FINAL

Wastewater Reclamation Plant
COMPREHENSIVE TECHNICAL EVALUATION REPORT

Prepared for

Rancho Murieta
Community Services District

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1.0 INTRODUCTION

Rancho Murieta is a 3,500-acre residential development located 20 miles east of Sacramento on State Highway 16 (Figure 1-1). Both the Cosumnes River and State Highway 16 bisect the community. Rancho Murieta Community Services District (RMCSD) operates a Wastewater Reclamation Plant (WWRP) that provides treatment for the entire Rancho Murieta community. Tertiary effluent from the WWRP is disposed of by the Rancho Murieta Country Club (RMCC), which applies the effluent on its two golf courses.

1.1 Waste Discharge Requirements

On May 11, 2001, the Regional Water Quality Control Board (RWQCB) issued a Waste Discharge Requirements (WDR) Order No. 5-01-124 (Appendix A) to RMCSD and RMCC. RMCSD and RMCC are collectively referred to as the Dischargers. The WDR required RMCSD to submit to RWQCB a *Preliminary Wastewater Reclamation Plant Evaluation* [Preliminary Report, (HSe, 2002)] by August 15, 2002, containing a preliminary evaluation of each component of the WWRP. A copy of the Preliminary Report is included in Appendix B. RWQCB reviewed the Preliminary Report and provided comments to RMCSD (Appendix C). On November 25, 2002, RMCSD submitted a *Preliminary Wastewater Reclamation Plant Evaluation Addendum* [Addendum (Appendix D)] to the RWQCB. The addendum provided additional water quality data and addressed concerns raised by RWQCB as to the proper determination of background contaminant levels in the groundwater. The WDR also required the submission of this Comprehensive Technical Evaluation Report (CTER). The CTER includes an evaluation of each process at the WWRP in order to determine if "best practical treatment and control" (BPTC) is employed at the WWRP.

1.2 Overview

This Comprehensive Technical Evaluation Report presents the following:

- A review of the findings and recommendations of the Preliminary Report;
- A review of the determination of the appropriate groundwater limitations to be applied to the operation of the WWRP as required by the WDR;
- A description of the WWRP, including process flow diagrams;
- Presentation of wastewater quality at various stages through the WWRP treatment processes, including the results of the additional sampling and analysis as recommended in the Preliminary Report;
- An evaluation of the efficiency of each unit process utilized at the WWRP and an assessment of the ability of the WWRP to comply with the WDR;
- A presentation of groundwater quality and an evaluation of the potential for the degradation of groundwater as a result of operations of the WWRP; and
- An assessment of the need for any modifications to the WWRP in order to comply with the WDR and a program (funding and schedule) for implementation of any needed modifications.

Figure 1-1 Site Map

2.0 REVIEW of the PRELIMINARY WASTEWATER RECLAMATION PLANT EVALUATION REPORT

The Preliminary Report provided certain recommendations for the further comprehensive evaluation of the WWRP. These findings and recommendations of the Preliminary Report are briefly reviewed in this section. The RWQCB also provided comments regarding the Preliminary Report. The concerns were addressed in an addendum to the Preliminary Report and are reviewed in Section 2.4. It should be noted that in reviewing the additional data compiled pursuant to the recommendations of the Preliminary Report, it became apparent that the concentrations of nitrogen compounds in the wastewater had been erroneously reported in the Preliminary Report. The erroneously reported nitrogen concentrations are discussed in Section 2.1, below.

2.1 Nitrogen Compounds

In the course of reviewing the additional wastewater quarterly data gathered since submittal of the Preliminary Report and preparation of this CTER, it became apparent that nitrite and nitrate concentrations were misreported in the Preliminary Report. The concentrations of nitrite and nitrate are to be reported as nitrogen (as N) when, in fact, the concentrations for these compounds were reported as nitrite (NO_2) and nitrate (NO_3), respectively. Consistent with the WDR limitations, nitrate and nitrite concentrations of the wastewater are reported herein as nitrogen (as N). Section 4.3.1.1 discusses the nitrate concentration analysis as it pertains to the wastewater treatment through the WWRP. Section 5.2 discusses the signification changes from the Preliminary Report conclusions regarding potential nitrite/nitrate problems in the groundwater.

2.2 Preliminary Evaluation of Plant Operation

The preliminary evaluation determined that the WWRP had consistently met the WDR secondary treatment limitation for biochemical oxygen demand (BOD_5) and tertiary treatment produced effluent quality fully compliant with California Code of Regulations Title 22 for Recycled Water (Title 22) criteria. Thus, the Preliminary Report concluded that the plant appeared to be operating consistent with BPTC for an aerated facultative pond wastewater treatment system.

2.3 Review of Preliminary Report Recommendations

2.3.1 Manganese

The Preliminary Report reported manganese concentrations in the wastewater above secondary Maximum Contaminant Levels (MCL) for drinking water, and thus, manganese was considered a constituent of potential concern to be further evaluated in the CTER. Section 4.3.1.2 addresses manganese concentrations in the wastewater and compares wastewater concentrations of manganese to background levels.

2.3.2 Nitrification/Denitrification Issues

Because of concerns regarding potential nitrate contamination of local groundwater, the Preliminary Report recommended further evaluation of the nitrification/denitrification processes at the WWRP and an assessment of the potential for nitrate in the wastewater to impact on the groundwater. However, as noted in Section 2.1, nitrite and nitrate levels were misreported in the Preliminary Report. Section 4.3.1.1 contains a discussion of the extent of nitrification at the WWRP and the potential for nitrate contamination of the groundwater.

2.3.3 Potential Wastewater Seepage from Aeration Ponds

Due to the erroneous reporting of nitrate concentrations, including those in Monitor Well 3, the Preliminary Report recommended that the potential for seepage of wastewater from the aeration ponds be evaluated. The potential for pond seepage, utilizing the groundwater limits established for the WWRP (Section 3) and correct nitrate concentrations, is addressed in Section 5.2 of this CTER.

2.3.4 Additional Wastewater Analyses

The Preliminary Report identified the need for additional wastewater analyses. Table 2-1 lists the constituents sampled and analyzed in conjunction with this comprehensive evaluation. The sampling and analyses was conducted monthly from November 2002 through to June 2003.

TABLE 2-1.
Additional Sampling Undertaken as Recommended in the Preliminary Report

Sample Location	NO_3^-	NH_3	Mn^{3+}
WWRP influent	×	×	×
Aeration Pond 1	×	×	×
Aeration Pond 2	×	×	
Aeration Pond 3	×	×	
Aeration Pond 4	×	×	
Aeration Pond 5	×	×	
Reservoir 1	×	×	×
Reservoir 2	×	×	×
Tertiary effluent	×	×	×

2.4 RWQCB Preliminary Evaluation Comment Letter

On October 15, 2002, RWQCB provided a letter to RMCSD regarding the Preliminary Report (Appendix D). The letter directed the RMCSD to prepare the following:

- A comparison of the Discharger's potable water source with treated tertiary effluent (discharge water) and drinking water MCLs;
- A description of the sampling plan for the BPTC evaluation (Table 2-1);
- Justification for assuming water quality data from Monitoring Well 1 is representative of background groundwater quality;
- An assessment of the potential of contaminants in the wastewater to migrate from WWRP to the Operator Engineers Pond.

A *Preliminary Wastewater Reclamation Plant Evaluation Addendum*, submitted to RWQCB on November 25, 2002, responded to each concern. For the purposes of completeness of this CTER, the concerns expressed by the RWQCB are again addressed in this Report.

