City of Cave Junction

JOSEPHINE COUNTY, OREGON

Wastewater Facilities Plan

September 2014

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87148PE
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OREGON
NOV. 13, 2012
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RENEWS: 12/31/15

Preparation of this document is funded through the
Community Development Block Grant program.

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Abbreviations and Acronyms Used

°C	Degrees Celsius
°F	Degrees Fahrenheit
AAF	Average Annual Flow
AAGR	Average Annual Growth Rate
AC	Asbestos Cement
ADWF	Average Dry-Weather Flow
APR	Annual Percentage Rate
AQI	Air Quality Index
ASTM	American Society for Testing and Materials
AWW I/I	Average Wet-Weather Inflow and Infiltration
AWWF	Average Wet-Weather Flow
BLM	Bureau of Land Management
BOD	Biochemical Oxygen Demand
BOLI	Bureau of Labor and Industries
CCI	Construction Cost Index
CCTV	Closed Circuit Television
CDBG	Community Development Block Grant
cf	Cubic Feet
CFR	Code of Federal Regulations
cm	Centimeter
COC	Chain of Custody
CWA	Clean Water Act
CWSRF	Clean Water State Revolving Fund
DA	Department of the Army
DEQ	Department of Environmental Quality
dia, D	Diameter
DMR	Discharge Monitoring Report
Dr	Drive
E	East
EDA	Economic Development Administration
ENR	Engineering News Record
EPA	Environmental Protection Agency
EQC	Environmental Quality Commission
ESH	Essential Salmonid Habitat
ETL	Excess Thermal Limit
ex.	Example
F/M	Food to Mass Ratio
ft	Feet
Gal	Gallons
GO	General Obligation

gpcd	Gallons per Capita-Day
gpm	Gallons per minute
HDPE	High-Density Polyethylene
Hg	Mercury
HP	Horsepower
HRT	Hydraulic Retention Time
Hz	Hertz
I/I	Inflow and Infiltration
in	Inches
kVA	Kilo Volt-Ampere
L	Length
LF	Lineal Foot
max	Maximum
MGD	Million Gallons per Day
MH	Manhole
MHI	Median Household Income
µg/L	micro-grams per liter
mg/L	milli-grams per liter
min	Minimum
min:	Minute
mJ	milli-Joule
mL	milli-Liter
MLE	Modified Ludzack-Ettinger
MLSS	Mixed Liquor Suspended Solids
MMDWF	Maximum Monthly Dry-Weather Flow
MMWW I/I	Maximum Monthly Wet-Weather Inflow and Infiltration
MMWWF	Maximum Monthly Wet-Weather Flow
N	North
NCDC	National Climatic Data Center
NE	Northeast
NEC	National Electric Code
NEMA	National Electric Manufacturers Association
No.	Number
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NR	National Registry
NRCS	Natural Resources Conservation Service
NTU	Nephelometric Turbidity Units
NW	Northwest
O&M	Operation and Maintenance
OAR	Oregon Administrative Rules
ODFW	Oregon Department of Fish and Wildlife

OECDD	Oregon Economic and Community Development Department
OHWL	Ordinary High-Water Line
OR	Oregon
ORS	Oregon Revised Statutes
PD I/I	Peak Day Inflow and Infiltration
PDAF	Peak Day Average Flow
PDF	Peak Daily Flow
PEM	Palustrine Emergent
PFO	Forested
PH	Phase
PIF	Peak Instantaneous (hourly) Flow
PIF I/I	Peak Instantaneous (hourly) Inflow and Infiltration
PS	Pump Station
psig	Pounds per Square Inch, Gage
PSS	Scrub
PUB	Riverine Unconsolidated Bottom
PVC	Poly-vinyl Chloride
PWF	Peak Week Flow
Q	Flow
R3UB	Riverine Intermittent Unconsolidated Bottom
R3US	Riverine Intermittent Unconsolidated Shore
RAS	Returned Activated Sludge
RB	Revenue Bond
RCP	Reinforced Concrete Pipe
Rd	Road
Rehab	Rehabilitation
RMZ	Regulatory Mixing Zone
RPM	Rotation per Minute
RV	Recreational Vehicle
S	South
S/N	Serial Number
SCADA	Supervisory Control and Data Acquisition
SDC	System Development Charge
SE	Southeast
sec	Second
SELP	Small Scale Energy Loan Program
SNMHI	State Non-Metropolitan Median Household Income
SRT	Solids Retention Time
SS	Suspended Solids
SSO	Sanitary Sewer Overflow
SSW	State Scenic Waterway
St	Street

SW	Southwest
T	Time
TDH	Total Dynamic Head
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UGB	Urban Growth Boundary
USFS	United States Forest Service
UV	Ultra-Violet
UVI	Ultra-Violet Intensity
UVT	Ultra-Violet Transmissivity
VFD	Variable Frequency Drive
W	West
WAS	Waste Activated Sludge
WEF	Water Environmental Federation
WTP	Water Treatment Plan
WWTP	Wastewater Treatment Plant
ZID	Zone of Immediate Dilution

Executive Summary

ES-1. Background

This document is intended to provide the City of Cave Junction a 20-year Wastewater Facilities Plan, in compliance with the 2013 *Guidelines for Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities*.

The city of Cave Junction is a southern Oregon community located approximately 30 miles south of Grants Pass, in the Illinois River Valley of the Siskiyou Mountains. The City of Cave Junction is located at 42º09'46"N, 123º38'52"W in Township 39 South, Range 8 West. The projected population to be used for design and analysis of the existing and recommended facilities is 3,396, based on a 2.50% average annual growth beginning at the 2010 census population of 1,883.

The following table summarizes the current and projected flows for the 20-year planning period for this document.

Table ES-1 – Current and Future Flows

Current (2013) Flows and Future (2035) Flows					
Parameter	2013 Flow (MGD)	2013 Population	Per Capita Flow (Gal/day)	2035 Population	2035 Flow (MGD)
Dry-Weather Flows					
ADWF	0.282	2000	140.8	3396	0.478
Base Sewerage	0.214		106.9		0.363
Base Infiltration	0.068		34.0		0.115
$MMDWF_{10}$	0.371		185.7		0.631
Wet-Weather Flows					
AWWF	0.408		204.1		0.693
$MMWWF_5$	0.598		299.0		1.015
Peak Week	0.870		435.0		1.477
Peak Day (PDAF)	1.272		636.0		2.160
Peak Hourly (PIF)	1.870		935.0		3.175

The City of Cave Junction collection system consists of approximately 14.2 miles of gravity pipe and four pump stations, three of which are owned by the city. The fourth pump station is owned by the US Forest Service, with the City performing operation and maintenance under a contract agreement between the US Forest Service and the City. The city also operates and maintains an aerated, activated sludge treatment plant, with secondary clarifiers and an aerobic sludge digester. The treatment plant discharges to the Illinois River, which operates under National Pollutant Discharge Elimination System (NPDES) permit number 102610.

ES-2. Recommended Improvement Projects

The collection system is exhibiting wet-weather flow increases indicative of inflow and infiltration. This facilities plan includes recommendations to further investigate, assess and rehabilitate manholes and pipe sections identified during recent flow mapping activities. Other improvement projects presented in this document include upgrades and improvements to the treatment plant processes, effluent discharge or biosolids disposal.

Project 1 – Rehabilitate Manholes. 14 manholes were found with leaks during recent flow mapping activities. Each manhole identified should be further assessed and a rehabilitation method selected and designed.

Project 2 – Rehabilitate Pipeline. Flow mapping also located several sections of pipe that exhibit leaks. The eight (8) pipe sections identified should be televised and assessed for repair or rehabilitation.

Project 3 – Replace Headworks Screen. Operation personnel have requested consideration of a new headworks screen. The existing automatic screen is a bar screen with ¾" bar spacing, which inadvertently allows some inorganics (plastics, rags, wipes, etc.) to pass into the secondary treatment basin.

Project 4 – RV Receiving Station. The City welcomes thousands of recreational visitors each year, many of whom travel in recreational vehicles. Currently, the City cannot accommodate the wastewater from most of these travelers. A receiving station would allow RVs to discharge wastewater prior to entering busy roadways. Operational costs may be offset by fees associated with discharging wastewater.

Project 5 – Septage Receiving Station. The City accepts septage discharge several times a week. Currently, the septage wastewater occupies one-half of the aeration basin capacity of the treatment plant. The receipt and treatment of septage is time-consuming for treatment plant staff. A formal septage receiving station will allow septage wastewater to be isolated from the domestic wastewater stream for stabilization. Once stabilized, the septage may be slowly introduced and mixed into the domestic wastewater stream for secondary treatment.

Project 6 – Additional Blower. The air supply system for the treatment plant is expected to reach capacity limits by the end of this 20-year planning cycle. The City can begin planning and budgeting for installation of a third blower in the aeration building.

Project 7 – Disinfection Upgrade. Currently, disinfection is achieved with closed-vessel ultra violet light units. The units use old technology, are not energy efficient, tend to overheat during low-flow conditions and replacement parts are becoming difficult to obtain. The City may plan and budget to replace the disinfection system.

Project 8 – Outfall Diffuser. The use of a multi-port diffuser will improve dispersion of effluent discharged to the Illinois River. Better dispersion and mixing will enhance dilution to further lower impacts outside the mixing zone.

Project 9 – Effluent Disposal. Seasonally, the effluent discharged from the treatment plant is diverted to the golf course, in accordance with the discharge permit. The recycled water is applied to the fairways and greens at the golf course. This arrangement relies on the private entity at the golf course for continued used of the recycled effluent. The City should make improvements to the temporary storage lagoons and secure the continued use of the golf course reuse of the effluent.

Project 10 – Aerobic Digester Aerator Upgrades. The existing aerators are high-maintenance, prone to problems, dangerous for personnel to work on and not providing the necessary mixing and aeration for the solids aerobic digester. The City should consider replacing the floating aerators with more efficient, more powerful, higher quality mixer/aerator units.

Project 11 – Biosolids Disposal. Based on current estimates, the biosolids facultative storage lagoon is about 67% full. The storage lagoon has stored more than 15 years of solids. The City should remove and dispose of the collected biosolids. The logical site for disposal of the biosolids is as a cap at the county landfill, located approximately 5 miles from the treatment plant.

ES-3. Summary of Capital Improvement Plan

The following table summarizes the recommended projects for the City of Cave Junction Capital Improvement Plan for the planning period. The projects are listed by project number, as described above. The recommended priority of the project is listed in the right-hand column of the table.

Table ES-3 – Summary of Project Capital Improvement Plan

Priority	Description	Cost	WWFP Project ID
1	Manhole Repair	$ 58,000	1
2	Pipeline Rehabilitation	$ 1,015,250	2
3	Biosolids Disposal	$ 188,500	11
4	Septage Receiving Station	$ 599,575	5
5	Aerobic Digester Aerator Upgrades	$ 401,650	10
6	Diffused Effluent Outfall	$ 213,500	8
7	Disinfection Upgrade	$ 552,450	7
8	Effluent Disposal	$ 913,500	9
9	Additional Blower	$ 203,000	6
10	RV Receiving Station	$ 145,000	4
11	Replace Headworks Screen	$ 436,450	3
Total		**$ 4,726,875**	

Projects were ranked in priority based on most effective use of resources and impact to current and future flows. For example, by addressing the inflow and infiltration first, the treatment plant will realize longevity and operational efficiency with reduced flows.

The City should secure funding necessary to begin work on the highest priority projects.

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Section
1

1.0 Project Planning

1.1. Location

The city of Cave Junction is a southern Oregon community located approximately 60 miles west of Medford, 30 miles south of Grants Pass, and 230 miles south of Portland. The City lies within the Illinois River Valley in the Siskiyou Mountains at an elevation of approximately 1,390 feet. The Siskiyou Mountains are only one of two mountain ranges that run west to east in the entire United States. The City limits on the south are defined by the approximate path of the East Fork of the Illinois River and Illinois River Forks State Park. The western boundary extends along the Illinois River and jogs to the north and east to the northern boundary located north of Laurel Road. The eastern boundary is defined by the approximate path of Laurel Road with the southeastern corner the approximate intersection of Laurel Road and Oregon Caves Highway. The City of Cave Junction is located at 42º09’46”N, 123º38’52”W in Township 39 South, Range 8 West, and covers portions of Sections 15, 16, 20, 21, and 22.

The planning area is primarily contained within the Cave Junction City limits. Figure 1.1a shows the USGS topographic map for the area of Cave Junction. Figure 1.1b shows the city limits for Cave Junction on an aerial image.

The city limits have extended to the urban growth boundary (UGB) on the north and west. There exists land for annexation and city expansion to the east and south within the UGB. There are also several property ‘islands’ that may be annexed into the city in the future. In general, the 66% of the UGB is within current city limits.

1.2. Land Use

Land use within Cave Junction is a mixture of residential, commercial, and recreational. The City has a total area of 1.8 square miles, of which 0.1 square miles is covered by water. After the decline of gold mining and the lumber industry, the City has turned to tourism and commercial services. There is light industry within the town limits.

1.3. Zoning Information

Much of the City is zoned as residential with a small amount of commercial in the center of the City. There are is also an area zoned as light industrial within the City of Cave Junction. A Zoning Map is provided as Figure 1.3.

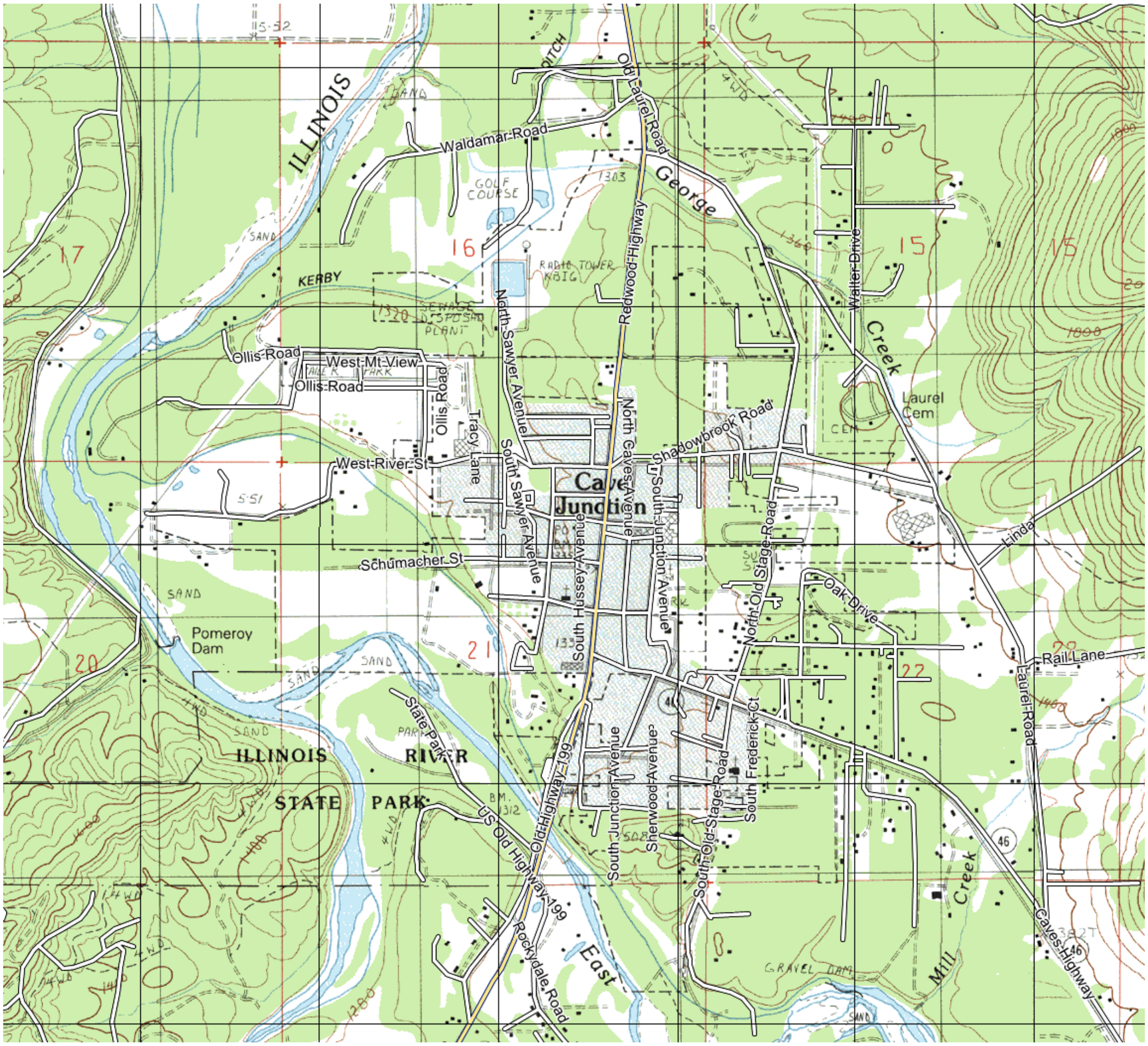


Figure 1.1a – USGS Topographic Map of Cave Junction

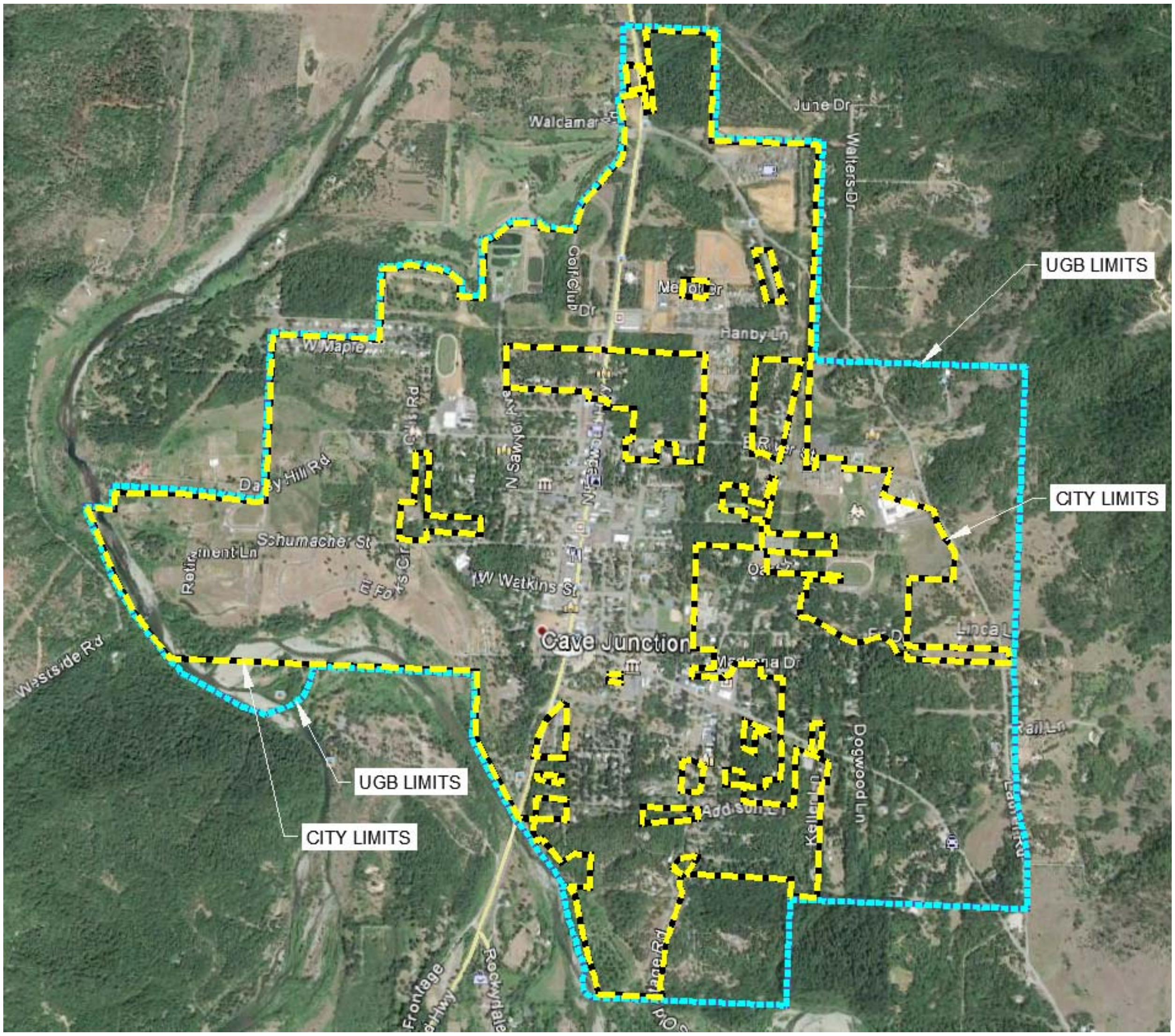


Figure 1.1b – Cave Junction, 2013 Google Earth Aerial Image

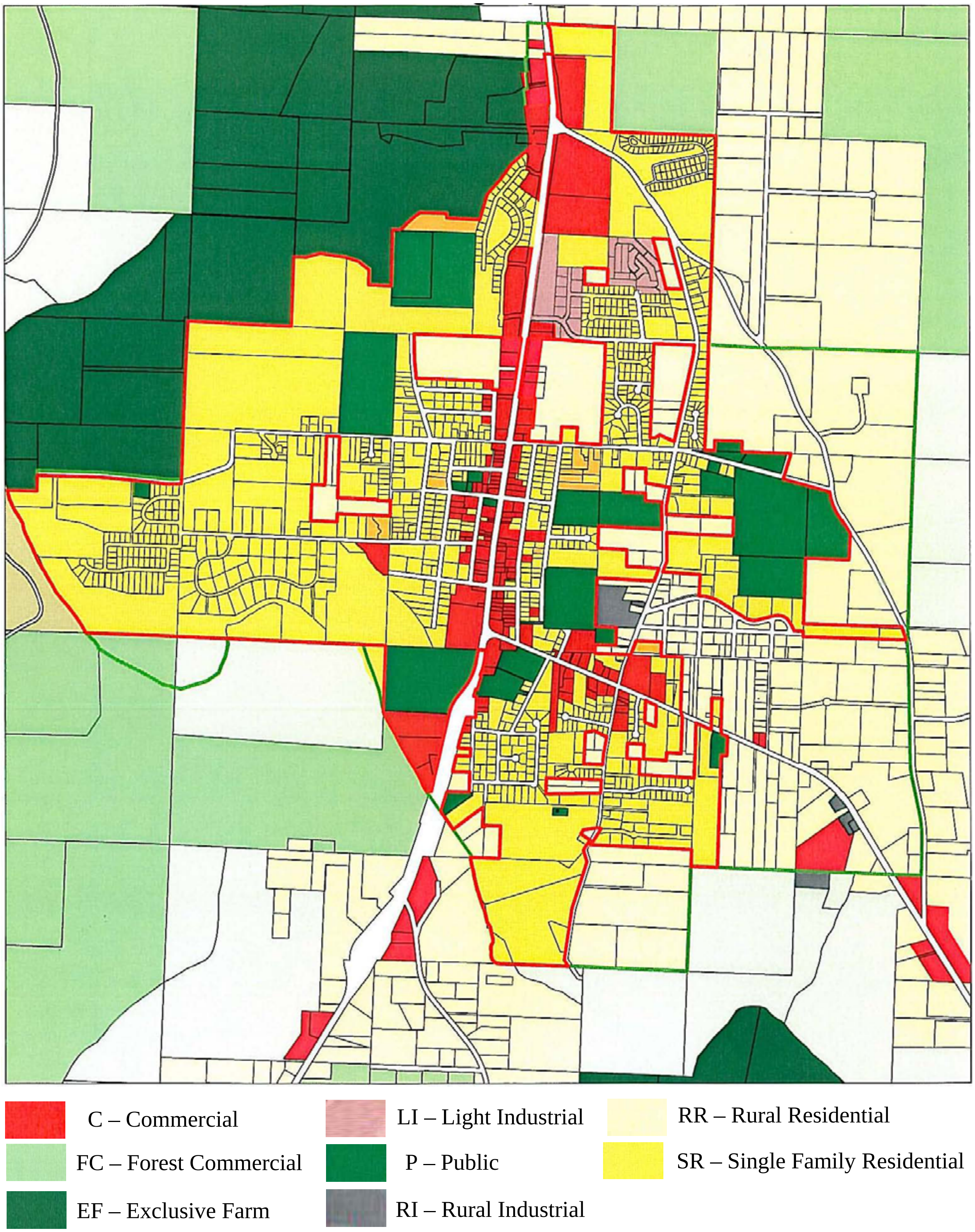


Figure 1.3 – Cave Junction Zoning Map

1.4. *Socio-econimic Conditions and Trends*

Over the decades since it was established in the late nineteenth century, the economic market in the area has shifted away from relying on the forest products and mining related industry. According to the 2010 Census data for the City of Cave Junction, 32.8% of jobs now occur in retail trade followed by educational, health and social services (17.7%), transportation, warehousing and utilities (10.9%), Arts, entertainment, recreation, accommodation and food services (8.1%), manufacturing industry (7.7%) and finance, insurance, real estate and rental and leasing (7.0%). See Figure 1.4.

The unemployment rate in the City of Cave Junction, according to the 2010 Census, was 17.5%. Several changes have occurred in the employment and economic environment of Curry County, in the last several years. According to the 2010 Census, the unemployment rate for Josephine County was 12.6%.

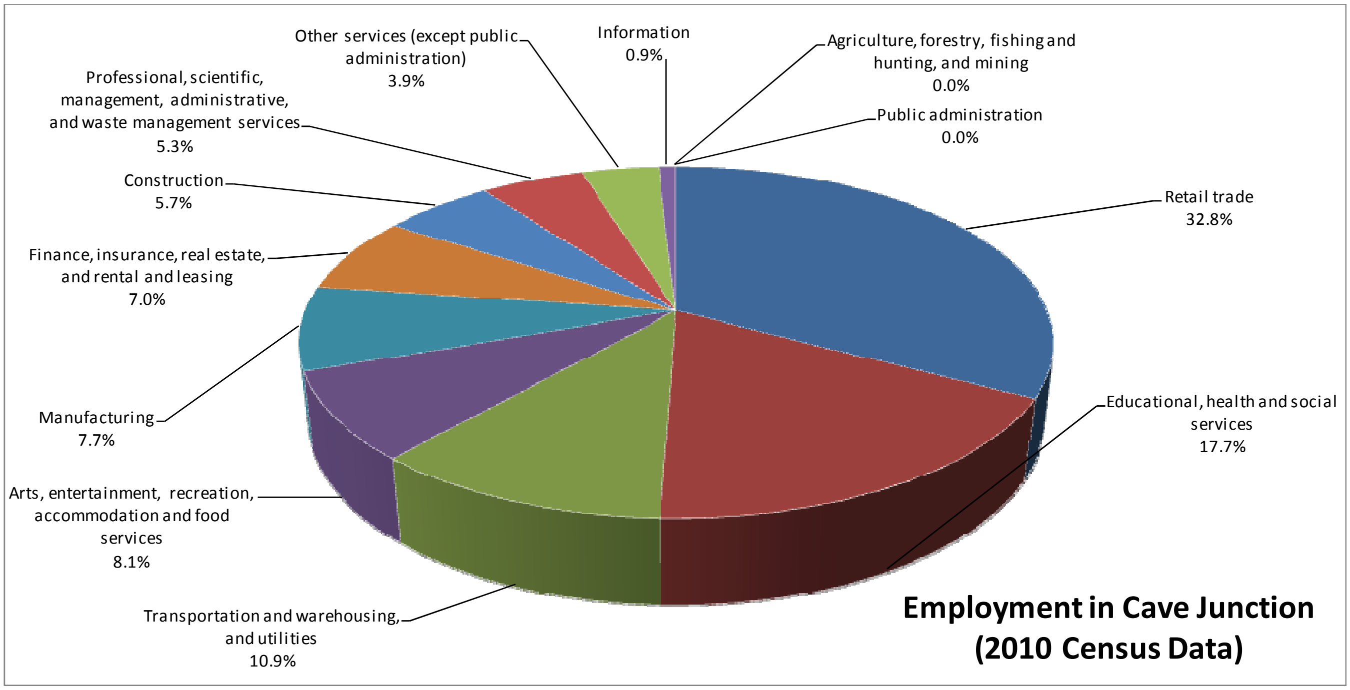


Figure 1.4 – Employment in Cave Junction, Per 2010 Census

According to the 2008-2012 American Community Survey, 5-year Estimates, median household income (MHI) in 2012 for the City of Cave Junction is $22,016. Comparatively, per the same American Community Survey, 5-year Estimates, the MHI for Josephine County is $36,699, State of Oregon is $50,036 and the U.S. is $53,046.

The 2008-2012 American Community Survey, 5-year Estimates, lists the percentage of individuals below the poverty level in 2012 is 33.7% in Cave Junction. This is significantly higher than the 20.0% for the county, 15.5% for the State and 14.9% for the nation.

The 2010 U.S. Census records that the average household size for the City of Cave Junction is 2.30 persons.

1.5. *Cultural Resources*

According to the National Register of Historic Places, several historical sites are listed for the vicinity of Cave Junction as shown in Table 1.5. No other historical sites or structures are listed.

Table 1.5 – Archaeological and Historic Sites

Historic Property/Site Name	Street Address	Period of Significance	Listed Date	NR Number
Allen Gulch Mill	1 mile SE of Junction of Waldo and Waldo Lookout Roads	1925-1949	2001	01001148
Allen Gulch Townsite	1 mile SE of Junction of Waldo and Waldo Lookout Roads	1850-1874	2001	01001136
Cameron Mine	2 miles south of Junction of Waldo and Waldo Lookout Roads	1900-1949	2001	01001144
Cedar Guard Station No. 1019	Illinois Valley Road	1925-1949	1986	86000837
Deep Gravel Mine	1 mile north of Junction of Waldo Rd and BLM Road 40-8-28	1875-1924	2001	01001141
Esterly Pit No. 2 – Llano De Oro Mine	1.5 mile north of Junction of Waldo Rd and BLM Road 40-8-28	1925-1974	2001	01001145
Fry Gulch Mine	0.75 mile from Junction of Waldo Rd and BLM Road 40-8-28	1875-1949	2001	01001143
High Gravel Mine	1.3 mile south of Junction of Waldo Rd and BLM Road 40-8-28	1900-1949	2001	0101142
Logan Cut	Historic Channel of Logan Cut	1875-1949	2001	01001154
Logan Drain Ditches	2 miles north of Junction of Waldo Rd and BLM Road 40-8-28	1900-1949	2001	01001155
Logan Wash Ditch	Historic Channel of Logan Wash Ditch	1900-1949	2001	01001153
Middle Ditch	Historic Channel of Logan-Esterly Middle Ditch	1850-1949	2001	01001150
Old Placer Mine	0.65 mile west of Junction of Rockydale Road and BLM Road 40-8-15	1850-1899	2001	01001140
Oregon Caves Chateau	Off of State Road 46, Oregon Caves National Monument	1925-1949	1987	87001346
Oregon Caves Historic District	Off of State Road 46, Oregon Caves National Monument	1900-1949	1992	92000058
Osgood Ditch	Historic Channel of Osgood Ditch	1900-1949	2001	01001151
Plataurica Mine	0.75 mile SE of Junction of Waldo and Waldo Lookout Roads	1925-1949	2001	01001146

Historic Property/Site Name	Street Address	Period of Significance	Listed Date	NR Number
Siskiyou Smokejumper Base	Smokejumper Way, 4 miles SE of OR 199	1925-1974	2006	06001035
St. Patrick's Roman Catholic Cemetery	1 mile SE of Junction of Waldo and Waldo Lookout Roads	1850-1924	2001	01001137
Store Gulch Guard Station No. 1020	Illinois Valley Road	1925-1949	1986	86000838
Upper Ditch	Historic Channel of Logan-Esterly Upper Ditch	1850-1949	2001	01001149
Waldo Cemetery	0.5 mile SW of Junction of Waldo Road and BLM Road 40-8-28	1850-1924	2001	01001138
Waldo Chinese Cemetery	0.5 mile SW of Junction of Waldo Road and BLM Road 40-8-28	1850-1949	2001	01001139
Waldo Mine	SW of Junction of Waldo Road and BLM Road 40-8-28	1925-1949	2001	01001147
Wimer Ditch	Historic Channel of Wimer Ditch	1875-1949	2001	01001152

1.6. Environmental Resources

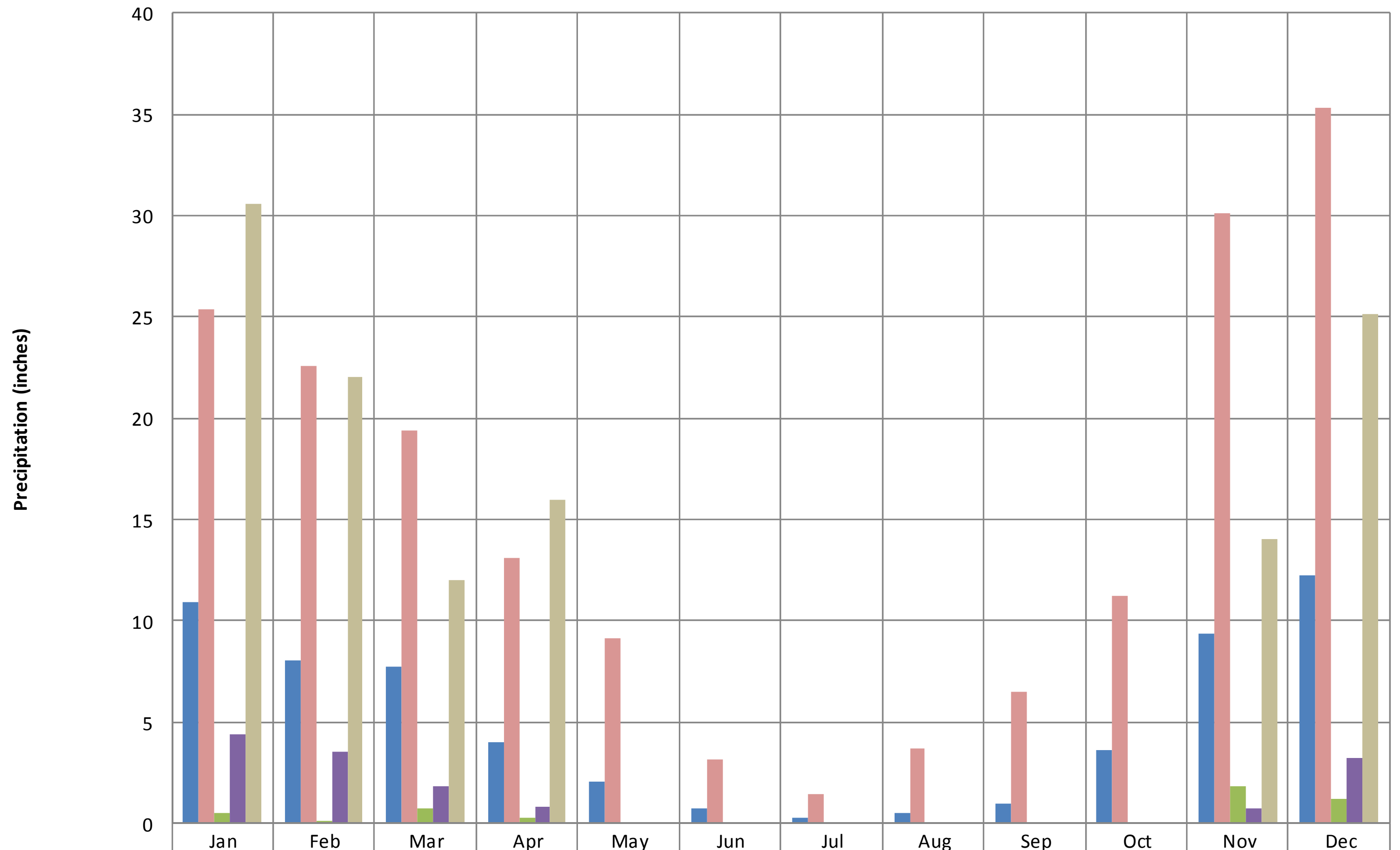
1.6.1. Climate

Climate data was obtained using long-term records collected at the Cave Junction weather station (Station 351448) as reported by the National Climatic Data Center.

Average snowfall is approximately 14.4 inches in Cave Junction. Record high snowfall of 51.6 inches was recorded in 1992-1993. On average, the majority of snowfall occurs from November to March. No statistically significant increasing or decreasing trend in annual snowfall is evident.

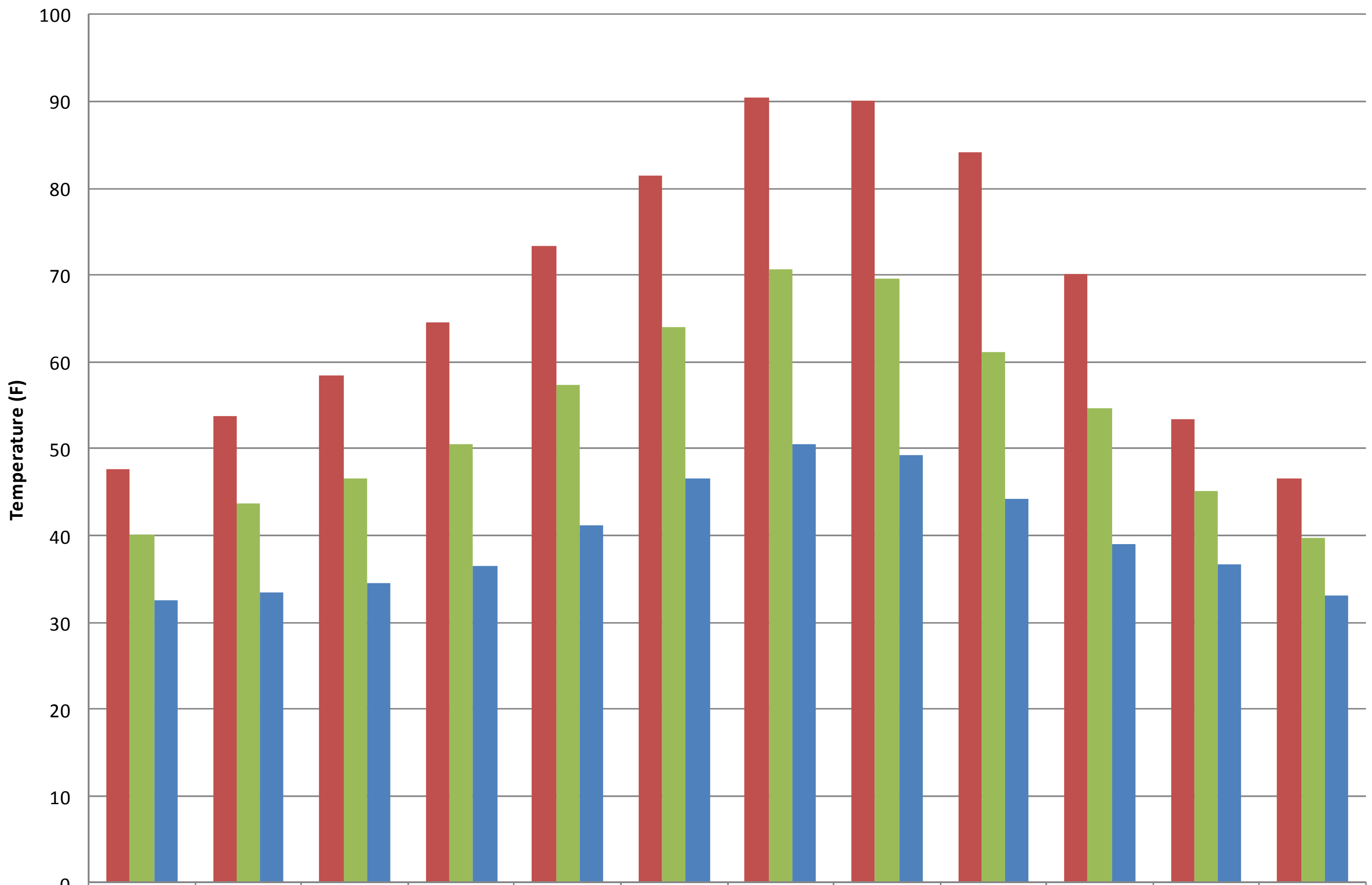
Average annual precipitation is approximately 61.7 inches in Cave Junction. Record low and high precipitation years recorded were 29.4 inches in 1976 and 104.2 inches in 1996, respectively. Normally, the majority of rainfall occurs from November to March. No statistically significant increasing or decreasing trend in annual rainfall is evident. Based on the NOAA Atlas 2, Volume X Isopluvial maps, the 5-year storm 24-hour rainfall is 5.5 inches. Figure 1.6.1a provides a monthly summary of precipitation for the climate station.

The average annual temperature in Cave Junction ranges from 32.5° to 90.5º F with an annual mean of 53.8° F. A record high temperature of 114° F was recorded in August of 2008. A record low temperature of -6°F was recorded in December of 1972. July is statistically the warmest month with a mean of 70.6° F while December is the coldest with a mean of 39.7° F. Figure 1.6.1b shows the monthly temperature statistics for Cave Junction.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	10.92	8.05	7.74	4.03	2.03	0.75	0.24	0.49	0.98	3.63	9.38	12.25
High	25.39	22.57	19.4	13.1	9.15	3.17	1.4	3.69	6.47	11.22	30.13	35.29
Low	0.53	0.13	0.72	0.27	0	0	0	0	0	0	1.79	1.16
Mean Snowfall	4.4	3.5	1.8	0.8	0	0	0	0	0	0	0.7	3.2
High Snowfall	30.6	22	12	16	0	0	0	0	0	0	14	25.1

Figure 1.6.1a – Precipitation Normals NCDC 1962-2012



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	47.6	53.7	58.5	64.5	73.4	81.4	90.5	90	84.2	70.2	53.4	46.5
Mean	40.1	43.6	46.6	50.5	57.3	64	70.6	69.6	61.2	54.6	45.1	39.7
Low	32.5	33.5	34.6	36.5	41.2	46.6	50.6	49.2	44.3	39	36.7	33

Figure 1.6.1b – Temperature Normals NCDC 1962-2012

1.6.2. Air

The air quality in Cave Junction is generally good, according to the 2011 Air Quality Index (AQI). Fires in the forested areas surrounding the valley in which Cave Junction is located will account for moderate to unhealthy levels of air. Figure 1.6.2 is from the Part of Oregon Ambient Air Monitoring Network, USFS Station CJFS, DEQ#31036, EPA#410330036. A full report for the state of Oregon is available for download at http://www.oregon.gov/DEQ.

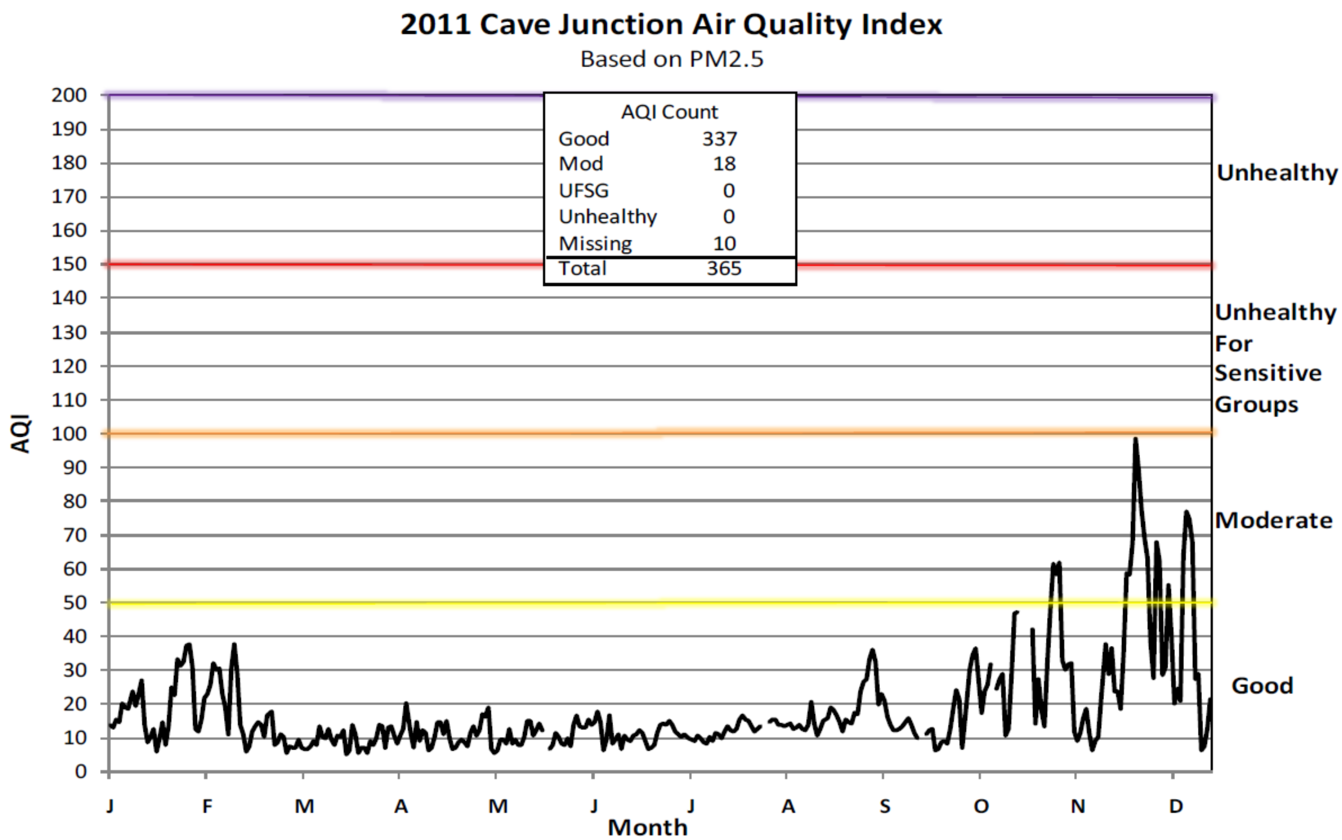


Figure 1.6.2 – Air Quality Index Graph

1.6.3. Floodplains

Areas within the City are within the 100-year floodplain. Floodplain areas occur along the Illinois River, located to the west and south of the City.

Figure 1.6.3 shows the areas of the City within the 100-year and the 500-year flood plain, based on the compilation of several FEMA Flood Insurance Rate Maps (41033C0791E, 41033C0792E & 41033C0794E) in the vicinity of the City. See Appendix G for FEMA "Firmette" Maps of the floodplain in the vicinity of the City. Flood Insurance Maps may be viewed on the FEMA Map Service Center at the following web address: www.msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView

The wastewater treatment plant is located outside the designated 100-year and 500-year floodplain limits.

1.6.4. Wetlands

A Wetland Map is included at the end of this Section in Figure 1.6.4. The wetlands are located as identified by the National Wetlands Inventory.

The wetlands are generally located along the Illinois River and small tributary creeks and streams. The wetlands consist of Palustrine Emergent (PEM), Forested (PFO) and Scrub (PSS) as well as Riverine Unconsolidated Bottom (PUB) and Riverine Intermittent Unconsolidated Bottom (R3UB) and Riverine Intermittent Unconsolidated Shore (R3US).

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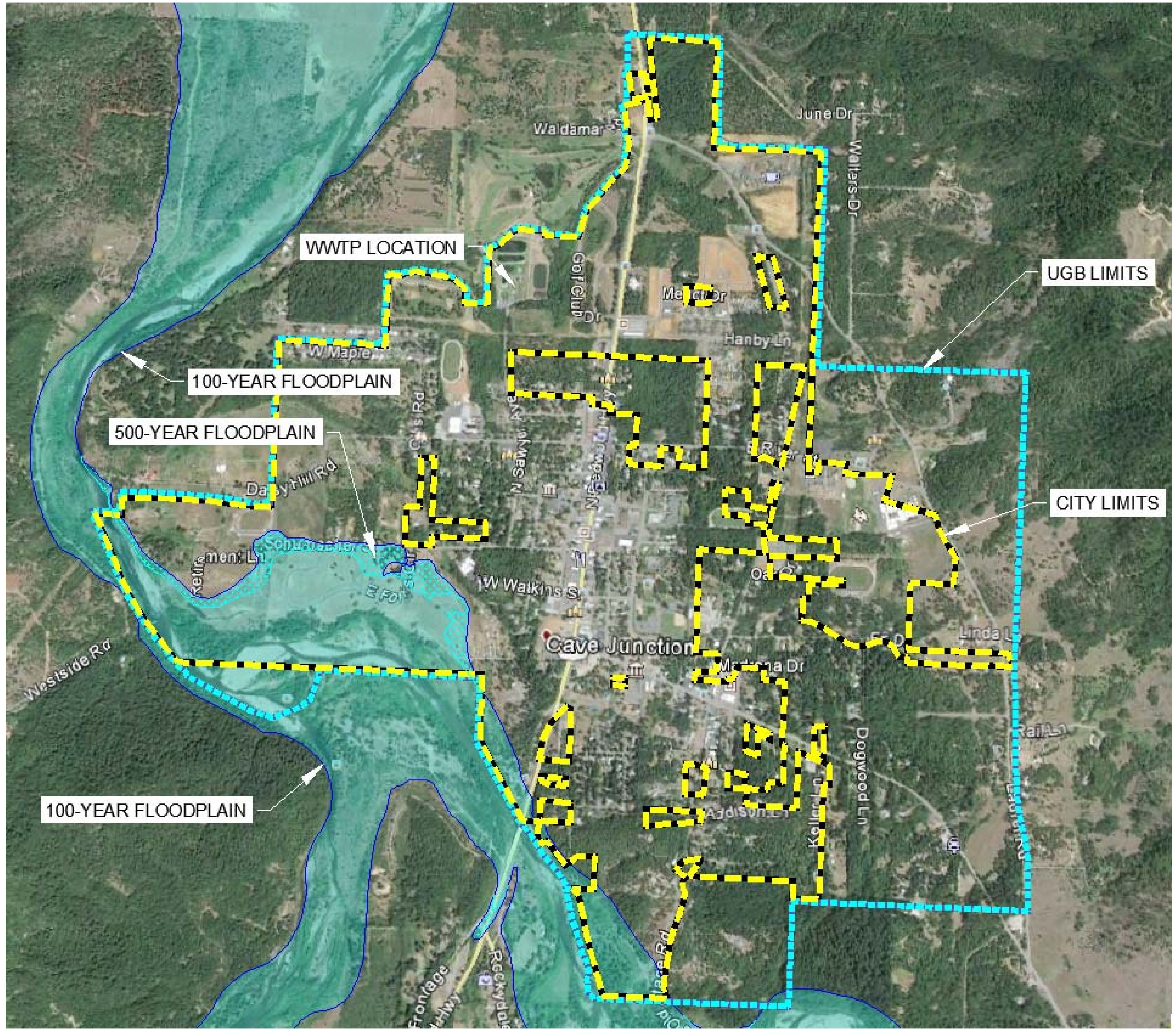

Figure 1.6.3 – Flood Hazard Map
(compiled from FEMA Flood Insurance Rate Maps 41033C0791E, 41033C0792E, & 41033C0794E)

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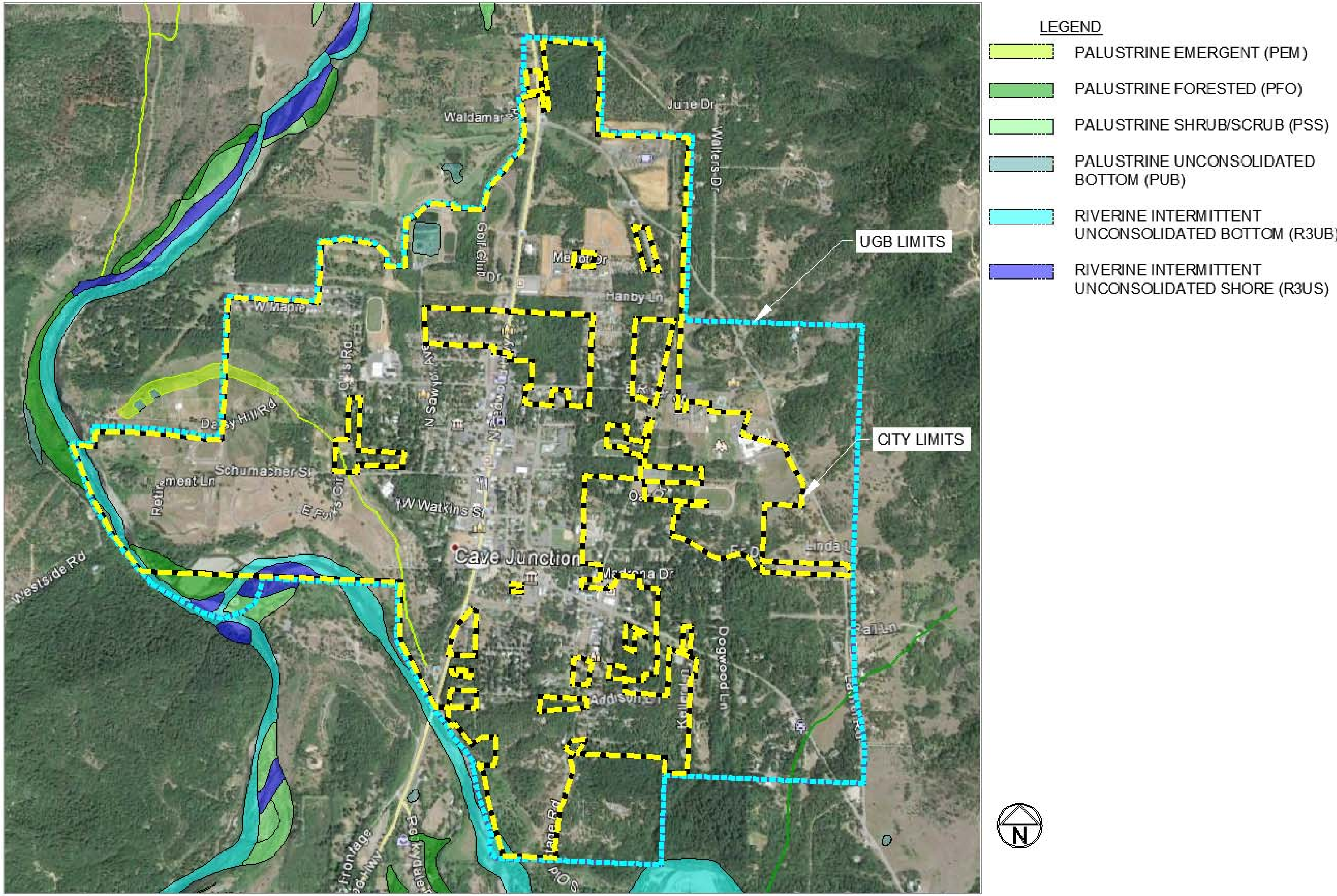

Figure 1.6.4 – Wetland Map (based on National Wetlands Inventory)

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1.6.5. Soils

The soils information for this report was developed from the Natural Resources Conservation Service (NRCS) Web Soil Survey. The full soils resource report can be found in the appendix.

The predominant soil type in the city is loam, which comprises about half of the soils identified. Gravelly loam makes up about one third of the soils. The remainder of the soils is clay loam and rock outcrops.

1.7. Biological Resources

Biological resources in the area include numerous fish, birds and mammals. Fish species in the Illinois River include Coho salmon, Chinook salmon, and steelhead. Several species of birds are known to breed in forests around Cave Junction. Mammals such as black bear, black-tailed deer, raccoon, and squirrels inhabit this area. Rarely, a Roosevelt elk may enter the wooded areas near town.

1.8. Coastal Resources

The City of Cave Junction is located outside the coastal zone.

1.9. Population Trends

Facility demand and design capacity is dependent on population.

1.9.1. Historic Growth Rate

Historic population data is based on available U.S. Census data. The following table summarizes the historical population for the City of Cave Junction, according to the Census data.

Table 1.9.1 – Historic Population Summary

Historic Population	
Year	Population
1960	248
1970	415
1980	1023
1990	1126
2000	1363
2010	1883

This report is intended to provide the City pertinent information through the year 2035. Projecting population growth based on historic population growth patterns for the City of Cave Junction has an inherent degree of uncertainty. The average annual growth rate (AAGR) for each decade fluctuates from 9.44% (1970-1980) to 0.96% (1980-1990).

1.9.2. Coordinated Growth Rate

According to recommendations and regulations, the future growth projections for population are to be based on values accepted and coordinated with Josephine County. Unfortunately, the most recent comprehensive plan was conducted in 2007, during a peak of land development in the City. The subdivisions and developments did not materialize as expected during preparation of the comprehensive plan. The comprehensive plan recommended use of excessive growth rates, which appear inappropriate at this time.

Therefore, the City has met with the County Planning Department and is working together on a new coordinated growth rate. The proposed growth rate by the City and County Planning Department, at the time this report is being prepared, is 2.50%.

The following graph presents the historic population for the City of Cave Junction and the projected population, based on the 2.50% growth rate.

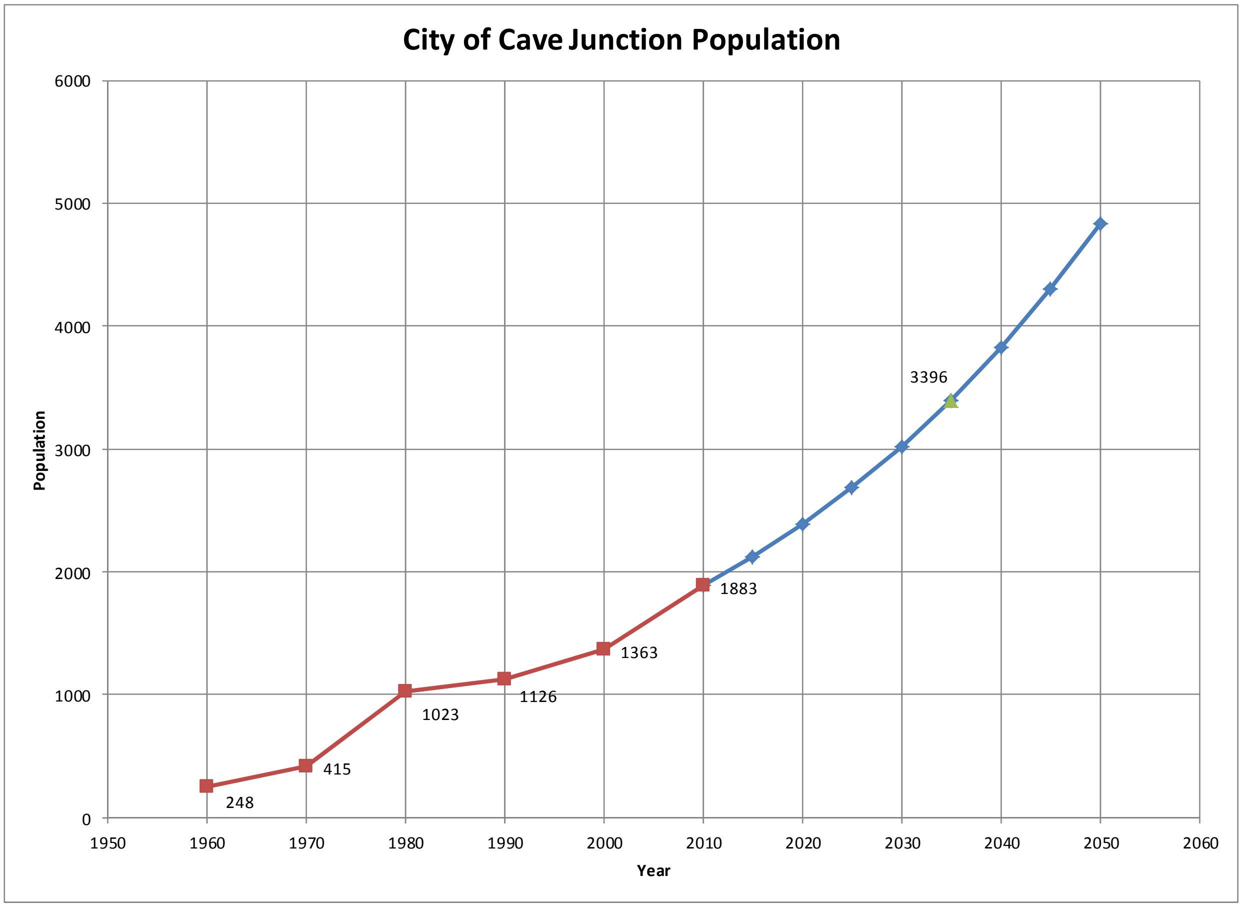

Figure 1.9.2 – Cave Junction Population Projection

The projected population to be used for design and analysis of the existing and recommended facilities is 3396, based on a 2.50% average annual growth beginning at the 2010 census population of 1883.

1.10. Community Engagement

The City holds public council meetings, which are advertised. The community is invited to provide comment during the public portion of the council meeting. Project status is discussed at these meetings. Planning documents are made available for viewing to the public at City Hall.

Section 2

2.0 Existing Facilities

2.1. Location Map

The existing facilities comprise the wastewater treatment plant and four (4) pump stations. Figure 2.1 displays the location of the facilities within the limits of the City.

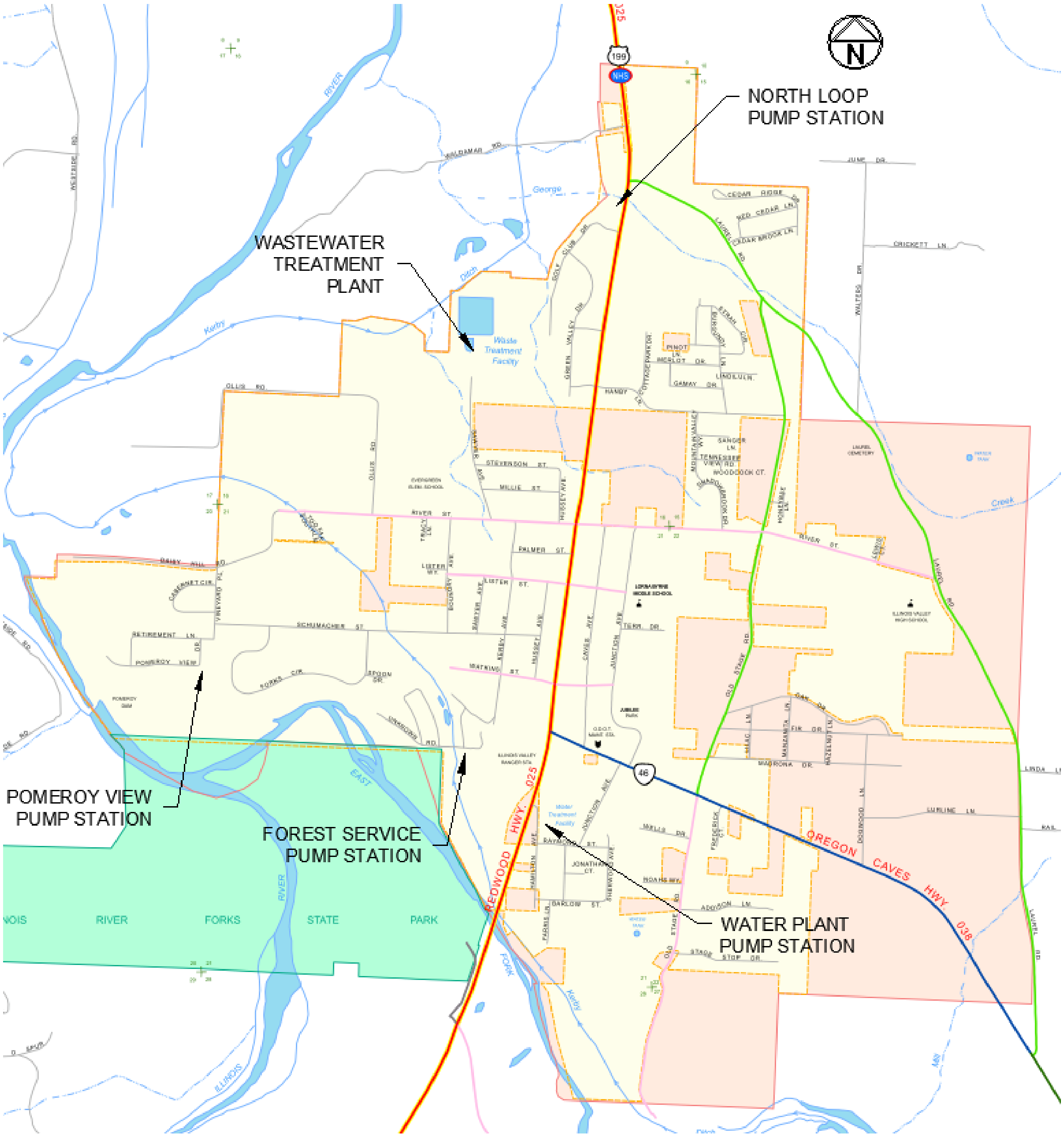

Figure 2.1 – Wastewater Facilities Location Map

This section will provide information and assessment of each facility within the collection and treatment systems of the City of Cave Junction.

2.2. History

2.2.1. Previous Studies and Reports

The following is a list of previous reports and studies that have discussed the City of Cave Junction wastewater collection and treatment systems.

1. July 1972. *Josephine County Areawide Water and Sewer Plan*, Stevens, Thompson and Runyan.

2. April 1976. *Facilities Plan, Municipal Waste Treatment Works*, T. Flatebo & Associates.

3. November 1984. *City of Cave Junction Comprehensive Plan*, Kelly & Rich, with Mary C. Hudson, Planning Assistant.

4. May 1991. *Report of Sewer Extension North Cave Junction*, T. Flatebo & Associates.

5. April 1994. *Wastewater Facilities Report, City of Cave Junction Wastewater Treatment Report*. BST Associates.

6. July 2003. *City of Cave Junction Reclaimed Water Plan*.

7. December 2006. *National Pollutant Discharge Elimination System, Permit Evaluation and Fact Sheet*, Julie Berndt, Oregon Department of Environmental Quality.

8. October 2005. *The Comprehensive Plan for Josephine County*.

9. August 2007. *Josephine County Coordinated Population Forecast*, ECONorthwest.

2.3. Collection System

2.3.1. Collection System Infrastructure

The City of Cave Junction collection system consists of approximately 14.2 miles of gravity pipe. The following table (Table 2.3.1a) summarizes the collection system gravity piping. This table does not include the quantity of private sewer laterals or connections to the collection system.

Table 2.3.1a – Pipe Size Summary

Pipe Diameter (in)	Quantity (lf)
4	985
8	70,254
12	260
15	800
18	627
21	2,201
Total	**75,127**

The following table provides a summary of the Cave Junction Wastewater Collection system based on pipe material. The asbestos cement pipe (AC) is predominantly 8-inch in diameter. All of the 21-inch pipe is made of reinforced concrete (RCP).

Table 2.3.1b – Pipe Material Summary

Pipe Material	Quantity (lf)
Reinforced Concrete (RCP)	2,201
Polyvinyl Chloride (PVC)	33,901
Asbestos Cement (AC)	38,765
Ductile Iron (DI)	260
Total	**75,127**

At locations where the pipe changes directions or intersects with another pipe, a manhole is supposed to be installed. At termination points of main line gravity pipe, a clean out may be installed, in lieu of a manhole. The Cave Junction wastewater collection system has 292 manholes and 48 clean outs. The collection system has been constructed over the past 50 years. The following table summarizes the lineal footage of pipe arranged by year installed.

Table 2.3.1c – Pipe Age Summary

Year Installed	Age (years)	Quantity (lf)	% of System
1963	50	15,591	20.8%
1975	38	3,610	4.8%
1976	37	12,052	16.0%
1977	36	1,432	1.9%
1978	35	5,399	7.2%
1997	16	2,882	3.8%
1998	15	634	0.8%
2001	12	4,270	5.7%
2004	9	2,536	3.4%
2005	8	8,026	10.7%
2006	7	9,318	12.4%
2007	6	8,750	11.6%
2008	5	627	0.8%
Total		75,127	

50% of the City's collection system is at least 35 years old with approximately 20% of the collection system 50 years old. Deterioration of pipe wall and joint material increases as pipe ages.

The collection system has been arranged into Basins A through L for manhole numbering and ease of identification. Figure M1 in Appendix G shows the location of each collection system basin. The following sub-sections summarize each of the sub-basins of the gravity collection system.

Many of the gravity pipes convey raw wastewater to several pump stations located throughout the City. . Pump stations are located at low points in the wastewater collection system. The City of Cave Junction owns three (3) pump stations and is under contract to maintain a fourth pump station, which is owned by the United Stated Forest Service. Figure 2.1 shows the general location of each pump station.

2.3.1.1. Collection System: Basin A

Basin A of the collection system is located in the northwest portion of the City. This basin is situated near the wastewater treatment plant and contains the last segment of gravity pipe in the collection system. The following table summarizes the manholes and pipe materials located within the basin.

Table 2.3.1.1 – Basin A Summary

Basin Summary: Basin A		
Basin Characteristics		
Approximate Basin Size		45.4 Acres
Basin Discharge Point		Wastewater Treatment Plant
Pump Station within Basin		None
Number of Manholes		6
Number of Cleanouts		0
Gravity Pipe:		
Material	Length	Date Installed
8" AC	830	1975
22" RCP	797	1997
Total Gravity Pipe	1,627	

2.3.1.2. Collection System: Basin B

Basin B of the collection system is located in the center portion of the City. This basin is situated to the west of Highway 199 and includes most of the commercial businesses that occupy the west side of the Highway. The following table summarizes the manholes and pipe materials located within the basin.

Table 2.3.1.2 – Basin B Summary

Basin Summary: Basin B		
Basin Characteristics		
Approximate Basin Size		130.8 Acres
Basin Discharge Point		A-3
Pump Station within Basin		None
Number of Manholes		48
Number of Cleanouts		6
Gravity Pipe:		
Material	Length	Date Installed
8" AC	8,698	1963
8" AC	2,780	1975
8" PVC	374	1998
18" PVC	627	2008
22" RCP	1,404	1997
Total Gravity Pipe	13,883	

2.3.1.3. Collection System: Basin C

Basin C of the collection system is also located in the center portion of the City. This basin is situated to the east of Highway 199 and includes most of the commercial businesses that occupy the east side of the Highway. The following table summarizes the manholes and pipe materials located within the basin.

Table 2.3.1.3 – Basin C Summary

Basin Summary: Basin C		
Basin Characteristics		
Approximate Basin Size		94.8 Acres
Basin Discharge Point		B-37
Pump Station within Basin		None
Number of Manholes		46
Number of Cleanouts		0
Gravity Pipe:		
Material	Length	Date Installed
8" AC	5,417	1963
8" PVC	454	2006
8" PVC	4,663	2007
Total Gravity Pipe	10,534	

2.3.1.4. Collection System: Basin D

Basin D of the collection system is the eastern most portion of the City. This basin is situated to the east and includes the Illinois Valley High School. The following table summarizes the manholes and pipe materials located within the basin.

Table 2.3.1.4 – Basin D Summary

Basin Summary: Basin D		
Basin Characteristics		
Approximate Basin Size		126.8 Acres
Basin Discharge Point		C-46
Pump Station within Basin		None
Number of Manholes		33
Number of Cleanouts		7
Gravity Pipe:		
Material	Length	Date Installed
8" AC	2,881	1976
8" AC	1,432	1977
8" AC	681	1997
8" PVC	2,536	2004
Total Gravity Pipe	7,530	

2.3.1.5. Collection System: Basin E

Basin E of the collection system is located in the eastern portion of the City. This basin is situated on the east side of Highway 199, where Highway 46, the Oregon Caves Highway begins. The following table summarizes the manholes and pipe materials located within the basin.

Table 2.3.1.5 – Basin E Summary

Basin Summary: Basin E		
Basin Characteristics		
Approximate Basin Size		59.9 Acres
Basin Discharge Point		B-46
Pump Station within Basin		None
Number of Manholes		20
Number of Cleanouts		6
Gravity Pipe:		
Material	Length	Date Installed
8" AC	6,019	1976
Total Gravity Pipe	6,019	

2.3.1.6. Collection System: Basin F

Basin F of the collection system is located in the southeastern portion of the City. This basin is situated on the south side of Highway 46, the Oregon Caves Highway. The following table summarizes the manholes and pipe materials located within the basin.

Table 2.3.1.6 – Basin F Summary

Basin Summary: Basin F		
Basin Characteristics		
Approximate Basin Size		104.7 Acres
Basin Discharge Point		E-20
Pump Station within Basin		None
Number of Manholes		14
Number of Cleanouts		3
Gravity Pipe:		
Material	Length	Date Installed
8" AC	421	1963
8" AC	3,971	1978
8" PVC	445	2006
Total Gravity Pipe	4,837	

2.3.1.7. Collection System: Basin G

Basin G of the collection system is also located in the southeastern portion of the City. This basin is the southerly most basin in the City, and includes the City's Water Treatment Plant. The following table summarizes the manholes and pipe materials located within the basin.

Table 2.3.1.7 – Basin G Summary

Basin Summary: Basin G		
Basin Characteristics		
Approximate Basin Size		95.1 Acres
Basin Discharge Point		E-17
Pump Station within Basin		Water Treatment Plant PS
Number of Manholes		9
Number of Cleanouts		3
Gravity Pipe:		
Material	Length	Date Installed
8" AC	3,152	1976
Total Gravity Pipe	3,152	

2.3.1.8. Collection System: Basin H

Basin H of the collection system is located in the southwestern portion of the City. This basin incorporates the Illinois Valley Forest Service Ranger Station. The following table summarizes the manholes and pipe materials located within the basin.

Table 2.3.1.8 – Basin H Summary

Basin Summary: Basin H		
Basin Characteristics		
Approximate Basin Size		51.2 Acres
Basin Discharge Point		B-43
Pump Station within Basin		Forest Service PS
Number of Manholes		6
Number of Cleanouts		0
Gravity Pipe:		
Material	Length	Date Installed
8" AC	628	1978
15" AC	800	1978
Total Gravity Pipe	1,428	

2.3.1.9. Collection System: Basin I

Basin I of the collection system is located in the western portion of the City. This basin is the western most basin in the City and includes several new, undeveloped subdivisions. The following table summarizes the manholes and pipe materials located within the basin.

Table 2.3.1.9 – Basin I Summary

Basin Summary: Basin I		
Basin Characteristics		
Approximate Basin Size		171.9 Acres
Basin Discharge Point		B-35
Pump Station within Basin		Pomeroy View PS
Number of Manholes		25
Number of Cleanouts		7
Gravity Pipe:		
Material	Length	Date Installed
8" PVC	8,013	2006
Total Gravity Pipe	8,013	

2.3.1.10. Collection System: Basin J

Basin J of the collection system is also located in the western portion of the City. The following table summarizes the manholes and pipe materials located within the basin.

Table 2.3.1.10 – Basin J Summary

Basin Summary: Basin J		
Basin Characteristics		
Approximate Basin Size		88.8 Acres
Basin Discharge Point		B-21
Pump Station within Basin		None
Number of Manholes		1
Number of Cleanouts		3
Gravity Pipe:		
Material	Length	Date Installed
4" AC	985	1963
8" AC	70	1963
Total Gravity Pipe	1,055	

2.3.1.11. Collection System: Basin K

Basin K of the collection system is located in the northern portion of the City, on the west side of Highway 199. This basin includes the North Loop Pump Station and the Wastewater Treatment Plant. The following table summarizes the manholes and pipe materials located within the basin.

Table 2.3.1.11 – Basin K Summary

Basin Summary: Basin K		
Basin Characteristics		
Approximate Basin Size		73.4 Acres
Basin Discharge Point		North Loop PS
Pump Station within Basin		North Loop PS
Number of Manholes		20
Number of Cleanouts		0
Gravity Pipe:		
Material	Length	Date Installed
8" PVC	4,087	2007
12" DI	20	1998
Total Gravity Pipe	4,107	

2.3.1.12. Collection System: Basin L

Basin L of the collection system is located in the farthest north portion of the City, on the east side of Highway 199. The following table summarizes the manholes and pipe materials located within the basin.

Table 2.3.1.11 – Basin L Summary

Basin Summary: Basin L		
Basin Characteristics		
Approximate Basin Size		155.1 Acres
Basin Discharge Point		K-1
Pump Station within Basin		None
Number of Manholes		53
Number of Cleanouts		13
Gravity Pipe:		
Material	Length	Date Installed
8" PVC	4,270	2001
8" PVC	8,026	2005
8" PVC	406	2006
12" DI	240	1998
Total Gravity Pipe	12,942	

2.3.2. North Loop Pump Station

The North Loop Pump Station is located near the north end of the City, adjacent to the Redwood Highway (Highway 199), near Golf Club Drive.

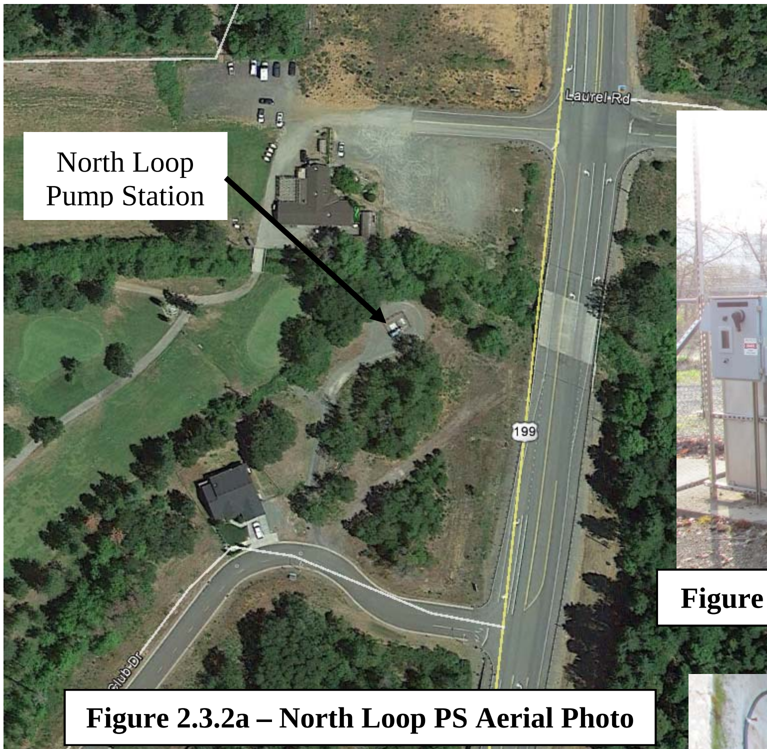

Figure 2.3.2a – North Loop PS Aerial Photo

Figure 2.3.2b – North Loop PS Controls and Generator

Figure 2.3.2c – North Loop PS Forcemain

Figure 2.3.2d – North Loop PS Wetwell

Summary of North Loop Pump Station System Components

Year Constructed	1998
Location	West side of Highway 199, North of Golf Course Drive
Pump Type	Two (2) Submersible, Centrifugal Pumps
Manufacturer of Pumps	Flygt
Model	3102 (5 HP) 3127 (7.5 HP)
Capacity	Estimated: 5 HP 7.5 HP = 475 gpm @ 22' TDH
Pump Hp	5 HP; 230 V; 60 Hz; 3 PH; 7.5 HP; 460 V; 60 Hz; 3 PH
Wet Well	96" (8-ft) dia. Concrete
Overflow Point	None; Overflow at wetwell hatch, if it occurs
Average Time to Overflow	1.8 hours (ADWF/Volume in Wetwell above High Water Alarm)
Auxiliary Power	Exterior 50 kVA – 3 PH Cummins Diesel Generator (DGHD-5737473)
Transfer Switch	Automatic
Telemetry	Autodialer
Reliability Class	Class I
Availability for Expansion	Wetwell constructed with space & piping for a third pump
Force Main	8-inch (2770± ft) forcemain to Manhole A-1 (At WWTP)
Force Main Profile	Descending to low point in Golf Course then ascending to discharge MH
Ave Detention Time in FM	122 minutes (ADWF/Volume in FM)
Air Release Valves	None
Level Control	Ultrasonic with backup floats
Elevation, Top of Wetwell	1296.0± feet
Bottom of Wetwell	1280.0± feet
Normal Water Surface	1282.0 feet to 1281.0 feet
Overflow Alarm	1284.5 feet
High Water Alarm	1284.0 feet
Lag Pump On	1282.5 feet
Lead Pump On	1282.0 feet
Pumps Off	1281.0 feet
Low Water Alarm	1280.80 feet
Ave Detention Time in Wetwell	9 minutes (ADWF/Pump Volume)
Sulfide Control	None
Discharge Point	Manhole A-1 (Elevation = 1290.9 feet ±)
Static Head (Approximate)	9.9 feet

Summary of North Loop Pump Station Deficiencies

General	Control panels (NEMA 12X) located out of doors.
Controls	5 HP on VFD, 7.5 HP on across line starter
Flow Meters	No flow meters.

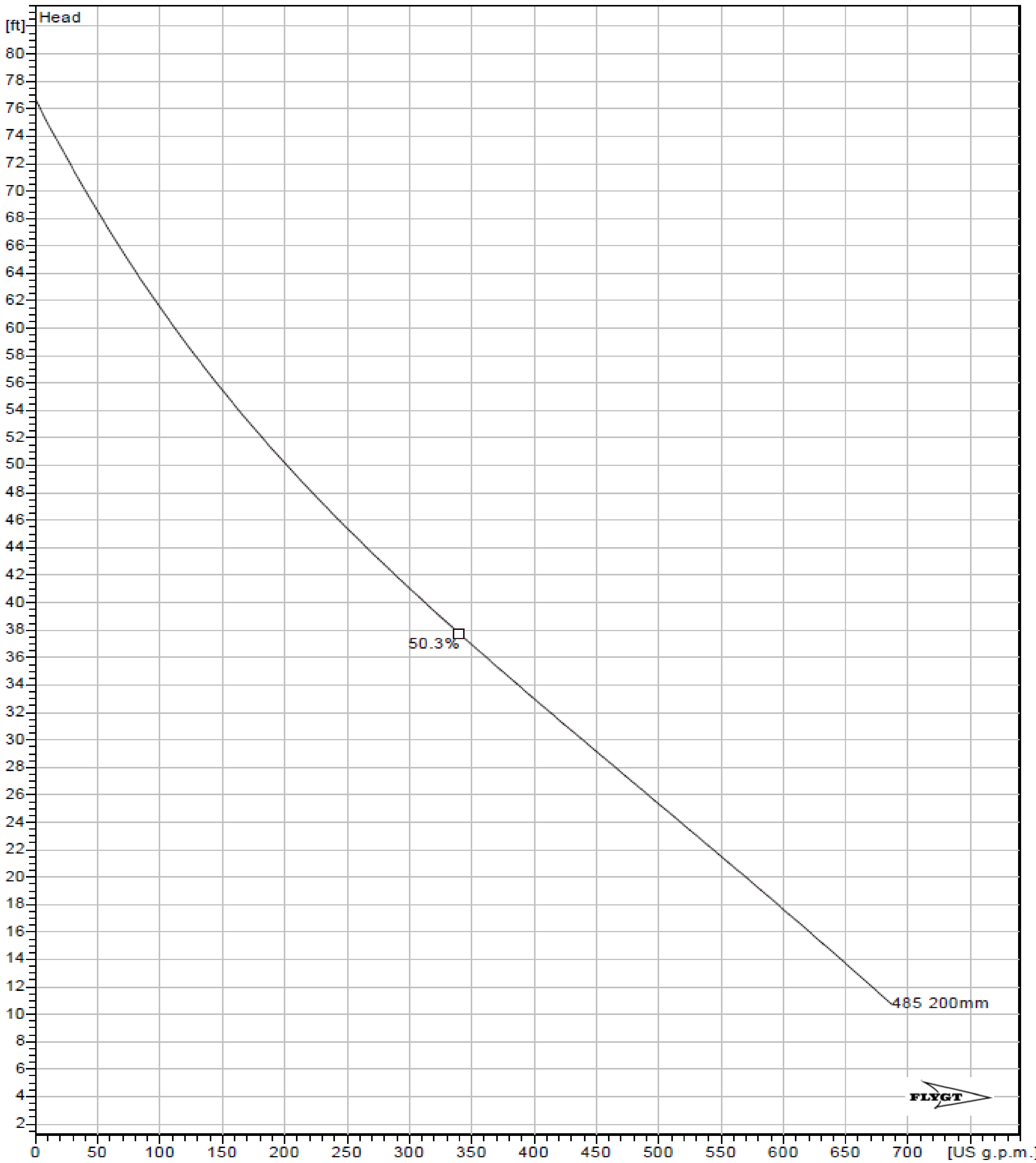

Figure 2.3.2e – North Loop PS Pump Curve – 7.5HP Pump

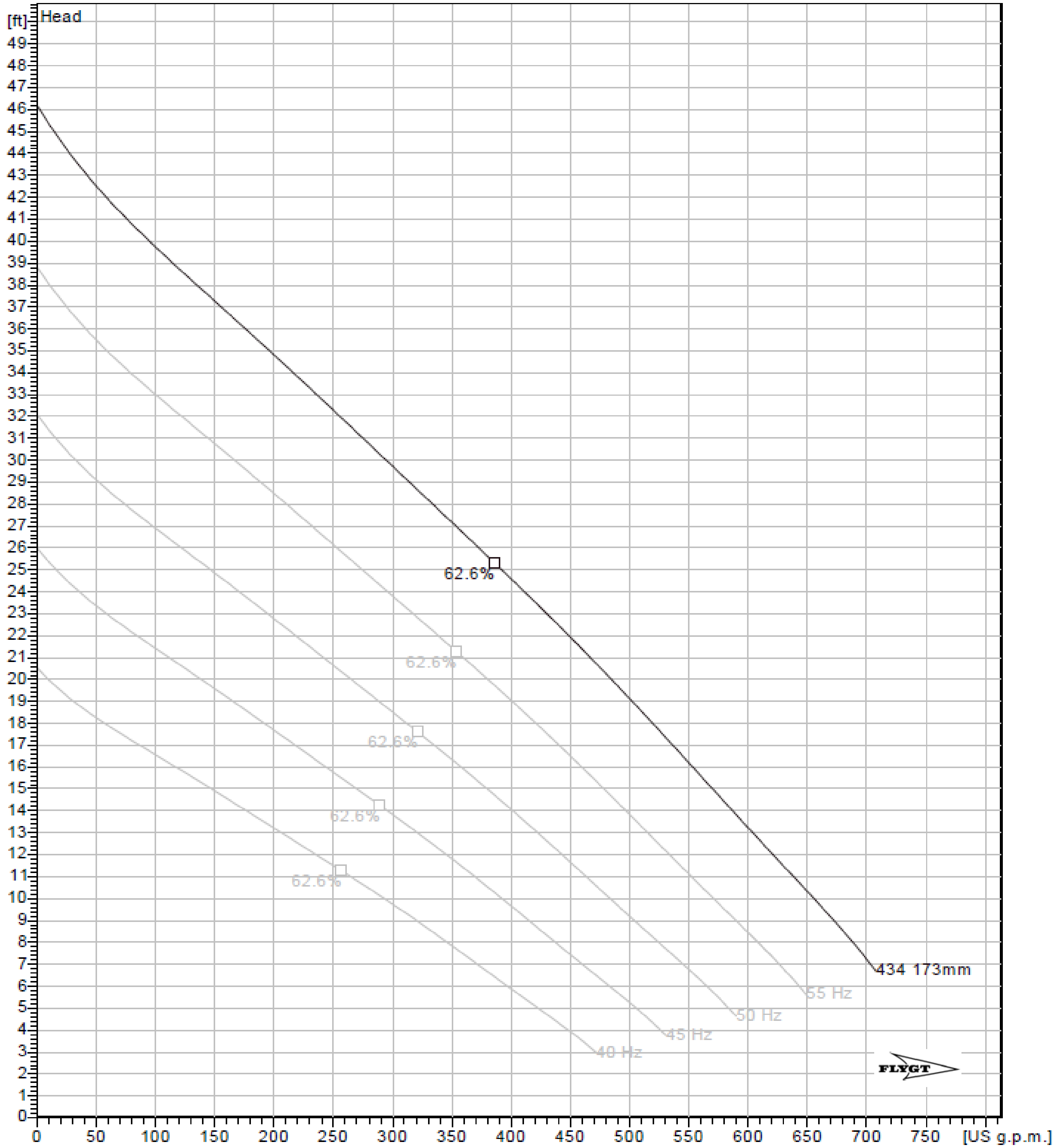

Figure 2.3.2f – North Loop PS Pump Curve – 5 HP Pump

2.3.3. Pomeroy View Pump Station

The Pomeroy View Pump Station is located in the western edge of the City, south of Pomeroy View Drive. The pump station was built in 2005 in conjunction with the Pomeroy View Subdivision. The pump station was installed with the intent to serve approximately 200 homes. Only about 10 homes have been constructed to date.

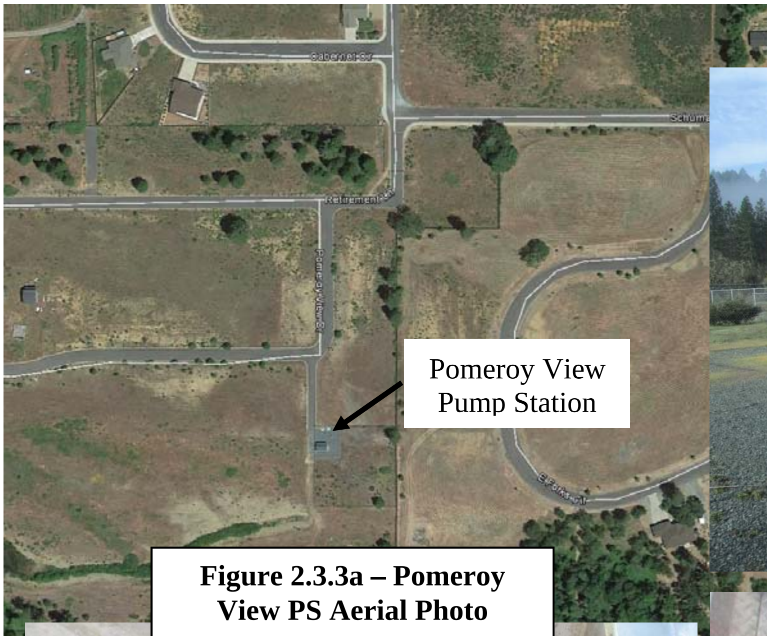

Figure 2.3.3a – Pomeroy View PS Aerial Photo

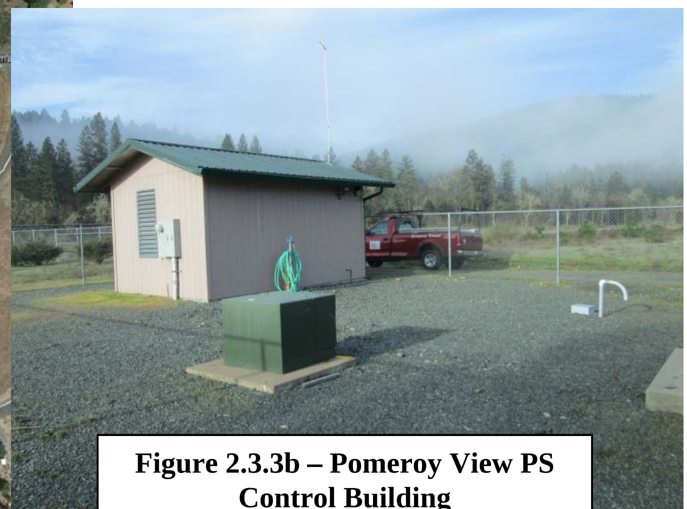

Figure 2.3.3b – Pomeroy View PS Control Building

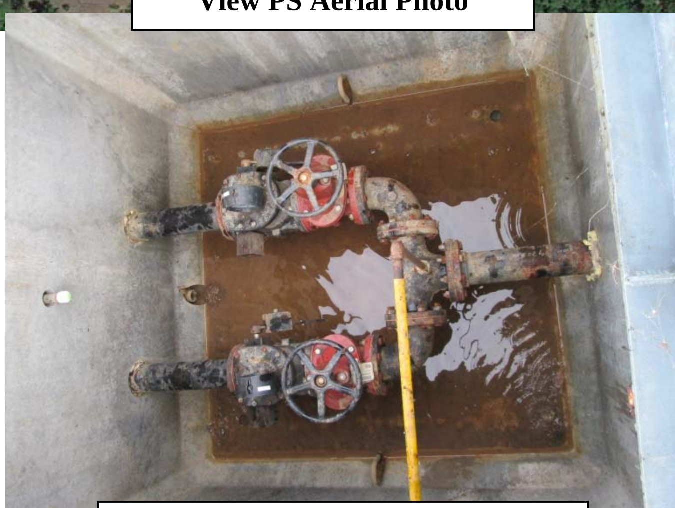

Figure 2.3.3c – Pomeroy View PS Forcemain Manifold

Figure 2.3.3d – Pomeroy View PS Wetwell

Summary of Pomeroy View Pump Station System Components

Year Constructed	2005
Location	South of Pomeroy View Drive
Pump Type	Two (2) Submersible, Centrifugal Pumps
Manufacturer of Pumps	Myers
Model	4RCX200M2-40 (S/N: 11569 & 11570)
Capacity	Estimated: 20 HP = 166 gpm @ 126' TDH
Pump Hp	20 HP; 230 V; 60 Hz; 3 PH; 1750 RPM
Wet Well	72" (6-ft) dia. Concrete
Overflow Point	None; Overflow at wetwell hatch, if it occurs
Average Time to Overflow	9.9 hours (ADWF/Volume in Wetwell above High Water Alarm)
Auxiliary Power	Exterior 80 kVA – 3 PH Cummins Diesel Generator
Transfer Switch	Automatic
Telemetry	Radio
Reliability Class	Class I
Availability for Expansion	Constructed to collect from approximately 200 residential properties
Force Main	4-inch (4,575 ft) forcemain to Manhole B-35 (At Schumacher St & Boundary Avenue)
Force Main Profile	Continuously ascending to discharge
Ave Detention Time in FM	500 minutes (ADWF/Volume in FM)
Air Release Valves	None
Level Control	Ultrasonic with backup floats
Elevation, Top of Wetwell	1281.0± feet
Bottom of Wetwell	1259.1± feet
Normal Water Surface	1263.6 feet to 1261.1 feet
Redundant Float	1265.7 feet
Overflow Alarm	1265.6 feet
High Water Alarm	1265.0 feet
Lag Pump On	1264.1 feet
Lead Pump On	1263.6 feet
Pumps Off	1261.1 feet
Low Water Alarm	1260.6 feet
Ave Detention Time in Wetwell	105 minutes (ADWF/Volume in Wetwell)
Sulfide Control	Air Compression for Injection
Discharge Point	Manhole B-35 in the Intersection of Schumacher St and Boundary Avenue (Elevation = 1326.0 feet ±)
Static Head (Approximate)	65 feet

Summary of Pomeroy View Pump Station Deficiencies

General	Control panels (NEMA 12X) located out of doors.
Controls	The pumps operate without VFD's
Air Injection System	Air compressor in need of repair
Communication	Radio/SCADA communication problems

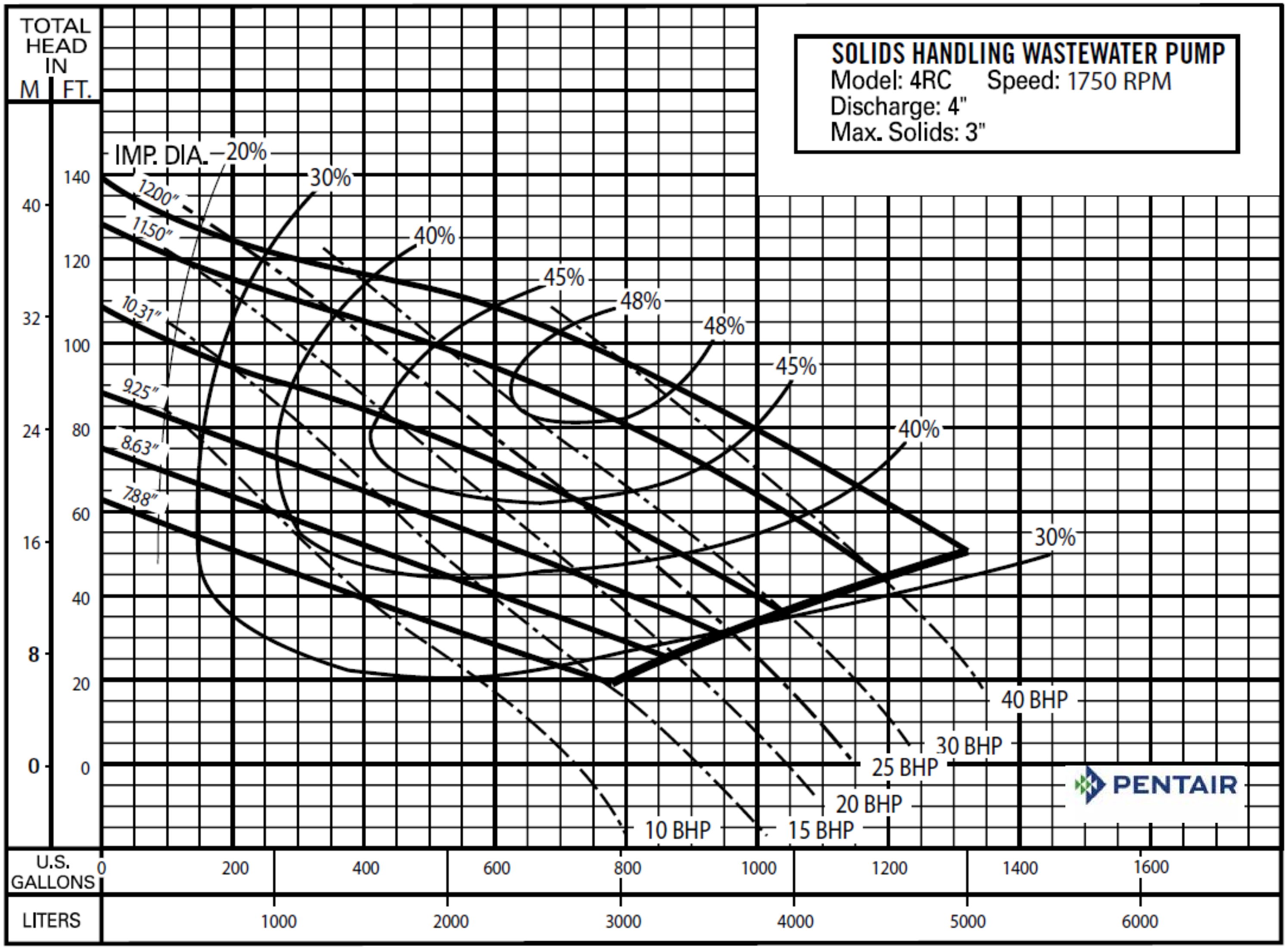

Figure 2.3.3e – Pomeroy View PS Pump Curve

2.3.4. Water Treatment Plant Wastewater Pump Station

The Water Treatment Plant Wastewater Pump Station is located in the western edge of the water treatment plant property, on the northeast corner of Highway 99 and Hamilton Avenue. The pump station was built in 1998 in conjunction with upgrades to the water treatment plant. The package pumps are a small, duplex configuration manufactured by Hydronix. The pump station serves only a commercial property and the water treatment plant.

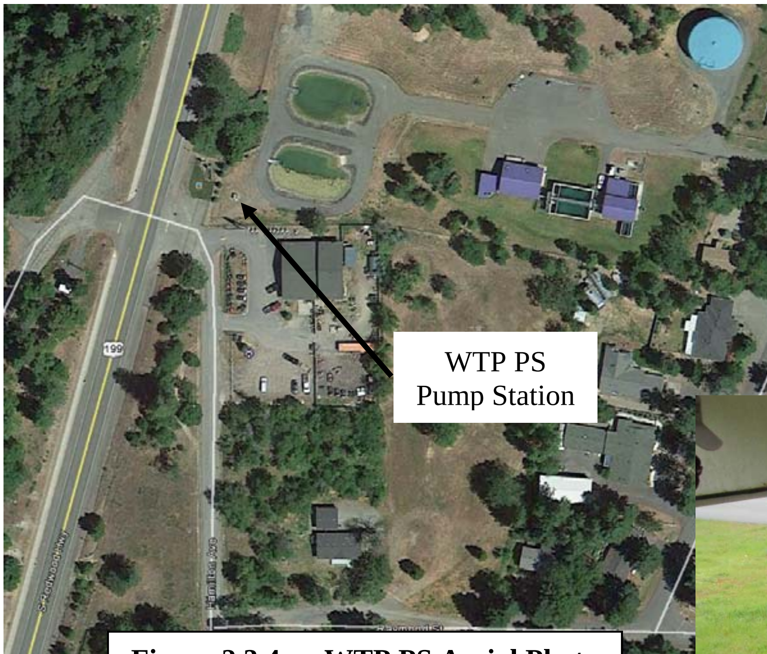

Figure 2.3.4a – WTP PS Aerial Photo

Figure 2.3.4b – WTP PS Pumps and Cover

Figure 2.3.4c – WTP PS Controls in Cover

Summary of Water Treatment Plant Pump Station System Components

Year Constructed	1998
Location	Northeast Corner Highway 199 & Hamilton Avenue
Pump Type	Two (2) Self-priming, Suction Lift Pumps
Manufacturer of Pumps	Hydromatic Pumps in a Hydronix Package Station
Model	40 MPV
Capacity	Estimated: 125 gpm @ 18' TDH
Pump Hp	3 HP; 208 V; 60 Hz; 3 PH
Wet Well	72" (6-ft) dia. Concrete
Overflow Point	None; Overflow at wetwell hatch, if it occurs
Average Time to Overflow	2.2 hours (ADWF/Volume in Wetwell above High Water Alarm)
Auxiliary Power	Water Treatment Plant Backup Generator
Transfer Switch	From WTP backup power
Telemetry	Integral with WTP
Reliability Class	Class I
Availability for Expansion	Land available adjacent, to the north.
Force Main	4-inch (800 ft) forcemain to Manhole G-1 (In Junction Avenue about 300 feet north of Raymond Street)
Force Main Profile	Continuously ascending to discharge
Ave Detention Time in FM	50 minutes (ADWF/Volume in FM)
Air Release Valves	None
Level Control	Floats
Elevation, Top of Wetwell	1340.0± feet
Bottom of Wetwell	1327.8± feet
Normal Water Surface	1332.5 feet to 1329.0 feet
High Water Alarm	1333.5 feet
Lag Pump On	1333.0 feet
Lead Pump On	1332.5 feet
Pumps Off	1329.0 feet
Ave Detention Time in Wetwell	72 minutes (ADWF/Volume in Wetwell)
Sulfide Control	None
Discharge Point	Manhole G-1 in Junction Avenue about 300 feet north of Raymond Street (Invert Elevation = 1340.5 feet ±)
Static Head (Approximate)	11.5 feet ±

Summary of Water Treatment Plant Pump Station Deficiencies

General	The station appears to be functioning properly.

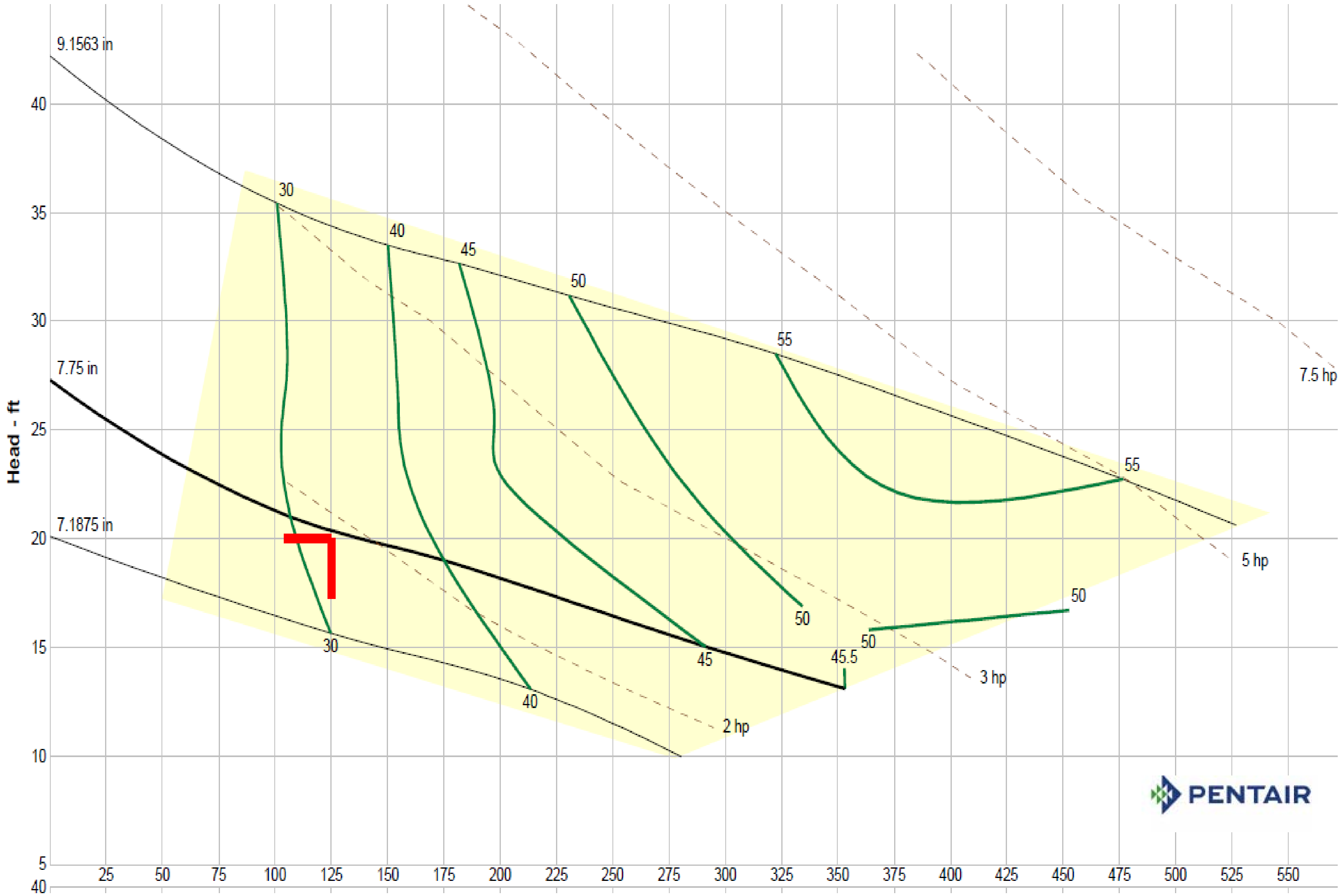

Figure 2.3.4d – WTP PS Pump Curve

2.3.5. Illinois Valley Forest Ranger Station Pump Station

The Illinois Valley Forest Ranger Station Pump Station is mentioned for informational purposes. The pump station is owned by the US Forest Service. The City is under contract to provide operations and maintenance services to the Forest Service. Non-compliance issues, capital improvements and maintenance costs are the responsibility of the US Forest Service.

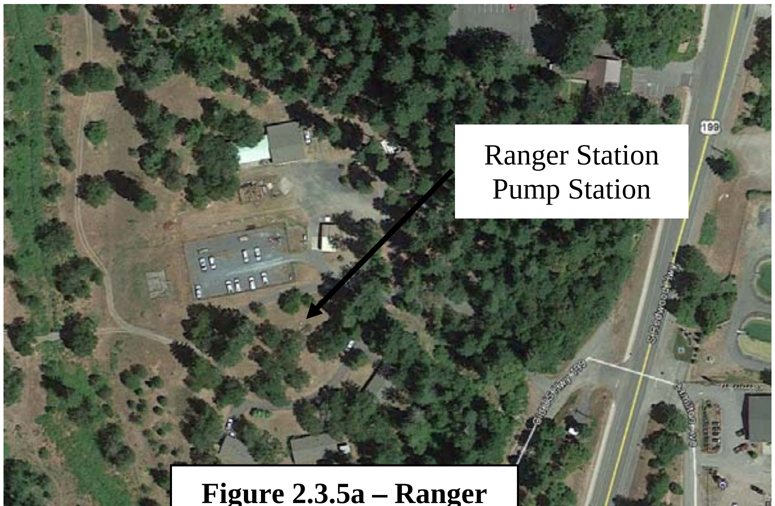

Figure 2.3.5a – Ranger Station PS Aerial Photo

Figure 2.3.5b – Ranger Station PS Control Building

Figure 2.3.5c – Ranger Station PS Forcemain Manifold

Figure 2.3.5d – Ranger Station PS Wetwell

Summary of Forest Service Pump Station System Components

Year Constructed	Unknown
Location	On Forest Service Property
Pump Type	Two (2) Submersible, Centrifugal Pumps
Manufacturer of Pumps	Yeomans
Model	9100
Capacity	Design: 125 gpm @ 74' TDH
Pump Hp	10 HP; 230 V; 60 Hz; 3 PH; 1750 RPM
Wet Well	72" (6-ft) dia. Concrete
Overflow Point	None; Overflow at wetwell hatch, if it occurs
Average Time to Overflow	>24 hours (ADWF/Volume in Wetwell above High Water Alarm)
Auxiliary Power	25 kVA Onan Generator
Transfer Switch	Automatic
Telemetry	Autodialer
Reliability Class	Class I
Availability for Expansion	Land available adjacent, to the north.
Force Main	4-inch (650 ft) forcemain to Manhole B-43 (In Kerby Avenue, 600 feet south of Watkins Street)
Force Main Profile	Continuously ascending to discharge
Ave Detention Time in FM	>2 hours (ADWF/Volume in FM)
Air Release Valves	None
Elevation, Top of Wetwell	1294.0± feet
Bottom of Wetwell	1275.3± feet
Normal Water Surface	1276.8 feet to 1281.1 feet (5.8 feet to 1.5 feet depth)
Level Control	Floats
High Water Alarm	1282.6 feet (7.3 feet depth)
Lag Pump On	1281.6 feet (6.3 feet depth)
Lead Pump On	1281.1 feet (5.8 feet depth)
Pumps Off	1276.8 feet (1.5 feet depth)
Ave Detention Time in Wetwell	>2 hours (ADWF/Volume in Wetwell)
Sulfide Control	None
Low Water Alarm	1275.8 feet (0.5 feet depth)
Discharge Point	Manhole B-43 in Kerby Avenue, 600 feet south of Watkins Avenue (Elevation = 1336.3 feet ±)
Static Head (Approximate)	59.5 feet

Summary of Forest Service Pump Station Deficiencies

General	No flow meters.
Controls	The pumps operate without VFDs.
Flow	Very low flow due to occupancy.

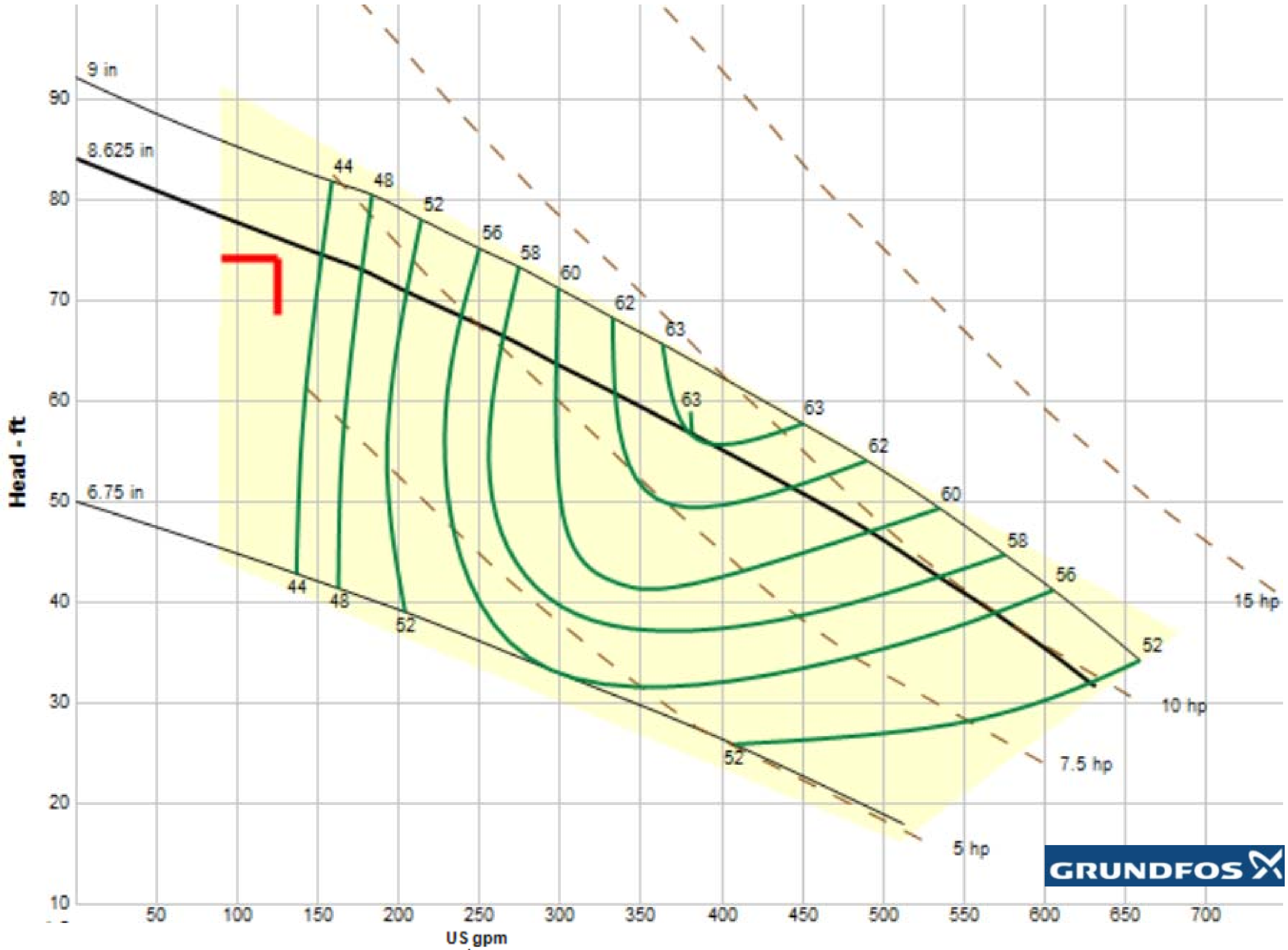

Figure 2.3.5e – Ranger Station PS Pump Curve

2.3.6. Infiltration and Inflow

Many communities in Oregon (particularly those west of the Cascade Mountains) struggle with the issue of inflow and infiltration (I/I) within their wastewater collection systems. Inflow and infiltration are defined as follows:

<u>Infiltration</u>: Flows that enter the collection system through underground paths. Infiltration can be caused by high groundwater levels, rain-induced groundwater, leaky water and storm drain systems, and other sources. Infiltration flows make their way into the collection system through cracks in pipe, open or offset pipe joints, broken piping sections, leaks in manholes, and other below-grade openings in the collection system.

<u>Inflow</u>: Flows that enter the collection system through above ground paths. Inflow is often related to building downspouts being connected to sanitary sewer service laterals, interconnections with storm drain systems that have not been separated, water flowing over manholes and entering in through the openings in the lids, catch basins, or area drains being connected to the sewer system, and other surface water sources.

When combined, Infiltration and Inflow (I/I) can result in tremendous increase in flows during the winter, particularly during prolonged storm events. Comparison of the records of daily rainfall and the WWTP flows shows a marked increase in wastewater inflow rates during heavy rain events. Current I/I levels can be summarized in the following table.

Table 2.3.6 – Inflow / Infiltration Summary

Current I/I Flow Summary									
Parameter		Calculation					I/I Flow		Per Capita
AWW I/I	=	AWWF - Base Sewerage =	0.408	-	0.214	=	0.195 MGD	=	103.3 gppd
MMWW I/I	=	MMWWF - Base Sewerage =	0.598	-	0.214	=	0.384 MGD	=	204.0 gppd
PD I/I	=	PDAF - Base Sewerage =	1.272	-	0.214	=	1.058 MGD	=	562.0 gppd
PIF I/I	=	PIF - Base Sewerage =	1.870	-	0.214	=	1.656 MGD	=	879.6 gppd

The City of Cave Junction commissioned a flow mapping study in March 2013. The results of that study are presented in the April 26, 2013 Memorandum, (2013, Civil West Engineering Services, Inc.) found in Appendix D. The flow mapping survey revealed areas where subsurface water leaks into the system. The memorandum presented 14 manholes and eight (8) sections of pipe that are in need of further investigation and likely rehabilitation.

Additionally, the City of Cave Junction conducts periodic smoke testing, cleaning and televising of gravity mains within the collection system. City personnel clean all of the gravity sewer mains in the collection system at least once each year with equipment owned by the City. The City staff also smoke test and televise 1/5th of the collection system each year with City equipment. Thereby, the entire collection system is televised and smoke tested at least once every five (5) years.

According to the EPA I/I Analysis and Project Certification publication (#97-03), the determination of "non-excessive" INFILTRATION is based on an average flow rate during a period of seasonal high groundwater. Oregon DEQ further defines the flow rate as the average flow for a minimum of 14 consecutive days within the wet season months, during which no significant rain events occur. Per the EPA publication, any flow less than 120 gpcd leads to a "non-excessive" determination.

For the purposes of this analysis, the data from the discharge monitoring reports for the period of record (2010-2012) were analyzed for 14-day periods during the months of December through May with rainfall that did not exceed the average rainfall event, 0.44 inches, for the time period. Data sets meeting the above described criteria occurred in May 2010, January 2011, April 2011, May 2011, December 2011, January 2012, February 2012, and May 2012. The average daily flow for the above mentioned time periods was 0.312 MGD. Converting 0.312 MGD to a per capita flow rate is done by dividing by the population served (1,883 persons), resulting in a daily per capita flow rate of 165.6 gpcd. This exceeds the EPA "non-excessive" criteria maximum flow rate. Therefore, per the EPA publication, the infiltration into the wastewater collection system for the City of Cave Junction does not qualify as "non-excessive".

Per the same EPA publication, excessive INFLOW is determined by the "highest daily flow recorded during a storm event". By this definition, the comparison should be made to the peak day average flow (PDAF). If the wet weather flow is below 275 gpcd, the inflow is considered "non-excessive". The peak day average flow per capita for Cave Junction, as determined in Figure 3.3.4a is 1.272 MGD. Dividing by the current population (1,883 persons) yields a flow rate of 675.5 gpcd. This exceeds the limit (275 gpcd) presented by the EPA. Therefore, per the EPA publication, the inflow into the City of Cave Junction wastewater collection system does not meet the criteria of "non-excessive".

Both Inflow and Infiltration values exceed the "non-excessive" thresholds warranting additional determination as to the cost effectiveness of I/I removal. Further analysis of potential cost effective inflow and infiltration removal can be found in Section 3.3.7.

2.4. Wastewater Treatment Facilities

2.4.1. General

The City of Cave Junction operates a wastewater treatment plant that is located in the northwest portion of the City, at the north end of Sawyer Avenue. The facility was originally constructed in 1963 as a series of stabilization and facultative lagoons with winter discharge and summer storage. The wastewater treatment facility was upgraded in 1977 with the addition of a Cantex package activated sludge plant. The lagoons were used for peak flow events and summer storage.

A new plant was designed and constructed in 1998. The wastewater treatment plant was designed to meet EPA Class 1 reliability standards. The 1998 plant remains in operation today. Figure 2.4.1a provides an aerial view of the existing plant site. Figure 2.4.1b presents the process diagram for the plant. The process sketch shows the liquid and solids stream for wastewater entering the plant. The plant receives and treats all the collected wastewater in the City. The facility also receives septage from local septic pumpers/haulers.

Table 2.4.1 presents a general summary of the each key component and the ability or lack to meet regulatory requirements. This section will present each of the primary components of the wastewater treatment facility.

Figure 2.4.1a – Existing Treatment Facility

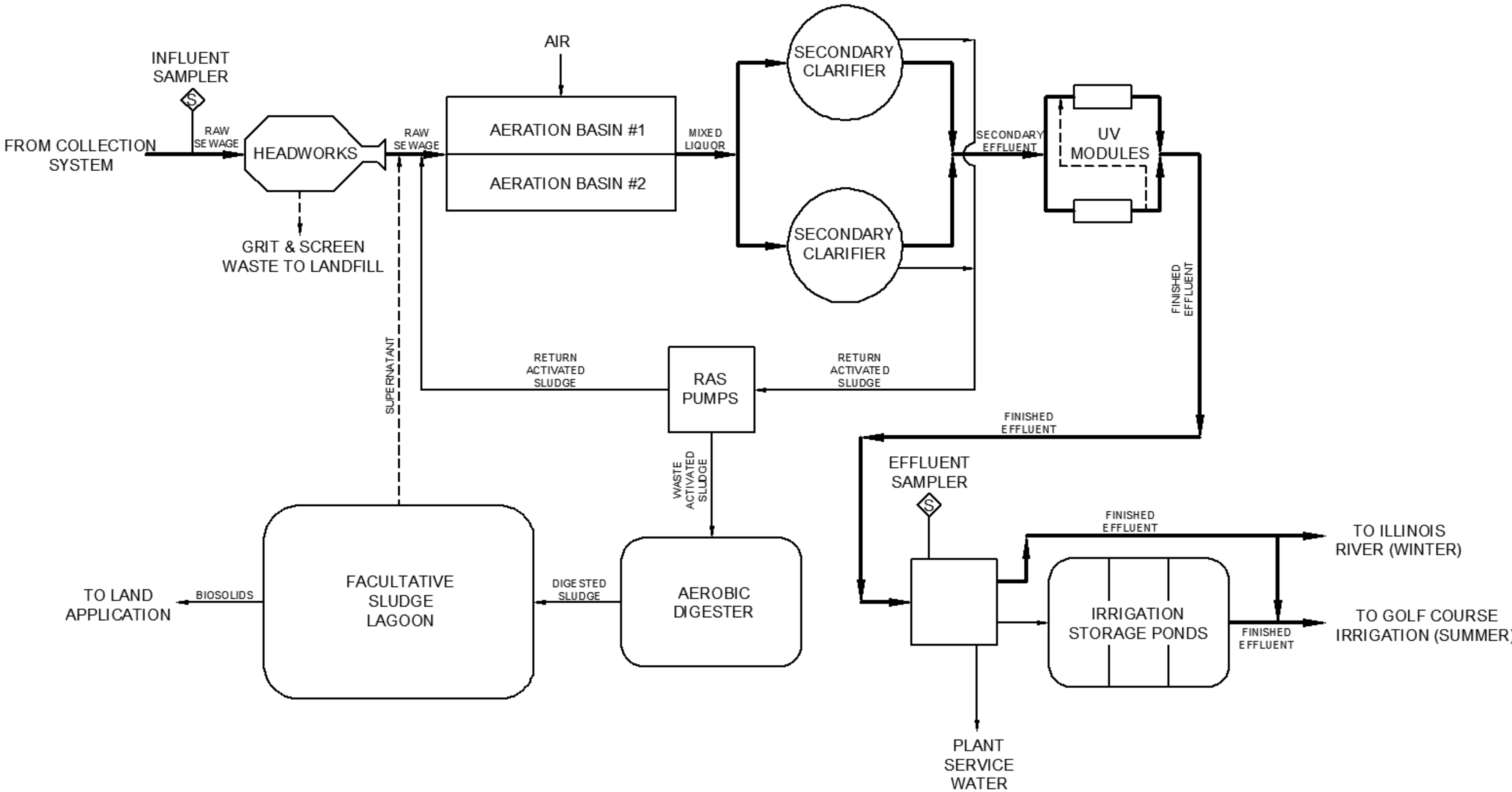

Figure 2.4.1b – Treatment Process Schematic

Table 2.4.1 – Design Capacity of Wastewater Plant Facilities

Unit Process	Design Basis	Current Flows (MGD)	2035 Design Flows (MGD)	Minimum Required Conditions	Existing Facilities Condition	Existing Facility Meets Class 1 Process Requirements
Influent Screening	PIF	1.870	3.175	Mechanically cleaned primary screen for PIF. Manually cleaned bar rack screen sized for PIF	Schloss screen with 8 MGD capacity, per manufacturer.	YES
Grit Removal	MMWWF	0.598	1.015	If required for subsequent treatment processes, minimum of two units, each designed for peak flow (PIF). If not, a single unit is acceptable for MMWWF	The capacity of the grit chamber is 7 MGD, well above the required 1.015 MGD.	YES
Aeration Basin	PIF	1.870	3.175	Must provide hydraulic capacity for PIF or one hour of storage capacity at PIF.	The hydraulic capacity of the combined aeration basins exceeds 1 hour at the peak instantaneous flow rate.	YES
	PDAF	1.272	2.160	Must be able to meet daily maximum discharge limits under Peak Day Flow condition with both basins online.	Projected Loadings are within the rated peak day design capacity of 2.3 MGD.	YES
	MMDWF	0.371	0.631	Must be able to meet monthly average discharge limits at Maximum Month Dry-Weather Flow condition with largest basin offline.	One basin can handle project MMDWF loadings at an SRT of 3-4 days. Septage loads may be interrupted.	YES
Aeration Blowers				Minimum two blowers. Must be able to supply the design air capacity with the largest blower out of service.	Two similar blowers are installed. Each capable of 436 scfm on low speed and 1,050 scfm on high. Future air demands are expected to be 1,700 scfm. Additional air supply is needed.	**NO**
Air Diffusers				Must be able to isolate and turn off largest section of diffusers within a basin without impairing oxygen transfer.	Each sub-basin within the aeration basins are independently valved.	YES
Secondary Clarifier	PIF	1.870	3.175	Must provide hydraulic capacity for PIF or one hour of storage capacity at PIF.	Combined, both basins can treat 4 MGD.	YES
	PDAF	1.272	2.160	Must be able to meet daily maximum discharge limits under Peak Day Flow condition with both basins online.	Combined, both basins can treat 4 MGD.	YES
	MMDWF	0.371	0.631	Must be able to meet monthly average discharge limits at Maximum Month Dry-Weather Flow condition with largest basin offline.	Individually, each basin can treat 2 MGD.	YES
Disinfection	PIF	1.870	3.175	Minimum two UV units. Must be able to provide a minimum dose of 30 mJ/cm^2 at Peak Instantaneous Flow with all units on.	Two similar UV units are installed. Combined they can disinfect 4 MGD.	YES
	MMDWF	0.371	0.631	Must be able to provide a minimum dose of 30 mJ/cm^2 at Maximum Monthly Dry-Weather Flow with the largest unit off-line.	Each UV unit is capable of disinfecting 2 MGD.	YES
UV Ballast and Control				Must have full redundancy of Ballasts and Controls.	Installed.	YES
UVT and UVI				Must have UV intensity and transmittance meters. UVT-based Controls are recommended.	UVI meters have been ordered. Transmittance measurement device is not installed at this time.	**NO**
Outfall	PIF	1.870	3.175	Must be able to convey Peak Instantaneous Flow under worst case hydraulic conditions (100 year flood elevation)	Outfall is designed to convey 10 MGD.	YES
Electrical Power				Two, separate and independent sources of electrical power are required. Primary power from utility service provider, back-up power from on-site generator. Back-up generator must have sufficient capacity to operate all vital process components, critical lighting and necessary ventilation during Peak Instantaneous Flow conditions.	Two sources of power: (1) Power Utility Line Power (2) 500 KW Diesel Generator.	YES

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2.4.2. Headworks

Figure 2.4.2a – Photo of Headworks

All flow from the collection system enters the headworks of the treatment plant (see Figure 2.4.2a) at a concrete channel. The channel divides into three channels where bar screens (primary and secondary) or a trash rack (emergency overflow) are installed.

Bar screens are installed in two of the concrete channels at the beginning of the headworks for the treatment plant. The primary screen is an automatic bar screen, manufactured by Schloss Engineering Equipment, which was installed in 2006 (seen in Figure 2.4.2b). The original ½-inch spaced bars were replaced with ¾-inch spaced bars to reduce the capture of organics. The secondary or backup screen is a manual screen installed in a concrete channel with bar spacing at ¾-inch. The third channel is installed with a trash rack and acts as an emergency overflow channel in the event both the primary and secondary screens are clogged with debris.

Figure 2.4.2b – Photo of Automatic Screen

The primary, automatic screen is capable of passing 8 MGD (5,500 gpm), according to the manufacturer. The secondary, manual screen has a 4 MGD (2,777 gpm) capacity.

Non-organic material and other foreign debris removed at the screens are lifted and dropped into a 1.5 hp compactor.

Following the screening, the concrete channels converge into one, main channel. A Parshall flume is nested in another flume that is installed in the main channel, with a sonic level transducer to measure depth of liquid in the flume. The Parshall flume provides continuous measurement of the influent to the treatment plant.

Figure 2.4.2c – Photo of Grit Chamber

Following flow measurement, the flow is directed to a mechanical vortex grit chamber (See Figure 2.4.2c), where sand, grit and other heavy material are removed. Grit slurry is pumped to a cyclone separator/washer. Dewatered grit drops into a dumpster with the screenings. The liquid stream is returned to the main concrete channel for further treatment in the aeration chambers.

2.4.3. Secondary Treatment: Aerated Selector Basins

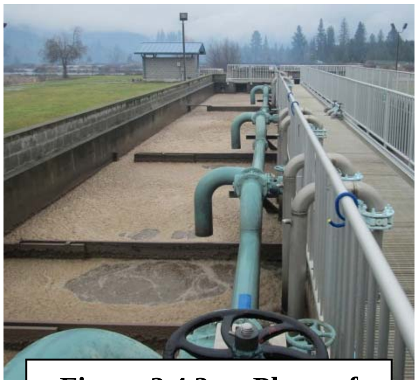

Figure 2.4.3a – Photo of West Aeration Chamber

The liquid stream continues from the headworks to the aeration basins. The City of Cave Junction operates a facility with two (2) aeration basins.

Together, the two basins comprise a Modified Ludzack-Ettinger (MLE) biological nutrient removal scheme. The facility does not have discharge limits for nutrients, so it is not necessary to operate in this mode. The two basins can be operated separately and in parallel. Under current operation, the west basin (Basin #1 – Figure 2.4.3a) is used for treating domestic flow and the east basin (Basin #2 – Figure 2.4.3b) is used for septage receiving and treatment.

Figure 2.4.3b – Photo of East Aeration Chamber

Both aeration basins are 106-feet long and 15-feet wide, with a side-water depth of 15-feet, resulting in a treatment volume of 162,500 gallons. Space is available to the east of the existing aeration basins for future expansion of a third similar basin.

According to the design data table presented in the 1999 record drawings, the target concentration of mixed liquor suspended solids (MLSS) in the aeration basins is 2,000 mg/L. The returned activated sludge concentration was designed at 7,500 mg/L, with a food-to-mass (F/M) ratio of 0.36. The design sludge age (SRT) is 5 days and the hydraulic retention time (HRT) is designed at 6 hours.

Figure 2.4.3c – Photo of Aeration Discs and Manifold

Septage is received twice a week, during limited hours of operation. Septic pumper/hauler trucks may deliver a load of septage, for a fee, to the treatment plant with a written chain of custody (COC) and a pH sample. If the pH is too low (acidic), the plant operator has the right to refuse the load. For acceptable loads, the septic truck discharges to the manhole immediately upstream of the headworks screens. The septage flows through the screen and grit chamber. Septage is then diverted to the east aeration basin for treatment. The operator treats the septage with high doses of air and long retention times.

Air is introduced to the liquid stream with circular, fine-bubble aerator discs installed on the bottom of the basins (See Figure 2.4.3c).

2.4.4. Aeration Blowers

Figure 2.4.4 – Photo of Aeration Blowers

Air is delivered to the aeration basins by two (2) positive displacement blowers, manufactured by Roots (a Division of Dresser Industries). The blower motors are 50 HP with manufacturer suggested capacity from 867 to 1347 scfm, each. Figure 2.4.4 shows a photograph of the blowers.

The building housing the blowers is adjacent to the aeration basins, to the west. A concrete pad is available inside the blower building for installation of a third blower.

2.4.5. Secondary Clarifiers

Figure 2.4.5 – Photo of Secondary Clarifier

After the aeration basins, the liquid stream is conveyed to two (2) concrete, circular upflow clarifiers, where the suspended solids are settled out and removed as return activated sludge (RAS), which is pumped back to the aeration basins or removed as waste activated sludge (WAS).

The clarifiers were constructed as peripheral weir, center-fed flocculator (See Figure 2.4.5). The clarifiers are both 45-feet diameter and 16-feet sidewater depth. The design overflow rate is 410 to 720 gallons per day per square foot at maximum month and peak daily flows, respectively.

Each clarifier is capable of treating approximately 2 million gallons per day.

2.4.6. Disinfection

The clarified liquid stream leaves the clarifiers and enters the ultra-violet (UV) disinfection units. Disinfection is comprised of two (2) BersonInLine 3000 UV enclosed chambers, Type HXLS8, manufactured by Berson UV-Techniek. Each chamber contains 8 lamps.

Per the manufacturer, each UV chamber can maintain an ultra-violet dose of 30 mJ/cm^2 at 2 MGD wastewater flow.

At the time of this report preparation, the City has ordered new UV intensity monitors for the chambers. The order is for the model UVDRX-DWS-M-NW25 10’-X2 from UV Doctor. The new sensors will be installed as soon as they arrive.

Figure 2.4.6 – Photo of Ultra-Violet Disinfection Units

The point of compliance for the treatment plant is immediately following the disinfection units, as the effluent leaves the plant.

2.4.7. River Outfall

The outfall conveys the treated and disinfected effluent to the point of final disposal or discharge. The outfall piping was also upgraded in conjunction with the plant upgrades in 1998. The current outfall is approximately 3,340 lineal feet of 21-inch diameter reinforced concrete pipe (RCP), with the last 40 feet made of 12-inch PVC.

The outfall pipe leaves the disinfection chamber and heads north and west around the lagoons. A flow-diverting manhole directs the flow to the lined storage pond on the golf course (summer) or to the west to discharge to the Illinois River (winter).

2.4.8. Seasonal Effluent Disposal at Golf Course

During the summer months (July through September) Effluent conveyed to the detention pond, to the north, is applied as reclaimed water by the golf course during dry summer months. The property owned by the golf course includes a total of 58.2 acres of land, of which only 33.9 acres is irrigated. The golf course is predominantly vegetated with grass, with some trees and shrubs. Water is applied with an underground sprinkler system. The legal agreement between the City and the golf course is included in the *Cave Junction Reclaimed Water Plan* (see Appendix I). The golf course applies between 27,000 gpd and 90,000 gpd reclaimed water during the summer months. This water usage equates to 1.3 million gallons to 8.2 million gallons per quarter for reporting purposes.

In addition to application of reclaimed water at the golf course, reclaimed water is applied at the wastewater treatment plant site. The wastewater treatment plant property includes approximately 4 acres of land vegetated with grass. Reclaimed water is applied using manually placed lawn sprinklers. When reclaimed water is available, treatment plant personnel report being able to apply approximately 40,000 gallons per day on the plant property.

Also, during the summer months, reclaimed water is diverted and used to maintain water level in the on-site storage pond and the facultative sludge lagoon, to retain the water level, maintain healthy wetlands and prevent noxious odors. The water diverted to the on-site ponds is used to combat evaporation from the ponds. Based on NOAA evaporation information found in NOAA Technical Report TR33 and TR34, as much as 40,000 gallons per day may be evaporated from the on-site storage ponds at the treatment plant site.

Currently, the treatment plant discharges effluent that meets the criteria for Class C classification, which is defined as “Class C recycled water must not exceed a median of 23 total coliform organisms per 100 milliliters, based on results of the last seven days that analyses have been completed, and 240 total coliform organisms per 100 milliliters in any two consecutive samples. OAR 340-055-0012(5)(c)”. Disposal of Class C recycled water is governed by OAR 340-055-0012(5). If improvements are made to the treatment process to improve effluent quality, regulation of disposal of Class A recycled water is found in OAR 340-055-0012 (7). The regulations provide requirements of setbacks, public access limitations and water quality conditions.

2.4.9. Biosolids

Waste activated sludge is pumped to a lined aerobic digester (Figure 2.4.9a). The aerobic digester is approximately 100-feet wide and 170-feet long, with a side-water depth of 10-feet. The liner is a 40 mil HDPE. The volume of the basin is about 105,000 ft^3. The design solids retention time (SRT) is 60 days at 1.5% suspended solids (SS).

Aeration and mixing are provided by several floating, surface aerator/mixer units. The floating aerators have 20 HP motors and are manufactured by Aeration Industries. Unfortunately, the operation personnel have had constant problems with the floating aerators. The floats are not of sufficient size or stability to support a man, so the units are removed from the basin for maintenance. The motors and bearings require frequent maintenance. At the time of the preparation of this document only two (2) of the designed four (4) surface aerator/mixers are functioning and in-place.

Figure 2.4.9a – Photo of Biosolids Aerobic Digester

Digested sludge flows by gravity from the aerobic digester to a lined facultative sludge storage basin (Figure 2.4.9b). The storage basin is lined with 40 mil HDPE and is about 320 feet long, 170 feet wide and 12 feet sidewater depth for an approximate volume of 458,000 cubic feet.

The facultative storage lagoon has not been emptied in the 15 years since it was constructed. The storage lagoon is estimated to be about 67% full of biosolids, according to staff estimates.

The portions of the HDPE liners above the liquid appear to be brittle, cracking and deteriorating from exposure.

Figure 2.4.9b – Photo of Biosolids Facultative Storage Basin

Disposal options for the biosolids will be discussed in later sections.

2.5. Financial Status of Existing Facilities

2.5.1. Annual Financial Reports

Table 2.5.1a provides annual actual and budget revenues and expenses for the Sewer Fund of the City of Cave Junction.

Table 2.5.1a – City Annual Sewer Fund Budget Summary

	FY 2013-2014 (Budget)	FY 2012-2013 (Budget)	FY 2011-2012 (Actual)	FY 2010-2011 (Actual)	FY 2009-2010 (Actual)	FY 2008-2009 (Actual)
Revenues	$ 515,950	$ 415,450	$ 419,570	$ 422,950	$ 418,532	$ 422,117
Expenditures						
Materials & Services (Utility)	$ 262,600	$ 166,000	$ 122,498	$ 122,984	$ 122,623	$ 107,354
Capital Outlay	$ 71,900	$ 80,000	$ 10,420	$ -	$ -	$ -
Operating Contigency	$ 5,663	$ 5,663	$ -	$ -	$ -	$ -
Total Expenditures	$ 340,163	$ 251,663	$ 132,918	$ 122,984	$ 122,623	$ 107,354
Excess (Deficiency) of Revenues over Expenditures	$ 175,787	$ 163,787	$ 286,652	$ 299,966	$ 295,909	$ 314,763
Other Financing Sources (Uses)						
Operating Transfers Out	$ (297,687)	$ (297,687)	$ (295,787)	$ (325,787)	$ (260,787)	$ (273,403)
Excess (Deficiency) of Revenues and Other Sources over Expenditures and Other Uses	$ (121,900)	$ (133,900)	$ (9,135)	$ (25,821)	$ 35,122	$ 41,360
Fund Balance July 1 (Beginning)	$ 121,900	$ 163,948	$ 173,083	$ 198,904	$ 163,782	$ 122,422
Fund Balance June 30 (Ending)	$ -	$ 30,048	$ 163,948	$ 173,083	$ 198,904	$ 163,782

Operating transfers out includes personnel, vehicle expenses and debt service payments.

Annual operations and maintenance expenses are included in the Materials & Services category in the City's Annual Budget. The expense item includes collection and treatment.

2.5.2. Current Sewer Rate Structure

The City of Cave Junction bases wastewater rates on a flat base fee and a nominal charge for each hundred cubic feet over the base 500 cubic feet. For customers that require a grease trap, such as commercial or industrial land uses, an additional fee is included in the monthly bill. The measurement for cubic feet of wastewater discharged is taken from the water meters, averaged over the winter months, for each account.

The following table summarizes the rate schedule for the City of Cave Junction:

Table 2.5.2 – Sewer Rate Summary

Description	Rate
Base Rate per month per EDU (up to 500 cf or 3,740 gallons)	$ 31.00
Each Additional 100 cf (748 gallons) based on Average Winter Water Usage	$ 1.00
Additional Fee for Grease Trap (As Required for Commercial or Industrial)	$ 15.00

For clarification purposes, the additional monthly grease trap fee is assessed to commercial or industrial customers who have been notified by the City Public Works of the requirement to operate and maintain a grease trap but have not, as yet, installed one. The fee is assessed monthly until the installation of a grease trap is completed.

Based on the actual water meter readings for the record period from January 2011 through April 2013 (2.5 years of record), the residential customers consume a monthly average of 4,302 gallons (575 cubic feet) of water during the winter months (November through April). The calculation of the average monthly winter water consumption was made using the recorded meter data for all of the full-time residential water users. Partial month or accounts with no apparent winter usage were removed from the analysis. The sewer bill associated with 4302 gallons is $32.00 per month, or $384 annually. Based on an annual, median household income (MHI) of $20,642 (2010 US Census), the sewer bill for 4,302 gallons per month encumbers 1.86% of the median income.

For comparative purposes, some funding agencies request reporting the average monthly rate based on 7,500 gallons per month consumption. Based on the City of Cave Junction rate structure, a resident using 7,500 gallons (1002.7 cf) per month will pay $37.00 per month. Assuming 7,500 gallons per month is an annual monthly average; the same user will pay $444.00 each year. Based on an annual, median household income (MHI) of $20,642 (2010 US Census), the sewer rate for 7,500 gallons per month use equates to 2.15% of the income.

