# WASTEWATER SYSTEM CAPITAL FACILITIES PLAN UPDATE

CITY OF SISTERS
DESCHUTES COUNTY
OREGON

FEBRUARY 2016

# Water System Capital Facilities Plan Update

February 2016

## Acknowledgements


| | |
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# EXECUTIVE SUMMARY

## S.1 PURPOSE

The purpose of this Wastewater Capital Facilities Plan Update is to provide the City of Sisters with a comprehensive wastewater utility planning document through the year 2035, and to identify improvements needed to satisfy wastewater demand of a growing community, including anticipated future regulatory requirements. The Update is intended to modify the Executive Summary and Section 8 of the 2006 Wastewater Capital Facilities Plan, and to utilize remaining sections for supporting data. Recommended improvements are based on the most cost effective alternatives, and provide planning for collection, treatment and effluent disposal needs through year 2035.

## S.2 POPULATION AND GROWTH

Current population was certified at 2,280 residents on July 1, 2015. Year 2035 population of 4,375 residents was projected and based on projected growth rates from analysis provided by Portland State. This reflects an average annual growth rate of 3.23% per year for the planning period. ***It should be noted that Sisters has experienced periods of rapid growth in the recent past, therefore, it is recommended that a population forecast update be prepared at a minimum of every 5 years, and, if necessary, corresponding revisions to the capital facilities plan. Regular population forecast updates will ensure that the capital facilities plan remains closely aligned with current population and current demand on City infrastructure.***

## S.3 EXISTING WASTEWATER SYSTEM

The City wastewater system is relatively new, with construction occurring during the period of 2000 to 2002. Gravity collection system piping varies from 6" to 24" diameter PVC wastewater mains, with four (4) wastewater pump stations. The entire system flows to Pump Station No. 1, which transmits all flow under pressure to the Wastewater Treatment Plant. The wastewater treatment plant is a 3-cell aerated lagoon system with winter holding, discharging to a dike and forest irrigation reuse system. Each of the two aerated treatment cells are 2.41 acres, providing for a capacity of 19.5 Ac. Ft. An 18-acre aerated winter holding lagoon is provided for storage, containing 213 Ac. Ft. of storage. Land reuse of the stored water is provided on 88.5 acres of natural forest and 11.8 acres of dike and lawn areas, and application is applied at agronomic rates.

## S.4 WASTEWATER FLOWS

Treatment Plant and Reuse System Design Flows:

| | |
|---|---|
| Summer average daily flows | 395,604 gallons per day (gpd) |
| Winter average daily flows | 291,042 gpd |
| Average net reuse application | 16 inches per year average on site |
| Permitted reuse volume | 178.3 Ac. Ft. |

*Actual and Projected Wastewater Flows*

| | Average Daily Flow (gpd) (2015) | Maximum Monthly Flows (gpd) (2015) | Maximum Weekly Flows (gpd) (2015) | Peak Daily Flow (gpd) (2015) | Average Reuse (in./yr applied to land) | Reuse Volume (Ac. ft.) (2015) |
|---|---|---|---|---|---|---|
| Summer Wastewater Flows | 203,864 | 220,900 | 230,100 | 248,000 | 17.74 * | 148.78 |
| Winter Wastewater Flows | 183,967 | 189,800 | 207,900 | 256,000 | | |
| 2035 Projected Summer Wastewater Flows | 391,186 | 422,000 | 442,000 | 472,000 | 16.00 | 282.00 |
| 2035 Projected Winter Wastewater Flows | 353,007 | 364,000 | 399,000 | 487,000 | | |

** (includes forest and dike irrigation)*

Year 2035 flow projections were based on current flows multiplied by the ratio of the projected 2035 population to the current population of 2,280 residents. This approach includes infiltration/inflow in current flows, and it is assumed that future I/I will be proportional to the existing, which is minimal.

Year 2035 flows can receive adequate treatment within the existing wastewater treatment facility design capacity. The most critical concern is the effluent reuse system and the lack of land area for effluent irrigation. The City's acquisition of a portion of the Lazy Z has adequate land for discharge of effluent waters, but it must be developed soon. Sufficient land is not available at this time for projected flows of water stored during winter months, with requirements for the effluent to be applied at agronomic rates.

## S.5 COLLECTION SYSTEM IMPROVEMENTS

Collection system improvements in Sisters were analyzed to satisfy long-term growth projections for current zoning in the City. Our analysis utilized zoning classifications to project population and flows from each area being considered, to the limits of the current Urban Growth Boundary. Design review found that each element of the existing collection system has sufficient capacity to handle projected flows for 2035, but capacity of Pump Station No. 1 and the main gravity 18" main will be marginal with anticipated flows. To develop capacity in these portions of the collection system, it is recommended that a new Pump Station No. 5 and Pressure Main No. 5 be provided to assume the system

capacity needs West of Highway 20 in this rapidly expanding portion of the City. This work will need to be developed prior to 2035, and sooner if the USFS land is developed into residential, commercial, or industrial usages. The pumps in Pump Station No. 1 are used extensively, and the effective lifetime of these units will be reached in the planning period. We also recommend that provisions be made to replace these pumps prior to 2035.

## S.6 WASTEWATER TREATMENT FACILITY RECOMMENDATIONS

Wastewater treatment facility improvements will be required to satisfy increasing population demand. Based on population projections, expansion of wastewater treatment capabilities and effluent reuse facilities will be required. Treatment facility needs are limited to software and security upgrades, and the irrigation reuse system needs to be expanded into the 49 acre forested parcel of the City's portion of the Lazy Z Ranch. Existing and recommended land area to provide reuse capacity for wastewater disposal in Sisters is adequate to allow for reuse of effluent waters through the Year 2035.

SCADA (Supervisory Control And Data Acquisition) and security upgrades for the existing treatment facility are recommended when each of the Lazy Z irrigation improvements occur.

Wastewater treatment facility improvements will involve biosolids removal and disposal, and removal and replacement of the existing lagoon aerators with larger, new energy efficient units.

## S.7 WASTEWATER REUSE SYSTEM IMPROVEMENTS

Wastewater reuse system improvements will be required in the near future to satisfy increasing resident demand. Population growth will require additional reuse capabilities, which will involve expansion into the 49-acre forested parcel of the City's ownership on the Lazy Z Ranch.

Additional reuse improvements should include developing additional agricultural portions of the City's Lazy Z property for reuse purposes when necessary.

# SECTION 1
# INTRODUCTION

## 1.1 GENERAL

Sisters is located in Deschutes County, 21 miles northwest of Bend and 20 miles west of Redmond *(Figure 1.1)*. The major transportation routes between the mid-Willamette Valley and central and eastern Oregon pass through Sisters. The City is a focal point for travelers, tourists, and part-time residents. Sisters was established along the Santiam and McKenzie Highways around 1880, and became an incorporated City in 1946.

Resident population was estimated on July 1, 2015 as approximately 2,280 people, with a significant influx of retirees, tourists, travelers, part time residents and associated commercial development. Sisters has been rapidly growing since completion of a new wastewater system in 2002, which allowed for a number of residential developments to occur.

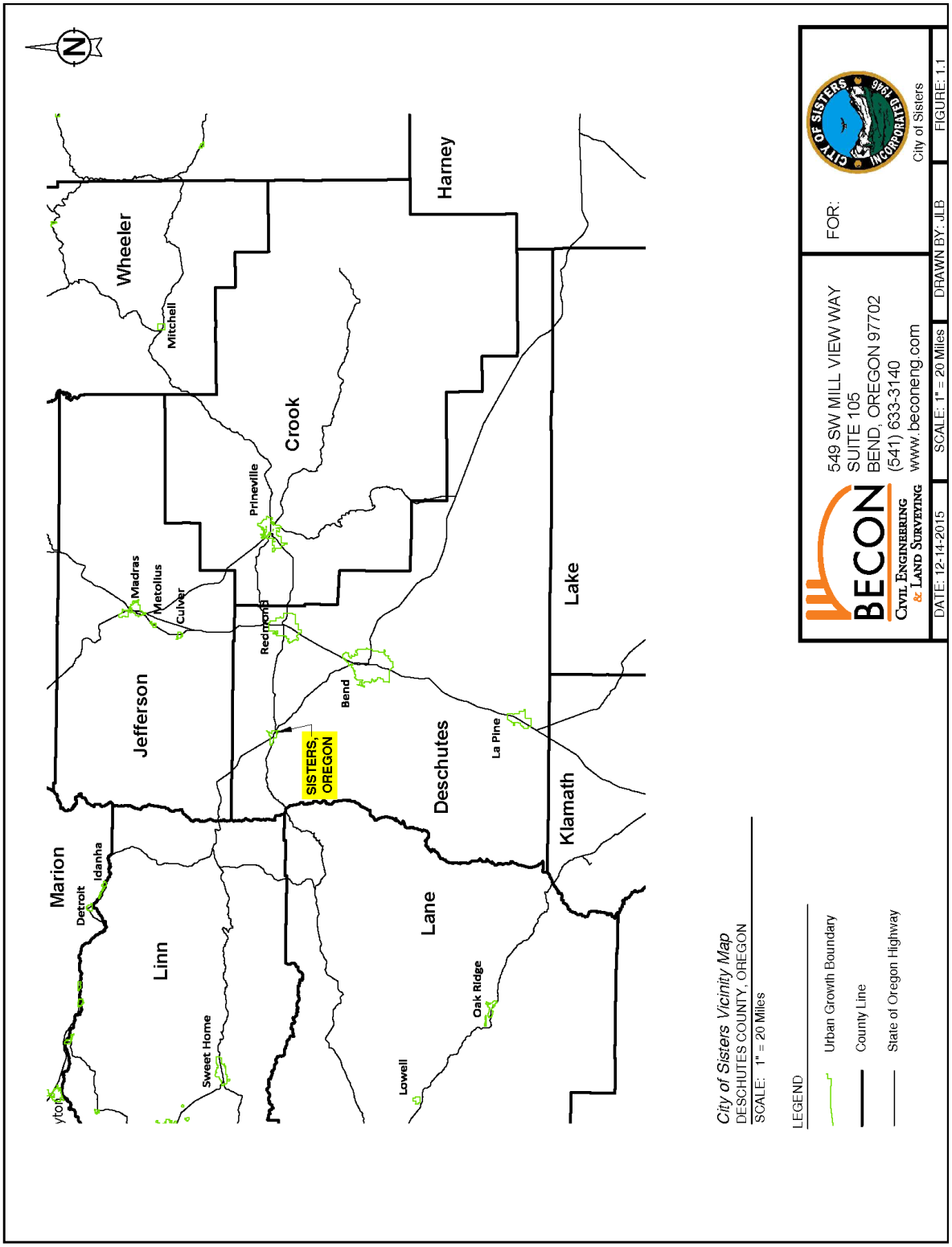
## 1.2 BACKGROUND

The City of Sisters owns and operates a municipal wastewater collection and treatment system. The system is relatively new, with construction extending from 2000-2002. Sisters had contemplated construction of a municipal sewer system since 1972, and residents approved bonds for $7,000,000 in construction funds on May 19, 1998. Construction grants and loans for construction were received from Rural Development, OECDD, EDA, Oregon Community Development Block Grants, the Rural Investment Fund, and from the Oregon Department of Environmental Quality to allow the project to proceed. Planning projections from the City of Sisters and from Deschutes County projected a resident population of 1,575 people by the year 2020, and this projection was exceeded in 2004. Oregon State funding sources were not willing to assist with major financial contributions for construction of the wastewater system, because they believed that planning projections were overly optimistic, and would not occur.

The entire City wastewater collection system was constructed of quality ASTM 3034 PVC pipe materials, with rubber ring joint connections. Construction included new service lines to connect every residence and business to the sewer system, and all lines were pressure tested. In addition, all manholes were vacuum tested, and all main lines were televised to make certain that a quality installation was achieved. Since the initial construction, similar materials have been utilized for all extensions, and all main and service line connections have been installed to City of Sisters and Oregon Plumbing Specialty Code Standards. Emphasis has been placed on maintaining a quality wastewater system. Continued community growth will demand substantial improvements in sizing, with construction of a new major pump station no. 5 and force main no. 5 to contain expansion.

An aerated lagoon wastewater treatment plant was constructed with two 2.41 acre cells, each holding 19.5 Ac. Ft. The treatment facility was followed with an 18-acre winter holding lagoon containing 213 Ac. Ft. of storage for wastewater. Land reuse of the stored

water is provided on 125 acres of natural forest, where application is applied at agronomic rates.



The City of Sisters purchased a 230 acre parcel of the Lazy Z Ranch following development of the November 2006 Wastewater Capital Facilities Plan, and this can readily be utilized for effluent reuse. Initial plans are to utilize a 49 acre forested section of the parcel for continuance of irrigation on natural forest, again at agronomic rates. As the community grows, adequate land is available on the Lazy Z parcel to provide reuse for the long term future needs of the City. Reuse on the remaining portions of the parcel will concentrate on agricultural production, with crops that are self-sustaining and consume reuse waters at agronomic rates.

## 1.3 PREVIOUS PLANNING DOCUMENTS

Master Planning for public wastewater improvements in Sisters has occurred on a regular basis in Sisters since 1972, including the following:

1. Comprehensive Development Plan for Sewerage Improvements, May 1972, HGE Inc., Engineers & Planners
2. Comprehensive Wastewater Facilities Plan, 1977, HGE Inc., Engineers & Planners
3. Sewer System Local Improvement District, 1979, HGE Inc., Engineers & Planners
4. Phase 1 Engineering and Sewer Technical Assistance Study, 1987-1990, Century West Engineers.
5. Wastewater System Engineering Study, 1994, HGE Inc., Architects, Engineers, Surveyors & Planners.
6. Wastewater System Facilities Plan, 1997, HGE Inc., Architects, Engineers, Surveyors & Planners
7. Wastewater System Capital Facilities Plan, 2006, HGE Inc., Architects, Engineers, Surveyors & Planners.
8. Wastewater Reuse and Conservation Project Planning Study, 2013, Newton Consultants, Inc.

## 1.4 CURRENT SITUATION

The City of Sisters has and continues to experience rapid growth and an update to the 2006 Wastewater Capital Facilities Plan is needed to evaluate and provide capacity for anticipated growth to year 2035. Land for treatment and disposal needs is owned at this time by the City of Sisters, and expansion plans will be addressed in this Capital Facilities Plan Update.

## 1.5 AUTHORIZATION

The City of Sisters has prepared this Wastewater System Capital Facilities Plan Update for current zoning of property within the Sisters Urban Growth Boundary (UGB).

## 1.6 ORGANIZATION

The overall structure of this Wastewater System Capital Facilities Plan Update follows the flow of wastewater from consumers to treatment and ultimate disposal of the effluent. Much of the 2006 Plan remains valid, and needed modifications to consider changed conditions are addressed in this Update. Separate chapters have been written to evaluate each of the following system components: wastewater collection and pumping improvements, wastewater treatment and winter holding facilities, and effluent land reuse meeting WPCF and Oregon Department of Environmental Quality Standards. Tables and figures in this update are numbered consecutively within each chapter, and they generally appear in the text of the report on the page or pages following the first reference.

## 1.7 PLANNING AREA

The planning area used in this Wastewater System Capital Facilities Plan Update is the area encompassed by the current Sisters UGB. See Figure 1.2

## 1.8 PLANNING SCOPE

The objective of this updated plan is to establish a short-term and long-term wastewater system capital facilities plan for the present and future needs of the City of Sisters. Overall, the scope of work is meant to enumerate an exacting plan for growth and satisfy requirements for potential funding sources. Needs will be addressed relative to wastewater collection, pumping, treatment and land reuse. An outline of basic considerations of the facilities plan update is as follows:

1. Describe the existing wastewater facilities and the area to be served. Include land use, current and estimated future population, and environmental concerns.

2. Utilize existing wastewater system requirements from the 2006 plan, based on estimated water consumption, and land use plans. Develop projected wastewater capacity needs to the year 2035.

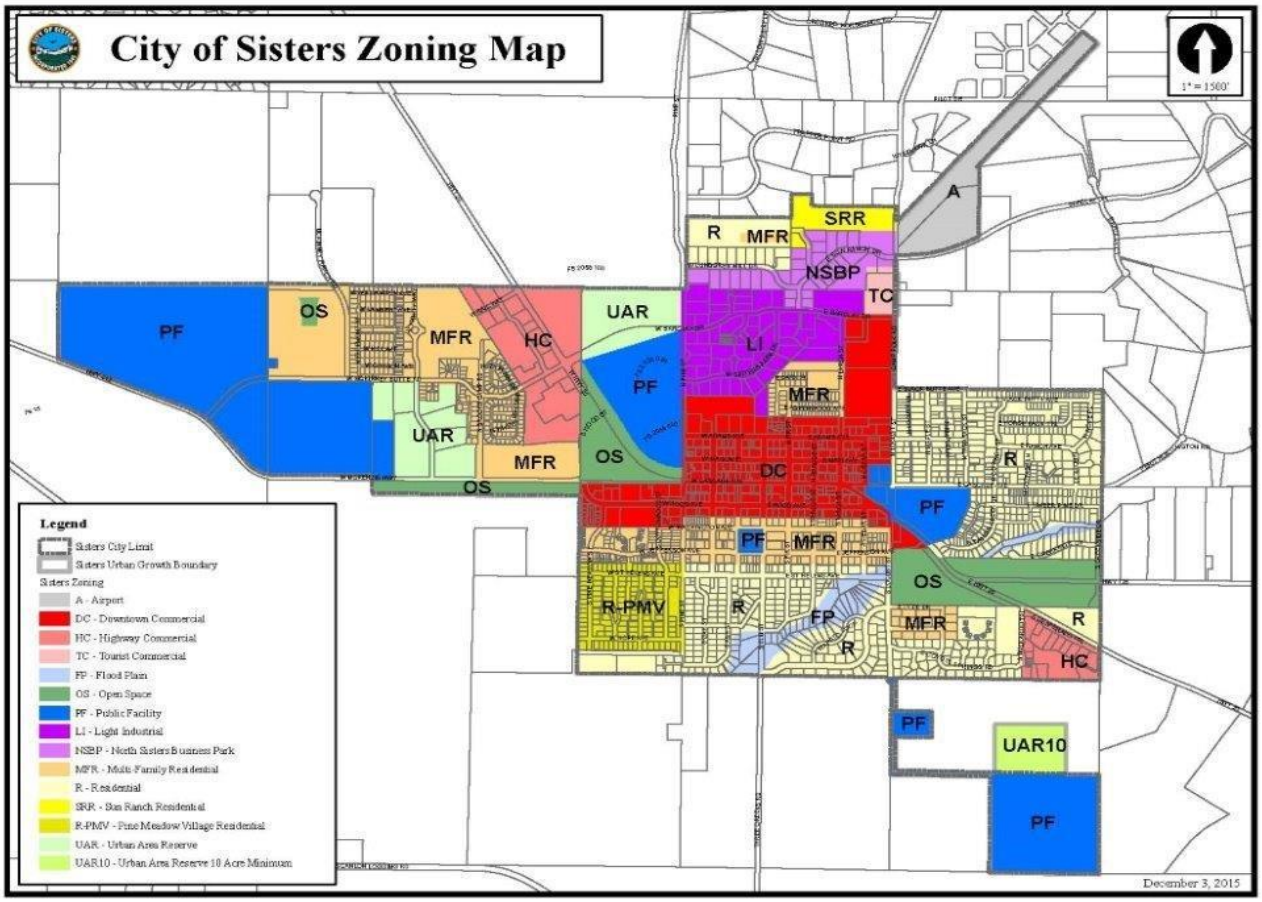
3. Description of the existing collection, pumping, treatment, and land reuse systems, and their ability to meet existing and future wastewater system demand. Long-range system needs will also be developed by the application of growth projections into the collection system model, and with a detailed layout of future system needs within the UGB.

4. Provide a base map showing the wastewater collection system, with pumping stations. Separate mapping shall be provided showing the wastewater treatment and land reuse systems.

5. Opinions of probable costs for various alternatives will be prepared and recommendations will be separated into priorities for development.

6. Preparation of a complete report of the updated work. Information will be presented to show designs with supporting data, preliminary drawings or sketches, and opinions of probable costs.

Figure 1.2



# SECTION 2
# METHODOLOGY USED FOR WASTEWATER SYSTEM EVALUATION

## 2.1 GENERAL

This section of the study covers the procedure used to establish the design parameters for the upgraded wastewater system, priorities for implementation, and the method used to develop opinions of probable cost.

## 2.2 DESIGN PERIOD

This update is based on a 20-year planning period with future projections to the year 2035. It is felt that this time frame is adequate to allow for adaptation to future needs, while being short enough to ensure that the facilities will be effectively utilized within their economic life. System recommendations are developed for construction in phases (priorities) and all components are designed to allow future expansion. Alternate recommendations are made to future improvements which are dependent on growth patterns and other variables which cannot be accurately predicted at this time.

## 2.3 SYSTEM CAPACITY AND LAYOUT

Capacity requirements and consequent system sizing are based on evaluations of population, and land use. Potential wastewater system volume is estimated based on actual flows received at the wastewater treatment facility, and on experience with facilities in other communities. System collection system layout includes an allowance for future growth to the limits of the established UGB.

## 2.4 REGULATORY REQUIREMENTS

Wastewater treatment in the state of Oregon must meet the requirements of the Oregon Department of Environmental Quality (DEQ) and the United States Environmental Protection Agency (EPA).

## 2.5 PRIORITIES

Major wastewater system construction requires considerable financial resources. In developing a wastewater system capital facilities plan, it is necessary to consider the relative importance of the proposed improvements and to assign priorities to the development program accordingly. An advantage of the phased approach, especially in regard to collection, treatment and land reuse system expansion, is the allowance of time in which actual system usage and growth can be evaluated in order to refine the sizing of subsequent improvements.

By prioritizing the proposed improvements, construction costs can be extended over a longer period of time in an effort to remain within the financial capabilities of the community. This will allow the City to take maximum advantage of potential Federal and State grants and loans that are available to assist small communities with major wastewater

system improvements. Initial improvements should be based on the most immediate critical needs and should provide the greatest benefit at the lowest cost. Later improvements should follow the short and long-range guidelines and meet future demands as the community develops and can finance the improvements.

## 2.6 BASIS FOR OPINIONS OF PROBABLE COST

### 2.6.1 General

Opinions of probable cost presented in this study include three components, each of which is discussed separately in this section. It must be recognized that opinions of probable cost are preliminary and are based on the level and detail of planning presented in this study. As any project element proceeds forward, it may be necessary to update the costs from time to time, as more information becomes available.

### 2.6.2 Construction Cost

Opinions of probable construction costs in this capital facilities plan are based on actual construction bidding results for similar work, published cost guides, and other construction cost experience of the authors within the state of Oregon. Opinions of probable cost are based on preliminary layouts of the proposed improvements.

Future changes in the cost of labor, equipment, and materials, may justify comparable changes in the opinions of probable cost presented herein. For this reason, it is common engineering practice to relate the costs to a particular index that varies in proportion to long-term changes in the national economy. The Engineering News Record (ENR) Construction Cost Index is most commonly used. It is based on a value of 100 for the year 1913, and the values since 1982 are shown in *Table 2.1* along with calculated annual percent increases.

All costs in this study are based on the August 2015 ENR Construction Cost Index value of 10,055. Opinions of probable costs should be updated at the actual time of funding applications and a decision made as to whether loan funds will be required. Note that when the community secures financing, a reserve factor should be added at that time for estimated increases in cost due to inflation. Estimates can be prepared at any future date by comparing the future ENR Construction Cost Index with the index value of 10,055; however, this approach is generally only considered valid for a 2 or 3 year period since construction techniques and materials change with time. If more time than this has elapsed, opinions of probable cost should be updated by an Engineer.

*Table 2.1: Engineering News Record Construction Cost Index*
*With Calculated Annual Percent Increases*

| *YEAR* | *20-CITY ENR (August)* | *% CHANGE* | *YEAR* | *20-CITY ENR (August)* | *% CHANGE* |
|---|---|---|---|---|---|
| 1982 | 3,899 | | 1999 | 6,091 | 2.7 |
| 1983 | 4,066 | 4.3 | 2000 | 6,233 | 2.3 |
| 1984 | 4,146 | 2.0 | 2001 | 6,389 | 2.5 |
| 1985 | 4,195 | 1.2 | 2002 | 6,592 | 3.2 |
| 1986 | 4,295 | 2.4 | 2003 | 6,733 | 2.1 |
| 1987 | 4,401 | 2.5 | 2004 | 7,188 | 6.8 |
| 1988 | 4,541 | 3.2 | 2005 | 7,479 | 4.0 |
| 1989 | 4,607 | 1.5 | 2006 | 7,722 | 3.2 |
| 1990 | 4,752 | 3.1 | 2007 | 8,007 | 3.7 |
| 1991 | 4,892 | 2.4 | 2008 | 8,362 | 4.4 |
| 1992 | 5,032 | 2.9 | 2009 | 8,564 | 2.4 |
| 1993 | 5,230 | 3.9 | 2010 | 8,837 | 3.2 |
| 1994 | 5,424 | 3.7 | 2011 | 9,088 | 2.8 |
| 1995 | 5,506 | 1.5 | 2012 | 9,351 | 2.9 |
| 1996 | 5,652 | 2.7 | 2013 | 9,524 | 1.9 |
| 1997 | 5,854 | 3.6 | 2014 | 9,840 | 3.3 |
| 1998 | 5,929 | 1.3 | 2015 | 10,055 | 2.2 |
| **Average Annual Increase (%)** | | | | | **2.9** |

### 2.6.3 Contingencies

In recognizing that the opinions of probable cost are based on preliminary design, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigation and studies, and other difficulties that cannot be foreseen at this time, but which may tend to increase final costs. A contingency factor of 10 percent of

the construction cost has therefore been added.

### 2.6.4 Engineering, Legal and Administrative

An allowance of 10 percent of the projected construction cost has been added for engineering, legal and administration. This allowance is intended to include internal project planning and budgeting, grant administration, liaison, interest on interim financing, legal services, review fees, legal advertising, and other related expenses associated with the project.

### 2.6.5 Opinion of Probable Cost Summary

Opinions of probable costs presented in this study include a combined allowance of 20 percent for contingencies, engineering, legal, and administrative costs.

## 2.7 RECOMMENDED IMPROVEMENTS

The assessment of the proposed wastewater system will be summarized and a recommended plan for construction will be developed in Section 10.

# SECTION 3:
# EXISTING WASTEWATER SYSTEM

## 3.1 GENERAL

This section includes a brief description of existing wastewater facilities in Sisters. The City wastewater system is relatively new, with construction occurring during the period of 2000 through 2002. Following sections discuss components of the system in greater detail, and present recommended improvements. The current wastewater system consists of a gravity sewer system with over 122,000 lineal feet of wastewater mains, four wastewater pump stations and force mains, a three-cell aerated lagoon treatment system with winter holding, and a 100.3 acre automated land reuse system. Land reuse is provided on 11.8 acres of dike and pasture grass, and on 88.5 acres of natural forest land.

System locations and sizing were developed from available as-built records in the City, and in extensive records available in the City Engineer's files. Construction plans were provided for all developments since the original wastewater system was completed, and City staff provided their knowledge of existing facilities.

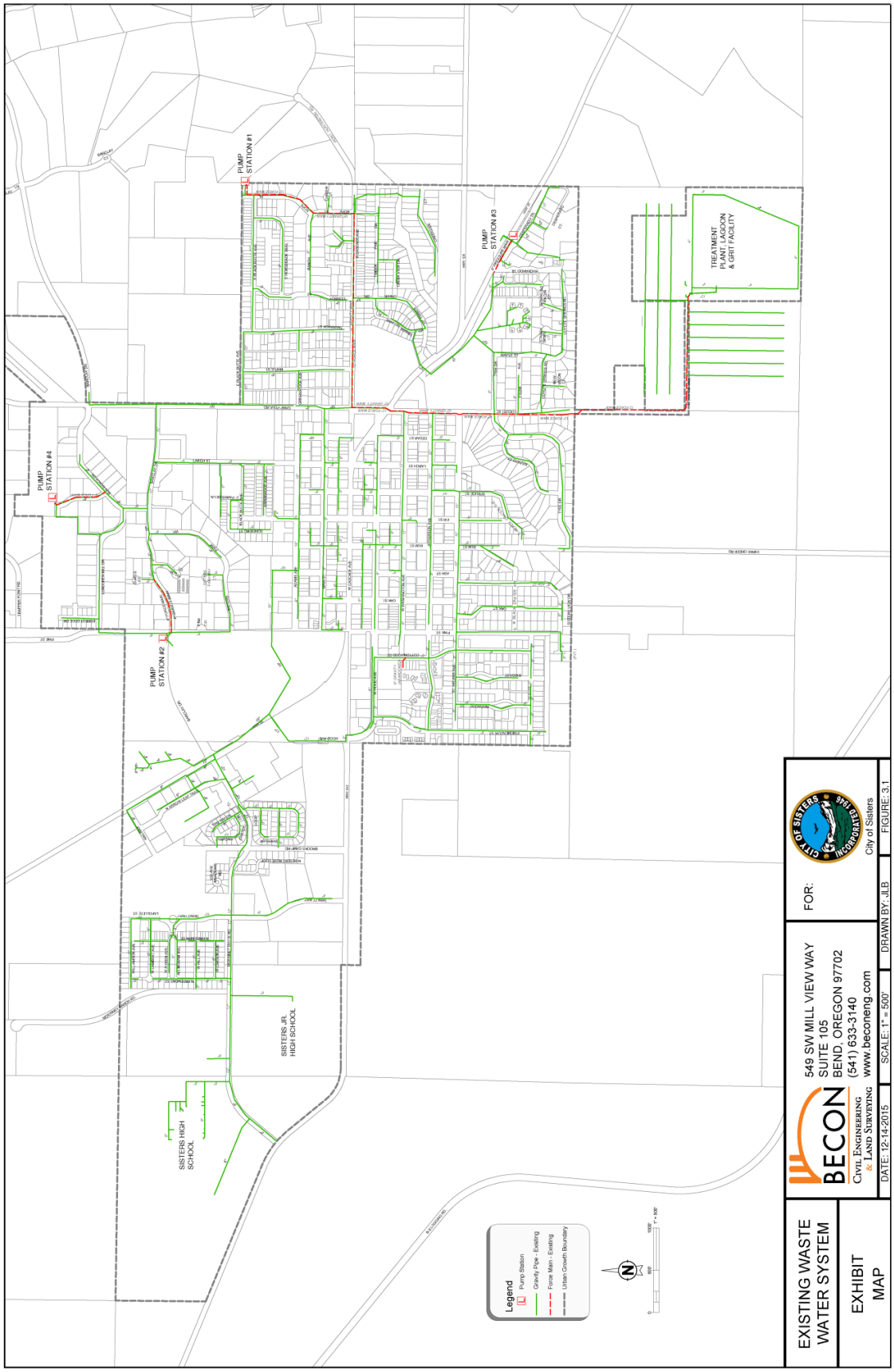
## 3.2 WASTEWATER COLLECTION SYSTEM

The existing wastewater collection system is shown in *Figure 3.1.* Collection facilities include 6" to 24" diameter ASTM 3034 PVC wastewater mains with 4" and 6" PVC service lines, all laid at varying grades. There are a limited number of individual semi-positive displacement grinder wastewater pump stations that provide wastewater service to residences that could not be served through the gravity collection system (Creekside and Timber Creek Phase VI subdivisions). Gravity conveyance facilities convey wastewater by gravity from individual users to the four wastewater pump stations. Individual developments have completed major expansions to the wastewater collection system since the original construction was completed in 2002. Two of the existing wastewater pumping facilities were completed by new private development, and numerous main extensions have been completed. All of the wastewater pump stations transmit flows through AWWA C-900 force mains of varying sizing.

In general, wastewater is conveyed to the primary wastewater pumping facilities via gravity lines. Wastewater from three of the pumping facilities is transmitted through force mains and additional gravity mains to the location of Wastewater Pump Station No. 1. All wastewater in the system is currently processed through Pump Station No. 1 and transmitted through a 12" diameter force main to the wastewater treatment facility, for ultimate land application to the forested reuse site.

### 3.2.1 Gravity Mains and Manholes

**Mains.** The collection system has 916 lineal feet of 6" gravity main, 95,050 lineal feet of 8" gravity main, 11,992 lineal feet of 10" gravity main, 5,909 lineal feet of 12" gravity main, 859 lineal feet of 15" gravity main, 8,204 lineal feet of 18" gravity main, 104 lineal feet of 21" gravity main, and 106 lineal feet of 24" gravity main. All mains are constructed of ASTM 3034 PVC pipe. Burial depths


PUMP STATION #1
PUMP STATION #2
PUMP STATION #3
PUMP STATION #4
TREATMENT PLANT LOCATION & GRIT FACILITY
SISTERS JR. HIGH SCHOOL
SISTERS HIGH SCHOOL
Legend
Pump Station
Gravity Pipe - Existing
Force Main - Existing
Urban Growth Boundary
EXISTING WASTE WATER SYSTEM
EXHIBIT MAP
BECON
Civil Engineering & Land Surveying
549 SW MILL VIEW WAY
SUITE 105
BEND, OREGON 97702
(541) 633-3140
www.beconeng.com
FOR:
City of Sisters
DATE: 12-14-2015
SCALE: 1" = 500'
DRAWN BY: JLB
FIGURE: 3.1

are typically 5' - 10' deep, with 16' feet being the deepest. Layout of the collection system is shown in *Figure 3.1.*

**Manholes.** There are 488 precast manholes in the collection system.

**Overflows/Bypasses.** There are no constructed overflows or bypasses in the system

**Hydrogen Sulfide.** City staff regularly maintains the collection system, and they have little evidence of hydrogen sulfide damage in the system.

### 3.2.2. Collection System Quality

**Mains.** The City of Sisters has worked diligently to develop a wastewater collection system that minimizes infiltration/inflow into the system. All construction has been air-tested in compliance with adopted Public Works Construction Standards for the City of Sisters, and with Oregon DEQ regulations. All gravity mains have been air-tested, and had a 95% mandrel pulled to verify that excessive deflection was not present. When all testing was completed, a television inspection was performed on the interior of all pipelines, and any deficiencies were corrected.

**Manholes.** All manholes have also been constructed in compliance with adopted Public Works Construction Standards for the City of Sisters, which are in excess of adopted DEQ regulations. All manholes have been vacuum tested, applying 10 inHG of vacuum and limiting allowable air loss to 1 psi for a fixed period of time. This test is the best means of testing to prevent infiltration available today, and the success of the program is evident in the infiltration/inflow discussion below.

**Infiltration/Inflow.** Infiltration/Inflow in the Sisters wastewater system is virtually non-existent. Influent flows to the wastewater treatment facility are substantially less than water consumption within the community, which indicates that infiltration and inflow to the system are very minimal.

### 3.2.3. Pressure Mains

Pressure mains are shown in *Figure 3.1.* Four pressure mains exist to transmit flows from each of the existing wastewater pump stations. All of the force mains are constructed of AWWA C-900 piping, of the following lengths and sizing.

Force main for Pump Station No. 1. 9,290 lineal feet -12" inch force main.
Force main for Pump Station No. 2. 710 lineal feet - 4" inch force main.
Force main for Pump Station No. 3. 1,152 lineal feet - 6" inch force main.
Force main for Pump Station No. 4. 687 lineal feet - 6" inch force main.

### 3.2.4 Wastewater Pump Stations

Four wastewater pump stations currently exist in the collection system. The stations are described as follows:

***Wastewater Pump Station No. 1***. This station was constructed in place, and is a triplex submersible facility with a trench style wetwell. Pumping is provided with three KSB pumps initially designed with two pumps capable of providing 850 gpm @ 95' feet TDH when pumping together. The third pump is provided for redundancy. The pump manufacturer made an error in trimming the impellers for all of the pumps, and the pumps were actually installed with the capability for two pumps to provide approximately 525 gpm @ 95' feet TDH. It was determined to be in the best interests of the City to have the correct impellers provided, but that the original impellers be utilized until demand necessitated the additional pumping capacity. City staff replaced the original impellers with the new impellers from storage in 2009 to increase the capacity of the pumps to the original design. Normal wear from the 14 years of system operation has incurred to the original pumps and staff will need to monitor the pumps through motor oil and amperage testing to determine when these pumps need to be re-built or if capacity issues arise be replaced.

100% of wastewater flow in the City of Sisters collection system is tributary to Pump Station No. 1. The station (constructed in 2001), is located at the north end of Rope Place, in the far northeast corner of the UGB. Flows from this station are conveyed via 9,290 lineal feet of 12" class 150 AWWA C-900 force main to the headworks of the WWTP. This station was constructed as a portion of the original Sisters wastewater system, and was completed in 2001.

Triplex submersible pumps located in a self-cleaning trench style wetwell are KSB, Model KRTK 100-316/294 XG, with 37 Hp motors. The station is a site-constructed submersible pump station with a block building constructed over the top. The building is insulated and has a concrete floor with drains. Pump controls are located in the building. The overall condition of the pump station is very good, and all equipment functions properly as originally constructed.

A 135 KW diesel generator manufactured by Kohler, Model 135ROZJ is provided for standby power purposes, complete with a 400 Amp Kohler automatic transfer switch. This unit is set on a 125 gallon double wall fuel tank that provides protection against contamination.

A sluice gate is provided on the influent to the station to stop the influent flows, and to allow buildup of flows for wetwell cleansing purposes. A Chatterbox dialer is utilized to call operators in the event that problems develop with station operation. New telemetry equipment will be needed to communicate with the treatment plant SCADA system during the planning period when increased flows result in capacity related concerns with the station (i.e. 2 pumps need to run to keep up with influent flows).

***Wastewater Pump Station No. 2.*** This station is a package wetwell mounted vacuum lift duplex pump station by Smith & Loveless, mounted on a 5' diameter precast concrete manhole. All pumping and electrical equipment is mounted under a fiberglass structure, and is above the wetwell. The station provides service to a small portion of the industrial park, and is located on the Northwest corner of Barclay Drive and North Pine Street. Pumping is provided with two Smith & Loveless Model 4B2B pumps, each capable of pumping 150 gpm at 43' feet TDH. Motors are 5 Hp, located under the fiberglass shell, and the station includes two small compressors for creating vacuum for operation. All electrical controls are also located inside the station cover. All pump station equipment functions properly as originally constructed with the Sisters wastewater system in 2002. A Chatterbox dialer is utilized to notify operators in the event that problems develop with system operation.

***Wastewater Pump Station No. 3.*** This station is a package wet well mounted vacuum lift duplex pump station by Smith & Loveless, mounted on an 8' diameter precast concrete manhole. All pumping and electrical equipment is mounted under a fiberglass structure, and is above the wetwell. The station is located in the Five Pine Development, and provides service to the most easterly portion of the City, both North and South of Highway 20. Pumping is provided with two Smith & Loveless Model 4B2B pumps, each capable of pumping 260 gpm at 20' feet TDH. Motors are 3 Hp, located under the fiberglass shell, and the station includes two small compressors for creating vacuum for operation. All electrical controls are also located inside the station cover. The pump station equipment functions properly as originally constructed in 2004. This station was provided by developers in expansion of the Sisters wastewater system. A Chatterbox dialer is utilized to notify operators in the event that problems develop with system operation.

***Wastewater Pump Station No. 4.*** This station is a package wet well mounted vacuum lift duplex pump station by Smith & Loveless, mounted on an 8' diameter precast concrete manhole. All pumping and electrical equipment is mounted under a fiberglass structure, and is above the wetwell. The station is located in the Sun Ranch Business Park, and provides service to the Sun Ranch and Three Sisters Business Parks North of Barclay Drive. Pumping is provided with two Smith & Loveless Model 4B2D pumps, each capable of pumping 270 gpm at 45' feet TDH. Motors are 7.5 Hp, located under the fiberglass shell, and the station includes two small compressors for creating vacuum for operation. All electrical controls are also located inside the station cover. The pump station equipment functions properly as originally constructed in 2006. This station was provided by developers in expansion of the Sisters wastewater system. A Chatterbox dialer is utilized to notify operators in the event that problems develop with system operation.

## 3.3 WASTEWATER TREATMENT FACILITY

The existing Sisters wastewater treatment plant (WWTP) is shown schematically in *Figure 3.2.* The wastewater treatment plant and effluent reuse site are located immediately south of the Sisters City limits on the south ½ of Section 9, T15S, 10E, W.M. Treatment is provided with two 2.41 acre aerated lagoons, followed by an 18 acre storage lagoon and 100.3 acres of land utilized for automated land reuse purposes. Design data for the existing wastewater treatment facility is provided in *Table 3.1.*

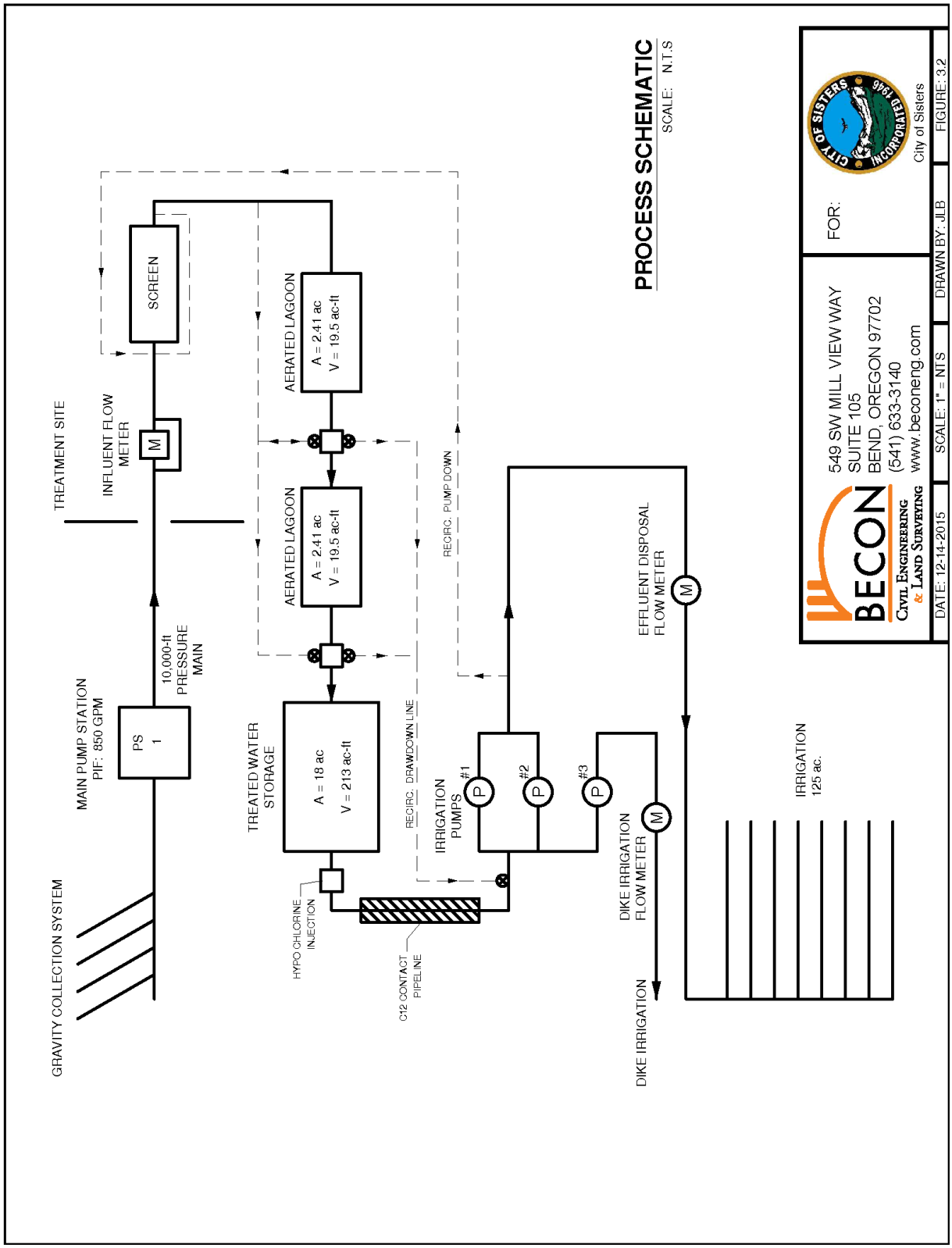

PROCESS SCHEMATIC
SCALE: N.T.S
GRAVITY COLLECTION SYSTEM
MAIN PUMP STATION
PIF: 850 GPM
PS 1
10,000-ft PRESSURE MAIN
TREATMENT SITE
INFLUENT FLOW METER
M
SCREEN
AERATED LAGOON
A = 2.41 ac
V = 19.5 ac-ft
AERATED LAGOON
A = 2.41 ac
V = 19.5 ac-ft
TREATED WATER STORAGE
A = 18 ac
V = 213 ac-ft
HYPO CHLORINE INJECTION
C12 CONTACT PIPELINE
RECIRC. DRAWDOWN LINE
RECIRC. PUMP DOWN
IRRIGATION PUMPS
#1
#2
#3
P
EFFLUENT DISPOSAL FLOW METER
DIKE IRRIGATION FLOW METER
DIKE IRRIGATION
IRRIGATION
125 ac.
BECON
CIVIL ENGINEERING & LAND SURVEYING
549 SW MILL VIEW WAY
SUITE 105
BEND, OREGON 97702
(541) 633-3140
www.beconeng.com
FOR:
City of Sisters
DATE: 12-14-2015
SCALE: 1" = N.T.S
DRAWN BY: JLB
FIGURE: 3.2

*Table 3.1 Sisters Wastewater Treatment Facility*
***Design Data***

| | | | | | | |
|---|---|---|---|---|---|---|
| **Influent Flow -** | | | **Summer, gpd** | | **395,604** | |
| | | | **Winter, gpd** | | **291,042** | |
| **Waste Loadings ($BOD_5$ and TSS) -** | | | **Summer, ppd** | | **759** | |
| | | | **Winter, ppd** | | **607** | |
| **Effluent Requirements** | | | **E. Coli - Shall not exceed monthly geometric mean of 126/100 ml** | | | |
| **Headworks** | | | **Type:** | | **Rotary Bar Screen w/Bypass Channel** | |
| | | | **Spacing:** | | **1/4"** | |
| | | | **Max. Flow (gpm):** | | **2061** | |
| **Influent Flowmeter** | | | **Type:** | | **8" Magnetic** | |
| **Treatment** | | | **Type:** | | **Aerated Lagoons in Series** | |
| | | | **Number of Cells:** | | **3** | |
| **Pond No.** | **Water Depth (Ft)** | **Freeboard (Ft)** | **Surface Area (Acres)** | **Volume (Ac-Ft)** | **Number of Aerators** | **Total Aeration Power (Hp)** |
| **1** | **10'** | **3'** | **2.41** | **19.5** | **6** | **45** |
| **2** | **10'** | **3'** | **2.41** | **19.5** | **2** | **15** |
| **3** | **13'** | **3'** | **18.0** | **213** | **3** | **22.5** |
| **Effluent Reuse** | | | | | | |
| | **Crop Data:** | | **Dike and Lawn Irrigation** | | | |
| | | | **Ponderosa, Lodgepole, Sage and Bitterbrush** | | | |
| | **Crop Area (ac)** | | **11.8 acres of dike and lawn irrigation** | | | |
| | | | **88.5 acres of ponderosa, lodgepole, sage, and bitterbrush** | | | |
| **Net Reuse Requirements** | | | **Season: Dike and Lawn Reuse -** | | **28.79 inches** | |
| | | | **Forest Reuse -** | | **14.3 inches** | |
| | | | **Peak month: Dike and Lawn Reuse -** | | **6.5 inches** | |
| | | | **Forest Reuse -** | | **4.27 inches** | |

| | | | |
|---|---|---|---|
| **Reuse Equipment** | **Forest Reuse** | **Dike and Lawn Reuse** | |
| **Type:** | **Fixed Cannon Sprinklers** | **Fixed Sprinklers** | |
| **Max. App. Rate (gpm):** | **1000** | **125** | |
| **Flow Meter:** | **6" Magnetic** | **4" Magnetic** | |
| **Effluent Reuse/Recirculation Pumps** | | | |
| **No.** | **# 1** | **# 2** | **# 3** |
| **Horsepower:** | **100** | **100** | **15** |
| **Capacity (gpm):** | **1000** | **1000** | **125** |
| **Total Dynamic Head (ft)** | **200** | **200** | **75** |
| **Chlorination Facilities** | | | |
| **Type:** | **Sodium Hypochlorite Solution** | | |
| **Contact Chamber:** | **1140' of 36" pipe** | | |
| **Volume (gal):** | **60,000** | | |
| **Detention Time (min):** | **60 minutes @ 1,000 gpm** | | |

### 3.3.1 Theory of Treatment Process

Aerated lagoons can be described as very lightly loaded activated sludge wastewater treatment systems. The microorganisms responsible for organic breakdown of incoming wastewater tend to be similar to those found in activated sludge systems. The process does not depend on algae and sunlight to furnish dissolved oxygen (DO) for bacterial respiration, but instead uses mechanical aeration to transfer the major portion of oxygen, and to achieve mixing of the wastewater. Because of the mixing, removal of suspended solids in the lagoon effluent is an important consideration.

The primary pond is provided for solids removal, and to further the aerobic treatment process for overall improved treatment performance. The theory of aerated lagoons involves necessity for oxygen additions in the major reactive phases of the lagoon, and mixing to improve the efficiency of the microorganisms. Transfer of oxygen into the lagoon wastewater occurs at the interface between the gas and liquid. Oxygen transfer is improved by increasing the interfacial area and by increasing turbulence through mixing. Oxygen transfer to a point of saturation or equilibrium occurs very rapidly at the interface. The interface is estimated to be only a few molecules thick. Oxygen molecules pass through this film and are diffused very gradually into the main body of liquid in the aerated lagoons.

Oxygen will transfer more readily into a liquid with low residual dissolved oxygen than when the dissolved oxygen level is at or near saturation. Therefore, mixing is required to create turbulence, so that liquid saturated with dissolved oxygen can be replaced with liquid that has an oxygen content less than saturation.

### 3.3.2 Influent Flow Measurement and Sampling

Influent flow measurement is provided in the pump room of the control building for the wastewater treatment plant. The meter is an 8" ASA electromagnetic flow meter which has been calibrated annually since installation.

Influent sampling is provided by an ISCO 3710FR refrigerated sampler located in the pump room of the control building at the treatment plant. This is a 24-hour composite sampler which provides composite data for influent $BOD_s$ and TSS.

### 3.3.3 Headworks

The headworks contains a mechanical fine screen with a coarse bar screen in the bypass channel and a fine screen in the normal channel for treatment operations. Only one screen is used at a time, and normal flows are directed through the fine screen mechanism unless problems prevent its operation. The screen is a Lakeside Equipment Corporation Rotamat, with weather protection. Operation of the fine screen allows for more efficient biological treatment within subsequent treatment units. Improved treatment is accomplished by removing all solids of a size 1/4" or larger from the raw influent. An aluminum gate is provided in front of each channel to manually direct flow in the desired location. During extreme flow periods, or during emergency conditions, the gate maybe overtopped with flow. This allows the bypass channel to automatically function for containment of excess flows. A spray wash system is provided on the fine screens to clean the removed screening prior to disposal. The main channel has been corroded by hydrogen sulfide action, and needs repair to function as it was originally intended.

A discharge chute, bagger and screenings collector are provided to dispose of screenings. Screenings are washed and dewatered upon deposit in the feed trough. The chute directs screenings to the bagger. Collected screenings are sent to the Deschutes County landfill for disposal.

All equipment in the Sisters Wastewater Treatment Plant is provided with control through the SCADA system provided for system operation. This unit is no longer supported by the manufacturer and will need to be replaced either with the expansion of the effluent disposal system or if there is a significant failure due to its importance of running the entire treatment plant.

### 3.3.4 Aerated Lagoons

The Sisters wastewater treatment plant has three aerated lagoons which are piped to flow in series. Total acreage provided at the top of the banks is approximately 22.82 acres of lagoon surface. Pond depths are capable of running at 10 feet in Lagoons No. 1 and No. 2, but are running at 9 feet due to inlet pipe placement, and 13 feet in Lagoon No. 3. (Holding Pond), when the units are filled to capacity. Total pond volume, with 3 feet of freeboard provided, is approximately 82 million gallons.

Lagoon levels in Lagoons No. 1 and No. 2 can be independently controlled with stop logs in their effluent transfer structures. An effluent structure with sluice gates controls the flow of effluent from the holding pond to the transfer structure, and an effluent decanter is provided to draw water from below the lagoon surface. 60 mil HDPE liners are provided to prevent leakage from all of the lagoons.

All the lagoons are provided with mechanical aeration. The holding pond operates as both a holding and polishing pond, and is also provided with mechanical aeration. Chlorine is introduced for disinfection purposes into a 1,140 feet long 36" contact pipeline installed in the diking West of Lagoons No. 1 and No. 3. Disinfection occurs prior to effluent reuse.

Varying flow regimes are possible in the lagoons, utilizing transfer structures provided. The lagoons can be operated on a flow through basis, which should be the normal process, batch basis, or a combination of the treatment methods. In addition, any lagoon can be bypassed for operational or cleaning purposes.

#### 3.3.4.1 Aerators

Lagoons No. 1 and No. 2 are equipped with eight (8) Aire-$0_2$ aerators; six (6) in the first lagoon and two (2) in the second. Aerators are provided for reduction of much of the settable solids (TSS) and associated $BOD_5$ loading from the liquid stream before it reaches the subsequent lagoons. The holding pond has three (3) identical aerators, which operate when the depth of liquid reaches a minimum of 5 feet underneath the aerators. Aerators are of the submerged aspirator type, meaning that they pull air from above the water surface and inject and disperse it below the water surface with a propeller aspirator pump. They are arranged to cause the contents of the lagoons to flow in a circular pattern, with the pattern created being away from the motor end of the aerator. This mixing action reduces short circuiting in the lagoons, thus effectively using the entire capacity for lagoon No. 1, and the area being aerated in the remaining lagoons.

Aerators are controlled through the SCADA system with the PLC provided, and timers are available to control the length of the operating cycle and the percentage of running time in that cycle for operation of all units. The

percentage of time on can be changed with the time of year to reflect changes in $BOD_5$ loading to the lagoons, water temperature, amount of solar energy and related algae growth, degree of ice cover, etc. In the summer, $BOD_5$ loading is the highest, but natural treatment activity is also the highest because of peak sunlight and water temperature. In the winter, $BOD_5$ loading is the lowest, but natural activity is also lowest because of low water temperature and ice cover. Aerators should be operated enough to maintain dissolved oxygen in the water, to prevent from freezing in winter ice and to produce an effluent which meets permit conditions.

Lagoon depths and surface areas are provided in *Table 3.1*. Lagoon levels are adjustable with stop logs provided in transfer structures, but generally lagoons No. 1 and No. 2 remain full depth, allowing variation in lagoon No. 3 with the season and the extent of land reuse. Control of lagoon depths can be utilized for operational flexibility, and to control the holding and biological capacity for the lagoons.

