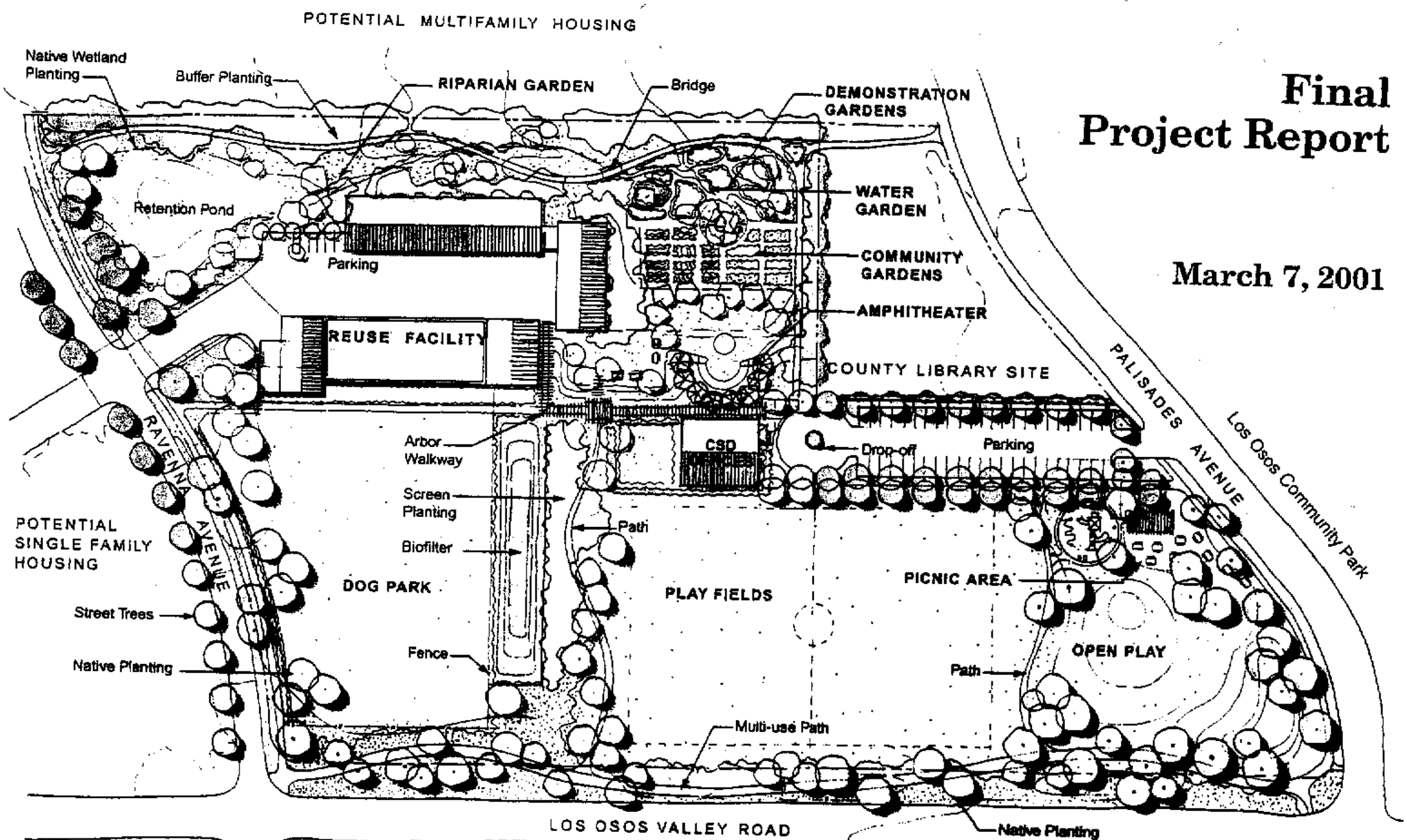
WASTEWATER FACILITIES PROJECT

Creating an asset the Community can be proud of



Final Project Report

March 7, 2001








Los Osos Community Services District
Wastewater Facilities Project

Final Project Report

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LIST OF ABBREVIATIONS

ac	acre
ADB	algal drying bed
AFP	advanced facultative pond
afy	acre feet per year
AIWPS	Advanced Integrated Wastewater Pond System
ASP	algae settling pond
AWWARF	American Water Works Association Research Foundation
Board	District Board of Directors
BOD	biological oxygen demand
Cal Cities	Southern California Water Company
cf	cubic feet
cfm	cubic feet per minute
Committee	District Wastewater Committee
County	San Luis Obispo County
CTR	California Toxics Rule
cy	cubic yards
d	day
DAF	dissolved air flotation
DHS	California Department of Health Services
District	Los Osos Community Services District
DUE	dwelling unit equivalent
ea	each
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
ft	feet
ft^2	square feet
$gal/ft^2/d$	gallons per square foot per day
GBT	Gravity Belt Thickener
gpd	gallons per day
gpm	gallons per minute
hp	horse power
HRP	high rate pond
I/I	infiltration/inflow
kw	kilowatts
kwhr	kilowatt hours
kwhr/yr	kilowatt hours per year
lbs	pounds
lbs/d	pounds per day
lf	linear feet
ls	lump sum
mg/l	milligrams per liter
mgd	million gallons per day

LIST OF ABBREVIATIONS
(Continued)

MLSS	mixed liquor suspended solids
MPN	Most Probable Number
mws/cm^2	milliwatts-second per square centimeter
N	nitrogen
NPDES	National Pollutant Discharge Elimination System
NTR	National Toxics Rule
NTU	nephelometric turbidity units
O&M	Operations and Maintenance
psi	pounds per square inch
PUC	California Public Utilities Commission
PW	Present Worth
RAS	return activated sludge
RWQCB	Regional Water Quality Control Board
SBR	sequencing batch reactors
scfm	standard cubic feet per minute
SRF	State Revolving Fund
SS	suspended solids
SSMMP	septic system maintenance management program
STEP/STEG	septic tank effluent pump/septic tank effluent gravity
SWRCB	State Water Resources Control Board
THMS	tri-halomethanes
Title 22	California Code of Regulations, Title 22
TMDL	Total Maximum Daily Load
UV	ultraviolet
WDR 97-8	Waste Discharge Requirement 97-8

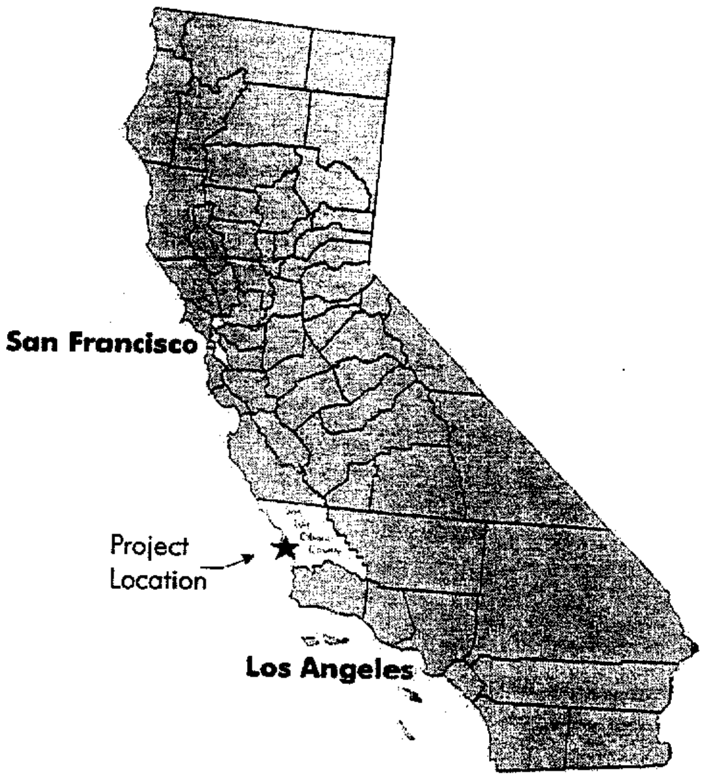
EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

INTRODUCTION

The community of Los Osos is located along the central coast of California on the southern edge of Morro Bay in San Luis Obispo County (Figure ES-1).

Figure ES-1. Project Location



It is a predominately residential community of approximately 14,606 residents. The community's drinking water system is composed of a series of groundwater wells in the Los Osos area. The community's wastewater system is composed of individual septic tanks and associated leach fields/pits. The Los Osos Community Services District (District) is the government body responsible for wastewater management within the community.

The purpose of this report is to describe the wastewater alternative analysis conducted by Montgomery Watson in conjunction with the District. This report is intended as the Project Report component of the Facilities Plan, which is required by the State Water Resources Control Board (SWRCB) for projects requesting State Revolving Fund (SRF) financing.

COMPLIANCE WITH SRF GUIDELINES

To be eligible for SRF financing, the State requires completion of a facilities planning process. A complete facilities plan includes a Project Report, a complete Environmental Document, and a draft Revenue Program. To meet these requirements, the District has contracted with three different consulting firms. Montgomery Watson is responsible for the Project Report while Crawford, Multari, Clark and Associates is responsible for the Environmental Document, and John L. Wallace and Associates is responsible for the Revenue Program.

Each of these program components is underway. The District has developed this report to meet the Project Report requirement. To meet the Environmental Document requirement, the District certified a *Final Environmental Impact Report* on March 1, 2001. To meet the Revenue Program requirement, the District is developing a Draft Revenue Program, which is scheduled for completion in March 2001.

In addition to requiring the three components described above, the SRF guidelines specify the required elements of the Project Report. The table below indicates where this report addresses each of these required elements.

Table ES-1. Location of SRF Required Elements within the Project Report

Required Element	Location
1. A statement of project needs and benefits, including a discussion of water quality benefits of the project and the public health or water quality problems to be corrected.	Section 1
2. A cost effectiveness evaluation of alternatives over a 20 year planning period. The evaluations presented must include an evaluation of the alternative of upgrading operation and maintenance of the existing facility to improve effluent quality.	Section 3 for Collection Section 4 for Treatment Section 5 for Disposal
3. An evaluation of alternative methods for reuse or ultimate disposal of treated wastewater and sludge material resulting from the treatment process. For wastewater projects producing sludge material, the following information needs to be identified and compared: a. All landfills within a 100 mile radius that accept sewage sludge b. Any composting facilities within a 100 mile radius accepting sewage sludge c. The potential for dedicated land disposal d. Conversion of sludge to biosolids for distribution as soil amendment or as another agricultural product e. Ultimate disposal methods approved by the RWQCB	Section 5
4. An evaluation of non-existence or possible existence of excessive I/I in the existing sewer system.	Not applicable
5. Information on total capital costs, annual operation and maintenance costs, as well as the estimated annual or monthly costs to residential and industrial users for all of the alternatives.	Section 3 for Collection Section 4 for Treatment Section 5 for Disposal

Table ES-1. Location of SRF Required Elements within the Report (continued)

Required Element	Location
6. A discussion of the existing population, flows, and loadings, and projections of the same, used to estimate the 20 year capacity needs for treatment facilities and collection systems and 40 year capacity needs for interceptors and outfalls.	Section 2
7. A discussion of the anticipated eligible capacity for the project and how that capacity was derived.	Section 2
8. A description of the Best Practicable Wastewater Treatment Technology.	Section 4
9. A summary of public participation.	Section 8
10. The following must be submitted for the selected alternative:	
a. A detailed description of the selected alternative and the complete waste treatment system of which it is a part	Section 7
b. A summary of relevant design criteria (i.e., design flow, peak flows, daily BOD loadings, daily suspended solids loadings, overflow rates, detention times, sludge production, etc.)	Section 7
c. The estimated construction and annual operation and maintenance costs and a description of the anticipated manner in which all the costs will be financed.	Section 7
d. A summary of the cost impacts on wastewater system users.	Draft Revenue Program, March 2001
e. A summary of significant environmental impacts of the selected project and any proposed mitigation measures.	Final EIR, February 2001
f. A copy of any proposed intermunicipal service agreements necessary for the project.	Appendix H
g. A statement that identifies and discusses the sources and the amount of unallocated potable water currently available in the project service area. If the amount of potable water is less than what is needed to serve the projected population for the proposed project, a plan identifying how that deficiency will be mitigated shall be presented.	Final EIR, February 2001
h. A discussion of facilities which were previously funded by federal/state grants or loans, if such facilities are to be repaired or replaced.	Not applicable
i. Applicants must comply with the Civil Rights Act of 1964. Where minority populations are included in the facilities planning area, the Project Report must show such areas will be served or excluded from service only for reasons of cost-effectiveness.	The District complies and will sign an application to this effect.
j. A description of operation and maintenance requirements.	Section 7
k. A demonstration that the selected alternative is consistent with any applicable approved water quality management plan.	Section 1
l. A summary of public participation.	Section 8
m. A copy of the current adopted waste discharge requirements issued by the RWQCB for the wastewater facility or improvements/expansion to be constructed. If no current adopted permit exists, a copy of the tentative waste discharge requirements, however, must be adopted by the RWQCB before the approval of either the plans and specifications or the Request for Design-Build Proposal (for Design-Build projects).	Appendix D

PROJECT NEED

Groundwater resources in the Los Osos area are divided into four distinct aquifers. The fault dividing the community into east and west also divides the groundwater resources into an eastside aquifer and a westside aquifer. In addition, an aquatard further divides both the eastside and westside aquifers into an upper and lower aquifer. In general, the upper aquifer is within 150 feet of the ground surface and the lower aquifer is below approximately 190 feet of the ground surface. Most of the community's drinking water wells draw groundwater from the lower aquifers.

According to water quality data collected by the California Regional Water Quality Control Board (RWQCB), elevated levels of nitrate are present in the upper aquifers on both the eastside and westside of the community. High nitrate levels in drinking water are a public health concern, particularly for newborns where it can cause "blue baby syndrome". To protect public health, the California Department of Health Services (DHS) has established a drinking water limit of 10 mg/l nitrate (as N) in drinking water supplies.

In the early 1980's, nitrate levels in the upper aquifers within Los Osos exceeded the drinking water limit of 10 mg/l (as N). In several areas, water quality data suggested that that a buildup of nitrate was occurring in the upper aquifers. The primary source of nitrate contamination was identified by the RWQCB to be septic tanks and their associated leach fields. As a result, the RWQCB amended its Basin Plan and adopted Resolution 83-13 (Appendix A) prohibiting the use of septic tanks with leach fields and seepage pits within the Prohibition Zone of Los Osos (see Figure ES-2 on the following page).

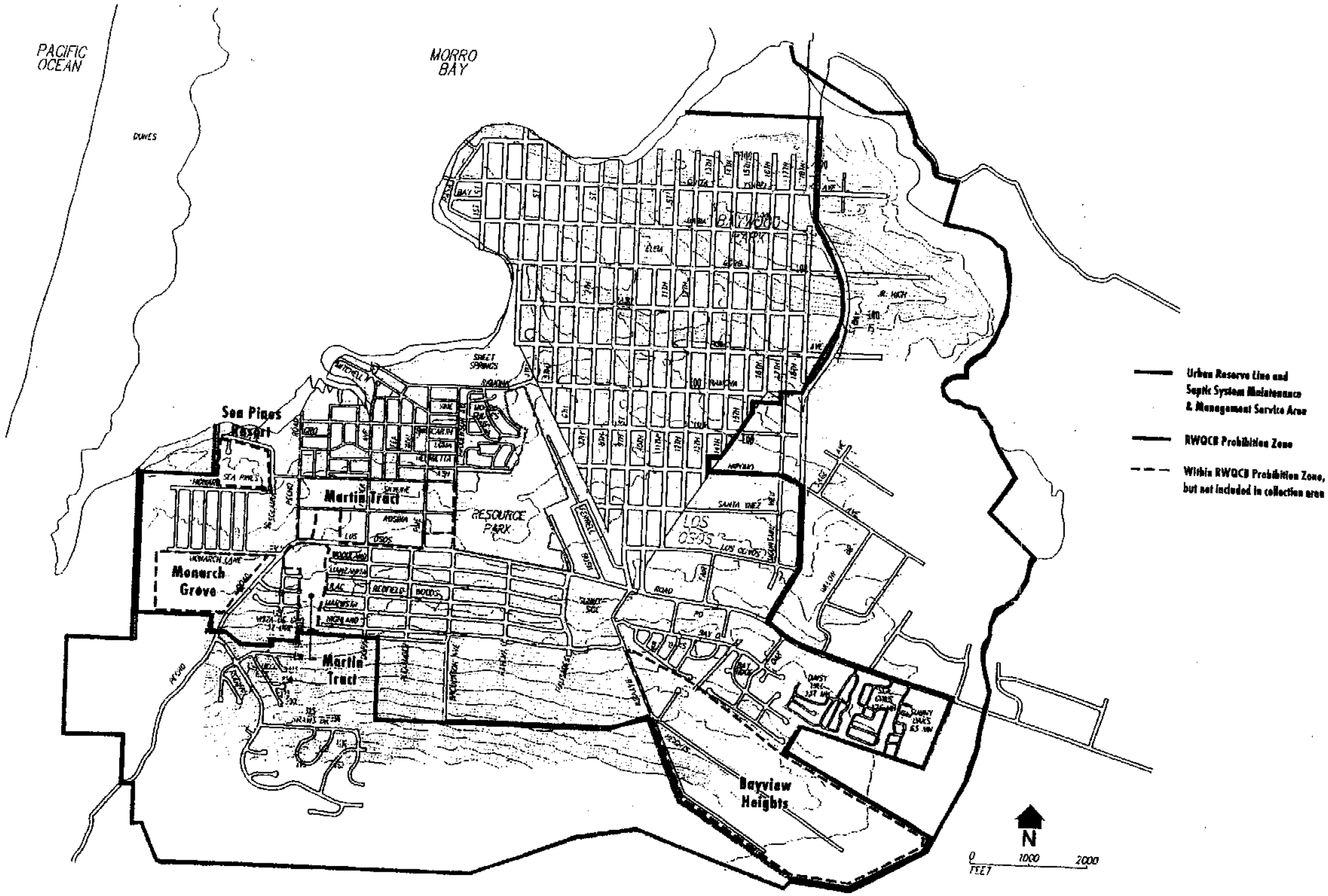


Figure ES-2. Prohibition Zone

To limit growth and the subsequent addition of new septic tanks within the Prohibition Zone, a building moratorium was imposed on Los Osos by the RWQCB in 1988. This building moratorium has been continuously in effect since 1988.

Four areas of the community are not included in the wastewater collection area. These areas are Bayview Heights, the Martin Tract, Monarch Grove, and Sea Pines Resort. Bayview Heights and the Martin tract are not included because the lot sizes are greater than 1 acre. Monarch Grove and Sea Pines Resort are not included because wastewater from these areas is currently collected and treated in a small package plant.

On October 27, 2000 the RWQCB replaced Resolution 83-13 with Time Schedule Order No. 00-131 (Appendix A). This order requires the District to demonstrate progress on a wastewater project by meeting a series of delivery dates. Specifically, the order identifies the following key dates:

• December 15, 2000	Submit proof of Draft Environmental Impact Report
• April 1, 2001	Submit final California Environmental Quality Act document
• July 29, 2001	Submit proof of voter approval of assessment district or comparable means of financing community wastewater system
• July 15, 2002	Submit approved complete construction design plans
• July 15, 2002	Submit County Use and Coastal Development permits
• September 6, 2002	Commence construction of community sewer system
• August 30, 2004	Complete construction of community sewer system

Failure to comply with the time schedule results in a fine of $10,000 per day. The District must implement a project to at least avoid these fines and address the public health concerns identified above.

The District must also submit a Facilities Plan and Funding Plan to the SWRCB by March 30, 2001. These submittals are required to maintain the District's eligibility for the low interest loan funding from the SRF. This Project Report is an integral part of the Facilities Plan.

Although a wastewater treatment project is needed to meet these requirements and avoid RWQCB fines, it must also simultaneously address community concerns. The *Vision Statement for Los Osos* developed by the Los Osos Community Advisory Council in 1995 (Appendix B) identifies several key community values that highlight the need for development of a sound wastewater management project. These values include:

- Decision-making based on a philosophy of sustainable development
- Managing the watershed in a manner that is consistent with protection of the Morro Bay Estuary
- Holistically managing local water resources to ensure its long-term viability

- Maintaining, managing, and recharging the local aquifer, preventing over-drafting of the aquifer and salt-water intrusion into the water supply
- Managing wastewater, cleansing and restoration to the lower aquifer or upper aquifer with pumping from upper aquifer for domestic use
- Reclaiming and conserving local water resources
- Developing a wastewater treatment facility based on a natural biological process rather than a mechanical system approach to the highest extent possible
- Creating a wastewater treatment facility that is a visual and recreational asset to the community, provides water for irrigation, agriculture, and habitat for wildlife
- Creating a wastewater project that is affordable to the community

It is essential that any proposed wastewater project within the community of Los Osos reflect these strongly held community values. To ensure that these community values were incorporated into the decision-making process, representatives from the community worked with District staff and Montgomery Watson to develop three key evaluation criteria that reflect the ideas contained in the community's *Vision Statement*. Table ES-2 shows that the three key evaluation criteria affected nearly all components of the project.

Table ES-2. Evaluation Criteria and Project Components

Criteria	Project Component				
	Collection	**Treatment Process**	**Facility Site**	**Effluent Disposal**	**Biosolids Disposal**
Cost	✔	✔	✔	✔	✔
Resource Sustainability		✔	✔	✔	✔
Community Acceptance	✔	✔	✔	✔	✔

As shown in the table, the treatment process and facility site are the most affected by community values. To more clearly assess how well these two components met the community's criteria two workshops were held with the community.

Owners of property within the community will be voting in the spring of 2001 on formation of an assessment district to fund the project. Their support of the assessment will be gained only if the wastewater project reflects their strongly held community values. Many community members have volunteered thousands of hours of their personal time and dedicated years of their life to the development of a sound wastewater management project that reflects the community's values. Thanks to their efforts the community at large is fully cognizant of the issues surrounding this project.

The importance of community values cannot be overstated and should not be underestimated. Several past efforts to implement a wastewater project in Los Osos have failed because of an inability to adequately reflect the community's values.

PROJECT BENEFITS

The community of Los Osos will benefit directly from the development of a wastewater project. The project will allow the community to realize its goals and achieve its vision. Specifically, the project will provide the following benefits:

- provides a cost-effective wastewater management solution
- improves local groundwater quality
- creates a community amenity and visual resource
- maintains local control of the community's water resources
- promotes sustainable use of local groundwater resources
- reduces seawater intrusion
- protects Morro Bay and Estuary
- avoids RWQCB fines
- returns decisions about growth and development to local officials

CAPACITY ESTIMATES

The estimates provided below form the basis of the 20 year capacity needs for all components of the project. The community of Los Osos is expected to achieve full build-out in the year 2020. As a result, capacity estimates for the year 2020 also reflect capacity needs to the year 2040.

The estimated build-out population of the community that will be included in the collection system by the year 2020 is equivalent to 18,428 people with an estimated 4,774 connections. These estimates were developed by the Wastewater Committee based on population projections from the 1990 Census and the County of San Luis Obispo. The estimates reflect a great deal of local knowledge about existing and future development.

The estimated wastewater flow associated with this build-out population ranges from an average dry weather flow of 1.3 mgd to an average wet weather flow of 1.6 mgd. The per capita flow for average dry weather is estimated to currently be 77 gpd. Once conservation measures are implemented the average dry weather per capita flow is expected to be 69 gpd. The per capita wet weather infiltration/inflow (I/I) ranges from 16 to 17 gpd, for a conventional and STEP/STEG collection system, respectively.

Based on the residential nature of the population, it is assumed that the wastewater flow generated in Los Osos will be predominantly residential in character. Small commercial loads from restaurant and retail sales sources are expected to amount to less than 3% of the flow. Virtually no loads are expected from industrial sources. For these reasons, it is expected that the concentration of BOD, suspended solids, and ammonia will be of residential strength.

ALTERNATIVES ANALYSIS

Currently, almost every resident in Los Osos operates an individual septic tank and leach field on their property. No common, community-wide wastewater collection, treatment, or disposal system exists. To identify the best wastewater system for the community several alternative collection, treatment, and disposal options were analyzed. Following is a summary of these alternatives.

Collection System Alternatives

The analysis of collection systems focused on two alternatives: STEP/STEG and a conventional collection system. The STEP/STEG collection system was the preferred collection system alternative in the previous Draft Project Report prepared for the District on January 31, 2000 by Oswald Engineering Associates, Inc. A complete discussion of the analysis of alternative collection systems is contained in Section 3.

STEP/STEG is an abbreviation for Septic Tank Effluent Pump/Septic Tank Effluent Gravity. This type of collection system would retain the use of septic tanks in the community. The septic tanks would serve to settle solids and provide a primary level of treatment. The effluent from the tanks would be conveyed to a collection system which, in turn would convey the flow to the treatment facility. Depending on the slope of the terrain, this pre-treated wastewater would then be either pumped (STEP system) or gravity-fed (STEG system) through small diameter plastic pipes to the collection system in the street. The in-street collection system would also have relatively small diameter pipes because the flow would be relatively free of solids.

A conventional collection system, in contrast, would eliminate the use of septic tanks in the community. As a result, solids and effluent would flow directly into the collection system. To accommodate the solids, larger diameter pipe would be used to convey the flow to the collection system in the street. In addition, the in-street collection system would use larger diameter pipe to convey flows to the treatment facility.

Both of these alternatives have advantages and disadvantages. To better evaluate these alternatives relative to each other, non-cost factors and cost factors were compared. The non-cost comparison considered nine key factors. Table ES-3 shows the non-cost comparison of the collection system alternatives relative to these factors.

Table ES-3. Non-Cost Comparison of Collection System Alternatives

Item	STEP/STEG	Conventional
Recurring disturbance to property owner	yes	no
Number of septage haulings per year to treatment plant	954	90
Average depth of pipelines	4 to 5 ft	7 to 8 ft
Pipe material	plastic	plastic
Average diameter of sewer mains	4 inches	8 inches
Average diameter of connection lines	2 inches	4 inches
Vulnerability to I/I	slightly less	slightly higher
Spare hydraulic capacity	smaller	greater
Allows property owner to build over area occupied by septic tanks and leach fields	no	yes

The cost comparison included an evaluation of the STEP/STEG alternative with various degrees of tank replacement. The number of tanks requiring replacement is a major factor determining the cost of the STEP/STEG alternative. Table ES-4 shows a cost comparison of the collection system alternatives.

Table ES-4. Cost Comparison of Collection System Alternatives

Item	Conventional	STEP/STEG with Various Degrees of Tank Replacement				
		0% tank replacement	10% tank replacement	20% tank replacement	30% tank replacement	100% tank replacement
Construction Cost ($ millions)						
District Collection Cost	40.3	35.3	35.3	35.3	35.3	35.3
Private Connection Cost	9.4	13.9	15.9	17.9	19.9	34.1
Subtotal	**49.7**	**49.2**	**51.2**	**53.2**	**55.2**	**69.4**
Annual O&M Cost ($ millions)						
Pipes and pumps	0.5	0.5	0.5	0.5	0.5	0.5
Septic tank maintenance	0.0	0.4	0.4	0.4	0.4	0.4
Septic tank replacement	0.0	0.3	0.3	0.3	0.3	0.0
Subtotal	0.5	1.2	1.2	1.2	1.2	0.9
Present Worth of Annual O&M, 6.625%, 20 yrs	**5.4**	**13.0**	**13.0**	**13.0**	**13.0**	**9.8**
Total Present Worth Cost	**55.1**	**62.2**	**64.2**	**66.2**	**68.2**	**79.2**
Annualized Present Worth	5.1	5.7	5.9	6.1	6.3	7.3

Treatment Alternatives

The analysis of treatment alternatives focused on the treatment process and the facility site. Six alternative treatment sites and four alternative treatment processes were combined to form 14 treatment alternatives. These 14 treatment alternatives are shown on the following page in Table ES-5. A complete discussion of the analysis of alternative treatment processes and facility sites is contained in Section 4. Following is a brief summary of the treatment process and facility site analysis.

Table ES-5. Treatment Alternatives

Sites	Treatment Process			
	Advanced Wastewater Treatment Pond	Extended Aeration	Hybrid	SBR
Andre		✔		
Eto		✔		✔
Holland			✔	
Pismo		✔		✔
Powell		✔		✔
Resource Park	✔			
Tri W		✔	✔	✔
Turri		✔		✔

The advanced wastewater treatment pond represents the type of recommended treatment process in the Draft Project Report prepared for the District on January 31, 2000 by Oswald Engineering Associates, Inc. In that report, the recommended treatment process was a specific type of advanced wastewater pond system known as an Advanced Integrated Wastewater Pond System (AIWPS). This system is a biologically based treatment process relying on a series of ponds and dissolved air flotation (DAF) units for treatment. This type of process generates biosolids in the form of algae biomass. It was only evaluated at the Resource Park site because it requires approximately 64 acres of land. The Resource Park site was the only site with this amount of acreage.

The extended aeration treatment process is a biologically based treatment process commonly referred to as "activated sludge". Wastewater is treated in a series of basins where mechanical mixers/aerators mix atmospheric oxygen with the wastewater. Naturally occurring microorganisms convert the organic matter in the wastewater to carbon dioxide, water, and nitrate. This type of process generates biosolids in the form of sludge. It was evaluated at all sites because it only requires approximately 6 acres of land.

The hybrid alternative uses the extended aeration treatment process. However, it differs from the traditional extended aeration facility in that its aeration basins are buried underground, limiting visual impacts and providing an opportunity for multi-use parkland on top of the facility. In addition, a hybrid facility is fully odor-scrubbed to prevent odor impacts and allow the facility to be located near the center of town, where park space is most valuable. A hybrid facility can be architecturally designed to meet the aesthetic characteristics of the community.

The SBR (sequencing batch reactors) alternative is a biologically based treatment process. The process uses a series of tanks that sequentially fill, aerate, settle, and decant wastewater to achieve discharge standards. This treatment process generates biosolids in the form of sludge.

Similar to the collection system alternatives, the 14 treatment alternatives were compared on the basis of cost and non-cost criteria. Because of the complexity of this comparison and the need to directly involve the community in any issues about siting the facility, a computer-based model was developed to incorporate community values into the process. This model was developed with input from the Wastewater Committee.

The community values defined in the community's *Vision Statement* were incorporated into the model as criteria and subcriteria. The weightings given to each criterium were based on their importance to the community. Table ES-6 shows the relative weightings given to the criteria.

Table ES-6. Criteria Weightings

Criteria	Relative Weight
Regulatory	31
Cost	56
Resource Sustainability	33
Community Acceptance	25
Future Flexibility	1

Upon first review of the table it may appear that affordability, and therefore cost, was given much more weight than any other criteria. However, the resource sustainability and community acceptance criteria embody the community's values. Taken together, these criteria have combined weighting of 58, which is nearly the same weighting given to affordability. In this way, the importance of achieving the community's values was incorporated into the evaluation process.

Disposal Alternatives

Many alternatives were analyzed for both the disposal of effluent and biosolids. For effluent disposal, four alternatives were analyzed: reuse/recycling, leach field disposal, surface water disposal, and land disposal. These alternatives were assessed based on their ability to dispose of 1.3 mgd average dry weather flow and 1.4 mgd average annual flow. For biosolids disposal, three alternatives were analyzed: local recycling, offsite disposal/recycling, and land disposal. Both the biosolids and effluent disposal alternatives were assessed relative to their ability to achieve community values and RWQCB requirements. A complete discussion of the analysis of disposal alternatives is contained in Section 5.

Effluent Disposal. Based on an analysis of recycled water demand within Los Osos, it is estimated that approximately 37% of the annual effluent generated by the facility could be disposed of in this way. Landscape irrigation accounts for approximately 132 afy, or roughly 23% of the recycled water demand; while agricultural irrigation accounts for 446 afy, or approximately 77% of the recycled water demand.

The cost of conveying treated effluent to the nearly 5,000 leach fields in Los Osos was estimated to be approximately $43 million. Given this extraordinary cost, use of the individual residential leach fields was not considered further. In contrast, the development of five to ten new large leach fields in areas with sufficient ground water separation would cost approximately $10.3 million.

Surface water disposal would involve the disposal of effluent to Los Osos Creek or directly to Morro Bay. Any surface water discharge of this nature would require compliance with state and federal water quality regulations. Both Los Osos Creek and Morro Bay have been listed by the state as impaired water bodies as part of the 303(d) list. The RWQCB is in the process of establishing TMDL's for these water bodies. As a result, compliance with state and federal requirements to obtain a discharge permit to these water bodies would likely require additional studies. These studies would exceed the existing time available in Time Schedule Order No. 00-131.

Land disposal via percolation ponds and dedicated agricultural irrigation were also analyzed. The wastewater project proposed by the County in 1997 recommended the construction of a percolation pond at the Broderson site. This recommendation evoked strong community opposition because of concerns about liquefaction and flooding of residences downslope of the site. Based on groundwater modeling work conducted by Cleath & Associates, the Broderson site will accommodate a maximum of 800,000 gpd which equates to approximately 60% of the average dry weather flow. The use of dedicated agricultural irrigation for disposal of effluent would require approximately 720 acres. The majority of agricultural land surrounding Los Osos is designated as prime agriculture. Any change in land practice would require approval from the California Coastal Commission. In addition, the transport of effluent to these areas outside of the community's watershed would not be consistent with the community's value of maintaining its local water resources.

Biosolids Disposal. The community of Los Osos is expected to generate approximately 2,080 wet tons of biosolids per year. Biosolids generated from any of the treatment alternatives could be recycled within the community, transported to offsite facilities for disposal/recycling, or sent to dedicated areas for land disposal. State and federal regulations regarding local recycling, require that biosolids be treated to Class A levels. This process takes from 20 to 40 days and would require the development of a composting operation for the community. Offsite disposal would involve removal of the biosolids to a facility outside the community where it would be composted with other biosolids or disposed of in a landfill. Land disposal would involve the purchase of land within the community for dedicated disposal of biosolids. This alternative is inconsistent with the community's value of composting/recycling. In addition, this alternative would likely have a negative environmental impact, given that much of the land available within Los Osos is habitat for sensitive species, prime agricultural land, or has relics of cultural significance.

RECOMMENDED PROJECT

Following a comprehensive analysis of collection, treatment, and disposal alternatives the District has identified a wastewater project that meets the community's values and RWQCB requirements. A detailed description of the recommended project is contained in Section 7.

The project is designed to collect, treat, and dispose of wastewater from the equivalent of 18,428 people. This is the build-out population of the community which will be reached in 2020.

Wastewater flows are estimated to be 1.3 mgd (average dry weather flow). The peak wet weather flow to be received in a 24-hour period is estimated to be 1.6 mgd.

To best manage the wastewater generated by the community, the recommended project uses a conventional collection system, hybrid extended aeration treatment process at the Tri W site, a leach field disposal method for effluent, and an off-site disposal method for biosolids. Following is a description of each component of the project.

Collection System

A preliminary layout of the collection system is shown on the following page in Figure ES-3. The major components of the system are summarized in Table ES-7.

Table ES-7. Recommended Collection System Components

Item	Description
Number of connections	4,774
Length of collection sewers	169,000 ft
Length of sewer mains	35,000 ft
Number of pump stations	10
Predominant sewer diameter	8 inch
Pipe material	PVC

The pump stations will be submersible pumps located in pre-cast concrete vaults. Two pumps will be provided, one duty, one standby. These vaults are estimated to be approximately 8 feet wide by 12 feet long. The depth of the stations is estimated to be 18 feet or less. The stations will be located in public rights of way that have low levels of traffic.

Each pump station will have engine generators to provide back-up power. The generators will be above ground and within a small structure. Siting of the generators will require purchasing land or easements near each pump station or using existing District land.

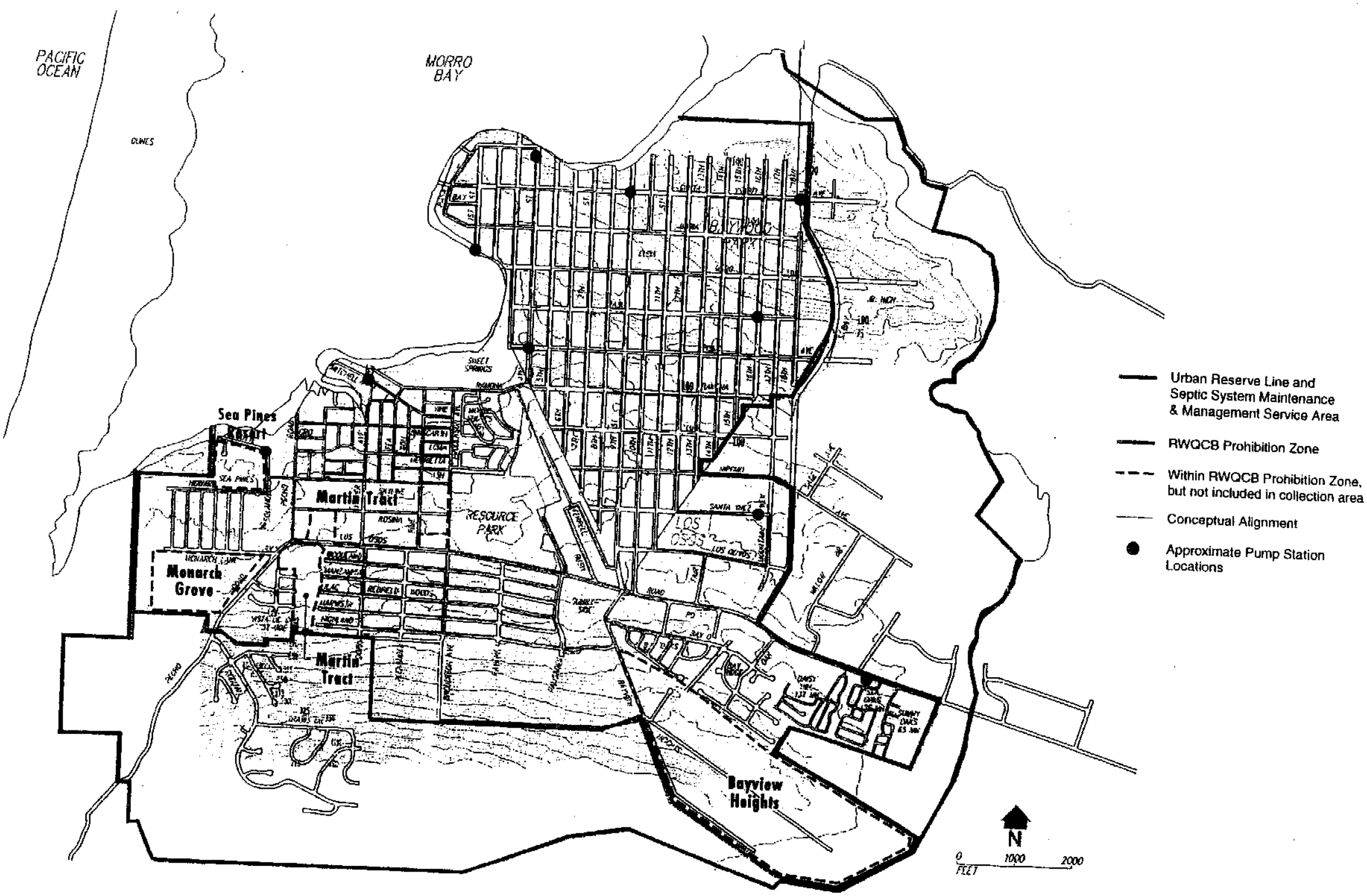


Figure ES-3. Conceptual Wastewater Collection System

Treatment Facility
The recommended treatment facility uses a hybrid extended aeration treatment process. The facility would be composed of ten major components:

- headworks
- septage handling facility
- extended aeration basins
- clarifiers
- filters
- UV disinfection
- solids processing
- odor control
- operations building
- electrical building

This facility would be located at the Tri W site to provide the greatest opportunity for community access to the park facilities placed on top of the facility. A conceptual site plan for the recommended treatment facility at the Tri W site is shown on the following page in Figure ES-4.

As depicted in the figure, a fenced off-leash dog park would be located on top of the facility. Directly adjacent to this park is open, active park space. Directly adjacent to the facility are the District offices and a garden. Walking paths will provide access to open play areas, the dog park, and gardens.

Cross-sectional views of the site are provided on the page following the site plan to show how the facility will look from the east (Figure ES-5) and from the south (Figure ES-6).

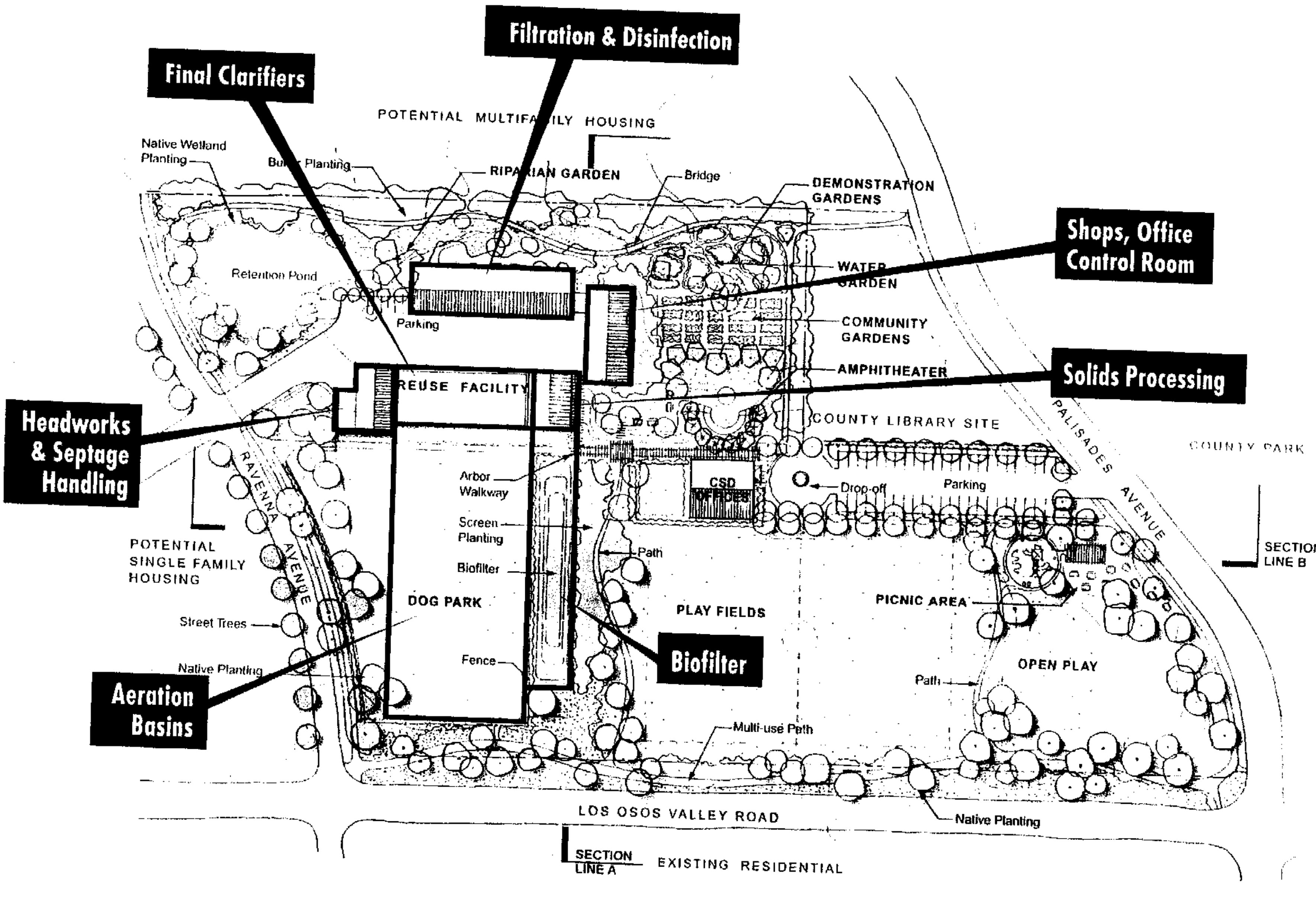


Figure ES-4. Conceptual Site Plan for Treatment Facility Site

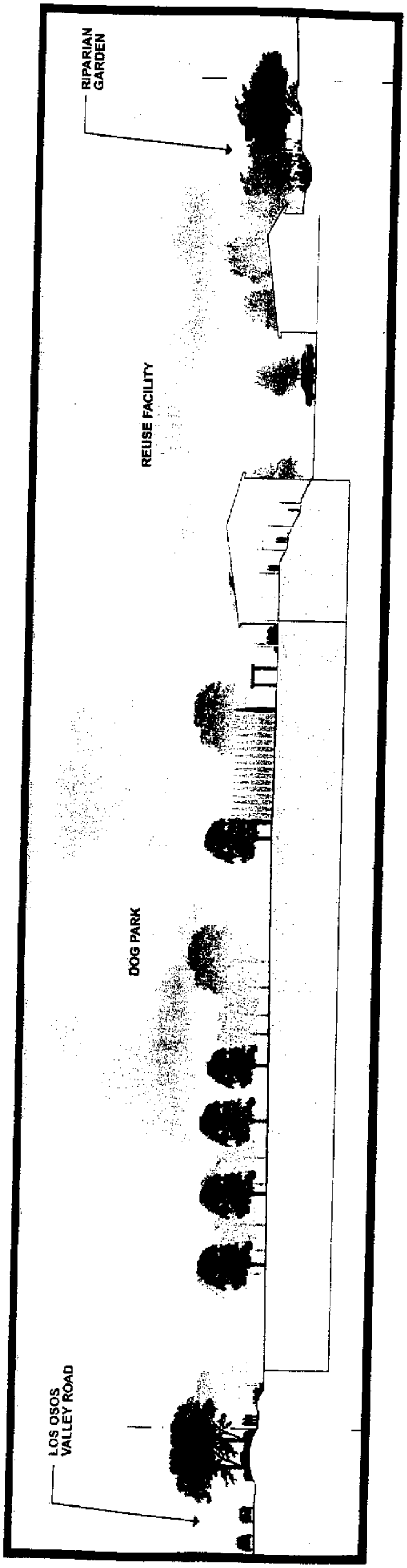


Figure ES-5. Section View A

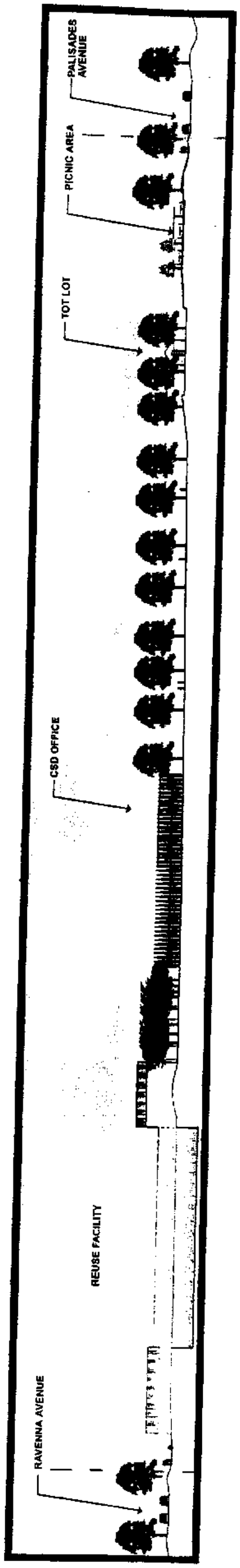


Figure ES-6. Section View B

Effluent and Biosolids Disposal

The recommended effluent disposal method uses constructed leach fields located throughout the community. To dispose of 1.4 mgd, plus provide stand by capacity for the community many effluent disposal sites are recommended. These disposal sites and their capacities are shown in Table ES-8.

