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Section 1 – Introduction

1.1 General.

Wastewater disposal is still the major concern as stated in the 1999 Wastewater Facilities Plan Update. The use of septic tanks continues and the concern with resulting groundwater contamination has not been abated.

1.2 Scope of Study.

The 1999 study is being evaluated for current regulatory standards, technology for collection, treatment and disposal of wastewater, population trends and present construction costs. The focus of this update is for the Crescent Sanitary District. Gilchrist and Westside Crescent are not a current focus of this update although the general population and estimated sewage flows from these two areas appear to be valid for general planning purposes if these areas are eventually included in wastewater facilities serving the Crescent Sanitary District.

1.3 Authorization.

Angle Consulting Engineering, LLC has been retained by the Crescent Sanitary District to prepare the facilities plan update.

1.4 Funding.

Funding for this update is provided by the Crescent Sanitary District.

SECTION 1
INTRODUCTION

1.1 GENERAL

The unincorporated area of Crescent is located 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. Drainage through the area is generally from south to north and towards the Little Deschutes River. A vicinity map is included as Figure 1-1. District boundaries are shown on Figure 1-2.

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 LaPine (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 LaPine Sanitary District has installed a public wastewater system.

1.2 SCOPE OF STUDY

The 1983 wastewater facilities plan will be updated to reflect present regulatory standards, current technology for collection, treatment, and disposal of wastewater, population and zoning changes, and today's costs.

1.3 AUTHORIZATION

Adkins Consulting Engineers, Inc. was retained by the Crescent Sanitary District to prepare the Crescent Sanitary District facilities plan update. HGE Inc., Architects, Engineers, Surveyors & Planners was hired as a subconsultant by Adkins Consulting Engineers, Inc.

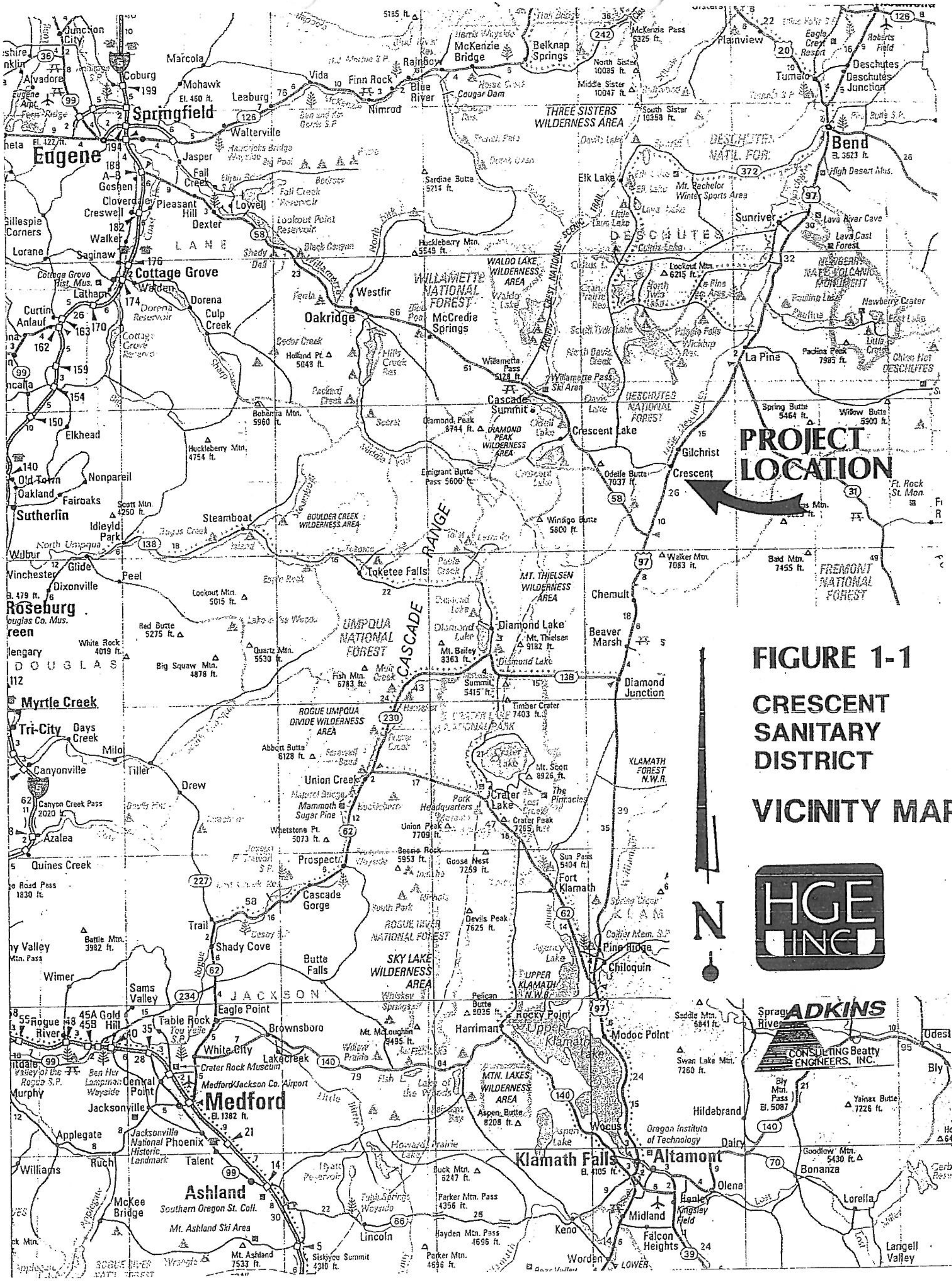

FIGURE 1-1

CRESCENT SANITARY DISTRICT

VICINITY MAP

1.4 FUNDING

Funding for the project was provided primarily through a South Central Oregon Regional Strategies Program, Rural Investment Fund Grant. Local match was provided by the Crescent Sanitary District.