Holding capacity in lagoon No. 3 is provided to contain all flows from November 1 to March 31 when no effluent reuse is permitted. Containment is also provided when weather conditions, such as high humidity, high winds, and low ambient temperatures do not permit land reuse.

The aerators have been in nearly continuous operation since the plant became operational in 2001 with a maximum 20 year life expectancy, and will need continued maintenance and eventually replacement during the planning period for this study. Larger aerators and more efficient models will need to be installed as BOD levels rise to the point of needing additional aeration for adequate treatment. In addition, there are now more energy efficient models, including solar options that could be installed to reduce operational costs.

#### 3.3.4.2 Transfer Structures

Transfer structures for the lagoons are equipped with wooden stop logs or slide gates to control the level in the ponds, and to provide for draining of each lagoon. An effluent decanter is attached to the effluent transfer structure to provide a means of securing quality water for land reuse purposes. A drain is also provided from lagoon No. 3 to the effluent transfer structure for draining of the final lagoon.

#### 3.3.4.3 Disinfection Facilities

Disinfection of effluent at the Sisters plant is provided by chlorination, specifically through sodium hypo-chlorite. Equipment includes a Lightnin chemical mixer, a 500-gallon polyethylene sodium hypo-chlorite tank, a Wallace & Tiernan chemical feed pump, a Grundgs Fost back-up chemical

feed pump, a Gas Mastrrr 3-hp flash mixer, a vacuum regulator, rate controller, ejector water supply system, and a chlorine contact pipeline. The chlorine contact pipeline is 1,140 feet of 36" PVC piping buried in the dike along the west side of lagoon # 1 and the holding pond. A Gas Mastrrr Series 32 chlorine induction feeder-flash mixer is provided in the transfer structure from the holding pond to the chlorine contact pipeline. This unit provides a positive flash mix of sodium hypo- chlorite solution which flows through the chlorine contact pipeline toward the land reuse system. A sampling tap is provided on the effluent (reuse) piping to allow for sampling of effluent pumped from the reuse pumps to either of the two reuse systems provided. Disinfection facilities are controlled through the SCADA system with the PLC provided.

The disinfection system is in good condition and working effectively. However, the chlorine pump and the flash mixer will need to be replaced as a portion of normal plant maintenance procedures, and budget should be provided for replacement of the aged equipment.

#### 3.3.4.4 Effluent Flow Measurement and Sampling

Effluent flow measurements are provided in the pump room of the control building for the WWTP. Two meters are provided, with one on the dike and lawn reuse system, and one on the forest reuse system. Each meter is an ASA model IF6 electromagnetic flow meter, which have been calibrated annually since installation. Grab samples are taken out of the transfer structure before the effluent enters the chlorine contact line. These samples are then tested for concentration of e.coli. Flow measurements are recorded in the SCADA system provided.

Flowmeter performance has been excellent, all the units were rebuilt in 2007 due to the pump building inadvertently flooding. All flow meters are flow tested and calibrated annually to ensure accuracy within specifications. Operations have experienced no problems in meeting permit conditions for e-coli.

#### 3.3.4.5 Treatment and Pumping Facility Control Building

The treatment and pumping facility control structure has functioned well. Existing pumps were flooded in 2007, and are being monitored and tested annually to help prevent pump and motor failures.

#### 3.3.4.6 General Plant Conditions

Overall conditions at this treatment facility are adequate, other than for the age of installed equipment. Equipment has functioned well, however, all operating equipment has a lifetime, and proper maintenance would suggest

replacement of all pumping and aeration equipment on a 15-20 year basis.

## 3.4 WASTEWATER EFFLUENT REUSE

### 3.4.1 General

The effluent reuse facilities are intended to discharge treated and disinfected effluent for land reuse through irrigation of both forest land and lagoon dikes and lawns on the treatment plant site. The effluent reuse system that is in place includes a holding pond for storage, a chlorine contact line for effluent disinfection, three irrigation pumps, a re-circulation system, and a sprinkler system to provide reuse on treatment plant lagoon dikes and lawn areas, and on 88.5 acres of forest land. Additional area for reuse is set aside for buffer to adjacent properties on the North, East and South boundaries of the treatment plant site, in compliance with Oregon DEQ regulations. In addition, a separate buffer area was set aside initially between the forest reuse site and the Buck Run Subdivision, and this area is potentially available for future expansion of the reuse site, utilizing Class A effluent (current treatment plant processes result in a Class D effluent), although not recommended due to proximity to development.

Prior to land reuse, the effluent is disinfected in 1,140 feet of 36" chlorine contact line, which provides for a minimum detention time of 60 minutes at peak discharge flows of 1,000 gpm. Sodium hypochlorite from the 500 gallon HDPE storage tank is mixed with effluent from Lagoon No. 3, in the chlorine contact facility. Effluent is discharged to forest land and pond dikes and lawn areas from April 1 to October 31 and stored in the holding pond during the remaining months.

### 3.4.2 Effluent Reuse System

The land reuse system diverts the majority of the effluent to 88.5 acres of forest land, and the remaining to the treatment plant lagoon dikes and lawn areas (11.8 acres). The effluent is pumped to these locations using three pumps. Two 100 HP, 1000 gpm capacity pumps transport effluent to the forest land, while one 15 HP, 125 gpm capacity pushes the water to the dike. The effluent is carried to the forest land in a 10" main line which branches out into 8" lines across the irrigation area. There are flow meters stationed after the pumping facility that are measuring the quantity of effluent traveling to both the forest land and dike.

Both effluent reuse systems provided for discharge from the Sisters WWTP are controlled through the SCADA system, with the Programmable Logic Controller provided.

Both the SCADA system and the PLC have been in use since the plant became operational, and equipment of this type and age becomes outdated, is not supported and difficult to repair due to availability of parts. Both the SCADA system and the PLC will need to be replaced in the near future.

# SECTION 4:
# POPULATION AND LAND USE

## 4.1 HISTORICAL POPULATION

Sisters maintained a historical population from 600 residents to 690 residents for more than 30 years through the year 1990. Population growth was relatively stagnant between 1980 and 1990, but averaged approximately 2 percent a year from 1990 to 1996. The population reached 775 residents in 1996. Beginning in 1997, when the citizens approved construction funding for the community sewer system, growth has escalated rapidly, in similar fashion to the growth throughout all of Deschutes County. By the year 2003, population in Sisters had reached 1,430 residents, and despite the slowing of growth during the recession of 2008-2013, Sisters population now stands at around 2,315.

## 4.2 CURRENT POPULATION

The certified population in 2015 for the City of Sisters was 2,280 residents on July 1, 2015, by the Population Research Center at Portland State University.

## 4.3 PROJECTED FUTURE POPULATION IN YEAR 2035

The City of Sisters Comprehensive Plan projects that population in the City will be moderate within the planning period. From 2015 to 2035 population is expected to grow at 3.23% per year. Assuming that the projections are realistic, and that the growth has slowed to the projected 3.23% growth rate, the City should anticipate a 89% population growth by the year 2035. ***It should be noted that Sisters has experienced periods of rapid growth in the recent past, therefore, it is recommended that a population forecast update be prepared at a minimum of every 5 years, and, if necessary, corresponding revisions to the capital facilities plan. Regular population forecast updates will ensure that the capital facilities plan remains closely aligned with current population and current demand on City infrastructure.***

## 4.4 COMPARISON WITH PREVIOUS GROWTH PROJECTIONS

Previous population projections by the City of Sisters and Deschutes County, and projections in the 1988 Water Facilities Study (Westech Engineering), and 1997 Wastewater System Facilities Plan (HGE Inc., Architects, Engineers, Surveyors & Planners) substantially underestimated the growth that has occurred in the City. The 1988 projection estimated that approximately 1,100 people would reside in Sisters by the year 2005, while the remaining projections all anticipated a population in the range of 1,000 people by the year 2005. Growth has been much more rapid than anticipated in projections during the 1980's and 1990's.

## 4.5 CAPITAL FACILITIES PLAN POPULATION FORECASTS

Development is occurring in Sisters and is anticipated to result in population growth of 3.23% per year between 2015 and 2035. (Source: Portland State University). A

population of 4,375 residents is forecast for year 2035.

## 4.6 BUILDOUT OF CURRENT UGB

The aforementioned population estimates assume year 2035 growth will occur as a result of the buildout of infill land within the existing UGB. Ultimate population in the Sisters UGB is difficult to estimate with continuing infill and partitioning of lots in older sections of the City. It is anticipated that future years will see a tendency toward partitioning of lots for coming generations, taking into account increasing land values. Growth projections should occur within the existing UGB, with the potential for continuing population expansion as existing land area continues to be redeveloped into smaller partitions. The Sisters Planning Department anticipates stable occupancy rates to occur within the 20-year planning period with an average of 2.08 people per dwelling unit by 2035 and approximately 2,140 dwelling units.

## 4.7 LAND USE

### 4.7.1 Current Land Use

Current land use is shown on *Figure 1.2* based on Sisters' Comprehensive Plan and zoning ordinances, effective in 2015. The Urban Growth Boundary (UGB) may be adequate for anticipated growth in the planning period.

### 4.7.2 Comprehensive Plans and Zoning Ordinance Revisions (Amended 2014)

The current Comprehensive Plan was adopted by the City of Sisters in 2005, and amended in 2014. Revisions since the 2005 plan include adoption of mixed use developments incorporating residential and light industrial development. The revisions also allow and encourage smaller minimum lot sizes, a density bonus and a height bonus when residential is incorporated with commercial development. Both have an impact on increasing needs for public infrastructure.

### 4.7.3 General Comments

Sisters is primarily a residential community, with a significant tourist-based economy. The City has a vibrant commercial district located on either side of U.S. Highway 20, and room for considerable expansion within the industrial district. Historically, there has not been a clear division between residential and industrial areas. As a result, the City has developed a zoning system that restricts industrial development to designated areas, while permitting mixed-use residential development in areas zoned for industrial purposes. Future industry, according to the City's Comprehensive Plan, will be encouraged to locate in areas with readily available utilities and minimal conflicts with existing development.

# SECTION 5:
# WASTEWATER CHARACTERISTICS

## 5.1 INTRODUCTION

### 5.1.1 Definitions

The following terms are used to define seasonal differences in wastewater flow characteristics:

*Dry-Weather (or Summer) Period:* Generally defined as the period when precipitation is limited and stream flows are low. This period is commonly defined in the Oregon Administrative Rules (OARs) for specific basins as May 1 through October 31. Sisters WPCF Permit does not include any specific reference to, or definition of, this parameter. It roughly corresponds, in Sisters, to the period during which irrigation takes place. Summer is a shorthand reference.

*Wet-Weather (or Winter) Period:* Generally defined as the period when precipitation is greatest and stream flow is highest. This period is commonly defined in the OARs for specific basins as November 1 through April 30. It roughly corresponds, in Sisters, to the period when no irrigation takes place and all effluent is held in the wastewater lagoon. Winter is a shorthand reference.

The following terms are used to characterize wastewater flows:

*Average Daily Flow (ADF):* Total wastewater flow for a defined period divided by the number of days in the period or season.

*Maximum Monthly Flow (MMF):* Total wastewater flow in the month of the highest flow, within a defined period or season, divided by the number of days in that month.

*Peak Daily Flow (PDF):* Total flow for the day with the highest flow, within a defined period or season.

*Peak Instantaneous Flow (PIF) or Peak Hourly Flow (PHF):* Highest sustained one hour flow during the year. For purposes of this facilities plan, the terms are treated as synonymous.

The following subscripts are utilized to further define the flow parameters according to the period or season of interest:

A: Annual. Defines a full year period.
WW: Wet-Weather. As defined above.
DW: Dry-Weather. As defined above.

Flow parameters in this facilities plan are typically abbreviated and combined with subscripts as follows[1]:

| | |
|---|---|
| $ADF_A$: | Annual Average Daily Flow |
| $ADF_{WW}$ | Average Daily Wet-Weather Flow |
| $ADF_{DW}$: | Average Daily Dry-Weather Flow |
| $MMF_{WW}$: | Maximum Monthly Wet-Weather Flow |
| $MMF_{DW}$: | Maximum Monthly Dry-Weather Flow |
| $PDF_{WW}$: | Peak Daily Wet-Weather Flow |
| $PHF_{WW}$: | Peak Hourly Wet-Weather Flow |

If a flow parameter is referenced without a subscript then it should be interpreted as applying equally to any season.

Flow parameters are typically abbreviated and expressed as:

| | |
|---|---|
| mgd: | millions of gallons per day |
| gpd: | gallons per day |
| gpcd: | gallons per capita per day |

Other flow rates commonly used include:

| | |
|---|---|
| gpm: | gallons per minute |
| cfs: | cubic feet per second |

Totalized flows are commonly referred to as:

| | |
|---|---|
| gal: | gallons |
| MG: | million gallons |
| cf: | cubic feet |
| Ac-ft.: | acre feet |

Water quality parameters discussed in this section include:

| | |
|---|---|
| $BOD_5$: | Biochemical Oxygen Demand |
| TSS: | Total Suspended Solids |

Water quality loadings are typically expressed as:

| | |
|---|---|
| mg/l: | milligrams per liter |
| ppd: | pounds per day |
| ppcd: | pounds per capita per day |

[1] Other combinations are easily formed and may be utilized for reference.

The following terms are included for clarification:

Current: Generally refers to recent condition valid for year 2015.

Design: With regard to flows, design refers to anticipated flows that would occur under conditions corresponding to the flow characteristics defined above. Design takes into account a full analysis of the flows and generally ignores current system limitation such as inadequate plant, pump station, and collection system capacities. As a result, current design flows may vary considerably from the record of flow currently or recently observed at the wastewater facility. Future design flows include allowances for community growth and, possibly, other changes in system characteristics. Unless qualified otherwise, future design parameters refer to projected parameters at the end of the design period. In this case, year 2035.

### 5.1.2 Parameters of Interest

The City's main pump station (Pump Station No. 1) transfers all of the City wastewater to the treatment facility. The primary parameter of interest is the extrapolated peak hourly flow. Headworks are also evaluated and sized according to peak hourly flow requirements.

Lagoon treatment/holding includes considerable equalization capabilities. Parameters of primary interest are averages of defined periods (winter or summer).

For mechanical treatment facilities, parameters of interest vary according to the nature of the processes involved. In general, hourly, daily, weekly, and monthly parameters may all be needed.

### 5.1.3 Methodology for Computing Flows

DEQ has developed guidelines for projecting wastewater flows, using relationships between wastewater flow and rainfall. These guidelines work well for estimating wastewater flows in Western Oregon, where winter rainfall often is a major contributor to the total and peak flows reaching the plant (through infiltration and inflow into the collection system). However, in Sisters these guidelines are not appropriate since rainfall does not directly have a significant impact on the amount or peaking of flow reaching the treatment facility. Sisters' design flows will be based on flows measured at the wastewater treatment facility. Peak hourly flow for Sisters will be extrapolated using general design guidelines.

## 5.2 ACCURACY OF DATA

### 5.2.1 Influent Flowmeter and Sampler

The influent flowmeter is located in the pump room of the control building at the Wastewater Treatment Plant. The meter is an 8" ASA electromagnetic flow meter, which records all flows received from Wastewater Pump Station No. 1. And was installed in 2001 as part of the City's wastewater treatment facility. Flowmeter calibration has been verified by a factory representative on an annual basis. Flowmeter performance has not been problematic.

The influent sampler is also located in the WWTP Control Building to record composite samples of influent flows. The sampler is an ISCO 3710 FR refrigerated sampler which provides for a 24 hour composite sample. Samples are taken weekly by the Lead Operator and all testing is provided by City staff. Sampler operation and sample handling/testing has not been problematic.

### 5.2.2 Bypass and Overflows

There are no constructed bypasses or overflows in the wastewater system.

### 5.2.3 Inflow and Infiltration (I/I)

There is little evidence of I/I in the Sisters collection system. The system itself was substantially constructed in 2002. Sewer lines are generally above the groundwater table. Annual precipitation is 13.62 inches; annual evaporation is approximately 46 inches (see Section 7.4.1). It is unlikely that I/I will pose a concern during the planning period.

### 5.2.4 Effects of Population Growth

Population growth has been very high in recent years. Growth from the 2000 Census figure of 959 persons to the Portland State Population Research Center (PSU) figure of 1,490 for July 1, 2004 averaged 11.65 percent per year. The largest growth occurred between 2002 and 2003 with an increase of 32.4 percent based on PSU figures of 1,080 and 1,430 persons respectively. Growth from 2003 to 2004 was more moderate at 4.2 percent (based on PSU figures on 1,430 and 1,490 respectively) and growth in population has reached 2,315 at 2015 end. The effect of such high growth rates on wastewater flows is marked; therefore, only the most recent flow data will be evaluated for the purposes of estimating current and future flow parameters.

The PSU figure of 2,280 persons will be used to estimate current per capita flows from the recent data. This will ensure a conservative design basis for recommended improvements and counter deficiencies associated with an abbreviated data set.

## 5.3 FLOW ANALYSIS

### 5.3.1 Observed Data

Observed data is summarized in *Table 5.1* for the two year period from November 2013 through October 2015. Primary source is the WPCF Discharge Monitoring Reports (*Appendix 5.1*).

*Table 5.1: Wastewater Influent Flow Data*

| *Month* | *2013-2014 Total (MG)* | *2014-2015 Total (MG)* | *Percent Increase* |
|---|---|---|---|
| November | 5.445 | 5.567 | 2.2 |
| December | 5.945 | 5.833 | -1.9 |
| January | 5.501 | 5.664 | 3.0 |
| February | 5.530 | 4.972 | -9.0 |
| March | 5.466 | 5.796 | 6.0 |
| April | 5.020 | 5.466 | 8.9 |
| May | 5.683 | 5.850 | 2.9 |
| June | 5.872 | 6.496 | 10.6 |
| July | 6.430 | 6.848 | 6.5 |
| August | 6.458 | 6.509 | 0.8 |
| September | 6.065 | 6.082 | 0.3 |
| October | 5.793 | 5.726 | -1.2 |
| **Total** | **69.208** | **70.809** | **2.3** |
| **Daily Average** | **0.190** | **0.194** | **2.3** |

*Table 5.1* shows the effects of population growth on flows. There was an average increase of 2.3 percent between the two years shown. Increases occurred throughout the year and in every month except December, February, and October, where the 2013-2014 totals were less than the 2014-2015 totals. Because of the flow increase associated with City growth, the flow analysis will focus on the 2014-2015 data.

*Table 5.2* provides a further elaboration of flow data for the period November 2014 to October 2015.

*Table 5.2: Daily Wastewater Data Summary*
*(November 2014 - October 2015)*

| *Month* | *Monthly Average (mgd)* | *7-Day Maximum (mgd)* | *Maximum Day (mgd)* | *Minimum Day (mgd)* |
|---|---|---|---|---|
| November | 0.185 | 0.185 | 0.212 | 0.166 |
| December | 0.190 | 0.190 | 0.254 | 0.156 |
| January | 0.182 | 0.182 | 0.233 | 0.161 |
| February | 0.176 | 0.176 | 0.209 | 0.164 |
| March | 0.187 | 0.187 | 0.256 | 0.172 |
| April | 0.182 | 0.182 | 0.196 | 0.166 |
| May | 0.188 | 0.188 | 0.234 | 0.179 |
| June | 0.216 | 0.216 | 0.248 | 0.190 |
| July | 0.221 | 0.230 | 0.246 | 0.205 |
| August | 0.210 | 0.210 | 0.220 | 0.192 |
| September | 0.202 | 0.202 | 0.226 | 0.186 |
| October | 0.184 | 0.184 | 0.205 | 0.173 |
| Summer | 0.204 | 0.205 | 0.248 | 0.156 |
| Winter | 0.184 | 0.184 | 0.256 | 0.173 |
| Annual | 0.194 | 0.194 | 0.256 | 0.156 |

A summary of recent wastewater flow characteristics is shown in *Table 5.3.*

*Table 5.3: Summary of Wastewater Flow Characteristics*
*(November 2014 - October 2015)*

| *Flow Characteristics* | *Flow (mgd)* | *Flow (gpcd)* [1] | *Date of Occurrence* |
|---|---|---|---|
| *Annual:* | | | |
| $ADF_A$: | 0.194 | 85.1 | Nov 14-Oct 15 |
| *Summer:* | | | |
| $ADF_{DW}$: | 0.204 | 89.4 | May-Oct 2015 |
| $MMF_{DW}$: | 0.221 | 96.9 | July 2015 |
| $MWF_{DW}$: | 0.230 | 100.9 | July 5-11, 2015 |
| $PDF_{DW}$: | 0.248 | 108.8 | June 14, 2015 |
| *Winter:* | | | |
| $ADF_{WW}$: | 0.184 | 80.7 | Nov 14 -April 15 |
| $MMF_{WW}$: | 0.190 | 83.3 | December 2014 |
| $MWF_{WW}$: | 0.226 | 99.3 | Dec 29 - Jan 4, 15 |
| $PDF_{WW}$: | 0.256 | 112.3 | March 27, 2015 |

[1] Population Basis: 2,280 (Section 5.2.4)

The highest flows typically occur in the summer and are associated with the high number of seasonal visitors and tourists. Approximately 33 percent of metered water sales returned as wastewater during the period November 2014-October 2015.

### 5.3.2 Design Flows

Current design flows are based on data presented in Section 5.3.1. The data utilized does not appear problematic or inconsistent; therefore, there is no need for supplemental data or analyses. Current design flows are summarized in *Table 5.4.*

Peak hourly flows (PHF) are estimated using methodology described in *Recommended Standards for Wastewater Facilities, 2004 Edition* (also known as the 10 State Standards):

$$\frac{PHF}{ADF} = \frac{18+P^{0.5}}{4+P^{0.5}}$$

*where P =population in thousands*

Future (year 2035) design flows are also shown in Table 5.4. Future flows, except PHF, are based on the 2015 design flows increased by the population ratio of 4,375 persons (the projected year 2035 population) and the PSU 2014 figure of 2,280 persons. PHF figures were recomputed using the projected population forecast of 4,375 persons in year 2035. It is assumed that the relative ratio of commercial and residential development will continue during the planning period. Disproportionate growth of commercial, industrial, or institutional sectors could result in design level flows occurring prior to achieving the forecasted population of 4,375 persons. The 2035 design flows represent an increase of approximately 192 percent over current conditions.

*Table 5.4: Design Flow Summary*

| *Flow Characteristics* | *Current 2015 Design Flow (mgd)* | *Future 2035 Design Flow [1] (mgd)* |
|---|---|---|
| *Annual:* | | |
| $ADF_A$: | 0.150 | 0.316 |
| *Summer:* | | |
| $ADF_{DW}$: | 0.165 | 0.347 |
| $MMF_{DW}$: | 0.175 | 0.368 |
| $MWF_{DW}$: | 0.185 | 0.389 |
| $PDF_{DW}$: | 0.200 | 0.421 |
| $PHF_{DW:}$ | 0.595 | 1.252 |
| *Winter:* | | |
| $ADF_{WW}$: | 0.135 | 0.284 |
| $MMF_{WW}$: | 0.140 | 0.294 |
| $MWF_{WW}$: | 0.150 | 0.316 |
| $PDF_{WW}$: | 0.180 | 0.379 |
| $PHF_{WW}$: | 0.480 | 1.010 |

| | | |
|---|---|---|
| | | |

[1] Population Basis: 4,375

## 5.4 WASTEWATER QUALITY

### 5.4.1 Current Influent Loadings

Influent BODs and TSS sampling and testing is conducted approximately four times per month. Influent BODs data for the period November 2014 to October 2015 is shown in *Table 5.5*; influent TSS data for the same period is shown in *Table 5.6*.

*Table 5.5: Influent $BOD_5$ Data*
*(November 2014 -October 2015)*

| *Month* | *Number of Sample Events* | *Concentration (mg/l)* | | | *Loading (ppd)* | | |
|---|---|---|---|---|---|---|---|
| | | *Average* | *Max.* | *Min.* | *Average* | *Max.* | *Min.* |
| November | 4 | 311 | 331 | 291 | 502 | 557 | 430 |
| December | 4 | 318 | 393 | 224 | 489 | 590 | 321 |
| January | 3 | 370 | 393 | 351 | 580 | 734 | 504 |
| February | 4 | 410 | 438 | 385 | 609 | 650 | 555 |
| March | 4 | 357 | 422 | 294 | 601 | 796 | 454 |
| April | 4 | 433 | 443 | 414 | 657 | 705 | 619 |
| May | 4 | 316 | 424 | 249 | 512 | 654 | 377 |
| June | 4 | 351 | 368 | 339 | 647 | 678 | 599 |
| July | 5 | 360 | 385 | 339 | 676 | 702 | 644 |
| August | 4 | 371 | 416 | 327 | 652 | 704 | 599 |
| September | 4 | 362 | 397 | 338 | 622 | 706 | 566 |
| October | 4 | 304 | 349 | 210 | 469 | 521 | 338 |
| Summer | 25 | 344 | 424 | 210 | 596 | 706 | 338 |
| Winter | 23 | 367 | 443 | 224 | 573 | 796 | 321 |
| Annual | 48 | 355 | 443 | 210 | 585 | 796 | 321 |

*Table 5.6: Influent TSS Data*
*(November 2014 -October 2015)*

| Month | Number of Sample Events | Concentration (mg/l) | | | Loading (ppd) | | |
|---|---|---|---|---|---|---|---|
| | | Average | Max. | Min. | Average | Max. | Min. |
| November | 4 | 201 | 212 | 191 | 322 | 338 | 295 |
| December | 4 | 165 | 198 | 103 | 255 | 325 | 148 |
| January | 3 | 170 | 190 | 138 | 268 | 346 | 198 |
| February | 4 | 188 | 201 | 190 | 280 | 292 | 248 |
| March | 4 | 175 | 194 | 144 | 287 | 414 | 222 |
| April | 4 | 195 | 220 | 172 | 296 | 350 | 265 |
| May | 4 | 160 | 210 | 89 | 262 | 364 | 135 |
| June | 4 | 122 | 165 | 85 | 227 | 323 | 159 |
| July | 5 | 171 | 200 | 130 | 297 | 368 | 247 |
| August | 4 | 219 | 245 | 201 | 387 | 449 | 340 |
| September | 4 | 195 | 202 | 189 | 335 | 375 | 316 |
| October | 4 | 175 | 210 | 140 | 272 | 324 | 202 |
| Summer | 25 | 174 | 245 | 85 | 297 | 449 | 135 |
| Winter | 23 | 182 | 220 | 103 | 285 | 414 | 414 |
| Annual | 48 | 178 | 245 | 85 | 291 | 449 | 449 |

Influent concentration data appears reasonable and does not include very low or very high figures that would suggest sampling errors or I/I.

Per capita $BOD_5$ and TSS Loadings are summarized in *Table 5.* 7. Average and Summer $BOD_5$ values are somewhat high. This is consistent with the substantial presence of visitors and tourists. TSS is relatively low throughout the year.

*Table 5.7: Influent BOD / TSS Data*
*(November 2014 -October 2015)*

| | $BOD_5$ (ppcd) | TSS (ppcd) |
|---|---|---|

| | | |
|---|---|---|
| *Annual:* | | |
| Average: | 0.257 | 0.128 |
| Average Monthly Maximum: | 0.296 | 0.170 |
| Daily Maximum: | 0.349 | 0.197 |
| *Summer:* | | |
| Average: | 0.261 | 0.130 |
| Average Monthly Maximum: | 0.296 | 0.170 |
| Daily Maximum: | 0.310 | 0.197 |
| *Winter:* | | |
| Average: | 0.251 | 0.125 |
| Average Monthly Maximum: | 0.288 | 0.141 |
| Daily Maximum: | 0.141 | 0.182 |

[1]Population Bases: 2,280 (See Section 5.2.4)

Design BOD5 and TSS loadings are summarized in Table 5.8.

*Table 5.8: Influent BOD / TSS Data*
*(November 2014 -October 2015)*

| | *2015* | | *2035* | |
|---|---|---|---|---|
| | *$BOD_5$ (ppcd)* | *TSS (ppcd)* | *$BOD_5$ (ppcd)* | *TSS (ppcd)* |
| *Annual:* | | | | |
| Average: | 585 | 291 | 1123 | 558 |
| Average Monthly Maximum: | 676 | 387 | 1297 | 743 |
| Daily Maximum: | 796 | 449 | 1527 | 862 |
| *Summer:* | | | | |
| Average: | 596 | 297 | 1144 | 570 |
| Average Monthly Maximum: | 676 | 387 | 1297 | 743 |
| Daily Maximum: | 706 | 449 | 1355 | 862 |
| *Winter:* | | | | |
| Average: | 573 | 285 | 1100 | 547 |
| Average Monthly Maximum: | 657 | 322 | 1261 | 618 |
| Daily Maximum: | 321 | 414 | 616 | 794 |

# SECTION 6:
# COLLECTION SYSTEM IMPROVEMENTS

## 6.1 GENERAL

This section describes the process by which the proposed flows for the collection system were calculated as well as the impact of those results. Each branch of the gravity system was analyzed in addition to all four pump stations and their associated force mains. Some considerations were noted for expansion that might take place after the designated planning period for the study.

## 6.2 DESIGN PARAMETERS

Design flows for the collection system were calculated on an EDU basis at build out. A specific amount of square feet was designated per EDU for each zone. The zoning can be seen in *Figure 1.2* and the square foot per EDU are displayed in *Table 6.1.* The number of EDU's serving each sewer lateral and main and the flow in each, was calculated using the following equation:

*Table 6.1 - EDU Designation*

| *Description* | *FT.$^2$/EDU* |
|---|---|
| Commercial | 5,000 |
| Multi-Family Res. | 5,000 |
| Industrial | 20,000 |
| Residential | 10,000 |
| Open Space | 20,000 |
| City Parks | 30,000 |
| Schools | 10,000 |
| Public Facilities | 10,000 |

$$EDU = \sum \frac{S_i}{D_i}$$

where: *S* is the total square foot for a given zone serving the sewer lateral or main, *D* is the square foot designation per EDU for that zone, and *i* is the summation for all the zones that are serving the given sewer lateral or main.

Once the EDU's were calculated for each sewer lateral or main they were multiplied by 125 Gallons/EDU, and increased by a peaking factor of 2.4 for a pipeline designed to run no greater than 50% full. Peak flows were then totaled for each main or lateral, including flows from upstream pipeline sections. This should be conservative for planning purposes.

The flow capacity for the gravity lines, given the slope, were calculated using Manning's equation shown below:

$$V = \frac{K}{N}(R_h)^{\frac{2}{3}}(S)^{\frac{1}{2}}$$

where *V* is the discharge velocity, *K* is the unit conversion factor, *N* is the Manning's coefficient, $R_h$ is the hydraulic radius, and *S* is the slope of the pipe. The flow capacities were calculated with the pipes half full and can be seen in *Table 6.2.*

## 6.3 SYSTEM ASSESSMENT

Flows vs system capacity are shown in *Table 6.2.* Following is a list that summarizes the results of the analysis. Individual lines showing higher flow rates should be flow tested to confirm analysis:

| ***Description*** | ***2035 Flow (gpm)*** | ***Capacity (gpm)*** |
|---|---|---|
| P.S. No. 1 | 850 | 850 |
| Force Main No. 1 | 850 | 1670 |
| P.S. No. 2 | 85 | 153 |
| Force Main No. 2 | 85 | 235 |
| P.S. No. 3 | 95 | 260 |
| Force Main No. 3 | 140 | 529 |
| P.S. No. 4 | 150 | 270 |
| Force Main No. 4 | 176 | 529 |
| 8" Grav. Main | 38 | 170 |
| 10" Grav. Main | 138 | 260 |
| 12" Grav. Main | 332 | 375 |
| 15" Grav. Main | 362 | 667 |
| 18" Grav. Main | 865 | 970 |
| 24" Grav. Main | 1004 | 3813 |

*Table 6.2 - System Flow Capacities*

1) All force mains appear to have sufficient capacity to handle projected flows and have additional capacity for growth after 2035.

2) Most gravity lines appear to be sufficiently sized for 2035 flows with existing zoning, and provide capacity for growth with the exception of the main 18" gravity main and the 10" main that serves the Industrial Park, which may reach their capacity with increasing density of development and property annexations.

3) Pump capacities are well above the projected flow, with the exception of Pump Station No. 1. These pumps, the main 18" gravity main and the 10" main that serves the Industrial Park are the portions of the current collection system that will have the potential to be at or very near its capacity within the planning period. Dependent on whether flows reach the projected levels, on a peak hourly dry weather flow ($PHF_{DW}$) basis, these system components will be marginal in capacity unless additional system capacity is developed. Density of development has increased significantly since the original system design, and it should be anticipated that this trend will continue in the future. A new Pump Station No. 5 and Force Main No. 5 should be planned and budgeted to reduce the flow to the 18" gravity main and Pump Station No. 1. The optimum location for a new major Pump Station No. 5 is on U.S.F.S. property planned to be sold for private development, which may further Increase the flows to the existing system. The most economical

location for a new pumping facility would be where the existing 18" line approaches North Pine Street on the westerly side, although the pump station could be located at alternative locations along the 18" line. Alternate locations that appear feasible at additional cost are at the beginning of the 18" line just East of Highway 20, in the East Portal property.

The 10" mainline that serves the Industrial Park and then flows east to Pump station #1 also collects flow from the Edge of the Pines and Saddlestone subdivisions. This line will need to be intercepted after it leaves the Industrial Park and collects the northern downtown commercial areas in the general area of N. Larch St. and N. Locust St. A new mainline will need to be installed from that point to Pump station #1 to create new capacity in the existing 10" Industrial Park line. West of Highway 20, installation of the new Pump Station No. 5 will be required. Future development of all types in the City should provide SDC fees for the City's portion of the construction of this pump station, and developer contributions should be imposed for future development planned for the U.S.F.S. property. In addition, the needed force main will likely extend along Pine Street to potentially Jefferson Avenue or St. Helens Avenue to minimize construction costs. As parking, street, and sidewalk improvements continue, costs for construction of the needed force main will increase substantially. Force Main No. 5 should be extended to interconnect with the existing Force Main No. 1 at Jefferson Avenue or St. Helens Avenue, and a common force main from that point to the Wastewater Treatment Plant will suffice beyond 2035.

In addition to a need for additional pumping and main line capacity, the main pumps in Pump Station No. 1 will have been in operation for 20 years by 2021. These pumps currently pump all of the sewage transmitted to the wastewater treatment plant, and should be replaced within the planning period.

# SECTION 7:
# WASTEWATER TREATMENT ANALYSIS

## 7.1 WPCF PERMIT

Sisters Water Pollution Control Facilities (WPCF) Permit No. 101779 expired on February 28, 2011. A new permit has been issued by DEQ in 2016 and a copy of the Permit is provided in *Appendix C.* and expires December 31, 2025

i. Schedule A of the permit includes provisions for waste disposal. Key provisions include: a permit flows basis of, less than or equal to, 0.38 mgd annual average daily influent flow; effluent to be disposed of in accordance with an approved Reclaimed Water Use Plan; and treated effluent may only be irrigated on land between April 1 through October 31 for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices.

Also included in the permit are the following bacterial limits which apply to the effluent and intended uses (from Schedule A (3)(b)):

1) Prior to reuse of treated effluent for Class D beneficial purposes, the wastewater shall comply with the following effluent limitations:

| Parameters | Limitations |
|---|---|
| E coli | Shall not exceed a monthly geometric mean of 126 organisms/100mls and 406 E. coli organisms/100 milliliters in any single sample. |

2) Prior to reuse of treated effluent for Class C beneficial purposes, the wastewater shall receive treatment required for Class C beneficial purposes and shall comply with the following effluent limitations:

| Parameters | Limitations |
|---|---|
| Total Coliform | Shall not exceed a 7 day median of 23 organisms/100mls and no two consecutive samples shall exceed 240 organisms/ 100mls |

The permit does not include other quantified effluent parameters such as BODs, TSS, and BODs and TSS removal efficiencies.

Minimum monitoring and reporting requirements are included in Schedule B of the permit. Monitoring requirements for influent and effluent are summarized in *Table 7.1*.

*Table 7.1: WPCF (Permit 101779) Minimum Monitoring Requirements*

| *Item or Parameter* | *Minimum Frequency* | *Type of Sample* |
|---|---|---|
| *Influent* | | |
| Total Flow (mgd) | Daily | Measurement |
| Flow Meter Calibration | Annually | Verification |
| BODS | Weekly | Composite |
| TSS | Weekly | Composite |
| pH | 3/Week | Grab |

| | | |
|---|---|---|
| *Effluent* | | |
| Total Flow (mgd) | Daily | Measurement |
| Flow Meter Calibration | Annually | Verification |
| pH | 3/Week | Grab |
| E. Coli Bacteria | 1/Week | Grab* |
| Total Coliform | 1/Week | Grab* |
| Chlorine Residual | Daily | Grab |
| Total P and Total N | Annually (During Irrigation) | Grab |
| Annual Irrigation Rate | Per Reclaimed Water Use | Per Reclaimed |
| Annual Nitrogen Loading | Plan | Water Use Plan |

* The permittee is only required to sample for either E. coli or total coliform, but not both. If the permittee is irrigating on crops requiring only Class D quality effluent, E. coli shall be monitored. If the permittee is reusing the effluent for Class C uses, total coliform shall be monitored.

## 7.2 EFFLUENT QUALITY

Effluent quality data is limited to a few parameters and is collected during active irrigation periods. Effluent TSS data is summarized in *Table 7.2* for the 2014 and 2015 irrigation seasons.

*Table 7.2: Effluent TSS Data*

| *Month* | *Parameter* | *Year 2014* | |
|---|---|---|---|
| | | *TSS (mg/l)* | *TSS (lbs)* |
| April | Total | 84 | 16 |
| | Average Day | 21 | 4 |
| | Maximum Day | 31 | 6 |
| May | Total | 90 | 173 |
| | Average Day | 18 | 35 |
| | Maximum Day | 23 | 47 |
| June | Total | 113 | 341 |
| | Average Day | 28 | 85 |
| | Maximum Day | 35 | 102 |
| July | Total | 118 | 528 |
| | Average Day | 29 | 144 |
| | Maximum Day | 51 | 220 |
| August | Total | - | - |
| | Average Day | - | - |
| | Maximum Day | - | - |
| September | Total | - | - |
| | Average Day | - | - |
| | Maximum Day | - | - |
| Season (183 days) | Total | 405 | 1058 |
| | Average Day | 24 | 67 |
| | Maximum Day | 51 | 220 |

[1] Estimated.

Based on *Table 5.6* annual average TSS loading of 227 ppd (101,105 lbs for year), and the average TSS removal efficiency was 80 percent.

Sisters samples and tests for E. coli rather than total coliform. E. coli data and chlorine data are summarized in *Table 7.3* for the 2014 and 2015 irrigation season.

*Table 7.3: Effluent E. Coli and Chlorine Data*

| | | *Year 2014* | | | *Year 2015* | | |
|---|---|---|---|---|---|---|---|
| *Month* | *Parameter* | *E. coli (MPN)* | *Chlorine (lbs)* | *Chlorine Residual (mg/l)* | *E. coli (MPN)* | *Chlorine (lbs)* | *Chlorine Residual (mg/l)* |
| April | Total | - | 60.28 | 138 | - | 40 | 94.2 |
| | Average Day | 1 | 2 | 4.6 | 1.0 | 2.3 | 6 |
| | Maximum Day | - | 6 | 3.3 | 1.0 | 5 | 9 |
| | Minimum Day | - | 2 | 0.08 | 0.0 | 0 | 1.2 |
| May | Total | - | - | - | - | 39.2 | 210 |
| | Average Day | 2 | - | - | 1.0 | 1.2 | 7 |
| | Maximum Day | - | - | - | 1.0 | 1.8 | 18 |
| | Minimum Day | - | - | - | 0.0 | 0.8 | 3 |
| June | Total | - | 81.4 | 257 | - | 51.2 | 202.5 |
| | Average Day | 2 | 2.7 | 8.5 | 4.25 | 1.7 | 6.75 |
| | Maximum Day | - | 5 | 31 | 11.0 | 5 | 20 |
| | Minimum Day | - | 0.8 | 2 | 0.0 | 1 | 0 |
| July | Total | - | 74.6 | 377 | - | 57.4 | 202 |
| | Average Day | 8.6 | 2.4 | 12 | 1.8 | 1.85 | 6.52 |
| | Maximum Day | - | 5 | 29 | 6.1 | 15 | 11 |
| | Minimum Day | - | 1.3 | 6 | 0.0 | 0.9 | 4 |
| August | Total | - | 33.9 | 248.2 | - | 53.1 | 199.1 |
| | Average Day | 8.9 | 1.4 | 9.3 | 3.6 | 1.71 | 6.42 |
| | Maximum Day | - | 1.6 | 22.7 | 11.0 | 4.1 | 11 |
| | Minimum Day | - | 0.5 | 2.1 | 0.0 | 0.8 | 0 |
| September | Total | - | 36.8 | 119.5 | - | 69.9 | 168.5 |
| | Average Day | 6.4 | 1.4 | 6.2 | 1.0 | 2.3 | 6 |
| | Maximum Day | - | 2.2 | 12.36 | 1.0 | 40 | 10 |
| | Minimum Day | - | 0.8 | 0 | 0.0 | 1.1 | 3 |
| Season (183 days) | Total | - | 286.98 | 1139.7 | - | 310.8 | 1076.3 |
| | Average Day | 4.82 | 1.65 | 6.77 | 2.12 | 1.84 | 6.45 |
| | Maximum Day | - | 30 | 31 | 11.0 | 40 | 20 |
| | Minimum Day | - | 0 | 0 | 0.0 | 0 | 0 |

There was an 8.3 percent increase in chlorine use in 2015 over 2014. All E. coli results are well within permitted limits.

Effluent nutrient data for August 2015 indicated the following:

Nitrate Nitrogen: 0.03 mg/l

Nutrient levels are reasonable and do not raise concerns regarding system performance or effluent loadings.

## 7.3 TREATMENT CAPACITY

### 7.3.1 Hydraulic Capacity

The treatment facility integrates both treatment and winter holding functions. Most treatment takes place in the first two cells; the third cell functions primarily as a storage reservoir for winter effluent holding and summer flow equalization and for storage associated with irrigation needs. Hydraulic capacity at the Sisters facility is therefore primarily related to the volumetric (holding) capacity of the pond system in general, and the holding pond specifically. Lagoon holding cell surface areas and volumes at various depths are shown in *Table 7.4.* Volumes are included for freeboard depths of less than 3.0 feet. Generally, facilities are not operated within this range; however, it does indicate potential reserve volume that could be utilized under extraordinary conditions.

*Table 7.4: Holding Pond Surface Areas and Volumes*

| *Elevation (ft.)* | *Depth[1] (ft.)* | *Water Surface Area ($ft^2$.)* | *Water Surface Area (Ac)* | *Incremental Volume ($ft^3$)* | *Incremental Volume (Ac-ft)* | *Accumulated Volume (Ac.-ft.)* |
|---|---|---|---|---|---|---|
| 3212 | 20 | 809,019 | 18.57 | 803,685 | 18.45 | 266.62 |
| 3211 | 19 | 798,351 | 18.33 | 793,046 | 18.21 | 248.17 |
| 3210 | 18 | 787,740 | 18.08 | 782,463 | 17.96 | 229.96 |
| 3209 | 17 | 777,186 | 17.84 | 771,937 | 17.72 | 212.00 |
| 3208 | 16 | 766,688 | 17.60 | 761,467 | 17.48 | 194.28 |
| 3207 | 15 | 756,247 | 17.36 | 751,054 | 17.24 | 176.80 |
| 3206 | 14 | 745,862 | 17.12 | 740,698 | 17.00 | 159.56 |
| 3205 | 13 | 735,533 | 16.89 | 730,398 | 16.77 | 142.55 |
| 3204 | 12 | 725,262 | 16.65 | 720,155 | 16.53 | 125.78 |
| 3203 | 11 | 715,047 | 16.42 | 709,968 | 16.30 | 109.25 |
| 3202 | 10 | 704,888 | 16.18 | 699,837 | 16.07 | 92.95 |
| 3201 | 9 | 694,786 | 15.95 | 689,763 | 15.83 | 76.89 |
| 3200 | 8 | 684,740 | 15.72 | 679,746 | 15.60 | 61.05 |
| 3199 | 7 | 674,751 | 15.49 | 669,785 | 15.38 | 45.45 |
| 3198 | 6 | 664,819 | 15.26 | 659,881 | 15.15 | 30.07 |
| 3197 | 5 | 654,943 | 15.04 | 650,033 | 14.92 | 14.92 |
| 3196 | 4 | 645,123 | 14.81 | 0 | 0 | 0.00 |

[1] Depth at deep end. 4.0 foot depth (elev. 3196) corresponds to 0.0 foot depth at shallow end of pond.

The aerated treatment cells, cell #1 and #2, are maintained at a depth of ten (10) feet (elevation 3209 feet). Utilization of potential capacity above elevation 3209

in the holding pond would require a comparable increase in cell #1 and #2 water surface elevations because of the hydraulic interconnections; as a result, the feasibility of utilizing potential capacity above elevation 3,209 feet is limited by the extent of surface agitation present in cell #1. For planning purposes, potential capacity above elevation 3209 feet will not be considered as a viable alternate to implementing capacity related improvements.

An abbreviated water balance for the period October 2014 to September 2015 is presented in *Table 7.5*.

*Table 7.5: Water Balance (October 2014-September 2015)*

| *Season* | *Initial Pond Depth (ft.)* | *Final Pond Depth (ft.)* | *Pond Volume Change (Ac.-ft.)* | *Influent Flow (Ac.-ft.)* | *Rain* | | *Total Irrigation (Ac-ft)* | *Computed Evaporation* | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | *(in.)* | *(Ac-ft)* | | *(in.)* | *(Ac-ft)* |
| Holding (Oct. 2014 - Mar. 2015) | 6 | 11.5 | 87.45 | 102.99 | 10.28 | 19.55 | 0.00 | 18.45 | 35.09 |
| Irrigation (Apr.15-Sept. 15) | 11.5 | 6 | -87.45 | 114.32 | 3.34 | 6.35 | 155.36 | 27.74 | 52.76 |
| Year (Oct. 2014-Sept. 2015) | 6 | 6 | 0 | 217.31 | 13.62 | 25.90 | 155.36 | 46.19 | 87.85 |

Notes: Pond depth at deep end. Influent flow based in figures in *Table 5.1*. Rainfall records from Western Regional Climate Center. Tributary area based on area at elev. 3212 ft. for cells 1, 2, and 3. Irrigation totals based on DMR reported irrigation totals (in inches) for Dike and Forest irrigation. Evaporation computed by mass balance. Evaporation from water surface of cells 1, 2, and 3.

The U.S. Bureau of Reclamation AgriMet Station in nearby Bend, Oregon reported an average annual evapotranspiration value of 43.47 inches between 2003 and 2010. This provides corroboration for the computed figure of 43.60 inches and suggests that measurements associated with data in *Table 7.5* are relatively accurate.

A synthetic water balance to estimate the hydraulic capacity of the existing holding pond is presented in *Table 7.6.*

*Table 7.6: Synthetic Water Balance and Estimate of Holding Pond Hydraulic Capacity*

| Season | Initial Pond Depth (ft.) | Final Pond Depth (ft.) | Pond Volume Change (Ac.-ft.) | Influent Flow (Ac.-ft.) | Rain | | Evaporation | | Total Irrigation (Ac-ft.) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | (in.) | (Ac-ft) | (in.) | (Ac-ft.) | |
| Holding (Oct.-March) | 4 | 17 | 212 | 227.54 | 10.28 | 19.55 | 18.45 | 35.09 | 0.0 |
| Irrigation (Apr - Sept) | 17 | 4 | -212 | 252.57 | 3.34 | 6.35 | 27.74 | 52.76 | 418.16 |
| Year (Oct.-Sept) | 4 | 4 | 0 | 480.11 | 13.62 | 25.90 | 46.19 | 87.85 | 418.16 |

Notes: Influent flow (holding period) based on maximum flow to fill holding pond with allowances for rain and evaporation. Rain and evaporation data from *Table 7.5* with no changes. Pond depth at deep end. Influent flow (irrigation period) determined by multiplying 114.32 Ac-ft (from *Table 7.5*) by the ratio of the holding period influent flows from *Table 7.6* (227.54 Ac-ft) and the irrigation influent flows *Table 7.5* (102.99 Ac-ft). Total irrigation computed as total volume needed to complete mass balance and return the pond level to 4 feet.

*Table 7.7* relates current year 2015 and future year 2035 influent flows to current holding pond capacity. For purposes of the computation, rainfall and evaporation figures are not varied from year to year, and the means or adequacy of effluent disposal is not considered.

*Table 7.7: Holding Pond Hydraulic Capabilities*

| Season | Maximum Holding Pond Capacity (Ac-ft) | Year 2015 Influent Volume (Ac-ft) | Year 2015 % of Maximum Capacity | Year 2035 Influent Volume (Ac-ft) | Year 2035 % of Maximum Capacity |
|---|---|---|---|---|---|
| Holding (Oct-March) | 227.54 | 102.99 | 45.3 | 197.62 | 86.9 |
| Irrigation (Apr-Sept) | 252.57 | 114.32 | 45.3 | 219.36 | 86.9 |
| Year (Oct-Sept) | 480.11 | 217.31 | 45.3 | 416.99 | 86.9 |

The holding pond has sufficient reserve capacity to handle projected influent flows through year 2035. This assumes that the pond is managed such as to have a 4.0 foot depth at the end of the irrigation season. Currently, the end of season depth is approximately 6 feet in order to keep the surface aerators in operation and to avoid the need for removing the unutilized aerators prior to the pond freezing over.

### 7.3.2 BODs Capacity Evaluation

The treatment facility was designed to provide treatment for summer influent with an average of 759 ppd BODs and for winter influent with an average of 607 ppd. Current 2015 BODs loadings are 608 ppd (summer) and 554 ppd (winter). *Table 7.8* summarizes capacity and utilization for the existing treatment facility.

*Table 7.8: BODs Loadings and Capacity Utilization*

| | *Influent (ppd)* | *Design Capacity (ppd)* | *Percent Capacity Utilization* |
|---|---|---|---|
| 2015 Summer Average | 608.0 | 759 | 80.1 |
| 2015 Winter Average | 554.4 | 607 | 91.3 |
| 2035 Summer Average | 1098.2 | 759 | 1.45 |
| 2035 Winter Average | 1001.4 | 607 | 1.65 |

Based on projected system growth, winter influent BODs will reach design capacity in approximately 3 years (year 2018). Summer influent BODs will reach design capacity in approximately 7 years (year 2022). BODs handling capabilities are directly related to the aeration provided. As the BODs design capacity is approached, consideration should be given to upgrading the aeration capabilities of the system either through additional units or replacement with new equipment.

## 7.4 RECOMMENDATIONS

Assuming adequate irrigation opportunities can be provided and/or development of a stream discharge so as to utilize all net flows generated, the existing facility has sufficient hydraulic capacity to meet projected year 2035 demands. The existing facility has sufficient BODs handling capabilities to meet loading projected through year 2018 at which time aeration equipment will require upgrade or replacement. We recommend that this project be completed in 2017.

Existing aeration equipment is operating nearly continuously, and will need extensive maintenance or replacement during the planning period to year 2035. In addition, energy costs are becoming more expensive, and energy conservation options should be explored. Solar and wind powered aerators with electrical power assists are proving success for similar facilities. It is recommended that the existing units be upgraded with energy saving

aeration devices as the units require replacement. Aeration equipment recommendations are described further in Section 10.

If water quality improvements are needed to allow other effluent disposal opportunities, such as stream discharge or less restrictive irrigation, then treatment improvements or alternate facilities will be needed. These should be developed consistent with the needs of the disposal scenarios considered. Other disposal opportunities are discussed in Section 8.

# SECTION 8:
# WASTEWATER DISPOSAL

## 8.1 INTRODUCTION

### 8.1.1 Current Status

Sisters currently holds all effluent over winter and irrigates all effluent on sites adjacent to the treatment facility. The 100.3 acre irrigation site currently includes: *88.5 acres of forest with an annual application limit of 14.3 inches, and 11.8 acres of grass-covered dikes with an annual application limit of 28.79 inches* (the overall average application rate is 16.00 inches [1]). Current (2015) application (reported) totals are: forest – 17.04 inches, and dikes - 30.20 inches. These totals did not include a correction for irrigation evaporation. The overhead sprinklers have an approximate 75% efficiency; therefore, *actual 2015 application totals were: forest -12.78 inches and dikes - 22.65 inches.* Although these totals are within imposed limits, it is evident that additional acreage for effluent irrigation must be provided in the near future on the Lazy Z Ranch.

With current City growth, the City must pursue expansion of irrigation opportunities on their portion of the Lazy Z Ranch in the near future. At the projected growth rate, Sisters must have new disposal options completed by 2018 to remain within permit conditions. Growth in the past five (5) years has averaged 1.91% per year, and projections anticipate that continued population growth will increase to a 3.23% rate through the year 2035.

### 8.1.2 Disposal Alternatives - Preliminary Considerations

The 1994 Wastewater System Engineering Study (WSES) included consideration of numerous effluent disposal alternatives including: year-round discharge to Whychus (formerly Squaw) Creek, wetlands polishing, winter holding and summer land irrigation, summer land irrigation and winter discharge to Whychus Creek, effluent filtration, and a subsurface drainfield. Treatment options were considered for Level 1 to Level 3 discharges. Subsequent discussions with DEQ indicated that Whychus Creek was considered to be a high quality water as (then) defined in OAR 340-41-026 and that stream discharge at any location would not be a viable option for Sisters. Moderate rate infiltration, which allows a controlled rate of subsurface percolation, was also considered to be a viable option. The City of Redmond was also pursuing a similar option at the time. Due to regulatory reservations and the great expense of demonstrating no adverse impact to groundwater, the subsurface disposal option was not deemed to be a viable option for Sisters. During preparation of the 1997 Wastewater System Facilities Plan (WSFP) it became apparent that winter holding

[1] [(88.5 acres)(14.3 inches) + (11.8 acres)(28.79 inches)]/100.3 acres = 16 inches

and summer irrigation was the only option practicable. The City's present system was developed against this background and history.

## 8.2 REGULATORY REQUIREMENTS

### 8.2.1 General Regulatory Requirements

General regulatory requirements related to wastewater disposal are described in:

- OAR Chapter 340, Division 40 (Groundwater Quality Protection)
- OAR Chapter 340, Division 41 (Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon)
- OAR Chapter 340, Division 55 (Regulations Pertaining to the Use of Reclaimed Water (Treated Effluent) from Sewage Treatment Plants).

The rules include numerous provisions and exceptions, but in general reflect a concern with preservation or enhancement of receiving surface waters or groundwater. This is expressed in the OAR's as an anti-degradation policy.