Table ES-8. Recommended Leachfield Disposal Capacities, Loadings and Distance to Nearest Municipal Well

Site	Area (ft^2)	Disposal Capacity (gpd)	Hydraulic Loading (inches/minute)	Approximate Distance to Nearest Municipal Well (ft)
West Side				
Broderson Site	300,000	800,000	0.003	600
Los Osos Valley Rd/ Pine St	48,000	50,000	0.003	550
Ziebarth Property	86,000	75,000	0.003	700
Vista de Oro	16,000	25,000	0.002	800
Monarch Grove Elementary School	43,560	stand by		400
East Side				
Pismo Avenue	108,000	100,000	0.001	1,200
14th Street through 17th Street	56,000	100,000	0.002	1,500
Santa Maria Avenue	68,000	75,000	0.001	1,500
El Morro Avenue	87,000	175,000	0.002	3,000
Los Osos Middle School	20,000	stand by		3,400
Total		**1,400,000**		

Notes:
Some properties will be purchased.

A map showing the location of these sites is located in Figure ES-7 on the following page.

To prevent groundwater surfacing in high groundwater areas, the District will be developing two new wells to draw from the shallow aquifer. One well will be located near the existing library well and the other will be located near Broderson and Loma streets.

The recommended biosolids disposal method is off-site disposal/recycling. This alternative achieves the community value of affordability, avoids local environmental impacts, and provides for the opportunity for future composting and recycling within the community.

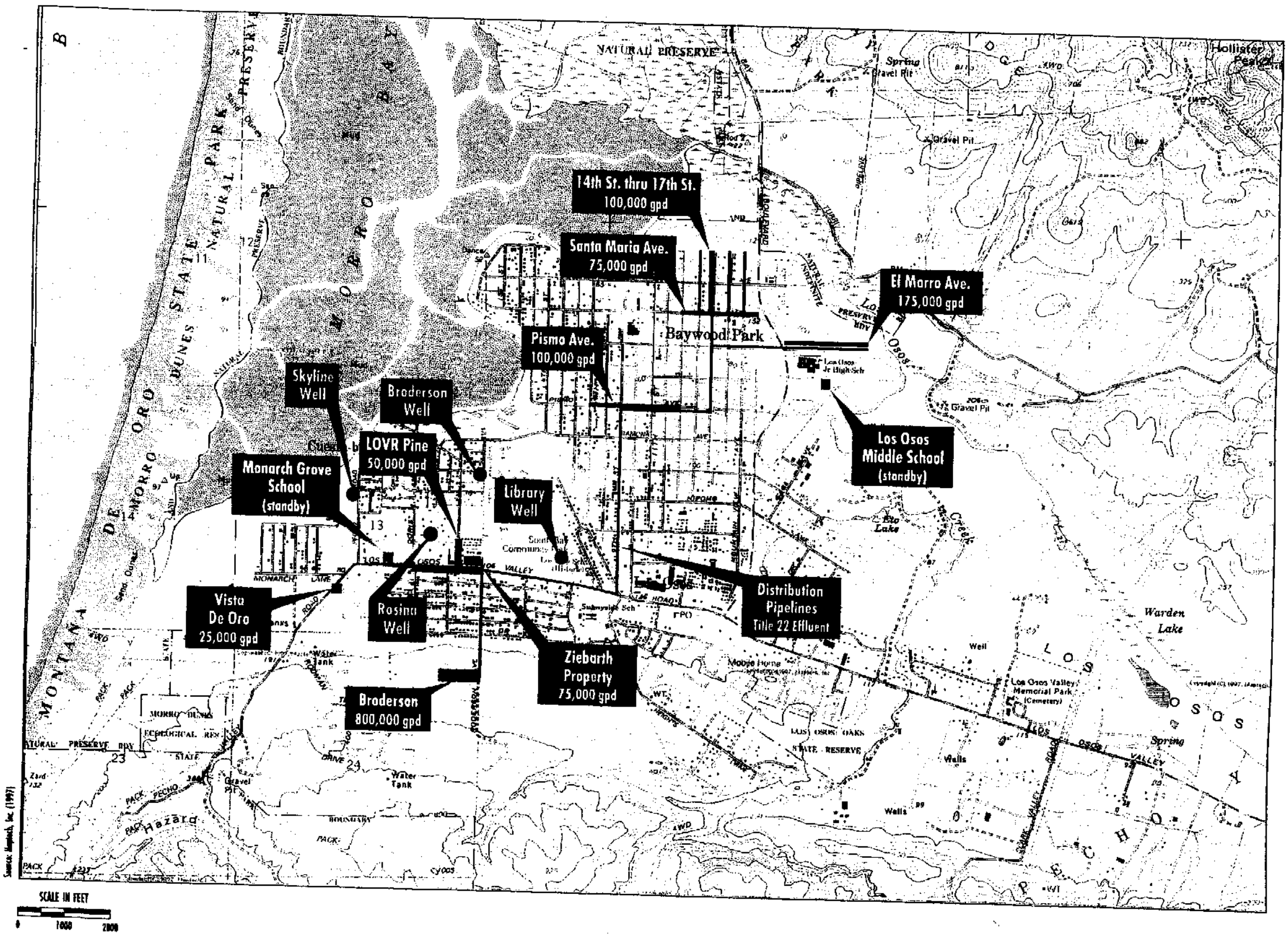


Figure ES-7. Effluent Disposal Sites

Cost

The total cost to the District of the recommended project described above is estimated to be approximately $84.6 million. Table ES-9 shows each component of the estimated capital cost of the recommended project.

Table ES-9. Estimated Capital Cost to the District of the Recommended Project

Item	Estimated Construction/ Purchase Cost ($ millions)	Estimated Design Cost ($ millions)	Estimated Construction & Design Cost ($ millions)	Amount to be SRF Funded ($ millions)	Amount to be Bond Funded ($ millions)
Conventional Collection	37.29	2.98	40.27	36.20	4.07
Hybrid Treatment Facility at Tri W	12.48	1.00	13.48	12.10	1.38
Aesthetic Mitigation at Tri W	2.32	0.19	2.51	2.20	0.31
Leach Fields	9.33	0.75	10.08	9.20	0.88
Groundwater Mitigation	0.3	0.02	0.32	0.30	0.020
Subtotal	**61.7**	**4.9**	**66.7**	**60.0**	**6.7**
Construction Inflation at 1.071	4.38	0.35	4.73	4.26	0.47
Subtotal	**66.1**	**5.3**	**71.4**	**64.3**	**7.1**
Water Conservation	1.2	0	1.2	0	1.2
Planning, Pre-Design, Studies	0	2.5	2.5	1.1	1.4
State Legislative Grant	0	-1.0	-1.0	0	-1.0
Subtotal	**67.3**	**6.8**	**74.1**	**65.4**	**8.7**
Tri W Site Purchase	3.3	0	3.3	0	3.3
Mitigation at Broderson	5.1	0	5.1	0	5.1
Ziebarth Purchase	0.24	0	0.24	0	0.24
Well Site at Broderson ROW	0.4	0	0.4	0	0.4
Cal Cities Highland Well	0.2	0	0.2	0	0.2
Standby Generator Sites/Easements	0.05	0	0.05	0	0.05
Water Tender Fire Truck	0.32	0	0.32	0	0.32
Assessment Contingency	0.9	0	0.9	0	0.9
Subtotal--Land	**10.5**	**0**	**10.5**	**0**	**10.5**
Total	**77.8**	**6.8**	**84.6**	**65.4**	**19.2**

Notes:
Total and subtotal estimates are rounded to the nearest tenth of a million.

Land costs are not eligible for financing by the State Revolving Fund and are therefore shown as being financed entirely by bonds. The construction costs are split between the two funding sources. The amount of construction capital shown as being financed via bonds reflects the contingency that the District wishes to have on hand to cover construction change orders. This amount is not eligible for financing by the State Revolving Fund.

The estimated annual operations and maintenance costs for the project are shown in Table ES-10.

Table ES-10. Estimated O&M Cost for the Recommended Project

Item	Estimated Annual O&M Costs ($ millions)
Collection System	0.500
Treatment at Tri W Site	0.498
Disposal Leach Fields	0.18
Water Conservation	0.065
Mitigation Habitat	0.01
District Overhead	0.130
District Billing	0.060
Contingency	0.050
Capital Replacement Fund at 0.5% of SRF Loan	0.33
Total	**1.82**

The estimated annual O&M cost for the recommended project is approximately $1.82 million. As shown in Table ES-10, the amount indicated for the Capital Replacement Fund would be set aside for a period of 10 years, after which time it is not required by the State.

SECTION 1

PROJECT NEED AND BENEFITS

SECTION 1
PROJECT NEED AND BENEFITS

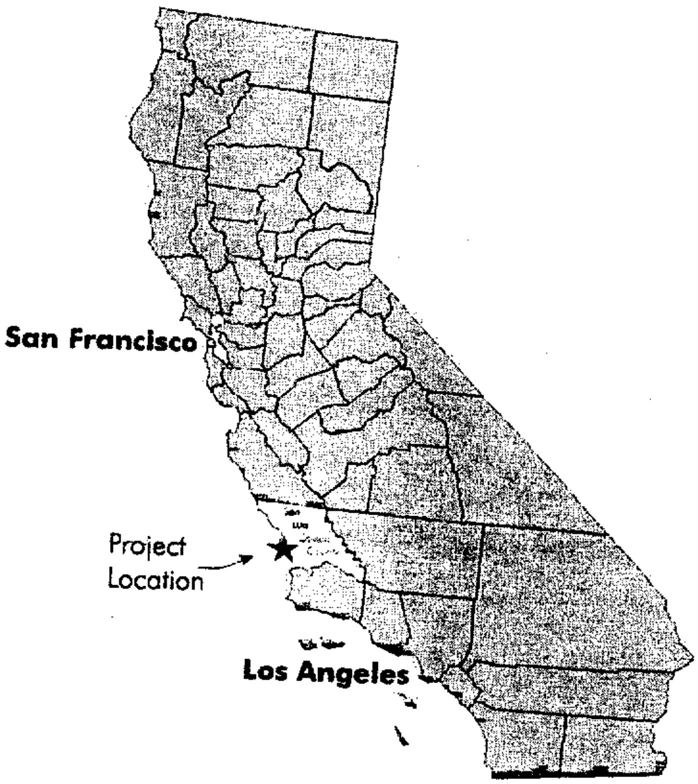
INTRODUCTION

This section provides background information on the community of Los Osos and describes the purpose of this report. It also describes the need for a wastewater project within the community and how the community will benefit from the project.

BACKGROUND

The community of Los Osos is located along the central coast of California on the southern edge of Morro Bay in San Luis Obispo County (Figure 1-1).

Figure 1-1. Project Location



It is a predominately residential community of approximately 14,606 residents. The community's drinking water system is composed of a series of groundwater wells in the Los Osos area. The community's wastewater system is composed of individual septic tanks and associated leach fields/pits. The Los Osos Community Services District (District) is the government body responsible for wastewater management within the community.

PURPOSE AND ORGANIZATION OF REPORT

The purpose of this Project Report is to describe the wastewater alternative analysis conducted by Montgomery Watson in conjunction with the District. This report is intended as the Project Report component of the Facilities Plan, which is required by the State Water Resources Control Board (SWRCB) for projects requesting State Revolving Fund (SRF) financing. The report is organized into nine sections. Following is a summary of the information contained in each section.

Section 1 shows how this report complies with SRF guidelines. It also describes the need for a wastewater project within the community of Los Osos, past efforts to implement a wastewater project, and the benefits associated with implementation of the wastewater project. Also presented are the community values of Los Osos that were used in developing and assessing the project alternatives.

Section 2 explains the basis of population estimates for the community, as well as the associated wastewater flows and treatment loads. This basic information is critical to determine the appropriate size of a wastewater treatment facility for the community, the project's eligibility for SRF financing, and the 20-year and 40-year capacities of the project.

Section 3 identifies the alternative collection system options that were analyzed for the project, assesses the non-cost and cost implications of each alternative, and identifies the recommended alternative.

Section 4 identifies the alternative treatment processes and treatment facility sites that were analyzed for the project. It outlines the process used to analyze 14 combinations of treatment processes and facility sites. It identifies the best practicable wastewater treatment technology, the recommended treatment process alternative, and site alternative.

Section 5 identifies the alternative wastewater and biosolids disposal options that were analyzed for the project, the constraints involved with each alternative, and identifies the recommended disposal alternatives.

Section 6 summarizes the findings and recommendations of the alternatives analysis for wastewater collection, treatment, and disposal.

Section 7 provides a description of the proposed wastewater project for the community, and the estimated total cost of the project.

Section 8 summarizes public participation activities conducted by the District for this project. It identifies the public meetings held by the District's Wastewater Committee and Board of Directors about the project.

Section 9 contains a list of references cited in this report.

COMPLIANCE WITH SRF GUIDELINES

To be eligible for SRF financing, the State requires completion of a facilities planning process. A complete facilities plan includes a Project Report, a complete Environmental Document, and a draft Revenue Program. To meet these requirements, the District has contracted with three different consulting firms. Montgomery Watson is responsible for the Project Report while Crawford, Multari, Clark and Associates is responsible for the Environmental Document, and John L. Wallace and Associates is responsible for the Revenue Program.

Each of these program components is underway. The District has developed this report to meet the Project Report requirement. To meet the Environmental Document requirement, the District's *Final Environmental Impact Report* was certified on March 1, 2001. To meet the Revenue Program requirement, the District is developing a Draft Revenue Program, which is scheduled for completion in March 2001.

In addition to requiring the three components described above, the SRF guidelines specify the required elements of the Project Report. The table below indicates where this report addresses each of these required elements.

Table 1-1. Location of SRF Required Elements within the Project Report

Required Element	Location
1. A statement of project needs and benefits, including a discussion of water quality benefits of the project and the public health or water quality problems to be corrected.	Section 1
2. A cost effectiveness evaluation of alternatives over a 20 year planning period. The evaluations presented must include an evaluation of the alternative of upgrading operation and maintenance of the existing facility to improve effluent quality.	Section 3 for Collection Section 4 for Treatment Section 5 for Disposal
3. An evaluation of alternative methods for reuse or ultimate disposal of treated wastewater and sludge material resulting from the treatment process. For wastewater projects producing sludge material, the following information needs to be identified and compared: a. All landfills within a 100 mile radius that accept sewage sludge b. Any composting facilities within a 100 mile radius accepting sewage sludge c. The potential for dedicated land disposal d. Conversion of sludge to biosolids for distribution as soil amendment or as another agricultural product e. Ultimate disposal methods approved by the RWQCB	Section 5
4. An evaluation of non-existence or possible existence of excessive I/I in the existing sewer system.	Not applicable
5. Information on total capital costs, annual operation and maintenance costs, as well as the estimated annual or monthly costs to residential and industrial users for all of the alternatives.	Section 3 for Collection Section 4 for Treatment Section 5 for Disposal
6. A discussion of the existing population, flows, and loadings, and projections of the same, used to estimate the 20 year capacity needs for treatment facilities and collection systems and 40 year capacity needs for interceptors and outfalls.	Section 2

Table 1-1. Location of SRF Required Elements within the Report (continued)

Required Element	Location
7. A discussion of the anticipated eligible capacity for the project and how that capacity was derived.	Section 2
8. A description of the Best Practicable Wastewater Treatment Technology.	Section 4
9. A summary of public participation.	Section 8
10. The following must be submitted for the selected alternative:	
a. A detailed description of the selected alternative and the complete waste treatment system of which it is a part	Section 7
b. A summary of relevant design criteria (i.e., design flow, peak flows, daily BOD loadings, daily suspended solids loadings, overflow rates, detention times, sludge production, etc.)	Section 7
c. The estimated construction and annual operation and maintenance costs and a description of the anticipated manner in which all the costs will be financed.	Section 7
d. A summary of the cost impacts on wastewater system users.	Draft Revenue Program, March 2001
e. A summary of significant environmental impacts of the selected project and any proposed mitigation measures.	Final EIR, February 2001
f. A copy of any proposed intermunicipal service agreements necessary for the project.	Appendix H
g. A statement that identifies and discusses the sources and the amount of unallocated potable water currently available in the project service area. If the amount of potable water is less than what is needed to serve the projected population for the proposed project, a plan identifying how that deficiency will be mitigated shall be presented.	Final EIR, February 2001
h. A discussion of facilities which were previously funded by federal/state grants or loans, if such facilities are to be repaired or replaced.	Not applicable
i. Applicants must comply with the Civil Rights Act of 1964. Where minority populations are included in the facilities planning area, the Project Report must show such areas will be served or excluded from service only for reasons of cost-effectiveness.	The District complies and will sign an application to this effect.
j. A description of operation and maintenance requirements.	Section 7
k. A demonstration that the selected alternative is consistent with any applicable approved water quality management plan.	Section 1
l. A summary of public participation.	Section 8
m. A copy of the current adopted waste discharge requirements issued by the RWQCB for the wastewater facility or improvements/ expansion to be constructed. If no current adopted permit exists, a copy of the tentative waste discharge requirements, however, must be adopted by the RWQCB before the approval of either the plans and specifications or the Request for Design-Build Proposal (for Design-Build projects).	Appendix D

NEED FOR PROJECT

Groundwater resources in the Los Osos area are divided into four distinct aquifers. The fault dividing the community into east and west also divides the groundwater resources into an eastside aquifer and a west side aquifer. In addition, an aquatard further divides both the eastside and west side aquifers into an upper and lower aquifer. In general, the upper aquifer is within 150 feet of the ground surface and the lower aquifer is below approximately 190 feet of the ground surface. Most of the community's drinking water wells draw groundwater from the lower aquifers.

According to water quality data collected by the California Regional Water Quality Control Board (RWQCB), elevated levels of nitrate are present in the upper aquifers on both the eastside and westside of the community. High nitrate levels in drinking water are a public health concern, particularly for newborns where it can cause "blue baby syndrome". To protect public health, the California Department of Health Services (DHS) has established a drinking water limit of 10 mg/l nitrate (as N) in drinking water supplies.

In the early 1980's, nitrate levels in the upper aquifers within Los Osos exceeded the drinking water limit of 10 mg/l (as N). In several areas, water quality data suggested that that a buildup of nitrate was occurring in the upper aquifers. The primary source of nitrate contamination was identified by the RWQCB to be septic tanks and their associated leach fields. As a result, the RWQCB amended its Basin Plan and adopted Resolution 83-13 (Appendix A) prohibiting the use of septic tanks with leach fields and seepage pits within the Prohibition Zone of Los Osos (see Figure 1-2 on the following page). To limit growth and the subsequent addition of new septic tanks within the Prohibition Zone, a building moratorium was imposed on Los Osos by the RWQCB in 1988. This building moratorium has been continuously in effect since 1988.

Four areas of the community within the Prohibition Zone are not included in the collection area. These areas are Bayview Heights, the Martin Tract, Monarch Grove, and Sea Pines Resort. Bayview Heights and the Martin tract are not included in the collection area because the lot sizes are greater than 1 acre. Monarch Grove and Sea Pines Resort are not included in the collection area because they currently collect and treat wastewater in a small package plant.

Figure 1-2. Prohibition Zone

When Resolution 83-13 was initially adopted by the RWQCB in 1983, residents within the community of Los Osos had no other means by which to collect and/or treat their wastewater. To this day, residents within the Prohibition Zone continue to use their septic tanks and leachfields, as no other alternative wastewater system has been implemented. In addition to concerns about nitrate contamination of the groundwater, the RWQCB in their letter of July 10, 1998 has cited additional public health concerns, as shown below.

> Dependence upon the deeper aquifer exacerbates the surface water problems because the community's water supply, formerly drawn from the upper aquifer is now drawn from the deeper aquifer and recharged (after use) to the upper aquifer causing ground water levels to rise and flood septic systems. Increasing surface water impacts including: restriction of portions of shellfish harvesting areas because of rising bacteria levels; waters surrounding the Los Osos area periodically do not meet bacteria standards for water contact recreation (such as swimming, wading, kayaking and small boat sailing); and the public is increasing exposed to surfacing wastewater.

On October 27, 2000 the RWQCB replaced Resolution 83-13 with Time Schedule Order No. 00-131 (Appendix A). This order requires the District to demonstrate progress on a wastewater project by meeting a series of delivery dates. Specifically, the order identifies the following key dates:

- December 15, 2000 — Submit proof of draft Environmental Impact Report
- April 1, 2001 — Submit final California Environmental Quality Act document
- July 29, 2001 — Submit proof of voter approval of assessment district or comparable means of financing community wastewater system
- July 15, 2002 — Submit approved complete construction design plans
- July 15, 2002 — Submit County Use and Coastal Development permits
- September 6, 2002 — Commence construction of community sewer system
- August 30, 2004 — Complete construction of community sewer system

Failure to comply with the time schedule results in a fine of $10,000 per day. The District must implement a project to at least avoid these fines and address the public health concerns identified above.

The District must also submit a Facilities Plan and Funding Plan to the SWRCB by March 30, 2001. These submittals are required to maintain the District's eligibility for the low interest loan funding from the SRF. This Project Report is an integral part of the Facilities Plan.

Although a wastewater treatment project is needed to meet these requirements and avoid RWQCB fines, it must also simultaneously address community concerns. The *Vision Statement for Los Osos* developed by the Los Osos Community Advisory Council in 1995 (Appendix B) identifies several key community values that highlight the need for development of a sound wastewater management project. These values include:

- Decision-making based on a philosophy of sustainable development
- Managing the watershed in a manner that is consistent with protection of the Morro Bay Estuary
- Holistically managing local water resources to ensure its long-term viability
- Maintaining, managing, and recharging the local aquifer, preventing over-drafting of the aquifer and salt-water intrusion into the water supply
- Managing wastewater, cleansing and restoration to the lower aquifer or upper aquifer with pumping from upper aquifer for domestic use
- Reclaiming and conserving local water resources
- Developing a wastewater treatment facility based on a natural biological process rather than a mechanical system approach to the highest extent possible
- Creating a wastewater treatment facility that is a visual and recreational asset to the community, provides water for irrigation, agriculture, and habitat for wildlife
- Creating a wastewater project that is affordable to the community

It is essential that any proposed wastewater project within the community of Los Osos reflect these strongly held community values. To ensure that these community values were incorporated into the decision-making process, representatives from the community worked with District staff and Montgomery Watson to develop three key evaluation criteria that reflect the ideas contained in the community's *Vision Statement*. Section 4 contains a detailed description of the decision-making process. Table 1-2 shows that the three key evaluation criteria developed by the District affected nearly all components of the project.

Table 1-2. Evaluation Criteria and Project Components

Criteria	Project Component				
	Collection	Treatment Process	Facility Site	Effluent Disposal	Biosolids Disposal
Cost	✔	✔	✔	✔	✔
Resource Sustainability		✔	✔	✔	✔
Community Acceptance	✔	✔	✔	✔	✔

As shown in the table, the treatment process and facility site are the most affected by community values. To more clearly assess how well these two components met the community's criteria two workshops were held with the community. A summary of the results of these workshops is located in Section 4.

Owners of property within the community will be voting in the spring of 2001 on formation of an assessment district to fund the project. Their support of the assessment will be gained only if the wastewater project reflects their strongly held community values. Many community members have volunteered thousands of hours of their personal time and dedicated years of their life to the development of a sound wastewater management project that reflects the community's values. Thanks to their efforts the community at large is fully cognizant of the issues surrounding this project. As described below, several past efforts to implement a wastewater project in Los Osos have failed because of an inability to adequately reflect the community's values.

PAST EFFORTS TO IMPLEMENT A PROJECT

A detailed history of past efforts to implement a wastewater project in Los Osos is located in the *Final Environmental Impact Report* for the Los Osos Community Services District Wastewater Facilities Project by Crawford Multari & Clark Associates, February 2001. An abbreviated summary is presented below.

Since the 1980's, three engineering studies have been conducted for the community of Los Osos to address high nitrate levels in the groundwater. The recommendations of these studies have been rejected by the community because of their inability to meet the community's goals and reflect its values. In response to this situation, the community voted to form the District, with 85 percent voter approval, on November 3, 1998.

The newly formed District commissioned Oswald Engineering Associates Inc. to conduct an engineering study to develop a wastewater project that would be lower in cost and achieve the community's goals of providing a community amenity, ensuring energy conservation, and maintaining sustainability. The intent of the District was to use this study as the Project Report element of its Facilities Plan for State Revolving Fund financing.

The *Wastewater Facilities Project, Draft Project Report* was completed by Oswald Engineering Associates Inc. on January 31, 2000. It recommended that the District use a STEP/STEG type system for wastewater collection, an Advanced Integrated Wastewater Pond System for treatment, and percolation via gravity wells for effluent disposal. It was submitted for review to the SWRCB, which found it inadequate for several reasons, as articulated in their letter of February 15, 2000 (Appendix C). The SWRCB found that the report did not adequately address project alternatives in terms of type of collection systems, treatment processes, project sites, and effluent disposal methods. The RWQCB also reviewed the draft report and was critical of its contents and lack of alternative analysis.

To remedy this situation, the District hired Montgomery Watson in March 2000. Montgomery Watson was hired to accomplish four major tasks:

- Conduct a comprehensive alternative analysis of the collection system, treatment process, treatment plant siting, and effluent disposal components of the project
- Address comments of the SWRCB and RWQCB

- Develop alternatives to meet the RWQCB's tentative discharge requirements, as stated in WDR 97-8 (Appendix D), including the following performance criteria:

Constituent	30-day Average (mg/l)	Daily Maximum (mg/l)
Settleable Solids	0.1	0.5
BOD, 5-day	60	100
Total Nitrogen as N	7	10
Dissolved Oxygen	2 at all times	

- Assess alternatives based on engineering, cost, environmental, and community value criteria

This report is a summary of the work completed by Montgomery Watson, in conjunction with the District, to identify a wastewater project that reflects community values while simultaneously achieving SWRCB and RWQCB requirements.

PROJECT BENEFITS

The community of Los Osos will benefit directly from the development of a wastewater project. The project will allow the community to realize its goals and achieve its vision. Following is a description of the benefits of the project and how the project relates to the community's values identified above.

Provides a Cost-Effective Wastewater Management Solution

Ultimately, property owners will be responsible for the cost of the project. It is estimated that approximately 33% of the community's residents are low income residents. Only a cost-effective solution will successfully pass the Assessment District Vote in spring 2001. This project provides the community with a cost-effective solution that meets RWQCB and SWRCB requirements and reflects community values.

Improves Local Groundwater Quality

According to the RWQCB, the community's existing septic tank system is contributing to high nitrate levels in the groundwater. Once implemented, the project will eliminate the use of the majority of septic tanks, limiting further contamination of the groundwater. Over time, it is expected that rainwater and other natural processes will reduce nitrate levels in the upper aquifer.

Creates a Community Amenity and Visual Resource

As currently envisioned, the wastewater treatment facility will be constructed and landscaped to maximize active and passive recreational space in the center of the community. Not only will this provide aesthetic benefits but it will also provide park space for local schools and community groups near the existing community center.

Maintains Local Control of the Community's Water Resources

Currently, the community has no way to centrally collect its wastewater effluent. As part of the project, a central collection and treatment system will allow the community to holistically manage its effluent and make it available as a resource to the community in the form of recycled water for irrigation and other uses.

Promotes Sustainable Use of Local Groundwater Resources
Currently, the community draws water from the lower aquifer for potable and non-potable uses. As part of the project, recycled water will be available to supplement the community's water supply, reduce its dependence on groundwater supplies, and minimize the need to import water supplies.

Reduces Seawater Intrusion
The lower aquifer is currently in a state of overdraft and is experiencing seawater intrusion. This project will provide the community with opportunities for water conservation and water recycling that will decrease its need for water from the lower aquifer.

Protects Morro Bay and Estuary
According to the RWQCB, septic tanks are a source of nitrate and bacterial contamination to the Bay. As part of this project, the majority of septic tanks will be abandoned and this source of contamination will be eliminated.

Avoids RWQCB Fines
By implementing the proposed project, the community will be able to meet the RWQCB Time Schedule Order 00-131. If significant changes are made to the project or if the community does not approve the project during the Assessment District Vote in 2001, it is unlikely that the community will be able to comply with the dates identified in the Order.

Returns Decisions about Growth and Development to Local Officials
By implementing the proposed project, the building moratorium imposed on the community in 1988 will be removed by the RWQCB. Although some members of the community view the existing building moratorium as a benefit, it has prevented the General Plan process from being an effective means of governing growth in the area. This process of local planning will resume once the project is implemented and the majority of septic tanks are abandoned.

SECTION 2
CAPACITY ESTIMATES

SECTION 2
CAPACITY ESTIMATES

INTRODUCTION

This section explains the basis of population estimates as well as the wastewater flows and treatment loads use to determine the appropriate size of the project needed to accommodate existing and future wastewater needs for the community. This information was developed in conjunction with the District's *Urban Water Management Plan, December 2000*. This information was used to develop estimated dry and wet weather wastewater flows and loads to the collection system and treatment facility. In addition, it formed the basis for disposal estimates of wastewater effluent and biosolids.

The estimates provided below form the basis of the 20-year capacity needs for all components of the project. The community of Los Osos is expected to achieve full build-out in the year 2020. As a result, capacity estimates for the year 2020 also reflect capacity needs to the year 2040.

POPULATION ESTIMATES

The estimated build out population of the community that will be connected to the wastewater treatment facility by the year 2020 is shown in Table 2-1.

Table 2-1. Build-Out Population and Number of Connections

Area	County Population Estimate	Wastewater Committee Adjustment	Build-Out Population	Number of Connections
Baywood Pk, Walker et al.	4,443	0	4,443	1,580
Multifamily outside Baywood Pk, Bush/Ferrel, Cuesta by the Sea, Holland Tract, Morro Shores	7,030	0	7,030	1,035
Vista de Oro, New Anastasi Tract	330	0	330	2
Daisy Hill, Sea Oaks, Sunny Oaks (mobile home parks)	815	0	815	3
NE Baywood	933	0	933	366
Central Baywood	1,593	0	1,593	637
Redfield Woods	1,778	0	1,778	696
Bay Oaks	213	0	213	85
Bayridge	370	0	370	1
Sunset Terrace	418	0	418	167
Morro Palisades	1,325	(1,325)	0	0
Portion Martin Tract	43	0	43	17
Commercial/Institutional	462	0	462*	185
Total	**19,753**	**(1,325)**	**18,428**	**4,774**

* Population equivalent assuming 2.5 persons/DUE

These population projections reflect adjustments to figures from the 1990 census and the County of San Luis Obispo (Draft Estero Area Plan, 2000) made by the Los Osos Wastewater

Committee (Committee). The Committee is an advisory body to the District Board and is made up of local individuals that have been working to develop a wastewater project for the community for many years. As shown in Table 2-1, the Wastewater Committee adjusted only one of the County's population projections. The Committee adjusted the population projection for Morro Palisades because this parcel will be purchased for environmental mitigation and will not be available for development as assumed by the County.

The population projections developed by the Committee reflect a great deal of local knowledge about existing and future development. To adjust the population projections, the Committee canvassed the entire community. Based on the information gathered, the Committee adjusted the projections to reflect development that had already occurred and remaining lots and land available for development. For example, the adjustments account for areas that once were available for development, but are now planned for use as land for environmental mitigation. As a result of these adjustments, the build out population to be served by the project is estimated to be approximately 18,428 people.

Based on its understanding of the community, the Committee also estimated the number of connections that would be needed for the wastewater collection system. The Committee estimated that approximately 4,774 connections would be needed. In general, each house, apartment building, and commercial building will require a connection. However, in the case of mobile home parks, and several developments such as Vista de Oro, Morro Shores and others, one connection will serve many dwellings. As a result, 790 dwellings will require only eight connections.

ESTIMATED FLOWS AND LOADS FOR TREATMENT

Estimated flows and loads for treatment were based on per capita water use, historic rainfall data, and future water conservation efforts as identified in the community's *Urban Water Management Plan*. Both dry weather and wet weather flows were used to determine the size the collection system, treatment facilities, and disposal facilities. Following is a description of the estimated dry weather flows, wet weather flows, water conservation amounts, and treatment loads used to size the project.

Estimated Average Dry Weather Flow

Because no collection system currently exists in Los Osos, there are no wastewater flow records. Therefore, water consumption records during periods of very low outside water use were analyzed to estimate wastewater flows. This information was developed in conjunction with John L. Wallace and Associates' work on the community's *Urban Water Management Plan.*

For purposes of this report, it was assumed that when outdoor water use is at a minimum (i.e., during the rainy season) indoor water use is the predominant source of wastewater flow. Other sources of flow into the wastewater system during dry weather include a small amount of irrigation and ground water infiltration. Following is a description of the method used to estimate indoor water use and associated dry weather flows.

Estimated Indoor Water Use. Water is provided to residents within Los Osos by three different water purveyors: -the District, Southern California Water Company, and the S&T Water

Company. Together the District and Southern California Water Company provide water to more than 97% of the Los Osos residents within the project's service area. The S&T Water Company provides water to the remaining residents but does not maintain records of water deliveries to each dwelling. As a result, water consumption records from the District and from Southern California Water Company were analyzed to estimate per capita indoor water use. This analysis was coordinated with John L. Wallace and Associates' work for the *Urban Water Management Plan, December 2000.*

The District's records provide information on water service to approximately 2,800 services with an estimated population of 6,980 people. The Southern California Water Company records provide information on water service to approximately 2,500 services with an estimated population of 6,300 people. Together these records represent consumption by 13,280 people. These records are based on meter readings at the dwellings, and therefore avoid the confusion of lost and unaccounted for water in the transmission and distribution system.

Unfortunately, the District and Southern California Water Company do not separate commercial and residential water accounts. Therefore, the per capita water consumption estimates discussed herein reflect both commercial and residential flows. For the purposes of estimating total wastewater flows to the treatment facility, this approach accounts for total flows for collection, treatment, and disposal.

District. The per capita water consumption for District water users is shown in Table 2-2.

Table 2-2. Indoor Water Consumption Estimates for District Water Users

Period	Rainfall (inches)	Per Capita Consumption (gpd)
January + February 1993	14.5	84
November + December 1994	3.3	91
Average Consumption	----	**88**

These estimates were developed by reviewing water consumption records for the District since 1987 for those months with the lowest water consumption, and during which there was meaningful rainfall. This approach ensured the analysis of water consumption data during periods when outdoor use was low and water was being predominantly used for indoor purposes. For indoor water use estimates, the months of January/February 1993 and November/December 1994 were analyzed. Paired months were used because District billing cycles are two months long and two months gives a better indication of sustained low indoor water consumption.

As shown in the table, the average water consumption for these periods is 88 gpd per person. It should be noted that there were periods of heavier rainfall than indicated in the table. However, these periods were not included in the analysis because water consumption by septic tank users may be falsely low during periods of very high rainfall. That is, experienced septic tank users would likely reduce their water use to avoid leach field and septic tank backups during heavy rain periods, especially in areas with high groundwater.

Southern California Water Company. The estimated per capita water consumption for Southern California Water Company water users is shown in Table 2-3.

Table 2-3. Indoor Water Consumption Estimates for Southern California Water Company Water Users

Period	Rainfall (inches)	Per Capita Consumption (gpd)
March 1998	0.5	70
April 1998	2.9	59
Average Consumption	----	**65**

These estimates were developed from water consumption records for Southern California Water Company from 1997 and 1998 on the same basis as the District water records. The months of March and April 1998 were selected as representative of indoor water consumption. Although only 0.5 inches of rainfall occurred in March 1998 it was preceded by 12.4 inches of rain in February. As a result, it was assumed that the outdoor water use in March was minimal, given the amount of rainfall in the preceding month.

As shown, the average per capita water consumption for the Southern California Water Company is approximately 65 gpd. This figure is lower than the estimated 88 gpd for District water users because the District service area includes a higher percentage of multi-family housing.

Combined Average Indoor Water Consumption. The combined average indoor water consumption for both District and Southern California Water Company water users is shown in Table 2-4.

Table 2-4. Combined Average Indoor Water Consumption

Area Served	Population Served	Per Capita Consumption (gpd)
District	6,980	88
Southern California Water Company	6,300	65
Population (weighted average)	**13,280**	**77**

These numbers represent average water use on a population weighted basis. As shown in the table the overall average consumption is 77 gpd. This figure is within 3 percent of the average daily per capita water consumption developed by John L. Wallace and Associates for the *Urban Water Management Plan.* The slight difference is attributable to the different methods used to estimate the served population. For the District's *Urban Water Management Plan*, John L. Wallace and Associates used estimates based on population figures from the latest census maps, whereas this report uses an average population density of 2.5 persons per DUE. This population density was derived from the 1990 Census and extensive polling by the Committee.

Comparison with AWWARF Study. To cross-check the validity of the combined average indoor water consumption estimate, it was compared with the results of a report by the American Water Works Association Research Foundation (AWWARF) called the *Residential End Uses of Water* (Mayer et al., 1999). This study intensively monitored the indoor residential water use of 12 communities in the United States and Canada, including four California communities. AWWARF states that a striking conclusion of the study is the similarities between the 12 communities in terms of the amount of water used by toilets, washing machines, showerheads, dishwashers, faucets, and fixture leaks. The report states that this portion of the data has "significant transfer value across North America". Therefore, the AWWARF's findings are considered a valid point of comparison for indoor water consumption estimates for Los Osos.

The report showed that indoor water consumption (and by inference wastewater flow) across these communities averaged 69 gallons/person/day. This figure reflects some degree of water conservation in the homes surveyed. AWWARF estimates that, with no water conservation, the average home would consume approximately 73 gallons/person/day in indoor water use. It estimates that this figure could be reduced to approximately 50 gallons/person/day if all members of the community implemented all available indoor water conservation measures. These measures include total conversion of all water fixtures and appliances including clothes washers.

Because Los Osos has not yet undertaken a comprehensive water conservation program, the 73 gallons/person/day figure is considered the more reasonable figure with which to make comparisons. Thus, the estimated average indoor consumption of 77 gallons/day/person for Los Osos is considered reasonable.

Total Estimated Dry Weather Flow

To estimate dry weather flow to the collection system, a small amount of dry weather infiltration was added to the indoor water use estimates to account for irrigation seepage and ground water infiltration into the collection system. The amount of seepage is assumed to be small, and will vary, depending upon the type of collection system installed. The two alternative collection systems analyzed for this project were STEP/STEG and conventional. Section 3 contains a detailed description of these collection system alternatives.

STEP/STEG Collection System. With a STEP/STEG collection system there would be some amount of dry weather infiltration because of the ingress of irrigation water at the septic tank and via the connection line from the dwelling to the tank. Assuming 0.5 inches of irrigation every second day, and that approximately 50 percent of the irrigation applied directly over the tank enters the tank, a per capita dry weather infiltration rate of approximately 2 gallons/person/day would result. Thus, it is estimated that the dry weather average flow rate would be approximately 79 gallons/person/day for a STEP/STEG collection system.

Conventional Collection System. With a conventional collection system the infiltration of irrigation water via the septic tank would not occur because the septic tanks would be abandoned. However, irrigation water could enter via defects in the collection system and in the connection of the dwelling to the sewer in the street. Because of the sandy soils throughout the community, this amount of water would be low, and would probably be on the order of one or two gallons per capita per day. For purposes of this report, it is estimated that the average dry weather flow with a conventional collection system would be 79 gallons/person/day, the same as for a STEP/STEG collection system.

Estimated Wet Weather Flows

In addition to dry weather flows, a wastewater system, particularly the collection system, must be able to accommodate increased flows during wet weather periods. Following are estimates of wet weather flows for the project associated with the two alternative collection systems.

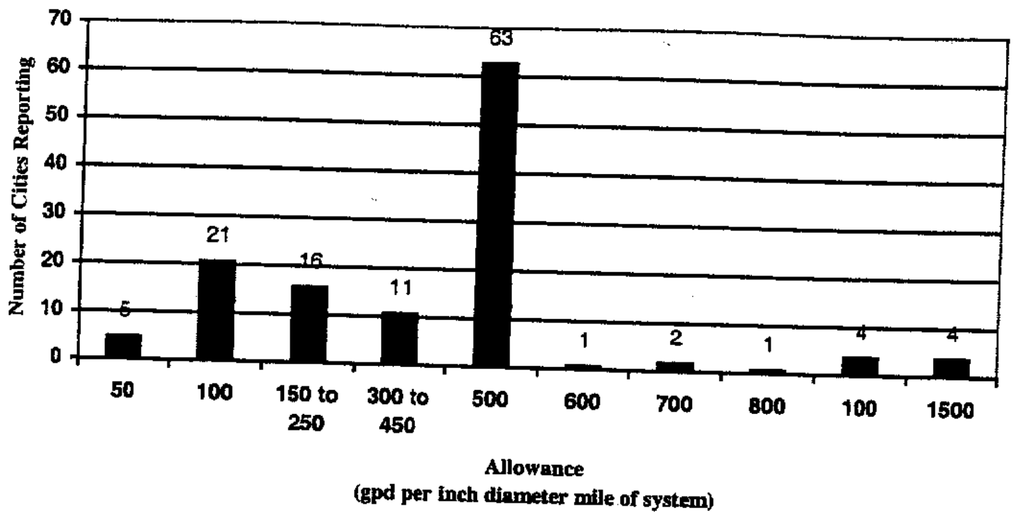
STEP/STEG System. To estimate wet weather flows for a STEP/STEG system, wet weather flows in other communities with this type of system were analyzed. This work was conducted by Bill Bowne who has more than 20 years experience with STEP/STEG systems and who co-authored the EPA manual *Alternative Wastewater Collection Systems* (1991).

In general, wet weather infiltration rates with STEP/STEG systems are greater than wet weather infiltration rates with conventional collection systems. These greater flows result from the fact that STEP/STEG systems maintain the use of existing septic tanks. Septic tanks and the piping connecting each home to the tank are rarely water tight, providing a ready route for rainwater to enter into the system. Based on information provided by Bill Bowne and previous experience with STEP/STEG systems, it is estimated that the wet weather infiltration rate would be approximately 40 gallons per day per connection. At an average population density of 2.5 persons per dwelling, this equates to a wet infiltration rate of approximately 16 gallons/person/day.