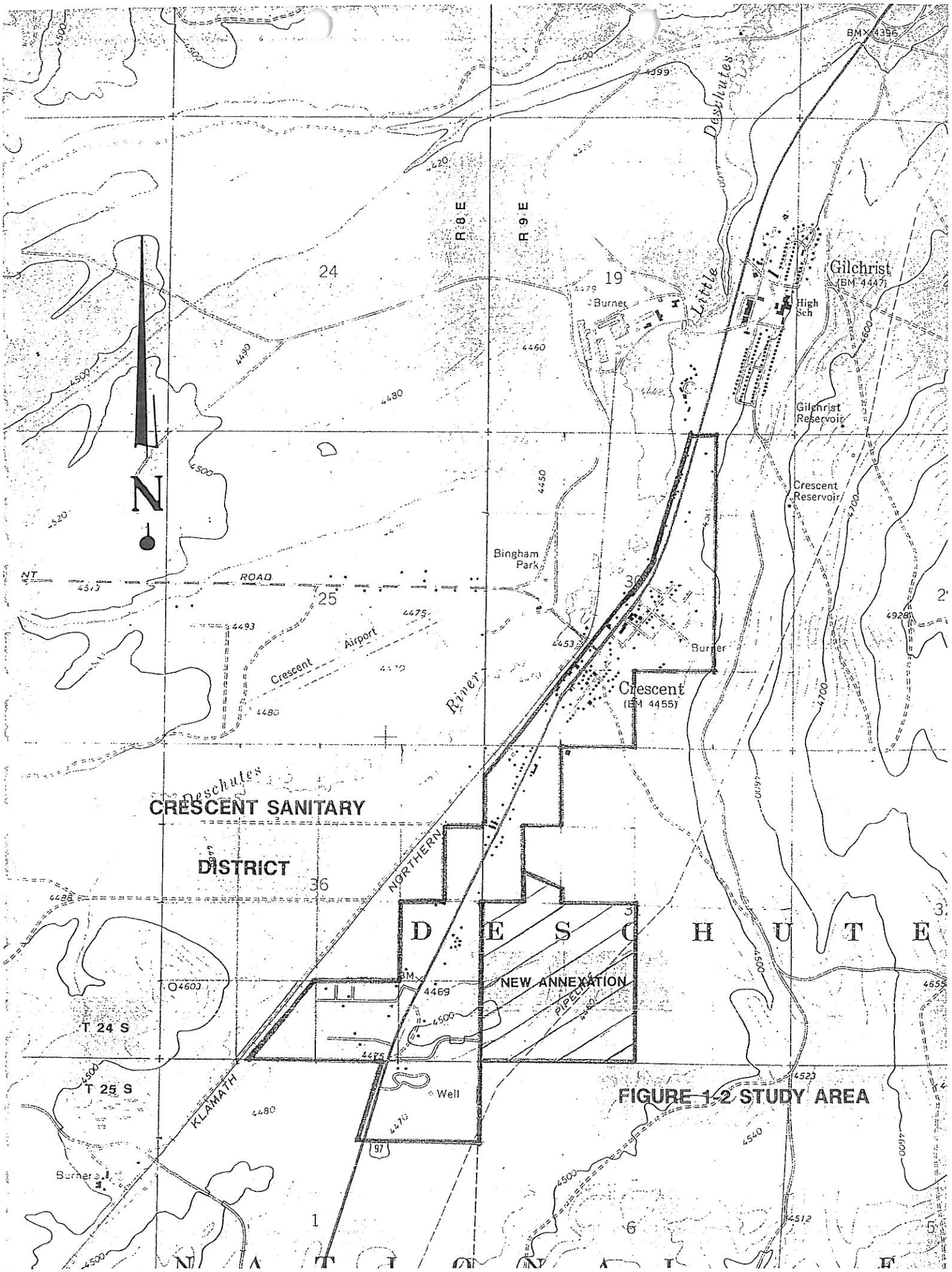

FIGURE 1-2 STUDY AREA

Section 2 – Summary

Updates to this section will address: 1) current population predictions and equivalent dwelling units (EDUs), 2) wastewater characteristics, 3) preliminary options, 4) revised regionalization and staging of improvements options, 5) preliminary screening for the wastewater system components, 6) collection system recommendations, 7) effluent disposal options, 8) tables to compare combined collection, treatment and disposal options, 9) recommended option, 10) details of the recommended option, 11) financing and 12) implementation schedule.

2.1 Planning Area.

The planning area for this wastewater facilities plan update is for the Crescent Sanitary District. Westside Crescent and Gilchrist are not updated and the information from the 1999 update is used to provide a conceptual level of planning data for purposes of land requirements.

Development of several land parcels could impact the ultimate buildout capacity of the Crescent wastewater facilities. As identified in the 1999 update there is a 155 acre parcel with no existing dwellings and another 142 acre parcel also without dwellings. When these parcels develop and are eventually served by the District it is expected they will pay their fair share of system capacity through connection fees and system development charges. 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 and future developments are expected to pay for the growth as explained above with connection fees and systems development charges.

SECTION 2
SUMMARY

2.1 PLANNING AREA

The planning area for this wastewater facilities plan update includes the Crescent Sanitary District, westside Crescent (currently outside sanitary district boundary, but inside the water district boundary), and Gilchrist. There is also approximately 140 acres of land adjacent to the district that the owner is in the process of annexing into the district. The additional wastewater needs of this potential development have not been specifically evaluated; since the development is in the preliminary stages and there are no existing dwellings it is assumed that new development will pay for their fair share of system capacity through connection fees and system development charges. New development would also pay the cost of extending collection system main lines to serve the development.

2.2 EXISTING SYSTEM

Crescent does not have a municipal wastewater system. Treatment and effluent disposal is provided with onsite septic tanks and drainfields.

Gilchrist has a community wastewater system which is privately owned. Approximately 150 equivalent dwelling units, and an estimated residential population of 210 people, are served. The collection system consists of approximately 15,400 feet of main line with pipe diameters larger than 4 inches, including 11,400 feet of 6-inch diameter, and 5,000 feet of 8-inch diameter pipe. There is one pump station, which pumps wastewater collected from several dwellings in a low lying area, through approximately 1,150 feet of 4-inch pressure main into the collection system. Most of the collection system was constructed prior to 1970, when wastewater was treated in two large septic tanks. In the early 1970's, the septic tanks were replaced with a 3-cell, facultative lagoon. Wastewater gravity flows from the collection system through an 8-inch diameter main into the ponds. The lagoon has a total surface area of 3.45 acres, and is relatively shallow, with a design water depth of 3.5 feet. Based on surface area and general design standards for organic loadings, it appears the lagoon was designed for a maximum treatment capacity of 550 people. Currently, the number of customers served (when the school and commercial customers are considered) is probably in the range of 50 percent of the design capacity. Effluent from the ponds is discharged to a subsurface drainfield located near the Little Deschutes River (Figure 3-2).