3.0 GROUNDWATER LIMITATIONS

The WDR requires that no release of any constituent from the WWRP shall cause groundwater in the vicinity of the WWRP to have concentrations of certain listed constituents exceeding those limits contained in the WDR or background groundwater concentrations for the respective contaminants, whichever is greater. This Section develops groundwater limitations for the WWRP.

3.1 Background Groundwater Contaminant Levels

Local groundwater was sampled in monitor and observation wells in order to determine background groundwater concentrations of each potential contaminant. Monitoring Well 1 (MW-1), the well used for determining background groundwater quality, is up-gradient of the WWRP, but adjacent to the RMCC South golf course. The RWQCB expressed concern that the proximity of the MW-1 to the golf course may make it not truly representative of local background groundwater quality because the golf course is being irrigated with recycled water. RMCC evaluated the potential for their irrigation practices to adversely impact local groundwater quality and submitted their findings to the RWQCB in the *Groundwater Limitations Report* (HSe, 2003). The Report concluded, based on volume of recycled water applied, turf up-take of nutrients, and extensive groundwater data, that RMCC irrigation practices were not adversely impacting groundwater in the vicinity of the golf courses. MW-1 water analyses are therefore considered representative of background groundwater quality.

3.2 Groundwater Limitations

Specific groundwater constituent limitations criteria for the WWRP are presented in WDR Order 5-01-124. These numerical limitations were compared to background groundwater quality data collected from MW-1. The greater of the two concentration levels was, in accordance with the WDR, established as the groundwater limitation for the WWRP as set forth in Table 3-1. Note that the limits that are applicable are highlighted in Table 3-1.

TABLE 3-1
WWRP Groundwater Limitations

CONSTITUENT	UNITS	WDR GROUNDWATER LIMITATION[a]	BACKGROUND[b] (MW-1)	CRITERIA OR JUSTIFICATION
Boron	mg/L	0.6	<0.06	Class I irrigation water (Basin Plan)
Chloride	mg/L	106	126	Agricultural use
Iron	mg/L	0.3	22.4	Secondary MCL
Manganese	mg/L	0.05	1.13	Secondary MCL
Sodium	mg/L	69	99	Sodium sensitivity on certain crops irrigated via sprinklers
Total coliform organisms	MPN/100 mL	ND	<2	Effluent to be used as recycled water to RMCC
Total dissolved solids	mg/L	450	765	Agricultural use
Total nitrogen	mg/L	10	1.60[c]	
Nitrite (as N)	mg/L	1	<0.15	Primary MCL
Nitrate (as N)	mg/L	10	0.3[c]	Primary MCL
Ammonia (as N)	mg/L	0.5	0.52	Taste and Odor
Total trihalomethanes	μg/L	100	<0.5	MCL
Total zinc	mg/L	2	0.80	Basin Plan
Total phenol	μg/L	5	<11	Taste and odor
Formaldehyde	μg/L	100	<10	
pH	-	6.5–8.5	4.2	Secondary MCL

[a] Groundwater limitation criteria from WDR Order 5-01-124.
[b] Based on mean water quality data collected from MW-1 between October 2001 to June 2003.
[c] Average concentration calculated using detection limits where non-detects are reported.

4.0 COMPREHENSIVE TECHNICAL EVALUATION OF WWRP UNIT PROCESSES

The WWRP treats wastewater to a tertiary level in accordance with California Code of Regulations Title 22, Recycled Water, for unrestricted use. The sources of raw wastewater for the WWRP are residential homes in the Rancho Murieta community and commercial facilities, such as stores and restaurants, which serve the community. There are no industrial discharges to the WWRP. The tertiary treated wastewater is used to irrigate 250 acres of adjacent golf course property owned and maintained by RMCC. Turf irrigation is the only current disposal option for RMCSD. This section describes the unit processes employed at the WWRP and compares WWRP water quality to the groundwater limitations established in Section 3.

4.1 Treatment Plant Unit Process Summary

Current flow to the WWRP is approximately 450,000 gallons per day (gpd) from approximately 2,100 residential units. The WWRP secondary treatment capacity is 1.55 million gallons per day (mgd) and was sized to serve a projected build-out capacity of 5,200 equivalent dwelling units (EDU) in 2009. This build-out projection has since been reduced to 4,100 EDUs. Current wastewater flows for the WWRP are summarized in Table 4-1, below.

TABLE 4-1
WWRP Wastewater Flow

Description	Flow (mgd)
Current Average Dry Weather Flow (ADWF)	0.45
Design Secondary Treatment Capacity	1.55
Design Tertiary Treatment Capacity	3.0

mgd = Million Gallons per Day.

The collection system, which serves the Rancho Murieta community, consists of gravity sewer lines that flow to eight lift stations situated throughout the community. Wastewater is transported to the WWRP through force mains from the lift stations. Five of the lift stations are located on the north side of the Cosumnes River and three on the south side. The wastewater force main crosses the Cosumnes River via the "old yellow bridge" adjacent to the State Highway 16 Bridge.

As schematically illustrated in Figure 4-1, influent wastewater to the WWRP undergoes primary and secondary treatment through five aerated facultative ponds. Secondary effluent is stored in two storage reservoirs before receiving tertiary treatment, which consists of coagulation, dissolved air flotation (DAF), and sand filtration, followed by chlorine disinfection. The disinfected tertiary treated water is then distributed to the golf courses for irrigation. Biosolids generated from wastewater treatment operations are collected, dewatered, and hauled off-site for disposal to a landfill. The plant layout is shown on an aerial photograph in Figure 4-2 and a detailed process flow diagram is shown in Figure 4-3.

Figure 4-1 Schematic Process Flow Diagram

Figure 4-2 Aerial Plant Layout

Figure 4-3 Detailed Process Flow Diagram

4.2 Treated Wastewater Quality Through the WWRP

Wastewater quality sampled and tested at various stages of the WWRP treatment process is presented in Table 4-2. All concentrations of the constituents in Tables 4-2 were less than the groundwater limits set forth in Table 3-1, with the expected exception of ammonia. Ammonia and nitrate/nitrite levels are discussed in Section 4.3.1.1 of this CTER.

Presented in Tables 4-3 through 4-5 are comparisons of the potable source water and the tertiary effluent for various contaminants, as requested by the RWQCB (October 15, 2002). The concentrations of all constituents sampled in the potable water and the tertiary effluent are less than their respective MCL. Sample locations for the data presented in Table 4-2 to 4-5 are illustrated in Figure 4-4. Copies of all laboratory reports incorporated in these tables are contained in Appendix E.

