees are subjected to wind throw (uprooted or broken by the wind). The coarse texture of the soil and inherent low fertility of the subsoil and substratum restrict root development.

Figure 2.5-Existing Site Vegetation

USDA Soils reports Soil properties and qualities as follows:

73C—Lapine gravelly loamy coarse sand, 0 to 15 percent slopes

- **Map Unit Setting**

Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 18 to 25 inches
Mean annual air temperature: 40 to 44 degrees F
Frost-free period: 20 to 50 days

- **Map Unit Composition**

Lapine and similar soils: 90 percent
Minor components: 3 percent

- **Description of Lapine Setting**

Landform: Lava plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash and gravel-sized pumice derived from dacite

- **Properties and qualities**

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.5 inches)

- **Interpretive groups**

Farmland classification: Farmland of statewide importance

Land capability (nonirrigated): 6s
Hydrologic Soil Group: A

- **Typical profile**

0 to 1 inches: Slightly decomposed plant material
1 to 8 inches: Gravelly loamy coarse sand
8 to 25 inches: Extremely gravelly loamy coarse sand
25 to 38 inches: Very gravelly coarse sand
38 to 61 inches: Gravelly coarse sand

The entire soil report is included in the Appendix.

On-site soils investigations were conducted on two different occasions. The first was done by using a hand auger boring conducted by ODEQ staff along with AES and District staff. The auger sample was limited to a depth of 5 feet. Photographs of the samples taken are shown below:

Figure 2.6-Soils Test Hole #1

Figure 2.7-Predominate site soils

In Figure 2.6 a hand auger was used and bored to a depth of 5 feet. Figure 2.7 shows the predominate site soils to consist of - Tan Pumice Lightly cemented (i.e. Lapine gravelly loamy coarse sand).

A more in-depth on-site soils survey was conducted by using a backhoe which was owned and operated by the Crescent Water District. The test hole was permitted and approved by the Oregon Department of Forestry. A test pit was excavated in April 2014 to approximately 10 feet deep. The ground surface elevation at the test hole location was 4,478'. No groundwater was encountered. A photograph and description of the findings are shown in Figure 2.8.

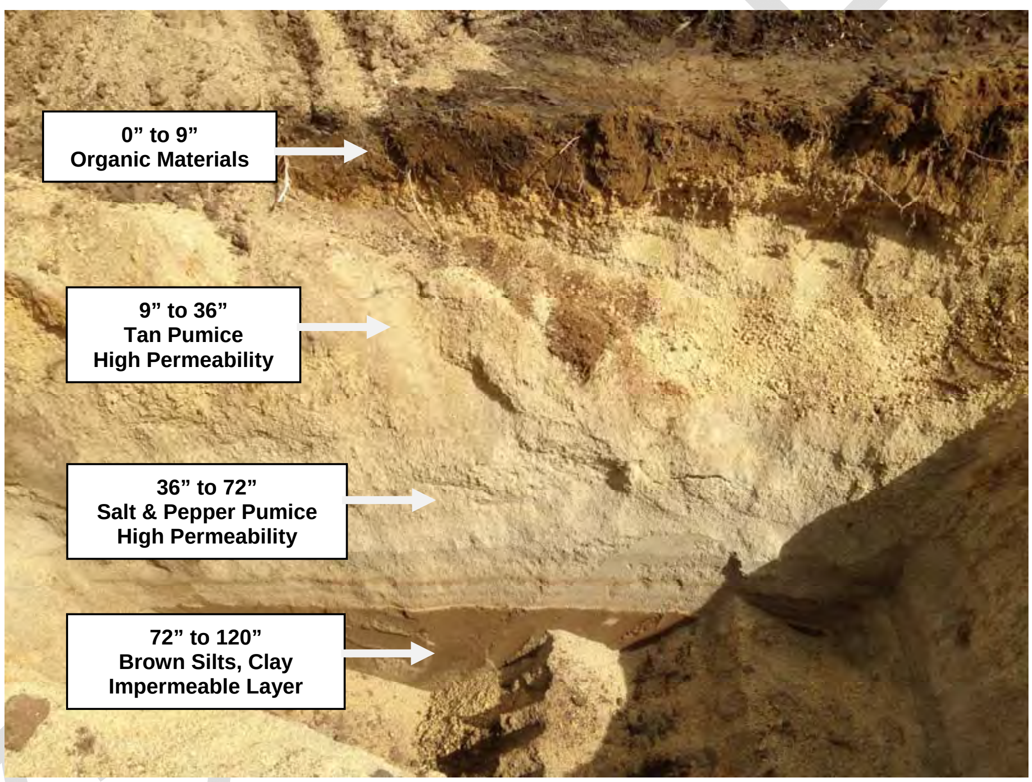


Figure 2.8-Site Soils Test Hole #2

Climate

The summer days are warm, summer nights cool and dry, and winter climate is crisp and cold with subfreezing nights. According to the Western Regional Climate Center (WRCC) Chemult 2 N station, rainfall averages about 21 inches annually, with 3 to 5 inches per month occurring in November through February. June, July and August are the driest months, averaging less than one inch of rain per month. The average daily temperature range is 26° F low to 58° F high.

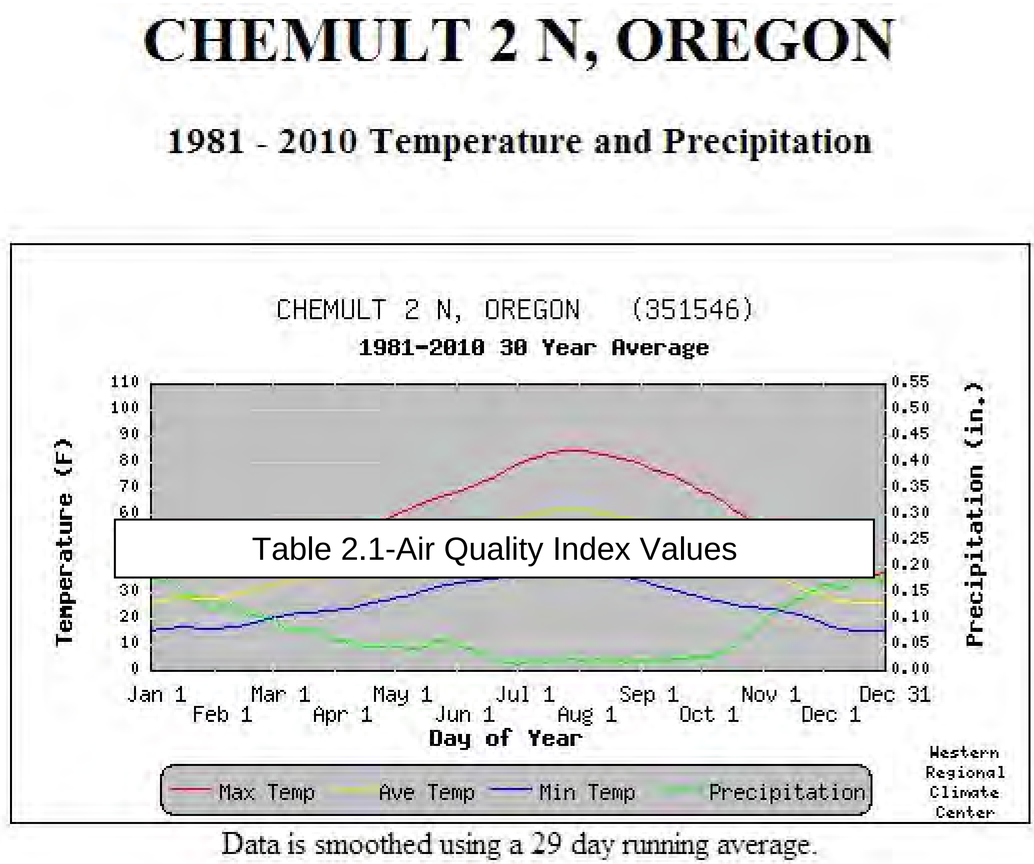


Table 2.1-Air Quality Index Values

Figure 2.9-Historic Temperature and Precipitation

Air Quality

Air quality indices (AQI) are numbers used by government agencies to characterize the quality of the air at a given location. As the AQI increases, an increasingly large percentage of the population is likely to experience increasingly severe adverse health effects. Air quality index values are divided into ranges, and each range is assigned a descriptor and a color code. Standardized public health advisories are associated with each AQI range. The United States Environmental Protection Agency (EPA) uses the following AQI:

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

The air quality in Crescent Oregon is rated 231 out of 480 communities in Oregon. There is no air quality station in the near vicinity so the air quality is averaged with other sites in the area. The graph below shows that the Air Quality in the area is generally good.

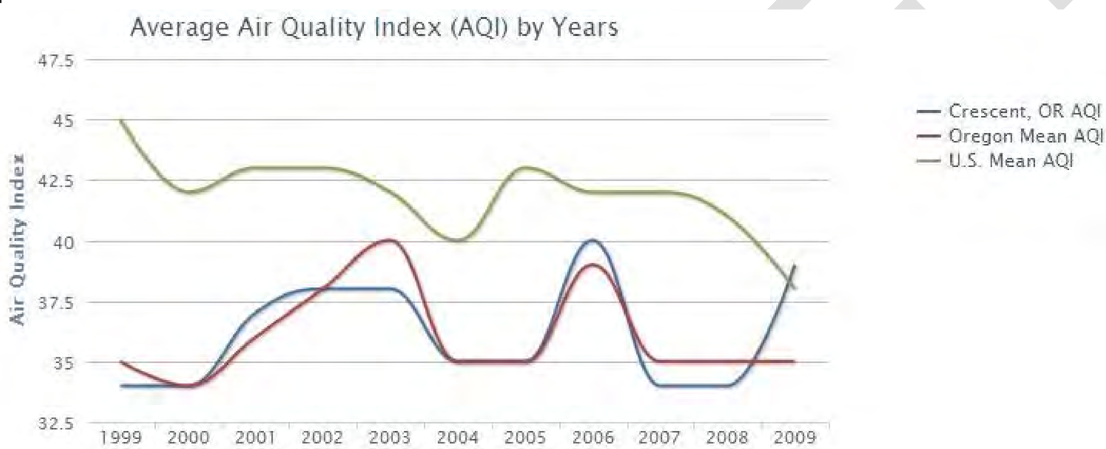


Figure 2.10-Historic Air Quality Index

Design and location of the proposed wastewater facilities will consider prevailing wind directions to minimize objectionable odors.

Water Quality:

Surface Water

The Little Deschutes River which is located just outside of the Crescent Sanitary District boundary, sections of the upper Little Deschutes River, and tributary streams are protected under the Federal Wild and Scenic Rivers Act (Act). In 1988 congress designated a 12-mile section (RM 84 to RM 97) at the headwaters of the Little Deschutes and a 10-mile section of Crescent Creek (from Crescent Lake dam downstream to County Road 61 crossing) as Wild and Scenic Rivers. See Figure 2.11. Big Marsh Creek from its headwaters to the confluence with Crescent Creek is designated as a recreation stream under the Act. The Forest Service has developed management plans for these streams that outline measures to protect and enhance key resource values cited in the Act's designation (Deschutes National Forest, 2001). The Wild and Scenic River plan includes resource management goals for scenery, vegetation, geology and hydrology, wildlife, fish habitat, recreation, roads and access, and water quality. The Little Deschutes River headwaters are within Klamath County and the river flows north into Deschutes County; a portion of the eastern edge of the sub-basin is in Lake County. Major tributaries include Crescent and Paulina Creeks, and headwater tributaries Clover, Hemlock, Rabbit and Big Marsh Creeks. A major concern about the water in the river downstream near Sun River and La Pine areas is unusually high temperatures in the summer and the abnormal growth of algae.

Groundwater

Nitrate levels in the ground-water aquifer are increasing due to contamination from residential septic systems. The area's highly permeable, rapidly draining soils and high water table with relatively cold water temperatures are not suitable for large numbers of septic systems. Nitrates, a by-product of septic systems and an indicator of human pathogens, are poorly retained in the fast draining soils and do not easily break down with the cool water temperatures. This contamination has public health implications because groundwater is the sole source of drinking water for area residents. The U.S. Geological Survey, in cooperation with Deschutes County and the Oregon Department of Environmental Quality, studied the movement and chemistry of nitrate in the aquifer and developed computer models that can be used to predict future nitrate levels and to evaluate alternatives for protecting water quality. Other studies indicated that there are problems with groundwater loading of nitrogen. Groundwater sampling was conducted as a part of the 1999 Wastewater Facilities Plan Update. Nitrate concentrations as high as 13 mg/L were detected at the central core of the community near the commercial district. The maximum contaminate level established by the EPA for drinking water is 10 mg/L. A copy of the nitrate sampling report is included in the Appendix.

Figure 2.11-Little Deschutes River Basin Watershed

Flood Plains

The Federal Emergency Management Agency (FEMA) has defined the extent of the 100-year flood boundary in order to establish actuarial flood insurance rates and to assist communities in efforts to promote sound flood plain management. The proposed sewer district is not within a designated floodway or flood plain. The planning area is Zone C (area of minimal flooding).

The areas adjacent to the river are in Zone A within the 100 year flood plain, but this area is outside of the planning area. See FEMA FIRM map 410109-0175B and Firmette in the Appendix.

Wetlands

A search of the U.S. Fish and Wildlife Service National Wetland mapping online database revealed that there are no regulated wetlands within the boundaries of the District. There are freshwater emergent mapped wetlands within the high water lines of the little Deschutes River. No ground disruption is planned in this area. Refer to the US Fish and Wildlife National Wetlands Map in the Appendix for the referenced GIS mapping, which was the basis for this determination. Based upon general field observations made during the geotechnical site investigation, no unmapped regulated wetlands were identified within the proposed sewer district. Test holes excavated at the proposed property for the treatment plant siting indicate that redox features are not present in the top 24 inches of soil (not much anaerobic activity). Also the site had no evidence of hydrophytic plant life. It should be noted that The National Wetland Inventory (NWI) program is a U. S. Fish and Wildlife Service wetland mapping program. NWI maps provide a basic level of information regarding location, type and size of wetlands for the whole United States. The NWI data includes attributed information on wetland system, sub-system, class, water-regime, and special modifiers indicating the general length of time water may be expected to exist in a wetland. Other special modifiers include water chemistry, soils, and manmade features and disturbances. The limitations of using NWI maps are that their mapping is incomplete. The data are also limited by the accuracy of the aerial photography interpretation and mapping. Frequently wetland areas are missed by interpreters and not mapped as wetlands, and sometimes non-wetland areas are identified as wetlands on the maps. Due to these inconsistencies a wetland delineation of the project areas will need to be completed after the preferred project alternative is selected.

Historical and Cultural Resources

The planning area has a very high probability for cultural resources based on known historical use of the area and previous experience evaluating the potential for cultural resources for similar projects in the area. A cultural resource study was conducted on-site and in cooperation with the State Historic Preservation Office in August 1982 (1983 Wastewater Facilities Plan). No impacts on historical and archeological sites were found for the wastewater project proposed at that time.

A Cultural Resources Technical Report will need to be completed after the preferred project alternative is selected. Pipe corridors will need to be adjusted to minimize potential effects on cultural resources. Areas that have been previously disturbed will be favored in selection of pipe corridors. Inadvertent discovery procedures and guidelines will need to be developed for construction activities.

Flora and Fauna

The Little Deschutes River Sub-basin supports a variety of resident and migratory wildlife species, including songbirds, waterfowl, reptiles, amphibians and mammals. There are no known endangered species listed within the project area. Due to the nature of the environmental sensitive areas and potential for listed threated species to be present within the planned project areas an assessment of the wildlife will need to be completed after the preferred project alternative is selected.

The low fertile volcanic soils in the upland areas area generally limit native vegetation to conifers such as lodge pole and ponderosa pines, interspersed with antelope bitterbrush and needle grasses. No federally listed threatened or endangered species are known from the Little Deschutes watershed. There are plant species listed as species of concern with the US Fish and Wildlife Service, and species listed as threatened and candidates for listing by Oregon Department of Agriculture.

Water System

The majority of the planning area receives water service from the Crescent Water Association Water System (PWS ID#00244). The existing water system has 1.8 cubic foot per second (cfs) water rights and delivers water to 315 services from two separate wells, Well #2 and Well #3, which are show on the map below. *Map of Well Locations to be Added.* The system also has a backup Well #1 that is listed inactive for emergency purposes. Infrastructure can currently deliver up to 120,000 gallons per day at 700 gallons per minute with a residual pressure of 75 psi. Static pressure in the planning area is in the range of 70 to 80 psi. The water system serves residents in both Gilchrest and West Crescent, outside of the District's boundary.

Utilities and Fire & Life Safety

Other utilities within the planning area include telephone service by CenturyLink, electrical service by Mid-State Electric, natural gas provided through Cascade Natural Gas, and garbage service provide by Wilderness Garbage Service from La Pine. The Klamath County Sheriff Office provides police protection and Crescent Volunteer Fire District provides fire and emergency services. Highway 97 runs directly through town and the nearest airport is Roberts Field located 120 miles north in Redmond, Oregon.

2.3 Growth and Population

Future projected growth and population along with estimated sewage flow and waste loads are estimated in this section of the report to provide a basis for design of collection system and treatment capacity necessary to accommodate existing development and future growth over the next 20 years.

Current population and flow estimates in the planning area include consideration of West Crescent and Gilchrest since these areas will need to address their wastewater treatment facilities in the future due to aging infrastructure and potential contamination of the Little Deschutes River Basin. The District understands that it may be financially necessary to include additional users outside the existing boundary in order to finance and pay for a project that includes these areas.

Current Population

Residential population and income demographics are available for incorporated communities conducted by the US Census Bureau. Since Crescent is a rural unincorporated community there is little accurate growth and population data, so the data needs to be estimated using available information. Historical water system information can be used to predict future growth and user trends in the sewer system. The Crescent Water Association currently provides water to 315 service connections both within the sewer district and outside the District to the West Crescent Area. The current census data indicates the population averages 2.5 people per household. Using this per unit or service connection (1-equivalent dwelling unit = 1 EDU) with the water District statistics equates to 790 people. Gilchrest has its own water system and supplies water to 210 residences. This puts the population of the surrounding area at approximately 1,000 people which includes Crescent, West Crescent and Gilchrest.

