DRAFT
PRELIMINARY ENGINEERING REPORT AND FEASIBILITY STUDY

FOR

CITY OF MT. SHASTA

STATE MANDATED
WASTEWATER TREATMENT
AND DISPOSAL IMPROVEMENT PROJECT

JOB NO. 111.44

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ABREVIATIONS

ADWF	Average Dry Weather Flow
AMEL	Average Monthly Effluent Limit
BOD	Biochemical Oxygen Demand
CAS	Conventional Activated Sludge
CEQA	California Environmental Quality Act
COD	Chemical Oxygen Demand
CVRWQCB	Central Valley Regional Water Quality Control Board
DAF	Dissolved Air Floatation
EC	Emerging Contaminant
EDU	Equivalent Dwelling Units
EIR	Environmental Impact Report
ERB	Emergency Retention Basin
ET	Evapotranspiration
LFDI	Leach Field Design Investigation
MBBR	Moving Bed Bioreactor
MBR	Membrane Bioreactor
MHI	Median Household Income
MLE	Modified Ludzack Ettinger
MMF	Maximum Monthly Flow
MSGC	Mt. Shasta Golf Course
MSWWTP	Mt. Shasta Wastewater Treatment Plant
MZDS	Mixing Zone Dilution Study
NEPA	National Environmental Policy Act

ABREVIATIONS (CONT'D)

NPDES	National Pollutant Discharge Elimination System
PWWF	Peak Wet Weather Flow
RD	Rural Development
RO	Reverse Osmosis
RSF	Rapid Sand Filter
SBR	Sequencing Batch Reactor
SRF	State Revolving Fund
SRT	Sludge Retention Time
SUP	Special Use Permit
TBF	Traveling Bridge Filter
TKN	Total Kjeldahl Nitrogen
TN	Total Nitrogen
TSO	Time Schedule Order
TSS	Total Suspended Solids
UF	Ultra Filtration
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UV	Ultraviolet
VSS	Total Volatile Solids
WDR	Waste Discharge Requirement
WWTP	Wastewater Treatment Plant

CITY OF MT. SHASTA
2014 WASTEWATER TREATEMENT AND DISPOSAL FEASIBILITY STUDY

I. GENERAL

The City of Mt. Shasta (City) owns and operates the Mt. Shasta Wastewater Treatment Plant (MSWWTP), which provides service to Mt. Shasta and adjacent areas. The MSWWTP is located approximately 60 miles north of Redding, in Siskiyou County. The plant treats municipal wastewater and discharges treated effluent to the Sacramento River seasonally. During the non-recreation season (November 16-April 14), treated effluent is discharged to the Sacramento River. With the addition of a dissolved air floatation (DAF) thickener and rapid sand filtration system, the Central Valley Regional Water Quality Control Board (CVRWQCB) revised the City's waste discharge permit to allow an extended period of discharge to the Sacramento River in the spring and fall (April 15-June 14 and September 16-November 15), referred to as the shoulder periods, provided that a higher quality of effluent is produced. If high quality effluent cannot be achieved, the effluent is discharged to a reclamation leach field site. During the recreation season (June 15-September 15), treated effluent is discharged to the adjacent Mt. Shasta Golf Course (MSGC) for irrigation use. If effluent quality standards cannot be met during the recreation season or irrigation water not needed at the MSGC, treated effluent is pumped to the reclamation leach field located along U.S. Highway 89.

The MSWWTP has undergone several treatment modifications and upgrades in the past several years. These improvements include the addition of a DAF thickening system, a doubling in the size of the chlorine contact basin, and replacement of the influent flow meter. The treatment plant currently consists of a headworks with Parshall flume for flow measurement, comminuter, bypass bar screen, six oxidation lagoons

(three of which are aerated), a DAF and sand filter for tertiary effluent treatment, and chlorination and dechlorination facilities. The MSWWTP has a theoretical average dry weather flow (ADWF) design capacity of about 0.75 million gallons per day (MGD) and a peak wet weather flow (PWWF) of 2.8 MGD. The MSWWTP is currently operating at an ADWF of 0.67 MGD, and a PWWF of 1.83 MGD.

In order to evaluate wastewater treatment and disposal alternatives for allowing the City to comply with its 2012-adopted National Pollution Discharge Elimination System (NPDES) permit, the City of Mt. Shasta contracted with PACE Engineering, Inc. to prepare this Feasibility Study. Construction and indirect costs, as well as financing costs, associated with these improvements are presented in this report. This report will aid in the development of future funding applications to implement improvements to the system. The format of this report follows Rural Utilities Services (RUS) Bulletin 1780-3.

II. PROJECT PLANNING AREA

A. LOCATION

The City of Mt. Shasta is located in Siskiyou County on Interstate 5 approximately 60 miles south of the California – Oregon border. See Figure 1 for the City's Wastewater Service Area Map.

B. ENVIRONMENTAL RESOURCES PRESENT

The proposed WWTP improvements will occur within the confines of the City's existing facility on previously developed areas. Thus, there does not appear to be any lasting impact on land resources, historic sites, wetlands, flood plain, endangered species, or critical habitat. The project design and construction will need to obtain the appropriate permits and take into account typical specific mitigation measures, so as to not impact natural resources. These requirements are discussed in Table 1.

C. POPULATION HISTORY GROWTH AREAS & POPULATION TRENDS

The City is primarily residential with an estimated population of 3,394 people, according to the 2010 US Census Bureau. Based on the 2003 City of Mt. Shasta Wastewater Treatment Plant Capacity Evaluation, there were approximately 2,304 household equivalents (HEs) within the sewer service area at that time. Siskiyou County population has grown from 44,301 in 2000 to 44,900 in 2010 which is an annual rate of roughly 0.14% since the 2000 Census. The unemployment rate for Siskiyou County is 11.8% (November 2013). According to the American Community Survey (ACS), the median household income (MHI) for Siskiyou County is $37,948, while the MHI for Mt. Shasta is about $38,504 (2008 - 2012). These numbers are significantly below the State average MHI of $61,400 (2008 - 2009).

Table 1: Mitigation Monitoring Checklist

Mitigation Measure		Monitoring Action
Work Area		
1	Minimize Work Area	Define limits of work area in Contract Documents and delineate any sensitive areas that are to be left undisturbed.
2	Erosion Control	Establish erosion control procedures in Contract Documents including sensitive areas to be left undisturbed. Standard practices required by the County will be strictly adhered to by the construction contractor and enforced by the engineer.
3	Revegetation of Disturbed Areas	All areas disturbed shall be seeded and mulched. Revegetation shall consist of native species, grasses, and forbs. Revegetation efforts shall be in place prior to the return of the wet season and in no case later than October 15th of each season.
Construction Activities		
1	Dust Control	Roads and work areas likely to generate dust shall be watered during construction activities and swept clean where possible.
2	Noise Control	Work hours will be limited typically to 7 a.m. to 7 p.m. in residential areas unless special activities, i.e. tie-ins, are required at night during periods of low flow times.
Sensitive Resources		
1	Subsurface Cultural Resources	If subsurface cultural materials are encountered during construction activities, all activities shall be halted within a 50-foot radius and an archaeologist called in to examine the artifacts and determine if additional mitigation measures are required.

III. EXISTING FACILITIES

A. LOCATION MAP

The City of Mt. Shasta Wastewater Treatment Plant is located in Township 40 North, Range 4 West. Also refer to Figure 1.

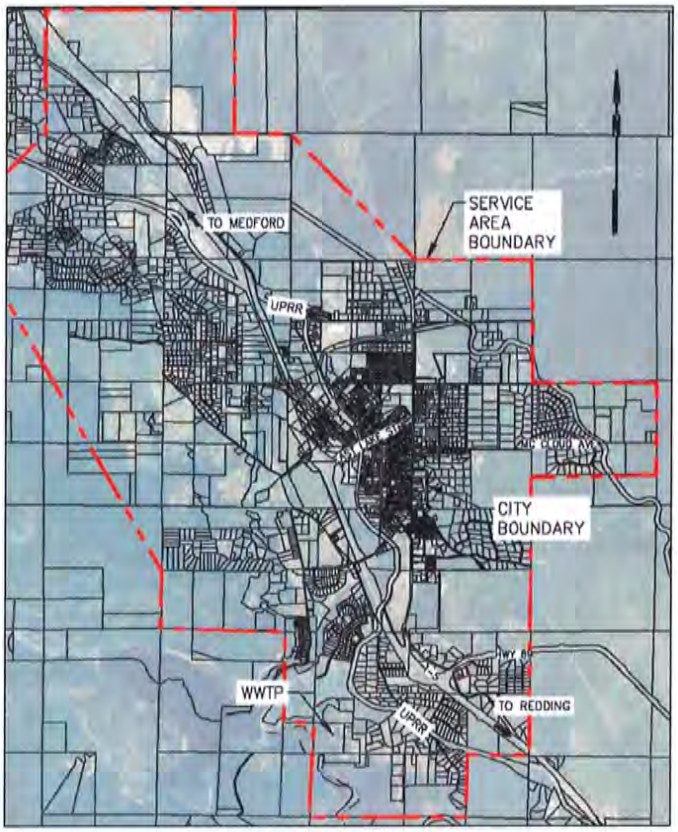

Figure 1 – Wastewater Service Area Map

B. HISTORY

The existing City of Mt. Shasta Wastewater Treatment Plant was originally constructed in 1976 and was designed for an average dry weather flow (ADWF) of 0.7 MGD and a peak wet weather flow of 2.1 MGD. In 1999 the original intermittent sand filter system was replaced with a dissolved air flotation thickener (DAF) and rapid sand filtration (RSF) system. Additional improvements included: (1) doubling of the size of the chlorine contact basin, (2) replacing the influent flow meter (3) upgrading aerators within Lagoons 1 and 2, (4) expanding the headwork's capacity and (5) removing sludge from Lagoons 1 and 2. In 2007, piping improvements were made to Lagoons 1 and 2 which increased the effective treatment capacity to about 0.75 MGD (ADWF).

On October 4, 2012, the CVRWQCB adopted Waste Discharge Requirements (WDR) Order No. R5-2012-0086 for the WWTP. At that time, Time Schedule Order (TSO) No.

R5-2012-0087 was issued. The TSO included a compliance schedule to bring ammonia, copper, zinc, BOD5, TSS and pH levels into compliance. In addition, the TSO requires a compliance schedule for Title 22 Disinfection Requirements. The TSO required that a preliminary engineering report be developed to determine a method of compliance. This feasibility study has been developed to fulfill this requirement.

C. CONDITION OF FACILITIES

The City's existing wastewater treatment plant oxidation lagoons are in need of repair to mitigate bank erosion caused by wave action from wind and aeration. In addition, the west dike of Lagoon 5 has a documented leak when the freeboard reaches about 18" or less from the top of dike. The City has attempted to repair this leak in the past with marginal success.

The existing DAF and RSF are located above ground and outdoors under a steel roof structure with no walls. Consequently, the equipment is exposed to the harsh winter cold and freezing conditions. The DAF/RSF processes contain numerous exposed small pipelines, pumps and instrumentation that freeze, rendering the equipment inoperable during wintertime conditions. Therefore, it is not practical to operate these facilities during the winter months. Requirements in the new NPDES permit require the need to operate these, or like facilities, during the winter months in order to remove additional solids from treated effluent. If these existing processes are to remain, they would need to be enclosed within an insulated or conditioned space.

Since the DAF/RSF processes were designed for smaller summer-time flows, there is inadequate capacity to treat higher flows during the winter. Thus, if these processes are to remain, they would need to be expanded.

The existing operations building is undersized and is in need of painting and a new roof. The existing composition roof has reached/exceeded its useful life and should be replaced with a metal roof. The laboratory facilities are undersized and do not contain the necessary ventilation facilities to protect operators during laboratory analysis. Any future improvement project at the treatment plant will require considerably more instrumentation in order to operate the facility. There is not adequate space for this

equipment at the existing facility.

As indicated in the NPDES permit, the City's outfall pipeline (to the Sacramento River) contains a leak that must be repaired by November 2017. In addition, modifications are required to the existing diffuser in the River in order to assure all treated effluent enters the River below the water surface. Improvements to the existing diffuser will allow the City to "re-open" the NPDES permit and apply for increased dilution credits.

a. NPDES Permit Background: In 2009, the City began the process of renewing its NPDES permit with the California Regional Water Quality Control Board (CRWQCB). PACE performed a Mixing Zone and Dilution Study (MZDS) and a number of supporting studies and reports to assist with the renewal process. The MZDS allowed the City to obtain dilution credits for some constituents which allows higher effluent concentrations due to the mixing and dilution characteristics in the Sacramento River.

   Due to the extent of new discharge requirements proposed in the new permit, it was recommended the City perform an overall Wastewater Treatment and Effluent Disposal Feasibility Study to evaluate alternatives for, 1) complying with the new NPDES permit, and 2) establishing the best course of action to serve the City's wastewater treatment and disposal practices in the future.

   The new NPDES permit (No. R5-2012-0086) and Time Schedule Order (TSO) (No. R5-2012-0087) were adopted October 4, 2012. The TSO was adopted to grant an additional five years to comply with the more stringent discharge requirements for copper, zinc and ammonia. Compliance schedules of up to eight years were granted for other constituents. Table 2 provides a summary of the special studies and reports required in the new permit, including the associated compliance dates. Note that the indicated work plans have been prepared and submitted to the CRWQCB. This feasibility study and associated methods of compliance are due June 1, 2014 and will satisfy the requirements for items 4, 7 and 8 in Table 2.

Continuous chlorine and pH monitoring (Items 11 and 12 in Table 2) improvements were constructed during summer 2013.

The new NPDES permit presents new effluent limits for the following constituents:

- Copper, zinc and ammonia
- BOD, TSS and pH
- Disinfection requirements
- Bis 2 phthalate (Bis 2)
- Dichlorobromomethane (DCBM)

Table 2: Special Studies and Reports Summary

No.	Report Description	Work Plan Due	Draft Report Due	Final Report Due
1	Chronic Whole Effluent Toxicity Reduction Evaluation (TRE)	2/21/2013	-	-
2	Pollution Prevention Plan for pH	-	-	4/3/2013
3	Biosolids Use and/or Disposal Plan	-	-	5/22/2013
4	Compliance for Cu, Zn & NH3	4/3/2013	-	6/1/2014
5	Groundwater Monitoring Well Network Technical Report	4/4/2013	-	4/4/2014
6	Leach Field Design Investigation	4/4/2013	-	4/4/2014
7	Compliance for Title 22 Disinfection	5/23/2013	-	6/1/2014
8	Compliance for BOD5, TSS, & pH	4/3/2013	-	6/1/2014
9	Salinity Evaluation & Minimization Plan	-	-	7/3/2013
10	Outfall Line and Diffuser Repair	10/4/2013	-	-
11	Continuous Chlorine Monitoring	-	-	-
12	Continuous pH Monitoring	-	-	-
13	Constituent Study for Cadmium	-	12/31/2014	7/15/2015
14	Report of Waste Discharge (ROWD)	-	11/1/2016	5/7/2017
15	Aluminum Site Specific Study	10/4/2016	-	5/7/2017
16	Ammonia Reduction Study	-	-	5/7/2017

b. Wastewater Monitoring: The new NPDES permit contains effluent limits for ammonia, among other constituents. The presence of ammonia is an indicator of poor of nitrogen removal in the treatment process. There are many factors that

affect nitrogen removal in wastewater treatment, including pH, alkalinity, temperature, dissolved oxygen (aeration), and hydraulic and solids retention times. In order to evaluate the effectiveness of the existing treatment plant for nitrogen removal, and characterize the incoming raw wastewater, we developed a sampling/testing protocol that was implemented by City operation's staff. Sampling/testing began in July 2013 and took place continuously through January 2014. Samples were taken at eight locations beginning at the headworks and ending at the treated effluent side of the facility. Refer to Appendix A for a schematic map of the sampling locations. Sampling/testing was performed weekly for the first two weeks and then every two weeks for the remaining testing period. The following constituents were tested:

- Total Kjeldahl Nitrogen (TKN)
- Ammonia
- Nitrate
- Nitrite plus Nitrate
- Total Nitrogen
- Dissolved Oxygen (DO)
- Alkalinity
- pH
- Temperature
- Dissolved Oxygen (DO)
- Chemical Oxygen Demand (COD)

Appendix A also contains the test results from this effort, as well as a number of graphical presentations of the data. The goals of this data collection effort were as follows:

- Characterize nitrogen removal in order to determine if reliable improvements can be made to the existing system.
- Characterize biological treatment effectiveness during varying seasonal and climatological changes.
- Establish wastewater characteristics for use in evaluating alternative

treatment processes.

Observations and conclusions from this data collection effort, pertaining to nitrogen removal and biological treatment effectiveness are discussed further below.

c. Nitrogen Removal: The data suggests Lagoon 1 provides effective nitrification by mid-point of the lagoon. However, ammonia levels increase through Lagoons 2 and 4. Through Lagoons 5 and 6, ammonia levels taper off but nitrate levels gradually increase. The swings in nitrogen form suggest nitrification and denitrification of other nitrogen sources (non-wastewater) are occurring in the downstream lagoons. This is typical of lagoon-based wastewater treatment plants.

d. Copper and Zinc Removal: The new NPDES permit contains effluent limits for copper and zinc. The City's MZDS contributed to higher limits than what would have granted without the MZDS. A review of effluent copper, zinc and total suspended solids (TSS) data from 2012 (April to May), revealed that both effluent copper and zinc were substantially reduced when operating the DAF/RSF processes, in all cases below the average monthly effluent limits (AMEL) in the new permit. Refer to Figure 2 and Figure 3. This observation indicates a strong correlation between TSS and copper and zinc, suggesting removal of TSS through efficient biological treatment and effluent filtration will be required in order to comply with the new permit.

e. Biological Treatment: The City's existing lagoon treatment process provides admirable removal of biochemical oxygen demand (BOD) and TSS. Figure 4 shows a graphical representation of effluent BOD and TSS data for 2010 through 2012. The AMEL for recreation season (10 parts per million, PPM) and non-recreation season (30 PPM), for both BOD and TSS, are shown on the graph. Except for one data point for BOD during December 2012, and TSS during April 2012, effluent BOD and TSS concentrations fall consistently below the maximum effluent limits.

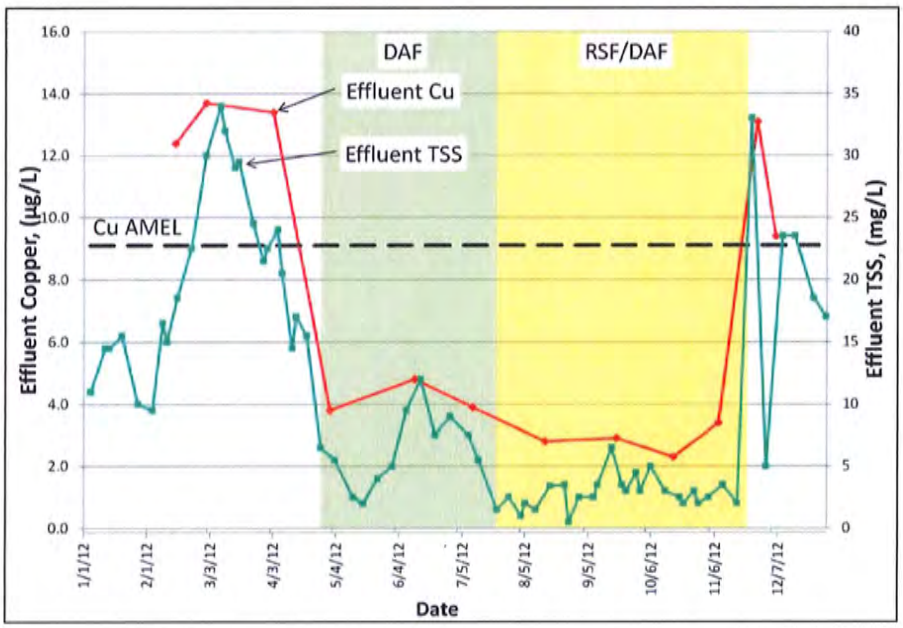

Figure 2 – Effluent Copper & Zinc Comparison

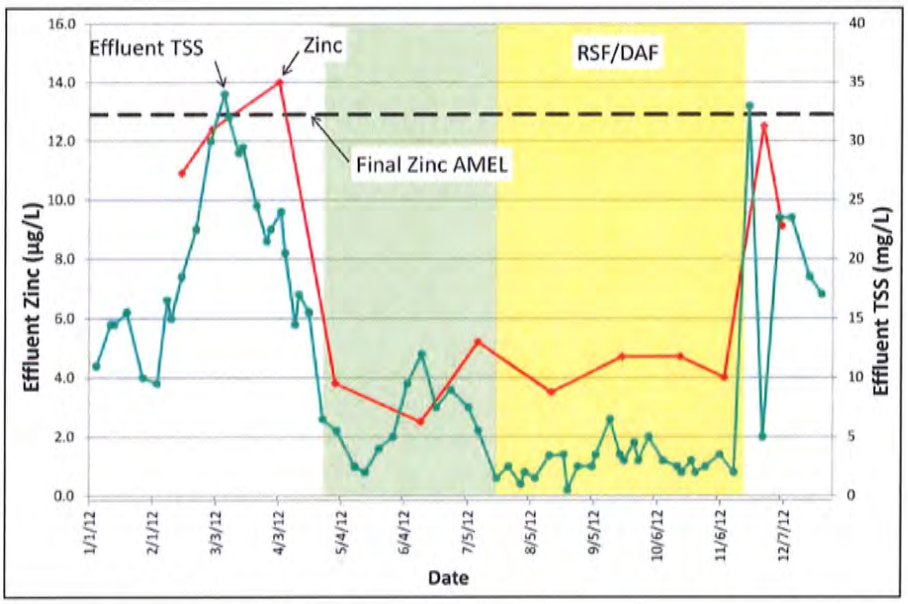

Figure 3 – Effluent Zinc & TSS Comparison

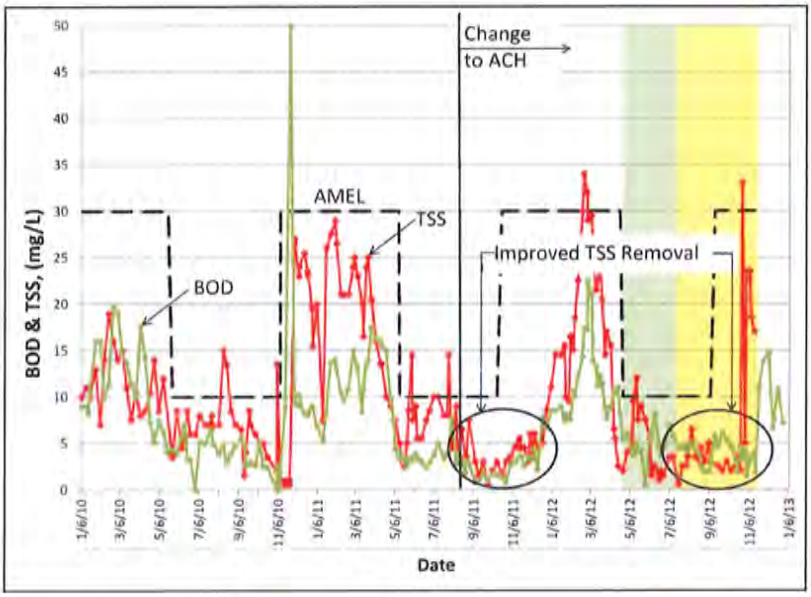

Figure 4 – Effluent BOD and TSS Data

Based on historical data, along with the specific monitoring performed for this study, the following conclusions pertaining to the City's treatment plant performance were drawn:

- The lagoon system provides consistent and acceptable removal of BOD and TSS.
- Nearly complete nitrification occurs in Lagoon 1 (primary). However, ammonia levels gradually increase through the downstream lagoon treatment train, presumably caused by bacterial reduction of nitrate and nitrite and bacterial decomposition of plant material and fecal matter from waterfowl.
- Some denitrification occurs in the downstream lagoons, but seasonal and diurnal variations in temperature, pH, and dissolved oxygen (DO) provide unpredictable results.
- The City's raw wastewater contains average BOD and TSS concentrations of 200 mg/l and 290 mg/l respectively, which is considered medium strength wastewater.
- Sampling of Total Kjeldahl Nitrogen (TKN) in the City's raw wastewater ranged from about 10 mg/l to 43.5 mg/l with an average of 28 mg/l. This is considered weak-to-medium strength wastewater.

- Average raw influent alkalinity is between 150 and 160 mg/l, which is considered medium-to-strong wastewater. Historically, the City has experienced low pH during certain periods of the year, causing NPDES permit violations. Causes for depressed pH are likely combinations of the following:
    - Seasonal and diurnal shifts in photosynthetic activity in the lagoons.
    - Nearly complete nitrification in Lagoon 1 and incomplete denitrification in remaining lagoons. Nitrification consumes approximately 7 mg/l of alkalinity for every 1 mg/l of nitrified nitrogen. Denitrification recovers about 3.5 mg/l of alkalinity.
    - The City's use of gas chlorine consumes additional alkalinity.
- Prior to August, 2011, the City used aluminum sulfate (alum) as its primary coagulant when operating the DAF/FSF, sometimes at dosages exceeding 100 ppm. Alum consumes alkalinity and contributes to depressed pH. Since switching to a more neutral aluminum chlorohydrate (ACH) coagulant, the City has experienced more consistent effluent pH but not always above the 6.5 lower limit.
- Copper and zinc concentrations are significantly reduced in the City's solids removal processes (DAF and RSF), suggesting a high enough insoluble metals fraction to effectively meet effluent limits. The use of coagulants may also be providing a chelating benefit by converting a portion of the dissolved metals fraction to filterable insoluble compounds. It is expected that continued use of coagulants with effluent filtration will continue to provide this benefit.

D. FINANCIAL STATUS OF ANY OPERATING FACILITIES

Annual Budget: Copies of the Fiscal Year 2012-2013 wastewater operating budget and Revenue/Expenditures Report, along with FY7-8 through FY11-12 General Ledger Reports are included in Appendix B. Refer to Appendix C for the Fiscal Year 2011-2012 audited financial statement. Pursuant to the City's Final Revised 2012-2013 operating budget, the Wastewater Operations Fund had the following revenues, expenditures, capital outlays, and debt service obligations.

Wastewater Operations Funds	2012-2013 Budget
Beginning Balance	$541,022
Revenue	
User Fees	$775,850
Misc. Income	$22,300
TOTAL REVENUE:	$798,150
Expenditures	
Salaries and Benefits	$243,844
Employee Related Costs	$6,950
Services – Personal and Professional	$121,500
Insurance, Licensing & Taxes	$29,300
Facilities Expenses	$88,678
Maintenance and Repairs	$71,150
Materials and Supplies	$70,750
Administrative Allocation	$113,000
TOTAL EXPENDITURES:	$745,172
Capital Outlays	$215,000
Debt Service	
I-Bank (maturation in 2038)	$73,868
Ending Balance	$305,132

As indicated above, not considering the $215,000 capital outlay, the City had to dip into its operating capital for approximately $21,000 ($541,022 - $215,000 - $305,132) in order to cover expenditures. Therefore, a small rate increase is needed to cover existing expenses.

Rate Schedule: The City's current wastewater rate schedule was adopted by the City Council effective October 1, 2008 – see Appendix D. There are currently approximately 1,670 billable accounts being served by the City wastewater system. Residential single

family, duplex, triplex, condos and mobile home connections are charged a wastewater service charge of $23.95 per month for each connection.

Nonresidential customers are charged pursuant to the rate schedule. Based on the Fiscal Year 2012-2013 budgeted revenue of $775,850 and the monthly wastewater rate of $23.95 per single family, the number to equivalent dwelling units (EDUs) is approximately 2,700, calculated as follows:

($775,850) ÷ ($23.95/mo./EDU) ÷ (12 mo/yr)

As a check of the current number of EDUs, we divided the City's current ADWF at the WWTP by the estimated flow per EDU used in the City's 1994 Master Sewer Plan.

670,000 gallons/day ÷ 230 gallons/day/EDU = 2,913 EDU

This correlates within about 8% of the revenue-based calculation method. Since the master sewer plan is twenty years old and minimal collection system improvements have occurred since then, it is likely the flow per EDU has increased based on summertime infiltration and inflow. Using 2,700 EDUs and 0.67 MGD ADWF, the flow per HE would be about 248 GPD/EDU, which is not unreasonable for an aged collection system with unmetered water. Since the revenue-based calculation method correlates best with determining the revenue requirements to fund the project, we are assuming there are 2,700 existing EDUs.

E. WATER/ENERGY/WASTE AUDITS

The City has not conducted any energy or waste audits related to the wastewater treatment plant or associated facilities.

IV. NEED FOR PROJECT

A. HEALTH, SANITATION AND SECURITY

The primary driver for the "Need for Project" is regulatory. However, the effluent limits established in the NPDES permit are determined by the United States Environmental

Protection Agency (USEPA) for impact to "human health" and "mobile aquatic organisms." Therefore, the regulatory driver is human health and environmental. The proposed project will convert the City's gas chlorination system to ultra-violet (UV) radiation or liquid chlorine. Both are a safer alternative to City workers than gas and eliminate the threat of a chlorine gas leak into the environment. After 9/11, the Federal Department of Homeland Security expressed concern with municipal facilities with on-site chlorine gas due to the terrorism threat.

B. REGULATORY COMPLIANCE/NPDES PERMIT

The City's lagoon wastewater treatment facility has served it well over the years and provides reasonably good removal of BOD and TSS. However, the lagoons fall short on nitrogen removal, in part, due to the decomposition of organic material (wastewater and non-wastewater based) that occurs in all the lagoons, as evidenced by the monitoring/testing efforts by City staff. The more stringent ammonia limit in the City's latest NPDES permit as well as new 2013 ammonia criteria is driving the need to review other biological treatment processes or augment the existing system with a nitrogen removal process.

Other downstream treatment processes have inadequate capacity for providing treatment to remove other constituents, such as certain metals, identified in the NPDES permit. In addition, the NPDES permit will require wintertime filtration and higher level disinfection when Sacramento River flows exceed 400 cubic feet per second (CFS.)

C. AGING INFRASTRUCTURE

The City's existing wastewater treatment facility was constructed in the mid 1970's. In the 1999, the City added the dissolved air flotation thickener (DAF) and rapid sand filter (RSF) system, and other improvements in order to provide higher quality effluent for the Mt. Shasta Resort and Golf Course and enable the City to discharge treated wastewater to the Sacramento River during the spring and fall recreation seasons. The existing lagoons are in need of bank stabilization improvements due to excessive erosion from wave action. In addition, the lagoons could use some water level control structures to

maintain the required two-foot freeboard, as mandated in the NPDES permit. Currently, levels are controlled by throttling valves so water levels are allowed to rise to within 6-inches of overtopping. It is believed this practice has contributed to the known leak in west Lagoon 5 dike.

The operations building is too small and does not contain the necessary ventilation equipment required for an on-site laboratory. In addition, there is inadequate room for future instrumentation that will be required to monitor the facility for compliance with the NPDES permit. Finally, the operations building requires a new roof, repairs/replacement of exposed eave lumber and painting.

D. REASONABLE GROWTH

The City of Mt. Shasta has had little population growth in the past six years with an average of less than 3 new sewer connections per year in the City during that time. Based on the City's 2003 Wastewater Treatment Plant Capacity Evaluation and the improvements that have been implemented since, the WWTP is near its design capacity. Currently, there are about 1,670 billable sewer and/or water accounts and an estimated average dry weather flow into the treatment plant of about 0.67 MGD, which represent a wastewater flow equal to about 2,700 equivalent dwelling units (EDUs).

Historical sewer connection data from the City's 2013 records is shown in Table 3. The values shown are taken from the number of active sewer and water service accounts in the system. City staff has suggested that a one-half percent growth rate would be reasonable for projecting the number of future sewer services. In addition, a new industrial user, Crystal Geyser, plans to occupy the existing Coca Cola facility. According to Crystal Geyser, additional flows during the first 5 years will be approximately 50,000 GPD. It is anticipated that the existing lagoon system can handle this additional flow while plant improvements are made. Crystal Geyser has committed to paying for its portion of the improvements. At full build-out, Crystal Geyser has indicated it could contribute up to 150,000 GPD into the City's wastewater system.

Table 3: Historic Number of Sewer Accounts

Year	2009	2010	2011	2012	2013
Number of Active Sewer Accounts [1]	1658	1662	1662	1667	1670
% Change	+0.2	+0.0	+0.3	+0.1	+0.2

Note:
1) Based on number of total active accounts, may include accounts that only have water service.

V. ALTERNATIVES CONSIDERED

Wastewater disposal typically drives the approach for wastewater treatment. For example, a direct discharge to a river or stream requires a higher degree of treatment than irrigating pasture land with little to no public access. However, developing a new site for land-applied wastewater disposal can be very expensive. There is a desire on behalf of the City of Mt. Shasta to explore options for eliminating its discharge to the upper Sacramento River and relieve itself from the associated regulatory umbrella of CVRWQCB.

The remainder of this section will discuss various effluent disposal and treatment options considered for Mt. Shasta to come into compliance with its recently adopted NPDES permit.

A. DESCRIPTION – EFFLUENT DISPOSAL

Ultimately, the strategy for evaluating improvements to the City's WWTP is dictated by the future effluent disposal practices and associated discharge permit limitations. Currently, the City utilizes three sites for effluent disposal:

- Sacramento River (During winter and early spring/late fall periods)
- Mt. Shasta Golf Course (Irrigation season)
- Leach field (anytime effluent standards cannot be met)

In addition to these existing disposal practices, two new disposal options have been identified:

- Wintertime effluent storage and summertime disposal via wetlands/pastureland or tree Irrigation
- Regionalization

Figure 5 contains a graphical comparison of annual effluent disposal volumes, along with precipitation amounts for the City's three existing disposal sites for years 2004 to 2013. Note the amount of rainfall in 2005 was nearly equivalent to the 100-year rainfall, and the total amount of effluent disposed in 2006 was significantly more as a result.

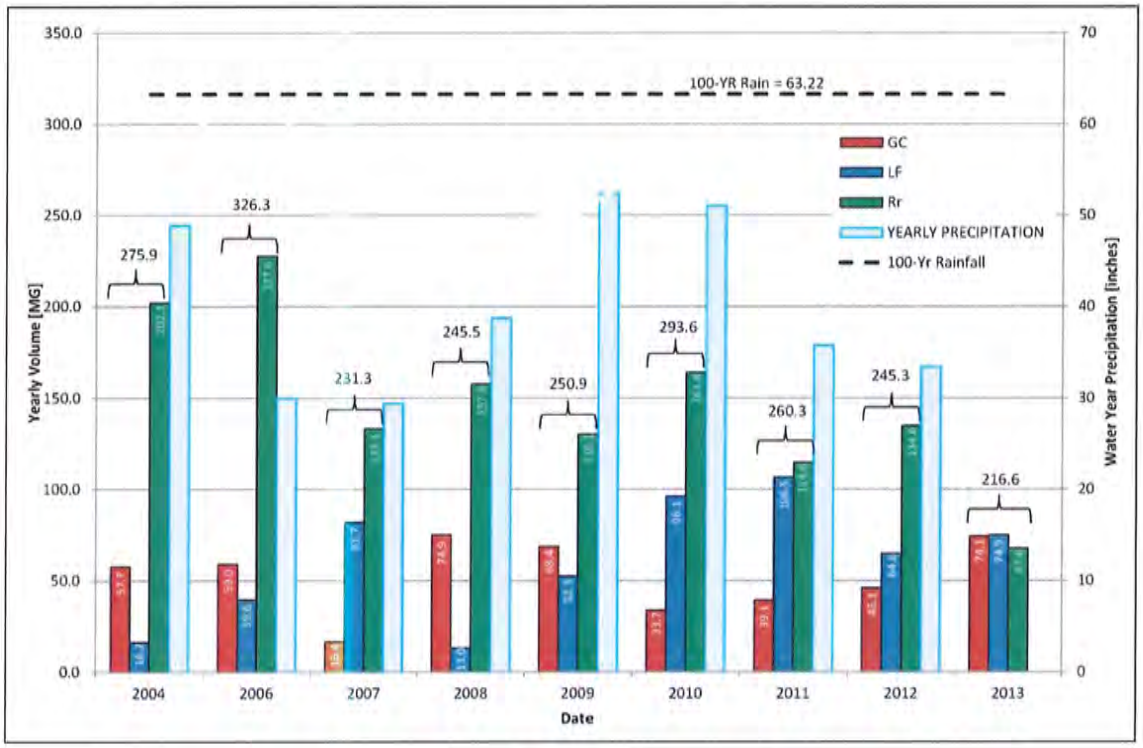

Figure 5 – Historic Effluent Disposal Volumes

The following are descriptions of the City's existing effluent disposal sites:

EXISTING DISPOSAL SITES

1) Leach Field

The City's leach field disposal system is located on the south side of US Highway 89, approximately 1.8 miles east of the intersection of Interstate 5 and US Highway 89, refer to Figure 6. It consists of approximately 20,000 linear feet of percolation trench from 8 to 12 feet deep taking up about half of the available 42 acres. Perforated leach pipe is installed approximately 5 feet deep in the percolation trenches. There are approximately 40 piezometers installed throughout the site which, accordingly to City staff, have always been dry. The property is owned by the United States Forest Service (USFS) and use is granted through a long-term use permit. The disposal site has a rated hydraulic capacity of 0.7 MGD.

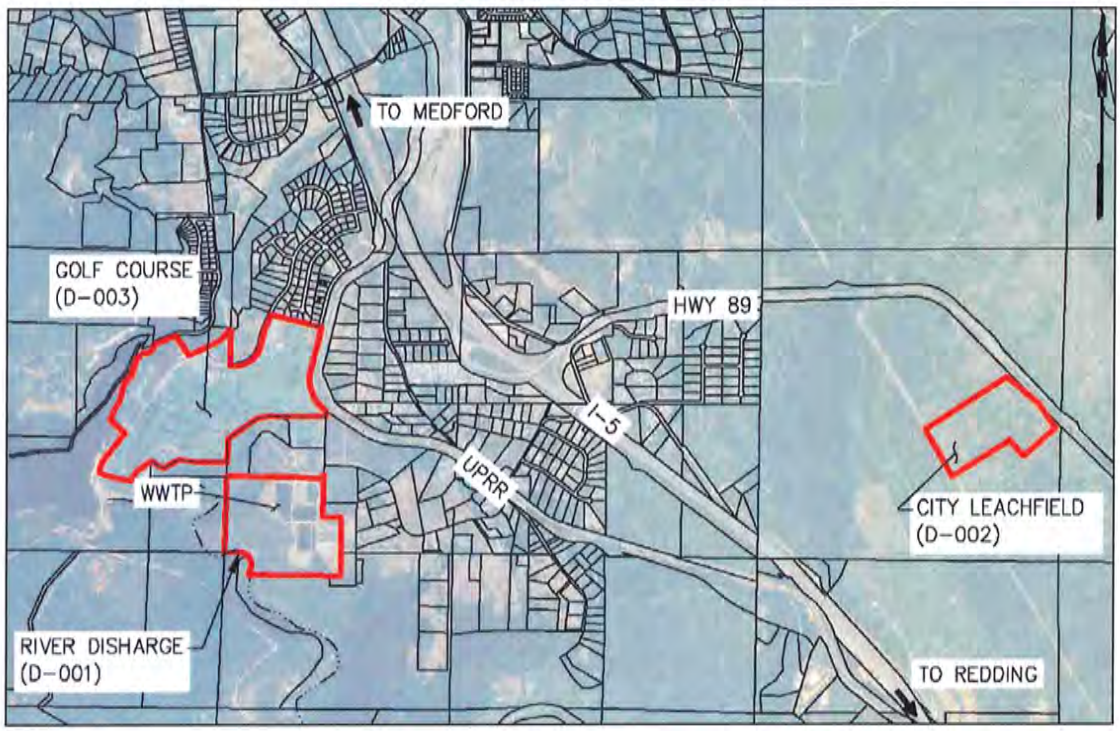

Figure 6 – Existing Disposal Sites

Currently the City operates the leach field as a backup disposal site for effluent during plant upsets or when the MSGC is unable to accept treated effluent during

the irrigation season. Although this is the historic use of the leach field, there is no language within the current permit that prevents the City from using the leach field as a primary disposal site. However, increased use of the leach field will likely result in increased regulatory burden including further studies, and monitoring requirements, and possibly more stringent groundwater criteria. Furthermore, the CVRWQCB's has expressed that the leach field be used as a backup disposal site when the City is unable to discharge to the Sacramento River or Golf Course.

The current effluent limits for treated wastewater sent to the leach field are based on water quality objectives. This is a lower standard and is more easily complied with. Future criteria may not allow incremental changes in pollutant concentration when compared with background concentrations. Currently, the City monitors the leach field at a single down-gradient monitoring well. In order to determine compliance with certain groundwater limitations, the CVRWQCB has required that the City evaluate its groundwater monitoring network to ensure there are one or more background monitoring wells and a sufficient number of designated monitoring wells down-gradient of the leach field. If the monitoring sites, established as a result of this evaluation, indicate increased pollutant concentrations in the groundwater, the permit will likely be reopened and modified.

In the recently-adopted NPDES permit, there is a requirement to perform a Leach Field Design Investigation (LFDI) which addresses the hydraulic, and subsurface treatment capacity of the leach field facility. In addition, there is a requirement to perform a Groundwater Monitoring Well Network Technical Report (GMWNTR). PACE hired Lawrence and Associates, Redding, CA to perform these investigations. The LFDI is contained in Appendix E. The GWMNTR will be provided by early fall after a new down gradient monitoring well is drilled in mid June 2014.

In 2010 and 2011, the City conveyed approximately 96 and 107 million gallons (MG), respectively, to the leach field, in part, because it had difficulty meeting requirements for discharging to the Sacramento River and/or golf course. As indicated in Figure 9 in the Leach Field Design Investigation , Appendix E, the additional discharge caused

elevated nitrate levels in the down-gradient monitoring well, although, the levels were less than the 10 ppm limitation for potable groundwater. These results suggest the leach field has some impact on groundwater and that it may be difficult to comply with more stringent requirements if the facility were expanded.

2) Golf Course Irrigation

The City of Mt. Shasta implemented improvements to their WWTP in 1999 to enable discharge of treated effluent to the Mt. Shasta Golf Course. Treated effluent is conveyed to the 2.1 MG pond No. 7 on the south side of the golf course, see Figure 7. However, there is piping and valving to convey effluent to the 9 MG Pond No. 9 located south-east of the club house facilities. An irrigation pump station is located adjacent to pond No. 7 that has a capacity of 0.5 to 0.6 MGD. There are approximately 69 acres of irrigated area throughout the golf course. According to the General Manager, Mr. John Fryer, the golf course can accommodate all of the summertime treated effluent the City can provide. If the City is unable to provide enough treated effluent, irrigation demand is supplemented by two small irrigation wells.

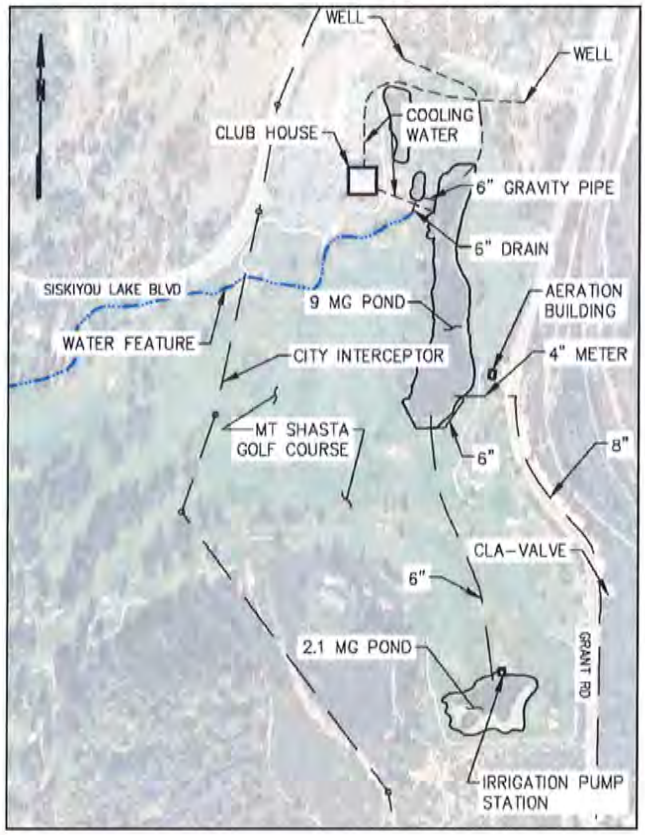

Figure 7 – Golf Course Irrigation System

During below average or average rainfall years, it's conceivable the Golf Course can accommodate the entire treated effluent flow from the WWTP. However, during a 100-year rainfall year, and using typical evapotranspiration rates for the area, it's likely the golf course irrigation demands would be less than the treated effluent

generated by the WWTP, in part, due to some summertime rainfall. We estimate the annual irrigation usage on the golf course would be about 175 ac-ft.

3) Sacramento River

The City of Mt. Shasta's Sacramento River discharge point is located about 1,300 yards downstream of the Box Canyon Dam and Lake Siskiyou. High quality effluent is discharged to the river through a partially submerged diffuser at the end of the City's effluent pipeline. During the recreational season (November 16 to April 14), effluent is discharged directly to the Sacramento River. With the addition of a tertiary treatment, the CRWQCB revised the City's waste discharge permit to allow an extended period of discharge to the Sacramento River in the spring and fall (April 15 to June 14 and September 16 to November 15). If the required Sacramento River discharge limits cannot be achieved, effluent is discharged to the leach field.

A number of alternative effluent disposal site options were considered as part of this study, including wetlands/pasture irrigation, additional subsurface disposal, tree irrigation, and regionalization. Each alternative is described below:

POTENTIAL ALTERNATIVE DISPOSAL PRACTICES

1) Wetlands/Pasture Irrigation

The community of Mt. Shasta is nestled amongst an alpine setting at the base of Mt. Shasta. The local flora consists of expansive conifer forests, interspersed with hardwoods and some wet meadows. Irrigated pastureland in the region generally consists of small parcels irrigated by ditched diversions from local water courses. The largest irrigated properties occur along the Interstate 5/Old Stage Road corridor through central Mt. Shasta.

There are eight properties, comprising about 132 acres, located west of Interstate 5 and north and south of Hatchery Lane, which have been developed for pasture irrigation or wetlands. The largest property (located south of Hatchery Lane) is a 41-acre parcel that is a designated wetlands mitigation site developed to offset impacts

to wetlands resulting from previous development on the east side of Interstate 5. In addition, the parcel contains a number of deed restrictions that limit impacts and prevent future development of the property.

Combined with the properties to the north and south of the "wetlands" parcel, it is estimated there are about 92 acres of usable area for application of treated wastewater effluent. Figure 8 shows the subject properties along with the infrastructure necessary to develop the sites for wastewater disposal. Note there are buffer zones required to water courses, private property lines, and road rights-of-way. In addition, tailwater collection facilities, consisting of berm or ditch diversions and pump stations are required to prevent applied wastewater from entering water courses.

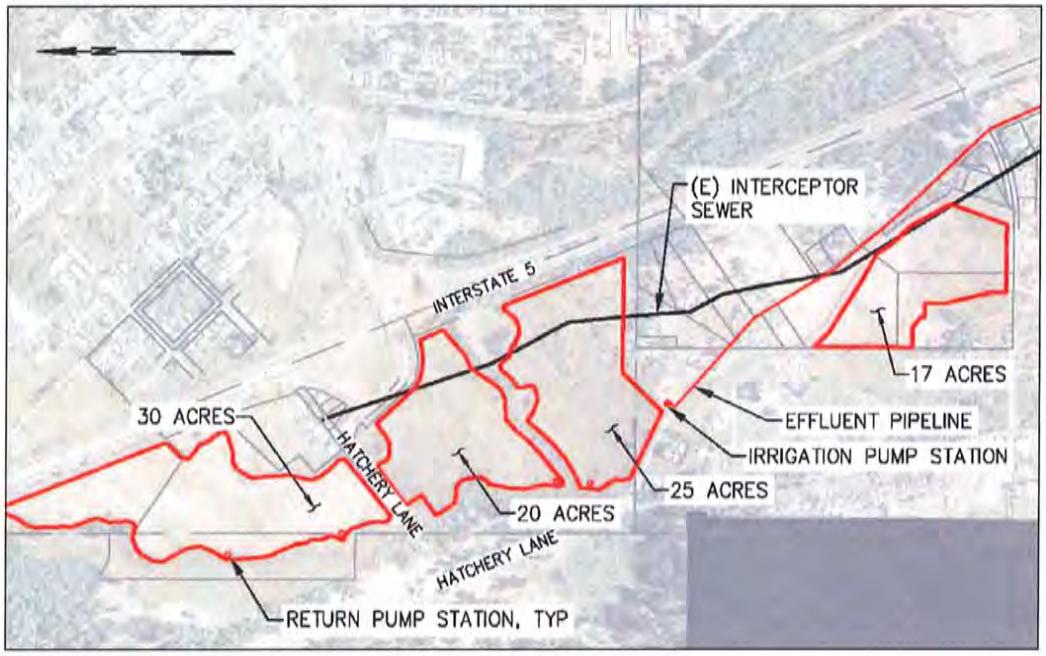

Figure 8 – Pasture Irrigation and Wetlands Disposal

A treated effluent pipeline would need to be installed between the WWTP and a new irrigation pump station located along Old Stage Road. Any wastewater collected by the tailwater return facilities would be conveyed to the existing interceptor sewer on Old Stage Road.

Wastewater would be applied to the area at agronomic rates throughout the irrigation season. However, any runoff caused by over irrigating or rainfall within 24 hours of the last application would need to be returned to the WWTP for treatment. Unlike treated wastewater applied on the Mt. Shasta Golf Course, irrigation water for pasturelands or wetlands is not subject to the same filtration and disinfection standards.

Table 4 : Pasture/Wetland Irrigation Agronomic Rate Determination

Month	Rainfall [1,2] Inch/Month	ETo Rate [3] Inch/Month	Pan to Pasture Coefficient4	Pasture ET Inch/Month	Agronomic Irrigation [5] Inch/Month	Minimum Potential Irrigation [6] Days/Month
OCT	4.61	3.8	0.76	2.9	0.0	17
NOV	2.11	1.2	0.73	0.9	0.0	8
DEC	5.01	0.7	0.71	0.5	0.0	2
JAN	15.62	0.8	0.72	0.6	0.0	18
FEB	8.03	1.3	0.74	1.0	0.0	12
MAR	5.04	3.0	0.76	2.2	0.0	2
APR	7.70	4.7	0.78	3.7	0.0	5
MAY	2.65	6.8	0.78	5.3	3.2	11
JUN	0.46	7.8	0.78	6.1	6.8	18
JUL	0.08	9.7	0.78	7.6	9.0	21
AUG	0.05	8.1	0.78	6.4	7.6	31
SEP	1.06	5.7	0.78	4.5	4.1	21
TOTAL	52.42	53.6		41.5	30.5	166

NOTES:

1) 100-yr rainfall based on Station Mt. Shasta City Precipitation Long-Duration-Frequency Table from DWR Bulletin 195, October 1976.
2) 100-yr rainfall of 63.22 (1948-2010 Western Regional Climate Center) spread in proportion to 2010 monthly data. 2010 selected based on similarity to 100-yr precipitation looking at last 20yrs.
3) Potential ETo based on 9 years of data for Station Glenburn Evaporation from Water Surface, DWR Bulletin 73-79, Nov 1979.
4) Pasture evapotranspiration ratio determined from DWR Bulletin 73-79, Nov 1979.
5) Effluent applied May through Sept. Application rate = (ET - Precip) * 1.2 Irrigation Application Efficiency Factor

Based on estimated evapotranspiration (ET) rates for irrigated pasture in the area, and accounting for some rainfall during the irrigation season based on historical 100-year rainfall data, it is estimated approximately 31 inches of treated wastewater

could be applied to the properties between May and September, refer to Table 4. This translates to about 76.6 million gallons during the irrigation season, or about 23 percent of the City's annual effluent disposal needs during a 100-year rainfall year.

The actual disposal capacity is likely significantly less because much of the wetlands parcel is wet throughout the year. Thus, wetland vegetation already has adequate water supply. Applying additional treated effluent could 1) cause site runoff and/or 2) accumulate in site ponds which would not likely be allowed by the CRWQCB. Rather than applying treated effluent at agronomic rates, another option is to develop the wetlands parcel into shallow wetland water holding impoundments designed to accommodate treated wastewater. The primary disposal mechanisms would be evaporation, evapotranspiration, and percolation. Factors that make this option infeasible are as follows:

Current deed restrictions on the parcel essentially prevent any disturbance, unless agreed upon by the property owner and US Army Corps of Engineers. This issue is probably not insurmountable, but would be time-consuming and costly to implement.

- The wetlands parcel has a considerable amount of elevation change, sloping east to west. To maximize use of the site would require significant terracing and grading.
- Since no water would be allowed to run off-site, the wetlands would need to accommodate not only wastewater, but the 100-year rainfall, which is over 60-inches per year, leaving less volume to accommodate treated wastewater.

Table 5 contains a total project cost estimate to develop 91 acres of irrigation area along the Interstate 5 corridor through central Mt. Shasta. The $7.6M cost translates to about $100 per 1,000 gallons, or about $83,000 per acre. These costs do not include annual operation and maintenance costs, which would be significant. For comparison, the City conveys about 50 MG per year to the golf course and receives

payment of $310 per MG or $14,000 annually[1]. In addition, the golf course is responsible for all O&M expenses associated with use of the treated effluent.

Table 5: Pasture/Wetland Irrigation Cost Estimate

ITEM NO.	DESCRIPTION	QTY	UNIT	INSTALLED COST UNIT	INSTALLED COST TOTAL
1	Irrigation Sprinkler System	92	AC	$15,000	$1,380,000
2	Runoff Return Facilities	4	EA	$165,000	$660,000
3	Diversion V-Ditch	1,000	LF	$55	$55,000
4	Border Ditch/Dike	11,000	LF	$50	$550,000
5	Field Fencing	6,000	LF	$17	$102,000
6	Slide Gates	4	EA	$5,000	$20,000
7	Irrigation Pump Station	1	LS	$300,000	$300,000
8	Pipeline From WWTP	12,500	LF	$100	$1,250,000
9	Return FM	4,500	LF	$80	$360,000
10	Manhole	1	EA	$5,000	$5,000
11	Misc	1	LS	$100,000	$100,000
				Subtotal	$4,782,000
				Contingency @ 20%:	$956,000
				TOTAL ESTIMATED CONSTRUCTION COST:	**$5,738,000**
				Site Acquisition/ Easements:	$400,000
				Indirect/Engineering @ 25%	$1,435,000
				TOTAL ESTIMATED PROJECT COST (Feb 2014)	**$7,573,000**

Due to the high capital and O&M cost to develop pasture/wetland irrigation and the fact that the City has an existing customer (Mt. Shasta Golf Course) willing and able to take the majority of the City's summertime treated effluent, and pay for it, we do not feel this is a wise use of the City's resources.

[1] Based on 2013 Title 22 rate and 2009 to 2013 Title 22 use.

2) Additional Subsurface Disposal

The City's existing subsurface (leach field) disposal system was described earlier. As indicated, the City is only utilizing about half of the existing 42-acre site. Figure 5 shows the City discharged about 107 MG of treated effluent to the leach field in 2011, or about 41 percent of the total effluent generated. Figure 9 in the Leach Field Design Investigation (LFDI) reveals a noticeable increase in nitrate in down-gradient groundwater at the end of 2011, presumably from the increased volume of treated effluent. The LFDI also suggests the existing leach field has considerably more hydraulic capacity than the current rated capacity of 0.7 MGD, possibly up to 5.9 MGD. However, as indicated, the overall site capacity will likely be determined by the impact of nitrate contribution to the underlying groundwater.

The 2011 disposal volume correlates to an average daily flow of about 0.29 MGD, which is about 40 percent of the theoretical 0.7 MGD design capacity. It is unclear how much additional effluent could be added to the site before down-gradient nitrate levels begin to approach the drinking water standard of 10 mg/l. However, based on the observed correlation between applied effluent and nitrate in the groundwater, it is likely increased subsurface disposal will lead to increased nitrate in the groundwater. For this reason, expanding the existing leach field site poses unknown risks for future regulatory compliance.

There are other USFS lands in the vicinity of south Mt. Shasta that may be conducive to use for subsurface disposal, see Figure 9. Site 6 contains the City's existing leach field disposal site. Site 1 is a 39 acre site located west of the WWTP but encompasses a portion of Box Canyon in which the Sacramento River flows through. Due to the steep, rocky topography and proximity to the river, this site is ruled out as a potential effluent disposal site.

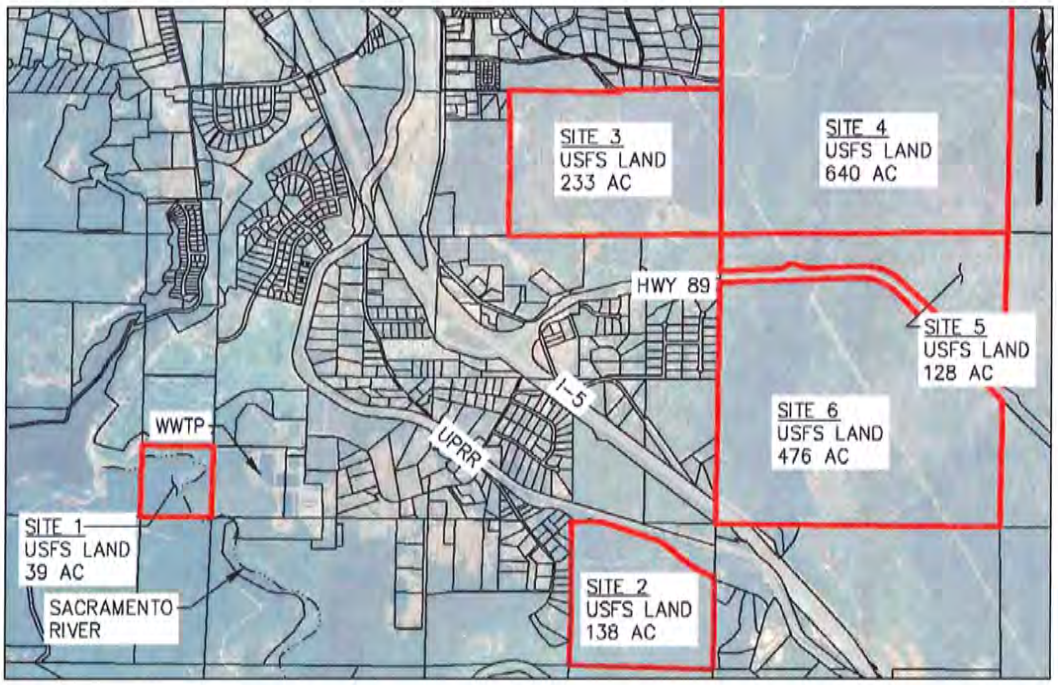

Figure 9 – Possible Subsurface Disposal

Site 2 is a 138 acre USFS parcel located southeast of the existing WWTP, south of Interstate 5 and the Union Pacific railroad right-of-way. Because the site is just up-gradient from the Sacramento River, future regulatory compliance may be more challenging.

Sites 3, 4, and 5 comprise approximately 1,000 acres of USFS land located north and east of the City's existing leach field disposal site (Site 6). Although no subsurface geological studies have been performed as part of this study, USDA Soil Resource Report maps suggest moderate to rapidly permeable soils. The soils range from 30 to 50% Neer gravelly sandy loam and 35 to 40% sandy loam. These soils are well suited for douglas-fir, ponderosa pine, and incense cedar. It's likely these sites have similar percolation characteristics as the City's existing leach field disposal facility.

The City's existing 42-acre leach field disposal site makes up about 9% of the land available at Site 6. Below is a list of considerations for expanding use of subsurface facilities for effluent disposal:

- Site 6 makes the most sense because:
  - The City's effluent disposal pipeline and related infrastructure is already extended to this site.
  - There is an additional 434 acres of area available.
  - Percolation rates and depth to groundwater are favorable.
  - There is ample room to expand on-site.
- Improving nitrogen removal at the WWTP is one way to help mitigate impacts of nitrate to groundwater. However, as will be discussed later, these improvements are costly. Since nitrogen compounds are driving the need for additional treatment for river discharge, it would not make sense to develop nitrogen removal facilities at the WWTP and spend an additional $80,000 to $100,000 per year to pump effluent to subsurface disposal. Although, with improved nitrogen removal at the WWTP, compliance with groundwater quality standards could be much easier.

3) <u>Tree Irrigation</u>

Similar to pasture irrigation, fast growing trees have been successfully used in recent years for effluent disposal. Trees, such as hybrid poplars and willows provide the following advantages:

- Agronomic uptake of treated effluent can be higher than grass crops, thus allowing for increased effluent disposal volumes per acre.
- The accelerated growth shortens the investment return time because harvested trees have market value as lumber, biomass for co-generation facilities, or wood chips.

Some disadvantages of tree irrigation are as follows:

- Requires more annual maintenance than grass crops to protect the trees from disease and pests.
- Any return on investment is dictated by the time it takes for the trees to mature. For example, smaller trees can be sold as biomass or wood chips after 10-12 years. However, larger trees used in the lumber market can take up to 20 years mature.
- Similar to any land disposal practice, trees are irrigated only during the growing season at agronomic rates. Thus, a separate wintertime disposal practice is still required.

While successfully used for effluent and sludge disposal in many communities, we do not feel development of a tree irrigation site is a good fit for Mt. Shasta because the City already has an agreement with Mt. Shasta Golf Course to take all of the summer time treated effluent the City can produce in all but the wettest years. The golf course reimburses the City for a portion of its treatment and pumping costs, and there are no maintenance costs borne by the City after the treated effluent is delivered.

4) <u>Regionalization</u>

Where feasible, regionalization with other nearby communities is favorable due to reduced impacts on the environment. However, it is not always a cost-effective or politically-favorable approach. The nearest WWTPs to the City of Mt. Shasta are the City of Dunsmuir ten miles to the south and the City of Weed twelve miles to the north. Conveyance of wastewater to either facility would require a large lift station and force main. It is estimated the pipeline itself would cost $12M to $15M.

The City of Weed has two WWTPs: 1) a lagoon system, and 2) an Imhoff tank/trickling filter. Treated effluent is stored in on-site lagoons and conveyed to percolation beds during the winter and alfalfa irrigation during the summer. Both Weed treatment and disposal facilities have limited surplus capacity and would require significant improvements to accommodate wastewater from the City of Mt. Shasta.

The City of Mt. Shasta's WWTP is located 10 miles upstream of the City of Dunsmuir's WWTP. The City of Dunsmuir's WWTP is located on a small widened area between the Sacramento River and the Cascade Mountain Range. The WWTP process consists of an oxidation ditch, secondary clarifier and tertiary sand filtration. At the time of this report, the Dunsmuir WWTP is undergoing improvements, which include a new secondary clarifier with increased capacity. Upon completion of these improvements, the Dunsmuir WWTP will have a peak wet weather design capacity of 2.0 MGD.

In general, oxidation ditch plants are an economical biological treatment process for small plants but not always for larger facilities. In addition, nitrogen removal is more challenging requiring precise controls and experienced operators. Furthermore, it is difficult to expand the capacity of an oxidation ditch. Given the Dunsmuir WWTP's existing capacity, limited footprint, and remoteness, it is not considered a viable site for significant expansion. For these reasons, regionalization with a neighboring community for providing wastewater treatment and disposal is deemed impractical and will not be considered further.

EFFLUENT DISPOSAL ALTERNATIVE DEVELOPMENT

In order to remove itself from the regulatory umbrella when discharging to the Sacramento River, the City desires to evaluate effluent disposal options that would eliminate its River discharge. In order to eliminate the river discharge, the City would need to 1) find another wintertime disposal practice, or 2) store treated effluent until summertime disposal can be employed. Crop or tree irrigation is limited to the growing season – non-winter season. There are not any other viable surface water disposal sites in the vicinity of Mt. Shasta that would be subject to less regulatory restrictions than the upper Sacramento River. The only other viable wintertime disposal process that has less regulatory burden than river disposal is subsurface disposal. Based on this, we have established the following disposal options for eliminating the need to discharge treated effluent to the upper Sacramento River:

Disposal Option 1: Wintertime effluent storage and summertime irrigation.

Disposal Option 2: Partial wintertime effluent storage with leach field disposal and summertime irrigation.

Disposal Option 1- Wintertime Effluent Storage and Summertime Irrigation

We evaluated the City's wintertime storage needs by considering incoming raw wastewater flows, 100-year rainfall, evaporation, percolation and evapotranspiration on irrigated land. Table 6 contains a month-by-month breakdown of these parameters along with footnotes describing a number of assumptions used in the hydraulic balance. Essentially, effluent storage ponds need to be designed to accommodate incoming wastewater flows during a 100-year rainfall year, as well as the rainfall the facilities will collect during this period. There are always minor losses from evaporation and percolation. We assumed the irrigation season begins in May and ends in September, which generally coincides with the golf course's irrigation season most years. As indicated in Table 6 if there was no wintertime discharge to the Sacramento River, the City would need to utilize all 70 acre-feet (AC-FT) of its existing lagoon capacity as effluent storage and about 842 acres (AC) of additional irrigation area to prevent accidental discharges of wastewater. Currently, the City has about 69 AC of irrigation area available at the golf course. Therefore, the irrigation area would need to increase by 774 AC. To reduce the irrigation area, additional effluent storage could be constructed on-site. It is estimated an additional 79 AC-FT of storage could be constructed at the WWTP, which would maximize the developable use of the site, see Figure 10. If this were accomplished, it would reduce the required irrigation area to about 449 acres or an additional 380 acres, see Table 7.

Table 6: Effluent Disposal Option 1 Hydraulic Balance - No Additional Effluent Storage
City of Mt. Shasta
Wastewater Treatment and Effluent Disposal Feasibility Study
100-Year Rainfall & 2010 Monthly Flow Percolation Rate Calibration
Effluent Storage (Winter) & Pasture/Wetland (Summer)

File: Water Balance with Min Perc.xls
Job #: 111.44
Date: 5/30/2014
By: GM

MONTH	RAINFALL [1,2] Inch/Month	ET_o RATE [3] Inch/Month	PASTURE: PAN TO PASTURE COEFFICIENT [4]	PASTURE: PASTURE ET Inch/Month	PASTURE: AGRONOMIC IRRIGATION [5] Inch/Month	PASTURE: MINIMUM POTENTIAL IRRIGATION [6] Days/Month	SEWAGE: Q_{MONTH}/ ADWF [7] DESIGN RATIO	SEWAGE: TO STORAGE MG/Month	SEWAGE: TO STORAGE Ac-Ft/Month	RAINFALL ON STORAGE Ac-Ft/Month	RESERVOIR & OXIDATION PONDS: PAN TO RESERVOIR COEFFICIENT [8]	EVAPORATION: Inch/Month	EVAPORATION: Ac-Ft/Month	IRRIGATION Ac-Ft/Month	GOLF COURSE Ac-Ft/Month	LEACH FIELD Ac-Ft/Month	LEACH FIELD MGD	RIVER [11] Ac-Ft/Month	RIVER MGD	RESERVOIR PERCOLATION [9] Ac-Ft/Month	TAILWATER RETURN Ac-Ft/Month	CHANGE IN STORAGE Ac-Ft	ESTIMATED TOTAL IN STORAGE Ac-Ft	Evap Pan A Glenburn A10 344102 (mm)	Average Annual Rainfall [2] (Inches)
																							50.34		
OCT	4.61	3.8	0.76	2.9	0.0	17		20.98	64.4	5.4	0.881	3.3	0.8	298.4	0.0	0.0	0.00	0.00	0.00	1.4	18.8	-211.9	0.0	96	4.61
NOV	2.11	1.2	0.73	0.9	0.0	8		20.31	62.3	2.5	0.801	1.0	0.4	140.4	0.0	0.0	0.00	0.00	0.00	2.5	8.8	-69.7	0.0	31	2.11
DEC	5.01	0.7	0.71	0.5	0.0	2		25.41	78.0	5.8	0.801	0.5	0.4	35.1	0.0	0.0	0.00	0.00	0.00	3.9	2.2	46.7	46.7	17	5.01
JAN	15.62	0.8	0.72	0.6	0.0	18		33.11	101.6	18.2	0.801	0.6	0.5	315.9	0.0	0.0	0.00	0.00	0.00	4.8	19.9	-181.5	0.0	20	15.62
FEB	8.03	1.3	0.74	1.0	0.0	12		35.43	108.7	9.4	0.801	1.1	0.9	210.6	0.0	0.0	0.00	0.00	0.00	5.3	13.3	-85.5	0.0	34	8.03
MAR	5.04	3.0	0.76	2.2	0.0	2		30.76	94.4	5.9	0.801	2.4	2.4	35.1	0.0	0.0	0.00	0.00	0.00	6.0	2.2	59.0	59.0	75	5.04
APR	7.70	4.7	0.78	3.7	0.0	5		30.50	93.6	9.0	0.744	3.5	3.5	87.8	0.0	0.0	0.00	0.00	0.00	6.0	5.5	10.9	69.9	120	7.70
MAY	2.65	6.8	0.78	5.3	3.2	11		25.43	78.1	3.1	0.744	5.0	5.0	193.1	0.0	0.0	0.00	0.00	0.00	6.0	12.2	-110.8	0.0	172	2.65
JUN	0.46	7.8	0.78	6.1	6.8	18		22.38	68.7	0.5	0.744	5.8	5.6	315.9	0.0	0.0	0.00	0.00	0.00	5.8	19.9	-238.1	0.0	199	0.46
JUL	0.08	9.7	0.78	7.6	9.0	21		23.49	72.1	0.1	0.744	7.2	5.8	368.6	0.0	0.0	0.00	0.00	0.00	4.8	23.2	-283.8	0.0	246	0.08
AUG	0.05	8.1	0.78	6.4	7.6	31		22.19	68.1	0.1	0.744	6.1	4.2	544.1	0.0	0.0	0.00	0.00	0.00	4.2	34.3	-450.0	0.0	207	0.05
SEP	1.06	5.7	0.78	4.5	4.1	21		20.71	63.6	1.2	0.744	4.2	2.5	368.6	0.0	0.0	0.00	0.00	0.00	3.5	23.2	-286.4	0.0	145	1.06
TOTAL	52.42	53.6		41.5	30.5	166		310.7	953.6	61.2		40.8	32.0	2913.3	0.0	0.0		0.0		54.2	183.5	-1801.2		1362	52.42

CONSTANTS

Storage pond runoff area (acres):	A	14		
Average storage pond water surface (acres):	B	12		
Irrigation area (acres):	C	842		
Storage pond percolation rate @ 12 ft WL (in/day)[10]:	D	0.20	5.9E-06	cm/sec
Current ADWF (MGD):	E	0.70	65.3	Ac-Ft/Month
Irrigation Application Efficiency Factor	F	1.2		
Offseason Irrigation Rate (in/day)	G	0.25		
Tailwater recovery percent of applied water	H	0.063		

NOTES:
1. 100-year rainfall based on Station Mt. Shasta City Precipitation Long-Duration-Frequency Table from DWR Bulletin 195, October 1976.
2. 100-year rainfall of 63.22 inches for years 1948-2010 from Western Regional Climate Center spread in proportion to 2010 monthly data. 2010 selected based on similarity to 100-year annual precipitation looking at the past 20 years
3. Potential ET_o based on 9 years of data for Station Glenburn Evaporation from Water Surface, DWR Bulletin 73-79, November 1979.
4. Pasture evapotranspiration ratio determined from DWR Bulletin 73-79, November 1979.
5. Effluent applied May through September. Application rate = (ET - Precipitation) * 1.2 Irrigation Application Efficiency Factor
6. Effluent applied in October through April based upon minimum irrigation days and historical offseason irrigation rate.
7. Sewage flow based upon 2012 monthly average dry weather flow, Qmonth/ADWF Design Ratios x Design ADWF.
8. Reservoir and oxidation ponds evaporation pan ratios from "Penman-Monteith Estimates of Reservoir Evaporation"; Marvin E. Jensen, Hon. M.ASCE; Avry Dotan; and Roland Sanford.
9. Reservoir percolation and evaporation rates take into account the surface area inundated. Evaporation includes oxidation pond area.
10. Percolation rate adjusted to calibrate initial and final pond values to those calculated for 2010 (50.34 Ac-Ft and 51.5 Ac-Ft respectively) while not exceeding pond capacil
11. Worst case maximum possible discharge based on Sept 15 - June 14 discharge period, 20:1 river to effluent dilution and no discharge when river flows exceed 400 CFS. Assumes no bypass needed as a result of plant upsel

Securing this much additional irrigation area would be very challenging. As was discussed previously, the amount of available irrigation area along the west side of Interstate 5, north of Ream Avenue, is about 92 AC.

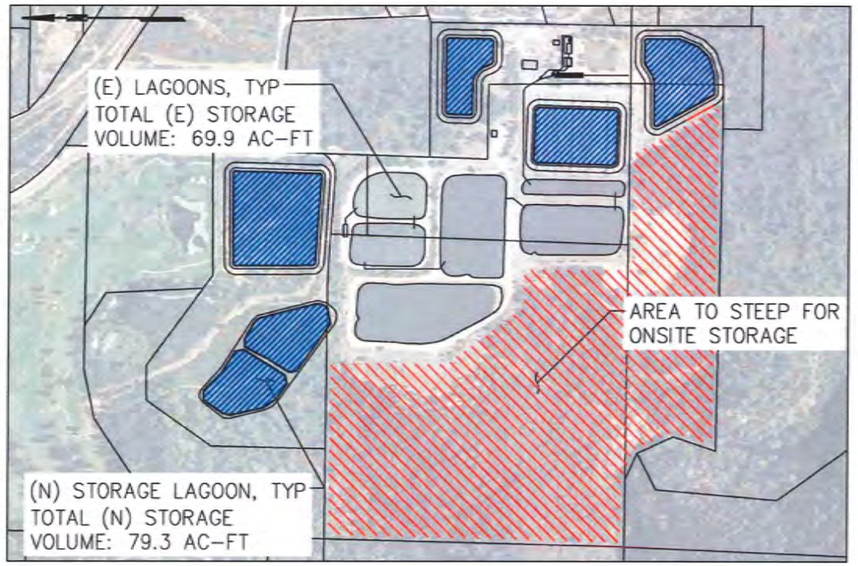

Figure 10 – Additional Effluent Storage at WWTP Site

Due to the unavailability of required irrigation area, it would be necessary to develop other less desirable lands for tree irrigation. The costs to secure and develop these lands for irrigation, extend infrastructure to convey treated effluent, and construct additional effluent storage make this option impractical.

Disposal Option 2- Partial Wintertime Effluent Storage with Leach Field Disposal and Summertime Irrigation

Disposal Option 2 is similar to Option 1 except that some wintertime disposal to the leach field would take place. We performed a similar hydraulic balance considering the factors described in Option 1, except we assumed up to 0.7 MGD of wastewater would be pumped to the leach field disposal area. During a 100-year rainfall year, the City would need an additional 170 AC-FT of effluent storage. Currently, the City has about 70 AC-FT of lagoon capacity. The 0.7 MGD disposal to the leach field represents over seven times the amount of effluent discharged to the leach field in 2010 and 2011 when elevated nitrate levels were observed in the down-gradient monitoring well. It's unclear what impacts the additional effluent would have on down-gradient groundwater, but the 2010 and 2011 data suggests nitrate levels would rise with increased effluent disposal.

It is difficult to predict the impacts of nitrate in the groundwater even if the City's existing leach field were expanded. Because of this uncertainty and the threat of increased regulation if the leach field were expanded, we feel any option relying upon expansion of or increased effluent to the leach field is too risky. Therefore, we believe Disposal Option 2 is not viable.

Table 8: Effluent Disposal Option 2 Hydraulic Balance - Effluent Storage Wintertime
City of Mt. Shasta
Wastewater Treatment and Effluent Disposal Feasibility Study
100-Year Rainfall & 2010 Monthly Flow Percolation Rate Calibratior
Effluent Storage (Winter) & Leachfield (Summer)

File: Water Balance with Min Perc.xls
Job #: 111.44
Date: 5/30/2014
By: GM

MONTH	RAINFALL [1,2] Inch/Month	ET_o RATE [3] Inch/Month	PASTURE: PAN TO PASTURE COEFFICIENT [4]	PASTURE: PASTURE ET Inch/Month	PASTURE: AGRONOMIC IRRIGATION [5] Inch/Month	PASTURE: MINIMUM POTENTIAL IRRIGATION [6] Days/Month	SEWAGE: Q_{MONTH}/ ADWF [7] DESIGN RATIO	SEWAGE: TO STORAGE MG/Month	SEWAGE: TO STORAGE Ac-Ft/Month	RAINFALL ON STORAGE Ac-Ft/Month	RESERVOIR & OXIDATION PONDS: PAN TO RESERVOIR COEFFICIENT [8]	RESERVOIR & OXIDATION PONDS: EVAPORATION Inch/Month	RESERVOIR & OXIDATION PONDS: EVAPORATION Ac-Ft/Month	IRRIGATION Ac-Ft/Month	GOLF COURSE Ac Ft/Month	LEACH FIELD Ac-Ft/Month	LEACH FIELD MGD	RIVER [11] Ac-Ft/Month	RIVER MGD	RESERVOIR PERCOLATION [9] Ac-Ft/Month	TAILWATER RETURN Ac-Ft/Month	CHANGE IN STORAGE Ac-Ft	ESTIMATED TOTAL IN STORAGE Ac-Ft	Evap Pan A Glenburn A10 344102 (mm)	Average Annual Rainfall [2] (inches)
																							50.34		
OCT	4.61	3.8	0.76	2.9	0.0	17		20.98	64.4	5.4	0.881	3.3	0.8	0.0	0.0	48.1	0.52	0.00	0.00	1.4	0.0	19.6	69.9	96	4.61
NOV	2.11	1.2	0.73	0.9	0.0	8		20.31	62.3	2.5	0.801	1.0	0.4	0.0	0.0	61.9	0.67	0.00	0.00	2.5	0.0	0.0	69.9	31	2.11
DEC	5.01	0.7	0.71	0.5	0.0	2		25.41	78.0	5.8	0.801	0.5	0.4	0.0	0.0	64.4	0.70	0.00	0.00	3.9	0.0	15.2	85.1	17	5.01
JAN	15.62	0.8	0.72	0.6	0.0	18		33.11	101.6	18.2	0.801	0.6	0.5	0.0	0.0	64.4	0.70	0.00	0.00	4.8	0.0	50.1	135.1	20	15.62
FEB	8.03	1.3	0.74	1.0	0.0	12		35.43	108.7	9.4	0.801	1.1	0.9	0.0	0.0	64.4	0.70	0.00	0.00	5.3	0.0	47.5	182.6	34	8.03
MAR	5.04	3.0	0.76	2.2	0.0	2		30.76	94.4	5.9	0.801	2.4	2.4	0.0	0.0	64.4	0.70	0.00	0.00	6.0	0.0	27.5	210.1	75	5.04
APR	7.70	4.7	0.78	3.7	0.0	5		30.50	93.6	9.0	0.744	3.5	3.5	0.0	0.0	64.4	0.70	0.00	0.00	6.0	0.0	28.7	238.8	120	7.70
MAY	2.65	6.8	0.78	5.3	3.2	11		25.43	78.1	3.1	0.744	5.0	5.0	0.0	18.1	64.4	0.70	0.00	0.00	6.0	0.0	-12.4	226.4	172	2.65
JUN	0.46	7.8	0.78	6.1	6.8	18		22.38	68.7	0.5	0.744	5.8	5.6	0.0	38.8	64.4	0.70	0.00	0.00	5.8	0.0	-45.4	181.0	199	0.46
JUL	0.08	9.7	0.78	7.6	9.0	21		23.49	72.1	0.1	0.744	7.2	5.8	0.0	51.4	64.4	0.30	0.00	0.00	4.8	0.0	-54.3	126.8	246	0.08
AUG	0.05	8.1	0.78	6.4	7.6	31		22.19	68.1	0.1	0.744	6.1	4.2	0.0	43.3	64.4	0.30	0.00	0.00	4.2	0.0	-47.9	78.8	207	0.05
SEP	1.06	5.7	0.78	4.5	4.1	21		20.71	63.6	1.2	0.744	4.2	2.5	0.0	23.3	64.1	0.30	0.00	0.00	3.5	0.0	-28.5	50.3	145	1.06
TOTAL	52.42	53.6		41.5	30.5	166		310.7	953.6	61.2		40.8	32.0	0.0	175.0	753.6		0.0		54.2	0.0	0.0		1362	52.42

CONSTANTS

Storage pond runoff area (acres):	A	14			
Average storage pond water surface (acres):	B	12			
Irrigation area (acres):	C	68.73			
Storage pond percolation rate @ 12 ft WL (in/day) [10]:	D	0.20	5.9E-06	cm/sec	92.05479452
Current ADWF (MGD):	E	0.55	51.3	Ac-Ft/Month	
Irrigation Application Efficiency Factor	F	1.2			
Offseason Irrigation Rate (in/day)	G	0.25			
Tailwater recovery percent of applied water		0.063			

NOTES:
1. 100-year rainfall based on Station Mt. Shasta City Precipitation Long-Duration-Frequency Table from DWR Bulletin 195, October 1976
2. 100-year rainfall of 63.22 inches for years 1948-2010 from Western Regional Climate Center spread in proportion to 2010 monthly data. 2010 selected based on similarity to 100-year annual precipitation looking at the past 20 yea
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4. Pasture evapotranspiration ratio determined from DWR Bulletin 73-79, November 1979
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11. Worst case maximum possibe dishcarge based on Sept 15 - June 14 discharge period, 20:1 river to effluent dilution and no discharge when river flows exceed 400 CFS. Assumes no bypass needed as a result of plant upse

B. DESCRIPTION - TREATMENT ALTERNATIVES

As indicated in the EFFLUENT DISPOSAL ALTERNATIVE DEVELOPMENT discussions earlier in this section, the challenges associated with wintertime effluent disposal make "getting out of the River" impractical. Subsurface disposal, beyond current permitted volumes, creates too great of potential for increased groundwater regulatory scrutiny and compliance. Limited data suggests increased subsurface disposal impacts groundwater with increased nitrate, although at concentrations well below drinking water standards.

The concept of storing effluent during the winter and irrigating pasture/wetlands or trees during the irrigation season is impractical due to the required effluent storage volume and land requirements for irrigation.

It appears the best approach for the City is to continue to utilize its three permitted effluent disposal sites and make improvements to its treatment facilities that will allow consistent compliance with NPDES permit requirements. The remainder of this section will discuss treatment improvement concepts and options that will be evaluated in later sections of this report.

SECONDARY TREATMENT CONSIDERATIONS

As discussed in Section III EXISTING FACILITIES, the City's existing lagoon treatment process provides an admirable job removing organics and suspended solids from the waste stream. However, as with most lagoon systems, the process falls short at removing nitrogen compounds (ammonia and nitrate.) The City's new NPDES permit imposed more stringent effluent ammonia limitations as well as a water quality based nitrate limit. In addition, new 2013 ammonia criteria reflects the latest scientific knowledge on the toxicity of ammonia to fresh water aquatic life, including freshwater mussels and gill-breathing snails. This new criteria supersedes the 1999 ammonia criteria which is what the City's 2012 NPDES permit was based. The presence of

ammonia in wastewater effluent is usually a sign of inadequate nitrification. In the City's case, data suggests adequate nitrification occurs in Lagoon 1 but as the wastewater progresses through the downstream lagoons, ammonia levels gradually increase, presumably due to bacterial reduction of nitrate and bacterial decomposition of organic material present in the lagoon, i.e. plant material (algae), waterfowl fecal material, etc.

Four alternatives were considered for replacing the existing lagoon system and three alternatives would make improvements to the existing system, for a total of seven treatment alternatives. Some alternatives provide more reliable nitrogen removal than others, the details of which will be discussed herein. The seven treatment alternatives are listed below and described in more detail in the following pages.

Lagoon Replacement Alternatives

Conventional Activated Sludge (CAS)

Sequential Oxidation Activated Sludge (Aero-Mod)

Membrane Bioreactor (MBR)

Sequencing Batch Reactor (SBR)

Lagoon Enhancement Alternatives

Biolac® Activated Sludge

Bioshell Nitrification

Moving Bed Bioreactor (MBBR)

A summary of preliminary design considerations used in evaluating these alternatives is included in the DESIGN CRITERIA subsection later in this section.

LAGOON REPLACEMENT ALTERNATIVES

Treatment Alternative 1 - Conventional Activated Sludge (CAS)

The activated sludge process dates back to the early 1880's and has become the widely accepted universal wastewater treatment process. The treatment concept relies on aeration of wastewater for growing a biological floc consisting of bacteria and protozoa to remove organics from wastewater. By controlling aeration and creating environments in which certain bacteria flourish, CAS can be used to target removal of certain constituents, i.e. nutrients. In Mt. Shasta's case, nitrogen removal is an important consideration in the design of a CAS system. Multiple variations of the activated sludge process have been developed to target biological nutrient (nitrogen and phosphorus) removal. One of the most common variations is the Modified Ludzack-Ettinger (MLE) process which utilizes internal recycling of nitrate-laden activated sludge to a pre-anoxic zone. The pre-anoxic zone is not aerated which promotes the endogenous respiration of nitrate by heterotrophic bacteria. The heterotrophic bacteria require a food source, which in this case is the raw sewage entering the pre-anoxic zone.

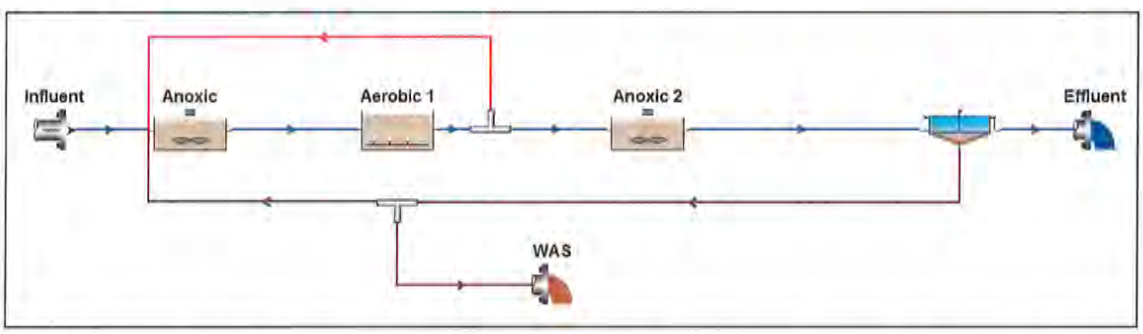

Figure 11 – Conventional Activated Sludge (CAS) Process Diagram

Using wastewater influent data collected during initial phases of the study, PACE prepared a computer model of the MLE activated sludge process using the BioWin software developed by Envirosim. Table 9 contains summary of the design criteria

used to model the CAS process. During development of the model, it became apparent the conventional MLE activated sludge process would not provide adequate nitrogen removal due to lower SRTs and low influent temperatures during wet weather flows. Therefore, it is proposed that a post-anoxic zone be added to further enhance denitrification. Refer to Figure 11 for the BioWin process flow diagram used in our modelling efforts. The bullet items below depict the most significant assumptions and observations resulting from our BioWin simulation:

Table 9: Conventional Activated Sludge Influent Design Criteria

Parameter [units]	Initial Flow	Expansion (15 yrs+)
Average Dry Weather Flow [MGD]	0.8	1.2
Maximum PWWF [MGD]	2.4	3.6
Historic maximum 30-Day Average [MGD]	1.3	2.3
Total COD mgCOD/L	386	386
Total Kjeldahl Nitrogen mgN/L	40	40
Winter Influent Temperature [°C]	8	8

- Influent Total Kjeldahl Nitrogen (TKN) is the sum of organic and inorganic nitrogen compounds found in raw wastewater. For Mt. Shasta, TKN was quite variable over the 7-month sampling period ranging from 10 to about 43.5 mg/l with an average of 28 mg/l. A TKN of 40 mg/l was used in the model to reflect the higher end of this range.
- The City's incoming wastewater alkalinity ranges from 150 to 160 mg/l which is not adequate to reach complete nitrification of 40 mg/l TKN. Therefore, it will be necessary to add lime to the upfront process. It's estimated that approximately 19 mg/l of lime will need to be added to the incoming raw wastewater in order to accomplish adequate nitrification.
- Between January 2012 and May 2013 and the City's sampling/testing efforts between July 2013 and January 2013, the temperature of raw

wastewater ranged from 8°C to about 20°C during the 7-month sampling period. At 8°C, the model showed adequate overall nitrogen removal; however, at temperatures below about 5°C, overall nitrogen removal is unpredictable. Based on unseasonably cold weather experienced in Mt. Shasta during December 2013 and January 2014, we feel the 8°C is a safe lower bound design point.

- Historical influent BOD is about 200 mg/l. The model indicates effective denitrification occurs at this waste strength and 40 mg/l TKN without addition of an external carbon source, such as methanol or glycerin. A "rule of thumb" is the ratio of BOD/TKN should be at least 4 in order to denitrify. The City's raw wastewater appears to have a BOD/TKN ratio of 5 under severe conditions.

Table 11 contains a summary of the BioWin modelling results based on the design criteria shown in Table 9 and Table 10 the assumptions described above.

Table 10: Conventional Activated Sludge Effluent Design Criteria

Parameter [units]	Ave. Monthly	Ave. Weekly	Max. Daily	Min. Percent Removal	Instan-taneous Min.	Instan-taneous Max.
Conventional Pollutants						
BOD [mg/L]	10	15	30	80	--	--
TSS [mg/L]	10	15	30	80	--	--
pH [std units]	--	--	--	--	6.5	8.5
Priority Pollutants						
Bis(2-Ethylhexyl)phthalate [µg/L]	3.0	--	5.6	--	--	--
Copper, Total Recoverable [µg/L]	9.1	--	19.3	--	--	--
Dichlorobromomethane [µg/L]	1.5	--	3.6	--	--	--
Zinc, Total Recoverable [µg/L]	12.9	--	26.2	--	--	--
Non-Conventional Pollutants						
Total Ammonia Nitrogen as N [mg/L]	4.6	--	8.4	--	--	--
Nitrate plus Nitrite as N [mg/L]	10	--	--	--	--	--
Settleable Solids [mL/L-hr]	0.1	--	0.2	--	--	--

Table 11: Conventional Activated Sludge Modeling Results

Effluent Constituents	Result
Lime Addition [mg/L]	19
BOD [mg/L]	1.92
TSS [mg/L]	4.88
pH [std units]	7.0
TKN [mg/L]	3.28
Total Ammonia Nitrogen as N [mg/L]	2.24
Nitrate plus Nitrite as N [mg/L]	4.54

The CAS process will consist of improved headworks screening, completely mixed anoxic and aerobic reactors, followed by clarification, filtration and final disinfection. New blowers will be required to provide air to the aerobic reactor and the aerobic digesters. Aerobic digesters will be used to stabilize waste sludge. Lagoon one will be lined and used as an emergency retention basin during extremely high flow conditions in order to limit the size of the treatment facilities. The new facilities will be located within the footprint of the existing intermittent sand filters and would replace the lagoon treatment system, except Lagoon 1 would be utilized for emergency retention during peak flows. See Figure 12 and Figure 13 for a preliminary site layout of the proposed facilities.

Two secondary clarifiers will provide solids separation after the CAS process. The clarifiers will be 50-foot diameter circular concrete tanks installed subgrade to limit icing during the winter months. The sludge collected at the bottom of the clarifiers will be returned to the CAS reactors as return activated sludge (RAS), or conveyed to the digester as waste activated sludge (WAS).

Two aerobic digesters will receive WAS for stabilization. The 50-foot diameter circular concrete digesters will be installed subgrade to minimize heat loss during the

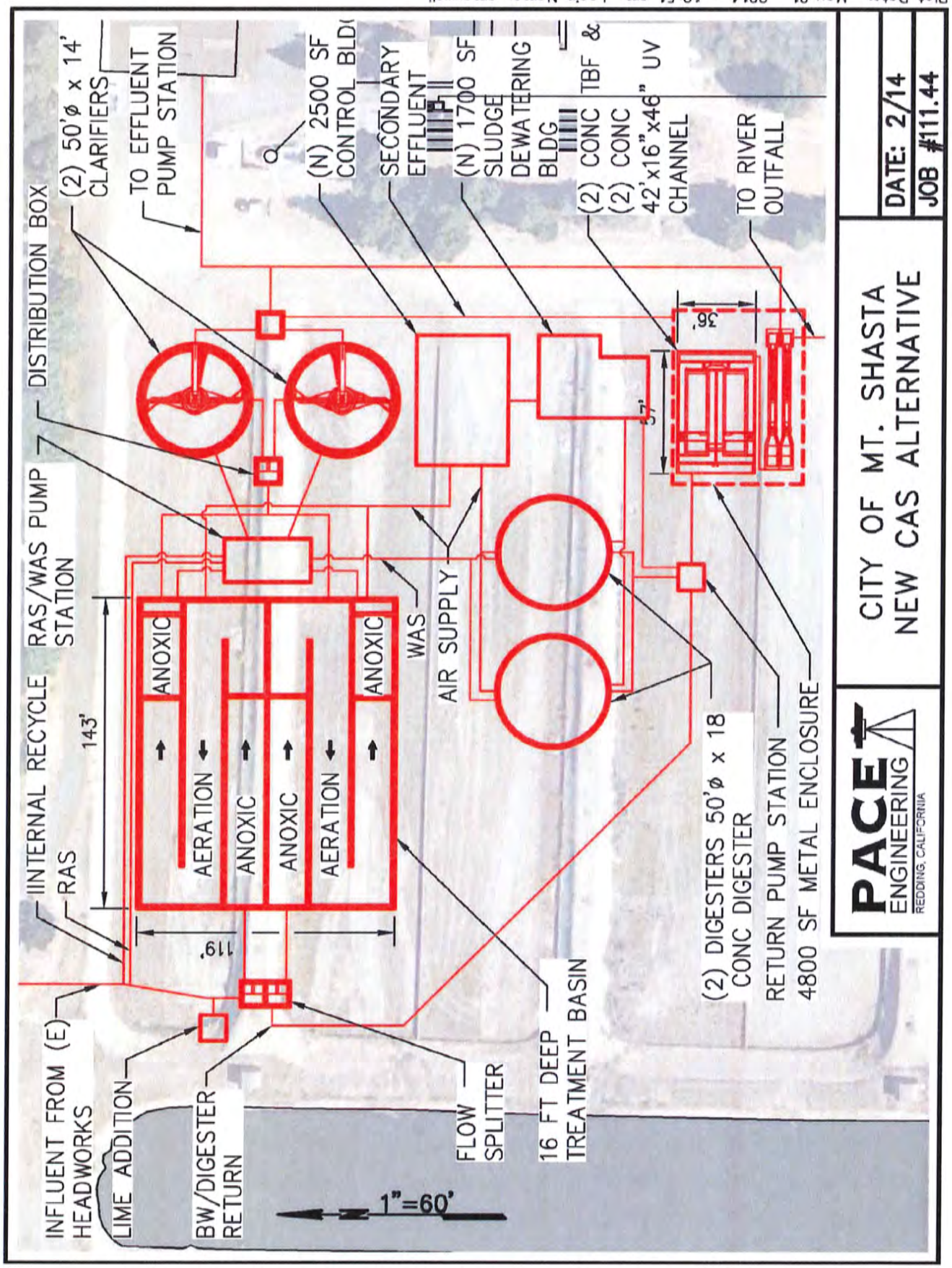

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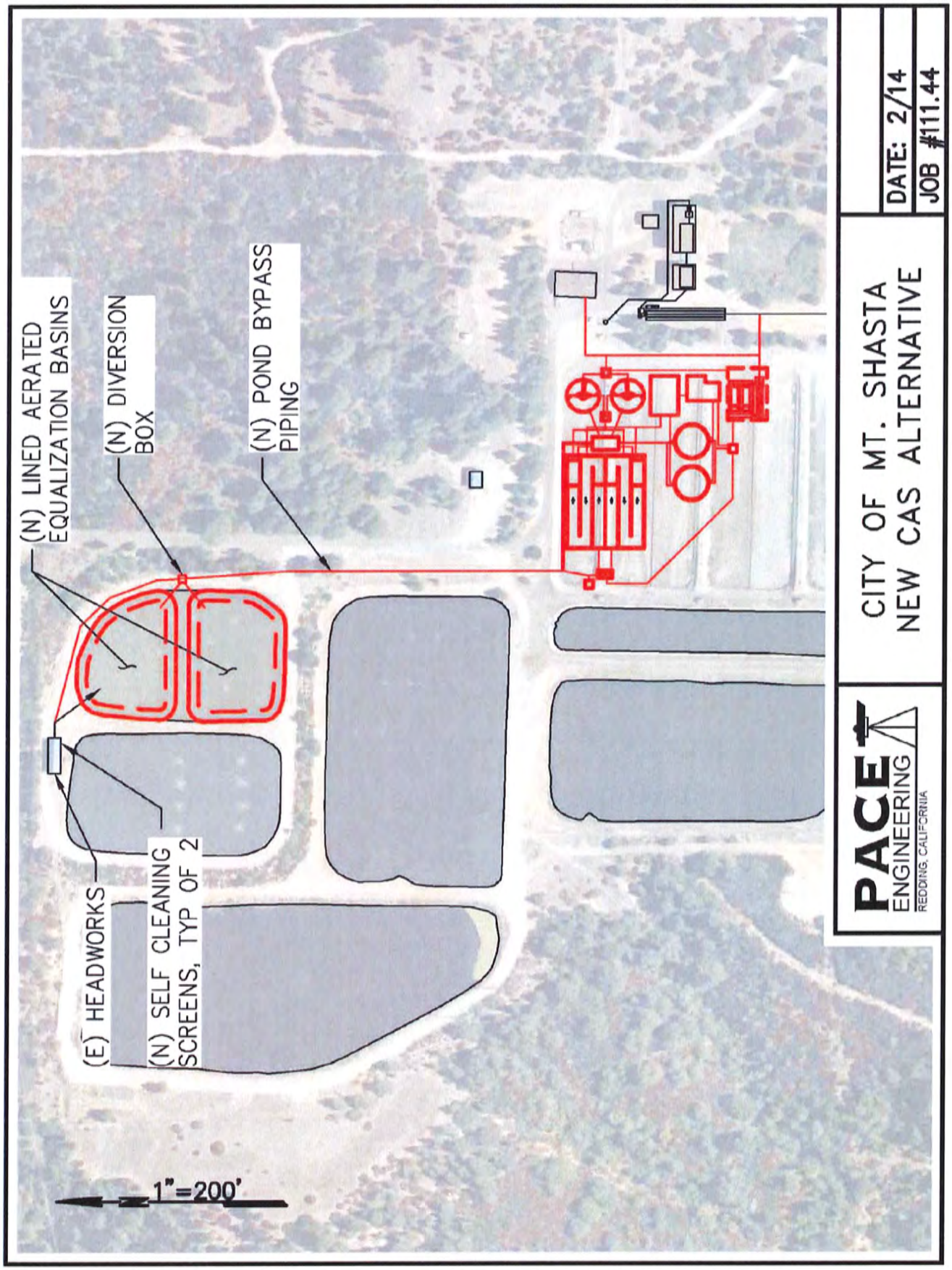
Figure 12 – Conventional Activated Sludge Preliminary Site Layout



Plot Date: May 20, 2014 - 7:55 am Login Name: gmaxwell
File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Alt-1 Conv Act Sludge.dwg, Layout: FIG2B

Figure 13 – Conventional Activated Sludge Preliminary Site Layout

winter months. Digested sludge will be pumped to a new dewatering facility for dewatering before being hauled to a final disposal site. Alternatively, stabilized sludge could be sent to a new lined sludge lagoon for storage during the winter months. During the summer, sludge could be dried using sludge drying beds before being hauled to a final disposal site. For cost estimating purposes, we assumed a new sludge dewatering facility will be incorporated into the new facility.

Treatment Alternative 2 - Sequential Oxidation (SEQUOX®) Activated Sludge By Aero-Mod

Another potential new treatment option for the City is the Sequential Oxidation Activated Sludge (SEQUOX®) process that was developed and marketed by Aero-Mod Wastewater Process Solutions (Aero-Mod.) Aero-Mod, stationed in Manhattan, Kansas, is a 25-year old company consisting of environmental, civil and chemical engineers that develop innovative custom wastewater treatment solutions for municipal and industrial applications. Currently, Aero-Mod has approximately 160 installations worldwide, including two relatively new installations on the northern California coast – Ferndale and Rio Dell.

Staff visited both sites to review facility operations and obtain feedback from on-site staff. Both facilities expressed their satisfaction with their new treatment facility and Aero-Mod's ongoing support after start-up. Based on data observed, both facilities appeared to consistently remove nitrogen. Additional discussions with an Aero-Mod WWTP's in Kingsley, Michigan, and Mt. Wolf, Pennsylvania, revealed similar performance for nitrogen removal and satisfaction with Aero-Mod's service record.

For Mt. Shasta, Aero-Mod recommended their SEQUOX® Nutrient Removal Process which is essentially a Ludzack-Ettinger activated sludge process with a second-stage aerobic/anoxic sequencing reactor downstream of the first-stage aerated reactor. Refer to Figure 14. Using data collected by City staff during the 7-month sampling program, Aero-Mod provided a BioWin simulation model for

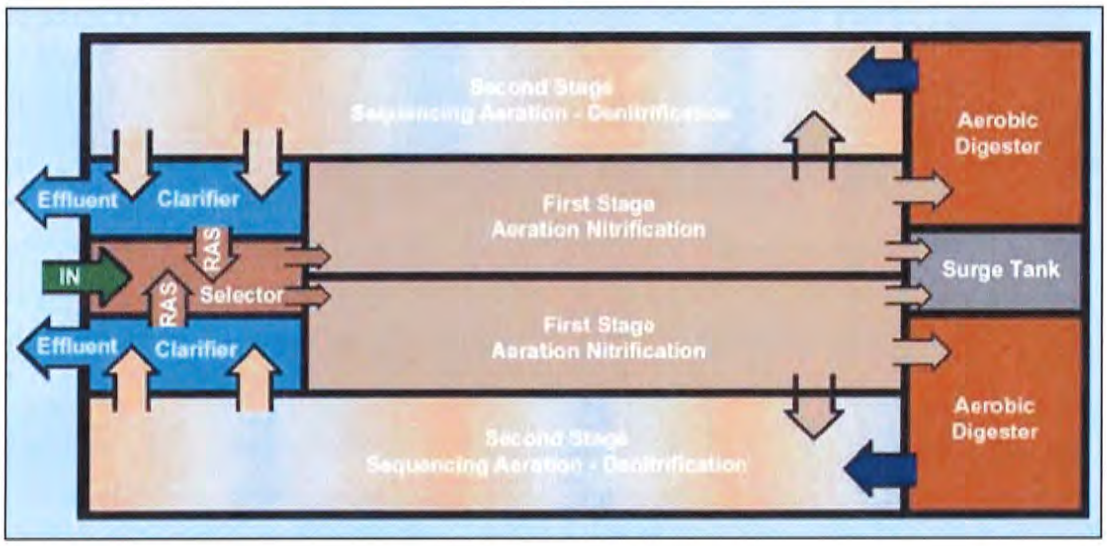


Figure 14 – Aero-Mod SEQUOX® Process Layout

PACE engineers to review and evaluate. Refer to Figure 15. The design criteria used for evaluating CAS, as shown in Table 9, was used for the SEQUOX® treatment plant as well. Below is a summary of observations and assumptions used in the SEQUOX® BioWin simulation:

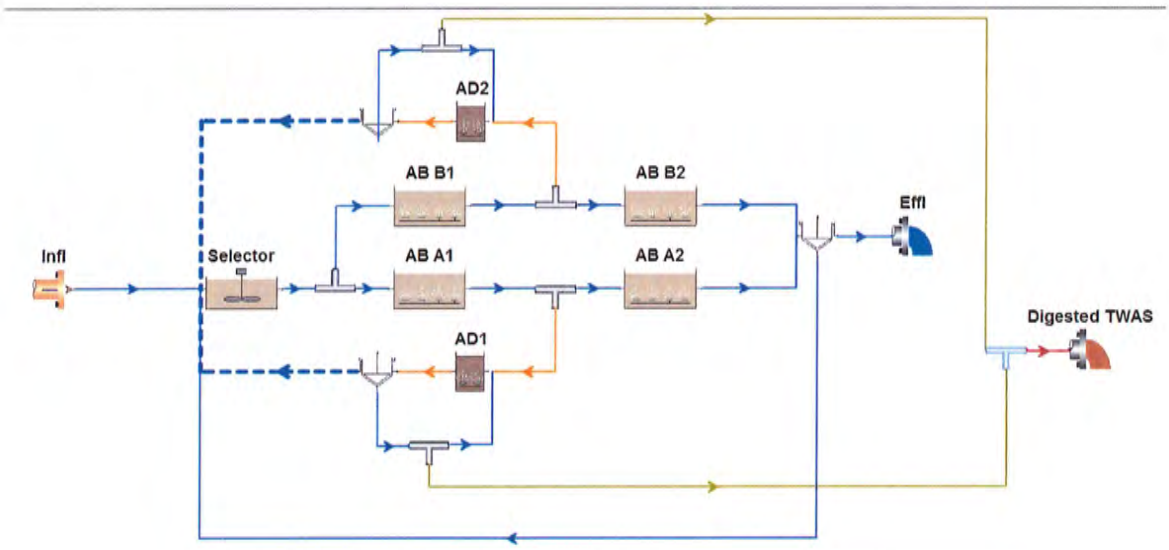
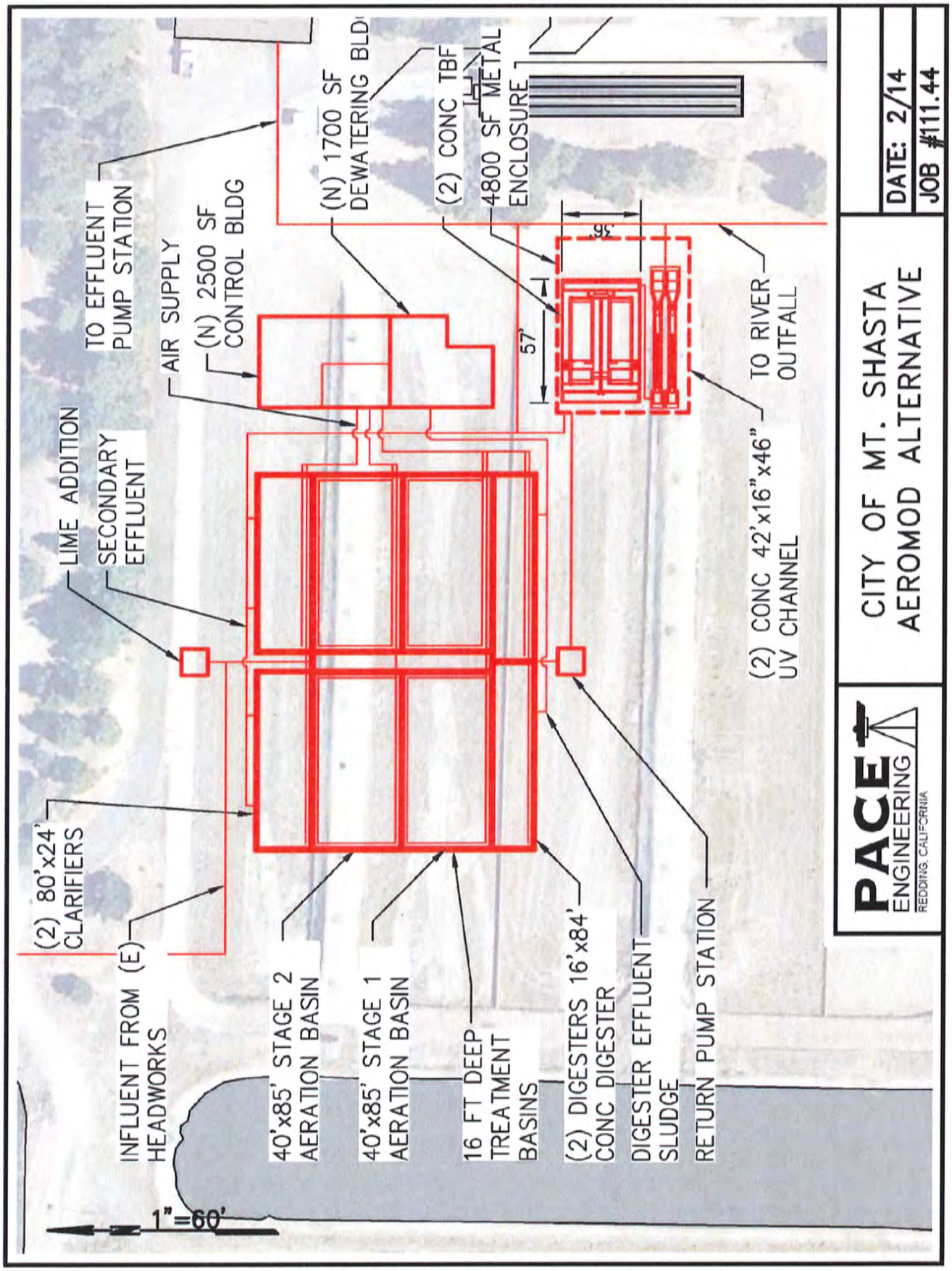


Figure 15 – Aero-Mod SEQUOX® Process Diagram

- The model suggests additional alkalinity will not be required to obtain adequate nitrification; however, we are planning on providing these facilities because modeling results were borderline.
- Denitrification is accomplished in the Stage 2 aerobic/anoxic sequencing reactor and anoxic selector. The sequencing reactor is similar to a Sequencing Batch Reactor (SBR) activated sludge process where the reactor tank undergoes alternate filling/mixing and re-aeration to promote nitrification and denitrification in the same reactor.
- Rectangular clarifiers provide solids separation at the end of the Stage 2 reactor. All accumulated solids (RAS) in the clarifiers are returned to the selector using air-lift pumps. Waste Activated Sludge (WAS) is wasted from the Stage 1 aerated reactor to the aerobic digesters. Digester supernatant is returned to the Stage 2 reactor.

