Cambria Community
Services District

GROUNDWATER RECHARGE ENGINEERING REPORT

"Draft"

John Carollo Engineers

March 1991

JOHN CAROLLO ENGINEERS

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March 25, 1991
WO #3395A.0A

Cambria Community Services District
2284 Center Street
Cambria, CA 93428

Attention: Mr. Dave Andres, General Manager

Subject: Draft Groundwater Recharge Engineering Report

Gentlemen:

Please find enclosed five (5) copies of the draft Groundwater Recharge Engineering Report for the wastewater reclamation facilities. Note that we have also forwarded two copies of the report to the Department of Health Services (DHS) and the Regional Water Quality Control Board-Central Coast Region. We are proceeding to set up meeting dates with these agencies to discuss their initial comments prior to submittal of a final report. We will inform you of those meeting dates so you can plan to attend.

We also need to schedule a separate meeting with you to receive your comments to the report. It would be best if we could meet with you at the same time we come down to meet with the two regulatory agencies.

If you have any questions please feel call us.

Very truly yours,

JOHN CAROLLO ENGINEERS

Howard M. Way

Steven G. Swanback

Jill A. Townley

HMW:SGS:JAT:kj

Enclosures: Draft Groundwater Recharge Engineering Report

W3395:Letter A0A Reclaim Letter 91/3

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ENGINEERING REPORT

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EXECUTIVE SUMMARY

GENERAL

Cambria is a coastal community located approximately 25 miles northwest of the City of San Luis Obispo and 20 miles west of the City of Paso Robles. In recent years it has experienced growing popularity as a resort and retirement community. The community is essentially a residential community with no significant industrial development. Cambria is served by the Cambria Community Services District (CCSD) which provides a domestic water treatment and delivery system as well as a wastewater collection, treatment and disposal system.

In 1990, CCSD completed a Facilities and Effluent Disposal Plan Update (1990 Plan Update). One purpose of the 1990 Plan Update was to investigate the feasibility of improving the safe yield of CCSD's domestic water supply. Several wastewater reclamation alternatives were considered including landscape irrigation; crop irrigation of agricultural land currently being irrigated with water from CCSD's domestic aquifer; and groundwater recharge of treated wastewater to the aquifer through direct injection, surface spreading, or stream flow discharge. The study concluded the most viable project because of ease of implementation and cost was groundwater recharge of treated wastewater to the domestic water supply aquifer through surface spreading.

Other domestic water supply alternatives considered included drilling additional wells, the State Water Project, desalination, and construction of small dams on wet weather streams for collection, storage, and recharge. The first three alternatives were deemed non-viable. The fourth alternative is still under study.

The purpose of this report is to develop the groundwater recharge project using treated wastewater in accordance with the requirements of the Department of Health Services (DHS) and Regional Water Quality Control Board (RWQCB).

BACKGROUND

The CCSD wastewater treatment system includes a wastewater treatment facility and effluent disposal site. The wastewater treatment facility is an activated sludge plant with flow monitoring facilities, an influent pump station, flow equalization basins, an aerated grit chamber, two package treatment plant systems, chlorination facilities, an effluent pump station, a blower building, and a control building.

The effluent disposal site is located 2.5 miles north of the wastewater treatment facilities. The disposal site includes 51 acres of land for surface spreading of which 22 acres are usable, an effluent storage reservoir, and a slow sand filter for use during direct discharge to Van Gordon Creek.

The existing CCSD domestic water supply system includes five wells located in two separate well fields near San Simeon Creek and Santa Rosa Creek. The water from the Santa Rosa Basin has high manganese concentrations and requires treatment in addition to chlorination prior to distribution. The water from San Simeon Basin is of better quality and only requires chlorination prior to distribution. The San Simeon Basin well field is located near the effluent disposal field and is the proposed location of the groundwater recharge project.

The existing and projected domestic water and wastewater flows are presented in Table 1. The projected flows and loadings are based on an estimated current water consumption rate of 80 gallons per capita per day, 2.0 persons per household and the anticipated number of building permits to be issued annually.

Table 1 Projected Domestic Water and Wastewater Flows
Cambria Community Services District

	Water Demand (ac-ft/yr)(1)		Wastewater Flows (mgd)(4)	
Year	Minimum(2)	Maximum(3)	Minimum	Maximum
1989			0.47	0.47
1990	475	475	0.48	0.48
1995	502	587	0.51	0.58
2000	529	699	0.54	0.68
2005	555	811	0.57	0.78
2010	582	923	0.60	0.88

(1) Based on a demand of 80 gallons/capita/day and two people per household.
(2) Based on issuance of 30 building permits per year.
(3) Based on issuance of 125 building permits per year.
(4) Million gallons per day.

According to the projected water flows, CCSD will require more water in the future than the domestic water supply system can currently provide.

RECOMMENDED GROUNDWATER RECHARGE PROJECT

The recommended groundwater recharge project discussed in this report proposes:

- Secondary treatment of municipal wastewater at existing wastewater treatment facilities;
- Effluent disposal of treated wastewater to percolation ponds (existing effluent disposal site);
- Extraction of treated wastewater (blended with groundwater) from the effluent disposal site;
- Advanced treatment of extracted and filtered wastewater and groundwater with reverse osmosis (RO);
- Transmission of reclaimed water to a spreading site upgradient of the San Simeon domestic well field; and
- Groundwater recharge at the proposed spreading site (San Simeon Creek stream bed).

This project was developed to comply with the requirements of the Proposed Guidelines for Groundwater Recharge of Municipal Wastewater (Proposed Guidelines), Title 22, and the RWQCB antidegradation policy (see Appendices A, B and E).

REGULATORY REQUIREMENTS

Several agencies have regulatory authority over projects involving land or stream discharge of reclaimed water including the DHS, RWQCB, State Department of Fish and Game, Coastal Commission, and the San Luis Obispo County Planning Department.

The major regulations which dictate wastewater treatment and quality criteria for a reclamation project are established by Title 22 of the California Administrative Code and are enforce by the DHS and the RWQCB. These regulations have specific requirements for the treatment of wastewater effluent for all uses except groundwater recharge. In the past, groundwater recharge projects were reviewed on a case by case basis.

The State of California has recently developed proposed guidelines for groundwater recharge projects using reclaimed wastewater which has recently been published (see Appendix B). These guidelines will be used to establish criteria for developing a groundwater recharge project (see Table 2). The other regulation or policy used to determine the viability of a wastewater reclamation project for CCSD is the antidegradation policy of the RWQCB (see Appendix E). The antidegradation policy essentially states that the waters of the State cannot be degraded unless it has been demonstrated that any change will be consistent with maximum benefit to the people of the State.

GROUNDWATER BASIN HYDROLOGY

Geological Conditions

Because the proposed groundwater recharge project will only affect the groundwater quality of the San Simeon Basin, only the geology and hydrogeology of the San Simeon Basin was investigated.

The San Simeon Basin is situated in the south central portion of the Coast Range Geomorphic Province. More specifically, the basin lies west of the southern end of the Saint Lucia mountain range and is underlain by the metamorphic rock of the Franciscan Complex. The metamorphic rock on the valley floor of the San Simeon Basin in turn is overlain by a relatively thin veneer of stream terrace alluvial sediments (40 to 130 feet thick).

This thin veneer of alluvial sediments is the San Simeon groundwater basin. The lower reaches of the basin are comprised of deposits of coarse grained sediment deposits including boulders and cobbles. The higher reaches of the basin are filled with less coarse material including gravel and sand.

The San Simeon Basin extends about five miles inland from the coast, is fairly narrow, and is bounded by relatively impermeable bedrock. The total estimated volume of the basin is approximately 30,000 acre-feet (ac-ft) of which 16,700 ac-ft is above sea level.

Table 2 Proposed Criteria for Groundwater Recharge with Reclaimed Water[1],[2]
Cambria Community Services District

Project Category[3]	Maximum Percent Reclaimed Water[4]	Depth to Groundwater (Feet)[5] / Per. Rate[6] ≤0.20 in/min	Depth to Groundwater (Feet)[5] / Perc. Rate[6] ≤0.33 in/min	Retention Time Underground (Months)	Horizontal Distance (Feet)[7]	Treatment
Surface Spreading						
I	50	10	20	6	500	Organics Removal, Oxidized, Filtered & Disinfected[8]
II	20	10	20	6	500	Oxidized, Filtered and Disinfected[8]
III	20	20	50	12	1,000	Oxidized & Disinfected[9]
IV	20	50	100	12	1,000	Oxidized
Direct Injection						
V	20	na[11]	na[11]	12	2,000	Organics Removal,[10] Oxidized, Filtered, & Disinfected[8]

(1) Source: Proposed Guidelines for Groundwater Recharge with Reclaimed Municipal Wastewater (Draft), State of California, June 5, 1990.

(2) Alternatives to the requirements specified in this table may be accepted if the applicant demonstrates an equivalent degree of health protection.

Table 2 **Proposed Criteria for Groundwater Recharge with Reclaimed Water[1] (Continued)**
Cambria Community Services District

(3) This is a designation to identify a set of conditions for an acceptable project.

(4) The above table is based on a 20 percent contribution of reclaimed water in recharged water. The percentage of reclaimed water in the recharged water may be increased to as much as 50 percent provided additional trace organics removal is accomplished to keep the total TOC contribution to no more than that level which would occur with a 5:1 dilution or 20 percent concentration. The maximum allowable TOC (mg/L) should comply with the performance standard listed in D-1. The percent contribution of reclaimed water may be determined by averaging over a maximum three year period of time.

(5) Depth to groundwater is the minimum depth to groundwater during the life of the project.

(6) Maximum percolation rate shall not exceed the listed values. Borings shall show the soil characteristics at least to the depths listed in this table.

(7) Horizontal distance measured from the injection well or closest edge of the recharge basin to the nearest point of extraction.

(8) The median number of total coliform organisms does not exceed 2.2 mpn per 100 mL, as determined from the bacteriological results of the last seven days for which analysis have been completed, and the number of total coliform organisms does not exceed 23 mpn per 100 mL in any sample.

(9) The median number of total coliform organisms does not exceed 23 mpn per 100 mL, as determined from the bacteriological results of the last seven days for which analysis have been completed, and the number of total coliform organisms does not exceed 240 mpn per 100 mL in any sample.

(10) TOC not to exceed 1 mg/L based on a monthly average.

(11) Not applicable.

Hydrogeological Conditions

From a hydrogeological perspective the San Simeon Basin is a fairly simple hydraulic system. The basin is a valley with boundaries defined by relatively impermeable bedrock and filled with permeable unconsolidated sediments. The groundwater is naturally recharged from precipitation/surface infiltration processes primarily and other less significant means such as artificial recharge from wastewater percolation.

Recent hydrogeological studies have been performed by the United States Geological Survey (USGS) (written communication with Mr. Gus Yates) and Mr. John Mann (see Appendix F). In addition data has been collected over several years by CCSD's consultant hydrogeologist Mr. Ken Schmidt. The results have fairly accurately quantified the hydraulic parameters of the basin including transmissivity, hydraulic conductivity, storativity, and vertical permeability.

Computer model simulations of the hydraulic flow within the basin based on single well and multiple well draw-down tests have estimated hydraulic conductivity values to range from 720 to 300 feet/day. For analysis in this report the hydraulic conductivity is assumed to be 400 ft/day (written communication with Mr. Gus Yates and Mr. John Mann). Based on the data collected from the draw down tests the transmissivity values ranged from 718 to 44,200 ft^2/day and storativity ranged from 0.0022 to 0.0400. The median transmissivity and storativity values were calculated to be 10,000 ft^2/day and 0.0097 respectively, (written communication with Mr. Gus Yates).

The geological nature of the San Simeon Basin is a significant controlling factors in groundwater flow directions and hydraulic gradients. The direction of groundwater is predominantly to the west towards the ocean. Any reversals in groundwater flow are localized and are the result of surface recharge (wastewater disposal), overdraft pumping, and differences in groundwater/seawater densities near the coast.

Groundwater levels generally follow a pattern of gradual decline in the dry summer season followed by rapid recovery when the San Simeon Creek is flowing in the winter. Groundwater recharge of the basin from stream runoff appears to be almost instantaneous. Although the basin fills very rapidly it also drains very rapidly because of the geological substrata. This means the annual inflows and outflows are a large fraction of the total groundwater in storage. Consequently, the basin cannot sustain a larger outflow than inflow without going completely dry in a few years. As an indicator of this phenomenon a calculation performed by USGS (written communication with Mr. Gus Yates) estimated that a groundwater level decline of 3 to 7 feet in the summer months would decrease cumulative basin storage by 65 percent.

Flow Velocity Estimates

Groundwater flow velocities have been calculated within the San Simeon Basin based on the equation:

$$V = Ki/n$$

where:

V = average groundwater velocity (ft/day)
K = hydraulic conductivity (ft/day)
i = average hydraulic gradient (dimensionless)
n = effective porosity (dimensionless)

The linear groundwater velocity is estimated to be 2.7 to 8.0 ft/day for the dry season. The estimates were calculated based on the following assumptions: hydraulic conductivity = 400 ft/day, hydraulic gradient = 0.002 to 0.006, and the mean effective porosity = 0.30.

This calculation is based on assumptions for the San Simeon Basin as a whole. Because the hydraulic gradients have such a significant impact on the groundwater flow velocities and because the gradients can vary considerably within the basin the calculated values are estimates at this time. The final project will provide monitoring wells to determine actual groundwater movement.

Travel Time Estimates

Groundwater travel times have been estimated in an effort to evaluate subsequent impacts from the proposed groundwater recharge site using the calculated flow velocities of 2.7 to 8 ft/d. In addition, isopleths have been prepared as a means of graphically illustrating the anticipated flow paths of groundwater versus time.

Based on the isopleths the recharge water is expected to reach the cone of influence of CCSD's domestic wells within one year. Because of relatively high groundwater velocities any recharge water not extracted by the domestic wells will flow downgradient toward the ocean and not spread laterally. Consequently, isopleths of greater duration than one year are meaningless.

In addition to the travel time estimate and corresponding isopleths a preliminary computer analysis was performed by USGS to simulate a groundwater recharge project (written communication with Mr. Gus Yates). Although the computer model did not simulate the precise conditions of the proposed project (it was based on construction of a spreading basin and disposal of 270 ac/ft per year), much valuable information was obtained from the evaluation. The computer model concluded that the recharge project would significantly minimize the decline of groundwater elevations in the basin, would not create a significant regional mound, and would not cause emergent seepage into the creekbed. In general terms, the model predicted the transfer of water to the basin thrcugh a recharge basin would significantly decrease the amount of dry-season water level decline without exceeding the capacity of the aquifer to accept or transmit the infiltrated water.

Groundwater Quality Analysis

Groundwater quality has been monitored by CCSD and USGS at several locations within the San Simeon Basin including the effluent disposal site and domestic well field. The majority of the testing in the past has been for chemical and bacteriological quality. Recently, CCSD has expanded the sampling program to include many volatile and semi-volatile organics and metals. The results of the data indicate:

The groundwater quality is best in the upper reaches of the San Simeon Basin and generally degrades with decreasing distance from the ocean. The water quality of the groundwater at the effluent disposal site has higher levels of Total Dissolved Solids (TDS), chlorides, boron, sodium, and sulfate than the domestic well water. Some of the degradation of the water at the effluent disposal site appears to be due to seawater intrusion and some to wastewater percolation.

The groundwater quality at the effluent disposal site exceeds the secondary drinking water standards for TDS consistently and nitrates occasionally. All other inorganic parameters tested were less than secondary drinking water standards.

Very low concentrations (near detection levels) of three trace volatile organic compounds (chloroform, Total Trihalomethanes, and methyl chloride) were detected in select wells at the effluent disposal site. The source of these compounds are unknown because they did not appear in any the wastewater effluent and should not occur without introduction from a foreign source. At this time no drinking water standard has been set for any of these compounds. Additional samples have been collected to verify the results.

Bacteriological and turbidity analysis indicated that levels for these constituents were higher in the effluent disposal site wells than the wastewater effluent. Because the wastewater is filtered in the soil before extraction, this is not expected. A possible explanation for the bacteriological results is that none of the extraction wells sampled have sanitary seals. The turbidities of the samples collected from wells at the effluent disposal site were never higher than 10 NTU. A possible reason for the higher values may be due to the fact that most of the samples were collected from small, shallow wells generally open to the atmosphere.

Concentrations of some of the priority metals tested were higher in the wastewater effluent and at the effluent disposal site than background groundwater concentrations.

CCSD is continuing a monitoring program to verify the data gathered to date. In addition, the proposed advanced treatment process will be designed to remove or reduce the levels of these constituents to levels well below the secondary drinking water standard.

GROUNDWATER RECHARGE PROJECT DESCRIPTION

The groundwater recharge project proposes using the existing activated sludge wastewater treatment process (including preliminary treatment, flow equalization, secondary treatment, and chlorination), and the existing effluent disposal site. The effluent disposal site currently has approximately 22 acres of irrigated sprayfields. In the near future CCSD proposes to convert the sprayfields to 22 acres of percolation ponds.

After the treated wastewater has percolated to groundwater the proposed project will extract the water (estimated to be a blend of 60 percent treated wastewater and 40 percent background groundwater) and pumped to an advanced treatment process.

The proposed advanced treatment process will include disinfection, dual-media filtration, cartridge filtration, and reverse osmosis. The waste stream (brine disposal) from the dual media filtration and reverse osmosis processes will be disposed by well injection to groundwater at a new well located near the ocean.

Following advanced treatment, the reclaimed water will be pumped upgradient to the groundwater recharge site. The proposed recharge site (the San Simeon Creek streambed) will allow the reclaimed water to percolate to groundwater and travel to the domestic well field. At the domestic well field the reclaimed water after blending with groundwater can be pumped out to the domestic water distribution system. The streambed was selected because it offers an area of rapid recharge and site access. The method of disposal will be a series of temporary perforated pipes laid directly on the stream bed surface and connected to the transmission pipeline.

The size of the recharge area is based on site permeabilities and depth to groundwater and is estimated to use approximately 75 to 100 feet of natural streambed length. Although permeabilities have not been taken at the proposed site, a boring log in the stream bed near the site indicates a gravelly or sandy substrata. Based on the substrata, predicted permeabilities are on the order of 1 to 5 in/min.

Recharge Area Operations

As discussed in the hydrogeologic description of area the San Simeon Basin is rapidly filled with any appreciable precipitation during the year. For CCSD and the local farmers, this means an abundant supply of groundwater for approximately six months during any normal year of precipitation. However, the basin has very little storage capacity which means a rapidly falling groundwater level and a reduced capacity during the remaining six months of the year. The lack of storage also means the basin is affected rapidly by any extended drought.

The reclamation project proposes to recharge the treated wastewater blended with groundwater only during periods of the year when groundwater levels have fallen and the groundwater supply begins to diminish. The proposed schedule is to begin operation of the project only after surface waters have ceased to flow at Palmer Flats Gaging Station which is located one and one quarter miles upstream of the proposed recharge site and stop operations when surface flows reappear.

The estimated recharge application rate is commensurate with attempting to provide no more than 20 percent reclaimed water at the domestic well which is estimated to be between 188 and 216 ac-ft/yr. At this rate, assuming six months of operation per year, the maximum daily capacity will be approximately 400,000 gallons per day. At this flow rate and the vertical permeabilities and horizontal transmissivities of the soil the hydrogeologic study concluded no groundwater mounding is expected.

Design Criteria

Design criteria for the proposed project is presented in Table 3. The total capacity of the system was based on conformance with the Category II of the Proposed Guidelines. Based on these guidelines the apparent maximum quantity of water that can be recharged is dependent on several factors including: level of treatment; horizontal distance measures from the closest edge of the recharge site to the nearest point of extraction; retention time underground; percolation rate; and the maximum percent of reclaimed water that can be recharged.

For the CCSD project the design criteria has been based on recharging no more than 20 percent of the domestic well extraction. Based on the proposed water quality from the reclamation treatment facilities this is conservative. However, the reason for conservatism is that the depth to groundwater requirements stipulated in the Proposed Guidelines may be periodically violated at the proposed site during the initial period of operation each year.

Although the proposed quantity of treated reclaimed water will not exceed 20 percent of the extracted water the total quantity of water that will be recharged will be significantly higher, because the water extracted from the effluent disposal site is treated wastewater blended with groundwater. The estimated quantities of each source of water, treated wastewater and groundwater, was made by comparing the TDS of the treated water, background water, and extracted water. Assuming the estimated total quantity of water extracted is equal to the amount percolated the extraction water is approximately 60 percent reclaimed water and 40 percent groundwater.

In the past five years, CCSD has extracted between 565 and 649 ac-ft/yr from the San Simeon Basin aquifer. Assuming the extracted water from the effluent disposal site is only 60 percent treated wastewater the total amount of water that can be recharged is 188 to 216 ac-ft/yr.

Because the advanced treatment process (reverse osmosis) can provide a water quality which exceeds the secondary drinking water standards and the quality of the background groundwater the proposal is to treat only a portion (50 percent) of the flow. The remainder of the flow would be filtered and disinfected and then blended with the water that had passed through the reverse osmosis process. The actual basis for sizing the advanced treatment system was dictated by TDS removal requirements.

Reclaimed Water Quality

A summary of the existing and the proposed reclaimed water quality is presented in Table 4. Existing water quality is based on the data collected to date, summarized in Chapter 2, and tabulated in Appendix D. Reclaimed water quality is based on the results of computer modeling and actual bench scale testing by reverse osmosis equipment manufacturers (see Appendix G).

The quality of the reclaimed water is better than secondary drinking water standards and the Proposed Guidelines requirements and in most cases better than the existing groundwater quality.

Table 3 **Design Criteria for Wastewater Reclamation**
Cambria Community Services District

Parameter	Value
General	
Design Flow, mgd	1.0
Design Flow, gpm(1)	695
Dual Media Filter	
Number	2
Diameter, in.	72
Depth, in.	72
Total Hydraulic Capacity, gpm	141
Loading Rate, gpm/ft^2	5.0
Media	Manganese green sand and anthracite
Cartridge Filter	
Number	7 to 30 inch filters
Type	Hitrex
Filter Opening Size	5 mm
Reverse Osmosis	
Number of Tubes	32-40
Recovery, %	75
Flow, mgd	1.0
Pressure, psig	440-480
Effluent Turbidity, NTU	<1
Chlorination	
Dose, mg/l	1-5
Contact time, hrs.	2
Pump Station	
Number of Pumps	2
Capacity, mgd	1.0

(1) Approximately 216 ac-ft of water may be reclaimed in a six month period.

Because of the high level of treatment and because the water quality meets or exceeds most background groundwater levels there will be no significant chemical impact on the groundwater quality. There is a potential hydraulic impact on some of the wells located downstream of the proposed recharge site. However, the estimated travel time between the recharge site and any of the wells is expected to be greater than six months as required by the Proposed Guidelines.

Table 4 **Summary of Water Qualities**
Cambria Community Services District

Contaminant, Units[1]	Maximum Contaminant Level Allowed[2]	Domestic Well Water	Wastewater Effluent	Effluent Disposal Site Extraction Well Water	Reverse Osmosis Treated Water	Reclaimed Water
Turbidity, NTU[3]	5	1.0	2.7	1.0	0.2	<1.0
Total Dissolved Solids (TDS), mg/l	1,000/500	290	690	528	48	288
pH, units	6.5-8.5	7.1	7.1	7.0	4.7	7.0
Chloride, mg/l	500/250	20	175	87	5	46
Fluoride, mg/l	1.4-2.4[4]	<0.1	0.2	0.2	<0.1	0.1
Sulfate, mg/l	500/250	56	86	64	<1	36
Nitrate (as N), mg/l	10	4.9	12	8.5	4.5	6.5
Zinc, mg/l	5	<0.05	0.08	<0.05	<0.05	<0.05
Copper, μg/l	1,000	<50	<50	<50	<50	<50
Iron, μg/l	300	<50	60	130	<50	65
Lead, μg/l	50	18	<5	<5	<5	<5
Selenium, μg/l	10	<5	<5	<5	<5	<5
Chromium, μg/l	50	<5	<5	<5	<5	<5
Aluminum, μg/l	1,000	<200	<200	<200	<200	<200
Manganese, μg/l	50	<20	30	<20	<20	<20
Cadmium, μg/l	10	<1	<1	<1	<1	<1
Mercury, μg/l	2	<0.2	<0.2	<0.2	<0.2	<0.2
Silver, μg/l	50	<5	<5	<5	<5	<5
Toluene, μg/l	40[5]	ND[6]	1	ND	ND	ND
Methyl Chloride, μg/l	NS[7]	ND	ND	6.1	--	--
Chloroform, μg/l	100[5]	ND	40	1	0.01	<0.5
Total Trihalomethanes (TTHMs) mg/l	0.1	--	--	0.01	0.01	
Foaming Agents (MBAS), mg/l	0.5	<0.02	0.31	0.05	<0.02	

(1) mg/l - milligrams per liter.
μg/l - micrograms per liter.

(2) Primary drinking water standards as established by Department of Health Services. If two numbers are present, the first number is primary standards and the second number is secondary standards.

(3) NTU - Nephelometric turbidity units.

(4) Fluoride concentrations are temperature dependent.

(5) Proposed drinking water standards.

(6) ND - none detected.

(7) NS - no standards.

Contingency Plan

Because CCSD has the ability to take the reclaimed water project out of service for extended periods of time the contingency plan is based on diversion of lower quality water rather than providing duplicate treatment systems. The two conditions which would require diversion include malfunction of the advanced water treatment facilities and an extraction well water quality which could not be adequately treated in the advanced treatment process.

The proposed contingency plan for malfunction of the advanced water treatment facilities is to divert the water to an existing reservoir (Van Gordon Reservoir) at the effluent disposal site. The reservoir is west of the proposed well extraction location and any percolation to groundwater from the reservoir is not expected to flow upgradient to the wells. Even should that be the case, it is important to note than any water that has passed through the advanced water treatment process is at least equivalent to the groundwater quality.

The proposed contingency for extraction well water which cannot be adequately treated in the advanced treatment facilities is also diversion. Currently, CCSD has the authority through its NPDES permit to pump groundwater from the effluent disposal site to Van Gordon Creek. If necessary any untreated extracted well water from the site which is of poor quality could be diverted to Van Gordon Creek.

Monitoring Program

The Proposed Guidelines require a monitoring program to provide early detection of potential unwanted impacts on the groundwater quality. The proposed monitoring program is intended to comply with the guidelines and will test for general mineral quality, general physical quality, inorganic chemical quality, natural radioactivity, man-made radioactivity, organic chemical, and general microbiological quality at a frequency at least equivalent to the requirements of the Proposed Guidelines and Title 22. It is also intended to install at least one monitoring well between the proposed recharge site and the domestic well field.

Project Implementation

Because of the severe drought conditions affecting the Cambria area implementation of the project in a timely fashion is imperative to CCSD. Consequently, a schedule has been developed to complete as much of the project as possible concurrently. The anticipated implementation schedule is presented in Table 5.

Table 5 Project Implementation
Cambria Community Service District

Item	Date
Submit "Draft" Project Report to CCSD, RWQCB, and DHS	3/22/91
Meet with Regulatory Agencies to Discuss Proposed Project	4/91
Complete Regulatory Agency Review	3/91 to 4/91
Complete Public Hearing Process	5/91
Complete Environmental Impact Review	5/91
Begin Final Design	6/91
Begin Pilot Study	6/91
Complete Final Design	10/91
Construction	12/91 to 8/92

INTRODUCTION

1.1 GENERAL

The Cambria Community Services District (CCSD) serves the unincorporated community of Cambria located on the California coast approximately 25 miles north of the City of San Luis Obispo. A location map is shown in Figure 1.1.

CCSD operates a domestic water treatment and delivery system and a wastewater treatment and collection system to serve a population of approximately 5,000. As the community grows, the ability of CCSD to service the needs of the users is increasingly tested. With the drought conditions in the area over the past four years, CCSD has experienced a water supply shortage and been forced to implement several conservation measures. Because of the water supply shortage, CCSD has decided to look at alternatives other than conservation to increase the safe yield of its water supply.

CCSD's wastewater treatment facility is an activated sludge treatment plant providing secondary treatment. Ultimate disposal of the treated wastewater is through land spreading at its effluent disposal fields. The treatment facility has two package treatment plants with an ultimate design capacity of 1.0 million gallons per day (mgd) when both package treatment plants are in service. However, with either of the plants out of service, the maximum capacity of the system is 0.5 mgd. Because flows already exceed 0.5 mgd on an annual average flow basis, the treatment facility has no standby capacity.

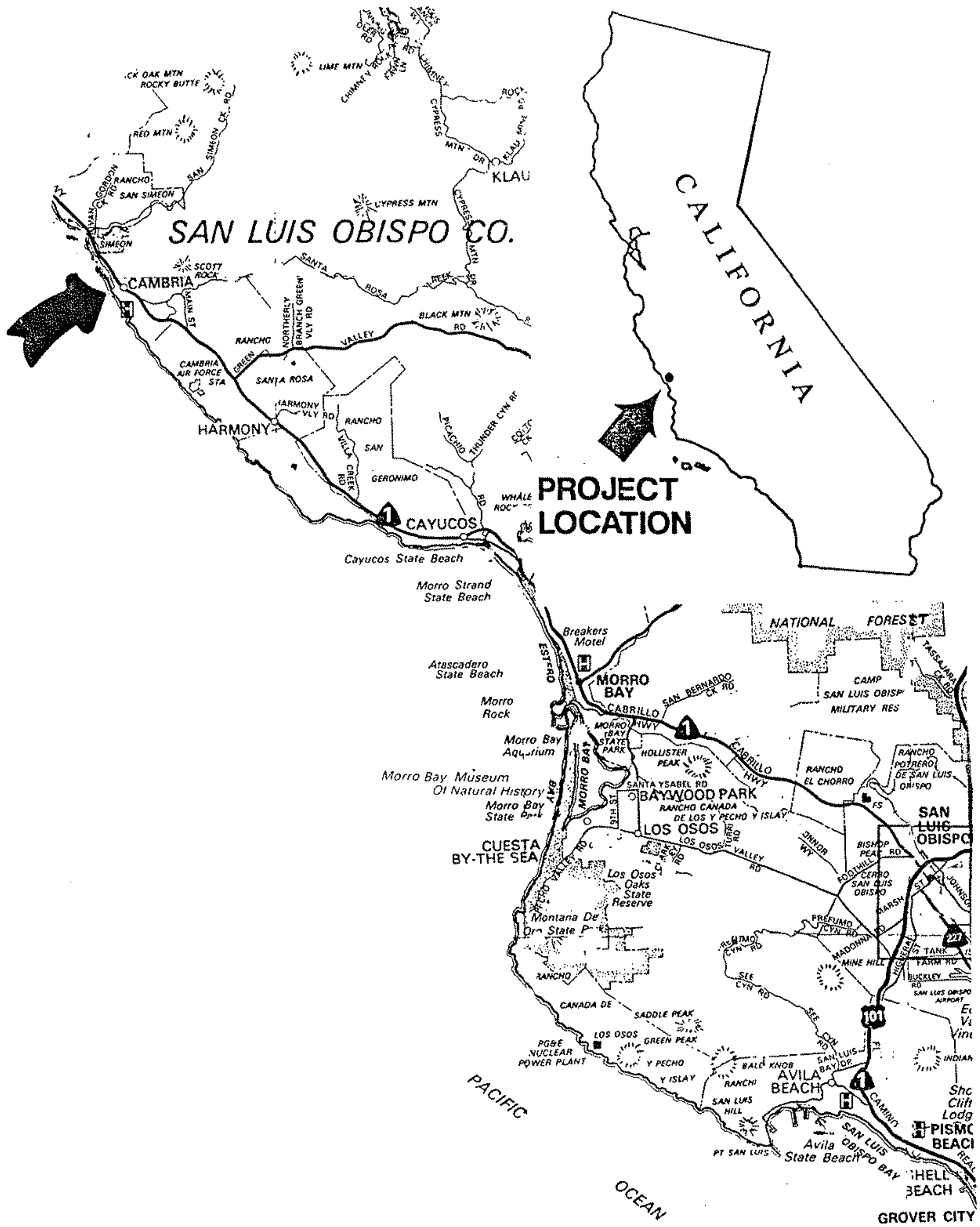
1.2 PURPOSE AND SCOPE

The purpose and scope of this engineering report is to propose a groundwater recharge project using reclaimed municipal wastewater in accordance with the Proposed Guidelines for Groundwater Recharge with Reclaimed Municipal Wastewater (Proposed Guidelines) (see Appendix A) and Title 22 Regulations on Wastewater Reclamation Criteria (see Appendix B). The primary intent of this report is to:

- Establish the need to develop a wastewater reclamation groundwater recharge project.
- Develop a groundwater recharge project; and
- Perform a technical study in compliance with the Proposed Guidelines to determine project feasibility.

The specific goals of the technical study were to:

- Describe the proposed groundwater recharge project.



CAMBRIA COMMUNITY

SERVICES DISTRICT

GROUNDWATER RECHARGE

ENGINEERING REPORT

FIGURE 1.1

- Analyze the geology and hydrogeology of the receiving groundwater basin.
- Based on water quality analysis, determine the impact of the project on the groundwater supply in the basin.
- Develop design criteria for the proposed groundwater recharge project (including treatment and recharge facilities) based on the Proposed Guidelines; and
- Describe the intended operation of the proposed recharge facilities.

The final goal of this report is to obtain approval of the RWQCB, Department of Health Services, and other affected regulatory agencies of the ultimate development of a project.

1.3 ACKNOWLEDGEMENTS

John Carollo Engineers would like to acknowledge Mr. David Andres, Mr. Bob Hamilton, and Mr. Bryan Bode of the CCSD staff; Mr. John Mann, Hydrogeologist; Mr. Gus Yates, Jones and Stokes (formerly with United States Geological Survey [USGS]); and Mr. Ken Schmidt, Hydrogeologist for their invaluable assistance and information in the preparation of this report.

BACKGROUND

2.1 GENERAL

Cambria, a coastal community, is located approximately 25 miles northwest of the City of San Luis Obispo and 20 miles west of the City of Paso Robles. In recent years, it has experienced growing popularity as a resort and retirement community. The users serviced by the Cambria Community Services District (CCSD) are largely residential with some commercial development. There is no significant industrial development within the community. CCSD provides a domestic water treatment and delivery system as well as a wastewater collection, treatment and disposal system for the community of Cambria. The service area for CCSD is shown in Figure 2.1. Projected population for the area is presented in Table 2.1.

Table 2.1 Population Projections
Cambria Community Services District

Year	Minimum Projected Population(1)	Maximum Projected Population(2)
1990	5,300	5,300
1995	5,600	6,550
2000	5,900	7,800
2005	6,200	9,050
2010	6,500	10,300

(1) Based on issuance of 30 building permits per year, 2 persons/household.
(2) Based on issuance of 125 building permits per year, 2 persons/household.

2.2 EXISTING WASTEWATER TREATMENT AND DISPOSAL FACILITIES

CCSD operates a secondary wastewater treatment facility which includes flow monitoring facilities, an influent pump station, flow equalization basins, an aerated grit chamber, two package treatment plant systems, chlorination facilities, an effluent pump station, a blower building, and a control building. A layout of the wastewater treatment facility is shown in Figure 2.2.

The wastewater effluent disposal site is located 2.5 miles north of the wastewater treatment facilities. The disposal site includes 51 acres of land for surface spreading, an effluent storage basin, and a slow sand filter for use during direct discharge to Van Gordon Creek.

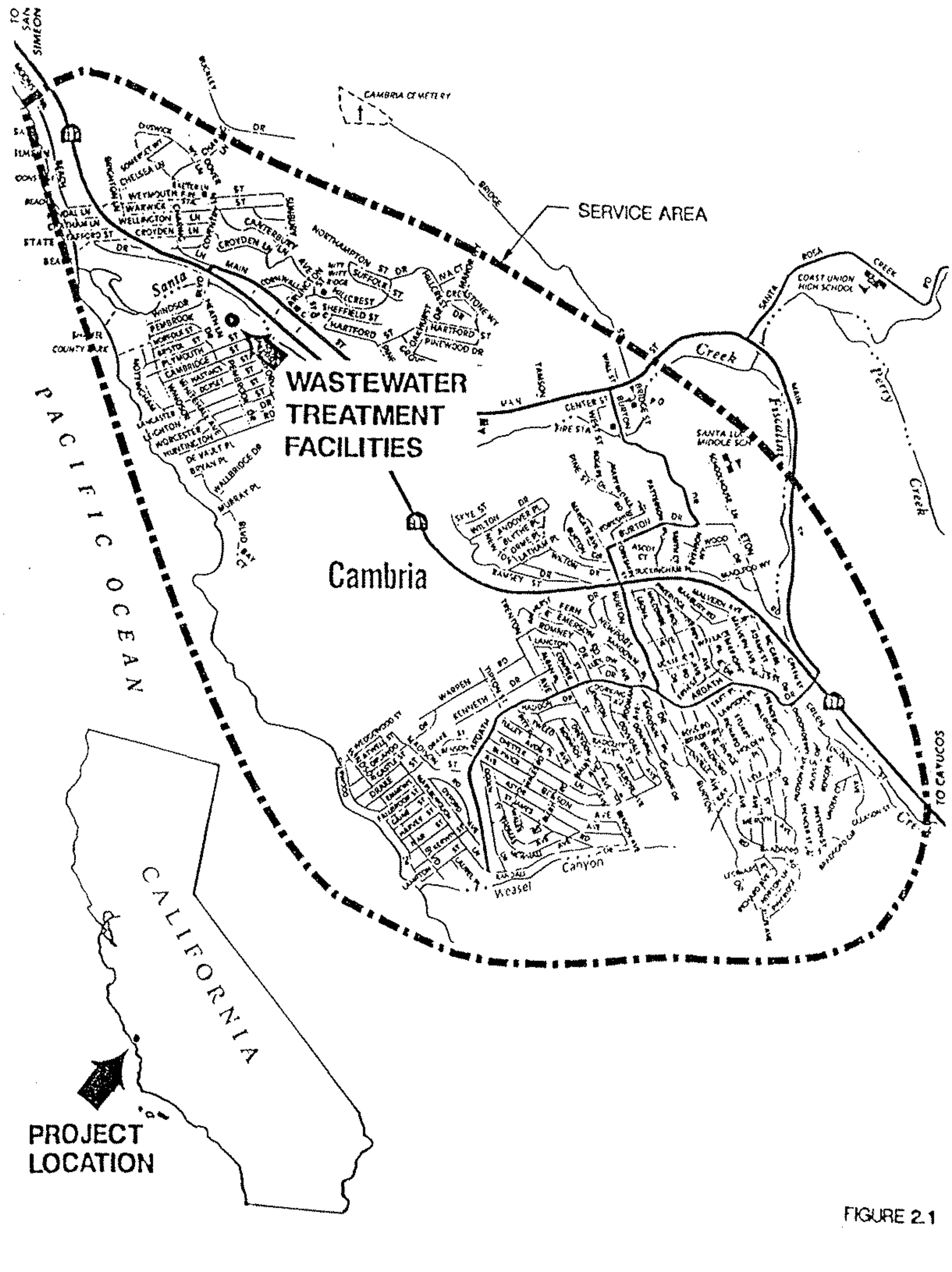
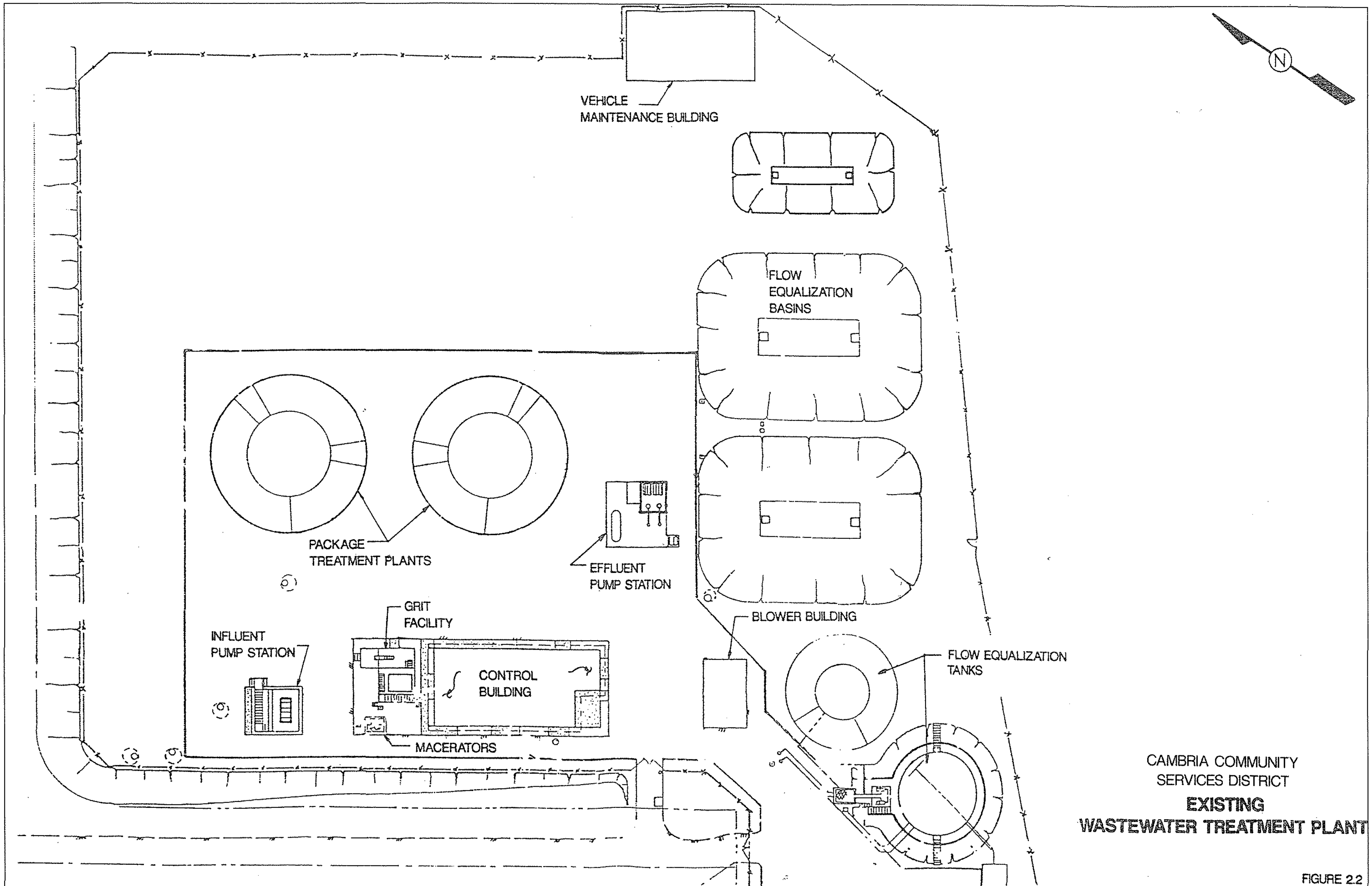


FIGURE 2.1

CAMBRIA COMMUNITY SERVICES DISTRICT

SERVICE AREA

FIGURE 2.1



CAMBRIA COMMUNITY
SERVICES DISTRICT

EXISTING
WASTEWATER TREATMENT PLANT

FIGURE 2.2

JOHN CAROLLO ENGINEERS

Because CCSD has the option of land disposal or direct stream discharge, it has a waste discharge permit which includes requirements for both land disposal and direct stream discharge. The permit (Order No. 89-07 [including NPDES Permit No. CA 0048615]) was issued by the Regional Water Quality Control Board - Central Coast Region (RWQCB) on February 10, 1989 (see Appendix C).

Wastewater Treatment Facilities

Wastewater reaches the treatment facility through a 24 inch gravity sewer pipeline. Influent flows are first measured in a metering manhole with a Palmer-Bowlus flume. From the metering manhole, the influent wastewater flows by gravity to an influent pump station.

The dry pit/wet pit influent pump station has three self priming raw sewage pumps each with a capacity of 600 gallons per minute (gpm). The raw sewage is pumped through one of two in-line macerators. The macerators are used to grind the larger solids in the raw sewage into smaller particles. The macerators have a capacity of 800 gpm each.

An aerated grit chamber follows the macerators and has an approximate volume of 5,500 gallons. The aerated grit chamber includes the chamber, aeration piping, grit pumps, and a grit classifier. The chamber is used to remove heavier solid particles such as sand and gravel from the raw sewage.

Following the aerated grit chamber, the influent flow is diverted to flow equalization basins. In the past, the flow equalization basins include two interconnected steel tanks. However, CCSD has recently modified two effluent storage basins and a third existing unused basin to provide additional flow equalization during wet weather flows. Equalized flow from the basins is mixed to keep solids in suspension and gradually returned to the treatment process by variable speed pumps.

The main secondary treatment facilities are two parallel package activated sludge wastewater treatment plants. The plants have the flexibility to operate either in the extended aeration or contact stabilization mode of the activated sludge process.

In this extended aeration mode, the wastewater flows are routed into an aeration zone (the contact zone and reaeration zone of the contact stabilization mode combined). From the aeration zone, the wastewater flows to the secondary clarifier. Some of the settled sludge from the clarifier is routed to the aeration zone for additional oxidation. The activated sludge not routed to the aeration zone is wasted to an aerobic digester prior to final sludge disposal.

In the contact stabilization mode, wastewater flows are routed through a contact zone, mixed with activated sludge from a reaeration zone, and held for approximately 1.5 hours. From the contact zone, the wastewater flows to the secondary clarifier. Most of the settled sludge from the clarifier is routed to the reaeration zone for oxidation and reduction of the soluble organics and held for three to six hours. The activated sludge not routed to the reaeration zone is wasted to the aerobic digester prior to final sludge disposal.

Currently, CCSD operates one of its package plants in an extended aeration mode and one in the contact stabilization mode. The maximum rated capacity of the treatment facilities in the current operation mode is 0.75 mgd.

Following the secondary clarifiers, the treated wastewater is chlorinated for disinfection and held in small chlorine contact basins built into the package treatment plants. After chlorination, the treated wastewater flows to the effluent pump station. In the past, the treatment facilities were designed to either pump the treated wastewater directly to the effluent disposal site or store the water in effluent storage basins. As stated earlier, CCSD has converted the effluent storage basins to influent equalization basins. The effluent pump station has two pumps each with a capacity of 600 gpm.

Effluent Disposal Facilities

The treated wastewater is pumped through a 12 inch force main 2.5 miles to a 51 acre effluent disposal site which includes effluent disposal fields, a storage reservoir and a slow sand filter. For location and layout of the disposal facilities, see Figure 2.3. The disposal site is partially hilly and only 22 of the 51 acres are currently usable for effluent disposal.

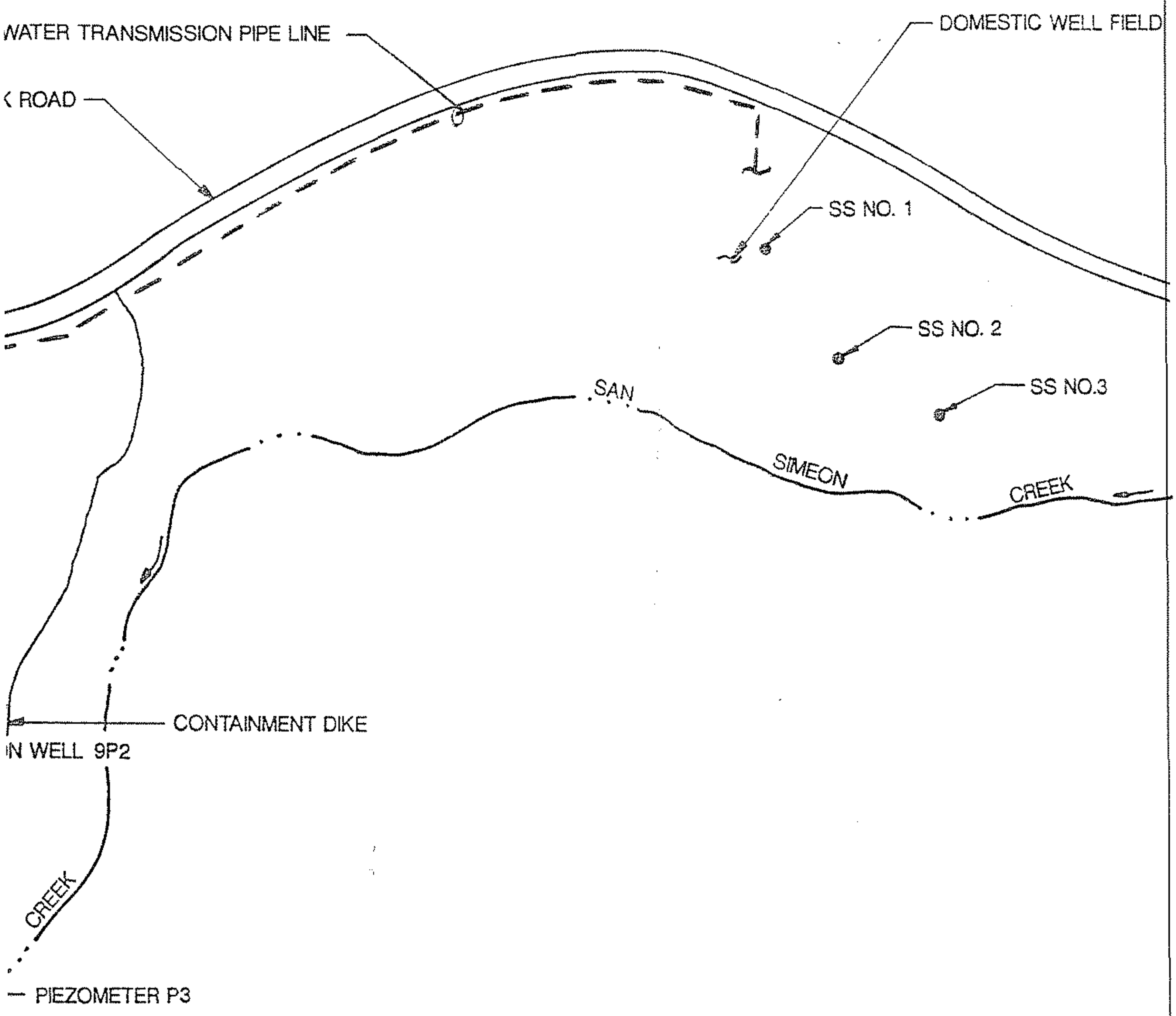
The treated wastewater can be pumped directly into the spray irrigation piping system at the effluent disposal field or the storage reservoir from the effluent force main. The spray irrigation system includes moveable irrigation piping and sprinklers. Currently, CCSD spray irrigates a portion of the field until the soil is near saturation and then relocates the irrigation piping to another area of the field. The site is partially bounded by San Simeon Creek and is transversed by Van Gordon Creek, which is a tributary of San Simeon Creek. Treated wastewater is prevented from entering the creeks by berms built along the stream beds.

As stated, treated wastewater can also be pumped to the storage reservoir. The storage reservoir has a capacity of approximately 6 million gallons. Water is disposed from the storage basin by percolation into the groundwater, evaporation, or discharging to Van Gordon Creek through a slow sand filter. There are no provisions to feed the spray irrigation system from the storage reservoir.

The slow sand filter has a rated design capacity of 390 gpm. In the past, CCSD has had difficulty meeting the discharge requirements to Van Gordon Creek using the sand filter, most notably turbidity and chlorine residual requirements. Because of the difficulty meeting the discharge requirements, the filter has not been used except on a demonstration basis. The storage reservoir is used to dispose of treated wastewater through percolation and evaporation only.