TABLE 4-2
Water Quality at Various Stages of the Treatment Process

Constituent	Units	GROUNDWATER LIMIT [a]	Potable Source Water [b]	Raw Wastewater [c]	Secondary Effluent [d]	Reservoir 2 [h]	Reservoir 1 [h]	Tertiary Effluent [i]
Boron	mg/L	**0.6**	< 0.020[i]	NA	NA	NA	NA	NA
Chloride	mg/L	**126**	3.0[i]	37	NA	36	41	54
Iron	mg/L	**22.4**	<0.10	0.3	NA	0.14	0.19	0.04
Manganese	mg/L	**1.13**	<0.01	0.11[e]	NA	0.11[d]	0.22[d]	0.21[d]
Sodium	mg/L	**99**	5.4[i]	38	NA	59	58	59
Total coliform organisms	MPN/100 mL	**<2**	201.4	NA	NA	NA	NA	< 2
TDS	mg/L	**765**	55[f]	293	287	270	280	318
Total nitrogen	mg/L	**10**	NA	NA	NA	NA	NA	NA
Nitrite (as N)	mg/L	**1**	<0.50	<0.40	NA	NA	NA	0.07
Nitrate (as N)	mg/L	**10**	<0.11	0.18[e]	0.20[e]	0.76[e]	2.22[e]	1.35[e]
Ammonia (as N)	mg/L	**0.52**	NA	27.9[e,g]	19.0[e,g]	12.7[e,g]	4.6[e,g]	11.3[e,g]
Total THM	μg/L	**100**	<0.50	NA	NA	NA	NA	NA
Total zinc	mg/L	**2**	<0.050	0.67	0.17[k]	0.05	0.03	0.03
Total phenol	μg/L	**<11**	20[i]	NA	10[k]	NA	NA	<10
Formaldehyde	μg/L	**100**	<10[i]	NA	17[k]	NA	NA	<10
pH	-	**4.2–8.5**	7.6[f]	7.2	7.6	7.1[L]	7.4[L]	6.8

[a] As established in Table 3-1.
[b] Based on December 7, 2000, sample results.
[c] Based on sample results collected during February 2002.
[d] Based on averages for samples collected between August 2001 to July 2003.
[e] Extrapolated from Table 4-7 and 4-8.
[f] Based on December 7, 2001, sample results.
[g] Constituents in excess of the groundwater limit are shown highlighted.
[h] Based on sample results collected between January 2002 and April 2002.
[i] Based on sample results collected between November 2001 and July 2003.
[j] Based on October 27, 2003, sample results.
[k] Average applies the less than number as actual concentrations.
[L] pH in Reservoirs – In late summer/fall of 2001, the RMCSD reported pH >9.0 in the reservoirs and Pond 4. The high pH was attributed to algae growth. As the pH is reduced before discharge with the addition of alum in the coagulation process, the RMCSD requested, in November 15, 2001, that the in-plant pH limitation be removed from the WDR.

TABLE 4-3
Title 22, Table 64431-A Comparison of MCL, Potable Source Water, and Tertiary Effluent [e]

Constituent	Units	MCL [a]	Potable Source Water [b]	Tertiary effluent [c]
Aluminum	mg/L	**1**	<0.050	0.020
Antimony	mg/L	**0.006**	<0.0060	<0.0050
Arsenic	mg/L	**0.05**	<0.0020	<0.001
Asbestos	MFL[f]	**7 MFL[f]**	<0.20[d]	<0.20
Barium	mg/L	**1**	<0.10	0.016
Beryllium	mg/L	**0.004**	<0.0010	<0.0005
Cadmium	mg/L	**0.005**	<0.0010	<0.0010
Chromium	mg/L	**0.05**	<0.010	<0.001
Cyanide	mg/L	**0.2**	<0.010	<0.010
Fluoride	mg/L	**2**	0.14	<0.1
Mercury	mg/L	**0.002**	<0.0010	<0.0000002
Nickel	mg/L	**0.1**	<0.010	0.011
Nitrate (as NO_3)	mg/L	**45**	<0.11	0.38
Nitrate + Nitrite (as N)	mg/L	**10**	<0.26	<0.53
Nitrite (as N)	mg/L	**1**	<0.147	<0.147
Selenium	mg/L	**0.05**	<0.0050	<0.0050
Thallium	mg/L	**0.002**	<0.0010	<0.0050

[a] Maximum Contaminant Limit (MCL) for each respective contaminant listed per CCR Title 22, Section 64431.
[b] Based on December 7, 2000 sample.
[c] Based on November 20, 2001 sample.
[d] Based on October 29, 2001 sample of the Cosumnes River.
[e] Constituents in excess of the limit are shown highlighted.
[f] MFL = Micro-fibers per liter.

TABLE 4-4
Title 22, Table 64444-A Comparison of MCL, Potable Source Water, and Tertiary Effluent

Constituent	MCL[a]	Units	Potable Source Water[b]	Tertiary Effluent[c]
Volatile Organic Carbons				
Benzene	0.001	mg/L	< 0.00050	< 0.0050
Carbon Tetrachloride	0.005	mg/L	< 0.00050	< 0.0050
1,2-Dichlorobenzene	0.6	mg/L	< 0.00050	< 0.0050
1,4-Dichlorobenzene	0.005	mg/L	< 0.00050	< 0.0050
1,1-Dichloroethane	0.005	mg/L	< 0.00050	< 0.0050
1,2-Dichloroethane	0.0005	mg/L	< 0.00050	< 0.0050
1,1-Dichlorethylene	0.006	mg/L	< 0.00050	< 0.0050
cis-1,2-Dichloroethylene	0.006	mg/L	< 0.00050	< 0.0050
trans-1,2-Dichloroethylene	0.01	mg/L	< 0.00050	< 0.0050
Dichloromethane	0.005	mg/L	< 0.0050[d]	< 0.0050
1,2-Dichloropropane	0.005	mg/L	< 0.00050	< 0.0050
1,3-Dichloropropene	0.0005	mg/L	< 0.00050	< 0.0050
Ethylbenzene	0.7	mg/L	< 0.00050	< 0.0050
Methyl-tert-butyl ether	0.013	mg/L	< 0.003	< 0.003 [c]
Monochlorobenzene	0.07	mg/L	< 0.0050[d]	< 0.0050
Styrene	0.1	mg/L	< 0.00050	< 0.0050
1,1,2,2-Tetrachloroethane	0.001	mg/L	< 0.00050	< 0.0050
Tetrachloroethylene	0.005	mg/L	< 0.00050	< 0.0050
Toluene	0.15	mg/L	< 0.00050	< 0.0050
1,2,4-Trichlorobenzene	0.07	mg/L	< 0.00050	< 0.0050
1,1,1-Trichloroethane	0.2	mg/L	< 0.00050	< 0.0050
1,1,2-Trichloroethane	0.005	mg/L	< 0.00050	< 0.0050
Trichloroethylene	0.005	mg/L	< 0.00050	< 0.0050
Trichlorofluoromethane	0.15	mg/L	< 0.00050	< 0.0050
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.2	mg/L	< 0.0050[d]	< 0.0050
Vinyl Chloride	0.0005	mg/L	< 0.00050	< 0.010
Xylenes	1.75	mg/L	< 0.00050	< 0.010

[a] Maximum Contamination Limit (MCL) for each respective contaminant listed per CCR Title 22, Section 64444.
[b] Based on December 7, 2000 sample results.
[c] Based on February 8, 2002 sample results.
[d] Based on November 20, 2001 sample results.