2.6. Water/Energy/Waste Audits

The City has not conducted water, energy or waste audits.

2.7. Equivalent Dwelling Unit Summary

The following table summarizes the equivalent dwelling unit for residential (permanent and seasonal), commercial (small and large), industrial and public (small and large) customers. Seasonal residents are those with water consumption less than six months in any given year. Small customers have a water meter 1-inch or less in size. Customers with water meters larger than 1-inch are "large". The number of users "before" for each category is based on the reporting of actual water meter customers from January 2011 to June 2013. The Number of Users "After" corresponds with a 2.5% growth over the 20-year planning period of this document. It is assumed that the ultimate number of public facilities (City Hall, Schools, Treatment Plants – Water and Sewer) will not increase.

Total Usage for residential customers represents an annual water usage, based on the average monthly water consumption during winter months (average winter month * 12). The Total Usage for Commercial, Industrial and Public customers is the average of the annual sum of water consumed from the available data.

Table 2.7 – Equivalent Dwelling Unit Summary

Type of User	Number of Users		Total Usage	Usage Per User	EDU[1]	EDU[2]
	Before	After	(Gal/year)	(Gal/year)		
Residential, Permanent	697	1260	37,289,500	53,500	697	697
Residential, Seasonal	6	13	153,000	25,500	6	6
Commercial, Small	128	232	15,383,000	120,180	288	171
Commercial, Large	8	17	13,294,000	1,661,750	249	148
Industrial	1	2	728,000	728,000	14	9
Public, Small	7	7	340,000	48,571	7	7
Public, Large	16	16	33,637,000	2,102,313	629	374
Totals	863	1547	100,824,500		1890	1412

Note 1: EDU calculation based on Usage Per User for Permanent Residential Customer.
Note 2: EDU calculation based on monthly average water consumption of 7,500 gallons per month.

The Usage Per User for permanent residents (53,500 gallons/year) represents the calculated equivalent dwelling unit (EDU) annual water consumption. Usage Per User for the Commercial, Industrial and Public categories is the calculated average usage determined by dividing the Total Usage by the Number of Users.

The following is a list of the Small Commercial (water meter 1-inch or smaller) water users in Cave Junction:

Small Commercial Account Name	ID
ADI ELECTRIC	02-340
ARTS RED GARTER STEAK HOUSE	07-110
BEAR IMAGES BOUTIQUE	04-510
BI-RITE AUTO INC	08-310
BLALOCK, RUTH	01-950
BODKIN, MARGARET	05-40
BOMONT, STEVEN	05-410
BRADEN, GARY	07-230
C & K PHARMACY EXPRESS, LLC	08-220
CABIN CHEMISTRY	08-295

CARLOS RESTAURANTE	06-660
CASCADE AUTO	08-380
CAVES ECONOMY DRUG	02-280
CEDARBROOK HOMEOWNERS ASSOCIATION	3C-05
CENTONZE, ANN	05-290
CENTURY 21 - HARRIS & TAYLOR	02-360
CHAN, ANTHONY	08-340
CHURCH OF JESUS CHRIST - LDS	04-350
CHURCH OF JESUS CHRIST- LDS	04-360
CITIZENS TELECOM	02-30
CJ VIDEO MART	04-530
CLEARY, MANSFIELD	06-745
COENRADI, TEUNIS	07-60
COMMUNITY BIBLE CHURCH	04-500
COMMUNITY CHURCH SCHOOL	02-350
COSEGAROTE, PAMELA	05-280
CROSSROADS ANIMAL HOSPITAL	01-530
CURTIS, JOE	05-420
DAIRY QUEEN	08-420
DALEY, PATRICK	01-940
DAVE'S OUTDOOR POWER	09-515
DUROUSSEAU, GERALDINE	08-290
DUTCH BROS LLC	04-520
EVERGREEN FEDERAL SAVINGS	05-50
EYE CARE GROUP	01-930
FIRST COMMUNITY CREDIT UNION	02-370
FISHER, DANIEL	02-325
FOLKERTS, JENNIFER	07-120
FOUNTAIN OF LIFE ASSM OF GOD	01-1000
GERBER, ALICIA	06-710
Small Commercial Account Name	ID
GIBBS ENTERPRISES	01-910
GOLDEN DRAGON GATE	05-260
GRIFFIN OREGON CORP	03-80
GUSTAFSON, ROBIN	01-525
GUTKOSKY, JOHN	08-300
HAMPTON, FRED	11-615
HAVENS, MICHAEL	07-100
HUYNH, TRI	06-680
ILLINOIS VALLEY HOUSING, LLC	09-530
ILLINOIS VALLEY HOUSING, LLC	09-550
ILLINOIS VALLEY NEWS	08-320
ILLINOIS VALLEY VIDEO	05-60
IMMANUEL METHODIST CHURCH	08-140
IMMANUEL UNITED METHODIST, PARSONAGE	08-120
IV BUILDING SUPPLY	01-660
IV FAMILY COALITION	03-215
IV MEDICAL CENTER	01-960
IV MEDICAL CENTER	01-980
IV REAL ESTATE PROPERTY MNGMNT	05-100

IV REAL ESTATE PROPERTY MNGMT	05-270
IV SAFE HOUSE ALLIANCE	06-790
IV SENIOR CENTER	03-242
IV SENIOR THRIFT SHOP	02-290
IV VISITORS CENTER	01-1080
JOHNSON, KENDRA	01-1090
JOHNSON, LYNN	07-220
JONES, CHERYL	08-180
JUNCTION REALTY	03-10
KERBY UNION MEMORIAL PARK	11-219
KERBYVILLE INDUSTRIAL CENTER	11-530
KERBYVILLE MUSEUM	11-290
KERBYVILLE MUSEUM	11-295
KRSKA, DENISE	08-210
LAFAYETTE CAPITAL GROUP, INC.	3A-245
LAFAYETTE CAPITAL GROUP, INC.	3A-250
LAMB, CONNIE	08-330
LAUREL CEMETERY ASSOC	03-250
LEMLEY, VIRGIL	04-60
LEMLEY, VIRGIL	04-80
LUBE 'N' SHINE	07-130
MASON, TRINA	04-550
MAY-BELLE APARTMENTS	04-30
MAY-BELLE APARTMENTS	04-35
MCALISTER, GARY	01-460
MINERVINI, JAMES	06-740
NAPA AUTO PARTS	08-280
NORDAL, JIM	06-655
NORTHWEST HAIRLINE	06-720
OREGON CAVES CHEVRON STATION	08-260
Small Commercial Account Name	ID
OREGON MOUNTAIN REAL ESTATE	08-410
PALMER, SALLY	02-302
PIETRO'S ITALIAN RESTAURANT	01-870
PIOMENA LLC	06-770
PROJECT BABY CHECK	02-180
REDWOOD SERVICE CENTER	04-560
RISING DRAGON MARTIAL ARTS	05-30
RISING SUNS	07-200
ROBBIES AUTO	05-10
ROGUE TRUCK	11-605
S AND B INVESTMENTS	04-203
S AND B INVESTMENTS	08-400
SEITZ, GARY	08-390
SEVENTH DAY ADVENTIST	01-330
SHINEROCK, JOY	07-170
SHINEROCK, HARVEY	11-345
SHINEROCK, HARVEY	11-350
SHOP SMART FOOD WAREHOUSE #28	08-155
SHOP SMART FOOD WAREHOUSE #28	08-225

SHOP SMART IRRIGATION	08-160
SISKIYOU MARKET	01-820
SOUTHERN OREGON OUTREACH FOUNDATION	02-310
SPORTSMAN TAVERN	02-300
ST PATRICKS CHURCH	06-140
STERLING SAVINGS BANK SITE #326	06-690
STONE, JOANNE	02-301
SU, JIMMY	08-350
TAYLORS COUNTRY STORE	07-210
TEXACO STATION-CAVE JUNCTION	07-20
THOMAS, JUDITH	08-305
TREEHOUSE FLORIST & GIFTS	07-150
TURCZYNSKI, AMBER	09-540
VALLEY MUFFLER & HITCH	08-370
VERSTEEG, RONALD	04-280
VIANNA, CAMILA	07-160
WALKER, LEE	05-230
WASHINGTON FEDERAL	02-315
WEEKLY BROS INC	09-195
WILD RIVER PIZZA DELI	04-570

The following lists the Large Commercial (water meter larger than 1-inch) accounts for the City:

Large Commercial Account Name	ID
ASSEMBLY OF GOD CHURCH	01-1060
JUNCTION INN	08-430
PINERIDGE ESTATES	08-105
RIVER VALLEY VILLAGE MOBILE	06-340
SISKIYOU COMMUNITY HEALTH CNTR	4A-05
SISKIYOU VILLAGE	07-530
TEXACO CAR WASH	07-30
Large Commercial Account Name	ID
VALLEY VILLAGE	07-380

The following presents a list of the Industrial customers in the City:

Industrial Account Name	ID
TAYLOR'S SAUSAGE INC.	07-360

The following lists the Small Public accounts in the City of Cave Junction:

Small Public Account Name	ID
CITY OF CAVE JUNCTION - TITLE CO	06-780
EARLY HEAD START	03-210
JOSEPHINE COUNTY PUBLIC WORKS	11-190
ODOT	02-10
ROGUE COMMUNITY COLLEGE	11-220
SO OR HEAD START	03-228
US POST OFFICE	06-760

Lastly, the following provides a list of the Large Public users in the Cave Junction water and sewer system:

Large Public Account Name	ID
CITY HALL	06-800
CITY OF CAVE JUNCTION	04-340
CITY OF CAVE JUNCTION	05-440
CITY OF CAVE JUNCTION	09-95
CITY OF CAVE JUNCTION - IV POOL	03-245
CITY OF CAVE JUNCTION - WTP	01-1010
CITY OF CAVE JUNCTION - WTP	01-1015
CITY OF CAVE JUNCTION - WWTP	05-450
COUNTY BUILDING	06-750
EVERGREEN ELEMENTARY	06-260
ILLINOIS VALLEY HIGH SCHOOL	03-230
JOSEPHINE COMMUNITY LIBRARY	06-630
KERBY WATER DISTRICT	4A-500
LORNA BYRNE MIDDLE SCHOOL	04-130
THREE RIVERS SCHOOL DISTRICT	01-780
UNITED STATES FOREST SERVICE	08-440

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3.0 Need for Project

3.1. Health, Sanitation, and Security

The Clean Water Act (CWA) as delegated to the State of Oregon and enforced through Oregon Revised Statues (ORS 468B.050), requires permits for all discharges of wastewater to waters of the state. The City of Cave Junction operates its wastewater system under the jurisdiction of the Oregon Department of Environmental Quality (DEQ), with a National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit (Permit No. 102610) which was issued on February 28, 2007 (See Appendix). NPDES permits are generally renewed every 5 years, at which time any changes to the rules will be included.

The 2007 NPDES permit allows the City to discharge treated wastewater to the Illinois River at river mile 54.6 under the prescribed effluent limitations and other requirements. These effluent limits are developed to protect the beneficial uses for the Rogue Basin (Oregon Administrative Rules 340-45-0271).

Oregon Administrative Rules (OAR) also contain both statewide and basin specific minimum design criteria and rules regarding sanitary sewage overflows. These rules are discussed below:

3.1.1. Minimum Design Criteria for Wastewater Treatment and Control of Wastes

OAR 340-041-0007 (Statewide Narrative Criteria) includes minimum design criteria for treatment and control of wastes. Generally, wastewater from a municipal wastewater treatment system must be treated and controlled in facilities designed in accordance with the following minimum criteria:

- In designing treatment facilities, average conditions and a normal range of variability are generally used in establishing design criteria. A facility once completed and placed in operation should operate at or near the design limit most of the time but may operate below the design criteria limit at times due to variables which are unpredictable or uncontrollable. This is particularly true for biological treatment facilities. The actual operating limits are intended to be established by permit pursuant to ORS 468B.050 and recognize that the actual performance level may at times be less than the design criteria.
- Effluent BOD concentrations in mg/l, divided by the dilution factor (ratio of receiving stream flow to effluent flow) may not exceed one unless otherwise approved by the Environmental Quality Commission;
- Sewage wastes must be disinfected, after treatment, equivalent to thorough mixing with sufficient chlorine to provide a residual of at least 1 part per million after 60 minutes of contact time unless otherwise specifically authorized by permit;
- Positive protection must be provided to prevent bypassing raw or inadequately treated sewage to public waters unless otherwise approved by the Department of Environmental Quality, where elimination of inflow and infiltration would be necessary but not presently practicable; and
- More stringent waste treatment and control requirements may be imposed where special conditions make such action appropriate.

OAR 340-041-0275 (Water Quality Standards and Policies for the Rogue Basin) includes minimum design criteria for treatment and control of wastes. These are as follows:

- pH values may not fall outside the range of 6.5 to 8.5.
- During periods of low stream flows (approximately May 1 to October 31), treatment resulting in monthly average effluent concentrations not to exceed 10 mg/l of BOD and 10 mg/l of SS or equivalent control;

- During the period of high stream flows (approximately November 1 to April 30), a minimum of secondary treatment or equivalent control and unless otherwise specifically authorized by the Department, operation of all waste treatment and control facilities at maximum practicable efficiency and effectiveness so as to minimize waste discharges to public waters.

New or expanded wastewater treatment systems must meet the requirements described above.

3.1.2. Sanitary Sewage Overflows (SSOs)

OAR 340-041-0009 (6) and (7) prohibit discharging of raw sewage to waters of the state in the winter and summer, respectively. During the summer (May 22 through October 31), raw sewage discharges are prohibited, except during a storm event greater than the one-in-ten year 24-hour duration storm. After January 1, 2010, raw sewage discharges will be prohibited during the winter (November 1 through May 21), except during a storm event greater than the one-in-five year, 24-hour duration storm.

3.1.3. Water Quality Status of Receiving Waterbody

Per OAR 340-041-0004, the Antidegradation Policy guides decisions that affect water quality such that unnecessary further degradation from new or increased point and nonpoint sources of pollution is prevented, and enhances existing surface water quality to ensure the full protection of all existing beneficial uses.

3.1.3.1. Clean Water Act, Section 303(d)

Section 305(b) of the Clean Water Act (CWA) requires DEQ to assess water quality in Oregon and report on the overall condition of waters. DEQ assigns an assessment status category to each water body where data are available to evaluate. The following are categories that may be used in a typical Section 305(b) list for each body of water:

- **Category 1:** All standards are met. (This category is not used.)
- **Category 2:** Attaining - Specific water quality standards are met
- **Category 3**: Insufficient data to determine whether a standard is met.
    - **3B:** Potential concern - Some data indicate non-attainment of a criterion, but data are insufficient to assign another category.
    - **3C**: Impairing pollutant unknown.
- **Category 4**: Water is water quality limited but a TMDL is not needed. This includes:
    - **4A:** TMDL approved - TMDLs needed to attain applicable water quality standards have been approved.
    - **4B:** Other pollution control requirements are expected to address all pollutants and will attain water quality standards.
    - **4C**: Impairment is not caused by a pollutant (e.g., flow or lack of flow is not considered a pollutant.)
- **Category 5**: Water is water quality limited and a TMDL is needed, Section 303(d) list.

Table 3.1.3.1 below summarizes the water quality status from the 305(b) assessment performed by DEQ of the Illinois River near the City of Cave Junction. Temperature is identified with a Category 4A status. Therefore, the Illinois River is water quality limited for temperature, with a TMDL and waste load allocation for temperature of effluent, which is included in the NPDES permit as an Excess Thermal Load Limit.

Table 3.1.3.1 – Illinois River Water Quality Status

River Miles	Parameter	Season	Criteria	Status	Year	Action
0 to 56.1	Alkalinity	Year Around	Table 20 Toxic Substances	Cat 2: Attaining some criteria/uses	2004	No 2010 action
0 to 56.1	Ammonia	Year Around	Table 20 Toxic Substances	Cat 2: Attaining some criteria/uses	2004	No 2010 action
32.1 to 56.1	Chlorophyll a	FallWinterSpring	Reservoir, river, estuary, non-thermally stratified lake: 0.015 mg/l	Cat 3: Insufficient data	2004	No 2010 action
32.1 to 56.1	Chlorophyll a	Summer	Reservoir, river, estuary, non-thermally stratified lake: 0.015 mg/l	Cat 2: Attaining some criteria/uses	2004	No 2010 action
32.1 to 56.1	Dissolved Oxygen	Summer	Cold water: Not less than 8.0 mg/l or 90% of saturation	Attaining	1998	No 2010 action
32.1 to 56.1	Dissolved Oxygen	Year Around	Spawning: Not less than 11.0 mg/L or 95% of saturation	Attaining	1998	No 2010 action
32.1 to 56.1	E. Coli	FallWinterSpring	30-day log mean of 126 E. coli organisms per 100 ml; no single sample > 406 organisms per 100 ml	Cat 2: Attaining some criteria/uses	2004	No 2010 action
32.1 to 56.1	E. Coli	Summer	30-day log mean of 126 E. coli organisms per 100 ml; no single sample > 406 organisms per 100 ml	Cat 2: Attaining some criteria/uses	2004	No 2010 action
32.1 to 56.1	Fecal Coliform	FallWinterSpring	N/A	Attaining	1998	No 2010 action
32.1 to 56.1	Fecal Coliform	Summer	N/A	Attaining	1998	No 2010 action
32.1 to 56.1	Flow Modification	Undefined	The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish or shellfish may not be allowed.	Water quality limited not needing a TMDL	2002	No 2010 action
32.1 to 56.1	pH	FallWinterSpring	pH 6.5 to 8.5	Cat 2: Attaining some criteria/uses	2004	No 2010 action
32.1 to 56.1	pH	Summer	pH 6.5 to 8.5	Cat 2: Attaining some criteria/uses	2004	No 2010 action
0 to 56.1	Phosphate Phosphorus	Summer	Total phosphates as phosphorus (P): Benchmark 50 ug/L in streams to control excessive aquatic growths	Cat 2: Attaining some criteria/uses	2004	No 2010 action
32.1 to 56.1	Sedimentation	Undefined	The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry may not be allowed.	Insufficient data	1998	No 2010 action
0 to 56.1	Temperature	October 15 - May 15	Salmon and steelhead spawning: 13.0 degrees Celsius 7-day-average maximum	Cat 4A: Water quality limited, TMDL approved	2010	Delisted - TMDL approved
0 to 56.1	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Cat 4A: Water quality limited, TMDL approved	2010	Delisted - TMDL approved

3.1.3.2. Mixing Zone Study

A Mixing Zone Study was completed in January 2014 by Liberte Environmental Associates, Inc. A copy of the study may be found in the appendix of this report.

The mixing zone analyzed for the study included a 10-foot, upstream, Zone of Immediate Dilution and a 100-foot long, 50-foot wide, downstream Regulatory Mixing Zone, as described in the NPDES permit. The following table summarizes the key facility and river flow conditions and model dilutions for the river discharge period (November through May).

Table 3.3.11 – Regulatory Permit Dilution and Basis

Illinois River Flow (cfs)	Cave Junction WWTP Flow (mgd)	Dilution of Existing Outfall
57.8 [1Q10]	0.699	3.0 (ZID at 10-feet)
75.2 [7Q10]	0.520	4.7 (RMZ at 100-feet)
200 [Regulatory]	0.520	5.6 (RMZ at 100-feet)

The mixing zone study also analyzed diffuser assemblies to improve the dilution factor within the mixing zone. With a 9-port diffuser, the dilution factor increases to 23.3 at the end of the regulatory mixing zone for the 7Q10 flow (75.2 cfs) and increases to 48.7 for the 200 cfs regulatory discharge limitation.

3.1.3.3. Temperature and Thermal Increase

Water temperatures affect the biological cycles of aquatic species and are a critical factor in maintaining and restoring healthy salmonid populations throughout the state. It is the policy of the Environmental Quality Commission (EQC) to protect aquatic ecosystems from adverse warming caused by anthropogenic activities. The purpose of the temperature criteria listed in OAR 340-041-0028 is to protect designated temperature sensitive beneficial uses, including salmonid life cycle stages in waters of the State.

DEQ's Fish Use Designation maps identify the applicable temperature criteria for each basin. The Rogue River sub-basin map is set out in OAR 340-041-0271 Figure 271A and Figure 271B. The Illinois River is a tributary to the Rogue River. According to the Fish Use Designation maps approved with the temperature standard, the Illinois River in this area is designated as a rearing and migration corridor.

The DEQ list of Water Quality Limited Water Bodies for 2010 indicates that the Illinois River is water quality limited for temperature in the area of the outfall. The temperature criterion is 13°C during the spawning period (October 15 through May 15) and 18°C during the rest of the year, to comply with the "rearing" criteria. Additionally, in order to protect cold water, a point source may not increase the stream temperature (at the point of maximum impact) by more than 0.3 degrees Celsius above the ambient temperature (OAR 340-041-0028(11)(a)).

DEQ used the existing discharge data (existing facility design flow and maximum effluent temperature) and assumed 7Q10 flows for the Illinois River and dilution factor in the mixing zone to calculate the potential for in-stream temperature increase. DEQ determined that the facility has a reasonable potential for an increase in temperature above the 0.3 degree Celsius criteria. Therefore, an Excess Thermal Load (ETL) limit was placed in the current permit. The ETL is based on dilution achieved in the mixing zone because that is the most stringent limit. The current limit is 4.1 million kcals per day as a weekly average, as listed in the existing NPDES permit.

In accordance with the Human Use Allowance regulation contained in OAR 340-041-0028(12)(b)(A) and with the data from the recently completed mixing zone study, the thermal impact calculations can be calculated based on available information. The mixing zone study provides a 7Q10 Illinois River flow of 75.2 cfs and a dilution of 4.6 at the end of the mixing zone. The discharge monitoring reports used for this report were analyzed for the regulatory fish passage time period of October 15 through May 15, for the maximum 7-day average temperature of the discharge effluent, resulting in a maximum temperature of 18.7 degrees Celsius. Using the following equation, change in temperature at the end of the mixing zone can be calculated.

$$\Delta T_{mz} = \frac{T_e + (S-1)T_a}{S} - T_a$$

Computing the change in temperature at the end of the mixing zone results in a "reasonable potential" for a theoretical 1.24 degree increase. Using the above equation and 25% of the stream flow shows a "no reasonable" potential to increase the temperature of the river more than the 0.3 degrees. Based on the calculations, an ETL continues to be warranted for this discharge.

3.1.3.4. Total Chlorine Residual

Disinfection of the effluent with chlorine is the process the plant is designed to use in order to comply with the waste discharge limitations for bacteria. Chlorine is a known toxic substance and as such is subject to limitation under Oregon Administrative Rules. The rule (OAR 340-041-0033(2)) states, in part, that toxic substances shall not be discharged to waters of the state at levels that adversely affect public health, aquatic life or other designated beneficial uses. In addition, levels of toxic substances shall not exceed the criteria listed in Table 30 which were based on criteria established by the EPA and published in Quality Criteria for Water (1986), unless otherwise noted.

However, OAR 340-041-0053(2)(b)(A) states that the DEQ may allow a designated portion of a receiving water to serve as a zone of dilution for wastewaters and receiving waters to mix thoroughly and this zone will be defined as a mixing zone. DEQ may suspend all or part of the water quality standards, or set less restrictive standards, in the defined mixing zone, provided the water within the mixing zone is free of materials in concentrations that will cause acute toxicity to aquatic life as measured by the acute bioassay method and outside the boundary of the mixing zone is free of materials in concentrations that will cause chronic toxicity.

Furthermore, 40 CFR §122.44(d) states that permit limitations must control all pollutants or pollutant parameters which are, or may be, discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard, including state narrative criteria for water quality. According to OAR 340-041, Table 30, chlorine concentrations of 11µg/L can result in chronic toxicity in fresh waters while 19 µg/L can result in acute chlorine toxicity in fresh waters.

Currently this facility uses ultra-violet disinfection; therefore chlorine residual is not a concern. However, should the City consider chlorine for disinfection, the residual in discharge will need to be considered.

3.1.3.5. Ammonia

Ammonia is a substance normally found in wastewater. The wastewater treatment processes, particularly aeration and biological treatment, can convert a large portion to nitrate and nitrite but the treated effluent still contains some ammonia. After discharge, the continued process of oxidizing the ammonia removes dissolved oxygen from the ambient water.

Unionized ammonia is also a toxic agent and may have to be limited to prevent toxicity. As with chlorine residual, the water outside the boundary of the mixing zone shall be free of materials in concentrations that may cause chronic (sub-lethal) toxicity while the water outside the ZID must be free of pollutants that will cause acute toxicity. If ammonia is discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard (dissolved oxygen or toxicity), it must be limited by the permit.

In accordance with regulations, wastewater treatment plants with a design average dry-weather flow greater than 0.1 MGD warrant an ammonia toxicity reasonable potential analysis or evaluation at every permit renewal application. Should the analysis show the potential for toxicity, ammonia limits will be placed on the permit.

3.1.4. Effluent Quality

The planned permit limitations, summarized below, are the same as the current limitations as described in Schedule A of the current NPDES permit.

Table 3.1.4 – NPDES Permit Schedule A - Waste Discharge Limitations not to be exceeded

a. Treated Effluent Outfall 001

(1) June 1 – October 31:

No discharge to waters of the State except under the following conditions:

• During the month of June, discharge may continue as long as the seven day average stream flow exceeds 200 cfs as measured at USGS gage station 14377100 (Illinois River near Kerby, OR). Once the seven day average stream flow falls below 200 cfs, discharge is not permitted through Outfall 001 for the remainder of the season, unless the seven day average stream flow rises above 200 cfs in October. When discharging, the effluent limitations for the discharge period (November through May) will apply.

(2) November 1 – May 31:

Parameter	Average Effluent Concentrations		Monthly* Average lb/day	Weekly* Average lb/day	Daily* Maximum lbs
	Monthly	Weekly			
BOD_5	30 mg/L	45 mg/L	56	84	110
TSS	30 mg/L	45 mg/L	56	84	110

* Average dry weather design flow to the facility equals 0.52 MGD. Winter mass load limits based upon average wet weather design flow to the former facility equaling 0.225 MGD. The daily mass load limit is suspended on any day in which the flow to the treatment facility exceeds 1.04 MGD (twice the design average dry weather flow of the plant).

(3)

Other parameters (year-round)	Limitations
E.coli Bacteria	Shall not exceed 126 organisms per 100 mL monthly geometric mean. No single sample shall exceed 406 organisms per 100 mL. (See Note 1)
pH	Shall be within the range of 6.0 – 9.0

BOD_5 and TSS Removal Efficiency	Shall not be less than 85% monthly average for BOD_5 and TSS
Excess Thermal Load (ETL) (October 15 – May 15)	Shall not exceed a weekly average of 4.1 million Kcals/day (See Note 2)

(4)

No wastes may be discharged or activities conducted that cause or contribute to a violation of water quality standards in OAR 340-041 applicable to the Rogue basin except as provided for in OAR 340-045-0080 and the following regulatory mixing zone:

The regulatory mixing zone is that portion of the Illinois River contained within a band extending out 50 feet from the right bank of the river and extending from a point ten feet upstream of the outfall to a point 100 feet downstream from the outfall. The Zone of Immediate Dilution (ZID) is defined as that portion of the regulatory mixing zone that is within ten feet of the point of discharge.

(5)

Raw sewage discharges are prohibited to waters of the state except as allowed in Schedule F, Section B, Condition 6 of this permit If an overflow occurs between May 22 and June 1, and if the permittee demonstrates to the Department's satisfaction that no increase in risk to beneficial uses occurred because of the overflow, no violation shall be triggered if the storm associated with the overflow was greater than the one-in-five-year, 24-hour duration storm.

b. Reclaimed Wastewater Outfall 002 (Class C Treatment – See Note 3)

(1)

No discharge to state waters is permitted. All reclaimed water shall be distributed on land, for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices so as to prevent:

a. Prolonged ponding of treated reclaimed 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.

(2)

Prior to land application of the reclaimed water, it shall receive at least Class C treatment as defined in OAR 340-055 to;

a. Reduce Total Coliform to 240 organisms per 100 ml in two consecutive samples, and a seven-day median of 23 organisms per 100 ml.

(3)

Irrigation shall conform to the irrigation management plan approved by the Department.

c. Reclaimed Wastewater Outfall 002a (Class A Treatment – See Note 3)

(1)

No discharge to state waters is permitted. All reclaimed water shall be distributed on land, for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices so as to prevent:

a. Prolonged ponding of treated reclaimed 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.

(2)

Prior to land application of the reclaimed water, it shall receive at least Class A treatment as defined in OAR 340-055 to;

a. Reduce Total Coliform to a seven-day median of 2.2 organisms per 100 mL and a maximum of 23 organisms per 100 mL.

b. Reduce turbidity to a 24-hour mean of 2 Nephelometric Turbidity Units (NTUs) with no more than five percent of the samples during a 24-hour period exceeding 5 NTUs.

(3)

Irrigation shall conform to the irrigation management plan approved by the Department.

d.

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

NOTES:

1. If a single sample exceeds 406 organisms per 100 mL, then five consecutive re-samples may be taken at four-hour intervals beginning within 48 hours after the original sample was taken. If the log mean of the five resamples is less than or equal to 126 organisms per 100 mL, a violation shall not be triggered.

2. The Excess Thermal Load limit was based on the average dry weather design flow, an estimated dilution in the mixing zone and maximum allowable increase in stream temperature. This permit may be re-opened, and the Excess Thermal Load modified up or down, when more accurate effluent dilution data becomes available.

3. Reclaimed water use for the current facilities (Class C water) must comply with the limitations listed in Schedule B(l)(c) for Outfall 002. At such time as the reclaimed water use facilities are upgraded to produce Class A water, the permittee must comply with the limitations listed in Schedule B(l)(d) for Outfall 002a.

3.1.5. System Reliability and Redundancy Requirements

New or expanding wastewater treatment plants should be designed to meet minimum reliability standards as described in EPA's technical bulletin, Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability, EPA 430-99-74-001, 1974. These standards shall be achieved in order to ensure effective operation of treatment facilities on a day-to-day basis as well as during emergencies including power failures, flooding, peak flows, and equipment failures. These reliability standards are critical to protect the receiving water body against degradation during maintenance shutdowns and emergencies.

The above referenced EPA technical bulletin identifies the following three reliability classes:

> Reliability Class I – Works which discharge into navigable waters that could be permanently or unacceptably damaged by effluent which was degraded in quality for only a few hours. Examples of Reliability Class I works might be those discharging near drinking water reservoirs, into shellfish waters, or in close proximity to areas used for water contact sports.
>
> Reliability Class II – Works which discharge into navigable waters that would not be permanently or unacceptably damaged by short-term effluent quality degradations, but could be damaged by continued (on the order of several days) effluent quality degradation. An example of a Reliability Class II works might be one which discharges into recreational waters.
>
> Reliability Class III – These are works not otherwise classified as Reliability Class I or Class II.

The beneficial uses of the Rogue Basin are private domestic water supply, industrial water supply, irrigation, livestock watering, fish and aquatic life (including salmonid passage), wildlife and hunting, fishing, boating, water contact recreation, aesthetic quality, and hydro power. Because the Illinois River is used for domestic water supply, fishing and hunting areas and is sometimes used for water contact sports, Class I reliability is required.

Lift stations shall be designed to pass the peak hydraulic flow with the largest pump out of service and major wastewater treatment process components will be designed to pass the peak wet weather flow without overflowing. The WWTP will be designed to meet all permit conditions during the maximum month dry weather flow with full redundancy of the major processes. Mechanical components in the facility will be designed to enable repair or replacement without violating the effluent limits.

Table 3.1.5 provides a summary of the EPA and Oregon DEQ Class I reliability and redundancy requirements. Table 2.4.1 provides a summary of component redundancy requirements for the City of Cave Junction wastewater treatment facilities.

Table 3.1.5 – Reliability Requirements Summary

Plant Component	Requirement
All	In general, all components of the treatment process should be able to hydraulically contain peak hourly flow rate without overflowing or damaging equipment, with the largest unit out of service. The system should contain enough flexibility to enable the wastewater flow to any unit out of service to be distributed to the remaining units in service.
Influent Pumps	Minimum two pumps. Designed with a firm capacity of peak instantaneous flow (PIF) with largest pump off line.
Coarse Screens	Mechanically cleaned screen (step screen) primary. Minimum two coarse screens. Manually cleaned bar screen may be used as backup. Each designed for peak flow (PIF).
Grit Removal	Single Unit. If required for subsequent treatment processes, designed for peak instantaneous flow (PIF). If not, design for MMWWF is acceptable.
Primary Clarifiers	Should be sized for Peak Daily Flow (PDF). No redundancy is needed if secondary treatment processes are adequate to treat dry weather flows without primary treatment.
Aerated Basins	Sized using modeling to generate desired treatment to meet discharge permit limits during $MMDWF_{10}$ (Summer) and $MMWWF_{5}$ (Winter) events. Minimum of two basins with designed for peak daily flow (PDF) and maximum month dry weather flow with largest basin off line.
Aeration Blowers	Supply the design air capacity with the largest blower out of service. Provide a minimum of two units.
Air Diffusers	Isolation of largest section of diffusers (within a basin) without measurably impairing oxygen transfer.
Sedimentation	Minimum of two basins designed for peak daily flow (PDF) and maximum month dry weather flow with largest basin off line.
Disinfection	Minimum of two units. For UV, must treat with a minimum dose of 30 mJ/cm^2 peak hourly flow (PIF) with all units on or Maximum Daily Flow with the largest unit out of service, whichever is greater. For chlorine, chemical feed pumps must provide peak demand with largest pump out of service. Contact tanks (a minimum of two, in series) must provide 60 minutes at Average Daily Flow, 20 minutes at Peak Day Flow and 15 minutes at Peak Hour Flow, with the largest tank out of service.
Outfall Pipe	Sized for peak flow (PIF) at worst case downstream hydraulic conditions (high water level).
Electrical Power	Two separate and independent sources of electrical power shall be provided. This may include primary power from the utility provider and an on-site generator. The backup generator shall have sufficient capacity to operate all vital process components, critical lighting, and ventilation during peak daily flow conditions (PDF).

3.1.6. Conveyance System

The conveyance system must be designed to convey the Peak Instantaneous Flow (PIF).

3.1.7. Wastewater Treatment Plant Facilities

See Figure 2.4.1b for a process by process description of the design capacity versus the Class 1 process requirements.

3.1.8. Design Concepts and Constraints

The City of Cave Junction Wastewater Treatment Plant and the individual pump stations (North Loop, Pomeroy View, & Water Plant) are all on property owned by the City. Each of the properties appears to leave room sufficient for expansion, should the need arise.

3.1.9. Oregon Department of State Lands

This section describes types and jurisdictional limits of waters of the state that are regulated by the Department of State Lands, in accordance with OAR Chapter 141 Division 085 Section 0515. Permits for work within the jurisdiction of the Department of State Lands will be obtained by the City prior to disturbance.

3.1.9.1. Waters, Including Rivers, Intermittent and Perennial Streams, Lakes and Ponds.

These waters are jurisdictional to the ordinary high water line (OHWL). The OHWL can be determined by direct observation of the annual high water event, using local gauge data to estimate bankfull stage, and/or by using readily identifiable field indicators. Field indicators for OHWL include:

a. Clear, natural line impressed on the shore;

b. Change in vegetation from riparian (e.g., willows) to upland (e.g., oak, fir) dominated;

c. Textural change of depositional sediment or changes in the character of the soil (e.g., from sand, sand and cobble, cobble and gravel to upland soils);

d. Elevation below which no fine debris (needles, leaves, cones, and seeds) occurs;

e. Presence of litter and debris, water-stained leaves, water lines on tree trunks; and/or

f. Other appropriate means that consider the characteristics of the surrounding areas.

3.1.9.2. Wetlands.

Wetlands are jurisdictional within the wetland boundary.

3.1.9.3. Reservoirs.

The Department's jurisdiction over reservoirs extends to the higher of either the normal operating pool level or the upper edge of adjacent wetland.

3.1.9.4. Artificially Created Wetlands and Ponds.

These waters are jurisdictional when they are:

a. Equal to or greater than one acre in size;

b. Created, in part or in whole, in waters of this state; or

c. Identified in an authorization as a mitigation site.

3.1.9.5. Exempt Artificially Created Wetlands and Ponds.

Artificially created wetlands and ponds created entirely from upland, regardless of size, are not waters of this state if they are constructed for the purpose of:

a. Wastewater treatment;

b. Settling of sediment;

c. Stormwater detention and/or treatment;

d. Agricultural crop irrigation or stock watering;

e. Fire suppression;

f. Cooling water;

g. Surface mining, even if the site is managed for interim wetlands functions and values;

h. Log storage; or

i. Aesthetic purposes.

3.1.9.6. Jurisdictional Ditches.

Except as provided under section (9) and (10) below, ditches are jurisdictional if they are:

a. Created in wetlands, estuaries, tidal rivers or other waters of this state; or

b. Created from upland and meet the following conditions:

    1. Contain food and game fish; and

    2. Have a free and open connection to waters of this state. A “free and open connection” means a connection by any means, including but not limited to culverts, to or between natural waterways and other navigable and non-navigable bodies of water that allows the interchange of surface flow at bankfull stage or ordinary high water, or at or below mean higher high tide between tidal waterways.

3.1.9.7. Non-Jurisdictional Irrigation Ditches.

Existing irrigation ditches that meet the following tests are not jurisdictional:

a. Are operated and maintained for the primary purpose of conveying water for irrigation; and

b. Are dewatered for the non-irrigation season except for water incidentally retained in isolated low areas of the ditch or are used for stock water runs, provision of water for fire suppression, or to collect storm water runoff.

3.1.9.8. Non-Jurisdictional Roadside and Railroad Ditches.

Roadside and railroad ditches that meet the following tests are not jurisdictional:

a. Ten feet wide or less at the ordinary high water line;

b. Artificially created from upland or from wetlands;

c. Not adjacent and connected or contiguous with other wetlands; and

d. Do not contain food or game fish.

3.1.9.9. Removal-Fill Jurisdiction by Volume of Material.

The following criteria are used to determine jurisdictional volume thresholds that trigger the requirement for an authorization.

a. Oregon State Scenic Waterways (SSWs). The threshold volume is any amount greater than zero.

b. Essential Indigenous Anadromous Salmonid Habitat (ESH). The threshold volume is any amount greater than zero.

c. Compensatory Mitigation Sites. The threshold volume is any amount greater than zero for compensatory mitigation sites referenced in an authorization.

d. All Other Waters of This State:

    1. For fill activities, any combination of either organic or inorganic material deposited by artificial means at any one location in waters of this state equal to or exceeding 50 cubic yards or the equivalent weight in tons; and

    2. For removal activities, the taking or movement by artificial means of more than 50 cubic yards of inorganic material or the equivalent weight in tons in any calendar year.

3.1.9.10. Oregon Essential Salmonid Habitat (ESH).

It is the policy of the State of Oregon to protect ESH, as outlined in OAR Division 141-102. To achieve this policy, the Department shall:

a. Consult with the Department of Fish and Wildlife (ODFW) concerning the status of Oregon's indigenous anadromous salmonid species;

b. Identify ESH in consultation with ODFW and the public through rulemaking; and

c. Review all projects proposed in ESH pursuant to the standards set forth in the state's Removal-Fill Law (ORS 196.600 to 196.990) and rules (OAR 141-085)

The Appendix contains the Essential Salmonid Habitat map for Josephine County.

3.1.10. Oregon Department of Fish and Wildlife (ODFW).

In accordance with OAR 635-415, it is the fish and wildlife habitat mitigation policy of the Oregon Department of Fish and Wildlife to require or recommend, depending upon the habitat protection and mitigation opportunities provided by specific statutes, mitigation for losses of fish and wildlife habitat resulting from development actions. Priority for mitigation actions shall be given to habitat for native fish and wildlife species. Mitigation actions for nonnative fish and wildlife species may not adversely affect habitat for native fish and wildlife.

The Department shall work with regulatory and planning agencies, land management agencies, private developers, operators, public interest groups, and the public to implement this Fish and Wildlife Habitat Mitigation Policy.

The Department shall apply the requirements of this division when implementing its own development actions, and when developing recommendations to other state, federal, or local agencies regarding development actions for which mitigation for impacts to fish and wildlife habitat is authorized or required by federal, state, or local environmental laws or land use regulations.

In applying this policy, the Department shall identify and utilize the habitat protection and mitigation opportunities provided by applicable federal, state, and local environmental laws and land use regulations, and shall participate throughout the duration of these regulatory processes to coordinate Department mitigation requirements or recommendations with those of other agencies. If the regulatory authority of an agency provides for mitigation of cumulative or historic losses, the Department shall apply the standards of OAR 635-415-0025 in making its recommendations.

When making recommendations on local land use actions, the Department shall follow the provisions of its certified State Agency Coordination Program and OAR Chapter 635 Division 405.

Unless required by statute, the Department may elect not to recommend or require mitigation for a development action if, in the opinion of the Department, the impacts to fish and wildlife habitat are expected to be inconsequential in either nature, extent, or duration; or if staff resources are not available.

3.1.10.1. Fish Passage.

No person shall construct or maintain any artificial obstruction across any waters of this state that are inhabited, or were historically inhabited, by native migratory fish without providing passage for native migratory fish.

Prior to construction, fundamental change in permit status or abandonment of an artificial obstruction in any waters of this state, a person owning or operating an artificial obstruction shall obtain a determination from the Department as to whether native migratory fish are or were historically present in the waters, unless the owner or operator assumes the presence of native migratory fish.

If the Department determines, or the owner or operator assumes, that native migratory fish are or were historically present in the waters, prior to construction, fundamental change in permit status, or abandonment of the artificial obstruction the person owning or operating the artificial obstruction shall either:

a. Obtain from the Department an approval determination of a fish passage plan that meets the requirements of OAR 635-412-0035 for the specific artificial obstruction.

b. Obtain from the Department a programmatic approval of a fish passage plan for multiple artificial obstructions of the same type. The Department may also grant programmatic approval to an agent for multiple owners or operators of artificial obstructions of the same type. Programmatic approvals are only valid so long as the owner or operator complies with the conditions of the programmatic approval. The Department shall only provide programmatic approval if:

   1. Fish passage structures placed under the programmatic approval meet criteria determined by the Department;

   2. The owner, operator, or agent demonstrates to the Department prior experience providing or approving acceptable fish passage structures;

   3. The owner, operator, or agent reports installation information annually to the Department, including but not limited to the location and installation date of all fish passage structures placed under the programmatic approval;

   4. The owner or operator allows, or the agent requires owners or operators to allow, the Department to inspect fish passage structures placed under the programmatic approval at reasonable times; and

   5. The owner, operator, or agent agrees to expeditiously remedy all fish passage structures placed under the programmatic approval which the Department finds do not meet the criteria or conditions of the programmatic approval.

c. Pursuant to ORS 527.710(6), install and maintain road-stream crossing structures on non-federal forestlands in compliance with State Board of Forestry, through the Oregon Department of Forestry, rules and guidelines. These rules and guidelines require concurrence by the Oregon Department of Fish and Wildlife that they meet the purposes of the Department's fish passage program;

d. Obtain a waiver from fish passage requirements for the artificial obstruction as provided in OAR 635-412-0025; or

e. Obtain an exemption from fish passage requirements for the artificial obstruction as provided in OAR 635-412-0025.

Fish passage plans shall provide for and be implemented such that fish passage is installed at the artificial obstruction prior to completion of or by the end of the same in-water work period as the action which triggered fish passage requirements under the section above, unless:

a. An owner or operator demonstrates to the Department an imminent or immediate threat to human safety which requires construction at a failed artificial obstruction prior to being able to complete the requirements of subsection (3), and the Department approves a fish passage plan in which the requirements of subsection (3) shall be met by the end of the next in-water work period or as soon as practicable. Providing passage at the time of construction is preferred;

b. The Commission finds that additional time is necessary and appropriate given the size and scope of the project;

c. Installation begins within this period and the Department finds that additional time to complete installation is necessary and appropriate given the size and scope of the project; or

d. The Department finds that additional time is necessary and appropriate as part of the terms and conditions of a negotiated settlement for a federal proceeding, or in coordination with other federal requirements.

3.1.10.2. In-Water Work Period.

The Oregon Department of Fish and Wildlife, (ODFW), under its authority to manage Oregon's fish and wildlife resources has prepared guidelines for timing of in-water work. The guidelines are to assist the public in minimizing potential impacts to important fish, wildlife and habitat resources.

The guidelines are based on ODFW district fish biologists' recommendations. Primary considerations were given to important fish species including anadromous and other game fish and threatened, endangered, or sensitive species (coded list of species included in the guidelines). Time periods were established to avoid the vulnerable life stages of these fish including migration, spawning and rearing. The preferred work period applies to the listed streams, unlisted upstream tributaries, and associated reservoirs and lakes.

These guidelines provide the public a way of planning in-water work during periods of time that would have the least impact on important fish, wildlife, and habitat resources. ODFW will use the guidelines as a basis for commenting on planning and regulatory processes. There are some circumstances where it may be appropriate to perform in-water work outside of the preferred work period indicated in the guidelines. ODFW, on a project by project basis, may consider variations in climate, location, and category of work that would allow more specific in-water work timing recommendations. These more specific timing recommendations will be made by the appropriate ODFW district office through the established planning and regulatory processes.

Per the guidelines, for the Illinois River, the recommended In-water Work Period is June 15 through September 15.

3.1.11. Army Corps of Engineers (Title 33, Chapter II, Part 320).

3.1.11.1. Regulatory Approach of the Army Corps of Engineers.

The U.S. Army Corps of Engineers has been involved in regulating certain activities in the nation's waters since 1890. Until 1968, the primary thrust of the Corps' regulatory program was the protection of navigation. As a result of several new laws and judicial decisions, the program has evolved to one involving the consideration of the full public interest by balancing the favorable impacts against the detrimental impacts. This is known as the "public interest review." The program is one which reflects the national concerns for both the protection and utilization of important resources.

The Corps is a highly decentralized organization. Most of the authority for administering the regulatory program has been delegated to the thirty-six district engineers and eleven division engineers. A district engineer's decision on an approved jurisdictional determination, a permit denial, or a declined individual permit is subject to an administrative appeal by the affected party in accordance with the procedures and authorities contained in 33 CFR part 331. Such administrative appeal must meet the criteria in 33 CFR 331.5; otherwise, no administrative appeal of that decision is allowed. The terms "approved jurisdictional determination," "permit denial," and "declined permit" are defined at 33 CFR 331.2. There shall be no administrative appeal of any issued individual permit that an applicant has accepted, unless the authorized work has not started in waters of the United States, and that issued permit is subsequently modified by the district engineer pursuant to 33 CFR 325.7 (see 33 CFR 331.5(b)(1)). An affected party must exhaust any administrative appeal available pursuant to 33 CFR part 331 and receive a final Corps decision on the appealed action prior to filing a lawsuit in the Federal courts (see 33 CFR 331.12).

The Corps seeks to avoid unnecessary regulatory controls. The general permit program described in 33 CFR parts 325 and 330 is the primary method of eliminating unnecessary federal control over activities which do not justify individual control or which are adequately regulated by another agency.

The Corps is neither a proponent nor opponent of any permit proposal. However, the Corps believes that applicants are due a timely decision. Reducing unnecessary paperwork and delays is a continuing Corps goal.

The Corps believes that state and federal regulatory programs should complement rather than duplicate one another. The Corps uses general permits, joint processing procedures, interagency review, coordination, and authority transfers (where authorized by law) to reduce duplication.

The Corps has authorized its district engineers to issue formal determinations concerning the applicability of the Clean Water Act or the Rivers and Harbors Act of 1899 to activities or tracts of land and the applicability of general permits or statutory exemptions to proposed activities. A determination pursuant to this authorization shall constitute a Corps final agency action. Nothing contained in this section is intended to affect any authority EPA has under the Clean Water Act.

3.1.11.2. Types of Activities Regulated.

This part (33 CFR 320) and the parts that follow (33 CFR parts 321 through 330) prescribe the statutory authorities, and general and special policies and procedures applicable to the review of applications for Department of the Army (DA) permits for controlling certain activities in waters of the United States or the oceans. This part identifies the various federal statutes which require that DA permits be issued before these activities can be lawfully undertaken; and related Federal laws and the general policies applicable to the review of those activities. Parts 321 through 324 and 330 address special policies and procedures applicable to the following specific classes of activities:

a. Dams or dikes in navigable waters of the United States (part 321);

b. Other structures or work including excavation, dredging, and/or disposal activities, in navigable waters of the United States (part 322);

c. Activities that alter or modify the course, condition, location, or capacity of a navigable water of the United States (part 322);

d. Construction of artificial islands, installations, and other devices on the outer continental shelf (part 322);

e. Discharges of dredged or fill material into waters of the United States (part 323);

f. Activities involving the transportation of dredged material for the purpose of disposal in ocean waters (part 324); and

g. Nationwide general permits for certain categories of activities (part 330).

3.1.11.3. Forms of Authorization.

DA permits for the above described activities are issued under various forms of authorization. These include individual permits that are issued following a review of individual applications and general permits that authorize a category or categories of activities in specific geographical regions or nationwide. The term “general permit” as used in these regulations (33 CFR parts 320 through 330) refers to both those regional permits issued by district or division engineers on a regional basis and to nationwide permits which are issued by the Chief of Engineers through publication in the FEDERAL REGISTER and are applicable throughout the nation. The nationwide permits are found in 33 CFR part 330. If an activity is covered by a general permit, an application for a DA permit does not have to be made. In such cases, a person must only comply with the conditions contained in the general permit to satisfy requirements of law for a DA permit. In certain cases pre-notification may be required before initiating construction. (See 33 CFR 330.7)

3.1.11.4. General Instructions.

General policies for evaluating permit applications are found in this part. Special policies that relate to particular activities are found in parts 321 through 324. The procedures for processing individual permits and general permits are contained in 33 CFR part 325. The terms “navigable waters of the United States” and “waters of the United States” are used frequently throughout these regulations, and it is important from the outset that the reader understand the difference between the two. “Navigable waters of the United States” are defined in 33 CFR part 329. These are waters that are navigable in the traditional sense where permits are required for certain work or structures pursuant to Sections 9 and 10 of the Rivers and Harbors Act of 1899. “Waters of the United States” are defined in 33 CFR part 328. These waters include more than navigable waters of the United States and are the waters where permits are required for the discharge of dredged or fill material pursuant to section 404 of the Clean Water Act.

3.1.12. Agency Correspondence.

At the time this report is being prepared, no agency contact has occurred.

3.2. Aging Infrastructure

Section 2 above, contains detailed assessment of the existing collection and treatment facilities.

3.3. Reasonable Growth

3.3.1. Flow Definitions

Wastewater is typically described through flow and loading characteristics. Flow characteristics define the hydraulic volumes that the plant experiences and what it must be capable of treating. Loading characteristics describe what is in the wastewater (i.e. contaminants, waste products, chemicals, etc) that must be substantially removed before the water can be discharged into the environment as effluent.

The following terms will be used in flow analysis and flow projections in this Study:

Dry Weather Period: Defined as the period when the precipitation and streamflows are low. This period is defined in the Oregon Administrative Rules (OAR 340-041-0275) as May 1 through October 31.

Wet Weather Period: Defined as the period when streamflows, rainfall and groundwater levels are high. This period is defined in OAR 340-041-0275 as November 1 through April 30.

Average Annual Flow (AAF): Total wastewater flow for an average 12-month period, from January 1 through December 31, divided by the total number of days in the year.

Base Sewerage: Total daily flow for the period between June 1 and September 31. This is used as a basis to calculate I/I.

Average Dry-Weather Flow (ADWF): Total wastewater flow for the dry-weather period divided by the number of days in the period.

Maximum Month Dry-Weather Flow (MMDWF): Total wastewater flow for the month with the highest flow during the dry-weather period, divided by the number of days in the month.

Average Wet-Weather Flow (AWWF): Total wastewater flow for the wet-weather period divided by the number of days in the period.

Maximum Month Wet-Weather Flow (MMWWF): Total wastewater flow for the month with the highest flow during the wet-weather period, divided by the number of days in the month.

Peak Day Average Flow (PDAF): Total flow for the day with the highest wastewater flow during the year.

Peak Week Flow (PWF): Average Daily Flow during the peak 7-day flow period.

Peak Instantaneous Flow (PIF): Flow for the highest peak of the year, expressed in MGD. Also known as the peak hour flow.

The following terms will be used in the statistical analysis of flow rates:

Ten-year Maximum Month Dry-Weather Flow ($MMDWF_{10}$): The monthly average dry-weather flow with a 10% probability of occurrence.

Five-year Maximum Month Wet-Weather Flow ($MMWWF_5$): The monthly average wet-weather flow with a 20% probability of occurrence.

Five-year Peak Day Average Flow ($PDAF_5$): The peak day average flow associated with a five-year storm event. This flow rate has a 0.27% probability of occurrence.

Five-year Peak Instantaneous Flow (PIF_5): The peak instantaneous flow during a five-year storm event. This flow rate has a 0.011% probability of occurrence.

The following terms will be used in the Inflow and Infiltration Analysis:

Base Infiltration Flow The base daily average flow in the wastewater collection and treatment system due to inflow and infiltration. It is calculated by subtracting the base sewer flow rate from the average dry-weather flow.

<u>Average Wet-Weather Inflow and Infiltration Flow (AWW I/I)</u> The daily average flow in the wastewater collection and treatment system due to inflow and infiltration. It is calculated by subtracting the base sewer flow rate from the average wet-weather flow.

<u>Maximum Monthly Wet-Weather Inflow and Infiltration Flow (MMWW I/I)</u> The average daily flow during the maximum monthly occurrence in the wastewater collection and treatment system due to inflow and infiltration. It is calculated by subtracting the base sewer flow rate from the system maximum monthly wet-weather flow.

<u>Peak Day Inflow and Infiltration Flow (PD I/I)</u> The maximum daily flow in the wastewater collection and treatment system due to inflow and infiltration. It is calculated by subtracting the base sewer flow rate from the system peak daily average flow.

<u>Peak Instantaneous Inflow and Infiltration Flow (PIF I/I)</u> The peak instantaneous or peak hourly flow in the wastewater collection and treatment system due to inflow and infiltration. It is calculated by subtracting the base sewer flow rate from the system peak instantaneous flow.

3.3.2. Summary of Available Data

The influent flow data included in the Discharge Monitoring Reports (DMRs) from January 2010 through December 2012 have been used for flow analysis and wastewater characteristics. Influent flows can be measured at the Parshall flume flow meter in the headworks of the treatment plant.

Daily rainfall totals were referenced from the Wastewater Plant daily records.

The following summary statistics are based on the DMR data described above. Below is the calculation AAF, Base Sewerage, ADWF, AWWF:

$$AAF = \frac{Average\ Total\ Wastewater\ Flow}{Days\ in\ Year} = \frac{125.977 MG}{365.25\ Days} = 0.345\ MG/Day$$

$$Base\ Sewerage = \frac{Average\ Total\ Flow\ During\ Jun.-Sept.}{Days\ in\ Jun.-Sept.} = \frac{27.904\ MG}{122\ Days} = 0.229\ MGD$$

$$ADWF = \frac{Average\ Total\ Flow\ During\ Dry\ Period}{Days\ in\ Dry\ Period} = \frac{51.826\ MG}{184\ Days} = 0.282\ MGD$$

$$AWWF = \frac{Total\ Flow\ During\ Wet\ Period}{Days\ in\ Wet\ Period} = \frac{73.997\ MG}{181.25\ Days} = 0.408\ MGD$$

3.3.3. Dry Weather Flow

As indicated in the referenced DEQ guidelines, the ten-year Maximum Monthly Average Dry-Weather Flow ($MMDWF_{10}$) would be the monthly average flow in the rainiest summer month of high groundwater. In Western Oregon, the $MMDWF_{10}$ almost invariably occurs in May. The 10-Year MMDWF represents the anticipated monthly flow corresponding to the monthly rainfall accumulation during May with a 10% probability of occurrence in any given year.

Precipitation probabilities for various locations in Oregon are included in the report entitled "Climatography of the United States No. 20, Monthly Station Climate Summaries, 1971 – 2000" as published by the National Climatic Data Center. National Climatic Data Center has a coop station near the city of Cave Junction (COOP ID: 351448). The coop observation station collects climatic data daily and reports to the Western Region Climatic Center. The 10-year MMDWF is the flow corresponding to the 10% probability precipitation of 4.90 inches for the month of May, as determined by the referenced climatography report.

The graph in Figure 3.3.3 is based on data points representing the average daily wastewater flows versus total rainfall for the winter months (October through March) as shown in Table 3.3.3. A linear regression trend line can be used to predict average wastewater flows for a given monthly rainfall total. As shown in Figure 3.3.3, the corresponding $MMDWF_{10}$ is 0.371 MGD (258 gpm).

Table 3.3.3 - Average Rainfall and Wastewater Flows

Precipitation and Rainfall Averages		
Month	Monthly Rainfall (in/Mo)	Monthly Avg. Day Flow (MGD)
Jan 2010	11.62	0.516
Feb 2010	7.70	0.455
Mar 2010	6.77	0.416
Oct 2010	6.09	0.216
Nov 2010	6.62	0.321
Dec 2010	15.92	0.613
Jan 2011	2.75	0.435
Feb 2011	7.19	0.448
Mar 2011	13.48	0.679
Oct 2011	2.95	0.179
Nov 2011	7.61	0.238
Dec 2011	3.44	0.219
Jan 2012	10.81	0.427
Feb 2012	3.96	0.341
Mar 2012	16.59	0.609
Oct 2012	5.86	0.210
Nov 2012	12.02	0.319
Dec 2012	17.06	0.699

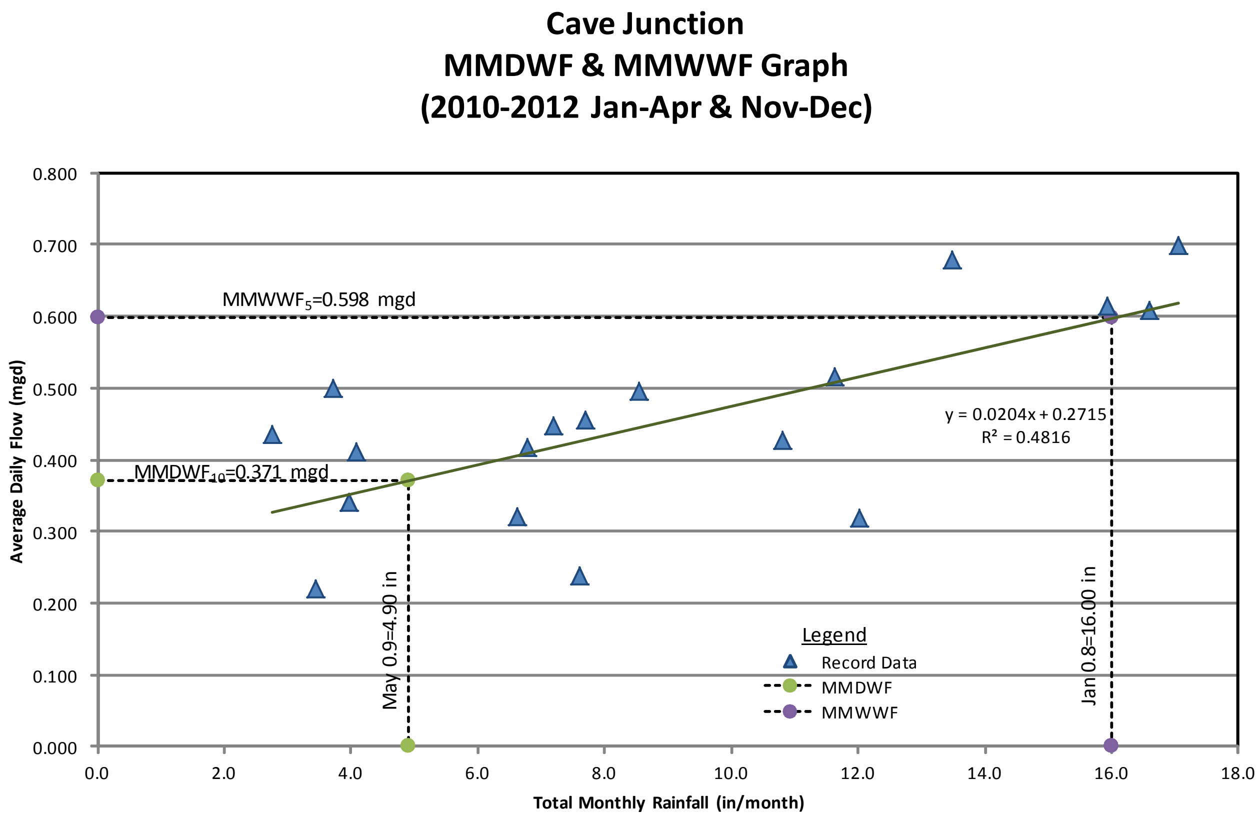

Figure 3.3.3 – $MMDWF_5$ & $MMWWF_{10}$ Calculation

3.3.4. Wet Weather Flow

Like many communities in western Oregon, the City of Cave Junction struggles with high volume wastewater flows caused by inflow and infiltration into the sanitary sewer system during the wet season. The flow analysis presented in the following section is based on the *Oregon DEQ Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon* (first published in 1996). These guidelines describe a detailed method for estimating wet-weather flow and peak flows in wastewater collection systems. This method is used to develop the minimum estimate for current flows from which to project future flow rates.

The referenced DEQ design guidelines indicate that high groundwater, west of the Cascades, is usually not attained until January, and heavy storms generally do not begin to cause a reliable or consistent infiltration response until January. Therefore, the MMWWF is expected to occur in January. The five-year January accumulation of 16.00 inches is indicated in the Climatography report based on rainfall probability data for City of Cave Junction. When plotted with actual recorded events, the current five-year MMWWF is calculated to be 0.598 MGD (415 gpm) as shown in Figure 3.3.3, above.

The Peak Day Average Flow ($PDAF_5$) corresponds to the five-year 24-hour storm event as defined by the NOAA isopluvial maps. The isopluvial map for this storm event is provided in the appendix. Based on the NOAA maps, the five-year 24-hour event for the Cave Junction area is 5.5 inches of rain.

To determine the $PDAF_5$ using the DEQ methodology, actual events are plotted and a best-fit trendline is used to approximate the character of the system under different rainfall events. As in the graph above, rainfall data from the years 2010 through 2012 is used in the $PDAF_5$ calculation. Data points were selected based on the criteria that the significant rainfall event occurred during the winter months (high groundwater), following several days without significant rain. A summary of the data points used are included in Table 3.3.4 below. Results are graphed in Figure 3.3.4a.

Table 3.3.4 – Significant Wet-Weather Rainfall and Flow Data

Daily Rainfall and Cooresponding Wastewater Flow (2010-2012)		
Date	Daily Rain (in)	WW Flow (mgd)
2/1/2010	0.40	0.397
4/27/2010	2.52	0.749
1/13/2011	1.24	0.632
2/15/2011	2.91	0.775
1/18/2012	2.64	0.795
1/19/2012	3.51	0.994
3/13/2012	1.50	0.534
11/29/2012	3.43	0.906
12/20/2012	2.01	0.757

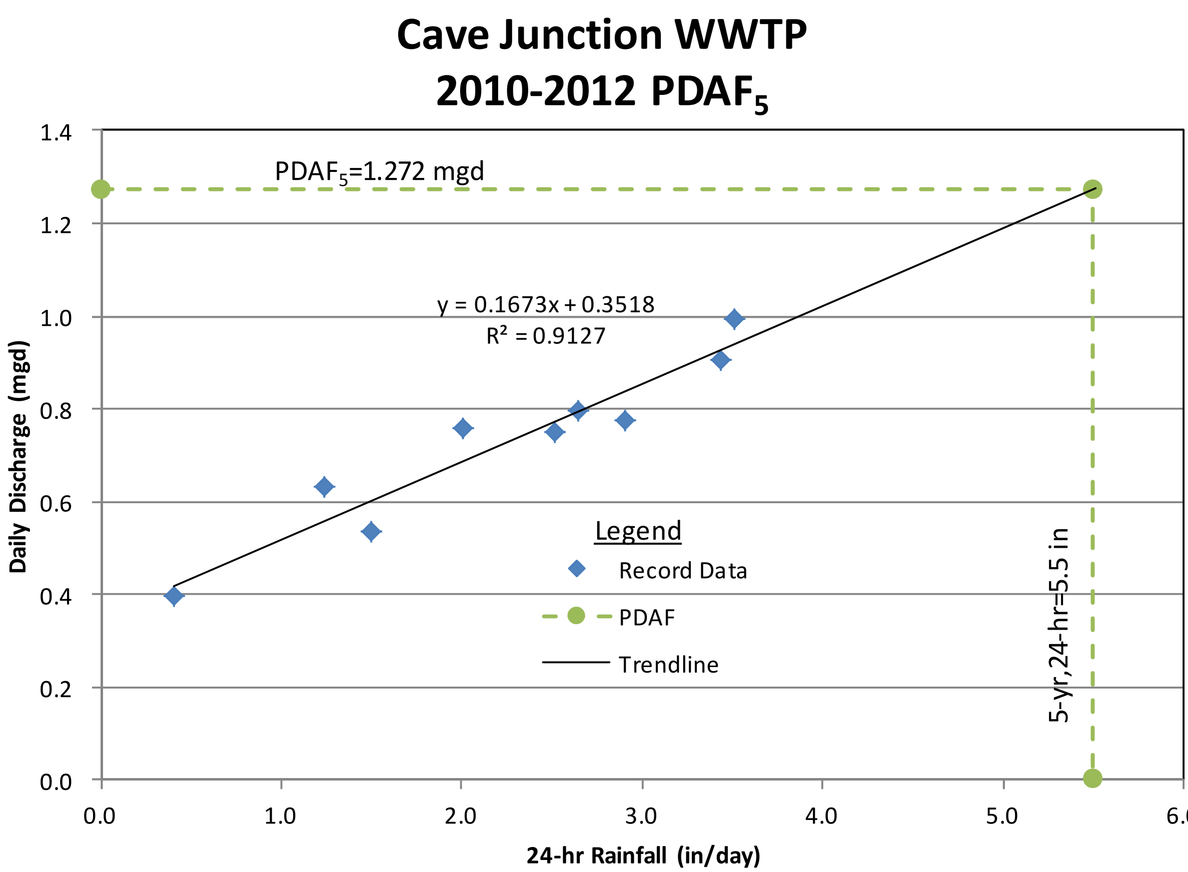

Figure 3.3.4a – PDAF Calculation

Based on Figure 3.3.4a, the current $PDAF_5$ is approximately 1.272 MGD (883 gpm). This corresponds reasonably well with the plant DMR data.

DEQ guidelines for wastewater treatment plant design require critical plant and lift station components to be sized for the projected peak instantaneous flow (PIF_5). The current PIF_5 and 5-year peak week flow for the City of Cave Junction has been estimated using a probability graph on logarithmic probability paper based on the data summarized below:

- The average annual flow (AAF) rate is the mean of the summer (ADWF) and winter (AWWF) flow rates. Exceedance probability of the AAF is 6/12 (50%). AAF=0.345 MGD
- The $MMWWF_5$, as determined in Figure 3.3.3, has a probability of exceedance of 1/12, or 8.33%. $MMWWF_5$ = 0.598 MGD.
- The $PDAF_5$ is the daily flow associated with the 5-year storm. The probability of exceeding the PDAF is 1/365, or 0.27%. As determined in Figure 3.3.4a, the $PDAF_5$ is 1.272 MGD.
- The PIF, or "peak hourly flow" occurs once per year for a probability of exceedance of: $\frac{1\ hour}{year} * \frac{1\ year}{365\ days} * \frac{1\ day}{24\ hours} = \frac{1}{8760} = 0.011\%$
- The peak week flow occurs one week out of the year, for a probability of exceedance of 1/52, or 1.92%.

Assuming, as allowed by the DEQ guidelines, that the maximum PIF occurs during the peak day, peak weak and peak month, we can create the graph shown below in Figure 3.3.4b.

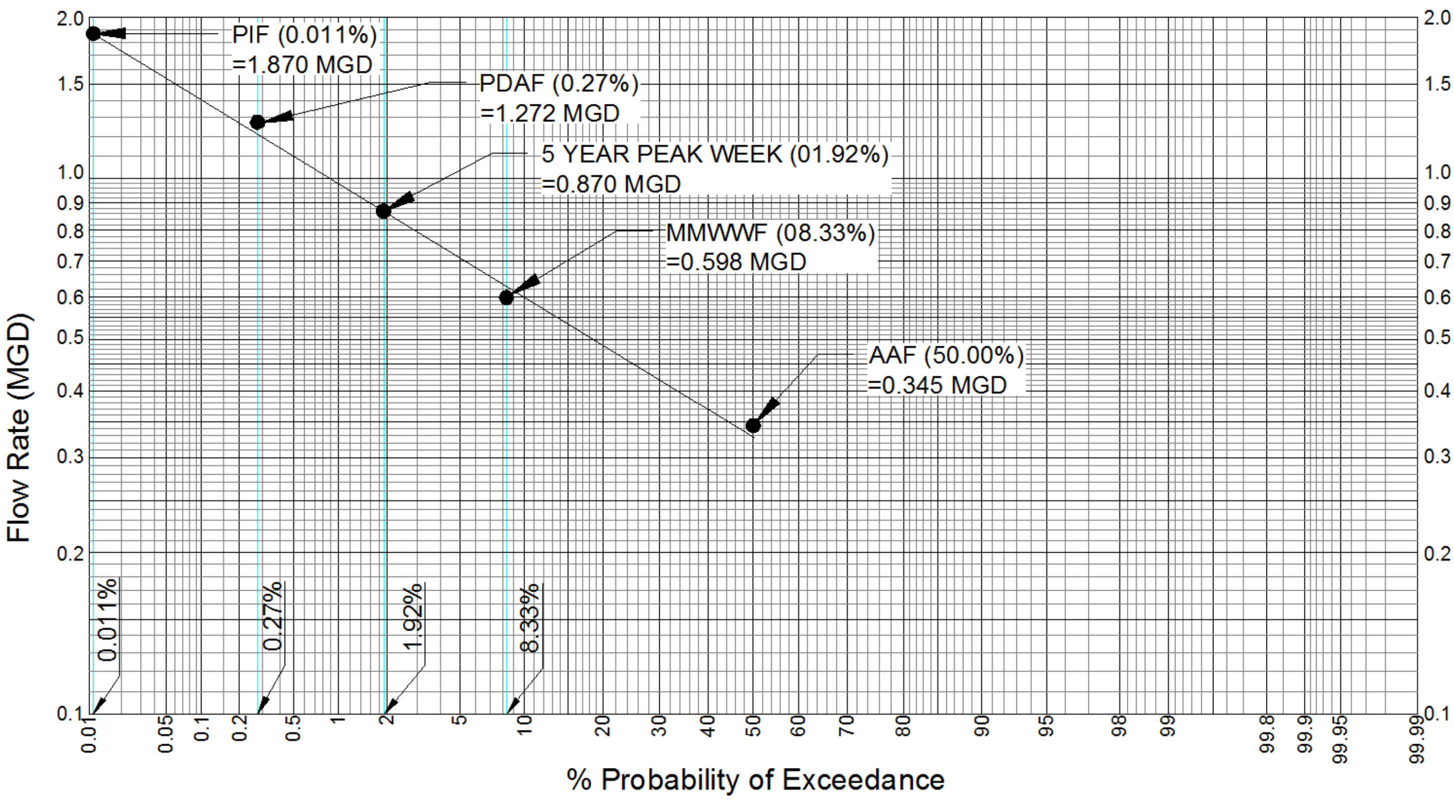

Figure 3.3.4b - PIF Calculation

As shown above, when the known flow amounts and probabilities are plotted on a probability x 2 logarithmic graph, and a best fit trendline is added, unknown flows can be interpolated. In this way, the 5-year Peak Week Flow (0.870 MGD) and the PIF (1.870 MGD) are determined.

3.3.5. Summary of Existing Flows

Table 3.3.5 below summarizes the current dry and wet weather flows for the City of Cave Junction. Definitions for the different flow criteria are provided in Section 3.3.1.

Table 3.3.5 – Existing Wastewater Flow Summary

Summary of Current (2013) Flows			
Parameter	2013 Flow (MGD)	Basis	Per Capita Flow (Gal/day)
Dry-Weather Flows			
ADWF	0.282	Analysis of 2010-2012 DMRs (May-Oct)	140.9
Base Sewerage	0.214	Assume no I/I (July-Sept)	107.1
Base Infiltration	0.068	ADWF - Base Sewerage	33.8
$MMDWF_{10}$	0.371	Figure 3.3.3 (DEQ Graph No. 1)	185.7
Wet-Weather Flows			
AWWF	0.409	Analysis of 2010-2012 DMRs (Nov-Apr)	204.3
$MMWWF_5$	0.598	Figure 3.3.3 (DEQ Graph No. 1)	299.0
Peak Week	0.870	Figure 3.3.4b (DEQ Graph No. 3)	435.0
Peak Day (PDAF)	1.272	Figure 3.3.4a (DEQ Graph No. 2)	636.0
Peak Hourly (PIF)	1.870	Figure 3.3.4b (DEQ Graph No. 3)	935.0
Inflow and Infiltration (I/I)			
AWW I/I	0.194	AWWF - Base Sewerage	97.2
MMWW I/I	0.384	MMWWF - Base Sewerage	191.9
Peak Day I/I	1.058	PDAF - Base Sewerage	528.9
PI I/I	1.656	PIF - Base Sewerage	827.9

Figure 3.3.5 provides a graph of the influent flows at the wastewater treatment plant from 2010 through 2012. Also displayed are the values for the ADWF, AAF, AWWF, MMWWF, PDAF, and PIF.

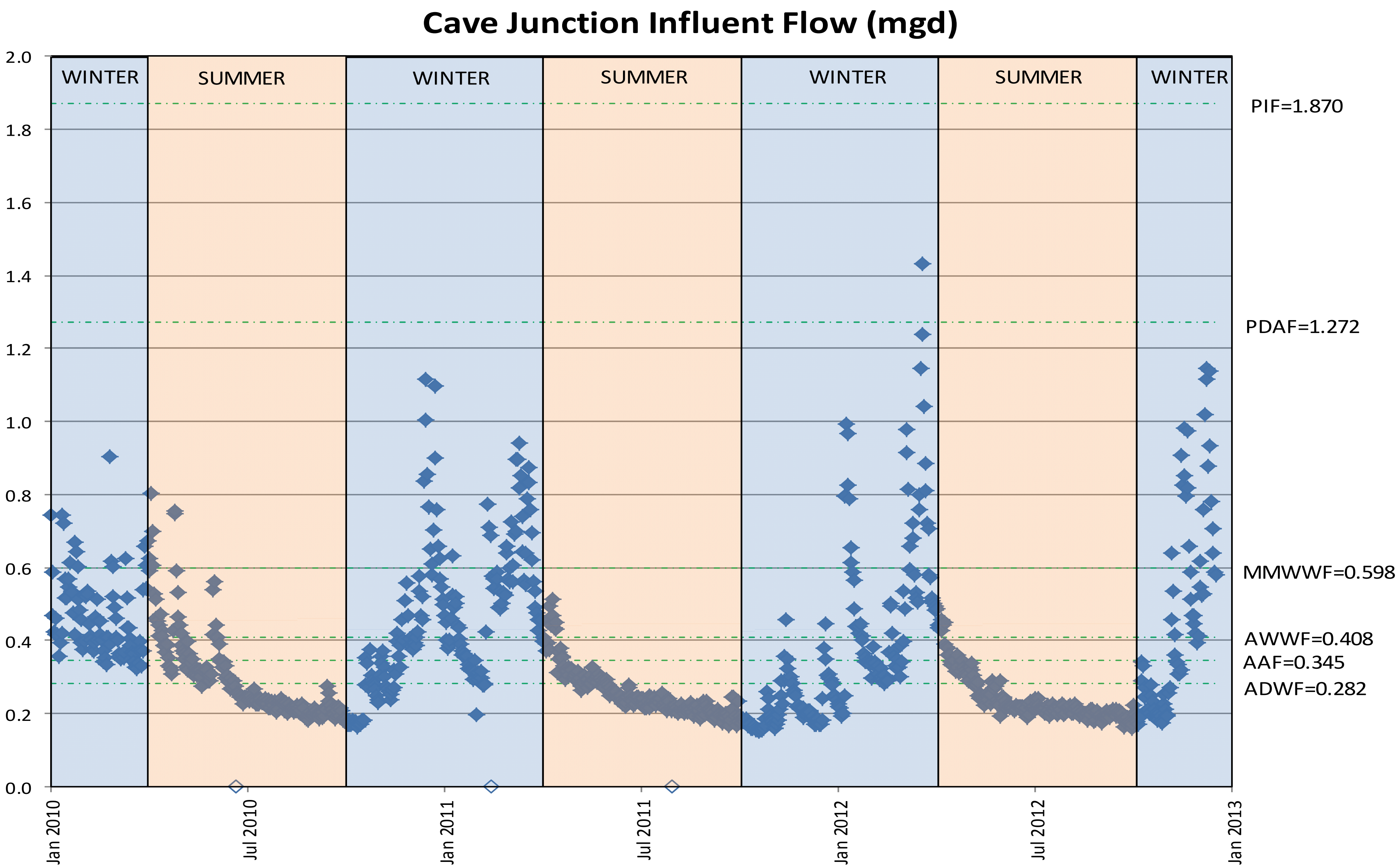

Figure 3.3.5 – Measured Flows at Treatment Plant

3.3.6. Projected Wastewater Flows

Projected wastewater flows are developed based on flow per capita values presented in Table 3.3.5. Projecting peak flows based on a per capita flow rate requires the assumption that all flow components, including I/I, will remain constant over time, per capita. This results in the increase of projected flows being proportional to the population growth.

The City is currently addressing I/I issues and has a plan in place to continue monitoring and repairing the worst areas as they are found, which should lead to less I/I. Left unchecked, inflow and infiltration will worsen over time.

Table 3.3.6 summarizes the projected flows at the end of this planning period. These projected flows will be used in assessment of the existing infrastructure and in sizing recommended improvements.

Table 3.3.6 – Summary of Current and Projected Wastewater Flows

<table>
<tr><th colspan="6">Current (2013) Flows and Future (2035) Flows</th></tr>
<tr><th>Parameter</th><th>2013 Flow (MGD)</th><th>2013 Population</th><th>Per Capita Flow (Gal/day)</th><th>2035 Population</th><th>2035 Flow (MGD)</th></tr>
<tr><td colspan="6">Dry-Weather Flows</td></tr>
<tr><td>ADWF</td><td>0.282</td><td rowspan="4">2000</td><td>140.8</td><td rowspan="4">3396</td><td>0.478</td></tr>
<tr><td>Base Sewerage</td><td>0.214</td><td>106.9</td><td>0.363</td></tr>
<tr><td>Base Infiltration</td><td>0.068</td><td>34.0</td><td>0.115</td></tr>
<tr><td>MMDWF$_{10}$</td><td>0.371</td><td>185.7</td><td>0.631</td></tr>
<tr><td colspan="6">Wet-Weather Flows</td></tr>
<tr><td>AWWF</td><td>0.408</td><td rowspan="5"></td><td>204.1</td><td rowspan="5"></td><td>0.693</td></tr>
<tr><td>MMWWF$_5$</td><td>0.598</td><td>299.0</td><td>1.015</td></tr>
<tr><td>Peak Week</td><td>0.870</td><td>435.0</td><td>1.477</td></tr>
<tr><td>Peak Day (PDAF)</td><td>1.272</td><td>636.0</td><td>2.160</td></tr>
<tr><td>Peak Hourly (PIF)</td><td>1.870</td><td>935.0</td><td>3.175</td></tr>
</table>

3.3.7. Cost Effective Infiltration and Inflow Removal Analysis

It is typical for I/I rehabilitation projects to be less than 100% effective. Repairs of one section of pipe will often cause ground water to migrate and cause pipes and connections adjacent to the rehabilitated sections to leak more. For example, the Lower Paxton Township Authority (LPTA) in Pennsylvania reported a 60 to 80% increase of infiltration in laterals adjacent to a recently completed mainline rehabilitation (See the “Inflow and Infiltration from Private Property Report for Sanitation District No. 1 of Northern, Kentucky. August 2006”. By Strand Associates. (http://www.wef.org/Utility/Library/OTHER/Reports/SD1%20Private%20Source%20Report.pdf) and in “Trenchless Techniques Enhance Service Lateral Repairs as an Infiltration/Inflow Control Option” (http://www.nastt.org/store/technical_papersPDF/244.pdf)). Often times pipe and manhole repairs are not 100% effective; sealing pipe and manhole joints may significantly reduce infiltration at the joints, but not completely eliminate leakage.

Service laterals are known to be large contributors to infiltration; Water Environmental Federation’s *Existing Sewer Evaluation and Rehabilitation* (WEF, 1994) explains that urban residential areas may contribute as much as 75% of system infiltration.

Actual success rates of I/I rehabilitation projects are highly variable. In 1994 the City of Nashville reported success rates ranging from 49 to 86% through reduction projects in five basins. A sewer rehabilitation project in Seattle, Washington reported a total I/I reduction of approximately 60%. The LPTA, in Pennsylvania, reported about 30% reduction of total measured I/I after a rehabilitation project. In *Controlling Inflow and Infiltration in Wastewater Collection Systems* (1999), author Mark Wade explains that conveyance system rehabilitation I/I reduction rates in excess of 50% are unusual. All of the above statistics are related to the reduction of both inflow and infiltration through rehabilitation of existing gravity sewer collection systems.

In accordance with DEQ requirements, this section provides I/I removal cost effective analysis for the City of Cave Junction wastewater collection system. The analysis is based on the method prescribed in *Wastewater Engineering: Collection and Pumping of Wastewater*, Metcalf and Eddy.

The wastewater collection system was broken into basins or zones of pipe during the flow mapping discussed above. The same basins are used in the I/I removal cost analysis.

The following table summarizes the collection system basins and the I/I flows measured during the flow mapping. The table also provides the percentage of the system I/I contributed by each basin within the collection system.

Table 3.3.7a – I/I per Collection System Basin

Basin	I/I Flow Cumulative	Basin I/I	Percentage of I/I
1	2	3	4
A	156	2	1.3%
B	110	5	3.2%
C	42	32	20.5%
D	10	10	6.4%
E	58	43	27.6%
F	12	12	7.7%
G	3	3	1.9%
H	1	1	0.6%
I	2	2	1.3%
J	2	2	1.3%
K	2	2	1.3%
L	42	42	26.9%

The flow mapping results suggest that approximately 70% of the I/I is coming from three (3) of the collection system basins (C, E & L), with each of those basins independently contributing more than 20% of the total system I/I.

The following table presents the approximate number of manholes and length of pipe in need of rehabilitation within each basin and an estimated cost to repair or rehabilitate the failing infrastructure. Lastly, the table provides a priority assigned to each basin within the collection system. The priority is determined by the percentage of I/I contributed by each basin, with the largest contributing basins being the highest priority for rehabilitation.

Table 3.3.7b – Basin Prioritization and Estimated Rehabilitation Costs

Basin	MH Rehab	Rehab Cost $/MH	Mainline Rehab	Rehab Cost $/LF	Estimated Cost	Priority
1	2	3	4	5	6	7
A	1	$ 5,000	0	$ 200	$ 5,000	7
B	3	$ 5,000	200	$ 200	$ 55,000	5
C	1	$ 5,000	1400	$ 200	$ 285,000	3
D	0	$ 5,000	1600	$ 200	$ 320,000	4
E	3	$ 5,000	3100	$ 200	$ 635,000	1
F	1	$ 5,000	300	$ 200	$ 65,000	6
G	0	$ 5,000	200	$ 200	$ 40,000	8
H	0	$ 5,000	200	$ 200	$ 40,000	9
I	0	$ 5,000	200	$ 200	$ 40,000	10
J	0	$ 5,000	200	$ 200	$ 40,000	11
K	0	$ 5,000	200	$ 200	$ 40,000	12
L	3	$ 5,000	2300	$ 200	$ 475,000	2
Total	12		9900		$2,040,000	

The following table presents the effect on future flows at various levels or percentages of I/I Reduction. It is assumed that point repairs, including manhole and mainline rehabilitation and replacement may result in a 20% overall reduction in I/I flows in the collection system. Replacement of the service lines throughout the collection system is assumed to provide a 40% reduction in I/I. Combinations of point repair and service pipe rehabilitation are assumed to culminate in a 60% reduction in I/I.

Table 3.3.7c – Estimated Flows for Various Levels of I/I Reduction

		Future Flows (MGD)			
Level	Description	AWWF	MMWWF	PDAF	PIF
1	2	3	4	5	6
1	0% I/I Reduction	0.693	1.015	2.160	3.175
2	20% I/I Reduction	0.627	0.885	1.801	2.613
3	40% I/I Reduction	0.561	0.754	1.441	2.050
4	60% I/I Reduction	0.495	0.624	1.082	1.488

The following table provides cost estimates associated with the impact of the I/I exceeding the capacity of the existing facilities.

Table 3.3.7d – Estimated Capital Costs of Transport Facilities

Level	Estimated Transport Cost
1	2
1	$ 4,517,500
2	$ 2,657,500
3	$ 2,060,000
4	$ 0

Increases in wastewater flows due to I/I result in necessary increases in facilities at the treatment plant. Larger flows require greater hydraulic and treatment capacities. The following table summarizes various components of the treatment process and the subsequent effect on the capital expenses necessary to accommodate projected future flows, including I/I. The cost estimates for the various levels of I/I reduction reflect the effect of lessening flows to the treatment plant.

Table 3.3.7e – Estimated Treatment Plant Capital Costs at Various Levels of I/I Reduction

Treatment Component	Design Basis	Level 1	Level 2	Level 3	Level 4
1	2	3	4	5	6
Septage Pretreatment	Demand	$ 400,000	$ 400,000	$ 400,000	$ 400,000
Headworks: Screen	Flow	$ 0	$ 0	$ 0	$ 0
Headworks: Grit Chamber	Flow	$ 0	$ 0	$ 0	$ 0
Aeration Basins	BOD	$ 0	$ 0	$ 0	$ 0
Aeration Blowers	BOD	$ 200,000	$ 180,000	$ 160,000	$ 150,000
Secondary Clarifiers	Flow	$ 0	$ 0	$ 0	$ 0
UV Disinfection	Flow	$ 800,000	$ 660,000	$ 520,000	$ 370,000
Solids Handling: Aeration	Solids	$ 250,000	$ 250,000	$ 250,000	$ 250,000
Solids Handling: Disposal	Solids	$ 150,000	$ 150,000	$ 150,000	$ 150,000
Miscellaneous Sitework	Misc.	$ 150,000	$ 150,000	$ 150,000	$ 150,000
Total		$ 1,950,000	$ 1,790,000	$ 1,630,000	$ 1,470,000

Operations and maintenance requirements will also change with the various flow reduction scenarios. The following table provides the estimated O&M costs for each of the levels of I/I reduction in each of treatment components listed in the above table. A present worth calculation is made for the O&M costs for life-cycle analysis of the cost effectiveness of I/I reduction.

Table 3.3.7f – Estimated Operation and Maintenance Costs at Various Levels of I/I Reduction

Treatment Component	Level 1	Level 2	Level 3	Level 4
1	2	3	4	5
Septage Pretreatment	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Headworks: Screen	$ 2,000	$ 2,000	$ 2,000	$ 2,000
Headworks: Grit Chamber	$ 2,000	$ 2,000	$ 2,000	$ 2,000
Aeration Basins	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Aeration Blowers	$ 25,000	$ 22,800	$ 20,100	$ 18,500
Secondary Clarifiers	$ 5,000	$ 5,000	$ 5,000	$ 5,000
UV Disinfection	$ 35,000	$ 32,000	$ 28,200	$ 25,900
Solids Handling: Aeration	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Solids Handling: Disposal	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Miscellaneous Sitework	$ 0	$ 0	$ 0	$ 0
Subtotal	$ 91,000	$ 85,800	$ 79,300	$ 75,400
Present Worth: 20-yr@6%	$1,050,000	$990,000	$910,000	$870,000

The following table summarizes and totals the transport, treatment plant component capital requirements and operations and maintenance cost estimates for each level of I/I reduction.

Table 3.3.7g – Summary of Transport and Treatment Plant Improvement Costs

Cost Description	Level 1	Level 2	Level 3	Level 4
1	2	3	4	5
Transport Costs	$ 4,517,500	$ 2,657,500	$ 2,060,000	$ 0
Treatment Capital Improvements	$ 1,950,000	$ 1,790,000	$ 1,630,000	$ 1,470,000
Treatment O&M Costs	$ 1,050,000	$ 990,000	$ 910,000	$ 870,000
Total: Transport + Treatment	$ 7,517,500	$ 5,437,500	$ 4,600,000	$ 2,340,000

The following table presents the calculations of the accumulated I/I reduction and resulting Peak Flow associated with the expected result of the rehabilitation efforts in each basin (columns 3 and 4). The basins are arranged in order of highest priority. Column 5 represents the accumulated cost of the I/I reduction costs from Table 3.3.7b for each basin. The values in column 6 show the treatment costs associated with treatment of the peak flow from column 4, interpolated from the cost totals shown in table

3.3.7g. Column 7 is the sum of the cost of rehabilitation (column 5) and the treatment cost in column 6. The net savings in column 8 are the difference between the associated cost of I/I rehab and treatment costs (column 7) and the total cost associated with no reduction in I/I flows.

Table 3.3.7h – Summary of Cost Effective Analysis of I/I Reduction

Priority	Basin	Accumulated I/I Reduction (MGD)	Peak Flow after I/I Reduction (MGD)	Accumulative I/I Rehab Cost	Acc. Treatment Cost	I/I Rehab + Treatment	Net Savings
1	2	3	4	5	6	7	8
--	--	0.000	3.175	$ 0	$ 7,517,500	$ 7,517,500	$ 0
1	E	0.310	2.865	$ 635,000	$ 6,370,833	$ 7,005,833	$ 511,667
2	L	0.613	2.562	$ 1,110,000	$ 5,362,340	$ 6,472,340	$ 1,045,160
3	C	0.844	2.331	$ 1,395,000	$ 5,018,750	$ 6,413,750	$ 1,103,750
4	D	0.916	2.259	$ 1,715,000	$ 4,911,378	$ 6,626,378	$ 891,122
5	B	0.952	2.223	$ 1,770,000	$ 4,857,692	$ 6,627,692	$ 889,808
6	F	1.038	2.137	$ 1,835,000	$ 4,728,846	$ 6,563,846	$ 953,654
7	A	1.053	2.122	$ 1,840,000	$ 4,707,372	$ 6,547,372	$ 970,128
8	G	1.074	2.101	$ 1,880,000	$ 4,675,160	$ 6,555,160	$ 962,340
9	H	1.082	2.093	$ 1,920,000	$ 4,664,423	$ 6,584,423	$ 933,077
10	I	1.096	2.079	$ 1,960,000	$ 4,642,949	$ 6,602,949	$ 914,551
11	J	1.110	2.065	$ 2,000,000	$ 4,621,474	$ 6,621,474	$ 896,026
12	K	1.125	2.050	$ 2,040,000	$ 4,600,000	$ 6,640,000	$ 877,500

Figure 3.3.7 is a graphical representation of the cost effective analysis calculated in table 3.3.7g and 3.3.7h. The minimum total cost in column 7 of table 3.3.7h corresponds with the greatest net savings and represents the point of expected maximum savings from I/I reduction. Where the graphed lines diverge from each other corresponds with the point at which, according to this analysis method, I/I reduction will not realize an effective return on the investment. Therefore, the graph demonstrates that the I/I from Basins E, L and C may be excessive and that it may be cost effective to address the deficiencies identified in these areas.

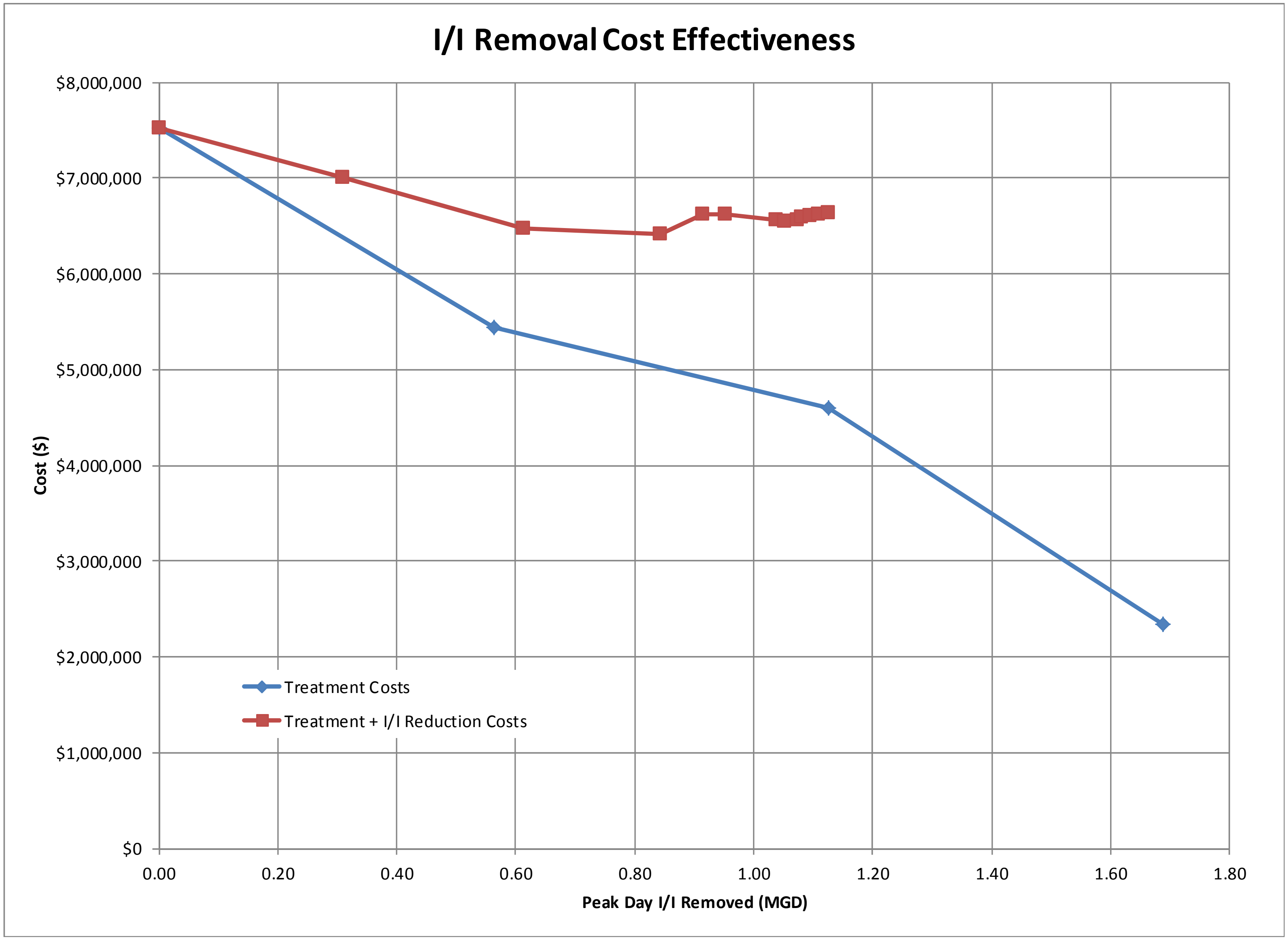

Figure 3.3.7 – Cost Effective Analysis of I/I Reduction

3.3.8. Constituent Analysis of Plant Records

Analysis of the most recent three (3) years (2010 – 2012) of Discharge Monitoring Reports (DMRs) from the City's Wastewater Treatment Plant has identified a number of parameters which characterize the City's wastewater. Plant records include influent measurement of BOD and TSS an average of three times per week. Figures 3.3.8a through 3.3.8d below summarize the concentration and loading of these primary constituents.

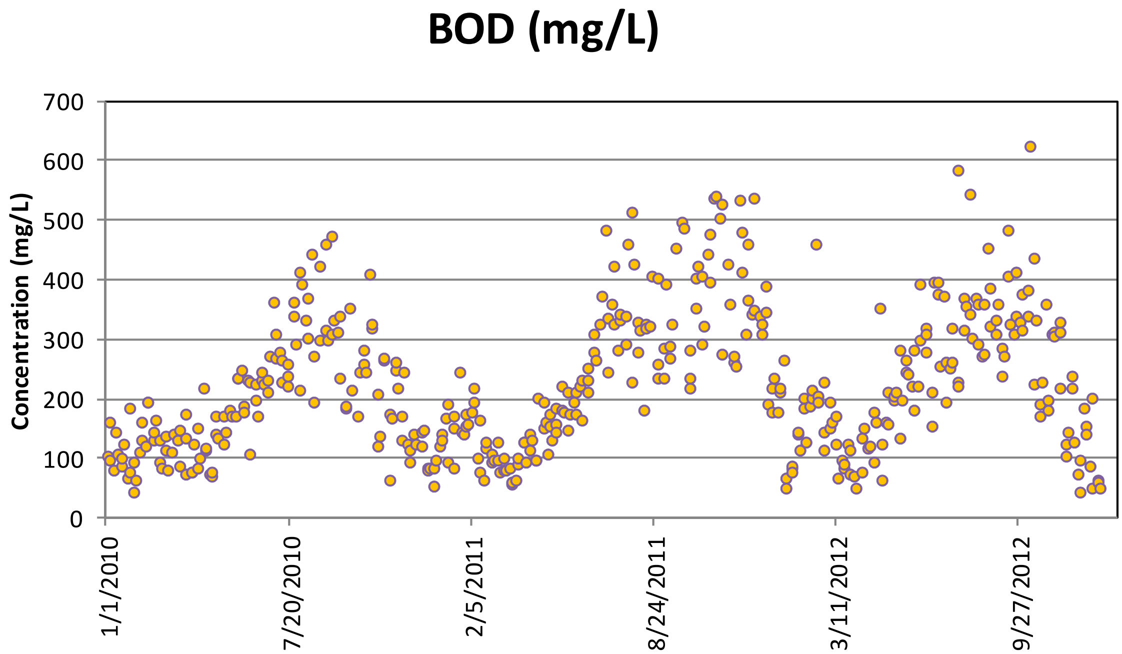

Figure 3.3.8a – BOD Composition

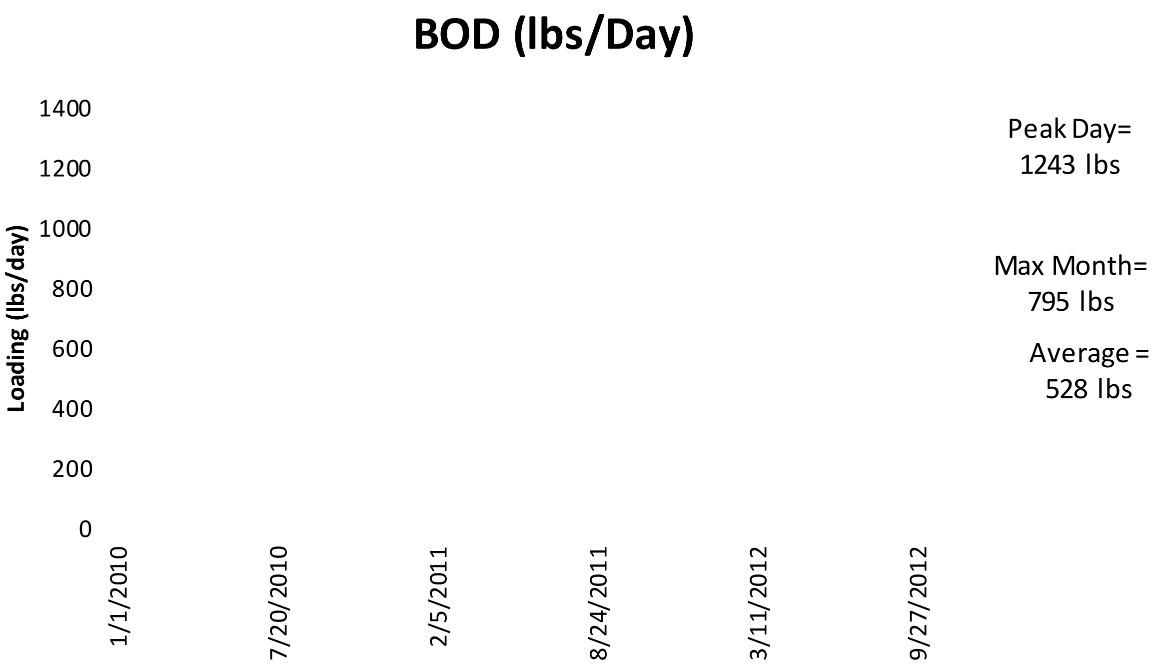

Figure 3.3.8b – BOD Influent Loading

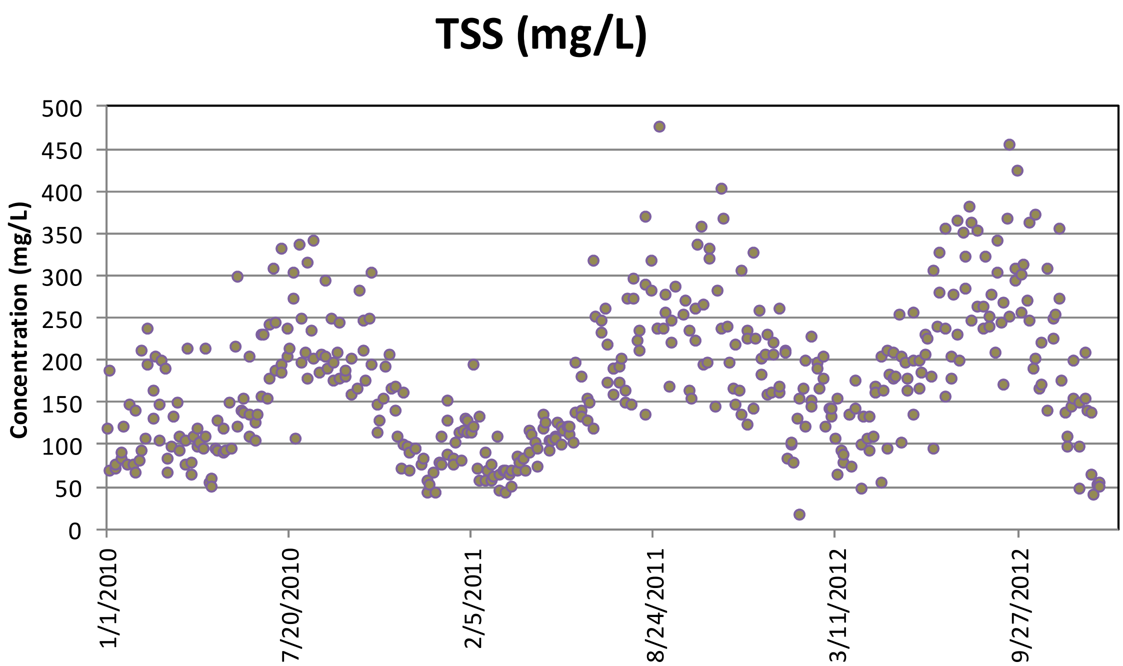

Figure 3.3.8c – TSS Composition

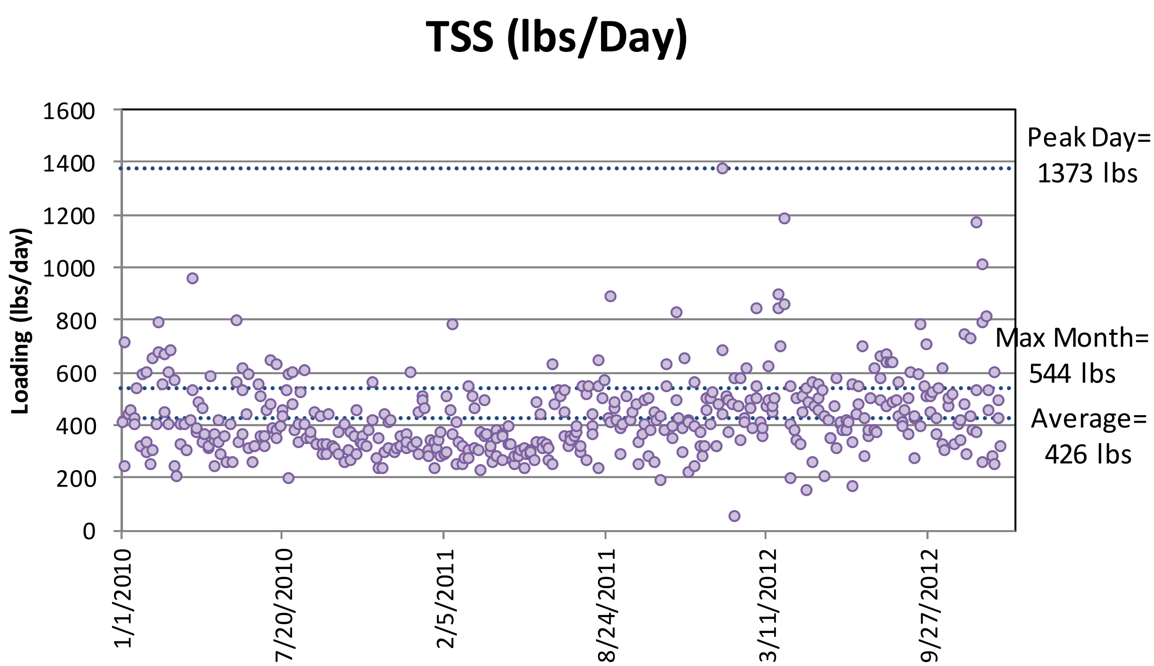

Figure 3.3.8d – TSS Influent Loading

The following graphs present the measured influent temperature and pH of the wastewater.

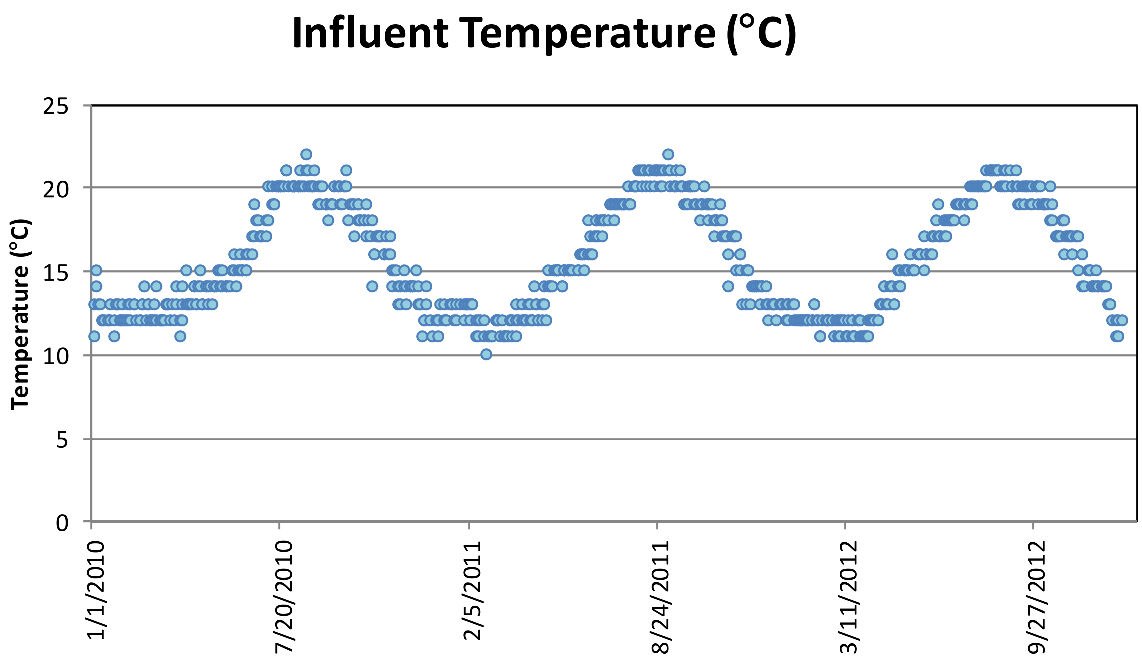

Figure 3.3.8e – Influent Temperature

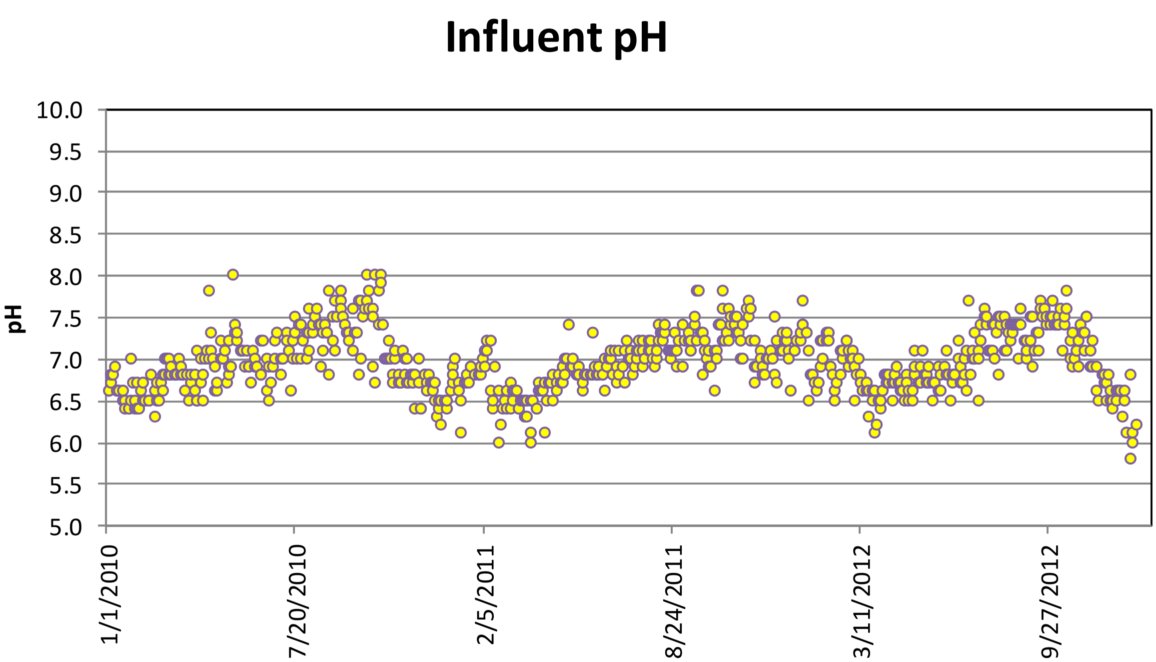

Figure 3.3.8f – Influent pH

The influent temperatures vary from 10 to 22 degrees Celsius and pH varies from 5.8 to 8.0. The following table summarizes the influent temperatures and pH measured at the headworks of the wastewater treatment plant.

Table 3.3.8a – Existing Influent Temperature and pH

Current Temperature and pH						
	Temperature			pH		
Flow Conditions	Min	Ave	Max	Min	Ave	Max
Winter	10.0	14.0	20.0	5.8	6.9	8.0
Summer	11.0	17.2	22.0	6.1	7.0	8.0
Annual	10.0	15.6	22.0	5.8	7.0	8.0
Maximum Month			20.6			7.5
Maximum Day			22.0			8.0

3.3.9. Wastewater Composition

Table 3.3.9a below identifies the current composition of the influent in terms of BOD, TSS and pH.

Table 3.3.9a – Current Influent Composition

Current Wastewater Composition Summary								
	BOD		TSS		pH		Temperature	
Flow Parameter	Composition (mg/L)	Loading (lbs)	Composition (mg/L)	Loading (lbs)	Min	Max	Min	Max
Annual Average	222.4	527.5	174.8	425.8	6.0	8.0	10.5	21.0
Winter Average	192.8	521.2	152.5	431.5	5.8	8.0	10.0	20.0
Summer Average	252.2	533.9	196.0	420.4	6.1	8.0	11.0	22.0
Maximum Month	394.5	795.3	302.1	544.0	6.4	7.5	11.5	20.6
Maximum Day	620.0	1242.7	476.0	1373.1	5.8	8.0	10.0	22.0

As seen above, summer and winter flows had significantly different compositions of BOD and TSS, while the loading of these constituents was relatively independent of the seasonal flow fluctuations as would be expected. The variance in concentrations appears to be due to the influx of I/I.

Typical concentrations of contaminants within untreated domestic wastewater are identified in the text, *Wastewater Engineering, Treatment and Reuse*, Metcalf & Eddy, 2003. Data given in the referenced text is summarized in Table 3.3.9b below for comparison to the average load concentrations shown in the table above, as measured at the Cave Junction WWTP.

Table 3.3.9b – Typical Composition of Untreated Domestic Wastewater

Typical Wastewater Composition				
		Concentration		
Contaminant	Unit	Low Strength	Medium Strength	High Strength
Biochemical Oxygen Demand, 5-day, 20°C (BOD_5)	mg/L	110	190	350
Total Suspended Solids (TSS)	mg/L	120	210	400
Fecal Coliform	No./100mL	10^3-10^5	10^4-10^6	10^5-10^8
Free Ammonia Nitrogen (NH_3-N)	mg/L	12	25	45

Source: Table 3-15, "Wastewater Engineering, Treatment and Reuse," Metcalf & Eddy, 2003.

By comparing the typical values in the above table (Table 3.3.9b) to the existing overall average constituent concentrations presented in Table 3.3.9a, average influent BOD and TSS values for Cave Junction are considered medium strength.

3.3.10. Projected Wastewater Composition

As developed in section 1.9, the current population, as of 2010, served by the City of Cave Junction is 1,883 persons. Based on growth projections discussed in section 1.9, the population served at the end of the design period will be approximately 3396 persons. Population growth is expected to occur in areas of vacant land, some of which is already subdivided, within the city limits or within the Urban Growth Area. New collection facilities will need to be constructed in order for development to occur in many areas.

At this time, no significant change to the current ratio of residential to commercial to industrial sources is expected. Therefore, for the purposes of projecting wastewater characteristics, it is assumed that flows and loading will increase over time based on the increase in population and that the composition, per unit volume, of the wastewater will remain the same.

Projected BOD and TSS loading for Cave Junction in the year 2035 are summarized in Table 3.3.10, below, including the unit loading presented in units of pounds per person per day. The values presented have been determined by dividing the average and peak loads determined from the DMRs by the existing population to obtain unit loads (design factors) in terms of pounds per capita day. The unit design factors were then multiplied by the projected population to determine projected loading.

Table 3.3.10 – Summary of Current and Projected Wastewater Loads

Current and Projected Loading								
Parameter	2013 Loading (lbs/day)		2013 Population	Unit Loading (lbs/capita/day)		2035 Population	2035 Loading (lbs/day)	
	BOD	TSS		BOD	TSS		BOD	TSS
Annual Average	527.5	425.8	2000	0.26	0.21	3396	895.7	723.1
Winter Average	521.2	431.5		0.26	0.22		884.9	732.7
Summer Average	533.9	420.4		0.27	0.21		906.6	713.8
Maximum Month	795.3	544.0		0.40	0.27		1350.4	923.7
Maximum Day	1242.7	1373.1		0.62	0.69		2110.1	2331.6

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4.0 Alternatives Considered

4.1. General

4.1.1. Introduction

This section presents alternatives and recommendations to address deficiencies identified in this planning effort. Ten (10) projects were generated for consideration and planning for the City. The projects are ordered based on the placement within the wastewater stream, with collection system elements first and following the wastewater through the treatment and disposal steps. The projects are later prioritized based on immediacy of the need.

Project 1 – Rehabilitate Manholes. 14 manholes were found with leaks during recent flow mapping activities. Each manhole identified should be assessed further and a rehabilitation method selected and designed.

Project 2 – Rehabilitate Pipeline. Flow mapping also located several sections of pipe that exhibit leaks. The pipe sections identified should be televised and assessed for the most appropriate repair or rehabilitation method.

Project 3 – Replace Headworks Screen. Operation personnel have requested consideration of a new headworks screen. The existing automatic screen is a bar screen with ¾" bar spacing, which inadvertently allows some inorganics (plastics, rags, wipes, etc.) to pass into the secondary treatment basin.

Project 4 – RV Receiving Station. The City welcomes thousands of recreational visitors each year, many of whom travel in recreational vehicles. Currently, the City cannot accommodate the wastewater from most of these travelers. A receiving station would allow RVs to discharge wastewater prior to entering busy roadways. Operational costs of receiving and treating may be offset by fees associated with discharging wastewater.

Project 5 – Septage Receiving Station. The City accepts septage discharge several times a week. Currently, the septage wastewater occupies one-half of the aeration basin capacity of the treatment plant. The receipt and treatment of septage is time-consuming for treatment plant staff. A formal septage receiving station will allow septage wastewater to be isolated from the domestic wastewater stream for stabilization. Once stabilized, the septage may be slowly introduced and mixed into the domestic wastewater stream for secondary treatment.

Project 6 – Additional Blower. The air supply system for the treatment plant is expected to reach capacity limits by the end of this 20-year planning cycle. The City can begin planning and budgeting for installation of a third blower in the aeration building.

Project 7 – Disinfection Upgrade. Currently, disinfection is achieved with closed-vessel ultra violet light units. The units use old technology, are not energy efficient, tend to overheat during low-flow conditions and replacement parts are becoming difficult to obtain. The City may plan and budget to replace the disinfection system.

Project 8 – Outfall Diffuser. During a recent mixing zone study, installation of a new diffused outfall was recommended. Diffusion of effluent will improve dispersion of discharge in the river.

Project 9 – Effluent Disposal. Seasonally, the effluent discharged from the treatment plant is diverted to the golf course, in accordance with the discharge permit. The recycled water is applied to the fairways and greens at the golf course. This arrangement relies on the private entity at the golf course for continued used of the recycled effluent. The City should make improvements to the temporary storage lagoons and secure the continued use of the golf course reuse of the effluent.

Project 10 – Aerobic Digester Aerator Upgrades. The existing aerators are high-maintenance, prone to problems, dangerous for personnel to work on and not providing the necessary mixing and aeration for the solids aerobic digester. The City should consider replacing the floating aerators with more efficient, more powerful, higher quality mixer/aerator units.

Project 11 – Biosolids Disposal. Based on current estimates, the biosolids facultative storage lagoon is about 67% full. The storage lagoon has stored more than 15 years of solids. The City should remove and dispose of the collected biosolids. The logical site for disposal of the biosolids is as a cap at the county landfill, located approximately 5 miles from the treatment plant.

Each project presented for further consideration will include estimates of costs associated with planning, design, construction, operation and maintenance.

4.1.2. Construction Costs

Construction costs are based on competitive bidding as public works projects with Davis-Bacon or Oregon Bureau of Labor and Industries (BOLI) prevailing wage rates. The estimated construction costs in this report are based on actual construction bidding results from similar work, published cost guides, budget quotes obtained from equipment suppliers, and other construction cost experience. Construction costs are preliminary budget level estimates prepared without design plans and details.

Future changes in the cost of labor, equipment, and materials may justify comparable changes in the cost estimates presented herein. For this reason, common engineering practices usually tie the cost estimates to a particular index that varies in proportion to long-term changes in the national economy. The Engineering News Record (ENR) construction cost index (CCI) is most commonly used. This index is based on the value of 100 for the year 1913. Average yearly values for the past 13 years are summarized in Table 4.1.2.

Table 4.1.2 – ENR Construction Cost Index History

YEAR	INDEX	% CHANGE/YR
2000	6221	2.67
2001	6343	1.96
2002	6538	3.07
2003	6695	2.40
2004	7115	6.27
2005	7446	4.65
2006	7751	4.10
2007	7967	2.79
2008	8310	4.31
2009	8570	3.13
2010	8801	2.70
2011	9070	3.06
2012	9309	2.64
Average since 2000		3.36%

Cost estimates presented in this report are based on average 2012 dollars with an ENR CCI of 9309. For construction performed in later years, estimated costs should be projected based on the then current year ENR Index using the following method:

Updated Cost = Report Cost Estimate x (current ENR CCI / 9309)

4.1.3. Contingencies

A contingency factor equal to approximately twenty percent (20%) of the estimated construction cost has been added to the budgetary costs estimated in this report. In recognition that the cost estimates presented are based on conceptual planning, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigation and studies, and other difficulties which cannot be foreseen at this time but may tend to increase final costs. Upon final design completion of any project, the contingency can be reduced to 10%. A contingency of at least 10% should always be maintained going into a construction project to allow for variances in quantities of materials and unforeseen conditions.

4.1.4. Engineering

Engineering services for major projects typically include surveying, preliminary and final design, preparation of contract/construction drawings and specifications, bidding services, construction management, inspection, construction staking, start-up services, and the preparation of operation and maintenance manuals. Depending on the size and type of project, engineering costs may range from 18 to 25% of the contract cost when all of the above services are provided. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small or complicated projects.

Engineering costs for basic design and construction services presented in this report are estimated at 20% of the estimated total construction cost. Other engineering costs such as specialized geotechnical explorations, hydro-geologic studies, easement research and preparation, pre-design reports, and other services outside the normal basic services will typically be in addition to the basic engineering fees charged by firms. When it was suspected that a specific project in this report may need any special engineering services, an effort has been made to include additional budget costs for such needs. Specific efforts required for individual basic engineering tasks such as surveying, design, construction management, etc. vary widely depending on the type of project, scheduling and timeframes, level of service desired during construction, and other project/site-specific conditions however an approximate breakdown of the 20% engineering budget is as follows:

Surveying and Data Collection – 0.5%
Civil/Mechanical Design – 8%
Electrical/Controls Design – 1.5%
Bid Phase Services – 1%
Construction Management – 4%
Construction Observation (Inspection) – 5%

4.1.5. Legal and Management

An allowance of five percent (5%) of construction cost has been added for legal and other project management services. This allowance is intended to include internal project planning and budgeting, funding program management, interest on interim loan financing, legal review fees, advertising costs, wage rate monitoring, and other related expenses associated with the project that could be incurred.

4.1.6. Land Acquisition

Some projects may require the acquisition of additional right-of-way, property, or easements for construction of a specific improvement. The need and cost for such expenditures is difficult to predict and must be reviewed as a project is developed. Effort was made to include costs for land acquisition, where expected, within the cost estimates included in this report.

4.2. Project 1: Collection System Rehabilitation – Manhole Repair

4.2.1. Description

During the flow mapping performed in April 2013, fourteen (14) manholes were found to be in need of repair or rehabilitation. Many manholes in the collection system were not open and visually inspected during the flow mapping. All of the manholes in the City's wastewater collection system should be assessed.

The manholes identified are summarized in the following list.

Table 4.2.1 – Summary of Manhole Repairs

ID	Manhole #	Description
A.	Manhole A-4	Small Leak in Stub
B.	Manhole B-3	Root Intrusion
C.	Manhole B-8	Root Intrusion
D.	Manhole B-30A	Leak Around Pipe (5± gpm)
E.	Manhole C-1	Grout limiting Access to Channel/Pipe
F.	Manhole E-1	Standing Water in Base, Unable to Measure Flow
G.	Manhole E-7	Leak Around Pipe (3± gpm)
H.	Manhole E-15	Small Leaks Around Pipe & at Old Patch Halfway up Manhole
I.	Manhole F-2	Small Leak Around Pipe
J.	Manhole L-2	Base and First Barrel Joints Leaking (10± gpm)
K.	Manhole L-9	Small Leak Around Pipe & at Old Patch in Manhole Barrel
L.	Manhole L-10	Small Leak Around Pipe
M.	Manhole L-11	Small Leak Between Base and First Barrel
N.	Manhole L-14	Small Leak Between Base and First Barrel

4.2.2. Design Criteria

Manholes should be watertight to prevent inflow and infiltration entering the collection system. Existing manholes with leaks may be repaired by various methods, including coatings, point or injection grouting, hydrophilic cement, gasket repair, etc. Many of the repairs may be performed from inside the manhole.

ASTM C1244, Vacuum Testing of Manholes should be used to assess the effectiveness of manhole repair and rehabilitation. ASTM C497, Hydrostatic Testing of Manholes may be used as an alternative test method. The following procedure summarizes the Vacuum Testing of Manholes as described in ASTM C1244:

1. Plug all pipes entering manhole. Secure all plugs to prevent movement while vacuum is being drawn.

2. Testing shall include the joint between the manhole cone or riser ring(s) and the manhole cover frame.

3. Installation and operation of vacuum equipment and indicating devices shall be in accordance with the manufacturer's specifications and instructions.

4. Withdraw air from the manhole until a measured vacuum of 10-inches of mercury (10" Hg = 4.9 psi) is established in the manhole interior.

5. Record the time it takes for the vacuum to drop to 9-inches of mercury (9" Hg = 4.4 psi). Acceptance standards are based on this 1-inch of mercury change in negative pressure. Time measured for the 1" Hg (1" Hg = 0.5 psi) pressure change shall be equal to or greater than the values in the following table:

Vacuum Testing Requirements (minimum test times, seconds)

Manhole Depth (ft)	Manhole Diameter (in)				
	42"	48"	54"	60"	72"
8' or less	17	20	23	26	33
10	21	25	29	33	41
12	25	30	35	39	49
14	30	35	41	46	57
16	34	40	46	52	67
18	38	45	52	59	73
20	42	50	53	65	81
22	46	55	64	72	89

4.2.3. Maps and Figures

The following maps show the schematic location of the 14 manholes identified during flow mapping. The manholes shown in red need rehabilitation.

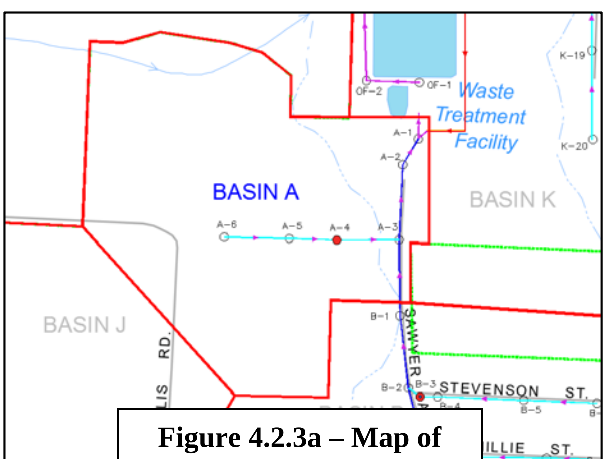

Figure 4.2.3a – Map of Basin A Manholes

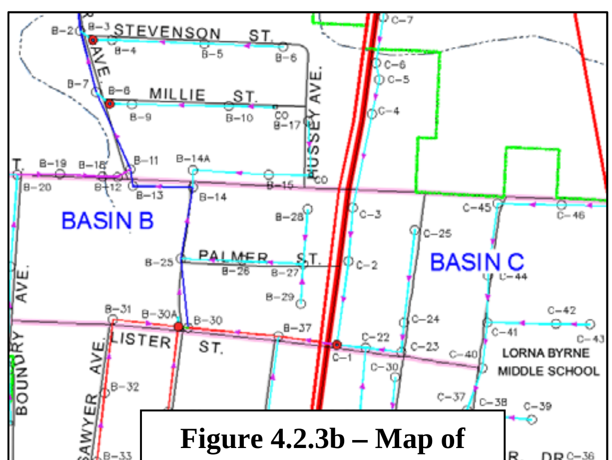

Figure 4.2.3b – Map of Basin B & C Manholes

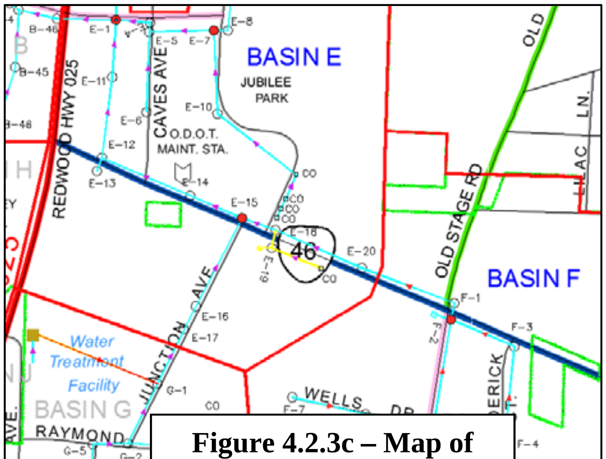

Figure 4.2.3c – Map of Basin E & F Manholes

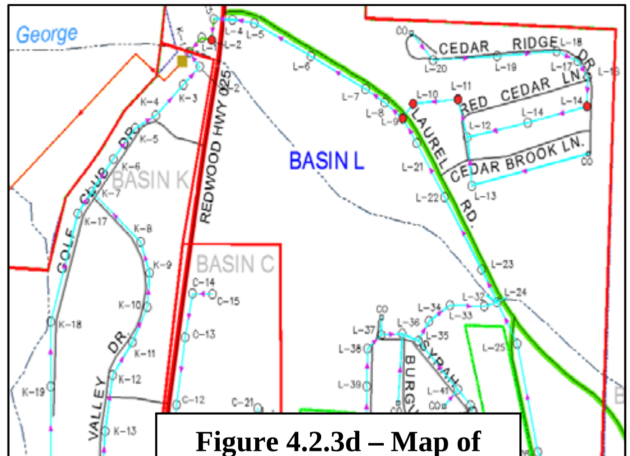

Figure 4.2.3d – Map of Basin L Manholes

4.2.4. Environmental Impacts

No direct environmental impacts.

4.2.5. Land Requirements

The manholes identified are located in public right-of-way. Therefore, additional land acquisition will not be necessary for the repairs.

4.2.6. Potential Construction Considerations

Traffic control will be necessary at most of the manholes because of the location (within the street). High water table may pose difficulty for point repairs. Site conditions will constitute confined space for point repairs conducted inside the manholes.

4.2.7. Sustainability Considerations

Repairs made to the leaking manholes will aid in the longevity of the collection system.

4.2.7.1. Water and Energy Efficiency

By lessening the I/I in the collection system, wastewater flows will be reduced, which will result in the treatment plant utilizing less energy.

4.2.7.2. Green Infrastructure

No impact to preserving or mimicking stormwater processes.

4.2.7.3. Other

Collection system rehabilitation will extend the life of the infrastructure.

4.2.8. Cost Estimates

The following table summarizes the projected cost estimates for the rehabilitation work necessary for each manhole.

Table 4.2.8 – Manhole Repair Cost Estimate

Manhole Rehabilitation Cost Estimates					
ID	Item Description	Unit	Quantity	Unit Cost	Item Cost
A	Manhole A-5; Small Leak in Stub	ls	1	$2,500	$2,500
B	Manhole B-3; Root Intrusion	ls	1	$3,000	$3,000
C	Manhole B-8; Root Intrusion	ls	1	$3,000	$3,000
D	Manhole B-30A; Leak Around Pipe (5± gpm)	ls	1	$3,500	$3,500
E	Manhole C-1; Grout limiting Access to Channel/Pipe	ls	1	$2,000	$2,000
F	Manhole E-1; Standing Water in Base, Unable to Measure Flow	ls	1	$3,500	$3,500
G	Manhole E-7; Leak Around Pipe (3± gpm)	ls	1	$3,000	$3,000
H	Manhole E-15; Small Leaks Around Pipe & at Old Patch Halfway up Manhole	ls	1	$2,500	$2,500
I	Manhole F-2; Small Leak Around Pipe	ls	1	$3,000	$3,000
J	Manhole L-2; Base and First Barrel Joints Leaking (10± gpm)	ls	1	$3,500	$3,500
K	Manhole L-9; Small Leak Around Pipe & at Old Patch in Manhole Barrel	ls	1	$2,500	$2,500
L	Manhole L-10; Small Leak Around Pipe	ls	1	$3,000	$3,000
M	Manhole L-11; Small Leak Between Base and First Barrel	ls	1	$2,500	$2,500
N	Manhole L-14; Small Leak Between Base and First Barrel	ls	1	$2,500	$2,500
Total Manhole Rehabilitation Estimated Costs					**$40,000**
Contingency (20%)					$8,000
Engineering (20%)					$8,000
Project Management and Legal (5%)					$2,000
Total Project Budget Estimate					**$58,000**

4.3. Project 2: Collection System Rehabilitation – Mainline Rehabilitation

4.3.1. Description

During the flow mapping performed in April 2013, eight (8) sections of mainline were identified to be in need of repair or rehabilitation. The sections of pipe were located based on increases in flow measured from one manhole to another. None of the pipes in the collection system were visually inspected for leaks. All of the pipe in the City's wastewater collection system should be formally assessed.

The sections of pipe identified are summarized in the following list.

Table 4.3.1 – Summary of Pipeline Repairs

ID	Manhole to Manhole	Length
A.	Manhole C-1 to C-22	130 LF
B.	Manhole C-37 to C34	150 LF
C.	Manhole B-37 to C-1	270 LF
D.	Manhole D-1 to D-18	410 LF
E.	Manhole E-15 to E-20	570 LF
F.	Manhole E-12 to E-15	660 LF
G.	Manhole L-1 to K-1	100 LF
H.	Manhole L-9 to L-11	330 LF

4.3.2. Design Criteria

Collection system pipe should be watertight to prevent inflow and infiltration entering the collection system. Existing pipes with leaks may be repaired by various methods, including dig and replace, spray-on coatings, injection grouting, pipe burst, slip lining, fold and form, spiral wound liner, cured in place liner, etc. Many of the repairs may be performed from inside the pipe, or trenchless.

ASTM F1417, Low-Pressure Air Testing of Gravity Sewers should be used to assess the effectiveness of pipeline repair and rehabilitation. The following summarizes the method of low-pressure air testing for gravity sewer pipe, as described in ASTM F1417.

1. Immediately following pipe cleaning, the pipe installation shall be tested with low pressure air. Each pipe section between manholes shall be tested. Service laterals from the main to the property line shall be included in the test.

2. Check the average height of ground water over the pipe invert. The test pressure required below shall be increased 0.433 psi for each foot of average water depth over the pipe (ex. If groundwater is 2.8 feet above pipe invert, add 1.2 psig to test pressures).

3. Air shall be slowly supplied to the plugged pipe until internal air pressure reaches 4.0 psi greater than the average back pressure of any ground water that may submerge the pipe. Do not exceed a total pressure of 9.0 psig.

4. After the internal test pressure is reached, at least two minutes shall be allowed for the air temperature to stabilize. After the stabilization period, disconnect the air supply.

5. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than 3.5 psig (greater than average backpressure of any groundwater over the pipe). At a reading of 3.5 psig, or any convenient pressure between 3.5 psig and 4.0 psig (above groundwater pressure), timing shall commence with an accurate stopwatch.

6. Acceptance - The tested section shall be considered acceptable if the required testing time has elapsed before a 1.0 psig pressure drop has occurred. If the pressure drops 1.0 psig before the minimum length of time has elapsed, the air loss rate is considered excessive and the section of pipe has failed the test.

7. Acceptance criteria is based on an allowable air loss of Q=0.0015 cfm per ft^2 of internal pipe surface area less than 625 ft^2. This results in a total allowable loss of 625Q = 0.94 cfm. The shortest time (T), in seconds, allowed for the air pressure to drop 1.0 psig is calculated with the following formula:

   $T = 0.085\ (DK/0.0015)$

   Where,
   K = 0.000419DL; (but not less than 1.0),
   D = pipe I.D. in inches, and
   L = length of pipe tested in feet.

8. Contractor shall record and document the testing procedure and results during the testing process. The UNI-Bell "Air Test Data Sheet" or similar approved equal shall be used and submitted to the

appropriate agency. Record the diameter (in), length (ft), start and end manhole numbers, time, date, pressure drop, and groundwater level on inspection form. Submit to appropriate agency.

Minimum Specified Time Required for 1.0 PSIG Pressure Drop

Pipe ø (in)	Tmin (min:sec)	L for Tmin (ft)	T for longer L (sec)	Specification Time for Length (L) Shown (min:sec)							
				100ft	150ft	200ft	250ft	300ft	350ft	400ft	450ft
4	3:46	597	.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15

If no pressure drop (0 psig) has occurred after 1 hour, test may conclude and section passes

9. Service laterals shall be included in test however the length of service laterals may be ignored and the length of main line only used in the above table. If desired, length of service laterals included in test section may be included in the calculation by following the method outlined in UNI-B-6-98 Section 9.4.

4.3.3. Maps and Figures

The following maps show the schematic location of the pipe sections identified during flow mapping. The pipes shown in green need further assessment and possibly rehabilitation.

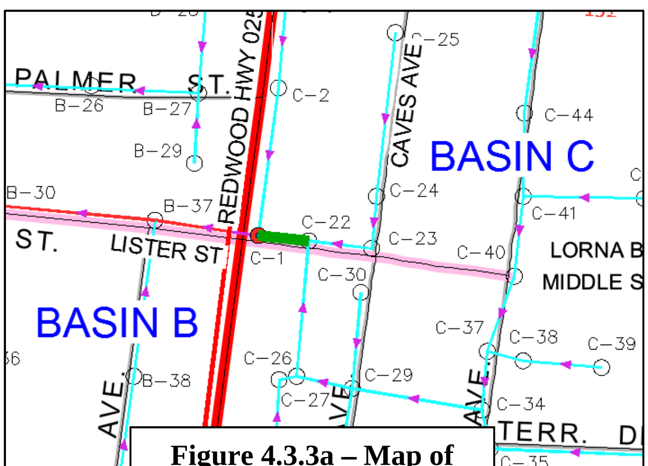

Figure 4.3.3a – Map of Pipe from C-1 to C-22

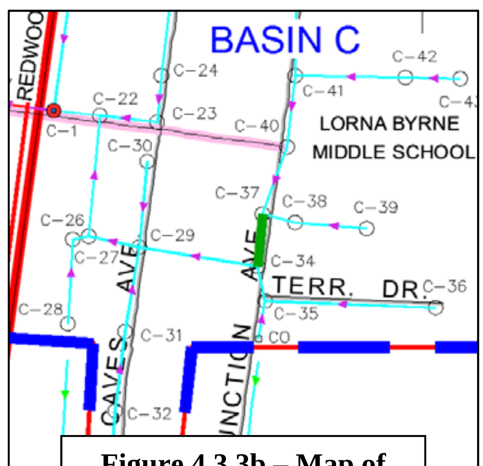

Figure 4.3.3b – Map of Pipe from C-37 to C-34

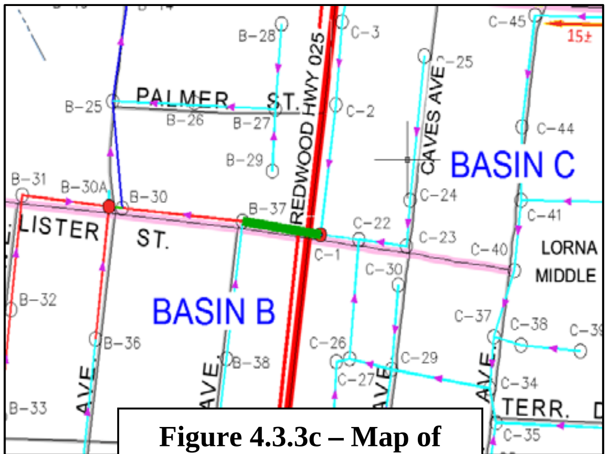

Figure 4.3.3c – Map of Pipe from B-37 to C-1

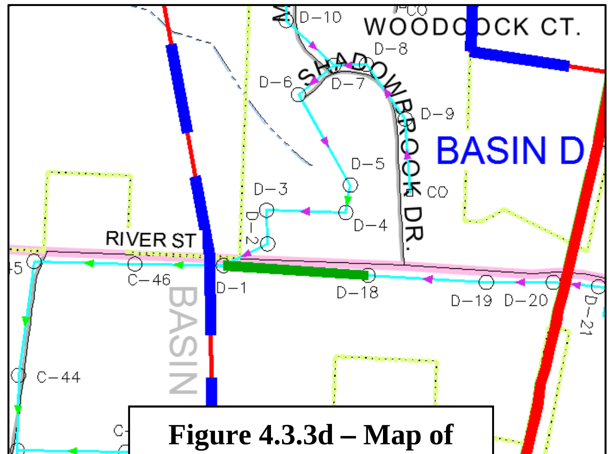

Figure 4.3.3d – Map of Pipe from D-1 to D-18

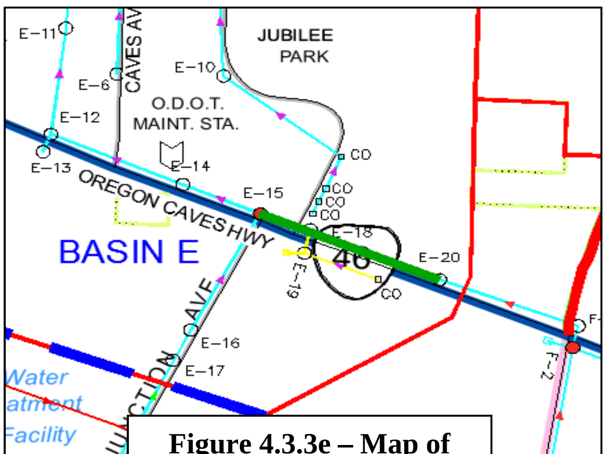

Figure 4.3.3e – Map of Pipe from E-15 to E-20

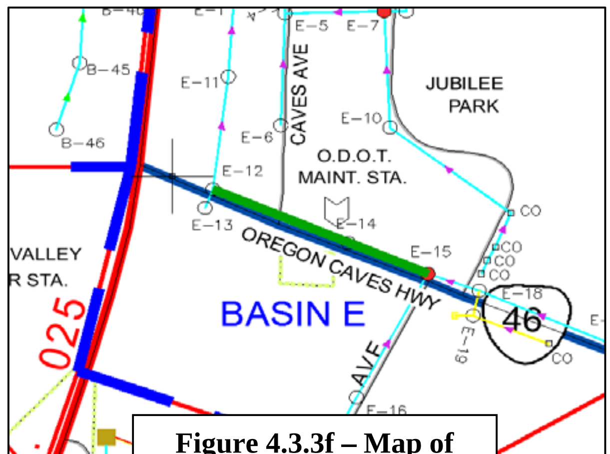

Figure 4.3.3f – Map of Pipe from E-12 to E-15

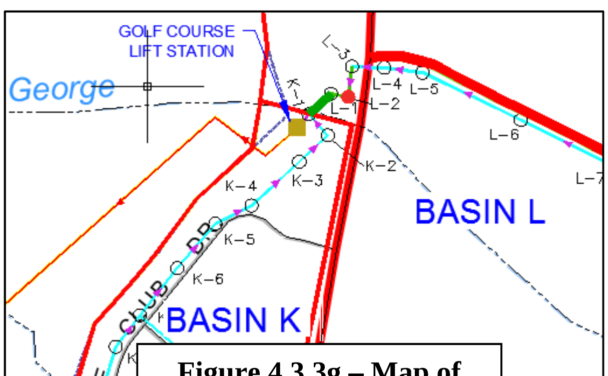

Figure 4.3.3g – Map of Pipe from L-1 to K-1

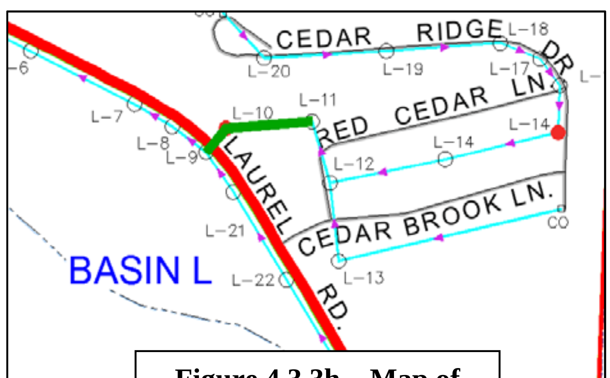

Figure 4.3.3h – Map of Pipe from L-9 to L-11

4.3.4. Environmental Impacts

The intent of the rehabilitation is to reduce inflow and infiltration, which will reduce the ultimate cost of treatment at the plant.