2.3 GROUNDWATER QUALITY

Groundwater nitrate sampling was conducted. A copy of the report is included in the Appendix A. Concentrations in shallow groundwater range between non-detectable to 13 mg/l. Figure 2-1 shows sample locations, measured concentrations, and projected contours of concentration. Highest concentrations were found in the higher elevation, east-central portion of Crescent. Lower concentrations were generally found to the west and south.

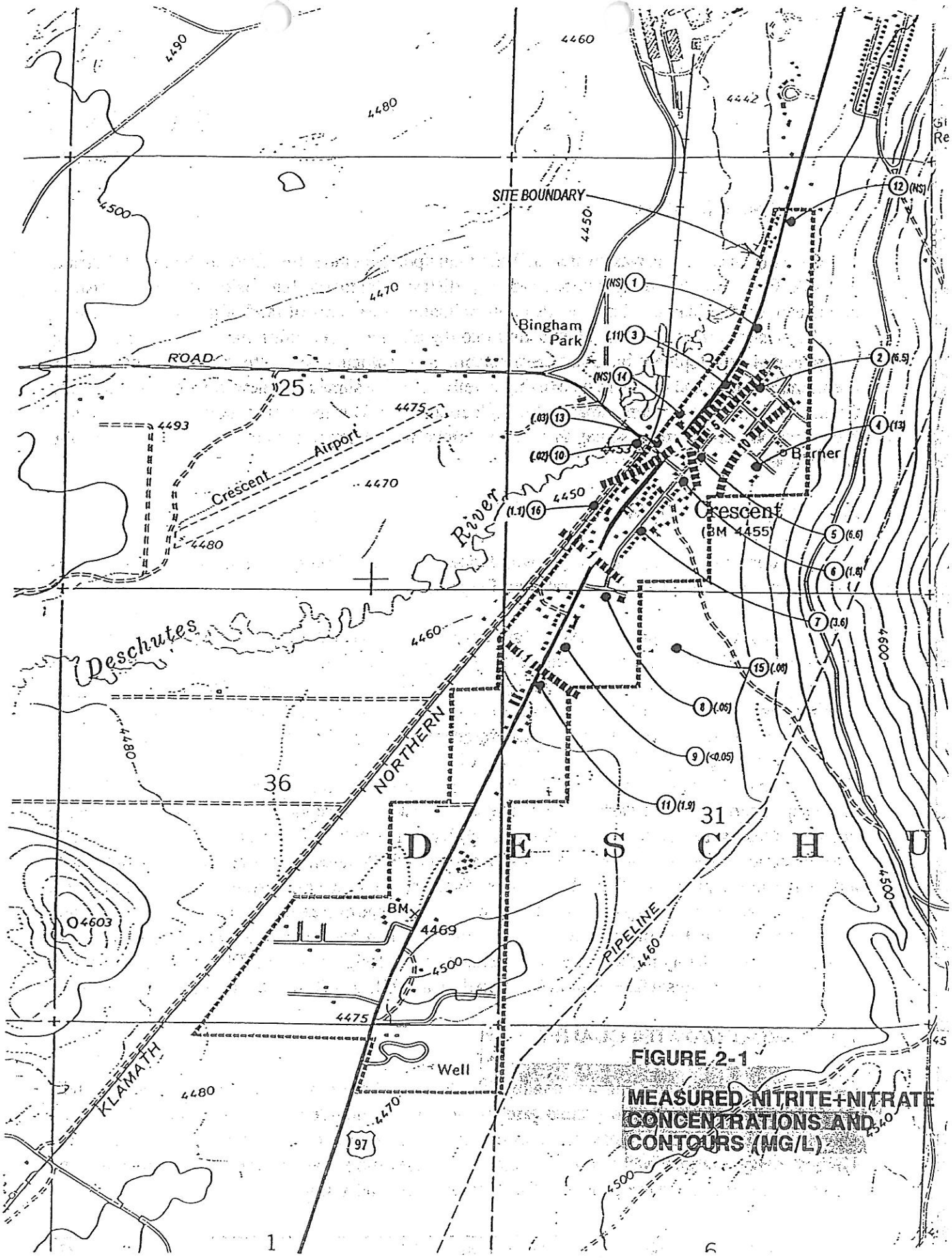

FIGURE 2-1

MEASURED NITRITE+NITRATE CONCENTRATIONS AND CONTOURS (MG/L)

Crescent Core Area

Parameter	Current	25-Year
Population	200	426
EDUs	140	295
ADF (gpd) MMF (gpd) PDF (gpd) PIF (gpd)	34,200 61,500 95,600 123,000	71,500 128,700 200,300 257,500
Average BOD_5 (ppd)	75	165

Westside Crescent

Parameter	Current	25-Year
Population	254	531
EDUs	100	209
ADF (gpd) MMF (gpd) PDF (gpd) PIF (gpd)	33,500 60,300 93,900 120,700	70,200 126,400 196,600 252,700
Average BOD_5 (ppd)	40	85

Table 2.3 Projected Flows for Gilchrist (all flows in gallons per day)

Parameter	Current	25-Year
Population	210	439
EDUs	150	304
ADF (gpd) MMF (gpd) PDF (gpd) PIF (gpd)	21,000 37,800 58,800 75,600	44,000 79,100 123,100 158,300
Average BOD_5 (ppd)	45	95

Average Daily Flow (ADF): Total wastewater flow for one year, divided by the number of days in that year.

Maximum Monthly Flow (MMF): Total wastewater flow for the month with the highest wastewater flow during the year, divided by the number of days in that month.

Peak Daily Flow (PDF): Total flow for the day with the highest wastewater flow during the year.