TABLE 4-4 (*continued*)
Title 22, Table 64444-A Comparison of MCL, Potable Source Water, and Tertiary Effluent

Constituent	MCL[a]	Units	Potable Source Water[b]	Tertiary Effluent[c]
Semi-Volatile Organic Carbons				
Alachlor	0.002	mg/L	< 0.0010	< 0.0010
Atrazine	0.003	mg/L	< 0.0010	< 0.0010
Bentazon	0.018	mg/L	< 0.0020 [d]	< 0.0020
Benzo(a)pyrene	0.0002	mg/L	< 0.00010	< 0.00020
Carbofuran	0.018	mg/L	< 0.00020 [d]	< 0.00020
Chlordane	0.0001	mg/L	< 0.00010	< 0.00050
2,4-D	0.07	mg/L	< 0.0010 [d]	< 0.0010
Dalapon	0.2	mg/L	< 0.0020 [d]	< 0.0020
Dibromochloropropane	0.0002	mg/L	< 0.000010	< 0.0050
Di(2-ethylhexyl)adipate	0.4	mg/L	NA	NA
Di(2-ethylhexyl)phthalate	0.004	mg/L	< 0.010[d]	< 0.010
Dinoseb	0.007	mg/L	< 0.0010 [d]	< 0.0010
Diquat	0.02	mg/L	< 0.0040[d]	< 0.0040
Endothall	0.1	mg/L	< 0.045[d]	< 0.045
Endrin	0.002	mg/L	< 0.00010	< 0.00010
Ethylene Dibromide (EDB)	0.00005	mg/L	< 0.000020	< 0.000020
Glyphosate	0.7	mg/L	< 0.025[d]	< 0.025
Heptachlor	0.00001	mg/L	< 0.000010	< 0.000050
Heptachlor Epoxide	0.00001	mg/L	< 0.000010	< 0.000050
Hexachlorobenzene	0.001	mg/L	< 0.00050	< 0.010
Hexachlorocyclapentadiene	0.05	mg/L	< 0.0010	< 0.010
Lindane	0.0002	mg/L	< 0.00020	< 0.000050
Methoxychlor	0.04	mg/L	< 0.010	< 0.00050
Molinate	0.02	mg/L	< 0.0020	< 0.0020
Oxamyl	0.2	mg/L	< 0.00010 [d]	< 0.00010
Pentachlorophenol	0.001	mg/L	< 0.025 [d]	< 0.025
Picloram	0.5	mg/L	< 0.0010 [d]	NA
Polychlorinated Biphenyls	0.0005	mg/L	< 0.00050	< 0.0050
Simazine	0.004	mg/L	< 0.0010	< 0.0010
Thiobencarb	0.07	mg/L	< 0.0010	< 0.0010
Toxaphene	0.003	mg/L	< 0.0010	< 0.0010
2,3,7,8-TCDD (Dioxin)	0.00000003	mg/L	< 0.0000000061[d]	< 0.0000000061
2,4,5-TP (Silvex)	0.05	mg/L	< 0.00020 [d]	<0.00020

[a] Maximum Contaminant Limit (MCL) for each respective contaminant listed per CCR Title 22, Section 64444.
[b] Based on December 7, 2000 sample results.
[c] Based on November 20, 2001 sample results.
[d] Based on October 29, 2001 sample results of the Cosumnes River.

TABLE 4-5
Title 22, Table 64449-A B Comparison of MCL, Potable Source Water, and Tertiary Effluent

Constituent	Units	MCL [a]	Potable Source Water [b]	Tertiary effluent [c]
Color	Units	**15**	0[d]	NA
Corrosivity	Std. units	**4.2-8.5**	7.6[d]	6.4
Foaming Agents (MBAS)	mg/L	**0.5**	<0.50[d]	<0.5
Odor	Units	**3**	0[d]	NA
Turbidity	NTU	**5.0**	<0.50 [d]	0.78[e]
Aluminum	mg/L	**0.2**	<0.050	0.020
Copper	mg/L	**1.0**	<0.050	0.0019
Iron	mg/L	**0.3**	<0.10	<0.050
Manganese	mg/L	**0.05**	<0.010	0.043
Silver	mg/L	**0.1**	<0.010	<0.00050
Zinc	mg/L	**5.0**	<0.050	0.028
Methyl-tert-butyl ether	mg/L	**0.005**	<0.003	<0.003 [g]
Thiobencarb	mg/L	**0.001**	<0.0010	<0.001
TDS	mg/L	**500**	55[d]	320
Specific Conductance	μg/L	**900**	100[d]	510
Chloride	mg/L	**250**	3.0[f]	75
Sulfate	mg/L	**250**	4.3[d]	100

[a] Maximum Contaminant Limit for each respective contaminant listed per CCR, Title 22, Section 64449.
[b] Based on December 7, 2000 sample results.
[c] Based on November 20, 2001 sample results.
[d] Based on December 7, 2001 sample results of the Cosumnes River.
[e] Based on July 8, 2002 daily sample results.
[f] Based on October 27, 2003, sample results.
[g] Based on February 8, 2002, sample results.
[h] Constituents in excess of Limit are shown highlighted.

Figure 4-4 Sample Location Map

4.3 Primary/Secondary Treatment Process Evaluation

The WWRP employs five aerated ponds, typically operated in series, as shown in Figure 4-4. These ponds provide both primary and secondary treatment of the wastewater. The raw wastewater entering the WWRP is slightly weaker than domestic-strength wastewater, averaging approximately 150 mg/L of BOD_5 and 120 mg/L of total suspended solids (TSS). To control odors, chlorine can be added to the raw wastewater prior to entering Pond 1. As illustrated (Figure 4-3), any of the ponds can be isolated and bypassed without interruption to other plant operations. The ponds are constructed with an inside slope of 3:1. The original ponds (Ponds 1, 2, 3, and 5) were constructed in 1984 and have a 2-foot thick clay liner constructed on the side slopes and pond bottom. Pond 4, built in 1986, was constructed with a clay liner and a concrete apron on the south and west side slopes.

A comparison of design and actual hydraulic detention time (HDT) for the aeration ponds, shown in Table 4-6, indicates the WWRP is currently operating at approximately 30% of the design capacity. Design details for each pond are further summarized in Table 4-6.

TABLE 4-6
Aerated Pond Design Criteria

AERATED PONDS	POND 1	POND 2	POND 3	POND 4	POND 5
Surface dimensions (ft × ft)	200 × 269	200 × 269	413 × 269	543 × 262	413 × 269
Depth (ft)	9.8	9.8	9.5	11.1	9.0
Total volume (ft^3)	345,870	349,350	787,560	1,157,390	737,040
Current HDT (day) [a]	6.0	6.1	13.7	20.1	12.8
Design HDT (day) [b]	1.7	1.7	3.8	5.6	3.6
Number of surface aerators	5	3	3	2	2
Number of Mixers	1	1	1	1	1

[a] Hydraulic detention time (HDT) at 430,000 gpd ADWF.
[b] At 1.55 mgd ADWF.

Aeration requirements are governed by the need to maintain adequate dissolved oxygen (DO) concentration in the upper zone (one foot) of the ponds. WDR Order No. 5-01-124 requires that the DO concentration in the upper zone of all aeration ponds shall not be less than 1.0 milligram per liter (mg/L). Currently, DO in the ponds typically range between 1.8 mg/L (Pond 1) and increase to approximately 8.8 mg/L in Pond 5, thus maintaining a DO greater than the WDR Limit of 1.0 mg/L. As the oxygen demand is reduced from Pond 1 to Pond 5, the aeration requirements of the ponds are also reduced. In Pond 1, five aerators are available to satisfy the relatively large demand for oxygen to stabilize the organic material in the wastewater. Typically, the four corner aerators operate continuously to maintain aerobic conditions in the upper zone. The fifth aerator, located in the center, is activated as needed. Unlike the aerators in Pond 1, which are operated continuously, timers control the aerators in Ponds 2 through 5. In addition, one solar mixer was installed per aeration pond to help facilitate and increase the efficiency of the aeration process.