2.3 EXISTING DOMESTIC WATER SUPPLY SYSTEM

The domestic water for Cambria is supplied from groundwater aquifers. Water is pumped from well fields near San Simeon Creek and Santa Rosa Creek. The water from the Santa Rosa Basin has high manganese concentrations and is treated for iron and manganese removal prior to distribution. The San Simeon Basin water is of better quality than that of the Santa Rosa



CAMBRIA COMMUNITY
SERVICES DISTRICT

EFFLUENT DISPOSAL AND DOMESTIC WELL FIELDS

FIGURE 2.3

JOHN CAROLLO ENGINEERS

Basin, and requires only chlorination for disinfection. The chlorination occurs at the wells, prior to entering the distribution system. Since 1980, the majority of the water (approximately 85 percent) has come from the San Simeon Basin because of the increased cost of treating water from the Santa Rosa Basin.

The San Simeon Basin extends from the ocean to just over three miles inland from the ocean where Steiner Creek merges with San Simeon Creek. There are approximately 35 wells extracting from this basin, three of which are operated by CCSD for the domestic water supply. The remaining wells in the basin are used to supply water for domestic use, agricultural irrigation, and a gravel mining operation, or have been abandoned.

The Santa Rosa Basin extends inland for six miles and underlies the town of Cambria. There are approximately 40 wells extracting water from the basin of which three are operated by CCSD for the domestic water supply. The remaining wells in the basin have similar uses as those in the San Simeon Basin. Figures 2.4 and 2.5 show the San Simeon Basin and the Santa Rosa Basin, respectively, and the location of wells within each.

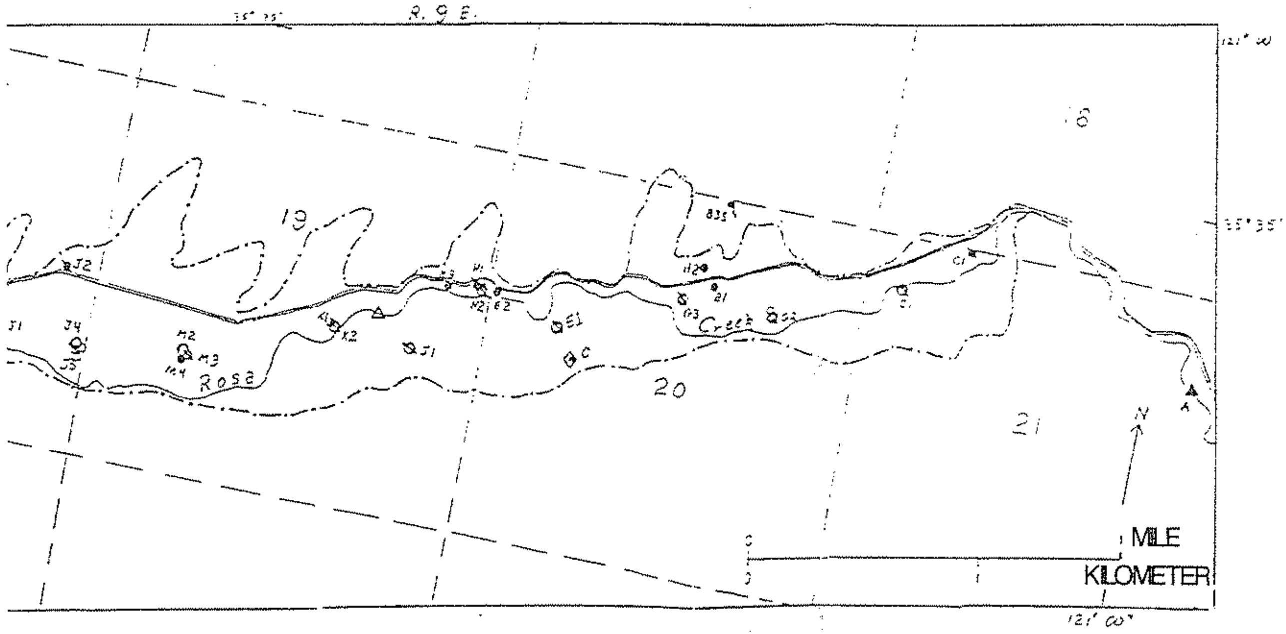
2.4 EXISTING AND PROJECTED WASTEWATER FLOWS AND LOADINGS

Historical wastewater flows to the CCSD wastewater treatment facility for the last three years are presented in Table 2.2. Because Cambria is a resort community, its population and corresponding water usage and wastewater flow is highest during the summer dry weather months.

The average day maximum month (ADMM) flow has historically been 1.1 times the annual average flow (AAF) for the past two years. Although peak hour data has not been reviewed, based on discussion with treatment facility staff and because of the recent drought conditions infiltration/inflow has not been a major operational problem and peak hour flows over the past three years have been decreasing. However, according to the 1987 Facilities Plan, the peak hour flows have averaged 2.5 times the annual average flows in the past.

Wastewater loadings to the wastewater treatment facility are also presented in Table 2.2. The monthly average five-day biochemical oxygen demand (BOD_5) to the facility has been 345 mg/l and ranged from 186 milligrams per liter (mg/l) to 605 mg/l. The total suspended solids (TSS) for the facility has averaged 336 mg/l and ranged from 151 mg/l to 856 mg/l.

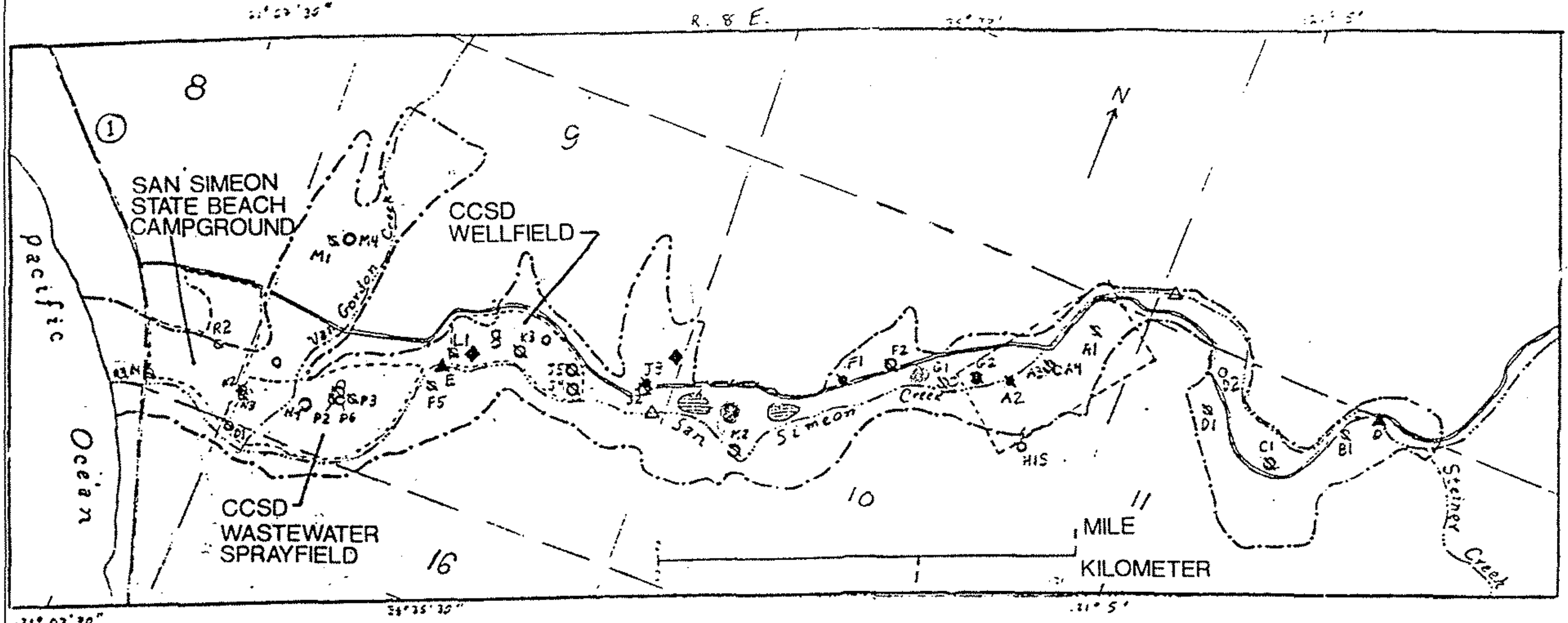
Projected flows and loadings are presented in Table 2.3. Projected flows were determined from three factors: 1) population growth, 2) per capita wastewater flow contribution, and 3) projected infiltration/inflow. The 1990 Facilities and Effluent Disposal Plan Update (1990 Plan Update) made flow projections based on "known 1989 flows and the assumptions of 80 gallons per capita per day wastewater flows and 2.0 persons per dwelling." Population growth was based on the issuance of 30 building permits per year for the minimum projected average flow and the issuance of 125 building permits per year for the maximum projected average flow. According to the 1990 Update, the maximum projected average day flow is 0.88 mgd. The projected average peak day flow based on a 2.5 peaking factor was calculated to be 2.20 mgd. Projected loadings were based on the average concentrations of 345 mg/l BOD and 336 mg/l TSS.



CAMBRIA COMMUNITY
SERVICES DISTRICT
SANTA ROSA
GROUNDWATER BASIN

FIGURE 2.4

JOHN CAROLLO ENGINEERS



SOURCE: YATES AND OTHERS

CAMBRIA COMMUNITY
SERVICES DISTRICT

SAN SIMEON
GROUNDWATER BASIN

FIGURE 2.5

JOHN CAROLLO ENGINEERS

Table 2.2 Wastewater Treatment Facility Influent Quality
Cambria Community Services District

Year	Average Daily Flow (mgd)	Peak Day Flow (mg/l)	BOD_5 (mg/l)	BOD_5 (lbs/day)	TSS (mg/l)	TSS (lbs/day)
1987	0.40	0.95	328	1,090	567	1,831
1988	0.44	0.97	293	1,105	256	918
1989	0.44	0.97	345	1,266	336	1,232
1990	0.48	0.98	414	1,657	185	740
Average			345		336	

Table 2.3 Wastewater Treatment Facility Flow and Loading Projections
Cambria Community Services District

Year	Minimum Projected Average Flow(1) (mgd)	Maximum Projected Average Flow(2) (mgd)	Maximum Peak Flow(3) (mgd)	BOD(2) (mg/l)	BOD(2) (lbs/day)	TSS(2) (mg/l)	TSS(2) (lbs/day)
1989	0.47	0.47	1.17	345	1,262	336	1,317
1990	0.48	0.48	1.25	345	1,381	336	1,345
1995	0.51	0.58	1.45	345	1,669	336	1,625
2000	0.54	0.68	1.70	345	1,956	336	1,905
2005	0.57	0.78	1.95	345	2,244	336	2,185
2010	0.60	0.88	2.20	345	2,532	336	2,465

(1) Based on issuance of 30 building permits per year
(2) Based on issuance of 125 building permits per year
(3) Based on 2.5 times the maximum projected average flow.

2.5 EXISTING AND PROJECTED DOMESTIC WATER USE

CCSD's historical domestic water production is presented in Table 2.4 (1975 to present). Production on a monthly basis by acre feet (ac-ft) for the San Simeon Basin and percent is presented in Table 2.5. This data shows the increase in production required in the dry weather months. Projected domestic water use is presented in Table 2.6, based on the same population assumptions used for wastewater projections.

Table 2.4 CCSD Domestic Water Production
Cambria Community Services District

	Santa Rosa Basin (ac-ft/yr)	San Simeon Basin (ac-ft/yr)	Total (ac-ft/yr)
1975	483.4	--	483.4
1976	517.8	--	517.8
1977	330.0	--	330.0
1978	447.5	--	447.5
1979	36.2	91.2	456.4
1980	--	473.1	473.1
1981	--	518.5	518.5
1982	--	510.6	510.6
1983	--	568.4	568.4
1984	113.8	558.6	672.4
1985	53.3	627.7	681.0
1986	91.1	649.5	740.6
1987	167.7	609.3	777.1
1988	253.9	565.6	819.5
1989	174.6	622.4	797.0
1990	206.7	457.1	663.8

According to those projections, CCSD will require more water in the future than the domestic water supply system can currently provide.

2.6 SUMMARY OF PREVIOUS STUDIES

A 1987 Facilities Plan written for CCSD recommended several projects in two phases to upgrade the existing wastewater treatment facilities. Phase 1 was intended to provide CCSD with adequate wastewater treatment capacity until the year 2000. Phase 2 was intended to provide CCSD with adequate capacity until the year 2010. Some of the recommendations for the wastewater treatment facilities under Phase 1 included: construction of a 1.0 (mgd) activated sludge package treatment plant, construction of new flow equalization basins, replacing the influent pump motors and pulleys, and construction of a new multi-purpose building. Some of the recommendations for the wastewater treatment facilities under Phase 2 included: replacing the macerators, construction of a new aerated grit chamber, replacing the flow equalization pumps, replacing the influent pumps, and expanding the effluent pumps.

A 1989 Effluent Disposal Evaluation written for CCSD also recommended several projects to upgrade the effluent disposal site. The projects were intended to provide CCSD with a more reliable effluent disposal operation and provide capacity until the year 2010. The immediate need recommendations included: completion of an emergency containment dike, preparation of a sprinkler plan layout, and installation of flow meters on the Molinari, Warren, and 9P2 wells. The near-term disposal alternative recommendations included: expansion of the sand filter

Table 2.5 San Simeon Basin Domestic Water Production[1]
Cambria Community Services District

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total
1985	42.6	40.1	43.2	51.6	62.7	67.3	67.2	73.9	53.2	41.8	39.1	45.0	627.7
1986	47.2	39.6	47.8	53.9	70.2	73.1	65.2	61.7	49.6	48.8	49.9	42.5	649.5
1987	41.5	41.3	48.4	63.0	68.8	63.8	66.1	62.9	42.0	36.4	32.9	42.3	609.3
1988	51.7	57.9	63.2	47.3	57.4	44.2	50.0	51.7	41.9	37.4	27.4	36.0	565.6
1989	51.2	47.9	53.9	61.9	57.2	62.2	69.2	60.9	36.3	38.7	42.6	40.6	622.4
1990	45.7	47.0	55.3	44.7	31.5	32.3	40.0	38.0	31.9	31.4	29.4	29.9	457.1
AVERAGE (Ac-Ft/Yr)	**46.6**	**45.6**	**52.0**	**53.7**	**58.0**	**57.2**	**59.6**	**58.2**	**42.5**	**39.1**	**36.9**	**39.4**	**588.6**
Average Percent of Annual Total	7.9	2.7	8.8	9.1	9.9	9.7	10.1	9.9	7.3	6.6	6.3	6.7	100

(1) Domestic water production is in acre feet/year.

Table 2.6 Projected CCSD Domestic Water Demand
Cambria Community Services District

Year	Water Demand (ac-ft/yr)(1) Minimum(2)	Maximum(3)
1990	475	475
1995	502	587
2000	529	699
2005	555	811
2010	582	923

1) Based on a demand of 80 gallons/capita/day and two people per household.
2) Based on issuance of 30 building permits per year.
3) Based on issuance of 125 building permits per year.

operation, construction of percolation ponds, increased groundwater extraction well operations, construction of two new extraction wells and piping extracted groundwater to sources committed to using reclaimed water for irrigation purposes. The long term disposal alternative recommendations included: development of export projects to deliver reclaimed wastewater to potential users.

A 1990 Facilities and Effluent Disposal Plan Update (1990 Plan Update) written for CCSD provided an update for the first two reports. The 1987 Facilities Plan recommended upgrading the wastewater treatment facilities at the existing site. However, due to the proximity of the facilities to the commercial center of Cambria and a residential neighborhood, CCSD decided to consider relocating the treatment facilities to the effluent disposal site. After an alternative cost analysis was performed to compare construction of new facilities versus upgrading the existing facilities, the 1990 Plan Update recommended upgrade of the existing facilities. The 1990 Plan Update also evaluated wastewater reclamation/reuse alternatives to determine the feasibility of using wastewater reclamation to improve the safe yield of CCSD's water supply. The alternatives studied included crop irrigation, landscape irrigation, groundwater recharge and stream flow augmentation. Based on a cost/acre-foot analysis, the amount of water conserved and the regulations effecting each alternative, the recommended alternative was crop irrigation. However, the project will be difficult to implement without cooperation of those proposed to receive the treated water. The second least cost alternative was groundwater recharge of treated wastewater into the domestic supply groundwater basin through surface spreading.

2.7 EXISTING WATER QUALITY

Introduction

CCSD has an ongoing water quality sampling program that includes analysis of: 1) domestic well water, 2) raw wastewater, 3) treated wastewater, 4) groundwater in the effluent disposal site (extraction well water), and 5) background groundwater of the San Simeon Basin. In the past, the analyses have included testing for general minerals and inorganics, oxygen demand, suspended solids and total dissolved solids. In the last year the sampling program has been expanded to include volatile and semi-volatile organics. A general discussion of water quality follows below for untreated wastewater and groundwater in the San Simeon Basin. A more detailed discussion and the impact of the various water sources on the recharge project is presented in Chapters 4 and 5.

Untreated Wastewater

Monthly data for BOD and TSS for untreated wastewater is summarized in Table 2.2 for the past three years. BOD concentrations have averaged 345 mg/l, and TSS concentrations have averaged 336/ mg/l. Because additional monitoring is not required for CCSD's NPDES permit requirements, very little additional data is available on the quality of the untreated wastewater. The major contributors of wastewater to the system are residential and commercial users. There is essentially no industrial user on the system.

Treated Wastewater

A summary of general quality for the treated wastewater is presented in Table 2.7. The data is an average of several samples collected over the last 2 1/2 years (raw data is presented in Appendix D). The data is typical of domestic wastewater. As a condition of its NPDES permit, CCSD is also required to perform quarterly analysis for selected inorganic minerals. The results of this data for the last three years is presented in Table 2.8.

In comparison to the domestic well water quality (San Simeon Basin groundwater), the data in Table 2.7 and 2.8 for the treated wastewater indicate there are slightly elevated levels of most dissolved inorganic minerals and metals as would be expected for domestic wastewater. The data also confirms there is no significant industrial wastewater contributor to the treatment system.

It should be noted that raw data in Table 1, Appendix D also includes analysis for volatile and semi-volatile organics. With minor exceptions, no volatile or semi-volatile organics were detected.

Because there is no industrial waste contribution to the wastewater system, CCSD has no source control.

San Simeon Basin Water

Surface Water Quality

There is very little data available substantiating the surface water quality of the San Simeon or Van Gordon Creeks in the San Simeon Basin. All known data was gathered by USGS for the unpublished report (written communication with Mr. Gus Yates) on the basin. The data indicates TDS ranged from 280 to 300 mg/l and specific conductance ranged from 472 to 556 mg/l. Other parameters tested included chloride, sodium, manganese, magnesium, potassium, calcium, sulfate, and hardness. In all cases the surface water quality was better than the groundwater quality in San Simeon Basin.

Table 2.7 Summary of Water Quality[1]
Cambria Community Services District

Constituent	Units	Treated Waste-water[2]	Extraction Well Water[3]	Domestic Well Water[4]
pH	--	7.1	7.0	7.1
Electrical Conductivity[4]	$EC_w x10^6$	1,325	800	550
Total Dissolved Solids	mg/l	845	528	420
Calcium	mg/l	65	76	53
Magnesium	mg/l	44	54	38
Sodium	mg/l	199	49	21
Potassium	mg/l	15	<3.0	<3.0
Carbonate	mg/l	<1.0	<1.0	<1.0
Bicarbonate (as HCO_3)	mg/l	369	342	252
Total Alkalinity (as $CaCO_3$)	mg/l	304	280	240
Sodium Adsorption Ratio	--	4.0	--	--
Adjusted Sodium Adsorption Ratio	--	9.4	--	--
Chloride	mg/l	175	87	20
Sulfate	mg/l	86.0	64	56
Boron	mg/l	0.62	0.3	0.2
Nitrate	mg/l	12.0	8.5	4.9
Total Nitrogen (as N)	mg/l	18.0	<0.5	0.6
Nitrogen-Ammonia	mg/l	16.0	<0.1	<0.1
Total Phosphorus	mg/l	7.3	0.14	0.02
Fluoride	mg/l	0.2	0.2	<0.1
Iron	mg/l	0.06	0.13	<0.05
Manganese	mg/l	0.03	<0.02	<0.02
Copper	mg/l	<0.05	<0.05	<0.05
Zinc	mg/l	0.08	<0.05	<0.05
Hydroxide (CaOH)	mg/l	--	--	--
Total Organic Carbon	mg/l	10.2	1.3	1
Total Hardness ($CaCO_3$)	mg/l	335	340	282
Total Suspended Solids	mg/l	18.0	<5.0	<5.0
Chemical Oxygen Demand	mg/l	44.0	5.5	<5
Biochemical Oxygen Demand	mg/l	40.0	3.5	<3

(1) Water quality analyses performed by Coast-to-Coast Analytical Services, San Luis Obispo, California.
(2) Average of three 24 hour composite samples collected 3/13/89, 4/10/90, and 9/14/90.
(3) Average of four 24 hour composite samples collected 3/13/89, 10/4/89, 3/8/90, and 4/10/90.
(4) Average of three 24 hour composite samples collected 3/13/89, 3/8/90, and 9/14/90 in the domestic well field.

Table 2.8 Chemical Quality of Treated Wastewater
Cambria Community Services District

Month	Chloride (mg/l)	Boron (mg/l)	Sodium (mg/l)	Sulfate (mg/l)
1986				
January	176	--	131	88
April	192	0.53	143	86
July	142	0.81	154	88
October	172	0.55	182	92
1987				
January	198	0.57	158	95
April	162	0.54	175	68
July	147	0.60	190	91
October	178	0.27	170	117
1988				
January	182	0.63	220	77
April	130	0.69	220	84
July	163	0.70	105	92
October	187	0.74	262	135
1989				
January	200	0.61	220	78
April	190	0.73	230	72
July	163	0.46	245	73
October	221	0.83	300	114
AVERAGE	**175**	**0.62**	**199**	**86**

Groundwater Quality

Fairly extensive groundwater quality data has been collected over the past several years by CCSD and other agencies studying the San Simeon Basin. Referring to Tables 1 and 2 in Appendix D, the groundwater quality varies depending on the point of extraction. Data has been collected from several wells in the basin including extraction wells and piezometers at the effluent disposal site, domestic wells, and privately owned wells upgradient and downgradient of the disposal site.

Generally the upper reaches of the San Basin have the highest quality groundwater. As the groundwater flows to the ocean, the concentration of dissolved materials increases. In addition to the water quality change due to subsurface residence time the groundwater quality is also impacted by the effluent disposal site and seawater intrusion. This is most readily seen in the chemical analysis data presented in Table 2, Appendix D. A more extensive analysis of the water quality is given in Chapter 4.

Extraction Well Water. Extraction well water is defined as groundwater pumped from wells located in or near the effluent disposal site. Analysis of the data collected from these wells is summarized in Table 2.7. Quarterly chemical analysis for selected general minerals is presented in Table 2.9. The results of the data appear to indicate the extraction well water is a blend of groundwater and percolated treated wastewater. This is substantiated by the fact that the total dissolved solids and dissolved minerals such as sodium and potassium and the dissolved salts (chlorides) and sulfates have lower concentrations than the treated wastewater but also have higher concentrations than the background groundwater (domestic water supply).

As with the treated wastewater, the summarized data for the extraction well water in Table 2.7 is based on raw data included in Tables 1 and 2, Appendix D.

Domestic Well Water. Domestic well water is assumed to be the equivalent of background groundwater. Data for the domestic well water is summarized in Table 2.7. Quarterly chemical analysis for selected general minerals included in Table 2.10. The raw data used to develop this summary is included in Table 1, Appendix D. The raw data presented also includes analysis for volatile and semi-volatile organics. None were detected. Generally, the water is of good quality, meets all secondary drinking water standards, and requires no treatment other than disinfection prior to reaching the domestic water distribution system.

Groundwater. Sampling of other groundwater sources was completed in the past few years to better determine the quality of groundwater in the San Simeon Basin (written communication with Gus Yates). The results of this sampling program are presented in Table 2, Appendix D. The sources sampled are wells located in the basin and range from the ocean to approximately 2 miles upgradient of the effluent disposal site.

The results of the sampling program determined (in terms of groundwater quality) that the San Simeon Basin could be divided into an upper and lower basin. The boundary between the upper and lower basin is near the downstream end of the domestic well field. This boundary was indicated by the concentration differences of sodium, chloride, sulfate, and dissolved solids. Additional discussion of groundwater quality and the impact on the proposed recharge project is included in Chapters 4 and 5.

Table 2.9 Chemical Quality of Extraction Well Water[(1)]
Cambria Community Services District

Month	Conductivity mmhos/cm	Chloride mg/l	Nitrate (mg/l)
1986			
January	500	--	1.0
April	350	--	0.5
July	460	--	--
October	700	--	8.0
1987			
January	920	164	2.0
April	520	46	7.1
July	650	100	5.5
October	910	145	6.2
1988			
January	670	47	1.7
April	670	20	0.6
July	800	69	6.5
October	740	67	2.7
1989			
January	680	97	4.0
April	870	73	3.3
July	900	88	6.8
October	1,208	134	11.0
AVERAGE	**725**	**87**	**4.5**

(1) Sample collected at Extraction Well 9P2.

Table 2.10 Chemical Quality of Domestic Well Water[1]
Cambria Community Services District

Month	Conductivity (mmhos/cm)	Chloride (mg/l)	Boron (mg/l)	Sodium (mg/l)	Nitrate (as N) (mg/l)	Sulfate (mg/l)
1986						
January	400	16[2]	--	26	1.0	44
April	400	21[2]	0.34	26	0.5	45
July	410	28[2]	0.58	33	1.0	31
October	440	35[2]	0.35	37	1.2	44
1987						
January	510	25	0.33	32	0.6	58
April	400	18	0.25	28	1.7	40
July	410	17	0.30	39	1.4	60
October	490	21	0.15	45	0.7	77
1988						
January	550	18	0.36	33	0.4	47
April	680	10	0.29	28	0.3	48
July	540	18	0.36	44	0.3	75
October	520	19	0.35	40	0.4	82
1989						
January	520	18	0.28[2]	25	0.6	46[2]
April	537	18	0.31[2]	27	0.4	42[2]
July	595	18	0.23[2]	24	0.4	70[2]
October	634	18	0.34[2]	31	0.5	85[2]
AVERAGE	**503**	**20**	**0.32**	**32**	**0.8**	**56**

(1) San Simeon Basin wells.
(2) Aggregate of San Simeon Basin and Santa Rosa Basin aquifer.

EVALUATION OF ALTERNATIVES TO IMPROVE DOMESTIC WATER SUPPLY CAPACITY

3.1 GENERAL

The central coast of California, including the area near Cambria, has been one of the areas in the state severely impacted by the recent drought conditions. In addition, as indicated in Table 2.4, the projected domestic water supply needs for Cambria are anticipated to exceed the safe yield of the San Simeon and Santa Rosa Basins' aquifers in the future.

In an attempt to increase the capacity of its domestic water supply, Cambria Community Services District (CCSD) has studied several alternatives including wastewater reclamation to increase the safe yield of its domestic water supply.

3.2 DOMESTIC WATER SUPPLY ALTERNATIVES

In the past, the District has considered several alternatives for providing additional potable water. Some of the alternatives considered include drilling additional wells in the existing Santa Rosa and San Simeon basins' aquifers, connecting into the State Water Project (SWP), desalination, and constructing small dams on wet weather streams for collection, storage, and recharge.

The CCSD has tapped two existing groundwater basins (Santa Rosa and San Simeon). Because of the number of existing wells and water allocation rights, drilling additional wells will not increase the safe yield of their domestic water supply. There are no other groundwater basins available which could provide supplementary yield.

CCSD did not join the SWP when it was first implemented and has no allocation. Consequently, CCSD would have to purchase SWP water allocation from another community. In addition, CCSD would be required to pay conveyance costs from the nearest pipeline which is several miles away. Regardless, this project will not be implemented by the State for several years. This alternative is not cost effective.

Desalination of sea water and brackish water for domestic use was also considered. Desalination of sea water is very energy intensive and expensive. At this time desalination has been eliminated as an alternative domestic water source because of cost.

CCSD is pursuing the feasibility of constructing small dams on wet weather streams for collection and recharge. The results of this study are presently undetermined.

Table 2.8 Chemical Quality of Treated Wastewater
Cambria Community Services District

Month	Chloride (mg/l)	Boron (mg/l)	Sodium (mg/l)	Sulfate (mg/l)
1986				
January	176	--	131	88
April	192	0.53	143	86
July	142	0.81	154	88
October	172	0.55	182	92
1987				
January	198	0.57	158	95
April	162	0.54	175	68
July	147	0.60	190	91
October	178	0.27	170	117
1988				
January	182	0.63	220	77
April	130	0.69	220	84
July	163	0.70	105	92
October	187	0.74	262	135
1989				
January	200	0.61	220	78
April	190	0.73	230	72
July	163	0.46	245	73
October	221	0.83	300	114
AVERAGE	**175**	**0.62**	**199**	**86**

Groundwater Quality

Fairly extensive groundwater quality data has been collected over the past several years by CCSD and other agencies studying the San Simeon Basin. Referring to Tables 1 and 2 in Appendix D, the groundwater quality varies depending on the point of extraction. Data has been collected from several wells in the basin including extraction wells and piezometers at the effluent disposal site, domestic wells, and privately owned wells upgradient and downgradient of the disposal site.

Generally the upper reaches of the San Basin have the highest quality groundwater. As the groundwater flows to the ocean, the concentration of dissolved materials increases. In addition to the water quality change due to subsurface residence time the groundwater quality is also impacted by the effluent disposal site and seawater intrusion. This is most readily seen in the chemical analysis data presented in Table 2, Appendix D. A more extensive analysis of the water quality is given in Chapter 4.

Extraction Well Water. Extraction well water is defined as groundwater pumped from wells located in or near the effluent disposal site. Analysis of the data collected from these wells is summarized in Table 2.7. Quarterly chemical analysis for selected general minerals is presented in Table 2.9. The results of the data appear to indicate the extraction well water is a blend of groundwater and percolated treated wastewater. This is substantiated by the fact that the total dissolved solids and dissolved minerals such as sodium and potassium and the dissolved salts (chlorides) and sulfates have lower concentrations than the treated wastewater but also have higher concentrations than the background groundwater (domestic water supply).

As with the treated wastewater, the summarized data for the extraction well water in Table 2.7 is based on raw data included in Tables 1 and 2, Appendix D.

Domestic Well Water. Domestic well water is assumed to be the equivalent of background groundwater. Data for the domestic well water is summarized in Table 2.7. Quarterly chemical analysis for selected general minerals included in Table 2.10. The raw data used to develop this summary is included in Table 1, Appendix D. The raw data presented also includes analysis for volatile and semi-volatile organics. None were detected. Generally, the water is of good quality, meets all secondary drinking water standards, and requires no treatment other than disinfection prior to reaching the domestic water distribution system.

Groundwater. Sampling of other groundwater sources was completed in the past few years to better determine the quality of groundwater in the San Simeon Basin (written communication with Gus Yates). The results of this sampling program are presented in Table 2, Appendix D. The sources sampled are wells located in the basin and range from the ocean to approximately 2 miles upgradient of the effluent disposal site.

The results of the sampling program determined (in terms of groundwater quality) that the San Simeon Basin could be divided into an upper and lower basin. The boundary between the upper and lower basin is near the downstream end of the domestic well field. This boundary was indicated by the concentration differences of sodium, chloride, sulfate, and dissolved solids. Additional discussion of groundwater quality and the impact on the proposed recharge project is included in Chapters 4 and 5.

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AVERAGE	**725**	**87**	**4.5**

(1) Sample collected at Extraction Well 9P2.

Table 2.10 Chemical Quality of Domestic Well Water[1]
Cambria Community Services District

Month	Conductivity (mmhos/cm)	Chloride (mg/l)	Boron (mg/l)	Sodium (mg/l)	Nitrate (as N) (mg/l)	Sulfate (mg/l)
<u>1986</u>						
January	400	16[2]	--	26	1.0	44
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January	510	25	0.33	32	0.6	58
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<u>1988</u>						
January	550	18	0.36	33	0.4	47
April	680	10	0.29	28	0.3	48
July	540	18	0.36	44	0.3	75
October	520	19	0.35	40	0.4	82
<u>1989</u>						
January	520	18	0.28[2]	25	0.6	46[2]
April	537	18	0.31[2]	27	0.4	42[2]
July	595	18	0.23[2]	24	0.4	70[2]
October	634	18	0.34[2]	31	0.5	85[2]
AVERAGE	**503**	**20**	**0.32**	**32**	**0.8**	**56**

(1) San Simeon Basin wells.
(2) Aggregate of San Simeon Basin and Santa Rosa Basin aquifer.

EVALUATION OF ALTERNATIVES TO IMPROVE DOMESTIC WATER SUPPLY CAPACITY

3.1 GENERAL

The central coast of California, including the area near Cambria, has been one of the areas in the state severely impacted by the recent drought conditions. In addition, as indicated in Table 2.4, the projected domestic water supply needs for Cambria are anticipated to exceed the safe yield of the San Simeon and Santa Rosa Basins' aquifers in the future.

In an attempt to increase the capacity of its domestic water supply, Cambria Community Services District (CCSD) has studied several alternatives including wastewater reclamation to increase the safe yield of its domestic water supply.

3.2 DOMESTIC WATER SUPPLY ALTERNATIVES

In the past, the District has considered several alternatives for providing additional potable water. Some of the alternatives considered include drilling additional wells in the existing Santa Rosa and San Simeon basins' aquifers, connecting into the State Water Project (SWP), desalination, and constructing small dams on wet weather streams for collection, storage, and recharge.

The CCSD has tapped two existing groundwater basins (Santa Rosa and San Simeon). Because of the number of existing wells and water allocation rights, drilling additional wells will not increase the safe yield of their domestic water supply. There are no other groundwater basins available which could provide supplementary yield.

CCSD did not join the SWP when it was first implemented and has no allocation. Consequently, CCSD would have to purchase SWP water allocation from another community. In addition, CCSD would be required to pay conveyance costs from the nearest pipeline which is several miles away. Regardless, this project will not be implemented by the State for several years. This alternative is not cost effective.

Desalination of sea water and brackish water for domestic use was also considered. Desalination of sea water is very energy intensive and expensive. At this time desalination has been eliminated as an alternative domestic water source because of cost.

CCSD is pursuing the feasibility of constructing small dams on wet weather streams for collection and recharge. The results of this study are presently undetermined.

3.3 WASTEWATER RECLAMATION ALTERNATIVES

Several alternatives have been considered in previous studies for the reclamation and use of the treated wastewater to increase the safe yield of the domestic water supply. The alternatives considered include crop irrigation of land currently irrigated by water drawn from CCSD's domestic supply aquifer, landscape irrigation, groundwater recharge, and stream flow augmentation. The results of the a previous study, the Facilities and Effluent Disposal Plan Update (1990 Plan Update), are summarized briefly in Chapter 2.

The study determined a crop irrigation system could provide an estimated additional 100 acre feet (ac-ft) of domestic water supply. Landscape irrigation could provide an estimated 50 ac-ft of domestic water supply. However, both of these projects would be difficult to implement because of anticipated resistance by users. Stream flow augmentation was determined non-viable because of anticipated regulatory requirements. The study estimated groundwater recharge may be able to provide 270 ac-ft/year of additional domestic water. Subsequent analysis has revised this figure to 216 ac-ft/year.

3.4 RECOMMENDED PROJECT

After review of all viable alternatives which could increase the capacity of the domestic water supply, CCSD selected groundwater recharge of treated municipal wastewater (see 1990 Plan Update). The selection was based on ease of implementation and cost. A brief description of the proposed project follows. In depth analysis of project feasibility based on compliance with the requirements of the Proposed Guidelines for Groundwater Recharge with Reclaimed Municipal Wastewater (Proposed Guidelines) Title 22, and the Regional Water Quality Control Board (RWQCB) antidegradation policy is presented in subsequent chapters.

The project for increasing the capacity of CCSD's domestic water supply proposes to recharge treated municipal wastewater into the domestic supply aquifer for future extraction. Specifically, the project proposes:

- Secondary treatment of municipal wastewater at existing wastewater treatment facilities.
- Effluent disposal of treated wastewater onto percolation ponds (existing effluent disposal site).
- Extraction of treated wastewater (blended with groundwater) from the effluent disposal site with extraction wells.
- Treatment of extracted treated and filtered wastewater and groundwater with advanced treatment (reverse osmosis).
- Transmission of treated reclaimed water and groundwater upgradient of the domestic well field to a proposed recharge site.
- Groundwater recharge at the proposed spreading site (San Simeon Creek streambed).

The project was developed to comply with the requirements of the Proposed Guidelines, Title 22, and the RWQCB antidegradation policy.

3.5 REGULATORY REQUIREMENTS

Several agencies have regulatory authority or jurisdiction over projects involving land or stream discharge of reclaimed wastewater. The major agencies include the Department of Health Services (DHS) and the Regional Water Quality Control Board (RWQCB). Other agencies which play lesser roles but still impact any proposed project include the State Department of Fish and Game (DFG), the California Coastal Commission, and the San Luis Obispo County Planning Department.

Department of Health Services

The regulations which dictate wastewater treatment and quality criteria for a reclamation project are established by Title 22 of the California Administrative Code. In assuming its responsibility to protect the public health of the people of California the DHS has established a set of regulations within Title 22 for projects using reclaimed wastewater.

According to Title 22 regulations no specific guidelines have been established using reclaimed wastewater for groundwater discharge. Any project proposing such an application will be reviewed on a case by case basis. However, the DHS in cooperation with the State Water Resources Control Board (SWRCB) has recently developed guidelines for groundwater recharge projects. A copy of a recent draft of the published guidelines is enclosed in Appendix A.

According to DHS officials, the proposed guidelines were based upon case studies and the State of California's experience with existing groundwater recharge projects. All of the projects studied involved direct injection or surface spreading of wastewater which had undergone extensive advanced treatment beyond secondary treatment (chemical clarification, air stripping, recarbonation, multimedia filtration, carbon adsorption, chlorination, and reverse osmosis). To date a project using soil as a filtration medium and blending with groundwater to achieve that same level of advanced treatment has not been studied.

The proposed criteria developed by these State agencies for groundwater recharge projects is presented in Table 3.1.

It should be noted that the criteria establish not only levels of treatment but other criteria essentially unrelated to level of treatment. For example, for a direct injection project, regardless of the quality of the reclaimed water, there must be at least a 4:1 dilution of reclaimed water with the recharge water, the horizontal distance between the recharge point and the nearest extraction well for domestic consumption must be 2,000 feet and the retention underground must be 12 months. Any exception to the criteria must substantiate no increased health risk.

The first step to obtain approval for a groundwater recharge project using reclaimed wastewater is submittal to the RWQCB of an application and an engineering report which addresses the specific issues outlined in the Proposed Guidelines. Following joint review and acceptance of

Table 3.1 Proposed Criteria for Groundwater Recharge with Reclaimed Water[1],[2]
Cambria Community Services District

Project Category[3]	Maximum Percent Reclaimed Water[4]	Depth to Groundwater (Feet)[5] Per. Rate[6] ≤0.20 in/min	Depth to Groundwater (Feet)[5] Perc. Rate[6] ≤0.33 in/min	Retention Time Underground (Months)	Horizontal Distance (Feet)[7]	Treatment
Surface Spreading						
I	50	10	20	6	500	Organics Removal, Oxidized, Filtered & Disinfected[8]
II	20	10	20	6	500	Oxidized, Filtered and Disinfected[8]
III	20	20	50	12	1,000	Oxidized & Disinfected[9]
IV	20	50	100	12	1,000	Oxidized
Direct Injection						
V	20	na[11]	na[11]	12	2,000	Organics Removal,[10] Oxidized, Filtered, & Disinfected[8]

(1) Source: Proposed Guidelines for Groundwater Recharge with Reclaimed Municipal Wastewater (Draft), State of California, June 5, 1990.

(2) Alternatives to the requirements specified in this table may be accepted if the applicant demonstrates an equivalent degree of health protection.

Table 3.1 Proposed Criteria for Groundwater Recharge with Reclaimed Water[1] (Continued)
Cambria Community Services District

(3) This is a designation to identify a set of conditions for an acceptable project.

(4) The above table is based on a 20 percent contribution of reclaimed water in recharged water. The percentage of reclaimed water in the recharged water may be increased to as much as 50 percent provided additional trace organics removal is accomplished to keep the total TOC contribution to no more than that level which would occur with a 5:1 dilution or 20 percent concentration. The maximum allowable TOC (mg/L) should comply with the performance standard listed in D-1. The percent contribution of reclaimed water may be determined by averaging over a maximum three year period of time.

(5) Depth to groundwater is the minimum depth to groundwater during the life of the project.

(6) Maximum percolation rate shall not exceed the listed values. Borings shall show the soil characteristics at least to the depths listed in this table.

(7) Horizontal distance measured from the injection well or closest edge of the recharge basin to the nearest point of extraction.

(8) The median number of total coliform organisms does not exceed 2.2 mpn per 100 mL, as determined from the bacteriological results of the last seven days for which analysis have been completed, and the number of total coliform organisms does not exceed 23 mpn per 100 mL in any sample.

(9) The median number of total coliform organisms does not exceed 23 mpn per 100 mL, as determined from the bacteriological results of the last seven days for which analysis have been completed, and the number of total coliform organisms does not exceed 240 mpn per 100 mL in any sample.

(10) TOC not to exceed 1 mg/L based on a monthly average.

(11) Not applicable.

the report and application by the RWQCB and DHS, each agency is required to hold a public hearing. Only upon completion of each of these steps may CCSD begin to implement a groundwater recharge project.

Regional Water Quality Control Board

The responsibility of the RWQCB is to protect the quality of the waters of the state. Different from the DHS, the RWQCB is a permitting agency which issues permits to anyone discharging to any body of water (stream, lake, river, ocean, etc) or to the land where it might percolate and reach groundwater. For reclaimed water projects the RWQCB also follows the Title 22 regulations in establishing water quality and treatment criteria.

In addition to the proposed groundwater reclamation guidelines, the SWRCB and RWQCBs have adopted an antidegradation policy for groundwater contamination. This policy was drafted for compliance with the Federal Clean Water Act and requires the RWQCB to approve only projects which do not degrade the groundwater (see Appendix E). The antidegradation policy does not allow any degradation of any waters of the State. For CCSD this may mean that any water discharged to the naturally occurring groundwater, with the exception of treated domestic wastewater effluent discharged at the existing effluent disposal site, must be of equivalent quality in all respects to the groundwater.

Any project recharging the groundwater aquifer through surface spreading would require a discharge permit from the RWQCB. Based on conversations with RWQCB staff, their concern over a groundwater recharge project is the long term degradation of the groundwater quality. To date the RWQCB has developed no database on either background water quality data or data CCSD has submitted in accordance with its existing discharge permit. However, one of the constituents the RWQCB has identified for concern is the TDS in the extraction well water which appears to be higher than the natural groundwater. This higher concentration may be due to the concentration of TDS in the treated effluent. It is likely the RWQCB may request the water used for recharge be of equivalent quality to the existing groundwater for these constituents.

Any project involving direct discharge to San Simeon Creek for ultimate discharge to the groundwater aquifer would also require a discharge permit from the RWQCB. In addition to these specific requirements of the RWQCB for issuance of an NPDES permit for stream flow discharge, the State of California (State) is in the process of developing a document called the Water Quality Control Plan for the Inland Surface Waters of California which could impact the discharge requirements of any discharge to San Simeon Creek. The purpose of the Inland Surface Waters Plans is to complement the existing statewide Water Quality Control Plan and provide a general, broad background basis for modifications to the specific regional water quality control plans already in existence.

A major reason for the development of the Inland Surface Waters Plan is that in accordance with Section 303(c) of the Federal Clean Water Act (CWA) the State is required to develop water quality objectives for toxic substances. The current draft of the Inland Surface Waters Plan has recommended the State adopt water quality objectives for the priority pollutants which could reasonably be expected to interfere with beneficial uses. The resulting list, for which the U.S. Environmental Protection Agency (EPA) and the State have developed criteria, contains 37 pollutants or classes of pollutants for which objectives would be proposed. The draft Inland Surface Waters Plan has recommended adoption of the EPA aquatic life criteria methodology as water quality objectives for protection of freshwater life, adoption of EPA's human health criteria for protection of human life, and adoption of a human life objective for dioxin of 0.013 picograms per liter (pg/l) for inland surface waters. The specific numerical limits for the Inland Surface Waters Plan water quality objectives are listed in Table 3.2 for Aquatic Life Criteria and Table 3.3 for Human Health Criteria.

In addition to recommending adoption of specific numerical values to the 37 pollutants the draft Inland Surface Waters Plan allows the RWQCBs to adopt more stringent site-specific water quality objectives with SWRCB concurrence. The draft Inland Surface Waters Plan also recommends that "all NPDES permits and waste discharge requirements for discharges that the Regional Board determines are likely to have an appreciable impact on receiving waters..." shall have an acute toxicity limit of one Total Unit Acute (TUA).

Although the Inland Surface Waters Plan is in a draft stage, it will eventually provide water quality objectives for so-called toxic pollutants with specific numerical values for all of the 37 priority pollutants. If the proposed recharge project, discharging treated extracted well water to San Simeon Creek, raises the concentration of any of the priority pollutants CCSD may be required to remove that pollutant. Even if a high level of treatment is achieved it is likely when the Inland Surface Waters Plan is implemented, CCSD would be required as part of a National Pollutant Discharge Elimination System (NPDES) permit to meet and test for an acute toxicity limit as well as monitor for several of the priority pollutants in its discharge.

California Coastal Commission

The State Coastal Commission (Commission) has jurisdiction over development along the California coast. Depending on the location and project, the Commission issues Coastal Development Permits for construction projects. CCSD was issued two permits (Nos. 131-20 and 132-18) for its domestic water system and its wastewater treatment facility and effluent disposal site in August 1977. The permits were amended in 1981 to modify the allowable annual connections to CCSD's water and wastewater systems.

The Commission may elect to review CCSD permit and require some of the conditions to be amended for a recharge project. However, the extent of the amendments is unknown at this time. Because the issue of importance to the Commission is protection of the coastal areas, the existing permits deal mostly with allowable development and growth rate within the community. New recommended projects for wastewater reclamation and reuse proposed by CCSD may not require permits if the community's growth rate does not exceed that allowed by the existing Commission's permit.

Table 3.2 Inland Surface Waters Plan for Aquatic Life Water Quality Objectives[1]
Cambria Community Services District

Aquatic Life	Units	4-Day Average	Daily Average	Instantaneous Maximum
Arsenic	µg/l	190	--	
Cadmium	µg/l	0.66 (2)	--	
Chromium (VI)[3]	µg/l	11	--	
Copper	µg/l	6.5 (2)	--	
Lead	µg/l	1.3 (2)	--	
Nickel	µg/l	88 (2)	--	
Selenium	µg/l	5	--	
Silver	µg/l	--	--	1.2[2]
Zinc	µg/l	59 (2)	--	
Chlordane	ng/l	--	4.3	
DDT	ng/l	--	1.0	
Dieldrin	ng/l	--	1.9	
Endosulfan	ng/l	--	56	
Endrin	ng/l	--	2.3	
HCH-gamma	ng/l	--	80	
Heptachlor	ng/l	--	3.8	
PCBs	ng/l	--	14	
Pentachlorophenol	ng/l	8 (4)	--	
Toxaphene	ng/l	0.2	--	
Tributyltin	ng/l	--	40	

(1) These objectives apply to ambient inland surface waters.

(2) Objectives for these metals are expressed by the following formula, where

H = ln (hardness) in mg/l as $CaCO_3$:

cadmium = $e^{0.7852H - 3.490}$

copper = $e^{0.8545H - 1.465}$

lead = $e^{1.273H - 4.705}$

nickel = $e^{0.846H + 1.1645}$

silver = $e^{1.72H - 6.52}$

zinc = $e^{0.8473H - 0.7614}$

Listed values correspond to a hardness of 50 mg/l.

(3) Dischargers may, at their option, meet this limitation as total chromium.

(4) The objective for pentachlorophenol is e = 1.005(pH) - 5.290. This is 13 µg/l at pH = 7.8.

Table 3.3 Inland Surface Waters Plan for Human Health Water Quality Objectives[1]
Cambria Community Services District

Chemical	Units	30-day Average
NONCARCINOGENS		
Dichlorobenzenes	µg/l	2,600
Fluoranthene	µg/l	54
Mercury	ng/l	150
Toluene	mg/l	300
CARCINOGENS		
Aldrin	pg/l	78
Benzene	µg/l	21
Chlordane	pg/l	81
Chloroform	µg/l	460
DDT	pg/l	600
1,4-Dichlorobenzene	µg/l	64
Dichloromethane	µg/l	1,600
Dieldrin	pg/l	140
Halomethanes	µg/l	460
Heptachlor	pg/l	250
Hexachlorobenzene	pg/l	740
Hexachlorocyclohexane		
Alpha	ng/l	13
Beta	ng/l	46
Gamma	ng/l	64
PAHs	ng/l	31
PCBs	pg/l	67
Toxaphene	pg/l	740
2,4,6-Trichlorophenol	µg/l	1.4
TCDD Equivalent	pg/l	0.014

(1) These objectives apply to ambient inland surface waters that are not existing or potential sources of drinking water.

Department of Fish and Game

Although the California State Department of Fish and Game (DFG) is not a permitting agency as far as discharging reclaimed wastewater to waters of the state, this agency is concerned with protection of the aquatic habitat. If CCSD were to pursue groundwater recharge into San Simeon Creek, the DFG would be required to investigate the impact on the aquatic habitat. Because of their concern for adequate quantities of water in a stream to provide a habitat for fish and other wildlife, if the water discharged to the stream is of adequate quality, it is possible the DFG may look favorably on a groundwater recharge project. However, based on conversations with DFG staff it is impossible to know their full response to any proposal until completion of an aquatic habitat study and EIR.

San Luis Obispo County Planning Department

Any project proposed for construction within the County's jurisdiction requires review by the County Planning Department. The Planning Department would be the lead agency for the County and incorporate the comments of other applicable County agencies such as the Public Health Department and the Public Works Department prior to construction. Ultimately, a project may require issuance of a building permit or more likely a minor use permit. Because of the length of time required to obtain approval (six months to one year) application for review should begin early in any proposed project.

San Luis Obispo County Health Department

County officials have indicated they would be involved in the permitting process for any project reviewed by the County Planning Department. However, they would rely primarily on the expertise of the DHS and RWQCB for technical review of any wastewater reclamation project and would most likely concur with the recommendations of those agencies.

Environmental Protection Agency

Although the U.S. (EPA) has no regulating authority over projects involving land discharge of reclaimed water, they may become involved in the proposed project because of well injection regulations. The EPA issues permits for well injection, which is one of the options for the disposal of the waste stream for the reclaimed water advanced treatment process. The type of permit necessary depends upon the class of the waste involved. This is discussed further in Chapter 5.

GROUNDWATER BASIN HYDROLOGY

4.1 GENERAL

A necessity in the development of a groundwater recharge project is a thorough understanding of the geological and hydrogeological nature of the groundwater basin. The intent of this chapter is to provide an in-depth discussion of the proposed groundwater basin.

Currently, domestic water is supplied to the Cambria Community Services District (CCSD) domestic water system by groundwater from two basins, the Santa Rosa Basin and the San Simeon Basin. Approximately 85 percent of the domestic water for CCSD is supplied by wells in the San Simeon Basin which is located a couple miles north of the community of Cambria. The Santa Rosa Basin domestic wells are used primarily to meet peak demands.