Peak Hourly Flow (PHF): A diurnal peak sustained for one hour during the year. May also be called Peak Instantaneous Flow (PIF)

BOD_5: Five day biological oxygen demand.

TSS: Total suspended solids.

Nitrate concentrations exceed the maximum of contaminant level (MCL) of 10 mg/l set by EPA for safe drinking water, and exceed the level of 5 mg/l generally used as a guideline for concern by Oregon's Health Division. Nitrate cumulates over time, and even if the nitrate concentrations closer to the Little Deschutes River are now lower due to more dilution, nitrate concentrations are likely to increase in the future as concentrations continue to build up.

Wells are the sole source of drinking water in Crescent and Gilchrist, and it is important to protect the groundwater resource. Nitrate concentrations are currently in excess of the level necessary to document a potential health threat created by the existing practice of using septic tanks and drainfields for wastewater disposal.

2.4 POPULATION AND EDU SUMMARY

Population and equivalent dwelling units (EDUs) are summarized in Table 2-1. For planning purpose, the annual rate of increase in population has been assumed to be 3 percent, based on historical growth of incorporated rural areas in Klamath County. The three critical time periods used for evaluating wastewater system needs are: current, 25 years, and ultimate buildout (UBO).

Table 2.1 Summary of Population and EDU Projections

Description	Crescent Sanitary District	Westside Crescent	Other	Gilchrist	Total
Current Population	535	254	0	210	999
25-Year Population	1121	532	0	439	2092
UBO Population	4132	3,956	0	983	9071
Current EDUs	288	100	----	150	538
25-Year EDUs	603	209	----	314	1126
UBO EDUs	2454	1,557	592	1,090	5693

2.5 WASTEWATER CHARACTERISTICS

Current and projected influent flows and design loadings are summarized in Tables 2-2 and 2-3. Wet-weather and dry-weather parameters are identical.

Table 2.2 Current and Projected Flow Rates and Loading for Crescent, Core Area and Westside

Crescent Sanitary District **(all flows in gpd)**

Parameter	Current	25-Year
Population	535	1,121
EDUs	288	603
ADF (gpd)	70,400	147,400
MMF (gpd)	126,700	265,400
PDF (gpd)	197,100	412,800
PIF (gpd)	253,500	530,700
Average BOD_5 (ppd)	120	250

2.6 PRELIMINARY OPTIONS

Continued usage of onsite 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 drainfields will lead to increased nitrate concentrations in the groundwater.

Preliminary options considered included:

A) Collection system
   1) Conventional gravity
   2) Septic tank effluent pumping (STEP)/Septic tank effluent gravity (STEG)
   3) Vacuum

B) Pretreatment - Septic tanks

C) Biosolids disposal
   1) Land application
   2) Transport to existing regional treatment plant

D) Effluent disposal
   1) Summer irrigation and winter holding
   2) Summer irrigation and winter discharge to Little Deschutes River
   3) Summer irrigation and drainfield

E) Centralized treatment
   1) Facultative lagoon
   2) Aerated lagoon
   3) Mechanical treatment
      a) Trickling filter
      b) Rotating biological contactor (RBC)
      c) Activated sludge
      d) Oxidation ditch
      e) Sequencing batch reactor (SBR)

2.7 REGIONALIZATION AND STAGING OF IMPROVEMENTS

Two major divisions of planning were considered: 1) independent systems for Gilchrist and Crescent and 2) regional system serving both Gilchrist and Crescent. Potential staging was also evaluated, where the core area of Crescent would be served initially, and service would be provided to the remainder of the sanitary district as a second stage in the future. An outline of the options evaluated for staging and/or regionalization follows:

I. Independent systems for Gilchrist and Crescent

IA. Crescent
IA.1 Provide service to entire district initially
IA.2 Provide service to core area initially and phase in rest of district

IB. Gilchrist - Improvements required dependent on results of future groundwater study
IB.1 No adverse impact - continued use of drainfield
IB.2 Adverse impact - develop storage and irrigation system

II Regional system

IIA. Initially construct system to serve Gilchrist and entire sanitary district

IIB. Phased construction to serve Gilchrist and core area of district initially, phase in rest of district later

2.8 PRELIMINARY SCREENING

Collection System

There are no existing vacuum systems in Oregon, but this method of collection has been attracting recent interest since new manufacturing techniques have resulted in more dependable systems. 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.

Soils in Crescent should be relatively easy to dig pipe line trenches in, consisting of pumice soil 6 to7 feet deep, overlaying an impervious layer of soil (believed to be remains of a former marsh). There is also enough slope in the topography to generally gravity flow wastewater to a central location for pumping. From a construction standpoint there is no major advantage to a vacuum system, and from an operations and maintenance standpoint there are disadvantages, since staffing will be limited for the relatively small service area. Therefore, vacuum systems were eliminated from further consideration.

Pretreatment - Septic tanks

Septic tanks are included in the detailed evaluation, since they are a necessary part of a STEP or STEG collection system.

Biosolids Disposal

The method of biosolids disposal is dependent on the collection and treatment method. If septic tanks are included in the process, the septic tanks must be pumped periodically and the solids

trucked away for disposal, likely to an existing wastewater treatment facility in the area that will accept septage. The septage is treated further at the treatment facility, and then generally disposed of at a land application site. land applied?

Biosolids remaining from secondary treatment (whether a lagoon or mechanical system), will most likely be disposed of on land. This process is considered a beneficial usage, since the biosolids act as a fertilizer. Lagoons are cleaned out as infrequently as once every 20 years. Mechanical plants generally have limited biosolids storage, and hauling requirements (and hauling frequency) are an important design consideration.

Both land application and disposal at an existing treatment facility were evaluated as principal alternatives. Disposal at a landfill was not considered, since there are many sites in the area where the biosolids could be applied to land at less cost.

Effluent Disposal

With today's stringent water quality standards, the method of effluent disposal generally has the greatest single influence on cost and the selection of the treatment process for new systems.

The Little Deschutes River has been designated as wild and scenic. This makes a new wastewater discharge into river highly unlikely. Even if a discharge was permitted, minimum criteria in the Deschutes Basin require that the monthly average concentrations not exceed 5 mg/l of BOD_5 and TSS. This is very stringent treatment, and would require advanced or tertiary treatment, at a relatively high capital cost plus additional operation and maintenance. For these reasons, discharge of treated effluent into the Little Deschutes River was screened at the preliminary stages of planning.