Conventional Collection System. To estimate wet weather flows for a conventional collection system, two references were reviewed. The first, *Wastewater Engineering, Collection and Pumping of Wastewater* by Metcalf & Eddy (1981), provides a chart for estimating the average wet weather flows/infiltration rates for new conventional sewers. Using this chart and a service area of 595 acres for Los Osos, the estimated infiltration rate is approximately 318,000 gallons per day. This equates to 17 gallons/person/day, assuming 18,428 equivalent population.

The second reference, *Gravity Sanitary Sewer Design and Construction* by the American Society of Civil Engineers (1982), provides a range of infiltration allowances reported by 128 cities for conventional collection systems. The ranges of values reported, and the number of cities reporting a given allowance, are presented on the following page in Figure 2-1.

Figure 2-1. Infiltration Allowances by Other Cities



As shown above, the predominant value reported is 500 gallons per day per inch-diameter-mile of sewer system. Within the range of infiltration values reported by the American Society of Civil Engineers, it is assumed that Los Osos will be at the lower end of the range because it will have a totally new collection system built with modern materials and construction practices. Additionally, the community's sandy soil conditions should contribute to lower than average infiltration rates. Runoff readily flows through the sandy soil past the pipe and pipe trench. This is in contrast to clay type soils which tend to funnel runoff into the pipe and pipe trench, resulting in large I/I flows.

Using a value of 400 gpd per inch-diameter mile from the second reference would result in a total infiltration rate of approximately 120,000 gpd for the community. In order to be conservative in the sizing and costing of facilities for this report, the larger wet weather flow estimate of 318,000 gpd was used.

Estimated Water Conservation Amounts

As part of its *Urban Water Management Plan* the community intends to implement a series of water conservation efforts. Because the community has not heretofore implemented a comprehensive water conservation plan, there are significant opportunities to diminish water consumption and associated wastewater flows. The plan recommends nine measures that will diminish water consumption and associated wastewater flows by approximately 150,000 gallons per day. This total reduction equates to a per capita reduction of wastewater flow of approximately 8 gallons/day/person. With this plan in place, the per capita average dry weather flows would be reduced from today's 77 gpd per person to 69 gpd per person (average dry weather flow) with a conventional or STEP/STEG system. This program is estimated to cost $1.2 million in capital cost, plus $65,000 per year.

Summary of Flow Estimates
Flow estimates based on the above information are summarized in Table 2-5.

Table 2-5. Wastewater Flow Estimates

Alternative	Population at Build-Out	Per Capita Flow* (gpd)		Total Flow (mgd)	
		Average Dry Weather	Wet Weather I/I	Average Dry Weather	Wet Weather
Conventional	18,428	69	17	1.3	1.6
STEP/STEG	18,428	69	16	1.3	1.6

* includes commercial flows

As shown in this table, the type of collection system does not affect the total amount of dry weather flow. Conventional and STEP/STEG would have essentially the same wet weather flows.

Organic Loads at Treatment Plant
It is assumed that the wastewater flow generated in Los Osos will be predominantly residential in character. Small commercial loads from restaurant and retail sales sources are expected to amount to less than 3 percent of the flow. Virtually no loads are expected from industrial sources. For these reasons, it is expected that the concentration of BOD, suspended solids, and ammonia will be of residential strength. The BOD concentration of 260 mg/l reflects an assumption of 0.15 pounds BOD per person per day. Flow data from Morro Bay/Cayucos shows a BOD concentration of 210 to 230 mg/l during August and September 2000 when rainfall infiltration would be absent. The BOD strength during these months would be representative of sewage from residences and commercial business.

Data from Morro Bay/Cayucos also show higher BOD concentrations in the range of 320 to 370 mg/l in December 2000 and January 2001, when rainwater infiltration would be present. As indicated by this information, rainwater infiltration did not dilute the concentration, but instead increased the concentration. This increase in concentration during the wetter months could be due to leaching of BOD laden solids or dissolved organics into the collection system. In the case of Los Osos, it is assumed that the collection system will be of plastic pipe construction, and installed with effective construction inspection. It will be less prone to infiltration than older systems that have relied upon clay pipe and therefore should not experience the wet weather increase in BOD concentration exhibited in the Morro Bay/Cayucos data. The assumed concentration of these constituents and the resultant daily loads to be treated are presented on the following page in Table 2-6.

Table 2-6. Solids Loading for Treatment

Parameter	Amount	Units
Flow		
Average Daily	1.3	mgd
Peak Daily	1.6	mgd
Influent Load		
Avg Daily BOD	260	mg/l
Avg Daily BOD Load	2,800	lbs/d
Peak Daily BOD	330	mg/l
Peak Daily BOD Load	3,600	lbs/d
Avg Daily Ammonia	30	mg/l
Avg Daily Ammonia Load	325	lbs/d
Peak Daily Ammonia	40	mg/l
Peak Daily Ammonia Load	434	lbs/d
Septage BOD		
Septage BOD	10,000	mg/l
Avg Daily BOD	250	gpd
Peak Daily BOD	1,000	gpd
Avg Septage BOD Load	21	lbs/d
Peak Septage BOD Load	83	lbs/d
Septage Ammonia		
Avg Daily Ammonia	150	mg/l
Peak Daily Ammonia	200	mg/l
Avg Septage Ammonia Load	0	lbs/d
Peak Septage Ammonia Load	2	lbs/d
Total Load		
Avg BOD Load	2,820	lbs/d
Peak BOD Load	3,680	lbs/d
Avg Ammonia Load	326	lbs/d
Peak Ammonia Load	435	lbs/d

SECTION 3

COLLECTION SYSTEM ALTERNATIVES

SECTION 3
COLLECTION SYSTEM ALTERNATIVES

INTRODUCTION

Currently, almost every resident in Los Osos operates an individual septic tank and leach field on their property. No community-wide collection system exists. The development of a community-wide collection system would centralize the collection and transmission of wastewater to a facility for treatment and disposal. This section identifies key assumptions used in the analysis of alternative collection systems, the cost and non-cost implications of each alternative, and the recommended alternative.

KEY ASSUMPTIONS

The information contained in Section 2 identifies key assumptions about population, number of connections and wastewater flows that are pertinent to the development of a collection system for the community. The collection systems described below assume a build-out population for collected areas within the community equivalent to 18,428 people and approximately 4,774 service connections. It is important to note that areas within the Prohibition Zone that are not included in the collection area are not included in these numbers. As described in Section 1, these areas are Bayview Heights, the Martin Tract, Monarch Grove, and Sea Pines Resort.

A second key assumption is that property owners would pay directly for the cost of connecting their properties to the collection system at the property line while the District would pay for the cost of the collection system from the property line to the treatment facility, including the sewer mains and pump stations. It is important to note that only District costs will be included in the Assessment Vote in 2001. However, the combined total cost of each collection system to the community was used to compare alternatives and develop a recommended alternative.

A third key assumption is that the septic tank survey of 176 homes in the community conducted by the District in summer 2000 accurately reflects, to the extent possible, the location and accessibility of septic tanks within the community (Table 3-1).

Table 3-1. Septic Tank Location and Accessibility

Front Yard	Rear Yard	Easy Access	Moderately Difficult Access	Difficult Access
77%	23%	54%	35%	11%

While this information is based on a limited sample size, it is the best and only information known to be available at this time. Properties with easily accessible tanks were defined as those with the tank in the front yard with little obstruction. Properties with the tank in the back yard were defined as more difficult because they require pumping to the street connection and relatively more private property disruption.

DESCRIPTION OF ALTERNATIVES

The analysis of collection systems focused on two alternatives: STEP/STEG and a conventional collection system. The STEP/STEG collection system was the preferred collection system alternative in the report by Oswald Engineering Associates, Inc. A description of both the STEP/STEG and conventional collection systems is presented below.

STEP/STEG Alternative

Description. Septic Tank Effluent Pump/ Septic Tank Effluent Gravity (STEP/STEG) collection systems retain the use of septic tanks to settle solids and provide a preliminary level of treatment. The effluent from the tanks is conveyed to a collection system which, in turn conveys the flow to the treatment facility. Depending on the slope of the terrain, this pre-treated wastewater is then either pumped (STEP system) or gravity-fed (STEG system) through small diameter plastic pipes to the collection system in the street. The in-street collection system is also relatively small diameter because the flow is relatively free of solids.

Applicability. If a STEP/STEG collection system was used for Los Osos, it is estimated that 70% of the collection system would be gravity flow (STEG) due to the sloping terrain, with 30% of the system requiring pumped discharge from the septic tanks (STEP). Each of the existing septic tanks and STEP/STEG connections would be inspected by the District's Septic System Maintenance and Management Program (SSMMP) personnel and the Design Engineer prior to and/or during the installation of the STEP/STEG collection system. This inspection would minimize the potential for future I/I, and assure quality control in connecting the properties.

For purposes of alternatives analysis, it was assumed that septic tanks installed after 1978 would be retrofitted if they met inspection standards and that all others would be replaced (Oswald, 2000). At this time, it is unknown how many tanks would need to be replaced at the start of the project. As discussed below, this uncertainty has a large impact on the potential cost of the STEP/STEG alternative.

A STEP/STEG system in Los Osos would use 2-inch diameter piping for connection lines. The average diameter of the in-street collection system would be 4 inches. There would be approximately 204,000 feet of sewer mains. The alignment of the mains would be similar to that of a conventional system, in that most streets would have a sewer main to collect flow from the adjacent properties. A conceptual alignment of a wastewater collection system (STEP/STEG or conventional) for Los Osos is shown on the following page in Figure 3-1.

Advantages. In comparison to conventional gravity systems, STEP/STEG systems can generally offer the advantage of reduced capital costs, especially for low-density communities. Because most of the solids have settled out in the septic tanks, pipe diameters can be smaller than in conventional systems. Two-inch diameter lines are typically used from the house to the connection in the street. Street mains as small as three inches can be used, depending on the total flows involved. Furthermore, the smaller diameter pipes can be installed at shallower depths than conventional gravity pipe and can be more readily 'snaked' around obstacles. Because of these factors, there is the potential to reduce the material and installation costs of the sewerage system. However, this advantage is limited because the 8-inch pipe diameters used with a

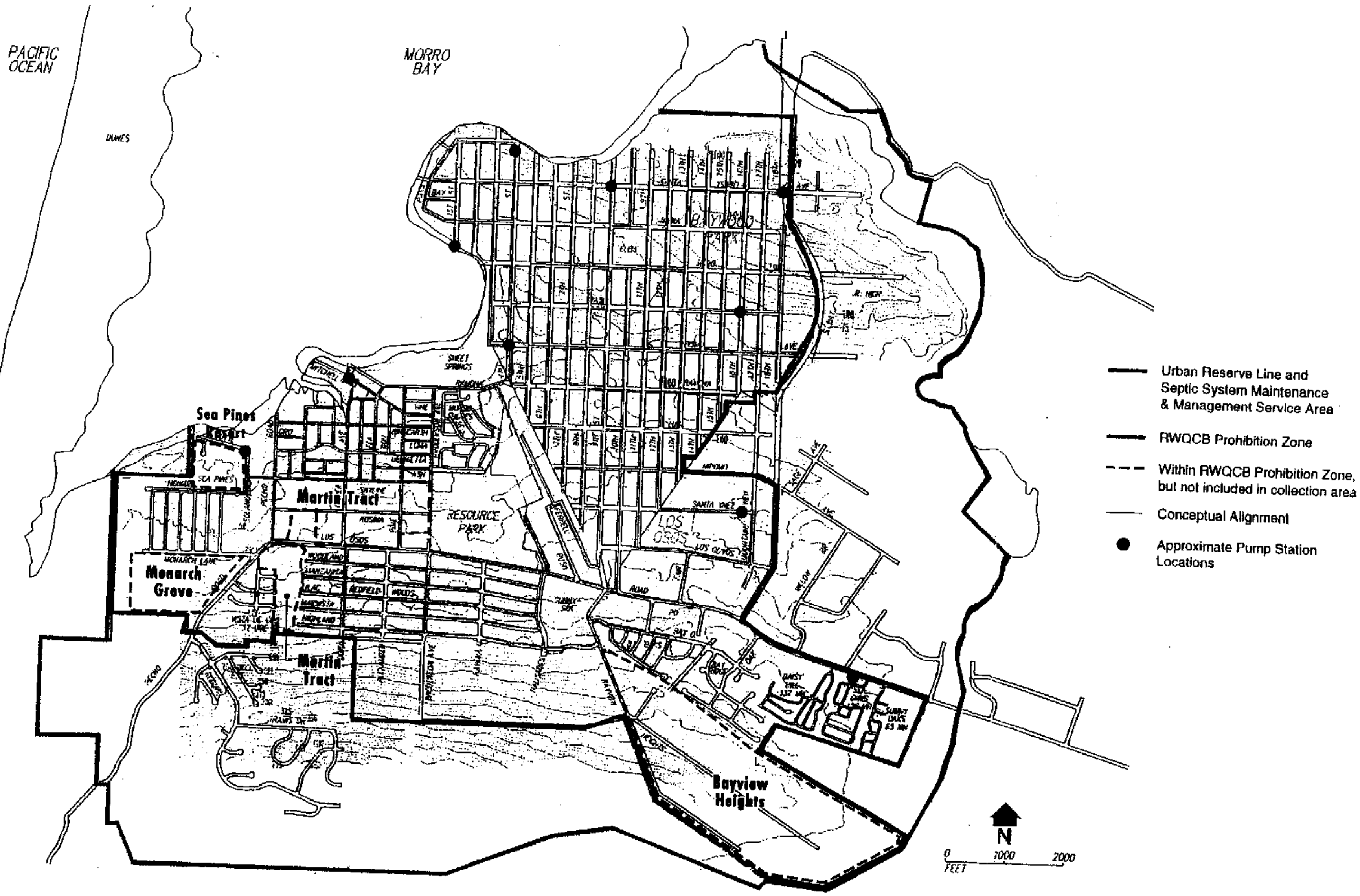


Figure 3-1. Conceptual Wastewater Collection System

conventional system have a flatter minimum slope than the 4 inch diameter pipe to convey the same flow. This means that after, for example, 2,000 feet the 8 inch pipe would be shallower than the 4 inch pipe. The ability to use shallower installation is also advantageous for locations of hilly terrain and high water tables (EPA, 1991), and in sandy soil conditions such as Los Osos where caving problems may add to the cost of deep trenching.

Disadvantages. The small size pipes used for a STEP/STEG collection system work best when wastewater flows are constant and relatively unaffected by wet weather infiltration and inflow (I/I). Although STEP/STEG systems are often associated with reduced I/I due to smaller diameter pipes, shallow pipe depths, and solvent welded joints, realization of this advantage requires that the septic tanks themselves be watertight and not a source of I/I. For this reason, most STEP/STEG projects replace all of their septic tanks at project inception. This is a very costly measure, impacting the cost viability of this alternative.

The principal operational disadvantage of a STEP/STEG system is that the septic tanks and pumps associated with STEP connections must be inspected, maintained, and pumped out periodically. As stated above, maintenance would include maintaining the water tightness of the tanks, as well as, structural integrity. Given the individualistic development of Los Osos, this would require varying degrees of disruption to the property owner, as many of the septic tanks are in difficult to access locations. Once pumped out, the contents of the tanks have to be trucked to the treatment facility for treatment and disposal.

Construction Impacts. Compared to a conventional system, the STEP/STEG system allows mains and service lines to be installed at shallower depths. As a result, disruption to the community is slightly less for the installation of a STEP/STEG system. However, the same length of mains and service lines would be required for both the conventional and STEP/STEG systems. Therefore the length of street that would be disrupted would be the same as with a conventional system. STEP/STEG would also require the inspection and possible replacement of up to 100% of existing septic tanks and disruption to property owners. The cooperation of property owners for access and possible replacement of these septic tanks is essential (Oswald Engineering Associates, 2000).

Costs. The construction and operation/maintenance costs for the STEP/STEG alternative were estimated so that the costs of collection system alternatives could be compared. The construction costs included the connection costs to be borne by the property owners, and the in-street collection system costs to be borne by the District. In this way, the total cost to the community was estimated and compared with a conventional collection system.

District Collection Cost. The estimated construction cost of the sewer mains and pump stations for the STEP/STEG alternative is approximately $35.3 million, as shown on the following page in Table 3-2.

Table 3-2. Estimated District Collection Cost for the STEP/STEG Alternative

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
4 inch diameter sewer main	204,284	lf	55	11,235,620
Dewatering/Shoring	7,000	lf	80	560,000
Manholes	292	ea	3,500	1,022,000
Large Pump Stations	8	ea	280,000	2,240,000
Small Pump Stations	8	ea	198,000	1,584,000
Connections: street to property line	4,774	ea	1,343	6,411,482
Subtotal				**23,053,102**
Contingency at 20%				4,610,620
Subtotal				**27,663,722**
Legal, admin, engineering at 27.5%				7,607,524
Total				**35,271,246**

For estimating purposes, an average diameter of 4 inches was used for the sewer mains and 2 inches was used for the connection lines. The detailed take off prepared by Bowne for the draft project report by Oswald Engineering Associates, Inc. includes several diameters for the street mains, but on a length-weighted basis, the average diameter was 4 inches. A relatively small amount of dewatering and shoring is shown in the estimate, as depth of the sewer mains is relatively shallow (most of the system would be located at a depth of 4 to 7 feet). To maintain a shallow profile, 16 pump stations are estimated at this level of planning.

Private Connection Cost. The costs for connecting the dwellings to the collection system are estimated to be approximately $14.9 million as shown on the following page in Table 3-3.

Table 3-3. Estimated Private Connection Costs for the STEP/STEG Alternative

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Connections: dwelling to property line	4,774	ea	1,575	7,519,050
Septic tank replacement at project inception (5% of tanks)	239	ea	2,763	660,357
Property repair (fences, pathways, landscaping)	4,774	ea	836	3,991,064
Subtotal				**12,170,471**
Contingency at 20%				2,434,094
Subtotal				**14,604,565**
District inspection & admin at 2%				292,091
Total				**14,896,656**

The costs shown in this table assume that only five percent of the septic tanks would have to be replaced at the inception of the project. As described later, this assumption would have a large impact on the cost of the STEP/STEG alternative. It was also assumed that 30 percent of the connections would be STEP (pumped) and 70 percent would be STEG (gravity).This assumption was based on the estimates done for the January 31, 2000 report by Oswald Engineering Associates, Inc.

Also shown in Table 3-3 is an estimate for repair of fences, pathways and landscaping to restore the owners' property. This would be a highly variable number, but is included to show that some level of cost would be incurred for this impact.

Total Present Worth Cost. The total present worth cost of the STEP/STEG alternative is shown on the following page in Table 3-4 as $63.2 million.

Table 3-4. Present Worth Cost of STEP/STEG Alternative

Item	Cost ($ millions)
District Collection Costs	35.3
Private Connection Costs	14.9
Total Construction Cost to Community	**50.2**
Annual O&M Costs	
Pipes and Pumps	0.5
Septic Tank Maintenance	0.4
Septic Tank Replacement, 50 yr life	0.3
Subtotal Annual Costs	**1.2**
Present Worth of annual costs, 6.625%, 20 yrs	13.0
Total Present Worth Cost, 6.625%, 20 yrs	**63.2**

This cost includes the annual operations and maintenance costs of the sewer mains and pump stations as well as the septic tanks. The O & M costs were based on costs presented in EPA's manual *Alternative Wastewater Collection Systems* (1991). The septic tank maintenance costs include pumping the tanks every five years and a general inspection at that time. The annual costs also assume that the septic tanks have a life of fifty years, and that 2 percent of the tanks are replaced in an average year.

Impact of Septic Tank Replacement on Costs. The cost of the STEP/STEG alternative is highly sensitive to the number of septic tanks that need replacement at project inception. As shown in Table 3-5 as the number of tanks needing replacement increases, the costs rapidly rise. However, there is little reliable information regarding the condition of the tanks in Los Osos. There have been few structural cave ins, but there is virtually no information regarding the water tightness of the tanks. Many of the community's septic tanks were installed prior to 1978 and thus they are already 22 years old. It is not unreasonable to assume that some level of root intrusion and corrosion of these tanks has occurred, but it is impossible to quantify the number of unacceptable tanks at this time. In light of this situation, the present worth cost of a STEP/STEG alternative would be somewhere between the $62.2 million and $79.2 million shown on the following page in Table 3-5.

Table 3-5. Impact of Tank Replacement on the Estimated Cost of the STEP/STEG Alternative

Item	STEP/STEG with Various Degrees of Tank Replacement				
	0% tank replacement	10% tank replacement	20% tank replacement	30% tank replacement	100% tank replacement
Construction Cost ($ millions)					
District Collection Cost	35.3	35.3	35.3	35.3	35.3
Private Connection Cost	13.9	15.9	17.9	19.9	34.1
Subtotal	**49.2**	**51.2**	**53.2**	**55.2**	**69.4**
Annual O&M Cost ($ millions)					
Pipes and pumps	0.5	0.5	0.5	0.5	0.5
Septic tank maintenance	0.4	0.4	0.4	0.4	0.4
Septic tank replacement	0.3	0.3	0.3	0.3	0.0
Subtotal	1.2	1.2	1.2	1.2	0.9
Present Worth of Annual O&M, 6.625%, 20 yrs	**13.0**	**13.0**	**13.0**	**13.0**	**9.8**
Total Present Worth Cost	**62.2**	**64.2**	**66.2**	**68.2**	**79.2**

Notes: All totals rounded to one decimal place.

It is this range of costs that was compared with the cost of a conventional collection system.

Conventional Collection System

Description. Conventional collection systems are widely used throughout the United States. These systems use a gravity flow sewer system. Their performance is well documented and there is an extensive knowledge base for their design, construction and operation. This alternative generally offers a cost-effective solution where housing densities are relatively high and the ground conditions are amenable to the depth of trenching needed to install the pipes. In addition, microtunneling can be used in areas of construction difficulties.

The cost of a conventional system can be higher than a STEP/STEG system in sparsely populated areas, or in areas of very high ground water and difficult trenching conditions. Many conventional collection systems also suffer from very high levels of infiltration/inflow. This latter aspect of conventional collection systems has received much scrutiny in the past 20 years due to unacceptability of frequent wet weather overflows. As a result, recent improvements in materials and jointing methods, combined with more effective construction inspection, have reduced the susceptibility of conventional sewerage systems to excessive infiltration/inflow.

Applicability. A conventional system is a viable option for Los Osos. In fact, design drawings for a conventional collection system serving the Prohibition Zone of Los Osos have already been prepared (Metcalf & Eddy, 1997). Based on this presumed 75 percent design, approximately 93 percent of the collection system would be constructed at a depth of 10 feet or less. Thus, the terrain in Los Osos would not force the construction a deep sewer system. However, sections of the community experience high ground water, which would require dewatering during construction. Discussions with engineers at CFS Geotechnical Engineers indicate that the use of trench shield and dewatering pumps would be sufficient to handle the areas of high groundwater. Thus, high ground water, in combination with the slumping sandy soil conditions, would not prevent the construction of a conventional collection system, but would add to its cost.

Cost. The construction cost and operation and maintenance costs for a conventional collection system have been estimated for comparison purposes. As with the other alternative, the construction costs included the connection costs to be borne by the property owners, and the in-street collection system costs to be borne by the District. The annual operation and maintenance costs associated with this system were based on a comparison of annual O&M budgets of other nearby communities that have similar populations and length of sewer mains.

District Collection Cost. As shown in Table 3-6, the estimated construction cost of the in-street sewers, pump stations, and connections to the property line is approximately $40.3 million.

Table 3-6. Estimated District Collection Cost for the Conventional Collection System Alternative

Item	Depth (ft)	Quantity	Unit	Unit Cost ($)	Total Cost ($)
8" PVC Piping	4 to 7	130,904	lf	65	8,508,760
8" PVC Piping	8 to 11	60,000	lf	90	5,400,000
8" PVC Piping	12 to15	5,300	lf	100	530,000
8" PVC Piping	over 15	4,080	lf	110	448,800
10" PVC Piping	12 to 15	4,000	lf	140	560,000
Subtotal					**15,447,560**
Sheeting/Shoring in high groundwater areas	10	13,500	lf of trench	130	1,755,000
Manholes		450	ea	3,500	1,575,000
Large Pump Station		7	ea	280,000	1,960,000
Small Pump Station		3	ea	198,000	594,000
Laterals: street to property line		4,774	ea	1,046	4,993,604
Subtotal					**10,877,604**
District Collection Subtotal					**26,325,164**
Contingency at 20%					5,265,033
Subtotal					**31,590,197**
Legal, admin, engineering at 27.5%					8,687,304
Total					**40,277,501**

The costs shown above would be borne by the District. The estimate in Table 3-6 assumes that most of the system would be located at a fairly shallow depth (4 to 7 feet), which in large part is based on the design completed by Metcalf & Eddy in 1997. The estimate also includes the costs associated with 10 pump stations, which would be used to keep the collection system fairly shallow. Final design may show that a deeper design is practical and some of these stations could be eliminated at that time.

To estimate costs for a conventional collection system, Metcalf & Eddy's design drawings were reviewed to determine the type and quantity of sewer pipe required to service the area, and to identify additional areas of the Prohibition Zone that were not included within the 1997 design. The length of sewer collection pipe required for each additional area was determined by mapping out sewer lines along roadways adjacent to the area's residences and connecting them to the proposed sewer lines in the 1997 design.

Private Connection Cost. Property owners would directly pay the cost to connect their properties to the collection system at the property line. These additional costs would be approximately $9.4 million, as shown in Table 3-7.

Table 3-7. Estimated Average Private Connection Cost for Conventional Collection System Alternative

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Connections: dwelling to property line	4,774	ea	864	4,124,736
Property repair: (fences, pathways, landscaping)	4,774	ea	750	3,580,500
Subtotal				**7,705,236**
Contingency at 20%				1,541,047
Subtotal				**9,246,283**
District inspection & admin at 2%				184,926
Total				**9,431,209**

These costs include the costs of abandoning the existing septic tank, including the pumping out of the tank contents, crushing the tank top and backfilling the tank. Based on work conducted by the Committee, approximately 156 properties would need pumped connections to the in-street collection system. These costs are reflected in the average connection cost shown in the table.

Annual O & M Costs. Annual operation and maintenance costs for the collection system were estimated based on a comparison of information provided by several small communities including Arroyo Grande, Paso Robles, Pacific Grove, and Atascadero. Each community provided details concerning their annual O&M budget, population served, miles of collection pipeline within the system, materials and equipment used, and number of personnel.

The majority of these communities were fairly proactive with respect to preventative maintenance for wet weather infiltration and inflow. Using this information, the annual O&M costs per person served and per mile of sewer were then calculated for each community.

For comparison, Los Osos would have a served population of 18,428, approximately 39 miles of sewer, and 10 pump stations. As shown in Table 3-8, the O&M costs range from $500,000 to $800,000 per year for these communities.

Table 3-8. Annual Operation and Maintenance Costs for Similar Communities

Item	Arroyo Grande	Paso Robles	Pacific Grove*	Atascadero	Average
Population	16,000	25,000	17,400	12,000	17,600
Miles of Sewer	52	85	55	43	59
Number of Pump Stations	6	13	9	12	10
Annual O&M Budget	$500,000	$600,000 - $800,000	$600,000	$713,000	$604,333
Number of Personnel	2	4	3	5	3.5
Cost per mile of sewer	$9,600	$7000 - $9400	$11,000	$16,600	$11,350
Cost per person served	$31.25	$24 - $32	$34.48	$59.42	$38.29

* Located in Monterey County. All other communities located in San Luis Obispo County.

The average cost per mile of sewer system is approximately $11,350/mile/year. Using this average cost for Los Osos the estimated O&M costs would be $442,000/year. However, the $500,000/yr cost shown by Arroyo Grande is considered the minimum cost of maintaining a collection system that would accommodate the community of Los Osos.

Arroyo Grande conducts a proactive maintenance program to prevent I/I that includes yearly cleaning of the entire system and video inspection of more than 80% of the system. This type of program would be needed in Los Osos to keep I/I to a minimum. It is also difficult to maintain a staff level of less than two persons to maintain a collection system of 39 miles. For these reasons, the estimated annual O&M costs for Los Osos are approximately $500,000.

<u>Total Present Worth Cost.</u> The total present worth cost of a conventional collection system is shown on the following page in Table 3-9 as $55.1 million. This cost includes annual operation and maintenance costs as well as capital costs for pipes and pump stations.

Table 3-9. Present Worth Cost of the Conventional Collection System Alternative

Item	Cost ($ millions)
District Collection Cost	40.3
Private Connection Cost	9.4
Total Construction Cost to Community	**49.7**
Annual O&M Costs: Pipes and Pump Stations	0.5
Present Worth of Annual O&M	**5.4**
Present Worth, construction cost + annual costs, 6.625%, 20 yrs	**55.1**

COMPARISON OF ALTERNATIVES

Non-cost Comparison of Alternatives. A comparison of the alternatives on a non-cost basis is shown in Table 3-10.

Table 3-10. Non-Cost Comparison of Alternatives

Item	STEP/STEG	Conventional
Recurring disturbance to property owner	yes	no
Number of septage haulings per year to treatment plant	954	90
Average depth of pipelines	4 to 5 ft	7 to 8 ft
Pipe material	plastic	plastic
Average diameter of sewer mains	4 inches	8 inches
Average diameter of connection lines	2 inches	4 inches
Vulnerability to I/I	slightly less	slightly higher
Spare hydraulic capacity	smaller	greater
Allows property owner to build over area occupied by septic tanks and leach fields	no	yes

Recurring Disturbance to Property Owner. The use of STEP/STEG would continue the use of existing septic tanks, which in turn requires that each septic tank be maintained and pumped out every five years. Thus, the property owners are disturbed on a recurring basis, whereas, a conventional system has no such disturbance. This concern was expressed by residents at several public meetings when the two alternatives were discussed. This disturbance would be more severe on smaller lots where the septic tank and leach field occupy a greater portion of the yard than on larger lots.

Frequency of Septage Hauling. STEP/STEG would result in nearly 1000 pump outs per year and the associated truck traffic to haul the septage to the treatment plant. A conventional system would still have some septage hauling due to the properties that are one acre or larger and which would be allowed to continue use of their septic tanks. However, the number of septage haulings would be less than 100 per year, i.e., less than a tenth of that associated with STEP/STEG. At several public meetings it was evident that the number of septage hauling trucks traveling through the community was of concern to some residents.

Depth of Pipelines. The average depth of pipelines for the STEP/STEG alternative would be approximately three feet less than for a conventional collection system. The shallower depth would result in less excavation and slightly less disturbance at street level. The community has seen this as a significant advantage of the STEP/STEG alternative given the high ground water and slumping sandy soil conditions in the area. However, discussions with geotechnical experts with CFS Geotechnical Engineers on this topic reveal that these conditions can be readily handled with a trench shield and dewatering measures. Thus, the high ground water and slumping soil conditions are not seen as a fatal flaw for the conventional alternative, but are reflected as a greater cost associated with this alternative.

Vulnerability to I/I and Pipe Material. The pipe diameters of a STEP/STEG alternative would be approximately half that used in a conventional system, which would lessen the system's vulnerability to I/I. However, both alternatives would use plastic pipe, which, at these small diameters, is fairly resistant to I/I. Therefore, the potential advantage of STEG/STEG in this regard is considered small.

Spare Hydraulic Capacity and Pipe Diameter. Because of the small pipe diameters used in the STEP/STEG alternative, the spare hydraulic capacity provided by this alternative is relatively small. The eight-inch sewers that would predominate the conventional system would have four times the hydraulic capacity of the four-inch sewers that would make up the bulk of the STEP/STEG alternative. This lack of spare capacity means that the septic tanks must be nearly watertight and cannot be a significant source of I/I. For this reason nearly all communities that have converted to STEP/STEG operation have replaced all of their septic tanks. Those few communities that have not replaced all septic tanks have experienced high wet weather flows due to excessive infiltration/inflow.

Impacts on Property Use. The use of a conventional collection system would allow the abandonment of the existing septic tanks and leach fields. This is a distinct advantage to many of the property owners that wish to expand their houses on the relatively small lots that are prevalent in Los Osos. Many of the lots are only 50 feet by 125 feet with much of that area occupied by the dwelling and septic tank/leach fields, leaving little room for expansion. In light of the above discussion a conventional collection system would offer significant non-cost advantages over a STEP/STEG system.

Cost Comparison. A present worth cost comparison of the two collection system alternatives is shown in Table 3-11.

Table 3-11. Cost Comparison of Collection Alternatives

Item	Conventional	STEP/STEG with Various Degrees of Tank Replacement				
		0% tank replacement	10% tank replacement	20% tank replacement	30% tank replacement	100% tank replacement
Construction Cost ($ millions)						
District Collection Cost	40.3	35.3	35.3	35.3	35.3	35.3
Private Connection Cost	9.4	13.9	15.9	17.9	19.9	34.1
Subtotal	**49.7**	**49.2**	**51.2**	**53.2**	**55.2**	**69.4**
Annual O&M Cost ($ millions)						
Pipes and pumps	0.5	0.5	0.5	0.5	0.5	0.5
Septic tank maintenance	0.0	0.4	0.4	0.4	0.4	0.4
Septic tank replacement	0.0	0.3	0.3	0.3	0.3	0.0
Subtotal	0.5	1.2	1.2	1.2	1.2	0.9
Present Worth of Annual O&M, 6.625%, 20 yrs	**5.4**	**13.0**	**13.0**	**13.0**	**13.0**	**9.8**
Total Present Worth Cost	**55.1**	**62.2**	**64.2**	**66.2**	**68.2**	**79.2**
Annualized Present Worth	5.1	5.7	5.9	6.1	6.3	7.3

Using present worth as the basis of comparison allows the total life cycle costs of the alternatives to be assessed. The cost of the STEP/STEG alternative is shown at various levels of septic tank replacement. As previously stated there is little hard evidence regarding the water-tightness of the septic tanks and it cannot be firmly stated how many tanks would need replacement at the start of the project.

As shown in the table, even if none of the tanks need replacement at the start of the project, STEP/STEG is a more expensive alternative. Furthermore, the STEP/STEG alternative has the potential to be nearly 40 percent more expensive than a conventional system if all of the tanks need replacement. Based on the estimated annualized present worth values in the table, the annual cost per connection would be approximately $1,068 for the conventional system alternative and for the STEP/STEG alternative would range from about $1,194 to $1,518.

The construction cost of the STEP/STEG alternative would be less than a conventional system if less than ten percent of the tanks were replaced at the project start. This reflects the savings due to shallower pipe trenches and smaller diameter pipes. However, because of the uncertainty regarding the condition of the septic tanks, there is a $17 million range in potential construction cost associated with the STEP/STEG alternative. In addition, the costs of maintaining the septic tanks, and replacing them in the future to ensure water tightness, causes the STEP/STEG alternative to be more costly than a conventional system.

Collection System Recommendation. In light of the above discussion, it is recommended that the District implement a conventional collection system. This recommendation would result in the following advantages:

- Lowest cost to the residents of the community
- Greatest hydraulic reserve thereby lessening chances of system overflows
- Least disturbance on individual properties
- Greatest flexibility for property owners who wish to use the area occupied by septic tanks and leach fields for improvements to their dwellings

SECTION 4

TREATMENT ALTERNATIVES

SECTION 4
TREATMENT ALTERNATIVES

INTRODUCTION

This section describes and compares the treatment processes and facility sites that were considered for this project. The alternatives were assessed relative to the community values described in Section 1 and the ability of the process to meet the discharge requirements identified in WDR 97-8 by the RWQCB (Appendix D). The treatment processes were evaluated at various sites within the community in order to make a recommendation regarding both the treatment process and the location of the facility. Following is a description of the evaluation used to select a facility site and treatment process.

ALTERNATIVE FACILITY SITES

Although the various treatment process alternatives require varying amounts of land, the minimum amount of land needed to site the most compact alternative is 6 acres. The Committee compiled a list of more than 50 parcels of this size and then reduced the list of parcels based on the following criteria:

- Designated as open space and therefore not developable
- Contained land slopes greater than 10%, which would be costly to develop
- Designated as critical habitat, and therefore not developable
- Already developed and occupied
- Designated or considered prime agricultural land and therefore not developable

Using these screening criteria the list of potential sites was reduced to the seven sites described below. The locations of these sites are presented on the following page in Figure 4-1.

Andre

The Andre property consists of two contiguous properties totaling 32 acres located at the north east corner of Los Osos Valley Road and Clark Valley Road, immediately east of the Los Osos Memorial Park Cemetery. The site is largely vacant; with the exception of a single-family residence located about one-half mile from Los Osos Valley Road.

This site is characterized by uncultivated agricultural land considered Locally Productive by the State Important Farmlands Mapping Program. The site slopes gently downward to the north away from Los Osos Valley Road; the northerly property boundary adjoins Warden Lake, a locally significant wetland. High voltage transmission lines cross the westside of the site from south to north emanating from Diablo Canyon Nuclear Power Plant.

Eto

This site consists of 43.3 acres located east of South Bay Boulevard and south of Los Osos Middle School. The site is relatively flat and contains chaparral, oak woodland, and coastal scrub vegetation. Surrounding land uses include open space and grazing to the east, single family residences on large lots to the south and west, and Los Osos Creek to the east. This site contains prime agricultural land.

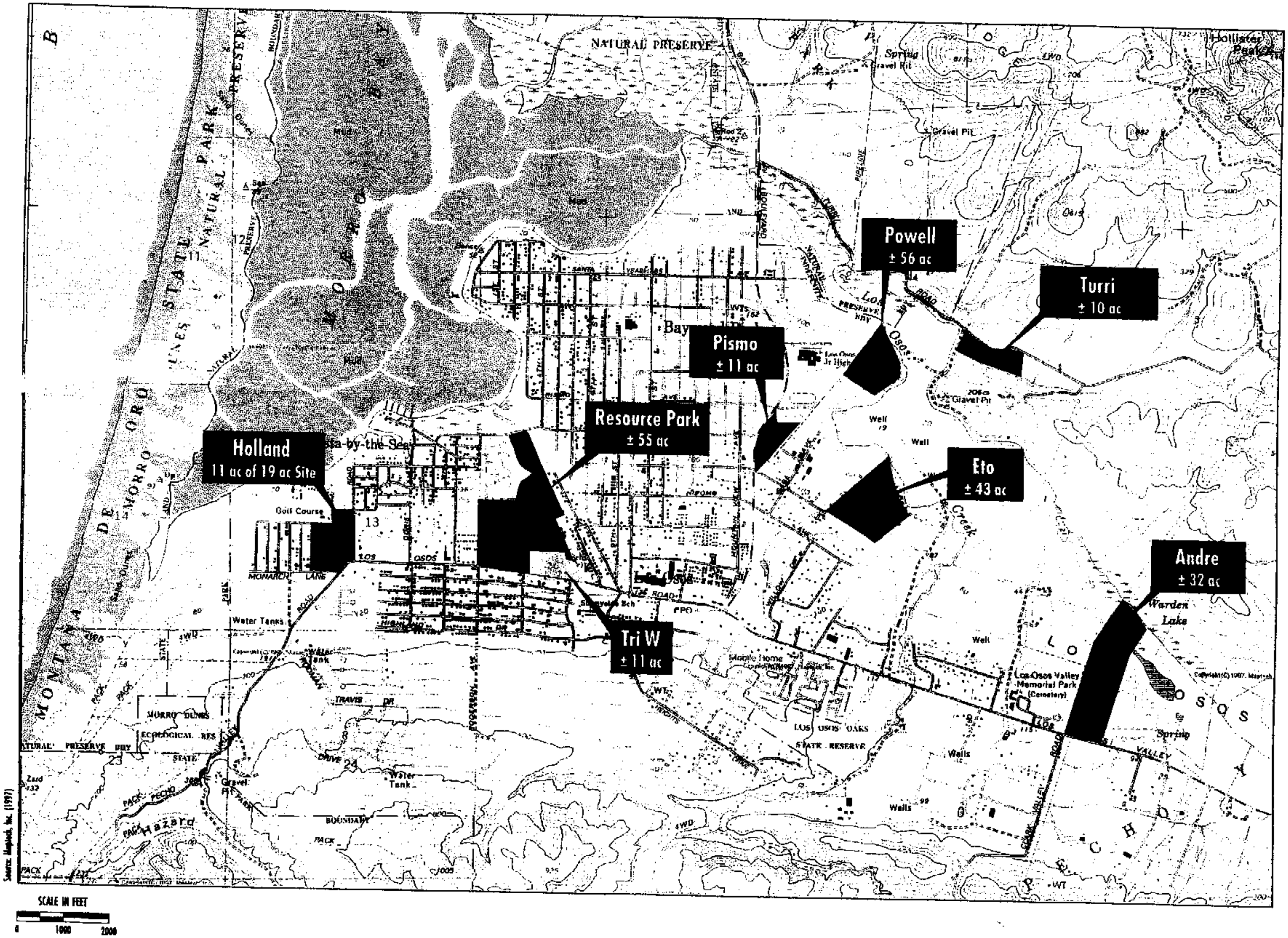


Figure 4-1. Location of Alternative Treatment Sites

Holland
This site consists of 19.4 acres located north of Los Osos Valley Road, south of the Sea Pines Golf Course, and west of Pecho Road. The site is vacant and currently used as a driving range for the nearby Sea Pines golf course. No significant stands of vegetation or other physical characteristics are present. The site slopes gently north to south and is rectangular in shape. Surrounding land uses include single family residences to the west and north, the golf course to the south and vacant land designated for residential development to the east. Monarch Grove Elementary school is 0.1 miles to the east along Los Osos Valley Road. This site is designated Single Family Residential by the Estero Area Plan/Local Coastal Program, which allows up to 7 dwelling units by gross acre.

Pismo
This site consists of an 11 acre parcel located east of South Bay Boulevard and immediately south and east of the Los Osos Middle School. The site is relatively flat and contains chaparral, oak woodland, and coastal scrub vegetation. This was the preferred site for a conventional treatment system discussed in the 1997 *Final Supplemental Environmental Impact Report* by Fugro West, Inc. This site is designated Residential Suburban by the Estero Suburban by the Estero Area Plan/Local Coastal Program.

Powell
This site consists of a 56-acre parcel located east of Los Osos High School and west of Los Osos Creek. This site is an environmentally sensitive area containing habitat for the federally endangered Morro shoulderband snail (*Helminthoglypta walkeriana*) as well as archaeological artifacts.

Resource Park
Resource Park is the name initially given to about 66 vacant acres bounded by Los Osos Valley Road on the south, Broderson Avenue to the west, Palisades Drive on the east and Ramona Avenue to the north, and west of the County Park, the Community Center, and the County library. Resource Park consists of two contiguous properties: the 55-acre Morro Shores property and the 11-acre Tri W site. The Resource Park site was selected for the advanced wastewater pond treatment system presented in the January 31, 2000 Draft Report by Oswald Engineering Associates, Inc.

During the course of public meetings during the summer of 2000 a representative of the owners of the Morro Shores property indicated that they would not willingly sell their property. This refusal means that condemnation would be required to acquire the Morro Shores property.

Turri
This site is located on the south side of Turri Road about one mile east of South Bay Boulevard and consists of a ten acre portion of the 84 acre site formerly used as a landfill and gravel pit. The level area most capable of supporting a wastewater treatment facility is composed of prime agricultural soils. The entire 84 acres is encumbered by a Land Conservation Act contract.

The southerly 55 acres of the site consists of hilly terrain rising sharply from the unnamed creek. This portion of the site contains an abandoned landfill formerly operated by San Luis Obispo

County. This site has been described in many environmental documents. It is currently undeveloped and vegetated with annual grasses. Two unnamed drainage courses tributary to Los Osos Creek run adjacent to the site; one such drainage divides the site in two in a north-south direction. Surrounding land uses consist primarily of grazing and open space.

ALTERNATIVE TREATMENT PROCESSES

According to the RWQCB, any treatment process for this project must meet the discharge requirements stated in WDR Order No. 97-8. The principal requirements are shown in Table 4-1.

Table 4-1. WDR 97-8 Effluent Requirements

Constituent	30 day average (mg/l)	Daily Maximum (mg/l)
Settleable Solids	0.1	0.5
BOD, 5-day	60	100
Total Nitrogen as N	7	10
Dissolved Oxygen	2 at all times	

The most stringent requirement in WDR 97-8 is the need to achieve an effluent total nitrogen concentration of 7 mg/l on a 30-day average basis. That is, a treatment process that is able to achieve this level of effluent nitrogen would be able to meet the settleable solids, BOD, and dissolved oxygen limits of WDR 97-8.