4.3.5. Land Requirements

The pipes identified are located in public right-of-way. Therefore, additional land acquisition will not be necessary for the repairs.

4.3.6. Potential Construction Considerations

Traffic control will be necessary at most of the pipe segments because of the location. High water table may pose difficulty for repairs. Site conditions may constitute confined space for trenchless methods conducted from inside the manholes or may require shoring for open trenches.

4.3.7. Sustainability Considerations

Repairs made to the leaking pipes will aid in the longevity of the collection system.

4.3.7.1. Water and Energy Efficiency

Lessening the I/I in the collection system will result in the treatment plant utilizing less energy.

4.3.7.2. Green Infrastructure

No impact to preserving or mimicking stormwater processes.

4.3.7.3. Other

Collection system rehabilitation will extend the life of the infrastructure.

4.3.8. Cost Estimates

The following table summarizes the projected cost estimates for the rehabilitation work necessary for each pipe segment. The cost per lineal foot includes the cost to perform CCTV operations, assess the condition of the pipe and design a rehabilitation solution.

Table 4.3.8 – Pipe Rehabilitation Cost Estimate

Pipe Rehabilitation Cost Estimates					
ID	***Item Description***	***Unit***	***Quantity***	***Unit Cost***	***Item Cost***
A	Manhole C-1 to C-22	lf	130	$250	$ 32,500
B	Manhole C-37 to C-34	lf	150	$250	$ 37,500
C	Manhole B-37 to C-1	lf	270	$250	$ 67,500
D	Manhole D-1 to D-18	lf	410	$250	$ 102,500
E	Manhole E-15 to E-20	lf	570	$250	$ 142,500
F	Manhole E-12 to E-15	lf	660	$250	$ 165,000
G	Manhole L-1 to K-1	lf	100	$250	$ 25,000
H	Manhole L-9 to L-11	lf	330	$250	$ 82,500
Total Pipe Rehabilitation Estimated Costs					**$ 655,000**
Contingency (20%)					$ 131,000
CCTV & Assessment (10%)					$ 65,500
Engineering (20%)					$ 131,000
Project Management and Legal (5%)					$ 32,750
Total Project Budget Estimate					**$ 1,015,250**

4.4. Project 3: Replace Headworks Screen

4.4.1. Description

The existing headworks automatic screen was installed in 2006. Operators have expressed maintenance concerns about the screen. Plant personnel have changed out the original bar screen for wider bar spacing because the narrow bar spacing removed biological elements from the waste stream. Unfortunately, the wider bar spacing seems to allow more inorganic material to pass.

Plant operators have requested pricing and information on other screen options.

4.4.2. Design Criteria

Screening systems are required to remove rags, paper products, plastics, large debris, rocks, and other large or floating debris from the liquid stream before the treatment process. Screening systems typically include automated systems to clean the screen through the use of a cycling rake, brushes, spray, auger, or other method. The screenings are commonly washed and compacted prior to being deposited into a dumpster, bagging system, or other container to be deposited in a landfill.

Screening systems are supplied in a wide variety of styles, designs, and capabilities. A brief summary is provided below for several different styles of headworks screens.

Step (Stair) Screens

Step screens operate like small escalators that allow raw sewage to flow through grating in the “face” of the escalator steps while trapping screenings on the grating. As the grating becomes clogged with screenings, the raw sewage water level begins to rise. The rising liquid level is automatically sensed causing the step screen to automatically advance to expose a clean and unclogged set of grating to the raw sewage flow. The liquid level falls as more flow pours through the clean grating until the cycle is repeated.

As the solids trapped on the face of the screen are lifted up by the advancing escalator action, they are partially dewatered as liquid drips off the solids and back into the liquid wastewater stream.

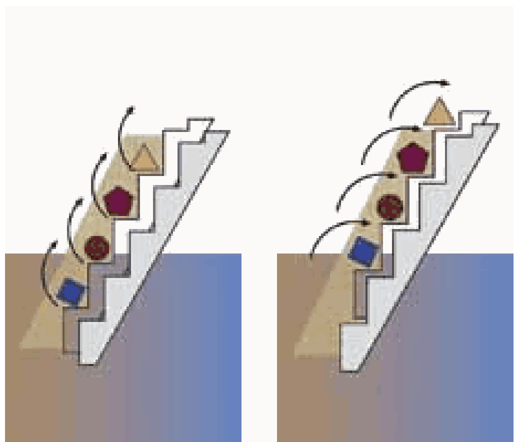

Figure 4.4.2a – Step Screen Graphic

Typically, the damp solids reach the top of the escalator and are deposited into a washer/compactor prior to being deposited into a dumpster, bagger, or other container to be taken to a landfill.

Advantages of the step/stair screen systems include:

- Effective screening and self-cleaning system
- Few moving parts (simple operation)
- Screenings form a mat on the face of the escalator trapping more screenings in the mat
- Washing and compaction system is simple
- No brushes required for replacement
- Fits into a variety of channel widths

Disadvantages of step/stair screen systems include:

- Typically more expensive than auger screen systems

This type of equipment is available from a number of manufacturers including Huber and Vulcan. Estimated costs for step/stair screening system equipment are between $150,000 and $200,000.

Spiral Screen

Spiral screens incorporate a spiral auger with brushes on the leading edge of the auger to clean screened debris and screenings from the screen surface. As the screenings are lifted by the auger, liquid drips from the screenings back into the raw water stream for further treatment. Ultimately, screenings are lifted to the top of the auger section where they are deposited into a bagger or container or are conveyed to a depository by an auger conveyor.

Figure 4.4.2b – Spiral Screen Graphic

The advantages of a spiral screen include:

- Screening and washing possible in a single unit
- Bagging option provides totally enclosed system (less odor)
- Less expensive capital costs
- Simple operation
- Easy installation

The disadvantages of a spiral screen include:

- Brushes on auger must be replaced every 3 years or so
- Less effective dewatering
- Screen and auger can often become clogged and develop a buildup of debris

This type of equipment is available from a number of manufacturer's including WesTech, Lakeside, Huber, and others. The estimated equipment cost for this type of screening system is between $100,000 and $150,000.

Basket/Barrel Screens

Basket or barrel screens utilize a screen structure shaped like a barrel that is placed in the flow channel to intercept screenings on the inside or outside of the barrel. The rotating barrel is then cleaning by a scraper or spray bar and all screenings are removed and deposited into an auger system for dewatering and compaction.

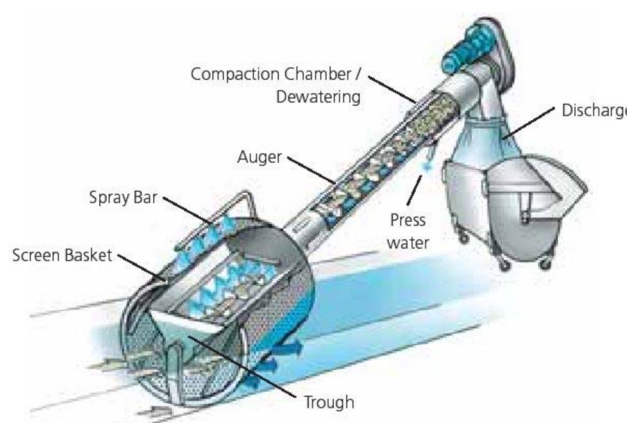

Figure 4.4.2c – Barrel Screen Graphic

The advantages of a basket or barrel screen include:

- Good screening performance
- Good washing and dewatering

- High capacity

The disadvantages to the basket or barrel screen include:

- Difficult to form channel to entrance of barrel
- May be prone to grease plugging
- Higher capital cost
- Few installations in the northwest

This type of equipment is relatively new to the market and is currently available from Huber. The estimated budget price for a barrel or basket screen equipment is between \$150,000 and \$200,000.

Perforated Plate Screen

The perforated plate filter panels join together to form a continuous belt that is cleaned by a stiff brush at the top of the belt. The screenings are then discharged to a washer/compactor from the top of the screen. Sealing at the sides of the screen belt prevent solids from bypassing the filter plates. Filter panels can be individually removed or replaced without removing the entire belt assembly. The units frame, filter plates, chains, and sprockets are all 304 or 316 stainless steel construction. Chain supports and side seals are Delrin plastic.

Figure 4.4.2d – Perforated Plate Screen Graphic

Automatic operation of the screen is achieved in the following manner. An upstream ultrasonic level sensor is mounted in the channel. When the level sensor recognizes that the water level in the channel is exceeding specified limits then a relay is activated and the screen is rotated. Rotating the screen allows for unclogged portions of the screen to come into contact with the channel and provides for brushing and cleaning of the perforations of partially blocked screens at the top of the mechanism. Rotation will stop after a predetermined period of time, or after upstream water levels drop back down to free flow levels.

The advantages of a plate screen include:

- These screens typically provide better performance of lifting solids from the bottom of the channel than rotary screens.
- High tolerance of grit allows the elimination of grit removal equipment.
- Screen speed can be adjusted to accommodate changes in flow and debris loading.
- The screen design includes a stainless steel mounted plate at the bottom of the channel to ensure a tight seal and reduce wear on the screen.
- Screenings are conveyed positively to the discharge point and the debris removal brush is effective in removing all types of debris without the need of washwater.
- Plate screens can fit more efficiently into a narrow channel.
- The perforated plate screen is suitable for outdoor use and winter operation.

The disadvantages of a perforated plate screen include:

- Greater headloss in channel
- Possible removal of more fecal and other organic material
- Potential for more odor from removed fecal matter
- Cleaning system may require hot water for grease removal

- Complex operation, compared with other alternatives

This type of equipment is currently available from several manufacturers such as Huber and FSM. The estimated budget price for the perforated plate screen equipment is between $100,000 and $150,000.

4.4.3. Recommendation

The perforated plate screen is the preferred alternative when selecting a screen. The perforated screen provides design and installation flexibility and individual plate panels may be replaced, as needed. The perforations can be sized to optimize inorganic removal and headloss in the channel.

4.4.4. Maps and Figures

The following shows a schematic layout of the headworks from the plant as-built.

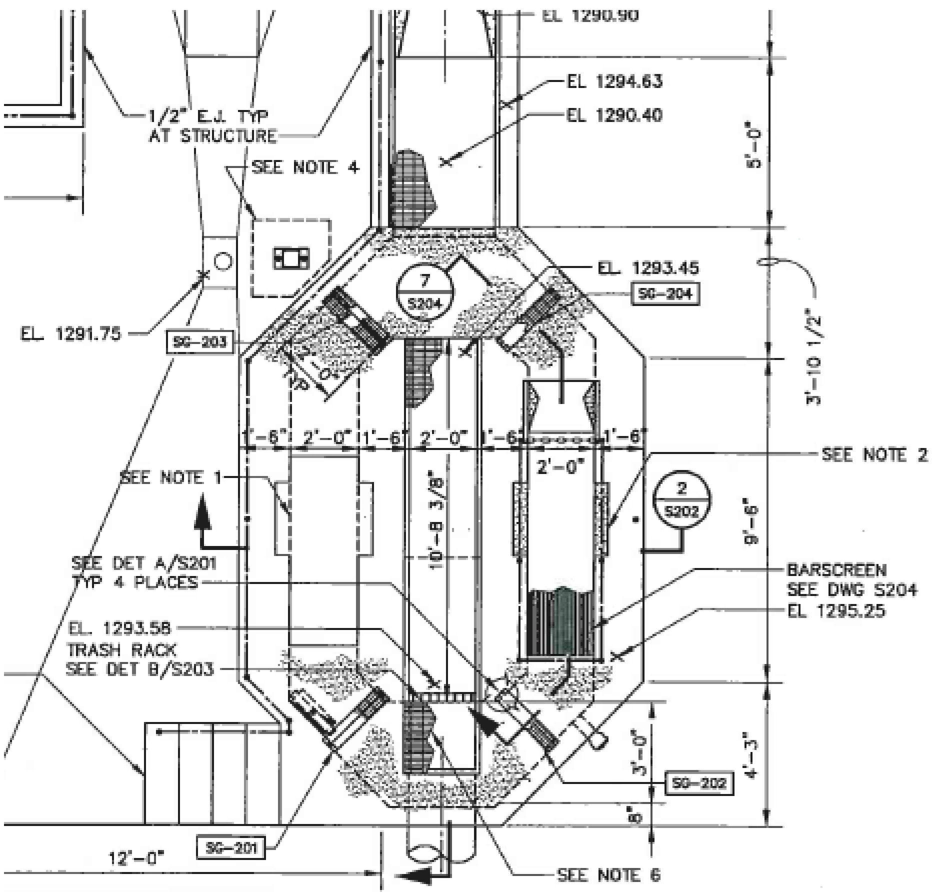

Figure 4.4.4 – As-Built Drawing of Headworks Channel

4.4.5. Environmental Impacts

Screenings will continue to be removed and transported to the landfill from the wastewater stream.

4.4.6. Land Requirements

The City owns sufficient land at the existing treatment plant site to contain all of the components for a septage receiving and pretreatment facility. Screened material will continue to be hauled to a landfill for ultimate disposal.

4.4.7. Potential Construction Considerations

Construction should be undertaken in a manner that will not impede the normal operations of the treatment plant. Flow may be diverted to the manual bar screen or the trash rack while the new screen is installed.

4.4.8. Sustainability Considerations

4.4.8.1. Water and Energy Efficiency

Effective screening will improve the efficiency of the downstream treatment basins. When the headworks screen is working properly, inorganics are removed from the wastewater and organic material is transferred to the aeration process. Proper screening allows the optimization of air required to treat the influent liquid resulting in the optimization of the energy required to drive the blowers.

4.4.8.2. Green Infrastructure

The project does not meet the definition of green infrastructure, as defined in the 2013 joint agency planning document guidelines.

4.4.8.3. Other

Effective screening is important to the longevity of the treatment plant equipment.

4.4.9. Cost Estimates

The following table summarizes the projected cost estimates for the work necessary to replace the existing headworks screen at the wastewater treatment facility. The cost of the equipment is assumed to the average cost of the various alternative styles.

Table 4.4.9a – Replace Headworks Capital Cost Estimate

Replace Headworks Screen Cost Estimates					
ID	*Item Description*	*Unit*	*Quantity*	*Unit Cost*	*Item Cost*
A	New Headworks Screen	ls	1	$150,000	$ 150,000
B	Remove and Install Screen	ls	1	$75,000	$ 75,000
C	Electrical	ls	1	$38,000	$ 38,000
D	Controls/Integration	ls	1	$38,000	$ 38,000
Total Estimated Construction Costs					**$ 301,000**
Contingency (20%)					$ 60,200
Engineering (20%)					$ 60,200
Project Management and Legal (5%)					$ 15,050
Total Project Budget Estimate					**$ 436,450**

The operation and maintenance costs for a replacement screen are not expected to change from the current costs.

4.5. Project 4: RV Receiving Station

4.5.1. Description

In addition to receiving septage, the City has expressed interest in accepting discharge from recreational vehicles (RV). Traffic on the highway through the City routinely includes RV and camper trailers. A City operated and maintained RV discharge station will protect the environment in and around the City by promoting legal dumping of RV wastewater.

4.5.2. Design Criteria

The RV receiving station will include a locking mechanism and fee collection to allow the City to cover costs associated with receiving and treating the wastewater discharged at the receiving facility. The RV receiving station should be located far enough from the treatment plant to allow mixing with the domestic wastewater in the collection system. Further, the City will need to develop a management plan to facilitate review of the collected fee (to ensure costs are being covered), the sampling of discharged wastewater in the collection system and assessment of effect of the influent quality and quantity on the treatment plant.

The design should also take into account the effect of the introduction of chemicals inherent in RV waste.

4.5.3. Maps and Figures

The following figures show possible locations for a RV discharge receiving station. Figure 4.5.3a shows one possible location at the visitor center on the Caves Highway, just east of Highway 199.

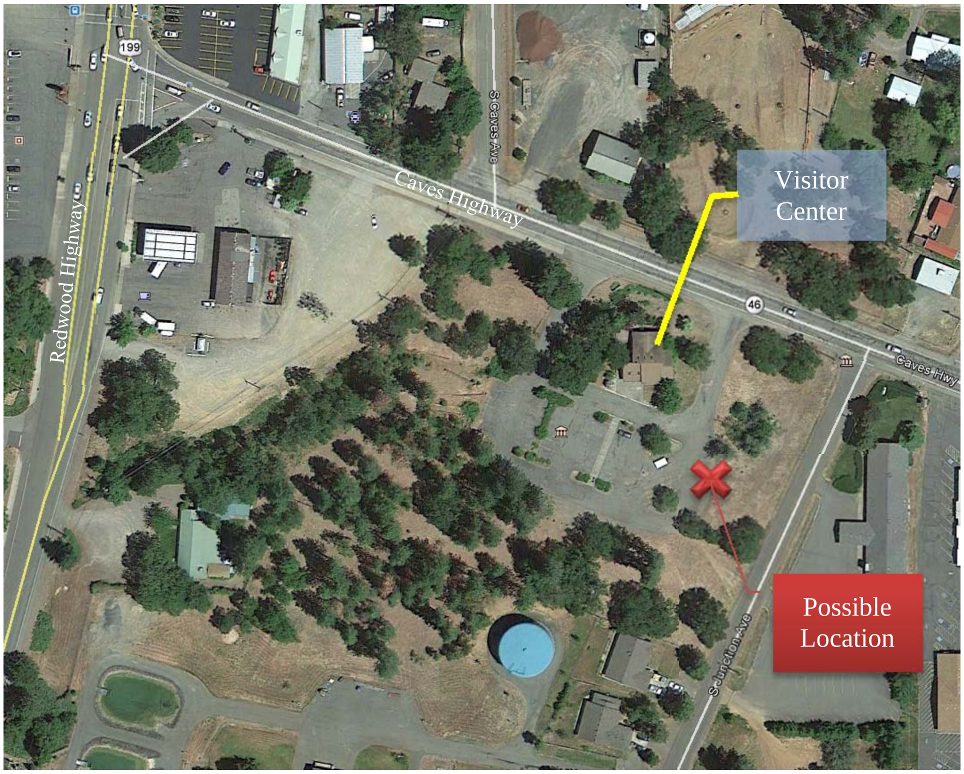

Figure 4.5.3a – Caves Highway at Visitor Center

Figure 4.5.3b shows another possible location near the city pool on River Road.

Figure 4.5.3b – River Road at City Pool

Figure 4.5.3c shows a sample section detail of a similar RV discharge station.

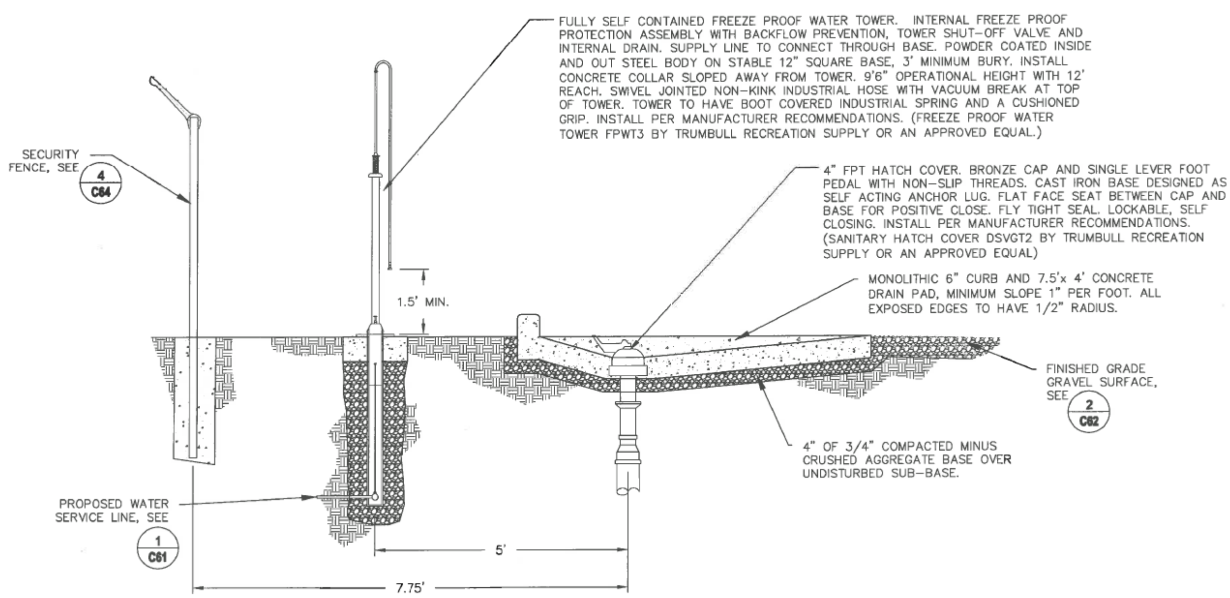

Figure 4.5.3c – RV Discharge Receiving Station Sample Detail

4.5.4. Environmental Impacts

City personnel have expressed concern with the lack of RV dump stations, public or private within reasonable distance of the Cave Junction area. Illegal dumping is an environmental hazard. The City may accept wastewater RV discharge which will promote environmentally friendly disposal and minimize mileage driven by private recreational vehicles carrying wastewater on the roads and highways. Security measures should be included in the final design and construction of the facility to discourage illegal dumping and other vandalism at the discharge site. The intent of an RV receiving station is to lessen potential hazardous spills, purposeful or inadvertent, of wastewater on public rights of way.

4.5.5. Land Requirements

The City owns sufficient land at the existing city pool site and visitors center to contain all of the components for a RV receiving facility.

4.5.6. Potential Construction Considerations

Construction should be performed in a manner to minimize impacts to the local businesses.

4.5.7. Sustainability Considerations

There following are sustainability considerations with respect to this project.

4.5.7.1. Water and Energy Efficiency

The collection of wastewater from RVs will need to be diluted with the wastewater in the collection system. If not sufficiently diluted, the higher concentrated RV wastewater and potential chemicals may upset the biological balance at the treatment plant. The addition of RV wastewater will require additional energy to add air to the secondary treatment process to treat the additional biological constituents.

4.5.7.2. Green Infrastructure

The project does not meet the definition of green infrastructure, as defined in the 2013 joint agency planning document guidelines.

4.5.7.3. Other

The receipt of RV wastewater will result in additional screenings to be removed at the headworks and disposed of with other screenings. The additional wastewater will also increase the amount of solids wasted from the secondary process to the sludge digester, ultimately adding to the final amount of biosolid disposal.

By locating the RV wastewater receiving station near the City Pool or the Visitor Center, existing public staff can provide site oversight during normal business hours.

4.5.8. Cost Estimates

The following table summarizes the projected cost estimates for the work necessary to construct a RV wastewater receiving facility.

Table 4.5.8a – RV Discharge Facility Capital Cost Estimate

New RV Receiving Station Cost Estimates					
ID	Item Description	Unit	Quantity	Unit Cost	Item Cost
A	Site Grading	ls	1	$10,000	$ 10,000
B	Sewer Improvements	ls	1	$30,000	$ 30,000
C	Water Improvements	ls	1	$20,000	$ 20,000
D	Electrical, Lighting and Security	ls	1	$15,000	$ 15,000
E	Site Improvements	ls	1	$20,000	$ 20,000
F	Landscaping	ls	1	$5,000	$ 5,000
Total Estimated Construction Costs					**$ 100,000**
Contingency (20%)					$ 20,000
Engineering (20%)					$ 20,000
Project Management and Legal (5%)					$ 5,000
Total Project Budget Estimate					**$ 145,000**

All of the costs associated with the RV wastewater receiving station should be borne by user fees collected at the receiving station. The fee should be reviewed and updated as costs to receive the additional wastewater change. Table 4.5.8b summarizes possible annual costs for operations and maintenance for the RV wastewater receiving and pretreatment facility. The costs are expected to include some cost sharing for oversight and maintenance at the site, additional treatment costs at the plant, some energy for security measures and periodic sampling and testing of the wastewater received.

Table 4.5.8b – RV Receiving Station O&M Cost Estimate

O&M Cost Estimate: RV Receiving Station	
Description	Annual Cost
Personnel Costs	$ 3,000
Administrative Costs	$ 1,000
Water/Waste Treatment Costs	$ 3,000
Insurance Costs	$ 0
Energy Costs	$ 100
Process Chemical Costs	$ 0
Monitoring & Testing Costs	$ 300
Short Lived Asset Maintenance/Replacement	$ 0
Professional Services	$ 0
Residuals Disposal	$ 0
Miscellaneous	$ 0
Total	**$ 7,400**

4.6. Project 5: Septage Receiving Station

4.6.1. Description

The treatment plant currently receives septage hauled by commercial pump trucks twice a week during limited hours. The septic wastewater is currently discharged to a manhole onsite immediately upstream of the existing headworks screens. The liquid is conveyed through the headworks to the second aeration basin where it is treated. This requires half of the plant aeration basins dedicated to treating septic waste.

The current method of delivery is labor-intensive and provides little room for operator flexibility. The plant will deny discharge for loads with pH that is not consistent with domestic wastewater because excessively high or low pH will disrupt the stabilization and treatment of sewage.

The City needs to install a septic wastewater pretreatment facility.

4.6.2. Design Criteria

The septage receiving station will include an influent flow meter to allow the City to accurately charge the hauler for wastewater discharged at the facility. The treatment plant should continue the practice of tracking and testing the septic wastewater received.

Septage waste includes inorganic solids that must be removed from the liquid stream prior to introduction to the treatment plant. An automatic screen will remove the undesirable solid material.

Grit should be removed from the septage discharged at the facility.

The wastewater pumped from a septic tank is generally in an anaerobic state. The septage may be injected directly into the activated sludge treatment stream in low doses. If injected too quickly, the septic sewage may disrupt the aerobic bacteria critical to the activated sludge process. The septic liquid may be “refreshed” or stabilized in an isolated, controlled basin with the introduction of air. The septage receiving basins should be sized to accommodate the peak day septage received. Based on existing DMR’s, the largest amount of septage received was 10,000 gallons in one day. The bottom of the basins should be sloped toward the pump to provide for removal of any solids that may settle in the basin.

The construction of multiple chambers, with independent air controls, within the basin will provide operational flexibility necessary to stabilize the range of contaminants (BOD, TSS, pH, etc.) of influent septic wastewater.

Air can be introduced with disk or tube diffused aeration. The air supply may come from the plant air blowers.

Once the liquid is stabilized and freshened, the wastewater is pumped from the pretreatment basins to the domestic wastewater stream and treated in the plant aeration basins and secondary clarifiers. The pumps should be submersible centrifugal pumps controlled with variable frequency drives to attenuate the flow.

4.6.3. Maps and Figures

The following map (Figure 4.6.3a) shows a schematic location of a possible location for a septage receiving station with aerated concrete basins. Figures 4.6.3b and 4.6.3c present sample septage receiving equipment.

4.6.4. Environmental Impacts

The City should continue to accept local pumped septage which will minimize mileage driven by commercial haulers. This will minimize vehicular emissions and potential spills of septic waste.

4.6.5. Land Requirements

The City owns sufficient land at the existing treatment plant site to contain all of the components for a septage receiving and pretreatment facility.

4.6.6. Potential Construction Considerations

A septage receiving, pretreatment facility will be a side-stream component to the treatment plant. Construction should be undertaken in a manner that will not impede the normal operations of the treatment plant.

4.6.7. Sustainability Considerations

The addition of a septage receiving facility will aid in the longevity of the existing treatment facility.

4.6.7.1. Water and Energy Efficiency

Currently, half of the treatment plant is dedicated to the treatment of septic wastewater in an aeration basin that was designed for treatment of domestic waste in an activated sludge process. The septic wastewater should be diluted with the domestic stream entering the plant. The energy currently used to aerate the anaerobic wastewater will be used to aerated aerobic wastewater. Air in the pre-treatment tank will be more efficiently used to "freshen" or aerate the septic liquid stream, in preparation for introduction to the domestic wastewater treatment stream.

Additionally, installation of the receiving station will promote fewer miles driven by septic pump trucks, which will reduce carbon emissions.

4.6.7.2. Green Infrastructure

The project does not meet the definition of green infrastructure, as defined in the 2013 joint agency planning document guidelines.

4.6.7.3. Other

The construction of a septage receiving and pretreatment facility will improve the operational efficiency and flexibility of the treatment plant and reduce the time demand on plant personnel.

Figure 4.6.3a – Septage Receiving Preliminary Layout

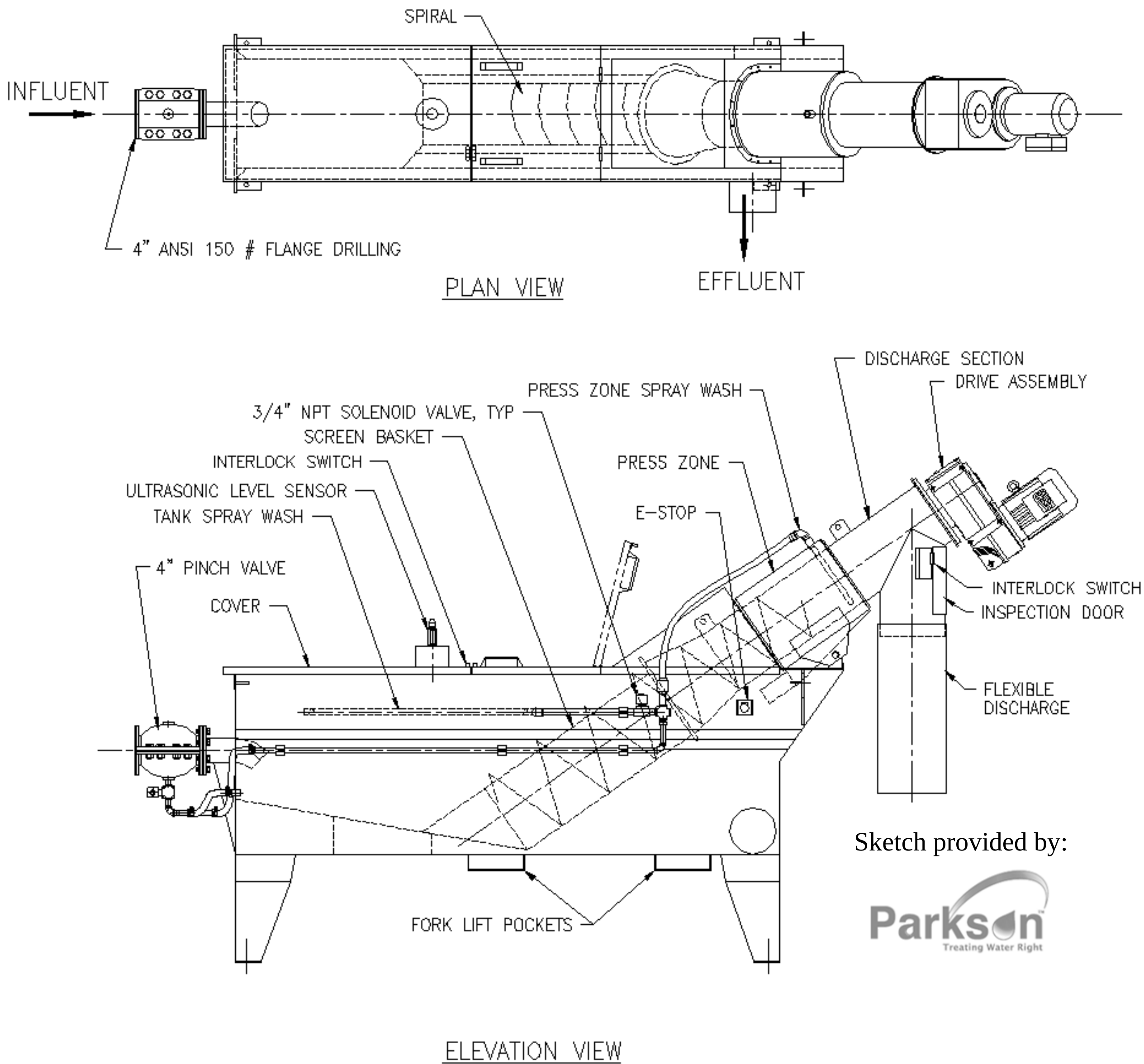

Figure 4.6.3b – Septage Receiving Screen Unit

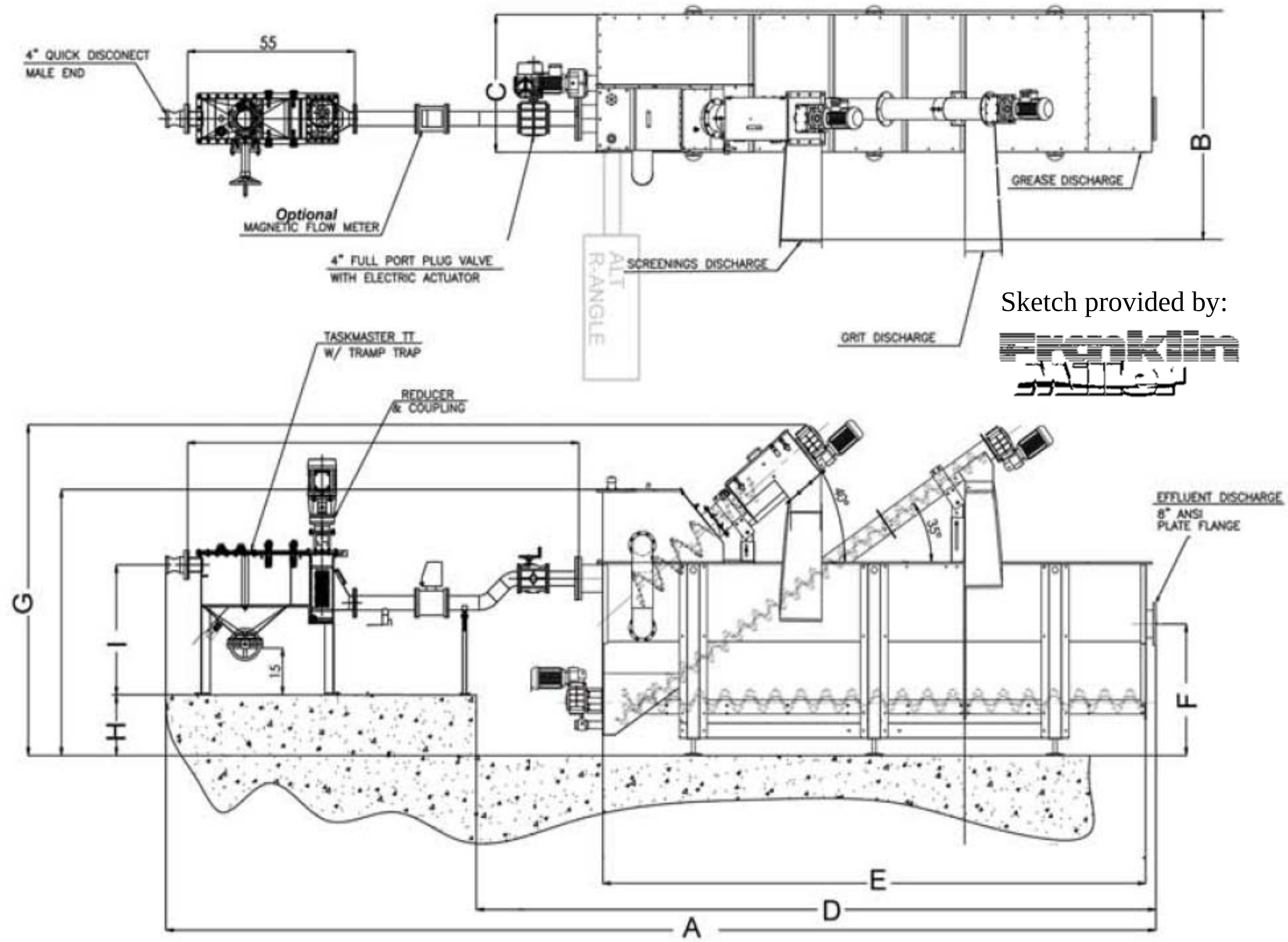

Figure 4.6.3c – Septage Receiving Grinder, Screen and Grit Removal Unit

4.6.8. Cost Estimates

The following table summarizes the projected cost estimates for the work necessary to construct a septage receiving and pretreatment facility.

Table 4.6.8a – Septage Receiving Facility Capital Cost Estimate

Septage Receiving Station					
ID	*Item Description*	*Unit*	*Quantity*	*Unit Cost*	*Item Cost*
A	User Interface Add-on	ls	1	$25,000	$ 25,000
B	Magnetic Flow Meter	ea	1	$3,500	$ 3,500
C	Septage Receiving Screen	ls	1	$90,000	$ 90,000
D	Septage Grit Chamber	ls	1	$30,000	$ 30,000
E	Aeration Basins (3,000 gallons each)	ea	4	$10,000	$ 40,000
F	Air Diffusers	ls	1	$15,000	$ 15,000
G	Submersible Centrifugal Pumps	ea	4	$35,000	$ 140,000
H	Electrical and Controls	ls	1	$50,000	$ 50,000
I	Miscellaneous Piping	ls	1	$20,000	$ 20,000
Total Estimated Construction Costs					**$ 413,500**
Contingency (20%)					$ 82,700
Engineering (20%)					$ 82,700
Project Management and Legal (5%)					$ 20,675
Total Project Budget Estimate					**$ 599,575**

Table 4.6.8b summarizes the projected annual costs for operations and maintenance for the septage receiving and pretreatment facility.

Table 4.6.8b – Septage Receiving Facility O&M Estimate

O&M Cost Estimate: Septage Receiving	
Description	Annual Cost
Personnel Costs	$ 5,000
Administrative Costs	$ 100
Water/Waste Treatment Costs	$ 100
Insurance Costs	$ 0
Energy Costs	$ 900
Process Chemical Costs	$ 0
Monitoring & Testing Costs	$ 0
Short Lived Asset Maintenance/Replacement	$ 450
Professional Services	$ 0
Residuals Disposal	$ 1,040
Miscellaneous	$ 0
Total	**$ 7,590**

4.7. *Project 6: Additional Blower for Air Supply*

4.7.1. Description

As population increases over time, the loads of BOD and TSS will continue to rise, thereby increasing the demand for air for aerobic treatment. The additional air may be supplied with the addition of a third blower.

4.7.2. Design Criteria

The existing blower room was designed and constructed to accommodate a third blower. The blower should be similar, in capability, to the other two blowers already installed.

To meet EPA redundancy requirements, the system of blowers must be able to provide sufficient air for the plant with the largest blower off-line. With a third blower of equivalent size, the system of blowers will be able to utilize two blowers simultaneously, as needed.

The existing blowers are 50 HP Universal RAI Blowers manufactured by Roots/Dresser with an operating range from 226 to 1315 scfm.

4.7.3. Maps and Figures

The following figure (Figure 4.7.3) is clipped from the 1999 as-builts for the treatment plant. The schematic shows the location of a future blower and the existing 12-inch diameter air piping.

4.7.4. Environmental Impacts

Environmental impacts will not change as a result of this project.

4.7.5. Land Requirements

The work will all be performed within the limits of property owned by the City.

4.7.6. Potential Construction Considerations

Conduit is already available for electrical and control wires. Access to the proposed location may be limited by existing equipment; however, sufficient room exists to complete installation.

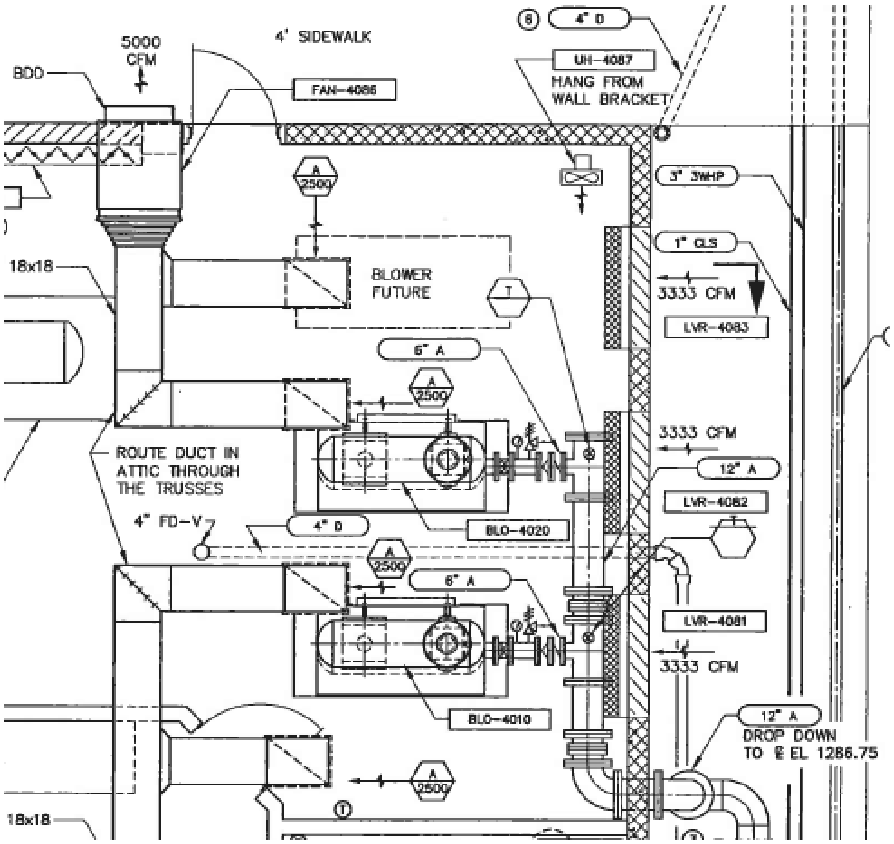

Figure 4.7.3 – Clip from Blower Building As-Built

4.7.7. Sustainability Considerations

Installation of a third blower will allow air demand to be spread over multiple blower units thereby contributing to the longevity of equipment.

4.7.7.1. Water and Energy Efficiency

Inclusion of a variable frequency drive coupled with a dissolved oxygen sensor in the aerobic treatment basin, will optimize energy efficiency for the blower motor.

4.7.7.2. Green Infrastructure

Not applicable.

4.7.7.3. Other

Multiple blower units provide operational efficiency and flexibility for future maintenance needs.

4.7.8. Cost Estimates

The following table summarizes the projected cost estimates for installing a new, third blower.

Table 4.7.8a – Cost Estimate for Additional Blower

Additional Blower					
ID	***Item Description***	***Unit***	***Quantity***	***Unit Cost***	***Item Cost***
A	50 HP, 1050 scfm Blower	ea	1	$55,000	$ 55,000
B	Controls, Including VFD	ls	1	$30,000	$ 30,000
C	Air Piping	ls	1	$20,000	$ 20,000
D	Electrical	ls	1	$25,000	$ 25,000
E	Integration	ls	1	$10,000	$ 10,000
Total Estimated Costs					**$ 140,000**
Contingency (20%)					$ 28,000
Engineering (20%)					$ 28,000
Project Management and Legal (5%)					$ 7,000
Total Project Budget Estimate					**$ 203,000**

Table 4.7.8b summarizes the projected annual costs for operations and maintenance for an additional blower at the treatment plant.

Table 4.7.8b – Additional Blower O&M Estimate

O&M Cost Estimate: Additional Blower	
Description	Annual Cost
Personnel Costs	$ 1,250
Administrative Costs	$ 0
Water/Waste Treatment Costs	$ 0
Insurance Costs	$ 0
Energy Costs	$ 0
Process Chemical Costs	$ 0
Monitoring & Testing Costs	$ 0
Short Lived Asset Maintenance/Replacement	$ 150
Professional Services	$ 0
Residuals Disposal	$ 0
Miscellaneous	$ 0
Total	**$ 1,400**

The energy cost is assumed to be zero because the additional blower will act as backup or standby equipment. The addition of the blower will not increase the amount of energy consumed for aeration of the treatment process.

4.8. Project 7: Disinfection Upgrade

4.8.1. Description

The existing ultra-violet (UV) disinfection units are approximately 15 years old. UV disinfection technology has improved since the units were installed. Repair and maintenance parts are difficult to obtain and in some cases are being salvaged from other installations. Additionally, the enclosed vessels tend to overheat during low flow periods.

The City should consider upgrading the older technology for new technology that is readily maintained and more energy efficient.

DISINFECTION ALTERNATIVE 1: New Chlorine Contact Basins

This alternative evaluates conversion of the UV disinfection to chlorine contact basins. DEQ requires two chlorine contact units, for redundancy, preferable in series to provide the required chlorine contact time. Typically, chlorine contact chambers contain baffles to provide a serpentine path for the effluent.

This alternative requires the addition of two contact basins, chlorine storage tank and associated manholes and piping. The manholes should include diversion structures to allow for flow diversion through or bypassing each basin, as necessary to meet disinfection requirements.

Use of chlorine for disinfection will also require dechlorination, most easily accomplished by introduction of sodium bisulfite, prior to discharge to the Illinois River. During the summer, when discharge is to the reclaimed water pond at the golf course, dechlorination may not be required.

This alternative will require the delivery, storage and application of chemicals, such as sodium hypochlorite and sodium bisulfite.

DISINFECTION ALTERNATIVE 2: New Ultra-Violet Channel

This alternative evaluates the installation of new ultra-violet disinfection units which are installed in a channel. Channel UV units are more common in today's market, with several manufacturers. UV units in channels are more accessible for maintenance and provide operational efficiency with flow based coordination.

Installation of a new channel with UV disinfection units will require the construction of a new channel near the existing disinfection building.

An advantage of UV is that it does not introduce chemicals to the wastewater effluent stream, like chlorination.

DISINFECTION ALTERNATIVE 3: Combined New Ultra-Violet Channel and Chlorine Contact Basin

This alternative evaluates the installation of a combination of new ultra-violet disinfection units, installed in a channel and a small chlorine contact basin, installed parallel to the new UV channel. The chlorine contact chamber would be used during summer months, when flow is diverted to the golf course. The UV disinfection would be used during the winter months prior to discharge to the Illinois River.

Installation of a new channel with UV disinfection units will require the construction of a new channel near the existing disinfection building. The new, small chlorine contact chamber could be constructed near the new UV channel, with a diversion manhole to direct flow to one or the other disinfection process.

The chlorine contact chamber will be sized to disinfect the smaller summer flows and redundancy requirements during those months will be met by the UV channel. The UV channel, however, will be required to contain fully redundant UV bulbs and ballasts and sized for the peak winter flows, identical to Disinfection Alternative 1.

Unfortunately, this alternative will not be cost effective, when compared with the other disinfection alternatives because the chlorine chamber is constructed in addition to the complete UV channel, including redundancy, described in alternative 1. Preliminary cost estimates are almost $900,000 for this combined option, which exceeds the cost of each of the other alternatives considered.

Because of the excessive cost, this alternative will NOT be considered further in this selection section.

4.8.2. Design Criteria

DISINFECTION ALTERNATIVE 1: New Chlorine Contact Basins

To meet EPA redundancy requirements, the disinfection system must have full redundancy. Chlorination systems must meet the following contact times: 60 minutes at Maximum Daily Flow and 15 minutes at Peak Instantaneous (Hour) Flow. For the flows at the Cave Junction Wastewater Treatment Plant, the 15 minutes contact time for the Peak Instantaneous Flow govern the size of the contact basin, which will need to be at least 33,000 gallons. DEQ also requires that the chlorine contact chamber have a minimum of two contact units, each with a length to width ratio of 40:1, with 72:1 preferred.

At an annual average flow rate of 0.586 mgd (2035 flows) and 12.5% sodium hypochlorite used to achieve 6 mg/L chlorine disinfection rate, it is calculated that 28.1 gallons of chlorine will be needed daily. Dechlorination will also be required prior to discharge to the river. Assuming 1.0 mg/L chlorine requires 1.46 mg/L of sodium bisulfite and use of 38% solution, 13.5 gallons of sodium bisulfite is required to provide dechlorination.

DISINFECTION ALTERNATIVE 2: New Ultra-Violet Channel

UV disinfection must treat with a minimum dose of 30 mJ/cm^2 at Peak Instantaneous Flow conditions, with fully redundant disinfection units, ballasts and controls. DEQ also requires Ultra-Violet Intensity (UVI) and Ultra-Violet Transmissivity (UVT) meters.

4.8.3. Maps and Figures

DISINFECTION ALTERNATIVE 1: New Chlorine Contact Basins

Figure 4.8.3a shows possible locations of new chlorine contact basins. The sketch is based on a 4-feet wide, 240-feet long (60:1 ratio), 5-feet deep channel for chlorine contact, which results in a contact basin that is 30-feet by 39-feet in dimensions.

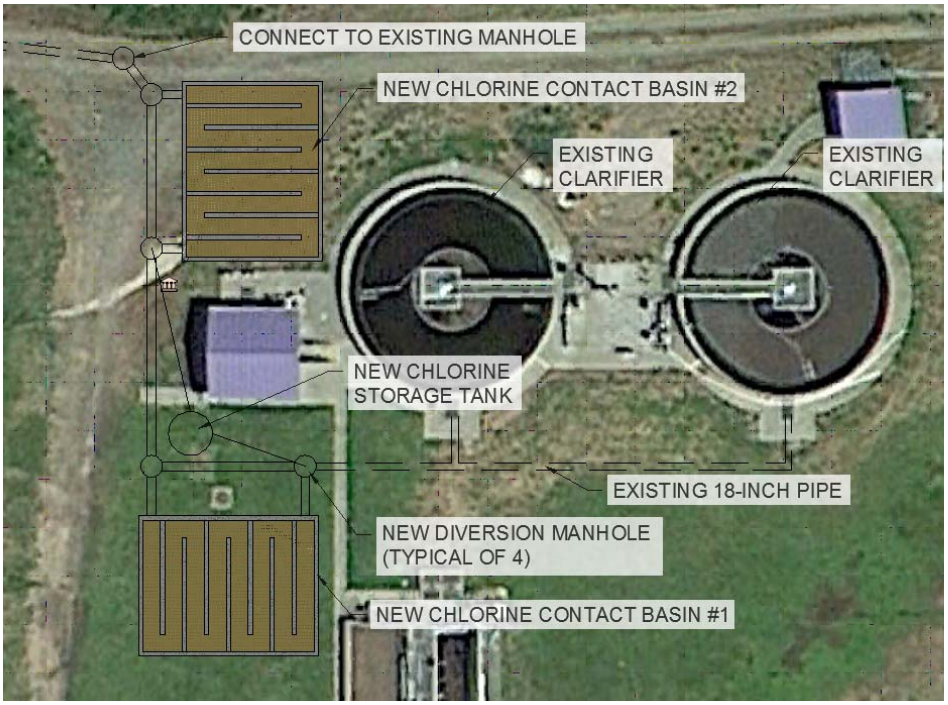

Figure 4.8.3a – Disinfection Alt 1 – Chlorine Contact Basins

DISINFECTION ALTERNATIVE 2: New Ultra-Violet Channel

Figure 4.8.3b presents a possible layout with a new UV channel and two (2) UV disinfection units. Many new UV units have integral UVI and UVT monitors. The layout is based on a 30-feet long, 1.5-feet wide, 4.5-feet deep channel.

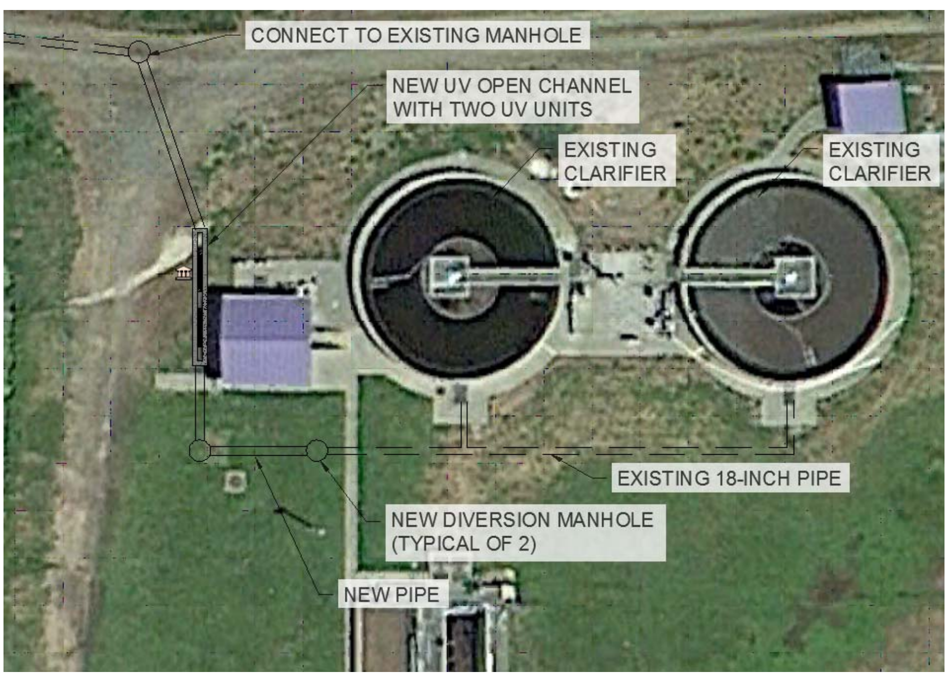

Figure 4.8.3b – Disinfection Alt 2 – UV Open Channel

4.8.4. Environmental Impacts

DISINFECTION ALTERNATIVE 1: New Chlorine Contact Basins

The acute and chronic water quality criteria for chlorine residual is 0.019 mg/L at the edge of the Zone of Immediate Dilution (ZID) and 0.011 mg/L at the edge of the Regulatory Mixing Zone (MZ), respectively. When the total residual chlorine limit in a permit is lower than 0.05 mg/L, the DEQ will use 0.05 mg/L as the compliance evaluation concentration (e.g. monthly average concentration below 0.05 mg/L will be considered in compliance with the limitation).

DISINFECTION ALTERNATIVE 2: New Ultra-Violet Channel

The continued use of UV disinfection will not change the current discharge impact to the environment.

4.8.5. Land Requirements

The work will all be performed within the limits of property owned by the City.

4.8.6. Potential Construction Considerations

Construction for the disinfection alternatives would be complete and tested prior to diverting flow from the existing flow path.

4.8.7. Sustainability Considerations

4.8.7.1. Water and Energy Efficiency

DISINFECTION ALTERNATIVE 1: New Chlorine Contact Basins

An advantage of the chlorine contact basin over the UV disinfection is the lower use of electricity.

DISINFECTION ALTERNATIVE 2: New Ultra-Violet Channel

The new channel installed UV units should be designed to be flow paced and energy efficient.

4.8.7.2. Green Infrastructure

Not applicable.

4.8.7.3. Other

DISINFECTION ALTERNATIVE 1: New Chlorine Contact Basins

Chlorine contact basin is mechanically simple to operate. Operation will require the storage, handling and application of chemicals.

DISINFECTION ALTERNATIVE 2: New Ultra-Violet Channel

With two UV units and turn-down capabilities, the UV option provides operational flexibility.

4.8.8. Cost Estimates

DISINFECTION ALTERNATIVE 1: New Chlorine Contact Basins

The following table summarizes the projected cost estimates for constructing chlorine contact chambers for disinfection of the finished effluent from the treatment plant.

Table 4.8.8a – Cost Estimate for Chlorine Contact Chambers

Disinfection Alt. 1: Chlorine Contact Cost Estimate					
ID	*Item Description*	*Unit*	*Quantity*	*Unit Cost*	*Item Cost*
A	Bulk Storage Tank	ea	1	$20,000	$ 20,000
B	Chemical Feed Pumps	ea	2	$3,000	$ 6,000
C	Chemical Feed Piping	ls	1	$2,000	$ 2,000
D	Concrete Contact Chamber	ea	2	$50,000	$ 100,000
E	Concrete Contact Baffling	ea	2	$40,000	$ 80,000
F	Chlorine Residual Analyzer	ls	1	$3,500	$ 3,500
G	Dechlorination System	ls	1	$20,000	$ 20,000
H	New Manhole	ea	4	$5,000	$ 20,000
I	Misc. Piping	ls	1	$30,000	$ 30,000
J	Electrical	ls	1	$50,000	$ 50,000
K	Controls and Integration	ls	1	$50,000	$ 50,000
Total Estimated Construction Costs					**$ 381,500**
Contingency (20%)					$ 76,300
Engineering (20%)					$ 76,300
Project Management and Legal (5%)					$ 19,075
Total Project Budget Estimate					**$ 553,175**

Table 4.8.8b summarizes the projected annual costs for operations and maintenance for chlorine disinfection at the treatment plant.

Table 4.8.8b – Chlorine Disinfection O&M Estimate

O&M Cost Estimate: Chlorine Contact	
Description	Annual Cost
Personnel Costs	$ 5,000
Administrative Costs	$ 0
Water/Waste Treatment Costs	$ 0
Insurance Costs	$ 0
Energy Costs	$ 700
Process Chemical Costs	$ 52,000
Monitoring & Testing Costs	$ 0
Short Lived Asset Maintenance/Replacement	$ 150
Professional Services	$ 0
Residuals Disposal	$ 0
Miscellaneous	$ 0
Total	**$ 57,850**
Present Worth Analysis	
"Real" Investment/Bond Rate	0.8%
Life Cycle Cost Analysis	20 yrs
Present Worth	**$1,249,300**

DISINFECTION ALTERNATIVE 2: New Ultra-Violet Channel

The following table summarizes the projected cost estimates for constructing open channel Ultra-Violet disinfection for the finished effluent from the treatment plant.

Table 4.8.8c – Cost Estimate for UV Disinfection

Disinfection Alt. 2: UV Disinfection Cost Estimate					
ID	*Item Description*	*Unit*	*Quantity*	*Unit Cost*	*Item Cost*
A	UV Disinfection Equipment	ls	1	$160,000	$ 160,000
B	Concrete Channel	ls	1	$10,000	$ 10,000
C	New Manhole	ea	2	$5,000	$ 10,000
D	Misc. Piping	ls	1	$16,000	$ 16,000
E	Electrical	ls	1	$80,000	$ 80,000
F	Cover	ls	1	$25,000	$ 25,000
G	Controls and Integration	ls	1	$80,000	$ 80,000
Total Estimated Construction Costs					**$ 381,000**
Contingency (20%)					$ 76,200
Engineering (20%)					$ 76,200
Project Management and Legal (5%)					$ 19,050
Total Project Budget Estimate					**$ 552,450**

Table 4.8.8d summarizes the projected annual costs for operations and maintenance for UV disinfection at the treatment plant.

Table 4.8.8d – UV Disinfection O&M Estimate

O&M Cost Estimate: UV Channel		
Description	Annual Cost	
Personnel Costs	$	5,000
Administrative Costs	$	0
Water/Waste Treatment Costs	$	0
Insurance Costs	$	0
Energy Costs	$	20,110
Process Chemical Costs	$	200
Monitoring & Testing Costs	$	0
Short Lived Asset Maintenance/Replacement	$	27,360
Professional Services	$	0
Residuals Disposal	$	0
Miscellaneous	$	0
Total	**$**	**52,670**
Present Worth Analysis		
"Real" Investment/Bond Rate		0.8%
Life Cycle Cost Analysis		20 yrs
Present Worth		**$1,137,427**

4.8.9. Recommendation

Because the capital construction cost and the project life cycle costs for the UV disinfection alternative are less than those expected for chlorine, UV is the recommended alternative for future disinfection.

4.9. Project 8: Outfall Diffuser

4.9.1. Description

The mixing zone study recently completed proposed that the dilution and diffusion of effluent to the Illinois River will be more efficient with the installation of a new multi-port diffuser outfall. The use of a multi-port diffuser will maximize dispersion of effluent within the mixing zone. Better dispersion and mixing in the zone of immediate diffusion (ZID) will produce lower constituent concentrations in the regulatory mixing zone (RMZ) and will enhance dilution to further lower concentrations outside the mixing zone.

4.9.2. Design Criteria

The individual port velocities should exceed 2 feet per second (fps) at the average daily flow. This minimum velocity is required to prevent sedimentation in the diffuser and to maintain a minimum velocity necessary for mixing and dilution.

Calculations made during the development of the mixing zone study recommended an outfall assembly comprised of an 8-inch pipe with (9) 1-3/4 inch diffuser ports.

4.9.3. Maps and Figures

The following figure (Figure 4.9.3a) shows an aerial view of the outfall pipe and the discharge location at the Illinois River.

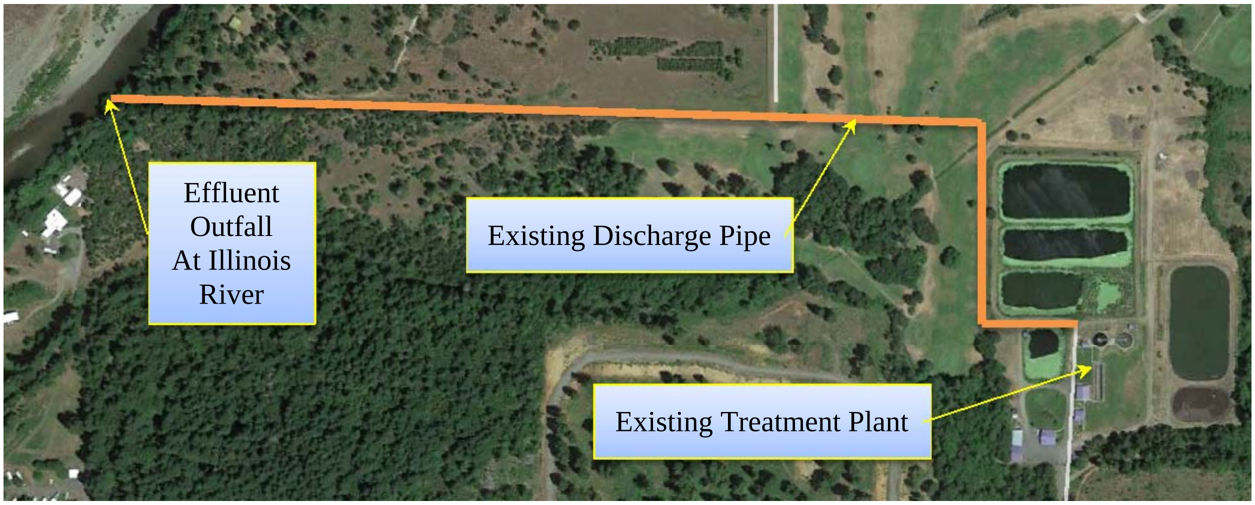

Figure 4.9.3a – Aerial Showing Outfall Location

Figure 4.9.3b shows a sample multi-port diffuser with (9) outlets.

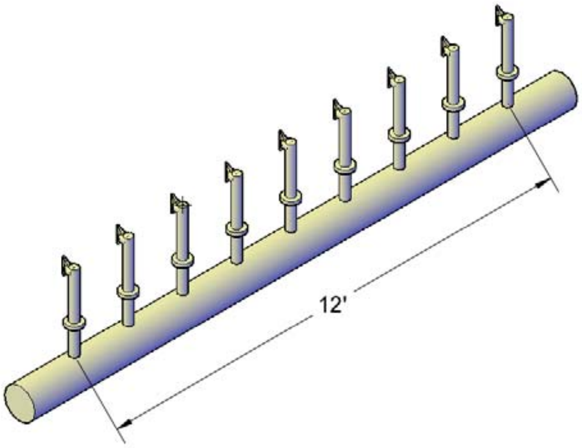

Figure 4.9.3b – Multi-Port Diffuser Sample

4.9.4. Environmental Impacts

The quality and quantity of the effluent is assumed to remain the same. However, with a diffuser, the dispersion of the effluent to the river will improve mixing and lessen the impact to the river.

4.9.5. Land Requirements

A small easement will be needed from the Oregon Department of State Lands for the location of the diffuser in the river. Permitting will be required from the Department of State Lands, Army Corps of Engineers and Department of Environmental Quality, including consultation with Oregon Department of Fish and Wildlife and National Marine Fisheries Service.

4.9.6. Potential Construction Considerations

In-water work will be limited due to the seasonal presence of spawning fish species. Equipment and work practices will require extra attention to ensure protection of the river.

4.9.7. Sustainability Considerations

Not applicable.

4.9.7.1. Water and Energy Efficiency

A diffuser will not impact water or energy usage.

4.9.7.2. Green Infrastructure

Installation of a diffuser will promote better mixing in the river, limiting temperature impacts to the river.

4.9.7.3. Other

A diffuser will limit aquatic species contact with toxicity by dispersed dilution.

4.9.8. Cost Estimates

The following table summarizes the projected cost estimates for installing a new effluent diffuser outfall.

Table 4.9.8 – Cost Estimate for Effluent Diffuser Outfall

Effluent Diffuser Outfall					
ID	***Item Description***	***Unit***	***Quantity***	***Unit Cost***	***Item Cost***
A	Install 8-inch Manifold, incl. Rock Exc	ls	1	$20,000	$ 20,000
B	Install 12-inch Pipe	lf	150	$250	$ 37,500
C	1-3/4 inch Diffuser Port	ls	9	$500	$ 4,500
D	1-3/4 inch Duckbill Check Valve	ls	9	$1,000	$ 9,000
E	Manhole	ls	1	$5,000	$ 5,000
F	Misc. In-stream Work	ls	1	$60,000	$ 60,000
G	Concrete Anchoring	ls	1	$5,000	$ 5,000
Total Estimated Construction Costs					**$ 141,000**
Contingency (20%)					$ 29,000
Engineering (20%)					$ 29,000
Project Management and Legal (5%)					$ 7,000
Environmental Permitting					$ 7,500
Total Project Budget Estimate					**$ 213,500**

The diffused outfall is not expected to result in annual O&M.

4.10. Project 9: Alternate Effluent Disposal

4.10.1. Description

Currently, the wastewater treatment plant discharges effluent to the Illinois River during winter months in compliance with the NPDES permit. During summer months effluent is conveyed to a storage pond for recycled use on the golf course to the north of the treatment plant site. The golf course is privately owned and maintained. A concern of the City is the potential loss of the golf course as a place of discharge for effluent from the wastewater treatment plant.

Currently reclaimed water is diverted to the storage pond and facultative lagoon on the wastewater treatment plant site and to the pond on the golf course property. Table 4.10.1 presents a water balance for the reclaimed water discharged during the summer months. The application rate, expressed in inches per month, is derived from the *Oregon Crop Water Use and Irrigation Requirements, Extension Miscellaneous 8530*, OSU 1999. The evaporation shown is calculated based on the NOAA Technical Reports TR33 and TR34.

Table 4.10.1 – Cost Estimate for Effluent Diffuser Outfall

Reclaimed Water Balance						
Month	in/month	Golf Couse (gpd)	Plant Site (gpd)	Evaporation (gpd)	Sum Water Used (gpd)	Average Daily Discharge (gpd)
June	5.20	159,548	18,826	32,804	211,178	273,667
July	7.95	236,055	27,853	40,845	304,753	227,333
August	7.52	223,287	26,347	34,845	284,479	213,000
September	5.59	171,514	20,238	24,100	215,852	201,667
October	3.50	107,388	12,671	11,291	131,350	201,667

The reclaimed water is being supplemented by potable water on the golf course during the months of July, August and September.

EFFLUENT DISPOSAL ALTERNATIVE 1: No Change Scenario

The city currently has a contract agreement with the owners of the golf course to ensure the longevity of the discharge. Renewal of the contract, as it comes due, will continue to include the regulatory restrictions associated with disposal of treated wastewater effluent disposal (e.g. limiting human contact during dispersion or spraying effluent, amount of effluent applied at any given location, disposal during rain events, etc.)

EFFLUENT DISPOSAL ALTERNATIVE 2: Purchase Golf Course Property

The city may opt to purchase the land where the golf course is located. Currently, any time the golf course changes ownership, the city is required to formalize agreements with the new owner. However, if the city purchased the property ultimate control of the site and disposal would remain with the city. The city may lease the property to a golf course management company or may decide to fence the property and dedicate the land to effluent disposal.

EFFLUENT DISPOSAL ALTERNATIVE 3: Seasonal storage

The city may construct storage basins large enough to retain the effluent during the summer season. The existing lagoons may be deepened to provide the necessary storage. Or additional storage basins constructed to provide sufficient storage volume.

4.10.2. Design Criteria

EFFLUENT DISPOSAL ALTERNATIVE 1: No Change Scenario

Disposal of Class C recycled water is governed by OAR 340-055-0012(5). If improvements are made to the treatment process to improve effluent quality, regulation of disposal of Class A recycled water is found in OAR 340-055-0012 (7). The regulations provide requirements of setbacks, public access limitations and water quality conditions.

Contractually, the golf course is required to abide by the rules and regulations associated with disposal of the effluent. The existing contract agreement between the city and the golf course owner includes provisions ensuring compliance with state and federal regulations.

Improvements need to be made to the existing lagoons to increase storage capacity for flows during the transition times of the year, when the flow in the Illinois River is too low for discharge, per the NPDES permit, but the golf course is still too wet, not needing irrigation. The improvements to the existing pond will consist of deepening and installing lining material.

EFFLUENT DISPOSAL ALTERNATIVE 2: Purchase Golf Course Property

By purchasing the golf course property, the city will control final disposal of the recycled water. The city will be responsible for compliance with the same regulations cited above regarding recycled water disposal. The golf course could be closed, thereby limiting public access or contact with recycled water. Or, the city could convert the golf course to a municipal course and lease or contract course management.

If the golf course was closed, the property could be converted to planting trees with high water use, such as poplar.

Improvements need to be made to the existing lagoons to increase storage capacity for flows during the transition times of the year, when the flow in the Illinois River is too low for discharge, per the NPDES permit, but the golf course is still too wet, not needing irrigation. The improvements to the existing pond will consist of deepening and installing lining material.

EFFLUENT DISPOSAL ALTERNATIVE 3: Seasonal storage

This alternative assumes the city loses the ability to land apply recycled water. Storage of effluent for the summer months will require substantial volume. Assuming an average daily dry-weather flow of 478,000 gallons per day for the time period from June 1 through October 31, the storage capacity will need to be 73 million gallons or 9.7 million cubic feet. Using the footprint of the existing lagoons at the wastewater treatment facility, the basin would need to be a minimum of 400-feet wide, 400-feet long and 63 feet deep. The effluent would be discharged to the river over the winter months.

If the expanded storage pond were unlined, some of the stored water will percolate to the groundwater, which will require further investigation and coordination with the appropriate regulatory agencies.

4.10.3. Maps and Figures

EFFLUENT DISPOSAL ALTERNATIVE 1: No Change Scenario

Figure 4.10.3a shows an aerial view of the golf course and its location relative to the wastewater treatment plant.

EFFLUENT DISPOSAL ALTERNATIVE 2: Purchase Golf Course Property

Figure 4.10.3a shows an aerial view of the golf course and its location relative to the wastewater treatment plant.

EFFLUENT DISPOSAL ALTERNATIVE 3: Seasonal storage

Figure 4.10.3b presents a possible layout with an effluent storage basin. The layout is based on a 400-feet long, 400-feet wide, 60-feet deep basin.

Figure 4.10.3a – Aerial of Golf Course

Figure 4.10.3b – Effluent Storage Basin

4.10.4. Environmental Impacts

EFFLUENT DISPOSAL ALTERNATIVE 1: No Change Scenario

Water is recycled and used to water the grass at the golf course. The use will continue under this alternative.

EFFLUENT DISPOSAL ALTERNATIVE 2: Purchase Golf Course Property

Water is recycled and used to water the grass at the golf course. The use will continue under this alternative.

EFFLUENT DISPOSAL ALTERNATIVE 3: Seasonal storage

Water for the golf course will need to come from other sources. The city will have to maintain a 60-foot deep basin.

4.10.5. Land Requirements

EFFLUENT DISPOSAL ALTERNATIVE 1: No Change Scenario

The city will not need to obtain additional property.

EFFLUENT DISPOSAL ALTERNATIVE 2: Purchase Golf Course Property

The city will need to purchase the golf course property.

EFFLUENT DISPOSAL ALTERNATIVE 3: Seasonal storage

The city will not need to obtain additional property. The enlarged basin is located on land already owned by the city.

4.10.6. Potential Construction Considerations

EFFLUENT DISPOSAL ALTERNATIVE 1: No Change Scenario

The infrastructure is already in place.

EFFLUENT DISPOSAL ALTERNATIVE 2: Purchase Golf Course Property

The infrastructure is already in place.

EFFLUENT DISPOSAL ALTERNATIVE 3: Seasonal storage

Enlarging the basins to 60 feet will require lining and may encounter the need for dewatering.

4.10.7. Sustainability Considerations

4.10.7.1. Water and Energy Efficiency

EFFLUENT DISPOSAL ALTERNATIVE 1: No Change Scenario

This alternative will continue the practice of watering the golf course with recycled water.

EFFLUENT DISPOSAL ALTERNATIVE 2: Purchase Golf Course Property

This alternative will continue the practice of watering the golf course with recycled water.

EFFLUENT DISPOSAL ALTERNATIVE 3: Seasonal storage

This alternative will require the golf course to obtain water during the summer from a different source.

4.10.7.2. Green Infrastructure

This project does not meet the definition of “Green Infrastructure” as listed in the 2013 *Guidelines for Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities.*

4.10.7.3. Other

EFFLUENT DISPOSAL ALTERNATIVE 1: No Change Scenario

This alternative will continue the practice of watering the golf course with recycled water. There will be no change to the procedures of the city.

EFFLUENT DISPOSAL ALTERNATIVE 2: Purchase Golf Course Property

This alternative will continue the practice of watering the golf course with recycled water. However, the city will need to find (through lease or contract services) a company to manage the golf course, unless the option to close the course is pursued.

EFFLUENT DISPOSAL ALTERNATIVE 3: Seasonal storage

The stored recycled water will be disposed of during the winter months. Operational staff will blend the stored volume with the normal influent treated during the winter into the outfall piping. This will result in an increase in the daily discharge during the winter months.

4.10.8. Cost Estimates

EFFLUENT DISPOSAL ALTERNATIVE 1: No Change Scenario

The following table summarizes the projected cost estimates for extending the contract with the golf course for recycled water disposal.

Table 4.10.8a – Cost Estimate for Discharge to Golf Course

Effluent Disposal Alternative 1					
ID	Item Description	Unit	Quantity	Unit Cost	Item Cost
A	Deepen Existing Lagoons	ls	1	$270,000	$ 270,000
B	Line Existing Lagoons	ls	1	$360,000	$ 360,000
Total Estimated Costs					**$ 630,000**
Contingency (20%)					$ 126,000
Engineering (20%)					$ 126,000
Project Management and Legal (5%)					$ 31,500
Total Project Budget Estimate					**$ 913,500**

This alternative assumes that there will be no additional O&M cost to the city associated with disposing recycled water at the golf course.

EFFLUENT DISPOSAL ALTERNATIVE 2: Purchase Golf Course Property

The following table summarizes the projected cost estimates for constructing open channel Ultra-Violet disinfection for the finished effluent from the treatment plant.

Table 4.10.8b – Cost Estimate for Purchasing Golf Course Property

Effluent Disposal Alternative 2					
ID	Item Description	Unit	Quantity	Unit Cost	Item Cost
A	Deepen Existing Lagoons	ls	1	$270,000	$ 270,000
B	Line Existing Lagoons	ls	1	$360,000	$ 360,000
Total Estimated Costs					**$ 630,000**
Contingency (20%)					$ 126,000
Engineering (20%)					$ 126,000
Project Management and Legal (5%)					$ 31,500
Land Acquisition					$ 650,000
Total Project Budget Estimate					**$ 1,563,500**

The cost estimated for purchase of the land is based on $10,000 per acre.

This alternative assumes that there will be no additional O&M cost to the city associated with disposing recycled water at the golf course. This alternative further assumes that any cost associated with management, operation and maintenance of the golf course will be paid for by green fees for play on the course.

EFFLUENT DISPOSAL ALTERNATIVE 3: Seasonal storage

The following table summarizes the projected cost estimates for constructing open channel Ultra-Violet disinfection for the finished effluent from the treatment plant.

Table 4.10.8c – Cost Estimate for Seasonal Storage

Effluent Disposal Alternative 3					
ID	***Item Description***	***Unit***	***Quantity***	***Unit Cost***	***Item Cost***
A	Deepen Existing Lagoons	ls	1	$4,900,000	$ 4,900,000
B	Line Existing Lagoons	ls	1	$800,000	$ 800,000
C	New Pumps	ls	1	$90,000	$ 90,000
D	New Piping	ls	1	$15,000	$ 15,000
E	Meter	ls	1	$25,000	$ 25,000
F	Controls, including VFD	ls	1	$60,000	$ 60,000
F	Electrical	ls	1	$50,000	$ 50,000
Total Estimated Costs					**$ 5,940,000**
Contingency (20%)					$ 1,188,000
Engineering (20%)					$ 1,188,000
Project Management and Legal (5%)					$ 297,000
Total Project Budget Estimate					**$ 8,613,000**

Because capital costs were eight times more than the other alternatives, operational costs were not calculated for this option. This alternative will not be considered further.

4.10.9. Recommendation

The least cost option is to continue the contract with the golf course for disposal of recycled water. The city must remain in communication with the owner of the golf course property to ensure compliance of disposal regulations.

4.11. Project 10: Aerobic Digester Aerator Upgrades

4.11.1. Description

The aerobic digester basin provides more than adequate volume to meet process requirements through the planning period, as long as periodic decanting is practiced to thicken the contents to 1% solids. This will be easily achievable.

Because of the long SRT in the secondary treatment process and absence of primary sludge, the oxygen demand in the digester is relatively low. As a result, the energy input required for mixing exceeds the energy needed to maintain dissolved oxygen. This is typical in aerobic digesters.

Original construction of the waste activated sludge aerobic digester included the installation of four (4) floating, surface aerator/mixers. Unfortunately, staff has struggled to keep even two (2) operational at any given time. Maintenance on the motors is difficult and dangerous. The floats do not provide sufficient buoyancy to keep a worker completely out of the liquid, so personnel attempt to remove the units from the basin for maintenance.

The availability of only two of the four original aerators compromises both mixing and aeration efficiency. The digester cannot provide its full benefits under this condition, and is operating at only partial capacity. This may lead to development of sludge blankets within the digester that could lead to production of odors.

ALTERNATIVE 1: Replace Floating Aerators

As noted above, the existing floating aerators are mechanically unreliable and at the end of their useful life, and they are unsafe. Replacement systems of similar configuration are available that have much better accommodation for maintenance work. These provide up to 2400 lbs. of buoyancy and a four-pontoon design for greater stability. They would be of a similar capacity to the existing 20 hp units.

The mixers can be equipped with small blowers that operate independently of the mixers to provide for separate control of aeration and mixing. This will improve efficiency because the blowers will need to be operated only a small portion of the time to maintain sufficient oxygen levels.

ALTERNATIVE 2: Diffused Air

The aerobic digester basin provides more than adequate volume to meet process requirements through the planning period, as long as periodic decanting is practiced to thicken the contents to 1% solids. This will be easily achievable.

Because of the long SRT in the secondary treatment process and absence of primary sludge, the oxygen demand in the digester is relatively low. As a result, the energy input required for mixing exceeds the energy needed to maintain dissolved oxygen. This is typical in aerobic digesters.

4.11.2. Design Criteria

The standard design approach for mixing aerobic digesters with diffused air calls for a rate of 30 scfm/1,000 cubic feet. For the sludge digester, this requires 3,000 scfm of air. This is well beyond the available air from the existing aeration blowers, so a new air supply system would be required. Two 3,000 scfm blowers would be needed to provide redundancy.

Because the oxygen demand in the basin is relatively low, coarse bubble diffusers will be sufficient to meet the aeration demand. These are less expensive and require less maintenance than fine bubble diffusers such as those used in the activated sludge basin.

4.11.3. Maps and Figures

The following aerial photo shows the aerobic digester at the wastewater treatment plant site. Visible in the aerial photo are two aerator/mixers in the basin.

Figure 4.11.3a – Aerial Photo of Aerobic Digester

4.11.4. Environmental Impacts

Proper aeration will result in more consistent digestion of wasted sludge, which will result in less biosolids generated and stored in the facultative storage lagoon.

4.11.5. Land Requirements

The work to be performed under all alternatives will be performed within the limits of property owned by the City.

4.11.6. Potential Construction Considerations

Any new installation must be done with care not to damage the existing HDPE liner.

4.11.7. Sustainability Considerations

The city will benefit by further digestion of the biosolids in the digester.

4.11.7.1. Water and Energy Efficiency

Variable frequency drives will result in the most efficient electrical usage.

4.11.7.2. Green Infrastructure

Not applicable.

4.11.7.3. Other

Proper and quality equipment for air diffusion and mixing will provide operational efficiency and flexibility and minimize maintenance.

4.11.8. Cost Estimates

The following table summarizes the projected cost estimates for installation of air diffusers in the aerobic digester basin.

ALTERNATIVE 1: Replace Floating Aerators

Table 4.11.8a – Cost Estimate for Digester Aeration Upgrade

Replace Floating Aerator/Mixer					
ID	***Item Description***	***Unit***	***Quantity***	***Unit Cost***	***Item Cost***
A	New Floating Aerator/Mixers	ea	4	$35,000	$ 140,000
B	Installation of New Aerator/Mixers	ea	4	$28,000	$ 112,000
C	Electrical	ls	1	$25,000	$ 25,000
Total Estimated Construction Costs					**$ 277,000**
Contingency (20%)					$ 55,400
Engineering (20%)					$ 55,400
Project Management and Legal (5%)					$ 13,850
Total Project Budget Estimate					**$ 401,650**

The following table provides estimated annual operations and maintenance costs for the replacement aeration equipment.

Table 4.11.8b – Estimated O&M Costs for Digester Aeration

O&M Cost Estimate: Replace Floating Aeration	
Description	Annual Cost
Personnel Costs	$ 5,000
Administrative Costs	$ 200
Water/Waste Treatment Costs	$ 0
Insurance Costs	$ 0
Energy Costs	$ 24,200
Process Chemical Costs	$ 0
Monitoring & Testing Costs	$ 0
Short Lived Asset Maintenance/Replacement	$ 500
Professional Services	$ 0
Residuals Disposal	$ 0
Miscellaneous	$ 0
Total	**$ 29,900**
Present Worth Analysis	
Investment/Bond Rate	0.8%
Life Cycle Cost Analysis	20 yrs
Present Worth	**$645,705.61**

ALTERNATIVE 2: Diffused Air

The following table summarizes the projected cost estimates for installation of air diffusers in the aerobic digester basin.

Table 4.11.8c – Cost Estimate for New Diffused Aeration at Digester

Diffused Aeration in Digester					
ID	***Item Description***	***Unit***	***Quantity***	***Unit Cost***	***Item Cost***
A	Air diffusers, Installed	ea	200	$2,000	$ 400,000
B	New Blowers	ea	4	$75,000	$ 300,000
C	New Blower Building	ls	1	$120,000	$ 120,000
D	Controls	ls	1	$150,000	$ 150,000
E	Air Piping	ls	1	$120,000	$ 120,000
F	Electrical	ls	1	$80,000	$ 80,000
G	Integration	ls	1	$25,000	$ 25,000
Total Estimated Construction Costs					**$ 1,195,000**
Contingency (20%)					$ 239,000
Engineering (20%)					$ 239,000
Project Management and Legal (5%)					$ 59,750
Total Project Budget Estimate					**$ 1,732,750**

The following table provides estimated annual operations and maintenance costs for the replacement aeration equipment.

Table 4.11.8d – Estimated O&M Costs for Diffused Aeration

O&M Cost Estimate: Diffused Air	
Description	Annual Cost
Personnel Costs	$ 2,500
Administrative Costs	$ 200
Water/Waste Treatment Costs	$ 0
Insurance Costs	$ 0
Energy Costs	$ 59,400
Process Chemical Costs	$ 0
Monitoring & Testing Costs	$ 0
Short Lived Asset Maintenance/Replacement	$ 250
Professional Services	$ 0
Residuals Disposal	$ 0
Miscellaneous	$ 0
Total	**$ 62,350**
Present Worth Analysis	
Investment/Bond Rate	0.8%
Life Cycle Cost Analysis	20 yrs
Present Worth	**$1,346,479.76**

4.11.9. Recommendation

The least cost option is to replace the existing floating aerator/mixer equipment with floating aerator/mixers made of higher quality equipment.

4.12. Project 11: Biosolids Disposal

4.12.1. Description

Upgrades of the plant in 1998 included construction of an aerobic digester for sludge produced at the plant and a facultative lagoon for storage of biosolids. The digester and lagoon have not been emptied since the construction. Operations personnel, using a boat and Sludge Judge instrument, estimate that the existing facultative lagoon contains 1.8% total solids occupying approximately 67% total capacity.

The aerobic digester was designed with a 60-day minimum solids retention time (SRT) to meet the EPA definition of Class B biosolids. The biosolids are then fed into the facultative storage lagoon by gravity. The facultative lagoon contains Class B, digested solids. With Class B biosolids, the City has several options for disposal.

REMOVAL ALTERNATIVE 1: No Action

The city may opt to not remove the biosolids from the digester and lagoon, at this time. The wastewater treatment plant will continue to waste activated sludge as long as it is treating raw sewage. The lagoon will continue to fill until the basin is completely filled with biosolids. When the facultative lagoon is completely filled, biosolids from the digester will return through the overflow weir back to the activated sludge treatment process, which will upset the food/mass ratio and the mixed liquor in the aeration basins.

The city must address the buildup of biosolids while the lagoon still has capacity. This report will proceed with the assumption the city will move forward with biosolids management. Therefore, this alternative will not be considered further in this document.

REMOVAL ALTERNATIVE 2: Haul Liquid Biosolids

The biosolids may be hauled and disposed of “wet”. Wet biosolids are generally pumped from the basin into an enclosed tanker truck. In order for biosolids to be pumped the concentration should be kept between 2% and 5% solids. If the solids content is too high, the solids become less viscous.

The biosolids in the lagoon have been allowed to settle over the past several years. Settled solids will have to be re-suspended for them to be pumped from the basin. A floating mixer may be used to agitate the settled solids. The liquid biosolids may then be pumped into a closed vessel for transport to a disposal site.

Unfortunately, hauling wet biosolids results in significantly more trips for hauling because of the extra water in the mix. Assuming the entire basin is hauled in trucks with 4,000 gallon capacity, 850 trips will be required to haul the existing 3.4 million gallons @ 1.8% solids currently in the facultative lagoon. Because of the additional expense and effort required to re-suspend the already settled biosolids and the excessive amount of haul trips to truck the liquid biosolids, this alternative will not be considered further in this report.

REMOVAL ALTERNATIVE 3: Decant and Haul Thickened Biosolids

In this alternative, the solids from the digester will be pumped into the facultative storage lagoon and the liquid in the digester would then be recirculated and blocked from the storage lagoon. Waste activated sludge will be recycled in the plant, as much as possible with periodic discharge to the digester to maintain healthy bacteria levels in the aeration treatment and clarification steps of the treatment plant.

The plant will be able to maintain a recirculation status for several weeks while the storage lagoon is emptied.

By use of a floating pump, much of the liquid in the facultative storage lagoon can be decanted and returned to the headworks of the treatment plant. As it is exposed to the air, the settled biosolids further dry out until the remaining solids is at an estimated 15% solids. With a consistency similar to playdough, the solids can be removed from the top of bank with a dredge. The dredge should carefully implement a smooth nosed bucket and must take care not to penetrate the HDPE liner in the bottom of the lagoon. The solids can then be loaded into the bed of a dump truck and hauled to the disposal site.

At 15% solids consistency, it is estimated that 2,100 cubic yards of material will be removed from the lagoon. Assuming a 10 cubic yard dump truck, the total number of trips to haul would be about 205 (less than a quarter the number of trips to haul the wet liquid biosolids).

This is the recommended alternative because it minimizes costs and other expenses of hauling.

Empty, the facultative lagoon should be able to provide another 10 to 15 years storage before needing to be emptied, again. The drained lagoon will also be a convenient time to assess the integrity of the HDPE liner.

DISPOSAL ALTERNATIVE 1: County Landfill Cap

The County-owned landfill has a large area of approximately 13 acres that has been closed and a liner, covered in gravel, cap installed. The existing cap is not re-vegetating well due to an apparent lack of nutrients in the cap material. The addition of nutrient-rich biosolids would promote plant growth.

The county landfill is located approximately 5 miles from the wastewater treatment plant.

If spread 3-inches thick, the current quantity of biosolids in the facultative lagoon, decanted to 15% solids, would cover 5 acres of the closed landfill.

The landfill will qualify as a site with low-potential for public exposure and will require 30-days access restriction to comply with federal laws.

Another advantage of this option is that the cost can also be shared by the city and the county, as both receive benefit from the application of the biosolids. This is the recommended alternative.

DISPOSAL ALTERNATIVE 2: Private Farm

Class B biosolids may be land applied on private farm land, with federally mandated restrictions.

The nearest farmland large enough to accept 2,100 cubic yards of biosolids is about 5 miles to the north with another about 5 miles to the south. The haul distance is not significantly shorter than other alternatives.

Due to the federal restrictions, many private farmers are reluctant to accept Class B biosolids.

The costs would be borne solely by the city for this alternative. Therefore, this report will not consider this disposal alternative further.

4.12.2. Recommendation

The recommended alternative for biosolids removal is to thicken and haul the biosolids to approximately 15% solids, which will minimize hauling trips to the disposal site. Further, it is recommended to dispose of the thickened biosolids at the County Landfill. The disposal site will then be limited to one property owner and the site provides the required access restrictions.

4.12.3. Design Criteria

As mentioned above, care must be taken to protect the HDPE liner in-place in the facultative sludge lagoon. Additionally, the liner should be inspected and assessed for structural integrity.

A Biosolids Management Plan will need to be developed and approved by DEQ. Additionally, site authorization letters will need to be obtained for each property on which biosolids is disposed.

Disposal of the biosolids is regulated by the EPA. In 40 CFR 503, the following site restrictions are presented:

1. Food crops with harvested parts that touch the sewage sludge/soil mixture and are totally above the land surface shall not be harvested for 14 months after application of sewage sludge.

2. Food crops with harvested parts below the surface of the land shall not be harvested for 20 months after application of sewage sludge when the sewage sludge remains on the land surface for four months or longer prior to incorporation into the soil.

3. Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after application of sewage sludge when the sewage sludge remains on the land surface for less than four months prior to incorporation into the soil.

4. Food crops, feed crops, and fiber crops shall not be harvested for 30 days after application of sewage sludge.

5. Animals shall not be grazed on the land for 30 days after application of sewage sludge.

6. Turf grown on land where sewage sludge is applied shall not be harvested for one year after application of the sewage sludge when the harvested turf is placed on either land with a high potential for public exposure or a lawn, unless otherwise specified by the permitting authority.

7. Public access to land with a high potential for public exposure shall be restricted for one year after application of sewage sludge.

8. Public access to land with a low potential for public exposure shall be restricted for 30 days after application of sewage sludge.

4.12.4. Maps and Figures

The following aerial photo shows the aerobic digester and the facultative storage lagoon at the wastewater treatment plant site. The aerobic digester is smaller and to the right-hand side of the photo, with the lagoon, larger and to the left of the frame.

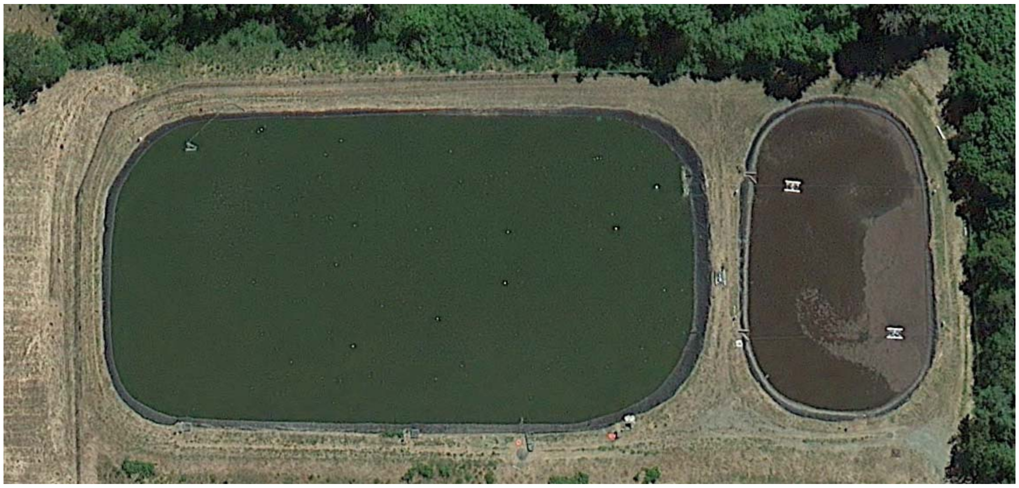

Figure 4.12.4a – Aerial Photo of Digester and Storage Lagoon

The following aerial photo shows the county-owned landfill. Visible is a small, paved landing strip for private remote-controlled airplanes.

Figure 4.12.4b – Aerial Photo of County Landfill

Figure 4.12.4c – Photo 1 of County Landfill

Figure 4.12.4d – Photo 2 of County Landfill

4.12.5. Environmental Impacts

Disposal of the biosolids will comply with federal and state guidelines.

4.12.6. Land Requirements

The recommended disposal site is owned by Josephine County, who seems equally interested in the beneficial use of the biosolids.

4.12.7. Potential Construction Considerations

The excavation or removal of the biosolids from the facultative lagoon must be done with care not to damage the existing HDPE liner.

4.12.8. Sustainability Considerations

The city will benefit by removal of the biosolids from the facultative storage lagoon and the county will benefit with a vegetated cap on the landfill.

4.12.8.1. Water and Energy Efficiency

Decanting the water off the biosolids and hauling thickened solids will result in an efficient use of hauling mileage.

4.12.8.2. Green Infrastructure

The application of nutrient-rich, particularly nitrogen, will encourage vegetative growth on the otherwise blighted landscape at the closed landfill.

4.12.8.3. Other

By minimizing hauling distance and number of trips, the potential impact of vehicular emissions and possible spills is reduced.

4.12.9. Cost Estimates

The following table summarizes the projected cost estimates for thickening through decanting and hauling and disposal at the county landfill, assuming the work is contracted. Cost may be saved if city equipment and personnel are used to perform the work.

Table 4.12.9a – Cost Estimate for Biosolids Disposal

Biosolids Disposal					
ID	***Item Description***	***Unit***	***Quantity***	***Unit Cost***	***Item Cost***
A	Decanting with floating pump	ls	1	$10,000	$ 10,000
B	Excavation and Loading	ls	1	$30,000	$ 30,000
C	Hauling to County Landfill	ls	1	$60,000	$ 60,000
D	Spreading at Landfill	ls	1	$30,000	$ 30,000
Total Estimated Costs					**$ 130,000**
Contingency (20%)					$ 26,000
Engineering (20%)					$ 26,000
Project Management and Legal (5%)					$ 6,500
Total Project Budget Estimate					**$ 188,500**

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5.0 Funding Alternatives

5.1. Evaluation of Local Funding Resources

A number of local funding sources are available to the City for sharing the cost of the planned wastewater treatment plant and conveyance system improvements. The amount and type of local funding obligations for infrastructure improvements will depend in part on the amount of grant funding anticipated and the requirements of potential loan funding. Local revenue sources for capital expenditures include various types of bonds, capital construction funds, system development charges, system user fees, and ad valorem taxes. Local revenue sources for operating costs include system user fees and ad valorem taxes. Each of these financing mechanisms is briefly described below along with the appropriateness of each for the improvements recommended in this Plan.

5.1.1. General Obligation Bonds

General Obligation (GO) bonds have the full faith and resources of the City behind them including property taxes, rate income, and other revenues to ensure that obligations are met. As a result of this backing, GO bonds often have a lower interest rate and are generally considered to have lower risk and are a more attractive investment in the municipal bond market. For a community to undertake a project funded with a GO bond, they must pass a vote of the people in order to sell the bonds. In some cases, communities spend a great deal of time, money and effort only to have the electorate reject the project by denying the GO bond funding measure. As a result, many communities shy away from GO bond funding options.

5.1.2. Revenue Bonds

Revenue Bonds (RB) are retired through revenues obtained through user rates and charges. They do not have the full faith of the community behind them in that property taxes and other forms of revenue are not pledged to retire the debt. As such, they are considered as a higher risk and often have slightly higher interests rates associated with them. However, as property taxes are not obligated, a vote of the public is not required for selling revenue bonds to fund a project. This often makes revenue bonds a preferred choice for public improvements.

Bonds sales, regardless of type, have several requirements and processes that must be met for the bond sale to move forward. These requirements vary but generally include:

- Project documentation to prove feasibility of the project and the funding plan.
- Assistance from a bond counsel agent
- Retain a year of payments, in reserve, to provide a level of confidence that the City will not default on their debt payments.
- The bond process includes issuance costs that increase the overall cost of a project.
- Other requirements and steps to negotiate the process of obtaining funding.

5.1.3. Improvement Bonds

Improvement (Bancroft) bonds can be issued under an Oregon law called the Bancroft Act. These bonds are an intermediate form of financing that is less than full-fledged general obligation or revenue bonds. This type of bond is quite useful, especially for smaller issuers or for limited purposes.

An improvement bond is payable only from the receipts of special benefit assessments, not from generally tax revenues. Such bonds are issued only where certain properties are recipients of special benefits not accruing to other properties. For a specific improvement, all property within the improvement area is assessed on an equal basis, regardless of whether it is developed or undeveloped. The assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the City sells Bancroft improvement bonds to finance the construction, and the assessment is paid over 20 years in 40 semiannual installments with interest. Cities and special districts are limited to improvement bonds not exceeding 3% of true cash value.

With improvement bond financing, an improvement district is formed, boundaries are established, and the benefiting properties and property owners are determined. The engineer usually determines an approximate assessment, either on a square foot or front-foot basis. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual 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. Commonly, warrants are issued to cover debts, with the warrants to be paid when the project is complete.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to 50% of the total assessments to be levied. As a result, owners of undeveloped properties usually require a substantial cash payment. In addition, the development of an assessment district is very cumbersome and expensive when facilities for an entire community are contemplated. In comparison, general obligation bonds can be issued in lieu of improvement bonds and are usually more favorable.

5.1.4. System Development Charges

System development charges (SDC’s) are fees collected as previously undeveloped property is developed. The fees are used to finance the necessary capital improvements and municipal services required by the development. Such fees can only be used to recover the capital costs of infrastructure improvements. Operating, maintenance, and replacement costs cannot be financed through SDC’s.

Two types of charges are permitted under the Oregon Systems Development Charges Act: improvement fees, and reimbursement fees. SDC’s that are charged before a project is undertaken are considered improvement fees and are used to finance capital improvements to be constructed. After construction, SDC’s are considered reimbursement fees and are collected to recapture the costs associated with capital improvements already constructed or under construction. A reimbursement fee represents a charge for utilizing excess capacity in an existing facility paid for by others. The revenue generated by this fee is typically used to pay back existing loans for improvements.

Under the Oregon SDC Act, methodologies for deriving improvement and reimbursement fees must be documented and available for review by the public. A capital improvement plan must also be prepared which lists the capital improvements that may be funded with improvement fee revenues. The estimated cost and timing of each improvement also must be included in the capital improvement plan. Thus, revenue from the collection of SDC’s can only be used to finance specific items listed in a capital improvement plan. In addition, SDC’s cannot be assessed on portions of the project paid for with grant funding.

5.1.5. Ad Valorem Taxes

Ad valorem property taxes are often used as a revenue source for utility improvements. Property taxes may be levied on real estate, personal property, or both. Historically, ad valorem taxes were the traditional means of obtaining revenue to support all local governmental functions.

A major advantage of these taxes is the simplicity of the system. It requires no monitoring program for developing charges, additional accounting and billing work is minimal, and default on payments is rare. In addition, ad valorem taxation provides a means of financing that reaches all property owners that benefit from a wastewater system, whether a property is developed or not. The construction costs for a project are shared proportionally among all property owners based on the assessed value of each property.

Depending on the project, ad valorem taxation may result in property owners paying a disproportionate share of the project costs compared to the benefits received. Public hearings and an election with voter approval would be required to implement ad valorem taxation.

5.1.6. System User Fees

System user fees can be used to retire general obligation bonds and are commonly the sole source of revenue used to retire revenue bonds and to finance operation and maintenance of a system. System user fees represent charges of all residences, businesses and other users that are connected to the wastewater system. These fees are established by resolution and may be modified as needed to account for increased or decreased operating and maintenance costs. User fees may be based on a metered volume of water consumption and/or on the type of user (i.e. residential, commercial, industrial, etc.).

5.1.7. Assessments

Under special circumstances, the beneficiary of a public works improvement may be assessed for the cost of a project. For example, the City may provide some improvements or services that directly benefit a particular development. The City may choose to assess the developer to provide up-front capital to pay for the improvements.

5.2. Evaluation of Federal and State Funding Resources

Some level of outside funding assistance in the form of grants or low interest loans may be necessary to make the proposed improvement projects affordable for the City of Cave Junction and its citizens. The amount and types of outside funding will dictate the amount of local funding that the City must secure. In evaluating grant and local programs, the major objective is to select a program or combination of programs that is available and the most beneficial for the planned project.

This section provides a brief description of the major Federal and State funding programs that are typically utilized to assist qualifying communities in the financing of infrastructure improvement projects. Each of the government assistance programs has certain prerequisites and requirements in order for a community to qualify. The assistance programs promote goals such as aiding economic development, benefiting areas of low to moderate income families, and providing for specific community improvement projects. Because each program has specific requirements, not all communities or projects will qualify for each of the programs.

5.2.1. Economic Development Administration Public Works Grant Program

The Economic Development Administration (EDA) Public Works Grant Program, administered by the U.S. Department of Commerce, is aimed at projects which directly create permanent jobs or remove impediments to job creation in the project area. Thus, to be eligible for this grant, a community must be able to demonstrate the potential to create jobs from the project. Potential job creation is assessed with a survey of businesses to demonstrate the prospective number of jobs that might be created if the proposed project is completed.

Projects must be located within an EDA designated Economic Development District. Priority consideration is given to projects that improve opportunities for the establishment or expansion of industry and which create or retain both short-term and long-term private sector jobs. Communities that can demonstrate that the existing system is at capacity (i.e. moratorium on new connections) have a greater chance of being awarded this type of grant. EDA grants are usually in the range of 50 to 80 percent of the project cost. Therefore, some type of local funding also is required. Grants typically do not exceed one million dollars.

5.2.2. Water and Waste Disposal Loans and Grants (Rural Development)

The Rural Utilities Service administers a water and wastewater loan and grant program designed to improve the quality of life and promote economic development in rural America. The Rural Utilities Service programs provide needed facilities to ensure health and safety and stimulate local economy by allowing access to new and advanced services and job opportunities. Program funds can be used for water, sewer, solid waste, and storm drainage projects. The most common uses are to restore deteriorating water supplies, or to improve, enlarge, or modify inadequate water or waste facilities.

Eligible applicants for Rural Utilities funds include public bodies and Indian Tribes. Non-profit corporations with significant ties to the local rural community may also be eligible. Funding is targeted to rural areas with populations of 10,000 or less. Applicants must be unable to obtain commercial financing at reasonable rates and terms or finance the project from existing resources.

The proposed project must serve a rural area not likely to decline in population below that for which the project is designed. The project should serve the present population and provide for foreseeable growth. Proposed projects should be necessary for orderly community development consistent with a comprehensive community or county development plan. Facilities must be modest in design, size, and cost. Water meters, a primary instrument for promoting conservation, are required by the agency. All water and wastewater systems must meet the standards set by the State Department of Environmental Quality.

The Rural Utilities staff review each project to determine need based on various priority points. Prioritization is necessary due to limited funding and to make sure the most deserving projects receive assistance.

When possible, loan funds are combined with other federal and state financing to reduce the end cost to users of the system. Depending on median household income (MHI) and need, communities may qualify for grant funds of up to 75% of the eligible project costs. These grants can help reduce water and waste disposal rates to reasonable levels. Rural Utilities loans have a term of up to 40 years or for the useful life of the facility, whichever is less.

There are three different interest rates available for Rural Utilities loans:

- ***Poverty Line Rate.*** The poverty line rate of 2.75% per annum applies to communities with a MHI below the state poverty level or 80% of the state non-metropolitan median household income (SNMHI). There must also be a health standard violation to receive the poverty loan rate (Rate is for quarter ending December 31, 2013).

- ***Intermediate Rate.*** The intermediate rate applies to projects in communities that are not eligible for the poverty rate and have a MHI between SNMHI and 80% of SNMHI. The intermediate interest rate is set halfway between the poverty line interest rate and the market rate.

- ***Market Rate.*** The market rate applies to projects in communities who do not qualify for the lower rates and who have MHI exceeding 100 % of the SNMHI for the state. The agency sets the intermediate and market rates quarterly, based on the bond market. The final rate for the project is the lowest rate in effect at the time of loan approval or closing.

To ensure the federal investment, the best security position practicable must be acquired. Acceptable forms of security for utility systems and public bodies include revenue bonds; other pledges of taxes or assessments; general obligation bonds; and assignment of income.

Grant fund eligibility is determined based on population, MHI, and user rates. Priority for grant funding is given to projects with populations of less than 5,500. Communities with low MHI may receive grant funding to reduce user costs to a reasonable level for rural residents. User rates are considered reasonable if they are less than or equal to existing prevailing rates in similar communities with similar systems.

Total grant funding cannot exceed the following percentages of eligible project development costs:

- 75% when the community meets poverty line interest rate criteria;
- 45% when the community meets intermediate interest rate criteria.

Maximum grant amounts based on MHI are provided in the following table.

Table 5.2.2 – Maximum Rural Development Grant Funds based on MHI

Median Household Income (MHI)	Meets Criteria for Health or Sanitary Concern	Maximum Grant	Interest Rate [(a)]
<$42,284	Yes	75%	2.75% (Poverty Rate)
<$42,284	No	45%	3.75% (Intermediate Rate)
$42,284 - $52,855	N/A	45%	3.75 % (Intermediate Rate)
>$52,855	N/A	0%	4.625% (Market Rate)

[(a)] Rates apply for quarter ending December 31, 2013.

The MHI of Cave Junction reported from the 2010 Census data was $20,642. At the time of this report, the MHI statewide was $52,855. Based on the cited MHI, it is estimated that the City would qualify for some grant assistance from Rural Development.

There are other restrictions and requirements associated with these loans and grants. If the City becomes eligible for grant assistance, the grant will apply only to eligible project costs. Additionally, grant funds may only be available after the City has incurred long-term debt resulting in an annual debt service obligation equal to 0.5% of the MHI. In addition, an annual funding allocation limits the Rural Development funds. To receive a Rural Development loan, the City must secure bonding authority, usually in the form of general obligation bonds or revenue bonds.

5.2.3. Oregon Community Development Block Grant Program

Since the late 1980's the state of Oregon has administered the U.S. Department of Housing and Urban Development's Community Development Block Grant (CDBG) funds for the non-entitlement cities and counties of the state. The primary objective of the program is the development of viable (livable) urban communities by expanding economic opportunities and providing decent housing and a suitable living environment principally for persons of low- and moderate-income. Each year the state develops an annual "Method of Distribution" which establishes how the funds will be used for that calendar year. The Method of Distribution can be found on the department's web site.

Under the 2012 CDBG Method of Distribution improvements to public water and wastewater systems are eligible for funding. To receive a grant the applicant must meet the following minimum criteria:

- Must be a City or County located in a non-metropolitan area of Oregon.
- Have over 51% of the population considered low- to moderate-income in the target area based on census data or a local survey.
- Annual waste disposal rates must be equal to or greater than the cost to handle an average of 7,500 gallons per residential connection per month.
- Use the funds to benefit current residents

Grant funding is subject to the applicant need, availability of funds and any other restrictions in the 2012 Method of Distribution. Under the 2012 program, a maximum grant amount of $2,000,000 is available for water and wastewater improvement projects. Applications for the CDBG program are accepted on a year round basis and evaluated quarterly in a competitive review process.

For additional information on the CDBG program, call (503) 986-0123 or visit the OECDD website at http://www.econ.state.or.us/cdbg.htm.

5.2.4. Special Public Works Fund

The Special Public Works Fund program provides funding for the infrastructure that supports job creation in Oregon. Loans and grants are made to eligible public entities for the purpose of studying, designing and building public infrastructure that leads to job creation or retention.

The public entities or "municipalities" that are eligible to apply for Special Public Works Fund assistance include:

- Cities
- Counties
- Ports incorporated under ORS 777.005 to 777.725 and 777.915 to 777.953 and under 778.010
- Domestic water supply districts organized under ORS chapter 264
- Sanitary districts organized under ORS 450.005 to 450.245
- Sanitary authority, water authority or joint water and sanitary authority organized under ORS 450.600 to 450.989
- County service districts organized under ORS chapter 451
- Tribal Councils of Indian Tribes in Oregon

- Airport district organized under ORS Chapter 838
- A district as defined in ORS 198.010

In order to be eligible, the proposed project must be owned by a public entity that is an eligible applicant. Examples of the many types of eligible municipally owned projects are listed below, although this is not a comprehensive list.

- Airport facilities
- Telecommunications infrastructure
- Port facilities, wharves and docks
- Railroads
- Buildings and associated equipment
- Solid waste disposal sites
- Acquisition of land
- Mitigation of environmental conditions
- Purchase of rights of way and easements necessary for infrastructure
- Roadways, bridges, etc.
- Storm drainage systems
- Wastewater systems
- Water systems
- The acquisition or construction of related equipment and fixtures

The Special Public Works Fund is comprehensive in terms of the types of project costs that can be financed. As well as actual construction, eligible project costs can include costs incurred in conducting feasibility and other preliminary studies and for the design and construction engineering.

The Fund is primarily a loan program. Grants can be awarded, up to the program limits, based on job creation or on a financial analysis of the applicant's capacity for carrying debt financing.

The total loan amount per project cannot exceed $10 million. The department is able to offer very attractive interest rates that typically reflect low market rates. In addition, the department absorbs the associated costs of debt issuance thereby saving applicants even more on the overall cost of borrowing. Loans are generally limited to the usable life of the contracted project, or 25 years from the year of project completion, whichever is less.

For infrastructure projects, grants are offered to projects creating or retaining jobs and are eligible for up to $5,000 per job created or retained. If a grant is offered it cannot exceed 85 percent of the project cost or $500,000, whichever is less. Additional grants may be awarded if there is a gap between the grant for jobs plus the loan and the total project costs.

For more information on the Special Public Works Fund program, call (503) 986-0123 or visit the OECDD website at http://www.econ.state.or.us/spwf.htm.

5.2.5. Water/Wastewater Financing Program

The Water/Wastewater Fund was created by the Oregon State Legislature in 1993. It was initially capitalized with lottery funds appropriated each biennium and with the sale of state revenue bonds since 1999. The purpose of the program is to provide financing for the design and construction of public infrastructure needed to ensure compliance with the Safe Drinking Water Act or the Clean Water Act.

The public entities that are eligible to apply for the program include: Cities, Counties, County Service districts (organized under ORS Chapter 451), Tribal Councils of Indian tribes, Ports, and Special Districts as defined in ORS 198.010.

Eligible activities include reasonable costs for construction improvement or expansion of drinking water, wastewater or storm water systems. Eligible projects include those related to drinking water source, treatment, storage and distribution; wastewater collection and capacity; stormwater system; purchase of rights-of-way and easements necessary for construction; and design and construction engineering. All projects must ensure that municipal water and wastewater systems comply with the Safe Drinking Water Act or the Clean Water Act.

To be eligible a system must have received, or is likely to soon receive, a Notice of Non-Compliance by the appropriate regulatory agency, associated with the Safe Drinking Water Act or the Clean Water Act. Projects also must meet other state or federal water quality statutes and standards.

Ineligible projects include privately owned facilities and infrastructure; purchase of property not related to infrastructure construction; costs incurred prior to award, except costs for engineering and other support activities necessary to construction.

The Fund provides both loans and grants, but it is primarily a loan program. The loan/grant amounts are determined by a financial analysis of the applicant's ability to afford a loan (debt capacity, repayment sources and other factors).

The Water/Wastewater Financing Program's guidelines, project administration, loan terms and interest rates are similar to the Special Public Works Fund program. The maximum loan term is 25 years or the useful life of the infrastructure financed, whichever is less. The maximum loan amount is $10,000,000 per project through a combination of direct and/or bond funded loans. Loans are generally repaid with utility revenues or voter approved bond issues. A limited tax obligation pledge may also be required. "Credit worthy" borrowers may be funded through sale of state revenue bonds.

Grant awards can be awarded up to a maximum of $750,000 depending on a financial review. An applicant is not eligible for grant funds if the annual median household income in the affected area is equal or greater than 100 percent of the state average median household income for the same year.

Technical assistance funding for preliminary planning, engineering studies and economic investigations are available to municipalities with populations under 15,000 residents. Technical assistance projects must be done in preparation for an eligible construction project and can be awarded loans of up to $50,000 or grants of up to $20,000 per project.

For more information on the Special Public Works Fund program, call (503) 986-0123 or visit the OECDD website at http://www.econ.state.or.us/wtrww.htm.

5.2.6. Clean Water State Revolving Fund (CWSRF)

The Clean Water State Revolving Fund (CWSRF) Loan Program administered by the Oregon Department of Environmental Quality (DEQ) provides low-cost loans for the planning, design and construction of a variety of projects that address water pollution. The loans through the CWSRF program are available to Oregon's public agencies, including cities, counties, sanitary districts, soil and water conservation districts, irrigation districts and various special districts.

Congress established the CWSRF in 1987, to replace the Construction Grants program, which had provided direct grants to communities to complete sewer infrastructure projects. The CWSRF program provides several types of loans and varying interest rates. As of July 2014, loans are available with terms of 5 years at 1.08% APR to 30 years at 2.88% APR.

There are six different types of loans available within the program. These include traditional planning, design and construction loans. There are also loans available for emergencies, urgent repairs and local community projects. Each of these loan types has different financial terms, and is intended to provide communities with choices when financing water quality improvements. Interest rates are based on the nation's bond buyer's index and fluctuate quarterly. The interest rates of various loans are substantially discounted from the bond rate. For example, with a quarterly bond rate of 5.0%, the CWSRF interest rates (depending on the type of loan) would range from 1.08% to 2.88%. Loan payback periods vary, ranging from 5 to 30 years. Loans do include an annual loan fee of 0.5% of the outstanding balance. Planning loans are exempt from this fee.

Eligible projects include:

- Wastewater system plans and studies
- Secondary or advanced wastewater treatment facilities
- Irrigation improvements
- Infiltration and inflow correction
- Major sewer replacement and rehabilitation
- Qualified storm water control
- Onsite wastewater system repairs
- Matching funds for some U.S. Department of Agriculture conservation programs
- Estuary management efforts
- Various nonpoint source projects (stream restorations, animal waste management, conservation easements)
- Qualified brownfields projects

All eligible proposed projects are ranked based upon their application information and entered on the program's Project Priority List. Points are assigned based on specific ranking criteria. Newly ranked projects are integrated into the priority list on a regular basis. The Project Priority List is incorporated within DEQ's annual Intended Use Plan which indicates the proposed use of the funds each year.

Projects are funded based on the availability of loan monies. If monies are insufficient to fund all the approved projects, funds are distributed to as many projects as possible based on the Project Priority List. Each time new monies become available, those monies are allocated to as many unfunded or partially funded projects as possible.

For additional information on the CWSRF loan program, call (800) 452-4011 or visit the DEQ website at http://www.deq.state.or.us/wq/loans/loans.htm.

5.2.7. Oregon Department of Energy, Small Scale Energy Loan Program (SELP)

The purpose of the Energy Loan Program (also known as SELP) is to promote energy conservation and renewable energy resource development. The Energy Loan Program can loan to individuals, businesses, schools, cities, counties, special districts, state and federal agencies, public corporations, cooperatives, tribes, and non-profits in Oregon.

The program offers low-interest loans for projects that:

- Save energy
- Produce energy from renewable resources such as water, wind, geothermal, solar, biomass, waste materials or waste heat
- Use recycled materials to create products
- Use alternative fuels

Current loan rates for cities vary depending on the bond market, term of loan. Loans also include an application fee of 0.1%, an underwriting fee of 0.5%, and a loan fee of 1.0% of the loan amount.

For more information on the SELP program, call (503) 503-2123 or visit the Oregon Department of Energy website at http://www.oregon.gov/ENERGY/LOANS/index.shtml.

Section 6

6.0 Conclusions and Recommendations

The following table summarizes the recommended projects for the City of Cave Junction Capital Improvement Plan for the planning period.

Table 6.0 – Summary of Project Capital Improvement Plan

Project No.	Description	Cost	Priority
1	Manhole Repair	$ 58,000	1
2	Pipeline Rehabilitation	$ 1,015,250	2
3	Replace Headworks Screen	$ 436,450	10
4	RV Receiving Station	$ 145,000	9
5	Septage Receiving Station	$ 599,575	4
6	Additional Blower	$ 203,000	8
7	Disinfection Upgrade	$ 516,200	6
8	Effluent Disposal	$ 913,500	7
9	Aerobic Digester Aerator Upgrades	$ 401,650	5
10	Biosolids Disposal	$ 188,500	3
Total		**$ 4,477,125**	

Projects were ranked in priority based on most effective use of resources and impact to current and future flows. For example, by addressing the inflow and infiltration first, the treatment plant will realize longevity and operational efficiency with reduced flows.

The City should secure funding necessary to begin work on the highest priority projects.

6.1. Priority 1: Project 1 – Rehabilitate Manholes.

Several manholes were found with leaks during recent flow mapping activities. Table 6.1a summarizes collection system manholes identified for further assessment and rehabilitation.

Table 6.1a – Summary of Manhole Repairs

ID	Manhole #	Description
A.	Manhole A-4	Small Leak in Stub
B.	Manhole B-3	Root Intrusion
C.	Manhole B-8	Root Intrusion
D.	Manhole B-30A	Leak Around Pipe (5± gpm)
E.	Manhole C-1	Grout limiting Access to Channel/Pipe
F.	Manhole E-1	Standing Water in Base, Unable to Measure Flow
G.	Manhole E-7	Leak Around Pipe (3± gpm)
H.	Manhole E-15	Small Leaks Around Pipe & at Old Patch Halfway up Manhole
I.	Manhole F-2	Small Leak Around Pipe
J.	Manhole L-2	Base and First Barrel Joints Leaking (10± gpm)
K.	Manhole L-9	Small Leak Around Pipe & at Old Patch in Manhole Barrel
L.	Manhole L-10	Small Leak Around Pipe
M.	Manhole L-11	Small Leak Between Base and First Barrel
N.	Manhole L-14	Small Leak Between Base and First Barrel

Each manhole should be thoroughly inspected and assessed. Then a rehabilitation design should be prepared for each manhole using the most appropriate repair method.

Manhole repair and rehabilitation methods include remove and replace the entire manhole, rebuild the upper portion of the manhole, joint sealants, concrete patching, grout patch, injection grout, epoxy liners (roll-on and spray-on), cured-in-place liners and liner inserts. Each manhole should be assessed for the most appropriate rehabilitation method.

The following cost estimate assumes an average rehabilitation cost per manhole of $2,500 multiplied by a severity factor, based on the observed inflow or infiltration in each manhole from the flow mapping.

Table 6.1b – Manhole Repair Cost Estimate

Manhole Rehabilitation Cost Estimates					
ID	*Item Description*	*Unit*	*Quantity*	*Unit Cost*	*Item Cost*
A	Manhole A-5; Small Leak in Stub	ls	1	$2,500	$2,500
B	Manhole B-3; Root Intrusion	ls	1	$3,000	$3,000
C	Manhole B-8; Root Intrusion	ls	1	$3,000	$3,000
D	Manhole B-30A; Leak Around Pipe (5± gpm)	ls	1	$3,500	$3,500
E	Manhole C-1; Grout limiting Access to Channel/Pipe	ls	1	$2,000	$2,000
F	Manhole E-1; Standing Water in Base, Unable to Measure Flow	ls	1	$3,500	$3,500
G	Manhole E-7; Leak Around Pipe (3± gpm)	ls	1	$3,000	$3,000
H	Manhole E-15; Small Leaks Around Pipe & at Old Patch Halfway up Manhole	ls	1	$2,500	$2,500
I	Manhole F-2; Small Leak Around Pipe	ls	1	$3,000	$3,000
J	Manhole L-2; Base and First Barrel Joints Leaking (10± gpm)	ls	1	$3,500	$3,500
K	Manhole L-9; Small Leak Around Pipe & at Old Patch in Manhole Barrel	ls	1	$2,500	$2,500
L	Manhole L-10; Small Leak Around Pipe	ls	1	$3,000	$3,000
M	Manhole L-11; Small Leak Between Base and First Barrel	ls	1	$2,500	$2,500
N	Manhole L-14; Small Leak Between Base and First Barrel	ls	1	$2,500	$2,500
Total Manhole Rehabilitation Estimated Costs					**$40,000**
Contingency (20%)					$8,000
Engineering (20%)					$8,000
Project Management and Legal (5%)					$2,000
Total Project Budget Estimate					**$58,000**

6.2. Priority 2: Project 2 – Rehabilitate Pipeline.

Flow mapping also located several sections of pipe that exhibit leaks, listed below in Table 6.2a.

Table 6.2a – Summary of Pipeline Repairs

ID	Manhole to Manhole	Length
A.	Manhole C-1 to C-22	130 LF
B.	Manhole C-37 to C34	150 LF
C.	Manhole B-37 to C-1	270 LF
D.	Manhole D-1 to D-18	410 LF
E.	Manhole E-15 to E-20	570 LF
F.	Manhole E-12 to E-15	660 LF
G.	Manhole L-1 to K-1	100 LF
H.	Manhole L-9 to L-11	330 LF

These sections of pipe should be televised and the pipe condition assessed. A design can then be prepared for the most applicable repair method. Pipeline rehabilitation methods include dig and replace, slip-line, fold and form, spiral wound, cured-in-place, spray-on liner, injection grouting, and point or spot repair.

The following table summarizes the estimated cost to repair or rehabilitate the identified sections of pipe using an assumed average cost per lineal foot of repair.

Table 6.2b – Pipe Rehabilitation Cost Estimate

Pipe Rehabilitation Cost Estimates					
ID	*Item Description*	*Unit*	*Quantity*	*Unit Cost*	*Item Cost*
A	Manhole C-1 to C-22	lf	130	$250	$ 32,500
B	Manhole C-37 to C-34	lf	150	$250	$ 37,500
C	Manhole B-37 to C-1	lf	270	$250	$ 67,500
D	Manhole D-1 to D-18	lf	410	$250	$ 102,500
E	Manhole E-15 to E-20	lf	570	$250	$ 142,500
F	Manhole E-12 to E-15	lf	660	$250	$ 165,000
G	Manhole L-1 to K-1	lf	100	$250	$ 25,000
H	Manhole L-9 to L-11	lf	330	$250	$ 82,500
Total Pipe Rehabilitation Estimated Costs					**$ 655,000**
Contingency (20%)					$ 131,000
CCTV & Assessment (10%)					$ 65,500
Engineering (20%)					$ 131,000
Project Management and Legal (5%)					$ 32,750
Total Project Budget Estimate					**$ 1,015,250**

6.3. Priority 3: Project 10 – Biosolids Disposal.

The City should remove and dispose of the collected biosolids. The logical site for disposal of the biosolids is as a cap at the county landfill, located approximately 5 miles from the treatment plant. Figure 6.3 shows an aerial image of the existing county landfill cap.

Figure 6.3 – Aerial Photo of County Landfill

The facultative sludge lagoon currently contains approximately 3.4 million gallons of biosolids at an estimated 1.8% solids per volume. The excess water should be removed, either by decanting or mechanically, which will reduce the amount of trips necessary to haul the biosolids to the landfill.

The following cost estimate assumes decanting the biosolids in place and hauling solids at a 15% consistency.

Table 6.3 – Cost Estimate for Biosolids Disposal

Biosolids Disposal					
ID	***Item Description***	***Unit***	***Quantity***	***Unit Cost***	***Item Cost***
A	Decanting with floating pump	ls	1	$10,000	$ 10,000
B	Excavation and Loading	ls	1	$30,000	$ 30,000
C	Hauling to County Landfill	ls	1	$60,000	$ 60,000
D	Spreading at Landfill	ls	1	$30,000	$ 30,000
Total Estimated Costs					**$ 130,000**
Contingency (20%)					$ 26,000
Engineering (20%)					$ 26,000
Project Management and Legal (5%)					$ 6,500
Total Project Budget Estimate					**$ 188,500**

6.4. Priority 4: Project 5 – Septage Receiving Station.

Currently, septage discharge accepted by the City wastewater treatment plant occupies one-half of the aeration basin capacity of the treatment facility. The receipt and treatment of septage is time-consuming for treatment plant staff.

A formal septage receiving station will allow septage wastewater to be isolated from the domestic wastewater stream for stabilization. Once stabilized, the septage may be metered into the domestic wastewater stream for secondary treatment.

The receiving station should include fine, automated screening and grit removal. The holding or storage tanks should include operational flexibility to add forced air, pH and alkalinity adjustment, as needed to stabilize the septage. A submersible pump and piping can be used to meter the setpage into the influent wastewater stream after the existing grit chamber.

Figure 6.4 provides a preliminary layout showing a septage receiving station and underground holding tanks adjacent to the existing plant headworks.

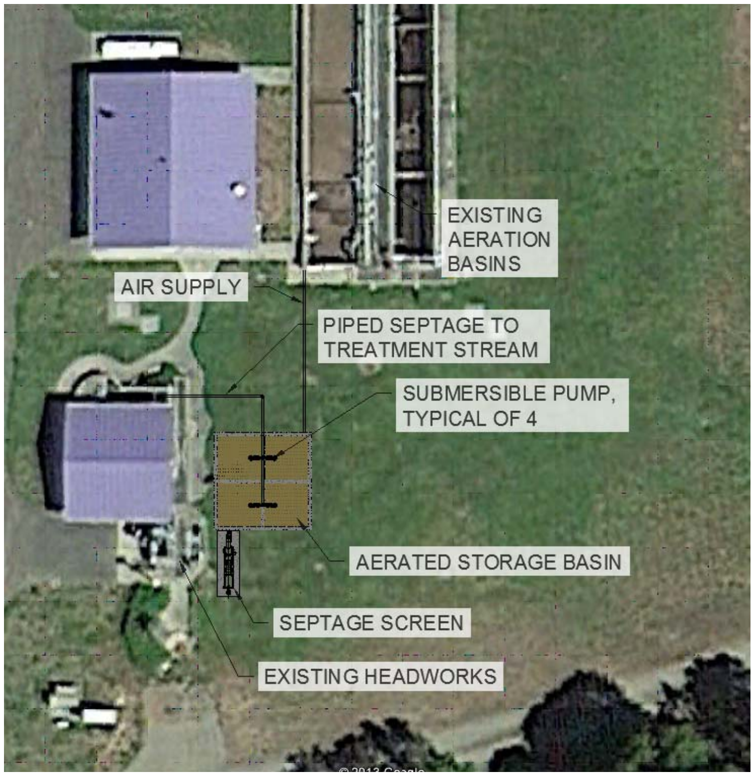

Figure 6.4 – Septage Receiving Preliminary Layout

The following cost estimate shows expected costs associated with installation of a new septage receiving station.

Table 6.4a – Cost Estimate for Septage Receiving Station

Septage Receiving Station					
ID	***Item Description***	***Unit***	***Quantity***	***Unit Cost***	***Item Cost***
A	User Interface Add-on	ls	1	$25,000	$ 25,000
B	Magnetic Flow Meter	ea	1	$3,500	$ 3,500
C	Septage Receiving Screen	ls	1	$90,000	$ 90,000
D	Septage Grit Chamber	ls	1	$30,000	$ 30,000
E	Aeration Basins (3,000 gallons each)	ea	4	$10,000	$ 40,000
F	Air Diffusers	ls	1	$15,000	$ 15,000
G	Submersible Centrifugal Pumps	ea	4	$35,000	$ 140,000
H	Electrical and Controls	ls	1	$50,000	$ 50,000
I	Miscellaneous Piping	ls	1	$20,000	$ 20,000
Total Estimated Construction Costs					**$ 413,500**
Contingency (20%)					$ 82,700
Engineering (20%)					$ 82,700
Project Management and Legal (5%)					$ 20,675
Total Project Budget Estimate					**$ 599,575**

Table 6.4b presents projected operations and maintenance costs associated with a new septage receiving station. These costs should be offset by discharge fees assessed to the septage haulers.

Table 6.4b – O&M Estimate for Septage Receiving Station

O&M Cost Estimate: Septage Receiving		
Description	Annual Cost	
Personnel Costs	$	5,000
Administrative Costs	$	100
Water/Waste Treatment Costs	$	100
Insurance Costs	$	0
Energy Costs	$	900
Process Chemical Costs	$	0
Monitoring & Testing Costs	$	0
Short Lived Asset Maintenance/Replacement	$	450
Professional Services	$	0
Residuals Disposal	$	1,040
Miscellaneous	$	0
Total	**$**	**7,590**

6.5. Priority 5: Project 9 – Aerobic Digester Aerator Upgrades.

The City should consider replacing the floating aerators with more efficient, more powerful, higher quality mixer/aerator units. The existing aerators are high-maintenance, prone to problems, dangerous for personnel to work on and not providing the necessary mixing and aeration for the solids aerobic digester.

Replacing the floating aerators with new, more efficient floating aerators is the most cost effective solution to providing air to the sludge digester. Table 6.5a provides the estimated cost to replace the existing aerator/mixer units.

Table 6.5a – Cost Estimate for Digester Aeration Upgrade

Replace Floating Aerator/Mixer						
ID	*Item Description*	*Unit*	*Quantity*	*Unit Cost*	*Item Cost*	
A	New Floating Aerator/Mixers	ea	4	$35,000	$	140,000
B	Installation of New Aerator/Mixers	ea	4	$28,000	$	112,000
C	Electrical	ls	1	$25,000	$	25,000
Total Estimated Construction Costs					**$**	**277,000**
Contingency (20%)					$	55,400
Engineering (20%)					$	55,400
Project Management and Legal (5%)					$	13,850
Total Project Budget Estimate					**$**	**401,650**

The following table provides estimated annual operations and maintenance costs for the replacement aeration equipment.

Table 6.5b – Estimated O&M Costs for Digester Aeration

O&M Cost Estimate: Replace Floating Aeration		
Description	Annual Cost	
Personnel Costs	$	5,000
Administrative Costs	$	200
Water/Waste Treatment Costs	$	0
Insurance Costs	$	0
Energy Costs	$	24,200
Process Chemical Costs	$	0
Monitoring & Testing Costs	$	0
Short Lived Asset Maintenance/Replacement	$	500
Professional Services	$	0
Residuals Disposal	$	0
Miscellaneous	$	0
Total	**$**	**29,900**
Present Worth Analysis		
Investment/Bond Rate		0.8%
Life Cycle Cost Analysis		20 yrs
Present Worth		**$645,705.61**

6.6. Priority 6: Project 8 – Outfall Diffuser

The use of a multi-port diffuser will maximize dispersion of effluent within the mixing zone. Better dispersion and mixing in the zone of immediate diffusion (ZID) will produce lower constituent concentrations in the regulatory mixing zone (RMZ) and will enhance dilution to further lower concentrations outside the mixing zone.

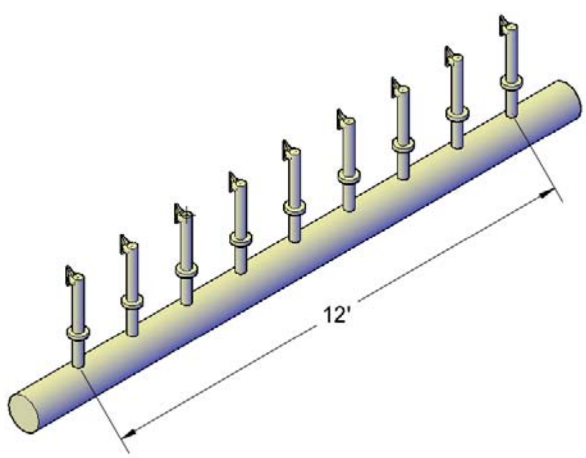

Figure 6.6a – Multi-Port Diffuser

6.6.1. Cost Estimates

The following table summarizes the projected cost estimates for installing a new effluent diffuser outfall.

Table 6.6 – Cost Estimate for Effluent Diffuser Outfall

Effluent Diffuser Outfall					
ID	***Item Description***	***Unit***	***Quantity***	***Unit Cost***	***Item Cost***
A	Install 8-inch Manifold, incl. Rock Exc	ls	1	$20,000	$ 20,000
B	Install 12-inch Pipe	lf	150	$250	$ 37,500
C	1-3/4 inch Diffuser Port	ls	9	$500	$ 4,500
D	1-3/4 inch Duckbill Check Valve	ls	9	$1,000	$ 9,000
E	Manhole	ls	1	$5,000	$ 5,000
F	Misc. In-stream Work	ls	1	$60,000	$ 60,000
G	Concrete Anchoring	ls	1	$5,000	$ 5,000
Total Estimated Construction Costs					**$ 141,000**
Contingency (20%)					$ 29,000
Engineering (20%)					$ 29,000
Project Management and Legal (5%)					$ 7,000
Environmental Permitting					$ 7,500
Total Project Budget Estimate					**$ 213,500**

The diffused outfall is not expected to result in annual O&M.

6.7. Priority 7: Project 7 – Disinfection Upgrade.

Currently, disinfection is achieved with closed-vessel ultra violet light units. The existing units are at the end of their useful life, are not energy efficient, tend to overheat during low-flow conditions and replacement parts are becoming difficult to obtain. The City should replace the disinfection system with open channel ultra violet light disinfection.

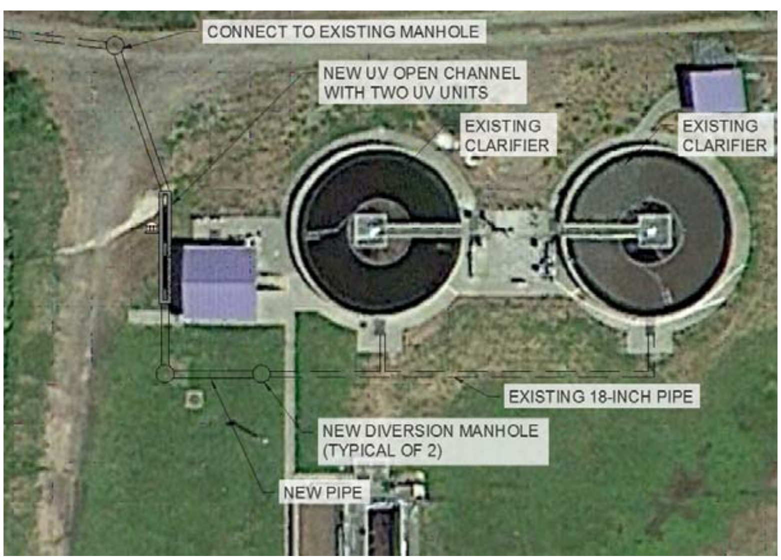

Figure 6.7a –Open Channel UV Disinfection

Figure 6.7a presents a possible layout adjacent to the existing disinfection facility with two (2) UV disinfection units in a new UV channel. The new UV installation must have UVI and UVT sensors. The layout is based on a 30-feet long, 1.5-feet wide, 4.5-feet deep channel. Table 6.7a provides a cost estimate for the proposed UV improvements.

Table 6.7a – Cost Estimate for UV Disinfection

Disinfection Alt. 2: UV Disinfection Cost Estimate					
ID	*Item Description*	*Unit*	*Quantity*	*Unit Cost*	*Item Cost*
A	UV Disinfection Equipment	ls	1	$160,000	$ 160,000
B	Concrete Channel	ls	1	$10,000	$ 10,000
C	New Manhole	ea	2	$5,000	$ 10,000
D	Misc. Piping	ls	1	$16,000	$ 16,000
E	Electrical	ls	1	$80,000	$ 80,000
F	Cover	ls	1	$25,000	$ 25,000
G	Controls and Integration	ls	1	$80,000	$ 80,000
Total Estimated Construction Costs					**$ 381,000**
Contingency (20%)					$ 76,200
Engineering (20%)					$ 76,200
Project Management and Legal (5%)					$ 19,050
Total Project Budget Estimate					**$ 552,450**

Table 6.7b summarizes the projected annual costs for operations and maintenance for UV disinfection at the treatment plant.

Table 6.7b – UV Disinfection O&M Estimate

O&M Cost Estimate: UV Channel	
Description	Annual Cost
Personnel Costs	$ 5,000
Administrative Costs	$ 0
Water/Waste Treatment Costs	$ 0
Insurance Costs	$ 0
Energy Costs	$ 3,077
Process Chemical Costs	$ 100
Monitoring & Testing Costs	$ 0
Short Lived Asset Maintenance/Replacement	$ 5,310
Professional Services	$ 0
Residuals Disposal	$ 0
Miscellaneous	$ 0
Total	**$ 13,487**
Present Worth Analysis	
"Real" Investment/Bond Rate	0.8%
Life Cycle Cost Analysis	20 yrs
Present Worth	**$291,250.89**

6.8. Priority 8: Project 8 – Effluent Disposal.

The effluent discharged from the treatment plant is diverted to the golf course in the summer, in accordance with the discharge permit. The recycled water is applied to the fairways and greens at the golf course. The city must rely on the private entity at the golf course for continued used of the recycled effluent. The City should make improvements to the temporary storage lagoons and secure the continued use of the golf course for reuse of the effluent.

The following cost estimate includes necessary improvements to on-site temporary storage lagoons. This estimate also assumes the relining of the existing lagoons.

Table 6.8 – Cost Estimate for Discharge to Golf Course

Effluent Disposal Alternative 1					
ID	***Item Description***	***Unit***	***Quantity***	***Unit Cost***	***Item Cost***
A	Deepen Existing Lagoons	ls	1	$270,000	$ 270,000
B	Line Existing Lagoons	ls	1	$360,000	$ 360,000
Total Estimated Costs					**$ 630,000**
Contingency (20%)					$ 126,000
Engineering (20%)					$ 126,000
Project Management and Legal (5%)					$ 31,500
Total Project Budget Estimate					**$ 913,500**

Installation of operation and maintenance costs.

6.9. Priority 9: Project 6 – Additional Blower.

The air supply system for the treatment plant is expected to reach capacity limits by the end of this 20-year planning cycle. The new blower will be installed in the existing blower building in the place previously designed for blower expansion.

The new blower will be sized to match the existing blowers and will function as a backup to the other blowers. The existing blowers are 50 HP Universal RAI Blowers manufactured by Roots/Dresser with an operating range from 226 to 1315 scfm.

Table 6.9a summarizes the expected costs for installing the new blower.

Table 6.9a – Cost Estimate for Additional Blower

Additional Blower					
ID	Item Description	Unit	Quantity	Unit Cost	Item Cost
A	50 HP, 1050 scfm Blower	ea	1	$55,000	$ 55,000
B	Controls, Including VFD	ls	1	$30,000	$ 30,000
C	Air Piping	ls	1	$20,000	$ 20,000
D	Electrical	ls	1	$25,000	$ 25,000
E	Integration	ls	1	$10,000	$ 10,000
Total Estimated Costs					**$ 140,000**
Contingency (20%)					$ 28,000
Engineering (20%)					$ 28,000
Project Management and Legal (5%)					$ 7,000
Total Project Budget Estimate					**$ 203,000**

Table 6.9b summarizes the projected annual costs for operations and maintenance for an additional blower at the treatment plant.