Nitrogen occurs as several different compounds in wastewater, including ammonia, nitrites, and nitrates. The concentrations of the different compounds can shift back and forth, depending on conditions. Nitrogen is very difficult to remove from wastewater. This is mother natures way of helping to insure that a natural cycle is completed with waste serving as fertilizer, and the nitrogen ultimately being released back into the atmosphere as nitrogen gas. Excessive concentrations of nitrates in drinking water have been found to cause birth defects in babies and health problems in adults. After a groundwater aquifer has been contaminated with nitrates, it can take years after the source of contamination is removed before concentrations drop back down to levels safe for human consumption.

Groundwater protection regulations have become quite stringent, in order to protect sources of safe drinking water. Essentially, the requirement for wastewater is that wastewater percolating into the ground can not change the background quality of the groundwater. Septic tank drainfields in rural settings generally do not have a measurable impact on groundwater quality, when the soils conditions are right. However, when drainfields are used in an urban setting, the relatively dense usage of onsite systems can have a significant impact on groundwater quality, as has been documented for Crescent.

Collecting the wastewater for a community and then disposing of it to a central drainfield does not necessarily fix the problem, and in fact can worsen it since the wastewater is being disposed of in a smaller area. In rare instances, variances are granted by DEQ to the groundwater protection regulations, if it can be documented that the nitrate concentrations are diluted and dissipate to safe levels by the time the groundwater migrates to locations where the groundwater is diverted for beneficial uses, such as drinking water. Receiving a variance generally requires very expensive groundwater studies to provide supporting documentation, and also generally requires adding sophisticated secondary or tertiary treatment processes to lower nitrate concentrations in the wastewater effluent prior to discharge.

Since field studies indicate that the high density of onsite systems in Crescent is causing nitrate contamination of the groundwater, and that disposal in a community drainfield will not likely solve the problem, the use of a drainfield for effluent disposal was eliminated from further consideration as part of the preliminary screen process. If subsequent agency reviews indicate that a variance to groundwater regulations might be granted without extensive groundwater testing and expensive treatment methods, then this option should be evaluated further in the future due to potential cost savings.

Crops can only be irrigated during months when the crop can utilize the effluent (when temperatures are warm enough, and soils conditions are dry enough). At other times, the wastewater effluent has to be stored in a holding pond.

Summer-time irrigation with winter-time holding was selected as the principal alternative for effluent disposal.

Centralized Treatment

The advantage of mechanical types of secondary treatment over lagoons are that a higher degree of treatment can generally be achieved and less land area is required. The primary disadvantage is that more operation and maintenance is needed.

In Crescent's case, a high degree of treatment is not required since the effluent will be used for land irrigation (not discharged to the Little Deschutes). Minimizing operation and maintenance requirements is important since the community will only be able to afford a minimum amount of operator time. Gilchrist already utilizes a 3-cell lagoon for treatment, so there is local experience with operation of this type of facility. Finally, a large holding pond will be required to store effluent during the non-irrigation season. When earthwork is being done for the holding pond, it would likely be most cost-effective to construct lagoons for treatment. For reasons discussed in this paragraph, mechanical types of secondary treatment were initially screened from further analysis. Facultative and aerated lagoons were evaluated in more detail.

2.9 COLLECTION SYSTEM RECOMMENDATIONS

Preliminary layouts and detailed opinions of probable cost were developed in Section 9 for both conventional gravity and a hybrid STEP/STEG collection system. Approximately 35,000 feet of main line would be needed to service all existing customers within the sanitary district.

Septic tanks are replaced at the time the collection system is installed with STEP/STEG systems. This insures consistent installation, age, and material standards for the tanks. Most of the sanitary district could be served by STEG (due to location, out of 288 customers about 10% would need to utilize septic tank pumping systems (STEP)). The tanks are installed on private property, but maintenance is the responsibility of the municipality, so permanent easements are required for each customer.

Pumping solids out of the tanks would be the District's responsibility. Finding locations that will accept the septage for disposal is becoming more difficult. Special care has to be taken during design and construction to minimize odor from the septic tanks, and to prevent odors from several tanks from venting through the neighbors plumbing.

A present-worth analysis was used to compare conventional gravity and STEP/STEG for wastewater collection. The costs are nearly the same, and are within the range of accuracy for cost estimating. Therefore, factors other than cost will determine the final selection of the collection system method. Most municipalities in the area use conventional systems, but a number of STEP/STEG systems exist, an example is the La Pine Sanitary District.

Due to the similarity in cost, the final selection of the type of collection system can be made during predesign. The preliminary opinion of probable cost for the collection system to serve all existing customers within the district boundary is $2.4 million. Serving the core area only has an opinion of probable cost of $1.2 million.

2.10 EFFLUENT DISPOSAL

Timber is initially the selected crop for irrigation. Acreage requirements for forest land are higher than alfalfa or pasture grass. However, irrigation of forest land is the preferred alternative for effluent disposal, since this appears to be the most common usage of land that may be available for irrigation.

Sunriver Utilities Company (SRUC) currently uses National Forest land for effluent disposal. The city of Sisters currently is in the process of designing an entirely new wastewater system, which also will incorporate the irrigation of forest land for effluent disposal. A detailed soils analysis was conducted for Sisters as part of the wastewater facilities planning process. The analysis included maximum hydraulic and nutrient loading rates for existing stands of Ponderosa-Lodgepole pine, and sage-bitter brush. The maximum loading rate was computed to be 425,000 gallons per acre per year (15.6 inches per acre per year). Although temperatures are colder and the growing season is shorter in Crescent than Sister, this loading rate was initially used for flow balance computations for Crescent's project. A more detailed soils analysis will be necessary during predesign to establish the irrigation rates used in design.

Effluent disposal is discussed in more detail in Section 10, and flow balance computations are included in the appendix.

2.11 COMBINED COLLECTION, TREATMENT, AND DISPOSAL OPTIONS

Six different combined options were evaluated in detail in Section 10. Opinions of probable cost, EDUs served, and anticipated monthly rates (with grants), are summarized in Table 2.4.