In addition to meeting the RWQCB requirements, any treatment process for this project must reflect the community values described in Section 1. The community value that has the greatest impact on the degree of treatment needed is the goal of water recycling. For general unrestricted non-potable recycling, this goal would require that the effluent meet Title 22 requirements. The effluent must have a turbidity less than 2 NTU and have a total coliform count of less than 2.2 MPN. To achieve this level of performance, filtration and disinfection of the effluent is necessary.

For this project, five wastewater treatment processes were assessed:

- Advanced wastewater treatment ponds
- Sequencing batch reactors
- Extended aeration
- Hybrid extended aeration
- Facultative ponds with constructed wetlands

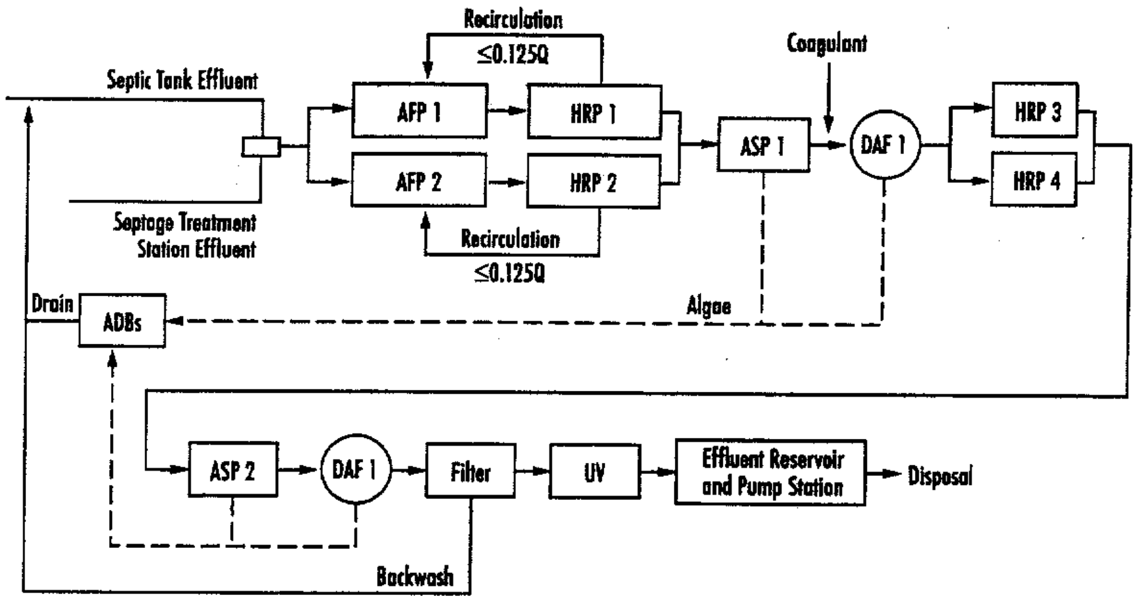
Each of these treatment processes is described below relative to its ability to achieve RWQCB requirements and community values.

Advanced Wastewater Treatment Ponds

This process was assessed in the *Wastewater Facilities Project, Draft Project Report, January 31, 2000* prepared by Oswald Engineering Associates, Inc. The specific type of pond system described in the report was the Advanced Integrated Wastewater Pond System (AIWPS), which is a process patented by Oswald Engineering Associates, Inc. The process was described in detail in the report by Oswald Engineering Associates and is briefly described herein.

Description. The advanced wastewater pond system proposed by Oswald Engineering Associates is biologically based, relying on a series of ponds and dissolved air flotation to treat the flow. It also relies on the growth of a large algal biomass in the ponds. For the AIWPS proposed by Oswald Engineering Associates, sand filtration was used to meet the required effluent nitrogen limit of 7 mg/l mandated in WDR 97-8. In addition, ultraviolet (UV) disinfection was included to meet Title 22 recycled water requirements. A flow schematic for an advanced wastewater pond treatment process, assuming AIWPS, is shown in Figure 4-2.

Figure 4-2. Flow Schematic for an Advanced Wastewater Pond Treatment Process



The first set of advanced facultative (AFP) and high rate ponds (HRP) provides about 40 percent of the nitrogen removal of the overall facility. The algal mass grown in this first set of ponds is removed in the algal settling pond (ASP) and dissolved air flotation unit (DAF).

The flow is then conveyed to a second set of high rate ponds to again grow algal biomass for further uptake of nitrogen. This second set of biomass is removed in the second algal settling pond and dissolved air flotation unit. Approximately 55 percent of the nitrogen removal of the facility occurs in this second set of ponds. Effluent nitrogen from the second DAF unit is predicted to be approximately 8 mg/l. Sand filtration would then be used to achieve the discharge requirement of 7 mg/l total nitrogen.

This alternative would require a site of approximately 64 acres for the treatment ponds and emergency storage ponds, as recommended in the report by Oswald Engineering Associates, Inc.

Ability to meet RWQCB Requirements. Pond systems have been used to treat wastewater for many years and have a proven track record for BOD and suspended solids removal. However, they have generally not been used to remove nitrogen to the low levels required by the RWQCB in WDR 97-8. It is therefore difficult to obtain long term nitrogen removal data for this type of pond system.

The draft report by Oswald Engineering Associates, Inc. cited the ponding facility in St. Helena as an example of a facility with a history of achieving high nitrogen removal. However, this facility does not have a nitrogen removal requirement in its discharge permit and therefore has not collected long term data on its nitrogen removal performance. It also does not include the two-stage algae settling ponds and two stage dissolved air flotation removal processes that Oswald Engineering Associates deemed necessary to meet the requirements of WDR 97-8.

Because documented nitrogen removal performance data are not available, the RWQCB would have serious concerns with this process alternative.

Ability to Achieve Community Values. An advanced wastewater pond system would reflect several community values and were very attractive to the community. Below is a summary of how this treatment process achieves each of the community's key evaluation criteria: cost, resource sustainability, and community acceptance.

Cost. An advanced wastewater pond system for the community of Los Osos would hold the promise of lower construction costs when compared to other treatment process alternatives. However, it would require the purchase of approximately 64 acres, which is five to six times the land requirements of the other alternatives. Together, the land and construction costs of an advanced wastewater pond system such as AIWPS may exceed the other alternatives. A detailed cost estimate for this alternative is located in Appendix E.

Resource Sustainability. An advanced wastewater pond system would achieve some aspects of resource sustainability. Following is a discussion of the byproducts generated by the process and its energy requirements.

An advanced wastewater pond system would generate biosolids in the form of an algal biomass. It is estimated that this alternative would produce approximately 1,250 to 2,700 pounds per day (dry weight basis) of algae. The draft report by Oswald Engineering Associates, Inc. recommended that this algal material be used within the community at homes and other locations that are publicly accessible. This type of use would require that the biosolids be treated to Class A standards to decrease the presence of bacteria and other pathogens.

In addition to the algal biomass, this alternative would generate approximately 500 pounds per day of alum sludge from the DAF process, which is used to remove the algae from the flow. Filtration chemicals would produce approximately 300 pounds per day of sludge. The alum laden solids from the DAF process would not be readily recyclable and would most likely require landfill disposal. The total amount of material associated with this alternative, including algal biomass, requiring disposal would be approximately 2,050 to 3,500 pounds per day (dry weight basis).

This alternative uses solar radiation for some of its energy. That is, sun light is used to grow the algae that is at the core of the treatment process. Mechanical energy is needed to mix the ponds and run the mechanical aspects of the plant. During sustained periods of dark cloudy weather mechanical aeration would be required. The mechanical aspects include: pumping, DAF operation, filtration, UV disinfection, and aeration on dark cloudy days. Overall, it is estimated that this alternative would use approximately 1.7 million kwhrs/yr.

Community Acceptance. An advanced wastewater pond system for the community of Los Osos would achieve several aspects of community acceptance. Following is a discussion of the odor, lighting, and noise issues associated with this type of process. In addition, the opportunity to provide a community amenity by creating park space in conjunction with this type of process is also discussed.

When operated properly, a well run pond system is generally low in odor emissions. However, should a short-term system upset occur, it would not be possible to enclose the entire 66 acre system. Furthermore, it would not be possible to retrofit odor scrubbing units on the ponds if a more long-term odor problem were to develop.

This alternative would require very little lighting, which is valuable to the community because lighting obscures views of the night sky. Residents have worked diligently to limit light pollution throughout Los Osos.

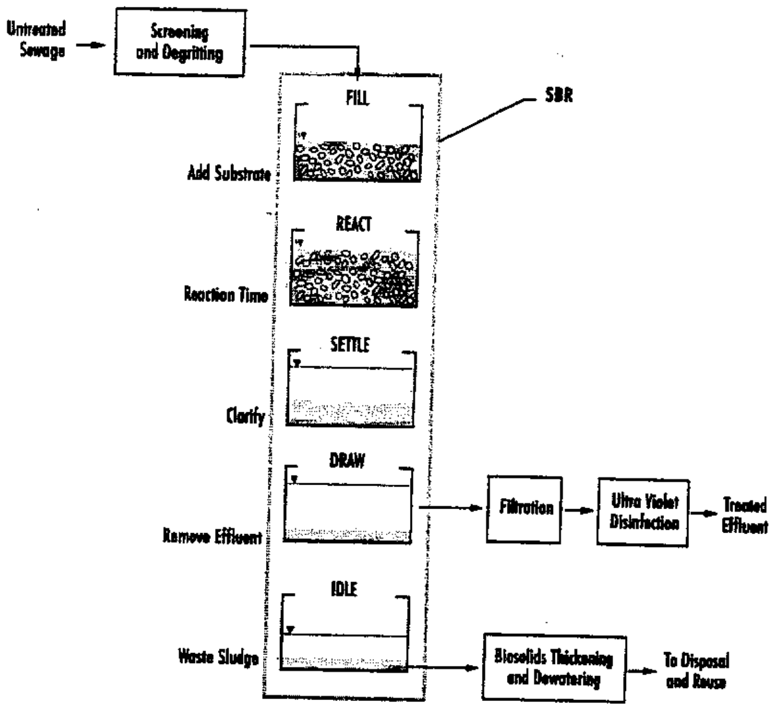
This alternative would generate little noise. However, the mechanical equipment associated with DAF and filtration would have to be housed in sound-treated structures. The operation of the ponds requires circulation of significant amounts of water that would generate sounds of water movement.

This alternative would provide the community with a limited amount of useable park space. In accordance with public health requirements, most of the treatment ponds would not be publicly accessible. As a result, the vast majority of land used for a ponding system would not be useable as community park space.

Sequencing Batch Reactors

Description. A sequencing batch reactor (SBR) is a biologically based system that relies on a series tanks that sequentially fill, aerate, settle, and decant the wastewater to achieve the discharge standards. A process schematic for an SBR is shown on the following page in Figure 4-3.

Figure 4-3. Flow Schematic for an SBR Treatment Process



An SBR is a compact process that has gained wide acceptance for its treatment capabilities and has been widely used to achieve low levels of effluent nitrogen. An SBR system for Los Osos would be composed of a headworks, septage handling facility, reactors, filters, UV disinfection equipment, odor control facility, solids processing facility, operations building, and electrical building. For safety, the facility would be built with two complete process trains.

The headworks facility would consist of equipment for influent pumping and grit removal. The structure would likely include a below grade facility approximately 15 to 20 feet deep with a single story building approximately 30 ft square above ground. The facility would likely consist of two 10 hp pumps, some ventilation fans, and electrical panels.

The septage handling facility would be located below grade. It would be a concrete structure approximately 20 ft by 20 ft. The underground tankage would be designed to receive septage from septage trucks. To control odors, the tankage would be connected to odor control ventilation. It is not envisioned that there would be mechanical equipment or chemical use needed for the septage handling facility.

The actual sequencing batch reactors would be located within two to three concrete tanks with a total footprint of approximately 100 ft by 250 ft. These tanks would be partially buried, with a total depth of about 25 feet, and could project above the ground surface as much as 15 feet. The contents of the tanks would be a mixed liquor activated sludge. The equipment housed with the tanks would include pumps, pipes, and valves.

The filter would be located in a partially buried structure approximately 25 ft by 25 ft. The structure would project above grade approximately 10 ft. Depending on the type of filter, the following equipment would be associated with these units: influent feed pumps, air scour blowers, and backwash pumps. The size of this equipment would likely be less than 15 hp each. A filter coagulant aid such as alum and/or polymer would be used. Approximately 300 pounds of alum would be used each day.

The UV disinfection system would be located in a partially buried concrete structure consisting of a channel 4 ft wide by 50 ft long with UV lamps banks. It is likely the structure would be less than 5 ft above grade. The UV equipment would consist of 3 or 4 UV lamp banks with a total power draw of 25 kw. A mild solution of 5% phosphoric acid would be used to clean mineral deposits from the lamp.

The biosolids processing system would be located in a two story building, approximately 40 ft by 100 ft. This system would consist of mechanical units for biosolids pumping, biosolids thickening, biosolids stabilization, biosolids dewatering, and biosolids cake loading and storage. The estimated size of this building is 40 ft by 100 ft. A representative list of equipment that would be housed in this facility is as follows:

- six biosolids pumps
- two gravity belt thickeners
- two biosolids digestion tanks
- two belt filter presses
- one biosolids cake conveyor
- one biosolids storage bin
- one polymer feed system

The estimated volume of biosolids produced with this alternative would be approximately 1,830 pounds per day (dry weight basis) of dewatered biosolids cake. This would equate to approximately 2 truckloads per week. Because the community is nearly all residential, the quality of the biosolids would be very acceptable to outside biosolids recyclers and local composting.

The odor potential for an SBR system is moderate. For Los Osos, the process units with higher odor potential such as the septage handling, SBRs and solids processing would be covered, ventilated and odor scrubbed. Foul odors from these areas would be scrubbed in a biofilter. The bed of the biofilter would be about 5 feet high and cover approximately 3,000 ft^2.

The operations building would likely be a single story building covering approximately 2,500 ft^2. The building would contain the following components:

- control room - 300 ft^2
- laboratory - 400 ft^2
- restrooms, showers and lockers - 400 ft^2
- maintenance shop - 500 ft^2
- spare parts room - 300 ft^2

- office space - 300 ft^2
- library/meeting room - 300 ft^2

The electrical building would house the plant electrical service including the transformer and switchboard. It would be a single story building, occupying approximately 400 ft^2.

Ability to Meet RWQCB Requirements. SBR facilities have been used to treat wastewater since the 1980's and have a proven track record throughout the United States for achieving low effluent nitrogen concentrations, such as those required by the RWQCB in WDR 97-8. In addition, the SBR process is particularly well suited to small communities like Los Osos with relatively small wastewater flows.

Ability to Achieve Community Values. An SBR would achieve some community values. Below is a summary of how well this treatment process may achieve each of the community's key evaluation criteria: cost, resource sustainability, and community acceptance.

Cost. The construction cost of an SBR would be relatively high because of the amount of concrete structure and mechanical equipment involved. A detailed construction cost estimate for an SBR alternative is provided in Appendix E. The compact size of the facility offers a potential cost savings by minimizing the amount of land to be purchased. Its compact size would require less than 6 acres for siting.

Community Acceptance. An SBR for the community of Los Osos would achieve some aspects of community acceptance. Following is a discussion of the odor, lighting, and noise issues associated with this type of process. In addition, the opportunity to provide a community amenity by creating park space in conjunction with this type of process is also discussed.

An SBR facility can generate recognizable odors, if left uncovered and without odor removal technologies. The community of Pacifica south of San Francisco operates a new SBR facility with odor control technologies adjacent to Highway 1. Odor control technologies would be an important component of any project for Los Osos located near residential areas.

An SBR facility would not require specialized lighting. The facility site, however, would have minimal safety lighting. Given the small size of the facility and the importance of night sky views to the community, lighting would be minimized to the maximum extent practicable.

The SBR alternative is a quiet process. Certain pieces of equipment such as blowers, pumps, and solids handling equipment would be housed within sound treated buildings to eliminate noise impacts to neighbors.

An SBR facility would be compact and would therefore maximize the ability to develop park space if sited on a parcel greater than 6 acres. In addition, the ability of this process to be buried allows for potential multi-use options above the treatment facility itself.

Resource Sustainability. This alternative would achieve some aspects of resource sustainability. Following is a discussion of the byproducts generated by the process and its energy requirements.

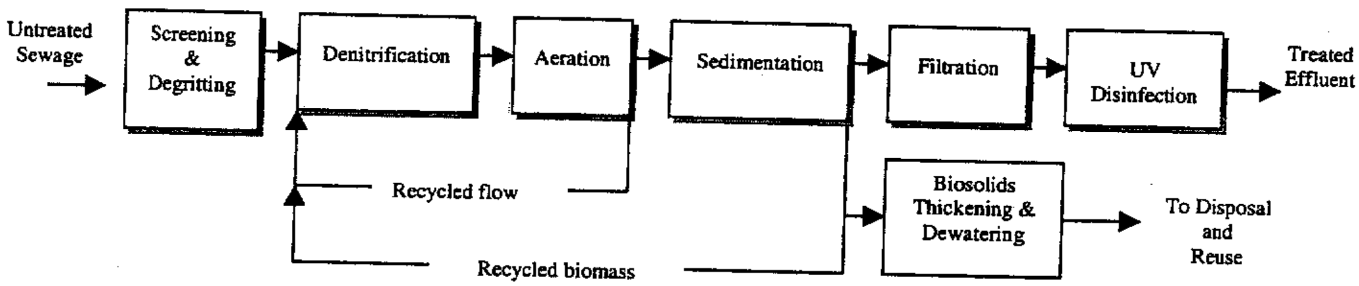
An SBR would generate approximately 1,830 pounds per day (dry weight basis) of biosolids. The biosolids would be characterized as Class B solids of high quality, given the residential character of the community's waste stream. The biosolids would be readily acceptable for composting by either the local community or by off-site facilities.

The energy requirement of an SBR for Los Osos would be approximately 2 million kwhrs/yr. For comparative purposes, this is the same amount of energy required for an extended aeration process and approximately 18% more than the energy required for an advanced pond system such as AIWPS.

Extended Aeration

Description. The extended aeration process is a form of wastewater treatment commonly referred to as 'activated sludge'. The treatment process is shown in Figure 4-4.

Figure 4-4. Flow Schematic for an Extended Aeration Treatment Process



Wastewater flow is screened to remove large objects that might foul treatment equipment. It is then moved to a grit removal process that settles out sand, rocks and other dense inorganic materials. The screened, degritted sewage then enters a series of basins. The first of these basins is known as a pre-anoxic chamber in which naturally occurring microorganisms convert nitrate to harmless nitrogen gas. This gas is neither explosive nor odorous. The flow then moves into the aeration basins where mechanical mixer/aerators mix atmospheric oxygen with the wastewater. Naturally occurring microorganisms convert the organic matter in the wastewater to CO_2, water, and nitrate. A large portion of the flow is recycled back to the pre-anoxic basins where, as previously stated, the nitrate is converted to harmless nitrogen gas.

The remainder of the flow is passed to sedimentation basins where the microorganisms are removed from the flow. At this point the wastewater is low in BOD, suspended solids and total nitrogen. However, to meet Title 22 requirements, which allow unrestricted non-potable reuse of the flow, the wastewater would then be subjected to sand filtration to further remove suspended solids and turbidity. After filtration, the flow would be subjected to ultraviolet disinfection. Ultra violet filtration has gained wide acceptance in the US and overseas and has been shown to be highly effective against bacterial and viral pathogens and can handily meet Title 22 disinfection requirements.

A portion of the microorganisms removed in the sedimentation basins are recycled to the pre-anoxic basins in order to provide the mass of 'activated' biomass needed to treat the organics in the flow. The remainder of the microorganisms is completely removed from the flow and becomes 'biosolids'. The biosolids are then thickened and dewatered, which produces a product that is readily handled. The extended aeration process produces biosolids that are stabilized and therefore non-putrescible. It is estimated that the treatment facility would generate approximately 1,830 pounds per day (dry weight basis) of biosolids, which can be composted for reuse as soil amendment or transported to off-site facilities.

An extended aeration system for Los Osos would be composed of a headworks, septage handling facility, aeration basins, filters, UV disinfection equipment, odor control facility, solids processing facility, operations building, and electrical building. For safety, two complete process trains would be constructed. Following is a description of each of these system components.

The headworks facility would consist of equipment for influent pumping and grit removal. The facility would likely include a below grade structure approximately 15 to 20 feet deep with a single story building approximately 30 ft square above ground. The facility would likely consist of two 10 hp pumps, some ventilation fans, and electrical panels.

The septage handling facility would be a below grade concrete structure approximately 20 ft by 20 ft. The underground tankage would be designed to receive septage from septage trucks. To control odors, the tankage would be connected to odor control ventilation. It is not envisioned that there would be mechanical equipment or chemical use needed for the septage handling facility.

The two aeration basins would each be about 80 ft by 320 ft and have less than a 15 ft water depth. The basins would likely be a partial cut, with an embankment approximately 5 ft high. The basins would be aerated with a submerged fine bubble diffuser or surface aerators. The contents of the basins would be a mixed liquor activated sludge. If submerged diffusers were used there would be piping from the blower building to the basins. If surface aerators were used it is estimated that four 15 hp units per basin would be required. There would not be chemical use in the aeration basins. Two secondary clarifiers would be used, each about 75 feet diameter. The clarifiers would be partially above grade about 3 to 10 ft and would have a water depth of approximately 12 to 15 feet.

The filter would consist of a partially buried structure approximately 25 ft by 25 ft. The structure would project above grade approximately 10 ft. Depending on the type of filter, the following equipment would be housed with the filter: influent feed pumps, air scour blowers, and backwash pumps. The size of this equipment would likely be less the 15 hp each. A filter coagulant aid such as alum and/or polymer would be used. Approximately 300 pounds of alum would be used each day.

The UV disinfection system would consist of a partially buried concrete structure consisting of a channel 4 ft wide by 50 ft long with UV lamp banks. The structure would likely be less than 5 ft above grade. The UV equipment would consist of 3 or 4 UV lamp banks with a total power draw of 25 kw. A mild solution of 5% phosphoric acid would be used to clean mineral deposits from the lamp.

The solids processing facility would consist of a two story building that includes biosolids pumping, biosolids thickening, biosolids stabilization, biosolids dewatering and biosolids cake loading and storage. The estimated size of the building is 40 ft by 100 ft. A representative list of equipment located within the solids processing facility is as follows:

- six biosolids pumps
- two gravity belt thickeners
- two biosolids digestion tanks
- two belt filter presses
- one biosolids cake conveyor
- one biosolids storage bin
- a polymer feed system

The estimated volume of biosolids produced at an extended aeration facility would be approximately 1,830 pounds per day (dry weight basis) of dewatered biosolids cake. This would equate to approximately 2 truckloads per week. Because the community is nearly all residential, the quality of the biosolids would likely be very acceptable to outside biosolids recyclers.

The odor potential for an extended aeration system is moderate. The process units with higher odor potential such as the septage handling and solids processing would be covered, ventilated, and odor scrubbed. Foul odors from these areas would be scrubbed in a biofilter. The bed of the biofilter would be about 5 feet high and cover approximately 3,000 ft^2.

The operations building would be approximately 2,500 ft^2 and would likely be a single story building with the following components:

- control room - 300 ft^2
- laboratory - 400 ft^2
- restrooms, showers and lockers - 400 ft^2
- maintenance shop - 500 ft^2
- spare parts room - 300 ft^2
- office space - 300 ft^2
- library/meeting room - 300 ft^2

The electrical building would house the plant electrical services including the transformer and switchboard. It would be a single story building and occupy approximately 400 ft^2.

Ability to Meet RWQCB Requirements. The extended aeration treatment process has been successfully used since 1914 and is one of the most proven wastewater treatment processes available. The form of extended aeration process proposed for this project has been in wide use for BOD, suspended solids, and nitrate removal since the 1970's. Experience with facilities in South Africa, Florida, California and other states has shown that this process can reliably meet the tentative discharge requirements set forth by the Regional Water Quality Control Board's Waste Discharge Requirements (WDR) 97-8.

There are treatment facilities in California and Florida that use extended aeration to meet even more stringent requirements than those set forth in WDR 97-8. An example is the Gilroy/Morgan Hill treatment facility in California. This facility treats flows to less than 5 mg/l nitrate. Notably, this facility has been very reliable and is located within the jurisdiction of the Central Coast RWQCB (the same RWQCB that the Los Osos facility would be operating within). In Florida, several facilities using extended aeration produce effluent with less than 3 mg/l total nitrogen and have established reliable performance records.

Ability to Achieve Community Values. An extended aeration facility would achieve some community values. Below is a summary of how well this treatment process may achieve each of the community's key evaluation criteria: cost, resource sustainability, and community acceptance.

Cost. The construction cost of an extended aeration facility would be relatively high because of the amount of concrete structure and mechanical equipment involved. However, the compact size of the facility would require less than 6 acres for siting. Therefore, this alternative offers a potential cost savings by minimizing the amount of land to be purchased. A detailed construction cost estimate for the extended aeration alternative is provided in Appendix E.

Community Acceptance. An extended aeration process for the community of Los Osos would achieve some aspects of community acceptance. Following is a discussion of the odor, lighting, and noise issues associated with this type of process. In addition, the opportunity to provide a community amenity by creating park space in conjunction with this type of process is also discussed.

An extended aeration facility can generate recognizable odors, if left uncovered and without odor removal technologies. Therefore, odor control technologies would be an important component of any project for Los Osos located near residential areas.

An extended aeration facility would not require specialized lighting. The facility site, however, would have minimal safety lighting. Given the small size of the facility and the importance of night sky views to the community, lighting would be minimized to the maximum extent practicable.

If left uncovered, the noise generated by an extended aeration process would be slightly greater than an SBR because of the aeration method employed. Specific pieces of equipment such as blowers, pumps, and solids handling equipment would be housed within sound treated buildings to eliminate noise impacts to neighbors.

An extended aeration facility would be compact and would therefore maximize the ability to develop park space if sited on a parcel greater than 6 acres. In addition, the ability of this process to be buried allows for potential multi-use options above the treatment facility itself.

Resource Sustainability. An extended aeration process for the community of Los Osos would achieve some aspects of resource sustainability. Following is a discussion of the byproducts generated by the process and its energy requirements.

An extended aeration facility would generate approximately 1,830 pounds per day (dry weight basis) of biosolids. The biosolids would be characterized as Class B solids of high quality, given the residential character of the community's waste stream. The biosolids would be readily acceptable for composting by either the local community or by off-site facilities.

The energy requirement of an extended aeration facility for Los Osos would be approximately 2 million kwhrs/yr. For comparative purposes, this is the same amount of energy required for an SBR process and approximately 18% more than the energy required for an advanced pond system such as AIWPS.

Hybrid Extended Aeration

Description. The extended aeration process described above is usually constructed with most of the treatment processes open to the outside. However, hybrid versions of this type of process have been developed that allow the entire facility to be covered and odor scrubbed. The covering of the facility allows the structures to become nearly unseen and almost totally unobtrusive to passerby's or nearby residents.

The cities of Pacifica, San Francisco, and Breckenridge have used hybrid wastewater treatment facilities for this purpose. The few buildings that cannot be covered are architecturally treated to aesthetically pleasing levels. Photos of the Pacifica and Breckenridge treatment plants are shown on the following pages in Figures 4-5 through 4-8.

The Pacifica facility (called the Calera Creek Water Recycling Facility), which is designed to treat 3.3 mgd, has most of the liquid treatment processes covered with a concrete roof, which in turn is covered with grass vegetation. It is fully odor scrubbed and is odor free. It has a small commercial area and public recreational areas nearby that are unaffected by odors or visual impacts from the facility. The aesthetic and odor scrubbing treatment of the facility allow it to be very unobtrusive and a 'good neighbor'.

The Breckenridge facility in Colorado, which treats 1.5 mgd, is also covered. The liquid treatment processes are covered by a parking lot, which is surrounded by architecturally treated buildings. This facility is fully odor scrubbed and is unobtrusive to its neighbors.

In using a hybrid approach for Los Osos, the headworks and aeration basins of a typical extended aeration facility would be covered by an off-leash dog park. These facilities represent the largest portion of the plant. The secondary clarifiers, filters, disinfection, and solids processing units

Figure 4-5. Breckenridge Facility

View over treatment facility. The facility is inconspicuous to passing traffic and neighbors.

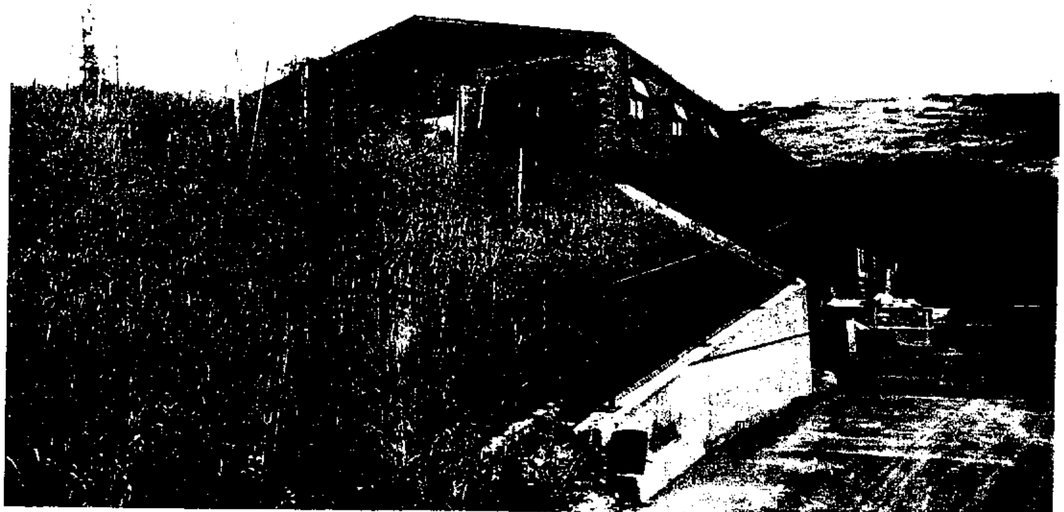
Figure 4-6. Breckenridge Facility

View from parking lot. The facility is located under the parking lot.

Figure 4-7. Pacifica Facility

View over treatment facility. The treatment facility is under the flat, grassy area.

Figure 4-8. Pacifica Facility



View of solids treatment and administration building.

would be placed in buildings that would be architecturally treated to a theme developed by the community.

The entire treatment facility would be covered and odor scrubbed. The buildings and enclosure structures of the treatment facility would be held under negative air pressure, meaning that clean outside air would be drawn into the air spaces above the treatment processes. This approach prevents the 'leakage' of unscrubbed air to the outside.

Air from the air spaces above the treatment processes would be collected and conveyed to the odor scrubbing unit(s). The deodorized air would then be discharged to the atmosphere. Given the degree of odor scrubbing and the set back distances in the siting of the treatment facility, it is expected that the frequency of odor detection by individuals would be very low and that the character of any detected odors would be very mild. Other wastewater treatment plants that have taken this approach have had a very low number of odor complaints.

Figure 4-9 on the following page shows an example hybrid extended aeration facility for Los Osos, assuming a site at the Tri W location. As shown in this figure, an off-leash dog park would be possible over the top of the headworks and aeration basins and within what would normally be the buffer zone. This figure was developed with community input at several public meetings and therefore reflects the type of development that the community would request if this type of facility were sited at the Resource Park location.

Ability to Meet RWQCB Requirements. The treatment process for a covered extended aeration facility would be exactly the same as the treatment process described above for a 'typical' extended aeration plant. Therefore, a hybrid treatment plant would be able to provide the level of treatment needed and would have the extensive performance track record of the extended aeration alternative.

Ability to Achieve Community Values. A hybrid extended aeration facility would achieve many community values. Below is a summary of how well this treatment process may achieve each of the community's key evaluation criteria: cost, resource sustainability, and community acceptance.

<u>Cost</u>. The construction cost of a hybrid extended aeration facility would be relatively high because of the amount of concrete structure, mechanical equipment, odor control technology, and architectural treatment involved. However, the compact size of the facility would require less than 6 acres for siting. Therefore, this alternative offers a potential cost savings by minimizing the amount of land to be purchased for both the treatment facility and mitigation. A detailed construction cost estimate for a hybrid extended aeration alternative is provided in Appendix E.

<u>Community Acceptance</u>. A hybrid extended aeration process for the community of Los Osos would achieve some aspects of community acceptance. Following is a discussion of the odor, lighting, and noise issues associated with this type of process. In addition, the opportunity to provide a community amenity by creating park space in conjunction with this type of process is also discussed.

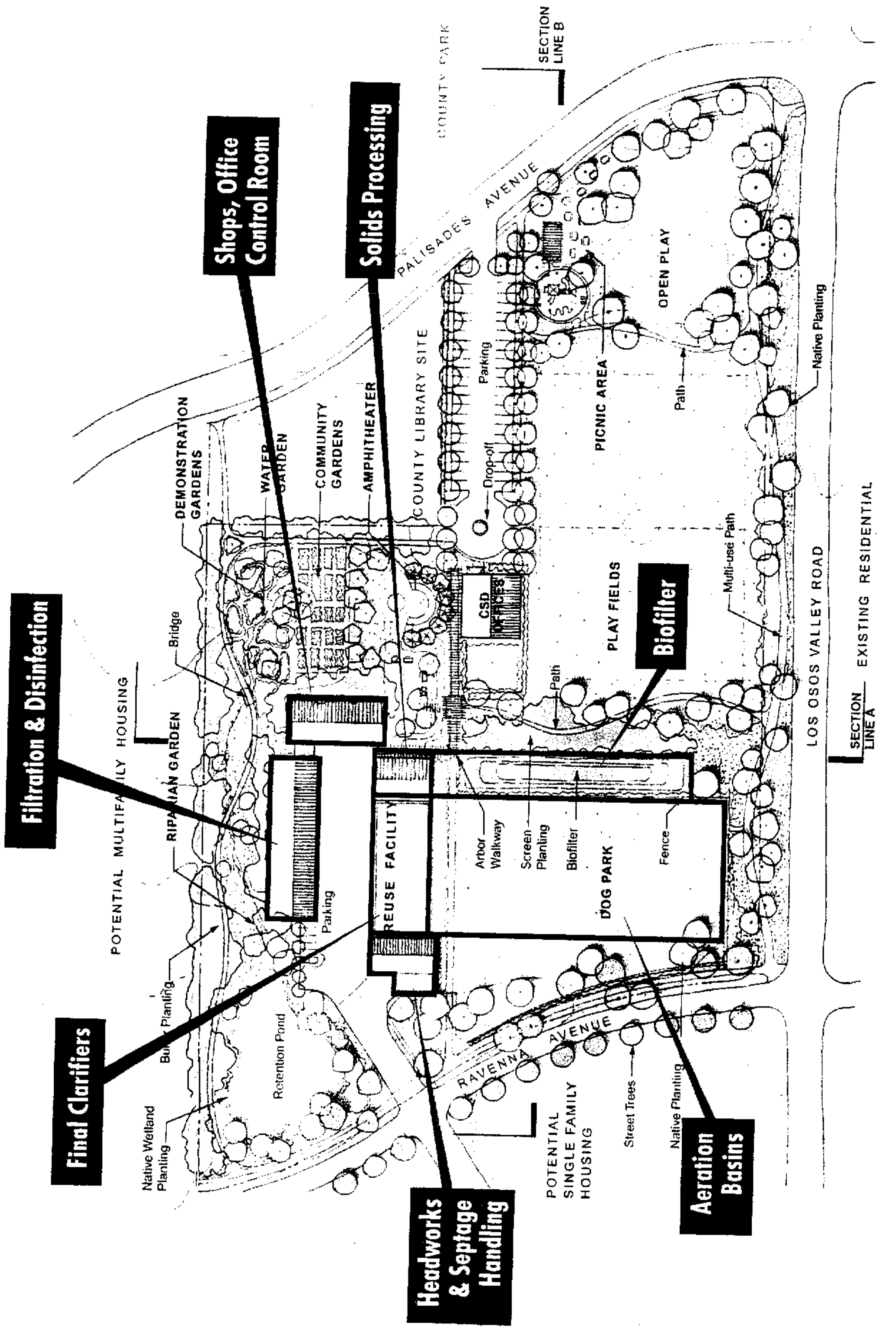


Figure 4-9. Conceptual Site Plan for Treatment Facility Site

A hybrid extended aeration facility would generate little if any odors. Odor control technologies would be used to prevent odors from disturbing nearby residents.

A hybrid extended aeration facility does not require specialized lighting. The facility site, however, would have minimal safety lighting. Given the small size of the facility and the importance of night sky views to the community, lighting would be minimized to the maximum extent practicable.

Since a hybrid extended aeration facility is covered, the noise generated by the process would be minimal. Specific pieces of equipment such as blowers, pumps, and solids handling equipment would be housed within sound treated buildings to eliminate noise impacts to neighbors.

A hybrid extended aeration facility would be compact and would therefore maximize the ability to develop park space if sited on a parcel greater than 6 acres. In addition, the fact that this type of facility is buried allows for potential multi-use options above the treatment facility itself.

Resource Sustainability. A hybrid extended aeration facility for the community of Los Osos would achieve some aspects of resource sustainability. Following is a discussion of the byproducts generated by the process and its energy requirements.

A hybrid extended aeration facility would generate approximately 1,830 pounds per day (dry weight basis) of biosolids. The biosolids would be characterized as Class B solids of high quality, given the residential character of the community's waste stream. The biosolids would be readily acceptable for composting by either the local community or by off-site facilities.

The energy requirement of a hybrid extended aeration facility for Los Osos would be approximately 2 million kwhrs/yr. For comparative purposes, this is the same amount of energy required for an SBR process and approximately 18% more than the energy required for an advanced pond system such as AIWPS.

Facultative Ponds with Constructed Wetlands

Description. A treatment process using facultative ponds with constructed wetlands was also analyzed. This process uses wetlands for the final step of nitrogen removal. To meet Title 22 requirements for recycling treated effluent, this alternative would also require filtration and disinfection of effluent.

This alternative would use two facultative ponds, with a total surface area of 14 acres. The ponds would be shaped various ways to fit the contours and boundaries of candidate sites and would be approximately 10 to 15 feet deep. The wetland treatment area would have a surface area of at least 40 to 45 acres.

The ponds and wetlands would need to be separated by dikes and berms, which adds to the total land area needed for this alternative. It is estimated that at least 90 acres of land area would be needed to site this alternative. Because this land area exceeds the area available at the candidate sites, it was not further developed nor carried forward for comparison with the other alternatives.

COMBINATIONS OF TREATMENT PROCESSES AND TREATMENT SITES

As described above, six candidate treatment sites and four treatment alternatives were shortlisted for further development and comparison. However, the advanced wastewater pond alternative requires a site with at least 64 acres. Because of its size only one site, the Resource Park site, could be used for this alternative. The other treatment alternatives are much less land intensive and could be implemented at any of the candidate sites.

Table 4-2 presents the combinations of treatment process alternatives and siting alternatives that were evaluated for this project.

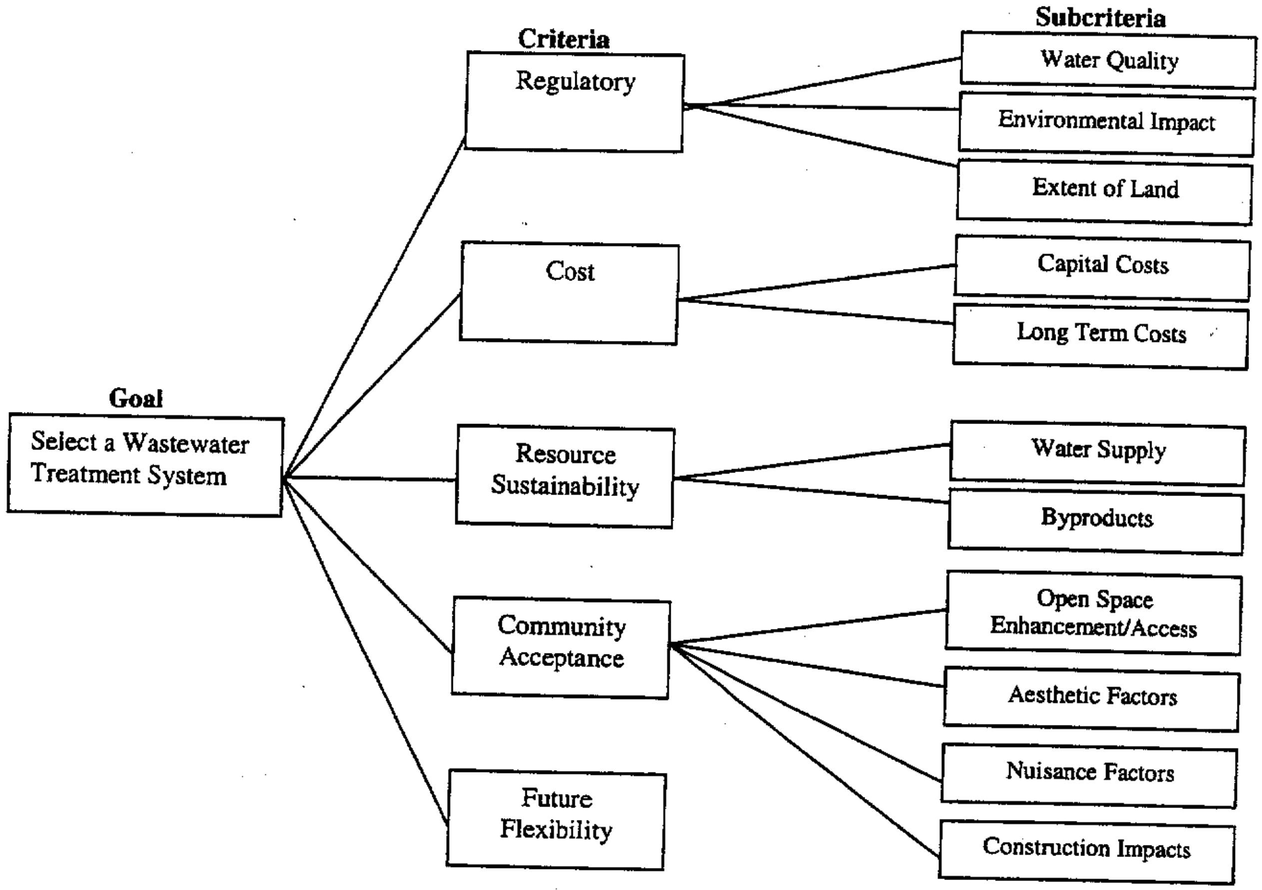
Table 4-2. Potential Sites for Wastewater Treatment Alternatives

Sites	Treatment Alternatives			
	Advanced Wastewater Treatment Pond	Extended Aeration	Hybrid	SBR
Andre		✔		
Eto		✔		✔
Holland			✔	
Pismo		✔		✔
Powell		✔		✔
Resource Park	✔			
Tri W		✔	✔	✔
Turri		✔		✔

Comparison of Treatment/Siting Alternatives

The treatment/siting alternatives were compared on the basis of non-cost criteria as well as cost criteria. Because of the complexity and the need to involve the community in the assessment of these alternatives, a decision model was developed with the Los Osos Wastewater Committee (Committee). This model used the commercially available software package called Decision Criterium Plus, which allowed a decision tree to be built with the involvement of the Committee. The decision tree is shown in Figure 4-10 on the following page.

Figure 4-10. Wastewater Treatment Criteria and Subcriteria



As can be seen in Figure 4-10, the fundamental goal of the decision tree is selecting a treatment/site alternative. Various criteria and sub criteria were developed based on the community's values as identified in the community's *Vision Statement* (Appendix B) and with input from the Committee. A full description of what each criterium and subcriterium represent is contained in Appendix F. The weightings given to each criterium were based on their importance to the community and are presented in Table 4-3.

Table 4-3. Criteria Weightings

Criteria	Relative Weight
Regulatory	31
Cost	56
Resource Sustainability	33
Community Acceptance	25
Future Flexibility	1

Upon first review of the table it may appear that cost was given much more weight than any other criteria. However, the resource sustainability and community acceptance criteria embody the community's values as identified in Section 1 of this report. Taken together, these criteria have combined weighting of 58, which is nearly the same weighting given to cost. In this way, the importance of achieving the community's values was incorporated into the evaluation process.

Results of Public Workshops
Two public workshops were held with a subgroup of Committee members (referred to as the Wastewater Subcommittee) to develop the decision model and to recommend a combined treatment process and facility site.

On June 20, 2000 the first workshop was held with the Wastewater Subcommittee to refine and apply the criteria and subcriteria to the wastewater alternatives. The clearest result of the first workshop was that the Resource Park site was the preferred site because of its size and central location. Its size would allow a sufficient buffer for nearby residents from the facility. Its central location would provide an opportunity for the community to make the project an amenity, in the form of a multi-use public area, that would be a model for other communities.

The size and location of other sites did not provide an opportunity to create a community amenity. The sites on the outskirts of town could not deliver a community use area that was readily accessible to the majority of residents in the manner that a central location such as Resource Park could. The other sites (such as Holland) that were close to the center of the community were too small to site a treatment plant and afford sufficient buffer to nearby residential neighbors.