Growth Rate

Based on historical census data from Economic Analysis, Department of Administrative Services, State of Oregon, the growth rate in communities in Klamath County averages 0.367% per year and Deschutes County averages 1.85% per year from year 2015 to 2035 (20 year period for planning). The growth rates to be considered to size the Crescent Sanitary District's facilities will be current population, 20 year forecast based on historic census data, and ultimate build out if all lots within the District boundary are developed. The ultimate build out is a moving target and difficult to predict when that build out will occur. A planning growth rate of 3% per year was assumed in the 1999 Facilities Study and update. The reasoning behind this growth rate is that the existence of a community sewer would create a 3% growth rate. According to the 1999 and 2007 facility plan update there are potential developments being planned that could allow a 3% growth rate to be reached and exceeded with a community sewage system. Even if the developments are established the likelihood that they will build out is doubtful. This has been seen throughout the Central Oregon recreational properties real estate market. The growth rate will most likely resemble the growth rate established for Deschutes County over the next 20 years which was forecast to be 1.85%. The facility plan estimated a growth rate of 3% over the next 25 years which is very possible if a new community sewer system is to be installed in the unincorporated areas of Crescent.

Equivalent Dwelling Units

An EDU, also known as an equivalent residential unit (ERU), is the average wastewater flow received by the proposed treatment facility for one single family residential housing unit and referred to as the level of wastewater service provided to a typical rural residential dwelling. EDUs are the basis for computing system development charges (SDCs), and also are useful for planning purposes since EDUs give an indication of the impacts of nonresidential development. OBDD-IFA Recommends a wastewater flow of 7,500 gallons per month, whereas ODEQ and USDA-RUS is based on actual usage and recommends a design flow rate of 150 gallons per day per capita. Table 2.2 below summarizes the Equivalent Dwelling Units (EDU's) that are within the District's boundary from data derived from the Crescent Water Association. Table 2.2

summarizes the current system users and flow rates and number of EDU's for Residential, Commercial, Industrial, and Public usage using the criteria discussed in this section. Since there has been relatively minor growth within the area over the last 8 years information provided in the Facilities Plan is still relatively valid and is summarized below with minor modifications based on current design criteria. The recent water use data supports the use of these Facilities Plan sewage flow estimates.

Table 2.2 Equivalent Dwelling Units Summary Table

Type of User	# of Users (Hookups)	Usage (gallons/year)	Usage per User(gallons/year)	EDU'S (RD)[1]	EDU'S (IFA)[2]
Residential	211	19340534	91661	211	215
Commercial	23	4527232	16403	49	50
Industrial	5	1902658	380532	21	21
Public	2	761063	380532	8	8
Totals	241	26531487	869127	288	295

Ultimate Build-out

Ultimate Build-out is an estimate of the amount and location of potential development for an area. Performing a build-out analysis identifies the holding capacity of the land. The build-out calculation provides the supply of development for forecasting future land use growth. Build-out applies land use or zoning assumptions about density to the available land area. The build-out calculations deduct land due to physical constraints to development (e.g. sensitive natural resources), potential infrastructure dedications (e.g. streets, public open space, or stormwater management structures), and practical design considerations (e.g. lot layout inefficiencies). Ultimate build-out (UBO) estimates are used for sizing sewer collection piping. Buried sewer lines are generally assumed to have a life expectancy of 50 years or more. It is disruptive and expensive to dig up undersized lines for replacement with larger pipes; therefore, buried sewer lines and other infrastructure are typically sized for ultimate build-out. Build-out calculations multiply the land area by density factors. Residential density is most often expressed as residential dwelling units per acre. The UBO population and EDUs are computed based on land use zoning.

The Klamath County Comprehensive plan currently restricts partitioning land less than two acres in size in the area. After a public sewer is constructed in Crescent, it is possible that the residential zoning will be rezoned to allow for smaller lot sizes since septic systems will no longer be installed. This will allow for more density of lots and potential higher growth. Installation of a community sewer system will also open the door to the potential for recreation resort properties that have been in planning for many years but tabled due to the absence of a sewer system.

The timing and magnitude of development on these larger properties within the area is difficult to estimate. If estimates are too conservative, the final alternative may be more costly and capacity will never be utilized. However, if not enough capacity is planned for, costly upgrades may be required before the collection system has met the useful life of the facility.

The larger private parcels of land within the Crescent area have had the same level of use for decades and may stay that way for future decades as well. However, as development pressure increases for more recreational properties in the area it may spur more growth. Because of these factors the timing for reaching build-out conditions is difficult to predict in the Crescent area. Using the forecast growth rates puts build-out at least 50 years into the future. The 1999/2007 Facilities Plan assumptions for forecasted growth, build out, and EDU's are reasonable and are summarized in the tables below.

Table 2.3 Ultimate Crescent Build-out

Zoning	District Area(AC)	EDU's per AC	Total EDU's	Residential Population
RI	374	4.35	1627	4132
RUC-C	74	5.6	414	-
RUC-I	12	34.4	413	-
F	50	0	0	-
Total	510	4.81	2454	4132

Based on 4.35 EDU's per Acre with 1 EDU=2.54 capita.

Table 2.4 Growth and EDU Summary

Parameter	**Crescent District**	**West Crescent**	**Gilchrist**	**Totals**
Population	535	254	210	999
20 year population	1,121	531	439	2,091
EDU's	288	100	150	538
20 year EDU's	603	209	304	1,116
BuildOut Population	4,132	3,956	983	9,071
BuildOut EDU's	2,454	1,557	1,090	5,101

Does not include the potential destination resort properties est. at 592 EDU, Population 1504.

2.4 Community Involvement

The current Crescent Sanitary District board members have been very proactive at involving the community and other stakeholders. In April of 2014, The District, along with ODEQ and AES held a town hall meeting to discuss questions and concerns that the community may have regarding the District's future direction. Because this project has been on the table and discussed for many years the public is somewhat skeptical about the process. Past Town Hall meetings had not gone well, but the current Board let the community know that they are also part of the community, are in the process for the long haul, and want to do what is best for the local community. This includes, but is not limited to, economic growth and stability for the area as well as protection of the local cultural and environmental resources. The Board members, led by the current president Cher Dolan, let the community know that their concerns are important and will be integrated into this current plan. ODEQ has also held numerous public education meetings in and around south Deschutes and northern Klamath Counties to educate the community about how on-site septic systems are affecting the local environment and drinking water resources.

3.0 EXISTING FACILITIES

3.1 Existing Facilities

The Crescent Sanitary District does not have a centralized sewage collection system. The majority of the existing development within the planning area currently utilizes individual on-site sewage disposal systems. The condition of each individual system is unknown. What is known is that the existing drain fields are creating a potential health hazard due to the elevated levels of nitrogen present in the temporary groundwater table. Some of the commercial properties use portable toilets during the tourism season to alleviate the strain on the system. The high groundwater and highly permeable sandy soil conditions create very poor conditions for installation of new on-site sewage systems or repair of existing systems. A groundwater sampling report was prepared by GRI in 1999. The results found that nitrate levels range from Non Detected to 13 mg/L which exceeds EPA set safe drinking water standards of 10 mg/L. A copy of the study is included in the Appendix.

The community of Gilchrist on the north boundary of the Crescent Sanitary District has a centralized sewer system which serves a population of 230 people. The collection system was installed prior to 1970 and consists mainly of vitrified clay pipe. The sewage is discharged into a sewage treatment plant that was constructed in 1972 and includes three one acre facultative lagoon cells, and a drain field consisting of approximately 4,200 lineal feet of disposal trench. The average flow measured from 2012 to 2013 was 12,788 gallons per day (gpd) (permitted flow is 60,000 gpd).The treatment plant is located adjacent to the Little Deschutes River on tax lot 101 in the Southwest Quarter of Section 17 and the Southwest Quarter of Section 18, Township 24 South, Range 9 East, of the Willamette Meridian. The system is permitted with WPCF Permit #102198 with ODEQ. In 2006 the ODEQ amended the WPCF permit requiring that the Gilchrist system be monitored for water quality specifically for nitrate contamination and heavy metals to the groundwater. Gilchrist Sewer Company has contracted with EGR & Associates, LLC to sample, test, and report the results to the ODEQ. The most recent 2012-2013 assessment noted 14 instances of levels exceeding EPA's maximum level of 10 parts per million (ppm) nitrates in the groundwater monitoring wells. Copies of the ground water monitoring reports are on file at the Bend ODEQ office for examination.

The community of West Crescent also does not have centralized sewerage facilities and the residential properties are served with on-site septic systems. West Crescent has high ground water, shallow aquifers, and very permeable pumice sandy soils. The housing density in the West Crescent area is located closer to the riparian Little Deschutes River Basin's sensitive wetland areas. The concern is that nitrogen released from on-site septic systems may not only contaminate groundwater that supplies drinking water, it may also make its way into the surface water, where nitrogen is known to increase dissolved oxygen and have an adverse affect on pH levels in the river. This can cause increased algae plumes that remove oxygen needed by plants, fish, and animals to sustain a healthy eco-system.

3.2 Wastewater Generation

Future projected sewage flow and wastewater loads are estimated to provide a basis for design of collection system and treatment capacity necessary to accommodate existing development and future growth over the next 20 years. The planning area is broken down into sub areas to better define and estimate population and growth characteristics. The sub areas of the planning area are designated as Crescent Sanitary District, West Crescent, and Gilchrist. The District has gone back and forth over the years as to the best approach for their community and the surrounding communities. All of the areas are presented and are being considered at this time. A final decision has not been made or discussions with other entities have not been entered into at the time of this report. The District wants to keep all options open to make the project as affordable as possible to all residents in the area and understands that it may take additional users outside of the District boundaries to make the project financially feasible. Therefore, all areas are presented at this time. It should be noted that when the project is decided any other areas willing to be included in the sanitary district will need to be annexed into the District boundaries. The assumptions and methodology used to develop the system design criteria was established in the District's Facilities Plan and is summarized in the Table below:

Table 3.1 Wastewater Treatment System Design Criteria

Parameter	Crescent District	West Crescent	Gilchrist	Totals
Average Daily Flow (gpd)	70,400	33,500	26,250	130,150
20 yr Daily Flow (gpd)	147,000	70,200	54,875	272,075
Current BOD_5 (ppd)	120	40	45	205
20 yr BOD_5 (ppd)	250	85	95	430
Avg Flow Per Capita (gpd)	131	132	125	130
Avg Flow Per EDU (gpd)	244	336	181	244
Avg Daily Flow (mgd)	0.147	0.070	0.055	0.272
Peak Design Flow (gpm)	322	125	172	578
BOD_5 (ppd)	224	106	88	418
TSS (ppd)	247	117	97	460
Nitrogen (ppd)	37	18	14	69
Phosphorus (ppd)	10	5	4	19

ODEQ & RD recommend a minimum average flow per capita of 150 gpd, and OBDD-IFA recommends a minimum flow rate per EDU of 7,500 gallons which is equivalent to 250 gpd per EDU.

3.3 Financial Information

Since there are currently no physical facilities installed for sewer collection and disposal, there is no formal rate structure at this time. The lots within the District boundary are currently taxed through the Klamath County Assessor with a tax levy. 2012-2013 tax revenue for the District was $15,266. This works out to $4.42/EDU per month. A copy of the District's current budget is included in the Appendix.

The District may consider applying for Community Development Block Grant (CDBG) funding through OBDD-IFA considering income levels may be over 51% of the low and moderate income level requirement. "Low income" means income equal to or less than 50 percent of the area median (adjusted by family size). "Moderate income" means income equal to or less than 80 percent of the area median (adjusted by family size). Applicable income limits are determined by HUD on an annual basis for all Oregon counties and metropolitan statistical areas. Because the Crescent area is unincorporated there is no current data available to determine the median income in the area. In order for the District to be able to apply for CDBG funding an income study will be required by the funding agencies to determine the community's income level.

4.0 NEED FOR PROJECT

4.1 Health, Sanitation, Environment

In 2013 the South Deschutes/North Klamath Groundwater Protection Project Steering Committee findings where summarized as follows:

"The area's shallow, unprotected groundwater and pumice-based sandy soils mean that water soluble substances put on or in the ground will likely end up in the groundwater. While fertilizers, pesticides and livestock manure can contribute contaminants to the groundwater, most groundwater contamination comes from individual on-site septic systems. All types of on-site systems in the region – standard septic, sand filter and ATT systems --discharge contaminants into the ground. Over time, many of these contaminants drain through the sandy, porous soil and reach the groundwater, which can be as low as two feet below the ground surface in some areas. Compounding the risk is the fact that there are about 14,000 properties in the area with over 75% of the properties in neighborhoods having parcels of 2 acre or less in size. Add in the fact that there is minimal precipitation in the area to dilute contaminants and the problem becomes clear: too many septic systems are discharging to porous soil and over time there will be increasing contamination of the shallow vulnerable aquifers that many people are using as their drinking water supply."

The committee identified on-site sewage disposal as a potential public health risk in the area and required property owners to either upgrade non-compliant on-site sewage disposal systems or connect to a centralized sewer system when it becomes available.

A study conducted by USGS and published under **Fact Sheet 2007–3103 December 2007** in the Deschutes County's La Pine area which has similar conditions as Crescent stated the following:

"Large areas of the shallow aquifer will have nitrate concentrations above 10 ppm, and more nitrates will be carried into streams by groundwater.

If residential development proceeds as planned and no efforts are made to reduce the rates of nitrate loading from septic systems, loading is projected to increase 52 percent above 2005 rates (fig. 2). Computer model simulations of this future scenario show that:

1. Peak nitrate concentrations will exceed 10 ppm over large areas of the shallow aquifer (fig. 4). On average drinking water in those areas will be composed of at least 22 percent septic system effluent.
2. The highest nitrate concentrations will be near the water table, but many wells that draw water from the upper 50 feet of the aquifer will be at risk for nitrate contamination.
3. It will take decades for peak concentrations to occur and decades for concentrations to subside if nitrate loading is reduced.
4. Increasing amounts of nitrate from septic systems will be carried into the Deschutes and Little Deschutes Rivers by groundwater.

The computer model integrates the current understanding of nitrogen geochemistry, hydrology, and geology of the aquifer underlying the La Pine area. The model was tested by simulating past ground-water levels, ground-water travel times, ground-water discharge to streams, and ground-water-quality conditions and then comparing the model results with measurements made in the study area. The simulated conditions, including past ground-water nitrate concentrations, matched measured conditions within acceptable limits. These results indicate that the model has sufficient accuracy to be a valid tool for evaluating the potential effects of septic systems on future ground-water quality."

4.2 Aging Infrastructure

Many of the septic systems in the Crescent area were installed decades ago when there was little or no regulatory oversight addressing their design, installation, and maintenance. The poor condition of the on-site sewage disposal systems in the Crescent area and the effect of the on-site sewage disposal on public health and the environment has been an on-going concern. The groundwater monitoring that was conducted within the Crescent Sanitary District in 1998 found that at that time nitrate levels exceeded EPA drinking water standards set at 10mg/l. The Gilchrist gravity sewer piping network was installed prior to 1970 and was constructed of vitrified clay pipe that has a useful service life of approximately 50 years. The collection system is approaching the end of its useful life and there are no funds or assets in place to replace this infrastructure. Also, the sewerage treatment plant that is located adjacent to the Little Deschutes River is being monitored for groundwater quality and nitrate levels exceeded EPA drinking water standards set a 10mg/l. Many of the properties in the West Crescent area are located in riparian areas of the Little Deschutes River. Although there is currently no scientific documentation, there are concerns that due to the permeable soil conditions and rapid infiltration qualities present, the Little Deschutes River may be subjected to septic infiltration that would affect river pH, temperatures, and dissolved oxygen rates. This could have a detrimental effect on the river's ecosystem. The section of the Little Deschutes River running through the area is not designated wild and scenic, but sections of the Upper Little Deschutes River and tributary streams are protected under the Federal Wild and Scenic Rivers Act (Act). (see Section 2.2 of this report under Environmental Resources).

Summary

This project is needed to protect public health due to sanitation issues and environmental concerns caused by release of contamination due to on-site septic systems. In summary this project is needed to protect the water quality, maintain the rural character of the area, recognize private property rights of existing lot owners, and to accommodate anticipated growth without taxpayer expense. The key concerns are as follows:

Groundwater Quality: The area's highly permeable, rapidly draining soils and high water table with relatively cold water temperatures are not suitable for large numbers of septic systems. Nitrates, a by-product of septic systems and an indicator of human pathogens, are poorly retained in the fast draining soils and do not easily break down with the cool water temperatures.

Riparian and Wetland Habitat: Many of the lots and subdivisions are in sensitive areas near the Little Deschutes River, impacting riparian and wetland habitats that are important for fish and wildlife habitat and water quality.

4.3 Reasonable Growth

The rural character of the Little Deschutes Sub basin, the attractive location of private property on the Little Deschutes River, and relatively inexpensive land prices have contributed to a rapidly growing population. Since 1989, Southern Deschutes and Northern Klamath County have seen considerable growth due to the attractiveness of the recreational facilities and tourism in the local area. The population growth rate dramatically increased between 1990 and 2000, with the area growing by over 40,000 residents. There are an estimated 16,000 residents in the unincorporated area around Southern Deschutes and Northern Klamath Counties in the lower portions of the little Deschutes watershed. Most of the developed lands and undeveloped lots are along the Little Deschutes River and Crescent Creek. This dramatic population growth is expected to continue into the foreseeable future. Figure 4.1 below depicts the projected growth in the unincorporated sections of Northern Klamath and Deschutes County over the next 20 years (Source: Deschutes County, 2000). Although the greatest growth in Deschutes County is expected to occur in the Bend area, the unincorporated areas, including the lower portions of the Little Deschutes River, are projected to experience an increase of as much as 56% over the 2000 population in the next 20 years. In the lower portions of the Little Deschutes River Sub basin, there were 200 subdivisions and 13,000 lots created, and many were purchased sight unseen (Deschutes County, 2000). At this time, in the La Pine area alone, there are more than 11,000 lots, of which only about 4,000 have been developed. If all of these lots were built out, the population density in the La Pine/Gilchrist/Crescent area would nearly triple (Deschutes County, 2000). According to county tax records there are a total of 14,110-platted tax lots within the watershed, only 7,097 of these lots are developed, and 2,763 of these lots are within one half mile of the river (Table below).