Table 2.4

Project	Opinion of Total Cost	Existing EDUs	Design EDUs	Monthly Rates
1. Crescent Sanitary District, Treatment & Disposal South of Crescent				
Collection System	$2,393,300			
Treatment, Storage & Disposal	$3,861,680			$50 to
Total	$6,254,980	288	603	$55
2. Core Area of Crescent First Phase, Treatment & Disposal South of Crescent				
Phase I Collection System	$1,170,000			
Treatment, Storage & Disposal	$2,933,000			$60 to
Subtotal	$4,103,000	140	295	$65
Phase II Collection System	$1,232,300			
Treatment, Storage & Disposal	$1,218,500			
Subtotal	$2,450,800	148	308	
Total	$6,553,800	288	603	
3. Gilchrist Alone, Add Holding & Irrigation				
Collection System	$ 0			
Treatment, Storage & Disposal	$1,830,750			$60 to
Total	$1,830,750	150	340	$70
4. Regional System, First Phase Crescent Core & Gilchrist Treatment & Disposal At Gilchrist				
Phase I Collection System	$1,170,000			
Treatment, Storage & Disposal	$2,847,120			$35 to
Purchase Gilchrist System	$ 750,000	290	635	$40
Subtotal	$4,767,120			
Phase II Collection System	$1,223,300			
Treatment, Storage & Disposal	$1,882,000	148	308	
Subtotal	$3,105,300			
		438	943	
Total	$7,872,505			

5. Regional System, Crescent and Gilchrist Treatment & Disposal At Gilchrist				
Collection System	$2,393,300			
Treatment, Storage & Disposal	$3,956,100			
Purchase Gilchrist System	$ 750,000	438	943	$40
Total	$7,099,400			
6. Regional System, Crescent and Gilchrist Treatment & Disposal At Gilchrist (Stage Treatment and Disposal)				
Phase I				
Collection System	$2,393,300	438	635	
Treatment, Storage & Disposal	$2,847,120			
Purchase Gilchrist System	$ 750,000			
Subtotal	$5,990,420			
Phase II				$35 to
Treatment, Storage & Disposal	$1,882,000	–	308	$40
Subtotal	$1,882,000			
Total	$7,872,420	438	943	

2.12 RECOMMENDED OPTION

A regional system that includes both Gilchrist and Crescent is recommended. There are not enough customers in Crescent alone to make the project affordable. Many of the costs are fixed for both construction and operation of a wastewater system. This is why large communities generally have lower water and sewer rates than small communities. The additional number of customers in Gilchrist helps to distribute the costs for capital improvements and system operation and maintenance.

When considering monthly rates and funding opportunities, it is important to recognize that most public works funding programs now consider monthly rates when determining grant awards. The community's rates (for loan repayment, operation and maintenance, and reserve accounts) must at least equal the state average, before the project becomes eligible for grant funding. This is the funding agencies method of insuring equity, i.e., that everybody is paying their fair share. The average is based on communities that recently completed a project (and also have low enough incomes to qualify for grant funding). The state average is now in the range of $35 to $37 a month. The minimum rates for the Crescent/Gilchrist project will need to be in this range in order to receive grant funding.

Monthly rates for Crescent to construct an independent system would be in the range of $50 to $55 a month, even assuming the best case scenario for grant funding. Staging the project to serve the core of Crescent first, actually increases the monthly cost per customer by approximately $10, since less customers are available to pay for the project.

Gilchrist's rates are currently $30 a month. The wastewater treated with the Gilchrist system currently discharges into a central drainfield. New regulations would no longer allow this effluent disposal method. Gilchrist's permit is currently expired. A condition of the permit renewal for Gilchrist is that groundwater monitoring be conducted to demonstrate that the drainfield is not elevating concentrations of nitrate in the groundwater above background levels. If it is determined that nitrate concentrations have been increased due to the drainfield, then the system will have to be upgraded to eliminate the discharge, which will require construction of a holding pond and irrigation system. Assuming the maximum expected grant funding is acquired, Gilchrist's rates would probably increase by at least $30 to $40 a month, resulting in a total monthly bill in excess of $60 or $70.

Funding agencies would require the average rate in Gilchrist to be in the range of $35 to $37 per month. This is approximately the same monthly rate expected if Gilchrist were to joint into a regional system with Crescent. Therefore, there is a significant financial advantage to Gilchrist customers of participating in a regional system, if Gilchrist's system needs to be upgraded anyway to meet current treatment standards.

The Gilchrist system is privately owned. The owners have indicated they would sell the Gilchrist collection system, treatment facilities, and approximately 40 acres of land (with the treatment facilities) for $750,000. This value has been used for rate computations. Some of the funding agencies can not fund the purchase of a private system; it appears that purchase is eligible for funding through both the Oregon Economic Development Department and DEQ's state revolving loan programs, based on personal communication with staff members. Preliminary conversations with the funding agencies indicate that if the purchase is an eligible activity, they can only fund the appraised value of the system. An appraisal would need to be conducted by a qualified professional(s) to determine the depreciated (salvage) value of the system.

The funding agencies have also indicated that Gilchrist would have to be annexed into the Crescent Sanitary District, since the sanitary district would be the applicant for funding.

Preliminary meetings with the Crescent Sanitary District board members indicate that the sanitary district is interested in serving all customers within the district service boundary initially, rather than just serving the core area. Also, in order to eliminate the contamination of groundwater from drainfields would require the elimination of all onsite systems within the service area.

The remaining options (options 5 and 6) are dependent on how much treatment capacity is initially provided with the system. Currently, there would be approximately 440 EDUs served by a regional system. The 25-year design projection is for service to an additional 500 EDUs. This is a relatively modest design projection, considering there are now 100 EDUs in westside Crescent that may desire connection within the planning period, there is a 140 acre annexation into the district for residential development underway, and there has recently been a relatively high annual growth rate (in excess of 3 percent) in rural areas of Klamath County due to the attractiveness and quality of life in the area.