Furthermore, the Powell, Eto, and Pismo sites had the added disadvantages of potentially impacting endangered species or removing prime agricultural land from production. These impacts contributed to the low ranking of these sites. Although, the Turri site would have less potential environmental impacts, its distance from the center of town precluded it from providing a community amenity in the form of a public use area. It also did not offer a large compensating cost advantage because of the cost conveying raw sewage to the site and treated effluent to the proposed disposal areas.

As a result of these findings, the following four treatment alternatives were evaluated at Resource Park:

- Advanced wastewater treatment ponds
- Sequencing batch reactors
- Extended aeration
- Hybrid extended aeration (fully covered, odor scrubbed, and aesthetically treated)

A second workshop was held on July 7, 2000 to evaluate the four alternative treatment systems at Resource Park. Using the criteria described above, the small foot print treatment alternatives (SBRs, extended aeration, and hybrid alternatives) delivered a wider range of community benefits.

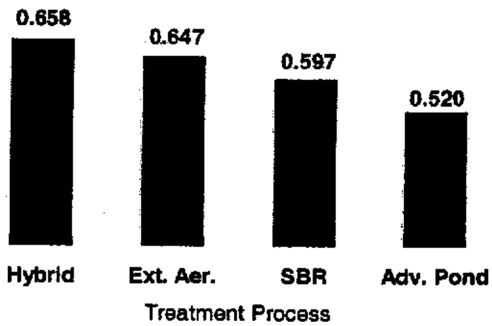
The small footprint alternatives could be sited within the Tri W parcel of Resource Park. The owners of this parcel are willing sellers, and siting the treatment facility here would avoid the litigation and delays associated with the Morro Shores parcel. The willingness to sell is a critical consideration because of the Regional Water Quality Control Board's time schedule order.

Small foot print alternatives use minimal amounts of land, making them more affordable. Although these alternatives have higher construction costs relative to the larger advanced wastewater treatment pond systems, their overall capital costs are lower. In addition to lower cost, small foot print alternatives provide the opportunity for creating community-accessible areas because the treatment system occupies only a portion of the site. Thus, they are able to deliver an important community benefit (accessible parkland) without a cost penalty.

Small footprint alternatives employ treatment processes that have been widely used in numerous locations for nitrogen removal. Thus, they are proven processes that would gain ready approval by the RWQCB and the State Water Resources Control Board. In contrast, advanced wastewater treatment ponds, such as the AIWPS facility previously proposed for Los Osos, do not have an established track record for removing effluent nitrogen to the levels required for this project.

The ranking and scores of alternatives is shown in Figure 4-11.

Figure 4-11. Decision Scores of Alternatives



As shown, the hybrid alternative is ranked the highest. Its ranking is due to its ability to deliver a large amount of accessible parkland at a cost that is lower than the advanced wastewater treatment pond alternative. Because it uses a widely proven treatment process, it would readily gain regulatory approval. Based on these findings the Committee recommended to the Board that a hybrid alternative be considered for the Tri W portion of the Resource Park site. The Board subsequently approved this recommendation.

Inclusion of Andre Site

After the public workshops on the selection of a treatment process/site alternative an additional site was identified on the outskirts of Los Osos. This site, known as the Andre Site, is located the north side of Los Osos Valley Road, and east of the junction with Clark Valley Road. As described in the Draft EIR for the project, this site has the lowest potential environmental impact. However, it is 1.5 miles from the edge of the community and would not be able to provide the community with a readily accessible recreational area, like the Resource Park site. On a non-cost basis this site was viewed as less favorable than the Resource Park site.

Cost Comparison
Estimated capital and operation/maintenance costs are summarized on the following page in Table 4-4 for each of the treatment/siting alternatives. The costs reflect a basic cost for a given treatment process plus various additional costs that would be needed to implement the given treatment process at a particular site. For example, the basic cost of an uncovered extended aeration process is $11.4 million. If this process alternative were implemented at the Turri site, $2.8 million of additional pipeline costs would be needed to convey the flow out to this site, and $2.2 million of additional cost would be needed to convey the treated effluent back to the disposal areas. This site would not need extensive odor control and aesthetic treatment, therefore additional costs for these items were not included. Detailed cost estimates for the treatment processes are provided in Appendix E.

Land costs for siting the treatment plant and for environmental mitigation are shown on the following page in Table 4-4. With regard to environmental mitigation, it is hoped that the purchase of the Broderson site will provide most of the environmental mitigation needed for the entire project. For the purposes of comparing the cost implications of the various treatment sites, site-specific mitigation costs were estimated based on information in the Final EIR and from Crawford, Multari, Clark and Associates on the potential environmental and cultural resource significance of each site. For comparative purposes, a per acre cost of $45,000 was assumed and the Pismo, Powell, and Eto sites were assumed to have the highest environmental/cultural resource significance. Mitigation associated with these sites was assumed to be equivalent. The Tri W site was assumed to have less environmental/cultural resource significance than the Pismo, Powell, and Eto sites but more significance than the Resource Park site. The Turri and Andre sites were assumed to have the lowest environmental/cultural resource significance.

The present worth costs of each alternative is also presented in Table 4-4. These costs reflect a project life of 20 years, and a discount rate of 6.625 percent/year, as per State Revolving Fund guidelines. The present worth costs were then annualized for comparison. These costs are used for comparison because they reflect the total life cycle costs of an alternative including capital, operation, and maintenance costs.

Cost Discussion
The annualized cost of the alternatives range from $1.89 million for the extended aeration alternative at the Eto site to $2.83 million for the advanced wastewater pond alternative at the Resource Park site. The advanced wastewater pond alternative at Resource Park is the most costly due to the large amount of land needed to site this alternative. The needed amount of land is available only at Resource Park, which is a very expensive parcel. Furthermore, this parcel is valuable habitat for the Morro shoulderband snail (*Helminthoglypta walkeriana*). Its use would require a large amount of mitigation land, which further increases the total land cost of this alternative. As a result, the land costs associated with the advanced wastewater pond alternative overwhelm its potential savings associated with construction and operation and maintenance.

The extended aeration alternatives were the least costly, ranging from $1.89 million to $2.09 million per year. On average, these alternatives are approximately 10% less costly than the recommended alternative on a life cycle cost basis. However, as stated in the public workshops, the principal disadvantages of the extended aeration and SBR alternatives are that

Table 4-4. Life Cycle Cost Comparison of Alternative Treatment Processes and Facility Sites

	Treatment Process:	Advanced Wastewater Treatment Pond	SBR	Hybrid	Extended Aeration	SBR	Extended Aeration	SBR
	Facility Site:	Resource Pk	Tri W	Tri W	Tri W	Pismo	Pismo	Powell
	Capital Costs							
	Land							
1	Facility Site	6,720,000	3,300,000	3,300,000	3,300,000	800,000	800,000	528,000
2	Mitigation Land	5,760,000	1,238,000	1,238,000	1,238,000	1,485,000	1,485,000	1,485,000
	Subtotal - Land	12,480,000	4,538,000	4,538,000	4,538,000	2,285,000	2,285,000	2,013,000
	Facility							
3	Base Capital	12,263,562	13,302,585	11,355,660	11,355,660	13,302,585	11,355,660	13,302,585
4	Additional Collection System	128,000	128,000	128,000	128,000	960,000	960,000	1,120,000
5	Additional Effluent Pipeline	0	0	0	0	640,000	640,000	800,000
6	Additional Odor Control (facility covering)	0	500,000	1,500,000	0	200,000	200,000	200,000
7	Additional Drainage Creek Improvements	550,000	500,000	500,000	250,000	0	0	0
8	Additional Biosolids Recycling Facilities	0	0	0	0	0	0	0
	Subtotal - Facility	12,941,562	14,430,585	13,483,660	11,733,660	15,102,585	13,155,660	15,422,585
	Total Capital Cost	25,421,562	18,968,585	18,021,660	16,271,660	17,387,585	15,440,660	17,435,585
9	Salvage Value - Land	3,494,400	1,270,640	1,270,640	1,400,000	639,800	639,800	563,640
10	Present Worth Capital Cost	21,927,162	17,697,945	16,751,020	14,871,660	16,747,785	14,800,860	16,871,945
	Annual O&M Costs							
	Labor	200,000	240,000	224,000	224,000	240,000	224,000	240,000
	Power	135,200	118,240	138,880	138,880	118,240	138,880	118,240
	Materials	161,000	143,400	135,400	135,400	143,400	135,400	143,400
11	Subtotal - O&M	496,200	501,640	498,280	498,280	501,640	498,280	501,640
12	Annualized Capital Costs, 6.625%, 20 yrs	2,338,784	1,745,110	1,657,993	1,496,993	1,599,658	1,420,541	1,604,074
	Total Annualized Cost ($ millions)	2.83	2.25	2.16	2.00	2.10	1.92	2.11

	Treatment Process:	Extended Aeration	SBR	Extended Aeration	SBR	Extended Aeration	Hybrid	Extended Aeration
	Facility Site:	Powell	Turri	Turri	Eto	Eto	Holland	Andre
	Capital Costs							
	Land							
1	Facility Site	528,000	750,000	750,000	500,000	500,000	4,500,000	700,000
2	Mitigation Land	1,485,000	200,000	200,000	810,000	810,000	1,238,000	200,000
	Subtotal - Land	2,013,000	950,000	950,000	1,310,000	1,310,000	5,738,000	900,000
	Facility							
3	Base Capital	11,355,660	13,302,585	11,355,660	13,302,585	11,355,660	11,355,660	11,355,660
4	Additional Collection System	1,120,000	2,807,000	2,807,000	1,280,000	1,280,000	1,600,000	1,943,000
5	Additional Effluent Pipeline	800,000	2,168,000	2,168,000	960,000	960,000	1,280,000	1,721,000
6	Additional Odor Control (facility covering)	200,000	0	0	200,000	200,000	500,000	0
7	Additional Drainage Creek Improvements	0	0	0	0	0	0	0
8	Additional Biosolids Recycling Facilities	0	0	0	0	0	0	0
	Subtotal - Facility	13,475,660	18,277,585	16,330,660	15,742,585	13,795,660	14,735,660	15,019,660
	Total Capital Cost	15,488,660	19,227,585	17,280,660	17,052,585	15,105,660	20,473,660	15,919,660
9	Salvage Value - Land	563,640	266,000	266,000	366,800	366,800	1,606,640	252,000
10	Present Worth Capital Cost	14,925,020	18,961,585	17,014,660	16,685,785	14,738,860	18,867,020	15,667,660
	Annual O&M Costs							
	Labor	224,000	240,000	224,000	240,000	224,000	224,000	224,000
	Power	138,880	138,240	158,880	118,240	138,880	138,880	138,880
	Materials	135,400	143,400	135,400	143,400	135,400	135,400	135,400
11	Subtotal - O&M	498,280	521,640	518,280	501,640	498,280	498,280	498,280
12	Annualized Capital Costs, 6.625%, 20 yrs	1,424,957	1,768,938	1,589,821	1,568,838	1,389,721	1,883,577	1,464,609
	Total Annualized Cost ($ millions)	1.92	2.29	2.11	2.07	1.89	2.38	1.96

Notes:

1 Facility Site — Estimated cost of each site including a 10% allowance for legal and admin. Advanced Wastewater Treatment Pond = 64 acres, Eto = 6 acres, Others = 11 acres.
2 Mitigation Land — Mitigation purchase estimate of $45,000 per acre. Estimates assume Resource Pk at 2:1; Tri W at 2.5:1; Pismo, Powell, and Eto at 3:1; Turri and Andre = $200,000 for onsite measures.
3 Base Capital — From process cost estimate, includes construction, contingency, engineering, legal and admin. for treatment facility. Refer to Appendix E for detailed costs used for this estimate.
4 Additional Collection system — Cost allowance to account for distance that treatment facility is from center of town. Assumes length of interceptor sewer from centroid of service area at 9th Street and Los Osos Valley Road to treatment facility.
5 Additional Effluent Pipeline — Cost allowance to account for distance that treatment facility is from the center of town. Assumes length of effluent pipe from treatment facility to centroid of service area at 9th Street and Los Osos Valley Road.
6 Additional Odor Control — Allowance for additional odor control costs to make the siting acceptable to neighbors. Includes allowance for covering aeration basins at Tri W.
7 Additional Drainage Creek Improvements — Allowance for modifying the existing creek for storm water drainage flowing from Los Osos Valley Rd onto Resource Park and Tri W sites.
8 Additional Biosolids Recycling Facilities — Biosolids recycling postponed, therefore costs shown as zero.
9 Salvage Value - Land — Salvage value of land purchased, assuming land retains full value, brought back from 20 years at 6.625%.
10 Present Worth Capital Cost — Capital subtotal less salvage value.
11 O&M Costs — Refer to Appendix E for detailed costs used for this estimate. O&M costs for the Turri site reflect an additional $20,000 in power costs for the collection system and effluent pipeline.
12 Annualized Capital Cost (6.625%, 20 yr) — Assumes 20 years at 6.625%.

All construction costs include 20% contingency, plus 27.5% for engineering, administration, and legal.
Facility costs for the Turri site reflect the use of a creek crossing at Santa Ysabel for the collection system and effluent pipeline.

they do not provide the community with accessible park land and they have the potential to produce unacceptable odors, noise, and visual impacts. This is particularly true if the Tri W site is used, given its central location within the community.

The SBR alternatives had higher costs than the comparable extended aeration alternatives due to their greater construction costs. Furthermore, the SBR treatment process offers no technical advantages over the extended aeration treatment process and thus could not overcome its cost disadvantage. Compared to the advanced wastewater pond alternative, however, the SBR alternatives were less costly due to smaller land requirements.

The hybrid alternative at the Tri W site has an estimated annualized cost of $2.16 million. This cost is 10% higher than the extended aeration alternatives, but is 23% lower than the advanced wastewater pond alternative at Resource Park. Although the hybrid alternative is not the least costly, it provides a balance between reasonable cost and delivery of a public amenity in the form of accessible park space and avoidance of odor and other nuisance impacts.

Summary of Alternative Comparison and Recommendation

The results of the alternatives comparison of treatment process/siting alternatives is summarized on the following page in Table 4-5.

Table 4-5. Summary of Alternative Comparison

Alternative	Annualized Cost ($ millions)	Annual Cost Per Connection ($)	Comment
Advanced Wastewater Treatment Pond at Resource Park	2.83	593	• Most costly • Difficult to obtain regulatory approval due to lack of proven nitrogen removal performance • Would require condemnation of site
Hybrid at Holland	2.38	499	• More expensive than Tri W with no overriding advantage • Very vocal public opposition to use of this parcel
Hybrid at Tri W	2.16	453	• Recommended alternative • Reasonable cost • Proven nitrogen removal performance would aid regulatory approval • Provides community park use at accessible location • Site has willing seller
SBR at all sites	2.07 to 2.29	434 to 480	• Higher cost than extended aeration alternatives with no overriding advantage
Ex. Aeration at Andre	1.96	411	• Low quality agricultural land • Unacceptable odor and visual impacts
Ex. Aeration at Eto	1.89	396	• Difficult to permit use due to prime agricultural land • Unacceptable odor and visual impacts
Ex. Aeration at Pismo	1.92	402	• Site is environmentally sensitive • Unacceptable odor and visual impacts
Ex. Aeration at Powell	1.92	402	• Site contains sensitive cultural resources • Unacceptable odor and visual impacts
Ex. Aeration at Tri W	2.00	419	• Usable site with willing seller. • Unacceptable odor and visual impacts
Ex. Aeration at Turri	2.11	442	• Most remote site • Difficult to obtain permit for use due to Land Conservation Act contract on land • Contains old dump site • Unacceptable odor and visual impacts

Based on the findings presented in the table, it is recommended that the hybrid alternative be implemented at the Tri W site. This alternative provides the best balance of cost and other community benefits while maximizing regulatory acceptance. As a result, it is the best practicable wastewater treatment technology.

SECTION 5
DISPOSAL ALTERNATIVES

SECTION 5
DISPOSAL ALTERNATIVES

INTRODUCTION

This section describes the effluent and biosolids disposal alternatives for the project. It identifies the constraints involved with each alternative and the recommended effluent and biosolids disposal alternatives. Similar to the treatment alternatives, the disposal alternatives were evaluated relative to their ability to meet RWQCB requirements and community values.

EFFLUENT DISPOSAL ALTERNATIVES

Four alternatives for the disposal of wastewater effluent were analyzed:

- reuse/recycling
- leach field disposal
- surface water disposal
- land disposal

These alternatives were assessed on their ability to dispose of 1.3mgd average dry weather flow and 1.4mgd average annual flow. The average annual flow includes wet weather flows. These capacities include the 150,000 gpd savings in wastewater flows that will result from the water conservation program, as described in the *District's Urban Water Management Plan, December 2000.*

Reuse/Recycling

It is an important community value to provide a disposal strategy that provides opportunities for reuse of treated effluent. In California, effluent that will be recycled for non-potable use must meet Title 22 requirements. Appendix G contains a copy of Title 22 and other information related to effluent reuse/recycling. Title 22 requires that effluent be at least treated to a secondary level, then filtered and disinfected. The level of treatment for all alternatives discussed in Section 4 would provide the community with effluent that meets Title 22 requirements.

In most cases, the most challenging aspects of developing a viable effluent reuse strategy is the amount of effluent that can be reused (reuse demand), and the cost of delivery (via a separate pipe system) of the effluent. Often, more wastewater is generated than can be recycled, and the cost of delivering the treated effluent to customers/users can be prohibitive. For these reasons, effluent recycling can often be used to dispose of some, but not all, of the effluent generated. For example, Irvine Ranch Water District in Southern California was developed from its inception with the goal of maximized effluent reuse. This district serves 200,000 persons and is able to reuse 70 percent of its effluent. Communities that adopted the goal of effluent recycling after they were developed are able to reuse much smaller percentages of their flow.

To assess the viability of effluent reuse in Los Osos, a preliminary assessment of the potential reuse markets was performed. This preliminary assessment was based in part upon the Draft Project Report prepared by Oswald and Associates Engineering, Inc, field reconnaissance activities, discussions with District staff, and approximation of demands based on land area.

This assessment targeted turf playing fields, nurseries, agricultural land, and golf courses. Following is a description of potential recycled water users, water demand, distribution system, and cost.

Potential Recycled Water Users. Potential water users were identified as those individuals within the vicinity of the Tri W site (the recommended location of the treatment facility) and within or adjacent to the Urban Reserve Line defined for the District. The locations of potential recycled water users within the community are shown in Figure 5-1 on the following page.

Potential recycled water users in the area were categorized as either landscape or agricultural irrigation. Landscape irrigation refers to water users such as parks, golf courses, cemeteries, and athletic fields. Agricultural irrigation refers to water users such as farmers and nurseries.

In order to provide a preliminary definition of the potential market, relevant information on each potential user was tabulated, including total demand, irrigation area, and current source of water. Table 5-1 provides a breakdown of the potential users, their type of use, and estimated recycled water demand.

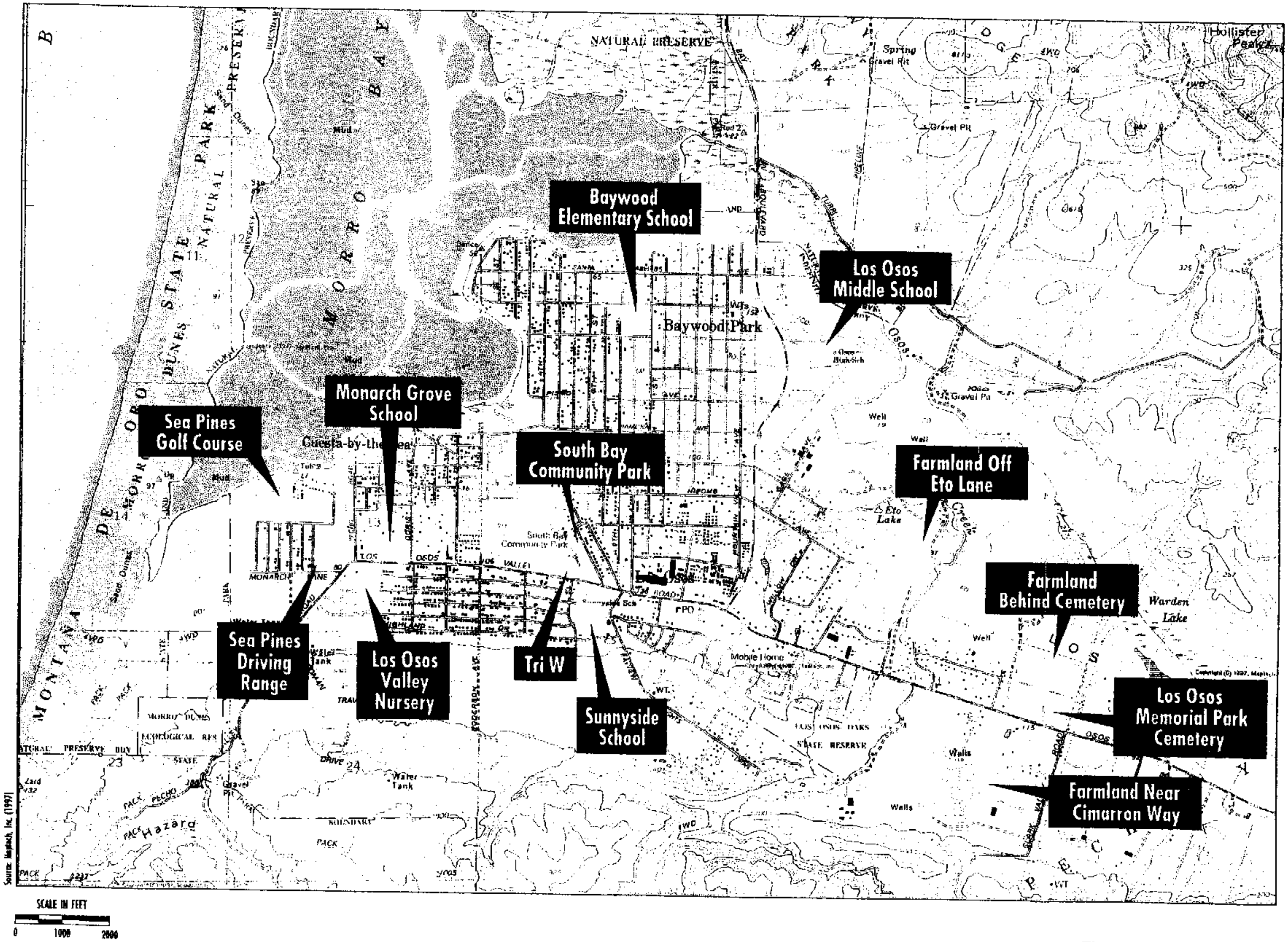


Figure 5-1. Potential Areas for Irrigation Reuse

Table 5-1. Estimated Recycled Water Demand within Los Osos

Customer Name	Average Annual Demand (afy)	Average Day Peak Month (July) (gpd)
Landscape Irrigation		
Tri W Site	21.6	38,400
South Bay Community Center	4.9	8,800
Sunnyside Elementary School	4.9	8,800
Monarch Grove School	4.9	8,800
Sea Pines Resort	16.5	29,300
Baywood Elementary School	7.4	13,100
Los Osos Valley Middle School	24.7	43,800
Los Osos Valley Memorial Park Cemetery	46.9	83,200
Subtotal	**132**	**234,200**
Agricultural Irrigation		
Los Osos Valley Nursery	N/A	N/A
Farmland off Eto Lane	300	532,900
Farmland near Cimarron Way	100	177,600
Farmland behind Cemetery	46	81,700
Subtotal	**446**	**792,200**
Total Estimated Recycled Water Demand	**578**	**1,026,400**

Notes:
N/A = Demand data not available. Nursery has been contacted regarding use of water supply well.

Description of Users. Following is a brief description of the potential recycled water users, the approximate area of land available for recycled water irrigation, the estimated recycled water demand (average annual and average day peak month [July] demand), current water supply (if known), and any potential constraints associated with recycled water delivery.

<u>Landscape Irrigation</u>

- **Tri W Site.** If the recommended treatment facility is developed, the Tri W site will contain approximately 6 acres of irrigated turf play fields and open meadow. The average annual and average day peak month demands are 21.6 acre-feet per year (afy) and 25,700 gallons per day (gpd), respectively. A recycled water irrigation system could be designed and constructed at this site as part of the treatment facility to supply recycled water to this area.

- **South Bay Community Center.** The South Bay Community Center and Park contains approximately 2 acres of irrigated turf on the north and south sides of the property. The community center is located on Los Osos Valley Road, across from the Tri W site. The average annual and average day peak month demands are 4.9 afy and 8,800 gpd, respectively. The current source of water supply is unknown. The possible constraint includes resistance from the current water supplier associated with the loss of a customer.

- **Sunnyside Elementary School.** The Sunnyside Elementary School is located on Los Osos Valley Road, across from the Tri W site and the community center. It contains approximately 2 acres of irrigated playing field adjacent to Los Osos Valley Road. The average annual and average day peak month demands are 4.9 afy and 8,800 gpd, respectively. Cal Cities currently supplies the school with water. The possible constraints include resistance from Cal Cities associated with the loss of a customer and the perceived health risks associated with recycled water irrigation on school playing fields.

- **Monarch Grove Elementary School.** The Monarch Grove Elementary School is located on Los Osos Valley Road approximately 4,000 feet west of the Tri W site. The school irrigates approximately 2 acres of playing field adjacent to Los Osos Valley Road. The average annual and average day peak month demands are 4.9 afy and 8,800 gpd, respectively. Cal Cities currently supplies the school with water. The possible constraints include resistance from Cal Cities associated with the loss of a customer and the perceived health risks associated with recycled water irrigation on school playing fields.

- **Sea Pines Resort.** Sea Pines Resort is located along Howard Avenue and Solano Street. The 10 acre driving range is located adjacent to the golf course along Monarch Lane and Pecho Road, approximately 4,500 feet west of the Tri W site. The resort currently use an on-site wastewater recycling system and storage ponds for irrigation and discussions with the golf pro, Mr. Gary Setting, indicate that the resort is interested in using recycled water to irrigate the driving range. The average annual and average day peak month demands are 24.7 afy and 43,800 gpd, respectively. One third of this demand is met by recycling treated effluent from the Monarch Grove treatment facility. Thus, two thirds of this demand could be supplied by treated effluent from the District's treatment facility. The major constraint associated with this site is that the driving range is owned by a private developer and leased back to the resort for use. The developer plans to build homes where the driving range is located following the suspension of the building moratorium.

- **Baywood Elementary School.** The Baywood Elementary School is located along El Moro Avenue, approximately one mile north of the Tri W site. The school irrigates approximately 3 acres of playing fields. The average annual and average day peak month demands are 7.4 afy and 13,100 gpd, respectively. The current source of water supply is unknown. The possible constraints include the perceived health risks associated with recycled water irrigation on school playing fields.

- **Los Osos Middle School.** The Los Osos Middle School is located at South Bay Boulevard and El Moro Avenue, approximately 2 miles north-east of the Tri W site. The school irrigates approximately 10 acres of playing fields. The average annual and average day peak month demands are 24.7 afy and 43,800 gpd, respectively. The current source of water supply is unknown. The possible constraints include resistance from the current water supplier associated with the loss of a customer and the perceived health risks associated with recycled water irrigation on school playing fields.

- **Los Osos Valley Memorial Park Cemetery.** Based on discussions with staff from the cemetery, approximately 19 acres are developed and irrigated on the property. The cemetery is located on the north side of Los Osos Valley Road, approximately 2.2 miles east of the Tri W site. The cemetery staff indicated that the turf is irrigated through the use of two private wells, but the production from these wells during the summer was unknown. Further investigation and analysis of well production data and utility billing information may provide the statistics on the amount of water used for irrigation during the summer. The average annual and average day peak month demands have been estimated at 46.9 afy and 83,200 gpd, respectively. A possible constraint is resistance from the owner to retrofit the existing irrigation system to accommodate a recycled water supply and the cost of plumbing and pumping.

<u>Agricultural Irrigation</u>

- **Los Osos Valley Nursery.** The Los Osos Valley Nursery is located on Los Osos Valley Road approximately 4,000 feet west of the proposed Resource Park and across from Monarch Elementary School. The nursery is currently served by Cal Cities and a private well on the nursery site. The owners of the nursery have been contacted but water supply information has not been provided to date. Discussions with the owner regarding water supply and recycled water use concerns are planned for the near future.

- **Agricultural Growers off Eto Lane.** There are several hundred acres of agricultural land off Eto Lane, north of Los Osos Valley Boulevard, approximately 2.5 miles east of the Tri W site. For the purposes of this study, the land available for recycled water irrigation has been arbitrarily set at 150 acres. The crop type is most likely row crop, but verification is necessary for a more detailed analysis. Growers have not been contacted regarding cropping patterns, crop type, water supply and water use. The average annual and average day peak month demands have been estimated at 150 afy and 532,900 gpd, respectively. The possible constraint includes resistance from growers to retrofit their existing irrigation system to accommodate a recycled water supply.

- **Agricultural Growers near Cimarron Way.** Approximately 50 acres of agricultural land near Cimarron Way, on the south side of Los Osos Valley Boulevard, are located immediately east of the Los Osos Oaks State Reserve, 2 miles away from the Tri W site. A site reconnaissance conducted during the month of April revealed that the grower planted row crop on this land. As with the agricultural land located off Eto Lane, growers have not been contacted regarding cropping patterns, crop type, water supply and water use. The average annual and average day peak month demands have been estimated at 100 afy and 177,600 gpd, respectively. A possible constraint is resistance from growers to retrofit their existing irrigation system to accommodate a recycled water supply and the capital as well as operation and maintenance costs for such a system.

- **Agricultural Growers behind Cemetery.** Discussions with the Los Osos Valley Memorial Park Cemetery staff revealed that approximately 23 acres of land located north of and owned by the cemetery are leased to a private grower. A separate well system from the cemetery's system is used to irrigate this land. No information on production data was available this time. Further investigation and analysis of well production data and utility billing information may provide the statistics on the amount of water used for irrigation during the summer. The average annual and average day peak month demands have been estimated at 46 afy and 81,700 gpd, respectively. A possible constraint is resistance from growers to retrofit their existing irrigation system to accommodate a recycled water supply and the capital as well as operation and maintenance cost for such a system.

Recycled Water Demand. As summarized in Table 5-1, the average annual recycled water demand totals approximately 578 afy and the average day demand in a peak month is approximately 1.0 mgd. This demand represents approximately 37% of the annual effluent that will be generated in Los Osos. Thus, the maximum potential for reuse is 37% of the community's wastewater flow.

Landscape irrigation accounts for 132 afy, or roughly 23 percent of the identified demand in the area. Agricultural irrigation accounts for 446 afy, or approximately 77 percent of the identified demand. It should be noted that the agricultural demand is potentially greater than 446 afy because the maximum agricultural land available for recycled water irrigation off Eto Lane (near Eto Lake) was arbitrarily set at 150 acres. If more land is identified as available for recycled water irrigation, then the agricultural demand would increase.

Based upon peak demand of the identified market, a water recycling plant to supply this market would need a capacity greater than 1.0 million gallons per day (mgd). However, seasonal variations in irrigation will create fluctuations in the recycled water demand. The treatment facility could potentially deliver 100 percent of the treated effluent to recycled water customers during the summer months, and have zero delivery to recycled water customers during winter months.

Table 5-2, on the following page, presents the estimated monthly variations in landscape and agricultural irrigation demand.

Table 5-2. Estimated Monthly Irrigation Demand

Month	Landscape Irrigation (gpd)	Agricultural Irrigation (gpd)	Total Estimated Demand (gpd)
January	0	0	**0**
February	0	0	**0**
March	28,000	93,800	**121,800**
April	125,600	426,300	**551,900**
May	210,300	713,500	**923,800**
June	236,600	804,100	**1,040,700**
July	234,200	792,200	**1,026,400**
August	233,700	792,200	**1,025,900**
September	183,500	620,000	**803,500**
October	144,900	492,200	**637,100**
November	4,800	14,500	**19,300**
December	0	0	**0**

As shown in the table, no irrigation demand exists during the winter months of December, January, and February. Thus, effluent reuse cannot be implemented throughout the year. During these months the treated effluent would have to be discharged or disposed of through some other means.

The average day demand in March is approximately 124,000 gpd and increases to greater than 1.0 mgd during the summer months of June, July, and August. Thus, effluent reuse cannot be used to dispose of all effluent even during the highest demand months. The implication of this finding is that the community of Los Osos needs to find more than one way to dispose of its effluent.

Recycled Water Distribution System. The approximate length of pipeline necessary to connect the customers shown in Figure 5-1 is summarized on the following page in Table 5-3.

Table 5-3. Estimated Reach Length and Demand

Reach	Pipeline Length (feet)	Customers Served[a]	Average Day Peak Month Demand (gpd)
West of Tri W Site	1,500	• Monarch Grove Elementary School • Los Osos Valley Nursery • Sea Pines Resort	38,100[b]
East of Tri W Site	14,100	• South Bay Community Center • Sunnyside Elementary School • Farmland off Eto Lane • Farmland near Cimarron Way • Los Osos Valley Memorial Park Cemetery • Farmland behind Cemetery	893,000
North of Tri W Site	8,900	• Baywood Elementary School • Los Osos Middle School	56,900

Notes:

a. Does not include demands at the Resource Park.

b. Does not include Los Osos Valley Nursery.

As shown in Table 5-3, the largest concentration of demand exists east of the Tri W site, primarily due to the potential agricultural customers off Los Osos Valley Road. Customers west of the Tri W site are near the supply (less than one mile), but their participation in a recycled water project is more tenuous for two primary reasons. These reasons include: (1) Sea Pines Driving Range may be developed in the future, following the suspension of the building moratorium (2) Los Osos Valley Nursery operates their own groundwater supply well.

Constructing a recycled water distribution system to serve customers east of the Tri W site presents a more viable project alternative because the demand is greater and customers north of the Tri W site could also be served. The additional wastewater management alternatives being investigated as part of this study also complement a distribution system east of the Tri W site. The relationship between the different wastewater management alternatives will be explained in the following sections.

Preliminary Cost Estimates. Preliminary construction cost estimates were developed for the recycled water pipeline distribution system. The estimated construction cost estimates are for planning level purposes only and do not include allowances for project development and implementation costs (i.e., engineering, administration, inspection, construction management, etc.). It was assumed that a unit construction cost of $8 per inch-diameter foot was appropriate for planning level pipeline construction cost estimates. Pipeline construction costs for each of the reaches are summarized in Table 5-4. The estimated pipeline construction cost for the recycled water distribution system is approximately $3.2 million.

Table 5-4. Construction Cost Estimates (Unit Cost, $8 per inch-diameter foot)

Reach	Diameter (inches)	Length (feet)	Cost ($)
West of Tri W Site	6	1,500	72,000
East of Tri W Site	10 12 16 18	2,100 2,350 7,850 1,800	168,000 225,600 1,004,800 259,200
North of Tri W Site	4 6	3,400 5,500	108,800 264,000
Subtotal			**2,102,400**
Contingency at 20%			420,480
Subtotal			**2,522,880**
Legal, admin., engineering at 27.5%			693,792
Total			**3,216,672**

As noted above, this system would not be able to dispose of all of the effluent generated, even in the summer months, and would not be able to dispose of any effluent during wet weather months.

Leach Field Disposal

This category of alternatives involves the use of existing and/or newly constructed leach fields for the disposal of treated effluent. The existing leach fields consist of the individual leach fields associated with the septic tanks located at nearly each dwelling, school, or public building. However, some residential developments in Los Osos have developed communal septic tanks and leach fields where the sewage from several homes is collected via pipeline and conveyed to a common septic tank and leach field. These communal leach fields are present at Vista de Oro and Bayridge Estates.

Existing Leach Fields. One concept that was considered was the conveyance of wastewater effluent flow to each of the existing residential leach fields for disposal. This concept would require the construction of a separate pipe distribution system throughout the community and the connection of thousands of separate leach fields. The layout of this system would be comparable to that of the STEP/STEG collection system, but would flow towards properties, rather than to the treatment facility. The cost of the pipes and pumps elements of the STEP/STEG alternative is approximately $43 million. The cost of conveying treated effluent to the nearly 5,000 leach fields in Los Osos would be comparable to this cost. Given this extraordinary cost, use of the individual residential leach fields was not considered further.

New Leach Fields. A more practical version of leach field disposal would be the construction of five to ten new large leach fields in areas of sufficient ground water separation. This concept is depicted in Figure 5-2, and consists of using the new and existing communal leach fields listed in Table 5-5. The long term capacities of each of the leach fields is also listed.

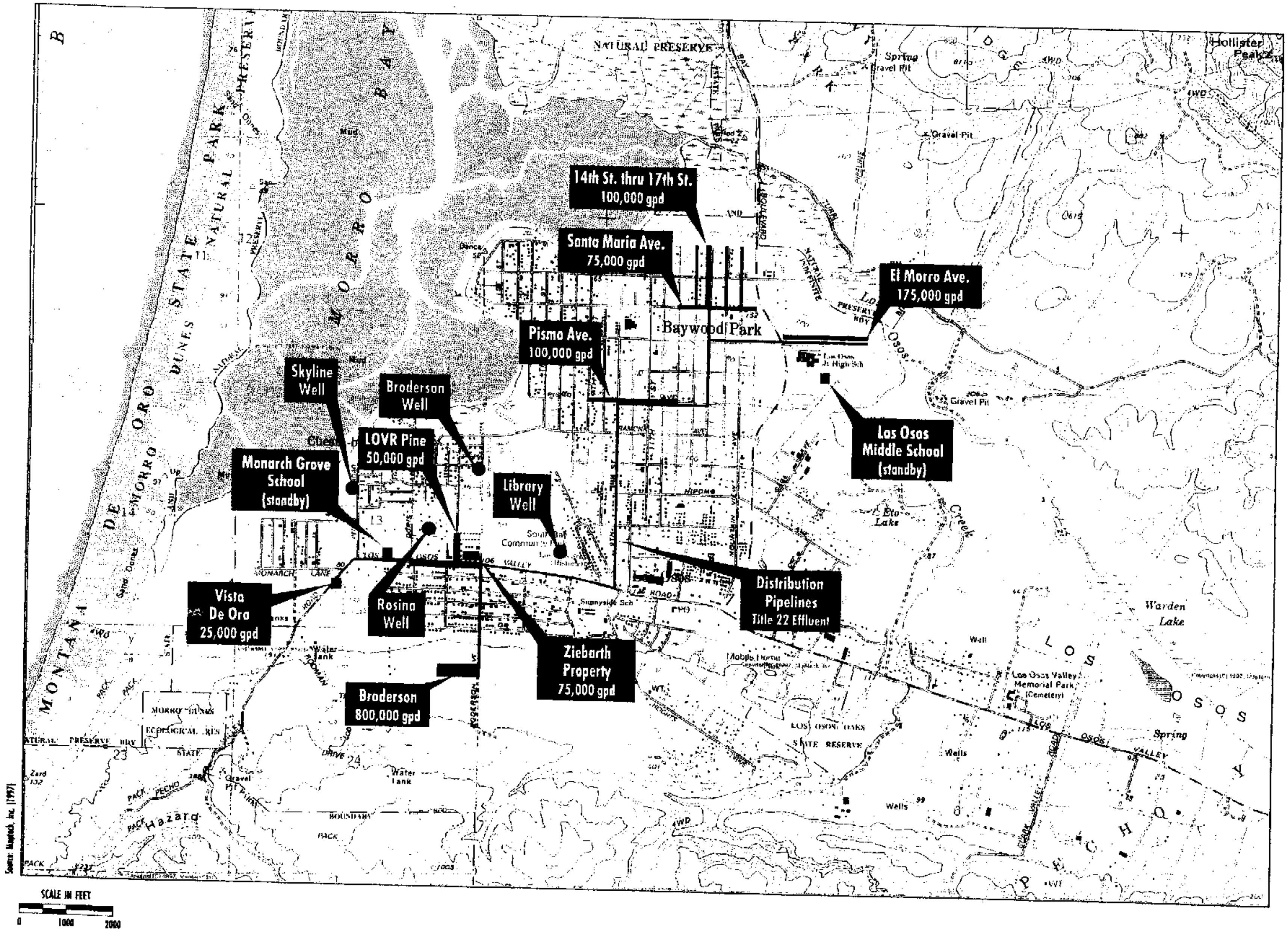


Figure 5-2. Effluent Disposal Sites

Table 5-5. Leach Field Disposal Capacities, Loadings, and Distance to Nearest Municipal Well

Site	Area (ft^2)	Disposal Capacity (gpd)	Hydraulic Loading (inches/minute)	Approximate Distance to Nearest Municipal Well (ft)
Westside				
Broderson Site	300,000	800,000	0.003	600
Los Osos Valley Rd/ Pine St	48,000	50,000	0.003	550
Ziebarth Property	86,000	75,000	0.003	700
Vista de Oro	16,000	25,000	0.002	800
Monarch Grove Elementary School	43,560	stand by		400
Eastside				
Pismo Avenue	108,000	100,000	0.001	1,200
Santa Maria Avenue	68,000	75,000	0.001	1,500
14th Street thru 17th Street	56,000	100,000	0.002	1,500
El Morro Avenue	87,000	175,000	0.002	3,000
Los Osos Middle School	20,000	stand by		3,400
Total		**1,400,000**		

Note: Some properties will be purchased.

As shown in Table 5-5, the total long-term capacity of the listed sites is 1.4 mgd. This capacity represents the year long average volume of water that could be disposed at a given site. Wet weather daily flows far in excess of these values can be disposed of at these sites, as long as the yearly average is maintained within the capacities listed. In addition, two sites are held in reserve as stand by sites. Use of these sites would also allow the other sites to undergo periodic maintenance.

The capacities shown in Table 5-5 are based on ground water modeling to ensure that separation to groundwater was at least 20 ft, which is in excess of the minimum allowed by the Department of Health Services (DHS). The hydraulic loading rates are reflective of leach field disposal operation and are 100 to 300 times less than that used in ground water recharge projects.

Although the proposed leach field alternative is considered a disposal alternative rather than a groundwater recharge alternative, the DHS' guidelines for groundwater recharge were analyzed. The results of this analysis are presented in Table 5-6 on the following page.

Table 5-6. Comparison of DHS Recharge Criteria and Los Osos Disposal Alternative

Item	DHS Criteria	Los Osos
	Pathogens	
Horizontal Separation	500 ft	500 ft
Retention time underground	6 months	20 months
Level of treatment	SS ≤ 30 mg/l	SS ≤ 10 mg/l
Filtration	≤ 2NTU	≤ 2NTU
Disinfection	4 log virus inactivation	4 log virus inactivation
	Regulated Contaminants	
Nitrate (as N)	≤ 10 mg/l	≤ 7 mg/l
	Unregulated Contaminants	
Depth to Groundwater	20 ft	20 ft
Percolation Rate vs. Application Rate	≤ 0.3 in/min	0.001 to 0.003 in/min
TOC ≤ $\frac{1\ mg/l}{(1\text{-}SATTOC)RWC}$	≤ 12 mg/l	≤ 10 to 11 mg/l
	Other	
Disinfection by products (THM)		Avoided with the use of UV disinfection

As shown in the table above, the proposed disposal alternative complies with DHS guidelines. With regard to Total Organic Carbon (TOC), the proposed treatment process will have a very long sludge age, which will result in low TOC concentrations in the effluent. It is expected that these will be in the range of 10 to 11 mg/l. This is lower than the TOC concentrations that DHS found in their informal survey of Southern California treatment facilities. The facilities surveyed by DHS did not have biological nutrient removal processes and therefore had lesser sludge ages and the carbonaceous removal at those facilities is lower than would be expected of the Los Osos facility. Furthermore, this project will use UV disinfection, which will avoid the formation of trihalomethane (THM) compounds inherent with chlorination based disinfection.

Figure 5-2 on page 5-11 shows the location of existing and proposed drinking water wells. The use of leach field disposal is not expected to impact the operation of these wells given the horizontal separations and travel times involved. The horizontal distance is at least 500 ft in the closest instance, and is between 1,000 ft and 1,700 ft in all other instances. Groundwater modeling by Cleath & Associates, Inc. has indicated that the expected travel time between leach field and well head is 20 months in the closest instance, and at least 8 years in all other instances. Thus, very good margins of safety are provided with this concept. Also, it is important to note that Cal Cities will be abandoning their well above Highland Avenue near the Broderson site.

The Broderson site has the greatest groundwater separation (more than 150 feet) and the largest capacity. A hydrogeologic study of the Broderson site was conducted in November 2000 by the District and is contained in Appendix J. In general, the westside of Los Osos has greater separation to groundwater and therefore has a greater capacity for disposal of treated effluent. However, groundwater modeling by Cleath and Associates, Inc. indicates that the westside is not capable of accepting the total effluent flow. As a result, eastside sites are also needed. In addition, leach field areas within the public right of way are important because of the scarcity of sites with sufficient ground water separation and low environmental impact.