### 8.2.2 WPCF Permit Requirements

Sisters' WPCF permit expired in 2011. DEQ has issued a draft WPCF permit which is anticipated to be issued in 2016. Schedule A of the draft Sisters' WPCF Permit includes the following provisions:

1. The permittee is authorized to construct, operate, and maintain wastewater collection, treatment and disposal systems to serve the City of Sisters in accordance with the conditions set forth in the permit.

2. The wastewater collections, treatment and land application system must not be hydraulically or organically loaded in excess of their respective, DEQ approved design capacities. At full build-out, however, the annual average daily infulent flow must not exceed 0.38 MGD.

3. All wastewater treatment and disposal systems must be operated in compliance with the following conditions:

    a. No discharge to state waters is permitted. All wastewater must be stored and treated for disposal by land application following sound irrigation practices.

b. Recycled Wastewater

i. Prior to land application of the recycled water, it must receive at least Class D treatment as defined in OAR 340-055. Class D recycled water must not exceed a 30-day log mean day log mean of 126 E. coli organisms per 100 milliliters and 406 E. coli organisms per 100 milliliters in any single sample. Class C recycled water must not exceed a 7 day median of 23 organisms/100 milliliters and no two consecutive samples must exceed 240 organisms/100 milliliters.

ii. Irrigation must conform to a Recycled Water Use Plan approved by DEQ and meet the required setbacks as defined in OAR 340-055.

iii. The City of Sisters must restrict public access to the reuse site(s) for the protection of public health.

iv. Treated effluent may only be irrigated on land between April 1 through October 31 for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices unless otherwise approved in writing by DEQ.

v. Recycled water equipment must be operated so as to prevent:

(A) Prolonged ponding of treated recycled water on the ground surface;

(B) Surface runoff or subsurface drainage through drainage tile;

(C) The creation of odors, fly and mosquito breeding or other nuisance conditions;

(D) The overloading of land with nutrients, organics, or other pollutant parameters; and

(E) Impairment of existing or potential beneficial uses of groundwater.

(F) Until otherwise approved in writing by the Department via a revised reclaimed water use plan, treated effluent must only be reused on Class D beneficial uses.

4. The storage lagoon must be lowered sufficiently by the end of the irrigation season to ensure maximum practicable storage capacity during the non-irrigation months.

5. The permittee must, during all times of treatment and disposal, provide personnel whose primary responsibilities are to assure the continuous performance of the disposal system in accordance with the conditions of this permit.

6. No activities must be conducted that could cause an adverse impact on existing or potential beneficial uses of groundwater. All wastewater and process related residuals must be managed and disposed in a manner that will prevent a violation of the Groundwater Quality Protection Rules (OAR 340-040).

## 8.3 CURRENT DISPOSAL PRACTICES

### 8.3.1 Effluent Water Quantity and Quality

**Quantity.** Based on computations in *Table 7.5 (Water Balance Table)*, a total of 155.36 Ac-ft of effluent was produced in 2015.

**Water Quality.** Effluent quality is discussed in Section 7.3. There are no parameters of concern. Effluent is classed as Class D. Class D is the most restrictive in terms of application and use.

### 8.3.2 Irrigation Site

**Irrigation Site.** The existing wastewater treatment facility and reclaimed water use irrigation site is on a 160 acre site immediately south of the Sisters City Limits on the South ½ of Section 9, T 15S, 10 E, W.M. Irrigation of the lagoon dikes provide for approximately 11.8 acres of grass irrigation, and irrigation of a natural forest provides for another 88.5 acres of irrigation area. Site elevation is approximately 3,200 feet above mean sea level.

**Soils.** Soils in the existing wastewater treatment and irrigation site were sampled (84 drilled holes and 16 test pits) and evaluated in 1997 by Wert & Associates, Inc. Soils are generally well drained and consist of a fine sand or loamy fine sand top layer (4" to 20" deep) followed by brown sand to a depth of 35"-60". Gravels

and sands form the lowest layer sampled. Detailed descriptions are included in the City's original *Wastewater Reclaimed Water Use Plan*, HGE, Inc, April 2002.

### 8.3.3 Irrigation System

The existing irrigation site surrounds the wastewater treatment and holding ponds. Two separate irrigation systems are provided. The forest irrigation site is served by two separate 10-inch diameter PVC irrigation headers from the effluent pumps located in the control building. The dike irrigation system is fed through a looped 4-inch diameter irrigation system. A marking ribbon is buried with each pipe to indicate non-potable water. Two alternating 100 Hp pumps are provided to deliver treated reclaimed water to the forest irrigation system, and a single 15 Hp pump is utilized for the dike irrigation system.

### 8.3.4 Crops

"Crops" are limited to 88.5 acres of ponderosa pine - Juniper - sage and bitterbrush forest, and 11.8 acres of pond dikes planted with grass.

### 8.3.5 Effluent Application

**Application Totals.** Irrigation application totals for the season ending in 2015 are presented in *Table 8.1* for the existing irrigation site.

*Table 8.1: Effluent Irrigation Application Totals (2015)*

| | ***Irrigation Volume (Ac-ft)*** | ***Irrigated Acreage (Ac)*** | ***Net Application[1] (in.)*** | ***Permitted Application (in.)*** | ***Percent of Permitted Application*** |
|---|---|---|---|---|---|
| Dike | 29.69 | 11.8 | 22.65 | 28.79 | 78.7 |
| Forest | 125.67 | 88.5 | 12.78 | 14.3 | 89.4 |
| **Total** | **155.36** | **100.3** | - | - | - |

[1] @ 75% efficiency.

The dike and forest irrigation systems are operated independently.

### 8.3.6 Access, Setbacks, and Aerosol Drift

**Access and Setbacks.** Public access is prevented from entry into the existing area by barb wire fences around the irrigation site, a 6-foot chain link site with barb wire around the treatment plant lagoon site, and locked gates for both. Signs are posted around the perimeter of the irrigation field to indicate the water is not safe for drinking and that effluent is being applied as irrigation. Site buffers include 10 feet from open waterways, 75 feet from the property boundary, on all except the North

boundary, where the USFS required a buffer of 250-300 feet in the environmental assessment for utilization of this site for reclaimed water use. At the present time, the setback from the North boundary of the treatment site is approximately 550 feet

**Aerosol Drift.** Adequate control of aerosol drift is now a regulatory requirement. Research in pesticide drift, for which studies and data are relatively abundant, indicate that drift is not linearly related to wind speed, but rather increases significantly as wind speeds reach approximately 15 mph. Guidelines for pesticide application (Clemson University Pesticide Information Program) recommends no application at times when wind speed exceeds 15 mph. Ontario, Oregon has used 15 mph as an upper limit in determining when effluent irrigation should be stopped.

Wind direction is also a factor, since wind blowing in a direction of potentially greater human contact increases potential exposure and compromises the adequacy of the aerosol control. The primary area of potential human contact in the vicinity of the irrigation site is along the North boundary; the prevailing NW and WNW winds blow toward the irrigation site, thereby significantly reducing this risk. In addition, the very large setback also significantly reduces any risks. Lastly, trees in the forest irrigation area also provide a barrier to wind drift of aerosols.

During the irrigation season, the prevailing wind direction is WNW and NW and the average wind speed is 8.8 mph. Monthly average wind data is summarized in *Table 8.2. Table 8.2* is based on Oregon Climate Service data for Redmond Airport.

*Table 8.2: Irrigation Season Wind Data - Summary (Redmond Airport)*

| ***Month*** | ***Prevailing Direction (From)*** | ***Average Speed (mph)*** | ***Percent of Time Exceeding*** | |
|---|---|---|---|---|
| | | | ***12 mph*** | ***19 mph*** |
| April | WNW | 9.2 | 18.9 | 2.4 |
| May | NW | 9.2 | 18.2 | 1.7 |
| June | NW | 9.0 | 16.9 | 1.5 |
| July | NW | 8.7 | 14.5 | 0.8 |
| August | NW | 8.3 | 11.3 | 0.7 |
| September | NW | 8.2 | 10.8 | 0.9 |
| October | SSE | 9.0 | 9.8 | 0.8 |
| **Average** | **NW** | **8.8** | **14.3** | **1.3** |

The City maintains a weather station on site. The system automatically terminates irrigation operations if winds are excessive. To date, excessive aerosol drift has not been noted. The existing SCADA system has the ability to shut down operations for the forest irrigation reuse system at any programmed wind speed.

## 8.4 COMPLIANCE EVALUATION

In general, the City is in compliance with its WPCF Permit and Reclaimed Water Reuse Plan. It should be noted, however, that to-date, City reported irrigation totals have not included a reduction for irrigation efficiency.

## 8.5 FUTURE IRRIGATION REQUIREMENTS

### 8.5.1 Water Quantity and Quality

**Water Quantity.** Projected year 2035 irrigation water disposal needs will be 282.5 Ac.ft., representing a 127.1 Ac.ft. increase over the current total of 155.36 Ac.ft. This estimate includes the assumption that precipitation and evaporation totals will be comparable and proportional to those indicated in *Table 7.6*[2] of the original plan.

**Water Quality.** No significant change in water quality is anticipated over the design period. However, new business proposals with high strength wastewater discharges, including water from commercial or industrial processes, should be evaluated by an engineer to determine the potential impact on treatment and disposal. It may be necessary to require pretreatment of some business wastewater prior to discharge to the public sewer.

### 8.5.2 Irrigation Acreage Needed

The current irrigation systems, when utilized to the DEQ permitted applications, taking evaporation into account, will allow for irrigation of 178.32 Ac-ft of reuse water. If land irrigation is to remain as the primary means of effluent reuse, approximately 95.33 net acres of new irrigation site[3] with similar capabilities will need to receive reuse water to accommodate year 2035 projected growth (In addition to full usage of the existing site). This land area assumes continued application of Class D effluent. Any parcels considered will need to be sufficiently larger to accommodate set-backs, unsuitable areas, and areas that cannot be irrigated with the type of irrigation system selected.

### 8.5.3 Expansion Sites

During the design of the original City of Sisters wastewater system, reuse on adjacent farm lands, such as portions of the Lazy Z Ranch, was considered. However, ownership of the land at that time was opposed to effluent reuse, and none of the Lazy Z was made available for reuse purposes. Several alternative reuse sites were considered, but owners were hesitant to commit lands for use over an extended period of time, or required other considerations such as future development guarantees.

Near the completion of the November 2006 Wastewater System Capital Facilities Plan, the opportunity arose for the City of Sisters to purchase 230.98 acres of the Lazy Z Ranch, in close proximity to the wastewater treatment facility. This site should have adequate area for effluent reuse, without modifications to the existing reuse site, for the design period of 2035 and beyond. Soils on the site were extensively sampled by Wert & Associates, Inc. prior to the purchase, and the majority of the purchased site appears to meets Oregon statutes for effluent reuse with Class D effluent. This site is immediately accessible from the existing wastewater treatment plant and effluent reuse site, contains adequate land area for required buffers to meet Oregon DEQ regulations, and topography is conducive to installation of automated type reuse systems. Portions of the purchased land has been farmed for many years, and effluent reuse can provide benefit to crop production on this portion of the site. A 62-acre portion of the Lazy Z site remains forested, and it is anticipated that this area will be the first to receive reuse waters, since it is remote from residential homes and is bounded on two sides by other forested properties. 3200' of mainline was installed to this area as part of the Uncle John Ditch piping project. This site is planned to receive reuse waters in a manner very similar to the existing reuse site, with the existing effluent pumps, a similar forest irrigation system for disposal, identical irrigation rates of application, use of the existing weather control system to control aerosol drift, and the existing SCADA system for reuse operation on both the existing and Lazy Z sites. Effluent reuse on remaining portions of the Lazy Z can utilize higher application rates, dependent on the crop utilized for harvesting. Crop choices for farmed sections of the site were analyzed in the 2013 Reuse Study and options are provided for future decision making.

*Figure 8.1* shows the proximity of potential reuse and disposal sites described in this plan.

### 8.5.4 Disinfection System

The existing hypochlorite system is designed to provide 60 minutes of contact time at the capacity of the irrigation pumps (1,000 gpm each). Allowing for higher mid-summer application rates, and potential downtime for wind, the system should be adequate for projected year 2035 needs.

### 8.5.5 Irrigation System

Any new irrigation areas developed will need an irrigation system constructed and connected to the existing system. The two existing irrigation pumps (1,000 gpm each) should be adequate to transfer effluent to the irrigation site for the planning period to year 2035.

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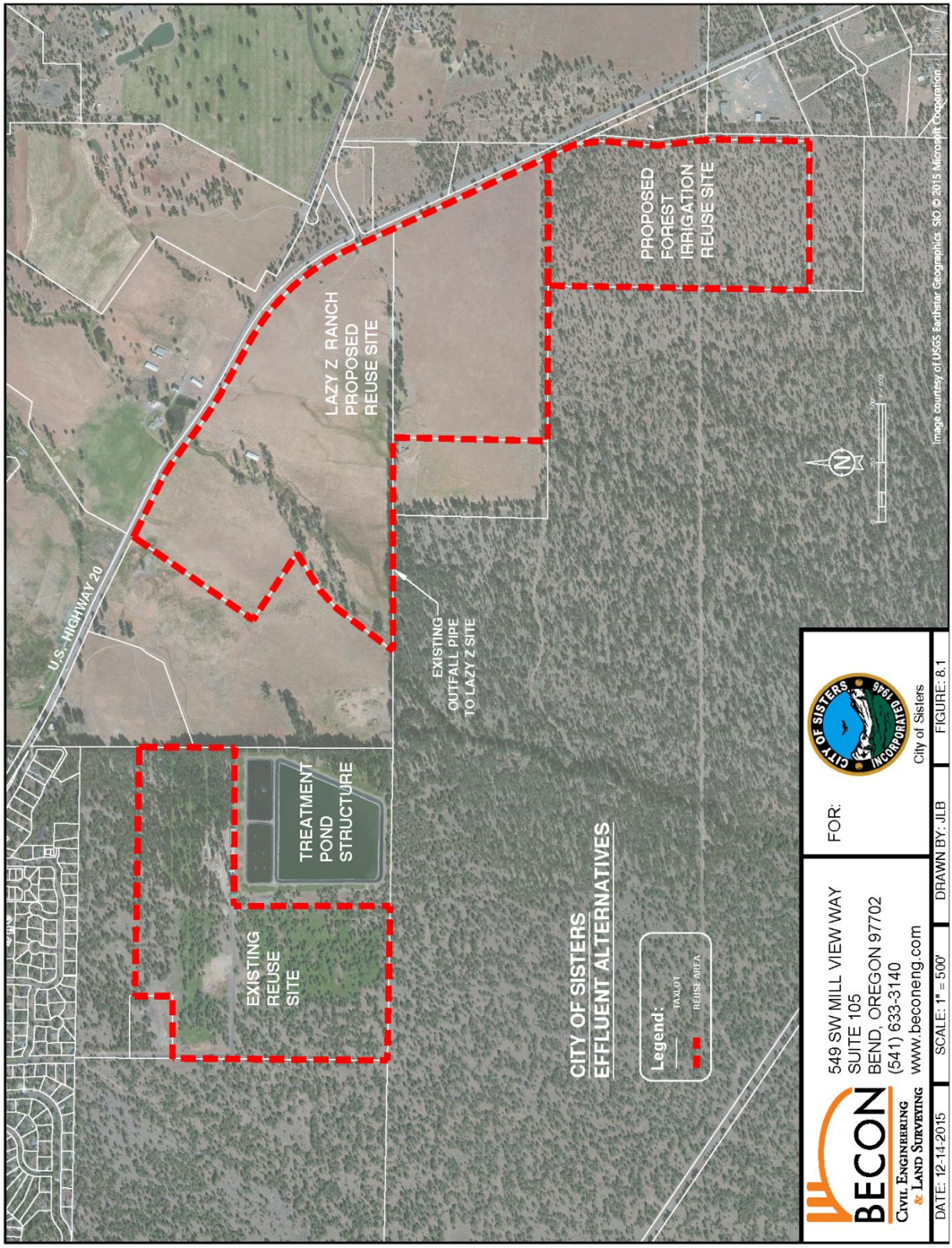

U.S. HIGHWAY 20
EXISTING REUSE SITE
TREATMENT POND STRUCTURE
LAZY Z RANCH PROPOSED REUSE SITE
EXISTING OUTFALL PIPE TO LAZY Z SITE
PROPOSED FOREST IRRIGATION REUSE SITE
CITY OF SISTERS
EFFLUENT ALTERNATIVES
Legend:
TAXLOT
REUSE AREA
N
Image courtesy of USGS Earthstar Geographics SIO © 2015 Microsoft Corporation
BECON
CIVIL ENGINEERING & LAND SURVEYING
549 SW MILL VIEW WAY
SUITE 105
BEND, OREGON 97702
(541) 633-3140
www.beconeng.com
FOR:
CITY OF SISTERS INCORPORATED 1946
City of Sisters
DATE: 12-14-2015
SCALE: 1" = 500'
DRAWN BY: JLB
FIGURE: 8.1

## 8.6 RECOMMENDATIONS

Effluent disposal recommendations are summarized below:

- Continue with forest and dike irrigation up to the maximum allowed.
- Develop the forested 62-acre (net 49 acres) portion of the Lazy Z site as described previously, in a very similar manner to the existing City reuse site as part of the Phase I Lazy Z Re-use improvements.
- Expand effluent disposal onto the remaining portions of the Lazy Z property as outlined in the 2013 Wastewater Re-Use study (Appendix A)
- The City of Sisters purchase of the 230.98 acre portion of the Lazy Z assures the City of a long term reuse site, with immediate accessibility to the existing wastewater treatment plant. The site appears to meet all of the Oregon Department of Environmental Quality effluent requirements for Class D reuse application, and a water reuse plan needs to be updated and approved by DEQ prior to disposing of effluent.
- The City of Sisters must continue to plan for long term disposal of wastewater effluent from the expanding community.

# SECTION 9:
# BIOSOLIDS MANAGEMENT

## 9.1 INTRODUCTION

Biosolids contain beneficial nutrients and soil conditioning properties for vegetation; however, they also contain viruses, parasites, and other disease-causing organisms (pathogens) considered potentially dangerous to human health and the environment. Biosolids are not stabilized when removed from the waste stream and must be handled and disposed of properly. Biosolids management practices are therefore needed to reduce the biological activity of the sludge and make it a relatively benign material for final disposal.

## 9.2 GENERAL REGULATORY REQUIREMENTS

Regulations for biosolids use and disposal were promulgated on February 19, 1993, as 40 CFR Part 503 (Subpart D). The regulation protects public health and the environment through requirements designed to reduce the potential for contact with disease-bearing microorganisms (pathogens) in wastewater biosolids applied to the land or placed on a surface disposal site. Wastewater biosolids cannot be applied to land or placed on a surface disposal site unless it has met the following two requirements:

- Requirements for pathogen reduction.

- Requirements to reduce the potential of the sewage to attract vectors (rodents, birds, insects, and other organisms that can transport pathogens).

Compliance with these two requirements must be demonstrated separately, which allows for some flexibility in biosolids management practice. The basic concepts for implementation of these rules are to understand potential routes of exposure to biosolids, both direct and indirect contacts. Direct and indirect contacts are defined as:

*Direct Contact:*

- Inadvertent contact with wastewater biosolids.

- Walking through an area (i.e. field, forest, or reclamation area) shortly after wastewater biosolids application.

- Handling soil and raw produce from fields or home gardens where wastewater biosolids has been applied.

- Inhaling microbes that become airborne (via aerosols, dust, etc.) during wastewater biosolids spreading or by strong winds, plowing, or cultivating the soil after application.

*Indirect Contact:*

- Consumption of pathogen-contaminated crops grown on wastewater biosolids amended soil or of other food products that have been contaminated by contact with these crops.

- Consumption of pathogen-contaminated milk or other food products from animals grazing in pastures or feed crops grown on wastewater biosolids amended fields.

- Ingestion of drinking water or recreational waters contaminated by runoff from nearby land application sites or by organisms from wastewater biosolids migrating into groundwater aquifers.

- Consumption of inadequately cooked or uncooked pathogen-contaminated fish from water contaminated by runoff from a nearby land application site.

- Contact with wastewater biosolids or pathogens transported away from the land application or surface disposal site by rodents, insects, or other vectors, including grazing animals.

Understanding routes of potential exposure allows for development of an overall strategy to protect public health and the environment. The biosolids rules were developed to implement this strategy. The overall strategy is described as follows:

- Reduce the number of pathogens in wastewater biosolids through treatment and/or environmental attenuation.

- Reduce transport of pathogens by reducing the attractiveness of the sewage wastewater biosolids to disease vectors (insects, rodents, birds, and other living organisms that can transport pathogens).

- Limit human and animal contact with the wastewater biosolids through site restrictions to allow natural die-off to reduce pathogen levels to low levels.

A detailed discussion of pathogen reduction requirements, vector attraction reduction requirements, and land application for biosolids disposal, is included as *Appendix 9.1*.

## 9.3 WPCF PERMIT REQUIREMENTS

Schedule D of Sisters draft WPCF Permit (No. 101779) includes the following special conditions:

Within 6 months of such time as the sewage lagoons require removal of accumulated biosolids, the permittee shall submit a biosolids management plan that complies with the Department's biosolids management regulations as established in OAR 340-50
This permit may be modified to incorporate any applicable standard for sewage sludge use or disposal promulgated under section 405(d) of the Clean Water Act, if the standard for sewage sludge use or disposal is more stringent than any requirements for sludge use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

## 9.4 CURRENT BIOSOLIDS TREATMENT AND DISPOSAL

Sisters retains all biosolids in its aerated lagoon treatment and holding facilities. The City has not yet needed to dredge and dispose of accumulated solids, nor has it been required to do so by any regulatory authority. The City should plan for removal in Lagoon 1 in 2021, the 20$^{th}$ year of operation.

Untreated solids, separated from the raw wastewater by means of the fine screen at the headworks, are collected, bagged, and sent to the Deschutes County Landfill.

## 9.5 ACCUMULATED BIOSOLIDS

### 9.5.1 Quantity

Solids accumulations in pond systems can vary considerably based on overall facility sizing and relative $BOD_5$ loading rates. As long as a facility is not overloaded (with $BOD_5$), solids tend to be digested over an extremely long retention time. It is quite common for such facilities to go well beyond their initial design life prior to needing solids removal. The original design provided additional depth in the lagoon system to provide an allowance for solids accumulation, without impacting the effective hydraulic capacity of the facility under normal hydraulic regimes, and this will allow for accumulation over time.

Because of the potential variability in real-world solids accumulations, the most reliable means of determining accumulations and, potentially, accumulation rates, is by physically sampling with a device called a "sludge-judge". As average $BOD_5$ influent loadings approach that of the facilities design, sampling should be undertaken to determine the amount of accumulated solids. Recommendations for handling the accumulated solids, or recommendations for future sampling, can be made at that time. The City of Sisters has acquired a sludge-judge and should periodically taken measurements of sludge depths, in order to calculate cumulative sludge volume.

Increased loading to this facility will ultimately create a need for some level of solids removal, and planning to the year 2035 should make provisions for removal and disposal of biosolids in compliance with an approved biosolids management plan. Cost projections for biosolids removal are provided in Section 10.

### 9.5.2 Quality

No sampling or testing of accumulated solids has been conducted to date. Typical test parameters for any given treatment facility are fairly extensive. Testing is primarily conducted to verify compliance with pathogen reduction requirements, vector attraction reduction requirements, and constituents that may potentially limit application, site usability, and longevity. Small rural, primarily residential, communities typically generate biosolids that comply with all regulatory requirements - assuming proper sizing and operation of the treatment facility. Sampling and testing is not needed at this time. Future timing and need for biosolids removal will necessarily be based on results of sampling and measurement of accumulated solids (as discussed in Section 9.5.1).

## 9.6 COMPLIANCE EVALUATION

Sisters is basically in compliance with requirements of its WPCF Permit. The City has not yet developed a need for a biosolids management plan.

## 9.7 RECOMMENDATIONS

As the treatment facility approaches its design $BOD_5$ capacity, the City should sample accumulated solids in the cells, determine accumulation depths, and determine if removal of the solids is warranted. Planning for development of a disposal site and a biosolids management plan, in full conformance with Oregon DEQ requirements, should be anticipated within three (3) years. Anticipated costs for a biosolids management plan and for biosolids removal from the existing lagoon system are provided in Section 10.

# SECTION 10:
# IMPROVEMENT RECOMMENDATIONS

## 10.1 Effluent Reuse Disposal Improvements:

The Lazy Z Ranch property provides multiple possibilities for effluent reuse expansion. Both forest irrigation and crop irrigation opportunities are available.

**Forest Irrigation Effluent Expansion**: A 49 acre forested area (after accounting for all setbacks) is available for effluent irrigation at the far southeast corner of the Lazy Z ranch property. It is anticipated that this area would have a permitted application rate of 14.3 inches per year and could be connected to the existing pipeline which terminates approximately 900 feet from the site. This area could provide for the disposal of 77 acre feet of effluent per year.

This expansion would increase the City's effluent disposal capacity from 178 acre feet per year to 255 acre feet per year. Assuming constant sewer influent growth rates, this expansion would provide effluent disposal capacity until 2031.

*Forest Irrigation Area with an effluent disposal potential of 77 acre feet per year*

**Crop Irrigation Effluent Expansion**: A 52 acre crop land area (after accounting for all setbacks) is available for effluent irrigation in the southeast portion of the Lazy Z Ranch property. It is anticipated that this area would have a permitted application rate of 28.79 inches per year (the same as the existing dike irrigation area) and could be connected to the existing pipeline which terminates in the center of the site. This area could provide for the disposal of 166 acre feet of effluent per year. The disadvantage of this area is that it would have to be a managed crop with maintenance costs. Per the 2013 Wastewater Reuse and Conservation Project Planning Study (Appendix A), this area would be best managed as a hay crop or an ornamental tree crop.

This expansion would increase the City's effluent disposal capacity from 178 acre feet per year to 344 acre feet per year, which would account for all effluent reuse demand until full UGB build out.

*Crop irrigation with an effluent disposal potential of approximately 166acre feet per year*

It is recommended that Forest irrigation improvements are constructed prior to 2018 to maintain compliance with DEQ effluent permit limits. It is recommended that Crop Irrigation improvements are implemented prior to 2031 to again maintain compliance with DEQ effluent permit limits.

**Costs for Effluent Reuse Expansion Improvements:**

Conceptual plans have not yet been prepared, but for budgetary purposes, the approximate costs for effluent expansion improvements are as follows:

| *Forest Irrigation Effluent Expansion* | | |
|---|---|---|
| Construction Cost | | $485,000 |
| Engineering and Administration | (10%) | $ 48,500 |
| Contingency Factor (10%) | | $ 56,100 |
| **Estimated Total Cost** | | **$579,600** |

| *Crop Irrigation Effluent Expansion* | |
|---|---|
| Cost (provided by Water Reuse Study) | $786,857 |
| **Estimated Total Cost** | **$786,857** |

## 10.2 Treatment Plant Improvements:

**Treatment Facility Software and Security System Upgrades**

This infrastructure is shown in the capital facilities plan as a short term priority. The proposed software improvements will improve monitoring of activities at the treatment plant. Security system upgrades include additional software and on-site cameras to provide additional monitoring of the treatment plant and disposal sites. It is recommended that these improvements be implemented by 2018.

| *Treatment Facility Software and Security Upgrades* | |
|---|---|
| Software and Security Upgrades | $72,000 |
| Contingency Factor (10%) | $ 7,200 |

| | |
|---|---|
| **Estimated Total Cost** | **$79,200** |

**Aeration Improvements**

The Capital Facilities Plan recommends replacement of the existing aerators at the treatment plant to provide more aeration which will improve the capacity and efficiency of the treatment process in the lagoons. The aeration improvements are recommended to be implemented by 2018 which is when the treatment plant will have been in operation for 17 years. If BOD design loading limits are exceeded then aeration improvements will be necessary to provide adequate treatment.

*Replacement of Aeration Equipment in Effluent Ponds*

| | |
|---|---|
| Replacement of Existing Aerators | $185,000 |
| Engineering and Administration (10%) | $ 18,500 |
| Contingency Factor (10%) | $ 20,350 |
| **Estimated Total Cost** | **$223,850** |

**Biosolids Removal**

Biosolids Removal includes the removal of "sludge" or the remaining material in the treatment ponds after treatment. These biosolids accumulate in the ponds and reduce the capacity of the treatment ponds over time. The removal of biosolids requires the creation of a biosolids management plan to determine the disposal methods and locations of the material. It is recommended that the biosolids management plan be prepared in 2017 and that preparations for the biosolids removal could begin as early 2018, which is 17 years from the construction of the treatment facility.

*Biosolids Removal and Disposal*

| | |
|---|---|
| Biosolids Management Plan | $ 24,000 |
| Biosolids Removal | $240,000 |
| Contingency Factor (10%) | $ 26,400 |
| **Estimated Total Cost** | **$290,400** |

## 10.3 Collection System Improvements

**Pump Station #1 New Pumps**

The existing pumps at Pump Station #1 are anticipated to reach capacity between 2022 and 2025. It is recommended that the existing pumps be replaced by larger pumps when the pumps are at a maximum of 75% of their operating capacity.

*Pump Station #1 New Pumps*

| | |
|---|---|
| Pump Replacement | $106,000 |
| Contingency Factor (10%) | $ 10,600 |
| **Estimated Total Cost** | **$116,600** |

**Locust Street Interceptor**

The Locust Street Interceptor is a proposed new sewer main which will divert sewer flows from the area of town north of Adams Avenue and east of Pine Street. Sewer

main lines located on North Locust St and Black Butte Avenue will be reaching their design flow capacity prior to full build-out of the UGB. It is recommended that the Locust Street Interceptor be constructed by 2020.

*Locust Street Interceptor*

| | |
|---|---|
| Sewer Main Construction | $420,000 |
| Engineering and Administration (10%) | $ 42,000 |
| Contingency Factor (10%) | $ 46,200 |
| **Estimated Total Cost** | **$508,200** |

**West Side Pump Station and Force Main**

The West Side Pump Station and Force Main is primarily tied to the development of the USFS property between Pine Street and Hwy 20. This force main provides an alternate route for sewer flows directly to the treatment plant, by-passing Pump Station #1. The timing of this infrastructure improvement would be based on the sale and development of the USFS property.

*West Side Pump Station and Force Main*

| | |
|---|---|
| West Side Pump Station | $ 925,000 |
| West Side Force Main | $ 321,000 |
| Engineering and Administration (10%) | $ 124,600 |
| Contingency Factor (10%) | $ 137,060 |
| **Estimated Total Cost** | **$1,507,660** |

## 10.4 Proposed Sewer System Infrastructure Improvements Timing and Cost Summary

| **Project Description** | **Timing** | **Project Cost (rounded)** | **Potential Funding Source(s)** |
|---|---|---|---|
| Effluent Expansion Phase I (Forest) | 2017-18 | $580,000 | SDC Fund/Grants/Loans |
| Treatment Plant SCADA/Software Upgrades | 2017-18 | $80,000 | SDC/Operating Funds/Grants/Loans |
| Locust Street Interceptor | 2020 | $509,000 | SDC/Operating Funds |
| Aeration Improvements | 2017-18 | $224,000 | SDC/Operating Funds |
| Biosolids Management Plan<br>Biosolids Removal | 2017<br>2018 | $27,000<br>$264,000 | Operating Fund<br>Operating Fund |
| Pumpstation #1 New Pumps | 2022-25 | $117,000 | SDC/Operating Funds |
| Effluent Expansion Phase II Crop Irrigation | 2031 | $787,000 | SDC Fund/Grants/Loans |
| Westside Pumpstation and Force Main | USFS Development | $1,508,000 | SDC/Development |
| **Total:** | | **$4,096,000** | |

| | | | |
|---|---|---|---|
| | | | |

# SECTION 11
# FINANCE OPTIONS

## 11.1 INTRODUCTION

The funding of needed wastewater improvements for the City of Sisters may utilize one or more of the following funding sources:

- Sale of Bonds by Acquiring Federal or State Grants and/or Loans
- Special Assessments
- Local Improvement Districts
- Serial Levies
- Capital Improvements (Sinking) Funds
- Systems Development Charges

The most successful financing plans utilize state or federal grants and/or loans that best address the characteristics of needed improvements. It is difficult to finance improvements with grant funding alone, and grant funding in general is limited. Some level of local funding or borrowing from available loan programs is usually necessary, although some cities accumulate sufficient reserves for construction. Funding programs vary in terms of their economic impact on the community, and often are created with specific program focuses. Some programs are available to create and retain jobs or benefit areas of low to moderate income families. Other programs provide for specific types of infrastructure improvements, such as improvements to address wastewater related compliance issues.

A thorough consideration of applicable state and federal funding programs, in addition to a potential means of securing local funding, is needed to minimize the long-term cost of wastewater system improvements, while providing quality construction.

If the City decides to pursue agency funding for recommended projects, it should contact Oregon DEQ, Oregon Business Development (Infrastructure Finance Authority), USDA and Rural Community Assistance for information and scheduling of a one-stop meeting. One-stop meetings are held in Salem or in Sisters. These meetings bring together staff from the various agencies that could potentially contribute funds, and representatives of the community, to discuss the project and funding needs. Staff has already begun this process and preliminary meetings have occurred in anticipation of adoption of this Master Plan.

This section is intended to provide a general overview of recently available programs. **Agency and program policies are continually evolving and specifics may vary if funding of improvements is delayed to any major extent.**

## 11.2 PUBLIC WORKS FINANCING PROGRAMS

Four grant programs and five loan/bond sale programs, which have the potential to provide funding for the City, are listed below:

**Grants**

| | |
|---|---|
| Federal | ■ USDA / Rural Development |
| State | ■ DEQ – Clean Water Revolving Fund (principle forgiveness)<br>■ IFA - Special Public Works Fund |

**Loans/Bond Sales**

| | |
|---|---|
| Federal | ■ USDA / Rural Development |
| State | ■ DEQ – Clean Water Revolving Fund<br>■ IFA – Safe Drinking Water / Special Public Works Fund<br>■ League of Oregon Cities – LOC Capital Asset Program |

Each of the available grant and loan programs varies in terms of the extent and complexity of the application process. In all cases, it is extremely important to communicate the program needs to the funding agency at the earliest possible date. A close working relationship with the potential grantor or lending agency can optimize the timing and amount of the grant and/or loan assistance. A brief overview of potential public works financing programs and an assessment of their availability follows.

### 11.2.1 US Department of Agriculture (USDA) Rural Development

Water Environmental Programs – Offer funds for construction, repair or improvement of Water, Wastewater, Solid Waste or Storm Water projects. Loans can be amortized for up to 40 years at current Municipal Bond market rates. Rate subsidies are available for distressed communities.

### 11.2.2 Department of Environmental Quality (DEQ)

Clean Water State Revolving Fund (CWSRF) – This program offers funding for planning, design and construction of Wastewater projects. Loans can be amortized for up to 30 years, current rates can go as low as 1.47% (depending on

demographics / economic distress). Up to $500,000 in principle forgiveness is available for distressed communities. Between $500,000 and $1,000,000 can be available for Green Infrastructure / Storm Water restoration projects

### 11.2.3 Infrastructure Finance Authority (IFA)

Oregon Health Authority / Safe Drinking Water Revolving Loan Fund (SDWRLF) – This program offers funding for resolving potential or existing compliance issues. Loans can be amortized for up to 20 years at 80% of the current Municipal Bond market rate. For distressed communities loans are available for up to 30 years at 1% interest.

### 11.2.4 League of Oregon Cities (LOC)

Capital Asset Program – This loan program is available through LOC for cities that lack the expertise to avail themselves of public market financing. It offers Municipal Bond funds at market rates.

### 11.2.5 Municipal Bond Financing

The city of Sisters can use the Municipal Bond markets, through an underwriter, to obtain financing at then current market rates.

## 11.3 LOCAL FUNDING SOURCES

A significant portion of a project may need to be financed with local funding sources. Local funding sources are listed below:

General Obligation Bonds
Revenue Bonds
Improvement Bonds *(Local Improvement District)*
Serial Levies
Sinking Funds
Ad Valorem Tax
System User Fees
Assessments
System Development Charges *(SDC's)*

The 1991 legislature clarified and defined the impact of Ballot Measure 5 on municipal finance in several special ways. Cities, counties, and special districts need to clearly

understand, and follow these rules, when they consider bonding for the financing of needed improvements.

The following information was provided in part by Howard A. Rankin, retired Bond Counsel:

1. Chapters 287 and 288 of the Oregon Revised Statutes describe the borrowing and bonding of counties, cities, and special districts, generally.

2. The advance sheets of the Laws of 1991 indicate that the general bond limitations of ORS 287.004 are still in force. Except with regard to the old 3% limitation on all issued and outstanding bonds, on true-cash value of all taxable property within the city's boundaries, has been changed to a 3% limitation on "real market value" as determined by the County Assessor.

3. The above limitation still does not apply to bonds issued for water, sanitary or storm sewers, sewage disposal plants; nor to bonds issued to pay assessments for improvements in installments under statutory or charter authority (i.e., revenue bonds).

A description of each of the preceding listed funding sources follows.

### 11.3.1 General Obligation Bonds

Financing of wastewater improvements by General Obligation *(G.O.)* Bonds is accomplished by the following procedures:

1. The City Engineer prepares a detailed cost estimate to determine the total monies required for construction.

2. An election is held.

3. When voter approval is granted (by a simple majority or a majority of the registered voters, depending on when the vote occurs), bonds are offered for sale. The money for detailed planning and construction is obtained prior to preparation of final engineering plans and the start of project construction unless interim financing has been developed.

G.O. bonds are backed by the full credit of the issuer and authorize the issuer to levy ad valorem taxes. The issuer can make the required payments on the bonds solely from the new tax levy or may instead use revenue from assessment, user charges, or some other source.

Oregon Revised Statutes limit the maximum term of G.O. bonds to 40 years for cities and 25 years for sanitary districts. Except in the event that RD purchases the bonds, the realistic term for which general obligation bonds would be issued is 15 to 20 years.

Ballot Measure 5 has limited the ability of communities to levy property taxes. Capital improvement projects, such as the proposed wastewater system improvements, are exempt from property tax limitations if an election is held and new public hearing requirements are met.

Cities, counties and special districts (all non-school taxing entities) must be very careful when seeking approval from the voters for a general obligation bond, new tax base, annual budget levy, or special levy. The current law now requires that all non-school taxing entities, including cities, counties, and special districts, hold a special public hearing more than 30 days before filing the election statement with the County Clerk. Notice of this special public hearing must be sent to all other non-school taxing entities with overlapping taxing jurisdictions no later than 10 days before the special public hearing. This special public hearing offers the opportunity for all overlapping taxing entities to determine the compaction impact of the proposed election on their respective assessment capability. Effectively, the municipality proposing the election measure must be thoroughly prepared with notice of special public hearing published no later than 41 days before a final public hearing and filing of the election statement.

If the special public hearing procedures are not followed, and no certificate is included in the filing that attests that the special public hearing was conducted pursuant to law, the County Clerk is required to reject the filing for an election. This results in additional unnecessary delays. Consideration should be given to hiring a competent Bond Counsel before proceeding with a General Bond Election. This action will insure that all requirements of current law are met.

Since bonding requirements are very stringent, most recent municipal improvements have been financed with either revenue bonds or one of the state financing programs which can be accomplished outside of bonding requirements.

### 11.3.2 Revenue Bonds

A revenue bond is one that is payable solely from charges made for the services provided or from collection of Systems Development Charges, although the City would need to be very careful that SDCs would be collectible. Such bonds cannot be paid from tax levies or special assessments, and their only security is the borrower's promise to operate the wastewater system in a way that will provide sufficient net revenue to meet the obligations of the bond issue. Revenue bonds are most commonly retired with revenue from user fees.

Successful issuance of revenue bonds depends on bond market evaluation of the dependability of the revenue pledged. Normally there are no legal limitations on the amount of revenue bonds to be issued, but excessive bond issue amounts are generally unattractive to bond buyers because they represent high investment risk. In rating revenue bonds, buyers consider the economic justification for the project, reputation of the borrower, methods for billing and collection, rate structures, and the degree to which forecasts of net revenues are realistic. RD will fund revenue bonds in which user rates are committed for the repayment of the bonds.

Under the provisions of the Oregon Uniform Revenue Bond Act (ORS 288.805-288.945), municipalities may elect to issue Revenue Bonds for revenue producing facilities without a vote of the electorate. In this case, certain notice and posting requirements must be met including a mandatory 60-day waiting period. A petition signed by 5% of the municipalities' registered voters may cause the issue to be referred to an election.

Laws enacted by the 1991 legislature have eliminated the limitation on revenue bonds. The law formally required that the revenues pledged for payment of the bonds have a direct relationship to the services financed by the bonds. Current law now allows revenue bonds to be paid with any revenue pledged for "any public purpose," without the relationship restriction.

### 11.3.3 Improvement Bonds (Local Improvement District)

Improvement bonds may be issued to assess certain portions of wastewater improvements directly against the parties being benefitted. An equitable means of distributing the assessed cost must be utilized so that all property, whether developed or undeveloped, receives the assessment on an equal basis. Cities are limited to improvement bonds not exceeding 3% of true cash value. For a particular improvement, all property within the assessment area is assessed on an equal basis, regardless of whether it is developed or undeveloped.

Improvement bond financing requires that an improvement district be formed, the boundaries established, and that benefitted properties and property owners be determined. The engineer usually determines an approximate assessment based on a square-foot, a front-foot basis, or a combined basis. Property owners are then given an opportunity to remonstrate against the project. The assessment against the properties is usually not levied until the actual total cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a pre-assessment program, based on the estimated total costs,

must be adopted. It is common practice to issue warrants, which are paid when the project is completed, to cover debts.

The primary disadvantages to this source of revenue (improvement bonds) are described below:

1. The property to be assessed must have a true cash valuation at least equal to 50% of the total assessments to be levied. This may require a substantial cash payment by owners of undeveloped property.

2. An assessment district is very cumbersome and expensive when facilities for an entire community are contemplated.

3. The project is impacted by Measure 5 tax limitations because the improvement bonds are backed or guaranteed by the city's authority to raise revenue via taxation. If the city is in compaction, then a general election (same procedures as for a general obligation bond) is required. If the city's property taxes are not under compaction, then the city can proceed with a L.I.D. as in the past; however, the project cost will count against the $10.00 limitation for non-school taxes.

This program should not be considered for improvements to satisfy the City's needs in general, but could be a definite consideration for specific projects benefitting an area of the community.

### 11.3.4 Serial Levies

Under Oregon Revised Statutes, if approved by the voters, the City can levy taxes for a fixed period of time to construct new facilities and maintain existing facilities. Generally, when a serial levy is presented to the voters, it is based upon a specific program and listing of planned improvements.

Since the time frame required for construction of the needed wastewater improvements is quite limited, it is doubtful that residents could afford a serial levy of sufficient size to provide for needed construction revenues.

### 11.3.5 Sinking Funds

Sinking funds can be established by budget for a particular capital improvement need. Budgeted amounts, from each annual budget, are carried in a sinking fund until sufficient revenue is available for the needed project. Funds can also be developed with revenue derived from system development charges or serial levies. The City's wastewater system financial needs can be met with a sinking fund,

although the cost of needed facilities will be higher after funds are collected than if revenues are utilized to repay a loan for construction in the near term.

### 11.3.6 Ad Valorem Tax

Many communities utilize an ad valorem tax as the basis for repaying general obligation bonds for system expansions, and provide partial or full repayment through means of additional wastewater use charges. This means of financing reach all properties to be ultimately benefitted by the wastewater system, whether the property is presently developed or not. Construction costs are more equally distributed among all property owners and the program does not impose a penalty on existing residential or business development. However, with Oregon tax limitations and the public's perception of taxes, this means of securing funds would not be popular.

### 11.3.7 System User Fees

Monthly charges are made to all residences, businesses, etc., that are connected to the wastewater system. Wastewater use charges are established by resolution, and can be modified as needed to serve increased or decreased operating costs. Rates are established depending on the various classes of users and the metered demand through their connection. By establishment of proper use charges, the City could repay the local share of bond amortization without imposition of property taxes. An increase in user fees could finance portions of the wastewater system that are maintenance related, particularly if done in conjunction with a revenue bond.

### 11.3.8 Assessments

In some cases the beneficiary of a public works improvement can simply be assessed for the cost of the project. It is not uncommon for an industrial or commercial developer to provide up-front capital to pay for a community administered improvement which serves the development.

### 11.3.9 System Development Charges

System Development Charges *(SDC's)* are charges assessed against new development to recover the costs incurred by local government who provide the capital facilities required to serve the new development. SDC's apply to new developments that generate revenue for the expansion or construction of facilities located outside the boundaries of new development. When capital improvements increase usage, SDC's can be billed for water, wastewater, drainage and flood control, transportation, and parks or recreational facilities.

## 11.4 PROPOSED FINANCIAL PROGRAM

Initially it appears that either the DEQ or IFA programs may be the most attractive since they offer lower rates and the potential for grants / principle forgiveness as well as loans at below market rates. Funding is likely to be predominantly loan, under any of the available funding programs.

A combination of loan, grant and systems development charges are recommended for funding of needed system improvements. Systems Development Charges should fund system improvements either through repayment of loans, or potentially by utilizing sinking funds to pay for improvements as monies become available. After selection of the initial project scope, the City will contact the IFA, DEQ and Regional Solutions Team to schedule a one-stop meeting with available state and federal funding agencies, to discuss project needs. When the project is presented to all funding agencies, each agency will evaluate their program's potential to assist with financing the needed wastewater system improvements, and the City can determine how construction can best be implemented.

# SECTION 12:
# WASTEWATER RATES AND FINANCING

## 12.1 WASTEWATER FUND BUDGET

*Table 12.1* includes recent wastewater fund budgets. *Table 12.2* provides the information in summary form with a focus on ordinary revenue and expenses.

*Table 12.1: Recent Wastewater Fund Budgets*

| Description | Actual FY 12-13 | Actual FY 13-14 | Actual FY-14-15 | Adopted FY 15-16 |
|---|---|---|---|---|
| **Revenues** | | | | |
| Sewer Receipts | $ 678,342 | $ 705,461 | $ 800,314 | $ 825,000 |
| Charges for Services | $ 8,389 | $ 9,402 | $ 10,308 | $ 8,500 |
| Licenses and Fees | $ 1,588 | $ 9,227 | $ 11,060 | $ 9,000 |
| Intergovernmental | $ 21,210 | $ - | $ - | $ 134,226 |
| Interest / Loan Proceeds | $ 4,414 | $ 783,263 | $ 3,893 | $ 4,000 |
| Rental Income | $ 48,000 | $ 48,000 | $ 24,000 | $ 12,000 |
| Miscellaneous | $ 88,831 | $ 20,603 | $ 1,869 | $ 1,100 |
| Total Revenues | $ 850,774 | $ 1,575,956 | $ 851,444 | $ 993,826 |
| Cash Carry Forward (Beginning Fund Balance | $ 944,415 | $ 942,062 | $ 896,917 | $ 1,004,116 |
| **Total Resources** | **$ 1,795,189** | **$ 2,518,018** | **$ 1,748,361** | **$ 1,997,942** |
| | | | | |
| **Expenditures** | | | | |
| Personnel Services | $ 196,038 | $ 183,905 | $ 153,866 | $ 166,977 |
| Materials & Services | $ 218,024 | $ 190,220 | $ 208,291 | $ 227,980 |
| Capital Improvements | $ - | $ 5,664 | $ 7,563 | $ 134,226 |
| Debt Service | $ 406,065 | $ 1,208,312 | $ 368,940 | $ 374,070 |
| **Total Expenditures** | **$ 820,127** | **$ 1,588,101** | **$ 738,660** | **$ 903,253** |
| | | | | |
| Unappropriated Reserves | $ - | $ - | $ - | $ 313,310 |
| Operating Contingency | $ - | $ - | $ - | $ 150,122 |
| Reserves | $ - | $ - | $ - | $ 617,857 |
| Transfers Out | $ 33,000 | $ 33,000 | $ 12,216 | $ 13,400 |
| **Net Total (Revenues less Expenditures)** | **$ 942,062** | **$ 896,917** | **$ 997,485** | **$ -** |

Reference to these Tables are made in sub-sections that follow.

## 12.2 WASTEWATER SYSTEM REVENUE

### 12.2.1 Current Wastewater Rates

Residential usage charges of $39.00 per month were adopted by the City Council for repayment of the original bond issues, and for needed operation and maintenance revenues. All residential rates are based on 1 Equivalent Dwelling

Unit (EDU) per residence or equivalent dwelling unit. All other system users are charged on an equivalent residential or dwelling unit basis, at the identical cost per EDU.

### 12.2.2 Current Rate Revenue

Potential rate revenue, based on projected service connections, is anticipated to equal $825,000 in the adopted 15/16 fiscal budget.

### 12.2.3 Property Taxes

Currently wastewater system revenue includes no property tax component.

### 12.2.4 Other Revenue

Other revenue may include such revenue as wastewater connections, lateral connection fees, interest, carryover funds, grants, etc. These sources, typically, contribute a relatively small portion of overall revenue and may vary considerably from year to year. Grant funding revenue may be significant; however, it is typically obtained and obligated for specific projects or purposes. Lateral connection fees are generally developed to cover the actual cost of making a new connection. System development charges (SDCs) can only be used for adding system capacity and cannot be used for general operating and maintenance expenses.

## 12.3 WASTEWATER SYSTEM EXPENSES

### 12.3.1 Debt Service

The wastewater system had outstanding bonds of $5,207,541 on September 2015.

### 12.3.2 Operations and Maintenance (O&M)

Operations, maintenance, and administrative costs are summarized in *Table 12.1*. Current expenditures appear to approximate revenues in both actual and adopted budgets. There are cash carry forward funds to cover the costs of major equipment or facility replacements, capital outlay reserves, and a contingency. Good fiscal planning would maintain the contingency fund for emergency purposes. Sisters has a relatively simple wastewater system, but replacements and maintenance are necessary. Mechanical equipment should be repaired or replaced as needed.

## 12.4 CURRENT RATES - ANALYSIS AND RECOMMENDATIONS

A simple formula for budget viability is: *Revenue - Expenses = 0.* At the present time, with a minimum level of reserves for emergencies, and contingencies, the budget is in balance, with the exception of the cash carried forward and the capital outlay reserves.

These funds include monies obtained from grant reimbursements from the original wastewater construction project, and are available for facility expansion. Available budget revenues for future construction total approximately $463,000.

The current rate structure is very simple and easy to apply. A specific reserve fund is probably not required, since unplanned expenses should not exceed the budgeted reserve and contingency amounts. However, rates may need to be adjusted for equipment replacement and increased operation and maintenance expenses addressed in the Capital Improvement Plan provided in Section 10.

## 12.5 FUTURE RATES

Usage fees are currently based on EDUs derived from winter water consumption for all users. This approach was originally adopted such that summer irrigation was not a factor in establishing usage fees for non-residential users. However, with a substantial tourist based economy, many commercial users are not paying fairly for sewer service, and water meter records are available to indicate overall summer peak usage. It is recommended that the rate structure be modified for non-residential users to charge equitably for flows contributed to the sewer system, on the basis of metered flows to the user. A primary factor in wastewater treatment plant design is peak flow volumes and capacity as described thoroughly in this Capital Facilities Plan.

For consideration of commercial flow contributions to the wastewater system, calculation of EDUs must take into account flows on a monthly basis throughout the year, rather than for 3 winter months as originally provided for residential evaluation purposes. Many commercial establishments do not provide landscape irrigation during summer periods, and the majority of their water usage generally enters the wastewater system throughout the year. Commercial usage should be considered separately on a monthly basis, based on total metered water usage averaged per day and equated to average residential usage. An equivalent number of EDUs should be calculated monthly for each non-residential user, and monthly service fees based on the current adopted monthly service fee per EDU. It is recommended that a minimum of 1 EDU per commercial user be maintained in establishment of monthly service fees.

## 12.6 CAPITAL IMPROVEMENTS PLAN

### 12.6.1 Capital Improvements

Recommended Capital improvements are addressed in detail in the Wastewater Capital Improvement Recommendations provided as Section 10. Costs are itemized in both priorities and by funding sources. It is recommended that available revenues from capital outlay funds be combined with available SDC funds to finance needed wastewater system improvements. It is recommended that bonds be issued for all improvements other than the West Side Pump Station, in order to minimize capital costs and to maintain rates at the lowest possible level. Capital costs which are eligible for Systems Development Charges total $ 3,823,000.

### 12.6.2 Financing

A general discussion of financing options is presented in Section 11. Probable financing is limited to loans (based on project scope, cost, impact on rates, and City eligibility). Loans can be obtained from either DEQ or IFA.

## 12.7 SYSTEMS DEVELOPMENT CHARGES (SDCs)

System Development Charges (SDCs) can be charged to all users of transportation, water, sewer, storm drainage, and parks and recreation facilities. The fee is usually charged as each piece of property is developed in the future and goes into a capital construction fund to pay for improvements required by growth in the community. The Oregon System Development Charges Act, House Bill 3224, became effective in 1991. Legislation requires that capital improvement plans be developed, and that methodology used to compute SDCs be documented and reviewed by the community before SDCs can be charged.

The Oregon System Development Charges Act permits two types of charges: 1) a reimbursement fee, and 2) an improvement charge. A reimbursement fee is a charge for unused capacity in existing capital improvements. An improvement charge is associated with capital improvements to be constructed, which creates new capacity. Improvement fees will likely need to be utilized for needed improvements to the Sisters Wastewater System. In addition, a reimbursement fee should be considered for eligible portions of the existing wastewater system that will benefit new development.

Inflation does continue at a steady pace, and all construction projections are based on an Engineering News Record Index (ENR) of 10,055. This index of construction costs is updated monthly, and it is recommended that the ENR be utilized to provide for inflation on an annual basis. Beginning in July 2016, we recommend that the City update SDC values based on this updated plan and construction estimates.

June 26, 2013

Mr. Bill Fujii
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem, Oregon 97301

**CITY OF SISTERS, WASTE WATER REUSE AND CONSERVATION PROJECT PLANNING STUDY**

Dear Mr. Fujii:

The City of Sisters planning study for its waste water reuse and conservation project is submitted herewith to the Oregon Water Resources Department (OWRD). This study was completed with financing under the Oregon Water Resources Department Water Conservation, Reuse and Storage Grant Program.

The study purpose was to determine the feasibility for the City to provide for its future water supply and waste water management needs through a unique program that reuses treated waste water and restores flow in Whychus Creek. The program transfers surface water irrigation rights back to Whychus Creek, their source, and replaces the rights with treated effluent for irrigation. The water right transfers to instream flow may be used to provide additional flows for fish and wildlife and to provide mitigation for new ground water permits needed for future City water supply. Use of treated effluent for irrigation allows the City to manage its future waste water discharges through the year 2033.