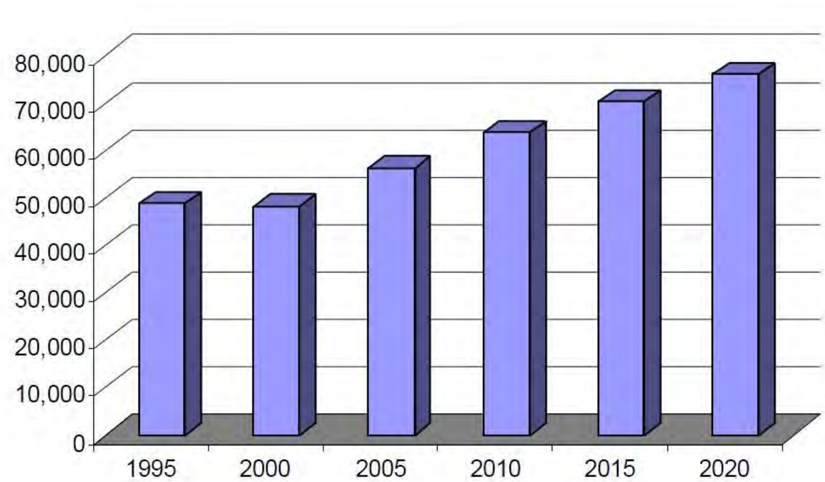


Figure 4.1-Projected Population Growth in N. Klamath and S. Deschutes Counties

Table 4.1-Distribution of County Tax Lots

County	Developed lots	Undeveloped lots	Total Lots	Developed lots w/in 1/2 mile of River	Undeveloped lots w/in 1/2 mile of River	Total Lots within 1/2 mile of River
Deschutes	4931	3630	8561	1312	1465	2777
Klamath	2166	3383	5549	735	1298	2033
Total	***7097***	***7013***	***14110***	***2047***	***2763***	***4810***

The planning area for the wastewater facilities plan update included the Crescent Sanitary District, West Crescent (currently outside sanitary district boundary, but inside the water district boundary), and Gilchrist. There has also been some planning for destination resorts in the West Crescent area that could come on line if a community sewer system was to be installed. Table 4.2 below summarizes the necessary growth capacity for the system based on the current census statics for a 20 year planning period. Any new private development would pay for the additional capacity through established connection fees and or system development charges that will need to be established by the District. New development would also be responsible for the installation of collection system main lines and connection to the District's system. The project will incorporate phased construction of the areas outside the existing District boundary so that revenue can be generated to eventually serve all areas and surrounding communities.

Table 4.2 - 20 Year Growth Capacity

Phase	Area	Growth 20 yr. Population	20 yr. EDU	Avg. Daily Flow (mgd) [1]	Avg. Daily Flow (mgd) [2]
1	Crescent District	1121	603	0.151	0.168
2	Gilchrist	439	304	0.076	0.066
3	West Crescent	531	209	0.052	0.080
	Totals	2091	1116	0.279	**0.314**
4	Potential Resorts	1504	592	0.148	0.226

1-Based on OBDD-IFAA recommended 7500gal/edu/month
2-Based on ODEQ-USDA-RD recommended 150gpd/capita

The reasonable design capacity for the system should be for an average daily flow of 0.314 million gallons per day. The design of the collection system will be based on the ultimate build out as was discussed in Section 2.

5.0 ALTERNATIVES CONSIDERED

There are many different ways to collect, treat, and dispose of wastewater. This section of the report will examine the different types of sewer system alternatives available to provide a solution to protect groundwater in the Crescent Sanitary District. The following alternatives are presented and examined for feasibility. The alternatives which were discussed with the District board members are as follows: No Action-continue with current on-site systems; Decentralized cluster systems; vacuum collection system; low pressure system with grinder pumps; lower pressure system with septic tank effluent pump (STEP) or septic tank effluent gravity (STEG); Conventional centralized system.

<u>No Action-(On-Site Systems)</u>

Currently all wastewater treatment in Crescent is provided by on-site (septic tanks) systems. Septic tanks are designed for rural areas with lot sizes of one acre or more. All types of on-site systems that exist within the district; standard septic, sand filter, and ATT (alternative treatment technologies) systems, discharge contaminants into the ground. Over time, many of these contaminants drain through the sandy, porous soil and reach the groundwater, which can be as low as two feet below the ground surface in some areas. Due to soil and groundwater conditions, and population density, these systems are contributing to excessively high nitrogen concentrations in the area, as demonstrated by groundwater testing (report included in Appendix A). There has been further concern that no matter what treatment technology is utilized; it cannot remove all the contaminants that pose health risks to the groundwater. Continued usage of on-site systems will lead to increased nitrate levels in the groundwater as well as other harmful heavy metals and pharmaceuticals. Groundwater nitrates can be a pre-cursor/warning of pharmaceuticals, personal care products, and harmful household contaminates not eliminated by sewage disposal systems. Nitrates and other harmful chemicals accumulate in the groundwater over a long period of time, and it can take a correspondingly long time for nitrate levels to decrease after the source of contamination has been eliminated. Based on the potential negative environmental impacts resulting from the “no action” concept, this alternative is not considered practical, and therefore, is not retained for further evaluation.

Decentralized Cluster Systems

This alternative would involve the construction of several smaller decentralized wastewater treatment facilities to serve a small grouping or "cluster" of residential users. The type of treatment selected for each cluster can vary significantly from more conventional soil-based treatment to the construction of aerobic tanks, sand filters, peat filters, or constructed wetlands depending upon site conditions. From both a surface and groundwater perspective, these systems (if properly sited, installed, and maintained) can provide a high degree of treatment. However, clustered treatment systems have the following disadvantages:

- Close proximity of cluster treatment facilities to residential users
- Development plans should be prepared and followed closely
- Restricting future development within the service area
- Separate treatment facility required to serve each residential cluster
- Requires disposal of effluent into seepage trenches or other similar dispersal
- Permitting and operator training required for systems over 2500 GPD

Most of the modern cluster systems use alternative treatment technologies to remove nitrogen and other harmful chemicals. Most systems are expensive to maintain and cannot remove all of the harmful constituents that are dispersed into underground disposal arrangements. The soils and high groundwater in the area do no lend themselves well to these types of treatment technologies. These systems have been demonstrated and studied in the La Pine area with some success in the right soil conditions, but not in porous, high permeable, high groundwater conditions. Continued usage of on-site systems, or development of cluster systems, are not acceptable long term options, since evidence of groundwater contamination has been documented, and continued usage of septic tanks and drain fields will lead to .increased nitrate concentrations in the groundwater. Based on the potential negative environmental impacts resulting from the "Decentralized Cluster System" concept, this alternative is not considered practical, and therefore, is not retained for further evaluation.

5.1 COLLECTION SYSTEM ALTERNATIVES

When on-site systems are not acceptable, wastewater must be collected for treatment at a centralized location. Collection systems can be divided into two categories, conventional and alternative. Conventional collection transports raw wastewater, primarily by gravity, through relatively large diameter (generally 8-inch diameter and greater) pipelines. Alternative systems primarily consist of three classes: septic tank effluent pumping (STEP/STEG), grinder pumps, and vacuum sewers. Crescent's population could be served by either conventional or alternative systems.

Centralized Effluent (STEP/STEG) Sewer Collection System

Effluent sewers are also known as STEP (Septic Tank Effluent Pumping) or STEG (Septic Tank Effluent Gravity) systems. With STEP sewers, a pump station equipment package is supplied by an independent material supplier. With an effluent sewer, raw sewage flows from the house or business to a watertight underground tank. Only the filtered liquid portion is discharged (by either pump or gravity) to shallow, small-diameter collection lines that follow the contour of the land. Solids remain in the underground tank, for passive, natural treatment, and need be pumped approximately every 7 to 10 years. Collection system installation time is reduced compared to conventional sewers. Inexpensive, small diameter collection lines are shallowly buried, just below the frost line, reducing material and excavation costs. Because only liquid is being pumped, system designers do not need to worry about minimum velocity of the effluent. Each customer uses a separate tank. Since most of the solids are removed in the septic tank, sewer clogging typically is less of a problem. Small diameter (typically 3 inch to 6 inch) pipes can be installed at shallow depths, and may generally follow the contour of the land. In most cases cleanouts can be installed rather than manholes. The smaller diameter piping and elimination of manholes can decrease costs, depending on density of development. These savings are often offset by the cost of septic tank installation. In some instances, it is possible to gravity flow out of the septic tank, eliminating the requirement for pumping. This type of system can be referred to as septic tank effluent gravity (STEG) or small diameter gravity sewer (SDGS). One of the benefits of

Figure 5.1 Effluent Sewer Collection System

STEP/STEG is the solids remain in the septic tank and reduce the BOD and TSS values to the treatment plant. This type of collection system does help expand sewer collection systems easier than conventional gravity systems, but there are the issues of installation oversight, operations, and ongoing maintenance that conventional systems don't exhibit. Down sides to this collection system are the septic tanks need to be pumped and the pump systems require higher levels of maintenance and replacement costs for pumps and parts. Additional electricity is required to run the pump inside the pump tanks. This cost would be paid directly by the user. Agencies would require the District to maintain and be responsible for equipment maintenance and tank pumping, since the permit would be with the District and not the individual users. New construction costs would be placed on the developer to install the system so the District would need an inspection program in place or work with the Klamath County Building Department to make sure additional systems are installed correctly. The topography in Crescent is well suited for gravity flow and a combination STEP/STEG system. The nearby community of La Pine has experimented with the effluent system and some indications are that the maintenance costs have exceeded estimates for pump replacement and tank pumping frequency. Also it has not eliminated the nitrogen contamination problem as well as other constituents that wastewater carries. The Engineer's opinion of the probable construction costs for this collection system is $4,948,125, and the operations and maintenance costs are $30,000 annually. The complete cost spreadsheet for this alternative is summarized in Section 6 of this report and attached in full in the Appendix for examination.

<u>Vacuum Sewer Collection System</u>

In vacuum sewer systems, no septic tanks or grinder pumps are used. Instead wastewater gravity flows from each customer, or group of customers, to a valve station vault. From the valve vaults, wastewater then flows by vacuum through special valves into small diameter pipes and then to a central vacuum station. Wastewater is then pumped by conventional means to another collection system or treatment site. The vacuum system allows the use of small diameter pipes without the need for septic tanks or pumps. The figure below illustrates the typical vacuum system components.

Figure 5.2 Vacuum Sewer Collection System

A vacuum system works just like any other sewer system. Traditional gravity lines carry wastewater from the source to a vacuum valve air pit. When 10 gallons of wastewater collects in the sump, the vacuum valve opens and differential pressure propels the contents into the vacuum main line. Wastewater travels at 15 to 18 feet per second in the vacuum main to the vacuum station. The vacuum main is laid in a saw tooth fashion to ensure adequate vacuum levels at the end of each line. At the vacuum station, vacuum pumps cycle on and off as needed to maintain a constant level of vacuum on the entire system. Wastewater enters the collection tank and when the tank fills to a predetermined level, sewage pumps transfer the contents to the treatment plant via a force main.

Vacuum sewage is also aerobic and mixes easily with conventional sewage. A disadvantage is that specially trained personnel must be on call 24 hours a day 7 days a week. Potential problems include valve vault pits that have been frozen with up to 18 inches of solid ice, valves frozen closed, and controllers for the valves freezing open or closed or being unseated by ice. In addition to freezing caused by water in the pits, valves can freeze due to the constant stream of freezing ambient air being pulled in through "candy cane" vents. Both the City of Bend and Oregon Water Wonderland

Sanitary District have experience with vacuum systems and can attest to the high maintenance needs of these systems. The operators are on call 24/7 to maintain the system when problems arise, which is fairly frequently according to staff. Parts and repairs are also frequent and expensive due to the technology not being widely used in the area. Advantages are smaller pipe diameters, shallower bury depths, reduced water consumption since less water is needed to flush toilets, less concern about slope of installation (simplifies construction in flat areas), and less concern about contamination due to exfiltration of wastewater out of pipes. The main disadvantage is the additional operation and maintenance required to continuously maintain a vacuum throughout the system. The Engineer's opinion of the probable construction costs for this collection system is $5,149,375, and the operations and maintenance costs are $40,000 annually. The complete cost spreadsheet for this alternative is summarized in Section 6 of this report and attached in full in the Appendix for examination.

<u>Low Pressure (Grinder Pump) Sewer Collection Systems</u>

The low pressure sewer system generally consists of individual grinder pumps and low pressure sewer collection mains. Wastewater flows by gravity from buildings to individual or shared grinder pump vaults located on private property. Solids in the raw wastewater are ground up and pumped from the sump through a service line (typically 1-1/4-inch diameter) to a small diameter pressure main (pipe diameters ranging from 1-1/2 to 6 inch). Low pressure sewer collection systems utilizing individual and shared grinder pumps have been utilized by municipal sewage systems for the past 50 years. Low pressure collection systems are typically arranged as zone networks without loops. Depending on topography, size of the system and planned rate of build out, appurtenances may include valve boxes, flushing arrangements, air release valves at significant high points, and check valves and full-ported stops at the junction of each house connection with the low pressure sewer main. The figure below shows the general arrangement of a low pressure sewer system.

Figure 5.3 Low Pressure Sewer Collection System

Grinder pump systems do not use a septic tank to store solids, but grind up these solids and pump them into the sewer. These pumps can be plugged or damaged by certain waste products, such as rags or cat litter. Generally, each individual customer has their own grinder pump. This helps discourage customers from disposal of improper materials that may interfere with pump operation. The system may require more sewer line cleaning and customer education. The grinder pumps themselves may require more maintenance than a STEP pump system. Power outages can also wreck havoc on low pressure pumping systems if the individual pump vault overflows due to power outage. When power resumes there can be a surge on the electric and pumping system. There usually is no emergency power backup on each individual pumping unit. This type of collection system could introduce high maintenance, safety, and health concerns. The Engineer's opinion of the probable construction costs for this collection system is $4,798,125, and the operations and maintenance costs are $35,000 annually. The complete cost spreadsheet for this alternative is summarized in Section 6 of this report and attached in full in the Appendix for examination.

Conventional Gravity Sewer Collection System

A conventional gravity sewer collection system is a network of pipes laid at specified slopes to transport raw wastewater by gravity without the use of any mechanical means through relatively large diameter (generally 8-inch diameter and greater) pipelines. Conventional gravity sewers do not require on-site pretreatment or storage of the wastewater. Because the waste is not treated before it is discharged, the sewer must be designed to maintain self-cleansing velocity (i.e. a flow that will not allow particles to accumulate). A minimum self-cleansing velocity of 2 feet per second (fps) needs to be maintained to keep solids from settling in gravity lines. A constant downhill gradient must be guaranteed along the length of the sewer to maintain self-cleaning flows. When a downhill grade cannot be maintained, a pump station must be installed. Primary sewers are laid beneath roads, and must be laid at depths of 4.5 to 10 feet to maintain positive slope and to avoid damages caused by traffic loads. Access manholes are placed at set intervals along the sewer, at pipe intersections and at changes in pipeline direction (vertically and horizontally). The primary network requires rigorous engineering design to ensure that a self-cleansing velocity is maintained, that manholes are placed as required and that the sewer line can support the traffic weight.

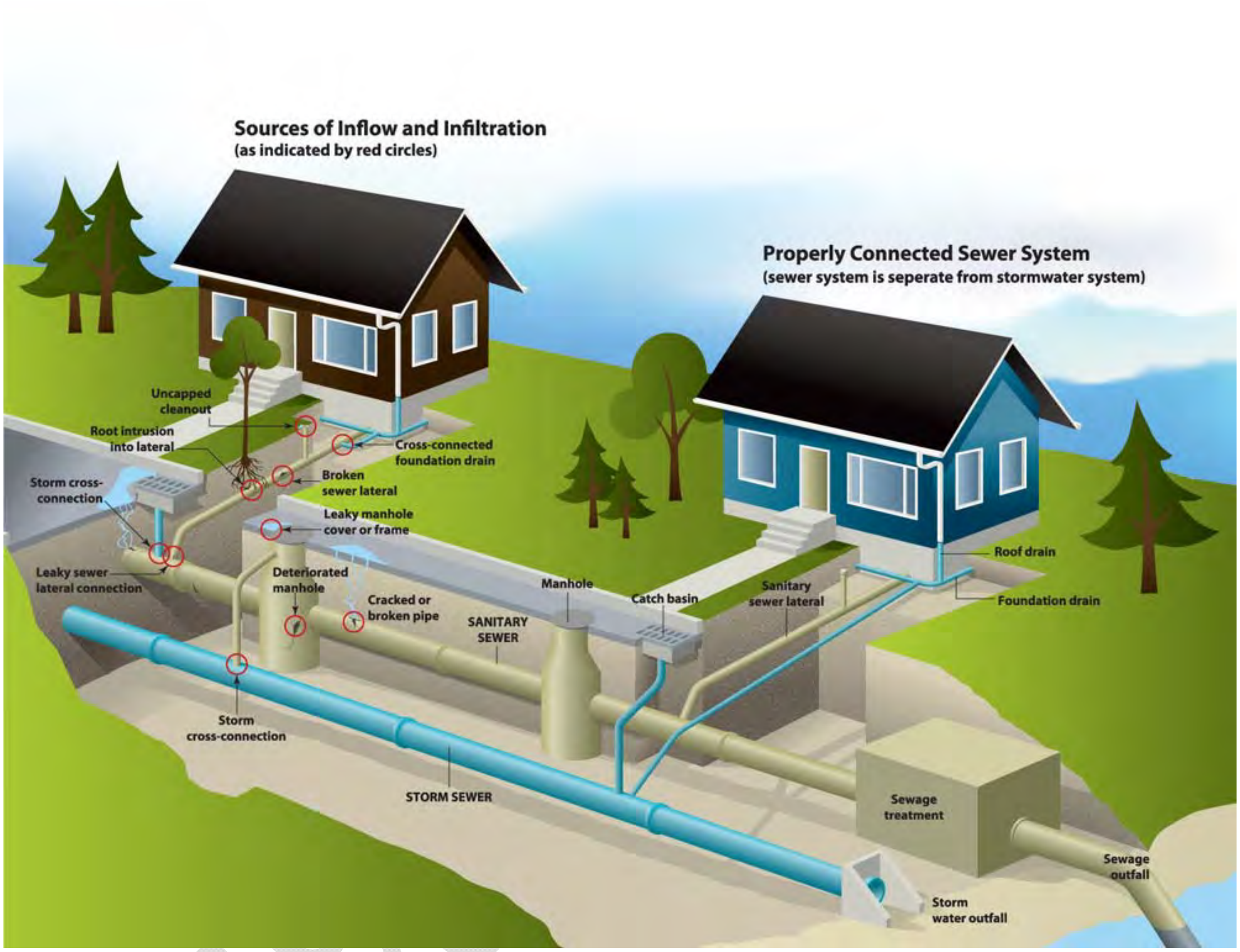


Figure 5.4 Conventional Gravity Sewer Collection System

ODEQ has established minimum slopes for gravity lines to maintain 2 feet per second cleansing velocity. Minimum line sizes of 8 inch and 4 inch for gravity and pressure line respectively, have also been established by ODEQ. A preliminary gravity sewer collection system has been provided in the District's existing facility plan. Ultimate build-out was used to size the gravity lines since they have a design life of 50 years and it is very disruptive to remove sewer lines. Flows were distributed throughout the district boundary based on zoning and area served. Initial assessment of the topography and soil conditions in the Crescent area would allow for good conditions for the installation of a conventional gravity system. Conventional gravity systems work well in cold weather climates due the depth of burial. Conventional gravity systems also have no mechanical parts so once installed maintenance is usually limited to line flushing and manhole cleaning annual or as required if there is a blockage. Conventional systems due have higher initial capital installation costs and can cause more disruption due to the construction required to bury the lines deeper than alternative systems. This technology provides a high level of hygiene and comfort for the user at the point of use and also the system operator. Most sewer system operators would recommend a gravity system over other conventional systems as far as maintenance goes. The Engineer's opinion of the probable construction costs for this collection system is $4,624,375, and the operations and maintenance costs are $25,000 annually. The complete cost spreadsheet for this alternative is summarized in Section 6 of this report and attached in full in the Appendix for examination.