The groundwater modeling by Cleath & Associates indicates that leach field disposal on the westside of Los Osos will cause surfacing of groundwater in the low lying reaches near Morro Bay. To alleviate this impact, approximately 400,000 gpd of groundwater needs to be extracted from the upper aquifer. Cal Cities has PUC approved plans to extract 300,000 gpd of groundwater from the upper aquifer. The District would therefore need to extract 100,000 gpd of groundwater from the upper aquifer. To do this, the District would construct two new shallow wells. The first well would be located at the site of the existing deep aquifer library well and the second well would be located near the intersection of Broderson and Loma streets, as shown previously in Figure 5-2.

The 100,000 gpd extracted by the District would be blended with 375,000 gpd of water from the District's deep aquifer Library well. This well has nitrate levels less than 1 mg/l (as N). When blended with water form the upper aquifer, a blended water with less than 5 mg/l nitrate (as N) would result. The blended water would be used in the drinking water supply. As nitrate concentrations in the shallow aquifer decrease with time, the nitrate concentrations of the blended water will also decrease. The construction cost of the new extraction wells and the piping needed to blend it with deep aquifer water would be approximately $300,000.

Estimated Cost of New Leach Fields. The total cost of this alternative is estimated to be approximately $10.3 million and is detailed on the following page in Table 5-7.

Table 5-7. Estimated Cost of New Leach Fields

System Component	Size (inches)	Length (feet)	Unit Price ($)	Estimated Cost ($)
Distribution Pipeline Reach				
Broderson Site to Vista de Oro	2	3,000	30	90,000
Wastewater Treatment Facility to Broderson Site	8	4,600	65	299,000
Wastewater Treatment Facility to Pismo Avenue	8	5,500	65	357,500
Pismo Ave to El Morro Avenue	6	6,800	60	408,000
Spur to 14th Street thru 17th Street	4	2,000	55	110,000
Subtotal				**1,264,500**
Connections to Existing Sites				
Vista De Oro			ls	50,000
Los Osos Middle School			ls	50,000
Monarch Grove Elementary School			ls	50,000
Subtotal				**150,000**
Development of Potential New Sites				
Pismo Avenue	4	15,800	50	790,000
Santa Maria Avenue	4	9,500	50	475,000
14th Street thru 17th Street	4	7,900	50	395,000
El Morro Avenue	4	12,300	50	615,000
Broderson Site	4	42,300	50	2,115,000
Ziebarth Property	4	6,600	50	330,000
Monitoring Wells				250,000
Telemetry System				200,000
Subtotal				**5,170,000**
Construction Subtotal				**6,584,500**
Contingency at 20%				1,316,900
Subtotal				**7,901,400**
Engineering, admin, legal at 27.5%				2,172,885
Capital Cost (without land)				**10,074,285**

Land Component			
Site	**Parcel Size (acres)**	**Unit Cost ($)**	**Estimated Cost ($)**
Land purchase at Ziebarth Property	3	80,000	240,000
Subtotal	3		**240,000**
Total			**10,314,285**

The majority of the cost shown above in Table 5-7 is the construction of the new leach fields. However, substantial costs are associated with the distribution piping that will convey flows from the treatment plant to each of the leach field sites. A modest allowance has been shown for easement fees for use of existing leach fields and for siting some of the new leach fields in public rights of way.

Surface Water Disposal
Implementation of a surface discharge alternative would involve the discharge of treated effluent to Los Osos Creek or directly to Morro Bay. Conversations with the RWQCB, Central Coast Region, indicated that pursuing a surface water discharge to Los Osos would be discouraged by the RWQCB. Discussions with the Coastal Commission indicate that they would discourage a fresh water discharge to Morro Bay.

The adoption on March 2, 2000 of the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Policy) by the State Water Resource Control Board establishes a standard approach for permitting discharges of toxic pollutants to non-ocean surface waters. The Policy establishes implementation provisions for priority pollutant criteria promulgated by the U.S. Environmental Protection Agency (EPA) through the National Toxics Rule (NTR) and through the California Toxics Rule (CTR), and for priority pollutant objectives established by RWQCBs in their water quality control plans (basin plans).

The specific, regulatory Policy provisions applicable to a proposed surface water discharge to Los Osos Creek include:

- Specifies the priority pollutant criteria and objectives, and their general application to beneficial uses designated in Central Coast Region basin plan, to which the Policy applies,

- A Total Maximum Daily Load (TMDL) could be used to calculate a water quality-based effluent limitation for priority pollutants or discharge to the creek could be prohibited if necessary to protect the beneficial uses of the creek or Morro Bay.

- The RWQCB could consider granting a mixing zone and dilution credit to use in calculating the water quality-based effluent limitation. But, certain procedures must be followed and conditions met prior to determining whether the RWQCB would approve or deny a mixing zone or dilution credit.

- Establishes a procedure for the RWQCB to determine the ambient background concentration of a priority pollutant in the receiving water (Los Osos Creek and Morro Bay) for use in determining the water quality-based effluent limitation.

The 1998 Central Coast Regional Board 303(d) and TMDL Priority Pollutant List for Los Osos Creek and Morro Bay include:

Los Osos Creek
- Nutrients
- Priority Organics
- Siltation

Morro Bay
- Metals
- Pathogens
- Siltation

It would take extensive additional studies to satisfy these provisions, which would make it impossible to meet the Time Schedule Order No. 00-131.

Central Coast Basin Plan. The RWQCB will use the provisions developed in the Policy to implement the objectives of the Central Coast Basin Plan (Basin Plan). The September 1994 Basin Plan shows how the quality of the surface and groundwaters in the Central Coast Region should be managed to provide the highest water quality reasonably possible. The RWQCB will implement the Basin Plan and protect receiving waters like Los Osos Creek and Morro Bay by issuing a National Pollutant Discharge Elimination System (NPDES) with stringent discharge requirements or rejecting the request to discharge to Los Osos Creek.

The beneficial uses identified in the Basin Plan by the RWQCB for Los Osos Creek and Morro Bay include:

Los Osos Creek
- Municipal and Domestic Supply,
- Agricultural Supply,
- Groundwater Recharge,
- Freshwater Replenishment,
- Water Contact Recreation,
- Non-Contact Water Recreation,
- Commercial and Sport Fishing,
- Warm Fresh Water Habitat,
- Cold Fresh Water Habitat,
- Wildlife Habitat,
- Rare, Threatened, or Endangered Species,
- Migration of Aquatic Organisms, and
- Spawning, Reproduction and/or Early Development Habitat.

Morro Bay
- Water Contact Recreation,
- Non-Contact Water Recreation,
- Industrial Service Supply,
- Navigation, .
- Marine Habitat,
- Shellfish Harvesting,
- Commercial and Sport Fishing,
- Rare, Threatened, or Endangered Species, and
- Wildlife Habitat.

Water Quality Objectives for Los Osos Creek and Morro Bay. The RWQCB has established water quality objectives for Los Osos Creek and Morro Bay to protect the beneficial uses identified above. The effluent limitations for disposal of treated wastewater will be based on the water quality objectives for the creek and bay, and applicable State and federal policies and effluent limits.

Watershed Management Initiative. The Central Coast RWQCB developed a Watershed Management Initiative along with the State Water Resource Control Board and EPA to develop TMDLs to improve water resource protection by applying and promoting watershed management. One of the watersheds targeted by the Central Coast RWQCB was the Morro Bay Watershed. This watershed was selected because it was one of six recognized as having the worst water quality problems. The major water quality problems identified in the Watershed Management Initiative for the Morro Bay Watershed include sedimentation, pathogens, nutrients and heavy metals. The source of the water quality problems included urban development and runoff, agricultural activities, and septic systems.

Implications for Surface Water Disposal Alternatives. The imposition of TMDLs for surface water discharge to Los Osos Creek or Morro Bay would require higher levels of treatment than was discussed in Section 4. The higher levels of treatment would be needed to meet load limits on metals and nitrate.

Although TMDLs have not been formally established for discharges to these surface waters, the RWQCB has indicated that discharge limits to Los Osos Creek would be similar to the requirements being set for Chorro Creek. Draft TMDL for discharges to Chorro Creek indicate that effluent nitrate concentrations of 2.2 mg/l (as N) or less will probably be imposed. This is much more stringent than the total N limit of 7 mg/l stipulated in WDR 97-8 for Los Osos.

Furthermore, the level of scrutiny that the RWQCB, Coastal Commission and other regulatory agencies would impose to meet the requirements of the National Toxics Rule, the California Toxics Rule, and the Central Coast Basin Plan would in turn require a new set of receiving water studies. These studies would take several years to complete and would be prevent the CSD from meeting the Time Schedule Order No. 00-131.

In addition to the water quality concerns identified above, a surface water disposal alternative does not achieve the community goal of retaining the effluent within the watershed of origin. From the perspective of the community, this type of alternative "throws away the water". For these reasons, a surface water discharge was not considered a viable alternative and was dropped from further consideration.

Land Disposal

Land based disposal, in the form of percolated ponds or dedicated agricultural irrigation was investigated. Large agricultural lands exist to the east of the community along Los Osos Valley Road, which could be potentially used for disposal.

Percolation Ponds. The 1997 county proposed project for Los Osos recommended the construction of a percolation pond at the Broderson site for disposal of effluent from the treatment plant. However, this alternative evoked a very strong and organized opposition from the residents immediately down slope of the percolation pond. They voiced fears of flooding in the event of an earthquake.

The ground water modeling for this report indicates that a maximum of 800,000 gpd could be disposed of at the Broderson site via percolation ponds or leach fields. Thus, this site could only accommodate 60 percent of the average dry weather flow.

Because of the strong opposition that occurred in the past regarding this alternative, and its inability to dispose of all of the flow, it was dropped from further consideration.

Agricultural Irrigation. The evapotransporation potential for these sites was assessed in order to estimate the amount of land that would be needed for irrigation disposal. For this estimate, it was assumed that approximately 2 months of storage would be provided to bridge the wet weather months of the year. This amount of storage would require approximately 20 acres to site.

Given this amount of storage, approximately 600 acres would have to be available for irrigation. Assuming that 15 percent of a given parcel of land would be unavailable for irrigation due to access roads and topographic reasons, results in a gross irrigation area of approximately 700 acres. The total land area, including the storage reservoir would be 720 acres.

The nearest areas of this size are approximately 2.5 miles from the Tri W site, along Los Osos Valley Road to the east of Los Osos Creek. A pump station and transmission pipeline would have to be constructed in conjunction with this option. As shown in Table 5-8, the estimated cost of this option is over $5.3 million.

Table 5-8. Estimated Cost of Land Disposal via Agricultural Irrigation

Item	Estimated Cost ($ millions)
Transmission pipeline	1.6
Storage ponds	0.2
Irrigation piping/pumps	0.1
Subtotal	1.9
Contingency at 20 %	0.38
Subtotal	2.28
Legal, admin, engineering at 27.5%	0.627
Subtotal	2.9
Land cost, 720 acres	2.4
Total	**5.3**

Although this cost would make this alternative attractive, it would be difficult to obtain Coastal Commission approval to use this much prime agricultural land for disposal of treated effluent. The 20 acres devoted to storage would be removed from any form of agriculture. The 700 acres of irrigated land would be operated to maximize effluent disposal, rather than to maintain agricultural practice.

In addition, this alternative would dispose of the treated effluent outside of the Los Osos community watershed. It therefore is counter to the community's strongly held goal of retaining the water to maintain the long-term viability of its own water supply. Given the difficulty in obtaining approval for conversion of the land to effluent disposal, and that it 'throws away the water', this alternative is not recommended.

Summary of Effluent Disposal Findings and Recommendation
As found in this analysis, effluent recycling within Los Osos can only dispose of 40% of the annual volume of effluent, and during wet weather winter months cannot be relied upon at all. Thus, implementation of this alternative alone would not address the total needs of the project. Even if this alternative were recommended in conjunction with some other disposal alternative, it would not be able to reduce the needed capacity of the other alternative.

Of the remaining alternatives, the only option that is viable and could be constructed at reasonable cost is the use of new leach fields. It mimics the existing disposal practice, which avoids the regulatory hurdles associated with a surface water discharge. It uses low nitrate, filtered, UV disinfected effluent instead of septic tank effluent to protect the groundwater. Therefore, the original need for the project will be addressed without imposing an environmental burden on waterways, bays or the ocean. For these reasons, the construction of new leach fields is the recommended disposal alternative.

As shown in Figure 5-2, the configuration of this alternative will provide a large network of distribution piping throughout the community. This network will convey highly treated water that meets Title 22 requirements. Thus, this alternative will provide the community with opportunity to implement effluent reuse in many areas. However, given the capital constraints on the newly formed District, it is recommended that these opportunities be undertaken after the project has been implemented.

The findings of this section are summarized on the following page in Table 5-9.

Table 5-9. Summary of Findings for Effluent Disposal

Disposal Option	Estimate Cost ($ millions)	Findings
Reuse/ Recycling within Los Osos	3.2	• Can dispose of up to 1 mgd during summer • Can dispose of 40 percent of annual demand • Project would need additional disposal options • Does not diminish capacity of additional disposal options
Leach field disposal via existing leach fields	43	• Due to high cost would not achieve community value of affordability
Leach field disposal via new leach fields	10.3	• Viable alternative • Mimics existing disposal practice, but with low nitrate, filtered, disinfected effluent
Surface water discharge to Los Osos Creek or Morro Bay	not estimated	• Regulatory agencies very reluctant to approve • Considered option of last resort by agencies • Studies needed to gain regulatory approval would require extension of RWQCB Time Schedule Order
Land disposal via percolation pond	not estimated	• Maximum disposal capacity: 800,000 gpd • Not acceptable to the community
Land disposal via agricultural irrigation	5.3	• Extraordinary land requirement • Doubtful that Coastal Commission approval could be obtained • Does not help maintain long-term viability of Los Osos' water resource

BIOSOLIDS DISPOSAL ALTERNATIVES

Biosolids generated by any of the treatment processes could be recycled within the community or hauled by offsite operators for disposal. Some offsite operators will compost and recycle the solids, while others will use it as cover in landfill operations.

Local Recycling

The biosolids from the facility would have to be treated to Class A levels if recycling within the community were to be undertaken. Treatment to this level effectively kills the pathogens, helminthes, and ova that could pose a potential public health threat. The most practical means of achieving Class A standards would be to compost the biosolids with green waste such as tree trimming, landscaping wastes, and yard wastes. The mulched green wastes would be combined

with the dewatered biosolids and composted to provide a Class A biosolids suitable for landscaping and agriculture. The process takes from 20 to 40 days.
For the purposes of this analysis a windrow process was assumed, given the small volume of solids that will be treated. This type of composting facility could be located on a two acre site. The site would consist of the following components:

- Windrow composting piles
- Yard waste bulk storage
- Mulch storage
- Bulk Compost pile
- Chipper/shredder area
- Screening boxes

The composting operation itself would consist of a number of components, as described below.

Green Waste Receiving. There are a number of sources of green waste suitable for composting such as chipped tree trimming, landscaping trimmings, and leaves. Normally, the use of grass cuttings is limited due to the high nitrogen content and the possibility of ammonia generation. Green waste from Eucalyptus trees is also not used due to its toxicity to other plants. The most reliable sources of these materials would be from landscape maintenance contractors, tree trimming services, park maintenance, school maintenance, and possibly the public.

Green Waste Processing. To facilitate composting, some of the green waste would need to be shredded and chipped to provide a bulking agent (mulch) which promotes the composting process.

Mulch Storage. The supply of green waste will vary throughout the year so storage will need to be provided. The estimated mulch requirement will be about 12 cubic yards per day.

Compost Mixing. The incoming dewatered biosolids from the facility would be mixed with the mulch and formed into a windrow. A typical mix would consist of approximately 30% biosolids and 70% mulch.

Windrow Turning. Periodically the windrows would be turned-over to ensure better mixing and aeration of the compost. The turning would take place about once a week for about 6 to 8 weeks.

Compost Storage. After the windrow operation is completed the compost will be stored.

Compost Screening. Depending on the compost use some additional screening may be required to remove some of the larger mulch chips.

Offsite Disposal/Recycling
Biosolids from the facility are expected to be of high quality due to the residential character of the community and the level of treatment needed to achieve the low nitrogen concentration in the

effluent. It should be very low in toxicants and well stabilized (not susceptible to going putrid). These factors will make it readily accepted by off site disposal operators.

It is estimated that the Los Osos facility will generate approximately 2,080 wet tons per year of biosolids. The following four operators stated that they would likely accept the biosolids from Los Osos and provided the following budget price quotations:

- McCarthy Farms will haul and land apply Class B biosolids to their sites in Kings County and Kern County. Estimated cost is $30 per wet ton, including hauling and permit costs.

- Yakima will haul and land apply Class B biosolids to their site in Buttonwillow. Estimated cost is $35 per wet ton, including hauling and permitting.

- Cold Canyon Landfill will accept Class B biosolids, at 20 percent solids, at a tipping fee of $75 per wet ton. This cost does not include hauling.

- Chicago Grade Landfill will accept Class B biosolids as intermediate cover, at 50 percent moisture content, at a tipping fee of $15. This cost does not include hauling.

Based on these cost quotes, an estimate of $30 per wet ton was assumed as the cost of offsite disposal/recycling of biosolids. This cost would allow recycling at McCarthy Farms. As noted in Section 1, recycling is one of the community's values.

Land Disposal

Disposal of biosolids at a dedicated land disposal site within the community was considered not viable for many reasons. As stated in the District's *Final Environmental Impact Report, February 2001*, most of the available land within Los Osos is habitat for sensitive species, is prime agricultural land, and/or has relics of cultural significance. Therefore, it would be difficult to gain approval from state and federal regulatory agencies and potentially very expensive to mitigate for a new dedicated land disposal site. In addition, land disposal of biosolids does not achieve the community value of biosolids composting and recycling.

Given these factors and the fact that offsite contractors are willing to recycle the biosolids at a reasonable cost, land disposal of biosolids within the community was not considered a viable option. At a future date, the District may implement local composting, but this recommendation does not preclude this from happening in the future.

Biosolids Disposal Costs

The estimated costs associated with the two viable alternatives for biosolids disposal are shown in Table 5-10 on the following page.

Table 5-10. Estimated Biosolids Disposal Costs

Item	Local Recycling ($)	Off Site Recycling ($)
Loader	75,000	0
Chipper/Shredder	50,000	0
Screens	50,000	0
Paving	125,000	0
Fencing	75,000	0
Drainage	200,000	0
Utilities	200,000	0
Building	150,000	0
Miscellaneous	200,000	0
Total Construction	**1,125,000**	**0**
Engineering, legal, admin at 27.5%	309,375	0
Total Capital	**1,434,375**	**0**
Annual O&M	64,000	62,400
PW of O&M, 6.625%, 20 yrs	**695,652**	**678,261**
Total PW Cost	**2,130,027**	**678,261**

As shown, the present worth cost of offsite disposal is far less than local recycling. Because of the capital constraints facing the District, it is recommended that off site recycling be used. This alternative involves no capital investment by the District. It therefore allows the District to undertake local recycling of biosolids at any time in the future without abandonment of any capital investment.

SECTION 6

SUMMARY OF FINDINGS
AND RECOMMENDATIONS

SECTION 6
SUMMARY OF FINDINGS AND RECOMMENDATIONS

This section summarizes the findings and recommendations of previous sections relating to alternative collection systems, treatment processes and facility sites, and effluent disposal options. These recommendations define the overall recommended project.

COLLECTION SYSTEM

It is recommended that a conventional collection system be constructed rather than the previously recommended STEP/STEG system. This recommendation is based on the following findings:

1. A conventional system is less costly to implement on a total life cycle cost basis. STEP/STEG could have a lower construction cost, but this advantage is negated by its operation and maintenance costs. These costs include the periodic pumping of septic tank solids and the maintenance of the tanks themselves to prevent I/I at the tank.
2. There is a $17 million uncertainty in the construction cost of a STEP/STEG system. That is, the cost of STEP/STEG would be highly dependent upon the number of septic tanks that would need replacement at the start of the project. The construction cost would be between $62.2 and $79.2 million depending on whether none of the tanks were replaced at the project start, or whether they were all replaced.

   Most communities that have implemented STEP/STEG systems have replaced all of their tanks at the start of the project to prevent excessive I/I. However, the condition of the Los Osos tanks is unknown at this time, and therefore it is impossible to reliably estimate the construction cost of this alternative.
3. A conventional system would eliminate the disruption to property owners associated with the periodic pumping of septic tank solids required with a STEP/STEG system. Residents at several public meetings cited this advantage.
4. A conventional collection system provides the greatest hydraulic capacity reserve because of the larger diameter pipes used. The small diameter pipes of a STEP/STEG system make it critical that I/I is prevented at the septic tanks.
5. A conventional system would allow property owners to extend their dwellings over the area currently occupied by the septic tank and leach fields. This is an advantage to the numerous owners of small lots in the community.

TREATMENT PROCESS AND FACILITY SITE

It is recommended that a hybrid treatment system be constructed at the Tri W site. This system would be an extended aeration treatment facility that is covered and odor scrubbed. The treatment process would also include filtration and UV disinfection. The aeration basins would be covered in a manner that would allow recreational development on top of the basins. Other treatment processes would be within building structures that are covered and odor scrubbed. These buildings would be architecturally treated to a theme acceptable to the community.

A potential site development plan incorporating these features is shown in Figure 6-1. This plan was developed by the SWA Group and the District with community input during several public meetings.

The treatment process and facility site recommendations are based on the following findings:

1. Siting of a hybrid facility at the Tri W site would provide the community with much of the amenity that it sought with the previously recommended pond system. Parkland would be provided at a central location that it is readily accessible by most members of the community.
2. An extended aeration process has a proven performance record in meeting the tentative discharge requirements of WDR 97-8. This record would promote approval by the RWQCB and SWRCB for the project.
3. The level of treatment provided by the extended aeration process would also meet Title 22 requirements, which would allow the community to recycle the treated effluent. This goal was strongly held by the community.
4. The cost of the hybrid alternative at the Tri W site is relatively reasonable. It is 23 percent less costly (on a total life cycle cost basis) than the advanced wastewater treatment pond, and was 10 percent more costly than the least costly alternatives. However, the least costly alternatives were not acceptable because they would not provide accessible park space, and could cause odors and visual impacts to the community.

DISPOSAL

It is recommended that new leach fields be constructed in the areas shown in Figure 6-2 to dispose of the treated effluent from the plant. The effluent conveyed to each of these sites would meet Title 22 requirements, which would allow effluent recycling in the community. Areas in close proximity to the distribution mains supplying each of these leach fields would be the areas of first opportunity. As shown in the figure, these areas of first opportunity cover a large area of the community.

The recommendation for effluent disposal is based on the following findings:

1. Leach field disposal provides sufficient capacity to dispose of all of the effluent produced by the treatment facility.
2. Leach field disposal provides reuse opportunities throughout large areas of the community and retains all effluent within the watershed. This concept is extremely important to the community.
3. Leach field disposal mimics the existing septic tank practice, but with low nitrate, filtered, disinfected effluent that would protect the ground water and meet regulatory requirements.
4. Leach field disposal is acceptable to regulatory agencies and avoids the need for lengthy new studies associated with surface discharge that would jeopardize the District's ability to meet the RWQCB's Time Schedule Order No. 00-131.

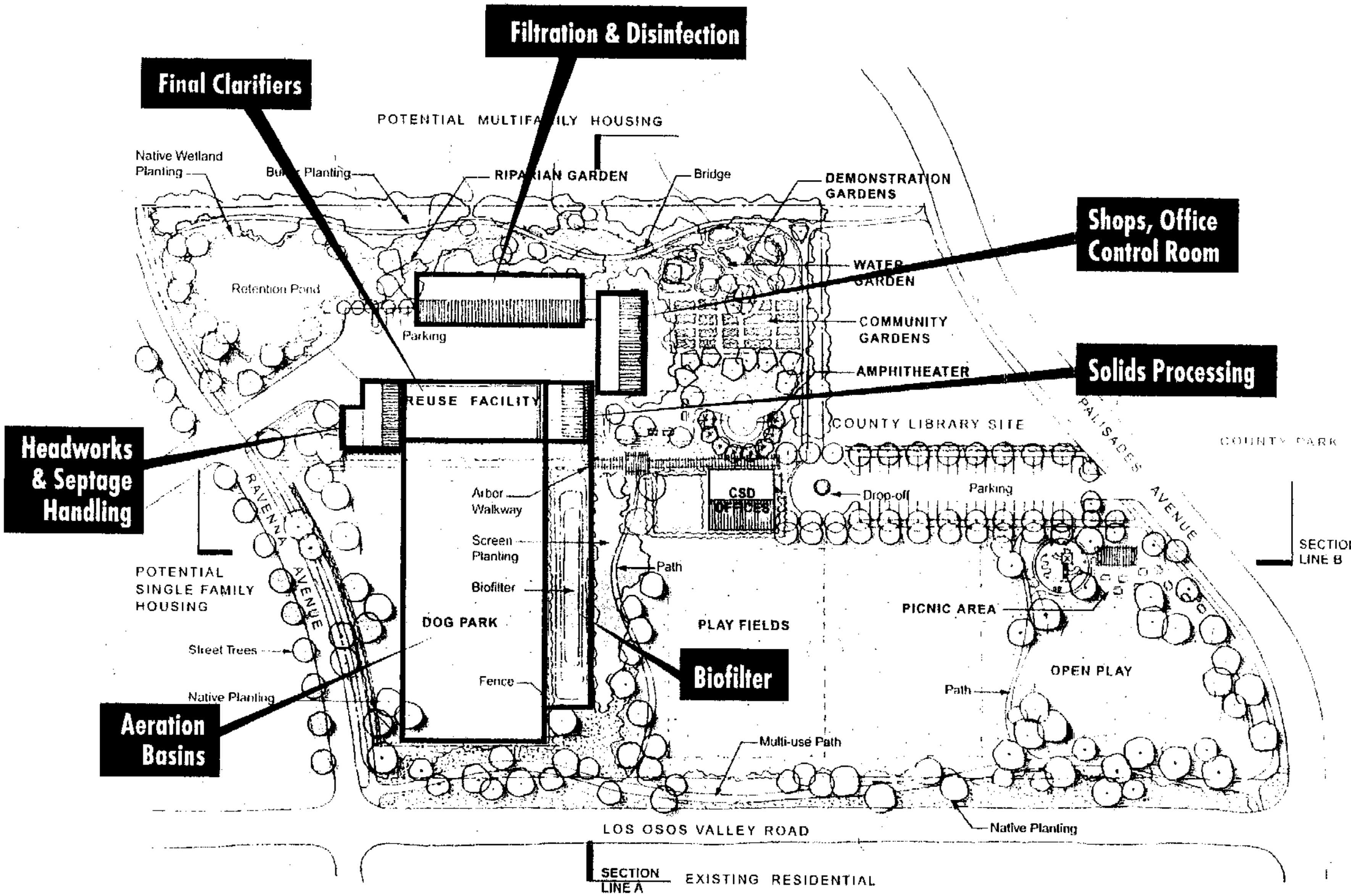


Figure 6-1. Conceptual Site Plan for Treatment Facility Site

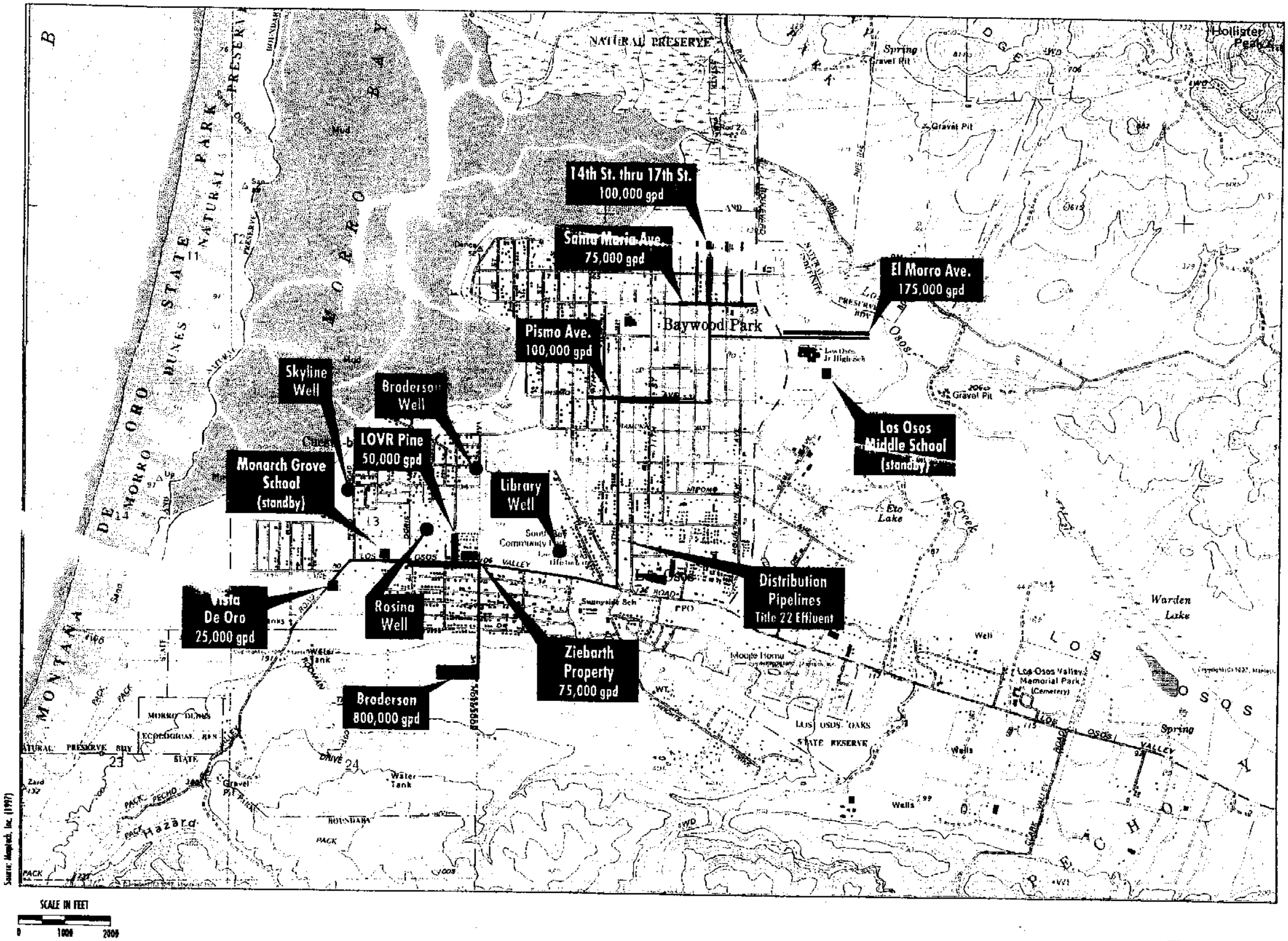


Figure 6-2. Effluent Disposal Sites

It is recommended that biosolids from the treatment facility be transported to an off-site facility for recycling/composting. This recommendation for biosolids disposal/recycling is based on the following findings:

1. Off-site disposal/recycling requires no capital investment by the District.
2. The high quality of the biosolids from the facility makes it likely that off-site recyclers would accept the biosolids for composting or recycling. As noted in Section 1, recycling is a community value.
3. Off-site disposal does not preclude the District from future local recycling or composting of the community's biosolids.

SECTION 7
PROJECT DESCRIPTION

SECTION 7
PROJECT DESCRIPTION

This section provides a summary of the recommended wastewater project for the community of Los Osos. Based on the findings contained in this report, it is recommended that the District implement a conventional collection system to convey wastewater to a hybrid treatment facility at the Tri W site. It is also recommended that the facility's treated effluent be conveyed to a series of leach fields, located throughout the community, for disposal. Following is a description of the project's major components.

FLOWS AND LOADS

This project would be designed to collect, treat, and dispose of the flows from the equivalent of 18,428 persons. This is the build-out population of the community, which would be reached in 2020.

The wastewater flow that would be generated by this population is estimated to be approximately 1.3 mgd, average dry weather flow. The peak wet weather flow to be received in a 24-hour period is estimated at 1.6 mgd.

The community is nearly all residential, with some small commercial loads, and virtually no industrial loads. The BOD and suspended solids concentrations were therefore assumed to be 260 mg/l each, and the ammonia concentration was assumed to be 30 mg/l. The loadings resulting from these concentrations are presented in Table 7-1.

Table 7-1. Solids Loading for Treatment

Parameter	Amount	Units
Flow		
Average Daily	1.3	mgd
Peak Daily	1.6	mgd
Influent Load		
Avg Daily BOD	260	mg/l
Avg Daily BOD Load	2,800	lbs/d
Peak Daily BOD	330	mg/l
Peak Daily BOD Load	3,600	lbs/d
Avg Daily Ammonia	30	mg/l
Avg Daily Ammonia Load	325	lbs/d
Peak Daily Ammonia	40	mg/l
Peak Daily Ammonia Load	434	lbs/d
Septage BOD		
Septage BOD	10,000	mg/l
Avg Daily BOD	250	gpd
Peak Daily BOD	1,000	gpd
Avg Septage BOD Load	21	lbs/d
Peak Septage BOD Load	83	lbs/d

Table 7-1. Solids Loading for Treatment (continued)

Parameter	Amount	Units
Septage Ammonia		
Avg Daily Ammonia	150	mg/l
Peak Daily Ammonia	200	mg/l
Avg Septage Ammonia Load	0	lbs/d
Peak Septage Ammonia Load	2	lbs/d
Total Load		
Avg BOD Load	2,820	lbs/d
Peak BOD Load	3,680	lbs/d
Avg Ammonia Load	326	lbs/d
Peak Ammonia Load	435	lbs/d

COLLECTION SYSTEM

A preliminary layout of the collection system is shown on the following page in Figure 7-1. The major components of this system are summarized in Table 7-2.

Table 7-2. Recommended Collection System Components

Item	Description
Number of connections	4,774
Length of collection sewers	169,000 ft
Length of sewer mains	35,000 ft
Number of pump stations	10
Predominant sewer diameter	8 inch
Pipe material	PVC

The pump stations would be submersible pumps located in pre-cast concrete vaults. Two pumps would be provided, one duty, one standby. These vaults are estimated to be approximately 8 feet wide by 12 feet long. Depth of the stations is estimated to be 18 feet or less. The stations would be located in public rights of way that have low levels of traffic.

Each pump station would have engine generators to provide back-up power. The generators would be above ground and within a small structure. Siting of the generators would require purchasing land near each pump station.

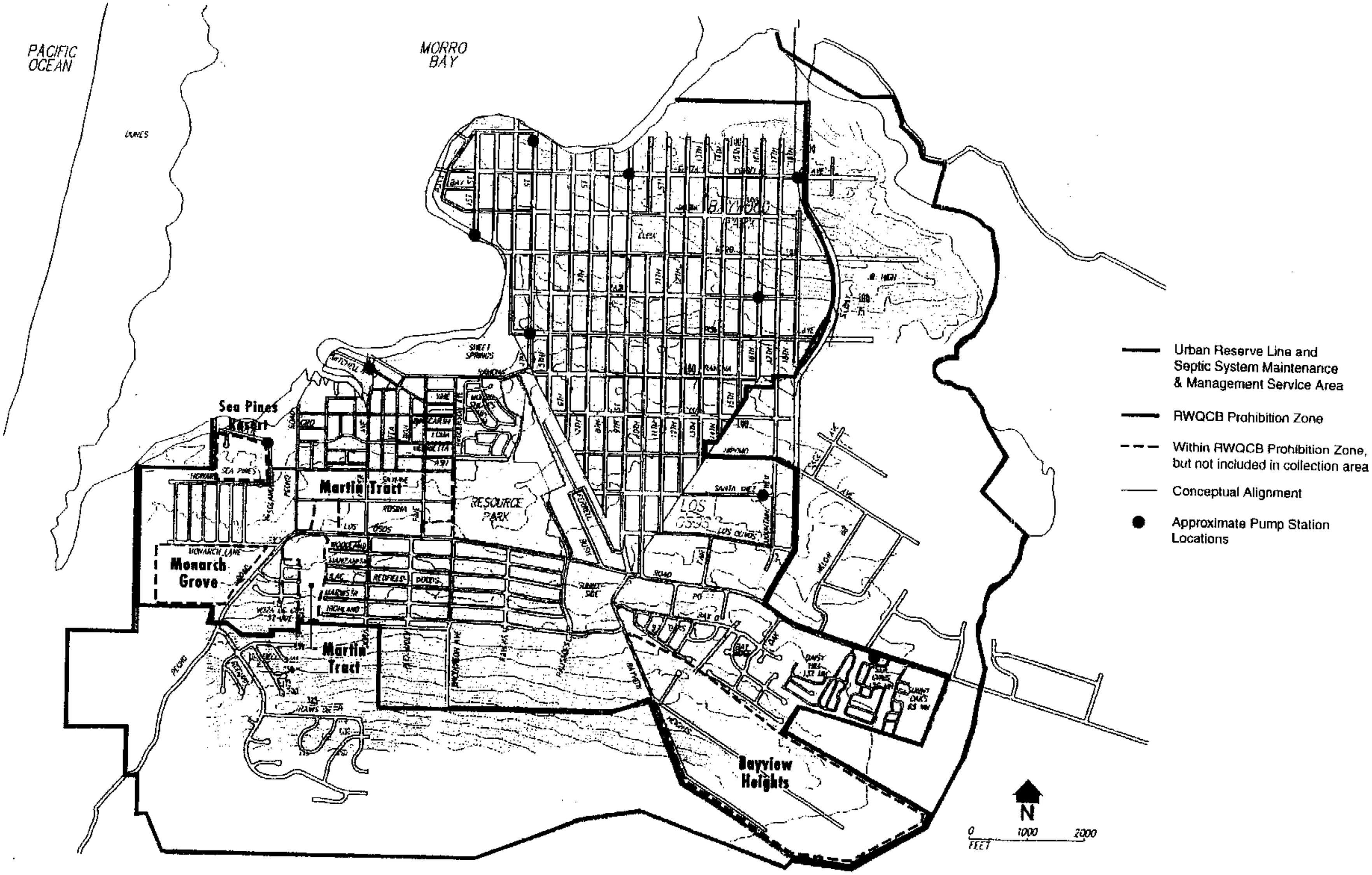


Figure 7-1. Conceptual Wastewater Collection System

TREATMENT FACILITY

The treatment facility would be composed of ten major components. Each of these components is described below. The costs associated with the recommended treatment process are contained in Appendix I.). The processing and loading criteria for the treatment facility are summarized in Table 7-3 on pages 7-9 and 10.

Headworks. The headworks facility would consist of influent pumping and grit removal equipment. The structure would include a below grade structure approximately 30 feet square, and 15 to 20 feet deep. It would be contiguous with the aeration basis and therefore covered and odor scrubbed with that facility. The headworks would likely consist of two 10 hp pumps, some ventilation fans, and electrical panels.

Septage Handling Facility. The septage handling facility would be a below grade concrete structure approximately 20 ft by 20 ft. A truck would off-load septage into the underground tankage. The tankage would be connected to odor control ventilation . Odors would be conveyed to the biofilter. It is not envisioned that there would be mechanical equipment or chemical use at this facility.

Extended Aeration Basins. The two basins would be located below grade. Each basin would be about 80 ft by 320 ft square, with a less than 15 ft water depth. The basins would be aerated with submerged fine bubble diffusers or surface aerators. The contents of the basin would be a mixed liquor activated sludge. If submerged diffusers were used there would be piping from the blower building to the basins. If surface aerators were used, probably about four 15 hp units per basin would be required. There would not be chemical use in the aeration basins. The basins would be fully covered and odor scrubbed. They would be constructed to allow recreational use of the roof of the structures, which would be located at close to grade elevation.

Clarifiers. Two secondary clarifiers would be provided, each about 75 feet diameter. The clarifiers would be partially above grade about 3 to 10 ft and would have a water depth of 12 to 15 feet. They would be enclosed within a roofed building. The roof would be designed so that it could be removed periodically to allow crane access to the scrapper mechanisms.

Filters. The filter would consist of a partially buried structure approximately 25 ft by 25 ft. The structure would be roofed and fully enclose the filters and mechanical equipment. Depending on the type of filter, the following equipment could be associated with these units: influent feed pumps, air scour blowers, and backwash pumps. The size of this equipment would likely be less than 15 hp each. A filter coagulant aid such as alum and/or polymer would be used. Approximately 300 pounds of alum would be used per day.

UV Disinfection. The UV disinfection system would consist of a partially buried concrete structure consisting of a channel 4 ft wide by 50 ft long with UV lamp banks. The UV equipment would likely consist of 3 or 4 UV lamp banks with a total power draw of 25 kw. A mild solution of 5% phosphoric acid would be used to clean mineral deposits from the lamp. This facility would be immediately adjacent to the filters and would be enclosed within a roofed building.

UV disinfection is recommended over chlorine based disinfection for the following reasons:

- On a present worth basis, UV disinfection is approximately 18 percent less costly. Detailed costs associated with a UV disinfection system are contained in Appendix I.
- UV disinfection requires a smaller foot print for siting because it does not need a contact chamber.
- UV disinfection does not create disinfection by-products such as THMs and thereby avoids concerns associated with these products.
- UV disinfection does not use toxic chemicals, which would be of public concern given the central location of the recommended site.

Solids Processing. Processing of the biosolids generated in the plant would occur in a two story building that includes biosolids pumping, biosolids thickening, biosolids stabilization, biosolids dewatering and biosolids cake loading and storage. The estimated size of this building is 40 ft by 100 ft. A representative list of equipment is as follows:

- six biosolids pumps
- two gravity belt thickeners
- two biosolids digestion tanks
- two belt filter presses
- one biosolids cake conveyor
- one biosolids storage bin
- one polymer feed system

The estimated quantity of biosolids produced at the facility would be approximately 1,830 pounds per day (dry weight basis) of dewatered biosolids cake. This would equate to approximately 2 truckloads per week. Because the community is nearly all residential, the quality of the biosolids would likely be very acceptable to outside biosolids recyclers.

Odor Control. Foul odors from the plant would be scrubbed in a biofilter, which would be a raised bed of sand or compost covering an air distribution system. The bed would be about 5 feet high and cover approximately 3,000 ft^2.

Operations Building. This structure would likely be a single story building covering a total of approximately 2,500 ft^2 that includes the following components:

- control room - 300 ft^2
- laboratory - 400 ft^2
- restrooms, showers and lockers - 400 ft^2
- maintenance shop - 500 ft^2

- spare parts room - 300 ft^2
- office space - 300 ft^2
- library/meeting room - 300 ft^2

Electrical Building. The electrical building would house the facility's electrical service including transformer and switchboard. The building would be single story and occupy approximately 400 ft^2.

Aesthetic Mitigation. As currently envisioned, the treatment facility structures would occupy a total of approximately 6 acres of the 11-acre Tri W site. The remainder of the site would be available for development as a park or buffer zone. A conceptual site plan for the recommended treatment facility has been developed with public input and is shown on the following page in Figure 7-2. Cross-sectional views of the site plan are provided to show how the facility would look from the east (Figure 7-3) and from the south (Figure 7-4).