Table 12 contains the results of the SEQUOX® BioWin modelling simulation effort. Note the BioWin model suggests effluent ammonia concentrations less than 1 mg/L, which is below the new 2013 ammonia criteria, if freshwater mussels are present in the Upper Sacramento River at sustained flows of 1.2 MGD. Peak flows up to 3.6 MGD can be accommodated before effluent nitrogen removal is compromised.

Similar to the CAS alternative, the new facility will be located in the existing intermittent sand filter beds. The SEQUOX® alternative will consist of improved headworks screening, followed by filtration and disinfection. See Table 16 and Figure 17. The SEQUOX® system utilizes concrete common-wall construction to form two parallel treatment trains consisting of a selector, aeration tank, sequencing aeration tank, clarifier and aerobic digester. This type of construction has lower up-front capital costs due to the savings from not having to construct multiple independent tanks. .



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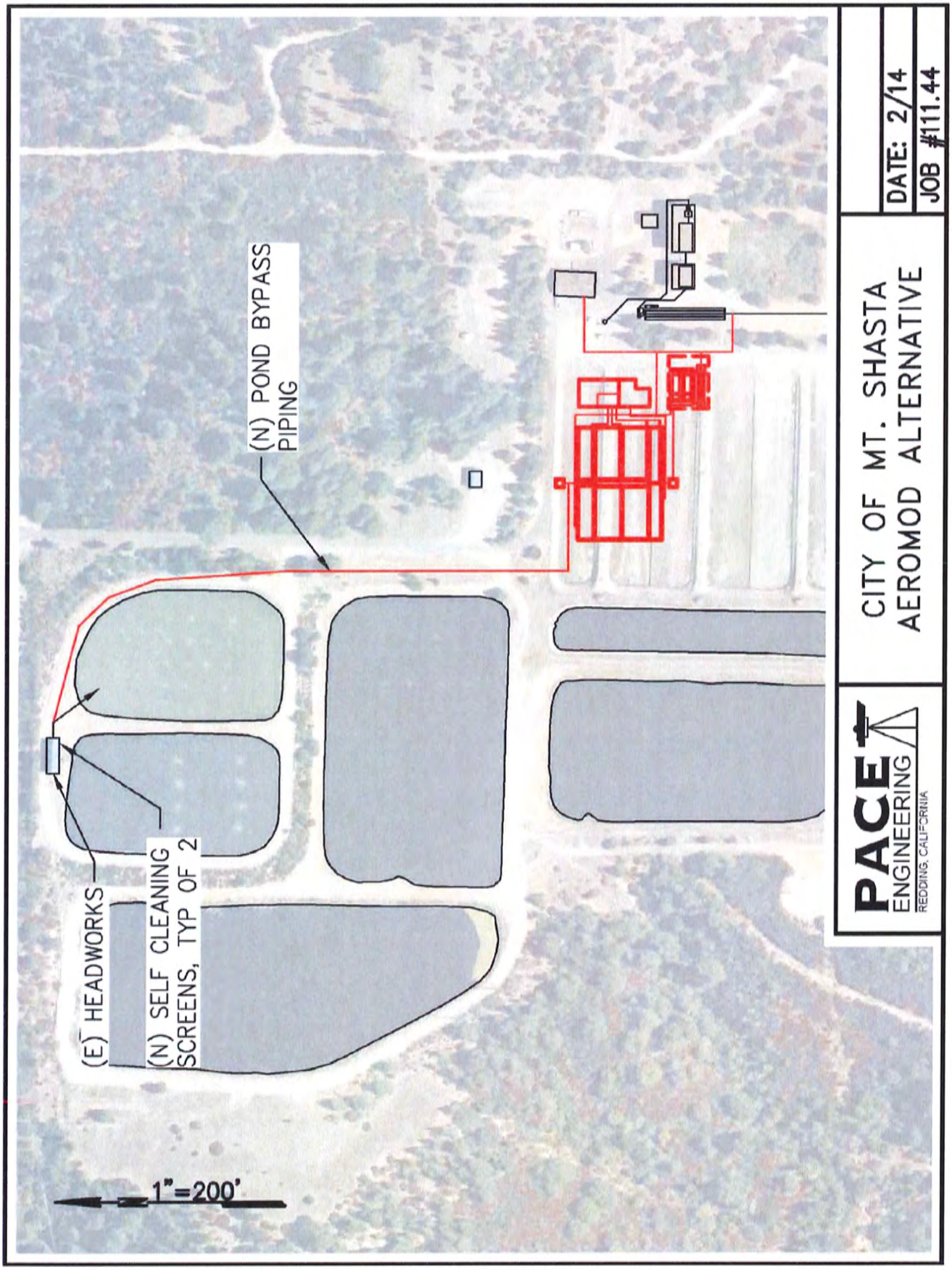
File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Alt-2 Aeromod V2.dwg, Layout: FIG7A

Figure 16 – Aero-Mod SEQOX® Preliminary Site Layout



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File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Alt-2 Aeromod V2.dwg, Layout: FIG7B

Figure 17 – Aero-Mod SEQUOX® Preliminary Site Layout

Table 12: Aero-Mod Activated Sludge Modeling Results

Effluent Constituents	Result
Lime Addition [mg/L]	0
BOD [mg/L]	1.07
TSS [mg/L]	15.67
pH [std units]	7.1
TKN [mg/L]	3.37
Total Ammonia Nitrogen as N [mg/L]	0.78
Nitrate plus Nitrite as N [mg/L]	3.23

Similar to the CAS Alternative 1, digested sludge will be pumped to a new dewatering facility for dewatering before being hauled to a final disposal site. Alternatively, stabilized sludge could be sent to a new lined sludge lagoon for storage during the winter months. During the summer, sludge could be dried using sludge drying beds before being hauled to a final disposal site. For cost estimating purposes, we assumed a new sludge dewatering facility will be incorporated into the new facility.

Treatment Alternative 3 - Membrane Bioreactor (MBR)

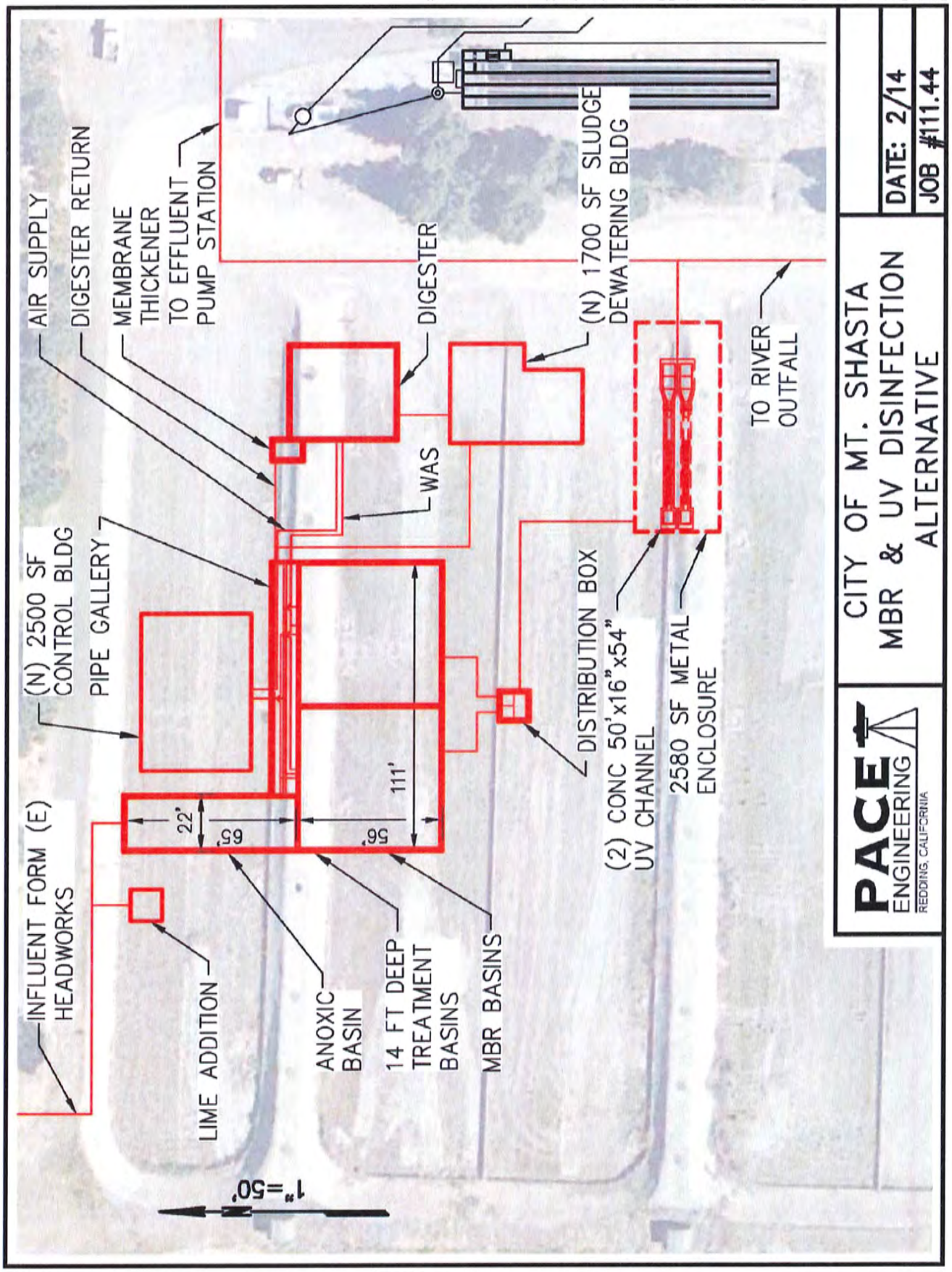
Membrane bioreactor (MBR) wastewater treatment plants are activated sludge plants that utilize membranes for the solids separation step, in lieu of clarifiers and filters. MBR's provide a very high quality effluent for use when, 1) environmental sensitivity and/or discharge permit conditions demand a high degree of treatment, or 2) there will be a high public exposure, such as irrigation of food crops. Neither of these situations applies to Mt. Shasta. However, the high quality effluent could have unforeseen future benefits to the City if certain unregulated constituents become regulated. Although, an MBR would provide very limited benefit for the removal of emerging contaminants (EC), such as pharmaceuticals. Studies suggest ultra-filtration (UF) and/or reverse osmosis (RO) membranes provide effective removal of

many potential EC's.

An MBR activated sludge plant has a smaller footprint than CAS, because clarifiers and filters are not required, which leads to lower infrastructure costs. However, equipment and O&M costs are typically higher, although some MBR facilities have optimized power consumption by fine tuning process controls to show overall O&M costs are in line with CAS. This is considered more the exception than the norm. Because MBR treatment provides such a high quality effluent and overall footprint and infrastructure cost (not including equipment) is less than CAS, it was felt the alternative should be compared against conventional activated sludge. Also, the project Request for Proposals (RFP) required it be considered as one of the treatment options.

For this study, PACE considered flat sheet membranes by Westech and Ovivo and fiber membranes by GE. Sludging, or clogging, are terms used to describe when debris are lodged between membranes. Although all membranes can be subject sludging, hollow fiber membranes are particularly susceptible especially when primary clarifiers are not utilized. The lack if primary clarification may lead to increased clogging and even ragging. Ragging is a term used to describe when particles lodged in the space between membranes, conglomerate to form larger particles. In order to combat potential sludging and ragging, hollow fiber membranes require finer headworks screening and more complex cleaning methods. As a result, it was decided to evaluate the flat plate membranes.

Similar to Alternatives 1 and 2, the new MBR treatment facility would be located in the existing intermittent sand filter beds. The MBR process would consist of improved headworks screening as well as anoxic, post anoxic, MBR and permeate basins, new blowers and disinfection facilities. See Figure 18 and Figure 19. Since MBR processes have limitations accommodating peak flows, lined equalization storage will be required in Lagoon 1. Peak flows up to twice the average dry weather flow are typically all the MBR can handle. Concrete MBR basins will be installed subgrade to help minimize heat loss during the winter months. The MBR



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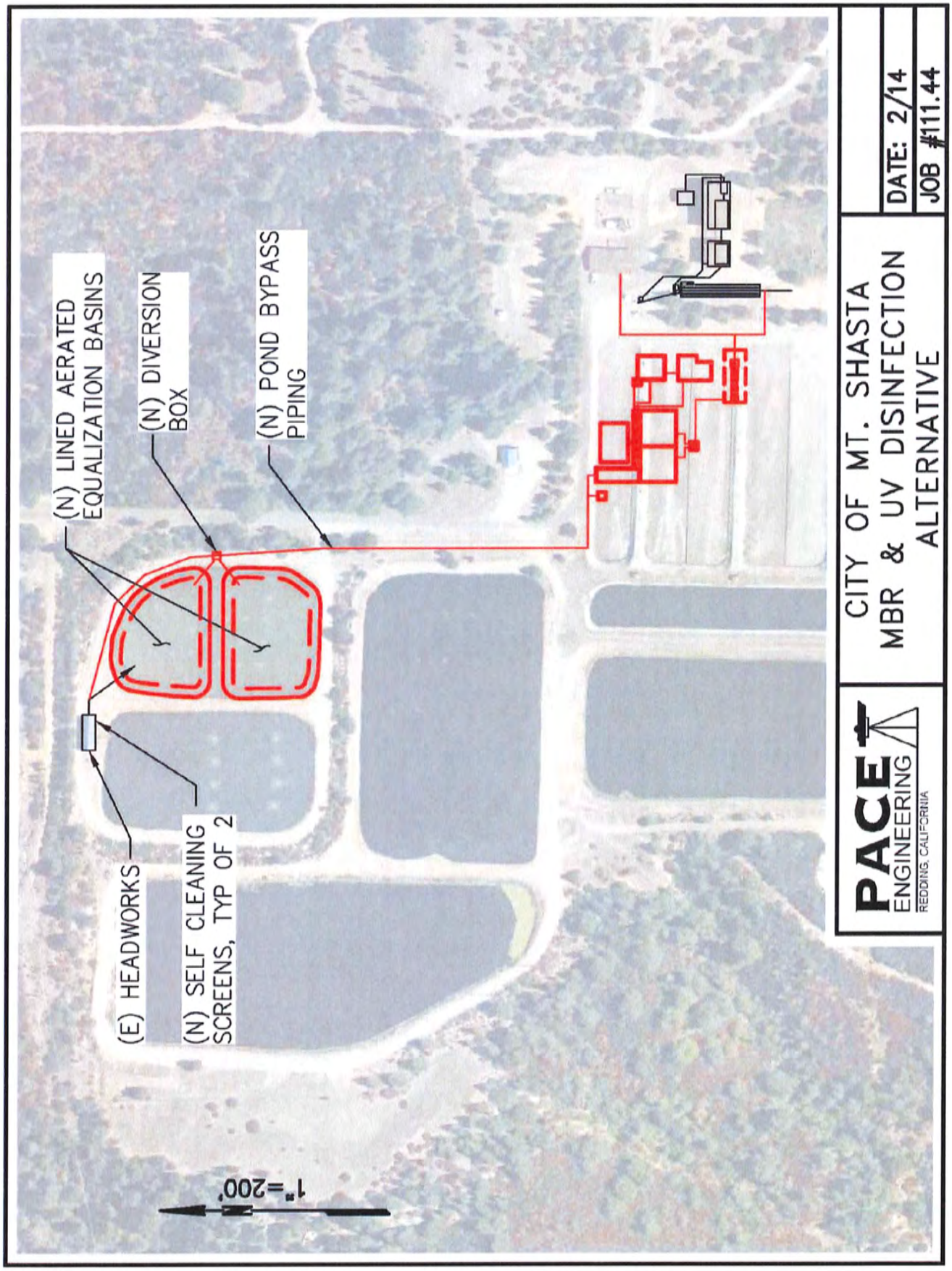
File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Alt-3 MBR.dwg, Layout: FIG 3A

Figure 18 – MBR Preliminary Site Layout



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File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Alt-3 MBR.dwg, Layout: FIG 3B

Figure 19 – MBR Preliminary Site Layout

process allows for effluent total nitrogen concentrations of less than 10 mg/L and effluent turbidity of less than 1 NTU under expected conditions.

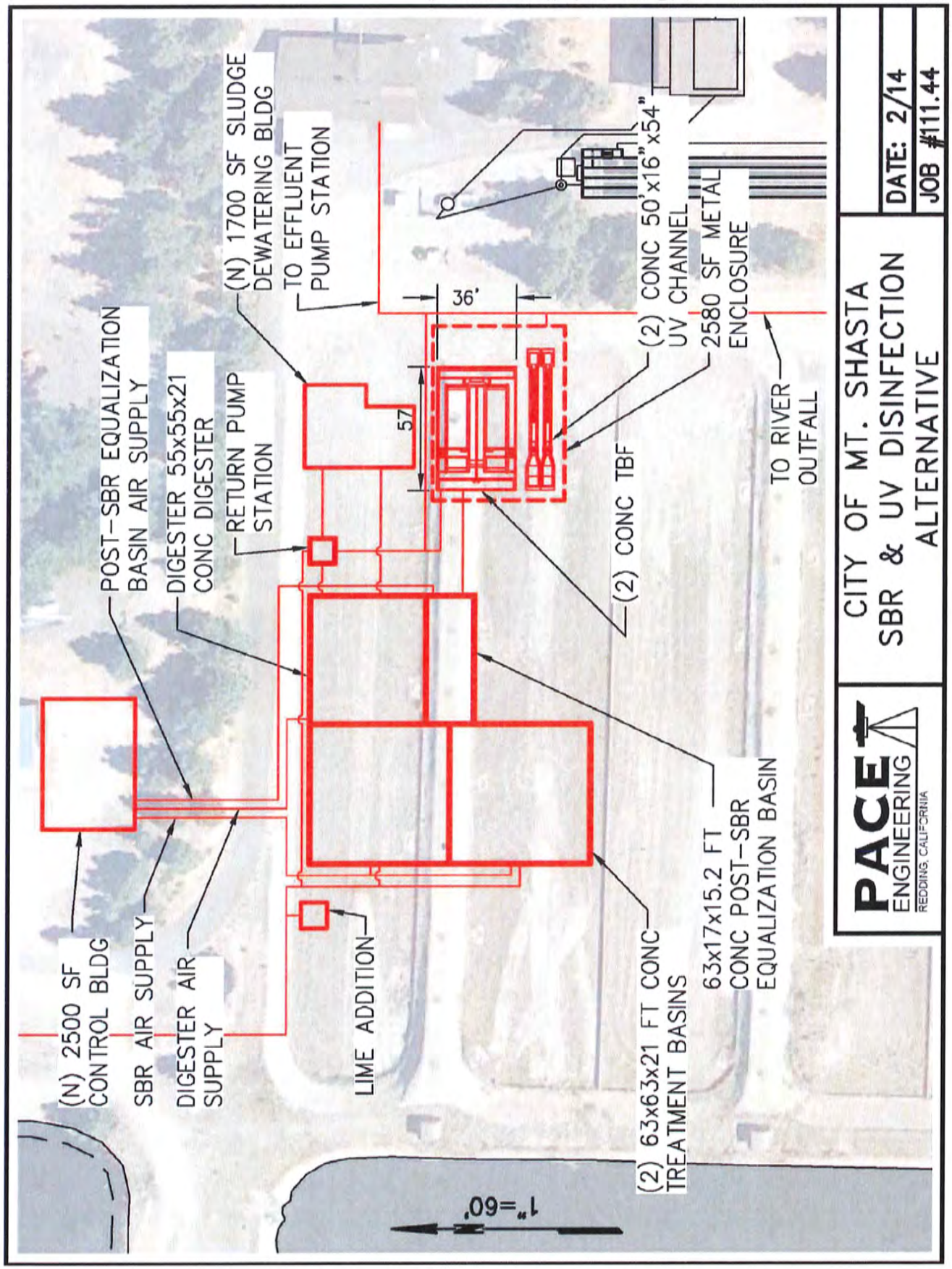
Rectangular, subgrade aerobic digesters would receive WAS for stabilization. A membrane thickener basin would be constructed adjacent to the digester to further concentrate the sludge. Digested sludge would be pumped to a new dewatering facility for dewatering before hauling to a final disposal site. Alternatively, stabilized sludge could be sent to a new lined sludge lagoon for storage during the winter months. During the summer, sludge could be dried using sludge drying beds before being hauled to a final disposal site. For cost estimating purposes, we have assumed a new sludge dewatering facility will be incorporated into the new facility.

Treatment Alternative 4 - Sequencing Batch Reactor (SBR)

The sequencing batch reactor (SBR) is an activated sludge process utilizing one basin to accomplish the following treatment steps: 1) fill, 2) aeration, 3) settling, 4) decant, and 5) idle. In order to accommodate continuous flow, a second basin is required to accept flow while the other basin goes through its treatment cycle. Similar to Alternatives 1 and 2, the SBR process employs pre-anoxic denitrification utilizing the influent BOD (food source) and endogenous respiration to remove nitrate. By the end of the settling and decant step, most of the nitrate is removed from the mixed liquor.

In order to facilitate continuous flow to the downstream filtration and disinfection processes, a small, post-SBR equalization basin would be required. The new facility will be located in the existing intermittent sand filter beds. See Figure 20 and Figure 21. Influent equalization volume will be required to limit the size of the SBR basin. Thus, Lagoon 1 would be lined. The concrete SBR basins will be installed subgrade to help minimize heat loss during the winter months.

Aerobic digesters will receive WAS for stabilization. Rectangular concrete digesters will be installed subgrade to minimize heat loss during the winter months. Digested sludge will be pumped to a new dewatering facility for dewatering before being



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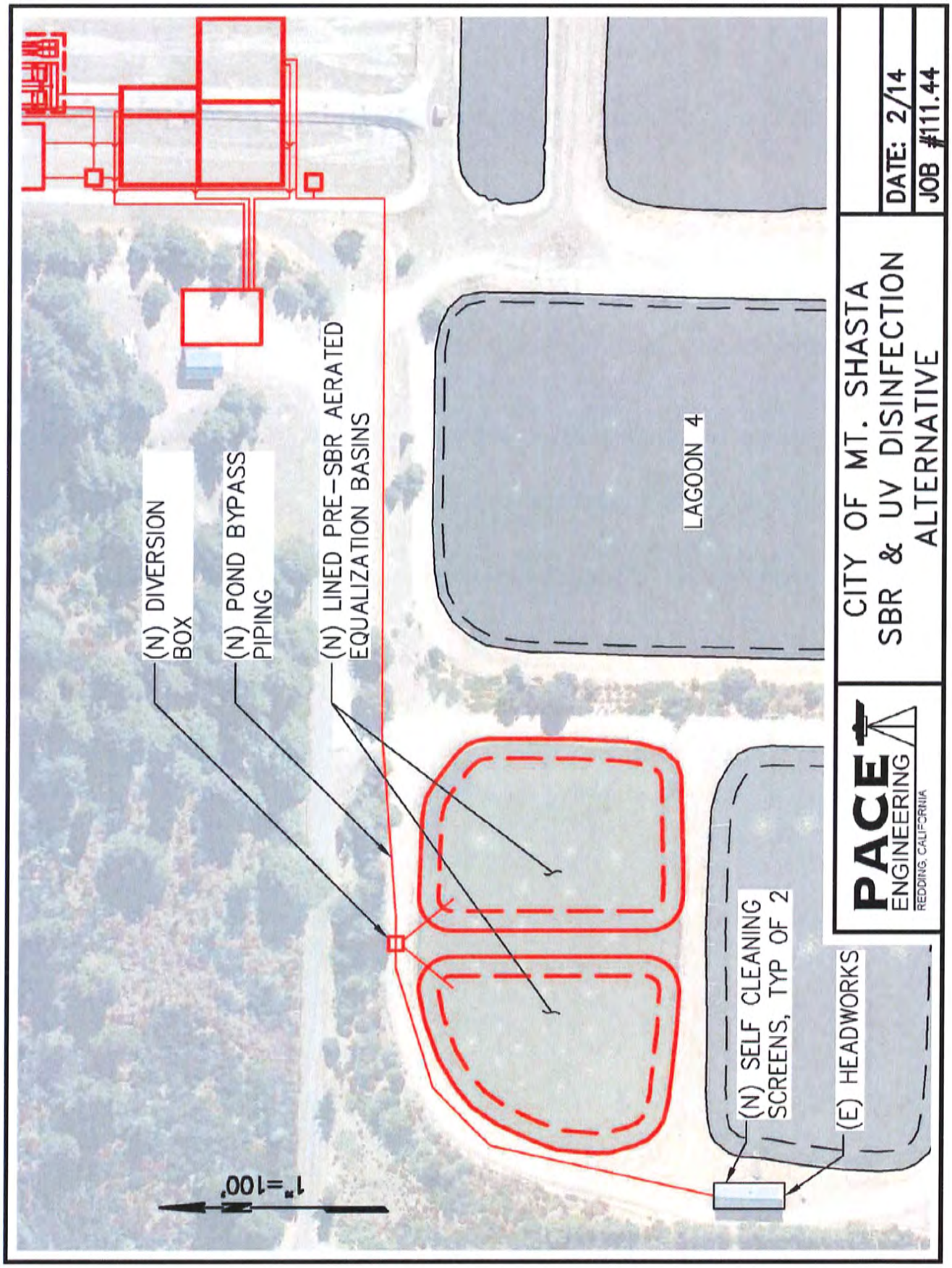
File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Alt-4 SBR.dwg, Layout: FIG 6A

Figure 20 – SBR Preliminary Site Layout



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File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Alt-4 SBR.dwg, Layout: FIG 6B

Figure 21 – SBR Preliminary Site Layout

hauled to a final disposal site. Alternatively, stabilized sludge could be sent to a new lined sludge lagoon for storage during the winter months. During the summer, sludge could be dried using sludge drying beds before being hauled to a final disposal site.

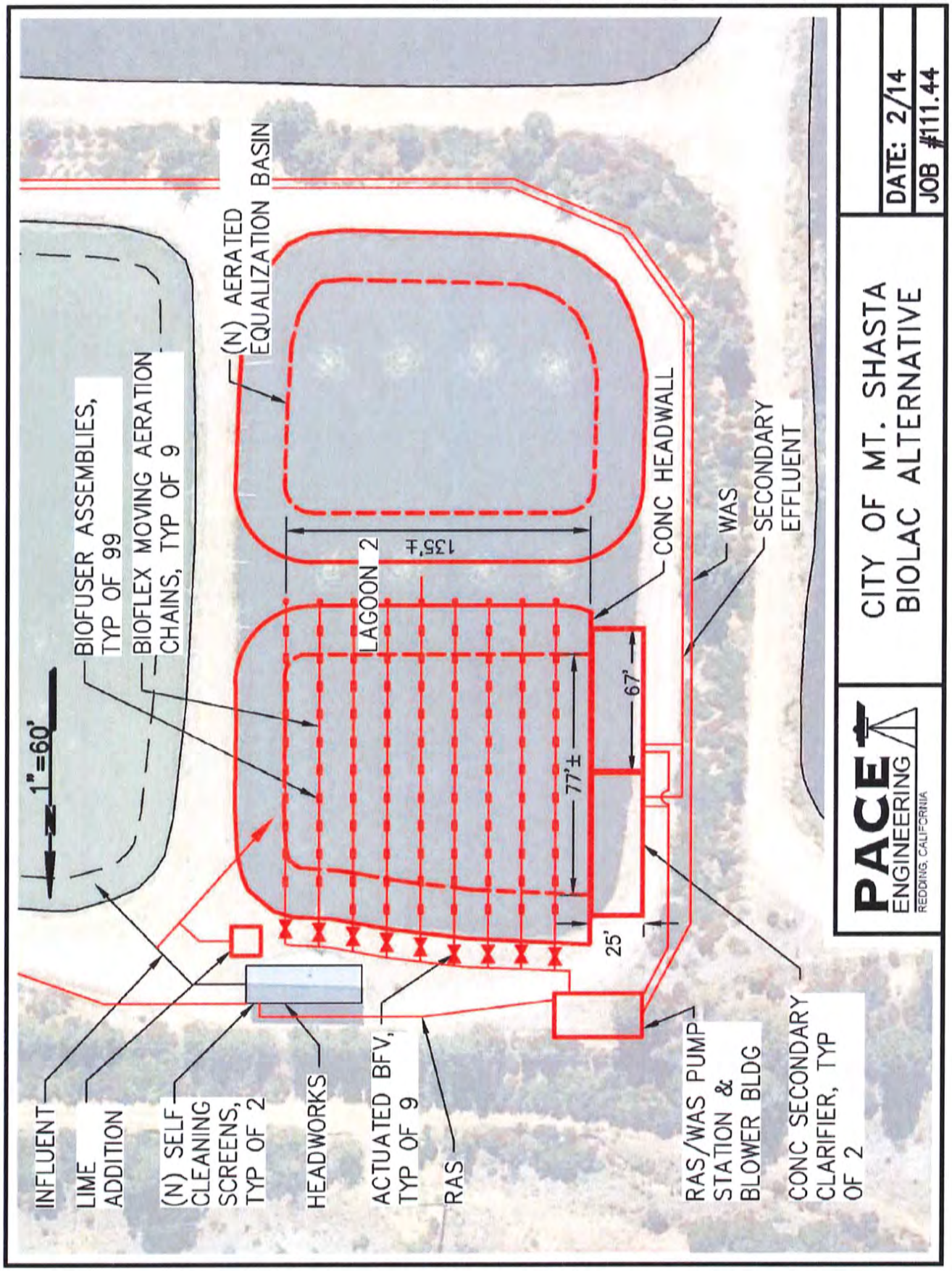
LAGOON ENHANCMENT ALTERNATIVES

Treatment Alternative 5 - Biolac® Activated Sludge

The BioLac® treatment system is essentially an aeration retrofit and clarification system that allows conversion of lagoons to a conventional activated sludge process. The aeration diffusers are supported by chains that are moored across the lagoon and as air is conveyed, the chains sway and provide additional mixing energy into the basin, thereby reducing aeration costs. The BioLac system would be installed in the north half of Lagoon 2 and consist of 99 fine bubble diffusers that hang beneath 9 air supply lines. Each of the air supply headers, creates an aerated nitrifying zone with anaerobic denitrifying zones between them. As wastewater passes from the inlet to the outlet of lagoon 2, multiple nitrification/denitrification cycles will have occurred. One disadvantages of the Biolac® system is the large surface area will subject the wastewater to cold temperatures and cause cooling of the wastewater as evidence by the City's monitoring and sampling efforts. At water temperatures much below about 5°C, nitrogen removal is unpredictable.

Activated sludge is returned to the headworks from new clarifiers and mixed with influent wastewater before conveyance to Lagoon 1. By limiting aeration in the first few rows of existing static tube diffusers, the north portion of Lagoon 1 becomes an anoxic selector, although with limited mixing ability, which will promote denitrification. Two new 65 Ft by 23 Ft rectangular concrete clarifiers would be constructed along the west side of Lagoon 2. Refer to Figure 22 and Figure 23.

The BioLac® treatment process would consist of improved headworks screening, lined earthen aerobic/anaerobic treatment basin, followed by clarification, filtration and disinfection. The City's existing Blower Building would be expanded to house



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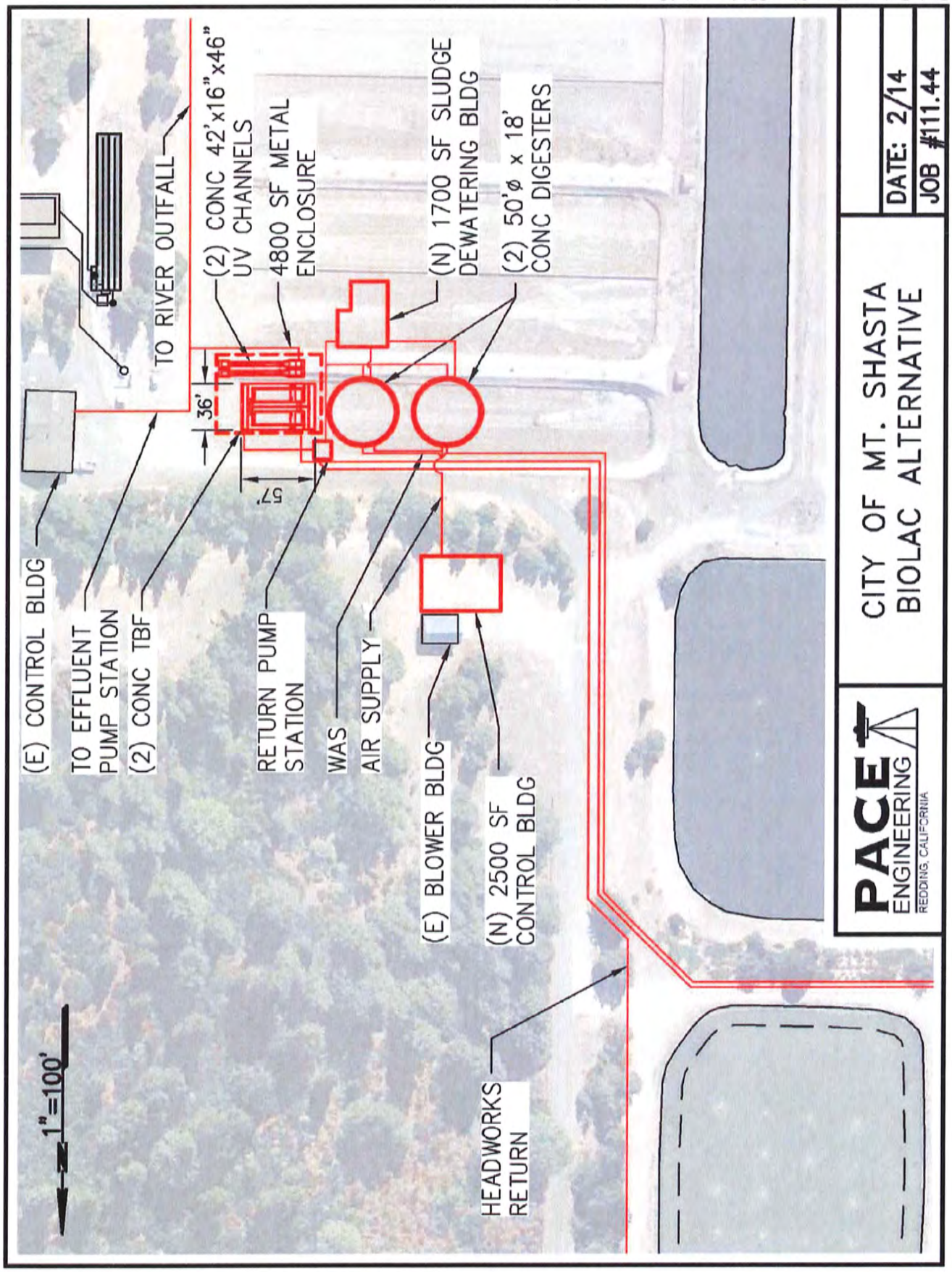
File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Alt-5 Biolac.dwg, Layout: Fig1A

Figure 22 – BioLac® Activated Sludge Preliminary Site Layout



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File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Alt-5 Biolac.dwg, Layout: Fig18

Figure 23 – BioLac® Activated Sludge Preliminary Site Layout

new blowers and controls for providing air for the Biolac® system as well as two new concrete aerobic digesters. The digesters will be used to stabilize waste sludge. The new circular concrete digesters will be installed subgrade to minimize heat loss during the winter months. Digested sludge will be pumped to a new dewatering facility for further thickening before being hauled to a final disposal site.

Alternatively, stabilized sludge could be sent to a new lined sludge lagoon for storage during the winter months. During the summer, sludge could be dried using sludge drying beds before being hauled to a final disposal site. For the cost estimating purposes, we have assumed a new sludge dewatering facility will be incorporated into the new facility.

Treatment Alternative 6 - Bio-Shell Attached Growth Nitrification

Alternatives 1 through 5 are all based on suspended-growth biological treatment processes. The Bio-Shell system is an attached growth (fixed film) process, developed at the University of Utah, which promotes the development of biofilm on a proprietary synthetic media. The biofilm contains the autotrophic bacteria responsible for nitrification. Each Bio-Shell unit consists of several concentric pipes, of decreasing diameter, cut in half longitudinally. These pipes are placed upon one another, small to large, to create a single Bio-Shell. Each Bio-Shell unit is 96" long by 70" wide by 5' tall. Within the annular space between pipe halves is a proprietary synthetic packing material that promotes attached growth, or a biofilm layer. Each Bio-Shells provides a surface area of approximately 10,500 SF for biofilm to grow. The units are secured to individual concrete bases on the lagoon bottom to prevent flotation.

Four hanging curtains will be placed within Lagoon 5 to minimize hydraulic short circuiting past the BioShells. An aeration system will deliver a relatively small amount of air to each Bio-Shell in order to develop/sustain the biofilm microbiology. As with all attached growth biological treatment systems, solids accumulate in the media over time as the biofilm sloughs and regenerates. Since the organic loading at this stage of the lagoon treatment system is relatively low, it is not expected the

solids build-up will be a problem as evidenced at other installations around the country. Data from other cold weather installations suggest the Bio-Shells provide effective nitrification down to temperatures near 2°C.

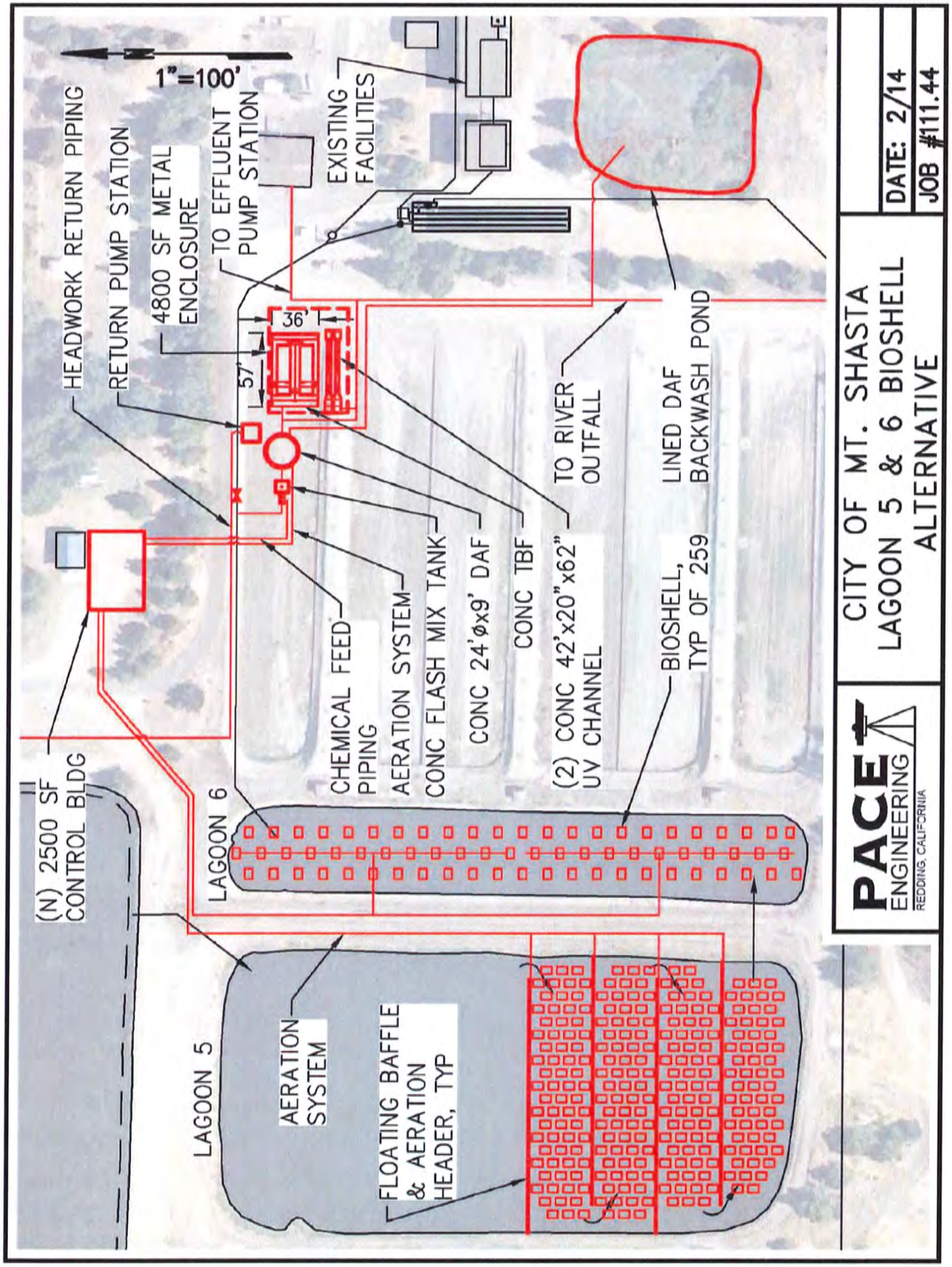
For this alternative, the existing lagoon system would remain in service. Approximately 488 Bio-Shells would be placed in Lagoons 5 and 6 in order to nitrify remaining ammonia before filtration and disinfection.

See Figure 24 and Figure 25. In order to promote the autotrophic (nitrifying) bacteria in the biofilm, it is necessary that the wastewater have relatively low BOD, thus, Lagoons 5 and 6 were chosen as the best location for the Bio-Shells.

Since the existing lagoon treatment system will remain, it will be necessary to provide dissolved air flotation (DAF) clarifiers to remove algae and non-settleable solids generated by the lagoons. The City's existing DAF process has limited capacity and is inoperable during freezing temperatures due to the exposure of small pipes and equipment. Therefore, it is proposed that two new DAF clarifiers be added utilizing sub-grade circular basins to insulate piping and equipment from freezing temperatures. DAF sludge would be conveyed to City's existing sludge lagoon which requires removing existing sludge and installing a synthetic liner.

Alternative 6 would consist of improved headworks screening, Bio-Shell attached growth process, DAF clarifiers, filtration and disinfection.

A significant limitation for the Bio-Shell process is it is primarily a nitrification process. Even though the biofilm will contain some heterotrophic (denitrifying) bacteria, it will form along the media/biofilm interface as the biofilm thickens and oxygen penetration is reduced. Also, the low wastewater BOD at the end of the lagoon treatment system does not provide an adequate carbon source for denitrification nor is it adequately available to the denitrifying bacteria at the media/biofilm interface. Addition of a supplemental carbon source is not practical.



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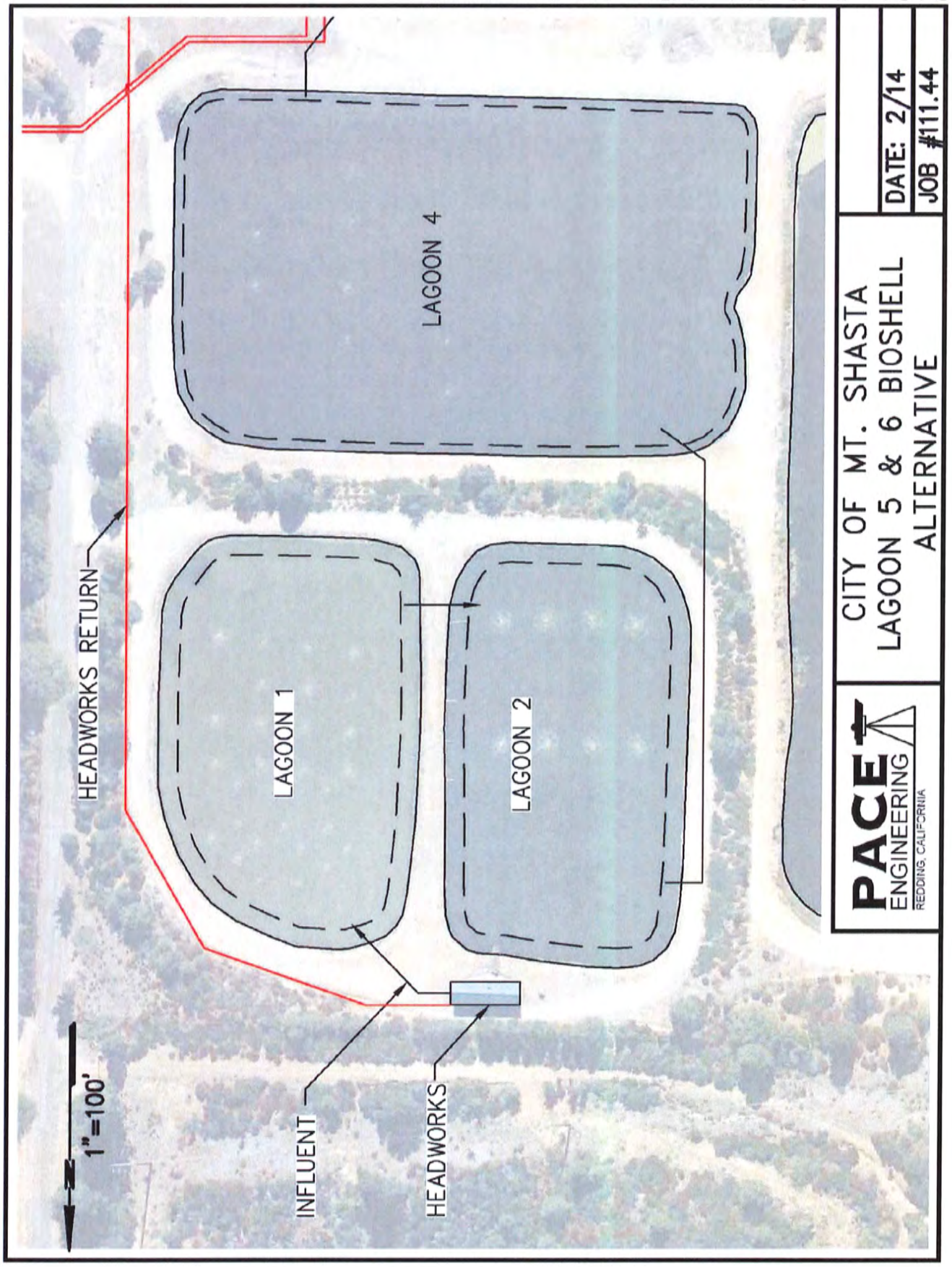
File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Alt-6 BioShell.dwg, Layout: Fig4B

Figure 24 – BioShell Attached Growth Preliminary Site Layout



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File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Alt-6 BioShell.dwg, Layout: Fig4A

Figure 25 – BioShell Attached Growth Preliminary Site Layout

The University of Utah has experimented with aeration sequencing to promote denitrification within the Bio-Shells but preliminary data suggests nitrification is reduced but there is very little overall nitrogen removal. However, since we are trying to nitrify relatively low levels of ammonia at the downstream end of the treatment system, the Bio-Shells may nitrify all remaining ammonia to a low enough levels of nitrate to still comply with NPDES effluent limits for nitrate. If the Bio-Shell alternative is to be considered further, it is recommended the process be pilot-tested for an extended period to cover varying climatological and influent flow conditions.

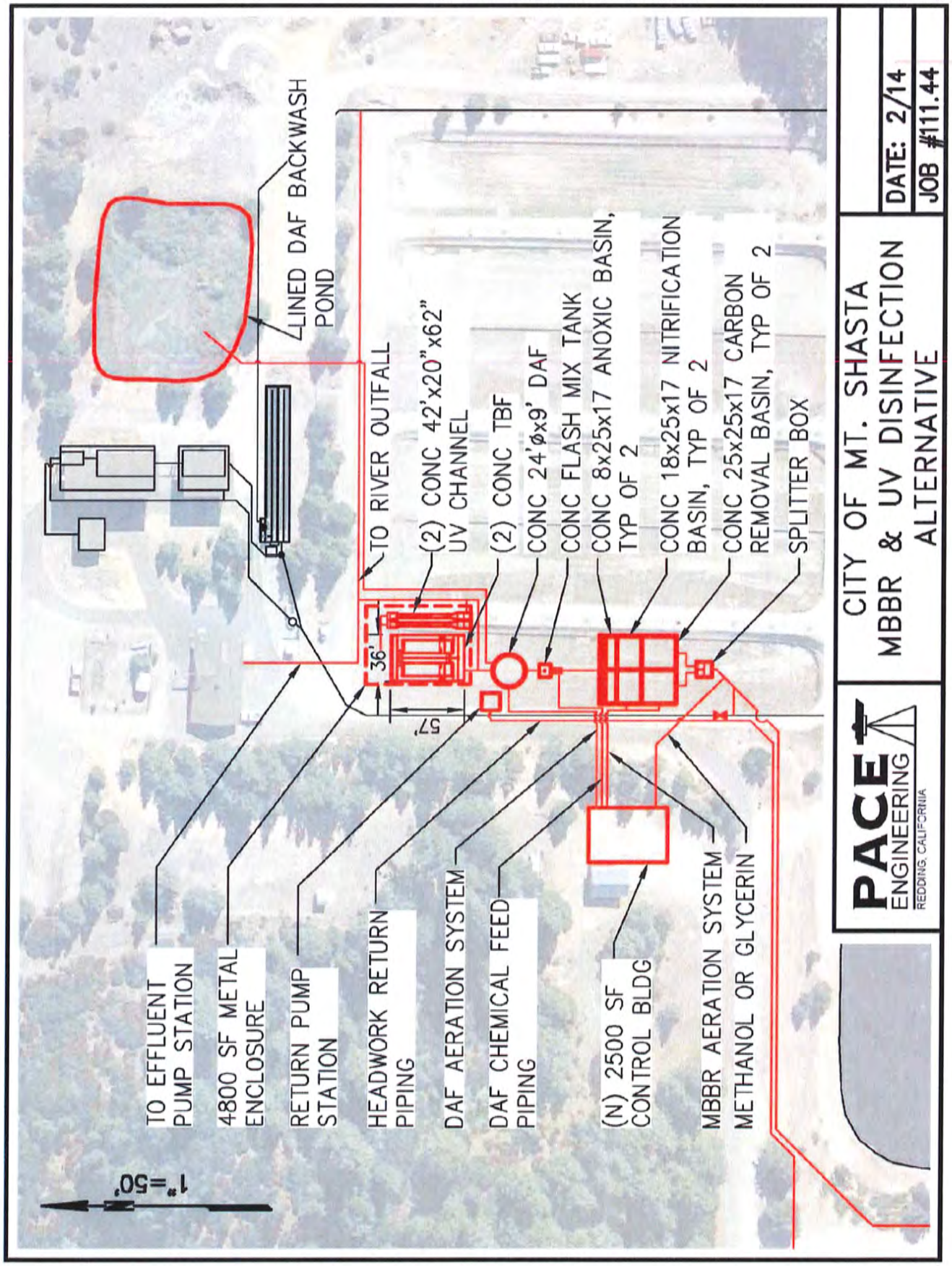
Treatment Alternative 7 - Moving Bed Bioreactor (MBBR) Nitrification/Denitrification

The moving bed bioreactor (MBBR) utilizes both suspended and attached growth biological treatment consisting of a concrete reactor tank, filled with polyethylene packing media. The media has large protected surface areas that allow for attached growth, or biofilm, to form. A nitrification (aerated) and denitrifcation (un-aerated) MBBR are proposed for this alternative. Air is injected into the bottom of the nitrification MBBR to support aerobic bacteria. An un-aerated post-anoxic reactor will promote the growth of denitrifying bacteria.

Similar to alternative 6, it will be necessary to incorporate DAF clarifiers in order to remove algae and unsettleable solids from the lagoons, prior to the filtration and disinfection. Refer to Figure 26 and Figure 27.

This alternative will consist of improved headworks, existing lagoons, new (nitrification and denitrification MBBR reactors and new DAF. The MBBR's would be installed in a concrete basin downstream of the lagoons but prior to filtration.

Clarification will be provided by new DAF process that will replace the existing undersized DAF. The new circular DAF will be constructed of concrete and installed subgrade to minimize heat loss and eliminate pipe freezing during the winter months. DAF sludge will be purveyed to the sludge lagoon for future drying and offsite disposal.



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File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Alt-7 MBBR.dwg, Layout: FIGURE 5A

Figure 26 - Moving Bed Bioreactor Preliminary Site Layout

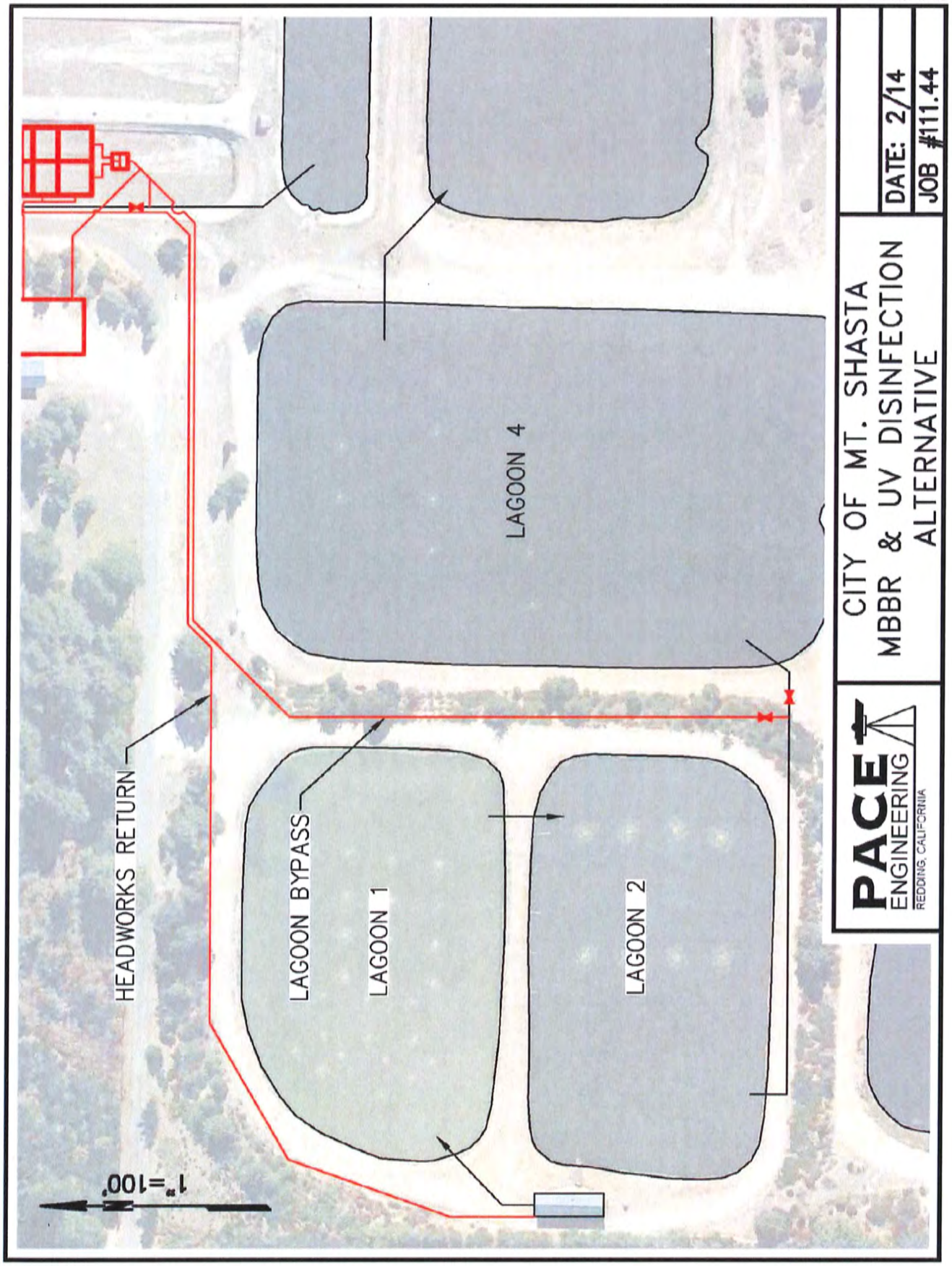

Figure 27 – Moving Bed Bioreactor Preliminary Site Layout

C. DESCRIPTION – DISINFECTION OPTIONS

The type of disinfection utilized by the City's WWTP depends on the future effluent disposal practices and associated discharge permit limitations, as well as safety concerns, cost considerations and disinfection effectiveness. Currently, the City utilizes gaseous chlorine for disinfection. Chlorine has been the historic disinfection method of choice for most WWTPs because of its low cost and effective disinfection capabilities. However, the introduction of disinfectant byproduct limitations in discharge permits and increasing safety concerns for both transportation and operations, makes alternative disinfection methods more feasible. The following disinfection options have been considered for use at the WWTP.

Disinfection Option 1 - Chlorine Gas

Disinfection Option 2 - Sodium Hypochlorite

Disinfection Option 3 - Ozone

Disinfection Option 4 - Ultraviolet Disinfection

Disinfection 1 - Chlorine Gas

The City currently utilizes a gas chlorine system. As a result, City staff are familiar with its operations and would be able to efficiently switch to a new chlorine system in any alternative treatment process with relative ease. Gas systems remain an effective means of disinfection and is a significantly cheaper disinfection option, both from a capital and O&M standpoint. However, the use of gas chlorine is a safety concern to the City. In addition, the use of gas chlorine can form disinfection byproducts such as trihalomethanes (THMs) and haloamethanes (HAAs). The City's new NPDES Permit contains stringent effluent limits for dichlorobromomethane (DCBM) which is a disinfection byproduct resulting from use of chlorine disinfection. These regulated compounds will remain a concern with any use of oxidants, such as

chlorine gas, for disinfection. Because the disinfection process takes place just before discharging effluent from the WWTP, there is little the plant can do to prevent discharge violations once disinfection byproducts have been formed without adding upstream and/or downstream treatment processes.

In order to limit the formation of disinfection byproducts, eliminate detrimental effects of chlorine on the environment and comply with the NPDES permit, residual chlorine must be removed before it is discharge. The City currently uses sulfur dioxide gas to dechlorinate its effluent.

The City's existing disinfection facilities may need to be upsized based on the selected treatment alternative and if equalization storage is required. Utilizing equalization storage, in effect, decreases the size of flows that must be designed for. If a treatment alternative not utilizing equalization storage is selected and chlorine gas is used for disinfection, the existing chlorine facility will need to be improved to increase its capacity. However, the City may be able to utilize its newly installed residual analyzer equipment.

Disinfection 2 - Sodium Hypochlorite

Sodium hypochlorite, commonly known as bleach, is frequently used in wastewater treatment plants. Many of the safety concerns related to the transport and storage of gaseous chlorine are eliminated by using sodium hypochlorite. Although sodium hypochlorite is more expensive than gaseous chlorine, there are significant savings in both capital and O&M costs compared to other disinfection options. As is the case with gaseous chlorine, the use of sodium hypochlorite can form disinfection byproducts such as trihalomethanes (THMs) and haloamethanes (HAAs).

The City's existing chlorine injection equipment would need to be replaced with storage tanks with secondary containment and metering pumps if sodium hypochlorite is to be used for disinfection. However, the City may be able to utilize the existing chlorine contact basin and residual analyzer equipment.

Disinfection 3 - Ozone

Ozone is an unstable gas that is an extremely reactive oxidant. It is more effective than chlorine in inactivating most viruses, spores, cysts and oocysts. Ozone is quickly converted to water and oxygen when in aqueous solution. As a result, no disinfectant neutralization is required (e.g. dechlorination). The short life of ozone requires that it is generated onsite. There are several methods used to generate ozone which include electrolysis, photochemical reaction, and radiochemical reaction by electrical discharge. Although the efficiency of ozone generators has improved in recent years, they still requires a considerable amount of energy. Onsite generation of ozone has high capital and O&M cost.

If future discharge requirements include pharmaceuticals, ozone can be combined with the hydrogen peroxide to destroy some regulated compounds. Although ozone does not form disinfection byproducts, such as THMs and HAAs, ozone does have the potential to form aldehydes, various acids, aldo- and ketoacids. In addition, if bromide is present, certain brominated byproducts can be formed.

In order to convert to ozone disinfection, City's existing chlorine injection equipment would be abandoned. Using ozone would require the construction of a new ozone contact reactor. Deep concrete basins are often used as ozone reactors to increase transfer efficiency of ozone into the treated secondary effluent. However, pipeline contactors have also been successfully used. Ozone is toxic gas. As a result, off-gas from the contactor would need to be treated by converting it to oxygen and discharging to the atmosphere.

Disinfection 4 - Ultraviolet (UV) Radiation

Ultraviolet (UV) light is a designation given to the spectrum of light with wavelengths between 10^{-7} meters and 10^{-3} meters. The UV spectrum, $10^{-6.595}$ meters (254 nm) in particular, has germicidal properties. Exposure of microorganisms to UV light, either prevents the replication of DNA and the ability of cells to reproduce, or it causes cell death. As a result, UV light is an effective disinfectant.

There are several different lamps that are used to produce UV light which include 1) low-pressure low-intensity, 2) low-pressure high-intensity and 3) medium-pressure high-intensity. Although there are specific differences between the characteristics of these lamps and the light they produce, they operate under the same principles. Similar to chlorine, a certain dose is required to obtain a required kill or inactivation. While chlorine disinfection is a function of concentration and time, UV disinfection is a function of light intensity and time. A key variable in determining the required UV intensity to achieve disinfection is the amount of UV light that is absorbed by dissolved material in the water. Ultraviolet transmittance (UVT) is a measurement used to quantify this. This measurement is analogous to the clarity of the water for the UV spectrum. It is worth noting that water samples that appear clear in the visible light spectrum, may not be clear in the UV spectrum. Waters with low UVT values require significantly more UV infrastructure and increased energy costs for disinfection.

The City has performed UVT monitoring to determine if their effluent has suitable characteristics for UV disinfection. The existing system produces effluent with an average of 75% UVT and a minimum of 52% UVT. The 75% UVT is considered to be very good transmittance for wastewater, but cannot be relied upon for design as it is inconsistent. Therefore, two UV options were evaluated, namely UV disinfection with the lagoons (55% UVT) and UV disinfection without lagoons (65% UVT). Ultraviolet transmittance is dependent on the treatment process and is expected to change with any of the treatment alternatives discussed herein. It is anticipated that any of the treatment alternatives will maintain or improve the level and consistency of the effluent wastewater's UVT.

Because UV disinfection is a physical process, as opposed to a chemical process (e.g. chlorine, ozone, etc.), there is no need for disinfectant neutralization. As a result, there are no disinfection byproducts formed with UV disinfection. In addition, no hazardous or toxic chemicals are required for normal operations. Nevertheless, there are significant infrastructure and energy cost requirements, especially for

wastewater with low UVT.

Conversion to UV disinfection would require the City's existing chlorine disinfection equipment to be abandoned. Two parallel concrete UV channels would be required so that one channel can be taken out of service for routine maintenance and algae removal[2]. These channels will need to be covered to limit exposure to sunlight and algae growth. In addition, the effluent point of NPDES permit compliance will need to be relocated to just downstream of the final UV lamps.

As an option to the open-channel UV approach, a closed-vessel UV configuration may be considered during preliminary design of the facilities. The closed-vessel UV has the advantage of eliminating the impacts of sunlight and associated algae growth. However, the closed-vessel UV lacks the automatic chemical cleaning step offered with the open-channel system. For waters with high hardness, this can cause lamp fouling and require periodic manual chemical cleaning.

Table 13 presents a summary of capital and O&M costs, as well as 20-year present worth of the four potential disinfection options.

Even though the chlorine disinfection options are not considered viable due to the potential to form regulated disinfection byproducts, a decision matrix was utilized to evaluate disinfection options against one another. The decision matrix assigns weight factors to various monetary and non-monetary evaluation criteria, see Table 14.

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[2] UV channels will have algae growth in areas outside the UV treatment zones because of the lack of residual disinfectant in the wastewater. Channels require regular hose downs to prevent algae from sloughing off and causing discharge violations.

Table 13: Disinfection Options Capital and O&M Costs

	Chlorine Gas [1]	Sodium Hypochlorite[5]	Ozone	UV (No Lagoons)	UV (W/ Lagoons
Capital Cost [2]	$100,000	$830,000	$2,115,000	$1,382,000	$1,823,000
Annual O&M Cost [3]	$5,000	$11,700	$54,200	$16,800	$41,800
Present Worth of Capital and O&M [4]	$167,952	$989,007	$2,851,596	$1,610,317	$2,391,076

NOTES:

1. Assumes minor improvements to existing gas system, such as rotameter replacements, controls modifications, etc.
2. Includes construction contingency at 20% and indirect/engineering costs at 25%.
3. Electrical power cost assumed to be $0.11/KW-HR which matches three months of City power bills during high useage months in 2013.
4. Present worth of O&M costs based on 20 years at 4% discount rate.
5. Sodium Hyperchlorite cost based on $1.20/gal per City of Yreka and City of Mt. Shasta current 32 Lb per day average chlorine use.
6. The capitol cost and O&M ranks were adjusted by the factors to the right of their respective rows to force the highest ranked option to be equal to 10. The remaining options were also adjusted by the same factor and rounded to the nearest whole number when entered into the decision matrix to the left.

Table 14: Disinfection Decision Matrix

No.	Criteria	Weight Factors	Disinfection Alternatives				
			Chlorine Gas	Sodium Hypochlorite	Ozone	UV (No Lagoons)	UV (W/ Lagoons)
1	Project Costs	20	10	6	1	3	2
2	O&M Costs	20	10	8	1	8	3
3	Likelihood to generate disinfection byproducts	15	5	5	6	10	10
4	Ability to Adapt/deal with potential Future Discharge Requirements, i.e. Pharmaceuticals	10	5	5	10	8	8
5	Lowest Potential Regulatory Burden, i.e. Least risk for disinfectant to cause a discharge violation	15	5	5	8	10	10
6	Security & Safety to Workers/Public	20	1	4	6	10	10
	Weighted Totals:	**100**	**62%**	**56%**	**47%**	**80%**	**68%**

Notes:

1= Least Favorable

10= Most Favorable

* Assigned criteria ranking could eliminate an alternative from future consideration

These criteria and weights help determine the most suitable option based on the unique values of the City. The evaluation criteria and their respective weights were determine by City staff, the Ad Hoc Council and input from PACE.

Based on the disinfection decision matrix, UV disinfection is the preferred disinfection method and will be utilized in all of the treatment alternatives as a standard for equal comparison. Treatment alternatives utilizing the existing lagoons require the more robust UV system to compensate for lower UVT values.

D. DESIGN CRITERIA

Design criteria for the described treatment alternatives are presented in the technical memorandum titled, "Preliminary Design Criteria Memorandum," contained in Appendix F. Design criteria pertaining to construction of recommended infrastructure will be based City of Redding design and development standards, and modified per City of Mt. Shasta requirements.

E. MAP

Refer to Figure 1 for a map of the City of Mt. Shasta service area. Figures 6 and 7 show the City's existing WWTP and disposal areas, and golf course irrigation system; respectively. Figure 8 and Figure 9 show potential effluent disposal sites and storage facilities at the WWTP site.

F. ENVIRONMENTAL IMPACTS

The proposed treatment alternatives do not appear to have any lasting, significant impact on land resources, historic sites, wetlands, flood plain, endangered species, or critical habitat. WWTP improvements will be installed within the existing developed site. However, some impacts are expected at the various existing and new disposal sites. These impacts and a description of the various mitigation measures to minimize their effect are discussed below.

The City has an agreement with the Mt. Shasta Resort to supply Title 22 compliant

water for irrigation of their golf course. This water is treated to a higher level than disinfected secondary 23 recycled water. The Mt. Shasta Resort is regulated by Water Recycling Requirements Order No. 5-01-083. In accordance with this order, the Resort can only apply recycled water at agronomic rates in a manner that meets the requirements for a Restricted Access golf course. As a result, no water should leave the golf course site and no environmental impacts are anticipated for the continued use of this existing discharge point.

The City has a Special Use Permit (SUP) with Forest Service to operate the leach field disposal site. As part of the original permit, the City had to develop a monitoring program to provide reasonable protection to all parties involved with, or potentially affected by, the waste discharge facility. This monitoring program was developed and reviewed by the City, CRWQCB and the Forest Service.

The current use of the leach field has been within the City's SUP and NPDES permit requirements. Limited groundwater monitoring data suggests nitrate levels may increase with increased effluent volume at the leach field disposal site. As discussed earlier, a groundwater monitoring network report is required by the current NPDES permit to ensure there is one or more background monitoring wells and a sufficient number of designated monitoring wells down-gradient of the leach field to monitor the impacts of the leach field on groundwater. Refer to Appendix E for results of the Leach Field Design Investigation. The Groundwater Monitoring Well Network Technical Report will be completed by Fall 2014. If the new monitoring sites indicate increased pollutant concentrations in the groundwater, the permit will likely be reopened and modified to ensure that environmental impacts to the groundwater are within acceptable limits as determined by the CVRWQCB.

If a new wetland or pasture irrigation reclamation site is utilized for treated wastewater disposal, certain protective measures will be required to insure environmental and public protection. Similar to the existing golf course reclamation site, wastewater would be treated to Title 22 standards. This water is treated to a higher level than disinfected secondary 23 recycled water. Wastewater sent to a new reclamation site would be

applied at agronomic rates to minimize percolation below the root zone (i.e., deep percolation). This would ensure that water applied to the land would remain on site. To further ensure the protection of any nearby surface waters, a berm system would be constructed to direct any site runoff to a tail water return pump station(s), which would return runoff to the WWTP. The irrigation area would utilize a 50-Ft buffer zone around any watercourses and a 100-Ft buffer zone between any spring, domestic water source, or irrigation well to further ensure environmental and public protection. The site would be fenced and signs placed to prevent access and inform the public of any hazards.

The overall project design and construction will need to take into account specific mitigation measures, so as not to cause any long-term environmental impacts. In addition, the permits for this project will likely require similar mitigation measures, which present no major hurdles as long as they are included in the construction contract documents and are monitored during the active phases of the project. A preliminary mitigation monitoring checklist is included in Table 1. The City will verify that these measures are included in the construction contract and that they are adhered to both during and after construction of the project, where applicable. CEQA and, potentially, NEPA environmental studies will need to be performed on the recommended project prior to implementation.

G. LAND REQUIREMENTS

Wastewater treatment improvements will take place within existing lands owned by the City of Mt. Shasta and will not require the acquisition of additional land.

Any leach field expansion will take place within the existing Special Use Permit Boundary and will not require acquisition of addition land.

A new wetland or pastureland reclamation site will require the City to acquire land outright, or enter into long-term agreements with multiple landowners. A reclamation site must have sufficient undeveloped area to be a feasible site. In addition, the site's topographic features must limit site runoff with minimal site improvements, i.e. grading, levelling, etc. Large areas of undeveloped land within feasible distance to the WWTP

are limited. As shown on Figure 8, development of 92 acres of reclamation area would require acquisition of 148 acres of land owned by 6 property owners and trusts.

H. POTENTIAL CONSTRUCTION PROBLEMS

Because the construction efforts for WWTP Alternatives 1 through 5 will take place within and around functioning facilities, care must be taken to coordinate construction efforts while maintaining functional use of the existing treatment facilities. The majority of the proposed facilities are located within the abandoned intermittent sand filters. No major construction problems related to the coordination of the existing intermittent sand filters are anticipated. Timing of connections to the existing influent and effluent WWTP facility pipelines must be performed without disturbing the existing treatment process. These connections are not considered to be major construction hurdles and can be managed by coordinating with the City WWTP operations staff and limited bypass pumping. All lagoon replacement alternatives require excavations up to 20 feet deep in order to construct various treatment basins. Contractors will need to manage groundwater and provide adequate shoring to protect workers during construction.

Alternative 6 will require that the existing lagoons be dredged and lined. This will require sequential removal individual lagoons from the treatment train. Care must be taken to carefully coordinate these efforts with City staff. Consideration for seasonal flow increases will need to be made when determining when lagoons can be taken offline to minimize impacts to hydraulic retention time. Lagoon intertie modifications and substantial bypass pumping are anticipated in these efforts. In addition, care must be taken when placing newly lined lagoons back online. This is especially true for primary Lagoons 1 and 2. The removal of the biological sludge at ponds bottom will slow the treatment process until the biology is replenished. In order to decrease the biological growth period and minimize offensive odors, a portion of the sludge from the unlined

lagoon should be relocated to a newly lined lagoon as an inoculum or seed[3]. Undesirable odors are anticipated during the first full spring and summer of the lagoon operations.

Similar to Alternative 6, Alternative 7 will require that primary Lagoons 1 and 2 be lined and the same considerations and planning will be required.

I. SUSTAINABILITY CONSIDERATIONS

All of the proposed alternatives are based on continued conveyance of treated effluent to the Mt. Shasta Resort and Golf Club for use as golf course irrigation. All alternatives recommend improvements that will allow the City to reliably convey treated effluent in order to eliminate or minimize use of fresh water for irrigation.

Power consumption for all alternatives was determined as part of the operations and maintenance costs. The monthly sewer utility rate for each alternative was estimated and used as one of the criteria in the alternative selection process.

In order to offset estimated power consumption, the size and capital cost of constructing a photovoltaic (PV) solar field was determined. The calculation was performed for both a 50% and 100% solar field reliance. See Table 15. The payback period for the alternatives is 16 years, which approaches the expected life of a PV system. As a result, solar energy was not considered to be viable as a primary or dual power source. If a grant can be secured for a significant portion of the capital cost of solar field, or if power rates are expected to increase, this alternative power source may prove viable. It's worth noting that the payback period was based on current average power rate of $0.11 per kW-Hr. For every $0.01 the cost of power increases, the payback period for

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[3] During this startup time, the lagoon should be filled with fresh water in the spring time to its minimum depth. This will allow for optimal conditions for establish a healthy lagoon biomass while limiting odors. Failure to properly startup the lagoons could take years to correct and the lagoons might never perform as well as one that was properly started.

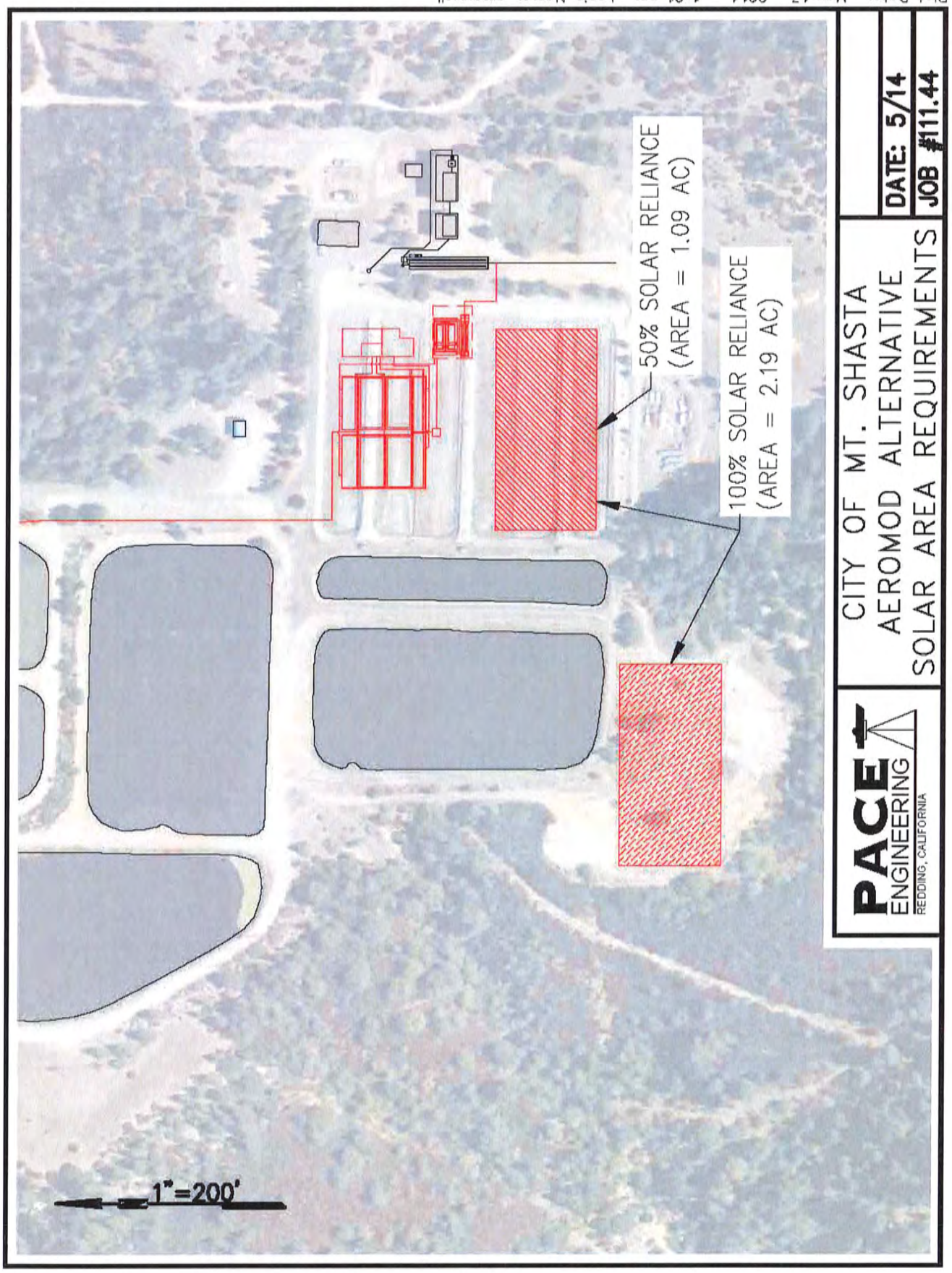
solar decreases by approximately 1 year. Figure 28 shows the solar field footprint required for both 50% and 100% solar reliance for Alternative 2 (Aero-Mod).

Where applicable, the size of facilities and equipment were minimized by supplying emergency retention basins. These basins allow for the proposed facilities to be sized for flows closer to those normally seen at the WWTP. Influent flows in excess of the plant's capacity are temporarily held in retention and slowly metered back into influent waste stream during lower flows.

Table 15: Solar Power Project Cost Estimate

	WWTP Alternatives	Annual Power Cost*	50% Solar Reliance		100% Solar Reliance		Payback Period (Years)
			Required Field Area** (Acres)	Capitol Cost	Required Field Area** (Acres)	Capitol Cost	
1	Conventional Activated Sludge	$265,204	2.16	$2,061,000	4.33	$4,122,000	16
2	Aero-Mod Activated Sludge	$134,100	1.09	$1,042,000	2.19	$2,084,000	16
3	Membrane Bioreactor	$189,974	1.55	$1,477,000	3.10	$2,953,000	16
4	Sequencing Batch Reactor	$139,254	1.14	$1,083,000	2.27	$2,165,000	16
5	BioLac	$205,846	1.68	$1,600,000	3.36	$3,199,000	16
6	BioShells	$126,651	1.03	$985,000	2.07	$1,969,000	16
7	Moving Bed Bioreactor	$134,706	1.10	$1,047,000	2.20	$2,094,000	16

Note:
*Annual power cost based on $0.11/kWhr
**Based on 250W solar panel per 20 square feet, 4 hrs of direct sunlight at 100% output and 5 hours of partial sunlight at 50% output. Area accounts for 8 ft X 200 ft panel array access and path



Plot Date: May 13, 2014 - 1:21 pm Login Name: gmaxwell
File Name: M:\Land Projects\0111.44 WW Trtmnt & Dspsl Study\dwg\Solar.dwg, Layout: FIGXX

Figure 28 – Solar Field Footprint

K. COST ESTIMATES

Detailed construction and project cost estimates, along with predicted operations and maintenance costs were prepared for all alternatives. A summary of these costs are shown in Table 16 below. Complete project cost estimates for Alternatives 1 through 7 are shown in Appendix G.

Table 16: Summary of Total Project and O&M Costs

Project Description	Construction Cost (June 2014)	(2)Non-Construction Cost	Total Project Cost (June 2014)	(3)New WWTP Annual O&M Cost
WWTP Alternatives				
Conventional Activated Sludge Plant	$13,785,000	$6,203,000	$20,000,000	$903,358
Aero-Mod Activated Sludge Plant	$11,244,000	$5,060,000	$16,300,000	$774,238
Membrane Bioreactor Plant	$10,035,000	$4,516,000	$14,600,000	$834,959
Sequencing Batch Reactor Plant	$9,204,000	$4,142,000	$13,300,000	$794,900
BioLac Plant	$11,461,000	$5,157,000	$16,600,000	$691,954
BioShell Lagoon System	$11,963,000	$5,384,000	$17,300,000	$691,954
Moving Bed Bioreactor	$8,303,000	$3,737,000	$12,000,000	$791,397
Existing Facility(1)			$0	$336,631

(1) Existing WWTP O&M Costs based on City budgeted facility and labor costs of $336,631.
(2) Includes 20% Construction Contingency and 25% Indirect/Engineering costs.
(3) Does not include effluent disposal pumping. Includes administration or overhead costs.

V. SELECTION OF AN ALTERNATIVE

Project cost estimates, along with estimated operations and maintenance costs were used to perform a net present worth analysis (Life Cycle Cost) for all seven alternatives. A summary of this analysis is provided in Table 17. The net present worth analysis is based on an interest rate of 1.6% from the White House Office of Management and Budget's (OMB) Appendix C Real 20 Interest Rates on Treasury Notes and Bonds for a 20 year period.

Table 17: Present Worth Analysis Summary

No.	Project Description	Total Project Cost	New WWTP Annual O&M Cost	Present Worth O&M(1)	Net Present Worth(2)
WWTP Alternatives					
1	Conventional Activated Sludge Plant	$20,000,000	$903,358	$15,357,602	$35,357,602
2	Aero-Mod Activated Sludge Plant	$16,300,000	$774,238	$13,162,495	$29,462,495
3	Membrane Bioreactor Plant	$14,600,000	$834,959	$14,194,782	$28,794,782
4	Sequencing Batch Reactor Plant	$13,300,000	$794,900	$13,513,766	$26,813,766
5	BioLac Plant	$16,600,000	$844,104	$14,350,255	$30,950,255
6	BioShell Lagoon System	$17,300,000	$691,954	$11,763,627	$29,063,627
7	Moving Bed Bioreactor	$12,000,000	$791,397	$13,454,216	$25,454,216

(1) Present worth based on 1.6% 20 year discount rate. Interest rate based on 20-yr federal discount rate from Appendix C of OMB Circular A-94 per USDA PER guidelines.

(2) Salvage value for all Alternatives is assumed to be zero

As indicated, Alternative 7, MBBR, has the lowest present worth cost, while Alternative 1, CAS, has the highest. Other factors besides costs will be used to select the best alternative, which will be described hereinafter.

A decision matrix was utilized to evaluate alternatives against one another. The decision

matrix assigns weight factors to various monetary and non-monetary evaluation criteria. These criteria and weights help determine the most suitable alternative based on the unique values of the City. The evaluation criteria and their respective weights were collectively determined by PACE, City staff, and the Ad Hoc Committee of the City Council. A description of each of the evaluation criteria used in the decision matrix are described below:

Monthly Wastewater Rate: In order accurately portray the financial impacts to the City, the required sewer rate for each of the alternatives was determined. The sewer rate reflects both the capital and O&M costs and is an impartial basis for cost comparison, see Table 18. For all alternatives, it was assumed a third WWTP operator will be required to help operate and maintain proposed facilities.

In the decision matrix, alternatives with the lowest monthly user rate are ranked highest. A weight factor of 20% was assigned to the monthly wastewater rate.

Environmental & Permitting Restraints: The ability to construct and operate each alternative with minimal impacts to the surrounding environment, both at the WWTP facility and disposal sites, is a concern. The alternatives were assigned scores based on the impacts to the existing WWTP site and environment, and the ease of obtaining permits. Environmental and permitting requirements will be similar for all alternatives because the majority of infrastructure is proposed to be constructed within the footprint of the old intermittent sand filters. However, alternatives such as the BioLac® Activated Sludge (Alternative 5) will require new infrastructure adjacent to Lagoon 2, so it is ranked lower than the others. The BioShell Nitrification (Alternative 6) is ranked the highest because it will have the smallest overall new footprint. The remaining alternatives will have similar footprint impacts. A weight factor 5 percent was assigned to Environmental & Permitting Constraints.

Constructability & Ability to Implement: The constructability and ability to implement a new facility is important for the operations of the current WWTP facility. The selected alternative must have the ability to be constructed within the existing WWTP site while

keeping the existing facilities online. This is of particular concern for alternatives that require the lining of the existing lagoons, see POTENTIAL CONSTRUCTION PROBLEMS, page 87. Alternatives 1, 2, 3, 4, and 7 require deep excavations and construction of deep concrete basins. Groundwater management and excavation stabilization and shoring will be important during construction to maintain a safe site. Therefore, these alternatives are considered less favorable. Alternative 5 requires constructing new rectangular clarifiers adjacent to Lagoon 2 near a steep hillside, so it is considered the least favorable. Alternative 6, BioShell Nitrification, is considered the most favorable. A weight factor of 10 percent was assigned to Constructability & Ability to Implement.

Table 18: Alternative Estimated Monthly Sewer Rate

Existing Sewer Usage	
ADWF, MGD:	0.7
Additional Bottling Plant Flow, MGD:	0.05
Flow Per Household, GPD/EDU:	230
Single Family Sewer Rates:	$23.95
Financing Parameters (USDA Rural Development Loan)	
Loan Term, Yrs:	40
Interest Rate:	3.5%
Approximate No. Existing Equivalent Dwelling Units (EDU):	2700
Approximate No. New Equivalent Dwelling Units (EDU):	2917
Approximate Annual Short Lived Asset Contribution:	$82,459
Crystal Geyser Contribution:	$2,500,000
City Contribution:	$500,000
Project Description	**(1)Total Monthly Rate per EDU Per Mo.**
WWTP Alternatives	
Conventional Activated Sludge Plant	$69.53
Aero-Mod Activated Sludge Plant	$59.99
Membrane Bioreactor Plant	$59.00
Sequencing Batch Reactor Plant (SBR)	$55.79
BioLac Plant	$62.47
BioShell Lagoon Nitrification	$59.21
Moving Bed Bioreactor (MBBR)	$53.61
Current Wastewater Rate	$23.95

(1) Total Monthly Rate Per EDU Per Mo. based on current single family sewer rate.

Operations and Maintenance (O&M) Difficulty: Each alternative requires a different O&M effort. In order to minimize the City Staff's labor burden, all alternatives were assigned scores to reflect their various levels of expected O&M, not including cost. In general, the alternatives (6 and 7) utilizing the existing lagoon treatment process were considered the easiest to operate. The MBR Activated Sludge process (Alternative 3) was considered the most difficult, in part because of the increased maintenance effort. Alternatives 1, 2, and 4 (CAS, Aero-Mod, and SBR) were considered similar and assigned comparable factors, although Alternative 4 (SBR) was marked down slightly because of the need to use equalizing storage prior to effluent filtration and disinfection due to the sequencing nature of the process. Alternative 5, BioLac® Activated Sludge was ranked slightly lower than the other activated sludge processes because the large reactor basin and lack of defined aerobic/anoxic processes limits operator flexibility. A weight factor of 10 percent was assigned to Operations and Maintenance difficulty.

Ability to Adapt/Modify to Meet Future Discharge Requirements: In general, alternatives that afford the City the most process flexibility will offer the greatest benefit for meeting future regulatory requirements. The activated sludge alternatives (1, 2, 3, and 4) that provide separate aerobic/anoxic reactors and the ability to change internal recycle and return sludge rates are ranked higher than alternatives relying on the existing lagoon treatment system (Alternatives 5, 6, and 7). In addition, concrete reactor basins are easier to expand and/or modify than earthen basins. Process flexibility will provide the City with a "tool box" of options to target other nutrients or more stringent limitations on constituents already present in the NPDES Permit. Alternative 3 (MBR) is ranked a little higher than Alternatives 1, 2, and 4 because the MBR process removes more BOD and TSS than these other alternatives using conventional filtration. Many of the insoluble portions of the targeted metals are tied up in suspended solids, so removal of solids helps metals removal as well.

Emerging Contaminants (ECs) are a concern for future NPDES compliance. ECs contain many of the pharmaceuticals discussed throughout the wastewater industry. Unfortunately, biological treatment is not an effective approach for removing

pharmaceuticals. Research shows that use of nano-filtration or reverse osmosis is necessary to remove many identified pharmaceuticals. These processes would be added downstream of the biological treatment process anyway and could be easily added to any of the proposed alternatives. A weight factor of 15 percent was assigned to Ability to Adapt/Modify to Meet Future Discharge Requirements.

Treatment Process Performance and Reliability: Each new treatment plant alternative must be able to consistently meet effluent limits. The activated sludge alternatives (1 through 4), utilizing new concrete basins with separate aerobic/anoxic reactors and flexibility to change internal solids recycle rates are deemed more reliable than other alternatives. Although Alternative 3 (MBR) gets slightly lower marks because of the amount of process equipment and membrane integrity concerns over time. It is expected that Alternatives 1 through 4 will provide similar levels of nitrogen removal to meet ammonia and nitrate limits established in the 2012 NPDES permit. However, since the new 2013 final ammonia criteria was published in April 2014, the City could face even more stringent ammonia limits if freshwater mussels are present in the Upper Sacramento River. Based on our modelling efforts, Alternative 2 (Aero-Mod) appears to offer the highest level of ammonia removal. Consequently, it is ranked slightly higher than alternative 1, 3 and 4.

Alternative 5 (BioLac®) gets lower scores than Alternatives 1 through 4 because of the large earthen basin leading to colder wastewater temperatures and potential for depressed nitrification and lack of partitioned reactors to control aerobic/anoxic environments.

Alternative 6 (BioShells) gets the lowest score because the process does not employ an effective denitrification step. Even though effluent ammonia limits could likely be consistently met, the nitrate effluent limit could be compromised.

Alternative 7 (MBBR) would provide adequate nitrogen removal, but would require addition of an external carbon source (methanol or glycerin) to obtain adequate dentrification. In addition, the process relies on the existing lagoon treatment which

lacks process flexibility for meeting potential future more-stringent effluent limits. Therefore, it is ranked below Alternatives 1 through 5, but above Alternative 6. Also, Alternatives 6 and 7, and to a lesser degree Alternative 5, will be subject to cooler wastewater temperatures resulting from exposure in the lagoons. Thus, these alternatives are not ranked as high as Alternatives 1 through 4. A weight factor of 35 percent was assigned to Treatment Process Performance & Reliability because it is the most important evaluation criteria.

Security and Safety to Workers and the Public: Alternatives must minimize security and safety risks to the operations staff and the public. Alternatives that utilize the existing lagoons are a safety concern for operators performing daily inspections and routine maintenance, especially during winter months when the dikes are covered with snow and ice. Alternatives that are more compact and limit opportunity for accidental submersion during both daily inspection and routine maintenance are given higher scores.

One of the major factors affecting safety is the choice of disinfection process. Currently, the City uses gas chlorine. Alternative disinfection processes were discussed in section DESCRIPTION – DISINFECTION OPTIONS. As indicated, UV disinfection was deemed the best alternative. All seven treatment options reflect use of UV disinfection. Thus, there is no consideration in this criteria for disinfection safety.

A weight factor of 5 percent was assigned to Security & Safety to Workers/Public.

Accounting for the scores assigned to each evaluation criteria described above and the respective weight factors, the decision matrix shown in Table 19 was prepared.

The results of the decision matrix evaluation suggest Alternatives 2, 3, and 4 are ranked similar, with Alternative 2 (Aero-Mod) ranked the highest. Alternative 4 (SBR) has the lowest 20-year present worth cost of the three highest ranked alternatives. The Aero-Mod alternative has the highest treatment performance and reliability. It offers a high level of treatment, increased flexibility to meet future regulatory requirements, and low operation and maintenance costs

The second highest ranked alternative is Alternative 4, the SBR process, which offers effective nitrogen removal and flexible operations, but employs the least common treatment process and requires equalizing storage to maintain consistent flow to tertiary treatment process.

Table 19: Treatment Alternative Decision Matrix

No.	Criteria	Weight Factors	Treatment Alternatives						
			Alt-1 CAS	Alt-2 AeroMod	Alt-3 MBR	Alt-4 SBR	Alt-5 BioLac	Alt-6 BioShell	Alt-7 MBBR
1	Monthly Wastewater Rate	20	3	6	7	9	5	7	10
2	Environmental & Permitting Constraints*	5	8	8	8	8	7	10	9
3	Constructability & Ability to Implement*	10	8	8	8	8	7	10	8
4	O&M Difficulty	10	7	7	5	6	6	10	8
5	Ability to Adapt/Modify to Meet Future Discharge Requirements	15	8	8	10	8	6	3	4
6	Treatment Process Performance & Reliability	35	9	10	8	8	7	4	6
7	Security & Safety to Workers/Public	5	9	9	10	9	7	6	5
	Weighted Totals:	100	**73%**	**83%**	**79%**	**80%**	**63%**	**60%**	**70%**

Notes:
1= Least Favorable
10= Most Favorable
* Assigned criteria ranking could eliminate an alternative from future consideration

Alternative 3, the MBR system, is the third highest ranked alternative and offers excellent solids removal and a small footprint. However, MBRs are capable of only handling limited fluctuations in flow. Typically, MBR systems can handle twice their design flow (i.e., peaking factor of 2) for a limited period of time which is considered less than conventional activated sludge process, such as Alternative 2 (Aero-Mod). The allowable peaking factor is also decreased in colder temperatures, as is the case for the

City of Mt. Shasta. It is anticipated that equalization storage will be required for all new treatment alternatives in order to keep costs down, but the volume requirement for an MBR process will be much greater than other processes. Furthermore, the MBR system is one the most complex alternatives to operate. The City has expressed that minimizing complexity is important to the operational staff. As a result, Alternative 3 is not the preferred treatment alternative.

Alternative 4, SBR activated sludge, is a proven process for nitrogen removal but less common than the continuous-flow variations of the Ludzack-Ettinger process as proposed in Alternative 2, Aero-Mod activated sludge. It is necessary to provide equalizing storage on the downstream side of the treatment process in order to deliver consistent flows to downstream filtration and disinfection processes. This is not a major issue but adds some complexity to the overall treatment process. The fill and draw sequences requires pumping or adequate elevation change in the WWTP hydraulic profile which adds operating costs. For these reasons, the SBR process is not considered the preferred treatment alternative.

Alternative 2 (Aero-Mod) replaces the City's lagoon treatment system. The Aero-Mod SEQUOX® process is a variation of the Ludzack-Ettinger (MLE) activated sludge process except that it contains a second stage sequencing aeration reactor to enhance denitrification.

The common wall construction of the various treatment basins helps to minimize the facility footprint and construction costs. Common walls allow for transfer of solids and recycle flows without pumping. Air lift pumps are used to convey RAS from the clarifiers. These features reduce power and associated O&M costs. In addition, the process can handle high peaking factors without the need for emergency retention basins (ERB), although a small ERB will be incorporated for extremely high sustained flows. The Aero-Mod dissolved oxygen control system allows for efficient use the aeration system, which results in low operational costs. Due to the current uncertainty relating to the presence of freshwater mussels in the Upper Sacramento River and associated more stringent ammonia limits, Alternative 2 (Aero-Mod) is considered the

most favorable because it can achieve the highest level of ammonia removal. It is for these reasons that Alternative 2, the Aero-Mod process, is the preferred alternative.

VI. PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

A. PROJECT DESCRIPTION

Figure 16 and Figure 17 show a site layout map of the proposed project components shown in Table 20. A schematic diagram of the treatment process is shown in Figure 14 and Figure 15

Table 20: Recommended WWTP Project Components

Item	Component
1	Headworks modifications and Self Cleaning Screens
2	Aero-Mod SEQUOX® Aeration Basins
3	Aero-Mod Secondary Clarifiers
4	Aero-Mod Digesters
5	Traveling Bridge Filters
6	Ultraviolet Disinfection System
7	Filter and Disinfection Enclosure
8	Sludge Dewatering Equipment and Building
9	Generator
10	Control and Blower Building

1) Effluent Disposal/Reuse

Based on the effluent disposal analysis previously described, see DESCRIPTION – EFFLUENT DISPOSAL page 27, the City will need to continue using the Sacramento River discharge in conjunction with the golf course and the leach field. Effluent will be conveyed to the golf course for reuse during the irrigation season. When the golf course and river cannot be used for effluent disposal, as a result discharge requirements or inability to meet effluent limits, the leach field disposal will be utilized.

The Sacramento River Discharge is limited to an ADWF of 0.8 MGD between 15th of

September and 16th of June. A 20 to 1 dilution ratio of river to WWTP effluent flow must be maintained at all times. The City's current NPDES permit is contained in Appendix H.

The leach field has a design capacity of 0.7 MGD. Historically, the leach field has been operated as a backup when more stringent discharge limits cannot be met due to WWTP upsets or irrigation water is not needed at the golf course. The current permit does not prohibit the use of the leach field as a primary disposal site. However, the CRWQCB has indicated that increased use of the leach field will likely result in increased monitoring and more stringent future permit limits. It is anticipated that no improvements will be necessary to the City's existing effluent pump station.

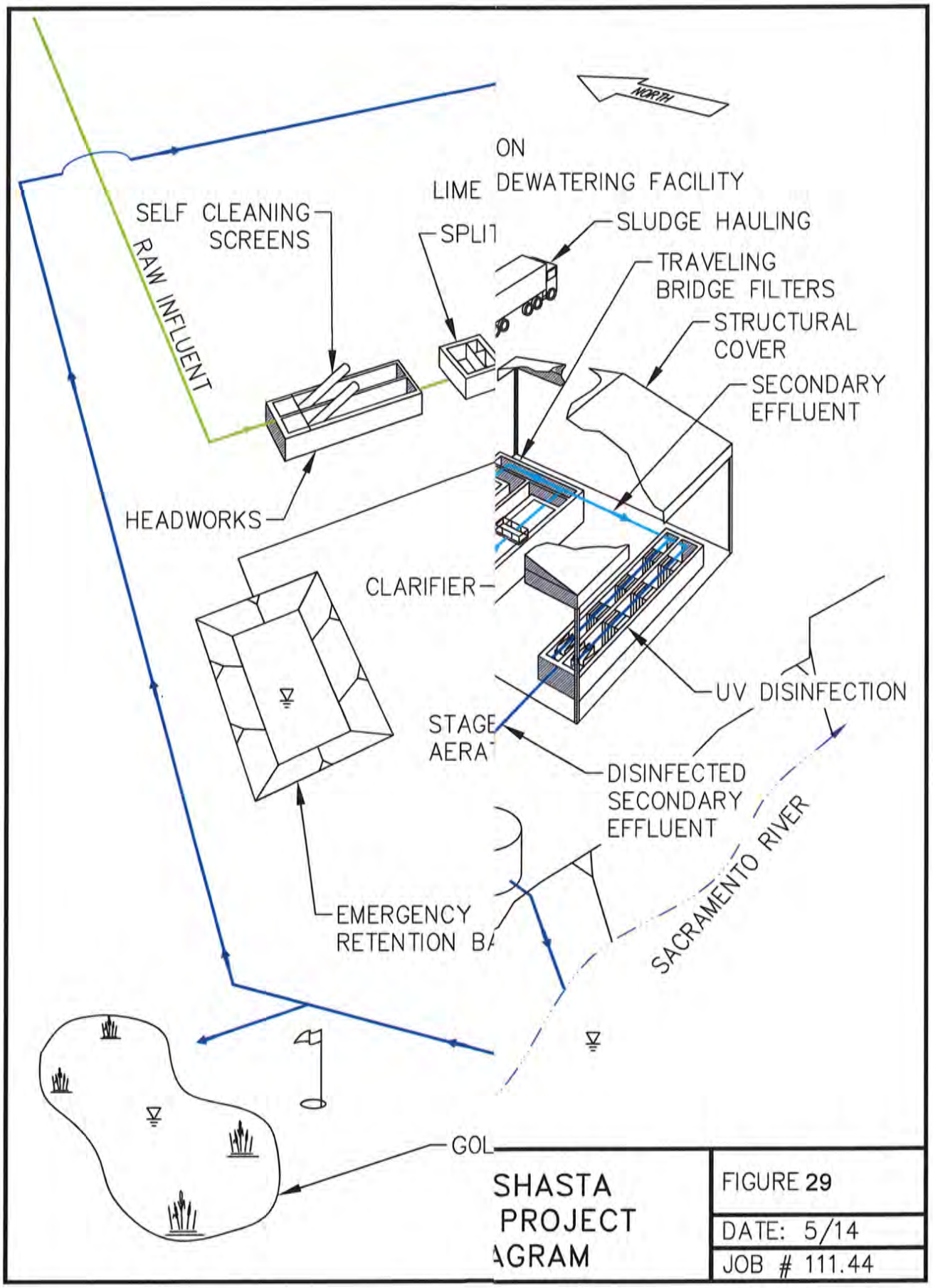
The golf course irrigation pump station has a reported pumping capacity of 0.5 to 0.6 MGD based on irrigateable area, irrigation season and agronomic application rates. During the irrigation season, the golf course can likely receive the entire WWTP effluent flow. However, in a year that sees a statistical 100-year annual rainfall, the golf course will not have enough capacity to receive the entire WWTP effluent flow.

During a 100-year annual rainfall year (approximately 6 inches), a combination of all 3 disposal sites will be required.

2) Treatment

The proposed treatment process is shown in Figure 14, Figure 15, Figure 16 and Figure 17. In addition, Figure 29 shows a process diagram of the proposed treatment and disposal system. Influent wastewater from the collection system will pass through one of two automatic cleaning spiral screens. Screenings will be deposited in a dumpster for disposal. Screened effluent will gravity flow to the Aero-Mod SEQUOX® treatment basins.

Screened influent will first enter an anoxic selector where it will be mixed with RAS from two secondary clarifiers. The RAS flow will be approximately equal to the



SHASTA
PROJECT
AGRAM

FIGURE 29

DATE: 5/14

JOB # 111.44

influent WWTP flow. This selector will promote the growth of bacteria that have excellent settling characteristics, while returning nitrate to the front of the treatment process for denitrification. A wall mounted course bubble aeration system will provide mixing.

Selector effluent is diverted to one of two stage 1 aeration tanks (Stage 1). A wall mounted fine bubble aeration system provides continuous mixing and dissolved oxygen for BOD consumption, ammonification and nitrification. Stage 1 effluent passes to a stage 2 aeration tank (Stage 2) through blockouts in the interior walls. An airlift pump distributes a portion of the Stage 1 mixed liquor to one of the two digesters as WAS. Similar to the Stage 1 aeration system, wall mounted course bubble aeration system provides sequenced aeration to the Stage 2 tank. The sequenced aeration allows for simultaneous nitrification and denitrification. At a design flow of 1.2 MGD, the mixed liquor suspended solids (MLSS) concentration within the aeration basin are estimated to be approximately 3,400 mg/l. The Stage 1 and 2 tanks will have a combined volume of 1.35 MG and a sustained peak treatment capacity of 3.6 MGD. During ADWF conditions the solids retention time (SRT) will be approximately 21 days, while the hydraulic retention time (HRT) will be 27 hours.

Stage 2 effluent is drawn from the surface of the aeration basins through outlet screens and dispersed along the bottom of one of two clarifiers. These clarifiers have an area of approximately 3,840 Sq-Ft and a side wall depth of 14 Ft. An air lift pump removes sludge at timed intervals from eight stationary suction hoods. At a design flow of 1.2 MGD, approximately 1.2 MGD of this sludge will be returned as RAS to the anoxic selector. Clarified effluent exits the clarifier through submerged effluent weirs. These weirs allow the effluent flow to be regulated so that surges in influent flow can be absorbed be utilizing the clarifiers as retention basins.

Clarified effluent travels to one of two traveling bridge filters for further TSS removal. These filters utilize sand media beds that are partitioned into many smaller cells. As the filter rate slows, a traveling carriage moves a suction hood from cell to cell,

backwashing individual sections of the filter. This type of filter does not require the entire filter shutdown to perform a backwash. An enclosure over the filter will help to protect the filter from the environment and limit the amount algae growth caused by direct sunlight exposure.

Filter effluent is received by one of two UV channels. Each of the UV channels contain three banks of UV lamps. A design UV dose of 80,000 $\mu Ws/cm^2$ will be provided per the National Water Research Institute (NWRI) guidelines. Both UV channels will share the same enclosure as the traveling bridge filters to reduce exposure to the environment. Disinfected effluent leaving the UV channels can gravity flow to the river during permitted times. Alternatively, effluent can be pumped to the golf course or leach field for disposal.

3) Sludge/Biosolids

Two aerobic digesters receive WAS from one of two air lift pumps in the Stage 1 aeration basins at a rate of approximately 1,370 Lbs per day. A wall mounted aeration system provides aeration and mixing to the digester sludge at a rate of 870 SCFM. Digester supernatant travels over weir into the anoxic selector to be blended with influent wastewater and RAS. The sludge retained in the digesters undergoes stabilization for 30 days before conveyance to the dewatering facility.

The recommended project incorporates biological activated sludge treatment which relies on continuous wasting of solids to control optimal environments with the treatment processes.

Biosolids (sludge) management will be a new concept for City staff. With the current lagoon system, solids are stored in the primary ponds, which have been cleaned once or twice since original construction. The City's existing DAF/RSF generates solids which are conveyed to the un-lined earthen basin located west of these processes. As part of the new NPDES permit, the CVRWQCB required the City to develop a biosolids use or disposal plan.

Waste sludge is about 98% water (by weight) so it is advantageous to remove as much water as possible before disposal. Drying can be accomplished by sun exposure in drying beds during the summer or by mechanical means. Drying on-site requires manipulation with equipment to accelerate drying and poses the risk of odors to nearby property owners. In addition, uncovered drying beds are subject to unseasonable rains during the drying season.

The City of Yreka tried to dry its sludge on-site using covered drying beds, but after odor complaints from surrounding residents, it changed to a mechanical dewatering process. Due to the space requirements and infrastructure costs for covered drying beds, additional operator attention and risk of odors, it was recommended the City of Mt. Shasta employ mechanical dewatering.

The most common sludge dewatering equipment are the filter belt presses. However, centrifuges are becoming more popular because they can remove even more water. In late 2011 – early 2012, PACE led efforts by the City of Yreka to pilot test a filter belt press and centrifuge for effectiveness of dewatering the City's aerobically-digested sludge. Because the City hauls its dewatered sludge to the Dry Creek Landfill in White City, Oregon, transportation costs are a significant component of its disposal costs. Therefore, water weight is a significant factor. The City of Dunsmuir also disposes its waste sludge to the Dry Creek Landfill. Based on our analysis, it was determined a centrifuge dewatering process was the most cost-effective, long-term means for sludge dewatering for the City of Yreka. Since it is likely waste sludge from the City of Mt. Shasta would also be hauled to the Dry Creek Landfill, it is expected the longer haul would show the centrifuge process is even more advantageous for Mt. Shasta.

The recommended project reflects a centrifuge dewatering facility, similar to the one currently being constructed for City of Yreka, and consists of sludge grinder and pumping facilities, polymer blending system, elevated centrifuge, and conveyors.

The centrifuge will thicken the waste sludge from about 1.5% solids to about 20%

solids. The addition of a polymer will be required to achieve optimal solids concentrations. Supernatant (liquid portion) from the sludge will be returned to the anoxic selector for further treatment. The dewatering facility will be required to run approximately 12 days per month for approximately 6 hours each day. A scale will weigh sludge before it is hauled off site for final disposal at a landfill. The dewatering facility will be enclosed in a separate building to protect equipment and electrical/controls facilities.

B. PROJECT SCHEDULE

Assuming the City takes a proactive approach with outreaching to the public of the importance of the recommended project and initiates the project environmental study within three months of the final feasibility study, we anticipate the project schedule shown in Table 21.