5.2 TREATMENT SYSTEM ALTERNATIVES

Package Treatment Plant

There are a number of commercially available packaged treatment plants on the market today which use varying types of technologies to treat wastewater. These systems do a fair job of removing BOD (biochemical oxygen demand) levels of the wastewater to arrive at acceptable limits set by state and local regulations. Most package plants are based on a biological treatment process with sludge by product. All sewage would be conveyed to a packaged treatment system, followed by surface discharge to a stream.

The treatment system would include primary, secondary and, potentially, tertiary treatment depending upon the receiving water body. Due to nature of the environment of the Little Deschutes Basin it is unlikely that an NPDES permit would be issued by the ODEQ. The packaged plants require a higher degree of maintenance and expertise to run than other tertiary treatment methods such as lagoons and ponds, or land irrigation. A secondary treatment pond and subsurface absorption or irrigation would be required to dispose of the final effluent byproduct. Sludge would also have to be handled and disposed on an as-needed basis. The figure below illustrates the basic flow characteristic of a packaged biological treatment plant operation.

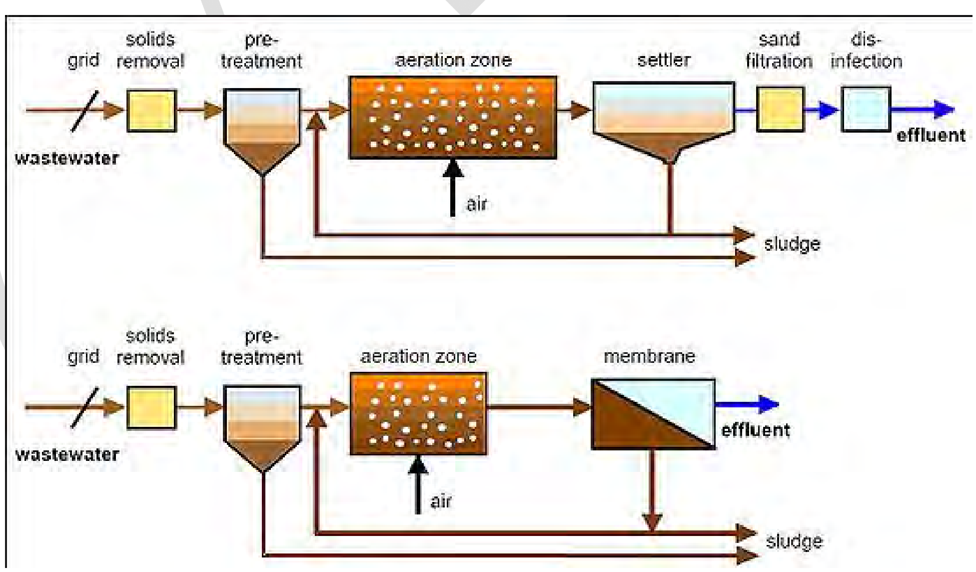


Figure 5.5 Package Treatment Plant System Process

The use of hazardous chemicals will require highly trained operators and may also require a hazard mitigation plan and will be a greater threat to the environment than other alternatives.

The pre-treatment process alternatives would be operator intensive, require frequent process and chemical adjustments, and result in relatively high operating costs due to chemical addition. Effluent filter or membrane options are capable of achieving quality suitable for reclaimed water. Disadvantages of the advanced treatment of effluent alternative include the costs for pretreatment prior to final filtration. High chemical costs for polymer and flocculent can be expected. Process reliability continues to be subject to seasonal changes of temperature and algal concentrations. It may also be a necessity to pre-treat final filters with chlorine. Ammonia removal with air stripping significantly increases operational complexity. Air stripping requires chemical addition to elevate the pH, which translates into significant operations and maintenance concerns. Solids handling processes are required for solids from pre-treatment processes and filter backwashes. The resulting treatment system would be highly operator intensive.

The Engineer's opinion of the probable construction costs for this treatment system is $4,396,688, and the operations and maintenance costs are $80,000 annually. The complete cost spreadsheet for this alternative is summarized in Section 6 of this report and attached in full in the Appendix for examination.

Facultative Ponds

A facultative pond system along with storage and land application of the effluent is a common and an acceptable way to dispose of municipal wastewater without discharging into public waters.

Facultative waste stabilization ponds, sometimes referred to as lagoons, are frequently used to treat municipal and industrial wastewater. The technology associated with facultative lagoons has been in widespread use in the United States for at least 90 years, with more than 7,000 facultative lagoons in operation today. These earthen lagoons are usually 4 to 8 feet in depth and are not mechanically mixed or aerated. The layer of water near the surface contains dissolved oxygen due to atmospheric re-aeration and algal respiration, a condition that supports aerobic and facultative organisms. The bottom layer of the lagoon includes sludge deposits and supports anaerobic organisms. The intermediate anoxic layer, termed the facultative zone, ranges from aerobic near the top to anaerobic at the bottom.

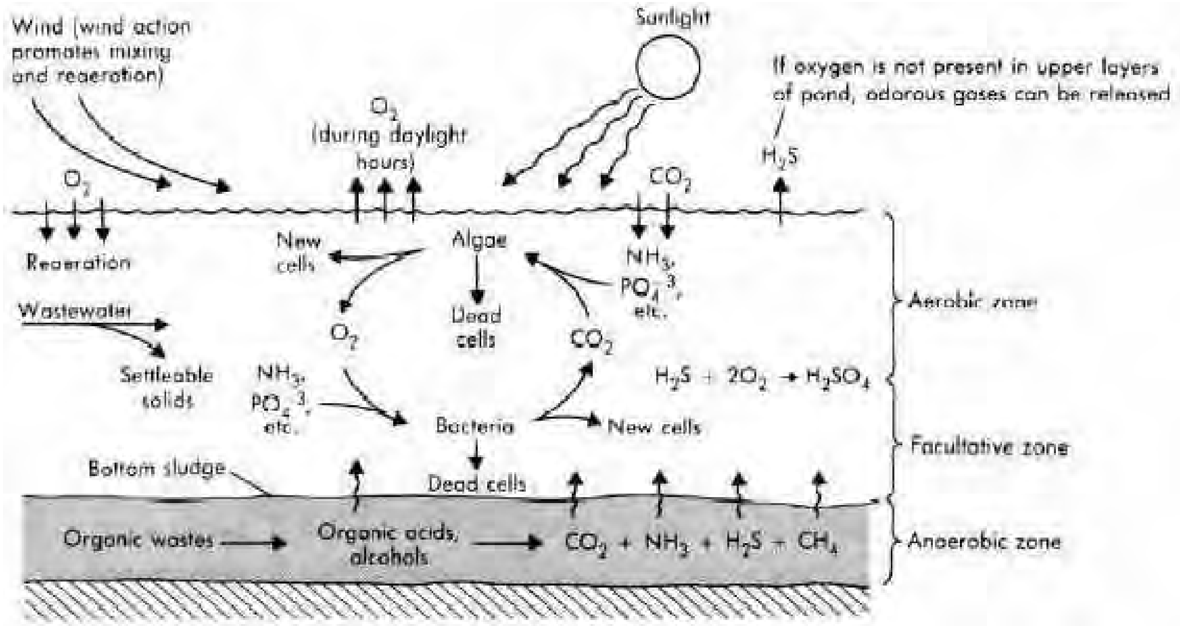


Figure 5.6 Facultative Pond System Process

These layers may persist for long periods due to temperature-induced water density variations. Inversions can occur in the spring and fall when the surface water layer may have a higher density than lower layers due to temperature fluctuations. This higher density water sinks during these unstable periods, creates turbidity, and produces objectionable odors. The presence of algae in the aerobic and facultative zones is essential to the successful performance of facultative ponds. In sunlight, the algal cells utilize CO_2 from the water and release O_2 produced from photosynthesis. On warm, sunny days, the oxygen concentration in the surface water can exceed saturation levels. Conversely, oxygen levels are decreased at night. In addition, the pH of the near surface water can exceed 10 due to the intense use of CO_2 by algae, creating conditions favorable for ammonia removal via volatilization. This photosynthetic activity occurs on a diurnal basis, causing both oxygen and pH levels to shift from a maximum in daylight hours to a minimum at night. The oxygen, produced by algae and surface re-aeration, is used by aerobic and facultative bacteria to stabilize organic material in the upper layer of water. Anaerobic fermentation is the dominant activity in the bottom layer in the lagoon. In cold climates, oxygenation and fermentation reaction rates are significantly reduced during the winter and early spring and effluent quality may be reduced to the equivalent of primary effluent when an ice cover persists on the water surface. As a result, many states in the northern United States and Canada prohibit discharge from facultative lagoons during the winter. Although the facultative lagoon concept is land intensive, especially in northern climates, it offers a reliable and easy-to-operate process that is attractive to small, rural communities.

Inflow coming in from the District's system will pump into the primary pond and then be directed to the secondary pond, run through a chlorinator contact chamber, and finally into the storage facility. The storage facility will store the effluent until land application is possible.

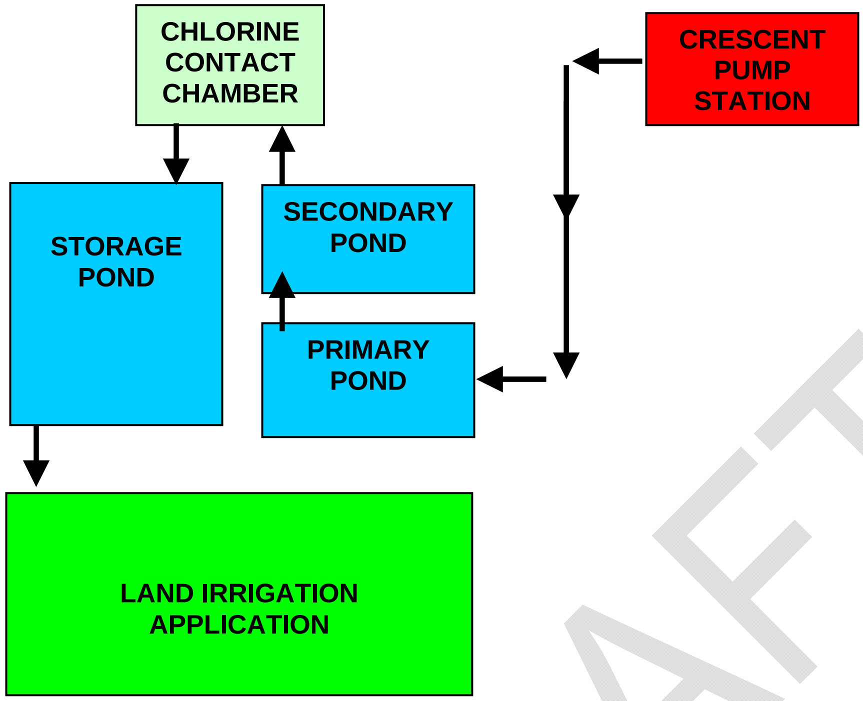


Figure 5.7 Diagram of Facultative Pond Treatment Facility

An irrigation diversion would be constructed at the storage pond. This will be a simple structure of a concrete pad and a centrifugal pump that will be primed by the operator and then directed to the sprinkler system. The pump would be on a timer so the operator can set the irrigation applications for the required duration, and the pump will shut off to allow the sprinklers to be drained for movement. The suction side of the pump will have a screened inlet on a concrete pad which will be located at the bottom of the pond. Suction piping will go over the dike so it will be easy to remove for maintenance and no siphoning of the water can occur during times when the pump is shut off.

Advantages of the facultative pond and storage alternative include low operating costs and less reliance on mechanical equipment and power. The District system operator has training and knowledge for this type of system, and has operator certification to operate the facility. The lagoons would provide additional treatment and increased storage capacity. The benefits include an increase in wildlife habitat, as well as enhancement of adjacent habitat. The District may encounter public opposition due to the potential for mosquito breeding and odors, although the lagoons will be kept at shallow depths to avoid odor and vector control measures can be put into place to control mosquito breeding. The Engineer's opinion of the probable construction costs for this treatment system is $4,514,525, and the operations and maintenance costs are 51,000 annually. The complete cost spreadsheet for this alternative is summarized in Section 6 of this report and attached in full in the Appendix for examination.

6.0 SELECTION OF ALTERNATIVE

Selection of an alternative depends on many factors, including the net present worth cost analysis, operation and maintenance, community interests, and long-term interests.

Operations and maintenance (O&M) costs for all of the alternatives are considered in determining the recommended project. For planning purposes, only alternative-dependant costs for maintenance, operations, chemicals, and utilities were compared.

A net present worth cost analysis will compare the present cost of the project alternatives. The net present worth analysis requires the conversion of all cash flows to the present. As such, it requires the consideration of the time value of money and all future cash flows (costs or profits) are discounted back to the present. In other words, the net present worth is a summation of all present day costs (cost of implementing the project) and future costs (i.e. operation and maintenance costs) or profits (salvage value) over the analysis period. The analysis period for these project alternatives is 30 years. To find the present worth of a project an interest rate is needed to discount future cash flows. The most appropriate value to use for this interest rate is the rate of return from investments.

The real discount rate found in Appendix C of OMB Circular No. A-94 was used to determine the present worth of the uniform series of operations and maintenance estimated for the feasible alternatives. The wastewater treatment improvements were considered to have useful lives longer than thirty years. The real discount rate selected by OMB for discounting real value for investments maturing in 30-years or more is 3.9%. The economic lifetimes of the alternatives were assumed to be equivalent. Therefore, salvage value was estimated to be zero dollars at the end of the life cycle. The following table shows how the alternatives ranked based on the lowest Capital Cost and the lowest O&M life cycle Present Worth.

Table 6.1 Comparison of Alternative Life Cycle O&M and Capital Costs

Alternative	Capital Cost	Construction Cost Estimate	Non-Construction	Annual O&M	O&M Present Worth	Total Present Worth
Collection Systems						
Gravity	$4,624,375	$3,591,500	$1,032,875	$22,500	$502,269	$5,126,644
Pressure	$4,798,125	$3,730,500	$1,067,625	$50,400	$703,177	$5,501,302
STEP/STEG	$4,948,125	$3,850,500	$1,097,625	$53,900	$602,723	$5,550,848
Vacuum	$5,149,375	$4,011,500	$1,137,875	$57,600	$803,631	$5,953,006
Treatment Systems						
Facultative Pond	$4,514,525	$3,231,000	$1,283,525	$76,000	$1,024,629	$5,539,154
Package Plant	$4,396,688	$3,142,500	$1,254,188	$102,000	$1,607,261	$6,003,949

6.2 Non-Monetary Factors Considered

Operation & Maintenance

Community Interests

Factors influencing community interests include providing a facility that will last for a long period of time (e.g., 40 year time frame) and is cost effective to build and operate. All three alternatives will provide a long term, reliable system. However, Alternative 2 will likely require more maintenance and more cost.

Long Term Interests

Long term interests are to provide a distribution system that meets current standards, provides for existing demands and some future growth, and meets regulatory requirements.

Evaluation of Alternatives

A ranking of the viable alternatives for both the economic and non-economic factors is provided below. The best alternative was scored a 1; second best a 2; and third best a 3, and so on. Equivalent factors received equal rankings. A summary of the ranking is shown in the Table below.

Table 6.2 Evaluation of Alternatives

#	Alternative	Cost Analysis	O&M	Community Interest	Long Term Interest	SCORE
1	Effluent					0
2	Gravity					0
3	Pressure					0
4	Vacuum					0
1	Facultative Pond					0
2	Package Plant					0

7.0 PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

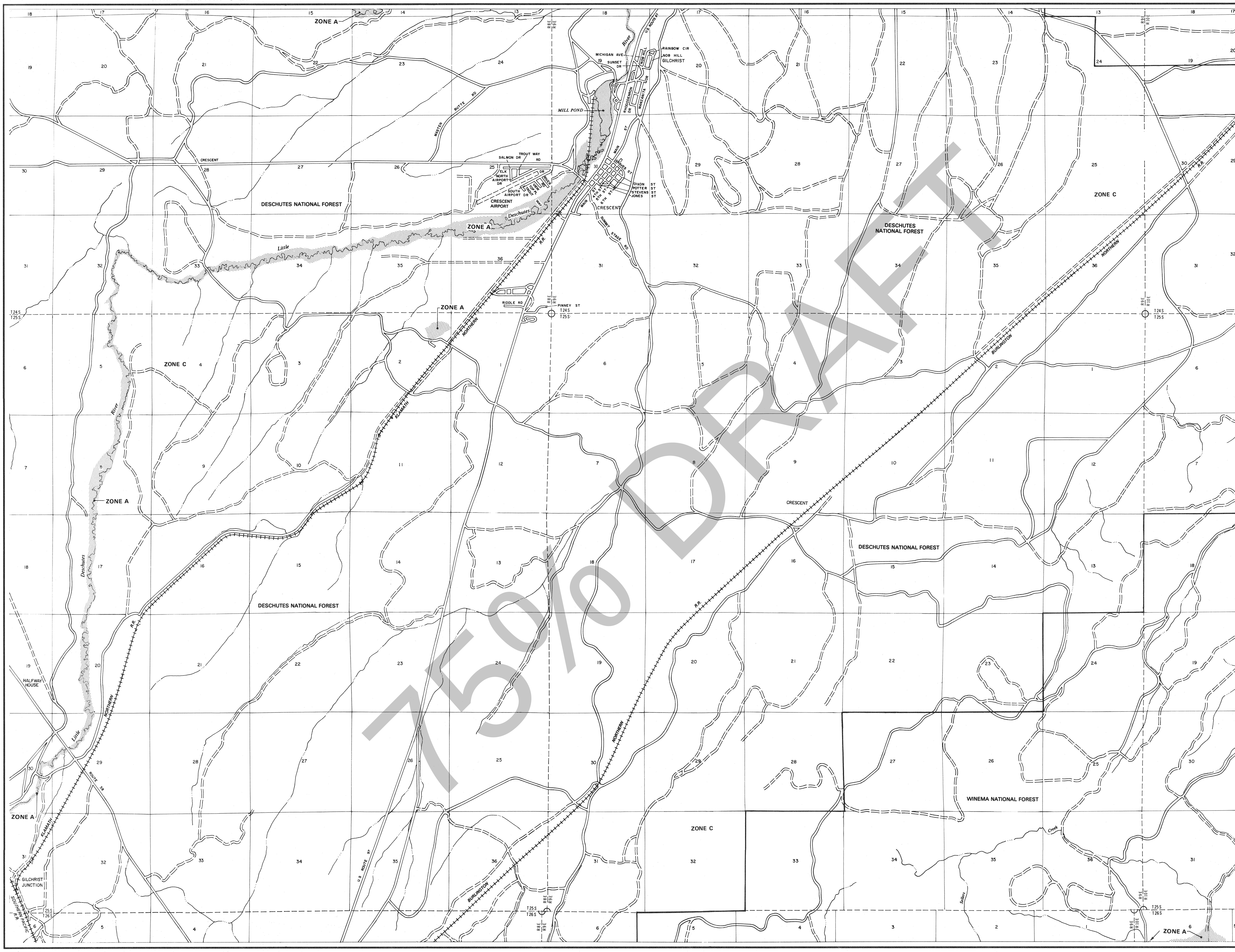
8.0 Conclusions and Recommendations

The need for wastewater system improvements for the Crescent Sanitary District is extensive and critical at this time.