Because the proposed groundwater recharge project will only affect the groundwater quality of the San Simeon Basin, this chapter will only discuss the geology and hydrogeology of the San Simeon Basin.

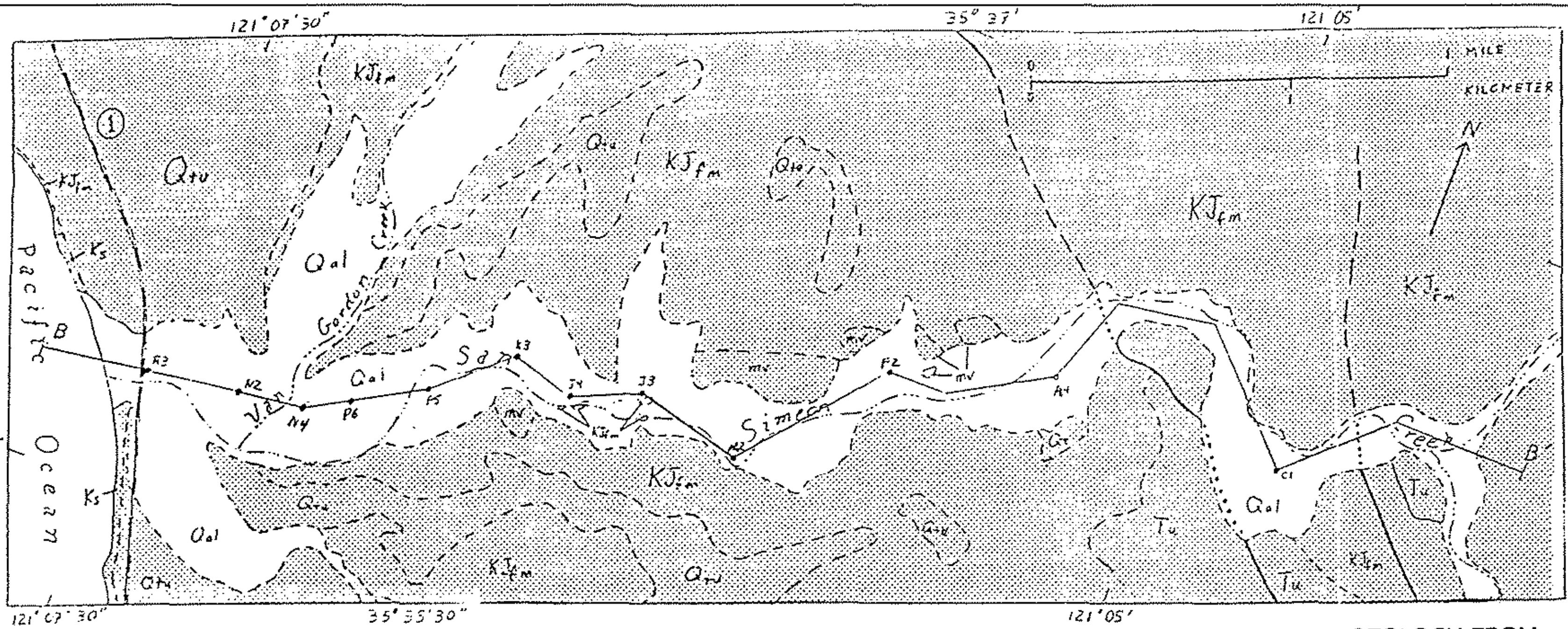
The evaluation of regional and local hydrogeologic flow regimes within the confines of the San Simeon Basin is complicated by the dynamic nature of the geologic environment in which the basin is situated. The San Simeon Basin includes the drainage areas of the San Simeon Creek and its major tributaries the Perry and Van Gordon Creek. The total drainage area is estimated to be 28.8 square miles. The local and regional geology have significant controlling influences on the natural topography, surface water, and the subsurface flow regimes. A brief summary of the regional and local geologic conditions is presented in the following section as an introduction to the hydrogeologic evaluations necessary to assess the feasibility of the proposed groundwater recharge project.

4.2 GEOLOGIC CONDITIONS

General

An extensive regional geologic characterization of the San Simeon Basin area has been completed in a report by the United States Geological Survey (USGS). To date, that report is unpublished. However, a summary of the data collected for that report was provided through written communications with Mr. Gus Yates. Some of the geological information presented in this chapter was developed for that report. The remainder was provided in the hydrogeological report written by Mr. John Mann for the project (see Appendix F).

A regional geologic map of the San Simeon Basin area is shown on Figure 4.1. In general, the basin is situated in the south central portion of the Coast Range Geomorphic Province. More specifically, the basin lies west of the southern end of the Saint Lucia mountain range. Typically, the headwaters of the creek valleys of the Santa Lucia mountain range form steep



EXPLANATION

Quaternary	Holocene	Qal	ALLUVIAL DEPOSITS
	Holocene and Pleistocene	Qt	STREAM TERRACE DEPOSITS
		Qtu	UNDIFFERENTIATED TERRACE DEPOSITS - Slightly consolidated. Marine and nonmarine
Tertiary		Tu	UNDIFFERENTIATED CONSOLIDATED ROCKS - Crystalline felsite and marine sediments
Cretaceous	Upper Cretaceous	Ks	SANDSTONE - Marine, with interbedded shale
Cretaceous and Jurassic		KJf	FRANCISCAN COMPLEX - Consolidated rocks including melange (m) and metavolcanics (mv)

— —?— CONTACT - Dashed where approximately located. Queried where inferred

— —?·· FAULT - Dashed where approximately located. Dotted where concealed. Queried where approximately located

▲ ▲ ▲ THRUST FAULT - sawteeth on upper plate

A — A' LINE OF GEOLOGIC SECTION

• R3 WELL AND NUMBER

GEOLOGY FROM YATES AND OTHERS

CAMBRIA COMMUNITY SERVICES DISTRICT

GEOLOGIC MAP OF SAN SIMEON BASIN

FIGURE 4.1

narrow canyons and then widen to valleys with relatively flat bottoms a few thousand feet wide in the final three to five miles before reaching the ocean. The flat-bottom areas lie over the groundwater basin and are flanked by steep hill slopes that rise 200 to 800 feet above the valley floor.

The geology of the area is somewhat typical of the Coast Range morphology with Cenezoic and Upper Mesozoic marine sedimentary rocks having been thrust over Mesozoic eugeosynclinal rocks of the Franciscan Complex. Most of the Cambria area is underlain by the Franciscan Complex, an aggregation of rocks that were tectonically fragmented and "mixed" during the late Cretaceous period. The Franciscan Complex in the Cambria area consists of a torn and sheared lenticular masses composed of graywacke, greenstone, diabase, gabbro, serpentine, chert, shale, tuff, blue schist, and other metamorphic rocks. Near the coastal areas are found Cretaceous sedimentary rocks consisting predominantly of marine sandstones and shales. Although these sedimentary rocks are estimated to be approximately the same age as the Franciscan Complex, it appears that this unnamed unit was displaced during a later episode of deformation in the Late Cretaceous Period. The Franciscan Complex is exposed on the hillsides in the vicinity of the San Simeon Basin and throughout the mountainous terrain which parallels the coast margin.

In the valley floor regions, the Franciscan Complex is overlain by a relatively thin veneer of younger Quaterary to recent age stream terrace alluvial sediments. According to literature, the "fining upwards" stratigraphic sequence (i.e., the sediments increase in grain-size as a function of depth) and the relative age of these sedimentary units suggests that deposition of these permeable materials took place sometime in the late Pliestocene Age (Hall, Ernst, Prior, and Wiese, 1979). As the great glaciers of this geologic era receded northward and sea levels rapidly rose, massive quantities of sediment were deposited in the pre-existing coastal valleys which had been carved by numerous east/west trending streams. Geologists hypothesize that the lower reaches of the coastal stream valleys filled with coarse grained sediments, including boulders and cobbles, which were deposited by fast moving streams. As the massive glaciers far to the north receded and paleo sea levels increased, the higher reaches of the valley were filled with less coarse materials, including gravel and sand, deposited by less turbulent streams. Surficial sediments of low permeability which are commonly found adjacent to the active stream channel are indicative of low-energy terrace deposits. It is these unconsolidated sediments which comprise the San Simeon groundwater basin and the adjacent neighboring basins.

Recent geophysical data and field reconnaissance completed by the USGS (written communication with Mr. Gus Yates) indicate that the Franciscan Complex is locally transected by numerous northwest-trending faults. These old faults are believed to have caused regional shearing and fracturing in the Franciscan "bedrock formation", however, the faulting activity does not appear to have significantly affected the surficial veneer of stream terrace and alluvial deposits in the creek valleys. This is significant as fault traces in sedimentary deposits are known to act as subsurface "dams" on occasion, which can impede the flow of groundwater.

San Simeon Basin

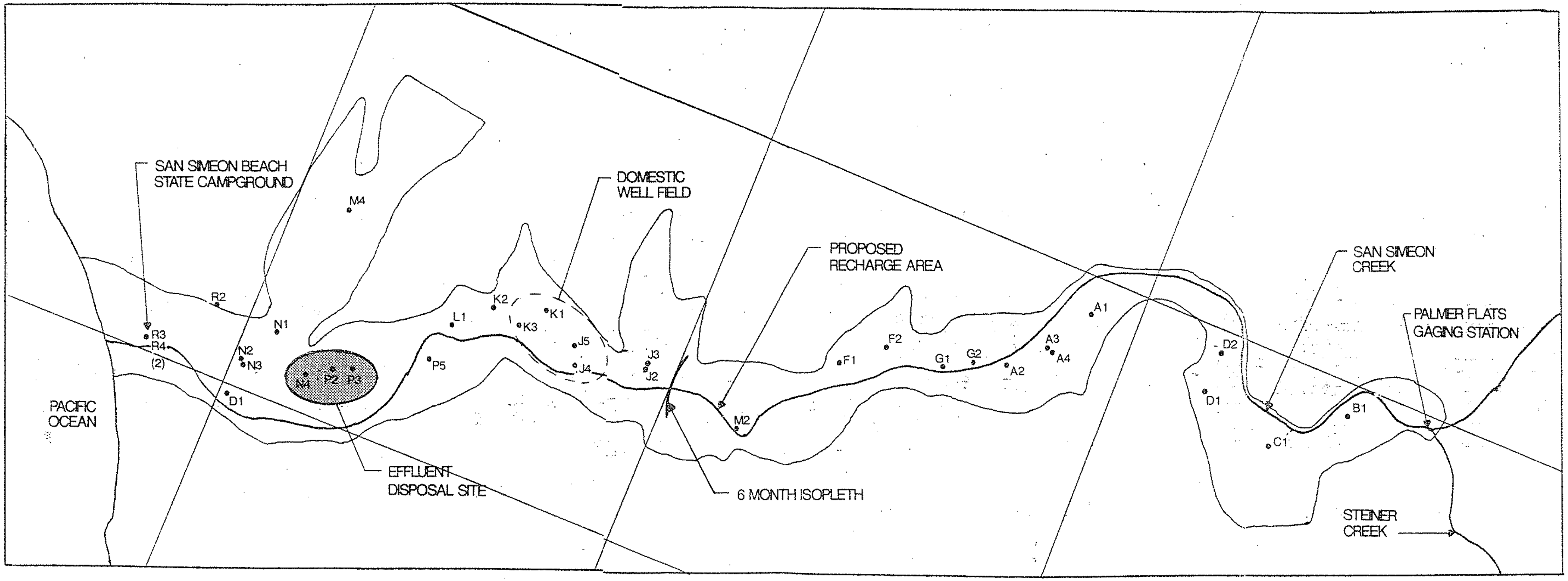
The San Simeon Basin extends approximately five miles inland from the coast and is bound by relatively impermeable bedrock. The on-shore boundaries of the basin are shown in Figure 4.2. According to written communication with Mr. Gus Yates and Mr. John Mann, the total estimated volume of the San Simeon Creek basin is approximately 30,000 acre feet (ac-ft), of which 16,700 ac-ft is above sea level.

The San Simeon Basin fill consists of unconsolidated alluvial and stream terrace deposits. Review of available geologic well logs indicate that the depositional faces of the valley sediments are consistent with alluvial and stream terrace stratigraphic models. The available data suggest that the individual stratigraphic units, or "layers," are variable and discontinuous. The lateral continuity of individual layers is evident at some locations within the basin and appears to be greater in the direction parallel to the valley axis. Because stream flow is the dominant factor controlling layers of the basin sediments, it is not surprising that the alluvial deposits appear to be more continuous in the direction of flow.

The thickness of the unconsolidated sediments within the valley is variable. In general, the thickness of these sediments is relatively thin adjacent to the valley walls, and becomes increasingly thick towards the central portion of the valley. Well log data indicate that the sediments which comprise the alluvial aquifer increase in thickness in a downstream direction. For example, sediment thickness in the vicinity of the rocky canyon at Palmer Flats Gaging Station is about 40 feet. In contrast, the thickness of the alluvium in the central portions of the valley is estimated to range from 80 feet (Well 10A3) to 108 feet (Well 9J4) further to the west. The thickness of the unconsolidated sediments in the vicinity of the Cambria Community Services District (CCSD) effluent disposal site and the proposed recharge site is approximately 98 feet, and 92 feet, respectively. The estimated thickness of the sediments in the vicinity of the domestic well field is 74 to 110 feet. With the possible exception of unknown isolated locations of low permeability layers, the unconsolidated sediments in the basin valley are relatively permeable.

4.3 HYDROGEOLOGIC CONDITIONS

From a hydrogeologic perspective, the San Simeon Basin is a fairly simple hydraulic system to understand. In general terms, the system consists of a valley with boundaries defined by relatively impermeable bedrock, and permeable unconsolidated sediments which comprise the water-bearing media encountered beneath the surface. The groundwater system is naturally recharged from precipitation/surface infiltration processes, and artificially recharged from wastewater percolation operations, domestic septic systems, and other less significant means. Groundwater discharge from the basin primarily includes pumpage from local domestic, and irrigation wells, municipal wells and natural discharge or underflow from the basin to the ocean.



NOTE: WITH ONE YEAR, RECHARGED WATER WILL HAVE REACHED THE OCEAN

SCALE: 1 SQUARE = 1 SQUARE MILE

CAMBRIA COMMUNITY
SERVICES DISTRICT

SAN SIMEON GROUNDWATER BASIN
WELL LOCATIONS AND ISOPLETHS

FIGURE 4.2

JOHN CAROLLO ENGINEERS

Hydraulic parameters of importance, including transmissivity, hydraulic conductivity, storativity, and vertical permeability have been recently estimated for the San Simeon Basin by the USGS (written communication with Mr. Gus Yates) and by Mr. John Mann, Hydrogeologist, in an effort to better understand the variables which comprise the water budget equation. These parameters were estimated using field testing methods in concert with computer simulation evaluations. Transmissivity (T), in units of square feet per day (ft^2/day), describes the ability of groundwater to flow through an aquifer and equals the product of aquifer thickness and hydraulic conductivity. Hydraulic conductivity (K), in units of feet per day (ft/day) is the quantity of water that will pass through one square foot of cross-sectional area of an aquifer under a water-level gradient of one foot per foot. The storage coefficient (S) of an aquifer is a dimensionless ratio equal to the volume of water that would drain by gravity from an aquifer, per square foot of aquifer area, following one-foot decline in water level. Vertical permeability is the quantity of water that will pass through the soil vertically in inches per minute (in/min).

Single well and multiple well draw-down tests conducted at eight selected locations yielded a highly variable range of transmissivity, conductivity, and storativity values. The ranges of values for transmissivity varied from 718 to 44,200 ft^2/day. The median transmissivity value was calculated to be 10,000 ft^2/day. Correspondingly, the estimates of storativity were somewhat variable and ranged from 0.0022 to 0.0400 with a median value of 0.0097.

The pump test data indicate that the hydraulic flow within the alluvial sediments which comprise the basin is anisotropic (i.e., groundwater flows in a preferred direction rather than all directions due to stratigraphic influences). As such, it can be assumed that hydraulic conductivity values are greater along the axis of the valley in comparison to the laminar flow directions perpendicular to the valley axis. Referring to the section on geologic conditions, the continuous coarse-grained channel deposits allow rapid down-valley groundwater flow while the continuous fine-grained deposits greatly impede lateral and vertical ground-water flow. Computer model simulations indicate conductivity values of 720 ft/day in the axial direction and 300 ft/day in the transverse direction. In addition, the computer analysis of the basin hydraulic conditions estimates the aquifer storativity to be 0.05. These estimated values appear to be consistent with accepted published values for similar environments and conditions. For further analysis the average hydraulic conductivity for the entire basin is assumed to be 400 ft/day (written communication with Mr. John Mann and Mr. Gus Yates).

Estimates of aquifer diffusivity characteristics have also been calculated by the USGS (written communication with Mr. Gus Yates). Results from actual stream flow - response tests indicate that aquifer diffusivities range from 1.0×10^3 to 1.5×10^5 ft^2/day with a median value of $1.3 \times 10^4 ft^2$/day. These estimates were determined using methods developed by Cooper and Rorabaugh (1963) and Hall and Moench (1972). The diffusivity estimates determined using the stream flow - response method were generally found to be lower than those values calculated from transmissivity and storativity values obtained from field draw-down tests. The calculated aquifer diffusivities ranged from 3.54×10^4 to 4.56×10^6 ft^2/day with a median value of 3.38×10^5 ft^2/day. Assuming that the storativity value is the same for both diffusivity estimates, the differences in values can be attributed to the relatively low transmissivity perpendicular to the valley axis.

Both paleo and current topography are significant controlling factors which influence groundwater flow directions and hydraulic gradients within the San Simeon basin. The regional direction of groundwater flow is predominantly to the west, towards the ocean. However, local gradient and flow reversals are known to exist. These reversals are not considered to be significant but are the result of both man-made and natural phenomena including localized mounding from surface recharge, overdraft pumping, and differences in groundwater/seawater densities near the coastal margin areas.

Groundwater Levels

The San Simeon Basin differs from larger basins, or basins that are less well developed, because the annual inflows and outflows are such a large fraction of the total groundwater in storage. Consequently, the basin cannot sustain a continued larger outflow than inflow without going completely dry in a few years.

Hydrograph data collected and provided by USGS (written communication with Mr. Gus Yates) indicate that groundwater levels and, therefore, hydraulic gradients, vary significantly with seasonal variation. Groundwater levels in the basin generally follow a pattern of gradual decline in the dry summer season followed by rapid recovery when the creeks are flowing in the winter. Groundwater recharge from storm runoff appears to be almost instantaneous which is indicative of the highly transmissive substrata. The hydrogeological data suggest that storage and subsequent inflow from the underlying bedrock formations is minimal.

Groundwater levels and gradients reach their maxima in March. Winter water levels are essentially the same every year, except in drought years, because even a small amount of streamflow is sufficient to fully recharge the groundwater basins. Conversely, static water levels and gradients approach their minima between October and December, depending on the location within the groundwater basin. The declining phase of seasonal water level elevations is primarily due to increasing groundwater pumpage and decreased stream flow during the dry summer season.

According to preliminary estimates calculated by the USGS (written communication with Mr. Gus Yates), during the later winter months the cumulative basin storage decreases by 40 percent of cumulative pumpage with only a one foot decline in groundwater levels. In comparison, groundwater levels declined between 3 and 7 feet in the summer months and the cumulative basin storage decrease was more than 65 percent of cumulative pumpage.

Between the domestic well field and the ocean water, groundwater elevations levels are somewhat elevated due to recharge from the CCSD effluent disposal site. However, regulatory constraints limit the build-up of the recharge mound to no more than about one foot above sea level. CCSD has installed piezometers around the perimeter of the effluent disposal site to monitor the water level. If the groundwater level indicates a reverse gradient flow from the effluent disposal site toward the domestic well field, CCSD is required to pump groundwater from an extraction well located in the disposal site to Van Gordon Creek. CCSD is required to use the extraction well nearly every year at some time. There is also an irrigation well located in the disposal site which is used by a local farmer. The water extracted for irrigation reduces the quantity of water CCSD has to extract to meet the regulatory requirements. In the past three years, water levels in the effluent disposal site have been measured at the piezometers as high as within 2 feet of the land surface but have generally average eight to ten feet.

In addition to the aforementioned artificial and natural phenomena which impact the flow of groundwater, subsurface constrictions in the valley bedrock formations influence the subsurface flow regime, particularly the hydraulic gradients. This phenomena is particularly evident in the vicinity of an area locally known as "Holland Gap" located approximately 1/4 mile from the proposed recharge site and a similar area located in the eastern portion of the valley. Hydraulic gradients appear to be anomalously steep in the vicinities of the basin.

In the vicinity of the proposed recharge site, the minimum and maximum depth to water is estimated to be about 0 feet (when the stream is flowing) and 20 feet below grade for the winter and summer seasons, respectively, which equates to approximately 55 to 35 feet above sea level. In 1988 water levels in the domestic well field declined to an elevation of 17.5 feet below ground level, which is 1.5 feet above sea level.

Horizontal Hydraulic Gradients

The available groundwater level data suggest that hydraulic gradients are generally steeper across the valleys in comparison to the gradients measured parallel to the valley axis. Cross-valley gradients measured in March 1988 ranged from almost zero to 0.958 and averaged about 0.027 (written communication with Mr. Gus Yates). Correspondingly, down-valley gradients were smaller, ranging from 0.002 to 0.008 and averaging less than 0.006. Apparently, the down-valley gradients are directly related to the slope of the stream channels when the streams are flowing.

Hydraulic gradients within the valley are also significantly influenced by pumpage of agricultural and municipal wells. According to preliminary findings (written communication with Mr. Gus Yates), agricultural pumpage causes up to about 10 feet of draw-down in the upper reaches of the basin and approximately a 3 foot decline near the coast during the dry season. Correspondingly, pumpage from the municipal wells decreases groundwater levels throughout the basin, with average draw-downs of 1 foot in the upper end of the valley, and about 7 feet in the vicinity of the CCSD well field. Based on the available data, municipal pumpage does have an effect on winter water levels and gradients within the valley, however, a significant amount of draw-down is attributable to natural drainage processes (i.e., underflow).

The significant decline of groundwater levels in the upper reaches of the valley without continued recharge support this hypothesis. For future analysis an estimated range of 0.002 to 0.006 will be used for the down valley gradient (written communication with Mr. John Mann and Mr. Gus Yates).

Vertical Hydraulic Gradients

Vertical hydraulic gradients are not believed to play a significant part in the overall assessment of the flow regime because most of the wells in the basin penetrate the entire thickness of the water-bearing unit. However, localized vertical gradients have been observed in the vicinity of the CCSD wastewater spray field operation (downward gradient component), in wells installed in the vicinity of the bedrock constrictions as described above (upward gradient component), and in wells located near the coast (variable upward and downward gradient components from tidal response).

4.4 FLOW VELOCITY ESTIMATES

Estimates of regional groundwater flow velocity within the San Simeon Basin have been calculated using the Darcian flow equation:

$$V = Ki/n$$

where:

V	=	average groundwater flow velocity (ft/day)
K	=	hydraulic conductivity (ft/day)
i	=	average hydraulic gradient (dimensionless)
n	=	effective porosity (dimensionless)

The linear groundwater velocity is estimated to be 2.7 to 8.0 ft/day and represent estimates for the dry season only . The groundwater velocity estimates were calculated based on the following assumptions:

- The hydraulic conductivity of the water-bearing sediments which comprises the San Simeon Basin was assumed to be 400 ft/day for regional estimating purposes.

- The hydraulic gradient value was assumed to be 0.002 to 0.006 for the area between Holland Gap and the domestic well field.

- The mean effective porosity of the water-bearing strata was conservatively estimated to be 0.30.

It is important to note that groundwater flow velocity is directly related to changes in hydraulic gradients. As discussed above, gradients are somewhat dynamic within this basin regime and vary considerably due to several natural and artificial factors. It is also important to note that the estimated flow velocity represents a groundwater velocity based on existing mean steady-state conditions. The flow regime is significantly influenced by numerous external factors including instantaneous recharge events and groundwater pumpage which, in turn, can cause considerable variability in flow velocity in a short period of time. As such, the estimated values for flow velocity, and consequently the travel times for percolated water from the proposed recharge site to the domestic well field, may vary considerably. The introduction of recharge water into the existing steady-state system will have a direct affect on local gradients and, therefore, local flow velocities. The ultimate project will provide monitoring wells to determine actual groundwater movement.

4.5 TRAVEL TIME ESTIMATES

Groundwater travel times have been estimated in an effort to evaluate subsequent impacts from the proposed groundwater recharge site to the domestic well field. In addition, isopleths have been prepared as a means of graphically illustrating the anticipated flow paths of groundwater as a function of time following initiation of the proposed basin recharge programs. For purposes of calculating travel time estimates and preparing the isopleths, the following assumptions have been made:

- Subsurface conditions are homogeneous, therefore, hydraulic conductivity and effective porosity values are somewhat constant variables throughout the basin. The hydraulic conductivity and effective porosity values used for the evaluation of travel time to evaluate the migration rates for groundwater to travel away from the proposed recharge site were 400 ft/day and 0.30, respectively.

- Approximately 216 ac-ft of reclaimed water will be introduced to the ground water by percolation. (See Chapter 5).

- Hydraulic gradients and local groundwater flow velocities are suspected to reach their maxima in the late winter and early spring months and, therefore, represent a "worse case travel time scenario" (i.e., reclaimed water related constituents would travel to neighboring wells at their fastest rate under these conditions). As such, gradients and velocities representative of peak flow conditions were used to estimate travel times and generate the isopleths. The minimum gradient in the vicinity of the proposed site was estimated to be 0.002. The maximum gradient in the vicinity of the proposed site is estimated to be 0.006.

Based on these assumptions, the travel times estimates for the proposed recharge site are based on groundwater velocities of 2.7 ft/day to 8.0 ft/day. The isopleths depicting the anticipated flow patterns of groundwater within the basin over a six month and one year period following initiation of the recharge operations at the proposed site are presented in Figure 4.2.

Because of the relatively high groundwater velocities and the highly permeable alluvium in the San Simeon Basin, isopleths of greater duration are not meaningful. The recharged water is expected to reach the cone of influence of CCSD's domestic wells within one year from the recharge site. To show isopleths with longer time periods is consequently irrelevant because any recharge water not extracted by the domestic wells will not necessarily spread but will flow downgradient toward the ocean.

It is important to note that the travel time estimates and corresponding isopleths are based on numerous assumptions. Preliminary computer analysis of the San Simeon basin recently completed in the unpublished report by the USGS (written communication with Mr. Gus Yates) offers some insights as to the effect of the proposed recharge project on the flow regime. Although the computer model developed in this unpublished report did not simulate the precise conditions and locations of the proposed project, much valuable information can be gained from this evaluation. The computer simulation was based on the following assumptions:

- A potential site near the domestic well field was evaluated. (Although the site differs from the actual proposed site, the location evaluated has fairly similar hydrogeologic environments and some general comparisons can be made.)

- A total of 270 ac-ft of groundwater would be pumped from the CCSD effluent disposal site to one of two 0.8 acre percolation basins at a uniform rate over a six month period during the dry summer months.

Based on these assumptions, the computer simulation data indicated that the recharge operation caused a decrease in net underflow (about 23 percent) to the ocean and resultant seawater encroachment. The model suggests that the apparent effect of the recharge operation on water levels would significantly minimize the decline of groundwater elevations, from the historically known decline of about 12 feet to about 1 foot in the inland portions of the valley. The simulation predicted that percolation from the modeled recharge site would not create a significant regional mound due to the transmissive nature of the vadose soil zones. The regional gradient was down-valley through the recharge site and there was no indication that emergent seepage into the creek would occur adjacent to the site or further downstream. In general terms, the model predicted that the transfer of 270 ac-ft of water from the effluent disposal site to the recharge site significantly decreased the amount of dry-season water level decline, without exceeding the capacity of the aquifer to accept or transmit the infiltrated water.

The results of the computer model study are in accordance with the hydrogeologist's report (see Appendix F). Neither anticipates localized groundwater mounding at the initially proposed recharge basin site or a significant decrease in the decline of dry-season water level. The actual project of reclaiming water in the San Simeon Creek streambed should have similar findings to the computer model study. Because the streambed is known to have higher permeabilities, there should be even less opportunity for groundwater mounding. However, once the reclaimed water reaches horizontal groundwater, flow is expected to be similar to the computer model because transmissivity and hydraulic conductivity of the groundwater are assumed to be similar for both sites.

Additional evaluations, including actual field testing of the in-situ permeabilities and hydraulic conductivities, and computer modeling of the local flow regime, could be completed to further refine the travel time and groundwater velocity estimates. In simple terms, the advantage of simulating the affect of artificial recharge with a computer model is that the model has the ability to predict the anticipated flow conditions and suspected impacts of recharge basin operations prior to project initiation.

4.6 GROUNDWATER QUALITY ANALYSIS

As discussed in Chapter 2, CCSD has been collecting groundwater quality data in the San Simeon Basin in recent years. Selected wells have been sampled in the past, by both CCSD and USGS, to determine groundwater quality at the effluent disposal site, the domestic well field site, and at other locations throughout the basin. Recently, the sampling program has been expanded to develop data on constituents not previously tested. The actual water quality data is presented in Chapter 2 and Appendix D. The following conclusions have been reached on the analysis collected to date.

Inorganic Constituents

The groundwater quality is best in the upper reaches of the San Simeon Basin, the lower boundary of which is defined as between the domestic well field and the effluent disposal site. Referring to Tables 2.8, 2.9 and 2.10, and Appendix D; inorganic parameters including TDS, specific conductance, chlorides, boron, sodium, sulfate, and nitrates were identified at elevated levels in the wastewater effluent and the groundwater extracted from the effluent disposal site (lower reaches of the basin) in comparison to the background groundwater. The increase is most significant in the well closest to the ocean (8R3) (for well location see Figure 4.2). This well had TDS concentrations between 1,280 and 1,380 milligrams per liter (mg/l) and chloride concentrations between 540 and 580 mg/l, levels which exceed the secondary drinking water standards set by the State of California and the Environmental Protection Agency (EPA) for constituents that affect aesthetic qualities of water such as taste and odor. Other wells in the lower reaches also had higher concentrations of these constituents than water in the upper reaches. Because the higher concentrations were most significant in the well located closest to the ocean, it is probable that the increase at this well is due to seawater intrusion.

Higher salinity levels in the lower reaches of the San Simeon Basin existed prior to the current effluent disposal operation per USGS (written communication with Mr. Gus Yates). Salinity also increases with depth in the basin which suggests that lateral inflow of relatively dense seawater is a source of salinity. Well 8R3 is perforated at a depth of 130 to 140 feet with 905 to 970 mg/l more TDS that Well 8R2 which had perforations at a depth of 85 to 90 feet. This would also imply that wastewater is not the source of all of the higher concentrations of organic minerals in the groundwater at the effluent disposal site.

Importantly, the data indicated the wastewater effluent and extraction well water were found to be in excess of the secondary drinking water standards for total dissolved solids on most occasions, and nitrates on selected occasions. The measured pH levels generally appear to be within the variance for naturally occurring groundwater for all sources tested. All other inorganic parameters, even if higher than background groundwater, met or exceeded secondary drinking water standards.

Priority Pollutants

The recent analysis of the groundwater samples and wastewater effluent performed for selected parameters included the following: priority pollutant volatile and semi-volatile organic compounds, pesticides, priority pollutant metals, and radiological constituents. The data is presented in Appendix D, Table 1. The samples were also analyzed for general mineral parameters including major anions/cations, and other inorganic parameters. The parameters tested were selected from the proposed monitoring program in the Proposed Guidelines for Groundwater Recharge with Reclaimed Municipal Wastewater (Proposed Guidelines) (see Appendix A).

Trace volatile organic compounds were detected in the extraction wells and wastewater effluent during recent sampling. Most notably, chloroform was identified in Well 9P2 (extraction well) (0.01 milligrams per liter [mg/l]), Piezometer 3 (located at the effluent disposal site) (0.0011 mg/l), and the wastewater effluent (0.04 mg/l). Methylene chloride (0.0061 mg/l) and trihalomethanes (THMs) (0.01 mg/l) were also detected in Well 9P2 and tolulene was detected in the wastewater effluent (0.001 mg/l).

The source of methylene chloride in the groundwater is unknown because it was not identified in the wastewater effluent and would not occur without introduction from a foreign source. Chloroform and THMS are by-products of chlorine and organic material. Consequently trace concentrations commonly occur in many domestic water supply systems. The concentrations are quite low for these compounds (near the laboratory detection level). Nevertheless, because they are considered potential health risks at substantially higher concentrations, additional sampling and analysis will be conducted to confirm the presence/absence of these constituents in the groundwater. The proposed treatment process will be designed to remove or reduce organic compounds to levels below any proposed secondary drinking water standards.

Concentrations of foaming agents (an organic constituent) were also detected in the wastewater effluent and the effluent disposal site groundwater.

Generally, the concentrations of organic compounds for the groundwater samples collected were low and near the detection level of laboratory analysis. All groundwater samples collected had values less than the secondary drinking water standard. Although the wastewater effluent consistently had higher levels than the groundwater, the data for the wastewater was also below secondary drinking water standards.

Analysis reveals higher levels of bacteriological activity and turbidity in effluent disposal site wells than in the wastewater effluent. This is not expected because the wastewater is filtered in the soil before extraction. One possible explanation for the high bacteriological results is that none of the extraction wells with high bacteriological results had sanitary seals (Piezometers 3, Piezometer 6, Well 9P3, and Well 9K2). Higher turbidities than domestic well field groundwater also occurred in Piezometers 3 and 6 and Extraction Well 9P3. The higher turbidities in the piezometers can be explained because these are small, shallow wells generally open to the atmosphere. No explanation is known at this time for the high turbidities for the extraction well (9P3). Additional samples are being collected to verify the results.

Selected priority pollutant metals have been detected at trace levels in groundwater at the effluent disposal site, but not in background groundwater samples. Occasionally some of these metals (chromium manganese, and lead) are present at levels slightly higher than California drinking water standards. These metals were detected only in samples from the shallower piezometer wells, not in the extraction well water. Aluminum was detected at both of the shallow, piezometer wells at levels significantly higher than drinking water standards.

The presence of these metals is not thoroughly understood because they have been detected only in the shallow, piezometer wells on the effluent disposal site, but not in the effluent or extraction well water. CCSD is continuing a water quality monitoring program to verify the data gathered to date.

The presence of these metals should not impact the reclamation project because they have not been detected in either the wastewater effluent or in the extraction well water. If these contaminants are detected in the extraction well water, they would be removed through reverse osmosis. Reverse osmosis removes approximately 99 percent of each of the priority pollutant metals which have been detected.

4.7 BENEFICIAL USES OF SAN SIMEON BASIN GROUNDWATER

The existing and anticipated beneficial uses of groundwater within the San Simeon Basin include domestic and agricultural uses. Currently, CCSD has three domestic supply wells located in the San Simeon Basin. There are no other public water utilities which obtain water from the basin. The remaining wells in the basin are privately owned and supply water for domestic and agricultural use. The water from one well is used for gravel processing. The percentage of water for each use in unknown because the majority of the wells do not have flow metering equipment.

All wells in the basin are shown in Figure 4.2. Because of the anistropic flow of water within the basin, only those wells located downgradient of the proposed recharge site or within 500 feet of the proposed recharge site will be affected by the project. Information on these wells is presented in Table 4.1. In addition, because the source of water for the recharge project is CCSD's effluent disposal site, only those wells located upgradient of the disposal site are of concern. These wells are discussed in Chapter 5. The wells located downgradient of the effluent disposal site are used only for irrigation or monitoring purposes.

Table 4.1 Groundwater Basin Well Information
Cambria Community Services District

Designation	Depth (ft)	Date Drilled	Use	Distance From Proposed Recharge Area (miles)
10M2	92	Sept 82	Irrigation	< 1/4
9J2	(1)	(1)	Irrigation	1/4 to 1/2
9J3	73	(1)	Domestic	1/4 to 1/2
9J4/SS1	108	Spring 78	CCSD Domestic(2)	1/4 to 1/2
9J5/SS2	74	(1)	CCSD Domestic(2)	1/4 to 1/2
9K1	40	(1)	Domestic/ Stock Watering/ Irrigation	1/2 to 3/4
9K3/SS3	110	(1)	CCSD Domestic (2)	1/2 to 3/4
9K2			Irrigation	1/2 to 3/4
9L1	60	(1)	Irrigation - Abandoned	3/4 to 1
9P5/SS4	98	Spring 78	Observation	3/4 to 1
P3	(1)	(1)	Monitoring Piezometers(2)	3/4 to 1
P6	(1)	(1)	Monitoring Piezometers (2)	1 to 1-1/4

(1) Not available.
(2) Only the CCSD domestic supply wells and piezometers are regularly monitored. The supply well water is chlorinated. No other wells are monitored or treated prior to use.

RECOMMENDED GROUNDWATER RECLAMATION PROJECT

5.1 GENERAL

Introduction

As discussed in Chapter 3, after review of several alternatives to improve the safe yield of its domestic water supply in previous studies, Cambria Community Services District (CCSD) determined the most feasible alternative was groundwater recharge using treated municipal wastewater. Groundwater recharge was selected because of ease of implementation and cost. This chapter provides a more detailed description of the project and its impact on the San Simeon Basin and domestic water supply.

Recommended Alternative

The proposed project has been developed to comply with the requirements of the Proposed Guidelines for Groundwater Recharge with Reclaimed Municipal Wastewater (Proposed Guidelines) for Category II groundwater recharge. A copy of this document is in Appendix A, and Table 3.1 defines the category type. The project also complies with Title 22 - Wastewater Reclamation Criteria (Title 22, [Appendix E]), and the Regional Water Quality Control Board's (RWQCB) antidegradation policy (Appendix C). In order to meet these requirements the reclaimed water must have gone through oxidation, filtration, disinfection, reduction in dissolved minerals, and possibly organics removal. The proposed groundwater recharge project meets these guidelines by providing the following:

- Secondary treatment of municipal wastewater (activated sludge process).
- Effluent disposal of treated wastewater onto percolation ponds (existing effluent disposal site).
- Extraction of treated wastewater (blended with groundwater) from the effluent disposal site with extraction wells.
- Treatment of extracted, treated, and filtered wastewater and groundwater with advanced treatment (reverse osmosis [RO]).
- Transmission of treated wastewater and groundwater upgradient of domestic well field to a proposed recharge site.
- Groundwater recharge at the proposed recharge site (San Simeon Creek streambed).

According to the Proposed Guidelines oxidized wastewater is defined as "wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen." The activated sludge process at the wastewater treatment plant is adequate to meet this definition.

According to the Proposed Guidelines filtration is defined as " ... coagulated, clarified wastewater which has been passed through natural undisturbed soils or filter media ... so that turbidity ... does not exceed an average operating turbidity of 2 turbidity units ..." or an alternatively approved process. The percolation of the wastewater at the future percolation ponds (existing effluent disposal site) is adequate to meet the definition of treatment. However, according to recent data, the extraction well water has not consistently met the turbidity requirements (see Appendix D). Turbidity requirements would be met through the proposed advanced treatment process.

According to the Proposed Guidelines disinfection is defined as "wastewater in which the pathogenic organisms have been destroyed by chemical, physical, or biological means". The disinfection with chlorine at the wastewater treatment plant and prior to the advanced treatment process is adequate to meet this definition.

According to the Proposed Guidelines organics removal is defined as "treatment of oxidized and filtered wastewater for the purpose of removing such compounds as synthetic organics." Specifically, for the purposes of groundwater recharge, organics must not exceed 1 milligrams per liter (mg/l) of total organic carbon (TOC) at the point the water is reclaimed (domestic well extraction). (Note: Per oral communication with Department of Health Services staff, a revision to the Proposed Guidelines is being discussed. This revision would allow up to 50 percent of the water reclaimed at the domestic well be treated wastewater for TOC levels of 2 mg/l.) Organic removal requirements would be met through the proposed advanced treatment process.

According to the RWQCB's "antidegradation policy" (see Appendix E) the quality of the recharge water must be adequate to prevent degradation of the background water. Because the concentration of total dissolved solids (TDS) and other dissolved minerals is higher in groundwater sampled from the extraction wells located in the percolation pond site (existing effluent disposal site) than background groundwater concentrations, treatment prior to recharge is required. The antidegradation policy would be met through the proposed advanced treatment process.

5.2 PROJECT DESCRIPTION

A complete project description is included in this section including proposed treatment facilities, proposed design criteria, proposed schematic, proposed chemical usage, and descriptions and operation of proposed recharge area.

Treatment Facilities

Following secondary treatment at the wastewater treatment plant the treated wastewater will be pumped to the future percolation ponds (existing effluent disposal site) for disposal. (Prior to completion of the groundwater recharge project the existing effluent disposal area will be converted from sprayfields to percolation ponds in a separate construction project).

Following disposal and percolation the new extraction well 9P5 will be used to extract the percolated wastewater (blended with groundwater) from the subsurface groundwater aquifer. Other new extraction wells may be added to the site to increase extraction capacity and prevent groundwater mounding on the site. All wells will be sited to comply with the Department of

Health Services Guidelines for Use of Reclaimed Wastewater which states "no irrigation or impoundment of reclaimed water may be within 500 feet of any well used for domestic supply or 100 feet of any irrigation well unless it can be demonstrated that special circumstances justify lesser distances to be acceptable." CCSD's extraction well water is not used for either domestic water supply or irrigation without further treatment so these guidelines are not expected to be applicable to the extraction wells. Because the purpose of the extraction wells is to extract the reclaimed water mixed with the groundwater the wells should be located as close to the percolation ponds as possible.

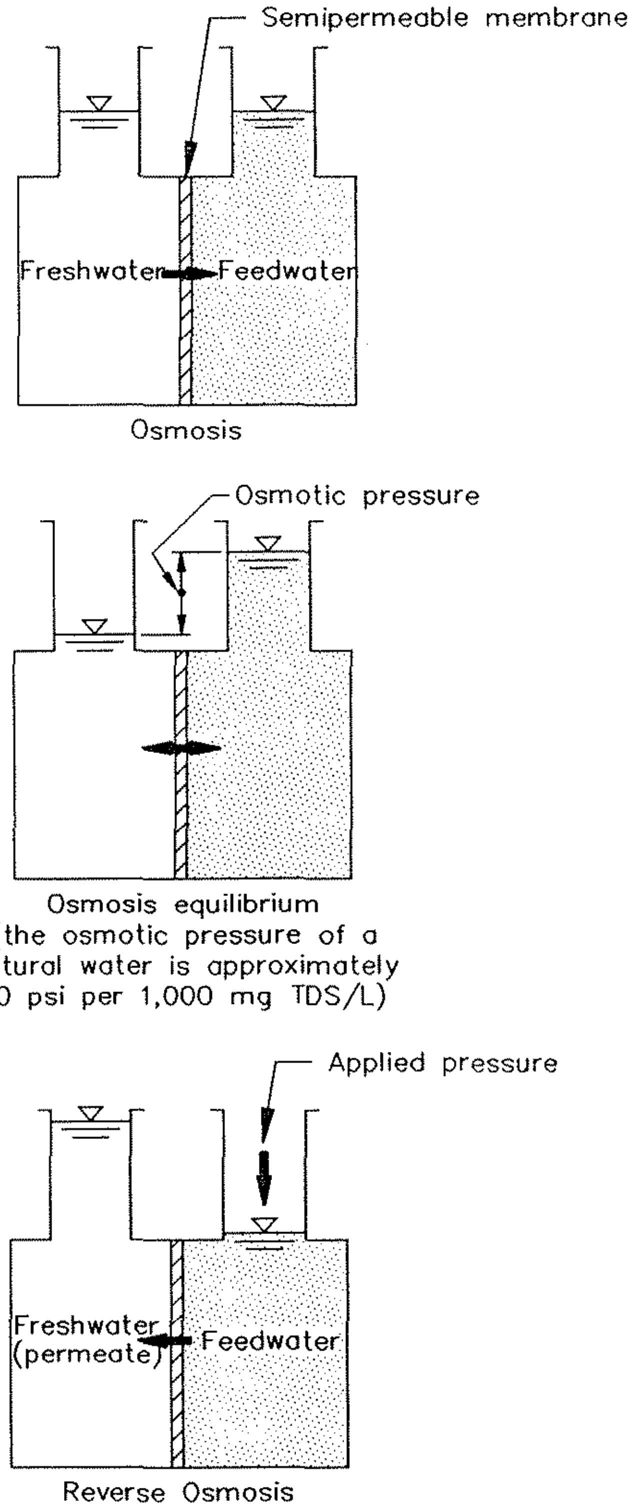
Final sites or numbers of additional extraction wells have not been determined at this time. Water will only be extracted from the disposal area east of Van Gordon Creek. The ponds and storage reservoir west of Van Gordon Creek will be used for disposal of treated municipal wastewater only.

The treated and percolated wastewater mixed with groundwater extracted from the subsurface aquifer will be pumped to an advanced treatment process. The recommended treatment process is RO. The RO treatment train includes chlorination, dual-media filtration, cartridge filtration, and RO.

RO is an advanced water treatment process which is based on osmotic theory. Osmosis is the natural process during which water diffuses through a semi-permeable membrane from a solution of lower concentration to one of higher concentration. At equilibrium, the pressure differential across the membrane is called osmotic pressure. RO involves applied pressure on the high concentration side which forces fresh water from the side of high concentration through the membrane to the side of low concentration. This process is illustrated in Figure 5.1. Depending on the pore size of the membrane, the larger molecular weight compounds are excluded by the membrane.

RO membranes typically reject (remove) 80 to 95 percent of the ions in solution, between 95 and 98 percent of salts in solution, 99.5 percent of organics, and over 90 percent of metals. The fraction of feedwater not rejected is called the permeate (product water) and is usually expressed as a percent of the feedwater rate. Because of the extremely high quality of the feedwater for this project the percent of recovery will be a minimum of 75 percent. The actual recovery rate and quality will be determined during a pilot test prior to final design. To determine reclaimed water quality, three RO equipment suppliers were contacted. Each was asked to provide estimated reclaimed water quality based on extraction well water quality. Two of the suppliers developed reclaimed water quality criteria based upon computer modeling. The third supplier developed reclaimed water quality criteria based upon actual on-site testing using a laboratory bench scale RO unit. The results of the analyses are included in Appendix F.

As discussed above, the RO removes the unwanted dissolved constituents in the reclaimed water and concentrates them in the reject water. This reject water is also referred to as the waste brine because of its relatively high salts (approximately 2,500 to 3,500 mg/l) and must be disposed off-site.



CAMBRIA COMMUNITY
SERVICES DISTRICT

REVERSE OSMOSIS SCHEMATIC

Simplified concepts of osmosis, osmotic pressure, and RO
Adapted from AWWA Committee Report

FIGURE 5.1

The proposed method for disposal is well injection near the surf zone of the ocean. The proposed well injection site is located west of Highway 1 and north of San Simeon Creek. At that location above the beach area a shallow well can be installed with the well below ground to inject the brine disposal to groundwater. The groundwater has been tested near this area at Well 8R3, and found to be very saline (>1,200 mg/l TDS). Of course, the reason for the high TDS is seawater intrusion. Although the concentration of the brine solution may be slightly higher than groundwater at the disposal site, no significant impact is expected because the background groundwater is already of poor quality, the quantity of brine disposal is fairly small, and the hydraulic gradient at that location is still in the direction of the ocean. Based on discussions with the Environmental Protection Agency (EPA), such a well would be a Class 5 well and should not require special construction techniques or monitoring to be sited. The well would be drilled to a depth 80 to 100 feet, the approximate depth to bedrock in the area.

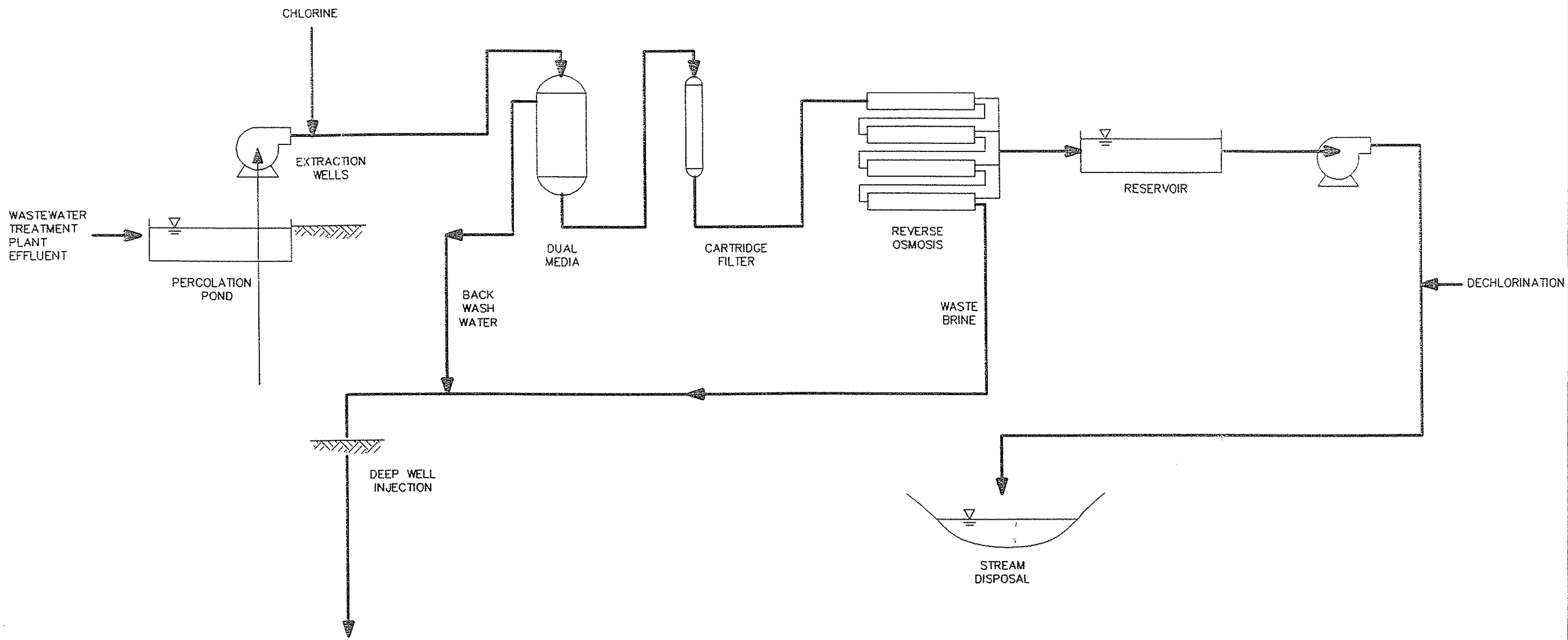
The preliminary treatment processes of chlorination, dual media filtration, and cartridge filtration are necessary components of the RO treatment system. Prechlorination, or other means of disinfection, is necessary to control potential biocontamination of the RO membranes, and to oxidize any metals in the extraction water.

Dual-media filtration follows chlorination and is necessary to reduce suspended solids to a level which will protect the RO membranes. Although the concentrations of suspended solids are very low in the extraction well (see Appendix D), the manufacturers of the RO treatment systems recommend dual-media filtration following review of the data. Dual media filtration should be followed by cartridge filtration to protect the RO membranes in the event of breakthrough in the dual-media filter.

A schematic of the entire reclamation treatment process is presented in Figure 5.2.

Following treatment, the reclaimed water will be pumped through a permanent transmission pipeline upgradient of the domestic well field and recharged into the groundwater in the San Simeon Creek bed. The creek bed was selected because it offers an area of rapid recharge and easy access. The method of disposal to the recharge site will be a series of temporary perforated pipes laid directly on the dry stream bed surface and connected to the transmission line. See Figure 5.3.