C. PERMIT AND POTENTIAL ENVIRONMENTAL REQUIREMENTS

Enplan, Redding, CA, performed a review of the proposed project and determined a list of special studies and potential permits that may be required to comply with California Environmental Quality Act (CEQA) and National Environmental Protection Act (NEPA) requirements, see Table 22. It is estimated the following environmental documents will apply to the recommended project.

Rural Development Financing:

- CEQA – Initial Study/Mitigated Negative Declarations
- NEPA – Environmental Report (EIR) Checklist for Projects

State Revolving Fund (SRF) Financing

- CEQA-Plus – CEQA as well as documentation satisfying State Water Resources Control Board

Table 21: Preliminary Project Schedule

Task	Estimated Completion Date	NPDES Compliance Date
Submit Leach Field Design Investigation	Feb 28, 2014	Apr 4, 2014
Submit Groundwater Monitoring Well Network Tech Report	Oct-2014	Apr 4. 2014
Submit *draft* Wastewater Treatment and Disposal Feasibility	May 30, 2014	Jun 1, 2014
Method of Compliance – Title 22 Disinfection Requirements	May 30, 2014	Jun 1, 2014
Method of Compliance – BOD, TSS, and pH	May 30, 2014	Jun 1, 2014
Method of Compliance – Cu, Zn, and ammonia	May 30, 2014	Jun 1, 2014
Workshop with project stakeholders	Jun 18, 2014	-
Public presentation of *draft* PER	Jul 21, 2014	-
Submit *final* PER to project stakeholders	Aug-2014	-
Initiate environmental review, permitting, and financing options	Oct-2014	Nov 23, 2016
Submit project financing plan to CVRWQCB	Nov-2014	Nov 23, 2014
Adopt project environmental documents	Apr-2015	-
Prepare funding applications for USDA and CWSRF funding	Dec-14 to Apr-15	-
Obtain preliminary project funding commitments	Oct-2015	-
Proposition 218 proceedings	Nov-15 to Mar-16	-
Engineering design	Mar-16 to Dec-16	-
Bidding/award/contract execution	Jan-17 to Apr-17	-
Construct improvements	May-17 to Dec 18	Nov 23, 2018
Final project completion – file Notice of Completion	Jan-2019	-
Compliance with Cu, Zn, ammonia	Apr-2019	Jun 1, 2017
Compliance with BOD, TSS, pH, and Title 22 Disinfection	Apr-2019	Nov 23, 2020
Progress Reports	Jan of each year	Jan of each year

Table 22: Environmental Studies and Permit Requirements

CEQA

- Air quality/greenhouse gas modeling
- Odor assessment
- Stream/wetland delineation (at diffuser site)
- Botanical and wildlife studies (at diffuser site)
- Cultural resources study (at diffuser site)
- Native American consultation and records search

NEPA

- Environmental Report (ER) checklist for project with a CEQA document

SRF Funding

- CEQA-Plus documentation

Permits

- Army Corps of Engineers
- Regional Water Quality Control Board
- California Department of Fish and Game
- NPDES permits
- General Construction Activity Storm Water Permit

D. SUSTAINABILITY CONSIDERATIONS

1) Water Efficiency

The proposed project will provide a new facility that will be able to consistently meet discharge requirements set forth in the City's current NPDES permit. Proposed improvements will provide more reliable treatment to allow the City to convey more of its summertime treated effluent to the golf course, thereby reducing the need to pump potable groundwater. In the past, the City had trouble consistently meeting

the golf course discharge requirements, so it had to convey large volumes of summertime effluent to the leach field. Similarly, the proposed improvements will allow the City to consistently meet NPDES permit requirements when discharging to the Sacramento River and reduce reliance on the leach field disposal site. This allows more water to be conveyed to the Sacramento River for beneficial use by downstream users.

2) Energy Efficiency

The proposed project utilizes common wall construction to minimize construction costs and operational pumping costs by minimizing the pumping distances. Gravity flow was used wherever possible to further decrease the pumping costs. Gravity separation of solids in the secondary clarifier and gravity filtration in the traveling bridge filters was utilized. In addition, an open channel style UV disinfection system was utilized to minimize pumping.

The proposed Aero-Mod treatment system utilizes sequenced aeration in the two Stage 2 aeration basins. This minimizes power consumption required for additional blowers to operate simultaneously.

By maximizing effluent disposal to the Sacramento River, pumping costs for discharging treated effluent to the leach field is reduced.

In order to offset the predicted power consumption a solar field could be utilized. As previously discussed, the payback period for such a project approaches the expected life of the project and therefore is not part of the recommended project. However, if the City believes that the cost of power will increase in the future, the payback period will roughly decrease one year for every $0.01 kWHr increases. In addition, if a grant can be secured for a significant portion of the capital cost of solar field, this alternative power source may prove viable.

E. TOTAL PROJECT COST ESTIMATE (ENGINEER'S OPINION OF PROBABLE COST)

Table 23 is a summary of the total recommended project cost estimate. Table 24 provides a more detailed breakdown of project construction costs. Note that three years of construction inflation has been added to account for construction of improvements beginning in spring 2017.

F. ANNUAL OPERATING BUDGET

The City will seek project funding from USDA Rural Development's Rural Utility Services Program and Clean Water State Revolving Fund administered by the State Water Resources Control Board. The City's existing operating budget and wastewater rates schedule are contained in Appendix B and D, respectively. The City will need to reconsider the income and expenditures within its wastewater fund along with the new debt service obligations required to repay any loan obtained. With a few exceptions, the major public works infrastructure funding programs expect an agency's monthly sewer bill to be at least 1.5 percent of median household income (MHI). The results of an income survey performed by Great Northern Corporation in early spring 2014 indicate the MHI within the City's utility service area is about $32,000, see Appendix I. However, USDA Rural Development has indicated they will utilize the MHI as determined by the US Census American Community Survey (ACS) which is $38,504. Using the 1.5 percent threshold and the higher MHI, the City's monthly wastewater rate would need to be at least $48.13 per month per equivalent dwelling unit (EDU) before qualifying for grant funding. The City's current sewer rate is $23.95 per month per EDU. Therefore, the monthly sewer rate needs to increase by $24.18 per month per EDU before it can effectively compete for grant funding.

The goal for funding the recommended project will be to secure a long-term, low-interest loan with debt service obligations up to 1.5 percent of MHI. Then, attempt to acquire grant funding for the amount beyond the loan amount.

Table 23: Total Recommended Project Cost Estimate

ITEM	Subtotal	Total
Property Purchase / Lease Agreements		$0
Easement Acquisition / Right of Way / Water Rights		$0
Bond Counsel		$50,000
Legal Counsel		$30,000
Interest/Refinancing Expense		$0
Other (identify)		$0
Environmental Services		
- CEQA Environmental Report	$80,000	
- NEPA Environmental Report	$30,000	
- Environmental Mitigation Contract Services	$10,000	
Total - Environmental Services:		$120,000
Engineering Services		
Basic Services:		
- Preliminary Engineering Report (PER)	$120,000	
- Preliminary and Final Design Phase Services	$1,000,000	
- Bidding/Contract Award Phase Services	$50,000	
- Construction and Post-Construction Phase Services (w/o inspection)	$400,000	
- Resident Project Representative Services (resident inspector)	$500,000	
Additional Services:		
- Permitting	$0	
- Regulatory Compliance Reports	$10,000	
- Environmental Mitigation Services (Construction Phase)	$20,000	
- Easement Acquisition/ROW's Services (Construction Phase)	$0	
- Surveying Services (Construction Phase)	$25,000	
- Operation & Maintenance Manual(s)	$50,000	
- Geotechnical Services	$20,000	
- Hydrogeologist Services	$0	
- Materials Testing Services (Construction Phase)	$10,000	
- Other Services (describe)		
Total – Engineering Services:		$2,205,000
Equipment/Materials (Direct purchase using approved methods, separate from construction bid/cost)		$0
Construction Cost Estimate (Attach breakdown)		$12,238,000
Contingency		$1,835,000
TOTAL PROJECT COST ESTIMATION:		$16,478,000

1) Income

According to the City's 2012-2013 operating budget (Appendix B), the wastewater fund generated about $798,000 in user fee revenue and miscellaneous income. During this same period, the City incurred about $819,000 of expenses and debt service obligation, not including capital outlay. Thus, it appears the City needs a small rate increase just to fund its current operations. However, a significant rate increase will be required to cover future debt service obligations and increased operation and maintenance (O&M) expenses for the proposed project.

Using the City's current user fee-generated revenue and dividing by the $23.95 per month per EDU yields about 2,700 existing EDU's

Crystal Geyser is currently in the planning stages with Siskiyou County and City of Mt. Shasta for a juice making facility in Mt. Shasta. It is expected this new facility will initially contribute up to 50,000 GPD of wastewater in the City's facility. At 230 GPD/EDU, this flow contribution represents about 217 EDUs.

Including the anticipated Crystal Geyser flow contribution, the total number of EDUs is about 2,917.

Crystal Geyser has obligated itself to pay $3.0M toward wastewater interceptor and WWTP improvements. Therefore, it will not be necessary to finance the portion of improvements funded by Crystal Geyser.

Table 25 shows a breakdown of the required wastewater rate increase assuming 100% loan financing from USDA Rural Development.

As indicated, the total required monthly sewer rate, reflecting cash contributions by Crystal Geyser and the City of Mt. Shasta, and accounting for debt service and O&M obligations is to fund the proposed $16.5M project approximately is $60.25 per month per EDU. There is a possibility that grant funding could be offered by USDA

Rural Development, but a determination cannot be made until a final funding application is submitted, and the City's eligibility evaluated. In addition to USDA Rural Development, it is recommended the City continue to explore grant opportunities through the Clean Water State Revolving Fund (CWSRF) program administered by the State Water Resources Control Board and other sources. Any grant component received will lower the monthly sewer rate by about $1.59 per month per EDU for every $1.0M in grant contributed.

2) Annual Operations and Maintenance (O&M Costs)

A detailed summary of the projected O&M costs for the recommended project are shown in Table 26. These costs reflect O&M costs for the proposed facilities only. Labor hours shown are zero because they are accounted for in new facility operations staff cost on line 40. It is anticipated that a third WWTP operator will be necessary to effectively operate the new facilities.

Table 24: Recommended Project Cost Estimate

	Item	Amount	Units	Unit Cost	ADWF = 1.2 MGD Total Cost
	Civil Site Work & Miscellaneous				
1	Mobilization & Demobilization	1	LS	$100,000	$100,000
2	Site Grading and Aggregate Base	1	LS	$20,000	$20,000
3	Erosion Control SWPPP & Implementation	1	LS	$25,000	$25,000
4	Shop Drawings/Testing/Equipment Manuals	1	LS	$50,000	$50,000
5	Cleanup	1	LS	$20,000	$20,000
	Subtotal				$215,000
	1.2 MGD ADWF Aero-Mod Equipment				
6	Excavation (Selector, CAS, Clarifier & Digester)	12200	CY	$30	$366,000
7	Headworks Excavation	63	CY	$30	$1,880
8	Headworks Screen	2	EA	$95,000	$190,000
9	Headworks Concrete	1	LS	$57,659	$57,659
10	Parshall Flume	1	LS	$6,000	$6,000
11	Pond Bypass Piping	1100	LF	$240	$264,000
12	Aero-Mod Equipment	1	LS	$2,190,000	$2,190,000
13	Aero-Mod Equipment & Interior Piping Installation Cost	1	LS	$360,000	$360,000
14	Concrete (Selector, Aeration Tank, Clarifier & Digester)	2100	CY	$1,200	$2,520,000
15	Aero-Mod Grout	242	CY	$800	$193,600
16	Aero-Mod Yard Piping	577	LF	$240	$138,000
17	12" Air Manifold, Process & Utility Piping	560	LF	$150	$84,000
18	Blowers Building	400	SF	$150	$60,000
19	Blower Building HVAC	1	LS	$20,000	$20,000
20	Soda Ash or Lime Dosing Station	1	LS	$130,000	$130,000
21	Generator & Ancillary Equipment	1	LS	$84,000	$84,000
	Subtotal				$6,665,139
	2.1 MGD ADWF 16'x46' TBF Equipment				
22	TBF Equip, Including Ancillary Equip, Instr/Controls	2	LS	$251,000	$502,000
23	TBF Concrete Basin	1	LS	$416,000	$416,000
24	TBF Excavation	1200	CY	$30	$36,000
25	Process & Utility Piping	240	LF	$175	$42,000
26	Metal Enclosure	4800	SF	$25	$120,000
	Subtotal				$1,116,000
	1.6 MGD PWWF UV Equipment				
27	UV Disinfection System Equipment	1	LS	$570,000	$570,000
28	UV Concrete Treatment Basins	1	LS	$130,000	$130,000
29	Electrical Controls	1	LS	$250,000	$250,000
	Subtotal				$950,000

	Item	Amount	Units	Unit Cost	ADWF = 1.2 MGD Total Cost
	1.55 MGD ADWF Dewatering Equipment				
30	Dewatering Equipment	1	LS	$1,018,000	$1,018,000
31	Electrical	1	LS	$250,000	$250,000
32	Building	1	LS	$381,000	$381,000
	Subtotal				$1,649,000
	New Lab & Control Building				
33	New Control Building	2500	SF	$250	$625,000
34	Laboratory Equipment	1	LS	$50,000	$50,000
	Subtotal				$675,000
	Outfall Improvements				
35	New Diffuser and Ancillary Improvements	1	LS	$93,000	$93,000
	Total Estimated Construction Cost without Contingency				$11,364,000
	Inflation to March 2017 @ 2.5% per year				$874,000
	Construction Contingency @ 15%				$1,835,000
	Indirect/Engineering				$2,405,000
	Subtotal				$4,240,000
	Total Estimated Project Cost (June 2014 Dollars)				**$16,478,000**

Table 25: Proposed Rate Schedule Summary

Existing Sewer Usage	
Additional Bottling Plant Flow, MGD:	0.05
Flow Per Household, GPD/EDU:	230
FY 2012-13 User Fee Revenue:	$776,000
Single Family Sewer Rates:	$23.95
Financing Parameters (USDA Rural Development Loan)	
Loan Term, Yrs:	40
Interest Rate:	3.5%
Approximate No. Existing Equivalent Dwelling Units (EDU):	2700
Approximate No. New Equivalent Dwelling Units (EDU):	2917
Approximate Annual Short Lived Asset Contribution:	$82,459
Crystal Geyser Contribution:	$2,500,000
City Contribution:	$500,000

Project Cost Estimate	Financed Amount	Dept. Service on Loan Per EDU Per Mo.	Debt. Service Reserve @ 10% Per EDU Per Mo.	(1)Short-lived Asset Reserve Per EDU Per Mo.	Total Monthly Rate Increase Per EDU Per Mo. (Debt Service)
$16,478,000	$13,478,000	$19.48	$1.95	$2.36	$23.78

(2) Additional WWTP Annual O&M Cost	(3)Additional WWTP O&M Cost Per EDU Per Mo.	(4)Total Monthly Rate per EDU Per Mo.	Without CG Contribution
$438,000	$12.51	$60.25	$65.42

(1) The Short-lived Assets Reserve allowance account for replacement of equipment with 5 to 15 year lives

(2) Additional WWTP O&M Costs based on difference between the projected total O&M cost ($774,238) and the City's existing O&M costs ($336,631).

(3) Assumes Crystal Geyser will contribute to short-lived asset reserve.

(4) Total Monthly Rate Per EDU Per Mo. based on current single family sewer rate.

Table 26: Recommended Project Operations and Maintenance Cost

	Item	Amount	Units	Unit Cost	ADWF = 1.2 MGD Total Cost
	AeroMod Activated Sludge Plant Operation & Maintenance				
1	Soda Ash	85100	Lbs	$0.70	$59,570
2	Aeration System Blowers (100 BHP: 2 Duty, 2 Standby)	991608	kWHr	$0.11	$109,077
3	PLC (0.003 kW)	26	kWHr	$0.11	$3
4	Lights (1 kW)	2920	kWHr	$0.11	$321
5	Labor	500	Hrs	$0.00	$0
9	Equipment Repairs/Lubrication/Replacement	1	LS	$2,221	$2,221
10	Diffuser Replacement	41	LS	$25.00	$1,035
11	Sampling	25	Hrs	$0.00	$0
	Subtotal				$172,227
	TBF Operations & Maintenance				
11	Power Consumption	19597	kWHr	$0.11	$2,156
12	Lubricate Gear Reducer	1	Hrs	$0.00	$0
13	Lubricate Drive Shaft	1	Hrs	$0.00	$0
14	Lubricate Sliding Wheels	1	Hrs	$0.00	$0
15	Gear Reducer Inspection, Tightening Set Screws	2	Hrs	$0.00	$0
16	Check Misc Alignments	2	Hrs	$0.00	$0
17	Underdrain Inspection	8	Hrs	$0.00	$0
18	Media Replacement(1)	0.81	LS	$200	$162
19	Media Replacement Labor	17	Hrs	$0.00	$0
20	Underdrain Replacement(2)	1	LS	$1,429	$1,429
21	Underdrain Replacement Labor	146	Hrs	$0.00	$0
22	Spare Parts(3)	1	LS	$1,186	$1,186
	Subtotal				$4,933
	Dewatering Operation & Maintenance				
26	Polymer	1	LS	$17,772	$17,772
27	Sludge Feed Pump (10 BHP)	13773	kWHr	$0.11	$1,515
28	Centrifuge System (75 BHP)	103300	kWHr	$0.11	$11,363
29	Sludge Grinder (3 & 5 BHP)	11019	kWHr	$0.11	$1,212
30	Polymer Feed (1 BHP)	1377	kWHr	$0.11	$152
31	Ventilation Fans (2 at 1.5 BHP & 1 at 1 BHP)	5509	kWHr	$0.11	$606
32	Conveyor (5 BHP)	6887	kWHr	$0.11	$758
33	Annual Sludge Hauling Cost	979	Tons	$39.62	$38,788
34	Annual Landfill Tipping Fees	979	Tons	$56.11	$54,936
35	Labor	484	Hrs	$0.00	$0
36	Annual Parts Replacement	1	LS	$3,000	$3,000
	Subtotal				$130,102

	Item	Amount	Units	Unit Cost	ADWF = 1.2 MGD Total Cost
	UV System Operation & Maintenance				
37	UV System Operation	63072	KWHr	$0.11	$6,938
38	Yearly Lamp Replacement	32	LS	$280	$8,960
39	Daily Maintenance	200	Hrs	$0.00	$0
	Subtotal				$15,898
40	**Facility Operations Staff (3)**	1	LS	$270,000	$270,000
	Annual Cost				**$594,000**
	Equipment 20 Year Present Cost				**$11,880,000**

Table 27 contains a breakdown of the total anticipated annual O&M cost for operating the proposed facility, including existing infrastructure

Table 27: Total Operations and Maintenance Costs

Expense Description	Cost
Personnel (salary, benefits, payroll tax, training)	$ 270,000
Administration Costs (office supplies, printing, etc.)	$ 1,272
Insurance	$ 45,330
Energy Costs (fuel and electricity)	$ 210,757
Process Chemical	$ 77,342
Monitoring and Testing	$ 9,436
Professional Services	
Residuals/Waste Disposal	$ 93,724
Other	$ 66,377
Total:	$ 774,238

3) Debt Repayment

Funding for the recommended project will likely be based upon obtaining a low-interest loan from Rural Development (RD). At a 100% loan amount of 13.5M for

40 years and 3.5% interest, the total annual debt service is about $631,138. Assuming there are about 2,700 EDUs. The approximate monthly debt service component would be about $19.48 per EDU. Note the current interest rate for RD is less than 3.5% but it is felt this is a conservative rate for this preliminary stage of the project. The actual interest rate will reflect market conditions at the time the funding agreement is executed.

4) Reserves

The Proposed RD Funding Package requires a debt service reserve and short-lived asset reserve described as follows.

- Debt Service Reserves: The required debt service for utilizing RD loan financing is equivalent to 10% of the annual debt service payment. For the proposed loan amount of $13.3M, the debt service reserve is about $63,114 per year and about $1.95 per month per EDU.

- Short-Lived Asset Reserve: Table 28 lists potential short-lived assets that will likely require significant maintenance or full replacement in the next five to fifteen years. As shown, it is estimated the City will need to reserve about $82,459 annually to pool adequate funds to replace short-lived assets, which corresponds to a monthly cost of about $2.36 per month per EDU and assumes the new Crystal Geyser facility will contribute to this as well.

Based on the projected income, O&M cost, debt service cost, and reserves, it is estimated the City may need to increase its monthly wastewater rate to about $60.25 per month per EDU based on 100% loan financing, see Table 25. As discussed, any grant contribution will reduce the monthly rate accordingly. It is estimated for every $1.0M in grant, the monthly rate will decrease by about $1.59 per month per EDU. In order to qualify for grants, the rates will need to be increased to at least $48 per month per EDU. .

Table 28: Short-Lived Assets Reserve Schedule

Equipment	Replacement Period	Estimated Cost	Annual Reserve
Replace UV Lamps	5	$ 8,960.00	$ 1,792.00
Replace UV Ballast	5	$ 500.00	$ 100.00
Replace Polymer Equipment	5	$ 20,000.00	$ 2,000.00
Replace Sludge Feed Pump	15	$ 20,000.00	$ 1,333.33
Centrifuge Scroll Replacement	15	$545,000.00	$36,333.33
Replace Sludge Grinder	15	$ 5,000.00	$ 333.33
Replace Scale	15	$ 40,000.00	$ 2,666.67
Replace TBF Media	15	$ 8,000.00	$ 800.00
Replace Soda Ash Pumps	10	$ 1,000.00	$ 100.00
Replace Aeration Basin Diffusers & Blower	10	$150,000.00	$15,000.00
Replace Digester Diffusers & Blowers	15	$150,000.00	$15,000.00
Replace Headworks Screen	15	$ 70,000.00	$ 7,000.00
		Total Annual Cost:	$82,458.67
		Total Annual Cost Per EDU (2,917 EDUs)	$ 28.27
		Total Cost Per EDU Per Month:	$ 2.36

VII. CONCLUSION AND RECOMMENDATIONS

The recommended project consists of the items summarized in Table 23 and contains the following advantages:

- Increased WWTP capacity
- Increased process reliability/minimized NPDES discharge violations
- Increased flexibility to meet future discharge requirements
- Minimized effluent pumping costs (i.e., leach field use)
- Increased effluent quality discharged to the Sacramento River
- Increased facility safety
- Increased water reuse

The total project cost, including indirect costs for administration and engineering, is estimated at $16,478,000.

It is recommended the City accept the recommendations presented in this report and

continue to explore financing opportunities that maximize grant opportunities to lower anticipated wastewater rates. In addition, the City should initiate environmental review in accordance with CEQA and NEPA requirements for USDA and CWSRF financing. Once environmental review and a financing plan is complete, the City needs to initiate Proposition 218 proceedings for raising monthly wastewater rates accordingly. Table 21 contains a preliminary project schedule from acceptance of the feasibility study to final construction of recommended improvements. There are specific milestones dates indicated in the schedule that must be met in order to maintain compliance with the 2012 NPDES permit.

COMPLIANCE WITH NPDES PERMIT

This feasibility study is intended to satisfy a number of requirements set forth in the City's NPDES permit, adopted in October 2012. Below is a brief description of those requirements.

1) Groundwater Monitoring Well Network Technical Report

Due to delays in renewing the City's Use Permit with USFS for drilling a new down-gradient monitoring well, we were unable to complete this report. The City was prepared to drill this well in August 2013 before learning of the permitting constraints. According to USFS staff, the permit is close to issuance at the time of this writing. Assuming this to be the case, it is expected the new monitoring well will be drilled during summer 2014. Although, the drilling contractor availability is somewhat in question due to the current contractor demand for mitigating the existing California drought. Our goal is to complete the final report by fall of 2014.

2) Leach Field Design Investigation

This report was completed and presented to the RWQCB during the February 28, 2014 workshop. A copy is attached in Appendix E.

3) Compliance Schedule – Title 22 Disinfection Requirements

Compliance with Title 22 disinfection requirements are addressed in the recommended project components, which includes use of UV disinfection when discharging to the Sacramento River and sodium hypochlorite when discharging to the golf course. Scheduling milestones as required on page 35 of the NPDES permit are reflected in the preliminary project schedule, Table 21.

4) Compliance Schedule – BOD, TSS, pH

Compliance with BOD, TSS, pH are addressed in the recommended project components. BOD and TSS will be removed to below NPDES permit limitations by the proposed activated sludge biological treatment process and effluent filtration processes. pH will be controlled by adding soda ash or lime on the influent side of the biological treatment process, which will provide alkalinity for nitrification. Since denitrification will occur in the pre-anoxic selector, some alkalinity will be released for nitrification, which will reduce the amount of soda ash or lime required. As indicated above, scheduling milestones required in the NPDES permit are reflected in Table 21.

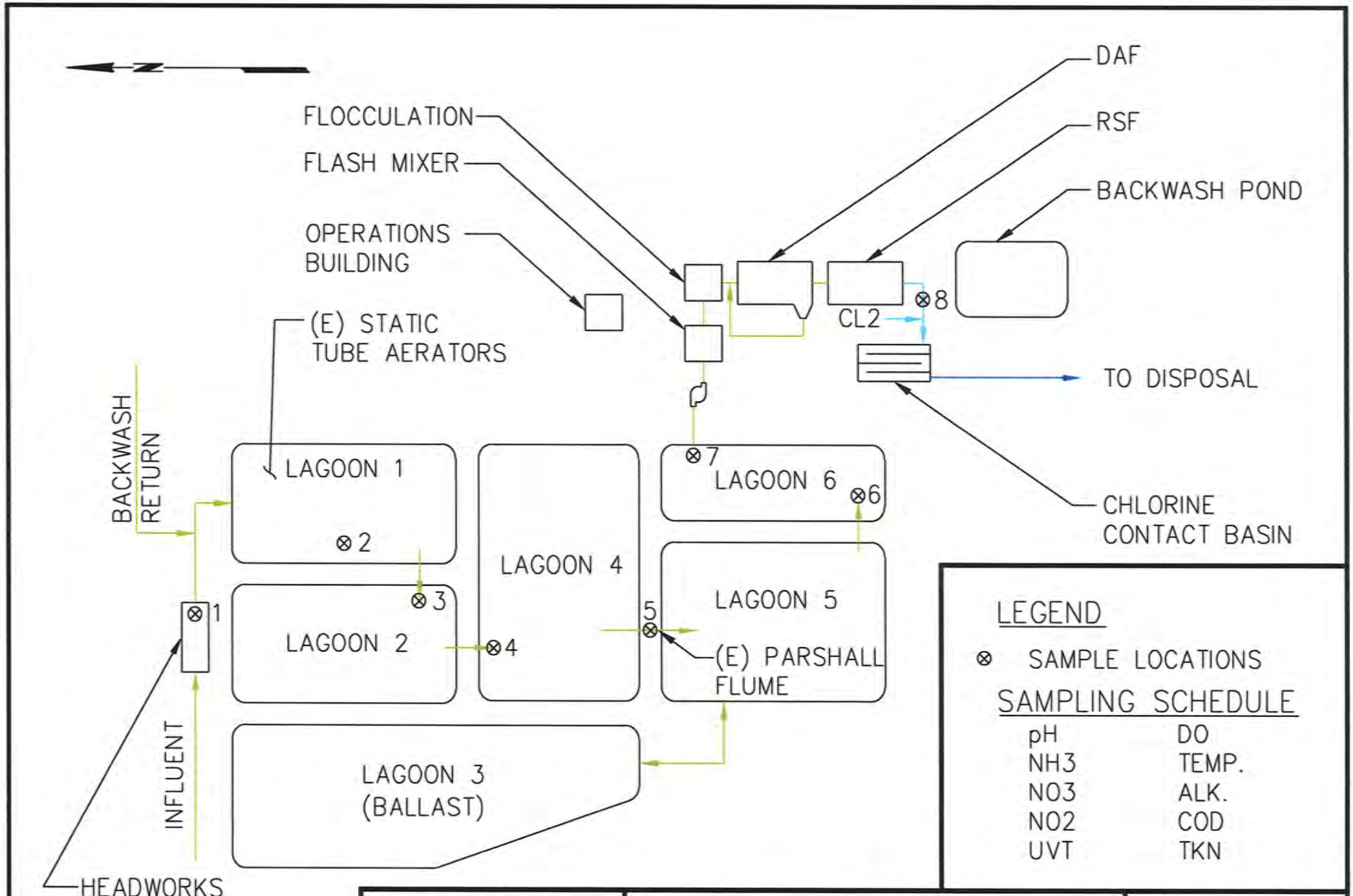
5) Time Schedule Order – Copper, Zinc, and Ammonia

Copper and zinc compliance will be accomplished by removing TSS through use of year-round filtration and enhanced by more efficient biological treatment and nitrogen removal. Effluent ammonia will be addressed by more effective nitrification in the proposed biological treatment process.

The Time Schedule Order for compliance with copper, zinc, and ammonia effluent limits is required by June 1, 2017. As indicated in the preliminary project schedule, Table 21, it is expected the project will be in the early stages of construction at that time.

It is hoped the CVRWQCB will impose some discretion before assessing monetary fines if the City is unable to comply with final effluent limits before the end of construction.

APPENDIX A

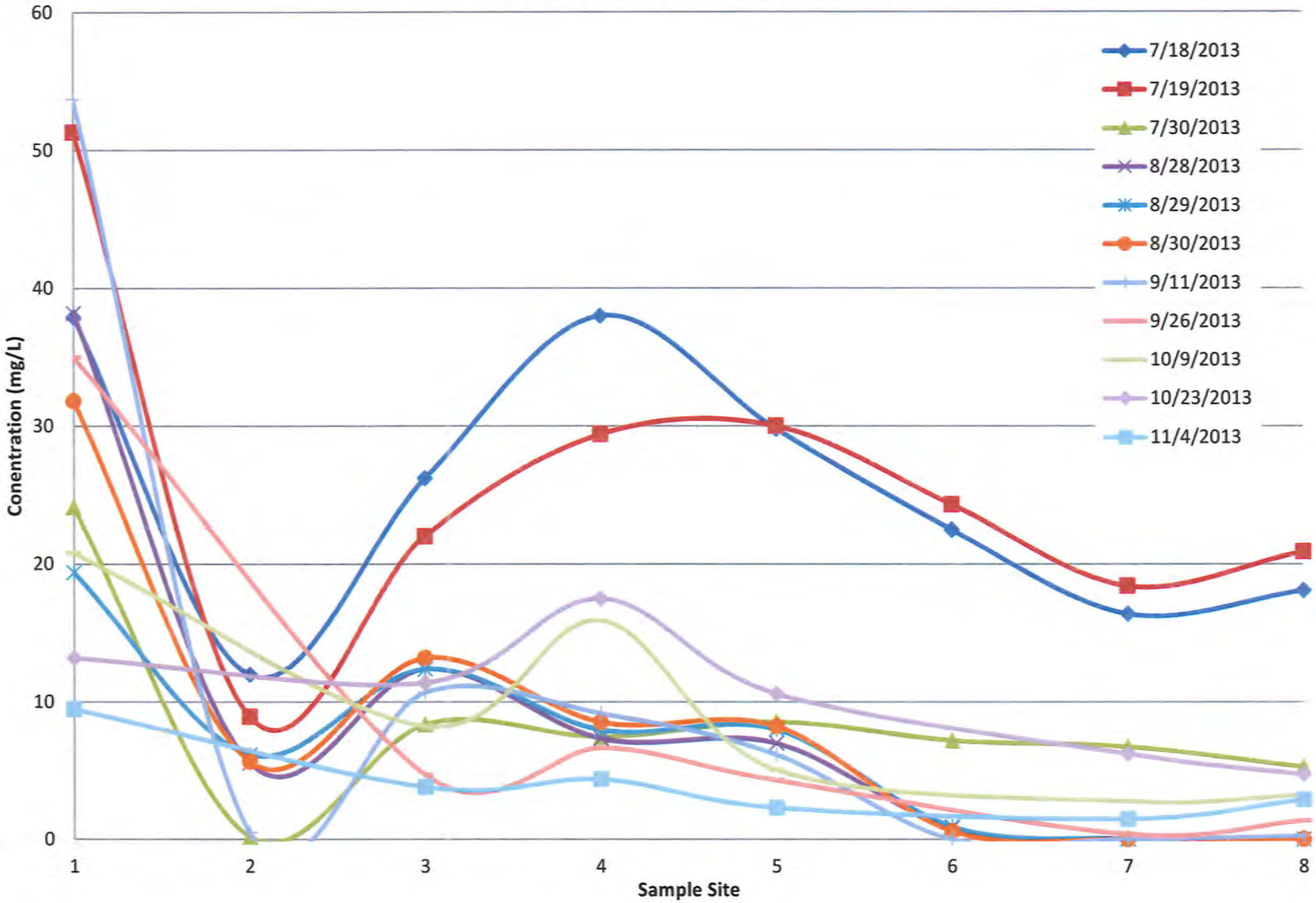


PACE ENGINEERING
REDDING, CALIFORNIA

CITY OF MT. SHASTA
WWTP SAMPLE SCHEDULE

FIGURE 6
DATE: 6/30/13
JOB # 111.44

FIGURE 1
CITY OF MT SHASTA
Ammonia Concentrations



M:\Jobs\0111\0111.44 Wastewater Treatment & Disposal Feasibility Study\MFR Data\MFR Data(1).xlsx

FIGURE 2
CITY OF MT SHASTA
Dissolved Oxygen Concentrations

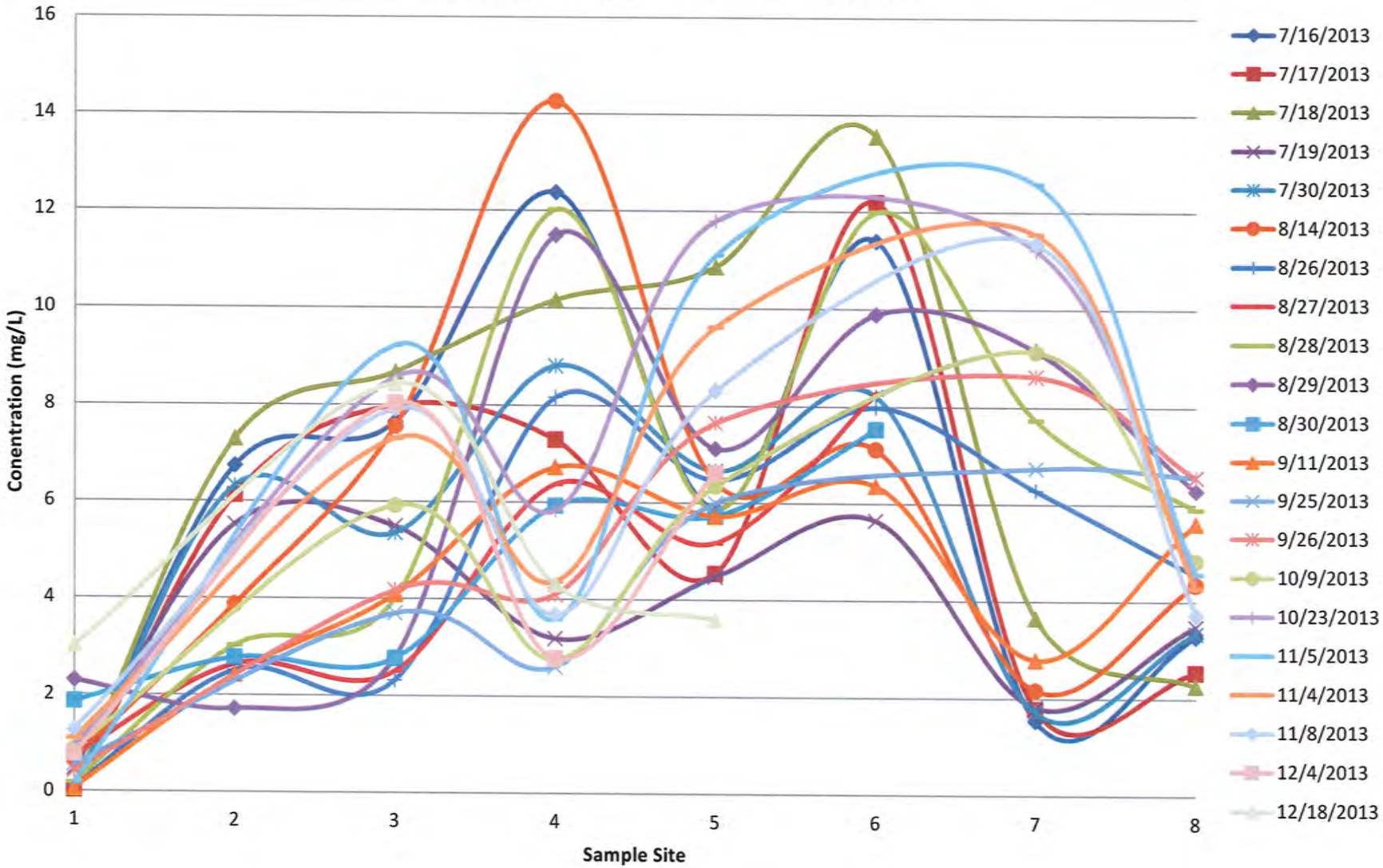


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FIGURE 3
CITY OF MT SHASTA
pH

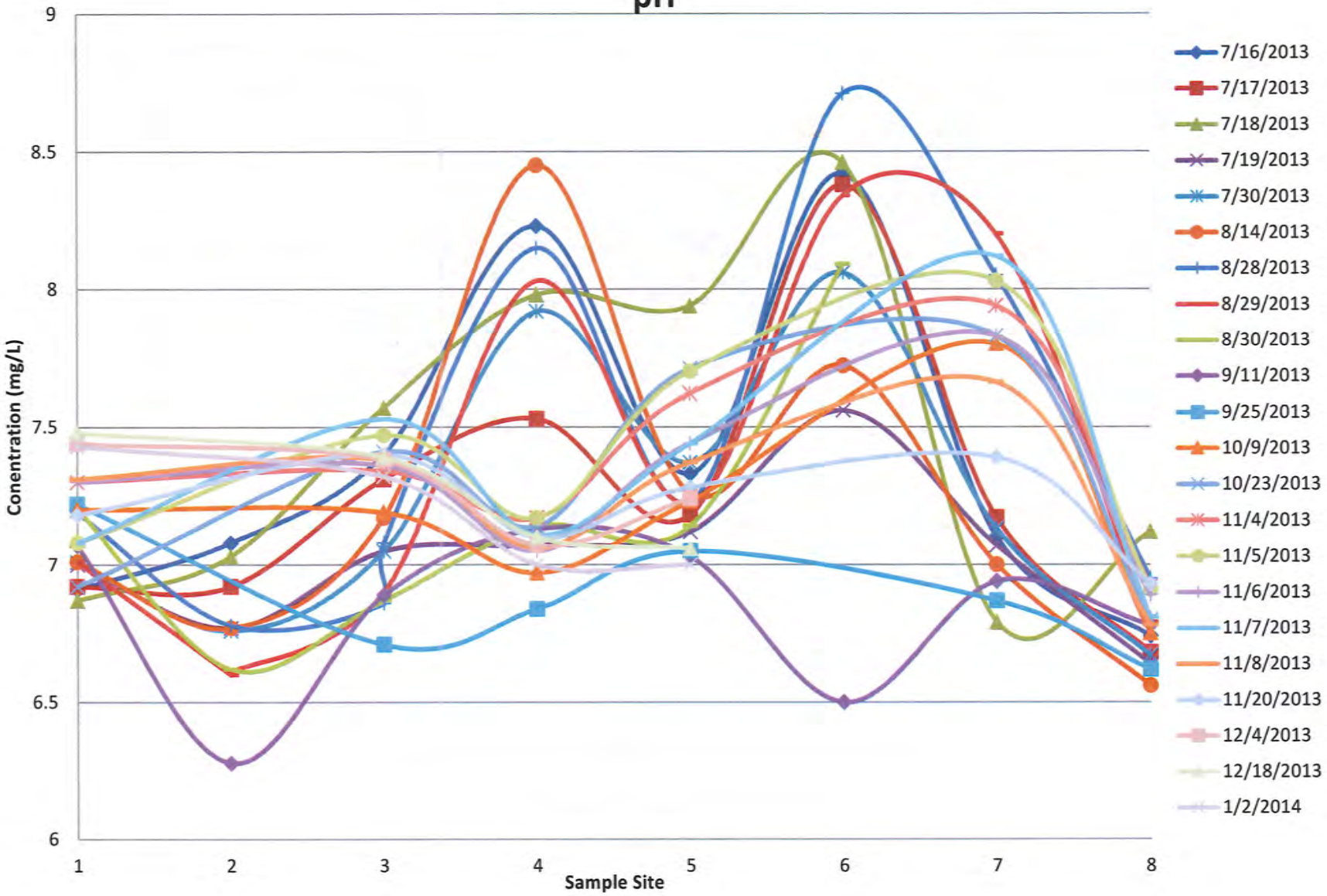

FIGURE 4
CITY OF MT SHASTA
Alkalinity Concentration

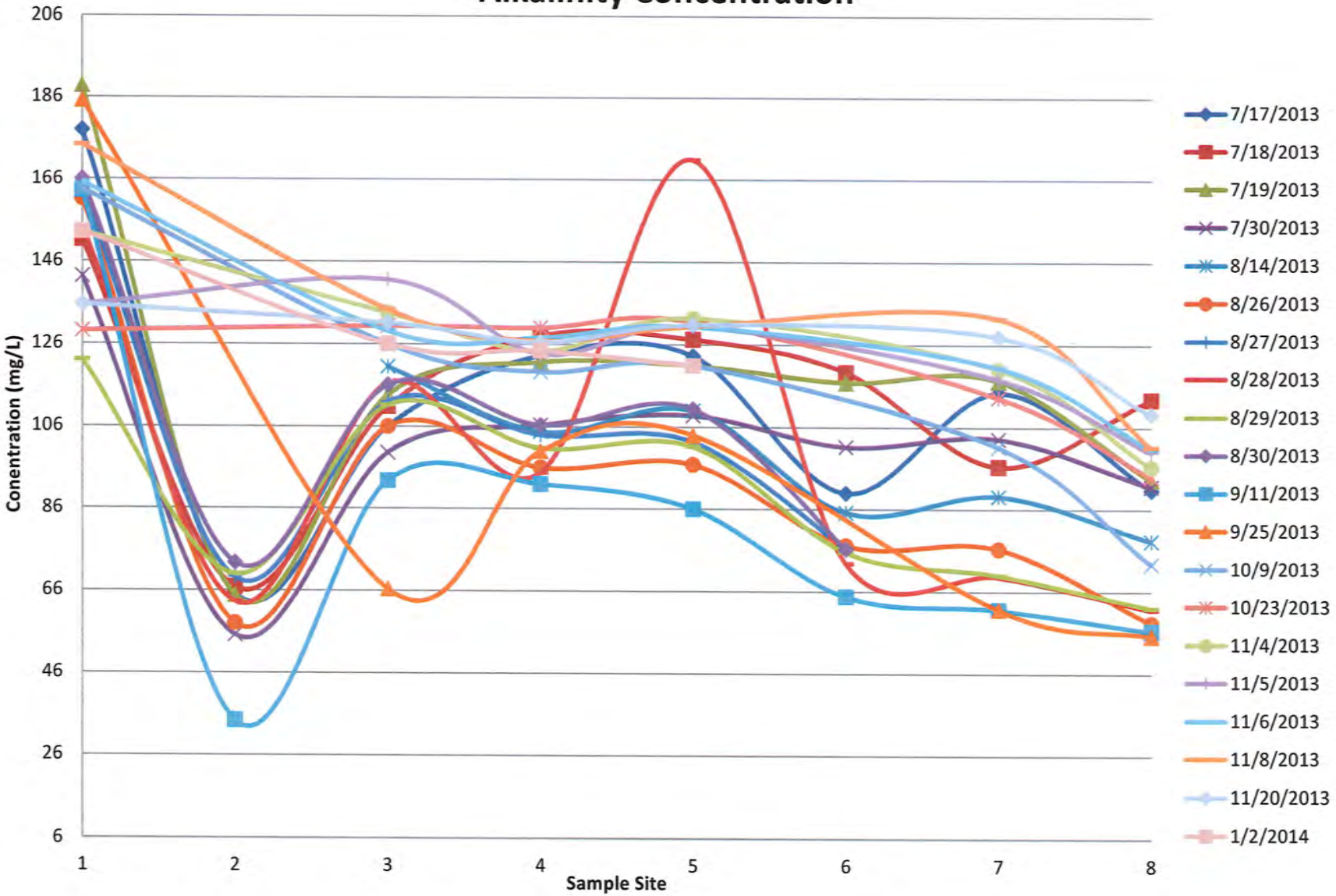

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FIGURE 5
CITY OF MT. SHASTA
Nitrate Concentration

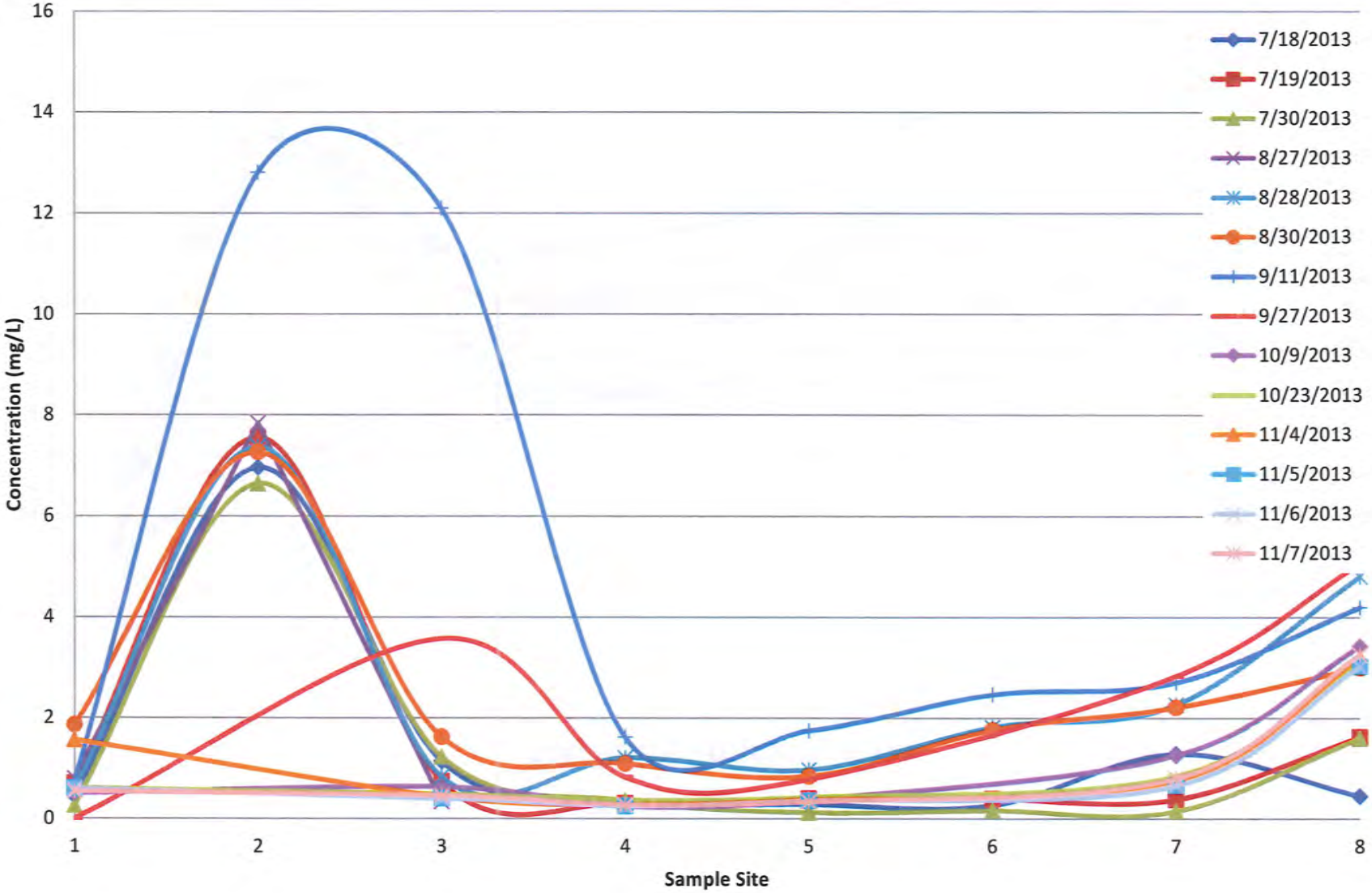


FIGURE 6A
CITY OF MT. SHASTA
Ultraviolet Transmittance

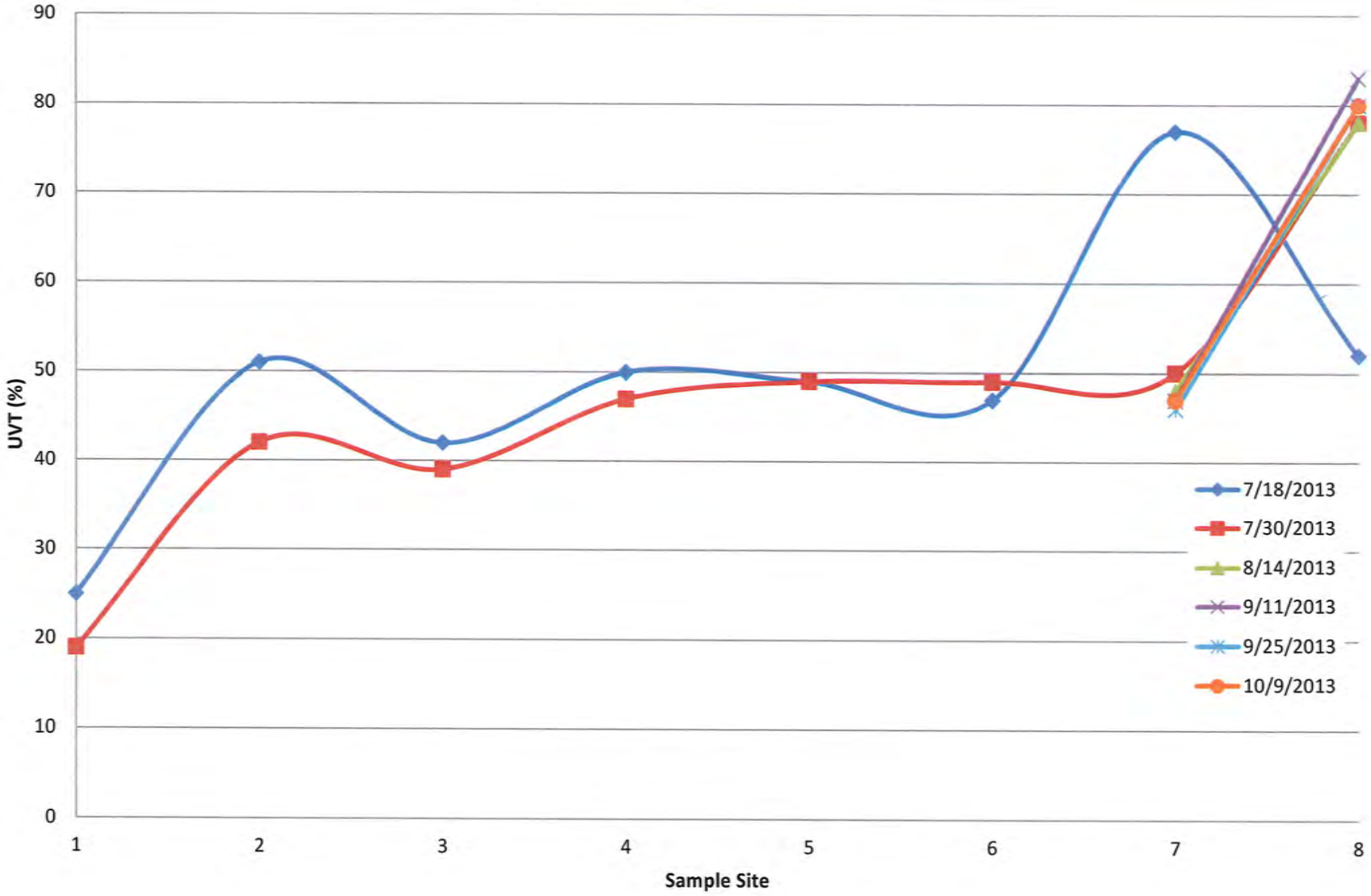
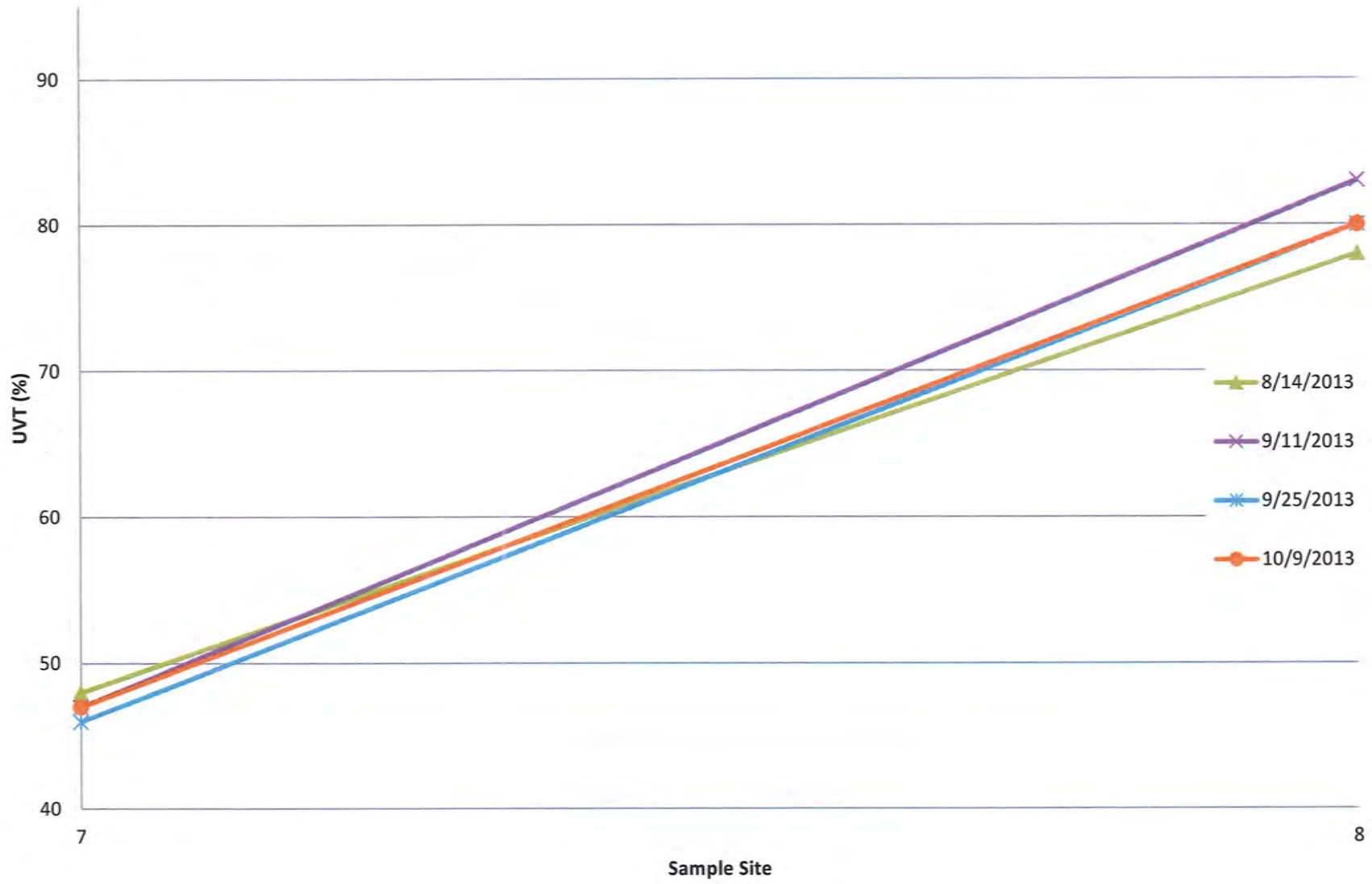


FIGURE 6B
CITY OF MT. SHASTA
Ultraviolet Transmittance



APPENDIX B

City of Mt. Shasta
Operating Budget
2012-2013

City of Mt. Shasta

FUND ACCOUNT GROUP	ADOPTED Budget 2012-13	Prev. Apprvd/Rllovr Budget Adj	Proposed Mid-Year Revision	FINAL Revised Budget	Percent of Budget	
WASTEWATER OPERATIONS FUND						
Beginning Working Capital (July 1) Carryover	**541,022**			**541,022**		
Revenues						
Interest and Rental Revenues	9,300			9,300	1.17%	
Current User Fees	775,850			775,850	97.82%	
Other Miscellaneous Revenues	8,000		5,000	13,000	1.01%	Outside City Reimbursements
Total Revenues	**793,150**	**0**	**5,000**	**798,150**		
Expenditures						
Field System Service						
Salaries and Benefits	55,127			55,127	6.25%	
Employee Related Costs	1,500			1,500	0.17%	
Services-Personal and Professional	4,000			4,000	0.45%	
Insurance, Licenses, and Taxes	5,600			5,600	0.64%	
Facilities Expenses	500			500	0.06%	
Maintenance and Repairs	28,800			28,800	3.27%	
Materials and Supplies	7,600			7,600	0.86%	
Debt Service Expenditure	73,868			73,868	8.38%	
Capital Outlay	25,000			25,000	2.84%	
Administrative Allocation	28,000			28,000	3.18%	
Total System Expenditures	**229,995**	**0**	**0**	**229,995**		
Treatment Plant Operations						
Salaries and Benefits	188,717			188,717	21.41%	
Employee Related Costs	5,450			5,450	0.62%	
Services-Personal and Professional	39,500		78,000	117,500	4.48%	NPEDS permit work, TR evaluation
Insurance, Licenses, and Taxes	23,700			23,700	2.69%	
Facilities Expenses	87,678		500	88,178	9.95%	internet access
Maintenance and Repairs	42,350			42,350	4.80%	
Materials and Supplies	55,650		7,500	63,150	6.31%	plant treatment chemicals
Capital Outlay	123,500		66,500	190,000	14.01%	Chlorine analyser building
Administrative Allocation	85,000			85,000	9.64%	
Total Plant Expenditures	**651,545**	**0**	**152,500**	**804,045**		
Total Wastewater Operations Expenses	**881,540**	**0**	**152,500**	**1,034,040**		
Net Revenues / (Expenditures)	(88,390)	0	(147,500)	(235,890)		
Ending Retained Earnings (June 30) Reserves	**452,632**	**0**	**(147,500)**	**305,132**		
WASTEWATER IMPROVEMENTS FUND						
Beginning Fund Balance (July 1) Carryover	**281,072**			**281,072**		
Revenues						
Interest and Rental Revenues	1,300			1,300	3.39%	
Current User Fees	37,000			37,000	96.61%	
Expenditures						
Services-Personal and Professional;	0			0	0.00%	
Capital Outlay	0			0	0.00%	
Transfers Out to Other Funds	0			0	0.00%	
Net Revenues / (Expenditures)	38,300	0	0	38,300		
Ending Fund Balance (June 30) Reserves	**319,372**	0	0	319,372		
COMBINED SEWER FUNDS BALANCE	**772,004**	0	**(147,500)**	**624,504**		

City of Mt. Shasta

For the Period: 7/1/2012 to 6/30/2013	Original Bud.	Amended Bud.	YTD Actual	CURR MTH	Encumb. YTD	UnencBal	% Bud
Fund: 45 - WasteWater Operations Fund							
Expenditures							
Dept: 250 Utility Plant Operations							
Acct Class: 1PER Personnel Salaries & Benefits							
6001.00 Salaries - Regular Time	93,023.00	93,023.00	90,216.61	7,731.43	0.00	2,806.39	97.0
6003.00 Salaries - Overtime	20,000.00	20,000.00	15,702.66	1,653.54	0.00	4,297.34	78.5
6005.00 Compensated Absences Earned	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6007.00 Salary Diff In Lieu of Benefit	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6009.00 Miscellaneous Labor Cost	0.00	0.00	987.05	987.05	0.00	-987.05	0.0
6010.00 F.I.C.A.	8,646.00	8,646.00	8,579.44	784.51	0.00	66.56	99.2
6015.00 P.E.R.S.	21,765.00	21,765.00	17,772.93	1,519.69	0.00	3,992.07	81.7
6020.00 Worker's Compensation Ins.	18,861.00	18,861.00	22,815.50	2,234.96	0.00	-3,954.50	121.0
6025.00 Health Insurance	26,422.00	26,422.00	26,112.20	2,092.09	0.00	309.80	98.8
Personnel Salaries & Benefits	188,717.00	188,717.00	182,186.39	17,003.27	0.00	6,530.61	96.5
Acct Class: 2EMP Employee Related Costs							
6240.00 Physical Examinations	250.00	250.00	166.00	0.00	0.00	84.00	66.4
6245.00 Employee Recruitment Expense	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6250.00 Employee Training (NonReimb)	4,200.00	4,200.00	300.00	300.00	0.00	3,900.00	7.1
6275.00 Dues and Publications	500.00	500.00	747.00	230.00	0.00	-247.00	149.4
6280.00 Employee Travel & Conference	500.00	500.00	0.00	0.00	0.00	500.00	0.0
Employee Related Costs	5,450.00	5,450.00	1,213.00	530.00	0.00	4,237.00	22.3
Acct Class: 3SVC Services - Personal & Profess							
7100.00 Professional Services	2,000.00	80,000.00	15,948.75	-42,729.75	0.00	64,051.25	19.9
7110.00 Contract Services	2,000.00	2,000.00	52,753.25	52,753.25	0.00	-50,753.25	2637.7
7115.00 Engineering Consultant Svcs	4,000.00	4,000.00	34,057.39	24,501.80	0.00	-30,057.39	851.4
7165.00 Police Dept Security Services	6,500.00	6,500.00	6,823.80	568.65	0.00	-323.80	105.0
7180.00 Contract Labratory Analysis	25,000.00	25,000.00	18,327.17	3,030.29	0.00	6,672.83	73.3
Services - Personal & Profess	39,500.00	117,500.00	127,910.36	38,124.24	0.00	-10,410.36	108.9
Acct Class: 4INS Insurance, Licenses, & Taxes							
7200.00 Public Liability Ins. - SCORE	10,000.00	10,000.00	12,262.00	12,262.00	0.00	-2,262.00	122.6
7220.00 Property Damage Insurance	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7245.00 Self-Insured Deductible Losses	500.00	500.00	0.00	0.00	0.00	500.00	0.0
7250.00 Permits and License	12,000.00	12,000.00	9,162.00	-1,445.00	0.00	2,838.00	76.4
7280.00 County Property Taxes	1,200.00	1,200.00	940.28	0.00	0.00	259.72	78.4
Insurance, Licenses, & Taxes	23,700.00	23,700.00	22,364.28	10,817.00	0.00	1,335.72	94.4
Acct Class: 5FAC Facilities Expenses							
7310.00 Utilities - Elec & Heating Oil	85,000.00	85,000.00	97,630.35	17,174.15	0.00	-12,630.35	114.9
7311.00 Utilities - Security Alarms	978.00	978.00	978.00	81.50	0.00	0.00	100.0
7320.00 Telephone Expense	1,000.00	1,000.00	1,027.79	161.01	0.00	-27.79	102.8
7321.00 Internet Access	700.00	1,200.00	1,300.63	99.95	0.00	-100.63	108.4
Facilities Expenses	87,678.00	88,178.00	100,936.77	17,516.61	0.00	-12,758.77	114.5
Acct Class: 6MNT Maintenance and Repairs							
7410.00 Heavy Equipment Maintenance	500.00	500.00	0.00	0.00	0.00	500.00	0.0
7420.00 Shop Equipment Maintenance	750.00	750.00	63.79	0.00	0.00	686.21	8.5
7430.00 Vehicle Maintenance	1,000.00	1,000.00	443.28	55.11	0.00	556.72	44.3
7435.00 Tires and Chains Maintenance	600.00	600.00	78.92	60.92	0.00	521.08	13.2
7440.00 Fuel and Oil Maintenance	4,000.00	4,000.00	3,608.13	630.77	0.00	391.87	90.2
7460.00 Radio & Communications Maint.	0.00	0.00	85.99	0.00	0.00	-85.99	0.0
7470.00 Building Maintenance	5,000.00	5,000.00	993.32	53.37	0.00	4,006.68	19.9
7475.00 Grounds Maintenance	500.00	500.00	0.39	0.00	0.00	499.61	0.1
7510.00 Plant Repairs & Maintenance	20,000.00	27,000.00	28,641.83	2,559.37	0.00	-1,641.83	106.1
7511.00 DAF Repairs & Maintenance	10,000.00	10,000.00	2,686.37	79.00	0.00	7,313.63	26.9
Maintenance and Repairs	42,350.00	49,350.00	36,602.02	3,438.54	0.00	12,747.98	74.2
Acct Class: 7SUP Materials and Supplies							
7710.00 Office Supplies	1,000.00	1,000.00	1,080.07	85.94	0.00	-80.07	108.0
7740.00 Laboratory Supplies/Equipment	10,000.00	10,000.00	13,524.75	2,576.95	0.00	-3,524.75	135.2
7745.00 Plant Treatment Chemicals	40,000.00	47,500.00	61,497.12	16,159.61	0.00	-13,997.12	129.5

City of Mt. Shasta

For the Period: 7/1/2012 to 6/30/2013	Original Bud.	Amended Bud.	YTD Actual	CURR MTH	Encumb. YTD	UnencBal	% Bud
Fund: 45 - WasteWater Operations Fund							
Expenditures							
Dept: 250 Utility Plant Operations							
Acct Class: 7SUP Materials and Supplies							
7770.00 Janitorial & Cleaning Supplies	150.00	150.00	41.36	0.00	0.00	108.64	27.6
7790.00 Miscellaneous Supplies	500.00	500.00	668.07	130.80	0.00	-168.07	133.6
7810.00 Expensed Equip. <$1000	1,000.00	1,000.00	87.71	0.00	0.00	912.29	8.8
7815.00 Equipment Rentals	1,000.00	1,000.00	579.89	0.00	0.00	420.11	58.0
7820.00 Safety Equipment	1,500.00	1,500.00	3,511.43	27.68	0.00	-2,011.43	234.1
7825.00 Personal Safety Clothing&Maint	500.00	500.00	910.48	0.00	0.00	-410.48	182.1
Materials and Supplies	55,650.00	63,150.00	81,900.88	18,980.98	0.00	-18,750.88	129.7
Acct Class: 90TH Other Miscellaneous Expenses							
8190.00 Depreciation	0.00	0.00	238,003.65	238,003.65	0.00	-238,003.65	0.0
Other Miscellaneous Expenses	0.00	0.00	238,003.65	238,003.65	0.00	-238,003.65	0.0
Acct Class: 95CO Capital Outlay							
8801.00 Capital Outlay	5,000.00	6,400.00	0.00	-4,153.88	0.00	6,400.00	0.0
8820.00 Capital Project Costs	53,500.00	160,000.00	0.00	-66,928.83	0.00	160,000.00	0.0
8821.00 Capital Project Costs II	40,000.00	0.00	0.00	0.00	0.00	0.00	0.0
8822.00 Capital Project Costs III	25,000.00	25,000.00	10,225.80	10,225.80	0.00	14,774.20	40.9
8825.00 Road Construction Projects	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Capital Outlay	123,500.00	191,400.00	10,225.80	-60,856.91	0.00	181,174.20	5.3
Acct Class: 99TR Transfers Out to Other Funds							
8801.00 Administrative Overhead Alloc.	85,000.00	85,000.00	107,025.00	29,112.00	0.00	-22,025.00	125.9
8900.00 Transfers Out to Other Funds	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Transfers Out to Other Funds	85,000.00	85,000.00	107,025.00	29,112.00	0.00	-22,025.00	125.9
Utility Plant Operations	651,545.00	812,445.00	908,368.15	312,669.38	0.00	-95,923.15	111.8
Expenditures	651,545.00	812,445.00	908,368.15	312,669.38	0.00	-95,923.15	111.8
Net Effect for WasteWater Operations Fund	-651,545.00	-812,445.00	-908,368.15	-312,669.38	0.00	95,923.15	111.8
Change in Fund Balance:			0.00				
Grand Total Net Effect:	-651,545.00	-812,445.00	-908,368.15	-312,669.38	0.00	95,923.15	

GENERAL LEDGER REPORT

FROM: 7/1/2011 TO: 6/30/2012
City of Mt. Shasta

11/13/2013
8:55 am

GL #	GL Description	Debit	Credit	
45-250-6001.00	Salaries - Regular Time	90,980.70	8,968.35	82,012.35
45-250-6003.00	Salaries - Overtime	18,204.11	1,867.36	16,336.75
45-250-6005.00	Compensated Absences Earned	1,453.57	2,009.62	-556.05
45-250-6007.00	Salary Diff In Lieu of Benefit	0.00	0.00	0.00
45-250-6009.00	Miscellaneous Labor Cost	419.55	0.00	419.55
45-250-6010.00	F.I.C.A.	8,795.44	879.51	7,915.93
45-250-6015.00	P.E.R.S.	16,953.51	1,631.65	15,321.86
45-250-6020.00	Worker's Compensation Ins.	21,893.64	1,252.48	20,641.16
45-250-6025.00	Health Insurance	28,676.95	3,030.87	25,646.08
45-250-6240.00	Physical Examinations	392.00	0.00	392.00
45-250-6245.00	Employee Recruitment Expense	0.00	0.00	0.00
45-250-6250.00	Employee Training (NonReimb)	1,001.95	90.00	911.95
45-250-6275.00	Dues and Publications	507.00	0.00	507.00
45-250-6280.00	Employee Travel & Conference	368.71	0.00	368.71
45-250-7100.00	Professional Services	14,201.04	0.00	14,201.04
45-250-7110.00	Contract Services	0.00	0.00	0.00
45-250-7115.00	Engineering Consultant Svcs	1,233.09	0.00	1,233.09
45-250-7165.00	Police Dept Security Services	7,392.45	568.65	6,823.80
45-250-7180.00	Contract Labratory Analysis	14,380.13	0.00	14,380.13
45-250-7200.00	Public Liability Ins. - SCORE	9,035.00	0.00	9,035.00
45-250-7220.00	Property Damage Insurance	0.00	0.00	0.00
45-250-7245.00	Self-Insured Deductible Losses	0.00	0.00	0.00
45-250-7250.00	Permits and License	9,162.00	0.00	9,162.00
45-250-7280.00	County Property Taxes	1,197.68	0.00	1,197.68
45-250-7310.00	Utilities - Elec & Heating Oil	100,168.73	0.00	100,168.73
45-250-7311.00	Utilities - Security Alarms	978.00	0.00	978.00
45-250-7320.00	Telephone Expense	1,394.87	0.00	1,394.87
45-250-7321.00	Internet Access	665.98	0.00	665.98
45-250-7410.00	Heavy Equipment Maintenance	0.00	0.00	0.00
45-250-7420.00	Shop Equipment Maintenance	252.91	0.00	252.91
45-250-7430.00	Vehicle Maintenance	499.45	69.87	429.58
45-250-7435.00	Tires and Chains Maintenance	0.00	0.00	0.00

FROM: 7/1/2011 TO: 6/30/2012
City of Mt. Shasta

GL #	GL Description	Debit	Credit	
45-250-7440.00	Fuel and Oil Maintenance	3,932.36	0.00	3,932.36
45-250-7460.00	Radio & Communications Maint.	41.43	0.00	41.43
45-250-7470.00	Building Maintenance	1,045.58	80.44	965.14
45-250-7475.00	Grounds Maintenance	271.13	0.00	271.13
45-250-7510.00	Plant Repairs & Maintenance	11,772.80	0.00	11,772.80
45-250-7511.00	DAF Repairs & Maintenance	10,337.31	0.00	10,337.31
45-250-7710.00	Office Supplies	1,284.37	0.00	1,284.37
45-250-7740.00	Laboratory Supplies/Equipment	7,296.83	176.45	7,120.38
45-250-7745.00	Plant Treatment Chemicals	50,849.94	10,100.00	40,749.94
45-250-7770.00	Janitorial & Cleaning Supplies	103.97	0.00	103.97
45-250-7790.00	Miscellaneous Supplies	602.91	0.00	602.91
45-250-7810.00	Expensed Equip. <$1000	1,147.63	0.00	1,147.63
45-250-7815.00	Equipment Rentals	270.20	0.00	270.20
45-250-7820.00	Safety Equipment	468.46	0.00	468.46
45-250-7825.00	Personal Safety Clothing&Maint	622.10	39.98	582.12
45-250-8190.00	Depreciation	405,719.54	172,689.25	233,030.29
45-250-8801.00	Capital Outlay	10,133.79	10,133.79	0.00
45-250-8820.00	Capital Project Costs	1,326.71	1,326.71	0.00
45-250-8821.00	Capital Project Costs II	117,557.52	117,557.52	0.00
45-250-8822.00	Capital Project Costs III	0.00	0.00	0.00
45-250-8825.00	Road Construction Projects	0.00	0.00	0.00
45-250-9801.00	Administrative Overhead Alloc.	194,939.00	92,079.00	102,860.00
45-250-9900.00	Transfers Out to Other Funds	0.00	0.00	0.00
	Fund: 45 - WasteWater Operations Fund Totals:	1,169,932.04	424,551.50	
	Grand Totals:	1,169,932.04	424,551.50	

GENERAL LEDGER REPORT

FROM: 7/1/2010 TO: 6/30/2011
City of Mt. Shasta

GL #	GL Description	Debit	Credit	
45-250-6001.00	Salaries - Regular Time	83,236.99	0.00	83,236.99
45-250-6003.00	Salaries - Overtime	22,878.48	0.00	22,878.48
45-250-6005.00	Compensated Absences Earned	1,521.07	0.00	1,521.07
45-250-6007.00	Salary Diff In Lieu of Benefit	0.00	0.00	0.00
45-250-6009.00	Miscellaneous Labor Cost	0.00	0.00	0.00
45-250-6010.00	F.I.C.A.	8,440.02	0.00	8,440.02
45-250-6015.00	P.E.R.S.	15,007.74	0.00	15,007.74
45-250-6020.00	Worker's Compensation Ins.	13,310.88	0.00	13,310.88
45-250-6025.00	Health Insurance	25,983.48	0.00	25,983.48
45-250-6240.00	Physical Examinations	0.00	0.00	0.00
45-250-6245.00	Employee Recruitment Expense	0.00	0.00	0.00
45-250-6250.00	Employee Training (NonReimb)	876.00	0.00	876.00
45-250-6275.00	Dues and Publications	807.79	0.00	807.79
45-250-6280.00	Employee Travel & Conference	863.78	0.00	863.78
45-250-7100.00	Professional Services	23,496.00	0.00	23,496.00
45-250-7110.00	Contract Services	0.00	0.00	0.00
45-250-7115.00	Engineering Consultant Svcs	1,511.25	0.00	1,511.25
45-250-7165.00	Police Dept Security Services	7,318.74	562.98	6,755.76
45-250-7180.00	Contract Labratory Analysis	32,180.96	0.00	32,180.96
45-250-7200.00	Public Liability Ins. - SCORE	17,216.00	0.00	17,216.00
45-250-7220.00	Property Damage Insurance	0.00	0.00	0.00
45-250-7245.00	Self-Insured Deductible Losses	0.00	0.00	0.00
45-250-7250.00	Permits and License	7,521.00	0.00	7,521.00
45-250-7280.00	County Property Taxes	1,197.68	0.00	1,197.68
45-250-7310.00	Utilities - Elec & Heating Oil	96,790.10	0.00	96,790.10
45-250-7311.00	Utilities - Security Alarms	978.00	0.00	978.00
45-250-7320.00	Telephone Expense	1,395.53	44.72	1,350.81
45-250-7321.00	Internet Access	465.15	0.00	465.15
45-250-7410.00	Heavy Equipment Maintenance	0.00	0.00	0.00
45-250-7420.00	Shop Equipment Maintenance	350.17	0.00	350.17
45-250-7430.00	Vehicle Maintenance	818.08	27.06	791.02
45-250-7435.00	Tires and Chains Maintenance	554.95	0.00	554.95

GL #	GL Description	Debit	Credit	
45-250-7440.00	Fuel and Oil Maintenance	4,000.33	0.00	4,000.33
45-250-7460.00	Radio & Communications Maint.	0.00	0.00	0.00
45-250-7470.00	Building Maintenance	5,748.45	0.00	5,748.45
45-250-7475.00	Grounds Maintenance	549.32	0.00	549.32
45-250-7510.00	Plant Repairs & Maintenance	31,316.70	244.25	31,072.45
45-250-7511.00	DAF Repairs & Maintenance	10,750.26	0.00	10,750.26
45-250-7710.00	Office Supplies	1,490.77	0.00	1,490.77
45-250-7740.00	Laboratory Supplies/Equipment	10,393.65	0.00	10,393.65
45-250-7745.00	Plant Treatment Chemicals	52,160.35	17,000.00	35,160.35
45-250-7770.00	Janitorial & Cleaning Supplies	15.09	0.00	15.09
45-250-7790.00	Miscellaneous Supplies	545.48	0.00	545.48
45-250-7810.00	Expensed Equip. <$1000	474.00	10.83	463.17
45-250-7815.00	Equipment Rentals	1,130.00	0.00	1,130.00
45-250-7820.00	Safety Equipment	236.18	0.00	236.18
45-250-7825.00	Personal Safety Clothing&Maint	538.27	80.99	457.28
45-250-8190.00	Depreciation	0.00	0.00	0.00
45-250-8801.00	Capital Outlay	9,191.10	9,191.10	0.00
45-250-8820.00	Capital Project Costs	2,593.67	2,593.67	0.00
45-250-8821.00	Capital Project Costs II	0.00	0.00	0.00
45-250-8822.00	Capital Project Costs III	0.00	0.00	0.00
45-250-8825.00	Road Construction Projects	0.00	0.00	0.00
45-250-9801.00	Administrative Overhead Alloc.	178,222.00	87,000.00	91,222.00
45-250-9900.00	Transfers Out to Other Funds	0.00	0.00	0.00
	Fund: 45 - WasteWater Operations Fund Totals:	674,075.46	116,755.60	
	Grand Totals:	674,075.46	116,755.60	

GENERAL LEDGER REPORT

FROM: 7/1/2009 TO: 6/30/2010
City of Mt. Shasta

GL #	GL Description	Debit	Credit	
45-250-6001.00	Salaries - Regular Time	56,185.47	1.52	56,183.95
45-250-6003.00	Salaries - Overtime	26,086.92	0.00	26,086.92
45-250-6005.00	Compensated Absences Earned	912.47	538.54	373.93
45-250-6007.00	Salary Diff In Lieu of Benefit	0.00	0.00	0.00
45-250-6009.00	Miscellaneous Labor Cost	18,960.00	0.00	18,960.00
45-250-6010.00	F.I.C.A.	6,870.57	0.00	6,870.57
45-250-6015.00	P.E.R.S.	10,068.81	0.00	10,068.81
45-250-6020.00	Worker's Compensation Ins.	9,600.56	0.00	9,600.56
45-250-6025.00	Health Insurance	20,352.17	0.00	20,352.17
45-250-6240.00	Physical Examinations	76.00	76.00	0.00
45-250-6245.00	Employee Recruitment Expense	490.92	0.00	490.92
45-250-6250.00	Employee Training (NonReimb)	223.90	0.00	223.90
45-250-6275.00	Dues and Publications	132.00	0.00	132.00
45-250-6280.00	Employee Travel & Conference	0.00	0.00	0.00
45-250-7100.00	Professional Services	5,163.00	82.00	5,081.00
45-250-7110.00	Contract Services	0.00	0.00	0.00
45-250-7115.00	Engineering Consultant Svcs	52,585.50	0.00	52,585.50
45-250-7165.00	Police Dept Security Services	5,624.16	0.00	5,624.16
45-250-7180.00	Contract Labratory Analysis	13,170.73	358.00	12,812.73
45-250-7200.00	Public Liability Ins. - SCORE	15,387.00	0.00	15,387.00
45-250-7220.00	Property Damage Insurance	0.00	0.00	0.00
45-250-7245.00	Self-Insured Deductible Losses	0.00	0.00	0.00
45-250-7250.00	Permits and License	7,158.00	0.00	7,158.00
45-250-7280.00	County Property Taxes	1,173.70	0.00	1,173.70
45-250-7310.00	Utilities - Elec & Heating Oil	87,889.10	1,291.73	86,597.37
45-250-7311.00	Utilities - Security Alarms	1,091.75	0.00	1,091.75
45-250-7320.00	Telephone Expense	1,320.67	0.00	1,320.67
45-250-7321.00	Internet Access	406.56	0.00	406.56
45-250-7410.00	Heavy Equipment Maintenance	0.00	0.00	0.00
45-250-7420.00	Shop Equipment Maintenance	305.92	0.00	305.92
45-250-7430.00	Vehicle Maintenance	1,038.16	87.13	951.03
45-250-7435.00	Tires and Chains Maintenance	12.50	0.00	12.50

FROM: 7/1/2009 TO: 6/30/2010
City of Mt. Shasta

GL #	GL Description	Debit	Credit	
45-250-7440.00	Fuel and Oil Maintenance	1,789.94	0.00	1,789.94
45-250-7460.00	Radio & Communications Maint.	0.00	0.00	0.00
45-250-7470.00	Building Maintenance	1,666.48	0.00	1,666.48
45-250-7475.00	Grounds Maintenance	132.36	0.00	132.36
45-250-7510.00	Plant Repairs & Maintenance	17,292.11	126.74	17,165.37
45-250-7511.00	DAF Repairs & Maintenance	7,346.17	0.00	7,346.17
45-250-7710.00	Office Supplies	786.79	0.00	786.79
45-250-7740.00	Laboratory Supplies/Equipment	11,443.29	320.12	11,123.17
45-250-7745.00	Plant Treatment Chemicals	40,718.69	3,000.00	37,718.69
45-250-7770.00	Janitorial & Cleaning Supplies	48.03	0.00	48.03
45-250-7790.00	Miscellaneous Supplies	612.11	0.00	612.11
45-250-7810.00	Expensed Equip. <$1000	304.48	0.00	304.48
45-250-7815.00	Equipment Rentals	0.00	0.00	0.00
45-250-7820.00	Safety Equipment	561.56	0.00	561.56
45-250-7825.00	Personal Safety Clothing&Maint	564.58	0.00	564.58
45-250-8190.00	Depreciation	208,269.00	0.00	208,269.00
45-250-8801.00	Capital Outlay	297.94	28.13	269.81
45-250-8820.00	Capital Project Costs	0.00	0.00	0.00
45-250-8821.00	Capital Project Costs II	10,087.45	9,800.05	287.40
45-250-8822.00	Capital Project Costs III	0.00	0.00	0.00
45-250-8825.00	Road Construction Projects	0.00	0.00	0.00
45-250-9801.00	Administrative Overhead Alloc.	176,855.00	87,000.00	89,855.00
45-250-9900.00	Transfers Out to Other Funds	0.00	0.00	0.00
	Fund: 45 - WasteWater Operations Fund Totals:	821,062.52	102,709.96	
	Grand Totals:	821,062.52	102,709.96	

GENERAL LEDGER REPORT

FROM: 7/1/2008 TO: 6/30/2009
City of Mt. Shasta

GL #	GL Description	Debit	Credit	
45-250-6001.00	Salaries - Regular Time	80,235.59	0.00	80,235.59
45-250-6003.00	Salaries - Overtime	20,797.67	0.00	20,797.67
45-250-6005.00	Compensated Absences Earned	0.00	2,189.85	-2,189.85
45-250-6007.00	Salary Diff In Lieu of Benefit	0.00	0.00	0.00
45-250-6009.00	Miscellaneous Labor Cost	0.00	0.00	0.00
45-250-6010.00	F.I.C.A.	8,666.32	0.00	8,666.32
45-250-6015.00	P.E.R.S.	14,760.78	0.00	14,760.78
45-250-6020.00	Worker's Compensation Ins.	9,549.82	0.00	9,549.82
45-250-6025.00	Health Insurance	28,869.45	0.00	28,869.45
45-250-6240.00	Physical Examinations	150.00	0.00	150.00
45-250-6245.00	Employee Recruitment Expense	885.00	0.00	885.00
45-250-6250.00	Employee Training (NonReimb)	640.00	0.00	640.00
45-250-6275.00	Dues and Publications	410.00	0.00	410.00
45-250-6280.00	Employee Travel & Conference	294.87	0.00	294.87
45-250-7100.00	Professional Services	1,274.50	0.00	1,274.50
45-250-7110.00	Contract Services	0.00	0.00	0.00
45-250-7115.00	Engineering Consultant Svcs	12,990.25	1,845.00	11,145.25
45-250-7165.00	Police Dept Security Services	6,515.04	0.00	6,515.04
45-250-7180.00	Contract Labratory Analysis	12,848.02	1.05	12,846.97
45-250-7200.00	Public Liability Ins. - SCORE	12,230.00	0.00	12,230.00
45-250-7220.00	Property Damage Insurance	0.00	0.00	0.00
45-250-7245.00	Self-Insured Deductible Losses	0.00	0.00	0.00
45-250-7250.00	Permits and License	6,595.00	0.00	6,595.00
45-250-7280.00	County Property Taxes	1,153.46	0.00	1,153.46
45-250-7310.00	Utilities - Elec & Heating Oil	72,336.67	0.00	72,336.67
45-250-7311.00	Utilities - Security Alarms	1,002.00	0.00	1,002.00
45-250-7320.00	Telephone Expense	1,388.94	13.53	1,375.41
45-250-7321.00	Internet Access	0.00	0.00	0.00
45-250-7410.00	Heavy Equipment Maintenance	5.31	0.00	5.31
45-250-7420.00	Shop Equipment Maintenance	1,535.84	0.00	1,535.84
45-250-7430.00	Vehicle Maintenance	371.74	27.04	344.70
45-250-7435.00	Tires and Chains Maintenance	772.28	0.00	772.28

FROM: 7/1/2008 TO: 6/30/2009
City of Mt. Shasta

GL #	GL Description	Debit	Credit	
45-250-7440.00	Fuel and Oil Maintenance	3,887.33	0.00	3,887.33
45-250-7460.00	Radio & Communications Maint.	0.00	0.00	0.00
45-250-7470.00	Building Maintenance	1,863.00	0.00	1,863.00
45-250-7475.00	Grounds Maintenance	1,048.02	0.00	1,048.02
45-250-7510.00	Plant Repairs & Maintenance	29,753.30	13,678.42	16,074.88
45-250-7511.00	DAF Repairs & Maintenance	0.00	0.00	0.00
45-250-7710.00	Office Supplies	961.52	0.00	961.52
45-250-7740.00	Laboratory Supplies/Equipment	10,382.96	257.63	10,125.33
45-250-7745.00	Plant Treatment Chemicals	48,107.54	0.00	48,107.54
45-250-7770.00	Janitorial & Cleaning Supplies	0.00	0.00	0.00
45-250-7790.00	Miscellaneous Supplies	648.16	0.00	648.16
45-250-7810.00	Expensed Equip. <$1000	980.55	0.00	980.55
45-250-7815.00	Equipment Rentals	163.30	0.00	163.30
45-250-7820.00	Safety Equipment	258.27	0.00	258.27
45-250-7825.00	Personal Safety Clothing&Maint	684.26	0.00	684.26
45-250-8190.00	Depreciation	201,214.67	0.00	201,214.67
45-250-8801.00	Capital Outlay	35,062.78	34,128.15	934.63
45-250-8820.00	Capital Project Costs	17,002.77	2,186.00	14,816.77
45-250-8821.00	Capital Project Costs II	0.00	0.00	0.00
45-250-8822.00	Capital Project Costs III	824.07	0.00	824.07
45-250-8825.00	Road Construction Projects	0.00	0.00	0.00
45-250-9801.00	Administrative Overhead Alloc.	176,662.00	84,696.00	91,966.00
45-250-9900.00	Transfers Out to Other Funds	0.00	0.00	0.00
	Fund: 45 - WasteWater Operations Fund Totals:	825,783.05	139,022.67	
	Grand Totals:	825,783.05	139,022.67	

GENERAL LEDGER REPORT

FROM: 7/1/2007 TO: 6/30/2008
City of Mt. Shasta

GL #	GL Description	Debit	Credit	
45-250-6001.00	Salaries - Regular Time	85,342.85	58.61	85,284.24
45-250-6003.00	Salaries - Overtime	20,973.90	0.00	20,973.90
45-250-6005.00	Compensated Absences Earned	1,837.58	1,960.75	-123.17
45-250-6007.00	Salary Diff In Lieu of Benefit	0.00	0.00	0.00
45-250-6009.00	Miscellaneous Labor Cost	0.00	0.00	0.00
45-250-6010.00	F.I.C.A.	8,977.50	4.48	8,973.02
45-250-6015.00	P.E.R.S.	15,690.94	20.98	15,669.96
45-250-6020.00	Worker's Compensation Ins.	8,877.87	0.00	8,877.87
45-250-6025.00	Health Insurance	30,219.17	0.00	30,219.17
45-250-6240.00	Physical Examinations	75.00	0.00	75.00
45-250-6245.00	Employee Recruitment Expense	0.00	0.00	0.00
45-250-6250.00	Employee Training (NonReimb)	195.00	0.00	195.00
45-250-6275.00	Dues and Publications	110.00	0.00	110.00
45-250-6280.00	Employee Travel & Conference	14.97	0.00	14.97
45-250-7100.00	Professional Services	750.00	0.00	750.00
45-250-7110.00	Contract Services	720.00	0.00	720.00
45-250-7115.00	Engineering Consultant Svcs	4,850.21	0.00	4,850.21
45-250-7165.00	Police Dept Security Services	6,515.04	0.00	6,515.04
45-250-7180.00	Contract Labratory Analysis	10,261.95	0.00	10,261.95
45-250-7200.00	Public Liability Ins. - SCORE	10,748.00	0.00	10,748.00
45-250-7220.00	Property Damage Insurance	0.00	0.00	0.00
45-250-7245.00	Self-Insured Deductible Losses	0.00	0.00	0.00
45-250-7250.00	Permits and License	8,809.00	0.00	8,809.00
45-250-7280.00	County Property Taxes	1,138.30	0.00	1,138.30
45-250-7310.00	Utilities - Elec & Heating Oil	67,345.97	0.00	67,345.97
45-250-7311.00	Utilities - Security Alarms	978.00	0.00	978.00
45-250-7320.00	Telephone Expense	1,903.11	30.80	1,872.31
45-250-7321.00	Internet Access	0.00	0.00	0.00
45-250-7410.00	Heavy Equipment Maintenance	0.00	0.00	0.00
45-250-7420.00	Shop Equipment Maintenance	2,013.22	0.00	2,013.22
45-250-7430.00	Vehicle Maintenance	875.54	0.00	875.54
45-250-7435.00	Tires and Chains Maintenance	0.00	0.00	0.00

GENERAL LEDGER REPORT

FROM: 7/1/2007 TO: 6/30/2008
City of Mt. Shasta

GL #	GL Description	Debit	Credit	
45-250-7440.00	Fuel and Oil Maintenance	6,291.44	0.00	6,291.44
45-250-7460.00	Radio & Communications Maint.	0.00	0.00	0.00
45-250-7470.00	Building Maintenance	3,254.29	83.60	3,170.69
45-250-7475.00	Grounds Maintenance	15.51	0.00	15.51
45-250-7510.00	Plant Repairs & Maintenance	38,855.15	1,350.30	37,504.85
45-250-7511.00	DAF Repairs & Maintenance	0.00	0.00	0.00
45-250-7710.00	Office Supplies	656.24	0.00	656.24
45-250-7740.00	Laboratory Supplies/Equipment	9,435.61	452.36	8,983.25
45-250-7745.00	Plant Treatment Chemicals	38,020.45	4,578.27	33,442.18
45-250-7770.00	Janitorial & Cleaning Supplies	117.84	0.00	117.84
45-250-7790.00	Miscellaneous Supplies	1,272.21	0.00	1,272.21
45-250-7810.00	Expensed Equip. <$1000	1,041.50	20.59	1,020.91
45-250-7815.00	Equipment Rentals	331.36	0.00	331.36
45-250-7820.00	Safety Equipment	0.00	0.00	0.00
45-250-7825.00	Personal Safety Clothing&Maint	1,079.55	0.00	1,079.55
45-250-8190.00	Depreciation	177,684.07	0.00	177,684.07
45-250-8801.00	Capital Outlay	690.69	0.00	690.69
45-250-8820.00	Capital Project Costs	24,191.69	2,779.55	21,412.14
45-250-8821.00	Capital Project Costs II	83,644.51	1,751.09	81,893.42
45-250-8822.00	Capital Project Costs III	26,416.90	26,416.90	0.00
45-250-8825.00	Road Construction Projects	0.00	0.00	0.00
45-250-9801.00	Administrative Overhead Alloc.	168,844.00	81,000.00	87,844.00
45-250-9900.00	Transfers Out to Other Funds	0.00	0.00	0.00
	Fund: 45 - WasteWater Operations Fund Totals:	871,066.13	120,508.28	
	Grand Totals:	871,066.13	120,508.28	

APPENDIX C

APPENDIX D

CITY OF MT. SHASTA
WATER AND WASTEWATER RATES

Description	Rates	Charge for Additional Units	
SEWER RATES			
Single Family Residence Includes Duplex,Triplex, Condo & Mobile	23.95	21.34	
1 Bedroom Apartment	17.10	10.26	
2 Bedroom Apartment	19.70	12.84	
3 Bedroom Apartment	22.24	15.40	
Car Wash - Commercial	101.23	98.63	
Commercial - Hi Volume	41.72	39.12	
Campground/RV Park	9.67	2.83	
Retail Commercial	27.35	24.76	
School - Elem. No Shower	7.62	0.78	/pupil
Gas Station	41.70	39.12	
Gas Station w/ Food Svc Also use for Bars	58.80	56.22	
Hospital	18.54	11.70	/bed
School - High w/ Showers	8.03	1.19	/pupil
Laundromat - Commercial	32.82	25.99	/2 machi
Hotel/Motel	16.28	9.44	/room
Office - Commercial	21.55	21.55	
Residential Care Facility	12.86	6.02	/bed
Restaurant	9.37	2.53	/seat
Public Showers	11.35	11.35	/shower
Theater	7.01	0.17	/seat
Extra Comm or Office Employees		1.24	/ea ovr 12
WATER RATES			
Single Family Residence Includes Duplex,Triplex, Condo & Mobile	18.35 -	15.32 -	

1 Bedroom Apartment	11.39	11.39	
2 Bedroom Apartment	13.78	13.78	
3 Bedroom Apartment	16.15	16.15	
Barber & Beauty Shops	23.87	5.51	/chair
Car Wash - Commercial	36.72	36.72	
Campground/RV Park	5.51	5.51	/space
Retail Commercial	24.42	24.42	
Commercial - Low Volume	18.36	18.36	
School - Elem. No Shower	5.51	5.51	/10 pupils
Gas Station	36.72	18.36	
Gas Station w/ Food Svc	45.90	18.36	
Hospital	33.05	9.18	/bed
School - High w/ Showers	9.18	9.18	/10 pupils
Laundromat - Commercial	9.18	9.18	/machine
Hotel/Motel	5.51	5.51	/room
Office - Commercial	18.36	18.36	
Residential Care Facility	4.60	4.60	
Restaurant	48.30	24.43	
Public Showers	22.96	22.96	/shower
Theater	20.76	0.05	/seat
Extra Comm or Office Employees	-	1.84	/ea ovr 12

Dinner Only	.5 X seats
Fast Food - no dishes	.6 X seats
Outdoor Seating	.25 X seats

Garbage Rate	$10.00
Each Additional Can	$4.50

APPENDIX E

LAWRENCE
& ASSOCIATES
ENGINEERS & GEOLOGISTS

013015.01, T2

February 27, 2014

Mr. Rod Bryan
Public Works Director
City of Mount Shasta
305 North Mt. Shasta Boulevard
Mt. Shasta, CA 96067

Dear Mr. Bryan:

SUBJECT: LEACHFIELD DESIGN EVALUATION, MT. SHASTA CITY WASTEWATER LEACHFIELD, SISKIYOU COUNTY, CALIFORNIA

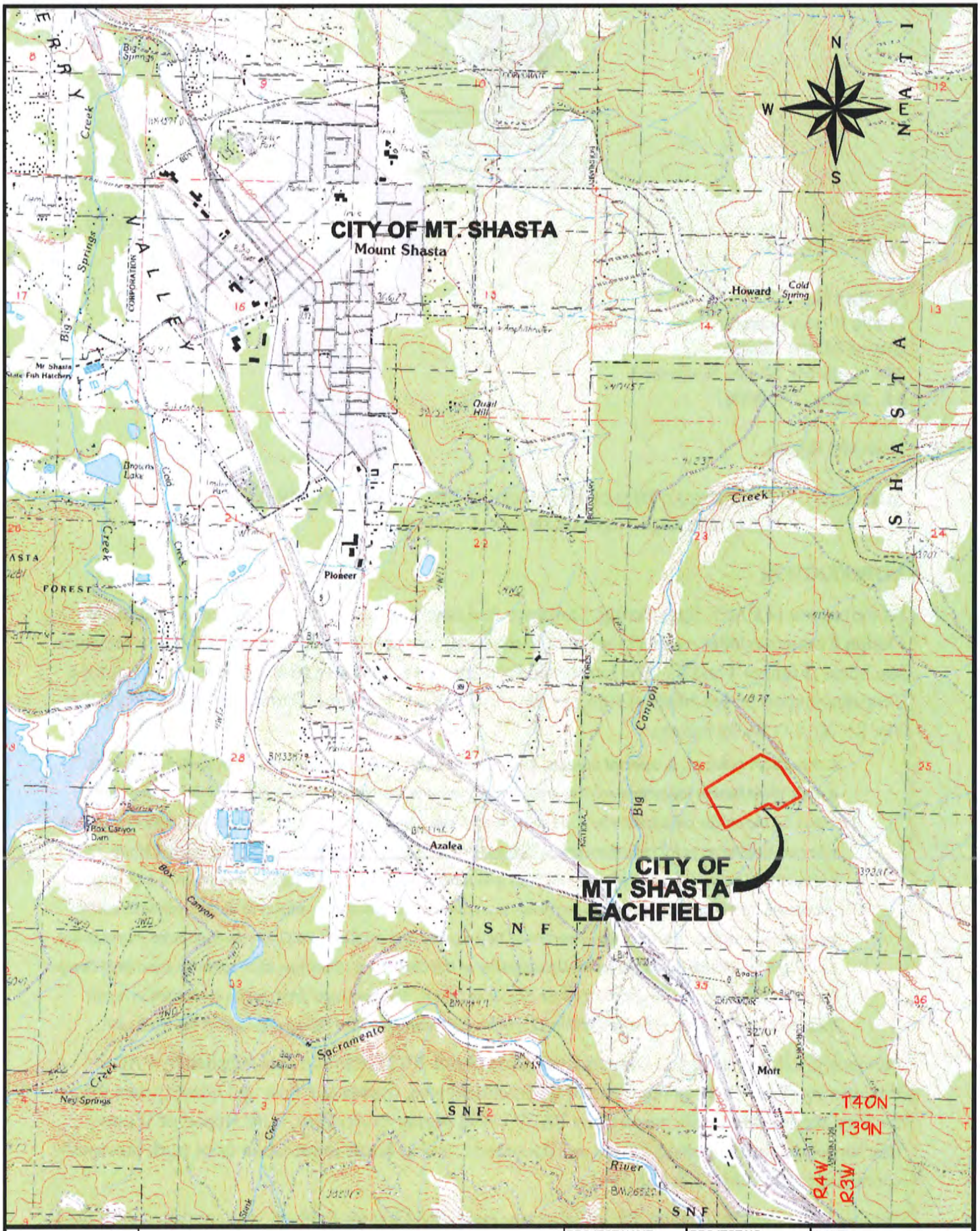
INTRODUCTION

At the request of PACE Engineering, Lawrence & Associates (L&A) has prepared this Leachfield Design Evaluation letter report (Leachfield Evaluation) for the City of Mt. Shasta's (City) wastewater leachfield (**Figures 1** and **2**). The Leachfield Evaluation is intended to address the requirement for a Technical Report on leachfield design, per the current Waste Discharge Requirements (WDR) Order No. R5-2012-0086, as follows:

> ***C. Special Provisions, 2. Special Studies, Technical Reports and Additional Monitoring Requirements***
> ***d. Leachfield Design Investigation.*** *This provision requires the Discharger to provide a technical engineering report on the design parameters for the Facility leachfields. Specifically, the Discharger must provide design flow rate and loading rates for treatment and soil conditions (including percolation rates) at the leachfield site. The seasonal and intermittent use of the leachfields and subsequent effect on subsurface treatment, if any, must be addressed. Year-round usage of the leachfields must also be evaluated with respect to design restraints and/or treatment capacities. The technical report must be prepared and certified by a California-registered Professional Civil Engineer.* ***Within 6 months following adoption of this Order,*** *the Discharger shall submit a Leachfield Design Investigation work plan for approval by the Executive Officer. The final Leachfield Design Investigation report must be completed and submitted within 12 months following Executive Officer approval of the work plan.*

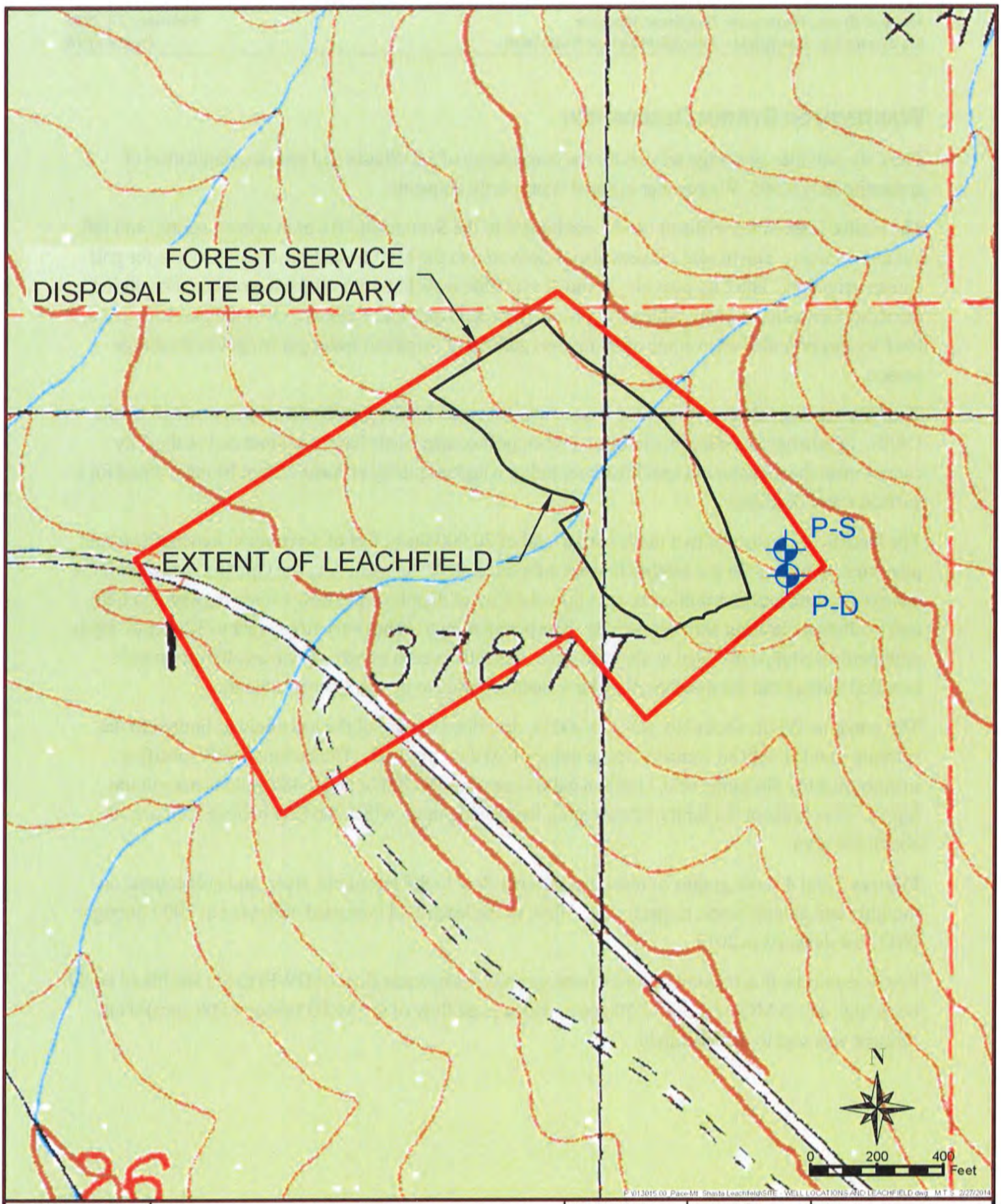
Previously, L&A prepared an Options Evaluation (April 2013) based on data supplied by PACE Engineering (PACE), an as-built map of the leachfield area, wastewater flow and quantity data from the City, reports previously prepared by PACE (1992 Master Sewer Plan, 2010 Report of Waste Discharge), published geologic maps and documents, and in-house information from work previously conducted at the site by L&A in 1991.

For this Leachfield Evaluation, the information used in the Options Evaluation is combined with field work at the leachfield site, to further interpret hydrogeologic conditions and address the items required in WDR Item C.2.d.



LAWRENCE & ASSOCIATES ENGINEERS & GEOLOGISTS	SITE LOCATION MAP MAP ADAPTED FROM USGS 7.5-MINUTE TOPOGRAPHIC QUAD CITY OF MOUNT SHASTA, CA.	PROJECT NAME: LEACHFIELD CLIENT: PACE ENGINEERING SCALE: 1"=3,000'	PROJECT NO: 013015.00 DRAWN BY: J. HOLDEN CHECKED BY: B. LAMPLEY	DATE: 3/28/2013 FIGURE 1

P:\013015.00_Pace-Mt. Shasta Leachfield\site-loc.dwg J.L.H. 3/28/2013



LAWRENCE & ASSOCIATES ENGINEERS & GEOLOGISTS	**LEACHFIELD AND PUMP-IN LOCATIONS** MAP ADAPTED FROM USGS 7.5-MINUTE TOPOGRAPHIC QUAD, CITY OF MOUNT SHASTA, CALIFORNIA	PROJECT NAME: LEACHFIELD	PROJECT NO: 013015.00	DATE: 2/27/2014
		CLIENT: CITY OF MT. SHASTA	DRAWN BY: M. STONE	**FIGURE 2**
		SCALE: 1" = 400'	CHECKED BY: B. LAMPLEY	

WASTEWATER SYSTEM DESCRIPTION

The City provides sewerage service for the community of Mt. Shasta and serves a population of approximately 3,595. Wastewater influent is primarily domestic.

The treated wastewater effluent can be discharged to the Sacramento River in winter, spring, and fall, but not summer. The treated effluent also is delivered to the Mt. Shasta Resort Golf Course for golf course irrigation. The City provides as much available recycled water as the Resort can take during the Resort irrigation season; which is typically between April and October. Over the past four years, the City has provided an average of 50 million gallons of irrigation water per irrigation discharge season.

The City also may dispose of treated wastewater to its leachfield, located on property owned by the USFS. Discharge to the leachfield occurs when golf course needs have been met and/or the City cannot meet the reclamation specifications and/or a higher quality effluent cannot be maintained for a surface water discharge.

The leachfield consists of two fields with a total of 20,000 lineal feet of percolation trenches (as-built plan-view drawings for the leachfield were submitted as Attachment A to the Options Evaluation). A series of splitter and distribution boxes allow the City of distribute the flow evenly through the field, and to alternate loading and rest periods. The percolation trenches vary from eight to 12 feet in depth, with perforated pipe installed at about five feet in depth in each trench. There are 40 piezometers installed throughout the trenches; they have been reported to be dry since installation.

The previous WDR, Order No. R5-2007-0056, described the use of the leachfield as limited to the summer months with an annual average usage of 20 days per year. The current WDR specify a maximum daily discharge of 0.7 million gallons per day (MGD) or about 486 gallons per minute (gpm). This is about the limit of the existing leachfield pump, which the City believes can deliver about 500 gpm.

Figures 3 and **4** show graphs of historical effluent flow to the leachfield, river, and golf course, on monthly and annual bases, respectively. Flow to the leachfield increased each year in 2009 through 2011, but declined in 2012.

PACE estimates that maximum future average daily wastewater flow (ADWF) to the leachfield could be as high as 1.8 MGD (about 1,250 gpm), with a peak flow of 6.5 MGD (about 4,500 gpm) if all effluent was sent to the leachfield.