The study finds that the proposed program is feasible. The implementation plan to transition from surface water irrigation to effluent irrigation is presented in the accompanying planning study.

Please contact me if you have any questions or inputs to this planning study report. The assistance of the OWRD through the grant made this study possible and is a key element in initiating unique water supply and water reuse management actions through the City's implementation plan.

Sincerely,

Paul Bertagna, Director of Public Works

Enclosure

CITY OF SISTERS

GSI Water Solutions, Inc.

NEWTON CONSULTANTS INC.
Earth, Water and Rock Specialists

# WASTE WATER REUSE & CONSERVATION PROJECT PLANNING STUDY

## Transitioning Irrigation from the Lazy Z Property from Surface Water to Treated Effluent

**Oregon Water Resources Department**
**Water Conservation, Reuse and Storage Grant Program**

Prepared for:

City of Sisters
Sisters City Hall
520 East Cascade
P.O. Box 39
Sisters, OR 97759

June 26, 2013

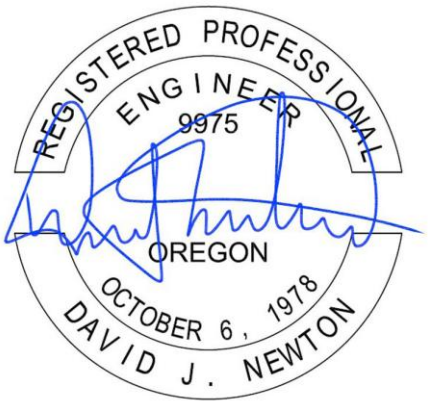
Project No.: 1138-101

# WASTE WATER REUSE AND CONSERVATION PROJECT PLANNING STUDY

***TRANSITIONING IRRIGATION FROM THE LAZY Z PROPERTY FROM SURFACE WATER TO TREATED EFFLUENT***

**OREGON WATER RESOURCES DEPARTMENT**
**WATER CONSERVATION, REUSE AND STORAGE GRANT PROGRAM**

June 26, 2013




EXPIRES: 12 / 31 / 13

**City of Sisters**
**Sisters City Hall**
**520 East Cascade**
**P.O. Box 39**
**Sisters, Oregon 97759**

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## EXECUTIVE SUMMARY

The City of Sisters, Oregon (the City) presently recycles its waste water for irrigation uses. The City collects waste water from within its service area, treats the effluent in aeration lagoons, stores it in a large holding pond over the winter and irrigates pine forest and grass areas with the treated effluent in the summer. The effluent collection, treatment and irrigation process is conducted under a Water Pollution Control Facilities permit (WCPF) issued to the City by the Oregon Department of Environmental Quality (ODEQ). This process is also conducted according to the City's updated Recycled Water Use Plan approved by the ODEQ in 2007.

The City is growing. Demand for water supply is increasing and provisions are required for managing increasing waste water discharges in the future. The increasing water demand and waste water discharge brings unique opportunities to the City and to Whychus Creek. The source of supply for increasing water demand is ground water. Hydraulic connectivity between the aquifer system and Whychus Creek requires mitigation of ground water pumping effects on creek flows. Water supply is needed by the City to accomplish the required mitigation, which is done conventionally in the upper Deschutes Basin by vacating irrigated land of water rights and transferring the rights back to their source stream to restore flows as an offset to pumping effects. Provisions for future water supply and waste water management contemplated by the City can also benefit Whychus Creek through flow restoration with surface water rights held by the City.

The present City process of recycling its waste water for irrigation use is successful. Accordingly, the City purchased 240 acres of Lazy Z Ranch property as a component of its plan for additional water supply and for managing additional waste water flows into the future. Under this plan, the City can transfer irrigation water rights on the Lazy Z property back to Whychus Creek, responding to its mitigation obligations and restoring flows in the creek. In exchange for the water right transfers, the City will irrigate the effected lands with treated effluent, expanding its capacity to manage increasing waste water discharges into the future.

The planning study presented in this report was intended to evaluate the feasibility of this plan to transition from surface water irrigation to effluent irrigation on the Lazy Z property. Feasibility depends on several factors including: 1) regulatory requirements; 2) amount of effluent available for future irrigation; 3) existing water rights on the Lazy Z property; 4) crops best-suited for effluent irrigation at the site and their irrigation water demand; 5) timing for conversion of surface water rights to instream rights; 6) suitable effluent irrigation mechanisms and their costs; and 7) financing opportunities for converting surface water rights to instream rights.

Evaluation of the feasibility factors finds that implementation of this plan or phases of the plan is feasible. The Lazy Z property provides more than enough capacity to irrigate 294 acre-feet of effluent under the Case I option in the year 2033 (and enough capacity to irrigate the total estimate effluent volume of 361 acre-feet in 2033). Hay (alfalfa, grass and timothy), poplar trees for wood fiber and ornamental trees can be grown by irrigation with treated effluent and are best suited for the site.

Irrigation can be done with conventional mechanisms including hand lines, K-lines and circle-pivot systems. Whychus Creek is a priority stream for steelhead reintroduction, the existing surface water rights on the Lazy Z property are supplied with Whychus Creek water and various proven administrative and financial mechanisms exist for transferring the water rights back to Whychus Creek as insteam flows for restoration purposes. Timing and opportunities are best accommodated through three phases of plan implementation.

The City plans to proceed with development of this transition plan, which will result in a unique set of benefits relative to future water supply and future waste water discharges in response to growth, and relative to flow restoration in Whychus Creek. However, to proceed, the City must secure adequate financial resources to develop and execute the plan in a timely manner. Financial needs and benefits for executing the three phases are summarized below in the following table:

| | **Costs** | | **Benefits** | | | |
|---|---|---|---|---|---|---|
| | **Infrastructure** | | **Lease**[1] | **Split-Season Lease** | **Restoration Transfer** | **Temporary Transfer** |
| | Hay | Poplar | | | | |
| **Phase I** (48.84 acres) | $786,857 | $865,745 | $1,026-$1,709 | 0 | $219,780-$317,460 | No data |
| **Phase II** (37.38 acres) | $636,352 | $749,780 | $785-$1,308 | 0 | $168,210-$242,970 | No data |
| **Phase III** (47.79 acres) | $727,417 | $846,668 | $1,004-$1,673 | 0 | $215,055-$310,635 | No data |
| **Total** | $2,150,626 | $2,503,193 | $2,815-$4,690 | 0 | $603,045-$871,065 | No data |

[1] The DRC pays $7/AF. This range is based on $3 AF/acre and $5 AF/acre leased.

## INTRODUCTION

Over time the City of Sisters (the City) must expand its waste water disposal capacity. To this end, the City is developing this planning study to transition from surface water irrigation to effluent irrigation on the City's Lazy Z Ranch property (Lazy Z property). This will fulfill the City's original intent in acquiring the property, expand waste water disposal capacity, and provide instream benefits to Whychus Creek.

The City has a Recycled Water Use Plan (RWUP) that was updated for the Lazy Z property and approved by the Oregon Department of Environmental Quality (ODEQ) in 2007. The City submitted for renewal of its Water Pollution Control Facilities (WPCF) permit in 2011.

This planning study evaluated considerations associated with (a) disposal of treated effluent by irrigation, including regulatory requirements, (b) the amount of treated effluent available over time, (c) surface water rights and phasing of the transition from surface water irrigation to effluent irrigation, and (d) irrigation mechanisms and costs, and financing. The study also assessed whether modifications to the RWUP or the WPCF permit are required.

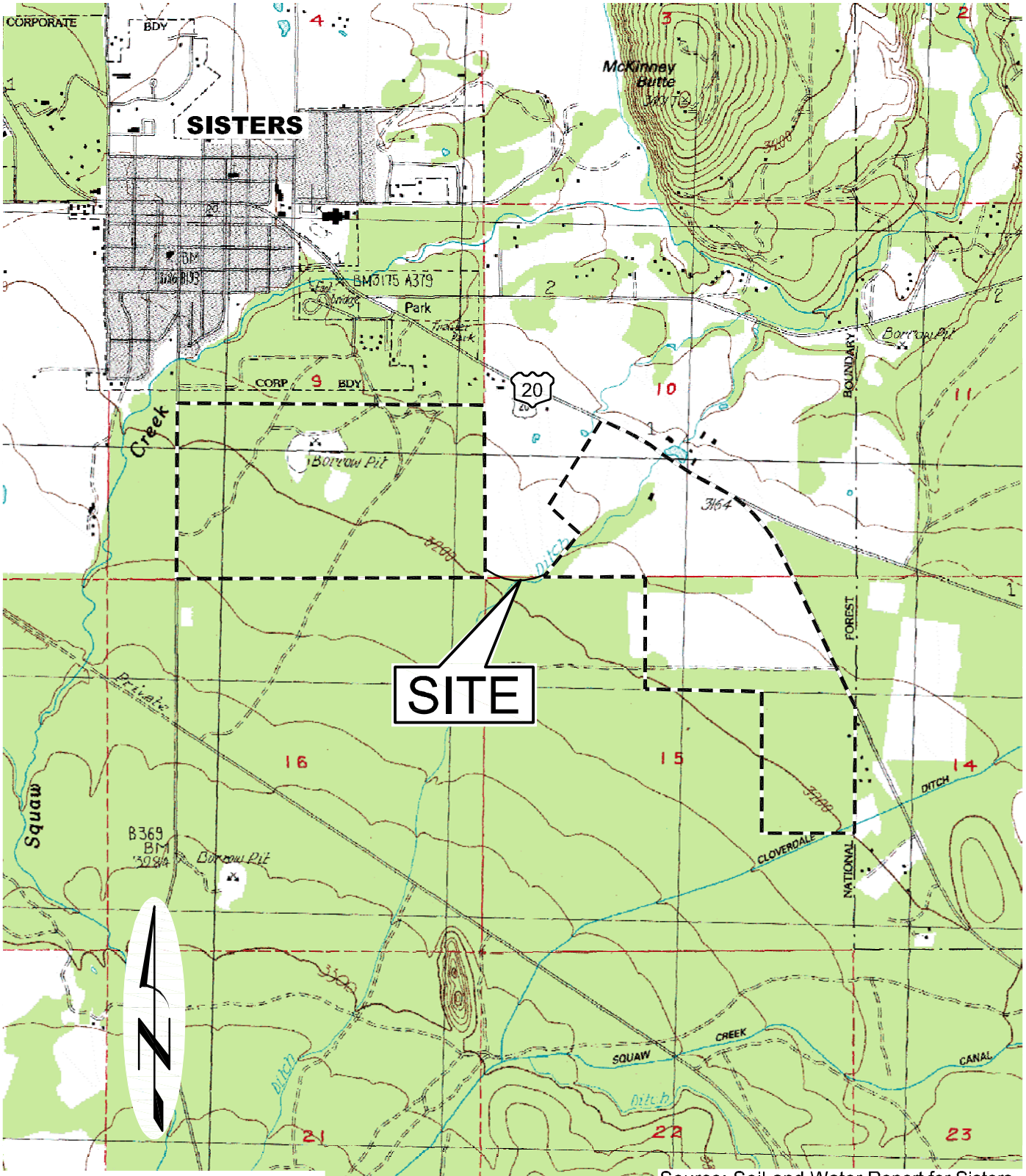
The results of the study are described below and include conceptual design framework, timeline for implementation and opportunities to use the City's Lazy Z property water rights to meet instream water demands and help finance the infrastructure necessary to irrigate with effluent.

The location of the site is shown on Figure 1 (Vicinity Map). The site area, existing waste water treatment facilities and Lazy Z property are shown on Figure 2.

## EXISTING FACILITIES

### General

The description of existing waste water facilities in this report section is focused on the waste water treatment facility. A brief summary of the City's waste water system is below. A detailed description of the waste water facilities is presented in the document *"Wastewater System Capital Facilities Plan – Final; City of Sisters, Deschutes County, Oregon,"* November 2006 (Facilities Plan).



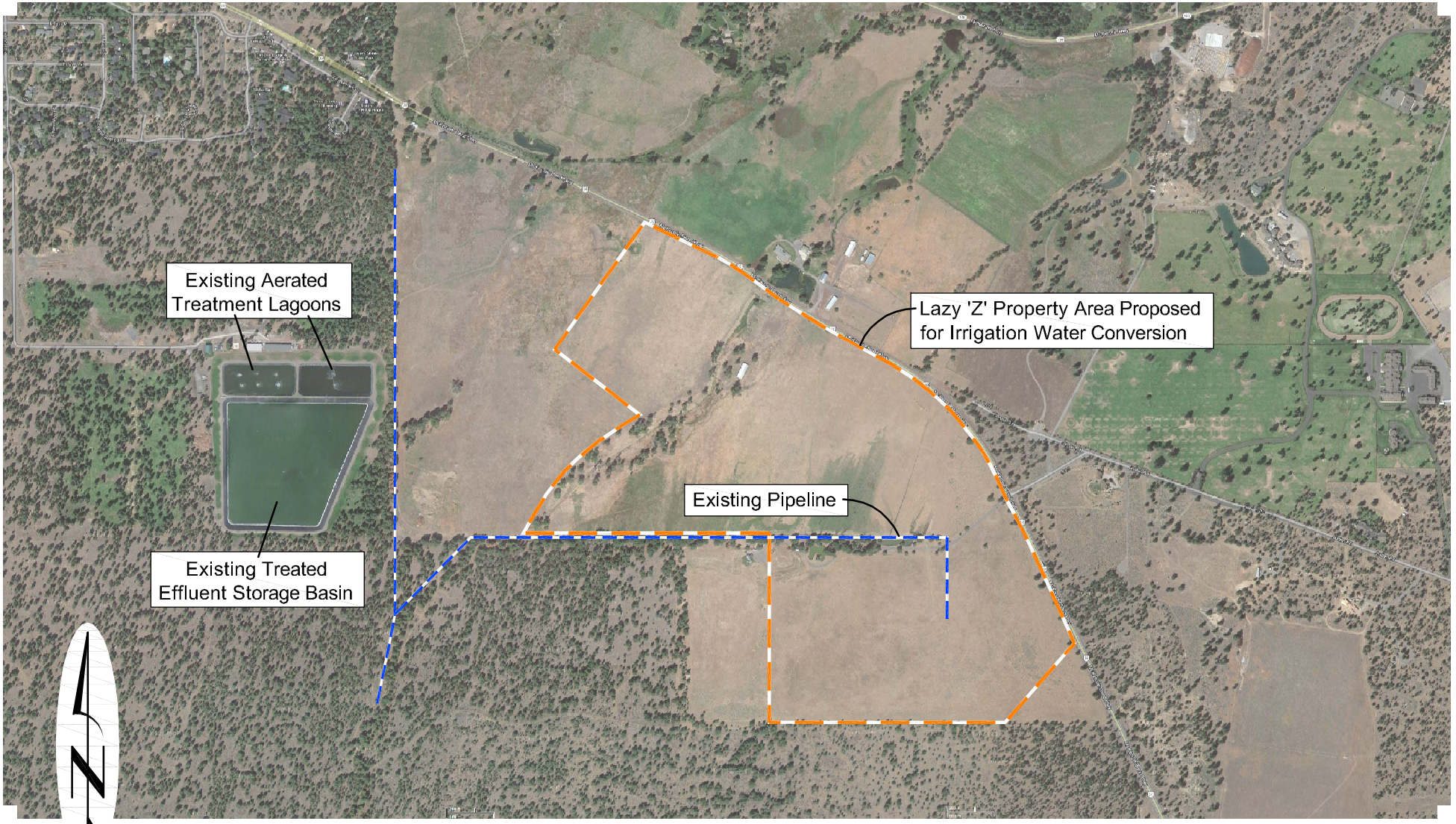

Source: Soil and Water Report for Sisters Wastewater Project, Page 5, Dated Feb 2007, authored by Wert & Associates, Bend Oregon

NEWTON CONSULTANTS INC.
Earth, Water and Rock Specialists
Ph: 541 504-9960 Fax: 541 504-9961

# Vicinity Map
# Lazy 'Z' Evaluation
# Sisters, Deschutes County, Oregon

| DESIGNED BY: | DRAWN BY: | DATE: | PROJECT NO. | FIGURE |
|---|---|---|---|---|
| D. Newton | S.Schenck | MAY 2013 | 1138-101 | 1 |

G:\1100\1138 Lazy Z\101\Cad\Water\W1138101_F1_Site 08:10 05/24/2013 SS




0' 1000' 2000'

SCALE: 1" = 1000'

NEWTON
CONSULTANTS INC.
Earth, Water and Rock Specialists
Ph: 541 504-9960 Fax: 541 504-9961

# Site Area - Proposed Conversion of Surface Water Irrigation to Treated Effluent Irrigation Lazy 'Z' Evaluation Sisters, Deschutes County, Oregon

| DESIGNED BY: | DRAWN BY: | DATE: | PROJECT NO. | FIGURE |
|---|---|---|---|---|
| D. Newton | S. Schenck | MAY 2013 | 1138-101 | 2 |

**Waste water Facilities**

The City of Sisters constructed its waste water facilities during the period 2000 through 2002. The facilities consist of a gravity sewer system with 106,775 lineal feet of waste water sewers, three waste water pump stations and force mains, two aerated treatment lagoons, a storage lagoon, and an automated system that irrigates 100.3 acres of land with treated effluent. Treated effluent is provided to 11.8 acres of dike and pasture grass, and 88.5 acres of forest land.

**Waste water Treatment Facility**

The waste water treatment facility and the effluent irrigation sites are located immediately south of the Sisters City limits on the south ½ of Section 9, Township 15 South, Range 10 East, W.M. (Figure 2). A schematic illustration of the facility is shown on Figure 3.

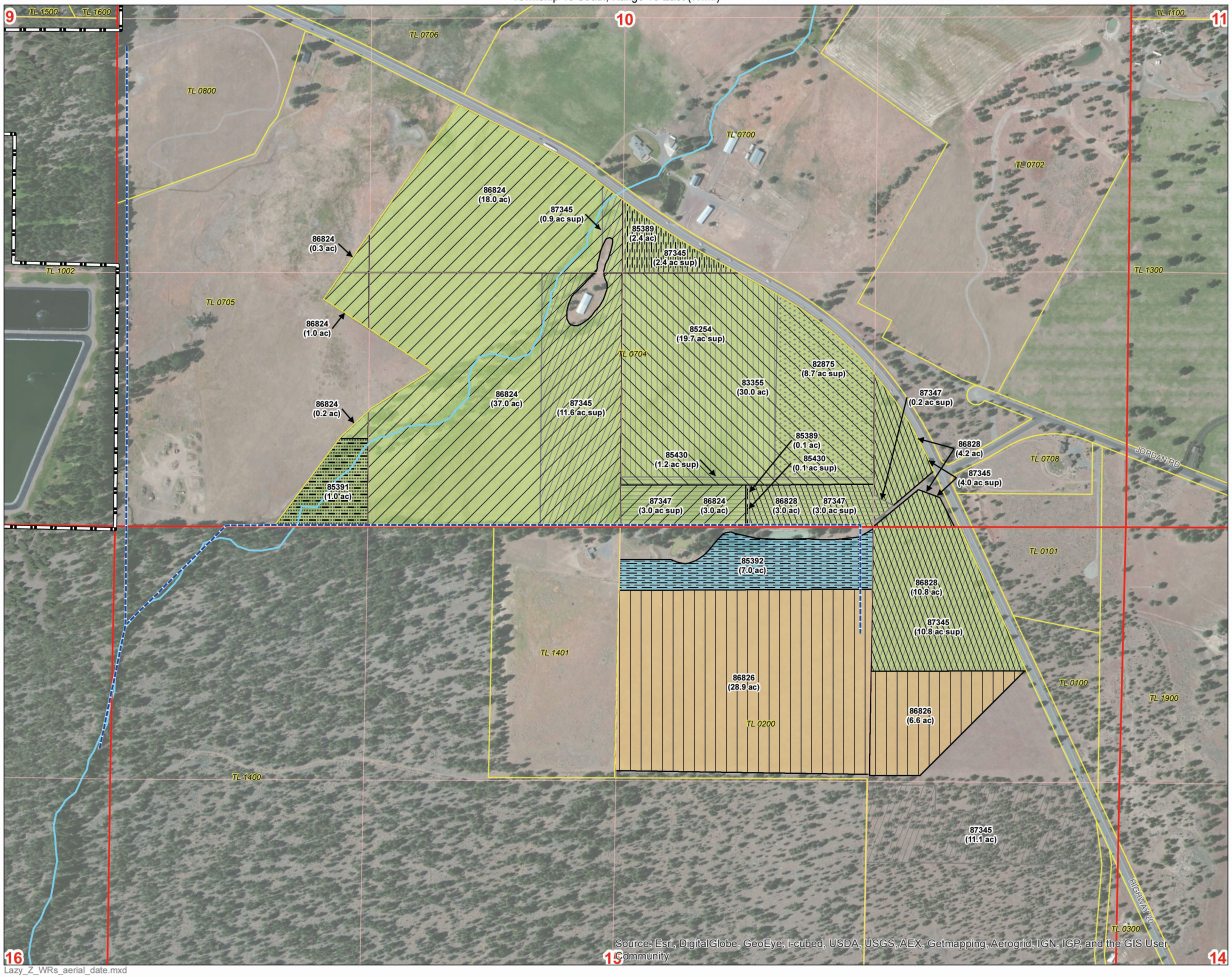
Waste water treatment is provided with two aerated lagoons. The holding capacity of each lagoon is 19.5 acre-feet with a maximum water surface area of 2.41 acres. Treated waste water is then conveyed from the treatment lagoons to a storage lagoon with storage capacity of 213 acre-feet at a maximum water surface area of 18 acres.

The aerated lagoons use mechanical aeration systems to provide oxygen for bacterial respiration and to achieve mixing of the waste water. Mixing of the waste water in the aeration process contributes to suspension of solid particles in the lagoon effluent. Solids removal and additional aerobic treatment are provided in the storage lagoon. A full discussion of the waste water treatment process is presented in the above-cited Facilities Plan.

**Waste Water Irrigation Facility**

The treated effluent is conveyed from the storage lagoon to pump stations that distribute it to 100.3 acres of land for irrigation reuse. Of the 100.3 3 acres, 88.5 acres are forested land; 11.8 acres are dikes that surround the waste water treatment and storage facilities. The maximum irrigation rates for these two areas are described in a later section of this report.

Township 15 South, Range 10 East (W.M.)




Lazy_Z_WRs_aerial_date.mxd

# Lazy Z Water Rights
## City of Sisters

**LEGEND**

**Priority Date**
- 1880
- 1886
- 1881

**Water Right Certificates**
- 82875 S (GW)
- 83355 (1880)
- 85254 S (GW)
- 85389 (1880)
- 85391 (1880)
- 85392 (1886)
- 86824 (1880)
- 86826 (1881)
- 86828 (1880)
- 87345 S (GW)
- 87347 S (GW)

**All Other Features**
- City of Sisters UGB
- Tax Lots
- Uncle John Ditch
- Existing Pipeline
- PLSS Section
- PLSS QQ Section

# Figure 3

N

0 250 500 750
Feet

**MAP NOTES:**
Date: May 19, 2013
Data Sources: Deschutes Co GIS, Deschutes River Conservancy, OGIC

GSI Water Solutions, Inc.

## SUMMARY OF REGULATORY REQUIREMENTS

The City of Sisters waste water facility operates under the authority of a Water Pollution Control Facilities (WPCF) permit issued by the Oregon Department of Environmental Quality (ODEQ). The permit allows the current waste water facility to produce and irrigate with an "enhanced" Level I effluent. The only effluent quality limitation in the permit for this level of treatment is that the E. coli in the effluent "shall not exceed a monthly geometric mean of 126 organisms per 100 milliliters. According to the City, it has no plans to upgrade its waste water facility to produce a higher class of effluent.

### Site Specific ODEQ Regulations (Administrative Rules) for Recycled Water

The use of recycled water (treated effluent) is governed by Oregon Administrative Rules (OAR) Chapter 340, Division 55. Since the City's current permit was issued in May of 2008, ODEQ updated its administrative rules that restrict the use of recycled water. An "enhanced" Level I effluent is now called Class D effluent.

The effluent quality requirements for Class D effluent state that the recycled water shall "not exceed a 30-day log mean of 126 E. coli organisms per 100 milliliters and 406 E. coli organisms per 100 milliliters in any single sample. A log mean as required by the new rules and a geometric mean, as required by the current permit, produce the same result.

OAR 340-041-0009(5) allows an exceedance of effluent limits for bacteria provided immediate and subsequent monitoring after an exceedance event shows no exceedances. The exception, however, is written to only apply to NPDES permits or storage and irrigation facilities with total coliform limits. The exception does not appear to apply to the type of facility and limitations required in the City's WPCF permit. While not certain, ODEQ may interpret the exception rule to apply to the City's facility. If it does, no violation would be found, for an exceedance of a single sample test if the permittee takes at least five consecutive re-samples at four-hour intervals beginning as soon as practicable (preferably within 28 hours) after the original sample was taken and the log mean of the five re-samples is less than or equal to 126 E. coli.

The original administrative rules, under which the current permit was issued, allowed effluent limits to be met anywhere in the treatment process. This meant that if the limits were met after treatment but prior to storage and irrigation, the requirements were met. The updated rules do not have this same allowance. When the permit is renewed, ODEQ may require that the effluent limits be met just prior to irrigation.

According to the current ODEQ rules, irrigation of Class D effluent is restricted to growing fodder, fiber, seed crops not intended for human ingestion, commercial timber, firewood, ornamental nursery stock, Christmas trees, sod, or pasture for animals.

In addition to the restrictions on the irrigation of Class D effluent, the following requirements also apply:

1. Monitoring for E. coli organisms must occur once per week at a minimum.
2. The following setback distances apply.
    a. Where an irrigation method is used to apply recycled water directly to the soil, there must be a minimum of 10 feet from the edge of the site used for irrigation and the site property line.
    b. Where sprinkler irrigation is used, there must be a minimum of 100 feet from the edge of the site used for irrigation and the site property line.
    c. There must be a minimum of 100 feet from the edge of an irrigation site to a water supply source used for human consumption.
    d. Where sprinkler irrigation is used, recycled water must not be sprayed within 70 feet of an area where food is prepared or served, or where a drinking fountain is located.
3. Access and Exposure.
    a. Animals used for production of milk must be restricted from direct contact with the recycled water.
    b. When using recycled water for irrigation of sod, ornamental nursery stock, or Christmas trees, the personnel at the use area must be notified that the water used is recycled water and is not safe for drinking. The recycled water use plan must specify how notification will be provided.
4. Site Management.
    a. When irrigating, signs must be posted around the perimeter of the irrigation site stating recycled water is used and is not safe for drinking.
    b. Irrigation of fodder, fiber, seed crops not intended for human ingestion, sod, commercial timber, firewood, ornamental nursery stock, or Christmas trees is prohibited for three days before harvesting.

The City could propose to blend its recycled water with other irrigation water in order to irrigate more land. Before blending recycled water, however, the owner must obtain written authorization from the ODEQ. In obtaining authorization, the waste water treatment system owner must submit to the ODEQ, at a minimum the following:

1. An operations plan,
2. A description of any additional treatment process,
3. A description of blending volumes, and
4. A range of final recycled water quality at the compliance point identified in the NPDES or WPCF permit.

**Land Use Requirements for Recycled Water**

The regulations requiring a recycled water use plan are ambiguous as it applies to the City. The City has a WPCF permit that authorizes reuse and it has an approved recycle water use plan for its current operation. OAR 3400-055-0016(2)(a) states that, except for use of recycled water authorized by a NPDES or WPCF permit, a waste water treatment system owner may not provide any recycled water for distribution or use or both until a recycled water use plan meeting the requirements of OAR 340-055-0025 has been approved in writing by the ODEQ. Upon approval of the plan, the permittee must comply with the conditions of the plan. OAR 3400-055-0016(2)(c) states that for use of recycled water previously authorized under a NPDES or WPCF permit but without a department approved recycled water use plan, the waste water treatment system owner must submit a recycled water use plan to the ODEQ within one year of the effective date of these rules. It would appear that the City would not have to submit a recycled water use plan because it has a WPCF permit authorizing use and it has an approved plan. It is highly unlikely, however, that ODEQ will allow use of recycled water on the Lazy Z Ranch property without an updated recycled water use plan. Most likely, the City will need to update the recycled water use plan to identify the location of treated effluent use.

Assuming that a new recycled water use plan will be required, the following requirements relative to land use will apply:

> OAR 340-055-0016(3) states that: A recycled water use plan will not be approved for the land application of recycled water on land zoned exclusive farm use until the requirements of ORS 215.213(1)(bb) and 215.283(1)(y) for recycled water are met. Since the ODEQ rules were adopted in 2008, the specific citations in ORS 215 have been re-codified. ORS 215.213(1)(bb) is now ORS 215.213(1)(y); ORS 215.283(1)(y) is now ORS 215.283(1)(v). The two statutes have to do with whether or not the county has or has not adopted marginal lands provisions. In any case, however, both statutes require compliance with in ORS 215.246 to 215.251. A summary of these requirement are provided in a ODEQ fact sheet and are repeated as follows:
>
> a. Subject to issuance of a permit or approval by ODEQ, land application of industrial process water, recycled water and biosolids is an allowed use on EFU zoned land. Because land application is listed as an allowed use in ORS 215.213(1), counties may not impose additional land use restrictions or conditions on land application practices, beyond those specified in the statute.
>
> b. Other facilities or uses on the same EFU tract are included in the allowed use if they are accessory to and reasonably needed for land application to occur on the

proposed site. The statutes also disallow certain uses, e.g. utility facility service lines.

c. Before a county land use decision is made on a land application proposal, the applicant responds in writing to public comments received by the county that identify alternative sites or methods for managing the industrial process water, recycled water or biosolids. The applicant's response describes how the alternative sites or methods were considered and why they were not selected. The land use decision cannot be remanded or reversed, unless the applicant fails to provide a written response when required.

d. ODEQ is required to determine, through its review and approval process, that the practice of land application will not reduce the productivity of the subject land.

e. Land application of biosolids is exempt under the Act when transported by vehicle to EFU land. A ODEQ Land Use Compatibility Statement (LUCS) is not required.

f. Land application of materials that are not described in the Act are not subject to the Act's provisions, e.g. confined animal feeding operation wastes.

g. Land division, for purposes of land application, is not allowed in EFU zones.

h. Restrictions apply in changing the use of land where land application practices has occurred.

ODEQ has adopted a process for assuring that the requirements of these land use statutes are met. Also from the ODEQ fact sheet, the process is as follows:

a. The applicant obtains the required ODEQ application and LUCS forms, and submits the LUCS to the county planning office for its review and approval.

b. The county conducts its land use review process in accordance with the requirements under the Act.

c. The county completes the LUCS form and returns it to the applicant with the attached findings:

- The proposed activity constitutes land application for purposes of agricultural, horticultural, silviculture production, or for irrigation in connection with a use allowable in EFU zoned land under ORS 215.
- Any proposed facilities necessary for the land application practice to occur on the subject site are accessory to and reasonably necessary as allowed by the Act.

- Approval of the LUCS is subject to ODEQ's issuance of the necessary environmental approvals or permits.

d. The applicant submits the ODEQ application and approved LUCS to ODEQ for processing. ODEQ processes the application and conducts a technical review in accordance with its rules. The review, depending on what material is applied to the land, may include the following:

   - Pollutant and nutrient testing
   - Determination of agronomic rate
   - Determination of agronomic or pollutant loading
   - Determination of water assimilation capacity
   - Site assessment and evaluation
   - Crop type and cropping system
   - Application methods and equipment requirements
   - Site access and harvest restrictions
   - Monitoring requirements
   - A written determination that the land application activity will not reduce the productivity of the land in question.

e. ODEQ submits all Recycled Water Reuse Plans to the DHS for comment (OAR 340-055-0015(2)), and consults with DHS on any effluent quality limitations (OAR 340-055-0015(4)).

f. Applicants intending to land apply recycled water are required to submit a "Registration of Recycled Water Use" form (http://www1.wrd.state.or.us/pdfs/reclaimform96.pdf) to the Oregon Water Resources Department (ORS 537.131, 537.132 and 537.610(h)). Either agency can supply applicants with this form, however it requires a ODEQ signature.

g. DEQ issues an approval or denial to the applicant, and provides a copy to the county planning office.

In situations where a LUCS is denied or appealed:

a. When ODEQ receives a county-denied LUCS, the applicant is informed that ODEQ cannot process the application until county approval is provided.

b. If a county land use decision is appealed after ODEQ receives an approved LUCS, ODEQ's policy is to process the application unless ordered otherwise by a court stay or invalidation of the county decision.

c. A county may withdraw or modify its LUCS decision before the permit is issued.

d. If a county-approved LUCS is successfully appealed after ODEQ issues a permit, ODEQ may revoke or suspend the permit, or delay its decision until the appeals process is exhausted. In making its decision, ODEQ consults closely with the applicant and county government.

**Other General Requirements for Recycled Water**

The following requirements must also be met when reusing recycled water. Most of these are likely already met by the City under its current, approved recycled water use plan.

1. Bypassing. The intentional diversion of waste water from any unit process in the waste water treatment system for a beneficial purpose is not allowed, unless with the unit process out of service the recycled water meets the criteria of this division for a specific class and beneficial purpose described in the recycled water use plan.

2. Alarm devices. Alarm devices are required to provide warning of power loss and failure of process equipment essential to the proper operation of the waste water treatment system and compliance with this division.

3. Standby power. Unless otherwise approved in writing by the ODEQ, a waste water treatment system providing recycled water for use must have sufficient standby power to fully operate all essential treatment processes. The ODEQ may grant an exception to this section only if the waste water treatment system owner demonstrates that power failure will not result in inadequately treated water being provided for use and will not result in any violation of an NPDES or WPCF permit limit or condition or Oregon Administrative Rule.

4. Redundancy. A waste water treatment system that provides recycled water for use must have a sufficient level of redundant treatment facilities and monitoring equipment to prevent inadequately treated recycled water from being used or discharged to public waters.

5. Distribution system requirements. Unless otherwise approved in writing by the department, all piping, valves, and other portions of the recycled water use system that is outside a building must be constructed and marked in a manner to prevent cross-connection with a potable water system. Unless otherwise approved in writing by the department or as required by the rules of this division, construction and marking must be consistent with sections (2), (3), (4), and (5) of the 1992 "Guidelines for the Distribution of Nonpotable Water" of the California-Nevada Section of the American Water Works Association.

6. Cross-connection control. Connection between a potable water supply system and a recycled water distribution system is not authorized unless the connection is through an air gap separation approved by the ODEQ. A reduced pressure principle backflow

prevention device may be used only when approved in writing by the ODEQ and the potable water system owner.

7. Annual report. The City must submit an annual report to the ODEQ describing the effectiveness of the system to comply with the approved recycled water use plan, the rules of this division, and the permit limits and conditions for recycled water.

**Ground Water Protection Requirements**

Recycled water will not be authorized for use unless all ground water quality protection requirements in OAR chapter 340, division 40 are met. The requirements in OAR chapter 340, division 40 are considered to be met if the waste water treatment system owner demonstrates recycled water will be used or land applied in a manner and at a rate that minimizes the movement of contaminants to ground water and does not adversely impact ground water quality. Generally, if the recycled water is irrigated at rates consistent with the needs to the crop being irrigated, compliance with the ground water quality requirements are deemed to be met.

**Other Considerations**

The current ODEQ rules do not require the City to have a contract if it decides to provide its recycled water to another party for use. Regardless of this omission, if the City does decide to provide its recycled water, it is highly recommended that a well-conceived contract be established between the City and the other party to ensure the City's interests are protected.

## EFFLUENT AVAILABLE FOR IRRIGATION

The opportunity for the City to transition from irrigation with surface water to treated effluent over time depends on the projected volume of treated effluent. The section below estimates the total volume of treated effluent that would be available for irrigation on the Lazy Z lands from the present time to the year 2033.

**Background**

The City currently uses treated effluent to irrigate lands near its waste water treatment facilities. These lands include grasses on the lagoon system dikes and forest lands (Ponderosa pine trees). The analysis for estimating the total volume of available treated effluent water in 2033 for irrigation at the Lazy Z lands was completed with the following assumptions:

1. The dikes are irrigated at 14.375 inches per season; the forest is irrigated at 7.15 inches per season; and the remainder is irrigated at the Lazy Z lands.

2. The dikes are irrigated at 28.75 inches per season; the forest is irrigated at 14.30 inches per season; and the remainder is irrigated at the Lazy Z lands.
3. All available water is irrigated at the Lazy Z lands; none on the dike or forest.

The irrigation volumes of 14.375 and 28.75 inches per year for the dikes (Case 1 and 2) were provided by the City of Sisters; the irrigation volume of 14.30 inches per season (Case 2, forest) is the maximum amount allowed by ODEQ to be irrigated on the forest land. The volume of 7.15 inches per season for the forest in Case 1 was suggested by the City as a reasonable amount to sustain the Ponderosa pine trees on the forest land. Although Ponderosa Pine trees grow naturally in the Sisters area and near the site without artificial irrigation, the trees presently irrigated with treated effluent were planted and nurtured with artificial irrigation. As such, the trees require continued irrigation to survive, which is the basis for the seasonal irrigation volume of 7.15 inches suggested by the City.

Estimations of future effluent flows for potential irrigation were presented in the report *"Waste Water Capital Facilities Plan Update",* dated October 2011 (hereinafter referred to as Report); however, these estimates of future flows were only to the year 2025. The flow estimates were based on a population growth rate of 3.13% which was taken from the City of Sisters Comprehensive Land Use Plan. This growth rate was also used to estimate the availability of treated effluent for irrigation presented in this report. .

**Analysis**

The following table summarizes the effluent irrigation water usage for 2010 and 2011.

**Table 1. Effluent Irrigation Water Usage for 2010 and 2011**

| | | Irrigation Volume, Acre-Feet | Irrigated Acreage, Acres | Net Application, inches |
|---|---|---|---|---|
| 2010 | Dike | 40.12 | 11.8 | 40.80 |
| | Forest | 146.21 | 88.5 | 19.83 |
| | **Total** | 186.33 | 100.3 | |
| 2011 | Dike | 38.32 | 11.8 | 29.23 |
| | Forest | 142.2 | 88.5 | 14.46 |
| | **Total** | 180.52 | 100.3 | |
| 2012 | Dike | 31.43 | 11.8 | 23.97 |
| | Forest | 115.72 | 88.5 | 11.77 |
| | **Total** | 147.15 | 100.3 | |

Pursuant to discussions with City staff, the estimated volume of treated effluent available for irrigation in 2033 is based on the average of the 2010 and 2011 irrigation usage projected from 2011 to 2033 according to an assumed population growth rate of 3.13%. Irrigation data for 2012 was not used because an estimated 40 acre-feet were carried over to the following irrigation season and not irrigated.

Using the above information, the following table shows the volume of treated effluent that may be available for irrigation at the Lazy Z lands under the three cases listed above:

**Table 2. Treated Effluent Available for Irrigation**

| | **Case 1** | | **Case 2** | | **Case 3** | |
|---|---|---|---|---|---|---|
| | Application Rate, Inches per Season | Total Amount, Acre-Feet | Application Rate, Inches per Season | Total Amount, Acre-Feet | Application Rate, Inches per Season | Total Amount, Acre-Feet |
| Total Estimated 2033 volume | - | 361 | - | 361 | - | 361 |
| Dike Irrigation (11.8 Acres) | 14.375 | 14 | 28.75 | 28 | 0 | 0 |
| Forest Irrigation (88.5 Acres) | 7.15 | 53 | 14.30 | 105 | 0 | 0 |
| Available for Lazy Z Lands | - | 294 | - | 228 | - | 361 |

The following table summarizes the potential amount of available treated effluent for irrigation at the Lazy Z property at 5 year increments: 2018, 2023, 2028, and 2033.

**Table 3. Treated Effluent Available for Irrigation, 5 Year Increments**

| Year | Estimated Total Available, Acre-Feet/Year | Estimated Available Water Available to Lazy Z Ranch, Acre-Feet/Year | | |
|---|---|---|---|---|
| | | Case 1 | Case 2 | Case 3 |
| 2013 | 195 | 128 | 62 | 195 |
| 2018 | 228 | 161 | 95 | 228 |
| 2023 | 266 | 199 | 133 | 266 |
| 2028 | 310 | 243 | 177 | 310 |
| 2033 | 361 | 294 | 228 | 361 |

The irrigation application rate for the Lazy Z lands will depend on the type of crop grown, which will be addressed in subsequent sections of this report.

## WATER RIGHT ANALYSIS

### Lazy Z Property Water Rights Summary

The City purchased a portion of the Lazy Z property that contains both surface and ground water rights for irrigation uses. There are four ground water rights and seven surface water rights appurtenant to the City's Lazy Z property. The priority dates of the Lazy Z surface water rights held by the City are generally senior in priority dates. These senior rights are some of the last water rights to be "regulated off" from Whychus Creek during low water flows. The following information details each of the water rights appurtenant to the City's Lazy Z property and the current status and are shown on Figure 4.

### Surface Water Rights

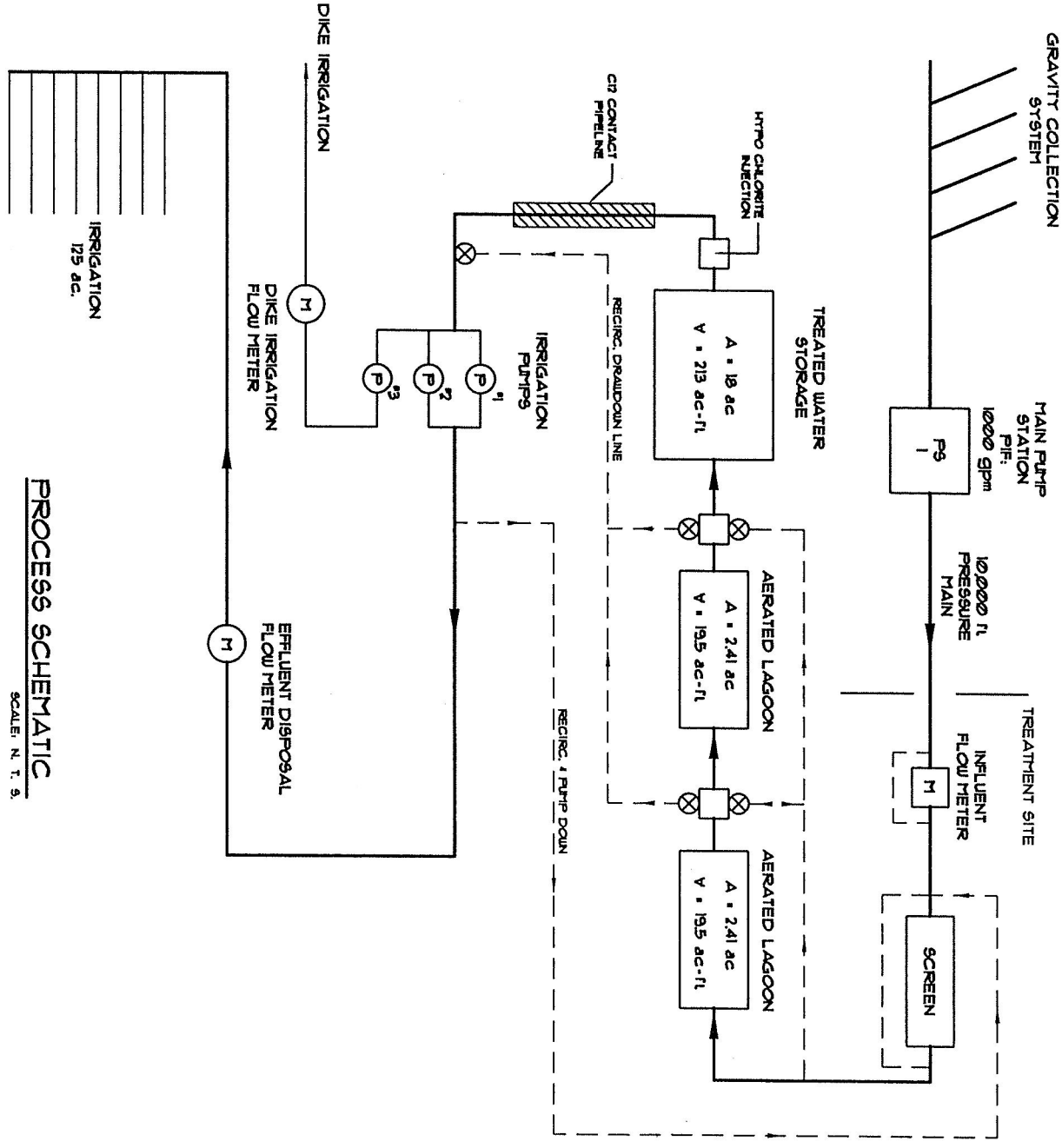
#### *Transfer Application T-11318 and Conserved Water Application CW-71*

On November 17, 2011, Three Sisters Irrigation District (TSID) and the water right holders on the Uncle John Ditch (which serves the City's Lazy Z property) submitted a transfer application (T-11318) to the Oregon Water Resources Department (OWRD) requesting a change in point of diversion. The point of diversion is proposed to be changed from the current in-creek push-up dam that diverts water into the Uncle John Ditch to TSID's main diversion, which has Oregon Department of Fish and Wildlife approved fish passage.

Additionally, on January 12, 2012 OWRD received a conserved water application (CW-71) from the "landowners of the Uncle John Ditch". The pending conserved water application proposes that the piping of 3.8 miles of open ditch (Uncle John Ditch) and the point of diversion change in transfer application T-11318 will conserve 2.49 cubic feet per second (cfs) from all of the

included Lazy Z water rights. The City's portion of conserved water is proposed to be a total of 0.76 cfs.

The transfer and conserved water project affect all of the City's surface water rights appurtenant to the Lazy Z property. On November 27, 2012, OWRD issued a draft Preliminary Determination proposing to approve the transfer request. To date, no orders have been issued regarding the conserved water application. The following water rights are appurtenant to the City's Lazy Z property.




PROCESS SCHEMATIC

SCALE: N. T. S.

| | |
|---|---|
| PROJECT: WASTEWATER FACILITIES PLAN | |
| PROJECT NO. : 05.63 | TITLE: T.P. SCHEMATIC |
| DATE: 11-02-05 | |
| Figure **Figure 4** | |

HGE INC
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375 Park Avenue Coos Bay, OR. 97420
(541) 269-1166
19 N.W. Fifth Avenue Portland, OR. 97209
(503) 222-1687

***Certificate 83355 (Squaw Creek Decree)***
The water right allows the use of up to 0.62 cfs, from Whychus Creek (formerly Squaw Creek), for primary irrigation of 30.0 acres with a priority of 1880. The water rights approved through the Squaw Creek Decree do not have an assigned volume per acre (duty).

Current Status:
Upon OWRD's issuance of the final order approving transfer T-11318, water right Certificate 83355 will be cancelled. A new confirming certificate will be issued once beneficial use is demonstrated from the new point of diversion, consistent with the order approving the transfer. The rate the water right is projected to be reduced by upon approval of CW-71 is 0.136 cfs, leaving a remaining rate of 0.48 cfs.

***Certificate 86824 (Squaw Creek Decree)***
The water right allows the use of up to 1.23 cfs, from Whychus Creek for primary irrigation of 59.5 acres with a priority of 1880. The water right does not have an assigned duty.

*Current Status:*
Upon OWRD's issuance of the final order approving transfer T-11318, water right Certificate 86824 will be cancelled. A new confirming certificate will be issued once beneficial use is demonstrated from the new point of diversion, consistent with the order approving the transfer. The rate the water right is projected to be reduced by upon approval of CW-71 is 0.271 cfs, leaving a remaining rate of 0.96 cfs.

***Certificate 85389 (Squaw Creek Decree)***
The water right allows the use of up to 0.08 cfs, from Whychus Creek for primary irrigation of 2.5 acres with a priority of 1880. The water right does not have an assigned duty.

*Current Status:*
Upon OWRD's issuance of the final order approving transfer T-11318, water right Certificate 85389 will be cancelled. A new confirming certificate will be issued once beneficial use is demonstrated at the new point of diversion, consistent with the order approving the transfer. The rate the water right is projected to be reduced by upon approval of CW-71 is 0.018 cfs, leaving a remaining rate of 0.06 cfs.

***Certificate 86828 (Squaw Creek Decree)***
The water right allows the use of up to 0.57 cfs, from Whychus Creek, for primary irrigation of 18.0 acres with a priority of 1880. The water right does not have an assigned duty.

*Current Status:*
Upon OWRD's issuance of the final order approving transfer T-11318, water right Certificate 86828 will be cancelled. A new confirming certificate will be issued once beneficial use is demonstrated at the new point of diversion, consistent with the order approving the transfer. The rate the water right is projected to be reduced by upon approval of CW-71 is 0.126 cfs, leaving a remaining rate of 0.44 cfs.

***Certificate 85391 (Squaw Creek Decree)***
The water right allows the use of up to 0.10 cfs, from Whychus Creek for primary irrigation of 3.0 acres with a priority of 1880. The water right does not have an assigned duty.

*Current Status:*
Upon OWRD's issuance of the final order approving transfer T-11318, water right Certificate 85391 will be cancelled. A new confirming certificate will be issued once beneficial use is demonstrated at the new point of diversion, consistent with the order approving the transfer. The rate the water right is projected to be reduced by upon approval of CW-71 is 0.022 cfs, leaving a remaining rate of 0.08 cfs.

***Certificate 86826 (Squaw Creek Decree)***
The water right allows the use of up to 0.71 cfs, from Whychus Creek, for primary irrigation of 35.5 acres with a priority of 1881. The water right does not have an assigned duty.

*Current Status:*
Upon OWRD's issuance of the final order approving transfer T-11318, water right Certificate 86826 will be cancelled. A new confirming certificate will be issued once beneficial use is demonstrated at the new point of diversion, consistent with the order approving the transfer. The rate the water right is projected to be reduced by upon approval of CW-71 is 0.156 cfs, leaving a remaining rate of 0.55 cfs.

***Certificate 85392 (Squaw Creek Decree)***
The water right allows the use of up to 0.14 cfs, from Whychus Creek, for primary irrigation of 7.0 acres with a priority of 1886. The water right does not have an assigned duty.

*Current Status:*
Upon OWRD's issuance of the final order approving transfer T-11318, water right Certificate 85392 will be cancelled. A new confirming certificate will be issued once beneficial use is demonstrated at the new point of diversion, consistent with the order approving the transfer. The rate the water right is projected to be reduced by upon approval of CW-71 is 0.031 cfs, leaving a remaining rate of 0.11 cfs.

## Ground water Rights

There are 4 ground water rights appurtenant to the City's Lazy Z property. Three rights are for supplemental irrigation only and the fourth is for both primary and supplemental irrigation.

***Certificate 85254 (Permit G-3095, Application G-3489)***
The water right allows the use of up to 0.246 cfs from a well in Whychus Creek basin, with a priority date of May 13, 1966. The use is for supplemental irrigation of 19.7 acres. The diversion is limited to 1/80$^{th}$ of a cfs per acre and is further limited to a diversion not to exceed 3 acre-feet (AF) per acre.

*Current Status:*
This certificate is in the name of Lloyd Brogan and was issued on December 26, 2008. There are no transactions currently pending on this water right.

***Certificate 82875 (Permit G-8148, Application G-8548)***
The water right allows for the use of up to 0.11 cfs from a well in Whychus Creek basin and has a priority date of November 25, 1977. The use is for supplemental irrigation of 8.7 acres. The diversion is limited to 1/80$^{th}$ of a cfs per acre and is further limited to a diversion not to exceed 3 AF per acre.

*Current Status:*
This certificate is in the name of Lloyd Brogan and was issued on November 17, 2006. Currently there are no transactions pending on this water right.

***Certificate 87345 (Permit G-4841, Application G-5295)***
This water right allows for the use of the up to 0.039 cfs for primary irrigation of 3.1 acres and 0.108 cfs for supplemental irrigation of 29.7 acres. The source is a well in Whychus Creek basin and has a priority date of August 25, 1970.

*Current Status:*
The City still holds the rights to 3.1 acres of primary irrigation under Certificate 87345 but the purchase agreement for the Lazy Z stated that 3.1 acres of this right would be transferred to the seller (David Herman) in the future. To date no transfer application requesting a change in place of use (off City property) has been submitted to OWRD.

***Certificate 87347 (Permit G-3095, Application G-3489)***
This water right allows for the use of up to 0.094 cfs from a well in Whychus Creek basin and has a priority date of May 13, 1966. The use is for supplemental irrigation of 7.5 acres. The

diversion is limited to 1/80$^{th}$ of a cfs per acre and is further limited to a diversion not to exceed 3 AF per acre.

*Current Status:*
This water right was issued on December 9, 2011. There does not appear to be any transactions occurring currently related to this water right.

### Conclusion

The City holds 155.5 acres of senior surface water rights for primary irrigation on the Lazy Z property; in addition they hold a few ground water rights which are mostly supplemental to the surface water. Currently all the surface water rights are involved in a point of diversion transfer and an allocation of conserved water project. Currently the City is irrigating two sections of the property and the remaining section is included in a one-year instream lease.

## POTENTIAL CROPS AND IRRIGATION DEMAND

### Purpose and Data Sources

Key considerations in evaluating the feasibility of irrigation with treated effluent include types of crops and their water demand, regulatory limits and opportunities, and economic factors important to the City. This section describes an evaluation of potential crops based on these considerations. Several information sources were used for evaluating allowable and likely crop choices for the Lazy Z property, including:

- ODEQ Oregon Administrative Rules (OAR)340-055-0012;
- Oregon State University Extension Service (OSU) personnel and Extension Miscellaneous 8530 Report, "Oregon Crop Water Use and Irrigation Requirements" 1999;
- Wert & Associates, Inc. Report "Soil and Water Reuse Report for Sisters Wastewater Project" Sisters, Oregon, February 2007 (Wert);
- Deschutes County Soil and Water Conservation District;
- Richard Zimmerlee, International Agri-Business Consultant; and
- Available online sources for climate and agricultural crops and potential seasonal growing conditions related to the Site.

The above sources provided useful, detailed information regarding potential crop types for the Lazy Z property and potential for crop value upon harvest.

**Regulatory Limitations Relative to Potential Crops**

An initial review of OAR 340-055-012(4)(a) identifies allowable crops for a class D effluent; stating *"Any beneficial purpose defined in subsection (3)(a) of this rule; [((3)(a) allows fodder, fiber, seed crops not intended for human ingestion, or commercial timber]; (B) Irrigation of firewood, ornamental nursery stock, Christmas trees, sod, or pasture for animals"*. These allowable crops may not be produced for human consumption; although, as discussed below, additional restrictions may be applied as well.