Table 6.9b – Additional Blower O&M Estimate

O&M Cost Estimate: Additional Blower	
Description	Annual Cost
Personnel Costs	$ 1,250
Administrative Costs	$ 0
Water/Waste Treatment Costs	$ 0
Insurance Costs	$ 0
Energy Costs	$ 0
Process Chemical Costs	$ 0
Monitoring & Testing Costs	$ 0
Short Lived Asset Maintenance/Replacement	$ 150
Professional Services	$ 0
Residuals Disposal	$ 0
Miscellaneous	$ 0
Total	**$ 1,400**

6.10. Priority 10: Project 4 – RV Receiving Station.

The City welcomes thousands of visitors and tourists each year, many of whom travel in recreational vehicles. A receiving station would allow RVs to discharge wastewater prior to entering surrounding roadways and highways. Two possible locations for a RV discharge receiving station are at the visitor center on the Caves Highway, just east of Highway 199 and at the City Pool on River Road, east of Highway 199. Both locations are viable and installation at either place should be similar cost, assuming the City owns the property and does not need to acquire easements or additional land.

Figure 6.10 shows a sample section detail of a similar RV discharge station.

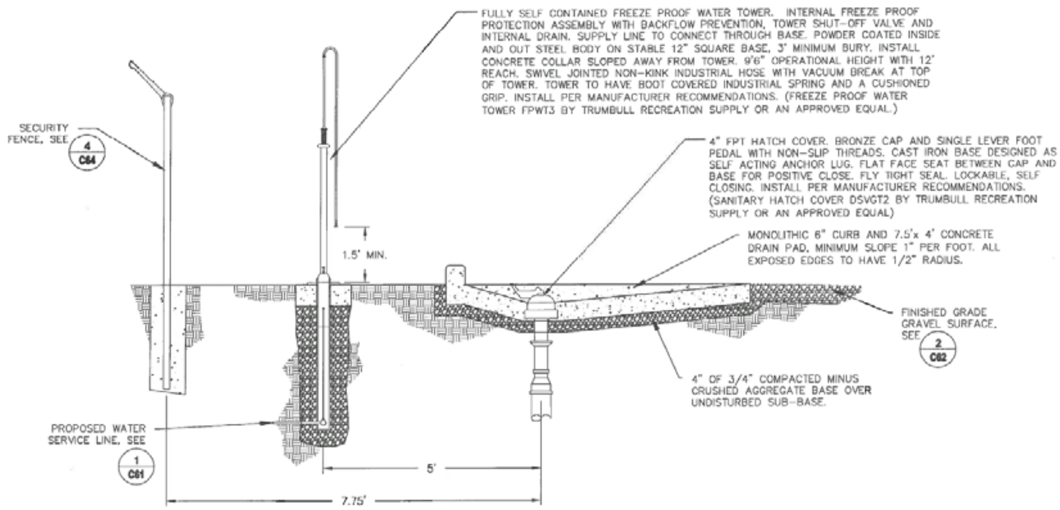

Figure 6.10 – RV Discharge Receiving Station Sample Detail

The following table provides probable cost estimate to install a new RV discharge facility.

Table 6.10a – RV Discharge Facility Capital Cost Estimate

New RV Receiving Station Cost Estimates					
ID	***Item Description***	***Unit***	***Quantity***	***Unit Cost***	***Item Cost***
A	Site Grading	ls	1	$10,000	$ 10,000
B	Sewer Improvements	ls	1	$30,000	$ 30,000
C	Water Improvements	ls	1	$20,000	$ 20,000
D	Electrical, Lighting and Security	ls	1	$15,000	$ 15,000
E	Site Improvements	ls	1	$20,000	$ 20,000
F	Landscaping	ls	1	$5,000	$ 5,000
Total Estimated Construction Costs					**$ 100,000**
Contingency (20%)					$ 20,000
Engineering (20%)					$ 20,000
Project Management and Legal (5%)					$ 5,000
Total Project Budget Estimate					**$ 145,000**

Table 6.10b summarizes the projected annual costs for operations and maintenance for an RV discharge facility.

Table 6.10b – RV Discharge Facility O&M Cost Estimate

O&M Cost Estimate: RV Receiving Station		
Description	Annual Cost	
Personnel Costs	$	3,000
Administrative Costs	$	1,000
Water/Waste Treatment Costs	$	3,000
Insurance Costs	$	0
Energy Costs	$	100
Process Chemical Costs	$	0
Monitoring & Testing Costs	$	300
Short Lived Asset Maintenance/Replacement	$	0
Professional Services	$	0
Residuals Disposal	$	0
Miscellaneous	$	0
Total	**$**	**7,400**

Operational and maintenance costs should be offset by fees associated with discharging wastewater.

6.11. Priority 11: Project 3 – Replace Headworks Screen.

Operation personnel have requested consideration of a new headworks screen. The existing automatic screen is a bar screen with ¾" bar spacing, which allows some inorganics to pass. Previously, ½" bar spacing was installed, which captured organics resulting in adverse effect to the aerated treatment process. Several alternative screens are presented above in Section 4. The following cost estimate assumes the average cost of a new headworks screen and the associated appurtenances.

Table 6.11 – Replace Headworks Capital Cost Estimate

Replace Headworks Screen Cost Estimates						
ID	*Item Description*	*Unit*	*Quantity*	*Unit Cost*	*Item Cost*	
A	New Headworks Screen	ls	1	$150,000	$	150,000
B	Remove and Install Screen	ls	1	$75,000	$	75,000
C	Electrical	ls	1	$38,000	$	38,000
D	Controls/Integration	ls	1	$38,000	$	38,000
Total Estimated Construction Costs					**$**	**301,000**
Contingency (20%)					$	60,200
Engineering (20%)					$	60,200
Project Management and Legal (5%)					$	15,050
Total Project Budget Estimate					**$**	**436,450**

Operation and maintenance costs of the headworks screen should not change with the installation of a new screen.

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APPENDIX A

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT
Department of Environmental Quality
Western Region – Salem Office
750 Front Street NE, Suite 120, Salem, OR 97301-1039
Telephone: (503) 378-8240

Issued pursuant to ORS 468B.050 and The Federal Clean Water Act

ISSUED TO:
Cave Junction, City of
PO Box 1396
Cave Junction, OR 97523

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Treated Wastewater	001	R.M. 54.6
Reclaimed Water Reuse	002	Level II Land Application
Reclaimed Water Reuse	002a	Level IV Land Application

FACILITY TYPE AND LOCATION:
Activated Sludge
Cave Junction STP
1300 Sawyer Avenue, Cave Junction
Treatment System Class: Level III
Collection System Class: Level II

RECEIVING STREAM INFORMATION:
Basin: Rogue
Sub-Basin: Illinois
Receiving Stream: Illinois River
LLID: 1240662425495 River Mile 54.6 D
County: Josephine

EPA REFERENCE NO: OR002833-9

Issued in response to Application No. 977798 received June 29, 2006. This permit is issued based on the land use findings in the permit record.

John J. Ruscigno

John J. Ruscigno, Water Quality Manager
Western Region North

February 28, 2007
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 and discharge to public waters adequately treated wastewaters only from the authorized discharge point or points established in Schedule A and only in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

Page

Unless specifically authorized by this permit, by another NPDES or WPCF permit, or by Oregon Administrative Rule, any other direct or indirect discharge of waste is prohibited, including discharge to waters of the state or an underground injection control system.

SCHEDULE A

1. **Waste Discharge Limitations not to be exceeded after permit issuance.**

a. Treated Effluent Outfall 001

(1) June 1 - October 31: No discharge to waters of the State except under the following conditions:

- During the month of June, discharge may continue as long as the seven day average stream flow exceeds 200 cfs as measured at USGS gage station 14377100 (Illinois River near Kerby, OR). Once the seven day average stream flow falls below 200m cfs, discharge is not permitted through Outfall 001 for the remainder of the season, unless the seven day average stream flow rises above 200 cfs in October. When discharging, the effluent limitations for the discharge period (November through May) will apply.

(2) November 1 - May 31:

Parameter	Average Effluent Concentrations Monthly	Weekly	Monthly* Average lb/day	Weekly* Average lb/day	Daily* Maximum lbs
BOD_5	30 mg/L	45 mg/L	56	84	110
TSS	30 mg/L	45 mg/L	56	84	110

* Average dry weather design flow to the facility equals 0.52 MGD. Winter mass load limits based upon average wet weather design flow to the former facility equaling 0.225 MGD. The daily mass load limit is suspended on any day in which the flow to the treatment facility exceeds 1.04 MGD (twice the design average dry weather flow of the plant).

(3)

Other parameters	*Limitations*
E. coli Bacteria	Shall not exceed 126 organisms per 100 mL monthly geometric mean. No single sample shall exceed 406 organisms per 100 mL. **(See Note 1)**
pH	Shall be within the range of 6.0 - 9.0
BOD_5 and TSS Removal Efficiency	Shall not be less than 85% monthly average for BOD_5 and TSS.
Excess Thermal Load (October 15-May 15)	Shall not exceed a weekly average of 4.1 million Kcals/day **(See Note 2)**

(4) No wastes may be discharged or activities conducted that cause or contribute to a violation of water quality standards in OAR 340-041 applicable to the Southern Oregon Coastal basin except as provided for in OAR 340-045-0080 and the following regulatory mixing zone:

The regulatory mixing zone is that portion of the Illinois River contained within a band extending out 50 feet from the right bank of the river and extending from a point ten feet upstream of the outfall to a point 100 feet downstream from the outfall. The Zone of Immediate Dilution (ZID) is defined as that portion of the regulatory mixing zone that is within ten feet of the point of discharge.

(5) Raw sewage discharges are prohibited to waters of the state except as allowed in Schedule F, Section B, Condition 6 of this permit. If an overflow occurs between May 22 and June 1, and if the permittee demonstrates to the Department's satisfaction that no increase in risk to beneficial uses occurred because of the overflow, no violation shall be triggered if the storm associated with the overflow was greater than the one-in-five-year, 24-hour duration storm.

b. Reclaimed Wastewater Outfall 002 (Level II Treatment – **(See Note 3)**

(1) No discharge to state waters is permitted. All reclaimed water shall be distributed on land, for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices so as to prevent:

a. Prolonged ponding of treated reclaimed 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.

(2) Prior to land application of the reclaimed water, it shall receive at least level II treatment as defined in OAR 340-055 to:

(a) Reduce Total Coliform to 240 organisms per 100 ml in two consecutive samples, and a seven-day median of 23 organisms per 100 ml.

(3) Irrigation shall conform to the irrigation management plan approved by the Department.

c. Reclaimed Wastewater Outfall 002a (Level IV Treatment – **(See Note 3)**

(1) No discharge to state waters is permitted. All reclaimed water shall be distributed on land, for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices so as to prevent:

a. Prolonged ponding of treated reclaimed 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.

(2) Prior to land application of the reclaimed water, it shall receive at least level IV treatment as defined in OAR 340-055 to:

(a) Reduce Total Coliform to a seven-day median of 2.2 organisms per 100 mL and a maximum of 23 organisms per 100 mL.

(b) Reduce turbidity to a 24-hour mean of 2 Nephelometric Turbidity Units (NTUs) with no more than five percent of the samples during a 24-hour period exceeding 5 NTUs.

(3) Irrigation shall conform to the irrigation management plan approved by the Department.

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

NOTES:

1. If a single sample exceeds 406 organisms per 100 mL, then five consecutive re-samples may be taken at four-hour intervals beginning within 48 hours after the original sample was taken. If the log mean of the five re-samples is less than or equal to 126 organisms per 100 mL, a violation shall not be triggered.

2. The Excess Thermal Load limit was based on the average dry weather design flow, an estimated dilution in the mixing zone and maximum allowable increase in stream temperature. This permit may be re-opened, and the Excess Thermal Load modified up or down, when more accurate effluent dilution data becomes available.

3. Reclaimed water use for the current facilities (Level II water) must comply with the limitations listed in Schedule B(1)(a) for Outfall 002. At such time as the reclaimed water use facilities are upgraded to produce Level IV water, the permittee must comply with the limitations listed in Schedule B(1)(b) for Outfall 002a.

SCHEDULE B

1. **Minimum Monitoring and Reporting Requirements** (unless otherwise approved in writing by the Department).
The permittee shall monitor the parameters as specified below at the locations indicated. The laboratory used by the permittee to analyze samples shall 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 shall be included in the report, but not used in calculations required by this permit. When possible, the permittee shall re-sample in a timely manner for parameters failing the QA/QC requirements, analyze the samples, and report the results.

a. Influent

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Measurement
Flow Meter Calibration	Annually	Verification
BOD_5	2/Week	Composite
TSS	2/Week	Composite
pH	3/Week	Grab

b. Treated Effluent Outfall 001

Item or Parameter	Minimum Frequency	Type of Sample
BOD_5	2/Week	Composite
TSS	2/Week	Composite
pH	3/Week	Grab
E. coli	Weekly	Grab **(See Note 1)**
UV Unit Lamps On-Line	Daily	Reading **(See Note 2)**
Pounds Discharged (BOD_5 and TSS)	2/Week	Calculation
Average Percent Removed (BOD_5 and TSS)	Monthly	Calculation
Effluent Temperature, Daily Max.	Daily	Grab **(See Note 3)**
Effluent Temperature, Average of Daily Maximums	Weekly	Calculation
Excess Thermal Load (October 15 – May 15)	Weekly	Calculation **(See Note 4)**
Stream Flow	Daily (reported as a seven day average flow)	Measurement **(See Note 5)**

c. Reclaimed Wastewater Outfall 002

Item or Parameter	Minimum Frequency	Type of Sample
Quantity Irrigated (inches/acre)	Daily	Measurement
Quantity Irrigated (MGD)	Daily	Measurement
UV Unit Lamps On-Line	Daily	Reading **(See Note 2)**
pH	2/Week	Grab
Total Coliform	1/Week	Grab
Nutrients (TKN, NO_2+NO_3-N, NH_3, Total Phosphorus)	Quarterly	Grab

d. Reclaimed Wastewater Outfall 002a

Item or Parameter	Minimum Frequency	Type of Sample
Quantity Irrigated (inches/acre)	Daily	Measurement
UV Unit Lamps On-Line	Daily	Reading **(See Note 2)**
pH	2/Week	Grab
Total Coliform	Daily	Grab
Turbidity	Hourly	Measurement
Nutrients (TKN, NO_2+NO_3-N, NH_3, Total Phosphorus)	Quarterly	Grab

e. Sludge Management (Cell #1)

Item or Parameter	Minimum Frequency	Type of Sample
Sludge Depth in Cell #1	Once prior to December 31, 2010	Representative Measurement

2. **Reporting Procedures**

a. Monitoring results shall be reported on approved forms. The reporting period is the calendar month. Reports must be submitted to the Department's Western Region - Salem office by the 15th day of the following month.

b. State monitoring reports shall 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 shall also identify each system classification as found on page one of this permit.

c. Monitoring reports shall 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.

3. **Report Submittals**

a. The permittee shall have in place a program to identify and reduce inflow and infiltration into the sewage collection system. An annual report shall be submitted to the Department by February 1 each year which details sewer collection maintenance activities that reduce inflow and infiltration. The report shall state those activities that have been done in the previous year and those activities planned for the following year.

b. By no later than February 15 of each year, the permittee shall submit to the Department an annual report describing the effectiveness of the reclaimed water system to comply with approved reclaimed water use plan, the rules of Division 55, and the limitations and conditions of this permit applicable to reuse of reclaimed water.

c. For any year in which biosolids are land applied, a report shall be submitted to the Department by February 19 of the following year that describes solids handling activities for the previous year and includes, but is not limited to, the required information outlined in OAR 340-050-0035(6)(a)-(e).

NOTES:

1. *E. coli* monitoring must be conducted according to any of the following test procedures as specified in **Standard Methods for the Examination of Water and Wastewater, 19th Edition,** or according to any test procedure that has been authorized and approved in writing by the Director or an authorized representative:

Method	Reference	Page	Method Number
mTEC agar, MF	Standard Methods, 18th Edition	9-29	9213 D
NA-MUG, MF	Standard Methods, 19th Edition	9-63	9222 G
Chromogenic Substrate, MPN	Standard Methods, 19th Edition	9-65	9223 B
Colilert QT	Idexx Laboratories, Inc.		

2. The number of UV lamps on line has a direct correlation with the performance of the units. The Permittee has two UV units that can be run separately or in series. The permittee will report daily on the DMR, the number of lamps that are on-line (8 total). Reporting will include an additional note on the DMR when the units are run in series. Overall performance of the units will be based on the *E.coli* results required on the effluent.

3. Permittee is required in Schedule C.4. of this permit to install a continuous temperature monitoring device that will enable the permittee to collect daily temperature data in accordance with Schedule B.1.b. of this permit. Until that time, the permittee will be allowed to report temperature at a minimum frequency of 5 days per week and use these data points for a weekly average to be used in the thermal load calculation.

4. Calculated as follows:
(Weekly average of daily maximum effluent temperatures in °C – the numeric criteria of 13°C) X (Weekly average of daily flow in MGD) X 3.785 = Excess Thermal load, in Million Kcals/day

5. Stream flow measurement must be obtained daily when discharging through Outfall 001 during June or October. Measurement must be obtained form the USGS gauge station#14377100 – Illinois River near Kerby, OR. The stream flow shall be reported daily as a running seven day average.

SCHEDULE C

Compliance Schedules and Conditions

1. By no later than December 31, 2007, the permittee shall submit to the Department for review and approval an updated plan and time schedule for identifying and reducing inflow. Within 60 days of receiving written Department comments, the permittee shall submit a final approvable program and time schedule. The program shall consist of the following:

   a. A program for identifying and removing all inflow sources into the permittee's sewer system over which the permittee has legal control; and

   b. If the permittee does not have the necessary legal authority for all portions of the sewer system or treatment facility, a program and schedule for gaining legal authority to require inflow reduction and a program and schedule for removing inflow sources.

   c. A plan to budget for and approve an adequate amount of money to be spent each year on I/I identification and removal projects.

2. By no later than February 1, 2008, the permittee will update the current septage management plan and submit for Department approval. The plan shall include at a minimum, the following:

   a. A method for adequate recordkeeping to describing how the funds generated from accepting septage are used to maintain or upgrade the septage station facilities;

   b. Recognition that acceptance of septage is not justification for upsets at the treatment plant or non-compliance with any condition or limitation set forth in the permit.

3. By no later than March 1, 2008, the permittee will submit to the Department a plan and schedule to install a pretreatment system that includes screening and grit removal adequate to handle septage received at the facility. Upon Department approval of the Plan, the permittee will implement the schedule to complete construction.

4. By no later than June 1, 2008, the permittee will install a continuous temperature monitoring device that will enable the permittee to collect daily temperature data in accordance with Schedule B.1.b. of this permit. Until that time, the permittee will be allowed to report temperature a minimum of five days per week and use these data points for a weekly average.

5. Three months prior to start-up of the new Level IV reclaimed water use system, permittee must submit a reclaimed water use plan for the new reuse facilities for Department approval.

6. Six months prior to the removal of accumulated solids from the lagoon, the permittee must submit to the Department a revised biosolids management plan developed in accordance with Oregon Administrative Rule 340, Division 50, "Land Application of Domestic Wastewater Treatment Facility Biosolids, Biosolids Derived Products, and Domestic Septage". Upon approval of the plan by the Department, the plan shall be implemented by the permittee.

7. The permittee is expected to meet the compliance dates which have been established in this schedule. Either prior to or no later than fourteen 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 may revise a schedule of compliance if he/she determines good and valid cause resulting from events over which the permittee has little or no control.

SCHEDULE D

Special Conditions

1. This permit may be modified to incorporate any applicable standard for biosolids use or disposal promulgated under section 405(d) of the Clean Water Act, if the standard for biosolids use or disposal is more stringent than any requirements for biosolids use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

2. The permittee shall meet the requirements for use of reclaimed water under Division 55, including the following:

   a. All reclaimed water shall be managed in accordance with the approved Reclaimed Water Use Plan. No substantial changes shall be made in the approved plan without written approval of the Department.

   b. No reclaimed water shall be released by the permittee to another person, as defined in Oregon Revised Statute (ORS) 468.005, for use unless there is a valid contract between the permittee and that person that meets the requirements of OAR 340-055-0015(9).

   c. The permittee shall notify the Department 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 Department offices are not open, the permittee shall report the incident of noncompliance to the Oregon Emergency Response System (Telephone Number 1-800-452-0311).

   d. No reclaimed water shall be made available to a person proposing to recycle unless that person certifies in writing that they have read and understand the provisions in these rules. This written certification shall be kept on file by the sewage treatment system owner and be made available to the Department for inspection.

3. Unless otherwise approved in writing by the Department, a deep-rooted, permanent grass cover shall be maintained on the land irrigation area at all times. Grass shall be periodically cut and removed to ensure maximum evapotranspiration and nutrient capture.

4. The permittee shall comply with Oregon Administrative Rules (OAR), Chapter 340, Division 49, "Regulations Pertaining To Certification of Wastewater System Operator Personnel" and accordingly:

   a. The permittee shall have its wastewater system supervised by one or more operators who are certified in a classification <u>and</u> grade level (equal to or greater) that corresponds with the classification (collection and/or treatment) of the system to be supervised as specified on page one of this permit.

Note: A "supervisor" is defined as the person exercising authority for establishing and executing the specific practice and procedures of operating the system in accordance with the policies of the permittee and requirements of the waste discharge permit. "Supervise" means responsible for the technical operation of a system, which may affect its performance or the quality of the effluent produced. Supervisors are not required to be on-site at all times.

   b. The permittee's wastewater system may not be without supervision (as required by Special Condition 4.a. above) for more than thirty days. During this period, and at any time that the supervisor is not available to respond on-site (i.e. vacation, sick leave or off-call), the permittee must make available another person who is certified at no less than one grade lower then the system classification.

   c. If the wastewater system has more than one daily shift, the permittee shall have the shift supervisor, if any, certified at no less than one grade lower than the system classification.

d. The permittee is responsible for ensuring the wastewater system has a properly certified supervisor available at all times to respond on-site at the request of the permittee and to any other operator.

e. The permittee shall notify the Department of Environmental Quality in writing within thirty days of replacement or redesignation of certified operators responsible for supervising wastewater system operation. The notice shall be filed with the Water Quality Division, Operator Certification Program, 400 East Scenic Drive, Suite 307, The Dalles, OR 97058. This requirement is in addition to the reporting requirements contained under Schedule B of this permit.

f. Upon written request, the Department may grant the permittee reasonable time, not to exceed 120 days, to obtain the services of a qualified person to supervise the wastewater system. The written request must include justification for the time needed, a schedule for recruiting and hiring, the date the system supervisor availability ceased and the name of the alternate system supervisor(s) as required by 4.b. above.

5. The permittee shall not be required to perform a hydrogeologic characterization or groundwater monitoring during the term of this permit provided:

   a. The facilities are operated in accordance with the permit conditions; and,

   b. There are no adverse groundwater quality impacts (complaints or other indirect evidence) resulting from the facility's operation.

   If warranted, at permit renewal the Department may evaluate the need for a full assessment of the facilities impact on groundwater quality.

6. Upon Department approval of the Septage Management Plan required in Schedule C.2. of this permit, the plan will become part of this permit. The permittee will discontinue acceptance of sludge at the facility should this activity create conditions which lead to non-compliance with permit limitations and conditions.

7. The permittee shall notify the DEQ Western Region - Medford Office (phone: (541) 776-6010) in accordance with the response times noted in the General Conditions of this permit, of any malfunction so that corrective action can be coordinated between the permittee and the Department.

SCHEDULE F
NPDES 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 the Clean Water Act, Oregon Revised Statutes (ORS) 468B.025, and 40 Code of Federal Regulations (CFR) Section 122.41(a), 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. Penalties for Water Pollution and Permit Condition Violations
ORS 468.140 allows the Department to impose civil penalties up to $10,000 per day for violation of a term, condition, or requirement of a permit. Additionally 40 CFR 122.41 (A) provides that any person who violates any permit condition, term, or requirement may be subject to a federal civil penalty not to exceed $25,000 per day for each violation.

Under ORS 468.943 and 40 CFR 122.41(a), unlawful water pollution, if committed by a person with criminal negligence, is punishable by a fine of up to $25,000 imprisonment for not more than one year, or both. Each day on which a violation occurs or continues is a separately punishable offense.

Under ORS 468.946, a person who knowingly discharges, places, or causes to be placed any waste into the waters of the state or in a location where the waste is likely to escape into the waters of the state is subject to a Class B felony punishable by a fine not to exceed $200,000 and up to 10 years in prison. Additionally, under 40 CFR 122.41(a) any person who knowingly discharges, places, or causes to be placed any waste into the waters of the state or in a location where the waste is likely to escape into the waters of the state is subject to a federal civil penalty not to exceed $100,000, and up to 6 years in prison.

3. Duty to Mitigate
The permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment. In addition, upon request of the Department, the permittee must correct any adverse impact on the environment or human health resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and have the permit renewed. The application must be submitted at least 180 days before the expiration date of this permit.

The Department may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

5. Permit Actions
This permit may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any term, condition, or requirement of this permit, a rule, or a statute
b. Obtaining this permit by misrepresentation or failure to disclose fully all material facts
c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge
d. The permittee is identified as a Designated Management Agency or allocated a wasteload under a Total Maximum Daily Load (TMDL)
e. New information or regulations
f. Modification of compliance schedules
g. Requirements of permit reopener conditions
h. Correction of technical mistakes made in determining permit conditions
i. Determination that the permitted activity endangers human health or the environment
j. Other causes as specified in 40 CFR 122.62, 122.64, and 124.5

The filing of a request by the permittee for a permit modification, revocation or reissuance, termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

6. Toxic Pollutants
The permittee must comply with any applicable effluent standards or prohibitions established under Oregon Administrative Rules (OAR) 340-041-0033 for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

7. Property Rights and Other Legal Requirements
The 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 private rights, or any infringement of federal, tribal, state, or local laws or regulations.

8. Permit References
Except for effluent standards or prohibitions established under OAR 340-041-0033 for toxic pollutants and standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act, all rules and statutes referred to in this permit are those in effect on the date this permit is issued.

9. 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
The permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems that are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Need to Halt or Reduce Activity Not a Defense
For industrial or commercial facilities, upon reduction, loss, or failure of the treatment facility, the permittee must, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It is not a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities

a. Definitions
(1) "Bypass" means intentional diversion of waste streams from any portion of the treatment facility. The term "bypass" does not apply if the diversion does not cause effluent limitations to be exceeded, provided the diversion is to allow essential maintenance to assure efficient operation or the diversion is due to nonuse of nonessential treatment units or processes at the treatment facility.
(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities or treatment processes that causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Prohibition of bypass.
(1) Bypass is prohibited unless:
(a) Bypass was necessary to prevent loss of life, personal injury, or severe property damage;
(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventative maintenance; and
(c) The permittee submitted notices and requests as required under General Condition B.3.c.
(2) The Department may approve an anticipated bypass, after considering its adverse effects and any alternatives to bypassing, when the Department determines that it will meet the three conditions listed above in General Condition B.3.b.(1).

c. Notice and request for bypass.
(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, a written notice must be submitted to the Department at least ten days before the date of the bypass.
(2) Unanticipated bypass. The permittee must submit notice of an unanticipated bypass as required in General Condition D.5.

4. Upset

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operation error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of General Condition B.4.c are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
(1) An upset occurred and that the permittee can identify the causes(s) of the upset;
(2) The permitted facility was at the time being properly operated;
(3) The permittee submitted notice of the upset as required in General Condition D.5, hereof (24-hour notice); and
(4) The permittee complied with any remedial measures required under General Condition A.3 hereof.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

5. Treatment of Single Operational Upset
For purposes of this permit, A Single Operational Upset that leads to simultaneous violations of more than one pollutant parameter will be treated as a single violation. A single operational upset is an exceptional incident that causes simultaneous,

unintentional, unknowing (not the result of a knowing act or omission), temporary noncompliance with more than one Clean Water Act effluent discharge pollutant parameter. A single operational upset does not include Clean Water Act violations involving discharge without a NPDES permit or noncompliance to the extent caused by improperly designed or inadequate treatment facilities. Each day of a single operational upset is a violation.

6. Overflows from Wastewater Conveyance Systems and Associated Pump Stations

a. Definitions

(1) "Overflow" means the diversion and discharge of waste streams from any portion of the wastewater conveyance system including pump stations, through a designed overflow device or structure, other than discharges to the wastewater treatment facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the conveyance system or pump station which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of an overflow.

(3) "Uncontrolled overflow" means the diversion of waste streams other than through a designed overflow device or structure, for example to overflowing manholes or overflowing into residences, commercial establishments, or industries that may be connected to a conveyance system.

b. Prohibition of storm related overflows. Storm related overflows of raw sewage are prohibited to waters of the State. However, the Environmental Quality Commission (EQC) recognizes that it is impossible to design and construct a conveyance system that will prevent overflows under all storm conditions. The State of Oregon has determined that all wastewater conveyance systems should be designed to transport storm events up to a specific size to the treatment facility. Therefore, such storm related overflows will not be considered a violation of this permit if:

(1) The permittee has conveyance and treatment facilities adequate to prevent overflows except during a storm event greater than the one-in-five-year, 24-hour duration storm from November 1 through May 21 and except during a storm event greater than the one-in-ten-year, 24-hour duration storm from May 22 through October 31. However, overflows during a storm event less than the one-in-five-year, 24-hour duration storm from November 1 through May 21 are also not permit violations if, the permittee had separate sanitary and storm sewers on January 10, 1996, had experienced sanitary sewer overflows due to inflow and infiltration problems, and has submitted an acceptable plan to the Department to address these sanitary sewer overflows by January 1, 2010;

(2) The permittee has provided the highest and best practicable treatment and/or control of wastes, activities, and flows and has properly operated the conveyance and treatment facilities in compliance with General Condition B.1.;

(3) The permittee has minimized the potential environmental and public health impacts from the overflow; and

(4) The permittee has properly maintained the capacity of the conveyance system.

c. Prohibition of other overflows. All overflows other than stormwater-related overflows (discussed in Schedule F, Section B, Condition 6.b.) are prohibited unless:

(1) Overflows were unavoidable to prevent an uncontrolled overflow, loss of life, personal injury, or severe property damage;

(2) There were no feasible alternatives to the overflows, such as the use of auxiliary pumping or conveyance systems, or maximization of conveyance system storage; and

(3) The overflows are the result of an upset as defined in General Condition B.4. and meeting all requirements of this condition.

d. Uncontrolled overflows are prohibited where wastewater is likely to escape or be carried into the waters of the State by any means.

e. Reporting required. Unless otherwise specified in writing by the Department, all overflows and uncontrolled overflows must be reported orally to the Department within 24 hours from the time the permittee becomes aware of the overflow. Reporting procedures are described in more detail in General Condition D.5. Reports concerning storm related overflows must include information about the amount and intensity of the rainfall event causing the overflow.

7. Public Notification of Effluent Violation or Overflow

If effluent limitations specified in this permit are exceeded or an overflow occurs, upon request by the Department, the permittee must take such steps as are necessary to alert the public about the extent and nature of the discharge. 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.

8. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must be disposed of in such a manner as to prevent any pollutant from such materials from entering waters of the state, causing nuisance conditions, or creating a public health hazard.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling

Sampling and measurements taken as required herein must be representative of the volume and nature of the monitored discharge. All samples must be taken at the monitoring points specified in this permit, and shall be taken, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water, or substance. Monitoring points may not be changed without notification to and the approval of the Department.

2. Flow Measurements
Appropriate flow measurement devices and methods consistent with accepted scientific practices must be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices must be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with the accepted capability of that type of device. Devices selected must be capable of measuring flows with a maximum deviation of less than ± 10 percent from true discharge rates throughout the range of expected discharge volumes.

3. Monitoring Procedures
Monitoring must be conducted according to test procedures approved under 40 CFR part 136, unless other test procedures have been specified in this permit.

4. Penalties of Tampering
The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit may, upon conviction, be punished by a fine of not more than $10,000 per violation, imprisonment for not more than two years, or both. If a conviction of a person is for a violation committed after a first conviction of such person, punishment is a fine not more than $20,000 per day of violation, or by imprisonment of not more than four years, or both.

5. Reporting of Monitoring Results
Monitoring results must be summarized each month on a Discharge Monitoring Report form approved by the Department. The reports must be submitted monthly and are to be mailed, delivered or otherwise transmitted by the 15th day of the following month unless specifically approved otherwise in Schedule B of this permit.

6. Additional Monitoring by the Permittee
If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR part 136 or as specified in this permit, the results of this monitoring must be included in the calculation and reporting of the data submitted in the Discharge Monitoring Report. Such increased frequency must also be indicated. For a pollutant parameter that may be sampled more than once per day (e.g., Total Chlorine Residual), only the average daily value must be recorded unless otherwise specified in this permit.

7. Averaging of Measurements
Calculations for all limitations that require averaging of measurements must utilize an arithmetic mean, except for bacteria which shall be averaged as specified in this permit.

8. *Retention of Records*
Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 CFR part 503). The permittee must retain records of all monitoring information, including: all calibration, maintenance records, all original strip chart recordings for continuous monitoring instrumentation, 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. This period may be extended by request of the Department at any time.

9. Records Contents

Records of monitoring information must include:
a. The date, exact place, time, and methods of sampling or measurements;
b. The individual(s) who performed the sampling or measurements;
c. The date(s) analyses were performed;
d. The individual(s) who performed the analyses;
e. The analytical techniques or methods used; and
f. The results of such analyses.

10. Inspection and Entry

The permittee must allow the Department representative upon the presentation of credentials to:
a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and
d. *Sample or monitor at reasonable times,* for the purpose of assuring permit compliance or as otherwise authorized by state law, any substances or parameters at any location.

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes
The permittee must comply with OAR chapter 340, division 52, "Review of Plans and Specifications" and 40 CFR Section 122.41(l) (1). Except where exempted under OAR chapter 340, division 52, no construction, installation, or modification involving disposal systems, treatment works, sewerage systems, or common sewers may be commenced until the plans and specifications are submitted to and approved by the Department. The permittee must give notice to the Department as soon as possible of any planned physical alternations or additions to the permitted facility.

2. Anticipated Noncompliance
The permittee must give advance notice to the Department of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

3. Transfers
This permit may be transferred to a new permittee provided the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of the permit and the rules of the Commission. No permit may be transferred to a third party without prior written approval from the Department. The Department may require modification, revocation, and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Clean Water Act (see 40 CFR Section 122.61; in some cases, modification or revocation and reissuance is mandatory).. The permittee must notify the Department when a transfer of property interest takes place.

4. Compliance Schedule
Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any compliance schedule of this permit must be submitted no later than 14 days following each schedule date. Any reports of noncompliance must include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements.

5. 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) within 24 hours, unless otherwise specified in this permit, from the time the permittee becomes aware of the circumstances. 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).

A written submission must also be provided within 5 days of the time the permittee becomes aware of the circumstances. Pursuant to ORS 468.959 (3) (a), if the permittee is establishing an affirmative defense of upset or bypass to any offense under ORS 468.922 to 468.946, delivered written notice must be made to the Department or other agency with regulatory jurisdiction within 4 (four) calendar days of the time the permittee becomes aware of the circumstances. The written submission must contain:

a. A description of the noncompliance and its cause;
b. The period of noncompliance, including exact dates and times;
c. The estimated time noncompliance is expected to continue if it has not been corrected;
d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and
e. Public notification steps taken, pursuant to General Condition B.7

The following must be included as information that must be reported within 24 hours under this paragraph:

f. Any unanticipated bypass that exceeds any effluent limitation in this permit;
g. Any upset that exceeds any effluent limitation in this permit;
h. Violation of maximum daily discharge limitation for any of the pollutants listed by the Department in this permit; and
i. Any noncompliance that may endanger human health or the environment.

The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

6. Other Noncompliance
The permittee must report all instances of noncompliance not reported under General Condition D.4 or D.5, at the time monitoring reports are submitted. The reports must contain:

a. A description of the noncompliance and its cause;
b. The period of noncompliance, including exact dates and times;
c. The estimated time noncompliance is expected to continue if it has not been corrected; and
d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

7. Duty to Provide Information
The permittee must furnish to the Department within a reasonable time any information that the Department may request to determine compliance with this permit. The permittee must also furnish to the Department, upon request, copies of records required to be kept by this permit.

Other Information: When the permittee becomes aware that it has failed to submit any relevant facts or has submitted incorrect information in a permit application or any report to the Department, it must promptly submit such facts or information.

8. Signatory Requirements
All applications, reports or information submitted to the Department must be signed and certified in accordance with 40 CFR Section 122.22.

9: Falsification of Information
Under ORS 468.953, any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, is subject to a Class C felony punishable by a fine not to exceed $100,000 per violation and up to 5 years in prison. Additionally, according to 40 CFR 122.41(k)(2), any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a federal civil penalty not to exceed $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

10. Changes to Indirect Dischargers
The permittee must provide adequate notice to the Department of the following:

a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of the Clean Water Act if it were directly discharging those pollutants and;
b. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

c. For the purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

SECTION E. DEFINITIONS

1. *BOD* means five-day biochemical oxygen demand.
2. *CBOD* means five day carbonaceous biochemical oxygen demand
3. *TSS* means total suspended solids.
4. "*Bacteria*" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.
5. *FC* means fecal coliform bacteria.
6. *Total residual chlorine* means combined chlorine forms plus free residual chlorine
7. *Technology based permit effluent limitations* means technology-based treatment requirements as defined in 40 CFR Section 125.3, and concentration and mass load effluent limitations that are based on minimum design criteria specified in OAR Chapter 340, Division 41.
8. *mg/l* means milligrams per liter.
9. *kg* means kilograms.
10. *m^3/d* means cubic meters per day.
11. *MGD* means million gallons per day.
12. 24-hour *Composite sample* means a sample formed by collecting and mixing discrete samples taken periodically and based on time or flow. The sample must be collected and stored in accordance with 40 CFR part 136.
13. *Grab sample* means an individual discrete sample collected over a period of time not to exceed 15 minutes.
14. *Quarter* means January through March, April through June, July through September, or October through December.
15. *Month* means calendar month.
16. *Week* means a calendar week of Sunday through Saturday.
17. *POTW* means a publicly owned treatment works.

State of Oregon
Department of Environmental Quality

National Pollutant Discharge Elimination System

PERMIT EVALUATION AND FACT SHEET

December 7, 2006

Oregon Department of Environmental Quality

Western Region
1102 Lincoln St., Ste. 210
Eugene, OR 97401
(541) 686-7838

Permittee:	City of Cave Junction PO Box 1396 Cave Junction, OR 97523 File Number: 15243
Current Permit:	NPDES Permit Number: 102610 EPA Reference Number: OR002833-9 Issue Date: October 9, 2002 Expiration Date: December 31, 2006
Source Information:	City of Cave Junction Wastewater Treatment Facilities 1300 Sawyer Avenue
Source Contact:	Mike Bollweg - Treatment Plant Operator Telephone Number: 541-592-4590
Proposed Action:	NPDES Minor Domestic Permit Renewal Application Number: 977798 Date Received: June 29, 2006
Permit Writer:	Julie M. Berndt Phone: 541-687-7342

INTRODUCTION

City of Cave Junction operates a wastewater treatment facility located in Cave Junction, Oregon. Wastewater is treated and discharged to the Illinois River at River Mile 54.6 in accordance with National Pollutant Discharge Elimination System (NPDES) Permit number 102610. The Permit for the facility was issued on October 9, 2002 and expires on December 31, 2006. The permit will remain in effect until action is taken on this renewal application.

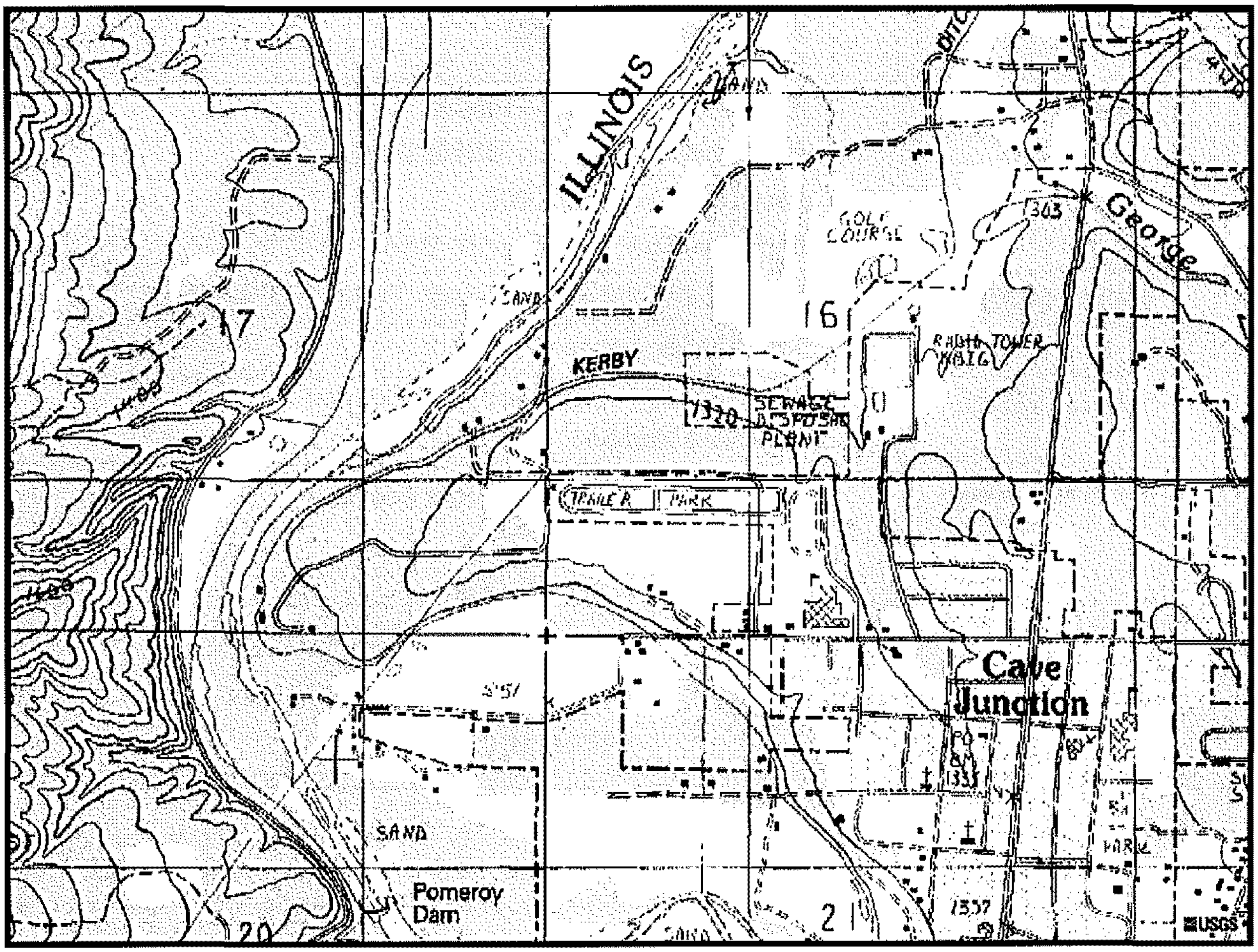
The Department received a renewal application on November 15, 2006. A renewal permit is necessary to discharge to state waters pursuant to provisions of Oregon Revised Statutes (ORS) 468B.050 and the Federal Clean Water Act. The Department proposes to renew the permit.

FACILITY DESCRIPTION

Background

The Cave Junction wastewater treatment facility (WWTF) was originally placed into operation in 1963. The facility consisted of stabilization lagoons with chlorination and discharge to the Illinois River in the winter. Population growth increased the flows to the lagoon, to the point where effluent could not always be held for the entire summer season. In addition, permit limits could not be consistently met during the discharge season. An expansion was completed 1977 which included the construction of a Cantex package activated sludge plant with chlorination and winter discharge. The City still utilized the stabilization lagoons for high flow events that exceeded the peak hydraulic capacity of the plant (0.3 MGD).

By the mid 1990's population growth had again increased the flows beyond the capacity of the package plant. In addition, the package plant had reached the end of its useful lifespan and was wearing out. A completely new plant was designed and built in 1998. Once the new plant was on-line, the old plant was demolished. The only part of the old plant that was retained was the effluent holding pond.



Current Facility Description

The collection system has four lift stations that pump flow to the headworks of the facility. Flow enters the plant through the headworks which consist of a hand raked and mechanical bar screen which goes to an auger type screenings compactor. Flow is then measured by a parshall flume and ultrasonic flow measurement device, and is followed by grit removal. Wastewater then enters a two basin anoxic/anaerobic selector activated sludge process. The process utilizes fine bubble diffusers in the basins. This is followed by clarification in two 45' diameter secondary clarifiers and ultraviolet disinfection before winter discharge to Outfall 001 (Illinois River) or summer discharge to Outfall 002 (irrigation to golf course). Sludge from the process is wasted to an aerated sludge lagoon and then stored in a facultative sludge lagoon. Sludge has not yet been removed from the lagoon since it was built as part of the new plant.

The former three cell lagoon system is utilized for summer storage prior to being pumped to the irrigation lagoon at the Illinois Valley Golf Course. A predetermined level is maintained in the lagoon during the summer months to protect the integrity of the lagoon lining. The lagoons are emptied as much as is possible in the winter months and used as stormwater storage for the facility.

The design average dry weather flow (DADWF) of the plant is 0.52 MGD and the design average wet weather design flow (DAWWF) is 0.87 MGD, with room for expansion for future population growth. The design flows were determined by the engineer who designed the facility. It is the estimated maximum flow during the two periods (expressed as a daily average flow), at which the design engineer expects the treatment facility can still consistently meet all effluent limits. The current actual average dry weather flow for June 1 to October 31, for the past two years, is 0.196 MGD and the current actual wet weather flow for November 1 to May 31 is 0.369 MGD with a maximum daily flow of 1.725 MGD. See the section on Inflow and Infiltration for a further discussion of winter flows and hydraulic capacity issues.

Operational Problems

Headworks

The bar openings for the screen in the headworks of the plant are a bit small for the facility and excess material that should be processed in the plant tends to hang up on the screen. Funds to replace the screen have not been available to date. The rakings go through a washer unit before going to a dumpster for landfill disposal. Because of the excess material captured by the screen, the washer is overloaded and is not doing as efficient a job as it should. The screen should be modified or replaced when funding becomes available.

UV Disinfection System

There have been problems with the UV system during low flows to the plant, particularly during low summertime flows. At these times the stock effluent weir does not keep the UV bulbs submerged, causing the bulbs to overheat and burn out. The staff have added a removable plate to the weir that maintains a higher water level past the bulbs. This does, however, affect the accuracy of the effluent flow meter. The plant staff have attempted to re-calibrate the effluent meter; however, the accuracy may be questionable under these circumstances. This permit will require only influent flow measurement to be used for compliance purposes because of the unreliability of the effluent meter caused by these conditions.

Storage Lagoons

The site has three effluent storage lagoons, which are the only remaining part of the old treatment facility. All three are reportedly lined with clay. During the most recent inspection, bank condition on all three appeared good with no slumping or erosion noted. There are no valves between the lagoons, so they essentially function as one large lagoon.

The effluent from the storage ponds can be directed to Outfall (001) or (002), however if any of the stored effluent has not previously met the disinfection limits prior to storage, the contents of the storage lagoons must be returned back to the plant and meet discharge requirements prior to discharge.

Typical operation therefore requires that once river discharge is permitted starting November 1st of each year, the contents of the storage lagoons are pumped back up to the treatment plant headworks, reprocessed through the plant, and discharged to the Illinois River. The City is looking into adding the necessary equipment to be able to re-use (irrigate) the storage lagoon contents, which would save considerable labor and expense of re-processing this effluent. The Department recommends this modification/upgrade be completed as soon as funds become available.

Septage Management

The permittee has a Septage management plan, but the plan has not been updated or made current for some time. Acceptance of septage at the facility is allowed; however, the management of the septage itself and the facility need to be modified accordingly to ensure that acceptance of septage does not result in violations of the permit, or create problems for the rest of the treatment plant or its treatment efficiency.

To ensure that proper management of septage is incorporate into the permit and that the facilities are maintained in a manner that deals properly with septage, Schedule C of the permit requires the following:

- By no later than February 1, 2008 the permittee will update the current septage management plan and submit for Department approval. The plan shall include at a minimum, the following:

  a. A method for adequate recordkeeping to describing how the funds generated from accepting septage are used to maintain or upgrade the septage station facilities;
  b. Recognition that acceptance of septage is not justification for upsets at the treatment plant or non-compliance with any condition or limitation set forth in the permit;

- By no later than March 1, 2008, the permittee will submit to the Department a plan and schedule to install a pretreatment system that includes screening and grit removal adequate to handle septage received at the facility. Upon Department approval of the Plan, the permittee will implement the schedule to complete construction.

Facility Classification

OAR 340-49-025 lists the criteria for classification of wastewater treatment plants based on parameters including, but not limited to type and complexity of process, design flow, population served, and effluent requirements. Based on an evaluation **(see Attachment #2),** the treatment facility has been classified as a Class III system. This classification is the same as the current permit. Treatment plant supervisor and operator(s) classification requirements will need to meet the necessary criteria for this level of classification. The collection system classification also remains the same (Level II).

Biosolids Management and Utilization

Waste sludge accumulates in a facultative sludge lagoon. A Biosolids Management Plan must be submitted six months prior to removing any biosolids from the lagoon. It is anticipated that biosolids will be land applied at agronomic rates after approval of application sites and a biosolids management plan by the Department.

No beneficial land application will be allowed under this permit until a Biosolids Management Plan is submitted by the permittee and is approved by the Department. The Biosolids Management Plan will ensure compliance with the federal biosolids regulations (40 CFR Part 503).

Biosolids are handled in a two-stage process. The first stage is aerobic digestion. Waste secondary sludge is pumped to the aerobic digester which is surface aerated and is designed for a retention time of 60 days with a 1.5% solids inventory. The digester is an open lagoon, with four floating mixers (aerators). The mixers are on timers, and the timers and number of running units are seasonally adjusted to maintain proper dissolved oxygen levels and minimise odors. The aerobic digester lagoon is lined with a synthetic liner.

After digestion, the contents are transferred to the Facultative Sludge Lagoon (FSL). The FSL is not equipped with aerators at this time, but is also lined with a synthetic material. The wiring is in place to add aerators in the future if needed. Decant from the FSL flows back to the headworks. The control valve is normally left open, maintaining the FSL at a constant level. The lagoon has been in service since 1998, and has not yet required solids to be removed. Solids accumulation was measured last year, and there is currently about eighteen inches of solids in the FSL. The depth is maintained at twelve feet, so there is a large amount of capacity remaining.

The permittee will be required to measure and report the biosolids accumulation in the lagoon once during this permit cycle prior to December 31, 2010. It is not anticipated that the permittee will have to remove sludge from the lagoon during this permit cycle.

Reclaimed Water

Treated wastewater may be beneficially land applied through Outfall 002. The permittee currently stores water in a lagoon which is then pumped to the 58 acre golf course adjacent to the treatment plant for irrigation of treated wastewater that meets Level II treatment requirements. The City has a contract with the golf course to apply the reclaimed water. This is in accordance with the requirements of OAR Chapter 340, Division 55, "Regulations Pertaining to the Use of Reclaimed Water (Treated Effluent) from Sewage Treatment Plants".

The current permits requires that the wastewater receive secondary treatment and disinfection to reduce Total Coliform to a seven day median of no greater than 23 organisms/100 mL with no two consecutive samples exceeding 240 organisms/100 mL.

The permittee is planning to build new treatment facilities that will treat to Level IV reclaimed water as follows:

(a) Reduce Total Coliform to a seven-day median of 2.2 organisms per 100 mL and a maximum of 23 organisms per 100 mL.

(b) Reduce turbidity to a 24-hour mean of 2 Nephelometric Turbidity Units (NTUs) with no more than five percent of the samples during a 24-hour period exceeding five NTUs.

Schedule C of the proposed permit requires that the City submit a new Reclaimed Water Use Plan for Department approval at such time as the new Level IV treatment facilities are built and placed into operation. This plan will be due by no later than three months prior to start-up of the facilities. Following Department approval, the land application of wastewater shall conform to the Department approved plan.

Inflow and Infiltration (I/I)

Inflow and Infiltration are still a significant problem and result in a reduction of the hydraulic and organic capacity of the treatment works. Data from the discharge monitoring reports (DMRs) suggest that wintertime storm events have a large influence on the amount of flow to the plant, suggesting that inflow is a big portion of the I/I. Based on the I/I report submitted by the permittee with the application for permit renewal, 22% of the flow on an annual basis is likely due to I/I into the collection system. During maximum flow events to the plant, it is estimated that as much as 85% of the flow comes from I/I. It is critical that the permittee allocate sufficient funds annually to remove I/I from the collection system in order to maintain current hydraulic capacity, to reduce costs at the treatment plant for treating the extraneous water that comes into the collection system, and to continue to be able to meet the current permit limits.

The removal efficiency requirement for BOD and TSS will become more difficult to meet as the influent strength of the raw wastewater continues to become more dilute.

The effluent mass load limitations listed in Schedule A of the permit for BOD5 and TSS are based on the design average wet weather flow (DAWWF) of the previous treatment plant of 0.225.

As a condition of the Department approving these wintertime mass load limits, the permittee is required to submit an updated inflow identification and removal program for Department approval as outlined in Schedule C.1. of this proposed permit. Inflow is defined as that portion of extraneous water that enters the collection system that can be cost effectively and relatively easily removed; it is generally from such sources as leaky manholes and roof drain or other stormwater connections. This plan is required to include the minimum amount of capital expenditure that will be budgeted per year for the collection system work.

Following approval, the permittee must implement the program. Schedule B requires that the permittee submit an annual report describing I/I identification and reduction activities completed in the past year, and a description of the work planned for the upcoming year.

No overflows have been occurring in the collection system or at the plant.

Pretreatment

The permittee does not have a formal pretreatment program, nor is one required for this source.

Groundwater

A Groundwater Prioritization Evaluation was completed as part of this permit evaluation **(see Attachment #3).** Based on the Department's current information, this facility has a low potential for adversely impacting groundwater quality.

The sludge lagoons are lined with synthetic liners, and the holding lagoons are clay lined and are only used to store treated wastewater. Past compliance inspections have documented that the lagoons appear to have good wall integrity. There are monitoring wells at the site that were used for monitoring groundwater for the former plant. They are not currently required to be sampled. Potential groundwater impacts will be evaluated again at the next permit renewal.

Schedule D of the proposed permit states that no groundwater evaluations will be required during this permit cycle. The permit also includes a condition in Schedule A that prohibits any adverse impact on groundwater quality.

Pollutants Discharged

The current permit allows the City of Cave Junction to discharge treated effluent from the wastewater treatment plant to the Illinois River from November 1 through May 31. The current permit sets limits on the following pollutants for discharge to the Illinois River: Five-day Biochemical Oxygen Demand (CBOD5), Total Suspended Solids (TSS), and *E.coli* bacteria. The discharge is also regulated for pH and pollutant removal efficiency. The permit also sets limits for Total Coliform bacteria for Outfall 002 which is irrigated on the golf course from June 1 through October 31.

Outfalls

Outfall 001

Treated wastewater is discharged to the Illinois River from Outfall 001 at river mile 54.6 during the winter. The outfall is a single port 24 inch diameter pipe that discharges from the bank of the river. The outfall may be exposed during times of low river flows, but otherwise is submerged. The effluent line is 3,340 feet from the plant to the river discharge point.

During the last permit renewal following completion of the new treatment facility, the City requested to have discharge based on stream flow during the winter "shoulder months". During wet years, the golf course requires less water for irrigation and the City has had difficulty in storing all the generated treated effluent. The City's engineers (Brown and Caldwell), submitted several documents that provided information regarding the impacts to the Illinois River and requested that the permit allow discharge during the months of May and October, when stream flows are adequate.

DEQ engineering staff reviewed the request and determined that the extended discharge season could be allowed, provided the mass loads in the current permit are used and, expanding the discharge season into spring and early summer when river flows exceed 200 cfs would not cause a measurable decrease in the DO concentration of the Illinois River. Likewise, allowing for discharge in October when stream flows exceed 200 cfs should not cause a measurable decrease in the DO concentration of the Illinois River. The same discharge season is proposed for this permit renewal.

Outfall 002

In the summertime, treated wastewater is discharged to the former three cell lagoon system. The effluent is then pumped through Outfall 002 to the Illinois Valley Golf Course irrigation pond where it is beneficially land applied to the golf course in accordance with the Department approved Reclaimed Water Use Plan. The lagoon system is used for extra storage in the summer when needed. If the permittee improves the treatment facilities for beneficial reuse of wastewater during this proposed permit cycle to Level IV treatment, the limitations and monitoring requirements will be listed for Outfall 002a in the proposed permit.

Mixing Zone Analysis

Federal regulations (40 CFR 131.13) allow for the use of mixing zones, also known as "allocated impact zones". When using mixing zones acute toxicity to drifting organisms must be prevented and the integrity of the waterbody as a whole may not be impaired. Mixing zones allow the initial mixing of waste and receiving water, but are not designed to allow for treatment. EPA does not have specific regulations pertaining to mixing zones. Each state must adopt its own mixing zone regulations that are subject to review and approval by EPA. In States that lack approved mixing zone regulations, ambient water quality standards must be met at the end of the pipe.

The Department has adopted the two-number aquatic life criteria and developed mixing zone regulations with respect to that. The regulations are primarily narrative and essentially require the permit writer to use best professional judgment in establishing the size of the mixing zone. Based on EPA guidance and the Department's mixing zone regulations, two mixing zones may be developed for each discharge that reflect acute and chronic effects: 1) The acute mixing zone, also known as the "zone of initial dilution" (ZID), and 2) the chronic mixing zone, usually referred to as "the mixing zone". The acute mixing zone is designed to prevent lethality to organisms passing through the ZID. The chronic mixing zone is designed to protect the integrity of the entire water body as a whole. The allowable size of the mixing zone should be based upon the relative size of the discharge to the receiving stream, the beneficial uses of the receiving stream, location of other discharges to the same water body, location of drinking water intakes, and other considerations. More specific guidance is available from EPA regarding criteria used in appropriately sizing a ZID. Primarily the ZID must be designed to prevent lethality to drifting organisms.

The Department's mixing zone regulations state the mixing zone must be less than the total stream width as necessary to allow passage of fish and other aquatic organisms. Early recommendations regarding the size of the zone of passage originated from the Department of Interior (1968). They recommended a zone of passage of 75 percent of the cross-sectional area and/or volume of flow of the receiving stream. Based on this recommendation, the Department's standard practice is to allow no more than 25 percent of the stream flow for mixing zones.

The current permit allows a mixing zone consisting of that portion of the Illinois River contained within a band extending out 50 feet from the right bank of the river and extending from a point ten feet upstream of the outfall to a point 100 feet downstream from the outfall. The Zone of Immediate Dilution (ZID) is defined as that portion of the regulatory mixing zone that is within ten feet of the point of discharge.

The Department believes that this regulatory mixing zone meets the requirements of the policy and rule described above. No changes to the existing mixing zone are proposed.

RECEIVING STREAM IMPACTS

The water quality standards for the Rogue Basin (Oregon Administrative Rules 340-41-0365) are intended to be protective of the beneficial uses for the basin. Treated wastewater from Cave Junction's WWTP is discharged to the Illinois River at river mile 54.6. OAR 340-41-362 (Table 5) lists the beneficial uses for which water quality will be protected.

Included in Table 5 for the Rogue Basin are:

- Public domestic water supply,
- Private domestic water supply,
- industrial water supply,
- irrigation,
- livestock watering,
- anadromous fish passage,
- resident fish and aquatic life, including salmonid fish rearing, migration and spawning,
- wildlife and hunting,
- fishing,
- boating,
- water contact recreation, and
- aesthetic quality

Applicable water quality standards for the Illinois River are found in OAR 340-41-362.

Section 303(d) of the Clean Water Act requires the establishment of a Total Maximum Daily Load (TMDL) in water bodies in which the technology based effluent limitations are not stringent enough to implement the water quality standards. Water quality standards are based on protection of beneficial uses designated for that water body. The Department has established a list of water bodies that do not meet one or more water quality standards during the year in accordance with Section 303(d) of the Clean Water Act.

The Illinois River in the area of the outfall is included on the Department's List of Water Quality Limited Water Bodies (also called the 303 (d) List) as water quality limited for the following parameters:

River Mile	Pollutant	Criteria	Season	Year Listed
0 to 56.1	Temperature	Salmon and steelhead spawning: 13.0 degrees Celsius 7-day-average maximum	October 15 - May 15	2004
0 to 56.1	Temperature	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Summer	1998

A Total Maximum Daily Load (TMDL) addressing the water quality limited status of the Illinois River should be finalized during 2007. The TMDL may assign Waste Load Allocations (WLA) to this source. Any WLA may be incorporated into the permit by modification or during the next permit renewal.

Anti-degradation Review

OAR 340-041-0004 describes the Environmental Quality Commission's (EQC) Antidegradation Policy for Surface Waters. In summary, the policy is intended to guide the decisions that affect water quality such that unnecessary degradation from point and nonpoint sources of pollution is prevented. The Department must make certain findings and consider certain issues before renewing the permit. This is to be in accordance with the Department's "Antidegradation Policy Implementation Internal Management Directive for NPDES Permits and Section 401 Water Quality Certifications (March, 2001)". The Department is obligated to review the request in relation to other alternatives to the request, beneficial uses which may be impacted, and the potential impacts to the water quality of the receiving stream.

An Anti-Degradation review was done with this proposed permit renewal to ensure that the proposed permit meets the intent of the policy and rule. As described below, these and other individual parameters were evaluated to ensure the policy and rule was being met **(See Attachment #4)**.

<u>Temperature Issues</u>

Water temperature affects the biological cycles of aquatic species and is a critical factor in maintaining and restoring healthy salmonid populations throughout the state. It is the policy of the Environmental Quality Commission (EQC) to protect aquatic ecosystems from adverse temperature changes caused by anthropogenic activities. The purpose of the temperature criteria listed in OAR 340-041-0028 is to protect designated beneficial uses that are temperature sensitive, including salmonids in waters of the State.

The Department utilizes Fish Use Designation and Salmon and Steelhead Spawning Use Designations maps to identify applicable temperature criteria for each basin. The Rogue Basin maps are contained in OAR 340-041, Figures 271A and 271B, respectively. According to the approved use designation maps, spawning occurs in the area of the outfall from October 15 through May 15. Therefore, the applicable numeric temperature criterion is 13 °C. During the rest of the year, the rearing criteria of 18 °C applies.

Winter Spawning Season

The Department's List of Water Quality Limited Water Bodies (also called the 303(d) List) for 2002 indicates the Illinois River is water quality limited for temperature during the winter spawning season. Prior to the completion of a temperature TMDL, each NPDES point source that discharges into a temperature water quality limited water is allowed a "Human Use Allowance". Each point source may cause the temperature of the water body to increase up to 0.3 degrees Celsius above the applicable criteria after mixing with either 25 percent of the stream flow, or at the edge of the mixing zone, whichever is more restrictive.

Based on the existing discharge, the Department calculated in-stream temperature increases using the existing facility wet weather design flow of 0.87 MGD and maximum effluent temperature of the effluent of 18 °C and the stream criteria of 13 °C by two separate methods as required by rule (OAR 340-041-0028(12)(b)):

- Based on 25 percent of the 7Q10 stream flow **(see Attachment 5d)**
- Based on the estimated dilution achieved in the mixing zone at 7Q10 stream flow **(see Attachment 5c)**

The evaluation shows there is a reasonable potential for an increase in temperature above the criteria. Therefore, an Excess Thermal Load (ETL) limit must be included in this permit. The ETL is based on dilution achieved in the mixing zone because that is the most stringent limit. The proposed limit is 4.1 million Kcals per day as a weekly average.

A thermal plume limit evaluation was also completed to determine whether the criteria are met at the edge of the ZID and within the ZID. This evaluation shows there is no reasonable potential to violate the thermal plume criteria **(See Attachment # 5a-b).**

The permit may be reopened and the Excess Thermal Load limit modified (up or down), when more accurate effluent temperature data becomes available. If the Total Maximum Daily Load (TMDL) for temperature for this sub-basin assigns a Waste Load Allocation (WLA) to this source, this permit may be re-opened to establish new thermal load limits and/or new temperature conditions or requirements.

Dissolved Oxygen (DO)

During the facilities planning for the treatment facility, the City and DEQ engineers evaluated the effects of the discharge from the new treatment facility on DO levels in the Illinois River. A Streeter-Phelps Model was used to predict instream DO levels (sag) at various conditions including low flow conditions during the permitted discharge period. This information was also used to determine a cutoff point for discharge through Outfall 001 or irrigation to the golf course based on dilution provided by the river.

All of the model runs demonstrated that the estimated maximum DO sag created by the WWTP discharge is less than 0.1 mg/l. It is important to note that all of the model runs used higher pollutant loading than are currently in the permit.

Ammonia Toxicity

The State of Oregon has adopted the EPA 1999 ammonia criteria but the new criteria have not been formally approved by EPA. Until that time, the existing toxicity standards currently contained in OAR Chapter 340, Table 20 from the EPA 1986 Gold Book Criteria are used for ammonia toxicity limits that might be necessary in a permit.

During this permit cycle, the permittee was required to monitor the effluent for ammonia for two years of discharge. DEQ staff evaluated ammonia toxicity at the edge of the mixing zone and the zone of immediate dilution (ZID). A reasonable potential analysis **(See Attachment #6)** was conducted using the effluent and stream data as described under the *"Temperature"* section above. Using the 90 the percentile highest effluent ammonia data from 37 samples for ammonia, the spreadsheet shows that there is a no reasonable potential to violate the ammonia toxicity standard at the edge of the mixing zone and ZID. Therefore, no limit is included in this permit. Monitoring for ammonia will no longer be required in the permit.

pH

The proposed effluent limits for pH remain unchanged at 6.0 to 9.0 for the facility. The Rogue Basin water quality standards for pH are established in OAR 340-041-0366. The allowed ambient range is 6.5 to 8.5. The proposed permit limits pH to the range of 6.0 to 9.0. An evaluation of pH at the edge of the mixing zone shows that the facility will not cause a violation of the standard with a range of 6.0 to 9.0 **(see Attachment #7).** This limit is in accordance with Federal wastewater treatment guidelines for sewage treatment facilities (in 40 CFR 133.102(c)) and is applied to the majority of NPDES permits in the state. Within the permittee's mixing zone, the water quality standard for pH does not have to be met. The Department considers the proposed permit limits to be protective of the water quality standard.

E. coli bacteria (Fecal Bacteria)

The Illinois River in the area of the discharge is not listed on the 303(d) list for fecal bacteria. The bacteria standard is established to be protective of the beneficial use of water contact recreation. The limit in the proposed permit is the same as the current permit and is based on the standard.

Chlorine Toxicity

The facility utilizes an Ultraviolet (UV) disinfection system instead of the use of chlorine. Therefore, chlorine toxicity is not an issue for this facility

PERMIT HISTORY

Current Permit

The Permit for the facility was issued on October 9, 2002 and expired on December 31, 2006. The permit will remain in effect until action is taken on this renewal application. The Department received a renewal application on June 29, 2006. Based on the evaluations discussed in this report, the Department proposes to renew the permit.

Compliance History

This facility was last inspected October 5, 2006 and was found to be operating in compliance.

The monitoring reports for this facility were reviewed for the period since the current permit was issued, including any actions taken relating to effluent violations. The permit compliance conditions were reviewed and all inspection reports for the same period were reviewed. Based on this review, the following violations have been documented at this facility during the term of the current permit.

Violation Date	NON Date	Violation	NON Class
2/1/2003	7/3/2003	Submitted Incomplete DMR	Class 3

The above violation is considered to be minor and has been corrected. Therefore, the Department considers this facility to be in substantial compliance with the terms of the current permit.

PROPOSED PERMIT DISCUSSION

Face Page

The permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system. Permits discharge of treated effluent to the Illinois River and by spray irrigation to the Illinois Valley Golf Course within limits set by Schedule A and the following schedules. All other discharges are prohibited. The treatment classification for the plant has been determined to be a Level III and the collection system a Level II. These classifications remain unchanged.

Schedule A - Waste Discharge limitations

BOD5 and TSS concentration and mass limits

Based on the Rogue Basin minimum design criteria, from November 1 - April 30, a minimum of secondary treatment or equivalent control is required. Secondary treatment for this facility is defined as monthly average concentration limit of 30 mg/L for BOD_5 and 30 mg/L for TSS with a weekly average limit of 45 mg/l.

The winter mass load limits for the facility are based on the design DAWWF of the previous treatment facility (0.225 MGD) and the monthly average BOD_5 and TSS concentration limits of 30 mg/L - 45 mg/L. The current design average dry weather flow (DADWF) of the upgraded plant is 0.52 MGD. On any day that the flow to the plant exceeds 1.04 MGD (twice the DADWF), the daily mass load limit shall not apply. The limits are in accordance with OAR 340-41-120(9)(a). All mass load limitations are rounded to two significant figures.

BOD_5 and TSS

The limits are:

Treated Effluent Outfall 001:

(1) June 1 - October 31: No discharge to waters of the State except under the following conditions:

- During the month of June, discharge may continue as long as the seven day average stream flow exceeds 200 cfs as measured at USGS gage station 14377100 (Illinois River near Kerby, OR). Once the seven day average stream flow falls below 200m cfs, discharge is not permitted through Outfall 001 for the remainder of the season, unless the seven day average stream flow rises above 200 cfs in October. When discharging, the effluent limitations for the discharge period (November through May) will apply.

These proposed discharge periods vary from the normal discharge periods allowed by the Department. An evaluation was completed by the Department to determine whether the discharge season could be based on stream flow rather than a predetermined season during the last permit renewal. This allows the City to discharge from Outfall 001 when there are high periods of precipitation and sufficient dilution in the river, rather than trying to irrigate on the golf course when it is too wet to have irrigation be a beneficial use.

(2) November 1 - May 31:

Parameter	Average Effluent Concentrations Monthly	Weekly	Monthly* Average lb/day	Weekly* Average lb/day	Daily* Maximum lbs
BOD_5	30 mg/L	45 mg/L	56	84	110
TSS	30 mg/L	45 mg/L	56	84	110

Calculations:

(1) BOD and TSS

(a) 0.225 MGD x 8.34 #/gal x 30 mg/L monthly avg. = 56 lbs/day

(b) 56 lbs/day monthly avg. x 1.5 = 84 lbs/day weekly avg.

(c) 56 lbs/day monthly avg. x 2.0 = 112 lbs/day daily max. (rounded to 110)

A review of recent monitoring data **(see Attachment #1)** indicates the City should generally be able to comply with the permit limits.

BOD5 and TSS Percent Removal Efficiency

A minimum level of percent removal for BOD_5 and TSS for municipal dischargers is required by the Code of Federal Regulations (CFR) secondary treatment standards (40 CFR, Part 133). An 85 percent removal efficiency limit is included in the proposed permit to comply with federal requirements. An examination of the DMR data **(See Attachment #1)** indicates the permittee currently has been meeting this limitation, however; if an aggressive I/I removal program is not funded by the City of Cave Junction, this limit will become more and more difficult to meet with the current facilities and may result in violations of this limitation.

pH

The Rogue Basin Water Quality Standard for pH is found in OAR 340-41-0365(2)(d). The allowed range is 6.5 to 8.5. The proposed permit limits pH to the range 6.0 to 9.0. This limit is based on Federal wastewater treatment guidelines for sewage treatment facilities, and is applied to the majority of NPDES permittees in the state. Within the permittee's mixing zone, the water quality standard for pH does not have to be met. It is the Department's belief that mixing with ambient water within the mixing zone will ensure that the pH at the edge of the mixing zone meets the standard, and the Department considers the proposed permit limits to be protective of the water quality standard.

Fecal Bacteria

The proposed permit limits are based on an *E. coli* standard approved in January 1996. The proposed limits are a monthly geometric mean of 126 E. coli per 100 mL, with no single sample exceeding 406 E. coli per 100 mL. The bacteria standard allows that if a single sample exceeds 406 E coli per 100 mL, then the permittee may take five consecutive re-samples. If the log mean of the five re-samples is less than or equal to 126, a violation is not triggered. The rule states that the re-samples should be taken at four hour intervals beginning as soon as practicable (preferably within 28 hours) after the original sample was taken. The rule also allows for changing the resampling timeframe if it would pose an undue hardship on the treatment facility. After discussions with the permittee, the Department is proposing that the five re-samples be taken beginning no later than 48 hours after the original sample was taken.

The proposed effluent limits are achievable through proper operation and maintenance.

Temperature

As discussed earlier in this report, because the in-stream temperature increase at the edge of the mixing zone is larger than the allowable increase, this facility has a reasonable potential to violate the temperature standard. Therefore, an Excess Thermal Load (ETL) limit must be included in this permit.

The proposed limit is as follows:

Parameter	Limitations
Excess Thermal Load (October 15-May 15)	Shall not exceed a weekly average of 4.1 million Kcals/day

The permit may be reopened and the Excess Thermal Load limit modified (up or down), when more accurate effluent temperature data becomes available. If the Total Maximum Daily Load (TMDL) for temperature for this sub-basin assigns a Waste Load Allocation (WLA) to this source, this permit may be re-opened to establish new thermal load limits and/or new temperature conditions or requirements.

Chlorine Residual

The treatment facility uses ultra-violet light to disinfect the treated wastewater. No chlorine or chlorine compounds may be used for disinfection purposes for discharge through Outfall 001 and no chlorine residual will be allowed in the effluent due to chlorine used for maintenance purposes.

Mixing Zone and Zone of Immediate Dilution (ZID)

The allowable mixing zone is that portion of the Illinois River extending out 50 feet from the right bank of the river and extending from a point ten feet upstream of the outfall to a point 100 feet downstream from the outfall. The Zone of Immediate Dilution shall be defined as that portion of the allowable mixing zone that is within ten feet of the point of discharge.

The Department believes that the defined mixing zone meets the criteria in the mixing zone rule as described earlier in this report.

Reclaimed Water

The utilization of treated effluent for agricultural purposes is regulated under OAR 340-55. The facility produces Level II reclaimed water and irrigates grass cover on the Illinois Valley Golf Course.

Prior to irrigation of the reclaimed water, the discharge must comply with total coliform limits based on protection of human health due to human pathogens. For Level II reclaimed water, the limits include a weekly median of 23 total coliform per 100 mL with no two consecutive samples to exceed 240 total coliform per 100 mL.

The application of reclaimed water must be managed in accordance with the Department approved Reclaimed Water Use Plan. All reclaimed water shall be distributed on land, for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices so as to prevent:

a. Prolonged ponding of treated reclaimed 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.
e. Impairment of existing or potential beneficial uses of groundwater.

The bacteria limits for irrigation of Level II reclaimed water are a seven-day median of 23 organisms/100 mL, with no two consecutive samples to exceed 240 total coliform per 100 mL.

The permittee is planning to build new treatment facilities that will treat to Level IV reclaimed water. When this occurs, the new limitation for bacteria will be reduce Total Coliform to a seven-day median of 2.2 organisms per 100 mL and a maximum of 23 organisms per 100 mL.

Specific crops, application rates and buffers will be approved by the Department within the Reclaimed Water Use Plan. The bacterial effluent limitations are achievable through proper operation and maintenance.

Raw Sewage Overflows

No overflows are allowed from this source unless the cause of the discharge is due to storm events as allowed under Schedule F.6.b. as described earlier in this report.

Groundwater

Based on the Department's current information, this facility has a low potential for adversely impacting groundwater quality. This will be evaluated again at the next permit renewal. A groundwater evaluation sheet is included in this report as **Attachment #3.**

Schedule A prohibits any adverse impact on groundwater quality. In addition, Schedule D of the proposed permit states that no groundwater evaluations will be required during this permit cycle.

Schedule B - Minimum Monitoring and Reporting Requirements

Schedule B describes the minimum monitoring and reporting necessary to demonstrate compliance with the conditions of this permit. The authority to require periodic reporting by permittees is included in ORS 468.065(5). Self-monitoring requirements are the primary means of ensuring that permit limitations are being met. However, other parameters need to be monitored to collect information when insufficient information exists to establish a limit, but where there is a potential for a water quality concern.

In 1988, the Department developed a monitoring matrix for commonly monitored parameters. The matrix was updated in 2004. Proposed monitoring frequencies for all parameters are based on this matrix and, in some cases, may have changed from the current permit. The proposed monitoring frequencies for all parameters correspond to those of facilities of similar size and complexity in the state.

The permittee is required to have a laboratory Quality Assurance/Quality Control program. The Department recognizes that some tests do not accurately reflect the performance of a treatment facility due to quality assurance/quality control problems. These tests should not be considered when evaluating the compliance of the facility with the permit limitations. Thus, the Department is also proposing to include in the opening paragraph of Schedule B a statement recognizing that some test results may be inaccurate, invalid, do not adequately represent the facility's performance and should not be used in calculations required by the permit.

Below is a discussion of some of the minimum monitoring requirements contained in the proposed permit:

Outfall 001

Daily monitoring of influent flow is required when discharging and calibration of the flow meter annually is required in this permit.

Monitoring of the influent and effluent for BOD5 and TSS is retained at twice per week when discharging. Pounds of effluent BOD5 and TSS must be calculated at the same frequency.

Federal secondary treatment standards require municipal sources to achieve a specific BOD5 and TSS removal efficiency as a monthly average. Reporting of the removal efficiencies is required in the current permit and no changes are proposed.

The proposed permit requires bacteria monitoring of the effluent for E. coli bacteria once per week. Monitoring for E. coli must be performed in accordance with one of the methods approved by the Department. Monitoring of the influent and effluent for pH is required three times per week as in the current permit in accordance with the monitoring matrix.

Temperature monitoring and reporting of excess thermal load is as follows:

Item or Parameter	**Minimum Frequency**	**Type of Sample**
Effluent Temperature, Daily Max.	Daily	Grab
Effluent Temperature, Average of Daily Maximums	Weekly	Calculation
Excess Thermal Load (October 15 – May 15)	Weekly	Calculation

The permittee is required in Schedule C.4. of this permit to install a continuous temperature monitoring device that will enable the permittee to collect daily temperature data in accordance with Schedule B.1.b. of this permit. Until that time, the permittee will be allowed to report temperature at a minimum frequency of 5 days per week and use these data points for a weekly average to be used in the thermal load calculation. The reason for this request is that staff work at the plant 5 days a week in accordance with the Department approved O&M manual for the upgraded plant.

In most systems using ultraviolet light as disinfection, the UV disinfection system includes a UV intensity meter with a sensor located in the water column at a specified distance from the UV bulbs. The daily UV radiation intensity reading is usually required to be read and reported daily.

The permittee has requested that an alternate reporting method be used for their UV system. The number of UV lamps on line has a direct correlation with the performance of the units. The Permittee has two UV units that can be run separately or in series. The permittee will report daily on the DMR, the number of lamps that are on-line (8 total). Reporting will include an additional note on the DMR when the units are run in series. Overall performance of the units will be based on the *E.coli* results required on the effluent.

Stream flow measurement must be obtained daily when discharging through Outfall 001 when discharging during June or October. Measurement must be obtained form the USGS gauge station#14377100 – Illinois River near Kerby, OR. The stream flow shall be reported daily as a running seven day average.

Monitoring for ammonia will be discontinued in this permit. The requirement in the current permit was to monitor for two years to gather enough data to determine whether the reasonable potential existed for ammonia toxicity at the edge of the mixing zone and ZID. The evaluation conducted by the Department using this data indicated there was not.

Outfall 002

The proposed permit includes monitoring of the reclaimed water through Outfall 002 for flow, inches per acre applied, UV radiation intensity, pH, nutrients and total coliform. The monitoring frequencies are in accordance with Department rules and guidance. An annual report describing the effectiveness of the reclaimed water system is required in Schedule B.

The permittee is planning to build new treatment facilities that will treat to Level IV reclaimed water, and the monitoring and reporting requirements are included for Level IV reclaimed water if this is completed during this permit cycle.

Reporting Requirements

The reporting period is the calendar month. Discharge monitoring reports must be submitted to the Department monthly by the 15th day of the following month. The monitoring reports need to identify the principal operators designated by the Permittee to supervise the treatment and collection systems. The reports must also include records concerning application of biosolids and all applicable equipment breakdowns and bypassing.

Schedule B of the permit includes the requirement for the submittal of three annual reports. The conditions are standard language requirements concerning:

- Annual report which details progress towards reducing inflow and infiltration.
- Annual report describing the reclaimed water use activities.
- For any year in which biosolids are land applied, a report shall be submitted to the Department by February 19 of the following year that describes solids handling activities for the previous year and includes, but is not limited to, the required information outlined in OAR 340-050-0035(6)(a)-(e).

Schedule C - Compliance Conditions

The proposed permit includes five compliance conditions with compliance deadlines. The requirements include:

1. By no later than December 31, 2007, the permittee shall submit to the Department for review and approval an updated plan and time schedule for identifying and reducing inflow. Within 60 days of receiving written Department comments, the permittee shall submit a final approvable program and time schedule. The program shall consist of the following:

    a. A program for identifying and removing all inflow sources into the permits sewer system over which the permittee has legal control; and

    b. If the permittee does not have the necessary legal authority for all portions of the sewer system or treatment facility, a program and schedule for gaining legal authority to require inflow reduction and a program and schedule for removing inflow sources.

    c. A plan to budget for and approve an adequate amount of money to be spent each year on I/I identification and removal projects.

2. By no later than February 1, 2008 the permittee will update the current septage management plan and submit for Department approval. The plan shall include at a minimum, the following:

    a. A method for adequate recordkeeping to describing how the funds generated from accepting septage are used to maintain or upgrade the septage station facilities;
    b. Recognition that acceptance of septage is not justification for upsets at the treatment plant or non-compliance with any condition or limitation set forth in the permit;

3. By no later than March 1, 2008, the permittee will submit to the Department a plan and schedule to install a pretreatment system that includes screening and grit removal adequate to handle septage received at the facility. Upon Department approval of the Plan, the permittee will implement the schedule to complete construction.

4. By no later than June 1, 2008, the permittee will install a continuous temperature monitoring device that will enable the permittee to collect daily temperature data in accordance with Schedule B.1.b. of this permit. Until that time, the permittee will be allowed to report temperature a minimum of 5 days per week and use these data points for a weekly average.

5. Three months prior to start-up of the new Level IV reclaimed water use system, permittee must submit a reclaimed water use plan for the new reuse facilities for Department approval.

6. Six months prior to the removal of accumulated solids from the lagoon, the permittee must submit to the Department a revised biosolids management plan developed in accordance with Oregon Administrative Rule 340, Division 50, "Land Application of Domestic Wastewater Treatment Facility Biosolids, Biosolids Derived Products, and Domestic Septage". Upon approval of the plan by the Department, the plan shall be implemented by the permittee.

Finally, there is a condition stating that the permittee is expected to meet the compliance dates established in this schedule or notify the Department within fourteen days following any lapsed compliance date.

Schedule D - Special Conditions

The proposed permit includes six special conditions. The requirements include:

- A condition requiring the permittee to comply with the rules concerning the use of reclaimed water and the Reclaimed Water Use Plan approved by the Department.

- A condition requiring the permittee to keep a cover crop on the irrigation site at all times unless otherwise approved by the Department in the Reclaimed Water Use Plan.

- A condition stating that the permit may be modified to incorporate any applicable standard for biosolids use or disposal promulgated under section 405(d) of the Clean Water Act, if the standard for biosolids use or disposal is more stringent than any requirements for biosolids use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

- The permittee must have the facilities supervised by personnel certified by the Department in the operation of treatment and/or collection systems.

- A condition that prohibits any adverse impact on groundwater quality.

- A condition requiring the permittee to notify the appropriate DEQ Western Regional Office in accordance with the response times noted in the General Conditions of this permit, of any malfunction so that corrective action can be coordinated between the permittee and the Department.

Schedule F, NPDES General Conditions

All NPDES permits issued in the State of Oregon contain certain conditions that remain the same regardless of the type of discharge and the activity causing the discharge. These conditions are called General Conditions. These conditions can be changed or modified only on a statewide basis. The latest edition of the NPDES General Conditions is July 2005 and this edition is included as Schedule F of the draft permit.

Section A contains standard conditions which include compliance with the permit, assessment of penalties, mitigation of noncompliance, permit renewal application, enforcement actions, toxic discharges, property rights and referenced rules and statutes. Section B contains requirements for operation and maintenance of the pollution control facilities. This section includes conditions for proper operation and maintenance, duty to halt or reduce activity in order to maintain compliance, bypass of treatment facilities, upset conditions, treatment of single operational events, overflows from wastewater conveyance systems and associated pump stations, public notification of effluent violation or overflow, and disposal of removed substances. Section C contains requirements for monitoring and reporting. This section includes conditions for representative sampling, flow measurement, monitoring procedures, penalties of tampering, reporting of monitoring results, additional monitoring by the permittee, averaging of measurements, retention of records, contents of records, and inspection and entry. Section D contains reporting requirements and includes conditions for reporting planned changes, anticipated noncompliance, permit transfers, progress on compliance schedules, noncompliance which may endanger public health or the environment, other noncompliances, and other information. Section D also contains signatory requirements and the consequences of falsifying reports. Section E contains the definitions used throughout the permit.

PERMIT PROCESSING/PUBLIC COMMENT/APPEAL PROCESS

The beginning and end date of the public comment period to receive written comments regarding this permit, and the contact name and telephone number are included in the public notice. The permittee is the only party having standing to file a permit appeal. If the Permittee is dissatisfied with the conditions of the permit when issued, they may request a hearing before the EQC or its designated hearing officer, within 20 days of the final permit being mailed. The request for hearing must be sent to the Director of the Department. Any hearing held shall be conducted pursuant to regulations of the Department.

	PERMITTEE NAME: City of Cave Junction												
	Attachment #1a Effluent Data 2004-2006 Outfall 001 - Illinois River												
	INFLUENT		***EFFLUENT***										
	BOD	TSS	Min	Max	Avg	Temp	BOD	BOD	BOD	TSS	TSS	TSS	Long Tom Flow
MONTH	mg/l	mg/l	Flow	Flow	Flow	max	mg/L	%Rmvl	lbs	mg/L	%Rmvl	lbs	Minimum CFS
4/03	163	221	0.430	0.990	0.713	14.1	2	99	10	3	99	20	203
11/03	186	154	0.150	0.822	0.323	16.5	1	99	3	4	98	9	28
12/03	291	245	0.440	1.270	0.866	14.7	3	99	21	4	98	30	*
1/04	259	481	0.516	1.399	0.995	12.0	1	99	11	3	99	30	640
2/04	170	273	0.483	1.287	0.852	12.2	1	99	6	4	99	28	*
3/04	208	220	0.295	0.964	0.500	14.6	1	99	6	4	98	16	190
4/04	258	236	0.363	1.409	0.489	15.9	2	99	7	3	99	16	149
11/04	309	526	0.211	0.508	0.310	14.6	3	99	6	4	98	9	33
12/04	240	281	0.252	1.336	0.535	13.7	13	84	54	13	85	60	8
1/05	533	556	0.310	0.799	0.499	13.4	2	99	6	2	99	8	82
2/05	244	201	0.283	0.475	0.404	13.4	1	99	3	5	98	17	145
3/05	342	314	0.294	1.080	0.503	15.3	1	99	8	3	99	17	68
Average	**267**	**309**	**0.336**	**1.028**	**0.590**	**14.2**	**3**	**98**	**12**	**4**	**97**	**22**	**155**

	PERMITTEE NAME: City of Cave Junction										
	Attachment #1b Effluent Data 2004-2006 Outfall 002 - Land Irrigation										
INFLUENT			***EFFLUENT***								
Average Flow	BOD mg/l	TSS mg/l	Temp max	Average Flow To Pond	BOD mg/L	BOD lbs	TSS mg/L	TSS lbs	Total Coliform org /100 mL	Quanity Irrigated Inches/acre	Quanity Irrigated Gallons
0.411	142	172	17.3	0.446	2	7	3	15	2	0.148	0.116
0.253	160	237	21.2	0.284	4	13	6	16	2	0.290	0.228
0.248	185	189	23.9	0.228	3	6	4	5	16	0.280	218.000
0.225	336	316	23.7	0.258	5	9	2	5	2	0.310	0.247
0.236	351	461	22.5	0.235	4	8	2	5	2	0.290	0.228
0.232	301	253	21.1	0.222	5	9	3	6	***510***	0.210	0.164
0.355	175	229	16.2	0.355	3	7	3	8	2	0.213	0.167
0.312	265	170	22.1	0.299	1	3	2	1	4	0.332	0.366
0.267	218	217	23.7	0.349	5	9	3	6	2	0.151	0.200
0.250	306	379	20.1	0.241	1	1	2	3	2	0.176	0.226
0.298	224	222	22.7	0.285	1	3	3	7	2	0.238	0.303
0.336	301	312	19.6	0.325	1	1	4	6	2	0.281	0.325
0.285	**247**	**263**	**21.2**	**0.294**	**3**	**6**	**3**	**7**	**46**	**0.243**	**18.381**

ATTACHMENT #2

Wastewater System Classification Worksheet for Operator Certification OAR 340-049-0020

City of Cave Junction

Classification of Wastewater Systems (OAR 340-049-0020) All wastewater systems regulated under OAR 340-049 will be classified by DEQ as wastewater treatment systems and/or wastewater collection systems, as appropriate, in accordance with the following classification system:

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 to 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

WW System Common Name: City of Cave Junction

Facility ID: 15243 **Location:** 1300 Sawyer Avenue, Cave Junction

Total Points (from page 3): 75 **WWT Class (check):** ☐ I ☐ II ☒ III ☐ IV

Design Population[1]: 5,000-10,000 **WWC Class (check):** ☐ I ☒ II ☐ III ☐ IV

Design ADWF load (Influent MGD) 0.52 **Design BOD load (Influent lbs./day)** ________

Classified by: Julie M. Berndt **Date:** January 18, 2007

Date this classification filed with the Operator Certification office: January, 2007

System start-up date for this classification (new, upgrade or expansion): n/a

Is this a change from a prior classification? (check): ☐ Yes ☒ No

[1] See "Population" definition. Use the design average daily per person load for Influent Flow or Influent BOD5, whichever is greater. This value is also used to determine the Collection System Classification.

Wastewater System Classification Worksheet

Criteria for Classifying Wastewater Treatment Systems (OAR 340-049-0025)

(1) **Design Population or Population Equivalent Points** (10 Points Maximum)

☐ Less than 750	0.5 points
☐ 751 to 2000	1 point
☐ 2001 to 5000	1.5 points
☒ 5001 to 10,000	2 points
☐ Greater than 10,000	3 points plus 1 per 10,000
Point subtotal	2

(2) **Average Dry Weather Flow (Design Capacity) Points** (10 points Maximum)

☐ Less than 0.075 MGD	0.5 point
☐ Greater than 0.075 to 0.1 MGD	1 point
☐ Greater than 0.1 to 0.5 MGD	1.5 points
☒ Greater than 0.5 to 1.0 MGD	2 points
☐ Greater than 1.0 MGD	3 points plus 1 per 1 MGD
Point subtotal	2

(3) **Unit Process Points** (Check all that apply)

Preliminary Treatment and Plant Hydraulics:

☒ Comminution (includes shredders, grinders, etc.)	1 point
☐ Grit Removal, gravity	1 point
☒ Grit Removal, mechanical	2 points
☒ Screen(s), in-situ or mechanical	1 point
☒ Pump/Lift Station(s) (pumping of main flow)	2 points
☐ Flow Equalization (any type)	1 point
Point subtotal	6

Primary Treatment:

☐ Community Septic Tank(s)	2 points
☐ Clarifier(s)	5 points
☐ Flotation Clarifier(s)	7 points
☒ Chemical Addition System	2 points
☐ Imhoff Tank (or similar)	3 points
Point subtotal	2

Total Points Page 1 — 12

Wastewater System Classification Worksheet

Unit Process Points – **Continued** (Check all that apply)

Secondary, Advanced, and Tertiary Treatment:

☐ Low Rate Trickling Filter(s) (no recirculation)		7 points
☐ High Rate Trickling Filter(s) (recirculation)		10 points
☐ Trickling Filter - Solids Contact System		12 points
☒ Activated Sludge (any type)		15 points
☐ Pure Oxygen Activated Sludge		20 points
☐ Activated Bio Filter Tower less than 0.1 MGD		6 points
☐ Rotating Biological Contactors, 5 or more shafts		12 points
☐ Stabilization Lagoons, 1 to 3 cells without aeration		5 points
☐ Stabilization Lagoons, 1 or more cells with primary aeration		7 points
☐ Stabilization Lagoons, 2 or more cells with full aeration		9 points
☐ Recirculating Gravel Filter		7 points
☐ Chemical Precipitation Unit(s)		3 points
☐ Pressure Filtration Unit(s)		4 points
☒ Nitrogen Removal, Biological or Chemical/Biological System		4 points
☐ Nitrogen Removal, Designed Extended Aeration Only		2 points
☐ Phosphorus Removal Unit(s)		4 points
☐ Effluent Microscreen(s)		2 points
☐ Chemical Flocculation Unit(s)		3 points
☒ Chemical Addition System(s) (6 points maximum)	@	2 points
Point subtotal		21

Solids Handling:

☐ Anaerobic Primary Sludge Digester(s) w/o Mixing and Heating	5 points
☐ Anaerobic Primary Sludge Digester(s) with Mixing and Heating	7 points
☐ Anaerobic Primary and Secondary Sludge Digesters	10 points
☐ Sludge Digester Gas reuse	3 points
☒ Aerobic Sludge Digester(s)	8 points
☐ Sludge Storage Lagoon(s) (or tanks, basins etc.)	2 points
☐ Sludge Lagoon(s) with aeration	3 points
☐ Sludge Drying Bed(s)	1 point
☐ Sludge Belt(s) or Vacuum Press/Dewatering	5 points
☐ Sludge Centrifuge(s)	5 points
☐ Sludge Incineration	12 points
☐ Sludge Chemical Addition Unit(s) (alum, polymer, etc.)	2 points
☐ Non-Beneficial Sludge Disposal	1 point
☐ Beneficial Sludge Utilization	3 points
Point subtotal	8

Disinfection:

☒ Liquid Chlorine Disinfection	2 points
☐ Gas Chlorine Disinfection	5 points
☐ Dechlorination System	4 points
☒ Other disinfection systems incl. ultraviolet and ozonation	5 points
Point subtotal	7

<u>Total Points Page 2</u> 36

Wastewater System Classification Worksheet

(4) <u>Effluent Permit Requirement Points</u> (Check as applicable):

☒ Minimum of secondary effluent limitations for BOD and/or TSS	2 points
☐ Minimum of 20 mg/L BOD and/or Total Suspended Solids	3 points
☐ Minimum of 10 mg/L BOD and/or Total Suspended Solids	4 points
☐ Minimum of 5 mg/L BOD and/or Total Suspended Solids	5 points
☐ Effluent limitations for effluent oxygen	1 point
Point subtotal	2

(5) <u>Variation in Raw Waste Points</u>. (6 points maximum) Points in this category will be awarded only when conditions are extreme to the extent that operation and handling procedure changes are needed to adequately treat waste due to variation of raw waste

☒ Recurring deviations or excessive variations 100% to 200%	2 points
☐ Recurring deviations or excessive variations of more than 200% **<u>or</u>** conveyance and treatment of industrial wastes by Pretreatment program	4 points
☒ Septage or other hauled waste (control and/or preliminary treatment)	2 points
Point subtotal	4

(6) <u>Sampling and Laboratory Testing Points</u> (check as applicable - maximum 11 points)

☐ Sample for BOD, Total Suspended Solids performed by outside lab	2 points
☒ BOD or Total Suspended Solids analysis performed at treatment plant	4 points
☐ Bacteriological analysis performed by outside lab	1 point
☒ Bacteriological analysis performed at WWT plant lab	2 points
☒ Nutrient, Heavy Metals or Organics analysis performed by outside lab	3 points
☐ Nutrient, Heavy Metals or Organics analysis performed at WWT plant	5 points
Point subtotal	9

(7) <u>Points For Other Complexities Not Reflected Above</u>: (see OAR 340-049 0020(4) & (5))

☐ Odor Control (2 points maximum)	1 to 2 points
☒ Standby Power Units	@ 1 point
☐ Solids Composting or Land Application of Biosolids	10 points
☐ Alkaline Stabilization (3 points maximum)	2 to 3 points
☒ Other Effluent Limits [ammonia, Cl2, temp., etc. (<u>list or attach list</u>)]	@ 1 point
☒ Pond(s) (advanced treatment polishing or irrigation holding)	2 points
☐ Effluent Land Disposal - Evaporation (surface or subsurface)	2 to 4 points
☒ Effluent direct Reuse or Recycle	6 points
☒ SCADA or similar for data (limited to extensive total process operation)	2 to 6 points
☐ Chemical/Physical advanced waste treatment following secondary	10 points
☐ Chemical/Physical advanced waste treatment w/o secondary	15 points
☐ Biological or Chemical/Biological advanced waste treatment	12 points
☐ Reverse Osmosis, Electro-dialysis or Membrane Filtration techniques	15 points
☐ Other complexities (<u>list or attach list</u>): ____________	
Point subtotal	12

<u>Total Points Page 3</u> 27

Total Accumulated Points (3 pages) 75

OpCertClassWorksheet.rev5 (10/9/03)

ATTACHMENT #3
GROUNDWATER PRIORITIZATION WORKSHEET
City of Cave Junction STP

WATER QUALITY PROGRAM NPDES AND WPCF PERMITTED FACILITIES PRIORITIZATION SCREENING CRITERIA FOR GROUNDWATER REVIEW

Permit Type (circle one): NPDES	
Type of Facility: Activated sludge plant with facultative sludge lagoon(s) and irrigation holding ponds	
Application Number: Application No. 977798 received 6/29/2006	
File Number: #15243	
Worksheet Completed by: Julie M. Berndt Date: December 6, 2006	Approved by: Mark E. Hamlin

DOMESTIC WASTEWATER FACILITIES

***EXISTING* Wastewater and Sludge/Biosolids Impoundment Systems (confirm all statements given as true or false):**		
1. System (any or all of its individual impoundment components) does not leak excessively. (An **"excessively"** leaking lagoon system or cell may be defined as one that has been designed for subsurface infiltration, rarely or never needs to discharge, dries up in the summer, or contains rooted vegetation.)	True based on recent leak test data and installation of pond liners	
2. System is not located in a Groundwater Management Area where an identified contaminant of concern (ie. nitrates) may be associated with domestic wastewater or sludge.	True	
3. System is not located within 500 ft. of an existing public or private drinking water supply well, is not located within a designated Wellhead Protection Area, and all land within 500 ft. of the system is zoned such that no drinking water wells are likely to be installed in the future.	True	
4. There are no **exceptional situations** under which the impoundment system may require further groundwater review to determine the likelihood of an adverse impact	True	
***NEW* and *EXISTING* Wastewater and Sludge/Biosolids Land Application (confirm all statements given as true or false):**		
1. Application is in compliance with the "reuse" rules (or municipal sewage sludge application rules) and application rates are at or less than agronomic rates. (Note: Nominal leaching fractions may be considered to be in compliance with the "reuse" rules in some areas of the state such as parts of eastern Oregon where climate conditions indicate the need.)	True	
2. There are no **exceptional situations** under which the impoundment system may require further groundwater review to determine the likelihood of an adverse impact.	True	

If *all* answers for a given facility type are true, then no further information is needed. Non-numerical groundwater limits should be included in the permit.

If *any* answers for a given facility type were false, then more information is needed. The permit applicant may proceed with a Preliminary Groundwater Assessment. If there is reason to believe the facility poses a high risk to groundwater quality, the applicant may be encouraged to skip the Preliminary Groundwater Assessment step and proceed directly with the Hydrogeologic Characterization.

ATTACHMENT #4

Individual NPDES Antidegradation Review Sheet
For Proposed City of Cave Junction Discharge

1. What is the name of Surface Water that receives the discharge? **Illinois River**

   Briefly describe the proposed activity: **NPDES Permit Renewal**

   Is this review for a renewal OR new permit application? (circle one)
   Go to Step 2.

2. Is this surface water an **Outstanding Resource Water** or **upstream** from an **Outstanding Resource Water**?
   No. Go to Step 3.

3. Is this surface water a **High Quality Water**?
   No. Go to Step 4.

4. Is this surface water a **Water Quality Limited Water**?
   Yes. The stream is listed on the 303(d) list for at the point of discharge for temperature and bacteria during the period of permitted discharge.
   Go to Step 14.

---

14. Will the proposed activity result in a Lowering of Water Quality in the **Water Quality Limited Water**? [see OAR 340-041-0004(3)-(5) for a description in rule of discharges that do not result in lowering of water quality or do not constitute a new and/or increased discharge or are otherwise exempt from antidegradation review; otherwise see "Is an Activity Likely to Lower Water Quality?" in *Antidegradation Policy Implementation Internal Management Directive for NPDES Permits and Section 401 Water Quality Certifications*.]

    No. Proceed with Permit Application. Applicant should provide basis for conclusion. Go to Step 21.

    This conclusion is explained and supported by data and evaluations included with the Permit Evaluation Report and attachments accompanying the proposed NPDES Permit Renewal. This is an existing discharge and there is no change in their operation. The discharge must meet the water quality criteria for all parameters at the edge of the mixing zone. There is no request for a mass load increase.

    Any waste load allocations that will be assigned by the Illinois River /Rogue Basin TMDL to this source will be incorporated into the permit by modification or at the time of the next permit renewal.

    Go to Step 21.

---

21. On the basis of the Antidegradation Review, the following is recommended:
    _X_ Proceed with Application to Interagency Coordination and Public Comment Phase.
    ____ Deny Application; return to applicant and provide public notice.

Action Approved

Section:	Western Region Water Quality Permitting
Review Prepared By:	Julie M. Berndt
Phone:	(541) 687-7342
Date Prepared:	December 6, 2006

Attachment #5a - **Thermal Calculator**

Facility Name: **Cave Junction** **Date:** **12/3/2006**

Enter data into white cells below:

7Q10 =	**17**	cfs
Ambient Temperature or Criterion	**13**	°C
Effluent Flow =	**0.87**	mgd
Effluent Temperature	**18**	°C

5% of 7Q10 =	**0.9**	cfs
5% dilution =	**2**	dilution = (Qe+Qr)/Qe

Temperature at 5% cross section = **16.06** **°C** **No Reasonable Potential**

Attachment #5b - **Thermal Calculator**

Facility Name: **Cave Junction** **Date:** **12/3/2006**

Enter data into white cells below:

7Q10 =	**17**	cfs
Ambient Temperature or Criterion	**13**	°C
Effluent Flow =	**0.87**	mgd
Effluent Temperature	**18**	°C

25% of 7Q10 =	**4.3**	cfs
25% dilution =	**4**	dilution = (Qe+Qr)/Qe

Temperature at 25% cross section = 14.20 °C **No Reasonable Potential**

Attachment #5c - **Thermal Calculator**

Facility Name: **Cave Junction** **Date:** **12/3/2006**

Enter data into white cells below:

7Q10 =	**17**	cfs
Ambient Temperature or Criterion	**13**	°C
Effluent Flow =	**0.87**	mgd
Effluent Temperature	**18**	°C
Allowable increase =	**0.3**	°C

25% of 7Q10 =	**4.3**	cfs
25% dilution =	**4**	dilution = (Qe+Qr)/Qe

ΔT at edge of MZ =	**1.20**	**°C**	**Reasonable Potential**

Thermal Load Limit =	**4.11**	**Million Kcals**

Attachment #5d - **Thermal Calculator**

Facility Name: **Cave Junction** **Date:** **12/3/2006**

Enter data into white cells below:

Dilution =	**4.2**	
Ambient Temperature or Criterion	**13**	°C
Effluent Temperature	**18**	°C
Allowable increase =	**0.3**	°C
Effluent Flow Rate =	**0.87**	mgd

ΔT at edge of MZ=	**1.19**	**°C**	**Reasonable Potential**

Thermal Load Limit =	**4.1**	**Million Kcals**

Reasonable Potential Analysis - Chlorine and Ammonia

Facility Name: City of Cave Junction **Attachment #6 - Reasonable Potential Analysis (RF Date: 12/6/2006**

Dilution Values? (Y/N)	n	calculated
Low Flow Dilution @ ZID (1Q10)	*	*
Low Flow Dilution @ MZ (7Q10)	*	*
Low Flow Dilution @ MZ (30Q5)	*	*
High Flow Dilution @ ZID (1Q10)	*	2.1
High Flow Dilution @ MZ (7Q10)	*	4.2
High Flow Dilution @ MZ (30Q5)	*	5.3
Enter data below if no dilution data is available		
Data to estimate dilution	Summer	Winter
Effluent Flow (mgd) =	*	0.87
1Q10 (CFS) =	*	15
7Q10 (CFS) =	*	17
30Q5 (CFS) =	*	23
% dilution at MZ =	*	25
% dilution at ZID =	*	10

Confidence Level =	99%
Probability Basis =	95%

Summer data	Effluent	Stream	Mixed ZID	Mixed MZ	
pH * =			*	*	(6.5-9)
Temp * =			*	*	° C
Alkalinity =					
Salmonids Present? (Y/N)					
Salmonid Spawning? (Y/N)					
Fresh Water ? (Y/N)					
Salinity (ppt)			*	*	
Winter data					
pH * =	7.5	7.5	7.5	7.5	(6.5-9)
Temp * =	18	18	18.0	18.0	° C
Alkalinity =	15	10			
Salmonids Present? (Y/N)	n/a	y			
Salmonid Spawning? (Y/N)	n/a	y			
Fresh Water ? (Y/N)	n/a	y			
Salinity (ppt)	0	0	*	*	

PARAMETER	# of Samples	Highest Conc. mg/l	Coef. of Variance	Calculated Maximum Conc. mg/l	Background Conc. mg/l	Maximum Conc. at ZID mg/l	Maximum Conc. at MZ mg/l	WQ CRITERIA Acute (CMC) mg/l	WQ CRITERIA Chronic (CCC) mg/l	REASONABLE POTENTIAL ? ACUTE	REASONABLE POTENTIAL ? CHRONIC
High Flow Season											
AMMONIA - Freshwater	37	4.0	0.88	5.60	0.04	2.67	1.38	12.1	1.4	**NO**	**NO**
AMMONIA - Proposed 1hr/4day	37	4.0	0.88	5.60	0.04	2.67	1.38	13.3	8.72	**NO**	**NO**
*AMMONIA - Proposed 30day**	37	4.0	0.88	5.60	0.04	n/a	1.09	n/a	3.5	**n/a**	**NO**

* -NOTES :

Temperature must be between 0 and 30 ° C
pH must be between 6.5 and 9
Ammonia is total ammonia as N

Freshwater Ammonia Criteria Calculator

Dilution Values? (Y/N)	Y	calculated
Dilution @ ZID =	1	*
Dilution @ MZ =	1	*
Enter data below if no dilution data is available		
Data to estimate dilution		
7Q10 (CFS) =	*	
1Q10 (CFS) =	*	
% dilution at MZ =	25	
% dilution at ZID =	10	
Effluent Flow (mgd) =	1	

*** Notes:**
pH must be between 6.5 and 9.0
Temperature must be between 0 C and 30 C

Water Chemistry	Effluent	Stream	Mixed		
			ZID	MZ	
pH * =	7	8	7.0	7.0	(6.5-9)
Temp * =	20	20	20.0	20.0	° C
Alkalinity =	25	25			
Salmonids Present? (Y/N)		y			

WQ CRITERIA	
1 Hour	4 Day
(CMC)	(CCC)
mg/l	mg/l
19.30	1.23

Calculation of pH of a mixture of two flows.
Based on the procedure in EPA's DESCON program (EPA, 1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington D.C.)

City of Cave Junction Attachment #7

INPUT	Lower pH	Upper pH
1. DILUTION FACTOR AT MIXING ZONE BOUNDARY	4.20	4.20
1. UPSTREAM/BACKGROUND CHARACTERISTICS		
Temperature (deg C):	18.0	18.0
pH:	7.1	7.1
Alkalinity (mg CaCO3/L):	25.0	25.0
2. EFFLUENT CHARACTERISTICS		
Temperature (deg C):	18.0	18.0
pH:	6.2	7.0
Alkalinity (mg CaCO3/L):	75.0	75.0
OUTPUT		
1. IONIZATION CONSTANTS		
Upstream/Background pKa:	6.40	6.40
Effluent pKa:	6.40	6.40
2. IONIZATION FRACTIONS		
Upstream/Background Ionization Fraction:	0.83	0.83
Effluent Ionization Fraction:	0.39	0.80
3. TOTAL INORGANIC CARBON		
Upstream/Background Total Inorganic Carbon (mg CaCO3/	29.95	29.95
Effluent Total Inorganic Carbon (mg CaCO3/L):	192.91	93.69
4. CONDITIONS AT MIXING ZONE BOUNDARY		
Temperature (deg C):	18.00	18.00
Alkalinity (mg CaCO3/L):	36.90	36.90
Total Inorganic Carbon (mg CaCO3/L):	68.75	45.12
pKa:	6.40	6.40
pH at Mixing Zone/ZID Boundary:	**6.5**	**7.0**

APPENDIX B

Mixing Zone Study
Cave Junction Wastewater Treatment Facility

Prepared for
City of Cave Junction
Michael Bollweg
Lead Treatment Operator
P.O. Box 1396
Cave Junction, OR
97523

Prepared by
Dave LaLiberte, MSCE
Principal Civil and Environmental Engineer
Liberte Environmental Associates, Inc.
Wilsonville, Oregon

LEA

January 31, 2014

Summary

This study evaluates the discharge conditions and outfall-mixing zone (MZ) for the City of Cave Junction Wastewater Treatment Facility (WWTF). The Oregon Department of Environmental Quality (DEQ) allows the treated discharge as part of the National Pollutant Discharge Elimination System (NPDES) waste discharge permit issued to Cave Junction (CJ).[1] The discharge is to the Illinois River in southern Oregon.[2]

Figure 1 shows the regional Cave Junction location. Figure 2 maps the WWTF outfall at the Illinois River. Figure 3 depicts the permitted regulatory mixing zone (RMZ) of 100 feet downstream from the outfall and 50 feet from the west riverbank. This figure also shows the 10-foot radius of the zone of immediate dilution (ZID). The existing outfal1 performance could be improved with future installation of a multi-port diffuser.

Important Mixing Zone Guidance Documents

This report relies on the Regulatory Mixing Zone Internal Management Directive (IMD) (2012) by DEQ.[3] The filled-in Mixing Zone Study Checklist, and based on a Level 2 analysis from the IMD, is attached to this report as Appendix A.[4] The Technical Support Document (TSD)[5] by the EPA is also used as a key guidance document. Key elements of the environmental mapping are contained in Table 3 of the main body of this report.

Critical Dilutions

Table 1 summarizes key facility and river flow conditions, and resulting model dilutions, for the main November through May discharge period called out in the permit.

Table 1. Regulatory Permit Dilution and Basis

WWTF Flow with Corresponding Illinois River Flow

Illinois River Flow (cfs)	**Cave Junction WWTF Flow** (mgd)	**Existing Outfall** MZ Model Dilution[6]	**Potential Diffuser** MZ Model Dilution
57.8 [1Q10]	0.699[7]	3.0 to 1 (ZID at 10 feet)	15.6 to 1 at ZID
75.2 [7Q10]	0.520[8]	4.7 to 1 (RMZ at 100 feet)	22.3 to 1 at RMZ

[1] DEQ Permit (2007), Permit Number: 102610, National Pollutant Discharge Elimination System Waste Discharge Permit, issued by DEQ to Cave Junction on February 28, 2007.

[2] DEQ FS (2006), Permit Evaluation and Fact Sheet for Permit No. 102610, DEQ support document dated December 7, 2006.

[3] DEQ IMD, 2012, Regulatory Mixing Zone Internal Management Directive, Part One - Allocating Regulatory Mixing Zones and Part Two - Reviewing Mixing Zone Studies, Oregon Department of Environmental Quality, May 31, 2012.

[4] See DEQ IMD Appendix A.

[5] EPA TSD, 1991, *Technical Support Document for Water Quality-based Toxics Control*, EPA\505\2-90-001, U.S. Environmental Protection Agency, Office of Water, Washington, DC. [2nd Printing 1992]

[6] Existing and potential diffuser dilution results from EPA CORMIX3 modeling as discussed on pp. 9-10.

[7] Projected maximum daily average flow during the 1Q10 critical period over at least the last three (3) years between January 2010 and April 2013.

The EPA statistical hydrologic program, DFLOW, is used to determine 1Q10 and 7Q10 low flows for the Illinois River. USGS river flow data[9] for November through May for the period 1961 to 2013[10] was inputted to DFLOW for analysis.

For the Illinois River, the 1Q10 of 57.8 cubic-feet per second (cfs) is the one-day average low flow for the critical projected 10-year period (1Q10), and the 7Q10 of 75.2 cfs is the seven-day average low river flow for the critical projected 10-year period (7Q10).

Consistent with DEQ's IMD, the facility design average dry weather flow (DADWF) is used with the low 7Q10 river flow to evaluate critical dilution for chronic conditions. The maximum daily average facility flow is used in combination with the 1Q10 river flow to evaluate critical dilution for acute conditions.

The constant total dilution approach used in this report for June and October is based on the existing permit. This approach uses a river flow of 200 cfs combined with the facility DADWF to determine the restrictive dilution of 248.6. Table 2 evaluates total dilution based on potential June and October facility discharges. Figure 4 shows how the controlling dilution for the months of June and October reduces the allowable facility flow rates with decreasing river flow.

Table 2. June and October Permit Conditions

Proportionally Varying Facility and River Flows with Fixed Dilution

Illinois River Flow (cfs)	**Allowable WWTF Flow** (mgd)	**Constant Dilution** [11]
200	0.520 [0.8045 cfs]	248.6[A]
150	0.390 [0.6034 cfs]	248.6
100	0.260 [0.4023 cfs]	248.6
75.2[12]	0.196 [0.3025 cfs]	248.6

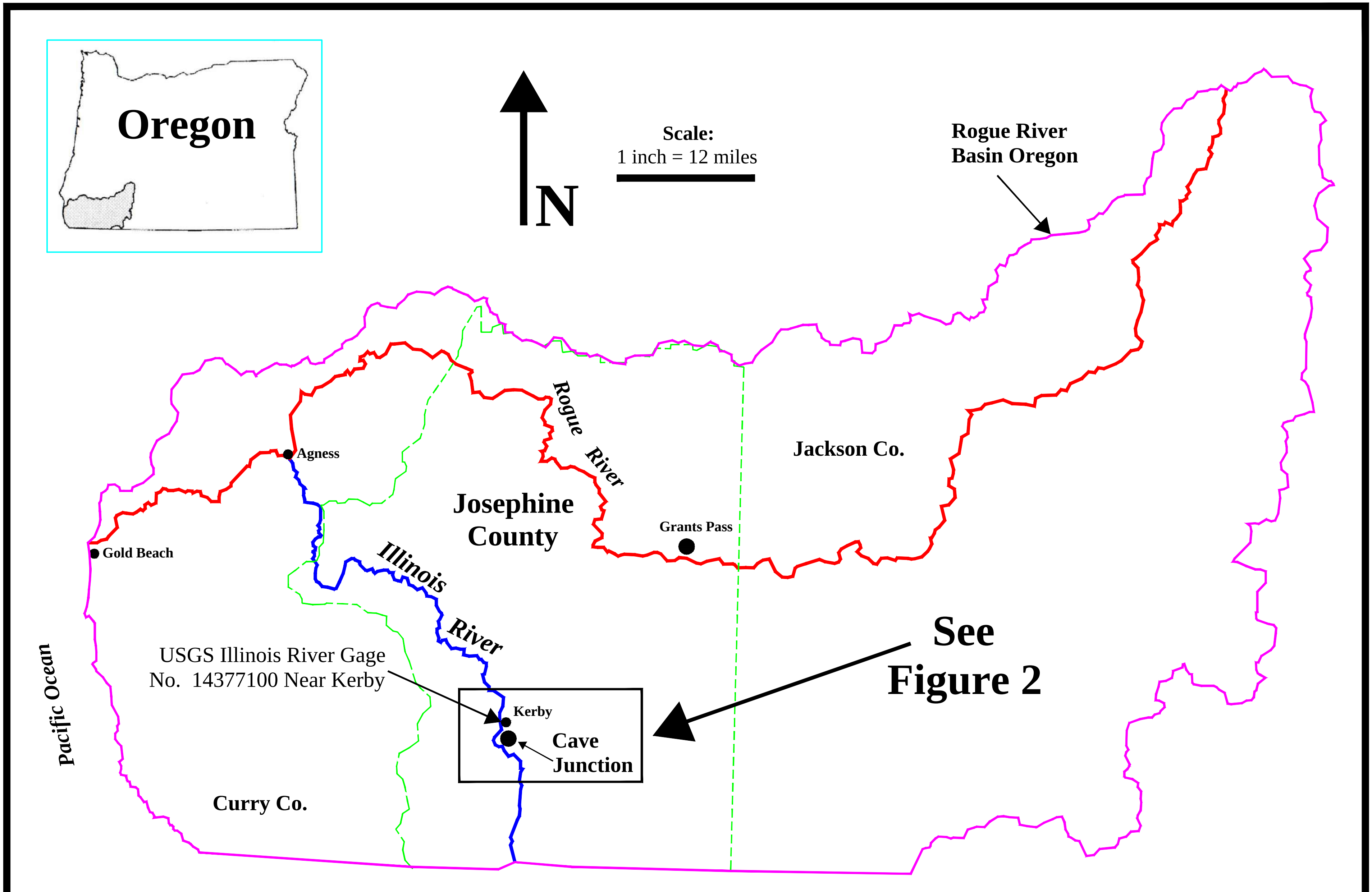
[8] Design average dry weather flow (DADWF).

[9] Flows are from USGS gage #14377100 for the Illinois River near Kerby, Oregon.

[10] This is a period of about 52 years with no dam affecting river flows.

[11] The controlling dilution is based on the existing permit for June & October. The permitted dilution remains unchanged while facility flow is proportionally decreased with decreasing river flow.

[12] The 75.2 cfs river flow equals the 7Q10 so that it is consistent with the main discharge period between November and May. No discharge would occur for June and October below the 7Q10 of 75.2 cfs.



Source: USGS

Figure 1. Cave Junction Vicinity Showing Illinois River Region

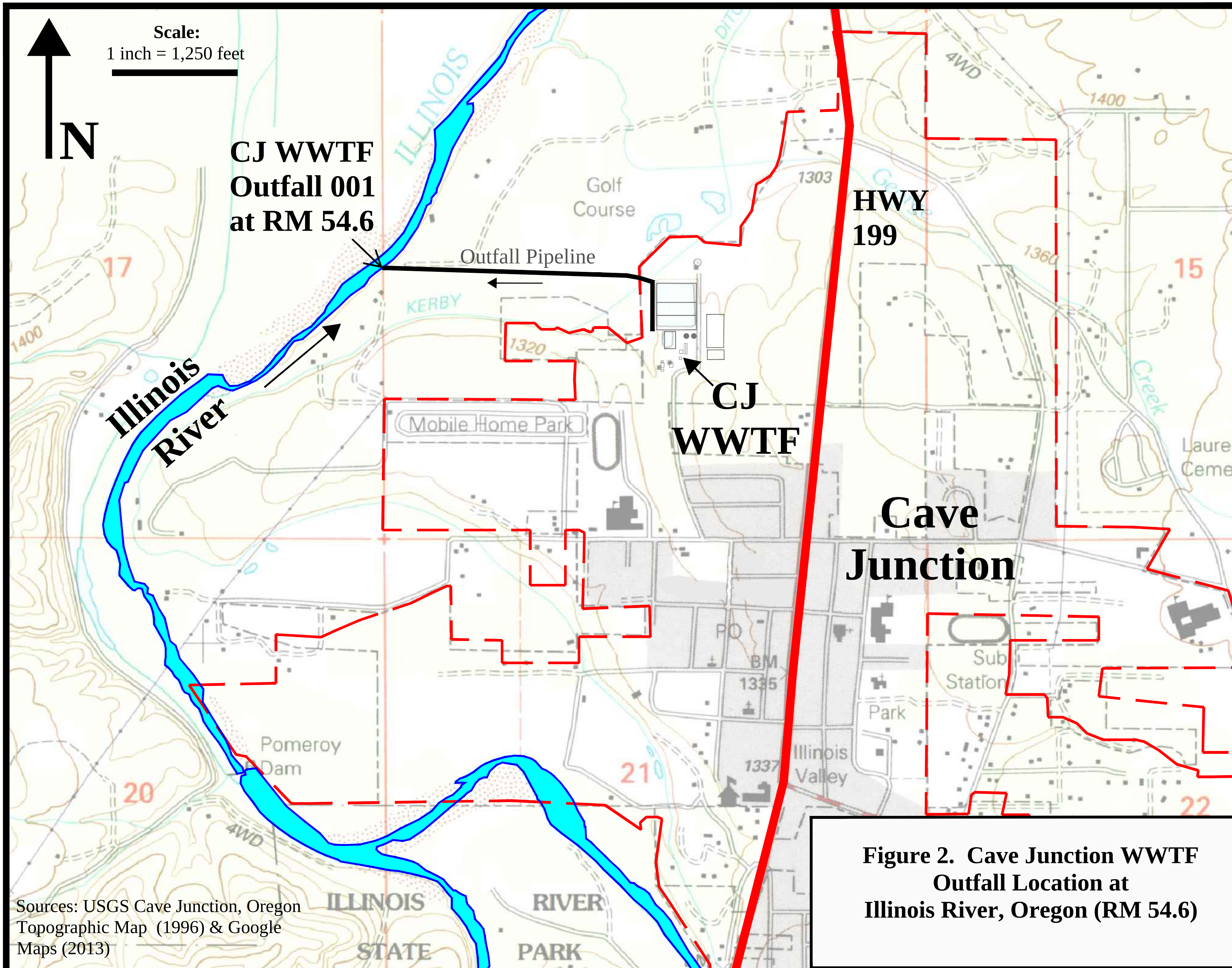
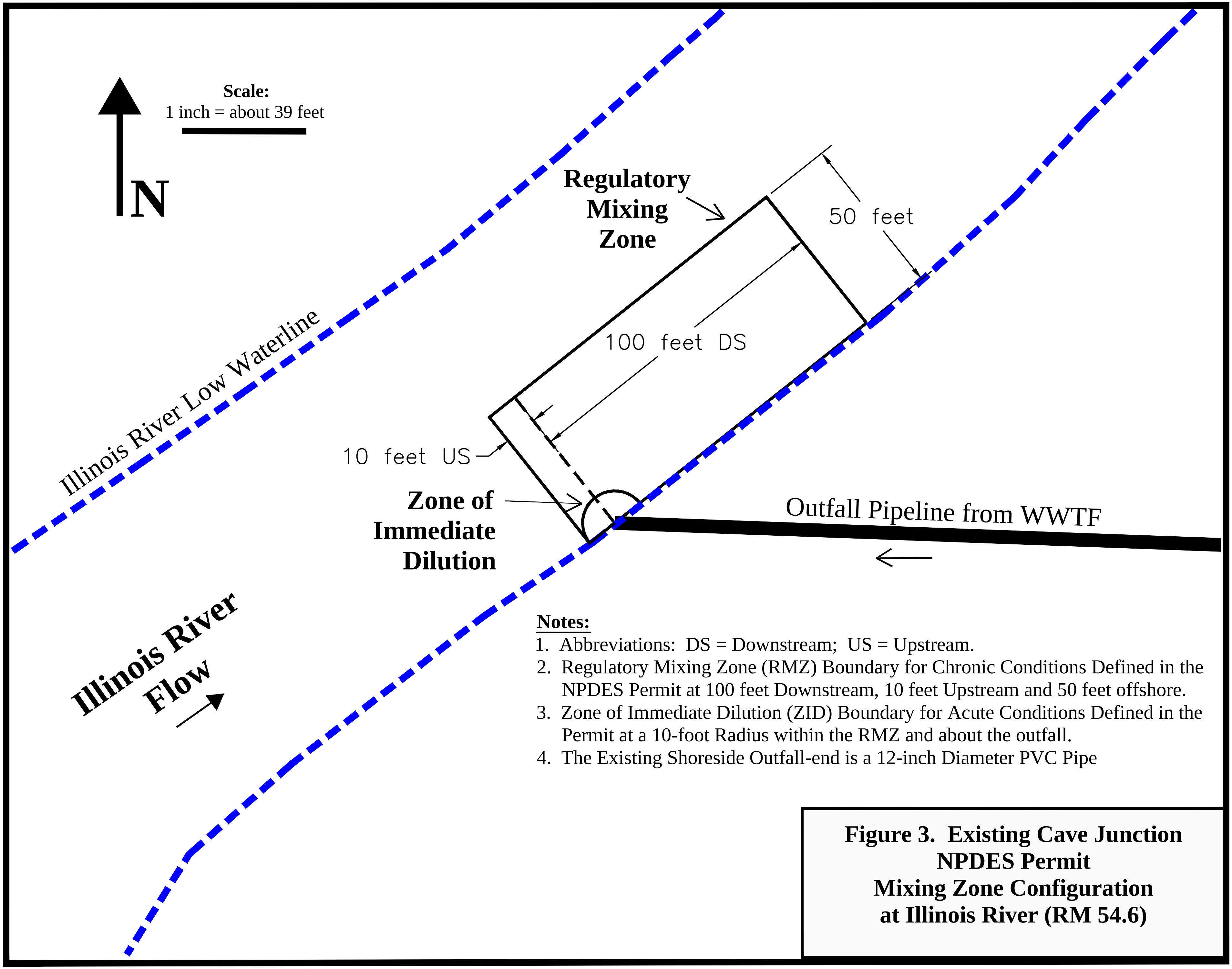


Figure 2. Cave Junction WWTF Outfall Location at Illinois River, Oregon (RM 54.6)

Sources: USGS Cave Junction, Oregon Topographic Map (1996) & Google Maps (2013)



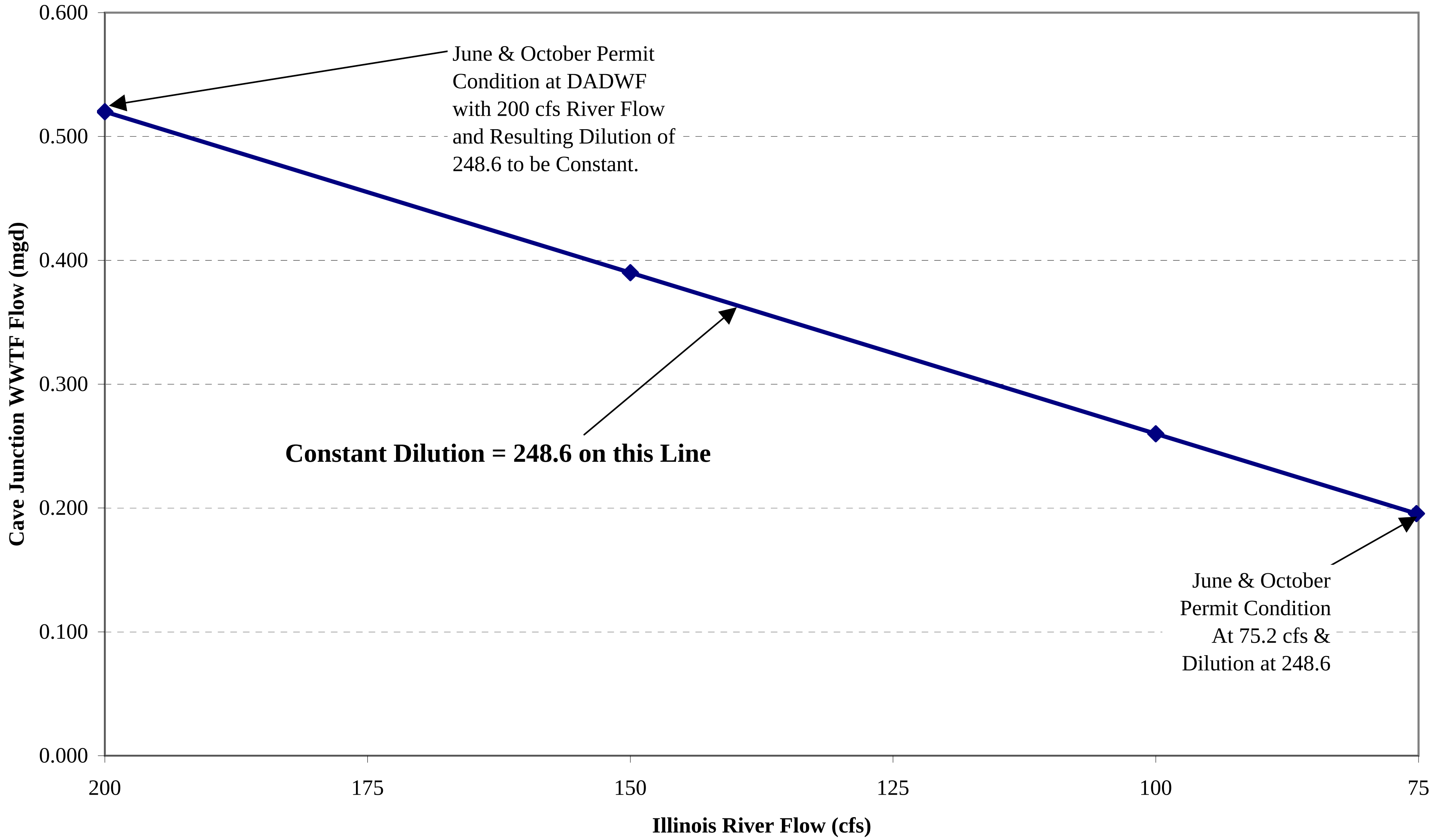
Notes:

1. Abbreviations: DS = Downstream; US = Upstream.
2. Regulatory Mixing Zone (RMZ) Boundary for Chronic Conditions Defined in the NPDES Permit at 100 feet Downstream, 10 feet Upstream and 50 feet offshore.
3. Zone of Immediate Dilution (ZID) Boundary for Acute Conditions Defined in the Permit at a 10-foot Radius within the RMZ and about the outfall.
4. The Existing Shoreside Outfall-end is a 12-inch Diameter PVC Pipe

Figure 3. Existing Cave Junction NPDES Permit Mixing Zone Configuration at Illinois River (RM 54.6)

Figure 4. Decreasing Allowable WWTF Flows with Decreasing River Flow

June and October Permit Dilution Constraint: Constant River Dilution at 248.6



Field Visit and Channel Hydraulics
Liberte Environmental Associates (LEA) conducted a field visit to the Cave Junction WWTF and outfall on June 13, 2013. Illinois River measurements were made at the facility outfall cross-section including flow depths, distances and velocities. Outfall photos are contained in Appendix B.

The river cross-section in the vicinity of the outfall, and used in this study, is developed from the field visit and other sources. Table 4 in the main body of this report provides flow depths, widths and velocities with varying river flows. Appendix C contains the detailed channel cross-section data and hydraulic analysis.

River Flow
Illinois River flow data was recorded by the USGS at the Kerby gage.[13] This gage is located about 4.3 miles downstream of the Cave Junction facility outfall.[14] The period of record from October 1961 to April 2013 was statistically evaluated using EPA's DFLOW program to determine the one-day average low river flow for a projected 10-year period (1Q10); and the seven-day average low river flow for a projected 10-year period (7Q10).

Summary results for low river flow 1Q10 equals 57.8 cubic feet per second (cfs), and the 7Q10 equal to 75.2 cfs, are based on wet weather months (November through May).[15] Facility discharges may also occur in June and October if river flows are 200 cfs or greater. These river flows are tabulated with corresponding allowable facility flows in million gallons per day (mgd) in Table 1.

Table 5 in the main body of this report has a summary comparison of statistical river flow rates with associated facility flow rates and dilutions used in this study. The detailed results of the river flow statistical analysis are contained in Appendix D.

Permitted versus Actual Correlated Dilution Conditions
Table 1 compares permit facility flow and Illinois River flows based on dilutions derived in this *Cave Junction WWTF Mixing Zone Study* (CJMZ). This table includes 1Q10 and 7Q10 for Illinois River low flows. The dilutions presented in this study are based on conditions that use less than 25 percent of the river flow to allow for fish passage.[16, 17]

Correlation of actual facility and river flows shows that the 7Q10 statistical hydrologic approach is conservative. For a recent three-year period (January 2010 to April 2013), flow correlation shows that lower river flows consistently pair with lower facility flow

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[13] USGS Gage No. 14377100, Illinois River Near Kerby, OR, US Geological Survey, Southern Oregon Coastal Basin.

[14] The Kerby gage is about 4.3 miles downstream of the Cave Junction WWTF outfall. The outfall is at river mile (RM) 54.6 and the Kerby gage is at RM 50.3.

[15] These 1Q10 and 7Q10 low river flow rates were derived from EPA's DFLOW hydrologic statistics model using USGS flow data for the Illinois River near Kerby.

[16] DEQ RMZ IMD (2012), see fifth paragraph on Page 22 of 51.

[17] This is based on DEQ communication (Mark Hamlin), February 22, 2013.

rates. The correlation for Cave Junction WWTF flows and Illinois River flows is contained in Appendix E.

The 7Q10 low river flow of 75.2 cfs is combined with the design average dry weather flow (DADWF) of 0.520 mgd. These are key regulatory dilution conditions applicable to this mixing zone study. Appendix E1 shows that a lower facility flow of 0.183 mgd actually correlates to a river flow of 75.7 cfs (approximately the 7Q10 flow).[18] This demonstrates that the 7Q10 and DADWF pairing approach is very conservative when applied to the Cave Junction WWTF.

Frequency analysis on Illinois River flows was performed for the available 52-year period of record. Corresponding to the low river 7Q10, the seven-day average flow rate of approximately 75 cfs occurs about 0.6 percent of the time.

For the low 1Q10, the average daily river flow rate of 57.8 cfs occurs about 0.3 percent of the time. The Illinois River flow frequency analysis is in Appendices D2 and D3 for the 1Q10 and 7Q10 low river flows, respectively.

Dilution Based River and Facility Flows
Table 1 was previously presented and is derived from this discussion comparing allowable WWTF flow with corresponding Illinois River flows based on dilution. Lower transitional river and WWTF flow rates were evaluated based on river dilution being held constant with the June/October conditions. This method was selected because it does not increase pollutant loads over those allowed in the existing permit.

The controlling dilution for June and October is based on the existing permit condition with a river flow of 200 cfs and DADWF of 0.520 mgd. This result is a permitted river dilution of 248.6, which is held constant while proportionally varying lower facility and lower river flows (see Table 2).

Mixing Zone Dilution Modeling
CORMIX was used to determine mixing zone dilutions downstream of the outfall. Figure 5 depicts centerline dilution[19] downstream of the EXISTING outfall while varying key facility. Key river flows include 1Q10, 7Q10 and 200 cfs. Two-stage mixing conditions, near field and far field, are apparent in this figure.

In the nearfield, outfall conditions dominate and relatively low dilution occurs with the shoreside outfall. In the farfield, ambient mixing results in a slowly increasing effluent dilution beyond a few feet. However, low initial dilutions cause the existing outfall to operate below achievable dilutions.

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[18] See Appendix E1 for October 5, 2010 on Page 3 of 12. The seven-day average river flow of 75.7 cfs (approximately the 7Q10 flow) corresponds to a facility flow of 0.183 mgd. This is based on the critical ‘shoulder” months of June and October for the years 2010, 2011 and 2012, but is also applicable to the main discharge period between November and May for which no facility flows occurred during a 7Q10 period.

[19] Centerline dilutions result in the most stringent allowable effluent concentrations.

The facility discharge is typically warmer than the river and is positively buoyant, i.e., will tend to float. A temperature difference of 3 ^oC, between the effluent and the river, is used in this analysis to characterize the initial buoyancy of the facility discharge. A characteristic high effluent temperature of 23 ^oC[20] is combined with the river ambient temperature set at the 20 ^oC standard. Vertically fully mixed conditions occur rapidly at the outfall site because of the relatively shallow water depths at 1Q10 and 7Q10 low river flow conditions. Accordingly, any stratifying effects of buoyant discharges are quickly minimized and the dilution analysis is not primarily reliant on effluent or river temperature conditions.

Dilution Figures. Figure 6 charts centerline dilution downstream of a potential DIFFUSER. Figure 6 plots dilution downstream of the EXISTING outfall while varying key facility and river flows. Key river flows include 1Q10, 7Q10 and 200 cfs. Two-field mixing conditions are apparent in Figure 6 but greater dilutions result with the diffuser compared to the existing outfall. In the farfield, ambient mixing results in a steady increase in effluent dilution after a few feet, and higher initial dilutions allow the diffuser to operate in a range approaching achievable completely mixed dilutions.

Figure 7 directly compares dilutions of the existing outfall and a potential diffuser. Appendix F contains the full CORMIX mixing zone dilution analysis for the existing outfall and potential diffuser.

Dilutions for the Existing Outfall. The EPA mixing zone model, CORMIX, is used in this analysis to evaluate dilutions based on facility versus river flows. [21] Specifically, the CORMIX3 subsystem[22] is used to assess the existing outfall with its unsubmerged surface discharge into the Illinois River during low water conditions.

A simplification of irregular discharge geometries, by CORMIX3[23], is followed in this analysis because the WWTF effluent flows from an unsubmerged outlet pipe discharging above the river water surface. A pipe flowing partially full configuration is taken to characterize the unsubmerged entry point of the outfall into the river. Accordingly, for this analysis, CORMIX3 requires that an equivalent rectangular cross section must be used with an equivalent discharge area based on the original 12-inch outlet pipe diameter.

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[20] Table 6 lists the Cave Junction WWTF - Effluent Characteristics and shows that a maximum temperature of 21 ^oC has been recorded in the DMR for October through June, the possible discharge period. However, as shown in Appendix D1, effluent temperatures as high as 23 ^oC may occur in the summer so this value was used.

[21] Jirka, et al., 1996, *User's Manual for CORMIX: A Hydrodynamic Mixing Zone Model and Decision Support System for Pollutant Discharges into Surface Waters*, by Jirka, Gerhard H., Doneker, Robert L. and Hinton, Steven W., for Office of Science and Technology, US EPA.

[22] Jones, et al., 1996, *CORMIX3: An Expert System For Mixing Zone Analysis and Prediction of Buoyant Surface Discharges*, by Jones, Gilbert R., Nash Jonathan D. and Jirka, Gerhard H., DeFrees Hydraulics Laboratory School of Civil and Environmental Engineering, Cornell University, Cooperative Agreement No. CR 818527, for the US EPA.

[23] Ibid, see page 106 subsection 6.2.2.2. Simplification of Irregular Discharge Geometries.

Consistent with DEQ's IMD, the facility design average dry weather flow (DADWF) is used with the low 7Q10 river flow to evaluate critical dilution for chronic conditions. The projected daily maximum facility flow is used in combination with the low 1Q10 river flow to evaluate critical dilution for acute conditions.

For acute conditions at the 10-foot ZID, the EXISTING outfall centerline dilution is 3.0 based on the projected maximum daily average facility flow of 0.699 mgd occurring during critical period[24] and low 1Q10 river flow. For chronic conditions at the 100-foot RMZ, the existing centerline outfall dilution is 4.7 based on the DADWF facility flow of 0.520 mgd and low 7Q10 river flow. For the June and October river flow restriction of 200 cfs, the existing dilution is 5.6 based on the facility DADWF.

Dilutions for the Potential Future Diffuser. On a preliminary basis, the CORMIX2 subsystem[25] is used to select the potential outfall diffuser of twelve (12) feet long with nine (9) 1.75-inch ports. Analysis for acute dilution was performed for 1Q10 low river flow at the maximum daily average facility flow and for chronic dilution using the 7Q10 low river flow at the facility DADWF. Additional analysis was performed for the 200 cfs river flow condition for June and October also using the facility DADWF.

For acute conditions at the 10-foot ZID, the DIFFUSER centerline dilution is 15.6 based on the projected maximum daily average facility flow of 0.699 mgd occurring during critical period and low 1Q10 river flow. For chronic conditions at the 100-foot RMZ, the diffuser outfall centerline dilution is 22.3 based on the DADWF facility flow of 0.520 mgd and low 7Q10 river flow. For the June and October river flow restriction of 200 cfs, the diffuser dilution is 48.7 based on the facility DADWF.

[24] The facility maximum daily average flow occurring during the 1Q10 critical period is projected at 0.699 mgd based on the maximum average monthly flow occurring over all periods (wet or dry) during the last three plus years. This is because no facility discharge has occurred during a 1Q10 critical period in the Illinois River over the last three years so there is no explicit maximum daily flow value. If the maximum daily flow for the 7Q10 period is used instead to define the critical period, then the highest correlated facility flow is 0.183 mgd (see Appendix E1 for October 5, 2010 on Page 3 of 12), which is less than the chronic case DADWF of 0.52 mgd. This occurs because the design flow (i.e., DADWF) is a future projection while the actual correlated flow is not. To be conservative and maintain consistency, the facility flow used with the 1Q10 acute case must be higher than the facility flow used with the 7Q10 chronic case. So an appropriately maximized flow value must be projected. Accordingly, the maximum daily average facility flow for the 1Q10 critical period is conservatively projected from the all-period average monthly flow (see December 2012 facility flow in Appendix D1). This projection carefully maintains actual higher facility flows sought in the acute case dilution analysis while employing the 1Q10 river flow.

[25] Akar, Paul J. and Jirka, Gerhard H., 1991, *CORMIX2: An Expert System for Hydrodynamic Mixing Zone Analysis of Conventional and Toxic Multiport Diffuser Discharges*, EPA/600/3-91/073.