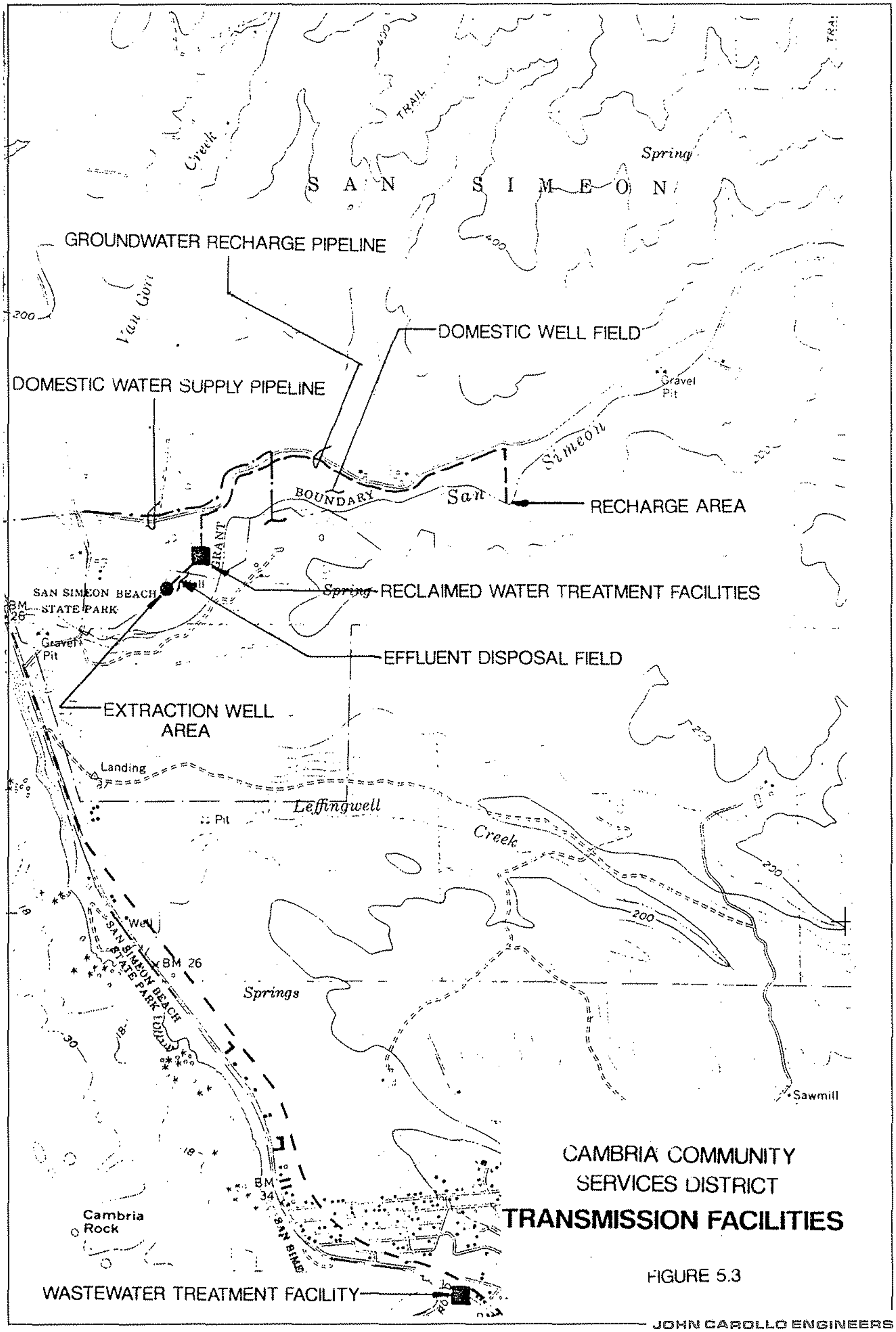
The proposed project will require installation of the temporary piping only after the stream bed had ceased surface flow and removal of the piping prior to the beginning of the wet weather season. The suggested requirement will be to install the system only after surface flow has ceased at Palmer Flats Gaging Station which is located approximately one and one quarter miles upstream of the proposed recharge site. Because groundwater elevations define stream flow in the San Simeon Creek if the creek has surface flow at Palmer Flats Gaging Station the groundwater levels have been historically sufficient at the domestic well field to meet all of CCSD's domestic water needs. It is also true historically since the installation of wells in the San Simeon Basin and diversion of groundwater for irrigation and domestic water supply the stream bed had ceased to flow for some period of time annually.



CAMBRIA COMMUNITY SERVICES DISTRICT

RECLAIMED WATER SCHEMATIC

FIGURE 5.2



CAMBRIA COMMUNITY SERVICES DISTRICT

TRANSMISSION FACILITIES

FIGURE 5.3

JOHN CAROLLO ENGINEERS

Description of Recharge Area

As discussed above, the wastewater reclamation project proposes to use the native streambed for groundwater recharge. The location of the recharge area is shown in Figure 5.3. The size of the recharge area is based upon site permeabilities and is estimated to use approximately 75 to 100 feet of the natural streambed length. Determination of sizing follows the discussion on site permeabilities.

Actual historical depths to groundwater are not recorded for this specific site. However, depths to groundwater were discussed in Chapter 4. Historical depth to groundwater data has been collected by CCSD for its domestic well field which is located approximately one half mile from the proposed recharge site. At the domestic well field, the groundwater elevations have varied from 1 foot to 20.5 feet above sea level which equates to 27.5 to 8 feet depth to groundwater.

A boring log has been drilled directly in the streambed by the soils firm of McClelland Engineers on April 4, 1988. The boring was located approximately 1/4 mile downstream of the proposed recharge site. A copy of the boring is shown in Figure 5.4. The boring log indicates a subsurface material of fine gravel to coarse grained sand to 6 feet, medium grained sand to coarse grained sand with some clayey laminations to 31 feet, and medium grained sand to gravel with traces of clay to 41 feet. Depth to groundwater was 1.5 feet which is to be expected during the wet weather periods of the year. Although permeabilities were not determined for this boring, the soils report issued with the boring log estimated a permeability based on grain-size characteristics for the clean sand and gravel to be "on the order of 10E-2 to 10E-3 cm/sec" which equates to 0.0236 to 0.236 inches per minute (in/min). However, according to CCSD's consultant hydrogeologist, Mr. Ken Schmidt, the permeabilities may be as high as 0.1 to 1.0 centimeters per second (cm/sec) which equates to 2.36 to 23.6 in/min based on past pump tests at the effluent disposal site and the domestic well field.

Although borings have not been taken yet on the proposed site for this report, it is reasonable to expect subsurfaces materials and permeabilities very similar to the boring log. The most reasonable range of permeabilities to expect in line with historic textbook data is 1 to 5 in/min. CCSD expects to take borings to determine subsurface materials and permeabilities for the proposed recharge site in the near future.

As noted earlier, the size of the recharge site is dependent on site permeabilities and quantities of water recharged. Assuming the water flow rate is 216 acre feet per year (ac-ft/yr) (see discussion on design criteria), that water is delivered over a 6 month time period, and the site permeability is 1 in/min, the calculated area requirement for recharge is approximately 400 to 500 square feet. Because the water cannot be evenly distributed across the entire streambed width through the perforated pipeline, CCSD may not operate the facility 24 hours per day; and in anticipation of the future possibility of increasing the capacity of the system, the proposed area will be approximately 100 feet in length across the width of the streambed which is roughly 20 feet wide. This will allow for rapid percolation and prevent any ponding.

LOG OF BORING NO. W2

San Simeon Creek Well Field Area

LOCATION : See Plate A-4

SURFACE EL : 19.9

WATER CONTENT, % — Plastic Limit[1], Natural, Liquid Limit[1] (20, 40, 60)

UNDRAINED SHEAR STRENGTH — KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5)

UNIT WEIGHT, PCF — ■ Dry, □ Total (80, 90, 100, 110, 120)

DEPTH, FT.	DESCRIPTION	U.S.C.S GROUP SYMBOL	BLOWS PER FT.	% PASSING NO. 200 SIEVE
0	Coarse Gravel and Cobbles (surface)			
	Dense to medium dense, fine gravel with brown fine to coarse Sand, some plastic silt, wet	GM	(57)	14
			23	
5'	Loose to medium dense, brown fine to coarse Sand with gravel, trace of silt, wet	SW-SM	(4)	
10			9	7
15			(34)	
18'	Loose to medium dense, brown fine Sand, with plastic silt, wet	SM-SC	7	46
25			(26)	
30	- Plasticity increases below 30'		23	
35	- Gravelly at 35'		(9)	
40	- With some clay fines at 40.5		24	
40.5'				

NOTE: (1) ATTERBERG LIMITS ARE REPRESENTATIVE ONLY OF THE FRACTION WITH PARTICLE SIZES FINER THAN THE NO. 40 (425-MICRON) SIEVE.

JOB NO.: 0587-1136
COMPLETION DEPTH : 40.5 ft
DATE : 4/5/88

DEPTH TO WATER : 1.5 ft
CAVED AT :
DATE :

SAMPLER :
3-in-OD, 2-1/2-in-ID Liner Sampler
2-in-OD, 1-3/8-in-ID SPT Split Spoon
3-in-OD, 2-7/8-in-ID Thin Wall Tube
NO RECOVERY
BLOWS : for last 12" of 18" penetration; values for Liner Sampler shown ( ).

DRILLING METHOD : Rotary Wash and Hollow Stem Auger

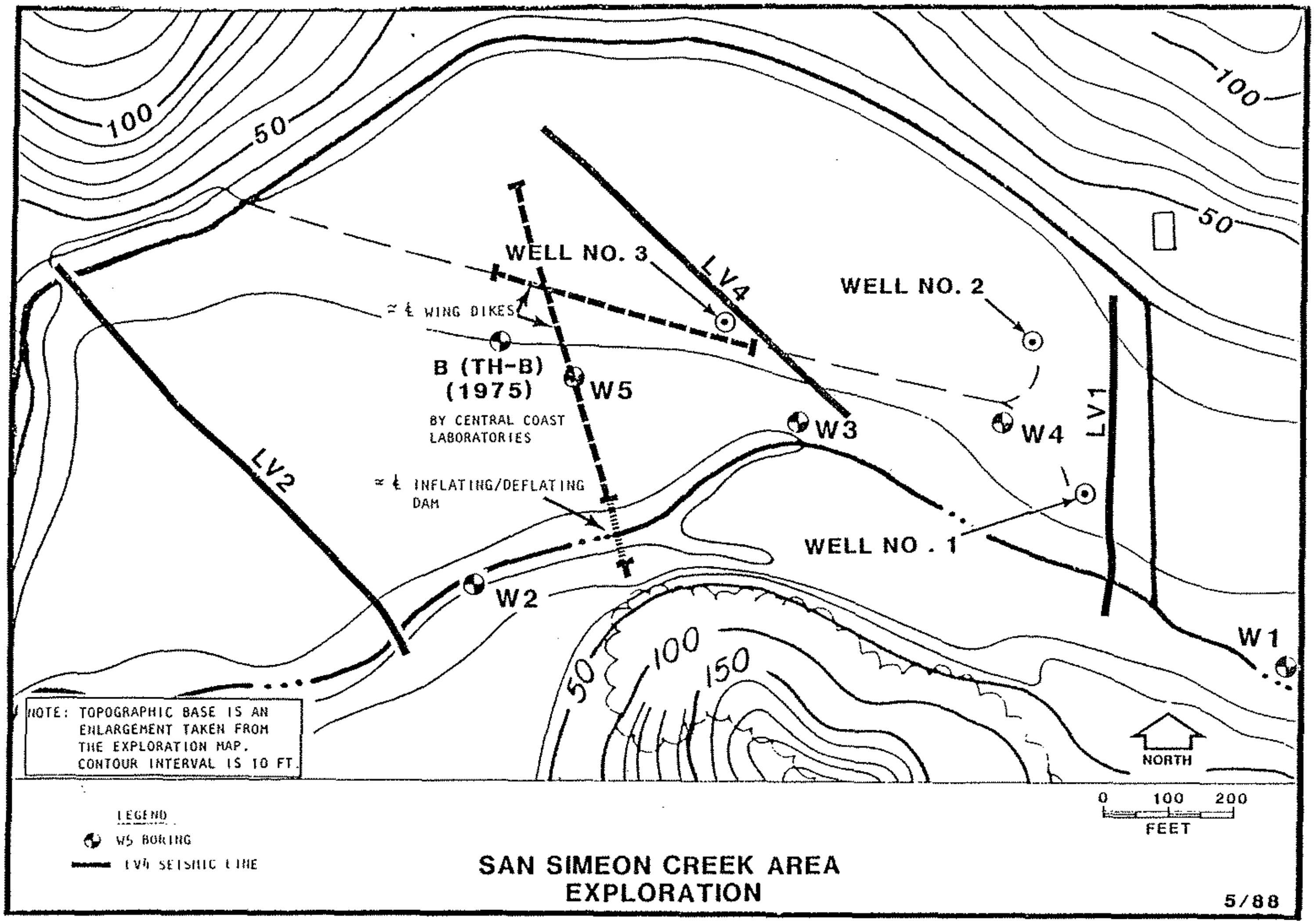
STRENGTH LEGEND
● Unconfined Compression
▲ Unconsolidated-Undrained Triaxial
◆ Miniature Vane
⧗ Direct Shear
(open symbols indicate remolded tests)
Torvane
Hand Penetrometer

CAMBRIA COMMUNITY SERVICES DISTRICT

BORING LOG OF W-2

FIGURE 5.4

JOHN CAROLLO ENGINEERS



JOHN CAROLLO ENGINEERS

CAMBRIA COMMUNITY SERVICES DISTRICT

BORING LOCATION MAP

FIGURE 5.5

It should be noted that the depth to groundwater and the permeability rates exceed those recommended in Table 1 of the Proposed Guidelines. However, because the treated wastewater receives soil filtration at the effluent disposal site prior to treatment in excess of the requirement (see Appendix B) and because of the high level of treatment (RO), these variances are deemed acceptable for this project. The quality of the reclaimed water will provide no significant impact on groundwater due to any chemical impurities.

Recharge Area Operations

As discussed previously in Chapter 4, the San Simeon Basin is rapidly filled by any appreciable precipitation during the year. Of course, it also rapidly drains from the basin as demonstrated by the relatively low storage capacities within the basin. For CCSD and the local farmers, this means an abundant supply of groundwater for approximately six months during a year of normal precipitation. It also means a rapidly falling groundwater level and reduction in capacity during the remaining six months of the year when there is no precipitation.

The reclamation project proposes to recharge treated wastewater blended with groundwater during the periods of the year when groundwater levels have fallen and the groundwater supply begins to diminish. The proposed schedule is to begin operation of the project only after surface waters have ceased to flow at the Palmer Flats Gaging Station which is located approximately one and one quarter miles upstream of the proposed recharge site. Because of the rapid percolation in the streambed, this insures no surface flow at the recharge site. As an alternate, CCSD may elect to begin groundwater recharge only after monitoring wells have determined depth to groundwater is adequate.

The estimated application rate at this time is commensurate with attempting to provide no more than 20 percent reclaimed water at the domestic wells which is estimated to be between 188 and 216 ac-ft/year. At this rate, assuming the project operates 6 months of the year, the maximum daily capacity will be approximately 400,000 gallons per day (gpd). Operation schedule has not been further defined at this time, but it is possible the system will not operate 24 hours per day or 7 days per week. Reduced operating time will increase flow rates but not the total capacity of the overall system. Consequently, the dilution requirement will be met by control of the quantity of water that is recharged.

The hydrogeologic study performed for this project investigated the feasibility of a groundwater mound at the proposed recharge site. Due to the high transmissivity of the underlying gravels and the percolation rates, the study concluded that no groundwater mounding was expected. This was confirmed by a computer model analysis completed for a proposed groundwater recharge project using percolation ponds by the United States Geological Survey (USGS) (written communication with Mr. Gus Yates). Because the proposed recharge site of this project has permeabilities higher than the site modeled and discussed in the original hydrogeologist's report, the possibility of producing a recharge mound is even less likely. Similarly, because of the low quantities of recharge water relative to the storage capacity of the basin and the high transmissivity of the underlying gravels, no affect on the depth to groundwater is expected beyond the immediate area of the recharge site.

Design Criteria

The capacity of the system was designed to conform with the requirements of the Proposed Guidelines. Based on these guidelines (see Table 3.1) the apparent maximum quantity of water is dependent on several factors including: level of treatment; horizontal distance measured from the closest edge of the recharge site to the nearest point of extraction; retention time underground; depth to groundwater; percolation rate; and maximum percent reclaimed of water that can be recharged.

For the CCSD project the design criteria has been based on designing and constructing a system that will recharge treated wastewater in quantities that will not exceed 20 percent of the domestic well extraction. Based on recent discussion with Department of Health Services staff this is a conservative estimate and higher percentages of reclamation may be allowed in the future depending on concentrations of total organic carbon (TOC) in the reclaimed water. However, the reason for the conservatism is that the depth to groundwater requirements and minimum percolation rates stipulated in the Proposed Guidelines (see Table 3.1 and Appendix B) may be periodically violated at the proposed site during the initial period of operation each year.

Although the proposed quantity of treated reclaimed water will not exceed 20 percent of the extracted domestic water the total quantity of water that will be recharged will be significantly higher. This is based on the fact that the water extracted from the effluent disposal site is treated wastewater diluted with groundwater. The amount of dilution in the effluent disposal field was determined based on the hydrogeological and water quality analysis of the existing effluent disposal site. An initial review of the native soil on the effluent disposal site indicated that there would be no synergistic effect of a chemical reaction between either the background groundwater or treated wastewater and the soil. Consequently the increase in levels of dissolved contaminants should be no higher than expected from just mixing the waters. In addition, based on oral and written communication with the hydrogeologist, Mr. John Mann, due to the anisotropic flow pattern of the groundwater basin, mixing is predicted to be related to the relative quantities of background groundwater and treated wastewater effluent disposal site. Consequently, the estimate of relative quantities of each source of water, treated wastewater and groundwater in the extracted water was made by comparing the TDS in the treated wastewater, background groundwater, and extracted water. Assuming the estimated total quantity of water extracted from the groundwater below the effluent disposal site is always equal to the amount percolated (approximately 0.45 mgd at this time), the extraction well water is estimated to be approximately 60 percent reclaimed water and 40 percent groundwater. This is based on TDS concentrations of 690 mg/l, 200 mg/l, and 540 mg/l for the treated wastewater, background groundwater, and extracted well water, respectively.

In the past five years, CCSD has extracted between 565 and 649 ac-ft/year from the San Simeon Basin aquifer. Because the drawdown in these wells has been very close to sea level it is assumed these figures are the approximate production capacity of the well field. Consequently, the maximum quantity of reclaimed waste water that can be percolated at the recharge disposal site is between 113 and 130 ac-ft/year. Assuming the extracted well water from the effluent disposal site is only 60 percent reclaimed water, the total amount of water that may be recharged is 188 to 216 ac-ft/year.

Design criteria for this wastewater reclamation project are presented in Table 5.1. Note that the capacity of the reclaimed water treatment system is based on a six month per year operation and a RO system which treats only a partial flow stream. The design philosophy for the RO system is to provide a water quality which will meet or exceed the TOC requirements of the Proposed Guidelines and will provide a water equivalent in quality to the background water. Because the RO system will provide a water which substantially exceeds these parameters the proposal is to only treat a portion (50 percent) of the flow. The remainder of the flow would be filtered and blended with the water that has passed through RO. A list of all chemicals to be used in the system is presented in Table 5.2. The actual basis for sizing the system was dictated by TDS removal requirements.

Table 5.1 Design Criteria for Wastewater Reclamation
Cambria Community Services District

Parameter	Value
General	
Design Flow, mgd	1.0
Design Flow, gpm(1)	695
Dual Media Filter	
Number	2
Diameter, in.	72
Depth, in.	72
Total Hydraulic Capacity, gpm	141
Loading Rate, gpm/ft^2	5.0
Media	Manganese green sand and anthracite
Cartridge Filter	
Number	7 to 30 inch filters
Type	Hitrex
Filter Opening Size	5 mm
Reverse Osmosis	
Number of Tubes	32-40
Recovery, %	75
Flow, mgd	1.0
Pressure, psig	440-480
Effluent Turbidity, NTU	<1
Chlorination	
Dose, mg/l	1-5
Contact time, hrs.	2
Pump Station	
Number of Pumps	2
Capacity, mgd	1.0

(1) Approximately 216 ac-ft of water may be reclaimed in a six month period.

Table 5.2 Chemical Usage
Cambria Community Services District

Chemical	Purpose	Application Point	Dose	Frequency
Chlorine	Biofouling Control, Oxidation	Following Extraction	1-5 mg/l	Continuous
Potassium Permanganate	Green Sand Regenerant	Dual Media Filter	250g	Two Weeks
Sulfuric Acid	pH Adjustment to 6	Prior to RO	33 mg/l	Continuous
Sodium Meta-Bisulfite	pH Adjustment	After RO	1-10 mg/l	Continuous
Detergent (phosphoric acid and soap	Membrane Cleaning	RO Unit	15-20 gal	6-10 Weeks

5.3 RECLAIMED WATER QUALITY

The quality of the domestic well water, extraction well water, and wastewater effluent, as well as the maximum contaminant level for drinking water standards was discussed in Chapter 2. Raw data collected to date is presented in Appendix D. A summary of the water quality of these water sources is presented in Table 5.3. The numerical values are based on an average of all known data collected to date. The predicted reclaimed water quality is also presented in Table 5.3, which is based on the results of water quality analysis performed by three RO equipment manufacturers.

The quality of the reclaimed water is better than secondary drinking water standards and the quality required by the Proposed Guidelines, and in most cases, is better than existing groundwater quality. However, according to the data collected to date (see Table 5.3 and Appendix D, Tables 1 and 2) the treated reclaimed water may have difficulty providing a water quality which will meet background water quality requirements for some of the inorganic minerals. Although the treatment process can always meet the background water quality, treating only 50 percent of the extraction well water flowstream could effect water quality. It should be noted that the presence of some of these constituents are in very low concentrations (approaching the levels of detection). There is very little to no likelihood that hazardous substances will be present at harmful levels based on data collected to date.

The uncharacterized fraction of TOC in the reclaimed water is estimated to be less than 1 mg/l based on the existing extraction well water quality of 1 to 2 mg/l. The method used to characterized the known fraction of TOC by the State Certified laboratory is EPA Method 415.

Table 5.3 **Summary of Water Qualities**
Cambria Community Services District

Contaminant, Units(1)	Maximum Contaminant Level Allowed(2)	Domestic Well Water	Wastewater Effluent	Effluent Disposal Site Extraction Well Water	Reverse Osmosis Treated Water	Reclaimed Water
Turbidity, NTU(3)	5	1.0	2.7	1.0	0.2	<1.0
Total Dissolved Solids (TDS), mg/l	1,000/500	290	690	528	48	288
pH, units	6.5-8.5	7.1	7.1	7.0	4.7	7.0
Chloride, mg/l	500/250	20	175	87	5	46
Fluoride, mg/l	1.4-2.4(4)	<0.1	0.2	0.2	<0.1	0.1
Sulfate, mg/l	500/250	56	86	64	<1	36
Nitrate (as N), mg/l	10	4.9	12	8.5	4.5	6.5
Zinc, mg/l	5	<0.05	0.08	<0.05	<0.05	<0.05
Copper, µg/l	1,000	<50	<50	<50	<50	<50
Iron, µg/l	300	<50	60	130	<50	65
Lead, µg/l	50	18	<5	<5	<5	<5
Selenium, µg/l	10	<5	<5	<5	<5	<5
Chromium, µg/l	50	<5	<5	<5	<5	<5
Aluminum, µg/l	1,000	<200	<200	<200	<200	<200
Manganese, µg/l	50	<20	30	<20	<20	<20
Cadmium, µg/l	10	<1	<1	<1	<1	<1
Mercury, µg/l	2	<0.2	<0.2	<0.2	<0.2	<0.2
Silver, µg/l	50	<5	<5	<5	<5	<5
Toluene, µg/l	40(5)	ND(6)	1	ND	ND	ND
Methyl Chloride, µg/l	NS(7)	ND	ND	6.1	--	--
Chloroform, µg/l	100(5)	ND	40	1	0.01	<0.5
Total Trihalomethanes (TTHMs) mg/l	0.1	--	--	0.01	0.01	
Foaming Agents (MBAS), mg/l	0.5	<0.02	0.31	0.05	<0.02	

(1) mg/l - milligrams per liter.
µg/l - micrograms per liter.

(2) Primary drinking water standards as established by Department of Health Services. If two numbers are present, the first number is primary standards and the second number is secondary standards.

(3) NTU - Nephelometric turbidity units.

(4) Fluoride concentrations are temperature dependent.

(5) Proposed drinking water standards.

(6) ND - none detected.

(7) NS - no standards.

5.4 IMPACT OF RECLAIMED WATER ON GROUNDWATER BASIN

As noted in Section 5.3 and Table 5.3, the proposed water quality for the reclaimed water is at least equivalent to the background groundwater with the exception of slightly higher levels of chlorides and nitrates, and even the concentrations of these constituents are below maximum contaminated level allowed for drinking water standards by the Department of Health Services.

Because the water quality meets or exceeds most background groundwater levels, there will be no significant chemical impact on groundwater quality. However there will potentially still be a hydraulic impact on some of the wells in the basin.

The closest well to the proposed recharge site is known as 10M2. It is upgradient of the site, but is closer than the 500 foot distance as discussed in the Proposed Guidelines. The well, owned by local farmer Jon Pedotti, was completed in September 1982, is 92 feet deep, and is perforated between a depth of 40 and 80 feet. It is used exclusively as a source of irrigation water. Because the well is located upgradient, the estimated travel time from the recharge site is approximately six months to one year. The first wells downgradient from the proposed recharge site are wells 9J2 and 9J3 and are also owned by Jon Pedotti. These wells are about 30 feet apart. No boring logs have been located for these wells. 9J2 is an active irrigation well. 9J3 is a domestic well reported to be 73 feet deep. According to the isopleth (see Figure 4.2), the travel time from the proposed recharge site to these wells is estimated to be six to eight months.

The next closest wells to the proposed recharge site are CCSD's domestic wells. Well 9J4 (SS-1) is the most upstream production well of CCSD in the San Simeon Basin. The well is 108 feet deep (bedrock), has a 24 inch conductor cemented to a depth of 30 feet and a 12 inch casing perforated between 30 and 105 feet. Well 9J5 (SS-2) is a production well located 250 feet from SS-1. It is 74 feet deep (bedrock), has a 24 inch conductor cemented to a depth of 30 feet and a 12 inch plastic casing perforated between 30 and 84 feet. Well 9K3 (SS-3) is the most downgradient production well. The well is 110 feet deep (bedrock), has a 24 inch steel conductor cemented to a depth of 32 feet and a 12 inch casing perforated between depths of 32 and 107 feet. According to the isopleth (see Figure 4.2), the travel time from the proposed recharge site is estimated to be eight months to one year.

There are also three other wells located in CCSD's domestic well field referred to as 9K1, 9K2, and 9L1. 9K1 is owned by Mr. Clyde Warren and is used for stock watering and drip irrigation of trees. It can also be used as a domestic water supply for a local residence. 9K2 is owned by CCSD and was formerly used as an irrigation well but is now only used to record water levels. 9L1 is an inactive irrigation well and is reported to have a depth of 60 feet. No boring logs were located for these three wells. Similar to CCSD's domestic wells, the travel time from the proposed recharge site is estimated to be eight months to one year.

Between the domestic well field and the effluent disposal site is Well 9P5 (SS-4). It was drilled in 1978 as an observation well to monitor water levels and water quality between the sprayfield and the domestic well field. The well is 98 feet deep (bedrock), has a 16 inch steel conductor cemented to a depth of 30 feet and an 8 inch casing perforated between 28 and 98 feet. The travel time from the proposed recharge site is estimated to be greater than one year.

Except as required for bacteriological monitoring by San Luis Obispo County Health Department for the wells that might be used for domestic purposes, there is no routine testing of wells owned by any of the local farmers. The only wells with established monitoring programs are CCSD's domestic wells and extraction wells. However, in recent years, CCSD and other agencies have periodically performed analysis on wells located between the ocean and upstream of the proposed recharge site. The results of the data are discussed in Chapter 4.

5.5 CONTINGENCY PLAN

A contingency plan has been developed to comply with the requirements of Title 22 and the Proposed Guidelines. The intent of the contingency plan is to prevent inadequately treated wastewater from being delivered to the recharge site. Specifically, Title 22 requires reliability features such as duplicate treatment facilities and long term storage and disposal facilities (see Appendix B, Title 22, Article 9). The Proposed Guidelines require a contingency plan to provide for emergency diversion from the recharge site.

The requirements of Title 22 and the Proposed Guidelines are applicable only to the treatment processes associated with the reclamation (well extraction and advanced water treatment). The secondary treatment and effluent disposal facilities should not require compliance with these regulations and and guidelines. The most appropriate method to determine detrimental impact from the secondary treatment facilities is to continue the monitoring program now in effect. The monitoring program should discover any negative impact the effluent secondary treatment facilities effluent may have on the groundwater quality and the reclamation project.

In compliance with the Proposed Guidelines, the reclamation facilities should provide diversion of reclaimed water from the recharge site for inadequately treated water. There are two conditions which could require diversion. The first condition is malfunction of the advanced water treatment facility. The second condition is an extraction well water quality which could not be treated in the advanced water treatment facility to meet required reclaimed water quality requirements.

The proposed contingency plan for treatment facility malfunctіcn is to take the facility out of service and divert any inadequately treated water. Because CCSD intends to use this facility only as a supplement to its domestic water supply and not as wastewater disposal, the facilities can be taken out of service for relatively long periods of time (several months) pending repair. During that time, domestic water could still be provided using the existing domestic water supply system.

The existing disposal facilities include a reservoir (Van Gordon Reservoir) with a capacity of 6 million gallons located on the west side (ocean side) of Van Gordon Creek. This reservoir, along with the effluent disposal site west of Van Gordon Creek will be used for diversion facilities. Because of the anisotropic nature of groundwater flow in the San Simeon Basin and because the diversion facilities are located west (in the direction of groundwater flow) of the effluent disposal site, no reverse migration of diverted water from the reservoir to the site of the extraction wells is expected. Groundwater velocities are high enough to convey contaminants downgradient and away from the effluent disposal site. Additionally, any waters that might migrate would first have to be filtered by the soil, and most contaminants would be removed.

It is important to remember that even with malfunction of the advanced treatment facilities, the quality of the inadequately treated water would be at least as good as the groundwater anywhere in the effluent disposal site. It should also be noted that, due to the high transmissivity of the soils in the San Simeon Basin, water is flushed through the site about once per year. This flushing action helps to prevent accumulation of contaminants in the groundwater basin.

The proposed contingency plan for extraction well water quality which cannot be adequately treated by the advanced treatment facilities is also diversion. Currently, CCSD has the authority through its National Pollutant Discharge Elimination System (NPDES) permit to pump groundwater from the effluent disposal site to Van Gordon Creek. The intent of the permit condition is to maintain certain groundwater levels on the site and prevent a reverse gradient movement toward CCSD's domestic well field. If the groundwater quality was inadequate for reclamation and diversion was necessary, the groundwater could be pumped directly to Van Gordon Creek without additional treatment.

Another measure CCSD will take to prevent inadequately treated wastewater from being delivered to the recharge site will be groundwater monitoring. Currently, CCSD has piezometers along the western perimeter of the effluent disposal site which may be monitored for contaminants. If piezometer readings or other results indicate contamination which cannot be removed by the reclamation system, the system may be shut down until adequate treatment can be obtained. Regular monitoring (see Section 5.6) of the extraction well water allows time to discontinue operation of the reclamation system in case of contamination of the effluent disposal site area due to inadequate secondary treatment.

Because CCSD owns and operates a domestic water treatment and distribution system, it already has a notification procedure in place. The plan for notification of the RWQCB, State Department of Health Services, and San Luis Obispo County Health Department in the event of treatment failure would be incorporated into the existing notification procedures and be handled according to existing current CCSD Administration Policy.

5.6 TRANSMISSION SYSTEM

The Proposed Guidelines require submission of plans of the pipelines transmitting reclaimed water. The location of all water pipes in the project area must be shown, along with arrangements to ensure that there will be no cross connecting of non-potable and potable waters. The following documents describe regulations and guidelines for these transmission systems:

- Guidelines for the Distribution of Nonpotable Water, California-Nevada Section American Water Works Association (AWWA)
- Guidelines for the Use of Reclaimed Water, Department of Health Services
- Regulations Relating to Cross-Connections, (California Code of Regulations, Title 17, Subdivision 1, Chapter 5, Subchapter 1)
- Manual of Cross Connection Control/Procedures and Practices, Department of Health Services

The pipeline carrying reclaimed wastewater must follow all regulations pertaining to cross connections of reclaimed water pipes, sewer pipes, and potable water pipes. The reclaimed water will be piped from the extraction well field, where it will have been treated, due north to San Simeon Creek Road. The pipeline will follow the roadway until north of the recharge area, where the piping will extend south to San Simeon Creek. This piping layout is shown in Figure 5.3.

In compliance with the Guidelines for Distribution of Nonpotable Water by the California-Nevada Section AWWA, the reclaimed water pipeline should be labeled as nonpotable water by either being stamped or installed with warning tape, regardless of whether the pipe will be above or below ground. If warning tape is used, it must be installed longitudinally along the top of the pipe and fastened to the pipe at least every ten feet.

The Guidelines for Use of Reclaimed Water from the Department of Health Services (DHS) state that all valves, outlets, water controllers, etc. should be labeled as reclaimed water and secured in a manner that permits operation only by authorized people.

The Guidelines for Distribution of Nonpotable Water by the California-Nevada AWWA state that any reclaimed water pipe should be at least ten feet horizontally from and one foot lower than any pipe containing potable water. The reclaimed water pipe is expected to cross a domestic water supply pipeline at one location due north of the domestic water well field. The pipes should be made to cross at right angles to each other, while retaining at least a one foot vertical separation between the pipes with the domestic water supply pipe at the higher elevation. The top of the reclaimed water pipe should be a minimum of 48 inches below the ground surface at all times.

There are no sewer pipes in the vicinity, so there are no current concerns of raw sewage entering the reclaimed water piping system. If sewer pipes are installed in the future, they should be kept at least one foot lower than the reclaimed water lines if the two pipes cross. As-built plans showing all buildings, domestic and reclaimed water facilities, and any sewage collection system should be maintained in accordance with the Guidelines for Use of Reclaimed Water by DHS. These should be updated as necessary.

5.7 MONITORING PROGRAM

The Proposed Guidelines require submission of a proposed monitoring program which must be consistent with the Proposed Guidelines for Monitoring of Groundwater Recharge Projects. The purpose of a monitoring program is to provide early detection of potential impacts on groundwater quality from the recharge operation. The following information is necessary for an adequate monitoring program:

- Quality of the existing groundwater
- Quality of the reclaimed water
- Quality of the water pumped from the groundwater basin domestic well water, and
- Quality of other major sources affecting the groundwater

Monitoring frequency should relate to the recharge rate and groundwater movement. A representative database must be established, which may require extensive initial testing. The CCSD has performed comprehensive testing and analysis since early 1989. The raw data is presented in Appendix D.

The Proposed Guidelines require, as a minimum, the following analyses:

- General Mineral: Analyses for the compounds listed in or added to the secondary drinking water standards in the California Code of Regulations, Title 22, Section 64473, Tables 6 and 7.

- General Physical: Analyses for the compounds listed in or added to the secondary drinking water standards in the California Code of Regulations, Title 22, Section 64473, Tables 6 and 7.

- Inorganic Chemical: Analyses for the compounds listed in or added to the primary drinking water standards (MCLs) in the California Code of Regulation, Title 22, Section 64435, Tables 2 and 3.

- Natural Radioactivity: Analyses for the compounds listed in or added to the primary drinking water standards (MCLs) in the California Code of Regulations, Title 22, Section 64443, Table 4.

- Man-made Radioactivity: Analyses for the compounds listed in or added to the primary drinking water standards (MCLs) in the California Code of Regulations, Title 22, Section 64443, Table 4.

- Organic Chemicals: Analyses for the compounds listed in or added to the primary drinking water standards, (MCLs, California Code of Regulations, Title 22, Section 64444.5, Table 5), the action level list, and list of unregulated organics. Pesticide monitoring shall be conducted at the discretion of the RWQCBs. In addition, analyses shall be conducted for gas-neutral-acid extractable components and purgeable organics as required by RWQCBs.

- General Microbiological: At the discretion of the RWQCBs, the recharge water and groundwater shall be analyzed for microbiological parameters, including viruses, listed in or added to the criteria set forth in this document and any microbiological contaminants listed in or added to the primary drinking water standards.

The initial testing provided data with which to propose a monitoring program. The data indicate that total dissolved solids (TDS), specific conductance, chlorides, and nitrates were identified at higher concentrations in the wastewater effluent, the sprayfield extraction water, and water from wells nearer the ocean than the concentration of these constituents in background samples. Of more concern are the trace volatile organic compounds detected during sampling. Total trihalomethanes (TTHMs), specifically chloroform, and methylene chloride were detected in water from well 9P2 (extraction well). Chloroform was also detected in samples from the treated wastewater effluent and piezometer 3. Toluene was detected in the treated wastewater effluent as well. A summary of water quality information is shown in Table 5.3.

Based on the requirements as discussed in the Proposed Guidelines, a comprehensive monitory requirements has been developed and is presented in Table 5.4. The proposed frequency of monitoring and number of analyses is more extensive than required by regulations in Title 22 and the Proposed Guidelines (see Appendix A). This program is proposed until additional background data has been collected which is estimate to be approximately one year. After that, the frequency of monitoring, number of samples collected, and type of analyses will be reduced to comply with Title 22 and the Proposed Guidelines.

5.8 PROJECT IMPLEMENTATION

Because of the severe drought conditions affecting the central coast of California (including Cambria), implementation of this project in a timely fashion is imperative to CCSD. Consequently, CCSD has developed a schedule to complete as much of the project as possible concurrently. Consequently, with the submittal of this report, CCSD has begun to obtain the approval of the regulatory agencies, the local community, and other public agencies. In addition, CCSD has also already begun the Environmental Impact Study process.

Upon approval of the project, CCSD will need to complete design and construction. However, prior to completion of the design, a pilot study is recommended. The intent of the pilot study is to establish the technical parameters of the advanced treatment system (filtration and RO). The proposed schedule includes completion of the pilot project study concurrently with the final design of the project.

The anticipated implementation schedule is presented in Table 5.5.

Table 5.4 Groundwater Monitoring Program
Cambria Community Services District

Monitoring Location	Analyses[1]	Frequency
Wastewater Effluent	Priority Pollutants Volatile Organics (E624)[2]	Quarterly
	Priority Pollutants Semi-Volatile Organics (E525)	Quarterly
	Priority Pollutants Pesticides (E608)[3]	Quarterly
	Priority Pollutant and Selected Metals[4]	Quarterly
	General Physical and Mineral Parameters[5]	Quarterly
	General Microbiology	Quarterly
	Inorganic Chemicals	Annually
	Radioactivity	Annually
Extraction Well (9P5)[6]	Priority Pollutants Volatile Organics (E624)	Quarterly
	Priority Pollutants Semi-Volatile Organics (E525)	Quarterly
	Priority Pollutants Pesticides (E608)[3]	Quarterly
	Priority Pollutant and Selected Metals[4]	Quarterly
	General Physical and Mineral Parameters[5]	Quarterly
	General Microbiology	Quarterly
	Inorganic Chemicals	Annually
	Radioactivity	Annually
Reclaimed Water	Priority Pollutants Volatile Organics (E624)	Quarterly
	Priority Pollutants Semi-Volatile Organics (E525)	Quarterly
	Priority Pollutants Pesticides (E608)[3]	Quarterly
	Priority Pollutant and Selected Metals[4]	Quarterly
	General Physical and Mineral Parameters[5]	Quarterly
	General Microbiology	Quarterly
	Inorganic Chemicals	Annually
	Radioactivity	Annually
Intermediate Monitoring Well[7]	Priority Pollutants Volatile Organics (E624)	Quarterly
	Priority Pollutants Semi-Volatile Organics (E525)	Quarterly
	Priority Pollutants Pesticides (E608)[3]	Quarterly
	Priority Pollutant and Selected Metals[4]	Quarterly
	General Physical and Mineral Parameters[5]	Quarterly
	General Microbiology	Quarterly
	Inorganic Chemicals	Annually
	Radioactivity	Annually

Table 5.4 Groundwater Monitoring Program (Continued)
Cambria Community Services District

Monitoring Location	Analyses[1]	Frequency
Domestic Well (9K2)	Priority Pollutants Volatile Organics (E624)	Annually
	Priority Pollutants Semi-Volatile Organics (E525)	Annually
	Priority Pollutants Pesticides (E608)[3]	Annually
	Priority Pollutant and Selected Metals[4]	Annually
	General Physical and Mineral Parameters[5]	Quarterly
	General Microbiology	Quarterly
	Inorganic Chemicals	Annually
	Radioactivity	Annually

(1) All analyses must be performed by a California Department of Health Services certified laboratory using approved EPA methods.
(2) Numbers in parentheses following the analyses refer to the EPA method applicable.
(3) Pesticide monitoring shall be conducted at the discretion of the RWQCB.
(4) Metals to be analyzed include chromium, lead, mercury, aluminum, and manganese.
(4) General mineral parameters to be analyzed include pH, major anions/cations, electric conductivity, total dissolved solids (TDS), and nitrates.
(6) If additional extraction wells are installed, they will be monitored separately.
(7) Location undetermined.

Table 5.5 Project Implementation
Cambria Community Service District

Item	Date
Submit "Draft" Project Report to CCSD, RWQCB, and DHS	3/22/91
Meet with Regulatory Agencies to Discuss Proposed Project	4/91
Complete Regulatory Agency Review	3/91 to 4/91
Complete Public Hearing Process	5/91
Complete Environmental Impact Review	5/91
Begin Final Design	6/91
Begin Pilot Study	6/91
Complete Final Design	10/91
Construction	12/91 to 8/92

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APPENDIX

PROPOSED GUIDELINES FOR GROUNDWATER RECHARGE WITH RECLAIMED MUNICIPAL WASTEWATER

OFFICE OF WATER RECYCLING

OFFICE OF WATER RECYCLING
State Water Resources Control Board
2014 T Street, P.O. Box 944212
Sacramento, CA 94244-2120

1 595

RECEIVED SEP 05 1990 JOHN CAROLLO ENGINEERS

June 25, 1990

PROPOSED GUIDELINES FOR GROUNDWATER RECHARGE WITH RECLAIMED MUNICIPAL WASTEWATER

Attached are the "Proposed Guidelines for Groundwater Recharge with Reclaimed Municipal Wastewater" (Guideline Document) and the "Background Information on Proposed Criteria for Groundwater Recharge with Reclaimed Municipal Wastewater" (Background Document). As a follow-up to the "Report of the Scientific Advisory Panel on Groundwater Recharge with Reclaimed Wastewater," which was published in November 1987, the proposed Guidelines were developed jointly by the State of California Interagency Water Reclamation Coordinating Committee (Interagency Committee) and the Groundwater Recharge Committee of the Office of Drinking Water, Department of Health Services (DHS).

The Interagency Committee, which consists of representatives from the State Water Resources Control Board, Department of Water Resources, and Department of Health Services, had an overall responsibility for developing the Guidelines. The DHS's Groundwater Recharge Committee was responsible for developing Groundwater Recharge Criteria (summarized in Table 1 of the Guideline Document) and preparing the Background Document.

If you have any specific comments to help us improve these two documents, please forward your comments in writing with the supporting data and references to the Interagency Committee at the following address. We would appreciate receiving your comments by July 31, 1990.

Dr. T. Asano
State Water Resources Control Board
P.O. Box 944212
Sacramento, CA 94244-2120

Since the Guideline Document contains statements on goals and objectives, and guiding principles for groundwater recharge, the Interagency Committee will be asking a broad expression of support by the three sponsoring agencies. The remaining groundwater recharge criteria and related regulation sections will be adopted, after public hearings, by the Department of Health Services as parts of the Wastewater Reclamation Criteria (California Code of Regulations, Title 22, Division 4, Chapter 3).

Thank you for your interest in the Proposed Guidelines for Groundwater Recharge with Reclaimed Municipal Wastewater.

PROPOSED GUIDELINES FOR GROUNDWATER RECHARGE WITH RECLAIMED MUNICIPAL WASTEWATER

Prepared by

State of California
Interagency Water Reclamation Coordinating Committee[1]
and
Groundwater Recharge Committee[2]

INTRODUCTION

Background and Intent

The demand for water in California exceeded the dependable supply, in 1985, by approximately 2,000,000 acre-feet. This water shortage is projected to increase by nearly 3,000,000 acre-feet per year by the year 2010 with much of the increase resulting from population growth and industrial development.

New surface water development and large-scale water importation projects have become difficult to implement. They are costly and are often perceived as having adverse environmental impacts. If this trend continues, it will result in heavy demand for groundwater to augment surface water supplies. At present, groundwater is used to meet about 39 percent of California's applied water requirements and will play a critical rôle. This demand for groundwater may increase the rate of overdraft and can have adverse effects such as increased costs of pumping and distribution, degradation of groundwater quality, causing land subsidence, and loss of useable groundwater storage. Recognizing these difficulties has led to an effort to increase the efficiency of water supply development and use, focusing on the conjunctive operation of surface and groundwater, use of reclaimed wastewater, and water conservation. Increasing demands for water in California, environmental concerns over new

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1 Representatives from the State of California, State Water Resources Control Board, Department of Health Services, and Department of Water Resources.

2 Department of Health Services, Office of Drinking Water.

water development, loss of existing groundwater resources due to contamination, and the rising cost of importing water have provided an incentive to use reclaimed municipal wastewater for groundwater recharge as a means of supplementing existing water supplies and meeting some of the future water demands.

Important benefits can be realized by reclaiming and reusing treated municipal wastewater that would otherwise be discarded. Reclaimed municipal wastewater in California is used for various purposes -- among them, agricultural and landscape irrigation, industrial cooling, groundwater recharge, and recreational impoundments. California produces about 3,400,000 acre-feet per year (af/y) of treated municipal wastewater but only 270,000 af/y (9%) is used in planned reclamation projects. Projections indicate that such reuse could double by 2010. For example, information developed by the Orange and Los Angeles counties [1] showed that groundwater recharge with reclaimed municipal wastewater could approach 120,400 af/y (72,000 af/y would be used for surface spreading and the remaining 48,400 af/y for sea water intrusion barriers).

Several constraints limit expanding the use of reclaimed municipal wastewater. For example, some wastewaters are not reclaimable due to toxic industrial discharges and opportunities for direct application are often situated a long distance from the point of supply resulting in excessive costs. However, the problem of excessive costs associated with the conveyance of reclaimed water can be circumvented in those situations where recharge of groundwater with reclaimed municipal wastewater is a viable option.

Groundwater recharge with reclaimed municipal wastewater in groundwater basins that serve as sources of domestic water supply presents a wide spectrum of health concerns that have been under study by the State of California since the early 1970's. Reports by nationally recognized experts [2-5] in water quality and public health have been prepared to provide information needed to assess health issues and to establish criteria for groundwater recharge with reclaimed municipal wastewater. These reports did not establish specific guidelines but provided assessments regarding risks, and comparisons of reclaimed water quality with other sources of water supply that have been historically acceptable.

It is essential that water extracted from a groundwater basin for domestic use be of acceptable physical, chemical, microbiological, and radiological quality. The main concerns governing the acceptability of groundwater recharge projects are that adverse health effects could result from the introduction of pathogens or trace organics into groundwater that is eventually consumed by the public. Because of the increasing concern for long-term health effects every effort should be made to reduce the number of chemical species and concentration of specific organic constituents in the applied water. Full reliance should not be placed on well head treatment by users at the point of extraction. A source control program to limit potentially harmful constituents shall be an integral part of any recharge project. Extreme caution is warranted because of the difficulty in restoring a groundwater basin once it is contaminated. Additional cost would be incurred if groundwater quality changes, resulting from recharge, necessitated the treatment of extracted groundwater and/or the development of additional water sources.

The level of municipal wastewater treatment necessary to produce a suitable reclaimed water for groundwater recharge depends upon the groundwater quality objectives, hydrogeologic characteristics of the groundwater basin, and the amount of reclaimed water and percentage of reclaimed water applied. Major considerations are the total amount and types of recharge water available for recharge on an annual basis, size of the groundwater basin and probability of dilution with natural groundwaters, soil types, depth to groundwater, method of recharge, and the length of time the reclaimed water is retained in the basin prior to withdrawal for domestic use.

The guidelines presented in this document have been developed by the Interagency Water Reclamation Coordinating Committee and Groundwater Recharge Committee after consultation with many experts. This document prescribes the necessary safeguards through source control, wastewater treatment, and operational control at the recharge facilities.

Present Policy

The Porter-Cologne Water Quality Control Act [6] establishes the State of California policy regarding the use of reclaimed municipal wastewater.

> "It is hereby declared that the people of the State have a primary interest in the development of facilities to reclaim water containing waste to supplement existing surface and underground water supplies and to assist in meeting the future water requirements of the State." (Sections 13510-13512 of the Water Code)

The responsibilities of the state agencies in implementing this policy are also established by the Porter-Cologne Act.

> **Department of Water Resources** (DWR) "shall conduct surveys and investigations relating to the reclamation of water from wastes for beneficial purposes including but not limited to the determination of quantities of such water presently wasted and possibilities of use of such

> water for recharge of underground water..." (Section 230 of the Water Code)
>
> **The Regional Water Quality Control Boards** (RWQCB) "after consulting with and receiving recommendations of the State Department of Health Services and after any necessary hearing, shall, if it determines such action necessary to protect the public health, safety, or welfare, prescribe water reclamation requirements for water which is used or proposed to be used as reclaimed water. -- Such requirements shall include, or be in conformance with, the statewide reclamation criteria..." (Section 13523 of the Water Code)
>
> **Department of Health Services** (DHS) "shall establish statewide reclamation criteria for each varying type of use of reclaimed water where such use involves the protection of public health." (Section 13521 of the Water Code)

Existing wastewater reclamation criteria (California Code of Regulations, Title 22, Chapter 3, Section 60320) for groundwater recharge using reclaimed municipal wastewater are listed in Appendix 1.

<u>Need for Policy Review</u>

Despite the vast potential for groundwater recharge, there are few planned groundwater recharge projects using reclaimed municipal wastewater in California. This is partly due to economic circumstances and continuing concerns by the public and state regulatory agencies about viruses, nitrate, nitrite, and trace organic compounds in the reclaimed water which could produce adverse health impacts when ingested. Another factor has been the lack of specific criteria and guidelines to assist in the planning of recharge projects using reclaimed municipal wastewater. These facts suggested that it was essential to undertake review of the existing regulations and to establish statewide policy and guidelines for planning and implementing new groundwater recharge projects using reclaimed municipal wastewater.

DEFINITION OF TERMS

As used in this document:

Action Level. An advisory level established by the Office of Drinking Water (ODW) of DHS which establishes concentrations of contaminants in drinking water at which adverse health effects would not be anticipated to occur.

Contaminant. Any physical, chemical, biological, or radiological substance or matter in water.

Contamination. An impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through spread of disease.

Dilution Water. Water, other than reclaimed water, which reduces the percentage of reclaimed water withdrawn at extraction wells.

Direct Beneficial Use. The use of reclaimed municipal wastewater which has been transported from the point of production to the point of use without an intervening discharge to waters of the State.

Direct Injection. The controlled subsurface application of recharge water directly into a groundwater basin for the purpose of salt water intrusion barrier and/or groundwater replenishment.