**Constraints & Opportunities for Crop Types**

***Locality***

The OSU extension service (OSU) was contacted to determine a list of crops that are compatible with the Lazy Z property, considering location, elevation and soil type. Based on the location, OSU narrowed the crops more suited for cultivation on the Lazy Z property to two basic groups: 1) hay, including grass hay and alfalfa hay, orchard grass and timothy hay; and 2) cereal grains. Cereal grains include oats, barley, wheat and triticale. Both general categories of grasses and cereal grains would be a marketable crop for animal feel, specifically cows, cattle and possibly horses.

OSU also provided insight as to the likely period of irrigation for the two crop categories. The grass hay, alfalfa hay and timothy hay will take water from essentially the beginning of the irrigation season, weather dependent, to November 1 of each year. The nutrient uptake and need for irrigation could be variable in April and October of each year depending on temperature, precipitation and overall climate conditions; however, a relatively full irrigation season for application of water is likely.

***Localized Climate Zones and Frost Free Days***

A summary table of frost free days throughout the major areas of Central Oregon is presented below:

**Table 4. Frost Free Days in Central Oregon**

| Location | Elevation, feet, MSL | Average Last Frost | Average First Frost |
|---|---|---|---|
| **Bend** | 3500 | July 1-10 | Sept 1-10 |
| **Madras** | 2398 | June 11-20 | Sept 11-20 |
| **LaPine** | 4234 | July 1 -10 | August 21-31 |
| **Prineville** | 2998 | July 1 -10 | August 21-31 |
| **Redmond** | 3031 | July 21-31 | Sept 1-10 |
| **Sisters** | 3200 | July 11-21 | August 11-20 |
| http://www.plantmaps.com/interactive-oregon-usda-plant-zone-hardiness-map.php | | | |

Based on above table, Sisters has the shortest period of frost free days of the locations throughout Central Oregon. The shorter period of frost-fee days reflects a greater limitation to crop types for the Lazy Z lands that are most effective in responding to the City's potential reuse project. Because of the very limited period of frost free days, upgrading effluent quality to produce Class A effluent would likely not provide any benefit because the high quality crops requiring Class A effluent cannot be grown in the Sisters area.

***Crop Types***

*Grass Hay and Alfalfa*

Grass hay and alfalfa hay were generally characterized by OSU staff as a fairly straight forward crop to cultivate on the Lazy Z property as there are many hay crop growers in the Sisters area and throughout Central Oregon. Grass hay and alfalfa hay tend to have up to three harvest cuttings per irrigation season with a likely total seasonal average of 4 to 6 tons per acre. According to OSU staff, harvest cuttings typically mature in June to July, with subsequent harvest cuttings occurring approximately 6 weeks after each previous harvest; with each harvest cutting being similar in yield.

*Timothy Hay*

Timothy hay was characterized by OSU staff generally as either early or late maturing varietals. The early maturing timothy hay tends to mature faster and the crop produces smaller crop heads with a typical first cutting harvest in July. Late maturing timothy hay tends to mature slower and produces larger crop heads with a typical first cutting harvest in August. Timothy hay usually has only two cutting harvests per irrigation season, with the first cutting producing in the range of 4 to 5 tons per acre, with the second cutting producing 1 to 2 tons per acre, regardless of the maturation varietal.

*Cereal Grain*

Cereal grains, on the other hand, are limited in the need for irrigation, as the crops tend to mature faster and are harvested usually beginning in August. Because of this, the cereal crop would likely not need irrigation after the first part of August, allowing time for the crop to cure prior to harvest. There would be no growing crop after harvest to assimilate the recycled water. Because of this, cereal crops are not a likely suitable crop for irrigation of the City's effluent.

*Additional Crop Constraints*

Crop types were narrowed by OSU based on the likely growing conditions of the site, specifically the likely temperature and average frost free days that significantly reduce the crops that are capable of being grown on the site. Discussions with OSU led to the understanding that Central Oregon is highly variable with localized climate zones, with the area of Sisters being the more restrictive areas for viable crop types.

These limitations as described by OSU staff negates crops that qualify under DEQ regulations, such as seed crops (carrot seed, grass seed, etc.) that are grown in other areas of Central Oregon with longer frost free days to allow for crop maturation for harvest. Grass hay, alfalfa hay and timothy hay were identified as being hardy crops that can withstand ice encasement and have growing seasons that generally can accept irrigation water throughout the available irrigation season. Cereal grain crops are tend to be hardy crops that can likely withstand the growing conditions in the Sisters area, however, cereal grains have a limited duration growing season.

*Poplar*

The City of Woodburn developed a small poplar plantation around 1999 to dispose of their treated effluent. According to the City of Woodburn, its poplar irrigation program indicates it has very stringent effluent limits relative to discharge to the Pudding River and irrigation of treated effluent in the summer is essential. The plantation has 80 acres of poplars. About 26 acres were harvested 3 to 4 years ago, for which the City obtained about $15 per wet ton of chipped material after harvesting, chipping and shipping of the material to the pulp mill in Toledo, Oregon. Curtis Stultz, Woodburn waste water superintendent, did not readily have cost figures for growing the poplar trees, but stated that the operation is not a money maker for the City[1]

In 2007, the cost of producing poplar for pulp ranged between $24 and $30 per dry metric ton ($21.34 and $26.67 per American ton).[2] Poplar wood moisture content is about 50% to 58% so

[1] Personal conversation with Curtis Stultz on February 8, 2013 and subsequent e-mail of the same date.
[2] Brian J. Stanton, Hybrid Poplar Feedstock Production: Economic Opportunity for Renewable Energy in North America, Power Point Presentation, Atlanta, Georgia, May 2007. Website: http://www.tappi.org/content/Events/07renew/07ren05.pdf.

the price received by the City of Woodburn, in dry tons, is about half of that derived from wet tons, or about $7.50 per dry ton. It is highly unlikely that The City of Sisters would receive the same price for its poplar production because the transportation costs would be higher due to the longer distance to the pulping plant. Poplar chips harvested by the City of Woodburn were transported to the pulp mill in Toledo, Oregon which was about 100 miles away. The City of Sisters is between 150 and 180 miles from Toledo, depending on which route is taken. If the pulp mill in Springfield would buy the City's poplar chips, the travel distance would be about 100 miles, the same as it was for Woodburn to Toledo. In another case, poplar chips harvested near Boardman are transported about 50 miles to Wallula, Washington. In any case, it is reasonable to expect that using treated effluent to grow poplars in Sisters could cost substantially more money than could be derived from the sale of the product.

*Ornamental Nursery Stock*

This could be a viable crop for the City of Sisters. The amount of water required for nursery stock will depend on the type of stock and its size (large plants would use more water than smaller, younger plants). The City would likely need to utilize soil moisture probes to determine crop water requirements over a given growing season. Managing nursery stock would also likely require more oversight by City employees to ensure proper irrigation, recognize and control pests and to plant and transplant stock. Irrigation methods would likely be similar to that used for poplar.

*Hops*

Hops require at least 120 frost free days so it is not a viable crop for the Sisters area.

**Water Demand**

A review of the OSU Extension Miscellaneous 8530 Report, 1999 (EM8530) separates the state into 27 distinct regions and provides tables for likely crop water need and the generalized growing season for up to 17 generalized crops for each of the 27 regions. The Sisters area resides in the western-most portion of region 17, which includes Bend in the northwest portion of the region, Brothers in the eastern portion and Christmas Valley in the far south-central portion of the region. Of the crops identified and recommended by OSU personnel, the general irrigation seasons and net irrigation water demand are shown below in Table 5.

**Table 5. Net Irrigation Water Demand**

| Crop | 5 of 10 yrs (inches) | 6 of 10 yrs (inches) | 7 of 10 yrs (inches) | 8 of 10 yrs (inches) | 9 of 10 yrs (inches) | 19 of 20 yrs (inches) | Typical Growing Season |
|---|---|---|---|---|---|---|---|
| Alfalfa Hay | 20.03 | 21.07 | 22.01 | 23.08 | 24.59 | 25.59 | April 10 to Oct. 1 |
| Grain (Spring)* | 15.87 | 16.68 | 17.55 | 18.35 | 19.6 | 20.35 | April 1 to Aug. 16 |
| Grain (Winter)** | 16.22 | 16.97 | 17.88 | 18.66 | 20.05 | 21.18 | March 15 to Aug. 10 |
| Pasture | 22.17 | 23.31 | 24.73 | 25.95 | 27.84 | 29.18 | April 12 to Oct. 24 |

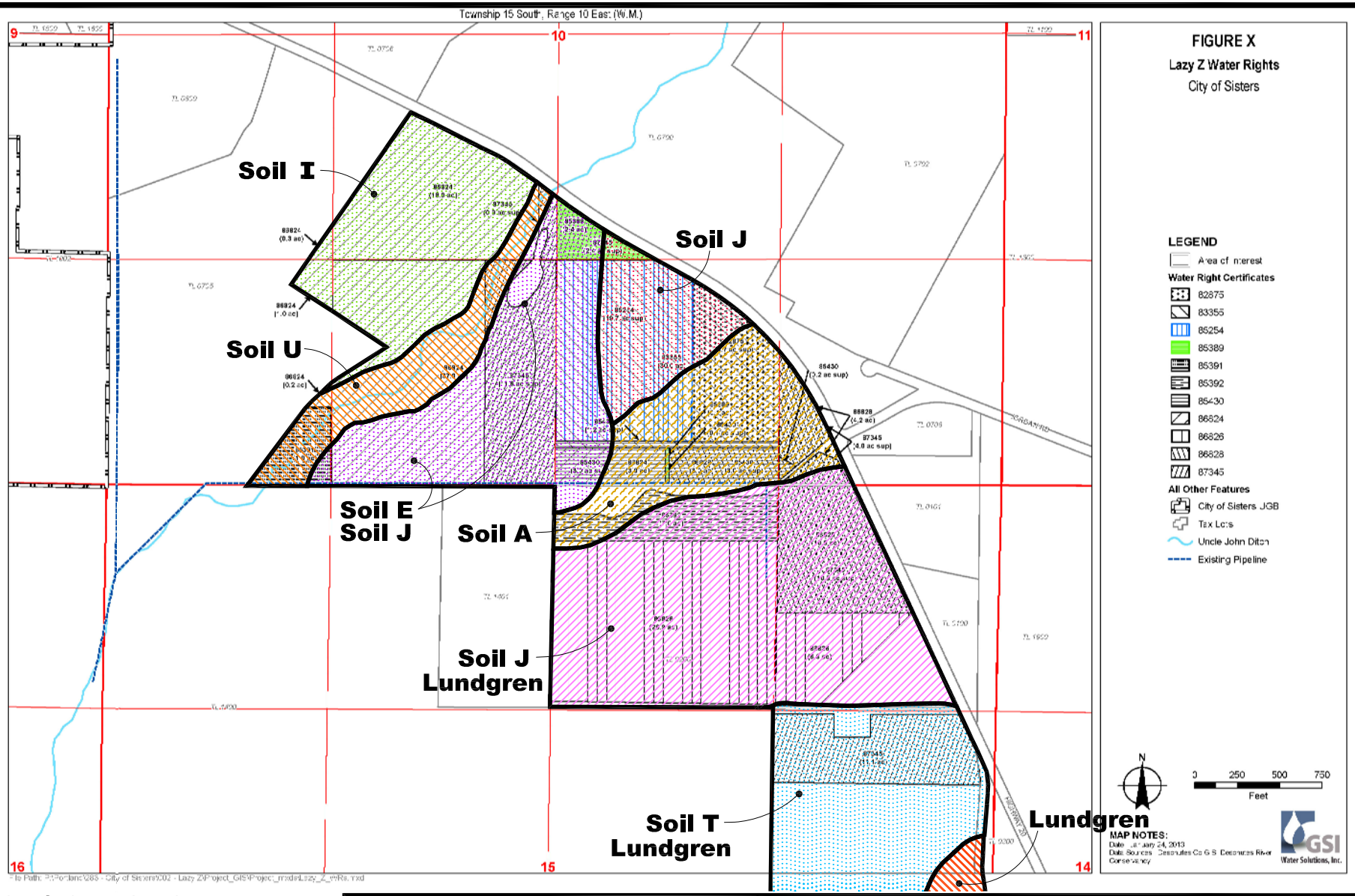
*Representative of spring planted cereal grains, according to OSU personnel.
**Representative of winter planted cereal grains, according to OSU personnel.

Based on the above data, the likely choices for the site are hay and grasses, including alfalfa hay, grass hay and pasture grass. Pasture grass would likely allow for more application of treated effluent with the longest application period. The "design" application rate for the irrigation system will depend on how the City wishes to manage the site. Management options are discussed further in subsequent sections of this report.

## Irrigation Constraints

The report by Wert & Associates, Inc. *Soil and Water Reuse Report for Sisters Wastewater Project, Sisters, Oregon,* February 2007 (Wert), noted varying soil types across the site with the potential for high seasonal ground water in some areas. Irrigation periods in the spring may be limited in these areas. A map showing these potential limited irrigation areas are shown on the attached Figure 5. Consideration of irrigation timing should account for potential high ground water conditions in these areas during the spring season. The soil types A, E and I identified by Wert, as shown on Figure 5, have potential for seasonal high water tables above a depth of 40 inches below the ground surface.

Additionally, Wert identified areas that have been previously used for irrigation and harvest of crops where surface soils have been cleared of gravel and cobble-sized rocks. These areas are referred to by Wert as the "Present Sprayfield". This area has been irrigated with wheel lines in the past and would likely not need modification to the soil horizon for sprinkler irrigation by wheel lines or pivots. The identified sprayfield areas are shown on the attached Figure 6 that was presented in Wert.




Wert identified soils that show seasonal high water tables above 40" are Soils A, E, and I.

Source: Soil and Water Report for Sisters Wastewater Project, Page 30, Dated Feb 2007, authored by Wert & Associates, Bend Oregon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Earth, Water and Rock Specialists
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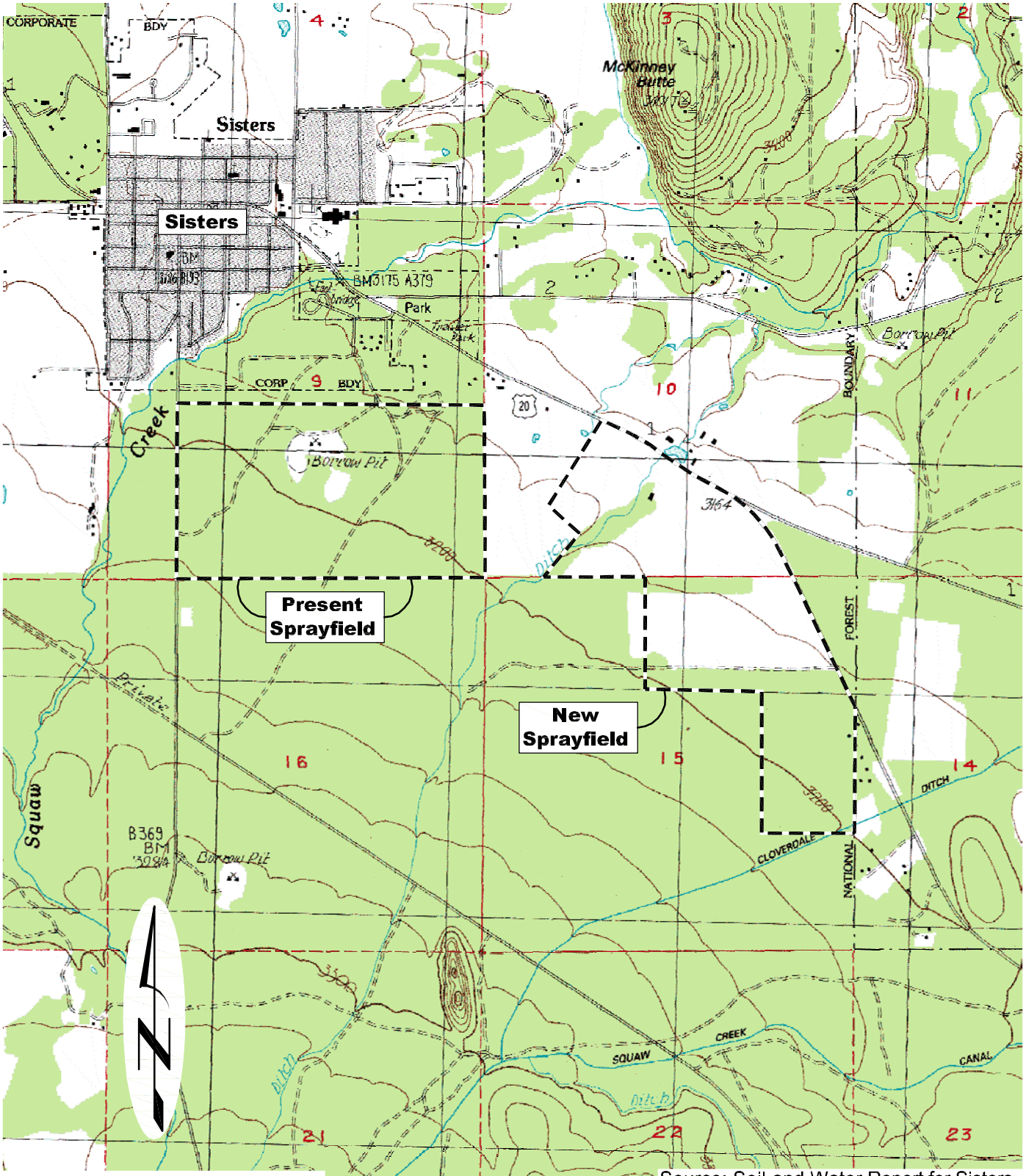
# Wert Identified Soil Areas
# Lazy 'Z' Evaluation
# Sisters, Deschutes County, Oregon

| DESIGNED BY: | DRAWN BY: | DATE: | PROJECT NO. | FIGURE |
|---|---|---|---|---|
| J. Newton | S.Schenck | MAY 2013 | 1138-101 | 5 |

G:\1100\1138 Lazy Z\101\Cad\Water\W1138101_F1_Site 08:51 06/25/2013 SS




Source: Soil and Water Report for Sisters Wastewater Project, Page 5, Dated Feb 2007, authored by Wert & Associates, Bend Oregon

NEWTON CONSULTANTS INC.
Earth, Water and Rock Specialists
Ph: 541 504-9960 Fax: 541 504-9961

# Wert Identified Sprayfield Locations
# Lazy 'Z' Evaluation
# Sisters, Deschutes County, Oregon

| DESIGNED BY: | DRAWN BY: | DATE: | PROJECT NO. | FIGURE |
|---|---|---|---|---|
| J. Newton | S.Schenck | MAY 2013 | 1138-101 | 6 |

G:\1100\1138 Lazy Z\101\Cad\Water\W1138101_F1_Site 08:10 05/24/2013 SS

Areas identified by Wert and referred to as "New Sprayfield" have been flood irrigated in the past for pasture. Apparently, gravel and cobble-sized rocks have not been removed from this area. Irrigation in this area could likely be done for pasture with hand lines or pivots (minimal rock removal may be required to allow for efficient travel of the pivot wheel tracks). Cultivation of a harvested crop could be impeded by gravel and cobble-sized rocks.

## Economic Considerations

### *Production Costs*

OSU personnel provided estimated costs to produce alfalfa hay and grass hay on a per acre basis annually. The estimated cost[3] to produce alfalfa hay is $135 per ton of alfalfa harvested; the estimated cost to produce grass hay is $155 per ton of grass hay harvested (OSU stated that although timothy hay was not specifically estimated for the cost to produce, that its cost to produce would likely be similar to grass hay). These estimated costs are based on an OSU-calculated value in 2008 dollars. Based on an average rate of inflation between 2008 and 2012 of approximately 6.6%[4]; the enterprise cost may have risen from $135 per ton harvested for alfalfa to $144; and from $155 per ton harvested for grass hay to $165.

OSU is currently conducting a study on the nitrogen uptake requirements for grass crops. This study is currently underway and nearing completion by OSU and may be useful to allow for a beneficial balance of nitrogen in effluent water and fertilizer introduced nitrogen. The results of this OSU study could allow for a reduction in the required fertilizer applied to the Site and subsequently reduce fertilizer costs.

### *Market Value*

OSU provided current and expected market value ranges for alfalfa hay and grass hay based on winter 2012-2013 pricing. Currently alfalfa hay pricing for beef cattle is typically $180 to $200 per ton; grass hay pricing is typically $230 to $250 per ton. Current pricing of timothy hay was estimated by OSU to typically range $250 to $300 per ton.

The Central Oregon Hay Report (COHR) is available online and updated and released weekly on Thursday and reports the price range for alfalfa and orchard grass (includes grass hay and pasture grasses), the website is:

http://www.ams.usda.gov/mnreports/ml_gr313.txt.

[3] OSU referred this as the "enterprise cost", which includes all input costs to grow and harvest a grass crop; including, but not limited to, soil preparation, seed, fertilizer, maintenance, irrigation and harvest.
[4] Data Source: Organization for Economic Cooperation and Development, http://stats.oecd.org/Index.aspx?DatasetCode=MEI_PRICES.

The current reported range for alfalfa as of the February 14, 2013 COHR is $220 to $250 per ton (good to premium grade); orchard grass is listed as $245 to $250 per ton (premium grade only shown); oat (cereal grain) is $145 per ton (fair grade only shown); timothy hay is not reported on the COHR.

*Condition & Yield of Harvested Crops*

Regarding the condition of possible harvested crops from the Lazy Z lands and the potential for marketability, OSU and an agri-business consultant (Richard Zimmerlee) were contacted to further investigate the potential value of harvested crops. Harvested feed crops, as discussed above, can vary depending on the nutrient capacity of the crop and also the general nature of the crop. Based on the above stated average sale price of harvested crops, cereal grains tend to bring the lowest value on a per ton basis; whereas, grass hay, alfalfa hay and timothy hay tend to bring greater value on a per ton basis.

Variability in the condition of the harvested crop will have an effect related to the market value as well (this was stated by both OSU staff and Mr. Zimmerlee); which includes weed potential, nutrients contained within the crop, size and condition of crop heads, etc. The general condition of the crop will likely dictate the potential sale, with domestic markets being more tolerant of moderate to lower quality feed crops, and international markets requiring premium quality feed crops. Generally, international feed crop markets maintain higher crop values.

*Crop Nutrient Uptake*

Discussions were conducted with OSU staff to ascertain further limitations that could affect marketability arising from the use of effluent water for irrigation, considering that the City of Redmond in the past has had some difficulty with cultivation and sale of crops grown from irrigated effluent. OSU worked with Redmond to conduct chemical analysis of alfalfa hay cultivated from effluent irrigated crop. This work found the crops to have elevated levels of nitrate. OSU stated that the nature of effluent irrigation containing nitrogen can concentrate nitrate in the feed crop, adversely affecting its marketability.

Limits on the marketability of feed crop with elevated nitrate, according to OSU staff, can limit the sale of the feed material and exclude cows and cattle that have a low tolerance for nitrate. OSU stated that horses have a higher tolerance for elevated nitrate in feed and, if feed crops display elevated nitrate at levels that could preclude cattle or cows, it could limit the marketability of feed crops for horses, or other similar nitrate tolerant livestock-or, if possible attempt to control nitrate build-up in harvested crops to allow for more wide acceptance of livestock that could accept the harvested crop.

*Available Feed Crop Markets*

Discussion was held with OSU regarding timothy hay based on its potential for high value crop production. OSU stated that timothy hay has a limited market based on its tendency for high calorie and carbohydrate content. Based on the high calories and carbohydrates the best markets for timothy hay, generally, are feed stores and horse race tracks-establishments that catering to working animals or livestock that may benefit from higher caloric and carbohydrate rich feed.

**Deschutes County Soil and Water Conservation District Input**

Deschutes County Soil and Water Conservation District (DCSWCD) was contacted to obtain information relative to crop selection and agricultural budget information. Discussion with Rex Barber of the DCSWCD indicated that the DCSWCD could not provide any specific information relative to the Lazy Z lands. However, Mr. Barber owns and operates a large agricultural farm near Lower Bridge on the Deschutes River approximately 5 miles west of Terrebonne, Oregon. His experience and knowledge in this regard brought hands-on information relative to cultivation of crops at the Lazy Z lands and the potential to market crops grown with treated effluent. Mr. Barber indicated, in his opinion, that the likely market for crops grown from treated effluent would be narrow, consisting mainly of hay or alfalfa hay crops. Regulatory limitations on crops only for non-human consumption would limit the ability to grow a larger variety of crops at the Lazy Z lands.

**International Agri-Business Consultant Input**

Discussion was held with Richard Zimmerlee, an international agri-business consultant, to investigate the potential for marketing crops grown from treated effluent. Mr. Zimmerlee has over 40 years of experience in managing and marketing agricultural crops, including international contracting and sales of specialized animal feed crops. Also discussed with Mr. Zimmerlee were additional potential business opportunities that could be authorized under ODEQ OARs for effluent reuse water.

The discussions indicate several limitations apply to crops grown from effluent reuse water versus fresh water. Although animal feed crops are authorized under ODEQ OARs, Mr. Zimmerlee stated that dairy cow farmers would resist the use of effluent-irrigated livestock feed, and that feed grown from such water would likely incur a 25% to 50% reduction in sale prices from the going rate of comparable crops grown from fresh water. These restrictions and limitations may further reduce the potential sale of feed crops grown on the Lazy Z lands.

Additional agricultural opportunities beyond grown-for-sale crops were discussed with Mr. Zimmerlee, including potential for a transitional nursery. A transitional nursery is typically an intermittent nursery used to acclimate nursery stock (ornamental trees, flowering plants, etc.) to

local conditions for plants grown in different climates. The viability of a transitional nursery is contingent on general economic conditions, in that, transitional nurseries are commonly associated with building of new residential and commercial sites that consume landscape plants, trees, etc. A transitional nursery may be of some benefit on a limited basis to provide for the City of Sisters Parks and streetscape tree establishment programs.

**Constructed Wetlands**

ODEQ would likely only allow lined wetlands without an extensive ground water analysis. The agency's ground water quality protection rules require point sources to employ the highest and best practicable methods to prevent the movement of pollutants to ground water. A lined wetland may be viable from a regulatory standpoint, but much less so from an economic standpoint.

According to evaporation data in Wert, 51.7 inches/year of evaporation should be expected, on average, in Sisters. These data were derived from U.S. Department of Commerce-National Oceanic and Atmospheric Science Department. This is assumed to be pan evaporation. Actual evaporation from a shallow lake or pond is expected to be between 70% and 80% of the pan evaporation. Using a percentage of 70%, then, the actual annual evaporation for a constructed wetland would be 36.2 inches per year.

Currently, the City produces about 183 acre-feet of effluent and, in 2033 is estimated to 361 acre-feet. The following table shows the estimated acreage and cost for wetlands required to dispose of current and estimated 2033 quantities of effluent.

**Table 6. Estimated Acreage and Cost for Wetlands**

| Year | Wetland Acreage Required, Acres | Estimated Construction Cost, $ |
|---|---|---|
| 2013 | 64.7 | $2,521,691 |
| 2033 | 119.7 | $4,668,361 |

**Conclusions**

Based upon the following summary of information, the best cropping option for the Lazy Z lands is a fodder crop, primarily a grass hay crop.

1. **Regulatory Aspect:** Allowable crops for irrigation with Class D recycled water as imposed by Oregon Administrative Rules (OAR) 340-055 are: fodder, fiber, seed crops not intended for human ingestion, or commercial timber, firewood, ornamental nursery stock, Christmas trees, sod, or pasture for animals.

2. **Site Conditions Aspect:** (location, elevation, soil types, shallow seasonal ground water) Based on the site conditions the Lazy Z property is suitable for irrigation of crops with limitations for areas to be irrigated by the potential for seasonal high ground water. Additional limits based on the amount of gravel to cobble-sized rock in surface soils may limit the areas that could allow cultivation of a harvest crop, however, do not limit these gravel and cobble areas from being irrigable for pasture. Additional limits of Lazy Z property for crop irrigation may be complicated by farming the lands during spring start up or harvest periods when a farmer may not require irrigation water, requiring Sisters to store treated effluent until crops require irrigation water.

3. **Economics Aspect:** The discussions with Mr. Zimmerlee indicates that a reduction in market value of harvested crops from the Site could be incurred in the range of 25 to 50% below the going rate for feed crops. Further limitations are foreseeable based on the available market for feed based on the end use (i.e. dairy cows would not likely purchase effluent irrigated feed crops for dairy cow feed; elevated nitrate in feed crop could further limit livestock that could accept the feed crop). Additional limits on crop irrigation and harvest may be reflected by obstacles the City of Redmond, Oregon has had to address. Redmond has been conducting crop irrigation with effluent since the mid-1990's and for several years has found it difficult to lease the land to be farmed-complicating the City's ability to use effluent for agronomic reuse purposes. Redmond has had periods of elevated nitrate in feed crops that limits the marketability of harvested crops and sale value.

4. **Crop Nutrient Aspect:** The potential for feed crops harvested from the Lazy Z property to have elevated levels of nitrate in the feed if not managed properly, as an identified concern from OSU staff regarding effluent irrigated feed crops, can have a significant impact on the marketability of harvested feed crops. Based on this limitation, additional laboratory testing of crops grown on Lazy Z lands to determine the nutrient condition during the growing season could allow for a greater control of crops and improved marketability. Additional laboratory testing may contribute to additional costs for crop cultivation and may require a more stringent fertilizer application program to maintain proper nutrient balance in feed crops grown on the Lazy Z lands.

5. **Crop Variability/Rotation:** Based on the variable growing seasons of cereal grains and timothy hay, it may be viable to cultivate a mix of crops on the Lazy Z lands to maximize allowable areas for irrigation and crop harvest potential. With the potential of early season shallow ground water on areas of the Lazy Z lands, a later-maturing crop (such as late maturing timothy hay) may be appropriate for these lands, maintaining a longer growing season without more intensive initial irrigation. During the early portion of the irrigation season, the areas without shallow seasonal ground water to be planted with a cereal grain that would take irrigation water as early as practicable, while being limited in duration by the extent of the total growing season.

## OPPORTUNITIES AND TIMING – CONVERTING SURFACE WATER RIGHTS TO INSTREAM RIGHTS

### Opportunities to Convert Surface Water Right to Instream Rights

For the last ten to fifteen years, there has been significant interest in restoring instream flows to Whychus Creek. Like many streams in the Deschutes Basin, Whychus Creek is over-appropriated, meaning during certain times of the year the amount of water in the stream is less than the sum of water use authorizations. Generally, during dry summer months, only water rights issued before 1895 are fully met in Whychus Creek.

Historically, Oregon Department of Fish and Wildlife's instream water right (ISWR) has served as an informal goal for both stream flow and water quality purposes. The ODFW ISWR is based on temperature criteria for redband trout (18 degrees) and current data show that it closely correlates with the minimum flow necessary to achieve these temperature criteria in Sisters. Due to a very junior priority date, the ODFW ISWR's are not met. To realize meaningful flow restoration in Whychus Creek, senior water rights must be transferred instream temporarily or permanently either through lease, purchase, or through an allocation of conserved water through the State's Conserved Water Program.

**Table 7. Whychus Creek Instream Water Rights**

| Whychus Creek Instream Water Rights | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Source | From | To | Priority Date | Instream Rates (cfs) | | | | | | | | | | | |
| | | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Whychus Cr | Indian Ford Creek | Mouth | 10/11/1990 | 33 | 33 | 50 | 50 | 50 | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| Whychus Cr | S. Fk Whychus | Indian Ford Creek | 10/11/1990 | 30 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 30 | 50 | 30 | 30 |

Fisheries provide the primary driver for flow restoration in Whychus Creek. Low stream flows limit habitat availability and fish movement. Water quality provides the second driver for flow restoration in Whychus Creek. Whychus Creek upstream of river mile 21 is listed as water quality limited for temperature. Low stream flow is a major factor contributing to temperature impairments in this reach. Public interest in restoring flows increased with the recent reintroduction of summer steelhead and spring Chinook above the Pelton Round Butte Dam Complex on the mainstem Deschutes River and into Whychus Creek. As part of their new Federal Energy Regulatory Commission license to operate the dam complex, Portland General Electric and the Confederated Tribes of the Warm Springs Reservation are facilitating fish passage and are investing in upstream restoration to increase the likelihood of success. Multiple partners in the basin are heavily invested in ensuring the success of the reintroduction. In addition, summer steelhead is listed as a threatened species under the Endangered Species Act. Historically, Whychus was an important tributary for steelhead in the Deschutes Basin.

Another driver for instream flow transactions in the Deschutes Basin is the State's Ground water Mitigation Program, established in 2002. In 1998, a United States Geological Services Ground water Study confirmed that ground water and surface water in the study area within the Deschutes Basin are directly linked, and that the removal of ground water will ultimately diminish stream flow. In response, OWRD established the Deschutes Basin Ground water Mitigation Program, which requires "mitigation" for all new ground water permits in the study area. Mitigation is typically generated by transferring existing surface water rights instream. This has created a new demand, varying throughout the basin, for instream flow transactions that can generate temporary and permanent ground water mitigation credits.

**Transactions and Market Characterization**

Over the last twelve years, there have been approximately 445 acres of Whychus and tributary irrigation water rights transferred permanently instream. About half of these water rights were transferred purely for restoration purposes, and half generated permanent mitigation credits. The mitigation transfers were generally to provide landowners the opportunity to pump ground water under a new permit. To our knowledge, permanent mitigation credits were not sold to other buyers.

On a temporary basis, the DRC annually leases instream 1,150-1,400 acres of Whychus and tributary water rights. A large percentage of this is leased from Three Sisters Irrigation Districts from farmers who choose not to use water in a certain year. Approximately 250 of these leased acres produce temporary mitigation credits. In addition, the Three Sisters Irrigation District has implemented an aggressive program of water conservation, transferring 8,500 acre-feet of water from 15 conserved water projects.

There are several funders actively financing instream restoration in Whychus Creek, including the Pelton Fund, the Oregon Watershed Enhancement Board, and the BPA/National Fish and Wildlife Foundation's Columbia Water Transactions Program. The Pelton Fund was set up specifically to provide habitat restoration funds to support the Confederated Tribes of the Warm Springs Reservation and Portland General Electric's reintroduction of anadromous fish. This Fund has a limited duration, and will likely be spent out in the next five to ten years. The DRC aims to meet its initial streamflow restoration goal of 33 cfs in Whychus Creek below the confluence of Indian Fork Creek in the next five or so years. While it is likely that there will still be public investment in instream restoration in Whychus Creek, it may become a less robust market in five to ten years. The market for mitigation credits will continue to be tied to development and growth demands.

## Types of Transactions Available

There are several "instream transactions" that can be utilized to add value to the City's Lazy Z water rights while irrigating the Lazy Z property with effluent. There are both permanent and temporary transactions that are available.

## Permanent Transactions

Permanent instream transfers allow for water rights, subject to transfer, to be placed instream. This mechanism allows the "new" instream water right to retain the priority of the originating water right. As the City's Lazy Z water rights are senior in priority, the ensuing instream rights would also be senior and therefore of high value. Water right transfers, including instream, are a relatively lengthy process as the water rights are thoroughly examined to verify use, ownership, enlargement and potential injury to holders of existing water rights on the system. The process can take anywhere from nine months to several years.

Water conserved from an efficiency project, known as an Allocation of Conserved Water, generates a new water right that can be transferred instream or on-farm like any water right subject to transfer, or some of the water can be used to firm-up a deficient water right. Allocations of Conserved Water automatically protect a portion of the subject water right, minimum 25 % instream, but an applicant can choose to transfer up to 100 % of the conserved water instream.

## Temporary Transactions

Instream leasing is a mechanism to place water instream temporarily (1 to 5 years) as a beneficial use. Instream leases can be renewed an indefinite number of times. Under a lease, the water right is never severed from the land so the right automatically reverts to the authorized place of use when the lease is expired or cancelled by the applicant. Leasing instream is a relatively quick process with applications generally being approved within a couple of months.

Split-season leasing is another temporary transaction that can be used to place water instream. This transaction allows the water right holder to protect the right instream for a portion of the season of use and apply water on-farm for a portion of the season of use. This is a useful mechanism but requires the applicant to measure and report the water use regularly throughout the season; this condition often creates a barrier to water right holders choosing this path.

Time-limited instream transfers allow the water right holder to place the water right instream for any period of time, generally for periods greater than a lease would be established for, i.e. 10 to 50+ years. A benefit of a time-limited transfer is that the water right holder can protect the water

instream for a significant amount of time yet still remain the water right holder when the transfer expires. Unlike a lease, a time-limited instream transfer cannot be terminated unless conditions are written into the transfer ahead of time.

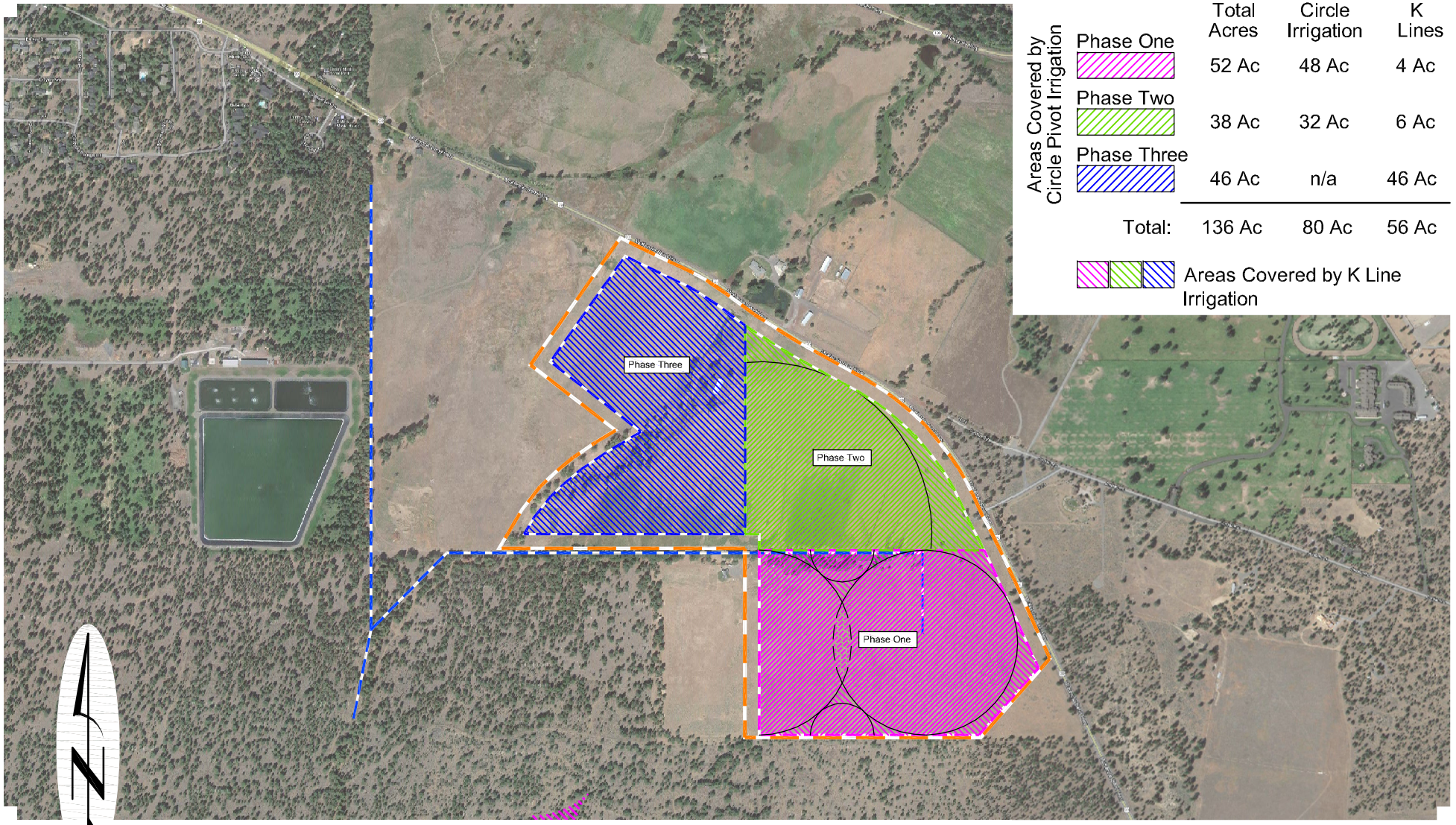
Since the City holds a ground water permit that requires mitigation under the Deschutes Basin Ground water Mitigation Program it may choose to use some portion of the Lazy Z water rights for mitigation. Currently, permanent mitigation credits can be generated from permanent instream transfers and temporary mitigation can be generated through instream leasing, time-limited transfers and potentially through split-season leasing. Any temporary credits generated must be through the DRC mitigation bank and currently those temporary credits have an annual fee of $105 per credit.

**Timing of Opportunities**

According to the analysis of effluent available for irrigation detailed earlier in this report, it is anticipated that there will be 128 acre-feet (AF) of effluent available in 2013. This volume, 128 AF, is the volume available under Case 1 (See Table 3), where the City continues to irrigate the forest and dikes at half the rate of current irrigation and moves the other half of the water to the Lazy Z. If applied on the City's Lazy Z property, this volume could irrigate approximately 51.2 acres applied at a rate of 2.5 AF per acre. This could allow the City to remove the equivalent number of acres of surface water irrigation from the land and protect the water instream either permanently or temporarily.

Through this feasibility study, 3 phases have been identified as likely group targets for effluent application and water right removal (see Figure 7). In each phase the mandatory set-back for irrigating with effluent was mapped and the new acreage footprint calculated. Figure 7 shows this phasing without the water rights overlay. When calculating the number of acres the City will have available for irrigating with effluent, the acreage totals accounted for the set-backs required for effluent irrigation. For example, Phase I has a total surface water right footprint of 53.3 acres, once the set-backs are accounted for there are 48.84 acres available for the City to apply effluent. Table 8 summarizes water rights and available acreage by phase.

Phase I is an area that the City identified as the most readily available for application of effluent due to existing infrastructure; this area has approximately 53.3 acres of senior Whychus Creek water rights appurtenant to it. Accounting for the mandatory set-backs, there are approximately 48.84 acres available to irrigate with effluent. Applying irrigation at a volume of 2.5 AF/acre allows for 122.1 AF of effluent irrigation on the 48.84 acres. The projected available effluent for 2013, 128 AF, is more than sufficient for irrigating Phase I.




0' 1000' 2000'

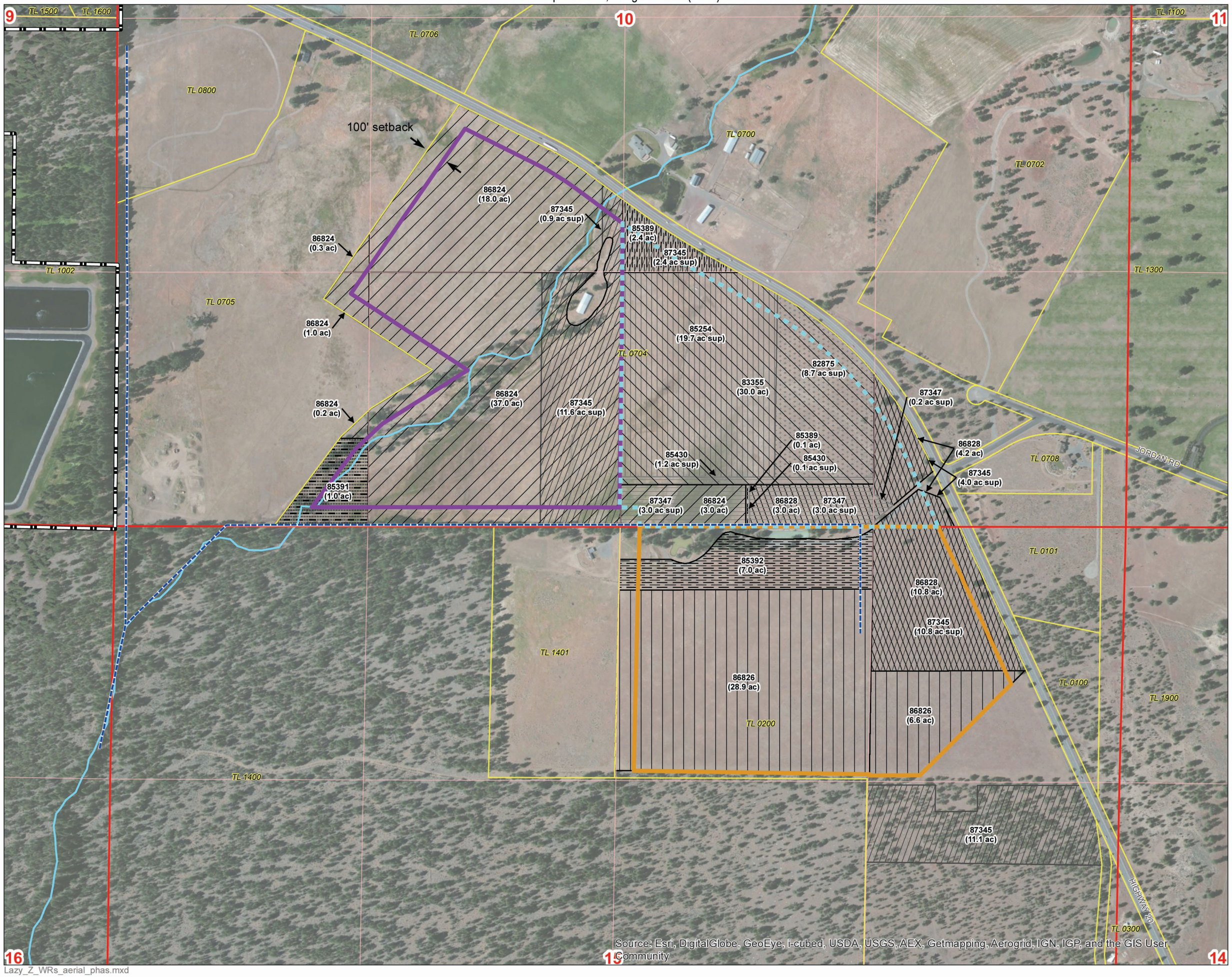
SCALE: 1" = 1000'

NEWTON CONSULTANTS INC.
Earth, Water and Rock Specialists
Ph: 541 504-9960 Fax: 541 504-9961

# Task 4; Irrigation Mechanisms Scenarios - Phases 1-3
# Lazy 'Z' Evaluation
# Sisters, Deschutes County, Oregon

| DESIGNED BY: | DRAWN BY: | DATE: | PROJECT NO. | FIGURE |
|---|---|---|---|---|
| D. Newton | S. Schenck | MAY 2013 | 1138-101 | 7 |

Township 15 South, Range 10 East (W.M.)




# Lazy Z
# Proposed Phasing
## City of Sisters

**LEGEND**

**Proposed Phasing**
- Phase 1
- Phase 2
- Phase 3

**Water Right Certificates**
- 82875 S (GW)
- 83355 (1880)
- 85254 S (GW)
- 85389 (1880)
- 85391 (1880)
- 85392 (1886)
- 86824 (1880)
- 86826 (1881)
- 86828 (1880)
- 87345 S (GW)
- 87347 S (GW)

**All Other Features**
- City of Sisters UGB
- Tax Lots
- Uncle John Ditch
- Existing Pipeline
- PLSS Section
- PLSS QQ Section

Figure 8

N

0 250 500 750
Feet

**MAP NOTES:**
Date: May 19, 2013
Data Sources: Deschutes Co GIS, Deschutes River Conservancy, OGIC

GSI Water Solutions, Inc.

Lazy_Z_WRs_aerial_phas.mxd

**Table 8. Water Rights and Available Acreage by Phase**

| ***Phase 1 Water Rights – Primary*** | | | | | | |
|---|---|---|---|---|---|---|
| | **Water Right** | **Acres of Surface Water Rights** | **Priority Date** | **Rate (cfs)** | **Volume (AF) 5 AF/acre** | **Acres Available for Effluent Irrigation *** |
| *Primary Irrigation* | c.86828 (T-11318/CW-71) | 10.8 | 1880 | 0.32 | 54.0 | 8.95 |
| | c.86826 (T-11318/CW-71) | 35.5 | 1881 | 0.71 | 177.5 | 33.29 |
| | c.85392 (T-11318/CW-71) | 7.0 | 1886 | 0.14 | 35.0 | 6.60 |
| | | **53.3** | | **1.17** | **266.5** | **48.84** |
| ***Phase 2 Water Rights - Primary*** | | | | | | |
| | **Water Right** | **Acres of Surface Water Rights** | **Priority Date** | **Rate (cfs)** | **Volume (AF) 5 AF/acre** | **Acres Available for Effluent Irrigation** |
| *Primary Irrigation* | c.83355 (T-11318/CW-71) | 30.0 | 1880 | 0.62 | 150.0 | 27.37 |
| | c.86828 (T-11318/CW-71) | 7.2 | 1880 | 0.23 | 36.0 | 5.78 |
| | c.85389 (T-11318/CW-71) | 2.5 | 1880 | 0.08 | 12.5 | 1.23 |
| | c.86824 (T-11318/CW-71) | 3.0 | 1880 | 0.06 | 15.0 | 3.00 |
| | | **42.7** | | **0.99** | **213.5** | **37.38** |
| ***Phase 3 Water Rights - Primary*** | | | | | | |
| | **Water Right** | **Acres of Surface Water Rights** | **Priority Date** | **Rate (cfs)** | **Volume (AF) 5 AF/acre** | **Acres Available for Effluent Irrigation** |
| *Primary Irrigation* | c.86824 (T-11318/CW-71) | 56.5 | 1880 | 1.13 | 282.5 | 46.50 |
| | c.85391 (T-11318/CW-71) | 3.0 | 1880 | 0.1 | 15 | 1.29 |
| | | **59.5** | | **1.23** | **297.5** | **47.79** |
| | | | | | | |
| | ***Total:*** | ***155.5*** | | ***3.39*** | ***777.5*** | ***134.01*** |

**Acreage accounts for required set-backs*

Phase II has approximately 42.7 acres of irrigation water rights; with the mandatory set-backs, there are approximately 37.38 acres available for effluent application. Applied at a rate of 2.5 AF/acre, 93.45 AF would accommodate irrigation of Phase II. According to the estimated available effluent under Case 1 (refer to Table 3 on), somewhere between 2023 and 2028 the City would have enough effluent to water the entirety of Phases I and II without the use of appurtenant surface water rights.

In Phase III, there are approximately 59.5 acres of irrigation water rights. This equals approximately 47.79 acres available for effluent application, accounting for mandatory set-backs. The effluent needed to irrigate this phase (based on 2.5 AF/acre) is approximately 119.48 AF. The projections for available effluent end in 2033 and estimate that 294 AF of effluent will be available for irrigating on the City's Lazy Z property at that point (Table 3, Case 1). Accounting for effluent used to irrigate Phases I and II, there will be approximately 78.45 AF of effluent available to irrigate Phase III in 2033; that equates to 65 % of the acreage in Phase III available for irrigating with effluent.

If the City chooses to permanently remove their surface water rights from the Lazy Z property as effluent becomes available, it will important to do so in a strategic manner. It would be prudent to remove water rights in portions large enough that it makes financial sense for potential restoration funders, for example, greater than 20 acres in the transaction. The phasing outlined in this report is based on current and future planned infrastructure locations and an approximately even split of appurtenant surface water rights. If water rights are to be removed it can occur in different parcel sizes than identified in the current phasing or they can be removed prior to sufficient effluent being available for irrigation, if the City chooses.

## EFFLUENT IRRIGATION MECHANISMS

### Purpose and Data Sources

Effluent irrigation can be accomplished in a number of ways. Considerations in selecting a method of irrigation generally include type of crop, whether a crop is harvested or grazed, labor and cost of conducting irrigation, operation and maintenance requirements, and regulatory restraints on application of effluent to irrigated area. This section describes evaluation of alternative mechanisms for irrigation of Lazy Z lands with treated effluent.

The evaluation included consideration of irrigation information from several sources including the following:

- Oregon Administrative Rule (OAR) 340-055-0022 and 340-055-0025(2) (d);
- John Rowley, Nelson Irrigation Company, Walla Walla, Washington;
- Central Oregon pump and irrigation contractors familiar with the Site area and likely choices for commercially available irrigation equipment.

**Regulatory Limitations Relative to Irrigation Mechanisms**

OAR 340-055-0022 of the regulations pertaining to the use of recycled water has the following requirements for Ground water Quality Protection:

> *Recycled water will not be authorized for use unless all groundwater quality protection requirements in OAR chapter 340, division 40 are met. The requirements in OAR chapter 340, division 40 are considered to be met if the wastewater treatment system owner demonstrates recycled water will be used or land applied in a manner and at a rate that minimizes the movement of contaminants to groundwater and does not adversely impact groundwater quality.*

Generally, ODEQ has determined that the movement of contaminants to ground water will be minimized if recycled water is applied in a uniform manner at agronomic rates. ODEQ is unlikely to accept flood irrigation as providing a uniform application rate; recycled water must be applied via spray or drip irrigation.

OAR 340-055-0025(2)(d) states "If Class B, C, or D, or non-disinfected recycled water is to be used for irrigation, a recycled water use plan must include a description of site management practices including, but not limited to, the timing of application and methods used to mitigate potential aerosol drift."

**Evaluation Criteria - Irrigation Mechanisms**

Considering the available volume of treated effluent and discussions with the City, the crops preferred for irrigation on the Lazy Z lands are harvestable hay/alfalfa/grass and poplar trees. Evaluation of irrigation mechanisms includes consideration of these crop types.

The following table lists the basic design considerations for the Lazy Z lands irrigation system and the basis for those considerations.

**Table 9. Basic Design Considerations for Irrigation System**

| Design Consideration | Design Basis |
|---|---|
| **General Irrigation** | |
| Cost Effective | Obviously, the City wishes to maintain its cost for disposing of its effluent as low as possible. |
| Low Operation/Maintenance | The City has limited staff for operating its sewerage facility; it needs to minimize the amount of time staff spends operating and maintaining its irrigation system. |
| Very uniform application. | In order to avoid groundwater contamination pursuant to DEQ rules and to provide sufficient water to all areas under cultivation, the recycled water needs to be applied uniformly at agonomic rates. |
| Unlikely to plug | The City stores effluent during the non-irrigation season and into parts of the irrigation season. During this storage period, the effluent will grow algae that could plug the irrigation nozzles. Nozzle need to be designed to avoid plugging which otherwise would cause non-uniform application of recycled water. |
| Flexible. i.e. expandable, adapatable to odd site shapes. | It is likely that the irrigation system will be installed in segments as additional areas become cultivated. Recycled water will gradually replace areas covered by existing water rights which may cover odd shapes. The irrigation system will need to be able to adapt to these new areas and shapes. |
| Unlikely to cause drift | Some irrigation systems could cause recycled water to be carried off the irrigation site during windy conditions. DEQ rules require that this be avoided. |
| Resistant to freezing problems. | Even during the growing season in Sisters, nights and mornings frequently are subject to sub freezing conditions. The irrigation system must not be damaged and be able to operate under these conditions. |
| **Additional Considerations for Poplar Irrigation** | |
| Easily removable or protected during harvest | During tree harvesting, the irrigation system must be removalble or otherwise be able to be protected. |
| Uniform application within tree columns | As the trees mature, tree trunks could block or impair the ability to provide a uniform application of recycled water. These system must be able to provid a uniform application to all trees. |

## Effluent Irrigation Mechanisms

Based on the above criteria for irrigation mechanisms relative to agronomic land application of treated effluent, the following types of irrigation equipment could apply to the Lazy Z lands:

- Hand Lines: composed primarily of relatively light weight aluminum pipes with a single sprinkler head on each pipe segment and coupled together at each end with simple self-locking coupler ends to allow for modular lengths of continuous (straight) hand lines; can be coupled with angle sections to make simple turns. Disadvantages: unless sufficient hand lines are provided to cover the entire irrigation area, the lines must be manually moved, perhaps several times a day. In any case, if hand lines were provide to cover the entire area they would require manual labor to move the lines for crop rotation or for crop harvesting; after harvest is complete hand

lines must be replaced for continued crop irrigation; and susceptibility of livestock or wildlife knocking over the sprinkler risers.