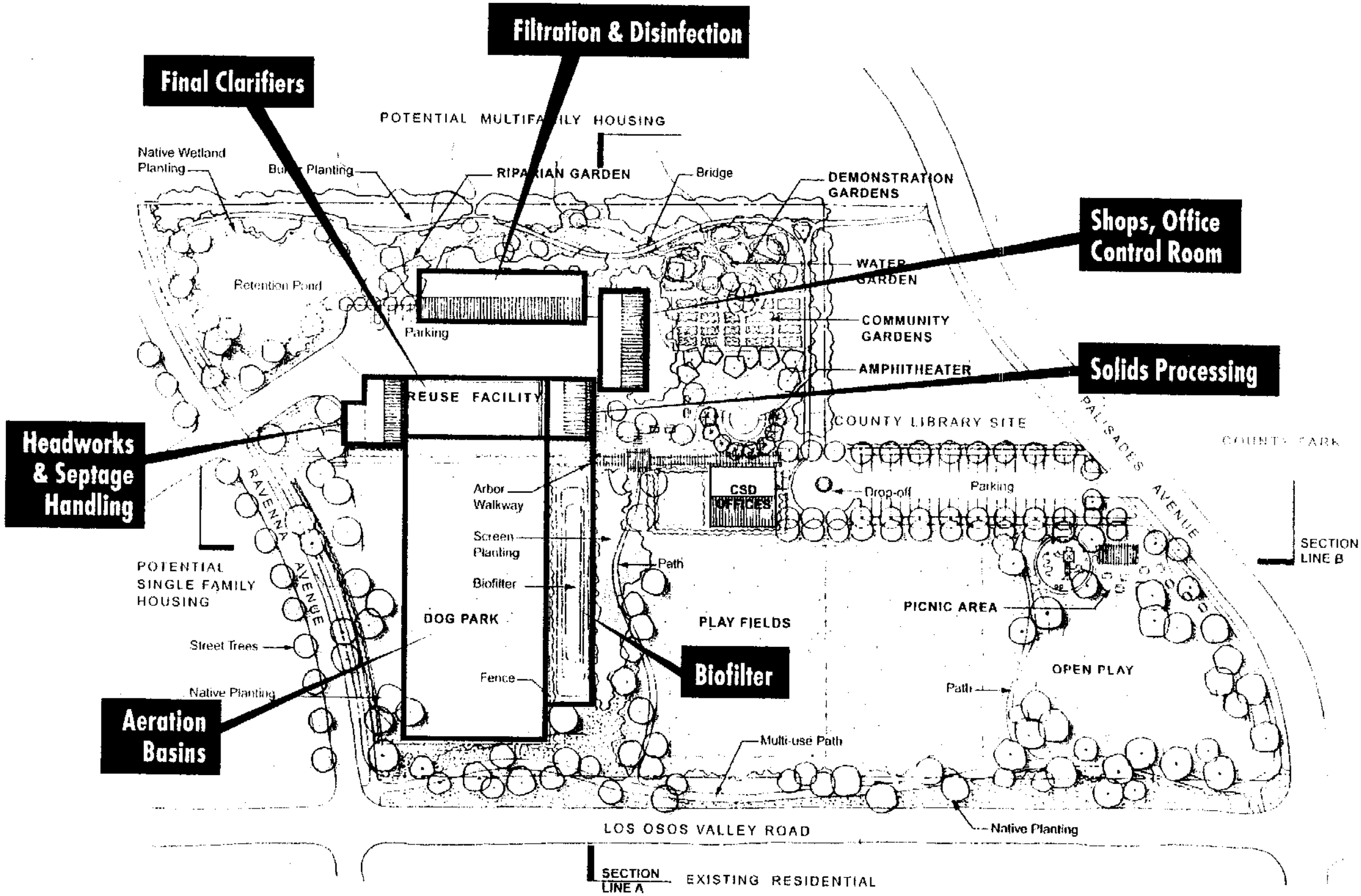


Figure 7-2. Conceptual Site Plan for Treatment Facility Site

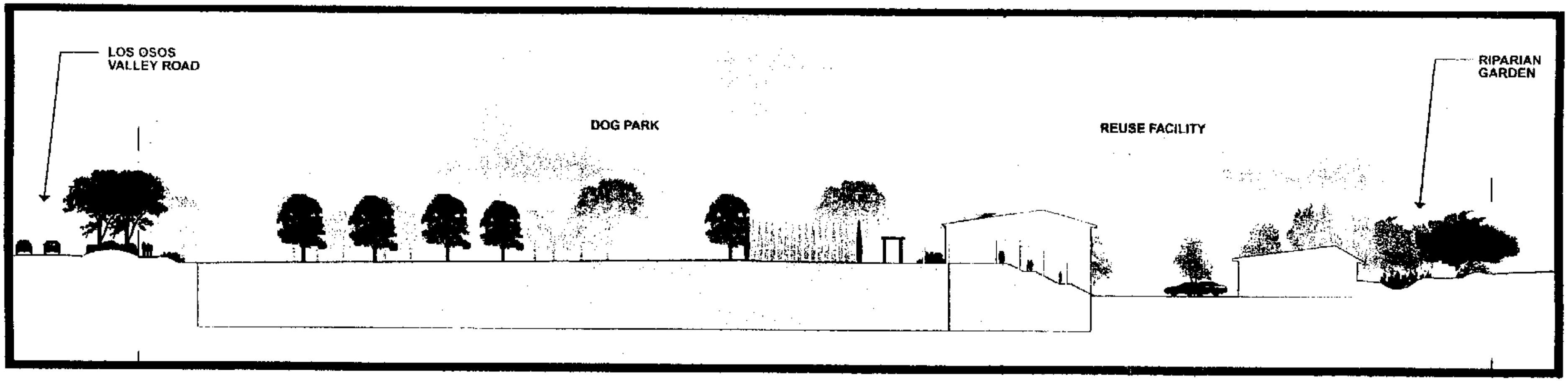


Figure 7-3. Section View A

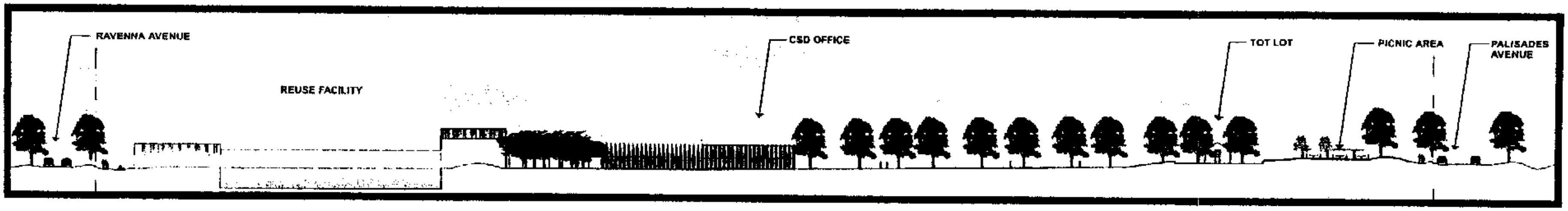


Figure 7-4. Section View B

Table 7-3. Processing and Loading Criteria

Sizing Criteria	Quantity	Units	Comment
	Extended Aeration Basins		
Number of Basins	2	ea	
Solid Flux	6	lbs/d/1000cf	
Basin Volume (each)	1,499,796	gal	V= BOD*1000/SF*7.48/2
Sidewater Depth	12	ft	
Basin Size	129	ftxft	
Hydraulic Retention Time	1	day	Assumes 100% recycle flow
Solids Inventory	76,143	lbs	MLSS in lbs@3000 mg/l
Solids Residence Time	42		SRT=MLSS in lbs/WAS in lbs/d
	Aeration		
Average Oxygen Demand	4,300		1lbO/lbBOD+4.6lbO/lbNH3
Peak Oxygen Demand	5,700	lbs/d	1lbO/lbBOD+4.6lbO/lbNH3
Average Aeration Rate	2,300	scfm	BOD/.23/0.075/1440/0.075
Peak Aeration Rate	3,060	scfm	BOD/.23/0.075/1440/0.075
Aeration Rate	4,400	scfm/mgd	
Aeration Capacity	5,720	scfm	
Number of Blowers	3	ea	Two duty
Blower Capacity (each)	2,000	scfm	
Blower Pressure	8	psi	
Blower Horsepower (each)	104	hp	
Blower Drives	VFD		
	Secondary Clarifiers		
Average Flow	1.3	mgd	
Recycle Flow	1	mgd	Assumes 75%
Overflow Rate	300	$gal/ft^2/d$	
Clarifier Diameter	53	ft	
Sidewater Depth	14	ft	
	Filters		
Number	3	ea	
Loading Rate	5	gpm/sf	AverageFlow 1 unit out of service
Cell Surface Area	90	sf	
	UV Disinfection		
Dose	100,000	mwsec/cm2	
Number of Lamps	256		
Number of Banks	4	ea	One redundant bank
	Odor Control		
Headworks	2,000	cfm	
Solids Building and Aeration	4,000	cfm	
Biofilter Loading Rate	2	cfm/ft^2	
Biofilter Area	3,000	ft^2	

Table 7-3. Processing and Loading Criteria (continued)

Sizing Criteria	Quantity	Units	Comment
	Solids Processing		
Solids Yield	0.65		lbs/lb BOD
Solids Production	1,830	lbs/d	
RAS/WAS MLSS	15,000	mg/l	
WAS Flow	14,628	gpd	WAS Q = solids Prod/WAS MLSSx 8.34
GBT Operation	4	hrs/d	
GBT Flow	61	gpm	
GBT Width	1	m	
GBT Hydraulic Loading	122	gpm/m	
GBT Number	2	ea	One Duty
Thickened Sludge	4	%	
Thickened Sludge Flow	5,486	gpd	Solids Prod*(100lbw/TS%lbs)*1 gal/8.34lbw
Aerobic Digestion SRT	15	days	
Aerobic Digestion Volume	82,284	gal	
Aerobic Digestion Rate	50	scfm/1000cf	
Aeration Rate	550	scfm	
Belt Press Flow	27	gpm	Assumes 24 hrs/ wk dewatering
BFP Width	1	meter	
BFP Loading	53	gpm/m	
Sludge Cake	5.7	wet tons/day	Assumes 16% cake

Notes:
Filter type is Dynasand.
UV Disinfection is low pressure.
Odor control type is biofilter.

DISPOSAL

Constructed leach fields would be used to dispose of the treated effluent. The locations of these fields are shown in Figure 7-5 on the following page. Flow would be conveyed to these sites via pipelines of 2 to 8 inch diameter, depending on the total flow to be conveyed. The disposal capacity at each site is summarized below in Table 7-4.

Table 7-4. Leach Field Disposal Capacities, Loadings, and Distance to Nearest Municipal Well

Site	Area (ft^2)	Disposal Capacity (gpd)	Hydraulic Loading (inches/minute)	Approximate Distance to Nearest Municipal Well (ft)
Westside				
Broderson Site	300,000	800,000	0.003	600
Los Osos Valley Rd/ Pine St	48,000	50,000	0.003	550
Ziebarth Property	86,000	75,000	0.003	700
Vista de Oro	16,000	25,000	0.002	800
Monarch Grove Elementary School	43,560	stand by		400
Eastside				
Pismo Avenue	108,000	100,000	0.001	1,200
Santa Maria Avenue	68,000	75,000	0.001	1,500
14th Street thru 17th Street	56,000	100,000	0.002	1,500
El Morro Avenue	87,000	175,000	0.002	3,000
Los Osos Middle School	20,000	stand by		3,400
Total		**1,400,000**		

A firm disposal capacity of 1.4 mgd is provided, plus standby capacity at five sites. The capacity of 1.4 mgd represents the average daily flow averaged over a year. That is, peak daily flows in resulting from wet weather conditions can be accommodated at these sites. Effluent reuse during dry months would further lessen the annual average volume disposed of at these sites, providing even further reserve the wet weather flows.

Off-site recycling/composting would be used to dispose of the community's biosolids. The high quality of the biosolids makes it likely that off-site recyclers would accept the biosolids for composting or recycling. This disposal method requires no capital investment by the District. In addition, it does not preclude the District from locally recycling or composting the biosolids in the future.

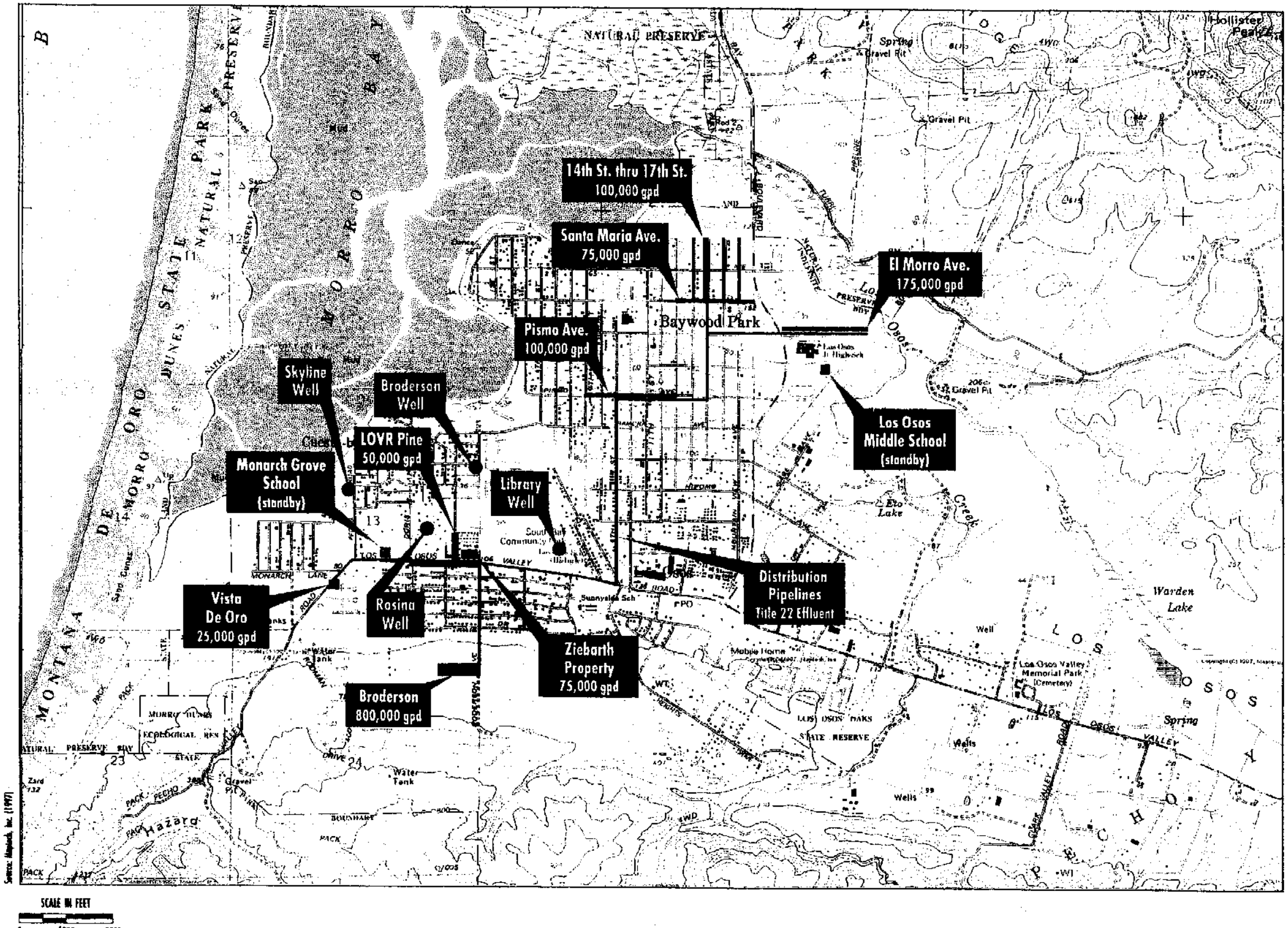


Figure 7-5. Effluent Disposal Sites

SUMMARY OF COSTS FOR THE RECOMMENDED PROJECT

The capital costs of the recommended project are summarized below in Table 7-5. As shown, the estimated construction and design cost of the wastewater facilities is $66.7 million. This amount is in year 2000 dollars; escalating this to year 2003 dollars (the mid point of construction) would increase the cost to $71.4 million. Also shown are the planning study and land purchase costs that would not be subject to this inflation adjustment because they would be incurred within the coming year. The total capital cost to the District for the recommended project is $84.6 million.

Table 7-5. Estimated District Costs of Recommended Project

Item	Estimated Construction/ Purchase Cost ($ millions)	Estimated Design Cost ($ millions)	Estimated Construction & Design Cost ($ millions)	Amount to be SRF Funded ($ millions)	Amount to be Bond Funded ($ millions)
Conventional Collection	37.29	2.98	40.27	36.20	4.07
Hybrid Treatment Facility at Tri W	12.48	1.00	13.48	12.10	1.38
Aesthetic Mitigation at Tri W	2.32	0.19	2.51	2.20	0.31
Leach Fields	9.33	0.75	10.08	9.20	0.88
Groundwater Mitigation	0.3	0.02	0.32	0.30	0.020
Subtotal	**61.7**	**4.9**	**66.7**	**60.0**	**6.7**
Construction Inflation at 1.071	4.38	0.35	4.73	4.26	0.47
Subtotal	**66.1**	**5.3**	**71.4**	**64.3**	**7.1**
Water Conservation	1.2	0	1.2	0	1.2
Planning, Pre-Design, Studies	0	2.5	2.5	1.1	1.4
State Legislative Grant	0	-1.0	-1.0	0	-1.0
Subtotal	**67.3**	**6.8**	**74.1**	**65.4**	**8.7**
Tri W Site Purchase	3.3	0	3.3	0	3.3
Mitigation at Broderson	5.1	0	5.1	0	5.1
Ziebarth Purchase	0.24	0	0.24	0	0.24
Well Site at Broderson ROW	0.4	0	0.4	0	0.4
Cal Cities Highland Well	0.2	0	0.2	0	0.2
Standby Generator Sites/Easements	0.05	0	0.05	0	0.05
Water Tender Fire Truck	0.32	0	0.32	0	0.32
Assessment Contingency	0.9	0	0.9	0	0.9
Subtotal--Land	**10.5**	**0**	**10.5**	**0**	**10.5**
Total	**77.8**	**6.8**	**84.6**	**65.4**	**19.2**

Notes:
Total and subtotal estimates are rounded to the nearest tenth of a million.

Table 7-5 also presents the anticipated sources of funding for the major components of the project. As shown, the majority of project costs are assumed to be funded from the State Revolving Fund, with the remainder being financed through bonds. Land costs are not eligible for financing by the State Revolving Fund and are therefore shown as being financed entirely by bonds. The construction costs are split between the two funding sources. The amount of construction capital shown as being financed via bonds reflects the contingency that the District wishes to have on hand to cover construction change orders. This amount is not eligible for financing by the State Revolving Fund.

The estimated annual operations and maintenance costs for the project are shown below in Table 7-6. As shown in the table, O&M for the recommended project is estimated to total $1.82 million per year. The amount shown for the Capital Replacement Fund is required to be set aside for a period of 10 years, after which it is not required by the State.

Table 7-6. Estimated O&M Cost for the Recommended Project

Item	Estimated Annual O&M Costs ($ millions)
Collection System	0.500
Treatment at Tri W Site	0.498
Disposal Leach Fields	0.18
Water Conservation	0.065
Mitigation Habitat	0.01
District Overhead	0.130
District Billing	0.060
Contingency	0.050
Capital Replacement Fund at 0.5% of SRF Loan	0.33
Total	**1.82**

SECTION 8
PUBLIC PARTICIPATION

SECTION 8
PUBLIC PARTICIPATION

INTRODUCTION

This section describes the history of public participation associated with the development of a wastewater project for the community of Los Osos. A detailed history of the public's involvement in the development of a wastewater project is contained in the *Draft Project Report, January 31, 2000* prepared by Oswald Engineering Associates, Inc. This section provides a summary of the public participation contained in that report and a more detailed description of the public participation during 2000.

BACKGROUND

As described in Section 1, past efforts to implement a wastewater project within the community have failed because of their inability to address local concerns and achieve the community's values. Appendix B contains the *Vision Statement for Los Osos* developed by the Los Osos Community Advisory Council in 1995. It identifies several key community values that are directly related to the development of a wastewater project. These values include:

- Decision-making based on a philosophy of sustainable development
- Managing the watershed in a manner that is consistent with protection of the Morro Bay Estuary
- Holistically managing local water resources to ensure its long-term viability
- Maintaining, managing, and recharging the local aquifer, preventing over-drafting of the aquifer and salt-water intrusion into the water supply
- Managing wastewater, cleansing and restoration to the lower aquifer or upper aquifer with pumping from upper aquifer for domestic use
- Reclaiming and conserving local water resources
- Developing a wastewater treatment facility based on a natural biological process rather than a mechanical system approach to the highest extent possible
- Creating a wastewater treatment facility that is a visual and recreational asset to the community, provides water for irrigation, agriculture, and habitat for wildlife
- Creating a wastewater project that is affordable to the community

To make sure these values were reflected in the wastewater project, the citizens of Los Osos formed their own local body of government, the Los Osos Community Services District, on November 3, 1998. Residents overwhelmingly supported the formation of the District when a 75% voter turnout generated an 87% approval rate.

The District is responsible for providing a variety of community services including wastewater management, flood control, fire protection, and a portion of the community's drinking water supply. The District is governed by a five member Board of Directors, who serve four year terms. The Board receives recommendations regarding the wastewater project from the Wastewater Committee. The Committee is composed of seven members who have knowledge of wastewater issues and an appreciation of local community values.

PUBLIC OUTREACH

The District is committed to providing information on the development of the wastewater project to the public. Each month, the District holds numerous public meetings to discuss the project. Some of these meetings are videotaped for broadcast on the District's public access channel to provide the greatest possible opportunity for public participation. In addition, the District publishes the *Bear Pride Newsletter*, which is mailed quarterly to every resident and out of District property owner. Following is a description of the public meetings held by the District in 2000 and 2001.

The Board held 39 public meetings in 2000 and 2001. The specific dates of these meetings are as follows:

- January 6, 20, and 25
- February 3, 12, and 17
- March 2, 16, and 30
- April 6, 10, 17, and 20
- May 4 and 18
- June 1, 15, and 9
- July 6, 7, and 20
- August 3, 4, 16, and 17
- September 5, 6, 7, 13, and 21
- October 5, 19, and 27
- November 2, 15, and 16
- December 7, 20, and 21
- January 4, 18, and 23
- February 1, 15, and 21
- March 1

These Board meetings were televised and broadcast numerous times to the public via the local community channel. During these meetings, the public was invited to provide verbal comments to the Board, prior to the Board voting on a particular issue. The minutes of every Board meeting were recorded by the Executive Secretary and made available to the public at the District office and on the District's website.

To ensure continued public participation in future Board meetings the following meeting dates have been scheduled in 2001:

- March 15
- April 5 and 19
- May 3 and 17
- June 7, 21, and 28

In addition to the Board meetings identified above, the District's Wastewater Committee held 28 public meetings in 2000 and 2001. The specific dates of these meetings were as follows:

- January 12 and 25
- February 9 and 22
- March 8 and 28
- April 12 and 25
- May 10 and 23
- June 14 and 27
- July 12 and 25
- August 9 and 22
- September 13 and 26
- October 11 and 24
- November 8 and 28
- December 13 and 26
- January 10 and 23
- February 14 and 27

During these meetings, the Committee received public comment prior to voting on an issue. The minutes of every Committee meeting were recorded by the General Manager and made available to the public at the District office.

To ensure continued public participation in future Committee meetings, the following meeting dates have been scheduled in 2001:

- March 14 and 27
- April 11 and 24
- May 9 and 22
- June 13 and 26

In addition to the Board and Wastewater Committee meetings, the District plans to expand its public involvement efforts in 2001. The District has hired a consulting firm that specializes in public involvement to develop a strategy for educating and informing the residents about the project.

PUBLIC INPUT

The residents of Los Osos are very interested in the development of a wastewater project for the community. The wastewater project is a very personal issue to many residents. With few exceptions, each resident operates and maintains his/her own septic tank and leach field on his/her own property. Any change to this existing practice will have a direct impact on almost every resident. As a result, the public has closely watched the development of the wastewater project and has provided valuable input to both the Board and Committee.

The community of Los Osos is made up of individuals with diverse perspectives. As a result, the wastewater project is viewed differently by each member of the community. During the course of public meetings over the past year, the community expressed three distinct views of the wastewater project. These views are critical to understanding both the history and future of a wastewater project in the community.

Some members of the community view the wastewater project as an opportunity to provide the community with a visual and recreational amenity that treats wastewater in an environmentally sound and affordable manner. This view is based on the idea that a wastewater project will solve many problems in the community by providing accessible park space, creating a visually pleasing center to the community, and preventing further groundwater contamination. It is believed that the multi-use nature of the project will serve as a model for other communities.

Some members of the community view the wastewater project as a way to bring an end to the building moratorium placed on the community in 1988. This view is based on the idea that some individuals bought land in Los Osos many years ago for their retirement. It is believed that some of these individuals suffered a financial hardship because the building moratorium prevented them from building on their property.

Some members of the community are opposed to any change to the existing septic tank practice. This view is based on the idea that the project will result in tremendous growth and development in Los Osos that has been prevented by the building moratorium. It is believed that this growth and development will bring an end to the small town feel of the community.

RESPONSE TO PUBLIC INPUT

The District has strived to create a wastewater project that addresses the public's concerns and reflects the community's values. The wastewater project described in Section 7 represents years of working with the community and regulatory agencies and results from a comprehensive analysis of wastewater treatment alternatives for the community. Public input has had a direct impact on the development of the wastewater project.

As a result of public input, the treatment facility will be designed to maximize park space and blend with the visual character of the community. Its unique use of space and location in the center of the community will serve as a model for other communities. In addition, the facility will prevent further groundwater contamination and bring an end to the building moratorium. Although, the project will not prevent future development and growth in the community, it will return decisions about growth and development to local officials rather than the RWQCB.

Public participation in the future will be critical to ensure that the wastewater project ultimately achieves the community's values.

SECTION 9
REFERENCES

SECTION 9
REFERENCES

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APPENDICES

APPENDIX A

RWQCB RESOLUTIONS AND ORDERS

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

RESOLUTION NO. 83-13

Revision and Amendment of Water Quality Control Plan by the Addition of a Prohibition of Waste Discharge from Individual Sewage Disposal Systems Within the Los Osos/Baywood Park Area, San Luis Obispo County

WHEREAS, the California Regional Water Quality Control Board, Central Coast Region (hereafter Regional Board), adopted the Water Quality Control Plan for the Central Coastal Basin (hereafter Basin Plan) on March 14, 1975; and,

WHEREAS, the Regional Board, after notice and public hearing in accordance with Water Code Section 13244, periodically revises and amends the Basin Plan to ensure reasonable protection of beneficial uses of water and prevention of pollution and nuisance; and,

WHEREAS, in protecting and enhancing water quality, the Basin Plan specifies certain areas where the discharge of waste, or certain types of waste, is prohibited; and,

WHEREAS, Article 5, Chapter 4, Division 7, of the California Water Code defines criteria for such prohibition areas (Section 13240 et seq.); and,

WHEREAS, Los Osos/Baywood Park is an unincorporated community, with a 1980 population of 10,933 persons located south of the City of Morro Bay, in San Luis Obispo County; and,

WHEREAS, current zoning will accommodate a population in excess of 27,000 people and an average residential lot size of about 6600 ft^2; and,

WHEREAS, on-site soil absorption or evapotranspiration systems are the sole means of wastewater disposal in the Los Osos/Baywood Park area; and,

WHEREAS, the Los Osos/Baywood Park area soil permeability is rapid and there are substantial areas with high groundwater; and,

WHEREAS, the majority of lots are too small to provide adequate dispersion of individual sewage disposal system effluent; and, WHEREAS, the San Luis Obispo County Environmental Health Department has provided documentation concerning the problem of liquid waste disposal in the Los Osos/Baywood Park area; and,

WHEREAS, the County of San Luis Obispo is preparing an environmental impact report (EIR) in accordance with the California Environmental Quality Act and a project report that identifies adverse environmental impacts from continued use of septic tanks in the Los Osos/Baywood Park area and discusses alternatives to existing wastewater management practices; and,

WHEREAS, "Los Osos-Baywood Park/Phase I Water Quality Management Study" cites conditions which constitute contamination and pollution as defined in Section 13050 of the California Water Code; and,

WHEREAS, chemical analyses of wells in Los Osos/Baywood Park indicates 38% of the shallow wells tested in the Phase I study, taking water from the Old Dune Sands deposits portion of the qauifer, contain nitrate concentrations which exceed State Health Department Drinking Water Standards of 45 milligrams per liter; and,

WHEREAS, bacterial analyses of 42 wells tested in the Phase I study resulted in 26 wells indicating total coliform in violation of State Health Drinking Water Standards, and 2 wells indicating fecal coliform in violation of Basin Plan limits for groundwater; and,

WHEREAS, surface water bacterial analyses tested in the Phase I study indicated total and fecal coliform levels exceeding Basin Plan recommended limits for water contact recreation (REC-1); and,

WHEREAS, a letter from the California Health and Welfare Agency, Department of Health Services, states their concerns regarding the high nitrate levels in the waters of Los Osos/Baywood Park area, and recommends adequate measures be taken to correct the nitrate problems to bring the waters into compliance with California Drinking Water Standards; and,

WHEREAS, a letter from the San Luis Obispo County Health Agency Director cites violation of the public health limit for nitrates and recommends elimination of shallow groundwater usage and adoption of a discharge prohibition; and,

WHEREAS, the Regional Board is obligated to include a program of implementation for achieving water quality objectives in its Basin Plan; and,

WHEREAS, present and anticipated future beneficial uses of Los Osos/Baywood Park creeks include recreation and aquatic habitat; and, WHEREAS, Los Osos Basin groundwaters are suitable for agricultural, municipal, domestic, and industrial water supply; and,

WHEREAS, a Regional Board staff report finds beneficial uses of Los Osos ground and surface waters are adversely affected by individual sewage disposal system discharges, there appears to be a trend of increasing degradation, and public health is jeopardized by occurrences of surfacing effluent; and,

WHEREAS, drafts of proposed revisions and amendments of the Basin Plan, prohibiting discharges from Los Osos/Baywood Park individual sewage disposal systems, have been prepared and provided to interested persons and agencies for review and comment; and,

WHEREAS, Regional Board staff has prepared documents and followed appropriate procedures to satisfy the environmental documentation requirements of both the California Environmental Quality Act, under Public Resources Code Section 21080.5 (Functional Equivalent), and the Federal Clean Water Act of 1977 (PL 92-500 and PL 95-217), and the Regional Board finds adoption of this prohibition area will not have a significant adverse effect on the environment; and,

WHEREAS, on September 16, 1983, in the San Luis Obispo City Council Chambers, 990 Palm Street, San Luis Obispo, California, after due notice, the Regional Board conducted a public hearing at which evidence was received pursuant to Section 13281 of the California Water Code concerning the impact of discharges from individual sewage disposal systems on water quality and public health; and,

WHEREAS, pursuant to Section 13280 of the California Water Code, the Regional Board finds that discharges of wastes from new and existing individual disposal systems which utilize subsurface disposal in the affected area will result in violation of water quality objectives; will impair beneficial uses of water; will cause pollution, nuisance, or contamination; and will unreasonably degrade the quality of waters of the State; and,

WHEREAS, the Regional Board finds the aforestated conditions in need of remedy to protect present and potential beneficial uses of water and to prevent pollution and nuisance.

NOW, THEREFORE, BE IT RESOLVED, that the Water Quality Control Plan, Central Coastal Basin, be amended as follows:

Page 5-66, after Item 7, following the legal description for Pasatiempo Pines (added by Resolution 83-09), insert the following prohibitions:

"8. Discharges of waste from individual and community sewage disposal systems are prohibited effective November 1, 1988, in the Los Osos/ Baywood Park area, and more particularly described as:

"<u>Groundwater Prohibition Zone</u>

(Legal description to be provided for area prescribed by Regional Board).

"Failure to comply with any of the compliance dates established by Resolution 83-13 will prompt a Regional Board hearing at the earliest possible date to consider adoption of an immediate prohibition of discharge from additional individual and community seware disposal systems."

Discharges from individual or community systems within the prohibition area in excess of an additional 1150 housing units (or equivalent) are prohibited, commencing with the date of State Water Resources Control Board approval.

BE IT FURTHER RESOLVED, that the above area is consistent with the recommendations of the staff report as shown on "Attachment A."

BE IT FURTHER RESOLVED, that the Regional Board does intend standard exemption criteria, first paragraph of Page 5-67 of the Basin Plan, to apply to this action.

BE IT FURTHER RESOLVED, that compliance with the above prohibition of existing individual or community sewage disposal systems shall be achieved according to the following time schedule:

Task	Compliance Date
Begin Design	November 1, 1984
Complete Design	November 1, 1985
Obtain Construction Funding	December 1, 1985
Begin Construction	April 1, 1986
Complete Construction	November 1, 1988

BE IT FURTHER RESOLVED, that reports of compliance or noncomplia schedules shall be submitted to the Regional Board within 14 days following each scheduled date unless otherwise specified, where noncompliance reports shall include a description of the reason, a description and schedule of tasks necessary to achieve compliance, and an estimated date for achieving full compliance.

BE IT FURTHER RESOLVED, the County will continue a monitoring program, approved by the Regional Board staff, that will monitor ground water quality within the prohibition boundaries as set forth in this resolution, and also a monitoring program which covers areas outside the prohibition boundaries but within the urban reserve line as shown in Attachment A.

BE IT FURTHER RESOLVED, that the Regional Board has determined this action will not have a significant adverse impact on the environment and the Executive Officer of the Regional Board is hereby directed to file a Notice of Decision to this effect with the Secretary of the Resources Agency.

BE IT FURTHER RESOLVED, that the State Water Resources Control Board is hereby requested to amend forthwith the Clean Water Grant Project Priority List to recognize the necessary structural solution for Los Osos/Baywood Park as a Priority "A" project.

BE IT FURTHER RESOLVED, that if the Board holds a hearing and adopts an immediate prohibition as described above, the prohibition is effective as of the date the Regional Water Quality Control Board adopts a prohibition of discharge from additional individual and community sewage disposal systems.

BE IT FURTHER RESOLVED, the Executive Officer of the Regional Board is hereby directed to submit this revision of the Basin Plan to the State Water Resources Control Board for approval pursuant to Section 13245 of the California Water Code.

BE IT FURTHER RESOLVED, upon approval by the State Water Resources Control Board, Chapter 5 of the Water Quality Control Plan is revised by the addition of the above prohibition.

I, KENNETH R. JONES, Executive Officer of the California Regional Water Quality Control Board, Central Coast Region, do hereby certify the foregoing is a full, true, and correct copy of a Resolution adopted by the California Regional Water Quality Control Board, Central Coast Region, on September 16, 1983.

Executive Officer

STATE OF CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
81 Higuera Street, Suite 200
San Luis Obispo, CA 93401-5427

ORDER NO. 00-131

A TIME SCHEDULE ORDER CONCERNING LOS OSOS COMMUNITY SERVICES DISTRICT In San Luis Obispo County

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

1. Los Osos Community Services District (hereafter CSD), owns and operates individual and community on-site sewage disposal systems that provide sewerage service to facilities discharging wastes within the Los Osos/Baywood Park area.

2. Sewage disposal facilities that were discharging as of October 27, 2000, consist of individual and community on-site sewage disposal systems located at the Bayridge Estates, Baywood Park Water Division, Baywood Park/Los Osos Fire District and Vista de Oro Subdivision (the discharges).

3. The discharges are subject to a prohibition of waste discharge from individual and community sewage disposal systems as specified in the <u>Water Quality Control Plan, Central Coastal Basin</u> (Basin Plan). The prohibition was adopted by the Board on September 16, 1983 as Resolution 83-13. The Basin Plan prohibition specifies, in part:

   Page IV-67,

   "3. Discharges from individual and community sewage disposal systems are prohibited effective November 1, 1988, in the Los Osos/Baywood Park area depicted in the Prohibition Boundary Map included as Attachment "A" of Resolution No. 83-13 which can be found in Appendix A-30."

4. On May 21, 1999, in San Luis Obispo, California, the Board held a public hearing and adopted Cease and Desist Orders finding that the discharges violated the Basin Plan Prohibition and establishing conditions for the County to achieve full compliance with the Basin Plan prohibition. Cease and Desist Order Nos. are as follows:

<u>FACILITY</u>	<u>ORDER NO.</u>
Bayridge Estates	99-53
Water Division	99-54
Fire District	99-55
Vista de Oro	99-56

5. Cease and Desist Order No. 99-53 requires the CSD to cease discharging to on-site disposal facilities serving Bayridge Estates, located at the terminus of Redwood Court and the west terminus of Encinas Drive, Los Osos, as shown on Attachment A of Cease and Desist Order No. 99-53. Cease and Desist Order No. 99-53 contains a time schedule with deadlines for achieving compliance with the Basin Plan Prohibition.

6. Cease and Desist Order No. 99-54 requires the CSD to cease discharging to on-site disposal facilities serving Baywood Park Water Division, located at the southeast corner of 8th Street and El Moro Avenue, Los Osos, as shown on Attachment A of Cease and Desist Order No. 99-54. Cease and Desist Order No. 99-54 contains a time schedule with deadlines

for achieving compliance with the Basin Plan Prohibition.

7. Cease and Desist Order No. 99-55 requires the CSD to cease discharging to on-site disposal facilities serving Baywood Park/Los Osos Fire District, located at 2315 Bayview Heights Drive, Los Osos, as shown on Attachment A of Cease and Desist Order No. 99-55. Cease and Desist Order No. 99-55 contains a time schedule with deadlines for achieving compliance with the Basin Plan Prohibition.

8. Cease and Desist Order No. 99-56 requires the CSD to cease discharging to on-site disposal facilities serving Vista de Oro Subdivision, located adjacent to Pecho Road, Los Osos, as shown on Attachment A of Cease and Desist Order No. 99-56. Cease and Desist Order No. 99-56 contains a time schedule for achieving compliance with the Basin Plan Prohibition.

9. All four Cease and Desist Orders, No. 99-53, 99-54, 99-55 and 99-56 had identical time schedules for achieving compliance with the Basin Plan Prohibition. The CSD has violated deadlines prescribed by all four Cease and Desist Orders. The deadlines the CSD has violated are:

   "2. Submit proof of circulation of draft Environmental Impact Report by May 1, 2000."

   "3. Submit final California Environmental Quality Act (CEQA) document by July 30, 2000."

   "4. Submit proof of voter approval of Assessment District or securing comparable method of collection system and treatment plant financing by October 15, 2000."

10. The CSD has proposed to comply with the Cease and Desist Orders by implementing a wastewater management plan that includes construction of a wastewater collection system and a wastewater treatment plant to serve the Basin Plan Prohibition area in Los Osos. The CSD has submitted a time schedule, which indicates that they will not be able to implement the wastewater management plan and complete compliance with the Cease and Desist Orders for approximately four years. Therefore, there has been and there will be a continuing violation of the Cease and Desist Orders.

11. California Water Code Section 13308 authorizes the Board to establish a time schedule and prescribe a daily civil penalty, which shall become due if compliance is not achieved in accordance with that time schedule.

12. The time schedule established in this Order is based on the time schedule submitted by the CSD and approximately 30 days were added to the dates estimated by the CSD in order to provide reasonable time for contingencies.

13. The civil penalty established in this Order, $10,000 per day of violation of the time schedule, is established in an amount necessary to achieve compliance and does not include any amount intended to punish or redress previous violations. This amount is necessary to achieve compliance in light of the project cost, estimated to be $70 million dollars. The $10,000 per day of penalty would amount to a penalty equal to only 6 percent of the total project cost after an entire year of violation. Additionally, the history of delayed compliance with the Basin Plan Prohibition indicates that substantial inducement is necessary to assure that the CSD will achieve compliance. Furthermore, because the Board does not intend to punish or redress previous violations, this Order provides that the Board may extend the time for compliance for delays beyond the reasonable control of the CSD.

14. This action is taken to enforce an existing Basin Plan Prohibition and order for the protection of the environment and as such is exempt from the provisions of the California Environmental Quality Act (Public Resources Code Section 21000, et seq.) in accordance with Section 15321, Chapter 3, Title 14, California Code of Regulations.

IT IS HEREBY ORDERED, pursuant to Section 13308 of the California Water Code, Los Osos Community Services District, shall comply with the following time schedule for implementation of a wastewater management plan for the Basin Plan prohibition area in Los Osos which will result in compliance with the Cease and Desist Orders.

Task	Completion Date
Submit proof of circulation of draft Environmental Impact Report	December 15, 2000
Submit final California Environmental Quality Act (CEQA) document	April 1, 2001
Submit proof of voter approval of assessment district or comparable means of financing community wastewater system	July 29, 2001
Submit approved complete construction design plans	July 15, 2002
Submit County Use and Coastal Development permits	July 15, 2002
Commence construction of the community sewer system	September 6, 2002
Complete construction of the community sewer system	August 30, 2004
Report on compliance (per California Water Code Section 13267)	Two weeks after each above date, as well as quarterly reports beginning January 15, 2001.

This Board reserves its jurisdiction to modify the time schedule in this Order to permit a specified task or tasks to be completed at later dates if the CSD demonstrates and the Board determines that the delay was beyond the reasonable control of the CSD to avoid.

If the CSD fails to complete a task in compliance with the time schedule (or Board approved modification of the time schedule), the CSD shall be liable in the amount of $10,000 per day for each day in which the violation of the time schedule occurs.

ORDERED BY [signature] fr Executive Officer

11-3-00
Date

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APPENDIX B
LOS OSOS VISION STATEMENT

LOS OSOS COMMUNITY ADVISORY COUNCIL

VISION STATEMENT FOR LOS OSOS

Approved June 22, 1995

- All land use policies and plans should be based on sustainable development that meets the needs of current population and visitors without endangering the ability of future population to meet its needs or drawing upon the water of others to sustain community livelihood.

MORRO BAY (ESTUARY)

- **Morro Bay** is clean and functioning, protected through local interest, with State and National Estuary status, harboring and nurturing wildlife.
    - The **watershed is managed** to minimize siltation and pollution from pesticides, herbicides and fertilizers.
    - **Chorro and Los Osos Creeks** run to the Bay free of pollution and again nurture steelhead and other species of flora and fauna, and maintain fresh-water flow to support the estuary.
    - **Fossil fuel transportation and delivery** is minimized and managed to prevent potential spills in Morro Bay and Estero Bay.
    - Analysis has been completed and appropriate actions have been taken to **restore the tidal current flow throughout the bay** for the purposes of promoting self-cleansing, deepening the back bay areas, supporting wildlife and providing recreational opportunities. Possible actions to be considered include dredging, restoration the north entrance to the bay, and increased stream flow into the bay.
    - **No hunting** is permitted on the bay.
- There are no fossil fuel **drilling platforms** off our coast.

WATER

- Our **water** is carefully managed on a holistic basis to provide a clean, sustainable resource for the community. Included in this management plan are:
    - **Aquifer maintenance, management and recharge**, preventing over-drafting of the aquifer and salt-water intrusion into the water supply.
    - A **septic system maintenance district.**
    - Management of **water extraction and delivery systems.**
    - **Waste water management**, cleansing and restoration to the lower aquifer or upper aquifer with pumping from upper aquifer for domestic use.
    - **Graywater reclamation**, management and recycling.
    - **Conservation** of water is an integral part of the management plan.
    - Runoff and storm drainage (in excess of that required to sustain the Estuary fresh-water flows) are managed, where possible, through the use of **retention/percolation basins** which are an integral part of the landscape and used for recreation purposes.

- Current **percolation "pits"** in the community have been redesigned to provide for landscaping or recreational uses, and are maintained.
- **Agricultural and landscape management** practices to reduce water usage and pollution from fertilizers, herbicides and pesticides.

- Our **waste water treatment facility(s)** is based on a natural biological process rather than mechanical system approach to the highest extent possible. These facilities have become a visual and recreational asset to the community, including development of water supply for agricultural or irrigation purposes, and habitat for wildlife.

AIR

- Our **air** is kept clean by reducing or eliminating pollution from sources within and outside of our community.

- Since automotive emissions are a primary source of air pollution, planning decisions and land use practices **minimize automobile trip miles** generated.

SOILS

- The productive **agricultural soils** of the watershed are maintained and protected for agricultural purposes. Those soils which are primarily supportive of grazing are managed to minimize siltation and pollution of the riparian habitats in the watershed.

PLANNING AND ZONING

- A **small-town, rural atmosphere** has been maintained.

- **Self-governance** has been achieved.

- The community of Los Osos, within the Urban Reserve Line, has been designated as a **"town"**. The "town's" influence (through recommendations) extends to the boundaries of the Los Osos Creek watershed.

- A **planning commission** for the town is responsible for planning recommendations, decisions and project evaluation.

- **Development proposals** are **analyzed** by visual analysis, planning assessment, excellence of design, from the community's viewpoint and from within the community.

- **Development standards** are performance-based.

- Development provides **incentives for solar heating, solar hot water heating and gray water recycling for irrigation.**

- **Well-designed, energy-efficient structures** are encouraged.

- **Site planning guidelines** are established for non-residential development in the community.

- We have in place a **General Plan** that contains a high level of **graphic and visual** content, supported by written content to clearly define intent and enforcement of the plan. This plan is easily understood and interpreted by a lay person.

- Planning documents are clarified to **strengthen directives** ("shall", rather than "should").

- Part of the charm of Los Osos is the **eclectic nature of the various neighborhoods.** With infill of existing neighborhoods, this is not a problem. In new development, multiple builders are encouraged, and newer neighborhoods provide variety and are not mass-produced, "cookie-cutter" designs.

- **New subdivisions** generally do not employ perimeter walls and fences unless justified, and are not "gated", implying exclusivity or isolation from adjacent neighborhoods and the community. They provide through auto, bicycle, equestrian and pedestrian traffic where desirable in accordance with the Traffic and Circulation Plan for the community.

- Neighborhoods have instituted **"neighborhoods-helping-neighbors" programs,** including exchange of labor, bartering, community vegetable gardens sharing excess garden produce, exchange child care and baby-sitting, health care help, helping the elderly with fix-up tasks, and neighborhood watch - looking out for each other.