4.3.1 Wastewater Analysis

As recommended in the Preliminary Report, additional wastewater sampling was conducted to further evaluate the operations of the WWRP and treatment process effectiveness. Additional sampling, as outlined in Table 2-1, was conducted on nitrates, ammonia, and manganese at various locations in the WWRP on a monthly basis from November 2002 through June of 2003. These constituents were identified in the Preliminary Report as the parameters at highest risk of impacting groundwater. A summary of the wastewater analysis for ammonia and nitrates is presented in Tables 4-7 and 4-8, respectively, and the full laboratory reports are included in Appendix B. Sampling locations throughout the WWRP are shown in Figure 4-2.

4.3.1.1 NITROGEN COMPOUNDS

As would be expected, ammonia concentrations (Table 4-7) in the wastewater throughout the WWRP are greater than the groundwater limits for ammonia established in Table 3-1. Nitrification in aerated pond systems is typically limited. Nitrate levels measured in the wastewater throughout the WWRP are consistently below the groundwater limit of 10 mg/L, as N (Table 4-8). The data further shows that ammonia concentrations tend to be reduced as the wastewater moves through the ponds. Conversely, as ammonia levels drop through the plant, the nitrate levels increase. This is likely the result of ammonia assimilation in algal biomass and limited partial nitrification due to long detention times and resultant high solids retention times (SRT), converting some of the ammonia into nitrates. This process is not very stable in pond systems and cannot be relied upon to consistently achieve significant levels of nitrification. As would be expected, the ammonia levels found in the WWRP are greater than the groundwater limitation. However, as discussed in Section 5.2, WWRP operations do not impact ammonia concentrations in the groundwater.

TABLE 4-7
Ammonia (as N) Concentrations Through the WWRP [a, b]

DATE	UNITS	INFLUENT	AERATION POND 1	AERATION POND 2	AERATION POND 3	AERATION POND 4	AERATION POND 5	RES. 2	RES. 1	TERTIARY EFFLUENT
11/25/02	mg/L	26	23	25	28	1.2	24	16	1.5	22[c]
12/9/02	mg/L	34	21	17	18	0.87	18	9.4	0.56	NA
1/8/03	mg/L	18	9.7	13	22	20	20	12	2.2	NA
2/6/03	mg/L	32	19	17	18	4.1	14	13	2.9	NA
3/19/03	mg/L	19	19	21	22	5.1	22	7.1	18[c]	NA
4/21/03	mg/L	30	20	21	24	1.5	24	22	3.9	NA
5/15/03	mg/L	34	21	22	23	6.3	23	17	6.3	NA
6/19/03	mg/L	30	12	15	19	0.7	7.2	4.8	1.6	0.6
Maximum	mg/L	34	23	25	28	20	24	22	18	22[c]
Average	mg/L	27.9	18.1	18.9	21.8	5.0	19.0	12.7	4.6	11.3
Minimum	mg/L	18	9.7	13	18	0.66	7.2	4.8	0.56	0.6

[a] Ammonia groundwater limit is 0.5 mg/L (as N) (Table 3-1).
[b] Ammonia concentrations in excess of the groundwater limit are shown highlighted.
[c] Appears to be an anomalous result.
NA= Not applicable; tertiary plant shut down during wet season and no discharge to golf courses.

TABLE 4-8
Nitrate (as N) Concentrations Through the WWRP [a, b]

DATE	UNITS	INFLUENT	AERATION POND 1	AERATION POND 2	AERATION POND 3	AERATION POND 4	AERATION POND 5	RES. 2	RES. 1	TERTIARY EFFLUENT
11/25/02	mg/L	0.20	0.17	0.23	0.22	0.25	0.22	0.41	3.84	0.23
12/9/02	mg/L	0.25	0.18	0.27	0.17	0.27	0.20	0.93	2.71	NA
1/8/03	mg/L	0.18	1.40	0.43	0.22	0.20	0.19	1.35	3.16	NA
2/6/03	mg/L	0.19	0.19	0.19	0.19	0.25	0.20	0.21	2.94	NA
3/19/03	mg/L	0.13	0.12	0.12	0.14	0.59	0.15	1.99	0.17	NA
4/21/03	mg/L	0.19	0.19	0.21	0.20	0.59	0.21	0.20	1.87	NA
5/15/03	mg/L	0.16	0.19	0.18	0.19	0.52	0.21	0.54	1.40	NA
6/19/03	mg/L	0.18	0.18	0.18	0.20	0.45	0.23	0.43	1.69	2.48
Maximum	mg/L	0.25	1.40	0.43	0.22	0.59	0.23	1.99	3.84	2.48
Average	mg/L	0.18	0.33	0.22	0.19	0.39	0.20	0.76	2.22	1.35
Minimum	mg/L	0.13	0.12	0.12	0.14	0.20	0.15	0.20	1.35	0.23

[a] Nitrate groundwater limit is 10 mg/L (as N) (Table 3-1).
[b] Nitrate concentrations in excess of the groundwater limit are shown highlighted (none)
NA= Not applicable; tertiary plant shut down during wet season and no discharge to golf courses.

4.3.1.2 MANGANESE

Manganese concentrations throughout the WWRP are uniformly substantially below the background groundwater limit of 1.13 mg/L reported in MW-1 and are consistent with, although slightly elevated over, those of potable source water and the secondary drinking water MCL of 0.05 mg/L (Table 4-9). The facts that the background concentration of manganese is high and the clay liners were constructed from local material are the likely reasons that the manganese levels in the reservoirs are elevated above concentrations in the influent wastewater. The higher background concentrations of manganese eliminates any potential for the operation of the WWRP to cause the groundwater limit of manganese to be exceeded.

TABLE 4-9
Manganese Concentrations Through the WWRP[a, b]

DATE	UNITS	INFLUENT	AERATION POND 1	RESERVOIR 2	RESERVOIR 1	TERTIARY EFFLUENT
11/20/01	mg/L	NA	NA	NA	NA	0.043
1/10/02	mg/L	NA	NA	0.050	0.20	NA
2/7/02	mg/L	0.047	NA	NA	NA	0.32
2/8/02	mg/L	0.053	NA	NA	NA	0.30
2/11/02	mg/L	0.074	NA	NA	NA	0.31
4/11/02	mg/L	NA	NA	NA	NA	0.40
11/25/02	mg/L	0.059	0.058	0.087	0.26	0.054
12/9/02	mg/L	0.27	0.084	0.11	0.31	NA
1/8/03	mg/L	0.089	0.20	0.11	0.34	NA
2/6/03	mg/L	0.10	0.078	0.15	0.30	NA
3/19/03	mg/L	0.19	0.066	0.26	0.10	NA
4/24/03	mg/L	0.14	0.072	0.097	0.21	NA
5/15/03	mg/L	0.08	0.087	0.032	0.24	NA
6/19/03	mg/L	0.083	0.07	0.064	0.024	<0.02
Maximum	mg/L	0.27	0.20	0.26	0.34	0.40
Average	mg/L	0.108	0.089	0.107	0.22	0.207
Minimum	mg/L	0.047	0.058	0.032	0.024	<0.02

[a] Manganese groundwater limit is 1.13 mg/L (Table 3-1).
[b] Constituents in excess of the groundwater limit are shown highlighted (none).
NA= Not applicable; tertiary plant shut down during wet season and no discharge to golf courses.