Disinfected Wastewater. Reclaimed wastewater to which a disinfectant has been added to destroy or inactivate pathogenic organisms. The reclaimed wastewater shall be considered adequately disinfected if it complies with the performance standards listed in B-1 of the proposed Criteria for a Planned Groundwater Recharge with Reclaimed Municipal Wastewater.

Filtered Wastewater. Reclaimed wastewater that meets the performance standards listed in section B-2 of the proposed Guidelines for Groundwater Recharge with Reclaimed Municipal Wastewater by being oxidized, coagulated, clarified, passed through filter media or meets the Department of Health Services *Policy Statement for Wastewater Reclamation Plants with Direct Filtration.*

Incidental Groundwater Recharge Project. A wastewater disposal project, the primary intent of which is not groundwater recharge, but which results in portions of the treated wastewater reaching groundwater. Discharging treated wastewater to an ephemeral stream is considered an incidental groundwater recharge project unless the physical characteristics of the stream bed have been modified by the project sponsor's activities to promote recharge.

Maximum Contaminant Level (MCL). The maximum permissible level of a contaminant in drinking water.

Oxidized Wastewater. Reclaimed wastewater in which the organic matter has been stabilized, is nonputrescible and contains dissolved oxygen and meets the performance standards listed in B-3 of the proposed Criteria for a Planned Groundwater Recharge with Reclaimed Municipal Wastewater.

Planned Groundwater Recharge Project with Reclaimed Municipal Wastewater. Any water reclamation project designed to recharge a groundwater basin used as a source of water supply.

Project Sponsor. An agency or agencies that apply to the RWQCBs for wastewater reclamation requirements in proposing a groundwater recharge project with reclaimed municipal wastewater.

Recharge Water. All waters, including reclaimed and dilution waters, which have entered an aquifer via surface spreading, injection, or natural infiltration.

Reclaimed Water. Municipal wastewater which, as a result of treatment, is suitable for direct beneficial reuse or controlled use that would not otherwise occur.

Source Control. An effective program, in conformance with applicable requirements of the pretreatment program of the United States

Environmental Protection Agency, to control the discharge of toxic materials into treatment works.

Surface Spreading. Surface spreading is the controlled application of recharge water to the ground surface for the purpose of replenishing a groundwater basin.

Organics Removal. Treatment of oxidized and filtered wastewater for the purpose of removing such compounds as synthetic organics. Typical treatment units are activated carbon and reverse osmosis.

Wastewater Disposal Project. A project that disposes treated municipal wastewater in accordance with prescribed waste discharge requirements or NPDES permit.

GOALS AND OBJECTIVES

The goals and objectives of the *proposed Guidelines for Groundwater Recharge with Reclaimed Municipal Wastewater* are:

To encourage efficient use of the State's water resources and increase water supply reliability by identifying the means for the safe use of treated municipal wastewater for groundwater recharge.

To guide the Regional Water Quality Control Boards in establishing groundwater quality objectives and water reclamation requirements which will adequately protect health and environment while encouraging optimum use of the region's water resources.

To ensure that groundwater recharge with reclaimed municipal wastewater is regulated in a consistent manner.

To assist planning for groundwater recharge projects with reclaimed municipal wastewater by providing the criteria and guidelines which detail the information needed for review by regulatory agencies.

GUIDING PRINCIPLES

In order to implement these guidelines, the following principles should be adhered to:

The RWQCBs, in formulating or revising water quality control plans shall consider a region's overall water supply and demand so that groundwater recharge with reclaimed municipal wastewater can be a viable part of water resources development.

The RWQCBs, before issuing water reclamation requirements for a groundwater recharge project with reclaimed municipal wastewater, shall determine that the project is consistent with any regional water management plan, including development of the region's nonpotable water reuse potential.

In implementing this policy and guidelines, the RWQCBs are to evaluate water quality in light of the SWRCB's Resolution 68-16 (Statement of Policy with Respect to Maintaining High Quality of Water in California, Appendix 2).

High quality drinking water should not be allowed to be degraded by the planned addition of contaminants as a result of recharge.

The responsibility for installation and operation of the groundwater recharge project, including related monitoring systems, to assure that the project will not pose a threat to health and environment, shall rest with the project sponsor and not the groundwater user.

The proposed Criteria contained in the proposed Guidelines are based on the best scientific knowledge currently available. However, SWRCB and DHS recognize the uncertain nature of groundwater recharge with reclaimed municipal wastewater and encourage further research.

PERMITTING PROCESS

To expedite the processing of a request for approval of a proposed groundwater recharge project, the procedural steps outlined below should be followed:

The project sponsor shall prepare an engineering report following the guidelines specified in *Guidelines for the Preparation of an Engineering Report on the Proposed Use of Reclaimed Municipal Wastewater for Groundwater Recharge* (see Appendix 3). The report shall be submitted to the appropriate RWQCB with a completed application for water reclamation requirements.

Upon receipt of the application and the engineering report, the RWQCB shall send copies to the Office of Drinking Water and local health departments with a request for comments and recommendations.

The RWQCB shall respond to the applicant within 30 days, as established by law, advising the applicant that the project report is complete and accepted or that specific additional information must be submitted.

Following a determination by the RWQCB that the project application is complete, the RWQCB will develop draft water reclamation requirements for groundwater recharge consistent with the proposed Criteria for Groundwater Recharge with Reclaimed Municipal Wastewater.

Draft water reclamation requirements for groundwater recharge shall be submitted to ODW for comments prior to public distribution of the Tentative Water Reclamation Requirements.

All recommendations by ODW which involve areas of critical or essential health concern shall be included in water reclamation requirements for groundwater recharge issued by RWQCBs and any variation therefrom must be fully documented and justified by RWQCBs.

The RWQCB shall be responsible for monitoring the performance of the recharge project and adherence to the water reclamation requirements. The ODW shall be promptly notified of any noncompliance detected by the RWQCB.

ODW shall provide technical assistance to the RWQCB as appropriate in determining compliance with specific aspects of the water reclamation requirements which directly relate to health.

Monitoring requirements shall be reviewed and updated at least every five years to incorporate new California drinking water standards, or to make necessary revisions based on review of prior monitoring data.

ODW shall notify the RWQCB if routine or other monitoring of a public water supply well, drawing water from the recharged aquifer, exceeds any MCL or action level.

RWQCB shall notify ODW if routine or other monitoring of a monitoring well, drawing water from the recharged aquifer, exceeds any MCL or action level.

PROPOSED CRITERIA FOR A PLANNED GROUNDWATER RECHARGE PROJECT WITH RECLAIMED MUNICIPAL WASTEWATER[3]

Introduction

These criteria were developed to provide necessary protection to prevent contamination of potable groundwater supplies. The criteria, shown in Table 1, are divided into five project categories. These project categories specify minimum treatment and recharge site requirements and are intended as statewide guidelines for surface spreading or direct injection projects utilizing reclaimed municipal wastewater to recharge domestic water supply aquifers (Water Code, Division 7, Chapter 7, Section 13521 and Section 13540).

A. Surface Spreading and Direct Injection Requirements.

Table 1 specifies the requirements for groundwater recharge with reclaimed municipal wastewater. Treatment requirements are defined in Section B. (Wastewater Treatment Performance Standards and Monitoring) and Section D. (Dilution Requirement and Maximum Allowable Organics Concentration).

B. Wastewater Treatment Performance Standards and Monitoring.

Reclaimed water used for groundwater recharge of domestic water supply aquifers by surface spreading and direct injection shall be treated and monitored in accordance with the following requirements.

1. Disinfected Wastewater.

All reclaimed wastewater requiring disinfection shall meet the standards designated in Table 1.

a. For category I, II, and V Projects in Table 1. The median number of total coliform organisms shall not exceed 2.2 MPN per 100 mL, as determined

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3 Prepared by the Groundwater Recharge Committee of the State of California, Department of Health Services, Office of Drinking Water.

TABLE 1. Proposed Criteria for Groundwater Recharge with Reclaimed Water[1]

		Minimum Requirements				
Project Category[2]	Maximum Percent Reclaimed Water	Depth to Groundwater (Feet)[4] Perc. Rate[5] ≤0.20 in/min	Depth to Groundwater (Feet)[4] Perc. rate[5] ≤0.33 in/min	Retention Time Underground (Months)	Horizontal Distance (Feet)[6]	Treatment
Surface Spreading[3]						
I	50	10	20	6	500	Organics Removal, Oxidized, Filtered & Disinfected[7]
II	20	10	20	6	500	Oxidized, Filtered & Disinfected[7]
III	20	20	50	12	1,000	Oxidized & Disinfected[8]
IV	20	50	100	12	1,000	Oxidized
Direct Injection						
V	20	na[10]	na[10]	12	2,000	Organics Removal[9], Oxidized, Filtered, & Disinfected[7]

1 Alternatives to the requirements specified in this table may be accepted if the applicant demonstrates an equivalent degree of health protection.

2 This is a designation to identify a set of conditions for an acceptable project.

3 The above table is based on a 20% contribution of reclaimed water in recharged water. The percentage of reclaimed water in the recharged water may be increased to as much as 50% provided additional trace organics removal is accomplished to keep the total TOC contribution to no more than that level which would occur with a 5:1 dilution or 20% concentration. The maximum allowable TOC (mg/L) should comply with the performance standard listed in D-1. The percent contribution of reclaimed water may be determined by averaging over a maximum three year period of time.

4 Depth to groundwater is the minimum depth to groundwater during the life of the project.

5 Maximum percolation rate shall not exceed the listed values. Borings shall show the soil characteristics at least to the depths listed in this table. (see Engineering Report Guidelines in Appendix 3)

6 Horizontal distance measured from the injection well or closest edge of the recharge basin to the nearest point of extraction.

7 The median number of total coliform organisms does not exceed 2.2 MPN per 100 mL, as determined from the bacteriological results of the last 7 days for which analysis have been completed, and the number of total coliform organisms does not exceed 23 MPN per 100 mL in any sample.

8 The median number of total coliform organisms does not exceed 23 MPN per 100 mL, as determined from the bacteriological results of the last 7 days for which analysis have been completed, and the number of total coliform organisms does not exceed 240 MPN per 100 mL in any sample.

9 TOC not to exceed 1 mg/L based on a monthly average.

10 Not applicable.

from the bacteriological results of the last 7 days for which analysis have been completed, and the maximum number of total coliform organisms shall not exceed 23 MPN per 100 mL, or

b. For category III Projects in Table 1. The median number of total coliform organisms shall not exceed 23 MPN per 100 mL, as determined from the bacteriological results of the last 7 days for which analysis have been completed, and the maximum number of total coliform organisms shall not exceed 240 MPN per 100 mL.

Samples for coliform bacteria shall be collected each day reclaimed water is produced for groundwater recharge, at some point in the treatment process, and at a time when wastewater characteristics are most demanding on the treatment facilities and disinfection procedures (see Appendix 4).

2. Filtered Wastewater.

When filtration is required pursuant to Table 1, the turbidity of the filtered wastewater, as determined by an approved laboratory method, shall not exceed an average of 2 turbidity units (flow-proportioned average daily value) and shall not exceed 5 turbidity units more than 5 percent of the time during any 24-hour period. Continuous measurement and recording of the filtered wastewater turbidity is required prior to disinfection.

3. Oxidized Wastewater.

All reclaimed water used for groundwater recharge shall be oxidized. The oxidized wastewater shall meet limits of 20 mg/L total organic carbon (TOC), 30 mg/L suspended solids (SS), and 30 mg/L biochemical oxygen demand (BOD). Daily sampling and analysis for TOC, SS, and BOD are required. Compliance is based on a monthly average of the daily samples.

C. Minimum Soil Depth Requirement.

Reclaimed water used for groundwater recharge of domestic water supply aquifers by surface spreading shall percolate through an unsaturated zone of soil for a minimum vertical distance of 10 feet. Operational procedures to assure an aerobic zone between the ground surface and the groundwater table shall be developed and maintained.

D. Dilution Requirement and Maximum Allowable Organics Concentration.

Not more than 50 percent of the water withdrawn at any domestic well shall be reclaimed water; the remainder shall be dilution water as defined herein. The project sponsor must demonstrate that any waters used to meet the dilution requirements will contribute to each domestic withdrawal in the required percentage. No credit may be taken for dilution water of municipal wastewater origin. No credit may be taken for dilution water that is being considered dilution water for another recharge project or wastewater disposal project. This dilution requirement can be met by spreading appropriate amounts of other recharge water during the year. The dilution requirement can be met by averaging over no more than a 36-month period.

For projects where organics removal is not provided beyond secondary treatment (oxidized wastewater) and filtration (Categories II thru IV), the percent reclaimed water shall not exceed 20%. For category I projects using up to 50% reclaimed water, additional organics removal is required. In no case shall the water in any domestic supply well exceed 50% reclaimed water. The organics removal requirement must be met by the running annual average determined on a monthly basis. The monthly average shall be determined by averaging samples taken at least weekly during the month.

1. For Category I projects, the percent TOC removal required in reclaimed water after secondary treatment (oxidized wastewater) for recharge is defined by the following equation. This is the additional percent TOC removal that must be achieved by filtration and organics removal.

$$\%TOC_{removal} = \left(1 - \frac{20}{\%R}\right) * 100 * \frac{TOC_{oxid}}{15}$$

where

$\%TOC_{removal}$ = Percent by which the TOC of the secondary effluent must be reduced.

%R = Maximum percent of reclaimed water in groundwater at the point of extraction.

TOC_{oxid} = TOC in the secondary effluent (oxidized wastewater).

For Category V projects, the TOC of reclaimed water shall not exceed 1 mg/L based on a monthly average.

E. Water Quality Requirements.

1. Reclaimed Water Quality Requirements. The running annual average of inorganic chemicals (except nitrogen compounds), organic chemicals, and radioactivity in the reclaimed wastewater shall not exceed the maximum contaminant levels (California Code of Regulations, Title 22, Division 5, Part 1, Chapter 15) and current drinking water action levels recommended by the Department of Health Services. At least quarterly sampling and analysis shall be made.

2. Reclaimed Water Quality Requirements. The total nitrogen concentration of the reclaimed water shall not exceed 10 mg/L as N unless the project sponsor can demonstrate that the total nitrogen standard of 10 mg/L as N can be consistently met prior to reaching the first groundwater directly beneath the recharge basin. At least weekly sampling and analysis shall be made and compliance shall be based on a monthly average.

F. Groundwater Quality Requirements.

Domestic water wells or monitoring wells influenced by the recharge operation shall not exceed the maximum contaminant levels or action levels as a result of the recharge of reclaimed wastewater. Designated monitoring wells and selected representative domestic wells influenced by the recharge operation shall be sampled and analyzed for all constituents as specified in the California Code of Regulations (Title 22, Division 5, Part 1, Chapter 15), current drinking water action levels, and Guidelines for Monitoring Groundwater Recharge Projects (Appendix 4). All domestic water wells influenced by the recharge operation shall conform to the water quality requirements in Title 22, Division 5, Part 1, Chapter 15.

G. Reliability Requirements.

All applicable provisions of Article 10 of Chapter 3 of Title 22 of the California Code of Regulations shall apply (Sections 60341-60355).

H. Alternatives to Requirements.

Alternatives to the requirements specified in these criteria may be accepted if the project sponsor demonstrates and documents an equivalent degree of health protection.

I. Engineering Report

A report prepared by an engineer registered in California and experienced in the fields of wastewater treatment and public water supply, and prepared in conjunction with a geologist, experienced in hydrogeology and registered in California shall be submitted to the Regional Water Quality Control Boards (RWQCB). The RWQCBs shall follow the procedures specified in the Permitting Process Section of this document and consult with DHS during the planning and design phase of the project. The report shall clearly indicate the means for compliance with the criteria given in this document and comply with all aspects of the *Guidelines for the Preparation of an Engineering Report on the Proposed Use of Reclaimed Water for Groundwater Recharge* (Appendix 3).

REFERENCES

1 *Orange & Los Angeles Counties Water Reuse Study*, Facilities Plan, Vol 1, Chapt. 1-6, April 1982.

2 *A "State-of-the-Art" Review of Health Aspects of Wastewater Reclamation for Groundwater Recharge*, State of California, State Water Resources Control Board, Department of Water Resources, and Department of Health, November 1975.

3 *Report of the Consulting Panel on Health Aspects of Wastewater Reclamation for Groundwater Recharge*, prepared for the State of California, State Water Resources Control Board, Department of Water Resources, and Department of Health, June 1976.

4 *Health Effects Study, Final Report*, County Sanitation Districts of Los Angeles County, Prepared by M.H. Nellor, R.B. Baird, J.R. Smyth, March 1984.

5 *Report of the Scientific Advisory Panel on Groundwater Recharge with Reclaimed Wastewater*, prepared for State of California, State Water Resources Control Board, Department of Water Resources, and Department of Health Services, November 1987.

6 *The Porter-Cologne Water Quality Control Act*, Portions of the Water Code, State of California, January 1987.

APPENDICES

Appendix 1. Excerpts from Wastewater Reclamation Criteria (taken from *Wastewater Reclamation Criteria (1978): An Excerpt from the California Code of Regulations Title 22 Division 4 Environmental Health.*)

In 1978 the Department of Health Services adopted regulations establishing statewide reclamation criteria. Those criteria as they relate to groundwater recharge are contained in Title 22, Division 4, Chapter 3, Section 60320 of the California Code of Regulations:

> "(a) Reclaimed water used for ground water recharge of domestic water supply aquifers by surface spreading shall be at all times of a quality that fully protects public health. The State Department of Health Services recommendations to the Regional Water Quality Control Boards for proposed ground water recharge projects and the expansion of existing projects will be made on an individual case basis where the use of reclaimed water involves a potential risk to public health."
>
> "(b) The State Department of Health Services recommendations will be based on all relevant aspects of each project, including the following factors: treatment provided; effluent quality and quantity; spreading area operations; soil characteristics; hydrogeology; residence time; and distance to withdrawals."
>
> "(c) the State Department of Health Services will hold a public hearing prior to making the final determination regarding the public health aspects of each ground water recharge project. Final recommendations will be submitted to the Regional Water Quality Control Board in an expeditious manner."

Appendix 2. State Water Resources Control Board Resolution 68-16

STATEMENT OF POLICY WITH RESPECT TO MAINTAINING HIGH QUALITY OF WATERS IN CALIFORNIA

(Adopted October 24, 1968)

WHEREAS the California Legislature has declared that it is the policy of the State that the granting of permits and licenses for unappropriated water and the disposal of wastes into the waters of the State shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the state and shall be controlled so as to promote the peace, health, safety and welfare of the people of the State; and

WHEREAS water quality control policies have been and are being adopted for waters of the State; and

WHEREAS the quality of some waters of the State is higher than that established by the adopted policies and it is the intent and purpose of this Board that such higher quality shall be maintained to the maximum extent possible consistent with the declaration of the Legislature;

NOW, THEREFORE, BE IT RESOLVED:

1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

3. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act.

Appendix 3. Guidelines for the Preparation of an Engineering Report on the Proposed Use of Reclaimed Municipal Wastewater for Groundwater Recharge

Introduction

The *proposed Guidelines for Groundwater Recharge with Reclaimed Municipal Wastewater* require the submission of an engineering report to the Regional Water Quality Control Board before groundwater recharge projects using reclaimed water are implemented. The report shall be amended prior to any modifications to the project. The report shall describe the manner by which the projects will comply with the *criteria* for Groundwater Recharge with Reclaimed Municipal Wastewater contained in the *proposed Guidelines for Groundwater Recharge with Reclaimed Municipal Wastewater,* hereafter referred to as the "Guidelines."

Section I of the Criteria for a Planned Groundwater Recharge Project With Reclaimed Municipal Wastewater contained in the *Guidelines,* hereafter referred to as the "Criteria," specifies that the report be prepared and signed by an engineer, registered in California and experienced in the field of wastewater treatment, and a geologist registered in California and experienced in the field of hydrogeology.

The report must contain sufficient information to assure the regulatory agencies that the degree of treatment and reliability is commensurate with the site conditions, and that the use of reclaimed water will not create a hazard or nuisance.

Description of the Project

Provide a brief description of the project, the involved agencies, and their relationship. Where more than one agency is involved in the treatment, conveyance, spreading, and management, the responsibilities of each agency must be described. Describe the need for the project and the available alternatives for drinking water supply and wastewater disposal or reuse.

Groundwater Basin Description

A project will only be considered if the hydrogeology of the basin and the impact of the project on groundwater quality are well defined.

1. Provide a brief geographical description of the basin.

2. Water Supply Uses of Basin

   - Characterize the water uses and groundwater quality within the basin.
   - Determine the travel time from the recharge site X by plotting residence time isopleths for a maximum residence time of 100 years. Isopleths for the first 10 years shall be drawn in 1 year intervals and in 5 year increments thereafter.
   - Identify all water wells, including private wells, within two miles from the edge of the recharge basin that may be impacted. Describe their location, use, treatment, water quality monitoring program, and travel time from the recharge site to those wells.
   - Discuss adjudication or other basin management considerations.
   - Describe all water utilities and their service areas which obtain water from the basin.

3. Hydrogeology

   - Provide a description of the basin and project site including:
     - Soil Types
     - Percolation rates
     - Transmissivity values
     - Rates and direction of groundwater movement
     - Historic high and low depths to the groundwater table
     - Thickness of the aquifer being recharged
     - Location and properties of low permeability layers
     - Useable storage capacity of basin
     - Aspects of the basin not understood
     - Number of aquifers in the area, and their depth, extent, and thickness
     - Head differences between aquifers
     - Interconnection (leakage) between aquifers
     - Depth, extent, and thickness of confining beds
     - Water-level contour maps for each aquifer
     - Hydrologic nature of site, including recharge and discharge areas

4. Hydrogeological Investigations

- Provide a description of the impact of all recharge waters on the basin which includes a description of all types of recharge water; their quantities, qualities, points of application, and movement.
- Identify known sources of contamination and their impact on water quality.
- A quantitative description of groundwater extractions (e.g., hydrologic balance) and effects on groundwater recharge.
- Analysis and documentation to demonstrate compliance with the minimum time, and vertical and horizontal distance requirements described in Table 1 of the Criteria.

Wastewater to be Used

- Describe the chemical quality of the untreated wastewater
- Describe the proportion and types of industrial waste in the wastewater
- Describe the source control program of the POTW

Treatment Processes

- Indicate the proposed type of treatment to be used for this project, according to Table 1 in Criteria.
- Provide a schematic of the treatment processes.
- All design criteria used must be provided for each process. Where applicable, the expected turbidities of the filter influent (prior to the addition of chemicals) and the filter effluent must be stated.
- Describe the chemicals, including disinfectants, that will be used, the method of mixing, the point of application, and the dosages.

- Describe the plant reliability features proposed to comply with Sections 60341-60355 of the California Code of Regulations, Title 22. The discussion of each reliability feature must state under what conditions it will be actuated.

Reclaimed Water Quality

- Describe the quality of reclaimed water that is expected to be achieved by the treatment process. Provide the expected average and range of concentrations. Compare these values to the required water quality prescribed in the Criteria.

- Where a contaminant concentration could exceed a maximum contaminant level or action level, state the number of times this is anticipated to occur in each twelve month period, the level, and the possible duration.

- Report the uncharacterized fraction of TOC in the reclaimed water and describe the analytical method(s) used to characterize the known fraction of TOC.

- Describe the anticipated likelihood that hazardous substances will be present in the reclaimed water at harmful levels.

Transmission Systems

Provide maps showing the location of the transmission facilities from the treatment plant to the spreading area. The plans must include the location of all proximate water and sewer lines. The report must describe how the transmission systems will comply with the most recent editions of the following documents:

- *Guidelines for the Distribution of Non-potable Water*, California-Nevada Section AWWA.

- *Guidelines for the Use of Reclaimed Water*, Department of Health Services.

- *Regulations Relating to Cross-Connections*, (California Code of Regulations, Title 17, Chapter 5, Subchapter 1)

- *Manual of Cross Connection Control/Procedures and Practices*, Department of Health Services.

Any deviation from the above, and the necessity thereof, must be discussed in the report.

Description of Recharge Area and Operations

The following apply, as appropriate, to surface spreading or injection wells.

- Describe the recharge area
  - Show the location and extent of all spreading basins.
  - Show location of all injection wells.
  - Provide design specifications for injection wells.
  - Provide the depth to groundwater and its historical variations.
  - Provide well logs and site borings identifying subsurface materials and their properties.
  - Provide percolation data. The number and location of tests should be sufficient to characterize the maximum percolation rate over the proposed area and required unsaturated depth.
  - Infiltration rates (permeability) of the vadose zone are extremely variable and sensitive to test conditions. A list of test methods that may be applicable to such characterization is contained in the section entitled "Methods for Determining Permeability." The list is not exhaustive and other methods may be acceptable.

- Describe the recharge area operations
  - Provide the planned reclaimed water application rate(s) and schedule
  - Describe to sources and provide the planned dilution water application rate(s) and schedule

- Describe how the recharge operation will affect the depth to groundwater--describe the height and extent of the recharge mound.
- Show how the dilution requirement will be met.
- Describe recharge facility maintenance and rehabilitation program including any chemicals used.

Monitoring

The report must describe a proposed monitoring program that is consistent with the *Guidelines for Monitoring of Groundwater Recharge Projects* (see Appendix 4).

Contingency Plan

The engineering report shall contain a contingency plan designed to prevent inadequately treated wastewater from being delivered to the recharge area. The "Contingency Plan" should include:

- A list of conditions which would require an immediate diversion from the recharge site.
- A description of the diversion procedures;
- Designation of the diversion area;
- A plan for the disposal or treatment of any inadequately treated effluent;
- A plan for project operator to notify the Regional Board, the state and local health departments, and other agencies as appropriate of any treatment failures that could result in the delivery of inadequately treated wastewater to the recharge area.
- A plan for supplying water if the basin is contaminated.

Methods for Determining Permeability

Bouwer, H., 1961 A Double-Tube Method for Measuring Hydraulic Conductivity of Soil Insitu Above a Water Table. Soil Sci. Soc. Am. Proc. 25: 334-339

Topp, G. C., and M. R. Binns, 1962, Field Measurements of Hydraulic Conductivity with a Modified Air Entry Permeameter.

Bouwer, H., and R. D. Jackson, 1974, Determining soil Properties. In Drainage for Agriculture. J. van Schilfgaarde (ed.), Agronomy Monograph No. 17, Am, Soc. Agron., Madison, WI, P. 611-672

Boersma, L. 1965, Field Measurement of Hydraulic Conductivity Above a Water Table. Methods of Soil Analysis, Pt. 1. Agronomy 9: 234-252.

Reynolds, W. D., and Erlick, D. E., 1986, A Method for Simultaneous Insitu Measurement in the Vadose Zone of Field Saturated Hydraulic Conductivity, Sorptivity and the Conductivity Pressure Head Relationship, Ground Water Monitoring Rev. p. 84-95.

ASTM Standard D 3385-75, "Standard Test Method for Infiltration Rate of Soils in Field Using double-Ring Infiltrometers".

Stephens, D. B., and S. P. Neuman, 1982, Vadose Zone Permeability Tests: Summary, Am. Soc. Civil Eng. Proc. J. Hydraul. Div. V. 108, No. HY5, pp. 623-639

Bouwer, H., 1967, Field Measurements of Saturated Hydraulic Conductivity in Initially Unsaturated Soils. IASH Pub. No. 72, pp. 243-251.

Appendix 4. Guidelines for Monitoring of Groundwater Recharge Projects

Introduction

Careful evaluation shall be made of the water quality of all source waters to be recharged as well as existing groundwater in the recharge area. The fundamental purpose of a monitoring program is to provide early detection of potential impacts on groundwater quality resulting from the recharge operation. The resulting data should be sufficiently sensitive to permit cessation or modification of recharge in the event that any degradation of groundwater quality is observed. Elements of knowledge required include: (a) the quality of existing groundwater, (b) the quality of the recharge water, (c) the quality of other major sources affecting groundwater quality, and (d) the quality of the water pumped from the groundwater basin.

It is important that the characteristics of the groundwater basin be defined to such a degree that an appropriate number of monitoring wells can be located. Monitoring frequency should relate to the rate of groundwater recharge and movement of groundwater in the aquifer. It is necessary to build a representative background database. Monthly, bimonthly, or quarterly monitoring may be necessary to accomplish this task. Subsequent monitoring frequency should be adjusted so that chemical changes or trends can be detected. Quarterly, semi-annual, or even annual monitoring may be sufficient in some cases. If a rapid increase is noted for a contaminant(s) at a particular source, prudence dictates confirmation of the finding. Depending upon the outcome of the reexamination, the monitoring frequency may need to be adjusted.

The types of analyses include inorganic chemicals, organic chemicals, radioactivity, and microbiology. A complete inventory of the major constituents and selected physical properties of the reclaimed water and the existing groundwater must be compiled. The inventory should include all constituents for which an action level or maximum contaminant level has been established by the State Department of Health Services.

Monitoring of Water Recharged and Extracted

The monitoring program should include all sources of recharged water and water from monitoring and extraction wells.

1. Types of Analyses Required

As a *minimum*, analyses shall be made for the following constituents:

a. General Mineral: Analyses for the compounds listed in or added to the secondary drinking water standards in the California Code of Regulations, Title 22 Section 64473, Tables 6 and 7.

b. General Physical: Analyses for the compounds listed in or added to the secondary drinking water standards in the California Code of Regulations, Title 22 Section 64473, Tables 6 and 7.

c. Inorganic Chemical: Analyses for the compounds listed in or added to the primary drinking water standards (MCLs) in the California Code of Regulations, Title 22 Section 64435, Tables 2 and 3.

d. Natural Radioactivity: Analyses for the compounds listed in or added to the primary drinking water standards (MCLs) in the California Code of Regulations, Title 22 Section 64443, Table 4.

e. Man-made Radioactivity: Analyses for the compounds listed in or added to the primary drinking water standards (MCLs) in the California Code of Regulations, Title 22 Section 64443, Table 4.

f. Organic Chemicals: Analyses for the compounds listed in or added to the primary drinking water standards, (MCLs, California Code of Regulations, Title 22 Section 64444.5, Table 5), the action level list, and list of unregulated organics. Pesticide monitoring shall be conducted at the discretion of the RWQCBs. In addition, analyses shall be conducted for base-neutral-acid extractable components and purgeable organics as required by RWQCBs. Project sponsor is required to report any unidentified peaks or compounds that may be present in the water sample.

g. General Microbiological: At the discretion of the RWQCBs, the recharge water and groundwater shall be analyzed for microbiological parameters, including viruses, listed in or added to the criteria set forth in this document and any microbiological contaminants listed in or added to the primary drinking water standards.

The RWQCBs may, at their discretion or after consideration of recommendations and justification from DHS, increase the list of any of these components.

2. Frequency of Monitoring

The recharge water and groundwater water should be monitored at the same frequency as required by the California Code of Regulations Title 22, Sections 64401-64475 for vulnerable water resources unless otherwise specified. Monitoring plans shall be submitted to DHS for review and approval prior to adoption by the RWQCBs. Monitoring reports shall be submitted monthly.

3. Procedures for Monitoring

1. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

2. The project operator shall retain records of all monitoring information, including all calibration and maintenance of monitoring instrumentation, copies of all reports required, and records of all data used for a period of at least three years from the date of the sample, measurement, report, or application. This period may be extended by request of the Regional Board at any time and shall be extended during the course of any unresolved litigation regarding groundwater recharge. Records of monitoring information shall include:

   a. The date, exact place, and time of sampling or measurements;

   b. The names of the individual(s) who performed the sampling or measurements;

   c. The date(s) analyses were performed;

d. The names of the individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

3. All sampling, sample preservation, and analyses shall be conducted according to test procedures approved by the Department of Health Services.

4. All chemical, bacteriological, and bioassay analyses shall be conducted at a laboratory certified for such analyses by the State Department of Health Services.

5. The project sponsor's laboratory shall calibrate and perform maintenance procedures on all monitoring instruments and equipment to insure accuracy of measurements.

Appendix B

TITLE 22 REGULATIONS

(Next page is 1701)

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WASTEWATER RECLAMATION CRITERIA

An Excerpt from the

CALIFORNIA ADMINISTRATIVE CODE
TITLE 22, DIVISION 4

ENVIRONMENTAL HEALTH

1978

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES
SANITARY ENGINEERING SECTION
2151 Berkeley Way, Berkeley 94704

INTENT OF REGULATIONS

The intent of these regulations is to establish acceptable levels of constituents of reclaimed water and to prescribe means for assurance of reliability in the production of reclaimed water in order to ensure that the use of reclaimed water for the specified purposes does not impose undue risks to health. The levels of constituents in combination with the means for assurance of reliability constitute reclamation criteria as defined in Section 13520 of the California Water Code.

As affirmed in Sections 13510 to 13512 of the California Water Code, water reclamation is in the best public interest and the policy of the State is to encourage reclamation. The reclamation criteria are intended to promote development of facilities which will assist in meeting water requirements of the State while assuring positive health protection. Appropriate surveillance and control of treatment facilities, distribution systems, and use areas must be provided in order to avoid health hazards. Precautions must be taken to avoid direct public contact with reclaimed wate which do not meet the standards specified in Article 5 for nonrestricteu recreational impoundments.

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CHAPTER 3. RECLAMATION CRITERIA

Article 1. Definitions

60301. Definitions. (a) **Reclaimed Water.** Reclaimed water means water which, as a result of treatment of domestic wastewater, is suitable for a direct beneficial use or a controlled use that would not otherwise occur.

(b) **Reclamation Plant.** Reclamation plant means an arrangement of devices, structures, equipment, processes and controls which produce a reclaimed water suitable for the intended reuse.

(c) **Regulatory Agency.** Regulatory agency means the California Regional Water Quality Control Board in whose jurisdiction the reclamation plant is located.

(d) **Direct Beneficial Use.** Direct beneficial use means the use of reclaimed water which has been transported from the point of production to the point of use without an intervening discharge to waters of the State.

(e) **Food Crops.** Food crops mean any crops intended for human consumption.

(f) **Spray Irrigation.** Spray irrigation means application of reclaimed water to crops by spraying it from orifices in piping.

(g) **Surface Irrigation.** Surface irrigation means application of reclaimed water by means other than spraying such that contact between the edible portion of any food crop and reclaimed water is prevented.

(h) **Restricted Recreational Impoundment.** A restricted recreational impoundment is a body of reclaimed water in which recreation is limited to fishing, boating, and other non-body-contact water recreation activities.

(i) **Nonrestricted Recreational Impoundment.** A nonrestricted recreational impoundment is an impoundment of reclaimed water in which no limitations are imposed on body-contact water sport activities.

(j) **Landscape Impoundment.** A landscape impoundment is a body of reclaimed water which is used for aesthetic enjoyment or which otherwise serves a function not intended to include public contact.

(k) **Approved Laboratory Methods.** Approved laboratory methods are those specified in the latest edition of "Standard Methods for the Examination of Water and Wastewater", prepared and published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation and which are conducted in laboratories approved by the State Department of Health.

(l) **Unit Process.** Unit process means an individual stage in the wastewater treatment sequence which performs a major single treatment operation.

(m) **Primary Effluent.** Primary effluent is the effluent from a wastewater treatment process which provides removal of sewage solids so that it contains not more than 0.5 milliliter per liter per hour of settleable solids as determined by an approved laboratory method.

(n) **Oxidized Wastewater.** Oxidized wastewater means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

(o) **Biological Treatment.** Biological treatment means methods of wastewater treatment in which bacterial or biochemical action is intensified as a means of producing an oxidized wastewater.

(p) **Secondary Sedimentation.** Secondary sedimentation means the removal by gravity of settleable solids remaining in the effluent after the biological treatment process.

(q) **Coagulated Wastewater.** Coagulated wastewater means oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated by the addition of suitable floc-forming chemicals or by an equally effective method.

(r) **Filtered Wastewater.** Filtered wastewater means an oxidized, coagulated, clarified wastewater which has been passed through natural undisturbed soils or filter media, such as sand or diatomaceous earth, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 turbidity units and does not exceed 5 turbidity units more than 5 percent of the time during any 24-hour period.

(s) **Disinfected Wastewater.** Disinfected wastewater means wastewater in which the pathogenic organisms have been destroyed by chemical, physical or biological means.

(t) **Multiple Units.** Multiple units means two or more units of a treatment process which operate in parallel and serve the same function.

(u) **Standby Unit Process.** A standby unit process is an alternate unit process or an equivalent alternative process which is maintained in operable condition and which is capable of providing comparable treatment for the entire design flow of the unit for which it is a substitute.

(v) **Power Source.** Power source means a source of supplying energy to operate unit processes.

(w) **Standby Power Source.** Standby power source means an automatically actuated self-starting alternate energy source maintained in immediately operable condition and of sufficient capacity to provide necessary service during failure of the normal power supply.

(x) **Standby Replacement Equipment.** Standby replacement equipment means reserve parts and equipment to replace broken-down or worn-out units which can be placed in operation within a 24-hour period.

(y) **Standby Chlorinator.** A standby chlorinator means a duplicate chlorinator for reclamation plants having one chlorinator and a duplicate of the largest unit for plants having multiple chlorinator units.

(z) **Multiple Point Chlorination.** Multiple point chlorination means that chlorine will be applied simultaneously at the reclamation plant and at subsequent chlorination stations located at the use area and/or some intermediate point. It does not include chlorine application for odor control purposes.

(aa) **Alarm.** Alarm means an instrument or device which continuously monitors a specific function of a treatment process and automatically gives warning of an unsafe or undesirable condition by means of visual and audible signals.

(bb) **Person.** Person also includes any private entity, city, county, district, the State or any department or agency thereof.

NOTE: Authority cited. Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13521, Water Code.

History: 1. New Chapter 4 (§§ 60301–60357, not consecutive) filed 4-2-75; effective thirtieth day thereafter (Register 75, No. 14).

2. Renumbering of Chapter 4 (Sections 60301–60357, not consecutive) to Chapter 3 (Sections 60301–60357, not consecutive), filed 10-14-77; effective thirtieth day thereafter (Register 77, No. 42).

Article 2. Irrigation of Food Crops

60303. **Spray Irrigation.** Reclaimed water used for the spray irrigation of food crops shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters and the number of coliform organisms does not exceed 23 per 100 milliliters in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.

60305. **Surface Irrigation.** (a) Reclaimed water used for surface irrigation of food crops shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

(b) Orchards and vineyards may be surface irrigated with reclaimed water that has the quality at least equivalent to that of primary effluent provided that no fruit is harvested that has come in contact with the irrigating water or the ground.

60307. **Exceptions.** Exceptions to the quality requirements for reclaimed water used for irrigation of food crops may be considered by the State Department of Health on an individual case basis where the reclaimed water is to be used to irrigate a food crop which must undergo extensive commercial, physical or chemical processing sufficient to destroy pathogenic agents before it is suitable for human consumption.

Article 3. Irrigation of Fodder, Fiber, and Seed Crops

60309. **Fodder, Fiber, and Seed Crops.** Reclaimed water used for the surface or spray irrigation of fodder, fiber, and seed crops shall have a level of quality no less than that of primary effluent.

60311. **Pasture for Milking Animals.** Reclaimed water used for the irrigation of pasture to which milking cows or goats have access shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

Article 4. Landscape Irrigation

60313. **Landscape Irrigation.** (a) Reclaimed water used for the irrigation of golf courses, cemeteries, freeway landscapes, and landscapes in other areas where the public has similar access or exposure shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if the median number of coliform organisms in the effluent does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 240 per 100 milliliters in any two consecutive samples.

(b) Reclaimed water used for the irrigation of parks, playgrounds, schoolyards, and other areas where the public has similar access or exposure shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater or a wastewater treated by a sequence of unit processes that will assure an equivalent degree of treatment and reliability. The wastewater shall be considered adequately disinfected if the median number of coliform organisms in the effluent does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of coliform organisms does not exceed 23 per 100 milliliters in any sample.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

History: 1. Amendment filed 9-22-78; effective thirtieth day thereafter (Register 78, No. 38).

Article 5. Recreational Impoundments

60315. **Nonrestricted Recreational Impoundment.** Reclaimed water used as a source of supply in a nonrestricted recreational impoundment shall be at all times an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters and the number of coliform organisms does not exceed 23 per 100 milliliters in more than one sample within any 30-day period. The median value shall be determined from the bacteriological results of the last 7 days for which analyses have been completed.

60317. **Restricted Recreational Impoundment.** Reclaimed water used as a source of supply in a restricted recreational impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

60319. **Landscape Impoundment.** Reclaimed water used as a source of supply in a landscape impoundment shall be at all times an adequately disinfected, oxidized wastewater. The wastewater shall be considered adequately disinfected if at some location in the treatment process the median number of coliform organisms does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed.

Article 5.1. Groundwater Recharge

60320. **Groundwater Recharge.** (a) Reclaimed water used for groundwater recharge of domestic water supply aquifers by surface spreading shall be at all times of a quality that fully protects public health. The State Department of Health Services' recommendations to the Regional Water Quality Control Boards for proposed groundwater recharge projects and for expansion of existing projects will be made on an individual case basis where the use of reclaimed water involves a potential risk to public health.

(b) The State Department of Health Services' recommendations will be based on all relevant aspects of each project, including the following factors: treatment provided; effluent quality and quantity; spreading area operations; soil characteristics; hydrogeology; residence time; and distance to withdrawal.

(c) The State Department of Health Services will hold a public hearing prior to making the final determination regarding the public health aspects of each groundwater recharge project. Final recommendations will be submitted to the Regional Water Quality Control Board in an expeditious manner.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

History: 1. New Article 5.1 (Section 60320) filed 9-22-78; effective thirtieth day thereafter (Register 78, No. 38).

Article 5.5. Other Methods of Treatment

60320.5. **Other Methods of Treatment.** Methods of treatment other than those included in this chapter and their reliability features may be accepted if the applicant demonstrates to the satisfaction of the State Department of Health that the methods of treatment and reliability features will assure an equal degree of treatment and reliability.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

History: 1. Renumbering of Article 11 (Section 60357) to Article 5.5 (Section 60320.5) filed 9-22-78; effective thirtieth day thereafter (Register 78, No. 38).

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Article 6. Sampling and Analysis

60321. **Sampling and Analysis.** (a) Samples for settleable solids and coliform bacteria, where required, shall be collected at least daily and at a time when wastewater characteristics are most demanding on the treatment facilities and disinfection procedures. Turbidity analysis, where required, shall be performed by a continuous recording turbidimeter.

(b) For uses requiring a level of quality no greater than that of primary effluent, samples shall be analyzed by an approved laboratory method of settleable solids.

(c) For uses requiring an adequately disinfected, oxidized wastewater, samples shall be analyzed by an approved laboratory method for coliform bacteria content.

(d) For uses requiring an adequately disinfected, oxidized, coagulated, clarified, filtered wastewater, samples shall be analyzed by approved laboratory methods for turbidity and coliform bacteria content.

Article 7. Engineering Report and Operational Requirements

60323. **Engineering Report.** (a) No person shall produce or supply reclaimed water for direct reuse from a proposed water reclamation plant unless he files an engineering report.

(b) The report shall be prepared by a properly qualified engineer registered in California and experienced in the field of wastewater treatment, and shall contain a description of the design of the proposed reclamation system. The report shall clearly indicate the means for compliance with these regulations and any other features specified by the regulatory agency.

(c) The report shall contain a contingency plan which will assure that no untreated or inadequately-treated wastewater will be delivered to the use area.

60325. **Personnel.** (a) Each reclamation plant shall be provided with a sufficient number of qualified personnel to operate the facility effectively so as to achieve the required level of treatment at all times.

(b) Qualified personnel shall be those meeting requirements established pursuant to Chapter 9 (commencing with Section 13625) of the Water Code.

60327. **Maintenance.** A preventive maintenance program shall be provided at each reclamation plant to ensure that all equipment is kept in a reliable operating condition.

60329. **Operating Records and Reports.** (a) Operating records shall be maintained at the reclamation plant or a central depository within the operating agency. These shall include: all analyses specified in the reclamation criteria; records of operational problems, plant and equipment breakdowns, and diversions to emergency storage or disposal; all corrective or preventive action taken.

(b) Process or equipment failures triggering an alarm shall be recorded and maintained as a separate record file. The recorded information shall include the time and cause of failure and corrective action taken.

(c) A monthly summary of operating records as specified under (a) of this section shall be filed monthly with the regulatory agency.

(d) Any discharge of untreated or partially treated wastewater to the use area, and the cessation of same, shall be reported immediately by telephone to the regulatory agency, the State Department of Health, and the local health officer.

60331. **Bypass.** There shall be no bypassing of untreated or partially treated wastewater from the reclamation plant or any intermediate unit processes to the point of use.

Article 8. General Requirements of Design

60333. **Flexibility of Design.** The design of process piping, equipment arrangement, and unit structures in the reclamation plant must allow for efficiency and convenience in operation and maintenance and provide flexibility of operation to permit the highest possible degree of treatment to be obtained under varying circumstances.

60335. **Alarms.** (a) Alarm devices required for various unit processes as specified in other sections of these regulations shall be installed to provide warning of:

(1) Loss of power from the normal power supply.
(2) Failure of a biological treatment process.
(3) Failure of a disinfection process.
(4) Failure of a coagulation process.
(5) Failure of a filtration process.
(6) Any other specific process failure for which warning is required by the regulatory agency.

(b) All required alarm devices shall be independent of the normal power supply of the reclamation plant.

(c) The person to be warned shall be the plant operator, superintendent, or any other responsible person designated by the management of the reclamation plant and capable of taking prompt corrective action.

(d) Individual alarm devices may be connected to a master alarm to sound at a location where it can be conveniently observed by the attendant. In case the reclamation plant is not attended full time, the alarm(s) shall be connected to sound at a police station, fire station or other full-time service unit with which arrangements have been made to alert the person in charge at times that the reclamation plant is unattended.

60337. **Power Supply.** The power supply shall be provided with one of the following reliability features:

(a) Alarm and standby power source.

(b) Alarm and automatically actuated short-term retention or disposal provisions as specified in Section 60341.

(c) Automatically actuated long-term storage or disposal provisions as specified in Section 60341.

Article 9. Alternative Reliability Requirements for Uses Permitting Primary Effluent

60339. **Primary Treatment.** Reclamation plants producing reclaimed water exclusively for uses for which primary effluent is permitted shall be provided with one of the following reliability features:

(a) Multiple primary treatment units capable of producing primary effluent with one unit not in operation.

(b) Long-term storage or disposal provisions as specified in Section 60341.

Article 10. Alternative Reliability Requirements for Uses Requiring Oxidized, Disinfected Wastewater or Oxidized, Coagulated, Clarified, Filtered, Disinfected Wastewater

60341. **Emergency Storage or Disposal.** (a) Where short-term retention or disposal provisions are used as a reliability feature, these shall consist of facilities reserved for the purpose of storing or disposing of untreated or partially treated wastewater for at least a 24-hour period. The facilities shall include all the necessary diversion devices, provisions for odor control, conduits, and pumping and pump back equipment. All of the equipment other than the pump back equipment shall be either independent of the normal power supply or provided with a standby power source.

(b) Where long-term storage or disposal provisions are used as a reliability feature, these shall consist of ponds, reservoirs, percolation areas, downstream sewers leading to other treatment or disposal facilities or any other facilities reserved for the purpose of emergency storage or disposal of untreated or partially treated wastewater. These facilities shall be of sufficient capacity to provide disposal or storage of wastewater for at least 20 days, and shall include all the necessary diversion works, provisions for odor and nuisance control, conduits, and pumping and pump back equipment. All of the equipment other than the pump back equipment shall be either independent of the normal power supply or provided with a standby power source.

(c) Diversion to a less demanding reuse is an acceptable alternative to emergency disposal of partially treated wastewater provided that the quality of the partially treated wastewater is suitable for the less demanding reuse.

(d) Subject to prior approval by the regulatory agency, diversion to a discharge point which requires lesser quality of wastewater is an acceptable alternative to emergency disposal of partially treated wastewater.

(e) Automatically actuated short-term retention or disposal provisions and automatically actuated long-term storage or disposal provisions shall include, in addition to provisions of (a), (b), (c), or (d) of this section, all the necessary sensors, instruments, valves and other devices to enable fully automatic diversion of untreated or partially treated wastewater to approved emergency storage or disposal in the event of failure of a treatment process, and a manual reset to prevent automatic restart until the failure is corrected.

60343. **Primary Treatment.** All primary treatment unit processes shall be provided with one of the following reliability features:

(a) Multiple primary treatment units capable of producing primary effluent with one unit not in operation.

(b) Standby primary treatment unit process.

(c) Long-term storage or disposal provisions.

60345. **Biological Treatment.** All biological treatment unit processes shall be provided with one of the following reliability features:

(a) Alarm and multiple biological treatment units capable of producing oxidized wastewater with one unit not in operation.

(b) Alarm, short-term retention or disposal provisions, and standby replacement equipment.

(c) Alarm and long-term storage or disposal provisions.

(d) Automatically actuated long-term storage or disposal provisions.

60347. **Secondary Sedimentation.** All secondary sedimentation unit processes shall be provided with one of the following reliability features:

(a) Multiple sedimentation units capable of treating the entire flow with one unit not in operation.

(b) Standby sedimentation unit process.

(c) Long-term storage or disposal provisions.

60349. **Coagulation.**

(a) All coagulation unit processes shall be provided with the following mandatory features for uninterrupted coagulant feed:

(1) Standby feeders,
(2) Adequate chemical stowage and conveyance facilities,
(3) Adequate reserve chemical supply, and
(4) Automatic dosage control.

(b) All coagulation unit processes shall be provided with one of the following reliability features:

(1) Alarm and multiple coagulation units capable of treating the entire flow with one unit not in operation;

(2) Alarm, short-term retention or disposal provisions, and standby replacement equipment;

(3) Alarm and long-term storage or disposal provisions;

(4) Automatically actuated long-term storage or disposal provisions, or

(5) Alarm and standby coagulation process.

60351. **Filtration.** All filtration unit processes shall be provided with one of the following reliability features:

(a) Alarm and multiple filter units capable of treating the entire flow with one unit not in operation.

(b) Alarm, short-term retention or disposal provisions and standby replacement equipment.

(c) Alarm and long-term storage or disposal provisions.

(d) Automatically actuated long-term storage or disposal provisions.

(e) Alarm and standby filtration unit process.

60353. **Disinfection.**

(a) All disinfection unit processes where chlorine is used as the disinfectant shall be provided with the following features for uninterrupted chlorine feed:

(1) Standby chlorine supply,
(2) Manifold systems to connect chlorine cylinders,
(3) Chlorine scales, and
(4) Automatic devices for switching to full chlorine cylinders.

Automatic residual control of chlorine dosage, automatic measuring and recording of chlorine residual, and hydraulic performance studies may also be required.

(b) All disinfection unit processes where chlorine is used as the disinfectant shall be provided with one of the following reliability features:

(1) Alarm and standby chlorinator;

(2) Alarm, short-term retention or disposal provisions, and standby replacement equipment;

(3) Alarm and long-term storage or disposal provisions;

(4) Automatically actuated long-term storage or disposal provisions; or

(5) Alarm and multiple point chlorination, each with independent power source, separate chlorinator, and separate chlorine supply.

60355. **Other Alternatives to Reliability Requirements.** Other alternatives to reliability requirements set forth in Articles 8 to 10 may be accepted if the applicant demonstrates to the satisfaction of the State Department of Health that the proposed alternative will assure an equal degree of reliability.