The District will be coordinating with permitting and funding agencies throughout the development of the project. The revised schedule assumes that environmental review and approval will be completed within one year after the funding is awarded, and that survey and design can be completed within that same time frame. We anticipate that construction will take approximately 18 months. The proposed schedule for this project xxxx These dates are dependent upon agency review and approval.

APPENDIX

EXHIBIT A



KEY TO MAP

SPECIAL FLOOD HAZARD AREA	ZONE A ZONE B
Base Flood Elevation Line With Elevation In Feet**	513
Base Flood Elevation in Feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	RM7×
Zone D Boundary	
River Mile	•M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

INITIAL IDENTIFICATION:
DECEMBER 27, 1974

FLOOD HAZARD BOUNDARY MAP REVISIONS:
JULY 18, 1978

FLOOD INSURANCE RATE MAP EFFECTIVE:
DECEMBER 18, 1984

FLOOD INSURANCE RATE MAP REVISIONS:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.

APPROXIMATE SCALE
2000 0 2000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

KLAMATH COUNTY, OREGON
(UNINCORPORATED AREAS)

PANEL 175 OF 1450
(SEE MAP INDEX FOR PANELS NOT PRINTED)

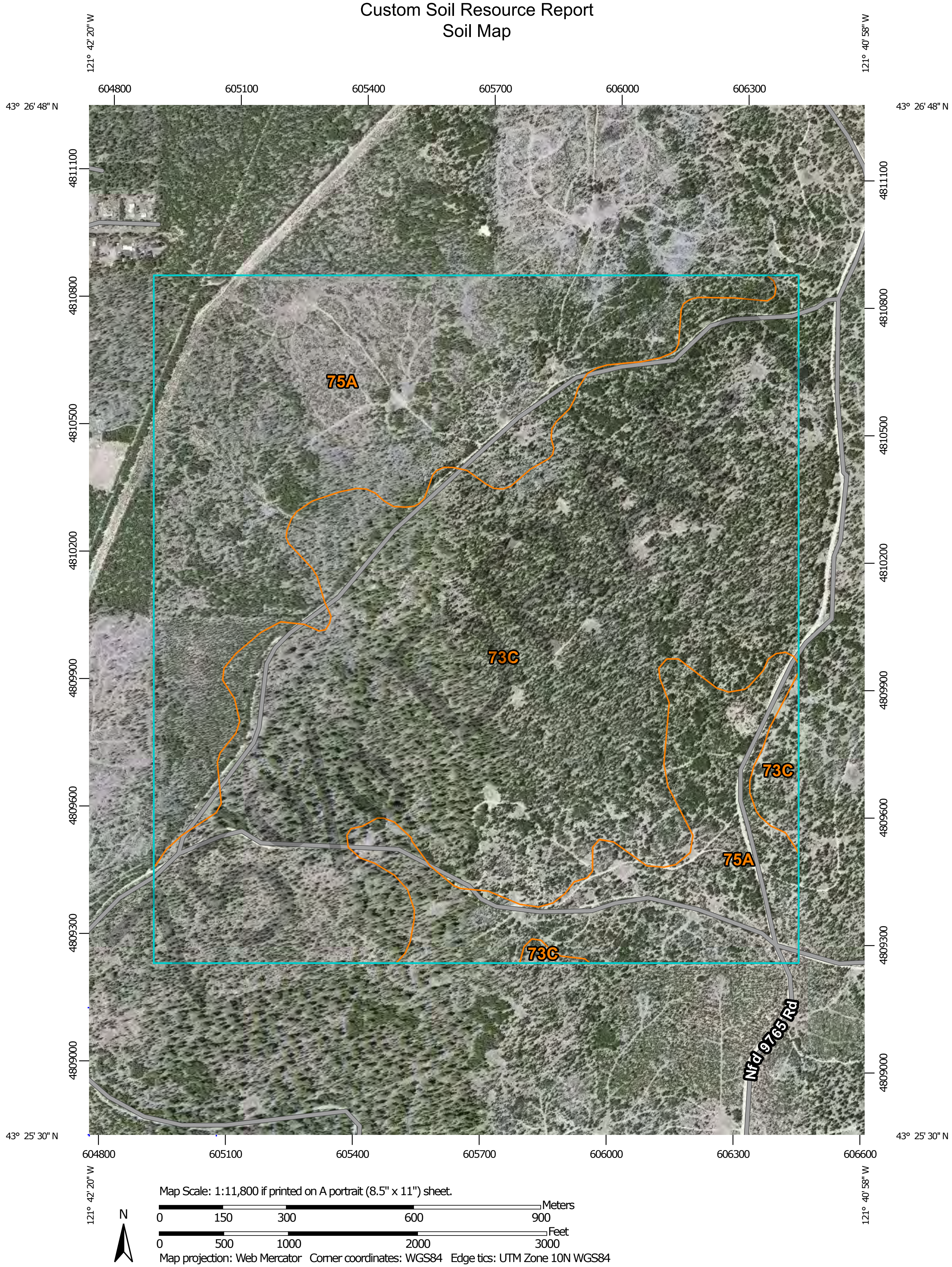
COMMUNITY-PANEL NUMBER
410109 0175 B

EFFECTIVE DATE:
DECEMBER 18, 1984

Federal Emergency Management Agency

EXHIBIT B

Soil Map



Map Scale: 1:11,800 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 150, 300, 600, 900

Feet: 0, 500, 1000, 2000, 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties

73C—Lapine gravelly loamy coarse sand, 0 to 15 percent slopes

Map Unit Setting

Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 18 to 25 inches
Mean annual air temperature: 40 to 44 degrees F
Frost-free period: 20 to 50 days

Map Unit Composition

Lapine and similar soils: 90 percent
Minor components: 3 percent

Description of Lapine

Setting

Landform: Lava plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash and gravel-sized pumice derived from dacite

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.5 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 6s
Hydrologic Soil Group: A

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 8 inches: Gravelly loamy coarse sand
8 to 25 inches: Extremely gravelly loamy coarse sand
25 to 38 inches: Very gravelly coarse sand
38 to 61 inches: Gravelly coarse sand

Minor Components

Cryaquolls

Percent of map unit: 3 percent
Landform: Terraces

75A—Lapine gravelly loamy coarse sand, low, 0 to 3 percent slopes

Map Unit Setting

Elevation: 4,200 to 4,500 feet
Mean annual precipitation: 18 to 25 inches
Mean annual air temperature: 40 to 44 degrees F
Frost-free period: 10 to 30 days

Map Unit Composition

Lapine, low, and similar soils: 90 percent
Minor components: 5 percent

Description of Lapine, Low

Setting

Landform: Lava plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Volcanic ash and gravel-sized pumice derived from dacite

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.5 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 6s
Hydrologic Soil Group: A

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 8 inches: Gravelly loamy coarse sand
8 to 25 inches: Extremely gravelly loamy coarse sand
25 to 38 inches: Very gravelly coarse sand
38 to 61 inches: Gravelly coarse sand

Minor Components

Cryaquolls

Percent of map unit: 5 percent
Landform: Terraces

EXHIBIT C

T.25S. R.09E. W.M.
KLAMATH COUNTY

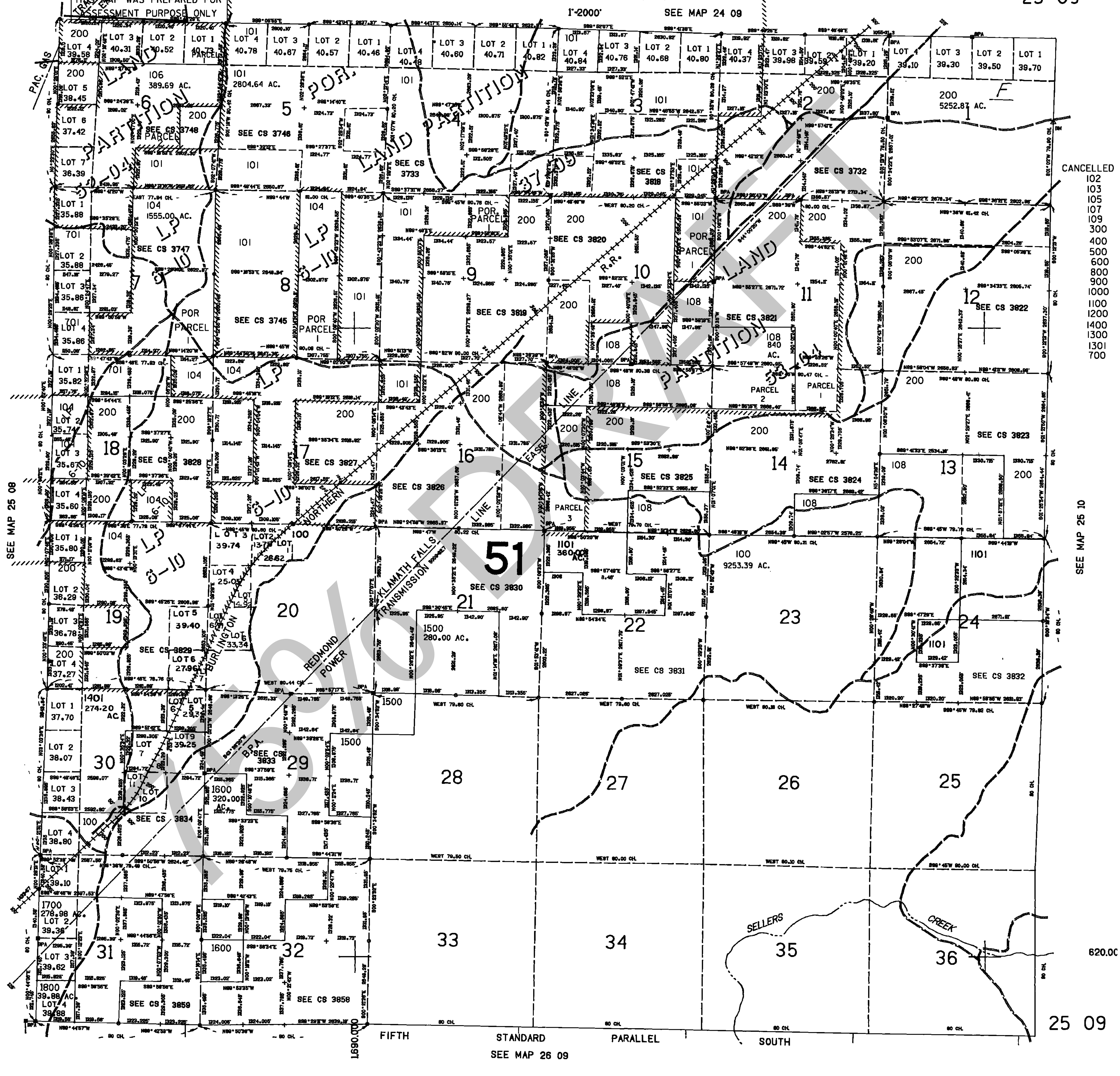


EXHIBIT D

U.S. Fish and Wildlife Service

National Wetlands Inventory

Crescent Sanitary District

Jun 11, 2014

Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

Riparian

- Herbaceous
- Forested/Shrub

Riparian Status

- Digital Data

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

User Remarks:

General Wetlands

EXHIBIT E

Geotechnical Resources Incorporated

Consulting Engineers, Geologists, and Environmental Scientists

November 24, 1998

2853_FINRPT

HGE, Inc.
375 Park Avenue
Coos Bay, OR 97420

Attention: Tim McGuire

SUBJECT: GROUNDWATER NITRATE+NITRITE SAMPLING, CRESCENT SANITARY DISTRICT, CRESCENT, OREGON

At your request, Geotechnical Resources, Inc. (GRI) has prepared this groundwater nitrate+nitrite sampling report for the Crescent Sanitary District in Crescent, Oregon. The general location of the site is shown on the Vicinity Map, Figure 1. The purpose of the work was to assist HGE, Inc. in their evaluation of the potential effect of local domestic sewage systems on shallow groundwater quality. Our work was conducted in general accordance with our proposal to HGE, Inc., dated September 8, 1998. This report describes the work accomplished and summarizes the findings of the groundwater testing.

Project Description

Crescent is located in Klamath County in southern Oregon, between the towns of Bend and Klamath Falls. The Crescent Sanitary District includes the community of Crescent and a relatively narrow corridor south of Crescent along State Highway 97. A wastewater treatment study for the Crescent Sanitary District was conducted by Robert E. Meyer Consultants of Beaverton, Oregon, in 1982. As part of the study, four shallow wells were installed in the sanitary district and sampled for nitrate, nitrite, and coliform. Analytical results showed low levels (<5 mg/L) of nitrates in all four wells. Nitrites were not detected, and coliform was detected in only one of the wells.

The 1982 study indicates the general sanitary district area is mantled with up to 7 ft of unconsolidated coarse pumiceous soils, underlain by relatively impermeable, organic-rich marsh deposits or basalt rock. In general, the shallow groundwater table at the site ranges from about 3 ft below the ground surface during the wet winter months to about 6 ft below the ground surface during the drier summer months and appears to be perched on the underlying marsh deposits or basalt rock.

As shown on Figure 2, the elevation of the project area ranges from about 4,500 ft in the eastern portion of the site, to about 4,460 ft in the western portion of the site near the Little Deschutes River. Topographically higher portions of the project area are underlain by basalt rock at the ground surface. The hydrogeological discharge for shallow groundwater in the project area is likely the Little Deschutes River, located west of the town center (Figure 2).

9725 SW Beaverton Hillsdale Hwy
Suite 140
Beaverton, Oregon 97005-3364
Phone (503) 641-3478 FAX (503) 644-8034
e-mail gri@teleport.com

Table 1 summarizes the soil/rock conditions and groundwater analytical data collected. A copy of the laboratory data report is provided in Appendix A.

METHODS

On November 18, 1998, a GRI geologist experienced in the collection of environmental samples met with a representative from HGE, Inc., and Dave Crider with the Crescent Water District. Sixteen sample locations, designated P-1 through P-16, were field reviewed and located throughout Crescent. The samples were collected from Geoprobe™ borings made at the approximate locations shown on Figure 2. The Geoprobe™ borings were made by Cascade Drilling, Inc. of Portland, Oregon. Groundwater samples were collected using a 4-ft-long, stainless steel, wire-strapped screen point attached to Geoprobe Envirorod™ (1.5-in.-O.D., 1.0-in.-I.D.) sealed with Teflon O-rings. Heavy-duty water-tight drill rods were used to advance the water sampler to the desired depth, and the screen was then opened by pulling back the probe. Prior to sampling, a small-diameter rod was sent down the hole to open the screen and ensure that the screen was still at the desired depth after pulling back the probe. A peristaltic pump mounted on the Cascade truck was used to draw water through the screen into new disposable polyethylene tubing. New tubing was used for each sample point. The Geoprobe Envirorod™ water sampler was cleaned between sample locations with a clean water rinse.

Insufficient water for sampling was encountered at three locations (P-1, P-12, and P-14). Adequate water for sample collection was obtained at the remaining 13 locations. Field work was completed the evening of November 18, 1998. The water samples were collected and placed in laboratory-prepared plastic bottles and delivered under chain of custody to Oregon Analytical Laboratory, in Beaverton, Oregon. The samples were analyzed for nitrate+nitrite by EPA method 300. A copy of the laboratory data report is provided in Appendix A.

RESULTS

The field and laboratory results are summarized on Table 1. A contour map of the nitrate+nitrite concentrations (in mg/l) is provided on Figure 2.

Table 1

Summary of Field and Laboratory Results

Location	Subsurface Conditions	Groundwater Encountered	Sample Interval	Nitrate+ Nitrite, mg/l
P-1	0 to 9 ft soil; refusal on basalt rock at 9 ft	no	no sample	—
P-2	0 to 11 ft soil; refusal on basalt/cobbles at 11 ft	yes, good recharge	7 to 11 ft	6.5
P-3	0 to 12 ft soil; refusal on basalt at 12 ft	yes, good recharge	8 to 12 ft	0.11

Table 1 (continued)

Summary of Field and Laboratory Results

Location	Subsurface Conditions	Groundwater Encountered	Sample Interval	Nitrate+ Nitrite, mg/l
P-4	0 to 9 ft soil; refusal on basalt/cobbles at 9 ft	yes, slow recharge	5 to 9 ft	13
P-5	0 to 8 ft soil; refusal on basalt/cobbles at 8 ft	yes, good recharge	4 to 8 ft	6.6
P-6	0 to 8 ft soil; refusal on basalt/cobbles at 8 ft	yes, good recharge	4 to 8 ft	1.8
P-7	0 to 9 ft soil; refusal on basalt/cobbles at 9 ft	yes, good recharge	5 to 9 ft	3.6
P-8	0 to 8 ft soil; refusal on basalt/cobbles at 8 ft	yes, good recharge	4 to 8 ft	0.06
P-9	0 to 9 ft soil; refusal on basalt/cobbles at 9 ft	yes, good recharge	5 to 9 ft	0.01
P-10	0 to 8 ft soil; refusal on basalt at 8 ft	yes, good recharge	4 to 8 ft	0.02
P-11	0 to 8 ft soil; refusal on basalt/cobbles at 8 ft	yes, good recharge	4 to 8 ft	1.9
P-12	0 to 9 ft soil; refusal on basalt rock at 9 ft	no	no sample	--
P-13	0 to 9 ft soil; refusal on basalt/cobbles at 9 ft	yes, good recharge	5 to 9 ft	0.03
P-14	0 to 9 ft soil; refusal on basalt rock at 9 ft	no	no sample	--
P-15	0 to 8 ft soil; probe stopped at 8 ft	yes, good recharge	4 to 8 ft	0.08
P-16	0 to 8 ft soil; probe stopped at 8 ft	yes, good recharge	4 to 8 ft	1.1

DISCUSSION

The data indicate that nitrate+nitrite concentrations in shallow groundwater range between non-detect (detection limit of the analysis = 0.05 mg/l) to 13 mg/l. The highest nitrate+nitrite concentration (13 mg/l) was found at location P-4, in the topographically higher east-central portion of Crescent, see Figure 2. Lower concentrations were generally found to the west and south of the town center. Sample point P-15, located in the southeastern portion of the project area, was taken at a location away and upgradient from obvious potential sources of nitrates and had a nitrate+nitrite concentration of 0.08 mg/l. Water was not encountered in sample points P-1, P-12, and P-14, where basalt rock was encountered in the probes above the shallow groundwater table.