4.3.2 Secondary Effluent Analysis

Secondary effluent limitations for the WWRP (BOD_5 and settleable solids) were reported in the Preliminary Report to be consistently achieved. However, the additional analysis for the period August 2001 through November 2003 resulted in excursions of the BOD_5 limitation (daily limit in May 2003; 30-day average in June and September 2003). These excursions were reported to the RWQCB in the Quarterly Monitoring Report for the period ending June 2003. As noted in the Quarterly Monitoring Report, these excursions appear to be the result of Pond 5 overturning due to high ambient temperatures with a resulting algae bloom. WWRP staff adjusted to the upset in Pond 5 by increasing the aeration in all of the ponds, resulting in BOD_5 returning to levels below the secondary effluent limitation by mid June. Similarly, the fall overturn of Pond 5 was the likely the cause of the 30-day average BOD_5 excursion that occurred in September 2003.

Table 4-10 presents BOD_5 and settleable solids analyses for the period August 2001 through November 2003, and shows that, with exceptions of the recent excursions due to overturning of Pond 5, secondary effluent from the pond system has consistently, over the past two years, been in compliance with the BOD_5 and settleable solids limitation set by the WDR.

TABLE 4-10
Secondary Effluent Water Quality Summary for BOD_5 and Settable Solids

MONTH/YEAR	BOD_5		SETTLEABLE SOLIDS	
	30-DAY AVG. Limit=40 mg/L[a]	DAILY MAX Limit=80 mg/L[a]	30 DAY AVG. Limit=0.5 mg/L[a]	DAILY MAX Limit=1 mg/L[a]
August-01	14.2	19	< 0.1	0.15
September-01	26.3	30	< 0.15	0.12
October-01	17.3	18	0.2	0.35
November-01	24.2	34	0.12	0.12
December-01	33	48	< 0.1	< 0.1
January-02	17.3	26	< 0.1	< 0.1
February-02	12.3	19	< 0.1	< 0.1
March-02	11.8	24	< 0.1	< 0.1
April-02	3.7	4.5	< 0.1	< 0.1
May-02	3.7	6.3	< 0.1	< 0.1
June-02	8.7	13	< 0.1	0.1
July-02	21.5	26	< 0.1	0.2
August-02	31	70	< 0.1	0.1
September-02	19.5	36	< 0.1	0.2
October-02	38	50	< 0.1	0.1
November-02	23	26	< 0.1	< 0.1
December-02	37	48	< 0.1	0.1
January-03	34	50	< 0.1	0.1
February-03	31.5	44	< 0.1	0.1
March-03	33	59	< 0.1	0.1
April-03	13.9	19	< 0.1	0.1
May-03	27.6	100	< 0.1	0.1
June-03	50.3	74	< 0.2	0.5
July-03	39	46	< 0.1	0.2
August-03	38.3	50.0	< 0.1	0.3
September-03	46.0	80.0	< 0.1	< 0.1
October-03	32.0	42.0	< 0.1	< 0.1
November-03	37.0	52.0	< 0.1	< 0.1

[a] WDR Order No. 5-01-124.
[b] Concentrations above the WDR Limit are shown highlighted.

4.4 Secondary Effluent Storage

The WWRP contains two secondary effluent storage reservoirs. These reservoirs provide seasonal storage of secondary effluent when tertiary treatment is not employed at the WWRP because the RMCC is not permitted to apply recycled water to the golf courses during the wet season. Current protocol prevents the discharge of effluent to the golf courses after September 25 (*Interim Surface Water Workplan*, HSe, 2001). Irrigation with recycled water by RMCC does not typically resume until after March 15 the following spring.

The two secondary effluent storage reservoirs were constructed with a three-foot thick clay liner and are connected in series. They have a combined capacity of 756 ac-ft (AF). This capacity, at current WWRP influent flows, is sufficient to contain the secondary treated effluent over the winter months when discharge to RMCC is not permitted. The reservoirs can also provide emergency temporary storage of partially treated wastewater in the event of process upsets. Design criteria for these reservoirs are summarized in Table 4-11.

TABLE 4-11
Storage Reservoirs Parameters

STORAGE RESERVOIR	RESERVOIR 1	RESERVOIR 2
Depth (ft)	28	28
Total Volume (million gallons)	199	47
Total volume (ft^3)	26,600,000	6,340,000
Days of Storage[a]	440	104

[a] At current average flow of 450,000 gpd.

4.5 Tertiary Treatment Evaluation

Tertiary treatment at the WWRP consists of coagulation, dissolved air flotation (DAF) and sand filtration, prior to disinfection.

4.5.1 Dissolved Air Flotation (DAF) Pump Station

The DAF Pump Station pumps secondary effluent stored in Reservoir 1 to the DAF units. This pump station is designed for average dry weather flows (ADWF) of 3.0 mgd. Three vertical turbine pumps, each with a capacity of 1.5 mgd, are set in a 50-foot deep concrete sump. The sump receives flow from Reservoir 1 under normal operation, or the aeration ponds when the reservoir is by-passed.

4.5.2 Dissolved Air Flotation (DAF)

The DAF system removes algae and suspended solids from the effluent. DAF units increase the buoyancy of suspended particles by attaching fine air bubbles to them, which cause particles to float to the surface for removal. To aid with the coagulation of particles, alum and/or polymer are added in the feed-water upstream of the DAF units. The automated chemical feed-system consists of two pumps, plus one standby.

The WWRP utilizes two independent circular DAF units. A summary of the DAF design criteria is presented in Table 4-12.

TABLE 4-12
DAF Design Criteria

DISSOLVED AIR FLOTATION UNITS	CRITERIA
Number of units	2
Capacity, each unit	1.5 mgd
Diameter (ft.)	27
Side water depth (ft.)	11.75
Type of pumps at DAF pump station	Vertical turbine
Number of pumps	3
Flow rate (gpm)	1,150 gpm at 43 ft. TDH unthrottled 950 gpm at 75 ft. TDH throttled
Air flow rate (cfm)	1
Recirculation pumps	2 each
Flow rate (gpm)	320 at 87 psig

4.5.3 Gravity Sand Filters

Downstream of each of the two DAFs is a sand filter unit with three separate cells, each in parallel operation, to produce a low-turbidity effluent (<2 NTU). These Hydroclear® gravity sand filters provide further removal of solids in the effluent. The design loading rate for the Hydroclear® filters is 4.74 gallons per minute per square foot (gpm/ft^2), with one cell out of service. This loading rate complies with the Title 22 requirement of a maximum filter loading rate of 5 gpm/ft^2 of surface area. Design criteria for the sand filters are presented in Table 4-13.

TABLE 4-13
Sand Filter Design Criteria

SAND FILTER	CRITERIA
Number of filters	2
Approximate dimension overall	11 x 30 x 9
Media depth (inches)	10
Number of filters cells (per filter)	3
Hydraulic loading (gpm/sq. ft.)	3.16 4.74 w/ one cell out of service
Surface area per cell (sq. ft.)	110
Number of backwash pumps	2
Flow rate (gpm)	1,320 at 25 ft. TDH

4.5.4 Tertiary Treatment Process Evaluation

Turbidity of the effluent from the gravity sand filter is typically less than 0.5 NTU, well below the limits set in Title 22 for use and distribution of recycled water and incorporated in WDR Order No. 5-01-124, which requires that the turbidity of the filter effluent not exceed 2.0 NTU as a daily average; not exceed 5 NTU more than five percent of the time during a 24 hour period; and never exceed 10 NTU. Turbidity meters monitor the water quality at the DAF effluent and sand filter effluent points. Average influent and effluent turbidities for the sand filters are typically less than 2 NTU and 0.5 NTU, respectively. Table 4-14 presents the turbidity data for the tertiary process effluent.