NPDES PERMIT

SGS

GEORGE DEUKMEJIAN, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD —
CENTRAL COAST REGION
1102 A LAUREL LANE
SAN LUIS OBISPO, CALIFORNIA 93401
(805) 549-3147

February 16, 1989

John Stratford, General Manager
Cambria Community Services District
P.O. Box 65
Cambria, CA 93428

Dear Mr. Stratford:

Enclosed is a copy of Order No. 89-07, "Waste Discharge Requirements for Cambria Community Services District, San Luis Obispo County," which was adopted by this Board on February 10, 1989.

Very truly yours,

CALIFORNIA REGIONAL WATER QUALITY
CONTROL BOARD, CENTRAL COAST REGION

By William R. Leonard
WILLIAM R. LEONARD
Executive Officer

JG:sm6

Enclosure

cs: U.S. Environmental Protection Agency
State Water Resources Control Board, DWQ, Attn.: Archie Matthews
State Department of Health Services, Santa Barbara
William C. Hanna, Coast Residents United, P.O. Box 1619, Cambria 93428

FEB 17 1989

ID#3 400102001

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
1102-A Laurel Lane
San Luis Obispo, California 93401

ORDER NO. 89-07
NPDES NO. CA0048615

WASTE DISCHARGE REQUIREMENTS
FOR
CAMBRIA COMMUNITY SERVICES DISTRICT
SAN LUIS OBISPO COUNTY

The California Regional Water Quality Control Board, Central Coast Region, (hereafter Board), finds:

1. The Cambria Community Services District (hereafter Discharger) operates a wastewater collection, treatment, and disposal system to provide sewerage service to the unincorporated community of Cambria.

2. On May 8, 1987, the Board issued Order No. 87-62, (NPDES Permit No. CA0048615), "Waste Discharge and Reclamation Requirements for Cambria Community Services District, San Luis Obispo County." On June 4, 1987, the State Water Resources Control Board (State Board) received a petition from Coastal Residents United seeking review of Order No. 87-62.

3. On June 16, 1988, the State Board adopted Order No. WQ88-06, remanding Order No. 87-62 to the Regional Board for reconsideration of: minimum ground water level differentials between the upgradient water supply well field and the downgradient spray disposal area; specific corrective actions to be taken if the ground water gradient is towards the water supply well field; and placing daily and instantaneous maximum effluent limitations on TDS and Sodium.

4. Maintenance of a minimum ground water level differential is necessary to protect the water supply well field from dissolved salts in the waste water discharge. The effluent limitation for total dissolved solids is based on maintaining the prescribed differential.

5. The Discharger's Wastewater Treatment Facility is located on property owned by the Discharger (Treatment-Section 27, T27S, R8E, MD B&M' Disposal-Section 9, T27S, R8E, MD B&M, or 35°36' N. Latitude, 121°7' W. Longitude), adjacent to Windsor Boulevard and southwest of Highway 1 in Cambria.

6. The treatment facility consists of flow equalization and grit removal facilities, two 0.5 MGD activated sludge treatment facilities (1.0 MGD total treatment capacity), two 0.3 MG holding ponds, and disinfection facilities. Effluent is pumped to the spray disposal area, which has an estimated 1.0 MGD capacity. Digested sludge is disposed at a private land disposal facility.

7. The discharge is sprayed onto a 51-acre land area shown on Attachments "B" "C" and "D", and located approximately 2 1/2 miles north of the treatment facility. Excess wasteflows are pumped to a 6 MG (18 ac-ft) effluent holding reservoir for redistribution to the land area or discharge through a slow-sandgravity filter to Van Gordon Creek at Discharge Point No. 1, approximately 1 1/2 miles from the Pacific Ocean. Van Gordon Creek is tributary to San Simeon Creek, which discharges to the Pacific Ocean.

8. The California Department of Health Services recommends specific disinfection and treatment standards for stream discharges based on the ratio of effluent flow to low stream flow during discharge. For San Simeon Creek this ratio varies from 25 to 57, based on 1970 to 1974 stream flow data for the months of November through March. This order implements the Department's recommendations.

9. Portions of the spray disposal area are currently used as pasture for cattle. Local landowners have approached the Discharger to purchase reclaimed water for reclamation uses.

10. The disposal area surface soils are generally sandy and silty clays, underlain by clays and impermeable bedrock of franciscan chert, volcanic rock, and sandstone. Permeabilities generally decrease with depth and distance from surface waters.

11. Depth of ground water at the disposal area was found to be 17 feet at the reservoir site, nine feet at the spray area, and shallowest near the springs westerly of Van Gordon Creek at a depth of four feet. Ground water movement within the disposal area is generally towards San Simeon Creek.

12. Cambria Community Services District's primary source of water supply is the San Simeon Creek well field, located approximately 2000 feet easterly of the disposal area. The San Simeon Valley Water Basin Management Program and Operation Manual was prepared by the Discharger to ensure degradation of water supply does not occur.

13. The Environmental Protection Agency and Board classify this discharge as a minor discharge.

14. The Water Quality Control Plan, Central Coastal Basin, (Basin Plan) was adopted by the Board on March 14, 1975, and approved by the State Water Resources Control Board on March 20, 1975. The Basin Plan incorporates statewide plans and policies by reference and contains a strategy for protecting beneficial uses of State waters.

15. Van Gordon Creek is an intermittent warmwater stream which flows during and immediately after rainfall. San Simeon Creek is an intermittent coldwater stream, which flows during the late fall, winter, and spring. Flushing of San Simeon Lagoon occurs when the sandbar is washed out by peak winter flows.

16. Existing and anticipated beneficial uses in the vicinity of the discharge include:

SURFACE WATERS:
a. Municipal and domestic supply;
b. Agricultural supply;
c. Industrial service supply;
d. Groundwater recharge;
e. Contact and non-contact water recreation;
f. Wildlife habitat;
g. Cold and warm freshwater habitat;
h. Fish migration; and,
i. Fish Spawning.

GROUNDWATERS:
a. Domestic supply; and,
b. Agricultural supply.

17. Waste discharge requirements for this discharge are exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21100, et seq.) in accordance with Section 13389 of the California Water Code, and Section 15301 of the California Code of Regulations.

18. A permit and the privilege to discharge waste into waters of the State is conditional upon the discharge complying with provisions of Division 7 of the California Water Code and of the Clean Water Act (as amended or as supplemented by implementing guidelines and regulations) and with any more stringent effluent limitations necessary to implement water quality control plans, to protect beneficial uses, and to prevent nuisance. This Order shall serve as a National

Pollutant Discharge Elimination System Permit pursuant to Section 402 of the Clean Water Act. Compliance with this Order should assure conditions are met and mitigate any potential changes in water quality due to the project.

19. On December 2, 1988, the Board notified the Discharger and interested agencies and persons of its intent to reconsider waste discharge requirements for the discharge and has provided them with a copy of the proposed order and an opportunity to submit written views and comments, and scheduled a public hearing.

20. In a public hearing on February 10, 1989, the Board heard and considered all comments pertaining to the discharge and found this Order consistent with the above findings.

IT IS HEREBY ORDERED, pursuant to authority in Sections 13263, 13377, and 13523 of the California Water Code, Cambria Community Services District, its agents, successors, and assigns, may discharge waste from the Wastewater Treatment Facility described above providing compliance is maintained with the following:

(Note: General permit conditions, definition of terms, explanation of what type sampling results may be compared with what limits, and the method of determining compliance, are contained in the attached "Standard Provisions and Reporting Requirements for National Pollutant Discharge Elimination System Permits," dated January, 1985. Applicable paragraphs are referenced in paragraph E.3. of this Order.)

A. Discharge Prohibitions

1. Discharge of treated wastewater at locations other than the disposal area or Discharge No. 1 (35°36′ N. Latitude, 121°7′ W. Longitude), both shown on Attachments "C" and "D", or where the discharge is part of a reclamation plan approved by the Executive Officer, is prohibited.

2. Use of Discharge Point No. 1 is prohibited unless the sand bar at the mouth of San Simeon Creek is breached and there is surface water continuity between the discharge point and the Pacific Ocean.

3. The disposal of wastes in a manner which causes static ground water levels at well No. 3 (9P2) to be 0.9 feet or more higher than at well No. 2 (SS4), for more than three months during any dry season, or which causes degradation of water quality at the production well field, is prohibited.

B. Effluent Limitations

1. Effluent daily dry weather flow shall not exceed a monthly average of 1.0 MGD (3758 m^3/day).

2. Effluent discharged to land areas, including effluent spray mists, shall be confined within the spray disposal area at all times.

3. Effluent discharge to land areas, including reclamation uses, shall not exceed the following limits:

Constituent	Units	(30-Day) Mean	Daily and Instantaneous Maximum
Chemical Oxygen Demand	mg/l	50	100
Settleable Solids	ml/l	0.1	0.3
Suspended Solids	mg/l	40	100
Total Dissolved	mg/l	1000*	1500

*Measurement of any three consecutive samples

4. Effluent discharged to Van Gordon Creek, Discharge No. 1, shall not exceed the following limits:

a. Removal efficiencies for Suspended Solids and Biochemical Oxygen Demand shall not be less than 85%;

b.

Constituent	Units	(7-Day) Mean	Daily and Instantaneous Maximum
Biochemical Oxygen Demand	mg/l	20	40
	lbs/day*	167	334
	Kg/day*	75.6	151
Suspended Solids	mg/l	30	60
	lbs/day*	250	500
	Kg/day*	113	227
Settleable Solids	ml/l	-	0.1
Turbidity	NTU	50	75
Toxicity Concentration	tu		0.59

Constituent	Units	(7-Day) Mean	Daily and Instantaneous Maximum
Total Chlorine Residual	mg/l	Undetectable	
Grease and Oil	mg/l	10	20
Dissolved Oxygen	mg/l	Minimum of 2.0 at any time.	
pH	-	Within limits of 6.5 to 8.3 at all times, and shall not change the normal ambient pH level more than 0.5 units.	

*These values are for maximum flow conditions. For flows less than 1.0 mgd, mass emission rates shall not exceed the "Maximum Allowable Mass Emission Rate."

During any 24-hour or 30-day period, the effluent mass emission rate shall not exceed the "Maximum Allowable Daily Mass Emission Rate."

5. Effluent discharged to Van Gordon Creek shall be continuously disinfected so, at some point in the treatment process, the median number of coliform organisms does not exceed 2.2 per 100 milliliters, as determined from the last seven (7) days for which analyses have been completed, and so the maximum number of coliform organisms does not exceed 240 per 100 milliliters.

6. The discharge shall not contain pesticides or herbicides in excess of the limiting concentrations set forth in the California Water Quality and Monitoring Regulations, California Code of Regulations, Title 22, Chapter 15, Article 4, Section 64435 or as prescribed in Chapter 4 of the Basin Plan.

7. Effluent spray areas and the effluent holding reservoir shall be located at least 100 feet from any domestic water well, food crop irrigation well, or surface water.

8. Effluent spray areas shall be managed to prevent effluent from ponding.

C. Receiving Water Limitations

1. The discharge shall not cause the following limits to be exceeded in Van Gordon Creek or San Simeon Creek:

Constituent	Maximum mg/l (Unless otherwise noted)
Aluminum	7.5
Arsenic	0.05
Beryllium	0.15
Boron	1.25
Cadmium	0.0045
Chromium	0.05
Cobalt	0.075
Copper	0.045
Fluoride	1.5
Iron	7.5
Lead	0.50
Lithium	3.75
Manganese	0.3
Mercury	0.0003
Molybdenum	0.015
Nickel	0.3
Selenium	0.01
Vanadium	0.15
Zinc	0.3
M.B.A.S.	0.2
Phenols	0.1
Polychlorinated Byphenyls	0.0003
Un-ionized Ammonia (NH_3 as N)	0.025
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
2, 4-D	0.1
2,4,5-TP Silvex	0.01

pH — Within limit of 7.0 to 8.3 at all times, and not changed more than 0.5 units.

Temperature — Maximum increase of 5°F above natural receiving water temperature

Turbidity (NTU) — Not to exceed the following:

Natural Turbidity* (NT), NTU	Maximum Increase
< 50	20%
50 <NT <100	10 NTU
>100	10%

*"Natural Turbidity" shall be determined from receiving water samples taken upstream of the discharge point.

2. The discharge shall not cause the dissolved oxygen concentration of Van Gordon Creek to be depressed below 5.0 mg/l, or the dissolved oxygen concentration of San Simeon Creek to be depressed below 7.0 mg/l.

3. The discharge shall not cause surface waters to be greater than 15 units or 10 percent above natural background color, whichever is greater.

4. The discharge shall not contain biostimulatory substances in concentrations which promote aquatic growths that cause nuisance or adversely affect beneficial uses.

5. The discharge shall not cause the median concentration of total coliform organisms in ground waters underlying effluent irrigation areas and the San Simeon Creek well field to be equal to or greater than 2.2 MPN/100ml over any seven day period.

6. The discharge shall not cause the nitrate-nitrogen (NO_3 as N) level of groundwater underlying effluent disposal and reclamation areas to exceed 8.0 mg/l.

7. The discharge shall not cause a violation of any applicable water quality standard for receiving waters adopted by the Regional Board or the State Water Resources Control Board as required by the Federal Water Pollution Control Act and regulations adopted thereunder.

E. Provisions

1. The requirements prescribed by this Order supersede the requirements prescribed by Order No. 87-62, adopted by the Board on May 8, 1987. Order No. 87-62 is hereby rescinded.

2. The Discharger shall comply with "Monitoring and Reporting Program No. 89-07," as ordered by the Executive Officer.

3. The following sections of the attached "Standard Provisions and Reporting Requirements for National Pollutant Discharge Elimination System Permits," dated January, 1985, apply to the discharger: A, General Permit Conditions, paragraphs 1-24; B, General Monitoring Requirements, paragraphs 1-7; C, General Reporting

Requirements, paragraph 1, 2, 4-17; E. Bypasses or Upsets, paragraphs 1, 2; F, Enforcement, paragraphs 1-6; and G, Definitions. Paragraph (a) of E.1. shall apply only if the bypass is for essential maintenance to assure efficient operation.

4. Objectionable odors of wastewater origin shall not be perceived beyond the limits of the wastewater treatment and disposal areas.

5. Use of the spray disposal area for growing of crops will require the Discharger to obtain prior approval from the Executive Officer of each proposal to assure compliance with Standard Provision A.24.

6. The Discharger shall institute whatever steps are necessary to insure compliance with Prohibition A.3., including but not limited to reduced production of domestic supply water from the production well field, and pumping of ground water from the spray disposal area.

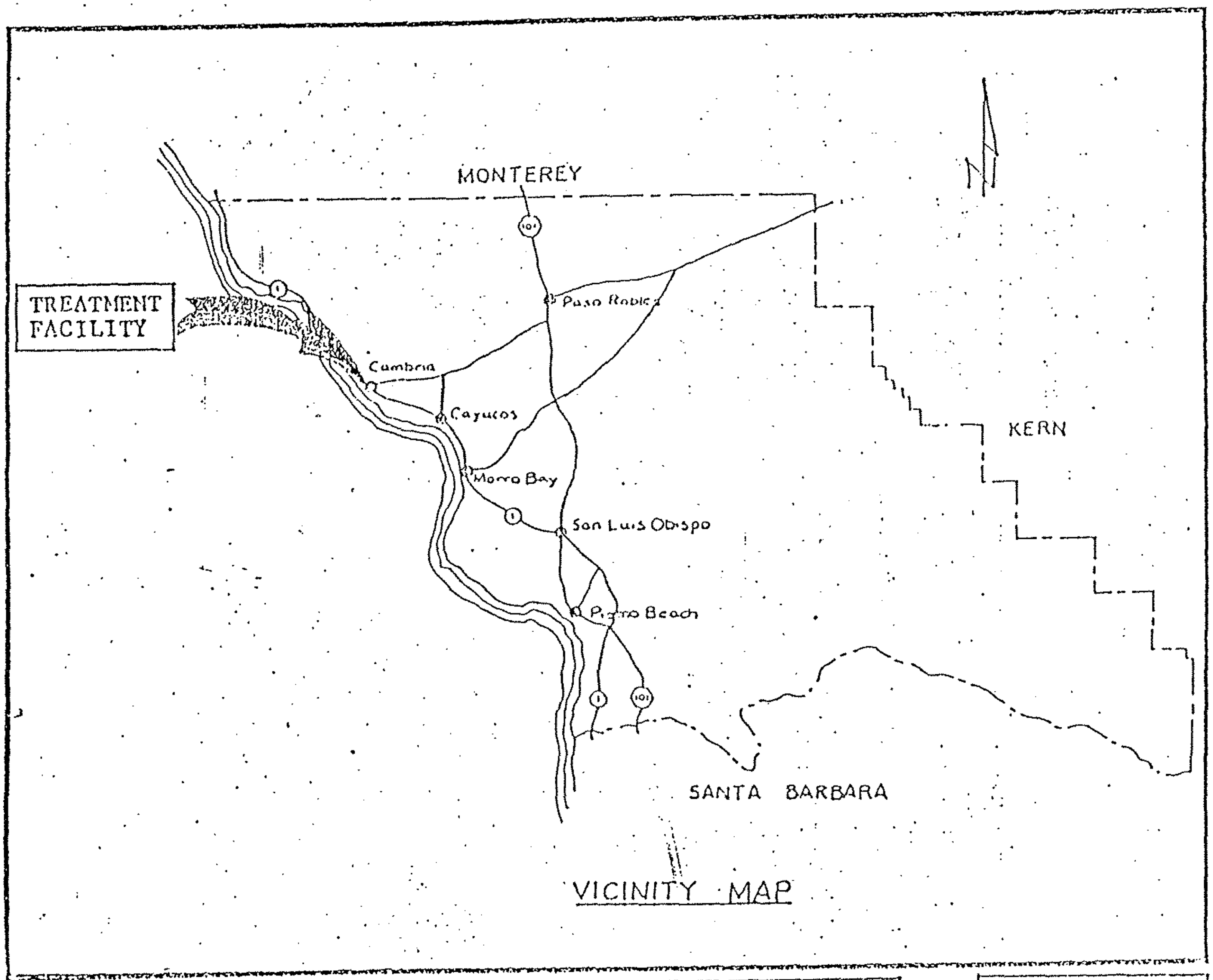
7. Should additional data become available through monitoring or investigation that indicates compliance with this order is not adequately protecting ground water, the Regional Board will review and revise this order as appropriate.

8. This Order expires March 1, 1992, and the Discharger must file a Report of Waste Discharge in accordance with Title 23, Chapter 3, Subchapter 9, of the California Code of Regulations, not later than September 1, 1991, if it wishes to continue the discharge.

I, WILLIAM R. LEONARD, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Coast Region, on February 10, 1989.

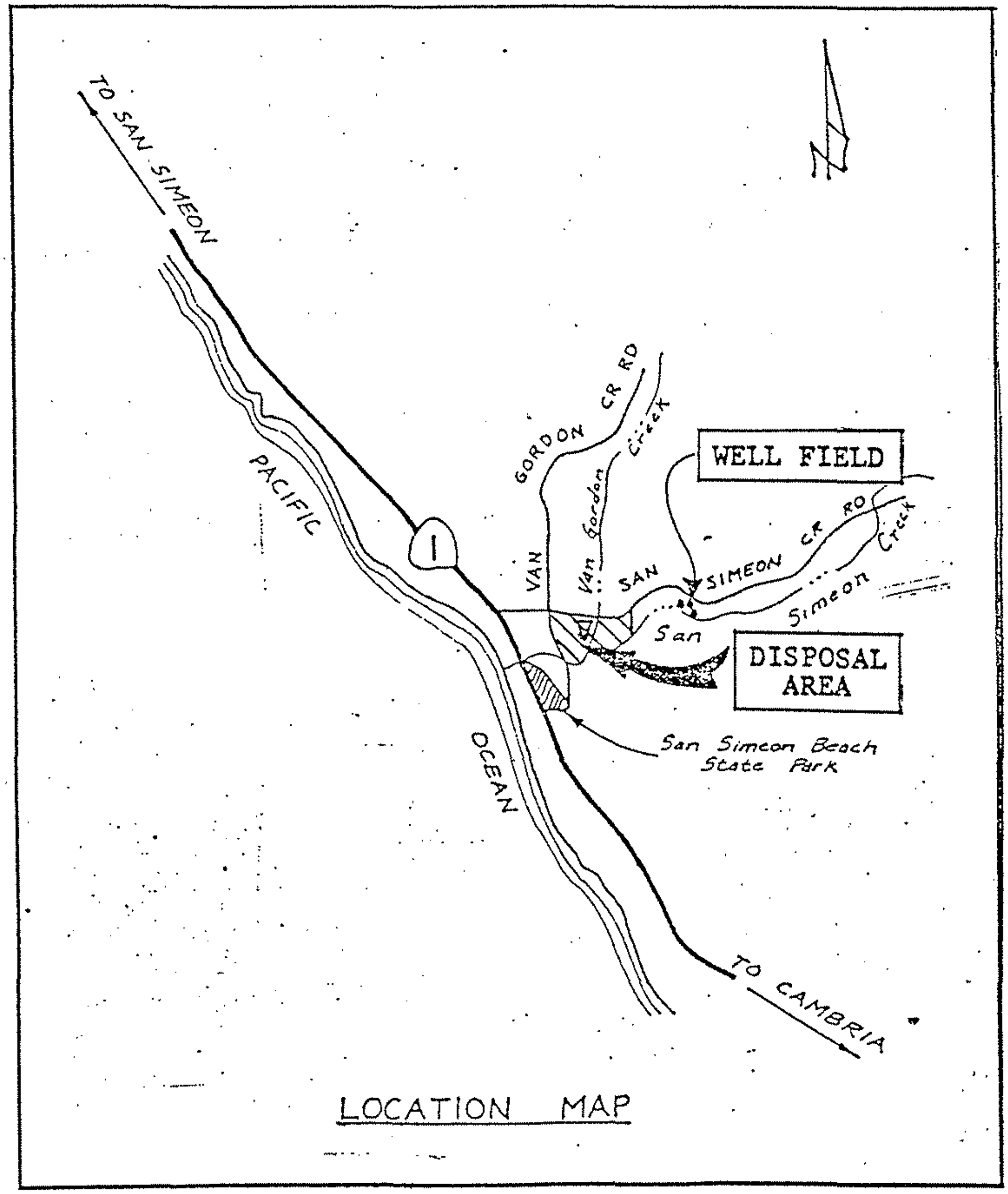
William R. Leonard
Executive Officer

sm6:89-07.WDR

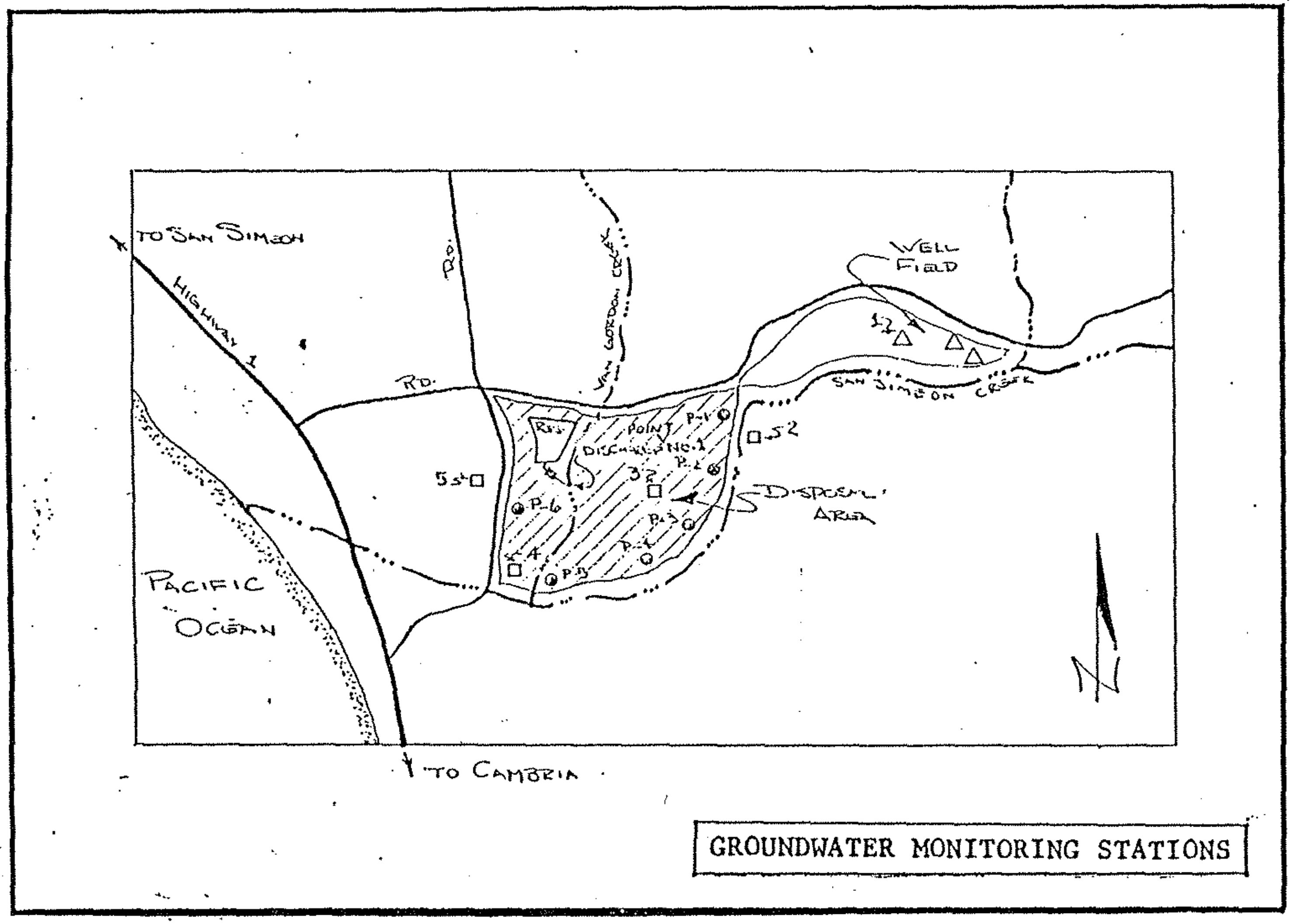


CAMBRIA COMMUNITY SERVICES DISTRICT

ATTACHMENT "A"

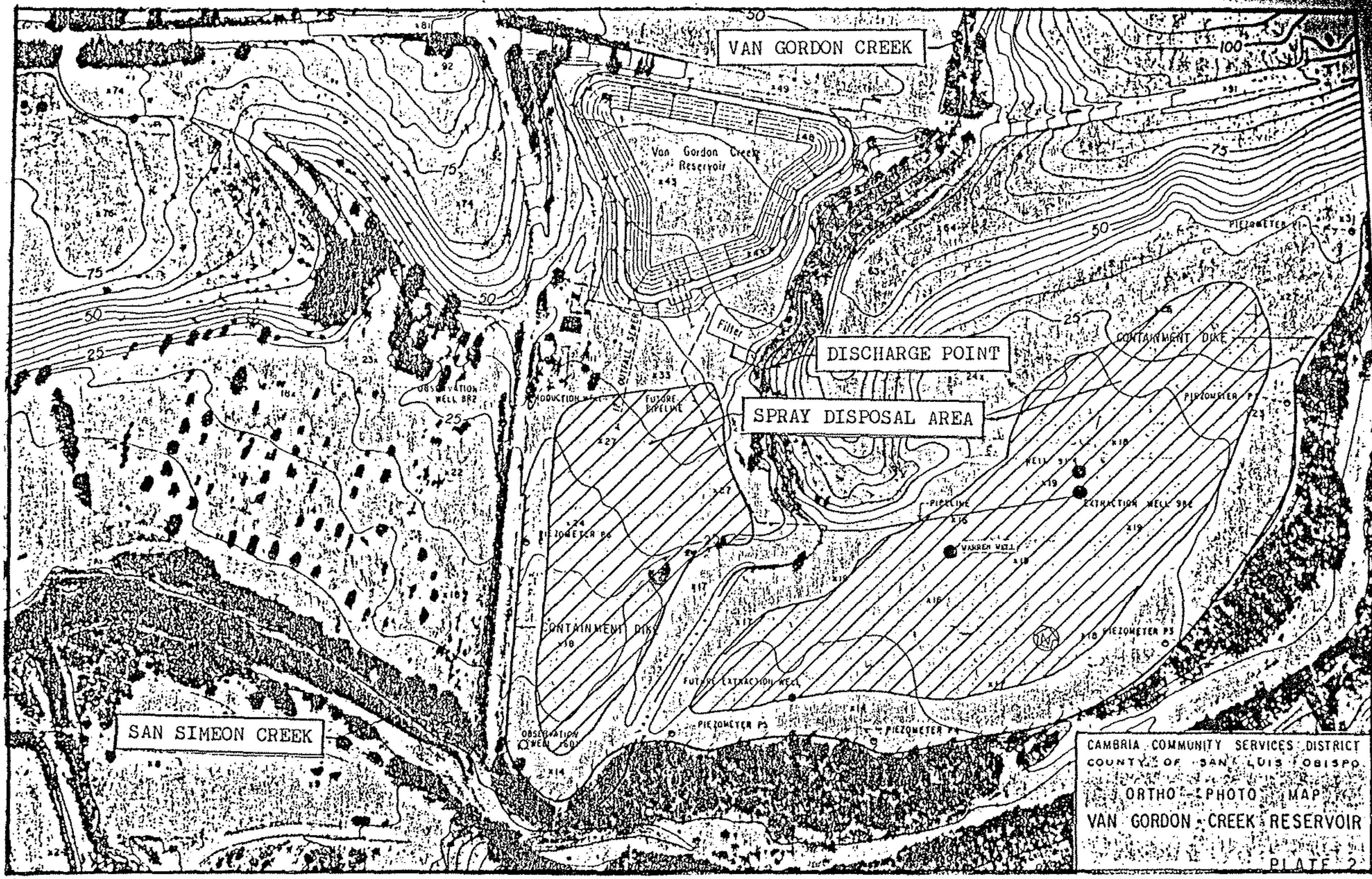


CAMBRIA COMMUNITY SERVICES DIST. | ATTACHMENT "B"



CAMBRIA COMMUNITY SERVICES DIST.

ATTACHMENT "C"



ATTACHMENT "D"

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COASTAL REGION

MONITORING AND REPORTING PROGRAM NO. 89-07
FOR
CAMBRIA COMMUNITY SERVICES DISTRICT
SAN LUIS OBISPO COUNTY

Water Supply Monitoring

Representative samples of the municipal water supply shall be collected and analyzed for the following constituents:

Constituent	Units	Type of Sample	Minimum Sampling and Analyzing Frequency
Total Dissolved Solids	mg/l	Grab	Quarterly (Jan.Apr.June & Oct)
Sodium	mg/l	Grab	" " " "
Chloride	mg/l	Grab	" " " "
Boron	mg/l	Grab	" " " "
Sulfate	mg/l	Grab	" " " "

Influent Monitoring

Samples of the influent to the treatment plant shall be collected at the plant headworks and analyzed for the following constituents:

Constituent	Units	Type of Sample	Minimum Sampling and Analyzing Frequency
Daily Flow	mgd	-	Daily
Instantaneous Maximum Flow Rate	mgd	-	"
Maximum Daily Flow	mgd	-	Monthly
Biochemical Oxygen Demand, 5-day	mg/l	24-hr. Composite	"
Chemical Oxygen Demand	mg/l	24-hr. Composite	Quarterly (Jan.Apr.July & Oct)
Suspended Solids	mg/l	24-hr. Composite	Once every two weeks (Monday)

Effluent Monitoring

Representative samples of the effluent applied to the spray disposal area shall be collected and analyzed for the following constituents:

Constituent	Units	Type of Sample	Minimum Sampling and Analyzing Frequency
Daily Flow	mgd	-	Daily
Settleable Solids	ml/l	Grab	"
pH	pH units	Grab	"
Suspended Solids	mg/l	24-hr. Composite	Weekly
Chemical Oxygen Demand	mg/l	24-hr. Composite	Once every two weeks (Monday)
Total Dissolved Solids	mg/l	24-hr. Composite	Quarterly (Jan.Apr.July & Oct)
Sodium	mg/l	24-hr. Composite	" " " "
Chloride	mg/l	24-hr. Composite	" " " "
Sulfate	mg/l	24-hr. Composite	" " " "
Boron	mg/l	Grab	Semi-Annually
Endrin	mg/l	Grab	Once every two years (July)
Lindane	mg/l	Grab	" "
Methoxychlor	mg/l	Grab	" "
Toxaphene	mg/l	Grab	" "
2, 4-D	mg/l	Grab	" "
2,4,5-TP Silvex	mg/l	Grab	" "

Representative samples of the effluent discharged at Point No. 1 shall be collected and analyzed for the following constituents:

Constituent	Units	Type of Sample	Minimum Sampling and Analyzing Frequency Discharging at Point 001
Daily Flow	Gallons	-	Daily
Total Chlorine Residual*	mg/l	Grab	"
Chorine Used	lbs/day	-	"
pH	pH units	Grab	"
Biochemical Oxygen Demand	mg/l	Grab	Weekly
Suspended Solids	mg/l	Grab	"
Turbidity	NTU	Grab	"
Dissolved Oxygen	mg/l	Grab	"
Color	CU	Grab	"
Grease and Oil	mg/l	Grab	"
Toxicity Bioassay	TU	Grab	Semi-Annually
Total Coliform Organisms	MPN/100 ml	Grab**	Daily

*To be analyzed by the Amperometric Titration Method.
**Sample may be obtained from any point in the treatment process.

Receiving Water Monitoring (Surface Waters)

Two receiving water monitoring stations shall be established (one approximately 100 feet upstream and one approximately 100 feet downstream of Discharge Point No. 1). Representative samples of the receiving water* shall be collected and analyzed for the following constituents:

Constituent	Units	Type of Sample	Minimum Sampling and Analyzing Frequency
**Total Ammonia (as N)	mg/l	Grab*	Weekly (when discharging to surface waters)
**Temperature	°F	Grab*	" " "
**pH	Units	Grab*	" " "
**Un-ionized Ammonia	mg/l	Calculated	" " "
Dissolved Oxygen	mg/l	Grab	" " "
Color	-	Grab	" " "
Turbidity	NTU	Grab	" " "
Aluminum	mg/l	6-hr. Composite*	Annually when discharging or Annually in May
Arsenic	mg/l	6-hr. Composite*	"
Beryllium	mg/l	6-hr. Composite*	"
Boron	mg/l	6-hr. Composite*	"
Cadmium	mg/l	6-hr. Composite*	"
Chromium	mg/l	6-hr. Composite*	"
Cobalt	mg/l	6-hr. Composite*	"
Copper	mg/l	6-hr. Composite*	"
Fluoride	mg/l	6-hr. Composite*	"
Iron	mg/l	6-hr. Composite*	"
Lead	mg/l	6-hr. Composite*	"
Lithium	mg/l	6-hr. Composite*	"
Magnesium	mg/l	6-hr. Composite*	"
Mercury	mg/l	6-hr. Composite*	"
Molybdenum	mg/l	6-hr. Composite*	"
Nickel	mg/l	6-hr. Composite*	"
Selenium	mg/l	6-hr. Composite*	"
Vanadium	mg/l	6-hr. Composite*	"
Zinc	mg/l	6-hr. Composite*	"
M.B.A.S.	mg/l	6-hr. Composite*	"
Polychlorinated Byphenyls	mg/l	6-hr. Composite*	"
Phenols	mg/l	Grab*	"
Endrin	mg/l	Grab*	"
Lindane	mg/l	Grab*	"
Methoxychlor	mg/l	Grab*	"
Toxaphene	mg/l	Grab*	"
2, 4-D	mg/l	Grab*	"
2,4,5-TP Silvex	mg/l	Grab*	"

*In order to keep the monitoring costs at a minimum, these receiving water constituents may be sampled in the effluent (1 station) instead of receiving water (2 stations). If review of analyses shows a constituent concentration exceeding an applicable receiving water limit, then three additional samples (one at Discharge Point No. 1 and one at each receiving water station) shall be promptly collected, analyzed and reported.

**Temperature and pH are to be measured at the same time the Total Ammonia sample is collected. Results shall be used to calculate and report Un-ionized Ammonia Concentrations.

Representative samples of the receiving water shall also be collected at a surface water monitoring station established at the east end of the coastal lagoon on San Simeon Creek, beneath the footbridge, and analyzed for the following constituents:

Constituent	Units	Minimum Sampling and Analyzing Frequency
Turbidity	NTU	Weekly (When discharging to surface waters) or annually in May
Color	Units	" " " "

At the time of receiving water sampling, a log shall be kept of receiving water conditions. Particular attention shall be given to the presence or absence of:

1. Floating or suspended matter,
2. Discoloration,
3. Foaming,
4. Aquatic, Plant & Animal life, and
5. Bottom deposits.

Receiving Water Monitoring (Groundwaters)

Representative samples of ground water shall be collected from five (5) designated wells and analyzed for the specified constituents:

Well No.	Cambria CSD or DWR Designation	Location Description (Refer to Attachment "C" of Requirements
1	SS3	Westernmost of three District water supply wells in Domestic Water Supply area.
2	SS4	Observation well on southeast bank of San Simeon Creek and east of Bonomi Ranch Discharge Area.

3	9P2	One of 4 older irrigation wells in approximate south-center of Bonomi Ranch Discharge Area.
4	16D1	A renovated well in southwestern corner of Bonomi Ranch Discharge Area near San Simeon Creek footbridge.
5	8R2	San Simeon Beach State Park water supply well west of Bonomi Ranch.

Constituent	Units	Type of Sample	Minimum Sampling and Analyzing Frequency
Nitrate (as N)	mg/l	Grab	Quarterly
Chloride	mg/l	Grab	Quarterly*
Sodium	mg/l	Grab	Quarterly*
Conductivity	umhos/cm	Grab	Quarterly*
Iron	mg/l	Grab	Quarterly (Jan.Apr.July,Oct)

* For these constituents, frequency for Wells No. 1, 2, and 3 shall be increased to twice a month when the water surface elevations of Well No. 9 P2 equals that of SS4; and increased to weekly when the water surface elevation of Well No. 9P2 is 0.9 feet or more above Well No. SS4.

In addition, static water surface elevations shall be measured at Well No. 1 (SS3) and Well No. 2 (SS4), and Well No. 3 (9P2) twice a month. Water surface elevations of 9P2 and SS4 shall be measured weekly when the water surface elevation of 9P2 is equal to or above that of SS4. All static water level measurements shall be made during periods when the District's well has been operated at peak operating pumping rates and wells within the disposal area and near 9P2 have not been operated within at least two hours. An annual summary of disposal area water surface elevations shall be submitted by July 20, of each year delineating the groundwater gradient between the spray disposal area and the San Simeon Creek well field.

Disposal Area Monitoring

The spray disposal area shall be inspected twice (morning and evening) each day effluent is spray irrigated at the disposal area. The inspector shall specifically check for: irrigation system malfunctions (such as leaks or sprinkler malfunctions); ponded effluent; overflows to Van Gordon or San Simeon Creek; the presence of abnormal, or a change in, flow conditions of Van Gordon or San Simeon Creek; and a discharge from the effluent holding reservoir.

An inspection log shall be kept of spray area conditions, observations, problems noted, and corrective actions taken. A summary of the log shall be included with each month's monitoring reports.

REPORTING

Monthly monitoring reports shall be submitted by the 20th day of each month following sampling. Receiving water resamples shall occur within two days of learning that a constituent exceeds an applicable limit.

ORDERED BY William R. Leonard
Executive Officer

February 10, 1989
Date

sm6

WATER QUALITY DATA

CAMBRIA COMMUNITY SERVICES DISTRICT
Summary of Sampling Data

2/20/91	CALIFORNIA STANDARDS		SAMPLING RESULTS												
			WASTEWATER EFFLUENT					EXTRACTION WELL 9P2				EXTRACTION WELL 9K2	PIEZOMETER 3	ALTERNATIVE WELL 9P3	PIEZOMETER 5
			DATES SAMPLES COLLECTED												
CONSTITUENT	MCL (mg/L)	SMCL (mg/L)	12/28/88	3/13/89	10/4/89	4/10/90	9/14/90	3/13/89	10/4/89	3/8/90	4/10/90	9/14/90	9/14/90	9/14/90	9/14/90
INORGANIC															
Arsenic	0.05	---				<0.005	<0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Aluminum	1.00	---				<0.200	<0.200			<0.2	<0.2	<0.2	21	0.3	5.2
Barium	1.00	---				0.06	0.1			0.140	0.130	0.18	0.24	0.16	0.26
Cadmium	0.010	---				<0.001	<0.001			<0.001	<0.001	<0.001	0.003	<0.001	<0.001
Chloride +	---	250		170			190	86	92	69	38	19	180	44	190
Chlorine	---	---													
Chromium	0.05	---				<0.005	<0.005			<0.005	<0.005	<0.005	0.069	<0.005	0.023
Copper	---	1.00		<0.05		<0.050	<0.050	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.05	<0.05
Total Dissolved Solids	---	500		690			1000	540	680	440	450	550	930	500	870
Fluoride	1.4-2.4 a)	---		0.3		0.2	<0.1	0.2	0.3	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hardness	---	---		270			400	370		330	320	360	570	340	520
Iron	---	0.3		0.07		<0.050	<0.050	<0.05	<0.05	0.070	0.190	<0.05	0.07	0.08	0.07
Lead	0.05	---				<0.005	<0.005			<0.005	<0.005	0.018	0.17	<0.005	0.018
Manganese	---	0.05		0.04		<0.020	<0.020	<0.02	<0.02	<0.020	<0.020	<0.02	<0.02	0.2	0.17
Mercury	0.002	---				<0.0002	<0.0002			<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002
Nitrate (as N) +	10	---		12		110	0.1	7	8.4	15	8.4	1.3	23	<0.1	0.1
pH (std. units) +	6.5-8.5	6.5-8.5		7.3		6.8	7.2	7.1	7.1	6.7	7.0	7.1	7.1	7.5	7.4
Selenium	0.01	---				<0.005	<0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silver	0.05	0.09 **				<0.005	<0.005			<0.005	<0.005	<0.005	0.009	<0.005	<0.005
Sodium +	---	---		160		170	200	55	60	45	37	26	87	53	120
Sulfate +	---	250		77			95	63	77	61	55	73	120	74	95
Zinc	---	5		0.1		0.070	0.06	<0.05	<0.05	<0.050	<0.050	<0.05	<0.05	<0.05	<0.05
MISCELLANEOUS ORGANIC															
Carbon-Alcohol Extract	---	---													
Carbon-Chloroform Extract	---	---													
Foaming Agents (MBAS)	---	0.5		0.8		0.09	0.05	<0.02		0.11	<0.02	<0.02	<0.02	<0.02	<0.02
Total Trihalomethanes (TTHMs)	0.001 b)	---								0.01					
Bromodichloromethane	5a,b)						0.0061			N.D.		ND	ND	ND	ND
Bromoform	5b,c)						ND			N.D.		ND	ND	ND	ND
Chloroform	5a,b,c)						0.04			0.01		ND	0.0011	ND	ND
Dibromochloromethane	5c)						ND			N.D.		ND	ND	ND	ND

Trichlorobenzene										
CHLORINATED HYDROCARBONS										
Endrin	0.0002	---		ND	N.T.		ND	ND	ND	ND
Lindane	0.004	---		ND	N.T.		ND	ND	ND	ND
Methoxychlor	0.1	---		ND	N.T.		ND	ND	ND	ND
Toxaphene	0.005	---		ND	N.T.		ND	ND	ND	ND
CHLOROPHENOXYS										
2,4-D	0.1	---		ND	N.T.		ND	ND	ND	ND
2,4,5-TP Silvex	0.01	---		ND	N.T.		ND	ND	ND	ND
SYNTHETICS										
Atrazine	0.003	---		ND	N.T.		ND	ND	ND	ND
Bentazon	0.018	---			N.T.					
Benzene	0.001	---		ND	N.D.		ND	ND	ND	ND
Carbon Tetrachloride	0.0005	---		ND	N.D.		ND	ND	ND	ND
Dibromochloropropane				ND	N.T.		ND	ND	ND	ND
(DBCP)	0.0002	---								
1,4-Dichlorobenzene				ND			ND	ND	ND	ND
(P-DCB)	0.005	---			N.D.					
1,2-Dichloroethane	0.0005	---		ND	N.D.		ND	ND	ND	ND
1,1-Dichloroethylene	0.006	---		ND	N.D.		ND	ND	ND	ND
1,3-Dichloropropene	0.0005	---			N.D.					
Ethylbenzene	0.680	0.03 **		ND	N.D.		ND	ND	ND	ND
Ethylene Dibromide	0.00002	---		ND	N.T.		ND	ND	ND	ND
Molinate	0.02	---		ND	N.T.		ND	ND	ND	ND
Monochlorobenzene	0.030	---		ND	N.D.		ND	ND	ND	ND
Simazine	0.010	---		ND	N.T.		ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	0.001	---		ND	N.D.		ND	ND	ND	ND
Tetrachloroethylene	0.005	---		ND	N.D.		ND	ND	ND	ND
Thiobencarb	0.07	---		ND	N.T.		ND	ND	ND	ND
1,1,1-Trichloroethane	0.200	---		ND	N.D.		ND	ND	ND	ND
1,1,2-Trichloroethane	0.032	---		ND	N.D.		ND	ND	ND	ND
Trichloroethylene	0.005	---		ND	N.D.		ND	ND	ND	ND
Vinyl Chloride	0.0005	---		ND	N.D.		ND	ND	ND	ND
Xylenes (Total)	1.750	0.02 **		ND	N.D.		ND	ND	ND	ND
PHYSICAL PARAMETERS										
Asbestos (MF/L)	7 **	---								
Color Units (CU)	---	15	15	55	<3	<3	3	45	55	3
Taste & Odor				200			<1	<1	50	<1
(Threshold Odor Number)	3	3	<1		<1	<1				
Specific Conductance +										

(umhos/cm)	---	900	1300	1350		900		800	700				
Temperature (C)	---	---											
Turbidity (ntu)	0.5 c)	0.2 d)		2.0	3.4				1.0	1	21	10	2.7
Particle Count/ml													
(2.5-150 microns)	---	---											
RADIOLOGICAL FACTORS													
Gross Alpha	15 pCi/L	---			ND					ND	ND	ND	ND
Gross Beta	50 pCi/L	---											
Radium 226 & 228 e)	5 pCi/L	---											
Strontium 90	8 pCi/L	---											
Tritium	20,000 pCi/L	---											
BACTERIOLOGICAL													
Coliform Organisms					23					>1600	4	>1600	70
(per 100 ml)	1	---											
Macrooganisms	---	---											
Heterotrophic Plate Count	<500 f)	---											
GIARDIA LAMBLIA	(2)	---											
CRYPTOSPORIDIUM	---	---											
Legionella	(2)	---											
Virus	(2)	---											
CORROSION AND SCALING													
Encrustation	---	---											
Corrosion of Galv. Iron	---	---											
Aggressiveness Index	---	---											
Langlier Index at 60 C	---	---		0.5				-0.6 g)	0.3				
Corrosivity	Non-Corrosive	Non-Corrosive											
MISCELLANEOUS													
Calcium	1 *		59	61	75	77	96	66	66	70	120	65	110
Magnesium	1 *		39	39	53	50	63	42	42	43	72	44	65
Potassium	3 *		17	13	15	<3	<3	<3	<3	<3	3	<3	<3
Hydroxide				<1	<1		<1	<1	<1	<1	<1	<1	<1
Carbonate				<1	<1		<1	<1	<1	<1	<1	<1	<1
Bicarbonate			366	290	450	378	400	310	280	240	590	570	660
Total Alkalinity (as CaCO3)	1 *		300	240	370	310	330	250	230	200	480	470	540
Total Filterable Residue													
at 180 C (TDS) +		500	690	860		540		440	450				
Total Suspended Solids +	5 *		18			<5	<5						

Total Organic Carbon	---		8	7	13	13	1	1		2	1	2	2	3
Chemical Oxygen Demand +	5 *		55		33		7	<5		<5				
Biochemical Oxygen Demand	3 *		40				<3	4						
Nitrogen, Ammonia	0.1 *		16				<0.1	<0.1						
Nitrogen, Nitrite	1 **		2.2				<0.01	<0.01						
Nitrite	0.03 *		7.2				<0.01	<0.03						
Nitrogen, Nitrate	10 **		2.8			0.1	7.0	8.4			1.3	23	<0.1	0.1
Nitrate	0.4 *		12			0.4	31	37			5.8	100	<0.4	0.4
Nitrogen, Total Kjeldahl	0.5 *		18				<0.5	<0.5	<0.5					
Phosporous, Ortho	0.1 *		6.0				<0.1	<0.1						
Phosphate, Ortho	0.3 *		18				<0.3	<0.3						
Phosphorous, Total	0.01 *		7.3				0.08	<0.2						
Phosphate, Total	0.03 *		22				0.25	<0.6						
Phosphorous, Organic -Calculated	0.2 *							<0.2						
Boron, Dissolved +	0.1 *		0.3	0.6			0.3	0.3						
UNREGULATED ORGANIC CHEMICALS														
Bromobenzene	***					ND			N.D.		ND	ND	ND	ND
Bromochloromethane	***								N.D.					
Bromomethane (Methyl Bromide)	***					ND			N.D.		ND	ND	ND	ND
n-Butylbenzene	***					ND			N.D.		ND	ND	ND	ND
sec-Butylbenzene	***					ND			N.D.		ND	ND	ND	ND
tert-Butylbenzene	***					ND			N.D.		ND	ND	ND	ND
Chloroethane	***					ND			N.D.		ND	ND	ND	ND
2-Chloroethylvinyl ether									N.D.					
Chloromethane (Methyl Chloride)	***					ND			0.0061		ND	ND	ND	ND
2-Chlorotoluene						ND			N.D.		ND	ND	ND	ND
4-Chlorotoluene						ND			N.D.		ND	ND	ND	ND
Dibromomethane	***					ND			N.D.		ND	ND	ND	ND
1,2-Dichlorobenzene (o-DCB)	***					ND			N.D.		ND	ND	ND	ND
1,3-Dichlorobenzene (m-DCB)	***					ND			N.D.		ND	ND	ND	ND
Dichlorodifluoromethane	***					ND			N.D.		ND	ND	ND	ND
1,1-Dichloroethane (1,1-DCA)	0.005(4)***					ND			N.D.		ND	ND	ND	ND
cis-1,2-Dichloroethylene	0.006(4)***					ND			N.D.		ND	ND	ND	ND
trans-1,2-Dichloroethylene	***					ND			N.D.		ND	ND	ND	ND
1,2-Dichloropropane	0.005(4)***					ND			N.D.		ND	ND	ND	ND
1,3-Dichloropropane	***					ND			N.D.		ND	ND	ND	ND
2,2-Dichloropropane	***					ND			N.D.		ND	ND	ND	ND
1,1-Dichloropropene	***					ND			N.D.		ND	ND	ND	ND
Hexachlorobutadiene	***					ND			N.D.		ND	ND	ND	ND
Isopropylbenzene	***					ND			N.D.		ND	ND	ND	ND
p-Isopropyltoluene	***					ND			N.D.		ND	ND	ND	ND
Styrene	***	0.01 **				ND			N.D.		ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	***					ND			N.D.		ND	ND	ND	ND
Toluene	***	0.04 **				0.001			N.D.		ND	ND	ND	ND
1,2,3-Trichlorobenzene	***					ND			N.D.		ND	ND	ND	ND
1,2,4-Trichlorobenzene	***					ND			N.D.		ND	ND	ND	ND
Trichlorofluoromethane (Freon 11)	0.15 (4)					ND			N.D.		ND	ND	ND	ND
1,2,3-Trichloropropane	***					ND			N.D.		ND	ND	ND	ND
Trichlorotrifluoroethane	1.2 (4)					ND			N.D.		ND	ND	ND	ND

(Freon 113)							
1,2,4-Trimethylbenzene	***	ND	N.D.	ND	ND	ND	ND
1,3,5-Trimethylbenzene	***	ND	N.D.	ND	ND	ND	ND
Methyl ethyl ketone	(3)		N.D.				
(MEK, Butanone)		ND					
Methyl isobutyl ketone (MIBK)	(3)		N.D.				
Alachlor (Alanex)	0.002	ND	N.T.	ND	ND	ND	ND
Chlordane	0.0001 (4)	ND	N.T.	ND	ND	ND	ND
Heptachlor	0.00001 (4)	ND	N.T.	ND	ND	ND	ND
Heptachlor epoxide	0.00001 (4)	ND	N.T.	ND	ND	ND	ND
Bromacil (Hyvar)	*** (1)	ND	N.T.	ND	ND	ND	ND
Diazinon	*** (1)	ND	N.T.	ND	ND	ND	ND
Prometryn (Caparol)	*** (1)	ND	N.T.	ND	ND	ND	ND
Chlorothalonil (Daconil, Bravo)	*** (1)		N.T.				
Dimethoate (Cygon)			N.T.				
Diethylhexylphthalate (DEHP)	0.004 (4)	ND	N.T.	ND	ND	ND	ND
Aldicarb (Temik)	0.01	ND	N.T.	ND	ND	ND	ND
Carbofuran (Furadan)	0.018 (4)	ND	N.T.	ND	ND	ND	ND
Glyphosate	0.7	ND	N.T.	ND	ND	ND	ND

NOTES:

a) California limit is temperature dependent.
b) THM standard is based on running average of quarterly sampling results.
c) Monthly average for unregulated raw water supply.
d) Draft proposed goal for new treatment plants, average daily (DOHS draft of October 1989).
e) Sum of Radium 226 and 228.
f) Proposed draft standard for verifying adequate bacteriological quality in lieu of monitoring for a minimum disinfectant residual in system, CFU/ML (DOHS draft of October 1989).
g) Langlier Index Source Temperature (not necessarily at 60 C).
h) MF/L = Million Fibers per Liter

* Detection Limit (mg/L) (Practical Quantitation Limit)
** Proposed May 1989/Compliance anticipated by late 1991.
*** Unregulated chemicals for which periodic monitoring may be required.