LIMITATIONS

This report has been prepared to assist the client with documenting the groundwater conditions at the sample locations. The scope of work was limited to the specific project, location, and activities described herein. In the performance of an assessment of this type, specific information is obtained at specific locations at specific times. Since site activities and regulations beyond our control could change at any time after the completion of this report, our observations and findings can be considered valid only as of the date of this report. Land use, on- and off-site conditions, regulatory considerations, or other factors may change over time. The information presented in this report is based on our evaluation of the information obtained thorough the procedures described in this report. No other warranty or representation, either expressed or implied, is included or intended in this report.

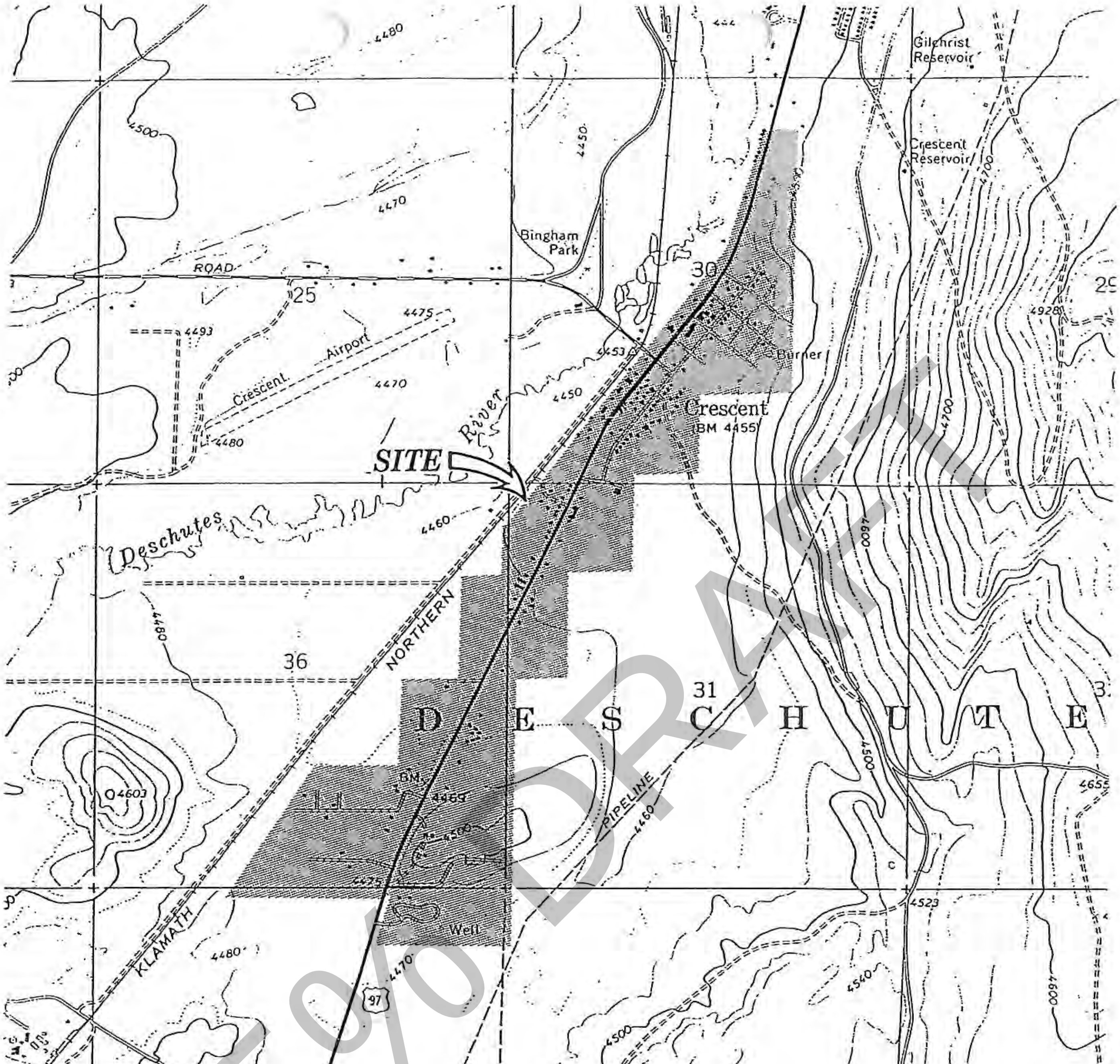
We appreciate the opportunity to be of continued service to HGE, Inc. Please contact the undersigned if you have any questions regarding this report.

Sincerely,

GEOTECHNICAL RESOURCES, INC.

H. Stanley Kelsay, P.E.
Principal

George A. Freitag, C.E.G.
Environmental Services Manager



USGS TOPOGRAPHIC MAP
CRESCENT, OREG. (2da) QUAD (1967)

North

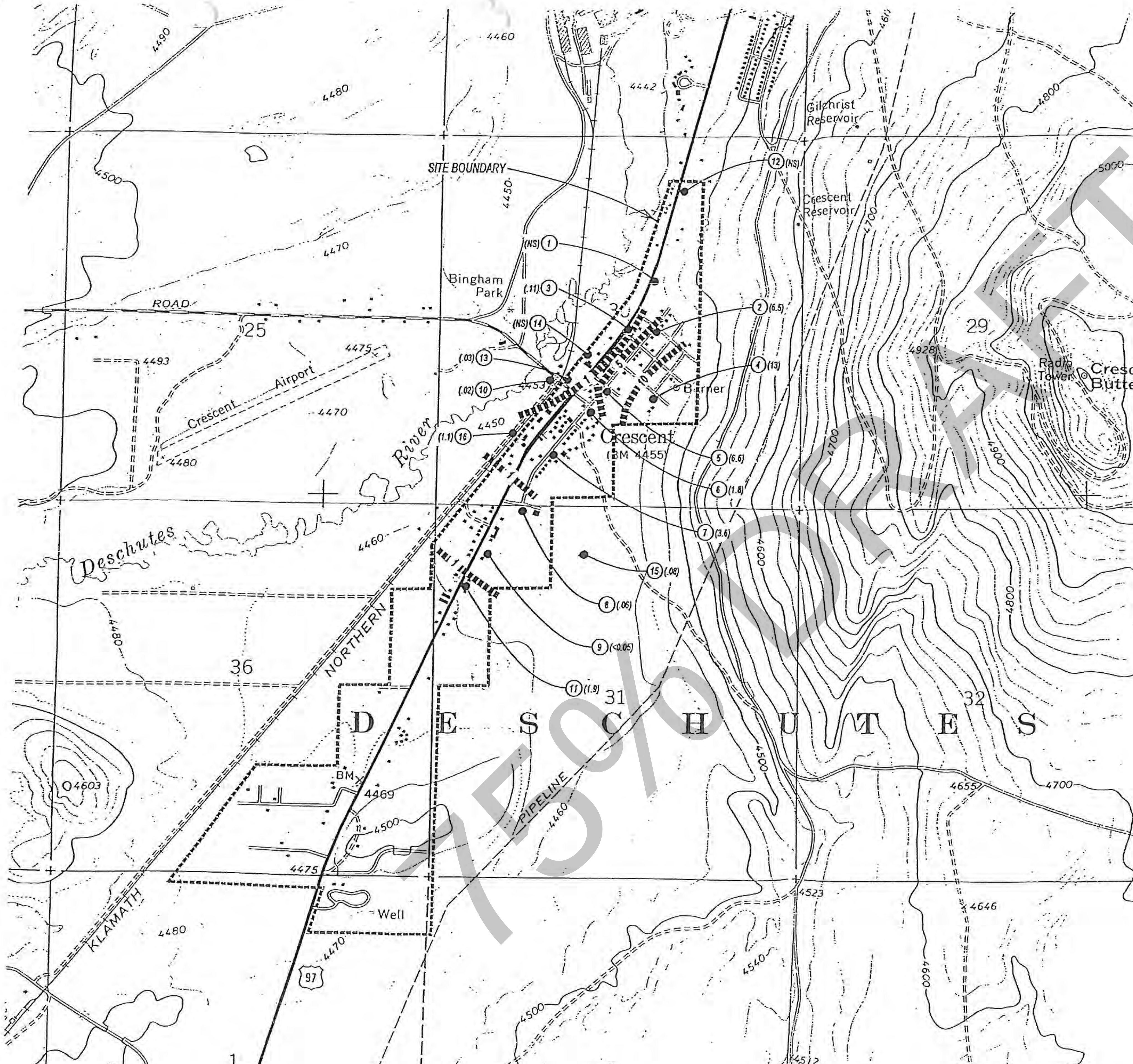
0 1/2 1 MILE

HGE, INC.
CRESCENT NITRATE STUDY

GRI

VICINITY MAP

NOV. 1998 JOB NO. 2853 FIG. 1



● (1) (6.6) SAMPLE LOCATION NUMBER WITH NITRATE+NITRITE CONCENTRATION (mg/1)

(NS) NO SAMPLE

■■■ 10 ■■■ INTERPRETED CONTOUR LINE OF EQUAL NITRATE+NITRITE CONCENTRATION (mg/l)

SITE PLAN FROM USGS TOPOGRAPHIC MAP (CRESCENT, OREG.), DATED 1967

North

0 1,500 3,000 FT

GRI

HGE, INC.
CRESCENT NITRATE STUDY

SITE PLAN

NOV. 1998 JOB NO. 2853 FIG. 2

OAL Oregon Analytical Laboratory

14686 S.W. Scholls Ferry Rd.
Beaverton, Oregon 97007
(503) 590-5300
FAX (503) 590-1404

CHAIN OF CUSTODY RECORD
LABORATORY ANALYSIS REQUEST

Sampling: ☐ Grab ☐ Comp
OAL hrs. ____
ISCO ____
Page 1 of 2
Site Visit ☐

Client Information
Company: GRI
Contact: GEORGE FREITAG
Address: 9725 SW BEAVERTON HILLSDALE HWY SUITE 140 BEAVERTON
Phone #: 503 641 8034 Fax #: 641 3478

Billing Information
Company: SAME
Contact: ____
Address: ____
Phone #: ____ Fax #: ____

Project Information
Project Name: CRESCENT
Project #: 2853
P.O. #: ____
Comments: ____

Sampler's Name: GEORGE FREITAG
Signature: [signature]
Quote #: ____
NOTE: If quote number is not referenced, standard pricing will be applied.
Provide Fax Results ☒ Yes ☐ No

Remarks: PHONE

#	Sample Identification	Date	Time	FOR LAB USE ONLY OAL Login #	# of Containers	Soil	Water	Other	NITRATE + NITRITE
1	P-2	11/18	200	L8939-1	1		1		X
2	P-3	11	220	-2	1		1		X
3	P-5	11	250	-3	1		1		X
4	P-4	11	300	-4	1		1		X
5	P-6	11	400	-5	1		1		X
6	P-7	11	420	-6	1		1		X
7	P-15	11	445	-7	1		1		X
8	P-8	11	500	-8	1		1		X
9	~~P-8~~ P-11	11	545	-9	1		1		X

Analyses (printed columns, unmarked): Metals 6010/7000; Semivolatiles 625/8270, PAH/SIM PAH 8310; Organochlorine 608/8080/8081, PCB Pesticide; NWTPH-HCID; NWTPH Quantification G D; BTEX 602/8020 ☐ MTBE ☐ Naphthalene; TPH 418.1 / 1664, Oil & Grease ☐ Total ☐ TRP; Metals ☐ Total ☐ TCLP ☐ Dissolved As Ba Cd Cr Pb Hg Se Ag, Other

Turnaround:
[N] Normal – 10 working days
[S] Special – 5 working days
[R] Rush – 24-72 hrs.
(O) Other – PRELIMINARY RESULTS BY TUESDAY 11/24 NOON (ON SAMPLER) PER D. GRIFFITHS

Remarks

Relinquished		Relinquished		Relinquished	
Signature: [signature]	Date: 11/18/98	Signature:	Date:	Signature:	Date:
Print Name: GEORGE FREITAG	Time: 1300	Print Name:	Time:	Print Name:	Time:
Company: GRI		Company:		Company:	
Received		**Received**		**Received**	
Signature: [signature]	Date: 11/18/98	Signature:	Date:	Signature:	Date:
Print Name: TEYENIT GOSSO	Time: 13:05	Print Name:	Time:	Print Name:	Time:
Company: OAL		Company:		Company:	

☒ Courier ☐ UPS ☐ FedEx ☐ Other
Received @ 8 °C
Appropriate Containers ☐ Yes ☐ No
____ 4oz./8oz. Jars
____ VOA Vials
9 Plastic Bottles 500 mL
____ Glass Bottles
____ Other ____

OAL

L8939

Client: *Geotechnical Resources, Inc.*
Contact: *George Freitag*

Project: *2853*
Crescent

Inorganics

Sample ID / Analyte	Matrix	Result	Reporting Limit	Units (ppm)	Date Analyzed	Method	Sampled	Comment	Lab Number / Analyst
P-9	*Water*						*11/18/98*		*L8939-10*
Nitrate + Nitrite as N		ND	0.01	mg/L	11/20/98	EPA 353.2		K1	NM
P-16	*Water*						*11/18/98*		*L8939-11*
Nitrate + Nitrite as N		1.1	0.10	mg/L	11/20/98	EPA 353.2		D,K1	NM
P-10	*Water*						*11/18/98*		*L8939-12*
Nitrate + Nitrite as N		0.02	0.01	mg/L	11/20/98	EPA 353.2		K1	NM
P-13	*Water*						*11/18/98*		*L8939-13*
Nitrate + Nitrite as N		0.03	0.01	mg/L	11/20/98	EPA 353.2		K1	NM

OAL

L8939

Sample Summary

Sample ID	Lab #	Description	Sampled	Received
P-2	L8939-1	water	11/18/98 14:00	11/19/98
P-3	L8939-2	water	11/18/98 14:20	11/19/98
P-5	L8939-3	water	11/18/98 14:50	11/19/98
P-4	L8939-4	water	11/18/98 15:00	11/19/98
P-6	L8939-5	water	11/18/98 16:00	11/19/98
P-7	L8939-6	water	11/18/98 16:20	11/19/98
P-15	L8939-7	water	11/18/98 16:45	11/19/98
P-8	L8939-8	water	11/18/98 17:00	11/19/98
P-11	L8939-9	water	11/18/98 17:45	11/19/98
P-9	L8939-10	water	11/18/98 17:50	11/19/98
P-16	L8939-11	water	11/18/98 18:10	11/19/98
P-10	L8939-12	water	11/18/98 18:25	11/19/98
P-13	L8939-13	water	11/18/98 18:45	11/19/98

Definition of Terms

D Reported value is based on a dilution.

K1 Batch matrix spike recovery outside laboratory QC limits due to suspected matrix interference.

ND Analytical result was below the reporting limit.

Analysts

Initials	Analyst	Title
NM	Nick Miller	Technician

Method Summary

Analysis	Method
Nitrate + Nitrite as N	EPA 353.2

OAL

L8939

November 23, 1998

George Freitag
Geotechnical Resources, Inc.
9725 SW Beaverton-Hillsdale Hwy.
Suite 140
Beaverton, OR 97005

Phone: (503) 641-3478
FAX: (503) 644-8034

Re: Laboratory Sample Analysis

Project: 2853
Crescent

Project Manager: George Freitag

Dear George Freitag:

On Thursday, November 19, 1998, OAL received thirteen (13) water samples for analysis. The samples were analyzed utilizing EPA, ASTM, or equivalent methodology.

Should you have any questions concerning the results in this report, please contact us at (503) 590-5300. Refer to OAL login number L8939.