- Large Gun Sprinklers on hose reels: large gun sprinklers distribute water over relatively long distances with high trajectories. The high trajectories have a high potential to cause air borne water droplets that would likely drift on to adjacent properties. It is likely that ODEQ would require an increased buffer distance if it allowed large gun sprinklers. For this reason, this irrigation mechanism is not recommended.

- Wheel Lines: composed primarily of lightweight aluminum pipes with a single sprinkler head on each pipe segment mounted on an aluminum spoke wheel to allow for easy traverse of series of wheel lines across a relatively level field. Each end is coupled together with simple self-locking coupler ends to allow for modular lengths of continuous (straight) wheel lines. Disadvantages: wheel lines require an irrigable field to be relatively flat and square or rectangular in shape and have minimal rocks; wheel lines tend to be very susceptible to wind movement and disruption of irrigation application.

- Circle Pivot: composed of large rubber wheel sections of overhead pipe with drop sprinklers that rotate about a center point (or pivot). A circle pivot can be operated to move across fields with moderate slope with clear wheel tracks. The one advantage to a circle pivot is that it requires minimal manual labor to operate. The disadvantages to circle pivots include high cost of installation, and, to irrigate field configuration other than a circle, it must be combined with other methods (hand lines, K Lines, etc.) to irrigate corners or areas not traversable by the circle pivot.

- Permanent Set Lines: may be composed of underground pipe installation with surface exposure of permanent riser sprinklers, or automated pop-up sprinklers, or individually installed 'plug-in' sprinklers. Disadvantages to permanent set lines are that, during plowing/disking of fields or during harvest, permanent set lines would likely be damaged and could lead to significant maintenance on an annual basis.

- Removable Set Lines: these are composed primarily a hand lines or *K Lines* (see below). Disadvantages to removable set lines are they need to be moved out of the way of equipment during harvest, field plowing/disking and reset prior to continued irrigation. K Lines can be moved with a vehicle and do not have the significant labor required to move and set hand lines.

- K Lines: composed of a non-rigid hose that connects a string of sprinklers mounted in self-contained polymer pods that can be moved with a vehicle (i.e. ATV, tractor, pickup truck). Standard length includes 5 sprinkler pods and can be coupled to make a continuous string of up to 10 sprinkler pods in a single K Line string. K Lines,

having sprinkler pods, provide protection from livestock or wildlife rubbing or knocking the pods out of position for irrigation.

Sprinkler heads for each of the above mechanisms are anticipated to be impact or rotary type sprinklers. These types of sprinklers are typical for these types of mechanisms.

***Sprinklers***

*Impact Sprinklers*

The basic operation of an impact sprinkler is relatively simple. As water leaves the sprinkler nozzle it comes in contact with a spring-loaded drive arm. This arm is shoved aside by the force of the water. The spring then returns the arm to its original position and it again comes into contact with the water and also a stop or shoulder on the sprinkler body. The impact against the shoulder causes the entire head assembly (and sprinkler stream) to rotate slightly. This constant impact and movement will cause the head to rotate a complete circle and slowly water the entire area within that circle. In addition, each time the water makes contact with the sprinkler arm, a small amount of "splash" is created that falls near the sprinkler head.

Advantages to impact sprinklers are uniform coverage of the area to be irrigated and with most impact sprinklers made of brass or stainless steel bodies, the sprinklers tend to have a long service life. Interchangeable nozzles within the sprinkler head allows for variability in the irrigation water volume and adjustability for varied input water pressure.

Disadvantages of impact sprinklers are the potential for high maintenance cost related to the exposed nature of the rotation mechanism with possible operation impedance by debris or contact with vegetation, and corrosion or deterioration of the rotation mechanism causing failure of the sprinkler head. Additionally, if an impact sprinkler becomes entangled with debris or becomes clogged, disabling rotation, an impact sprinkler will tend to spray in a single direction. If left unrepaired, this can cause oversaturation or erosion of soil in area of water impact.

*Rotary Sprinklers*

Rotary sprinklers (or more specifically, gear-driven rotary sprinklers), operate by water turning a small turbine (water wheel or fan) in the base of the unit which drives a series of gears that cause the head to rotate. The gear drive mechanism is protected from soil and debris by a screen.

The advantage of the Nelson rotary sprinkler is that the sprinkler heads can be fed by polyethylene pipe laterals or portable pipes including aluminum, polyethylene or PVC which would allow the sprinkler system to be removed during harvesting of poplar trees, if they are the chosen crop. Additionally, rotary sprinklers have the gear-driven portion (the unit within the

sprinkler that allows for sprinkler rotation) enclosed within the sprinkler providing protection from clogging or impacted by external debris.

Some potential drawbacks may come with these sprinklers. Nelson Irrigation Company (Nelson) of Walla Walla, Washington manufactures and sells rotary sprinkler heads of various types. Discussion with Nelson indicates they do not have experience with use of the rotary sprinklers to irrigate recycled water with high concentrations of algae. In addition, there could be problems during freezing conditions. According to John Rowley, "if the irrigation water temperature in use is greater the 55 degrees F, the R2000 will resist Rotator failure in most conditions. If the water temperature is below 40 degrees F, in some of the conditions, there will be freezing up of the sprinkler and rotation failure. Overall the R2000 will resist rotation failure in freezing temperatures if water is above 55 degrees and there are low winds. Wind speed is also an important factor, High winds (greater than 7 MPH) will cause rotation failure in freezing temps."

***Sprinkler Options Summary***

Before considering a sprinkler system, it is recommended that a small set be purchased and installed on an existing irrigation site for a season. This would allow the City to determine if nozzle plugging and sprinkler freezing would be a problem, as sprinklers of all types may be subject to potential freezing conditions.

The poplar plantation at Woodburn, Oregon uses the R-10 sprinkler heads. John Rowley of Nelson, recommends the R-2000 sprinkler head, which is also rotary, because it can be fitted with a one-eighth inch nozzle which may be less prone to plugging due to algal concentrations in the recycled water. This head would apply recycled water at 0.4 inches/hour.

Based on discussions with other municipalities that conduct effluent irrigation, rotary sprinklers were identified as a likely best choice for sprinkler irrigation of effluent.

**Conclusions**

Based upon the following summary of information, and discussions with City of Sisters personnel, irrigation mechanisms with minimal labor to operate are preferred. With that in mind, limitations on irrigation mechanisms for either hay/alfalfa/grass or poplar trees, distinct irrigation mechanisms are described below:

Hay/Alfalfa/Grass

Irrigation mechanisms that are best applied to a hay/alfalfa/grass crop would be circle pivots, K Lines, and permanent set lines (permanent set lines will only work on a harvested crop if in-ground sprinklers are mounted outside of the harvest area, as harvest equipment or plow/disking of the field would likely damage the equipment). The K Lines would likely be a best choice for ease of movement to irrigate the corner areas not irrigable by circle pivots.

Poplar Trees

Irrigation Mechanisms that are best applied to a poplar tree crop would be had lines or K Lines. With the harvest duration of poplar trees being on the order of 9 to 12 years, K Lines could be pulled into and out of position with an ATV, tractor, etc. and set for the crop duration. Hand lines could be laid in rows and removed prior to tree harvest; however, wildlife may knock the sprinkler risers requiring periodic attention to reset the sprinkler risers.

## COST ANALYSIS – IRRIGATION MECHANISMS

### Identified Irrigation Mechanisms

A generalized cost estimate has been prepared based on the irrigation mechanisms identified under the section *Cost Analysis – Irrigation Mechanisms*. Newton conduct research for installation costs of irrigation mechanisms from Cascade Pump and Irrigation of Bend, Oregon. The estimated costs for irrigation mechanisms included the following key items below:

- Discussions with City of Sisters personnel on irrigation equipment that requires minimal supervision and maintenance cost;
- Capital costs to for initial purchase and installation of irrigation equipment based on the phase scenario included on the attached Table 10 7;
- Estimates of annualized power demands to operate the system;
- Potential annual operation and maintenance cost;
- Cost improvements provided by HGE, Inc. to allow for delivery of effluent irrigation water to each project phase (see table below):

**Table 10. Reuse Improvements ***

| | |
|---|---|
| **Phase I** | |
| Mobilization | $32,600 |
| Clearing and Grubbing | $3,500 |
| Gravel Roadway Construction 3,250 ft. | $65,000 |
| Excavation and Class 3 BF, 3,250 ft. | $81,250 |
| Rock Excavation | $5,000 |
| Foundation Stabilization, 120 CY | $3,600 |
| 18" HDPE Force Main, 3,250 ft. | $121,875 |
| 18" Culvert Installation | $2,500 |
| Forcemain Appurtenances | $42,700 |
| Aggregate Base and Surfacing, 20 CY | $600 |
| **Total Phase I** | **$358,625** |
| **Phase II**** | |
| Irrigation Line Controllers | $13,333 |
| Conduit | $13,333 |
| SCADA Modifications | $13,333 |
| **Total Phase II** | **$400,000** |
| **Engineering Contingencies** | $150,000 |
| **PROJECT TOTAL** | **$908,625** |

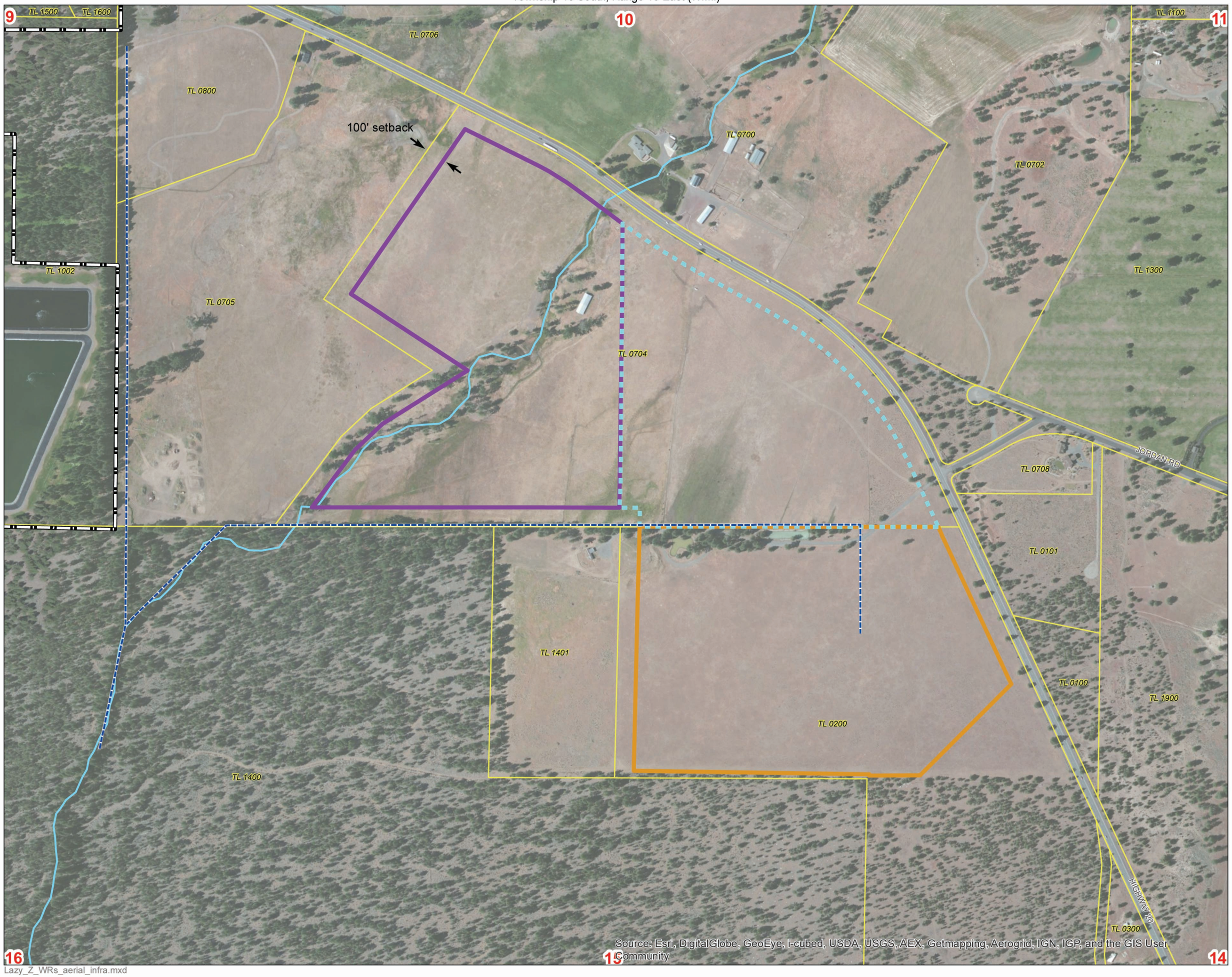
*Values for the reuse improvements were provided by HGE, Inc. in a letter to Paul Bertagna, Sisters Public Works Director, dated May 6, 2013.
**Phase II cost was provided as a lump sum value and was divided equally among each component. The cost will likely change extensively depending on equipment desired, conduit lengths, and the extent of SCADA modifications.

## Preferred Irrigation Mechanisms

The rate of recycled water application is limited to the agronomic requirement of the crop. Exceeding the agronomic rate creates the potential for waste water to migrate into the ground water and cause contamination. The agronomic rate varies based upon the type of crop, the time of year, and actual weather conditions which are impossible to predict from year to year. The irrigation system on the Lazy Z Ranch should include a system to measure soil moisture content so that application rates can be adjusted as needed based upon actual conditions. Irrigation of Hay/Alfalfa/Grass

Irrigation of hay/alfalfa/grass crops has been estimated in each phase of the project, with a specific layout of likely irrigation methods presented on the attached Figure 9. In this scenario the primary areas for irrigation of phase 1 and phase 2 have been provided, with the potential cost for irrigation of phase 3 being based on the average per acre cost of phases 1 and 2.

Township 15 South, Range 10 East (W.M.)




# Lazy Z Existing Infrastructure and Proposed Phasing

## City of Sisters

**LEGEND**

**Proposed Phasing**
- Phase 1
- Phase 2
- Phase 3

**All Other Features**
- City of Sisters UGB
- Tax Lots
- Uncle John Ditch
- Existing Pipeline

Figure 9

N

0 250 500 750
Feet

**MAP NOTES:**
Date: May 19, 2013
Data Sources: Deschutes Co GIS, Deschutes River Conservancy, OGIC

GSI Water Solutions, Inc.

Lazy_Z_WRs_aerial_infra.mxd

Irrigation mechanisms to irrigate a hay/alfalfa/grass crop need to be easily moved from the irrigation field to allow for crop harvest, which can occur between 2 to 6 times annually. Emphasis on minimal maintenance and ease of removal and resetting of the irrigation system was necessary. The mechanisms identified for the primary areas within the phases are circle pivots, with K Lines being used to fill in the small areas that a circle pivot could not accommodate.

Based on this scenario of circle pivots and K Lines to provide irrigation for a hay/alfalfa/grass crop, the following cost summary table was developed:

**Table 11. Cost Summary for Irrigation of Hay/Alfalfa/Grass**

| **Phase 1** | | | | |
|---|---|---|---|---|
| **Irrigation Mechanism** | **Acres** | **Cost/Acre** | **Total Cost** | **Annualized O & M*** |
| Circle Pivots(4) | 48 | $6,854.00 | $328,992.00 | $16,449.60 |
| K Lines | 4 | $6,060.00 | $24,240.00 | $8,544.00 |
| Reuse Improvements (HGE, Inc) | | | $433,625.00 | |
| **Summary Phase 1** | | **$6,457.00** | **$786,857.00** | **$24,993.60** |
| | | | | |
| **Phase 2** | | | | |
| **Irrigation Mechanism** | **Acres** | **Cost/Acre** | **Total Cost** | **Annualized O & M*** |
| Circle Pivots (1) | 32 | $3,906.00 | $124,992.00 | $6,249.60 |
| K Lines | 6 | $6,060.00 | $36,360.00 | $9,756.00 |
| Reuse Improvements (HGE, Inc) | | | $475,000.00 | |
| **Summary Phase 2** | | **$4,983.00** | **$636,352.00** | **$16,005.60** |
| | | | | |
| **Phase 3** | | | | |
| **Irrigation Mechanism** | **Acres** | **Cost/Acre** | **Total Cost** | **Annualized O & M**** |
| Circle Pivots<br>K Lines | 46 | $5,720.00 | $727,417.93 | $20,499.60 |
| **Summary Phase 3** | | **$5,720.00** | **$727,417.93** | **$20,499.60** |
| | | | | |

*Annualized O & M costs are based on an annual equipment cost of maintenance & repair of approximately 5% of materials cost. Labor to operate irrigation of hand lines is based on 1 person 2 hours per day 7 days per week for 140 day irrigation season at a pay rate of $30/hour/person. Four annual harvest removal and reset costs (assumes 4 crop cuttings per irrigation season) are assumed to require 2 persons 8 hours for removal, and 2 persons 8 hours for re-set of hand lines for each of the four harvest events. Labor to operate irrigation with K Lines is based on 1 person 1 hour per day 7 days per week for 140 day irrigation season at a pay rate of $30/hour/person. Four annual harvest removal and reset costs of K Lines (assumes 4 crop cuttings per irrigation season) is assumed to require 1 person 8 hours for removal; and 1 persons 8 hours for re-set of hand lines.

**Annualized O & M costs are based on an average Annual O & M for Phases 1 and 2 above.

**NOTE:** Costs for irrigation equipment and installation are based on estimates provided by Cascade Pump and Irrigation of Bend, Oregon based on similar acreage size projects where applicable.

The above costs were evaluated on a per acre cost for each phase of effluent irrigation. The cost per acre associated with circle pivots changes between phase 1 and phase 2 based on the portions of partial pivots and the added cost for installation of each circle pivot center.

The potential for phase 3 equipment costs could be off set if the pivot track from the phase 2 pivot could be extended to allow pivot rotation across the phase boundary to phase 3.

The estimated annual power cost per phase is shown in the table below assuming a cost of $0.06 per kilowatt-hour (KwH):

**Table 12. Estimated Annual Power Cost for Irrigation (Hay/Alfalfa/Grass)**

| **Estimated Annual Power Cost for Irrigation** | | |
|---|---|---|
| **Phase 1** | | |
| **Irrigation Mechanism** | **Acres** | **Cost @ $0.06/KwH** |
| Circle Pivots(4) | 48 | $6,854.00 |
| K Lines | 4 | $193.00 |
| **Summary Phase 1** | | **$7,047.00** |
| | | |
| **Phase 2** | | |
| **Irrigation Mechanism** | **Acres** | **Cost** |
| Circle Pivots (1) | 32 | $3,527.00 |
| K Lines | 6 | $386.00 |
| **Summary Phase 2** | | **$3,913.00** |
| | | |
| **Phase 3** | | |
| **Irrigation Mechanism** | **Acres** | **Cost** |
| Circle Pivots | | |
| K Lines | 46 | $5,601.78 |
| **Summary Phase 3** | | **$5,601.78** |

### *Irrigation of Poplar Trees*

Irrigation of a poplar tree crop has been estimated in each phase of the project, with a generalized layout of likely irrigation methods based on the acreage of each irrigable phase as shown on the attached Figure 7. In this scenario the primary areas for irrigation of phase 1 and phase 2 have been provided, with the potential cost for irrigation of phase 3 being based on the average per acre cost of phases 1 and 2.

Irrigation mechanisms to irrigate a poplar tree crop need only be removable for harvest on a likely 9 to 12 year cycle. During harvest, the entire irrigation system should be removed, and then replaced after tree crop harvest. Emphasis on minimal maintenance and complete removal and resetting of the irrigation system was necessary. The mechanisms identified for the primary areas within the phases are hand lines or K Lines.

Based on this scenario of hand lines or K Lines to provide irrigation for a poplar tree crop, the following cost summary table was developed:

**Table 13. Cost Summary for Irrigation of Poplar Tree Crop**

| **Phase 1** | | | | |
|---|---|---|---|---|
| **Irrigation Mechanism** | **Acres** | **Cost/Acre** | **Total Cost** | **Annualized O & M*** |
| Hand Lines | 52 | $2,250.00 | $117,000.00 | $16,650.00 |
| K Lines | | $6,060.00 | $315,120.00 | $7,695.60 |
| Reuse Improvements (HGE, Inc) | | | $433,625.00 | |
| **Summary Phase 1** | | **$4,155.00** | **$865,745.00** | **$24,345.60** |
| | | | | |
| **Phase 2** | | | | |
| **Irrigation Mechanism** | **Acres** | **Cost/Acre** | **Total Cost** | **Annualized O & M*** |
| Hand Lines | 38 | $2,250.00 | $85,500.00 | $15,075.00 |
| K Lines | | $6,060.00 | $230,280.00 | $16,914.00 |
| Reuse Improvements (HGE, Inc) | | | $475,000.00 | |
| **Summary Phase 2** | | **$4,155.00** | **$790,780.00** | **$31,989.00** |
| | | | | |
| **Phase 3** | | | | |
| **Irrigation Mechanism** | **Acres** | **Cost/Acre** | **Total Cost** | **Annualized O & M*** |
| Hand Lines | 46 | $2,250.00 | $103,500.00 | $15,975.00 |
| K Lines | | $6,060.00 | $278,760.00 | $6,793.80 |
| **Summary Phase 3** | | **$2,250.00** | **$846,668.33** | **$11,384.40** |
| | | | | |

*Annualized O & M costs are based on an annual equipment cost of maintenance & repair of approximately 5% of materials cost. Labor to operate irrigation of hand lines is based on 1 person 2 hours per day 7 days per week for 180 day irrigation season at a pay rate of $30/hour/person. A single harvest removal and reset cost (approximately once every 9-12 years) is assumed to require 2 persons 8 hours for removal; and 2 persons 8 hours for re-set of hand lines. Labor to operate irrigation with K Lines is based on 1 person 1 hour per day 7 days per week for 180 day irrigation season at a pay rate of $30/hour/person. A single harvest removal and reset cost of K Lines (approximately once every 9-12 years) is assumed to require 1 person 8 hours for removal; and 1 persons 8 hours for re-set of hand lines. Single poplar harvest event is not included in the Annualized O & M cost above

**NOTE:** Costs for irrigation equipment and installation are based on estimates provided by Cascade Pump and Irrigation of Bend, Oregon based on similar acreage size projects where applicable.

The above costs were evaluated on a per acre cost for each phase of effluent irrigation.

The estimated annual power cost per phase is shown in the table below assuming a cost of $0.06 per kilowatt-hour (KwH):

**Table 14. Estimated Annual Power Cost for Irrigation (Poplar Trees)**

| **Estimated Annual Power Cost for Irrigation** | | |
|---|---|---|
| **Phase 1** | | |
| **Irrigation Mechanism** | **Acres** | **Cost @ $0.06/KwH** |
| Hand or K Lines | 48 | $1,932.84 |
| **Summary Phase 1** | | **$1,932.84** |
| | | |
| **Phase 2** | | |
| **Irrigation Mechanism** | **Acres** | **Cost** |
| Hand or K Lines | 32 | $1,352.94 |
| **Summary Phase 2** | | **$1,352.94** |
| | | |
| **Phase 3** | | |
| **Irrigation Mechanism** | **Acres** | **Cost** |
| Hand or K Lines | 46 | $1,546.26 |
| **Summary Phase 3** | | **$1,546.26** |

**Table 15. Water Rights and Available Acreage by Phase**

City of Sisters: Lazy Z Water Re-Use Study (2013)

| | | | | | | |
|---|---|---|---|---|---|---|
| ***Phase 1 Water Rights - Primary*** | | | | | | |
| | **Water Right** | **Acres of Surface Water Rights** | **Priority Date** | **Rate (cfs)** | **Volume (AF) 5 AF/acre** | **Acres Available for Effluent Irrigation *** |
| *Primary Irrigation* | c.86828 (T-11318/CW-71) | 10.8 | 1880 | 0.32 | 54.0 | 8.95 |
| | c.86826 (T-11318/CW-71) | 35.5 | 1881 | 0.71 | 177.5 | 33.29 |
| | c.85392 (T-11318/CW-71) | 7.0 | 1886 | 0.14 | 35.0 | 6.60 |
| | | **53.3** | | **1.17** | **266.5** | **48.84** |
| ***Phase 2 Water Rights - Primary*** | | | | | | |
| | **Water Right** | **Acres of Surface Water Rights** | **Priority Date** | **Rate (cfs)** | **Volume (AF) 5 AF/acre** | **Acres Available for Effluent Irrigation** |
| *Primary Irrigation* | c.83355 (T-11318/CW-71) | 30.0 | 1880 | 0.62 | 150.0 | 27.37 |
| | c.86828 (T-11318/CW-71) | 7.2 | 1880 | 0.23 | 36.0 | 5.78 |
| | c.85389 (T-11318/CW-71) | 2.5 | 1880 | 0.08 | 12.5 | 1.23 |
| | c.86824 (T-11318/CW-71) | 3.0 | 1880 | 0.06 | 15.0 | 3.00 |
| | | **42.7** | | **0.99** | **213.5** | **37.38** |
| ***Phase 3 Water Rights - Primary*** | | | | | | |
| | **Water Right** | **Acres of Surface Water Rights** | **Priority Date** | **Rate (cfs)** | **Volume (AF) 5 AF/acre** | **Acres Available for Effluent Irrigation** |
| *Primary Irrigation* | c.86824 (T-11318/CW-71) | 56.5 | 1880 | 1.13 | 282.5 | 46.50 |
| | c.85391 (T-11318/CW-71) | 3.0 | 1880 | 0.1 | 15 | 1.29 |
| | | **59.5** | | **1.23** | **297.5** | **47.79** |
| | | | | | | |
| | ***Total:*** | ***155.5*** | | ***3.39*** | ***777.5*** | ***134.01*** |

**Acreage accounts for required set-backs*

## FINANCING OPPORTUNITIES – CONVERSION OF SURFACE WATER RIGHTS TO INSTREAM RIGHTS

### Valuation & Feasibility of Transactional Opportunities

This section provides some historical information on water transactions and a range of estimates for potential transactions the City may consider. The valuation of water contains many variables and needs to be looked at on a case-by-case basis. Important variables include specifics of the water rights in question, including location, priority date, rate and duty (allowable application volume per-acre over an irrigation season), as well as current market demand for the water. In some cases, third-party appraisals are required. Thus, this discussion should be viewed as a tool for the City to consider their options, not as a firm valuation of water rights. Extensive due diligence is required as part of individual water transactions. This section also briefly discusses the current feasibility and utility of each opportunity.

### Permanent Transactions

Permanent Restoration Transfer

Several Whychus Creek surface water rights have been acquired over the last several years within the range of $4,500-$6,500/acre. The value of surface water rights for restoration are heavily-dependent on the specifics of the water right, including point of diversion and return flow from source stream, priority date, rate and duty. It is also contingent on what a restoration funder is willing to pay to purchase the water rights, based on variables like how important the outcome is to the funder and the price of other options available to generate the water instream. Any permanent purchase of water rights requires extensive due diligence on the transferability of the right and its value. While permanent transfers can take several years to get finalized through the State, it is possible to get paid up-front upon execution of a purchase agreement with a funder.

There is a well-defined and active market for permanent restoration transfers in Whychus Creek. It is anticipated that funders exist in the near term to invest in this activity. In the next decade, as restoration interests get closer to reaching the current instream water right target in Whychus Creek, and as the Pelton Fund gets spent out, this market may decline. Permanent restoration transfers represent the highest value opportunity for the City.

As a policy, Three Sisters Irrigation District does not allow district water rights to exit the district, including permanent instream transfers. In 2001, the owners of the Lazy Z Ranch (Lazy Z Partners, LLC) entered into an agreement with the Three Sisters Irrigation District to include 442 irrigated acres within the property into the irrigation district's service area. This "Inclusion

Agreement" also allowed for 201.2 acres of water rights, within the 442 acre area, to be excluded from the irrigation district. To date, 63 acres have been "excluded" from the irrigation district which leaves 138.2 acres remaining that are available to be removed from the irrigation district. Thus, the City presently has the ability to exclude 138.2 of its 155.5 acres from the irrigation district, opening up the potential to permanently transfer those water rights instream. Further conversation with the district would be required to assess the feasibility of excluding the remaining 17.3 acres of water rights on the City's Lazy Z property.

Permanent Mitigation Transfer

No data on the acquisition of permanent mitigation exists to our knowledge. Several landowners have transferred surface water rights instream to generate permanent mitigation credits, but to our knowledge those mitigation credits have not been sold to mitigation buyers.

While there is not currently an active market for permanent instream transactions that result in mitigation credits in Whychus Creek, transferring Lazy Z water rights instream for its own mitigation needs may be a cost-effective way for the City to fulfill its own mitigation obligations. The City would need to consider its projected mitigation obligation, assess the costs of alternative ways to meet these needs, and consider the opportunity cost of holding onto the water rights.

Allocation of Conserved Water

Restoration funders have invested in Allocation of Conserved Water projects within Three Sisters Irrigation District. OWRD requires that 25% of the savings are protected as an instream water right. Restoration funders can invest in efficiency projects to protect a higher percentage of the conserved water instream**.**

Attracting conservation investment by restoration funders as part of a long-term effluent irrigation plan, however, is uncertain. Potential restoration buyers will likely question the value of investing up-front in infrastructure to irrigate more efficiently with surface water when that water may ultimately be transferred instream. The cost of setting up a surface water sprinkler irrigation system in advance of an effluent system would also need to be considered.

The USDA Farm Bill has an EQIP Program that is designed to cost-share with landowners on on-farm efficiency projects. While that program has been successfully used in Three Sisters Irrigation District, municipalities are not eligible to apply to the EQIP program.

***Temporary Transactions***

Temporary Instream Transfer (10-50+ years)

To date, there has been no investment by restoration funders in temporary instream transfers in Whychus Creek. The level of interest from restoration funders in this type of transaction is uncertain. A temporary transfer would likely attract greater investment than an annual lease because it ensures water is instream for a longer period of time. Because it provides no assurances, however, that the water will be permanently protected instream, it would likely not approach the value of a permanent instream transfer. Funders would most likely value this approach more highly if it played a functional role within a longer-term restoration strategy in Whychus Creek.

This approach would build in long-term flexibility for the City to make future decisions about its surface water rights, but the interest in and value of the water would be markedly less than a permanent instream transfer due to the future uncertainty of the water.

Instream Leasing

The Deschutes River Conservancy actively funds leasing in Whychus Creek, and pays $7/acre-foot for water that is protected instream. Because Whychus Creek is over-appropriated, the actual volume of water protected instream per acre of irrigation varies widely by priority date. Depending on the priority dates of the water rights the DRC has leased historically, the payment has ranged from $21-$38/acre. For the purposes of this report, based on the priority dates of the City's Lazy Z water rights, we estimate that the City would receive at least 5 acre-feet per acre, or $35/acre. The DRC is unable to pay public entities for leased water. If, however, the City submitted a lease as a temporary mitigation project, the DRC could compensate for the lease.

District patrons who lease instream are still obligated to pay annual assessments to the Three Sisters Irrigation District. These assessments are based on the acre-feet per acre delivered on-farm, or protected instream in the case of instream leases. Thus, the City may choose to lease less than 5 AF/acre instream, which would reduce the City's assessment, but would also reduce the potential lease payment.

The DRC has done split-season leases with Three Sisters Irrigation District, and pays the same $7/acre foot for water protected instream. Because the water is leased for only part of the season, the compensation is lower than a full-season lease. However, since the DRC is unable to generate temporary mitigation credits from split-season leases, it would be unable to compensate the City for a split-season lease. The City would also incur additional costs with a split-season lease because the OWRD requires weekly monitoring and measurement of water use.

Instream leasing maximizes the City's flexibility with its surface water rights, and protects the beneficial use of the water rights, however does not provide significant offset to operating costs.

Summary

A permanent restoration transfer of Lazy Z water rights is the highest-value opportunity for the City with a high certainty of funding, particularly in the next five years. A permanent mitigation transfer could satisfy potential mitigation obligations, but would not generate revenue to offset infrastructure and operating costs associated with the effluent irrigation system. A time-limited transfer may generate some revenue, but the level is uncertain and, from the perspective of restoration funders, would likely depend on the utility of the transfer within a long-term restoration strategy. Instream leasing and split-season leasing offers flexibility with water rights on an annual basis, and protects the beneficial use of the water rights. It does not, however, generate significant financial value to offset operating costs, and may not have utility as a long-term solution once effluent irrigation is in place.

Figure 10 diagrams potential water transaction pathways for Phases I and II.

**Figure 10. Potential Transaction Pathways for Phases I and II**

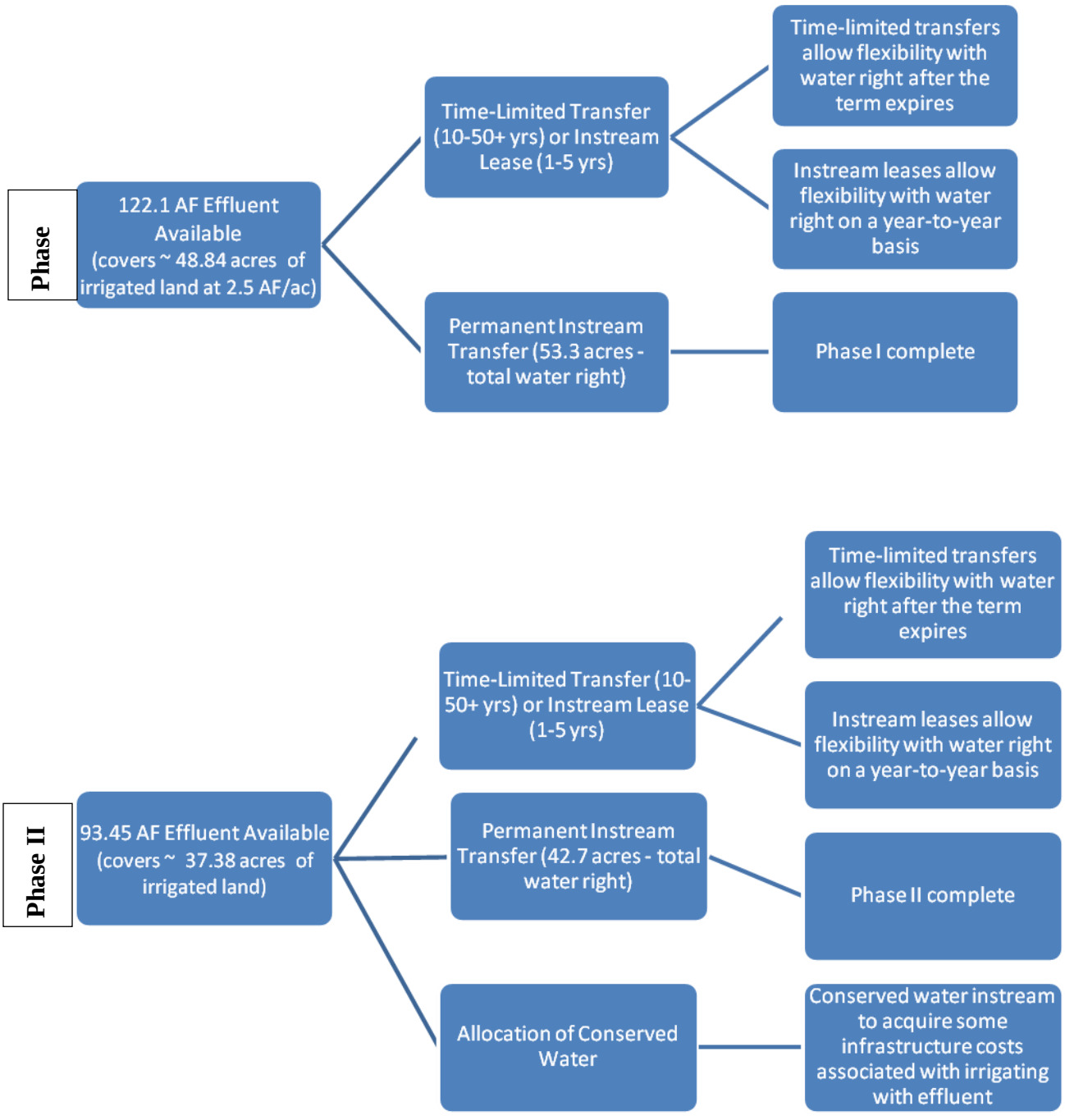


Table 16 summarizes capital costs from Tables 12, 13 and 14 above and potential value of different water transaction opportunities by phase.

**Table 16. Summary of Capital Costs and Potential Benefits**

| | **Costs** | | **Benefits** | | | |
|---|---|---|---|---|---|---|
| | **Infrastructure** | | **Lease** [5] | **Split-Season Lease** | **Restoration Transfer** | **Temporary Transfer** |
| | Hay | Poplar | | | | |
| **Phase I** (48.84 acres) | $786,857 | $865,745 | $1,026-$1,709 | 0 | $219,780-$317,460 | No data |
| **Phase II** (37.38 acres) | $636,352 | $749,780 | $785-$1,308 | 0 | $168,210- $242,970 | No data |
| **Phase III** (47.79 acres) | $727,417 | $846,668 | $1,004-$1,673 | 0 | $215,055- $310,635 | No data |
| **Total** | $2,150,626 | $2,503,193 | $2,815-$4,690 | 0 | $603,045- $871,065 | No data |

## Conclusion

Over time the City of Sisters will need to expand its waste water disposal capacity onto its Lazy Z property. This study examines the regulatory framework, mechanics, and timeline of such a transition and evaluates to what extent transferring the City's Lazy Z water rights instream can off-set the required infrastructure improvements.

The study estimates that 128 acre-feet of effluent are presently available for transition to irrigation on the Lazy Z. This will increase incrementally to 294 acre-feet by 2033. Hay, poplars, and ornamental nursery stock were identified as the most suitable crops for this property. Irrigation infrastructure for these crops was recommended and cost estimates for the systems supplied.

The study identified three phases, or areas of the property, for transition to effluent irrigation. Phase I (49 acres) could be transitioned with existing effluent. By 2033, effluent is projected to be available to cover all of Phases I & II (86 acres) and 65% of Phase III (48 acres). These phases are currently covered with 155.5 acres of senior Whychus Creek water rights. There are

[5] The DRC pays $7/AF. This range is based on $3 AF/acre and $5 AF/acre leased.

several permanent and temporary water transactions the City could pursue with these surface water rights. Permanent instream transfers for restoration are the highest value opportunity for the City that could help offset costs of effluent irrigation. Permanent instream transfers for mitigation could be used to meet mitigation obligations associated with one of the City's ground water permits. Instream leases or temporary transfers retain flexibility with the water rights and could provide temporary mitigation credits but do not generate significant revenue to offset operating costs.

# WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: 541-419-2561 | From - Month & Year: November 2014
DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: December 2014
System Type: Dom. Sewage lagoons | Population Served: 2038 | County: Deschutes

Operator Certification

Collection sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 11836 I
Treatment sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 12242 I

| DATE | | INFLUENT | | | | | EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:* | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MGD | BOD Grab / Comp. X | | TSS Grab / Comp. X | | BOD Grab / Composite | | | TSS Grab / Composite | | | NUTRIENTS Grab / Composite | | | | CHLORINE | | COLIFORM MPN / MF | | |
| Month | Day | GPD Flow | Concentration | Loading | Concentration | Loading | Concentration | Removal | Loading | Concentration | Removal | Loading | Total Phosphorous | Total Kjeldahl Nitrogen | Ammonia Nitrogen | Nitrate Nitrogen | Used | Total Residual | Total | Fecal | E.coli |
| | | | mg/L | lbs. | mg/L | lbs. | mg/L | % | lbs. | mg/L | % | lbs. | mg/L | | | | lbs. | mg/L | CFU/100 ml | | |
| 11 | 1 | .179 | | | | | | | | | | | | | | | | | | | |
| | 2 | .189 | | | | | | | | | | | | | | | | | | | |
| | 3 | .166 | | | | | | | | | | | | | | | | | | | |
| | 4 | .171 | | | | | | | | | | | | | | | | | | | |
| | 5 | .173 | | | | | | | | | | | | | | | | | | | |
| | 6 | .173 | | | | | | | | | | | | | | | | | | | |
| | 7 | .177 | 291 | 430 | 200 | 295 | | | | | | | | | | | | | | | |
| | 8 | .174 | | | | | | | | | | | | | | | | | | | |
| | 9 | .185 | | | | | | | | | | | | | | | | | | | |
| | 10 | .185 | | | | | | | | | | | | | | | | | | | |
| | 11 | .180 | | | | | | | | | | | | | | | | | | | |
| | 12 | .182 | | | | | | | | | | | | | | | | | | | |
| | 13 | .181 | | | | | | | | | | | | | | | | | | | |
| | 14 | .182 | 307 | 466 | 212 | 322 | | | | | | | | | | | | | | | |
| | 15 | .199 | | | | | | | | | | | | | | | | | | | |
| | 16 | .204 | | | | | | | | | | | | | | | | | | | |
| | 17 | .196 | | | | | | | | | | | | | | | | | | | |
| | 18 | .187 | | | | | | | | | | | | | | | | | | | |
| | 19 | .188 | | | | | | | | | | | | | | | | | | | |
| | 20 | .177 | | | | | | | | | | | | | | | | | | | |
| | 21 | .212 | 315 | 557 | 191 | 338 | | | | | | | | | | | | | | | |
| | 22 | .191 | | | | | | | | | | | | | | | | | | | |
| | 23 | .188 | | | | | | | | | | | | | | | | | | | |
| | 24 | .185 | | | | | | | | | | | | | | | | | | | |
| | 25 | .183 | | | | | | | | | | | | | | | | | | | |
| | 26 | .185 | | | | | | | | | | | | | | | | | | | |
| | 27 | .164 | | | | | | | | | | | | | | | | | | | |
| | 28 | .201 | 331 | 555 | 199 | 334 | | | | | | | | | | | | | | | |
| | 29 | .199 | | | | | | | | | | | | | | | | | | | |
| | 30 | .211 | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| TOTAL | | 5.567 | 1244 | 2008 | 802 | 1289 | | | | | | | | | | | | | | | |
| DAILY MIN. | | .166 | 291 | 430 | 191 | 295 | | | | | | | | | | | | | | | |
| DAILY MAX. | | .212 | 331 | 557 | 212 | 338 | | | | | | | | | | | | | | | |
| WKLY. AVG. MAX. | | .185 | 311 | 502 | 201 | 322 | | | | | | | | | | | | | | | |
| MTHLY. AVG. | | .185 | 311 | 502 | 201 | 322 | | | | | | | | | | | | | | | |
| DAILY LIMITS | | | | | | | | | | | | | | | | | | | | | |
| WKLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |
| MTHLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |

Effluent Off for Season

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Douglas McIntosh
Authorized Signature

Date 12-1-14

Name (print) Douglas McIntosh

**Notes:**

**Mail Original To:** Oregon DEQ, Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

| LAGOON AND POLISHING POND | | | | | RECLAIMED WATER Outfall ____ | | SEWER SYS. BYPASS | | | MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION) | | | | | | | LOG Regarding breakdowns, bypassing, odors, complaints, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary Depth | | Secondary Depth | | Perimeter Inspection | Quanity Irrigated | | Flow | Duration | Solids Transported to Other WWTF | Test Dosing Pumps/Alarms | Inspect Pump Screens | Check Pumps for Accurate Cycle | Inspect Monitoring Ports | Inspect & Maintain Dist. Mechanisms | Inspect Dosing Tank | Influent P.H. | |
| | | | | | In./Acr | | Gal. | Hrs. | | | | | | | | | |
| 9.1 | | 9 | 6' | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.83 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.91 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.95 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | N/A | | | | | | X | | | | N/A | | |
| | | | | X | | | | | | | X | | | | | 6.98 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.93 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.98 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.76 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.65 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.01 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.07 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.11 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.13 | |
| | | | | X | | | | | | | X | | | | | | |
| V | | V | 7' | X | | | | | | | X | | | | | | |
| | | | | | | | | | | | | | | | | 84.31 | TOTAL |
| | | | | | | | | | | | | | | | | 6.65 | DAILY MINIMUM |
| | | | | | | | | | | | | | | | | 7.13 | DAILY MAXIMUM |
| | | | | | | | | | | | | | | | | 7.02 | WEEKLY AVERAGE MAXIMUM |
| | | | | | | | | | | | | | | | | 7.02 | MONTHLY AVERAGE |
| | | | | | | | | | | | | | | | | | DAILY LIMITS |
| | | | | | | | | | | | | | | | | | WEEKLY LIMITS |
| | | | | | | | | | | | | | | | | | MONTHLY LIMITS |

# WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: 541-419-2561 | From - Month & Year: December 2014

DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: January 2015

System Type: Dom. Sewage lagoons | Population Served: 2038 | County: Deschutes

**Operator Certification**

Collection sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 11836 I

Treatment sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 12242 I

| DATE | | INFLUENT | | | | | EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MGD / GPD | BOD Grab / Comp. X | | TSS Grab / Comp. X | | BOD Grab / Composite | | | TSS Grab / Composite | | | NUTRIENTS Grab / Composite | | | | CHLORINE | | COLIFORM MPN / MF | | |
| Month | Day | Flow | Concentration | Loading | Concentration | Loading | Concentration | Removal | Loading | Concentration | Removal | Loading | Total Phosphorous | Total Kjeldahl Nitrogen | Ammonia Nitrogen | Nitrate Nitrogen | Used | Total Residual | Total | Fecal | E.coli |
| | | | mg/L | lbs. | mg/L | lbs. | mg/L | % | lbs. | mg/L | % | lbs. | mg/L | | | | lbs. | mg/L | CFU/100 ml | | |
| 12 | 1 | .179 | | | | | | | | | | | | | | | | | | | |
| | 2 | .179 | | | | | | | | | | | | | | | | | | | |
| | 3 | .178 | | | | | | | | | | | | | | | | | | | |
| | 4 | .174 | | | | | | | | | | | | | | | | | | | |
| | 5 | .172 | 224 | 321 | 103 | 148 | | | | | | | | | | | | | | | |
| | 6 | .187 | | | | | | | | | | | | | | | | | | | |
| | 7 | .191 | | | | | | | | | | | | | | | | | | | |
| | 8 | .172 | | | | | | | | | | | | | | | | | | | |
| | 9 | .172 | | | | | | | | | | | | | | | | | | | |
| | 10 | .177 | | | | | | | | | | | | | | | | | | | |
| | 11 | .179 | | | | | | | | | | | | | | | | | | | |
| | 12 | .180 | 393 | 590 | 177 | 266 | | | | | | | | | | | | | | | |
| | 13 | .183 | | | | | | | | | | | | | | | | | | | |
| | 14 | .187 | | | | | | | | | | | | | | | | | | | |
| | 15 | .175 | | | | | | | | | | | | | | | | | | | |
| | 16 | .179 | | | | | | | | | | | | | | | | | | | |
| | 17 | .173 | | | | | | | | | | | | | | | | | | | |
| | 18 | .180 | | | | | | | | | | | | | | | | | | | |
| | 19 | .185 | 312 | 481 | 181 | 279 | | | | | | | | | | | | | | | |
| | 20 | .222 | | | | | | | | | | | | | | | | | | | |
| | 21 | .193 | | | | | | | | | | | | | | | | | | | |
| | 22 | .189 | | | | | | | | | | | | | | | | | | | |
| | 23 | .186 | | | | | | | | | | | | | | | | | | | |
| | 24 | .186 | | | | | | | | | | | | | | | | | | | |
| | 25 | .156 | | | | | | | | | | | | | | | | | | | |
| | 26 | .197 | 343 | 565 | 198 | 325 | | | | | | | | | | | | | | | |
| | 27 | .188 | | | | | | | | | | | | | | | | | | | |
| | 28 | .202 | | | | | | | | | | | | | | | | | | | |
| | 29 | .223 | | | | | | | | | | | | | | | | | | | |
| | 30 | .264 | | | | | | | | | | | | | | | | | | | |
| | 31 | .225 | | | | | | | | | | | | | | | | | | | |
| TOTAL | | 5.833 | 272 | 1957 | 659 | 1018 | | | | | | | | | | | | | | | |
| DAILY MIN. | | .156 | 224 | 321 | 103 | 148 | | | | | | | | | | | | | | | |
| DAILY MAX. | | .264 | 393 | 590 | 198 | 325 | | | | | | | | | | | | | | | |
| WKLY. AVG. MAX. | | .188 | 318 | 489 | 165 | 255 | | | | | | | | | | | | | | | |
| MTHLY. AVG. | | .188 | 318 | 489 | 165 | 255 | | | | | | | | | | | | | | | |
| DAILY LIMITS | | | | | | | | | | | | | | | | | | | | | |
| WKLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |
| MTHLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |

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X Doug McIntosh
Authorized Signature

Date 1-12-15

Name (print) Douglas McIntosh

**Notes:**

**Mail Original To:** Oregon DEQ, Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

| LAGOON AND POLISHING POND | | | | | RECLAIMED WATER Outfall ____ | | SEWER SYS. BYPASS | | | MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION) | | | | | | Influent P.H. | LOG Regarding breakdowns, bypassing, odors, complaints, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary Depth | | Secondary Depth | Pond 3 | Perimeter Inspection | Quanity Irrigated | | Flow | Duration | Solids Transported to Other WWTF | Test Dosing Pumps/Alarms | Inspect Screens | Check Pumps for Accurate Cycle | Inspect Monitoring Ports | Inspect & Maintain Dist. Mechanisms | Inspect Dosing Tank | | |
| | | | | | In./Acr | | Gal. | Hrs. | | | | | | | | | |
| 9.1 | | 9 | 7' | X | | | | | | | X | | | | | 7.23 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.21 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.28 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.31 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.10 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.92 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.43 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.03 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.97 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.21 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.87 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.13 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.21 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | 9' | X | | | | | | | X | | | | | 7.19 | |
| | | | | | | | | | | | | | | | | | TOTAL |
| | | | | | | | | | | | | | | | | | DAILY MINIMUM |
| | | | | | | | | | | | | | | | | | DAILY MAXIMUM |
| | | | | | | | | | | | | | | | | | WEEKLY AVERAGE MAXIMUM |
| | | | | | | | | | | | | | | | | | MONTHLY AVERAGE |
| | | | | | | | | | | | | | | | | | DAILY LIMITS |
| | | | | | | | | | | | | | | | | | WEEKLY LIMITS |
| | | | | | | | | | | | | | | | | | MONTHLY LIMITS |

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| DATE | | INFLUENT | | | | | EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:* | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MGD [X] | BOD Grab [ ] Comp. [X] | | TSS Grab [ ] Comp. [X] | | BOD Grab [ ] Composite [ ] | | | TSS Grab [ ] Composite [ ] | | | NUTRIENTS Grab [ ] Composite [ ] | | | | CHLORINE | | COLIFORM MPN MF | | |
| Month | Day | GPD Flow | Concentration | Loading | Concentration | Loading | Concentration | Removal | Loading | Concentration | Removal | Loading | Total Phosphorous | Total Kjeldahl Nitrogen | Ammonia Nitrogen | Nitrate Nitrogen | Used | Total Residual | Total | Fecal | E.coli |
| | | | mg/L | lbs. | mg/L | lbs. | mg/L | % | lbs. | mg/L | % | lbs. | mg/L | | | | lbs. | mg/L | CFU/100 ml | | |
| 1 | 1 | .225 | | | | | | | | | | | | | | | | | | | |
| | 2 | .233 | 378 | 734 | 178 | 346 | | | | | | | | | | | | | | | |
| | 3 | .216 | | | | | | | | | | | | | | | | | | | |
| | 4 | .209 | | | | | | | | | | | | | | | | | | | |
| | 5 | .180 | | | | | | | | | | | | | | | | | | | |
| | 6 | .178 | | | | | | | | | | | | | | | | | | | |
| | 7 | .177 | | | | | | | | | | | | | | | | | | | |
| | 8 | .172 | 354 | 508 | 138 | 198 | | | | | | | | | | | | | | | |
| | 9 | .177 | | | | | | | | | | | | | | | | | | | |
| | 10 | .188 | | | | | | | | | | | | | | | | | | | |
| | 11 | .183 | | | | | | | | | | | | | | | | | | | |
| | 12 | .180 | | | | | | | | | | | | | | | | | | | |
| | 13 | .176 | | | | | | | | | | | | | | | | | | | |
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| | 15 | .178 | | | | | | | | | | | | | | | | | | | |
| | 16 | .182 | 393 | 597 | 190 | 288 | | | | | | | | | | | | | | | |
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| | 22 | .161 | | | | | | | | | | | | | | | | | | | |
| | 23 | .172 | 351 | 504 | 181 | 260 | | | | | | | | | | | | | | | |
| | 24 | .175 | | | | | | | | | | | | | | | | | | | |
| | 25 | .185 | | | | | | | | | | | | | | | | | | | |
| | 26 | .172 | | | | | | | | | | | | | | | | | | | |
| | 27 | .168 | | | | | | | | | | | | | | | | | | | |
| | 28 | .167 | | | | | | | | | | | | | | | | | | | |
| | 29 | .168 | | | | | | | | | | | | | | | | | | | |
| | 30 | .180 | 372 | 558 | 164 | 246 | | | | | | | | | | | | | | | |
| | 31 | .180 | | | | | | | | | | | | | | | | | | | |
| TOTAL | | 5.664 | 1848 | 2901 | 851 | 1336 | | | | | | | | | | | | | | | |
| DAILY MIN. | | .161 | 351 | 504 | 138 | 198 | | | | | | | | | | | | | | | |
| DAILY MAX. | | .233 | 393 | 734 | 190 | 346 | | | | | | | | | | | | | | | |
| WKLY. AVG. MAX. | | .182 | 370 | 580 | 170 | 268 | | | | | | | | | | | | | | | |
| MTHLY. AVG. | | .182 | 370 | 580 | 170 | 268 | | | | | | | | | | | | | | | |
| DAILY LIMITS | | | | | | | | | | | | | | | | | | | | | |
| WKLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |
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Authorized Signature