If the project is staged, the initial treatment phase could have a design capacity of approximately 640 EDUs, providing capacity for 200 new EDUs, by initially adding a single aerated pond and smaller holding facility. A second aerated pond and holding facility could be added in the future, with a major portion of the financing through SDCs. The improvement SDC would be approximately $6,000 per EDU (assuming no grant funding). Initial savings would be approximately $1 million. Over the long run the net increase in cost would be approximately $0.8 million, due to additional costs for mobilization, extra dike construction, etc.(second phase would have a cost of $1.8 million in today's dollars, not considering inflation).

If adequate grant funding is available, then it is recommend that system capacity be initially constructed to serve the design population of 940 EDUs (Option 5), since this sizing is cost effective and provides capacity to accommodate expected development during the planning period. If adequate grant funding can not be secured, than it is recommended that the treatment facilities be phased (Option 6), and SDCs set at a high enough level that a combination of SDCs and future grants/loans can finance the system expansion at a later date.

2.13 DETAILS OF RECOMMENDED ALTERNATIVE

The recommended alternative is described in detail in Sections 9 and 10. The first phase will include a gravity collection system to service all existing customers within the sanitary district boundary. An aerated pond with a surface area of approximately 0.275 acres would be added in front of Gilchrist's existing three-cell facultative lagoon. Combined, the aerated and facultative cells will have capacity to serve approximately 640 EDUs, 200 more EDUs than the current service population. The effluent holding pond would have a surface area of approximately 11 acres (storage volume of 110 acre-feet). Effluent would be irrigated to approximately 75 acres of forest land. Total land requirements for the aerated cell, holding pond, irrigation, and buffer strips is approximately 100 acres for the phase 1 project. Approximately 40 acres of land would be purchased with the Gilchrist system. As growth occurs and the service population approaches the design capacity, a second aerated pond of equal size would be added. A second holding pond, approximately 8 acres in size would also be added (storage volume of 80 acre-feet). The final layout of phase I and II ponds will be determined during predesign, when detailed topographic field surveys are available. An additional 60 acres of forest land will be needed to land apply the effluent for the second phase. Phase II would add approximately 300 EDUs of additional capacity.

2.14 FINANCING

Due to the relatively large size of the project a combination of funding sources will be required. A detailed funding analysis was conducted in Chapter 12. Some preliminary funding alternatives for Option 5 and Option 6 (staged construction for treatment) are included as Tables 2-5 and 2-6. An important consideration for funding is that an income survey will need to be conducted to determine if Crescent qualifies for Oregon Community Development Block Grant funds.

The required loan amount will be in the range of $1.9 to $2.3 million depending on the funding secured. Initially, it is suggested that the bond amount be set at $2.5 million, to provide some added contingency. Depending on the funding and final scope of the project, monthly rates are anticipated to be in the range of $35 to $40 a month per EDU.

Table 2.5 Funding Scenarios for Project Option #5

EDUs Served	438	Connection Fee	$1,000
New Connections	288		

Project Cost				
Treatment Plant	$4,706,100			
Collections	$2,393,300			
Total	$7,099,400			
Funding Source	RD & W/WW Grants	RD 50/50 Match	w/Connection Fees	w/ Other
RD Grant	$1,674,700	$2,000,000	$2,030,700	$2,030,700
RD Loan	$1,674,700	$2,349,400	$2,030,700	$2,030,700
W/WW Grant	$500,000	–	–	–
W/WW Loan	$500,000	–	–	–
SRF Loan	–	–	–	–
EDA Grant	$1,000,000	$1,000,000	$1,000,000	$1,000,000
OCDBG Community Facil.	$500,000	$500,000	$500,000	$500,000
OCDBG Public Works	$750,000	$750,000	$750,000	$750,000
WW Hardship Grant	$500,000	$500,000	$500,000	$500,000
Connection Fees			$288,000	$288,000
Other				--
Total Loan Amount	$2,174,700	$2,349,400	$2,030,700	$2,030,700
% Loan	30.6%	33.1%	28.6%	28.6%
Annual Loan Payment and O&M Costs				
RD				
Interest Rate	4.5%	4.5%	4.5%	4.5%
Principal	$1,674,700	$2,349,400	$2,030,700	$2,030,700
Period	30	30	30	30
Annual Payment	$102,812	$144,233	$124,668	$124,668
Reserve Payment	$10,281	$14,423	$12,467	$12,467
Total RD Payment	$113,094	$158,657	$137,135	$137,135
W/WW				
Interest Rate	6.0%	6.0%	6.0%	6.0%
Principal	$500,000	–	–	–
Period	20	20	20	20
Annual Payment	$43,592	–	–	–
Annual O&M Cost	$52,500	$52,500	$52,500	$52,500
Annual Loan Payment	$156,686	$158,657	$137,135	$137,135
Total Annual Cost	$209,186	$211,157	$189,635	$189,635
New Monthly Costs per EDU	$29.81	$30.19	$26.09	$26.09
New O&M	$9.99	$9.99	$9.99	$9.99
Final Monthly Rate	$39.80	$40.17	$36.08	$36.08

Table 2.6 Funding Scenarios for Project Option #6

EDUs Served	438	Connection Fee	$1,000
New Connections	288		

Project Cost				
Treatment Plant	$3,597,120			
Collections	$2,393,300			
Total	$5,990,420			
Funding Source	RD & W/WW Grants	RD 50/50 Match	w/Connection Fees	w/ Other
RD Grant	$900,000	$1,250,000	$1,250,000	$1,250,000
RD Loan	$1,340,420	$1,990,420	$1,990,420	$1,990,420
W/WW Grant	$500,000	–	–	–
W/WW Loan	$500,000	–	–	–
SRF Loan	–	–	–	–
EDA Grant	$1,000,000	$1,000,000	$1,000,000	$1,000,000
OCDBG Community Facil.	$500,000	$500,000	$500,000	$500,000
OCDBG Public Works	$750,000	$750,000	$750,000	$750,000
WW Hardship Grant	$500,000	$500,000	$500,000	$500,000
Connection Fees				
Other				
Total Loan Amount	$1,840,420	$1,990,420	$1,990,420	$1,990,420
% Loan	30.7%	33.2%	33.2%	33.2%
Annual Loan Payment and O&M Costs				
RD				
Interest Rate	4.5%	4.5%	4.5%	4.5%
Principal	$1,340,420	$1,990,420	$1,990,420	$1,990,420
Period	30	30	30	30
Annual Payment	$82,290	$122,195	$122,195	$122,195
Reserve Payment	$8,229	$12,219	$12,219	$12,219
Total RD Payment	$90,519	$134,414	$134,414	$134,414
W/WW				
Interest Rate	6.0%	6.0%	6.0%	6.0%
Principal	$500,000	–	–	–
Period	20	20	20	20
Annual Payment	$43,592	–	–	–
Annual O&M Cost	$52,500	$52,500	$52,500	$52,500
Annual Loan Payment	$134,112	$134,414	$134,414	$134,414
Total Annual Cost	$186,612	$186,914	$186,914	$186,914
New Monthly Costs per EDU	$52.52	$25.57	$25.57	$25.57
New O&M	$9.99	$9.99	$9.99	$9.99
Final Monthly Rate	$35.50	$35.56	$35.56	$35.56