Sincerely,

Deborah Griffiths
Project Manager

Suzanne LeMay
QA/QC Officer

EXHIBIT F

Map Tax Lot	***Prop ID***	***Owner Name***	***Address 1***	***City, State Zip***
P-003151	P889281	AMERIGAS PROPANE LP	PO BOX 798	VALLEY FORGE, PA 19482
P-030062	P897917	BIG FOOT TAVERN & LOWE MATT	P O BOX 224	CRESCENT, OR 97733
P-011441	P890000	BIG PINES R V PARK & HALL BRUCE & DONNA	135151 HWY 97 N	CRESCENT, OR 97733
U-000044	U799611	CASCADE NATURAL GAS CORP TAMMY NYGARD	8113 W GRANDRIDGE BLVD	KENNEWICK, WA 99336-7166
U-000050	U880499	CENTURYLINK	700 W MINERAL AVE ND #D05.32	LITTLETON, CO 80120
P-000992	P897507	CRESCENT MOTEL & OLBERG STEVEN H	P O BOX 603	BEAVERTON, OR 97075
P-010425	P893957	CRESCENT RV PARK & DEFOE CHARLES E JR & JUDI'	12455 SW 68TH AVE	PORTLAND, OR 97223
P-003749	P877650	CRESCENT SHELL INC & COKER JEFF	P O BOX 229	CRESCENT, OR 97733
P-009485	P884797	DE'CARLO & DBA DE'CARLO TRUCK & EQUIP REPAI	134745 HWY 97 N	CRESCENT, OR 97733
P-900646	P897744	DESIGN SPACE MODULAR BUILDINGS	1935 CAMINO VIDA ROBLE STE 210	CARLSBAD, CA 92008-5573
U-000307	U895928	DIRECTV INC SAMSON ANG	2250 E IMPERIAL HWY	EL SEGUNDO, CA 90245
U-000308	U895941	DISH NETWORK CORPORATION BILL BACHER	P O BOX 6623	ENGLEWOOD, CO 80155
P-006900	P872303	FARMER BROS COFFEE CO	20333 S NORMANDIE AVENUE	TORRANCE, CA 90502
P-000499	P896275	FIRST DATA MERCHANT SERVICES COPRORATION	PO BOX 3868	ENGLEWOOD, CO 80112
U-000005	U890444	GAS TRANSMISSION NORTHWEST	PO BOX 2168	HOUSTON, TX 77252-2168
P-012320	P894290	GE CAPITAL INFORMATION TECH SOLUTIONS	P O BOX 5043	CHICAGO, IL 60680-5043
P-007616	P878553	GTECH CORPORATE HEADQUARTERS	10 MEMORIAL BLVD	PROVIDENCE, RI 02903
P-007616	P894615	GTECH CORPORATE HEADQUARTERS	10 MEMORIAL BLVD	PROVIDENCE, RI 02903
P-900688	P897751	HILL-ROM COMPANY INC	1069 STATE ROUTE 46 E	BATESVILLE, IN 47006
P-900610	P897767	K12 MANAGEMENT INC	2300 CORPORATE PARK DR STE 200	HERNDON, VA 20171
P-010763	P888227	KEN'S SPORTING GOODS	12455 S W 68TH AVE	PORTLAND, OR 97223
P-010513	P887791	MOHAWK RESTAURANT & LOUNGE & KOCH BRIAN	PO BOX 190	CRESCENT, OR 97733
P-000080	P897636	MUZAK LLC	3318 LAKEMONT BLVD	FORT MILL, SC 29708
P-900553	P896474	NEOPOST USA INC	478 WHEELERS FARM RD	MILFORD, CT 06461
P-900311	P892800	NORTHERN LEASING SYSTEMS INC	7303 SE LAKE ROAD	PORTLAND, OR 97267
P-900065	P894412	PITNEY BOWES GLOBAL FINANCIAL SVCS LLC	5310 CYPRESS CENTER DR SUITE 110	TAMPA, FL 33609
P-002220	P880663	QUAIL MOUNTAIN INC & PEPSI COLA BOTTLING	4033 MILLER AVE	KLAMATH FALLS, OR 97603
P-084202	P872219	ROSEBERRY TIMBER INC & ROSEBERRY TERRY RAY	PO BOX 225	CRESCENT, OR 97733
P-066930	P619432	THE COCA-COLA COMPANY	P O BOX 4440	BRANDON, FL 33509-4440
M-0095-8	M877810	USDA FOREST SERVICE	P O BOX 208	CRESCENT, OR 97733
P-900672	P896485	WABASHA LEASING LLC	386 WABASHA STREET N STE 1200	SAINT PAUL, MN 55102-1362
P-000613	P892202	WOODSMAN COUNTRY LODGE & LARSON DOUGLAS	P O BOX 186	CRESCENT, OR 97733
P-084811	P28115	YOUNG'S CUT STOCK INC & YOUNG DWAYNE & KAY	P O BOX 222	CRESCENT, OR 97733

Map Tax Lot	Prop ID	Owner Name	Address 1	City, State Zip
R-2409-030CC-00700-000	R154335	ACKLEY LYNN E & SANDY L	136230 HWY 97 N	CRESCENT, OR 97733
R-2408-036DD-00900-00(	R150641	ADAMS LAURETTA & WESLEY	231 PINNEY ST	CRESCENT, OR 97733
R-2409-030AC-01300-000	R153274	ALEXANDER RALPH C	PO BOX 324	CRESCENT, OR 97733
R-2408-036DD-01200-00(	R150614	ALLPHIN FOREST E	115 PINNEY ST	CRESCENT, OR 97733
R-2409-030AC-02000-000	R152818	ARMSTRONG LARRY	P O BOX 153	CRESCENT, OR 97733
M-223314	M883330	BAYNE HORACE P & SHARON G	P O BOX 319	CRESCENT, OR 97733-0319
R-2409-030CA-01100-000	R153416	BC KOCH LLC	PO BOX 190	CRESCENT, OR 97733
M-093471	M41314	BELL DAVID C & DONNA M	PO BOX 227	CRESCENT, OR 97733
R-2409-030CD-03100-000	R154754	BENSON RANDALL & THOMAS LINDA	P O BOX 291	CRESCENT, OR 97733
P-030062	P897917	BIG FOOT TAVERN & LOWE MATT	P O BOX 224	CRESCENT, OR 97733
P-011441	P890000	BIG PINES R V PARK & HALL BRUCE & DONNA	135151 HWY 97 N	CRESCENT, OR 97733
M-137245	M55362	BISBEE BENJAMIN L & LINDA R	P O BOX 35	CRESCENT, OR 97733
R-2408-036DC-01901-000	R886672	BISHOP EDWARD M & ROBERTA A	PO BOX 84	CRESCENT, OR 97733
R-2409-030DB-01100-00(	R154889	BISHOP JAMES M & BISHOP ALICE L	PO BOX 221	CRESCENT, OR 97733
R-2409-030DB-01199-00(	R816834	BISHOP JAMES M & ALICE L	P O BOX 221	CRESCENT, OR 97733
R-2409-030AC-02900-000	R153201	BONNER MELVIN & GEORGIA	PO BOX 246	CRESCENT, OR 97733
R-2409-030AC-02800-000	R153210	BONNER MELVIN R & GEORGIA L	P O BOX 246	CRESCENT, OR 97733
R-2409-030DB-11900-00(	R154219	BOWEN WILLIAM G & BOWEN LINDA R	PO BOX 145	CRESCENT, OR 97733
M-128792	M51801	BROWN IVAN G & MARY LOU	PO BOX 71	CRESCENT, OR 97733
R-2409-030CD-00500-000	R154521	BRUNES LORI	PO BOX 366	CRESCENT, OR 97733
R-2409-030AC-01800-000	R153327	CARLSON MICHAEL D & ANNETTE	P O BOX 173	CRESCENT, OR 97733
M-079853	M35553	CARLSON TED & PEGGY	P O BOX 39	CRESCENT, OR 97733
M-068023	M31833	CASEY WANNA LEE & GARRICK JAMES E	PO BOX 94	CRESCENT, OR 97733
R-2409-030CD-00400-000	R154451	CHOATE MILTON C & CLIFFORD JUDITH J	441 BONNER LN	CRESCENT, OR 97733
R-2409-030CA-02000-000	R153504	COKER JEFF	PO BOX 229	CRESCENT, OR 97733
R-2408-036DC-00200-000	R150179	COLLIER GLENN ARTHUR	117 KAEHN RD	CRESCENT, OR 97733-1000
M-132824	M53514	COX DORAN H	PO BOX 12	CRESCENT, OR 97733
R-2409-031BB-03100-000	R156057	COX KENNETH A TRUSTEE & COX KAREN TRUSTEI	PO BOX 68	CRESCENT, OR 97733
R-2408-036DC-02300-000	R150384	COX THOMAS C & LISA M	P O BOX 117	CRESCENT, OR 97733
R-2409-030DB-10300-00(	R746900	CRESCENT RURAL FIRE DIST	P O BOX 230	CRESCENT, OR 97733
P-003749	P877650	CRESCENT SHELL INC & COKER JEFF	P O BOX 229	CRESCENT, OR 97733
R-2409-030AC-00300-000	R746893	CRESCENT WATER SUPPLY & IMPROVEMENT DIST	PO BOX 247	CRESCENT, OR 97733
R-2409-031BB-00600-000	R155780	CRESCENT WATER SUPPLY & IMPROVEMENT DIST	PO BOX 247	CRESCENT, OR 97733
R-2409-031BB-02100-000	R155977	CUSSINS RONALD E & NANCY	PO BOX 82	CRESCENT, OR 97733
M-114469	M47381	CUSSINS RONALD E & NANCY L	P O BOX 82	CRESCENT, OR 97733
R-2409-030AC-05200-000	R153130	CUSTER CLAY C	PO BOX 303	CRESCENT, OR 97733
P-009485	P884797	DE'CARLO & DBA DE'CARLO TRUCK & EQUIP REPA	134745 HWY 97 N	CRESCENT, OR 97733

Map Tax Lot	***Prop ID***	***Owner Name***	***Address 1***	***City, State Zip***
M-141646	M875114	DE'CARLO SCOTT THOMAS	134745 HWY 97 N	CRESCENT, OR 97733
R-2409-030DB-06700-00(	R155548	DE'PUE SHAWN H	PO BOX 38	CRESCENT, OR 97733
R-2408-036DD-00600-00(	R150678	DIPP VIVIAN	PO BOX 69	CRESCENT, OR 97733
R-2409-030CA-02200-000	R153513	DOLAN CHER L & COKER JEFF	PO BOX 229	CRESCENT, OR 97733
M-088986	M39620	DORAN EDWARD A	P O BOX 312	CRESCENT, OR 97733
R-2409-030DB-07500-00(	R155619	DRAKE DOUGLAS & SANDRA	P O BOX 121	CRESCENT, OR 97733
R-2409-030DB-07300-00(	R155637	DRAKE SANDRA K & DOUGLAS D	PO BOX 121	CRESCENT, OR 97733
R-2409-030DB-08300-00(	R155691	DREAN GARY A	P O BOX 3	CRESCENT, OR 97733
R-2409-030AC-03100-000	R153185	DUMAS RENE' M & TITUS TERRENCE R	P O BOX 15	CRESCENT, OR 97733
M-194235	M731569	DUMAS RUTH & STUMBAUGH RENE M	P O BOX 18	CRESCENT, OR 97733
R-2409-030CD-03600-000	R746964	FIRST BAPTIST CHURCH	PO BOX 102	CRESCENT, OR 97733
R-2409-030AC-01500-000	R153292	FITZER LINDA K	P O BOX 242	CRESCENT, OR 97733
M-067881	M31780	FORREST VIOLET	PO BOX 50	CRESCENT, OR 97733
R-2409-031BC-00900-000	R155904	FOUNTINELLE JOHN & DAVIS JANET LYNN	135744 HWY 97N	CRESCENT, OR 97733
R-2409-031BC-01000-000	R156235	FOUST RONALD EDWARD & JO ANN	135614 HWY 97	CRESCENT, OR 97733
R-2408-036DC-01800-000	R150339	FULLER THOMAS W & MARY G	PO BOX 325	CRESCENT, OR 97733
R-2409-030CD-00200-000	R154460	GARICK JOHN L	P O BOX 94	CRESCENT, OR 97733
R-2409-030CD-01600-000	R154558	GARRICK JILL E & GRAHAM LAVERN	PO BOX 34	CRESCENT, OR 97733
R-2409-030CD-01400-000	R154424	GARRICK JOHN & GARRICK STEPHEN	P O BOX 94	CRESCENT, OR 97733
R-2408-03600-02200-000	R150026	HAIGHT KAREN S	2213 RIVIERA CT	CRESCENT, OR 97733
M-170577	M26894	HALE PHILLIP & JANET JT REV LIV TRUST	PO BOX 97	CRESCENT, OR 97733
M-260301	M897685	HALL BRUCE D & DONNA M	135151 HWY 97 N	CRESCENT, OR 97733
R-2408-036DA-00500-00(	R150080	HALL BRUCE D & DONNA M	135151 HWY 97 N	CRESCENT, OR 97733-9711
M-03-008	M889289	HAMMAN A JUNE	438 STEVENS ST PO BOX 1:	CRESCENT, OR 97733
R-2408-036DA-00900-00(	R150133	HANSEN ROGER D & PATTY A	PO BOX 198	CRESCENT, OR 97733
R-2408-036DC-02800-000	R150419	HICKS MARVIN W & PEGGY E	P O BOX 36	CRESCENT, OR 97733
M-086463	M38694	HALE PHILLIP & JANET JT REV LIV TRUST ETAL	PO BOX 97	CRESCENT, OR 97733
R-2408-036DA-00100-00(	R150053	HUMBERT CHARLES R & VOLK AMY M	135287 HWY 97 N	CRESCENT, OR 97733
M-177461	M779465	HUNT THOMAS E & ALMA D	PO BOX 286	CRESCENT, OR 97733
R-2409-030DB-06500-00(	R155566	IRVIN DELORES A & JOSEPH S	430 STEVENS ST	CRESCENT, OR 97733
R-2409-030DB-00300-00(	R154825	JAQUES LELAND M & DEBORAH L	P O BOX 135	CRESCENT, OR 97733
R-2409-030DB-09200-00(	R153988	JOHNSON KAREN E & ROSE JIM A	PO BOX 271	CRESCENT, OR 97733
M-086393	M38612	JORDAN KENNETH L & ROBIN G & DE'ARMOND DA	P O BOX 290	CRESCENT, OR 97733
R-2408-036DC-03100-000	R150446	LANE ALAN R & LANE CATHERINE M	PO BOX 109	CRESCENT, OR 97733
M-085835	M38480	LANE ALAN ROSS & LANE LELAND ROSS	P O BOX 109	CRESCENT, OR 97733
M-181115	M809174	LANE CATHERINE M	P O BOX 109	CRESCENT, OR 97733
R-2409-030CA-00800-000	R820017	LARSON DOUGLAS L TRUSTEE & LARSON 2004 FAI	PO BOX 186	CRESCENT, OR 97733

Map Tax Lot	Prop ID	Owner Name	Address 1	City, State Zip
R-2409-030DB-02200-000	R154914	LEWIS MARY R	PO BOX 101	CRESCENT, OR 97733
R-2408-036DC-01600-000	R150320	LOWELL TRAVIS J & CORINA M	P O BOX 307	CRESCENT, OR 97733
M-132588	M53471	MATSON JAMES L	PO BOX 185	CRESCENT, OR 97733
M-223698	M891578	MC'GILL WILMA	PO BOX 374	CRESCENT, OR 97733
R-2409-030DB-02800-000	R155012	MEADOWS DANA M & MEADOWS SCOTT E	P O BOX 165	CRESCENT, OR 97733
M-070271	M32422	MEADOWS DARRELL RAY	PO BOX 165	CRESCENT, OR 97733
M-160463	M63335	MILLER GARY W & LINDA J	P O BOX 137	CRESCENT, OR 97733
M-168441	M885325	MILLER LORI	P O BOX 149	CRESCENT, OR 97733
P-010513	P887791	MOHAWK RESTAURANT & LOUNGE & KOCH BRIAN	PO BOX 190	CRESCENT, OR 97733
M-135053	M54835	MOORE HELEN E	P O BOX 51	CRESCENT, OR 97733
R-2408-036DD-00700-000	R150669	MOORE HELEN E	PO BOX 51	CRESCENT, OR 97733
M-182374	M26331	MOORE RONALD W & ROXANNE E	P O BOX 52	CRESCENT, OR 97733
R-2409-031BB-00700-000	R155806	MORRIS LAWRENCE TRUMAN & BETTY J	PO BOX 139	CRESCENT, OR 97733-0139
R-2408-036DC-02701-000	R875481	OZIAS ARTHUR J & RUTH MARIE	PO BOX 83	CRESCENT, OR 97733
R-2408-036DA-00800-000	R150552	PARKER CHARLES D	134915 HWY 97 N BOX 65	CRESCENT, OR 97733
R-2409-031BB-01700-000	R155931	PERCY FLOYD L	135878 HWY 97 N	CRESCENT, OR 97733
R-2409-030DB-09100-000	R153997	PONDEROSA CHRISTIAN FELLOWSHIP	P O BOX 254	CRESCENT, OR 97733
R-2408-036DA-01100-000	R150115	PORTER HARRIS H & JANE L	P O BOX 87	CRESCENT, OR 97733
R-2409-031BC-00400-000	R156146	PORTER PAULINE S	P O BOX 43	CRESCENT, OR 97733
R-2409-031BB-01801-000	R863024	PUTMAN ALLEN D & PATRICIA J	135873 RIVERVIEW ST PO	CRESCENT, OR 97733
R-2409-031BB-01600-000	R155922	PUTMAN ALLEN D & PATRICIA J	PO BOX 86	CRESCENT, OR 97733
R-2409-030AB-00800-000	R152710	RAMSEY JAMES D	PO BOX 42	CRESCENT, OR 97733
R-2409-030DB-01300-000	R154905	REID STEVEN LEE	137003 MAIN ST PO BOX 28	CRESCENT, OR 97733
R-2409-030CD-02400-000	R801252	ROBERDS RANDI K & DBA MICKS HARDWARE	PO BOX 302	CRESCENT, OR 97733
R-2409-030CD-04000-000	R154647	ROLAND ROGER LEE	PO BOX 273	CRESCENT, OR 97733
R-2409-030DB-04200-000	R155192	ROSEBERRY TERRY R & DEBBIE L	PO BOX 67	CRESCENT, OR 97733
R-2409-030DB-04000-000	R155174	ROSEBERRY TERRY R & DEBORAH L	P O BOX 67	CRESCENT, OR 97733
P-084202	P872219	ROSEBERRY TIMBER INC & ROSEBERRY TERRY RA	PO BOX 225	CRESCENT, OR 97733
R-2408-036DC-00700-000	R150240	SANT KEVIN G	PO BOX 287	CRESCENT, OR 97733
R-2409-030AC-04900-000	R153176	SHAW KELLEY M	PO BOX 56	CRESCENT, OR 97733
R-2408-036DC-02700-000	R150437	SHEETS FAMILY TRUST & SHEETS BETTY ANN TR	PO BOX 72	CRESCENT, OR 97733
R-2409-030DB-03200-000	R155094	SMITH JANICE E	PO BOX 2	CRESCENT, OR 97733
M-137873	M55488	SMITH LARRY A & CYDNEY A	P O BOX 156	CRESCENT, OR 97733
R-2408-036DD-01600-000	R150721	SMITH LARRY MICHAEL & CYNDEY ANN JOINT LIV	PO BOX 156	CRESCENT, OR 97733
M-061155	M29962	SMITH WILLIAM H & LORETTA A	P O BOX 212	CRESCENT, OR 97733
R-2409-030AB-01400-000	R152774	STINSON RICKY LEE & KAREN MARIE	PO BOX 158	CRESCENT, OR 97733
R-2409-031BB-02500-000	R156011	STINSON WINSTON R & LAVONNE M	PO BOX 261	CRESCENT, OR 97733