Figure 5. Mixing Zone Centerline Dilutions with Distance Downstream of the WWTF Existing Outfall

Based on CORMIX3 for Existing Outfall at 1Q10 & 7Q10 Low Flow and 200 cfs June/October Condition

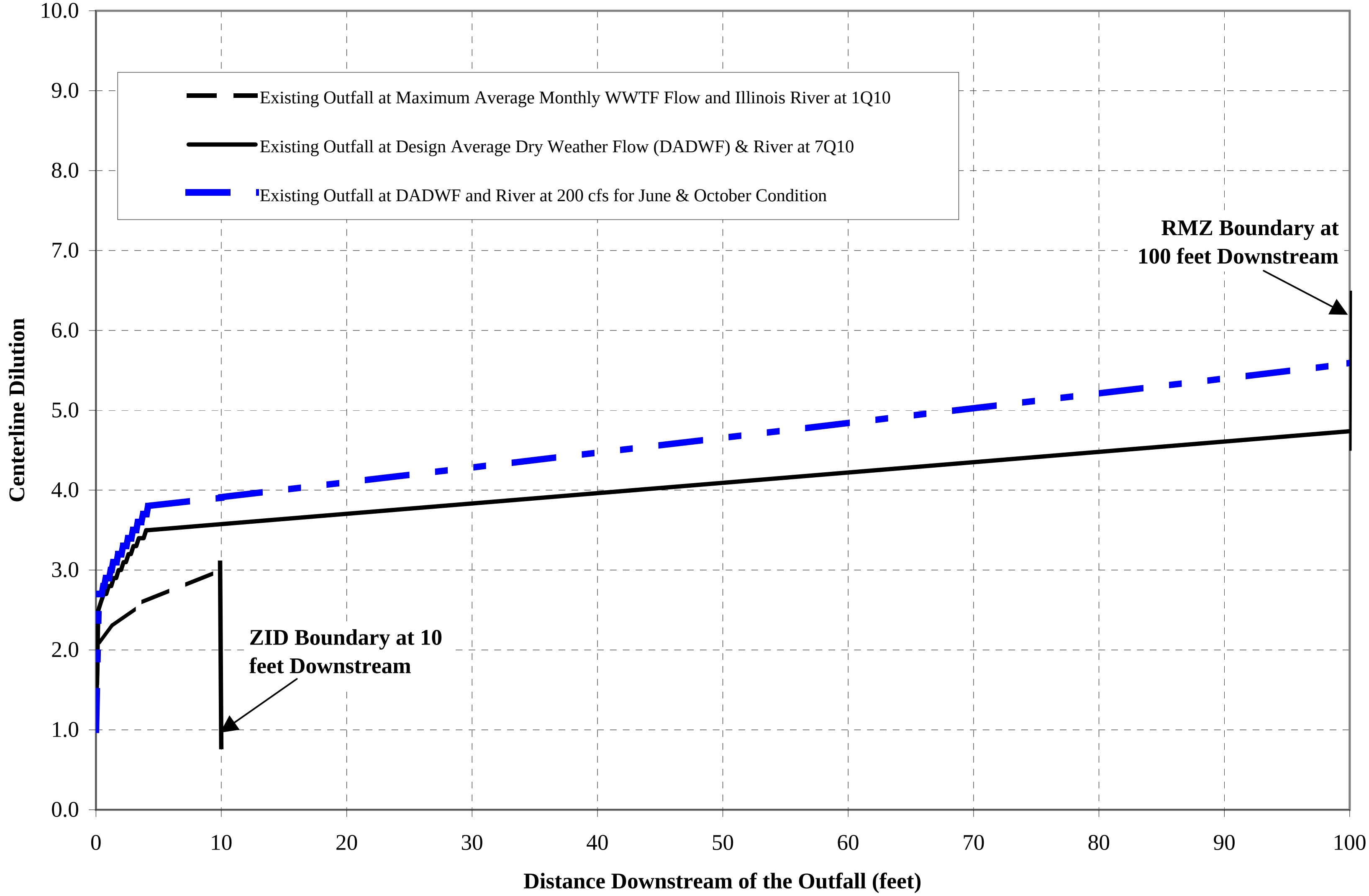


Figure 6. Mixing Zone Centerline Dilution with Distance Downstream of the WWTF Potential Diffuser

Based on CORMIX2 for Existing Outfall at 1Q10 & 7Q10 Low Flow and 200 cfs June/October Condition

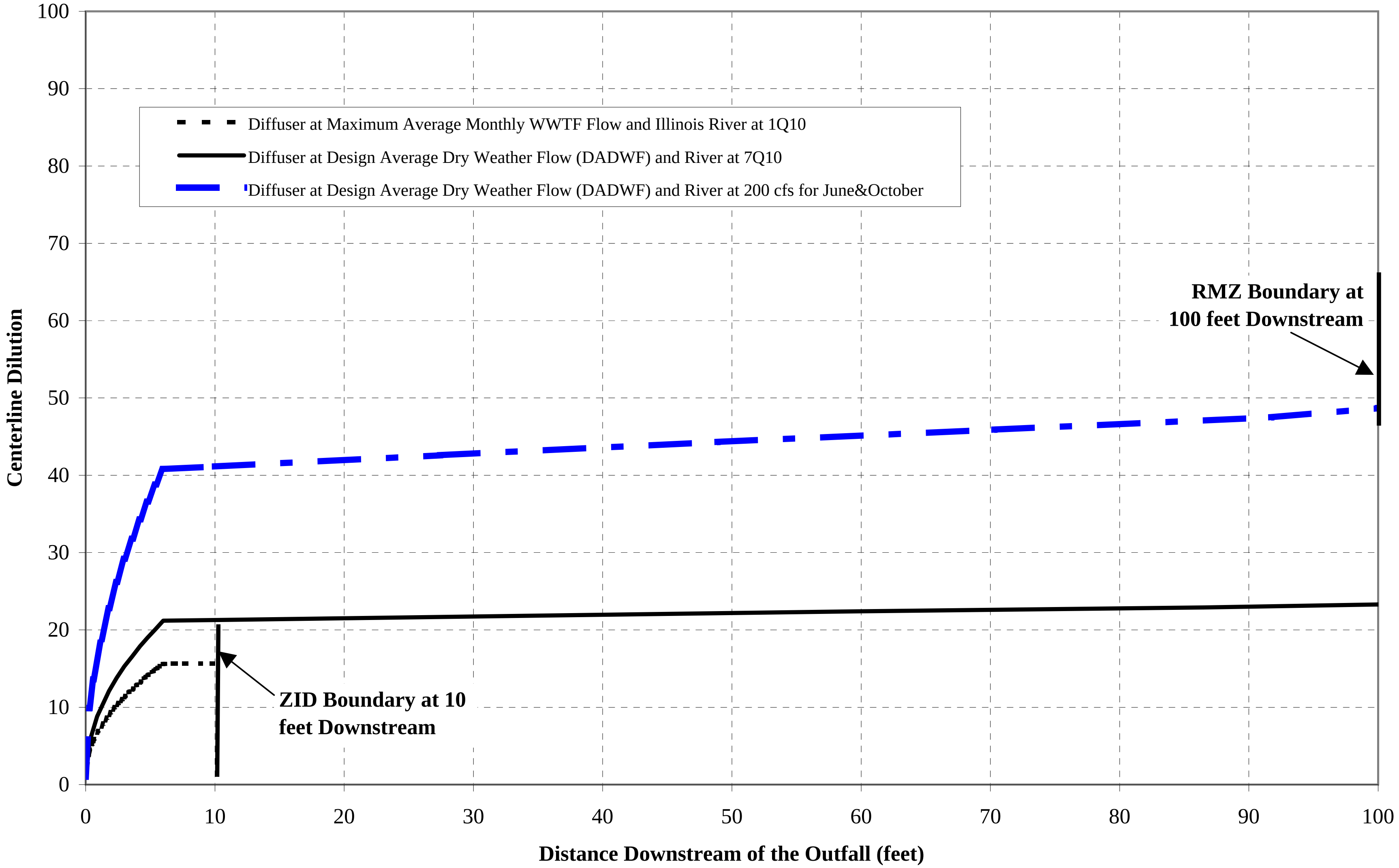
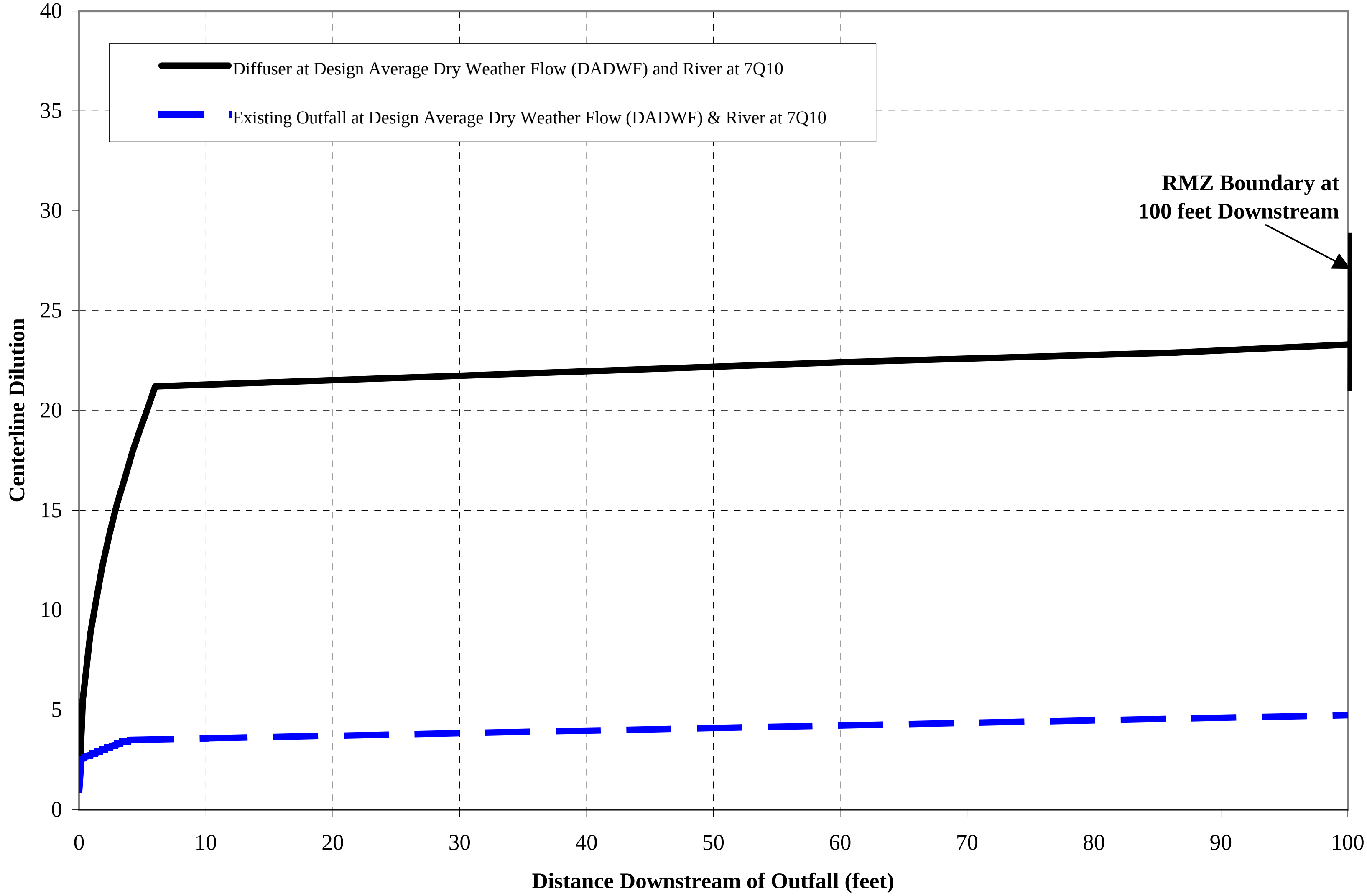


Figure 7. MZ Dilution with Distance Downstream from WWTF Outfall - Comparison at 7Q10

Comparison of Existing Outfall and Potential Diffuser



Background

This report evaluates the Cave Junction (CJ) Waste Water Treatment Facility (WWTF) discharge into the permitted Illinois River mixing zone. The Oregon Department of Environmental Quality (DEQ) identifies this allowance in the National Pollutant Discharge Elimination System (NPDES) permit issued to the Cave Junction WWTF.

The NPDES permit identifies the present regulatory mixing zone size and shape as a hundred (100) feet downstream of the outfall and ten (10) feet upstream of the outfall. An additional boundary requirement for evaluating potential acute toxicity conditions is set at ten (10) feet from the outfall.

This report focuses on the wastewater discharge from Outfall 001 during representative wet weather conditions identified in the NPDES permit as nominally occurring from November through May. Facility discharges may also occur in June and October if river flows are 200 cubic feet per second (cfs) or greater. Figure 1 shows the WWTF outfall vicinity relative to the Illinois River receiving water. Figure 3 shows the mixing zone schematic for Outfall 001 overlaid on a USGS base map of the Illinois River.

The CORMIX mixing zone model system developed by EPA, and identified by DEQ, is suited to the outfall configurations and river conditions developed in this study.[26] Specifically, the CORMIX3 and CORMIX2 subsystems used to analyze the Outfall 001 pipe end as a single-port diffuser under tidal conditions.

The DEQ uses two mixing zone regions when assessing acute and chronic conditions for instream water quality.[27, 28] The Zone of Initial Dilution (ZID) where acute toxicity conditions are met is defined as a ten-foot radius about the outfall; and the encompassing Regulatory Mixing Zone (RMZ), beyond which chronic toxicity conditions are met at 100 feet downstream of the outfall.[29] These boundaries are illustrated in Figure 3.

Environmental Mapping

As shown in Figure 2, the Illinois River is the receiving water for the Cave Junction WWTF discharge. Figure 1 shows the location of the Illinois River within the Rogue River Basin. The Rogue River Basin Total Maximum Daily Load (TMDL) issued in 2008 by DEQ[30] discusses WQ limited streams in the basin and is a primary source of environmental mapping information used in this study.

There is no commercial or recreational shell fishing in the Illinois River. There are no other NPDES discharges or drinking water intakes within a half-mile of the outfall.

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[26] EPA TSD, 1991, *Technical Support Document for Water Quality-based Toxics Control*, EPA\505\2-90-001, U.S. Environmental Protection Agency, Office of Water. Washington, DC. March, 1991. [Second Printing 1992 Cited Herein]

[27] OAR 340-041-0053 – Mixing Zones.

[28] EPA TSD (1991), see pages 70-72.

[29] The permitted RMZ also extends ten (10) feet upstream of the outfall.

[30] TMDL 2008, Rogue River Basin Total Maximum Daily Load (TMDL) issued in 2008 by DEQ.

There are no public beaches. There are no critical habitat areas in the RMZ in need of additional protection.

As a tributary in the Rogue River, the Illinois River produces coho salmon (NMFS listed Southern Oregon Coast ESU[31] as threatened, 1997), fall chinook salmon, winter and summer steelhead, and species of resident trout.[32, 33]

OAR 340-041-0271 states the "Beneficial Uses to Be Protected in the Rogue Basin". These are:

> (1) Water quality in the Rogue Basin (see Figure 1) must be managed to protect the designated beneficial uses shown in Table 271A (November 2003).
>
> (2) Designated fish uses to be protected in the Rogue Basin are shown in Figures 271A (November 2003) and 271B (August 2005).

Table 3 lists the numeric temperature criteria for salmonids. The main stem Illinois River is not considered Core Cold Water Habitat.[34]

Table 3. Salmonid Based Numeric Temperature Criteria

Beneficial Use	**Numeric Criteria** (7-Day Average Maximum)	**Season**
Salmon and Steelhead Spawning	13.0 ^oC (55.4 ^oF)	October 15 through May 15
Salmon and Trout Rearing and Migration	18.0 ^oC (64.4 ^oF)	Year around
Salmon and Steelhead Migration Corridors	20.0 ^oC (68.0 ^oF)	Year around

Mixing Zone Model and Inputs

This report relies upon the DEQ IMD for model selection as well as identifying key model inputs.

Mixing Zone Model Selection

The IMD identifies CORMIX as an appropriate model for simulating dilution under typical river conditions. The CORMIX model system[35] is used to evaluate mixing zone (MZ) dilutions resulting from WWTF discharges into the Illinois River.

31 ESU is Evolutionarily Significant Unit.

32 DEQ TMDL 2008, see Chapter 1 – Summary, section on Rogue River Basin Fisheries, Pages 1-6&7.

33 ODFW (July 2013), list of Threatened, Endangered, and Candidate Fish and Wildlife Species in Oregon.

34 OAR 340-041-271 Figure 271A – Fish Use Designations Rogue Basin, Oregon.

35 Jirka, et al., 1996, *User's Manual for CORMIX: A Hydrodynamic Mixing Zone Model and Decision Support System for Pollutant Discharges into Surface Waters*, by Jirka, Gerhard H., Doneker, Robert L. and Hinton, Steven W., for Office of Science and Technology, US EPA.

Two CORMIX subsystems are used in this mixing zone study. The CORMIX3 subsystem[36] is used to evaluate the existing outfall configuration, which constitutes an unsubmerged buoyant surface discharge. The CORMIX2 subsystem[37] is used to simulate a potential future outfall configuration using a submerged multi-port diffuser.

Detailed mixing zone inputs for both the existing and potential future outfall configurations are in Appendix F along with corresponding river conditions. The model runs employing these conditions are also presented in Appendix F. CORMIX model inputs include three general areas: receiving water conditions, outfall configuration and effluent characterization.

Illinois River Conditions

This analysis uses available data and site measurements to develop the receiving water hydraulic conditions for the Illinois River.

Cross-sectional Measurements and River Flow
A field visit to the WWTF and the Illinois River outfall vicinity was conducted by LEA on June 13, 2013. Cross-sectional and river flow data were collected and consisted of distance and width measurements as well as flow depths and velocities.[38] The river cross-section recorded at the outfall site is presented in Figure 8. Table 4 summarizes river hydraulic flow, depth, width and velocity based on this cross-section.

The river hydraulics analysis is developed based on WWTF drawings, the field collected data, USGS flow data for the Illinois River, USGS topographic mapping, and other related sources. Hydraulic conditions on the day of the field study, June 13, 2013, were related to the USGS reported Illinois River flow of 152 cfs for the same day.

A scale model drawing of the channel cross-section was developed in AutoCAD so that flow areas, widths and wetted perimeters could be determined based on a given water surface elevation (WSEL). Flows were projected based on Manning's Equation and the channel information previously indicated.[39, 40] With these tools, an iterative approach was used to determined the WSEL and channel hydraulic conditions for 1Q10, 7Q10 and other river flows. The comprehensive river analysis for the channel hydraulics is available in Appendix C.

[36] Jones, et al., 1996, *CORMIX3: An Expert System For Mixing Zone Analysis and Prediction of Buoyant Surface Discharges*, by Jones, Gilbert R., Nash, Jonathan D. and Jirka, Gerhard H., at the DeFrees Hydraulics Laboratory School of Civil and Environmental Engineering, Cornell University, Cooperative Agreement No. CR 818527, for the US EPA.

[37] Akar, Paul J. and Jirka, Gerhard H., 1991, *CORMIX2: An Expert System for Hydrodynamic Mixing Zone Analysis of Conventional and Toxic Multiport Diffuser Discharges*, EPA/600/3-91/073

[38] A calibrated Swoffer current meter, Model 2100, was used to collect the flow velocity data. Distances and widths were measured using a Bushnell range finder, Model - Yardage Pro Sport.

[39] White (1986), *Fluid Mechanics*, author Frank M. White, McGraw-Hill, see page 598 through 603.

[40] Linsley (1979), *Water-Resources Engineering*, author Ray K. Linsley, McGraw-Hill, see Pages 251 through 255.

Figure 8. Cave Junction - Illinois River Cross-section at the WWTF Outfall - At Low Water Depths

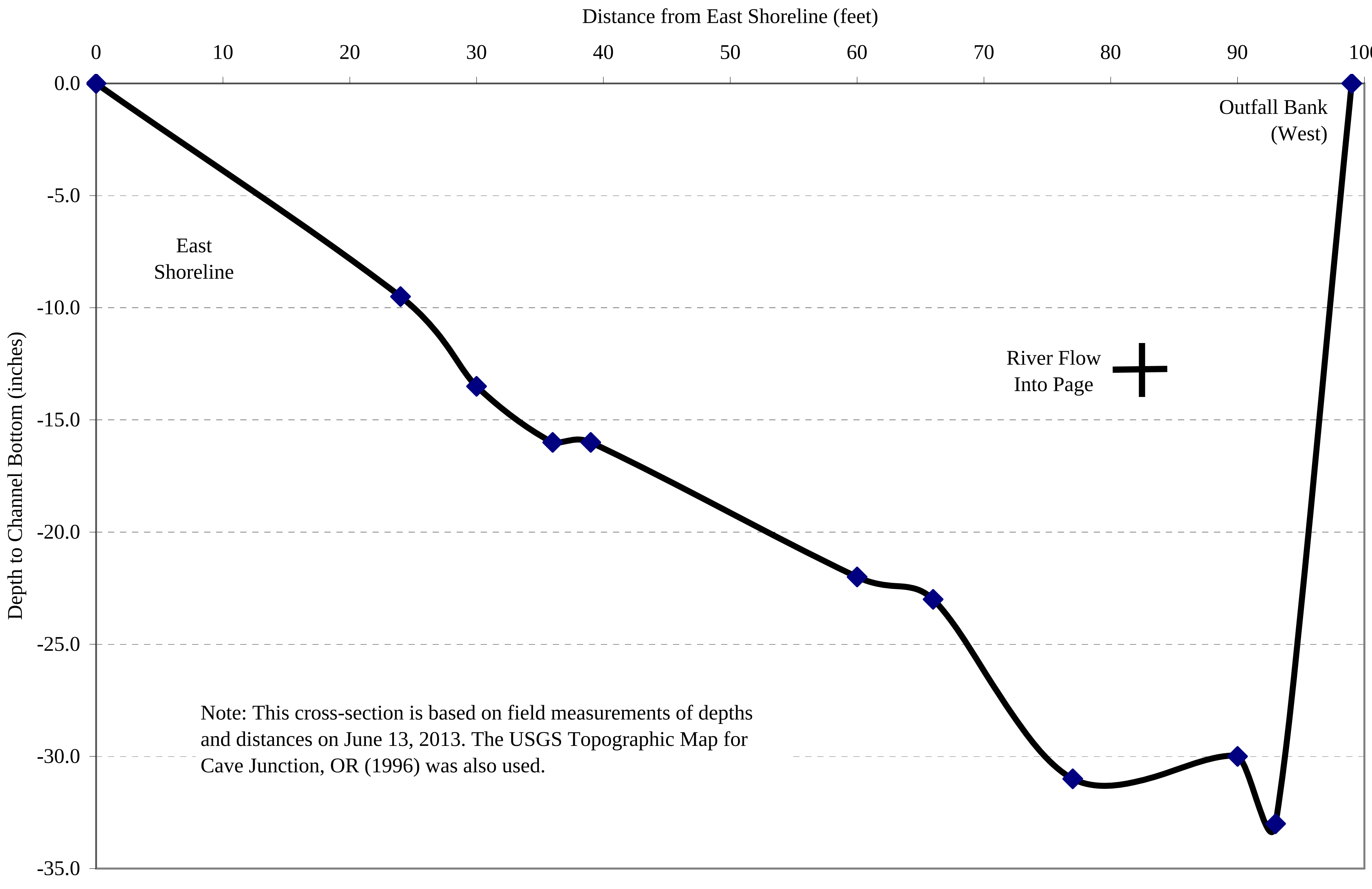


Table 4. Illinois River Flow Characteristics at the Outfall Cross-section

Flow rate estimated based on Manning's Equation

	Flow Area[A]			Flow Width[B]		Calculated Depth[C]		Calc[D]	Est.	
Elev ft NGVD USGS	**Incr Area** in^2	**Incr Area** ft^2	**Total Cumu** ft^2	**width** inches	**width** feet	**avg depth** inches	**avg depth** ft	**flow velocity** fps	**River flow** cfs	**Notes**
1263.4	1281733	8901	17560	15772	1314	160.3	13.4	2.67	46,850	Approx. 100-yr flood conditon
1255.4	565302	3926	8659	10932	911	114.1	9.50	2.13	18,404	
1250.4	385212	2675	4733	7912	659	86.1	7.18	1.76	8,338	
1245.4	228363	1586	2058	4929	411	60.1	5.01	1.69	3,480	
1239.4	42877	298	472	1871	160	35.4	2.95	1.30	612	
1238.4	4205	29.2	174	1248	104	20.1	1.68	1.15	200	June & October River Condition
1238.2	5002	34.7	145	1188	99.0	17.6	1.47	1.05	152	Field check using USGS- lower flow (6-13-13)
1237.9	3026	21.0	110	1020	94.0	14.1	1.17	0.91	100	
1237.8	2399	16.7	89.3	958	85.0	12.6	1.05	0.84	75.2	7Q10 Low River Flow Condition
1237.6	10459	72.6	72.6	1020	79.8	10.9	0.91	0.80	57.8	1Q10 Low River Flow Condition
1235.9	0	0	0	0	0	0	0	0	0	

[A]Cross-sectional flow area based on the AutoCAD scale model of the river channel at the outfall. "Incr" means Incremental flow area & "Cumu" means Cumulative flow area. Channel hydraulic charts were used for interpolating width, depth, & velocity for some river flows.

[B]Width of cross-section as determined from the AutoCAD scale model of the river channel at the outfall.

[C]Average depth used in the Mannings Equation and calculated based on AutoCAD scale model flow area divided by the flow width.

[D]Average flow velocity estimated based on Manning's Equation.

[E]Flow area calculations were not required because channel conditions for width, depth, velocity and flow were interpolated from the hydraulic charts.

River Flow Statistics

Illinois River flow data was recorded by the USGS at the Kerby gage.[41] This gage is located about 4.3 miles downstream of the Cave Junction facility outfall.[42] The USGS period of record from October 1961 to April 2013 was statistically evaluated to determine the one-day average low flow for a projected 10-year period (1Q10); and the seven-day average low flow for a projected 10-year period (7Q10).[43] Appendix D contains the statistical flow data for the 1Q10 and 7Q10 with the 25 percent reduction calculations to allow for fish passage.

Table 5 compares total dilution for recent and design WWTF flows combined with regulatory based Illinois River flows. For the analysis presented in this study, the dilution values are less than 25 percent of Illinois River 1Q10 and 7Q10 flows to allow for fish passage.[44, 45]

Table 5. Dilution Comparison for Historical WWTF and Illinois River Flows

Wet weather months (November through May)

	Facility Flow mgd	**River Flow** cfs	**Completely Mixed River Dilution**
Existing Average Wet Weather Flow [A] (EAWWF)	0.383 (0.0593 cfs)	57.8 (1Q10) 75.2 (7Q10) 200.0 cfs (permit condition)	97.6 126.9 337.6
Previous Average (2006) [B]	0.369 (0.571 cfs)	57.8 75.2 200.0	101.2 131.7 350.4
DADWF	00.520 (0.8044 cfs)	57.8 75.2 200.0	71.9 93.5 248.6

[A] For 2010 through April 2013 periods of wet weather flow (Nov. – May) for the WWTF.

[B] For periods of wet weather flow for the WWTF (see DEQ Fact Sheet from 2006).

Summary Facility Flows

The Design Average Dry Weather Flow (DADWF) for the Cave Junction facility is 0.520 mgd. Wet weather months are defined as nominally occurring from November through May. Facility discharges may also occur in June and October if river flows are 200 cfs or greater. Table 5 compares completely mixed river dilutions resulting from key combinations of facility and river flows.

[41] USGS Gage No. 14377100, Illinois River Near Kerby Oregon, US Geological Survey, Southern Oregon Coastal Basin.

[42] The Kerby gage is about 4.3 miles downstream of the Cave Junction WWTF outfall. The outfall is at river mile (RM) 54.6 and the Kerby gage is at RM 50.3.

[43] USGS Fact Sheet 229-96, The “100-Year Flood” , by Karen Dinicola, USGS Washington Water Service Center, Tacoma, WA, 1996. This document discusses how the probability of an event is calculated.

[44] DEQ RMZ IMD (2012), see fifth paragraph on Page 22 of 51.

[45] DEQ email (Mark Hamlin), February 22, 2013.

The Existing Average Wet Weather Flow (EAWWF) for these conditions is 0.383 in million gallons per day (mgd).[46] At the time of the last permit renewal in 2007 the existing average wet weather flow was 0.369 mgd.[47] It can be seen that the Cave Junction facility flow only slowly approaches the DADWF of 0.520 mgd.

Effluent Characteristics

Discharge monitoring reports (DMRs) for more than three (3) years were assessed to characterize effluent discharges. The period from January 2010 through April 2013 was evaluated. Effluent temperatures, dissolved oxygen in milligrams per liter (mg/l), and pH in standard units (S.U.) are summarized in Table 6 in addition to average daily facility flow. Detailed data for effluent water quality is contained in Appendix E - Facility and River Flow Correlation including effluent quality data as part of the data from the DMRs.

Table 6. Cave Junction WWTF - Effluent Characteristics
Minimum, Average and Maximum Values based on DMRs

	Q_E mgd	**Daily Max Temperature** ^oC	**Seven-day Temperature** [A] **^oC**	**pH** S.U.	**Dissolved Oxygen** mg/l
Wet Weather Period - November through May					
Minimum	0.157	9	10.7	6.0	2.4
Average	0.419	13.4	13.4	6.5	5.8
Maximum	1.431	19	18.6	7.2	10.4
Wet Weather Period - November through May plus June & October					
Minimum	0.152	9	10.7	6.0	1.9
Average	0.383	14.3	14.4	6.6	5.6
Maximum	1.431	21 (June)	20.3	7.2	10.4

[A] This is the seven (7)-day average of the daily maximums based on recorded samples.

Outfall Configuration

Figure 2 shows a plan view of the Cave Junction WWTF outfall pipeline. The outfall pipeline is about 3,340 feet long consisting of HDPE material. The existing outfall pipe-end is 12 inches (PVC) in diameter and terminates at the Illinois River shoreside (RM 54.6). Photos of the outfall are available in Appendix B.

Two CORMIX subsystems are used in this mixing zone study. The CORMIX3 subsystem[48] is used to evaluate the existing outfall configuration, which constitutes a

[46] For the wet weather months during the period January 2010 through April 2013.

[47] DEQ FS (2006), see third paragraph on page 3 of Fact Sheet.

[48] Jones, et al. (1996).

unsubmerged buoyant surface discharge. Table 7 lists important outfall configuration inputs to CORMIX3 to simulate the existing outfall.

The CORMIX2 subsystem[49] evaluated potential future outfall configurations based on a submerged multi-port diffuser. For this option, which significantly improves outfall mixing, several port and size arrangements were considered as listed in Appendix G. Table 8 lists important outfall configuration inputs to CORMIX2 to simulate a potential future diffuser.

The hydraulics efficiency of potential multi-port diffusers were used to narrow the list of initial diffuser arrangements. CORMIX2 was then employed to evaluated mixing zone dilution. For the first case, an 8-foot long diffuser with five (5) 1.50-inch ports was considered. For the second case, a 12-foot long diffuser with nine (9) 1.75-inch ports was considered. Of the compared potential diffusers, the 12-foot diffuser with nine (9) 1.75-inch ports was found, on a preliminary basis, to be the most efficient for the effluent hydraulics and mixing zone considered.

Table 7. Important Outfall Configuration Inputs for Existing Conditions
For CORMIX3 Subsystem for the unsubmerged outfall

Parameter	Input Value
Outfall Type	Single-Pipe: Un-submerged (during lower river flows)
Outfall Pipe End Distance from Shore	Shoreside discharge
Pipe Diameter	Outfall Pipeline is 24-inch (pipe-end is 12 inches)
Pipe Material	PVC End
Pipe Horizontal Orientation	Perpendicular to River Flow
Pipe Vertical Orientation	Parallel to bank slope (about 1:1)

Table 8. Important Outfall Configuration Inputs for Potential Future Diffuser
For CORMIX2 Subsystem for the multiport diffuser

Parameter	Input Value
Outfall Type	Submerged Multi-Port Diffuser Nine (9) 1.75-inch Ports (Preliminary Basis)
Diffuser Pipe Length	12 feet
Outfall Pipe End Distance from Shore	5 feet
Outfall Diffuser Pipe Diameter	8 inches
Pipe Horizontal Orientation	Perpendicular to River Flow
Pipe Vertical Orientation	20^{o} (All ports point in downstream direction, co-flowing diffuser)

49 Akar and Jirka (1991).

Dilution Mixing Zone Results

Table 9 compares CORMIX dilutions under the permitted regulatory mixing zone conditions. The EPA mixing zone model, CORMIX[50], is used in this analysis to evaluate dilutions based on varying facility and river flows. Centerline dilutions result in the more stringent allowable effluent concentrations or parameter.

Table 9. CORMIX Dilutions for Key Permit Mixing Zone Conditions

Flow Condition		**Mixing Zone Dilution**	
River	*Facility*	*Existing Outfall*	*Potential Future Diffuser*
1Q10 [A]	DADWF [C]	3.0 (at 10-foot ZID)	15.6 at ZID
7Q10 [B]	DADWF	4.7 (at 100-foot RMZ)	23.3 at RMZ
200 cfs [B]	DADWF	5.6 (at 100-foot RMZ)	48.7 at RMZ

[A] 1Q10 river dilution taken at the acute toxicity boundary of 10 feet.

[B] 7Q10 and 200 cfs river dilution taken at the chronic toxicity boundary of 100 feet.

[C] Design Average Dry Weather Flow (DADWF) of 0.520 mgd for the facility.

The CORMIX3 subsystem[51] is used to assess the existing outfall with its surface facility flow into the Illinois River. Dilution simulation was conducted for 1Q10, 7Q10 and 200 cfs river flow conditions while varying between existing and design facility flows.
On a preliminary basis, the CORMIX2 subsystem[52], is used to select the potential outfall diffuser of twelve (12) feet long with nine (9) 1.75-inch ports. Analysis was performed for 1Q10, 7Q10 and 200 cfs river flow conditions while varying between existing and design facility flows.

The permitted outfall regulatory mixing zone (RMZ) of 100 feet is evaluated in this study because of potential discharge components such as ammonia. Mixing zone dilution analysis is required to ensure that water quality standards for toxicity are being met with the outfall mixing zone.

Figure 5 depicts dilution downstream of the existing WWTF outfall varying key facility and river flows. Figure 6 charts dilution downstream of a potential future diffuser varying key facility and river values. Figure 7 directly compares dilutions of the existing outfall and a potential diffuser. Appendix F contains the full CORMIX analysis for the existing outfall and potential diffuser.`

[50] Jirka, et al. (1996), CORMIX expert system.

[51] Jones, et al. (1996), CORMIX3 subsystem.

[52] Akar (1991), CORMIX2 subsystem.

Appendix A

IMD Mixing Zone Study Checklist

Appendix A: Mixing Zone Study Checklist

Oregon DEQ Mixing Zone Study Checklist
(to be submitted to DEQ with Report on Mixing Zone Study) (v. 2.0, May 2012)

Legal Name: Cave Junction Wastewater Treatment Facility
Common Name: Cave Junction WWTF
Facility ID#: 15243
Application #: 965840

Date Submitted: January 31, 2014
Attachment: Cave Junction MZ (CJMZ) Study
Conducted by: Dave LaLiberte, P.E.
Liberte Environmental Associates (LEA)

Study Level ***(to be filled out by DEQ)***:
☐ **Level 1 - Simple**
☑ **Level 2 - Moderate** (DEQ Required)
☐ **Level 3 – Complex**
(See Part 2 of RMZ, Section 3.1, p.8)

Information:
X = required
E = estimate is acceptable
M = measurement (field or engineering plans)
D = desirable

Check if Complete (or note deficiencies) ***To be filled out by DEQ.***

1	2	3	1. **Environmental Mapping** (RMZ IMD Part 2, Section 4.1, p. 19)	
X	X	X	A. Attach plan view map showing outfall and a segment of river that extends at least 1/2 mile upstream and downstream of outfall. Map should indicate the following features downstream of outfall unless otherwise noted. By checking whether the specific feature is present or not, the permittee is certifying they have researched the information resources listed in Section 4.1 (Environmental Mapping) of the RMZ IMD.	

Feature	Present	Not present
Known commercial or recreational shellfish areas		✓
Fish spawning/rearing habitat	✓	
Cold water refugia for fish		✓
Areas identified as having species (fish or non-fish) that may be sensitive to impact of discharge*	✓	
Physical structures expected to attract fish (e.g., piers, large woody debris, outfalls)	✓	
Public access areas such as boat ramps, docks or public beaches		✓
Drinking water intakes within the vicinity of the outfall and ½ mile downstream (to be identified by DEQ. Link to internal webpage is http://deq05/wqoutfalls/EOPbasics.aspx	To be determined by DEQ	
Other NPDES discharges upstream and downstream within ½ mile of outfall (to be identified by DEQ. Link to internal webpage is http://deq05/wqoutfalls/EOPbasics.aspx)	To be determined by DEQ	

*If such species are found to be present, report should include a description of such species.
Page number(s) 14 and 15 of the CJMZ Study, subsection "Environmental Mapping".

1	2	3		
X	X	X	B. Are there threatened and endangered species in the RMZ? ☑ Yes ☐ No If yes, report should include a description of threatened and endangered species present, habitat, and migration pathways as well as source(s) of information. Page number(s) 14 and 15 of the CJMZ Study	

Oregon DEQ Mixing Zone Study Checklist
(to be submitted to DEQ with Report on Mixing Zone Study) (v. 2.0, May 2012)

		D	C. Other information as appropriate. Type of Information (check all that apply) / Page Number(s): □ Detailed salmonid use □ Bioassessment. □ Fish migration study □ Thermal imagery □ Map or measurements of channel width/depth □ Published information supporting environmental mapping □ Other. Describe:	
			2. Outfall Location and Mixing Description (RMZ IMD Part 2, Section 4.2, p.24)	
E	M	M	A. Outfall Measurements: Measurement / Page Number(s) Distance from bank (ft): Shoreside — pp. 20-21 - Outfall Config. Height above bottom (ft): about 9 feet	
E	M	M	B. If present, diffuser and port dimensions, orientation angle and configuration (include drawings, if available) A Potential Future Multi-port Diffuser is Possible for the site (12-foot with 9 1.75 ports). □ N/A ☑ Description on page number(s) p. 21 □ Drawing on page number(s):	
X	M	M	C. Outfall Location: Latitude: 42° 10' 32.5" Longitude: -123° 39' 2.9" *This information may be available on the following internal webpage:* http://deq05/wqoutfalls/EOPbasics.aspx	
E	E	E	D. River mile of outfall: RM 54.6 *This information may be available on the following internal webpage:* http://deq05/wqoutfalls/EOPbasics.aspx	
D	D	D	E. Photographs of the outfall vicinity □ N/A ☑ See attached on page number(s): See Appendix B of the CJMZ Study.	
X	X	X	F. Description and plan view of current RMZ and ZID as described in permit: ☑ See attached on page number(s): See Figure 3, Summary description on p.1, and Background on p. 14 of the CJMZ Study.	

			Part 3. Ambient Receiving Water Conditions (RMZ IMD Part 2, Section 4.3, p.26)	

E | E | E

A. Parameter: River flow, November through May,
Dates of Critical Period: June & October if above 200 cfs.
(Note:may vary with parameter. See Section 4.3, p.26)
☑ See attached on page number(s) p. 7, River Flow - Illinois R. Conditions.

Justification for Critical Period: Low river flow.
☑ See attached on page number(s) p. 7, River Flow - Illinois R. Conditions.

For Riverine Systems:
Flow statistics and dilutions corresponding to critical period:

Flow Statistic	Stream Flow (cfs)	Velocity (ft/sec)*	Dilution at edge of ZID	Dilution at edge of RMZ At DADWF	Page Number(s)
1Q10	57.8 cfs	0.84	3.0 (15.6)	NA	pp. 1,7,9,10
7Q10	75.2 cfs	0.80	**NA	4.7 (22.3)	pp. 1,7,9,10
30Q5	NA				
Harmonic Mean	NA				

*For systems where velocity can be approximated by a single value. If velocity profile is needed, go to next section B. ✓**Parentheses - Dilution with the Potential Diffuser.
✓RMZ Dilutions at Facility DADWF - Design Average Dry Weather Flow.
Describe source (USGS, other) and extent of flow data on which critical flow statistics are based.
☐ N/A
☑ See attached on page number(s) p. 2, River Flow Statistics based on EPA DFLOW and USGS Illinois River gage at Kirby, OR.

For Marine/Estuarine Systems:
Refer to Table 4-2 on p. 30 for appropriate statistics and describe in an attachment.
☐ N/A
☐ See attached on page number(s) ___________

E | E/M | E/M

B. Velocity profile* for each critical flow condition
☑ N/A
☐ See attached on page number(s) ___________
*for systems that where velocity cannot be approximated by a single value.

E | E/M | M

C. Cross sectional area (width and depth) for each critical flow.
☑ See attached on page number(s) pp. 17-18

E | E/M | M

D. Temperature and salinity profiles
☑ N/A (no stratification)
☐ See attached on page number(s) ___________

E | E | E

E. Manning's roughness coefficient:
Page number See Appendix F of CJMZ - CORMIX inputs.

			Part 4. Discharge Characteristics (RMZ IMD Part 2, Section 4.4, Table 4-3, p. 31)	
E	X	X	C. Discharge flow rates for critical flow scenarios:	

	☑ **Domestic**	□ **Industrial**
Aquatic Life: Acute	☑ For plants operating at <85% DWDF[1] during the critical period: Use maximum daily average flow for the past 3 years during the period when the critical receiving water flow is most likely to occur. □ For plants operating at 85-100% of DWDF: Use DWDF x PF[2]	□ Use maximum daily average flow for the past 3 years during the period when the critical receiving water flow is most likely to occur. □ If flows are expected to increase over the life of the permit, estimate highest daily maximum flow.
	Applicable Effluent Flow : 0.699 mgd	Page No.:pp. 1 & 10
Aquatic Life: Chronic	☑ For plants operating at 85-100% of DWDF during the critical period: Use DWDF. Approaching 85% □ For plants operating at <85% DWDF: Use highest monthly average flow for the past 3 years during the critical period or during the period when the critical condition is likely to occur.	□ Use highest monthly average flow for the past 3 years during the period when the critical receiving water flow is most likely to occur. □ If flow is expected to increase, estimate highest monthly average maximum flow.
	Applicable Effluent Flow : DADWF of 0.520 mgd	Page No.:pp. 1 & 10
Human Health	□ Carcinogens: Use the annual average design flow as specified in the engineering report or permit application, or use the annual average flow based on DMR analysis. ☑ Non-carcinogens: ☑ For plants operating at 85-100% of design capacity: Approaching 85% Use the dry weather design flow. □ For plants operating at <85% of design flow: Use highest monthly average flow for the past 3 years during the period when the critical receiving water flow is most likely to occur.	□ Carcinogens: Use the annual average flow based on the permit application or DMR analysis. □ Non-carcinogens: Use highest monthly average flow for the past 3 years during the period when the critical receiving water flow is most likely to occur. If flows are expected to increase over the life of the permit, estimate highest average monthly flow.
	Applicable Effluent Flow :DADWF of 0.520 mgd	Page No.:pp. 1 & 10

Notes:
[1]DWDF - Dry Weather Design Flow, same as DADWF.
[2]PF – Peaking Factor

	E/M	M	D. Discharge chemistry data: Check if N/A | Parameter | Value | Page Number(s) — | Temperature (F) | 57.9 avg (68.5 7d max) | p. 26 ✓ | Conductivity (μmhos) | | ✓ | Salinity (ppt) | |	
			Part 5. Mixing Zone Modeling* (RMZ IMD Part 2, Section 4.5, p. 32)	
	D	M	A. Field mixing measurements (e.g., dye studies) ☑ N/A □ See attached on page number(s) ___________	
X	X	X	B. Model selection and application discussion □ N/A ☑ See attached on page number(s) p. 14	
X	X	X	C. Description of mixing and plume dynamics (near-field and far-field) □ N/A ☑ See attached on page number(s) p. 6	
X	X	X	D. Sensitivity analysis □ N/A ☑ See attached on page number(s) p. 6	
X	X	X	E. Model results table (see Table 4-4 on page 34 of Section 4.5 of Part 2 of the RMZ IMD for an example) □ N/A ☑ See attached on page number(s) Table 9, Summary p. 11, and Dilution Figs. 4, 5 & 6.	

*Note: In some cases (e.g., shallow streams with non-uniform flow and tidally-influence waterbodies), modeling is not appropriate. See RMZ IMD Part 2, Section 2.2, p. 6.

DEQ Reviewer Comments

Name of DEQ Reviewer:

Date:

4. Describe deficiencies, if any.

5. Which if any need to be addressed before the permit can be issued?

6. Which if any may be addressed through permit conditions?

The checklist and reviewer comments should be attached to the permit evaluation report.

Appendix B

WWTF Outfall and Vicinity Photos

Photo 1 is the Cave Junction WWTF outfall at the Illinois River. Flow of river is from right to left in the photo. This photo is from Mike Bollweg (WWTF) and is dated May 22, 2013.

Photo 2 is the Illinois River view immediately downstream of the Cave Junction WWTF outfall. The outfall is just off camera to the right. Photo taken during LEA site visit on June 13, 2013.

Appendix C

Cross-sectional and Hydraulic Analysis

Figure C1. Cave Junction - Illinois River cross-section at the WWTF outfall

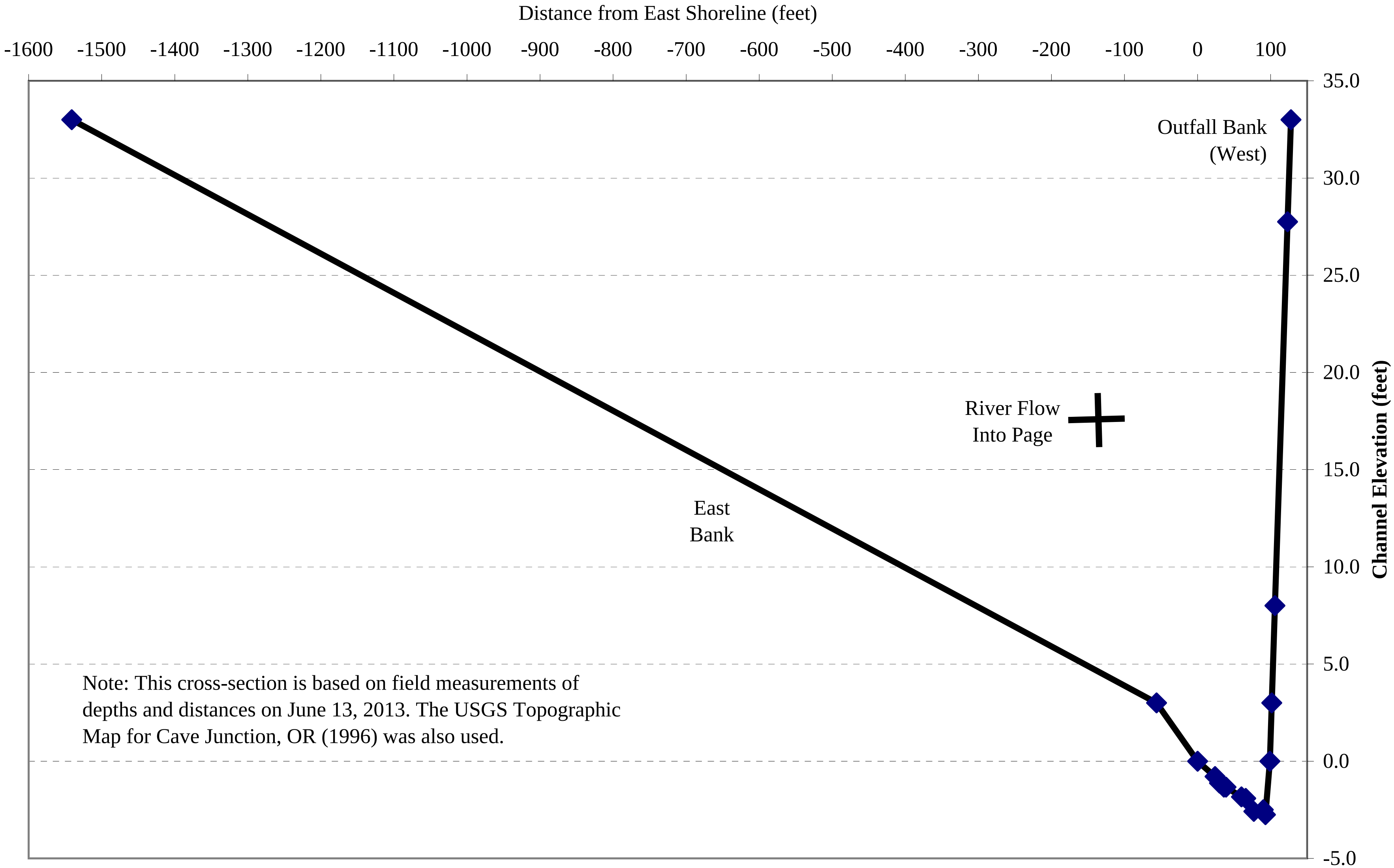


Figure C2. Illinois River Flow versus Elevations at the Outfall Cross-section for Low Flow Stages

Flow rate estimated based on Manning's Equation

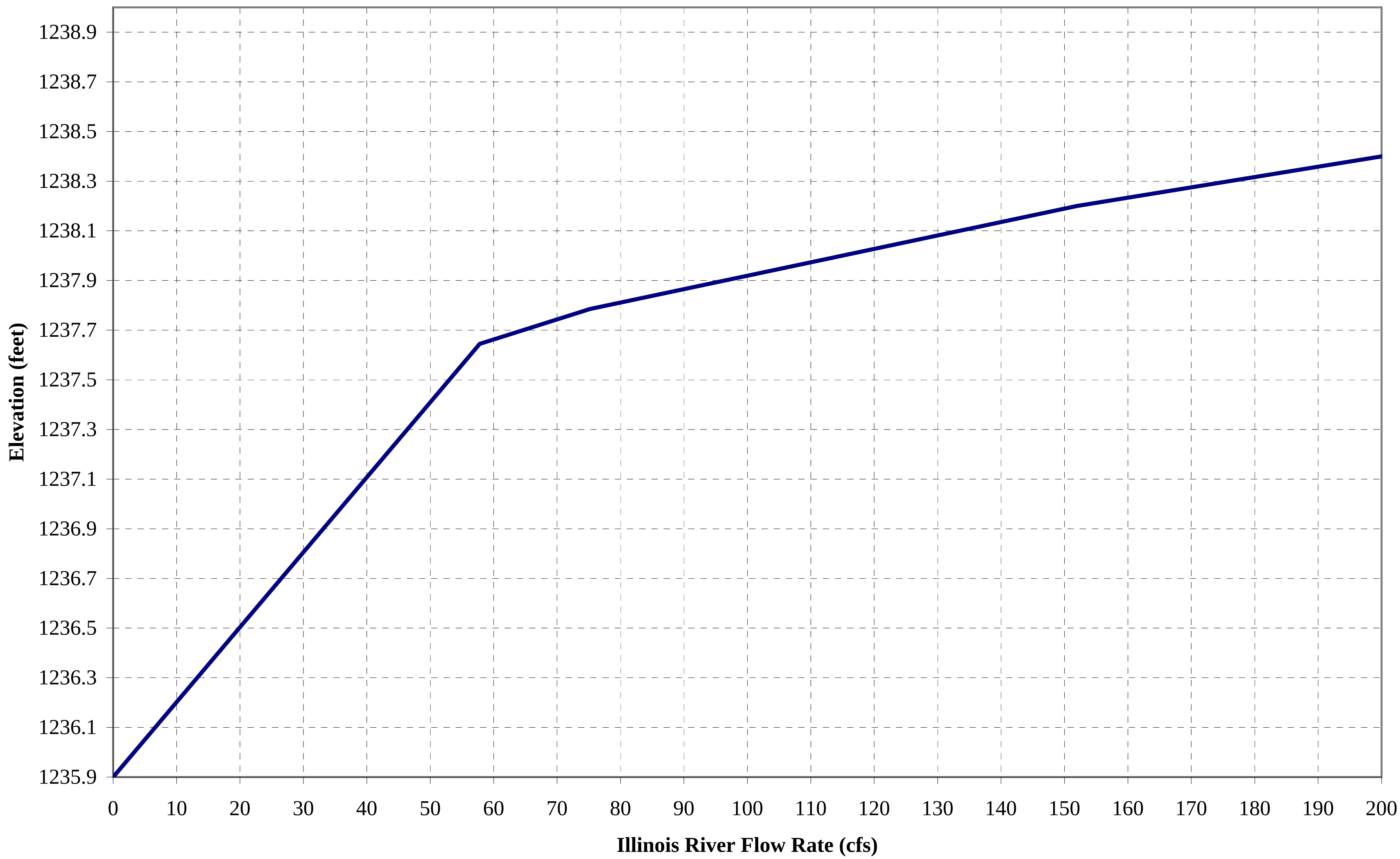


Figure C3. Illinois River Flow versus Elevations at the Outfall Cross-section for all Flows

Flow rate estimated based on Manning's Equation

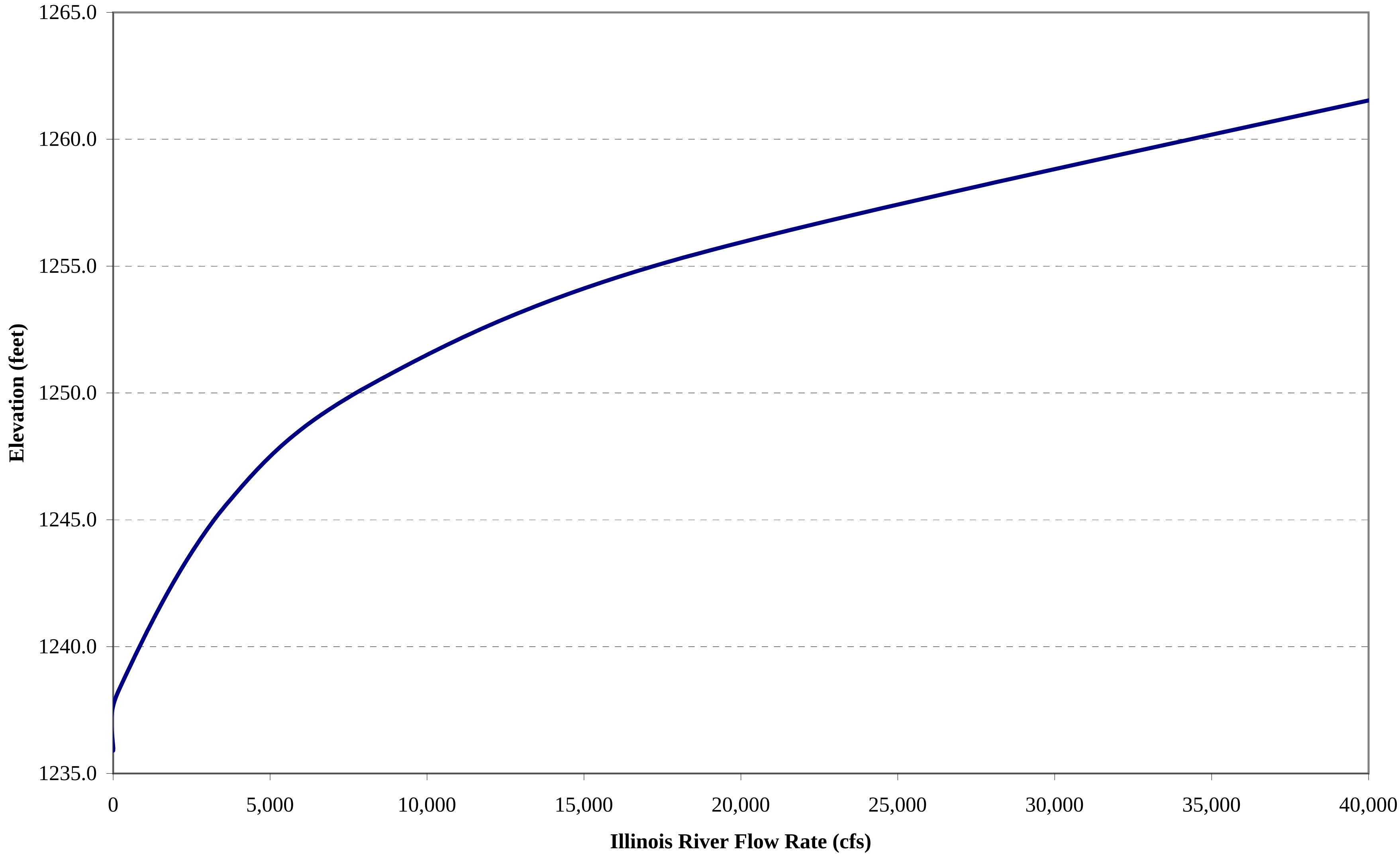


Table C1. Cave Junction MZ: Illinois River Cross-section at the Mixing Zone
Field Data recorded 6-13-13

River width at outfall section =	99	ft
Top of Bank - Angular Distance =	132	ft

x-sect	Dist.[A] ft	Dist. in	Depth[B] in	Elev in	Elev feet	River Flow Velocity[C] fps		Height y inches	Height y ft	Horz. Distance x ft	slope	USGS vertical datum ft		
-3	-2008.0	-24096.0	----	516.0	43.0	----	far east bank	516.00	43.00	-2008.00	-0.021	1280.41		
-2	-1541.0	-18492.3	----	396.0	33.0	----	east bank	396.00	33.00	-1541.02		1270.41		
-1	-56.1	-673.0	----	36.0	3.0	----		36.00	3.00	-56.08	-0.053	1240.41		
0	0.0	0.0	0.0	0.0	0.0	0.00	east shoreline	0.00	0.00	0.00		1237.41	USGS lower water elevation	
1	24.0	288.0	9.5	-9.5	-0.79	0.13	depth					1237.04		
2	30.0	360.0	13.5	-13.5	-1.13	0.51	depth					1236.70		
3	36.0	432.0	16.0	-16.0	-1.33	0.89	depth					1236.50		
4	39.0	468.0	16.0	-16.0	-1.33	1.13	depth					1236.50		
5	60.0	720.0	22.0	-22.0	-1.83	1.60	depth					1236.00		
6	66.0	792.0	23.0	-23.0	-1.92	1.86	depth			Horz.		1235.91		
7	77.0	924.0	31.0	-31.0	-2.58	2.89	depth	Height	Height	Distance		1235.25		
8	90.0	1080.0	30.0	-30.0	-2.50	1.98	depth	y	y	x		1235.33		
9	93.0	1116.0	33.0	-33.0	-2.75	0.75	depth	inches	ft	ft	slope	1235.08		
10	99.0	1188.0	0.0	0.0	0.0	0.00	west shoreline	0.00	0.00	0.00		1237.41	lower water	BC/USGS El
11	101.6	1219.4	----	36.0	3.0	----		36.00	3.00	2.62	1.15	1240.41	original outfall end	BC/USGS El
12	106.0	1271.8	----	96.0	8.0	----	existing outfall end	96.00	8.00	6.98	1.15	1245.41	existing outfall end	BC/USGS El
13	123.2	1478.6	----	333.0	27.8	----	bank - outfall invert	333.00	27.75	24.22	1.15	1265.16	outfall invert at Bank	BC/USGS El
14	127.8	1533.6	----	396.0	33.0	----	west - top of bank	396.00	33.00	28.80	1.15	1270.41	top of bank	BC/USGS El

[A] Distance of Point Location from East Shoreline
[B] Depth in inches (surface to channel bottom)
[C] Illinois River Point Velocity in feet per second (fps)
[D] Low water is taken as the 7Q10 for the Illinois River Point

Horizontal distance (x) from the West Shoreline to Top of Bank (TOB) = 28.8 feet
[This is based on field measurements and related elevations from Brown & Caldwell's (BC) outfall profile.]

Table C2. Cave Junction MZ: Illinois River Site Vist - Field Data recorded 6-13-13

x-sect	Point Location dist.[A] ft	Point Location depth[B] in	Field Section avg depth in	x-sect weighted area ft^2	Field Point avg velocity[C] fps		
0	0.0	0.0			0.00	east shoreline	
1	24.0	9.5	4.75	9.50	0.13	depth	
2	30.0	13.5	11.50	5.75	0.51	depth	
3	36.0	16.0	14.75	7.38	0.89	depth	
4	39.0	16.0	16.00	4.00	1.13	depth	
5	60.0	22.0	19.00	33.25	1.60	depth	
6	66.0	23.0	22.50	11.25	1.86	depth	
7	77.0	31.0	27.00	24.75	2.89	depth	Critical
8	90.0	30.0	30.50	33.04	1.98	depth	Design
9	93.0	33.0	31.50	7.88	0.75	depth	Section
10	99.0	0.0	16.50	8.25	0.00	west shoreline	

Flow at USGS Kirby Gage on 6-13-13 (cfs) = 152.0

Cross-sectional Averages:

Average Flow Depth (feet) =	1.47
Average Flow Depth (inches) =	17.6
Flow Width (feet) =	99.0
cross-sectional area (ft^2) =	145.0

[A] Distance of Point Location from East Shoreline

[B] Depth in inches (surface to channel bottom)

[C] Illinois River Point Velocity in feet per second (fps)

Table C3. Calculated Channel Characteristics varying with River Flow Rate
Using Manning's Equation

1Q10 WS Elevation =	1237.6	feet			1Q10 low flow condition			
	1.49	conversion			x-sect area (A) =	72.6	wetted perimeter (P) =	81.6
n	0.030	friction factor						
Rh	0.890	hyd radius			Rh is hydraulic radius (feet, Area/Perimeter) =			0.89
			d	0.91 ft				
			w	79.8 ft				
S	0.0003	slope						
Manning's Equation:								
	$V \sim 1.49/n \times (Rh)^{2/3} \times S^{1/2}$		=	0.7958	fps			
			A =	72.6	ft^2			
			Q =	57.8	cfs	57.8 cfs, check		
7Q10 WS Elevation =	1237.8	feet			7Q10 low flow condition			
	1.49	conversion			x-sect area (A) =	89.3	wetted perimeter (P) =	87.1
n	0.030	friction factor						
Rh	1.025	hyd radius			Rh is hydraulic radius (feet, Area/Perimeter) =			1.03
			d	1.05 ft				
			w	85.0 ft				
S	0.0003	slope						
Manning's Equation:								
	$V \sim 1.49/n \times (Rh)^{2/3} \times S^{1/2}$		=	0.842	fps			
			A =	89.3	ft^2			
			Q =	75.2	cfs	75.2 cfs, check		
USGS low water height =	1237.9	feet			Field (6-13-13) condition			
	1.49	conversion			x-sect area (A) =	110.3	wetted perimeter (P) =	96.3
n	0.030	friction factor						
Rh	1.145	hyd radius			Rh is hydraulic radius (feet, Area/Perimeter) =			1.14
			d	1.17				
			w	94.0				
S	0.0003	slope						
Manning's Equation:								
	$V \sim 1.49/n \times (Rh)^{2/3} \times S^{1/2}$		=	0.907	fps			
			A =	145.0	ft^2			
			Q =	100.0	cfs	100 cfs, check		

USGS low water height = 1238.2 feet Field (6-13-13) condition

	1.49	conversion			x-sect area (A) = 145.0	wetted perimeter (P) = 101.9
n	0.030	friction factor				
Rh	1.423	hyd radius			Rh is hydraulic radius (feet, Area/Perimeter) = 1.42	
			d	1.47		
			w	99.0		
S	0.0003	slope				

Manning's Equation:

$V \sim 1.49/n \times (Rh)^{2/3} \times S^{1/2}$ = 1.048 fps

A = 145.0 ft^2

Q = 152.0 cfs 152 cfs, check

USGS low water height = 1238.4 feet 200 cfs condition

	1.49	conversion			x-sect area (A) = 174.2	wetted perimeter (P) = 107.4
n	0.030	friction factor				
Rh	1.623	hyd radius			Rh is hydraulic radius (feet, Area/Perimeter) = 1.62	
			d	1.68 ft		
			w	104.0 ft		
S	0.0003	slope				

Manning's Equation:

$V \sim 1.49/n \times (Rh)^{2/3} \times S^{1/2}$ = 1.148 fps

A = 174.2 ft^2

Q = 200.0 cfs 200 cfs, check

USGS moderate height = 1239.4 feet

	1.49	conversion			x-sect area (A) = 472.0	wetted perimeter (P) = 165.9
n	0.04	friction factor				
Rh	2.845	hyd radius			Rh is hydraulic radius (feet, Area/Perimeter) = 2.85	
			d	2.95 ft		
			w	160.0 ft		
S	0.0003	slope				

Manning's Equation:

$V \sim 1.49/n \times (Rh)^{2/3} \times S^{1/2}$ = 1.2970 fps

A = 472.0 ft^2

Q = 612.2 cfs 612.2 cfs, check

USGS moderate height = 1245.4 feet

x-sect area (A) = 2057.9 wetted perimeter (P) = 420.8

	1.49	conversion
n	0.0425	friction factor
Rh	4.891	hyd radius

Rh is hydraulic radius (feet, Area/Perimeter) = 4.89

d 5.01
w 410.8

S	0.0003	slope

Manning's Equation:

$V\sim 1.49/n \times (Rh)^{2/3} \times S^{1/2}$ = 1.6910 fps

A = 2057.9 ft^2
Q = 3479.8 cfs

USGS moderate height = 1250.4 feet

x-sect area (A) = 4732.9 wetted perimeter (P) = 673.7

	1.49	conversion
n	0.05	friction factor
Rh	7.026	hyd radius

Rh is hydraulic radius (feet, Area/Perimeter) = 7.03

d 7.18
w 659.3

S	0.00026	slope

Manning's Equation:

$V\sim 1.49/n \times (Rh)^{2/3} \times S^{1/2}$ = 1.7617 fps

A = 4732.9 ft^2
Q = 8338.2 cfs

USGS higher flood height = 1255.4 feet

x-sect area (A) = 8658.6 wetted perimeter (P) = 930.0

	1.49	conversion
n	0.05	friction factor
Rh	9.311	hyd radius

Rh is hydraulic radius (feet, Area/Perimeter) = 9.31

d 9.50
w 911.0

S	0.00026	slope

Manning's Equation:

$V\sim 1.49/n \times (Rh)^{2/3} \times S^{1/2}$ = 2.1255 fps

A = 8658.6 ft^2
Q = 18404.4 cfs

	USGS 100-yr =	1263.4 feet				
	1.49	conversion			x-sect area (A) = 17559.6	wetted perimeter (P) = 1341.1
n	0.05	friction factor				
Rh	13.094	hyd radius				Rh is hydraulic radius (feet, Area/Perimeter) = 13.09
			d	13.36		
			w	1314.3		
S	0.00026	slope				

Manning's Equation:

$V\sim 1.49/n \times (Rh)^{2/3} \times S^{1/2}$ = 2.6681 fps

A = 17559.6 ft^2

Q = 46850.2 cfs

Slope Calculation based on USGS Topo Map for the Illinois River between approximately the outfall site and Kerby, Oregon.

0.0	1240	ft	
15400	1236	ft	
x	y		
15400	4.0	ft	Slope = 0.00026

Appendix D

Monthly WWTF Flows and River Flow Frequency Analysis

Appendix D1

Cave Junction Summary
Average Monthly WWTF Flows

Table D1. Cave Junction Summary of Average Monthly WWTF Flows

Month	Yr	Avg Flow mgd	Avg of Max Daily Temp ^{o}C	Avg pH S.U.	Avg DO mg/l
January	2010	0.516	12.7	6.4	6.1
February	2010	0.453	12.4	6.5	7.4
March	2010	0.416	12.4	6.4	6.4
April	2010	0.495	13.0	6.5	5.7
May	2010	0.338	14.4	6.6	5.5
June	2010	0.330	17.0	6.5	5.2
July	2010	0.234	20.7	6.6	4.1
August	2010	0.214	20.8	6.6	3.5
September	2010	0.207	19.6	6.6	2.8
October	2010	0.214	17.7	6.7	3.1
November	2010	0.320	15.5	6.6	5.5
December	2010	0.613	13.2	6.6	6.3
January	2011	0.433	12.4	6.6	6.0
February	2011	0.445	12.0	6.5	7.5
March	2011	0.680	11.8	6.4	7.7
April	2011	0.409	13.3	6.3	6.0
May	2011	0.299	15.6	6.5	7.1
June	2011	0.258	18.4	6.5	5.8
July	2011	0.235	21.5	6.5	4.8
August	2011	0.217	23.1	6.7	5.3
September	2011	0.201	21.0	6.7	4.6
October	2011	0.179	18.4	6.6	4.5
November	2011	0.239	15.6	6.6	3.8
December	2011	0.219	13.4	6.6	4.5
January	2012	0.427	12.2	6.7	7.1
February	2012	0.340	12.0	6.6	6.5
March	2012	0.601	11.9	6.5	5.7
April	2012	0.495	13.5	6.4	5.0
May	2012	0.289	16.7	6.5	3.7
June	2012	0.231	19.3	6.5	3.7
July	2012	0.214	20.3	6.7	3.2
August	2012	0.208	21.3	6.8	3.4
September	2012	0.197	19.9	6.8	4.5
October	2012	0.210	18.0	6.9	5.6
November	2012	0.319	16.7	6.8	4.0
December	2012	0.699	13.4	6.5	5.8
January	2013	0.413	11.6	6.5	5.5
February	2013	0.336	11.8	6.7	4.6
March	2013	0.326	13.0	6.7	5.6
April	2013	0.324	14.9	6.5	5.7
	avg	0.345	15.813	6.580	5.230
	min	0.179	11.613	6.340	2.750
	max	0.699	23.097	6.852	7.726

Appendix D2

River Frequency Analysis of One-day Average Flows –
For 1Q10 Low River Flow Comparison

Table D2. Illinois River One-Q frequency data
for November through May Low Flows
1-day flow, Q in (cfs)

(cfs) Bin	(cfs)	Frequency	Cumulative %			
0	0	0	.0%			
5	5	0	.0%			
10	10	0	.0%			
15	15	0	.0%			
20	20	0	.0%			
25	25	0	.0%			
30	30	2	.0%			
35	35	1	.0%			
40	40	3	.1%			
45	45	1	.1%			
50	50	5	.1%			
55	55	11	.2%			
60	60	10	.3%	**1Q10 =**	**57.8**	**cfs**
65	65	6	.4%			
70	70	9	.4%			
75	75	7	.5%			
80	80	11	.6%			
85	85	11	.7%			
90	90	31	1.0%			
95	95	26	1.2%			
100	100	25	1.4%			
105	105	20	1.6%			
110	110	16	1.8%			
115	115	25	2.0%			
120	120	25	2.2%			
125	125	30	2.5%			
130	130	20	2.7%			
135	135	26	2.9%			
140	140	25	3.1%			
145	145	19	3.3%			
150	150	20	3.5%			
155	155	16	3.6%			
160	160	14	3.8%			
165	165	20	3.9%			
170	170	21	4.1%			
175	175	29	4.4%			
180	180	19	4.6%			
185	185	21	4.8%			
190	190	22	5.0%			
195	195	20	5.1%			
200	200	23	5.4%			
205	205	21	5.5%			
210	210	20	5.7%			
215	215	16	5.9%			
220	220	26	6.1%			
225	225	28	6.4%			
230	230	18	6.5%			
235	235	13	6.6%			
240	240	21	6.8%			
245	245	16	7.0%			
250	250	17	7.1%			
255	255	16	7.3%			
260	260	13	7.4%			
265	265	10	7.5%			
270	270	22	7.7%			
275	275	20	7.9%			
280	280	20	8.1%			
285	285	14	8.2%			
290	290	22	8.4%			
295	295	23	8.6%			

Table D2. Illinois River One-Q frequency data
for November through May Low Flows
1-day flow, Q in (cfs)

(cfs) Bin	*(cfs)*	*Frequency*	*Cumulative %*
300	300	23	8.8%
305	305	23	9.0%
310	310	27	9.2%
315	315	27	9.5%
320	320	19	9.7%
325	325	25	9.9%
330	330	20	10.1%
335	335	21	10.3%
340	340	27	10.5%
345	345	15	10.6%
350	350	24	10.9%
355	355	26	11.1%
360	360	27	11.3%
365	365	18	11.5%
370	370	36	11.8%
375	375	37	12.2%
380	380	23	12.4%
385	385	17	12.5%
390	390	26	12.8%
395	395	29	13.0%
400	400	34	13.3%
405	405	22	13.5%
410	410	23	13.8%
415	415	28	14.0%
420	420	28	14.3%
425	425	29	14.5%
430	430	25	14.7%
435	435	26	15.0%
440	440	24	15.2%
445	445	20	15.4%
450	450	25	15.6%
455	455	21	15.8%
460	460	21	16.0%
465	465	28	16.2%
470	470	23	16.5%
475	475	22	16.7%
480	480	25	16.9%
485	485	27	17.1%
490	490	26	17.4%
495	495	17	17.5%
500	500	24	17.7%
505	505	32	18.0%
510	510	27	18.3%
515	515	20	18.5%
520	520	32	18.7%
525	525	17	18.9%
530	530	26	19.1%
535	535	28	19.4%
540	540	31	19.7%
545	545	25	19.9%
550	550	29	20.2%
555	555	17	20.3%
560	560	30	20.6%
565	565	27	20.8%
570	570	37	21.2%
575	575	24	21.4%
580	580	35	21.7%
585	585	29	22.0%
590	590	24	22.2%
595	595	20	22.4%

Appendix D3

River Frequency Analysis of Seven-day Average Flows –
For 7Q10 Low River Flow Comparison

Table D3. Illinois River Seven-Q frequency data
for November through May Low Flows
7-day flow, Q in (cfs)

(cfs)	*Frequency*	*Cumulative %*
0	0	.0%
5	0	.0%
10	0	.0%
15	0	.0%
20	0	.0%
25	0	.0%
30	3	.0%
35	2	.0%
40	4	.1%
45	4	.1%
50	5	.2%
55	9	.2%
60	9	.3%
65	11	.4%
70	6	.5%
75	14	.6%
80	13	.7%
85	13	.8%
90	38	1.2%
95	35	1.5%
100	19	1.7%
105	15	1.8%
110	18	2.0%
115	21	2.2%
120	20	2.4%
125	18	2.5%
130	24	2.7%
135	17	2.9%
140	18	3.0%
145	15	3.2%
150	20	3.4%
155	18	3.5%
160	17	3.7%
165	14	3.8%
170	12	3.9%
175	26	4.2%
180	22	4.4%
185	32	4.6%
190	16	4.8%
195	16	4.9%
200	20	5.1%
205	21	5.3%
210	25	5.5%
215	17	5.7%
220	16	5.8%
225	17	6.0%
230	14	6.1%
235	21	6.3%
240	13	6.4%
245	14	6.6%
250	15	6.7%
255	15	6.8%
260	16	7.0%
265	19	7.1%
270	17	7.3%
275	14	7.4%
280	8	7.5%
285	14	7.6%
290	18	7.8%
295	20	8.0%

7Q10 = 75.2 cfs

Table D3. Illinois River Seven-Q frequency data
for November through May Low Flows
7-day flow, Q in (cfs)

(cfs)	*Frequency*	*Cumulative %*
300	16	8.1%
305	24	8.3%
310	17	8.5%
315	18	8.6%
320	16	8.8%
325	16	8.9%
330	22	9.1%
335	19	9.3%
340	14	9.4%
345	19	9.6%
350	15	9.7%
355	19	9.9%
360	20	10.1%
365	20	10.3%
370	25	10.5%
375	19	10.7%
380	25	10.9%
385	21	11.1%
390	20	11.3%
395	19	11.5%
400	15	11.6%
405	25	11.8%
410	26	12.1%
415	20	12.2%
420	27	12.5%
425	29	12.7%
430	22	12.9%
435	30	13.2%
440	31	13.5%
445	18	13.7%
450	26	13.9%
455	28	14.1%
460	23	14.4%
465	20	14.5%
470	24	14.8%
475	26	15.0%
480	30	15.3%
485	19	15.4%
490	20	15.6%
495	24	15.8%
500	15	16.0%
505	27	16.2%
510	22	16.4%
515	25	16.6%
520	25	16.9%
525	27	17.1%
530	12	17.2%
535	22	17.4%
540	20	17.6%
545	21	17.8%
550	32	18.1%
555	19	18.3%
560	21	18.5%
565	33	18.8%
570	29	19.0%
575	32	19.3%
580	26	19.5%
585	27	19.8%
590	23	20.0%
595	40	20.4%

Appendix E

Facility and River Flow Correlation
(Includes Effluent Quality Data from DMRs)

Summary Facility and River Flow Correlation

Correlation of facility and river flows is carried out in this study for the period January 2010 through April 2013. Daily flows from Cave Junction WWTF discharge monitoring reports (DMRs) are combined with the USGS Illinois River flow data to yield a detailed correlation of flows as presented in Tables E-1 and E-2 for June and October, respectively. Appendix E1 makes available the detailed facility and river flow correlation. Appendix E2 expands the correlation to include effluent quality data from the DMRs.

Correlations for June shows that while river flows may be lower so too are the facility flows. The result, based on flow correlation, is that relatively high dilution rates continue to occur for the Illinois River throughout June. As shown in Table 5, completely mixed river dilutions ranged from 849 up to 1701. This is based on the strictest cases of river low flow occurring in all Junes for the recent three-year (2010-2012) period, and the corresponding facility flow.

The correlation for October, compared to June, again shows that while river flows may be lower so too are the facility flows. October river low flows were lower than for June, however. As shown in Table E-2, completely mixed river dilutions still ranged from 99.3 up to 264. This is based on the strictest cases of river low flow occurring in all Octobers for the recent three-year (2010-2012) period, and the corresponding facility flow.

Correlation of Facility and River Flows

Figures E-1, E-2, and E-3 depict the correlation of facility and river flows with increasing detail on the ‘shoulder’ months of June and October. Figure E-1 compares the entire January 2010 through April 2013 period evaluated in this study for facility versus river flows. The dry weather periods, bracketed by the shoulder months, are labeled “1”, “2” and “3” for years 2010, 2011 and 2012, respectively. This is done to help identify areas of focus in the corresponding figures. Appendix E1 contains the detailed facility versus river flow correlation, for November through May plus June and October, with corresponding dilutions. Appendix E2 expands the detailed correlation, for November through May plus June and October, including temperature, pH and dissolved oxygen (DO).

<u>June River and Facility Flows</u>

Both river and facility flows decrease as the dry weather period is approached in May and the ‘shoulder’ month of June. This is graphed in the more detailed Figure E-2. Consequently, as listed in Table E-1, facility flows through June 30th are consistently lower ranging from 0.218 mgd to 0.247 mgd compared to the DADWF of 0.520 mgd.

River flows are also decreasing in this period ranging between 286.3 cfs to 649.9 cfs but still yield relatively high raw dilution[1] ranging from 849 to 1701, i.e., river to facility

[1] Completely mixed dilution is used here to indicate the total available river dilution.

flow ratios. Figure E-3 shows this graphically by combining the facility and river flows in the form of dilution and then depicting the dilution on June 30th for each of the three years investigated.

Compare the above dilution range of 849 to 1701 to the completely mixed river dilution of 93.5 in Table 4 (of the main report) based on the 7Q10 flow at the DADWF. It can be seen that with basic operation of the outfall, sufficient dilution is available during the shoulder month of June.

Table E-1. Available Completely Mixed Dilution Through June 30th
For the Years 2010 to 2012

	Facility Flow [A] mgd	**River Flow** [B] mgd	**Completely Mixed Dilution**
June 2010	0.238	350.5 (542.3 cfs)	1473
June 2011	0.247	420.1 (649.9 cfs)	1701
June 2012	0.218	185.1 (286.3 cfs)	849

[A] Facility flow based on daily average.

[B] River flow based on seven (7)-day average.

<u>October River and Facility Flows</u>
Both river and facility flows increase as the wet weather period is approached in the 'shoulder" month of October and November. This is graphed in the more detailed Figure E-2. Consequently, as listed in Table E-2, facility flows beginning October 1st are consistently lower ranging from 0.167 mgd to 0.279 mgd compared to the DADWF of 0.520 mgd.

Table E-2. Available Completely Mixed Dilution Beginning October 1st
For Years 2010 through 2012

	Facility Flow [A] mgd	**River Flow** [B] mgd	**Completely Mixed Dilution**
October 1st, 2010	0.206	54.4 (84.1 cfs)	264
October 23rd, 2010	0.279	47.1 (72.9 cfs)	169
October 2011	0.167	28.2 (43.6 cfs)	169
October 2012	0.200	19.9 (30.7 cfs)	99.3

[A] Facility flow based on daily average.

[B] River flow based on seven (7)-day average.

River flows are also decreasing in this period ranging between 30.7 cfs to 84.1 cfs but still yield relatively high raw dilution ranging from 99 to 264, i.e., river to facility flow ratios. Figure E-3 shows this graphically by combining the facility and river flows in the form of dilution and then depicting the dilution on October 1st for each of the three years investigated.[2]

Compare the above dilution range of 99 to 264 to the completely mixed river dilution of 93.5 in Table 4 (of the main report) based on the 7Q10 flow at the DADWF. It can be seen that with basic operation of the outfall, sufficient dilution is available during the shoulder month of October.

[2] Note that for October 2010 two controlling dilutions are listed because lower dilution was recorded after October 1st, i.e., October 23rd. However, this dilution is not the controlling dilution for the three year data set because the October 2012 data indicates a lower dilution at 99.3.

Figure E-1. Cave Junction WWTF: Comparison of Facility and Illinois River Flows
Daily Flows January 2010 - April 2013

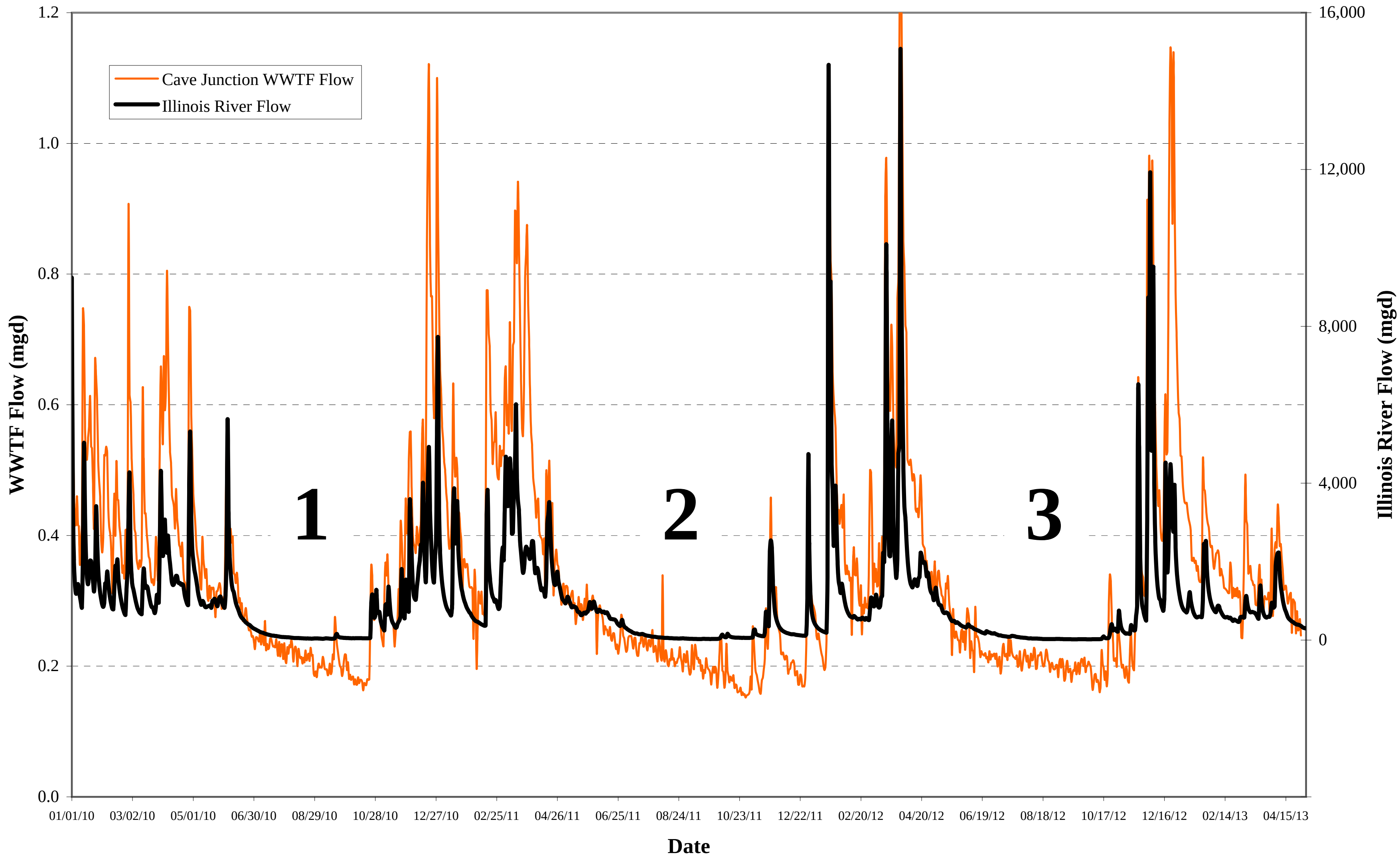


Figure E-2. Cave Junction WWTF: Comparison of Facility Flow and River Flow up to 400 mgd

Daily Flows January 2010 - April 2013

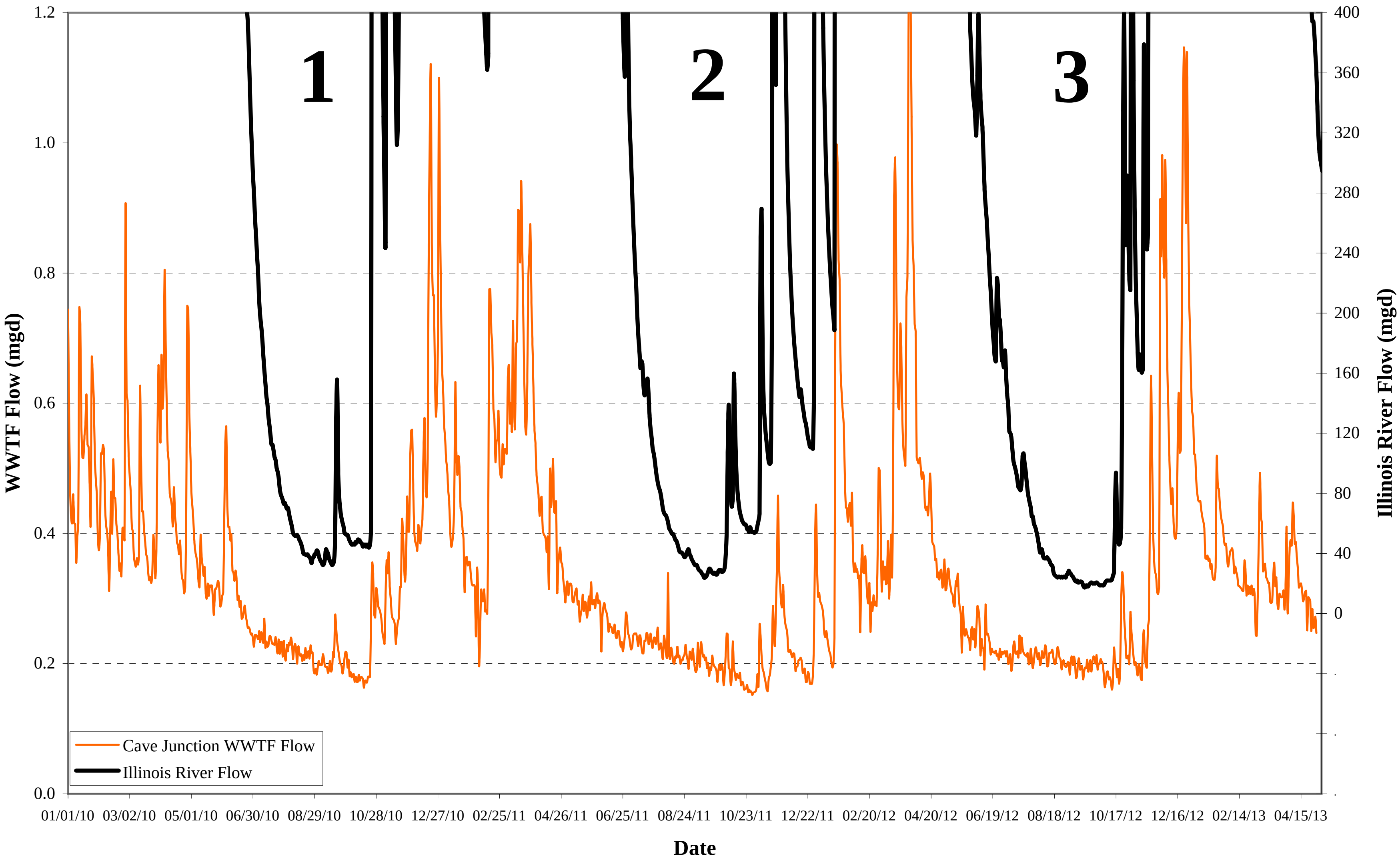
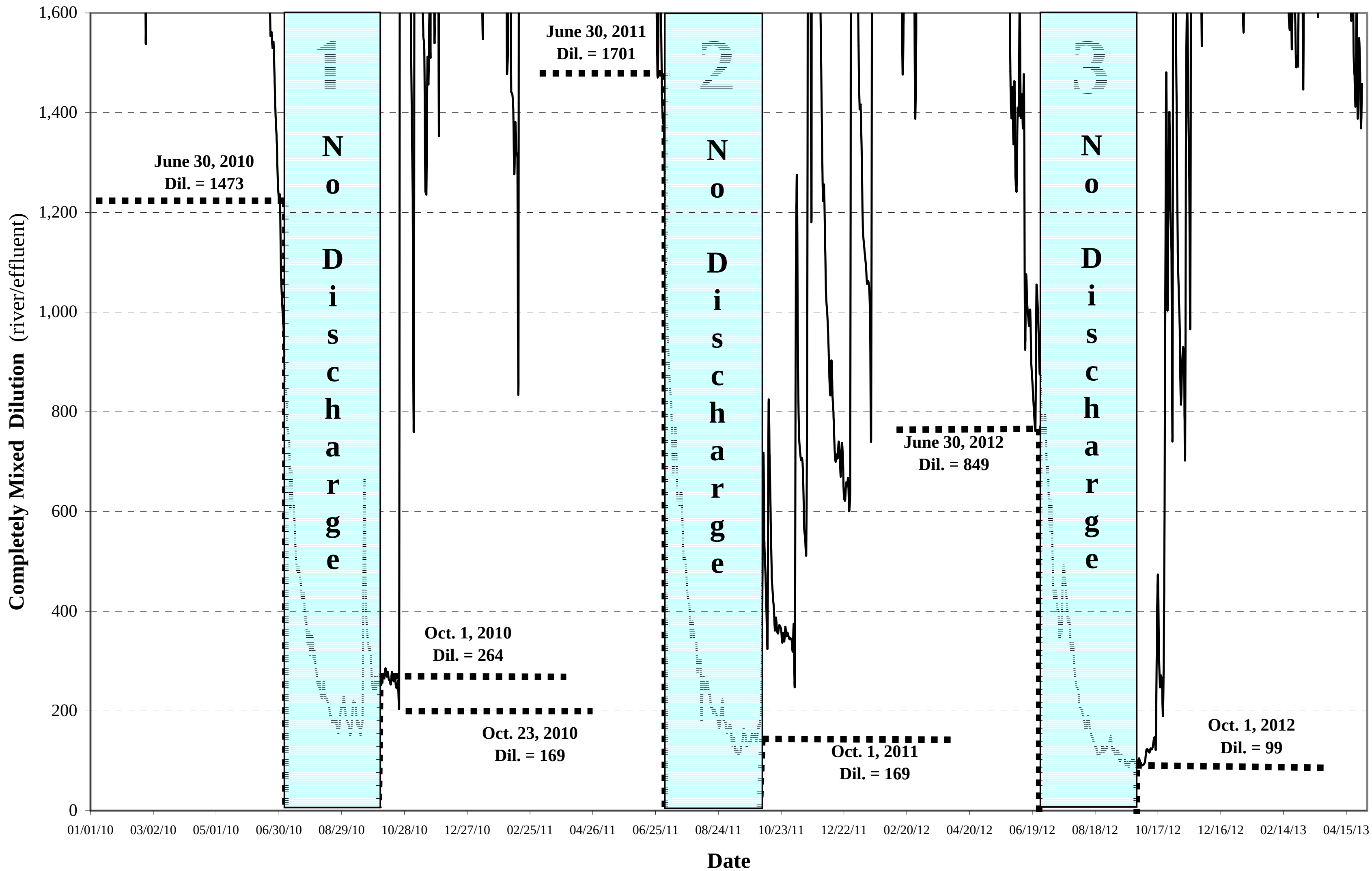


Figure E-3. Cave Junction WWTF Evaluation of the 'Shoulder" Months - June and October

Dilutions based on Daily Flows January 2010 - April 2013



Appendix E1

Facility and River Flow Correlation Data
For November through May plus June and October

Table E1 (12 pages). Correlation of Illinois River and CJ WWTF Flows November through May plus June and October

Illinois River Date	1-day flow (cfs)	1-day flow (mgd)	1-day tot raw dilution riv/eff	1-day tot adj dilution 0.25	7-day flow (cfs)	7-day flow (mgd)	7-day tot raw dilution riv/eff	7-day tot adj dilution 0.25	WWTF Flow (mgd)
01/01/10	14300	9243.7	12424.3	3106.1	3047.9	1970.2	2648.1	662.0	0.744
01/02/10	5730	3703.9	6310.0	1577.5	3754.0	2426.6	4134.0	1033.5	0.587
01/03/10	3170	2049.1	4359.8	1090.0	4107.1	2654.9	5648.7	1412.2	0.470
01/04/10	2240	1448.0	3415.0	853.8	4338.1	2804.2	6613.7	1653.4	0.424
01/05/10	1830	1182.9	2843.6	710.9	4516.0	2919.2	7017.3	1754.3	0.416
01/06/10	1870	1208.8	2627.8	657.0	4664.3	3015.1	6554.5	1638.6	0.460
01/07/10	2210	1428.6	3434.1	858.5	4478.6	2895.0	6959.1	1739.8	0.416
01/08/10	1910	1234.6	2982.2	745.6	2708.6	1750.9	4229.1	1057.3	0.414
01/09/10	1720	1111.8	3131.9	783.0	2135.7	1380.6	3888.9	972.2	0.355
01/10/10	1480	956.7	2428.1	607.0	1894.3	1224.5	3107.8	777.0	0.394
01/11/10	1290	833.9	1980.7	495.2	1758.6	1136.8	2700.1	675.0	0.421
01/12/10	3610	2333.5	3132.3	783.1	2012.9	1301.1	1746.5	436.6	0.745
01/13/10	7770	5022.6	6975.9	1744.0	2855.7	1846.0	2563.8	641.0	0.720
01/14/10	5040	3257.9	5725.7	1431.4	3260.0	2107.3	3703.5	925.9	0.569
01/15/10	3180	2055.6	3976.0	994.0	3441.4	2224.6	4302.9	1075.7	0.517
01/16/10	2430	1570.8	3044.2	761.0	3542.9	2290.1	4438.3	1109.6	0.516
01/17/10	2200	1422.1	2595.1	648.8	3645.7	2356.6	4300.4	1075.1	0.548
01/18/10	2630	1700.1	2987.8	747.0	3837.1	2480.4	4359.2	1089.8	0.569
01/19/10	3130	2023.3	3300.6	825.2	3768.6	2436.1	3974.0	993.5	0.613
01/20/10	3110	2010.3	3743.7	935.9	3102.9	2005.7	3735.1	933.8	0.537
01/21/10	2660	1719.5	3226.0	806.5	2762.9	1785.9	3350.7	837.7	0.533
01/22/10	2320	1499.7	3157.2	789.3	2640.0	1706.5	3592.7	898.2	0.475
01/23/10	1910	1234.6	2960.8	740.2	2565.7	1658.5	3977.2	994.3	0.417
01/24/10	2520	1629.0	2434.9	608.7	2611.4	1688.1	2523.3	630.8	0.669
01/25/10	5250	3393.7	5286.1	1321.5	2985.7	1930.0	3006.2	751.6	0.642
01/26/10	3920	2533.9	4202.2	1050.6	3098.6	2003.0	3321.7	830.4	0.603
01/27/10	2840	1835.8	3544.0	886.0	3060.0	1978.0	3818.6	954.6	0.518
01/28/10	2240	1448.0	2997.9	749.5	3000.0	1939.2	4015.0	1003.7	0.483
01/29/10	1860	1202.3	2630.9	657.7	2934.3	1896.8	4150.5	1037.6	0.457
01/30/10	1600	1034.3	2638.4	659.6	2890.0	1868.1	4765.6	1191.4	0.392
01/31/10	1400	905.0	2419.7	604.9	2730.0	1764.7	4718.5	1179.6	0.374
02/01/10	1310	846.8	2133.0	533.2	2167.1	1400.9	3528.6	882.2	0.397
02/02/10	1470	950.2	1816.9	454.2	1817.1	1174.6	2245.9	561.5	0.523
02/03/10	2230	1441.5	2761.5	690.4	1730.0	1118.3	2142.3	535.6	0.522
02/04/10	2160	1396.3	2604.9	651.2	1718.6	1110.9	2072.6	518.1	0.536
02/05/10	2710	1751.8	3330.4	832.6	1840.0	1189.4	2261.2	565.3	0.526
02/06/10	2280	1473.8	3319.4	829.9	1937.1	1252.2	2820.3	705.1	0.444
02/07/10	1890	1221.7	2958.2	739.5	2007.1	1297.4	3141.5	785.4	0.413
02/08/10	1610	1040.7	2588.9	647.2	2050.0	1325.1	3296.4	824.1	0.402
02/09/10	1400	905.0	2413.3	603.3	2040.0	1318.7	3516.5	879.1	0.375
02/10/10	1230	795.1	2548.4	637.1	1897.1	1226.3	3930.6	982.6	0.312
02/11/10	1210	782.2	1990.2	497.6	1761.4	1138.6	2897.2	724.3	0.393
02/12/10	2070	1338.1	2883.8	720.9	1670.0	1079.5	2326.5	581.6	0.464
02/13/10	2920	1887.5	4718.8	1179.7	1761.4	1138.6	2846.5	711.6	0.400
02/14/10	2780	1797.0	3503.0	875.7	1888.6	1220.8	2379.7	594.9	0.513
02/15/10	3180	2055.6	4517.8	1129.4	2112.9	1365.8	3001.7	750.4	0.455
02/16/10	2470	1596.6	3516.8	879.2	2265.7	1464.6	3226.0	806.5	0.454
02/17/10	2050	1325.1	3185.4	796.4	2382.9	1540.3	3702.7	925.7	0.416
02/18/10	1750	1131.2	2821.0	705.3	2460.0	1590.2	3965.5	991.4	0.401
02/19/10	1520	982.5	2634.2	658.5	2381.4	1539.4	4127.0	1031.8	0.373
02/20/10	1320	853.3	2487.7	621.9	2152.9	1391.6	4057.2	1014.3	0.343
02/21/10	1170	756.3	2136.4	534.1	1922.9	1243.0	3511.2	877.8	0.354
02/22/10	1050	678.7	2020.0	505.0	1618.6	1046.3	3113.9	778.5	0.336
02/23/10	996	643.8	1578.0	394.5	1408.0	910.1	2230.8	557.7	0.408
02/24/10	2000	1292.8	3160.9	790.2	1400.9	905.5	2214.0	553.5	0.409
02/25/10	2800	1810.0	4629.0	1157.3	1550.9	1002.5	2563.9	641.0	0.391
02/26/10	5000	3232.1	3575.3	893.8	2048.0	1323.9	1464.4	366.1	0.904
02/27/10	6580	4253.4	6882.5	1720.6	2799.4	1809.6	2928.1	732.0	0.618
02/28/10	3490	2256.0	3741.3	935.3	3130.9	2023.8	3356.3	839.1	0.603
03/01/10	2530	1635.4	3139.0	784.8	3342.3	2160.5	4146.8	1036.7	0.521
03/02/10	2150	1389.8	2836.3	709.1	3507.1	2267.1	4626.7	1156.7	0.490
03/03/10	1980	1279.9	2782.4	695.6	3504.3	2265.2	4924.4	1231.1	0.460
03/04/10	1770	1144.1	2790.6	697.7	3357.1	2170.1	5292.9	1323.2	0.410
03/05/10	1570	1014.9	2518.3	629.6	2867.1	1853.4	4598.9	1149.7	0.403
03/06/10	1400	905.0	2479.4	619.8	2127.1	1375.0	3767.2	941.8	0.365
03/07/10	1250	808.0	2276.1	569.0	1807.1	1168.2	3290.6	822.6	0.355
03/08/10	1160	749.8	2148.5	537.1	1611.4	1041.6	2984.7	746.2	0.349
03/09/10	1080	698.1	1928.5	482.1	1458.6	942.8	2604.5	651.1	0.362
03/10/10	1050	678.7	1928.2	482.1	1325.7	857.0	2434.5	608.6	0.352
03/11/10	1020	659.3	1796.6	449.1	1218.6	787.7	2146.3	536.6	0.367
03/12/10	2130	1376.9	2210.0	552.5	1298.6	839.4	1347.4	336.8	0.623
03/13/10	2830	1829.3	3538.4	884.6	1502.9	971.5	1879.0	469.8	0.517
03/14/10	2290	1480.3	3410.8	852.7	1651.4	1067.5	2459.7	614.9	0.434
03/15/10	2060	1331.6	3068.2	767.1	1780.0	1150.6	2651.2	662.8	0.434
03/16/10	2130	1376.9	3399.7	849.9	1930.0	1247.6	3080.4	770.1	0.405
03/17/10	2060	1331.6	3432.0	858.0	2074.3	1340.8	3455.8	863.9	0.388
03/18/10	1810	1170.0	3179.4	794.8	2187.1	1413.8	3841.8	960.5	0.368
03/19/10	1590	1027.8	2831.4	707.8	2110.0	1363.9	3757.4	939.3	0.363
03/20/10	1410	911.4	2680.7	670.2	1907.1	1232.8	3625.9	906.5	0.340
03/21/10	1300	840.3	2562.0	640.5	1765.7	1141.4	3479.8	870.0	0.328
03/22/10	1290	833.9	2504.1	626.0	1655.7	1070.3	3214.0	803.5	0.333
03/23/10	1170	756.3	2334.3	583.6	1518.6	981.6	3029.7	757.4	0.324
03/24/10	1060	685.2	2027.2	506.8	1375.7	889.3	2631.0	657.8	0.338
03/25/10	1290	833.9	2100.4	525.1	1301.4	841.3	2119.0	529.8	0.397

Table E1 (12 pages). Correlation of Illinois River and CJ WWTF Flows November through May plus June and October

Illinois River Date	1-day flow (cfs)	1-day flow (mgd)	1-day tot raw dilution riv/eff	1-day tot adj dilution 0.25	7-day flow (cfs)	7-day flow (mgd)	7-day tot raw dilution riv/eff	7-day tot adj dilution 0.25	WWTF Flow (mgd)
03/26/10	1780	1150.6	3101.4	775.3	1328.6	858.8	2314.8	578.7	0.371
03/27/10	1570	1014.9	3066.1	766.5	1351.4	873.6	2639.2	659.8	0.331
03/28/10	1480	956.7	2564.9	641.2	1377.1	890.2	2386.6	596.7	0.373
03/29/10	3770	2437.0	4512.9	1128.2	1731.4	1119.2	2072.6	518.2	0.540
03/30/10	6670	4311.6	6562.5	1640.6	2517.1	1627.1	2476.6	619.1	0.657
03/31/10	4690	3031.7	5002.8	1250.7	3035.7	1962.3	3238.2	809.5	0.606
04/01/10	3320	2146.1	3966.9	991.7	3325.7	2149.8	3973.7	993.4	0.541
04/02/10	4170	2695.5	3999.3	999.8	3667.1	2370.5	3517.0	879.3	0.674
04/03/10	4740	3064.0	5175.7	1293.9	4120.0	2663.2	4498.7	1124.7	0.592
04/04/10	3500	2262.4	3625.7	906.4	4408.6	2849.8	4566.9	1141.7	0.624
04/05/10	3450	2230.1	2773.8	693.4	4362.9	2820.2	3507.7	876.9	0.804
04/06/10	4120	2663.2	3810.0	952.5	3998.6	2584.7	3697.7	924.4	0.699
04/07/10	3410	2204.3	3649.4	912.4	3815.7	2466.5	4083.7	1020.9	0.604
04/08/10	3020	1952.2	3690.3	922.6	3772.9	2438.8	4610.2	1152.6	0.529
04/09/10	2600	1680.7	3289.0	822.2	3548.6	2293.8	4488.9	1122.2	0.511
04/10/10	2270	1467.4	3176.1	794.0	3195.7	2065.7	4471.3	1117.8	0.462
04/11/10	2170	1402.7	3096.5	774.1	3005.7	1942.9	4289.0	1072.3	0.453
04/12/10	2210	1428.6	3224.8	806.2	2828.6	1828.4	4127.4	1031.8	0.443
04/13/10	2370	1532.0	3727.5	931.9	2578.6	1666.8	4055.5	1013.9	0.411
04/14/10	2530	1635.4	3472.2	868.1	2452.9	1585.6	3366.4	841.6	0.471
04/15/10	2520	1629.0	3797.1	949.3	2381.4	1539.4	3588.3	897.1	0.429
04/16/10	2290	1480.3	3601.7	900.4	2337.1	1510.8	3675.8	919.0	0.411
04/17/10	2240	1448.0	3751.2	937.8	2332.9	1508.0	3906.7	976.7	0.386
04/18/10	2250	1454.4	3807.4	951.9	2344.3	1515.4	3967.0	991.7	0.382
04/19/10	2180	1409.2	3829.3	957.3	2340.0	1512.6	4110.3	1027.6	0.368
04/20/10	2210	1428.6	3672.4	918.1	2317.1	1497.8	3850.5	962.6	0.389
04/21/10	2170	1402.7	3996.3	999.1	2265.7	1464.6	4172.6	1043.2	0.351
04/22/10	1920	1241.1	3749.6	937.4	2180.0	1409.2	4257.3	1064.3	0.331
04/23/10	1700	1098.9	3360.6	840.1	2095.7	1354.7	4142.8	1035.7	0.327
04/24/10	1550	1001.9	3253.0	813.3	1997.1	1291.0	4191.5	1047.9	0.308
04/25/10	1430	924.4	2906.8	726.7	1880.0	1215.3	3821.6	955.4	0.318
04/26/10	1380	892.0	2089.1	522.3	1765.7	1141.4	2673.0	668.3	0.427
04/27/10	5920	3826.8	5109.2	1277.3	2295.7	1484.0	1981.3	495.3	0.749
04/28/10	8220	5313.5	7151.4	1787.9	3160.0	2042.7	2749.2	687.3	0.743
04/29/10	5000	3232.1	5459.6	1364.9	3600.0	2327.1	3930.9	982.7	0.592
04/30/10	3600	2327.1	4390.7	1097.7	3871.4	2502.5	4721.8	1180.4	0.530
05/01/10	3160	2042.7	4392.8	1098.2	4101.4	2651.2	5701.5	1425.4	0.465
05/02/10	2800	1810.0	4094.9	1023.7	4297.1	2777.7	6284.4	1571.1	0.442
05/03/10	2580	1667.7	3989.8	997.5	4468.6	2888.5	6910.4	1727.6	0.418
05/04/10	2350	1519.1	3935.4	983.9	3958.6	2558.9	6629.2	1657.3	0.386
05/05/10	2090	1351.0	3641.5	910.4	3082.9	1992.8	5371.4	1342.9	0.371
05/06/10	1830	1182.9	3258.8	814.7	2630.0	1700.1	4683.4	1170.8	0.363
05/07/10	1640	1060.1	3028.9	757.2	2350.0	1519.1	4340.2	1085.0	0.350
05/08/10	1500	969.6	2974.3	743.6	2112.9	1365.8	4189.5	1047.4	0.326
05/09/10	1390	898.5	2825.5	706.4	1911.4	1235.6	3885.4	971.4	0.318
05/10/10	1540	995.5	2507.5	626.9	1762.9	1139.5	2870.4	717.6	0.397
05/11/10	1510	976.1	2674.2	668.5	1642.9	1062.0	2909.5	727.4	0.365
05/12/10	1370	885.6	2530.2	632.6	1540.0	995.5	2844.2	711.1	0.350
05/13/10	1300	840.3	2508.5	627.1	1464.3	946.5	2825.5	706.4	0.335
05/14/10	1300	840.3	2414.8	603.7	1415.7	915.1	2629.7	657.4	0.348
05/15/10	1330	859.7	2791.3	697.8	1391.4	899.4	2920.2	730.1	0.308
05/16/10	1340	866.2	2887.3	721.8	1384.3	894.8	2982.7	745.7	0.300
05/17/10	1360	879.1	2721.7	680.4	1358.6	878.2	2718.9	679.7	0.323
05/18/10	1370	885.6	2913.1	728.3	1338.6	865.3	2846.3	711.6	0.304
05/19/10	1270	820.9	2565.4	641.4	1324.3	856.0	2675.1	668.8	0.320
05/20/10	1550	1001.9	3150.8	787.7	1360.0	879.1	2764.5	691.1	0.318
05/21/10	1520	982.5	3070.5	767.6	1391.4	899.4	2810.7	702.7	0.320
05/22/10	1630	1053.7	3500.5	875.1	1434.3	927.1	3080.2	770.0	0.301
05/23/10	1540	995.5	3619.9	905.0	1462.9	945.6	3438.6	859.6	0.275
05/24/10	1410	911.4	2902.7	725.7	1470.0	950.2	3026.2	756.5	0.314
05/25/10	1340	866.2	2749.8	687.5	1465.7	947.5	3007.8	751.9	0.315
05/26/10	1570	1014.9	3161.6	790.4	1508.6	975.2	3037.9	759.5	0.321
05/27/10	1690	1092.4	3340.8	835.2	1528.6	988.1	3021.7	755.4	0.327
05/28/10	1710	1105.4	3465.1	866.3	1555.7	1005.6	3152.5	788.1	0.319
05/29/10	1550	1001.9	3479.0	869.7	1544.3	998.2	3466.1	866.5	0.288
05/30/10	1410	911.4	3132.1	783.0	1525.7	986.2	3389.1	847.3	0.291
05/31/10	1330	859.7	2828.1	707.0	1514.3	978.9	3219.9	805.0	0.304
06/01/10	1270	820.9	2648.2	662.1	1504.3	972.4	3136.7	784.2	0.310
06/02/10	1770	1144.1	2743.8	685.9	1532.9	990.9	2376.2	594.0	0.417
06/03/10	3490	2256.0	4193.3	1048.3	1790.0	1157.1	2150.7	537.7	0.538
06/04/10	8700	5623.8	9989.0	2497.2	2788.6	1802.6	3201.7	800.4	0.563
06/05/10	5010	3238.5	7310.4	1827.6	3282.9	2122.1	4790.2	1197.6	0.443
06/06/10	3350	2165.5	5281.7	1320.4	3560.0	2301.2	5612.8	1403.2	0.410
06/07/10	2670	1725.9	4209.6	1052.4	3751.4	2425.0	5914.6	1478.6	0.410
06/08/10	2220	1435.0	3689.0	922.3	3887.1	2512.7	6459.4	1614.8	0.389
06/09/10	1990	1286.4	3232.1	808.0	3918.6	2533.0	6364.4	1591.1	0.398
06/10/10	1890	1221.7	3561.9	890.5	3690.0	2385.3	6954.1	1738.5	0.343
06/11/10	1680	1086.0	3194.0	798.5	2687.1	1737.0	5108.8	1277.2	0.340
06/12/10	1480	956.7	2925.7	731.4	2182.9	1411.0	4315.1	1078.8	0.327
06/13/10	1350	872.7	2544.2	636.0	1897.1	1226.3	3575.3	893.8	0.343
06/14/10	1260	814.5	2460.7	615.2	1695.7	1096.1	3311.6	827.9	0.331
06/15/10	1150	743.4	2494.5	623.6	1542.9	997.3	3346.7	836.7	0.298
06/16/10	1030	665.8	2190.1	547.5	1405.7	908.7	2989.0	747.3	0.304
06/17/10	941	608.3	2119.4	529.9	1270.1	821.0	2860.8	715.2	0.287

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Illinois River Date	1-day flow (cfs)	1-day flow (mgd)	1-day tot raw dilution riv/eff	1-day tot adj dilution 0.25	7-day flow (cfs)	7-day flow (mgd)	7-day tot raw dilution riv/eff	7-day tot adj dilution 0.25	WWTF Flow (mgd)
06/18/10	881	569.5	1924.0	481.0	1156.0	747.3	2524.5	631.1	0.296
06/19/10	835	539.8	2006.5	501.6	1063.9	687.7	2556.5	639.1	0.269
06/20/10	791	511.3	1886.8	471.7	984.0	636.1	2347.1	586.8	0.271
06/21/10	736	475.8	1699.1	424.8	909.1	587.7	2098.9	524.7	0.280
06/22/10	695	449.3	1554.5	388.6	844.1	545.7	1888.1	472.0	0.289
06/23/10	662	427.9	1561.8	390.4	791.6	511.7	1867.5	466.9	0.274
06/24/10	627	405.3	1529.4	382.4	746.7	482.7	1821.5	455.4	0.265
06/25/10	608	393.0	1541.2	385.3	707.7	457.5	1794.0	448.5	0.255
06/26/10	580	374.9	1464.5	366.1	671.3	433.9	1695.0	423.8	0.256
06/27/10	542	350.4	1390.3	347.6	635.7	410.9	1630.7	407.7	0.252
06/28/10	508	328.4	1340.3	335.1	603.1	389.9	1591.3	397.8	0.245
06/29/10	478	309.0	1256.0	314.0	572.1	369.8	1503.4	375.9	0.246
06/30/10	453	292.8	1230.4	307.6	542.3	350.5	1472.9	368.2	0.238
10/01/10	78	50.4	244.8	61.2	84.1	54.4	264.0	66.0	0.206
10/02/10	75	48.5	267.9	67.0	81.4	52.6	290.8	72.7	0.181
10/03/10	73	47.2	252.3	63.1	79.0	51.1	273.1	68.3	0.187
10/04/10	71	45.9	256.4	64.1	77.3	50.0	279.1	69.8	0.179
10/05/10	71	45.9	250.8	62.7	75.7	48.9	267.4	66.9	0.183
10/06/10	72	46.5	252.9	63.2	74.4	48.1	261.5	65.4	0.184
10/07/10	71	45.9	266.8	66.7	73.0	47.2	274.3	68.6	0.172
10/08/10	74	47.8	265.7	66.4	72.4	46.8	260.1	65.0	0.180
10/09/10	73	47.2	274.3	68.6	72.1	46.6	271.1	67.8	0.172
10/10/10	76	49.1	285.6	71.4	72.6	46.9	272.7	68.2	0.172
10/11/10	76	49.1	268.5	67.1	73.3	47.4	258.9	64.7	0.183
10/12/10	75	48.5	278.6	69.7	73.9	47.7	274.4	68.6	0.174
10/13/10	73	47.2	263.6	65.9	74.0	47.8	267.2	66.8	0.179
10/14/10	72	46.5	260.0	65.0	74.1	47.9	267.7	66.9	0.179
10/15/10	69	44.6	253.4	63.4	73.4	47.5	269.7	67.4	0.176
10/16/10	70	45.2	277.6	69.4	73.0	47.2	289.5	72.4	0.163
10/17/10	71	45.9	263.8	65.9	72.3	46.7	268.5	67.1	0.174
10/18/10	69	44.6	259.3	64.8	71.3	46.1	267.9	67.0	0.172
10/19/10	71	45.9	268.4	67.1	70.7	45.7	267.3	66.8	0.171
10/20/10	69	44.6	247.8	61.9	70.1	45.3	251.9	63.0	0.180
10/21/10	68	44.0	245.6	61.4	69.6	45.0	251.2	62.8	0.179
10/22/10	72	46.5	258.6	64.6	70.0	45.2	251.4	62.8	0.180
10/23/10	90	58.2	208.5	52.1	72.9	47.1	168.8	42.2	0.279
10/24/10	1460	943.8	2666.0	666.5	271.3	175.4	495.4	123.8	0.354
10/25/10	1800	1163.5	3452.6	863.2	518.6	335.2	994.7	248.7	0.337
10/26/10	1390	898.5	3243.7	810.9	707.0	457.0	1649.9	412.5	0.277
10/27/10	879	568.2	2096.7	524.2	822.7	531.8	1962.4	490.6	0.271
10/28/10	975	630.3	2000.8	500.2	952.3	615.6	1954.2	488.5	0.315
10/29/10	1980	1279.9	4182.7	1045.7	1224.9	791.8	2587.5	646.9	0.306
10/30/10	1110	717.5	2491.4	622.8	1370.6	886.0	3076.2	769.1	0.288
10/31/10	1060	685.2	2412.7	603.2	1313.4	849.0	2989.5	747.4	0.284
11/01/10	1110	717.5	2571.7	642.9	1214.9	785.3	2814.7	703.7	0.279
11/02/10	819	529.4	1982.8	495.7	1133.3	732.6	2743.7	685.9	0.267
11/03/10	631	407.9	1651.4	412.8	1097.9	709.7	2873.2	718.3	0.247
11/04/10	512	331.0	1390.6	347.7	1031.7	666.9	2802.2	700.5	0.238
11/05/10	435	281.2	1217.3	304.3	811.0	524.2	2269.4	567.4	0.231
11/06/10	382	246.9	807.0	201.7	707.0	457.0	1493.5	373.4	0.306
11/07/10	1380	892.0	2491.8	622.9	752.7	486.6	1359.1	339.8	0.358
11/08/10	1420	917.9	2707.7	676.9	797.0	515.2	1519.7	379.9	0.339
11/09/10	1020	659.3	1777.2	444.3	825.7	533.8	1438.7	359.7	0.371
11/10/10	2100	1357.5	4228.9	1057.2	1035.6	669.4	2085.4	521.3	0.321
11/11/10	1560	1008.4	3361.3	840.3	1185.3	766.2	2553.9	638.5	0.300
11/12/10	1070	691.7	2506.0	626.5	1276.0	824.8	2988.5	747.1	0.276
11/13/10	822	531.4	1975.3	493.8	1338.9	865.5	3217.3	804.3	0.269
11/14/10	698	451.2	1689.9	422.5	1241.4	802.5	3005.5	751.4	0.267
11/15/10	626	404.7	1556.4	389.1	1128.0	729.2	2804.4	701.1	0.260
11/16/10	543	351.0	1526.1	381.5	1059.9	685.1	2978.7	744.7	0.230
11/17/10	483	312.2	1243.9	311.0	828.9	535.8	2134.6	533.6	0.251
11/18/10	505	326.4	1236.5	309.1	678.1	438.4	1660.5	415.1	0.264
11/19/10	632	408.5	1507.5	376.9	615.6	397.9	1468.3	367.1	0.271
11/20/10	717	463.5	1457.5	364.4	600.6	388.2	1220.8	305.2	0.318
11/21/10	794	513.3	1614.0	403.5	614.3	397.1	1248.7	312.2	0.318
11/22/10	987	638.0	1519.1	379.8	665.9	430.4	1024.8	256.2	0.420
11/23/10	2800	1810.0	4536.2	1134.1	988.3	638.8	1601.1	400.3	0.399
11/24/10	1600	1034.3	2913.4	728.4	1147.9	742.0	2090.1	522.5	0.355
11/25/10	1070	691.7	2121.7	530.4	1228.6	794.2	2436.1	609.0	0.326
11/26/10	873	564.3	1585.2	396.3	1263.0	816.4	2293.3	573.3	0.356
11/27/10	2350	1519.1	3331.3	832.8	1496.3	967.2	2121.1	530.3	0.456
11/28/10	2090	1351.0	3352.4	838.1	1681.4	1086.9	2697.0	674.3	0.403
11/29/10	1430	924.4	2293.7	573.4	1744.7	1127.8	2798.5	699.6	0.403
11/30/10	1140	736.9	1450.6	362.7	1507.6	974.5	1918.3	479.6	0.508
12/01/10	5470	3535.9	6336.7	1584.2	2060.4	1331.9	2386.9	596.7	0.558
12/02/10	4740	3064.0	5481.2	1370.3	2584.7	1670.8	2988.9	747.2	0.559
12/03/10	3310	2139.6	4552.4	1138.1	2932.9	1895.8	4033.7	1008.4	0.470
12/04/10	2280	1473.8	3648.1	912.0	2922.9	1889.4	4676.7	1169.2	0.404
12/05/10	1770	1144.1	2956.5	739.1	2877.1	1859.8	4805.7	1201.4	0.387
12/06/10	1630	1053.7	2751.1	687.8	2905.7	1878.3	4904.2	1226.0	0.383
12/07/10	1590	1027.8	2748.1	687.0	2970.0	1919.8	5133.3	1283.3	0.374
12/08/10	2070	1338.1	3239.9	810.0	2484.3	1605.9	3888.3	972.1	0.413
12/09/10	2420	1564.3	3980.5	995.1	2152.9	1391.6	3541.1	885.3	0.393
12/10/10	2880	1861.7	4835.5	1208.9	2091.4	1351.9	3511.5	877.9	0.385

Table E1 (12 pages). Correlation of Illinois River and CJ WWTF Flows November through May plus June and October

Illinois River Date	1-day flow (cfs)	1-day flow (mgd)	1-day tot raw dilution riv/eff	1-day tot adj dilution 0.25	7-day flow (cfs)	7-day flow (mgd)	7-day tot raw dilution riv/eff	7-day tot adj dilution 0.25	WWTF Flow (mgd)
12/11/10	3170	2049.1	5022.4	1255.6	2218.6	1434.1	3515.0	878.7	0.408
12/12/10	3760	2430.5	5759.5	1439.9	2502.9	1617.9	3833.8	958.5	0.422
12/13/10	3680	2378.8	4438.1	1109.5	2795.7	1807.2	3371.6	842.9	0.536
12/14/10	6200	4007.8	6957.9	1739.5	3454.3	2232.9	3876.6	969.1	0.576
12/15/10	4490	2902.4	6188.5	1547.1	3800.0	2456.4	5237.5	1309.4	0.469
12/16/10	2990	1932.8	4238.5	1059.6	3881.4	2509.0	5502.2	1375.6	0.456
12/17/10	2300	1486.7	2853.6	713.4	3798.6	2455.4	4712.9	1178.2	0.521
12/18/10	3930	2540.4	3038.8	759.7	3907.1	2525.6	3021.1	755.3	0.836
12/19/10	6250	4040.1	4024.0	1006.0	4262.9	2755.6	2744.6	686.1	1.004
12/20/10	7600	4912.7	4398.2	1099.5	4822.9	3117.6	2791.0	697.8	1.117
12/21/10	5230	3380.7	3954.1	988.5	4684.3	3028.0	3541.5	885.4	0.855
12/22/10	4040	2611.5	3409.3	852.3	4620.0	2986.4	3898.7	974.7	0.766
12/23/10	3050	1971.6	2573.8	643.5	4628.6	2992.0	3906.0	976.5	0.766
12/24/10	2460	1590.2	2446.4	611.6	4651.4	3006.7	4625.8	1156.4	0.650
12/25/10	2290	1480.3	2552.2	638.1	4417.1	2855.3	4922.9	1230.7	0.580
12/26/10	3330	2152.6	3523.0	880.8	4000.0	2585.6	4231.8	1058.0	0.611
12/27/10	3950	2553.3	3637.2	909.3	3478.6	2248.6	3203.1	800.8	0.702
12/28/10	8250	5332.9	4865.8	1216.4	3910.0	2527.5	2306.1	576.5	1.096
12/29/10	11900	7692.3	8537.5	2134.4	5032.9	3253.3	3610.8	902.7	0.901
12/30/10	5370	3471.2	4573.4	1143.4	5364.3	3467.5	4568.6	1142.1	0.759
12/31/10	3510	2268.9	3453.4	863.4	5514.3	3564.5	5425.4	1356.4	0.657
01/01/11	2750	1777.6	2853.3	713.3	5580.0	3607.0	5789.7	1447.4	0.623
01/02/11	2270	1467.4	2578.8	644.7	5428.6	3509.1	6167.1	1541.8	0.569
01/03/11	1940	1254.0	2296.8	574.2	5141.4	3323.5	6087.0	1521.7	0.546
01/04/11	1680	1086.0	2112.8	528.2	4202.9	2716.8	5285.6	1321.4	0.514
01/05/11	1490	963.2	1930.2	482.5	2715.7	1755.5	3518.0	879.5	0.499
01/06/11	1340	866.2	1854.8	463.7	2140.0	1383.3	2962.1	740.5	0.467
01/07/11	1230	795.1	1774.7	443.7	1814.3	1172.8	2617.8	654.5	0.448
01/08/11	1150	743.4	1844.6	461.2	1585.7	1025.0	2543.5	635.9	0.403
01/09/11	1090	704.6	1854.2	463.5	1417.1	916.1	2410.7	602.7	0.380
01/10/11	1020	659.3	1703.7	425.9	1285.7	831.1	2147.5	536.9	0.387
01/11/11	971	627.7	1557.5	389.4	1184.4	765.6	1899.8	475.0	0.403
01/12/11	1420	917.9	1991.1	497.8	1174.4	759.2	1646.8	411.7	0.461
01/13/11	5290	3419.5	5410.6	1352.7	1738.7	1123.9	1778.4	444.6	0.632
01/14/11	5970	3859.1	7350.6	1837.7	2415.9	1561.6	2974.6	743.6	0.525
01/15/11	3860	2495.2	5092.1	1273.0	2803.0	1811.9	3697.7	924.4	0.490
01/16/11	4510	2915.3	5617.2	1404.3	3291.6	2127.7	4099.6	1024.9	0.519
01/17/11	5470	3535.9	7043.6	1760.9	3927.3	2538.6	5057.1	1264.3	0.502
01/18/11	3650	2359.4	5350.1	1337.5	4310.0	2786.0	6317.5	1579.4	0.441
01/19/11	2860	1848.7	4269.6	1067.4	4515.7	2919.0	6741.4	1685.3	0.433
01/20/11	2400	1551.4	3821.2	955.3	4102.9	2652.1	6532.4	1633.1	0.406
01/21/11	2070	1338.1	3422.2	855.5	3545.7	2292.0	5861.9	1465.5	0.391
01/22/11	1880	1215.3	3920.2	980.0	3262.9	2109.2	6803.7	1700.9	0.310
01/23/11	1700	1098.9	3035.6	758.9	2861.4	1849.7	5109.6	1277.4	0.362
01/24/11	1550	1001.9	2752.6	688.1	2301.4	1487.7	4087.0	1021.8	0.364
01/25/11	1440	930.8	2651.9	663.0	1985.7	1283.6	3657.0	914.2	0.351
01/26/11	1320	853.3	2396.8	599.2	1765.7	1141.4	3206.1	801.5	0.356
01/27/11	1230	795.1	2233.4	558.3	1598.6	1033.3	2902.6	725.7	0.356
01/28/11	1160	749.8	2231.7	557.9	1468.6	949.3	2825.3	706.3	0.336
01/29/11	1090	704.6	2188.2	547.0	1355.7	876.4	2721.6	680.4	0.322
01/30/11	1050	678.7	2121.0	530.3	1262.9	816.3	2551.0	637.8	0.320
01/31/11	964	623.1	1941.3	485.3	1179.1	762.2	2374.5	593.6	0.321
02/01/11	900	581.8	1835.2	458.8	1102.0	712.3	2247.1	561.8	0.317
02/02/11	846	546.9	2259.8	564.9	1034.3	668.6	2762.7	690.7	0.242
02/03/11	794	513.3	1483.4	370.8	972.0	628.3	1815.9	454.0	0.346
02/04/11	754	487.4	1542.4	385.6	914.0	590.8	1869.7	467.4	0.316
02/05/11	733	473.8	2393.0	598.3	863.0	557.9	2817.4	704.4	0.198
02/06/11	722	466.7	1904.9	476.2	816.1	527.6	2153.3	538.3	0.245
02/07/11	698	451.2	1441.5	360.4	778.1	503.0	1607.0	401.8	0.313
02/08/11	672	434.4	1438.4	359.6	745.6	481.9	1595.8	399.0	0.302
02/09/11	644	416.3	1406.4	351.6	716.7	463.3	1565.2	391.3	0.296
02/10/11	620	400.8	1276.4	319.1	691.9	447.2	1424.3	356.1	0.314
02/11/11	598	386.6	1380.6	345.1	669.6	432.8	1545.8	386.4	0.280
02/12/11	577	373.0	1322.6	330.7	647.3	418.4	1483.7	370.9	0.282
02/13/11	560	362.0	1306.8	326.7	624.1	403.5	1456.5	364.1	0.277
02/14/11	577	373.0	879.7	219.9	606.9	392.3	925.2	231.3	0.424
02/15/11	4860	3141.6	4053.6	1013.4	1205.1	779.0	1005.2	251.3	0.775
02/16/11	5900	3813.8	4921.1	1230.3	1956.0	1264.4	1631.5	407.9	0.775
02/17/11	3200	2068.5	2917.5	729.4	2324.6	1502.6	2119.4	529.8	0.709
02/18/11	2570	1661.3	2414.7	603.7	2606.3	1684.7	2448.7	612.2	0.688
02/19/11	2180	1409.2	2380.4	595.1	2835.3	1832.8	3095.9	774.0	0.592
02/20/11	1880	1215.3	2109.8	527.5	3023.9	1954.7	3393.5	848.4	0.576
02/21/11	1710	1105.4	2167.4	541.8	3185.7	2059.3	4037.8	1009.5	0.510
02/22/11	1630	1053.7	1947.6	486.9	2724.3	1761.0	3255.1	813.8	0.541
02/23/11	1510	976.1	1791.0	447.7	2097.1	1355.6	2487.4	621.8	0.545
02/24/11	1580	1021.3	1737.0	434.2	1865.7	1206.0	2051.1	512.8	0.588
02/25/11	1470	950.2	1874.2	468.6	1708.6	1104.4	2178.4	544.6	0.507
02/26/11	1320	853.3	1744.9	436.2	1585.7	1025.0	2096.2	524.0	0.489
02/27/11	1220	788.6	1622.7	405.7	1491.4	964.1	1983.7	495.9	0.486
02/28/11	1350	872.7	1625.1	406.3	1440.0	930.8	1733.4	433.3	0.537
03/01/11	2360	1525.5	3014.9	753.7	1544.3	998.2	1972.8	493.2	0.506
03/02/11	3270	2113.8	3995.8	998.9	1795.7	1160.8	2194.3	548.6	0.529
03/03/11	3660	2365.9	4463.9	1116.0	2092.9	1352.8	2552.5	638.1	0.530
03/04/11	3190	2062.1	3942.7	985.7	2338.6	1511.7	2890.4	722.6	0.523

Table E1 (12 pages). Correlation of Illinois River and CJ WWTF Flows November through May plus June and October

Illinois River Date	1-day flow (cfs)	1-day flow (mgd)	1-day tot raw dilution riv/eff	1-day tot adj dilution 0.25	7-day flow (cfs)	7-day flow (mgd)	7-day tot raw dilution riv/eff	7-day tot adj dilution 0.25	WWTF Flow (mgd)
03/05/11	5130	3316.1	5181.4	1295.3	2882.9	1863.5	2911.7	727.9	0.640
03/06/11	7230	4673.6	7102.7	1775.7	3741.4	2418.5	3675.5	918.9	0.658
03/07/11	5310	3432.4	6021.8	1505.5	4307.1	2784.2	4884.5	1221.1	0.570
03/08/11	5280	3413.1	5688.4	1422.1	4724.3	3053.8	5089.7	1272.4	0.600
03/09/11	5320	3438.9	6140.9	1535.2	5017.1	3243.1	5791.3	1447.8	0.560
03/10/11	7150	4621.8	6366.2	1591.5	5515.7	3565.4	4911.1	1227.8	0.726
03/11/11	6330	4091.8	6763.3	1690.8	5964.3	3855.4	6372.5	1593.1	0.605
03/12/11	4200	2714.9	4830.8	1207.7	5831.4	3769.5	6707.3	1676.8	0.562
03/13/11	4250	2747.3	3981.5	995.4	5405.7	3494.3	5064.2	1266.1	0.690
03/14/11	6170	3988.4	5714.0	1428.5	5528.6	3573.7	5120.0	1280.0	0.698
03/15/11	6880	4447.3	4958.0	1239.5	5757.1	3721.5	4148.8	1037.2	0.897
03/16/11	9300	6011.6	6716.9	1679.2	6325.7	4089.0	4568.7	1142.2	0.895
03/17/11	6400	4137.0	5063.7	1265.9	6218.6	4019.8	4920.1	1230.0	0.817
03/18/11	5510	3561.7	3785.1	946.3	6101.4	3944.0	4191.3	1047.8	0.941
03/19/11	5100	3296.7	3878.5	969.6	6230.0	4027.1	4737.8	1184.5	0.850
03/20/11	3970	2566.3	3472.6	868.2	6190.0	4001.3	5414.5	1353.6	0.739
03/21/11	3470	2243.1	3483.0	870.7	5804.3	3752.0	5826.0	1456.5	0.644
03/22/11	3010	1945.7	3449.8	862.5	5251.4	3394.6	6018.8	1504.7	0.564
03/23/11	2650	1713.0	3097.6	774.4	4301.4	2780.5	5028.0	1257.0	0.553
03/24/11	2840	1835.8	2868.5	717.1	3792.9	2451.7	3830.9	957.7	0.640
03/25/11	3430	2217.2	2806.6	701.6	3495.7	2259.7	2860.3	715.1	0.790
03/26/11	3680	2378.8	2862.6	715.6	3292.9	2128.5	2561.4	640.4	0.831
03/27/11	3600	2327.1	2665.6	666.4	3240.0	2094.4	2399.1	599.8	0.873
03/28/11	3580	2314.2	3044.9	761.2	3255.7	2104.5	2769.1	692.3	0.760
03/29/11	3290	2126.7	3060.0	765.0	3295.7	2130.4	3065.3	766.3	0.695
03/30/11	3200	2068.5	3341.7	835.4	3374.3	2181.2	3523.7	880.9	0.619
03/31/11	3500	2262.4	4040.1	1010.0	3468.6	2242.1	4003.8	1000.9	0.560
04/01/11	3900	2521.0	4694.6	1173.7	3535.7	2285.5	4256.1	1064.0	0.537
04/02/11	3880	2508.1	5118.5	1279.6	3564.3	2304.0	4702.0	1175.5	0.490
04/03/11	3190	2062.1	4341.2	1085.3	3505.7	2266.1	4770.8	1192.7	0.475
04/04/11	2650	1713.0	3740.2	935.0	3372.9	2180.3	4760.4	1190.1	0.458
04/05/11	2760	1784.1	4178.2	1044.6	3297.1	2131.3	4991.4	1247.8	0.427
04/06/11	2850	1842.3	4075.8	1019.0	3247.1	2099.0	4643.8	1160.9	0.452
04/07/11	2710	1751.8	3841.6	960.4	3134.3	2026.0	4443.1	1110.8	0.456
04/08/11	2390	1544.9	3795.9	949.0	2918.6	1886.6	4635.4	1158.8	0.407
04/09/11	2160	1396.3	3499.4	874.8	2672.9	1727.8	4330.2	1082.6	0.399
04/10/11	1970	1273.4	3215.7	803.9	2498.6	1615.1	4078.6	1019.6	0.396
04/11/11	2040	1318.7	3372.6	843.1	2411.4	1558.8	3986.6	996.7	0.391
04/12/11	2000	1292.8	3484.7	871.2	2302.9	1488.6	4012.4	1003.1	0.371
04/13/11	1860	1202.3	3051.6	762.9	2161.4	1397.2	3546.1	886.5	0.394
04/14/11	1720	1111.8	3507.3	876.8	2020.0	1305.8	4119.1	1029.8	0.317
04/15/11	2450	1583.7	3193.0	798.2	2028.6	1311.3	2643.7	660.9	0.496
04/16/11	4580	2960.6	6713.3	1678.3	2374.3	1534.8	3480.2	870.0	0.441
04/17/11	4940	3193.3	6823.2	1705.8	2798.6	1809.0	3865.5	966.4	0.468
04/18/11	5430	3510.0	6828.8	1707.2	3282.9	2122.1	4128.6	1032.1	0.514
04/19/11	4330	2799.0	6449.2	1612.3	3615.7	2337.2	5385.4	1346.3	0.434
04/20/11	3380	2184.9	5069.3	1267.3	3832.9	2477.6	5748.5	1437.1	0.431
04/21/11	2820	1822.9	4068.9	1017.2	3990.0	2579.2	5757.1	1439.3	0.448
04/22/11	2410	1557.9	4993.1	1248.3	3984.3	2575.5	8254.8	2063.7	0.312
04/23/11	2190	1415.6	4056.3	1014.1	3642.9	2354.8	6747.2	1686.8	0.349
04/24/11	2180	1409.2	3829.3	957.3	3248.6	2099.9	5706.3	1426.6	0.368
04/25/11	2460	1590.2	4206.8	1051.7	2824.3	1825.7	4829.8	1207.4	0.378
04/26/11	2700	1745.3	4902.6	1225.6	2591.4	1675.1	4705.4	1176.4	0.356
04/27/11	2340	1512.6	4297.2	1074.3	2442.9	1579.1	4486.1	1121.5	0.352
04/28/11	2150	1389.8	4224.3	1056.1	2347.1	1517.2	4611.6	1152.9	0.329
04/29/11	1960	1267.0	4022.1	1005.5	2282.9	1475.7	4684.7	1171.2	0.315
04/30/11	1750	1131.2	3847.7	961.9	2220.0	1435.0	4881.1	1220.3	0.294
05/01/11	1610	1040.7	3283.0	820.8	2138.6	1382.4	4360.9	1090.2	0.317
05/02/11	1560	1008.4	3093.3	773.3	2010.0	1299.3	3985.5	996.4	0.326
05/03/11	1490	963.2	3157.9	789.5	1837.1	1187.6	3893.6	973.4	0.305
05/04/11	1450	937.3	2910.9	727.7	1710.0	1105.4	3432.8	858.2	0.322
05/05/11	1570	1014.9	3142.0	785.5	1627.1	1051.8	3256.4	814.1	0.323
05/06/11	1710	1105.4	3454.3	863.6	1591.4	1028.7	3214.7	803.7	0.320
05/07/11	1630	1053.7	3559.6	889.9	1574.3	1017.6	3438.0	859.5	0.296
05/08/11	1530	989.0	3364.0	841.0	1562.9	1010.3	3436.2	859.1	0.294
05/09/11	1420	917.9	3019.4	754.9	1542.9	997.3	3280.7	820.2	0.304
05/10/11	1300	840.3	2693.4	673.3	1515.7	979.8	3140.3	785.1	0.312
05/11/11	1300	840.3	2667.7	666.9	1494.3	965.9	3066.4	766.6	0.315
05/12/11	1340	866.2	2976.6	744.2	1461.4	944.7	3246.3	811.6	0.291
05/13/11	1300	840.3	2839.0	709.7	1402.9	906.8	3063.6	765.9	0.296
05/14/11	1300	840.3	3171.1	792.8	1355.7	876.4	3307.0	826.7	0.265
05/15/11	1230	795.1	2880.8	720.2	1312.9	848.6	3074.8	768.7	0.276
05/16/11	1120	724.0	2540.3	635.1	1270.0	820.9	2880.5	720.1	0.285
05/17/11	1110	717.5	2344.8	586.2	1242.9	803.4	2625.5	656.4	0.306
05/18/11	1080	698.1	2484.4	621.1	1211.4	783.1	2786.8	696.7	0.281
05/19/11	990	639.9	2169.3	542.3	1161.4	750.8	2545.0	636.2	0.295
05/20/11	987	638.0	2177.5	544.4	1116.7	721.9	2463.7	615.9	0.293
05/21/11	1020	659.3	2433.0	608.2	1076.7	696.0	2568.3	642.1	0.271
05/22/11	1070	691.7	2461.4	615.4	1053.9	681.2	2424.3	606.1	0.281
05/23/11	1080	698.1	2304.0	576.0	1048.1	677.5	2236.1	559.0	0.303
05/24/11	1040	672.3	2383.9	596.0	1038.1	671.1	2379.7	594.9	0.282
05/25/11	1110	717.5	2207.7	551.9	1042.4	673.8	2073.4	518.3	0.325
05/26/11	1120	724.0	2479.4	619.8	1061.0	685.8	2348.8	587.2	0.292
05/27/11	1300	840.3	2887.8	721.9	1105.7	714.7	2456.2	614.0	0.291

Table E1 (12 pages). Correlation of Illinois River and CJ WWTF Flows November through May plus June and October