Figure 3. Treated Wastewater Flow, Monthly - Mt. Shasta

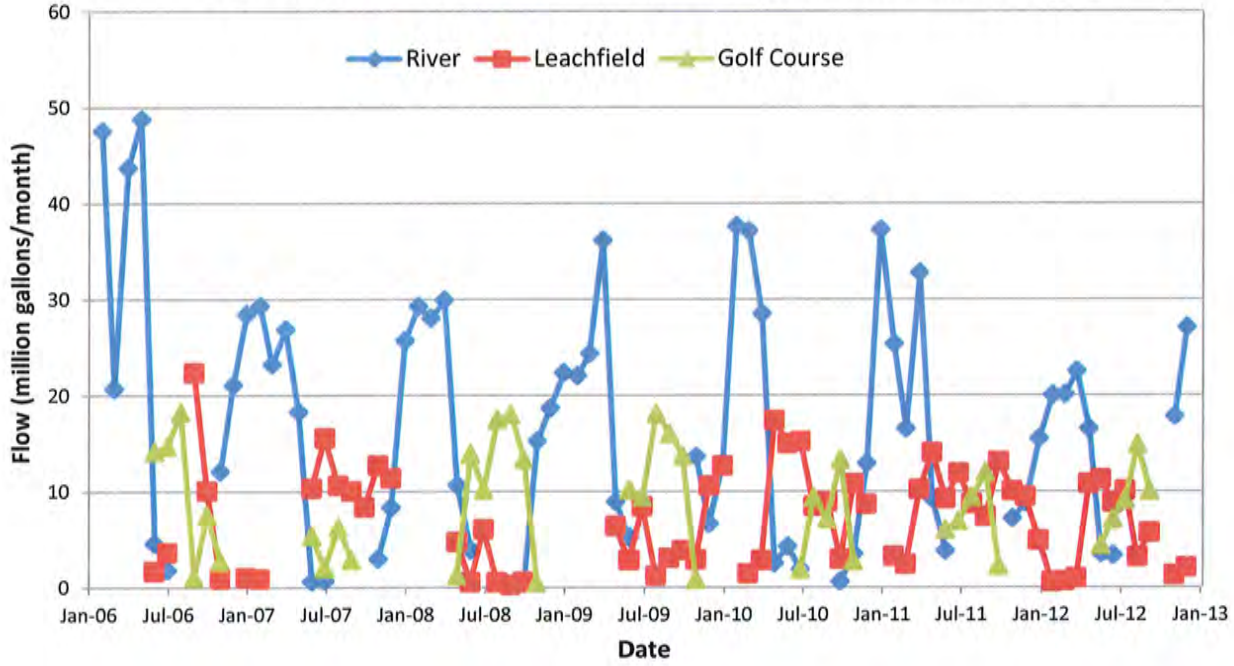
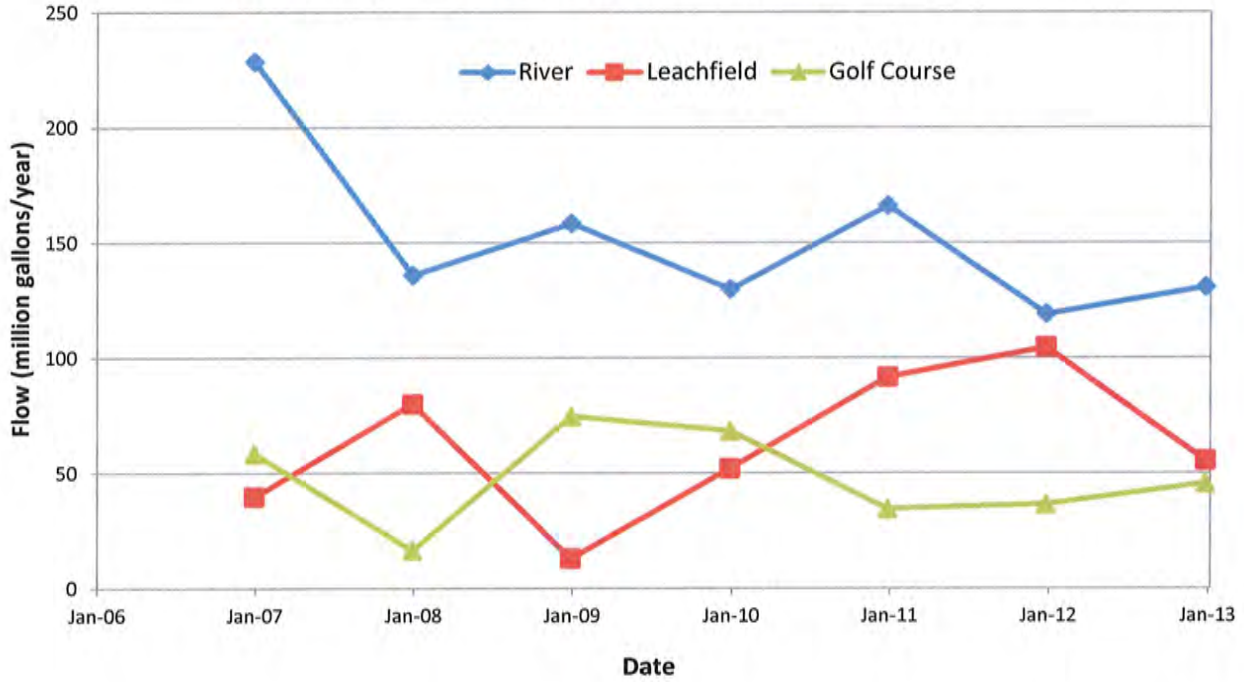


Figure 4. Treated Wastewater Flow, Annually - Mt. Shasta



LEACHFIELD DESIGN EVALUATION

Two aspects of soil conditions must be considered for the leachfield design study – the rate at which the soil can accept wastewater (percolation rate) and its treatment capacity.

PERCOLATION RATE

The rate at which the soil can accept wastewater is dictated by the geology. The soil and underlying geologic units at the leachfield site are composed of volcanic deposits which have very high porosity and permeability, with good capacity for water transmission. This is the reason that there are not many surface-water courses on the slopes of Mt. Shasta – most of the snowmelt and rainfall immediately percolate into the soil rather than running off.

Based on the log for monitoring well MW-3, the leachfield site is underlain by about 225 feet of volcanic deposits, which in turn are underlain by shale to a depth of at least 317 feet below ground surface (bgs; see **Attachment A**, well logs). The volcanic deposits consist of about 20 feet of brown clay and gravel, underlain by about 135 feet of basalt (to a depth of about 155 feet), which is in turn underlain by about 70 feet of brown clay, gravel, and boulders (to a depth of about 225 feet). Two very hard basalt layers were observed during the drilling of MW-3, at 35 to 42 feet and at 96 to 115 feet.

The depth to groundwater is about 255 feet bgs in MW-3, the current on-site groundwater monitoring well that is downgradient of the leachfield. The depth to groundwater in a previously monitored well, MW-2, was about 155 feet bgs. Thus, there is a thick sequence – at least 150 feet, and up to 250 feet – of unsaturated material underlying the leachfield.

Forty piezometers were installed within the leach trenches when the leachfield was constructed. City staff report that the piezometers have always been dry. This indicates that the soil immediately surrounding and underlying the leach trenches has more than adequate capacity to transmit the quantities of wastewater historically discharged at the site.

Because of the depth of the leach trenches (generally more than10 feet), standard percolation tests to estimate permeability were not safely feasible. Based on the description of the geologic materials in the drillers logs and our experience in the vicinity, it is unlikely that even a relatively undisturbed sample of the materials between 10 and 20 feet bgs could be collected for laboratory analysis of permeability. Instead, we recommend estimating the unsaturated permeability *in situ*.

In-place testing of vadose zone permeability is often done through permeameter testing, either constant-head or falling-head tests. Constant-head permeameters are a better choice when the permeability is expected to be relatively high (as at the leachfield site), although the permeability must be low enough that a constant head can be maintained with a reasonable water supply. That is, if the permeability is very high, it may not be possible to maintain a constant head (1) with a reasonable amount of water or (2) with the maximum amount of water that can move through the casing. In that case, a less formal pump-in test can be conducted, where a known volume of water is pumped into a casing set at the depth of interest, and the head in the casing is maintained at a more or less constant

level. This is similar to the constant-head permeability test, but the constant-head test uses a reservoir and float (or other flow control device) to maintain the head until a constant input flow is reached. The pump-in test is conducted until the measured head and input flow both stabilize.

It was proposed in the Leachfield Options report that the choice of either a constant-head permeameter test or a pump-in test would be made in the field upon completion of drilling two boreholes to depths of 10 and 20 feet, to evaluate the permeability of the zone in which the leach lines are installed and immediately beneath the lines.

These boreholes were installed by L&A on September 17, 2013, to the planned depths. Each hole was cased with four-inch, Schedule 40 PVC casing, with two feet of factory-slotted screen at the bottom. The annular space above the slotted interval was sealed with bentonite, wetted and allowed to hydrate. **Figures 5** and **6** show the boring logs and completion details.

The two test holes were installed in the southeastern portion of the site, near the existing access road, as this was the only location accessible at the time. Drilling in other locations on the site necessitates environmental review by the Forest Service, adding an unknown amount of time to the process; because it was desired to install the boreholes this season, the holes were drilled near the road.

Stratigraphy at the two locations varied from silt to silty gravel. In hole P-S (10 feet deep), the upper five feet consisted of dry silt with minor gravel; underlying the silt was a silty gravel to total depth (refusal). The gravel also was dry. In hole P-D, the upper silt was present to four feet below ground surface (bgs). Underlying the silt was a foot of gravelly silt. Underlying the gravelly silt was silt and gravelly silt to a depth of 18 feet bgs; there was one foot of silty gravel at 12 feet bgs. Weathered volcanics were encountered at 18 feet bgs to 20.5 feet bgs (total depth). Hole P-S was completed in the silty gravel; hole P-D was completed in the weathered volcanics.

On October 29, 2013, short pump-in tests were conducted to assess the general permeability of the zones in which the boreholes were completed. **Figure 7** shows the data and interpretations, and **Figure 8** presents graphs of the test flows and water levels. For each hole, about 250 gallons of clean water were introduced into the formation.

The following equation was used to evaluate the data:

$$K = Q / 5.5\, r\, h$$

Where:

Q = Inflow rate
h = Head over tested interval
r = Casing radius

LAWRENCE & ASSOCIATES 3590 IRON COURT SHASTA LAKE, CA 96019	PHONE: (530) 275-4800 FAX: (530) 275-7970	PROJECT: CITY OF MT SHASTA LEACHFIELD EVALUATION	SHEET 2 OF 2 HOLE #: P-S
		JOB #: 013015.01	DATE: 9/17/2013
FIELD LOCATION OF WELL:		LOGGED BY: D. L. K. DRILLER: LAWRENCE & ASSOCIATES	
		WELL CASING: 4" ϕ SCH 40 PVC	
		EQUIPMENT AND SPECIFICATIONS: CME 55 DRILL WITH 10" ϕ HOLLOW-STEM AUGERS	

DEPTH (FT)	SOIL GROUP USCS SYMBOL	LITHOLOGY PROFILE	DESCRIPTION
0			
2	ML		SILT WITH MINOR (<5%) SMALL GRAVEL. SOFT, DRY, PINK (7.5 YR 8/4).
4			COLOR CHANGES AT 2 FEET TO LIGHT BROWN (7.5 YR 6/4)
6			
8	GM		SILTY GRAVEL: 1/2" ϕ CLASTS, SUBROUNDED TO ROUNDED, MEDIUM DENSE, DRY, LIGHT BROWN (7.5 YR 6/4)
10			
12			REFUSAL, NO RETURN, BORING TERMINATED
14			
16			
18			
20			
22			
24			

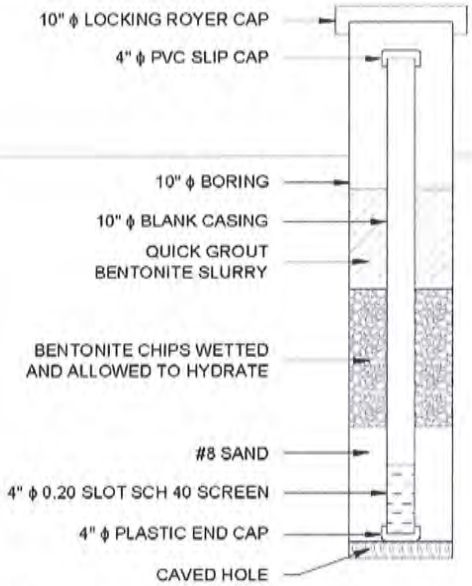


FIGURE 5

LAWRENCE & ASSOCIATES
3590 IRON COURT
SHASTA LAKE, CA 96019
PHONE: (530) 275-4800
FAX: (530) 275-7970

FIELD LOCATION OF WELL:

PROJECT: CITY OF MT SHASTA LEACHFIELD EVALUATION
SHEET 1 OF 2
HOLE #: P-D
JOB #: 013015.01
DATE: 9/17/2013
LOGGED BY: D. L. K. DRILLER: LAWRENCE & ASSOCIATES
WELL CASING: 4" ϕ SCH 40 PVC
EQUIPMENT AND SPECIFICATIONS:
CME 55 DRILL WITH HOLLOW-STEM AUGERS

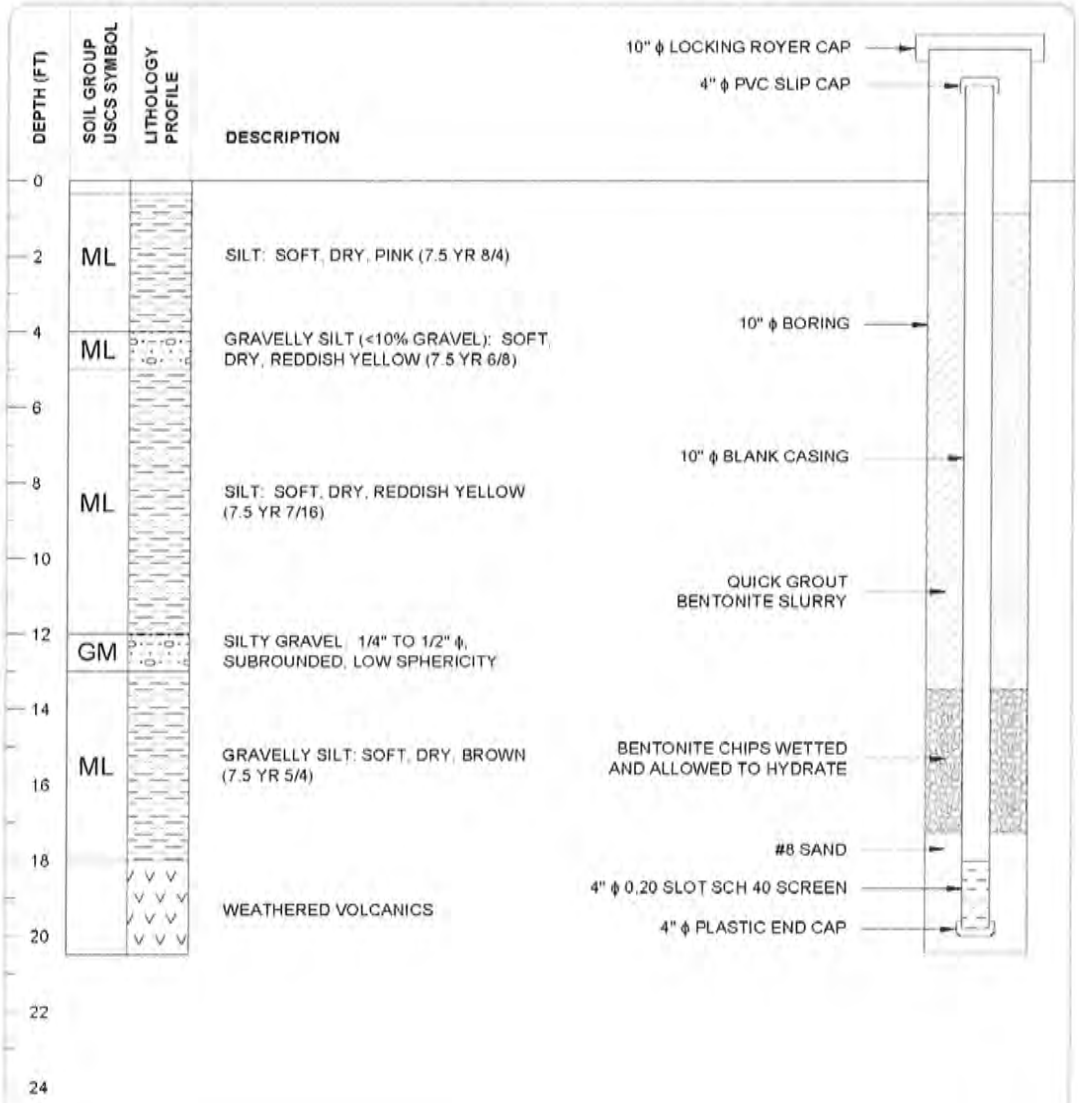


FIGURE 6

City of Mt. Shasta Wastewater Dispersal Field

Pumping-In Tests, 10-29-13

Both probes dry at beginning of test.

P-S (Shallow - 10.25 feet TOC)

Time	Flow	Cumulative Volume	Cumulative Rate	Time	Depth to Water
	gpm	cubic feet	cfm		feet TOC
14:25	0.0	0.0	0.0	14:25	10.25
14:30	2.5	1.7	0.3	14:28	10.05
14:35	2.5	3.3	0.3	14:36	5.08
14:40	2.5	5.0	0.3	14:41	2.85
14:44	2.5	6.4	0.3	14:43	1.95
14:48	1.5	7.2	0.3	14:49	1.65
14:55	1.4	8.5	0.3	14:57	1.64
15:00	1.4	9.4	0.3	15:01	1.62
15:09	1.4	11.1	0.3	15:10	1.96
15:15	1.4	12.2	0.2	15:16	1.92
15:30	1.4	15.0	0.2	15:28	1.96
15:35	1.5	16.0	0.2	15:37	1.78
15:41	1.5	17.2	0.2	15:42	1.72
15:52	1.5	19.4	0.2	15:50	1.65
16:00	1.5	21.0	0.2	16:01	1.65
16:10	1.5	23.0	0.2	16:05	1.69
16:20	1.5	25.0	0.2	16:09	1.65
16:25	1.5	26.0	0.2	16:22	1.64
16:31	1.5	27.2	0.2	16:25	1.70
16:35	1.7	28.2	0.2	16:30	1.72
16:40	1.6	29.2	0.2	16:36	1.64
16:45	1.6	30.3	0.2	16:41	1.64
16:50	1.6	31.4	0.2	16:46	1.64
16:52	0.0	31.4	0.2	16:51	1.64
				16:54	4.52
				16:55	6.58
				16:57	7.57
				16:59	8.52
				17:05	9.41
				17:10	9.83
				17:15	9.98
				17:20	10.13

Head, H 8.5 feet
Length, L (gravel pack length) 2.8 feet
Radius, r (hole radius) 0.4 feet
Final discharge, Q 307.2 cubic feet/day

K = Q / 5.5 r h
K = 16 feet/day
K = 9.1E-03 cm/sec

K = Q/(2piLH) * sinh-1(L/2r)
K = 28 feet/day
K = 1.64E-02 cm/sec

P-D (Deep - 22 feet TOC)

Time	Flow	Cumulative Volume	Cumulative Rate	Time	Depth to Water
	gpm	cubic feet	cfm		feet TOC
11:17	0.0	0.0	0.0	11:18	22.0
11:18	2.5	0.3	0.3	11:20	18.45
11:31	2.3	4.3	0.3	11:28	18.35
11:48	2.4	9.8	0.3	11:50	18.33
12:10	2.3	16.6	0.3	12:11	18.05
12:14	2.6	17.9	0.3	12:15	17.90
12:21	2.5	20.3	0.3	12:22	18.10
12:40	2.4	26.4	0.3	12:41	18.05
12:50	2.4	29.6	0.3	12:51	18.20
13:00	2.5	32.9	0.3	13:01	18.25
13:10	2.5	36.3	0.3	13:11	18.30
13:15	2.3	37.8	0.3	13:16	18.60
13:18	0.0	37.8	0.3	13:25	20.35
				17:15	21.83

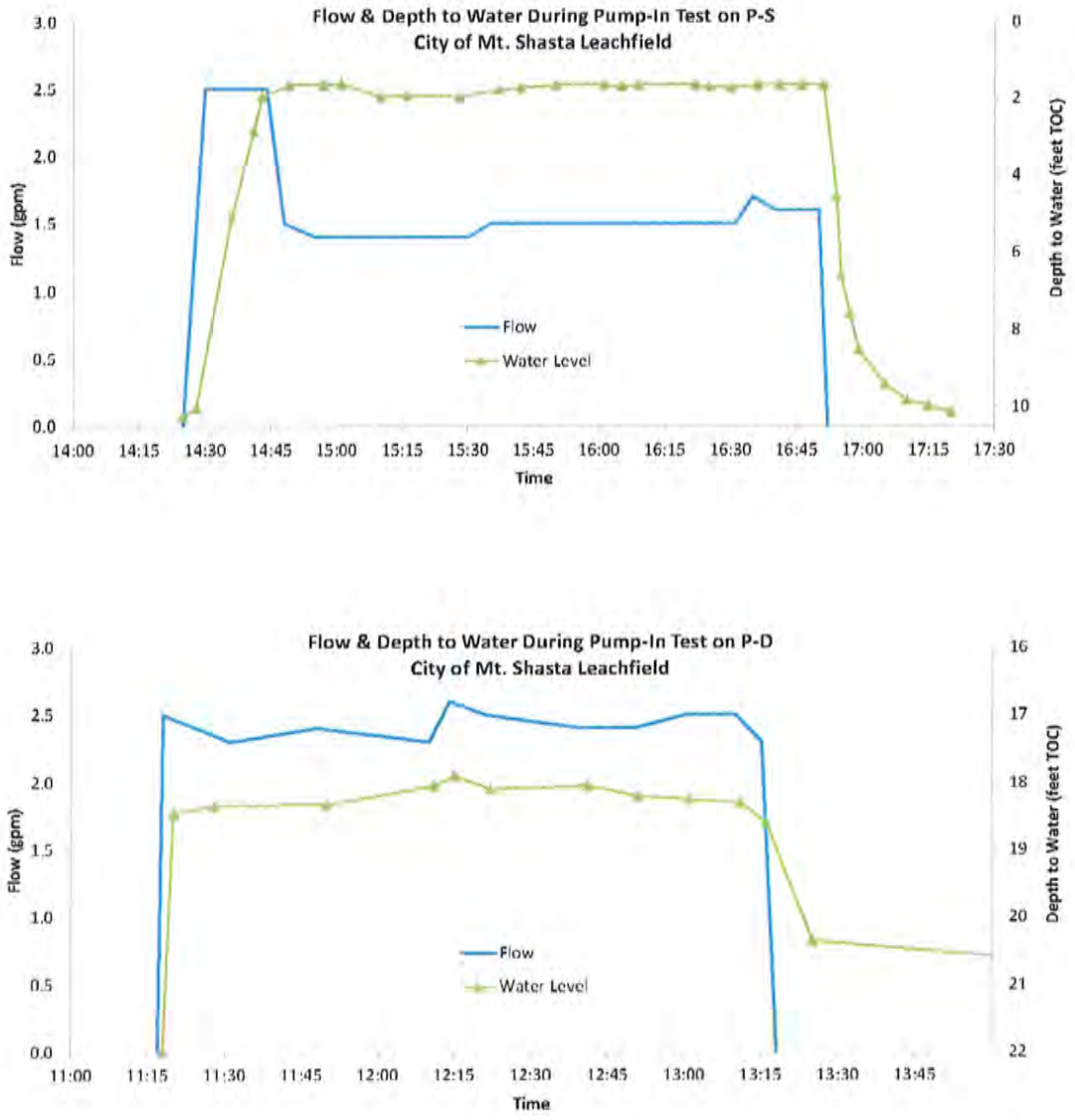
Head, H 3.8
Length, L (gravel pack length) 3.0
Radius, r (hole radius) 0.4
Final discharge, Q 461.4

K = Q / 5.5 r h
K = 53 feet/day
K = 3.1E-02 cm/sec

K = Q/(2piLH) * sinh-1(L/2r)
K = 119 feet/day
K = 6.90E-02 cm/sec

Lawrence & Associates
W:\CLIENTS\Mt. Shasta, City of\013066.00 - Leachfield Evaluation\Report\ Pump_In_Tests_B

FIGURE 7



Lawrence & Associates
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FIGURE 8

The results of the permeability testing show that the permeability is relatively high – about 16 feet/day at 10 feet bgs and 53 feet/day at 20 feet bgs. A limitation to the testing, however, is the short length of the test. It would be difficult to conduct a long-term test at this location, in that it would take at least 25,000 gallons for the water to move even as short a distance as 35 feet from the casing.

The results of the pump-in test, however, correlate to the "observed" rate of inflow. The observed rate can be calculated by dividing the trench area by the known flow (we assumed the wastewater moves through the lower 10 feet of each active trench). The calculated observed application rate that the formation takes is 0.7 feet/day at ADWF and 2.3 feet/day at maximum flow. Comparing the

observed rate with the approximate values from the pump-in test, and considering that the piezometers are always dry, the existing field has sufficient capacity to at least double the flow. Using the lowest measured permeability (16 feet/day) and the available side-wall area of one field (50,000 square feet), the calculated potential flow is about 6 million gallons per day; **Table 1** shows the calculations. While this is speculative, it illustrates that the existing fields can accept more than the current average or maximum day flows.

Table 1. Existing & Potential Wastewater Application Rates

Wastewater		
ADWF	0.26	MGD
	34,759	cubic feet/day
Max Flow	0.87	MGD
	116,310	cubic feet/day
Leachfield		
Length	20,000	lineal feet, total in two fields
	10,000	lineal feet/field
Depth	10	feet, average trench depth
	5	feet, pipe depth
Area	50,000	square feet, side-wall area/field (bottom 5 feet of each trench)
Soil		
Permeability from pump-in tests	16	feet/day, at ~10 feet in depth
	53	feet/day, at ~20 feet in depth
Current Wastewater Percolation		
Assumes all wastewater percolates +/- immediately because piezometers have always been dry.		
Rate = Actual Flow/Field Area		
ADWF	0.7	feet/day
Max Flow	2.3	feet/day
Potential Wastewater Percolation		
Potential Flow = Lowest Measured Rate (16 ft/day) x Field Side-Wall Area (50,000 ft^2)		
Potential Flow	786,129	cubic feet/day
	5.9	MGD, one field

GROUNDWATER MOUNDING

Because the depth to water is relatively large (at least 150 feet beneath the leach trenches), groundwater mounding would not be expected to be a problem at this site. It was evaluated, however, using the Hantush method. **Table 2** shows the calculations. The calculated separation from one leachfield at current ADWF is approximately 88 feet; this assumes a depth to water of about 150 feet, based on the previous monitoring well data. Based on historic groundwater data, it is unlikely that groundwater mounding of this magnitude occurs – water levels near 88 feet bgs have never been noted at the site.

Doubling the ADWF gives a separation of about 35 feet. Both of the foregoing calculations assume an aquifer hydraulic conductivity of 53 feet/day, based on the limited pump-in test conducted for this work. It is possible, and likely, that the actual aquifer hydraulic conductivity is higher. This is based on the typical characteristics of the volcanic aquifers that underlie the site and vicinity. The high volume discharge from springs in the area and the presence of voids noted in the driller's logs for site wells indicate that aquifer permeabilities can be higher than measured in P-D at the site. Additionally, the likely heterogeneity of the subsurface materials (interbedded volcanic flows and volcaniclastic deposits) suggests that aquifer permeabilities beneath the site can be variable.

Table 2. Calculation of Groundwater Mounding

Hantush Analytical Method to Determine Height of Mounding in Response to Vertically Downward Recharge from a Rectangular Area

From: *Septic Tank System Effects on Ground Water Quality,*
Canter, L.W. and Knox, R. C., 1986.

Scenario:	365 days with water table starting at 150 feet below wetlands Assumed hydraulic conductivity of underlying aquifer, 53 feet/day Infiltration rate of 5.2 gpd/square foot	
Water table rise = (W_m * t) / (30 * Sy) * SUM(W*(a_n,b_n)) =	52.1	feet
Water table height = Water table rise + Initial w.t. height =	102.1	feet
Depth to water = 200 feet - water table height =	97.9	feet
Depth to bottom of leachfield =	10.0	feet

11.5 acres of leachfield will have 87.9 feet of separation at center of recharge area.

b	200	thickness of layer above aquiclude, feet
wt	150	depth to water table below original ground at leachfield, feet
h_i	50	initial height of water table above aquiclude, feet
W_m	5.2	recharge rate, gpd/sq. ft.
t	365	time after recharge starts, days
Sy	0.3	specific yield
K	53	hydraulic conductivity, feet/day
T	19776	tranmissivity, gpd/ft
a_m	500	one-half length of recharge area, feet
b_m	250	one-half width of recharge area, feet
x	0	x coordinate of obs. pt. in relation to center of pond, feet
y	0	y coordinate of obs. pt. in relation to center of pond, feet
a_1	0.0698	1.37 (bm + x) sqrt(Sy/Tt)
a_2	0.0698	1.37 (bm - x) sqrt(Sy/Tt)
b_1	0.1396	1.37 (am + x) sqrt(Sy/Tt)
b_2	0.1396	1.37 (am - x) sqrt(Sy/Tt)
W*		W*(a,b); from tables in Appendix D
W*(a_1,b_1)	0.0618	
W*(a_1,b_2)	0.0618	
W*(a_2,b_1)	0.0618	
W*(a_2,b_2)	0.0618	

Table 3. Groundwater Quality Data

Well	Date	pH (units)	Chloride (mg/L)	Nitrate as N (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Sulfate (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Conductance (umhos/cm)	TDS (mg/L)	Iron (ug/L)
Tillman (RGW-001)	9/12/2006	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Upgradient well; approx. 1.5 miles east of leachfield	6/13/2007	7.45	0.45	0.26	n/a	n/a	n/a	n/a	n/a	n/a	n/a	87	80	n/a
	10/10/2008	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	11/14/2008	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	10/20/2010	n/a	0.26	0.29	58	<1	*<0.01*	10	3	2.1	4	92	83	180
	10/27/2010	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	11/15/2011	n/a	0.48	0.31	58	<1	n/a	10	3	2.2	5	89	97	931
	12/6/2012	n/a	0.52	0.30	57	<1	*<0.01*	10	3	2.2	5	92	80	139
Neeland (RGW-002)	9/12/2006	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Downgradient well; approx.. 1 mile south of leachfield	6/13/2007	7.34	1.44	0.47	n/a	n/a	n/a	n/a	n/a	n/a	n/a	61	47	n/a
	10/10/2008	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	11/14/2008	n/a	n/a	0.47	n/a	n/a	0.16	7	2	1	3	71	55	n/a
	10/20/2010	n/a	1.31	1.07	39	<1	*0.16*	6	3	1	4	73	61	<25
	10/27/2010	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	11/15/2011	n/a	1.32	0.75	43	<1	n/a	8	3	0.8	3	74	65	329
	12/6/2012	n/a	1.09	1.59	44	<1	*0.16*	8.5	3	0.9	4	87	75	4
MW-3 (RGW-003)	10/15/1991	7.20	0.65	0.08	37	<1	<0.01	6.05	4.06	0.52	3.27	79	74	<100
Downgradient well; south-west corner of leachfield site	9/12/2006	n/a	0.70	0.63	n/a	n/a	n/a	n/a	n/a	n/a	n/a	72	55	n/a
	6/13/2007	7.58	0.67	0.23	n/a	n/a	n/a	n/a	n/a	n/a	n/a	84	81	n/a
	10/10/2008	n/a	0.90	0.60	44	1	0.07	7	3	1	3	72	54	n/a
	11/14/2008	n/a	n/a	0.21	n/a	n/a	0.91	10	4	2	6	116	98	n/a
	10/27/2010	n/a	1.04	0.57	40	<1	n/a	7	3	0.7	3	68	56	556
	11/15/2011	n/a	1.04	1.67	40	<1	n/a	8	3	0.8	4	79	77	700
	12/6/2012	n/a	1.10	0.70	42	<1	*0.07*	7.2	3	0.9	3	75	58	639

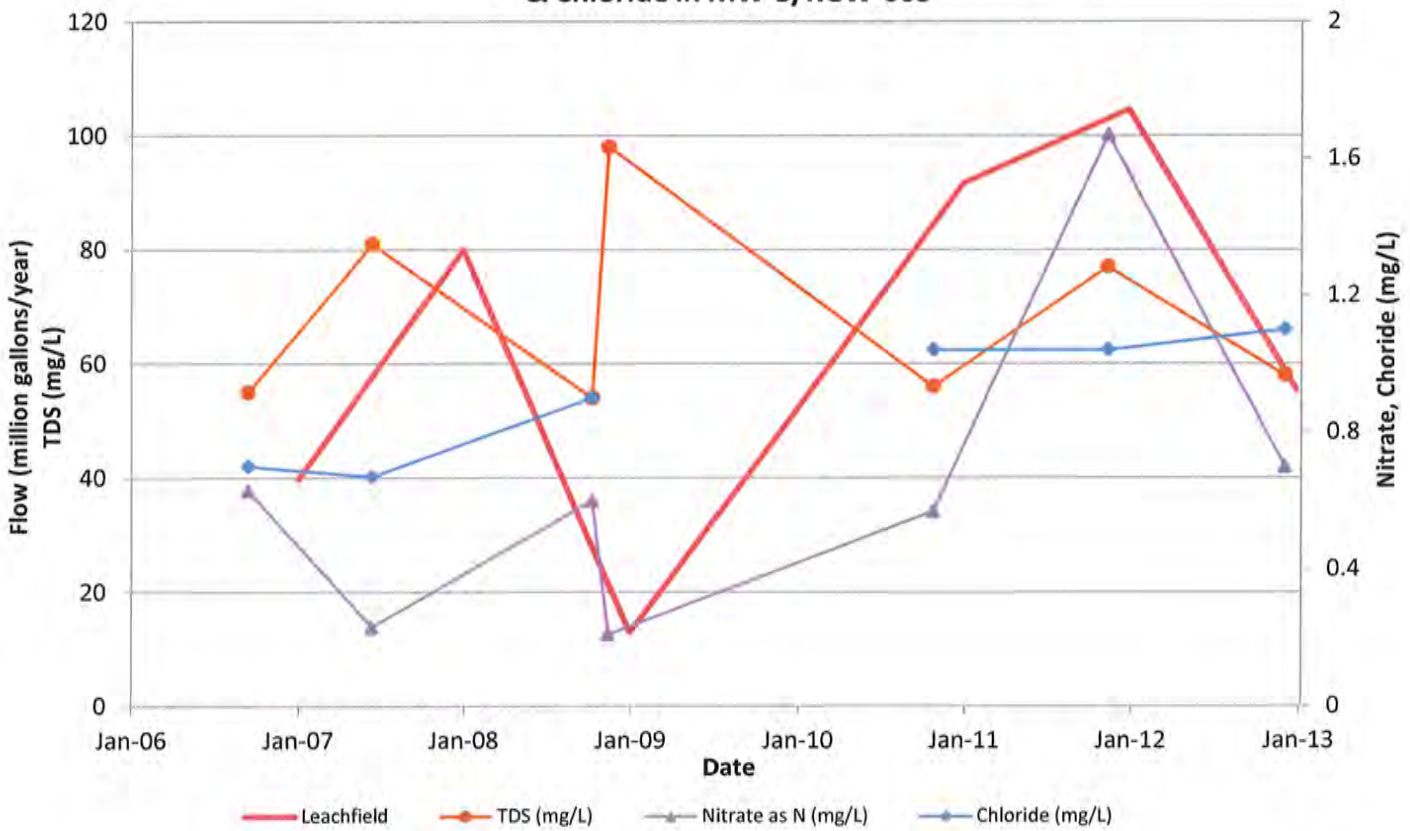
Notes:: n/a = Not sampled on that date. Italicized values are estimated, based on other detected values; estimates used for water-quality diagrams.
Mt. Shasta City well and spring sampled by U.S. Geological Survey as part of the Groundwater Ambient Monitoring and Assessment Program.

TREATMENT CAPACITY

The treatment capacity of the soil beneath the leachfield is reflected in the groundwater quality downgradient of the leachfield because the groundwater is the ultimate endpoint of the percolating wastewater. Therefore, to evaluate the treatment capacity of the soil, we proposed to use existing empirical data on effluent quality and groundwater quality. It has not been possible to install an additional downgradient well yet (Federal agency permits are still in process); therefore we used data from only the existing wells and effluent monitoring. The following discussion of water quality was presented in the Options Evaluation, and is included herein again for completeness and ease of reference.

The leachfield has been in place and operating since 1976 (the date on the as-built plans). Groundwater quality downgradient of the leachfield and in the vicinity has been monitored at least periodically since the late 1980s, and routinely since 2006. **Table 3** (page 14) shows a summary of data from 1991 (the time of the initial sampling of MW-3/RGW-003) and 2006 through the present. **Figure 9** shows a time-series graph of flow to the leachfield and selected water-quality parameters.

Figure 9. Annual Treated Wastewater Flow, TDS, Nitrate, & Chloride in MW-3/RGW-003

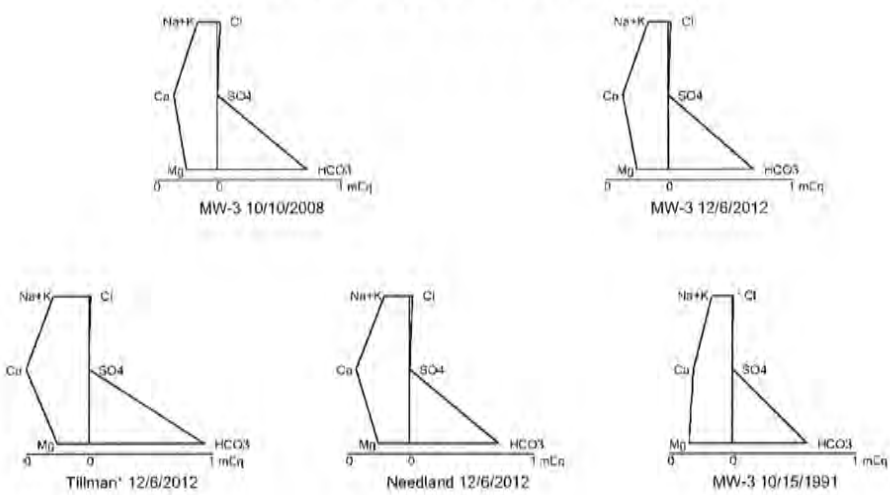


Of the monitored water-quality parameters, nitrate is the only one that showed an appreciable increase within, or after, the period when discharge to the leachfield increased, and then a decrease when the leachfield discharge returned to a historical level. Current nitrate levels are higher than in 1991, although well below the Maximum Contaminant Level (10 mg/L). Total dissolved solids (TDS) showed variability through the period 2006 to present; chloride showed a slight increase over the same period. Chloride is slightly higher now than in 1991; TDS has remained essentially the same since 1991. Statistical analysis of these data show that there are no statistically significant trends (Attachment C of the previously submitted Options Evaluation contained the statistical analysis sheets). That is, even though there are slight to moderate increases at certain times, the overall data do not show significant trends.

Comparing downgradient to the presumed background values using Analysis of Variance (ANOVA) shows no statistical differences between background and downgradient quality for nitrate, TDS, and specific conductance. Chloride is statistically higher in the downgradient well compared to the background well (Tillman/RGW-001).

Figure 10 shows a graphical comparison of groundwater quality of the wells monitored for the leachfield (MW-3/RGW-002, Tillman/RGW-001, and Neeland/RGW-002) . As **Figure 10** illustrates, groundwater immediately downgradient of the leachfield (MW-3/RGW-003) currently is similar in quality to both upgradient (RGW-001) and downgradient (RGW-002) neighboring wells. Water-quality in MW-3 has changed slightly since 1991, with calcium becoming the dominant cation, rather than magnesium, as in 1991. The change reflects a decrease in the relative percentage of magnesium rather than an increase in calcium. Overall, the groundwater quality beneath the leachfield and in the vicinity historically has been, and is, excellent.

Figure 10. Stiff Diagrams of Water Quality



To evaluate the soil's treatment capacity, we compared the data on effluent quantity and quality over time to that of groundwater quality over time. The emphasis was on nitrate and chloride, for which groundwater shows apparent changes since 1991.

The mass loading of chloride and nitrate was calculated assuming that all of the mass reached groundwater (*i.e.*, the theoretical maximum loading assuming no treatment in the soil). An aquifer thickness of 50 feet and a width of 1,000 feet (the length of the longest axis of the leachfield perpendicular to groundwater flow), with a porosity of 30%, was assumed. The theoretical concentrations then were compared to the actual observed concentrations (which are assumed to represent conditions from the long-term operation of the leachfield). It was thought that the difference between the theoretical and actual concentrations would give an order of magnitude estimate of the soil's treatment capacity.

Table 4. Comparison of Measured Groundwater Concentrations to Theoretical Concentrations

Chloride			
Year	**Volume (MG)**	**Concentration (mg/L)**	**Mass (mg)**
2006	39.72	28	4,209,525,600
2010	91.66	26	9,020,260,600
	Resultant Theoretical Concentration	**Actual Concentration, MW-3**	**Percent of Theoretical**
2006	9.9	0.70	7.1%
2010	21.2	1.04	4.9%
Average	15.6	0.9	5.6%
Nitrate			
	Volume (MG)	**Concentration (mg/L)**	**Mass (mg)**
2006	39.7	0.37	55,375,307
2007	80.0	1.03	312,528,661
2008	12.9	0.10	4,875,837
2009	52.0	0.11	21,654,364
2010	91.7	4.96	1,720,788,176
2011	104.7	0.39	154,479,098
	Resultant Theoretical Concentration	**Actual Concentration, MW-3**	**Percent of Theoretical**
2006	0.13	0.63	483.3%
2007	0.74	0.23	31.3%
2008	0.01	0.41	3528.5%
2009	0.05	Not measured	
2010	4.05	0.57	14.1%
2011	0.36	1.67	459.2%
Average	0.89	0.70	78.7%

As **Table 4**, shows, however, the comparison of theoretical vs. observed concentrations for chloride and nitrate shows wide variation and is not consistent. The chloride calculations suggest that only about five to seven percent of the chloride imparted via the leachfield discharge reaches groundwater. The nitrate calculations, however, suggest that about 80% of the nitrate reaches groundwater. It would be expected that chloride, a conservative compound that generally does not react or degrade in the subsurface, would show higher relative concentrations in groundwater than nitrate. The groundwater nitrate concentrations may reflect previous years discharges. Regardless, the comparison of actual vs. theoretical concentrations did not yield conclusive results.

As previously discussed in the Options Evaluation, it is not expected that the soils and geologic materials underlying the site will provide treatment that is significantly greater than the effluent receives, or will receive, at the treatment plant. The geologic materials underlying the site are relatively inert with respect to the effluent quality (the contaminants of which are predominantly salts), and are unlikely to provide additional treatment of the effluent, beyond diffusion within the vadose zone or underlying aquifers.

Please feel free to contact me at blampley@lwrnc.com or 530-275-4800 if you have questions regarding this Leachfield Design Evaluation.

Sincerely,

Bonnie E. Lampley

PROFESSIONAL GEOLOGIST
BONNIE E. LAMPLEY
No. HG626
CERTIFIED HYDROGEOLOGIST
STATE OF CALIFORNIA

Bonnie Lampley
Principal Hydrogeologist, CHG 626

Enc.: Attachment A. Well logs for MW-2 and MW-3

ATTACHMENT A
Well Logs for MW-2 and MW-3

this is the No. 2 well which is currently being sampled!

DUPLICATE
Retain this copy

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do Not Fill In

№ 123855

State Well No. ____
Other Well No. ____

(1) OWNER:
Name City of Mt Shasta
Address

(2) LOCATION OF WELL:
County Sishiyou Owner's number, if any #2
Township, Range, and Section reclamation site
Distance from cities, roads, railroads, etc. Hiway 89

(3) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐
If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☒ Other ☐

(5) EQUIPMENT:
Rotary ☐
Cable ☒
Other ☐

(6) CASING INSTALLED:
STEEL: SINGLE ☒ DOUBLE ☒ OTHER:

If gravel packed

From ft.	To ft.	Diam.	Gage or Wall	Diameter of Bore	From ft.	To ft.
0	90	6	188			
0	199	4	12ga			

Size of shoe or well ring: Size of gravel:
Describe joint

(7) PERFORATIONS OR SCREEN:
Type of perforation or name of screen factory / torch

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
80	90	3	2	1/8 x 12
90	199	4	4	1/8 x 6

(8) CONSTRUCTION:
Was a surface sanitary seal provided? Yes ☐ No ☒ To what depth ft.
Were any strata sealed against pollution? Yes ☐ No ☐ If yes, note depth of strata
From ft. to ft.
From ft. to ft.
Method of sealing

(9) WATER LEVELS:
Depth at which water was first found, if known 155 ft.
Standing level before perforating, if known 169 ft.
Standing level after perforating and developing 169 ft.

(10) WELL TESTS:
Was pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: 3 gal./min. with ft. drawdown after hrs.
Temperature of water Was a chemical analysis made? Yes ☐ No ☒
Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

(11) WELL LOG:
Total depth 199 ft. Depth of completed well 199 ft.
Formation: *Describe by color, character, size of material, and structure*

ft. to ft.	
0-25	red clay / boulders
25-27	boulder (grn)
27-45	conglomorated volcanic rock
45-48	tube or crevice (blows cold air)
48-54	rock as 27-45
54-55	crevice
55-84	rock as above
84-88	crevice
88-98½	brn rock (boul
98½-120	red rock (soft like cinders)
120-127	brn rock (bould
127-155	red clay / boulders
water 155-159	red clay / gravel
159-163	boulder
163-180	clay gravel
180-199	red cinder

Work started 1-20 1976, Completed 2-3 1976

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME Hi Lo Industries
(Person, firm, or corporation) (Typed or printed)
Address POB 603 Mt Shasta
[SIGNED] [signature]
(Well Driller)
License No. 296195 Dated 4-27, 1976

→ left unsealed until decision on logging is made!

SKETCH LOCATION OF WELL ON REVERSE SIDE

DWR 188 (REV. 9-68)

87138-780 6-72 30M TRIP ①T OSP

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 349890

Notice of Intent No. _____
Local Permit No. or Date _____ Monitoring Well 3 MW-3

State Well No. _____
Other Well No. _____

(1) OWNER: Name City of Mt. Shasta
Address 305 N. Mt. Shasta Blvd.
City Mt. Shasta, CA ZIP 96067
AP#37-280-010

(2) LOCATION OF WELL (See instructions):
County Siskiyou Owner's Well Number _____
Well address if different from above LAND Shasta Natl. Forest
Township 40N Range 4W Section 26
Distance from cities, roads, railroads, fences, etc.
South of Hwy. 89
¼ Mile West of Robinson Rd. Turnoff

See Attached

WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Municipal ☐
Other Monitoring ☒
(Describe)

(5) EQUIPMENT:
Rotary ☒ Reverse ☐
Cable ☐ Air ☒
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☒ No ☐ Size #3 Sand
Diameter of bore _____
Packed from _____ to _____ ft.

(7) CASING INSTALLED:
Steel ☐ Plastic XX Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	305	4	PVC	245	295	20 thous.

(8) PERFORATIONS:
Type of perforation or size of screen

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 153 ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval _____ ft.
Method of sealing Cement Grout

(10) WATER LEVELS:
Depth of first water, if known _____ ft.
Standing level after well completion 254 ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? Driller
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test _____ ft. At end of test _____ ft.
Discharge 3/4 gal/min after 1.5 hours Water temperature _____
Chemical analysis made? Yes ☐ No ☒ If yes, by whom? _____
Was electric log made Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 317 ft. Completed depth 317 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	17	Brown Clay & Gravel
17	18	Black Boulder
18	20	Brown Clay & Gravel
20	25	Volcanic Rock (Basalt)sof
25	35	Extremely Fractured Basalt
		(Lose Circulation @25',
		Regain Circulation w/hel
		From Foam @35'-Very Messy
35	42	Very Hard Basalt-4', 1 Hr.
42	74	Softer Black Basalt w/som
		Brown Rock. (Grey-Red Col-
		In Foam)
74	96	Harder Basalt (Crevice @7
		(Crevice @9
96	115	Extremely Hard Basalt
		(3 to 4', 1 Hr., w/Crevice
115	120	Softer Basalt w/Brown Cla
		& Brown Rock
120	130	Harder Basalt
130	150	Softer Basalt
150	154	Severe Fractures or Bould
		& Brown Clay
154	159	Brown Clay & Gravel
159	179	Brown Clay, Gravel & Few
		Boulders
179	199	Brown Clay & Gravel
199	224	Brown Clay w/few Boulders
224	259	Brown-Green Shale
259	307	Brown Shale
307	317	Black Shale

Work started 7-26 19 91 Completed 8-12 19 91

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Signed Royal C. Well Pres (Well Driller)
NAME AQUARIUS WELL DRILLING, INC. (Person, firm, or corporation) (Typed or printed)
Address P.O. BOX 6
City MT. SHASTA, CA ZIP 96067
License No. 366439 Date of this report 8-12-91

CONFIDENTIAL
NOT FOR PUBLIC USE
WATER CODE SEC. 13752

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

DWR 188 (REV. 12-86) 86 96355

APPENDIX F

PACE ENGINEERING
REDDING, CALIFORNIA

Preliminary Design Criteria Memorandum

TO: City of Mt. Shasta

DATE: May 30, 2014

FROM: Paul Reuter, P.E.
Grant Maxwell, P.E.

JOB NO.: 111.44

SUBJECT: CITY OF MT. SHASTA
Wastewater Treatment and Disposal Feasibility Study

---

1. INTRODUCTION

The purpose of this memorandum is to present background information and data substantiating various criteria used in the development and evaluation of alternatives contained in the Wastewater Treatment and Disposal Feasibility Study. The following criterion is discussed herein:

- Design Flows
- Raw Wastewater Characteristics
  - Biochemical Oxygen Demand (BOD)
  - Total Suspended Solids (TSS)
  - Total Kjeldahl Nitrogen (TKN)
  - Temperature
  - Alkalinity
- Effluent Disposal
  - Effluent Volumes
  - Land Disposal
    - Pasture/crop irrigation
    - Tree irrigation
    - Golf Course irrigation
  - Subsurface Disposal
  - Discharge to Upper Sacramento River
- Biological Treatment
  - Nitrogen removal
  - Lagoon modifications
  - New treatment processes
- Ancillary Chemical Addition
  - pH Adjustment
  - External carbon source for denitrification

- Filtration
  - Cloth filters
  - Sand filters
- Disinfection
  - Chlorination
  - Ozone
  - Ultraviolet (UV) radiation
- Flow equalization
  - Raw wastewater
  - Tertiary treatment

2. DESIGN CRITERIA

A. DESIGN FLOWS

The average dry weather flow (ADWF) received at the City's wastewater treatment facilities has increased from about 0.55 million gallons per day (MGD) in 1991 to about 0.67 MGD in 2013, representing an annual increase of approximately 0.9% per year. The existing treatment facility is designed for an ADWF of approximately 0.75 MGD. In November 2012, Crystal Geyser Roxane (CG), Calistoga, CA, began negotiations to purchase the old Coca-Cola water bottling facility in Mt. Shasta and install a juice-making facility. Conservative wastewater flow estimates from the proposed facility were conveyed to reach up to 0.75 MGD at full build-out over a five-year period. Since that time, CG has indicated it expects to modify its process to significantly reduce the amount wastewater.

Even though no formal wastewater flow estimates have been offered by CG, informal discussions with CG staff have indicated initial flows could be approximately 50,000 gallons per day (GPD) and increase to 150,000 GPD at complete build-out. Subsequent informal discussions have indicated wastewater flows could be even less. For planning purposes, we have assumed wastewater treatment alternatives will be evaluated assuming up to a 0.15 MGD (150,000 GPD) wastewater contribution from CG. Therefore, adding the CG contribution to the 0.75 MGD existing wastewater treatment plant capacity yields a total flow of 0.9 MGD. Adding 0.3 MGD to cover some uncertainty regarding expected CG wastewater flows and allowing for reasonable growth, a design ADWF of 1.2 MGD will be used for evaluating treatment alternatives.

Various peak flows are used for sizing individual treatment process. For example, maximum day flows (MDF) are used for sizing biological treatment processes, while peak wet weather flows (PWWF) are used for sizing tertiary (filtration and disinfection) processes. Table 1, below, presents a summary of the various design flows used in sizing and evaluating the subject project treatment alternatives.

TABLE 1
Design Flows for 1.2 MGD Treatment Alternatives

1	2	3	4	5	6	7	8
Flow Condition	**Existing (MGD)**	**Existing WWTP Capacity (MGD)**	**Existing Peak Factor**	**Crystal Geyser (MGD)**	**Growth (MGD)**	**Growth Peak Factor**	**Design Flow (MGD)**
ADWF	0.67	0.75	1.0	0.15	0.30	1.0	**1.2**
MMF	1.3	1.5	1.9	0.15	0.54	1.8	**2.2**
MDF	1.6	1.8	2.4	0.15	0.6	2.0	**2.6**
PHF	3.2	3.6	4.8	0.15	0.90	3.0	**4.7**

The ADWF shown in Column 2 reflects the average daily flow received at the WWTP between August 1st and September 30th, 2012. The MMF reflects the average daily flow during March 2011. The MDF and PWWF occurred during January, 2010 as well. Column 3 reflects the theoretical existing capacity of the City's existing WWTP. The peak factors in column 4 were determined by dividing the existing flow condition by the ADWF. The peak factors shown in column 7 reflect expected peak factors contributed by future growth. It is expected that new wastewater infrastructure, constructed with modern materials and workmanship, will create a "tighter," less leak-prone collection system. Thus, the peak factors are less than existing peak factors. Column 8 reflects the combined existing, CG, and growth related flows. In order to reduce the size and cost of biological and tertiary treatment processes, sustained flows above about 3.6 MGD will be diverted to an emergency retention basin (ERB) until the peak subsides.

B. RAW WASTEWATER CHARACTERISTICS

City staff performed a considerable amount of sampling and testing at strategic locations throughout the existing WWTP between July, 2013 and January, 2014 in order to 1) characterize the existing raw wastewater and 2) evaluate performance of the existing lagoon treatment system. Based on this effort, the following observations were made pertaining to characteristics of the City's wastewater.

a. Biochemical Oxygen Demand (BOD)

BOD is a measure of the oxygen demand in wastewater necessary to oxidize the organic component through use of aeration. Based on the City's raw wastewater data between January 2009 and January, 2012, the City's average 5-day BOD is about 200 mg/L, which is considered medium strength wastewater. In addition, during the City's sampling/testing efforts, the average chemical oxygen demand (COD) was measured at approximately 386 mg/L. These values were used in all of the new treatment process alternative evaluations.

b. Total Suspended Solids (TSS)

Based on the City's raw wastewater data between January 2009 and January, 2012, the City's average TSS is about 290 mg/L, which is considered medium strength wastewater.

c. Total Kjeldahl Nitrogen (TKN)

TKN represents the sum of organic nitrogen (including urea) and ammonia. TKN is a key parameter for sizing nitrogen removal components of the biological treatment process. The City was not required to test for TKN, consequently no historical data existed. City staff sampled and tested for TKN as part of the sampling/testing protocol for this project. Results varied from about 10 mg/L to about 43.5 mg/L and averaged 28 mg/L. It was decided to use 40 mg/L as a conservative basis for the purpose of evaluating nitrogen removal in the treatment process alternatives, which is considered weak to medium strength wastewater.

d. Temperature

Wastewater temperature is also a key consideration when evaluating nitrogen removal in biological wastewater treatment. At temperatures below about 5°C, nitrification becomes unpredictable. Wastewater temperature was measured at the headworks as well as a number of points through the lagoon treatment system. In addition, we reviewed influent and effluent temperature data taken between February 2012 and May 2013. As expected, the data revealed that wastewater temperatures were affected by the surface area exposure of the lagoons. Influent temperatures ranged from 19.6°C to 8.3°C while effluent temperatures ranged from 22.4°C to 3.2°C.

The approximate 5°C (8.3°C – 3.2°C) reduction in temperature through the lagoons is problematic for effective nitrification. Consequently, it is more difficult to achieve effective nitrogen removal utilizing the existing lagoons for biological treatment. For treatment alternatives utilizing the existing lagoons, a wastewater temperature of 3°C was used. Treatment alternatives utilizing only portions of the existing lagoon used wastewater temperatures of 5°C. For other treatment alternatives, a wastewater temperature of 8°C was used.

e. Alkalinity

Alkalinity is also another important constituent in raw wastewater especially as it relates to nitrogen removal. In order to remove nitrogen from wastewater, the organic and ammonia nitrogen must be converted to nitrate through aeration (nitrification.) This process consumes alkalinity from the wastewater at a ratio of about 7.1 units of alkalinity for every unit of nitrogen converted to nitrate. Therefore, adequate alkalinity in the wastewater is necessary to maximize nitrification. The process by which nitrate is

converted to nitrogen gas and released into the atmosphere is denitrification. Denitrification releases alkalinity back into the wastewater at a ratio of about 3.6 units of alkalinity for every unit of nitrate converted to gas.
Based on the City's sampling/testing efforts, the raw wastewater alkalinity varied from 189 mg/L to 122 mg/L during the six-month testing period, with an average value of 157 mg/L. For biological treatment and nitrogen removal modelling, a value of 160 mg/L was used. While industry literature considers this alkalinity range to be medium-to-strong wastewater, in order to maximize nitrogen removal, it may be necessary to add alkalinity upstream of the biological treatment process.

C. EFFLUENT DISPOSAL

A primary goal for performing the Wastewater Treatment and Disposal Feasibility Study was to evaluate alternatives for eliminating the discharge point to the Upper Sacramento River, and the associated regulatory umbrella associated with it. A number of alternatives are considered in the feasibility study. Below are some considerations for design criteria for the alternatives considered.

a. Effluent Volumes

Figure 1, below, presents a summary of wastewater effluent volumes conveyed to the City's three existing discharge points; Upper Sacramento River, Mt. Shasta Golf Course, and Leach Field for the years 2004 to 2013. In addition, the associated total rainfall for each year is presented. For years in which the City had trouble meeting effluent limits for discharging to the river or golf course, the volume of wastewater conveyed to the leach field is higher.

As the data suggests, this phenomenon has been variable from year to year. Year 2005 had a total rainfall of 62.3 inches, which was just shy of the statistical 100-year rainfall amount of 63.2 inches, and was the closest to a 100-year rainfall year in the 10-year data set. Therefore, the wastewater volumes generated during 2005 were prorated up based on the difference between actual and 100-year rainfall and used to evaluate land disposal options discussed below. As indicated a total of 326.2 million gallons (MG) was disposed in 2005.

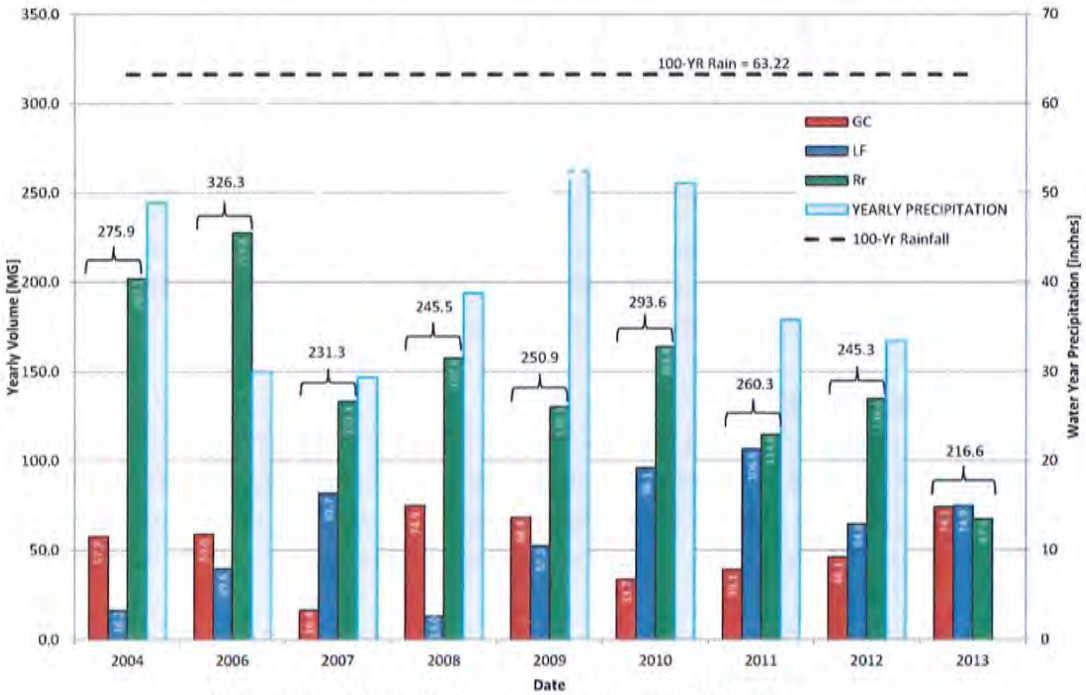


Figure 1 – Historic Annual Discharge Volumes

b. Land Disposal

Discharge of treated wastewater to land is based on the agronomic rate of the crop being irrigated. Thus, crops with higher water needs are considered more favorable than those with less. In order to eliminate the river discharge point, it is necessary to, 1) store treated wastewater during the winter, and/or 2) expanded the leach field disposal facilities.

i. Pasture/crop Irrigation

A common practice for land disposal systems is to irrigate pasture land or hay crops which have relatively high agronomic rates. The land can be grazed by cattle or harvested and sold as stock feed. Mt. Shasta has a shorter growing season compared to communities located in the California central valley where land disposal systems are common for smaller communities. In addition, Mt. Shasta has higher annual rainfall and less available land for irrigation. Nevertheless, water balance calculations were made to determine the extent of required effluent storage and irrigation area needed to develop a land disposal system. Table 2, below, conveys a determination of the agronomic rate used for pasture/crop irrigation for the land disposal options.

ii. Tree Irrigation

Irrigation of tree crops has been successfully used in many communities throughout the country, including a number of communities in Oregon. The most common trees

are Hybrid Poplars and Willows because they have very high water and nutrient requirements, typically 20% to 25% more than irrigated crops. In addition, they are fast growing so the time from planting to harvest is reduced. Trees with 10- to 12 years maturation can be sold for wood chips for landscaping and erosion control or biomass for co-generation facilities. For selling in lumber markets, the trees typically require 20 years of maturation.

Table 1: Agronomic Rates

Month	Rainfall [1,2] Inch/Month	ET_o Rate [3] Inch/Month	Pan to Pasture Coefficient[4]	Pasture ET Inch/Month	Agronomic Irrigation [5] Inch/Month	Minimum Potential Irrigation [6] Days/Month
OCT	4.61	3.8	0.76	2.9	0.0	17
NOV	2.11	1.2	0.73	0.9	0.0	8
DEC	5.01	0.7	0.71	0.5	0.0	2
JAN	15.62	0.8	0.72	0.6	0.0	18
FEB	8.03	1.3	0.74	1.0	0.0	12
MAR	5.04	3.0	0.76	2.2	0.0	2
APR	7.70	4.7	0.78	3.7	0.0	5
MAY	2.65	6.8	0.78	5.3	3.2	11
JUN	0.46	7.8	0.78	6.1	6.8	18
JUL	0.08	9.7	0.78	7.6	9.0	21
AUG	0.05	8.1	0.78	6.4	7.6	31
SEP	1.06	5.7	0.78	4.5	4.1	21
TOTAL	52.42	53.6		41.5	30.5	166

NOTES:

1) 100-yr rainfall based on Station Mt. Shasta City Precipitation Long-Duration-Frequency Table from DWR Bulletin 195, October 1976.
2) 100-yr rainfall of 63.22 (1948-2010 Western Regional Climate Center) spread in proportion to 2010 monthly data. 2010 selected based on similarity to 100-yr precipitation looking at last 20yrs.
3) Potential ET_o based on 9 years of data for Station Glenburn Evaporation from Water Surface, DWR Bulletin 73-79, Nov 1979.
4) Pasture evapotranspiration ratio determined from DWR Bulletin 73-79, Nov 1979.
5) Effluent applied May through Sept. Application rate = (ET - Precip) * 1.2 Irrigation Application Efficiency Factor

iii. Golf Course Irrigation

The City has an agreement with the Mt. Shasta Golf Course for accepting treated wastewater for irrigation at a cost (to the Golf Course) of $0.031 per 100 gallons. During fiscal year 2013-14, the City generated approximately $16K of revenue for conveyance of approximately 51.5 MG of treated effluent. The Golf Course is currently permitted to accept up to 0.7 MGD of treated wastewater from the City and will remain a critical partner to the City for disposal summertime treatment wastewater. As will be discussed below, the only other summertime effluent disposal option is the leach field which has hydraulic limitations based on evidence of potential impacts to groundwater when significant volumes are conveyed.

Based on historical irrigation records and an evaluation of typical agronomic rates for turf irrigation in Mt. Shasta, it is estimated the Golf Course can accept about 57 MG of treated wastewater during a normal rainfall year. The number of irrigateable days was based 2003 to 2011 precipitation data. Irrigation was not permitted 24 hours before precipitation, during periods of precipitation and at least 24 hours after cessation of precipitation. The estimated agronomic rate is less than the amount of wastewater expected to be generated. Therefore, during a wet years, the City will have to utilize the leach field to dispose of additional treated effluent.

c. Subsurface Disposal

The City's existing subsurface disposal facility is permitted for 0.7 MGD maximum daily flow and consists of about 20,000 linear feet of disposal trench covering approximately 20 acres of the existing 42-acre site. As part of the Wastewater Treatment and Disposal Feasibility Study, the City of Mt. Shasta hired Lawrence and Associates to perform a Leach Field Design Evaluation, a copy of which is included in Appendix E of that report. The results of the evaluation suggest the Leach Field has a much higher hydraulic capacity than 0.7 MGD. However, historical data reveals increased nitrate levels in underlying groundwater at disposal volumes much less than 0.7 MGD – approximately 0.29 MGD. The Central Valley Regional Water Quality Control Board (CVRWQCB) has indicated the practice of disposing more than historical volumes to the leach field will subject the City for much higher scrutiny from the CVRWQCB and the potential for additional studies, monitoring and more stringent discharge requirements.

d. Discharge to Upper Sacramento River

If the City is to keep it river discharge, it will need to consider making significant improvements to the existing lagoon treatment system, including employment of a nitrogen removal process. In addition, its effluent filtration facilities will need to be expanded or replaced in order to accommodate wintertime filtration of all wastewater.

Finally, alternatives to chlorine disinfection need to be considered in order to eliminate the threat of formation of disinfection byproducts. The City has already violated effluent limits for dichlorobromomethane (DCBM) which is a disinfection byproduct resulting from disinfection with chlorine. Other disinfection processes include ozone and ultraviolet (UV) radiation.

D. BIOLOGICAL TREATMENT

The driving force behind the need to improve biological treatment is the necessity to enhance nitrogen removal in order to comply with new ammonia effluent limits. Historically, the lagoon treatment system has provided adequate removal of BOD and TSS to meet discharge requirements. However, it does not adequately remove nitrogen. Based on the City's sampling/testing work, it appears Lagoon 1 provides effective nitrification (conversion of ammonia to nitrate), but testing reveals ammonia level tend to creep back up as the wastewater traverses through downstream lagoons. This is common in lagoon treatment system, as elevated ammonia levels can be caused by bacterial reduction of nitrate and/or decomposition of non-wastewater based biological material inherent to lagoon environments. Treatment alternatives for enhancing the existing lagoon system, as well as new treatment processes need to be considered, and are briefly discussed below.

a. Nitrogen Removal

As discussed above, the necessity to improve nitrogen removal is driving the need for improvements to the City's existing biological treatment process. Nitrogen removal is best accomplished, biologically, by creating environments in which nitrifying and denitrifying bacteria flourish. Unfortunately, lagoon treatment system do no afford the ability to maintain these environments. In order to affectively nitrify incoming ammonia to nitrate, an environment containing the following conditions must be provided:

- Adequate alkalinity.
- Wastewater temperature above 5°C.
- Adequate dissolved oxygen (DO) concentration to sustain the autotrophic nitrifying bacteria.

In the 2012 NPDES permit, the City received a new effluent limit for nitrate. Therefore, it will be necessary to denitrify by converting nitrate to nitrogen gas. In order to affectively accomplish this, the following conditions must be provided:

- Anoxic (low DO) environment.
- Adequate carbon source (food) to sustain the heterotrophic denitrifying bacteria.

The carbon source can be provided by the BOD in the raw wastewater or from an external source such as methanol, or glycerin. Methanol is, by far, the most commonly used carbon source for denitrification processes. However, many facilities have moved away from methanol due to the hazards associated with use of a volatile fuel source. Other carbon sources, such as glycerin, are safer but require modified process controls for effective use. For treatment alternatives utilizing nitrogen removal processes downstream of the existing lagoons, it will be necessary to add an external carbon source because adequate BOD will not exist to sustain the denitrifying bacteria.

New treatment processes will utilize anoxic selectors upstream of the biological treatment process in which nitrified wastewater will be returned and mixed with incoming wastewater to promote denitrification. This process is referred to as the Ludsack Ettinger activated sludge process. In addition, some alternatives will have an internal recycle that returns mixed liquor to the anoxic selector. This technique is referred to as the Modified Ludzack-Ettinger (MLE) activated sludge process and is used in many wastewater treatment plants in which nitrogen removal is required. A rule of thumb is that raw BOD concentrations must be at least four times TKN concentrations to promote effective denitrification. In Mt. Shasta's case this ratio is about 5.0 (200 mg/L / 40 mg/L), thus it's likely that an external carbon source will not be required for new treatment processes. Although, this will be further confirmed as part of our biological modelling efforts using BioWin.

Below are some additional considerations for wastewater treatment plant improvements.

b. Lagoon Modifications

Three alternatives will be considered for, 1) augmenting the existing lagoons to obtain nitrogen removal, and 2) adding processes downstream of the lagoons to promote nitrogen removal. They are as follows and described in more detail below

- BioLac® Activated Sludge
- BioShell Attached Growth Nitrification
- Moving Bed Bio-reactor (MBBR)

Since the Bioshell and MBBR options will rely on the existing lagoons for secondary treatment, algae is expected to be an issue, as it is in all lagoon-based treatment systems. Therefore, these alternatives will require dissolved air flotation (DAF) processes prior to filtration.

BioLac®: In order to promote nitrogen removal in the existing lagoons, it will be necessary to perform the following:

- Improve aeration system to provide aeration timing flexibility and control based on DO.
- Add clarification facilities so nitrified solids can be returned to the headworks.

Essentially, it will be necessary to convert an existing lagoon to an activated sludge reactor. The BioLac® process by Parkson Corporation is a lagoon-to-activated sludge retrofit system that incorporates the features described above. Consideration will need to be made for expected lower wastewater temperatures due to the surface area exposure to cold temperatures, and what affects this may have on nitrification.

BioShell: The use of BioShell attached growth nitrification would keep the existing lagoon treatment system in service and provide nitrification prior to tertiary treatment. BioShells were developed by the University of Utah and consist of a series of pipes in various sizes, cut longitudinally, and stacked on one another. In the annular space between pipes is a synthetic media that is available for autotrophic nitrifying bacteria to flourish. The BioShells are ab out 5.5 feet wide by 8 feet long by 5 feet high and are installed on the bottom of the lagoon with an air supply to each unit. By providing this process downstream of existing primary lagoons, process can be reduced in size because organics in the wastewater are much lower and the surface area requirements less.

A potentially major issue with the BioShells is they are primarily a nitrification process. Through pilot testing with another northern California wastewater agency, aeration times were modified to try to promote denitrification but limited results showed ammonia concentrations increased while nitrate concentrations decreased during the anoxic periods.

MBBR: Another post-lagoon nitrogen removal process that will be considered is the MBBR. Similar to the BioShells, this process would be installed downstream of the lagoon treatment system to take advantage of the reduced organic load. The MBBR is both a fixed-film and suspended growth process consisting of concrete basins filled with a free-floating polyethylene packing media. The media creates protected surface areas for attached-growth (biofilm) to form. There would be two processes – one for nitrification and one for denitrification. The nitrification MBBR would be aerated.

Because of the low organic content in the wastewater at this point of the treatment process, an external carbon source would be required to obtain denitrification.

A potential disadvantage of both the BioShell and MBBR processes is that wastewater temperatures would be lower than the incoming raw wastewater due to the lagoon exposure to low ambient temperatures during the winter months. As discussed earlier, at temperatures below about 5°C, nitrification becomes somewhat unpredictable.

c. New Treatment Processes

Four new treatment processes are to be evaluated for replacing the existing lagoon treatment system. Three of the four processes rely on the MLE activated sludge configuration described earlier for its proven nitrogen removal effectiveness. One process creates similar nitrogen removal conditions by timed aeration and filling and drawing a reactor basin. The new treatment plant options are as follows.

- Conventional Activated Sludge (CAS) using MLE
- Aero-Mod Activated Sludge
- Membrane Bioreactor (MBR)
- Sequencing Batch Reactor (SBR)

Compared to alternatives that modify the existing lagoons, all new treatment alternatives will take advantage of slightly higher wastewater temperatures to enhance nitrification. In addition, treatment process control will be much easier with properly-sized concrete basins hydraulic conveyance systems. Below is a brief description of the four alternatives considered for replacing the existing lagoon treatment facilities.

CAS: The CAS alternative will consist of a suspended growth aerated reactor basin preceded by an anoxic selector. Mixed liquor and return activated sludge (RAS) will be returned to the selector to promote denitrification. Nitrification will occur in the aeration basin. Secondary clarifiers will be provided to separate sludge from the mixed liquor. Aerobic digesters will be used to stabilize waste activate sludge (WAS) before dewatering and final disposal. Using historical raw wastewater characterization data, a biological treatment model of the CAS process will be prepared using BioWin by Envirosim. The model will be used to size reactor basins and determine what, if any, ancillary chemicals are required to obtain desired effluent limits.

Aero-Mod Activated Sludge: Aero-Mod Wastewater Process Solutions (Aero-Mod), stationed in Manhattan, Kansas, is a developer and supplier of municipal and industrial wastewater treatment facilities. At the time of this writing, Aero-Mod had over 160 installations worldwide and recently developed its Sequential Oxidation (SEQUOX®) nutrient removal activated sludge process. The SEQUOX® process is essentially a variation of the Ludzack Ettinger process but contains a second-stage aerobic/anoxic sequencing reactor to promote denitrification.

Working with Aero-Mod process engineers, we will develop a BioWin model to evaluate performance of this process. The process relies on common-wall construction such that some walls are shared by two processes (one each side of the wall) which reduces overall footprint size and construction cost. Air lift pumps are used to convey RAS from the clarifier to an up-front selector. Aeration is accomplished using side-cast aerators than can be removed and/or maintained from above the water surface.

There are two relatively new Aero-Mod facilities in Rio Del and Ferndale, CA which PACE and City Staff will visit as part of the alternative evaluation.

Membrane Bio-reactor (MBR): The MBR activated sludge process was required to be analyzed as part of the consultant solicitation documents for the subject project. MBR facilities are activated sludge facilities that utilize microfiltration in the aeration basin to separate liquid from solid phases in wastewater. Consequently, there is no need for secondary clarification or filtration. MBR's provide an extremely high quality effluent, in terms of BOD and TSS, but nitrogen removal is still dependent on the activated sludge process, and not the membrane. Although, solids residence time (SRT) can be increased without fear of solids carryover in secondary clarifiers which tends to enhance denitrification.

MBR facilities require a smaller overall footprint so infrastructure capital cost can be significantly less than conventional facilities. However, capital costs for membranes and ancillary equipment is expensive, often erasing any savings from smaller infrastructure. In addition, operations and maintenance (O&M) costs are higher than conventional facilities due to increased maintenance of membranes and power needs necessary to convey wastewater through the membranes. For Mt. Shasta, membranes would likely need to be de-rated due to the cold wastewater temperatures.

Nevertheless, we will evaluate an MBR treatment facility against all other alternatives.

SBR: The sequencing batch reactor (SBR) is proven, long-standing activated sludge process that provides effective nitrogen removal. The process utilizes one basin to accomplish the following treatment steps: 1) fill, 2) aeration, 3) settling, 4) decant, and 5) idle. In order to accommodate continuous flow, a second basin is required to accept flow while the other basin goes through its treatment cycle. The SBR process employs pre-anoxic denitrification utilizing the influent BOD (food source) and endogenous respiration to remove nitrate. By the end of the settling and decant step, most of the nitrate is removed from the mixed liquor.

In order to facilitate continuous flow to the downstream filtration and disinfection processes, a small, post-SBR equalization basin would be required. The decant step usually requires pumping which increases power consumption.

E. ANCILIARY CHEMICAL ADDITION

Depending on the treatment alternative, the following chemicals may need to be incorporated into the treatment process.

a. pH Adjustment

In the past, the City has struggled with meeting effluent pH discharge limits between 6.0 and 9.0. The 2012 NPDES permits tightened these limits to between 6.5 and 8.5. The City has taken steps to control effluent pH by switching primary coagulants from the alkalinity-consuming aluminum sulfate (alum) to more neutral coagulant blends. The results have been much better but, at times, it still struggles keeping pH above 6.5. Additional modifications that could enhance consistent pH compliance include:

- Switching from gas chlorination to liquid chlorine or other disinfection process, such as ozone or ultraviolet (UV) radiation.
- Provide more effective denitrification.

The City's future WWTP will need to provide more effective nitrification which will consume even more alkalinity. Denitrification is most effective at a pH slightly greater than neutral (7.0.) BioWin modelling will reveal the need for pH adjustment and/or alkalinity addition to promote the most effective treatment. However, given the City's past struggles with pH compliance, we anticipate the future WWTP should have the ability to adjust pH at the headworks. Common chemicals for adjusting pH are soda ash, lime and caustic. Soda ash is used in many small facilities throughout northern California and is considered much safer to operations personnel, and less expensive than caustic.

However, soda ash is not very soluble in water and requires continuous agitation to keep in in suspension. Caustic is easily mixed with water but poses safety threats to operations personnel. In addition, if used at high concentrations (above 50%), it has a high freezing point (about 60°F.) Therefore, caustic is often used at lower concentrations.
Lime is the most expensive neutralizing agent listed but is the least soluble in water, requiring preparation of a slurry prior to addition to water. Consequently, it is considered the most difficult to deal with, but is relatively safe for operations personnel.

During preliminary design of recommended improvements, the most appropriate pH neutralization chemical should be determined. However, a cost allowance will be provided in the recommended project.

b. External Carbon Source for Denitrification

Addition of an external carbon (food) may be required for biological treatment process alternatives that will not contain enough BOD during the denitrification step. For alternatives that replace the existing lagoon treatment system, it's not likely an external carbon source will be required because denitrification will occur in a selector with incoming raw wastewater which possesses adequate BOD.

The lagoon enhancement alternatives employ nitrification/denitrification downstream of the primary biological treatment process. Therefore, it will be necessary to add a carbon (food) source to promote denitrification. Due to safety issues, methanol is not the preferred choice. As part of preliminary design of the recommended project, the designer should evaluate other carbon sources, such as glycerin or acetate, and determine the best chemical for meeting the City's needs.

F. FILTRATION

The City's new NPDES permit requires filtration of its effluent prior to discharge to the Sacramento River during the winter months which is when wastewater flows are highest. The existing rapid sand filter has a capacity of about 1.0 MGD. Current peak wet weather flows could reach 3.2 MGD or more. Thus, the existing effluent filtration facilities need to be expanded or replaced with higher capacity units. The existing facilities are located above ground under a steel framed cover with no sides. Consequently, the vessels, including process equipment and small diameter piping are subject to harsh, wintertime temperatures, rending the equipment inoperable. The existing structure is not large enough to accommodate additional like facilities for meeting expected wintertime flows. In addition, the cost to expand the structure, add insulated walls and ceiling with heated interior would be very expensive. Instead, it is proposed the existing filter and DAF processes be abandoned and new in-ground, covered facilities constructed.

Two types of effluent filtration processes will be considered, and are described in more detail below.

a. Disk Filters

Disk filters have gained in popularity in recent years due to the relatively small footprint, low backwash rates, and relatively ease of maintenance. Disk filters rely on a series of cloth-covered disks mounted to a central feed tube that is partially submerged within a steel box. Effluent enters the feed tube and is conveyed into the disks and through the cloth medium into the basin in which the disks reside. The cloth medium has pore opening in the range of 10 μm to 30 μm. High pressure spray nozzles remove accumulated solids by spraying the outside of the disks which dislodges solids accumulation on the inside.

Disks filters are relatively expensive compared to other filtration types and, in Mt. Shasta, would likely need to be installed inside in insulated building to protect from freezing. In addition, the proposed upstream biological treatment process do not include primary clarification. As a result, the fats and oils that may reach the cloth filter media may cause the blinding of the filter.

b. Sand Filters

Sand filtration has been the historical means to remove TSS prior to disinfection and disposal in wastewater treatment for many years. There are a number of sand filtration configurations, but the most common are travelling bridge filters, deep bed filters, and continuous backwash up-flow filters. Deep bed filters are typically expensive to construct and require high backwash rates in order to adequately fluidize the bed during backwashing. Continuous up-flow filters are less common and are expensive to construct.

Travelling bridge filters are the most common in the north state as they are relatively inexpensive to construct, can be installed subgrade to mitigate freezing, do not require an insulated enclosure and require small backwash rates because only a small portion of the filter bed is backwashed at one time while the remaining filter bed remains in service. A key factor in the effectiveness of travelling bridge filters is the care taken during construction to make sure the individual filter beds are sealed properly to the underdrain system below to prevent sand migration into the underdrain.

For cost estimating and alternative evaluation purposes, travelling bridge filters installed under a fixed roof structure have been assumed for all alternatives. However, it is recommended that other filtration technologies, such as disk filtration, be further evaluated during initial design of the improvements.

G. DISINFECTION

The City uses gaseous chlorine for disinfection which is very effective and inexpensive compared to other disinfection methods. However, chlorine gas is extremely hazardous to workers with and many municipalities have moved away from gas for these reasons. With any chlorine-based disinfection, it is necessary to remove any chlorine residual from the wastewater prior to discharging to water bodies. The City currently uses gaseous sulfur dioxide for dechlorination. Below are the various disinfection methods considered for this project.

a. Chlorination

As indicated above, gaseous chlorine is cost-effective but hazardous to workers and the environment. In addition, gaseous chlorine consumes alkalinity in the wastewater which lowers pH and makes compliance with pH effluent limits more difficult. The City has struggled, at times, complying with the lower-bound pH limit of 6.5. The City's effluent pH limits were tightened in the 2012 NPDES permit. To mitigate this, many municipalities

have switched to liquid chlorine (sodium hypochlorite) which is less hazardous and has slightly alkaline properties so there are no impacts to effluent pH. Liquid chlorination is more expensive than gaseous chlorine and has a limited shelf life, so the timing of bulk deliveries relative to usage rates is important to properly manage.

A key factor driving the need to consider alternative disinfection methods is the presence of regulated disinfection byproducts (DBP) present in NPDES permits. Currently, the City has an effluent limit for dichlorobromomethane which is a DBP resulting from use of gaseous or liquid chlorine. For this reason, it's not likely chlorine disinfection will be the best approach for the City if it is to retain its Sacramento River discharge. Nevertheless, both gaseous and liquid chlorine disinfection will be evaluated against other disinfection methods.

b. Ozone

Ozone is an unstable and extremely reactive oxidant that is more effective than chlorine for inactivating most viruses, spores, cysts and oocysts. Ozone is quickly converted to water and oxygen when in aqueous solution, thus no disinfectant neutralization is required (e.g. dechlorination). The short life of ozone requires that it is generated onsite. There are several methods used to generate ozone which include electrolysis, photochemical reaction, and radiochemical reaction by electrical discharge. Although the efficiency of ozone generators has improved in recent years, it still requires a large amount of energy. Onsite generation of ozone has high capital and O&M cost.

If future discharge requirements include pharmaceuticals, ozone can be combined with the hydrogen peroxide to destroy regulated compounds. Although ozone does not form disinfection byproducts, such as THMs and HAAs, ozone does have the potential to form aldehydes, various acids, aldo- and ketoacids. In addition, if bromide is present, certain brominated byproducts can be formed.

c. Ultraviolet (UV) Radiation

Many municipalities have converted their chlorination disinfection facilities to UV systems in order to avoid discharge violations associated with the presence of DBP's. Ultraviolet (UV) light is a designation given to the spectrum of light with wavelengths between 10^{-7} meters and 10^{-3} meters. The UV spectrum, $10^{-6.595}$ meters (254 nm) in particular, has germicidal properties. Exposure of microorganisms to UV light, either prevents the replication of DNA and the ability of cells to reproduce, or it causes cell death. As a result, UV light is an effective disinfectant.

There are several different lamps that are used to produce UV light which include 1) low-pressure low-intensity, 2) low-pressure high-intensity and 3) medium-pressure high-intensity. Although there are specific differences between the characteristics of

these lamps and the light produced, they all operate under the same principles. Similar to chlorine, a specific dose is required to obtain a required kill or inactivation.

While chlorine disinfection is a function of concentration and time, UV disinfection is a function of light intensity and time. A key variable in determining the required UV intensity to achieve disinfection is the amount of UV light that is absorbed by dissolved material in the water. Ultraviolet transmittance (UVT) is a measurement used to quantify this. This measurement is analogous to the clarity of the water for the UV spectrum. It is worth noting that water samples that appear clear in the visible light spectrum, may not be clear in the UV spectrum. Waters with low UVT values require significantly more UV infrastructure and increased energy costs for disinfection.

As part of the City's data sampling and testing protocol for this project, it measured UVT at various points throughout the existing treatment process. UVT readings were quite variable, suggesting the lagoons have a seasonal impact on the UVT. Therefore, for treatment alternatives utilizing the existing lagoons, a lower UVT was assumed for the purpose of sizing appropriate UV systems.

H. FLOW EQUALIZATION

Flow equalization is a common practice at wastewater treatment plants serving collection systems with high infiltration and inflow (I&I) like Mt. Shasta's. Employing flow equalization allows secondary and tertiary treatment processes to be downsized. For new treatment alternatives, depending on the associated ability to accommodate peak flows, emergency retention will be accomplished be converting Lagoon 1, or portions thereof, to an emergency retention basin (ERB). Based on an evaluation of peak wet weather flows occurring in 2003, we determined that the volume in excess of the Aero-Mod's 3.6 mgd capacity would be stored in an ERB. This corresponds with a volume of 0.23 MG. To be conservative, we assumed that similar rainfall and snow melts could occur up to one week. This translates to 1.6 mg, which is approximately equal half of lagoon 1.

a. Raw Wastewater

Based on historical influent flow data, the City has received high peak wet weather flows up to five times ADWF. However, these peaks typically last for hours as opposed to days. Each treatment alternative has a unique ability to accommodate peak flows. For example, the continuous-flow activated sludge alternatives can accommodate peak daily flows up to about 3.5 times the ADWF design flow rate. However, for sustained flows at this level, equalizing storage may be required. The MBR treatment alternative only has the ability to accommodate peak flows of about twice the design ADWF so will require more equalizing storage.

For the purpose of the alternatives evaluation, it is assumed that Lagoon 1 would be converted to two ERB's by dredging and disposing existing sludge and lining with a synthetic liner. The City's existing static-tube aeration system would be re-used in the ERB's to provide enough aeration to keep the stored raw wastewater "fresh" until it can be recycled into the treatment process.

b. Tertiary Treatment

In general, tertiary treatment processes (filtration and disinfection) will be sized to match the capacity of the secondary treatment process. However, the SBR treatment alternative requires equalizing storage downstream of the secondary process in order to convey continuous flows to tertiary processes. This is due to the non-continuous flow inherent to the SBR's fill, draw, and idle characteristics in the reactor basins.

APPENDIX G

TABLE 1A
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
CONVENTIONAL ACTIVATED SLUDGE PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units		Unit Cost		ADWF = 1.2 MGD Total Cost
	Civil Site Work & Miscellaneous						
1	Mobilization & Demobilization	1	LS	$	100,000	$	100,000
2	Site Grading and Aggregate Base	1	LS	$	20,000	$	20,000
3	Erosion Control SWPPP & Implemetation	1	LS	$	25,000	$	25,000
4	Shop Drawings/Testing/Equipment Manuals	1	LS	$	50,000	$	50,000
5	Cleanup	1	LS	$	20,000	$	20,000
	Subtotal					$	215,000
	0.8 MGD ADWF Conventional Activated Sludge Equipment						
6	Excavation (Selector, CAS, Clarifier & Digester)	19100	CY	$	30	$	573,000
7	Headworks Excavation	63	CY	$	30	$	1,880
8	Headworks Screen	2	EA	$	95,000	$	190,000
9	Headworks Concrete	1	LS	$	57,659	$	57,659
10	Parshall Flume	1	LS	$	6,000	$	6,000
11	Pond Bypass Piping	1000	LF	$	240	$	240,000
12	Anoxic Selector Mixing System	4	LS	$	40,000	$	160,000
13	CAS Concrete (Selector, CAS, Clarifier & Digester)	1	LS	$	3,711,000	$	3,711,000
14	CAS Mixing System	16	LS	$	40,000	$	640,000
15	CAS Aeration System	10296	SF	$	38	$	391,000
16	CAS Underground Piping	400	LF	$	240	$	96,000
17	ML/RAS/WAS Pump Underground Piping	1621	LF	$	240	$	389,040
18	ML/RAS/WAS Pump Station and Building	1	LS	$	460,000	$	460,000
19	12" Air Manifold, Process & Utility Piping	350	LF	$	150	$	53,000
20	Blowers Building	200	SF	$	150	$	30,000
21	Blower Building HVAC	1	LS	$	20,000	$	20,000
22	CAS Blowers	1	LS	$	198,000	$	198,000
23	Digester Aeration System	4410	SF	$	25.00	$	110,000.00
24	Digester Blowers	1	LS	$	142,000	$	142,000
25	Soda Ash Dosing Station	1	LS	$	10,000	$	10,000
26	Clarifier Equipment	2	LS	$	300,000	$	600,000
27	Clarifier Underground Piping	900	LF	$	240	$	216,000
28	Headworks Return Pump Station	1	LS	$	230,000	$	230,000
29	Generator & Ancillary Equipment	1	LS	$	122,000	$	122,000
	Subtotal					$	8,646,579
	CAS Emergency Retention Basin						
30	Sludge Removal and Excavation	3000	CY	$	125	$	375,000
31	ERB Liner	1	LS	$	65,000	$	65,000
	Subtotal					$	440,000
	2.1 MGD ADWF 16'x46' TBF Equipment						
32	TBF Equip, Including Ancillary Equip, Instr/Controls	2	LS	$	251,000	$	502,000
33	TBF Concrete Basin	1	LS	$	416,000	$	416,000
34	TBF Excavation	1200	CY	$	30	$	36,000
35	Process & Utility Piping	240	LF	$	175	$	42,000
36	Metal Enclosure	4800	SF	$	25	$	120,000
	Subtotal					$	1,116,000
	1.6 MGD PWWF UV Equipment						
37	UV Disinfection System Equipment	1	LS	$	570,000	$	570,000
38	UV Concrete Treatment Basins	1	LS	$	130,000	$	130,000
39	Electrical Controls	1	LS	$	250,000	$	250,000
	Subtotal					$	950,000
	1.55 MGD ADWF Dewatering Equipment						
40	Dewatering Equipment	1	LS	$	1,018,000	$	1,018,000
41	Electrical	1	LS	$	250,000	$	250,000
42	Building	1	LS	$	381,000	$	381,000
	Subtotal					$	1,649,000
	New Lab & Control Building						
43	New Control Building	2500	SF	$	250	$	625,000
44	Laboratory Equipment	1	LS	$	50,000	$	50,000
	Subtotal					$	675,000
	Outfall Improvements						
44	New Diffuser and Ancillary Improvements	1	LS	$	93,000	$	93,000
	Total Estimated Construction Cost without Contingency					$	13,785,000
	Construction Contingency @ 20%					$	2,757,000
	Indirect/Engineering @ 25%					$	3,446,000
	Subtotal					$	6,203,000
	Total Estimated Project Cost (October 2013 Dollars)					**$**	**20,000,000**

TABLE 1B
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
CONVENTIONAL ACTIVATED SLUDGE PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units		Unit Cost		ADWF = 1.2 MGD Total Cost
	CAS Plant Operation & Maintenance						
1	Soda Ash	85100	Lbs	$	0.70	$	59,570.00
2	Aeration System Blowers (50 BHP: 1 Duty, 1 Standby)	326617	kWHr	$	0.11	$	35,927.83
3	ML/RAS Pumps (25 BHP: 4 Duty 1 Standby)	653233	kWHr	$	0.11	$	71,855.65
4	Clarifier Motor (1 HP: 2 Duty)	13065	kWHr	$	0.11	$	1,437.11
5	Digester System Blowers (50 BHP: 1 Duty, 1 Standby)	13065	kWHr	$	0.11	$	1,437.11
6	Anoxic Mixer (2 HP: 2 Duty)	26445	kWHr	$	0.11	$	2,908.92
7	PLC (0.003 kW)	26	kWHr	$	0.11	$	2.89
8	Lights (1 kW)	2920	kWHr	$	0.11	$	321.20
9	Equipment Repairs/Lubrication/Replacement	1	LS	$	2,221.00	$	2,221.00
10	Diffuser Replacement	41	LS	$	25.00	$	1,035.00
11	Sampling	25	Hrs	$	-	$	-
12	Labor	500	Hrs		0.00	$	-
	Subtotal					$	176,716.71
	TBF Operations & Maintenance						
12	Power Consumption	19597	kWHr	$	0	$	2,156
13	Lubricate Gear Reducer	1	Hrs	$	-	$	-
14	Lubricate Drive Shaft	1	Hrs	$	-	$	-
15	Lubricate Sliding Wheels	1	Hrs	$	-	$	-
16	Gear Reducer Inspection, Tightening Set Screws	2	Hrs	$	-	$	-
17	Check Misc Alignments	2	Hrs	$	-	$	-
18	Underdrain Inspection	8	Hrs	$	-	$	-
19	Media Replacement(1)	0.81	LS	$	200	$	162
20	Media Replacement Labor	17	Hrs	$	-	$	-
21	Underdrain Replacement(2)	1	LS	$	1,429	$	1,429
22	Underdrain Replacement Labor	146	Hrs	$	-	$	-
23	Spare Parts(3)	1	LS	$	1,186	$	1,186
	Subtotal					$	4,933
	Digester Operation & Maintenance						
24	Aeration System Blowers (75 BHP: 1 Duty, 1 Standby)	489925	kWHr	$	0.11	$	53,891.74
25	Mixer (40 BHP: 2 Duty)	661117	kWHr	$	0.11	$	72,722.89
26	Diffuser Replacement	41	LS	$	25.00	$	1,035.00
	Subtotal						$127,650
	Dewatering Operation & Maintenance						
27	Polymer	1	LS	$	17,772.30	$	17,772
28	Sludge Feed Pump (10 BHP)	13773	kWHr	$	0.11	$	1,515
29	Centrifuge System (75 BHP)	103300	kWHr	$	0.11	$	11,363
30	Sludge Grinder (3 & 5 BHP)	11019	kWHr	$	0.11	$	1,212
31	Polymer Feed (1 BHP)	1377	kWHr	$	0.11	$	152
32	Ventilation Fans (2 at 1.5 BHP & 1 at 1 BHP)	5509	kWHr	$	0.11	$	606
33	Conveyor (5 BHP)	6887	kWHr	$	0.11	$	758
34	Annual Sludge Hauling Cost	979	Tons	$	40	$	38,788
35	Annual Landfill Tipping Fees	979	Tons	$	56	$	54,936
36	Labor	484	Hrs	$	-	$	-
37	Annual Parts Replacement	1	LS	$	3,000.00	$	3,000
	Subtotal					$	130,101.74
	UV System Operation & Maintenance						
38	UV System Operation	63072	KWHr	$	0.11	$	6,937.92
39	Yearly Lamp Replacement	32	LS	$	280.00	$	8,960.00
40	Daily Maintenance	200	Hrs	$	-	$	-
	Subtotal					$	15,897.92
41	**Facility Operations Staff (3)**	1	LS	$	270,000	$	270,000
	Annual Cost					**$**	**726,000.00**
	Equipment 20 Year Present Cost					**$**	**14,520,000.00**

TABLE 2A
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
AERO-MOD ACTIVATED SLUDGE PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units	Unit Cost	ADWF = 1.2 MGD Total Cost
	Civil Site Work & Miscellaneous				
1	Mobilization & Demobilization	1	LS	$100,000	$100,000
2	Site Grading and Aggregate Base	1	LS	$20,000	$20,000
3	Erosion Control SWPPP & Implementation	1	LS	$25,000	$25,000
4	Shop Drawings/Testing/Equipment Manuals	1	LS	$50,000	$50,000
5	Cleanup	1	LS	$20,000	$20,000
	Subtotal				$215,000
	1.2 MGD ADWF Aero-Mod Equipment				
6	Excavation (Selector, CAS, Clarifier & Digester)	12200	CY	$30	$366,000
7	Headworks Excavation	63	CY	$30	$1,880
8	Headworks Screen	2	EA	$95,000	$190,000
9	Headworks Concrete	1	LS	$57,659	$57,659
10	Parshall Flume	1	LS	$6,000	$6,000
11	Pond Bypass Piping	1100	LF	$240	$264,000
12	Aero-Mod Equipment	1	LS	$2,190,000	$2,190,000
13	Aero-Mod Equipment & Interior Piping Installation Cost	1	LS	$360,000	$360,000
14	Concrete (Selector, Aeration Tank, Clarifier & Digester)	2100	CY	$1,200	$2,520,000
15	Aero-Mod Grout	242	CY	$800	$193,600
16	Aero-Mod Yard Piping	577	LF	$240	$138,000
17	12" Air Manifold, Process & Utility Piping	560	LF	$150	$84,000
18	Blowers Building	400	SF	$150	$60,000
19	Blower Building HVAC	1	LS	$20,000	$20,000
20	Soda Ash Dosing Station	1	LS	$10,000	$10,000
21	Generator & Ancillary Equipment	1	LS	$84,000	$84,000
	Subtotal				$6,545,139
	2.1 MGD ADWF 16'x46' TBF Equipment				
22	TBF Equip, Including Ancillary Equip, Instr/Controls	2	LS	$251,000	$502,000
23	TBF Concrete Basin	1	LS	$416,000	$416,000
24	TBF Excavation	1200	CY	$30	$36,000
25	Process & Utility Piping	240	LF	$175	$42,000
26	Metal Enclosure	4800	SF	$25	$120,000
	Subtotal				$1,116,000
	1.6 MGD PWWF UV Equipment				
27	UV Disinfection System Equipment	1	LS	$570,000	$570,000
28	UV Concrete Treatment Basins	1	LS	$130,000	$130,000
29	Electrical Controls	1	LS	$250,000	$250,000
	Subtotal				$950,000
	1.55 MGD ADWF Dewatering Equipment				
30	Dewatering Equipment	1	LS	$1,018,000	$1,018,000
31	Electrical	1	LS	$250,000	$250,000
32	Building	1	LS	$381,000	$381,000
	Subtotal				$1,649,000
	New Lab & Control Building				
33	New Control Building	2500	SF	$250	$625,000
34	Laboratory Equipment	1	LS	$50,000	$50,000
	Subtotal				$675,000
	Outfall Improvements				
35	New Diffuser and Ancillary Improvements	1	LS	$93,000	$93,000
	Total Estimated Construction Cost without Contingency				$11,244,000
	Construction Contingency @ 20%				$2,249,000
	Indirect/Engineering @ 25%				$2,811,000
	Subtotal				$5,060,000
	Total Estimated Project Cost (June 2014 Dollars)				**$16,300,000**

TABLE 2B
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
AEROMOD ACTIVATED SLUDGE PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units	Unit Cost	ADWF = 1.2 MGD Total Cost
	AeroMod Activated Sludge Plant Operation & Maintenance				
1	Soda Ash	85100	Lbs	$0.70	$59,570
2	Aeration System Blowers (100 BHP: 2 Duty, 2	991608	kWHr	$0.11	$109,077
3	PLC (0.003 kW)	26	kWHr	$0.11	$3
4	Lights (1 kW)	2920	kWHr	$0.11	$321
5	Labor	500	Hrs	$0.00	$0
9	Equipment Repairs/Lubrication/Replacement	1	LS	$2,221	$2,221
10	Diffuser Replacement	41	LS	$25.00	$1,035
11	Sampling	25	Hrs	$0.00	$0
	Subtotal				$172,227
	TBF Operations & Maintenance				
11	Power Consumption	19597	kWHr	$0.11	$2,156
12	Lubricate Gear Reducer	1	Hrs	$0.00	$0
13	Lubricate Drive Shaft	1	Hrs	$0.00	$0
14	Lubricate Sliding Wheels	1	Hrs	$0.00	$0
15	Gear Reducer Inspection, Tightening Set Scre	2	Hrs	$0.00	$0
16	Check Misc Alignments	2	Hrs	$0.00	$0
17	Underdrain Inspection	8	Hrs	$0.00	$0
18	Media Replacement(1)	0.81	LS	$200	$162
19	Media Replacement Labor	17	Hrs	$0.00	$0
20	Underdrain Replacement(2)	1	LS	$1,429	$1,429
21	Underdrain Replacement Labor	146	Hrs	$0.00	$0
22	Spare Parts(3)	1	LS	$1,186	$1,186
	Subtotal				$4,933
	Dewatering Operation & Maintenance				
26	Polymer	1	LS	$17,772	$17,772
27	Sludge Feed Pump (10 BHP)	13773	kWHr	$0.11	$1,515
28	Centrifuge System (75 BHP)	103300	kWHr	$0.11	$11,363
29	Sludge Grinder (3 & 5 BHP)	11019	kWHr	$0.11	$1,212
30	Polymer Feed (1 BHP)	1377	kWHr	$0.11	$152
31	Ventilation Fans (2 at 1.5 BHP & 1 at 1 BHP)	5509	kWHr	$0.11	$606
32	Conveyor (5 BHP)	6887	kWHr	$0.11	$758
33	Annual Sludge Hauling Cost	979	Tons	$39.62	$38,788
34	Annual Landfill Tipping Fees	979	Tons	$56.11	$54,936
35	Labor	484	Hrs	$0.00	$0
36	Annual Parts Replacement	1	LS	$3,000	$3,000
	Subtotal				$130,102
	UV System Operation & Maintenance				
37	UV System Operation	63072	KWHr	$0.11	$6,938
38	Yearly Lamp Replacement	32	LS	$280	$8,960
39	Daily Maintenance	200	Hrs	$0.00	$0
	Subtotal				$15,898
40	**Facility Operations Staff (3)**	1	LS	$270,000	$270,000
	Annual Cost				**$594,000**
	Equipment 20 Year Present Cost				**$11,880,000**

TABLE 3A
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
MEMBRANE BIOREACTOR PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units	Unit Cost	ADWF = 1.2 MGD Total Cost
	Civil Site Work & Miscellaneous				
1	Mobilization & Demobilization	1	LS	$ 100,000	$ 100,000
2	Site Grading and Aggregate Base	1	LS	$ 20,000	$ 20,000
3	Erosion Control SWPPP & Implementation	1	LS	$ 25,000	$ 25,000
4	Shop Drawings/Testing/Equipment Manuals	1	LS	$ 50,000	$ 50,000
5	Cleanup	1	LS	$ 20,000	$ 20,000
	Subtotal				$ 215,000
	1.3 MGD MMF Membrane Bioreactor Equipment				
6	MBR Equip, Including Ancillary Equip, Instr/controls	1	LS	$ 2,725,000	$ 2,725,000
7	MBR Excavation	4500	CY	$ 30	$ 135,000
8	Headworks Excavation	63	CY	$ 30	$ 1,880
9	Headworks Screen	2	EA	$ 95,000	$ 190,000
10	Headworks Concrete	1	LS	$ 57,659	$ 57,659
11	Parshall Flume	1	LS	$ 6,000	$ 6,000
12	Pond Bypass Piping	1100	LF	$ 150	$ 165,000
13	Soda Ash Dosing Station	1	LS	$ 10,000	$ 10,000
14	MBR SS Above Ground Recirculation Piping	400	LF	$ 240	$ 96,000
15	MBR Underground Piping	400	LF	$ 240	$ 96,000
16	MBR Concrete Treatment Basins	1	LS	$ 1,184,292	$ 1,184,292
17	Digester MBT Equip, Including Ancillary Equip, Instr/controls	1	LS	$ 699,000	$ 699,000
18	12" Air Manifold, Process & Utility Piping	200	LF	$ 150	$ 30,000
19	Digester Excavation	1090	CY	$ 30	$ 33,000
20	Digester Underground Piping	150	LF	$ 240	$ 36,000
21	Digester Concrete Basin	301	CY	$ 1,200	$ 361,000
22	Generator & Ancillary Equipment	1	LS	$ 122,000	$ 122,000
	Subtotal				$ 5,947,831
	MBR Emergency Retention Basin				
23	Sludge Removal and Excavation	3000	CY	$ 125	$ 375,000
22	ERB Liner	1	LS	$ 65,000	$ 65,000
	Subtotal				$ 440,000
	1.6 MGD PWWF UV Equipment				
25	UV Disinfection System Equipment	1	LS	$ 570,000	$ 570,000
26	UV Concrete Treatment Basins	1	LS	$ 130,000	$ 130,000
27	Electrical Controls	1	LS	$ 250,000	$ 250,000
28	Metal Enclosure	2580	SF	$ 25	$ 64,500
	Subtotal				$ 1,014,500
	1.55 MGD ADWF Dewatering Equipment				
29	Dewatering Equipment	1	LS	$ 1,018,000	$ 1,018,000
30	Electrical	1	LS	$ 250,000	$ 250,000
31	Building	1	LS	$ 381,000	$ 381,000
	Subtotal				$ 1,649,000
	New Lab & Control Building				
32	New Control Building	2500	SF	$ 250	$ 625,000
33	Laboratory Equipment	1	LS	$ 50,000	$ 50,000
	Subtotal				$ 675,000
	Outfall Improvements				
33	New Diffuser and Ancillary Improvements	1	LS	$ 93,000	$ 93,000
	Total Estimated Construction Cost without Contingency				$ 10,035,000
	Construction Contingency @ 20%				$ 2,007,000
	Indirect/Engineering @ 25%				$ 2,509,000
	Subtotal				$ 4,516,000
	Total Estimated Project Cost (without Cost Adders)				**$ 14,600,000**

TABLE 3B
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
MEMBRANE BIOREACTOR PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units	Unit Cost	ADWF = 1.2 MGD Total Cost
	MBR Plant Operation & Maintenance				
1	Sodium Hypochlorite	6663	Lbs	$ 0.10	$ 666
2	Oxalic Acid	2304	Lbs	$ 0.71	$ 1,636
3	MBR & MBT Labor	715	Hrs	$ -	$ -
4	MBR Blowers (75 HP: 2 duty, 1 Common Standby)	582766	KWHr	$ 0.11	$ 64,104
5	Pre-Anoxic Blowers (30 HP: 2 Duty)	126994	KWHr	$ 0.11	$ 13,969
6	RAS Pumps (7.5 HP: 2 Duty)	0	KWHr	$ 0.11	$ -
7	Permeate Pumps (10 HP: 2 Duty, 0 Standby)	114610	KWHr	$ 0.11	$ 12,607
8	Feed Forward Pumps (36 HP: 2 Duty, 1 Stanby	141222	KWHr	$ 0.11	$ 15,534
9	PLC (0.003 Kw)	26	KWHr	$ 0.11	$ 3
10	Mixer (9.2 HP: 2 Duty)	120195	KWHr	$ 0.11	$ 13,221
11	Blowers Oil & Filter Change	25	Hrs	$ -	$ -
12	Permeate Pumps Inspection and Lubrication	6	Hrs	$ -	$ -
13	RAS Pumps Inspection and Lubrication	8	Hrs	$ -	$ -
14	Instrumentation Calibration and Cleaning	21	Hrs	$ -	$ -
15	Sampling	25	Hrs	$ -	$ -
16	Mixer Seal Replacement	1	Hrs	$ -	$ -
17	Crane Rental	1	LS	$ 3,000	$ 3,000
18	Diffuser Replacement	45	LS	$ 25	$ 1,133
19	Membrane Replacement Cost (20%/Year after 10 Years)	8	LS	$ 5,583	$ 44,664
	Subtotal				$ 230,108
	Membrane Thickner & Digester				
20	MBT System Blowers (15 BHP: 1 Duty, 1 Standby)	93221	kWHr	$ 0.11	$ 10,254
21	Permeate Pumps (5 BHP: 1 Duty, 1 Standby)	16294	kWHr	$ 0.11	$ 1,792
22	Digester System Blowers (125 BHP: 1 Duty, 1 Standby)	326748	kWHr	$ 0.11	$ 35,942
23	PLC (0.003 Kw)	26.28	KWHr	$ 0.11	$ 3
24	Diffuser Replacement	3.6	LS	$ 25.00	$ 90
25	Membrane Replacement Cost (20%/Year after 10 Years)	0.3	LS	$ 5,583.00	$ 1,489
	Subtotal				$ 49,571
	Dewatering Operation & Maintenance				
26	Polymer	1	LS	$ 17,772.30	$ 17,772
27	Sludge Feed Pump (10 BHP)	13773	kWHr	$ 0.11	$ 1,515
28	Centrifuge System (75 BHP)	103300	kWHr	$ 0.11	$ 11,363
29	Sludge Grinder (3 & 5 BHP)	11019	kWHr	$ 0.11	$ 1,212
30	Polymer Feed (1 BHP)	1377	kWHr	$ 0.11	$ 152
31	Ventilation Fans (2 at 1.5 BHP & 1 at 1 BHP)	5509	kWHr	$ 0.11	$ 606
32	Conveyor (5 BHP)	6887	kWHr	$ 0.11	$ 758
33	Annual Sludge Hauling Cost	979	Tons	$ 40	$ 38,788
34	Annual Landfill Tipping Fees	979	Tons	$ 56	$ 54,936
35	Labor	484	Hrs	$ -	$ -
36	Annual Parts Replacement	1	LS	$ 3,000.00	$ 3,000
	Subtotal				$ 130,102
	UV System Operation & Maintenance				
37	Power Consumption	63072	KWHr	$ 0.11	$ 6,938
38	Yearly Lamp Replacement	32	LS	$ 280.00	$ 8,960
39	Daily Maintenance	200	Hrs	$ -	$ -
	Subtotal				$ 15,898
40	**Facility Operations Staff (3)**	1	LS	$ 270,000	$ 270,000
	Annual Cost				**$ 696,000**
	Equipment 20 Year Present Cost				**$ 13,920,000**