TABLE 4-14
Typical Effluent Turbidity

MONITORING POINT	AVERAGE TURBIDITY (NTU)[a]
DAF Effluent	1.03
Gravity Sand Filter Effluent	0.35
Chlorine Contact Basin Effluent	0.39

[a] Average turbidity readings between May and September 2003.

4.6 Disinfection System Evaluation

RMCSD supplies recycled water to RMCC for unrestricted golf course turf irrigation purposes. This recycled water must comply with full Title 22 requirements for unrestricted use. Title 22 requires that a chlorine disinfection process must provide a CT (the product of total chlorine residual (C) and modal contact time (T) measured at the same point) value of not less than 450 milligrams-minutes per liter (mg-min/L) at all times, with a modal contact time of at least 90 minutes, based on peak dry weather design flow. In addition, the median concentration of total coliform bacteria shall not exceed a MPN of 2.2 per 100 ml. Flow rates through the disinfection system depend on the irrigation demands of the RMCC golf courses. Current flows through the chlorine contact basin typically range between 1 and 1.5 mgd. The system is designed to operate at a maximum flow rate of 3 mgd.

The WWRP disinfection system consists of the chlorine gas feed system, the original chlorine contact basin (CCB) and a chlorinated effluent storage basin, which provides additional contact time.

4.6.1 Chlorine Contact Basin

The Chlorine Contact Basin (CCB) is a concrete channel, around the end baffle configuration, designed to provide extended contact time and minimize short-circuiting after the filtered effluent is initially injected with chlorine gas. Details on the CCB are summarized in Table 4-15.

TABLE 4-15
Chlorine Contact Basin Design Criteria

CHLORINE CONTACT BASIN	CRITERIA
Dimension overall (ft. x ft.)	45.5 x 15.75
Length to width ratio	66:1
Length to depth ratio	33:1
Theoretical detention time at 3 mgd (minutes)	32

4.6.2 Equalization Basin

A study of the disinfection system was conducted in February 2003 to evaluate compliance of the disinfection system with Title 22 requirements as outlined in Section 4.6, above. The evaluation, which included a tracer dye study [*Title 22 Tracer Study Report*, (HSe, 2003)], concluded that the existing concrete lined storage basin (Equalization Basin) downstream of the CCB would need to be employed to provide additional chlorine contact time in order to comply with the Title 22 requirements of a minimum contact time of 90 minutes. Design criteria for the equalization basin (EQ basin)are presented in Table 4-16.

TABLE 4-16
Equalization Basin Design Criteria

EQUALIZATION BASIN	CRITERIA
Overall dimensions (ft. x ft. x ft.)	321 x 190 x 6.25
Total volume ($ft.^3$)	238,000
Theoretical detention time at 3 mgd (minutes)	625

The Title 22 Tracer Study Report concluded that the minimum operational detention in the chlorine disinfection system was only 120 minutes. This is significantly less than the theoretical detention time of 625 minutes from the chlorinated effluent storage basin. The Title 22 Tracer Study Report also recommended that RMCSD up-grade the chlorination process and control systems. A new chlorine residual analyzer was located at the discharge point of the chlorinated effluent storage basin to continuously monitor residual chlorine. In addition, total coliforms, turbidity, and flow are measured at the discharge point. Coliform levels in the effluent are typically less than 2 MPN and turbidity less than 0.5 NTU. Residual chlorine concentrations range between 2.7 and 5 mg/L, depending on flow rates, after a minimum of 120 minutes of contact time.

The irrigation season of 2003 was the first year of operation of the EQ basin for additional chlorine contact time to achieve full compliance with Title 22 recycled water effluent. While in operation, higher chlorine dosage to the tertiary effluent, compared to historical, was experienced. The large chlorine dosage can be attributed to the large water surface area of the basin whereby the chlorine was dissipating to the atmosphere. As a consequence, the effluent chlorine residual varied substantially, and at times, would not meet the required minimum residual concentration. When this occurred, the automatic controls at the WWRP shut down the tertiary process, the North Course pumps were turned off, and the South Course valve was closed to prevent recycled water, which did not meet CT requirements, from being applied to the golf courses. The non-compliant water in the EQ basin was pumped to Pond 1.

Another significant factor that contributed to the problem of maintaining adequate chlorine residuals in the EQ basin was that the RMCC introduced changes in irrigation practices during the 2003 irrigation season. The modified irrigation practice calls for the application of large volumes of water on specified irrigation days, but little or no irrigation for the next few days (up to three). Because there could be no discharge from the EQ basin for a few days, the long residence time caused the chlorine residual of the tertiary effluent in the EQ basin to drop below the minimum required to achieve compliance with the CT requirements at the effluent point for discharge to the golf course ponds. RMCSD and RMCC addressed this problem by coordinating the schedules to more effectively use the recycled water when it is produced for irrigation.

To further reduce chlorine usage and residual variability, RMCSD is evaluating extending the chlorine contact time by passing the chlorinated tertiary treated wastewater through a closed pipe system placed in a serpentine pattern on the bottom of the EQ basin. The monitoring effluent point would remain at the discharge point of the pipe (90 minutes of contact time, minimum).

The tertiary treated, disinfected, recycled water overflows a weir and is delivered either to the South golf course by gravity or pumped to the North golf course.

4.7 North Course Pump Station

The North Course Pump Station delivers tertiary treated effluent from the chlorinated effluent storage basin to Bass Lake in the RMCC North Golf Course for turf irrigation. Flow through the discharge pipe is continuously measured. Table 4-17 below summarizes the North Pump Station design criteria. The North Course Lift Station can also redirect the effluent to Aeration Pond 1, if required.

TABLE 4-17
North Course Lift Station Design Criteria

LIFT STATION	CRITERIA
Number of pumps	3
Flow rate (gpm)	1,062 at 323 ft. TDH

4.8 South Course Gravity Line

Tertiary-treated effluent from the chlorinated effluent storage basin is delivered to Lakes 16 and 17 on the RMCC South Golf Course via 12-inch gravity pipeline. The water is then pumped by RMCC to Lake 11 for turf irrigation distribution. Flow to the South Course is continuously measured.

4.9 Sludge Drying Beds

Residual biosolids produced at the WWRP are collected and treated prior to being hauled off-site for disposal. On-site biosolids treatment consists of sludge drying beds that dewater the biosolids by evaporation and drainage. This process increases solids concentration and reduces the volume of sludge requiring disposal. Two sludge drying bed trains are available and enclosed by low concrete walls and a concrete pad. Collection pipes along the floor and beneath a layer of sand collect and divert filtrate to the underdrain pump station where it is pumped to Reservoir 2. Design criteria for the sludge drying beds are summarized in Table 4-18.

TABLE 4-18
Sludge Drying Beds Design Criteria

SLUDGE DRYING BEDS	CRITERIA
Number of large beds	3
Type	Sand
Dimensions (ft. x ft.)	191.5 x 39.5
Sand depth (inches)	Varies 6–9
Number of small beds	4
Type	Concrete
Number of percolation trenches	2
Percolation trench dimensions (ft. x ft.)	128 x 4
Sand depth (inches)	18
Overall surface area (sq. ft.)	46,400
Number of underdrain pumps	2
Flow rate (gpm)	180 at 45 ft. TDH

5.0 EVALUATION OF THE IMPACTS OF THE WWRP OPERATIONS ON GROUNDWATER QUALITY

In order to assess the impact of WWRP operations on local groundwater quality, a comparison of groundwater quality for certain constituents of potential concern was made utilizing water quality data from five monitoring and observations wells in the vicinity of the WWRP (Figure 4-4). Differences in water quality, particularly between samples taken from wells up-gradient, and those samples taken from wells down-gradient of the WWRP, would suggest that the WWRP may be impacting groundwater.