\+ Historical data is available -- 1986 to 1988 (montly).

N.D. = Not Detected
N.T. = Not Tested For/No Results

(1) Monitoring is at the discretion of the State.
(2) Contaminants required to be regulated under the SDWA of 1986.
(3) Chemicals being considered for regulation in the Disinfectant/Disinfection By-Products Rule.
(4) State of California proposed MCLs.
(5) Drinking Water Contaminant Priority List:
- 5a) on SARA List
- 5b) Monitored but currently unregulated contaminants.
- 5c) Disinfectants and their By-Products.

CAMBRIA COMMUNITY SERVICES DISTRICT
Summary of Sampling Data

SAMPLING RESULTS

CONSTITUENT	CALIFORNIA STANDARDS MCL (mg/L)	CALIFORNIA STANDARDS SMCL (mg/L)	WELL # 8R3 12/13/88	WELL # 8R3 2/21/89	WELL # 8R4 12/13/88	WELL # 8R4 2/21/89	WELL # 9M4 12/14/88	WELL # 9M4 2/23/89	WELL # 9N2 12/14/88	WELL # 9N2 2/22/89	WELL # 10A3 12/14/88	WELL # 10A3 2/22/89	WELL # 10H1S 2/22/88
Chloride	---	250	580	540	77	30	81	82	180	190	15	15	150
Copper	---	1.00											
Total Dissolved Solids	---	500	1380	1280	501	257	606	608	868	884	353	333	881
Fluoride	1.4-2.4 a)	---	0.3	0.2	0.2	0.2	0.5	0.5	0.4	0.5	0.1	0.2	0.6
Hardness	---	---	460	570	230	96	400	400	680	680	290	270	450
Iron	---	0.3	0.00001	0.00006	9.0E-06	0.00037	0.000018	0.00003	0.000012	0.00087	4E-06	9.0000000E-06	0.000016
Manganese	---	0.05	0.00019	0.00033	0.00018	0.00023	0.00091	0.00092	0.0014	0.0016	0.00000	2.0000000E-07	0.00019
Nitrate	0.4 *		0.014	0.01	0.011	0.01	0.01	0.01	0.018	0.01	0.697	0.531	0.036
pH (std. units)	6.5-8.5	6.5-8.5	8.3	7.8	7.8	7.5	7.6	7.6	7.8	7.4	7.8	7.5	7
Sodium	---	---	340	250	99	54	73	72	64	68	20	18	110
Sulfate	---	250	140	100	63	31	18	19	77	80	51	45	290
Zinc	---	5		0.08			0.05		0.05				
Calcium	1 *		74	95	39	17	83	84	120	120	54	50	89
Magnesium	1 *		66	80	33	13	48	47	92	93	38	35	55
Potassium	3 *		6.7	4.4	3.2	4.2	1.6	1.4	1	0.7	1	0.8	5
Total Alkalinity (as CaCO3)	1 *		250	298	270	157	446	448	500	494	250	243	211
Boron, Dissolved	0.1 *		0.0014	0.00056	0.00024	0.00017	0.00031	0.00031	0.00019	0.00016	0.00017	0.00017	0.00015
Nitrogen, Ammonia	0.1 *												
Electrical Conductivity			2320	2010	816	426	960	978	1390	1420	535	608	1230
Sodium Adsorption Ratio			7	5	3	2	2	2	1	1	0.5	0.5	2
Adjusted Sodium Adsorption Ratio													
Silica (as SiO2)			18	27	24	13	32	32	32	33	21	20	54
Nitrite	0.03 *												
Nitrogen, Nitrate	10 **												

NOTES:
a) California limit is temperature dependent.
* Detection Limit (mg/L) (Practical Quantitation Limit)
** Proposed May 1989/Compliance anticipated by late 1991.

ANTIDEGRADATION POLICY

STATE WATER RESOURCES CONTROL BOARD

RESOLUTION NO. 68-16

STATEMENT OF POLICY WITH RESPECT TO MAINTAINING HIGH QUALITY OF WATERS IN CALIFORNIA

WHEREAS the California Legislature has declared that it is the policy of the State that the granting of permits and licenses for unappropriated water and the disposal of wastes into the waters of the State shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the State and shall be controlled so as to promote the peace, health, safety and welfare of the people of the State; and

WHEREAS water quality control policies have been and are being adopted for waters of the State; and

WHEREAS the quality of some waters of the State is higher than that established by the adopted policies and it is the intent and purpose of this Board that such higher quality shall be maintained to the maximum extent possible consistent with the declaration of the Legislature;

NOW, THEREFORE, BE IT RESOLVED:

1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

3. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act.

BE IT FURTHER RESOLVED that a copy of this resolution be forwarded to the Secretary of the Interior as part of California's water quality control policy submission.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on October 24, 1968.

Dated: October 28, 1968

Kerry W. Mulligan
Executive Officer
State Water Resources
Control Board

HYDROGEOLOGIST REPORT

2bi - Identification of all water wells that may be impacted

Two recharge sites are under consideration. The Preferred Site is at location 10M. Theoretically, all wells downgradient (to the west) of this site may be impacted. However, from a practical standpoint, only those wells upgradient of the spray field in location 9P should be considered. The Alternate Site for the spreading grounds is farther upstream, in location 10A. If this site is used, several other wells must be added to the list of those that might be impacted.

The closest well to the Preferred Site is 10M2. It is probably somewhat upgradient from the Preferred Site but is closer than the 500 feet given on Table 1 of the Proposed Guidelines. This well is owned by Jon Pedotti and was completed in September 1982 to a depth of 92 feet. It was drilled by the cable-tool method and was perforated by Mills knife between depths of 40 and 80 feet. It was constructed to supply water for irrigation and has been used exclusively for that purpose. Because of its possibly upgradient position and exclusive use for irrigation, a variance from the Proposed Guidelines might be requested, or other arrangements made, such as providing an alternative supply, or retiring this agriculatural acreage.

The first wells downgradient from the Preferred Site are Pedotti wells 9J2 and 9J3, which are about 30 feet apart. No logs were located. 9J2 is an active irrigation well (Pedotti Ag No. 3) of unknown depth. 9J3 is a domestic well (Pedotti Domestic No. 3), which is reported to be 73 feet deep.

Well 9J4 (also called SS-1) is the most upstream production well of the Cambria CSD. Along with the other two production wells, it was drilled in the Spring of 1978 by the rotary method.

9J4 reached bedrock at a depth of 108 feet. It has a 24-inch steel conductor cemented to a depth of 30 feet and a 12-inch plastic casing perforated between depths of 30 and 105 feet.

Well 9J5 (SS-2) is another Cambria CSD production well. It is only 250 feet from 9J4 but the alluvial depth is much less. 9J5 reached bedrock at a depth of only 74 feet. Inside the 24-inch conductor cemented to a depth of 30 feet is the 12-inch plastic casing perforated between depth of 30 and 75 feet.

Well 9K1 is the Warren or "Girl Scout" well which is used for domestic, stock watering, and the drip irrigation of trees. It is reported to be 40 feet or less in depth. The pump burned out in June 1984. The District paid for a new pump and allowed a connection to its system.

Well 9K3 (SS-3) is the downgradient production well in the District well field. It reached bedrock at a depth of 110 feet. It has a 24-inch steel conductor cemented to 32 feet. Perforations in the 12-inch plastic casing are between depths of 32 and 107 feet.

The objective of the spreading program is to recapture all the recharged water in the production wells 9J4, 9J5, and 9K3.

Well 9K2 is an irrigation well formerly used by Bonomi. No log was found. It is now covered by a 24-inch corrugated pipe used as a housing for an automatic water-level recorder.

Well 9L1 is an inactive irrigation well formerly used by Warren. No log was found. The reported depth is 60 feet.

Well 9P5 (SS-4) was drilled in the Spring of 1978 as an observation well to monitor water levels and water quality between the District's spray field and the District's production wells. It was drilled by the rotary method and reached bedrock at a depth of 98 feet. It has a 16-inch steel conductor cemented to 30 feet and 108 feet of 8-inch plastic casing perforated between depths of 28 and 98 feet.

The quality monitoring program in and near the spray field calls for the annual sampling of the new extraction well and 9K3 (SS-3), and quarterly sampling of two shallow piezometers (P3 and P6).

If the Alternate Site (location 10A) is used for the recharge basins, several additional wells may be impacted. Well 10A2 is a Pedotti domestic well which is across the creek but within 500 feet of the recharge basins. This well would probably have to be inactivated and the demands satisfied from a well farther upstream.

Well 10G2 is an active well used for gravel processing. It was drilled about October 1987 to a reported depth of 77 feet. It would be immediately adjacent to the recharge basins and would have to be deactivated unless the intended use is deemed a basis for a variance from the Proposed Guidelines.

Well 10G1 is an older well formerly used for gravel processing which experienced casing collapse. It was rehabilitated in about October 1987 and is now used as a domestic well. It would be close to 500 feet downgradient of the recharge basins.

Well 10F2 is a new Warren well about 250 feet westerly of the Mary Warren house. It has a 6-inch casing and is equipped with a small submersible pump. No log was found.

Well 10F1 is an old Warren domestic well (Trailer well) which is reported to be very shallow (only 33 feet) and with a history of becoming dry periodically. It was dry on November 30, 1990.

2bii - Travel times

For purposes of calculating travel times, the hydraulic conductivity is assumed to be 400 feet per day and the effective porosity is assumed to be 0.30. Gradients are dependent upon the hydrogeologic conditions such as alluvial depths and widths.

Downgradient from the Preferred Site, a gradient of 0.002 is assumed for the reach above the alluvial constriction known as "Holland Gap". This results in a groundwater velocity of 2.7 feet per day. The isopleth at the end of 6 months is shown on Plate _____. Downstream from Holland Gap the gradient is expected to steepen and within one year the isopleth would plot within the pumping influence of the District's well field.

Downgradient from the Alternate Site, the gradient is assumed to be average (0.006), which results in a velocity of 8 feet per day. At this velocity, the 6-month and 1-year isopleths are shown on Plate ____.

2c - Hydrogeologic description of the basin

The San Simeon Basin is basically a strip of thin alluvium extending from a rocky channel at the Palmer Flats Gaging Station to the ocean at San Simeon State Park. The bottom and sides of the basin consist of old, hard rocks of the Franciscan formation (Hall, Ernst, Prior and Wiese, 1979). At the end of the Ice Age (Pleistocene), San Simeon Creek in its lower reaches was flowing in a rock-bottomed channel. As sea level rose following the end of the Ice Age, the rocky channel was slowly backfilled by stream deposits (alluvium). The lowest and narrowest part of the channel was filled first, mainly by coarse gravelly deposits of very high permeability. As the alluvium became thicker, the stream deposits were spread over a wider area and were silty because they were related to lower velocity stream flow (off-stream deposits). Some of these off-stream deposits are old enough to have developed good soil profiles. Most of the so-called "terrace deposits" have a soil in the Salinas Series with a surface layer of dark gray silty clay loam extending to a depth of about 29 inches. Beneath the surface layer is a sandy loam or silty clay loam to a depth of about 60 inches. Below the top 5 feet (which has relatively low permeability) may be sands and gravels of very high permeability. In the existing stream bed, the surficial gravels are clean, the fines having been carried to the ocean by the high velocity winter flows. Percolation rates in the existing stream bed are very high, and the alluvium fills completely within a few weeks after the start of the normal winter stream flows.

Transmissivities of the alluvial gravels as determined from several pump tests are very high -- 200,000 gpd/ft (gallons per day per foot) -- and are usually much higher parallel to the direction of stream flow than at right angles to it.

The direction of groundwater flow is dominantly to the west, toward the ocean. Groundwater velocities are variable, depending on the water table gradients, which range from 0.002 to 0.008. Upstream from alluvial constrictions such as at "Holland Gap" between wells 10M2 and 9J2, the gradients would be lowest, and the velocity would be lowest (2.7 feet per day). At the steepest gradient of 0.008, the velocity would be about 10.7 feet per day.

Historic fluctuations of the water table show a typical seasonal pattern, with minimum depths to water through the Winter and early Spring, then progressive lowering through the Summer and early Fall. With the first good stream flow there is usually a rapid and complete recovery. Near the Preferred Site, Well 10M2 has shown a minimum depth-to-water of about 20 feet and a maximum of about 46 feet. Near the Alternate Site, Well 10G2 has shown a minimum depth-to-water of about 17 feet and a maximum of about 45 feet.

The alluvial aquifer increases in thickness in the downstream direction from the rocky canyon at the Palmer Flats Gaging Station to perhaps 40 feet at Well 11D1, to 80 feet at Well 10A3, to 108 feet at Well 9J4, which is in a deep channel. About 250 feet to the north of Well 9J4, at Well 9J5, bedrock was reached at a depth of only 74 feet.

Low permeability soil layers are found mainly adjacent to the active stream channel, on low "terraces", which are at elevations of only a few feet above the active channel.

The usable storage capacity of the San Simeon Basin above sea level is about 1000 acre-feet.

2cii - Characterization of groundwater quality

Groundwater quality in the upper part of the San Simeon Basin (from samples taken prior to 1969) was very good with a total dissolved solids (TDS) of only 323 mg/l (milligrams per liter). Samples taken in 1988 and 1989 show a TDS range of 320-461 mg/l. The salinity tends to rise through the Summer and Fall as the volume of stored groundwater is reduced, then drops in response to the recharge of a large volume of high quality storm flows.

2d - Impacts of all recharge waters

The following comments apply to the area of interest -- the upper part of the San Simeon Basin upstream of the spray field.

The primary source of recharge to the upper part of the San Simeon Basin is the water which flows in San Simeon Creek during the Winter. Basically, San Simeon Creek functions as a line source. The volumes flowing in all but the very driest years are far in excess of the underground storage space made available by pumping and drainage during the preceding Summer and Fall. Within a few weeks of the start of the normal Winter surface flows, the groundwater storage space becomes completely filled, and during most of the Winter, there is "rejected recharge" and the unpercolated flows go to the ocean. The high flows of San Simeon Creek are of excellent quality, usually with a TDS less than 300 mg/l.

Only in very wet years is there runoff from side tributaries and penetration of rainfall through the alluvial soils. The average annual amounts are only a small fraction of creek percolation and are generally of good quality.

There is some natural inflow to the alluvium of San Simeon Creek through fractures in the Franciscan bedrock. This is difficult to quantify but must be very small in volume. It is basically rain water which enters the fractured bedrock, then moves to lower levels. En route, it dissolves minerals from the bedrock. One spring south of San Simeon Creek showed a TDS of almost 900 mg/l.

There are only a few houses in the upper part of San Simeon Creek Basin, so contributions of domestic sewage via septic tank systems are no more than a few acre-feet per year.

Within the upper part of the San Simeon Basin, the recharge related to irrigation return is second only to the percolation of stream flows. Water used for irrigation undergoes an evapotranspirative concentration, so that the water which moves through the soil is higher in salinity than the water applied. Increases in groundwater salinity, which are probably mainly seasonal, are probably related to irrigation return.

7a - Groundwater recharge areas

Preferred Site. The Preferred Site for the recharge basins is in the 10M location. Pending further information on soil permeabilities, an area of 2 acres is suggested, consisting of two basins of one acre each. These basins should be located no closer than 100 feet to the creek bed to prevent short-circuiting of the recharge water back to the creek bed, and should be diked to prevent flooding. As the proposed project involves the recharging of 216 acre-feet each year over a 6-month period, the spreading rate would be 36 acre-feet per month or 1.2 acre-feet per day. This is equivalent to only 0.01 inch per minute, far below the minimum of 0.2 in/min given in the Proposed Guidelines. It will be necessary to obtain site specific information on permeabilities through coring and testing. In the old terrace soils, in preparing the basins for spreading, there is an optimization problem of providing an adequate percolation rate while staying below the 0.2 in/min percolation rate given as a minimum in the Proposed Guidelines. Depths to the water table (based upon information from nearby Well 10M2) are expected to range between 20 and 46 feet.

Alternate Site. This site is just upgradient from Well 10G2, within and near a scattered group of sycamore trees. These basins should also kept 100 feet from the banks of the creek and diked to prevent flooding. There are the same constraints on percolation rates as at the Preferred Site, and coring and testing for permeability will be necessary. Depths to water are expected to range from 17 to 45 feet.

8 - Groundwater recharge operations

The spreading grounds would be used for about six months each year -- at the times when the water table is normally low. The planned rate of application is 1.2 acre-feet per day. The size of the two-pond configuration will be based upon the permeability tests and the requirements of the Proposed Guidelines. Because of the high transmissivity of the underlying gravels and the required slow rate of percolation, no mounding of the water table is expected.

The water used for recharge will be pumped from an extraction well in the spray field. Studies of the quality of the water pumped from an extraction well in the spray field indicate that the water so pumped is about 60 per cent reclaimed water and 40 per cent natural underflow. Assuming that 649 acre-feet is pumped from the District's production wells, the required 4:1 dilution would limit the volume of reclaimed water to 130 acre-feet per year. As the water pumped from the extraction well in the spray field is only 60 per cent reclaimed water, the volume which could be delivered for recharge is 216 acre-feet per year.

Maintenance of the recharge basins is expected to be minimal because the water delivered from the spray field extraction well will be of low turbidity. However, if the spreading rate decreases with time at an unacceptable rate, the two-basin arrangement will allow the drying of one basin while using the other. It is not expected that any chemicals will be needed to treat the water.

JOHN F. MANN, JR.
CONSULTING GEOLOGIST AND HYDROLOGIST
945 REPOSADO DRIVE
LA HABRA, CALIFORNIA 90631
TELEPHONE
(213) 697-9604

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JOHN CAROLLO ENGINEERS

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February 9, 1991

Mr. Steven G. Swanback, P.E.
John Carollo Engineers
450 North Wiget Lane
Walnut Creek, California 94598

Re: Cambria Community Services District
Wastewater Reclamation Project

Dear Steve:

The purpose of this letter is to answer the questions raised in your letter of January 31, 1991 and also to offer some comments on the Draft Engineering Report of January 1991.

First, I would like to call your attention to the third paragraph of the letter tansmitting the Gus Yates report to the District:

> "Please note that the copy is for your review only. The report should not be cited as a reference or released to the general public until publication is authorized by the Director of the U. S. Geological Survey."

You should check with Gus Yates before your Engineering Report is finalized to make sure that your report is not in conflict with the above understanding.

I have problems with the third sentence of the top paragraph of your Draft Report, page 4.4. The suggestion of local mounding seems to be in conflict with the statement elsewhere that spreading will produce no mounding. I do not agree that there has been "overdraft pumping". I would suggest that this entire sentence be deleted.

A copy of your January 31 letter is enclosed with numbers opposite the questions raised. My answers and suggestions are keyed to those numbers.

1. The two-mile criterion from the Proposed Guidelines envisions an extensive ground water basin with alluvial deposits extending for long distances in all directions from the spreading grounds. The San Simeon Basin is a ribbon-like basin of alluvium flanked by hard non-water-bearing rocks. Because of the high permeability and lack of mounding, the effects extend only in a downstream direction.

2. The hydraulic conductivity of 400 feet per day comes from my personal discussions with Gus Yates. He feels very strongly that the use of 400 feet per day results in the best fit of assumed heads to actual heads in his model. The use of 0.30 for effective porosity was derived from discussions with Ken Schmidt, a long-time consultant for the District, who has extensive experience with the flow of ground water contaminants.

3. The use of a gradient of 0.002 is the minimum gradient used by Gus Yates. I have independently checked this on his water table maps. The minimum gradient would be expected upstream from Holland Gap, which is just downstream from the Preferred Site.

4. The equation used in my velocity determinations is the same one given in your Draft Report on page 4.5.

$$V = Ki/n$$

   where K = the hydraulic conductivity, i = gradient, and n = effective porosity. There is much disagreement among practicing hydrogeologists about the value to be used for n. Because of diffusion, the calculated velocity often does not agree with the plume velocity determined from monitoring wells. In Ken Schmidt's experience, the use of 0.30 for n gives the most credible values for velocity.

5. Because of the relatively high ground water velocities in the highly permeable alluvium of the San Simeon Basin, the spread water is expected to reach the cone of influence of the District's production wells within one year from the Preferred Site and within two years from the Alternate Site. Longer time periods are thus irrelevant. The 6-month and 1-year isopleths were included with the draft I submitted in December and another copy is enclosed.

6. The locations of the Palmer Flats Gaging Station and "Holland Gap" are indicated on the enclosed map.

7. The total storage capacity of the aquifer from the Yates report is 30,000 acre-feet, of which 16,700 acre-feet is above sea level. This is basically the surface area times the average depth of the alluvium. If the specific yield is considered as 16.7 per cent, the volume of fresh water stored above sea level is 1000 acre-feet. Bulletin No. 18 of the State Water Resources Board (page B-43) gives the usable storage of the San Simeon Basin as 1300 acre-feet. Considering the probable accuracy of estimating specific yield, the figure of usable storage capacity above sea level which you use on page 2.5 of your Draft Report is reasonable.

8. Approximate alluvial thicknesses:
   Spray field - 98 feet
   Proposed Site - 92 feet
   Alternate Site - 77 feet
   Domestic Well Field - 74-110 feet

9. When water levels drop in the upper part of the Basin, I believe they drop in a parallel manner such that there is little change in gradient between the wet and dry seasons. Average velocity is considered to be about 8 feet per day.

10. I believe the analysis you have given on page 6.27 of the Facilities and Effluent Disposal Plan Update dated June 1990 (with the corrections we discussed over the telephone) is the best approach that can be made with existing data. Under these assumptions, the total amount of extraction well water that may be injected into the San Simeon Basin is 188 to 216 acre-feet per year.

11. The type of information required on the actual recharge sites should be similar to those obtained by McClelland Engineers as presented in their August 1988 report for the spray field area. This was discussed with Dennis Shallenberger of Pacific Geoscience yesterday just before he was planning to visit the San Simeon Creek area.

12. The Proposed Guidelines refer to maximum rates of percolation of 0.20 - 0.33 in/min depending on the depth to ground water. Whereas on the one hand it is desirable to have a high percolation rate to minimize the required size of the spreading grounds, it will be necessary to meet the above maxima. Rather than remove all the low permeability soils, it may be necessary to leave some of this material to stay below the required maximum percolation rate.

13. If "domestic wells" refers to the District's production wells, I would envision that all of the spread water would be captured by those production wells. With regard to recycling (in Item 1), it would have to be acknowledged that the process of spraying, extraction, recharge, and recovery by the production wells results in some recycling which would tend to cause an increase in salinity. This appears to be a unique plan; I know of no precedent. The increase of salinity could be determined only by a long period of monitoring, with the expectation that there would be an acceleration during droughts and a slowing during wet periods.

REVERSE OSMOSIS ANALYSIS

BLUE SPRING™

Attn: Mr. Steve Swanback
John Corollo Engineers
450 North Wiget Lane
Walnut Creek CA 94598

May 12-1990

Dear Mr. Swanback,

Following are the answers to your questions:

1. Cost of the RO unit to treat 500 gpm of effluent is $ 540,000. This unit will be made as two parallel modules each with a capacity of 250 gpm effluent feed. The freight and installation cost is approximately $ 8,000. This does not include cost of land, site improvement etc. We will need a suitable housing with suitable power supply and pipelines for feed, output and reject water brought into the housing. Also, a floor drain will be required for cleaning operations.

   Without further pilot-scale work, it is not possible to pinpoint the additional equipment required. The minimum pre-treatment required for direct effluent is media filtration unit. The extraction well water may not need filtration. The RO unit includes polishing filters but they could be overloaded if the influent has too much particulates.

   - If the influent water contains volatile organics such as trihalomethane, free ammonia, methyulene chloride, chloroform etc, then an air-stripping column may be required. This can be done either on the feed water to the RO or the output of the RO unit. This needs to be done only if the RO output water will be used for drinking purposes.

   - Softening of the influent to RO may be required for either direct effluent or extraction well water. Lime-softening process is preferred because it can also act as clarification process. The lime can be recovered as calcium carbonate, recalcined and recycled. The carbon dioxide gas generated during calcining process can be used to lower the pH of the softened effluent to reduce LSI parameter. This process is most cost-effective because all the chemicals are recycled. Also, there is no addition to the TDS of the water. But this is an involved processing requiring much equipment. The other alternative is not to recycle the lime sludge and simply haul it away to a landfill. Sulfuric acid is then used to lower the pH of the softened water. This process is simpler and requires less equipment but has more operational costs because of non-recovery of chemicals, and also, it adds to the TDS of the reject water of RO due to increased amount of sulfate ions.

     The alternative to softening is use of an anti-scaling agent such as sodium hexametaphosphate or a new-generation polyelectrolyte. This process is much simpler than softening process, but will add about 5-10% to the total operating cost of the overlall treatment.

     Even a combination of softening and anti-scalant may be required.

     But there is a good possibility that neither softening nor anti-scalant addition may be required. This is because the naturally ocurring organics in the effluent water act as scale-inhibitors because of their high-molecular weight and polypeptide structure. To what extent the organics will prevent scaling of RO membranes can only be proven by a field test lasting approximately three months,

   - If a pressure filter is used for pre-filtration, then a pump of suitable capacity and approximately 30 feet head will be required.

- A storage tank or man-made reservoir may be required if the RO output water will be blended with fresh, potable water supply. This is not a technical requirement, but it may be mandated by the health department, as a quality-assurance measure. The water in this reservoir would be tested on a daily basis before it is blended with drinking water supply.

  This reservoir is not required if the RO output water will not be used for drinking purposes.

- A storage tank of suitable capacity will be required to hold back-wash from the pre-filter. The solids trapped in this filter will be too fine to be recycled back into the sewage treatment system. The back-wash may be hauled away for spraying, or it can be further filter on a small, pre-coat type filter from which the cake can be discharged into a landfill. The same reservoir could be used to hold cleaning solution and rinse water from the RO unit during its periodic cleaning.

- If the health department insists on chlorination of the secondary effluent, then some type of dechlorination equipment will be required. Only free chlorine needs to be neutralized. Bound chlorine is safe to be used for RO. One method would be to add sodium metabisulfite to the effluent in amount just enough to neutralize the free chlorine. A closed-loop chlorine controller could be used for this purpose. Activated carbon treatment can achieve the same goal but it will be expensive and will deprive the RO reject water of its excellent fertilizing value.

  We strongly feel that ultra-violet light disinfection is the preferred method for disinfecting the effluent before it enters the RO unit.

  The RO reject water may be chlorinated if desired, before it is sprayed on the fields. Again, chlorination would generate highly toxic side-products which could contaminate the ground-water supply and may even be harmful to the vegetation.

2. The cost of RO unit to treat 1,000 gpm of treated effluent is $ 1,080,000 (twice the cost of the 500 gpm unit). This unit will consist of four each of 250 gpm modules in parallel. Cost of installation of this unit will be approximately $ 14,000 under the same conditions prescribed for the 500 gpm unit.

   Comments regarding additional equipment for 500 gpm unit also apply to 1,000 gpm unit.

3. & 4. The estimated quality of the purified water and the reject water from the RO unit is shown in table below for both direct effluent and extraction well water feed, without pre-softening of the feed water.

Two important parameters are missing from the analyses you had supplied us: suspended solids and volatile organics. These are necessary to ascertain pre-treatment requirements, for producing drinking quality water from the secondary effluent. Fortunately, CCSD provided me with some information which enabled me to make some educated guesses regarding these parameters.

ESTIMATED QUALITY OF RO PURIFIED AND REJECT WATER

IMPURITY	DIRECT EFFLUENT FEED			EXTRACTION WELL FEED		
	Feed mg/L	Output mg/L	Reject mg/L	Feed mg/L	Output mg/L	Reject mg/L
Calcium	59	1.2	232	77	1.5	303
Magnesium	38	0.8	150	50	1.0	197
Sodium	160	6.4	620	55	2.2	213
Bicarbonate	366	14.6	1,420	378	15.1	1,467
Chloride	170	8.5	655	86	4.3	331
Sulfate	77	1.5	303	63	2.5	245
Boron	0.3	0.15	.75	0.3	.15	0.75
Nitrate (N)	2.8	0.34	10.1	7.0	0.84	25.5
Nitrogen (N) total	18	0.9	69.3	<0.5	<0.1	<2.0
Phosphorus	7.3	0.3	28.3	0.08	<0.01	0.3
Fluoride	0.3	0.01	1.2	0.2	<0.01	0.8
Iron	0.07	< 0.01	0.3	<0.05	<0.01	<0.2
Manganese	0.04	<0.01	0.2	<0.02	<0.01	<0.08
Copper	<0.05	<0.01	<0.2	<0.05	<0.01	<0.2
Zinc	0.1	<0.01	0.4	<0.05	<0.01	<0.2
pH	7.3	6.5	7.8	7.1	6.3	7.7
TDS	690	25.5	2,683	540	20	2,100
Elect. Cond.(micro-S.cm)	1,300	48.1	5,056	900	33.3	3,500

The following table shows the same estimated parameters when the feed water is pre-softened by lime-process. The pH of the feed water has been dropped to 6.5 to maintain a negative LSI factor. Aeration is not taken into account. If aeration is undertaken, then the carbon dioxide gas will also be released from the feed water, which will increase pH values considerabley.

The following table shows the same estimated parameters when the feed water is pre-softened by lime-process. The pH of the feed water has been dropped to 6.5 to maintain a negative LSI factor. Aeration is not taken into account. If aeration is undertaken, then the carbon dioxide gas will also be released from the feed water, which will increase pH values considerabley.

ESTIMATED QUALITY OF RO PURIFIED AND REJECT WATER (SOFT FEED)

IMPURITY	DIRECT EFFLUENT FEED			EXTRACTION WELL FEED		
	Feed mg/L	Output mg/L	Reject mg/L	Feed mg/L	Output mg/L	Reject mg/L
Calcium	24	0.5	95	24	0.5	95
Magnesium	15	0.3	59	20	0.4	78
Sodium	160	6.4	620	55	2.2	213
Bicarbonate	180	7.2	698	192	7.7	745
Chloride	170	8.5	655	86	4.3	331
Sulfate	237	4.7	934	228	4.6	898
Boron	0.3	0.15	.75	0.3	.15	0.75
Nitrate (N)	2.8	0.34	10.1	7.0	0.84	25.5
Nitrogen (N) total	18	0.9	69.3	<0.5	<0.1	<2.0
Phosphorus	7.3	0.3	28.3	0.08	<0.01	0.3
Fluoride	0.3	0.01	1.2	0.2	<0.01	0.8
Iron	0.07	< 0.01	0.3	<0.05	<0.01	<0.2
Manganese	0.04	<0.01	0.2	<0.02	<0.01	<0.08
Copper	<0.05	<0.01	<0.2	<0.05	<0.01	<0.2
Zinc	0.1	<0.01	0.4	<0.05	<0.01	<0.2
pH	6.5	6.1	7.8	6.5	6.1	7.8
TDS	913	33.8	3,350	705	26	2,742
Elect. Cond.(micro-S.cm)	1,720	64	6,311	1,328	49	5,166

5. The quantity of the reject stream has been assumed to be 25% of the feed stream. This is based on assumed 75% recovery of water by RO. The actual recovery can be controlled at the RO unit. However, too much recovery will lead to premature fouling of the membranes. The optimum recovery must be determined at the time of pilot-scale runs. With proper tertiary treatment of the feed water, recoveries in the range of 75%-85% are practical. Correspondingly, the reject stream will be in the range of 15%-25% of the feed stream to the RO. This transplates into 75-125 gpm reject for the 500 gpm plant and 150-250 gpm for the 1,000 gpm plant.

6. In my previous letter to Mr. Bob Hamilton of CCSD, we have offered free loaner of our WP-25 pilot unit. We will install it free of charge, with the co-operation of CCSD staff at the effluent facilities. This unit has the necessary instrumentaion to determine recovery ratios, quality factors, fouling factors etc., but it has limited capacity of 0.5 gpm input flow-rate. This

unit can be used for all determinations except for operating costs. This is because the pump-efficiencies, labor costs etc are related to the size of the unit.

A larger pilot unit of 10 gpm capacity is available for $ 22,950. A brochure for the same is enclosed (model WP-600). The installation cost of this unit is $ 1,200. We can make certain pre-treatment items such as filters make available free. Specialized items, if required (for example, pumps) will be charged extra. A still larger, 63 gpm unit is available for $ 112,000, for which a brochure is enclosed (model WP-3800). The 63 gpm unit will be quite representative of the full-scale units in regards to operating costs.

NOTE: These capacities have been re-evaluated for constant recovery operation. The output capacity of the standard units varies with temperature and as the result, the recovery ratio varies. In constant recovery operation, the capacity is reduced approx. 25%. Also, the conventional way of stating capacity of an RO unit is based on the *output* (purified) water flow. We have been refering to the *influent* (feed) flow as the capacity of the unit because of the nature of this application.

What we suggest that the CCSD accept our offer for free loaner WP-25 unit for the purpose of determining technical feasibilities. After establishing technical parameters, CCSD may wish to purchase a WP-3800 unit for operating cost data and for hands-on operating experience. This unit can also serve as a *Life Saver* unit should the state of California undergo another year of drought. The technical evaluation could last 3-6 months. The operational evaluation could last approx. one year. The operational evaluation could be co-ordinated with application of permits from the concerned state agencies, to save time.

7. The following tables lists operating costs for 500 gpm and 1,000 gpm units respectively, on annual basis and on the basis of acre.feet of effluent water feed to the RO unit.

OPERATING COSTS FOR 500 GPM RO UNIT WITHOUT PRE-SOFTENING

COST FACTOR	YEARLY COST	COST PER ACRE-FT	PERCENT CONTRIBUTION
Electricity,74 kw at 9 cents/kwh	$ 58,341	$ 72.33	37.6 %
Module Replacement,3 year life	$ 61,200	$ 75.87	39.5 %
Cleaning solution,334 gal/yr	$ 4,008	$ 4.97	2.6 %
Pre-filters,60 per change,once a month	$ 4,464	$ 5.53	2.9 %
Rebuild pump,every 5 yrs	$ 2,600	$ 3.22	1.7 %
Misc. maintenance parts & supplies	$ 5,800	$ 7.19	3.7 %
Operating and maintenance labor,4 hrs/wk	$ 3,120	$ 3.87	2.0 %
Depreciation (Installed Equipment less modules)	15,576	$ 19.31	10.0 %
Total Operating Costs	**$ 155,109**	**$ 192.29**	**100 %**

OPERATING COSTS FOR 1,000 GPM RO UNIT WITHOUT PRE-SOFTENING

COST FACTOR	YEARLY COST	COST PER ACRE-FT	PERCENT CONTRIBUTION
Electricity,148 kw at 9 cents/kwh	$ 116,682	$ 72.33	37.6 %
Module Replacement,3 year life	$ 122,400	$ 75.87	39.5 %
Cleaning solution,668 gal/yr	$ 8,016	$ 4.97	2.6 %
Pre-filters,120 per change,once a month	$ 8,928	$ 5.53	2.9 %
Rebuild pump,every 5 yrs	$ 5,200	$ 3.22	1.7 %
Misc. maintenance parts & supplies	$ 11,600	$ 7.19	3.7 %
Operating and maintenance labor,8 hrs/wk	$ 6,240	$ 3.87	2.0 %
Depreciation (Installed Equipment less modules)	30,872	$ 19.14	10.0 %
Total Operating Costs	**$ 309,938**	**$ 192.12**	**100 %**

NOTES:

1. In these computations, the capacity of the RO units is based on units of *feed* water to the RO. The conventional way of rating capacity is on the basis of *output* of RO. This modification is made in view of the primary goal of the project: to process the effluent water from sewage treatment.

2. The operation of the units is assumed to be 24 hours per day, 365 days per week.

3. In arriving at the cost of plant depreciation, the cost of RO elements is deducted from the price of the RO units because this cost is considered as a separate cost element. The equipment cost includes freight, cost of a steel shed, internal wiring and factory installation service, but it does not include cost of land, site improvements, bringing in pipelines, power etc. to the site. Depreciation is straight-line with 25 year life-span.

4. Operating costs for pre-treatment is not considered in these calculations. These costs must be determined after pilot-scale evaluation. Cost of pre-filtration alone is minimal. Pre-softening may add substantial costs, perhaps 20% of the total costs). If lime-softening route is considered, approx. 300 mg/L lime will be required. Post-softening acidification will require sulfuric acid in amount equivalent to about 170 mg/L. Anti-scalant polymer feed, if required, is usually 2-5 mg/L. Settling agent is usually fed at a rate of 0.1 mg/L. As mentioned above, none of these may be required or some may be required.

If you have further questions, please give me a call or send me FAX message. We appreciate your interest in BLUE SPRING water purification systems and we hope to be able to help your client, CCSD very soon.

sincerely,

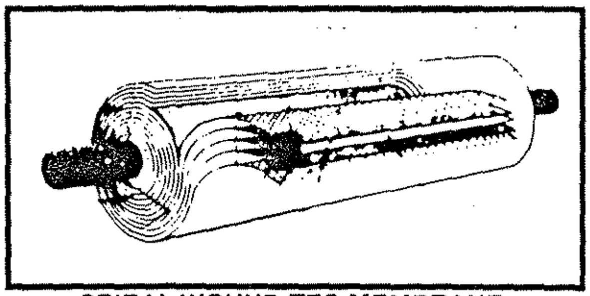
S. Desai

Satish Desai, Ph.D.

c.c.: Mr. Bob Hamilton,
CCSD

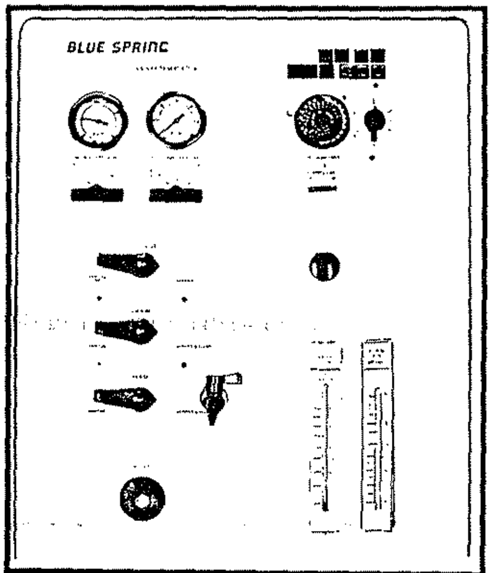
BLUE SPRING SYSTEM WP-3800 is a compact, high performance water purification plant capable of converting brackish or low-grade effluent water containing excessive salts and other impurities into high-quality drinking water exceeding E.P.A. and W.H.O. standards. The same unit can be used to convert drinking-quality city water into high-purity water for industrial uses. The unit is fully pre-assembled, skid-mounted and is ready to connect to your electrical power source and the source of raw water. It has a giant, 350 cu. meter-per-day capacity, which easily supports a population of 3,000 persons for their daily drinking water, cooking and hygienic needs. The unit is ideal for island resorts, coastal townships and military bases for their domestic water needs, and also for power-plants, industrial plants, food processing plants for their need of purified water.

SYSTEM WP-3800 water purification plant incorporates the latest advances in reverse osmosis technology. The unit uses a special, heavy-duty high-pressure pump which is of high-efficiency design and which shows a long operating life. The thin-film composite (TFC) membrane modules used in our systems represent the state of the art. They demonstrate the lowest energy requirements, highest salt-rejection, highest resistance to water-borne micro-organisms and a long operating life. The fresh water produced by BLUE SPRING SYSTEM WP-3800 is of superior quality which surpasses the drinking water standards established by U.S. Environmental Protection Agency and by the World Health Organization. BLUE SPRING's high-efficiency design philosophy results in an incredibly low energy consumption of only 0.8 kwh per cu. meter of purified water produced. Such low energy consumption and long operating life of modules result in an exceptionally low operating costs.



SPIRAL-WOUND TFC MEMBRANE: CUT-AWAY VIEW

BLUE SPRING SYSTEM WP-3800 is designed for heavy-duty, continuous operation. All materials of construction are specially selected for corrosion-resistance to water and to operating environment. The frame is constructed of corrosion-resistant, welded aluminum, instead of painted steel. The pump is made of corrosion-resistant stainless-steel instead of cast iron. The instrumentation and piping which comes in contact with water is either stainless-steel or corrosion-resistant plastic. Every precaution is taken to assure long, trouble-free performance from the unit. The unit's built-in pre-treatment system consists of a bank of high-capacity, cartridge-type filter elements. A choice of hardness control system is available, based on either acid-feed or anti-scalant feed, to assure a long operating life from the reverse osmosis membrane modules. The unit also contains our exclusive membrane cleaning system with easy-to-operate front-panel controls. This assures top purification performance from the unit, year after year.



CONTROL PANEL OF WP-3800

The unit features an ergonomic control panel with up-to-date instrumentation. Our standard instrumentation includes two on-line purity meters, two pressure gauges, two flow meters, a 7-day program timer with battery back-up, a 60-minute count-down timer, an automatic level controller for product water reservoir. And for added safety during unattended operation, the system has a three-way safety shut-down mechanism with front-panel indication of fault condition.

BLUE SPRING SYSTEM WP-3800 can provide you with a low-cost, reliable source of purified water for domestic and for industrial needs of your community. And it is backed by BLUE SPRING CORPORATION, the world's most trusted name in water purification since 1980.

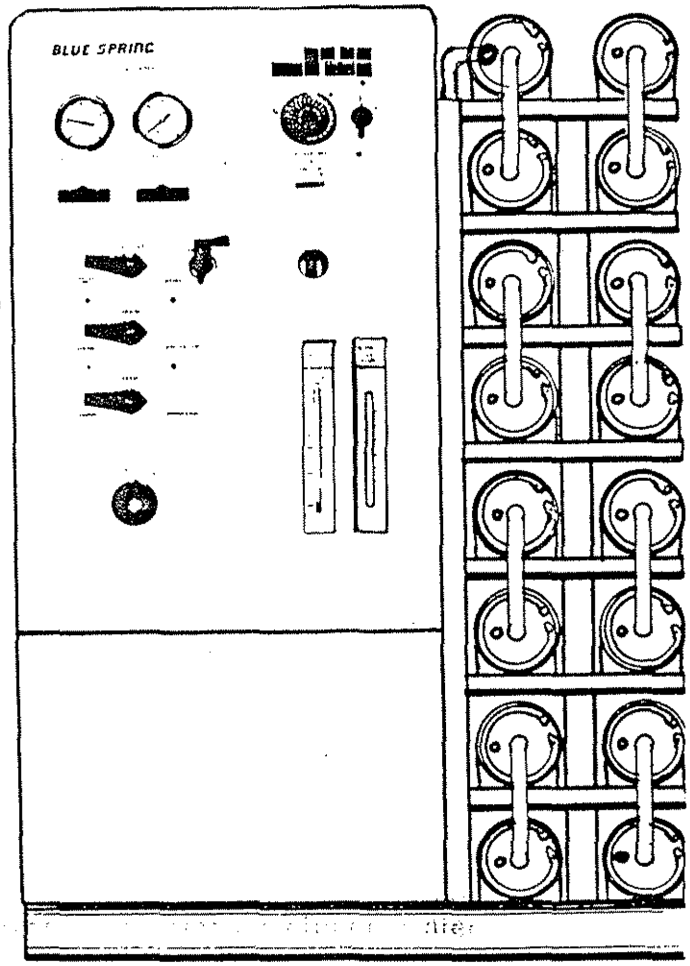
SPECIFICATIONS

SIZE	1.2 m W x 2.2 m D x 1.5 m H
SHIPPING WT.	850 kg
ELECTRICAL	460 VAC/3 ph,60 Hz,15 amp
PLUMBING	1½" USNPT feed/output/reject
OUTPUT	350 m^3/day ±10% at 25 °C
FEED WATER	80 gpm,at 10-100 psi pressure,5-45 °C
SALT REJECTION	95-98 %
ORGANIC REJECTION	Greater than 99.5%

WATER PURIFIER

BLUE SPRING®

SYSTEM WP-3800



Ideal for desalinating brackish water to produce drinking water, reclaiming effluent water, also for purifying city water for industrial uses . . .

COMPACT 1.2 X 2.2 X 1.5 m SIZE. GIANT 350 m^3/DAY OUTPUT

- PRE-ASSEMBLED, SKID-MOUNTED, REVERSE OSMOSIS SYSTEM
- ADVANCED TECHNOLOGY DESIGN
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- STAINLESS-STEEL PUMP, GAUGES, CORROSION-RESISTANT PIPING

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PHONE: (818) 767-3116 FAX:(818) 767-1470

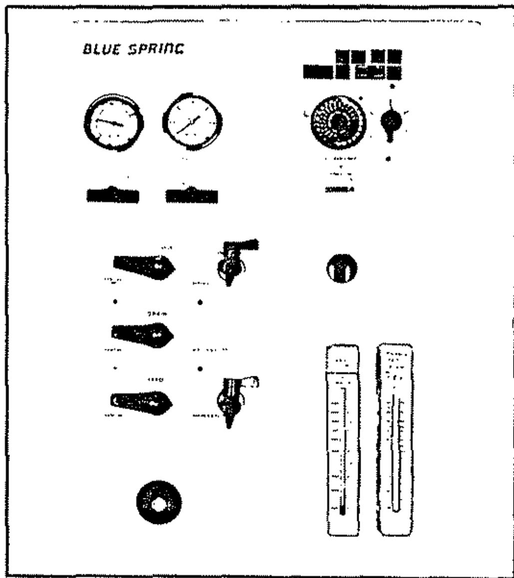
YOUR LOCAL REPRESENTATIVE

BLUE SPRING SERIES WP water purification systems represent the most up-to-date reverse osmosis technology for low-cost purification of water. The units are extremely compact, measuring about the size of a file-cabinet or a small refrigerator, yet have giant output capacities in the range of 10 lpm to 60 lpm (see specifications below). When used to purify brackish water, they produce high-quality drinking water exceeding W.H.O. standards. When used to purify city water, they produce high-purity water suitable for diverse industrial and commercial applications such as boiler feed water, food-processing, chemical manufacturing and pharmaceutical manufacturing. The units come fully pre-assembled, enclosed, and are ready to connect to your electrical power source and the source of raw water. A recirculating loop option is available for medical applications. Ask for brochure WP-R. Smaller units in WP-series are available for laboratory applications.

BLUE SPRING WP-SERIES water purification systems incorporate the latest advances in reverse osmosis technology. The units use special, high-efficiency reverse osmosis membranes of thin-film-composite design, which demonstrate the lowest energy consumption, highest rejection of all kinds of impurities, highest resistance to water-borne micro-organisms and a long operating life. The fresh water produced by BLUE SPRING SERIES WP water purification systems is of superior quality surpassing the drinking water quality standards established by world-wide organizations such as W.H.O. Typically, the output water from these units contains as low as 60 ppm of dissolved solids when operated on brackish water and as low as 5 ppm of dissolved solids when operated on most city waters. Unlike ion-exchange deionization systems which remove only dissolved salts, the BLUE SPRING reverse osmosis units indiscriminately remove all kinds of impurities, regardless of their nature or the source. The output water generally contains less than 10 colonies of bacteria per milliliter, and it is free of all particulate and organic matter. BLUE SPRING's high-efficiency design results in an incredibly low energy consumption of only 1.1 kwh per cu. meter of purified water produced. Also, the consumption of raw water is held down to only 1.3-1.5 cu. meter per cu. meter of purified water. Such low water and energy consumption combined with long operating life of reverse osmosis modules result in exceptionally low operating costs.

BLUE SPRING WP-SERIES water purification systems are designed for heavy-duty, continuous operation. Every precaution is taken to assure long, trouble-free performance from the units. All materials of construction are specially selected for corrosion-resistance to water and to the operating environment. The frame is constructed of corrosion-resistant, welded aluminum, instead of painted steel. The functional parts and the piping are made of corrosion-resistant stainless-steel or space-age polymeric materials. The units include high-capacity, cartridge-type filter elements. Additional pre-treatment is available to overcome deficiencies in local water supply. The units also contain our time-proven membrane cleaning system with easy-to-operate front-panel controls. This helps maintain the purity of output water and assures top purification performance from the units, year after year.

The units feature an ergonomic control panel with up-to-date instrumentation which includes two on-line purity meters, two pressure gauges, two flow meters, an elapsed time meter, a 7-day program timer with battery back-up, a 60-minute count-down timer, an automatic level controller for product water reservoir. And for added safety during unattended operation, the system has a three-way safety shut-down mechanism with front-panel indication of fault condition.



CONTROL PANEL FOR WP UNITS

BLUE SPRING SERIES WP water purification systems can provide you with a low-cost, reliable source of purified water. And they are backed by BLUE SPRING CORPORATION, the world's most trusted name in water purification since 1980.