TABLE 4A
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
SBR PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units		Unit Cost		ADWF = 1.2 MGD Total Cost
	Civil Site Work & Miscellaneous						
1	Mobilization & Demobilization	1	LS	$	100,000	$	100,000
2	Site Grading and Aggregate Base	1	LS	$	20,000	$	20,000
3	Erosion Control SWPPP & Implemetation	1	LS	$	25,000	$	25,000
4	Shop Drawings/Testing/Equipment Manuals	1	LS	$	50,000	$	50,000
5	Cleanup	1	LS	$	20,000	$	20,000
	Subtotal					$	215,000
	1.55 MGD ADWF Sequencing Batch Reactor Equipment						
6	SBR Equipment & Instrumentation/controls	1	LS	$	885,000	$	885,000
7	SBR & Post SBR Equalization Excavation	7300	CY	$	30	$	219,000
8	ERB Basin Liners	1	LS	$	65,000	$	65,000
9	Sludge Removal	3000	CY	$	125	$	375,000
10	Headworks Excavation	63	CY	$	30	$	1,880
11	Headworks Screen	2	EA	$	95,000	$	190,000
12	Headworks Concrete	1	LS	$	57,659	$	57,659
13	Parshall Flume	1	LS	$	6,000	$	6,000
14	Pond Bypass Piping	1100	LF	$	240	$	264,000
15	Soda Ash Dosing Station	1	LS	$	10,000	$	10,000
16	12" Air Manifold, Process & Utility Piping	600	LF	$	150	$	90,000
17	SBR & Post SBR Equalization Basin Concrete	1	LS	$	1,367,000	$	1,367,000
18	BW Return Utility Piping	50	LF	$	240	$	12,000
19	SBR Utility Piping	50	LF	$	240	$	12,000
20	Return Pump Station	1	LS	$	230,000	$	230,000
21	Return Pump Station	200	LF	$	240	$	48,000
22	Digester Excavation	3000	CY	$	30	$	90,000
23	Digester Concrete	355	CY	$	1,200	$	425,417
24	Digester Utility Piping	50	LF	$	240	$	12,000
25	Effluent Utility Piping	100	LF	$	239	$	23,900
26	Generator & Ancillary Equipment	1	LS	$	122,000	$	122,000
	Subtotal					$	4,505,856
	2.1 MGD ADWF 16'x46' TBF Equipment						
27	TBF Equip. Including Ancillary Equip. Instr/Controls	2	LS	$	251,000	$	502,000
28	TBF Concrete Basin	1	LS	$	416,000	$	416,000
29	TBF Excavation	1200	CY	$	30	$	36,000
30	Process & Utility Piping	240	LF	$	175	$	42,000
31	Metal Enclosure	4800	SF	$	25	$	120,000
	Subtotal					$	1,116,000
	1.6 MGD PWWF UV Equipment						
32	UV Disinfection System Equipment	1	LS	$	570,000	$	570,000
33	UV Concrete Treatment Basins	1	LS	$	130,000	$	130,000
34	Electrical Controls	1	LS	$	250,000	$	250,000
	Subtotal					$	950,000
	1.55 MGD ADWF Dewatering Equipment						
35	Dewatering Equipment	1	LS	$	1,018,000	$	1,018,000
36	Electrical	1	LS	$	250,000	$	250,000
37	Building	1	LS	$	381,000	$	381,000
	Subtotal					$	1,649,000
	New Lab & Control Building						
38	New Control Building	2500	SF	$	250	$	625,000
39	Laboratory Equipment	1	LS	$	50,000	$	50,000
	Subtotal					$	675,000
	Outfall Improvements						
40	New Diffuser and Ancillary Improvements	1	LS	$	93,000	$	93,000
	Total Estimated Construction Cost without Contingency					$	9,204,000
	Construction Contingency @ 20%					$	1,841,000
	Indirect/Engineering @ 25%					$	2,301,000
	Subtotal					$	4,142,000
	Total Estimated Project Cost (October 2013 Dollars)					**$**	**13,300,000**

TABLE 4B
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
SBR PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units	Unit Cost	ADWF = 1.2 MGD Total Cost
	SBR Plant Operation & Maintenance				
1	Sodium Hypochlorite	5330	Lbs	$ 0.10	$ 533
2	Oxalic Acid	1843	Lbs	$ 0.71	$ 1,309
3	Soda Ash	85100	Lbs	$ 0.70	$ 59,570
4	SBR Labor	31	Hrs	$ -	$ -
5	SBR Blowers (60 HP: 3 Duty)	439290	KWHr	$ 0.11	$ 48,322
6	SBR Transfer Pumps (3 HP: 2 Duty)	39194	KWHr	$ 0.11	$ 4,311
7	SBR Mixer (20 HP: 2 Duty)	10755	KWHr	$ 0.11	$ 1,183
8	Equalization Basin Blower (15 HP)	75957	KWHr	$ 0.11	$ 8,355
9	Equalization Basin Transfer Pumps (3 HP: 2 Duty)	39194	KWHr	$ 0	$ 4,311
10	Digester Mixer (25 HP: 1 Duty)	71970	KWHr	$ 0	$ 7,917
11	Digester Transfer Pump (3 HP: 1 Duty)	19597	KWHr	$ 0	$ 2,156
12	Digester Blowers (60 HP: 2 Duty)	345455	KWHr	$ 0	$ 38,000
15	Positive Displacement Blowers Oil & Filter Change	25	Hrs	$ -	$ -
16	Positive Displacement Blowers Inlet Air Filter Elemements (6 Months)	6	LS	$ 40	$ 240
17	Positive Displacement Blowers Belt Replacent (5 Years)	1	LS	$ 154	$ 92
18	Positive Displacement Blower Repair Kit (5 Years)	1	LS	$ 1,750	$ 2,100
19	Decanter Actuator, Capacitor, Limit Switch Replacement (3 Years)	0.67	LS	$ 719	$ 479
20	DO Sensor Head Replacement	2	LS	$ 126	$ 252
21	Diffuser Replacement (25%/5Years)	156	LS	$ 31	$ 4,825
22	Sludge Pump Repair Kit	2	LS	$ 451	$ 902
23	Sludge Pumps Inspection and Lubrication	8	Hrs	$ -	$ -
24	Controller, Relay, Switches and Fuse Replacement	1	LS	$ 50	$ 50
25	Controller Microprocessor Batter Replacement (3 Year)	0.33	LS	$ 26	$ 9
	Subtotal				$184,916
	TBF Operations & Maintenance				
26	Power Consumption	19597	kWHr	$ 0	$ 2,156
27	Lubricate Gear Reducer	1	Hrs	$ -	$ -
28	Lubricate Drive Shaft	1	Hrs	$ -	$ -
29	Lubricate Sliding Wheels	1	Hrs	$ -	$ -
30	Gear Reducer Inspection, Tightening Set Screws	2	Hrs	$ -	$ -
31	Check Misc Alignments	2	Hrs	$ -	$ -
32	Underdrain Inspection	8	Hrs	$ -	$ -
33	Media Replacement(1)	0.81	LS	$ 200	$ 162
34	Media Replacement Labor	17	Hrs	$ -	$ -
35	Underdrain Replacement(2)	1	LS	$ 1,429	$ 1,429
36	Underdrain Replacement Labor	146	Hrs	$ -	$ -
37	Spare Parts(3)	1	LS	$ 1,186	$ 1,186
	Subtotal				$ 4,933
	Digester Operation & Maintenance				
38	Diffuser Replacement	41	LS	$ 25.00	$ 1,035.00
	Subtotal				$ 1,100.00
	Dewatering Operation & Maintenance				
39	Polymer	1	LS	$ 17,772.30	$ 17,772
40	Sludge Feed Pump (10 BHP)	13773	kWHr	$ 0.11	$ 1,515
41	Centrifuge System (75 BHP)	103300	kWHr	$ 0.11	$ 11,363
42	Sludge Grinder (3 & 5 BHP)	11019	kWHr	$ 0.11	$ 1,212
43	Polymer Feed (1 BHP)	1377	kWHr	$ 0.11	$ 152
44	Ventilation Fans (2 at 1.5 BHP & 1 at 1 BHP)	5509	kWHr	$ 0.11	$ 606
45	Conveyor (5 BHP)	6887	kWHr	$ 0.11	$ 758
46	Annual Sludge Hauling Cost	979	Tons	$ 40	$ 38,788
47	Annual Landfill Tipping Fees	979	Tons	$ 56	$ 54,936
48	Labor	484	Hrs	$ -	$ -
49	Annual Parts Replacement	1	LS	$ 3,000.00	$ 3,000
	Subtotal				$ 130,101.74
	UV System Operation & Maintenance				
50	UV System Operation	63072	KWHr	$ 0.11	$ 6,937.92
51	Yearly Lamp Replacement	32	LS	$ 280.00	$ 8,960.00
52	Daily Maintenance	200	Hrs	$ -	$ -
	Subtotal				$ 15,897.92
53	**Facility Operations Staff (3)**	1	LS	$ 270,000	$ 270,000
	Annual Cost				**$607,000**
	Equipment 20 Year Present Cost				**$ 12,140,000.00**

TABLE 5A
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
BIOLAC PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units	Unit Cost	ADWF = 1.2 MGD Total Cost
	Civil Site Work & Miscellaneous				
1	Mobilization & Demobilization	1	LS	$ 100,000	$ 100,000
2	Site Grading and Aggregate Base	1	LS	$ 20,000	$ 20,000
3	Erosion Control SWPPP & Implemetation	1	LS	$ 25,000	$ 25,000
3	Shop Drawings/Testing/Equipment Manuals	1	LS	$ 50,000	$ 50,000
4	Cleanup	1	LS	$ 20,000	$ 20,000
	Subtotal				$ 215,000
	0.8 MGD ADWF BioLac Equipment				
5	BioLac Equipment, Inclucing Ancillary Equipment, Instrumentation/controls	1	LS	$ 1,085,000	$ 1,085,000
	BioLac Site Work & Ancillary Equipment				
6	Sludge Removal and Excavation	10512	CY	$ 125	$ 1,314,028
7	Headworks Excavation	63	CY	$ 30	$ 1,880
8	Headworks Screen	2	EA	$ 95,000	$ 190,000
9	Headworks Concrete	1	LS	$ 57,659	$ 57,659
10	Parshall Flume	1	LS	$ 6,000	$ 6,000
11	BioLac & ERB Basin Liners	1	LS	$ 65,000	$ 65,000
12	Integral Concrete Clarifiers (2) and Headwall	1	LS	$ 664,000	$ 664,000
13	Clarifier & Dike Backfill	8000	CY	$ 25	$ 200,000
14	Soda Ash Dosing Station	1	LS	$ 10,000	$ 10,000
15	Clarifier Underground Piping	100	LF	$ 240	$ 24,000
16	Blower Building	1000	SF	$ 150	$ 150,000
17	Blower Building HVAC	1	LS	$ 20,000	$ 20,000
18	12" Air Manifold, Process & Utility Piping	1100	LF	$ 150	$ 165,000
19	Digester Excavation	2900	CY	$ 30	$ 87,000
20	Digester Concrete	568	CY	$ 1,200	$ 682,000
21	Digester Aeration System	3925	SF	$ 25	$ 98,000
22	Digester Blowers	1	LS	$ 142,000	$ 142,000
23	RAS/WAS Underground Piping	1600	LF	$ 240	$ 384,000
24	RAS/WAS Pump Station and Blower Building	1	LS	$ 280,000	$ 280,000
25	Headworks Return Underground Piping	1200	LF	$ 240	$ 288,000
26	Headworks Return Pump Station	1	LS	$ 230,000	$ 230,000
27	Outfall Underground Piping	330	LF	$ 240	$ 79,000
28	Process & Utility Piping	1900	LS	$ 240	$ 456,000
29	Generator & Ancillary Equipment	1	LS	$ 84,000	$ 84,000
	Subtotal				$ 5,677,567
	2.1 MGD ADWF 16'x46' TBF Equipment				
30	TBF Equip, Including Ancillary Equip, Instr/Controls	2	LS	$ 251,000	$ 502,000
31	TBF Concrete Basin	1	LS	$ 416,000	$ 416,000
32	TBF Excavation	1200	CY	$ 30	$ 36,000
33	Process & Utility Piping	240	LF	$ 175	$ 42,000
34	Metal Enclosure	4800	SF	$ 25	$ 120,000
	Subtotal				$ 1,116,000
	1.6 MGD PWWF UV Equipment				
35	UV Disinfection System Equipment	1	LS	$ 570,000	$ 570,000
36	UV Concrete Treatment Basins	1	LS	$ 130,000	$ 130,000
37	Electrical Controls	1	LS	$ 250,000	$ 250,000
	Subtotal				$ 950,000
	1.55 MGD ADWF Dewatering Equipment				
38	Dewatering Equipment	1	LS	$ 1,018,000	$ 1,018,000
39	Electrical	1	LS	$ 250,000	$ 250,000
40	Building	1	LS	$ 381,000	$ 381,000
	Subtotal				$ 1,649,000
	New Lab & Control Building				
41	New Control Building	2500	SF	$ 250	$ 625,000
42	Laboratory Equipment	1	LS	$ 50,000	$ 50,000
	Subtotal				$ 675,000
	Outfall Improvements				
43	New Diffuser and Ancillary Improvements	1	LS	$ 93,000	$ 93,000
	Total Estimated Construction Cost without Contingency				$ 11,461,000
	Construction Contingency @ 20%				$ 2,292,000
	Indirect/Engineering @ 25%				$ 2,865,000
	Subtotal				$ 5,157,000
	Total Estimated Project Cost (October 2013 Dollars)				**$ 16,600,000**

TABLE 5B
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
BIOLAC PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units	Unit Cost	ADWF = 1.2 MGD Total Cost
	Annual BioLac Plant Operation & Maintenance				
1	Soda Ash	85100	Lbs	$ 0.70	$ 59,570
2	Blowers (60 HP: 2 duty, 1-Standby)	496457	KWHr	$ 0.11	$ 54,610
3	Clarifier Rake Drives (1 HP: 2-Duty)	13065	KWHr	$ 0.11	$ 1,437
4	Daily Blower Inspection (10 Min/Blower/Day)	130	Hrs	$ -	$ -
5	Daily Blower Maintenance	1	Hrs	$ -	$ -
6	Monthly Aeration Chain Inspection	7	Hrs	$ -	$ -
7	Monthly Cleaning of Diffuser	59	Hrs	$ -	$ -
8	Annual Biofusers Assebly Inspection	99	Hrs	$ -	$ -
9	Annual Purging of Blower Bearing Grease	3	Hrs	$ -	$ -
10	Sampling	25	Hrs	$ -	$ -
11	Mixer Seal Replacement	1	Hrs	$ -	$ -
	Subtotal				$ 115,617
	7 Year BioLac Maintenance Cost				
12	Replace Difuser Sheaths	396	LS	$ -	$ -
13	Sheath Replacment Labor	50	Hrs	$ -	$ -
14	Sampling	25	Hrs	$ -	$ -
15	Relubricate Blower Motors	3	LS	$ 100	$ 300
16	Relubricate Blower Motor Labor	3	Hrs	$ -	$ -
	Subtotal				$ 300
	Yearly Cost				$ 43
	10 Year BioLac Maintenance Cost				
17	Replace Half of High Temperature Hoses	1	LS	$ 2,980.00	$ 2,980.00
18	Replace Half of High Temperature Hoses Labor	4	Hrs	$ -	$ -
19	Sampling	25	Hrs	$ -	$ -
	Subtotal				$ 2,980.00
	Yearly Cost				$ 298.00
	TBF Operations & Maintenance				
27	Power Consumption	19597	kWHr	$ 0.11	$ 2,155.67
28	Lubricate Gear Reducer	1	Hrs	$ -	$ -
29	Lubricate Drive Shaft	1	Hrs	$ -	$ -
30	Lubricate Sliding Wheels	1	Hrs	$ -	$ -
31	Gear Reducer Inspection, Tightening Set Screws	2	Hrs	$ -	$ -
32	Check Misc Alignments	2	Hrs	$ -	$ -
33	Underdrain Inspection	8	Hrs	$ -	$ -
34	Media Replacement(1)	1	LS	$ 200.00	$ 162.00
35	Media Replacement Labor	17	Hrs	$ -	$ -
36	Underdrain Replacement(2)	1	LS	$ 1,429.49	$ 1,429.49
37	Underdrain Replacement Labor	146	Hrs	$ -	$ -
38	Spare Parts(3)	1	LS	$ 1,186.02	$ 1,186.02
	Subtotal				$4,933
	Digester Operation & Maintenance				
39	Aeration System Blowers (75 BHP: 1 Duty, 1 Standby)	489925	kWHr	$ 0.11	$ 53,891.74
40	Mixer (40 BHP)	661117	kWHr	$ 0.11	$ 72,722.89
41	Diffuser Replacement	41	LS	$ 25.00	$ 1,035.00
	Subtotal				$ 127,649.63
	Dewatering Operation & Maintenance				
42	Polymer	1	LS	$ 17,772	$ 17,772
43	Centrifuge System (75 BHP)	103300	kWHr	$ 0.11	$ 11,363
44	Sludge Grinder (3 & 5 BHP)	11019	kWHr	$ 0.11	$ 1,212
45	Polymer Feed (1 BHP)	1377	kWHr	$ 0.11	$ 152
46	Ventilation Fans (2 at 1.5 BHP & 1 at 1 BHP)	5509	kWHr	$ 0.11	$ 606
47	Conveyor (5 BHP)	6887	kWHr	$ 0.11	$ 758
48	Annual Sludge Hauling Cost	979	Tons	$ 40	$ 38,788
49	Annual Landfill Tipping Fees	979	Tons	$ 56	$ 54,936
50	Labor	484	Hrs	$ -	$ -
51	Annual Parts Replacement	1	LS	$ 3,000	$ 3,000
	Subtotal				$130,102
	UV System Operation & Maintenance				
52	UV System Operation	63072	KWHr	$ 0.11	$ 6,937.92
53	Yearly Lamp Replacement	32	LS	$ 280.00	$ 8,960.00
54	Daily Maintenance	200	Hrs	$ -	$ -
	Subtotal				$ 15,897.92
55	**Facility Operations Staff (3)**	1	LS	$ 270,000	$ 270,000
	Annual Cost				**$ 665,000.00**
	Equipment 20 Year Present Cost				**$ 13,300,000.00**

TABLE 6A
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
BIOSHELL PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units		Unit Cost		ADWF = 1.2 MGD Total Cost
	Civil Site Work & Miscellaneous						
1	Mobilization & Demobilization	1	LS	$	100,000	$	100,000
2	Site Grading and Aggregate Base	1	LS	$	20,000	$	20,000
3	Erosion Control SWPPP & Implementation	1	LS	$	25,000	$	25,000
4	Shop Drawings/Testing/Equipment Manuals	1	LS	$	50,000	$	50,000
5	Cleanup	1	LS	$	20,000	$	20,000
	Subtotal					$	215,000
	0.8 MGD ADWF Bio-Shell Equipment						
6	Bio-Shell Equip, Inclucing Ancillary Equip, Instr/controls	1	LS	$	4,010,000	$	4,010,000
7	Headworks Screen	2	EA	$	95,000	$	190,000
8	Headworks Excavation	63	CY	$	30	$	1,880
9	Headworks Concrete	1	LS	$	57,659	$	57,659
10	Parshall Flume	1	LS	$	6,000	$	6,000
11	Hanging Curtains	1	LS	$	138,000	$	138,000
12	Sludge Removal	3000	CY	$	125	$	375,000
13	BioShell Blowers	1	LS	$	198,000	$	198,000
14	12" Air Manifold, Process & Utility Piping	1400	LF	$	150	$	210,000
15	4" Sinkable Hose	2400	LF	$	9	$	21,600
16	1/2 Sinkable Hose	3108	LF	$	2	$	6,216
17	Headworks Return Underground Piping	1170	LF	$	240	$	280,800
18	Sludge Removal and Excavation	13000	CY	$	125	$	1,625,000
19	Lagoon Liner	1	LS	$	402,000	$	402,000
20	Headworks Return Pump Station	1	LS	$	230,000	$	230,000
21	Lagoon Effluent Underground Piping	350	LF	$	240	$	84,000
22	Generator & Ancillary Equipment	1	LS	$	74,000	$	74,000
	Subtotal					$	7,910,155
	1.9 MGD DAF Equipment						
23	DAF Equip, Inclucing Ancillary Equip, Instr/Controls	1	LS	$	285,000	$	285,000
24	Spare PLC, PSI Switch & Solenoid/Actuator	1	LS	$	9,000	$	9,000
25	DAF Excavation	170	CY	$	30	$	5,087
26	DAF Concrete Treatment Basins	1	LS	$	73,476	$	73,476
27	DAF Backwash Pond Sludge Removal	1200	CY	$	125	$	150,000
28	DAF Backwash Pond Liner	1	LS	$	32,500	$	32,500
29	DAF Backwash Piping	450	LF	$	240	$	108,000
30	DAF Chemical Dosing Station	1	LS	$	10,000	$	10,000
31	DAF Chemical Feed Piping	150	LF	$	150	$	22,500
	Subtotal					$	695,563
	2.1 MGD ADWF 16'x46' TBF Equipment						
32	TBF Equip, Including Ancillary Equip, Instr/Controls	2	LS	$	251,000	$	502,000
33	TBF Concrete Basin	1	LS	$	416,000	$	416,000
34	TBF Excavation	1200	CY	$	30	$	36,000
35	Process & Utility Piping	240	LF	$	175	$	42,000
36	Metal Enclosure	4800	SF	$	25	$	120,000
	Subtotal					$	1,116,000
	1.6 MGD PWWF UV Equipment						
37	UV Disinfection System Equipment	1	LS	$	828,000	$	828,000
38	UV Concrete Treatment Basins	1	LS	$	180,000	$	180,000
39	Electrical Controls	1	LS	$	250,000	$	250,000
	Subtotal					$	1,258,000
	New Lab & Control Building						
40	New Control Building	2500	SF	$	250	$	625,000
41	Laboratory Equipment	1	LS	$	50,000	$	50,000
	Subtotal					$	675,000
	Outfall Improvements						
42	New Diffuser and Ancillary Improvements	1	LS	$	93,000	$	93,000
	Total Estimated Construction Cost without Contingency					$	11,963,000
	Construction Contingency @ 20%					$	2,393,000
	Indirect/Engineering @ 25%					$	2,991,000
	Subtotal					$	5,384,000
	Total Estimated Project Cost (October 2013 Dollars)					**$**	**17,300,000**

TABLE 6B
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
BIOSHELL PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units		Unit Cost		ADWF = 1.2 MGD Total Cost
	Existing Plant Operations						
1	Blowers	222099	kWHr	$	0.11	$	24,431
	BioShell Plant Operation & Maintenance						
2	BioShell Operation (66 HP: 1 Duty)	747625	kWHr	$	0.11	$	82,239
3	Annual BioShell Maintenance	327	Hrs	$	-	$	-
4	Purging of Air Diffusor	327	Hrs	$	-	$	-
5	Blowers Oil & Filter Change	25	Hrs	$	-	$	-
6	Sampling	25	Hrs	$	-	$	-
7	10 Years BioShell Inspection	164	Hrs	$	50	$	8,175
8	Sludge Removal (20 yr cycle)	344	CY	$	50	$	17,183
	Subtotal					$	107,596
	DAF Operation						
9	Filter Labor	625	Hrs	$	50	$	31,250
10	Backwash Pump (15 BHP: 1 Duty)	515	kWHr	$	0.11	$	57
11	Air Scour Blower (10 BHP: 1 Duty)	343	kWHr	$	0.11	$	38
12	Electrical Backwash Consumption	3	kWHr	$	0.11	$	0.34
13	Electrical Process Consumption	4	kWHr	$	0.11	$	0
14	Polymer	1	LS	$	1,500	$	1,500
16	DAF Pond Sludge Removal	600	CY	$	50	$	30,000
	Subtotal						$62,845
	TBF Operations & Maintenance						
17	Power Consumption	19597	kWHr	$	0	$	2,156
18	Lubricate Gear Reducer	1	Hrs	$	-	$	-
19	Lubricate Drive Shaft	1	Hrs	$	-	$	-
20	Lubricate Sliding Wheels	1	Hrs	$	-	$	-
21	Gear Reducer Inspection, Tightening Set Screws	2	Hrs	$	-	$	-
22	Check Misc Alignments	2	Hrs	$	-	$	-
23	Underdrain Inspection	8	Hrs	$	-	$	-
24	Media Replacement(1)	0.81	LS	$	200	$	162
25	Media Replacement Labor	17	Hrs	$	-	$	-
26	Underdrain Replacement(2)	1	LS	$	1,429	$	1,429
27	Underdrain Replacement Labor	146	Hrs	$	-	$	-
28	Spare Parts(3)	1	LS	$	1,186	$	1,186
	Subtotal					$	4,933
	UV Operations & Maintenance						
29	UV System Operation	161184	KWHr	$	0.11	$	17,730
30	Yearly Lamp Replacement	78	LS	$	280	$	21,840
31	Daily Maintenance	200	Hrs	$	-	$	-
	Subtotal					$	39,570
32	**Facility Operations Staff (3)**	1	LS	$	270,000	$	270,000
	Annual Cost					**$**	**510,000.00**
	Equipment 20 Year Present Cost					**$**	**10,200,000.00**

TABLE 7A
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
MBBR PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units	Unit Cost	ADWF = 1.2 MGD Total Cost
	Civil Site Work & Miscellaneous				
1	Mobilization & Demobilization	1	LS	$ 100,000	$ 100,000
2	Site Grading and Aggregate Base	1	LS	$ 20,000	$ 20,000
3	Erosion Control SWPPP & Implementation	1	LS	$ 25,000	$ 25,000
4	Shop Drawings/Testing/Equipment Manuals	1	LS	$ 50,000	$ 50,000
5	Cleanup	1	LS	$ 20,000	$ 20,000
	Subtotal				$ 215,000
	1.3 MGD MMF MBBR Equipment				
6	MBBR Equip, Inclucing Ancillary Equip, Instr/Controls	1	LS	$ 1,577,000	$ 1,577,000
7	Excavation	2200	CY	$ 30	$ 66,000
8	Headworks Excavation	1112	CY	$ 30	$ 33,360
9	Headworks Screen	2	EA	$ 95,000	$ 190,000
10	Headworks Concrete	1	LS	$ 57,659	$ 57,659
11	Parshall Flume	1	LS	$ 6,000	$ 6,000
12	Lagoon Dike Repairs	1	LS	$ 40,000	$ 6,000
13	MBBR Concrete Treatment Basins	1	LS	$ 748,000	$ 748,000
14	Headworks Return Utility Piping	1200	LF	$ 240	$ 288,000
15	Headworks Return Pump Station	1	LS	$ 230,000	$ 230,000
16	Lagoon Bypass Utility Piping	900	LF	$ 240	$ 216,000
17	Sludge Removal and Excavation	4200	CY	$ 125	$ 525,000
18	Lagoon Liner	1	LS	$ 130,000	$ 130,000
19	Soda Ash Dosing Station	1	LS	$ 10,000	$ 10,000
20	Carbon Source Dosing Station	1	LS	$ 60,000	$ 60,000
21	12" Air Manifold, Process & Utility Piping	150	LF	$ 150	$ 22,500
22	Generator & Ancillary Equipment	1	LS	$ 84,000	$ 84,000
	Subtotal				$ 4,249,519
	1.9 MGD DAF Equipment				
23	DAF Equip, Inclucing Ancillary Equip, Instr/Controls	1	LS	$ 285,000	$ 285,000
24	Spare PLC, PSI Switch & Solenoid/Actuator	1	LS	$ 9,000	$ 9,000
25	DAF Excavation	170	CY	$ 30	$ 5,087
26	DAF Concrete Treatment Basins	1	LS	$ 73,476	$ 73,476
27	DAF Backwash Pond Sludge Removal	1200	CY	$ 125	$ 150,000
28	DAF Backwash Pond Liner	1	LS	$ 32,500	$ 32,500
29	DAF Backwash Piping	450	LF	$ 240	$ 108,000
30	DAF Chemical Dosing Station	1	LS	$ 10,000	$ 10,000
31	DAF Chemical Feed Piping	150	LF	$ 150	$ 22,500
	Subtotal				$ 695,563
	2.1 MGD ADWF 16'x46' TBF Equipment				
32	TBF Equip, Including Ancillary Equip, Instr/Controls	2	LS	$ 251,000	$ 502,000
33	TBF Concrete Basin	1	LS	$ 416,000	$ 416,000
34	TBF Excavation	1200	CY	$ 30	$ 36,000
35	Process & Utility Piping	240	LF	$ 175	$ 42,000
36	Metal Enclosure	4800	SF	$ 25	$ 120,000
	Subtotal				$ 1,116,000
	1.6 MGD PWWF UV Equipment				
37	UV Disinfection System Equipment	1	LS	$ 828,000	$ 828,000
38	UV Concrete Treatment Basins	1	LS	$ 180,000	$ 180,000
39	Electrical Controls	1	LS	$ 250,000	$ 250,000
	Subtotal				$ 1,258,000
	New Lab & Control Building				
40	New Control Building	2500	SF	$ 250	$ 625,000
41	Laboratory Equipment	1	LS	$ 50,000	$ 50,000
	Subtotal				$ 675,000
	Outfall Improvements				
42	New Diffuser and Ancillary Improvements	1	LS	$ 93,000	$ 93,000
	Total Estimated Construction Cost without Contingency				$ 8,303,000
	Construction Contingency @ 20%				$ 1,661,000
	Indirect/Engineering @ 25%				$ 2,076,000
	Subtotal				$ 3,737,000
	Total Estimated Project Cost (October 2013 Dollars)				**$ 12,000,000**

TABLE 7B
CITY OF MT. SHASTA
WASTEWATER TREATMENT AND DISPOSAL FEASIBILITY STUDY
MBBR PLANT - PRELIMINARY PROJECT COST ESTIMATE

	Item	Amount	Units		Unit Cost		ADWF = 1.2 MGD Total Cost
	Existing Plant Operations						
1	Blowers	222099	kWHr	$	0.11	$	24,430.92
	Subtotal					$	24,430.92
	MBBR Plant Operation & Maintenance						
2	Soda Ash	85100	Lbs	$	0.70	$	59,570
3	Glycerol	112712	Lbs	$	0.50	$	56,356
4	MBBR Labor	31	Hrs	$	-	$	-
5	MBBR Blowers (40 HP: 2 Duty, 1 Standby)	522587	KWHr	$	0.11	$	57,485
6	MBBR Air Scour Blowers (15 HP: 2 Duty)	195970	KWHr	$	0.11	$	21,557
7	Mixer (2.61 HP: 6 Duty)	102296	KWHr	$	0.11	$	11,253
8	Blowers Belts Replacement	4	LS	$	150.00	$	600
9	Blower Filter Replacement	4	LS	$	30.00	$	120
10	Blower Oil Replacment	4	Gal	$	30.00	$	120
11	Dissolved Oxygen Probe Membrane Replacement	8	LS	$	185.00	$	1,480
12	Labor	500	Hrs	$	-	$	-
	Subtotal						$208,540
	DAF Operation						
13	Filter Labor	625	Hrs	$	50	$	31,250
14	Backwash Pump (15 BHP: 1 Duty)	515	kWHr	$	0.11	$	57
15	Air Scour Blower (10 BHP: 1 Duty)	343	kWHr	$	0.11	$	38
16	Electrical Backwash Consumption	3	kWHr	$	0.11	$	0.34
17	Electrical Process Consumption	4	kWHr	$	0.11	$	0.44
18	Polymer	1	LS	$	1,500	$	1,500
19	DAF Pond Sludge Removal	600	CY	$	50	$	30,000
	Subtotal						$62,845
	TBF Operations & Maintenance						
19	Power Consumption	19597	kWHr	$	0	$	2,156
20	Lubricate Gear Reducer	1	Hrs	$	-	$	-
21	Lubricate Drive Shaft	1	Hrs	$	-	$	-
22	Lubricate Sliding Wheels	1	Hrs	$	-	$	-
23	Gear Reducer Inspection, Tightening Set Screws	2	Hrs	$	-	$	-
24	Check Misc Alignments	2	Hrs	$	-	$	-
25	Underdrain Inspection	8	Hrs	$	-	$	-
26	Media Replacement(1)	0.81	LS	$	200	$	162
27	Media Replacement Labor	17	Hrs	$	-	$	-
28	Underdrain Replacement(2)	1	LS	$	1,429	$	1,429
29	Underdrain Replacement Labor	146	Hrs	$	-	$	-
30	Spare Parts(3)	1	LS	$	1,186	$	1,186
	Subtotal					$	4,933
	UV Operations & Maintenance						
31	UV System Operation	161184	KWHr	$	0.11	$	17,730
32	Yearly Lamp Replacement	78	LS	$	280	$	21,840
33	Daily Maintenance	200	Hrs	$	-	$	-
	Subtotal					$	39,570
34	**Facility Operations Staff (3)**	1	LS	$	270,000	$	270,000
	Annual Cost					**$**	**611,000.00**
	Equipment 20 Year Present Cost					**$**	**12,220,000.00**

APPENDIX H

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

CENTRAL VALLEY REGION

364 Knollcrest Drive, Suite 205, Redding, California 96002
Phone (530) 224-4845 • Fax (530) 224-4857
http://www.waterboards.ca.gov/centralvalley

ORDER R5-2012-0086
NPDES NO. CA0078051

WASTE DISCHARGE REQUIREMENTS FOR THE CITY OF MT. SHASTA AND U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE CITY OF MT. SHASTA WASTEWATER TREATMENT PLANT SISKIYOU COUNTY

The following Discharger is subject to waste discharge requirements as set forth in this Order:

Table 1. Discharger Information

Discharger	City of Mt. Shasta
Name of Facility	City of Mt. Shasta Wastewater Treatment Plant
Facility Address	2500 Grant Road
	Mt. Shasta, CA 96067
	Siskiyou County
The U.S. Environmental Protection Agency (USEPA) and the Regional Water Quality Control Board have classified this discharge as a minor discharge.	

The discharge by the City of Mt. Shasta from the discharge points identified below is subject to waste discharge requirements as set forth in this Order:

Table 2. Discharge Location

Discharge Point	Effluent Description	Discharge Point Latitude	Discharge Point Longitude	Receiving Water
D-001	Treated effluent	41° 16' 35.18" N	122° 19' 6.98" W	Sacramento River
D-002	Treated effluent	41° 17' 8.34" N	122° 16' 24.65" W	Leachfield
D-003	Treated effluent	41° 16' 59.16" N	122° 19' 7.80" W	Mt. Shasta Resort Golf Course

Table 3. Administrative Information

This Order was adopted by the Regional Water Quality Control Board on:	**04 October 2012**
This Order shall become effective on:	**23 November 2012**
This Order shall expire on:	**01 November 2017**
The Discharger shall file a Report of Waste Discharge in accordance with title 23, California Code of Regulations, as application for issuance of new waste discharge requirements no later than:	**180 days prior to the Order expiration date**

I, **PAMELA C. CREEDON**, Executive Officer, do hereby certify that this Order with all attachments is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region, on **4 October 2012**.

ORIGINAL SIGNED BY

PAMELA C. CREEDON, Executive Officer

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I. FACILITY INFORMATION

The following Discharger is subject to waste discharge requirements as set forth in this Order:

Table 4. Facility Information

Discharger	City of Mt. Shasta
Name of Facility	City of Mt. Shasta Wastewater Treatment Plant
Facility Address	2500 Grant Road Mt. Shasta, CA 96067 Siskiyou County
Facility Contact, Title, and Phone	Rodney Bryan, Public Works Director, (530) 926-7510 Jackie Brown, Treatment Plant Operator, (530) 926-7535
Mailing Address	305 North Mt. Shasta Boulevard, Mt. Shasta, CA 96067
Type of Facility	Publicly Owned Treatment Works (POTW)
Facility Design Flow	0.80 million gallons per day (MGD) ADWF 0.70 MGD (Leachfield)

II. FINDINGS

The California Regional Water Quality Control Board, Central Valley Region (hereinafter Central Valley Water Board), finds:

A. Background. The City of Mt. Shasta (hereinafter Discharger) is currently discharging pursuant to Order No. R5-2007-0056 and National Pollutant Discharge Elimination System (NPDES) Permit No. CA0078051. The Discharger submitted a Report of Waste Discharge, dated 18 July 2011, and applied for a NPDES permit renewal to discharge up to 0.80 MGD of treated wastewater from the City of Mt. Shasta Wastewater Treatment Plant, hereinafter Facility. The application was deemed complete on 16 August 2011.

For the purposes of this Order, references to the "discharger" or "permittee" in applicable federal and state laws, regulations, plans, or policy are held to be equivalent to references to the Discharger herein.

B. Facility Description. The Discharger owns and operates the municipal wastewater treatment plant. The treatment system consists of headworks (Parshall flume, mechanical shredder, and bypass bar screen), oxidation lagoons, dissolved air flotation thickener and rapid sand filtration, chlorine contact chamber, dechlorination system, and a discharge line. Currently, the dissolved air flotation thickener and rapid sand filter are not utilized during the winter period discharge (16 November through 14 April).

Wastewater is discharged from one of the following (see table on cover page): Discharge Point No. 001 to the Sacramento River, a water of the United States, or Discharge Point No. 002 to a leachfield adjacent to Highway 89 on land owned by the U.S. Department of Agriculture, Forest Service (hereinafter Forest Service), or Discharge Point No. 003 to the Mt. Shasta Resort Golf Course. The Sacramento River

is within the Box Canyon Hydrologic Sub Area of the Upper Sacramento River Hydrologic Unit (525.22). Attachment B provides a map of the area around the Facility. Attachment C provides a flow schematic of the Facility.

The Discharger currently provides up to 0.7 MGD of treated wastewater to the Mt. Shasta Resort Golf Course (owned and operated by Siskiyou Golf Resort, Inc.) for restricted use during the summer period. Siskiyou Golf Resort, Inc. is regulated under Water Recycling Requirements Order No. 5-01-083.

C. **Legal Authorities.** This Order is issued pursuant to section 402 of the Clean Water Act (CWA) and implementing regulations adopted by USEPA and chapter 5.5, division 7 of the California Water Code (Water Code; commencing with section 13370). It shall serve as a NPDES permit for point source discharges from this facility to surface waters. This Order also serves as Waste Discharge Requirements (WDRs) pursuant to article 4, chapter 4, division 7 of the Water Code (commencing with section 13260).

D. **Background and Rationale for Requirements.** The Central Valley Water Board developed the requirements in this Order based on information submitted as part of the application, through monitoring and reporting programs, and other available information. The Fact Sheet (Attachment F), which contains background information and rationale for Order requirements, is hereby incorporated into this Order and constitutes part of the Findings for this Order. Attachments A through E and G through J are also incorporated into this Order.

E. **California Environmental Quality Act (CEQA).** Under Water Code section 13389, this action to adopt an NPDES permit is exempt from the provisions of CEQA, Public Resources Code sections 21100-21177.

F. **Technology-based Effluent Limitations.** Section 301(b) of the CWA and implementing USEPA permit regulations at section 122.44, title 40 of the Code of Federal Regulations (40 CFR 122.44), require that permits include conditions meeting applicable technology-based requirements at a minimum, and any more stringent effluent limitations necessary to meet applicable water quality standards. The discharge authorized by this Order must meet minimum federal technology-based requirements based on Secondary Treatment Standards at 40 CFR Part 133. A detailed discussion of the technology-based effluent limitations development is included in the Fact Sheet.

G. **Water Quality-based Effluent Limitations (WQBELs).** Section 301(b) of the CWA and 40 CFR 122.44(d) require that permits include limitations more stringent than applicable federal technology-based requirements where necessary to achieve applicable water quality standards. This Order contains requirements, expressed as technology equivalence requirements, which are necessary to achieve water quality standards. The Central Valley Water Board has considered the factors listed in Water Code section 13241 in establishing these requirements. The rationale for these requirements, which consist of tertiary treatment or equivalent requirements, is discussed in the Fact Sheet.

40 CFR 122.44(d)(1)(i) mandates that permits include effluent limitations for all

pollutants that are or may be discharged at levels that have the reasonable potential to cause or contribute to an exceedance of a water quality standard, including numeric and narrative objectives within a standard. Where reasonable potential has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, WQBELs must be established using: (1) USEPA criteria guidance under CWA section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information, as provided in 40 CFR 122.44(d)(1)(vi).

H. **Water Quality Control Plans.** The Central Valley Water Board adopted a *Water Quality Control Plan, Fourth Edition (Revised October 2011),* for the Sacramento and San Joaquin River Basins (hereinafter Basin Plan) on 1 September 1998 that designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan. In addition, the Basin Plan implements State Water Resources Control Board (State Water Board) Resolution No. 88-63, which established state policy that all waters, with certain exceptions, should be considered suitable or potentially suitable for municipal or domestic supply. Beneficial uses applicable to the Sacramento River (Box Canyon Dam to Shasta Lake) are as follows:

Table 5. Basin Plan Beneficial Uses

Discharge Point	Receiving Water Name	Beneficial Use(s)
D-001	**Sacramento River (Box Canyon Dam to Shasta Lake)**	Existing: Municipal and domestic supply (MUN); Agricultural supply, including irrigation and stock watering (AGR); Water contact recreation, including canoeing and rafting (REC-1); Non-contact water recreation (REC-2); Cold freshwater habitat (COLD); Spawning, reproduction, and/or early development, cold (SPWN); and Wildlife habitat (WILD)
D-002 **D-003**	**Underlying Groundwater**	Potential: Municipal and domestic supply (MUN) Industrial service supply (IND), Industrial process supply (PRO), and Agricultural supply (AGR)

The Basin Plan includes a list of Water Quality Limited Segments (WQLSs), which are defined as "*...those sections of lakes, streams, rivers or other fresh water bodies where water quality does not meet (or is not expected to meet) water quality standards even after the application of appropriate limitations for point sources (40 CFR 130, et seq.).*" The Basin Plan also states, "*Additional treatment beyond minimum federal standards will be imposed on dischargers to WQLSs. Dischargers will be assigned or allocated a maximum allowable load of critical pollutants so that water quality objectives can be met in the segment.*" The Sacramento River (Box Canyon Dam to Shasta Lake) is not listed as a WQLS in the 303(d) list of impaired water bodies.

Requirements of this Order implement the Basin Plan.

I. **National Toxics Rule (NTR) and California Toxics Rule (CTR).** USEPA adopted the NTR on 22 December 1992, and later amended it on 4 May 1995 and 9 November 1999. About 40 criteria in the NTR applied in California. On 18 May 2000, USEPA adopted the CTR. The CTR promulgated new toxics criteria for California and, in addition, incorporated the previously adopted NTR criteria that were applicable in the state. The CTR was amended on 13 February 2001. These rules contain water quality criteria for priority pollutants.

J. **State Implementation Policy.** On 2 March 2000, the State Water Board adopted the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (State Implementation Policy or SIP). The SIP became effective on 28 April 2000 with respect to the priority pollutant criteria promulgated for California by USEPA through the NTR and to the priority pollutant objectives established by the Central Valley Water Board in the Basin Plan. The SIP became effective on 18 May 2000 with respect to the priority pollutant criteria promulgated by USEPA through the CTR. The State Water Board adopted amendments to the SIP on 24 February 2005 that became effective on 13 July 2005. The SIP establishes implementation provisions for priority pollutant criteria and objectives and provisions for chronic toxicity control. Requirements of this Order implement the SIP.

K. **Compliance Schedules and Interim Requirements.** In general, an NPDES permit must include final effluent limitations that are consistent with CWA section 301 and with 40 CFR 122.44(d). There are exceptions to this general rule. The State Water Board's *Policy for Compliance Schedules in National Pollutant Discharge Elimination System Permits* (Compliance Schedule Policy) allows compliance schedules for new, revised, or newly interpreted water quality objectives or criteria, or in accordance with a TMDL. All compliance schedules must be as short as possible, and may not exceed ten years from the effective date of the adoption, revision, or new interpretation of the applicable water quality objective or criterion, unless a TMDL allows a longer schedule. A Regional Water Board, however, is not required to include a compliance schedule, but may issue a Time Schedule Order pursuant to Water Code section 13300 or a Cease and Desist Order pursuant to Water Code section 13301 where it finds that the discharger is violating or threatening to violate the permit. The Regional Water Board will consider the merits of each case in determining whether it is appropriate to include a compliance schedule in a permit, and, consistent with the Compliance Schedule Policy, should consider feasibility of achieving compliance, and must impose a schedule that is as short as possible to achieve compliance with the effluent limit based on the objective or criteria.

The Compliance Schedule Policy and the SIP do not allow compliance schedules for priority pollutants beyond 18 May 2010, except for new or more stringent priority pollutant criteria adopted by USEPA after 17 December 2008.

Where a compliance schedule for a final effluent limitation exceeds one year, the Order must include interim numeric limitations for that constituent or parameter, interim

milestones and compliance reporting within 14 days after each interim milestone. The permit may also include interim requirements to control the pollutant, such as pollutant minimization and source control measures. This Order does include compliance schedules and interim effluent limitations and discharge specifications. A detailed discussion of the basis for the compliance schedule(s) and interim effluent limitation(s) and discharge specifications is included in the Fact Sheet.

L. **Alaska Rule.** On 30 March 2000, USEPA revised its regulation that specifies when new and revised state and tribal water quality standards become effective for CWA purposes. (40 CFR 131.21 and 65 FR 24641 (27 April 2000).) Under the revised regulation (also known as the Alaska rule), new and revised standards submitted to USEPA after 30 May 2000, must be approved by USEPA before being used for CWA purposes. The final rule also provides that standards already in effect and submitted to USEPA by 30 May 2000 may be used for CWA purposes, whether or not approved by USEPA.

M. **Stringency of Requirements for Individual Pollutants.** This Order contains both technology-based effluent limitations and WQBELs for individual pollutants. The technology-based effluent limitations consist of restrictions on flow and percent removal requirements for 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS). The WQBELs consist of restrictions on acute toxicity, ammonia, bis(2-ethylhexyl) phthalate, chlorine residual, copper, dichlorobromomethane, nitrate, nitrite, settleable solids, and zinc. This Order's technology-based pollutant restrictions implement the minimum, applicable federal technology-based requirements. In addition, this Order includes water-quality based effluent limitations for BOD_5, pH, total coliform organisms, and TSS to meet numeric objectives or protect beneficial uses. The rationale for including these limitations is explained in the Fact Sheet. In addition, the Central Valley Water Board has considered the factors in Water Code section 13241 in establishing these requirements.

This Order contains pollutant restrictions that are more stringent than applicable federal requirements and standards. Specifically, this Order includes effluent limitations for BOD_5, TSS, and pH that are more stringent than applicable federal standards, but that are nonetheless necessary to meet numeric objectives or protect beneficial uses. The rationale for including these limitations is explained in the Fact Sheet (Attachment F section IV). In addition, the Central Valley Water Board has considered the factors in Water Code section 13241 in the Fact Sheet (Attachment F section IV.C.3).

N. **Antidegradation Policy**. 40 CFR 131.12 requires that the state water quality standards include an antidegradation policy consistent with the federal policy. The State Water Board established California's antidegradation policy in State Water Board Resolution No. 68-16. Resolution No. 68-16 incorporates the federal antidegradation policy where the federal policy applies under federal law. Resolution No. 68-16 requires that existing quality of waters be maintained unless degradation is justified based on specific findings. The Central Valley Water Board's Basin Plan implements, and incorporates by reference, both the state and federal antidegradation policies. As discussed in detail in the Fact Sheet, the permitted discharge is consistent with the antidegradation provision of 40 CFR 131.12 and Resolution No. 68-16.

O. **Anti-Backsliding Requirements.** Sections 303(d)(4) and 402(o)(2) of the CWA and federal regulations at 40 CFR 122.44(l) prohibit backsliding in NPDES permits. These anti-backsliding provisions require effluent limitations in a reissued permit to be as stringent as those in the previous permit, with some exceptions. Some effluent limitations in this Order are less stringent that those in Order No. R5-2007-0056. As discussed in detail in the Fact Sheet, this relaxation of effluent limitations is consistent with the anti-backsliding requirements of the CWA and federal regulations.

P. **Endangered Species Act.** This Order does not authorize any act that results in the taking of a threatened or endangered species or any act that is now prohibited, or becomes prohibited in the future, under either the California Endangered Species Act (Fish and Game Code sections 2050 to 2097) or the Federal Endangered Species Act (16 U.S.C.A. sections 1531 to 1544). This Order requires compliance with effluent limits, receiving water limits, and other requirements to protect the beneficial uses of waters of the state. The discharger is responsible for meeting all requirements of the applicable Endangered Species Act.

Q. **Monitoring and Reporting.** 40 CFR 122.48 requires that all NPDES permits specify requirements for recording and reporting monitoring results. Water Code sections 13267 and 13383 authorize the Central Valley Water Board to require technical and monitoring reports. The Monitoring and Reporting Program establishes monitoring and reporting requirements to implement federal and State requirements. The Monitoring and Reporting Program is provided in Attachment E.

The technical and monitoring reports in this Order are required in accordance with Water Code section 13267, which states the following in subsection (b)(1), "*In conducting an investigation specified in subdivision (a), the regional board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge, waste outside of its region that could affect the quality of waters within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the regional board requires. The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports. In requiring those reports, the regional board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports.*"

The monitoring reports required by this Order are necessary to determine compliance with this Order. The need for the monitoring reports is discussed in the Fact Sheet.

R. **Standard and Special Provisions.** Standard Provisions, which apply to all NPDES permits in accordance with 40 CFR 122.41, and additional conditions applicable to specified categories of permits in accordance with 40 CFR 122.42, are provided in Attachment D. The discharger must comply with all standard provisions and with those additional conditions that are applicable under 40 CFR 122.42. The Central Valley Water Board has also included in this Order special provisions applicable to the

Discharger. Some special provisions require submittal of technical reports. All technical reports are required in accordance with Water Code section 13267. The rationale for the special provisions and need for technical reports required in this Order is provided in the Fact Sheet.

S. **Provisions and Requirements Implementing State Law.** The provisions/requirements in sections IV.B, IV.C, and V.B of this Order are included to implement state law only. These provisions/requirements are not required or authorized under the federal CWA; consequently, violations of these provisions/requirements are not subject to the enforcement remedies that are available for NPDES violations.

T. **Notification of Interested Parties.** The Central Valley Water Board has notified the Discharger and interested agencies and persons of its intent to prescribe WDRs for the discharge and has provided them with an opportunity to submit their written comments and recommendations. Details of notification are provided in the Fact Sheet of this Order.

U. **Consideration of Public Comment.** The Central Valley Water Board, in a public meeting, heard and considered all comments pertaining to the discharge. Details of the Public Hearing are provided in the Fact Sheet.

THEREFORE, IT IS HEREBY ORDERED, that Order No. R5-2007-0056 is rescinded upon the effective date of this Order except for enforcement purposes, and, in order to meet the provisions contained in division 7 of the Water Code (commencing with section 13000) and regulations adopted thereunder, and the provisions of the federal CWA and regulations and guidelines adopted thereunder, the Discharger shall comply with the requirements in this Order.

III. DISCHARGE PROHIBITIONS

A. Discharge of wastewater at a location or in a manner different from that described in the Findings is prohibited.

B. The by-pass or overflow of wastes to surface waters is prohibited, except as allowed by Federal Standard Provisions I.G. and I.H. (Attachment D).

C. Neither the discharge nor its treatment shall create a nuisance as defined in section 13050 of the Water Code.

D. The Discharger shall not allow pollutant-free wastewater to be discharged into the treatment or disposal, system in amounts that significantly diminish the system's capability to comply with this Order. Pollutant-free wastewater means rainfall, groundwater, cooling waters, and condensates that are essentially free of pollutants.

E. The discharge of wastewater to the Sacramento River during the recreation season (15 June through 14 September) is prohibited.

F. The discharge of waste classified as hazardous as defined in Section 2521(a) of Title 23, CCR, Section 2510, et seq. (hereafter Chapter 15) or designated as defined in Section 13173 of the California Water Code, is prohibited.

IV. EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS

A. Effluent Limitations – Discharge Point No. 001

1. Final Effluent Limitations – Discharge Point No. 001

a. The Discharger shall maintain compliance with the following effluent limitations at Discharge Point No. 001, with compliance measured at Monitoring Location EFF-001 as described in the Monitoring and Reporting Program:

Table 6. Effluent Limitations

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum
Conventional Pollutants						
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	10	15	30	--	--
	lbs/day[1]	67	100	200	--	--
Total Suspended Solids	mg/L	10	15	30	--	--
	lbs/day[1]	67	100	200	--	--
pH	standard units	--	--	--	6.5	8.5
Priority Pollutants						
Bis(2-Ethylhexyl) phthalate	µg/L	3.0	--	5.6	--	--
Copper, Total Recoverable	µg/L	9.1	--	19.3	--	--
Dichlorobromomethane	µg/L	1.5	--	3.6	--	--
Zinc, Total Recoverable	µg/L	12.9	--	26.2	--	--
Non-Conventional Pollutants						
Ammonia Nitrogen, Total (as N)	mg/L	4.6	--	8.4	--	--
Nitrate Plus Nitrite (as N)	mg/L	10	--	--	--	--
Settleable Solids	ml/L-hr	0.1	--	0.2	--	--

[1]Based on an ADWF of 0.80 mgd.

b. **Average Dry Weather Flow.** The average dry weather discharge flow shall not exceed 0.80 million gallons per day (mgd).

c. **Percent Removal.** The average monthly percent removal of 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) shall not be less than 85 percent.

d. **Acute Whole Effluent Toxicity.** Survival of aquatic organisms in 96-hour bioassays of undiluted waste shall be no less than:

   i. 70%, minimum for any one bioassay; and
   ii. 90%, median for any three consecutive bioassays

e. **Total Residual Chlorine.** Effluent total residual chlorine shall not exceed:

   i. 0.011 mg/L, as a 4-day average; and
   ii. 0.019 mg/L, as a 1-hour average.

f. **Total Coliform Organisms**. Effluent total coliform organisms shall not exceed:

   i. 2.2 most probable number (MPN) per 100 mL, as a 7-day median;
   ii. 23 MPN/100 mL, more than once in any 30-day period; and
   iii. 240 MPN/100 mL, at any time.

g. **Total Coliform Organisms.** From 16 November through 14 April, during periods of discharge when a receiving water to effluent flow ratio of ≥20:1 exists and the receiving water is <400 cfs, effluent total coliform organisms shall not exceed:

i. 23 MPN/100 mL, more than once in any 7-day period; and
ii. 240 MPN/100 mL, at any time.

2. **Interim Effluent Limitations**

a. **Effective immediately and ending 8 years from the effective date of this Order**, the Discharger shall maintain compliance with the following limitations at Discharge Point No. 001, with compliance measured at Monitoring Location EFF-001 as described in the Monitoring and Reporting Program. These interim effluent limitations shall apply in lieu of the corresponding final effluent limitations specified for the same parameters during the term of this Order.

Table 7. Interim Effluent Limitations

Parameter	Units	Effluent Limitations			
		Average Monthly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum
Biochemical Oxygen Demand 5-day @ 20°C [1]	mg/L	30	45	60	--
	lbs/day[2]	200	300	400	--
Total Suspended Solids[1]	mg/L	30	45	60	--
	lbs/day[2]	200	300	400	--
pH	Standard Units	--	--	6.0	--

[1] Interim limitation only applies from 16 November through 14 April.
[2] Based on ADWF of 0.8 mgd.

b. **Total Coliform Organisms. Effective immediately and ending 8 years from the effective date of this Order,** from 16 November through 14 April, during periods of discharge when a receiving water to effluent flow ratio of <20:1 exists or the receiving water is ≥400 cfs, effluent total coliform organisms shall not exceed:

i. 23 most probable number (MPN) per 100 mL, as a 7-day median; and
ii. 240 MPN/100 mL, at any time.

B. **Land Discharge Specifications – Discharge Point No. 002**

1. **Final Land Discharge Specifications – Discharge Point No. 002**

a. **Effective immediately** the Discharger shall maintain compliance with the following limitations at Discharge Point No. 002, with compliance measured at Monitoring Location LND-001 as described in the Monitoring and Reporting Program.

Table 8. Land Discharge Specifications

Parameter	Units	Discharge Specifications		
		Average Monthly	Average Weekly	Maximum Daily
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	30	45	60
Total Suspended Solids	mg/L	30	45	60
Settleable Solids	mL/L-Hr	0.1	--	0.2

b. **Average Daily Discharge Flow.** The average daily discharge flow for discharges to the leachfield shall not exceed 0.70 mgd.

c. **Total Coliform Organisms.** Effluent total coliform organisms shall not exceed:

i. 23 most probable number (MPN) per 100 mL, as a 7-day median; and
ii. 240 MPN/10 mL, at any time.

C. Reclamation Specifications – Discharge Point No. 003

1. The Discharger shall recycle its treated wastewater to the maximum extent practicable, as discussed in Section III.E.2 of the Fact Sheet.

2. The discharge shall be distributed uniformly on adequate acreage in compliance with the Discharge Specifications. All tail water must be returned to the spray fields or treatment facilities.

3. Hydraulic loading of wastewater shall be at reasonable agronomic rates designed to minimize the percolation of process wastewater below the root zone (i.e., deep percolation).

4. Public contact with effluent shall be precluded through such means as fences, signs, and other acceptable alternatives.

5. Areas irrigated with effluent shall be managed to prevent breeding of mosquitoes. More specifically:

   a. All applied irrigation water must infiltrate completely within 24 hours.

   b. Ditches not serving as wildlife habitat should be maintained free of emergent, marginal, and floating vegetation.

   c. Low-pressure and un-pressurized pipelines and ditches, which are accessible to mosquitoes, shall not be used to store reclaimed water.

6. Discharges to the spray irrigation fields shall be managed to minimize erosion. Runoff from the disposal area must be captured and returned to the treatment facilities or spray fields.

7. There shall be no standing water in the disposal area 24 hours after wastewater is applied.

8. The Discharger may not discharge effluent to the disposal fields 24 hours before precipitation, during periods of precipitation, and for at least 24 hours after cessation of precipitation, or when soils are saturated.

9. A 50-foot buffer zone shall be maintained between any watercourse and the wetted area produced during irrigation used for effluent disposal.

10. A 100-foot buffer zone shall be maintained between any spring, domestic well or irrigation well and the wetted area produced during irrigation used for effluent disposal.

11. A 50-foot buffer zone shall be maintained between effluent disposal areas and all property boundaries.

12. The discharge shall be adequately dechlorinated.

13. Effective immediately, the Discharger shall maintain compliance with the following limitations at Discharge Point 003, with compliance measured at Monitoring Location REC-001 as described in the Monitoring and Reporting Program.

Table 9. Reclamation Discharge Specifications

Parameter	Units	Discharge Specifications		
		Average Monthly	Average Weekly	Maximum Daily
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	10	15	30
Total Suspended Solids	mg/L	10	15	30
pH	Standard units	--	--	6.0 – 9.0[1]
Turbidity	NTU	--	5	10

[1] Instantaneous minimum and maximum.

a. **Average Daily Discharge Flow.** The average daily discharge flow for discharges to Mt. Shasta Golf Resort shall not exceed 0.80 mgd.

b. **Percent Removal.** The average monthly percent removal of 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) shall not be less than 85 percent.

c. **Total Coliform Organisms.** Effluent total coliform organisms shall not exceed:

i. 2.2 most probable number (MPN) per 100 mL, as a 7-day median;
ii. 23 MPN/100 mL, more than once in any 30-day period; and
iii. 240 MPN/100 mL, at any time.

V. RECEIVING WATER LIMITATIONS

A. Surface Water Limitations

Receiving water limitations are based on water quality objectives contained in the Basin Plan and are a required part of this Order. The discharge shall not cause the following in the Sacramento River:

1. **Bacteria.** The fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, to exceed a geometric mean of 200 MPN/100 mL, nor more than 10 percent of the total number of fecal coliform samples taken during any 30-day period to exceed 400 MPN/100 mL.

2. **Biostimulatory Substances.** Water to contain biostimulatory substances which promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses.

3. **Chemical Constituents.** Chemical constituents to be present in concentrations that adversely affect beneficial uses.

4. **Color.** Discoloration that causes nuisance or adversely affects beneficial uses.

5. **Dissolved Oxygen:**

   a. The monthly median of the mean daily dissolved oxygen concentration to fall below 85 percent of saturation in the main water mass;

   b. The 95 percentile dissolved oxygen concentration to fall below 75 percent of saturation; nor

   c. The dissolved oxygen concentration to be reduced below 7.0 mg/L at any time.

6. **Floating Material.** Floating material to be present in amounts that cause nuisance or adversely affect beneficial uses.

7. **Oil and Grease.** Oils, greases, waxes, or other materials to be present in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.

8. **pH.** The pH to be depressed below 6.5 nor raised above 8.5.

9. **Pesticides:**

   a. Pesticides to be present, individually or in combination, in concentrations that adversely affect beneficial uses;

   b. Pesticides to be present in bottom sediments or aquatic life in concentrations that adversely affect beneficial uses;

   c. Total identifiable persistent chlorinated hydrocarbon pesticides to be present in the water column at concentrations detectable within the accuracy of analytical methods approved by USEPA or the Executive Officer;

   d. Pesticide concentrations to exceed those allowable by applicable antidegradation policies (see State Water Board Resolution No. 68-16 and 40 CFR 131.12.);

   e. Pesticide concentrations to exceed the lowest levels technically and economically achievable;

   f. Pesticides to be present in concentration in excess of the maximum contaminant levels set forth in CCR, Title 22, division 4, chapter 15; nor

   g. Thiobencarb to be present in excess of 1.0 µg/L.

10. **Radioactivity:**

   a. Radionuclides to be present in concentrations that are harmful to human, plant, animal, or aquatic life nor that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life.

   b. Radionuclides to be present in excess of the maximum contaminant levels (MCLs) specified in Table 64442 of section 64442 and Table 64443 of section 64443 of Title 22 of the California Code of Regulations.

11. **Suspended Sediments**. The suspended sediment load and suspended sediment discharge rate of surface waters to be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

12. **Settleable Substances.** Substances to be present in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.

13. **Suspended Material.** Suspended material to be present in concentrations that cause nuisance or adversely affect beneficial uses.

14. **Taste and Odors.** Taste- or odor-producing substances to be present in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses.

15. **Temperature.** The natural temperature to be increased by more than 5°F. Compliance to be determined based on the difference in temperature at RSW-001 and RSW-002. Temperature changes due to controllable factors shall be limited as described below. To the extent of any conflict with the above temperature objective, the more stringent objective applies.

    - From 1 December to 15 March, the maximum temperature shall be 55°F.
    - From 16 March to 15 April, the maximum temperature shall be 60°F.
    - From 16 April to 15 May, the maximum temperature shall be 65°F.
    - From 16 May to 15 October, the maximum temperature shall be 70°F.
    - From 16 October to 15 November, the maximum temperature shall be 65°F.
    - From 16 November to 30 November, the maximum temperature shall be 60°F.

16. **Toxicity.** Toxic substances to be present, individually or in combination, in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life.

17. **Turbidity.**

    a. Shall not exceed 2 Nephelometric Turbidity Units (NTU) where natural turbidity is less than 1 NTU;

    b. Shall not increase more than 1 NTU where natural turbidity is between 1 and 5 NTUs;

    c. Shall not increase more than 20 percent where natural turbidity is between 5 and 50 NTUs;

    d. Shall not increase more than 10 NTU where natural turbidity is between 50 and 100 NTUs; nor

    e. Shall not increase more than 10 percent where natural turbidity is greater than 100 NTUs.

B. Groundwater Limitations

1. Release of waste constituents from any portion of the Facility shall not cause or contribute to, in combination with other sources of waste constituents, groundwater within influence of the Facility to contain:

    a. Taste or odor-producing constituents, toxic substances, or any other constituents, in concentrations that cause nuisance or adversely affect beneficial uses;

    b. Waste constituent concentrations in excess of water quality objectives or background water quality, whichever is greater;

c. Waste constituent concentrations in excess of the concentrations specified below or background water quality, whichever is greater:

i. Total coliform organisms shall be less than 2.2 MPN/100 mL over any 7-day period.

ii. Nitrate plus nitrite (as N) shall not exceed 10 mg/L.

VI. PROVISIONS

A. Standard Provisions

1. The Discharger shall comply with all Standard Provisions (federal NPDES standard conditions from 40 CFR Part 122) included in Attachment D of this Order.

2. The Discharger shall comply with the following provisions:

a. If the Discharger's wastewater treatment plant is publicly owned or subject to regulation by California Public Utilities Commission, it shall be supervised and operated by persons possessing certificates of appropriate grade according to Title 23, CCR, division 3, chapter 26.

b. After notice and opportunity for a hearing, this Order may be terminated or modified for cause, including, but not limited to:

i. violation of any term or condition contained in this Order;

ii. obtaining this Order by misrepresentation or by failing to disclose fully all relevant facts;

iii. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge; and

iv. a material change in the character, location, or volume of discharge.

The causes for modification include:

- *New regulations.* New regulations have been promulgated under section 405(d) of the CWA, or the standards or regulations on which the permit was based have been changed by promulgation of amended standards or regulations or by judicial decision after the permit was issued.

- *Land application plans.* When required by a permit condition to incorporate a land application plan for beneficial reuse of sewage sludge, to revise an existing land application plan, or to add a land application plan.

- *Change in sludge use or disposal practice.* Under 40 CFR 122.62(a)(1), a change in the Discharger's sludge use or disposal practice is a cause for modification of the permit. It is cause for revocation and reissuance if the Discharger requests or agrees.

The Central Valley Water Board may review and revise this Order at any time upon application of any affected person or the Central Valley Water Board's own motion.

c. If a toxic effluent standard or prohibition (including any scheduled compliance specified in such effluent standard or prohibition) is established under section 307(a) of the CWA, or amendments thereto, for a toxic pollutant that is present in the discharge authorized herein, and such standard or prohibition is more stringent than any limitation upon such pollutant in this Order, the Central Valley Water Board will revise or modify this Order in accordance with such toxic effluent standard or prohibition.

The Discharger shall comply with effluent standards and prohibitions within the time provided in the regulations that establish those standards or prohibitions, even if this Order has not yet been modified.

d. This Order shall be modified, or alternately revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved under sections 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) of the CWA, if the effluent standard or limitation so issued or approved:

Contains different conditions or is otherwise more stringent than any effluent limitation in the Order; or

Controls any pollutant limited in the Order.

The Order, as modified or reissued under this paragraph, shall also contain any other requirements of the CWA then applicable.

e. The provisions of this Order are severable. If any provision of this Order is found invalid, the remainder of this Order shall not be affected.

f. The Discharger shall take all reasonable steps to minimize any adverse effects to waters of the State or users of those waters resulting from any discharge or sludge use or disposal in violation of this Order. Reasonable steps shall include such accelerated or additional monitoring as necessary to determine the nature and impact of the non-complying discharge or sludge use or disposal.

g. The Discharger shall ensure compliance with any existing or future pretreatment standard promulgated by USEPA under section 307 of the CWA, or amendment thereto, for any discharge to the municipal system.

h. A copy of this Order shall be maintained at the discharge facility and be available at all times to operating personnel. Key operating personnel shall be familiar with its content.

i. Safeguard to electric power failure:

The Discharger shall provide safeguards to assure that, should there be reduction, loss, or failure of electric power, the discharge shall comply with the terms and conditions of this Order.

Upon written request by the Central Valley Water Board, the Discharger shall submit a written description of safeguards. Such safeguards may include alternate power sources, standby generators, retention capacity, operating procedures, or other means. A description of the safeguards provided shall include an analysis of the frequency, duration, and impact of power failures experienced over the past 5 years on effluent quality and on the capability of the Discharger to comply with the terms and conditions of the Order. The adequacy of the safeguards is subject to the approval of the Central Valley Water Board.

Should the treatment works not include safeguards against reduction, loss, or failure of electric power, or should the Central Valley Water Board not approve the existing safeguards, the Discharger shall, within 90 days of having been advised in writing by the Central Valley Water Board that the existing safeguards are inadequate, provide to the Central Valley Water Board and USEPA a schedule of compliance for providing safeguards such that in the event of reduction, loss, or failure of electric power, the Discharger shall comply with the terms and conditions of this Order. The schedule of compliance shall, upon approval of the Central Valley Water Board, become a condition of this Order.

j. The Discharger, upon written request of the Central Valley Water Board, shall file with the Board a technical report on its preventive (failsafe) and contingency (cleanup) plans for controlling accidental discharges, and for minimizing the effect of such events. This report may be combined with that required under the Central Valley Water Board Standard Provision contained in section VI.A.2.i of this Order.

The technical report shall:

Identify the possible sources of spills, leaks, untreated waste by-pass, and contaminated drainage. Loading and storage areas, power outage, waste treatment unit outage, and failure of process equipment, tanks and pipes should be considered.

Evaluate the effectiveness of present facilities and procedures and state when they became operational.

Predict the effectiveness of the proposed facilities and procedures and provide an implementation schedule containing interim and final dates when they will be constructed, implemented, or operational.

The Central Valley Water Board, after review of the technical report, may establish conditions which it deems necessary to control accidental discharges and to minimize the effects of such events. Such conditions shall be incorporated as part of this Order, upon notice to the Discharger.

k. A publicly owned treatment works whose waste flow has been increasing, or is projected to increase, shall estimate when flows will reach hydraulic and treatment capacities of its treatment and disposal facilities. The projections shall be made in January, based on the last 3 years' average dry weather flows, peak wet weather flows and total annual flows, as appropriate. When any projection shows that capacity of any part of the facilities may be exceeded in 4 years, the Discharger shall notify the Central Valley Water Board by 31 January. A copy of the notification shall be sent to appropriate local elected officials, local permitting agencies and the press. Within 120 days of the notification, the Discharger shall submit a technical report showing how it will prevent flow volumes from exceeding capacity or how it will increase capacity to handle the larger flows. The Central Valley Water Board may extend the time for submitting the report.

l. The Discharger shall submit technical reports as directed by the Executive Officer. All technical reports required herein that involve planning, investigation, evaluation, or design, or other work requiring interpretation and proper application of engineering or geologic sciences, shall be prepared by or under the direction of persons registered to practice in California pursuant to California Business and Professions Code, sections 6735, 7835, and 7835.1. To demonstrate compliance with Title 16, CCR, sections 415 and 3065, all technical reports must contain a statement of the qualifications of the responsible registered professional(s). As required by these laws, completed technical reports must bear the signature(s) and seal(s) of the registered professional(s) in a manner such that all work can be clearly attributed to the professional responsible for the work.

m. The Central Valley Water Board is authorized to enforce the terms of this permit under several provisions of the Water Code, including, but not limited to, sections 13385, 13386, and 13387.

n. For publicly owned treatment works, prior to making any change in the point of discharge, place of use, or purpose of use of treated wastewater that results in a permanent decrease of flow in any portion of a watercourse, the Discharger must file a petition with the State Water Board, Division of Water Rights, and receive approval for such a change. (Water Code section 1211).

o. In the event the Discharger does not comply or will be unable to comply for any reason, with any prohibition, maximum daily effluent limitation, 1-hour average effluent limitation, or receiving water limitation contained in this Order, the

Discharger shall notify the Central Valley Water Board by telephone (916) 464-3291 within 24 hours of having knowledge of such noncompliance, and shall confirm this notification in writing within 5 days, unless the Central Valley Water Board waives confirmation. The written notification shall include the information required by the Standard Provision contained in Attachment D section V.E.1. [40 CFR 122.41(l)(6)(i)].

p. Failure to comply with provisions or requirements of this Order, or violation of other applicable laws or regulations governing discharges from this facility, may subject the Discharger to administrative or civil liabilities, criminal penalties, and/or other enforcement remedies to ensure compliance. Additionally, certain violations may subject the Discharger to civil or criminal enforcement from appropriate local, state, or federal law enforcement entities.

q. In the event of any change in control or ownership of land or waste discharge facilities presently owned or controlled by the Discharger, the Discharger shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be immediately forwarded to the Central Valley Water Board.

To assume operation under this Order, the succeeding owner or operator must apply in writing to the Executive Officer requesting transfer of the Order. The request must contain the requesting entity's full legal name, the state of incorporation if a corporation, address and telephone number of the persons responsible for contact with the Central Valley Water Board and a statement. The statement shall comply with the signatory and certification requirements in the federal Standard Provisions (Attachment D, section V.B) and state that the new owner or operator assumes full responsibility for compliance with this Order. Failure to submit the request shall be considered a discharge without requirements, a violation of the Water Code. Transfer shall be approved or disapproved in writing by the Executive Officer.

B. Monitoring and Reporting Program Requirements

The Discharger shall comply with the Monitoring and Reporting Program, and future revisions thereto, in Attachment E of this Order.

C. Special Provisions

1. Reopener Provisions

a. Conditions that necessitate a major modification of a permit are described in 40 CFR 122.62, including, but not limited to:

i. If new or amended applicable water quality standards are promulgated or approved pursuant to section 303 of the CWA, or amendments thereto, this permit may be reopened and modified in accordance with the new or amended standards.

ii. When new information, that was not available at the time of permit issuance, would have justified different permit conditions at the time of issuance, including justification for seasonal limitations. For example, modifications to the Chronic Whole Effluent Toxicity Accelerated Monitoring Trigger, or the effluent limitations for ammonia, may be appropriate.

b. This Order may be reopened for modification, or revocation and reissuance, as a result of the detection of a reportable priority pollutant generated by special conditions included in this Order. These special conditions may be, but are not limited to, fish tissue sampling, whole effluent toxicity, monitoring requirements on internal waste stream(s), and monitoring for surrogate parameters. Additional requirements may be included in this Order as a result of the special condition monitoring data.

c. **Mercury.** If mercury is found to be causing toxicity based on acute or chronic toxicity test results, or if a TMDL program is adopted, this Order shall be reopened and an effluent concentration limitation imposed. If the Central Valley Water Board determines that a mercury offset program is feasible for Dischargers subject to a NPDES permit, then this Order may be reopened to evaluate the need for a mercury offset program for the Discharger.

d. **Pollution Prevention.** This Order requires the Discharger to prepare a pollution prevention plan following Water Code section 13263.3(d)(3) for pH. Based on a review of the pollution prevention plan, this Order may be reopened for addition and/or modification of effluent limitations and requirements for this constituent.

e. **Whole Effluent Toxicity.** As a result of a Toxicity Reduction Evaluation (TRE), this Order may be reopened to include a chronic toxicity limitation, a new acute toxicity limitation, and/or a limitation for a specific toxicant identified in the TRE. Additionally, if the State Water Board revises the SIP's toxicity control provisions that would require the establishment of numeric chronic toxicity effluent limitations, this Order may be reopened to include a numeric chronic toxicity effluent limitation based on the new provisions.

f. **Water Effects Ratios (WER) and Metal Translators.** A default WER of 1.0 has been used in this Order for calculating CTR criteria for applicable priority pollutant inorganic constituents. In addition, default dissolved-to-total metal translators have been used to convert water quality objectives from dissolved to total recoverable when developing effluent limitations for copper and zinc. If the Discharger performs studies to determine site-specific WERs and/or site-specific dissolved-to-total metal translators, this Order may be reopened to modify the effluent limitations for the applicable inorganic constituents.

g. **Constituent Study.** If after review of the study results it is determined that the discharge has reasonable potential to cause or contribute to an exceedance of a water quality objective this Order may be reopened and effluent limitations added for the subject constituent.

h. **Groundwater Monitoring Well Network Technical Report**. Based on a review of the results of the Groundwater Monitoring Well Network Technical Report, this Order may be reopened for addition and/or modification of land discharge specifications, groundwater limitations, and/or water quality monitoring requirements.

i. **Leachfield Design Investigation**. Based on a review of the results of the Leachfield Design Investigation, this Order may be reopened for addition and/or modification of land discharge specifications, and/or monitoring requirements.

j. **Aluminum Site-Specific Study.** This Order requires the Discharger to conduct a site-specific study or other study acceptable to the Executive Officer to determine the appropriate chronic aquatic life criterion for aluminum. If the results of the Study indicate the appropriate chronic aquatic life criterion is being exceeded in the discharge, the permit may be reopened and aluminum effluent limitations established, if appropriate.

k. **Mixing Improvements**. This Order may be reopened to increase dilution credits and/or modify final effluent limitations, if appropriate, based on implementation of measures that improve mixing dynamics and minimize the size of the mixing zone(s). These improvements may include modifications to the diffuser.

l. **Flow Control**. This Order may be reopened for addition and/or modification of effluent limitations, mixing zones, and/or dilution credits, if appropriate, based on implementation of operational measures that ensure a higher minimum river to effluent flow ratio.

m. **Minimum Whitewater Recreation Flow Rate**. This Order may be reopened to allow for an adjustment to the minimum whitewater recreation flow rate, if appropriate, as a result of the establishment of an upstream receiving water flow measurement station (located downstream of Box Canyon Dam) and the submittal of information that would justify a modification to the minimum whitewater recreation flow rate.

n. **Ammonia Removal Study**. Upon completion of the Ammonia Removal Study, this Order may be reopened to add or modify final ammonia effluent limitations and/or mixing zones, as appropriate.

2. **Special Studies, Technical Reports and Additional Monitoring Requirements**

a. **Chronic Whole Effluent Toxicity.** For compliance with the Basin Plan's narrative toxicity objective, this Order requires the Discharger to conduct chronic whole effluent toxicity (WET) testing, as specified in the Monitoring and Reporting Program (Attachment E, section V). Furthermore, this Provision requires the Discharger to investigate the causes of, and identify corrective actions to reduce or eliminate effluent toxicity. If the discharge exhibits toxicity, as described in subsection ii below, the Discharger is required to initiate a TRE in accordance with an approved TRE Workplan, and take actions to mitigate

the impact of the discharge and prevent recurrence of toxicity. A TRE is a site-specific study conducted in a stepwise process to identify the source(s) of toxicity and the effective control measures for effluent toxicity. TREs are designed to identify the causative agents and sources of effluent toxicity, evaluate the effectiveness of the toxicity control options, and confirm the reduction in effluent toxicity. This Provision includes requirements for the Discharger to develop and submit a TRE Workplan and includes procedures for accelerated chronic toxicity monitoring and TRE initiation.

i. Initial Investigative TRE Workplan. Within 90 days of the effective date of this Order, the Discharger shall submit to the Central Valley Water Board an Initial Investigative TRE Workplan for approval by the Executive Officer. This should be a one to two page document including, at a minimum:

(a) A description of the investigation and evaluation techniques that will be used to identify potential causes and sources of effluent toxicity, effluent variability, and treatment system efficiency;

(b) A description of the facility's methods of maximizing in-house treatment efficiency and good housekeeping practices, and a list of all chemicals used in operation of the facility; and

(c) A discussion of who will conduct the Toxicity Identification Evaluation (TIE), if necessary (e.g., an in-house expert or outside contractor).

ii. Accelerated Monitoring and TRE Initiation. When the numeric toxicity monitoring trigger is exceeded during regular chronic toxicity monitoring, the Discharger shall initiate accelerated monitoring as required in the Accelerated Monitoring Specifications. The Discharger shall initiate a TRE to address effluent toxicity if any WET testing results exceed the numeric toxicity monitoring trigger during accelerated monitoring.

iii. Numeric Toxicity Monitoring Trigger. The numeric toxicity monitoring trigger to initiate a TRE is > 1 TU_C (where TU_C = 100/NOEC). The monitoring trigger is not an effluent limitation; it is the toxicity threshold at which the Discharger is required to begin accelerated monitoring and initiate a TRE when the effluent exhibits toxicity.

iv. Accelerated Monitoring Specifications. If the numeric toxicity monitoring trigger is exceeded during regular chronic toxicity testing, the Discharger shall initiate accelerated monitoring within 14 days of notification by the laboratory of the exceedance. Accelerated monitoring shall consist of four (4) chronic toxicity tests conducted once every 2 weeks using the species that exhibited toxicity. The following protocol shall be used for accelerated monitoring and TRE initiation:

(a) If the results of four (4) consecutive accelerated monitoring tests do not exceed the monitoring trigger, the Discharger may cease accelerated

monitoring and resume regular chronic toxicity monitoring. However, notwithstanding the accelerated monitoring results, if there is evidence of effluent toxicity, the Executive Officer may require that the Discharger initiate a TRE.

(b) If the source(s) of the toxicity is easily identified (e.g., temporary plant upset), the Discharger shall make necessary corrections to the facility and shall continue accelerated monitoring until four (4) consecutive accelerated tests do not exceed the monitoring trigger. Upon confirmation that the effluent toxicity has been removed, the Discharger may cease accelerated monitoring and resume regular chronic toxicity monitoring.

(c) If the result of any accelerated toxicity test exceeds the monitoring trigger, the Discharger shall cease accelerated monitoring and begin a TRE to investigate the cause(s) of, and identify corrective actions to reduce or eliminate effluent toxicity. Within thirty (30) days of notification by the laboratory of any test result exceeding the monitoring trigger during accelerated monitoring, the Discharger shall submit a TRE Action Plan to the Central Valley Water Board including, at minimum:

(1) Specific actions the Discharger will take to investigate and identify the cause(s) of toxicity, including a TRE WET monitoring schedule;

(2) Specific actions the Discharger will take to mitigate the impact of the discharge and prevent the recurrence of toxicity; and

(3) A schedule for these actions.

Within sixty (60) days of notification by the laboratory of the test results, the Discharger shall submit to the Central Valley Water Board a TRE Workplan for approval by the Executive Officer. The TRE Workplan shall outline the procedures for identifying the source(s) of, and reducing or eliminating effluent toxicity. The TRE Workplan must be developed in accordance with USEPA guidance[1].

b. Constituent Study. There are indications that the discharge may contain constituents that have a reasonable potential to cause or contribute to an exceedance of water quality objectives: cadmium. The Discharger shall conduct a study to evaluate the source of cadmium and conduct quarterly monitoring of cadmium in the effluent and the receiving water during the first 2 years of the permit term (8 consecutive sampling events). A study report, evaluating the results of the monitoring and the constituent's potential effect to surface water, must be submitted within **6 months following completion of the final monitoring event**.

[1] See the Fact Sheet (Attachment F section VII.B.2.a.) for a list of USEPA guidance documents that must be considered in development of the TRE Workplan.

c. **Groundwater Monitoring Well Network Technical Report.** To determine compliance with Groundwater Limitations V.B. this provision requires the Discharger to evaluate its groundwater monitoring network to ensure there are one or more background monitoring wells and a sufficient number of designated monitoring wells downgradient of the leachfields. The technical report must be prepared and certified by a California-registered Professional Engineer or Geologist. **Within 6 months following adoption of this Order,** the Discharger shall submit a Groundwater Monitoring Well Network Work Plan for approval by the Executive Officer. The technical report must be completed and submitted within 12 months following Executive Officer approval of the work plan.

d. **Leachfield Design Investigation.** This provision requires the Discharger to provide a technical engineering report on the design of the Facility leachfields. Specifically, the Discharger must provide design flow rate and loading rates for treatment and soil conditions (including percolation rates) at the leachfield site. The seasonal and intermittent use of the leachfields and subsequent effect on subsurface treatment, if any, must be addressed. Year-round usage of the leachfields must also be evaluated with respect to design constraints and/or treatment capacities. The technical report must be prepared and certified by a California-registered Professional Civil Engineer. **Within 6 months following adoption of this Order,** the Discharger shall submit a Leachfield Design Investigation work plan for approval by the Executive Officer. The final Leachfield Design Investigation report must be completed and submitted within 12 months following Executive Officer approval of the work plan.

e. **Total Residual Chlorine Monitoring**. **Within 18 months of the effective date of this Order**, the Discharger shall install an electronic, real-time residual chlorine analyzer on the treatment plant effluent following the dechlorination process. The device shall continuously measure and record the chlorine residual and automatically notify the treatment plant operator of errors and effluent violations. The device shall have sensitivity and accuracy to demonstrate compliance with the effluent limits for chlorine residual contained in this Order. Documentation of such installation shall be submitted to the Regional Board following completion of this task.

f. **Continuous pH Analyzer**. **Within 18 months of the effective date of this Order**, the Discharger shall install an electronic, real-time pH analyzer on the treatment plant effluent. The device shall continuously measure and record the effluent pH and automatically notify the treatment plant operator of errors and effluent violations. The device shall have sensitivity and accuracy to demonstrate compliance with the effluent limits for pH contained in this Order. Documentation of such installation shall be submitted to the Regional Board following completion of this task.

g. **Outfall Line and Diffuser Repair.** The Facility's outfall line and diffuser must be repaired to eliminate leaks in the pipeline and to ensure effluent is discharged below the receiving water surface in a manner that optimizes the available mixing of the effluent with the receiving water. **Within 12 months following adoption**

of this Order, the Discharger shall submit a work plan for approval by the Executive Officer, to address the outfall pipeline and diffuser deficiencies. The outfall line and diffuser deficiencies must be remedied **within 5 years of the effective date of this Order**.

h. **Aluminum Site-Specific Study.** This Order requires the Discharger to conduct a site-specific study or other study acceptable to the Executive Officer to determine the appropriate chronic aquatic life criterion for aluminum. A workplan for the Study must be submitted prior to commencement of activities, for approval by the Executive Officer, and the results of the Study are due to the Central Valley Water Board no later than 180 days prior to the expiration of the permit. If the results of the Study indicate the appropriate chronic aquatic life criterion is being exceeded in the discharge, the permit may be reopened and aluminum effluent limitations established, if appropriate.

   The Executive Officer may waive this requirement to complete the Study, if after two years of aluminum monitoring (as outlined in Attachment E) of the effluent and the receiving water, the monitoring results indicate that the Discharger's efforts at aluminum source control at the Facility have reduced effluent aluminum levels to below the National Recommended Water Quality Criteria of 87 µg/L (chronic aquatic-life criteria) and the development of site-specific aluminum chronic aquatic life criterion for the discharge is not necessary.

k. **Ammonia Reduction Study. 180 days prior to the expiration date of this Order**, the Discharger shall submit an ammonia reduction study. The study shall include a description of ammonia reduction measures implemented during the current permit cycle and/or scheduled for future implementation, site-specific constraints, if any, related to effluent ammonia reduction, and an evaluation of whether there are additional practicable ammonia reduction measures that may be implemented at the facility in order to reduce ammonia concentrations in the effluent and minimize the size of the ammonia mixing zone. If additional ammonia concentration reductions are practicable then the size of future mixing zones and dilution credits for ammonia may be reduced until such practicable concentration reductions have been achieved.

3. **Best Management Practices and Pollution Prevention**

a. **Salinity Evaluation and Minimization Plan.** The Discharger shall prepare a salinity evaluation and minimization plan to identify and address sources of salinity from the Facility. The plan shall be completed and submitted to the Central Valley Water Board **within 9 months of the adoption date of this Order** for the approval by the Executive Officer.

4. Construction, Operation and Maintenance Specifications

a. Turbidity. Effective **immediately** or upon compliance with Special Provision VI.C.6.a, whichever is sooner, effluent turbidity shall not exceed:

i. 2 NTU, as a daily average;
ii. 5 NTU, more than 5% of the time within a 24-hour period; and
iii. 10 NTU, at any time.

The effluent turbidity specification shall not apply from 16 November through 14 April when a receiving water to effluent flow ratio of ≥20:1 exists and the receiving water is <400 cfs.

Prior to compliance with Special Provision VI.C.6.a., effluent turbidity shall not exceed 5.0 NTU and 10 NTU, as a weekly average and a daily maximum, respectively, from 15 April through 14 June and 16 September through 15 November. This interim specification is consistent with the turbidity effluent limitations contained in the previous Order.

b. The treatment facilities shall be designed, constructed, operated, and maintained to prevent inundation or washout due to floods with a 100-year return frequency.

i. Public contact with wastewater shall be precluded through such means as fences, signs, and other acceptable alternatives.

ii. Ponds shall be managed to prevent breeding of mosquitoes. In particular,

(b) An erosion control program should assure that small coves and irregularities are not created around the perimeter of the water surface.

(c) Weeds shall be minimized.

(d) Dead algae, vegetation, and debris shall not accumulate on the water surface.

iii. Freeboard shall never be less than 2 feet (measured vertically to the lowest point of overflow.

iv. Ponds shall have sufficient capacity to accommodate allowable wastewater flow and design seasonal precipitation and ancillary inflow and infiltration during the non-irrigation season. Design seasonal precipitation shall be based on total annual precipitation using a return period of 100 years, distributed monthly in accordance with historical rainfall patterns. Freeboard shall never be less than 2 feet (measured vertically to the lowest point of overflow).

v. Prior to the onset of the rainy season of each year, available pond storage capacity shall at least equal the volume necessary to comply with the Land Discharge Specification at section IV.C.4.a.iv., above.

vi. The discharge of waste classified as "hazardous" as defined in section 2521(a) of Title 23, California Code of Regulations (CCR), or "designated", as defined in section 13173 of the Water Code, to the treatment ponds is prohibited.

Objectionable odors originating at this Facility shall not be perceivable beyond the limits of the wastewater treatment and disposal areas (or property owned by the Discharger).

5. **Special Provisions for Municipal Facilities (POTWs Only)**

a. **Pretreatment Requirements**. The average dry weather design flow for the Facility is less than 5 mgd and the Facility does not receive discharges from Significant Industrial Users. Under these conditions, the Discharger is not required to develop a pretreatment program pursuant to USEPA regulations set forth in 40 CFR Part 403.

b. **Sludge/Biosolids Treatment or Discharge Specifications.** Sludge in this document means the solid, semisolid, and liquid residues removed during primary, secondary, or advanced wastewater treatment processes. Solid waste refers to grit and screening material generated during preliminary treatment. Residual sludge means sludge that will not be subject to further treatment at the wastewater treatment plant. Biosolids refer to sludge that has been treated and tested and shown to be capable of being beneficially and legally used pursuant to federal and state regulations as a soil amendment for agricultural, silvicultural, horticultural, and land reclamation activities as specified under 40 CFR Part 503.

i. Collected screenings, residual sludge, biosolids, and other solids removed from liquid wastes shall be disposed of in a manner approved by the Executive Officer, and consistent with Consolidated Regulations for Treatment, Storage, Processing, or Disposal of Solid Waste, as set forth in Title 27, CCR, division 2, subdivision 1, section 20005, et seq. Removal for further treatment, storage, disposal, or reuse at sites (e.g., landfill, composting sites, soil amendment sites) that are operated in accordance with valid waste discharge requirements issued by a Regional Water Board will satisfy these specifications.

ii. Sludge and solid waste shall be removed from screens, sumps, ponds, clarifiers, etc. as needed to ensure optimal plant performance.

iii. The treatment of sludge generated at the Facility shall be confined to the Facility property and conducted in a manner that precludes infiltration of waste constituents into soils in a mass or concentration that will violate groundwater limitations in section V.B. of this Order. In addition, the storage

of residual sludge, solid waste, and biosolids on Facility property shall be temporary and controlled, and contained in a manner that minimizes leachate formation and precludes infiltration of waste constituents into soils in a mass or concentration that will violate groundwater limitations included in section V.B. of this Order.

The use, disposal, storage, and transportation of biosolids shall comply with existing federal and state laws and regulations, including permitting requirements and technical standards included in 40 CFR Part 503. If the State Water Board and the Central Valley Water Board are given the authority to implement regulations contained in 40 CFR Part 503, this Order may be reopened to incorporate appropriate time schedules and technical standards. The Discharger must comply with the standards and time schedules contained in 40 CFR Part 503 whether or not they have been incorporated into this Order.

The Discharger shall comply with Section IX.A. Biosolids of the Monitoring and Reporting Program, Attachment E.

Any proposed change in biosolids use or disposal practice from a previously approved practice shall be reported to the Executive Officer and USEPA Regional Administrator at least **90 days** in advance of the change.

Within 180 days of the permit effective date, the Discharger shall review and update its existing biosolids use or disposal plan, and submit it to the Central Valley Water Board. The updated plan shall describe at a minimum:

(a) Sources and amounts of biosolids generated annually.

(b) Location(s) of on-site storage and description of the containment area.

(c) Plans for ultimate disposal. For landfill disposal, include the Central Valley Water Board's waste discharge requirement numbers that regulate the particular landfill; the present classification of the landfill; and the name and location of the landfill.

c. Biosolids Storage and Transportation Specifications. Biosolids shall be considered to be "stored" if they are placed on the ground or in non-mobile containers (i.e. not in a truck or trailer) at an intermediate storage location away from the generator/processing for more than 48 hours. Biosolids shall be considered to be "staged" if placed on the ground for brief periods of time solely to facilitate transfer of the biosolids between transportation and application vehicles.

i. Biosolids shall not be stored directly on the ground at any one location for more than seven (7) consecutive days.

ii. Facilities for the storage of Class B biosolids shall be located, designed and maintained to restrict public access to biosolids.

iii. Biosolids storage facilities shall be designed and maintained to prevent washout or inundation from a storm or flood with a return frequency of 100 years.

iv. Biosolids storage facilities, which contain biosolids, shall be designed and maintained to contain all storm water falling on the biosolids storage area during a rainfall year with a return frequency of 100 years.

v. Biosolids placed on site for more than 24 hours shall be covered.

vi. Biosolids storage facilities shall be designed, maintained and operated to minimize the generation of leachate and the effects of erosion.

vii. If biosolids are to be stored at the site, a plan describing the storage program and means of complying with the specifications contained in sections VI.C.5.b and c of this Order shall be submitted for the Central Valley Water Board's staff approval. The storage plan shall also include an adverse weather plan.

viii. The Discharger shall operate the biosolids storage facilities in accordance with the approved biosolids storage plan.

ix. The Discharger shall immediately remove and relocate any biosolids stored on site in violation of this Order.

x. All biosolids shall be transported in covered vehicles capable of containing the designated load.

xi. All biosolids having a water content that is capable of leaching liquids shall be transported in leak proof vehicles.

xii. Each biosolids transport driver shall be trained as to the nature of its load and the proper response to accidents or spill events and shall carry a copy of an approved spill response plan.

xiii. The Discharger shall avoid the use of haul routes near residential land uses to the extent possible. If the use of haul routes near residential land uses cannot be avoided, the Discharger shall limit project-related truck traffic to daylight hours.

d. **Collection System.** On 2 May 2006, the State Water Board adopted State Water Resources Control Board Order No. 2006-0003-DWQ, Statewide General Waste Discharge Requirements (WDRs) for Sanitary Sewer Systems. The Discharger shall be subject to the requirements of Order No. 2006-0003-DWQ and any future revisions thereto. Order No. 2006-0003-DWQ requires that all

public agencies that currently own or operate sanitary sewer systems apply for coverage under the general WDRs. The Discharger has applied for and has been approved for coverage under Order 2006-0003-DWQ for operation of its wastewater collection system.

This Order, and the Monitoring and Reporting Program which is a part of this Order, requires that certain parameters be monitored on a continuous basis. The wastewater treatment plant is not staffed on a full time basis. Permit violations or system upsets can go undetected during this period. The Discharger shall establish an electronic system for operator notification for continuous recording device alarms. For existing continuous monitoring systems, the electronic notification system shall be installed within 6 months of adoption of this permit. For systems installed following permit adoption, the notification system shall be installed simultaneously.

6. Other Special Provisions

a. During periods of effluent discharge to surface water, with the exception of effluent discharges from 16 November through 14 April when a receiving water to effluent flow ratio of ≥20:1 exists and the receiving water is <400 cfs, all wastewater shall be oxidized, coagulated, filtered, and adequately disinfected pursuant to DPH reclamation criteria, California Code of Regulations, Title 22, Division 4, Chapter 3 (Title 22), or equivalent, as discussed in the Fact Sheet, Section VII.B.6.a., and in accordance with the compliance schedule in Section VI.C.7.a, below.

7. Compliance Schedules

a. Compliance Schedule for Title 22, or Equivalent, Disinfection Requirements. By **8 years from the effective date of this Order**, wastewater discharged to the Sacramento River (with the exception of effluent discharges from 16 November through 14 April when a receiving water to effluent flow ratio of ≥20:1 exists and the receiving water is <400 cfs) shall be oxidized, coagulated, filtered, and adequately disinfected pursuant to the Department of Public Health (DPH; formerly the Department of Health Services) reclamation criteria, Title 22 CCR, Division 4, Chapter 3, (Title 22), or equivalent. The effluent shall be disinfected in accordance with the total coliform organisms effluent limitations set forth in this Order, which are equivalent to "disinfected tertiary recycled water" disinfection requirements, however; wastewater treated for discharge need not comply with the CT[1] requirement specified in Title 22 Section 60301.230(a) or the disinfection process outlined in Section 60301.230(b). Until final compliance, the Discharger shall submit progress reports in accordance with the Monitoring and Reporting Program (Attachment E, section X.D.1). The Discharger shall comply with the following time schedule to ensure compliance with the final effluent limitations:

[1] The product of the total chlorine residual multiplied by the modal contact time measured at the same point.

Task	Date Due
i. Submit Method of Compliance Workplan/Schedule	**Within 6 months** after effective date of this Order
ii. Progress Reports[1]	1 **June**, annually, after approval of work plan until final compliance
iii. Submit Method of Compliance Project Report (e.g. preliminary engineering report)	**1 June 2014**
iv. Submit Financing Plan	**Within 2 years** after effective date of this Order.
v. Begin environmental review and/or permitting process for Compliance Project	**Within 4 years** after effective date of this Order
vi. Begin construction of Compliance Project	**Within 6 years** after effective date of this Order.
vii. Achieve Full Compliance and submit project completion report.	**Within 8 years** after the effective date of this Order.
[1] The progress reports shall detail what steps have been implemented towards achieving compliance with waste discharge requirements, including studies, construction progress, evaluation of measures implemented, and recommendations for additional measures as necessary to achieve full compliance by the final compliance date.	

b. Compliance Schedules for Final Effluent Limitations for BOD_5, TSS, and pH. This Order requires compliance with the final effluent limitations for BOD_5, TSS, and pH by **8 years from the effective date of this Order**. Until final compliance, the Discharger shall submit progress reports in accordance with the Monitoring and Reporting Program (Attachment E, section X.D.1). The Discharger shall comply with the following time schedule to ensure compliance with the final effluent limitations:

Task	Date Due
i. Submit Method of Compliance Workplan/Schedule	**Within 6 months** after adoption of this Order
ii. Submit and Implement Pollution Prevention Plan (PPP)[1] for pH	**Within 6 months** after adoption of this Order
iii. Progress Reports[2]	1 **June**, annually, after approval of work plan until final compliance
iv. Submit Method of Compliance Project Report (e.g. preliminary engineering report)	**1 June 2014**
v. Submit Financing Plan	**Within 2 years** after effective date of this Order.

Task	Date Due
vi. Begin environmental review and/or permitting process for Compliance Project	**Within 4 years** after effective date of this Order
vii. Begin construction of Compliance Project	**Within 6 years** after effective date of this Order.
viii. Achieve Full Compliance and submit project completion report.	**Within 8 years** after the effective date of this Order.

[1] The PPP for pH shall be prepared and implemented in accordance with Water Code section 13263.3(d)(3) as outlined in the Fact Sheet (Attachment F section VII.B.3.b).

[2] The progress reports shall detail what steps have been implemented towards achieving compliance with waste discharge requirements, including studies, construction progress, evaluation of measures implemented, and recommendations for additional measures as necessary to achieve full compliance by the final compliance date.

VII. COMPLIANCE DETERMINATION

A. BOD_5 and TSS Effluent Limitations (Section IV). Compliance with the final effluent limitations for BOD_5 and TSS required in Limitations and Discharge Requirements section IV shall be ascertained by 24-hour composite samples. Compliance with effluent limitations required in Limitations and Discharge Requirements section IV for percent removal shall be calculated using the arithmetic mean of BOD_5 and TSS in effluent samples collected over a monthly period as a percentage of the arithmetic mean of the values for influent samples collected at approximately the same times during the same period.

B. Average Dry Weather Flow Effluent Limitations (Section IV). The average dry weather discharge flow represents the daily average flow when groundwater is at or near normal and runoff is not occurring. Compliance with the average dry weather flow effluent limitations will be determined annually based on the average daily flow over three consecutive dry weather months (e.g., July, August, and September). The inflow and infiltration in the Mt. Shasta area is high due to the presence of springs and high groundwater which persist late into the summer. For this reason, the dry weather flow period may be considered to be 1 August through 31 October.

C. Total Coliform Organisms Effluent Limitations (Section IV.A.1.f. and g.). For each day that an effluent sample is collected and analyzed for total coliform organisms, the 7-day median shall be determined by calculating the median concentration of total coliform bacteria in the effluent utilizing the bacteriological results of the last 7 days. For example, if a sample is collected on a Wednesday, the result from that sampling event and all results from the previous 6 days (i.e., Tuesday, Monday, Sunday, Saturday, Friday, and Thursday) are used to calculate the 7-day median. If the 7-day median of total coliform organisms exceeds a most probable number (MPN) of 2.2 or 23 (depending in flow conditions) per 100 milliliters, the Discharger will be considered out of compliance. Because total coliform organism limitations vary based on effluent and receiving water flows and dilution ratios, determination of compliance with the limitations requires the Discharger to report effluent and receiving water flows and dilution ratios

for the appropriate time period. If the Discharger is unable to adequately demonstrate compliance with the "flow-dependent" limitations for total coliform organisms, as a result of limited real-time access to receiving water flow conditions, then the more stringent of the total coliform organism limitations (Section IV.A.1.g) will apply for the purpose of compliance determination.

D. **Total Residual Chlorine Effluent Limitations (Section IV).** Continuous monitoring analyzers for chlorine residual or for dechlorination agent residual in the effluent are appropriate methods for compliance determination. A positive residual dechlorination agent in the effluent indicates that chlorine is not present in the discharge, which demonstrates compliance with the effluent limitations. This type of monitoring can also be used to prove that some chlorine residual exceedances are false positives. Continuous monitoring data showing either a positive dechlorination agent residual or a chlorine residual at or below the prescribed limit are sufficient to show compliance with the total residual chlorine effluent limitations, as long as the instruments are maintained and calibrated in accordance with the manufacturer's recommendations.

Any excursion above the 1-hour average or 4-day average total residual chlorine effluent limitations is a violation. If the Discharger conducts continuous monitoring and the Discharger can demonstrate, through data collected from a back-up monitoring system, that a chlorine spike recorded by the continuous monitor was not actually due to chlorine, then any excursion resulting from the recorded spike will not be considered an exceedance, but rather reported as a false positive. Records supporting validation of false positives shall be maintained in accordance with Section IV Standard Provisions (Attachment D).

E. **Volatile Organic Compounds (VOCs).** VOCs include all constituents listed in USEPA Method 502.2 (Attachment I). When calculating the average monthly of each VOC, non-detect results shall be counted as one-half the detection level.

F. **Mass Effluent Limitations.** The mass effluent limitations contained in the Final Effluent Limitations IV.A.1 and Interim Effluent Limitations IV.A.2 are based on the permitted average dry weather flow and calculated as follows:.

Mass (lbs/day) = Flow (MGD) x Concentration (mg/L) x 8.34 (conversion factor)

If the effluent flow exceeds the permitted average dry weather flow during wet-weather seasons, the effluent mass limitations contained in Final Effluent Limitations IV.A.1.a and Interim Effluent Limitations IV.A.2 shall not apply. If the effluent flow is below the permitted average dry weather flow during wet-weather seasons, the effluent mass limitations do apply.

G. **Priority Pollutant Effluent Limitations.** Compliance with effluent limitations for priority pollutants shall be determined using sample reporting protocols defined in Attachment A, Attachment E, and Attachment I of this Order. For purposes of reporting and administrative enforcement by the Central Valley Water Board and the State Water Board, the Discharger shall be deemed out of compliance with effluent limitations if the

concentration of the priority pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the reporting level (RL).

ATTACHMENT A – DEFINITIONS

Acutely Toxic Conditions
As used in the context of mixing zones, refers to lethality that occurs to mobile aquatic organisms that move or drift through the mixing zone.

Arithmetic Mean (μ)
Also called the average, is the sum of measured values divided by the number of samples. For ambient water concentrations, the arithmetic mean is calculated as follows:

Arithmetic mean = $\mu = \Sigma x / n$ where: Σx is the sum of the measured ambient water concentrations, and n is the number of samples.

Average Monthly Effluent Limitation (AMEL)
The highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

Average Weekly Effluent Limitation (AWEL)
The highest allowable average of daily discharges over a calendar week (Sunday through Saturday), calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.

Bioaccumulative
Those substances taken up by an organism from its surrounding medium through gill membranes, epithelial tissue, or from food and subsequently concentrated and retained in the body of the organism.

Carcinogenic
Pollutants are substances that are known to cause cancer in living organisms.

Coefficient of Variation (CV)
CV is a measure of the data variability and is calculated as the estimated standard deviation divided by the arithmetic mean of the observed values.

Completely-Mixed Discharge
A condition that means not more than a 5 percent difference, accounting for analytical variability, in the concentration of a pollutant exists across a transect of the water body at a point within two stream/river widths from the discharge point.

Daily Discharge
Daily Discharge is defined as either: (1) the total mass of the constituent discharged over the calendar day (12:00 am through 11:59 pm) or any 24-hour period that reasonably represents a calendar day for purposes of sampling (as specified in the permit), for a constituent with limitations expressed in units of mass or; (2) the unweighted arithmetic mean measurement of the constituent over the day for a constituent with limitations expressed in other units of measurement (e.g., concentration).

The daily discharge may be determined by the analytical results of a composite sample taken over the course of 1 day (a calendar day or other 24-hour period defined as a day) or by the arithmetic mean of analytical results from one or more grab samples taken over the course of the day.

For composite sampling, if 1 day is defined as a 24-hour period other than a calendar day, the analytical result for the 24-hour period will be considered as the result for the calendar day in which the 24-hour period ends.

Detected, but Not Quantified (DNQ)
DNQ are those sample results less than the RL, but greater than or equal to the laboratory's MDL.

Dilution Credit
Dilution Credit is the amount of dilution granted to a discharge in the calculation of a water quality-based effluent limitation, based on the allowance of a specified mixing zone. It is calculated from the dilution ratio or determined through conducting a mixing zone study or modeling of the discharge and receiving water.

Dilution Ratio
Dilution ratio is the critical low flow of the upstream receiving water divided by the flow of the effluent discharged.

Effluent Concentration Allowance (ECA)
ECA is a value derived from the water quality criterion/objective, dilution credit, and ambient background concentration that is used, in conjunction with the coefficient of variation for the effluent monitoring data, to calculate a long-term average (LTA) discharge concentration. The ECA has the same meaning as waste load allocation (WLA) as used in USEPA guidance (Technical Support Document For Water Quality-based Toxics Control, March 1991, second printing, EPA/505/2-90-001).

Enclosed Bays
Enclosed Bays means indentations along the coast that enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between the headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. Enclosed bays include, but are not limited to, Humboldt Bay, Bodega Harbor, Tomales Bay, Drake's Estero, San Francisco Bay, Morro Bay, Los Angeles-Long Beach Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay. Enclosed bays do not include inland surface waters or ocean waters.

Estimated Chemical Concentration
The estimated chemical concentration that results from the confirmed detection of the substance by the analytical method below the ML value.