Illinois River Date	1-day flow (cfs)	1-day flow (mgd)	1-day tot raw dilution riv/eff	1-day tot adj dilution 0.25	7-day flow (cfs)	7-day flow (mgd)	7-day tot raw dilution riv/eff	7-day tot adj dilution 0.25	WWTF Flow (mgd)
05/28/11	1500	969.6	3253.8	813.4	1174.3	759.1	2547.2	636.8	0.298
05/29/11	1380	892.0	3130.0	782.5	1218.6	787.7	2763.9	691.0	0.285
05/30/11	1230	795.1	2641.5	660.4	1240.0	801.6	2663.0	665.7	0.301
05/31/11	1410	911.4	2959.2	739.8	1292.9	835.7	2713.4	678.3	0.308
06/01/11	1520	982.5	3353.4	838.4	1351.4	873.6	2981.5	745.4	0.293
06/02/11	1370	885.6	2981.8	745.4	1387.1	896.7	3019.1	754.8	0.297
06/03/11	1230	795.1	2741.7	685.4	1377.1	890.2	3069.7	767.4	0.290
06/04/11	1120	724.0	3305.9	826.5	1322.9	855.1	3904.6	976.2	0.219
06/05/11	1110	717.5	2647.7	661.9	1284.3	830.2	3063.4	765.8	0.271
06/06/11	1190	769.2	2680.2	670.1	1278.6	826.5	2879.7	719.9	0.287
06/07/11	1180	762.8	2603.3	650.8	1245.7	805.2	2748.3	687.1	0.293
06/08/11	1140	736.9	2603.9	651.0	1191.4	770.2	2721.4	680.3	0.283
06/09/11	1100	711.1	2548.6	637.1	1152.9	745.2	2671.0	667.8	0.279
06/10/11	1110	717.5	2657.5	664.4	1135.7	734.1	2719.0	679.8	0.270
06/11/11	1120	724.0	2907.6	726.9	1135.7	734.1	2948.4	737.1	0.249
06/12/11	1060	685.2	2625.3	656.3	1128.6	729.5	2795.1	698.8	0.261
06/13/11	1080	698.1	2727.1	681.8	1112.9	719.4	2810.0	702.5	0.256
06/14/11	1090	704.6	2752.3	688.1	1100.0	711.1	2777.6	694.4	0.256
06/15/11	1010	652.9	2643.2	660.8	1081.4	699.0	2830.2	707.5	0.247
06/16/11	937	605.7	2442.3	610.6	1058.1	684.0	2758.1	689.5	0.248
06/17/11	852	550.7	2118.2	529.6	1021.3	660.2	2539.1	634.8	0.260
06/18/11	831	537.2	2219.7	554.9	980.0	633.5	2617.7	654.4	0.242
06/19/11	831	537.2	2247.6	561.9	947.3	612.3	2562.1	640.5	0.239
06/20/11	813	525.5	2102.1	525.5	909.1	587.7	2350.7	587.7	0.250
06/21/11	815	526.8	2107.3	526.8	869.9	562.3	2249.1	562.3	0.250
06/22/11	801	517.8	2184.7	546.2	840.0	543.0	2291.1	572.8	0.237
06/23/11	747	482.9	2136.6	534.1	812.9	525.4	2325.0	581.2	0.226
06/24/11	667	431.2	1850.5	462.6	786.4	508.4	2181.8	545.4	0.233
06/25/11	613	396.3	1809.4	452.3	755.3	488.2	2229.3	557.3	0.219
06/26/11	575	371.7	1623.1	405.8	718.7	464.6	2028.8	507.2	0.229
06/27/11	555	358.8	1470.3	367.6	681.9	440.8	1806.4	451.6	0.244
06/28/11	708	457.7	1646.3	411.6	666.6	430.9	1549.9	387.5	0.278
06/29/11	795	513.9	1889.3	472.3	665.7	430.3	1582.1	395.5	0.272
06/30/11	636	411.1	1664.4	416.1	649.9	420.1	1700.7	425.2	0.247
10/01/11	44	28.4	170.3	42.6	43.6	28.2	168.7	42.2	0.167
10/02/11	47	30.4	166.0	41.5	44.4	28.7	156.9	39.2	0.183
10/03/11	59	38.1	179.9	45.0	46.6	30.1	142.0	35.5	0.212
10/04/11	85	54.9	223.4	55.8	52.3	33.8	137.4	34.3	0.246
10/05/11	162	104.7	427.4	106.9	69.0	44.6	182.1	45.5	0.245
10/06/11	215	139.0	716.4	179.1	93.6	60.5	311.8	77.9	0.194
10/07/11	159	102.8	538.1	134.5	110.1	71.2	372.8	93.2	0.191
10/08/11	123	79.5	476.1	119.0	121.4	78.5	470.0	117.5	0.167
10/09/11	110	71.1	397.2	99.3	130.4	84.3	471.0	117.8	0.179
10/10/11	120	77.6	331.5	82.9	139.1	89.9	384.4	96.1	0.234
10/11/11	244	157.7	813.0	203.3	161.9	104.6	539.3	134.8	0.194
10/12/11	205	132.5	712.4	178.1	168.0	108.6	583.9	146.0	0.186
10/13/11	161	104.1	594.7	148.7	160.3	103.6	592.1	148.0	0.175
10/14/11	135	87.3	474.3	118.6	156.9	101.4	551.1	137.8	0.184
10/15/11	121	78.2	437.0	109.2	156.6	101.2	565.4	141.4	0.179
10/16/11	111	71.8	403.1	100.8	156.7	101.3	569.1	142.3	0.178
10/17/11	104	67.2	361.4	90.4	154.4	99.8	536.7	134.2	0.186
10/18/11	100	64.6	387.1	96.8	133.9	86.5	518.1	129.5	0.167
10/19/11	96	62.1	360.8	90.2	118.3	76.5	444.5	111.1	0.172
10/20/11	94	60.8	355.3	88.8	108.7	70.3	411.0	102.7	0.171
10/21/11	92	59.5	371.7	92.9	102.6	66.3	414.4	103.6	0.160
10/22/11	92	59.5	369.4	92.3	98.4	63.6	395.2	98.8	0.161
10/23/11	91	58.8	363.1	90.8	95.6	61.8	381.3	95.3	0.162
10/24/11	87	56.2	336.8	84.2	93.1	60.2	360.5	90.1	0.167
10/25/11	86	55.6	356.4	89.1	91.1	58.9	377.7	94.4	0.156
10/26/11	84	54.3	339.4	84.8	89.4	57.8	361.3	90.3	0.160
10/27/11	89	57.5	368.8	92.2	88.7	57.3	367.6	91.9	0.156
10/28/11	85	54.9	350.0	87.5	87.7	56.7	361.1	90.3	0.157
10/29/11	84	54.3	357.2	89.3	86.6	56.0	368.2	92.0	0.152
10/30/11	84	54.3	350.3	87.6	85.6	55.3	356.9	89.2	0.155
10/31/11	83	53.7	343.9	86.0	85.0	54.9	352.2	88.1	0.156
11/01/11	84	54.3	345.9	86.5	84.7	54.8	348.8	87.2	0.157
11/02/11	85	54.9	341.3	85.3	84.9	54.9	340.7	85.2	0.161
11/03/11	91	58.8	319.7	79.9	85.1	55.0	299.1	74.8	0.184
11/04/11	96	62.1	373.8	93.5	86.7	56.1	337.7	84.4	0.166
11/05/11	104	67.2	259.6	64.9	89.6	57.9	223.6	55.9	0.259
11/06/11	385	248.9	1032.7	258.2	132.6	85.7	355.6	88.9	0.241
11/07/11	416	268.9	1274.4	318.6	180.1	116.4	551.9	138.0	0.211
11/08/11	271	175.2	912.4	228.1	206.9	133.7	696.4	174.1	0.192
11/09/11	219	141.6	757.0	189.3	226.0	146.1	781.2	195.3	0.187
11/10/11	199	128.6	722.7	180.7	241.4	156.1	876.8	219.2	0.178
11/11/11	185	119.6	703.4	175.9	254.1	164.3	966.4	241.6	0.170
11/12/11	175	113.1	707.0	176.8	264.3	170.8	1067.7	266.9	0.160
11/13/11	165	106.7	675.1	168.8	232.9	150.5	952.7	238.2	0.158
11/14/11	156	100.8	566.5	141.6	195.7	126.5	710.7	177.7	0.178
11/15/11	154	99.5	547.0	136.7	179.0	115.7	635.8	158.9	0.182
11/16/11	156	100.8	514.5	128.6	170.0	109.9	560.7	140.2	0.196
11/17/11	306	197.8	933.0	233.3	185.3	119.8	565.0	141.2	0.212
11/18/11	1100	711.1	2468.9	617.2	316.0	204.3	709.3	177.3	0.288
11/19/11	938	606.3	2454.8	613.7	425.0	274.7	1112.2	278.1	0.247

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Illinois River Date	1-day flow (cfs)	1-day flow (mgd)	1-day tot raw dilution riv/eff	1-day tot adj dilution 0.25	7-day flow (cfs)	7-day flow (mgd)	7-day tot raw dilution riv/eff	7-day tot adj dilution 0.25	WWTF Flow (mgd)
11/20/11	635	410.5	1800.3	450.1	492.1	318.1	1395.3	348.8	0.228
11/21/11	553	357.5	1241.2	310.3	548.9	354.8	1231.9	308.0	0.288
11/22/11	3500	2262.4	6373.1	1593.3	1026.9	663.8	1869.8	467.4	0.355
11/23/11	3930	2540.4	5546.7	1386.7	1566.0	1012.3	2210.2	552.6	0.458
11/24/11	3640	2352.9	6742.0	1685.5	2042.3	1320.2	3782.7	945.7	0.349
11/25/11	2280	1473.8	4562.9	1140.7	2210.9	1429.1	4424.5	1106.1	0.323
11/26/11	1620	1047.2	3561.9	890.5	2308.3	1492.1	5075.2	1268.8	0.294
11/27/11	1130	730.4	2545.1	636.3	2379.0	1537.8	5358.2	1339.6	0.287
11/28/11	895	578.5	1802.3	450.6	2427.9	1569.4	4889.1	1222.3	0.321
11/29/11	740	478.3	1702.3	425.6	2033.6	1314.5	4678.0	1169.5	0.281
11/30/11	626	404.7	1538.6	384.7	1561.6	1009.4	3838.1	959.5	0.263
12/01/11	538	347.8	1363.8	341.0	1118.4	723.0	2835.2	708.8	0.255
12/02/11	470	303.8	1225.1	306.3	859.9	555.8	2241.2	560.3	0.248
12/03/11	425	274.7	1254.5	313.6	689.1	445.5	2034.1	508.5	0.219
12/04/11	386	249.5	1144.6	286.1	582.9	376.8	1728.3	432.1	0.218
12/05/11	354	228.8	1035.4	258.9	505.6	326.8	1478.8	369.7	0.221
12/06/11	330	213.3	996.8	249.2	447.0	288.9	1350.2	337.6	0.214
12/07/11	308	199.1	948.1	237.0	401.6	259.6	1236.1	309.0	0.210
12/08/11	291	188.1	870.9	217.7	366.3	236.8	1096.2	274.0	0.216
12/09/11	276	178.4	833.7	208.4	338.6	218.9	1022.7	255.7	0.214
12/10/11	264	170.7	902.9	225.7	315.6	204.0	1079.3	269.8	0.189
12/11/11	252	162.9	835.4	208.8	296.4	191.6	982.6	245.7	0.195
12/12/11	241	155.8	794.8	198.7	280.3	181.2	924.4	231.1	0.196
12/13/11	231	149.3	728.4	182.1	266.1	172.0	839.2	209.8	0.205
12/14/11	223	144.1	699.8	174.9	254.0	164.2	797.0	199.3	0.206
12/15/11	231	149.3	714.5	178.6	245.4	158.6	759.1	189.8	0.209
12/16/11	223	144.1	706.6	176.7	237.9	153.8	753.7	188.4	0.204
12/17/11	213	137.7	740.2	185.1	230.6	149.0	801.3	200.3	0.186
12/18/11	207	133.8	711.7	177.9	224.1	144.9	770.7	192.7	0.188
12/19/11	199	128.6	670.0	167.5	218.1	141.0	734.4	183.6	0.192
12/20/11	196	126.7	736.6	184.2	213.1	137.8	801.0	200.3	0.172
12/21/11	189	122.2	710.3	177.6	208.3	134.6	782.8	195.7	0.172
12/22/11	182	117.6	629.1	157.3	201.3	130.1	695.8	173.9	0.187
12/23/11	177	114.4	621.8	155.5	194.7	125.9	684.1	171.0	0.184
12/24/11	172	111.2	657.9	164.5	188.9	122.1	722.4	180.6	0.169
12/25/11	171	110.5	650.2	162.6	183.7	118.8	698.6	174.6	0.170
12/26/11	174	112.5	665.5	166.4	180.1	116.4	689.0	172.3	0.169
12/27/11	170	109.9	600.5	150.1	176.4	114.0	623.2	155.8	0.183
12/28/11	239	154.5	643.7	160.9	183.6	118.7	494.4	123.6	0.240
12/29/11	1780	1150.6	3035.9	759.0	411.9	266.2	702.5	175.6	0.379
12/30/11	7310	4725.3	10642.5	2660.6	1430.9	924.9	2083.2	520.8	0.444
12/31/11	3800	2456.4	7018.2	1754.5	1949.1	1260.0	3599.9	900.0	0.350
01/01/12	1920	1241.1	4096.1	1024.0	2199.0	1421.5	4691.3	1172.8	0.303
01/02/12	1290	833.9	2698.6	674.7	2358.4	1524.5	4933.7	1233.4	0.309
01/03/12	970	627.0	2118.3	529.6	2472.7	1598.4	5400.0	1350.0	0.296
01/04/12	788	509.4	1744.4	436.1	2551.1	1649.1	5647.6	1411.9	0.292
01/05/12	679	438.9	1534.7	383.7	2393.9	1547.4	5410.6	1352.6	0.286
01/06/12	603	389.8	1407.2	351.8	1435.7	928.1	3350.4	837.6	0.277
01/07/12	541	349.7	1415.8	354.0	970.1	627.1	2538.9	634.7	0.247
01/08/12	492	318.0	1319.6	329.9	766.1	495.2	2055.0	513.7	0.241
01/09/12	452	292.2	1168.7	292.2	646.4	417.9	1671.4	417.9	0.250
01/10/12	421	272.1	1138.7	284.7	568.0	367.2	1536.2	384.1	0.239
01/11/12	393	254.0	1114.2	278.6	511.6	330.7	1450.4	362.6	0.228
01/12/12	370	239.2	1092.1	273.0	467.4	302.2	1379.7	344.9	0.219
01/13/12	350	226.2	1057.2	264.3	431.3	278.8	1302.7	325.7	0.214
01/14/12	332	214.6	1062.4	265.6	401.4	259.5	1284.6	321.1	0.202
01/15/12	316	204.3	1052.9	263.2	376.3	243.2	1253.8	313.4	0.194
01/16/12	305	197.2	985.8	246.4	355.3	229.7	1148.3	287.1	0.200
01/17/12	293	189.4	763.7	190.9	337.0	217.8	878.4	219.6	0.248
01/18/12	2710	1751.8	2203.5	550.9	668.0	431.8	543.1	135.8	0.795
01/19/12	22500	14544.3	14632.1	3658.0	3829.4	2475.4	2490.3	622.6	0.994
01/20/12	12800	8274.1	8556.4	2139.1	5608.0	3625.1	3748.8	937.2	0.967
01/21/12	14100	9114.4	11061.2	2765.3	7574.9	4896.5	5942.3	1485.6	0.824
01/22/12	7040	4550.7	5782.4	1445.6	8535.4	5517.4	7010.7	1752.7	0.787
01/23/12	5930	3833.2	5852.3	1463.1	9339.0	6036.8	9216.6	2304.1	0.655
01/24/12	3720	2404.7	3929.2	982.3	9828.6	6353.3	10381.2	2595.3	0.612
01/25/12	5150	3329.0	5680.9	1420.2	10177.1	6578.6	11226.3	2806.6	0.586
01/26/12	6080	3930.2	6968.4	1742.1	7831.4	5062.3	8975.8	2243.9	0.564
01/27/12	4440	2870.1	5917.7	1479.4	6637.1	4290.3	8846.0	2211.5	0.485
01/28/12	3010	1945.7	4422.0	1105.5	5052.9	3266.2	7423.2	1855.8	0.440
01/29/12	2340	1512.6	3445.6	861.4	4381.4	2832.2	6451.5	1612.9	0.439
01/30/12	2120	1370.4	3278.5	819.6	3837.1	2480.4	5933.9	1483.5	0.418
01/31/12	1850	1195.9	2717.9	679.5	3570.0	2307.7	5244.8	1311.2	0.440
02/01/12	2220	1435.0	3217.6	804.4	3151.4	2037.1	4567.5	1141.9	0.446
02/02/12	2040	1318.7	3200.7	800.2	2574.3	1664.1	4039.0	1009.7	0.412
02/03/12	1760	1137.7	2462.5	615.6	2191.4	1416.6	3066.2	766.5	0.462
02/04/12	1520	982.5	2699.3	674.8	1978.6	1279.0	3513.7	878.4	0.364
02/05/12	1330	859.7	2521.2	630.3	1834.3	1185.7	3477.1	869.3	0.341
02/06/12	1190	769.2	2173.0	543.2	1701.4	1099.8	3106.8	776.7	0.354
02/07/12	1090	704.6	2066.2	516.6	1592.9	1029.6	3019.5	754.9	0.341
02/08/12	1020	659.3	1911.1	477.8	1421.4	918.8	2663.3	665.8	0.345
02/09/12	952	615.4	1859.2	464.8	1266.0	818.4	2472.4	618.1	0.331
02/10/12	915	591.5	1765.6	441.4	1145.3	740.3	2209.9	552.5	0.335
02/11/12	919	594.1	2395.4	598.8	1059.4	684.8	2761.4	690.4	0.248

Table E1 (12 pages). Correlation of Illinois River and CJ WWTF Flows November through May plus June and October

Illinois River Date	1-day flow (cfs)	1-day flow (mgd)	1-day tot raw dilution riv/eff	1-day tot adj dilution 0.25	7-day flow (cfs)	7-day flow (mgd)	7-day tot raw dilution riv/eff	7-day tot adj dilution 0.25	WWTF Flow (mgd)
02/12/12	880	568.8	1658.4	414.6	995.1	643.3	1875.4	468.9	0.343
02/13/12	949	613.4	1605.9	401.5	960.7	621.0	1625.7	406.4	0.382
02/14/12	925	597.9	1758.6	439.7	937.1	605.8	1781.7	445.4	0.340
02/15/12	886	572.7	1689.4	422.4	918.0	593.4	1750.5	437.6	0.339
02/16/12	835	539.8	1478.8	369.7	901.3	582.6	1596.2	399.0	0.365
02/17/12	810	523.6	1586.6	396.7	886.3	572.9	1736.1	434.0	0.330
02/18/12	840	543.0	1803.9	451.0	875.0	565.6	1879.1	469.8	0.301
02/19/12	824	532.6	1817.9	454.5	867.0	560.4	1912.8	478.2	0.293
02/20/12	813	525.5	1627.0	406.8	847.6	547.9	1696.2	424.1	0.323
02/21/12	874	565.0	2268.9	567.2	840.3	543.2	2181.4	545.4	0.249
02/22/12	872	563.7	1923.8	480.9	838.3	541.9	1849.4	462.4	0.293
02/23/12	846	546.9	1946.1	486.5	839.9	542.9	1932.0	483.0	0.281
02/24/12	801	517.8	1697.6	424.4	838.6	542.1	1777.3	444.3	0.305
02/25/12	867	560.4	1932.6	483.1	842.4	544.6	1877.8	469.4	0.290
02/26/12	839	542.3	1838.4	459.6	844.6	545.9	1850.6	462.7	0.295
02/27/12	801	517.8	1791.6	447.9	842.9	544.8	1885.2	471.3	0.289
02/28/12	792	512.0	1391.2	347.8	831.1	537.3	1459.9	365.0	0.368
02/29/12	1220	788.6	1577.2	394.3	880.9	569.4	1138.8	284.7	0.500
03/01/12	1670	1079.5	2176.4	544.1	998.6	645.5	1301.4	325.3	0.496
03/02/12	1620	1047.2	2487.4	621.8	1115.6	721.1	1712.9	428.2	0.421
03/03/12	1380	892.0	2859.1	714.8	1188.9	768.5	2463.1	615.8	0.312
03/04/12	1330	859.7	2408.2	602.1	1259.0	813.8	2279.6	569.9	0.357
03/05/12	1520	982.5	2986.5	746.6	1361.7	880.2	2675.5	668.9	0.329
03/06/12	1790	1157.1	3315.4	828.9	1504.3	972.4	2786.2	696.6	0.349
03/07/12	1550	1001.9	3111.6	777.9	1551.4	1002.9	3114.5	778.6	0.322
03/08/12	1330	859.7	2645.3	661.3	1502.9	971.5	2989.1	747.3	0.325
03/09/12	1280	827.4	2132.5	533.1	1454.3	940.1	2422.9	605.7	0.388
03/10/12	1340	866.2	2877.7	719.4	1448.6	936.4	3110.9	777.7	0.301
03/11/12	1690	1092.4	3213.0	803.3	1500.0	969.6	2851.8	713.0	0.340
03/12/12	1750	1131.2	2842.3	710.6	1532.9	990.9	2489.6	622.4	0.398
03/13/12	3440	2223.7	6657.7	1664.4	1768.6	1143.2	3422.8	855.7	0.334
03/14/12	3100	2003.9	4123.2	1030.8	1990.0	1286.4	2646.8	661.7	0.486
03/15/12	7080	4576.6	5012.7	1253.2	2811.4	1817.3	1990.5	497.6	0.913
03/16/12	15600	10084.0	10321.4	2580.4	4857.1	3139.7	3213.6	803.4	0.977
03/17/12	9080	5869.4	7210.6	1802.6	5962.9	3854.5	4735.2	1183.8	0.814
03/18/12	4970	3212.7	4882.5	1220.6	6431.4	4157.4	6318.2	1579.5	0.658
03/19/12	3350	2165.5	3639.5	909.9	6660.0	4305.1	7235.5	1808.9	0.595
03/20/12	3310	2139.6	3620.3	905.1	6641.4	4293.1	7264.1	1816.0	0.591
03/21/12	7350	4751.1	6598.8	1649.7	7248.6	4685.6	6507.7	1626.9	0.720
03/22/12	8610	5565.6	8160.7	2040.2	7467.1	4826.9	7077.5	1769.4	0.682
03/23/12	5010	3238.5	5583.7	1395.9	5954.3	3848.9	6636.1	1659.0	0.580
03/24/12	3580	2314.2	4349.9	1087.5	5168.6	3341.0	6280.1	1570.0	0.532
03/25/12	2930	1894.0	3670.5	917.6	4877.1	3152.6	6109.8	1527.4	0.516
03/26/12	2450	1583.7	3136.1	784.0	4748.6	3069.5	6078.3	1519.6	0.505
03/27/12	3200	2068.5	2721.7	680.4	4732.9	3059.4	4025.5	1006.4	0.760
03/28/12	7350	4751.1	5946.3	1486.6	4732.9	3059.4	3829.0	957.3	0.799
03/29/12	7770	5022.6	4378.9	1094.7	4612.9	2981.8	2599.7	649.9	1.147
03/30/12	23200	14996.8	10479.9	2620.0	7211.4	4661.6	3257.6	814.4	1.431
03/31/12	14800	9566.9	7727.7	1931.9	8814.3	5697.7	4602.3	1150.6	1.238
04/01/12	10200	6593.4	6339.8	1585.0	9852.9	6369.0	6124.0	1531.0	1.040
04/02/12	6920	4473.2	5231.8	1307.9	10491.4	6781.8	7931.9	1983.0	0.855
04/03/12	5270	3406.6	4200.5	1050.1	10787.1	6972.9	8598.0	2149.5	0.811
04/04/12	4830	3122.2	4318.4	1079.6	10427.1	6740.2	9322.6	2330.6	0.723
04/05/12	3970	2566.3	3624.7	906.2	9884.3	6389.3	9024.5	2256.1	0.708
04/06/12	3270	2113.8	4080.6	1020.2	7037.1	4548.9	8781.7	2195.4	0.518
04/07/12	2780	1797.0	3516.7	879.2	5320.0	3438.9	6729.8	1682.4	0.511
04/08/12	2450	1583.7	3117.5	779.4	4212.9	2723.2	5360.7	1340.2	0.508
04/09/12	2240	1448.0	2806.1	701.5	3544.3	2291.1	4440.1	1110.0	0.516
04/10/12	2140	1383.3	2761.1	690.3	3097.1	2002.0	3996.1	999.0	0.501
04/11/12	2080	1344.5	2778.0	694.5	2704.3	1748.1	3611.7	902.9	0.484
04/12/12	2240	1448.0	2931.1	732.8	2457.1	1588.3	3215.2	803.8	0.494
04/13/12	2390	1544.9	3178.9	794.7	2331.4	1507.1	3101.0	775.2	0.486
04/14/12	2340	1512.6	3422.2	855.5	2268.6	1466.4	3317.7	829.4	0.442
04/15/12	2170	1402.7	3217.2	804.3	2228.6	1440.6	3304.1	826.0	0.436
04/16/12	2140	1383.3	3136.8	784.2	2214.3	1431.3	3245.7	811.4	0.441
04/17/12	2440	1577.2	3685.2	921.3	2257.1	1459.0	3409.0	852.2	0.428
04/18/12	2490	1609.6	3529.8	882.4	2315.7	1496.9	3282.7	820.7	0.456
04/19/12	3440	2223.7	4519.6	1129.9	2487.1	1607.7	3267.7	816.9	0.492
04/20/12	3340	2159.0	4797.8	1199.5	2622.9	1695.4	3767.7	941.9	0.450
04/21/12	3080	1991.0	5118.1	1279.5	2728.6	1763.8	4534.1	1133.5	0.389
04/22/12	3040	1965.1	5130.8	1282.7	2852.9	1844.1	4814.9	1203.7	0.383
04/23/12	3070	1984.5	5222.3	1305.6	2985.7	1930.0	5079.0	1269.7	0.380
04/24/12	2860	1848.7	5149.7	1287.4	3045.7	1968.8	5484.1	1371.0	0.359
04/25/12	2510	1622.5	4494.4	1123.6	3048.6	1970.6	5458.8	1364.7	0.361
04/26/12	2670	1725.9	5182.9	1295.7	2938.6	1899.5	5704.3	1426.1	0.333
04/27/12	2480	1603.1	4715.0	1178.8	2815.7	1820.1	5353.3	1338.3	0.340
04/28/12	2110	1363.9	4145.7	1036.4	2677.1	1730.5	5260.0	1315.0	0.329
04/29/12	1920	1241.1	3629.0	907.2	2517.1	1627.1	4757.6	1189.4	0.342
04/30/12	1840	1189.4	3457.6	864.4	2341.4	1513.5	4399.8	1099.9	0.344
05/01/12	1770	1144.1	3609.3	902.3	2185.7	1412.9	4457.0	1114.3	0.317
05/02/12	1570	1014.9	3103.6	775.9	2051.4	1326.1	4055.3	1013.8	0.327
05/03/12	1790	1157.1	3214.1	803.5	1925.7	1244.8	3457.8	864.4	0.360
05/04/12	2070	1338.1	4275.0	1068.7	1867.1	1206.9	3856.1	964.0	0.313
05/05/12	1750	1131.2	3579.8	895.0	1815.7	1173.7	3714.2	928.6	0.316

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Illinois River Date	1-day flow (cfs)	1-day flow (mgd)	1-day tot raw dilution riv/eff	1-day tot adj dilution 0.25	7-day flow (cfs)	7-day flow (mgd)	7-day tot raw dilution riv/eff	7-day tot adj dilution 0.25	WWTF Flow (mgd)
05/06/12	1540	995.5	2902.3	725.6	1761.4	1138.6	3319.6	829.9	0.343
05/07/12	1410	911.4	2634.2	658.6	1700.0	1098.9	3176.0	794.0	0.346
05/08/12	1370	885.6	2716.5	679.1	1642.9	1062.0	3257.6	814.4	0.326
05/09/12	1370	885.6	2784.9	696.2	1614.3	1043.5	3281.4	820.4	0.318
05/10/12	1250	808.0	2623.4	655.9	1537.1	993.6	3226.1	806.5	0.308
05/11/12	1130	730.4	2387.1	596.8	1402.9	906.8	2963.5	740.9	0.306
05/12/12	1070	691.7	2385.0	596.3	1305.7	844.0	2910.4	727.6	0.290
05/13/12	1060	685.2	2379.2	594.8	1237.1	799.7	2776.8	694.2	0.288
05/14/12	1090	704.6	2161.3	540.3	1191.4	770.2	2362.4	590.6	0.326
05/15/12	1070	691.7	2168.2	542.1	1148.6	742.5	2327.4	581.9	0.319
05/16/12	1050	678.7	2008.1	502.0	1102.9	712.9	2109.2	527.3	0.338
05/17/12	966	624.4	2060.8	515.2	1062.3	686.7	2266.3	566.6	0.303
05/18/12	875	565.6	1984.6	496.1	1025.9	663.1	2326.8	581.7	0.285
05/19/12	799	516.5	1878.1	469.5	987.1	638.1	2320.4	580.1	0.275
05/20/12	751	485.5	2237.1	559.3	943.0	609.6	2809.1	702.3	0.217
05/21/12	747	482.9	1682.5	420.6	894.0	577.9	2013.6	503.4	0.287
05/22/12	760	491.3	1965.1	491.3	849.7	549.3	2197.1	549.3	0.250
05/23/12	715	462.2	1902.0	475.5	801.9	518.3	2133.0	533.3	0.243
05/24/12	674	435.7	1722.1	430.5	760.1	491.4	1942.2	485.5	0.253
05/25/12	704	455.1	1849.9	462.5	735.7	475.6	1933.2	483.3	0.246
05/26/12	679	438.9	1828.8	457.2	718.6	464.5	1935.4	483.8	0.240
05/27/12	650	420.2	1758.0	439.5	704.1	455.2	1904.5	476.1	0.239
05/28/12	605	391.1	1769.6	442.4	683.9	442.1	2000.2	500.1	0.221
05/29/12	578	373.6	1482.6	370.7	657.9	425.2	1687.5	421.9	0.252
05/30/12	550	355.5	1388.8	347.2	634.3	410.0	1601.6	400.4	0.256
05/31/12	532	343.9	1451.0	362.8	614.0	396.9	1674.7	418.7	0.237
06/01/12	523	338.1	1336.3	334.1	588.1	380.2	1502.7	375.7	0.253
06/02/12	509	329.0	1462.3	365.6	563.9	364.5	1619.9	405.0	0.225
06/03/12	494	319.3	1267.2	316.8	541.6	350.1	1389.2	347.3	0.252
06/04/12	554	358.1	1243.4	310.9	534.3	345.4	1199.2	299.8	0.288
06/05/12	617	398.8	1409.3	352.3	539.9	349.0	1233.1	308.3	0.283
06/06/12	580	374.9	1393.8	348.4	544.1	351.7	1307.6	326.9	0.269
06/07/12	532	343.9	1614.5	403.6	544.1	351.7	1651.4	412.8	0.213
06/08/12	513	331.6	1393.3	348.3	542.7	350.8	1474.0	368.5	0.238
06/09/12	500	323.2	1436.5	359.1	541.4	350.0	1555.5	388.9	0.225
06/10/12	470	303.8	1368.5	342.1	538.0	347.8	1566.5	391.6	0.222
06/11/12	438	283.1	1467.0	366.7	521.4	337.1	1746.4	436.6	0.193
06/12/12	421	272.1	938.4	234.6	493.4	319.0	1099.9	275.0	0.290
06/13/12	407	263.1	1073.8	268.5	468.7	303.0	1236.7	309.2	0.245
06/14/12	388	250.8	1019.5	254.9	448.1	289.7	1177.6	294.4	0.246
06/15/12	370	239.2	992.4	248.1	427.7	276.5	1147.2	286.8	0.241
06/16/12	349	225.6	972.4	243.1	406.1	262.5	1131.6	282.9	0.232
06/17/12	332	214.6	1002.8	250.7	386.4	249.8	1167.3	291.8	0.214
06/18/12	311	201.0	901.5	225.4	368.3	238.1	1067.6	266.9	0.223
06/19/12	291	188.1	862.9	215.7	349.7	226.1	1037.0	259.2	0.218
06/20/12	278	179.7	824.3	206.1	331.3	214.1	982.3	245.6	0.218
06/21/12	263	170.0	787.1	196.8	313.4	202.6	938.0	234.5	0.216
06/22/12	260	168.1	763.9	191.0	297.7	192.4	874.8	218.7	0.220
06/23/12	345	223.0	1051.9	263.0	297.1	192.1	906.0	226.5	0.212
06/24/12	338	218.5	1021.0	255.2	298.0	192.6	900.1	225.0	0.214
06/25/12	306	197.8	960.2	240.1	297.3	192.2	932.9	233.2	0.206
06/26/12	302	195.2	875.4	218.9	298.9	193.2	866.3	216.6	0.223
06/27/12	284	183.6	874.2	218.5	299.7	193.7	922.6	230.6	0.210
06/28/12	261	168.7	773.9	193.5	299.4	193.6	887.9	222.0	0.218
06/29/12	259	167.4	778.7	194.7	299.3	193.5	899.8	225.0	0.215
06/30/12	254	164.2	753.2	188.3	286.3	185.1	848.9	212.2	0.218
10/01/12	29	18.7	93.7	23.4	30.7	19.9	99.3	24.8	0.200
10/02/12	29	18.7	90.6	22.6	30.4	19.7	95.0	23.8	0.207
10/03/12	29	18.7	92.3	23.1	30.1	19.5	96.0	24.0	0.203
10/04/12	29	18.7	93.7	23.4	29.9	19.3	96.5	24.1	0.200
10/05/12	29	18.7	101.9	25.5	29.4	19.0	103.4	25.8	0.184
10/06/12	31	20.0	122.2	30.5	29.4	19.0	116.0	29.0	0.164
10/07/12	33	21.3	123.3	30.8	29.9	19.3	111.6	27.9	0.173
10/08/12	34	22.0	117.5	29.4	30.6	19.8	105.7	26.4	0.187
10/09/12	34	22.0	116.9	29.2	31.3	20.2	107.6	26.9	0.188
10/10/12	34	22.0	124.9	31.2	32.0	20.7	117.5	29.4	0.176
10/11/12	34	22.0	122.8	30.7	32.7	21.1	118.1	29.5	0.179
10/12/12	34	22.0	127.0	31.8	33.4	21.6	124.9	31.2	0.173
10/13/12	35	22.6	141.4	35.4	34.0	22.0	137.4	34.3	0.160
10/14/12	39	25.2	146.6	36.6	34.9	22.5	131.0	32.8	0.172
10/15/12	43	27.8	124.1	31.0	36.1	23.4	104.3	26.1	0.224
10/16/12	106	68.5	337.5	84.4	46.4	30.0	147.8	37.0	0.203
10/17/12	145	93.7	473.4	118.3	62.3	40.3	203.3	50.8	0.198
10/18/12	91	58.8	328.6	82.2	70.4	45.5	254.3	63.6	0.179
10/19/12	74	47.8	249.1	62.3	76.1	49.2	256.4	64.1	0.192
10/20/12	71	45.9	271.6	67.9	81.3	52.5	310.9	77.7	0.169
10/21/12	73	47.2	251.0	62.8	86.1	55.7	296.2	74.0	0.188
10/22/12	88	56.9	196.2	49.0	92.6	59.8	206.3	51.6	0.290
10/23/12	241	155.8	458.2	114.5	111.9	72.3	212.7	53.2	0.340
10/24/12	518	334.8	1014.7	253.7	165.1	106.8	323.5	80.9	0.330
10/25/12	623	402.7	1480.6	370.1	241.1	155.9	573.1	143.3	0.272
10/26/12	381	246.3	1009.4	252.3	285.0	184.2	755.0	188.8	0.244
10/27/12	395	255.3	1221.7	305.4	331.3	214.1	1024.6	256.2	0.209
10/28/12	451	291.5	1401.6	350.4	385.3	249.1	1197.4	299.3	0.208

Table E1 (12 pages). Correlation of Illinois River and CJ WWTF Flows November through May plus June and October

Illinois River			1-day	1-day			7-day	7-day	
	1-day	1-day	tot raw	tot adj	7-day	7-day	tot raw	tot adj	WWTF
	flow	flow	dilution	dilution	flow	flow	dilution	dilution	Flow
Date	(cfs)	(mgd)	riv/eff	0.25	(cfs)	(mgd)	riv/eff	0.25	(mgd)
10/29/12	393	254.0	1198.3	299.6	428.9	277.2	1307.6	326.9	0.212
10/30/12	344	222.4	1111.8	278.0	443.6	286.7	1433.7	358.4	0.200
10/31/12	334	215.9	776.6	194.2	417.3	269.7	970.3	242.6	0.278
11/01/12	1150	743.4	2973.5	743.4	492.6	318.4	1273.6	318.4	0.250
11/02/12	815	526.8	2270.8	567.7	554.6	358.5	1545.2	386.3	0.232
11/03/12	549	354.9	1689.9	422.5	576.6	372.7	1774.8	443.7	0.210
11/04/12	425	274.7	1387.5	346.9	572.9	370.3	1870.2	467.6	0.198
11/05/12	353	228.2	1129.6	282.4	567.1	366.6	1814.9	453.7	0.202
11/06/12	309	199.7	1040.3	260.1	562.1	363.4	1892.6	473.1	0.192
11/07/12	269	173.9	955.4	238.9	552.9	357.4	1963.6	490.9	0.182
11/08/12	251	162.2	815.3	203.8	424.4	274.4	1378.7	344.7	0.199
11/09/12	267	172.6	889.7	222.4	346.1	223.8	1153.4	288.3	0.194
11/10/12	256	165.5	929.7	232.4	304.3	196.7	1105.0	276.3	0.178
11/11/12	248	160.3	916.1	229.0	279.0	180.3	1030.6	257.6	0.175
11/12/12	252	162.9	724.0	181.0	264.6	171.0	760.1	190.0	0.225
11/13/12	580	374.9	1493.7	373.4	303.3	196.0	781.1	195.3	0.251
11/14/12	529	342.0	1620.6	405.2	340.4	220.1	1042.9	260.7	0.211
11/15/12	434	280.5	1424.1	356.0	366.6	237.0	1202.8	300.7	0.197
11/16/12	375	242.4	1249.5	312.4	382.0	246.9	1272.8	318.2	0.194
11/17/12	394	254.7	994.9	248.7	401.7	259.7	1014.3	253.6	0.256
11/18/12	950	614.1	2274.4	568.6	502.0	324.5	1201.8	300.5	0.270
11/19/12	1430	924.4	2022.7	505.7	670.3	433.3	948.1	237.0	0.457
11/20/12	9820	6347.8	9902.9	2475.7	1990.3	1286.5	2007.1	501.8	0.641
11/21/12	7610	4919.2	9194.8	2298.7	3001.9	1940.4	3627.0	906.7	0.535
11/22/12	3410	2204.3	5286.0	1321.5	3427.0	2215.3	5312.4	1328.1	0.417
11/23/12	1950	1260.5	3511.2	877.8	3652.0	2360.7	6575.8	1643.9	0.359
11/24/12	1390	898.5	2634.9	658.7	3794.3	2452.7	7192.6	1798.1	0.341
11/25/12	1200	775.7	2315.5	578.9	3830.0	2475.8	7390.3	1847.6	0.335
11/26/12	1000	646.4	2085.2	521.3	3768.6	2436.1	7858.2	1964.6	0.310
11/27/12	858	554.6	1806.6	451.6	2488.3	1608.5	5239.3	1309.8	0.307
11/28/12	775	501.0	1560.7	390.2	1511.9	977.3	3044.5	761.1	0.321
11/29/12	5150	3329.0	3674.4	918.6	1760.4	1138.0	1256.0	314.0	0.906
11/30/12	13400	8661.9	10486.6	2621.6	3396.1	2195.3	2657.8	664.4	0.826
12/01/12	12000	7756.9	7907.2	1976.8	4911.9	3175.1	3236.6	809.1	0.981
12/02/12	18400	11894.0	13960.1	3490.0	7369.0	4763.4	5590.9	1397.7	0.852
12/03/12	7650	4945.1	6204.6	1551.1	8319.0	5377.5	6747.2	1686.8	0.797
12/04/12	9060	5856.5	6012.8	1503.2	9490.7	6134.9	6298.7	1574.7	0.974
12/05/12	14700	9502.3	11602.3	2900.6	11480.0	7420.8	9060.8	2265.2	0.819
12/06/12	6450	4169.4	6326.8	1581.7	11665.7	7540.9	11442.9	2860.7	0.659
12/07/12	3970	2566.3	4394.3	1098.6	10318.6	6670.1	11421.3	2855.3	0.584
12/08/12	2890	1868.1	3641.6	910.4	9017.1	5828.8	11362.2	2840.5	0.513
12/09/12	2250	1454.4	3094.5	773.6	6710.0	4337.4	9228.6	2307.1	0.470
12/10/12	1870	1208.8	2716.4	679.1	5884.3	3803.7	8547.6	2136.9	0.445
12/11/12	1630	1053.7	2246.6	561.6	4822.9	3117.6	6647.2	1661.8	0.469
12/12/12	1590	1027.8	2453.0	613.2	2950.0	1906.9	4551.1	1137.8	0.419
12/13/12	1380	892.0	2258.4	564.6	2225.7	1438.7	3642.4	910.6	0.395
12/14/12	1240	801.6	2044.8	511.2	1835.7	1186.6	3027.1	756.8	0.392
12/15/12	1160	749.8	1820.0	455.0	1588.6	1026.9	2492.4	623.1	0.412
12/16/12	1850	1195.9	2186.2	546.6	1531.4	989.9	1809.8	452.4	0.547
12/17/12	6970	4505.5	7314.1	1828.5	2260.0	1460.9	2371.6	592.9	0.616
12/18/12	3970	2566.3	4897.4	1224.4	2594.3	1677.0	3200.3	800.1	0.524
12/19/12	2670	1725.9	3262.6	815.7	2748.6	1776.7	3358.6	839.7	0.529
12/20/12	3490	2256.0	2980.2	745.0	3050.0	1971.6	2604.4	651.1	0.757
12/21/12	5500	3555.3	3489.0	872.2	3658.6	2364.9	2320.8	580.2	1.019
12/22/12	6930	4479.6	3908.9	977.2	4482.9	2897.8	2528.6	632.1	1.146
12/23/12	6140	3969.0	3556.4	889.1	5095.7	3293.9	2951.6	737.9	1.116
12/24/12	4820	3115.7	3552.7	888.2	4788.6	3095.4	3529.5	882.4	0.877
12/25/12	4310	2786.0	2446.0	611.5	4837.1	3126.8	2745.2	686.3	1.139
12/26/12	6120	3956.0	4235.6	1058.9	5330.0	3445.4	3688.8	922.2	0.934
12/27/12	3740	2417.6	3095.5	773.9	5365.7	3468.5	4441.1	1110.3	0.781
12/28/12	2830	1829.3	2591.1	647.8	4984.3	3221.9	4563.6	1140.9	0.706
12/29/12	2340	1512.6	2367.1	591.8	4328.6	2798.0	4378.8	1094.7	0.639
12/30/12	2000	1292.8	2198.7	549.7	3737.1	2415.7	4108.4	1027.1	0.588
12/31/12	1740	1124.8	1945.9	486.5	3297.1	2131.3	3687.4	921.8	0.578
01/01/13	1550	1001.9	1919.4	479.9	2902.9	1876.4	3594.7	898.7	0.522
01/02/13	1390	898.5	1724.6	431.1	2227.1	1439.7	2763.2	690.8	0.521
01/03/13	1280	827.4	1709.5	427.4	1875.7	1212.5	2505.1	626.3	0.484
01/04/13	1200	775.7	1675.4	418.8	1642.9	1062.0	2293.7	573.4	0.463
01/05/13	1150	743.4	1648.3	412.1	1472.9	952.1	2111.0	527.8	0.451
01/06/13	1120	724.0	1612.4	403.1	1347.1	870.8	1939.4	484.9	0.449
01/07/13	1090	704.6	1565.8	391.4	1254.3	810.8	1801.7	450.4	0.450
01/08/13	1230	795.1	1823.6	455.9	1208.6	781.2	1791.8	448.0	0.436
01/09/13	1610	1040.7	2448.8	612.2	1240.0	801.6	1886.0	471.5	0.425
01/10/13	1890	1221.7	2922.8	730.7	1327.1	857.9	2052.3	513.1	0.418
01/11/13	1570	1014.9	2493.5	623.4	1380.0	892.0	2191.8	547.9	0.407
01/12/13	1350	872.7	2410.7	602.7	1408.6	910.5	2515.2	628.8	0.362
01/13/13	1180	762.8	2112.9	528.2	1417.1	916.1	2537.6	634.4	0.361
01/14/13	1070	691.7	1889.8	472.4	1414.3	914.2	2497.8	624.5	0.366
01/15/13	978	632.2	1765.9	441.5	1378.3	890.9	2488.7	622.2	0.358
01/16/13	918	593.4	1643.8	410.9	1279.4	827.0	2291.0	572.7	0.361
01/17/13	891	576.0	1664.6	416.2	1136.7	734.8	2123.7	530.9	0.346
01/18/13	906	585.6	1659.1	414.8	1041.9	673.5	1907.8	477.0	0.353
01/19/13	921	595.3	1787.8	447.0	980.6	633.9	1903.5	475.9	0.333
01/20/13	923	596.6	1813.5	453.4	943.9	610.1	1854.5	463.6	0.329

Table E1 (12 pages). Correlation of Illinois River and CJ WWTF Flows November through May plus June and October

Illinois River Date	1-day flow (cfs)	1-day flow (mgd)	1-day tot raw dilution riv/eff	1-day tot adj dilution 0.25	7-day flow (cfs)	7-day flow (mgd)	7-day tot raw dilution riv/eff	7-day tot adj dilution 0.25	WWTF Flow (mgd)
01/21/13	912	589.5	1791.9	448.0	921.3	595.5	1810.1	452.5	0.329
01/22/13	909	587.6	1688.5	422.1	911.4	589.2	1693.0	423.2	0.348
01/23/13	1580	1021.3	1983.2	495.8	1006.0	650.3	1262.7	315.7	0.515
01/24/13	3750	2424.0	5135.7	1283.9	1414.4	914.3	1937.1	484.3	0.472
01/25/13	3110	2010.3	4295.6	1073.9	1729.3	1117.8	2388.5	597.1	0.468
01/26/13	3910	2527.5	5679.7	1419.9	2156.3	1393.8	3132.2	783.1	0.445
01/27/13	2830	1829.3	4274.2	1068.5	2428.7	1570.0	3668.1	917.0	0.428
01/28/13	2250	1454.4	3479.5	869.9	2619.9	1693.5	4051.5	1012.9	0.418
01/29/13	1890	1221.7	2972.6	743.1	2760.0	1784.1	4340.9	1085.2	0.411
01/30/13	1650	1066.6	2741.9	685.5	2770.0	1790.6	4603.0	1150.7	0.389
01/31/13	1480	956.7	2504.4	626.1	2445.7	1580.9	4138.6	1034.6	0.382
02/01/13	1350	872.7	2272.5	568.1	2194.3	1418.4	3693.8	923.4	0.384
02/02/13	1250	808.0	2225.9	556.5	1814.3	1172.8	3230.8	807.7	0.363
02/03/13	1180	762.8	2185.6	546.4	1578.6	1020.4	2923.8	731.0	0.349
02/04/13	1120	724.0	2016.7	504.2	1417.1	916.1	2551.7	637.9	0.359
02/05/13	1100	711.1	1911.4	477.9	1304.3	843.1	2266.4	566.6	0.372
02/06/13	1270	820.9	2195.0	548.8	1250.0	808.0	2160.5	540.1	0.374
02/07/13	1360	879.1	2331.9	583.0	1232.9	796.9	2113.9	528.5	0.377
02/08/13	1330	859.7	2342.6	585.6	1230.0	795.1	2166.5	541.6	0.367
02/09/13	1200	775.7	2288.2	572.0	1222.9	790.5	2331.8	582.9	0.339
02/10/13	1110	717.5	2055.9	514.0	1212.9	784.0	2246.4	561.6	0.349
02/11/13	1030	665.8	1952.5	488.1	1200.0	775.7	2274.8	568.7	0.341
02/12/13	963	622.5	1858.2	464.5	1180.4	763.0	2277.7	569.4	0.335
02/13/13	916	592.1	1850.4	462.6	1129.9	730.4	2282.4	570.6	0.320
02/14/13	888	574.0	1799.4	449.9	1062.4	686.8	2152.9	538.2	0.319
02/15/13	893	577.2	1821.0	455.2	1000.0	646.4	2039.2	509.8	0.317
02/16/13	909	587.6	1865.4	466.3	958.4	619.5	1966.8	491.7	0.315
02/17/13	897	579.8	1858.4	464.6	928.0	599.9	1922.7	480.7	0.312
02/18/13	860	555.9	1781.8	445.4	903.7	584.2	1872.3	468.1	0.312
02/19/13	884	571.4	1596.2	399.0	892.4	576.9	1611.4	402.8	0.358
02/20/13	836	540.4	1566.4	391.6	881.0	569.5	1650.7	412.7	0.345
02/21/13	787	508.7	1668.0	417.0	866.6	560.2	1836.6	459.1	0.305
02/22/13	756	488.7	1527.1	381.8	847.0	547.5	1711.0	427.7	0.320
02/23/13	811	524.2	1707.6	426.9	833.0	538.5	1753.9	438.5	0.307
02/24/13	789	510.0	1603.8	401.0	817.6	528.5	1661.9	415.5	0.318
02/25/13	764	493.9	1608.7	402.2	803.9	519.6	1692.6	423.1	0.307
02/26/13	739	477.7	1492.8	373.2	783.1	506.2	1582.0	395.5	0.320
02/27/13	714	461.5	1513.2	378.3	765.7	495.0	1622.8	405.7	0.305
02/28/13	728	470.6	1493.9	373.5	757.3	489.5	1554.0	388.5	0.315
03/01/13	899	581.1	1899.1	474.8	777.7	502.7	1642.9	410.7	0.306
03/02/13	909	587.6	2408.2	602.0	791.7	511.8	2097.4	524.4	0.244
03/03/13	922	596.0	2452.6	613.2	810.7	524.1	2156.6	539.2	0.243
03/04/13	887	573.4	1879.9	470.0	828.3	535.4	1755.5	438.9	0.305
03/05/13	894	577.9	1448.4	362.1	850.4	549.7	1377.8	344.4	0.399
03/06/13	1570	1014.9	2058.6	514.6	972.7	628.8	1275.4	318.9	0.493
03/07/13	1740	1124.8	2646.5	661.6	1117.3	722.2	1699.4	424.8	0.425
03/08/13	1450	937.3	2258.5	564.6	1196.0	773.1	1862.9	465.7	0.415
03/09/13	1250	808.0	2362.6	590.7	1244.7	804.6	2352.6	588.2	0.342
03/10/13	1150	743.4	2148.5	537.1	1277.3	825.7	2386.3	596.6	0.346
03/11/13	1090	704.6	1996.0	499.0	1306.3	844.4	2392.1	598.0	0.353
03/12/13	1100	711.1	2135.3	533.8	1335.7	863.4	2592.9	648.2	0.333
03/13/13	1110	717.5	2174.3	543.6	1270.0	820.9	2487.7	621.9	0.330
03/14/13	1090	704.6	2174.7	543.7	1177.1	760.9	2348.5	587.1	0.324
03/15/13	1080	698.1	2154.7	538.7	1124.3	726.8	2243.1	560.8	0.324
03/16/13	1040	672.3	2278.9	569.7	1094.3	707.4	2397.8	599.5	0.295
03/17/13	979	632.8	2159.9	540.0	1069.9	691.6	2360.3	590.1	0.293
03/18/13	898	580.5	1961.1	490.3	1042.4	673.8	2276.5	569.1	0.296
03/19/13	842	544.3	1629.6	407.4	1005.6	650.0	1946.1	486.5	0.334
03/20/13	1740	1124.8	3168.3	792.1	1095.6	708.2	1994.9	498.7	0.355
03/21/13	2150	1389.8	4356.7	1089.2	1247.0	806.1	2526.9	631.7	0.319
03/22/13	1510	976.1	2940.0	735.0	1308.4	845.8	2547.5	636.9	0.332
03/23/13	1220	788.6	2691.5	672.9	1334.1	862.4	2943.4	735.8	0.293
03/24/13	1050	678.7	2389.9	597.5	1344.3	869.0	3059.7	764.9	0.284
03/25/13	949	613.4	1998.2	499.5	1351.6	873.7	2845.8	711.5	0.307
03/26/13	902	583.1	1918.0	479.5	1360.1	879.2	2892.1	723.0	0.304
03/27/13	885	572.1	1894.3	473.6	1238.0	800.3	2649.9	662.5	0.302
03/28/13	916	592.1	1954.2	488.5	1061.7	686.3	2265.0	566.3	0.303
03/29/13	918	593.4	1901.9	475.5	977.1	631.6	2024.5	506.1	0.312
03/30/13	923	596.6	2108.3	527.1	934.7	604.2	2135.0	533.8	0.283
03/31/13	1100	711.1	2243.1	560.8	941.9	608.8	1920.6	480.1	0.317
04/01/13	1470	950.2	2317.6	579.4	1016.3	656.9	1602.3	400.6	0.410
04/02/13	1440	930.8	3324.4	831.1	1093.1	706.6	2523.6	630.9	0.280
04/03/13	1270	820.9	2541.6	635.4	1148.1	742.2	2297.8	574.4	0.323
04/04/13	1340	866.2	2291.5	572.9	1208.7	781.3	2067.0	516.8	0.378
04/05/13	2910	1881.1	4823.2	1205.8	1493.3	965.3	2475.1	618.8	0.390
04/06/13	3260	2107.3	5516.5	1379.1	1827.1	1181.1	3091.9	773.0	0.382
04/07/13	3430	2217.2	4971.3	1242.8	2160.0	1396.3	3130.6	782.7	0.446
04/08/13	3450	2230.1	5247.3	1311.8	2442.9	1579.1	3715.5	928.9	0.425
04/09/13	2640	1706.5	4444.1	1111.0	2614.3	1689.9	4400.8	1100.2	0.384
04/10/13	2130	1376.9	3557.8	889.4	2737.1	1769.3	4571.9	1143.0	0.387
04/11/13	1860	1202.3	3303.1	825.8	2811.4	1817.3	4992.7	1248.2	0.364
04/12/13	1580	1021.3	2951.8	738.0	2621.4	1694.5	4897.5	1224.4	0.346
04/13/13	1380	892.0	2814.0	703.5	2352.9	1520.9	4797.8	1199.5	0.317
04/14/13	1220	788.6	2464.4	616.1	2037.1	1316.8	4115.1	1028.8	0.320

Table E1 (12 pages). Correlation of Illinois River and CJ WWTF Flows November through May plus June and October

Illinois River Date	1-day flow (cfs)	1-day flow (mgd)	1-day tot raw dilution riv/eff	1-day tot adj dilution 0.25	7-day flow (cfs)	7-day flow (mgd)	7-day tot raw dilution riv/eff	7-day tot adj dilution 0.25	WWTF Flow (mgd)
04/15/13	1120	724.0	2241.4	560.4	1704.3	1101.7	3410.7	852.7	0.323
04/16/13	1020	659.3	2113.3	528.3	1472.9	952.1	3051.5	762.9	0.312
04/17/13	917	592.8	2002.6	500.6	1299.6	840.1	2838.0	709.5	0.296
04/18/13	844	545.6	1806.5	451.6	1154.4	746.2	2471.0	617.7	0.302
04/19/13	802	518.4	1672.3	418.1	1043.3	674.4	2175.5	543.9	0.310
04/20/13	769	497.1	1593.2	398.3	956.0	618.0	1980.7	495.2	0.312
04/21/13	735	475.1	1892.9	473.2	886.7	573.2	2283.6	570.9	0.251
04/22/13	711	459.6	1521.9	380.5	828.3	535.4	1772.9	443.2	0.302
04/23/13	683	441.5	1471.7	367.9	780.1	504.3	1681.0	420.2	0.300
04/24/13	649	419.5	1417.3	354.3	741.9	479.5	1620.1	405.0	0.296
04/25/13	627	405.3	1621.2	405.3	710.9	459.5	1838.0	459.5	0.250
04/26/13	610	394.3	1388.4	347.1	683.4	441.8	1555.6	388.9	0.284
04/27/13	610	394.3	1546.3	386.6	660.7	427.1	1674.9	418.7	0.255
04/28/13	597	385.9	1501.6	375.4	641.0	414.4	1612.3	403.1	0.257
04/29/13	576	372.3	1368.9	342.2	621.7	401.9	1477.5	369.4	0.272
04/30/13	557	360.1	1457.7	364.4	603.7	390.2	1580.0	395.0	0.247

Appendix E2

Effluent Quality Data from Discharge Monitoring Reports (DMRs)

Table E2 (12 pages). Discharge Monitoring Report Data for the CJ WWTF

WWTF Date	Flow (mgd)	Flow (cfs)	Max T (oC)	7-day Avg Max T (oC)	pH (S.U.)	DO (mg/l)
01/01/10	0.744	1.151				
01/02/10	0.587	0.908				
01/03/10	0.470	0.727				
01/04/10	0.424	0.656	12		6.6	7.1
01/05/10	0.416	0.644	13		6.5	6.8
01/06/10	0.460	0.712	14		6.5	7.0
01/07/10	0.416	0.644	14		6.4	8.0
01/08/10	0.414	0.640	13		6.4	
01/09/10	0.355	0.549				
01/10/10	0.394	0.610		13.2		
01/11/10	0.421	0.651	13	13.4	6.5	
01/12/10	0.745	1.153	13	13.4	6.5	5.2
01/13/10	0.720	1.114	12	13.0	6.4	
01/14/10	0.569	0.880	13	12.8	6.6	5.5
01/15/10	0.517	0.800	13	12.8	6.5	5.6
01/16/10	0.516	0.798		12.8		
01/17/10	0.548	0.848		12.8		
01/18/10	0.569	0.880		12.8		
01/19/10	0.613	0.948	12	12.5	6.4	3.7
01/20/10	0.537	0.831	11	12.3	6.3	
01/21/10	0.533	0.825	13	12.3	6.2	6.0
01/22/10	0.475	0.735	13	12.3	6.2	5.6
01/23/10	0.417	0.645		12.3		
01/24/10	0.669	1.035		12.3		
01/25/10	0.642	0.993	12	12.2	6.3	
01/26/10	0.603	0.933	12	12.2	6.3	5.9
01/27/10	0.518	0.801	12	12.4	6.3	5.8
01/28/10	0.483	0.747	13	12.4	6.3	7.0
01/29/10	0.457	0.707	13	12.4	6.4	
01/30/10	0.392	0.606		12.4		
01/31/10	0.374	0.579		12.4		
02/01/10	0.397	0.614	12	12.4	6.4	
02/02/10	0.523	0.809	12	12.4	6.5	6.9
02/03/10	0.522	0.808	12	12.4	6.7	8.3
02/04/10	0.536	0.829	12	12.2	6.4	7.1
02/05/10	0.526	0.814	12	12.0	6.4	7.3
02/06/10	0.444	0.687		12.0		
02/07/10	0.413	0.639		12.0		
02/08/10	0.402	0.622	12	12.0	6.6	7.9
02/09/10	0.375	0.580	12	12.0	6.5	7.3
02/10/10	0.312	0.483	12	12.0	6.7	7.7
02/11/10	0.393	0.608	13	12.2	6.5	7.4
02/12/10	0.464	0.718	12	12.2	6.5	
02/13/10	0.400	0.619		12.2		
02/14/10	0.513	0.794		12.2		
02/15/10	0.455	0.704		12.3		
02/16/10	0.454	0.702	13	12.5	6.5	7.8
02/17/10	0.416	0.644	13	12.8	6.5	6.3
02/18/10	0.401	0.620	13	12.8	6.8	9.0
02/19/10	0.373	0.577	12	12.8	6.6	7.9
02/20/10	0.343	0.531		12.8		
02/21/10	0.354	0.548		12.8		
02/22/10	0.336	0.520	12	12.6	6.6	
02/23/10	0.408	0.631	12	12.4	6.3	
02/24/10	0.409	0.633	13	12.4	6.7	6.2
02/25/10	0.391	0.605	13	12.4	6.5	7.0
02/26/10	0.904	1.398	13	12.6	6.5	
02/27/10	0.618	0.956		12.6		
02/28/10	0.603	0.933		12.6		
03/01/10	0.521	0.806	12	12.6	6.6	6.4
03/02/10	0.490	0.758	13	12.8	6.4	6.5
03/03/10	0.460	0.712	13	12.8	6.5	6.0
03/04/10	0.410	0.634	12	12.6	6.3	6.1
03/05/10	0.403	0.623	12	12.4	6.6	6.9
03/06/10	0.365	0.565		12.4		
03/07/10	0.355	0.549		12.4		
03/08/10	0.349	0.540	12	12.4	6.6	6.9
03/09/10	0.362	0.560	13	12.4	6.5	7.8
03/10/10	0.352	0.545	12	12.2	6.4	5.8
03/11/10	0.367	0.568	14	12.6	6.2	
03/12/10	0.623	0.964	12	12.6	6.4	3.8
03/13/10	0.517	0.800		12.6		
03/14/10	0.434	0.671		12.6		
03/15/10	0.434	0.671	12	12.6	6.3	
03/16/10	0.405	0.627	12	12.4	6.4	6.8
03/17/10	0.388	0.600	12	12.4	6.0	6.0
03/18/10	0.368	0.569	12	12.0	6.4	7.3
03/19/10	0.363	0.562	12	12.0	6.3	
03/20/10	0.340	0.526		12.0		
03/21/10	0.328	0.507		12.0		
03/22/10	0.333	0.515	13	12.2	6.4	6.1
03/23/10	0.324	0.501	13	12.4	6.4	6.5
03/24/10	0.338	0.523	13	12.6	6.4	6.3
03/25/10	0.397	0.614	13	12.8	6.4	6.7

Table E2 (12 pages). Discharge Monitoring Report Data for the CJ WWTF

WWTF Date	Flow (mgd)	Flow (cfs)	Max T (oC)	7-day Avg Max T (oC)	pH (S.U.)	DO (mg/l)
03/26/10	0.371	0.574	12	12.8	6.3	7.2
03/27/10	0.331	0.512		12.8		
03/28/10	0.373	0.577		12.8		
03/29/10	0.540	0.835	13	12.8	6.4	6.5
03/30/10	0.657	1.016	12	12.6	6.4	
03/31/10	0.606	0.937	12	12.4	6.3	
04/01/10	0.541	0.837	12	12.2	6.5	6.1
04/02/10	0.674	1.043	12	12.2	6.3	6.9
04/03/10	0.592	0.916		12.2		
04/04/10	0.624	0.965		12.2		
04/05/10	0.804	1.244	10	11.6	6.7	7.3
04/06/10	0.699	1.081	12	11.6	6.6	5.4
04/07/10	0.604	0.934	12	11.6	6.3	6.9
04/08/10	0.529	0.818	13	11.8	6.2	5.8
04/09/10	0.511	0.791	12	11.8	6.8	6.9
04/10/10	0.462	0.715		11.8		
04/11/10	0.453	0.701		11.8		
04/12/10	0.443	0.685	13	12.4	6.5	6.5
04/13/10	0.411	0.636	13	12.6	6.5	5.4
04/14/10	0.471	0.729	13	12.8	6.5	6.5
04/15/10	0.429	0.664	13	12.8	6.9	5.2
04/16/10	0.411	0.636	13	13.0	6.6	
04/17/10	0.386	0.597	14	13.2		
04/18/10	0.382	0.591		13.2		
04/19/10	0.368	0.569	14	13.3	6.6	3.9
04/20/10	0.389	0.602	14	13.5	6.4	4.5
04/21/10	0.351	0.543	14	13.7	6.5	4.4
04/22/10	0.331	0.512	14	13.8	6.4	4.4
04/23/10	0.327	0.506	14	14.0	6.5	5.7
04/24/10	0.308	0.476		14.0		
04/25/10	0.318	0.492		14.0		
04/26/10	0.427	0.661	14	14.0	6.5	4.7
04/27/10	0.749	1.159	14	14.0	6.4	5.6
04/28/10	0.743	1.149	13	13.8	6.4	5.4
04/29/10	0.592	0.916	13	13.6	6.6	6.9
04/30/10	0.530	0.820	13	13.4	6.6	4.7
05/01/10	0.465	0.719		13.4		
05/02/10	0.442	0.684		13.4		
05/03/10	0.418	0.647	14	13.4	6.5	5.2
05/04/10	0.386	0.597	14	13.4	6.6	4.5
05/05/10	0.371	0.574	13	13.4	6.6	4.6
05/06/10	0.363	0.562	13	13.4	6.6	7.1
05/07/10	0.350	0.541	14	13.6	6.5	5.5
05/08/10	0.326	0.504		13.6		
05/09/10	0.318	0.492		13.6		
05/10/10	0.397	0.614	14	13.6	6.5	5.5
05/11/10	0.365	0.565	14	13.6	6.4	6.2
05/12/10	0.350	0.541	14	13.8	6.6	5.0
05/13/10	0.335	0.518	14	14.0	6.8	6.5
05/14/10	0.348	0.538	14	14.0	6.5	5.5
05/15/10	0.308	0.476		14.0		
05/16/10	0.300	0.464		14.0		
05/17/10	0.323	0.500	15	14.2	7.0	5.4
05/18/10	0.304	0.470	15	14.4	6.5	5.7
05/19/10	0.320	0.495	15	14.6	6.5	5.5
05/20/10	0.318	0.492	15	14.8	6.5	6.0
05/21/10	0.320	0.495	14	14.8	6.6	6.8
05/22/10	0.301	0.466		14.8		
05/23/10	0.275	0.425		14.8		
05/24/10	0.314	0.486	15	14.8	6.5	5.2
05/25/10	0.315	0.487	15	14.8	6.4	5.1
05/26/10	0.321	0.497	15	14.8	6.4	
05/27/10	0.327	0.506	15	14.8	6.6	5.0
05/28/10	0.319	0.493	15	15.0	6.4	3.8
05/29/10	0.288	0.446		15.0		
05/30/10	0.291	0.450		15.0		
05/31/10	0.304	0.470		15.0		
06/01/10	0.310	0.480	16	15.3	6.5	3.2
06/02/10	0.417	0.645	16	15.5	6.4	3.5
06/03/10	0.538	0.832	16	15.8	6.6	5.3
06/04/10	0.563	0.871	15	15.8	6.6	6.8
06/05/10	0.443	0.685		15.8		
06/06/10	0.410	0.634		15.8		
06/07/10	0.410	0.634	16	15.8	6.7	5.6
06/08/10	0.389	0.602	16	15.8	6.6	5.6
06/09/10	0.398	0.616	16	15.8	6.6	5.0
06/10/10	0.343	0.531	16	15.8	6.4	6.1
06/11/10	0.340	0.526	15	15.8	6.6	7.0
06/12/10	0.327	0.506		15.8		
06/13/10	0.343	0.531		15.8		
06/14/10	0.331	0.512	17	16.0	6.5	6.2
06/15/10	0.298	0.461	16	16.0	6.5	6.7
06/16/10	0.304	0.470	16	16.0	6.4	6.1
06/17/10	0.287	0.444	16	16.0	6.5	4.2

Table E2 (12 pages). Discharge Monitoring Report Data for the CJ WWTF

WWTF Date	Flow (mgd)	Flow (cfs)	Max T (oC)	7-day Avg Max T (oC)	pH (S.U.)	DO (mg/l)
06/18/10	0.296	0.458	17	16.4	6.5	4.5
06/19/10	0.269	0.416		16.4		
06/20/10	0.271	0.419		16.4		
06/21/10	0.280	0.433	17	16.4	6.6	5.0
06/22/10	0.289	0.447	18	16.8	6.3	3.7
06/23/10	0.274	0.424	19	17.4	6.3	5.9
06/24/10	0.265	0.410	20	18.2	6.2	7.2
06/25/10	0.255	0.394	20	18.8	6.2	3.0
06/26/10	0.256	0.396		18.8		
06/27/10	0.252	0.390		18.8		
06/28/10	0.245	0.379	19	19.2	6.5	3.0
06/29/10	0.246	0.381	19	19.4	6.5	5.3
06/30/10	0.238	0.368	19	19.4	6.6	5.6
10/01/10	0.206	0.319	19	19.2	6.7	3.9
10/02/10	0.181	0.280		19.0		
10/03/10	0.187	0.289		19.0		
10/04/10	0.179	0.277	19	19.0	6.7	3.9
10/05/10	0.183	0.283	19	19.0	7.0	3.5
10/06/10	0.184	0.285	19	19.0	6.7	3.6
10/07/10	0.172	0.266	18	18.8	7.0	3.5
10/08/10	0.180	0.278	18	18.6	6.8	4.0
10/09/10	0.172	0.266		18.6		
10/10/10	0.172	0.266		18.6		
10/11/10	0.183	0.283	18	18.4	6.4	3.2
10/12/10	0.174	0.269	19	18.4	6.5	2.2
10/13/10	0.179	0.277	18	18.2	6.4	2.5
10/14/10	0.179	0.277	19	18.4	6.6	3.0
10/15/10	0.176	0.272	18	18.4	6.7	2.0
10/16/10	0.163	0.252		18.4		
10/17/10	0.174	0.269		18.4		
10/18/10	0.172	0.266	17	18.2	6.6	3.9
10/19/10	0.171	0.265	17	17.8	6.7	3.0
10/20/10	0.180	0.278	16	17.4	6.8	
10/21/10	0.179	0.277	18	17.2	6.8	2.0
10/22/10	0.180	0.278	19	17.4	6.8	2.5
10/23/10	0.279	0.432		17.4		
10/24/10	0.354	0.548		17.4		
10/25/10	0.337	0.521	17	17.4	6.6	2.8
10/26/10	0.277	0.429	15	17.0	6.7	4.2
10/27/10	0.271	0.419	17	17.2	6.6	1.9
10/28/10	0.315	0.487	16	16.8	6.6	4.0
10/29/10	0.306	0.473	15	16.0	6.6	3.0
10/30/10	0.288	0.446		16.0		
10/31/10	0.284	0.439		16.0		
11/01/10	0.279	0.432	17	16.0	6.4	2.6
11/02/10	0.267	0.413	17	16.4	6.4	4.4
11/03/10	0.247	0.382	17	16.4	6.4	4.5
11/04/10	0.238	0.368	17	16.6	6.5	4.4
11/05/10	0.231	0.357	17	17.0	6.6	3.0
11/06/10	0.306	0.473		17.0		
11/07/10	0.358	0.554		17.0		
11/08/10	0.339	0.524	16	16.8	6.5	4.5
11/09/10	0.371	0.574	15	16.4	6.6	3.7
11/10/10	0.321	0.497	16	16.2	6.6	6.7
11/11/10	0.300	0.464		16.0		
11/12/10	0.276	0.427		15.7	6.7	6.7
11/13/10	0.269	0.416		15.7		
11/14/10	0.267	0.413		15.7		
11/15/10	0.260	0.402	16	15.7	6.7	5.7
11/16/10	0.230	0.356	15	15.7	6.7	5.5
11/17/10	0.251	0.388	16	15.7	6.8	5.7
11/18/10	0.264	0.408	16	15.8	6.5	5.4
11/19/10	0.271	0.419	16	15.8	6.5	5.4
11/20/10	0.318	0.492		15.8		
11/21/10	0.318	0.492		15.8		
11/22/10	0.420	0.650	16	15.8	6.6	6.3
11/23/10	0.399	0.617	14	15.6	6.7	6.7
11/24/10	0.355	0.549	15	15.4	6.8	6.5
11/25/10	0.326	0.504	12	14.6	6.3	6.3
11/26/10	0.356	0.551	13	14.0	6.7	7.8
11/27/10	0.456	0.705		14.0		
11/28/10	0.403	0.623		14.0		
11/29/10	0.403	0.623	15	13.8	6.6	6.4
11/30/10	0.508	0.786	14	13.8	6.8	6.3
12/01/10	0.558	0.863	15	13.8	6.7	5.8
12/02/10	0.559	0.865	14	14.2	6.5	6.0
12/03/10	0.470	0.727	14	14.4	6.3	6.1
12/04/10	0.404	0.625	14	14.3		
12/05/10	0.387	0.599	14	14.3		
12/06/10	0.383	0.593	14	14.1	6.0	5.7
12/07/10	0.374	0.579	14	14.1	6.7	5.8
12/08/10	0.413	0.639	14	14.0	6.5	5.6
12/09/10	0.393	0.608	14	14.0	6.6	6.1
12/10/10	0.385	0.596	14	14.0	6.7	

Table E2 (12 pages). Discharge Monitoring Report Data for the CJ WWTF

WWTF Date	Flow (mgd)	Flow (cfs)	Max T (oC)	7-day Avg Max T (oC)	pH (S.U.)	DO (mg/l)
12/11/10	0.408	0.631	14	14.0		
12/12/10	0.422	0.653	14	14.0		
12/13/10	0.536	0.829	14	14.0	6.7	6.3
12/14/10	0.576	0.891	14	14.0	6.7	6.4
12/15/10	0.469	0.726	13	13.9	6.4	5.4
12/16/10	0.456	0.705	13	13.7	6.5	5.8
12/17/10	0.521	0.806	13	13.6	6.6	
12/18/10	0.836	1.293	13	13.4		
12/19/10	1.004	1.553	13	13.3		
12/20/10	1.117	1.728	11	12.9	6.8	5.6
12/21/10	0.855	1.323	12	12.6	6.6	8.1
12/22/10	0.766	1.185	13	12.6	6.7	6.8
12/23/10	0.766	1.185	13	12.6	6.2	6.8
12/24/10	0.650	1.006	13	12.6	6.4	6.8
12/25/10	0.580	0.897	13	12.6		
12/26/10	0.611	0.945	13	12.6		
12/27/10	0.702	1.086	12	12.7		
12/28/10	1.096	1.696	12	12.7	6.6	5.3
12/29/10	0.901	1.394	12	12.6	6.7	6.7
12/30/10	0.759	1.174	12	12.4	7.0	8.8
12/31/10	0.657	1.016	12	12.3	7.0	
01/01/11	0.623	0.964	13	12.3		
01/02/11	0.569	0.880	12	12.1		
01/03/11	0.546	0.845	12	12.1	6.7	6.8
01/04/11	0.514	0.795	12	12.1	6.9	6.8
01/05/11	0.499	0.772	12	12.1	6.8	4.7
01/06/11	0.467	0.722	12	12.1	6.8	5.9
01/07/11	0.448	0.693	12	12.1	6.5	5.6
01/08/11	0.403	0.623	12	12.0		
01/09/11	0.380	0.588	12	12.0		
01/10/11	0.387	0.599	12	12.0	6.5	6.5
01/11/11	0.403	0.623	12	12.0	6.5	6.2
01/12/11	0.461	0.713	12	12.0	6.4	5.9
01/13/11	0.632	0.978	12	12.0	6.0	5.7
01/14/11	0.525	0.812	12	12.0	6.4	7.3
01/15/11	0.490	0.758	13	12.1		
01/16/11	0.519	0.803	13	12.3		
01/17/11	0.502	0.777	13	12.4		
01/18/11	0.441	0.682	13	12.6	6.6	7.1
01/19/11	0.433	0.670	13	12.7	6.6	6.0
01/20/11	0.406	0.628	13	12.9	6.6	6.1
01/21/11	0.391	0.605	12	12.9	6.4	
01/22/11	0.310	0.480	12	12.7		
01/23/11	0.362	0.560	12	12.6		
01/24/11	0.364	0.563	12	12.4	6.5	6.3
01/25/11	0.351	0.543	12	12.3	6.7	5.8
01/26/11	0.356	0.551	12	12.1	6.5	5.7
01/27/11	0.356	0.551	12	12.0	6.8	5.0
01/28/11	0.336	0.520	13	12.1	6.7	5.3
01/29/11	0.322	0.498	13	12.3		
01/30/11	0.320	0.495	13	12.4		
01/31/11	0.321	0.497	13	12.6	6.6	5.9
02/01/11	0.317	0.490	13	12.7	6.6	6.2
02/02/11	0.242	0.374	13	12.9	6.5	6.3
02/03/11	0.346	0.535	13	13.0	6.5	7.4
02/04/11	0.316	0.489	13	13.0	6.5	7.8
02/05/11	0.198	0.306	13	13.0		
02/06/11	0.245	0.379	13	13.0		
02/07/11	0.313	0.484	13	13.0	6.6	7.5
02/08/11	0.302	0.467	13	13.0	6.6	7.3
02/09/11	0.296	0.458	12	12.9	6.6	7.3
02/10/11	0.314	0.486	12	12.7	6.7	7.4
02/11/11	0.280	0.433	13	12.7	6.5	7.5
02/12/11	0.282	0.436	13	12.7		
02/13/11	0.277	0.429	13	12.7		
02/14/11	0.424	0.656	13	12.7	6.9	7.2
02/15/11	0.775	1.199	12	12.6	6.4	7.9
02/16/11	0.775	1.199	10	12.3	6.5	9.0
02/17/11	0.709	1.097	11	12.1	6.5	6.8
02/18/11	0.688	1.064	11	11.9	6.5	6.7
02/19/11	0.592	0.916	11	11.6		
02/20/11	0.576	0.891	11	11.3		
02/21/11	0.510	0.789	12	11.1		
02/22/11	0.541	0.837	12	11.1	6.4	9.3
02/23/11	0.545	0.843	12	11.4	6.5	8.1
02/24/11	0.588	0.910	11	11.4	6.0	7.5
02/25/11	0.507	0.784	11	11.4	6.2	8.1
02/26/11	0.489	0.756	11	11.4		
02/27/11	0.486	0.752	11	11.4		
02/28/11	0.537	0.831	11	11.3	6.1	7.8
03/01/11	0.506	0.783	12	11.3	6.4	8.7
03/02/11	0.529	0.818	11	11.1	6.3	8.0
03/03/11	0.530	0.820	11	11.1	6.2	8.5
03/04/11	0.523	0.809	12	11.3	6.6	8.5

Table E2 (12 pages). Discharge Monitoring Report Data for the CJ WWTF

WWTF Date	Flow (mgd)	Flow (cfs)	Max T (oC)	7-day Avg Max T (oC)	pH (S.U.)	DO (mg/l)
03/05/11	0.640	0.990	12	11.4		
03/06/11	0.658	1.018	12	11.6		
03/07/11	0.570	0.882	12	11.7	6.8	8.8
03/08/11	0.600	0.928	12	11.7	6.1	7.8
03/09/11	0.560	0.866	12	11.9	6.2	
03/10/11	0.726	1.123	12	12.0	6.9	7.8
03/11/11	0.605	0.936	12	12.0	6.5	8.2
03/12/11	0.562	0.869	12	12.0		
03/13/11	0.690	1.067	12	12.0		
03/14/11	0.698	1.080	12	12.0	6.7	9.7
03/15/11	0.897	1.388	12	12.0		
03/16/11	0.895	1.385	11	11.9	6.6	
03/17/11	0.817	1.264	12	11.9	6.4	7.6
03/18/11	0.941	1.456	11	11.7	6.7	8.3
03/19/11	0.850	1.315	11	11.6		
03/20/11	0.739	1.143	12	11.6		
03/21/11	0.644	0.996	12	11.6	6.3	6.8
03/22/11	0.564	0.873	12	11.6	6.4	6.5
03/23/11	0.553	0.855	12	11.7	6.4	6.7
03/24/11	0.640	0.990	12	11.7	6.7	5.8
03/25/11	0.790	1.222	12	11.9	6.2	6.5
03/26/11	0.831	1.286	11	11.9		
03/27/11	0.873	1.351	11	11.7		
03/28/11	0.760	1.176	12	11.7	6.1	6.7
03/29/11	0.695	1.075	12	11.7	6.4	8.2
03/30/11	0.619	0.958	13	11.9	6.1	7.7
03/31/11	0.560	0.866	13	12.0	6.4	
04/01/11	0.537	0.831	13	12.1	6.2	5.9
04/02/11	0.490	0.758	13	12.4		
04/03/11	0.475	0.735	13	12.7		
04/04/11	0.458	0.709	13	12.9	6.2	4.6
04/05/11	0.427	0.661	13	13.0	6.3	6.8
04/06/11	0.452	0.699	13	13.0	6.3	6.7
04/07/11	0.456	0.705	13	13.0	6.3	6.7
04/08/11	0.407	0.630	13	13.0	6.3	6.6
04/09/11	0.399	0.617	13	13.0		
04/10/11	0.396	0.613	13	13.0		
04/11/11	0.391	0.605	13	13.0	6.3	
04/12/11	0.371	0.574	13	13.0	6.1	7.2
04/13/11	0.394	0.610	13	13.0	6.3	
04/14/11	0.317	0.490	13	13.0	6.1	5.3
04/15/11	0.496	0.767	13	13.0	6.2	5.4
04/16/11	0.441	0.682	13	13.0		
04/17/11	0.468	0.724	13	13.0		
04/18/11	0.514	0.795	13	13.0	6.6	5.8
04/19/11	0.434	0.671	13	13.0	6.4	5.8
04/20/11	0.431	0.667	13	13.0	6.5	6.0
04/21/11	0.448	0.693	14	13.1	6.5	5.3
04/22/11	0.312	0.483	14	13.3	6.5	5.7
04/23/11	0.349	0.540	14	13.4		
04/24/11	0.368	0.569	14	13.6		
04/25/11	0.378	0.585	14	13.7	6.6	6.0
04/26/11	0.356	0.551	14	13.9	6.2	6.4
04/27/11	0.352	0.545	14	14.0	6.4	6.3
04/28/11	0.329	0.509	14	14.0	6.5	5.5
04/29/11	0.315	0.487	14	14.0		5.7
04/30/11	0.294	0.455	14	14.0		
05/01/11	0.317	0.490	15	14.1		
05/02/11	0.326	0.504	14	14.1	6.3	6.6
05/03/11	0.305	0.472	15	14.3	6.4	6.3
05/04/11	0.322	0.498	15	14.4	6.3	6.1
05/05/11	0.323	0.500	15	14.6	6.4	6.5
05/06/11	0.320	0.495	15	14.7	6.6	6.8
05/07/11	0.296	0.458	15	14.9		
05/08/11	0.294	0.455	15	14.9		
05/09/11	0.304	0.470	15	15.0	6.3	6.6
05/10/11	0.312	0.483	16	15.1	6.7	8.3
05/11/11	0.315	0.487	15	15.1	6.4	8.8
05/12/11	0.291	0.450	16	15.3	6.4	7.6
05/13/11	0.296	0.458	16	15.4	6.3	5.8
05/14/11	0.265	0.410	15	15.4		
05/15/11	0.276	0.427	15	15.4		
05/16/11	0.285	0.441	16	15.6	6.3	7.9
05/17/11	0.306	0.473	16	15.6	6.3	7.8
05/18/11	0.281	0.435	16	15.7	6.5	7.8
05/19/11	0.295	0.456	16	15.7	6.6	7.3
05/20/11	0.293	0.453	16	15.7	6.6	7.3
05/21/11	0.271	0.419	16	15.9		
05/22/11	0.281	0.435	16	16.0		
05/23/11	0.303	0.469	17	16.1	6.3	
05/24/11	0.282	0.436	16	16.1	6.3	
05/25/11	0.325	0.503	16	16.1	6.8	6.8
05/26/11	0.292	0.452	16	16.1	6.7	7.2
05/27/11	0.291	0.450	16	16.1	6.5	7.1

Table E2 (12 pages). Discharge Monitoring Report Data for the CJ WWTF

WWTF Date	Flow (mgd)	Flow (cfs)	Max T (oC)	7-day Avg Max T (oC)	pH (S.U.)	DO (mg/l)
05/28/11	0.298	0.461	16	16.1		
05/29/11	0.285	0.441	17	16.3		
05/30/11	0.301	0.466	16	16.1		
05/31/11	0.308	0.476	16	16.1	6.7	
06/01/11	0.293	0.453	16	16.1	6.7	5.6
06/02/11	0.297	0.459	16	16.1	6.5	7.2
06/03/11	0.290	0.449	16	16.1	6.8	7.1
06/04/11	0.219	0.339	16	16.1		
06/05/11	0.271	0.419	17	16.1		
06/06/11	0.287	0.444	17	16.3	6.5	6.8
06/07/11	0.293	0.453	17	16.4	6.4	6.8
06/08/11	0.283	0.438	17	16.6	6.5	6.5
06/09/11	0.279	0.432	18	16.9	6.4	6.5
06/10/11	0.270	0.418	19	17.3	6.5	6.6
06/11/11	0.249	0.385	19	17.7		
06/12/11	0.261	0.404	18	17.9		
06/13/11	0.256	0.396	19	18.1	6.3	6.4
06/14/11	0.256	0.396	18	18.3	6.3	6.5
06/15/11	0.247	0.382	18	18.4	6.5	5.6
06/16/11	0.248	0.384	18	18.4	6.5	3.1
06/17/11	0.260	0.402	18	18.3	6.8	5.1
06/18/11	0.242	0.374	19	18.3		
06/19/11	0.239	0.370	19	18.4		
06/20/11	0.250	0.387	19	18.4	6.6	
06/21/11	0.250	0.387	19	18.6	6.4	4.2
06/22/11	0.237	0.367	20	18.9	6.7	4.9
06/23/11	0.226	0.350	20	19.1	6.7	4.7
06/24/11	0.233	0.360	20	19.4	6.6	5.0
06/25/11	0.219	0.339	20	19.6		
06/26/11	0.229	0.354	20	19.7		
06/27/11	0.244	0.377	20	19.9	6.6	5.1
06/28/11	0.278	0.430	19	19.9	6.6	6.2
06/29/11	0.272	0.421	20	19.9	6.4	6.3
06/30/11	0.247	0.382	20	19.9	6.5	
10/01/11	0.167	0.258		19.8		
10/02/11	0.183	0.283		19.8		
10/03/11	0.212	0.328	19	19.6	6.9	5.0
10/04/11	0.246	0.381	20	19.6	7.0	4.4
10/05/11	0.245	0.379	19	19.6	6.8	
10/06/11	0.194	0.300	18	19.2	6.8	
10/07/11	0.191	0.295	18	18.8	6.8	3.0
10/08/11	0.167	0.258		18.8		
10/09/11	0.179	0.277		18.8		
10/10/11	0.234	0.362	20	19.0	6.3	
10/11/11	0.194	0.300	19	18.8	6.4	
10/12/11	0.186	0.288	18	18.6	6.5	
10/13/11	0.175	0.271	19	18.8	6.5	
10/14/11	0.184	0.285	19	19.0	6.5	
10/15/11	0.179	0.277		19.0		
10/16/11	0.178	0.275		19.0		
10/17/11	0.186	0.288	19	18.8	6.4	
10/18/11	0.167	0.258	19	18.8	6.4	
10/19/11	0.172	0.266	18	18.8	6.7	
10/20/11	0.171	0.265	18	18.6	6.4	3.2
10/21/11	0.160	0.248	19	18.6	6.6	
10/22/11	0.161	0.249		18.6		
10/23/11	0.162	0.251		18.6		
10/24/11	0.167	0.258	18	18.4	6.3	
10/25/11	0.156	0.241	18	18.2	6.4	5.3
10/26/11	0.160	0.248	17	18.0	6.7	4.9
10/27/11	0.156	0.241	16	17.6	6.6	5.1
10/28/11	0.157	0.243	17	17.2	6.5	5.5
10/29/11	0.152	0.235		17.2		
10/30/11	0.155	0.240		17.2		
10/31/11	0.156	0.241	18	17.2	6.2	4.4
11/01/11	0.157	0.243	17	17.0	6.4	4.1
11/02/11	0.161	0.249	16	16.8	6.4	4.3
11/03/11	0.184	0.285	17	17.0	6.6	4.7
11/04/11	0.166	0.257	16	16.8	6.3	4.0
11/05/11	0.259	0.401		16.8		
11/06/11	0.241	0.373		16.8		
11/07/11	0.211	0.326	16	16.4	6.1	3.9
11/08/11	0.192	0.297	16	16.2	6.2	3.0
11/09/11	0.187	0.289	15	16.0	6.7	3.5
11/10/11	0.178	0.275	15	15.6	6.9	3.3
11/11/11	0.170	0.263		15.5		
11/12/11	0.160	0.248		15.5		
11/13/11	0.158	0.244		15.5		
11/14/11	0.178	0.275	16	15.5	7.0	4.0
11/15/11	0.182	0.282	15	15.3	7.0	4.5
11/16/11	0.196	0.303	17	15.8	6.9	4.1
11/17/11	0.212	0.328	17	16.3	6.9	
11/18/11	0.288	0.446	16	16.2	6.5	5.0
11/19/11	0.247	0.382	16	16.2		

Table E2 (12 pages). Discharge Monitoring Report Data for the CJ WWTF

WWTF Date	Flow (mgd)	Flow (cfs)	Max T (oC)	7-day Avg Max T (oC)	pH (S.U.)	DO (mg/l)
11/20/11	0.228	0.353	15	16.0		
11/21/11	0.288	0.446	15	15.9	6.7	4.2
11/22/11	0.355	0.549	15	15.9	6.6	4.0
11/23/11	0.458	0.709	15	15.6	6.6	3.7
11/24/11	0.349	0.540	15	15.3		
11/25/11	0.323	0.500	15	15.1	6.6	
11/26/11	0.294	0.455	15	15.0		
11/27/11	0.287	0.444	15	15.0		
11/28/11	0.321	0.497	15	15.0	6.7	2.4
11/29/11	0.281	0.435	15	15.0	6.7	3.2
11/30/11	0.263	0.407	15	15.0	6.5	3.3
12/01/11	0.255	0.394	15	15.0	6.8	3.4
12/02/11	0.248	0.384	14	14.9	6.8	3.5
12/03/11	0.219	0.339	13	14.6		
12/04/11	0.218	0.337	14	14.4		
12/05/11	0.221	0.342	14	14.3	6.6	3.0
12/06/11	0.214	0.331	13	14.0	6.6	3.6
12/07/11	0.210	0.325	13	13.7	6.6	3.7
12/08/11	0.216	0.334	13	13.4	6.5	3.3
12/09/11	0.214	0.331	14	13.4	6.6	3.1
12/10/11	0.189	0.292	14	13.6		
12/11/11	0.195	0.302	14	13.6		
12/12/11	0.196	0.303	14	13.6	6.3	
12/13/11	0.205	0.317	14	13.7	6.3	3.0
12/14/11	0.206	0.319	14	13.9	6.9	5.1
12/15/11	0.209	0.323	13	13.9	6.6	5.0
12/16/11	0.204	0.316	14	13.9	6.8	3.8
12/17/11	0.186	0.288	14	13.9		
12/18/11	0.188	0.291	14	13.9		
12/19/11	0.192	0.297	13	13.7	6.6	3.7
12/20/11	0.172	0.266	13	13.6	6.5	3.2
12/21/11	0.172	0.266	13	13.4	6.6	4.3
12/22/11	0.187	0.289	13	13.4	6.7	5.1
12/23/11	0.184	0.285	13	13.3	6.6	7.2
12/24/11	0.169	0.261	13	13.1		
12/25/11	0.170	0.263	13	13.0		
12/26/11	0.169	0.261	12	12.9	6.5	6.4
12/27/11	0.183	0.283	13	12.9	6.3	6.9
12/28/11	0.240	0.371	13	12.9	6.5	6.0
12/29/11	0.379	0.586	13	12.9	6.4	5.1
12/30/11	0.444	0.687	13	12.9	6.3	6.3
12/31/11	0.350	0.541	12	12.7		
1/1/12	0.303	0.469	12	12.6		
1/2/12	0.309	0.478	13	12.7		
1/3/12	0.296	0.458	13	12.7	6.7	6.0
1/4/12	0.292	0.452	13	12.7	6.7	6.1
1/5/12	0.286	0.442	13	12.7	6.7	5.5
1/6/12	0.277	0.429	13	12.7	6.8	5.7
1/7/12	0.247	0.382	13	12.9		
1/8/12	0.241	0.373	13	13.0		
1/9/12	0.250	0.387	13	13.0	6.8	6.0
1/10/12	0.239	0.370	13	13.0	6.8	5.1
1/11/12	0.228	0.353	13	13.0	6.7	5.5
1/12/12	0.219	0.339	13	13.0	6.7	6.0
1/13/12	0.214	0.331	12	12.9	6.7	8.3
1/14/12	0.202	0.312	13	12.9		
1/15/12	0.194	0.300	12	12.7		
1/16/12	0.200	0.309	12	12.6		
1/17/12	0.248	0.384	12	12.4	6.6	7.7
1/18/12	0.795	1.230	12	12.3	6.6	7.5
1/19/12	0.994	1.538	11	12.0	6.5	10.4
1/20/12	0.967	1.496	11	11.9	6.8	
1/21/12	0.824	1.275	11	11.6		
1/22/12	0.787	1.217	11	11.4		
1/23/12	0.655	1.013	11	11.3	7.1	9.4
1/24/12	0.612	0.947	12	11.3	6.9	7.3
1/25/12	0.586	0.907	12	11.3	6.9	9.1
1/26/12	0.564	0.873	12	11.4	6.6	8.3
1/27/12	0.485	0.750	12	11.6	6.6	8.2
1/28/12	0.440	0.681	12	11.7		
1/29/12	0.439	0.679	12	11.9		
1/30/12	0.418	0.647	12	12.0	6.7	7.0
1/31/12	0.440	0.681	12	12.0	6.6	6.5
2/1/12	0.446	0.690	12	12.0	7.0	7.8
2/2/12	0.412	0.637	12	12.0	6.8	7.5
2/3/12	0.462	0.715	12	12.0	6.9	7.3
2/4/12	0.364	0.563	12	12.0		
2/5/12	0.341	0.528	12	12.0		
2/6/12	0.354	0.548	12	12.0	6.8	7.0
2/7/12	0.341	0.528	12	12.0	6.6	6.6
2/8/12	0.345	0.534	12	12.0	6.7	7.8
2/9/12	0.331	0.512	12	12.0	6.5	
2/10/12	0.335	0.518	13	12.1	6.6	7.4
2/11/12	0.248	0.384	11	12.0		

Table E2 (12 pages). Discharge Monitoring Report Data for the CJ WWTF

WWTF Date	Flow (mgd)	Flow (cfs)	Max T (oC)	7-day Avg Max T (oC)	pH (S.U.)	DO (mg/l)
2/12/12	0.343	0.531	9	11.6		
2/13/12	0.382	0.591	10	11.3	6.3	7.0
2/14/12	0.340	0.526	12	11.3	6.4	6.1
2/15/12	0.339	0.524	12	11.3	6.3	6.5
2/16/12	0.365	0.565	12	11.3	6.5	5.5
2/17/12	0.330	0.511	13	11.3	6.6	5.7
2/18/12	0.301	0.466	13	11.6		
2/19/12	0.293	0.453	12	12.0		
2/20/12	0.323	0.500	12	12.3		
2/21/12	0.249	0.385	13	12.4	6.6	5.5
2/22/12	0.293	0.453	13	12.6	6.5	5.0
2/23/12	0.281	0.435	13	12.7	6.1	5.8
2/24/12	0.305	0.472	13	12.7	6.6	6.0
2/25/12	0.290	0.449	13	12.7		
2/26/12	0.295	0.456	12	12.7		
2/27/12	0.289	0.447	12	12.7	6.6	6.2
2/28/12	0.368	0.569	12	12.6	6.6	6.6
2/29/12	0.500	0.774	11	12.3	6.8	6.9
3/1/12	0.496	0.767	11	12.0	6.7	7.2
3/2/12	0.421	0.651	11	11.7	7.0	6.5
3/3/12	0.312	0.483	12	11.6		
3/4/12	0.357	0.552	12	11.6		
3/5/12	0.329	0.509	13	11.7	6.9	6.5
3/6/12	0.349	0.540	12	11.7	6.7	
3/7/12	0.322	0.498	12	11.9	6.3	6.4
3/8/12	0.325	0.503	13	12.1	6.5	6.2
3/9/12	0.388	0.600	13	12.4	6.2	6.5
3/10/12	0.301	0.466	12	12.4		
3/11/12	0.340	0.526	12	12.4		
3/12/12	0.398	0.616	12	12.3	6.8	5.9
3/13/12	0.334	0.517	12	12.3	6.6	6.1
3/14/12	0.486	0.752	12	12.3	6.5	6.3
3/15/12	0.913	1.412	11	12.0	6.3	5.3
3/16/12	0.977	1.511	11	11.7	6.3	4.8
3/17/12	0.814	1.259	12	11.7		
3/18/12	0.658	1.018	12	11.7		
3/19/12	0.595	0.920	12	11.7	6.4	5.0
3/20/12	0.591	0.914	12	11.7	6.6	4.1
3/21/12	0.720	1.114	12	11.7	6.7	4.0
3/22/12	0.682	1.055	12	11.9	6.6	3.9
3/23/12	0.580	0.897	12	12.0	6.6	6.3
3/24/12	0.532	0.823	12	12.0		
3/25/12	0.516	0.798	12	12.0		
3/26/12	0.505	0.781	12	12.0	6.4	5.7
3/27/12	0.760	1.176	12	12.0	6.4	6.0
3/28/12	0.799	1.236	12	12.0	6.4	
3/29/12	1.147	1.774	12	12.0	6.5	6.0
3/30/12	1.431	2.214	12	12.0	6.2	5.5
3/31/12	1.238	1.915	11	11.9		
4/1/12	1.040	1.609	11	11.7		
4/2/12	0.855	1.323	12	11.7	6.3	6.1
4/3/12	0.811	1.255	12	11.7	6.4	5.1
4/4/12	0.723	1.118	12	11.7	6.4	5.5
4/5/12	0.708	1.095	12	11.7	6.3	6.0
4/6/12	0.518	0.801	12	11.7	6.5	7.2
4/7/12	0.511	0.791	13	12.0		
4/8/12	0.508	0.786	13	12.3		
4/9/12	0.516	0.798	13	12.4	6.8	6.8
4/10/12	0.501	0.775	13	12.6	6.8	4.6
4/11/12	0.484	0.749	13	12.7	6.5	5.0
4/12/12	0.494	0.764	13	12.9	6.6	5.3
4/13/12	0.486	0.752	13	13.0	6.6	5.5
4/14/12	0.442	0.684	13	13.0		
4/15/12	0.436	0.674	13	13.0		
4/16/12	0.441	0.682	13	13.0	6.4	4.5
4/17/12	0.428	0.662	13	13.0	6.5	4.9
4/18/12	0.456	0.705	13	13.0	6.5	4.9
4/19/12	0.492	0.761	14	13.1	6.5	5.1
4/20/12	0.450	0.696	15	13.4	6.2	4.9
4/21/12	0.389	0.602	15	13.7		
4/22/12	0.383	0.593	15	14.0		
4/23/12	0.380	0.588	15	14.3	6.3	4.4
4/24/12	0.359	0.555	15	14.6	6.3	3.7
4/25/12	0.361	0.558	15	14.9	6.5	4.0
4/26/12	0.333	0.515	15	15.0	6.5	4.1
4/27/12	0.340	0.526	15	15.0	6.3	3.6
4/28/12	0.329	0.509	15	15.0		
4/29/12	0.342	0.529	15	15.0		
4/30/12	0.344	0.532	15	15.0	6.2	4.4
5/1/12	0.317	0.490	16	15.1	6.5	4.7
5/2/12	0.327	0.506	15	15.1	6.1	4.5
5/3/12	0.360	0.557	15	15.1	6.5	4.0
5/4/12	0.313	0.484	15	15.1	6.2	4.1
5/5/12	0.316	0.489	15	15.1		

Table E2 (12 pages). Discharge Monitoring Report Data for the CJ WWTF

WWTF Date	Flow (mgd)	Flow (cfs)	Max T (oC)	7-day Avg Max T (oC)	pH (S.U.)	DO (mg/l)
5/6/12	0.343	0.531	16	15.3		
5/7/12	0.346	0.535	16	15.4	6.5	5.1
5/8/12	0.326	0.504	16	15.4	6.5	4.0
5/9/12	0.318	0.492	16	15.6	6.5	5.3
5/10/12	0.308	0.476	16	15.7	6.4	6.3
5/11/12	0.306	0.473	16	15.9	6.3	2.7
5/12/12	0.290	0.449	16	16.0		
5/13/12	0.288	0.446	17	16.1		
5/14/12	0.326	0.504	18	16.4	6.6	3.1
5/15/12	0.319	0.493	17	16.6	6.6	3.3
5/16/12	0.338	0.523	17	16.7	6.5	3.1
5/17/12	0.303	0.469	18	17.0	6.7	2.9
5/18/12	0.285	0.441	17	17.1	6.7	3.5
5/19/12	0.275	0.425	17	17.3		
5/20/12	0.217	0.336	17	17.3		
5/21/12	0.287	0.444	17	17.1	6.7	3.5
5/22/12	0.250	0.387	17	17.1	6.4	3.0
5/23/12	0.243	0.376	17	17.1	6.2	3.3
5/24/12	0.253	0.391	17	17.0	6.7	3.1
5/25/12	0.246	0.381	17	17.0	6.7	3.0
5/26/12	0.240	0.371	17	17.0		
5/27/12	0.239	0.370	17	17.0		
5/28/12	0.221	0.342	18	17.1		
5/29/12	0.252	0.390	18	17.3	6.8	3.3
5/30/12	0.256	0.396	18	17.4	6.8	2.9
5/31/12	0.237	0.367	18	17.6	6.8	3.3
06/01/12	0.253	0.391	19	17.9	6.7	4.9
06/02/12	0.225	0.348	19	18.1		
06/03/12	0.252	0.390	18	18.3		
06/04/12	0.288	0.446	18	18.3	6.6	5.0
06/05/12	0.283	0.438	18	18.3	6.5	5.5
06/06/12	0.269	0.416	18	18.3	6.6	5.1
06/07/12	0.213	0.330	18	18.3	6.6	5.7
06/08/12	0.238	0.368	18	18.1	6.8	3.7
06/09/12	0.225	0.348	19	18.1		
06/10/12	0.222	0.343	19	18.3		
06/11/12	0.193	0.299	19	18.4	6.4	5.8
06/12/12	0.290	0.449	19	18.6	6.5	3.0
06/13/12	0.245	0.379	19	18.7	6.4	3.2
06/14/12	0.246	0.381	19	18.9	6.8	2.9
06/15/12	0.241	0.373	21	19.3	6.6	2.9
06/16/12	0.232	0.359	20	19.4	6.7	
06/17/12	0.214	0.331	21	19.7		
06/18/12	0.223	0.345	20	19.9	6.6	3.6
06/19/12	0.218	0.337	20	20.0	6.2	1.9
06/20/12	0.218	0.337	20	20.1	6.3	2.5
06/21/12	0.216	0.334	20	20.3	6.6	2.7
06/22/12	0.220	0.340	19	20.0	6.6	
06/23/12	0.212	0.328	19	19.9		
06/24/12	0.214	0.331	19	19.6		
06/25/12	0.206	0.319	19	19.4	6.4	3.4
06/26/12	0.223	0.345	20	19.4	6.3	3.0
06/27/12	0.210	0.325	20	19.4	6.4	3.1
06/28/12	0.218	0.337	20	19.4	6.5	3.1
06/29/12	0.215	0.333	20	19.6	6.5	3.6
06/30/12	0.218	0.337	20	19.7		
10/01/12	0.200	0.309	19	19.7	6.9	5.0
10/02/12	0.207	0.320	19	19.7	7.0	5.0
10/03/12	0.203	0.314	19	19.6	7.0	5.1
10/04/12	0.200	0.309	19	19.4	7.1	5.0
10/05/12	0.184	0.285	19	19.3	6.9	5.5
10/06/12	0.164	0.254		19.2		
10/07/12	0.173	0.268		19.0		
10/08/12	0.187	0.289	19	19.0	6.9	4.6
10/09/12	0.188	0.291	19	19.0	7.0	6.0
10/10/12	0.176	0.272	19	19.0	6.9	6.2
10/11/12	0.179	0.277	19	19.0	7.0	6.6
10/12/12	0.173	0.268	19	19.0	6.9	6.4
10/13/12	0.160	0.248		19.0		
10/14/12	0.172	0.266		19.0		
10/15/12	0.224	0.347	20	19.2	7.0	5.5
10/16/12	0.203	0.314	20	19.4	6.8	
10/17/12	0.198	0.306	19	19.4	6.9	5.0
10/18/12	0.179	0.277	17	19.0	6.9	5.5
10/19/12	0.192	0.297	18	18.8	6.6	5.9
10/20/12	0.169	0.261		18.8		
10/21/12	0.188	0.291		18.8		
10/22/12	0.290	0.449	17	18.2	6.9	6.1
10/23/12	0.340	0.526	16	17.4	6.7	6.1
10/24/12	0.330	0.511	16	16.8	6.4	6.0
10/25/12	0.272	0.421	16	16.6	6.7	6.7
10/26/12	0.244	0.377	15	16.0	6.5	6.6
10/27/12	0.209	0.323	17	16.2		
10/28/12	0.208	0.322	17	16.3		

Table E2 (12 pages). Discharge Monitoring Report Data for the CJ WWTF

WWTF Date	Flow (mgd)	Flow (cfs)	Max T (oC)	7-day Avg Max T (oC)	pH (S.U.)	DO (mg/l)
10/29/12	0.212	0.328	17	16.3	6.9	5.3
10/30/12	0.200	0.309	18	16.6	6.9	5.1
10/31/12	0.278	0.430	18	16.9	6.8	4.9
11/01/12	0.250	0.387	18	17.1	6.7	4.6
11/02/12	0.232	0.359	18	17.6	6.9	4.7
11/03/12	0.210	0.325	18	17.7		
11/04/12	0.198	0.306	19	18.0		
11/05/12	0.202	0.312	19	18.3	6.8	4.9
11/06/12	0.192	0.297	19	18.4	6.9	4.5
11/07/12	0.182	0.282	19	18.6	6.9	4.5
11/08/12	0.199	0.308	18	18.6	6.9	4.0
11/09/12	0.194	0.300	18	18.6	6.9	4.1
11/10/12	0.178	0.275	17	18.4		
11/11/12	0.175	0.271	16	18.0		
11/12/12	0.225	0.348	17	17.7		
11/13/12	0.251	0.388	17	17.4	6.8	3.3
11/14/12	0.211	0.326	17	17.1	6.9	3.5
11/15/12	0.197	0.305	17	17.0	6.9	
11/16/12	0.194	0.300	16	16.7	6.9	3.0
11/17/12	0.256	0.396	17	16.7		
11/18/12	0.270	0.418	16	16.7		
11/19/12	0.457	0.707	16	16.6	6.8	3.7
11/20/12	0.641	0.992	16	16.4	6.9	4.7
11/21/12	0.535	0.828	15	16.1	6.7	4.9
11/22/12	0.417	0.645	15	15.9		
11/23/12	0.359	0.555	15	15.7		
11/24/12	0.341	0.528	16	15.6		
11/25/12	0.335	0.518	16	15.6		
11/26/12	0.310	0.480	16	15.6	6.8	4.1
11/27/12	0.307	0.475	16	15.6	6.7	3.7
11/28/12	0.321	0.497	16	15.7	6.8	3.6
11/29/12	0.906	1.402	15	15.7	6.8	3.0
11/30/12	0.826	1.278	14	15.6	6.6	3.9
12/01/12	0.981	1.518	14	15.3		
12/02/12	0.852	1.318	14	15.0		
12/03/12	0.797	1.233	15	14.9	6.7	4.2
12/04/12	0.974	1.507	15	14.7	6.9	4.7
12/05/12	0.819	1.267	15	14.6	6.8	5.5
12/06/12	0.659	1.019	15	14.6	6.7	5.9
12/07/12	0.584	0.903	15	14.7	6.7	6.1
12/08/12	0.513	0.794	14	14.7		
12/09/12	0.470	0.727	14	14.7		
12/10/12	0.445	0.688	15	14.7	6.5	5.1
12/11/12	0.469	0.726	15	14.7	6.5	5.0
12/12/12	0.419	0.648	15	14.7	6.5	4.4
12/13/12	0.395	0.611	14	14.6	6.5	4.0
12/14/12	0.392	0.606	14	14.4	6.5	5.0
12/15/12	0.412	0.637	14	14.4		
12/16/12	0.547	0.846	14	14.4		
12/17/12	0.616	0.953	14	14.3		
12/18/12	0.524	0.811	13	14.0	6.7	6.7
12/19/12	0.529	0.818	13	13.7	6.6	6.8
12/20/12	0.757	1.171	13	13.6	6.5	6.9
12/21/12	1.019	1.576	11	13.1	6.2	7.9
12/22/12	1.146	1.773	11	12.7		
12/23/12	1.116	1.726	11	12.3		
12/24/12	0.877	1.357	12	12.0		
12/25/12	1.139	1.762	12	11.9	6.6	8.1
12/26/12	0.934	1.445	12	11.7	6.0	7.9
12/27/12	0.781	1.208	12	11.6	6.2	6.1
12/28/12	0.706	1.092	12	11.7	6.1	5.2
12/29/12	0.639	0.989	12	11.9		
12/30/12	0.588	0.910	12	12.0		
12/31/12	0.578	0.894	12	12.0	6.1	4.9
1/1/13	0.522	0.808	12	12.0		
1/2/13	0.521	0.806	12	12.0	6.5	7.2
1/3/13	0.484	0.749	12	12.0	6.5	6.8
1/4/13	0.463	0.716	12	12.0	6.7	4.3
1/5/13	0.451	0.698	12	12.0		
1/6/13	0.449	0.695	13	12.1		
1/7/13	0.450	0.696	13	12.3	6.3	5.0
1/8/13	0.436	0.674	13	12.4	6.5	5.5
1/9/13	0.425	0.657	13	12.6	6.8	5.1
1/10/13	0.418	0.647	13	12.7	6.7	6.0
1/11/13	0.407	0.630	12	12.7	6.4	5.7
1/12/13	0.362	0.560	12	12.7		
1/13/13	0.361	0.558	12	12.6		
1/14/13	0.366	0.566	11	12.3	6.6	6.0
1/15/13	0.358	0.554	11	12.0	6.3	5.3
1/16/13	0.361	0.558	11	11.7	6.6	3.3
1/17/13	0.346	0.535	10	11.3	6.7	5.7
1/18/13	0.353	0.546	10	11.0	6.4	5.7
1/19/13	0.333	0.515	11	10.9		
1/20/13	0.329	0.509	11	10.7		

Table E2 (12 pages). Discharge Monitoring Report Data for the CJ WWTF

WWTF Date	Flow (mgd)	Flow (cfs)	Max T (oC)	7-day Avg Max T (oC)	pH (S.U.)	DO (mg/l)
1/21/13	0.329	0.509	11	10.7		
1/22/13	0.348	0.538	11	10.7	6.5	5.5
1/23/13	0.515	0.797	11	10.7	6.1	5.9
1/24/13	0.472	0.730	11	10.9	6.5	5.5
1/25/13	0.468	0.724	11	11.0	6.5	5.0
1/26/13	0.445	0.688	11	11.0		
1/27/13	0.428	0.662	11	11.0		
1/28/13	0.418	0.647	11	11.0	6.5	4.9
1/29/13	0.411	0.636	12	11.1	6.5	5.1
1/30/13	0.389	0.602	12	11.3	6.5	5.6
1/31/13	0.382	0.591	12	11.4	6.6	5.9
2/1/13	0.384	0.594	12	11.6	6.6	5.3
2/2/13	0.363	0.562	11	11.6		
2/3/13	0.349	0.540	11	11.6		
2/4/13	0.359	0.555	12	11.7	6.5	5.0
2/5/13	0.372	0.575	12	11.7	6.6	5.6
2/6/13	0.374	0.579	12	11.7	6.6	6.1
2/7/13	0.377	0.583	11	11.6	6.6	5.0
2/8/13	0.367	0.568	11	11.4	6.7	4.8
2/9/13	0.339	0.524	11	11.4		
2/10/13	0.349	0.540	11	11.4		
2/11/13	0.341	0.528	11	11.3	6.3	4.9
2/12/13	0.335	0.518	12	11.3	6.7	4.9
2/13/13	0.320	0.495	12	11.3	6.4	4.6
2/14/13	0.319	0.493	12	11.4	6.3	4.3
2/15/13	0.317	0.490	13	11.7	6.7	4.0
2/16/13	0.315	0.487	12	11.9		
2/17/13	0.312	0.483	12	12.0		
2/18/13	0.312	0.483	12	12.1		
2/19/13	0.358	0.554	12	12.1	6.5	3.9
2/20/13	0.345	0.534	12	12.1	6.8	3.5
2/21/13	0.305	0.472	12	12.1	7.0	4.3
2/22/13	0.320	0.495	12	12.0	7.2	4.9
2/23/13	0.307	0.475	11	11.9		
2/24/13	0.318	0.492	11	11.7		
2/25/13	0.307	0.475	12	11.7	6.6	4.1
2/26/13	0.320	0.495	12	11.7	6.6	3.9
2/27/13	0.305	0.472	12	11.7	7.0	4.2
2/28/13	0.315	0.487	13	11.9	7.0	4.3
3/1/13	0.306	0.473	13	12.0	6.7	3.2
3/2/13	0.244	0.377	13	12.3		
3/3/13	0.243	0.376	13	12.6		
3/4/13	0.305	0.472	13	12.7	6.6	3.8
3/5/13	0.399	0.617	12	12.7	6.5	3.1
3/6/13	0.493	0.763	12	12.7	6.8	3.1
3/7/13	0.425	0.657	11	12.4	6.8	3.7
3/8/13	0.415	0.642	12	12.3	7.0	7.2
3/9/13	0.342	0.529	12	12.1		
3/10/13	0.346	0.535	12	12.0		
3/11/13	0.353	0.546	13	12.0	6.8	6.1
3/12/13	0.333	0.515	13	12.1	6.7	5.9
3/13/13	0.330	0.511	13	12.3	6.9	6.8
3/14/13	0.324	0.501	13	12.6	6.8	6.3
3/15/13	0.324	0.501	13	12.7	6.7	5.9
3/16/13	0.295	0.456	13	12.9		
3/17/13	0.293	0.453	13	13.0		
3/18/13	0.296	0.458	13	13.0	6.6	6.9
3/19/13	0.334	0.517	13	13.0	6.4	6.5
3/20/13	0.355	0.549	13	13.0	6.9	7.1
3/21/13	0.319	0.493	13	13.0	6.5	6.6
3/22/13	0.332	0.514	13	13.0	6.6	6.9
3/23/13	0.293	0.453	13	13.0		
3/24/13	0.284	0.439	13	13.0		
3/25/13	0.307	0.475	13	13.0	6.7	6.1
3/26/13	0.304	0.470	13	13.0	6.7	5.7
3/27/13	0.302	0.467	14	13.1	6.7	6.1
3/28/13	0.303	0.469	14	13.3	6.5	6.6
3/29/13	0.312	0.483	14	13.4	6.5	5.0
3/30/13	0.283	0.438	15	13.7		
3/31/13	0.317	0.490	14	13.9		
4/1/13	0.410	0.634	14	14.0	6.6	4.6
4/2/13	0.280	0.433	15	14.3	6.4	3.0
4/3/13	0.323	0.500	14	14.3	6.3	5.1
4/4/13	0.378	0.585	13	14.1	6.2	5.8
4/5/13	0.390	0.603	13	14.0	6.4	5.0
4/6/13	0.382	0.591	14	13.9		
4/7/13	0.446	0.690	13	13.7		
4/8/13	0.425	0.657	13	13.6	6.5	5.5
4/9/13	0.384	0.594	14	13.4	6.6	6.7
4/10/13	0.387	0.599	14	13.4	6.5	6.1
4/11/13	0.364	0.563	14	13.6	6.5	5.7
4/12/13	0.346	0.535	15	13.9	6.5	6.0
4/13/13	0.317	0.490	15	14.0		
4/14/13	0.320	0.495	15	14.3		

Table E2 (12 pages). Discharge Monitoring Report Data for the CJ WWTF

WWTF Date	Flow (mgd)	Flow (cfs)	Max T (oC)	7-day Avg Max T (oC)	pH (S.U.)	DO (mg/l)
4/15/13	0.323	0.500	14	14.4	6.5	6.3
4/16/13	0.312	0.483	14	14.4	6.5	6.3
4/17/13	0.296	0.458	15	14.6	6.7	
4/18/13	0.302	0.467	15	14.7	6.6	5.8
4/19/13	0.310	0.480	15	14.7	6.6	5.9
4/20/13	0.312	0.483	15	14.7		
4/21/13	0.251	0.388	15	14.7		
4/22/13	0.302	0.467	16	15.0	6.3	6.2
4/23/13	0.300	0.464	16	15.3	6.6	6.1
4/24/13	0.296	0.458	16	15.4	6.5	5.5
4/25/13	0.250	0.387	16	15.6	6.5	6.3
4/26/13	0.284	0.439	16	15.7	6.4	5.7
4/27/13	0.255	0.394	17	16.0		
4/28/13	0.257	0.398	17	16.3		
4/29/13	0.272	0.421	17	16.4	6.4	5.4
4/30/13	0.247	0.382	16	16.4	6.4	6.0

	Qe	TM1	TM7	pH	DO
min	0.152	9	10.7	6.0	1.9
avg	0.383	14.26	14.35	6.55	5.56
max	1.431	21	20.3	7.2	10.4

Appendix F

CORMIX Mixing Zone Dilution Model Inputs and Model Runs
For the Existing Outfall and the Potential Diffuser

Table Fu. "U" Scenarios based on Unsubmerged Outfall

Case File ID	River Flow Condition
With Maximum Daily Average Facility Flow for Critical Period UDx	1Q10 (57.8 cfs)
With Design Average Dry Weather Flow (DADWF) UDb UDe	7Q10 (75.2 cfs) and 200 cfs

Table Fs. "S" Scenarios based on Submerged Outfall Diffuser

Case File ID		River Flow Condition
With Maximum Daily Average Facility Flow for Critical Period		1Q10 (57.8 cfs)
SDy	9 ports at 1.75 inches each	
With Design Average Dry Weather Flow (DADWF)		7Q10 (75.2 cfs)
SDb	9 ports at 1.75 inches each	and 200 cfs
SDe		

Appendix F1

CORMIX3 Runs for Existing Outfall

Table F1a. Illinois River Ambient Conditions for Cave Junction WWTF Discharge for Outfall 001

Using CORMIX3 for an Unsubmerged Outfall and including 1Q10 and 7Q10 Low River Flow Conditions

	Input			
Input Description	*meters*	*meters*	*ft*	**Comment**
Cross-section Boundary	Bounded			River Flow Conditions based on Field Measurement (June 13, 2013)
Width		24.3	79.8	1Q10 Low River Flow
	25.9	25.9	85.0	7Q10 Low River Flow
		28.7	94.0	100 cfs
		30.2	99.0	152 cfs
		31.7	104.0	200 cfs
	1	Channel - Fairly Straight		
Average or Characteristic Depth	0.28	0.277	0.91	1Q10
		0.320	1.05	7Q10
		0.357	1.17	100 cfs
		0.448	1.47	152 cfs
		0.512	1.68	200 cfs
Local Depth	0.36	0.36	1.18	1Q10
		0.41	1.35	7Q10
		0.46	1.51	100 cfs
		0.58	1.90	152 cfs
		0.66	2.17	200 cfs
Ambient Flow Field	Steady			Steady River Flow
Specify Ambient Flow	Velocity			
				Ambient Flows:
Instantaneous Ambient Velocity	0.244	0.244	0.80	1Q10
		0.256	0.84	7Q10
		0.277	0.91	100 cfs
		0.320	1.05	152 cfs
		0.351	1.15	200 cfs
Channel Friction Type	Manning			
Bottom Friction Factor	0.030			Manning's Friction
Ambient Density	Unstratified			Uniform Density (Unstratified) and Non-Uniform Density (Stratified)
	Uniform Density			
Ambient Water	Fresh			
Based on Temp or Density	Temperature			
Temperature	20.0	^{o}C		Choose temperature a) 13^{o}C or b) 20 ^{o}C
Wind	2.0	m/s		CORMIX recommended value

Table F1b. Cave Junction Outfall 001 Discharge to the Illinois River: CORMIX3 (Surface Discharge) Inputs

Using CORMIX3 for an Unsubmerged Outfall and including 1Q10 and 7Q10 Low River Conditions

Input Description	Value	Explanations & Conversions					Comments
Nearest Bank Looking Downstream	Right						
Discharge Configuration	Flush	Choices: 1) Flush, 2) Protruding, & 3) Co-flowing along bank.					
Discharge Channel Enter Ambient at:	90^o	90^o - Surface Discharge Enters ambient Perpendicular to bank					
		30^o - Surface Discharge Enters ambient Mostly Co-flowing with bank					
			Characteristic Depth		Local Depth		
Average or Characteristic Water Depth (m)	0.320	Flow Cond.	meters	feet	m	ft	
		1Q10	0.277	0.91	0.36	1.18	
Local Water Depth (m) at CORMIX 130%	0.410	7Q10	0.320	1.05	0.41	1.35	
		100 cfs	0.357	1.17	0.46	1.51	
		152 cfs	0.448	1.47	0.58	1.90	
		200 cfs	0.512	1.68	0.66	2.17	
Slope	1.0						
Channel Type	Rectangular	Choices: 1) Rectangular or 2) Circular					
				meters	feet	inches	
Discharge Dimension, meters (m)	0.305		*Dimension:*	0.305	1.0	12.0	
Ambient Depth at Discharge (m)	0.15		Dimension about 1/2 diameter basis.				
Ambient: Flowrate or velocity?	Flowrate						
Facility Flow, cms	0.02278	***Total Flow***			***Range of Facility Flows***		
		cms	MGD				
		0.01678	0.3830		Existing Average - Wet Period Facility Flow		
		0.02278	0.5200		Design Average Dry Weather Flow (DADWF) for 7Q10		
		0.03062	0.6990		Highest Monthly Average (for 1Q10)		
Effluent Type - Freshwater?	Yes						

Input Description	Value	Explanations & Conversions					Comments
For Density, use Density or Temperature?	Temp						
Temperature	23.0	°C	Characteristic effluent temperature				
Heated Discharge?	No						
Units	Deg C						
Concentration of Pollutant, mgl	1.0		Concentration Scale				
Conservative Substance	YES						
Accept Values?	YES						

```
CORMIX3 PREDICTION FILE:
33333333333333333333333333333333333333333333333333333333333333333333333333333
                      CORNELL MIXING ZONE EXPERT SYSTEM
Subsystem CORMIX3:                                         Subsystem version:
 Buoyant Surface Discharges                 CORMIX_v.3.20_____September_1996
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:         CJMZ^7Q10^DADWF
 Design case:             Cave^Junction^at^Illinois^R^7Q10^&^DADWF
 FILE NAME:               cormix\sim\UDb     .cx3
 Time of Fortran run:     12/13/13--13:25:55

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     25.90  AS    =      8.29  QA    =      2.12  ICHREG= 1
 HA    =       .32  HD    =       .41
 UA    =       .256 F     =       .103 USTAR = .2908E-01
 UW    =      2.000 UWSTAR= .2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  998.2051

DISCHARGE PARAMETERS (metric units)
 BANK  =  RIGHT     DISTB =       .00  Configuration: flush_discharge
 SIGMA =     90.00  HD0   =       .32  SLOPE =      1.00
 Rectangular channel geometry:
 B0    =       .305 H0    =       .150 A0    = .4570E-01  AR    =       .492
 U0    =       .498 Q0    =       .023       = .2275E-01
 RHO0  =  997.5393  DRHO0 = .6658E+00  GP0   = .6541E-02
 C0    = .1000E+01  CUNITS=  mgl
 IPOLL =  1         KS    = .0000E+00  KD    = .0000E+00

FLUX VARIABLES (metric units)
 Q0    = .2275E-01  M0    = .1133E-01  J0    = .1488E-03
 Associated length scales (meters)
 LQ    =       .21  LM    =      2.85  Lm    =       .42  Lb    =       .01

NON-DIMENSIONAL PARAMETERS
 FR0   =     13.31  FRCH  =     15.87  R     =      1.94

FLOW CLASSIFICATION
 333333333333333333333333333333333333333333
 3  Flow class (CORMIX3)      =    SA1    3
 3  Applicable layer depth HS =      .41  3
 333333333333333333333333333333333333333333

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = .1000E+01  CUNITS=  mgl
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1700.00  XMAX  =   1700.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the WATER SURFACE and at center of discharge
      channel/outlet:       .00 m  from the RIGHT bank/shore.
    X-axis points downstream
    Y-axis points to left as seen by an observer looking downstream
    Z-axis points vertically upward (in CORMIX3, all values Z = 0.00)
NSTEP = 20 display intervals per module
-----------------------------------------------------------------------------
        TRJBUO    TRJATT    TRJBND    TRJNBY    TRJCOR    DILCOR
C        1.000      .693      .941      .653      .653      .693
-----------------------------------------------------------------------------
BEGIN MOD301: DISCHARGE MODULE

 Efflux conditions:
       X        Y       Z        S       C       BV       BH
       .00      .00    0.00     1.0  .100E+01    .15      .15

END OF MOD301: DISCHARGE MODULE
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD302: ZONE OF FLOW ESTABLISHMENT
```

```
  Control volume inflow:
       X        Y       Z        S       C       BV       BH
       .00      .00    0.00     1.0  .100E+01    .15      .15

 VERTICAL MIXING occurs in the initial zone of flow establishment.
 Profile definitions:
   BV = Gaussian 1/e (37%) vertical thickness
   BH = Gaussian 1/e (37%) horizontal half-width, normal to trajectory
   S = hydrodynamic centerline dilution
   C = centerline concentration (includes reaction effects, if any)

  Control volume outflow:
       X        Y       Z        S       C       BV       BH
       .06      .52    0.00     2.5  .394E+00    .33      .76
 Cumulative travel time =           1. sec

END OF MOD302: ZONE OF FLOW ESTABLISHMENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD317: WEAKLY DEFLECTED JET (3-D) WITH LEESIDE RECIRCULATION ZONE

 Surface JET into a crossflow

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD317: WEAKLY DEFLECTED JET (3-D) WITH LEESIDE RECIRCULATION ZONE
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD327: STRONGLY DEFLECTED JET (3-D) WITH LEESIDE RECIRCULATION ZONE

 Profile definitions:
   BV = Gaussian 1/e (37%) vertical thickness
   BH = Gaussian 1/e (37%) horizontal half-width, normal to trajectory
   S = hydrodynamic centerline dilution
   C = centerline concentration (includes reaction effects, if any)

       X        Y       Z        S       C       BV       BH
       .06      .52    0.00     2.5  .394E+00    .29      .76
       .12      .54    0.00     2.6  .385E+00    .30      .76
       .19      .56    0.00     2.7  .376E+00    .30      .77
       .25      .57    0.00     2.7  .367E+00    .31      .77
       .31      .59    0.00     2.8  .360E+00    .31      .78
       .37      .61    0.00     2.8  .353E+00    .32      .78
       .43      .62    0.00     2.9  .346E+00    .32      .79
       .49      .63    0.00     2.9  .340E+00    .33      .79
       .55      .65    0.00     3.0  .334E+00    .33      .80
       .61      .66    0.00     3.0  .329E+00    .33      .80
       .67      .67    0.00     3.1  .324E+00    .34      .80
       .73      .69    0.00     3.1  .319E+00    .34      .81
       .79      .70    0.00     3.2  .314E+00    .34      .81
       .85      .71    0.00     3.2  .310E+00    .35      .82
       .91      .72    0.00     3.3  .306E+00    .35      .82
       .98      .73    0.00     3.3  .302E+00    .35      .82
      1.04      .74    0.00     3.4  .298E+00    .36      .82
      1.10      .75    0.00     3.4  .294E+00    .36      .83
      1.16      .76    0.00     3.4  .291E+00    .36      .83
      1.22      .77    0.00     3.5  .288E+00    .36      .83
      1.28      .78    0.00     3.5  .284E+00    .37      .84
 Cumulative travel time =           6. sec

  Some concentration build-up near bank/shore due to recirculation effects.
    Find concentration and thickness values for the RECIRCULATION REGION
    at end of MOD329!

END OF MOD327: STRONGLY DEFLECTED JET (3-D) WITH LEESIDE RECIRCULATION ZONE
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD329: STRONGLY DEFLECTED PLUME WITH LEESIDE RECIRCULATION ZONE

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

  The near-shore RECIRCULATION REGION extends back to the discharge location:
    Concentration C within that region:         .185E+00
```

```
    Layer thickness BV within that region:      .37

END OF MOD329: STRONGLY DEFLECTED PLUME WITH LEESIDE RECIRCULATION ZONE
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **
-----------------------------------------------------------------------------

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor   .71 to conserve the mass flux in the far-field!
-----------------------------------------------------------------------------
BEGIN MOD341: BUOYANT AMBIENT SPREADING

 Plume is ATTACHED to RIGHT bank/shore.
   Plume width is now determined from RIGHT bank/shore.

 Plume condition is non-buoyant or weakly buoyant,
   or it is governed by full vertical mixing at the end of the NFR.
 Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD341: BUOYANT AMBIENT SPREADING
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD361: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   =  .186E-02 m^2/s
  Horizontal diffusivity (initial value) =  .233E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to water depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   S = hydrodynamic centerline dilution
   C = centerline concentration (includes reaction effects, if any)

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH
      1.28      .00    0.00     3.5  .284E+00    .26     1.19
 Plume interacts with BOTTOM.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
     86.22      .00    0.00     7.1  .141E+00    .32     1.95
    171.15      .00    0.00     9.1  .110E+00    .32     2.49
    256.09      .00    0.00    10.7  .936E-01    .32     2.93
    341.02      .00    0.00    12.1  .828E-01    .32     3.32
    425.96      .00    0.00    13.3  .750E-01    .32     3.66
    510.90      .00    0.00    14.5  .691E-01    .32     3.98
    595.83      .00    0.00    15.5  .644E-01    .32     4.27
    680.77      .00    0.00    16.5  .605E-01    .32     4.54
    765.70      .00    0.00    17.5  .573E-01    .32     4.80
    850.64      .00    0.00    18.3  .545E-01    .32     5.04
    935.58      .00    0.00    19.2  .521E-01    .32     5.27
   1020.51      .00    0.00    20.0  .500E-01    .32     5.50
   1105.45      .00    0.00    20.8  .481E-01    .32     5.71
   1190.38      .00    0.00    21.5  .464E-01    .32     5.92
   1275.32      .00    0.00    22.3  .449E-01    .32     6.12
   1360.26      .00    0.00    23.0  .436E-01    .32     6.31
   1445.19      .00    0.00    23.6  .423E-01    .32     6.50
   1530.13      .00    0.00    24.3  .411E-01    .32     6.68
   1615.06      .00    0.00    24.9  .401E-01    .32     6.86
   1700.00      .00    0.00    25.6  .391E-01    .32     7.03
 Cumulative travel time =        6571. sec

 Simulation limit based on maximum specified distance =   1700.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD361: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX3: Buoyant Surface Discharges                    End of Prediction File
33333333333333333333333333333333333333333333333333333333333333333333333333333
```

```
CORMIX3 PREDICTION FILE:
333333333333333333333333333333333333333333333333333333333333333333333333333333
                      CORNELL MIXING ZONE EXPERT SYSTEM
Subsystem CORMIX3:                                          Subsystem version:
 Buoyant Surface Discharges                 CORMIX_v.3.20_____September_1996
------------------------------------------------------------------------------
------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:         CJMZ^7Q10^DADWF
 Design case:             CJ^at^Illinois^R^200^cfs^&^DADWF
 FILE NAME:               cormix\sim\UDe     .cx3
 Time of Fortran run:     12/13/13--13:35:20

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     28.70  AS    =     10.25  QA    =      2.84  ICHREG= 1
 HA    =       .36  HD    =       .46
 UA    =       .277 F     =       .099 USTAR = .3089E-01
 UW    =      2.000 UWSTAR= .2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  998.2051

DISCHARGE PARAMETERS (metric units)
 BANK  =  RIGHT     DISTB =       .00  Configuration: flush_discharge
 SIGMA =     90.00  HD0   =       .32  SLOPE =      1.00
 Rectangular channel geometry:
 B0    =       .305 H0    =       .150 A0    = .4570E-01  AR    =       .492
 U0    =       .498 Q0    =       .023       = .2275E-01
 RHO0  =  997.5393  DRHO0 = .6658E+00  GP0   = .6541E-02
 C0    = .1000E+01  CUNITS=  mgl
 IPOLL =  1         KS    = .0000E+00  KD    = .0000E+00

FLUX VARIABLES (metric units)
 Q0    = .2275E-01  M0    = .1133E-01  J0    = .1488E-03
 Associated length scales (meters)
 LQ    =       .21  LM    =      2.85  Lm    =       .38  Lb    =       .01

NON-DIMENSIONAL PARAMETERS
 FR0   =     13.31  FRCH  =     15.87  R     =      1.79

FLOW CLASSIFICATION
 333333333333333333333333333333333333333333
 3  Flow class (CORMIX3)      =    SA1    3
 3  Applicable layer depth HS =      .46  3
 333333333333333333333333333333333333333333

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = .1000E+01  CUNITS=  mgl
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1700.00  XMAX  =   1700.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the WATER SURFACE and at center of discharge
      channel/outlet:       .00 m  from the RIGHT bank/shore.
    X-axis points downstream
    Y-axis points to left as seen by an observer looking downstream
    Z-axis points vertically upward (in CORMIX3, all values Z = 0.00)
NSTEP = 20 display intervals per module
------------------------------------------------------------------------------
        TRJBUO    TRJATT    TRJBND    TRJNBY    TRJCOR    DILCOR
C        1.000      .717      .959      .687      .687      .717
------------------------------------------------------------------------------
BEGIN MOD301: DISCHARGE MODULE

 Efflux conditions:
       X        Y       Z        S       C       BV       BH
       .00      .00    0.00     1.0  .100E+01    .15      .15

END OF MOD301: DISCHARGE MODULE
------------------------------------------------------------------------------
------------------------------------------------------------------------------
BEGIN MOD302: ZONE OF FLOW ESTABLISHMENT
```

```
  Control volume inflow:
       X        Y       Z        S       C       BV       BH
      .00      .00    0.00     1.0  .100E+01    .15      .15

 VERTICAL MIXING occurs in the initial zone of flow establishment.
 Profile definitions:
   BV = Gaussian 1/e (37%) vertical thickness
   BH = Gaussian 1/e (37%) horizontal half-width, normal to trajectory
   S = hydrodynamic centerline dilution
   C = centerline concentration (includes reaction effects, if any)

  Control volume outflow:
       X        Y       Z        S       C       BV       BH
      .07      .49    0.00     2.7  .376E+00    .33      .84
 Cumulative travel time =           1. sec

END OF MOD302: ZONE OF FLOW ESTABLISHMENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD317: WEAKLY DEFLECTED JET (3-D) WITH LEESIDE RECIRCULATION ZONE

 Surface JET into a crossflow

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD317: WEAKLY DEFLECTED JET (3-D) WITH LEESIDE RECIRCULATION ZONE
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD327: STRONGLY DEFLECTED JET (3-D) WITH LEESIDE RECIRCULATION ZONE

 Profile definitions:
   BV = Gaussian 1/e (37%) vertical thickness
   BH = Gaussian 1/e (37%) horizontal half-width, normal to trajectory
   S = hydrodynamic centerline dilution
   C = centerline concentration (includes reaction effects, if any)

       X        Y       Z        S       C       BV       BH
      .07      .49    0.00     2.7  .376E+00    .27      .84
      .13      .51    0.00     2.7  .366E+00    .27      .84
      .19      .53    0.00     2.8  .357E+00    .28      .85
      .25      .55    0.00     2.9  .348E+00    .29      .85
      .31      .56    0.00     2.9  .341E+00    .29      .86
      .37      .58    0.00     3.0  .334E+00    .30      .86
      .43      .60    0.00     3.1  .327E+00    .30      .87
      .49      .61    0.00     3.1  .321E+00    .30      .87
      .55      .62    0.00     3.2  .315E+00    .31      .88
      .61      .64    0.00     3.2  .310E+00    .31      .88
      .67      .65    0.00     3.3  .305E+00    .32      .88
      .73      .66    0.00     3.3  .300E+00    .32      .89
      .79      .67    0.00     3.4  .295E+00    .32      .89
      .85      .69    0.00     3.4  .291E+00    .33      .90
      .91      .70    0.00     3.5  .287E+00    .33      .90
      .97      .71    0.00     3.5  .283E+00    .33      .90
     1.03      .72    0.00     3.6  .279E+00    .34      .91
     1.09      .73    0.00     3.6  .276E+00    .34      .91
     1.16      .74    0.00     3.7  .273E+00    .34      .91
     1.22      .75    0.00     3.7  .269E+00    .34      .91
     1.28      .76    0.00     3.8  .266E+00    .35      .92
 Cumulative travel time =           5. sec

  Some concentration build-up near bank/shore due to recirculation effects.
    Find concentration and thickness values for the RECIRCULATION REGION
    at end of MOD329!

END OF MOD327: STRONGLY DEFLECTED JET (3-D) WITH LEESIDE RECIRCULATION ZONE
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD329: STRONGLY DEFLECTED PLUME WITH LEESIDE RECIRCULATION ZONE

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

  The near-shore RECIRCULATION REGION extends back to the discharge location:
    Concentration C within that region:         .191E+00
```

```
    Layer thickness BV within that region:      .35

END OF MOD329: STRONGLY DEFLECTED PLUME WITH LEESIDE RECIRCULATION ZONE
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **
-----------------------------------------------------------------------------

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor   .69 to conserve the mass flux in the far-field!
-----------------------------------------------------------------------------
BEGIN MOD341: BUOYANT AMBIENT SPREADING

 Plume is ATTACHED to RIGHT bank/shore.
   Plume width is now determined from RIGHT bank/shore.

 Plume condition is non-buoyant or weakly buoyant,
   or it is governed by full vertical mixing at the end of the NFR.
 Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD341: BUOYANT AMBIENT SPREADING
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD361: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   =  .221E-02 m^2/s
  Horizontal diffusivity (initial value) =  .276E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to water depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   S = hydrodynamic centerline dilution
   C = centerline concentration (includes reaction effects, if any)

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH
      1.28      .00    0.00     3.8  .266E+00    .24     1.27
 Plume interacts with BOTTOM.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
     86.21      .00    0.00     9.0  .111E+00    .36     2.06
    171.15      .00    0.00    11.5  .870E-01    .36     2.63
    256.08      .00    0.00    13.5  .740E-01    .36     3.09
    341.02      .00    0.00    15.3  .654E-01    .36     3.49
    425.96      .00    0.00    16.9  .593E-01    .36     3.85
    510.89      .00    0.00    18.3  .547E-01    .36     4.18
    595.83      .00    0.00    19.6  .510E-01    .36     4.48
    680.77      .00    0.00    20.9  .479E-01    .36     4.77
    765.70      .00    0.00    22.1  .453E-01    .36     5.03
    850.64      .00    0.00    23.2  .432E-01    .36     5.29
    935.57      .00    0.00    24.2  .413E-01    .36     5.53
   1020.51      .00    0.00    25.3  .396E-01    .36     5.77
   1105.45      .00    0.00    26.2  .381E-01    .36     5.99
   1190.38      .00    0.00    27.2  .368E-01    .36     6.21
   1275.32      .00    0.00    28.1  .356E-01    .36     6.42
   1360.26      .00    0.00    29.0  .345E-01    .36     6.62
   1445.19      .00    0.00    29.9  .335E-01    .36     6.81
   1530.13      .00    0.00    30.7  .326E-01    .36     7.00
   1615.06      .00    0.00    31.5  .317E-01    .36     7.19
   1700.00      .00    0.00    32.3  .310E-01    .36     7.37
 Cumulative travel time =        6089. sec

 Simulation limit based on maximum specified distance =   1700.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD361: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX3: Buoyant Surface Discharges                    End of Prediction File
33333333333333333333333333333333333333333333333333333333333333333333333333333
```

```
CORMIX3 PREDICTION FILE:
33333333333333333333333333333333333333333333333333333333333333333333333333333
                      CORNELL MIXING ZONE EXPERT SYSTEM
Subsystem CORMIX3:                                         Subsystem version:
 Buoyant Surface Discharges                 CORMIX_v.3.20_____September_1996
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:         CJMZ^7Q10^DADWF
 Design case:             1q10^trans
 FILE NAME:               cormix\sim\UDx     .cx3
 Time of Fortran run:     12/13/13--13:42:52

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     24.30  AS    =      6.80  QA    =      1.66  ICHREG= 1
 HA    =       .28  HD    =       .36
 UA    =       .244 F     =       .108 USTAR = .2833E-01
 UW    =      2.000 UWSTAR= .2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  998.2051

DISCHARGE PARAMETERS (metric units)
 BANK  =  RIGHT     DISTB =       .00  Configuration: flush_discharge
 SIGMA =     90.00  HD0   =       .28  SLOPE =      1.00
 Rectangular channel geometry:
 B0    =       .305 H0    =       .150 A0    = .4570E-01  AR    =       .492
 U0    =       .669 Q0    =       .031       = .3058E-01
 RHO0  =  997.5393  DRHO0 = .6658E+00  GP0   = .6541E-02
 C0    = .1000E+01  CUNITS=  mgl
 IPOLL =  1         KS    = .0000E+00  KD    = .0000E+00

FLUX VARIABLES (metric units)
 Q0    = .3058E-01  M0    = .2047E-01  J0    = .2000E-03
 Associated length scales (meters)
 LQ    =       .21  LM    =      3.83  Lm    =       .59  Lb    =       .01
 LQ2D  =       .16  LM2D  =      9.15  Lm2D  =      1.23

NON-DIMENSIONAL PARAMETERS
 FR0   =     17.89  FRCH  =     21.34  R     =      2.74

FLOW CLASSIFICATION
 333333333333333333333333333333333333333333
 3  Flow class (CORMIX3)      =    SA2    3
 3  Applicable layer depth HS =      .36  3
 333333333333333333333333333333333333333333

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = .1000E+01  CUNITS=  mgl
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1700.00  XMAX  =   1700.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the WATER SURFACE and at center of discharge
      channel/outlet:       .00 m  from the RIGHT bank/shore.
    X-axis points downstream
    Y-axis points to left as seen by an observer looking downstream
    Z-axis points vertically upward (in CORMIX3, all values Z = 0.00)
NSTEP = 20 display intervals per module
-----------------------------------------------------------------------------
        TRJBUO    TRJATT    TRJBND    TRJNBY    TRJCOR    DILCOR
C        1.000      .609      .868      .529      .529      .609
-----------------------------------------------------------------------------
BEGIN MOD301: DISCHARGE MODULE

 Efflux conditions:
       X        Y       Z        S       C        BV       BH
       .00      .00    0.00     1.0  .100E+01    .15      .15
```

```
END OF MOD301: DISCHARGE MODULE
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD302: ZONE OF FLOW ESTABLISHMENT

  Control volume inflow:
       X        Y       Z        S       C       BV       BH
      .00      .00    0.00     1.0  .100E+01    .15      .15

 VERTICAL MIXING occurs in the initial zone of flow establishment.
 Profile definitions:
   BV = Gaussian 1/e (37%) vertical thickness
   BH = Gaussian 1/e (37%) horizontal half-width, normal to trajectory
   S = hydrodynamic centerline dilution
   C = centerline concentration (includes reaction effects, if any)

  Control volume outflow:
       X        Y       Z        S       C       BV       BH
      .05      .62    0.00     2.1  .478E+00    .29      .58
 Cumulative travel time =           1. sec

END OF MOD302: ZONE OF FLOW ESTABLISHMENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD318: WEAKLY DEFLECTED JET (2-D) WITH LEESIDE RECIRCULATION ZONE

 Surface JET into a crossflow

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD318: WEAKLY DEFLECTED JET (2-D) WITH LEESIDE RECIRCULATION ZONE
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD328: STRONGLY DEFLECTED JET (2-D) WITH LEESIDE RECIRCULATION ZONE

 Profile definitions:
   BV = water depth (vertically mixed)
   BH = Gaussian 1/e (37%) horizontal half-width, measured normally from shore
   S = hydrodynamic centerline dilution
   C = centerline concentration (includes reaction effects, if any)

       X        Y       Z        S       C       BV       BH
      .05      .62    0.00     2.1  .478E+00    .29      .53
      .42      .86    0.00     2.3  .430E+00    .30      .59
      .79     1.00    0.00     2.5  .407E+00    .30      .62
     1.16     1.11    0.00     2.6  .389E+00    .30      .65
     1.53     1.21    0.00     2.7  .376E+00    .30      .67
     1.90     1.29    0.00     2.7  .364E+00    .30      .69
     2.27     1.36    0.00     2.8  .355E+00    .30      .71
     2.64     1.43    0.00     2.9  .346E+00    .30      .73
     3.01     1.50    0.00     3.0  .338E+00    .31      .75
     3.38     1.56    0.00     3.0  .331E+00    .31      .76
     3.74     1.61    0.00     3.1  .325E+00    .31      .77
     4.11     1.67    0.00     3.1  .319E+00    .31      .79
     4.48     1.72    0.00     3.2  .314E+00    .31      .80
     4.85     1.77    0.00     3.2  .308E+00    .31      .81
     5.22     1.82    0.00     3.3  .304E+00    .31      .83
     5.59     1.87    0.00     3.3  .299E+00    .31      .84
     5.96     1.91    0.00     3.4  .295E+00    .31      .85
     6.33     1.95    0.00     3.4  .291E+00    .31      .86
     6.70     2.00    0.00     3.5  .287E+00    .31      .87
     7.07     2.04    0.00     3.5  .284E+00    .32      .88
     7.44     2.08    0.00     3.6  .280E+00    .32      .89
 Cumulative travel time =          31. sec

  The near-shore RECIRCULATION REGION extends back to the discharge location:
    Concentration C within that region:         .224E+00
    Layer thickness BV within that region:      .32

END OF MOD328: STRONGLY DEFLECTED JET (2-D) WITH LEESIDE RECIRCULATION ZONE
-----------------------------------------------------------------------------
```

```
-----------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **
-----------------------------------------------------------------------------

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor   .88 to conserve the mass flux in the far-field!
-----------------------------------------------------------------------------
BEGIN MOD341: BUOYANT AMBIENT SPREADING

 Plume is ATTACHED to RIGHT bank/shore.
   Plume width is now determined from RIGHT bank/shore.

 Plume condition is non-buoyant or weakly buoyant,
   or it is governed by full vertical mixing at the end of the NFR.
 Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD341: BUOYANT AMBIENT SPREADING
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD361: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   =  .159E-02 m^2/s
  Horizontal diffusivity (initial value) =  .198E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to water depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   S = hydrodynamic centerline dilution
   C = centerline concentration (includes reaction effects, if any)

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH
      7.44      .00    0.00     3.6  .280E+00    .28     1.57
 Plume interacts with BOTTOM.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
     92.06      .00    0.00     4.9  .205E+00    .28     2.14
    176.69      .00    0.00     5.9  .170E+00    .28     2.59
    261.32      .00    0.00     6.8  .148E+00    .28     2.97
    345.95      .00    0.00     7.5  .133E+00    .28     3.31
    430.58      .00    0.00     8.2  .122E+00    .28     3.62
    515.20      .00    0.00     8.9  .113E+00    .28     3.90
    599.83      .00    0.00     9.5  .106E+00    .28     4.16
    684.46      .00    0.00    10.0  .997E-01    .28     4.41
    769.09      .00    0.00    10.6  .946E-01    .28     4.64
    853.72      .00    0.00    11.1  .903E-01    .28     4.87
    938.35      .00    0.00    11.6  .865E-01    .28     5.08
   1022.97      .00    0.00    12.0  .832E-01    .28     5.29
   1107.60      .00    0.00    12.5  .802E-01    .28     5.48
   1192.23      .00    0.00    12.9  .775E-01    .28     5.67
   1276.86      .00    0.00    13.3  .750E-01    .28     5.86
   1361.49      .00    0.00    13.7  .728E-01    .28     6.04
   1446.12      .00    0.00    14.1  .708E-01    .28     6.21
   1530.74      .00    0.00    14.5  .689E-01    .28     6.38
   1615.37      .00    0.00    14.9  .672E-01    .28     6.54
   1700.00      .00    0.00    15.2  .656E-01    .28     6.70
 Cumulative travel time =        6841. sec

 Simulation limit based on maximum specified distance =   1700.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD361: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX3: Buoyant Surface Discharges                    End of Prediction File
33333333333333333333333333333333333333333333333333333333333333333333333333333
```

Appendix F2

CORMIX2 Runs for Potential Future Diffuser

Table F2a. Illinois River Ambient Conditions for Cave Junction WWTF Discharge for Outfall 001

Using CORMIX2 for a Submerged Outfall Diffuser and including 1Q10 and 7Q10 Low River Flow Conditions

	Input			
Input Description	*meters*	*meters*	*ft*	**Comment**
				River Flow Conditions based on Field Measurement (June 13, 2013)
Cross-section Boundary	Bounded			
Width		24.3	79.8	1Q10 Low River Flow
	25.9	25.9	85.0	7Q10 Low River Flow
		28.7	94.0	100 cfs
		30.2	99.0	152 cfs
		31.7	104.0	200 cfs
	1	Channel - Fairly Straight		
Average or Characteristic Depth		0.28	0.91	1Q10 Low River Flow
	0.32	0.32	1.05	7Q10 Low River Flow
		0.36	1.17	100 cfs
		0.45	1.47	152 cfs
		0.51	1.68	200 cfs
Local Depth		0.36	1.18	1Q10 Low River Flow
	0.41	0.41	1.35	7Q10 Low River Flow
		0.46	1.51	100 cfs
		0.58	1.90	152 cfs
		0.66	2.17	200 cfs
Ambient Flow Field	Steady			Steady River Flow
Specify Ambient Flow	Velocity			
				Characteristic Ambient Velocities:
Instantaneous Ambient Velocity		0.244	0.80	1Q10 Low River Flow
	0.256	0.256	0.84	7Q10 Low River Flow
		0.277	0.91	100 cfs
		0.320	1.05	152 cfs
		0.351	1.15	200 cfs
Channel Friction Type	Manning			
Bottom Friction Factor	0.030			Manning's Friction
Ambient Density	Unstratified			Uniform Density (Unstratified) and Non-Uniform Density (Stratified)
	Uniform Density			
Ambient Water	Fresh			
Based on Temp or Density	Temperature			
Temperature	20.0			Choose temperature a) 13^{o}C or b) 20 ^{o}C
Wind (m/s)	2.0			CORMIX recommended value

Table F2b. Cave Junction Outfall 001 Discharge to the Illinois River

Using CORMIX2 for a Submerged Multiport Diffuser and including 1Q10 and 7Q10 Conditions

Abbre.	Input Description	Value	Explanations & Conversions					Comments
					m	ft		
LEN	Length, meters (m)	3.66	Diffuser Length		3.658	12.0		
	Nearest Bank Looking Downstream	Right						
YB1[A]	First Diffuser End Point, meters (m)	1.50			**Distance from Right Boundary**	**m**	**ft**	
					Length:	1.50	4.9	
YB2[B]	Second Diffuser End Point, meters (m)	5.16			**Distance from Right Boundary**	**m**	**ft**	
					Length:	5.16	16.9	
Gamma[C]	Horizontal Diffuser Orientation	90°						
Ports	Number of Ports	9		*#Ports/Diam:*	Nine (9) 1.75-inch average port size			
Single Ports[D]		A						
			Port Diameter Options		**m**	**ft**	**in**	
Diam	Port Diameter, Option A, meters (m)	0.044		*#Ports/Diam:*	0.044	0.15	1.75	
C	Contraction Coeff.	0.6	Sharped Edged Orifice					
						m	**ft**	
h	Discharge Port Center Height Off Bottom, m	0.0			**Discharge Height:**	0.05	0.15	
	Diffuser Type	A[D]	All ports point downstream					
Theta	Diffuser Port Vertical Orientation[F]	20°						
Beta	Horz Port vs Diffuser Pipe Angle	90°	All ports point perpendicular to diffuser line					
	Port Array[G], w/o Fanning	A						
Sigma	Horz Port vs Ambient Flow Angle[H]	0°	Co-flowing (downstream) diffuser					
				Range of Facility Flows and Filenames:				
Qf	Facility Flow[I], cms	0.02278	***Total***		***Port Flow***		***Disch. Filename***	**Ambient Filename**
			cms	MGD	cms	MGD		
			0.01678	0.3830	1.86E-03	4.26E-02	Existing Avg	
		0.02278	0.02278	0.5200	2.53E-03	5.78E-02	DADWF (for 7Q10)	
			0.03062	0.6990	3.40E-03	7.77E-02	Highest Monthly Average (for 1Q10)	
	Effluent Type - Freshwater?	Yes						

Abbre.	Input Description	Value	Explanations & Conversions					Comments
	For Density, use Density or Temperature?	Temp						
	Temperature	23.0	^{o}C	Characteristic effluent temperature				
	Heated Discharge?	NO						
	Units	mgl						
	Concentration of Pollutant [J], mgl	1.0		Scale Concentration				
	Conservative Substance [K]	YES						
	Accept Values?	YES						

[A,B] YB1 and YB2 are measured from the near shore

[C] Horizontal Diffuser orientation relative to Waterbody Centerline (where perpendicular is at 90^{o})

[D] Single ports -- Only one port per riser (Choose A). Other choice is B for two ports per riser.