5.1 Evaluation of WWRP Impacts on Groundwater Quality

Table 5-1 presents groundwater data for the five monitoring wells used to assess potential water quality impacts of the operation of the WWRP. Monitoring Well 1 (MW-1) is up-gradient from the WWRP and provides background groundwater quality data.

Figure 5-1 provides a graphic illustration of groundwater quality for the five wells. It also shows wastewater quality through the treatment process. Figure 5-1 also shows the locations and groundwater level for the five monitoring wells relative to the hydraulic profile through the WWRP.

TABLE 5-1
Water Quality Results for Monitoring and Observation Wells [c]

CONSTITUENT	UNITS	GW LIMIT [a]	MW - 1[b, e] (Back-ground)	MW - 2[b]	MW - 3[b]	OW - 1[b]	OW - 2[b]
Boron	mg/L	**0.6**	<0.06	<0.05	<0.057	<0.21	<0.12
Chloride	mg/L	**126**	126	78	30	66	103
Iron	mg/L	**22.4**	22.4	0.29[d]	<0.10	4.01	0.31
Manganese	mg/L	**1.13**	1.13	0.87	0.12	1.04	1.67
Sodium	mg/L	**99**	99	97	46	69	63
Total coliform organisms	MPN/100 mL	**<2**	<2	<2	<2	<2	<2
Total dissolved solids (TDS)	mg/L	**765**	765	1,324	363	505	533
Total nitrogen	mg/L	**10**	1.60[d]	3.65[d]	4.48[d]	0.96[d]	4.00[d]
Nitrite (as N)	mg/L	**1**	<0.15	<0.15	<0.15	<0.15	<0.15
Nitrate (as N)	mg/L	**10**	0.3[d]	2.96	4.0	0.16[d]	0.44[d]
Ammonia (as N)	mg/L	**0.52**	0.52	0.22[d]	0.11[d]	0.25[d]	0.14[d]
Total trihalomethanes	μg/L	**100**	<0.5	<0.5	<0.5	<0.5	<0.5
Total zinc	mg/L	**2**	0.80	0.062	<0.03	0.19	0.20
Total phenol	μg/L	**<11[d]**	<11[d]	<18[d]	<10	<10	<10
Formaldehyde	μg/L	**100**	<10	<10	<10	<10	<10
pH	-	**4.2–8.5**	4.2	5.2	6.1	4.1	4.0

[a] Groundwater Limit as established in Section 3 and as listed in Table 3-1.
[b] Average concentrations based on testing October 2001 through June 2003.
[c] Constituents in excess of the limit are shown highlighted.
[d] Average concentration calculated using detection limits where non-detects are reported.
[e] MW-1 is up-gradient of the WWRP.

Review of Table 5-1 and Figure 5-1 indicate that the only constituents that exceed the groundwater limitations were TDS and Total Phenols in MW-2, manganese in OW- 2, and pH in both OW-1 and OW-2. However, none of the constituent concentration in excess of the groundwater limitations can reasonably be attributed to the operation of the WWRP. For example, TDS levels throughout the WWRP are substantially lower than those found in MW-2 or any of the other wells (Table 4-2). As previously noted, only ammonia concentrations in the wastewater exceeds groundwater limitations for the constituents of potential concern. Ammonia levels in the monitoring wells never exceed groundwater limitations.

The average total phenol concentrations for MW-2 appear to be skewed due to an erroneous sample result collected on October 18, 2001. A total phenol concentration of 62 ug/L was detected in the sample collected on that date, compared to the second closest concentration of 13 ug/L five quarters later in January 2003. All other sample results were non-detect, or less than

Figure 5-1 Groundwater Hydraulic Gradient

10 ug/L. Removing the anomalous result from the sample set produces an average concentration of less than 11 ug/L, which is below the groundwater limitation. Moreover, phenol concentrations in the wastewater are well below groundwater limitations.

Although the manganese level in OW-2 is relatively high, the WWRP would not appear to be the cause. Background manganese levels are high in nearly all the monitoring and observation wells and manganese levels in the wastewater are substantially lower than the 1.67 mg/L manganese level in OW-2.

The pH in OW-1 and OW-2 were measured at 4.1 and 4.0, respectively, and essentially the same as the pH level of 4.2 found in the background (MW-1). The low pH of the local groundwater would appear to be naturally occurring and is significantly lower than the range of pH (6.8-7.6) found in the wastewater throughout the WWRP.

5.2 Evaluation of the Potential for Pond Leakage

The Preliminary Report recommended a review of the potential for leakage from the WWRP aeration ponds. This recommendation was based on the misreported high nitrate concentrations in MW-3. The corrected nitrate concentration for MW-3 is 4.0 mg/L (as N), which is below the groundwater limitation of 10 mg/L (as N). Although some increase in nitrate levels above background levels were observed in MW-2 and MW-3, these levels are still significantly below groundwater limitations. There is no evidence to suggest this increase is caused by pond leakage. All corrected monitoring and observation well nitrate levels are consistently below the groundwater limitations, as shown in Table 5-1 and Figure 5-1. Thus, the concern for potential leakage from the aeration ponds, based on elevated nitrate levels in the monitoring wells, appears unfounded.

Moreover, the ponds were constructed with a 2-foot thick clay liner. Pond 4 additionally contains a concrete apron along the perimeter of the south and west ends of the Pond. The storage reservoirs were constructed with a 3-foot thick clay liner. The original ponds and reservoirs were constructed in the early to mid 1980's. After more than 20 years of operation, there is no apparent impact on the groundwater to suggest any pond leakage.

The RWQCB requested an evaluation of the potential for the Operator Engineer's Pond (OEP), adjacent to the WWRP, to receive wastewater via leakage from the aeration ponds. Examination of water quality data in MW-3, which is situated between the OEP and the WWRP, shows a slightly increased concentration of nitrate over background levels (4.0 mg/L in MW-3 vs. 0.3 mg/L in MW-1). However, this nitrate concentration is well above the nitrate concentration found in the aeration ponds. For example, the nitrate levels in the secondary effluent only reach 0.20 mg/L, with the highest average nitrate concentration in Pond 4 only reaching 0.31 mg/L. Moreover, MW-2, which is in the vicinity of the OEP, also has nitrate levels higher than those in the aeration ponds.

Based on the groundwater quality data gathered to date, it can be concluded that the ponds and reservoirs as constructed, represent the BPTC for the pond system. No further modifications are recommended, as the groundwater quality appears to be adequately protected.

6.0 SUMMARY

Except for the modification relating to the equalization basin that is currently being evaluated by RMCSD, this Comprehensive Technical Evaluation Report recommends no other additional modifications, upgrades, or retrofits to the WWRP treatment process at this time and concludes that RMCSD currently operates this pond system in accordance with the BPTC measures. The funding for potential future modifications to the disinfection system, if implemented, would be derived from the general WWRP operating budget. Thus, there is no additional direct capital funding required.

Appendix A
WDR ORDER 5-01-124

Appendix B
Preliminary Report

Appendix C
RWQCB Response Letter

Appendix D
Preliminary Report Addendum

Appendix E
Water Quality Analysis
Laboratory Reports

Water quality analysis laboratory reports will be included in the FINAL draft.