Date 2-9-15

Name (print) Douglas McIntosh

**Notes:**

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| Primary Depth | | Secondary Depth | | Perimeter Inspection | Quanity Irrigated | | Flow | Duration | | Test Dosing Pumps/Alarms | Inspect Effluent Screens | Check Pumps for Accurate Cycle | Inspect Monitoring Ports | Inspect & Maintain Dist. Mechanisms | Inspect Dosing Tank | | |
| | | | | | In./Acr | | Gal. | Hrs. | | | | | | | | | |
| 9.1 | | 9 | 9' | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.87 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.01 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.09 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.13 | |
| | | | | X | | | | | | | X | | | | | 6.83 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.10 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.05 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.79 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.71 | |
| | | | | X | | | | | | | X | | | | | 7.10 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.17 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.19 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | 10' | X | | | | | | | X | | | | | 7.15 | |
| | | | | | | | | | | | | | | | | | TOTAL |
| | | | | | | | | | | | | | | | | | DAILY MINIMUM |
| | | | | | | | | | | | | | | | | | DAILY MAXIMUM |
| | | | | | | | | | | | | | | | | | WEEKLY AVERAGE MAXIMUM |
| | | | | | | | | | | | | | | | | | MONTHLY AVERAGE |
| | | | | | | | | | | | | | | | | | DAILY LIMITS |
| | | | | | | | | | | | | | | | | | WEEKLY LIMITS |
| | | | | | | | | | | | | | | | | | MONTHLY LIMITS |

# WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters
Phone Number: 541-419-2561
From - Month & Year: Feb 2015
DEQ Permit No.: 101799
DEQ File No./Facility ID: 81850
To - Month & Year: March 2015
System Type: Dom. Sewage lagoons
Population Served: 2038
County: Deschutes

**Operator Certification**

Collection sys. class: I
Principal operator name (print): Douglas McIntosh
Certification No. & grade: 11836 I
Treatment sys. class: I
Principal operator name (print): Douglas McIntosh
Certification No. & grade: 12242 I

| DATE | | INFLUENT | | | | | EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MGD X / GPD | BOD Grab | BOD Comp. X | TSS Grab | TSS Comp. X | BOD Grab | BOD Composite | | TSS Grab | TSS Composite | | NUTRIENTS Grab | NUTRIENTS Composite | | | CHLORINE | | COLIFORM MPN / MF | COLIFORM MPN / MF | COLIFORM MPN / MF |
| Month | Day | Flow | Concentration | Loading | Concentration | Loading | Concentration | Removal | Loading | Concentration | Removal | Loading | Total Phosphorous | Total Kjeldahl Nitrogen | Ammonia Nitrogen | Nitrate Nitrogen | Used | Total Residual | Total | Fecal | E.coli |
| | | | mg/L | lbs. | mg/L | lbs. | mg/L | % | lbs. | mg/L | % | lbs. | mg/L | | | | lbs. | mg/L | CFU/100 ml | | |
| 2 | 1 | .179 | | | | | | | | | | | | | | | | | | | |
| | 2 | .176 | | | | | | | | | | | | | | | | | | | |
| | 3 | .174 | | | | | | | | | | | | | | | | | | | |
| | 4 | .164 | | | | | | | | | | | | | | | | | | | |
| | 5 | .180 | | | | | | | | | | | | | | | | | | | |
| | 6 | .183 | 397 | 605 | 190 | 290 | | | | | | | | | | | | | | | |
| | 7 | .176 | | | | | | | | | | | | | | | | | | | |
| | 8 | .169 | | | | | | | | | | | | | | | | | | | |
| | 9 | .176 | | | | | | | | | | | | | | | | | | | |
| | 10 | .165 | | | | | | | | | | | | | | | | | | | |
| | 11 | .165 | | | | | | | | | | | | | | | | | | | |
| | 12 | .172 | | | | | | | | | | | | | | | | | | | |
| | 13 | .179 | 420 | 627 | 196 | 292 | | | | | | | | | | | | | | | |
| | 14 | .209 | | | | | | | | | | | | | | | | | | | |
| | 15 | .200 | | | | | | | | | | | | | | | | | | | |
| | 16 | .194 | | | | | | | | | | | | | | | | | | | |
| | 17 | .174 | | | | | | | | | | | | | | | | | | | |
| | 18 | .172 | | | | | | | | | | | | | | | | | | | |
| | 19 | .181 | | | | | | | | | | | | | | | | | | | |
| | 20 | .173 | 385 | 555 | 201 | 290 | | | | | | | | | | | | | | | |
| | 21 | .182 | | | | | | | | | | | | | | | | | | | |
| | 22 | .184 | | | | | | | | | | | | | | | | | | | |
| | 23 | .173 | | | | | | | | | | | | | | | | | | | |
| | 24 | .174 | | | | | | | | | | | | | | | | | | | |
| | 25 | .170 | | | | | | | | | | | | | | | | | | | |
| | 26 | .172 | | | | | | | | | | | | | | | | | | | |
| | 27 | .178 | 458 | 650 | 167 | 248 | | | | | | | | | | | | | | | |
| | 28 | .178 | | | | | | | | | | | | | | | | | | | |
| TOTAL | | 4.972 | 1640 | 2437 | 754 | 1120 | | | | | | | | | | | | | | | |
| DAILY MIN. | | .164 | 385 | 555 | 190 | 248 | | | | | | | | | | | | | | | |
| DAILY MAX. | | .209 | 438 | 650 | 201 | 292 | | | | | | | | | | | | | | | |
| WKLY. AVG. MAX. | | .176 | 410 | 609 | 188 | 280 | | | | | | | | | | | | | | | |
| MTHLY. AVG. | | .176 | 410 | 609 | 188 | 280 | | | | | | | | | | | | | | | |
| DAILY LIMITS | | | | | | | | | | | | | | | | | | | | | |
| WKLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |
| MTHLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |

0 Eff for season

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Doug McIntosh
Authorized Signature

Date 3-11-15

Name (print) Douglas McIntosh

**Notes:** Took 960 lbs of screenings to Knott land fill

**Mail Original To:** Oregon DEQ, Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

| LAGOON AND POLISHING POND | | | | | RECLAIMED WATER Outfall ____ | | SEWER SYS. BYPASS | | | MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION) | | | | | | Influent P.H. | LOG Regarding breakdowns, bypassing, odors, complaints, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary Depth | | Secondary Depth | Pond 3 | Perimeter Inspection | Quanity Irrigated | | Flow | Duration | Solids Transported to Other WWTF | Test Dosing Pumps/Alarms | Inspect Pump Screens | Check Pumps for Accurate Cycle | Inspect Monitoring Ports | Inspect & Maintain Dist. Mechanisms | Inspect Dosing Tank | | |
| | | | | | In./Acr | | Gal. | Hrs. | | | | | | | | | |
| 9.1 | | 9 | 10' | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.10 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.05 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.11 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | A | 7.01 | |
| | | | | X | A | | | | | | X | | | | | | |
| | | | | X | | A | | | | | X | | | | | 7.21 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.13 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | V | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | V | 7.08 | |
| | | | | X | 0 | V | | | | | X | | | | | | |
| | | | | X | | 0 | | | | | X | | | | 0 | 7.01 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | V | | | | | | X | | | | | 6.88 | |
| | | | | X | | V | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | V | 6.91 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.78 | |
| | | V | V | X | | | | | | | X | | | | | | |
| V | | | 10.5 | X | | | | | | | X | | | | | 7.06 | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | TOTAL |
| | | | | | | | | | | | | | | | | | DAILY MINIMUM |
| | | | | | | | | | | | | | | | | | DAILY MAXIMUM |
| | | | | | | | | | | | | | | | | | WEEKLY AVERAGE MAXIMUM |
| | | | | | | | | | | | | | | | | | MONTHLY AVERAGE |
| | | | | | | | | | | | | | | | | | DAILY LIMITS |
| | | | | | | | | | | | | | | | | | WEEKLY LIMITS |
| | | | | | | | | | | | | | | | | | MONTHLY LIMITS |

# WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

| | | | | | |
|---|---|---|---|---|---|
| Facility Name | City of Sisters | Phone Number | 541-419-2561 | From - Month & Year | March 2015 |
| DEQ Permit No. | 101799 | DEQ File No./Facility ID | 81850 | To - Month & Year | April 2015 |
| System Type | Dom. Sewage lagoons | Population Served | 2038 | County | Deschutes |

**Operator Certification**

| | | | | | |
|---|---|---|---|---|---|
| Collection sys. class | I | Principal operator name (print) | Douglas McIntosh | Certification No. & grade | 11836 I |
| Treatment sys. class | I | Principal operator name (print) | Douglas McIntosh | Certification No. & grade | 12242 I |

| DATE | | INFLUENT | | | | | EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MGD / GPD | BOD Grab / Comp. X | | TSS Grab / Comp. X | | BOD Grab / Composite | | | TSS Grab / Composite | | | NUTRIENTS Grab / Composite | | | | CHLORINE | | COLIFORM MPN / MF | | |
| Month | Day | Flow | Concentration | Loading | Concentration | Loading | Concentration | Removal | Loading | Concentration | Removal | Loading | Total Phosphorous | Total Kjeldahl Nitrogen | Ammonia Nitrogen | Nitrate Nitrogen | Used | Total Residual | Total | Fecal | E.coli |
| | | | mg/L | lbs. | mg/L | lbs. | mg/L | % | lbs. | mg/L | % | lbs. | mg/L | | | | lbs. | mg/L | CFU/100 ml | | |
| 3 | 1 | .184 | | | | | | | | | | | | | | | | | | | |
| | 2 | .184 | | | | | | | | | | | | | | | | | | | |
| | 3 | .181 | | | | | | | | | | | | | | | | | | | |
| | 4 | .175 | | | | | | | | | | | | | | | | | | | |
| | 5 | .172 | | | | | | | | | | | | | | | | | | | |
| | 6 | .172 | 422 | 605 | 190 | 273 | | | | | | | | | | | | | | | |
| | 7 | .182 | | | | | | | | | | | | | | | | | | | |
| | 8 | .197 | | | | | | | | | | | | | | | | | | | |
| | 9 | .182 | | | | | | | | | | | | | | | | | | | |
| | 10 | .177 | | | | | | | | | | | | | | | | | | | |
| | 11 | .172 | | | | | | | | | | | | | | | | | | | |
| | 12 | .182 | | | | | | | | | | | | | | | | | | | |
| | 13 | .185 | 294 | 454 | 144 | 222 | | | | | | | | | | | | | | | |
| | 14 | .202 | | | | | | | | | | | | | | | | | | | |
| | 15 | .205 | | | | | | | | | | | | | | | | | | | |
| | 16 | .189 | | | | | | | | | | | | | | | | | | | |
| | 17 | .180 | | | | | | | | | | | | | | | | | | | |
| | 18 | .178 | | | | | | | | | | | | | | | | | | | |
| | 19 | .189 | | | | | | | | | | | | | | | | | | | |
| | 20 | .194 | 339 | 548 | 171 | 277 | | | | | | | | | | | | | | | |
| | 21 | .201 | | | | | | | | | | | | | | | | | | | |
| | 22 | .196 | | | | | | | | | | | | | | | | | | | |
| | 23 | .194 | | | | | | | | | | | | | | | | | | | |
| | 24 | .182 | | | | | | | | | | | | | | | | | | | |
| | 25 | .193 | | | | | | | | | | | | | | | | | | | |
| | 26 | .178 | | | | | | | | | | | | | | | | | | | |
| | 27 | .256 | 373 | 796 | 194 | 414 | | | | | | | | | | | | | | | |
| | 28 | .200 | | | | | | | | | | | | | | | | | | | |
| | 29 | .179 | | | | | | | | | | | | | | | | | | | |
| | 30 | .169 | | | | | | | | | | | | | | | | | | | |
| | 31 | .166 | | | | | | | | | | | | | | | | | | | |
| TOTAL | | 5.796 | 1428 | 2403 | 699 | 1146 | | | | | | | | | | | | | | | |
| DAILY MIN. | | .172 | 294 | 454 | 144 | 222 | | | | | | | | | | | | | | | |
| DAILY MAX. | | .256 | 422 | 796 | 194 | 414 | | | | | | | | | | | | | | | |
| WKLY. AVG. MAX. | | .187 | 357 | 601 | 175 | 287 | | | | | | | | | | | | | | | |
| MTHLY. AVG. | | .187 | 357 | 601 | 175 | 287 | | | | | | | | | | | | | | | |
| LIMITS | | | | | | | | | | | | | | | | | | | | | |
| ...r. LIMITS | | | | | | | | | | | | | | | | | | | | | |
| MTHLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |

OFF for Season

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Douglas McIntosh
Authorized Signature

Date 4-6-15

Name (print) Douglas McIntosh

**Notes:**

**Mail Original To:** Oregon DEQ, Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

| LAGOON AND POLISHING POND | | | | | RECLAIMED WATER Outfall ____ | | SEWER SYS. BYPASS | | | MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION) | | | | | | Effluent P.H. | LOG Regarding breakdowns, bypassing, odors, complaints, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary Depth | | Secondary Depth | Pond 3 | Perimeter Inspection | Quanity Irrigated | | Flow | Duration | Solids Transported to Other WWTF | Test Dosing Pumps/Alarms | Inspect Pump Screens | Check Pumps for Accurate Cycle | Inspect Monitoring Ports | Inspect & Maintain Dist. Mechanisms | Inspect Dosing Tank | | |
| | | | | | In /Acr | | Gal. | Hrs. | | | | | | | | | |
| 9.1 | | 9 | 10.5 | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.70 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.26 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.01 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.36 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.13 | |
| | | | | X | ↑ | ↑ | | | | | X | | | | ↑ | | |
| | | | | X | | | | | | | X | | | | | 7.04 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | 4 | X | | | | | X | | | | X | 6.82 | |
| | | | | X | 4 | 11 | | | | | X | | | | | | |
| | | | | X | 0 | 0 | | | | | X | | | | 0 | 7.00 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.01 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | ↓ | ↓ | | | | | X | | | | ↓ | | |
| | | | | X | | | | | | | X | | | | | 7.09 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.13 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.00 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | . | |
| ↓ | | ↓ | ↓ | X | | | | | | | X | | | | | 7.07 | |
| | | | 11.5 | X | | | | | | | X | | | | | | |
| | | | | | | | | | | | | | | | | | TOTAL |
| | | | | | | | | | | | | | | | | | DAILY MINIMUM |
| | | | | | | | | | | | | | | | | | DAILY MAXIMUM |
| | | | | | | | | | | | | | | | | | WEEKLY AVERAGE MAXIMUM |
| | | | | | | | | | | | | | | | | | MONTHLY AVERAGE |
| | | | | | | | | | | | | | | | | | DAILY LIMITS |
| | | | | | | | | | | | | | | | | | WEEKLY LIMITS |
| | | | | | | | | | | | | | | | | | MONTHLY LIMITS |

# WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: 541-419-2561 | From - Month & Year: April 2015
Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: May 2015
System Type: Dom. Sewage Lagoons | Population Served: 2038 | County: Deschutes

**Operator Certification**

Collection sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 11836 I
Treatment sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 12242 I

| DATE | | INFLUENT | | | | | EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MGD / GPD | BOD Grab | BOD Comp. X | TSS Grab | TSS Comp. X | BOD Grab | BOD Composite | | TSS Grab X | TSS Composite | | NUTRIENTS Grab | | NUTRIENTS Composite | | CHLORINE | | COLIFORM MPN / MF | COLIFORM MPN / MF | COLIFORM MPN / MF |
| Month | Day | Flow | Concentration | Loading | Concentration | Loading | Concentration | Removal | Loading | Concentration | Removal | Loading | Total Phosphorous | Total Kjeldahl Nitrogen | Ammonia Nitrogen | Nitrate Nitrogen | Used | Total Residual | Total | Fecal | E.coli |
| | | | mg/L | lbs | mg/L | lbs | mg/L | % | lbs | mg/L | % | lbs | mg/L | | | | lbs | mg/L | CFU/100 ml | | |
| 4 | 1 | .166 | | | | | | | | | | | | | | | | | | | |
| | 2 | .167 | | | | | | | | | | | | | | | | | | | |
| | 3 | .170 | 437 | 619 | 190 | 269 | | | | | | | | | | | | | | | |
| | 4 | .178 | | | | | | | | | | | | | | | | | | | |
| | 5 | .172 | | | | | | | | | | | | | | | | | | | |
| | 6 | .183 | | | | | | | | | | | | | | | | | | | |
| | 7 | .175 | | | | | | | | | | | | | | | | | | | |
| | 8 | .177 | | | | | | | | | | | | | | | | | | | |
| | 9 | .182 | | | | | | | | | | | | | | | | | | | |
| | 10 | .191 | 443 | 705 | 220 | 350 | | | | | | | | | | | | | | | |
| | 11 | .187 | | | | | | | | | | | | | | | | | | | |
| | 12 | .197 | | | | | | | | | | | | | | | | | | | |
| | 13 | .181 | | | | | | | | | | | | | | | | | | | |
| | 14 | .183 | | | | | | | | | | | | | | | 1.2 | 1.2 | | | |
| | 15 | .182 | | | | | | | | | | | | | | | 5 | 5.0 | | | 0 |
| | 16 | .186 | | | | | | | | | | | | | | | 6 | 8.0 | | | |
| | 17 | .183 | 414 | 631 | 198 | 302 | | | | 19 | 90 | 6 | | | | | 7 | 3.8 | | | |
| | 18 | .195 | | | | | | | | | | | | | | | 6 | 2.8 | | | |
| | 19 | .196 | | | | | | | | | | | | | | | 5 | 3.1 | | | |
| | 20 | .178 | | | | | | | | | | | | | | | 4 | 2.8 | | | |
| | 21 | .179 | | | | | | | | | | | | | | | 9 | 0 | | | |
| | 22 | .179 | | | | | | | | | | | | | | | 6 | 0 | | | 0 |
| | 23 | .188 | | | | | | | | | | | | | | | 3 | 0 | | | |
| | 24 | .185 | 438 | 675 | 172 | 265 | | | | 21 | 88 | 7 | | | | | 9 | 5.0 | | | |
| | 25 | .191 | | | | | | | | | | | | | | | 6 | 1.7 | | | |
| | 26 | .196 | | | | | | | | | | | | | | | 6 | 1.8 | | | |
| | 27 | .185 | | | | | | | | | | | | | | | 4 | 1.4 | | | |
| | 28 | .179 | | | | | | | | | | | | | | | 6 | 1.3 | | | |
| | 29 | .169 | | | | | | | | | | | | | | | 6 | 1.8 | | | 0 |
| | 30 | .186 | | | | | | | | | | | | | | | 5 | 2.1 | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| TOTAL | | 5.466 | 1732 | 2630 | 780 | 1186 | | | | 40 | | 13 | | | | | 94.2 | 40 | | | |
| DAILY MIN. | | .166 | 414 | 619 | 172 | 265 | | | | 19 | | 6 | | | | | 1.2 | 0 | | | |
| DAILY MAX. | | .196 | 443 | 705 | 220 | 350 | | | | 21 | | 7 | | | | | 9 | 5.0 | | | |
| WKLY. AVG. MAX. | | .182 | 433 | 657 | 195 | 296 | | | | 20 | | 7 | | | | | 6 | 2.5 | | | |
| MTHLY. AVG. | | .182 | 433 | 657 | 195 | 296 | | | | 20 | | 7 | | | | | 6 | 2.3 | | GM | 1 |
| DAILY LIMITS | | | | | | | | | | | | | | | | | | | | | |
| WKLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |
| MTHLY. LIMITS | | | | | | | | | | | | | | | | | | | | GM | 126 |

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Douglas McIntosh
Authorized Signature

Date 5-14-15

Name (print) Douglas McIntosh

**Notes:**

**Mail Original To:** Oregon DEQ, Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

| LAGOON AND POLISHING POND | | | | | RECLAIMED WATER Outfall ____ | | SEWER SYS. BYPASS | | | MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION) | | | | | | | LOG Regarding breakdowns, bypassing, odors, complaints, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary Depth | | Secondary Depth | Pond 3 | Perimeter Inspection | Quanity Irrigated | | Flow | Duration | Solids Transported to Other WWTF | Test Dosing Pumps/Alarms | Inspect Bar Screens | Check Pumps for Accurate Cycle | Inspect Monitoring Ports | Inspect & Maintain Dist. Mechanisms | Inspect Dosing Tank | Tr Effluent P.H. | |
| | | | | | Dike | Forest | | | | | | | | | | | |
| | | | | | In./Acr | | Gal. | Hrs. | | | | | | | | | |
| 9.1 | | 9 | 11.5 | | | | | | | | X | | | | X | 6.99 | |
| | | | | | | | | | | | X | | | | X | | |
| | | | | | | | | | | | X | | | | X | 7.05 | |
| | | | | | | | | | | | X | | | | X | | |
| | | | | | | | | | | | X | | | | X | | |
| | | | | | | | | | | | X | | | | X | 7.04 | |
| | | | | | | | | | | | X | | | | X | | |
| | | | | | | | | | | | X | | | | X | 7.02 | |
| | | | | | | | | | | | X | | | | X | | |
| | | | | | | | | | | | X | | | | X | 6.94 | |
| | | | | | | | | | | | X | | | | X | | |
| | | | | | | | | | | | X | | | | X | | |
| | | | | | | | | | | | X | | | | X | 6.67 | |
| | | | | | .11 | | | | | | X | | | | X | | |
| | | | | | .11 | | | | | | X | | | | X | 6.60 | 7.15 |
| | | | | | .11 | | | | | | X | | | | X | | |
| | | | | | .11 | | | | | | X | | | | X | 7.02 | 7.36 |
| | | | | | .11 | | | | | | X | | | | X | | |
| | | | | | .11 | | | | | | X | | | | X | | |
| | | | | | .11 | | | | | | X | | | | X | 6.99 | 7.20 |
| | | | | | .11 | | | | | | X | | | | X | | |
| | | | | | .11 | | | | | | X | | | | X | 7.03 | 7.31 |
| | | | | | .11 | | | | | | X | | | | X | | |
| | | | | | .11 | | | | | | X | | | | X | 7.05 | 7.28 |
| | | | | | .11 | | | | | | X | | | | X | | |
| | | | | | .11 | | | | | | X | | | | X | | |
| | | | | | .11 | | | | | | X | | | | X | 6.95 | 7.25 |
| | | | | | .11 | | | | | | X | | | | X | | |
| | | | | | .11 | | | | | | X | | | | X | 6.91 | 7.36 |
| | | | 12 | | .41 | | | | | | X | | | | X | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | 1.87 | | | | | | | | | | | | TOTAL |
| | | | | | .11 | | | | | | | | | | | | DAILY MINIMUM |
| | | | | | .11 | | | | | | | | | | | | DAILY MAXIMUM |
| | | | | | .11 | | | | | | | | | | | | WEEKLY AVERAGE MAXIMUM |
| | | | | | .11 | | | | | | | | | | | | MONTHLY AVERAGE |
| | | | | | | | | | | | | | | | | | DAILY LIMITS |
| | | | | | | | | | | | | | | | | | WEEKLY LIMITS |
| | | | | | | | | | | | | | | | | | MONTHLY LIMITS |

Effluent P.H.

# WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: 541-419-2561 | From - Month & Year: May 2015
DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: June 2015
System Type: Dom. Sewage lagoons | Population Served: 2038 | County: Deschutes

**Operator Certification**

Collection sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 11836 I
Treatment sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 12242 I

| DATE | | INFLUENT | | | | | EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MGD / GPD | BOD Grab / Comp. X | | TSS Grab / Comp. X | | BOD Grab / Composite | | | TSS Grab X / Composite | | | NUTRIENTS Grab / Composite | | | | CHLORINE | | COLIFORM MPN / MF | | |
| Month | Day | Flow | Concentration | Loading | Concentration | Loading | Concentration | Removal | Loading | Concentration | Removal | Loading | Total Phosphorous | Total Kjeldahl Nitrogen | Ammonia Nitrogen | Nitrate Nitrogen | Used | Total Residual | Total | Fecal | E.coli |
| | | | mg/L | lbs. | mg/L | lbs. | mg/L | % | lbs. | mg/L | % | lbs. | mg/L | | | | lbs. | mg/L | CFU/100 ml | | |
| 5 | 1 | .185 | 424 | 654 | 110 | 169 | | | | | | | | | | | 3 | 1.0 | | | |
| | 2 | .186 | | | | | | | | | | | | | | | 18 | 1.4 | | | |
| | 3 | .189 | | | | | | | | | | | | | | | 6 | 1.6 | | | |
| | 4 | .186 | | | | | | | | | | | | | | | 3 | 1.2 | | | |
| | 5 | .180 | | | | | | | | | | | | | | | 3 | 1.5 | | | |
| | 6 | .184 | | | | | | | | | | | | | | | 3 | 1.0 | | | |
| | 7 | .189 | | | | | | | | | | | | | | | 6 | 1.1 | | | 0 |
| | 8 | .191 | 256 | 407 | 190 | 302 | | | | | | | | | | | 6 | 1.8 | | | |
| | 9 | .206 | | | | | | | | | | | | | | | 6 | 1.2 | | | |
| | 10 | .195 | | | | | | | | | | | | | | | 6 | 1.5 | | | |
| | 11 | .193 | | | | | | | | | | | | | | | 6 | 1.0 | | | |
| | 12 | .179 | | | | | | | | | | | | | | | 6 | 1.1 | | | |
| | 13 | .182 | | | | | | | | | | | | | | | 6 | 1.8 | | | |
| | 14 | .186 | | | | | | | | | | | | | | | 5 | 1.7 | | | 0 |
| | 15 | .182 | 249 | 377 | 89 | 135 | | | | | | | | | | | 6 | 1.5 | | | |
| | 16 | .186 | | | | | | | | | | | | | | | 18 | 1.2 | | | |
| | 17 | .186 | | | | | | | | | | | | | | | 18 | .8 | | | |
| | 18 | .186 | | | | | | | | | | | | | | | 3 | .10 | | | |
| | 19 | .185 | | | | | | | | | | | | | | | 3 | .15 | | | |
| | 20 | .196 | | | | | | | | | | | | | | | 7 | 1.1 | | | |
| | 21 | .191 | | | | | | | | | | | | | | | 6 | 1.7 | | | 0 |
| | 22 | .208 | 325 | 563 | 210 | 364 | | | | | | | | | | | 6 | 1.6 | | | |
| | 23 | .219 | | | | | | | | | | | | | | | 6 | 1.8 | | | |
| | 24 | .225 | | | | | | | | | | | | | | | 6 | 1.0 | | | |
| | 25 | .234 | | | | | | | | | | | | | | | 6 | 1.4 | | | |
| | 26 | .202 | | | | | | | | | | | | | | | 6 | 1.1 | | | |
| | 27 | .199 | | | | | | | | | | | | | | | 6 | 1.4 | | | |
| | 28 | .199 | | | | | | | | | | | | | | | 6 | 1.3 | | | 0 |
| | 29 | .204 | 329 | 559 | 201 | 341 | | | | | | | | | | | 6 | 1.2 | | | |
| | 30 | .206 | | | | | | | | | | | | | | | 6 | 1.4 | | | |
| | 31 | .210 | | | | | | | | | | | | | | | 6 | 1.5 | | | |
| TOTAL | | 5.85 | 1583 | 2560 | 800 | 1311 | | | | | | | | | | | 210 | 39.15 | | | |
| DAILY MIN. | | .179 | 249 | 377 | 89 | 135 | | | | | | | | | | | 3 | .8 | | | |
| DAILY MAX. | | .234 | 424 | 654 | 210 | 364 | | | | | | | | | | | 18 | 1.8 | | | |
| WKLY. AVG. MAX. | | .188 | 316 | 512 | 160 | 262 | | | | | | | | | | | 7 | 1.2 | | | |
| MTHLY. AVG. | | .188 | 316 | 512 | 160 | 262 | | | | | | | | | | | 7 | 1.2 | | GM | 1 |
| DAILY LIMITS | | | | | | | | | | | | | | | | | | | | | |
| WKLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |
| MTHLY. LIMITS | | | | | | | | | | | | | | | | | | | | GM | 126 |

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Douglas McIntosh
Authorized Signature

Date 6-15-15

Name (print) Douglas McIntosh

**Notes:**

**Mail Original To:** Oregon DEQ, Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

| LAGOON AND POLISHING POND | | | | | RECLAIMED WATER Outfall ____ | | SEWER SYS. BYPASS | | | MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION) | | | | | | Influent P.H. | LOG Regarding breakdowns, bypassing, odors, complaints, etc. | Effluent P.H. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary Depth | | Secondary Depth | Pond 3 | Perimeter Inspection | Quanity Irrigated Pike | Forest | Flow | Duration | Solids Transported to Other WWTF | Test Dosing Pumps/Alarms | Inspect Pump Screens | Check Pumps for Accurate Cycle | Inspect Monitoring Ports | Inspect & Maintain Dist. Machanisms | Inspect Dosing Tank | | | |
| | | | | | In./Acr | | Gal. | Hrs. | | | | | | | | | | |
| 9.1 | | 9 | 12 | | .11 | | | | | | X | | | | X | 7.00 | | 7.21 |
| | | | | | .11 | | | | | | X | | | | X | | | |
| | | | | | .11 | | | | | | X | | | | X | | | |
| | | | | | .11 | | | | | | X | | | | X | 7.02 | | 7.19 |
| | | | | | .11 | | | | | | X | | | | X | | | |
| | | | | | .11 | | | | | | X | | | | X | 7.08 | | 7.21 |
| | | | | | .11 | | | | | | X | | | | X | | | |
| | | | | | .11 | | | | | | X | | | | X | 7.00 | | 7.13 |
| | | | | | .11 | | | | | | X | | | | X | | | |
| | | | | | .11 | | | | | | X | | | | X | | | |
| | | | | | .11 | | | | | | X | | | | X | 6.98 | | 7.31 |
| | | | | | .11 | | | | | | X | | | | X | | | |
| | | | | | .11 | | | | | | X | | | | X | 7.03 | | 7.11 |
| | | | | | .11 | .08 | | | | | X | | | | X | | | |
| | | | | | .12 | .08 | | | | | X | | | | X | 7.29 | | 6.93 |
| | | | | | .13 | .11 | | | | | X | | | | X | | | |
| | | | | | .13 | .12 | | | | | X | | | | X | | | |
| | | | | | .13 | .11 | | | | | X | | | | X | 6.98 | | 6.9? |
| | | | | | .13 | .11 | | | | | X | | | | X | | | |
| | | | | | .16 | .12 | | | | | X | | | | X | 7.00 | | 7.04 |
| | | | | | .16 | .12 | | | | | X | | | | X | | | |
| | | | | | .16 | .12 | | | | | X | | | | X | 7.06 | | 7.08 |
| | | | | | .16 | .12 | | | | | X | | | | X | | | |
| | | | | | .16 | .12 | | | | | X | | | | X | | | |
| | | | | | .16 | .10 | | | | | X | | | | X | 6.99 | | 7.18 |
| | | | | | .16 | .10 | | | | | X | | | | X | | | |
| | | | | | .16 | .10 | | | | | X | | | | X | 6.87 | | 6.9? |
| | | | | | .16 | .09 | | | | | X | | | | X | | | |
| | | | | | .16 | .10 | | | | | X | | | | X | 7.03 | | 6.9? |
| | | | | | .16 | .10 | | | | | X | | | | X | | | |
| | | | 11.5 | | .16 | .11 | | | | | X | | | | X | | | |
| | | | | | 4.1 | 1.91 | | | | | | | | | | | TOTAL | |
| | | | | | .11 | .08 | | | | | | | | | | | DAILY MINIMUM | |
| | | | | | .16 | .12 | | | | | | | | | | | DAILY MAXIMUM | |
| | | | | | .13 | .10 | | | | | | | | | | | WEEKLY AVERAGE MAXIMUM | |
| | | | | | .13 | .10 | | | | | | | | | | | MONTHLY AVERAGE | |
| | | | | | | | | | | | | | | | | | DAILY LIMITS | |
| | | | | | | | | | | | | | | | | | WEEKLY LIMITS | |
| | | | | | | | | | | | | | | | | | MONTHLY LIMITS | |

# WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: 541-419-2561 | From - Month & Year: June 2015
DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: July 2014
System Type: Dom. Sewage lagoons | Population Served: 2038 | County: Deschutes

Collection sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 11836 I
Treatment sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 12242 I

Operator Certification

| DATE | | INFLUENT | | | | | EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MGD / GPD | BOD Grab / Comp. X | | TSS Grab / Comp. X | | BOD Grab / Composite | | | TSS Grab / Composite | | | NUTRIENTS Grab | | NUTRIENTS Composite | | CHLORINE | | COLIFORM MPN / MF | | |
| Month | Day | Flow | Concentration | Loading | Concentration | Loading | Concentration | Removal | Loading | Concentration | Removal | Loading | Total Phosphorous | Total Kjeldahl Nitrogen | Ammonia Nitrogen | Nitrate Nitrogen | Used | Total Residual | Total | Fecal | E.coli |
| | | | mg/L | lbs. | mg/L | lbs. | mg/L | % | lbs. | mg/L | % | lbs. | mg/L | | | | lbs. | mg/L | CFU/100 ml | | |
| 6 | 1 | .190 | | | | | | | | | | | | | | | 7.5 | 1.0 | | | |
| | 2 | .195 | | | | | | | | | | | | | | | 6 | 1.1 | | | |
| | 3 | .200 | | | | | | | | | | | | | | | 4 | 1.0 | | | |
| | 4 | .200 | | | | | | | | | | | | | | | 20 | 1.5 | | | |
| | 5 | .212 | 379 | 599 | 108 | 191 | | | | | | | | | | | 6 | 1.4 | | | 4.1 |
| | 6 | .214 | | | | | | | | | | | | | | | 7 | 1.2 | | | |
| | 7 | .238 | | | | | | | | | | | | | | | 9 | 1.7 | | | |
| | 8 | .208 | | | | | | | | | | | | | | | 6 | 2.1 | | | |
| | 9 | .217 | | | | | | | | | | | | | | | 6 | 5.0 | | | |
| | 10 | .220 | | | | | | | | | | | | | | | 6 | 3.8 | | | |
| | 11 | .222 | | | | | | | | | | | | | | | 6 | 2.6 | | | |
| | 12 | .235 | 346 | 678 | 165 | 323 | | | | | | | | | | | 6 | 1.9 | | | 0 |
| | 13 | .238 | | | | | | | | | | | | | | | 6 | 1.6 | | | |
| | 14 | .248 | | | | | | | | | | | | | | | 6 | 1.7 | | | |
| | 15 | .223 | | | | | | | | | | | | | | | 18 | 1.3 | | | |
| | 16 | .213 | | | | | | | | | | | | | | | 9 | 1.5 | | | |
| | 17 | .213 | | | | | | | | | | | | | | | 0 | 1.6 | | | |
| | 18 | .215 | | | | | | | | | | | | | | | 7 | 1.0 | | | |
| | 19 | .224 | 368 | 687 | 85 | 159 | | | | | | | | | | | 0 | 1.3 | | | 7.3 |
| | 20 | .219 | | | | | | | | | | | | | | | 6 | 1.6 | | | |
| | 21 | .219 | | | | | | | | | | | | | | | 15 | 1.4 | | | |
| | 22 | .212 | | | | | | | | | | | | | | | 3 | 1.7 | | | |
| | 23 | .211 | | | | | | | | | | | | | | | 7 | 1.4 | | | |
| | 24 | .211 | | | | | | | | | | | | | | | 6 | 1.5 | | | |
| | 25 | .221 | | | | | | | | | | | | | | | 6 | 1.6 | | | |
| | 26 | .214 | 351 | 626 | 133 | 237 | | | | | | | | | | | 6 | 1.4 | | | 11.0 |
| | 27 | .222 | | | | | | | | | | | | | | | 6 | 1.5 | | | |
| | 28 | .219 | | | | | | | | | | | | | | | 6 | 1.4 | | | |
| | 29 | .214 | | | | | | | | | | | | | | | 6 | 1.1 | | | |
| | 30 | .209 | | | | | | | | | | | | | | | 6 | 2.7 | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| TOTAL | | 6496 | 1404 | 2590 | 491 | 910 | | | | | | | | | | | 2025 | 51.2 | | | |
| DAILY MIN. | | .190 | 339 | 599 | 85 | 159 | | | | | | | | | | | 0 | 1.0 | | | |
| DAILY MAX. | | .248 | 368 | 678 | 165 | 323 | | | | | | | | | | | 20 | 5.0 | | | |
| WKLY. AVG. MAX. | | .216 | 351 | 647 | 122 | 227 | | | | | | | | | | | 6.75 | 1.7 | | | |
| MTHLY. AVG. | | .216 | 351 | 647 | 122 | 227 | | | | | | | | | | | 6.75 | 1.7 | | 6.1 | 4.25 |
| DAILY LIMITS | | | | | | | | | | | | | | | | | | | | | |
| WKLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |
| MTHLY. LIMITS | | | | | | | | | | | | | | | | | | | | 6.1 | 126 |

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Douglas McIntosh
Authorized Signature

Date 7-15-19

Name (print) Douglas McIntosh

**Notes:**

**Mail Original To:** Oregon DEQ, Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

| LAGOON AND POLISHING POND | | | | | RECLAIMED WATER Outfall ____ | | SEWER SYS. BYPASS | | | MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION) | | | | | | Influent P.H. | LOG Regarding breakdowns, bypassing, odors, complaints, etc. | Effluent P.H. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary Depth | | Secondary Depth | Pond 3 | Perimeter Inspection | Quanity Irrigated | Forest | Flow | Duration | Solids Transported to Other WWTF | Test Dosing Pumps/Alarms | Inspect Pump Screens | Check Pumps for Accurate Cycle | Inspect Monitoring Ports | Inspect & Maintain Dist. Mechanisms | Inspect Dosing Tank | | | |
| | | | | | D:Le In./Acr | | Gal. | Hrs. | | | | | | | | | | |
| 9.1 | | 9 | 11.5 | X | .17 | .09 | | | | | X | | | | X | 6.89 | | 7.65 |
| | | | | X | .17 | .11 | | | | | X | | | | X | | | |
| | | | | X | .17 | .11 | | | | | X | | | | X | 7.01 | | 7.51 |
| | | | | X | .17 | .09 | | | | | X | | | | X | | | |
| | | | | X | .17 | .08 | | | | | X | | | | X | 6.95 | | 7.49 |
| | | | | X | .17 | .08 | | | | | X | | | | X | | | |
| | | | | X | .17 | .08 | | | | | X | | | | X | | | |
| | | | | X | .17 | .09 | | | | | X | | | | X | 7.00 | | 7.36 |
| | | | | X | .17 | .09 | | | | | X | | | | X | | | |
| | | | | X | .18 | .09 | | | | | X | | | | X | 7.11 | | 7.20 |
| | | | | X | .19 | .11 | | | | | X | | | | X | | | |
| | | | | X | .19 | .13 | | | | | X | | | | X | 6.98 | | 7.21 |
| | | | | X | .19 | .13 | | | | | X | | | | X | | | |
| | | | | X | .19 | .13 | | | | | X | | | | X | | | |
| | | | | X | .19 | .11 | | | | | X | | | | X | 6.91 | | 7.38 |
| | | | | X | .17 | .11 | | | | | X | | | | X | | | |
| | | | | X | .19 | .11 | | | | | X | | | | X | 6.93 | | 7.3 |
| | | | | X | .19 | .11 | | | | | X | | | | X | | | |
| | | | | X | .19 | .11 | | | | | X | | | | X | 7.17 | | 7.36 |
| | | | | X | .19 | .11 | | | | | X | | | | X | | | |
| | | | | X | .19 | .10 | | | | | X | | | | X | | | |
| | | | | X | .19 | .10 | | | | | X | | | | X | 7.09 | | 7.19 |
| | | | | X | .19 | .10 | | | | | X | | | | X | | | |
| | | | | X | .12 | .06 | | | | | X | | | | X | 7.11 | | 7.15 |
| | | | | X | .17 | .11 | | | | | X | | | | X | | | |
| | | | | X | .19 | .16 | | | | | X | | | | X | 6.95 | | 7.19 |
| | | | | X | .19 | .16 | | | | | X | | | | X | | | |
| | | | | X | .19 | .16 | | | | | X | | | | X | | | |
| | | | V | X | .19 | .16 | | | | | X | | | | X | 6.64 | | 7.11 |
| V | | V | 9 | X | .19 | .16 | | | | | X | | | | X | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | 35.9 | 3.34 | | | | | | | | | | | TOTAL | |
| | | | | | .12 | .06 | | | | | | | | | | | DAILY MINIMUM | |
| | | | | | .19 | .16 | | | | | | | | | | | DAILY MAXIMUM | |
| | | | | | 1.2 | .11 | | | | | | | | | | | WEEKLY AVERAGE MAXIMUM | |
| | | | | | 1.2 | .11 | | | | | | | | | | | MONTHLY AVERAGE | |
| | | | | | | | | | | | | | | | | | DAILY LIMITS | |
| | | | | | | | | | | | | | | | | | WEEKLY LIMITS | |
| | | | | | | | | | | | | | | | | | MONTHLY LIMITS | |

# WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: 541-419-2561 | From - Month & Year: July 2015
DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: Aug 2015
Item Type: Dom. Sewage lagoons | Population Served: 2078 | County: Deschutes

Operator Certification

Collection sys. class: I | Principal operator name (print): Douglas McClintock | Certification No. & grade: 11836I
Treatment sys. class: I | Principal operator name (print): Douglas McClintock | Certification No. & grade: 12242I

| DATE | | INFLUENT | | | | | EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:* | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MGD / GPD | BOD Grab Concentration | BOD Comp. Loading | TSS Grab Concentration | TSS Comp. Loading | BOD Grab Concentration | BOD Composite Removal | BOD Composite Loading | TSS Grab Concentration | TSS Composite Removal | TSS Composite Loading | NUTRIENTS Grab Total Phosphorous | NUTRIENTS Grab Total Kjeldahl Nitrogen | NUTRIENTS Composite Ammonia Nitrogen | NUTRIENTS Composite Nitrate Nitrogen | CHLORINE Used | CHLORINE Total Residual | COLIFORM MPN/MF Total | COLIFORM MPN/MF Fecal | COLIFORM MPN/MF E.coli |
| Month | Day | Flow | Concentration | Loading | Concentration | Loading | Concentration | Removal | Loading | Concentration | Removal | Loading | Total Phosphorous | Total Kjeldahl Nitrogen | Ammonia Nitrogen | Nitrate Nitrogen | Used | Total Residual | Total | Fecal | E.coli |
| | | GPD | mg/L | lbs. | mg/L | lbs. | mg/L | % | lbs. | mg/L | % | lbs. | mg/L | | | | lbs. | mg/L | CFU/100 ml | | |
| 7 | 1 | .213 | | | | | | | | | | | | | | | 6 | 2.7 | | | |
| | 2 | .214 | | | | | | | | | | | | | | | 6 | 1.4 | | | |
| | 3 | .228 | 339 | 644 | 130 | 247 | | | | | | | | | | | 7 | 1.3 | | | 0 |
| | 4 | .205 | | | | | | | | | | | | | | | 8 | 1.4 | | | |
| | 5 | .226 | | | | | | | | | | | | | | | 6 | 1.5 | | | |
| | 6 | .222 | | | | | | | | | | | | | | | 6 | 1.1 | | | |
| | 7 | .224 | | | | | | | | | | | | | | | 6 | 1.3 | | | |
| | 8 | .222 | | | | | | | | | | | | | | | 4 | 1.4 | | | |
| | 9 | .234 | | | | | | | | | | | | | | | 11 | 1.6 | | | |
| | 10 | .240 | 351 | 702 | 176 | 352 | | | | | | | | | | | 6 | 1.3 | | | 0 |
| | 11 | .246 | | | | | | | | | | | | | | | 7 | 1.5 | | | |
| | 12 | .223 | | | | | | | | | | | | | | | 10 | 1.0 | | | |
| | 13 | .212 | | | | | | | | | | | | | | | 6 | 1.3 | | | |
| | 14 | .209 | | | | | | | | | | | | | | | 6 | .9 | | | |
| | 15 | .207 | | | | | | | | | | | | | | | 6 | 1.1 | | | |
| | 16 | .211 | | | | | | | | | | | | | | | 6 | 1.6 | | | |
| | 17 | .221 | 352 | 667 | 200 | 368 | | | | | | | | | | | 6 | 1.9 | | | 3.2 |
| | 18 | .228 | | | | | | | | | | | | | | | 7 | 1.3 | | | |
| | 19 | .226 | | | | | | | | | | | | | | | 6 | 1.5 | | | |
| | 20 | .224 | | | | | | | | | | | | | | | 6 | 1.4 | | | |
| | 21 | .222 | | | | | | | | | | | | | | | 8 | 1.1 | | | |
| | 22 | .219 | | | | | | | | | | | | | | | 7 | 1.2 | | | |
| | 23 | .220 | | | | | | | | | | | | | | | 7 | 1.5 | | | |
| | 24 | .224 | 366 | 683 | 188 | 351 | | | | | | | | | | | 6 | 1.4 | | | 0 |
| | 25 | .223 | | | | | | | | | | | | | | | 6 | 1.2 | | | |
| | 26 | .218 | | | | | | | | | | | | | | | 6 | 1.3 | | | |
| | 27 | .221 | | | | | | | | | | | | | | | 6 | 1.4 | | | |
| | 28 | .220 | | | | | | | | | | | | | | | 6 | 1.5 | | | |
| | 29 | .216 | | | | | | | | | | | | | | | 6 | 1.6 | | | |
| | 30 | .217 | | | | | | | | | | | | | | | 6 | 1.7 | | | |
| | 31 | .214 | 385 | 687 | 161 | 287 | | | | | | | | | | | 6 | 1.5 | | | 6.1 |
| TOTAL | | 6848 | 1803 | 3387 | 855 | 1498 | | | | | | | | | | | | | | | |
| DAILY MIN. | | .205 | 339 | 644 | 130 | 247 | | | | | | | | | | | | | | | |
| DAILY MAX. | | .246 | 385 | 702 | 200 | 368 | | | | | | | | | | | | | | | |
| WKLY. AVG. MAX. | | .220 | 360 | 676 | 171 | 297 | | | | | | | | | | | | | | | |
| MTHLY. AVG. | | .220 | 360 | 676 | 171 | 297 | | | | | | | | | | | | | | | |
| DAILY LIMITS | | | | | | | | | | | | | | | | | | | | GM | 1.8 |
| WKLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |
| MTHLY. LIMITS | | | | | | | | | | | | | | | | | | | | GM | 126 |

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Douglas McGlothlin

Authorized Signature

Date 7-6-15

Name (print) Douglas McGlothlin

**Notes:**

**Mail Original To:** Oregon DEQ, Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

| LAGOON AND POLISHING POND | | | | | RECLAIMED WATER Outfall ____ | | SEWER SYS. BYPASS | | | MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION) | | | | | | Effluent P.H. | LOG Regarding breakdowns, bypassing, odors, complaints, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary Depth | | Secondary Depth | Pond 3 | Perimeter Inspection | Quanity Irrigated | Forest | Flow | Duration | Solids Transported to Other WWTF | Test Dosing Pumps/Alarms | Inspect Pump Screens | Check Pumps for Accurate Cycle | Inspect Monitoring Ports | Inspect & Maintain Dist. Mechanisms | Inspect Dosing Tank | | |
| | | | | | Dike | | | | | | | | | | | | |
| | | | | | In./Acr | | Gal. | Hrs. | | | | | | | | | |
| 9.1 | | 9 | 9 | | .19 | .16 | | | | | | | | | | 6.95 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | 6.64 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .18 | .16 | | | | | | | | | | 6.91 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | 6.99 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | 7.00 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | 6.87 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | 6.89 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | 6.72 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | 6.81 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | 6 | |
| | | | | | .19 | .16 | | | | | | | | | | 6.79 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | 6.90 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | 6.69 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | 6.90 | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | | | .19 | .16 | | | | | | | | | | | |
| | | | 7 | | .19 | .16 | | | | | | | | | | 6.48 | |
| | | | | | 5.89 | | | | | | | | | | | | TOTAL |
| | | | | | .19 | .16 | | | | | | | | | | | DAILY MINIMUM |
| | | | | | .19 | .16 | | | | | | | | | | | DAILY MAXIMUM |
| | | | | | .19 | .16 | | | | | | | | | | | WEEKLY AVERAGE MAXIMUM |
| | | | | | .19 | .16 | | | | | | | | | | | MONTHLY AVERAGE |
| | | | | | | | | | | | | | | | | | DAILY LIMITS |
| | | | | | | | | | | | | | | | | | WEEKLY LIMITS |
| | | | | | | | | | | | | | | | | | MONTHLY LIMITS |

Effluent P.H.