[E] A = Unidirectional or Staged Diffuser Port Arrangement; B = Alternating Arrangement

[F] Design Vertical Port orientation will generally alternate between 0^{o} and 90 ^{o} relative to the bottom.

[G] Port Array: Choose (A) = without port fanning; B = with port fanning

[H] Degrees Counter-clockwise from perpendicular diffusr pipe alignment

[I] Valid Range of Facility Flows that could be evaluated overall.

[J] Actual chemical concentrations are simply multiplied against the CORMIX2 inputted concentration of 1.0 mg/l

[K] Conservative Substance - Yes. Decay rates are handles in separate model calculation, eg., Streeter-Phelps model.

```
CORMIX2 PREDICTION FILE:
222222222222222222222222222222222222222222222222222222222222222222222222222777
                      CORNELL MIXING ZONE EXPERT SYSTEM
Subsystem CORMIX2:                                         Subsystem version:
 Submerged Multiport Diffuser Discharges    CORMIX_v.3.20_____September_1996
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:         CJMZ^with^12-ft^nine^1.75^port^diffuser^
 Design case:             Cave^Junction^potential^diffuser
 FILE NAME:               cormix\sim\SDb      .cx2
 Time of Fortran run:     12/16/13--08:15:30

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     25.90  AS    =      8.29  QA    =      2.12  ICHREG= 1
 HA    =       .32  HD    =       .41
 UA    =      .256 F     =       .103 USTAR = .2908E-01
 UW    =     2.000 UWSTAR= .2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  998.2051

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  RIGHT     DISTB =      3.33  YB1   =      1.50  YB2   =      5.16
 LD    =      3.66  NOPEN =    9       SPAC  =       .46
 D0    =      .044 A0    =       .002 H0    =       .05
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =     20.00  SIGMA =       .00  BETA  =     90.00
 U0    =     2.775 Q0    =       .023       = .2278E-01
 RHO0  =  997.5393  DRHO0 = .6658E+00  GP0   = .6541E-02
 C0    = .1000E+01  CUNITS=  mgl
 IPOLL =  1         KS    = .0000E+00  KD    = .0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    = .6224E-02  m0    = .1728E-01  j0    = .4072E-04  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      .002 lM    =     14.56  lm    =       .26
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    = .2278E-01  M0    = .6323E-01  J0    = .1490E-03
 Associated 3-d length scales (meters)
 LQ    =       .09  LM    =     10.33  Lm    =       .98  Lb    =       .01
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =    724.56  FRD0  =    163.59  R     =     10.84
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2    2
 2  Applicable layer depth HS =      .41  2
 222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = .1000E+01  CUNITS=  mgl
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1700.00  XMAX  =   1700.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
         3.33 m  from the RIGHT bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 20 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE
```

```
 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

       X        Y       Z        S       C       BV       BH
       .00      .00     .05     1.0  .100E+01    .00     1.83

END OF MOD201: DIFFUSER DISCHARGE MODULE
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =     .41m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)

       X        Y       Z        S       C       BV       BH
       .00      .00     .05     1.0  .100E+01    .00     1.83
       .09      .00     .06     5.5  .181E+00    .02     1.79
       .18      .00     .07     7.4  .135E+00    .04     1.75
       .27      .00     .07     8.8  .113E+00    .06     1.72
       .37      .00     .08    10.0  .998E-01    .08     1.69
       .46      .00     .09    11.1  .902E-01    .10     1.66
       .55      .00     .10    12.1  .830E-01    .12     1.64
       .64      .00     .10    12.9  .773E-01    .14     1.62
       .73      .00     .11    13.8  .727E-01    .16     1.61
       .82      .00     .12    14.5  .688E-01    .18     1.59
       .91      .00     .13    15.3  .655E-01    .20     1.58
      1.01      .00     .14    16.0  .626E-01    .23     1.57
      1.10      .00     .14    16.6  .601E-01    .25     1.55
      1.19      .00     .15    17.3  .579E-01    .27     1.55
      1.28      .00     .16    17.9  .559E-01    .29     1.54
      1.37      .00     .17    18.5  .541E-01    .31     1.53
      1.46      .00     .17    19.0  .525E-01    .33     1.53
      1.56      .00     .18    19.6  .510E-01    .35     1.53
      1.65      .00     .19    20.1  .496E-01    .37     1.52
      1.74      .00     .20    20.7  .484E-01    .39     1.52
      1.83      .00     .21    21.2  .472E-01    .41     1.52
 Cumulative travel time =           5. sec

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
         entire layer depth.
 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.
-----------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-----------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **
```

The initial plume WIDTH values in the next far-field module will be
CORRECTED by a factor 1.49 to conserve the mass flux in the far-field!

BEGIN MOD241: BUOYANT AMBIENT SPREADING

Discharge is non-buoyant or weakly buoyant.
Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING

Due to the attachment or proximity of the plume to the bottom, the bottom
coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
In a subsequent analysis set "depth at discharge" equal to "ambient depth".

BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

Vertical diffusivity (initial value) = .239E-02 m^2/s
Horizontal diffusivity (initial value) = .298E-02 m^2/s

The passive diffusion plume is VERTICALLY FULLY MIXED at beginning of region.

Profile definitions:
BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
= or equal to layer depth, if fully mixed
BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
measured horizontally in Y-direction
ZU = upper plume boundary (Z-coordinate)
ZL = lower plume boundary (Z-coordinate)
S = hydrodynamic centerline dilution
C = centerline concentration (includes reaction effects, if any)

Plume Stage 1 (not bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL
1.83	.00	.41	21.2	.472E-01	.41	2.27	.41	.00
10.01	.00	.41	21.8	.459E-01	.41	2.34	.41	.00
18.18	.00	.41	22.4	.447E-01	.41	2.40	.41	.00
26.36	.00	.41	22.9	.436E-01	.41	2.46	.41	.00
34.53	.00	.41	23.5	.426E-01	.41	2.52	.41	.00
42.71	.00	.41	24.0	.416E-01	.41	2.58	.41	.00
50.88	.00	.41	24.5	.407E-01	.41	2.64	.41	.00
59.06	.00	.41	25.1	.399E-01	.41	2.69	.41	.00
67.23	.00	.41	25.6	.391E-01	.41	2.75	.41	.00
75.41	.00	.41	26.1	.384E-01	.41	2.80	.41	.00
83.58	.00	.41	26.6	.377E-01	.41	2.85	.41	.00
91.76	.00	.41	27.0	.370E-01	.41	2.90	.41	.00
99.93	.00	.41	27.5	.364E-01	.41	2.95	.41	.00
108.11	.00	.41	28.0	.358E-01	.41	3.00	.41	.00
116.28	.00	.41	28.4	.352E-01	.41	3.05	.41	.00
124.46	.00	.41	28.9	.346E-01	.41	3.10	.41	.00
132.63	.00	.41	29.3	.341E-01	.41	3.15	.41	.00
140.81	.00	.41	29.7	.336E-01	.41	3.19	.41	.00
148.98	.00	.41	30.2	.331E-01	.41	3.24	.41	.00
157.16	.00	.41	30.6	.327E-01	.41	3.29	.41	.00
165.33	.00	.41	31.0	.322E-01	.41	3.33	.41	.00