Estuaries
Estuaries means waters, including coastal lagoons, located at the mouths of streams that serve as areas of mixing for fresh and ocean waters. Coastal lagoons and mouths of streams

that are temporarily separated from the ocean by sandbars shall be considered estuaries. Estuarine waters shall be considered to extend from a bay or the open ocean to a point upstream where there is no significant mixing of fresh water and seawater. Estuarine waters included, but are not limited to, the Sacramento-San Joaquin Delta, as defined in Water Code section 12220, Suisun Bay, Carquinez Strait downstream to the Carquinez Bridge, and appropriate areas of the Smith, Mad, Eel, Noyo, Russian, Klamath, San Diego, and Otay rivers. Estuaries do not include inland surface waters or ocean waters.

Four-Day Average of Daily Maximum Flows
The average of daily maximums taken from the data set in four-day intervals.

Incompletely-Mixed Discharge
A discharge that contributes to a condition that does not meet the meaning of a completely-mixed discharge condition.

Inland Surface Waters
All surface waters of the State that do not include the ocean, enclosed bays, or estuaries.

Instantaneous Maximum Effluent Limitation
The highest allowable value for any single grab sample or aliquot (i.e., each grab sample or aliquot is independently compared to the instantaneous maximum limitation).

Instantaneous Minimum Effluent Limitation
The lowest allowable value for any single grab sample or aliquot (i.e., each grab sample or aliquot is independently compared to the instantaneous minimum limitation)

Maximum Daily Effluent Limitation (MDEL)
The highest allowable daily discharge of a pollutant, over a calendar day (or 24-hour period). For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the daily discharge is calculated as the arithmetic mean measurement of the pollutant over the day.

Median
The middle measurement in a set of data. The median of a set of data is found by first arranging the measurements in order of magnitude (either increasing or decreasing order). If the number of measurements (n) is odd, then the median = $X_{(n+1)/2}$. If n is even, then the median = $(X_{n/2} + X_{(n/2)+1})/2$ (i.e., the midpoint between the $n/2$ and $n/2+1$).

Method Detection Limit (MDL)
MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero, as defined in 40 CFR Part 136, Attachment B, revised as of 3 July 1999.

Minimum Level (ML)
ML is the concentration at which the entire analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical

procedure, assuming that all the method specified sample weights, volumes, and processing steps have been followed.

Mixing Zone
Mixing Zone is a limited volume of receiving water that is allocated for mixing with a wastewater discharge where water quality criteria can be exceeded without causing adverse effects to the overall water body.

Not Detected (ND)
Sample results which are less than the laboratory's MDL.

Ocean Waters
The territorial marine waters of the State as defined by California law to the extent these waters are outside of enclosed bays, estuaries, and coastal lagoons. Discharges to ocean waters are regulated in accordance with the State Water Board's California Ocean Plan.

Persistent Pollutants
Persistent pollutants are substances for which degradation or decomposition in the environment is nonexistent or very slow.

Pollutant Minimization Program (PMP)
PMP means waste minimization and pollution prevention actions that include, but are not limited to, product substitution, waste stream recycling, alternative waste management methods, and education of the public and businesses. The goal of the PMP shall be to reduce all potential sources of a priority pollutant(s) through pollutant minimization (control) strategies, including pollution prevention measures as appropriate, to maintain the effluent concentration at or below the water quality-based effluent limitation. Pollution prevention measures may be particularly appropriate for persistent bioaccumulative priority pollutants where there is evidence that beneficial uses are being impacted. The Central Valley Water Board may consider cost effectiveness when establishing the requirements of a PMP. The completion and implementation of a Pollution Prevention Plan, if required pursuant to Water Code section 13263.3(d), shall be considered to fulfill the PMP requirements.

Pollution Prevention
Pollution Prevention means any action that causes a net reduction in the use or generation of a hazardous substance or other pollutant that is discharged into water and includes, but is not limited to, input change, operational improvement, production process change, and product reformulation (as defined in Water Code section 13263.3). Pollution prevention does not include actions that merely shift a pollutant in wastewater from one environmental medium to another environmental medium, unless clear environmental benefits of such an approach are identified to the satisfaction of the State or Regional Water Board.

Reporting Level (RL)
RL is the ML (and its associated analytical method) chosen by the Discharger for reporting and compliance determination from the MLs included in this Order. The MLs included in this Order correspond to approved analytical methods for reporting a sample result that are selected by the Central Valley Water Board either from Appendix 4 of the SIP in accordance with section 2.4.2 of the SIP or established in accordance with section 2.4.3 of the SIP. The ML is based

on the proper application of method-based analytical procedures for sample preparation and the absence of any matrix interferences. Other factors may be applied to the ML depending on the specific sample preparation steps employed. For example, the treatment typically applied in cases where there are matrix-effects is to dilute the sample or sample aliquot by a factor of ten. In such cases, this additional factor must be applied to the ML in the computation of the RL.

Satellite Collection System
The portion, if any, of a sanitary sewer system owned or operated by a different public agency than the agency that owns and operates the wastewater treatment facility that a sanitary sewer system is tributary to.

Source of Drinking Water
Any water designated as municipal or domestic supply (MUN) in a Regional Water Board Basin Plan.

Standard Deviation (σ)
Standard Deviation is a measure of variability that is calculated as follows:

$$\sigma = (\sum[(x - \mu)^2]/(n - 1))^{0.5}$$

where:

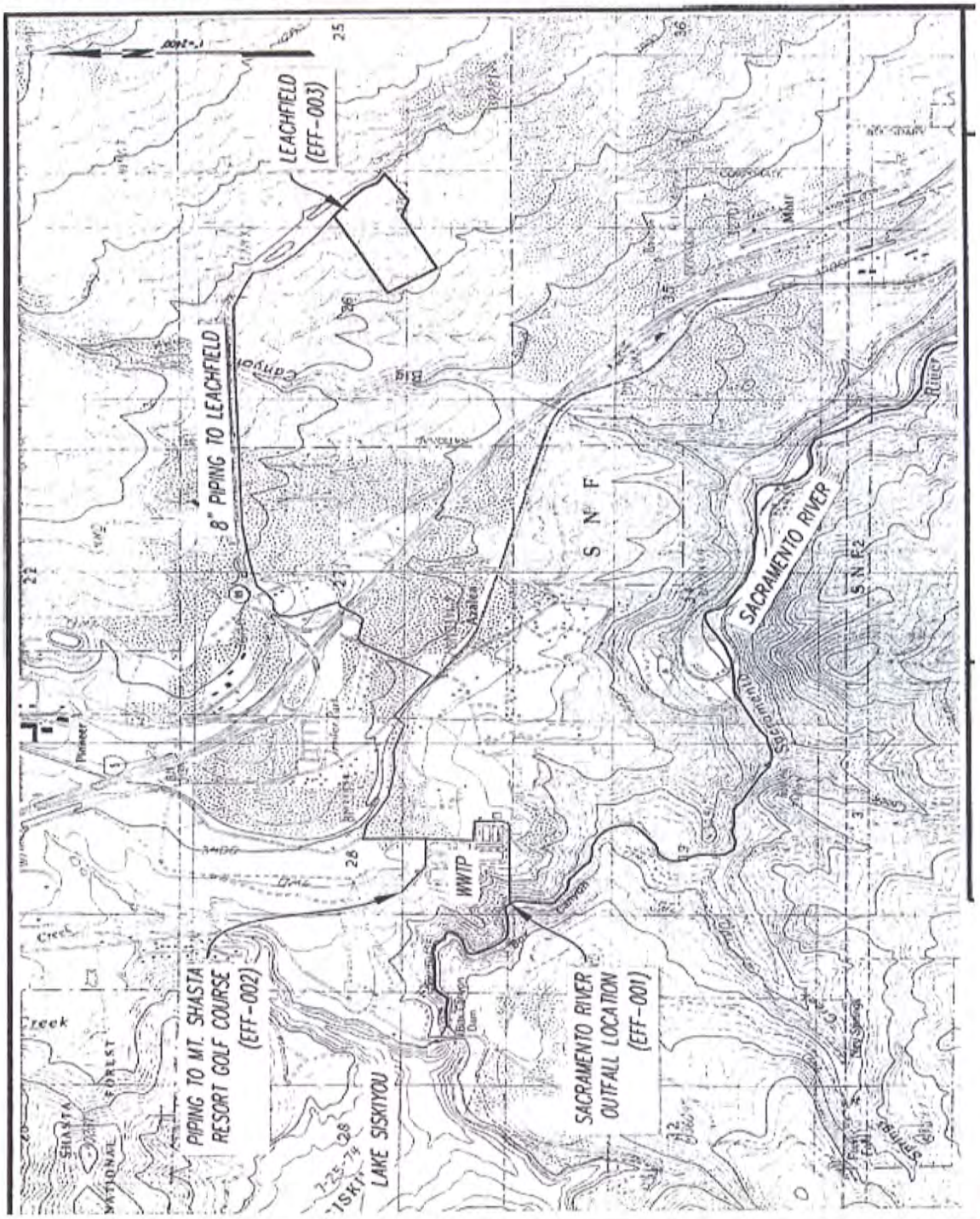
- x is the observed value;
- μ is the arithmetic mean of the observed values; and
- n is the number of samples.

Toxicity Reduction Evaluation (TRE)
TRE is a study conducted in a step-wise process designed to identify the causative agents of effluent or ambient toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity. The first steps of the TRE consist of the collection of data relevant to the toxicity, including additional toxicity testing, and an evaluation of facility operations and maintenance practices, and best management practices. A Toxicity Identification Evaluation (TIE) may be required as part of the TRE, if appropriate. (A TIE is a set of procedures to identify the specific chemical(s) responsible for toxicity. These procedures are performed in three phases (characterization, identification, and confirmation) using aquatic organism toxicity tests.)

IQ10
1Q10 is the lowest flow that occurs for one day with a statistical frequency of once every 10 years.

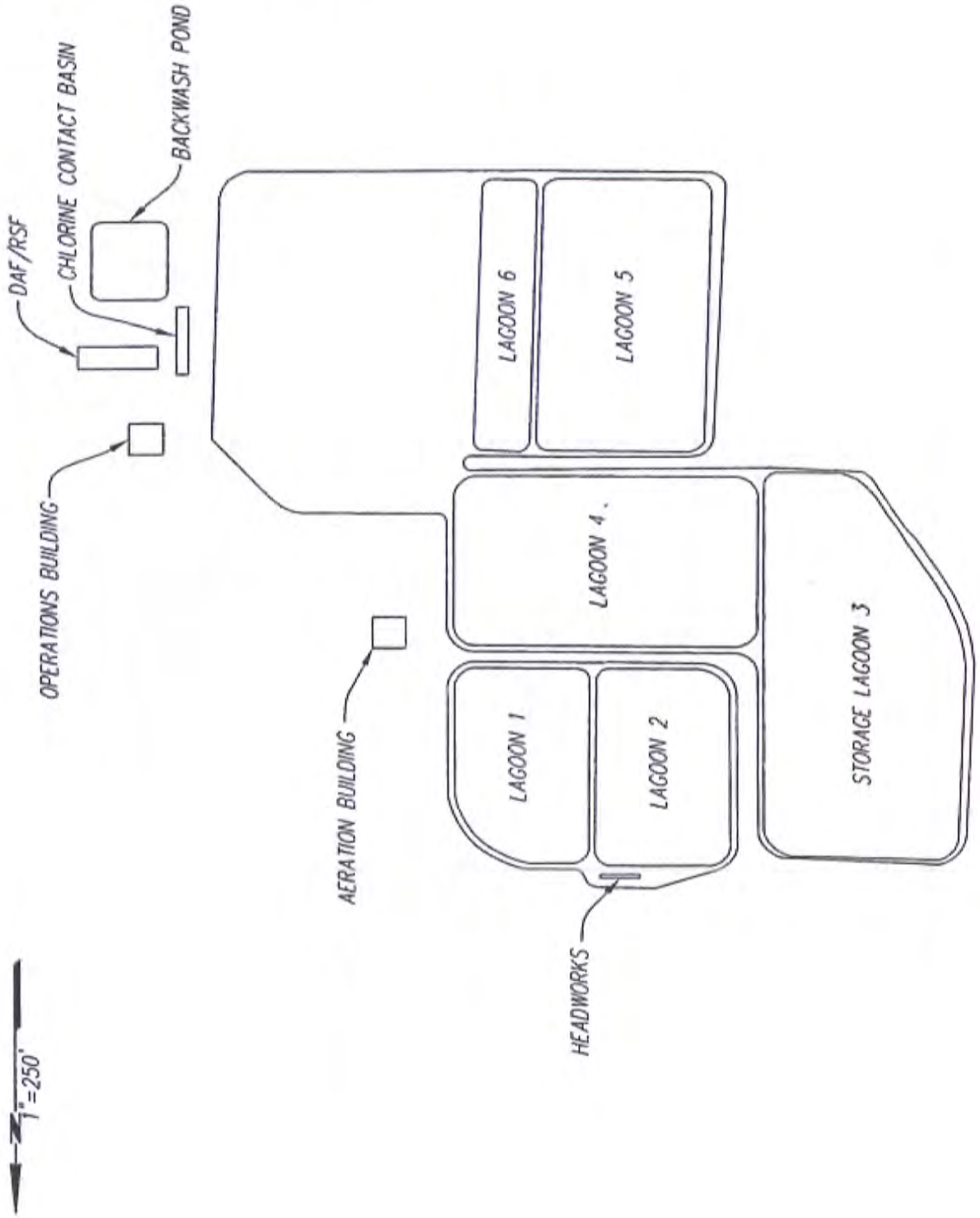
7Q10
7Q10 is the average low flow that occurs for seven consecutive days with a statistical frequency of once every 10 years.

ATTACHMENT B – MAP



WEED, CALIFORNIA U.S.G.S TOPOGRAPHIC MAP 7.5 MINUTE QUADRANGLE *Date: 1954* *1" = 1500'*	SITE LOCATION MAP **CITY OF MT. SHASTA** **MT. SHASTA WWTP** **SISKIYOU COUNTY**	W N E S

ATTACHMENT C – FLOW SCHEMATIC



ATTACHMENT D – STANDARD PROVISIONS

I. STANDARD PROVISIONS – PERMIT COMPLIANCE

A. Duty to Comply

1. The Discharger must comply with all of the conditions of this Order. Any noncompliance constitutes a violation of the Clean Water Act (CWA) and the California Water Code (Water Code) and is grounds for enforcement action, for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application. (40 CFR 122.41(a).)

2. The Discharger shall comply with effluent standards or prohibitions established under section 307(a) of the CWA for toxic pollutants and with standards for sewage sludge use or disposal established under section 405(d) of the CWA within the time provided in the regulations that establish these standards or prohibitions, even if this Order has not yet been modified to incorporate the requirement. (40 CFR 122.41(a)(1).)

B. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a Discharger 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 Order. (40 CFR 122.41(c))

C. Duty to Mitigate

The Discharger shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this Order that has a reasonable likelihood of adversely affecting human health or the environment. (40 CFR 122.41(d))

D. Proper Operation and Maintenance

The Discharger shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Discharger to achieve compliance with the conditions of this Order. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems that are installed by a Discharger only when necessary to achieve compliance with the conditions of this Order. (40 CFR 122.41(e).)

E. Property Rights

1. This Order does not convey any property rights of any sort or any exclusive privileges. (40 CFR 122.41(g))

2. The issuance of this Order does not authorize any injury to persons or property or invasion of other private rights, or any infringement of state or local law or regulations. (40 CFR 122.5(c))

F. Inspection and Entry

The Discharger shall allow the Regional Water Board, State Water Board, United States Environmental Protection Agency (USEPA), and/or their authorized representatives (including an authorized contractor acting as their representative), upon the presentation of credentials and other documents, as may be required by law, to (40 CFR 122.41(i); Water Code section 13383):

1. Enter upon the Discharger's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this Order (40 CFR 122.41(i)(1));

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Order (40 CFR 122.41(i)(2));

3. Inspect and photograph, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order (40 CFR 122.41(i)(3)); and

4. Sample or monitor, at reasonable times, for the purposes of assuring Order compliance or as otherwise authorized by the CWA or the Water Code, any substances or parameters at any location. (40 CFR 122.41(i)(4))

G. Bypass

1. Definitions

   a. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility. (40 CFR 122.41(m)(1)(i))

   b. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities, which 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. (40 CFR 122.41(m)(1)(ii))

2. Bypass not exceeding limitations. The Discharger may allow any bypass to occur which does not cause exceedances of effluent limitations, but only if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions listed in Standard Provisions – Permit Compliance I.G.3, I.G.4, and I.G.5 below. (40 CFR 122.41(m)(2))

3. Prohibition of bypass. Bypass is prohibited, and the Regional Water Board may take enforcement action against a Discharger for bypass, unless (40 CFR 122.41(m)(4)(i)):

   a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage (40 CFR 122.41(m)(4)(i)(A));

   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 back-up 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 preventive maintenance (40 CFR 122.41(m)(4)(i)(B)); and

   c. The Discharger submitted notice to the Regional Water Board as required under Standard Provisions – Permit Compliance I.G.5 below. (40 CFR 122.41(m)(4)(i)(C))

4. The Regional Water Board may approve an anticipated bypass, after considering its adverse effects, if the Regional Water Board determines that it will meet the three conditions listed in Standard Provisions – Permit Compliance I.G.3 above. (40 CFR 122.41(m)(4)(ii))

5. Notice

   a. Anticipated bypass. If the Discharger knows in advance of the need for a bypass, it shall submit a notice, if possible at least 10 days before the date of the bypass. (40 CFR 122.41(m)(3)(i))

   b. Unanticipated bypass. The Discharger shall submit notice of an unanticipated bypass as required in Standard Provisions - Reporting V.E below (24-hour notice). (40 CFR 122.41(m)(3)(ii))

H. Upset

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 Discharger. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation. (40 CFR 122.41(n)(1))

1. 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 Standard Provisions – Permit Compliance I.H.2 below 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. (40 CFR 122.41(n)(2))

2. Conditions necessary for a demonstration of upset. A Discharger who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that (40 CFR 122.41(n)(3)):

   a. An upset occurred and that the Discharger can identify the cause(s) of the upset (40 CFR 122.41(n)(3)(i));

   b. The permitted facility was, at the time, being properly operated (40 CFR 122.41(n)(3)(ii));

   c. The Discharger submitted notice of the upset as required in Standard Provisions – Reporting V.E.2.b below (24-hour notice) (40 CFR 122.41(n)(3)(iii)); and

   d. The Discharger complied with any remedial measures required under Standard Provisions – Permit Compliance I.C above. (40 CFR 122.41(n)(3)(iv))

3. Burden of proof. In any enforcement proceeding, the Discharger seeking to establish the occurrence of an upset has the burden of proof. (40 CFR 122.41(n)(4))

II. STANDARD PROVISIONS – PERMIT ACTION

A. General

This Order may be modified, revoked and reissued, or terminated for cause. The filing of a request by the Discharger for modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any Order condition. (40 CFR 122.41(f))

B. Duty to Reapply

If the Discharger wishes to continue an activity regulated by this Order after the expiration date of this Order, the Discharger must apply for and obtain a new permit. (40 CFR 122.41(b))

C. Transfers

This Order is not transferable to any person except after notice to the Regional Water Board. The Regional Water Board may require modification or revocation and reissuance of the Order to change the name of the Discharger and incorporate such other requirements as may be necessary under the CWA and the Water Code. (40 CFR 122.41(l)(3) and 122.61)

III. STANDARD PROVISIONS – MONITORING

A. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. (40 CFR 122.41(j)(1))

B. Monitoring results must be conducted according to test procedures under 40 CFR Part 136 or, in the case of sludge use or disposal, approved under 40 CFR Part 136 unless otherwise specified in 40 CFR Part 503 unless other test procedures have been specified in this Order. (40 CFR 122.41(j)(4) and 122.44(i)(1)(iv))

IV. STANDARD PROVISIONS – RECORDS

A. Except for records of monitoring information required by this Order related to the Discharger's sewage sludge use and disposal activities, which shall be retained for a period of at least 5 years (or longer as required by 40 CFR Part 503), the Discharger shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this Order, and records of all data used to complete the application for this Order, for a period of at least three (3) years from the date of the sample, measurement, report or application. This period may be extended by request of the Regional Water Board Executive Officer at any time. (40 CFR 122.41(j)(2))

B. Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements (40 CFR 122.41(j)(3)(i));
2. The individual(s) who performed the sampling or measurements (40 CFR 122.41(j)(3)(ii));
3. The date(s) analyses were performed (40 CFR 122.41(j)(3)(iii));
4. The individual(s) who performed the analyses (40 CFR 122.41(j)(3)(iv));
5. The analytical techniques or methods used (40 CFR 122.41(j)(3)(v)); and
6. The results of such analyses. (40 CFR 122.41(j)(3)(vi))

C. Claims of confidentiality for the following information will be denied (40 CFR 122.7(b)):

1. The name and address of any permit applicant or Discharger (40 CFR 122.7(b)(1)); and
2. Permit applications and attachments, permits and effluent data. (40 CFR 122.7(b)(2))

V. STANDARD PROVISIONS – REPORTING

A. Duty to Provide Information

The Discharger shall furnish to the Regional Water Board, State Water Board, or USEPA within a reasonable time, any information which the Regional Water Board, State Water Board, or USEPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order or to determine compliance with this Order. Upon request, the Discharger shall also furnish to the Regional Water Board, State Water Board, or USEPA copies of records required to be kept by this Order. (40 CFR 122.41(h); Wat. Code, § 13267)

B. Signatory and Certification Requirements

1. All applications, reports, or information submitted to the Regional Water Board, State Water Board, and/or USEPA shall be signed and certified in accordance with Standard Provisions – Reporting V.B.2, V.B.3, V.B.4, and V.B.5 below. (40 CFR 122.41(k))

2. All permit applications shall be signed by either a principal executive officer or ranking elected official. For purposes of this provision, a principal executive officer of a federal agency includes: (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of USEPA). (40 CFR 122.22(a)(3))

3. All reports required by this Order and other information requested by the Regional Water Board, State Water Board, or USEPA shall be signed by a person described in Standard Provisions – Reporting V.B.2 above, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described in Standard Provisions – Reporting V.B.2 above (40 CFR 122.22(b)(1));

   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.) (40 CFR 122.22(b)(2)); and

   c. The written authorization is submitted to the Regional Water Board and State Water Board. (40 CFR 122.22(b)(3))

4. If an authorization under Standard Provisions – Reporting V.B.3 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of

Standard Provisions – Reporting V.B.3 above must be submitted to the Regional Water Board and State Water Board prior to or together with any reports, information, or applications, to be signed by an authorized representative. (40 CFR 122.22(c))

5. Any person signing a document under Standard Provisions – Reporting V.B.2 or V.B.3 above shall make the following certification:

   "*I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.*" (40 CFR 122.22(d))

C. Monitoring Reports

1. Monitoring results shall be reported at the intervals specified in Section VI.C., Monitoring and Reporting Program (Attachment E), and Attachment I in this Order. (40 CFR 122.22(l)(4))

2. Monitoring results must be reported on a Discharge Monitoring Report (DMR) form or forms provided or specified by the Regional Water Board or State Water Board for reporting results of monitoring of sludge use or disposal practices. (40 CFR 122.41(l)(4)(i))

3. If the Discharger monitors any pollutant more frequently than required by this Order using test procedures approved under 40 CFR Part 136 or, in the case of sludge use or disposal, approved under 40 CFR Part 136 unless otherwise specified in 40 CFR Part 503, or as specified in this Order, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or sludge reporting form specified by the Regional Water Board. (40 CFR 122.41(l)(4)(ii))

4. Calculations for all limitations, which require averaging of measurements, shall utilize an arithmetic mean unless otherwise specified in this Order. (40 CFR 122.41(l)(4)(iii))

D. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this Order, shall be submitted no later than 14 days following each schedule date. (40 CFR 122.41(l)(5))

E. Twenty-Four Hour Reporting

1. The Discharger shall notify the Office of Emergency Services of any noncompliance that may endanger health or the environment within two (2) hours from the time the Discharger becomes aware of the circumstances. The Discharger shall notify the Central Valley Water Board of the noncompliance by telephone or fax within 24 hours from the time the Discharger becomes aware of the circumstances. A written submission shall also be provided to the Central Valley Water Board within five (5) days of the time the Discharger becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. (40 CFR 122.41(l)(6)(i))

2. The following shall be included as information that must be reported within 24 hours under this paragraph (40 CFR 122.41(l)(6)(ii)):

   a. Any unanticipated bypass that exceeds any effluent limitation in this Order. (40 CFR 122.41(l)(6)(ii)(A))

   b. Any upset that exceeds any effluent limitation in this Order. (40 CFR 122.41(l)(6)(ii)(B))

3. The Regional Water Board may waive the above-required written report under this provision on a case-by-case basis if an oral report has been received within 24 hours. (40 CFR 122.41(l)(6)(iii))

F. Planned Changes

The Discharger shall give notice to the Regional Water Board as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required under this provision only when (40 CFR 122.41(l)(1)):

1. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR 122.29(b) (40 CFR 122.41(l)(1)(i)); or

2. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are not subject to effluent limitations in this Order. (40 CFR 122.41(l)(1)(ii))

G. Anticipated Noncompliance

The Discharger shall give advance notice to the Regional Water Board or State Water Board of any planned changes in the permitted facility or activity that may result in noncompliance with General Order requirements. (40 CFR 122.41(l)(2))

H. Other Noncompliance

The Discharger shall report all instances of noncompliance not reported under Standard Provisions – Reporting V.C, V.D, and V.E above at the time monitoring reports are submitted. The reports shall contain the information listed in Standard Provision – Reporting V.E above. (40 CFR 122.41(l)(7))

I. Other Information

When the Discharger becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Regional Water Board, State Water Board, or USEPA, the Discharger shall promptly submit such facts or information. (40 CFR 122.41(l)(8))

VI. STANDARD PROVISIONS – ENFORCEMENT

A. The Regional Water Board is authorized to enforce the terms of this permit under several provisions of the Water Code, including, but not limited to, sections 13385, 13386, and 13387.

VII. ADDITIONAL PROVISIONS – NOTIFICATION LEVELS

A. Publicly-Owned Treatment Works (POTWs)

All POTWs shall provide adequate notice to the Regional Water Board of the following (40 CFR 122.42(b)):

1. Any new introduction of pollutants into the POTW from an indirect discharger that would be subject to sections 301 or 306 of the CWA if it were directly discharging those pollutants (40 CFR 122.42(b)(1)); and

2. Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of adoption of the Order. (40 CFR 122.42(b)(2))

3. Adequate notice shall include information on the quality and quantity of effluent introduced into the POTW as well as any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW. (40 CFR 122.42(b)(3))

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ATTACHMENT E – MONITORING AND REPORTING PROGRAM

Title 40 of the Code of Federal Regulations (CFR), section 122.48 (40 CFR 122.48) requires that all NPDES permits specify monitoring and reporting requirements. California Water Code (Water Code) sections 13267 and 13383 also authorize the Regional Water Quality Control Board, Central Valley Region (Central Valley Water Board) to require technical and monitoring reports. This Monitoring and Reporting Program establishes monitoring and reporting requirements, which implement the federal and California regulations.

I. GENERAL MONITORING PROVISIONS

A. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring locations specified below and, unless otherwise specified, before the monitored flow joins or is diluted by any other waste stream, body of water, or substance. Monitoring locations shall not be changed without notification to and the approval of the Central Valley Water Board.

B. Effluent samples shall be taken downstream of the last addition of wastes to the treatment or discharge works where a representative sample may be obtained prior to mixing with the receiving waters. Samples shall be collected at such a point and in such a manner to ensure a representative sample of the discharge.

C. Chemical, bacteriological, and bioassay analyses of any material required by this Order shall be conducted by a laboratory certified for such analyses by the Department of Public Health (DPH). Laboratories that perform sample analyses must be identified in all monitoring reports submitted to the Central Valley Water Board. In the event a certified laboratory is not available to the Discharger for any onsite field measurements such as pH, DO, turbidity, temperature, and residual chlorine, such analyses performed by a noncertified laboratory will be accepted provided a Quality Assurance-Quality Control Program is instituted by the laboratory. A manual containing the steps followed in this program for any onsite field measurements such as pH, DO, turbidity, temperature, and residual chlorine must be kept onsite in the treatment facility laboratory and shall be available for inspection by Central Valley Water Board staff. The Discharger must demonstrate sufficient capability (qualified and trained employees, properly calibrated and maintained field instruments, etc.) to adequately perform these field measurements. The Quality Assurance-Quality Control Program must conform to USEPA guidelines or to procedures approved by the Central Valley Water Board.

D. Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. All monitoring instruments and devices used by the Discharger to fulfill the prescribed monitoring program shall be properly maintained and calibrated as necessary, at least yearly, to ensure their continued accuracy. All flow measurement devices shall be calibrated at least once per year to ensure continued accuracy of the devices.

E. Monitoring results, including noncompliance, shall be reported at intervals and in a manner specified in this Monitoring and Reporting Program.

F. Laboratories analyzing monitoring samples shall be certified by DPH, in accordance with the provision of CWC section 13176, and must include quality assurance/quality control data with their reports.

G. The Discharger shall conduct analysis on any sample provided by USEPA as part of the Discharge Monitoring Quality Assurance (DMQA) program. The results of any such analysis shall be submitted to USEPA's DMQA manager.

H. The Discharger shall file with the Central Valley Water Board technical reports on self-monitoring performed according to the detailed specifications contained in this Monitoring and Reporting Program.

I. The results of all monitoring required by this Order shall be reported to the Central Valley Water Board, and shall be submitted in such a format as to allow direct comparison with the limitations and requirements of this Order. Unless otherwise specified, discharge flows shall be reported in terms of the monthly average and the daily maximum discharge flows.

II. MONITORING LOCATIONS

The Discharger shall establish the following monitoring locations to demonstrate compliance with the effluent limitations, discharge specifications, and other requirements in this Order:

Table E-1. Monitoring Station Locations

Discharge Point Name	Monitoring Location Name	Monitoring Location Description
--	**INF-001**	Immediately upstream of influent Parshall Flume. 41°16'48.72" N, 122°18'53.08" W
001	**EFF-001**	Sampled at effluent discharge from dechlorination chamber (to river). 41°16'35.18" N, 122°19'6.98" W
002	**LND-001**	Sampled at effluent discharge from dechlorination chamber (to Highway 89 Leachfield). 41°16'35.18" N, 122°19'6.98" W
003	**REC-001**	Sampled at effluent discharge from dechlorination chamber (to Mt. Shasta Golf Resort). 41°16'35.18" N, 122°19'6.98" W
--	**REC-002**	Effluent prior to dechlorination chamber.
--	**RSW-001**	Lake Siskiyou immediately upstream of lake discharge to Sacramento River at Box Canyon Dam or Sacramento River immediately downstream of Box Canyon Dam. 41°16'45.15" N, 122°19"40.65" W
--	**RSW-002**	Sacramento River 1.15 miles downstream of Facility outfall, upstream of Ney Springs fishing access. 41°16'17.84" N, 122°18'50.28" W
--	**RGW-001**	Upgradient Monitoring Well (Tillman Well) 41°16'42.0" N, 122°14'34.8" W
--	**RGW-002**	Downgradient Monitoring Well (Needland Well) 41°15'52.5" N, 122°16'27.0" W
--	**RGW-003**	Downgradient Monitoring Well (Highway 89 Leachfield Well) 41°16'48.7" N, 122°16'31.5" W
--	**LND-002**	Highway 89 Leachfield Area
--	**BIO-001**	Biosolids Storage Area
--	**SPL-001**	Municipal water supply

III. INFLUENT MONITORING REQUIREMENTS

A. Monitoring Location INF-001

1. The Discharger shall monitor influent to the Facility at Monitoring Location INF-001 as follows:

Table E-2. Influent Monitoring

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Flow	MGD	Meter	Continuous	[1]
pH	Standard Units	Grab [2]	1/Week	[1]
BOD 5-day @ 20°C	mg/L, lbs/day	24-hr Composite, [3] Calculate	1/Week	[1]
Total Suspended Solids	mg/L, Calculate	24-hr Composite, [3] Calculate	1/Week	[1]

[1] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136; or by methods approved by the Central Valley Water Board or the State Water Board.

[2] Grab samples shall not be collected at the same time each day to get a complete representation of variations in the influent.

[3] 24-hour flow proportional composite.

IV. EFFLUENT MONITORING REQUIREMENTS

A. Monitoring Location EFF-001

1. The Discharger shall monitor treated wastewater at EFF-001 as follows. If more than one analytical test method is listed for a given parameter, the Discharger must select from the listed methods and corresponding Minimum Level:

Table E-3. Effluent Monitoring (EFF-001)

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Flow	mgd	Meter	Continuous	[1]
Conventional Pollutants				
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C)	mg/L	24-hr Composite [2]	1/Week	[1]
	lbs/day	Calculate	1/Week	--
Total Suspended Solids	mg/L	24-hr Composite [2]	1/Week	[1]
	lbs/day	Calculate	1/Week	--
pH	Standard Units	Meter	Continuous [3, 4, 15]	[1]
Priority Pollutants				
Bis (2-ethylhexyl) phthalate	µg/L	Grab	1/Month	[1, 5, 6]
Cadmium, Total Recoverable	µg/L	24-hr Composite	1/Quarter[16]	[1, 6]
Copper, Total Recoverable	µg/L	24-hr Composite	1/Month	[1, 6]
Dichlorobromomethane	µg/L	Grab	1/Month	[1, 6]
Zinc, Total Recoverable	µg/L	24-hr Composite	1/Month	[1, 6]
Priority Pollutants (Attachment I Study)	µg/L	24-hr Composite[7]	[8]	[1, 6]
Non-Conventional Pollutants				
Aluminum, Total Recoverable	µg/L	24-hr Composite	1/Month	[1, 9]
Ammonia Nitrogen, Total (as N)	mg/L	Grab	1/Month [3, 11]	[1]
Chlorine, Total Residual	mg/L	Meter	Continuous	[1, 10]
Electrical Conductivity @ 25°C	µmhos/cm	Grab	1/Month	[1]
Hardness (as $CaCO_3$)	mg/L	Grab	1/Month [12]	[1]
Nitrate Nitrogen, Total (as N)	mg/L	Grab	1/Month [13]	[1]
Nitrite Nitrogen, Total (as N)	mg/L	Grab	1/Month [13]	[1]
Settleable Solids	mL/L	Grab	1/Week	[1]
Standard Minerals[14]	mg/L	Grab	1/Year	[1]
Temperature	°C	Grab	3/Week [3, 4]	[1]
Total Coliform Organisms	MPN/100 mL	Grab	2/Week	[1]
Total Dissolved Solids	mg/L	Grab	1/Month	[1]
Turbidity	NTU	Meter	1/Day	
Whole Effluent Toxicity (see Section V. below)	--	--	--	--

[1] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 or by methods approved by the Central Valley Water Board or the State Water Board.

[2] 24-hour flow-proportional or time composite.

[3] pH and temperature shall be recorded at the time of ammonia sample collection.

[4] A hand-held field meter may be used, provided the meter utilizes a USEPA-approved algorithm/method and is calibrated and maintained in accordance with the manufacturer's instructions. A calibration and maintenance log for each meter used for monitoring required by this Monitoring and Reporting Program shall be maintained at the Facility.

[5] In order to verify if bis (2-ethylhexyl) phthalate is truly present in the effluent discharge, the Discharger shall take steps to assure that sample containers, sampling apparatus, and analytical equipment are not sources of the detected contaminant.

[6] For priority pollutant constituents with effluent limitations, detection limits shall be below the effluent limitations. If the lowest minimum level (ML) published in Appendix 4 of the Policy for Implementation of

Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Plan or SIP) is not below the effluent limitation, the detection limit shall be the lowest ML. For priority pollutant constituents without effluent limitations, the detection limits shall be equal to or less than the lowest ML published in Appendix 4 of the SIP. Sampling and analysis of Bis (2-ethylhexyl) phthalate shall be conducted using ultra-clean techniques that eliminate the possibility of sample contamination.

[7] Volatile constituents shall be sampled in accordance with 40 CFR Part 136 or by methods approved by the Central Valley Water Board or the State Water Board.

[8] Priority pollutants shall be sampled semiannually during the third and fourth year following the date of permit adoption and shall be conducted concurrently with upstream receiving water monitoring for hardness (as $CaCO_3$) and pH. [Refer to Attachment I]

[9] Compliance with the final effluent limitations for aluminum can be demonstrated using either total or acid-soluble (inductively coupled plasma/atomic emission spectrometry or inductively coupled plasma/mass spectrometry) analysis methods, as supported by USEPA's Ambient Water Quality Criteria for Aluminum document (EPA 440/5-86-008), or other standard methods that exclude aluminum silicate particles as approved by the Executive Officer.

[10] Total chlorine residual must be monitored with a method sensitive to and accurate at the permitted level of 0.01 mg/L.

[11] Concurrent with whole effluent toxicity monitoring.

[12] Hardness samples shall be collected concurrently with metals samples.

[13] Monitoring for nitrite and nitrate shall be conducted concurrently.

[14] Standard minerals shall include the following: boron, calcium, iron, magnesium, potassium, sodium, chloride, manganese, phosphorus, total alkalinity (including alkalinity series), and hardness, and include verification that the analysis is complete (i.e., cation/anion balance).

[15] Daily grab sample allowed during interim period prior to continuous pH analyzer installation.

[16] Quarterly for the first two years, annual thereafter if results indicate no Reasonable Potential.

V. WHOLE EFFLUENT TOXICITY TESTING REQUIREMENTS

A. Acute Toxicity Testing. The Discharger shall conduct acute toxicity testing to determine whether the effluent is contributing acute toxicity to the receiving water. The Discharger shall meet the following acute toxicity testing requirements:

1. *Monitoring Frequency* – The Discharger shall perform quarterly acute toxicity testing, concurrent with effluent ammonia sampling.

2. *Sample Types* – For static non-renewal and static renewal testing, the samples shall be grab samples and shall be representative of the volume and quality of the discharge. The effluent samples shall be taken at the effluent monitoring location EFF-001.

3. *Test Species* – Test species shall be rainbow trout (*Oncorhynchus Mykiss*).

4. *Methods* – The acute toxicity testing samples shall be analyzed using EPA-821-R-02-012, Fifth Edition. Temperature, total residual chlorine, and pH shall be recorded at the time of sample collection. No pH adjustment may be made unless approved by the Executive Officer.

5. *Test Failure* – If an acute toxicity test does not meet all test acceptability criteria, as specified in the test method, the Discharger must re-sample and re-test as soon as possible, not to exceed 7 days following notification of test failure.

B. **Chronic Toxicity Testing**. The Discharger shall conduct three species chronic toxicity testing to determine whether the effluent is contributing chronic toxicity to the receiving water. The Discharger shall meet the following chronic toxicity testing requirements:

1. *Monitoring Frequency* – The Discharger shall perform annual three species chronic toxicity testing.

2. *Sample Types* – Effluent samples shall be grab samples and shall be representative of the volume and quality of the discharge. The effluent samples shall be taken at the effluent monitoring location EFF-001. The receiving water control shall be a grab sample obtained from the RSW-001 sampling location, as identified in this Monitoring and Reporting Program.

3. *Sample Volumes* – Adequate sample volumes shall be collected to provide renewal water to complete the test in the event that the discharge is intermittent.

4. *Test Species* – Chronic toxicity testing measures sublethal (e.g., reduced growth, reproduction) and/or lethal effects to test organisms exposed to an effluent compared to that of the control organisms. The Discharger shall conduct chronic toxicity tests with:

   - The cladoceran, water flea, *Ceriodaphnia dubia* (survival and reproduction test);
   - The fathead minnow, *Pimephales promelas* (larval survival and growth test); and
   - The green alga, *Selenastrum capricornutum* (growth test).

5. *Methods* – The presence of chronic toxicity shall be estimated as specified in *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition*, EPA/821-R-02-013, October 2002.

6. *Reference Toxicant* – As required by the SIP, all chronic toxicity tests shall be conducted with concurrent testing with a reference toxicant and shall be reported with the chronic toxicity test results.

7. *Dilutions* – For regular and accelerated chronic toxicity monitoring, it is not necessary to perform the test using a dilution series. The test may be performed using 100% effluent and two controls. For TRE monitoring, the chronic toxicity testing shall be performed using the dilution series identified in Table E-4, below. The receiving water control shall be used as the diluent (unless the receiving water is toxic).

Table E-4. Chronic Toxicity Testing Dilution Series

Sample	Dilutions (%)					Controls	
	100	75	50	25	12.5	Receiving Water	Laboratory Water
% Effluent	100	75	50	25	12.5	0	0
% Receiving Water	0	25	50	75	87.5	100	0
% Laboratory Water	0	0	0	0	0	0	100

8. *Test Failure* – The Discharger must re-sample and re-test as soon as possible, but no later than fourteen (14) days after receiving notification of a test failure. A test failure is defined as follows:

   a. The reference toxicant test or the effluent test does not meet all test acceptability criteria as specified in the *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition*, EPA/821-R-02-013, October 2002 (Method Manual), and its subsequent amendments or revisions; or

   b. The percent minimum significant difference (PMSD) measured for the test exceeds the upper PMSD bound variability criterion in Table 6 on page 52 of the Method Manual. (A retest is only required in this case if the test results do not exceed the monitoring trigger specified in the Special Provision at section VI. 2.a.iii. of the Order.)

C. **WET Testing Notification Requirements.** The Discharger shall notify the Central Valley Water Board within 24-hours after the receipt of test results exceeding the monitoring trigger during regular or accelerated monitoring, or an exceedance of the acute toxicity effluent limitation.

D. **WET Testing Reporting Requirements.** All toxicity test reports shall include the contracting laboratory's complete report provided to the Discharger and shall be in accordance with the appropriate "Report Preparation and Test Review" sections of the method manuals. At a minimum, whole effluent toxicity monitoring shall be reported as follows:

   1. **Chronic WET Reporting.** Regular chronic toxicity monitoring results shall be reported to the Central Valley Water Board within 30 days following completion of the test, and shall contain, at minimum:

      a. The results expressed in TUc, measured as 100/NOEC, and also measured as 100/LC50, 100/EC25, 100/IC25, and 100/IC50, as appropriate, when testing is performed using the full dilution series.

      b. The statistical methods used to calculate endpoints (when testing is performed using the full dilution series);

c. The statistical output page, which includes the calculation of the percent minimum significant difference (PMSD) (when testing is performed using the full dilution series);

d. The dates of sample collection and initiation of each toxicity test; and

e. The results compared to the numeric toxicity monitoring trigger.

Additionally, the monthly discharger self-monitoring reports shall contain an updated chronology of chronic toxicity test results expressed in TUc, and organized by test species, type of test (survival, growth or reproduction), and monitoring frequency, i.e., either quarterly, monthly, accelerated, or Toxicity Reduction Evaluation (TRE).

2. **Acute WET Reporting.** Acute toxicity test results shall be submitted with the monthly discharger self-monitoring reports and reported as percent survival.

3. **TRE Reporting.** Reports for TREs shall be submitted in accordance with the schedule contained in the Discharger's approved TRE Workplan.

4. **Quality Assurance (QA).** The Discharger must provide the following information for QA purposes:

   a. Results of the applicable reference toxicant data with the statistical output page giving the species, NOEC, LOEC, type of toxicant, dilution water used, concentrations used, PMSD, and dates tested.

   b. The reference toxicant control charts for each endpoint, which include summaries of reference toxicant tests performed by the contracting laboratory.

   c. Any information on deviations or problems encountered and how they were dealt with.

VI. LAND DISCHARGE MONITORING REQUIREMENTS

A. Monitoring Location LND-001

1. The Discharger shall monitor treated wastewater discharged to the Highway 89 Leachfield at LND-001 as follows:

Table E-5. Land Discharge Monitoring Requirements (LND-001)

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Flow	mgd	Meter	Continuous	--
Monthly Discharge volume	MG	Calculated	1/Month	--
Chlorine, Total Residual	mg/L	Meter	Continuous	1
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	24-hr Composite	1/Week	1
	lbs/day	Calculate	1/Week	--
Total Suspended Solids	mg/L	24-hr Composite	1/Week	1
	lbs/day	Calculate	1/Week	--
pH	s.u.	Meter	Continuous[2]	1
Settleable Solids	mL/L – Hr	Grab	1/Week	1
Total Coliform Organisms	MPN/ 100 mL	Grab	2/Week	1

1 Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 or by methods approved by the Central Valley Water Board or the State Water Board.
2 Daily grab sample allowed during interim period prior to continuous pH analyzer installation.

VII. RECLAMATION MONITORING REQUIREMENTS

A. Monitoring Location REC-001

1. The Discharger shall monitor treated wastewater for discharge to the Mt. Shasta Golf Course at REC-001 as follows:

Table E-6a. Reclamation Monitoring Requirements (REC-001)

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Flow	mgd	Meter	Continuous	--
Monthly Discharge volume	MG	Calculated	1/Month	--
Chlorine, Total Residual	mg/L	Meter	Continuous	1
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	24-hr Composite	1/Week	1
	lbs/day	Calculate	1/Week	--
Total Suspended Solids	mg/L	24-hr Composite	1/Week	1
	lbs/day	Calculate	1/Week	--
pH	s.u.	Meter	Continuous[2]	1
Total Coliform	MPN/	Grab	1/Day	1

Organisms	100 mL			
Turbidity	NTU	Meter	3/Day	[1]

[1] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 or by methods approved by the Central Valley Water Board or the State Water Board.

[2] Daily grab sample allowed during interim period prior to continuous pH analyzer installation.

B. Monitoring Location REC-002

1. The Discharger shall monitor treated wastewater prior to dechlorination at REC-002 as follows:

Table E-6b. Reclamation Monitoring Requirements (REC-002)

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Chlorine, Total Residual	mg/L	Grab	1/Week	[1]

[1]Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 or by methods approved by the Central Valley Water Board or the State Water Board.

VIII. RECEIVING WATER MONITORING REQUIREMENTS – SURFACE WATER AND GROUNDWATER

A. Monitoring Location RSW-001

1. The Discharger shall monitor the Sacramento River, upstream of the discharge, at RSW-001 as follows:

Table E-7a. Receiving Water Monitoring Requirements (RSW-001)

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Flow[3]	cfs	Meter	Daily	--
pH	s.u.	Grab	1/Week	[1]
Temperature	°F	Grab	1/Week	[1]
Dissolved Oxygen	mg/L	Grab	1/Week	[1]
Turbidity	NTU	Grab	1/Week	[1]
Total Coliform Organisms	MPN/ 100 mL	Grab	1/Week	[1]
Hardness as $CaCO_3$	mg/L	Grab	1/Month	[1]
Bis (2-ethylhexyl) phthalate	µg/L	Grab	2/Year	[1]
Cadmium, Total Recoverable	µg/L	Grab	2/Year	[1]
Dichlorobromomethane	µg/L	Grab	2/Year	[1]
Copper, Total Recoverable	µg/L	Grab	2/Year	[1]
Zinc, Total Recoverable	µg/L	Grab	2/Year	[1]
Aluminum, Total Recoverable	µg/L	Grab	2/Year	[1]
Standard Minerals[2]	mg/L	Grab	1/Year	[1]

[1] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 or by methods approved by the Central Valley Water Board or the State Water Board.

[2] Standard minerals shall include the following: boron, calcium, iron, magnesium, potassium, sodium, chloride, manganese, phosphorus, total alkalinity (including alkalinity series), and hardness, and include verification that the analysis is complete (i.e., cation/anion balance).

[3] Flow to be measured at discharge from Box Canyon Dam from Lake Siskiyou.

B. Monitoring Location RSW-002

1. The Discharger shall monitor the Sacramento River, downstream of the discharge, at RSW-002 as follows:

Table E-7b. Receiving Water Monitoring Requirements (RSW-002)

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Dilution Ratio	cfs	Calculated[3]	Daily[4]	--
pH	s.u.	Grab	1/Week	[1]
Temperature	°F	Grab	1/Week	[1]
Dissolved Oxygen	mg/L	Grab	1/Week	[1]
Turbidity	NTU	Grab	1/Week	[1]
Total Coliform Organisms	MPN/ 100 mL	Grab	1/Week	[1]
Hardness as $CaCO_3$[2]	mg/L	Grab	2/Year	[1]
Bis (2-ethylhexyl) phthalate	µg/L	Grab	2/Year	[1]
Dichlorobromomethane	µg/L	Grab	2/Year	[1]
Copper	µg/L	Grab	2/Year	[1]
Zinc	µg/L	Grab	2/Year	[1]

[1] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 or by methods approved by the Central Valley Water Board or the State Water Board.
[2] Concurrent with semiannual receiving water metals sampling.
[3] Calculated using Box Canyon Dam flow measurement data and plant effluent flow data.
[4] Monitoring only required between from 16 November through 14 April.

C. Monitoring Location RGW-001, RGW-002, RGW-003

1. Prior to construction and/or beginning a sampling program of any new groundwater monitoring wells, the Discharger shall submit plans and specifications to the Central Valley Water Board for approval. Once installed, all new wells shall be added to the monitoring network (which currently consists of Monitoring Well Nos. RGW-001. RGW-002, and RGW-003) and shall be sampled and analyzed according to the schedule below. All samples shall be collected using approved EPA methods. Water table elevations shall be calculated to determine groundwater gradient and direction of flow.

   Prior to sampling, the groundwater elevations shall be measured and the wells shall be purged of at least three well volumes until temperature, pH, and electrical conductivity have stabilized. Depth to groundwater shall be measured to the nearest 0.01 feet. Groundwater monitoring at RGW-001, RGW-002, RGW-003, and any new groundwater monitoring wells shall include, at a minimum, the following:

Table E-8. Groundwater Monitoring Requirements

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Depth to Groundwater	±0.01 feet	Measurement	1/Quarter	--
Groundwater Elevation [1]	±0.01 feet	Calculated	1/Quarter	--
Gradient	feet/feet	Calculated	1/Quarter	--
Gradient Direction	degrees	Calculated	1/Quarter	--
Electrical Conductivity @ 25°C	µmhos/cm	Grab	1/Quarter	[2]
Total Dissolved Solids	mg/L	Grab	1/Quarter	[2]
Fixed Dissolved Solids	mg/L	Grab	1/Quarter	[2]
pH	standard units	Grab	1/Quarter	[2]
Total Coliform Organisms	MPN/100 mL	Grab	1/Quarter	[2]
Total Nitrogen	mg/L	Grab	1/Quarter	[2]
Nitrate Nitrogen, Total (as N)	mg/L	Grab	1/Quarter	[2]
Ammonia (as NH_4)	mg/L	Grab	1/Quarter	[2]
Total Kjeldahl Nitrogen	mg/L	Grab	1/Quarter	[2]
Standard Minerals [3]	µg/L	Grab	1/Quarter	[2]

[1] Groundwater elevation shall be determined based on depth-to-water measurements from a surveyed measuring point elevation on the well. The groundwater elevation shall be used to calculate the direction and gradient of groundwater flow, which must be reported.

[2] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 or by methods approved by the Central Valley Water Board or the State Water Board.

[3] Standard minerals shall include the following: boron, calcium, iron, magnesium, potassium, sodium, chloride, manganese, phosphorus, total alkalinity (including alkalinity series), and hardness, and include verification that the analysis is complete (i.e., cation/anion balance).

IX. OTHER MONITORING REQUIREMENTS

A. Biosolids

1. Monitoring Location BIO-001

a. A composite sample of sludge shall be collected annually, at Monitoring Location BIO-001 in accordance with USEPA's *POTW Sludge Sampling and Analysis Guidance Document*, August 1989, and tested for the metals listed in Title 22. In addition to the quantitative results of the chemical analysis, sludge percent solids must be included with the results.

b. Sampling records shall be retained for a minimum of **5 years**. A log shall be maintained of sludge quantities generated and of handling and disposal activities. The frequency of entries is discretionary; however, the log must be complete enough to serve as a basis for part of the annual report.

B. Municipal Water Supply

1. Monitoring Location SPL-001

The Discharger shall monitor the municipal water supply at SPL-001 as follows. A sampling station shall be established where a representative sample of the municipal water supply can be obtained. Municipal water supply samples shall be collected at approximately the same time as effluent samples.

Table E-9. Municipal Water Supply Monitoring Requirements

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Total Dissolved Solids[1]	mg/L	Grab	1/year	[3]
Electrical Conductivity @ 25°C[1]	µmhos/cm	Grab	1/year	[3]
Standard Minerals[2]	mg/L	Grab	1/year	[3]

1 If the water supply is from more than one source, the total dissolved solids and electrical conductivity shall be reported as a weighted average and include copies of supporting calculations.

2 Standard minerals shall include all major cations and anions and include verification that the analysis is complete (i.e., cation/anion balance).

3 Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 or by methods approved by the Central Valley Water Board or the State Water Board.

C. Leachfield Area

1. Monitoring Location LND-002

b. During periods of discharge to the leachfield, the Discharger shall inspect the leachfield area weekly and submit the results in the monthly monitoring report.

Monitoring shall include any observations of seeps, erosion, field saturation, ponding liquid, the presence of nuisance, and other field conditions.

X. REPORTING REQUIREMENTS

A. General Monitoring and Reporting Requirements

1. The Discharger shall comply with all Standard Provisions (Attachment D) related to monitoring, reporting, and recordkeeping.

2. Upon written request of the Central Valley Water Board, the Discharger shall submit a summary monitoring report. The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year(s).

3. **Compliance Time Schedules.** For compliance time schedules included in the Order, the Discharger shall submit to the Central Valley Water Board, on or before each compliance due date, the specified document or a written report detailing compliance or noncompliance with the specific date and task. If noncompliance is reported, the Discharger shall state the reasons for noncompliance and include an estimate of the date when the Discharger will be in compliance. The Discharger shall notify the Central Valley Water Board by letter when it returns to compliance with the compliance time schedule.

4. The Discharger shall report to the Central Valley Water Board any toxic chemical release data it reports to the State Emergency Response Commission within 15 days of reporting the data to the Commission pursuant to section 313 of the "*Emergency Planning and Community Right to Know Act*" of 1986.

B. Self Monitoring Reports (SMRs)

1. At any time during the term of this permit, the State Water Board or the Central Valley Water Board may notify the Discharger to electronically submit Self-Monitoring Reports (SMRs) using the State Water Board's California Integrated Water Quality System (CIWQS) Program Web site (http://www.waterboards.ca.gov/ciwqs/index.html). Until such notification is given, the Discharger shall submit hard copy SMRs. The CIWQS Web site will provide additional directions for SMR submittal in the event there will be service interruption for electronic submittal. Upon notification directing the Discharger to submit electronic SMRs (eSMRs) and discontinue submitting hard copy SMRs, the Discharger shall maintain sufficient staffing and resources to ensure it submits eSMRs for the effective duration of this Order. This includes provision of training and supervision of individuals (e.g., Discharger personnel or consultant) on how to prepare and submit eSMRs.

2. The Discharger shall report in the SMR the results for all monitoring specified in this Monitoring and Reporting Program under sections III through IX. The Discharger shall submit monthly, quarterly, semiannual, annual SMRs including the

results of all required monitoring using USEPA-approved test methods or other test methods specified in this Order. If the Discharger monitors any pollutant more frequently than required by this Order, the results of this monitoring shall be included in the calculations and reporting of the data submitted in the SMR.

3. Monitoring periods and reporting for all required monitoring shall be completed according to the following schedule:

Table E-10. Monitoring Periods and Reporting Schedule

Sampling Frequency	Monitoring Period Begins On...	Monitoring Period	SMR Due Date
Continuous	**1st day of month following Permit effective date [1]**	Continuous	Submit with monthly SMR
1/Hour	**1st day of month following Permit effective date [1]**	Hourly	Submit with monthly SMR
1/Day	**1st day of month following Permit effective date [1]**	(Midnight through 11:59 PM) or any 24-hour period that reasonably represents a calendar day for purposes of sampling.	Submit with monthly SMR
1/Week	**1st day of month following Permit effective date [1]**	Sunday through Saturday	Submit with monthly SMR
1/Month	**1st day of month following Permit effective date [1]**	First day of calendar month through last day of calendar month	32 days from the end of the monitoring period
1/Quarter	**1st day of month following Permit effective date [1]**	1 January through 31 March 1 April through 30 June 1 July through 30 September 1 October through 31 December	32 days from the end of the monitoring period
2/Year	**1st day of month following Permit effective date [1]**	1 January through 30 June 1 July through 31 December	32 days from the end of the monitoring period
1/Year	**1st day of month following Permit effective date [1]**	1 January through 31 December	32 days from the end of the monitoring period

[1] Monitoring from the permit effective date to the 1st day of month following permit effective date shall be conducted in accordance with the Monitoring and Reporting Program in previous Order R5-2007-0056.

4. **Reporting Protocols.** The Discharger shall report with each sample result the applicable reported Minimum Level (ML) and the current Method Detection Limit (MDL), as determined by the procedure in 40 CFR Part 136.

   The Discharger shall report the results of analytical determinations for the presence of chemical constituents in a sample using the following reporting protocols:

a. Sample results greater than or equal to the reported ML shall be reported as measured by the laboratory (i.e., the measured chemical concentration in the sample).

b. Sample results less than the RL, but greater than or equal to the laboratory's MDL, shall be reported as "Detected, but Not Quantified," or DNQ. The estimated chemical concentration of the sample shall also be reported.

   For the purposes of data collection, the laboratory shall write the estimated chemical concentration next to DNQ as well as the words "Estimated Concentration" (may be shortened to "Est. Conc."). The laboratory may, if such information is available, include numerical estimates of the data quality for the reported result. Numerical estimates of data quality may be percent accuracy (+ a percentage of the reported value), numerical ranges (low to high), or any other means considered appropriate by the laboratory.

c. Sample results less than the laboratory's MDL shall be reported as "Not Detected," or ND.

d. Dischargers are to instruct laboratories to establish calibration standards so that the ML value (or its equivalent if there is differential treatment of samples relative to calibration standards) is the lowest calibration standard. At no time is the Discharger to use analytical data derived from extrapolation beyond the lowest point of the calibration curve.

5. **Compliance Determination.** Compliance with effluent limitations for priority pollutants shall be determined using sample reporting protocols defined above and in Attachment A and Attachment I of this Order. For purposes of reporting and administrative enforcement by the Central Valley Water Board and the State Water Board, the Discharger shall be deemed out of compliance with effluent limitations if the concentration of the priority pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the reporting level (RL).

6. **Multiple Sample Data.** When determining compliance with an AMEL, AWEL, or MDEL for priority pollutants and more than one sample result is available, the Discharger shall compute the arithmetic mean unless the data set contains one or more reported determinations of "Detected, but Not Quantified" (DNQ) or "Not Detected" (ND). In those cases, the Discharger shall compute the median in place of the arithmetic mean in accordance with the following procedure:

a. The data set shall be ranked from low to high, ranking the reported ND determinations lowest, DNQ determinations next, followed by quantified values (if any). The order of the individual ND or DNQ determinations is unimportant.

b. The median value of the data set shall be determined. If the data set has an odd number of data points, then the median is the middle value. If the data set has an even number of data points, then the median is the average of the two values around the middle unless one or both of the points are ND or DNQ, in which case

the median value shall be the lower of the two data points where DNQ is lower than a value and ND is lower than DNQ.

7. **Reporting Requirements.** In reporting the monitoring data, the Discharger shall arrange the data in tabular form so that the date, the constituents, and the concentrations are readily discernible.

   a. The data shall be summarized to clearly illustrate whether the facility is operating in compliance with interim and/or final effluent limitations or with other waste discharge requirements (e.g., discharge specifications, receiving water limitations, special provisions, etc.).

   b. Reports must clearly show when discharging to EFF-001 or other permitted discharge locations. Reports must show the date and time that the discharge started and stopped at each location.

   c. The highest daily maximum for the month and monthly and weekly averages shall be determined and recorded as needed to demonstrate compliance.

8. **Calculation Requirements**. The following shall be calculated and reported in the SMRs:

   a. **Annual Average Limitations**. For constituents with effluent limitations specified as "annual average" the Discharger shall report the annual average in the June SMR. The annual average shall be calculated as the average of the samples gathered for the calendar year.

   b. **Mass Loading Limitations**. For BOD_5, TSS, and ammonia, the Discharger shall calculate and report the mass loading (lbs/day) in the SMRs. The mass loading shall be calculated as follows:

      Mass Loading (lbs/day) = Flow (MGD) x Concentration (mg/L) x 8.34

      When calculating daily mass loading, the daily average flow and constituent concentration shall be used. For weekly average mass loading, the weekly average flow and constituent concentration shall be used. For monthly average mass loading, the monthly average flow and constituent concentration shall be used.

   c. **Removal Efficiency (BOD_5 and TSS)**. The Discharger shall calculate and report the percent removal of BOD_5 and TSS in the SMRs. The percent removal shall be calculated as specified in Section VII.A. of the Limitations and Discharge Requirements.

   d. **Total Coliform Organisms Effluent Limitations.** The Discharger shall calculate and report the 7-day median of total coliform organisms for the effluent. The 7-day median of total coliform organisms shall be calculated as specified in Section VII.C. of the Limitations and Discharge Requirements.

e. **Dissolved Oxygen Receiving Water Limitations.** The Discharger shall calculate and report monthly in the self-monitoring report: i) the dissolved oxygen concentration, ii) the percent of saturation in the main water mass, and iii) the 95th percentile dissolved oxygen concentration.

f. **Turbidity Receiving Water Limitations.** The Discharger shall calculate and report the turbidity increase in the receiving water applicable to the natural turbidity condition specified in Section V.A.17.a-e. of the Limitations and Discharge Requirements.

g. **Temperature Receiving Water Limitations.** The Discharger shall calculate and report the temperature increase in the receiving water based on the difference in temperature at RSW-001 and RSW-002.

9. The Discharger shall **submit** SMRs in accordance with the following requirements:

a. When electronic submittal of data is required and CIWQS does not provide for entry into a tabular format within the system, the Discharger shall electronically submit the data in a tabular format as an attachment. The Discharger is not required to duplicate the submittal of data that is entered in a tabular format within CIWQS.

b. The Discharger shall attach a cover letter to the SMR. The information contained in the cover letter shall clearly identify violations of the WDRs; discuss corrective actions taken or planned; and the proposed time schedule for corrective actions. Identified violations must include a description of the requirement that was violated and a description of the violation.

c. SMRs must be submitted to the Central Valley Water Board, signed and certified as required by the Standard Provisions (Attachment D), to the address listed below:

Regional Water Quality Control Board
Central Valley Region
NPDES Compliance and Enforcement Unit
364 Knollcrest Drive, Suite #205
Redding, CA 96002

C. Discharge Monitoring Reports (DMRs)

1. As described in section X.B.1 above, at any time during the term of this permit, the State Water Board or Central Valley Water Board may notify the Discharger to electronically submit SMRs that will satisfy federal requirements for submittal of Discharge Monitoring Reports (DMRs).

D. Other Reports

1. **Special Study Reports and Progress Reports.** As specified in the compliance time schedules required in the Special Provisions contained in section VI of the Order, special study and progress reports shall be submitted in accordance with the following reporting requirements. At minimum, the progress reports shall include a discussion of the status of final compliance, whether the Discharger is on schedule to meet the final compliance date, and the remaining tasks to meet the final compliance date.

Table E-11. Reporting Requirements for Special Provisions Reports

Special Provision	Reporting Requirements
Title 22 Disinfection Requirements (Section VI.C.7.a.)	**1 December**, annually, until final compliance
Compliance Schedules for Final Effluent Limitations for BOD_5, TSS, and pH, compliance with final effluent limitations. (Section VI.C.7.b.)	**1 June**, annually, until final compliance
Compliance Schedules for Final Effluent Limitations for pH, Pollution Prevention Plan (Section VI.C.7.b)	**1 June**, annually, after approval of workplan until final compliance

2. The Discharger shall report the results of any special studies, acute and chronic toxicity testing, TRE/TIE, PMP, and Pollution Prevention Plan required by Special Provisions VI.C.2, VI.C.3, and VI.C.7 of this Order. The Discharger shall report the progress in satisfaction of compliance schedule dates specified in the Special Provision at section VI.C.7 of this Order. The Discharger shall submit reports with the first monthly SMR scheduled to be submitted on or immediately following the report due date or in compliance with SMR reporting requirements described in subsection X.B.5 above.

3. Within 60 days of permit adoption, the Discharger shall submit a report outlining minimum levels, method detection limits, and analytical methods for approval, with a goal to achieve detection levels below applicable water quality criteria. At a minimum, the Discharger shall comply with the monitoring requirements for CTR constituents as outlined in section 2.3 and 2.4 of the SIP.

4. The Discharger's sanitary sewer system collects wastewater using sewers, pipes, pumps, and/or other conveyance systems and directs the raw sewage to the wastewater treatment plant. A "sanitary sewer overflow" is defined as a discharge to ground or surface water from the sanitary sewer system at any point upstream of the wastewater treatment plant. Sanitary sewer overflows are prohibited by this Order. All violations must be reported as required in Standard Provisions. Facilities (such as wet wells, regulated impoundments, tanks, highlines, etc.) may be part of a sanitary sewer system and discharges to these facilities are not considered sanitary sewer overflows, provided that the waste is fully contained within these temporary storage facilities.

5. **Effluent and Receiving Water Characterization Study.** An effluent and receiving water monitoring study is required to ensure adequate information is available for the next permit renewal. During the third and fourth year of this permit term, the Discharger shall conduct semi-annual monitoring of the effluent at EFF-001 and of the receiving water at RSW-001 for all priority pollutants and other constituents of concern as described in Attachment I.

6. **Annual Operations Report.** By 30 January of each year, the Discharger shall submit a written report to the Executive Officer containing the following:

   a. The names, certificate grades, and general responsibilities of all persons employed at the Facility.

   b. The names and telephone numbers of persons to contact regarding the plant for emergency and routine situations.

   c. A statement certifying when the flow meter(s) and other monitoring instruments and devices were last calibrated, including identification of who performed the calibration.

   d. A statement certifying whether the current operation and maintenance manual, and contingency plan, reflect the wastewater treatment plant as currently constructed and operated, and the dates when these documents were last revised and last reviewed for adequacy.

   e. The Discharger may also be requested to submit an annual report to the Central Valley Water Board with both tabular and graphical summaries of the monitoring data obtained during the previous year. Any such request shall be made in writing. The report shall discuss the compliance record. If violations have occurred, the report shall also discuss the corrective actions taken and planned to bring the discharge into full compliance with the waste discharge requirements.

ATTACHMENT F – FACT SHEET

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ATTACHMENT F – FACT SHEET

As described in the Findings in section II of this Order, this Fact Sheet includes the legal requirements and technical rationale that serve as the basis for the requirements of this Order.

This Order has been prepared under a standardized format to accommodate a broad range of discharge requirements for Dischargers in California. Only those sections or subsections of this Order that are specifically identified as "not applicable" have been determined not to apply to this Discharger. Sections or subsections of this Order not specifically identified as "not applicable" are fully applicable to this Discharger.

I. PERMIT INFORMATION

The following table summarizes administrative information related to the Facility.

Table F-1. Facility Information

WDID	5A470105001
Discharger	City of Mt. Shasta
Name of Facility	City of Mt. Shasta Wastewater Treatment Plant
Facility Address	2500 Grant Road Mt. Shasta, CA 96067 Siskiyou County
Facility Contact, Title and Phone	Rodney Bryan, Public Works Director, (530) 926-7510 Jackie Brown, Treatment Plant Operator, (530) 926-7535
Authorized Person to Sign and Submit Reports	Rodney Bryan, Public Works Director, (530) 926-7510
Mailing Address	305 North Mt. Shasta Boulevard, Mt. Shasta, CA 96067
Billing Address	305 North Mt. Shasta Boulevard, Mt. Shasta, CA 96067
Type of Facility	POTW
Major or Minor Facility	Minor
Threat to Water Quality	1
Complexity	B
Pretreatment Program	N
Reclamation Requirements	Producer
Facility Permitted Flow	0.80 million gallons per day (mgd) (ADWF) 0.70 mgd (Leachfield)
Facility Design Flow	0.80 mgd (ADWF) 2.1 mgd (PWWF) 0.70 mgd (Leachfield)
Watershed	Upper Sacramento Hydrologic Unit (525.00) Mount Shasta Hydrologic Area (525.20) Box Canyon Hydrologic Subarea (525.22)
Receiving Water	Sacramento River
Receiving Water Type	Inland Surface Water

A. The City of Mt. Shasta (hereinafter Discharger) is the owner and operator of the City of Mt. Shasta Wastewater Treatment Plant (hereinafter Facility), a publicly-owned treatment works. The U.S. Department of Agriculture, Forest Service (hereinafter

USFS) owns the land property associated with the Facility's land disposal to leachfield operation.

For the purposes of this Order, references to the "discharger" or "permittee" in applicable federal and state laws, regulations, plans, or policy are held to be equivalent to references to the Discharger herein.

B. The Facility discharges wastewater to the Sacramento River, a water of the United States, and is currently regulated by Order No. R5-2007-0056 which was adopted on 21 June 2007 and expired on 1 June 2012. The terms and conditions of the current Order have been automatically continued and remain in effect until new Waste Discharge Requirements (WDRs) and National Pollutant Discharge Elimination System (NPDES) permit are adopted pursuant to this Order.

C. The Discharger filed a report of waste discharge and submitted an application for renewal of its WDRs and NPDES permit on 18 July 2011. On 10 May 2012, the USFS submitted a letter of concurrence on the information provided in the Discharger's ROWD.

II. FACILITY DESCRIPTION

The Discharger provides sewerage service for the community of Mt. Shasta and serves a population of approximately 3,595. Wastewater influent is primarily domestic.

The Facility is located approximately 2 miles south of the City of Mt. Shasta on the west side of Interstate-5 and adjacent to the Sacramento River immediately downstream of Box Canyon Dam and Lake Siskiyou.

The Discharger is the owner and operated of the collection system, which is regulated under the State Water Board General Order, Water Quality Order No. 2006-0003, effective November 2006.

Order R5-2007-0056 contained seasonal effluent limitations on the discharge which required secondary treatment during the winter period and advanced-secondary treatment during the fall and spring discharge period. Surface water discharge during the summer period is prohibited.

The Discharger has an agreement with Siskiyou Golf Resort, Inc. (owner and operator of Mt. Shasta Resort Golf Course) to provide treated wastewater from the Facility to Mt. Shasta Resort Golf Course (Resort) for golf course irrigation. Siskiyou Golf Resort, Inc. is regulated under Water Recycling Requirements Order No. 5-01-083. The Resort is required to apply recycled water in a manner to meet requirements for a "Restricted Access" golf course. The effluent limits, prohibitions, and specifications in Water Recycling Requirements Order No. 5-01-083 require the Discharger to treat the recycled water to a standard that is higher than that for "disinfected-secondary-23 recycled water" (as defined in Chapter 3, Division 4, Title 22, CCR, Section 60301 et seq. (hereafter Title 22)). These more stringent limits, which essentially meet "disinfected secondary-2.2 recycled water" (as defined in Title 22) requirements, are justified based on the

Discharger's proven ability to treat to a higher level, and the practices of the Resort, which may include washing of equipment and hand irrigation at times when golfers are present.

The recycled water is filtered, but due to the current Facility design (lagoon treatment) being conducive to the growth of algae, the effluent cannot consistently meet Title 22 filtered wastewater criteria for an "Unrestricted Access" golf course.

The Discharger provides as much available recycled water the Resort can take during the Resort irrigation season; which is typically between April and October. Over the past 4 years, the Discharger has provided an average of 50 million gallons of irrigation water per irrigation discharge season.

The Discharger may also dispose of treated wastewater to a leachfield on property owned by the USFS. Discharge to the leachfield occurs when golf course needs have been met and/or the Discharger cannot meet the reclamation specifications and/or a higher quality effluent cannot be maintained for a surface water discharge. Order No. R5-2007-0056 described the use of the leachfield as limited to the summer months with an annual average usage of 20 days per year, however; the Discharger discharged to the leachfield 222 days in 2011.

A. Description of Wastewater and Biosolids Treatment or Controls

The Facility design daily average flow (ADWF) capacity is 0.8 million gallons per day (mgd). The peak wet weather capacity is 2.1 mgd, based on secondary treatment only. The treatment system consists of headworks (Parshall flume, mechanical shredder, and bypass bar screen), oxidation lagoons, dissolved air flotation thickener and rapid sand filtration, chlorine contact chamber, dechlorination system, and a discharge line. The dissolved air flotation thickener and sand filtration unit have a hydraulic capacity of 0.8 mgd. The dissolved air flotation thickener and rapid sand filter are not utilized in the winter.

The Facility's current ADWF is 0.55 mgd and the average peak wet weather flow is 1.8 mgd. The highest PWWF was recorded on 22 March 2011 at 2.65 mgd.

The outfall to the Sacramento River is located at the base of a steep canyon wall located approximately 200 feet below the elevation of the Facility. Treated effluent is discharged from the Facility through a combination 15-inch and 10-inch diameter gravity outfall pipeline to an energy dissipater. The pipeline from the dissipater to the outfall is a 12–inch diameter pipe. The angle of entry to the river is approximately 30 degrees. Effluent is discharged to the river through a multiport diffuser.

Land disposal is to a 42-acre leachfield with a design ADWF of 0.7 mgd. The disposal area consists of two intermittent leachfields with a total of 20,000 lineal feet of percolation trench. The trenches vary from 8 to 12 feet in depth, with perforated leachpipe generally installed at a depth of 5 feet. A series of splitter boxes allow the Discharger to distribute flow evenly through the field and to alternate loading and rest periods.

Aside from sludge buildup over time in the lagoons, the Facility does not generate or handle solids other than what is removed manually from the headworks. An estimated 15 cubic yards of debris is removed from the headworks annually. Solids are hauled to a landfill.

B. Discharge Points and Receiving Waters

1. The Facility is located in Section 28, T40N, R4W, MDB&M, as shown in Attachment B, a part of this Order.

2. Treated municipal wastewater is discharged at Discharge Point No. 001 to the Sacramento River, a water of the United States at a point latitude 41°16'35.18" N and longitude 122°19'6.98" W. The discharge point is approximately 0.6 miles downstream of Box Canyon Dam.

3. Treated municipal wastewater may also be discharged at Reclamation Point REC-001 to the Mt. Shasta Resort Golf Course as recycled water at latitude 41°16'59.16" N and longitude 122°19'7.80" W.

4. Treated municipal wastewater may also be discharged at Land Discharge Point LND-001 to the subsurface leachfield south of Highway 89 at latitude 41°17'8.34" N and longitude 122°16'24.65" W. The leachfield is on USFS property and is located approximately 3 miles east of the Facility and the Sacramento River.

5. Separate effluent limitations apply to discharges at each of the three discharge points above.

C. Summary of Existing Requirements and Self-Monitoring Report (SMR) Data

Effluent limitations and Discharge Specifications contained in Order No. R5-2007-0056 for discharges from Discharge Point No. 001 (Monitoring Location EFF-001), Discharge Point No. 002 (Monitoring Location LND-001), and Discharge Point No. 003 (Monitoring Location REC-001) and representative monitoring data from the term of Order No. R5-2007-0056 are as follows:

Table F-2. Historic Effluent Limitations and Monitoring Data

Parameter	Units	Effluent Limitation			Monitoring Data (2007 - 2011)	
		Average Monthly	Average Weekly	Maximum Daily	Average	Maximum Daily
pH	s.u.			6.0 – 9.0[7]	6.9	6.1 – 8.0
Settleable Solids	mL/L – Hr.	0.1	--	0.2	0.05	0.05
EC	µmhos/cm	700	--	--	340	454
BOD_5 (winter[4])	mg/L	30	45	60	11.8	49.8
	lbs/day	200	300	400	93.5	320
BOD_5 (shoulder[5])	mg/L	10	15	30	3.1	8
	lbs/day	67	100	200	15.6	37

Parameter	Units	Effluent Limitation			Monitoring Data (2007 - 2011)	
		Average Monthly	Average Weekly	Maximum Daily	Average	Maximum Daily
TSS (winter[4])	mg/L	30	45	60	11.9	26.5
	lbs/day	200	300	400	93.8	334
TSS (shoulder[5])	mg/L	10	15	30	4.3	8.5
	lbs/day	67	100	200	20.1	36
Ammonia	mg/L	3.68	--	29.57[2]	10.5	18.10
4,4'-DDT	µg/L	0.00059	--	0.00118	<0.002	<0.002
Copper, Total Recoverable	µg/L	3.94	--	7.9	6.72	32
Zinc, Total Recoverable	µg/L	10.76	--	21.58	11.95	47.6
Total Residual Chlorine	mg/L	--	0.01[1]	0.02[2]	<0.02	1.46
Total Coliform Organisms	MPN/ 100 mL	--	23[3]	240	2.65	30
Average Dry Weather Flow	mgd	--	--	0.80	0.87[6]	2.61[6]
Turbidity (shoulder[5])	NTU	--	5.0	10.0	2.3	4.1

1 . 4-day average.
2 . 1–hour average.
3 . Weekly median.
4 . Winter period only (16 November through 14 April).
5 . Shoulder period only (15 April through 14 June and 16 September through 15 November).
6 . No discharge to receiving water during summer period, value represents entire discharge to surface water period.
7 Instantaneous minimum and maximum

Table F-3. Historic Land Discharge Specifications and Monitoring Data

Parameter	Units	Land Discharge Specification			Monitoring Data (2007 - 2010)	
		Average Monthly	Average Weekly	Maximum Daily	Average	Maximum Daily
Settleable Solids	mL/L – Hr.	0.1	--	0.2	n/a[2]	n/a[2]
BOD_5	mg/L	30	45	60	9.25	30.0
TSS	mg/L	30	45	60	8.8	27.0
Total Coliform Organisms	MPN/ 100 mL	--	23[1]	240	2[2,7]	99[2]
Average Dry Weather Flow	mgd	--	--	0.70	0.53 59 mg[5] 92 mg[6]	0.865[4]

[1] Weekly median.
[2] Order No. R5-2007-0056 did not contain land discharge monitoring requirements for total coliform organisms.
[3] See historic effluent monitoring summary table.
[4] April 2010.
[5] Annual discharge volume average (million gallons).
[6] Maximum annual volume (million gallons).
[7] Median of the data set.

Table F-4. Historic Reclamation Discharge Specifications and Monitoring Data

Parameter	Units	Reclamation Discharge Specification			Monitoring Data (From Jan. 2007 To June 2011)	
		Average Monthly	Average Weekly	Maximum Daily	Average	Maximum Daily
pH	s.u.	--	--	6.0 – 9.0[1]	6.14	4.5 – 7.3[5]
BOD_5	mg/L	10	15	30	4.0	5.6
TSS	mg/L	10	15	30	5.9	8.0
% BOD_5 and TSS Removal	%	85	--	--	n/a[6]	n/a[6]
Total Coliform Organisms	MPN/ 100 mL	2.2[2]	--	23	4[7]	99
Average Dry Weather Flow	mgd	--	--	0.80	0.54	0.75
Acute Toxicity, 96-hour static bioassay using Rainbow Trout	% Survival	--	--	70 – 90[3]	n/a[6]	n/a[6]
Turbidity	NTU	--	5[4]	10	3.2	5.0

[1] Instantaneous minimum and maximum.
[2] Monthly median.
[3] The minimum survival for any one bioassay shall be no less than 70%, the median for any three or more consecutive bioassays shall be no less than 90%.
[4] Weekly average
[5] Minimum and maximum observed pH.
[6] Order No. R5-2007-0056 did not contain reclamation discharge monitoring requirements.
[7] Median of the data set.

D. Compliance Summary

Order R5-2007-0056 contained final new effluent limitations for copper, zinc, ammonia, and 4-4'-DDT which the Discharger could not meet. Interim limitations for these parameters and associated compliance schedules were established upon adoption of Order R5-2007-0056 and Cease and Desist Order R5-2007-0057 on 21 June 2007. After additional monitoring during the permit term, it was determined that 4-4'-DDT was not present in the effluent in detectable amounts.

The interim limitations for copper, zinc, and ammonia expired 18 May 2010. However, the Discharger was unable to meet the final effluent limitations at that time. Subsequently, Cease and Desist Order R5-2010-0064 was adopted on 27 May 2010 which provided new interim limitations for copper, zinc, and ammonia and compliance schedules for each parameter. Cease and Desist Order R5-2010-0064 expired on 1 June 2012. The Discharger conducted a mixing zone study in October 2009 and is requesting mixing zones and dilution credits for the subject parameters.

The Discharger has a history of effluent and discharge specification violations for all three discharge locations (receiving water, reclamation/golf course, and leachfield).

Effluent limitation violations for total chlorine residual occurred in February 2008, March 2011, and November 2011. In 2009 the Discharger refurbished the continuous sulfur dioxide analyzer; however the system is unreliable and has ongoing issues. The discharge has also exceeded the average monthly total recoverable zinc limitation

(March 2009) and a weekly BOD_5 limitation for the winter period discharge (November 2010).

Effluent discharged for reclamation (golf course) has exceeded reclamation specifications for total coliform organisms and pH. Total coliform organism reclamation specifications were exceeded in August 2008 and August 2010. In August, September, and October 2010, the discharge to the golf course was below the minimum pH limit of 6.0 s.u. on 10 occasions.

Effluent discharge to the leachfield has exceeded the land discharge specification flow limitation of 0.7 mgd on numerous occasions (approximately 36 daily violations between January 2010 and June 2011).

During the past permit cycle, the Discharger has heavily relied on the ability to discharge effluent to the leachfield that otherwise would have exceeded effluent limitations or reclamation specifications. These discharges to the leachfield have essentially masked treatment or effluent-quality problems at the Facility that normally would have been identified through the violations that would have occurred if the effluent was discharged to the river or the golf course.

Order No. R5-2007-0056 did not contain a discharge specification that limited the period of time or number of days per year to which discharges to the leachfield were allowed, the previous Order only specified an average annual discharge flow limitation of 0.7 mgd. Historically, the leachfield was only used for disposal between 1 May and 15 November (6.5 months), as effluent discharge to surface water was prohibited during this time period[3]. In 2001, reliance on the leachfield was reduced as the surface water discharge prohibition period was reduced to 14 June through 14 September (3 months). Facility improvements in early 2000 allowed the Discharger to produce recycled water for the Mt. Shasta Golf course for use predominately in the summer months and discharge higher quality effluent during the "new" fall and spring surface water discharge periods[4]. Order No. R5-2007-0056 references the leachfield discharges only occurring in the summer period and when the golf course does not utilize the recycled water. In addition, Order No. R5-2007-0056 states the usage of the leachfield had been considerably reduced over the past permit cycle after the Facility began discharging treated recycled water to Mt. Shasta Golf Resort. Order No. R5-2007-0056 states the annual average number of days treated effluent is pumped to the leachfield is less than 20 days. The Discharger sent treated effluent to the leachfield 222 days over a 12 month period in 2011.

E. Planned Changes

The Discharger has acknowledged that improvements and updates to the Facility are needed in order to meet water quality standards. The ROWD considers potential upgrades to the existing lagoon system in order to produce a "higher level of treatment." These improvements and upgrades include year-round filtration and a

[3] WDR Order No. 96-038.
[4] WDR Order No. 5-01-218.

possible conversion from a lagoon-treatment system to a packaged activated sludge treatment plant. However, there are currently no formal proposals, plans, and/or secured funding for any "higher level of treatment" improvements.

III. APPLICABLE PLANS, POLICIES, AND REGULATIONS

The requirements contained in this Order are based on the applicable plans, policies, and regulations identified in the Findings in section II of this Order. The applicable plans, policies, and regulations relevant to the discharge include the following:

A. Legal Authorities

This Order is issued pursuant to regulations in the Clean Water Act (CWA) and the California Water Code (Water Code) as specified in the Finding contained at section II.C of this Order.

B. California Environmental Quality Act (CEQA)

This Order meets the requirements of CEQA as specified in the Finding contained at section II.E of this Order.

C. State and Federal Regulations, Policies, and Plans

1. **Water Quality Control Plans.** This Order implements the following water quality control plans as specified in the Finding contained at section II.H of this Order.

   a. *Water Quality Control Plan, Fourth Edition (Revised October 2011), for the Sacramento and San Joaquin River Basins* (Basin Plan)

2. **National Toxics Rule (NTR) and California Toxics Rule (CTR).** This Order implements the NTR and CTR as specified in the Finding contained at section II.I of this Order.

3. **State Implementation Policy (SIP).** This Order implements the SIP as specified in the Finding contained at section II.I of this Order.

4. **Alaska Rule.** This Order is consistent with the Alaska Rule as specified in the Finding contained at section II.L of this Order.

5. **Antidegradation Policy.** As specified in the Finding contained at section II.N of this Order and as discussed in detail in the Fact Sheet (Attachment F, Section IV.D.4.), the discharge is consistent with the antidegradation provisions of 40 CFR section 131.12 and State Water Resources Control Board (State Water Board) Resolution 68-16.

6. **Anti-Backsliding Requirements.** This Order is consistent with anti-backsliding policies as specified in the Finding contained at section II.M of this Order. Compliance with the anti-backsliding requirements is discussed in the Fact Sheet (Attachment F, Section IV.D.3).

7. Emergency Planning and Community Right to Know Act

Section 13263.6(a) of the Water Code, requires that "*the Regional Water Board shall prescribe effluent limitations as part of the waste discharge requirements of a POTW for all substances that the most recent toxic chemical release data reported to the state emergency response commission pursuant to Section 313 of the Emergency Planning and Community Right to Know Act of 1986 (42 U.S.C. Sec. 11023) (EPCRA) indicate as discharged into the POTW, for which the State Water Board or the Regional Water Board has established numeric water quality objectives, and has determined that the discharge is or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to, an excursion above any numeric water quality objective*".

The most recent toxic chemical data report does not indicate any reportable off-site releases or discharges to the collection system for this Facility. Therefore, a reasonable potential analysis based on information from EPCRA cannot be conducted. Based on information from EPCRA, there is no reasonable potential to cause or contribute to an excursion above any numeric water quality objectives included within the Basin Plan or in any State Water Board plan, so no effluent limitations are included in this permit pursuant to Water Code section 13263.6(a).

However, as detailed elsewhere in this Order, available effluent data indicate that there are constituents present in the effluent that have a reasonable potential to cause or contribute to exceedances of water quality standards and require inclusion of effluent limitations based on federal and state laws and regulations.

8. Storm Water Requirements

USEPA promulgated federal regulations for storm water on 16 November 1990 in 40 CFR Parts 122, 123, and 124. The NPDES Industrial Storm Water Program regulates storm water discharges from wastewater treatment facilities. Wastewater treatment plants are applicable industries under the storm water program and are obligated to comply with the federal regulations.

9. Endangered Species Act. This Order is consistent with the Endangered Species Act as specified in the Finding contained at section II.P of this Order.

D. Impaired Water Bodies on CWA 303(d) List

1. Under section 303(d) of the 1972 CWA, states, territories and authorized tribes are required to develop lists of water quality limited segments. The waters on these lists do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. On 30 November 2006 USEPA gave final approval to California's 2006 section 303(d) List of Water Quality Limited Segments. The Basin Plan references this list of Water Quality Limited Segments (WQLSs), which are defined as "*...those sections of lakes, streams, rivers or other fresh water bodies where water quality does not meet (or is not expected to meet) water quality standards even after the application*

of appropriate limitations for point sources (40 CFR Part 130, et seq.)." The Basin Plan also states, "*Additional treatment beyond minimum federal standards will be imposed on dischargers to [WQLSs]. Dischargers will be assigned or allocated a maximum allowable load of critical pollutants so that water quality objectives can be met in the segment.*" The Sacramento River (Box Canyon Dam to Shasta Lake) is not listed as a WQLS in the 303(d) list of impaired water bodies.

2. **Total Maximum Daily Loads (TMDLs).** USEPA requires the Central Valley Water Board to develop TMDLs for each 303(d) listed pollutant and water body combination. The Sacramento River (Box Canyon Dam to Shasta Lake) is not listed as a WQLS in the 303(d) list of impaired water bodies, therefore no TMDLs are scheduled for development on this water body.

E. Other Plans, Policies and Regulations

1. The discharge authorized herein and the treatment and storage facilities associated with the discharge of treated municipal wastewater, except for discharges of residual sludge and solid waste, are exempt from the requirements of Title 27, California Code of Regulations (CCR), section 20005 *et seq* (hereafter Title 27). The exemption, pursuant to Title 27 CCR section 20090(a), is based on the following:

   a. The waste consists primarily of domestic sewage and treated effluent;

   b. The waste discharge requirements are consistent with water quality objectives; and

   c. The treatment and storage facilities described herein are associated with a municipal wastewater treatment plant.

2. The State Water Resources Control Board adopted Resolution 2009-0011, "Policy for Water Quality Control for Recycled Water," (Recycled Water Policy) on 3 February 2009. Section 4 of the Recycled Water Policy, Mandate for the Use of Recycled Water, paragraph a(2) states, "Agencies producing recycled water that is available for reuse and not being put to beneficial use shall make that recycled water available to water purveyors for reuse on reasonable terms and conditions. Such terms and conditions may include payment by the water purveyor of a fair and reasonable share of the cost of the recycled water supply and facilities." The Central Valley Water Board adopted a similar resolution, Resolution No. R5-2009-0028, "Resolution in Support of Regionalization, Reclamation, Recycling and Conservation for Wastewater Treatment Plants," on 23 April 2009.

   This Order requires the Discharger to recycle its treated wastewater to the maximum extent practicable. The Discharger is not expected to shoulder the entire cost of providing recycled wastewater, however some incremental cost to the City is warranted if a recycled water project is practicable, and the user is willing to pay its fair share of the incremental costs associated with producing, transporting and using the recycled water.

IV. RATIONALE FOR EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS

Effluent limitations and toxic and pretreatment effluent standards established pursuant to sections 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 304 (Information and Guidelines), and 307 (Toxic and Pretreatment Effluent Standards) of the CWA and amendments thereto are applicable to the discharge.

The CWA mandates the implementation of effluent limitations that are as stringent as necessary to meet water quality standards established pursuant to state or federal law [33 U.S.C., §1311(b)(1)(C); 40 CFR 122.44(d)(1)]. NPDES permits must incorporate discharge limits necessary to ensure that water quality standards are met. This requirement applies to narrative criteria as well as to criteria specifying maximum amounts of particular pollutants. Pursuant to federal regulations, 40 CFR 122.44(d)(1)(i), NPDES permits must contain limits that control all pollutants that "*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.*" Federal regulations, 40 CFR 122.44(d)(1)(vi), further provide that "[w]*here a state has not established a water quality criterion for a specific chemical pollutant that is present in an effluent at a concentration that causes, has the reasonable potential to cause, or contributes to an excursion above a narrative criterion within an applicable State water quality standard, the permitting authority must establish effluent limits.*"

The CWA requires point source dischargers to control the amount of conventional, non-conventional, and toxic pollutants that are discharged into the waters of the United States. The control of pollutants discharged is established through effluent limitations and other requirements in NPDES permits. There are two principal bases for effluent limitations in the Code of Federal Regulations: 40 CFR 122.44(a) requires that permits include applicable technology-based limitations and standards; and 40 CFR 122.44(d) requires that permits include WQBELs to attain and maintain applicable numeric and narrative water quality criteria to protect the beneficial uses of the receiving water where numeric water quality objectives have not been established. The Basin Plan at page IV-17.00, contains an implementation policy, "*Policy for Application of Water Quality Objectives,*" that specifies that the Central Valley Water Board "*will, on a case-by-case basis, adopt numerical limitations in orders which will implement the narrative objectives.*" This Policy complies with 40 CFR 122.44(d)(1). With respect to narrative objectives, the Central Valley Water Board must establish effluent limitations using one or more of three specified sources, including: (1) USEPA's published water quality criteria, (2) a proposed state criterion (i.e., water quality objective) or an explicit state policy interpreting its narrative water quality criteria (i.e., the Central Valley Water Board's "*Policy for Application of Water Quality Objectives*")(40 CFR 122.44(d)(1)(vi)(A), (B) or (C)), or (3) an indicator parameter.

The Basin Plan includes numeric site-specific water quality objectives and narrative objectives for toxicity, chemical constituents, discoloration, radionuclides, and tastes and odors. The narrative toxicity objective states: "*All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life.*" (Basin Plan at III-8.00) The Basin Plan states that material

and relevant information, including numeric criteria, and recommendations from other agencies and scientific literature will be utilized in evaluating compliance with the narrative toxicity objective. The narrative chemical constituents objective states that waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At minimum, "*...water designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs)" in Title 22 of CCR.* The Basin Plan further states that, to protect all beneficial uses, the Central Valley Water Board may apply limits more stringent than MCLs. The narrative tastes and odors objective states: *"Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses."*

A. Discharge Prohibitions

1. **Prohibition III.A (No discharge or application of waste other than that described in this Order).** This prohibition is based on Water Code section 13260 that requires filing of a report of waste discharge (ROWD) before discharges can occur. The Discharger submitted a ROWD for the discharges described in this Order; therefore, discharges not described in this Order are prohibited.

2. **Prohibition III.B (No bypasses or overflow of untreated wastewater, except under the conditions at CFR Part 122.41(m)(4)).** As stated in section I.G of Attachment D, Standard Provisions, this Order prohibits bypass from any portion of the treatment facility. Federal regulations, 40 CFR 122.41(m), define "bypass" as the intentional diversion of waste streams from any portion of a treatment facility. This section of the federal regulations, 40 CFR 122.41(m)(4), prohibits bypass unless it is unavoidable to prevent loss of life, personal injury, or severe property damage. In considering the Regional Water Board's prohibition of bypasses, the State Water Board adopted a precedential decision, Order No. WQO 2002-0015, which cites the federal regulations, 40 CFR 122.41(m), as allowing bypass only for essential maintenance to assure efficient operation.

3. **Prohibition III.C (No controllable condition shall create a nuisance).** This prohibition is based on Water Code section 13050 that requires water quality objectives established for the prevention of nuisance within a specific area. The Basin Plan prohibits conditions that create a nuisance

4. **Prohibition III.D (No inclusion of pollutant free wastewater shall cause improper operation of the Facility's systems).** This prohibition is based on CFR Part 122.41 et seq. that requires the proper design and operation of treatment facilities

5. **Prohibition III.E (The discharge of wastewater to the Sacramento River during 15 June through 14 September is prohibited).** Order No. R5-2007-0056 included the discharge prohibition of no discharge during the recreation season (15 June through 14 September).

B. Technology-Based Effluent Limitations

1. Scope and Authority

Section 301(b) of the CWA and implementing USEPA permit regulations at 40 CFR 122.44 require that permits include conditions meeting applicable technology-based requirements at a minimum, and any more stringent effluent limitations necessary to meet applicable water quality standards. The discharge authorized by this Order must meet minimum federal technology-based requirements based on Secondary Treatment Standards at 40 CFR Part 133.

Regulations promulgated in 40 CFR 125.3(a)(1) require technology-based effluent limitations for municipal Dischargers to be placed in NPDES permits based on Secondary Treatment Standards or Equivalent to Secondary Treatment Standards.

The Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) established the minimum performance requirements for POTWs [defined in section 304(d)(1)]. Section 301(b)(1)(B) of that Act requires that such treatment works must, as a minimum, meet effluent limitations based on secondary treatment as defined by the USEPA Administrator.

Based on this statutory requirement, USEPA developed secondary treatment regulations, which are specified in 40 CFR Part 133. These technology-based regulations apply to all municipal wastewater treatment plants and identify the minimum level of effluent quality attainable by secondary treatment in terms of 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), and pH.

2. Applicable Technology-Based Effluent Limitations

a. **BOD_5 and TSS.** Federal regulations, 40 CFR Part 133, establish the minimum weekly and monthly average level of effluent quality attainable by secondary treatment for BOD_5 and TSS. Tertiary treatment is necessary to protect the beneficial uses of the receiving stream and the final effluent limitations for BOD_5 and TSS are based on the technical capability of the tertiary process. BOD_5 is a measure of the amount of oxygen used in the biochemical oxidation of organic matter. The secondary and tertiary treatment standards for BOD_5 and TSS are indicators of the effectiveness of the treatment processes. The principal design parameter for wastewater treatment plants is the daily BOD_5 and TSS loading rates and the corresponding removal rate of the system. In applying 40 CFR Part 133 for weekly and monthly average BOD_5 and TSS limitations, the application of tertiary treatment processes results in the ability to achieve lower levels for BOD_5 and TSS than the secondary standards currently prescribed; the 30-day average BOD_5 and TSS limitations have been revised to 10 mg/L, which is technically based on the capability of a tertiary system. In addition to the average weekly and average monthly effluent limitations, a daily maximum effluent limitation for BOD_5 and TSS is included in the Order to ensure that the treatment works are not organically overloaded and operate in accordance with design capabilities. In addition, 40 CFR 133.102, in describing

the minimum level of effluent quality attainable by secondary treatment, states that the 30-day average percent removal shall not be less than 85 percent. If 85 percent removal of BOD_5 and TSS must be achieved by a secondary treatment plant, it must also be achieved by a tertiary (i.e., treatment beyond secondary level) treatment plant. This Order contains a limitation requiring an average of 85 percent removal of BOD_5 and TSS over each calendar month. This Order requires Water Quality Based Effluent Limitations (WQBELs) that are equal to or more stringent than the secondary technology-based treatment described in 40 CFR Part 133. (See section IV.C.3.d of this Attachment for the discussion on Pathogens which includes WQBELs for BOD_5 and TSS.)

b. **Flow.** The Facility was designed to provide a tertiary (advanced secondary) level of treatment for up to a design flow of 0.80 mgd. Therefore, this Order contains an average dry weather discharge flow effluent limit of 0.80 mgd.

c. **pH.** The secondary treatment regulations at 40 CFR Part 133 also require that pH be maintained between 6.0 and 9.0 standard units.

Summary of Technology-based Effluent Limitations
Discharge Point No. 001

Table F-5. Summary of Technology-based Effluent Limitations

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum
BOD_5	mg/L	10	15	30	--	--
	lbs/day[1]	67	100	200	--	--
Total Suspended Solids	mg/L	10	15	30	--	--
	lbs/day[1]	67	100	200	--	--
pH	Standard Units	--	--	--	6.0	9.0
Average Dry Weather Flow	mgd	--	--	0.80[2]	--	--

[1] Based on average dry weather flow of 0.80 mgd.
[2] Average daily maximum.

C. Water Quality-Based Effluent Limitations (WQBELs)

1. Scope and Authority

Section 301(b) of the CWA and 40 CFR 122.44(d) require that permits include limitations more stringent than applicable federal technology-based requirements where necessary to achieve applicable water quality standards. This Order contains requirements, expressed as a technology equivalence requirement, more stringent than secondary treatment requirements that are necessary to meet applicable water quality standards. The rationale for these requirements, which consist of tertiary treatment or equivalent requirements or other provisions, is discussed in section IV.C.3 of this Fact Sheet.

40 CFR 122.44(d)(1)(i) mandates that permits include effluent limitations for all pollutants that are or may be discharged at levels that have the reasonable potential to cause or contribute to an exceedance of a water quality standard, including numeric and narrative objectives within a standard. Where reasonable potential has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, WQBELs must be established using: (1) USEPA criteria guidance under CWA section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information, as provided in 40 CFR 122.44(d)(1)(vi).

The process for determining reasonable potential and calculating WQBELs when necessary is intended to protect the designated uses of the receiving water as specified in the Basin Plan, and achieve applicable water quality objectives and criteria that are contained in other state plans and policies, or any applicable water quality criteria contained in the CTR and NTR.

2. Applicable Beneficial Uses and Water Quality Criteria and Objectives

The Basin Plan designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan. In addition, the Basin Plan implements State Water Board Resolution No. 88-63, which established state policy that all waters, with certain exceptions, should be considered suitable or potentially suitable for municipal or domestic supply.

The Basin Plan on page II-1.00 states: "*Protection and enhancement of existing and potential beneficial uses are primary goals of water quality planning…*" and with respect to disposal of wastewaters states that "*...disposal of wastewaters is [not] a prohibited use of waters of the State; it is merely a use which cannot be satisfied to the detriment of beneficial uses.*"

The federal CWA section 101(a)(2), states: "*it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife, and for recreation in and on the water be achieved by July 1, 1983.*" Federal Regulations, developed to implement the requirements of the CWA, create a rebuttable presumption that all waters be designated as fishable and swimmable. Federal Regulations, 40 CFR sections 131.2 and 131.10, require that all waters of the State regulated to protect the beneficial uses of public water supply, protection and propagation of fish, shell fish and wildlife, recreation in and on the water, agricultural, industrial and other purposes including navigation. Section 131.3(e), 40 CFR, defines existing beneficial uses as those uses actually attained after 28 November 1975, whether or not they are included in the water quality standards. Federal Regulation, 40 CFR section 131.10 requires that uses be obtained by implementing effluent limitations, requires that all downstream uses be protected and states that in no

case shall a state adopt waste transport or waste assimilation as a beneficial use for any waters of the United States.

a. **Receiving Water and Beneficial Uses.** Beneficial uses applicable to the Sacramento River (Box Canyon Dam to Shasta Lake) are as follows:

Table F-6. Basin Plan Beneficial Uses

Discharge Point	Receiving Water Name	Beneficial Use(s)
D-001	Sacramento River (Box Canyon Dam to Shasta Lake)	Existing: Municipal and domestic supply (MUN); Agricultural supply, including irrigation and stock watering (AGR); Water contact recreation, including canoeing and rafting (REC-1); Non-contact water recreation (REC-2); Cold freshwater habitat (COLD); Spawning, reproduction, and/or early development, cold (SPWN); and Wildlife habitat (WILD)
D-002 D-003	Underlying Groundwater	Potential: Municipal and domestic supply (MUN) Industrial service supply (IND), Industrial process supply (PRO), and Agricultural supply (AGR)

Most of the water in the upper Sacramento River and its tributaries is derived from snowmelt; as a result, the water in the system is relatively pure and low in dissolved minerals. The Facility is the first point-source municipal effluent discharge in the watershed. The upper Sacramento River is promoted as an excellent recreational fishing waterway, based primarily around salmonids, and specifically rainbow trout. Fishing is allowed year-round in the mainstem of the river from Box Canyon to Shasta Lake, with several fishing events and tournaments occurring throughout the year in the local area[5]. The discharge is located in an area reserved for "catch and release" fishing only and the outfall is located within one mile upstream of a California Department of Fish and Game Wildlife Area which provides access to year-round fishing. The discharge location is also within a segment of river used for recreational boating, specifically, whitewater kayaking. Whitewater kayaking is present year-round, on days when releases from Box Canyon Dam are greater than or equal to approximately 400 cfs[6].

b. **Effluent and Ambient Background Data.** The reasonable potential analysis (RPA), as described in section IV.C.3 of this Fact Sheet, was based on data from January 2007 through June 2011, which includes effluent and ambient

[5] Upper Sacramento River Watershed Assessment, June 2010

[6] Holbek, Lars and Chuck Stanley. The Best Whitewater in California. 3rd ed. Coloma, CA: Watershed Books, 1998.
Cassady, Jim and Fryar Calhoun. California Whitewater. 3rd ed., Berkeley, CA: North Fork Press, 1995.
Sacramento River (Box Canyon). Retrieved 28 Aug 2012, from http://www.awetstate.com/SacBox.html.
Box Canyon of the Sacramento. Retrieved 28 Aug 2012, from http://www.kayakphoto.com/darinmcquoid/boxcanyonsac.html.

background data submitted in SMRs and the Report of Waste Discharge (ROWD).

c. **Assimilative Capacity/Mixing Zone.** The Discharger has requested mixing zones and dilution credits for compliance with acute and chronic aquatic life water quality criteria, and human carcinogen water quality criteria. The Central Valley Water Board has discretion to accept or deny mixing zones and dilution credits. The CWA directs states to adopt water quality standards to protect the quality of its waters. USEPA's current water quality standards regulation authorizes states to adopt general policies, such as mixing zones, to implement state water quality standards (40 CFR section 122.44 and section 122.45). The USEPA allows states to have broad flexibility in designing its mixing zone policies. Primary policy and guidance on determining mixing zone and dilution credits is provided by the SIP and the Basin Plan. If no procedure applies in the SIP or the Basin Plan, then the Central Valley Water Board may use the USEPA Technical Support Document for Water Quality-Based Toxics Control (EPA/505/2-90-001) (TSD).

The TSD defines a mixing zone as follows, "*...a mixing zone is an area where an effluent discharge undergoes initial dilution and is extended to cover the secondary mixing in the ambient waterbody. A mixing zone is an allocated impact zone where water quality criteria can be exceeded as long as acutely toxic conditions are prevented.*"[7] The SIP provides guidance on mixing zones and dilution credits in establishing water quality-based effluent limitations. Water quality criteria and objectives must be met throughout a water body except within a mixing zone. **All mixing zones shall be as small as practicable and must meet specific conditions**.

The allowance of mixing zones by the Central Valley Water Board is discretionary and can be granted parameter-by-parameter and/or type of criteria (e.g., acute or chronic aquatic life criteria). The allowance of mixing zones by the Central Valley Water Board is discussed in the Basin Plan, Policy for Application of Water Quality Objectives, which states in part, "*In conjunction with the issuance of NPDES and storm water permits, the Regional Board may designate mixing zones within which water quality objectives will not apply provided the discharger has demonstrated to the satisfaction of the Regional Board that the mixing zone will not adversely impact beneficial uses. If allowed, different mixing zones may be designated for different types of objectives, including, but not limited to, acute aquatic life objectives, chronic aquatic life objectives, human health objectives, and acute and chronic whole effluent toxicity objectives, depending in part on the averaging period over which the objectives apply. In determining the size of such mixing zones, the Regional Board will consider the applicable procedures and guidelines in the EPA's Water Quality Standards Handbook and the [TSD]. Pursuant to EPA guidelines, mixing zones designated for acute aquatic life objectives will generally be*

[7] TDS Glossary

limited to a small zone of initial dilution in the immediate vicinity of the discharge."[8]

Section 1.4.2 of the SIP states, in part, "*...with the exception of effluent limitations derived from TMDLs, in establishing and determining compliance with effluent limitations for applicable human health, acute aquatic life, or chronic aquatic life priority pollutant criteria/objectives or the toxicity objective for aquatic life protection in a basin plan, the Regional Board may grant mixing zones and dilution credits to dischargers ... The applicable priority pollutant criteria and objectives are to be met throughout a water body except within any mixing zone granted by the Regional Board. The allowance of mixing zones is discretionary and shall be determined on a discharge-by-discharge basis. The Regional Board may consider allowing mixing zones and dilution credits only for discharges with a physically identifiable point of discharge that is regulated through an NPDES permit issued by the Regional Board."*[9]

Both federal and state guidance include similar mixing zone conditions, the SIP conditions are as follows:

"A mixing zone *shall be as small as practicable. The following conditions must be met in allowing a mixing zone:*

A mixing zone *shall not:*

1. *Compromise the integrity of the entire water body.*
2. *Cause acutely toxic conditions to aquatic life passing through the mixing zone.*
3. *Restrict passage of aquatic life.*
4. *Adversely impact biologically sensitive or critical habitats, including but not limited to, habitat of species listed under Federal or State endangered species laws;*
5. *Produce undesirable or nuisance aquatic life;*
6. *Result in floating debris, oil, or scum;*
7. *Produce objectionable color, odor, taste, or turbidity;*
8. *Cause objectionable bottom deposits;*
9. *Cause nuisance;*
10. *Dominate the receiving water body or overlap a mixing zone from a different outfall;*
11. *Be allowed at or near any drinking water intake. A mixing zone is not a source of drinking water. To the extent of any conflict between this determination and Sources of Drinking Water Policy (Resolution No. 88-63), this SIP supersedes the provisions of that policy."*[10]

[8] Basin Plan, page IV-16.00
[9] SIP, page 15
[10] SIP, page 17

The mixing zone is thus an administrative construct defined as an area around the outfall that may exceed water quality objectives, but is otherwise protective of the beneficial uses. Dilution is defined as the amount of mixing that has occurred at the edge of this mixing zone under critical conditions, thus protecting the beneficial uses at the concentration and for the duration and frequency required.

iii. **Sacramento River Hydrology.** The discharge location is less than one mile downstream of Box Canyon Dam and approximately 40 miles upstream of Shasta Lake. Shasta Dam and Box Canyon Dam and the reservoirs created by them are the most prominent water supply/flood control features present in the watershed. The Sacramento River watershed upstream from Shasta Lake has an area of about 6,420 square miles. Approximately 50 percent of the watershed is located above 3,000 feet and, as a result, snowfall and snowpack are major influences on the hydrologic cycle of the area[11]. Lake Siskiyou (created by Box Canyon Dam in 1968 for purposes of hydroelectric power production) is a 430-acre reservoir with source water derived primarily from snowmelt. Recreation is a primary use of Lake Siskiyou and lake levels are maintained at or near full year-round. However, Siskiyou County Flood Control and Water Conservation District (owner and operator of Box Canyon Dam) is mandated to maintain a minimum outflow discharge rate of 40 cfs from Box Canyon Dam. There are no major tributaries adding to the flow between Box Canyon Dam and the Facility outfall, therefore historic flow releases from Box Canyon Dam have been used to quantify receiving water flows at the discharge point.