SPECIFICATIONS

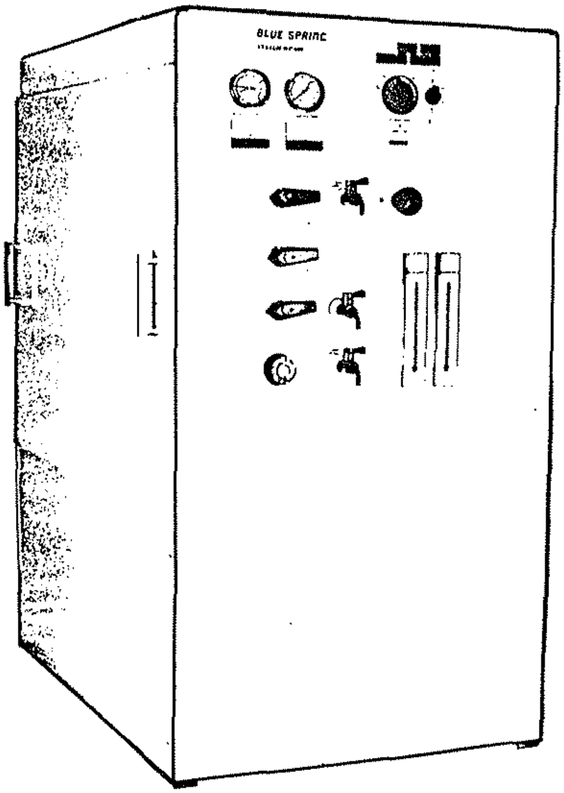
	SYSTEM WP-170	SYSTEM WP-280	SYSTEM WP-400	SYSTEM WP-600	SYSTEM WP-1000
DIMENSIONS	20"W x 26"D x 48"H	20"W x 26"D x 48"H	20"W x 30"D x 48"H	26"W x 38"D x 48"H	32"W x 38"D x 48"H
SHIPPING WT.	265 lbs	325 lbs	365 lbs	650 lbs	840 lbs
ELECTRICAL	117 VAC/60 Hz 1 ph/8.5 A	117 VAC/60 Hz 1 ph/11 A	230 VAC/60 Hz 1 ph/8 A	230 VAC/60 Hz 3 ph/6.5 A	230 VAC/60 Hz 3 ph/11 A
PLUMBING	½" FPT Unions for feed,output and reject lines	½" FPT Unions for feed,output and reject lines	¾" FPT Unions for feed,output and reject lines	¾" FPT Unions for feed,output and reject lines	1" FPT Unions for feed,output and reject lines
CAPACITY	10 lpm ±10%	18 lpm ±10%	25 lpm ±10%	38 lpm ±10%	60 lpm ±10%
	Output measured with 500 ppm salt in feed water. About 20% lower capacity, using brackish water feed.				
FEED WATER	15 lpm at 20-75 psi pressure,5-45 °C	23 lpm at 20-75 psi pressure,5-45 °C	34 lpm at 20-75 psi pressure,5-45 °C	53 lpm at 20-75 psi pressure,5-45 °C	83 lpm at 20-75 psi pressure,5-45 °C
PERFORMANCE	Removes 96-98% of salts, > 99.5% of particulate matter, organics, bacteria etc., from feed water				

WATER PURIFIERS

BLUE SPRING ®

WP - SERIES

Ideal for desalinating brackish water to produce drinking water, also for purifying city water for producing high-purity water for industrial, medical uses . . .



COMPACT SIZE ■ GIANT 10-60 LPM OUTPUT

- PORTABLE SOURCE OF HIGH-QUALITY WATER FREE OF PARTICULATES, CHEMICAL CONTAMINANTS, BACTERIA AND ALL OTHER IMPURITIES
- ADVANCED TECHNOLOGY, REVERSE OSMOSIS DESIGN
- FULLY AUTOMATIC OPERATION WITH PROGRAM TIMER, LEVEL-CONTROL
- ON-LINE PURITY METERS, PRESSURE GAUGES, FLOW METERS, ELAPSED TIME METER, COUNT-DOWN TIMER, OTHER INSTRUMENTATION
- THREE-WAY PROTECTION AGAINST CATASTROPHIC FAILURE
- STAINLESS-STEEL PUMP, GAUGES, CORROSION-RESISTANT PIPING
- EASY-TO-USE, FOOL-PROOF CLEANING/SANITIZING SYSTEM

BLUE SPRING CORPORATION	YOUR LOCAL REPRESENTATIVE
8101 CLYBOURN AVENUE SUN VALLEY CA 91352 PHONE: (818) 767-3116 FAX: (818) 767-1470	

OSMONICS, INC.®

5951 CLEARWATER DRIVE
MINNETONKA, MINNESOTA 55343 U.S.A.
(15 miles west of Minneapolis airport)
TELEX: 29-0847-OSMONICS MTKA
PHONE: 612/933-2277

SPECIALISTS REVERSE OSMOSIS • ULTRAFILTRATION • PURE WATER SYSTEMS

3 May 1990

Mr. Steven G. Swanback
JOHN CAROLLO ENGINEERS
450 North Wiget Lane
Walnut Creek, CA 94598

Re: Cambria Community Services District

Dear Steve:

Thank you for your telephone call and letter of 1 May 1990. Your interest in the systems designed and manufactured by Osmonics is greatly appreciated.

Referencing our discussions, we have used our reverse osmosis worksheet to predict water quality using membrane treatment for each water supply. Printouts have been attached for your reference. To meet your requirement for total dissolved solids requires the use of a fairly tight pored membrane. A true nanofiltration membrane will not meet your requirement for total dissolved solids less than 100 mg/l. We recommend our Osmo SR or PR membrane for this application. These membranes are larger pored versions of our high rejection CA membranes and are compatible with chlorine and other disinfectants. This is an important consideration in effluent treatment systems. Biological foulants are often seen to cause membrane fouling. It is important that these foulants be controlled.

Proper pretreatment of any membrane system is essential for optimum system performance. We recommend the use of a good dual media prefilter to remove feed water sediment. Our Osmonics dual media filters use manganese greensand and anthracite. This provides the dual function of oxidizing materials in the feed such as iron while providing an excellent filtration bed. In addition, to maximize the recovery acid addition is recommended. At a feed pH of 5.5 we predict recoveries of 85% or greater are possible. Pilot testing will determine the maximum recovery possible.

We estimate the uninstalled capital price for a system sized to treat 500 gpm from either source at $300,000 - $350,000. This pricing includes dual media prefilters and skid mounted RO system complete with pumps, motors, motor starters, automatic acid feed system, complete intrumentation and control functions (controlled by Allen Bradley processor), cartridge prefilters, membrane elements and housings. Since 500 gpm is the largest size that can be placed on a single skid, a system sized to treat 1000 gpm would be approximately double the price. Operating costs for either system have been calculated at about $0.68 per 1000 gallons produced. A spread sheet showing these calculations has also been attached.

Osmonics has available a number of pilot test systems for evaluating processes. Most of these systems are sized to produce about 10 gpm of permeate. The systems are designed to operate with several membrane elements (sepralators) and approximate performance in a full size system. Each system is a complete skid mounted system ready for immediate installation on shipment. These systems are designed for variable flow and pressure operation and can be operated at recoveries in excess of 95%. These systems are perfect for evaluating your process. The rental price for our Osmo 80B-PES systems is $4000 per month plus the purchase price of the sepralators ($2608 total). Therefore, the price for a three month pilot system rental would be 3 x $4000 + 2608 = $14,608. Included in the rental price is a separate CIP cleaning skid and one day of onsite start up supervision and operator training by an Osmonics factory engineer. We of course remain available throughout the lease period to provide consultation.

We hope that you find this information complete. Please contact us with any questions. We look forward to working with you.

Sincerely,
OSMONICS, INC.

Kevin T. Finkenbiner
Sales Engineer
Engineered Products and Systems

Encl. ROWS Worksheets
Operating Cost Spreadsheet
Osmonics General Brochure
Annual Report
Filtration Spectrum

REVERSE OSMOSIS WORK SHEET — By KTF

Date 05-03-1990

Job CAMBRIA - TREATED EFFLUENT

eed Concentration(Cf) ppm

ation	As Ion	As CaCO3
Ca++	59	148
g++	38	156
a+	160	349
K+	0	0

Anion	As Ion	As CaCO3	pH Adj
HCO3-	366	300	110
SO4=	77	80	270
Cl-	191	269	
NO3-	3	2	
F-	0	0	

Operating conditions: pH= 6.0, Recovery= 75%, Temperature= 77 F

Operating Pressure is 420psi for PR,SR,HR and 225psi for PA membranes

alt	C_feed	Cc(PR)	Cc(SR)	Cc(HR)	Cc(PA)	Cp(PR)	Cp(SR)	Cp(HR)	Cp(PA)
CaSO4	148	563	573	579	581	8.9	5.8	3.6	2.9
a(HCO3)2	0	0	0	0	0	0.0	0.0	0.0	0.0
aCl	269	865	934	984	1039	70.9	48.1	31.3	13.1
NaHCO3	79	266	283	295	306	17.2	11.6	7.5	3.9
Na2SO4	0	0	0	0	0	0.0	0.0	0.0	0.0
Cl2	0	0	0	0	0	0.0	0.0	0.0	0.0
(HCO3)2	30	106	111	115	117	5.1	3.4	2.2	1.5
MgCl2	0	0	0	0	0	0.0	0.0	0.0	0.0
gSO4	123	470	477	483	485	7.4	4.8	3.0	2.4
g(NO3)2	2	5	7	7	7	1.5	1.1	0.7	0.7
Total	652	2275	2384	2463	2535	111.0	74.7	48.4	24.5

	(PR)	(SR)	(HR)	(PA)
stimated osmotic pressure of concentrates are (psi):	20	21	22	23
stimated osmotic pressure of averages are (psi) :	13	14	14	15

O2 concentration in feed, concentrate, and permeate is 220 ppm

The Actual pH of the feed: RAW 7.3 Adjusted: 6.0
The Saturation pH of the feed: RAW 7.2 Adjusted: 7.7

	(PR)	(SR)	(HR)	(PA)
he actual pH's of the concentrates are :	6.5	6.6	6.6	6.6
he saturation pH's of the concentrates are :	6.6	6.6	6.5	6.5
The actual pH's of the averages are :	6.3	6.4	6.4	6.4
he saturation pH's of the averages are :	7.0	6.9	6.9	6.9
actual pH's of the permeates are :	5.3	5.2	5.0	4.7
he saturation pH's of the permeates are :	9.5	9.8	10.2	10.5

Percentage of Saturation of CaSO4 in Concentrate = 32 %

THERE IS A SCALING PROBLEM FOR CaCO3 ON THIS WATER!

REVERSE OSMOSIS WORK SHEET By KTF

Date 05-03-1990

Job CAMBRIA - TREATED EFFLUENT

Feed Concentration(Cf) ppm

Cation	As Ion	As CaCO3
Ca++	59	148
Mg++	38	156
Na+	160	349
K+	0	0

Anion	As Ion	As CaCO3	pH Adj
HCO3-	366	300	44
SO4=	77	80	336
Cl-	191	269	
NO3-	3	2	
F-	0	0	

Operating conditions: pH= 5.5, Recovery= 75%, Temperature= 77 F

Operating Pressure is 420psi for PR,SR,HR and 225psi for PA membranes

Salt	C_feed	Cc(PR)	Cc(SR)	Cc(HR)	Cc(PA)	Cp(PR)	Cp(SR)	Cp(HR)	Cp(PA)
CaSO4	148	563	573	579	581	8.9	5.8	3.6	2.9
Ca(HCO3)2	0	0	0	0	0	0.0	0.0	0.0	0.0
NaCl	269	865	934	984	1039	70.9	48.1	31.3	13.1
NaHCO3	44	148	157	164	170	9.6	6.5	4.2	2.1
Na2SO4	35	134	136	138	138	2.1	1.4	0.9	0.7
CaCl2	0	0	0	0	0	0.0	0.0	0.0	0.0
Mg(HCO3)2	0	0	0	0	0	0.0	0.0	0.0	0.0
MgCl2	0	0	0	0	0	0.0	0.0	0.0	0.0
MgSO4	153	586	596	602	604	9.2	6.0	3.8	3.0
Mg(NO3)2	2	5	7	7	7	1.5	1.1	0.7	0.7
Total	652	2302	2402	2475	2541	102.2	68.8	44.5	22.6

	(PR)	(SR)	(HR)	(PA)
Estimated osmotic pressure of concentrates are (psi):	19	20	21	22
Estimated osmotic pressure of averages are (psi) :	12	13	13	14

CO2 concentration in feed, concentrate, and permeate is 285 ppm

The Actual pH of the feed: RAW 7.3 Adjusted: 5.5
The Saturation pH of the feed: RAW 7.2 Adjusted: 8.1

	(PR)	(SR)	(HR)	(PA)
The actual pH's of the concentrates are :	6.0	6.1	6.1	6.1
The saturation pH's of the concentrates are :	7.0	7.0	6.9	6.9
The actual pH's of the averages are :	5.8	5.9	5.9	5.9
The saturation pH's of the averages are :	7.4	7.3	7.3	7.3
The actual pH's of the permeates are :	4.9	4.7	4.5	4.2
The saturation pH's of the permeates are :	9.8	10.1	10.5	10.8

Percentage of Saturation of CaSO4 in Concentrate = 32 %

REVERSE OSMOSIS WORK SHEET — By KTF

Date 05-03-1990

Job CAMBRIA - TREATED EFFLUENT

eed Concentration(Cf) ppm

ation	As Ion	As CaCO3
Ca++	59	148
g++	38	156
a+	160	349
K+	0	0

Anion	As Ion	As CaCO3	pH Adj
HCO3-	366	300	44
SO4=	77	80	336
Cl-	191	269	
NO3-	3	2	
F-	0	0	

Operating conditions: pH= 5.5, Recovery= 85%, Temperature= 77 F

Operating Pressure is 420psi for PR,SR,HR and 225psi for PA membranes

alt	C_feed	Cc(PR)	Cc(SR)	Cc(HR)	Cc(PA)	Cp(PR)	Cp(SR)	Cp(HR)	Cp(PA)
CaSO4	148	909	934	952	958	13.2	8.7	5.5	4.4
a(HCO3)2	0	0	0	0	0	0.0	0.0	0.0	0.0
aCl	269	1256	1415	1540	1686	95.4	67.4	45.2	19.6
NaHCO3	44	220	243	260	276	13.2	9.2	6.1	3.2
Na2SO4	35	216	223	227	228	3.1	2.1	1.3	1.1
Cl2	0	0	0	0	0	0.0	0.0	0.0	0.0
(HCO3)2	0	0	0	0	0	0.0	0.0	0.0	0.0
MgCl2	0	0	0	0	0	0.0	0.0	0.0	0.0
gSO4	153	945	971	990	996	13.7	9.0	5.7	4.6
g(NO3)2	2	7	9	11	11	1.7	1.3	1.0	1.0
Total	652	3552	3794	3980	4156	140.3	97.6	64.8	33.8

	(PR)	(SR)	(HR)	(PA)
stimated osmotic pressure of concentrates are (psi):	29	32	34	36
stimated osmotic pressure of averages are (psi) :	17	19	20	21

O2 concentration in feed, concentrate, and permeate is 285 ppm

The Actual pH of the feed: RAW 7.3 Adjusted: 5.5

The Saturation pH of the feed: RAW 7.2 Adjusted: 8.1

	(PR)	(SR)	(HR)	(PA)
he actual pH's of the concentrates are :	6.2	6.2	6.3	6.3
he saturation pH's of the concentrates are :	6.6	6.6	6.5	6.5
The actual pH's of the averages are :	6.0	6.0	6.0	6.1
he saturation pH's of the averages are :	7.1	7.0	7.0	7.0
actual pH's of the permeates are :	5.0	4.8	4.7	4.4
he saturation pH's of the permeates are :	9.5	9.8	10.1	10.4

Percentage of Saturation of CaSO4 in Concentrate = 50 %

Ca may cause CaCO3 Scaling problems, based on LSI.

REVERSE OSMOSIS WORK SHEET By KTF

Date 05-03-1990

Job CAMBRIA - EXTRACTION WELL

Feed Concentration(Cf) ppm

Cation	As Ion	As CaCO3
Ca++	77	193
Mg++	50	205
Na+	55	120
K+	0	0

Anion	As Ion	As CaCO3	pH Adj
HCO3-	378	310	120
SO4=	63	66	255
Cl-	101	142	
NO3-	0	0	
F-	0	0	

Operating conditions: pH= 6.0, Recovery= 75%, Temperature= 77 F

Operating Pressure is 420psi for PR,SR,HR and 225psi for PA membranes

Salt	C_feed	Cc(PR)	Cc(SR)	Cc(HR)	Cc(PA)	Cp(PR)	Cp(SR)	Cp(HR)	Cp(PA)
CaSO4	193	735	747	756	759	11.6	7.5	4.7	3.8
Ca(HCO3)2	0	0	0	0	0	0.0	0.0	0.0	0.0
NaCl	120	385	415	438	462	31.6	21.4	13.9	5.8
NaHCO3	0	0	0	0	0	0.0	0.0	0.0	0.0
Na2SO4	0	0	0	0	0	0.0	0.0	0.0	0.0
Cl2	0	0	0	0	0	0.0	0.0	0.0	0.0
Mg(HCO3)2	120	420	440	455	463	20.2	13.4	8.6	5.8
MgCl2	22	77	81	83	85	3.7	2.5	1.6	1.1
MgSO4	63	240	244	247	248	3.8	2.5	1.5	1.2
Total	517	1857	1928	1978	2016	70.9	47.3	30.4	17.8

	(PR)	(SR)	(HR)	(PA)
Estimated osmotic pressure of concentrates are (psi):	14	15	15	16
Estimated osmotic pressure of averages are (psi) :	9	9	10	10

CO2 concentration in feed, concentrate, and permeate is 240 ppm

The Actual pH of the feed: RAW 7.1 Adjusted: 6.0
The Saturation pH of the feed: RAW 7.1 Adjusted: 7.5

	(PR)	(SR)	(HR)	(PA)
The actual pH's of the concentrates are :	6.5	6.6	6.6	6.6
The saturation pH's of the concentrates are :	6.4	6.4	6.4	6.4
The actual pH's of the averages are :	6.4	6.4	6.4	6.4
The saturation pH's of the averages are :	6.8	6.8	6.8	6.8
The actual pH's of the permeates are :	5.3	5.1	4.9	4.7
The saturation pH's of the permeates are :	9.4	9.7	10.1	10.4

Percentage of Saturation of CaSO4 in Concentrate = 42 %

NOTICE: THERE IS A SCALING PROBLEM FOR CaCO3 ON THIS WATER!

REVERSE OSMOSIS WORK SHEET By KTF

Date 05-03-1990

Job CAMBRIA - EXTRACTION WELL

Feed Concentration(Cf) ppm

Cation	As Ion	As CaCO3
Ca++	77	193
Mg++	50	205
Na+	55	120
K+	0	0

Anion	As Ion	As CaCO3	pH Adj
HCO3-	378	310	48
SO4=	63	66	327
Cl-	101	142	
NO3-	0	0	
F-	0	0	

Operating conditions: pH= 5.5, Recovery= 75%, Temperature= 77 F

Operating Pressure is 420psi for PR,SR,HR and 225psi for PA membranes

Salt	C_feed	Cc(PR)	Cc(SR)	Cc(HR)	Cc(PA)	Cp(PR)	Cp(SR)	Cp(HR)	Cp(PA)
CaSO4	193	735	747	756	759	11.6	7.5	4.7	3.8
Ca(HCO3)2	0	0	0	0	0	0.0	0.0	0.0	0.0
NaCl	120	385	415	438	462	31.6	21.4	13.9	5.8
NaHCO3	0	0	0	0	0	0.0	0.0	0.0	0.0
Na2SO4	0	0	0	0	0	0.0	0.0	0.0	0.0
CaCl2	0	0	0	0	0	0.0	0.0	0.0	0.0
Mg(HCO3)2	48	169	177	183	186	8.2	5.4	3.5	2.3
MgCl2	22	77	81	83	85	3.7	2.5	1.6	1.1
MgSO4	135	514	523	529	530	8.1	5.3	3.3	2.7
Total	517	1880	1943	1988	2022	63.1	42.1	27.1	15.7

	(PR)	(SR)	(HR)	(PA)
Estimated osmotic pressure of concentrates are (psi):	13	14	14	15
Estimated osmotic pressure of averages are (psi) :	8	9	9	9

CO2 concentration in feed, concentrate, and permeate is 312 ppm

The Actual pH of the feed: RAW 7.1 Adjusted: 5.5
The Saturation pH of the feed: RAW 7.1 Adjusted: 7.9

	(PR)	(SR)	(HR)	(PA)
The actual pH's of the concentrates are :	6.0	6.1	6.1	6.1
The saturation pH's of the concentrates are :	6.8	6.8	6.8	6.8
The actual pH's of the averages are :	5.9	5.9	5.9	5.9
The saturation pH's of the averages are :	7.2	7.2	7.2	7.2
The actual pH's of the permeates are :	4.8	4.6	4.4	4.2
The saturation pH's of the permeates are :	9.7	10.1	10.4	10.7

Percentage of Saturation of CaSO4 in Concentrate = 42 %

No Scaling Problem for CaCO3
[illegible] for CaSO4

REVERSE OSMOSIS WORK SHEET — By KTF

Date 05-03-1990

Job CAMBRIA - EXTRACTION WELL

Feed Concentration(Cf) ppm

Cation	As Ion	As $CaCO_3$
Ca^{++}	77	193
Mg^{++}	50	205
Na^{+}	55	120
K^{+}	0	0

Anion	As Ion	As $CaCO_3$	pH Adj
HCO_3^-	378	310	48
$SO_4^{=}$	63	66	327
Cl^-	101	142	
NO_3^-	0	0	
F^-	0	0	

Operating conditions: pH= 5.5, Recovery= 85%, Temperature= 77 F

Operating Pressure is 420psi for PR,SR,HR and 225psi for PA membranes

Salt	C_feed	Cc(PR)	Cc(SR)	Cc(HR)	Cc(PA)	Cp(PR)	Cp(SR)	Cp(HR)	Cp(PA)
$CaSO_4$	193	1186	1219	1243	1251	17.2	11.3	7.2	5.8
$Ca(HCO_3)_2$	0	0	0	0	0	0.0	0.0	0.0	0.0
$NaCl$	120	559	629	685	750	42.4	30.0	20.1	8.7
$NaHCO_3$	0	0	0	0	0	0.0	0.0	0.0	0.0
Na_2SO_4	0	0	0	0	0	0.0	0.0	0.0	0.0
Cl_2	0	0	0	0	0	0.0	0.0	0.0	0.0
$Mg(HCO_3)_2$	48	257	278	293	303	11.5	7.8	5.1	3.5
$MgCl_2$	22	117	127	134	138	5.2	3.6	2.3	1.6
$MgSO_4$	135	829	853	869	875	12.0	7.9	5.0	4.0
Total	517	2948	3106	3224	3316	88.4	60.6	39.8	23.6

	(PR)	(SR)	(HR)	(PA)
Estimated osmotic pressure of concentrates are (psi):	20	22	23	24
Estimated osmotic pressure of averages are (psi) :	12	13	13	14

CO_2 concentration in feed, concentrate, and permeate is 312 ppm

The Actual pH of the feed: RAW 7.1 Adjusted: 5.5

The Saturation pH of the feed: RAW 7.1 Adjusted: 7.9

	(PR)	(SR)	(HR)	(PA)
The actual pH's of the concentrates are :	6.2	6.3	6.3	6.3
The saturation pH's of the concentrates are :	6.6	6.6	6.6	6.6
The actual pH's of the averages are :	6.0	6.0	6.1	6.1
The saturation pH's of the averages are :	6.9	6.9	6.8	6.8
The actual pH's of the permeates are :	4.9	4.7	4.6	4.4
The saturation pH's of the permeates are :	9.4	9.8	10.1	10.4

Percentage of Saturation of $CaSO_4$ in Concentrate = 66 %

Small Changes in pH, Alk, Ca may cause $CaCO_3$ Scaling problems, based on LSI.

COST OF OPERATION SPREADSHEET
Version AMT-0190

BASIC OPERATING PARAMETERS:

Flow Rate	Water Produced (gpm):	425
Capital Costs	RO	250,000
	Twin Bed DI	0
	Mixed Bed DI	0
Common Operating Costs	Labor ($/hour):	15
	Water ($/1000 gal feed):	0
	Sewer ($/1000 gl waste):	0
Other	Hours per day Operation:	24

RO COST OF OPERATION DATA

General	2-Pass RO (Y or N)	N
Sepralator Replacement	Number of Sepralators:	72
	Replacement Cost/Sep ($):	792
	Sepralator Life (Years):	3
Power	RO Recovery (%):	85
	Operating Pressure (psi):	400
	Recycle (gpm)	20
	Pump Efficiency (%):	60
	Motor Efficiency (%):	90
	Power Cost ($/KWH):	0.06
Prefilters	Number of Prefilter TIES:	100
	Filter Life (Days):	14
	Cost Per TIE ($):	2.25
Acid Injection	Acid Injected (ppm SO4):	230
	% Sulfuric Acid Purchased:	93
	Cost Per Gallon Acid ($):	1
Flocon Injection	Dosage of Flocon (ppm):	0
	Cost Per Gallon Flocon ($):	15
Cleaning	Fl Oz Cleaner/Gal Solution:	2
	Vol. Cleaning Soln. (gallons):	2000
	Cost Per Gallon Cleaner ($):	11
	Cleaning Frequency (Weeks):	12
Labor	Labor per day (hours):	0.5
Other	Other Costs ($/1000 gal):	0

COST OF OPERATION SUMMARY

RO ($/1000 gal Perm.)

Sepralator Replacement:	$0.09
Power:	$0.39
Prefilters:	$0.03
Acid:	$0.16
Dispersant:	$0.00
Cleaning:	$0.01
Labor:	$0.01
Water & Sewer:	$0.00
Other:	$0.00
TOTAL $/1000 Gal Perm.	$0.68
TOTAL $/Day	$419

PERMEATION
Technologies Inc.

May 11, 1990

John Carollo Engineers
450 North Wiget Lane
Walnut Creek, CA 94598

Attn: Mr. Steven G. Swanback

Ref: Reverse Osmosis Wastewater Treatment Plants
Cambria Community Services District

Gentlemen:

The following information is provided in reference to your letter dated April 30, 1990.

1. Estimated installed cost for a 500-gpm plant is $900.000. Refer to the attached scope of supply for equipment. The cost does not include civil works, building, wells, well piping, storage tanks etc.

2. Estimated installed cost for a 1000-gpm plant is $1,600,000.

3. The permeate (process effluent) quality is less than 100 mg/1. Refer to the attached computer projections at start and 3-year.

4. Refer to the attached computer projections for reject (concentrate) quality.

5. The reject volume is set at 15% of the feed.

6. The recommended pilot unit size is 10,000 gpd. Approximate cost will be $20,000. The major operating cost will be that of engineering services, evaluation and report preparation. The direct cost including the labor cost to operate the unit is not significant.

7. Refer to attached Tables I, II and III. All costs are approximate.

More information is required on raw water to define the exact pretreatment requirement. If you have any questions, please free to call me.

Very truly yours,

Ashwin M. Desai
President

cc: Cambria Community Services District

1706 LASUEN ROAD, SANTA BARBARA, CA 93103
PHONE: (805) 965-0910 FAX: (805) 683-1763

PERMEATION
Technologies Inc.

SCOPE OF SUPPLY

PRETREATMENT

1- coagulant feed system consisting of

- 2- metering pumps (1 operating, 1 standby)
- 1- mix tank
- 1lot- instrumentation and controls

1- polymer feed system consisting of

- 2- metering pumps (1 operating, 1 standby)
- 1- mix tank
- 1lot- instrumentation and controls

1- media filtration system consisting of

- 1set- media filters
- 1- backwash pump
- 1lot- instrumentation and controls

REVERSE OSMOSIS

1- sodium bisulfite feed system consisting of

- 2- metering pumps (1 operating, 1 standby)
- 1- mix tank
- 1lot- instrumentation and controls

1- anti-scalant feed system consisting of

- 2- metering pumps (1 operating, 1 standby)
- 1- mix tank
- 1lot- instrumentation and controls

1- acid feed system consisting of

- 2- metering pumps (1 operating, 1 standby)
- 1- day tank
- 1- bulk storage tank (30-day)
- 1- transfer pump
- 1lot- instrumentation and controls

2+ 5 micron cartridge filters (1+ operating, 1 standby)

2+ high pressure pumps (1+ operating, 1 standby)

1 RO section consisting of

- 1set- membrane elements
- 1set- pressure tubes
- 1lot- ss/pvc headers

PERMEATION
Technologies Inc.

1 degasifier complete with air blowers and packing

1 soda-ash feed system consisting of

2- metering pumps (1 operating, 1 standby)
1- mix tank
1lot- instrumentation and controls

1- cleaning system consisting of

1- recirculation pump
1- 5 micron cartridge filter
1- mix tank
1lot- instrumentation and controls

1lot- piping and fittings

1lot- instruments

1lot valves

1lot- structural skids

1- control panel with programmable logic controller

1lot- electrical (starters, transformers, switches, lights etc.

CUSTOMER'S SCOPE OF SUPPLY

plant installation in a suitable building

power and chemicals

piping and electrical connections

startup and commissioning

operation and maintenance

chlorination system

special pretreatment of the raw water if required

permits

TABLE I

PROCESS DATA

	500-GPM RO PLANT	1000-GPM RO PLANT
permeate:		
Flow(gpm)	500	1000
(gpd)	720000	1440000
Quality(ppm)	<100	<100
Pressure(psi)	10	10
pH*	<5(7.5)	<5(7.5)
CO2(ppm)*	250(<3)	250(<3)
Recovery(%)	85	85
Feed:		
Flow(gpm)	588	1176
Quality(ppm)	Refer to attached	
Pressure(psi)	60	60
Temperature(F)	68	68
pH	7.1-7.3	7.1-7.3
CO2(ppm)	30-50	30-50
Concentrate:		
Flow(gpm)	88	176
Quality(ppm)(apprx.)	5000	5000
Pressure(psi)	<100	<100
pH(apprx)	6.4	6.4
RO section: (preliminary sizing)		
tube array	18:12:6	36:24:12
no. of tubes	36	72
no. of elem./tube	4	4
no. of elements	144	288
HP pump: (# operating plus 1 standby)	1+1	2+1
TDH(psi)	350	350
BHP	160	160
motor hp	200	200
Power consumption(kwhr/day):		
HP pumps	3083	6166
Chemicals consumption(lb./day)		
chlorine	58	116
coagulant(50%)	290	580
polymer	36	72
acid(93 % H2SO4)	1865	3730
anti-scalant(35%)	20	40
sodium bisulfide(97.5)	36	72
soda-ash	120	240

*bracketed values are post-degasification and soda-ash feed(pH adj.)

PERMEATION
Technologies Inc.

TABLE II
<u>OPERATING COST PARAMETERS</u>
(500-GPM RO PLANT)

	UNIT COST, $	CONSUMPTION /DAY	CONSUMPTION /1000-GAL	OPERATING COST, $ DAILY	OPERATING COST, $ ANNUAL	OPERATING COST, $ /KGAL	OPERATING COST, $ /ACRE-FT
Power(kwh)							
HP pump	0.08	3083	4.28	246.64	90024	0.34	111.64
boost pump	0.08	602	0.84	48.16	17578	0.07	21.80
Chemicals(lb)							
Pretreat							
chlorine	0.25	58	0.08	14.52	5300	0.02	6.57
coagl.(50%)	0.20	290	0.40	58.08	21199	0.08	26.29
polym.(20%)	0.80	36	0.05	29.04	10600	0.04	13.15
Reverse Osmosis							
H2SO4(93%)	0.05	1865	2.59	93.25	34036	0.13	42.21
antisc(35%)	1.50	20	0.03	30.24	11038	0.04	13.69
sod.bis(97%)	.40	36	0.05	14.47	5282	0.02	6.55
cleaning		--	--	28.80	10512	0.04	13.04
Post-treat							
soda-ash	0.20	120	0.17	24.00	8760	0.03	10.86
Membr.Repl.	-	-	-	131.51	48000	0.18	59.53
Su fil.Repl.	-	-	-	15.78	5760	0.02	7.14
Total Direct Cost		-	-	734.49	268089	1.01	332.47
Labor Costs(pro-rated)		-	-	200.00	73000	0.28	90.52
Maintenance Supplies		-	-	50.00	18250	0.07	22.63
Total Operating Cost		-	-	984.49	359339	1.36	445.62
Annualized Capital Cost for RO system including installation, start-up & commissioning, and training but excluding civil works, building, wells, transmission lines, booster pumps, storage tanks etc. (apprx.)		-	-	246.57	90000	0.35	111.61
Total Cost		-	-	1231.06	449339	1.71	557.23

notes: 1. Annual power and chemicals costs are based on 365 days per year.
2. Membrane replacement cost is based on a 3-year prorata life.
3. K-GAL= 1000 gallons of permeate

TABLE III
OPERATING COST PARAMETERS
(1000-GPM RO PLANT)

	UNIT COST, $	CONSUMPTION /DAY	CONSUMPTION /1000-GAL	OPERATING COST, $ DAILY	ANNUAL	/KGAL	/ACRE-FT
Power(kwh)							
HP pump	0.08	6166	4.28	493.28	180048	0.34	111.64
boost pump	0.08	1204	0.84	96.32	35156	0.07	21.80
Chemicals(lb)							
Pretreat							
chlorine	0.25	116	0.08	29.04	10600	0.02	6.57
coagl.(50%)	0.20	580	0.40	116.16	42398	0.08	26.29
polym.(20%)	0.80	72	0.05	58.08	21200	0.04	13.15
Reverse Osmosis							
H2SO4(93%)	0.05	3730	2.59	186.50	68072	0.13	42.21
antisc(35%)	1.50	40	0.03	60.48	22076	0.04	13.69
sod.bis(97%)	.40	72	0.05	28.94	10564	0.02	6.55
cleaning	-	-	-	57.60	21024	0.04	13.04
Post-treat							
soda-ash	0.20	240	0.17	48.00	17520	0.03	10.86
Membr.Repl.	-	-	-	263.02	96000	0.18	59.53
5u fil.Repl.	-	-	-	31.56	11520	0.02	7.14
Total Direct Cost		-	-	1468.98	536178	1.01	332.47
Labor Costs(pro-rated)		-	-	250.00	91250	0.17	56.58
Maintenance Supplies		-	-	90.00	32850	0.06	20.37
Total Operating Cost		-	-	1808.98	660278	1.24	409.42
Annualized Capital Cost for RO system including installation, start-up & commissioning, and training but excluding civil works, building, wells, transmission lines, booster pumps, storage tanks etc. (apprx.)		-	-	438.36	160000	0.31	99.21
Total Cost		-	-	2247.34	820278	1.55	508.63

notes: 1. Annual power and chemicals costs are based on 365 days per year.
2. Membrane replacement cost is based on a 3-year prorata life.
3. K-GAL= 1000 gallons of permeate

PERMEATION
Technologies Inc.

TREATED EFFLUENT

RAW/FEED WATER ANALYSIS

Project : CAMBRIA COMMUNITY SERV.   Project code : P149TE   Date : 05-09-90

E cond :	1300 uS/cm	Turb :	0.0 NTU	pH :	7.30	CO2 :	29.7
Temp :	20.0 xC	SDI :	0.00 15min	H2S :	0.00	Fe :	0.07

		meq			meq
Ca :	59.0 ppm	2.943	CO3 :	0.3 ppm	0.011
Mg :	38.0 ppm	3.128	HCO3 :	366.0 ppm	6.000
Na :	160.0 ppm	6.957	SO4 :	77.0 ppm	1.604
K :	0.0 ppm	0.000	Cl :	170.0 ppm	4.795
NH4 :	0.0 ppm	0.000	F :	0.3 ppm	0.016
Ba :	0.000 ppm	0.000	NO3 :	12.0 ppm	0.194
Sr :	0.000 ppm	0.000	SiO2 :	0.0 ppm	

Tot. positive : 13.03   Tot. negative : 12.62
CaSO4 sat .% : 1.46   BaSO4 sat .% : 0.00
Silica sat .% : 0.00   SrSO4 sat .% : 0.00
Calc. TDS,ppm : 883   TDS/E. cond : 0.679   Ionic str. :0.017 Osm. press: 7
Langelier Saturation Index : -0.07   Stiff & Davis Sat.Index : -0.07

Press S to save or DDY to continue :

CONCENTRATE COMPOSITION

Project : CAMBRIA COMMUNITY SERV.   Project code : P149TE   Date : 05-08-90

Temp : 20.0 xC   Raw water pH: 7.30

			meq				meq
Ca :	376.6	ppm	18.784	CO3 :	0.0	ppm	0.000
Mg :	242.6	ppm	19.964	HCO3 :	307.4	ppm	5.039
Na :	1021.3	ppm	44.406	SO4 :	2030.1	ppm	42.293
K :	0.0	ppm	0.000	Cl :	1085.2	ppm	30.611
NH4 :	0.0	ppm	0.000	F :	1.9	ppm	0.101
Ba :	0.000	ppm	0.000	NO3 :	76.6	ppm	1.235
Sr :	0.000	ppm	0.000	SiO2 :	0.0	ppm	

Tot. positive : 83.15   Tot. negative : 79.28
CaSO4 sat .% : 55.17   BaSO4 sat .% : 0.00
Silica sat .% : 0.00   SrSO4 sat .% : 0.00
Calc. TDS,ppm : 5142   Ionic str. :0.122 Osm. press: 40
Langelier Saturation Index : -0.40   Stiff & Davis Sat.Index : -0.69
Concentrate pH : 6.3   Product pH : 5.1   CO2 : 249.7 Acid dosing,ppm : 245.9
Recovery,% : 85.0   Feed pH : 5.6   Acid : H2SO4   Av. salt passage,% : 5.0

Press R for recov. calcu., P for plant design or X to exit :

TREATED EFFLUENT
START

PERMEATION
Technologies Inc.

HYDRANAUTICS DESIGN PROGRAM - VERSION 4.02 (1989) 05-09-90
Calculation was made by: AMD

Project name : CAMBRIA COMMUNITY SERVICES DISTRICTPermeate flow : 720000 GPD

Feedwater temperature :	20.0 C	Recovery :	85.0%
Raw water pH :	7.30	Element age :	0.0 years
Acid dosage, ppm(100%):	245.8 H2SO4	Flux decline coefficient :	-0.035
Acidified feed CO2,ppm :	249.7	3-yr salt passage increase factor :	2.0

Feed Pressure : 239.0 psi Concentrate Pressure : 208.1 psi

Pass	Feed Flow Total gpm	Feed Flow Vessel gpm	Conc. Flow Total gpm	Conc. Flow Vessel gpm	Beta	Conc. Press. psi	Element Type	Element No.	Array
1	588.2	32.7	322.1	17.9	1.11	229.0	8060-MSY-CAB2	72	18x4
2	322.1	26.8	159.7	13.3	1.13	218.7	8060-MSY-CAB2	48	12x4
3	159.7	26.6	88.2	14.7	1.10	208.1	8060-MSY-CAB2	24	6x4

Ion	Raw water mg/l	Raw water ppm*	Feed water mg/l	Feed water ppm*	Permeate mg/l	Permeate ppm*	Concentrate mg/l	Concentrate ppm*
Ca	59.0	147.1	59.0	147.1	0.5	1.2	390.7	974.3
Mg	38.0	156.4	38.0	156.4	0.3	1.2	251.6	1035.6
Na	160.0	347.8	160.0	347.8	12.1	26.3	998.2	2170.1
K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NH4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ba	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO3	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.1
HCO3	366.0	300.0	61.3	50.2	2.4	2.0	394.9	323.7
SO4	77.0	80.2	317.9	331.2	1.6	1.7	2110.4	2198.3
Cl	170.0	239.8	170.0	239.8	16.4	23.1	1040.3	1467.3
F	0.3	0.8	0.3	0.8	0.0	0.0	1.9	5.0
NO3	12.0	9.7	12.0	9.7	2.2	1.8	67.4	54.4
SiO2	0.0		0.0		0.0		0.0	
TDS	882.6		818.5		35.5		5255.6	
pH	7.3		5.6		4.2		6.4	

Notes: *ppm as CaCO3. Calculated concentrations are accurate to +/- 10%

	Raw water	Feed water	Concentrate
CaSO4/Ksp*100,%	1.5	5.4	58.5
SrSO4/Ksp*100,%	0.0	0.0	0.0
BaSO4/Ksp*100,%	0.0	0.0	0.0
SiO2 sat.,%	0.0	0.0	0.0
Langelier ind.	-0.07	-2.55	-0.17
Stiff & Davis ind.	-0.07	-2.55	-0.46
Ionic strength	0.02	0.02	0.13
Osmotic press.,psi	7.2	6.3	40.4

TREATED EFFLUENT
3-YR

PERMEATION
Technologies Inc.

HYDRANAUTICS DESIGN PROGRAM - VERSION 4.02 (1989) 05-09-90
Calculation was made by: AMD

Project name : CAMBRIA COMMUNITY SERVICES DISTRICTPermeate flow : 720000 GPD

Feedwater temperature : 20.0 C
Raw water pH : 7.30
Acid dosage, ppm(100%): 245.8 H2SO4
Acidified feed CO2,ppm : 249.7

Recovery : 85.0%
Element age : 3.0 years
Flux decline coefficient : -0.035
3-yr salt passage increase factor :2.0

Feed Pressure : 296.7 psi

Concentrate Pressure : 265.4 psi

Pass	Feed Flow Total gpm	Feed Flow Vessel gpm	Conc. Flow Total gpm	Conc. Flow Vessel gpm	Beta	Conc. Press. psi	Element Type	Element No.	Array
1	588.2	32.7	325.9	18.1	1.11	286.6	8060-MSY-CAB2	72	18x4
2	325.9	27.2	162.5	13.5	1.13	276.2	8060-MSY-CAB2	48	12x4
3	162.5	27.1	88.2	14.7	1.11	265.4	8060-MSY-CAB2	24	6x4

Ion	Raw water mg/l	Raw water ppm*	Feed water mg/l	Feed water ppm*	Permeate mg/l	Permeate ppm*	Concentrate mg/l	Concentrate ppm*
Ca	59.0	147.1	59.0	147.1	0.9	2.3	388.2	968.1
Mg	38.0	156.4	38.0	156.4	0.6	2.4	250.0	1028.9
Na	160.0	347.8	160.0	347.8	22.8	49.5	937.5	2038.1
K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NH4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ba	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO3	0.3	[illegible]	0.0	0.0	0.0	0.0	0.0	0.1
HCO3	366.0	300.0	61.3	50.2	4.7	3.9	381.9	313.0
SO4	77.0	80.2	317.9	331.2	3.2	3.3	2101.6	2189.1
Cl	170.0	239.8	170.0	239.8	31.0	43.7	957.6	1350.7
F	0.3	0.8	0.3	0.8	0.0	0.1	1.5	4.8
NO3	12.0	9.7	12.0	9.7	4.0	3.2	57.2	46.2
SiO2	0.0		0.0		0.0		0.0	
TDS	882.6		818.5		67.2		5076.0	
pH	7.3		5.6		4.5		6.4	

Notes: *ppm as CaCO3. Calculated concentrations are accurate to +/- 10%

	Raw water	Feed water	Concentrate
CaSO4/Ksp*100,%	1.5	5.4	59.0
SrSO4/Ksp*100,%	0.0	0.0	0.0
BaSO4/Ksp*100,%	0.0	0.0	0.0
SiO2 sat.,%	0.0	0.0	0.0
Langelier ind.	-0.07	-2.55	-0.20
Stiff & Davis ind.	-0.07	-2.55	-0.48
Ionic strength	0.02	0.02	0.12
Osmotic press.,psi	7.2	6.3	38.6

PERMEATION
Technologies Inc.

EXTRACTION WELL

RAW/FEED WATER ANALYSIS

Project : CAMBRIA COMMUNITY SERV.   Project code : P149EW   Date : 05-09-90

E cond : 900 uS/cm   Turb : 0.0 NTU   pH : 7.10   CO2 : 48.6
Temp : 20.0 xC   SDI : 0.00 15min   H2S : 0.00   Fe : 0.05

			meq				meq
Ca :	77.0	ppm	3.840	CO3 :	0.2	ppm	0.007
Mg :	50.0	ppm	4.115	HCO3 :	378.0	ppm	6.197
Na :	55.0	ppm	2.391	SO4 :	63.0	ppm	1.313
K :	0.0	ppm	0.000	Cl :	86.0	ppm	2.426
NH4 :	0.0	ppm	0.000	F :	0.2	ppm	0.011
Ba :	0.000	ppm	0.000	NO3 :	31.0	ppm	0.500
Sr :	0.000	ppm	0.000	SiO2 :	0.0	ppm	

Tot. positive : 10.35   Tot. negative : 10.45
CaSO4 sat ,% : 1.69   BaSO4 sat ,% : 0.00
Silica sat ,% : 0.00   SrSO4 sat ,% : 0.00
Calc. TDS,ppm : 740   TDS/E. cond : 0.823   Ionic str. :0.015 Osm. press: 5
Langelier Saturation Index : -0.14   Stiff & Davis Sat.Index : -0.13

Press S to save or ANY to continue :

CONCENTRATE COMPOSITION

Project : CAMBRIA COMMUNITY SERV.   Project code : P149EW   Date : 05-08-90

Temp : 20.0 xC   Raw water pH: 7.10

			meq				meq
Ca :	491.5	ppm	24.515	CO3 :	0.0	ppm	0.000
Mg :	319.2	ppm	26.269	HCO3 :	336.2	ppm	5.511
Na :	351.1	ppm	15.264	SO4 :	1969.8	ppm	41.037
K :	0.0	ppm	0.000	Cl :	549.0	ppm	15.486
NH4:	0.0	ppm	0.000	F :	1.3	ppm	0.067
Ba :	0.000	ppm	0.000	NO3 :	197.9	ppm	3.192
Sr :	0.000	ppm	0.000	SiO2 :	0.0	ppm	

Tot. positive : 66.05   Tot. negative : 65.29
CaSO4 sat ,% : 74.63   BaSO4 sat ,% : 0.00
Silica sat ,% : 0.00   SrSO4 sat ,% : 0.00
Calc. TDS,ppm : 4216   Ionic str. :0.112 Osm. press: 28
Langelier Saturation Index : -0.24   Stiff & Davis Sat.Index : -0.50
Concentrate pH : 6.3   Product pH : 5.1   CO2 : 273.1 Acid dosing,ppm : 250.6
Recovery,% : 85.0   Feed pH : 5.6   Acid : H2SO4   Av. salt passage,% : 5.0

Press R for recov. calcu., P for plant design or X to exit :

EXTRACTION WELL START

PERMEATION
Technologies Inc.

HYDRANAUTICS DESIGN PROGRAM - VERSION 4.02 (1989) 05-09-90

alculation was made by: AMD

Project name : CAMBRIA COMMUNITY SERVICES DISTRICT Permeate flow : 720000 GPD

eedwater temperature : 20.0 C
Raw water pH : 7.10
Acid dosage, ppm(100%): 250.5 H2SO4
cidified feed CO2,ppm : 273.1

Recovery : 85.0%
Element age : 0.0 years
Flux decline coefficient : -0.035
3-yr salt passage increase factor :2.0

eed Pressure : 234.2 psi Concentrate Pressure : 203.0 psi

Pass	Feed Flow Total gpm	Feed Flow Vessel gpm	Conc. Flow Total gpm	Conc. Flow Vessel gpm	Beta	Conc. Press. psi	Element Type	Element No.	Array
1	588.2	32.7	324.2	18.0	1.11	224.2	8060-MSY-CAB2	72	18x4
	324.2	27.0	161.4	13.5	1.13	213.7	8060-MSY-CAB2	48	12x4
	161.4	26.9	88.2	14.7	1.11	203.0	8060-MSY-CAB2	24	6x4

Ion	Raw water mg/l	Raw water ppm*	Feed water mg/l	Feed water ppm*	Permeate mg/l	Permeate ppm*	Concentrate mg/l	Concentrate ppm*
Ca	77.0	192.0	77.0	192.0	0.8	1.9	509.0	1269.2
Mg	50.0	205.8	50.0	205.8	0.5	2.1	330.5	1360.1
Na	55.0	119.6	55.0	119.6	5.3	11.5	336.7	731.9
K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NH4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ba	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO3	0.2	0.3	0.0	0.0	0.0	0.0	0.1	0.1
HCO3	378.0	309.6	67.0	55.0	2.0	1.7	435.4	356.9
SO4	63.0	65.6	308.5	321.4	1.2	1.2	2050.1	2135.5
Cl	86.0	121.3	86.0	121.3	6.4	9.0	537.2	757.7
F	0.2	0.5	0.2	0.5	0.0	0.0	1.3	3.4
NO3	31.0	25.0	31.0	25.0	4.4	3.6	181.7	146.5
SiO2	0.0		0.0		0.0		0.0	
TDS	740.4		674.8		20.6		4381.8	
pH	7.1		5.6		4.1		6.4	

Notes: *ppm as CaCO3. Calculated concentrations are accurate to +/- 10%

	Raw water	Feed water	Concentrate
CaSO4/Ksp*100,%	1.7	7.3	78.5
SrSO4/Ksp*100,%	0.0	0.0	0.0
BaSO4/Ksp*100,%	0.0	0.0	0.0
SiO2 sat.,%	0.0	0.0	0.0
Langelier ind.	-0.14	-2.39	-0.00
Stiff & Davis ind.	-0.13	-2.39	-0.27
Ionic strength	0.02	0.02	0.12
Osmotic press.,psi	5.3	4.5	28.9

EXTRACTION WELL
3-YR

PERMEATION
Technologies Inc.

HYDRANAUTICS DESIGN PROGRAM -- VERSION 4.02 (1989) 05-09-90
Calculation was made by: AMD

Project name : CAMBRIA COMMUNITY SERVICES DISTRICT Permeate flow : 720000 GPD

Feedwater temperature : 20.0 C Recovery : 85.0%
Raw water pH : 7.10 Element age : 3.0 years
Acid dosage, ppm(100%): 250.5 H2SO4 Flux decline coefficient : -0.035
Acidified feed CO2,ppm : 273.1 3-yr salt passage increase factor :2.0

Feed Pressure : 292.8 psi Concentrate Pressure : 261.3 psi

Pass	Feed Flow Total gpm	Feed Flow Vessel gpm	Conc. Flow Total gpm	Conc. Flow Vessel gpm	Beta	Conc. Press. psi	Element Type	Element No.	Array
1	588.2	32.7	327.3	18.2	1.10	282.7	8060-MSY-CAB2	72	18x4
	327.3	27.3	163.7	13.6	1.13	272.1	8060-MSY-CAB2	48	12x4
	163.7	27.3	88.2	14.7	1.11	261.3	8060-MSY-CAB2	24	6x4

Ion	Raw water mg/l	Raw water ppm*	Feed water mg/l	Feed water ppm*	Permeate mg/l	Permeate ppm*	Concentrate mg/l	Concentrate ppm*
Ca	77.0	192.0	77.0	192.0	1.5	3.8	504.7	1258.7
Mg	50.0	205.8	50.0	205.8	1.0	4.1	327.8	1348.8
Na	55.0	119.6	55.0	119.6	10.0	21.7	310.0	674.0
K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NH4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ba	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO3	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.1
HCO3	[illegible]	309.8	67.0	55.0	4.0	3.3	424.3	347.8
SO4	63.0	65.6	308.5	321.4	2.4	2.5	2043.4	2128.5
Cl	86.0	121.3	86.0	121.3	12.2	17.2	504.1	711.1
F	0.2	0.5	0.2	0.5	0.0	0.0	1.2	3.3
NO3	31.0	25.0	31.0	25.0	8.1	6.6	160.6	129.5
SiO2	0.0		0.0		0.0		0.0	
TDS	740.4		674.8		39.2		4276.3	
pH	7.1		5.6		4.4		6.4	

Notes: *ppm as CaCO3. Calculated concentrations are accurate to +/- 10%

	Raw water	Feed water	Concentrate
CaSO4/Ksp*100,%	1.7	7.3	78.6
SrSO4/Ksp*100,%	0.0	0.0	0.0
BaSO4/Ksp*100,%	0.0	0.0	0.0
SiO2 sat.,%	0.0	0.0	0.0
Langelier ind.	-0.14	-2.39	-0.03
Stiff & Davis ind.	-0.13	-2.39	-0.30
Ionic strength	0.02	0.02	0.11
Osmotic press.,psi	5.3	4.5	27.9