Cumulative travel time = 637. sec

Plume Stage 2 (bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL
165.33	-3.33	.41	31.0	.322E-01	.41	6.66	.41	.00
242.06	-3.33	.41	32.0	.313E-01	.41	6.87	.41	.00
318.80	-3.33	.41	32.9	.304E-01	.41	7.06	.41	.00
395.53	-3.33	.41	33.8	.296E-01	.41	7.26	.41	.00
472.26	-3.33	.41	34.7	.288E-01	.41	7.45	.41	.00
549.00	-3.33	.41	35.5	.281E-01	.41	7.63	.41	.00
625.73	-3.33	.41	36.4	.275E-01	.41	7.81	.41	.00
702.46	-3.33	.41	37.2	.269E-01	.41	7.99	.41	.00
779.20	-3.33	.41	38.0	.263E-01	.41	8.16	.41	.00
855.93	-3.33	.41	38.8	.258E-01	.41	8.33	.41	.00
932.67	-3.33	.41	39.6	.253E-01	.41	8.49	.41	.00
1009.40	-3.33	.41	40.3	.248E-01	.41	8.66	.41	.00

```
   1086.13    -3.33     .41    41.0  .244E-01    .41     8.81     .41     .00
   1162.87    -3.33     .41    41.8  .239E-01    .41     8.97     .41     .00
   1239.60    -3.33     .41    42.5  .235E-01    .41     9.12     .41     .00
   1316.33    -3.33     .41    43.2  .232E-01    .41     9.27     .41     .00
   1393.07    -3.33     .41    43.9  .228E-01    .41     9.42     .41     .00
   1469.80    -3.33     .41    44.6  .224E-01    .41     9.57     .41     .00
   1546.53    -3.33     .41    45.2  .221E-01    .41     9.71     .41     .00
   1623.27    -3.33     .41    45.9  .218E-01    .41     9.86     .41     .00
   1700.00    -3.33     .41    46.6  .215E-01    .41    10.00     .41     .00
 Cumulative travel time =        6568. sec

 Simulation limit based on maximum specified distance =   1700.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
```

```
CORMIX2 PREDICTION FILE:
22222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
Subsystem CORMIX2:                                           Subsystem version:
 Submerged Multiport Diffuser Discharges    CORMIX_v.3.20_____September_1996
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:         CJMZ^with^12-ft^nine^1.75^port^diffuser^
 Design case:             CJ^Potential^Diffuser^with^200^cfs^river
 FILE NAME:               cormix\sim\SDe     .cx2
 Time of Fortran run:     12/16/13--08:18:57

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     31.70  AS    =     16.17  QA    =      5.67  ICHREG= 1
 HA    =       .51  HD    =       .66
 UA    =       .351 F     =       .088 USTAR = .3689E-01
 UW    =      2.000 UWSTAR= .2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  998.2051

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  RIGHT     DISTB =      3.33  YB1   =      1.50  YB2   =      5.16
 LD    =      3.66  NOPEN =    9       SPAC  =       .46
 D0    =       .044 A0    =       .002 H0    =       .05
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =     20.00  SIGMA =       .00  BETA  =     90.00
 U0    =      2.775 Q0    =       .023       = .2278E-01
 RHO0  =  997.5393  DRHO0 = .6658E+00  GP0   = .6541E-02
 C0    = .1000E+01  CUNITS=  mgl
 IPOLL =  1         KS    = .0000E+00  KD    = .0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    = .6224E-02  m0    = .1728E-01  j0    = .4072E-04  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =       .002 lM    =     14.56  lm    =       .14
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    = .2278E-01  M0    = .6323E-01  J0    = .1490E-03
 Associated 3-d length scales (meters)
 LQ    =       .09  LM    =     10.33  Lm    =       .72  Lb    =       .00
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =    724.56  FRD0  =    163.59  R     =      7.90
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2    2
 2  Applicable layer depth HS =      .66  2
 222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = .1000E+01  CUNITS=  mgl
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1700.00  XMAX  =   1700.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
         3.33 m  from the RIGHT bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 20 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE
```

```
 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

       X        Y       Z        S       C       BV       BH
       .00      .00     .05     1.0  .100E+01    .00     1.83

END OF MOD201: DIFFUSER DISCHARGE MODULE
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =     .66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)

       X        Y       Z        S       C       BV       BH
       .00      .00     .05     1.0  .100E+01    .00     1.83
       .09      .00     .06     9.9  .101E+00    .03     1.81
       .18      .00     .08    13.6  .736E-01    .07     1.79
       .27      .00     .09    16.4  .609E-01    .10     1.78
       .37      .00     .11    18.8  .532E-01    .13     1.76
       .46      .00     .12    20.9  .478E-01    .16     1.75
       .55      .00     .13    22.8  .438E-01    .20     1.74
       .64      .00     .15    24.6  .407E-01    .23     1.73
       .73      .00     .16    26.2  .382E-01    .26     1.72
       .82      .00     .18    27.7  .361E-01    .30     1.72
       .91      .00     .19    29.2  .343E-01    .33     1.71
      1.01      .00     .20    30.5  .328E-01    .36     1.70
      1.10      .00     .22    31.8  .314E-01    .40     1.70
      1.19      .00     .23    33.1  .302E-01    .43     1.69
      1.28      .00     .25    34.3  .291E-01    .46     1.69
      1.37      .00     .26    35.5  .282E-01    .50     1.69
      1.46      .00     .27    36.6  .273E-01    .53     1.69
      1.56      .00     .29    37.7  .265E-01    .56     1.68
      1.65      .00     .30    38.8  .258E-01    .59     1.68
      1.74      .00     .32    39.8  .251E-01    .63     1.68
      1.83      .00     .33    40.8  .245E-01    .66     1.68
 Cumulative travel time =           4. sec

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
         entire layer depth.
 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.
-----------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-----------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **
```

```
 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.19 to conserve the mass flux in the far-field!
-----------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Discharge is non-buoyant or weakly buoyant.
   Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING
-----------------------------------------------------------------------------
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-----------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   =  .487E-02 m^2/s
  Horizontal diffusivity (initial value) =  .609E-02 m^2/s

 The passive diffusion plume is VERTICALLY FULLY MIXED at beginning of region.

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

 Plume Stage 1 (not bank attached):
       X         Y        Z        S       C        BV       BH       ZU       ZL
      1.83      .00      .66     40.8  .245E-01    .66     2.00      .66      .00
      8.36      .00      .66     42.6  .235E-01    .66     2.09      .66      .00
     14.90      .00      .66     44.3  .226E-01    .66     2.17      .66      .00
     21.43      .00      .66     45.9  .218E-01    .66     2.25      .66      .00
     27.96      .00      .66     47.5  .210E-01    .66     2.33      .66      .00
     34.50      .00      .66     49.0  .204E-01    .66     2.40      .66      .00
     41.03      .00      .66     50.5  .198E-01    .66     2.47      .66      .00
     47.57      .00      .66     52.0  .192E-01    .66     2.55      .66      .00
     54.10      .00      .66     53.4  .187E-01    .66     2.61      .66      .00
     60.63      .00      .66     54.7  .183E-01    .66     2.68      .66      .00
     67.17      .00      .66     56.1  .178E-01    .66     2.75      .66      .00
     73.70      .00      .66     57.4  .174E-01    .66     2.81      .66      .00
     80.23      .00      .66     58.7  .170E-01    .66     2.87      .66      .00
     86.77      .00      .66     59.9  .167E-01    .66     2.93      .66      .00
     93.30      .00      .66     61.1  .164E-01    .66     2.99      .66      .00
     99.84      .00      .66     62.3  .160E-01    .66     3.05      .66      .00
    106.37      .00      .66     63.5  .157E-01    .66     3.11      .66      .00
    112.90      .00      .66     64.7  .155E-01    .66     3.17      .66      .00
    119.44      .00      .66     65.8  .152E-01    .66     3.22      .66      .00
    125.97      .00      .66     66.9  .149E-01    .66     3.28      .66      .00
    132.50      .00      .66     68.0  .147E-01    .66     3.33      .66      .00
 Cumulative travel time =         375. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X         Y        Z        S       C        BV       BH       ZU       ZL
    132.50    -3.33      .66     68.0  .147E-01    .66     6.66      .66      .00
    210.88    -3.33      .66     71.2  .140E-01    .66     6.97      .66      .00
    289.25    -3.33      .66     74.2  .135E-01    .66     7.27      .66      .00
    367.63    -3.33      .66     77.2  .130E-01    .66     7.56      .66      .00
    446.00    -3.33      .66     80.0  .125E-01    .66     7.83      .66      .00
    524.38    -3.33      .66     82.7  .121E-01    .66     8.10      .66      .00
    602.75    -3.33      .66     85.4  .117E-01    .66     8.36      .66      .00
    681.13    -3.33      .66     87.9  .114E-01    .66     8.61      .66      .00
    759.50    -3.33      .66     90.4  .111E-01    .66     8.85      .66      .00
    837.88    -3.33      .66     92.8  .108E-01    .66     9.09      .66      .00
    916.25    -3.33      .66     95.2  .105E-01    .66     9.32      .66      .00
    994.63    -3.33      .66     97.5  .103E-01    .66     9.55      .66      .00
```

```
   1073.00    -3.33     .66    99.7  .100E-01    .66     9.77     .66     .00
   1151.38    -3.33     .66   101.9  .981E-02    .66     9.98     .66     .00
   1229.75    -3.33     .66   104.1  .961E-02    .66    10.19     .66     .00
   1308.13    -3.33     .66   106.2  .942E-02    .66    10.40     .66     .00
   1386.50    -3.33     .66   108.3  .924E-02    .66    10.60     .66     .00
   1464.88    -3.33     .66   110.3  .907E-02    .66    10.80     .66     .00
   1543.25    -3.33     .66   112.3  .891E-02    .66    11.00     .66     .00
   1621.63    -3.33     .66   114.2  .875E-02    .66    11.19     .66     .00
   1700.00    -3.33     .66   116.2  .861E-02    .66    11.38     .66     .00
 Cumulative travel time =        4823. sec

 Simulation limit based on maximum specified distance =   1700.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
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CORMIX2 PREDICTION FILE:
22222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
Subsystem CORMIX2:                                         Subsystem version:
 Submerged Multiport Diffuser Discharges    CORMIX_v.3.20_____September_1996
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:         CJMZ^with^12-ft^nine^1.75^port^diffuser^
 Design case:             CJ^Potential^Diffuser^with^1Q10^river
 FILE NAME:               cormix\sim\SDy     .cx2
 Time of Fortran run:     12/16/13--08:24:42

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     24.30  AS    =      6.80  QA    =      1.66  ICHREG= 1
 HA    =       .28  HD    =       .36
 UA    =       .244 F     =       .108 USTAR = .2833E-01
 UW    =      2.000 UWSTAR= .2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  998.2051

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  RIGHT     DISTB =      3.33  YB1   =      1.50  YB2   =      5.16
 LD    =      3.66  NOPEN =    9       SPAC  =       .46
 D0    =       .044 A0    =       .002 H0    =       .05
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =     20.00  SIGMA =       .00  BETA  =     90.00
 U0    =      3.730 Q0    =       .031       = .3062E-01
 RHO0  =  997.5393  DRHO0 = .6658E+00  GP0   = .6541E-02
 C0    = .1000E+01  CUNITS=  mgl
 IPOLL =  1         KS    = .0000E+00  KD    = .0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    = .8366E-02  m0    = .3122E-01  j0    = .5473E-04  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =       .002 lM    =     21.59  lm    =       .52
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    = .3062E-01  M0    = .1142E+00  J0    = .2003E-03
 Associated 3-d length scales (meters)
 LQ    =       .09  LM    =     13.88  Lm    =      1.39  Lb    =       .01
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =    973.93  FRD0  =    219.89  R     =     15.28
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2    2
 2  Applicable layer depth HS =      .36  2
 222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = .1000E+01  CUNITS=  mgl
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1700.00  XMAX  =   1700.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
         3.33 m  from the RIGHT bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 20 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE
```

```
 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

       X        Y       Z        S       C       BV       BH
      .00      .00     .05     1.0  .100E+01    .00     1.83

END OF MOD201: DIFFUSER DISCHARGE MODULE
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =     .36m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)

       X        Y       Z        S       C       BV       BH
      .00      .00     .05     1.0  .100E+01    .00     1.83
      .09      .00     .06     4.3  .234E+00    .02     1.77
      .18      .00     .06     5.6  .178E+00    .04     1.71
      .27      .00     .07     6.7  .150E+00    .06     1.67
      .37      .00     .08     7.5  .133E+00    .07     1.62
      .46      .00     .08     8.3  .120E+00    .09     1.59
      .55      .00     .09     9.0  .111E+00    .11     1.56
      .64      .00     .10     9.7  .104E+00    .13     1.53
      .73      .00     .10    10.3  .975E-01    .15     1.50
      .82      .00     .11    10.8  .925E-01    .17     1.48
      .91      .00     .11    11.3  .881E-01    .18     1.46
     1.01      .00     .12    11.9  .844E-01    .20     1.44
     1.10      .00     .13    12.3  .811E-01    .22     1.43
     1.19      .00     .13    12.8  .781E-01    .24     1.42
     1.28      .00     .14    13.2  .755E-01    .26     1.40
     1.37      .00     .15    13.7  .731E-01    .28     1.40
     1.46      .00     .15    14.1  .710E-01    .29     1.39
     1.56      .00     .16    14.5  .690E-01    .31     1.39
     1.65      .00     .17    14.9  .672E-01    .33     1.38
     1.74      .00     .17    15.3  .655E-01    .35     1.38
     1.83      .00     .18    15.6  .640E-01    .36     1.38
 Cumulative travel time =          4. sec

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
         entire layer depth.
 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.
-----------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-----------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **
```

```
 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.94 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and internal hydraulic JUMPS.
-----------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Discharge is non-buoyant or weakly buoyant.
   Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING
-----------------------------------------------------------------------------
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-----------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   =  .204E-02 m^2/s
  Horizontal diffusivity (initial value) =  .255E-02 m^2/s

 The passive diffusion plume is VERTICALLY FULLY MIXED at beginning of region.

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
      1.83      .00     .36    15.6  .640E-01    .36     2.68     .36     .00
      7.92      .00     .36    15.8  .631E-01    .36     2.71     .36     .00
     14.02      .00     .36    16.1  .623E-01    .36     2.75     .36     .00
     20.11      .00     .36    16.3  .615E-01    .36     2.78     .36     .00
     26.21      .00     .36    16.5  .607E-01    .36     2.82     .36     .00
     32.30      .00     .36    16.7  .600E-01    .36     2.85     .36     .00
     38.40      .00     .36    16.9  .593E-01    .36     2.89     .36     .00
     44.49      .00     .36    17.1  .586E-01    .36     2.92     .36     .00
     50.59      .00     .36    17.3  .579E-01    .36     2.95     .36     .00
     56.68      .00     .36    17.5  .573E-01    .36     2.99     .36     .00
     62.78      .00     .36    17.6  .567E-01    .36     3.02     .36     .00
     68.87      .00     .36    17.8  .561E-01    .36     3.05     .36     .00
     74.97      .00     .36    18.0  .555E-01    .36     3.08     .36     .00
     81.06      .00     .36    18.2  .549E-01    .36     3.12     .36     .00
     87.16      .00     .36    18.4  .544E-01    .36     3.15     .36     .00
     93.25      .00     .36    18.6  .538E-01    .36     3.18     .36     .00
     99.35      .00     .36    18.8  .533E-01    .36     3.21     .36     .00
    105.44      .00     .36    18.9  .528E-01    .36     3.24     .36     .00
    111.53      .00     .36    19.1  .523E-01    .36     3.27     .36     .00
    117.63      .00     .36    19.3  .519E-01    .36     3.30     .36     .00
    123.72      .00     .36    19.5  .514E-01    .36     3.33     .36     .00
 Cumulative travel time =         494. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
    123.72    -3.33     .36    19.5  .514E-01    .36     6.66     .36     .00
    202.54    -3.33     .36    20.0  .500E-01    .36     6.85     .36     .00
    281.35    -3.33     .36    20.5  .487E-01    .36     7.03     .36     .00
    360.17    -3.33     .36    21.1  .475E-01    .36     7.21     .36     .00
    438.98    -3.33     .36    21.6  .464E-01    .36     7.38     .36     .00
    517.79    -3.33     .36    22.1  .453E-01    .36     7.55     .36     .00
    596.61    -3.33     .36    22.6  .443E-01    .36     7.72     .36     .00
    675.42    -3.33     .36    23.0  .434E-01    .36     7.88     .36     .00
    754.23    -3.33     .36    23.5  .426E-01    .36     8.04     .36     .00
```

```
    833.05    -3.33     .36    24.0  .417E-01    .36     8.20     .36     .00
    911.86    -3.33     .36    24.4  .410E-01    .36     8.35     .36     .00
    990.68    -3.33     .36    24.8  .402E-01    .36     8.50     .36     .00
   1069.49    -3.33     .36    25.3  .396E-01    .36     8.65     .36     .00
   1148.30    -3.33     .36    25.7  .389E-01    .36     8.80     .36     .00
   1227.12    -3.33     .36    26.1  .383E-01    .36     8.94     .36     .00
   1305.93    -3.33     .36    26.5  .377E-01    .36     9.08     .36     .00
   1384.75    -3.33     .36    26.9  .371E-01    .36     9.22     .36     .00
   1463.56    -3.33     .36    27.3  .366E-01    .36     9.36     .36     .00
   1542.37    -3.33     .36    27.7  .361E-01    .36     9.49     .36     .00
   1621.19    -3.33     .36    28.1  .356E-01    .36     9.63     .36     .00
   1700.00    -3.33     .36    28.5  .351E-01    .36     9.76     .36     .00
 Cumulative travel time =        6837. sec

 Simulation limit based on maximum specified distance =   1700.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
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Appendix G

Diffuser Hydraulics

Table G1. Diffuser Port Configuration Options for CJ WWTF Outfall 001

Number of Port 5
Port Diameter 1.5 inches

WWTF Flow Condition	Total Flow		port area	Flow per Port	Port Velocity		Comments
	mgd	cfs	ft^2	cfs	fps	mps	
Exist Average Wet Period	0.38	0.593	0.0123	0.1185	9.66	2.94	For Annual Wet Weather Periods - January 2010 through April 2013
DADWF	0.52	0.804	0.0123	0.1609	13.11	4.00	Dry Weather Design Flow Parameter
DAWWF	0.87	1.346	0.0123	0.2692	21.93	6.69	Wet Weather Design Flow Parameter
Maximum Flow	2.21	3.419	0.0123	0.6838	55.72	16.98	For Annual Wet Weather Periods - January 2010 through April 2013

Table G2. Diffuser Port Configuration Options for CJ WWTF Outfall 001

Number of Port 7
Port Diameter 1.75 inches

WWTF Flow Condition	Total Flow		port area	Flow per Port	Port Velocity		Comments
	mgd	cfs	ft^2	cfs	fps	mps	
Exist Average Wet Period	0.38	0.593	0.0167	0.0846	5.07	1.54	For Annual Wet Weather Periods - January 2010 through April 2013
DADWF	0.52	0.804	0.0167	0.1149	6.88	2.10	Dry Weather Design Flow Parameter
DAWWF	0.87	1.346	0.0167	0.1923	11.51	3.51	Wet Weather Design Flow Parameter
Maximum Flow	2.21	3.419	0.0167	0.4884	29.24	8.91	For Annual Wet Weather Periods - January 2010 through April 2013

Table G3. Diffuser Port Configuration Options for CJ WWTF Outfall 001

Number of Port 9
Port Diameter 1.75 inches

WWTF Flow Condition	Total Flow		port area	Flow per Port	Port Velocity		Comments
	mgd	cfs	ft^2	cfs	fps	mps	
Exist Average Wet Period	0.38	0.593	0.0167	0.0658	3.94	1.20	For Annual Wet Weather Periods - January 2010 through April 2013
DADWF	0.52	0.804	0.0167	0.0894	5.35	1.63	Dry Weather Design Flow Parameter
DAWWF	0.87	1.346	0.0167	0.1495	8.95	2.73	Wet Weather Design Flow Parameter
Maximum Flow	2.21	3.419	0.0167	0.3799	22.74	6.93	For Annual Wet Weather Periods - January 2010 through April 2013

Table G4. Diffuser Port Configuration Options for CJ WWTF Outfall 001

Number of Diffuser Pipes	1	
Diffuser Pipe Diameter	8	inches

WWTF Flow Condition	Total Flow		port area	Flow per Port	Port Velocity		Comments
	mgd	cfs	ft^2	cfs	fps	mps	
Exist Average Wet Period	0.38	0.593	0.3491	0.5925	1.70	0.52	For Annual Wet Weather Periods - January 2010 through April 2013
DADWF	0.52	0.804	0.3491	0.8044	2.30	0.70	Dry Weather Design Flow Parameter
DAWWF	0.87	1.346	0.3491	1.3459	3.86	1.18	Wet Weather Design Flow Parameter
Maximum Flow	2.21	3.419	0.3491	3.4189	9.79	2.99	For Annual Wet Weather Periods - January 2010 through April 2013

Table G5. Potential Diffuser Configurations for the Potential CJ WWTF Diffuser
Comparison of Nominal Fixed Orifice Diffuser Port Flow Areas and Other Engineering Parameters

Diffuser Pipe Diameter = 8 inches
Diffuser Length = 10 feet
Pipe Extension = 5.0 feet
Facility Flow Rate = 0.87 mgd Qf = DAWWF
= 1.35 cfs

Total Number of Ports	Nominal Port Diam. in	Diffuser Pipe Diam. in	Diffuser Length ft	Port Spacing O.C. ft	Diffuser Pipe Area ft^2	Diffuser Pipe Area in^2	Diffuser Pipe Velocity fps	Single Port Area ft^2	Single Port Area in^2	Total Port Area ft^2	Total Port Area in^2	P/P Area Ratio [A] P/P <0.67	Comment
Trial Configurations for Potential TSCA-002 Diffuser													
5	1.50	8	10.0	2.50	0.349	4.189	3.86	0.012	1.8	0.06	8.8	0.18	*Acceptable since P/P < 0.67*
5	2.00	8	10.0	2.50	0.349	4.189	3.86	0.022	3.1	0.11	15.7	0.31	*Acceptable since P/P < 0.67*
7	1.50	8	10.0	1.67	0.349	4.189	3.86	0.012	1.8	0.09	12.4	0.25	*Acceptable since P/P < 0.67*
7	1.75	8	10.0	1.67	0.349	4.189	3.86	0.017	2.4	0.12	16.8	0.33	*Acceptable since P/P < 0.67*
9	1.75	8	10.0	1.25	0.349	4.189	3.86	0.017	2.4	0.15	21.6	0.43	*Acceptable since P/P < 0.67*

[A] Ideally, the Diffuser Pipe/Diffuser Ports (P/P) Area ratio should be between 1/3 and 2/3 for balanced flow across all the diffuser ports.

Table G6. Potential Diffuser Configurations for the Potential CJ WWTF Diffuser
Comparison of Nominal Fixed Orifice Diffuser Port Flow Areas and Other Engineering Parameters

Diffuser Pipe Diameter =	8	inches	
Diffuser Length =	12	feet	
Pipe Extension =	5.0	feet	
Facility Flow Rate =	0.87	mgd	Qf = DAWWF
=	1.35	cfs	

Total Number of Ports	Nominal Port Diam. in	Diffuser Pipe Diam. in	Diffuser Length ft	Port Spacing O.C. ft	Diffuser Pipe Area		Diffuser Pipe Velocity fps	Single Port Area		Total Port Area		P/P Area Ratio [A] P/P <0.67	Comment
					ft^2	in^2		ft^2	in^2	ft^2	in^2		
Trial Configurations for Potential TSCA-002 Diffuser													
5	1.50	8	12.0	3.00	0.349	4.189	3.86	0.012	1.8	0.06	8.8	0.18	*Acceptable since P/P < 0.67*
5	2.00	8	12.0	3.00	0.349	4.189	3.86	0.022	3.1	0.11	15.7	0.31	*Acceptable since P/P < 0.67*
7	1.50	8	12.0	2.00	0.349	4.189	3.86	0.012	1.8	0.09	12.4	0.25	*Acceptable since P/P < 0.67*
7	1.75	8	12.0	2.00	0.349	4.189	3.86	0.017	2.4	0.12	16.8	0.33	*Acceptable since P/P < 0.67*
9	1.75	8	12.0	1.50	0.349	4.189	3.86	0.017	2.4	0.15	21.6	0.43	*Acceptable since P/P < 0.67*

[A] Ideally, the Diffuser Pipe/Diffuser Ports (P/P) Area ratio should be between 1/3 and 2/3 for balanced flow across all the diffuser ports.

APPENDIX C

Facility Name: Cave Junction WWTP **Date:** 7/28/2014

Enter data into white cells below:

Mixing Zone Dilution =	**4.6**	
7Q10 =	**75.2**	cfs
Effluent Flow =	**0.52**	mgd
Applicable Temperature Criterion	**13.0**	ºC
Effluent Temperature	**18.7**	ºC
Allowable increase =	**0.30**	ºC

Dilution at 25% Stream Flow = **24**

ΔT at edge of MZ=	**1.24**	**ºC**	**Reasonable Potential**
ΔT at 25% Stream Flow=	**0.23**	**ºC**	

Thermal Load Limit = 2.7 Million Kcals

Equation used to calculate ΔT at edge of MZ

$$\Delta T_{mz} = \frac{T_e + (S-1)T_a}{S} - T_a$$

Equation used to calculate thermal load limit

$$TLL = 3.78541 Q_e S \Delta T_{all} C_p \rho$$

Where:

Q_e = Effluent Flow in mgd

S = Dilution

ΔT_{all} = Allowable temperature increase at edge of MZ (°C)

Cp = Specific Heat of Water (1 cal/g °C)

ρ = Density of Water (1 g/cm^3)

3785.41 = Flow conversion from mgd to m^3/day

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APPENDIX D

Civil West
Engineering Services, Inc.

486 E Street • Coos Bay, OR 97420 • 541/266-8601 • Fax 541/266-8681
609 SW Hurbert Street• Newport, OR 97365

MEMORANDUM

Date: April 26th, 2013 Work Order Number:

To: Ryan L. Nolan, Recorder and Travis Robbins, Public Works, City of Cave Junction

From: Marlin Gochnour, Civil West Engineering Services, Inc.

RE: Flowmapping Study Results
Civil West Project Number: 1207-002

Dear Ryan and Travis,

Civil West recently completed a flowmapping study of the entire wastewater system for the City of Cave Junction. Flowmapping is utilized to check for infiltration of groundwater into sewer pipes. Western Oregon experiences high winter groundwater levels which can place an unneeded burden on wastewater treatment facilities if infiltration is left unaddressed. Our team found approximately 14 manholes requiring repairs or cleaning with several locations identified as having high levels of potential infiltration. A summary of the 14 manholes and the observed issues are:

A. Manhole A-4; Small Leak in Stub
B. Manhole B-3; Root Intrusion
C. Manhole B-8; Root Intrusion
D. Manhole B-30A; Leak Around Pipe (5± gpm)
E. Manhole C-1; Grout limiting Access to Channel/Pipe
F. Manhole E-1; Standing Water in Base, Unable to Measure Flow
G. Manhole E-7; Leak Around Pipe (3± gpm)
H. Manhole E-15; Small Leaks Around Pipe & at Old Patch Halfway up Manhole
I. Manhole F-2; Small Leak Around Pipe
J. Manhole L-2; Base and First Barrel Joints Leaking (10± gpm)
K. Manhole L-9; Small Leak Around Pipe & at Old Patch in Manhole Barrel
L. Manhole L-10; Small Leak Around Pipe
M. Manhole L-11; Small Leak Between Base and First Barrel
N. Manhole L-14; Small Leak Between Base and First Barrel

Flowmapping is done at night following winter storms so it effectively measures infiltration while minimizing any flows caused from residential and business use. Measuring flows in winter allows observation and measurement of peak infiltration and avoids the need to check every pipeline and manhole in the system. Dry nights are chosen to reduce the impact of surface water inflow. Potential inflow is typically found through a smoketesting study and combined with flowmapping to complete an inflow and infiltration (I/I) Study. The procedure we used to complete the flowmapping study was:

1. Divide the City's sewer system into drainage basins (we used a sewer facility map provided by the City and broke the City's system into 12 basins).
2. Open the manhole at the bottom of the basin.
3. Inspect the manhole condition and inspect flows coming from each inlet pipe.
4. Manholes in need of repair or filled with debris are recorded in a field notebook.
5. Visually sizeable flows are measured with the use of an Isco Flow Poke. It allows our teams in the field to quickly and accurately check flow rates. The Flow Poke is an instrument which creates an upstream backpressure calibrated to known flow rates across a weir. This pressure is read by the operator from a liquid gage scale marked with flow rates. Each pipe diameter has a matching weir calibrated for it and can be changed in the field.
6. Flow rates were recorded into a field notebook.
7. If flows were found significant we moved onto the next accessible upstream manhole connected to the inlet.
8. Repeat the process until flows become insignificant (usually less than 1-2 gpm indicates insignificant flow).
9. Move onto the next basin.

One team was used to complete the study in a single night. The notes from the team have been compiled and drawn onto a map of the city. Manholes were checked until they had little flow compared to their drainage area. For instance, if a manhole has 5 gallons per minute (gpm) coming from one inlet, and 1 gpm from another, it can be deduced the pipeline and manholes upstream are contributing very little infiltration into the system. Likewise if a manhole has 40 gpm flowing out of an inlet (over 50,000 gallons per day), the upstream manholes and piping network require measurement.

The map we are providing has the following information on them:

- Sewer Basins
- Manholes and Manhole numbers
- Markings indicating leaking or debris-filled/damaged manholes
- Arrows indicating the direction of flow and the measured flow rate in GPM

The map can be used to see variations in the flow rate over a short distance. An example would be manhole L-25 which has 9 gpm flowing north from manhole L-26 that has almost no flow coming into it. Here, an approximate 9 gpm flow is found with the likely source being infiltration. Some other places with infiltration potential are:

A. Manhole C-1 to C-22
B. Manhole C-37 to C34
C. Manhole B-37 to C-1
D. Manhole D-1 to D-18
E. Manhole E-15 to E-20
F. Manhole E-12 to E-15
G. Manhole L-1 to K-1
H. Manhole L-9 to L-11

This list is not exhaustive and as you go through the map you will find other areas with leaking manholes or potential pipeline infiltration.

The next step is to televise potential problem areas to identify the sources of I/I. Televising must be completed while groundwater levels are still high and infiltration is active. The goal of televising is to record video of the exact inflow and infiltration sources. High groundwater typically lasts until the end of May in western Oregon.

Televising of sewer lines is offered by a variety of companies and costs approximately $1.50 per lineal foot of pipe. Since televising is capable of identifying both types of I/I sources, locations would be chosen from results both the smoketesting and flowmapping studies.

With televising, the flowmapping study, and a smoketesting study complete, the City will have the information required to complete a preliminary engineering report. That report should contain recommended projects for reducing I/I and estimated project costs. Steps can then be taken towards securing funding to repair and replace deficient facilities.

If any questions arise regarding how to use the map or assistance is required to acquire televising services, please contact me.

Sincerely,
Civil West Engineering Services, Inc.

Marlin Gochnour, PE

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APPENDIX E

File 15243

City of Cave Junction • Home of the Oregon Caves

HOME OF THE OREGON CAVES

P.O. Box 1396 • 222 Lister Street • Cave Junction, OR 97523
Phone (541) 592-2156 • Fax (541) 592-6694 • TDD Relay 1-800-735-2900
e-mail: cityofcj@cavenet.com

August, 25 2004

Mr. Andy Ullrich
Department of Environmental Quality
22 Stewart Ave, Suite 201
Medford, OR 97501

RE: Request for Approval
Temporary Waste Plan (with modifications) as Permanent Plan

The City of Cave Junction is requesting the Department approve the City's Temporary Waste Plan (approved in June 2004) as a permanent plan, allowing the City of Cave Junction to accept septage on a recurring basis.

The City is requesting the plan approval with the following changes:

- The waste hauler will be primarily a local septage company and not limited to Roto-Rooter.
- The waste received will be from pumping of septic tanks.
- The hauler will submit with each load the source of the load to include:
  Address
  Name of property owner
  Telephone number
  An affidavit that the waste contains no hazardous or toxic substances.
- The City will require, prior to disposal, hauler to be licensed with the City, and Certificate of Insurance naming the City as an also insured, and a copy of bond if bonded.

Thank you for your consideration in this matter. If you have any questions please feel free to contact me at (541)592-4590.

Michael J. Bollweg

MICHAEL J. BOLLWEG
Lead Treatment Operator

RECEIVED
AUG 27 2004
DEQ - MEDFORD

File 15243

City of Cave Junction • Home of the Oregon Caves

P.O. Box 1396 • 222 Lister Street • Cave Junction, OR 97523
Phone (541) 592-2156 • Fax (541) 592-6694 • TDD Relay 1-800-735-2900
e-mail: cityofcj@cavenet.com

May, 3 2004

Mr. Andy Ullrich
Department of Environmental Quality
201 W Main Suite 2-D
Medford, OR 97501

RE: Request to allow Temporary Waste Disposal

The City of Cave Junction received a request to accept for final disposal of both Grey and Black water from the Cycle Oregon event.

The City requests the Department of Environmental Quality to allow the City to accept the wastewater from this event. Please consider the following:

1. Background

1.a. The City of Cave Junction's history of compliance since construction of its new plant 7 years ago is excellent

1.b. The City of Cave Junction's Wastewater Treatment Plant has adequate capacity to accept septage

1.c. The City's Staff at the facility has the operational and laboratory equipment and skills to determine waste characteristics and make proper determination on the acceptance of septage and its potential impact on the treatment process with adequate safe guards to prevent pass through or upset.

1.d. The period of acceptance will be at a time that the facility is under-loaded and discharge can be stopped at any time.

1.e. The City will be working on a long term plan for accepting septage and what is learned from this event will provide additional information to create that plan

1.f. This is a one-time request

2. Collecting waste hauler information, characterizing hauled waste and evaluating potential impacts to the treatment plant.

2.a Waste Hauler information

2.a(1) The Waste Hauler will be Roto-Rooter.

2.a(2) The waste will be "domestic only waste" from portable toilets and showers. The toilets will contain a chemical of which the hauler will be required to submit MSDS and manufacturer information prior to disposal. The chemical that was suggested should be non-toxic to the treatment process.

2.a(3) No other hauler will be transporting waste.

RECEIVED
MAY 12 2004
DEQ - MEDFORD

2.a(4). The following information as required will be on record from the hauler:

Name of Business
Name of Owner
Address and phone number
Types of waste hauled (Domestic Only)
Number and capacity of Vehicles
Hours of Operation
Names of other POTW in area they discharge into

2.a(5) Maintenance records Data information

2.a(5)(a) See supplied Tracking sheets, which includes:

Name of company
Address
Phone
Superintendent
Location of Generation of waste
Truck capacity
Date load accepted
Random check for pH of Grey water
pH and % of Solids on all Black water

2.b. Determining Waste Characteristics and acceptance

Source of Waste Domestic?	Yes/ No	No, Do not accept waste and notify other POTW of refusal. Yes…Proceed down list
Will Waste Cause Toxic fumes/ Gases, Flammable or Explosive Conditions?	Yes/ No	Yes , Do not accept waste and notify other POTW of refusal NO…Proceed down list
Will waste cause corrosion or exceed pH limits?	Yes/ No	Yes, Do not accept waste and notify other POTW of refusal No…Proceed down list
Will waste cause slug loading interference/ Pass through?	Yes/ No	Yes Refuse waste and notify other POTW No…Accept waste

2.c. Disposal location of accepted Wastes

Classification of Waste	Location of Disposal	Testing Required
Black water	Aerobic Digester	PH….Percentage of Solids
Grey water	Man hole at Treatment plant head works	PH random at least every five loads

Volume of waste Requested Estimate:

Black Water < 10,000 gallons

Grey Water <50,000 gallons

Legal Authority

The City will be developing proposed changes to local ordinances for our final plan. Adequate safe guards to maintain legal authorities for this one time event exist. The hauler will be only allowed to discharge characterized domestic wastes that would not cause a negative affect on the waste treatment system. The City reserves the right to refuse any waste for any reason. The prohibitions as defined in the 40CFR 403.5 apply to all discharges including domestic hauled waste will be strictly enforced. The hauler will receive a copy of this temporary plan if approved.

Thank you for consideration in this matter. Please contact me if you have any questions, need additional information or to discuss this request.

Michael Bollweg

Michael Bollweg
Lead Treatment Operator

Mayor's Review: ______

GREY WATER TREATMENT AGREEMENT

Date: ____________________

Name: ________________________________

Mailing Address: ________________________

________________________ Phone: ____________________

Physical Address: ________________________

____

The City of Cave Junction will accept grey water treatment for $0.01 per gallon (charge to based on the capacity of the truck, when full).

The purchaser assumes all responsibility and liability for the condition and/or sanitation of the container being used to transport the grey water. All waste will be domestic and consistent with the Department of Environmental Quality approved plan and will comply with the rules stated in 40CFR403.5.

The purchaser shall hold the City of Cave Junction, or members thereof, its officers, agents or employees harmless, and said purchaser shall indemnify them against any loss, injury or damage which they or any of them may sustain by reason of the acts, conduct or operations of the purchaser, its agents or employees in connection with this agreement.

The City of Cave Junction reserves the right to refuse any waste for any reason. The City shall hold the hauler responsible for discharge of waste that is not consistent with the characteristics of domestic waste. Any waste except domestic waste is strictly prohibited.

Signature: ______________________________

CITY OF CAVE JUNCTION
222 W. LISTER STREET
PO BOX 1396
CAVE JUNCTION OR 97523
(541) 592-2156

TEMPORARY - GREY WATER DISPOSAL
(Head Works Only)

Name of Company: ____

Address: ____

Phone: ______________________________

Location (Generated): ____

Date	Time	Truck Capacity (Gal)	Full (Yes/No)	pH

Authorized Signature: ______________________________

Date: ________________________

BLACK WATER TREATMENT AGREEMENT

Date: ____________________

Name: __________________________________

Mailing Address: _________________________

_________________________ Phone: ____________________

Physical Address: ________________________

____

The City of Cave Junction will accept grey water treatment for $0.13 per gallon (charge to based on the capacity of the truck, when full).

The purchaser assumes all responsibility and liability for the condition and/or sanitation of the container being used to transport the grey water. All waste will be domestic and consistent with the Department of Environmental Quality approved plan and will comply with the rules stated in 40CFR403.5.

The purchaser shall hold the City of Cave Junction, or members thereof, its officers, agents or employees harmless, and said purchaser shall indemnify them against any loss, injury or damage which they or any of them may sustain by reason of the acts, conduct or operations of the purchaser, its agents or employees in connection with this agreement.

The City of Cave Junction reserves the right to refuse any waste for any reason. The City shall hold the hauler responsible for discharge of waste that is not consistent with the characteristics of domestic waste. Any waste except domestic waste is strictly prohibited.

Signature: ________________________________

CITY OF CAVE JUNCTION
222 W. LISTER STREET
PO BOX 1396
CAVE JUNCTION OR 97523
(541) 592-2156

TEMPORARY - BLACK WATER DISPOSAL
(Digester Only)
(*All Loads must be Sampled*)

Name of Company: ____________________

Address: ____________________

Phone: ____________________

Location (Generated): ____________________

Driver Initials	Date	Time	Truck Capacity (Gal)	Full (Yes/No)	pH/%Solids

Authorized Signature: ____________________

Date: ____________________

May __, 2004

Cycle Oregon

SUBJECT: Letter of Agreement

The City of Cave Junction is proposing an agreement to provide potable water to the Cycle Oregon event that will encamp at Lake Selmac. The City will provide log sheets to account for all water taken. Each transport vehicle operator will require training in the proper operation of the City's distribution system to obtain potable water. The cost for potable water will be $0.01 per gallon. The training for each transport operator will cost $20.00. The charge for potable water will be based on a per truck rate, maximum capacity of the truck.

The City of Cave Junction is proposing an agreement to provide treatment of grey water from the event. The City will provide log sheets to account for all grey water dumped into the City's collection system. The City will provide a location for the transport operators to use to dump grey water: The cost for disposal of grey water will be $0.01 per gallon. The charge for grey water will be based on the maximum capacity of the truck used to transport the waste.

The City of Cave Junction is proposing an agreement to provide treatment of a limited amount of black water from the event. The City will provide log sheets to account for all black water dumped into the City's collection system. The City will provide a location for the transport operators to use to dump black water: The cost for disposal of black water will be $0.13 per gallon. The charge for black water will be based on the maximum capacity of the truck used to transport the waste.

The City is requesting a list of all commercial operators under contract to transport potable, grey or black water to and from the City to ensure accountability of the resources.

Please feel free to contact Gary Biggs or myself if you have any questions or need additional information.

CHARLES J. (Jim) POLK
Recorder

Mayor's Review: ____

WATER PURCHASE AGREEMENT

Date: ____________________

Name: _________________________________

Mailing Address: _________________________

_________________________ Phone: ____________________

Physical Address: ________________________

____

The City of Cave Junction sells potable water for $0.01 per gallon. The minimum quantity is 400 gallons per load ($4.00). The charge for potable water will be based on the capacity of the truck used to transport the water.

The City of Cave Junction warrants the water has been tested and meets all requirements of the Department of Human Resources, Drinking Water Program, for potable water.

The purchaser assumes all responsibility and liability for the condition and/or sanitation of the container being used to transport the water.

The purchaser shall hold the City of Cave Junction, or members thereof, its officers, agents or employees harmless, and said purchaser shall indemnify them against any loss, injury or damage which they or any of them may sustain by reason of the acts, conduct or operations of the purchaser, its agents or employees in connection with this agreement.

Signature: ______________________________

CITY OF CAVE JUNCTION
222 W. LISTER STREET
PO BOX 1396
CAVE JUNCTION OR 97523
(541) 592-2156

TEMPORARY - POTABLE WATER

Name of Company: ______________________________

Address: ______________________________

Phone: ________________ Super: ________________

Location: ________________ Truck Size: ____________

Date: ____________ Amount Taken: ____________ gals/cubic ft.

Date: ____________ Amount Taken: ____________

Date: ____________ Amount Taken: ____________

Date: ____________ Amount Taken: ____________

Date: ____________ Amount Taken: ____________

Date: ____________ Amount Taken: ____________

Date: ____________ Amount Taken: ____________

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Date: ____________ Amount Taken: ____________

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Date: ____________ Amount Taken: ____________

Date: ____________ Amount Taken: ____________

Authorized Signature: ______________________

Date: ____________

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APPENDIX F

United States Department of Agriculture

NRCS

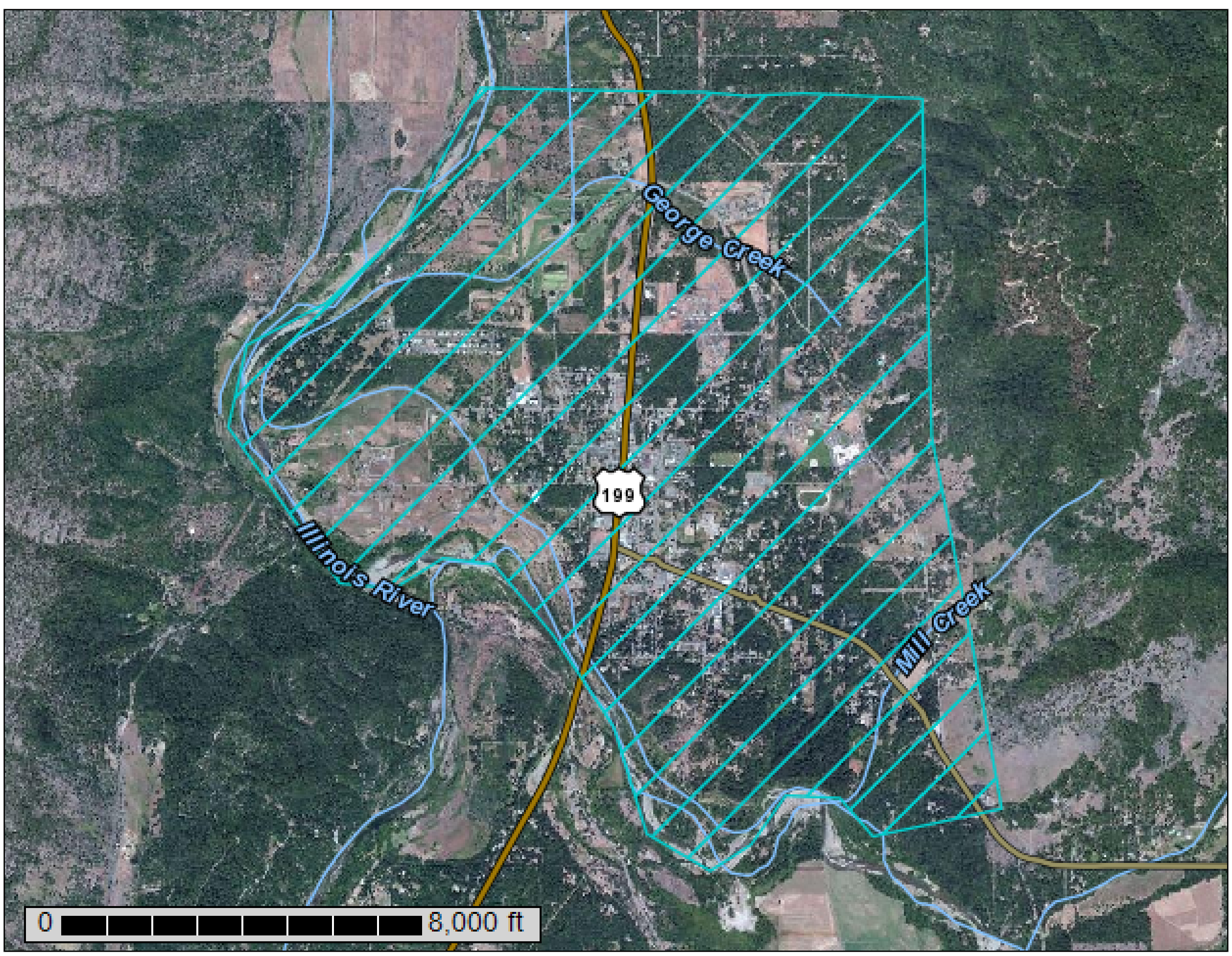
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Josephine County, Oregon

Cave Junction



August 14, 2013

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

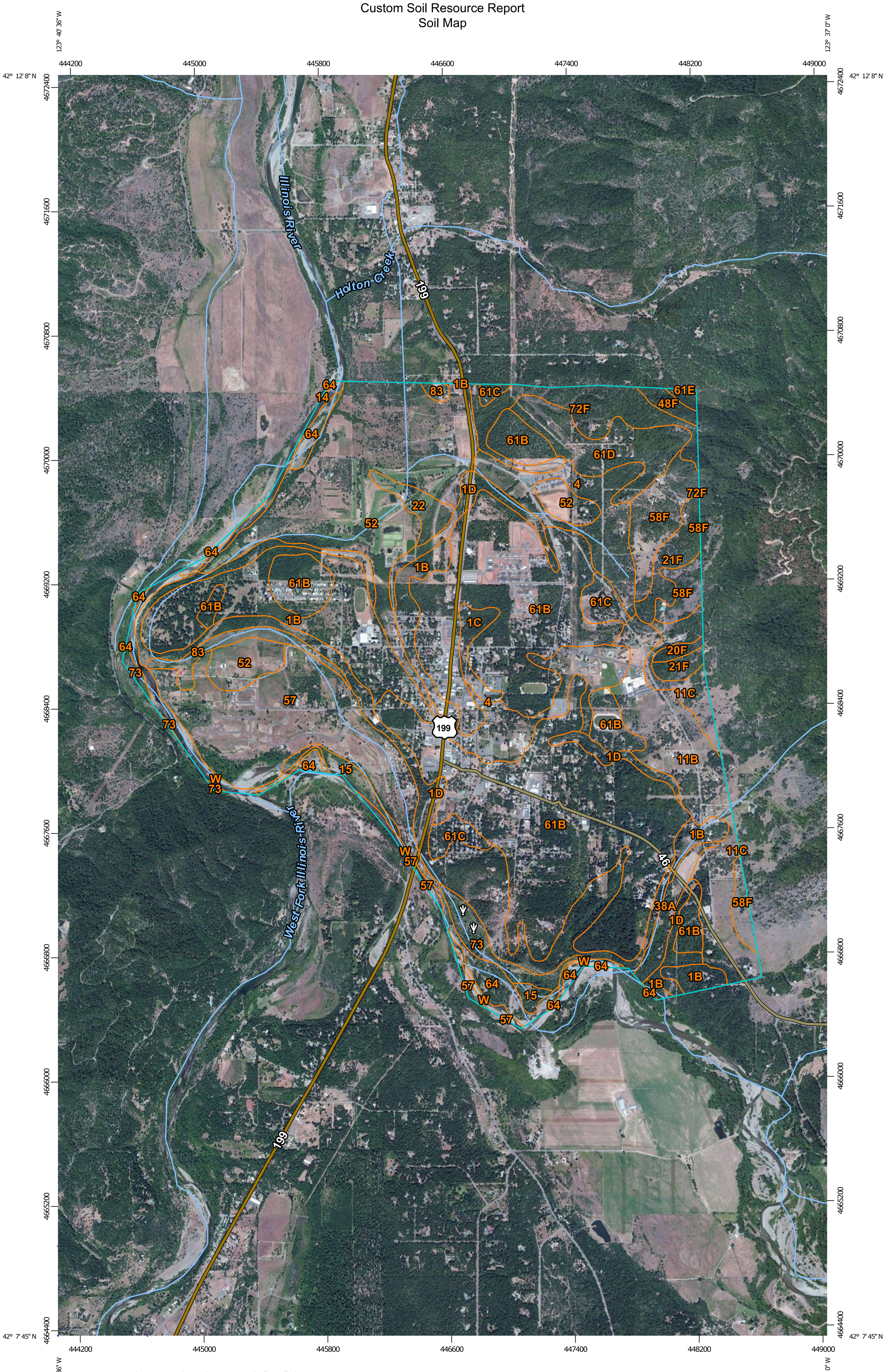
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:22,700 if printed on B portrait (11" x 17") sheet.

Meters: 0, 300, 600, 1200, 1800

Feet: 0, 1000, 2000, 4000, 6000

N

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Josephine County, Oregon
Survey Area Data: Version 8, Aug 20, 2012

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 30, 2010—Jul 17, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Josephine County, Oregon (OR033)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1B	Abegg gravelly loam, 2 to 7 percent slopes	220.0	8.0%
1C	Abegg gravelly loam, 7 to 12 percent slopes	18.3	0.7%
1D	Abegg gravelly loam, 12 to 20 percent slopes	235.3	8.6%
4	Banning loam	161.6	5.9%
11B	Brockman clay loam, 2 to 7 percent slopes	161.1	5.9%
11C	Brockman clay loam, 7 to 12 percent slopes	34.3	1.3%
14	Camas gravelly sandy loam	0.2	0.0%
15	Camas-Newberg complex	22.8	0.8%
20F	Cornutt-Dubakella complex, 35 to 55 percent north slopes	6.1	0.2%
21F	Cornutt-Dubakella complex, 35 to 55 percent south slopes	41.2	1.5%
22	Cove silty clay loam	21.0	0.8%
38A	Foehlin gravelly loam, 0 to 3 percent slopes	24.6	0.9%
48F	Josephine gravelly loam, 35 to 55 percent north slopes	9.9	0.4%
52	Kerby loam	340.2	12.4%
57	Newberg fine sandy loam	225.8	8.2%
58F	Pearsoll-Rock outcrop complex, 20 to 60 percent slopes	84.0	3.1%
61B	Pollard loam, 2 to 7 percent slopes	768.3	28.1%
61C	Pollard loam, 7 to 12 percent slopes	36.0	1.3%
61D	Pollard loam, 12 to 20 percent slopes	76.0	2.8%
61E	Pollard loam, 20 to 35 percent slopes	4.1	0.1%
64	Riverwash	53.6	2.0%
72F	Speaker-Josephine gravelly loams, 35 to 55 percent south slopes	72.9	2.7%
73	Takilma cobbly loam	34.5	1.3%
83	Wapato silt loam	29.3	1.1%
W	Water	57.8	2.1%
Totals for Area of Interest		**2,739.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Josephine County, Oregon

1B—Abegg gravelly loam, 2 to 7 percent slopes

Map Unit Setting

Elevation: 800 to 2,500 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 140 to 170 days

Map Unit Composition

Abegg and similar soils: 82 percent
Minor components: 1 percent

Description of Abegg

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium from igneous, metamorphic and sedimentary rock

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 3s
Land capability (nonirrigated): 4s
Hydrologic Soil Group: B

Typical profile

0 to 2 inches: Slightly decomposed plant material
2 to 18 inches: Gravelly loam
18 to 28 inches: Very gravelly clay loam
28 to 57 inches: Extremely gravelly loam
57 to 61 inches: Extremely gravelly loamy sand

Minor Components

Aqualfs

Percent of map unit: 1 percent
Landform: Terraces

1C—Abegg gravelly loam, 7 to 12 percent slopes

Map Unit Setting

Elevation: 800 to 2,500 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 140 to 170 days

Map Unit Composition

Abegg and similar soils: 83 percent
Minor components: 1 percent

Description of Abegg

Setting

Landform: Stream terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium from igneous, metamorphic and sedimentary rock

Properties and qualities

Slope: 7 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 4s
Land capability (nonirrigated): 4s
Hydrologic Soil Group: B

Typical profile

0 to 2 inches: Slightly decomposed plant material
2 to 18 inches: Gravelly loam
18 to 28 inches: Very gravelly clay loam
28 to 57 inches: Extremely gravelly loam
57 to 61 inches: Extremely gravelly loamy sand

Minor Components

Aqualfs

Percent of map unit: 1 percent

Landform: Terraces

1D—Abegg gravelly loam, 12 to 20 percent slopes

Map Unit Setting

Elevation: 800 to 2,500 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 140 to 170 days

Map Unit Composition

Abegg and similar soils: 79 percent
Minor components: 1 percent

Description of Abegg

Setting

Landform: Stream terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium from igneous, metamorphic and sedimentary rock

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 4s
Land capability (nonirrigated): 4s
Hydrologic Soil Group: B

Typical profile

0 to 2 inches: Slightly decomposed plant material
2 to 18 inches: Gravelly loam
18 to 28 inches: Very gravelly clay loam
28 to 57 inches: Extremely gravelly loam
57 to 61 inches: Extremely gravelly loamy sand

Minor Components

Aqualfs

Percent of map unit: 1 percent
Landform: Terraces

4—Banning loam

Map Unit Setting

Elevation: 800 to 2,500 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 140 to 170 days

Map Unit Composition

Banning and similar soils: 81 percent
Minor components: 13 percent

Description of Banning

Setting

Landform: Alluvial fans, drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and metamorphic rock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.6 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability classification (irrigated): 2w
Land capability (nonirrigated): 2w
Hydrologic Soil Group: C

Typical profile

0 to 6 inches: Loam
6 to 60 inches: Clay loam

Minor Components

Wapato

Percent of map unit: 10 percent
Landform: Flood plains, basin floors
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Cove

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Aquolls

Percent of map unit: 1 percent
Landform: Alluvial fans

11B—Brockman clay loam, 2 to 7 percent slopes

Map Unit Setting

Elevation: 800 to 4,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 120 to 170 days

Map Unit Composition

Brockman and similar soils: 72 percent
Minor components: 6 percent

Description of Brockman

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium derived from peridotite and serpentinite

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None

Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 3e
Land capability (nonirrigated): 6e
Hydrologic Soil Group: D

Typical profile

0 to 9 inches: Clay loam
9 to 16 inches: Cobbly clay
16 to 60 inches: Cobbly clay

Minor Components

Copsey

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Aquepts

Percent of map unit: 1 percent
Landform: Alluvial fans

11C—Brockman clay loam, 7 to 12 percent slopes

Map Unit Setting

Elevation: 800 to 4,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 120 to 170 days

Map Unit Composition

Brockman and similar soils: 71 percent
Minor components: 3 percent

Description of Brockman

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium derived from peridotite and serpentinite

Properties and qualities

Slope: 7 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 4e
Land capability (nonirrigated): 6e
Hydrologic Soil Group: D

Typical profile

0 to 9 inches: Clay loam
9 to 16 inches: Cobbly clay
16 to 60 inches: Cobbly clay

Minor Components

Copsey

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Aquepts

Percent of map unit: 1 percent
Landform: Alluvial fans

14—Camas gravelly sandy loam

Map Unit Setting

Elevation: 750 to 2,500 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 150 to 170 days

Map Unit Composition

Camas and similar soils: 73 percent
Minor components: 11 percent

Description of Camas

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 9 to 17 inches to strongly contrasting textural stratification
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None
Available water capacity: Very low (about 0.8 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 4w
Land capability (nonirrigated): 4w
Hydrologic Soil Group: A

Typical profile

0 to 10 inches: Gravelly sandy loam
10 to 60 inches: Extremely gravelly sand

Minor Components

Riverwash

Percent of map unit: 10 percent
Landform: Flood plains

Aquolls

Percent of map unit: 1 percent
Landform: Flood plains

15—Camas-Newberg complex

Map Unit Setting

Elevation: 750 to 2,500 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 150 to 170 days

Map Unit Composition

Camas and similar soils: 45 percent
Newberg and similar soils: 35 percent
Minor components: 10 percent

Description of Camas

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Gravelly alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 9 to 17 inches to strongly contrasting textural stratification
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None
Available water capacity: Very low (about 0.8 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 4w
Land capability (nonirrigated): 4w
Hydrologic Soil Group: A

Typical profile

0 to 10 inches: Gravelly sandy loam
10 to 60 inches: Extremely gravelly sand

Description of Newberg

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: NoneOccasional
Frequency of ponding: None
Available water capacity: Moderate (about 7.3 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 2w
Land capability (nonirrigated): 2w
Hydrologic Soil Group: A

Typical profile

0 to 15 inches: Fine sandy loam
15 to 24 inches: Sandy loam
24 to 61 inches: Loamy fine sand

Minor Components

Riverwash

Percent of map unit: 9 percent
Landform: Flood plains

Aquolls

Percent of map unit: 1 percent
Landform: Flood plains

20F—Cornutt-Dubakella complex, 35 to 55 percent north slopes

Map Unit Setting

Elevation: 1,000 to 5,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 100 to 160 days

Map Unit Composition

Cornutt, north, and similar soils: 40 percent
Dubakella, north, and similar soils: 30 percent

Description of Cornutt, North

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium and colluvium derived from ultramafic rock and metasedimentary rock

Properties and qualities

Slope: 35 to 55 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: C

Typical profile

0 to 1 inches: Moderately decomposed plant material
1 to 12 inches: Cobbly clay loam
12 to 42 inches: Clay
42 to 52 inches: Weathered bedrock

Description of Dubakella, North

Setting

Landform: Mountain slopes, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Colluvium and/or residuum weathered from serpentinite

Properties and qualities

Slope: 35 to 55 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: D

Typical profile

0 to 7 inches: Very cobbly clay loam
7 to 28 inches: Extremely cobbly clay
28 to 32 inches: Unweathered bedrock

21F—Cornutt-Dubakella complex, 35 to 55 percent south slopes

Map Unit Setting

Elevation: 1,000 to 5,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 100 to 160 days

Map Unit Composition

Cornutt, south, and similar soils: 40 percent
Dubakella, south, and similar soils: 35 percent

Description of Cornutt, South

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex

Across-slope shape: Convex
Parent material: Alluvium and colluvium derived from ultramafic rock and metasedimentary rock

Properties and qualities

Slope: 35 to 55 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: C

Typical profile

0 to 1 inches: Moderately decomposed plant material
1 to 12 inches: Cobbly clay loam
12 to 42 inches: Clay
42 to 52 inches: Weathered bedrock

Description of Dubakella, South

Setting

Landform: Mountain slopes, ridges
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium and/or residuum weathered from serpentinite

Properties and qualities

Slope: 35 to 55 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: D

Typical profile

0 to 7 inches: Very cobbly clay loam
7 to 28 inches: Extremely cobbly clay
28 to 32 inches: Unweathered bedrock

22—Cove silty clay loam

Map Unit Setting

Elevation: 100 to 2,500 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 140 to 210 days

Map Unit Composition

Cove and similar soils: 84 percent
Minor components: 11 percent

Description of Cove

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None
Available water capacity: High (about 9.9 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 3w
Land capability (nonirrigated): 3w
Hydrologic Soil Group: D

Typical profile

0 to 8 inches: Silty clay loam
8 to 60 inches: Silty clay

Minor Components

Wapato

Percent of map unit: 10 percent
Landform: Flood plains, basin floors
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Cove, gravelly surface

Percent of map unit: 1 percent
Landform: Flood plains

38A—Foehlin gravelly loam, 0 to 3 percent slopes

Map Unit Setting

Elevation: 800 to 2,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 140 to 170 days

Map Unit Composition

Foehlin and similar soils: 74 percent
Minor components: 1 percent

Description of Foehlin

Setting

Landform: Alluvial fans, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from ultramafic or granitic rock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 9.4 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability classification (irrigated): 2s
Land capability (nonirrigated): 4c
Hydrologic Soil Group: C

Typical profile

0 to 13 inches: Gravelly loam
13 to 66 inches: Gravelly clay loam

Minor Components

Aquolls

Percent of map unit: 1 percent
Landform: Alluvial fans

48F—Josephine gravelly loam, 35 to 55 percent north slopes

Map Unit Setting

Elevation: 1,000 to 4,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 100 to 170 days

Map Unit Composition

Josephine, north, and similar soils: 51 percent

Description of Josephine, North

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Colluvium and residuum weathered from metavolcanics and metasedimentary rock

Properties and qualities

Slope: 35 to 55 percent
Depth to restrictive feature: 40 to 61 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.8 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: C

Typical profile

0 to 2 inches: Moderately decomposed plant material
2 to 11 inches: Gravelly loam
11 to 59 inches: Clay loam
59 to 69 inches: Weathered bedrock

52—Kerby loam

Map Unit Setting

Elevation: 800 to 2,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 140 to 170 days

Map Unit Composition

Kerby and similar soils: 81 percent
Minor components: 1 percent

Description of Kerby

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.2 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability classification (irrigated): 2s
Land capability (nonirrigated): 2s
Hydrologic Soil Group: B

Typical profile

0 to 7 inches: Loam
7 to 40 inches: Loam
40 to 60 inches: Extremely gravelly sandy loam

Minor Components

Aquepts

Percent of map unit: 1 percent
Landform: Terraces

57—Newberg fine sandy loam

Map Unit Setting

Elevation: 750 to 2,500 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 150 to 170 days

Map Unit Composition

Newberg and similar soils: 81 percent
Minor components: 3 percent

Description of Newberg

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: NoneOccasional
Frequency of ponding: None
Available water capacity: Moderate (about 7.3 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2w
Land capability (nonirrigated): 2w
Hydrologic Soil Group: A

Typical profile

0 to 15 inches: Fine sandy loam
15 to 24 inches: Sandy loam
24 to 61 inches: Loamy fine sand

Minor Components

Wapato

Percent of map unit: 2 percent
Landform: Basin floors, flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Aquolls

Percent of map unit: 1 percent
Landform: Flood plains

58F—Pearsoll-Rock outcrop complex, 20 to 60 percent slopes

Map Unit Setting

Elevation: 750 to 4,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 100 to 170 days

Map Unit Composition

Pearsoll and similar soils: 50 percent
Rock outcrop: 25 percent

Description of Pearsoll

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium and residuum derived from serpentinite and peridotite

Properties and qualities

Slope: 20 to 60 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 0.9 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7s
Hydrologic Soil Group: D

Typical profile

0 to 5 inches: Extremely stony clay loam
5 to 14 inches: Extremely cobbly clay
14 to 18 inches: Unweathered bedrock

Description of Rock Outcrop

Properties and qualities

Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8

Typical profile

0 to 60 inches: Unweathered bedrock

61B—Pollard loam, 2 to 7 percent slopes

Map Unit Setting

Elevation: 1,000 to 4,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 100 to 170 days

Map Unit Composition

Pollard and similar soils: 83 percent
Minor components: 1 percent

Description of Pollard

Setting

Landform: Saddles, stream terraces, hillslopes
Landform position (two-dimensional): Summit, shoulder, footslope
Landform position (three-dimensional): Mountaintop, base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium derived from metavolcanics and metasedimentary rock

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.0 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability classification (irrigated): 2e
Land capability (nonirrigated): 2e
Hydrologic Soil Group: C

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 4 inches: Loam
4 to 61 inches: Clay

Minor Components

Aquults

Percent of map unit: 1 percent
Landform: Mountains

61C—Pollard loam, 7 to 12 percent slopes

Map Unit Setting

Elevation: 1,000 to 4,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 100 to 170 days

Map Unit Composition

Pollard and similar soils: 83 percent
Minor components: 1 percent

Description of Pollard

Setting

Landform: Saddles, hillslopes, stream terraces
Landform position (two-dimensional): Summit, shoulder, footslope
Landform position (three-dimensional): Mountaintop, base slope, riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium derived from metavolcanics and metasedimentary rock

Properties and qualities

Slope: 7 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.0 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 3e
Land capability (nonirrigated): 2e
Hydrologic Soil Group: C

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 4 inches: Loam
4 to 61 inches: Clay

Minor Components

Aquults

Percent of map unit: 1 percent
Landform: Mountains

61D—Pollard loam, 12 to 20 percent slopes

Map Unit Setting

Elevation: 1,000 to 4,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 100 to 170 days

Map Unit Composition

Pollard and similar soils: 76 percent
Minor components: 1 percent

Description of Pollard

Setting

Landform: Saddles, mountain slopes
Landform position (two-dimensional): Summit, shoulder, footslope
Landform position (three-dimensional): Mountaintop, mountainbase
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium and colluvium derived from metavolcanics and metasedimentary rock

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.0 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 4e
Land capability (nonirrigated): 3e
Hydrologic Soil Group: C

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 4 inches: Loam
4 to 61 inches: Clay

Minor Components

Aquults

Percent of map unit: 1 percent
Landform: Mountains

61E—Pollard loam, 20 to 35 percent slopes

Map Unit Setting

Elevation: 1,000 to 4,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 100 to 170 days

Map Unit Composition

Pollard and similar soils: 77 percent

Description of Pollard

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountainbase
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium and colluvium derived from metavolcanics and metasedimentary rock

Properties and qualities

Slope: 20 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.0 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 4e
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 4 inches: Loam
4 to 61 inches: Clay

64—Riverwash

Map Unit Composition

Riverwash: 100 percent

Description of Riverwash

Setting

Landform: Flood plains
Parent material: Alluvium

Properties and qualities

Slope: 0 to 3 percent
Drainage class: Poorly drained
Depth to water table: About 0 to 24 inches
Frequency of flooding: FrequentNone

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8

Typical profile

0 to 60 inches: Stratified sand to gravel

72F—Speaker-Josephine gravelly loams, 35 to 55 percent south slopes

Map Unit Setting

Elevation: 1,000 to 4,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 100 to 170 days

Map Unit Composition

Speaker, south, and similar soils: 55 percent
Josephine, south, and similar soils: 30 percent
Minor components: 1 percent

Description of Speaker, South

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium and residuum derived from mudstone, metavolcanics and/or metasedimentary rock

Properties and qualities

Slope: 35 to 55 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.5 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: C

Typical profile

0 to 13 inches: Gravelly loam
13 to 30 inches: Gravelly clay loam
30 to 40 inches: Weathered bedrock

Description of Josephine, South

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium and residuum weathered from metavolcanics and metasedimentary rock

Properties and qualities

Slope: 35 to 55 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: C

Typical profile

0 to 2 inches: Moderately decomposed plant material
2 to 15 inches: Gravelly loam
15 to 43 inches: Clay loam
43 to 53 inches: Weathered bedrock

Minor Components

Aqualfs

Percent of map unit: 1 percent
Landform: Mountains

73—Takilma cobbly loam

Map Unit Setting

Elevation: 800 to 2,500 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 140 to 170 days

Map Unit Composition

Takilma and similar soils: 72 percent
Minor components: 1 percent

Description of Takilma

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.5 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 4s
Land capability (nonirrigated): 4s
Hydrologic Soil Group: A

Typical profile

0 to 6 inches: Very cobbly loam
6 to 18 inches: Very cobbly loam
18 to 60 inches: Extremely cobbly sandy loam

Minor Components

Aquolls

Percent of map unit: 1 percent
Landform: Terraces

83—Wapato silt loam

Map Unit Setting

Elevation: 800 to 2,500 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 140 to 170 days

Map Unit Composition

Wapato and similar soils: 89 percent
Minor components: 4 percent

Description of Wapato

Setting

Landform: Basin floors, flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Recent alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water capacity: High (about 9.7 inches)

Interpretive groups

Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
Land capability classification (irrigated): 3w
Land capability (nonirrigated): 3w
Hydrologic Soil Group: C/D

Typical profile

0 to 8 inches: Silt loam
8 to 42 inches: Silty clay loam
42 to 60 inches: Silty clay

Minor Components

Cove

Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

W—Water

Map Unit Composition

Water: 100 percent

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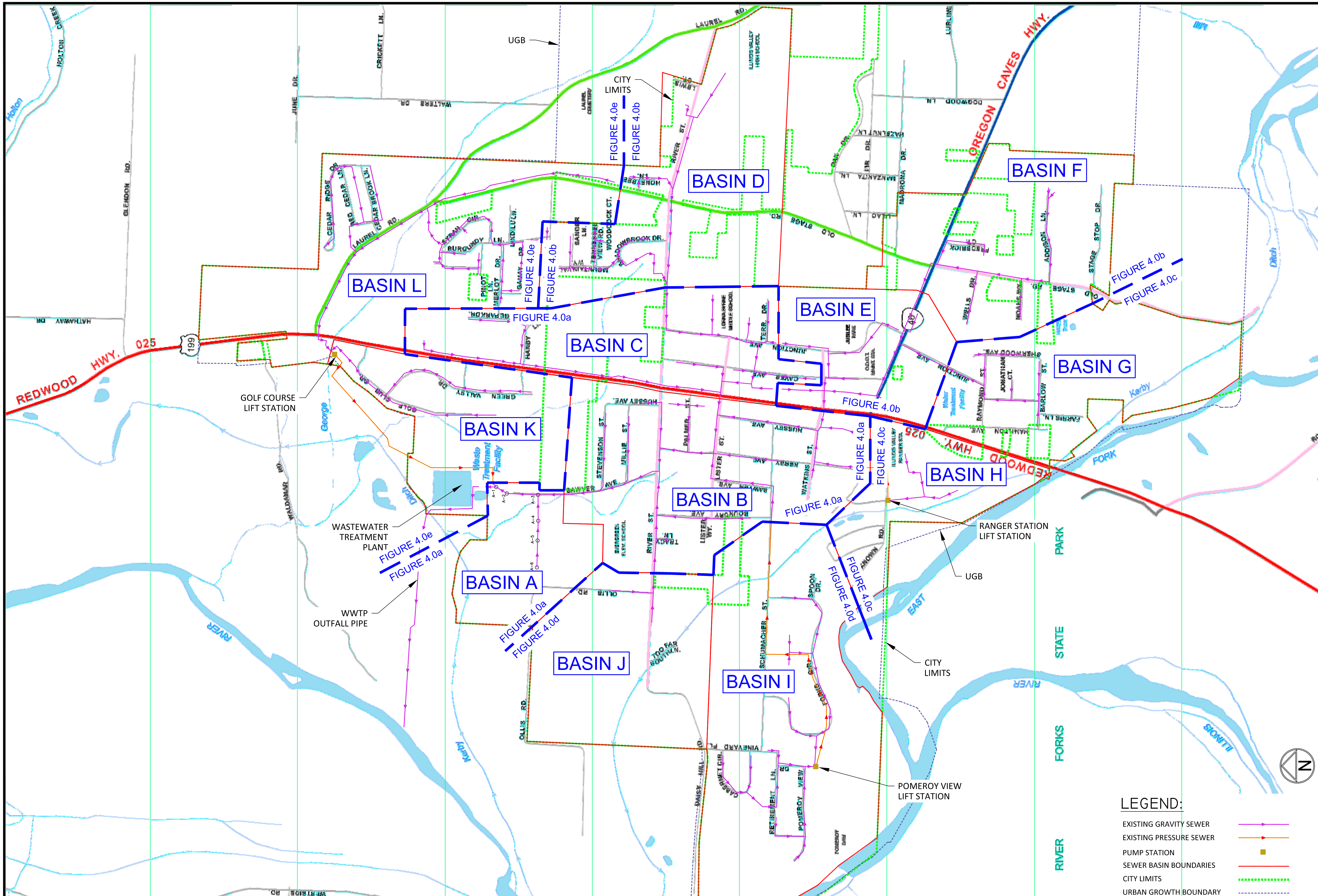
APPENDIX G



Civil West Engineering Services, Inc.

CITY OF CAVE JUNCTION
JOSEPHINE COUNTY, OREGON

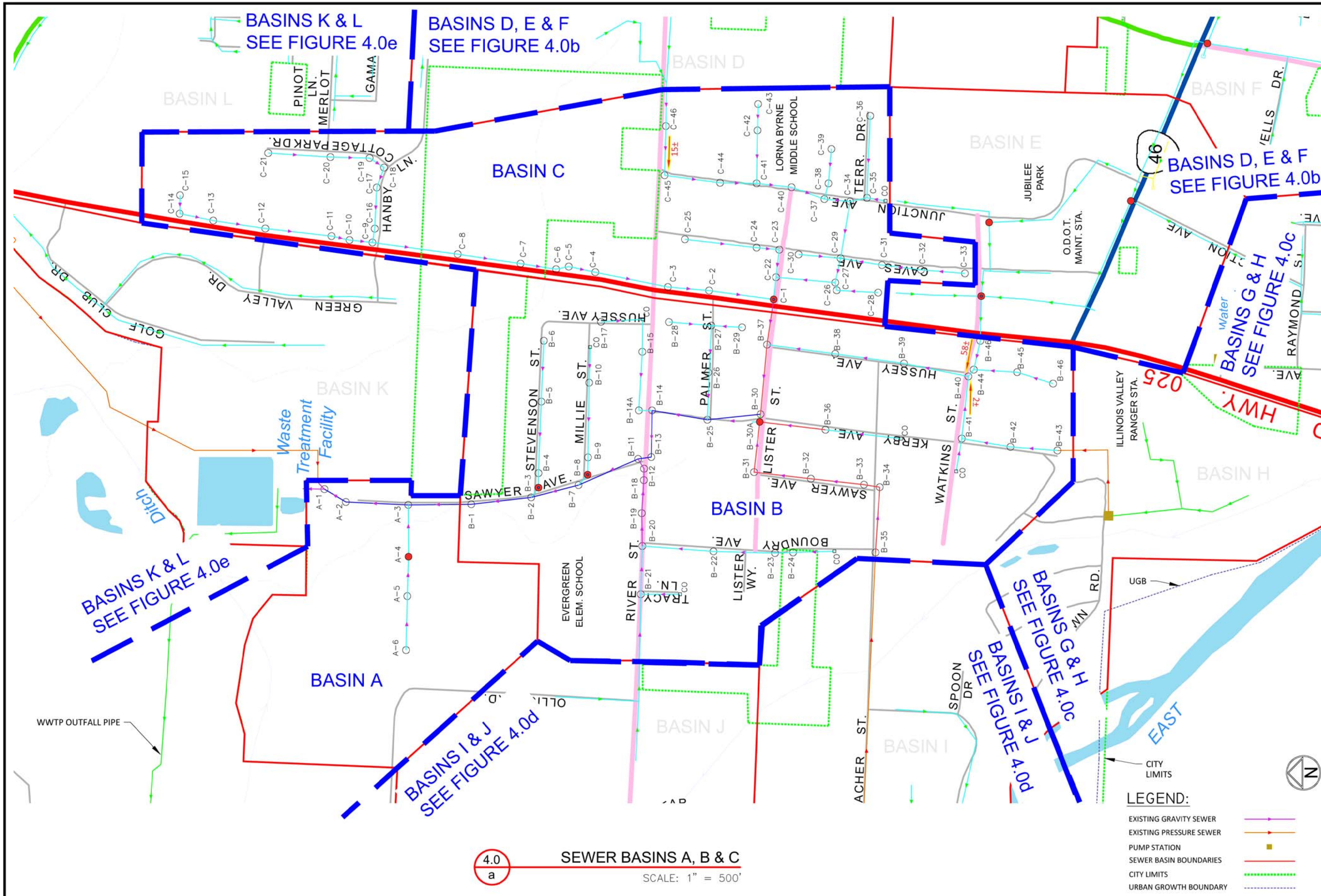
SEWER BASIN MAP

WASTEWATER FACILITIES PLAN - FLOW MAPPING

0 1"
1" = 1000'

DRAWN BY: MLG
DATE: OCT. 2013

FIGURE
M1



Civil West Engineering Services, Inc.

CITY OF CAVE JUNCTION
JOSEPHINE COUNTY, OREGON

SEWER BASINS A, B & C

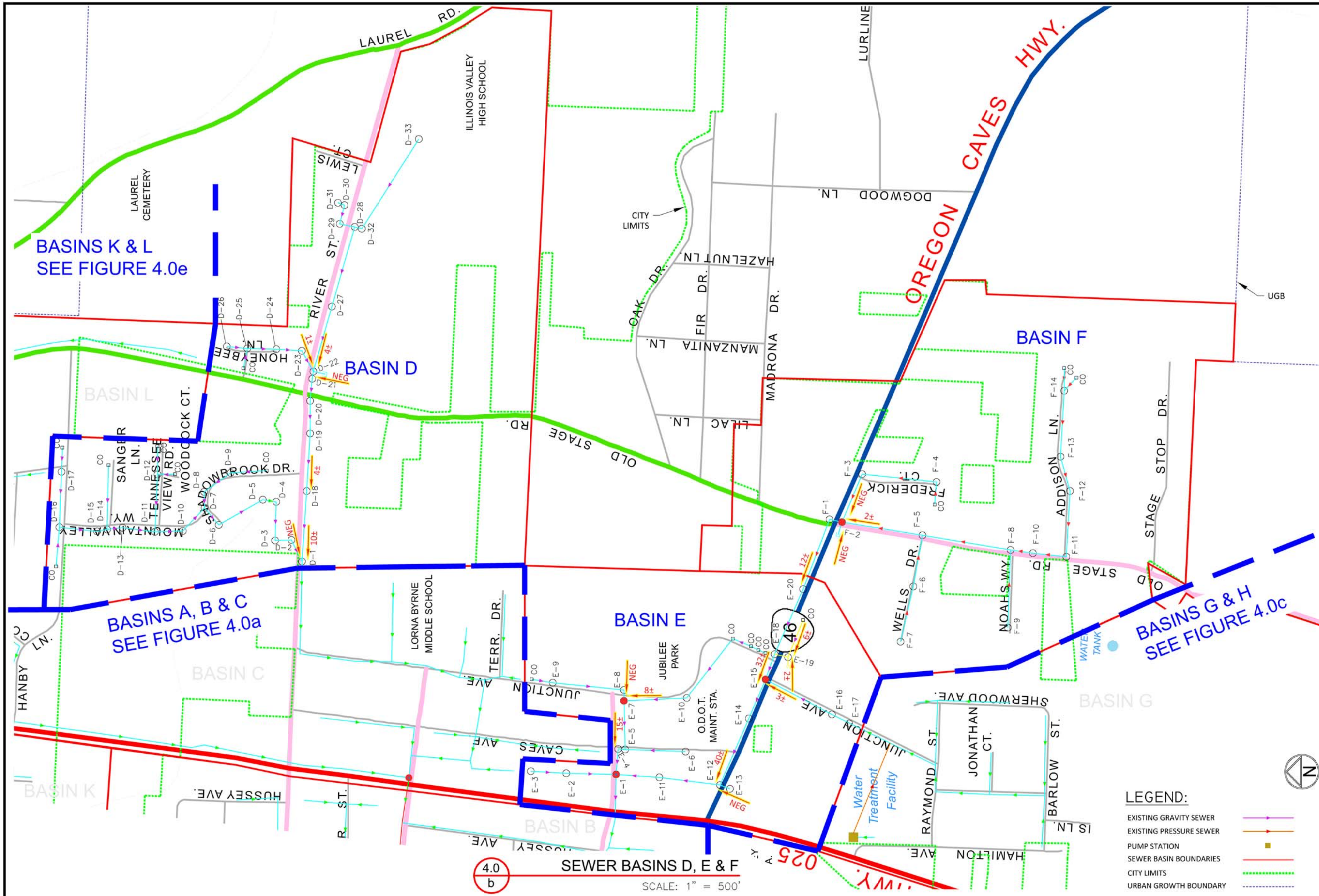
WASTEWATER FACILITIES PLAN

1" = 500'

DRAWN BY: MLG
DATE: FEB. 2013

FIGURE 4.0a

4.0 a SEWER BASINS A, B & C
SCALE: 1" = 500'



Civil West Engineering Services, Inc.

CITY OF CAVE JUNCTION
JOSEPHINE COUNTY, OREGON

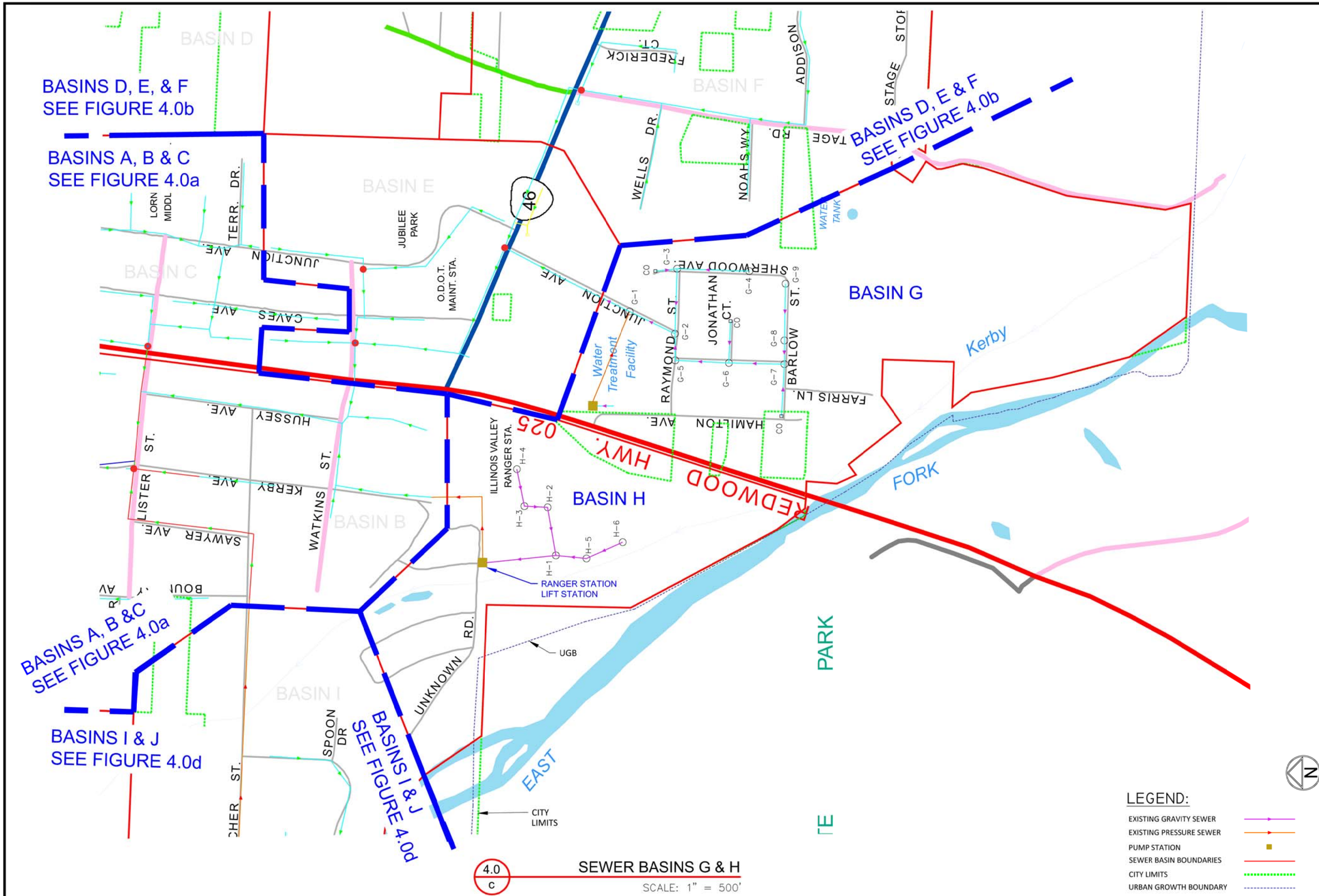
SEWER BASINS D, E & F

WASTEWATER FACILITIES PLAN

1" = 500'

DRAWN BY: MLG
DATE: FEB. 2013

FIGURE
4.0b



4.0 c SEWER BASINS G & H

SCALE: 1" = 500'

Civil West Engineering Services, Inc.

CITY OF CAVE JUNCTION
JOSEPHINE COUNTY, OREGON

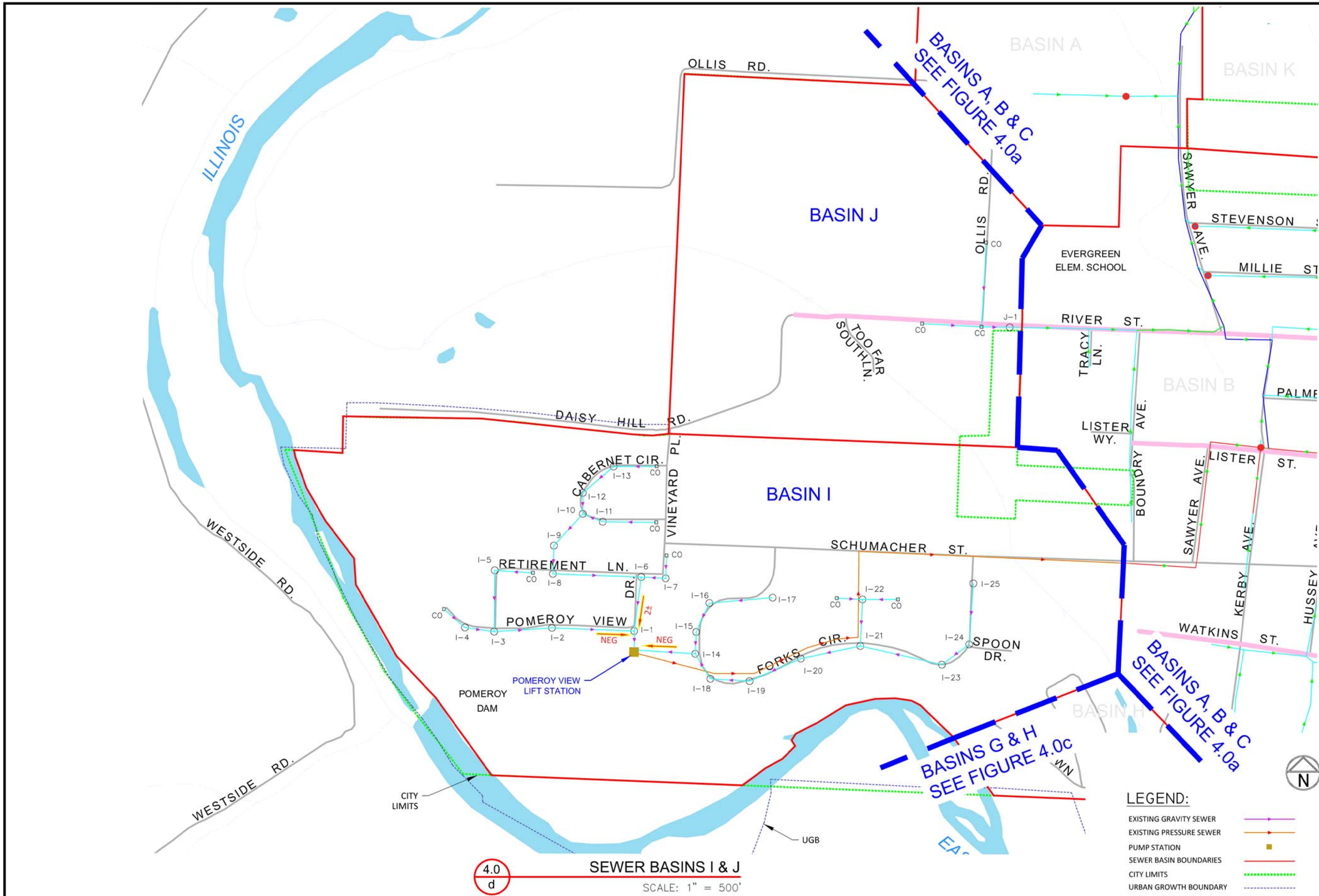
SEWER BASINS G & H

WASTEWATER FACILITIES PLAN

1" = 500'

DRAWN BY: MLG
DATE: FEB. 2013

FIGURE 4.0c



Civil West Engineering Services, Inc.

CITY OF CAVE JUNCTION
JOSEPHINE COUNTY, OREGON

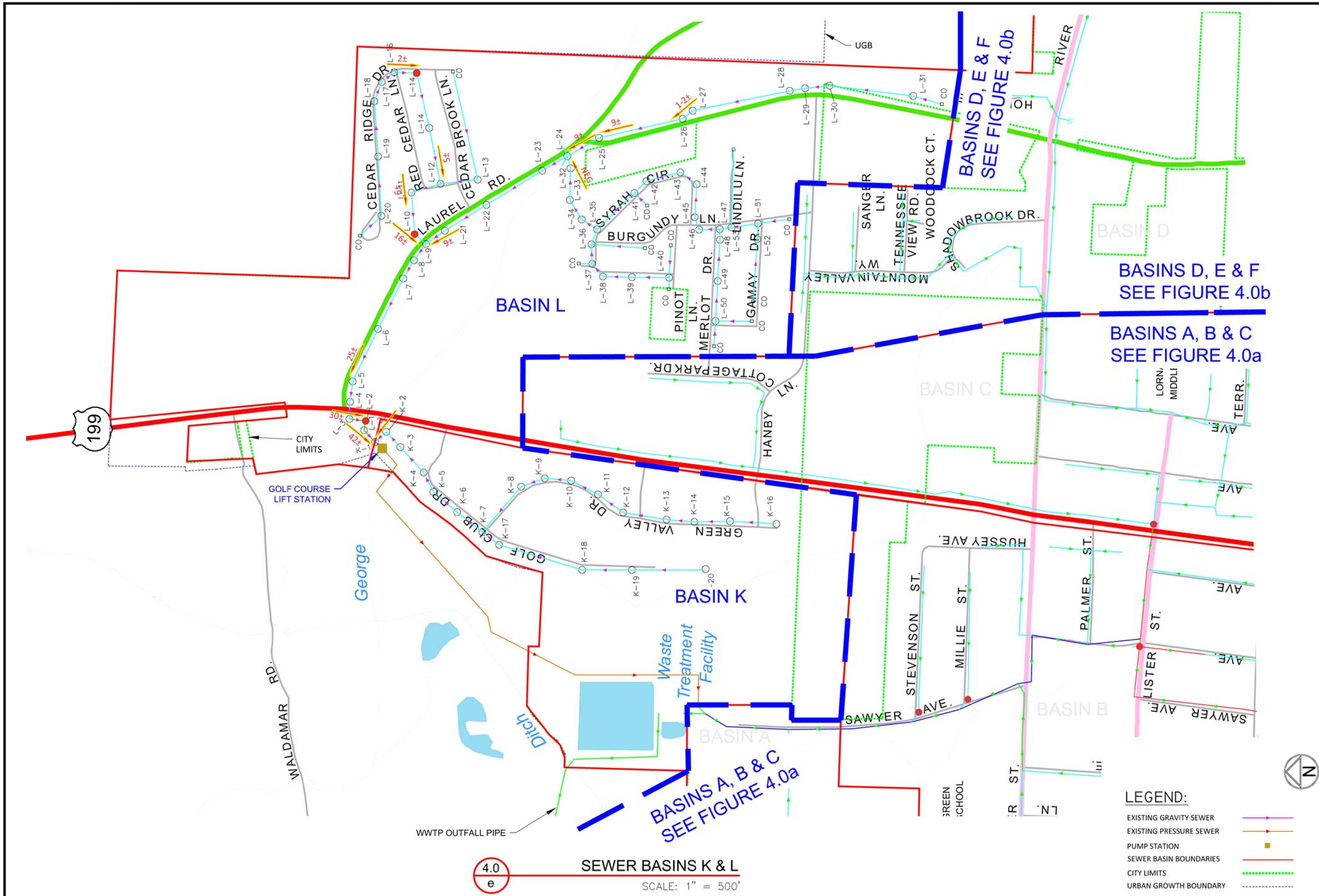
SEWER BASINS I & J

WASTEWATER FACILITIES PLAN

1" = 500'

DRAWN BY: MLG
DATE: FEB. 2013

FIGURE 4.0d



Civil West Engineering Services, Inc.

CITY OF CAVE JUNCTION
JOSEPHINE COUNTY, OREGON

SEWER BASINS K & L

WASTEWATER FACILITIES PLAN

1" = 500'

DRAWN BY: MLG
DATE: FEB. 2013

FIGURE 4.0e

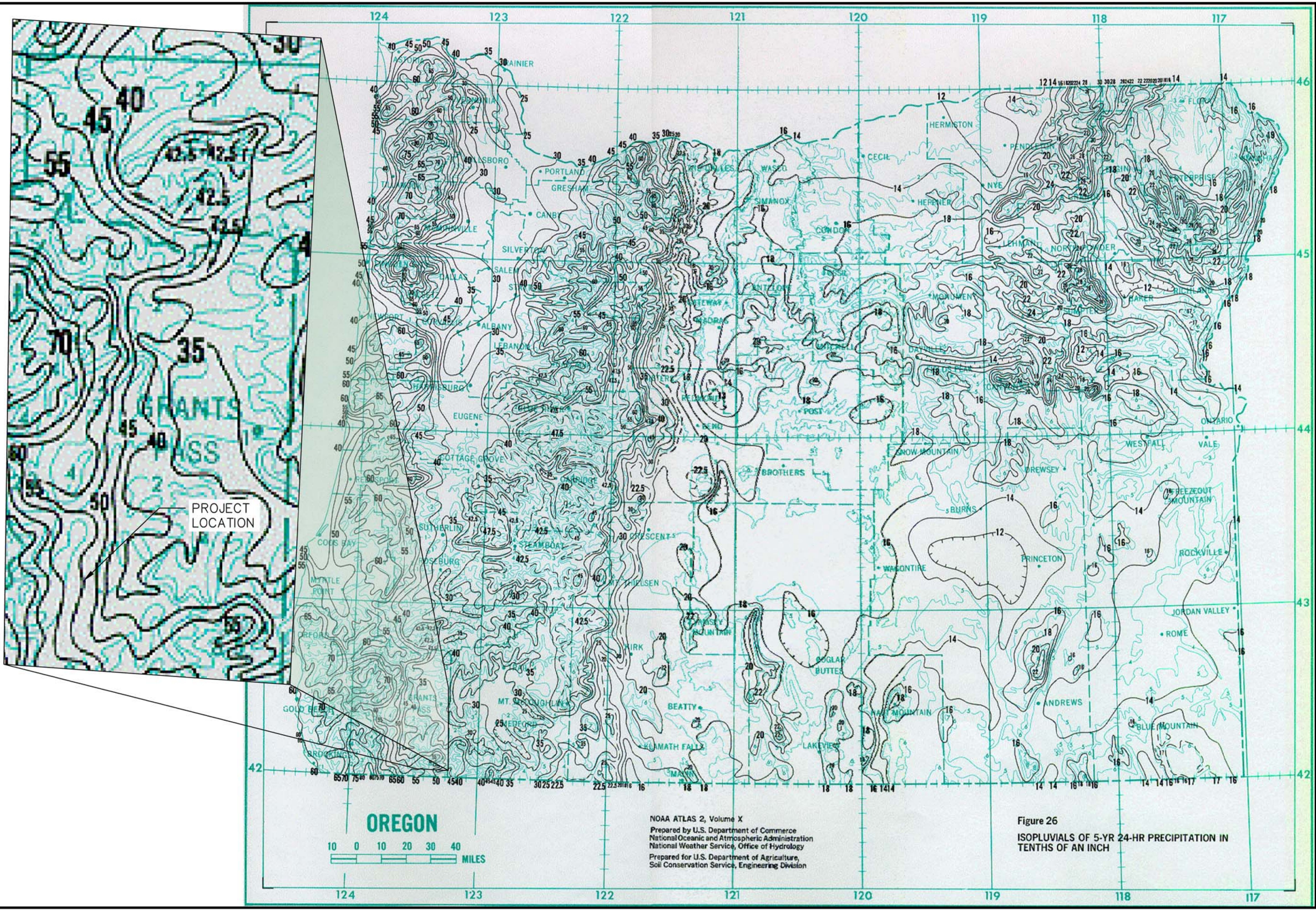


Figure 26
ISOPLUVIALS OF 5-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

Civil West Engineering Services, Inc.

City of Cave Junction
Josephine County, Oregon

NOAA ATLAS 2 VOLUME X

FACILITIES PLAN

NOT TO SCALE

Drawn By: WDB
Date: May 1, 2013

FIGURE

Figure 271B: Salmon and Steelhead Spawning Use Designations*
Rogue Basin, Oregon

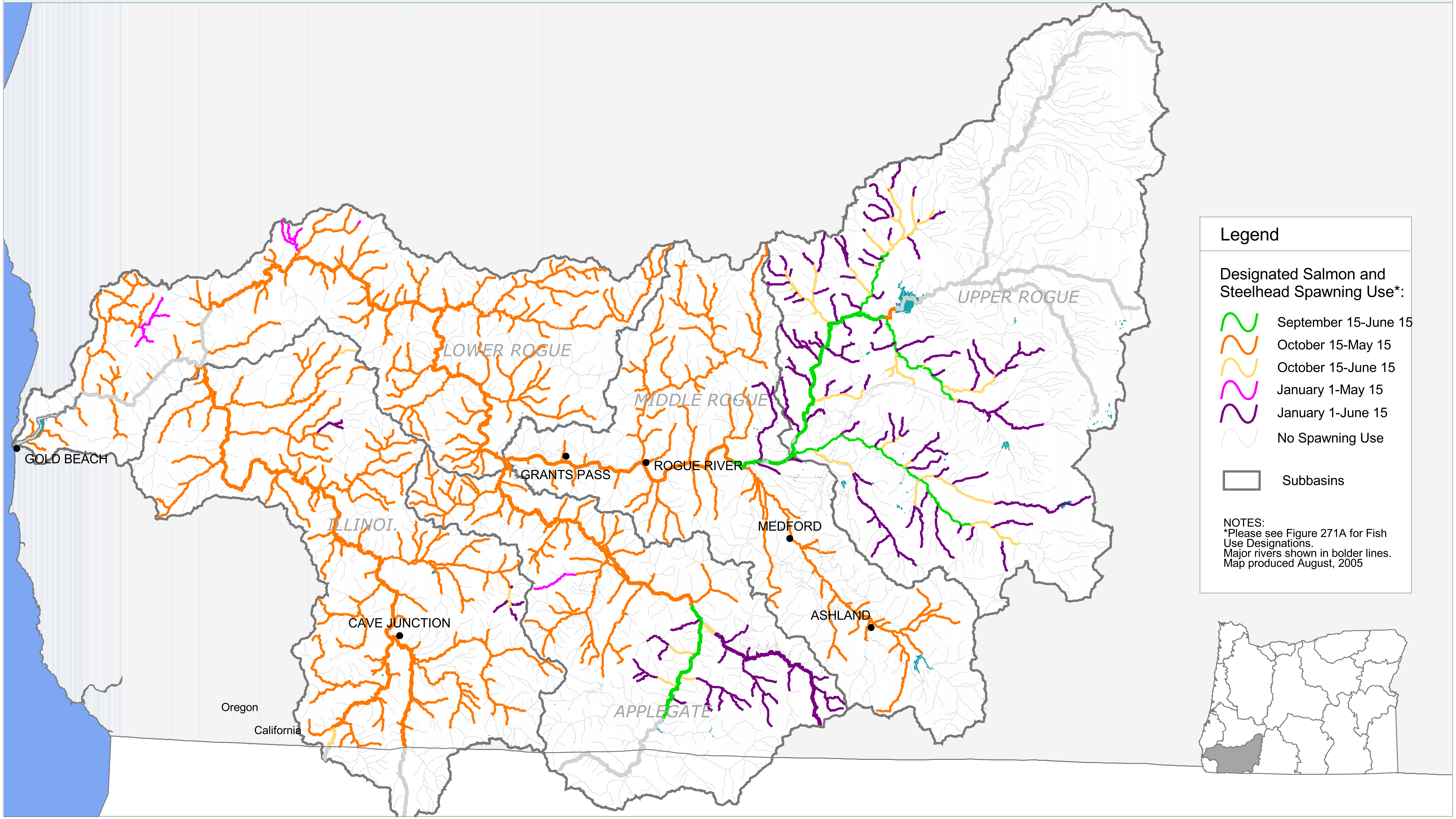
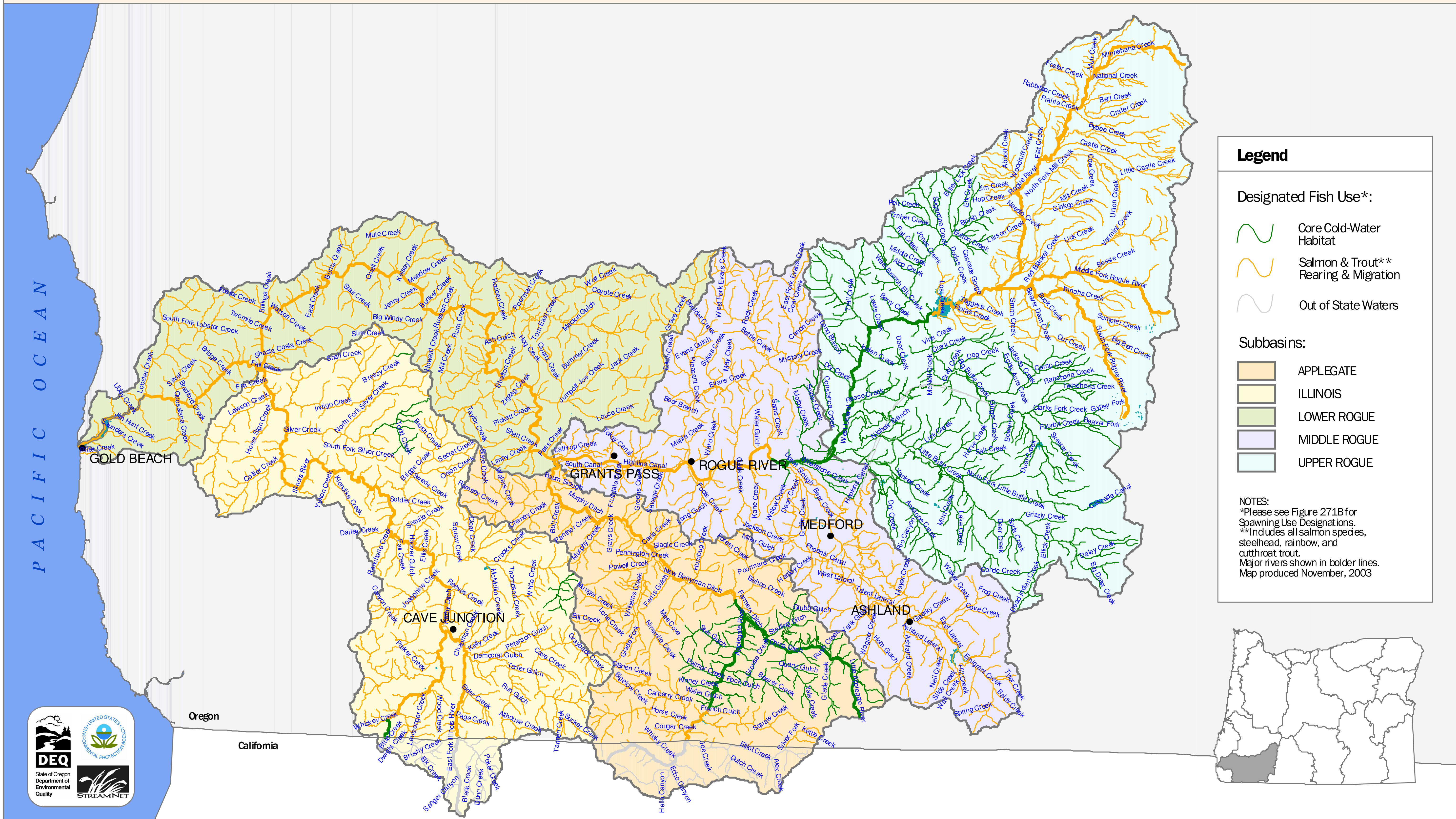


*Figure 271A: Fish Use Designations**
Rogue Basin, Oregon



State of Oregon
Department of State Lands

Essential Salmonid Habitat

Josephine County

Legend

Essential Salmonid Habitat

County Boundary

Township

USA Topo Maps

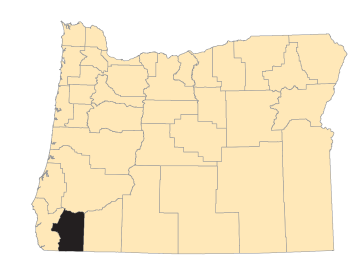
April 1, 2010

The Essential Indigenous Anadromous Salmonid Habitat (ESH) maps are produced from fish distribution data provided by the Oregon Department of Fish and Wildlife (ODFW). According to the Removal-Fill Law {ORS 196.810 (1)(f)(B)}, ESH means the habitat that is necessary to prevent the depletion of indigenous anadromous salmonid species during their history stages of spawning and rearing. Pursuant to ORS 196.810 (1)(f)(C), "indigenous anadromous salmonid" means chum, sockeye, Chinook and Coho salmon, steelhead and cutthroat trout that are members of the family Salmonid and are listed as sensitive, threatened or endangered by a state or federal authority. ODFW maps and depicts fish habitat without the regard to listing status. The Department of State Lands (DSL) determines which of these runs is state or federal designated pursuant to the definitions used in the Removal-Fill Law. The ESH maps consist of the following: Chinook Salmon (fall and spring), Coho Salmon, chum salmon, and steelhead (winter and summer). Note: The 2010 Statewide ESH stream mileage (approx. 20,095) is slightly less than that of 2009 (approx. 20,359).

A list of all affected water bodies in each county in the State of Oregon can be found at the following link: (http://tualatin.dsl.state.or.us/salmonlist/salmon.txt) There is also a PDF document detailing the Timing of In-Water Work for each ODFW Watershed District throughout the state, and can be found at the following link: (http://tualatin.dsl.state.or.us/salmonlist/InWaterWork2008.pdf) On-line interactive web mapping visualization of ESH distribution can be found at the following link: (http://tualatin.dsl.state.or.us/public).

All data is provided as is, with all faults, and without any warranty of any kind expressed or implied, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Any and all questions related to the ESH maps should be addressed to the DSL GIS Coordinator at: randy.sounhein@state.or.us , or (503) 986-5270.

Scale 1:175,039



Index Map

0 2 4 8 12 16 Miles

Sounhein 2010

APPENDIX H

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data,
and Information Service

Climatography of the United States No. 20 1971-2000

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801
www.ncdc.noaa.gov

Station: CAVE JUNCTION 1 WNW, OR **COOP ID: 351448**

Climate Division: OR 3 **NWS Call Sign:** **Elevation: 1,280 Feet** **Lat: 42˚11N** **Lon: 123˚41W**

Temperature (˚F)

	Mean (1)			Extremes										Degree Days (1) Base Temp 65		Mean Number of Days (3)					
Month	Daily Max	Daily Min	Mean	Highest Daily(2)	Year	Day	Highest Month(1) Mean	Year	Lowest Daily(2)	Year	Day	Lowest Month(1) Mean	Year	Heating	Cooling	Max >= 100	Max >= 90	Max >= 50	Max <= 32	Min <= 32	Min <= 0
Jan	46.5	32.0	39.3	66	1981	21	44.1	1995	11+	1974	7	35.5	1982	798	0	.0	.0	12.4	@	16.2	.0
Feb	52.3	33.6	43.0	76	1992	25	48.7	1995	4	1989	7	37.0	1989	618	0	.0	.0	18.9	.2	12.5	.0
Mar	58.0	34.8	46.4	82	1994	27	51.0	1992	20	1987	28	42.3	1971	577	0	.0	.0	26.3	.0	11.8	.0
Apr	65.3	36.5	50.9	90+	1987	27	56.1	1990	21	1963	16	45.1	1975	424	0	.0	.1	28.8	.0	7.6	.0
May	74.2	41.1	57.7	99	2001	31	64.6	1992	28+	1999	9	52.6	1977	240	12	.0	1.8	30.8	.0	2.0	.0
Jun	83.1	46.5	64.8	109	1992	22	70.0	1977	28	1966	1	60.7	1980	78	72	.4	6.0	30.0	.0	.2	.0
Jul	91.9	50.6	71.3	108+	1994	20	75.2	1972	36+	1976	1	67.0	1983	15	208	3.3	16.0	31.0	.0	.0	.0
Aug	91.7	49.3	70.5	109	1998	4	74.4	1986	34	1969	25	67.7	1976	9	179	3.4	15.7	31.0	.0	.0	.0
Sep	84.9	44.4	64.7	110	1998	1	69.4	1991	25	1970	14	60.1	1986	86	75	1.0	8.5	30.0	.0	.4	.0
Oct	71.5	38.6	55.1	100	2001	1	59.6	1988	19	1971	28	51.3	1984	311	4	.0	1.1	30.8	.0	5.0	.0
Nov	53.6	36.0	44.8	78	1991	6	50.9	1995	11	1978	14	38.8	1985	606	0	.0	.0	20.8	@	7.9	.0
Dec	45.7	32.3	39.0	69+	1979	17	45.3	1995	-6	1972	10	33.0	1990	807	0	.0	.0	10.1	.4	15.6	.1
Ann	68.2	39.6	54.0	110	Sep 1998	1	75.2	Jul 1972	-6	Dec 1972	10	33.0	Dec 1990	4569	550	8.1	49.2	300.9	.6	79.2	.1

+ Also occurred on an earlier date(s)

@ Denotes mean number of days greater than 0 but less than .05

Complete documentation available from: www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

(1) From the 1971-2000 Monthly Normals

(2) Derived from station's available digital record: 1962-2001

(3) Derived from 1971-2000 serially complete daily data

Issue Date: February 2004

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Climatography of the United States No. 20 1971-2000

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www.ncdc.noaa.gov

Station: CAVE JUNCTION 1 WNW, OR **COOP ID: 351448**

Climate Division: OR 3 **NWS Call Sign:** **Elevation: 1,280 Feet** **Lat: 42˚11N** **Lon: 123˚41W**

Precipitation (inches)

	Precipitation Totals								Mean Number of Days (3)				Precipitation Probabilities (1) Probability that the monthly/annual precipitation will be equal to or less than the indicated amount										
	Means/ Medians(1)		Extremes						Daily Precipitation				Monthly/Annual Precipitation vs Probability Levels These values were determined from the incomplete gamma distribution										
Month	Mean	Med-ian	Highest Daily(2)	Year	Day	Highest Monthly(1)	Year	Lowest Monthly(1)	Year	>= 0.01	>= 0.10	>= 0.50	>= 1.00	.05	.10	.20	.30	.40	.50	.60	.70	.80	.90	.95
Jan	10.81	12.00	4.94	1980	12	25.39	1995	.53	1985	14.6	11.9	7.1	3.8	2.15	3.13	4.72	6.18	7.65	9.22	11.01	13.16	16.00	20.56	24.89
Feb	9.75	8.30	3.46	1998	21	22.57	1986	.13	1988	14.4	11.8	6.8	3.7	1.55	2.38	3.80	5.14	6.53	8.04	9.78	11.90	14.74	19.34	23.76
Mar	8.15	7.36	3.45	1975	18	19.40	1995	1.68	1988	15.6	11.7	5.4	2.7	1.90	2.66	3.85	4.92	5.98	7.11	8.37	9.88	11.86	15.00	17.96
Apr	4.10	3.84	2.25	1982	13	13.10	1982	.27	1973	10.9	7.9	3.0	1.0	.52	.85	1.43	2.00	2.61	3.28	4.05	5.01	6.31	8.44	10.50
May	2.27	1.82	3.63	1990	31	9.15	1990	.00	1982	7.4	4.6	1.3	.6	.11	.32	.66	.99	1.35	1.75	2.22	2.80	3.59	4.90	6.18
Jun	.74	.59	1.07	1971	25	2.35	1988	.00	1999	3.6	2.2	.3	@	.01	.05	.14	.24	.36	.50	.67	.89	1.20	1.74	2.27
Jul	.28	.17	.97	1983	1	1.40	1983	.00+	1998	1.5	.9	.1	@	.00	.00	.00	.00	.06	.14	.23	.35	.51	.79	1.06
Aug	.55	.15	1.70	1983	30	3.23	1983	.00+	1998	2.3	1.3	.3	.1	.00	.00	.00	.00	.00	.12	.31	.57	.97	1.69	2.42
Sep	1.32	.58	3.50	1977	28	6.47	1977	.00+	1999	3.8	2.6	1.0	.3	.00	.00	.01	.13	.32	.58	.95	1.46	2.24	3.65	5.13
Oct	3.66	3.20	4.01	1962	9	10.50	1979	.00	1978	7.4	5.4	2.7	1.3	.12	.40	.91	1.43	2.02	2.68	3.48	4.48	5.86	8.19	10.48
Nov	10.04	7.54	6.15	1996	18	30.13	1973	1.87	1976	15.2	11.8	6.4	3.5	1.51	2.35	3.81	5.19	6.64	8.22	10.04	12.27	15.25	20.12	24.79
Dec	10.98	8.39	8.12	1964	22	35.29	1996	1.16	1976	14.9	12.0	6.9	3.9	1.46	2.34	3.91	5.44	7.04	8.82	10.88	13.41	16.84	22.44	27.86
Ann	62.65	59.68	8.12	Dec 1964	22	35.29	Dec 1996	.00+	Sep 1999	111.6	84.1	41.3	20.9	34.67	39.58	46.13	51.30	56.01	60.68	65.59	71.13	78.00	88.23	97.30

\+ Also occurred on an earlier date(s)
\# Denotes amounts of a trace
@ Denotes mean number of days greater than 0 but less than .05
****** Statistics not computed because less than six years out of thirty had measurable precipitation

(1) From the 1971-2000 Monthly Normals
(2) Derived from station's available digital record: 1962-2001
(3) Derived from 1971-2000 serially complete daily data
Complete documentation available from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

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Climate Division: OR 3 **NWS Call Sign:** **Elevation: 1,280 Feet** **Lat: 42°11N** **Lon: 123°41W**

Snow (inches)

	Snow Totals														Mean Number of Days (1)								
	Means/Medians (1)				Extremes (2)										Snow Fall >= Thresholds					Snow Depth >= Thresholds			
Month	Snow Fall Mean	Snow Fall Median	Snow Depth Mean	Snow Depth Median	Highest Daily Snow Fall	Year	Day	Highest Monthly Snow Fall	Year	Highest Daily Snow Depth	Year	Day	Highest Monthly Mean Snow Depth	Year	0.1	1.0	3.0	5.0	10.0	1	3	5	10
Jan	3.4	.0	1	0	14.5	1972	26	24.5	1972	18	1971	13	9	1993	1.1	1.0	.3	.1	.1	1.5	1.1	1.0	.6
Feb	3.0	.0	#	0	12.0	1993	20	17.0+	1989	13	1989	3	2	1993	1.3	1.1	.6	.3	@	1.3	1.0	.7	.2
Mar	2.3	.3	#	0	6.5	1985	27	12.0	1995	10	1995	23	1	1995	1.0	.7	.3	.1	.0	.5	.2	.1	@
Apr	.3	.0	#	0	6.0	1982	6	6.0	1982	4	1982	6	#+	2000	.3	.3	.1	.1	.0	@	@	.0	.0
May	#	.0	0	0	#	1986	6	#	1986	0	0	0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Jun	.0	.0	#	0	.0	0	0	.0	0	#	1998	7	#	1998	.0	.0	.0	.0	.0	.0	.0	.0	.0
Jul	.0	.0	0	0	.0	0	0	.0	0	0	0	0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Aug	.0	.0	0	0	.0	0	0	.0	0	0	0	0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Sep	.0	.0	0	0	.0	0	0	.0	0	0	0	0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Oct	#	.0	0	0	#	1971	27	#	1971	0	0	0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Nov	.8	.0	#	0	14.0	1977	21	14.0	1977	9	1977	21	#+	1994	.2	.2	.1	@	@	.1	@	@	.0
Dec	2.9	.5	#	0	8.0	1987	15	24.8	1992	18	1992	30	2	1992	1.2	.8	.4	.2	.0	1.4	.9	.6	.1
Ann	12.7	.8	N/A	N/A	14.5	Jan 1972	26	24.8	Dec 1992	18+	Dec 1992	30	9	Jan 1993	5.1	4.1	1.8	.8	.1	4.8	3.2	2.4	.9

+ Also occurred on an earlier date(s) #Denotes trace amounts

@ Denotes mean number of days greater than 0 but less than .05

-9/-9.9 represents missing values
Annual statistics for Mean/Median snow depths are not appropriate

(1) Derived from Snow Climatology and 1971-2000 daily data

(2) Derived from 1971-2000 daily data

Complete documentation available from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

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Freeze Data

Spring Freeze Dates (Month/Day)

Temp (F)	Probability of later date in spring (thru Jul 31) than indicated(*)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	6/20	6/13	6/09	6/05	6/02	5/29	5/25	5/21	5/14
32	5/27	5/20	5/15	5/10	5/06	5/02	4/28	4/23	4/16
28	5/01	4/23	4/17	4/13	4/08	4/04	3/30	3/24	3/16
24	3/19	3/04	2/22	2/12	2/03	1/25	1/15	1/01	12/08
20	2/19	2/04	1/24	1/13	1/02	12/19	0/00	0/00	0/00
16	2/01	1/18	1/05	12/20	0/00	0/00	0/00	0/00	0/00

Fall Freeze Dates (Month/Day)

Temp (F)	Probability of earlier date in fall (beginning Aug 1) than indicated(*)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	9/01	9/08	9/13	9/18	9/22	9/26	9/30	10/06	10/13
32	9/23	9/30	10/05	10/09	10/12	10/16	10/20	10/25	11/01
28	10/09	10/21	10/30	11/06	11/12	11/19	11/26	12/05	12/16
24	11/10	11/22	11/30	12/08	12/15	12/23	1/01	1/13	0/00
20	11/18	12/06	12/19	1/01	1/16	2/06	0/00	0/00	0/00
16	12/12	12/30	1/15	2/09	0/00	0/00	0/00	0/00	0/00

Freeze Free Period

Temp (F)	Probability of longer than indicated freeze free period (Days)								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
36	140	130	123	117	111	106	100	93	83
32	187	177	170	164	158	153	147	140	130
28	256	243	233	225	218	210	202	192	179
24	>365	>365	344	323	309	297	285	272	254
20	>365	>365	>365	>365	>365	>365	345	322	300
16	>365	>365	>365	>365	>365	>365	>365	>365	356

***** Probability of observing a temperature as cold, or colder, later in the spring or earlier in the fall than the indicated date.

0/00 Indicates that the probability of occurrence of threshold temperature is less than the indicated probability.

Derived from 1971-2000 serially complete daily data

Complete documentation available from: www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

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Degree Days to Selected Base Temperatures (˚F)

Heating Degree Days (1)

Base Below	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
65	798	618	577	424	240	78	15	9	86	311	606	807	4569
60	643	478	422	283	123	22	2	0	29	176	456	652	3286
57	550	394	334	205	73	8	0	0	11	111	368	559	2613
55	488	340	277	161	48	3	0	0	6	76	312	497	2208
50	336	212	154	76	12	0	0	0	0	23	185	347	1345
32	12	3	0	0	0	0	0	0	0	0	3	17	35

Cooling Degree Days (1)

Base Above	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
32	237	309	446	567	795	984	1217	1193	979	715	388	234	8064
55	0	2	11	37	129	297	504	480	295	79	6	0	1840
57	0	0	6	22	93	242	442	418	240	51	2	0	1516
60	0	0	1	9	50	166	351	326	168	24	0	0	1095
65	0	0	0	0	12	72	208	179	75	4	0	0	550
70	0	0	0	0	1	20	99	68	22	0	0	0	210

Growing Degree Units (2)

Base	Growing Degree Units (Monthly)												Growing Degree Units (Accumulated Monthly)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
40	77	139	223	329	528	713	931	912	720	464	173	76	77	216	439	768	1296	2009	2940	3852	4572	5036	5209	5285
45	23	53	100	191	374	563	776	757	570	313	71	31	23	76	176	367	741	1304	2080	2837	3407	3720	3791	3822
50	1	8	31	89	237	414	621	602	420	173	17	2	1	9	40	129	366	780	1401	2003	2423	2596	2613	2615
55	0	0	0	32	119	273	466	447	274	72	2	0	0	0	0	32	151	424	890	1337	1611	1683	1685	1685
60	0	0	0	2	46	146	314	295	148	21	0	0	0	0	0	2	48	194	508	803	951	972	972	972
Base	Growing Degree Units for Corn (Monthly)												Growing Degree Units for Corn (Accumulated Monthly)											
50/86	29	74	143	229	353	453	569	554	467	317	79	28	29	103	246	475	828	1281	1850	2404	2871	3188	3267	3295

(1) Derived from the 1971-2000 Monthly Normals
(2) Derived from 1971-2000 serially complete daily data
Note: For corn, temperatures below 50 are set to 50, and temperatures above 86 are set to 86

Complete documentation available from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

Notes

a. The monthly means are simple arithmetic averages computed by summing the monthly values for the period 1971-2000 and dividing by thirty. Prior to averaging, the data are adjusted if necessary to compensate for data quality issues, station moves or changes in station reporting practices. Missing months are replaced by estimates based on neighboring stations.

b. The median is defined as the middle value in an ordered set of values. The median is being provided for the snow and precipitation elements because the mean can be a misleading value for precipitation normals.

c. Only observed validated values were used to select the extreme daily values.

d. Extreme monthly temperature/precipitation means were selected from the monthly normals data.
Monthly snow extremes were calculated from daily values quality controlled to be consistent with the Snow Climatology.

e. Degree Days were derived using the same techniques as the 1971-2000 normals.
Compete documentation for the 1971-2000 Normals is available on the internet from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

f. Mean "number of days statistics" for temperature and precipitation were calculated from a serially complete daily data set .
Documentation of the serially complete data set is available from the link below:

g. Snowfall and snow depth statistics were derived from the Snow Climatology.
Documentation for the Snow Climatology project is available from the link under references.

Data Sources for Tables

Several different data sources were used to create the Clim20 climate summaries. In some cases the daily extremes appear inconsistent with the monthly extremes and or the mean number of days statistics. For example, a high daily extreme value may not be reflected in the highest monthly value or the mean number of days threshold that is less than and equal to the extreme value. Some of these difference are caused by different periods of record. Daily extremes are derived from the station's entire period of record while the serial data and normals data were are for the 1971-2000 period. Therefore extremes observed before 1971 would not be included in the 1971-2000 normals or the 1971-2000 serial daily data set. Inconsistencies can also occur when monthly values are adjusted to reflect the current observing conditions or were replaced during the 1971-2000 Monthly Normals processing and are not reconciled with the Summary of the Day data.

a. Temperature/ Precipitation Tables
1. 1971-2000 Monthly Normals
2. Cooperative Summary of the Day
3. National Weather Service station records
4. 1971-2000 serially complete daily data

b. Degree Day Table
1. Monthly and Annual Heating and Cooling Degree Days Normals to Selected Bases derived from 1971-2000 Monthly Normals
2. Daily Normal Growing Degree Units to Selected Base Temperatures derived from 1971-2000 serially complete daily data

c. Snow Tables
1. Snow Climatology
2. Cooperative Summary of the Day

d. Freeze Data Table
1971-2000 serially complete daily data

References

U.S. Climate Normals 1971-2000, www.ncdc.noaa.gov/normals.html
U.S. Climate Normals 1971-2000-Products Clim20, www.ncdc.noaa.gov/oa/climate/normals/usnormalsprods.html
Snow Climatology Project Description, www.ncdc.noaa.gov/oa/climate/monitoring/snowclim/mainpage.html
Eischeid, J. K., P. Pasteris, H. F. Diaz, M. Plantico, and N. Lott, 2000: Creating a serially complete, national daily time series of temperature and precipitation for the Western United States. J. Appl. Meteorol., 39, 1580-1591,
www1.ncdc.noaa.gov/pub/data/special/ serialcomplete_jam_0900.pdf

APPENDIX I

City of Cave Junction

Reclaimed Water Plan

July 2003

CONTENTS

Permit No.: 102610
File No.: 15243
Contact:

Michael Bollweg
Treatment Operator

RECLAIMED WATER USE PLAN

Wastewater Processing

The Cave Junction Wastewater Treatment Plant can provides treatment and disinfection of approximately 1 million gallons a day of wastewater from residences and businesses to levels specified in the City's National Pollutant Discharge Elimination System (NPEDES) permit.

The City's Wastewater treatment plant is an activated sludge facility. The facility consists of a head works structure that contains an Automated and a manual Bar-screen that removes floatable and screen-able material. The screen wastewater flows into a parshall flume measurement device and then goes through a grit removal system.

The screened and degritted wastewater flows into the aeration basins were it undergoes biological treatment. Microorganisms feed, grow and reproduce by feeding on organic materials in the wastewater. As the microorganisms grow and reproduce, they remove more wastes from the wastewater, leaving it partially cleaned. Compressed air is added to the wastewater to provide oxygen required for the survival and health of these microorganisms.

From the aeration basin, the wastewater, or mixed liquor, flows to the two secondary clarifiers. The clarifiers' area is used to separate the activated sludge solids from the treated wastewater, producing a "clarified" effluent. Most of the biological solids are removed from the secondary process and returned to the aeration basin to treat the incoming sewage. A portion of these biological solids are diverted and wasted from the system and sent to the Digester for further treatment and eventually to a Facultative Sludge Lagoon.

Effluent form the secondary clarifiers, flows to the UV disinfection system. The UV disinfection, system that is composed of two medium-pressure closed vessel modules. The UV system disinfects the wastewater prior to discharge.
There is also a Chlorine system that can be utilized during times when we are unable to utilize the UV system due to low flows. The treatment facility had built into it provision for chlorine disinfection that included a chlorine contact chamber. The chlorine contact chamber had hydraulic limitations that makes it impossible to use. The chlorine contact time using the outfall piping should be utilized for chlorine backup during outfall (002) and disinfection requirements met prior to the addition of the effluent into the Golf course holding ponds.

Effluent Reclamation System

- Details of the system: The system begins as water is conveyed by a series of valves down the 24 "effluent outfall pipe to a flow control manhole which is located on the NW corner just outside the fence of the Treatment plant. The flow control manhole diverts the flow into a 12" line that intern sends the effluent to another flow control manhole eventually flowing by gravity to the storage pond at the Golf Course (See attached drawings ***City's system***).
- Golf course pumping and piping The Golf Course has transferred a .65 cfs water right form the Kerby Ditch to the Illinois River. A six-inch line has been installed from the river to the existing fresh water holding pond for pump #1. A 10-hp pump will transfer approximately 270 gpm. (see attached set ***Golf Course System***)
- The quantity of the effluent will vary. Initial estimates are that we may make up to 0.25 MGD available for beneficial use, while over the next 5-10 years depending on growth as much a 0.87 MGD.
- Nutrient loading at this point would only be an estimate, as the city has not historically collected all of this data, agronomic loading rates for nutrients should be considered to be minimal, as the effluent quality of the treatment facility is very good. The facility also has the ability to remove nutrients if needed. This data should be collected for one irrigation season and then loading per acre could be calculated.

(1) No discharge to state water is permitted. All reclaimed water shall be distributed on land, for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices as so to prevent:

a. Prolonged ponding of treated reclaimed water on the ground surface;
b. Surface runoff or subsurface drainage through drainage tiles;
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;
e. Impairment of existing or potential beneficial uses of groundwater

(2) Prior to land application of the reclaimed water, it shall receive at least level II treatment as defined in OAR 340-55 to:

a. Reduce Total Coliform to 240 organisms per 100mls in two consecutive samples, and a seven-day median of 23 organisms per 100mls.

(3) Irrigation shall conform to this reclaimed water use plan

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

The Treatment plants effluent is discharged to the Illinois River from November 1-May 31, with restricted discharge for the month of June based on stream flow. Outfall (001). Outfall (002) allows for discharge with an approved plan for beneficial use June1-October 31, under outfall (002) No discharge to state waters is permitted. All reclaimed water shall be distributed on land, for dissipation by evapotranspiration and controlled seepage by following sound irrigation practices.

Reclaimed Water Outfall (002)

Item or Parameter	Minimum Frequency	Type of Sample
Quantity Irrigated (inches/acre)	Daily	Measurement
Flow Meter Calibration	Annually	Verification
UV Radiation Intensity	Daily	Reading (see note 1)
Chlorine Residual	Daily	Grab (see note 2)

Quantity Chlorine used	Daily	Measurement (see note 2)
pH	2/week	Grab
Total Coliform	1/Week	Grab
Nutrients (TKN, NO2+ NO3, Total Phosphorous)	Quarterly	Grab

Notes:

1. The UV radiation passing through the water column will affect the systems ability to kill organisms. To track the reduction in intensity, the UV disinfection system must include a UV intensity meter with a sensor located in the water column at a specified distance from the UV bulbs. This meter will measure the intensity of UV radiation n mWatts-secound/cm2. The daily UV radiation intensity shall be determined by reading the meter each day. If more than one meter is used, the daily recording will be and average of all meter readings each day.
2. Chlorine can be used as a back-up disinfection method for outfall (002) when low flow condition may cause malfunctioning of the UV system. Chlorine residual and amount used must be reported.

Effluent Irrigation Site

The site is described as follows:

58.22 acres identified as Tax lot 804, section 16, township 39, Range 08. Illinois Valley Golf Course. Owned by the Illinois Valley Golf Course Association.

Reuse Site Characteristics/ See attached section ***Effluent use agreement***

Reuse Site Characteristics

Topography, The land is primarily flat, bottomland surrounded by trees. There are 3 seasonal streams that flow through the site, two fresh water irrigation ponds and one effluent holding pond that is lined and fenced. Adequate buffer zones have been established for these waters/ although the streams are dry during the irrigation season. The site is a Golf Course with 9 holes the irrigation area is approximately 15 acres total; the vegetation is grass and some mature trees.

- Fairways are seeded with a 3-way rye. Greens are seeded with Bentgrass
- Soil is made up of Brown clay, medium gravel and sand

Reclaimed Effluent Application Rates

- Monitored dailies by Golf course in inches/ Acre see suggested form.

Monitoring and Record Keeping

- The Cities Treatment staff will monitor the parameters as outlined in the discharge permit.
- The Golf course will be supplied a suggested form that will show daily application of effluent in inches per/acre.

DAILY RECLAIMED WATER WORK SHEET FOR IV GOLF COURSE

CALCULATION:

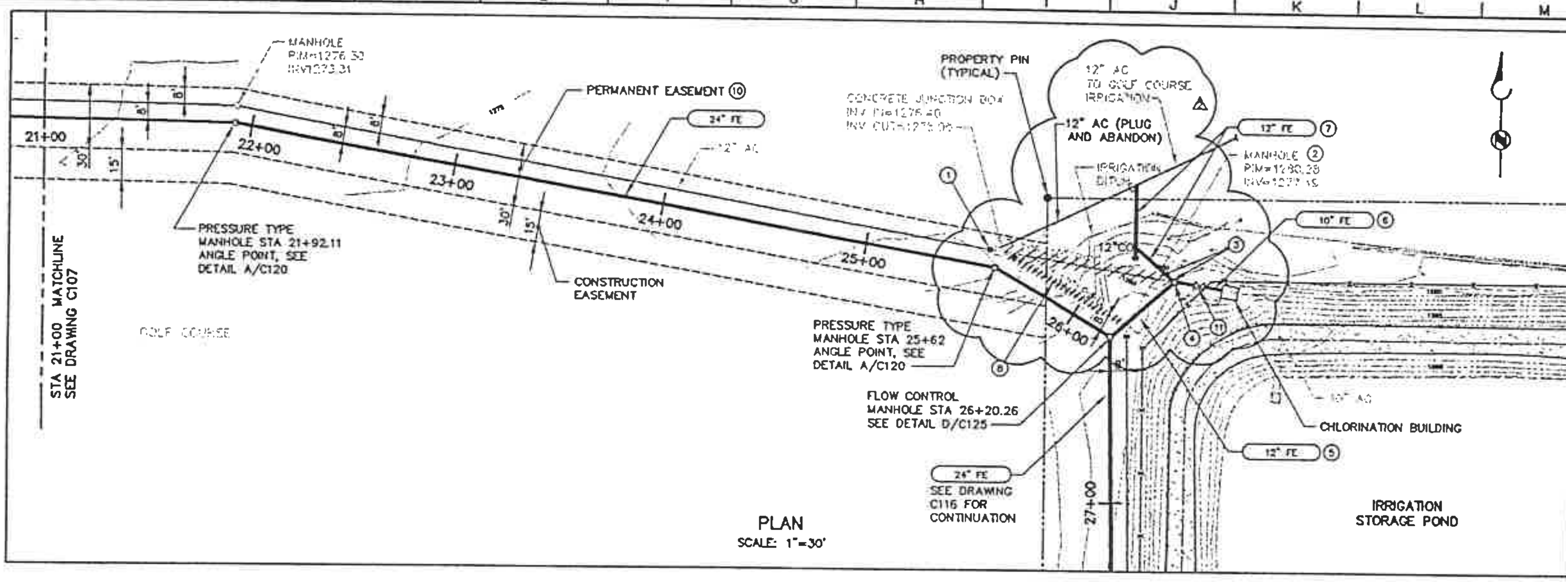
Gallons pumped/ Acres Applied/ 27,000 Gal/inch/acre = Inches / Acre

Examples: 250,000 Gal/pumped / 5 acres/ applied/ 27,000 Gal/inch/acre = 2 inches/ acre

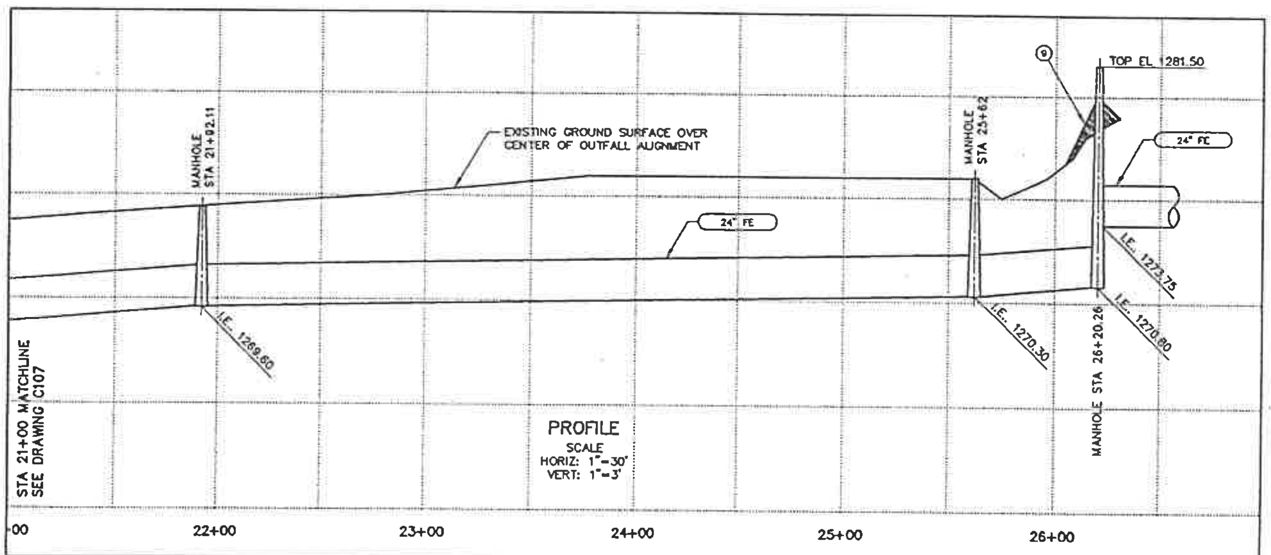
Month_______________

DATE	GALLONS PUMPED	ACRES/APPLIED	INCHES/ACRE	OPERATOR
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				

City's system drawing for Reclaimed water



PLAN
SCALE: 1"=30'



PROFILE
SCALE
HORIZ: 1"=30'
VERT: 1"=3'

NOTES:

1. CONTRACTOR SHALL FIELD VERIFY THE LOCATION OF AL UTILITIES PRIOR TO CONSTRUCTION.
2. THE EXISTING OUTFALL SHALL REMAIN UNDISTURBED.

KEY NOTES:

① PLUG EXISTING 12 INCH OUTFALL PIPE AT OUTLET OF JUNCTION BOX. DEMOLISH EXISTING CONCRETE JUNCTIO BOX.

② DEMOLISH MANHOLE TO PERMIT INSTALLATION OF 12" PLUG EXISTING 12 INCH OUTFALL AND FILL REMAINING MANHOLE.

③ EXISTING CHLORINE CONTACT TANK AND 10 INCH OUTFALL PIPING BETWEEN CONTACT TANK AND CONCR JUNCTION BOX. DEMOLISH CONTACT TANK AND PIPING.

④ PROVIDE NEW 48 INCH DIAMETER MANHOLE. SET TOP MANHOLE AT ELEVATION 1281.0 BACKFILL TO TOP OF MANHOLE. GRADE SURROUNDING GROUND TO DRAIN.

⑤ PROVIDE 12" FE. IE 1276.25 AT FLOW CONTROL MANH IE 1276.15 AT EASTERLY MANHOLE.

⑥ PROVIDE 10" FE. CONNECT TO EXISTING 10 INCH OUTF PIPING AND TO NEW MANHOLE AT IE 1277.00.

⑦ PROVIDE 12" FE. IE 1276.10 AT EASTERLY MANHOLE. CONNECT TO EXISTING 12 INCH AC TO GOLF COURSE IRRIGATION. PROVIDE CONCRETE CLOSURE COLLAR. SEE DETAIL B/C117.

⑧ DEMOLISH 12 INCH OUTFALL PIPING BETWEEN MANHOLE AND CONCRETE JUNCTION BOX.

⑨ PROVIDE FILL MATERIAL. SEE DETAIL D/C125.

⑩ FROM STATION 13+14 TO STATION 26+00, ACROSS THE FULL WIDTH OF THE PERMANENT AND CONSTRUCTION EASEMENTS, PROVIDE 8 INCH TOPPING LIFT OF TYPE L TOPSOIL MATERIAL SMOOTHLY GRADED TO MATCH EXISTING GRADE.

⑪ PROVIDE 10" GATE VALVE IN 10" FE PIPING. SEE BURIE VALVE DETAIL A/M10.

BROWN AND CALDWELL
EUGENE, OREGON

SUBMITTED: DATE:
APPROVED: DATE:

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

FILE	2656
DRAWN	REJ/GTM
DESIGNED	WMH
CHECKED	JDB

RECORD DRAWING
This record drawing was prepared using information reported to Brown and Caldwell and contains only the standard and customary level of detail. The information was not independently field verified. There is no ongoing program to update the drawings to reflect changes subsequent to the date indicated. Therefore, this drawing cannot be relied upon as an exact representation of actual conditions.

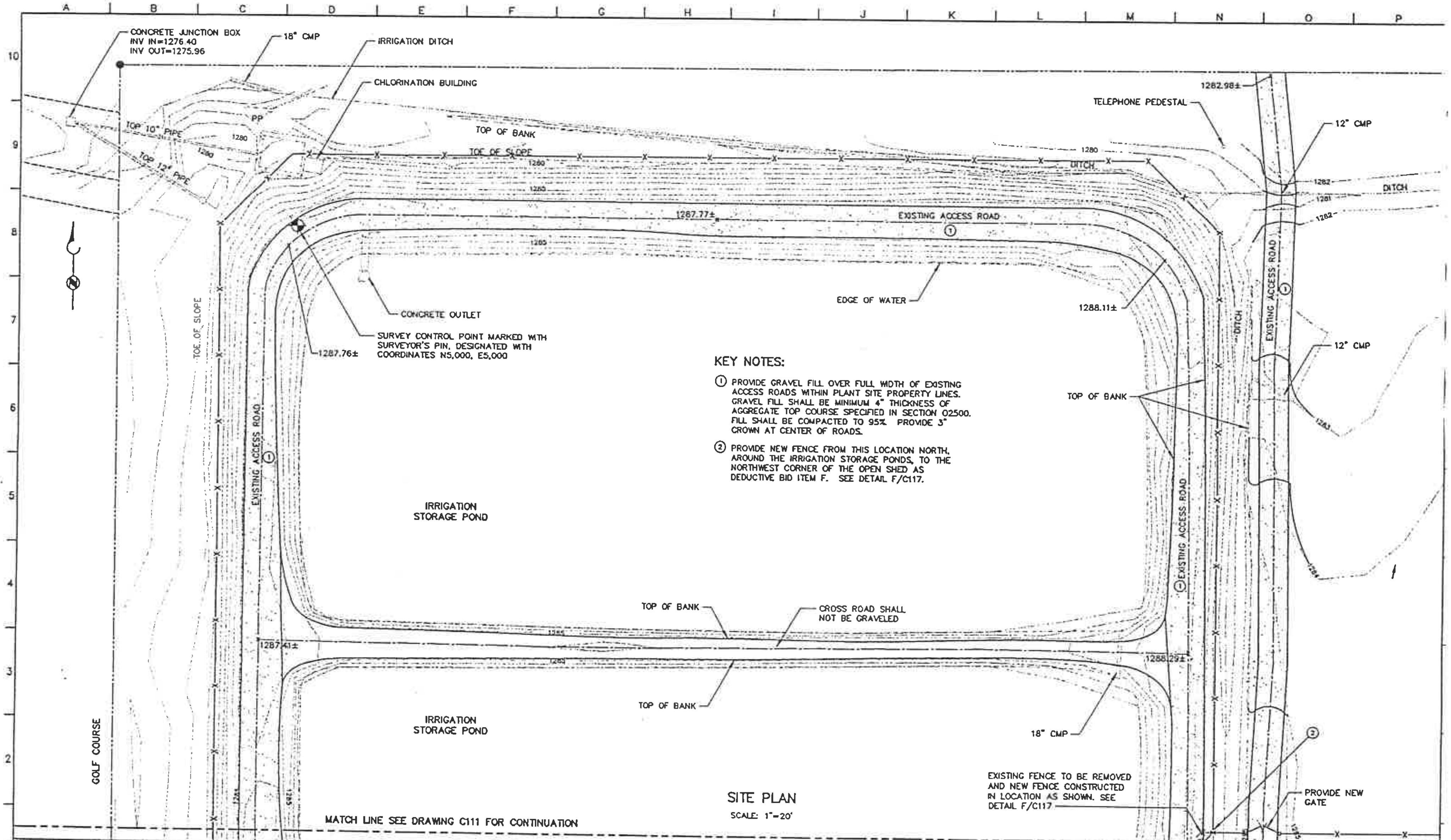
△	AS-BUILT	REM	01/99
△	REVISED DRAWINGS	REJ	11/96

CITY OF CAVE JUNCTION, OREGON

WASTEWATER TREATMENT PLANT

CIVIL
OUTFALL
PLAN AND PROFILE – 4

SCALE: AS NOTED
DRAWING NUMBER: C108
SHEET NUMBER



BROWN AND CALDWELL
EUGENE, OREGON

SUBMITTED: ____ DATE: ____
APPROVED: ____ DATE: ____
APPROVED: ____ DATE: ____

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

FILE 2656
DRAWN GTM
DESIGNED WMH
CHECKED JDB
CHECKED

RECORD DRAWING

This record drawing was prepared using information reported to Brown and Caldwell and contains only the standard and customary level of detail. The information was not independently field verified. There is no ongoing program to update the drawings to reflect changes subsequent to the date indicated. Therefore, this drawing cannot be relied upon as an exact representation of actual conditions.

By WMH Date 2/16/99

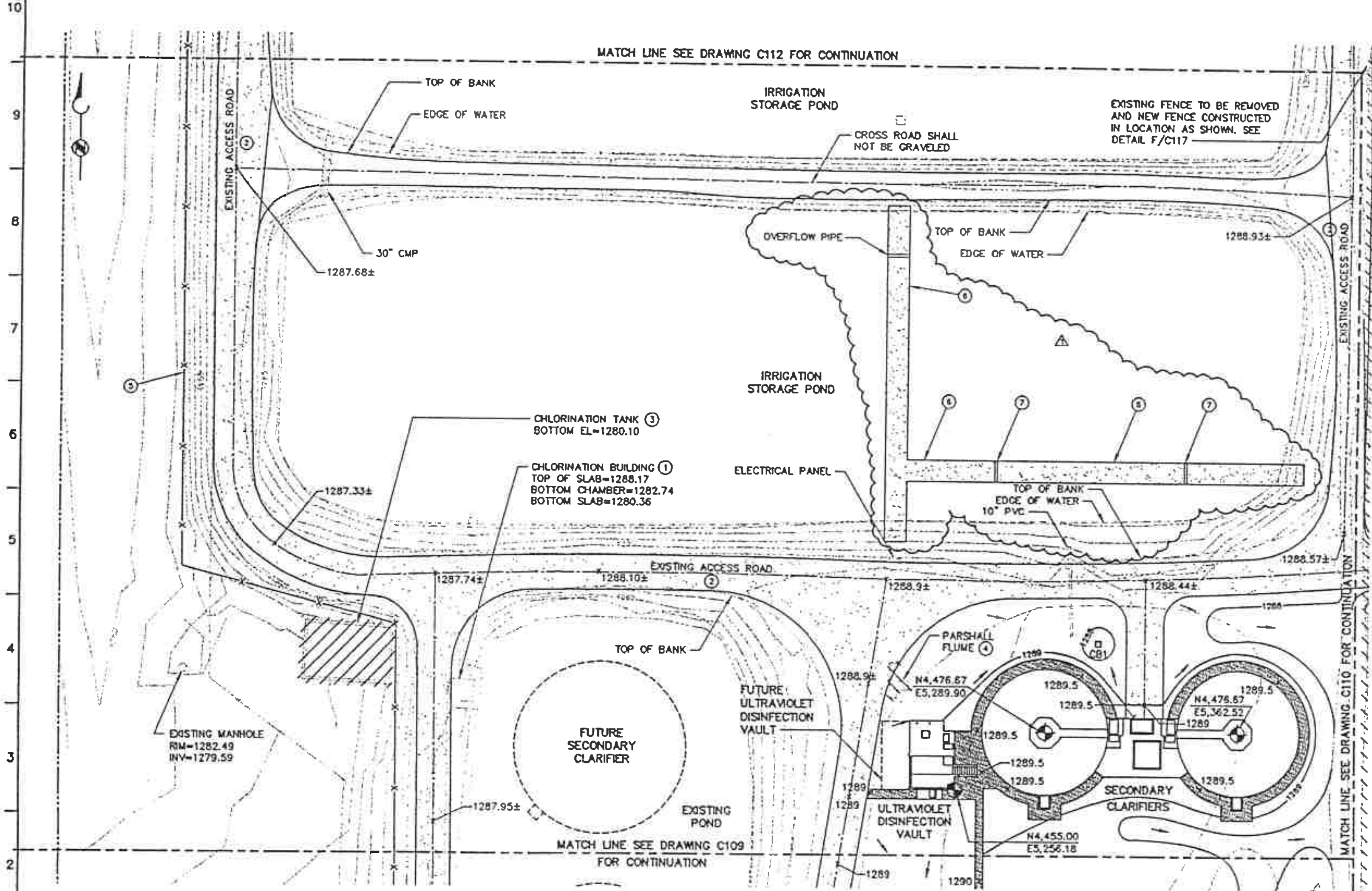
ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	1	AS-BUILT	REM	01/99	

CITY OF CAVE JUNCTION, OREGON

WASTEWATER TREATMENT PLANT IMPROVEMENTS

CIVIL
PLANT SURVEY CONTROL, PAVING, GRADING AND DEMOLITION PLAN – 4

SCALE AS NOTED
DRAWING NUMBER C112
SHEET NUMBER 18



SITE PLAN

SCALE: 1"=20'

NOTES:

1. THE FINISHED FLOOR OF THE OPERATIONS BUILDING AT ELEVATION 1296.00 WAS USED AS THE PLANT BENCHMARK ELEVATION. A SURVEY CONTROL POINT LOCATED ON THE NORTHWEST CORNER OF THE PLANT SITE WAS DESIGNATED WITH COORDINATES N5,000, E5,000. SEE DWG C112.
2. SIDEWALKS SHALL DRAIN AWAY FROM STRUCTURES AT A 2 PERCENT SLOPE. GRADES SHALL BE DETERMINED IN THE FIELD.

KEY NOTES:

① REMOVE EXISTING EQUIPMENT AND APPURTENANCES FROM CHLORINATION BUILDING. STORE EQUIPMENT IN A LOCATION AS DIRECTED.

② PROVIDE GRAVEL FILL OVER FULL WIDTH OF EXISTING ACCESS ROADS WITHIN PLANT SITE PROPERTY LINES. GRAVEL FILL SHALL BE MINIMUM 4" THICKNESS OF AGGREGATE TOP COURSE SPECIFIED IN SECTION 02500. FILL SHALL BE COMPACTED TO 95%. PROVIDE 3" CROWN AT CENTER OF ROADS.

③ FILL CHLORINATION TANK TO 1 FOOT ABOVE TOP OF WALLS WITH CLASS C2 FILL. SLOPE FILL TO EXISTING GRADE WITH A MAXIMUM SLOPE OF 1 FOOT VERTICAL TO 2.5 FEET HORIZONTAL.

④ DEMOLISH STRUCTURE, EQUIPMENT, PIPING, ELECTRICAL AND ASSOCIATED APPURTENCES.

⑤ PROVIDE NEW FENCE FROM THE NORTHWEST CORNER OF THE OPEN SHED, AROUND THE IRRIGATION STORAGE PONDS, TO NORTHWEST OF THE FACULTATIVE SLUDGE LAGOONS AS DEDUCTIVE BID ITEM F. SEE DETAIL F/C117.

⑥ PROVIDE SHALE BERM. TOP ELEVATION 1285.50± TOP OF BERM SHALL BE 8 TO 10 FEET WIDE.

⑦ PROVIDE OVERFLOW CHANNEL I.E. 1283.00 COVER WITH TREATED WOOD PLANKS.

BROWN AND CALDWELL
EUGENE, OREGON

SUBMITTED: ______ DATE: ______
APPROVED: ______ DATE: ______
APPROVED: ______ DATE: ______

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

FILE	2656
DRAWN	GTW
DESIGNED	WMH
CHECKED	JDS
CHECKED	

RECORD DRAWING
This record drawing was prepared using information reported to Brown and Caldwell and contains only the standard and customary level of detail. The information was not independently field verified. There is no ongoing program to update the drawings to reflect changes subsequent to the date indicated. Therefore, this drawing cannot be relied upon as an exact representation of actual conditions.
By WMH Date 2/16/99

ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	△	AS-BUILT	REM	01/99	

REVISIONS

CITY OF CAVE JUNCTION, OREGON

WASTEWATER TREATMENT PLANT IMPROVEMENTS

CIVIL
PLANT SURVEY CONTROL, PAVING, GRADING AND DEMOLITION PLAN – 3

SCALE: AS NOTED
DRAWING NUMBER: C111
SHEET NUMBER: 17

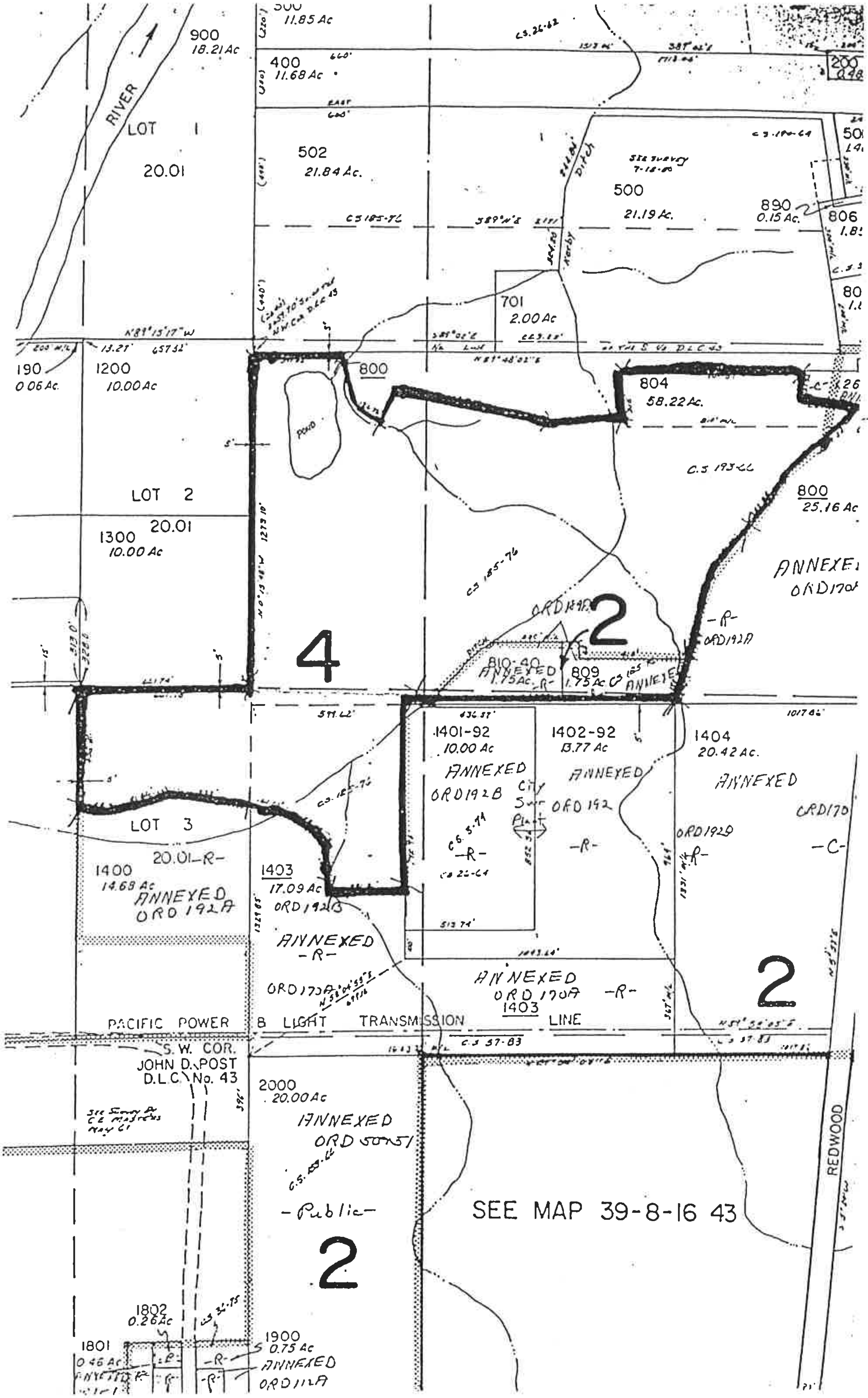
2656C111 08-03-

IV Golf course reclaimed water sytem

EXHIBIT "A" TO
LEASE AND
SEWER EFFLUENT USE AGREEMENT
BY AND BETWEEN THE CITY OF CAVE JUNCTION
AND THE ILLINOIS VALLEY GOLF ASSOCIATION, INC.
DATED MAY 1, 1978

A parcel of land in Donation Land Claim No. 43 & Section 16, Township 39 South, Range 8 West, Willamette Meridian, Josephine County, Oregon, being more particularly described as follows:

Beginning at the Southwest corner of the North 1/2 of the South 1/2 of said D.L.C. no. 43; thence along the West line of said D.L.C. no. 43, North 0°15'48" West 51.83 feet; thence South 89°04'51" East 5.00 feet to an Iron Rod which is the true point of beginning; thence parallel with said West line, North 0°15'48" West 1273.10 feet to an Iron Rod which is 5.00 feet South of the North line of said North 1/2 of the South 1/2; thence parallel with said North line, North 89°48'02" East 347.02 feet to the center of George Creek; thence along the center of said creek, South 11°24'10" East 194.22 feet; thence continue along the center of said creek, South 61°19'15" East 126.76 feet; thence North 17°57'06" East 120.87 feet to an Iron Rod; thence South 79°03'26" East 629.73 feet to the center of George Creek; thence along the center of said creek, North 65°50' East 230.00 feet; thence continue along the center of said creek, North 83°16'00" East 69.76 feet; thence North 7°32'45" West 171.65 feet to an Iron Rod; thence North 89°48'02" East 701.59 feet to an Iron Rod; thence South 4°48'43" West 107.52 feet to the center of George Creek; thence along the center of said creek, South 86°22'06" East 234.71 feet; thence South 47°15' West 377.52 feet to an Iron Rod; thence South 34°19'15" West 252.84 feet to an Iron Rod; thence South 40°47'30" West 251.33 feet to an Iron Rod; thence South 14°42'15" West 497.89 feet to an Iron Rod which is 5.00 feet North of the South line of said North 1/2 of the South 1/2; thence South 89°53'04" West 1044.35 feet to an Iron Rod; thence South 0°00'15" West 710.09 feet to an Iron Rod; thence South 89°44'09" West 291.21 feet to an Iron Rod; thence North 0°15'51" West 190.00 feet to an Iron Rod; thence North 55°02'32" West 179.59 feet to an Iron Rod; thence North 75°52'23" West 161.61 feet to an Iron Rod; thence North 84°09'34" West 332.00 feet to an Iron Rod; thence South 71°36'12" West 181.66 feet to an Iron Rod; thence West 158.54 feet to an Iron Rod 5.00 feet East of the West line of the East 1/2 of the Southwest 1/4 of said Section 16; thence parallel with said West line North 0°07'02" East 458.80 feet to an Iron Rod 5.00 feet South of the North line of said East 1/2 of the Southwest 1/4; thence parallel with said North line South 89°04'51" East 661.78 feet to the true point of beginning.



900
18.21 Ac
500
11.85 Ac
400
11.68 Ac
RIVER
LOT 1
20.01
502
21.84 Ac.
500
21.19 Ac.
890
0.15 Ac.
806
701
2.00 Ac
190
0.06 Ac.
1200
10.00 Ac
800
804
58.22 Ac.
POND
LOT 2
20.01
1300
10.00 Ac
800
25.16 Ac
ANNEXED
4
2
810-40
1.75 Ac.
809
1.75 Ac
1401-92
10.00 Ac
ANNEXED
ORD 192B
1402-92
13.77 Ac
ANNEXED
ORD 192
1404
20.42 Ac.
ANNEXED
ORD 170
ORD 192A
LOT 3
20.01-R-
1400
14.68 Ac
ANNEXED
ORD 192A
1403
17.09 Ac
ORD 192B
ANNEXED
-R-
ORD 170A
ANNEXED
ORD 170A
1403
-R-
2
PACIFIC POWER & LIGHT TRANSMISSION LINE
S.W. COR.
JOHN D. POST
D.L.C. No. 43
2000
20.00 Ac
ANNEXED
ORD 505/
-Public-
2
SEE MAP 39-8-16 43
REDWOOD
1802
0.26 Ac
1801
0.46 Ac
1900
0.75 Ac
ANNEXED
ORD 112A

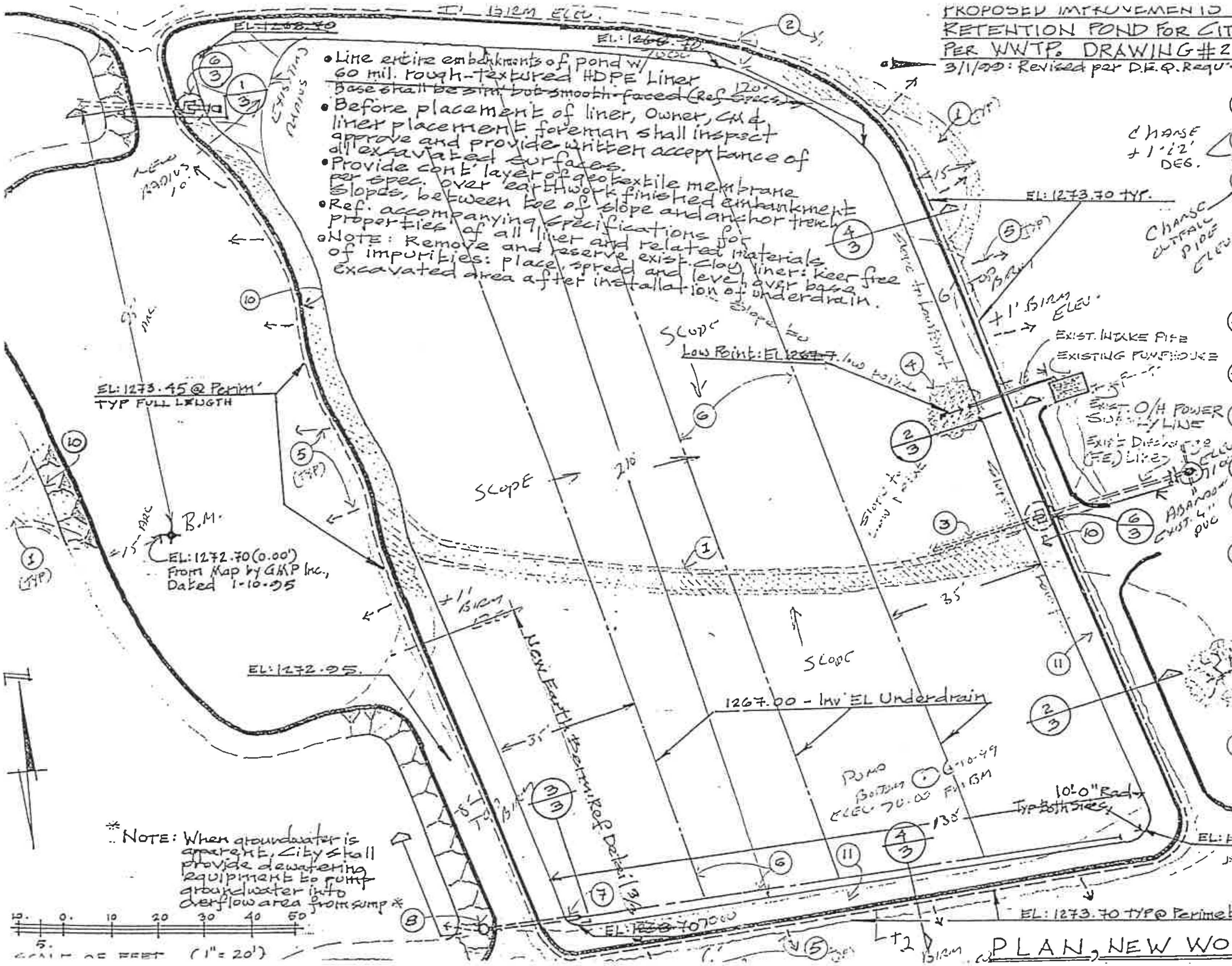
Property Information

North Latitude
42 10 40.9426

West Longitude
123 38 59.6092

MAP NUMBER	39081600000804
OWNERSHIP TYPE	PRIVATE
OWNER NAME	ILLINOIS VALLEY GOLF ASSOC INC
SITUS	25320 REDWOOD HWY
OWNER ADDRESS	PO BOX 749
CITY	CAVE JUNCTION
STATE	OR
ZIP	97523-0749
ZONE	EF,C
ACRES	58.22
PROPERTY FLAGS	
IMPROVEMENTS	MAIN.AREA

PROPOSED IMPROVEMENTS TO TREATED EFFLUENT
RETENTION POND FOR CITY OF CAVE JUNCTION,
PER WWTP. DRAWING #2
3/1/99: Revised per D.E.Q. Requ.



KEYED NOTES

1. Remove existing raised earth berms, and discard material
2. Maintain exist. North top & and line slope as typ.
3. Remove exposed length of existing PVC discharge pipe, to a point 30" from u/side of daylight in new embankment slope. Fo Standard HDPE boot & se around exposed pipe w/ extrusion-welded seam to primary liner.
4. Deposit 5 cu yd of round rock (6"-1½") on liner @ pump intake pipe.
5. Provide positive drainage away from pond @ perimeter
6. Provide 4" ø perf. HDPE or underdrain pipe per spec & Detail 6/6.3
7. 6" P.V.C. pipe, reducer & adaptor under berm to s
8. 15" ø P.V.C. vert sump for dewatering pump. Provide removeable co
9. Earthwork contractor sho verify, by means of an independent testing agency, that existing and new berms meet specified compaction standards for HDPE-R Liner
10. Consolidate and re-shape embankments where loos earth dykes removed.
11. Reshape entire east & so embankments to require slope.

PLAN, NEW WORK.

REGISTERED PROFESSIONAL ENGINEER 12,318 OREGON MAY 23, 19[illegible] RONALD A. BUSH

Ronald A. Bush

December 31, 1999

Illinois Valley Golf Association Irrigation System

Watering Statistics:

1. Pump 1 will pump 360 gallons per minute, operates from the fresh water pond only.
2. Pump 2 will pump 360 gallons per minute, operates from the effluent pond only.
3. Pumps are electrically interlocked so only one pump can run at any given time.
4. A total of 173 heads are located on the course. (Not including 27 hose connectors)
5. Each head uses 18 gallons per minute.
6. Quick connector head pressure is 75-80 psi. (Full set head pressure is not available until effluent system has water available to charge the system.)
7. Auto head pressure is 70-75 psi.
8. Quick connector sprinklers located around the greens are only used if the automatic system fails and can be supplemented with the hose and rainbird connected at the hose connectors.
9. Radius for sprinklers is a maximum of 45 feet.

When a pump is started, the entire system is charged. The system requires a minimum of 12 quick connector sprinklers (manually set) or 3 greens (auto - 15 sprinkler heads) must be in use at start up. Quick connector sprinklers are placed randomly on two holes during the watering schedule.

All piping is PVC with metal heads

WATERING:

1. The system operates on 10 sets per night (4 fresh water and 6 effluent).
2. Each set runs 45 minutes.
3. Each set has 20 heads.
4. Each head uses 810 gallons per set.
5. Each set uses 16,200 gallons of water.
6. Operating the system from 6:30 p.m. until 9:30 p.m.(first 4 sets with fresh water).
7. Operating the system from 9:30 p.m. until 2:00 a.m. (last 6 sets), applies 97,200 gallons of effluent.

SCHEDULE (Example only - starting times may vary)

1. 6:00 - 6:30 p.m.: First set is readied and system is energized.
2. 6:30 - 9:30 p.m.: 4 sets are made at 45 minutes per set using pump 1.
3. 9:30 - 2:00 a.m.: Watering is switched from pump 1 to pump 2 and 6 sets are made at 45 minutes per set.
4. 2:00 a.m.: Pump 2 is switched off and all heads are picked up. Pump 1 is switched to automatic and the system is re-energized.
5. Automatic run: Watering all greens and flushing all water lines with fresh water.

Placement of sprinkler sets will vary from time to time due to tournaments, twilight league golf, wet areas that require less water and dry areas that require more.

Watering is generally started in the proximity of the tees and worked toward the greens as the night progresses.

Where the placement of sprinklers have proximity to fresh water or human contact, the sprinklers are used during the first 4 sets with fresh water.

LEGEND:

1. Black dots - quick connector couplers for manual placement of sprinklers
2. Dots in diamond - automatic sprinkler system
3. X - hose connector
4. Semi-Circles: Spray pattern for 180 degree sprinklers

WATERING STATISTICS-

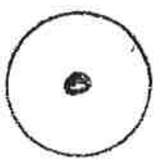
PUMPS 1 & 2 WILL PUMP 360 G.P.M. EACH
173 HEADS
EACH HEAD USES 18 G.P.M.

HEAD PRESSURE

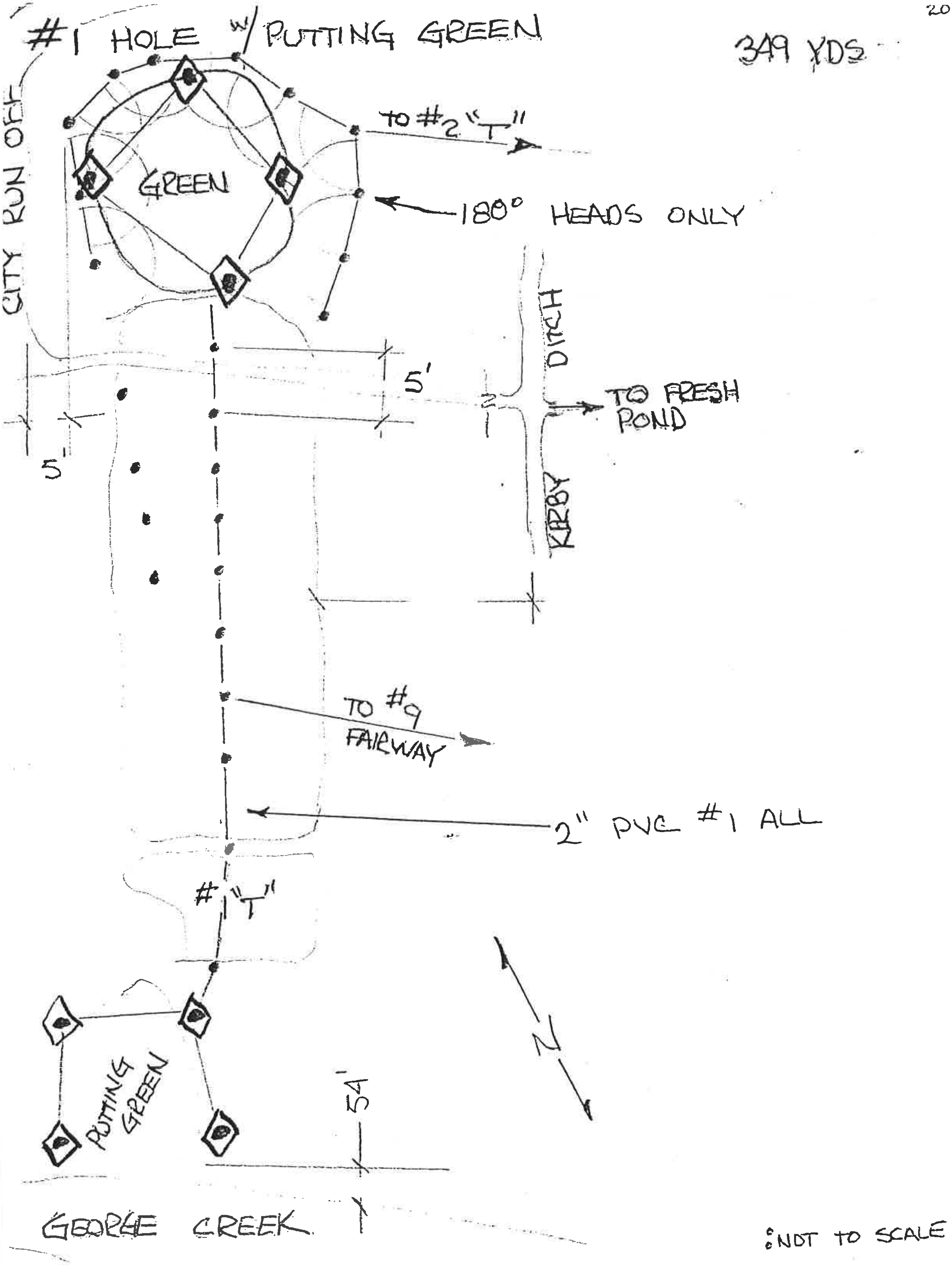
MANUAL – 75-80 PSI
AUTO'S – 70-75 PSI.

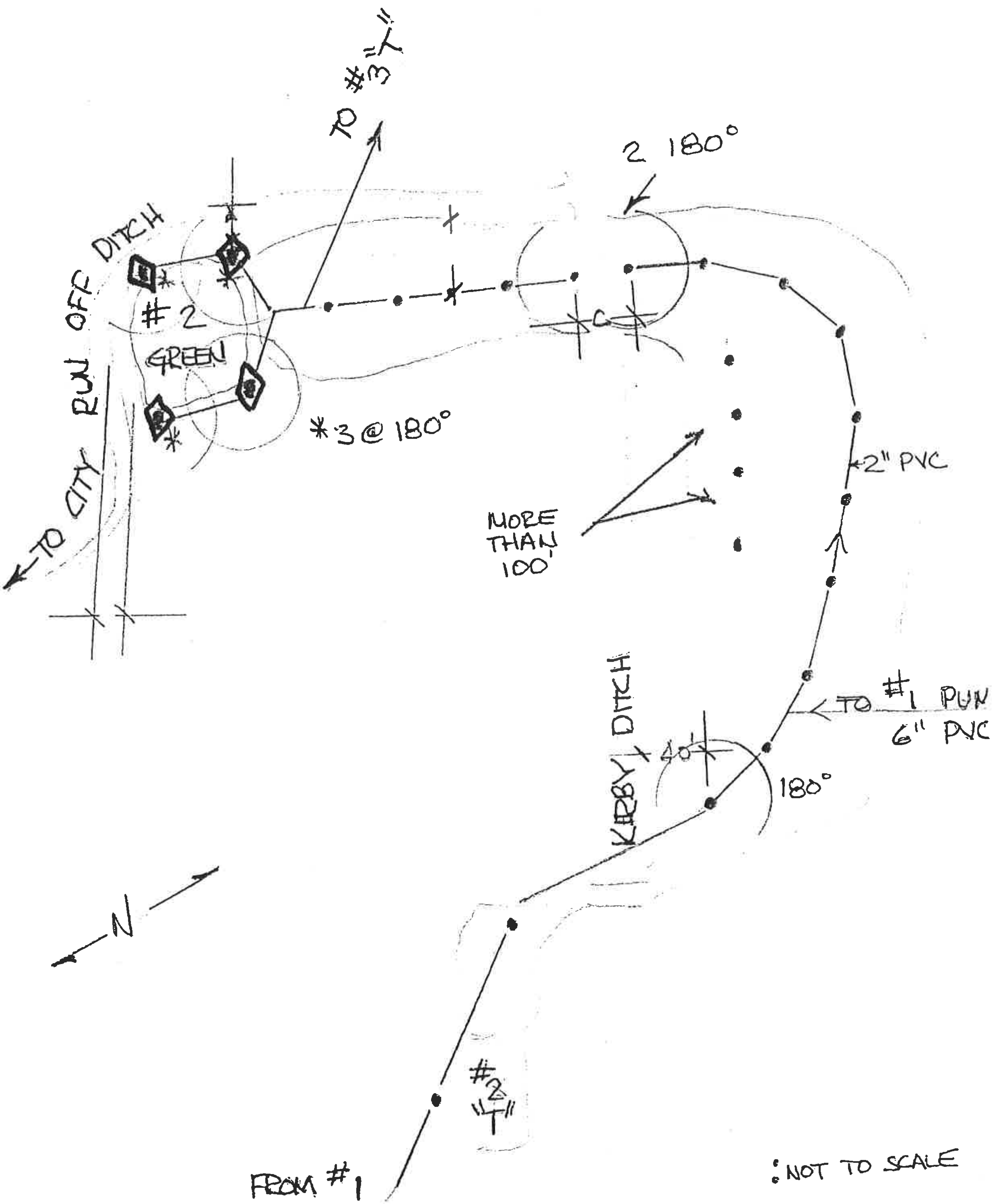
PIPE – PVC W/METAL HEADS

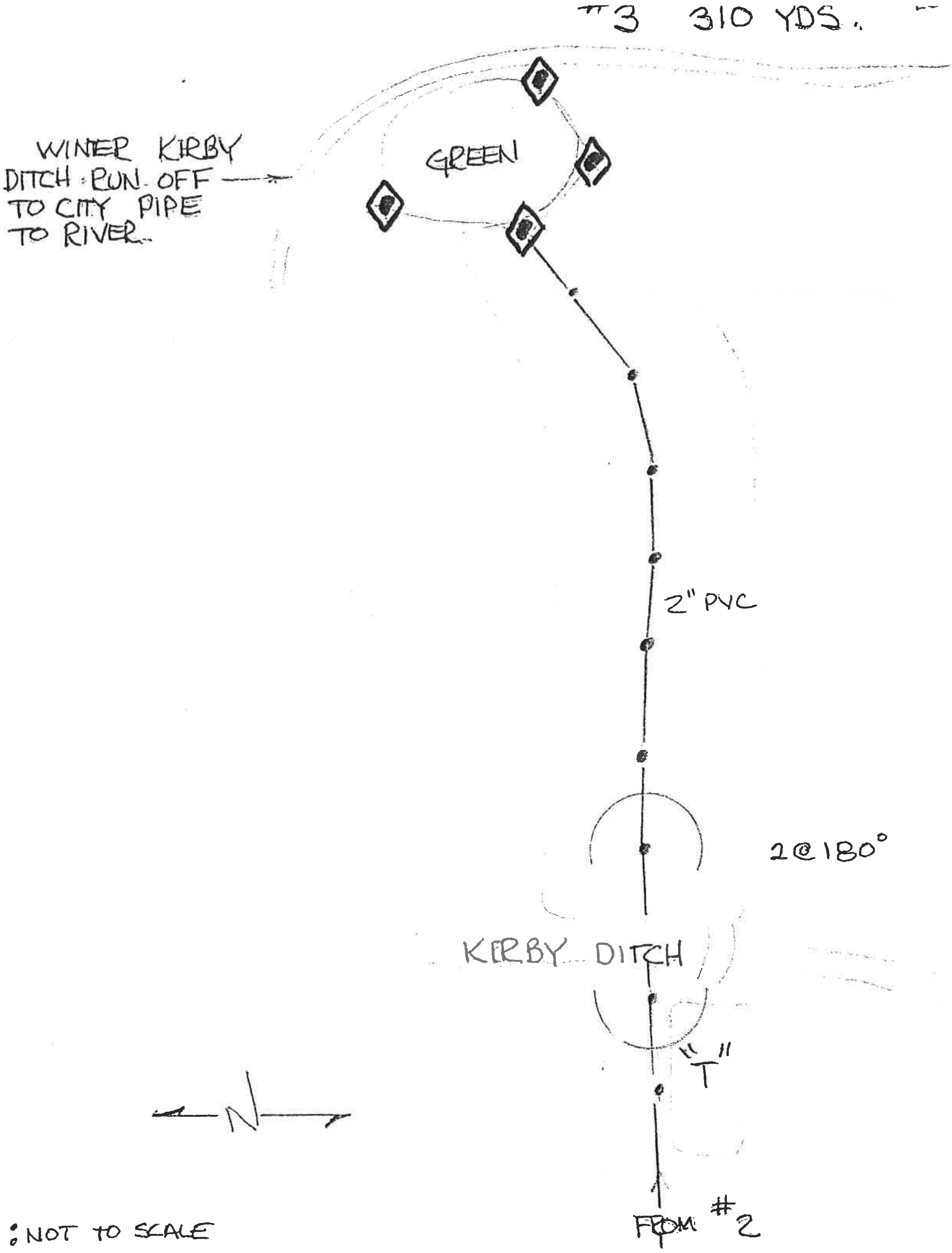
AUTOMATICS
RADIUS 45' @ 70-75 PSI



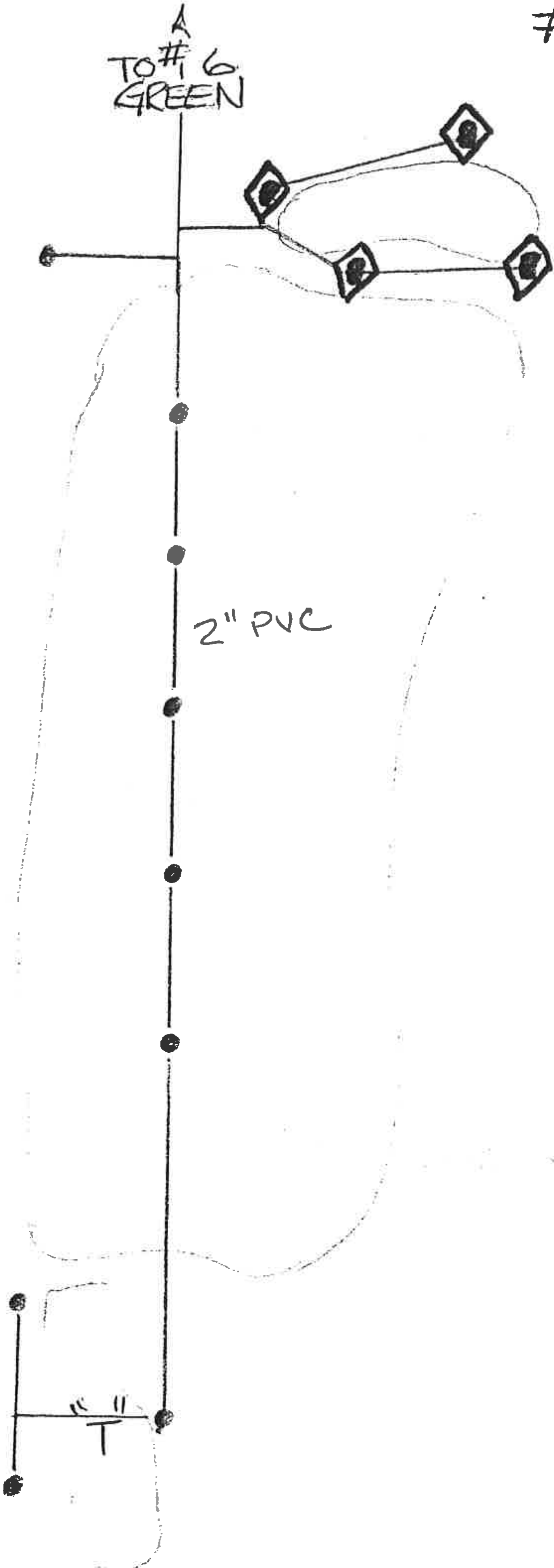
RADIUS 45' @ 75-80 PSI


#1 HOLE w/ PUTTING GREEN
349 YDS
CITY RUN OFF
GREEN
TO #2 "T"
180° HEADS ONLY
DITCH
KIRBY
TO FRESH POND
5'
5'
TO #9 FAIRWAY
2" PVC #1 ALL
#1 "T"
PUTTING GREEN
54'
N
GEORGE CREEK
:NOT TO SCALE

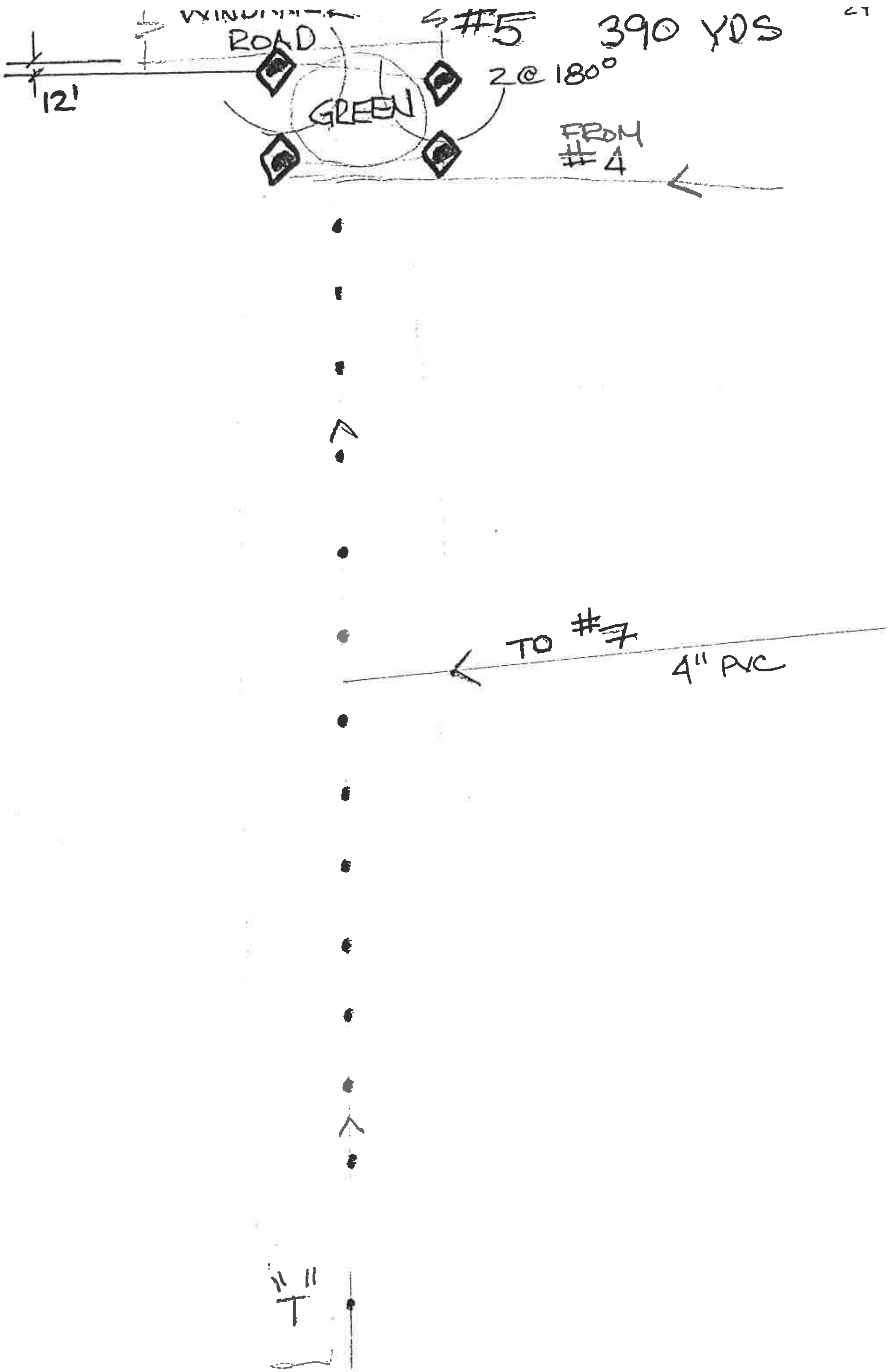

TO #3 "T"
RUN OFF DITCH
#2
GREEN
TO CITY
*3 @ 180°
2 180°
C
MORE THAN 100'
2" PVC
TO #1 PUN
6" PVC
KIRBY DITCH
40'
180°
N
#2 "T"
FROM #1
NOT TO SCALE


#3 310 YDS.
WINER KIRBY DITCH RUN OFF TO CITY PIPE TO RIVER
GREEN
2" PVC
2@180°
KIRBY DITCH
"T"
N
FROM #2
NOT TO SCALE

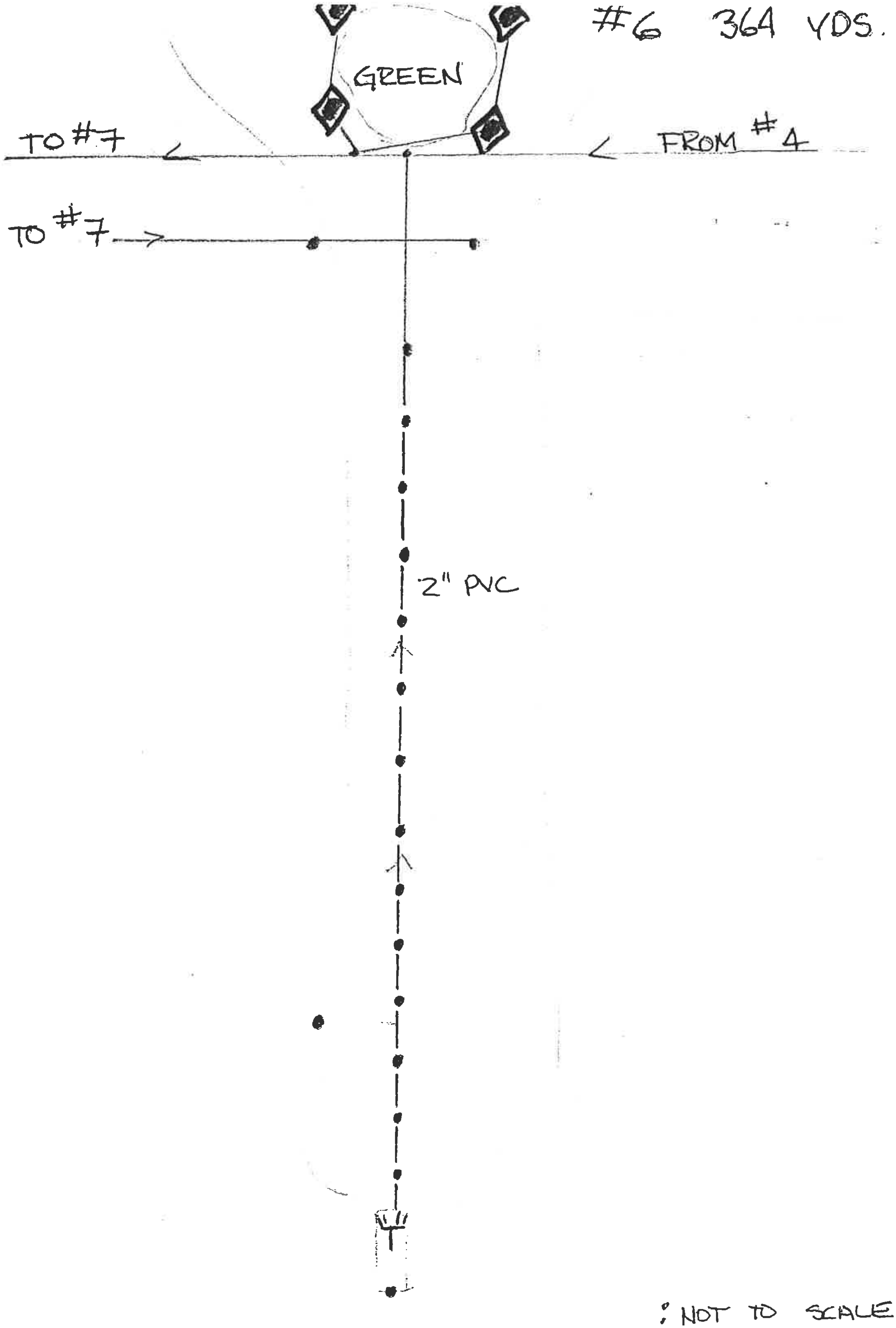
#4 150 YDS



NOT TO SCALE

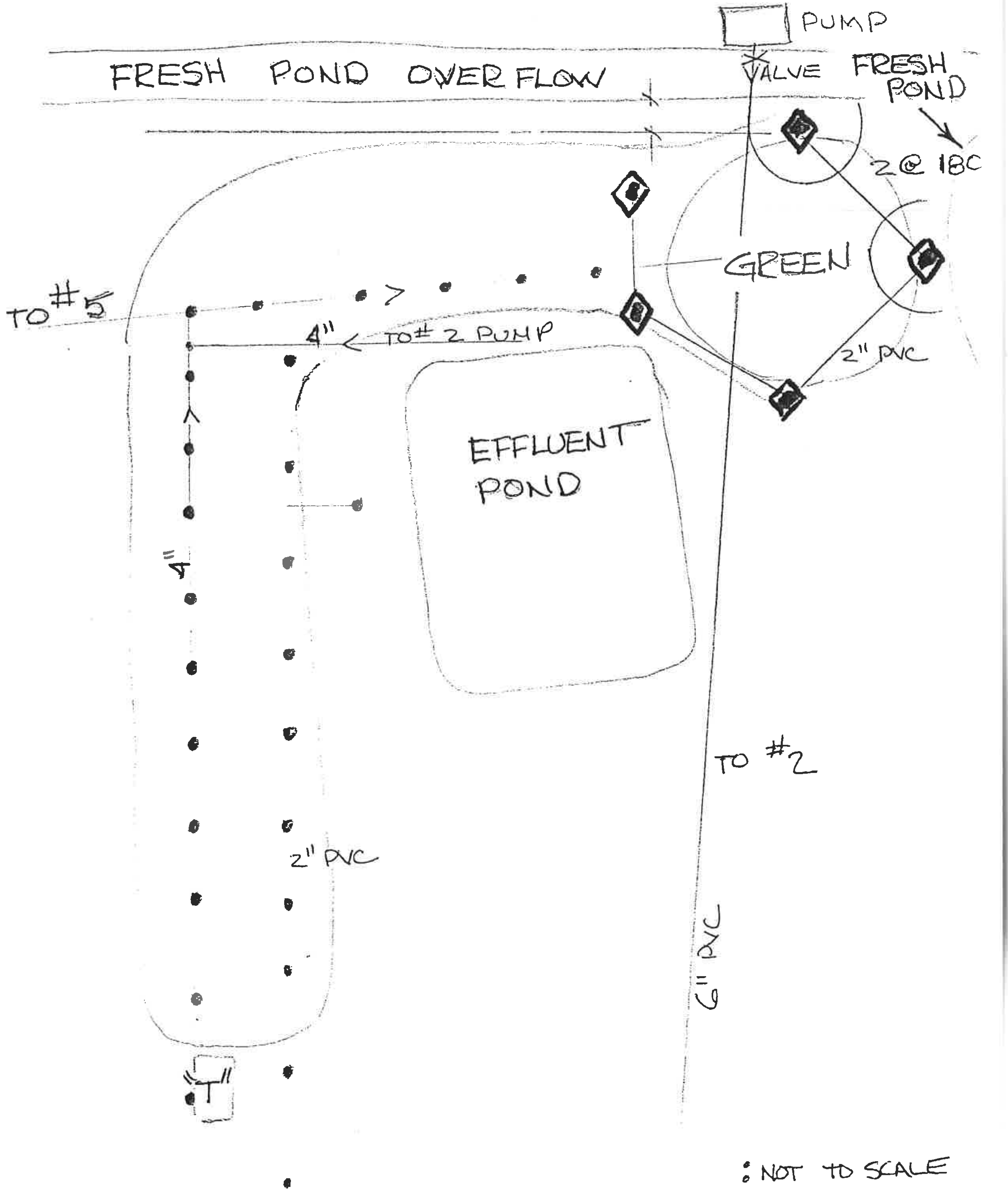


: NOT TO SCALE



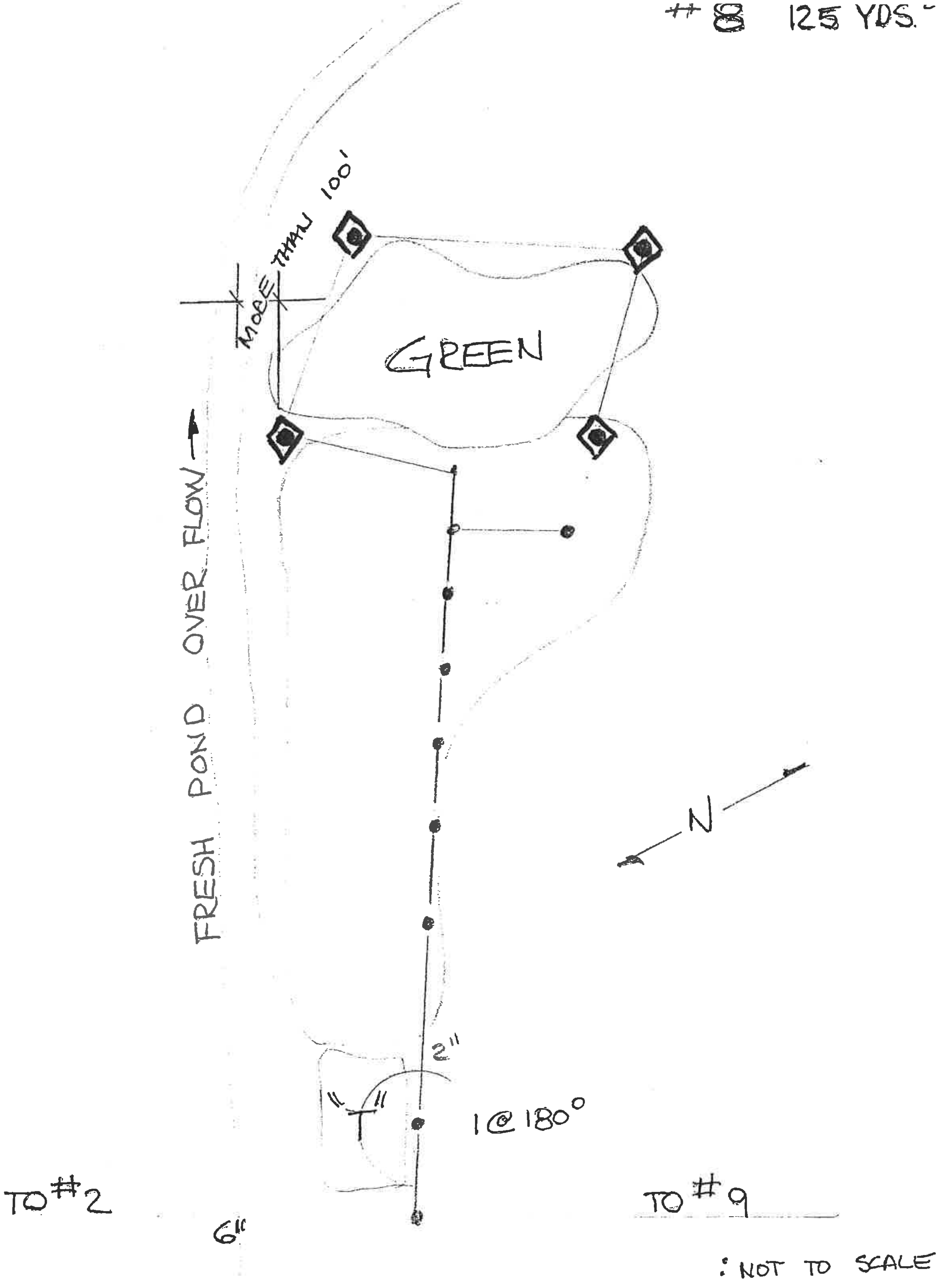
#6 364 YDS.
GREEN
TO #7
FROM #4
TO #7
2" PVC
NOT TO SCALE

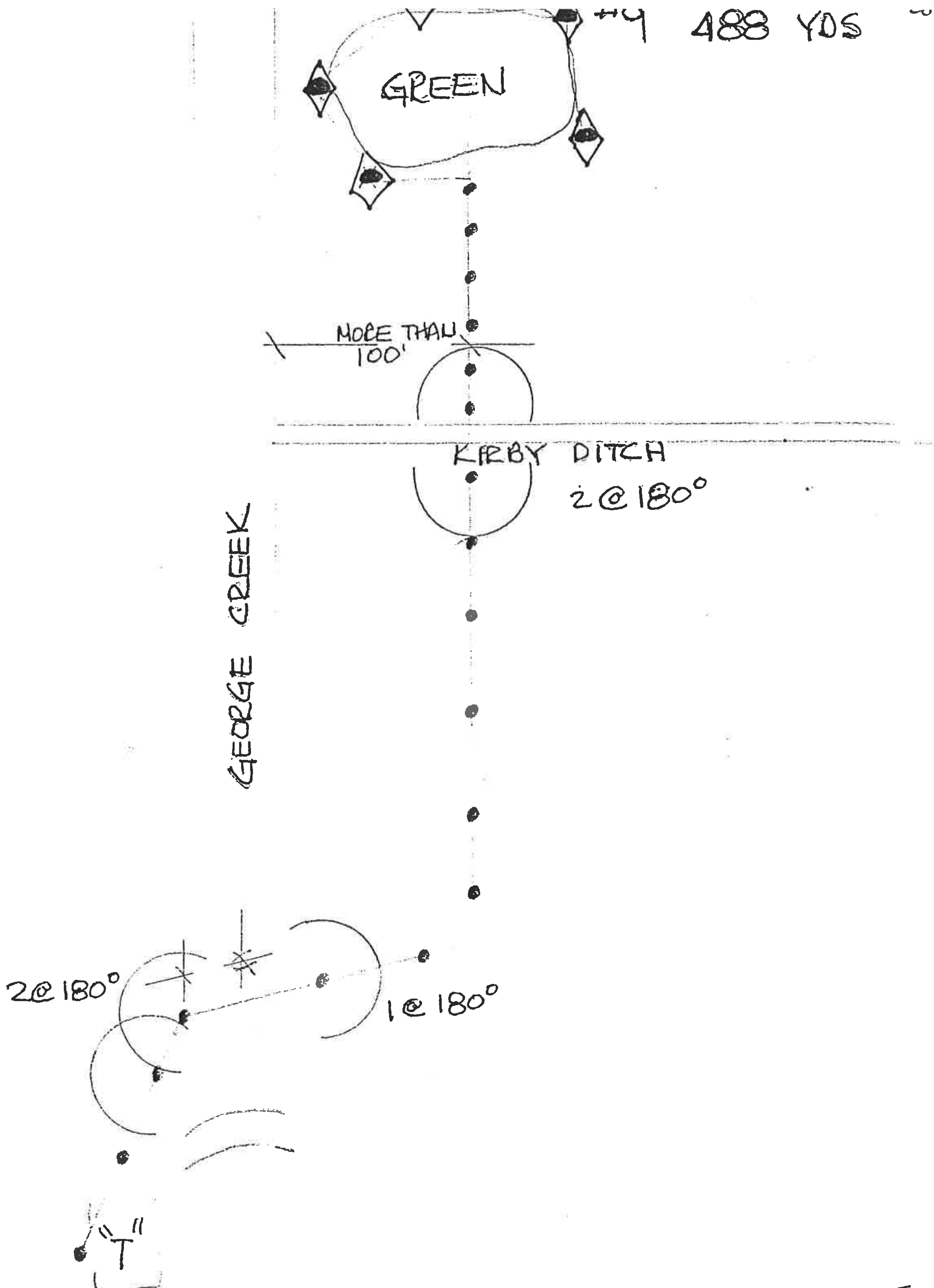
#7 371 YDS



: NOT TO SCALE

#8 125 YDS.


MORE THAN 100'
GREEN
FRESH POND OVER FLOW
N
2"
"T"
1@180°
TO #2
6"
TO #9
: NOT TO SCALE


#4 488 YDS
GREEN
MORE THAN 100'
KIRBY DITCH
2@180°
GEORGE CREEK
2@180°
1@180°
"T"

NOT TO SCALE

PG Hole

Set # Auto

Number of Heads: 4

Head Number	Type	Direction	GPM	PSI
1	Rainbird 51DS	360	18	70 to 75
2	Rainbird 51DS	360	18	70 to 75
3	Rainbird 51DS	360	18	70 to 75
4	Rainbird 51DS	360	18	70 to 75
5				
6				
7				
8				
9				
10				
11				
12				
13	Note: The Rainbird 51DS			
14	sprinkler heads will be replaced			
15	with Hunter 125 ADS sprinkler			
16	heads through attrition.			
17				
18				
19				
20				
21				
22				
23				
24				
25				

1 Hole | Set # Auto

Number of Heads: 4

Head Number	Type	Direction	GPM	PSI
1	Rainbird 51DS	360	18	70 to 75
2	Rainbird 51DS	360	18	70 to 75
3	Rainbird 51DS	180	18	70 to 75
4	Rainbird 51DS	180	18	70 to 75
	Note: The Rainbird 51DS			
	sprinkler heads will be replaced			
	with Hunter 125 ADS sprinkler			
	heads through attrition			

1 Hole

Set # Manual

Number of Heads: 14 w/11 Alt

Head Number	Type	Direction	GPM	PSI
1	Rainbird 70C Plug In	360	18	75 to 80
2	Rainbird 70C Plug In	360	18	75 to 80
3	Rainbird 70C Plug In	360	18	75 to 80
4	Rainbird 70C Plug In	360	18	75 to 80
5	Rainbird 70C Plug In	360	18	75 to 80
6	Rainbird 70C Plug In	360	18	75 to 80
7	Rainbird 70C Plug In	360	18	75 to 80
8	Rainbird 70C Plug In	360	18	75 to 80
9	Rainbird 70C Plug In	360	18	75 to 80
10	Rainbird 70C Plug In	360	18	75 to 80
11	Rainbird 70C Plug In	360	18	75 to 80
12	Rainbird 70C Plug In	360	18	75 to 80
13	Rainbird 70C Plug In	180	18	75 to 80
14	Rainbird 70C Plug In	180	18	75 to 80
A1	Rainbird 70C Plug In	180	18	75 to 80
A2	Rainbird 70C Plug In	180	18	75 to 80
A3	Rainbird 70C Plug In	180	18	75 to 80
A4	Rainbird 70C Plug In	180	18	75 to 80
A5	Rainbird 70C Plug In	180	18	75 to 80
A6	Rainbird 70C Plug In	180	18	75 to 80
A7	Rainbird 70C Plug In	180	18	75 to 80
A8	Rainbird 70C Plug In	180	18	75 to 80
A9	Rainbird 70C Plug In	180	18	75 to 80
A10	Rainbird 70C Plug In	180	18	75 to 80
A11	Rainbird 70C Plug In	180	18	75 to 80

2 Hole

Set # Auto

Number of Heads: 4

Head Number	Type	Direction	GPM	PSI
1	Rainbird 51DS	360	18	70 to 75
2	Rainbird 51DS	180	18	70 to 75
3	Rainbird 51DS	180	18	70 to 75
4	Rainbird 51DS	180	18	70 to 75
	Note: The Rainbird 51DS			
	sprinkler heads will be replaced			
	with Hunter 125 ADS sprinkler			
	heads through attrition			

2 Hole

Set # Manual

Number of Heads: Up to 21

Head Number	Type	Direction	GPM	PSI
1	Rainbird 70C Plug In	360	18	75 to 80
2	Rainbird 70C Plug In	360	18	75 to 80
3	Rainbird 70C Plug In	180	18	75 to 80
4	Rainbird 70C Plug In	360	18	75 to 80
5	Rainbird 70C Plug In	360	18	75 to 80
6	Rainbird 70C Plug In	360	18	75 to 80
7	Rainbird 70C Plug In	360	18	75 to 80
8	Rainbird 70C Plug In	360	18	75 to 80
9	Rainbird 70C Plug In	360	18	75 to 80
10	Rainbird 70C Plug In	360	18	75 to 80
11	Rainbird 70C Plug In	360	18	75 to 80
12	Rainbird 70C Plug In	360	18	75 to 80
13	Rainbird 70C Plug In	360	18	75 to 80
14	Rainbird 70C Plug In	360	18	75 to 80
15	Rainbird 70C Plug In	360	18	75 to 80
16	Rainbird 70C Plug In	180	18	75 to 80
17	Rainbird 70C Plug In	180	18	75 to 80
18	Rainbird 70C Plug In	360	18	75 to 80
19	Rainbird 70C Plug In	360	18	75 to 80
20	Rainbird 70C Plug In	360	18	75 to 80
21	Rainbird 70C Plug In	360	18	75 to 80
22				
23				
24				
25				
26				
27				

3 Hole

Set # Auto

Number of Heads: 4

Head Number	Type	Direction	GPM	PSI
1	Rainbird 51DS	360	18	70 to 75
2	Rainbird 51DS	360	18	70 to 75
3	Rainbird 51DS	360	18	70 to 75
4	Rainbird 51DS	360	18	70 to 75
5				
6				
7				
8				
9				
10				
11				
12				
13	Note: The Rainbird 51DS			
14	sprinkler heads will be replaced			
15	with Hunter 125 ADS sprinkler			
16	heads through attrition.			
17				
18				
19				
20				
21				
22				
23				
24				
25				

3 Hole

Set # Manual

Number of Heads: Up to 9

Head Number	Type	Direction	GPM	PSI
1	Rainbird 70C Plug In	360	18	75 to 80
2	Rainbird 70C Plug In	180	18	75 to 80
3	Rainbird 70C Plug In	180	18	75 to 80
4	Rainbird 70C Plug In	360	18	75 to 80
5	Rainbird 70C Plug In	360	18	75 to 80
6	Rainbird 70C Plug In	360	18	75 to 80
7	Rainbird 70C Plug In	360	18	75 to 80
8	Rainbird 70C Plug In	360	18	75 to 80
9	Rainbird 70C Plug In	360	18	75 to 80
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				

4 Hole

Set # Auto

Number of Heads: 4

Head Number	Type	Direction	GPM	PSI
1	Rainbird 51DS	360	18	70 to 75
2	Rainbird 51DS	360	18	70 to 75
3	Rainbird 51DS	360	18	70 to 75
4	Rainbird 51DS	360	18	70 to 75
5				
6				
7				
8				
9				
10				
11				
12				
13	Note: The Rainbird 51DS			
14	sprinkler heads will be replaced			
15	with Hunter 125 ADS sprinkler			
16	heads through attrition.			
17				
18				
19				
20				
21				
22				
23				
24				
25				

#4 Hole

Set # Manual

Number of Heads: Up to 9

Head Number	Type	Direction	GPM	PSI
1	Rainbird 70C Plug In	360	18	75 to 80
2	Rainbird 70C Plug In	360	18	75 to 80
3	Rainbird 70C Plug In	360	18	75 to 80
4	Rainbird 70C Plug In	360	18	75 to 80
5	Rainbird 70C Plug In	360	18	75 to 80
6	Rainbird 70C Plug In	360	18	75 to 80
7	Rainbird 70C Plug In	360	18	75 to 80
8	Rainbird 70C Plug In	360	18	75 to 80
9	Rainbird 70C Plug In	360	18	75 to 80
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				

5 Hole

Set # Auto

Number of Heads: 4

Head Number	Type	Direction	GPM	PSI
1	Rainbird 51DS	360	18	70 to 75
2	Rainbird 51DS	180	18	70 to 75
3	Rainbird 51DS	180	18	70 to 75
4	Rainbird 51DS	360	18	70 to 75
5				

5 Hole

Set # Manual

Number of Heads: Up to 14

Head Number	Type	Direction	GPM	PSI
1	Rainbird 70C Plug In	360	18	75 to 80
2	Rainbird 70C Plug In	360	18	75 to 80
3	Rainbird 70C Plug In	360	18	75 to 80
4	Rainbird 70C Plug In	360	18	75 to 80
5	Rainbird 70C Plug In	360	18	75 to 80
6	Rainbird 70C Plug In	360	18	75 to 80
7	Rainbird 70C Plug In	360	18	75 to 80
8	Rainbird 70C Plug In	360	18	75 to 80
9	Rainbird 70C Plug In	360	18	75 to 80
10	Rainbird 70C Plug In	360	18	75 to 80
11	Rainbird 70C Plug In	360	18	75 to 80
12	Rainbird 70C Plug In	360	18	75 to 80
13	Rainbird 70C Plug In	360	18	75 to 80
14	Rainbird 70C Plug In	360	18	75 to 80
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				

6 Hole

Set # Auto

Number of Heads: 4

Head Number	Type	Direction	GPM	PSI
1	Rainbird 51DS	360	18	70 to 75
2	Rainbird 51DS	360	18	70 to 75
3	Rainbird 51DS	360	18	70 to 75
4	Rainbird 51DS	360	18	70 to 75
5				
6				
7				
8				
9				
10				
11				
12				
13	Note: The Rainbird 51DS			
14	sprinkler heads will be replaced			
15	with Hunter 125 ADS sprinkler			
16	heads through attrition.			
17				
18				
19				
20				
21				
22				
23				
24				
25				

6 Hole

Set # Manual

Number of Heads: Up to 19

Head Number	Type	Direction	GPM	PSI
1	Rainbird 70C Plug In	360	18	75 to 80
2	Rainbird 70C Plug In	360	18	75 to 80
3	Rainbird 70C Plug In	360	18	75 to 80
4	Rainbird 70C Plug In	360	18	75 to 80
5	Rainbird 70C Plug In	360	18	75 to 80
6	Rainbird 70C Plug In	360	18	75 to 80
7	Rainbird 70C Plug In	360	18	75 to 80
8	Rainbird 70C Plug In	360	18	75 to 80
9	Rainbird 70C Plug In	360	18	75 to 80
10	Rainbird 70C Plug In	360	18	75 to 80
11	Rainbird 70C Plug In	360	18	75 to 80
12	Rainbird 70C Plug In	360	18	75 to 80
13	Rainbird 70C Plug In	360	18	75 to 80
14	Rainbird 70C Plug In	360	18	75 to 80
15	Rainbird 70C Plug In	360	18	75 to 80
16	Rainbird 70C Plug In	360	18	75 to 80
17	Rainbird 70C Plug In	360	18	75 to 80
18	Rainbird 70C Plug In	360	18	75 to 80
19	Rainbird 70C Plug In	360	18	75 to 80
20				
21				
22				
23				
24				
25				
26				
27				

7 Hole

Set # Auto

Number of Heads: 5

Head Number	Type	Direction	GPM	PSI
1	Rainbird 51DS	360	18	70 to 75
2	Rainbird 51DS	360	18	70 to 75
3	Rainbird 51DS	180	18	70 to 75
4	Rainbird 51DS	180	18	70 to 75
5	Rainbird 51DS	360	18	70 to 75

7 Hole

Set # Manual

Number of Heads: Up to 27

Head Number	Type	Direction	GPM	PSI
1	Rainbird 70C Plug In	360	18	75 to 80
2	Rainbird 70C Plug In	360	18	75 to 80
3	Rainbird 70C Plug In	360	18	75 to 80
4	Rainbird 70C Plug In	360	18	75 to 80
5	Rainbird 70C Plug In	360	18	75 to 80
6	Rainbird 70C Plug In	360	18	75 to 80
7	Rainbird 70C Plug In	360	18	75 to 80
8	Rainbird 70C Plug In	360	18	75 to 80
9	Rainbird 70C Plug In	360	18	75 to 80
10	Rainbird 70C Plug In	360	18	75 to 80
11	Rainbird 70C Plug In	360	18	75 to 80
12	Rainbird 70C Plug In	360	18	75 to 80
13	Rainbird 70C Plug In	360	18	75 to 80
14	Rainbird 70C Plug In	360	18	75 to 80
15	Rainbird 70C Plug In	360	18	75 to 80
16	Rainbird 70C Plug In	360	18	75 to 80
17	Rainbird 70C Plug In	360	18	75 to 80
18	Rainbird 70C Plug In	360	18	75 to 80
19	Rainbird 70C Plug In	360	18	75 to 80
20	Rainbird 70C Plug In	360	18	75 to 80
21	Rainbird 70C Plug In	360	18	75 to 80
22	Rainbird 70C Plug In	360	18	75 to 80
23	Rainbird 70C Plug In	360	18	75 to 80
24	Rainbird 70C Plug In	360	18	75 to 80
25	Rainbird 70C Plug In	360	18	75 to 80
26	Rainbird 70C Plug In	360	18	75 to 80
27	Rainbird 70C Plug In	360	18	75 to 80

8 Hole

Set # Auto

Number of Heads: 4

Head Number	Type	Direction	GPM	PSI
1	Rainbird 51DS	360	18	70 to 75
2	Rainbird 51DS	360	18	70 to 75
3	Rainbird 51DS	360	18	70 to 75
4	Rainbird 51DS	360	18	70 to 75
5				
6				
7				
8				
9				
10				
11				
12				
13	Note: The Rainbird 51DS			
14	sprinkler heads will be replaced			
15	with Hunter 125 ADS sprinkler			
16	heads through attrition.			
17				
18				
19				
20				
21				
22				
23				
24				
25				

8 Hole

Set # Manual

Number of Heads: Up to 10

Head Number	Type	Direction	GPM	PSI
1	Rainbird 70C Plug In	360	18	75 to 80
2	Rainbird 70C Plug In	180	18	75 to 80
3	Rainbird 70C Plug In	360	18	75 to 80
4	Rainbird 70C Plug In	360	18	75 to 80
5	Rainbird 70C Plug In	360	18	75 to 80
6	Rainbird 70C Plug In	360	18	75 to 80
7	Rainbird 70C Plug In	360	18	75 to 80
8	Rainbird 70C Plug In	360	18	75 to 80
9	Rainbird 70C Plug In	360	18	75 to 80
10	Rainbird 70C Plug In	360	18	75 to 80
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

9 Hole

Set # Auto

Number of Heads: 5

Head Number	Type	Direction	GPM	PSI
1	Rainbird 51DS	360	18	70 to 75
2	Rainbird 51DS	360	18	70 to 75
3	Rainbird 51DS	360	18	70 to 75
4	Rainbird 51DS	360	18	70 to 75
5	Rainbird 51DS	360	18	70 to 75
6				
7				
8				
9				
10				
11				
12				
13	Note: The Rainbird 51DS			
14	sprinkler heads will be replaced			
15	with Hunter 125 ADS sprinkler			
16	heads through attrition.			
17				
18				
19				
20				
21				
22				
23				
24				
25				

9 Hole

Set # Manual

Number of Heads: Up to 18

Head Number	Type	Direction	GPM	PSI
1	Rainbird 70C Plug In	360	18	75 to 80
2	Rainbird 70C Plug In	360	18	75 to 80
3	Rainbird 70C Plug In	180	18	75 to 80
4	Rainbird 70C Plug In	180	18	75 to 80
5	Rainbird 70C Plug In	180	18	75 to 80
6	Rainbird 70C Plug In	360	18	75 to 80
7	Rainbird 70C Plug In	360	18	75 to 80
8	Rainbird 70C Plug In	360	18	75 to 80
9	Rainbird 70C Plug In	360	18	75 to 80
10	Rainbird 70C Plug In	360	18	75 to 80
11	Rainbird 70C Plug In	360	18	75 to 80
12	Rainbird 70C Plug In	180	18	75 to 80
13	Rainbird 70C Plug In	180	18	75 to 80
14	Rainbird 70C Plug In	360	18	75 to 80
15	Rainbird 70C Plug In	360	18	75 to 80
16	Rainbird 70C Plug In	360	18	75 to 80
17	Rainbird 70C Plug In	360	18	75 to 80
18	Rainbird 70C Plug In	360	18	75 to 80
19				
20				
21				
22				
23				
24				
25				

EFFLUENT USE AGREEMENT

1999

LEASE AND
SEWER EFFLUENT USE AGREEMENT

THIS LEASE AND SEWER EFFLUENT USE AGREEMENT, made and entered into this 1st day of May , 1978, by and between ILLINOIS VALLEY GOLF ASSOCIATION, INC., an Oregon corporation, hereinafter known as "Golf Association", and the CITY OF CAVE JUNCTION, a municipal corporation in the State of Oregon, hereinafter known as "City",

WITNESSETH:

WHEREAS City is in the process of expansion of a municipal sewage treatment plant, hereinafter known as "Plant"; and

WHEREAS Golf Association is contract purchaser the real property described in Exhibit "A" attached hereto and hereby made a part hereof as though set out in full and at length herein and a greater portion of said property is being used and will be used as a golf course; and

WHEREAS the City because of said governmental regulations must not discharge Plant effluent, hereinafter known as "Effluent", or discharge water from said Plant into the Illinois River during certain times of the year and must discharge all of said Effluent from said Plant elsewhere during said times; and

WHEREAS it is expected that early during the term of this agreement the City will not be able to discharge any of its Effluent or water from said Plant into the Illinois River but will be required to dispose of all of such material other than by discharge into the Illinois River; and

WHEREAS Golf Association is desirous of taking designated quantities of said Effluent from said Plant for the purpose of using the said Effluent water in connection with the operation and maintenance of the Golf Association's golf course located on the real property described in the attached Exhibit "A",

NOW, THEREFORE, IT IS HEREBY AGREED between the Golf Association and the City as follows:

1. The recitals above set forth are especially made a part of this agreement.

2. The Golf Association leases and lets to the City and the City rents from the Golf Association the real property described in Exhibit "A" attached hereto for the special uses and purposes as herein contained for a term beginning the 1st day of May, 1979, and terminating the 30th day of April, 1999.

3. The rental to be paid by City to Golf Association for said twenty-year period shall be the sum of Sixty Seven Thousand Dollars ($67,000.00) to be paid as follows:

a. One Hundred Dollars ($100.00) upon the execution of this agreement, the receipt of which is acknowledged by Golf Association.

b. The balance of Sixty Six Thousand Nine Hundred Dollars ($66,900.00) shall be paid as soon as the money is made available to City as herein provided. It shall be paid, in any event, prior to the time the City begins the delivery of Effluent to the property described in Exhibit "A" hereto.

4. Each and all of the City's obligations hereunder are conditioned upon the City receiving an EPA grant of not less than seventy-five percent (75%) of the cost of the completed Plant and obtaining the remaining twenty-five percent (25%) through additional grants from governmental bodies and bond issue by the City and any combination of such means. City shall make every reasonable effort to obtain and comply with the EPA grant and make every reasonable effort to raise and obtain the additional twenty-five percent (25%) of the cost.

5. City shall operate its Plant in compliance with the valid rules and regulations of the State of Oregon and the United States of America and the agency or agencies of both governmental bodies having jurisdiction of the operation of the said Plant of the City. This includes not only the operation of the Plant, but also the storage and discharge of the Effluent therefrom.

6. City shall deliver said Effluent from the Plant to a point on the property line of the property described in Exhibit "A" hereto, said point is shown on the map attached hereto, marked Exhibit "B" and hereby made a part of this agreement.

7. The parties recognize that prior to the start of delivery of the Effluent to the Golf Association and at any time or times thereafter the requirements for the treatment of the effluent by the City may be increased or otherwise changed before the same may be sprayed or otherwise used on the golf course. Such change and requirements may come from the Oregon Department of Environmental Quality or any other state or federal agency, bureau, or any body having jurisdiction thereof. The responsibility of meeting such new, additional or changed requirement shall at all times be the direct responsibility of the City, which shall promptly and faithfully comply with any new or additional regulations.

Golf Association, however, shall have the obligation and responsibility of complying with any present and existing statute, rules or regulations governing the spraying or other disposal of the Effluent on the property described in Exhibit "A" hereto, and of meeting any new, additional or changed provisions of any statute, rule or regulation of any governmental body having jurisdiction of the spraying of the Effluent, and the Golf Association shall pay the entire cost thereof, except as hereinafter provided. In the event any governmental body having jurisdiction of the spraying of the Effluent shall impose a new, additional or changed provision for spraying the Effluent which shall result in increased cost to the Golf Association, the City agrees to make a good faith effort to apply for any governmental aid or grant which might be available to pay all or a portion of the cost of such change. Any such aid or grant which might be obtained by City for such purpose shall be applied by the City toward the cost of such change, and this shall constitute the sole liability of the City toward the cost of such change.

8. The City agrees to supply the Golf Association all of the Effluent from the City's Plant during the period June 1 to October 31st of each year. Golf Association agrees to accept the Effluent during this period and at other times when directed by the Oregon Department of Environmental Quality or agreed upon by the parties. Golf Association is not required, however, to accept more than 400,000 gallons of Effluent per day. City has the right to dispose of any Effluent in excess of 400,000 gallons of Effluent per day or its equivalent elsewhere as the City may desire. City agrees to cooperate with Golf Association in making use of any present storage facilities for temporarily storing said Effluent as may be permitted under existing or future governmental regulations and requirements.

9. The Golf Association agrees to use the said Effluent and apply the same on its golf course. Golf Association has the entire responsibility for the spraying or other application of the Effluent after it is delivered by City as herein provided. Golf Association shall not apply the Effluent beyond the boundaries of the property described in Exhibit "A", nor permit the Effluent to flow off the said real property.

10. City's obligation shall be the delivery of the Effluent to Golf Association's property line and the payment of the rental reserved hereunder. Association will take Effluent as long as it meets requirements of the Department of Environmental Quality or other controlling body for Effluent to be sprayed on Golf Association's golf course.

11. Golf Association must obtain and present to City executed documents to be recorded by it showing existing contract to purchase property described in Exhibit "A" or other right therein acceptable to City and other bodies as herein required. Golf Association must further obtain from each person, firm or corporation having title to, a lien upon or interest in any portion of the property described in Exhibit "A" hereto the consent of such person, firm or corporation to this agreement and its recording and further making each such person, firm or corporation's interest in the property subordinate to the paramount rights of the City in and to the property described in Exhibit "A" and all of the terms of this agreement. Such agreement shall provide that in the event any of said parties retake or otherwise exercise control of all or any portion of the property described in Exhibit "A" that such action shall be subject to the prior rights of the City under the terms of the conditions of this agreement and the rights of the City to continue under this agreement for the full term thereof. Each and all such agreements shall be made binding upon the heirs, successors and assigns of the parties executing the same. All such documents must be in a form approved by City and by each and all the State of Oregon or federal government agencies or bodies providing financial assistance to the City's Plant, or having jurisdiction over the same.

12. Golf Association shall pay all taxes levied and assessed on the property promptly as the same become due and before they begin to draw interest or incur other penalty. In addition, Golf Association shall pay promptly the payments of principal and interest when the same come due on any and all liens or encumbrances against all or any portion of the property described in Exhibit "A" hereto.

13. Golf Association assumes all responsibility for the care and the use of the Effluent from the City's Plant from the time it is delivered to the Golf Association property.

14. In the event that Golf Association should fail to pay taxes or other charges against the real property described in Exhibit "A" hereto, the City has the option, but is not obligated so to do, to pay any of such charges to protect its right to the use of the property. The payments, if any, by the City shall be a first lien upon the real property described in Exhibit "A" paramount to any title, right, interest or lien in or on said property.

15. In the event the Golf Association for any reason should fail or refuse to accept and dispose of the Effluent from the City's Plant to a volume not exceeding 400,000 gallons per day in an acceptable manner, and in compliance with all present and future governmental rules, regulations and laws, City is hereby granted the right to the use of the sprinkling system, pumping facilities and all other facilities necessary or convenient in the spraying and disposal of said Effluent on the property described in Exhibit "A" hereto. All of the reasonable costs and expenses incurred by the City in such operation in handling the disposal of the said Effluent shall be a charge against the Golf Association and are hereby made a first lien against the property described in Exhibit "A" hereto paramount and superior to any liens now or hereafter on the property or any portion thereof. Golf Association shall obtain the consent of such lienholders to this subrogation.

16. In the event any of the liens herein granted City by the Golf Association on the property described in Exhibit "A" hereto are not paid and the same are not paid within thirty (30) days of written demand for the payment of the same, the City may proceed to foreclose said liens as a mortgage upon real property is foreclosed.

17. In the event of any suit, action or proceedings to enforce any of the terms or conditions of this agreement, the party prevailing in such suit, action or other proceeding shall have and recover, in addition to any other relief, such sum as the court may adjudge reasonable as attorney's fees in such suit, action or other proceeding, in addition to such prevailing party's statutory costs and disbursements. If any appeal or appeals are taken from any judgment or decree of the trial court, the ultimately prevailing party in such appeal or appeals shall, in like manner, have and recover such sum as said court or courts may adjudge reasonable as attorney's fees, statutory costs and disbursements in such appeal or appeals.

In addition, if City forecloses this contract, Golf Association promises to pay the cost of a preliminary foreclosure report furnished by a duly authorized title company.

18. This agreement shall be binding upon and inure to the benefit of the successors and assigns of the parties.

19. Prior to the payment of the full rental, the Golf Association shall give City two scale maps setting forth the Golf Association's proposed layout of the system for disposing of the Effluent upon the real property described in Exhibit "A". The plan shall show the entire layout of the sprinkling system with the location of the disposal and sprinkling system, the location of the sprinklers and similar maps shall be supplied for any additions or changes hereafter made in the disposal system. The present plans and any additions or changes in the future shall be subject to approval of the Oregon Department of Environmental Quality and any other regulatory body having jurisdiction of the disposal system.

20. Golf Association agrees that it shall not abandon or permit to lapse its water rights for irrigation of the property described in Exhibit "A". In addition, Golf Association shall not sell nor attempt to sell nor transfer nor attempt to transfer any part of the water rights now pertaining to the property described in Exhibit "A" and shall at all times have a valid right to transfer the water from its point of diversion to the property described in Exhibit "A".

21. It is recognized and agreed that this lease and all of its terms are subject to the prior approval of the Oregon Department of Environmental Quality and any other government agency or agencies having jurisdiction of the matters treated in this agreement. Prior approval of such agency or agencies must be obtained before City can execute this document.

22. The Golf Association shall, at all reasonable times, allow authorized representatives of the Department of Environmental Quality and/or the City:

a. To enter upon the Golf Association's premises where an Effluent source or disposal system is located;

b. To inspect any equipment required by this agreement.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be executed by their duly authorized officers as of the day and year first above written.

CITY: CITY OF CAVE JUNCTION, a municipal corporation in the State of Oregon	GOLF ASSOCIATION: ILLINOIS VALLEY GOLF ASSOCIATION, INC., an Oregon corporation
By Herbert R. Higgins Mayor	By Frank Ault President
ATTEST: Wilma D. Anderson Clerk	By Marjorie Culbertson Secretary Asst.

On the day, May 1, 1978, personally appeared the above named Herbert R. Higgins, known to me as the Mayor of the City of Cave Junction, Frank Ault, President of the Illinois Valley Golf Association, and Marjorie Culbertson, Assistant Secretary for the Illinois Valley Golf Association and did acknowledge the foregoing instrument to be their own voluntary act and deed.

Wilma D. Anderson
Wilma D. Anderson Notary Public
My Commission Expires 5-8-79

EXHIBIT "A" TO
LEASE AND
SEWER EFFLUENT USE AGREEMENT
BY AND BETWEEN THE CITY OF CAVE JUNCTION
AND THE ILLINOIS VALLEY GOLF ASSOCIATION, INC.
DATED MAY 1, 1978

A parcel of land in Donation Land Claim No. 43 & Section 16, Township 39 South, Range 8 West, Willamette Meridian, Josephine County, Oregon, being more particularly described as follows:

Beginning at the Southwest corner of the North 1/2 of the South 1/2 of said D.L.C. no. 43; thence along the West line of said D.L.C. no. 43, North 0°15'48" West 51.83 feet; thence South 89°04'51" East 5.00 feet to an Iron Rod which is the true point of beginning; thence parallel with said West line, North 0°15'48" West 1273.10 feet to an Iron Rod which is 5.00 feet South of the North line of said North 1/2 of the South 1/2; thence parallel with said North line, North 89°48'02" East 347.02 feet to the center of George Creek; thence along the center of said creek, South 11°24'10" East 194.22 feet; thence continue along the center of said creek, South 61°19'15" East 126.76 feet; thence North 17°57'06" East 120.87 feet to an Iron Rod; thence South 79°03'26" East 629.73 feet to the center of George Creek; thence along the center of said creek, North 65°58' East 230.00 feet; thence continue along the center of said creek, North 83°16'00" East 69.76 feet; thence North 7°32'45" West 171.65 feet to an Iron Rod; thence North 89°48'02" East 701.59 feet to an Iron Rod; thence South 4°48'43" West 107.52 feet to the center of George Creek; thence along the center of said creek, South 86°22'08" East 234.71 feet; thence South 47°15' West 377.52 feet to an Iron Rod; thence South 34°19'15" West 252.84 feet to an Iron Rod; thence South 40°47'30" West 251.33 feet to an Iron Rod; thence South 14°42'15" West 497.89 feet to an Iron Rod which is 5.00 feet North of the South line of said North 1/2 of the South 1/2; thence South 89°53'04" West 1044.35 feet to an Iron Rod; thence South 0°00'15" West 710.09 feet to an Iron Rod; thence South 89°44'09" West 291.21 feet to an Iron Rod; thence North 0°15'51" West 190.00 feet to an Iron Rod; thence North 55°02'32" West 179.59 feet to an Iron Rod; thence North 75°52'23" West 161.61 feet to an Iron Rod; thence North 84°09'34" West 332.00 feet to an Iron Rod; thence South 71°36'12" West 181.66 feet to an Iron Rod; thence West 158.54 feet to an Iron Rod 5.00 feet East of the West line of the East 1/2 of the Southwest 1/4 of said Section 16; thence parallel with said West line North 0°07'02" East 458.80 feet to an Iron Rod 5.00 feet South of the North line of said East 1/2 of the Southwest 1/4; thence parallel with said North line South 89°04'51" East 661.78 feet to the true point of beginning.

LEASE AND SEWER EFFLUENT USE AGREEMENT MODIFICATION

THIS LEASE AND SEWER EFFLUENT USE AGREEMENT MODIFICATION, made and entered into this 1st day of June, 1994, by and between ILLINOIS VALLEY GOLF ASSOCIATION, INC., an Oregon corporation, hereinafter known as "Golf Association", and the CITY OF CAVE JUNCTION, a municipal corporation in the State of Oregon, hereinafter known as "CITY".

WHEREAS, on May 1, 1978, the ILLINOIS VALLEY GOLF ASSOCIATION, an Oregon corporation, and the CITY OF CAVE JUNCTION, a municipal corporation of the State of Oregon, entered into a certain Sewer Effluent Agreement. A copy of this agreement is attached hereto.

WHEREAS, this agreement provided that "The parties recognize that prior to the start of delivery of the Effluent to the Golf Association and at any time or times thereafter the requirements for the treatment of the Effluent by the City may be increased or otherwise changed before the same may be sprayed or otherwise used on the golf course. Such change and requirements may come from the Oregon Department of Environmental Quality or any other state or federal agency, bureau, or any body having jurisdiction thereof. The responsibility of meeting such new, additional or changed requirement shall at all times be the direct responsibility of the City, which shall promptly and faithfully comply with any new or additional regulations.

Golf Association, however, shall have the obligation and responsibility of complying with any present and existing statute, rules or regulations governing the spraying or other disposal of the Effluent on the property described in EXHIBIT "A" hereto, and of meeting any new, additional or changed provisions of any statute, rule or regulation of any governmental body having jurisdiction of the spraying of the Effluent, and the Golf Association shall pay the entire cost thereof, except as hereinafter provided. In the event any governmental body having jurisdiction of the spraying of the Effluent shall impose a new, additional or changed provision for spraying the Effluent which shall result in increased cost to the Golf Association, the City agrees to make a good faith effort to apply for any governmental aid or grant which might be available to pay all or a portion of the cost of such change. Any such aid or grant which might be obtained by City for such purpose shall be applied by the City toward the cost of such change, and this shall constitute the sole liability of the City toward the cost of such change."

WHEREAS, OAR 340-55-015(9) states that:

> "Any reclaimed water released for use on property not under the direct control of the sewage treatment system owner shall be allowed only if there is a legally enforceable contract between the treatment plant owner and the user.

The contract shall set forth as a minimum:

a. The quality and maximum quantity of waste water to be released for use by the sewage treatment system;

b. The specific use(s) for which the reclaimed water will be used by the user;

c. The maximum quantity of reclaimed water that shall be used on an annual basis;

d. A condition that the direct release of any reclaimed water to surface waters of the State of Oregon shall be prohibited;

e. A statement specifying the parties in the contract responsible for compliance with these rules and the sewage treatment system permit;

f. A provision allowing the sewage treatment system owner to cease providing reclaimed water if the Department or the owner determine that the requirements of this Division are not being met;

g. A condition that requires the user of reclaimed water to report to the sewage treatment plant owner any and all violations of the terms of these rules or the contract."

NOW, THEREFORE, IT IS AGREED between the parties hereto that the original above referenced Effluent Contract is hereby modified to specifically state the following:

a. The quality of the waste water released by the city to the Golf Association shall be as follows:

(1) Prior to land application of the reclaimed water, it shall receive treatment and disinfection to reduce TOTAL COLIFORM to a 7-day median of 23 organisms/100 milliliter with no two consecutive samples to exceed 240 organisms/100 for level II reclaimed water uses. No reclaimed water shall be used on food crops or any other level III or IV uses.

(2) The City can release a maximum amount of Four Hundred Thousand gallons per day of waste water to the Golf Association. In the event that the Golf Association completes an additional 9 hole (18 hole total) golf course, the City can release a max amount of 1,000,000 gallons per day of waste water to the Golf Association.

b. The Golf Association shall use the reclaimed water for the following specific purposes only:

(1) Irrigation of the real property described in the original agreement as EXHIBIT "A", or such additional 9 holes of expansion.

(2) This water shall be used only between the following dates: Beginning May 1, 1979 and terminating April 30, 1999.
2010

c. The Golf Association shall use a maximum quantity of ~~150,000,000~~ 130 mil. gallons of reclaimed water on an annual basis.

d. The Golf Association shall under no circumstances directly release any of the reclaimed water to the surface water of the State of Oregon.

e. The City is responsible for compliance with NPDES requirements, the Oregon Administration Rules and the City's Reclaimed Water Use Plan pertaining to the treatment of the effluent to acceptable levels to allow for spraying of the effluent on the Golf Association property. The Golf Association shall be the party responsible for all reclaimed water released for use on property not under the direct control of the City's waste water treatment system. The Golf Association shall further be the party responsible for compliance with that portion of the Oregon Administration Rule of the Department of Environmental Quality Chapter 340, Division 55, and the City's Reclaimed Water Use Plan dealing with the spraying of the effluent.

f. The City may at it's option cease providing the Golf Association reclaimed water if the Department of Environmental Quality or the City determines that the Department of Environmental Quality requirements are not met.

g. The Golf Association must report any and all instances of noncompliance with OAR Chapter 340, Division 55 to the City's waste water treatment facility within 24 hours of when the permittee becomes aware of an incident of noncompliance. The City's waster water treatment facility can be reached at 592-4590, after hours 592-3131 paging service and DEQ, Medford at 776-6010. If the City or DEQ cannot be reached, the incident shall be reported to the Oregon Emergency Response System, 1-800-452-3011.

Except as specifically stated herein, all other terms of the original contract shall remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be executed by their duly authorized officers as of the day and year first above written.

CITY:
CITY OF CAVE JUNCTION, a municipal corporation in the State of Oregon

By: James R. Sullivan
Mayor

Attest:
Recorder

GOLF ASSOCIATION:
ILLINOIS VALLEY GOLF ASSOCIATION, INC., an Oregon corporation

By: Wilma White
Vice President

By: John S Hocker
Secretary

STATE OF OREGON) ss.
JOSEPHINE COUNTY)

Date: June 1, 1994

On the day above, personally appeared the above named James R. Sullivan, known to me as the Mayor of the City of Cave Junction, Wilma White, Vice President of the Illinois Valley Golf Association, and John Hocker, Secretary for the Illinois Valley Golf Association and did acknowledge the foregoing instrument to be their own voluntary act and deed.

OFFICIAL SEAL
CHARLES J POLK
NOTARY PUBLIC - OREGON
COMMISSION NO. 023297
MY COMMISSION EXPIRES MAR. 29, 1997

Notary Public for Oregon
My commission expires: 3-29-97

LEASE AND SEWER EFFLUENT USE AGREEMENT

THIS LEASE AND SEWER EFFLUENT USE AGREEMENT, made and entered into this 23rd day of February, 1995, by and between the ILLINOIS VALLEY GOLF ASSOCIATION, INC., an Oregon corporation, hereinafter known as "Golf Association", and the CITY OF CAVE JUNCTION, a municipal corporation in the State of Oregon, hereinafter known as "City",

WITNESSETH:

WHEREAS, the City is in the process of expansion of a municipal sewage treatment plant, hereinafter known as "Plant"; and

WHEREAS, the Golf Association is the owner of the property described in Exhibit "A" attached hereto and made a part hereof as though set out in full and at length herein and a greater portion of said property is being used and will be used as a golf course; and

WHEREAS, the City, because of said governmental regulations must not discharge Plant effluent, hereinafter known as "Effluent", or discharge water from said Plant into the Illinois River during certain times of the year and must discharge all of said Effluent from said Plant elsewhere during said times; and

WHEREAS, it is expected that during the term of this agreement, the City will not be able to discharge any of its Effluent or water from said Plant into the Illinois River, but will be required to dispose of all of such material other than by discharge into the Illinois River; and

WHEREAS, the Golf Association is desirous of taking designated quantities of said Effluent from said Plant for the purpose of using the said Effluent water in connection with the operation and maintenance of the Golf Association's golf course located on the real property described in the attached Exhibit "A"; and,

WHEREAS, OAR 340-55-015(9) states that: "Any reclaimed water released for use on property not under the direct control of the sewage treatment system owner shall be allowed only if there is a legally enforceable contract between the treatment plant owner and the user. The contract shall set forth as a minimum:

a. The quality and maximum quantity of waste water to be released for use by the sewage treatment system;

b. the specific use(s) for which the reclaimed water will be used by the users;

c. The maximum quantity of reclaimed water that shall be used on an annual basis;

d. A condition that the direct release of any reclaimed water to surface waters of the State of Oregon shall be prohibited;

e. A statement specifying the parties in the contract responsible for compliance with these rules and the sewage treatment system permit;

f. A provision allowing the sewage treatment system owner to cease providing reclaimed water if the Department or the owner determine that the requirements of this Division are not being met;

g. A condition that requires the user of reclaimed water to report to the sewage treatment plant owner any and all violations of the terms of these rules or the contract.",

NOW, THEREFORE, IT IS HEREBY AGREED between the Golf Association and the City as follows:

1. The recitals above set forth are especially made a part of this agreement.

2. The Golf Association leases and lets to the City and the City rents from the Golf Association the real property described in Exhibit "A" attached hereto for the special uses and purposes as herein contained for a term beginning the 1st day of May, 1995, and terminating the 30th day of April, 2025.

3. The rental to be paid by City to Golf Association for said thirty year period shall be the sum of One Dollar ($1.00).

4. City shall operate its Plant in compliance with the valid rules and regulations of the State of Oregon and the United States of America and the agency or agencies of both governmental bodies having jurisdiction of the operation of the said Plant of the City. This includes not only the operation of the Plant, but also the storage and discharge of the Effluent therefrom.

5. City shall deliver said Effluent from the Plant to a point on the property line of the property described in Exhibit "A" hereto, said point is shown on the map attached hereto, marked Exhibit "B" and hereby made a part of this agreement.

6. The parties recognize that prior to the start of delivery of the Effluent to the Golf Association and at any time or times thereafter, the requirements for the treatment of the effluent by the City may be increased or otherwise changed before the same may be sprayed or otherwise used on the golf course. Such change and requirements may come from the Oregon Department of Environmental Quality or any other state or federal agency, bureau, or any body having jurisdiction thereof. The responsibility of meeting such new, additional or changed requirement shall at all times be the direct responsibility of the City, which shall promptly and faithfully comply with any new or additional regulations.

Golf Association, however, shall have the obligation and responsibility of complying with any present and existing statute, rules or regulation governing the spraying or other disposal of the Effluent on the property described in Exhibit "A" hereto, and of meeting any new, additional or changed provisions of any statute, rule or regulation of any governmental body having jurisdiction of the spraying of the Effluent, and the Golf Association shall pay the entire cost thereof, except as hereinafter provided. In the event any governmental body having jurisdiction of the spraying of the Effluent shall impose a new, additional or increased cost to the Golf Association, the City agrees to make a good faith effort to apply for any governmental aid or grant which might be available to pay all or a portion of the cost of such change. Any such aid or grant which might be obtained by the City for such purpose shall be applied by the City toward the cost of such change, and this shall constitute the sole liability of the City toward the cost of such change.

7. The City agrees to supply the Golf Association all of the Effluent from the City's Plant during the period of June 1 to October 31st of each year. Golf Association agrees to accept the Effluent during this period and at other times when directed by the Oregon Department of Environmental Quality or agreed upon by the parties. Golf Association is not required, however, to accept more than 1,000,000 gallons of Effluent per day. City has the right to dispose of any Effluent in excess of 1,000,000 gallons of Effluent per day or its equivalent elsewhere as the City may desire. City agrees to cooperate with Golf Association in making use of any present storage facilities for temporarily storing said Effluent as may be permitted under existing or future governmental regulations and requirements.

8. The quality of the Effluent (wastewater) released by the City to the Golf Association shall be as follows:

a. Prior to land application of the Effluent, it shall receive treatment and disinfection to reduce TOTAL COLIFORM to a 7-day median of 23 organisms/100 milliliter with no two consecutive samples to exceed 240 organisms/100 for level II reclaimed water uses. No reclaimed water (effluent) shall be used on food crops or any other level III or IV uses.

b. The City can release a maximum amount of 1,000,000 gallons per day of wastewater to the Golf Association.

9. The Golf Association shall use the reclaimed water (Effluent) for the following specific purposes only:

a. Irrigation of the real property described in the original agreement or as shown described in Exhibit "A".

b. This water shall be used only between the following dates: Beginning May 1, 1979 and terminating April 30, 2025.

10. Golf Association agrees to use said Effluent and apply the same on its golf course. Golf Association has the entire responsibility for the spraying or other application of the Effluent after it is delivered by City as herein provided. Golf Association shall not apply the Effluent beyond the boundaries of the property described in Exhibit "A", nor permit the Effluent to flow off the said real property.

11. City's obligation shall be the delivery of the Effluent to Golf Associations property line. Golf Association will take Effluent as long as it meets requirements of the Department of Environmental Quality of other controlling body for Effluent to be sprayed on Golf Association's golf course.

12. Golf Association must obtain and present to City executed documents to be recorded by its showing existing contract to purchase property described in Exhibit "A" or other right therein acceptable to City and other bodies as herein required. Golf Association must further obtain from each person, firm or corporation having title to, a lien upon or interest in any portion of the property described in Exhibit "A" hereto the consent of such person, firm or corporation to this agreement and its recording and further making each such person, firm or corporation's interest in the property subordinate to the paramount rights of the City in and to the property described in Exhibit "A" and all of the terms of this agreement. Such agreement shall provide that in the event any of said parties retake or otherwise exercise control of all or any portion of the property described in Exhibit "A" that such action shall be subject to the prior rights of the City under the terms of the conditions of this agreement and the rights of the City to continue under this agreement for the full term thereof.

Each and all such agreements shall be made binding upon the heirs, successors and assigns of the parties executing the same. All such documents must be in a form approved by City and by each and all State of Oregon or federal government agencies or bodies providing financial assistance to the City's Plant, or having jurisdiction over the same.

13. Golf Association shall pay all taxes levied and assessed on the property promptly as the same become due and before they begin to draw interest or incur other penalty. In addition, Golf Association shall pay promptly the payments of principal and interest when the same come due on any and all liens or encumbrances against all or any portion of the property described in Exhibit "A" hereto.

14. Golf Association assumes all responsibility for the care and the use of the Effluent from the City's Plant from the time it is delivered to the Golf Association property.

15. In the event that Golf Association should fail to pay taxes or other charges against the real property described in Exhibit "A" hereto, the City has the option, but is not obligated so to do, to pay any of such charges to protect its right to the use of the property. The payments, if any, by the City shall be a first lien upon the real property described in Exhibit "A" paramount to any title, right, interest or lien in or on said property.

16. In the event the Golf Association for any reason should fail or refuse to accept and dispose of the Effluent from the City's Plant to a volume not exceeding 1,000,000 gallons per day in an acceptable manner, and in compliance with all present and future government rules, regulations and laws, City is hereby granted the right to the use of the sprinkling system, pumping facilities and all other facilities necessary or convenient in the spraying and disposal of said Effluent on the property described in Exhibit "A" hereto. All of the reasonable costs and expenses incurred by the city in such operation in handling the disposal of the said Effluent shall be a charge against the Golf Association and are hereby made a first lien against the property described in Exhibit "A" hereto paramount and superior to any liens now or hereafter on the property or any portion thereof. Golf Association shall obtain the consent of such lien holders to this subrogation.

17. In the event any of the liens herein granted to the City by the Golf Association on the property described in Exhibit "A" hereto are not paid and the same are not paid within thirty (30) days of written demand for the payment of the same, the City may proceed to foreclose said liens as a mortgage upon real property.

18. In the event of any suit, action or proceedings to enforce any of the terms or conditions of this agreement, the party prevailing in such suit, action or other proceeding shall have and recover, in addition to any other relief, such sum as the court may adjudge reasonable as attorney's fees in such suit, action or other proceeding, in addition to such prevailing party's statutory costs and disbursements. If any appeal or appeals are taken from any judgment or decree of the trial court, the ultimately prevailing party in such appeal or appeals shall, in like manner, have and recover such sum as said court or courts may adjudge reasonable as attorney's fees, statutory costs and disbursements in such appeal or appeals.

In addition, if City forecloses this contract, Golf Association promises to pay the cost of a preliminary foreclosure report furnished by a duly authorized title company.

19. This agreement shall be binding upon and inure to the benefit of the successors and assigns of the parties.

20. The Golf Association shall use a maximum quantity of 150,000,000 gallons of reclaimed water on an annual basis.

21. The Golf Association shall under no circumstances directly release any of the reclaimed water to the surface water of the State of Oregon.

22. The City is responsible for compliance with the National Pollutant Discharge Elimination System permit requirements, the Oregon Administrative Rules and the City's Reclaimed Water Use Plan pertaining to the treatment of the Effluent to acceptable levels to allow for spraying of the Effluent on the Golf Association property. the Golf Association shall be the party responsible for all reclaimed water released for use on property not under the direct control of the City's wastewater treatment system. The Golf Association shall further be the party responsible for compliance with that portion of the Oregon Administrative Rule of the Department of Environmental Quality, Chapter 340, Division 55, and the City's Reclaimed Water Use Plan dealing with the spraying of the Effluent.

23. The City may at its option, cease providing the Golf Association reclaimed water if the Department of Environmental Quality or the City determines that the Department of Environmental Quality requirements are not met.

24. The Golf Association must report any and all instances of non-compliance with OAR Chapter 340, Division 55 to the City's wastewater treatment facility within 24 hours of when the permittee becomes aware of an incident of non-compliance. the City's wastewater treatment facility can be reached at

592-4590, after hours 592-3131 paging service and the Department of Environmental Quality, Medford at 77606010. If the City of Department of Environmental Quality cannot be reached, the incident shall be reported to the Oregon Emergency Response System, 1-800-452-3011.

25. Prior to the enactment of this agreement, the Golf Association shall give the City two scale maps setting forth the Golf Association's proposed layout of the system for disposing of the Effluent upon the real property described in Exhibit "A". The plan shall show the entire layout of the sprinkling system with the location of the disposal and sprinkling system, the location of the sprinklers and similar maps shall be supplied for any additions or changes hereafter made in the disposal system. The present plans and any additions or changes in the future shall be subject to approval of the Oregon Department of Environmental Quality and any other regulatory body having jurisdiction of the disposal system.

26. Golf Association agrees that it shall not abandon or permit to lapse its water rights for irrigation of the property described in Exhibit "A". In addition, Golf Association shall not sell nor attempt to sell nor transfer nor attempt to transfer any part of the water rights now pertaining to the property described in Exhibit "A" and shall at all times have a valid right to transfer the water from its point of diversion to the property described in Exhibit "A".

27. It is recognized and agreed that this lease and all of its terms are subject to the prior approval of the Oregon Department of Environmental Quality and any other government agency or agencies having jurisdiction of the matters treated in this agreement. Prior approval of such agency or agencies must be obtained before City can execute this document.

28. The Golf Association shall, at all reasonable times, allow authorized representatives of the Department of Environmental Quality and/or the City:

a. To enter upon the Golf Association's premises where an Effluent source or disposal system is located;

b. To inspect any equipment required by this agreement.

29. The City and the Golf Association maintain the right and privilege to review and update this agreement each year.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be executed by their duly authorized officers as of the day and year first above written.

CITY:
City of Cave Junction,
A municipal corporation in
the State of Oregon

BY: James R. Sullivan
Mayor

Attest:
Recorder

GOLF ASSOCIATION:
Illinois Valley Golf
Association, Inc.,
An Oregon Corporation

BY: Wilma E. White
President

BY: Carol M. Combs
Secretary

STATE OF OREGON)
) ss.
JOSEPHINE COUNTY)

DATE: 2-23-95

On the day above, personally appeared the above named James R. Sullivan known to me as the Mayor of the City of Cave Junction, Wilma White, President of the Illinois Valley Golf Association and Carol Combs, Secretary of the Illinois Valley Golf Association, and did acknowledge the foregoing instrument to be their own voluntary act and deed.

OFFICIAL SEAL
CHARLES J POLK
NOTARY PUBLIC - OREGON
COMMISSION NO. 023297
MY COMMISSION EXPIRES MAR. 29, 1997

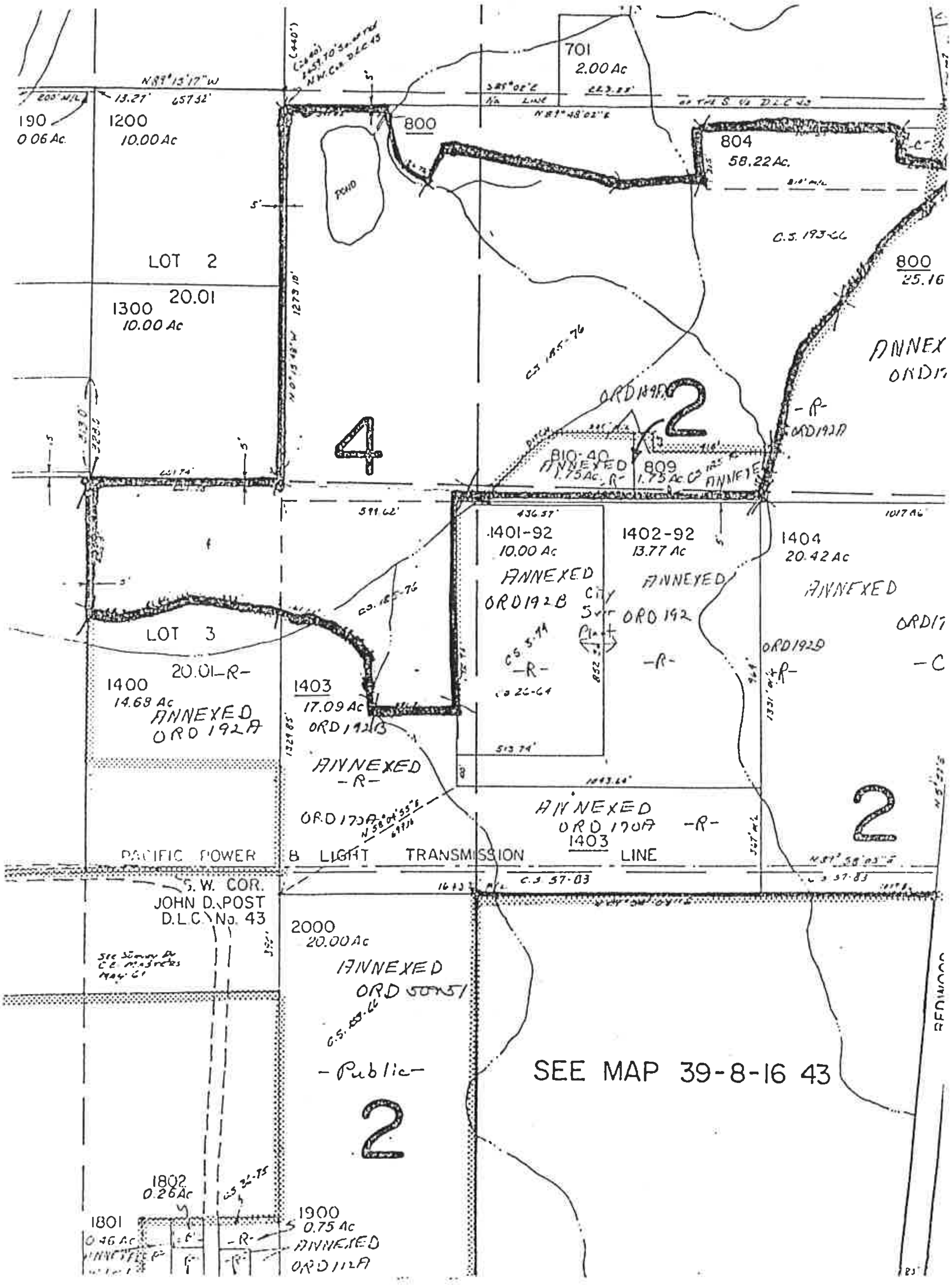
Notary Public for Oregon
My Commission Expires: 3-29-97

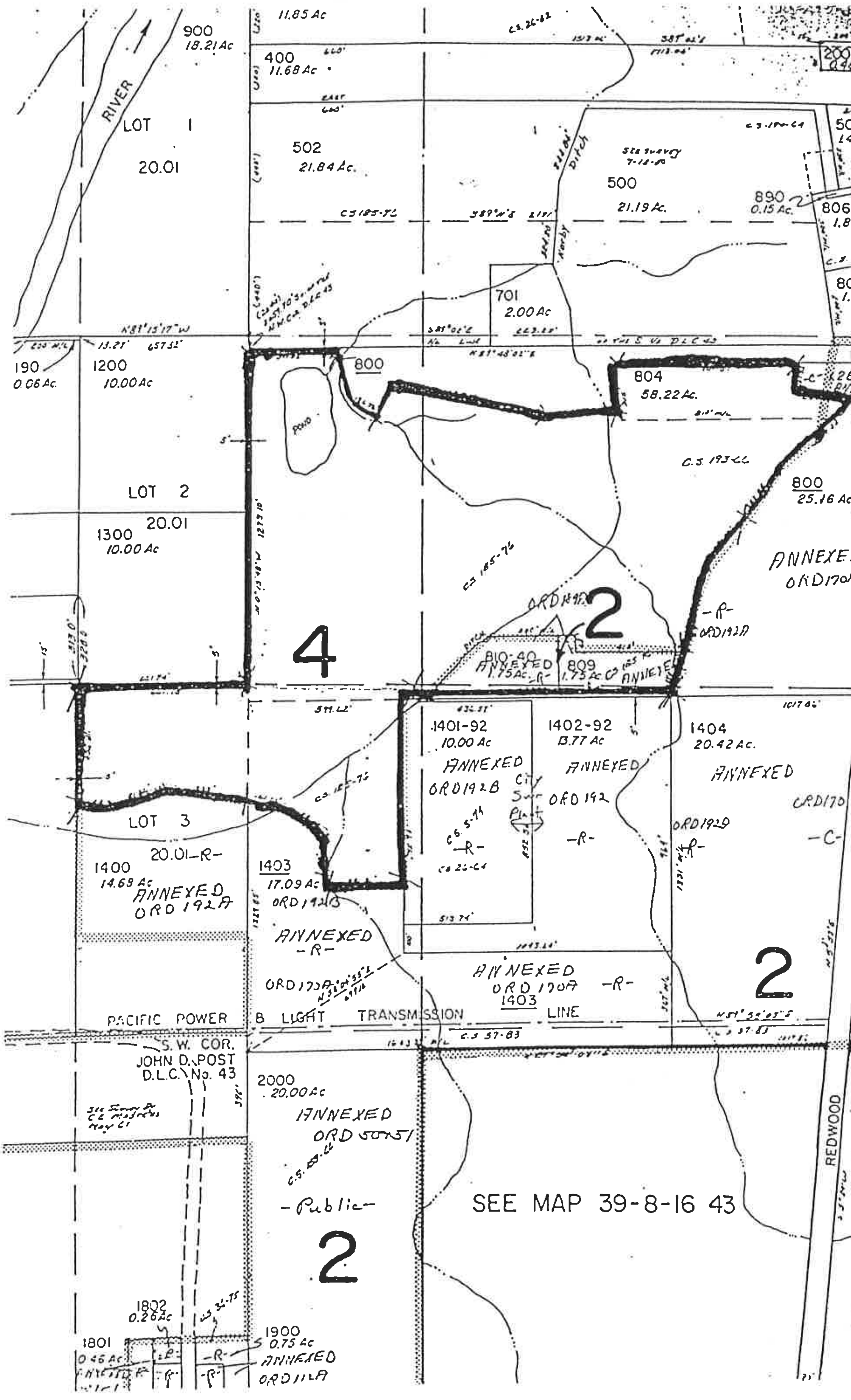
EXHIBIT "A" TO
LEASE AND
SEWER EFFLUENT USE AGREEMENT
BY AND BETWEEN THE CITY OF CAVE JUNCTION
AND THE ILLINOIS VALLEY GOLF ASSOCIATION, INC.

A parcel of land in Donation Land Claim No. 43 & Section 16, Township 39 South, Range 8 West, Willamette Meridian, Josephine County, Oregon, being more particularly described as follows:

Beginning at the Southwest corner of the North 1/2 of the South 1/2 of said D.L.C. no. 43; thence along the West line of said D.L.C. no. 43, North 0°15'48" West 51.83 feet; thence South 89°04'51" East 5.00 feet to an Iron Rod which is the true point of beginning; thence parallel with said West line, North 0°15'48" West 1273.10 feet to an Iron Rod which is 5.00 feet South of the North line of said North 1/2 of the South 1/2; thence parallel with said North line, North 89°48'02" East 347.02 feet to the center of George Creek; thence along the center of said creek, South 11°24'10" East 194.22 feet; thence continue along the center of said creek, South 61°19'15" East 126.76 feet; thence North 17°57'06" East 120.87 feet to an Iron Rod; thence South 79°03'26" East 629.73 feet to the center of George Creek; thence along the center of said creek, North 65°53' East 230.00 feet; thence continue along the center of said creek, North 83°16'00" East 69.76 feet; thence North 7°32'45" West 171.65 feet to an Iron Rod; thence North 89°48'02" East 701.59 feet to an Iron Rod; thence South 4°48'43" West 107.52 feet to the center of George Creek; thence along the center of said creek, South 36°22'06" East 234.71 feet; thence South 47°15' West 377.52 feet to an Iron Rod; thence South 34°19'15" West 252.84 feet to an Iron Rod; thence South 40°47'30" West 251.33 feet to an Iron Rod; thence South 14°42'15" West 497.89 feet to an Iron Rod which is 5.00 feet North of the South line of said North 1/2 of the South 1/2; thence South 89°53'04" West 1044.35 feet to an Iron Rod; thence South 0°00'15" West 710.09 feet to an Iron Rod; thence South 89°44'09" West 291.21 feet to an Iron Rod; thence North 0°15'51" West 190.00 feet to an Iron Rod; thence North 55°02'32" West 179.59 feet to an Iron Rod; thence North 75°52'23" West 161.61 feet to an Iron Rod; thence North 64°09'34" West 332.00 feet to an Iron Rod; thence South 71°36'12" West 181.66 feet to an Iron Rod; thence West 158.54 feet to an Iron Rod 5.00 feet East of the West line of the East 1/2 of the Southwest 1/4 of said Section 16; thence parallel with said West line North 0°07'02" East 458.80 feet to an Iron Rod 5.00 feet South of the North line of said East 1/2 of the Southwest 1/4; thence parallel with said North line South 89°04'51" East 661.78 feet to the true point of beginning.

EXHIBIT "B" TO
LEASE AND
SEWER EFFLUENT USE AGREEMENT
BY AND BETWEEN THE CITY OF CAVE JUNCTION
AND THE ILLINOIS VALLEY GOLF ASSOCIATION, INC.





RIVER
LOT 1
20.01
900
18.21 Ac
400
11.68 Ac
11.85 Ac
502
21.84 Ac.
500
21.19 Ac.
890
0.15 Ac.
806
701
2.00 Ac
800
804
58.22 Ac.
190
0.06 Ac.
1200
10.00 Ac
LOT 2
20.01
1300
10.00 Ac
800
25.16 Ac
ANNEXED
ORD 192A
4
2
BIO-40
ANNEXED
1.75 Ac.
809
1.75 Ac
LOT 3
20.01
1400
14.69 Ac
ANNEXED
ORD 192A
1401-92
10.00 Ac
ANNEXED
ORD 192B
1402-92
13.77 Ac
ANNEXED
ORD 192
1404
20.42 Ac.
ANNEXED
1403
17.09 Ac
ORD 192B
ANNEXED
ANNEXED
ORD 170A
1403
2
PACIFIC POWER & LIGHT TRANSMISSION LINE
S.W. COR.
JOHN D. POST
D.L.C. No. 43
2000
20.00 Ac
ANNEXED
-Public-
2
SEE MAP 39-8-16 43
REDWOOD
1802
0.26 Ac
1801
0.46 Ac
1900
0.75 Ac
ANNEXED

Property Information

North Latitude
42 10 40.9426

West Longitude
123 38 59.6092

MAP NUMBER	39081600000804
OWNERSHIP TYPE	PRIVATE
OWNER NAME	ILLINOIS VALLEY GOLF ASSOC INC
SITUS	25320 REDWOOD HWY
OWNER ADDRESS	PO BOX 749
CITY	CAVE JUNCTION
STATE	OR
ZIP	97523-0749
ZONE	EF,C
ACRES	58.22
PROPERTY FLAGS	
IMPROVEMENTS	MAIN.AREA