The Facility does not discharge to the Sacramento River during the summer, which Order R5-2007-0056 refers to as the "recreation season" and defines as 15 June through 14 September. Effluent is therefore discharged to the receiving water between 15 September and 14 June, however, Order R5-2007-0056 applied advanced secondary treatment standards to the fall and spring discharge period and secondary treatment standards to the winter period discharge. Receiving water flow statistics in Table F-7 have been calculated for the three specific discharge to surface water periods, as they were defined in Order R5-2007-0056.

[11] Upper Sacramento River Watershed Assessment, June 2010

Table F-7. Critical Receiving Water Flow (cfs)

Season	1Q10[1]	7Q10[2]	Harmonic Mean[3]
Fall (15 September through 15 November)	41	41	45
Winter (16 November through 14 April)	42	42	115
Spring (15 April through 14 June)	44	45	256
Full Surface Water Discharge Period (Average) (15 September through 14 June)	--	--	139

1. Lowest daily average flow with a return frequency of 10 years.
2. Lowest 7-day average flow with a return frequency of 10 years.
3. Box Canyon Dam flow data (August 1998 – September 2009).

The fall period is the lowest receiving water flow period, with a calculated 1Q10 of 41 cfs and a harmonic mean flow of 45 cfs. However, all three historic effluent discharge periods have a receiving water critical low flow value in a range between 41 and 45 cfs. Average peak receiving water flows of 2000 cfs are typically observed for a short period of time in late spring (i.e. April and/or May) and periodically observed in the winter.

iv. **Dilution Ratios.** Before establishing a mixing zone and a dilution credit for a discharge, it must first be determined if and how much (if any), receiving water is available to dilute the discharge. In determining the appropriate available receiving water flow, the Regional Board may take into account actual and seasonal variations of the receiving water and the effluent. For example, the Regional Board may prohibit mixing zones during seasonal low flows and allow them during seasonal high flows. However, for year-round mixing zones, the mixing zone and dilution credit shall be determined using the parameters specified in Table F-8, below.

Table F-8. Effluent and Receiving Water Flows for Calculating Dilution Ratios

In calculating a dilution ratio for:	Use the critical receiving water flow of:	Use the discharged effluent flow of:
Acute aquatic life criteria/objective	1Q10	Maximum daily flow during period of discharge
Chronic aquatic life criteria/objective	7Q10	Four-day average of daily maximum flows during period of discharge
Human health criteria/objective	Harmonic mean	Long-term average during period of discharge

For completely-mixed[12] discharges, the amount of receiving water available to dilute the effluent may be determined by calculating the dilution ratio using the flows in Table F-8, above. The Regional Board cannot grant a dilution credit that is greater than the calculated dilution ratio. Site-specific

[12] Per the SIP, completely mixed discharges are defined as "not more than 5 percent difference, accounting for analytical variability, in the concentration of a pollutant across a transect of the water body at a point within two stream/river widths from the discharge point."

conditions concerning the discharge and the receiving water may also justify a smaller dilution credit for completely-mixed discharges, as well. For incompletely-mixed discharges, dilution credits and mixing zones may be considered by the Regional Board only after the Discharger has completed an independent mixing zone study and demonstrated to the satisfaction of the Regional Board that a dilution credit is appropriate. Dilution credits for incompletely-mixed discharges, inherently, cannot be greater than the calculated dilution ratios from the flows values in Table F-8, as well.

Tables F-9, F-10, and F-11 below provide the calculated dilution ratios for the applicable acute, chronic, and human health objective/criteria, respectively. The tables provide the receiving water and effluent flow rates for each historic discharge season and the applicable flow values for the entire effluent discharge period (fall, winter, and spring). A year-round mixing zone requires analyzing the dilution ratios for the entire effluent discharge period.

Table F-9. Calculated Dilution Ratios for Acute Criteria

Season	Receiving Water 1Q10 (cfs)	Effluent 1-Day Max (mgd)	Dilution Ratio
Fall (16 September - 15 November)	41	0.96	27:1
Winter (16 November – 14 April)	42	2.3	12:1
Spring (15 April – 14 June)	44	2.1	14:1
Full Discharge Period (16 September through 14 June)	41	2.3	11:1

Table F-10. Calculated Dilution Ratios for Chronic Criteria

Season	Receiving Water 7Q10 (cfs)	Effluent 4-Day Average Max (mgd)	Dilution Ratio
Fall (16 September - 15 November)	41	0.96	27:1
Winter (16 November – 14 April)	42	2.2	12:1
Spring (15 April – 14 June)	45	2.0	15:1
Full Discharge Period (16 September through 14 June)	41	2.2	12:1

Table F-11. Calculated Dilution Ratios for Human Health Criteria

Season	Receiving Water Harmonic Mean (cfs)	Long-term Average (mgd)	Dilution Ratio
Fall (16 September - 15 November)	45	0.5	57:1
Winter (16 November – 14 April)	115	0.98	76:1
Spring (15 April – 14 June)	256	0.62	266:1
Full Discharge Period (16 September through 14 June)	45	0.98	30:1

The Regional Board cannot grant a dilution credit that is greater than the calculated dilution ratio. Therefore, based on the data summarized in Tables F-9, F-10, and F-11, year–round dilution credits for acute aquatic-life, chronic aquatic-life, and human health criteria cannot be larger than 11:1, 12:1, and 30:1, respectively. These dilution ratios represent allocating the entire assimilative capacity of the localized river segment.

Analyses of the seasonal dilution ratios show no significant difference between the winter and spring seasons flow ratios for both acute and chronic aquatic life criteria. Further, all three seasons share the same receiving water critical low flow value of approximately 40 cfs (the minimum mandated Box Canyon Dam release value). The fall season has larger acute and chronic-life criteria dilution ratios than the winter and spring as a result of the observed peak effluent discharge rate during the fall being half the equivalent value for the winter and spring season.

v. **Mixing Zone Study Results**. The Discharger conducted a Mixing Zone Study (Study) in October 2009. The Study included a tracer-dye study with instream monitoring to characterize the extent of the actual dilution. The Study was conducted during a receiving water flow of 47 cfs and an effluent flow of approximately 0.5 mgd. Field-obtained dilution credits were adjusted linearly and reduced to account for the critical flow regimes as outline in Table F-8, above.

The Study found that the discharge is not a completely-mixed discharge. The river width at the diffuser is approximately 35 feet. Measurements taken at 75 feet downstream of the diffuser indicated the dye plume covered approximately 60 percent of the river width. The dye plume was observed to be covering 100 percent of the river width at 100 feet downstream of the diffuser, however, the concentration of the dye varied by more than 5 percent throughout the width of the transect. The furthest downstream measured transect was at 400 feet, however, complete mixing was also not observed at this transect.

Calculated dilution credits, as presented in the 2009 Mixing Zone Study, for the 75-foot downstream transect are provided in Table F-12. The Study presented seasonal calculated dilution credits. Measurements were not taken between 0 and 75 feet downstream of the discharge and the dye plume was observed to be covering 100 percent of the river at 100 feet downstream.

Table F-12. Mixing Zone Study Dilution Credits Comparison to Dilution Ratios

	Mixing Zone Study Results		Maximum "Available" Dilution Ratio	
	@Diffuser	Dilution Credit @75-feet downstream	Dilution Ratio[1] (seasonal)	Dilution Ratio[1] (Entire Discharge Period[2])
Acute				
Fall	1	8	27:1	11:1
Winter	0	3	12:1	
Spring	0	4	14:1	
Chronic				
Fall	1	8	27:1	12:1
Winter	0	4	12:1	
Spring	0	4	15:1	
Human Health				
Fall	1	17	57:1	30:1
Winter	2	22	76:1	
Spring	7	77	266:1	

[1] Based on parameters outlined in Table F-8.
[2] Dilution ratio for entire discharge period (fall, winter, spring).

The Discharger also performed a biological assessment of the mixing zone and submitted the findings (Biological Assessment of the City of Mt. Shasta Wastewater Treatment Plant Mixing Zone, November 2009) to California Department of Fish and Game (DFG) for review and comment. DFG found the biological assessment to be adequate for trustee purposes.

vi. **Evaluation of Available Dilution for Acute Aquatic Life Criteria.** USEPA Region VIII, in its "EPA Region VIII Mixing Zones and Dilution Policy", recommends no dilution for acute aquatic life criteria, stating the following, "*In* incomplete *mix situations, discharge limitations to implement acute chemical-specific aquatic life criteria and narrative (no acute toxicity) criteria shall be based on achieving such acute criteria at the end-of-pipe (i.e., without an allowance for dilution). This approach is intended to implement the narrative requirement prohibiting acutely toxic conditions in the mixing zone.*"[13] The Discharger has requested an acute mixing zone for compliance with acute water quality criteria for ammonia, copper, and zinc.

The Discharger has requested year-round acute aquatic-life dilution credits of 15, 20, and 18 for copper, zinc, and ammonia, respectively. The specific

[13] USEPA Region VIII Mixing Zones and Dilution Policy, December 1994 (Updated September 1995), (page 18)

values were requested in order to obtain water quality-based effluent limitations that the Discharger could meet based on past Facility performance. The maximum available year-round acute dilution credit legally available at this site location is 11:1 (which represents allocating the entire assimilative capacity of the localized river segment). The Discharger's requested dilution credits are greater than the maximum available, therefore they cannot be considered for analysis.

Seasonal dilution credits and/or a dilution credit less than the maximum available credit, however, may be considered by the Regional Board. The receiving water to effluent flow regimes in the winter and spring are not significantly different from each other and the fall period experiences the lowest receiving water flows on average, therefore, seasonal dilution credits are not considered appropriate for further analysis at this time.

For the purpose of evaluating available dilution for acute aquatic-life criteria, a mixing zone length of 75 feet downstream of the diffuser was chosen for evaluation, as this distance was the only downstream transect from the Study that did not have dye observed across the entire width of the receiving water. Since the Discharger requested year-round dilution credits, the smallest dilution available between the three seasons was chosen as a conservative approach to analysis.

The Study reports that a mixing zone of 75 feet downstream of the diffuser (at a width of approximately 24 feet) results in an acute aquatic-life criteria dilution credit of 3. A dilution credit of 3 does not provide the Discharger with a water quality-based effluent limitation for copper, zinc, and ammonia that the Facility can reliably meet based on historic plant performance. However, a 75-foot acute mixing zone has been examined for the purpose of compliance determination with the requirements of the SIP as follows:

(1) *Shall not compromise the integrity of the entire waterbody* - The TSD states that, "*If the total area affected by elevated concentrations within all* mixing *zones combined is small compared to the total area of a waterbody (such as a river segment), then mixing zones are likely to have little effect on the integrity of the waterbody as a whole, provided that the mixing zone does not impinge on unique or critical habitats.*"[14] The discharge is one of only two municipal wastewater treatment facility outfalls in 40 river miles. The river width at the outfall is approximately 40 feet wide and the acute mixing zone is approximately 24 feet wide by 75 feet in length, allowing for a 16-foot zone-free passage on the west side of the river. Therefore, the total area affected is small compared to the total area of the waterbody and the acute mixing zone is likely to have little effect on the integrity of the waterbody as a whole.

[14] TSD, pg. 33

(2) *Shall not cause acutely toxic conditions to aquatic life passing through the mixing* zone –This Order requires acute bioassays to be conducted using 100% effluent. Compliance with these requirements ensures that acutely toxic conditions to aquatic life passing through the acute mixing zone do not occur.

(3) *Shall not restrict the passage of aquatic life* – The acute mixing zone length is 75 feet downstream from the diffuser. The width of the river is approximately 40 feet at the 75 feet transect location and the mixing zone is 60 percent of the river width at this location. Therefore, the mixing zone is approximately 24 feet wide at the 75-foot transect which allows for a 16-foot aquatic life passage on the west side of the river. Therefore, the acute mixing zone does not restrict the passage of aquatic life.

(4) *Shall not adversely impact biologically sensitive or critical habitats, including, but not limited to, habitat of species listed under federal or State endangered species laws* –Compliance with these requirements ensures that acutely toxic conditions to aquatic life passing through the acute mixing zone do not occur. Furthermore, the acute mixing zone will not cause acutely toxic conditions, allows adequate zones of passage and is sized appropriately to ensure that there will be no adverse impacts to biologically sensitive or critical habitats.

(5) *Shall not produce undesirable or nuisance aquatic life; result in floating debris, oil, or scum; produce objectionable color, odor, taste, or turbidity; cause objectionable bottom deposits; cause nuisance* – The acute mixing zone was for select parameters with aquatic toxicity criteria and objectives (copper, zinc, and ammonia) none of which should cause floating debris, oil, or scum; produce objectionable color, odor, taste, or turbidity; or cause objectionable bottom deposits; or cause a nuisance. Furthermore, this Order requires end-of-pipe effluent limitations for BOD_5 and TSS and discharge prohibitions to prevent these conditions from occurring. Receiving water monitoring is included to detect any problems.

(6) *Shall not dominate the receiving water body or overlap a mixing zone from different outfalls* – The acute mixing zone is small relative to the water body, so it will not dominate the water body. Furthermore, the mixing zone does not overlap mixing zones from other outfalls. The only other outfall and/or mixing zone in the 40-mile river segment is approximately 10 miles downstream of the Discharger's outfall.

(7) *Shall not be allowed at or near any drinking water intake* – There are no drinking water intakes within the acute mixing zone. There are no known downstream drinking water intakes between the discharge and Shasta Lake, 40 miles downstream.

The acute mixing zone of 75 feet for the subject parameters complies with the SIP and the Basin Plan; and an acute dilution credit of 3:1 for acute aquatic-life criteria for copper, zinc, and ammonia have been granted for the discharge and the Central Valley Water Board has used an acute aquatic life mixing zone of approximately 75 feet (length) by 24 feet (width) for calculating effluent limits for copper and zinc.

v. Evaluation of Available Dilution for Chronic Aquatic Life Criteria. The chronic aquatic life mixing zone is sized to protect the water body as a whole and is generally larger than the acute mixing zone. The Discharger has requested a chronic mixing zone for compliance with chronic aquatic-life water quality criteria for copper, zinc, and ammonia.

The Discharger has requested year-round chronic aquatic-life dilution credits of 15, 20, and 18 for copper, zinc, and ammonia, respectively. The specific values were requested in order to obtain water quality-based effluent limitations that the Discharger could meet based on past Facility performance. The maximum available year-round chronic dilution credit legally available at this site location is 12:1(which represents allocating the entire assimilative capacity of the localized river segment). The Discharger's requested dilution credits are greater than the maximum available, therefore they cannot be considered for analysis.

Seasonal dilution credits and/or a dilution credit less than the maximum available credit, however, may be considered by the Regional Board. The receiving water to effluent flow regimes in the winter and spring are not significantly different from each other and the fall period experiences the lowest receiving water flows on average, therefore, seasonal dilution credits are not considered appropriate for further analysis at this time.

For the purpose of evaluating available dilution for chronic aquatic-life criteria, a mixing zone length of 75 feet downstream of the diffuser was chosen for evaluation as this distance was the only downstream transect that did not have dye observed across the entire width of the river. Since the Discharger requested year-round dilution credits, the smallest dilution available between the three seasons was chosen as a conservative approach to analysis.

The Study reports that a mixing zone of 75 feet downstream of the diffuser (at a width of 24 feet) results in a chronic aquatic-life criteria dilution credit of 4. A dilution credit of 4:1 does not provide the Discharger with a water quality-based effluent limitation for copper, zinc, and ammonia that the Facility can reliably meet, based on past Facility performance. However, the 75-foot mixing zone has been examined for the purpose of compliance with the requirements of the SIP as follows:

(1) *Shall not compromise the integrity of the entire waterbody* - The TSD states that, "*If the total area affected by elevated concentrations within all* mixing *zones combined is small compared to the total area of a waterbody (such as a river segment), then mixing zones are likely to have little effect on the integrity of the waterbody as a whole, provided that the mixing zone does not impinge on unique or critical habitats.*"[15] The discharge is one of only two municipal wastewater treatment facility outfalls in 40 river miles. The river width at the outfall is approximately 40 feet wide and the chronic mixing zone is approximately 24 feet wide by 75 feet in length, allowing for a 16 feet zone-free passage on the west side of the river. Therefore, the total area affected is small compared to the total area of a waterbody and the chronic mixing zone is likely to have little effect on the integrity of the waterbody as a whole.

(2) *Shall not cause acutely toxic conditions to aquatic life passing through the mixing* zone –The chronic mixing zone does not allow acute aquatic life criteria to be exceeded and this Order requires acute bioassays to be conducted using 100% effluent. Compliance with these requirements ensures that acutely toxic conditions to aquatic life passing through the chronic mixing zone do not occur.

(3) *Shall not restrict the passage of aquatic life* – The chronic mixing zone length is 75 feet downstream from the diffuser. The width of the river is approximately 40 feet at the 75 feet transect location and the mixing zone is 60 percent of the river width at this location. Therefore, the chronic mixing zone is approximately 24 feet wide and allows for a 16 foot aquatic life passage on the west side of the river. Therefore, the chronic mixing zone does not restrict the passage of aquatic life..

(4) *Shall not adversely impact biologically sensitive or critical habitats, including, but not limited to, habitat of species listed under federal or State endangered species laws* – The chronic mixing zone does not allow acute aquatic life criteria to be exceeded and this Order requires acute bioassays to be conducted using 100% effluent. Compliance with these requirements ensures that acutely toxic conditions to aquatic life passing through the chronic mixing zone do not occur. Furthermore, the chronic mixing zone will not cause acutely toxic conditions, allows adequate zones of passage and is sized appropriately to ensure that there will be no adverse impacts to biologically sensitive or critical habitats.

(5) *Shall not produce undesirable or nuisance aquatic life; result in floating debris, oil, or scum; produce objectionable color, odor, taste, or turbidity; cause objectionable bottom deposits; cause nuisance* – The chronic mixing zone was for select aqutic toxicity criteria and objectives (copper, zinc, and ammonia) none of which should cause floating debris, oil, or scum;

[15] TSD, pg. 33

produce objectionable color, odor, taste, or turbidity; or cause objectionable bottom deposits; or cause a nuisance. Furthermore, this Order requires end-of-pipe effluent limitations for BOD_5 and TSS and discharge prohibitions to prevent these conditions from occurring. Receiving water monitoring is included to detect any problems.

(6) *Shall not dominate the receiving water body or overlap a mixing zone from different outfalls* – The chronic mixing zone is small relative to the water body, so it will not dominate the water body. Furthermore, the mixing zone does not overlap mixing zones from other outfalls. The only other outfall and/or mixing zone in the 40-mile river segment is approximately 10 miles downstream of the Discharger's outfall.

(7) *Shall not be allowed at or near any drinking water intake* – There are no drinking water intakes within the human health mixing zone. There are no known downstream drinking water intakes between the discharge and Shasta Lake, 40 miles downstream.

The chronic mixing zone of 75 feet for the subject parameters complies with the SIP and the Basin Plan; and an chronic dilution credit of 4:1 for chronic aquatic-life criteria for copper, zinc, and ammonia have been granted for the discharge and the Central Valley Water Board has used an chronic aquatic life mixing zone of approximately 75 feet (length) by 24 feet (width) for calculating effluent limits for copper and zinc.

vi. **Evaluation of Available Dilution for Human Health Criteria.** Human health-based criteria are generally based long-term exposures, such as safe levels for lifetime exposure (e.g., for carcinogens, consumption of 1 liter/day for 70 years) and the mixing zones typically extend beyond the near-field mixing zone. The Discharger has requested a human health mixing zone for compliance with human carcinogen criteria for bis (2-ethylhexyl) phthalate and dichlorobromomethane.

The Discharger has requested a human health dilution credit of 2 for both bis (2-ethylhexyl) phthalate and dichlorobromomethane. The Mixing Zone Study reports that a dilution credit of 2 results in a mixing zone size of approximately 17 feet downstream of the discharge for the fall, winter, and spring discharge periods. The width of the mixing zone at 17 feet downstream of the discharge is approximately 10 feet. The ultimate human health dilution ratio for the entire surface water discharge period is 30:1.

The proposed carcinogen mixing zone meets the requirements of the SIP as follows:

(1) *Shall not compromise the integrity of the entire waterbody* - The TSD states that, "*If the total area affected by elevated concentrations within all* mixing *zones combined is small compared to the total area of a waterbody*

(such as a river segment), then mixing zones are likely to have little effect on the integrity of the waterbody as a whole, provided that the mixing zone does not impinge on unique or critical habitats."[16] The Sacramento River is a large waterbody and the human health mixing zone is not applicable to aquatic life criteria. The human health mixing zone does not compromise the integrity of the entire waterbody.

(2) *Shall not cause acutely toxic conditions to aquatic life passing through the mixing* zone –The human health mixing zone is not applicable to aquatic life criteria. Therefore, acutely toxic conditions will not occur in the mixing zone.

(3) *Shall not restrict the passage of aquatic life* – The human health mixing zone is not applicable to aquatic life criteria. Therefore, the mixing zone will not restrict the passage of aquatic life.

(4) *Shall not adversely impact biologically sensitive or critical habitats, including, but not limited to, habitat of species listed under federal or State endangered species laws* – The human health mixing zone is not applicable to aquatic life criteria. The mixing zone will not impact biologically sensitive or critical habitats.

(5) *Shall not produce undesirable or nuisance aquatic life; result in floating debris, oil, or scum; produce objectionable color, odor, taste, or turbidity; cause objectionable bottom deposits; cause nuisance* – The allowance of a human health mixing zone will not produce undesirable or nuisance aquatic life, result in floating debris, oil, or scum; produce objectionable color, odor, taste, or turbidity; cause objectionable bottom deposits; or cause nuisance.

(6) *Shall not dominate the receiving water body or overlap a mixing zone from different outfalls* – The human health mixing zone is small relative to the water body, so it will not dominate the water body. Furthermore, the mixing zone does not overlap mixing zones from other outfalls. There are no outfalls or mixing zones in the vicinity of the discharge.

(7) *Shall not be allowed at or near any drinking water intake* – There are no drinking water intakes within the human health mixing zone. There are no known downstream drinking water intakes between the discharge and Shasta Lake, 40 miles downstream.

The human health mixing zone therefore complies with the SIP. The mixing zone also complies with the Basin Plan, which requires that the mixing zone not adversely impact beneficial uses. Beneficial uses will not be adversely affected for the same reasons discussed above. In determining the size of the mixing zone, the Central Valley Water Board

[16] TSD, pg. 33

considered the procedures and guidelines in the EPA's Water Quality Standards Handbook, 2d Edition (updated July 2007), Section 5.1, and Section 2.2.2 of the Technical Support Document for Water Quality-based Toxics Control (TSD). The SIP incorporates the same guidelines.

The Central Valley Water Board has used a human health mixing zone of approximately 17 feet (length) by 10 feet (width) for calculating effluent limits for bis (2-ethylhexyl) phthalate and dichlorobromomethane.

d. **Conversion Factors.** The CTR contains aquatic life criteria for arsenic, cadmium, chromium III, chromium VI, copper, lead, nickel, silver, and zinc which are presented in dissolved concentrations. USEPA recommends conversion factors to translate dissolved concentrations to total concentrations. The default USEPA conversion factors contained in Appendix 3 of the SIP were used to convert the applicable dissolved criteria to total recoverable criteria.

e. **Hardness-Dependent CTR Metals Criteria.** The *California Toxics Rule* and the *National Toxics Rule* contain water quality criteria for seven metals that vary as a function of hardness. The lower the hardness the lower the water quality criteria. The metals with hardness-dependent criteria include cadmium, copper, chromium III, lead, nickel, silver, and zinc.

This Order has established the criteria for hardness-dependent metals based on the reasonable worst-case ambient hardness as required by the SIP[17], the CTR[18] and State Water Board Order No. WQO 2008-0008 (City of Davis). The SIP and the CTR require the use of "receiving water" or "actual ambient" hardness, respectively, to determine effluent limitations for these metals. (SIP, § 1.2; 40 CFR § 131.38(c)(4)). The CTR does not define whether the term "ambient," as applied in the regulations, necessarily requires the consideration of upstream as opposed to downstream hardness conditions. Therefore, where reliable, representative data are available, the hardness value for calculating criteria can be the downstream receiving water hardness, after mixing with the effluent (Order WQO 2008-0008, p. 11). The Central Valley Water Board thus has considerable discretion in determining ambient hardness (*Id.*, p.10).

As discussed below, scientific literature provides a reliable method for calculating protective hardness-dependent CTR criteria, considering all discharge conditions. This methodology produces hardness-dependent CTR criteria based on the reasonable worst-case downstream ambient hardness that ensure these metals do not cause receiving water toxicity under any downstream receiving water condition. Under this methodology, the Central Valley Water Board considers all hardness conditions that could occur in the

[17] The SIP does not address how to determine the hardness for application to the equations for the protection of aquatic life when using hardness-dependent metals criteria. It simply states, in Section 1.2, that the criteria shall be properly adjusted for hardness using the hardness of the receiving water.

[18] The CTR requires that, for waters with a hardness of 400 mg/L (as $CaCO_3$), or less, the actual ambient hardness of the surface water must be used. It further requires that the hardness values used must be consistent with the design discharge conditions for design flows and mixing zones.

ambient downstream receiving water after the effluent has mixed with the water body[19]. This ensures that effluent limitations are fully protective of aquatic life in all areas of the receiving water affected by the discharge under all flow conditions, at the fully mixed location, and throughout the water body including at the point of discharge into the water body.

i. **Conducting the Reasonable Potential Analysis (RPA).** The SIP in Section 1.3 states, "The RWQCB shall...determine whether a discharge may: (1) cause, (2) have a reasonable potential to cause, or (3) contribute to an excursion above any applicable priority pollutant criterion or objective." Section 1.3 provides a step-by-step procedure for conducting the RPA. The procedure requires the comparison of the maximum effluent concentration Maximum Effluent Concentration (MEC) and maximum ambient background concentration Maximum Ambient Background Concentration to the applicable criterion that has been properly adjusted for hardness. Unless otherwise noted, for the hardness-dependent CTR metals criteria the following procedures were followed for properly adjusting the criterion for hardness when conducting the RPA.

a) The SIP requires a WQBEL if the MEC exceeds the applicable criterion, adjusted for hardness. For comparing the MEC to the applicable criterion, the "fully mixed" reasonable worst-case downstream ambient hardness was used to adjust the criterion. In this evaluation the portion of the receiving water affected by the discharge is analyzed. For hardness-dependent criteria, the hardness of the effluent has an impact on the determination of the applicable criterion in areas in the receiving water affected by the discharge. Therefore, for comparing the MEC to the applicable criterion, the reasonable worst-case downstream ambient hardness was used to adjust the criterion. For this situation it is necessary to consider the hardness of the effluent in determining the applicable hardness to adjust the criterion. The procedures for determining the applicable criterion after proper adjustment using the reasonable worst-case downstream hardness is outlined in subsection ii, below.

b) The SIP requires a WQBEL if the receiving water is impaired upstream (outside the influence) of the discharge, i.e., if the Maximum Ambient Background Concentration of a pollutant exceeds the applicable criterion, adjusted for hardness[20]. For comparing the Maximum Ambient Background Concentration to the applicable criterion, the reasonable worst-case upstream ambient hardness was used to adjust the criteria. This is appropriate, because this area is outside the influence of the discharge. Since the discharge does not impact the

[19] All effluent discharges will change the ambient downstream metals concentration and hardness. It is not possible to change the metals concentration without also changing the hardness.
[20] The pollutant must also be detected in the effluent.

upstream hardness, the effect of the effluent hardness was not included in this evaluation.

ii. Calculating Water Quality-Based Effluent Limitations. The remaining discussion in this section relates to the development of water quality-based effluent limitations (WQBELs) limits when it has been determined that the discharge has reasonable potential to cause or contribute to an exceedance of the CTR hardness-dependent metals criteria in the receiving water.

A 2006 Study[21] developed procedures for calculating the effluent concentration allowance (ECA)[22] for CTR hardness-dependent metals. The 2006 Study demonstrated that it is necessary to evaluate all discharge conditions (e.g. high and low flow conditions) and the hardness and metals concentrations of the effluent and receiving water when determining the appropriate ECA for these hardness-dependent metals. This method is superior to relying on downstream receiving water samples alone because it captures all possible mixed conditions in the receiving water. Both receiving water and effluent hardness vary based on flow and other factors, but the variability of receiving water and effluent hardness is sometimes independent. Using a calculated hardness value ensures that the Central Valley Water Board considers all possible mixed downstream values that may result from these two independent variables. Relying on receiving water sampling alone is less likely to capture all possible mixed downstream conditions.

The equation describing the total recoverable regulatory criterion, as established in the CTR[23], is as follows:

$$\text{CTR Criterion} = \text{WER} \times (e^{m[\ln(H)]+b}) \qquad \text{(Equation 1)}$$

Where:

H = hardness (as $CaCO_3$)[24]
WER = water-effect ratio
m, b = metal- and criterion-specific constants

In accordance with the CTR, the default value for the WER is 1. A WER study must be conducted to use a value other than 1. The constants "m" and "b" are specific to both the metal under consideration, and the type of total recoverable criterion (i.e., acute or chronic). The metal-specific

[21] Emerick, R.W.; Borroum, Y.; & Pedri, J.E., 2006. California and National Toxics Rule Implementation and Development of Protective Hardness Based Metal Effluent Limitations. WEFTEC, Chicago, Ill.
[22] The ECA is defined in Appendix 1 of the SIP (page Appendix 1-2). The ECA is used to calculate water quality-based effluent limitations in accordance with Section 1.4 of the SIP
[23] 40 CFR § 131.38(b)(2).
[24] For this discussion, all hardness values are in mg/L as $CaCO_3$.

values for these constants are provided in the CTR at paragraph (b)(2), Table 1.

The equation for the ECA is defined in Section 1.4, Step 2, of the SIP and is as follows:

$$ECA = C \quad (\text{when } C \leq B)^{25} \qquad \text{(Equation 2)}$$

Where:

C = the priority pollutant criterion/objective, adjusted for hardness (see Equation 1, above)

B = the ambient background concentration

The 2006 Study demonstrated that the relationship between hardness and the calculated criteria is the same for some metals, so the same procedure for calculating the ECA may be used for these metals. The same procedure can be used for chronic cadmium, chromium III, copper, nickel, and zinc. These metals are hereinafter referred to as "Concave Down Metals". "Concave Down" refers to the shape of the curve represented by the relationship between hardness and the CTR criteria in Equation 1. Another similar procedure can be used for determining the ECA for acute cadmium, lead, and acute silver, which are referred to hereafter as "Concave Up Metals".

ECA for Chronic Cadmium, Chromium III, Copper, Nickel, and Zinc – For Concave Down Metals (i.e., chronic cadmium, chromium III, copper, nickel, and zinc) the 2006 Study demonstrates that when the effluent is in compliance with the CTR criteria and the upstream receiving water is in compliance with the CTR criteria, any mixture of the effluent and receiving water will always be in compliance with the CTR criteria[26]. The 2006 Study proves that regardless of whether the effluent hardness is lower or greater than the upstream hardness, the reasonable worst-case flow condition is the effluent dominated condition (i.e., no receiving water flow)[27]. Consequently, for Concave Down Metals, the CTR criteria have been calculated using the downstream ambient hardness under this condition.

The effluent hardness ranged from 39 mg/L to 67 mg/L, based on 16 samples from January 2007 through June 2011. The upstream receiving

[25] The 2006 Study assumes the ambient background metals concentration is equal to the CTR criterion (i.e. C ≤ B)

[26] 2006 Study, p. 5700

[27] There are two typographical errors in the 2006 Study in the discussion of Concave Down Metals when the effluent hardness is less than the receiving water hardness. The effluent and receiving water hardness were transposed in the discussion, but the correct hardness values were used in the calculations. The typographical errors were confirmed by the author of the 2006 Study, by email dated 1 April 2011, from Dr. Robert Emerick to Mr. James Marshall, Central Valley Water Board.

water hardness varied from 47 mg/L to 69 mg/L, based on 28 samples from January 2007 through June 2011, and the downstream receiving water hardness varied from 43 mg/L to 69 mg/L, during the same period. Under the effluent dominated condition, the reasonable worst-case downstream ambient hardness is 39 mg/L. As demonstrated in the example shown in Table F-13a, below, using this hardness to calculate the ECA for all Concave Down Metals will result in water quality-based effluent limitations that are protective under all flow conditions, from the effluent dominated condition to high flow condition. This example for copper assumes the following conservative conditions for the upstream receiving water:

- Upstream receiving water always at the lowest observed upstream receiving water hardness (i.e., 47 mg/L)
- Upstream receiving water copper concentration always at the CTR criteria (i.e., no assimilative capacity).

Using these reasonable worst-case receiving water conditions, a simple mass balance (as shown in Equation 3, below) accounts for all possible mixtures of effluent and receiving water under all flow conditions.

$$C_{MIX} = C_{RW} \times (1\text{-}EF) + C_{Eff} \times (EF) \qquad \text{(Equation 3)}$$

Where:

C_{MIX} = Mixed concentration (e.g. metals or hardness)
C_{RW} = Upstream receiving water concentration
C_{Eff} = Effluent concentration
EF = Effluent Fraction

In this example, for copper, for any receiving water flow condition (high flow to low flow), the fully-mixed downstream ambient copper concentration is in compliance with the CTR criteria.[28].

[28] This method considers the actual lowest upstream hardness and actual lowest effluent hardness to determine the reasonable worst-case ambient downstream hardness under all possible receiving water flow conditions. Table F-13a demonstrates that the receiving water is always in compliance with the CTR criteria at the fully-mixed location in the receiving water. It also demonstrates that the receiving water is in compliance with the CTR criteria for all mixtures from the point of discharge to the fully-mixed location. Therefore, a mixing zone is not used for compliance.

Table F-13a. Copper ECA Evaluation

Lowest Observed Effluent Hardness					**39mg/L (as $CaCO_3$)**
Lowest Observed Upstream Receiving Water Hardness					**47 mg/L (as $CaCO_3$)**
Highest Assumed Upstream Receiving Water Copper Concentration					**4.89 µg/L[1]**
Copper $ECA_{chronic}$[2]					**4.17 µg/L**
Effluent Fraction[6]		**Fully Mixed Downstream Ambient Concentration**			
		Hardness[3] (mg/L)	**CTR Criteria[4] (µg/L)**	**Copper[5] (µg/L)**	**Complies with CTR Criteria**
High Flow	1%	46.9	4.89	4.89	**Yes**
	5%	46.6	4.86	4.86	**Yes**
	15%	45.8	4.79	4.79	**Yes**
	25%	45.0	4.72	4.71	**Yes**
	50%	43.0	4.54	4.53	**Yes**
	75%	41.0	4.35	4.35	**Yes**
Low Flow	100%	39.0	4.17	4.17	**Yes**

1 Highest assumed upstream receiving water copper concentration calculated using Equation 1 for chronic criterion at a hardness of 47 mg/L.

2 ECA calculated using Equation 1 for chronic criterion at a hardness of 39 mg/L.

3 Fully mixed downstream ambient hardness is the mixture of the receiving water and effluent hardness at the applicable effluent fraction using Equation 3.

4 Fully mixed downstream ambient criteria are the chronic criteria calculated using Equation 1 at the mixed hardness.

5 Fully mixed downstream ambient copper concentration is the mixture of the receiving water and effluent copper concentrations at the applicable effluent fraction using Equation 3.

6 The effluent fraction ranges from 1% at the high receiving water flow condition, to 100% at the lowest receiving water flow condition (i.e., effluent dominated).

ECA for Acute Cadmium, Lead, and Acute Silver – For Concave Up Metals (i.e., acute cadmium, lead, and acute silver), the relationship between hardness and the metals criteria is different than for Concave Down Metals. The 2006 Study demonstrates that for Concave Up Metals, the effluent and upstream receiving water can be in compliance with the CTR criteria, but the resulting mixture may contain metals concentrations that exceed the CTR criteria and could cause toxicity. For these metals, the 2006 Study provides a mathematical approach to calculate the ECA that is protective of aquatic life, in all areas of the receiving water affected by the discharge, under all discharge and receiving water flow (see Equation 4, below).

The ECA, as calculated using Equation 4, is based on the reasonable worst-case upstream receiving water hardness, the lowest observed effluent hardness, and assuming no receiving water assimilative capacity for metals (i.e., ambient background metals concentrations are at their respective CTR criterion). Equation 4 is not used in place of the CTR equation (Equation 1). Rather, Equation 4, which is derived using the CTR equation, is used as a direct approach for calculating the ECA. This

replaces an iterative approach for calculating the ECA. The CTR equation has been used to evaluate the receiving water downstream of the discharge at all discharge and flow conditions to ensure the ECA is protective (e.g., see Table F-13b).

$$ECA = \left(\frac{m(H_e - H_{rw})\left(e^{m\{\ln(H_{rw})\}+b}\right)}{H_{rw}} \right) + e^{m\{\ln(H_{rw})\}+b} \qquad \text{(Equation 4)}$$

Where:

m, b = criterion specific constants (from CTR)

H_e = lowest observed effluent hardness

H_{rw} = reasonable worst-case upstream receiving water hardness

In some instances, the receiving water may already contain concentrations of concave up metals that exceed water quality criteria associated with the hardness condition previous to the discharge. The 2006 study procedures remain applicable under these conditions. The discharge cannot cause or contribute to a violation of water quality criteria/objectives in the receiving water. Although metals concentrations downstream of the discharge exceed CTR criteria, the cause of the exceedance is not due to the discharge, it is due to the elevated metals concentrations upstream of the discharge. Implementing the procedures of the 2006 study does not result in an increase in toxicity downstream of the discharge, and in fact reduces the amount of toxicity already present in the receiving water. This is demonstrated in the example below for lead (see Table F-13b).

An example similar to the Concave Down Metals is shown for lead, a Concave Up Metal, in Table F-13b, below. As previously mentioned, the lowest effluent hardness is 39 mg/L, while the upstream receiving water hardness ranged from 47 mg/L to 69 mg/L, and the downstream receiving water hardness ranged from 43 mg/L to 69 mg/L. In this case, the reasonable worst-case upstream receiving water hardness to use in Equation 4 to calculate the ECA is 47 mg/L.

In this case for lead, the lowest possible fully-mixed downstream hardness is 39 mg/L (see last row of Table F-13b), which corresponds to a total recoverable chronic ECA of 1.0 µg/L, using Equations 1 and 2. However, a lower chronic ECA is required to ensure the discharge does not cause toxicity at any location in the receiving water, at or downstream of the discharge, which would be a violation the Basin Plan's narrative toxicity

objective[29]. This is because for concave up metals, mixing two waters with different hardness with metals concentrations at their respective CTR criteria will always result in CTR criterion exceedances[30]. As shown in Table F-13b, a chronic ECA of 1.0 µg/L is necessary to be protective under all discharge conditions. In this example for lead, for any receiving water flow condition (high flow to low flow), the fully-mixed downstream ambient lead concentration is in compliance with the CTR criteria.

Using the procedures discussed above to calculate the ECA for all Concave Up Metals will result in water quality-based effluent limitations that are protective under all potential effluent/receiving water flow conditions (high flow to low flow) and under all known hardness conditions, as demonstrated in Table F-13b, for lead.

Table F-13b. Lead ECA Evaluation

				Lowest Observed Effluent Hardness	**39 mg/L**
				Reasonable Worst-case Upstream Receiving Water Hardness	**47 mg/L**
				Reasonable Worst-case Upstream Receiving Water Lead Concentration	**1.22 µg/L[1]**
				Lead $ECA_{chronic}$[2]	**1.0 µg/L**
Effluent Fraction[6]		**Fully Mixed Downstream Ambient Concentration**			
		Hardness[3] (mg/L) (as $CaCO_3$)	**CTR Criteria[4] (µg/L)**	**Lead[5] (µg/L)**	**Complies with CTR Criteria**
High Flow	1%	46.9	1.2	1.2	**Yes**
	5%	46.6	1.2	1.2	**Yes**
	15%	45.8	1.2	1.2	**Yes**
	25%	45.0	1.2	1.2	**Yes**
	50%	43.0	1.1	1.1	**Yes**
	75%	41.0	1.0	1.0	**Yes**
Low Flow	100%	39.0	1.0	1.0	**Yes**

1 Reasonable worst-case upstream receiving water lead concentration calculated using Equation 1 for chronic criterion at a hardness of 47 mg/L.

2 ECA calculated using Equation 4 for chronic criteria.

3 Fully mixed downstream ambient hardness is the mixture of the receiving water and effluent hardness at the applicable effluent fraction.

4 Fully mixed downstream ambient criteria are the chronic criteria calculated using Equation 1 at the mixed hardness.

5 Fully mixed downstream ambient lead concentration is the mixture of the receiving water and effluent lead concentrations at the applicable effluent fraction.

6 The effluent fraction ranges from 1% at the high receiving water flow condition, to 100% at the lowest receiving water flow condition (i.e., effluent dominated).

[29] "All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life." (Basin Plan, p. III-8.01.)

[30] Emerick, R.W.; Borroum, Y.; & Pedri, J.E., 2006. California and National Toxics Rule Implementation and Development of Protective Hardness Based Metal Effluent Limitations. WEFTEC, Chicago, Ill. (p. 5702)

Based on the procedures discussed above, Table F-14 lists all the CTR hardness-dependent metals and the associated ECA used in this Order.

Table F-14. Summary of ECA Evaluations for CTR Hardness-dependent Metals

CTR Metals	ECA (µg/L, total recoverable)		
	Acute	Chronic	Basin Plan Instantaneous Maximum
Copper	4.17	5.77	5.72
Chromium III	--	95.72	--
Cadmium	1.56	1.18	0.22
Lead	24.5	1.0	--
Nickel	--	23.52	--
Silver	0.78	--	--
Zinc	53.95	53.95	16.02

3. Determining the Need for WQBELs

a. The Central Valley Water Board conducted the reasonable potential analysis (RPA) in accordance with section 1.3 of the SIP. Although the SIP applies directly to the control of CTR priority pollutants, the State Water Board has held that the Regional Water Boards may use the SIP as guidance for water quality-based toxics control.[31] The SIP states in the introduction "*The goal of this Policy is to establish a standardized approach for permitting discharges of toxic pollutants to non-ocean surface waters in a manner that promotes statewide consistency.*" Therefore, in this Order the RPA procedures from the SIP were used to evaluate reasonable potential for both CTR and non-CTR constituents based on information submitted as part of the application, in studies, and as directed by monitoring and reporting programs.

b. Constituents with No Reasonable Potential. WQBELs are not included in this Order for constituents that do not demonstrate reasonable potential (i.e. constituents were not detected in the effluent or receiving water); however, monitoring for those pollutants is established in this Order as required by the SIP. If the results of effluent monitoring demonstrate reasonable potential, this Order may be reopened and modified by adding an appropriate effluent limitation.

i. 4,4'-DDT

(a) WQO. The CTR includes a 4,4'-DDT criterion of 0.00059 µg/L for the protection of human health for waters from which both water and organisms are consumed.

[31] See Order WQO 2001-16 (Napa) and Order WQO 2004-0013 (Yuba City).

(b) RPA Results. The maximum effluent concentration (MEC) for 4,4'-DDT was <0.002 µg/L (non-detect) in all 7 effluent samples collected between September 2007 and December 2010. The maximum observed upstream receiving water concentration <0.002 µg/L (non-detect) out of 4 samples collected between January 2009 and December 2010. The minimum quantifiable level for 4,4'-DDT required by the SIP is 0.01 µg/L. The detection limit for the subject samples were 0.002 µg/L, which is less than the minimum reporting levels required by the SIP. Therefore, 4,4'-DDT in the discharge does not have reasonable potential to cause or contribute to an in-stream excursion above the CTR criterion for the protection of human health.

c. Constituents with Limited Data. Reasonable potential cannot be determined for the following constituents because effluent data are limited or ambient background concentrations are not available. Aluminum has been included in this section due to the need for the development of an appropriate site-specific chronic aquatic-life criterion for this discharge. The Discharger is required to continue to monitor for these constituents in the effluent using analytical methods that provide the best feasible detection limits. When additional data become available, further analysis will be conducted to determine whether to add numeric effluent limitations or to continue monitoring.

i. Aluminum

(a) WQO. Aluminum is not a CTR constituent. The Basin Plan includes the narrative toxicity objective, which states that, "*All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life.*" (Basin Plan at III-8.00) The Basin Plan's *Policy for Application of Water Quality Objectives* requires the Central Valley Water Board to consider, "*on a case-by case basis, direct evidence of beneficial use impacts, all material and relevant information submitted by the discharger and other interested parties, and relevant numerical criteria and guidelines developed and/or published by other agencies and organizations. In considering such criteria, the Board evaluates whether the specific numerical criteria which are available through these sources and through other information supplied to the Board, are relevant and appropriate to the situation at hand and, therefore, should be used in determining compliance with the narrative objective.*" (Basin Plan, p. IV.-17.00; see also, 40 CFR 122.44(d)(vi).).

The Central Valley Water Board considered all available material and relevant information submitted by the Discharger, and relevant numerical criteria and guidelines developed and/or published by other agencies and organizations, the USEPA National Recommended Ambient Water Quality Criteria (NAWQC) and supporting studies, National Recommended Water Quality Criteria-Correction and site-

specific aluminum studies conducted by other dischargers within the Central Valley Region in evaluating the appropriate criteria for protection of the beneficial uses to comply with the narrative toxicity objective.

USEPA developed the NAWQC for protection of freshwater aquatic life for aluminum. The recommended 4-day average (chronic) and 1-hour average (acute) criteria for aluminum are 87 µg/L and 750 µg/L, respectively, for waters with a pH of 6.5 to 9.0. The NAWQC chronic aquatic life criterion of 87 µg/L is based on studies conducted under conditions with low pH (6.5 – 6.6) and low hardness (<10 mg/L as $CaCO_3$) to determine the effects on striped bass and brook trout. The USEPA secondary maximum contaminant level for protection of human health is 200 µg/L.

In April 1999, USEPA released the National Recommended Water Quality Criteria-Correction. There were no corrections to the 1988 aluminum recommended criteria; however, USEPA recognized that they were aware of field data indicating that many high quality waters of the U.S. contain more than 87 µg/L aluminum, when either total recoverable or dissolved is measured (i.e., the higher levels of aluminum did not affect beneficial uses). Information in Footnote L to the NAWQC Correction summary table for aluminum suggests the use of a WER may be appropriate in instances where water quality ambient conditions differ from those used by EPA.

Receiving water monitoring data demonstrates that NAWQC study conditions (low pH and low hardness) are not similar to those in the upper Sacramento River, which consistently has an upstream hardness concentrations ranging from 47 to 69 mg/L as $CaCO_3$ and the pH ranging from 6.7 to 8.4 s.u. However, the upper Sacramento River does support a large population of rainbow trout, and brook trout may be present in the watershed.

Site specific aluminum toxicity studies have also been conducted within the Central Valley Region. These studies were performed by dischargers for the purpose of evaluating the appropriate chronic aquatic life criterion for implementing the Basin Plan's narrative toxicity objective. The results of the Central Valley Region aluminum toxicity studies indicate that the NAWQC chronic criterion of 87 µg/L may be overly stringent for hardness ranging from 16 to 250 mg/L as $CaCO_3$.

Therefore, due to 1) the site-specific hardness and pH conditions being greater than the hardness conditions under which the NAWQC chronic criterion was developed, 2) the results of Central Valley Region aluminum toxicity studies, 3) the Discharger's chronic toxicity test (which showed no adverse effects at 100% effluent), and 4) the

Discharger's acute toxicity tests (which showed no adverse effects to rainbow trout at 100% effluent), the applicability of the NAWQC chronic criterion remains uncertain. For these reasons, the NAWQC chronic criterion of 87 µg/L has not been included in the Reasonable Potential Analysis at this time. This Order requires the Discharger to conduct a site-specific study to determine the appropriate chronic aquatic life criterion for aluminum. The NAWQC acute aquatic life criterion of 750 µg/L and the USEPA secondary MCL for protection of human health of 200 µg/L have been used to conduct the RPA.

(b) RPA Results. The maximum effluent concentration (MEC) for aluminum was 377 µg/L while the maximum observed upstream receiving water concentration was 20.9 µg/L. Therefore, aluminum in the discharge does not have the reasonable potential to cause or contribute to an in-stream excursion above the 750 µg/L acute criterion. Furthermore, the maximum annual effluent concentration for aluminum was 179 µg/L while the maximum annual average upstream receiving water concentration was 18.1 µg/L. Therefore, aluminum in the discharge does not have a reasonable potential to cause or contribute to an in-stream excursion above the Secondary MCL - Consumer Acceptance Limit for aluminum of 200 µg/L.

During the past permit cycle, the Discharger used an aluminum-based coagulant in the wastewater treatment process. This use was the likely source of aluminum in the effluent. In July 2012, the Discharger discontinued the use of the aluminum-based coagulant and replaced the product with coagulant that does not contain aluminum. Monthly effluent and semi-annual receiving water aluminum monitoring has been established in this Order. The Discharger is required to submit a report on the results of aluminum site-specific studies to determine appropriate aluminum levels necessary to protect downstream aquatic life beneficial uses.

ii. Cadmium

(a) WQO. The CTR includes hardness dependent criteria for the protection of freshwater aquatic life for cadmium. The Basin Plan also includes a hardness dependent water quality objective for cadmium. Using the default conversion factors and reasonable worst-case measured hardness, as described in section VI.C.2.c of this Fact Sheet, the applicable CTR acute (1-hour average) criterion is 1.5 µg/L and the applicable CTR chronic (4-day average) criterion is 1.18 µg/L., as total recoverable. The Basin Plan maximum water quality objective for cadmium is 0.22 µg/L.

(b) RPA Results. Five effluent samples were collected between October 2010 and January 2011 and analyzed for total recoverable cadmium. The maximum effluent concentration (MEC) for cadmium

was 0.24 µg/L; however, this result was not quantifiable by the laboratory that performed the analysis and is considered an estimated concentration. All other effluent cadmium concentrations were non-detect (<0.05 µg/L). Four receiving water samples were collected between October 2010 and December 2010. The maximum observed upstream concentration was 0.32 µg/L. All other receiving water cadmium concentrations were reported as non-detect (<0.05 µg/L).

Effluent and receiving water cadmium data is summarize in the table below:

Date	Effluent (µg/L)	Receiving Water (µg/L)	SIP Minimum Level (µg/L)
10/27/2010	<0.05	<0.05	0.25
11/09/2010	<0.05	0.32	0.25
12/01/2010	<0.05	<0.05	0.25
12/16/2010	<0.05	<0.05	0.25
1/19/2011	0.24 DNQ	--	0.25

SIP Section 2.4.2 states that the Minimum Level (ML) is the lowest quantifiable concentration in a sample based on the proper application of all method-based analytical procedures and the absence of any matrix interferences.

a) Required MLs are listed in Appendix 4 of the SIP. Where more than one ML is listed in Appendix 4, the discharger may select any one of the cited analytical methods for compliance determination. The selected ML used for compliance determination is referred to as the Reporting Level (RL).

b) A Reporting Level can be lower than the Minimum Level in Appendix 4 only when the discharger agrees to use a Reporting Level that is lower than the Minimum Level listed in Appendix 4. The Regional Board and the discharger have no agreement to use a Reporting Limit lower than the listed Minimum Levels.

c) SIP Section 1.2 requires that the Regional Board use all available, valid, relevant, representative data and information, as determined by the Regional Board, to implement the SIP. SIP Section 1.2 further states that the Regional Board has the discretion to consider if any data are inappropriate or insufficient for use in implementing the SIP.

d) Data reported below the Minimum Level indicates the data may not be valid due to possible matrix interferences during the analytical procedure.

e) Further, SIP Section 2.4.5 (Compliance Determination) supports the insufficiency of data reported below the Minimum Level or Reporting Level. In part it states, "Dischargers shall be deemed out of compliance with an effluent limitation, for reporting and administrative

enforcement purposes, if the concentration of the priority pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the RL." Thus, if submitted data is below the Reporting Limit, that data cannot be used to determine compliance with effluent limitations.

f) Data reported below the Minimum Level is not considered valid data for use in determining Reasonable Potential. Therefore, in accordance with Section 1.2 of the SIP, the Board has determined that data reported below the Minimum Level is inappropriate and insufficient to be used to determine Reasonable Potential.

g) In implementing its discretion, the Board is not finding that Reasonable Potential does not exist; rather the Board cannot make such a determination given the invalid data. Therefore, the Board will require additional monitoring for such constituents until such time a determination can be made in accordance with the SIP policy.

SIP Appendix 4 cites several Minimum Levels (ML) for cadmium. The lowest ML cited for cadmium is 0.25 µg/L. The Discharger used an analytical method that was more sensitive than the minimum level required by the SIP. The effluent results contained one estimated value and four non-detects, all below the lowest ML (refer to table above). Therefore the submitted effluent cadmium data is inappropriate and insufficient to determine reasonable potential under the SIP.

The upstream receiving water concentration of 0.32 µg/L exceeds the Basin Plan objective. Section 1.3, Step 6 of the SIP states that if the receiving water concentration exceeds the criteria and the pollutant is detected in the effluent, an effluent limitation is required. However; only one of five effluent samples collected detected cadmium and the detected value was a laboratory estimate. Therefore, as discussed in detail above, insufficient effluent data is available at this time to justify establishing an effluent limitation for cadmium.

Section 1.3, Step 8 of the SIP allows the Central Valley Water Board to require additional monitoring for a pollutant in place of an effluent limitation if data are unavailable or insufficient. Instead of limitations, additional monitoring has been established for cadmium. Should monitoring results indicate that the discharge has the reasonable potential to cause or contribute to an exceedance of a water quality standard, then this Order may be reopened and modified by adding an appropriate effluent limitation.

iii. Salinity

(a) WQO. The Basin Plan contains a chemical constituent objective that incorporates state MCLs, contains narrative objectives, and contains

numeric water quality objectives for certain specified water bodies for electrical conductivity, total dissolved solids, sulfate, and chloride. The USEPA Ambient Water Quality Criteria for Chloride recommends acute and chronic criteria for the protection of aquatic life. There are no USEPA water quality criteria for the protection of aquatic life for electrical conductivity, total dissolved solids, and sulfate. Additionally, there is no USEPA numeric water quality criteria for the protection of agriculture, industrial and livestock are typical. Numeric values for the protection of these uses are typically done based on site specific conditions and evaluations to determine the appropriate constituent threshold necessary to interpret the narrative chemical constituent Basin Plan objective.

Table F-15. Salinity Water Quality Criteria/Objectives

Parameter	Agricultural WQ Objective[1]	Secondary MCL[3]	USEPA NAWQC	Effluent	
				Average	Maximum
EC (µmhos/cm)	Varies[2]	900, 1600, 2200	N/A	**340**	**454**
TDS (mg/L)	Varies	500, 1000, 1500	N/A	**198**	**276**
Sulfate (mg/L)	Varies	250, 500, 600	N/A	**n/a**	**n/a**
Chloride (mg/L)	Varies	250, 500, 600	860 1-hr, 230 4-day	**24.2**	**29.2**

1 Narrative chemical constituent objective of the Basin Plan. Procedures for establishing the applicable numeric limitation to implement the narrative objective can be found in the Policy for Application of Water Quality, Chapter IV, Section 8 of the Basin Plan., However, the Basin Plan does not require improvement over naturally occurring background concentrations. In cases where the natural background concentration of a particular constituent exceeds an applicable water quality objective, the natural background concentration will be considered to comply with the objective.

2 The EC level in irrigation water that harms crop production depends on the crop type, soil type, irrigation methods, rainfall, and other factors.

3 The secondary MCLs are stated as a recommended level, upper level, and a short-term maximum level.

(1) Chloride. The secondary MCL for chloride is 250 mg/L, as a recommended level, 500 mg/L as an upper level, and 600 mg/L as a short-term maximum. The Central Valley Water Board must determine the applicable numeric limit to implement the narrative objective for the protection of agricultural supply. The most limiting agricultural water quality goal to interpret the narrative chemical constituents objective is 106 mg/L as a long-term average based on Water Quality for Agriculture, Food and Agriculture Organization of the United Nations—Irrigation and Drainage Paper No. 29, Rev. 1 (R.S. Ayers and D.W. Westcot, Rome, 1985). The 106 mg/L water quality goal is intended to protect against adverse effects on sensitive crops when irrigated via sprinklers. However, the agricultural water quality goal is not a site-specific goal or objective, but rather a general measure to protect salt-

sensitive crops. Site specific levels of chloride for the receiving waters are necessary to interpret the narrative chemical constituents objective for protection of agricultural supply.

The Central Valley Water Board is currently implementing the CV-SALTS initiative to develop a Basin Plan Amendment that will establish a salt and nitrate Management Plan for the Central Valley. Through this effort the Basin Plan will be amended to define how the narrative water quality objective is to be interpreted for the protection of agricultural use. All studies conducted through this Order to establish an agricultural limit to implement the narrative objective will be reviewed by and consistent with the efforts currently underway by CV-SALTS.

(2) Electrical Conductivity. The secondary MCL for EC is 900 µmhos/cm as a recommended level, 1600 µmhos/cm as an upper level, and 2200 µmhos/cm as a short-term maximum. The Central Valley Water Board must determine the applicable numeric limit to implement the narrative objective for the protection of agricultural supply, The most limiting agricultural water quality goal may be as low as 700 µmhos/cm as a long-term average based on Water Quality for Agriculture, Food and Agriculture Organization of the United Nations—Irrigation and Drainage Paper No. 29, Rev. 1 (R.S. Ayers and D.W. Westcot, Rome, 1985). However, the 700 µmhos/cm agricultural water quality goal is not a site-specific goal or objective, but rather a general measure of electrical conductivity that was determined to protect salt-sensitive crops, such as beans, carrots, turnips, and strawberries under certain soil and climate conditions. Site specific levels of EC for the receiving waters to interpret the narrative chemical constituents objective in the Basin Plan for protection of agricultural supply are necessary. Overall, however, the salinity of the agricultural irrigation water must be maintained at levels in which growers do not need to take extra measures to minimize or eliminate any harmful impacts.

The Central Valley Water Board is currently implementing the CV-SALTS initiative to develop a Basin Plan Amendment that will establish a salt and nitrate Management Plan for the Central Valley. Through this effort the Basin Plan will be amended to define how the narrative water quality objective is to be interpreted for the protection of agricultural use. All studies conducted through this Order to establish an agricultural limit to implement the narrative objective will be reviewed by and consistent with the efforts currently underway by CV-SALTS.

(3) Sulfate. The secondary MCL for sulfate is 250 mg/L as a recommended level, 500 mg/L as an upper level, and 600 mg/L as a short-term maximum.

(4) Total Dissolved Solids. The secondary MCL for TDS is 500 mg/L as a recommended level, 1000 mg/L as an upper level, and 1500 mg/L as a short-term maximum. The Central Valley Water Board must determine the applicable numeric limit to implement the narrative objective for the protection of agricultural supply, the most limiting agricultural water quality goal may be as low as 450 mg/L as a long-term average based on Water Quality for Agriculture, Food and Agriculture Organization of the United Nations—Irrigation and Drainage Paper No. 29, Rev. 1 (R.S. Ayers and D.W. Westcot, Rome, 1985). Water Quality for Agriculture evaluates the impacts of salinity levels on crop tolerance and yield reduction, and establishes water quality goals that is not a site-specific goal, but rather a general measure of TDS that was determined to protect salt-sensitive crops. Only the most salt sensitive crops require irrigation water of 450 mg/L or less to prevent loss of yield. Most other crops can tolerate higher TDS concentrations without harm. Site specific levels of TDS for the receiving waters to interpret the narrative chemical constituents objective are necessary.

The Central Valley Water Board is currently implementing the CV-SALTS initiative to develop a Basin Plan Amendment that will establish a salt and nitrate Management Plan for the Central Valley. Through this effort the Basin Plan will be amended to define how the narrative water quality objective is to be interpreted for the protection of agricultural use. All studies conducted through this Order to establish an agricultural limit to implement the narrative objective will be reviewed by and consistent with the efforts currently underway by CV-SALTS.

(b) RPA Results.

(1) Chloride. Chloride concentrations in the effluent ranged from 15 mg/L to 29.2 mg/L, with an average of 24.2 mg/L, for the 6 samples collected by the Discharger in 2009 and 2010. Ambient background concentrations of chloride in the receiving water are not available. Based on the effluent data the discharge does not have reasonable potential to cause or contribute to an instream excursion of the applicable water quality objective for chloride. The Discharger is required to monitor for these constituents in the effluent and receiving water.

(2) Electrical Conductivity. A review of the Discharger's monitoring reports shows an average effluent EC of 340.5 µmhos/cm, with a range from 236 µmhos/cm to 454 µmhos/cm, for the 44 samples collected between 2007 and 2011. Ambient background concentrations of electrical conductivity in the receiving water are not available. Staff is not aware of any production of salt-sensitive crops in the local area and concluded there is no justification to apply salt-

sensitive objectives to the discharge. The effluent levels do not exceed the secondary MCL for EC. Based on the effluent data the discharge does not have reasonable potential to cause or contribute to an instream excursion of the applicable water quality objective for EC. The Discharger is required to monitor for these constituents in the effluent and receiving water.

(3) Sulfate. The previous Order did not require the Discharger to monitor for sulfate. Reasonable potential cannot be determined due to the lack of effluent and receiving water data. Section 1.3, Step 8 of the SIP allows the Central Valley Water Board to require additional monitoring for a pollutant in place of an effluent limitation if data are unavailable or insufficient. Therefore, the Central Valley Water Board is not requiring effluent limitations for sulfate at this time. Instead of limitations, additional monitoring has been established for sulfate within the Salinity Evaluation and Minimization Plan.

(4) Total Dissolved Solids. The average TDS effluent concentration was 198 mg/L with concentrations ranging from 135 mg/L to 276 mg/L. These levels do not exceed the applicable water quality objectives. Ambient background concentrations of TDS in the receiving water are not available. Staff is not aware of any production of salt-sensitive crops in the local area and concluded there is no justification to apply salt-sensitive objectives to the discharge. The effluent levels do not exceed the secondary MCL for TDS. Based on the effluent data the discharge does not have reasonable potential to cause or contribute to an instream excursion of the applicable water quality objective for TDS. The Discharger is required to monitor for these constituents in the effluent and receiving water.

(c) WQBELS. . Effluent limitations based on the MCL or the Basin Plan would likely require construction and operation of a reverse osmosis treatment plant. The State Water Board, in Water Quality Order 2005-005 (for the City of Manteca), states, "*...the State Board takes official notice [pursuant to Title 23 of California Code of Regulations, Section 648.2] of the fact that operation of a large-scale reverse osmosis treatment plant would result in production of highly saline brine for which an acceptable method of disposal would have to be developed. Consequently, any decision that would require use of reverse osmosis to treat the City's municipal wastewater effluent on a large scale should involve thorough consideration of the expected environmental effects.*" The State Water Board states in that Order, "*Although the ultimate solution to southern Delta salinity problems have not yet been determined, previous actions establish that the State Board intended for permit limitations to play a limited role with respect to achieving compliance with the EC water quality objectives in the southern Delta.*" The State Water Board goes on to say, "*Construction and operation of reverse osmosis facilities to treat discharges...prior to implementation*

of other measures to reduce the salt load in the southern Delta, would not be a reasonable approach."

The Central Valley Water Board, with cooperation of the State Water Board, has begun the process to develop a new policy for the regulation of salinity in the Central Valley. In a statement issued at the 16 March 2006, Central Valley Water Board meeting, Board Member Dr. Karl Longley recommended that the Central Valley Water Board continue to exercise its authority to regulate discharges of salt to minimize salinity increases within the Central Valley. Dr. Longley stated, "*The process of developing new salinity control policies does not, therefore, mean that we should stop regulating salt discharges until a salinity Policy is developed. In the meantime, the Board should consider all possible interim approaches to continue controlling and regulating salts in a reasonable manner, and encourage all stakeholder groups that may be affected by the Regional Board's policy to actively participate in policy development.*"

The discharge does not have reasonable potential to cause or contribute to an in-stream excursion of water quality objectives for salinity. However, since the Discharger discharges to the upper Sacramento River and eventually the Sacramento-San Joaquin Delta, of additional concern is the salt contribution to Delta waters. Allowing the Discharger to increase its current salt loading is contrary to the Region-wide effort to address salinity in the Central Valley. In order to ensure that the Discharger will continue to control the discharge of salinity, this Order includes a requirement to develop and implement a salinity evaluation and minimization plan and water supply monitoring is required to evaluate the relative contribution of salinity from the source water to the effluent.

d. Constituents with Reasonable Potential. The Central Valley Water Board finds that the discharge has a reasonable potential to cause or contribute to an in-stream excursion above a water quality standard for ammonia, bis(2-ethylhexyl) phthalate, chlorine residual, copper, dichlorobromomethane, nitrate, nitrite, pH, settleable solids, and zinc. WQBELs for these constituents are included in this Order. A summary of the RPA is provided in Attachment G, and a detailed discussion of the RPA for each constituent is provided below.

i. Ammonia

(a) WQO. The NAWQC for the protection of freshwater aquatic life for total ammonia, recommends acute (1-hour average; criteria maximum concentration or CMC) standards based on pH and chronic (30-day average; criteria continuous concentration or CCC) standards based on pH and temperature. USEPA also recommends that no 4-day average concentration should exceed 2.5 times the 30-day CCC. USEPA found that as pH increased, both the acute and chronic toxicity

of ammonia increased. Salmonids were more sensitive to acute toxicity effects than other species. However, while the acute toxicity of ammonia was not influenced by temperature, it was found that invertebrates and young fish experienced increasing chronic toxicity effects with increasing temperature. Because the upper Sacramento River has a beneficial use of cold freshwater habitat and the presence of salmonids and early fish life stages in the upper Sacramento River is well-documented, the recommended criteria for waters where salmonids and early life stages are present were used.

The maximum permitted effluent pH is 8.5, as the Basin Plan objective for pH in the receiving stream is the range of 6.5 to 8.5. In order to protect against the worst-case short-term exposure of an organism, a pH value of 8.5 was used to derive the acute criterion. The resulting acute criterion is 2.14 mg/L.

The 30-day average chronic criterion (or CCC) was evaluated for the receiving water based on monitoring data obtained during the discharge season from the period of September 2007 through February 2011. The chronic criterion values were calculated using the CCC equation and the rolling 30-day average pH and temperature of the downstream receiving water. 53 paired data sets of receiving water pH and temperature were available for analyses. The 1/10th percentile (i.e. lowest 99.9th percentile) of each data set was selected as the most stringent criteria, which is consistent with the 1-in-3 year average frequency for criteria excursions recommended by the USEPA. As a result, the receiving water CCC was 2.6 mg/L ammonia as N. Analyses of annual fluctuations in receiving water CCC showed no significant pattern of occurrence with respect to the seasons of fall, winter, and spring; as annual peak receiving water CCCs occurred in all 3 of these seasons within the four-year data set. In addition, the Discharger does not discharge during the summer season. Therefore, the resulting receiving water 30-day CCC is 2.6 mg/L ammonia as N The 4-day average concentration is derived in accordance with the USEPA criterion as 2.5 times the 30-day CCC. Based on the 30-day CCC of 2.6 mg/L (as N), the 4-day average concentration that should not be exceeded is 6.5 mg/L (as N).

(b) RPA Results. The maximum effluent concentration (MEC) for ammonia was 18.1 mg/L while the maximum observed upstream receiving water concentration was 0.04 mg/L. Therefore, ammonia in the discharge has a reasonable potential to cause or contribute to an in-stream excursion above the NAWQC.

(c) WQBELs. The Central Valley Water Board calculates WQBELs in accordance with SIP procedures for non-CTR constituents, and ammonia is a non-CTR constituent. The SIP procedure assumes a

4-day averaging period for calculating the long-term average discharge condition (LTA). However, USEPA recommends modifying the procedure for calculating permit limits for ammonia using a 30-day averaging period for the calculation of the LTA corresponding to the 30-day CCC. Therefore, while the LTAs corresponding to the acute and 4-day chronic criteria were calculated according to SIP procedures, the LTA corresponding to the 30-day CCC was calculated assuming a 30-day averaging period. The lowest LTA representing the acute, 4-day CCC, and 30-day CCC is then selected for deriving the average monthly effluent limitation (AMEL) and the maximum daily effluent limitation (MDEL). The remainder of the WQBEL calculation for ammonia was performed according to the SIP procedures. An acute aquatic-life dilution credit of 3 and a chronic aquatic-life dilution credit of 4 have been allowed for development of the WQBELs for ammonia. This Order contains a final average monthly effluent limitation (AMEL) and maximum daily effluent limitation (MDEL) for ammonia of 4.6 mg/L and 8.4 mg/L, respectively, based on the NAWQC standard.

(d) Plant Performance and Attainability. Analysis of the effluent data shows that the MEC of 18.1 mg/L is greater than applicable WQBELs. Based on the sample results for the effluent, the limitations appear to put the Discharger in immediate non-compliance. New or modified control measures may be necessary in order to comply with the effluent limitations, and the new or modified control measures cannot be designed, installed and put into operation within 30 calendar days. The Discharger submitted an infeasibility analysis on 26 July 2012. A compliance time schedule for compliance with the ammonia effluent limitations is established in TSO No. R5-2012-0087 in accordance with Water Code section 13300, that requires preparation and implementation of a pollution prevention plan in compliance with Water Code section 13263.3.

ii. Bis(2-ethylhexyl) phthalate

(a) WQO. The CTR includes a criterion of 1.8 ug/L for bis(2-ethylhexyl) phthalate for the protection of human health for waters from which both water and organisms are consumed

(b) RPA Results. The maximum effluent concentration (MEC) for bis(2-ethylhexyl) phthalate was 3.0 ug/L out of 39 samples collected between September 2007 and May 2011. The maximum observed upstream receiving water concentration was 2.0 ug/L out of 4 samples collected between January 2009 and December 2010. The arithmetic mean of the observed upstream receiving water concentrations was 1.2 ug/L. Therefore, bis(2-ethylhexyl) phthalate in the discharge has reasonable potential to cause or contribute to an in-stream excursion above the CTR criterion for the protection of human health.

(c) WQBELs. The receiving water contains assimilative capacity for bis(2-ethylhexyl) phthalate based on the arithmetic mean of the upstream receiving water data. Therefore, a dilution credit of 2:1 was allowed in the development of the WQBELs for bis(2-ethylhexyl) phthalate. Based on the allocated dilution credit, an AMEL of 3.0 ug/L and a MDEL of 5.6 ug/L is calculated. Effluent limitations for bis(2-ethylhexyl) phthalate is a new limitation for the Discharger.

(d) Plant Performance and Attainability. Analysis of the effluent data shows that a MEC of 3.0 ug/L is less than or equal to the applicable WQBEL. Furthermore, the average bis(2-ethylhexyl) phthalate effluent concentration was 1.4, with a standard deviation of 0.7 and a coefficient of variation of 0.51. The maximum projected concentration based on past plant performance (based on normally distributed data where 99.9% of the data points will lie within 3.3 standard deviations of the mean) has been calculated to be 3.5 ug/L. The maximum projected value is also less than the applicable WQBELs. Therefore, the Discharger should able to comply with the AMEL and MDEL.

iii. Chlorine Residual

(a) WQO. USEPA developed NAWQC for protection of freshwater aquatic life for chlorine residual. The recommended 4-day average (chronic) and 1-hour average (acute) criteria for chlorine residual are 0.011 µg/L and 0.019 µg/L, respectively. These criteria are protective of the Basin Plan's narrative toxicity objective.

(b) RPA Results. The Discharger uses chlorine for disinfection, which is extremely toxic to aquatic organisms. The Discharger uses a sulfur dioxide process to dechlorinate the effluent prior to discharge to the Sacramento River. Due to the existing chlorine use and the potential for chlorine to be discharged, the discharge has a reasonable potential to cause or contribute to an in-stream excursion above the NAWQC.

(c) WQBELs. The USEPA *Technical Support Document for Water Quality-Based Toxics Control* [EPA/505/2-90-001] contains statistical methods for converting chronic (4-day) and acute (1-hour) aquatic life criteria to average monthly and maximum daily effluent limitations based on the variability of the existing data and the expected frequency of monitoring. However, because chlorine is an acutely toxic constituent that can and will be monitored continuously, an average 1-hour limitation is considered more appropriate than an average daily limitation. This Order contains a 4-day average effluent limitation and 1-hour average effluent limitation for chlorine residual of 0.011 µg/L and 0.019 µg/L, respectively, based on USEPA's NAWQC, which implements the Basin Plan's narrative toxicity objective for protection of aquatic life.

(d) Plant Performance and Attainability. Although the Discharger has violated the chlorine residual limitation on five occasions since 2008, the Central Valley Water Board believes immediate compliance with these effluent limitations is feasible.

iv. Copper

(a) WQO. The CTR includes hardness dependent criteria for the protection of freshwater aquatic life for copper. The Basin Plan also includes a hardness dependent water quality objective for copper. Using the default conversion factors and reasonable worst-case measured hardness, as described in section VI.C.2.c of this Fact Sheet, the applicable CTR acute (1-hour average) criterion is 5.77 µg/L and the applicable CTR chronic (4-day average) criterion is 4.17 µg/L., as total recoverable. The Basin Plan maximum objective for copper is 5.72 µg/L.

(b) RPA Results. The maximum effluent concentration (MEC) for copper was 32 µg/L (as total recoverable) while the maximum observed upstream receiving water concentration was 1.2 µg/L (as total recoverable). Therefore, copper in the discharge has a reasonable potential to cause or contribute to an in-stream excursion above both the CTR criterion for the protection of freshwater aquatic life and the Basin Plan instantaneous maximum water quality objective.

(c) WQBELs. An acute aquatic life dilution credit of 3 and chronic aquatic life dilution credit of 4 have been allowed for development of the WQBELs for copper. This Order contains a final average monthly effluent limitation (AMEL) and maximum daily effluent limitation (MDEL) for copper of 9.1 µg/L and 19.3 µg/L, respectively, based on the CTR criterion for the protection of freshwater aquatic life.

(d) Plant Performance and Attainability. Analysis of the effluent data shows that the MEC of 32 µg/L is greater than applicable WQBELs. Based on the sample results for the effluent, the limitations appear to put the Discharger in immediate non-compliance. New or modified control measures may be necessary in order to comply with the effluent limitations, and the new or modified control measures cannot be designed, installed and put into operation within 30 calendar days. The Discharger submitted an infeasibility analysis on 26 July 2012. A compliance time schedule for compliance with the copper effluent limitations is established in TSO No. R5-2012-0087 in accordance with Water Code section 13300, that requires preparation and implementation of a pollution prevention plan in compliance with Water Code section 13263.3.

v. Dichlorobromomethane

(a) WQO. The CTR includes a criterion of 0.56 ug/L for dichlorobromomethane for the protection of human health for waters from which both water and organisms are consumed. The following example is for if the discharge is subject to a TMDL.

(b) RPA Results. The maximum effluent concentration (MEC) for dichlorobromomethane was 1.4 µg/L based on 6 samples collected between January 2009 and December 2010. The maximum observed upstream receiving water concentration was <0.1 µg/L based on six samples collected during the same time period. Therefore, dichlorobromomethane in the discharge has a reasonable potential to cause or contribute to an in-stream excursion above the CTR criterion for the protection of human health.

(d) WQBELs. The receiving water contains assimilative capacity for dichlorobromomethane, therefore, a dilution credit of 2:1 was allowed in the development of the WQBELs for dichlorobromomethane. This Order contains a final average monthly effluent limitation (AMEL) and maximum daily effluent limitation (MDEL) for dichlorobromomethane of 1.5 µg/L and 3.6 µg/L, respectively, based on protection of the CTR criterion for the protection of human health.

(e) Plant Performance and Attainability. Analysis of the effluent data shows that a MEC of 1.4 ug/L is less than the applicable WQBELs. Furthermore, the average dichlorobromomethane effluent concentration was 0.6, with a standard deviation of 0.5 and a coefficient of variation of 0.9. The maximum projected concentration based on past plant performance (based on normally distributed data where 99.9% of the data points will lie within 3.3 standard deviations of the mean) has been calculated to be 2.2 ug/L. The maximum projected value is also less than the applicable WQBEL. Therefore, the Discharger should able to comply with the AMEL and MDEL.

vi. Nitrate and Nitrite

(a) WQO. DPH has adopted Primary MCLs for the protection of human health for nitrite and nitrate that are equal to 1 mg/L and 10 mg/L (measured as nitrogen), respectively. DPH has also adopted a primary MCL of 10,000 µg/L for the sum of nitrate and nitrite, measured as nitrogen.

USEPA has developed a primary MCL and an MCL goal of 1,000 µg/L for nitrite (as nitrogen). For nitrate, USEPA has developed Drinking Water Standards (10,000 µg/L as Primary MCL) and NAWQC for

protection of human health (10,000 µg/L for non-cancer health effects). Recent toxicity studies have indicated a possibility that nitrate is toxic to aquatic organisms.

(b) RPA Results. Untreated domestic wastewater contains ammonia. Nitrification is a biological process that converts ammonia to nitrite and nitrite to nitrate. Denitrification is a process that converts nitrate to nitrite or nitric oxide and then to nitrous oxide or nitrogen gas, which is then released to the atmosphere. Nitrate and nitrite are known to cause adverse health effects in humans. Inadequate or incomplete denitrification may result in the discharge of nitrate and/or nitrite to the receiving stream. The conversion of ammonia to nitrites and the conversion of nitrites to nitrates present a reasonable potential for the discharge to cause or contribute to an in-stream excursion above the Primary MCLs for nitrite and nitrate.

(c) WQBELs. This Order contains a final average monthly effluent limitation (AMEL) for nitrate plus nitrite (as N) of 10 mg/L, based on the protection of the Basin Plan's narrative chemical constituents objective and to assure the treatment process adequately nitrifies and denitrifies the waste stream.

(d) Plant Performance and Attainability. The maximum effluent concentration (MEC) for nitrate was 4.53 ug/L out of 26 samples collected between September 2007 and May 2011. The second highest effluent nitrate concentration was 1.25 mg/L. The maximum MEC for nitrite was 0.08 ug/L out of 5 samples collected during the same time period. The maximum projected nitrate concentration based on past plant performance (based on normally distributed data where 99.9% of the data points will lie within 3.3 standard deviations of the mean) has been calculated to be 3.2 ug/L. The Discharger's MECs and maximum projected value for nitrate are all less than the applicable WQBEL. Therefore, the Discharger should able to comply with the AMEL for nitrate plus nitrite (as N). Effluent limitations on nitrate plus nitrite (as N) is new limitation for the Discharger.

vii. Pathogens

(a) WQO. DPH has developed reclamation criteria, CCR, Division 4, Chapter 3 (Title 22), for the reuse of wastewater. Title 22 requires that for spray irrigation of food crops, parks, playgrounds, schoolyards, and other areas of similar public access, wastewater be adequately disinfected, oxidized, coagulated, clarified, and filtered, and that the effluent total coliform levels not exceed 2.2 MPN/100 mL as a 7-day median. As coliform organisms are living and mobile, it is impracticable to quantify an exact number of coliform organisms and to establish weekly average limitations. Instead, coliform organisms are measured as a most probable number and regulated based on a 7-day

median limitation.

Title 22 also requires that recycled water used as a source of water supply for non-restricted recreational impoundments be disinfected tertiary recycled water that has been subjected to conventional treatment. A non-restricted recreational impoundment is defined as *"...an impoundment of recycled water, in which no limitations are imposed on body-contact water recreational activities."* Title 22 is not directly applicable to surface waters; however, the Central Valley Water Board finds that it is appropriate to apply an equivalent level of treatment to that required by the DPH's reclamation criteria because the receiving water is used for irrigation of agricultural land and for contact recreation purposes. The stringent disinfection criteria of Title 22 are appropriate since the undiluted effluent may be used for the irrigation of food crops and/or for body-contact water recreation. Coliform organisms are intended as an indicator of the effectiveness of the entire treatment train and the effectiveness of removing other pathogens.

In addition, in a letter to the Central Valley Water Board dated 8 April 1999, DPH indicated it would consider wastewater discharged to water bodies with identified beneficial uses of irrigation or contact recreation and where the wastewater receives dilution of more than 20:1 to be adequately disinfected if the effluent coliform concentration does not exceed 23 MPN/100 mL as a 7-day median and if the effluent coliform concentration does not exceed 240 MPN/100 mL more than once in any 30 day period.

(b) RPA Results. The beneficial uses of the Sacramento River (Box Canyon to Shasta Lake include municipal and domestic supply, water contact recreation, and agricultural irrigation supply, and there may be, at times, less than 20:1 dilution. Although less than 20:1 dilution is not common, the flow in the receiving water is dictated by releases from Box Canyon Dam which do not necessarily mimic the natural hydrologic cycle of the watershed. As such, minimum receiving water flows may occur at any time, including at times when high wet weather effluent flows are present. The minimum flow in the receiving water at any time is 42 cfs, therefore any effluent flow greater than 1.29 mgd will result in a river to effluent dilution of less than 20:1 (once the discharge is fully mixed with the receiving water). It is not uncommon for effluent flow to be above 1.29 mgd in the winter and spring[32], and the minimum Box Canyon Dam flow release of 42 cfs may occur during these periods.

Furthermore, the effluent discharges to a segment of river that is a year-round whitewater recreation (kayaking) area provided receiving

[32] Observed effluent winter peak: 2.6 mgd, effluent winter average: 1 mgd, and effluent spring peak: 2.1 mgd.

water flows are greater than or equal to 400 cfs[33]. The whitewater kayaking segment is known as the Box Canyon Run. The effluent outfall location is in the immediate vicinity of a technical river rapid that whitewater kayakers must navigate and therefore undoubtedly come in body-contact with the receiving water and effluent. During periods when whitewater recreation is present near the outfall, the river to effluent flows are greater than 20:1 once the discharge has fully mixed with the receiving water. However, because the effluent discharges to the river in an area of slack water immediately above a technical river rapid, boaters may come in direct contact with undiluted effluent or minimally diluted effluent (i.e. <20:1) in either the slack water (where they stop to scout the rapid) or in the rapid itself. Whitewater kayaking is considered contact recreation.

To protect the beneficial uses, the Central Valley Water Board finds that the wastewater must be disinfected and adequately treated to prevent disease during periods of less than 20:1 dilution, which includes the period of time in which whitewater recreation is present, in and around the outfall. The method of treatment is not prescribed by this Order; however, wastewater must be treated to a level equivalent to that recommended by DPH.

There are periods of time when wastewater receives dilution of more than 20:1 and the whitewater recreation, as described above, is not present. Therefore, the DPH requirements for effluent coliform concentration not to exceed 23 MPN/100 mL as a 7-day median and 240 MPN/100 mL more than once in any 30 day period are applicable for such flow regimes.

(c) WQBELs. In accordance with the requirements of Title 22, this Order includes effluent limitations for total coliform organisms of 2.2 MPN/100 mL as a 7-day median; 23 MPN/100 mL, not to be exceeded more than once in a 30-day period; and 240 MPN/100 mL as an instantaneous maximum.

In addition to coliform limitations, a turbidity operation and maintenance specifications have been included as a second indicator of the effectiveness of the treatment process and to assure compliance with the required level of treatment. The tertiary treatment process, or equivalent, is capable of reliably meeting a turbidity limitation of 2 nephelometric turbidity units (NTU) as a daily average. Failure of the filtration system such that virus removal is impaired would normally result in increased particles in the effluent, which result in higher effluent turbidity. Turbidity has a major advantage for monitoring filter performance, allowing immediate detection of filter failure and rapid corrective action. Coliform testing, by comparison, is not conducted

[33] As measured at Box Canyon Dam.

continuously and requires several hours, to days, to identify high coliform concentrations. Therefore, to ensure compliance with DPH recommended Title 22 disinfection criteria, weekly average effluent limitations are impracticable for turbidity. This Order includes operation and maintenance specifications for turbidity of 2 NTU as a daily average; 5 NTU, not to be exceeded more than 5% of the time within a 24-hour period; and 10 NTU as an instantaneous maximum. The previous Order included effluent limitations for turbidity during the fall and spring discharge period (15 April through 14 June and 15 September through 15 November) of 5.0 NTU as a weekly average and 10.0 as a daily maximum. Turbidity effluent limitations for the fall and spring discharge period have been not been carried over from the previous Order as receiving water data indicated no reasonable potential for the effluent cause an exceedance to the Basin Plan receiving water turbidity objective.

Final WQBELs for BOD_5 and TSS are included in this permit to ensure that Best Practicable Treatment or Control (BPTC) measures are being implemented for these constituents. The numeric limits are based on the technical capability of the tertiary process (filtration) which has proven to be an effective BPTC measure, as discussed in Section IV.D.4. The limitations are necessary to protect the beneficial uses of the receiving water and to limit any new degradation to the high-quality receiving water. BOD_5 is a measure of the amount of oxygen used in the biochemical oxidation of organic matter. The tertiary treatment standards for BOD_5 and TSS are indicators of the effectiveness of the tertiary treatment process. The principal design parameter for wastewater treatment plants is the daily BOD_5 and TSS loading rates and the corresponding removal rate of the system. The application of tertiary treatment processes results in the ability to achieve lower levels for BOD_5 and TSS than the secondary standards currently prescribed during the winter discharge period (16 November through 14 April). This fact is demonstrated below in the Discharger's BOD_5 and TSS mass loading data collected during the last permit cycle. Mass loading rates during the winter discharge period are significantly greater than mass loading rates during the fall and spring period when the discharge is already subject to the more stringent BOD_5 and TSS limitations.

	Fall and Spring Loading Rates (lbs/day)	Winter Loading Rates (lbs/day)	Percent Increase (%)
BOD_5 - Average	16	94	488
BOD_5 - Maximum	37	320	765
TSS - Average	20	94	370
TSS - Maximum	36	334	828

Therefore, this Order requires AMELs for BOD_5 and TSS of 10 mg/L, which is technically based on the capability of a tertiary system and to ensure BPTC is implemented. In addition to the average weekly and average monthly effluent limitations, a daily maximum effluent limitation for BOD_5 and TSS is included in the Order to ensure that the treatment works are not organically overloaded and operate in accordance with design capabilities.

This Order contains effluent limitations for BOD_5, TSS, and total coliform organisms, and operation and maintenance specifications for turbidity, that require a tertiary level of treatment, or equivalent. The treatment is necessary to protect the beneficial uses of the receiving water. Effluent meeting 10 mg/L BOD_5, 10 mg/L TSS, and a coliform effluent limit of 2.2 MPN/100 mL during the fall and spring discharge period (15 April through 14 June and 15 September through 15 November) was required in the previous permit[34] and the Central Valley Water Board previously considered the factors in Water Code section 13241 is establishing the fall and spring period discharge requirements for BOD_5, TSS, and total coliform. However, equivalent effluent limitations for BOD_5, TSS, and total coliform in the winter period (16 November through 14 April) are a new requirement on the discharge. Also, the operation and maintenance specifications for turbidity are new requirements for the full discharge to surface water period. Therefore, the Central Valley Water Board has considered the following factors in Water Code section 13241:

(1) The past, present and probable future beneficial uses of the Sacramento River (Box Canyon to Shasta lake) include municipal and domestic supply, agricultural irrigation, agricultural stock watering, body contact water recreation, other non-body contact water recreation, cold freshwater aquatic habitat, cold fish migration habitat, and wildlife habitat.

(2) The environmental characteristics of the hydrographic unit, including the quality of the available water, will be improved by the requirement to provide tertiary treatment for this wastewater discharge. Tertiary treatment will allow for the reuse of the undiluted wastewater for food crop irrigation and contact recreation activities that would otherwise be unsafe according to recommendations from DPH.

[34] The final effluent limitations table in WDR Order No. R5-2007-0056 contained incorrect coliform limits for the fall and spring discharge period; however the fact sheet included language that supported the application of the 2.2 MPN/100 mL coliform limits in the fall and spring period. Furthermore, the Order prior to the 2007 Order, WDR Order No. 5-01-218, clearly presented the more stringent, fall and spring period, effluent coliform limits.

(3) Fishable and swimmable water quality conditions can be reasonably achieved through the coordinated control of all factors that affect water quality in the area.

(4) The economic impact of requiring an increased level of treatment has been considered. The Discharger has estimated that the increased level of treatment will cost approximately $10 million. The loss of beneficial uses within downstream waters, without the tertiary treatment requirement, which includes prohibiting the irrigation of food crops and prohibiting public access for contact recreational purposes, would have a detrimental economic impact. In addition to pathogen removal to protect irrigation and recreation, tertiary treatment may also aid in meeting discharge limitations for other pollutants, such as heavy metals, reducing the need for

(5) advanced treatment specific for those pollutants.

(6) The requirement to provide tertiary treatment for this discharge will not adversely impact the need for housing in the area. The potential for developing housing in the area will be facilitated by improved water quality, which protects the contact recreation and irrigation uses of the receiving water. DPH recommends that, in order to protect the public health, relatively undiluted wastewater effluent must be treated to a tertiary level for contact recreational and food crop irrigation uses. Without tertiary treatment, the downstream waters could not be safely utilized for contact recreation or the irrigation of food crops.

(7) It is the Central Valley Water Board's policy, (Basin Plan, page IV-12.00, Policy 2) to encourage the reuse of wastewater. The Central Valley Water Board requires dischargers to evaluate how reuse or land disposal of wastewater can be optimized. The need to develop and use recycled water is facilitated by providing a tertiary level of wastewater treatment that will allow for a greater variety of uses in accordance with CCR, Title 22.

(8) The Central Valley Water Board has considered the factors specified in Water Code section 13263, including considering the provisions in Water Code section 13241, in adopting the disinfection and filtration requirements under Title 22 criteria. The Central Valley Water Board finds, on balance, that these requirements are necessary to protect the beneficial uses of the Sacramento River (Box Canyon to Shasta Lake), including water contact recreation and irrigation uses.

During periods of discharge when a river to effluent flow ratio of ≥20:1 exists and the receiving water is <400 cfs and only during the time period from 16 November through 14 April, effluent total coliform

organisms shall not to exceed 23 MPN/100 mL as a 7-day median and 240 MPN/100 mL more than once in any 30 day period. As such, the turbidity operation and maintenance specification, as described in this section, does not apply when a river to effluent flow ratio of ≥20:1 exists and the receiving water is <400 cfs within the 16 November through 14 April time period.

(d) Plant Performance and Attainability. New or modified control measures are necessary in order to comply with the disinfection and filtration requirements, and the new or modified control measures cannot be designed, installed and put into operation within 30 calendar days. Furthermore, the more stringent effluent limitations for total coliform organisms, BOD_5, and TSS between 16 November through 14 April are new regulatory requirements within this permit. The Discharger submitted an infeasibility analysis on 26 July 2012. As discussed in section IV.E of this Fact Sheet, a compliance schedule has been included in this Order.

viii. pH

(a) WQO. The Basin Plan includes a water quality objective for surface waters (except for Goose Lake) that the *"...pH shall not be depressed below 6.5 nor raised above 8.5. Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters with designated COLD or WARM beneficial uses."*

(b) RPA Results. The discharge of domestic wastewater has a reasonable potential to cause or contribute to an excursion above the Basin Plan's numeric objectives for pH.

(c) WQBELs. Effluent limitations for pH of 6.5 as an instantaneous minimum and 8.5 as an instantaneous maximum are included in this Order based on protection of the Basin Plan objectives for pH. In addition, the instantaneous maximum pH effluent limitation has been used to calculate the acute criteria for ammonia.

(d) Plant Performance and Attainability. The minimum and maximum effluent pH values were 6.1 and 8.0, respectively, based on 767 data points collected between January 2007 and May 2011. The average and median pH values were both 6.9. The effluent data shows that the minimum observed pH value is less than the instantaneous minimum effluent limitation of 6.5, therefore the minimum pH limitation appears to put the Discharger in immediate non-compliance. The Discharger can immediately comply with the instantaneous maximum of 8.5. The instantaneous minimum pH effluent limitation of 6.0 is a new limitation for the Discharger. The Discharger submitted an infeasibility analysis

on 26 July 2012. As discussed in section IV.E of this Fact Sheet, a compliance schedule has been included in this Order.

ix. Settleable Solids

(a) WQO. For inland surface waters, the Basin Plan states that "[w]*ater shall not contain substances in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.*"

(b) RPA Results. The discharge of municipal wastewater has a reasonable potential to cause or contribute to an excursion above the Basin Plan's narrative objective for settleable solids.

(c) WQBELs. This Order contains average monthly and average daily effluent limitations for settleable solids. Because the amount of settleable solids is measured in terms of volume per volume without a mass component, it is impracticable to calculate mass limitations for inclusion in this Order. A daily maximum effluent limitation for settleable solids is included in the Order, in lieu of a weekly average, to ensure that the treatment works operate in accordance with design capabilities. These limitations are equal to the effluent settleable solids limitations in the previous Order.

(d) Plant Performance and Attainability. Analysis of the effluent data shows that the MEC of <0.2 mL/L-hour is less than the applicable WQBELs. The Central Valley Water Board concludes, therefore, that immediate compliance with these effluent limitations is feasible.

x. Zinc

(a) WQO. The CTR includes hardness dependent criteria for the protection of freshwater aquatic life for zinc. The Basin Plan also includes a hardness dependent water quality objective for zinc. Using the default conversion factors and reasonable worst-case measured hardness, as described in section VI.C.2.c of this Fact Sheet, the applicable CTR acute (1-hour average) criterion is 54.0 µg/L and the applicable CTR chronic (4-day average) criterion is 54.0 µg/L., as total recoverable. The Basin Plan maximum water quality objective for zinc is 16.0 µg/L.

(b) RPA Results. The maximum effluent concentration (MEC) for zinc was 47.6 µg/L (as total recoverable) while the maximum observed upstream receiving water concentration was 12.6 µg/L (as total recoverable). Therefore, zinc in the discharge has a reasonable

potential to cause or contribute to an in-stream excursion above the Basin Plan maximum water quality objective.

(c) WQBELs. An acute aquatic life dilution credit of 3 and chronic aquatic life dilution credit of 4 have been allowed for development of the WQBELs for zinc. This Order contains a final average monthly effluent limitation (AMEL) and maximum daily effluent limitation (MDEL) for zinc of 12.9 µg/L and 26.2 µg/L, respectively, based on the Basin Plan instantaneous maximum water quality objective.

(d) Plant Performance and Attainability. Analysis of the effluent data shows that the MEC of 47.6 µg/L is greater than applicable WQBELs. Based on the sample results for the effluent, the limitations appear to put the Discharger in immediate non-compliance. New or modified control measures may be necessary in order to comply with the effluent limitations, and the new or modified control measures cannot be designed, installed and put into operation within 30 calendar days. The Discharger submitted an infeasibility analysis on 26 July 2012. A compliance time schedule for compliance with the zinc effluent limitations is established in TSO No. R5-2012-0087 in accordance with Water Code section 13300, that requires preparation and implementation of a pollution prevention plan in compliance with Water Code section 13263.3.

4. WQBEL Calculations

a. This Order includes WQBELs for ammonia, bis(2-ethylhexyl) phthalate, chlorine residual, copper, dichlorobromomethane, nitrate, nitrite, pH, pathogens, BOD_5, TSS, settleable solids, and zinc. The general methodology for calculating WQBELs based on the different criteria/objectives is described in subsections IV.C.4.b through e, below. See Attachment H for the WQBEL calculations.

b. Effluent Concentration Allowance. For each water quality criterion/objective, the ECA is calculated using the following steady-state mass balance equation from Section 1.4 of the SIP:

$$ECA = C + D(C - B) \quad \text{where } C>B, \text{ and}$$
$$ECA = C \quad \text{where } C \leq B$$

where:

ECA = effluent concentration allowance
D = dilution credit
C = the priority pollutant criterion/objective
B = the ambient background concentration.

According to the SIP, the ambient background concentration (B) in the equation above shall be the observed maximum with the exception that an ECA calculated from a priority pollutant criterion/objective that is intended to protect human health from carcinogenic effects shall use the arithmetic mean concentration of the ambient background samples. For ECAs based on MCLs, which implement the Basin Plan's chemical constituents objective and are applied as annual averages, an arithmetic mean is also used for B due to the long-term basis of the criteria.

c. **Basin Plan Objectives and MCLs.** For WQBELs based on site-specific numeric Basin Plan objectives or MCLs, the effluent limitations are applied directly as the ECA as either an MDEL, AMEL, or average annual effluent limitations, depending on the averaging period of the objective.

d. **Aquatic Toxicity Criteria.** WQBELs based on acute and chronic aquatic toxicity criteria are calculated in accordance with Section 1.4 of the SIP. The ECAs are converted to equivalent long-term averages (i.e. LTAacute and LTAchronic) using statistical multipliers and the lowest LTA is used to calculate the AMEL and MDEL using additional statistical multipliers.

e. **Human Health Criteria.** WQBELs based on human health criteria, are also calculated in accordance with Section 1.4 of the SIP. The ECAs are set equal to the AMEL and a statistical multiplier was used to calculate the MDEL.

$$AMEL = mult_{AMEL}\left[\min\left(\overbrace{M_A ECA_{acute}}^{LTA_{acute}}, M_C ECA_{chronic}\right)\right]$$

$$MDEL = mult_{MDEL}\left[\min\left(M_A ECA_{acute}, \underbrace{M_C ECA_{chronic}}_{LTA_{chronic}}\right)\right]$$

$$MDEL_{HH} = \left(\frac{mult_{MDEL}}{mult_{AMEL}}\right) AMEL_{HH}$$

where:

$mult_{AMEL}$ = statistical multiplier converting minimum LTA to AMEL
$mult_{MDEL}$ = statistical multiplier converting minimum LTA to MDEL
M_A = statistical multiplier converting acute ECA to LTA_{acute}
M_C = statistical multiplier converting chronic ECA to $LTA_{chronic}$

Summary of Water Quality-Based Effluent Limitations
Discharge Point No. 001

Table F-16. Summary of Water Quality-Based Effluent Limitations

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum
Conventional Pollutants						
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	10	15	30	--	--
	lbs/day[1]	67	100	200	--	--
Total Suspended Solids	mg/L	10	15	30	--	--
	lbs/day[1]	67	100	200	--	--
pH	standard units	--	--	--	6.5	8.5
Priority Pollutants						
Bis(2-Ethylhexyl) phthalate	µg/L	3.0	--	5.6	--	--
Copper, Total Recoverable	µg/L	9.1	--	19.3	--	--
Dichlorobromomethane	µg/L	1.5	--	3.6	--	--
Zinc, Total Recoverable	µg/L	12.9	--	26.2	--	--
Non-Conventional Pollutants						
Ammonia Nitrogen, Total (as N)	mg/L	4.6	--	8.4	--	--
Nitrate Plus Nitrite (as N)	mg/L	10.0	--	--	--	--
Settleable Solids	ml/L-hr	0.1	--	0.2	--	--

[1]Based on an ADWF of 0.80 mgd.

5. Whole Effluent Toxicity (WET)

For compliance with the Basin Plan's narrative toxicity objective, this Order requires the Discharger to conduct whole effluent toxicity testing for acute and chronic toxicity, as specified in the Monitoring and Reporting Program (Attachment E section V.). This Order also contains effluent limitations for acute toxicity and requires the Discharger to implement best management practices to investigate the causes of, and identify corrective actions to reduce or eliminate effluent toxicity.

a. **Acute Aquatic Toxicity.** The Basin Plan contains a narrative toxicity objective that states, "All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life." (Basin Plan at page III-8.00) The Basin Plan also states that, "...effluent limits based upon acute biotoxicity tests of effluents will be prescribed where appropriate...". USEPA Region 9 provided guidance for the development of acute toxicity effluent limitations in the absence of numeric water quality objectives for toxicity in its document titled "Guidance for NPDES Permit Issuance", dated February 1994. In section B.2. "Toxicity Requirements" (pgs. 14-15) it states that, "In the absence of specific numeric

water quality objectives for acute and chronic toxicity, the narrative criterion 'no toxics in toxic amounts' applies. Achievement of the narrative criterion, as applied herein, means that ambient waters shall not demonstrate for acute toxicity: 1) less than 90% survival, 50% of the time, based on the monthly median, or 2) less than 70% survival, 10% of the time, based on any monthly median. For chronic toxicity, ambient waters shall not demonstrate a test result of greater than 1 TUc." Accordingly, effluent limitations for acute toxicity have been included in this Order as follows:

Acute Toxicity. Survival of aquatic organisms in 96-hour bioassays of undiluted waste shall be no less than:

Minimum for any one bioassay---------- 70%
Median for any three consecutive bioassays---------- 90%

b. **Chronic Aquatic Toxicity.** The Basin Plan contains a narrative toxicity objective that states, "*All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life.*" (Basin Plan at page III-8.00). Based on chronic WET testing performed by the Discharger from October 2007 through September 2011, the discharge does not have reasonable potential to cause or contribute to an in-stream excursion above of the Basin Plan's narrative toxicity objective. As shown in Table F-17 below.

Table F-17. Whole Effluent Chronic Toxicity Testing Results

	Fathead Minnow *Pimephales promelas*		**Water Flea** *Ceriodaphnia dubia*		**Green Algae** *Selenastrum capricornutum*
Date	Survival (TUc)	Growth (TUc)	Survival (TUc)	Reproduction (TUc)	Growth (TUc)
10/25/2007	1	1	1	1	1
10/07/2008	1	1	1	1	1
11/18/2009	1	1	1	1	1
11/30/2010	1	1	1	1	1
9/19/2011	1	1	1	1	1

The Monitoring and Reporting Program of this Order requires annual chronic WET monitoring for demonstration of compliance with the narrative toxicity objective. In addition to WET monitoring, the Special Provision in section VI.C.2.a of the Order requires the Discharger to submit to the Central Valley Water Board an Initial Investigative TRE Workplan for approval by the Executive Officer, to ensure the Discharger has a plan to immediately move forward with the initial tiers of a TRE, in the event effluent toxicity is encountered in the future. The provision also includes a numeric toxicity monitoring trigger, requirements for accelerated monitoring, and requirements for TRE initiation if toxicity is demonstrated. A dilution credit for whole effluent toxicity is not being included in this Order; therefore the monitoring trigger is set at 1 TUc. The previous Order set a monitoring trigger of 10 TUc. As stated above, the Discharger's WET testing on the discharge did not demonstrate

reasonable potential to cause or contribute to an in-stream excursion above the Basin Plan's narrative toxicity objective and therefore; the TUc for this Order has been set at 1.

Numeric chronic WET effluent limitations have not been included in this Order. The SIP contains implementation gaps regarding the appropriate form and implementation of chronic toxicity limits. This has resulted in the petitioning of a NPDES permit in the Los Angeles Region[35] that contained numeric chronic toxicity effluent limitations. To address the petition, the State Water Board adopted WQO 2003-012 directing its staff to revise the toxicity control provisions in the SIP. The State Water Board states the following in WQO 2003-012, "*In reviewing this petition and receiving comments from numerous interested persons on the propriety of including numeric effluent limitations for chronic toxicity in NPDES permits for publicly-owned treatment works that discharge to inland waters, we have determined that this issue should be considered in a regulatory setting, in order to allow for full public discussion and deliberation. We intend to modify the SIP to specifically address the issue. We anticipate that review will occur within the next year. We therefore decline to make a determination here regarding the propriety of the final numeric effluent limitations for chronic toxicity contained in these permits.*" The process to revise the SIP is currently underway. Proposed changes include clarifying the appropriate form of effluent toxicity limits in NPDES permits and general expansion and standardization of toxicity control implementation related to the NPDES permitting process. Since the toxicity control provisions in the SIP are under revision it is infeasible to develop numeric effluent limitations for chronic toxicity. Therefore, this Order requires that the Discharger meet best management practices for compliance with the Basin Plan's narrative toxicity objective, as allowed under 40 CFR 122.44(k).

To ensure compliance with the Basin Plan's narrative toxicity objective, the Discharger is required to conduct chronic WET testing, as specified in the Monitoring and Reporting Program (Attachment E section V.). Furthermore, the Special Provision contained at VI.C.2.a. of this Order requires the Discharger to investigate the causes of, and identify and implement corrective actions to reduce or eliminate effluent toxicity. If the discharge demonstrates toxicity exceeding the numeric toxicity monitoring trigger, the Discharger is required to initiate a Toxicity Reduction Evaluation (TRE) in accordance with an approved TRE workplan. The numeric toxicity monitoring trigger is not an effluent limitation; it is the toxicity threshold at which the Discharger is required to perform accelerated chronic toxicity monitoring, as well as, the threshold to initiate a TRE if effluent toxicity has been demonstrated.

[35] In the Matter of the Review of Own Motion of Waste Discharge Requirements Order Nos. R4-2002-0121 [NPDES No. CA0054011] and R4-2002-0123 [NPDES NO. CA0055119] and Time Schedule Order Nos. R4-2002-0122 and R4-2002-0124 for Los Coyotes and Long Beach Wastewater Reclamation Plants Issued by the California Regional Water Quality Control Board, Los Angeles Region SWRCB/OCC FILES A-1496 AND 1496(a)

D. Final Effluent Limitations

1. Mass-based Effluent Limitations

40 CFR 122.45(f)(1) requires effluent limitations be expressed in terms of mass, with some exceptions, and 40 CFR 122.45(f)(2) allows pollutants that are limited in terms of mass to additionally be limited in terms of other units of measurement. This Order includes effluent limitations expressed in terms of mass and concentration. In addition, pursuant to the exceptions to mass limitations provided in 40 CFR 122.45(f)(1), some effluent limitations are not expressed in terms of mass, such as pH and temperature, and when the applicable standards are expressed in terms of concentration (e.g., CTR criteria and MCLs) and mass limitations are not necessary to protect the beneficial uses of the receiving water.

Mass-based effluent limitations were calculated based upon the design flow (Average Dry Weather Flow) permitted in section IV.A.1.g. of this Order.

2. Averaging Periods for Effluent Limitations

40 CFR 122.45 (d) requires average weekly and average monthly discharge limitations for publicly owned treatment works (POTWs) unless impracticable. However, for toxic pollutants and pollutant parameters in water quality permitting, USEPA recommends the use of a maximum daily effluent limitation in lieu of average weekly effluent limitations for two reasons. "*First, the basis for the 7-day average for POTWs derives from the secondary treatment requirements. This basis is not related to the need for assuring achievement of water quality standards. Second, a 7-day average, which could comprise up to seven or more daily samples, could average out peak toxic concentrations and therefore the discharge's potential for causing acute toxic effects would be missed.*" (TSD, pg. 96) This Order uses maximum daily effluent limitations in lieu of average weekly effluent limitations for ammonia, bis(2-ethylhexyl) phthalate, copper, dichlorobromomethane, and zinc as recommended by the TSD for the achievement of water quality standards and for the protection of the beneficial uses of the receiving stream. Furthermore, for BOD_5, TSS, pH, chlorine residual, and total coliform organisms, weekly average effluent limitations have been replaced or supplemented with effluent limitations utilizing shorter averaging periods. The rationale for using shorter averaging periods for these constituents is discussed in section IV.C.3 of this Fact Sheet.

For effluent limitations based on Primary and Secondary MCLs, except nitrate and nitrite, this Order includes annual average effluent limitations. The Primary and Secondary MCLs are drinking water standards contained in Title 22 of the California Code of Regulations. Title 22 requires compliance with these standards on an annual average basis (except for nitrate and nitrite), when sampling at least quarterly. Since it is necessary to determine compliance on an annual average basis, it is impracticable to calculate average weekly and average monthly effluent limitations.

3. Satisfaction of Anti-Backsliding Requirements

The Clean Water Act specifies that a revised permit may not include effluent limitations that are less stringent than the previous permit unless a less stringent limitation is justified based on exceptions to the anti-backsliding provisions contained in Clean Water Act sections 402(o) or 303(d)(4), or, where applicable, 40 CFR 122.44(l).

The effluent limitations in this Order are at least as stringent as the effluent limitations in the existing Order, with the exception of effluent limitations for copper, zinc, ammonia, electrical conductivity, turbidity, 4,4'-DDT, and temperature. The effluent limitations for these pollutants are less stringent than those in Order No. R5-2007-0056. This relaxation of effluent limitations is consistent with the anti-backsliding requirements of the CWA and federal regulations, as explained below.

The following is a comparison of the copper, zinc, and ammonia effluent limitations in the previous Order to the new final copper, zinc, and ammonia effluent limitations:

Constituent	**Order No. R5-2007-0056 Existing Limits** (AMEL/MDEL)	**Final Limits** (AMEL/MDEL)
Copper, Total Recoverable (ug/L)	3.94/7.90	9.1/19.3
Zinc, Total Recoverable (ug/L)	10.76/21.58	12.9/26.2
Ammonia (as N) (mg/L)	3.68/29.57[1]	4.6/8.4

1 One-hour average.

Order R5-2007-0056 established end-of-pipe effluent limitations for copper, zinc, and ammonia without dilution credits. As discussed in section IV.C.2.c of this Fact Sheet, a mixing zone and dilution credits for aquatic-life criteria are appropriate, and assimilative capacity is available, based on new information that was not available at the time Order R5-2007-0056 was adopted, which supports the calculation of less stringent effluent limitations for copper, zinc, and ammonia. Because effluent limitations may only be as high as is justified under State and federal Antidegradation policies, this Order does not allocate all of the available assimilative capacity and establishes water quality-based effluent limitations for copper, zinc, and ammonia based on a dilution credit of 3:1 and 4:1 for acute and chronic aquatic-life criteria, respectively.