7.31
7.11
7.61
7.52
7.21
7.18
7.70
7.9
7.40
7.37
7.20
7.13
7.20

# WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: 541-419-2561 | From - Month & Year: Aug 2015
DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: Sept 2015
System Type: Dom. Sewage lagoons | Population Served: 2038 | County: Deschutes

**Operator Certification**

Collection sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 11836 I
Treatment sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 12242 I

| DATE | | INFLUENT | | | | | EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MGD / GPD | BOD Grab / Comp. X | | TSS Grab / Comp. X | | BOD Grab / Composite | | | TSS Grab / Composite X | | | NUTRIENTS Grab | | Composite | | CHLORINE | | COLIFORM MPN / MF | | |
| Month | Day | Flow | Concentration | Loading | Concentration | Loading | Concentration | Removal | Loading | Concentration | Removal | Loading | Total Phosphorous | Total Kjeldahl Nitrogen | Ammonia Nitrogen | Nitrate Nitrogen | Used | Total Residual | Total | Fecal | E.coli |
| | | | mg/L | lbs. | mg/L | lbs. | mg/L | % | lbs. | mg/L | % | lbs. | mg/L | | | | lbs. | mg/L | CFU/100 ml | | |
| 8 | 1 | .214 | | | | | | | | | | | | | | | 2.5 | 1.7 | | | |
| | 2 | .220 | | | | | | | | | | | | | | | 9 | 1.4 | | | |
| | 3 | .208 | | | | | | | | | | | | | | | 11 | 1.3 | | | |
| | 4 | .211 | | | | | | | | | | | | | | | 7.5 | 1.9 | | | |
| | 5 | .210 | | | | | | | | | | | | | | | 11 | 1.6 | | | |
| | 6 | .210 | | | | | | | | | | | | | | | 5.6 | 1.4 | | | |
| | 7 | .220 | 327 | 599 | 245 | 449 | | | | | | | | | | | 4 | 1.4 | | | 11.0 |
| | 8 | .218 | | | | | | | | | | | | | | | 4 | 1.1 | | | |
| | 9 | .223 | | | | | | | | | | | | | | | 6 | 1.3 | | | |
| | 10 | .208 | | | | | | | | | | | | | | | 6 | 1.6 | | | |
| | 11 | .212 | | | | | | | | | | | | | | | 0 | 1.3 | | | |
| | 12 | .213 | | | | | | | | | | | | | | | 5 | .8 | | | |
| | 13 | .216 | | | | | | | | | | | | | | | 5 | 1.1 | | | |
| | 14 | .206 | 375 | 644 | 221 | 380 | | | | | | | | | | | 6 | 1.0 | | | 0 |
| | 15 | .213 | | | | | | | | | | | | | | | 7.5 | 1.3 | | | |
| | 16 | .210 | | | | | | | | | | | | | | | 11 | 1.5 | | | |
| | 17 | .209 | | | | | | | | | | | | | | | 2 | 1.0 | | | |
| | 18 | .205 | | | | | | | | | | | | | | | 6 | 1.7 | | | |
| | 19 | .208 | | | | | | | | | | | | | | | 6 | 1.6 | | | |
| | 20 | .211 | | | | | | | | | | | | | | | 4 | 2.3 | | | |
| | 21 | .216 | | | | | | | | | | | | | | | 4 | 4.1 | | | |
| | 22 | .216 | 367 | 661 | 211 | 380 | | | | | | | | | | | 9 | 3.2 | | | 5.2 |
| | 23 | .209 | | | | | | | | | | | | | | | 6 | 2.6 | | | |
| | 24 | .204 | | | | | | | | | | | | | | | 6 | 2.8 | | | |
| | 25 | .196 | | | | | | | | | | | | | | | 10 | 1.9 | | | |
| | 26 | .192 | | | | | | | | | | | | | | | 10 | 1.6 | | | |
| | 27 | .201 | | | | | | | | | | | | | | | 6 | 1.8 | | | |
| | 28 | .203 | 416 | 704 | 201 | 340 | | | | | | | | | | | 6 | 1.3 | | | 3.1 |
| | 29 | .209 | | | | | | | | | | | | | | | 6 | 1.6 | | | |
| | 30 | .217 | | | | | | | | | | | | | | | 6 | 2.1 | | | |
| | 31 | .201 | | | | | | | | | | | | | | | 6 | 1.8 | | | |
| TOTAL | | 6509 | 1485 | 2608 | 878 | 1549 | | | | | | | | | | | | | | | |
| DAILY MIN. | | .192 | 327 | 599 | 201 | 340 | | | | | | | | | | | | | | | |
| DAILY MAX. | | .220 | 416 | 704 | 245 | 449 | | | | | | | | | | | | | | | |
| WKLY. AVG. MAX. | | .210 | 371 | 652 | 219 | 387 | | | | | | | | | | | | | | | |
| MTHLY. AVG. | | .210 | 371 | 652 | 219 | 387 | | | | | | | | | | | | | | GM | 3.6 |
| DAILY LIMITS | | | | | | | | | | | | | | | | | | | | | |
| WKLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |
| MTHLY. LIMITS | | | | | | | | | | | | | | | | | | | | GM | 126 |

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Doug McIntosh
Authorized Signature

Date 9-8-15

Douglas McIntosh
Name (print)

**Notes:**

**Mail Original To:** Oregon DEQ, Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

| LAGOON AND POLISHING POND | | | | | RECLAIMED WATER Outfall ____ | | SEWER SYS. BYPASS | | | MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary Depth | | Secondary Depth | Pond 3 | Perimeter Inspection | Quanity Irrigated | Forrest | Flow | Duration | Solids Transported to Other WWTF | Test Dosing Pumps/Alarms | Inspect Pump Screens | Check Pumps for Accurate Cycle | Inspect Monitoring Ports | Inspect & Maintain Dist. Mechanisms | Inspect Dosing Tank | Effluent P.H. | LOG Regarding breakdowns, bypassing, odors, complaints, etc. | Effluent P.H. |
| | | | | | In./Acr | | Gal. | Hrs. | | | | | | | | | | |
| 9.1 | | 9 | 7 | X | .28 | .16 | | | | | X | | | | X | | | |
| ( | | ( | ( | X | .28 | .16 | | | | | X | | | | X | | | |
| | | | | X | .28 | .16 | | | | | X | | | | X | 6.88 | | 6.61 |
| | | | | X | .28 | .16 | | | | | X | | | | X | | | |
| | | | | X | .28 | .16 | | | | | X | | | | X | 6.71 | | 6.60 |
| | | | | X | .28 | .12 | | | | | X | | | | X | | | |
| | | | | X | .28 | .12 | | | | | X | | | | X | 6.84 | | 6.73 |
| | | | | X | .28 | .12 | | | | | X | | | | X | | | |
| | | | | X | .28 | .12 | | | | | X | | | | X | | | |
| | | | | X | .28 | .12 | | | | | X | | | | X | 6.93 | | 6.81 |
| | | | | X | .25 | .12 | | | | | X | | | | X | | | |
| | | | | X | .25 | .12 | | | | | X | | | | X | 6.83 | | 6.69 |
| | | | | X | .25 | .12 | | | | | X | | | | X | | | |
| | | | | X | .25 | .12 | | | | | X | | | | X | 6.98 | | 6.93 |
| | | | | X | .25 | .12 | | | | | X | | | | X | | | |
| | | | | X | .25 | .12 | | | | | X | | | | X | | | |
| | | | | X | .25 | .12 | | | | | X | | | | X | 7.00 | | 6.91 |
| | | | | X | .25 | .13 | | | | | X | | | | X | | | |
| | | | | X | .25 | .13 | | | | | X | | | | X | 6.91 | | 6.85 |
| | | | | X | .25 | .13 | | | | | X | | | | X | ( | | |
| | | | | X | .25 | .13 | | | | | X | | | | X | 6.80 | | 6.97 |
| | | | | X | .25 | .13 | | | | | X | | | | X | | | |
| | | | | X | .25 | .13 | | | | | X | | | | X | | | |
| | | | | X | .006 | .13 | | | | | X | | | | X | 7.11 | | 6.97 |
| | | | | X | 0 | 0 | | | | | X | | | | X | | | |
| | | | | X | .24 | 12 | | | | | X | | | | X | 7.06 | | 7.01 |
| | | | | X | .24 | .12 | | | | | X | | | | X | | | |
| | | | | X | .24 | .12 | | | | | X | | | | X | 6.99 | | 7.08 |
| | | | | X | .24 | .12 | | | | | X | | | | X | | | |
| | | | | X | .24 | .12 | | | | | X | | | | X | | | |
| V | | V | 6 | X | .24 | .12 | | | | | X | | | | X | 7.02 | | 6.89 |
| | | | | | 7.496 | 3.87 | | | | | | | | | | | TOTAL | |
| | | | | | .28 | 0 | | | | | | | | | | | DAILY MINIMUM | |
| | | | | | .24 | .16 | | | | | | | | | | | DAILY MAXIMUM | |
| | | | | | .24 | .12 | | | | | | | | | | | WEEKLY AVERAGE MAXIMUM | |
| | | | | | .24 | .12 | | | | | | | | | | | MONTHLY AVERAGE | |
| | | | | | | | | | | | | | | | | | DAILY LIMITS | |
| | | | | | | | | | | | | | | | | | WEEKLY LIMITS | |
| | | | | | | | | | | | | | | | | | MONTHLY LIMITS | |

# WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: 541-419-2561 | From - Month & Year: Sept 2015
DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: Oct 2015
System Type: Dom. Sewage lagoons | Population Served: 2038 | County: Deschutes

**Operator Certification**

Collection sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 11836 I
Treatment sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 12242 I

| DATE | | INFLUENT | | | | | EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MGD / GPD | BOD Grab / Comp. X | | TSS Grab / Comp. X | | BOD Grab X / Composite | | | TSS Grab / Composite | | | NUTRIENTS Grab / Composite | | | | CHLORINE | | COLIFORM MPN / MF | MPN / MF | MPN / MF |
| Month | Day | Flow | Concentration | Loading | Concentration | Loading | Concentration | Removal | Loading | Concentration | Removal | Loading | Total Phosphorous | Total Kjeldahl Nitrogen | Ammonia Nitrogen | Nitrate Nitrogen | Used | Total Residual | Total | Fecal | E.coli |
| | | | mg/L | lbs. | mg/L | lbs. | mg/L | % | lbs. | mg/L | % | lbs. | mg/L | | | | lbs. | mg/L | CFU/100 ml | | |
| 9 | 1 | .195 | | | | | | | | | | | | | | | 5 | 3.5 | | | |
| | 2 | .197 | | | | | | | | | | | | | | | 7.5 | 2.6 | | | |
| | 3 | .196 | | | | | | | | | | | | | | | 6 | 2.8 | | | 0 |
| | 4 | .196 | 397 | 648 | 202 | 330 | | | | | | | | | | | 3 | 2.6 | | | |
| | 5 | .197 | | | | | | | | | | | | | | | 6 | 3.1 | | | |
| | 6 | .207 | | | | | | | | | | | | | | | 6 | 2.7 | | | |
| | 7 | .209 | | | | | | | | | | | | | | | 6 | 4.0 | | | |
| | 8 | .219 | | | | | | | | | | | | | | | 6 | 2.3 | | | |
| | 9 | .193 | | | | | | | | | | | | | | | 6 | 2.0 | | | |
| | 10 | .206 | | | | | | | | | | | | | | | 6 | 2.3 | | | 0 |
| | 11 | .226 | 375 | 706 | 199 | 375 | | | | | | | | | | | 10 | 3.4 | | | |
| | 12 | .226 | | | | | | | | | | | | | | | 5 | 3.2 | | | |
| | 13 | .225 | | | | | | | | | | | | | | | 5 | 3.1 | | | |
| | 14 | .210 | | | | | | | | | | | | | | | 5 | 1.9 | | | |
| | 15 | .205 | | | | | | | | | | | | | | | 6 | 2.1 | | | |
| | 16 | .205 | | | | | | | | | | | | | | | 6 | 2.0 | | | |
| | 17 | .206 | | | | | | | | | | | | | | | 6 | 2.2 | | | 0 |
| | 18 | .201 | 338 | 566 | 189 | 316 | | | | | | | | | | | 3 | 1.5 | | | |
| | 19 | .203 | | | | | | | | | | | | | | | 5 | 3.3 | | | |
| | 20 | .206 | | | | | | | | | | | | | | | 5 | 2.1 | | | |
| | 21 | .194 | | | | | | | | | | | | | | | 6 | 2.3 | | | |
| | 22 | .196 | | | | | | | | | | | | | | | 6 | 2.7 | | | |
| | 23 | .195 | | | | | | | | | | | | | | | 3 | 2.4 | | | |
| | 24 | .196 | | | | | | | | | | | | | | | 5 | 1.4 | | | 0 |
| | 25 | .201 | 341 | 571 | 191 | 320 | | | | | | | | | | | 5 | 1.8 | | | |
| | 26 | .203 | | | | | | | | | | | | | | | 6 | 1.3 | | | |
| | 27 | .200 | | | | | | | | | | | | | | | 6 | 1.5 | | | |
| | 28 | .192 | | | | | | | | | | | | | | | 6 | 1.1 | | | |
| | 29 | .189 | | | | | | | | | | | | | | | 6 | 1.4 | | | |
| | 30 | .186 | | | | | | | | | | | | | | | 6 | 1.3 | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| TOTAL | | 6082 | 1451 | 2491 | 781 | 1341 | | | | | | | | | | | 168.5 | [illegible] | | | |
| DAILY MIN. | | .186 | 338 | 566 | 189 | 316 | | | | | | | | | | | 3 | 1.1 | | | |
| DAILY MAX. | | .226 | 397 | 706 | 202 | 375 | | | | | | | | | | | 10 | 4.0 | | | |
| WKLY. AVG. MAX. | | .202 | 362 | 622 | 195 | 335 | | | | | | | | | | | 6 | 2.3 | | | |
| MTHLY. AVG. | | .202 | 362 | 622 | 195 | 335 | | | | | | | | | | | 6 | 2.3 | | GM | 1 |
| DAILY LIMITS | | | | | | | | | | | | | | | | | | | | | |
| WKLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |
| MTHLY. LIMITS | | | | | | | | | | | | | | | | | | | | GM | 126 |

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Douglas McIntosh — Authorized Signature

Date: 10-12-15

Name (print) Douglas McIntosh

**Notes:** 1000 lbs of screenings to Knott landfill

**Mail Original To:** Oregon DEQ, Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

| LAGOON AND POLISHING POND | | | | | RECLAIMED WATER Outfall ____ | | SEWER SYS. BYPASS | | | MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary Depth | | Secondary Depth | Pond 3 | Perimeter Inspection | Quanity Irrigated Dike | Forest | Flow | Duration | Solids Transported to Other WWTF | Test Dosing Pumps/Alarms | Inspect Pump Screens Bar | Check Pumps for Accurate Cycle | Inspect Monitoring Ports | Inspect & Maintain Dist. Mechanisms | Inspect Dosing Tank | Influent P.H. | LOG Regarding breakdowns, bypassing, odors, complaints, etc. | Effluent P.H. |
| | | | | | In /Acr | | Gal. | Hrs. | | | | | | | | | | |
| 9.1 | | 9 | 6 | X | .25 | .12 | | | | | X | | | | X | | | |
| | | | | X | .25 | .12 | | | | | X | | | | X | 7.05 | | 7.01 |
| | | | | X | .25 | .12 | | | | | X | | | | X | | | |
| | | | | X | 0 | 0 | | | | | X | | | | X | 7.11 | | 6.71 |
| | | | | X | .08 | .06 | | | | | X | | | | X | | | |
| | | | | X | .24 | .12 | | | | | X | | | | X | | | |
| | | | | X | .24 | .12 | | | | | X | | | | X | 7.09 | | 7.04 |
| | | | | X | .24 | .12 | | | | | X | | | | X | | | |
| | | | | X | .12 | .10 | | | | | X | | | | X | 7.17 | | 7.00 |
| | | | | X | .12 | .12 | | | | | X | | | | X | | | |
| | | | | X | .12 | .12 | | | | | X | | | | X | 7.26 | | 6 |
| | | | | X | .12 | .12 | | | | | X | | | | X | | | |
| | | | | X | .12 | .10 | | | | | X | | | | X | | | |
| | | | | X | .12 | .08 | | | | | X | | | | X | 7.14 | | 7.83 |
| | | | | X | .14 | .09 | | | | | X | | | | X | | | |
| | | | | X | .14 | .10 | | | | | X | | | | X | 7.21 | | 7.28 |
| | | | | X | .14 | .11 | | | | | X | | | | X | | | |
| | | | | X | .14 | .08 | | | | | X | | | | X | 7.13 | | 7.59 |
| | | | | X | .14 | .08 | | | | | X | | | | X | | | |
| | | | | X | .14 | .07 | | | | | X | | | | X | | | |
| | | | | X | .12 | .07 | | | | | X | | | | X | 7.02 | | 7.4 |
| | | | | X | .12 | .07 | | | | | X | | | | X | | | |
| | | | | X | .12 | .07 | | | | | X | | | | X | 6.83 | | 7.2 |
| | | | | X | .12 | .07 | | | | | X | | | | X | | | |
| | | | | X | .12 | .07 | | | | | X | | | | X | 6.88 | | 7.11 |
| | | | | X | .12 | .07 | | | | | X | | | | X | | | |
| | | | | X | .12 | .07 | | | | | X | | | | X | | | |
| | | | | X | .12 | .07 | | | | | X | | | | X | 6.97 | | 7.0 |
| | | | | X | .12 | .06 | | | | | X | | | | X | | | |
| V | | V | 5.5 | X | .12 | .06 | | | | | X | | | | V | 7.10 | | 7.1 |
| | | | | | | | | | | | | | | | | | | |
| | | | | | 4.19 | 2.96 | | | | | | | | | | | TOTAL | |
| | | | | | 0 | 0 | | | | | | | | | | | DAILY MINIMUM | |
| | | | | | .25 | .12 | | | | | | | | | | | DAILY MAXIMUM | |
| | | | | | .13 | .09 | | | | | | | | | | | WEEKLY AVERAGE MAXIMUM | |
| | | | | | .13 | .09 | | | | | | | | | | | MONTHLY AVERAGE | |
| | | | | | | | | | | | | | | | | | DAILY LIMITS | |
| | | | | | | | | | | | | | | | | | WEEKLY LIMITS | |
| | | | | | | | | | | | | | | | | | MONTHLY LIMITS | |

# WPCF Discharge Monitoring Report - Oregon Department of Environmental Quality

Facility Name: City of Sisters | Phone Number: 541-419-2561 | From - Month & Year: OCT 2015
DEQ Permit No.: 101799 | DEQ File No./Facility ID: 81850 | To - Month & Year: Nov 2015
System Type: Dom. Sewage lagoons | Population Served: 2038 | County: Deschutes

**Operator Certification**

Collection sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 11836 I
Treatment sys. class: I | Principal operator name (print): Douglas McIntosh | Certification No. & grade: 12242 I

| DATE | | INFLUENT | | | | | EFFLUENT - *Identify outfall number (e.g. 001, 002) or sampling location:* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BOD | | TSS | | BOD | | | TSS | | | NUTRIENTS | | | | CHLORINE | | COLIFORM | | |
| | | | Grab | Comp. X | Grab | Comp. X | Grab X | Composite | | Grab X | Composite | | Grab | | Composite | | | | MPN / MF | MPN / MF | MPN / MF |
| Month | Day | Flow (MGD / GPD) | Concentration | Loading | Concentration | Loading | Concentration | Removal | Loading | Concentration | Removal | Loading | Total Phosphorous | Total Kjeldahl Nitrogen | Ammonia Nitrogen | Nitrate Nitrogen | Used | Total Residual | Total | Fecal | E.coli |
| | | | mg/L | lbs. | mg/L | lbs. | mg/L | % | lbs. | mg/L | % | lbs. | mg/L | | | | lbs. | mg/L | CFU/100 ml | | |
| 10 | 1 | .192 | | | | | | | | | | | | | | | 6 | 1.4 | | | 0 |
| | 2 | .185 | 338 | 521 | 210 | 324 | | | | | | | | | | | 6 | 1.3 | | | |
| | 3 | .191 | | | | | | | | | | | | | | | 6 | 1.8 | | | |
| | 4 | .204 | | | | | | | | | | | | | | | 6 | 1.9 | | | |
| | 5 | .187 | | | | | | | | | | | | | | | 0 | 1.7 | | | |
| | 6 | .175 | | | | | | | | | | | | | | | 6 | 1.8 | | | |
| | 7 | .180 | | | | | | | | | | | | | | | 3 | 1.6 | | | |
| | 8 | .196 | | | | | | | | | | | | | | | 9 | 1.8 | | | 0 |
| | 9 | .198 | 305 | 504 | 195 | 322 | | | | | | | | | | | 3 | 1.6 | | | |
| | 10 | .205 | | | | | | | | | | | | | | | 6 | 1.7 | | | |
| | 11 | .200 | | | | | | | | | | | | | | | 6 | 1.3 | | | |
| | 12 | .193 | | | | | | | | | | | | | | | | | | | |
| | 13 | .176 | | | | | | | | | | | | | | | | | | | |
| | 14 | .181 | | | | | | | | | | | | | | | | | | | |
| | 15 | .181 | | | | | | | | | | | | | | | | | | | |
| | 16 | .180 | 320 | 480 | 189 | 284 | | | | | | | | | | | | | | | |
| | 17 | .192 | | | | | | | | | | | | | | | | | | | |
| | 18 | .180 | | | | | | | | | | | | | | | | | | | |
| | 19 | .177 | | | | | | | | | | | | | | | | | | | |
| | 20 | .168 | | | | | | | | | | | | | | | | | | | |
| | 21 | .179 | | | | | | | | | | | | | | | | | | | |
| | 22 | .174 | | | | | | | | | | | | | | | | | | | |
| | 23 | .193 | 210 | 338 | 141 | 227 | | | | | | | | | | | | | | | |
| | 24 | .183 | | | | | | | | | | | | | | | | | | | |
| | 25 | .188 | | | | | | | | | | | | | | | | | | | |
| | 26 | .180 | | | | | | | | | | | | | | | | | | | |
| | 27 | .173 | | | | | | | | | | | | | | | | | | | |
| | 28 | .177 | | | | | | | | | | | | | | | | | | | |
| | 29 | .179 | | | | | | | | | | | | | | | | | | | |
| | 30 | .173 | 349 | 504 | 140 | 202 | | | | | | | | | | | | | | | |
| | 31 | .186 | | | | | | | | | | | | | | | | | | | |
| TOTAL | | 5.726 | 1522 | 2347 | 875 | 1359 | | | | | | | | | | | 57 | 17.9 | | | |
| DAILY MIN. | | .173 | 210 | 338 | 140 | 202 | | | | | | | | | | | 0 | 1.3 | | | |
| DAILY MAX. | | .205 | 349 | 521 | 210 | 324 | | | | | | | | | | | 9 | 1.9 | | | |
| WKLY. AVG. MAX. | | .184 | 304 | 469 | 175 | 272 | | | | | | | | | | | 5 | 1.6 | | | |
| MTHLY. AVG. | | .184 | 304 | 469 | 175 | 272 | | | | | | | | | | | 5 | 1.6 | | GM | 1 |
| DAILY LIMITS | | | | | | | | | | | | | | | | | | | | | |
| WKLY. LIMITS | | | | | | | | | | | | | | | | | | | | | |
| MTHLY. LIMITS | | | | | | | | | | | | | | | | | | | | GM | 126 |

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND, THAT TO THE BEST OF MY KNOWLEDGE SUCH INFORMATION IS TRUE, COMPLETE AND ACCURATE.

X Doug McIntosh
Authorized Signature

Date 11-9-15

Name (print) Douglas McIntosh

**Notes:**

**Mail Original To:** Oregon DEQ, Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

| LAGOON AND POLISHING POND | | | | | RECLAIMED WATER Outfall ____ | | SEWER SYS. BYPASS | | | MAINTENANCE ACTIVITIES (CHECK OFF ACTIVITY UPON COMPLETION) | | | | | | | LOG Regarding breakdowns, bypassing, odors, complaints, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary Depth | | Secondary Depth | Pond 3 | Perimeter Inspection | Quanity Irrigated | Forrest | Flow | Duration | Solids Transported to Other WWTF | Test Dosing Pumps/Alarms | Inspect Rotary Screens | Check Pumps for Accurate Cycle | Inspect Monitoring Ports | Inspect & Maintain Dist. Mechanisms | Inspect Dosing Tank | Influent P.H. | |
| | | | | | In./Acr | | Gal. | Hrs. | | | | | | | | | |
| 9.1 | | 9 | 6 | ✓ | .12 | | | | | | X | | | | X | | |
| | | | | ✓ | .17 | | | | | | X | | | | X | 7.01 | |
| | | | | X | .12 | | | | | | X | | | | X | | |
| | | | | X | .12 | | | | | | X | | | | X | | |
| | | | | X | .12 | | | | | | X | | | | X | 6.99 | |
| | | | | X | .12 | | | | | | X | | | | X | | |
| | | | | X | .06 | | | | | | X | | | | X | 6.91 | |
| | | | | X | .12 | | | | | | X | | | | X | | |
| | | | | X | .12 | | | | | | X | | | | X | 6.93 | |
| | | | | X | .12 | | | | | | X | | | | X | | |
| | | | | X | .12 | | | | | | X | | | | X | | |
| | | | | X | 1 | | | | | | X | | | | | 7.11 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.16 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.08 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 7.09 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.25 | |
| | | | | X | | | | | | | X | | | | | 6.39 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.45 | |
| | | | | X | | | | | | | X | | | | | 7.00 | |
| | | | | X | | | | | | | X | | | | | | |
| | | | | X | | | | | | | X | | | | | 6.74 | |
| ✓ | | ✓ | 6.5 | X | | | | | | | | | | | | | |
| | | | | | 1.26 | | | | | | | | | | | | TOTAL |
| | | | | | .06 | | | | | | | | | | | | DAILY MINIMUM |
| | | | | | .12 | | | | | | | | | | | | DAILY MAXIMUM |
| | | | | | .11 | | | | | | | | | | | | WEEKLY AVERAGE MAXIMUM |
| | | | | | .4 | | | | | | | | | | | | MONTHLY AVERAGE |
| | | | | | | | | | | | | | | | | | DAILY LIMITS |
| | | | | | | | | | | | | | | | | | WEEKLY LIMITS |
| | | | | | | | | | | | | | | | | | MONTHLY LIMITS |

Effluent P.H.
7.11
6.98
7.07
7.19
7.1

# WATER POLLUTION CONTROL FACILITIES PERMIT

Department of Environmental Quality
475 NE Bellevue Dr. Suite 110, Bend, OR 97701
Telephone: 541-388-6146
(541) 388-6146
Issued pursuant to ORS 468B.050

**ISSUED TO:**

City of Sisters
P.O. Box 39
Sisters, OR 97759

**SOURCES COVERED BY THIS PERMIT:**

| Type of Waste | Outfall Number | Method of Disposal |
|---|---|---|
| Domestic Sewage | 001 | Recycled Water Reuse |

**SYSTEM TYPE AND LOCATION:**

Domestic Sewage Lagoons
912 S. Locust Street
T15S, R10 EWM, S09; TL 1002
Longitude -121.538480;
Latitude 44.280506
Sisters, Oregon

**RIVER BASIN INFORMATION:**

Basin: Deschutes
Sub-Basin: Upper Deschutes
LLID: 1213357444600-20.47-N
County: Deschutes
Nearest surface stream which would receive waste if it were to discharge: Whychus Creek formally called Squaw Creek

**Treatment System Class: I**
**Collection System Class: II**

Issued in response to Application No. 968002 received December 17, 2010.

This permit is issued based on the land use findings in the permit record.

Don Butcher, Water Quality Permit Manager
Eastern Region

January 22, 2016
Date

## PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:



All direct a discharge to surface waters is prohibited.

## SCHEDULE A

Waste Disposal Limitations

1. The permittee is authorized to construct, operate, and maintain wastewater collection, treatment and disposal systems to serve the City of Sisters in accordance with the conditions set forth in this permit.

2. The wastewater collections, treatment and land application system must not be hydraulically or organically loaded in excess of their respective, DEQ approved design capacities. At full build-out, however, the annual average daily influent flow must not exceed 0.38 MGD.

3. All wastewater treatment and disposal systems must be operated in compliance with the following conditions:

   a. No discharge to state waters is permitted. All wastewater must be stored and treated for disposal by land application following sound irrigation practices.

   b. Recycled Wastewater
      i. Prior to land application of the recycled water, it must receive at least Class D treatment as defined in OAR 340-055. Class D recycled water must not exceed a 30-day log mean of 126 E. coli organisms per 100 milliliters and 406 E. coli organisms per 100 milliliters in any single sample. Class C recycled water must not exceed a 7 day median of 23 organisms/100 milliliters and no two consecutive samples must exceed 240 organisms/100 milliliters.
      ii. Irrigation must conform to a Recycled Water Use Plan approved by DEQ and meet the required setbacks as defined in OAR 340-055.
      iii. The City of Sisters must restrict public access to the reuse site(s) for the protection of public health.
      iv. Treated effluent may only be irrigated on land between April 1 through October 31 for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices unless otherwise approved in writing by DEQ.
      v. Recycled water equipment must be operated so as to prevent:
         (A) Prolonged ponding of treated recycled water on the ground surface;
         (B) Surface runoff or subsurface drainage through drainage tile;
         (C) The creation of odors, fly and mosquito breeding or other nuisance conditions;
         (D) The overloading of land with nutrients, organics, or other pollutant parameters; and
         (E) Impairment of existing or potential beneficial uses of groundwater.
         (F) Until otherwise approved in writing by the Department via a revised reclaimed water use plan, treated effluent must only be reused on Class D beneficial uses.

4. The storage lagoon must be lowered sufficiently by the end of the irrigation season to ensure maximum practicable storage capacity during the non-irrigation months.

5. The permittee must, during all times of treatment and disposal, provide personnel whose primary responsibilities are to assure the continuous performance of the disposal system in accordance with the conditions of this permit.

6. No activities must be conducted that could cause an adverse impact on existing or potential beneficial uses of groundwater. All wastewater and process related residuals must be managed and disposed in a manner that will prevent a violation of the Groundwater Quality Protection Rules (OAR 340-040).

## SCHEDULE B

1. System Monitoring Requirements

The permittee must monitor the operation and efficiency of all treatment and disposal facilities. Sampling and measurements taken as required herein must be representative of the nature of the wastewater, and must be taken under normal operating conditions. Unless otherwise agreed to in writing by the Department of Environmental Quality, data collected, and submitted must include but not necessarily be limited to the following parameters and minimum frequencies:

**a. Influent Monitoring and Reporting Requirements**

**Table B 1: Influent Monitoring**

| Item or Parameter | Time Period | Minimum Frequency | Sample Type/Required Action | Report |
|---|---|---|---|---|
| Total Flow (MGD) | Year-round | Daily | Measurement | Daily totals<br>Monthly maximum<br>Monthly minimum<br>Monthly average<br>Monthly total |
| Flow Meter Verification | Year-round | Annually | Verification | Completed or not completed<br>(Pass, Fail) |
| $BOD_5$ and TSS (mg/L) | Year-round | Weekly | Composite | Monthly averages<br>Weekly values |
| pH (S.U.) | Year-round | 3/week | Grab | Monthly maximum<br>Monthly minimum<br>Monthly average |

**b. Recycled Water Monitoring Requirements:**

**Table B2: Recycled Water Monitoring**

| Item or Parameter | Minimum Frequency | Sample Type/Required Action |
|---|---|---|
| Total Flow (MGD) or Quantity Irrigated (in/ac) | Daily | Measurement |
| Flow Meter Calibration | Annually | Verification |
| Chlorine, Total Residual (mg/L) | Daily | Grab |
| pH | 3/Week | Grab |
| E. coli Bacteria | 1/Week | Grab* |
| Total Coliform | 1/Week | Grab* |
| Total P and Total N | Annually | Grab |
| Annual Irigation | | |

*The permittee is only required to sample for either E. coli or total coliform, but not both for an individual use. If the permittee is irrigating on crops requiring only Class D quality effluent, E. coli must be monitored. If the permittee irrigates/reuses effluent for Class C uses, total coliform must be monitored.

2. Reporting Procedures

a. Monitoring results must be reported on DEQ approved forms. Reports must be submitted to DEQ's Eastern Region – Bend office by the 15th day of the following month.

b. State monitoring reports must identify the name, certificate classification and grade level of each principal operator designated by the permittee as responsible for supervising the wastewater collection and treatment systems during the reporting period. Monitoring reports must also identify each system classification as found on page one of this permit.

c. Monitoring reports must also include a record of the quantity and method of use of all sludge removed from the treatment facility and a record of all applicable equipment breakdowns and bypassing.

d. The laboratory used by the permittee to analyze samples must have a quality assurance/quality control (QA/QC) program to verify the accuracy of sample analysis. If QA/QC requirements are not met for any analysis, the results must be included in the report, but not used in calculations required by this permit. When possible, the permittee must re-sample in a timely manner for parameters failing the QA/QC requirements, analyze the samples, and report the results.

e. By no later than January 15 of each year, the permittee must submit to DEQ an annual report describing the effectiveness of the recycle water system to comply with the approved recycle water use plan, the rules of Division 55, and the limitations and conditions of this permit applicable to reuse of recycled water. The review is to provide a summary of land application conducted at each site which is adequate to demonstrate that reuse water was applied agronomically and/or hydraulic loading rates, and that required site management practices were followed.

## SCHEDULE C

**Compliance Conditions and Schedules**

a. Within 180 days the permittee must update their recycled water use plan for DEQ approval. A recycled water use plan must describe how the wastewater treatment system owner will comply with OAR 340-055 (refer to OAR 340-055-0025).

b. The permittee is expected to meet the compliance date that have been established in this schedule. Either prior to or no later than 14 days following any lapsed compliance date, the permittee shall submit to the Department a notice of compliance or noncompliance with the established schedule. The Director or his authorized representative may revise a schedule of compliance if he determines good and valid cause resulting from events over which the permittee has little or no control.

## SCHEDULE D

Special Conditions

1. Prior to constructing or modifying any wastewater control facilities, detailed plans and specifications shall be approved in writing by DEQ. After approval of the plans, all construction shall be in strict conformance with the plans unless otherwise approved in writing by DEQ.

2. Within 6 months of such time as the sewage lagoons require removal of accumulated biosolids, the permittee shall submit a biosolids management plan that complies with the Department's biosolids management regulations as established in OAR 340-50.

3. This permit may be modified to incorporate any applicable standard for sewage sludge use or disposal promulgated under section 405(d) of the Clean Water Act, if the standard for sewage sludge use or disposal is more stringent than any requirements for sludge use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

4. The permittee must, during all times of disposal, provide personnel to ensure the continuous performance of the disposal system within the limitations of this permit. In the event that any condition of this permit or DEQ rules are violated, the permittee must immediately take action to correct the violation and to notify DEQ **within 24 hours** at: DEQ's Eastern Region Water Quality Program Office (541) 388-6146.

   Response: In response to a notification, DEQ may conduct an investigation to evaluate the nature and extent of the problem, and may require additional corrective actions, as necessary. Compliance with this requirement does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.

5. All materials and equipment, including but not limited to tanks, pumps, controls, valves, etc. must be installed, operated, and maintained in accordance with manufacturer's minimum specifications.

6. The permittee must immediately notify the DEQ Bend office (phone 388-6146) of any occurrence of surfacing sewage so corrective action can be coordinated between the permittee and DEQ. When the DEQ offices are not open, the permittee must report the incident to the Oregon Emergency Response System (phone 1-800-452-0311).

7. Emergency Response and Public Notification Plan

   a. The permittee must develop, and maintain and implement an Emergency Response and Public Notification Plan (the Plan) per Schedule F, Section B, and Conditions 5 & 6. The permit holder must develop the plan within six months of permit issuance and update the Plan annually to ensure that telephone and email contact information for applicable public agencies are current and accurate. An updated copy of the plan must be kept on file at the wastewater treatment facility for Department review. The latest plan revision date must be listed on the Plan cover along with the reviewer's initials or signature.

8. Recycled Water Use Plan

   a. In order to distribute recycled water for reuse, the permittee must develop, have and maintain and implement a DEQ-approved Recycled Water Use Plan meeting the requirements in OAR 340-055-0025. The permittee must submit substantial modifications to an existing plan to DEQ for approval at least 60 days prior to making the proposed changes. Conditions in the Plan are enforceable requirements under this permit.

9. The permittee must meet the requirements for use of recycled water under Division 55, including the following:

   a. All recycled water must be managed in accordance with the approved Recycled Water Use Plan. No substantial changes must be made in the approved plan without written approval by DEQ.

   b. The permittee must notify DEQ within 24 hours if it is determined that the treated effluent is being used in a manner not in compliance with OAR 340-055. When the DEQ offices are not open, the permittee must report the incident of noncompliance to the Oregon Emergency Response System (Telephone Number 1-800-452-0311).

   c. No recycled water must be made available to a person proposing to recycle unless that person certifies in writing that they have read and understand the provisions in Division 55. This written certification must be kept on file by the sewage treatment system owner and be made available to DEQ for inspection.

   e. Treated effluent must not be irrigated on ground that is frozen, snow-covered, or saturated with water. The volume of irrigated effluent and its total nitrogen loading must not exceed that established in a DEQ-approved recycled water use plan.

   f. Unless otherwise approved in writing by DEQ, a vegetative cover must be maintained on the land irrigation area at all times. Vegetation is to be periodically cut and removed to ensure maximum evapotranspiration and nutrient capture.

10. Operator Certification

The permittee must comply with Oregon Administrative Rules (OAR), Chapter 340, Division 49, "Regulations Pertaining To Certification of Wastewater System Operator Personnel" and designate a supervisor whose certification corresponds with the classification of the collection and/or treatment system as specified on page 1 of this permit.

   a. Definitions

      i. "Supervise" means to have full and active responsibility for the daily onsite technical operation of a wastewater treatment system or wastewater collection system.
      ii. "Supervisor" or "designated operator", means the operator delegated authority by the permittee for establishing and executing the specific practice and procedures for operating the wastewater treatment system or wastewater collection system in accordance with the policies of the owner of the system and any permit requirements.
      iii. "Shift Supervisor" means the operator delegated authority by the permittee for executing the specific practice and procedures for operating the wastewater treatment

system or wastewater collection system when the system is operated on more than one daily shift.

iv. "System" includes both the collection system and the treatment systems.

b. The permittee must have its system supervised by one or more operators who hold a valid certificate for the type of wastewater treatment or wastewater collection system, and at a grade equal to or greater than the wastewater system's classification as specified on page 1 of this permit.

c. The permittee's wastewater system may not be without the designated supervisor for more than 30 days. During this period, there must be another person available to supervisor who is certified at no more than one grade lower than the classification of the wastewater system. The permittee must delegate authority to this operator to supervise the operation of the system.

d. If the wastewater system has more than one daily shift, the permittee must have another properly certified operator available to supervisor operation of the system. Each shift supervisor, if any, must be certified at no more than one grade lower than the system classification.

e. The permittee is not required to have a supervisor on site at all times; however, the supervisor must be available to the permittee and operator at all times.

f. The permittee must notify DEQ in writing of the name of the system supervisor. The permittee may replace or re-designate the system supervisor with another properly certified operator at any time and must notify DEQ in writing within 30 days of replacement or re-designation of operator in charge. As of this writing, the notice of replacement or re-designation must be sent to Water Quality Division, Operator Certification Program, 2020 SW 4th Avenue, Suite 400, Portland, OR 97201. This address may be updated in writing by DEQ during the term of this permit.

g. When compliance with paragraph (c) of Item 8 in this section is not possible or practicable because the system supervisor is not available or the position is vacated unexpectedly, and another certified operator is not qualified to assume supervisory responsibility, the Director may grant a time extension for compliance with the requirements in response to a written request from the system owner. The Director will not grant an extension longer than 120 days unless the system owner documents the existence of extraordinary circumstances.

11. DEQ may reopen the Schedules in this permit, if necessary, to include new or revised conditions.

12. If warranted, at any time, DEQ may evaluate the need for or require a full assessment of the facilty's impact on groundwater quality.

# SCHEDULE F

## WPCF GENERAL CONDITIONS – DOMESTIC FACILITIES

### SECTION A. STANDARD CONDITIONS

1. Duty to Comply with Permit

The permittee must comply with all conditions of this permit. Failure to comply with any permit condition is a violation of Oregon Revised Statutes (ORS) 468B.025 and grounds for an enforcement action. Failure to comply is also grounds for the Department to modify, revoke, or deny renewal of a permit.

2. Property Rights and Other Legal Requirements

Issuance of this permit does not convey any property rights of any sort, or any exclusive privilege, or authorize any injury to persons or property or invasion of any other rights, or any infringement of federal, tribal, state, or local laws or regulations.

3. Liability

The Department of Environmental Quality or its officers, agents, or employees may not sustain any liability on account of the issuance of this permit or on account of the construction or maintenance of facilities or systems because of this permit.

4. Permit Actions

After notice by the Department, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including but not limited to the following:

a. Violation of any term or condition of this permit, any applicable rule or statute, or any order of the Commission;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts.

5. Transfer of Permit

This permit may not be transferred to a third party without prior written approval from the Department. The Department may approve transfers where the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of this permit and the rules of the Commission. A transfer application and filing fee must be submitted to the Department.

6. Permit Fees

The permittee must pay the fees required by Oregon Administrative Rules.

### SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

At all times the permittee must maintain in good working order and properly operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to comply with the terms and conditions of this permit.

2. Standard Operation and Maintenance

All waste collection, control, treatment, and disposal facilities or systems must be operated in a manner consistent with the following:

a. At all times, all facilities or systems must be operated as efficiently as possible in a manner that will prevent discharges, health hazards, and nuisance conditions.

b. All screenings, grit, and sludge must be disposed of in a manner approved by the Department to prevent any pollutant from the materials from reaching waters of the state, creating a public health hazard, or causing a nuisance condition.

c. Bypassing untreated waste is generally prohibited. Bypassing may not occur without prior written permission from the Department except where unavoidable to prevent loss of life, personal injury, or severe property damage.

3. Noncompliance and Notification Procedures

If the permittee is unable to comply with conditions of this permit because of surfacing sewage; a breakdown of equipment, facilities or systems; an accident caused by human error or negligence; or any other cause such as an act of nature, the permittee must:

a. Immediately take action to stop, contain, and clean up the unauthorized discharges and correct the problem.

b. Immediately notify the Department's Regional office so that an investigation can be made to evaluate the impact and the corrective actions taken, and to determine any additional action that must be taken.

c. Within 5 days of the time the permittee becomes aware of the circumstances, the permittee must submit to the Department a detailed written report describing the breakdown, the actual quantity and quality of waste discharged, corrective action taken, steps taken to prevent a recurrence, and any other pertinent information.

Compliance with these requirements does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or liability for failure to comply.

4. Wastewater System Personnel

The permittee must provide an adequate operating staff that is duly qualified to carry out the operation, maintenance, and monitoring requirements to assure continuous compliance with the conditions of this permit.

5. Public Notification of Effluent Violation or Overflow

If effluent limitations specified in this permit are exceeded or an overflow occurs that threatens public health, the permittee must take such steps as are necessary to alert the public, health agencies and other affected entities (e.g., public water systems) about the extent and nature of the discharge in accordance with the notification procedures developed under General Condition B.6. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

6. Emergency Response and Public Notification Plan

The permittee must develop and implement an emergency response and public notification plan that identifies measures to protect public health from overflows, bypasses or upsets that may endanger public health. At a minimum the plan must include mechanisms to:

a. Ensure that the permittee is aware (to the greatest extent possible) of such events;
b. Ensure notification of appropriate personnel and ensure that they are immediately dispatched for investigation and response;
c. Ensure immediate notification to the public, health agencies, and other affected public entities (including public water systems). The overflow response plan must identify the public health and other officials who will receive immediate notification;
d. Ensure that appropriate personnel are aware of and follow the plan and are appropriately trained;
e. Provide emergency operations; and
f. Ensure that DEQ is notified of the public notification steps taken.

## SECTION C. MONITORING AND RECORDS

1. Inspection and Entry

The permittee must at all reasonable times allow authorized representatives of the Department to:

a. Enter upon the permittee's premises where a waste source or disposal system is located or where any records are required to be kept under the terms and conditions of this permit;

b. Have access to and copy any records required by this permit;

c. Inspect any treatment or disposal system, practices, operations, monitoring equipment, or monitoring method regulated or required by this permit; or

d. Sample or monitor any substances or permit parameters at any location at reasonable times for the purpose of assuring permit compliance or as otherwise authorized by state law...

2. Averaging of Measurements

Calculations of averages of measurements required for all parameters except bacteria must use an arithmetic mean; bacteria must be averaged as specified in the permit.

3. Monitoring Procedures

Monitoring must be conducted according to test procedures specified in the most recent edition of **Standard Methods for the Examination of Water and Wastewater**, unless other test procedures have been approved in writing by the Department and specified in this permit.

4. Representative Sampling

Sampling and measurements taken as required herein must be representative of the volume and nature of the monitored discharge when discharging or land applying. Monitoring points must not be changed without notification to and the approval of DEQ.

5. Retention of Records

The permittee must retain records of all monitoring and maintenance information, including all calibrations, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. The Department may extend this period at any time.

## SECTION D. REPORTING REQUIREMENTS

1. Plan Submittal

Pursuant to Oregon Revised Statute 468B.055, unless specifically exempted by rule, construction, installation, or modification of disposal systems, treatment works, or sewerage systems may not commence until plans and specifications are submitted to and approved in writing by the Department. All construction, installation, or modification shall be in strict conformance with the Department's written approval of the plans.

2. Change in Discharge

Whenever a facility expansion, production increase, or process modification is expected to result in a change in the character of pollutants to be discharged or in a new or increased discharge that will exceed the conditions of this permit, a new application must be submitted together with the necessary reports, plans, and specifications for the proposed changes. A change may not be made until plans have been approved and a new permit or permit modification has been issued.

3. Signatory Requirements

All applications, reports, or information submitted to the Department must be signed and certified by the official applicant of record (owner) or authorized designee.

4. Twenty-Four Hour Reporting

The permittee must report any noncompliance that may endanger health or the environment. Any information must be provided orally (by telephone) to DEQ or to the Oregon Emergency Response System (1-800-452-0311) as specified below within 24 hours from the time the permittee becomes aware of the circumstances.

a. Overflows.

(1) Oral Reporting within 24 hours.

i. For overflows other than basement backups, the following information must be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311. For basement backups, this information should be reported directly to DEQ.

a) The location of the overflow;
b) The receiving water (if there is one);
c) An estimate of the volume of the overflow;
d) A description of the sewer system component from which the release occurred (e.g., manhole, constructed overflow pipe, crack in pipe); and
e) The estimated date and time when the overflow began and stopped or will be stopped.

ii. The following information must be reported to the Department's Regional office within 24 hours, or during normal business hours, whichever is first:

a) The OERS incident number (if applicable) along with a brief description of the event.

(2) Written reporting within 5 days.

i. The following information must be provided in writing to the Department's Regional office within 5 days of the time the permittee becomes aware of the overflow:

a) The OERS incident number (if applicable);
b) The cause or suspected cause of the overflow;
c) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the overflow and a schedule of major milestones for those steps;
d) Steps taken or planned to mitigate the impact(s) of the overflow and a schedule of major milestones for those steps; and
e) (for storm-related overflows) The rainfall intensity (inches/hour) and duration of the storm associated with the overflow.

The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

b. Other instances of noncompliance.

(1) The following instances of noncompliance must be reported:

i. Any unanticipated bypass that exceeds any effluent limitation in this permit;
ii. Any upset that exceeds any effluent limitation in this permit;
iii. Violation of maximum daily discharge limitation for any of the pollutants listed by the Department in this permit; and
iv. Any noncompliance that may endanger human health or the environment.

(2) During normal business hours, the Department's Regional office must be called. Outside of normal business hours, the Department must be contacted at 1-800-452-0311 (Oregon Emergency Response System).

(3) A written submission must be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission must contain:

i. A description of the noncompliance and its cause;
ii. The period of noncompliance, including exact dates and times;
iii. The estimated time noncompliance is expected to continue if it has not been corrected;
iv. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and
v. Public notification steps taken, pursuant to General Condition B.6.

(4) The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

**SECTION E. DEFINITIONS**

1. *$BOD_5$* means five-day biochemical oxygen demand.
2. *TSS* means total suspended solids.
3. *FC* means fecal coliform bacteria.
4. *$NH_3$-N* means Ammonia Nitrogen.
5. *$NO_3$-N* means Nitrate Nitrogen.
6. *$NO_2$-N* means Nitrite Nitrogen.
7. *TKN* means Total Kjeldahl Nitrogen.
8. *Cl* means Chloride.
9. *TN* means Total Nitrogen.
10. "*Bacteria*" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.
11. *Total residual chlorine* means combined chlorine forms plus free residual chlorine.
12. *mg/l* means milligrams per liter.
13. *ug/l* means micrograms per liter.
14. *kg* means kilograms.
15. *GPD* means gallons per day.
16. *MGD* means million gallons per day.
17. *Grab sample* means an individual discrete sample collected over a period of time not to exceed 15 minutes.
18. *Composite sample* means a combination of samples collected, generally at equal flow or time intervals over a 24-hour period.
19. *Week* means a calendar week of Sunday through Saturday.
20. *Month* means a calendar month.
21. *Quarter* means January through March, April through June, July through September, or October through December.

# Permit Evaluation Report

Oregon Department of Environmental Quality
Eastern Region – Bend Office
475 NE Bellevue Drive, Suite 110
Bend, OR 97701

State of Oregon Department of Environmental Quality

| | |
|---|---|
| **Permittee:** | City of Sisters<br>P.O. Box 39<br>Sisters, OR 97759 |
| **File Information:** | File Number: 81850<br>Permit Number: 101779<br>Expiration Date: December 31, 2025 |
| **Source Contact:** | Paul Bertagna<br>541-323-5212 |
| **Facility Name & Location:** | Sisters Wastewater Treatment Plant<br>912 S. Locust Street; Sisters OR 97759<br>T15S, R10EWM, S09; Tax Lot 1002 and 1002A1<br>Longitude -121.538480; Latitude 44.280506<br>Deschutes County |
| **LLID:** | LLID: 1213357444600-20.47-N |
| **Receiving Stream/Basin:** | Whychus Creek (no discharge) – formally called Squaw Creek; USGS Deschutes Basin; Upper Deschutes Sub-basin |
| **Proposed Action:** | Issue Permit<br>Application Number: 968002<br>Date Received: December 17, 2010 |
| **Source Category:** | Domestic |
| **Sources Covered:** | Domestic Sewage Lagoon and Irrigation Reuse |
| **Permit Type:** | WPCF-Domestic |
| **Permit Writer:** | Lawrence Brown REHS<br>Environmental Health Specialist<br>Date Prepared: November 13, 2015 |

## Introduction

The City of Sisters operates a domestic sewage wastewater collection and treatment system under a DEQ Water Pollution Control Facility (WPCF) permit #101779 which was last issued on July 12, 2005. This permit has an expiration date of February 28, 2011. However, because DEQ received a timely WPCF permit renewal application from the City of Sisters their permit remains in effect pursuant to OAR 340-045-0040.

In response to the City of Sisters permit renewal application, I have drafted a proposed permit for permit issuance. My evaluation report describes any concerns as well as permit requirements for effluent limitations, monitoring and reporting, compliance schedules, and special conditions necessary to carry out state and federal law.

**Land Use Approval**

On file is a signed land use compatibility statement from the Deschutes County Planning Department dated July 26, 1999 for a municipal wastewater treatment facility indicating that the use is compatible with the Land Conservation and Development Commission-acknowledged comprehensive plan or complies with statewide planning goals.

**Wastewater Treatment Facilities Description**

The City of Sisters wastewater treatment system consists of a collection system that collects sewage and directs it to various pump stations where sewage is then pumped to a three-cell aerated lagoon system with winter holding capacity. The wastewater treatment plant and effluent reuse site for the City of Sisters is located on the south ½ of Section 9, Township 15 South, Range 10 East of the Willamette Meridian.

Treatment is provided with two 2.41 acre aerated lagoons followed by an 18 acre storage lagoon and 100.3 acres of land utilized for automated land irrigation reuse purposes (88.5 acres of natural forest land and 11.8 acres of lagoon dikes consisting of pasture grass). The land reuse system diverts the majority of the effluent to the natural forest area. Prior to land application of the recycled water to the forest area, it must receive at least Class D treatment as defined in OAR 340-055.

The City of Sisters uses chlorination to meet this treatment level Class D where Class D recycled water must not exceed a 30-day log mean of 126 E. coli organisms per 100 milliliters and no more than 406 E. coli organisms per 100 milliliters in any single sample. With this level of treatment it is required that the site be restricted to public access for public health protection. Managing access and exposure to recycled water is the primary mechanism for protection of public health at reuse sites.

The City is currently limited to the quantity of treated effluent that can be land applied on the existing 100.3 acre land application reuse site. For future increase in flows the City looked at expanding their irrigation reuse sites to include the Lazy Z Ranch. This would allow for expansion of waste water disposal capacity and provide in-stream benefits to Whychus Creek by transferring irrigation water rights back to Whychus Creek.

The City of Sisters then purchased the Lazy Z Ranch property which includes both: T15, R10, S10; TL 704 (105.26 acres) and T15, R10, S15; TL 200 (125.68 acres) for a total of 230.94 acres. However, only TL 200 has received land use approval, to date, from Deschutes County - signed and dated August 6, 2008. The use of effluent on this property was found to be in compliance with applicable local land use regulations.

In November of 2006, DEQ evaluated the Lazy Z Ranch site for the use of recycled water for beneficial purposes. The soils mostly consist of a sandy loam to loamy sand ranging 30 to 45 inches in soil depth. DEQ determined that the site appeared to be suitable for the land application of treated effluent and should be able to support a crop for nutrient removal. However, before using this site the City is required to update their recycled water reuse plan for DEQ approval.

**Environmental Issues**
The aquifer, which will receive the percolate from the spray field is about 15 feet below the ground surface during the growing season. In review of their recycled water reuse plan and past operations DEQ has determined that the application rates and site management practices for the land application activities are protective of public health and have a low potential for adversely impacting groundwater quality.

Based on DEQ's screening criteria for groundwater review no further groundwater information is needed at this time. However, DEQ may evaluate the need for a full assessment of the facility's impact on groundwater quality at the next permit renewal or sooner if there is any evidence of an adverse impact resulting from the facilities operation or the facility fails to operate in accordance with permit conditions.

**Compliance History**
The most recent DEQ inspection was conducted on August 25, 2015. The City of Sisters was found to be in compliance with permit conditions. Additionally, no compliance issues have been documented in file for the permit period.

As a permit condition, the permittee must report incidents of noncompliance.

## PROPOSED PERMIT LIMITS AND CONDITIONS

***Schedule A - Waste Disposal Limitations***
No discharge to state waters is permitted. All wastewater is treated in aerated lagoons, stored through the non-irrigation season and irrigated on DEQ approved land application sites following sound irrigation management practices. Additionally, the wastewater collections, treatment and land application system must not be hydraulically or organically loaded in excess of their respective, DEQ approved design capacities. Recycled water must conform to a recycled water use plan approved by DEQ. Prior to land application recycled water must be treated to at least Class D as stipulated in OAR 340-055.

Effluent is irrigated at agronomic rates and only during the irrigation season. In addition, the lagoon cells are lined to prevent leakage. Based upon this, the Department believes the proposed facility will have no adverse impact on groundwater quality and therefore complies with the Department's groundwater protection regulations in OAR 340-40.

***Schedule B - Minimum Monitoring and Reporting Requirements***
The monitoring requirements of Schedule B are the primary means of ensuring that permit limitations are being met. The monitoring data also provides DEQ with information to evaluate the performance of the wastewater treatment facility. The authority to require periodic reporting by permittee's is included in ORS 468.065(5). The proposed monitoring and reporting requirements are based upon DEQ's monitoring and reporting requirements for similar facilities of this type and size.

***Schedule C - Compliance Conditions and Schedules:***
DEQ is requesting that the permittee submit an updated water reuse plan for DEQ approval.

***Schedule D - Special Conditions:***
Prior to constructing new or modifying existing wastewater systems, detailed plans and specifications must be submitted to DEQ for review and approval in writing. Qualified personnel must also be available to operate and maintain the wastewater treatment system to help ensure that the wastewater treatment facility functions as designed. Additionally, this section includes operator certification requirements to assure an appropriate operator for this type of wastewater system. The operator certification level as

listed on the front page of the permit was calculated using DEQ's Certified Operator Determination Worksheet – See Appendix A of this evaluation report. This is a change from the prior permit where the number of people served has increased putting the collection system in a Class II category.

This schedule also contains the normal conditions for facilities that reuse reclaimed wastewater. DEQ is not requiring a biosolids management plan at this time since the system will not routinely remove, treat and dispose of biosolids. A plan will be required, however, at such time as biosolids are needed to be removed from the system.

**Schedule F – General Conditions:**
This schedule includes conditions and definitions that are applicable to all WPCF permits in Oregon of this type.

**Public Participation**
The City of Sisters has submitted a complete permit renewal application. DEQ should send the draft permit documents to the applicant for review and comment, and then proceed with a Category II permitting action for public notification.

Appendix A – Certified Operator Determination Worksheet

Oregon Department of Environmental Quality

**Wastewater System Classification Worksheet for Operator Certification**

| | | | | | |
|---|---|---|---|---|---|
| **STEP 1: Criteria for Classifying Wastewater Treatment Systems** (OAR 340-049-0025) | | | | | |
| Wastewater System Common Name: | Sisters Wastewater Treatment Plant | | | | |
| Location: | 912 S. Locust St.; Sisters OR 97759 | | Region: | Eastern Region | |
| County: | Deschutes | | Date: | | |
| Facility ID: | File #81850; Permit #101779 | | Classified by: | LMB | |
| Design ADWF (Influent MDG): | 0.38 MGD | | **WWC Class:** | II | |
| Design Population*: | 3747 | | WWT Class: | I | |
| Design BOD (Influent lbs/day): | | | or SWWS: | | |
| | | | If SWWS, connections: | | |
| Is this a change from a prior classification? | Yes | | Total Points: | 26 | |
| 1. Design Population | 3747 | or Population Equivalent | | | |
| Based on: | Flow (gallons/person/day) | 99.3 | BOD (pounds/person/day) | 0.256 | |
| 2,001 to 5,000 | | | | 1.5 | 1.5 |
| 2. Average Dry Weather Flow (Design Capacity) | | | | | |
| Greater than 0.1 to 0.5 MGD | | | | 1.5 | 1.5 |
| 3. Unit Processes | | | | | |
| *Preliminary Treatment and Plant Hydraulics* | | | | | |
| Grit Removal (mechanical) | | | | 2.0 | 2.0 |
| Screen(s) (in-situ or mechanical, coarse solids only) | | | | 1.0 | 1.0 |
| Pump/Lift Station(s) (pumping of main flow) | | | | 2.0 | 2.0 |
| *Secondary, Advanced, and Tertiary Treatment* | | | | | |
| Stabilization Lagoons (1 or more cells with primary aeration) | | | | 7.0 | 7.0 |
| *Disinfection* | | | | | |
| Liquid Chlorine Disinfection | | | | 2.0 | 2.0 |
| 6. Sampling and Laboratory Testing | | | | | |
| Sample for BOD, Total Suspended Solids (performed by outside lab) | | | | 2.0 | |
| BOD or Total Suspended Solids analysis (performed at treatment plant) | | | | 4.0 | 4.0 |
| Bacteriological analysis (performed by outside lab) | | | | 1.0 | |
| Bacteriological analysis (performed at wastewater treatment plant lab) | | | | 2.0 | |
| Nutrient, Heavy Metals, or Organic analysis (performed by outside lab) | | | | *3.0 | 1.0 |
| **STEP 2: Complexity Reflected in OAR 340-049 0020(4)** | | | | | |
| ***Note:** This step may justify a higher classification. Points shown are given as guidance.* | | | | | |
| Class B, C, D and Non-disinfected Recycle (surface & subsurface) | | | | 3.0 | 3.0 |
| Standby power | | | | 1.0 - 3.0 | 1.0 |
| Description: | | | | | |
| | | | | **Total** | 26.0 |

| **Small Wastewater Treatment and Collection Systems** | | | |
|---|---|---|---|
| less than 500 design population or < 150 connections, and 30 total points or less | | | |
| **Wastewater Treatment Systems** | | **Wastewater Collection Systems** | |
| **Class I:** | 30 total points or less | **Class I:** | 1,500 or less design population |
| **Class II:** | 31-55 total points | **Class II:** | 1,501 15,000 design population |
| **Class III:** | 56-75 total points | **Class III:** | 15,001 to 50,000 design population |
| **Class IV:** | 76 or more points | **Class IV:** | 50,001 or more design population |