2.15 IMPLEMENTATION

A time line for implementation of the proposed wastewater system improvements is presented in Table 2-7. The time line is for general purposes as actual times will vary. There are four general elections scheduled each year, in March, May, September, and November. Ballot wording must be submitted to the County elections department at least 60 days prior to the election date. One major issue, which may complicate scheduling, is whether Gilchrist will need to be annexed into the Crescent Sanitary District in order to create the regional treatment system. Developing an appraised value for, and acquisition of, the Gilchrist facilities is another major issue.

Table 2.7 Schedule

Milestone	Tentative Completion Date
Recommendations to board of directors	May 1999
Plan submitted to DEQ	May 1999
Income survey to determine percent low and moderate income	July 1999
Appraisal for Gilchrist wastewater system	August 1999
Plan submitted to funding agencies (one-stop meeting)	July 1999
Determine whether, and if so how, Gilchrist is to be annexed into District	July 1999
Submit grant applications	August 1999
Retain bond counsel	August 1999
Submit wording to county for bond election 60 days prior	September 1999
Hold bond election	November 1999
Secure funding	March 2000
Complete engineering design	November 2000
Advertise for construction bids	March 2001
Open bids	May 2001
Award contracts	June 2001
Begin construction	June 2001
Complete construction	November 2002

Section 3 – Study Area Delineation and Regionalization

3.1 Study Area and Potential Regionalization.

The planning area is essentially unchanged from the previous studies. General zoning maps have been revised as explained below.

The County has adopted Work Task #18 in 2003 for the Crescent area that applied revised commercial and industrial zoning designations to commercial and industrial land within the boundaries of the unincorporated community of Crescent. Klamath County Work Task #18 also applied a Limited Use Overlay to residential lands within the community that restricted the partition or subdivision of residential lands to a two-acre minimum within the boundaries of the unincorporated community ...."until a public sewage collection/treatment system is in place" (page 1 of paragraph 2 in Work Task #18) . A copy of Klamath County Work Task #18 is attached as Appendix 3-1.

The study area focus is the Crescent Sanitary District (CSD) boundary. The area known as Westside Crescent has been included for evaluating ultimate buildout wastewater treatment and disposal needs as well as two vacant parcels owned by Gisler and Ward that are discussed below.

Gilchrist's wastewater system and potential regionalization with the CSD is not being considered at this time. The current direction is based on preliminary comments from District board members that it is unlikely the CSD and Gilchrist owners could agree to consolidate facilities and create a single wastewater system that would be operated and maintained as a regional facility.

Adjacent to the Crescent Sanitary District southwest boundary there are two large private vacant parcels that have been proposed to be developed for residential lots. The parcels are identified by the owners names; Gisler and Ward. Both owners have proposed to be annexed into the District. The Gisler parcel is approximately 155 acres and could be developed to contain 620 homes at a density of 4 homes per acre (10,890 square feet per lot). The Ward parcel is approximately 142 acres and could be developed for 568 homes at a density of 4 homes per acres. Land for expansion of the CSD wastewater treatment facilities and disposal needs for these future parcels will be evaluated for these parcels.

3.2 Zoning Map

Klamath County Work Task #18 (WT 18) applied Rural Community Commercial (RUC-C) zoning to lands previously designated as General Commercial (CG), Recreation Commercial (CR) and Transportation Commercial (CT). WT 18 applied Rural Community-Industrial (RUC-I) zoning to land that were designated as Heavy Industrial (IH). The zoning map that illustrates commercial, industrial and residential land is shown in Appendix 3-1.

SECTION 3
STUDY AREA DELINEATION AND REGIONALIZATION

3.1 PLANNING AREA AND POTENTIAL REGIONALIZATION

The planning area has been divided into three study areas, as shown on Figure 3-1:

1. Crescent Sanitary District
2. Gilchrist
3. Westside Crescent

Primary focus of the facilities plan update is the area within the Crescent Sanitary District (CSD) boundary. The potential for staging improvements within Crescent has also been evaluated, with the core area of the CSD served initially. There is an area west of the Little Deschutes River that is currently within the Crescent Water District Association boundary, but outside the CSD boundary. This area is referred to as Westside Crescent. Potential wastewater flows from Westside Crescent have been considered when evaluating future wastewater treatment and disposal needs, in case the area is someday annexed into the sanitary district. However, a detailed analysis of collection system piping and pumping requirements to service Westside Crescent was not conducted since the area is not currently within the CSD service area.

Gilchrist's wastewater system includes a gravity collection system, three-cell stabilization lagoon for treatment, and a subsurface drainfield for treatment. The potential of expanding the lagoon system to provide regional treatment for Crescent, or expanding the size of facilities in Crescent to accommodate Gilchrist were also considered. An aerial photo of Gilchrist, the Gilchrist treatment system, and the core area of Crescent is included as Figure 3-2.

3.2 ZONING MAP

Current land use zoning for the planning area is identified on Figure 3-1. Although all the residential zoning is for a minimum lot size of 1 acre, much of the planning area is platted for lots smaller than an acre. Based on personal communication with the sanitary district and county planning department, there have been discussions about changing the zoning to RCR (rural community residential), which would allow for a minimum lot size of 5,000 square feet.