Map Tax Lot	Prop ID	Owner Name	Address 1	City, State Zip
R-2409-030AB-00500-000	R152694	STUMBAUGH DOUGLAS E & BILLIE JEAN	P O BOX 209	CRESCENT, OR 97733
R-2409-030AC-00800-000	R153229	STUMBAUGH ELLWYN B & MARJORIE	P O BOX 209	CRESCENT, OR 97733-0209
R-2409-030CD-03200-000	R154745	THOMAS LINDA	P O BOX 291	CRESCENT, OR 97733
M-168037	M39069	THOMAS ROBERT L	PO BOX 98	CRESCENT, OR 97733
R-2409-030DB-11801-000	R717503	TOOMBS DENISE A	136735 5TH HILL	CRESCENT, OR 97733
M-0095-8	M877810	USDA FOREST SERVICE	P O BOX 208	CRESCENT, OR 97733
R-2409-030AC-03700-000	R152998	WALKER NEAL R & LESLIE C	PO BOX 108	CRESCENT, OR 97633
R-2409-030CD-00700-000	R154488	WIRTZ WILLIAM L & WIRTZ MARILYN H	PO BOX 19 567 BONNER LA	CRESCENT, OR 97733
P-000613	P892202	WOODSMAN COUNTRY LODGE & LARSON DOUGLA	P O BOX 186	CRESCENT, OR 97733
M-184027	M809110	WRIGHT VIRGINIA MARIE JANISCH LINDA K	PO BOX 116	CRESCENT, OR 97733
M-118952	M48816	WYLIE ALLEN & SANDS SANDRA	P O BOX 313	CRESCENT, OR 97733
R-2409-030AC-01100-000	R153256	YOUNG DWAYNE A TRUSTEE & YOUNG DWAYNE A	PO BOX 175	CRESCENT, OR 97733
R-2409-030DB-05700-000	R155334	YOUNG DWAYNE A TRUSTEE & YOUNG DWAYNE A	PO BOX 222	CRESCENT, OR 97733
P-084811	P28115	YOUNG'S CUT STOCK INC & YOUNG DWAYNE & KA	P O BOX 222	CRESCENT, OR 97733

EXHIBIT G

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Gravity Collection System
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.
Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$150,000.00	$150,000.00
2	18" PVC Sewer Main	L.F.	1,000	$70.00	$70,000.00
3	12" PVC Sewer Main	L.F.	3,000	$65.00	$195,000.00
4	10" PVC Sewer Main	L.F.	5,000	$60.00	$300,000.00
5	8" PVC Sewer Main	L.F.	26,000	$55.00	$1,430,000.00
6	6" PVC Sewer Laterals	L.F.	11,000	$45.00	$495,000.00
7	Service Connections	EA.	288	$1,500.00	$432,000.00
8	Standard 48" Manholes	EA.	90	$3,000.00	$270,000.00
9	Cleanouts	EA.	10	$500.00	$5,000.00
10	Highway Boring (18" sewer)	L.F.	100	$500.00	$50,000.00
11	Highway Boring (8" sewer)	L.F.	250	$350.00	$87,500.00
12	Gravel Surface Replacement	C.Y.	500	$40.00	$20,000.00
13	Asphalt Surface Replacement	TON	300	$140.00	$42,000.00
14	Concrete Surface Replacement	S.Y.	1,500	$30.00	$45,000.00
15	**Total Construction Costs**				**$3,591,500.00**
16	Construction Contingency at 10%				$359,150.00
17	Engineering and Construction Inspection at 15%				$538,725.00
18	Legal and Administrative Fees				$15,000.00
19	Permits				$5,000.00
20	Cultural Resources Site Study				$15,000.00
21	Environmental Site Study				$30,000.00
22	Interim Financing				$15,000.00
23	A133 Audit				$15,000.00
24	**Total Estimated Project Costs**				**$4,584,375.00**

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Effluent Collection System
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.
Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$150,000.00	$150,000.00
2	10" PVC Sewer Main	L.F.	1,000	$60.00	$60,000.00
3	8" PVC Sewer Main	L.F.	3,000	$55.00	$165,000.00
4	6" PVC Sewer Main	L.F.	5,000	$45.00	$225,000.00
4	4" PVC Sewer Main	L.F.	26,000	$40.00	$1,040,000.00
5	4" PVC Sewer Laterals	L.F.	11,000	$40.00	$440,000.00
5	Service Connections	EA.	288	$1,500.00	$432,000.00
6	Standard 48" Manholes	EA.	2	$3,000.00	$6,000.00
6	Cleanouts	EA.	40	$500.00	$20,000.00
6	STEG Tank System	EA.	258	$3,500.00	$903,000.00
7	STEP Tank System	EA.	30	$5,500.00	$165,000.00
7	Highway Boring (10" sewer)	L.F.	100	$500.00	$50,000.00
8	Highway Boring (4" sewer)	L.F.	250	$350.00	$87,500.00
8	Gravel Surface Replacement	C.Y.	500	$40.00	$20,000.00
9	Asphalt Surface Replacement	TON	300	$140.00	$42,000.00
9	Concrete Surface Replacement	S.Y.	1,500	$30.00	$45,000.00
10	**Total Construction Costs**				**$3,850,500.00**
10	Construction Contingency at 10%				$385,050.00
11	Engineering and Construction Inspection at 15%				$577,575.00
11	Legal and Administrative Fees				$15,000.00
12	Permits				$5,000.00
12	Cultural Resources Site Study				$15,000.00
13	Environmental Site Study				$30,000.00
13	Interim Financing				$35,000.00
14	A133 Audit				$15,000.00
14	**Total Estimated Project Costs**				**$4,928,125.00**

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Pressure Collection System
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.
Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$150,000.00	$150,000.00
2	6" PVC Pressure Main	L.F.	4,000	$50.00	$200,000.00
3	4" PVC Pressure Main	L.F.	31,000	$40.00	$1,240,000.00
4	4" PVC Pressure Laterals	L.F.	11,000	$40.00	$440,000.00
5	Service Connections	EA.	288	$1,500.00	$432,000.00
6	Standard 48" Manholes	EA.	2	$3,000.00	$6,000.00
7	Cleanouts	EA.	40	$500.00	$20,000.00
8	Pressure Vault System	EA.	288	$3,500.00	$1,008,000.00
9	Highway Boring (6" line)	L.F.	100	$400.00	$40,000.00
10	Highway Boring (4" sewer)	L.F.	250	$350.00	$87,500.00
11	Gravel Surface Replacement	C.Y.	500	$40.00	$20,000.00
12	Asphalt Surface Replacement	TON	300	$140.00	$42,000.00
13	Concrete Surface Replacement	S.Y.	1,500	$30.00	$45,000.00
14	**Total Construction Costs**				**$3,730,500.00**
15	Construction Contingency at 10%				$373,050.00
16	Engineering and Construction Inspection at 15%				$559,575.00
17	Legal and Administrative Fees				$15,000.00
18	Permits				$5,000.00
19	Cultural Resources Site Study				$15,000.00
20	Environmental Site Study				$30,000.00
21	Interim Financing				$35,000.00
22	A133 Audit				$15,000.00
23	**Total Estimated Project Costs**				**$4,778,125.00**

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Vacuum Collection System
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.
Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$150,000.00	$150,000.00
2	6" PVC Pressure Main	L.F.	4,000	$50.00	$200,000.00
3	4" PVC Pressure Main	L.F.	31,000	$40.00	$1,240,000.00
4	4" PVC Pressure Laterals	L.F.	11,000	$40.00	$440,000.00
5	Service Connections	EA.	288	$1,500.00	$432,000.00
6	Standard 48" Manholes	EA.	2	$3,000.00	$6,000.00
7	Cleanouts	EA.	40	$500.00	$20,000.00
8	Vacuum Vault System	EA.	288	$3,000.00	$864,000.00
	Vacuum Equipment Building	L.S.	1	$425,000.00	$425,000.00
9	Highway Boring (6" line)	L.F.	100	$400.00	$40,000.00
10	Highway Boring (4" sewer)	L.F.	250	$350.00	$87,500.00
11	Gravel Surface Replacement	C.Y.	500	$40.00	$20,000.00
12	Asphalt Surface Replacement	TON	300	$140.00	$42,000.00
13	Concrete Surface Replacement	S.Y.	1,500	$30.00	$45,000.00
14	**Total Construction Costs**				**$4,011,500.00**
15	Construction Contingency at 10%				$401,150.00
16	Engineering and Construction Inspection at 15%				$601,725.00
17	Legal and Administrative Fees				$15,000.00
18	Permits				$5,000.00
19	Cultural Resources Site Study				$15,000.00
20	Environmental Site Study				$30,000.00
21	Interim Financing				$35,000.00
22	A133 Audit				$15,000.00
23	**Total Estimated Project Costs**				**$5,129,375.00**

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Facility
Facultative Ponds
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.

Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$150,000.00	$150,000.00
2	Dike Construction	C.Y.	120,000	$7.25	$870,000.00
3	60 Mil HDPE Liner	S.F.	1,000,000	$0.75	$750,000.00
4	Dike Rip-Rap	C.Y.	8,000	$10.00	$80,000.00
5	3/4"-0" Tops of Dike and Access Roads	C.Y.	4,000	$25.00	$100,000.00
6	Bank Seeding Dike Slopes	acre	5	$1,500.00	$7,500.00
7	Chlorine Contact Chamber & Equipment	L.S.	1	$100,000.00	$100,000.00
8	Site Pump Stations	EA.	2	$20,000.00	$40,000.00
9	Inlet and Outlet Structures	EA.	5	$8,000.00	$40,000.00
10	Structure Piping	L.S.	1	$50,000.00	$50,000.00
11	Flow Meters	EA.	2	$10,000.00	$20,000.00
12	Site Piping	L.S.	1	$30,000.00	$30,000.00
13	Dike Fencing	L.F.	7,000	$15.00	$105,000.00
14	Site Building	L.S.	1	$45,000.00	$45,000.00
15	Lab / Office Equipment	L.S.	1	$15,000.00	$15,000.00
16	Power To Site	L.S.	1	$30,000.00	$30,000.00
17	Force Main Line	L.F.	10,500	$35.00	$367,500.00
18	Water Service to Site	L.F.	1,000	$20.00	$20,000.00
19	Transfer Pump Station	EA.	1	$135,000.00	$135,000.00
20	Irrigation Equipment and Piping	L.S.	1	$150,000.00	$150,000.00
21	Telemetry and Controls	L.S.	1	$45,000.00	$45,000.00
22	Monitoring Wells	EA.	4	$4,000.00	$16,000.00
23	Erosion Control	L.S.	1	$40,000.00	$40,000.00
24	Gas Line Crossing	EA.	1	$25,000.00	$25,000.00
25	**Total Construction Costs**				**$3,231,000.00**
26	Construction Contingency at 10%				$323,100.00
27	Engineering Design and Inspection at 15%				$484,650.00
28	Contract Management Administration				$80,775.00
29	Legal and Administrative Fees				$30,000.00
30	WPCF and Reclaimed Water Permits				$15,000.00
31	Land Acquisition (Estimated) 160 ACRES				$250,000.00
32	Geotechnical Study				$15,000.00
33	Groundwater Study				$15,000.00
34	Cultural Resources Site Study				$10,000.00
35	Environmental Site Study				$30,000.00
36	Interim Financing				$15,000.00
37	A133 Audit				$15,000.00
38	**Total Estimated Project Costs**				**$4,514,525.00**

Engineers Opinion of Probable Costs
Crescent Sanitary District
Waste Water Treatment Package Plant
Klamath County, Oregon

Anderson Engineering & Surveying, Inc.
Lakeview OR

ITEM	DESCRIPTION	UNIT	QUANTITY	COST/UNIT	TOTAL COST
1	Mobilization/Demobilization	L.S.	1	$150,000.00	$150,000.00
2	120,000 gal. Package Treatment System	EA.	1	$500,000.00	$500,000.00
3	40,000 gal. Flow Equalization System	EA.	1	$150,000.00	$150,000.00
4	Integral Sludge Digester	EA.	1	$75,000.00	$75,000.00
5	90,000 gpd Rapid Sand Tertiary Filter	EA.	2	$150,000.00	$300,000.00
6	Dike Rip-Rap	C.Y.	4,000	$10.00	$40,000.00
7	Storage Pond Construction	C.Y.	60,000	$7.25	$435,000.00
8	60 Mil HDPE Liner	S.F.	500,000	$0.75	$375,000.00
9	3/4"-0" Tops of Dike and Access Roads	C.Y.	3,000	$20.00	$60,000.00
10	Bank Seeding Dike Slopes	acre	2	$1,500.00	$3,000.00
11	Site Pump Station	EA.	2	$20,000.00	$40,000.00
12	Inlet and Outlet Structures	EA.	2	$8,000.00	$16,000.00
13	Flow Meters	EA.	2	$10,000.00	$20,000.00
14	Site Piping	L.S.	1	$30,000.00	$30,000.00
15	Dike Fencing	L.F.	4,000	$15.00	$60,000.00
16	Site Building	L.S.	1	$45,000.00	$45,000.00
17	Lab Office Equipment	L.S.	1	$15,000.00	$15,000.00
18	Power To Site	L.S.	1	$30,000.00	$30,000.00
19	Force Main	L.F.	10,500	$35.00	$367,500.00
20	Water Service to Site	L.F.	1,000	$20.00	$20,000.00
21	Transfer Pump Station	EA.	1	$135,000.00	$135,000.00
22	Irrigation Equipment and Piping	L.S.	1	$150,000.00	$150,000.00
23	Telemetry and Controls	L.S.	1	$45,000.00	$45,000.00
24	Monitoring Wells	EA.	4	$4,000.00	$16,000.00
25	Erosion Control	L.S.	1	$40,000.00	$40,000.00
26	Gas Line Crossing	EA.	1	$25,000.00	$25,000.00
27	**Total Construction Costs**				**$3,142,500.00**
28	Construction Contingency at 10%				$314,250.00
29	Engineering Design and Inspection at 15%				$471,375.00
30	Contract Management Administration				$78,562.50
31	Legal and Administrative Fees				$25,000.00
32	WPCF and Reclaimed Water Permits				$15,000.00
33	Land Acquisition (Estimated) 160 ACRES				$250,000.00
34	Geotechnical Study				$15,000.00
35	Groundwater Study				$15,000.00
36	Cultural Resources Site Study				$10,000.00
37	Environmental Site Study				$30,000.00
38	Interim Financing				$15,000.00
39	A133 Audit				$15,000.00
40	**Total Estimated Project Costs**				**$4,396,687.50**

COST COMPARISON
Crescent Sanitary District

Gravity Collection-Facultative Ponds CSD Only

Option #1 Serve Sanitary District Only		
Assumes 75% Grant/Loan Forgiveness		
Estimated Cost of Project	$2,284,725	
Yearly Payment over 30 years at 3.875%	$130,127.93	
Operational Costs per year	$146,094.50	
Repair Fund Contribution (10% of Debt Service)	$13,012.79	
Total Yearly Cost		$289,235.22
Number of EDU's	288	
Cost per year per Unit		$1,004.29
Cost per Month per Unit		**$83.69**

COST COMPARISON
Crescent Sanitary District

Gravity Collection-Facultative Ponds CSD and Gilchrist

Option #2 Serve Sanitary District Only		
Assumes 75% Grant/Loan Forgiveness		
Estimated Cost of Project	$2,409,725.00	
Yearly Payment over 30 years at 3.875%	$137,247.38	
Operational Costs per year	$146,094.50	
Repair Fund Contribution (10% of Debt Service)	$13,724.74	
Total Yearly Cost		$297,066.62
Number of EDU's	438	
Cost per year per Unit		$678.23
Cost per Month per Unit		**$56.52**

COST COMPARISON
Crescent Sanitary District

Gravity Collection-Facultative Ponds CSD and West Crescent

Option #3 Serve Sanitary District Only		
Assumes 75% Grant/Loan Forgiveness		
Estimated Cost of Project	$2,534,725	
Yearly Payment over 30 years at 3.875%	$144,366.83	
Operational Costs per year	$146,094.50	
Repair Fund Contribution (10% of Debt Service)	$14,436.68	
Total Yearly Cost		$304,898.02
Number of EDU's	388	
Cost per year per Unit		$785.82
Cost per Month per Unit		**$65.48**

COST COMPARISON
Crescent Sanitary District

Gravity Collection-Facultative Ponds All Communities

Option #4 Serve Sanitary District Only		
Assumes 75% Grant/Loan Forgiveness		
Estimated Cost of Project	$2,659,725	
Yearly Payment over 30 years at 3.875%	$151,486.29	
Operational Costs per year	$146,094.50	
Repair Fund Contribution (10% of Debt Service)	$15,148.63	
Total Yearly Cost		$312,729.42
Number of EDU's	538	
Cost per year per Unit		$581.28
Cost per Month per Unit		**$48.44**

EXHIBIT H

FORM LB-1 NOTICE OF BUDGET HEARING

A public meeting of the Crescent Sanitary District will be held on June 11, 2014, at 5:00 p.m. at Crescent Community Center in Crescent, Oregon. The purpose of this meeting is to discuss the budget for the fiscal year beginning July 1, 2014, as approved by the Crescent Sanitary District Budget Committee. A summary of the budget is presented below. A copy of the budget may be inspected or obtained at the Crescent Post Office, 136728 Main Street, Crescent, Oregon, between the hours of 10:00 a.m. and 3:00 p.m. This budget is for an annual budget period. This budget was prepared on a basis of accounting that is the same as the preceding year.

Contact: Cher Dolan Telephone: 541-480-3040 Email:

FINANCIAL SUMMARY - RESOURCES			
TOTAL OF ALL FUNDS	Actual Amount 2012-2013	Adopted Budget This Year 2013-2014	Approved Budget Next Year 2014-2015
Beginning Fund Balance/Net Working Capital	74,177	74,200	103,219
Fees, Licenses, Permits, Fines, Assessments & Other Service Charges	0	7,000,000	0
Federal, State and all Other Grants, Gifts, Allocations and Donations	0	0	935,000
Interfund Transfers / Internal Service Reimbursements	0	100,000	0
All Other Resources Except Current Year Property Taxes	0	2,401,500	824
Current Year Property Taxes Estimated to be Received	15,299	11,000	16,000
Total Resources	**89,476**	**9,586,700**	**1,055,043**

FINANCIAL SUMMARY - REQUIREMENTS BY OBJECT CLASSIFICATION			
Materials and Services	20,171	137,900	685,300
Capital Outlay	0	200,000	0
Interfund Transfers	0	100,000	0
Contingencies	0	807,000	0
Unappropriated Ending Balance and Reserved for Future Expenditure	69,305	8,341,800	369,743
Total Requirements	**89,476**	**9,586,700**	**1,055,043**

FINANCIAL SUMMARY - REQUIREMENTS AND FULL-TIME EQUIVALENT EMPLOYEES (FTE) BY ORGANIZATIONAL UNIT OR PROGRAM *			
Name of Organizational Unit or Program **FTE** for that unit or program			
Not Allocated to Organizational Unit or Program	89,476	9,586,700	1,055,043
FTE			
Total Requirements	**89,476**	**9,586,700**	**1,055,043**
Total FTE			

PROPERTY TAX LEVIES			
	Rate or Amount Imposed 2012-2013	Rate or Amount Imposed This Year 2013-2014	Rate or Amount Approved Next Year 2014-2015
Permanent Rate Levy (rate limit 1.0321 per $1,000)	1.0321	1.0321	1.0321
Local Option Levy			
Levy For General Obligation Bonds			

***** If more space is needed to complete any section of this form, insert lines (rows) on this sheet. You may delete blank lines.

150-504-073-2 (Rev. 02-14)