Order No. R5-2007-0056 included effluent limitations on electrical conductivity, turbidity, 4,4'-DDT, and temperature. Based on the new information obtained by the effluent and receiving water monitoring data collected from September 2007 through June 2011, the discharge does not indicate reasonable potential to exceed water quality objectives or criteria for electrical conductivity, turbidity, 4,4'-DDT, and temperature.

Relaxation and removal of the WQBELs in the previous permit is in accordance with CWA sections 303(d)(4) and 402(o), which allow for the removal of WQBELs for attainment waters where antidegradation requirements are satisfied. Removal of the WQBELs is consistent with the antidegradation provisions of 40 CFR 131.12 and State Water Board Resolution No. 68-16. Therefore, the modifications to these effluent limitations do not violate anti-backsliding requirements.

4. Satisfaction of Antidegradation Policy

a. Surface Water. This Order does not allow for an increase in flow or mass of pollutants to the receiving water. The permitted surface water discharge is consistent with the antidegradation provisions of 40 CFR 131.12 and State Water Board Resolution No. 68-16. Compliance with these requirements will result in the use of best practicable treatment or control of the discharge. The impact on existing water quality will be insignificant.

This Order requires the implementation of additional treatment or control measures to ensure that BPTC is being used at the Facility for BOD_5 and total suspended solids (TSS). Practicable treatment or control technologies are available to reduce the concentrations of BOD_5 and TSS in the discharge. Such reductions will result in lower loading of oxygen demanding substances and suspended solids and result in improved downstream water quality. Technologies such as granular media filtration of secondary-treated wastewater have proven to be capable of meeting the effluent limitations for BOD_5 and TSS contained in this Order. Other similarly-sized, located, and financed dischargers have implemented, or are actively working toward implementing treatment or controls sufficient to achieve the BOD_5 and TSS effluent limitations contained in this Order.

b. Groundwater. The Discharger utilizes a leachfield for effluent disposal. Effluent discharge to the leachfield is not raw wastewater; it has been treated to secondary standards, and disinfected. This Order does not allow for an increase in flow or mass of pollutants to the groundwater. The permitted groundwater water discharge is consistent with the antidegradation provisions of 40 CFR 131.12 and State Water Board Resolution No. 68-16. Compliance with these requirements will result in the use of best practicable treatment or control of the discharge. The impact on existing water quality will be insignificant.

5. Stringency of Requirements for Individual Pollutants

This Order contains both technology-based effluent limitations and WQBELs for individual pollutants. The technology-based effluent limitations consist of restrictions on flow and percent removal requirements for BOD_5 and TSS. The WQBELs consist of restrictions on acute toxicity, ammonia, bis(2-ethylhexyl) phthalate, chlorine residual, copper, dichlorobromomethane, nitrate, nitrite, settleable solids, and zinc. This Order's technology-based pollutant restrictions implement the minimum, applicable federal technology-based requirements. In

addition, this Order includes new, more stringent, effluent limitations for BOD_5, TSS, total coliform organisms (for specific receiving water flow conditions), and pH to meet numeric objectives or protect beneficial uses. The rationale for including these limitations is explained in the Fact Sheet. In addition, the Central Valley Water Board has considered the factors in Water Code section 13241 in establishing these requirements.

This Order contains pollutant restrictions that are more stringent than applicable federal requirements and standards. Specifically, this Order includes effluent limitations for BOD_5, TSS, and pH that are more stringent than applicable federal standards, but that are nonetheless necessary to meet numeric objectives or protect beneficial uses. The rationale for including these limitations is explained in section IV.C.3 of this Fact Sheet. In addition, the Central Valley Water Board has considered the factors in Water Code section 13241 in section IV.C.3.d. of this Fact Sheet.

Summary of Final Effluent Limitations
Discharge Point No. 001

Table F-18. Summary of Final Effluent Limitation

Parameter	Units	Effluent Limitations					Basis[1]
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum	
Average Dry Weather Flow	mgd	--	--	0.8	--	--	DC
Biochemical Oxygen Demand 5-day @ 20°C	mg/L	10	15	30	--	--	TTC
	lbs/day[1]	67	100	200	--	--	
	% Removal	85	--	--	--	--	CFR
Total Suspended Solids	mg/L	10	15	30	--	--	TTC
	lbs/day	67	100	200	--	--	
	%Removal[1]	85	--	--	--	--	CFR
pH		--	--	--	6.5	8.5	BP
Bis(2-Ethylhexyl) phthalate	µg/L	3.0	--	5.6	--	--	CTR
Copper, Total Recoverable	µg/L	9.1	--	19.3	--	--	CTR
Dichloro-bromomethane	µg/L	1.5	--	3.6	--	--	CTR
Zinc, Total Recoverable	µg/L	12.9	--	26.2	--	--	BP
Ammonia Nitrogen, Total (as N)	mg/L	4.6	--	8.4	--	--	NAWQC
Nitrate Plus Nitrite (as N)	mg/L	10	--	--	--	--	MCL
Settleable Solids	mL/L-hr	0.1	--	0.2	--	--	BP

Parameter	Units	Effluent Limitations					Basis[1]
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum	
Total Coliform Organisms[4]	MPN/100 mL	--	2.2[2]	240	23[3]	--	Title 22
Total Coliform Organisms	MPN/100 mL	--	23[2]	240	--	--	DPH

DC – Based on the design capacity of the Facility.
TTC – Based on tertiary treatment capability. These effluent limitations reflect the capability of a properly operated tertiary treatment plant.
CFR – Based on secondary treatment standards contained in 40 CFR Part 133.
BP – Based on water quality objectives contained in the Basin Plan.
CTR – Based on water quality criteria contained in the California Toxics Rule and applied as specified in the SIP.
NAWQC – Based on USEPA's National Ambient Water Quality Criteria for the protection of freshwater aquatic life.
SEC MCL – Based on the Secondary Maximum Contaminant Level.
TMDL – Based on the TMDL for salinity and boron in the lower San Joaquin River.
MCL – Based on the Primary Maximum Contaminant Level.
Title 22 – Based on CA Department of Public Health Reclamation Criteria, CCR, Division 4, Chapter 3 (Title 22).
[1] Based on ADWF of 0.8 mgd.
[2] 7-day median.
[3] No more than once in a 30-day period.
[4] From 16 November through 14 April when a receiving water to effluent flow ratio of ≥20:1 exists and the receiving water is <400 cfs.

E. Interim Effluent Limitations

1. **Compliance Schedule for BOD_5, TSS, pH, and Title 22 (or Equivalent) disinfection requirements.** The permit limitations for BOD_5, TSS, pH, and total coliform organisms are more stringent than the limitations previously imposed. These new limitations are based effluent sampling and the California Department of Public Health's recommendations. The Discharger has complied with the application requirements in paragraph 4 of the State Water Board's Compliance Schedule Policy, and the Discharger's application demonstrates the need for additional time to implement actions to comply with the new limitations, as described below. Therefore, a compliance schedule for compliance with the effluent limitations for BOD_5, TSS, pH, and total coliform organisms is established in the Order.

   A compliance schedule is necessary because the Discharger must implement actions, including designing and constructing facilities and securing financing to comply with the more stringent permit limitations and disinfection requirements. Construction includes purchase and installation of necessary equipment.

   The Discharger has made diligent efforts to quantify pollutant levels in the discharge and the sources of the pollutant in the waste stream, and the results of those efforts. The compliance schedule is as short as possible.

   Interim limitations based on existing effluent limitations have been established in this Order. The interim limitations were determined as described in section IV.E.2., below, and are in effect through until the final limitations take effect. (As part of the compliance schedule, this Order requires the Discharger to submit a corrective

action plan and implementation schedule to assure compliance with the final effluent limitations for BOD_5, TSS, pH, and Title 22 (or equivalent) disinfection requirements. In addition, the Discharger shall prepare and implement a pollution prevention plan that is in compliance with Water Code section 13263.3(d)(3). The interim numeric effluent limitations and source control measures will result in the highest discharge quality that can reasonably be achieved until final compliance is attained.

2. **Interim Limits for BOD_5, TSS, pH, and total coliform organisms.** The Compliance Schedule Policy requires the Central Valley Water Board to establish interim requirements and dates for their achievement in the NPDES permit. Interim numeric effluent limitations are required for compliance schedules longer than one year. Interim effluent limitations must be based on current treatment plant performance or existing final permit limitations, whichever is more stringent. When feasible, interim limitations must correspond with final permit effluent limitations with respect to averaging bases (e.g., AMEL, MDEL, average monthly, etc.) for effluent limitations for which compliance protection is intended.

   The interim limitations for BOD_5, TSS, pH, and total coliform organisms in this Order are based on the final effluent limitations from the previous Order.

   Interim limitations are established when compliance with final effluent limitations cannot be achieved by the existing discharge. Discharge of constituents in concentrations in excess of the final effluent limitations, but in compliance with the interim effluent limitations, can significantly degrade water quality and adversely affect the beneficial uses of the receiving stream on a long-term basis. The interim limitations, however, establish an enforceable ceiling concentration until compliance with the effluent limitation can be achieved. Limited, short-term degradation is consistent with state and federal policies and is specifically authorized by 40 CFR § 122.47 and the EPA-approved Compliance Schedule Policy.

   The following table summarizes the interim effluent limitations for BOD_5, TSS, and pH:

Table F-19. Interim Effluent Limitation Summary

Parameter	Units	Effluent Limitations			
		Average Monthly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum
Biochemical Oxygen Demand 5-day @ 20°C [1]	mg/L	30	45	60	--
	lbs/day[2]	200	300	400	--
Total Suspended Solids[1]	mg/L	30	45	60	--
	lbs/day[2]	200	300	400	--
pH	Standard Units	--	--	6.0	--

[1] Interim limitation only applies from 16 November through 14 April.
[2] Based on ADWF of 0.8 mgd.

3. **Title 22 (or equivalent) Disinfection Requirements.** The establishment of Title 22 (or equivalent) disinfection requirements has not been previously required for this discharge; therefore, a schedule for compliance with these requirements is included as a Provision in this Order. This Order provides interim effluent limitations for total coliform organisms during periods of discharge from 16 November through 14 April, when a receiving water to effluent flow ratio of <20:1 exists or the receiving water is ≥400 cfs, based on the existing effluent limitations required by Order No. R5-2007-0056, which the Discharger is currently capable of meeting. Full compliance with Title 22 (or equivalent) disinfection requirements is not required by this Order until **8 years from the effective date of this Order**. The compliance schedule for tertiary treatment has been developed in accordance with the Discharger's implementation schedule.

F. Land Discharge Specifications

1. The Land Discharge Specifications are necessary to protect the beneficial uses of the groundwater.

2. **Daily Average Discharge Specification**. The discharge specification is based on the leachfield design average dry weather flow rate of 0.7 mgd.

G. Reclamation Specifications

1. Treated wastewater discharged for reclamation is regulated under Water Recycling Requirements Order No. 5-01-083 and must meet the requirements of CCR, Title 22.

2. **TSS and BOD_5**. The reclamation specifications for TSS and BOD_5 are based on limitations that are achievable by the Discharger with the dissolved air-flotation and continuous sand filter system. The TSS and BOD_5 specifications are the same as in the previous Order.

3. **Total Coliform Organisms**. The previous Order limited total coliform organisms to 2.2 MPN/100 mL as a monthly median and 23 MPN/100 mL at any time. These discharge specifications have been changed to be consistent with the recycled water limitations for total coliform organisms in Water Recycling Requirements Order No. 5-01-083 which consist of limits for total coliform organisms of 2.2 MPN per 100 mL as a 7-day median and 23 MPN per 100 mL, more than once in any 30-day period. A daily maximum total coliform organisms limitation of 240 MPN/100 mL has been added as a specification as a result of the removal of the 23 MPN/100 mL daily maximum limitation and the Facility's proven ability to meet the limitation.

4. **Turbidity**. The turbidity specifications are the same as in the previous Order. The values are based on what can be achieved by the Discharger with the existing filtration system for an effluent containing a high algae content. These limits are required to enhance the effectiveness of chlorine disinfection.

5. Order No. R5-2007-0056 contained an acute whole effluent toxicity reclamation discharge specification; however, the acute whole effluent toxicity specification on the reclamation discharge has not been retained in this Order. There are no residual chlorine limitations on the reclamation discharge; however the Discharger is required to dechlorinate the reclamation discharge, as the recycled water may be stored in ponds at the Mt. Shasta Golf Resort that contain aquatic life.

V. RATIONALE FOR RECEIVING WATER LIMITATIONS

Basin Plan water quality objectives to protect the beneficial uses of surface water and groundwater include numeric objectives and narrative objectives, including objectives for chemical constituents, toxicity, and tastes and odors. The toxicity objective requires that surface water and groundwater be maintained free of toxic substances in concentrations that produce detrimental physiological responses in humans, plants, animals, or aquatic life. The chemical constituent objective requires that surface water and groundwater shall not contain chemical constituents in concentrations that adversely affect any beneficial use or that exceed the maximum contaminant levels (MCLs) in Title 22, CCR. The tastes and odors objective states that surface water and groundwater shall not contain taste- or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses. The Basin Plan requires the application of the most stringent objective necessary to ensure that surface water and groundwater do not contain chemical constituents, toxic substances, radionuclides, or taste and odor producing substances in concentrations that adversely affect domestic drinking water supply, agricultural supply, or any other beneficial use.

A. Surface Water

1. CWA section 303(a-c), requires states to adopt water quality standards, including criteria where they are necessary to protect beneficial uses. The Central Valley Water Board adopted water quality criteria as water quality objectives in the Basin Plan. The Basin Plan states that "[t]*he numerical and narrative water quality objectives define the least stringent standards that the Regional Water Board will apply to regional waters in order to protect the beneficial uses.*" The Basin Plan includes numeric and narrative water quality objectives for various beneficial uses and water bodies. This Order contains receiving surface water limitations based on the Basin Plan numerical and narrative water quality objectives for bacteria, biostimulatory substances, color, chemical constituents, dissolved oxygen, floating material, oil and grease, pH, pesticides, radioactivity, suspended sediment, settleable substances, suspended material, tastes and odors, temperature, toxicity, and turbidity.

2. **Turbidity.** Order No. R5-2007-0056 established a receiving water limitation for turbidity specifying that discharges from the Facility shall not cause the turbidity to increase more than 1 NTU where natural turbidity is between 0 and 5 NTU based on the water quality objective for turbidity in the Basin Plan. The Central Valley Water Board adopted Resolution No. R5-2007-0136 on 25 October 2007, amending the Basin Plan to limit turbidity to 2 NTU when the natural turbidity is less than 1 NTU. The Basin Plan amendment has been approved by the State

Water Board, the Office of Administrative Law, and USEPA. Consistent with the revised water quality objective in the Basin Plan, this Order limits turbidity to 2 NTU when the natural turbidity is less than 1 NTU.

In Finding No. 14 of Resolution No. R5-2007-0136 the Central Valley Water Board found that the change in the turbidity receiving water objective is consistent with the State Water Board Resolution No. 68-16, in that the changes to water quality objectives (i) consider maximum benefit to the people of the State, (ii) will not unreasonably affect present and anticipated beneficial use of waters, and (iii) will not result in water quality less than that prescribed in policies, and is consistent with the federal Antidegradation Policy (40 CFR 131.12).

This Order includes operational specifications that require the Discharger to operate the treatment system to insure that turbidity shall not exceed 2 NTU as a daily average, and 5 NTU more than 5 percent of the time within a 24 hour period, and 10 NTU during specific time and flow periods that warrant the specification. Because this Order limits the average daily discharge of turbidity to 2 NTU, the Order will be protective of the receiving water under all natural background conditions as defined in the Basin Plan's revised water quality objective for turbidity. The relaxation of the turbidity receiving water limitation will protect aquatic life and other beneficial uses and will not unreasonably affect present and anticipated beneficial uses nor result in water quality less than described in applicable policies. The relaxation of the receiving water limitation is not expected to cause other impacts on water quality. The Regional Water Board finds that the relaxation of the turbidity receiving water limitation is to the maximum benefit to the people of the State, (ii) will not unreasonably affect present and anticipated beneficial use of waters, and (iii) will not result in water quality less than that prescribed in policies, and is consistent with the federal Antidegradation Policy (40 CFR 131.12).

The revised receiving water limitation for turbidity, which is based on the amendment to the Basin Plan's turbidity water quality objective, reflects current scientifically supported turbidity requirements for the protection of aquatic life and other beneficial uses and, therefore, will be fully protective of aquatic life and the other beneficial uses listed in the Basin Plan. Changes in turbidity allowed by the revised receiving water limitation, when ambient turbidity is below 1 NTU, would not adversely affect beneficial uses and would maintain water quality at a level higher than necessary to protect beneficial uses. Restricting low-level turbidity changes further may require costly upgrades, which would not provide any additional protection of beneficial uses. Thus, any changes in turbidity that would occur under the amended turbidity receiving water limitation would not only be protective of beneficial uses, but also would be consistent with maximum benefit to people of the State. Therefore, the relaxed receiving water limitations for turbidity will not violate antidegradation policies.

B. Groundwater

1. The beneficial uses of the underlying ground water are municipal and domestic supply, industrial service supply, industrial process supply, and agricultural supply.

2. Basin Plan water quality objectives include narrative objectives for chemical constituents, tastes and odors, and toxicity of groundwater. The toxicity objective requires that groundwater be maintained free of toxic substances in concentrations that produce detrimental physiological responses in humans, plants, animals, or aquatic life. The chemical constituent objective states groundwater shall not contain chemical constituents in concentrations that adversely affect any beneficial use. The tastes and odors objective prohibits taste- or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses. The Basin Plan also establishes numerical water quality objectives for chemical constituents and radioactivity in groundwaters designated as municipal supply. These include, at a minimum, compliance with MCLs in Title 22 of the CCR. The bacteria objective prohibits coliform organisms at or above 2.2 MPN/100 mL. The Basin Plan requires the application of the most stringent objective necessary to ensure that waters do not contain chemical constituents, toxic substances, radionuclides, taste- or odor-producing substances, or bacteria in concentrations that adversely affect municipal or domestic supply, agricultural supply, industrial supply or some other beneficial use.

3. Groundwater limitations are required to protect the beneficial uses of the underlying groundwater.

VI. RATIONALE FOR MONITORING AND REPORTING REQUIREMENTS

40 CFR 122.48 requires that all NPDES permits specify requirements for recording and reporting monitoring results. Water Code sections 13267 and 13383 authorize the Regional Water Boards to require technical and monitoring reports. The Monitoring and Reporting Program (Attachment E) of this Order, establishes monitoring and reporting requirements to implement federal and state requirements. The following provides the rationale for the monitoring and reporting requirements contained in the Monitoring and Reporting Program for the Facility.

A. Influent Monitoring

1. Influent monitoring is required to collect data on the characteristics of the wastewater and to assess compliance with effluent limitations (e.g., BOD_5 and TSS reduction requirements). The monitoring frequencies for BOD_5, and TSS (1/week) and flow (continuous) have been retained from Order No. R5-2007-0056. Weekly monitoring for pH has been added to this Order.

B. Effluent Monitoring

1. Pursuant to the requirements of 40 CFR 122.44(i)(2) effluent monitoring is required for all constituents with effluent limitations. Effluent monitoring is necessary to

assess compliance with effluent limitations, assess the effectiveness of the treatment process, and to assess the impacts of the discharge on the receiving stream and groundwater.

2. Effluent monitoring frequencies and sample types for flow, acute toxicity, BOD_5, TSS, total chlorine residual, bis (2-ethylhexyl)phthalate, settleable solids, have been retained from Order No. R5-2007-0056 to determine compliance with effluent limitations for these parameters.

3. Effluent monitoring frequencies and sample types for chronic toxicity, turbidity, total dissolved solids, EC, standard minerals have been retained from Order No. R5-2007-0056.

4. Effluent monitoring frequencies for copper and zinc (1/month) have been retained from Order No. R5-2007-0056, however the type of sample has been changed from grab to 24-hour composite.

5. Effluent sample types for nitrate and nitrite (grab) have been retained from Order No. R5-2007-0056, however sampling frequency has been increased from semiannually to once per month to determine compliance with effluent limitations for these parameters.

6. Effluent sample type for ammonia (grab) has been retained from Order No. R5-2007-0056, however the sampling frequency has been increased from quarterly to once per month to determine compliance with effluent limitations for this parameter.

7. Effluent monitoring frequency for total coliform organisms has increased from weekly to 2/week to assess compliance with effluent limitations and to assess the effectiveness of the treatment process.

8. Effluent monitoring requirements for pH (continuous) and temperature (3/week), hardness (1/month), and aluminum (1/month), and cadmium (1/quarter) are new requirements for this Order. Monitoring is necessary to assess compliance with effluent limitations, assess the effectiveness of the treatment process, and/or to assess the impacts of the discharge on the receiving stream and groundwater.

9. Monitoring data collected over the existing permit term for 4,4'-DDT did not demonstrate reasonable potential to exceed water quality objectives/criteria. Thus, specific monitoring requirements for this parameter has not been retained from Order No. R5-2007-0056.

10. Effluent monitoring frequency for priority pollutants has changed from once per year to semiannually during the third and fourth year of the Order. In accordance with Section 1.3 of the SIP, periodic monitoring is required for priority pollutants for which criteria or objectives apply and for which no effluent limitations have been established. See Attachment I for more detailed requirements related to performing priority pollutant monitoring.

11. California Water Code section 13176, subdivision (a), states: "The analysis of any material required by [Water Code sections 13000-16104] shall be performed by a laboratory that has accreditation or certification pursuant to Article 3 (commencing with Section 100825) of Chapter 4 of Part 1 of Division 101 of the Health and Safety Code." The Department of Public Health certifies laboratories through its Environmental Laboratory Accreditation Program (ELAP).

Section 13176 cannot be interpreted in a manner that would violate federal holding time requirements that apply to NPDES permits pursuant to the Clean Water Act. (Wat. Code §§ 13370, subd. (c), 13372, 13377.) Section 13176 is inapplicable to NPDES permits to the extent it is inconsistent with Clean Water Act requirements. (Wat. Code § 13372, subd. (a).) The holding time requirements are 15 minutes for chlorine residual, dissolved oxygen, and pH, and immediate analysis is required for temperature. (40 C.F.R. § 136.3(e), Table II) Due to the location of the Facility, it is both legally and factually impossible for the Discharger to comply with section 13176 for constituents with short holding times. Analyses for these constituents are conducted on site by the Discharger.

C. Whole Effluent Toxicity Testing Requirements

1. **Acute Toxicity.** Consistent with Order No. R5-2007-0056 96-hour bioassay testing is required quarterly to demonstrate compliance with the effluent limitation for acute toxicity.

2. **Chronic Toxicity.** Consistent with Order No. R5-2007-0056 chronic whole effluent toxicity testing is required annually in order to demonstrate compliance with the Basin Plan's narrative toxicity objective.

D. Receiving Water Monitoring

1. Surface Water

a. Receiving water monitoring is necessary to assess compliance with receiving water limitations and to assess the impacts of the discharge on the receiving stream.

b. This Order retains sample types and monitoring frequencies from Order No. R5-2007-0056 for the receiving water at Monitoring Locations RSW-001 and RSW-002 for flow, temperature, total coliform organisms, pH, hardness (RSW-001 only), dissolved oxygen, and turbidity.

c. Surface water monitoring requirements (semi-annual) for copper, zinc, bis(2-ethylhexyl)phthalate, dichlorobromomethane, and cadmium are new requirements for this Order. Monitoring is necessary to assess compliance with receiving water limitations and to assess the impacts of the discharge on the receiving stream.

d. Consistent with the effluent monitoring requirements, monitoring for priority pollutants and other constituents of concern upstream of Discharge Point No. 001 at Monitoring Location RSW-001 is required twice during the third year and fourth year of the permit term (i.e. 4 sampling events) to collect the necessary data to determine reasonable potential as required in section 1.2 of the SIP. The hardness (as CaCO3) of the upstream receiving water shall also be monitored concurrently with the priority pollutants as well as pH to ensure the water quality criteria/objectives are correctly adjusted for the receiving water when determining reasonable potential as specified in section 1.3 of the SIP. See Attachment I for more detailed requirements related to performing priority pollutant monitoring.

2. Groundwater

a. Water Code section 13267 states, in part, "(a) A Regional Water Board, in establishing...waste discharge requirements... may investigate the quality of any waters of the state within its region" and "(b) (1) In conducting an investigation..., the Regional Water Board may require that any person who... discharges... waste...that could affect the quality of waters within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the Regional Water Board requires. The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports." The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports. In requiring those reports, a Regional Water Board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports. The Monitoring and Reporting Program is issued pursuant to Water Code section 13267. The groundwater monitoring and reporting program required by this Order and the Monitoring and Reporting Program are necessary to assure compliance with these waste discharge requirements. The Discharger is responsible for the discharges of waste at the facility subject to this Order.

b. Monitoring of the groundwater must be conducted to determine if the discharge has caused an increase in constituent concentrations, when compared to background. The monitoring must, at a minimum, require a complete assessment of groundwater impacts including the vertical and lateral extent of degradation, an assessment of all wastewater-related constituents which may have migrated to groundwater, an analysis of whether additional or different methods of treatment or control of the discharge are necessary to provide best practicable treatment or control to comply with Resolution No. 68-16. Economic analysis is only one of many factors considered in determining best practicable treatment or control. If monitoring indicates that the discharge has incrementally increased constituent concentrations in groundwater above background, this permit may be reopened and modified. Until groundwater monitoring is sufficient, this Order contains Groundwater Limitations that allow groundwater quality to be degraded for certain constituents when compared to

background groundwater quality, but not to exceed water quality objectives. If groundwater quality has been degraded by the discharge, the incremental change in pollutant concentration (when compared with background) may not be increased. If groundwater quality has been or may be degraded by the discharge, this Order may be reopened and specific numeric limitations established consistent with Resolution No. 68-16 and the Basin Plan.

c. This Order requires the Discharger to continue groundwater monitoring and includes a regular schedule of groundwater monitoring in the attached Monitoring and Reporting Program. The groundwater monitoring reports are necessary to evaluate impacts to waters of the State to assure protection of beneficial uses and compliance with Central Valley Water Board plans and policies, including Resolution No. 68-16. Evidence in the record includes effluent monitoring data that indicates the presence of constituents that may degrade groundwater and surface water.

d. Groundwater monitoring frequency for EC, TDS, nitrate, and standard minerals has increased from 1/year to 1/quarter as a result of the Discharger's year-round usage of the leachfield for disposal and to determine any increase in constituent concentrations, when compared to background

e. Groundwater monitoring requirements (1/quarter) for depth to groundwater, groundwater elevation, gradient, gradient direction, fixed dissolved solids, pH, total coliform organisms, total nitrogen, ammonia, TKN are new requirements for this Order. The monitoring is necessary to determine if the discharge has caused an increase in constituent concentrations, when compared to background and the frequency (1/quarter) is necessary because the Discharger utilizes the leachfield for disposal year-round.

E. Other Monitoring Requirements

1. Biosolids Monitoring

Biosolids monitoring is required to ensure compliance with the biosolids disposal requirements contained in the Special Provision contained in section VI.C.6.a. of this Order. Biosolids disposal requirements are imposed pursuant to 40 CFR Part 503 to protect public health and prevent groundwater degradation.

2. Water Supply Monitoring

Water supply monitoring is required to evaluate the source of constituents in the wastewater.

3. Reclamation Discharge Monitoring

a. Reclamation discharge monitoring is required to determine compliance with reclamation discharge specifications. Reclamation monitoring for flow (continuous), total residual chlorine (before (1/week) and after (continuous)

dechlorination), BOD_5 (1/week), TSS (1/week), turbidity (3/day) has been retained from Order No. R5-2007-0056.

b. Reclamation discharge monitoring frequency for total coliform organisms has increased from 1/week to 1/day in accordance with chapter 3, division 4, Title 22, CCR, Section 60321.

c. Reclamation monitoring for pH (continuous) is a new monitoring requirement. pH monitoring is necessary to determine compliance with reclamation discharge specifications.

4. Land Discharge Monitoring

a. Land discharge monitoring is required to ensure that the discharge to the land disposal area complies with the land discharge specifications in section IV.B and Treatment and Storage Pond and Land Disposal Operating Requirements in section VI.C.4 of this Order.

b. Monitoring frequencies and sample types for flow (continuous), BOD_5 (1/week), TSS (1/week) have been retained from Order No. R5-2007-0056.

c. Total residual chlorine monitoring has increase from 1/week to continuous as the Discharger is able to monitoring chlorine residual on a continuous basis.

d. Settleable solids (1/week), total coliform organisms (2/week), and pH (1/day) are new parameters subject to monitoring. Monitoring for settleable solids and total coliform organisms is necessary to determine compliance with discharge specifications and pH monitoring is necessary to characterize the discharge to the leachfield.

5. Effluent and Receiving Water Characterization Study.

An effluent and receiving water monitoring study is required to ensure adequate information is available for the next permit renewal. During the third and fourth year of this permit term, the Discharger is required to conduct semiannual monitoring of the effluent at EFF-001 and of the receiving water at RSW-001 for all priority pollutants and other constituents of concern as described in Attachment I.

VII. RATIONALE FOR PROVISIONS

A. Standard Provisions

Standard Provisions, which apply to all NPDES permits in accordance with 40 CFR 122.41, and additional conditions applicable to specified categories of permits in accordance with 40 CFR 122.42, are provided in Attachment D. The discharger must comply with all standard provisions and with those additional conditions that are applicable under 40 CFR 122.42.

40 CFR 122.41(a)(1) and (b) through (n) establish conditions that apply to all State-issued NPDES permits. These conditions must be incorporated into the permits either expressly or by reference. If incorporated by reference, a specific citation to the regulations must be included in the Order. 40 CFR 123.25(a)(12) allows the state to omit or modify conditions to impose more stringent requirements. In accordance with 40 CFR 123.25, this Order omits federal conditions that address enforcement authority specified in 40 CFR 122.41(j)(5) and (k)(2) because the enforcement authority under the Water Code is more stringent. In lieu of these conditions, this Order incorporates by reference Water Code section 13387(e).

B. Special Provisions

1. Reopener Provisions

a. **Mercury.** This provision allows the Central Valley Water Board to reopen this Order in the event mercury is found to be causing toxicity based on acute or chronic toxicity test results, or if a TMDL program is adopted. In addition, this Order may be reopened if the Central Valley Water Board determines that a mercury offset program is feasible for dischargers subject to NPDES permits.

b. **Pollution Prevention.** This Order requires the Discharger prepare pollution prevention plans following Water Code section 13263.3(d)(3) for pH. This reopener provision allows the Central Valley Water Board to reopen this Order for addition and/or modification of effluent limitations and requirements for this constituent based on a review of the pollution prevention plan.

c. **Whole Effluent Toxicity.** This Order requires the Discharger to investigate the causes of, and identify corrective actions to reduce or eliminate effluent toxicity through a Toxicity Reduction Evaluation (TRE). This Order may be reopened to include a numeric chronic toxicity limitation, a new acute toxicity limitation, and/or a limitation for a specific toxicant identified in the TRE. Additionally, if a numeric chronic toxicity water quality objective is adopted by the State Water Board, this Order may be reopened to include a numeric chronic toxicity limitation based on that objective.

d. **Water Effects Ratio (WER) and Metal Translators.** A default WER of 1.0 has been used in this Order for calculating CTR criteria for applicable priority pollutant inorganic constituents. In addition, default dissolved-to-total metal translators have been used to convert water quality objectives from dissolved to total recoverable when developing effluent limitations for copper and zinc. If the Discharger performs studies to determine site-specific WERs and/or site-specific dissolved-to-total metal translators, this Order may be reopened to modify the effluent limitations for the applicable inorganic constituents.

e. **Constituent Study.** There are indications that the discharge may have a reasonable potential to cause or contribute to an exceedance of water quality objectives for cadmium. This Order requires the Discharger to complete a study of this constituent's potential effect in the receiving water. This reopener

provision allows the Central Valley Water Board to reopen this Order for addition of effluent limitations and requirements for this constituent if after review of the study results it is determined that the discharge has reasonable potential to cause or contribute to an exceedance of a water quality objective.

f. **Groundwater Monitoring Well Network Technical Report**. Based on a review of the results of the Groundwater Monitoring Well Network Technical Report, this Order may be reopened for addition and/or modification of land discharge specifications, groundwater limitations, and/or water quality monitoring requirements.

g. **Leachfield Design Investigation**. Based on a review of the results of the Leachfield Design Investigation, this Order may be reopened for addition and/or modification of land discharge specifications, and/or monitoring requirements.

h. **Aluminum Site-Specific Study**. This Order requires the Discharger to conduct a site-specific study or other study acceptable to the Executive Officer to determine the appropriate chronic aquatic life criterion for aluminum. If the results of the Study indicate the appropriate chronic aquatic life criterion is being exceeded in the discharge, the permit may be reopened and aluminum effluent limitations established, if appropriate.

i. **Mixing Improvements**. This Order may be reopened to increase dilution credits and/or modify final effluent limitations, if appropriate, based on implementation of measures that improve mixing dynamics and minimize the size of the mixing zone(s). These improvements may include modifications to the diffuser.

j. **Flow Control**. This Order may be reopened for addition and/or modification of effluent limitations, mixing zones, and/or dilution credits, if appropriate, based on implementation of operational measures that ensure a higher minimum river to effluent flow ratio.

k. **Minimum Whitewater Recreation Flow Rate**. The minimum flow rate necessary for whitewater recreation is based on the measurement of flow releases at Box Canyon Dam. Box Canyon Dam is located approximately 0.6 mile upstream of the Discharger's outfall and the Central Valley Water Board is not aware of any major tributary between the Dam and the outfall that would significantly change the flow rate at the outfall compared to that at the Dam. The Discharger may not desire to use Box Canyon Dam flow rates and/or may be unable to adequately access the flow rate data from the operator of the Dam, therefore they may establish an in-stream flow measurement station upstream of their outfall (and below the Dam). This Order may be reopened to allow for an adjustment to the minimum whitewater recreation flow rate, if appropriate, as a result of the establishment of an upstream receiving water flow measurement station (located downstream of Box Canyon Dam) and the submittal of information that would justify a modification to the minimum whitewater recreation flow rate.

l. **Ammonia Reduction Study**. Upon completion of the Ammonia Reduction Study, this Order may be reopened to add or modify final ammonia effluent limitations and/or mixing zone, as appropriate.

2. **Special Studies and Additional Monitoring Requirements**

a. **Chronic Whole Effluent Toxicity Requirements.** The Basin Plan contains a narrative toxicity objective that states, "All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life." (Basin Plan at page III-8.00). Based on whole effluent chronic toxicity testing performed by the Discharger from 2007 through 2011, the discharge does not have reasonable potential to cause or contribute to an in-stream excursion above of the Basin Plan's narrative toxicity objective.

The Monitoring and Reporting Program of this Order requires chronic WET monitoring for demonstration of compliance with the narrative toxicity objective. In addition to WET monitoring, this provision requires the Discharger to submit to the Central Valley Water Board an Initial Investigative TRE Workplan for approval by the Executive Officer, to ensure the Discharger has a plan to immediately move forward with the initial tiers of a TRE, in the event effluent toxicity is encountered in the future. The provision also includes a numeric toxicity monitoring trigger, requirements for accelerated monitoring, and requirements for TRE initiation if toxicity is demonstrated.

Monitoring Trigger. A numeric toxicity monitoring trigger of > 1 TUc (where TUc = 100/NOEC) is applied in the provision, because this Order does not allow any dilution for the chronic condition. Therefore, a TRE is triggered when the effluent exhibits toxicity at 100% effluent.

Accelerated Monitoring. The provision requires accelerated WET testing when a regular WET test result exceeds the monitoring trigger. The purpose of accelerated monitoring is to determine, in an expedient manner, whether there is toxicity before requiring the implementation of a TRE. Due to possible seasonality of the toxicity, the accelerated monitoring should be performed in a timely manner, preferably taking no more than 2 to 3 months to complete.

The provision requires accelerated monitoring consisting of four chronic toxicity tests in a six-week period (i.e., one test every two weeks) using the species that exhibited toxicity. Guidance regarding accelerated monitoring and TRE initiation is provided in the *Technical Support Document for Water Quality-based Toxics Control,* EPA/505/2-90-001, March 1991 (TSD). The TSD at page 118 states, "*EPA recommends if toxicity is repeatedly or periodically present at levels above effluent limits more than 20 percent of the time, a TRE should be required.*" Therefore, four accelerated monitoring tests are required in this provision. If no toxicity is demonstrated in the four accelerated tests, then it demonstrates that toxicity is not present at levels above the monitoring trigger more than 20 percent of the time (only 1 of 5 tests are toxic, including

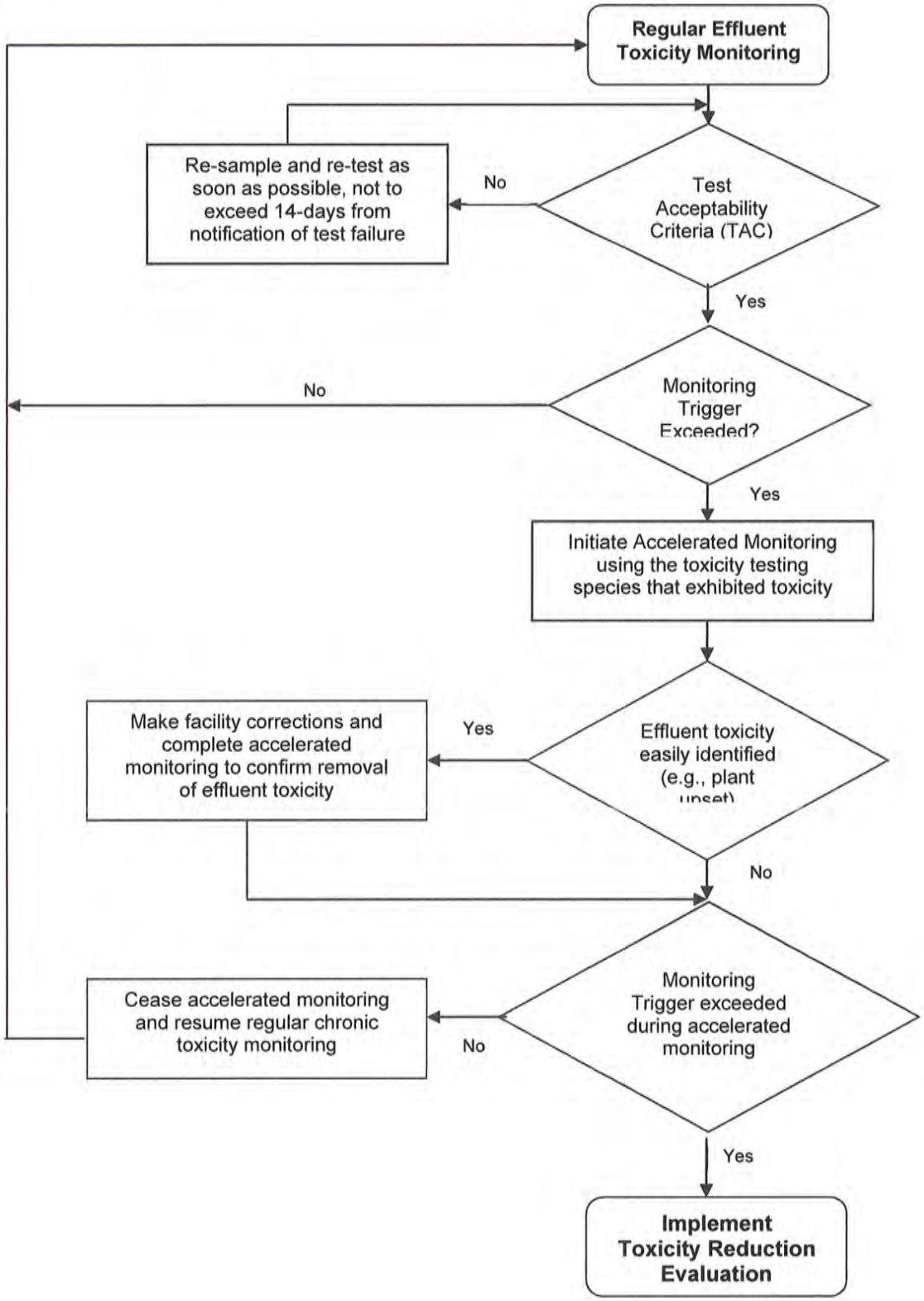
the initial test). However, notwithstanding the accelerated monitoring results, if there is adequate evidence of effluent toxicity (i.e. toxicity present exceeding the monitoring trigger more than 20 percent of the time), the Executive Officer may require that the Discharger initiate a TRE.

See the WET Accelerated Monitoring Flow Chart (Figure F-1), below, for further clarification of the accelerated monitoring requirements and for the decision points for determining the need for TRE initiation.

TRE Guidance. The Discharger is required to prepare a TRE Workplan in accordance with USEPA guidance. Numerous guidance documents are available, as identified below:

- Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants, EPA/833-B-99/002, August 1999.
- Generalized Methodology for Conducting Industrial Toxicity Reduction Evaluations (TREs), EPA/600/2-88/070, April 1989.
- Methods for Aquatic Toxicity Identification Evaluations: Phase I Toxicity Characterization Procedures, Second Edition, EPA 600/6-91/003, February 1991.
- Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I, EPA/600/6-91/005F, May 1992.
- Methods for Aquatic Toxicity Identification Evaluations: Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity, Second Edition, EPA/600/R-92/080, September 1993.
- Methods for Aquatic Toxicity Identification Evaluations: Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity, Second Edition, EPA 600/R-92/081, September 1993.
- Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition, EPA-821-R-02-012, October 2002.
- Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition, EPA-821-R-02-013, October 2002.
- Technical Support Document for Water Quality-based Toxics Control, EPA/505/2-90-001, March 1991.

Figure F-1
WET Accelerated Monitoring Flow Chart



b. **Constituent Study.** There are indications that the discharge may contain constituents that have a reasonable potential to cause or contribute to an exceedance of water quality objectives: cadmium. This Order requires the Discharger to complete a study to evaluate the source of cadmium. If after a review of the study results it is determined that the discharge has reasonable potential to cause or contribute to an exceedance of a water quality objective this Order may be reopened and effluent limitations added for the subject constituents.

c. **Groundwater Monitoring Well Network Technical Report.** To determine compliance with the groundwater limitations contained in section V.B. of this Order, the Discharger is required to evaluate its groundwater monitoring network to ensure there are one or more background monitoring wells and a sufficient number of designated monitoring wells downgradient of the leachfields.

d. **Leachfield Design Investigation.** This provision requires the Discharger to provide a technical engineering report on the design of the Facility leachfields. Specifically, the Discharger must provide design flow rate and loading rates for treatment and soil conditions (including percolation rates) at the leachfield site. The seasonal and intermittent use of the leachfields and subsequent effect on subsurface treatment, if any, must be addressed. Year-round usage of the leachfields must also be evaluated with respect to design constraints and/or treatment capacities.

e. **Total Residual Chlorine Monitoring.** The Facility's disinfection and dechlorination monitoring systems must be upgraded in order to reliability demonstrate compliance with the total chlorine residual effluent limitations.

f. **Continuous pH Analyzer.** The Discharger must install a continuous effluent pH analyzer in order demonstrate compliance with the effluent pH limitations.

g. **Outfall Line and Diffuser Repair.** The Facility's outfall line and diffuser must be repaired to eliminate leaks in the pipeline and to ensure effluent is discharged below the receiving water surface in a manner that optimizes the available mixing of the effluent with the receiving water.

h. **Aluminum Site-Specific Study.** This Order requires the Discharger to conduct a site-specific study or other study acceptable to the Executive Officer to determine the appropriate chronic aquatic life criterion for aluminum.

i. **Ammonia Reduction Study**. To evaluate whether best practicable treatment or control measures are being implemented at the facility in order to minimize the size of the ammonia mixing zone, the Discharger is required to submit an Ammonia Reduction Study. The study shall include a description of ammonia reduction measures implemented during the current permit cycle and/or scheduled for future implementation, site-specific constraints, if any, related to effluent ammonia reduction, and an evaluation of whether there are additional

practicable ammonia reduction measures that may be implemented at the facility in order to reduce ammonia concentrations in the effluent and minimize the size of the ammonia mixing zone. The study shall be submitted by the Discharger 180 days prior to the expiration date of this Order.

3. **Best Management Practices and Pollution Prevention**

   a. **Salinity Evaluation and Minimization Plan.** An Evaluation and Minimization Plan for salinity is required in this Order to ensure adequate measures are developed and implemented by the Discharger to reduce the discharge of salinity to the Sacramento River.

   b. **Water Code Section 13263.3(d)(3) Pollution Prevention Plans**. A pollution prevention plan for pH is required in this Order per Water Code section 13263.3(d)(1)(C). The pollution prevention plans required in section VI.C.7.b of this Order, shall, at a minimum, meet the requirements outlined in Water Code section 13263.3(d)(3). The minimum requirements for the pollution prevention plans include the following:

      i. An estimate of all of the sources of a pollutant contributing, or potentially contributing, to the loadings of a pollutant in the treatment plant influent.

      ii. An analysis of the methods that could be used to prevent the discharge of the pollutants into the Facility, including application of local limits to industrial or commercial dischargers regarding pollution prevention techniques, public education and outreach, or other innovative and alternative approaches to reduce discharges of the pollutant to the Facility. The analysis also shall identify sources, or potential sources, not within the ability or authority of the Discharger to control, such as pollutants in the potable water supply, airborne pollutants, pharmaceuticals, or pesticides, and estimate the magnitude of those sources, to the extent feasible.

      iii. An estimate of load reductions that may be attained through the methods identified in subparagraph ii.

      iv. A plan for monitoring the results of the pollution prevention program.

      v. A description of the tasks, cost, and time required to investigate and implement various elements in the pollution prevention plan.

      vi. A statement of the Discharger's pollution prevention goals and strategies, including priorities for short-term and long-term action, and a description of the Discharger's intended pollution prevention activities for the immediate future.

      vii. A description of the Discharger's existing pollution prevention programs.

viii. An analysis, to the extent feasible, of any adverse environmental impacts, including cross-media impacts or substitute chemicals that may result from the implementation of the pollution prevention program.

ix. An analysis, to the extent feasible, of the costs and benefits that may be incurred to implement the pollution prevention program.

4. **Construction, Operation, and Maintenance Specifications**

a. Turbidity. Operations specifications for turbidity are included as an indicator of the effectiveness of the treatment process and to assure compliance with effluent limitations for total coliform organisms. The tertiary treatment process is capable of reliably meeting a turbidity limitation of 2 nephelometric turbidity units (NTU) as a daily average. Failure of the treatment system such that virus removal is impaired would normally result in increased particles in the effluent, which result in higher effluent turbidity. Turbidity has a major advantage for monitoring filter performance, allowing immediate detection of filter failure and rapid corrective action. The operational specification requires that turbidity shall not exceed 2 NTU as a daily average; 5 NTU, more than 5 percent of the time within a 24-hour period; and an instantaneous maximum of 10 NTU.

5. **Special Provisions for Municipal Facilities (POTWs Only)**

a. Pretreatment Requirements.

i. The federal CWA section 307(b), and federal regulations, 40 CFR Part 403, require publicly owned treatment works to develop an acceptable industrial pretreatment program. A pretreatment program is required to prevent the introduction of pollutants, which will interfere with treatment plant operations or sludge disposal, and prevent pass through of pollutants that exceed water quality objectives, standards or permit limitations. Pretreatment requirements are imposed pursuant to 40 CFR Part 403.

ii. The Discharger shall implement and enforce its approved pretreatment program and is an enforceable condition of this Order. If the Discharger fails to perform the pretreatment functions, the Central Valley Water Board, the State Water Board or USEPA may take enforcement actions against the Discharger as authorized by the CWA.

b. The State Water Board issued General Waste Discharge Requirements for Sanitary Sewer Systems, Water Quality Order No. 2006-0003-DWQ (General Order) on 2 May 2006. The General Order requires public agencies that own or operate sanitary sewer systems with greater than one mile of pipes or sewer lines to enroll for coverage under the General Order. The General Order requires agencies to develop sanitary sewer management plans (SSMPs) and report all sanitary sewer overflows (SSOs), among other requirements and prohibitions.

Furthermore, the General Order contains requirements for operation and maintenance of collection systems and for reporting and mitigating sanitary sewer overflows. Inasmuch that the Discharger's collection system is part of the system that is subject to this Order, certain standard provisions are applicable as specified in Provisions, section VI.C.5. For instance, the 24-hour reporting requirements in this Order are not included in the General Order. The Discharger must comply with both the General Order and this Order. The Discharger and public agencies that are discharging wastewater into the facility were required to obtain enrollment for regulation under the General Order by 1 December 2006.

6. Other Special Provisions

a. Operations specifications for wastewater, during critical flow periods, to be oxidized, coagulated, filtered, and adequately disinfected pursuant to DPH reclamation criteria, California Code of Regulations, Title 22, Division 4, Chapter 3 (Title 22), or equivalent, are necessary in accordance with a 1 July 2003 DPH guidance memo on wastewater treatment levels for potential recreation and reclamation use. The effluent shall be disinfected in accordance with the total coliform organisms effluent limitations set forth in this Order, which are equivalent to "disinfected tertiary recycled water" disinfection requirements, however; wastewater treated for discharge need not comply with the CT[1] requirement specified in Title 22 Section 60301.230(a) or the disinfection process outlined in Section 60301.230(b).

b. **Ownership Change.** To maintain the accountability of the operation of the Facility, the Discharger is required to notify the succeeding owner or operator of the existence of this Order by letter if, and when, there is any change in control or ownership of land or waste discharge facilities presently owned or controlled by the Discharger.

7. Compliance Schedules

a. The Discharger submitted a request, and justification (dated 26 July 2012), for a compliance schedule for compliance with final effluent limitations for BOD_5, TSS, and pH and compliance with Title 22, or equivalent, disinfection requirements. The compliance schedule justification included all items specified in the Compliance Schedule Policy. This Order establishes a compliance schedule for the new, final, WQBELs for BOD_5, TSS, and pH, and Title 22 disinfection requirements and requires full compliance by **8 years from the effective date of this Order.**

VIII. PUBLIC PARTICIPATION

The Central Valley Water Board is considering the issuance of WDRs that will serve as an NPDES permit for the Facility. As a step in the WDR adoption process, the Central Valley

[1] The product of the total chlorine residual multiplied by the modal contact time measured at the same point.

Water Board staff has developed tentative WDRs. The Central Valley Water Board encourages public participation in the WDR adoption process.

A. Notification of Interested Parties

The Central Valley Water Board has notified the Discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for the discharge and has provided them with an opportunity to submit their written comments and recommendations. Notification was provided through physical posting, mailing, and internet posting.

B. Written Comments

The staff determinations are tentative. Interested persons are invited to submit written comments concerning these tentative WDRs. Comments must be submitted either in person or by mail to the Executive Office at the Central Valley Water Board at the address above on the cover page of this Order.

To be fully responded to by staff and considered by the Central Valley Water Board, written comments must be received at the Central Valley Water Board offices by 5:00 p.m. on **27 August 2012**.

C. Public Hearing

The Central Valley Water Board will hold a public hearing on the tentative WDRs during its regular Board meeting on the following date and time and at the following location:

Date:	4, 5 October 2012
Time:	8:30 a.m.
Location:	Regional Water Quality Control Board, Central Valley Region 11020 Sun Center Dr., Suite #200 Rancho Cordova, CA 95670

Interested persons are invited to attend. At the public hearing, the Central Valley Water Board will hear testimony, if any, pertinent to the discharge, WDRs, and permit. Oral testimony will be heard; however, for accuracy of the record, important testimony should be in writing.

Please be aware that dates and venues may change. Our Web address is www.waterboards.ca.gov/centralvalley where you can access the current agenda for changes in dates and locations.

D. Waste Discharge Requirements Petitions

Any aggrieved person may petition the State Water Board to review the decision of the Central Valley Water Board regarding the final WDRs. The petition must be received by the State Water Board within 30 days of the Central Valley Water Board's action, and must be submitted to the following address:

State Water Resources Control Board
Office of Chief Counsel
P.O. Box 100, 1001 I Street
Sacramento, CA 95812-0100

E. Information and Copying

The Report of Waste Discharge, related documents, tentative effluent limitations and special provisions, comments received, and other information are on file and may be inspected at the address above at any time between 8:30 a.m. and 4:45 p.m., Monday through Friday. Copying of documents may be arranged through the Central Valley Water Board by calling (530) 224-4845.

F. Register of Interested Persons

Any person interested in being placed on the mailing list for information regarding the WDRs and NPDES permit should contact the Central Valley Water Board, reference this Facility, and provide a name, address, and phone number.

G. Additional Information

Requests for additional information or questions regarding this order should be directed to Stacy Gotham at (530) 224-4993.

ATTACHMENT G – SUMMARY OF REASONABLE POTENTIAL ANALYSIS

Constituent	Units	MEC	B	C	CMC	CCC	Water & Org	Basin Plan	MCL	Reasonable Potential
Aluminum (aquatic)	µg/L	377	20.9	87	750[5]	87[5]	--	--	--	MEC>C
Aluminum (HH)	µg/L	179[1]	18.1[1]	200	--	--	--	--	200[4]	No
Ammonia	mg/L	18.1	0.04	2.14	2.14	2.6[9] 6.5[8]	--	--	--	MEC>C
Bis(2-Ethylhexyl) Phthalate	µg/L	3	1.2[2]	1.8	--	--	1.8	--	6[3]	MEC>C
Cadmium	µg/L	0.24J	0.32	0.27[6] 0.22[7]	1.9[6] 1.5[7]	1.36[6] 1.18[7]	--	0.27[6] 0.22[7]	5[3]	B>C
Chloride	mg/L	29.2	NA	250	--	--	--	--	250[4]	No
Chlorodibromomethane	µg/L	0.1	0.04	0.41	--	--	0.41	--		No
Copper	µg/L	32	1.2	4.89[6] 4.17[7]	6.87[6] 5.77[7]	4.89[6] 4.17[7]	--	6.77[6] 5.72[7]	1000[4]	MEC>C
Dichlorobromomethane	µg/L	1.4	<0.1	0.56	--	--	0.56	--		MEC>C
Electrical Conductivity	µmhos/cm	454	NA	900	--	--	--	--	900[4]	No
Iron	µg/L	274[1]	82[1]	300	--	1000[5]	--	--	300[4]	No
Lead	µg/L	0.4	<0.1	1.22[6] 0.89[7]	31.23[6] 22.73[7]	1.22[6] 0.89[7]	--	--		No
Manganese	µg/L	39[1]	11.1	50	--	--	--	--	50[4]	No
Nitrate	µg/L	6.74	0.06	10	--	--	--	--	10[3]	No
Mercury	µg/L	0.0079	0.0011	0.05	1.4	0.77	0.05	--	--	No
Silver	µg/L	1.4J	<0.1	1.11[6] 0.8[7]	1.11[6] 0.8[7]	--	--	--	100[4]	No
Total Dissolved Solids	mg/L	276	NA	500	--	--	--	--	500[4]	No
Zinc	µg/L	47.6	12.6	18.71[6] 16.02[7]	63.2[6] 54.0[7]	63.2[6] 54.0[7]	--	18.71[6] 16.02[7]	5000[4]	MEC>C

Constituent	Units	MEC	B	C	CMC	CCC	Water & Org	Basin Plan	MCL	Reasonable Potential

General Note: All inorganic concentrations are given as a total recoverable.
Background data date range is 27 October 2010 – 1 December 2010.
Effluent data range 2007 –2011.
MEC = Maximum Effluent Concentration
B = Maximum Receiving Water Concentration or lowest detection level, if non-detect
C = Criterion used for Reasonable Potential Analysis
CMC = Criterion Maximum Concentration (CTR or NTR)
CCC = Criterion Continuous Concentration (CTR or NTR)
Water & Org = Human Health Criterion for Consumption of Water & Organisms (CTR or NTR)
Org. Only = Human Health Criterion for Consumption of Organisms Only (CTR or NTR)
Basin Plan = Numeric Site-specific Basin Plan Water Quality Objective
MCL = Drinking Water Standards Maximum Contaminant Level
NA = Not Available
ND = Non-detect

Footnotes:
(1) Maximum annual average
(2) Arithmetic mean
(3) Primary MCL
(4) Secondary MCL
(5) NAWQC
(6) Based on minimum receiving water hardness of 47 mg/L $CaCO_3$
(7) Based on minimum effluent hardness of 39 mg/L $CaCO_3$
(8) 4-day ammonia criteria
(9) 30-day ammonia criteria

ATTACHMENT H – CALCULATION OF WQBELS

Parameter	Units	Most Stringent Criteria			Dilution Factors			HH Calculations			Aquatic Life Calculations									Final Effluent Limitations	
		HH	CMC	CCC	HH	CMC	CCC	ECA_{HH} = $AMEL_{HH}$	AMEL/MDEL $Multiplier_{HH}$	$MDEL_{HH}$	ECA $Multiplier_{acute}$	LTA_{acute}	ECA $Multiplier_{chronic}$	$LTA_{chronic}$	Lowest LTA	AMEL $Multiplier_{95}$	$AMEL_{AL}$	MDEL $Multiplier_{99}$	$MDEL_{AL}$	Lowest AMEL	Lowest MDEL
Ammonia (as N)	mg/L	--	2.14	2.6[1] 6.5[2]	--	3	4	--	--	--	0.373	3.1	0.812[1] 0.581[2]	10.4[1] 18.8[2]	3.1	1.45	4.6	2.68	8.4	4.6	8.4
Bis(2-Ethlhexyl) Phthalate	µg/L	1.8	--	--	2	--	--	3.0	1.86	5.6	--	--	--	--	--	--	--	--	--	3.0	5.6
Copper, Total Recoverable	µg/L	--	5.72	4.17	--	3	4	--	--	--	0.288	5.56	0.489	7.85	5.56	1.63	9.1	3.47	19.3	9.1	19.3
DCBM	µg/L	0.56	--	--	2	--	--	1.5	2.41	3.6	--	--	--	--	--	--	--	--	--	1.5	3.6
Zinc, Total Recoverable	µg/L	--	16.0	54.0	--	3	4	--	--	--	0.312	8.18	0.518	113.7	8.18	1.57	12.9	3.20	26.2	12.9	26.2

[1] 30-day ammonia criteria.
[2] 4-day ammonia criteria.

ATTACHMENT I – EFFLUENT AND RECEIVING WATER CHARACTERIZATION STUDY

I. **Background.** Sections 2.4.1 through 2.4.4 of the SIP provide minimum standards for analyses and reporting. (Copies of the SIP may be obtained from the State Water Resources Control Board, or downloaded from http://www.waterboards.ca.gov/iswp/index.html). To implement the SIP, effluent and receiving water data are needed for all priority pollutants. Effluent and receiving water pH and hardness are required to evaluate the toxicity of certain priority pollutants (such as heavy metals) where the toxicity of the constituents varies with pH and/or hardness. In addition to specific requirements of the SIP, the Central Valley Water Board is requiring the following monitoring:

A. **Drinking water constituents**. Constituents for which drinking water Maximum Contaminant Levels (MCLs) have been prescribed in the California Code of Regulation are included in the *Water Quality Control Plan, Fourth Edition, for the Sacramento and San Joaquin River Basins* (Basin Plan). The Basin Plan defines virtually all surface waters within the Central Valley Region as having existing or potential beneficial uses for municipal and domestic supply. The Basin Plan further requires that, at a minimum, water designated for use as domestic or municipal supply shall not contain concentrations of chemical constituents in excess of the MCLs contained in the California Code of Regulations.

B. **Effluent and receiving water temperature.** This is both a concern for application of certain temperature-sensitive constituents, such as fluoride, and for compliance with the Basin Plan's thermal discharge requirements.

C. **Effluent and receiving water hardness and pH.** These are necessary because several of the CTR constituents are hardness and pH dependent.

D. **Dioxin and furan sampling.** This Order does not require the Discharger to conduct dioxin and furan congener sampling. Monitoring for dioxin and furan congeners has been performed by the Discharger in conjunction with past monitoring requirements. Based on the results of past dioxin and furan sampling these pollutants are not present in the discharge. [Semiannual monitoring for 2,3,7,8-TCDD (Dioxin), as described below and contained in Table I-1, is required in this Order]

II. **Monitoring Requirements.**

A. **Semiannual Monitoring**. Semiannual priority pollutant samples shall be collected from the effluent and upstream receiving water (EFF-001 and RSW-001) and analyzed for the constituents listed in Table I-1. Semiannual monitoring shall be conducted for 2 years (4 consecutive samples, evenly distributed throughout discharge to surface water period) and the results of such monitoring be submitted to the Central Valley Water Board, during the fourth year of the permit term. Each individual monitoring event shall provide representative sample results for the effluent and upstream receiving water.

B. Semi-annual Monitoring (dioxins and furans only). NOT APPLICABLE.

C. Concurrent Sampling. Effluent and receiving water sampling shall be performed at approximately the same time, on the same date.

D. Sample type. All effluent samples shall be taken as 24-hour flow proportioned or time composite samples.[1] All receiving water samples shall be taken as grab samples.

Table I-1. Priority Pollutants

CTR #	Constituent	CAS Number	Criterion Quantitation Limit µg/L or noted	Suggested Test Methods
28	1,1-Dichloroethane	75343	0.5	EPA 8260B
30	1,1-Dichloroethene	75354	0.5	EPA 8260B
41	1,1,1-Trichloroethane	71556	0.5	EPA 8260B
42	1,1,2-Trichloroethane	79005	0.5	EPA 8260B
37	1,1,2,2-Tetrachloroethane	79345	0.5	EPA 8260B
75	1,2-Dichlorobenzene	95501	0.5	EPA 8260B
29	1,2-Dichloroethane	107062	0.5	EPA 8260B
	cis-1,2-Dichloroethene	156592	0.5	EPA 8260B
31	1,2-Dichloropropane	78875	0.5	EPA 8260B
101	1,2,4-Trichlorobenzene	120821	0.5	EPA 8260B
76	1,3-Dichlorobenzene	541731	0.5	EPA 8260B
32	1,3-Dichloropropene	542756	0.5	EPA 8260B
77	1,4-Dichlorobenzene	106467	0.5	EPA 8260B
17	Acrolein	107028	2	EPA 8260B
18	Acrylonitrile	107131	2	EPA 8260B
19	Benzene	71432	0.5	EPA 8260B
20	Bromoform	75252	0.5	EPA 8260B
34	Bromomethane	74839	1	EPA 8260B
21	Carbon tetrachloride	56235	0.5	EPA 8260B
22	Chlorobenzene (mono chlorobenzene)	108907	0.5	EPA 8260B
24	Chloroethane	75003	0.5	EPA 8260B
25	2- Chloroethyl vinyl ether	110758	1	EPA 8260B
26	Chloroform	67663	0.5	EPA 8260B
35	Chloromethane	74873	0.5	EPA 8260B
23	Dibromochloromethane	124481	0.5	EPA 8260B
27	Dichlorobromomethane	75274	0.5	EPA 8260B

[1] Volatile constituents shall be sampled in accordance with 40 CFR Part 136 or by methods approved by the Central Valley Water Board or the State Water Board.

CTR #	Constituent	CAS Number	Criterion Quantitation Limit µg/L or noted	Suggested Test Methods
36	Dichloromethane	75092	0.5	EPA 8260B
33	Ethylbenzene	100414	0.5	EPA 8260B
88	Hexachlorobenzene	118741	1	EPA 8260B
89	Hexachlorobutadiene	87683	1	EPA 8260B
91	Hexachloroethane	67721	1	EPA 8260B
94	Naphthalene	91203	10	EPA 8260B
38	Tetrachloroethene	127184	0.5	EPA 8260B
39	Toluene	108883	0.5	EPA 8260B
40	trans-1,2-Dichloroethylene	156605	0.5	EPA 8260B
43	Trichloroethene	79016	0.5	EPA 8260B
44	Vinyl chloride	75014	0.5	EPA 8260B
	Methyl-tert-butyl ether (MTBE)	1634044	0.5	EPA 8260B
	Trichlorofluoromethane	75694	5	EPA 8260B
	1,1,2-Trichloro-1,2,2-Trifluoroethane	76131	10	EPA 8260B
	Styrene	100425	0.5	EPA 8260B
	Xylenes	1330207	0.5	EPA 8260B
60	1,2-Benzanthracene	56553	5	EPA 8270C
85	1,2-Diphenylhydrazine	122667	1	EPA 8270C
45	2-Chlorophenol	95578	2	EPA 8270C
46	2,4-Dichlorophenol	120832	1	EPA 8270C
47	2,4-Dimethylphenol	105679	2	EPA 8270C
49	2,4-Dinitrophenol	51285	5	EPA 8270C
82	2,4-Dinitrotoluene	121142	5	EPA 8270C
55	2,4,6-Trichlorophenol	88062	10	EPA 8270C
83	2,6-Dinitrotoluene	606202	5	EPA 8270C
50	2-Nitrophenol	25154557	10	EPA 8270C
71	2-Chloronaphthalene	91587	10	EPA 8270C
78	3,3'-Dichlorobenzidine	91941	5	EPA 8270C
62	3,4-Benzofluoranthene	205992	10	EPA 8270C
52	4-Chloro-3-methylphenol	59507	5	EPA 8270C
48	4,6-Dinitro-2-methylphenol	534521	10	EPA 8270C
51	4-Nitrophenol	100027	5	EPA 8270C
69	4-Bromophenyl phenyl ether	101553	10	EPA 8270C
72	4-Chlorophenyl phenyl ether	7005723	5	EPA 8270C
56	Acenaphthene	83329	1	EPA 8270C
57	Acenaphthylene	208968	10	EPA 8270C

CTR #	Constituent	CAS Number	Criterion Quantitation Limit µg/L or noted	Suggested Test Methods
58	Anthracene	120127	10	EPA 8270C
59	Benzidine	92875	5	EPA 8270C
61	Benzo(a)pyrene (3,4-Benzopyrene)	50328	0.1	EPA 8270C
63	Benzo(g,h,i)perylene	191242	5	EPA 8270C
64	Benzo(k)fluoranthene	207089	2	EPA 8270C
65	Bis(2-chloroethoxy) methane	111911	5	EPA 8270C
66	Bis(2-chloroethyl) ether	111444	1	EPA 8270C
67	Bis(2-chloroisopropyl) ether	39638329	10	EPA 8270C
68	Bis(2-ethylhexyl) phthalate	117817	3	EPA 8270C
70	Butyl benzyl phthalate	85687	10	EPA 8270C
73	Chrysene	218019	5	EPA 8270C
81	Di-n-butylphthalate	84742	10	EPA 8270C
84	Di-n-octylphthalate	117840	10	EPA 8270C
74	Dibenzo(a,h)-anthracene	53703	0.1	EPA 8270C
79	Diethyl phthalate	84662	2	EPA 8270C
80	Dimethyl phthalate	131113	2	EPA 8270C
86	Fluoranthene	206440	10	EPA 8270C
87	Fluorene	86737	10	EPA 8270C
90	Hexachlorocyclopentadiene	77474	1	EPA 8270C
92	Indeno(1,2,3-c,d)pyrene	193395	0.05	EPA 8270C
93	Isophorone	78591	1	EPA 8270C
98	N-Nitrosodiphenylamine	86306	1	EPA 8270C
96	N-Nitrosodimethylamine	62759	5	EPA 8270C
97	N-Nitrosodi-n-propylamine	621647	5	EPA 8270C
95	Nitrobenzene	98953	10	EPA 8270C
53	Pentachlorophenol	87865	0.2	EPA 8270C
99	Phenanthrene	85018	5	EPA 8270C
54	Phenol	108952	1	EPA 8270C
100	Pyrene	129000	10	EPA 8270C
	Aluminum	7429905	50	EPA 6020/200.8
1	Antimony	7440360	5	EPA 6020/200.8
2	Arsenic	7440382	0.01	EPA 1632
15	Asbestos	1332214	0.2 MFL >10um	EPA/600/R-93/116(PCM)
	Barium	7440393	100	EPA 6020/200.8
3	Beryllium	7440417	1	EPA 6020/200.8
4	Cadmium	7440439	0.25	EPA 1638/200.8

CTR #	Constituent	CAS Number	Criterion Quantitation Limit µg/L or noted	Suggested Test Methods
5a	Chromium (total)	7440473	2	EPA 6020/200.8
5b	Chromium (VI)	18540299	0.5	EPA 7199/1636
6	Copper	7440508	0.5	EPA 6020/200.8
14	Cyanide	57125	5	EPA 9012A
	Fluoride	7782414	0.1	EPA 300
	Iron	7439896	100	EPA 6020/200.8
7	Lead	7439921	0.5	EPA 1638
8	Mercury	7439976	0.0002 (11)	EPA 1669/1631
	Manganese	7439965	20	EPA 6020/200.8
9	Nickel	7440020	5	EPA 6020/200.8
10	Selenium	7782492	5	EPA 6020/200.8
11	Silver	7440224	1	EPA 6020/200.8
12	Thallium	7440280	1	EPA 6020/200.8
	Tributyltin	688733	0.002	EV-024/025
13	Zinc	7440666	10	EPA 6020/200.8
110	4,4'-DDD	72548	0.02	EPA 8081A
109	4,4'-DDE	72559	0.01	EPA 8081A
108	4,4'-DDT	50293	0.01	EPA 8081A
112	alpha-Endosulfan	959988	0.02	EPA 8081A
103	alpha-Hexachlorocyclohexane (BHC)	319846	0.01	EPA 8081A
	Alachlor	15972608	1	EPA 8081A
102	Aldrin	309002	0.005	EPA 8081A
113	beta-Endosulfan	33213659	0.01	EPA 8081A
104	beta-Hexachlorocyclohexane	319857	0.005	EPA 8081A
107	Chlordane	57749	0.1	EPA 8081A
106	delta-Hexachlorocyclohexane	319868	0.005	EPA 8081A
111	Dieldrin	60571	0.01	EPA 8081A
114	Endosulfan sulfate	1031078	0.05	EPA 8081A
115	Endrin	72208	0.01	EPA 8081A
116	Endrin Aldehyde	7421934	0.01	EPA 8081A
117	Heptachlor	76448	0.01	EPA 8081A
118	Heptachlor Epoxide	1024573	0.01	EPA 8081A
105	Lindane (gamma-Hexachlorocyclohexane)	58899	0.019	EPA 8081A
119	PCB-1016	12674112	0.5	EPA 8082
120	PCB-1221	11104282	0.5	EPA 8082
121	PCB-1232	11141165	0.5	EPA 8082

CTR #	Constituent	CAS Number	Criterion Quantitation Limit µg/L or noted	Suggested Test Methods
122	PCB-1242	53469219	0.5	EPA 8082
123	PCB-1248	12672296	0.5	EPA 8082
124	PCB-1254	11097691	0.5	EPA 8082
125	PCB-1260	11096825	0.5	EPA 8082
126	Toxaphene	8001352	0.5	EPA 8081A
	Atrazine	1912249	1	EPA 8141A
	Bentazon	25057890	2	EPA 643/ 515.2
	Carbofuran	1563662	5	EPA 8318
	2,4-D	94757	10	EPA 8151A
	Dalapon	75990	10	EPA 8151A
	1,2-Dibromo-3-chloropropane (DBCP)	96128	0.01	EPA 8260B
	Di(2-ethylhexyl)adipate	103231	5	EPA 8270C
	Dinoseb	88857	2	EPA 8151A
	Diquat	85007	4	EPA 8340/ 549.1/HPLC
	Endothal	145733	45	EPA 548.1
	Ethylene Dibromide	106934	0.02	EPA 8260B/504
	Glyphosate	1071836	25	HPLC/EPA 547
	Methoxychlor	72435	10	EPA 8081A
	Molinate (Ordram)	2212671	2	EPA 634
	Oxamyl	23135220	20	EPA 8318/632
	Picloram	1918021	1	EPA 8151A
	Simazine (Princep)	122349	1	EPA 8141A
	Thiobencarb	28249776	1	HPLC/EPA 639
16	2,3,7,8-TCDD (Dioxin)	1746016	5.00E-06	EPA 8290 (HRGC) MS
	2,4,5-TP (Silvex)	93765	1	EPA 8151A
	Diazinon	333415	0.25	EPA 8141A/GCMS
	Chlorpyrifos	2921882	1	EPA 8141A/GCMS
	Ammonia (as N)	7664417		EPA 350.1
	Chloride	16887006		EPA 300.0
	Flow			
	Hardness (as $CaCO_3$)			EPA 130.2
	Foaming Agents (MBAS)			SM5540C
	Nitrate (as N)	14797558	2,000	EPA 300.0
	Nitrite (as N)	14797650	400	EPA 300.0
	pH		0.1	EPA 150.1

CTR #	Constituent	CAS Number	Criterion Quantitation Limit µg/L or noted	Suggested Test Methods
	Phosphorus, Total (as P)	7723140		EPA 365.3
	Specific conductance (EC)			EPA 120.1
	Sulfate		500	EPA 300.0
	Sulfide (as S)			EPA 376.2
	Sulfite (as SO_3)			SM4500-SO3
	Temperature			
	Total Disolved Solids (TDS)			EPA 160.1

FOOTNOTES:

III. Additional Study Requirements

A. Laboratory Requirements. The laboratory analyzing the monitoring samples shall be certified by the Department of Health Services in accordance with the provisions of Water Code 13176 and must include quality assurance/quality control data with their reports (ELAP certified).

B. Criterion Quantitation Limit (CQL). The criterion quantitation limits will be equal to or lower than the minimum levels (MLs) in Appendix 4 of the SIP or the detection limits for purposes of reporting (DLRs) below the controlling water quality criterion concentrations summarized in Table I-1 of this Order. In cases where the controlling water quality criteria concentrations are below the detection limits of all approved analytical methods, the best available procedure will be utilized that meets the lowest of the MLs and DLR. Table I-1 contains suggested analytical procedures. The Discharger is not required to

use these specific procedures as long as the procedure selected achieves the desired minimum detection level.

C. **Method Detection Limit (MDL)**. The method detection limit for the laboratory shall be determined by the procedure found in 40 CFR Part 136, Appendix B (revised as of May 14, 1999).

D. **Reporting Limit (RL).** The reporting limit for the laboratory. This is the lowest quantifiable concentration that the laboratory can determine. Ideally, the RL should be equal to or lower than the CQL to meet the purposes of this monitoring.

E. **Reporting Protocols.** The results of analytical determinations for the presence of chemical constituents in a sample shall use the following reporting protocols:

1. Sample results greater than or equal to the reported RL shall be reported as measured by the laboratory (i.e., the measured chemical concentration in the sample).

2. Sample results less than the reported RL, but greater than or equal to the laboratory's MDL, shall be reported as "Detected, but Not Quantified," or DNQ. The estimated chemical concentration of the sample shall also be reported.

3. For the purposes of data collection, the laboratory shall write the estimated chemical concentration next to DNQ as well as the words "Estimated Concentration" (may shortened to "Est. Conc."). The laboratory, if such information is available, may include numerical estimates of the data quantity for the reported result. Numerical estimates of data quality may be percent accuracy (+ or – a percentage of the reported value), numerical ranges (low and high), or any other means considered appropriate by the laboratory.

4. Sample results that are less than the laboratory's MDL shall be reported as "Not Detected" or ND.

F. Data Format. The monitoring report shall contain the following information for each pollutant:

1. The name of the constituent.
2. Sampling location.
3. The date the sample was collected.
4. The time the sample was collected.
5. The date the sample was analyzed. For organic analyses, the extraction data will also be indicated to assure that hold times are not exceeded for prepared samples.
6. The analytical method utilized.
7. The measured or estimated concentration.
8. The required Criterion Quantitation Limit (CQL).
9. The laboratory's current Method Detection Limit (MDL), as determined by the procedure found in 40 CFR Part 136, Appendix B (revised as of May 14, 1999).
10. The laboratory's lowest reporting limit (RL).
11. Any additional comments.

ATTACHMENT J – DIOXIN AND FURAN SAMPLING – NOT APPLICABLE

APPENDIX I

GNC

Solutions to improve lives and enrich communities

Economic Development
Access to Capital
Portfolio Management
Housing Rehabilitation
Infrastructure Development
Energy Assistance
Home Weatherization
Community Development
HIV/AIDS Assistance
USDA Food Commodities

April 24, 2014

CITY-WIDE INCOME SURVEY RESULTS FOR THE CITY OF MOUNT SHASTA

Introduction: Great Northern Corporation responded to and received the contract for the Request for Proposals dated December 3, 2013. The proposal was for the conduction of a city-wide income survey for the purpose of determining the Low/Mod Income population. The results of the survey would potentially be used to assist the City in qualifying for grant funding, particularly under the Community Development Block Grant Program (CDBG). Funding under CDBG for community wide benefit projects such as public works and planning requires documented proof that the city population as a whole is at least 51% low-moderate income according to the most current income guidelines from the Department of Housing and Community Development.

Survey Methodology: Great Northern conducted the city-wide income survey in accordance with the guidelines set forth in Appendix F, of the most current Community Development Block Grant Notice of Funding Availability for 2014. Additionally, the state provided income survey form and Survey Data Analysis worksheet were used (see attachments).

Great Northern coordinated with City staff to determine the number of households located within the city limits, along with the mailing addresses for the families located at each physical address. Staff was careful to remove any businesses from the list and to ensure surveys were mailed to the tenants as opposed to the landlords. The sampling universe was created from the Mt. Shasta utility billing database.

Based on a universe consisting of 1,857 households, the survey required a minimum of 350 responses for it to be deemed valid by the State. In order to achieve this, 1,257 surveys were mailed out to households randomly selected by a computer program. Initially, there were two random sample lists created. Two weeks after list one was mailed out, the unique addresses on list two were mailed the second round of surveys.

Surveys were coded and all other identifying information was kept separate to maintain confidentiality and returned surveys were tallied as a group.

Survey Results: Out of the 1,257 surveys that were mailed out to randomly selected household within the city's limits, 378 valid responses were received, representing 715 individuals. According to the 2014 household income limits by size of household that was provided by HCD, 345 individual were identified as

being below low-mod income and 370 were above low-mod income. Effectively, results show that 48.25% of the responses were low-mod income. Based on these results, the City of Mt. Shasta does not meet the minimum 51% low-mod threshold necessary to qualify under Low-Mod Area (LMA) for certain CDBG activities.

Attachments:

1. **Appendix F: Conducting an Income Survey (2014 CDBG NOFA)**
2. **Sample income survey form**
3. **Survey Data Analysis**
4. **Documentation of public outreach**

Survey Data Analysis

Survey Start Date 3/19/2014 | Survey End Date 4/15/2014

City/County of Mt. Shasta | Service Area Description: The city limits of the City of Mt. Shasta, CA

Link to Current CDBG Income Limits http://www.hcd.ca.gov/fa/home/homelimits.html

Number of Persons in Household

80% Area Median Income	1	2	3	4	5	6	7	8
	32,450	37,050	41,700	46,300	50,050	53,750	57,450	61,150

48.25%

Tracking Code	Address	Family Income	Number of Persons in Family	Below Low-Mod Incomes	Above Low-Mod Incomes
0		54,000	2		2
9		50,000	2		2
49		75,000	1		1
60		55,000	2		2
64		55,000	3		3
157		75,000	1		1
255		0	1	1	
376		33,000	1		1
452		53,000	2		2
453		95,085	3		3
461		140,000	2		2
462		150,000	2		2
464		40,000	1		1
473		225,000	2		2
477		80,000	3		3
478		160,000	2		2
481		102,000	2		2
483		60,000	2		2
490		86,808	2		2
501		50,000	1		1
503		58,496	2		2
510		120,000	4		4
515		187,000	3		3
522		47,000	1		1
533		100,000	2		2
557		60,000	2		2
562		40,000	1		1
616		55,000	1		1
620		80,000	2		2
627		80,000	2		2
654		85,000	2		2
656		200,000	2		2
667		50,900	1		1
675		160,000	4		4
685		33,000	1		1

48.25%

Tracking Code	Address	Family Income	Number of Persons in Family	Below Low-Mod Incomes	Above Low-Mod Incomes
687		39,000	1		1
708		50,000	1		1
710		50,000	2		2
718		112,000	5		5
724		46,000	1		1
725		95,000	2		2
730		80,000	2		2
733		50,000	3		3
744		37,000	1		1
745		60,000	4		4
746		39,000	1		1
755		90,000	6		6
757		61,450	2		2
806		60,200	2		2
817		110,000	2		2
820		56,000	2		2
821		190,000	2		2
829		49,580	1		1
830		97,000	1		1
835		58,000	3		3
847		37,000	1		1
849		45,000	2		2
851		45,000	2		2
855		90,000	2		2
858		80,000	7		7
864		46,000	2		2
873		47,000	3		3
888		39,000	2		2
891		50,000	1		1
892		96,105	2		2
908		110,000	4		4
915		100,000	4		4
981		85,000	2		2
984		140,000	2		2
990		55,000	2		2
999		55,000	1		1
1006		92,000	4		4
1007		170,000	3		3
1008		41,000	2		2
1016		100,000	2		2
1018		55,000	6		6
1037		59,300	1		1
1063		80,000	3		3
1097		60,000	3		3
1103		75,000	4		4
1109		65,000	2		2
1113		48,000	2		2

48.25%

Tracking Code	Address	Family Income	Number of Persons in Family	Below Low-Mod Incomes	Above Low-Mod Incomes
1116		76,000	2		**2**
1147		105,000	4		**4**
1150		35,000	1		**1**
1158		42,000	2		**2**
1171		56,000	2		**2**
1176		85,000	2		**2**
1187		105,000	2		**2**
1191		100,000	4		**4**
1208		33,000	1		**1**
1216		150,000	2		**2**
1221		40,000	2		**2**
1222		72,000	5		**5**
1225		40,000	2		**2**
1246		65,000	1		**1**
1260		51,000	5		**5**
1276		57,000	2		**2**
1299		115,000	2		**2**
1301		68,000	3		**3**
1304		83,054	2		**2**
1305		90,000	1		**1**
1313		144,000	3		**3**
1318		42,000	2		**2**
1367		50,000	2		**2**
1398		80,000	1		**1**
1410		77,000	1		**1**
1399		80,000	1		**1**
1415		50,000	4		**4**
1418		34,000	1		**1**
1420		74,000	2		**2**
1429		43,000	2		**2**
1438		198,444	3		**3**
1456		75,000	1		**1**
1462		48,000	2		**2**
1465		115,000	2		**2**
1471		40,000	2		**2**
1473		50,000	1		**1**
1485		95,000	3		**3**
1489		80,000	2		**2**
1492		55,000	2		**2**
1521		140,000	4		**4**
1526		70,000	3		**3**
1535		65,000	3		**3**
1537		40,000	2		**2**
1555		100,000	2		**2**
1571		52,000	2		**2**
1573		75,000	3		**3**
1576		75,000	4		**4**

48.25%

Tracking Code	Address	Family Income	Number of Persons in Family	Below Low-Mod Incomes	Above Low-Mod Incomes
1602		50,000	2		2
1604		33,500	1		1
1607		90,688	2		2
1613		40,000	1		1
1619		100,000	2		2
1622		69,000	2		2
1657		50,000	2		2
1674		45,000	2		2
1683		75,000	1		1
1684		50,000	2		2
1685		70,000	1		1
1695		70,000	1		1
1696		95,000	6		6
1699		70,000	4		4
1716		40,000	1		1
1724		37,000	1		1
1728		75,000	3		3
1729		78,880	1		1
1735		75,000	2		2
1752		54,000	2		2
1767		88,000	2		2
1769		80,000	3		3
1779		175,000	3		3
1782		80,000	1		1
1786		80,000	4		4
1793		120,000	2		2
1797		75,000	1		1
1801		89,000	3		3
1816		48,000	3		3
1820		75,000	3		3
1821		60,000	2		2
1823		42,561	1		1
1834		55,000	2		2
1856		100,000	2		2
1857		120,000	2		2
1		36,000	3	3	
2		10,500	1	1	
4		25,000	4	4	
7		36,000	2	2	
8		28,491	2	2	
11		21,000	2	2	
13		19,500	1	1	
32		17,650	1	1	
61		15,156	1	1	
84		27,000	2	2	
94		13,000	2	2	
98		12,000	2	2	

48.25%

Tracking Code	Address	Family Income	Number of Persons in Family	Below Low-Mod Incomes	Above Low-Mod Incomes
99		6,720	1	**1**	
100		17,663	1	**1**	
135		25,320	2	**2**	
129		11,100	4	**4**	
161		15,132	1	**1**	
166		11,448	1	**1**	
167		10,320	1	**1**	
168		12,000	1	**1**	
171		12,588	1	**1**	
172		10,768	2	**2**	
179		13,000	1	**1**	
180		6,680	1	**1**	
181		20,124	1	**1**	
183		14,328	1	**1**	
186		897	1	**1**	
188		16,000	1	**1**	
192		19,040	1	**1**	
196		10,769	1	**1**	
200		17,000	1	**1**	
204		10,768	1	**1**	
205		10,284	1	**1**	
219		15,542	1	**1**	
220		13,560	1	**1**	
222		1,000	1	**1**	
224		7,878	1	**1**	
227		10,752	1	**1**	
233		14,400	1	**1**	
242		9,984	1	**1**	
247		11,213	1	**1**	
253		8,000	1	**1**	
263		1,179	1	**1**	
268		10,700	1	**1**	
273		11,136	1	**1**	
277		12,048	1	**1**	
278		0	1	**1**	
287		8,088	1	**1**	
289		10,560	1	**1**	
295		12,132	1	**1**	
302		12,672	1	**1**	
312		24,855	1	**1**	
314		30,000	1	**1**	
317		12,150	1	**1**	
319		15,000	1	**1**	
339		10,632	1	**1**	
341		10,764	1	**1**	
342		10,528	1	**1**	
345		10,392	1	**1**	

48.25%

Tracking Code	Address	Family Income	Number of Persons in Family	Below Low-Mod Incomes	Above Low-Mod Incomes
348		1,000	1	1	
349		10,300	1	1	
350		10,392	1	1	
351		12,936	1	1	
353		10,440	1	1	
368		15,022	1	1	
373		11,000	1	1	
374		25,000	3	3	
401		36,000	3	3	
425		16,000	1	1	
457		22,416	1	1	
357		25,000	2	2	
469		30,000	2	2	
476		50,000	5	5	
493		24,000	1	1	
512		32,000	2	2	
525		29,733	1	1	
531		12,000	1	1	
531		28,000	1	1	
537		16,000	1	1	
538		20,000	1	1	
545		10,400	1	1	
546		22,200	1	1	
547		50,000	6	6	
549		11,961	2	2	
556		28,000	2	2	
570		9,540	1	1	
573		24,000	4	4	
589		16,000	1	1	
590		19,000	1	1	
604		14,400	3	3	
619		22,000	2	2	
622		35,000	2	2	
623		957	1	1	
645		12,000	1	1	
676		33,600	2	2	
702		3,200	4	4	
735		4,000	1	1	
740		15,000	2	2	
748		0	1	1	
750		19,000	1	1	
758		46,000	4	4	
778		0	2	2	
783		35,000	2	2	
784		25,000	2	2	
792		10,000	1	1	
801		2,000	2	2	

48.25%

Tracking Code	Address	Family Income	Number of Persons in Family	Below Low-Mod Incomes	Above Low-Mod Incomes
807		22,284	3	**3**	
815		20,000	1	**1**	
843		10,524	1	**1**	
850		26,001	6	**6**	
872		30,000	2	**2**	
878		24,000	1	**1**	
881		22,272	2	**2**	
913		29,000	1	**1**	
926		30,000	1	**1**	
928		17,000	1	**1**	
952		27,000	2	**2**	
962		12,000	1	**1**	
963		26,000	1	**1**	
965		22,950	1	**1**	
982		35,000	2	**2**	
1028		32,000	2	**2**	
1035		30,000	1	**1**	
1043		19,536	1	**1**	
1054		32,000	3	**3**	
1057		9,600	1	**1**	
1073		17,600	1	**1**	
1074		22,142	1	**1**	
1076		10,000	2	**2**	
1091		15,000	1	**1**	
1093		30,000	1	**1**	
1107		13,200	3	**3**	
1119		24,286	2	**2**	
1130		0	1	**1**	
1146		14,400	1	**1**	
1151		32,000	2	**2**	
1156		10,000	1	**1**	
1157		27,000	2	**2**	
1165		6,000	1	**1**	
1175		2,500	3	**3**	
1189		30,000	4	**4**	
1241		35,000	2	**2**	
1247		27,000	2	**2**	
1268		8,500	1	**1**	
1271		7,200	4	**4**	
1278		11,544	1	**1**	
1282		31,440	2	**2**	
1287		10,768	1	**1**	
1294		0	2	**2**	
1310		16,800	1	**1**	
1328		0	2	**2**	
1355		11,519	1	**1**	
1363		32,000	4	**4**	

48.25%

Tracking Code	Address	Family Income	Number of Persons in Family	Below Low-Mod Incomes	Above Low-Mod Incomes
1366		24,000	1	1	
1394		0	1	1	
1417		20,000	1	1	
1437		0	2	2	
1449		25,000	2	2	
1455		31,200	2	2	
1464		14,063	2	2	
1481		22,000	2	2	
1483		25,000	3	3	
1496		20,632	2	2	
1506		18,000	4	4	
1513		8,496	1	1	
1514		25,000	3	3	
1517		50,000	5	5	
1529		18,000	1	1	
1531		36,000	2	2	
1543		30,000	2	2	
1582		32,000	2	2	
1594		10,200	2	2	
1599		14,850	1	1	
1605		30,760	2	2	
1632		30,000	1	1	
1644		16,068	2	2	
1653		0	1	1	
1659		16,000	2	2	
1663		14,160	1	1	
1671		34,000	2	2	
1677		14,880	1	1	
1679		12,827	1	1	
1691		36,000	3	3	
1704		25,000	2	2	
1718		25,000	3	3	
1723		25,000	2	2	
1736		16,000	1	1	
1738		12,000	3	3	
1760		8,000	1	1	
1762		18,036	1	1	
1763		22,000	2	2	
1764		29,000	1	1	
1770		35,000	2	2	
1771		1,137	2	2	
1776		20,000	2	2	
1798		34,999	2	2	
1805		14,703	1	1	
1814		30,000	1	1	
1841		3,200	2	2	
1843		8,000	2	2	

48.25%

Tracking Code	Address	Family Income	Number of Persons in Family	Below Low-Mod Incomes	Above Low-Mod Incomes
19		25,000	2	**2**	
1846		90	2	**2**	
1170		30,000	3	**3**	
713		15,000	2	**2**	
367		14,000	2	**2**	
1027		70,000	1		**1**
1072		250,000	2		**2**
606		90,000	2		**2**
976		70,000	2		**2**
659		100,000	1		**1**
392		40,000	1		**1**
1356		30,000	1	**1**	
1317		23,000	1	**1**	
967		19,000	1	**1**	
1505		23,000	1	**1**	

379

TOTAL	**715**	**345**	**370**

Survey Data Analysis

Survey Start Date: 3/19/2014

Survey End Date: 4/15/2014

City/County of: Mt. Shasta

Service Area Description: The city limits of the City of Mt. Shasta, CA

Link to Current CDBG Income Limits: http://www.hcd.ca.gov/fa/home/homelimits.html

Head of Household Only

Tracking Code	Address	Ethnicity: Hispanic or Latino	Ethnicity: Not Hispanic or Latino	Racial: White	Racial: Asian	Racial: Native Hawaiian/Other Pacific Island	Racial: Asian & White	Racial: Am. Indian/Alaskan & Black African Am.	Racial: Black/ African Am. & White	Racial: American Indian /Alaskan Native & White	Racial: Black /African Am. & White	Racial: Other Multi-Racial	Is Head of Household Female? Y	Is Head of Household Female? N	Own or Rent? Rent	Own or Rent? Own	Is Head of Household 62 or older? Y	Is Head of Household 62 or older? N	Is any family member disable /handicapped? Y	Is any family member disable /handicapped? N
9			x	x										n		o	y			n
49		x												n	R			N		N
60			X	X										N	R		Y			N
64		X										X		N	R			N		N
157			X	X										N		O	Y			N
255			X	X											R		Y			N
376			X	X										N	R			N		N
452			X	X										N	R		Y			N
453			X	X										N		O		N		N
461			X	X										N		O	Y			N
462			X	X										N		O	Y			N
464			X	X									Y		R		Y			N
473			X	X										N		O		N		N
477			X	X										N		O		N		N
478			X	X										N		O	Y			N
481			X	X										N		O	Y			N
483			X	X										N		O	Y		Y	
490			X	X										N		O	Y			N
501			X	X										N		O	Y			N
503			X	X									Y			O		N		N
510			X	X										N		O		N		N
515			X	X										N		O		N	Y	
522			X	X										N	R			N		N
533			X	X										N		O		N		N
557			X	X									Y		R			N		N
562			X	X										N	R			N		N
616			X	X										N		O		N		N
620			X	X										N	R			N		N
627			X	X											R					N
654			X	X										N		O		N		N
656			X	X									Y			O	Y			N
667			X	X									Y			O	Y			N
675			X	X										N		O		N		N
685			X	X									Y		R			N		N
687			X	X									Y		R		Y			N
708			X	X									Y			O		N		N
710			X	X									Y			O		N		N
718		X										X	Y		R			N		N
724			X	X									Y			O		N		N
725			X	X										N		O		N		N
730			X	X										N		O		N		N
733		X										X		N		O		N		N
744			X	X										N		O	Y			N
745			X									X		N		O		N	Y	
746			X	X									Y			O	Y			N
755			X	X									Y			O		N		N
757			X	X										N		O	Y			N
806			X	X										N		O		N		N
817			X	X										N		O	Y		Y	
820			X	X										N		O	Y			N
821			X	X										N		O		N		N
829			X	X										N		O	Y			N
830			X	X									Y			O	Y			N
835			X	X										N		O		N	Y	
847			X	X										N		O		N		N
849			X	X									Y			O	Y			N
851			X	X										N	R			N		N
855		X												N		O	Y		Y	
858			X	X										N		O		N		N
864			X	X										N		O	Y			N
873			X	X										N		O		N		N
888			X	X										N		O	Y			N
891			X	X									Y			O		N		N
892			X	X										N		O		N		N

Head of Household Only

Tracking Code	Address	Ethnicity		Racial										Is Head of Household Female?		Own or Rent?		Is Head of Household 62 or older?		Is **any** family member disable /handicapped?	
		Hispanic or Latino	Not Hispanic or Latino	White	Asian	Native Hawaiian/Other Pacific Island	Asian & White	Am. Indian/Alaskan & Black African Am.	Black/ African Am. & White	American Indian /Alaskan Native	American Indian /Alaskan Native & White	Black /African Am. & White	Other Multi-Racial								
908			X	X											N	R			N		N
915			X	X											N		O		N		N
981			X	X											N		O	Y			N
984			X	X											N		O	Y			N
990			X	X											N		O	Y			N
999			X	X										Y			O	Y			N
1006			X	X										Y			O		N		N
1007			X	X											N		O	Y			N
1008															N		O	Y			N
1016			X	X											N		O	Y		Y	
1018			X	X											N		O		N		N
1037			X	X										Y			O	Y			N
1063			X	X											N		O		N		N
1097			X	X										Y			O		N		N
1103			X		X										N		O		N		N
1109			X	X											N		O	Y			N
1113			X	X											N		O	Y			N
1116			X	X										Y			O	Y		Y	
1147			X	X											N		O		N		N
1150			X	X											N		O	Y		Y	
1158			X										X	Y		R			N		N
1171			X	X											N		O		N		N
1176			X	X											N		O		N		N
1187			X	X											N		O	Y		Y	
1191			X	X											N		O		N		N
1208			X	X										Y			O	Y			N
1216			X	X										Y			O		N		N
1221			X	X											N		O	Y			N
1222			X	X											N		O		N		N
1225			X		X									Y			O		N		N
1246			X	X										Y			O	Y			N
1260			X	X										Y			O		N		N
1276			X	X											N		O	Y			N
1299			X	X											N		O		N	Y	
1301			X	X													O		N		N
1304			X	X											N		O		N		N
1305			X	X										Y			O		N		N
1313			X	X											N		O	Y			N
1318			X	X											N	R			N		N
1367			X	X											N		O		N		N
1398			X	X										Y		R		Y			N
1410			X	X										Y			O		N		N
1399			X	X											N	R			N		N
1415			X	X											N	R			N		N
1418			X	X										Y			O	Y			N
1420			X	X										Y			O		N		N
1429			X										X	Y			O		N		N
1438			X	X											N		O	Y		Y	
1456			X	X										Y			O	Y			N
1462			X	X										Y		R			N		N
1465			X	X											N		O		N		N
1471			X	X											N	R		Y			N
1473			X	X										Y		R		Y		Y	
1485			X	X										Y			O		N		N
1489			X	X										Y			O		N	Y	
1492			X	X										Y		R			N		N
1521			X	X											N		O		N		N
1526		X													N		O	Y			N
1535			X	X										Y			O		N		N
1537			X	X											N		O	Y		Y	
1555			X	X											N		O		N		N
1571			X	X										Y			O	Y		Y	
1573			X	X											N		O	Y		Y	
1576			X	X													O		N		N
1602			X	X											N		O	Y			N
1604			X	X										Y			O	Y			N
1607			X	X											N		O	Y			N
1613			X	X											N	R			N		N
1619			X	X											N		O	Y			N
1622			X	X											N		O	Y			N
1657			X				X							Y			O	Y			N
1674			X	X											N		O		N	Y	
1683			X	X										Y			O	Y			N
1684			X	X										Y		R			N		N
1685			X	X											N		O		N		N

Head of Household Only

Tracking Code	Address	Ethnicity		Racial										Is Head of Household Female?		Own or Rent?		Is Head of Household 62 or older?		Is any family member disabl /handicapped?	
		Hispanic or Latino	Not Hispanic or Latino	White	Asian	Native Hawaiian/Other Pacific Island	Asian & White	Am. Indian/Alaskan & Black African Am.	Black/ African Am. & White	America n Indian /Alaskan Native	American Indian /Alaskan Native & White	Black /African Am. & White	Other Multi-Racial								
1695			X	X										Y		R			N		N
1696			X	X										Y		R			N	Y	
1699			X	X											N		O		N		N
1716			X	X										Y			O	Y			N
1724			X	X										Y			O	Y			N
1728			X	X											N		O		N		N
1729			X	X										Y			O		N		N
1735			X	X											N		O	Y			N
1752			X	X										Y			O	Y			N
1767			X	X											N		O		N		N
1769			X	X											N		O	Y		Y	
1779		X		X										Y			O		N		N
1782			X	X										Y			O	Y			N
1786			X	X										Y			O		N		N
1793			X	X										Y			O		N		N
1797			X	X											N		O	Y			N
1801			X	X											N		O	Y			N
1816			X	X										Y			O	Y		Y	
1820			X	X											N		O		N		N
1821			X	X											N	R		Y			N
1823			X	X										Y		R			N		N
1834			X	X											N		O		N		N
1856			X	X											N		O	Y			N
1857			X	X											N		O		N		N
1			X	X											N	R			N		N
2			X	X										Y		R		Y			N
4			X	X										Y		R			N		N
7			X	X										Y		R			N		N
8			X	X												R		Y			N
11			X	X											N	R			N		N
13			X	X											N		O		N	Y	
32			X	X											N	R		Y			N
61			X										X	Y			O		N	Y	
84			X	X											N		O	Y			N
94			X	X										Y		R			N		N
98			X	X											N	R			N	Y	
99			X	X										Y		R		Y		Y	
100			X	X											N	R			N	Y	
135			X	X											N	R		Y		Y	
129			X	X											N	R			N		N
161			X	X										Y		R		Y		Y	
166			X	X										Y		R		Y			N
167			X	X										Y		R		Y		Y	
168			X	X										Y		R		Y			N
171			X	X										Y		R		Y		Y	
172			X	X											N	R		Y			N
179			X	X										Y		R		Y			N
180		X												Y		R		Y		Y	
181			X	X										Y		R		Y		Y	
183			X	X										Y		R		Y			N
186			X	X										Y		R		Y			N
188			X	X										Y		R		Y			N
192			X	X										Y		R		Y			N
196			X	X										Y		R		Y		Y	
200			X	X										Y		R		Y			N
204				X		X								Y		R		Y			N
205			X	X										Y		R		Y			N
219			X	X										Y		R		Y		Y	
220			X	X										Y		R		Y		Y	
222			X	X											N	R			N	Y	
224			X	X										Y		R		Y			N
227			X	X										Y		R		Y		Y	
233			X	X											N	R		Y			N
242			X	X										Y		R		Y		Y	
247			X	X											N	R		Y		Y	
253			X	X										Y		R		Y		Y	
263			X	X										Y		R		Y		Y	
268			X	X											N	R		Y		Y	
273			X	X										Y		R		Y		Y	
277			X	X										Y		R		Y			N
278			X	X										Y		R			N	Y	
287			X	X										Y		R		Y			N
289			X	X										Y		R		Y			N
295			X	X											N	R		Y			N
302			X	X											N	R		Y			N

Head of Household Only

Tracking Code	Address	Ethnicity: Hispanic or Latino	Ethnicity: Not Hispanic or Latino	Racial: White	Racial: Asian	Racial: Native Hawaiian/Other Pacific Island	Racial: Asian & White	Racial: Am. Indian/Alaskan & Black African Am.	Racial: Black/ African Am. & White	Racial: American Indian /Alaskan Native	Racial: American Indian /Alaskan Native & White	Racial: Black /African Am. & White	Racial: Other Multi-Racial	Is Head of Household Female?		Own or Rent?		Is Head of Household 62 or older?		Is **any** family member disable /handicapped?	
312			X	X											N	R		Y			N
314			X	X										Y		R			N		N
317														Y		R			N		N
319			X	X											N	R		Y			N
339			X	X										Y		R			N		N
341			X	X										Y		R		Y		Y	
342			X	X											N	R			N	Y	
345			X	X											N	R			N	Y	
348		X		X				X	X					Y		R			N	Y	
349			X	X										Y		R		Y			N
350		X		X										Y		R			N	Y	
351			X	X											N	R			N	Y	
353			X	X										Y		R			N	Y	
368			X	X											N	R		Y			N
373			X	X										Y		R			N	Y	
374			X	X										Y		R			N		N
401			X	X										Y		R			N		N
425														Y		R		Y		Y	
457			X	X										Y			O		N		N
357			X	X										Y		R			N		N
469			X	X											N		O	Y			N
476			X	X													O		N		N
493			X	X										Y		R			N		N
512			X	X											N		O		N		N
525			X	X										Y		R			N	Y	
531			X	X											N	R			N		N
531			X	X										Y			O	Y			N
537			X	X										Y		R			N		N
538			X	X										Y		R			N		N
545			X	X										Y				Y		Y	
546			X	X										Y		R		Y			N
547			X	X		X									N	R			N		N
549			X	X											N		O	Y			N
556			X	X										Y		R			N	Y	
570		X												Y			O	Y			N
573			X	X											N	R			N		N
589			X	X										Y		R		Y			N
590			X	X										Y		R		Y			N
604			X	X											N	R			N		N
619			X	X										Y			O	Y		Y	
622			X	X											N		O		N	Y	
623			X	X										Y			O		N	Y	
645			X	X										Y			O	Y			N
676			X	X											N		O	Y			N
702			X	X										Y		R			N		N
735			X	X										Y			O		N		N
740								X	X						N	R		Y			N
748		X												Y			O	Y			
750			X	X										Y		R		Y			N
758			X	X											N		O		N	Y	
778																					
783			X	X										Y		R			N		N
784			X	X										Y			O	Y			N
792			X	X										Y		R		Y			N
801			X						X						N	R			N		N
807			X	X											N	R			N	Y	
815			X	X										Y			O	Y		Y	
843			X	X											N	R			N	Y	
850			X	X	X										N	R			N		N
872			X	X										Y			O		N		N
878			X	X											N		O	Y			N
881		X							X			X		Y			O	Y		Y	
913			X	X										Y		R		Y			N
926			X	X											N	R		Y			N
928			X	X										Y			O	Y			N
952			X	X										Y			O	Y		Y	
962			X	X										Y		R			N		N
963			X	X										Y			O	Y			N
965			X	X										Y		R			N		N
982			X	X											N		O	Y			N
1028			X	X											N		O		N		N
1035			X	X											N	R			N		N
1043			X	X											N		O	Y			
1054			X	X										Y			O	Y		Y	
1057			X	X											N	R			N		N

Head of Household Only

Tracking Code	Address	Ethnicity		Racial										Is Head of Household Female?		Own or Rent?		Is Head of Household 62 or older?		Is any family member disabl /handicapped?	
		Hispanic or Latino	Not Hispanic or Latino	White	Asian	Native Hawaiian/Other Pacific Island	Asian & White	Am. Indian/Alaskan & Black African Am.	Black/ African Am. & White	America n Indian /Alaskan Native	American Indian /Alaskan Native & White	Black /African Am. & White	Other Multi-Racial								
1073			X	X										Y		R		Y		Y	
1074			X	X										Y			O	Y			N
1076			X	X											N	R		Y			N
1091			X	X										Y		R			N	Y	
1093			X	X										Y			O		N		N
1107			X	X										Y			O		N		N
1119			X	X											N	R		Y			N
1130			X	X										Y		R			N		N
1146			X						X						N		O	Y		Y	
1151			X	X											N		O		N	Y	
1156			X	X											N		O	Y			N
1157			X	X											N	R			N		N
1165			X	X											N	R		Y			N
1175			X	X											N		O		N		N
1189		X		X										Y		R			N		N
1241			X	X											N		O	Y			N
1247			X	X											N		O	Y			N
1268			X	X										Y			O		N		N
1271			X	X											N		O		N	Y	
1278			X	X										Y		R			N		N
1282			X	X											N	R			N		N
1287			X	X										Y			O	Y			N
1294			X	X											N		O	Y			N
1310			X	X											N		O	Y			N
1328			X	X											N		O		N	Y	
1355			X	X										Y			O	Y		Y	
1363			X	X											N	R			N		N
1366									X					Y			O		N		N
1394			X	X										Y			O	Y			N
1417			X	X										Y		R			N		N
1437			X	X											N		O		N		N
1449			X	X										Y			O	Y		Y	
1455			X	X											N		O	Y			N
1464			X	X													O	Y			N
1481			X	X											N		O		N	Y	
1483			X	X										Y			O		N		N
1496			X	X											N	R		Y			N
1506			X	X											N	R			N		N
1513			X	X										Y		R			N	Y	
1514			X	X										Y		R			N		N
1517			X	X										Y		R			N		N
1529			X	X										Y			O	Y			N
1531			X	X											N		O		N		N
1543			X	X											N		O		N		N
1582			X	X										Y		R			N		N
1594			X	X											N	R			N	Y	
1599			X	X										Y			O	Y		Y	
1605			X	X											N		O		N		N
1632			X	X										Y			O		N		N
1644			X	X											N		O	Y			N
1653			X	X										Y			O	Y		Y	
1659										X				Y			O	Y		Y	
1663			X	X										Y			O	Y			N
1671			X	X										Y			O	Y			N
1677			X	X										Y			O	Y			N
1679			X	X										Y			O	Y			
1691			X	X											N		O		N		N
1704			X	X											N		O	Y			N
1718			X	X											N	R			N		N
1723			X	X											N		O	Y		Y	
1736			X	X											N		O		N		N
1738			X	X										Y		R			N		N
1760			X		X									Y		R			N		N
1762			X	X										Y			O	Y			N
1763			X	X											N		O		N	Y	
1764			X	X										Y			O	Y			N
1770			X	X										Y			O	Y			
1771			X	X										Y			O	Y			N
1776			X	X										Y		R			N		N
1798			X	X											N		O	Y			N
1805			X	X										Y			O	Y			
1814			X	X										Y			O	Y			N
1841			X	X											N		O	Y			N
1843			X	X										Y			O	Y			N
19			X	X										Y		R			N		N

Head of Household Only

Tracking Code	Address	Ethnicity		Racial										Is Head of Household Female?		Own or Rent?		Is Head of Household 62 or older?		Is **any** family member disable /handicapped?	
		Hispanic or Latino	Not Hispanic or Latino	White	Asian	Native Hawaiian/Other Pacific Island	Asian & White	Am. Indian/Alaskan & Black African Am.	Black/ African Am. & White	America n Indian /Alaskan Native	American Indian /Alaskan Native & White	Black /African Am. & White	Other Multi-Racial								
1846			X	X											N		O		N		N
1170			X	X											N	R			N		N
713			X	X										Y			O		N		N
367			X	X											N	R			N		N
1027		X		X											N	R			N		N
1072			X	X											N		O		N		N
606			X	X										Y		R			N		N
976			X	X											N		O		N		N
659		X		X													O		N		N
392			X	X										Y			O		N		N
1356			X	X										Y			O		N		N
1317			X	X											N	R			N		N
967			X	X										Y			O		Y		N
1505			X	X										Y			O		N		N
400	**Totals**	16	354	351	4	2	1	2	6	1	0	1	7	182	187	155	221	183	193	82	290