- Incentives have been initiated to encourage **walking and bike riding.**

- The **focus of development** is on infill and mixed use.

  - Residential and businesses co-exist as mixed uses.
  - Multi-family and affordable housing exists and is encouraged.
  - Mixed-use incentives make development of affordable housing feasible for developers and acceptable to the community.
  - In-law units, bed & breakfast, and second small rental units are allowed in residential neighborhoods on lots of adequate size.

- Improvement of the "**jobs/housing balance**" has not changed the small-town and rural character.

- One or more **senior residential care facilities** offering independent living, assisted living and convalescent care have become an integral part of the community.

- **Land uses shall be performance-based and shall include:**

  - Passive recreation/ground water recharge.
  - Commercial retail/residential.
  - Office and professional/residential.
  - A category emphasizing research and development.
  - Industrial is redefined with performance standards.
  - Wholesale

- The current **Urban Reserve Line** remains in place.

- Current **zoning east of the Urban Reserve Line** to the boundaries of the watershed has been clearly defined, promotes agriculture and agriculturally-related land uses in the Los Osos Valley, and discourages speculative purchase and development for other uses.

    - Agricultural owners have been provided with **incentives** to maintain land in productive **agricultural use.** These incentives include a transfer of development rights program, tax incentives, or other programs which permit property taxation assessed on an agricultural basis as "highest and best use".

    - Incentives are offered to property owners willing to grant **easements for bike routes** to San Luis Obispo.

- There is **no commercial development east of South Bay Boulevard.**

- All **vertical accesses** to the Bay are designated recreation/open space for the public benefit and are developed as mini-parks.

- **Permit processing** in the urban area of Los Osos has been streamlined and provides incentives for excellence in design and planning through reduced processing time and fees. Plans which fall within the stated planning and design criteria are expedited for immediate processing and approval within 10 days.

- **Impact fees** are fairly assessed to new development.

- Infill of **existing subdivided lots** within the Urban Reserve Line has **priority** over any further subdivision of lands, subject to review of excellence in planning and design and community benefit.

- There is **no increase of density** on land **outside the Urban Reserve Line.**

- There is no further development of land which is **30% slope** or steeper.

- **No development** has been permitted to the south of the proposed South Bay Boulevard Extension **above the elevation of 400 feet, with proper compensation to affected land owners.**

    - If **lands south and north of the South Bay Boulevard Extension** are deemed developable, consider development as a resort hotel/golf/shopping as a gateway to Montaña de Oro with high density and considerable open space.

- Any **development** must protect the watershed; control runoff; reduce water diversions and limit the number of trees and natural vegetation removed in order to be permitted. Serious penalties apply to unapproved vegetation removal.

- No buildings have been permitted within federally-designated **flood plains**; however, recreational uses have been permitted.

GROWTH

- A maximum **rate of growth** based on the population of the community of Los Osos within the Urban Reserve Line has been established, consistent with the resources available, services and infrastructure provided, and with maintaining our sense of place.

  - Note: The **population at maximum buildout of currently zoned land within the Urban Reserve Line** of the Los Osos community has been established by County Planning to be approximately 28,000 people. This figure may be adjusted depending upon finally-determined land use designations.

- **Greenbelts** have been implemented providing a clearly defined "green edge" to the urban area and providing and protecting a riparian wildlife corridor.

- The **Moros** have been incorporated into a permanent agriculture/open space/view shed protective district, eliminating speculative development of this scenic resource.

INFRASTRUCTURE

- Our **street system** (on the grid) has been completed and paved, except where other uses have been designated in the Traffic and Circulation Plan.

  - **Logical street connections exist between neighborhoods** to encourage efficient circulation and reduce the distance of vehicular travel in the community.
  - Street **cross-sections are minimal** and sufficient to provide a reasonable flow of traffic and emergency vehicles.
  - Major and minor roadways have been planted with **street trees** (5-gallon can size) of species and characteristics consistent with the scale of the roadway (height limitations ?).
  - Streets in **commercial areas** have landscaping, trees, social areas, curbs, gutters, street lighting and sidewalks, and utilities are underground. Streets in **residential areas** do not unless a majority of the residents of the neighborhoods request these improvements.
  - Where street improvements have been scheduled, opportunities have been **coordinated** to complete **other improvements** during the same construction process, i.e., undergrounding utilities.
  - **Circulation systems** by means **other than automobile** have been encouraged and are in place.
  - Newly developed and newly paved streets are **minimum width** with bike lanes included and parking on one side of street (where this is consistent with the Traffic Circulation Study recommendations). **Street tree planting** is a requirement.
  - Minimum street widths and good street design **maximize traffic safety** throughout the community.
  - **Los Osos Valley Road** from the bridge at Los Osos Creek to Foothill Boulevard remains at current level (1995) of improvement; from South Bay Boulevard to 9th Street has a landscaped median with street trees, and turning lanes. West of 9th Street to Pecho Road (or the intersection with the South Bay Boulevard

Extension), it is a two lane road with center turning lane; from that point south, it is two-lane.

        - The pedestrian **crosswalk at Sunset Avenue** is provided with a flashing light for pedestrian activation.
        - **No new traffic signals** have been installed and those at 9th and 10th streets and South Bay Boulevard are sequenced to reduce traffic speeds to 25 mph.

    - **Utilities** have been placed underground.
    - A **community-wide wastewater and drainage system** is in place.

- The automobile (perhaps electric) will be around for a long time. **Auto use must still be accommodated** in the plan.

- Parking in business districts is mitigated by **shared parking facilities** and **on-street availability** is included in calculated requirements.

- A **transit system** is established, permitting residents to access public transit within 1500 feet of their residences. A local transit loop connects with a regional transit terminal which provides frequent, fast and convenient connection to the major employment centers served by our residents.

- **South Bay Boulevard extension** to the south and east with connection to Pecho Road has been completed, diverting through traffic to Montaña de Oro from downtown Los Osos and relieving this through traffic from Los Osos Valley Road west of South Bay Boulevard. This extension is completed only when needed by new development in the area and is fully funded as an improvement by the developers through impact fee assessment.

- **Entrances to the community** are well-defined, designed, and planted, with appropriate signage and/or elements of community identity.

COMMUNITY FACILITIES/SERVICES

- Another **elementary school** and a **high school** and related recreation areas and park facilities have been built in Los Osos. A partnership between schools and parks allows maximization of recreational benefits for schools and residents and shared development and maintenance costs.

- The **library** has doubled in size, with hours convenient to the residents.

- Residents have the ability to **subscribe and be charged for waste collection and recycling on an as-used basis**, rather than a flat rate basis. Reward self-sorting and waste reduction.

- A program has been developed to work with the suppliers of products to enable buying in bulk and reducing packaging costs and the waste material generated from packaging and wrapping articles multiple times. **Reduce waste material at the source.**

- A **recreation district** has been formed for the purpose of providing community recreation facilities and park land purchases and development (through CSA #9?).

- **Public/private/community partnerships** have been established to create and maintain parkways, mini-parks, street-end parks, and recreational and social opportunities for people of all ages.

- Our **recreation facilities** include:

  - Neighborhood and community **parks**, consistent with the population size and needs. Some of these parks are established in conjunction with the school district and on land already owned by the County. A minimum of 70 acres of community and neighborhood parks is required to bring the community up to established standards now on a population basis of 15,000.
  - A **cinema.**
  - **Recreation facilities for teen-agers and younger residents.**
  - A community **swimming pool.**
  - A **community center**, central to the community, where anyone can drop in for ping-pong; to play cards or other games; have conversations, with soft chairs, plants, soft lights and reading material; a crafts shop; and inside and outside recreation for the children. Include a snack bar open long hours. Wings for senior citizens, family activities, teenagers, but with a common center shared by all.
  - A **small performing arts area** (amphitheater).

- A **green-waste recycling/composting center** has been established with the proceeds, if any going to fund youth and senior activities. Include a worm farm.

- A **community tree lot or tree bank** is established, run by volunteers, making trees inexpensive or free to residents. Species are indigenous and culturally adapted, according to the tree master plan of the community.

- Neighborhoods have developed **volunteer groups to water and maintain** their **public plant materials.**

- **Awards** are given to the neighborhood(s) making the most improvements.

BUSINESS/COMMERCIAL FACILITIES

- Our **business and commercial** areas encourage pedestrian activities and include:

  - An additional "full-service" **supermarket.**
  - A **farmers market** with local produce and products with both permanent and day stalls are held at times when local residents are in the community.
  - User-friendly businesses that are open during hours convenient to local residents.
  - Business areas exist in which **pedestrians, rather than cars, rule the streets**; walk-streets exist in the commercial and residential areas.
  - **Landscaped pedestrian spaces throughout.**
  - The present commercial center (**Von's complex**) has been expanded and redesigned to provide pedestrian spaces and additional shopping which encourage

pedestrian rather than automobile movement within the complex and provide pedestrian scaled spaces and activities to encourage shopping and business. It is no longer a typical automobile-oriented strip-commercial center. Incentives were provided to the owner to accomplish this.

- All **commercial, retail, office, service commercial, and multi-residential zoning** has been re-evaluated to permit flexibility, mixed use, and planned development with emphasis on providing accelerated processing and other **incentives for design which exceed minimum standards.**
- **Shared, landscaped automobile parking** integral with the businesses with pedestrian-oriented and scaled spaces connecting the businesses and parking areas.
- More **outside dining**, reasonably screened from our prevailing winds.
- **Buildings that present a good facade** to roadways (instead of parking lots).
- **Zoning flexibility** that enables expansion of businesses (to retain them in the local economy) and that places incentive on good design.
- We have actively pursued and attracted **user- and environmentally-friendly businesses** that value the amenities of our community and provide jobs for our residents.
- A **multi-media center** which can be linked to the world through Internet and World Wide Web.
- **Media links** to Cal Poly, Cuesta and other networks to permit in-home occupation and business development without commuting.
- Environmentally-oriented **retreats/conference centers** for professionals and/or tourists have been developed in conjunction with Cuesta College/Cal Poly.
- We have developed a **small, user-friendly government center.**
- We have developed a community-sized **medical center** for the residents.

TOURIST-ORIENTED FACILITIES

- We have provided for **tourist-oriented facilities**, including:
  - One or more 18-hole **golf courses strategically** located (as part of the greenbelt) to use land which is not primary agricultural land; which use treated waste water effluent for irrigation; and provide, through irrigation practices, return of the effluent to the water system.
  - **Tourist-oriented recreation** focused on the Bay (kayaking, canoeing, sailing) and our scenic environment (hiking, biking, equestrian paths; picnicking; arts and crafts).
  - **Trail systems** have been provided which link Montaña de Oro, the Estuary, the Moros and Los Padres National Forest adjacent to riparian corridors and scenic reserves.

During all of this activity, we have remained a community which upholds our community values and scale, who have taken control of our own destiny, who have shunned gated communities and encouraged neighborhood and community continuity and, best of all, made our Los Osos community uniquely ours, not a replica of some other vision or model.

We live in one of the most beautiful places in the world. We have our own values and sense of place. Let's enhance those and maximize our involvement with them, not try to copy someone else's lifestyle, environment, or reasons for protecting and preserving them.

The name of this beautiful place is **Los Osos**, not "South Bay".

Approved by the Los Osos Community Advisory Council June 22, 1995.

VISION TEAM:

Henry Hammer
Warren Hamrick
Gary Karner, co-chair
Pandora Nash-Karner
June Shepard
Maryellen Simkins
Lesa Smith, co-chair
Al Switzer

APPENDIX C
CORRESPONDENCE

County of San Luis Obispo • Health Agency

Public Health Department

Environmental Health Division

2156 Sierra Way • P.O. Box 1489
San Luis Obispo, California 93406
(805) 781-5544 • FAX: (805) 781-4211

Gregory Thomas, M.D., M.P.H.
Health Officer
Health Agency Director

Curtis A. Batson, R.E.H.S.
Director

September 19, 2000

Robert van't Riet
2751 Rodman Drive
Los Osos CA 93402

RE: Los Osos/Failing Septic Systems/Risk to Public Health

The following is in response to your concerns that 1) existing septic systems in areas where groundwater is within 30 feet should be considered as having "failed", and 2) that standing groundwater (ponds) containing feces, possibly human, is a public health risk.

First, recognizing that literally volumes of studies exist regarding the wastewater disposal and high groundwater issues, the Division can address those areas falling only within its purview.

As background to this ongoing wastewater issue, this office will first point out, again, that the Division of Environmental Health recommended and supported the public sewering of the Los Osos area some thirty years ago. This office has not changed its position; a publicly operated and maintained wastewater disposal system should be built as soon as possible. With that perspective, your concerns are addressed below.

1) <u>Concern</u>: That existing septic systems in areas of Los Osos where groundwater is within 30 feet should be considered as having "failed."

First, be advised that the Division of Environmental Health has the authority to address failed septic systems that clearly can be shown to be a public health hazard. As Dr. Greg Thomas has stated to you previously, this office has typically relied heavily on evidence of system failure where sewage is on the ground surface. Septic system effluent on the ground surface has historically been the determining factor in declaring an imminent public health threat.

The Division of Environmental Health, like you, is also concerned about the possibility of failing septic systems in Los Osos. Where raw sewage is found to be present on the ground surface, and a point source can be identified, this office requires action be taken to correct system deficiencies immediately. However, where **existing** septic systems are said to be failing because groundwater comes within 30 feet of the system, a multi-agency review would be required to address the issue. However, any approach to deal with septic systems within 30 feet of groundwater independent of the community-wide sewage disposal plan, would need to be considered carefully. The Division will discuss this specific issue with the Regional Water Quality Control Board and the County Planning and Building Department.

For <u>new</u> construction county-wide, depending on the soil percolation rate for each individual lot, anywhere from 5 to 50 feet of separation is required between the highest known groundwater and the bottom of leachline trenches. Existing approved development utilizing septic systems that are shown to be within 30 feet of groundwater should not automatically be assumed to be failing. However, on the whole, there's little argument that nitrate levels in groundwater are being directly influenced by the areas septic systems. From a public health standpoint, the answer to the problem is a comprehensive public sewage collection, treatment and disposal system. From a potential public health risk standpoint, this office considers the current wastewater disposal conditions in Los Osos to be cause for serious concern. As stated before, the solution to this protracted problem is to construct a comprehensive sewer system within the community at the soonest possible date.

2) Concern: That standing groundwater (winter surface ponds) contains feces (which has a high probability of being human with shallow septic systems) and is a public health risk.

As you are aware, the County Health Department worked with Cal Poly on a pilot study for tracking the origins of environmental E. coli strains. The study was designed to determine if human-derived E. coli strains could be differentiated from strains present in animal feces. The results of the study were unable to provide a clear differentiation between human E. coli strains and animal strains. This study was intended to directly address the standing water in the community, which has been identified as a possible health hazard due to high fecal coliform counts.

As mentioned in the study, septic systems in the community may leach untreated wastewater into the water table. During the rainy season, the water table may rise and flood low-lying streets and properties with septic system water. The study further stated that "standing pools may result from aboveground runoff and/or a rising water table free of human waste – either of which may carry fecal coliforms from non-human sources such as animal feces." Finally, as the study states, "regardless of source, fecal coliform contaminating the standing water will indicate, using standard methods, the presence of a health hazard and require Department action. Determining the course of this action would be greatly assisted by establishing the fecal coliform source(s). From a public health perspective, the distinction is important. Although animal fecal contamination would present some public risk, a much greater threat to people is posed by human sewage." Although some additional new testing methodologies are being looked at by the Department, again, the pilot study testing methodology was unable to assist in determining the sources of the E. coli.

Based on the above discussion, the Department agrees that the standing pools do pose a public health risk. Until a public sewer and comprehensive surface water drainage system is built, this office will continue to monitor the standing pools and apprise the community of the potential for disease transmission.

Finally, the Department strongly urges the Los Osos Community Services District move as quickly as possible to bring a community-wide wastewater treatment plan into reality.

R. Lichtenfels

RICHARD J. LICHTENFELS
Supervising Environmental Health Specialist

c: Curt Batson, Director of Environmental Health
Dr. Greg Thomas, Health Agency Director
Sorrel Marks, RWQCB
Forrest Wermuth, County Planning & Building
Los Osos CSD

Attachment

Winston H. Hickox
Secretary for
Environmental
Protection

State Water Resources Control Board

Division of Clean Water Programs
2014 T Street • Sacramento, California 95814 • (916) 227-4400
Mailing Address: P.O. Box 944212 • Sacramento, California • 94244-2120
FAX (916) 227-4349 • Internet Address: http://www.swrcb.ca.gov

Gray Davis
Governor

FEB 15 2000

RECEIVED
FEB 18 2000
BY: [signature]

Mr. Bruce Buel
General Manager
Los Osos Community Services District
P.O. Box 6064
Los Osos, CA 93412

Dear Mr. Buel:

DRAFT PROJECT REPORT COMMENTS; LOS OSOS COMMUNITY SERVICES DISTRICT WASTEWATER FACILITIES PROJECT, LOS OSOS COMMUNITY SERVICES DISTRICT (DISTRICT); STATE REVOLVING FUND (SRF) LOAN PROGRAM, PROJECT NO. C-06-4014-110

Thank you for submitting the Draft Project Report for the Los Osos Community Services District Wastewater Facilities Project. We briefly discussed the report with Mr. Bruce Buel and Mr. Mark Ysusi on January 19, 2000, but promised written comments. The following items must be resolved in order for the report to comply with the SRF loan program requirements[1] for a complete project report.

1. The main problem with the report is the inadequacy of the cost-effectiveness evaluation of project alternatives. There are several items that should be considered for improving the cost-effectiveness evaluation:

   a) Project alternatives are not considered equally. The evaluation should consider project alternatives using the same criteria, i.e. service area, influent loadings, and effluent quality. This may mean the old evaluations used in the report will need to be re-evaluated.

   b) Once a treatment alternative is selected, please show cost-effectiveness of separate components, i.e. disinfection, filtration, etc.

   c) Additional treatment plant site locations should be identified and analyzed to determine the best site.

---

[1] *Policy for Implementing the State Revolving Fund for Construction of Wastewater Treatment Facilities*, February 1995, amended June 18, 1998

d) More wastewater disposal alternatives should be considered and evaluated. Currently, the report evaluates disposal alternatives; however, it is the same type of disposal, just two different configurations.

e) The cost-effectiveness evaluation should compare present worth values using a 20-year planning period. The current discount rate established by the U.S. Environmental Protection Agency (EPA) for construction of wastewater facilities is 6.625 percent. If you would like to use a discount rate other than the EPA established rate, please provide justification.

f) Please provide more detail on the estimated operation and maintenance costs. At minimum, separate the O&M costs by collection, treatment, and disposal. For the selected project alternative, please provide an even greater level of detail.

2. The Draft Report uses a per capita flow of only 49 gallons per day (gpd) for the average dry weather flow. Generally in sewer design, a per capita flow of 80 gpd to 100 gpd is used. Please provide information to substantiate this low per capita flow (i.e. water usage records).

3. Section 7 – SRF Eligible Capacity explains that the current population of Los Osos CSD is 14,653 and the build-out population is 18,745, but requests a SRF eligible population of 20,000. Please provide justification for the requested eligible capacity.

4. Page 9-5 of the Draft Report refers to the "Facilities Plan" which is required to be submitted by September 1, 2000, per SWRCB Resolution No. 99-051. The Draft Report refers to the "Facilities Plan" as one particular document. For clarification, the "Facilities Plan", as defined by the SRF Policy, is a combination of documents. The "Facilities Plan" includes:

- a final project report;
- a water conservation plan;
- a draft revenue program; and
- a final adopted environmental document.

5. The selected alternative must be consistent with applicable water quality management plans. This subject must be addressed more fully in the final project report. Based on the Central Coast Regional Water Quality Control Board's comment letter dated January 19, 2000, there seems to be some issues which need to be resolved before the selected project meets this requirement.

There are some concerns and questions regarding the selected project alternative. However, I will wait for clarifications until the cost-effectiveness evaluation is improved. An adequate cost-effectiveness evaluation may lead to a different project alternative all together. If you have any questions please do not hesitate to contact me. I can be reached on my direct line at (916) 227-4584.

Sincerely,

Jim Marshall, P.E.
Associate WRC Engineer

cc: Ms. Sorrel Marks
Central Coast Regional Water Quality Control Board
81 Higuera Street, Suite 200
San Luis Obispo, CA 93401-5427

Mr. Mark Ysusi
Project Manager
Montgomery Watson
516 West Shaw Avenue
Fresno, CA 93704

APPENDIX D

RWQCB WASTE DISCHARGE REQUIREMENT (WDR) 97-8

ID#3 401078001

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
81 Higuera Street, Suite 200
San Luis Obispo, California 93401-5427

ORDER NO. 97-8

WASTE DISCHARGE REQUIREMENTS FOR SAN LUIS OBISPO COUNTY SERVICES AREA 9, BAYWOOD PARK/LOS OSOS SAN LUIS OBISPO COUNTY

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

1. San Luis Obispo County (hereafter Discharger) submitted a report of waste discharge (application) on October 22, 1996, for authorization to discharge treated municipal wastewater from proposed County Services Area (CSA) 9 Wastewater Treatment Facilities serving the communities of Cuesta-by-the-Sea, Baywood Park and Los Osos, in San Luis Obispo County.

2. The Discharger's Wastewater Treatment Plant will be located on property owned by the Discharger in San Luis Obispo County at the easterly end of Pismo Avenue, as shown on Attachment A, included as part of this Order.

3. The proposed treatment system consists of grit removal, secondary treatment (an activated sludge process) and secondary sedimentation. Solids will be aerobically digested, dewatered and disposed of at an approved biosolids disposal site. The treatment plant's average dry weather flow (ADWF) design capacity is 1.32 million gallons per day (MGD). A diagram of the treatment facility processes is shown on Attachment B, included as part of this Order.

4. Treated municipal wastewater will be discharged to 2.1 acres of infiltration basins at a separate location, shown on Attachment A. The Discharger proposes to incorporate recycling for landscape irrigation at a future date. However, details of water recycling projects are not yet available and provisions for recycling are not included in this Order. Details of the disposal system are depicted on Attachment C of this Order.

5. The disposal area is located on moderately sloping terrain, overlying approximately 150 feet of soil separation to ground water in the Los Osos Valley Ground Water Basin.

6. Existing ground water quality in the uppermost aquifer in the vicinity of the discharge includes:

Total Dissolved Solids	400 mg/l
Sodium	66 mg/l
Chloride	58 mg/l
Nitrate Nitrogen (as N)	23 mg/l

7. The Water Quality Control Plan, Central Coast Basin (Basin Plan), was adopted by the Board on and approved on September 8, 1994. The Basin Plan incorporates statewide plans and policies by reference and contains a strategy for protecting beneficial uses of surface and ground waters in the vicinity of the discharge.

8. Existing and anticipated beneficial uses of ground water in the vicinity of the discharge include:

    a. Municipal and domestic water supply;
    b. Agricultural supply; and
    c. Industrial supply

9. Federal Regulations for stormwater discharges were promulgated by the U.S. Environmental Protection Agency on November 19, 1990. The regulations [40 Code of Federal Regulations (CFR) Parts 122, 123, and 124] require specific categories of industrial activities including Publicly Owned Treatment Works (POTWs) which discharge stormwater to obtain a NPDES permit and to implement Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT) to control pollutants in industrial stormwater discharges.

10. Stormwater flows from the wastewater treatment facility process areas are directed to the treatment processes and discharged with treated wastewater. These stormwater flows constitute all industrial stormwater at this facility and consequently this Order regulates all industrial stormwater discharge at this facility along with wastewater discharge.

11. San Luis Obispo County certified a Final Environmental Impact Report (EIR) on December 8, 1987, with Supplemental EIRs prepared in September 1989 and (current draft November 1996) in accordance with the California Environmental Quality Act (Public Resources Code, Section 21000, et seq. and the California Code of Regulations.

    Pursuant to CEQA guidelines Section 15096, the Regional Board, as a responsible agency, has a more limited role than the lead agency. The Regional Board is responsible for mitigating or avoiding only the direct or indirect environmental effects of those parts of the project which it approves. The EIR does not identify any significant unavoidable environmental impact resulting from proposed wastewater treatment or discharge. Impacts relating to construction erosion, odors, biosolids disposal and wastewater discharge shall be mitigated by the proposed Order. Potentially significant impacts which fall within the purview of the Regional Board are as follows.

    Potential impacts to surface water quality from construction related erosion are identified. Mitigation measures are proposed including compliance with the statewide stormwater permit for construction activities. Another potential source of water quality impacts is from construction dewatering. Such discharges will also be regulated by the Board through separate order.

    In addition, there is potential for significant impacts to surface waters from an accidental spill of untreated wastewater from the collection system or treatment plant.

    Potential impacts to air quality form periodic odors and air emissions from the collection, treatment, or disposal facilities are considered unavoidable. The EIR does not identify negative impacts to groundwater quantity or quality which cannot be mitigated to insignificance. Mitigation measures to prevent nuisance and assure protection of beneficial uses of surface and ground waters will be implemented through this Order.

    Pursuant to CEQA guidelines Section 15096, the Regional Board, as a responsible agency, has a more limited role than the lead agency. The Regional Board is responsible for mitigating or avoiding only the direct or indirect environmental effects of those parts of the project which it approves. The EIR does not identify any significant environmental impact resulting from proposed wastewater treatment or discharge. Insignificant impacts relating to odors, biosolids disposal and wastewater discharge shall be mitigated by the proposed Order.

12. A permit and the privilege to discharge waste into waters of the State are 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. Compliance with this Order should assure conditions are met and mitigate any potential changes in water quality due to the discharge.

13. On **December 20, 1996**, the Board notified the Discharger and interested agencies and persons of its intent to consider adoption of waste discharge requirements for the discharge and has provided them with a copy of the proposed Order and an opportunity to submit written comments and scheduled a public hearing.

14. In public hearings on February 7, 1997 and April 4, 1997, 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 Section 13377 of the California Water Code, that San Luis Obispo County, its agents, successors, and assigns, may discharge waste from the County Services Area 9 Wastewater Treatment Facility providing compliance is maintained with the following:

> (Note: General permit conditions, definitions and the method of determining compliance are contained in the attached "Standard Provisions and Reporting Requirements for Waste Discharge Requirements," dated January 1984, referenced in paragraph D.2. of this Order.)

Throughout these requirements footnotes are listed to indicate the source of requirements specified. Requirement footnotes are as follows:

A = Basin Plan
B = Administrative Procedures Manual

Requirements without footnotes are based on Staff's professional judgment.

A. PROHIBITIONS

1. Discharge to areas other than the disposal facilities shown on Attachment A of this Order is prohibited.
2. Discharge of any wastes including overflow, bypass and runoff from transport, treatment or disposal systems to adjacent drainageways or adjacent properties is prohibited.
3. Discharge of untreated or partially treated wastewater is prohibited.
4. Discharge of wastewater within 100 feet of any well used for domestic supply or irrigation of food crops is prohibited.

B. EFFLUENT LIMITATIONS

1. Effluent flow averaged over each month shall not exceed a monthly average of 1.32 MGD.
2. Effluent discharged to the disposal system shall not exceed the following limitations:

Constituent	Units	Monthly (30-Day) Average	Daily Maximum
Settleable Solids	ml/l	0.1	0.5
BOD, 5-Day	mg/l	60	100
Suspended Solids	mg/l	60	100
Total Nitrogen (as N)	mg/l	7	10
Dissolved Oxygen	Minimum 2 mg/l at any time.[A]		

3. Freeboard shall exceed two feet in lagoons and ponds (unless technical justification is provided to support lesser freeboard).

4. Treatment and discharge shall not cause pollution or nuisance as defined in Section 13050 of the California Water Code.
5. All accumulated biosolids or solid residue shall be disposed in a manner approved by the Executive Officer.

6. Treatment, storage and disposal facilities shall be managed to exclude the public and posted to warn the public of the presence of wastewater.

C. RECEIVING WATER LIMITATIONS
(Ground Water Limitations)

(Receiving water quality is a result of many factors, some unrelated to the discharge. This permit considers these factors and is designed to minimize the influence of the discharge to the receiving water.)

The discharge shall not cause:

1. The following limits to be exceeded in ground water in the vicinity of the discharge:[A]

Constituent	Maximum (mg/l)
Aluminum	1.0
Arsenic	0.05
Barium	1.0
Beryllium	0.15
Boron	1.125
Cadmium	0.01
Chloride	106
Chromium	0.05
Cobalt	0.075
Copper	0.3
Fluoride	1.5
Iron	7.5
Lead	0.05
Lithium	3.75
Manganese	0.3
Mercury	0.002
Molybdenum	0.015
Nickel	0.3
Nitrate (as NO_3)	45
Nitrite	15
Selenium	0.01
Silver	0.05
Sodium	69
Vanadium	0.15
Zinc	3.0
Phenols	0.001
Chlorinated Hydrocarbons	
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
Chlorophenoxys	
2,4-D	0.1
2,4.5-TP Silvex	0.01
Synthetics	
Atrazine	0.003
Bentazon	0.018
Benzene	0.001
Carbon Tetrachloride	0.0005
Carbofuran	0.018
Chlordane	0.0001
1,2-Dibromo-3-chloropropane	0.0002
1,4-Dichlorobenzene	0.005
1,1-Dichloroethane	0.005
1,2-Dichloroethane	0.0005
cis-1,2-Dichloroethylene	0.006
trans-1,2-Dichloroethylene	0.01
1,1-Dichloroethylene	0.006
1,2-Dichloropropane	0.005
1,3-Dichloropropene	0.0005
Ethylbenzene	0.680
Ethylene Dibromide	0.00002
Glyphosate	0.7
Heptachlor	0.00001
Heptachlor Epoxide	0.00001
Molinate	0.02
Monochlorobenzene	0.030
Simazine	0.010
1,1,2,2-Tetrachloroethane	0.001
Tetrachloroethylene	0.005
Thiobencarb	0.07
1,1,1-Trichloroethane	0.200
1,1,2-Trichloroethane	0.032
Trichloroethylene	0.005
Trichlorotrifluromethane	0.15
1,1,2-Trichloro-1,2,2-trifluroethane	1.2

Vinyl Chloride	0.0005
Xylenes	1.750

2. The nitrate-nitrogen (NO_3 as N) level of ground water to exceed 10 mg/l.

3. A significant increase of mineral constituent concentrations in underlying ground water, as determined by comparison of samples collected from wells located upgradient and downgradient of the disposal area.

4. Concentrations of chemicals and radionuclides in ground water to exceed limits set forth in Title 22, Chapter 15, Articles 4 and 5 of the California Code of Regulations.[A]

5. The median concentration of total coliform organisms to equal or exceed 2.2 MPN/100 ml over a seven day period.[A]

6. The pH of underlying groundwater to exceed the range of 6.5 to 8.3.[A]

D. PROVISIONS

1. Discharger shall comply with "Monitoring and Reporting Program No. 97-8" (included as part of this Order), as ordered by the Executive Officer.

2. Discharger shall comply with all items of the attached "Standard Provisions and Reporting Requirements for Waste Discharge Requirements," dated January, 1984 (included as part of this Order).

3. Discharger shall develop and implement an on-site wastewater management district to assure ongoing operations, maintenance and monitoring of on-site disposal systems within the unsewered areas in the community of Los Osos and depicted on Attachment A of this Order.

4. Pursuant to Title 23, Division 3, Chapter 9, of the California Code of Regulations, the Discharger must submit a report to the Executive Officer, not later than August 7, 2001, addressing:[B]

   a. Whether there will be changes in the continuity, character, location, or volume of the discharge; and,

   b. Whether, in their opinion, their is any portion of the Order that is incorrect, obsolete, or otherwise in need of revision.

APPENDIX E

TREATMENT FACILITY COST ESTIMATES

Capital Cost Estimate: Advanced Wastewater Treatment Pond

Facility	Quantity	Units	Unit Price ($)	Item Cost ($)
Influent Pump Station				
Excavation and Shoring	ls			25,000
Wet Well & Dry Pit	ls			50,000
Pumping Equipment	ls			50,000
Piping & Valves	ls			50,000
Screenings Equipment	ls			75,000
Electrical Equipment	ls			75,000
Building Superstructure	600	ft^2	125	75,000
Total				400,000
Septage Receiving	ls			200,000
Grit Facilities	ls			200,000
Pond Splitter Box	ls			75,000
Facultative Ponds				
Excavation and Levees	80,000	cy	7	560,000
Liners	350,000	ft^2	2	700,000
Aerators - 25 hp	6	ea	7,500	45,000
Sludge Pits	2	ea	75,000	150,000
Piping & Valves	ls			150,000
Total				1,605,000
HRP Splitter Boxes	ls			75,000
High Rate Ponds				
Excavation and Levees	40,000	cy	7	280,000
Paddle Wheels	8	ea	15,000	120,000
Liners	350,000	ft^2	2	700,000
Total				1,100,000
Recycle Pump Station				
Concrete Structure	ls			15,000
Pumps- 500 gpm, 10 hp	3	ea	7,500	22,500
Piping & Valves	ls			25,000
Electrical	ls			75,000
Total				137,500
Dissolved Air Flotation Units				
Site Work	ls			75,000
Equipment	3	ea	150,000	450,000
Piping & Valves	ls			50,000
Electrical	ls			100,000
Total				675,000
Filter				
Site Work	ls			75,000
Equipment	3	ea	100,000	300,000
Piping & Valves	ls			50,000
Electrical	ls			100,000
Total				525,000
Maturation Pond				
Excavation and Levees	50,000	cy	7	350,000
Liners	160,000	ft^2	2	320,000
Total				670,000
Algae Settling Pond				
Excavation and Levees	1,000	cy	7	7,000
Liners	25,000	ft^2	2	50,000
Total				57,000

Capital Cost Estimate: Advanced Wastewater Treatment Pond

Facility	Quantity	Units	Unit Price ($)	Item Cost ($)
Algae Drying Beds				
Excavation and Levees	2,300	cy	8	18,400
Piping & Underdrains	ls			40,000
Liners	50,000	ft^2	2	100,000
Total				158,400
UV System				
Site Work	ls			100,000
Equipment	256	lamps	1,000	256,000
Piping & Valves	ls			75,000
Electrical	ls			150,000
Total				581,000
Effluent Pump Station				
Site Work and Concrete				50,000
Pumps - 500 gpm, 25 hp	3	ea	12,500	37,500
Piping & Valves	ls			50,000
Electrical	ls			75,000
Total				212,500
Biofilter				
Site Work	ls			50,000
Fans	3	ea	3,000	9,000
Duct Work	ls			60,000
Media	250	cy	50	12,500
Electrical	ls			50,000
Total				181,500
O&M Building				
Control Room	400	ft^2	150	60,000
SCADA System	ls			100,000
Locker & Showers	400	ft^2	200	80,000
Process Lab Area	400	ft^2	400	160,000
Maintenance Shop	500	ft^2	125	62,500
Total				462,500
Site Paving	ls			100,000
Site Landscaping	ls			100,000
Site Yard Piping	ls			200,000
Electrical Service and Distribution	ls			300,000
Construction Subtotal				**8,015,400**
Contingency at 20%			0.20	1,603,080
Estimated Construction Cost				**9,618,480**
Engineering and Admin at 27.5%			0.275	2,645,082
Total Estimated Base Capital Cost				**12,263,562**

Notes:

Assumes 1.3 mgd.

Assumes maturation pond capacity of 20 mgal.

All estimates for conceptual sizing of facility.

Includes costs for back-up power.

Total Estimated Base Capital Cost does not include site-specific costs. Refer to Table 4-4.

Annual O&M Cost Estimate: Advanced Wastewater Treatment Pond

Facility	Quantity	Units	Unit Price ($)	Item Cost ($)
Influent Pump Station				
Pumping Power	90,000	kwhr/yr	0.08	7,200
HVAC & Lighting	45,000	kwhr/yr	0.08	3,600
Parts & Materials	ls			5,000
Chemicals	ls			1,500
Total				17,300
Facultative Ponds				
Aeration Power	270,000	kwhr/yr	0.08	21,600
Parts & Materials	ls			5,000
Total				26,600
High Rate Ponds				
Power	175,000	kwhr/yr	0.08	14,000
Misc	ls			5,000
Total				19,000
Recycle Pump Station				
Pumps Power	15,000	kwhr/yr	0.08	1,200
Parts & Materials	ls			5,000
Total				6,200
Dissolved Air Flotation Units				
Power	150,000	kwhr/yr	0.08	12,000
Chemicals	ls			50,000
Total				62,000
Filter				
Power	50,000	kwhr/yr	0.08	4,000
Chemicals	ls			5,000
Total				9,000
UV System				
UV Lamp Power	140,000	kwhr/yr	0.08	11,200
Lamp Replacement	200	lamps/yr	40	8,000
Total				19,200
Effluent Pump Station	600,000	kwhr/yr	0.08	48,000
Algae Biosolids Disposal	2,000	wet tons/yr	30	60,000
Biofilter				
Fan Power	30,000	kwhr/yr	0.08	2,400
Parts & Materials	ls			1,500
Total				3,900
O&M Building				
HVAC and Lighting	75,000	kwhr/yr	0.08	6,000
Total				6,000
Site Landscaping	ls			5,000
Site Yard Lighting	50,000	kwhr/yr	0.08	4,000
O&M Labor	5,000	hrs/yr	40	200,000
Laboratory Analysis	ls			10,000
Total Estimated Annual O&M				**496,200**

Notes:

Cost estimate for O&M labor assumes 2.5 full-time employees.

Capital Cost Estimate: Extended Aeration

Facility	Quantity	Units	Unit Price ($)	Item Cost ($)
Influent Pump Station				
Excavation and shoring	ls			25,000
Wet Well & Dry Pit	ls			50,000
Pumping Equipment	ls			50,000
Piping	ls			50,000
Screenings Equipment	ls			75,000
Electrical Equipment	ls			75,000
Building Superstructure	600	ft^2	125	75,000
Total				400,000
Septage Receiving	ls			200,000
Grit Facilities	ls			200,000
Aeration Splitter Box	ls			75,000
Aeration Basins				
Excavation & Levees	12,000	cy	7	84,000
Liners	55,000	ft^2	2	110,000
Aeration Diffusers	ls			300,000
Aeration Piping	ls			300,000
Total				794,000
MLSS Splitter Box	ls			125,000
Secondary Clarifiers	2	ea	350,000	700,000
RAS /Blower Building				
RAS Pumps- 700 gpm,10hp	2	ea	3,000	6,000
WAS Pumps	2	ea	1,000	2,000
Blowers- 2000cfm, 60hp	3	ea	20,000	60,000
Electrical	ls			125,000
Building Superstructure	1,000	ft^2	125	125,000
Total				318,000
Filter				
Site Work	ls			75,000
Equipment- Dynasand	ls			300,000
Piping	ls			50,000
Electrical	ls			100,000
Total				525,000
UV System				
Site Work	ls			100,000
Equipment	256	lamps	1,000	256,000
Piping	ls			75,000
Electrical	ls			150,000
Total				581,000
Effluent Pump Station				
Site Work & Concrete	ls			50,000
Pumps - 500 gpm, 25 hp	3	ea	12,500	37,500
Piping	ls			50,000
Electrical	ls			75,000
Total				212,500
Effluent Storage Basin	2	mgal	250,000	500,000

Capital Cost Estimate: Extended Aeration

Facility	Quantity	Units	Unit Price ($)	Item Cost ($)
Solids Stabilization				
Gravity Belt Thickener	1	ea	100,000	100,000
Belt Press- 1 meter, 3 belt	2	ea	100,000	200,000
Sludge Cake Conveyors	40	lf	1,000	40,000
Sludge Cake Loading	ls			75,000
Polymer System	ls			50,000
Aerobic Digester	70,000	gal	3	210,000
Building Superstructure	1,500	ft^2	200	300,000
Electrical	ls			200,000
Support Mechanical	ls			200,000
Total				1,375,000
Biofilter				
Site Work	ls			50,000
Fans	3	ea	3,000	9,000
Duct Work	ls			75,000
Media	400	cy	50	20,000
Electrical	ls			50,000
Total				204,000
O&M Building				
Control Room	400	ft^2	150	60,000
SCADA System	ls			100,000
Locker & Showers	400	ft^2	200	80,000
Process Lab Area	400	ft^2	400	160,000
Maintenance Shop	500	ft^2	125	62,500
Total				462,500
Site Landscaping	ls			150,000
Site Yard Piping	ls			300,000
Electrical Service and Distribution	ls			300,000
Construction Subtotal				**7,422,000**
Contingency at 20 %			0.2	1,484,400
Estimated Construction Cost				**8,906,400**
Engineering and Admin at 27.5%			0.275	2,449,260
Total Estimated Base Capital Cost				**11,355,660**

Notes:

Assumes 1.3 mgd.

All estimates are for conceptual sizing of facility.

Includes costs for back-up power.

Total Estimated Base Capital Cost does not include site-specific costs. Refer to Table 4-4.

Annual O&M Cost Estimate: Extended Aeration

Facility	Quantity	Units	Unit Price ($)	Item Cost ($)
Influent Pump Station				
Pumping Power	90,000	kwhr/yr	0.08	7,200
HVAC & Lighting	45,000	kwhr/yr	0.08	3,600
Parts & Materials	ls			5,000
Chemicals	ls			1,500
Total				17,300
Aeration Basins				
Aeration Power	750,000	kwhr/yr	0.08	60,000
Parts & Materials	ls			5,000
Total				65,000
Secondary Clarifiers				
Power	10,000	kwhr/yr	0.08	800
Total				800
RAS Pump Station				
RAS Pumps Power	156,000	kwhr/yr	0.08	12,480
Parts & Materials	ls			5,000
Total				17,480
Filter				
Power	40,000	kwhr/yr	0.08	3,200
Chemical	ls			5,000
Total				8,200
UV System				
UV Lamp Power	140,000	kwhr/yr	0.08	11,200
Lamp Replacement	200	lamps/yr	40	8,000
Total				19,200
Solids Stabilization				
Aeration Power	170,000	kwhr/yr	0.08	13,600
Belt Press Power	30,000	kwhr/yr	0.08	2,400
Sludge Cake Conveyors Power	10,000	kwhr/yr	0.08	800
Sludge Cake Loading Power	5,000	kwhr/yr	0.08	400
Building HVAC & Lighting	75,000	kwhr/yr	0.08	6,000
Parts & Materials	ls			5,000
Chemicals	ls			12,000
Total				40,200
Biosolids Disposal	2,080	wet tons/yr	30	62,400
Biofilter				
Fan Power	90,000	kwhr/yr	0.08	7,200
Parts & Materials	ls			1,500
Total				8,700
O&M Building				
HVAC and Lighting	75,000	kwhr/yr	0.08	6,000
Total				6,000
Site Landscaping	ls			15,000
Site Yard Lighting	50,000	kwhr/yr	0.08	4,000
O&M Labor	5,600	hrs/yr	40	224,000
Laboratory Analysis	ls			10,000
Total Estimated Annual O&M				**498,280**

Notes:

Cost estimate for O&M labor assumes 2.7 full-time employees.

Capital Cost Estimate: Sequencing Batch Reactor

Facility	Quantity	Units	Unit Price ($)	Item Cost ($)
Influent Pump Station				
Excavation and Shoring	ls			25,000
Wet Well & Dry Pit	ls			50,000
Pumping Equipment	ls			50,000
Piping	ls			50,000
Screenings Equipment	ls			75,000
Electrical Equipment	ls			75,000
Building Superstructure	600	ft^2	125	75,000
Total				400,000
Septage Receiving	ls			150,000
Grit Facilities	ls			150,000
SBRs				
Concrete Structures with Cover	2.7	mgal	750,000	2,025,000
SBR Equipment	ls			300,000
Piping Allowance	ls			100,000
Electrical Allowance	ls			75,000
Total				2,500,000
RAS/Blower Gallery				
Concrete Substructure	ls			150,000
RAS Pumps- 400 gpm, 5hp	3	ea	7,500	22,500
WAS Pumps	2	ea	1,000	2,000
Blowers - 2000 cfm, 30 hp	3	ea	20,000	60,000
Piping & Valves	ls			100,000
Electrical	ls			150,000
Building Superstructure	1,000	ft^2	150	150,000
Total				634,500
Filter				
Site Work	ls			75,000
Equipment	ls			300,000
Piping & Valves	ls			50,000
Electrical	ls			100,000
Total				525,000
UV System				
Site Work	ls			100,000
Equipment	256	lamps	1,000	256,000
Piping & Valves	ls			75,000
Electrical	ls			150,000
Total				581,000
Effluent Pump Station				
Site Work	ls			50,000
Pumps 500 gpm, 25 hp	3	ea	12,500	37,500
Piping & Valves	ls			50,000
Electrical	ls			75,000
Total				212,500
Effluent Storage Basin	2	mgal	250,000	500,000

Capital Cost Estimate: Sequencing Batch Reactor

Facility	Quantity	Units	Unit Price ($)	Item Cost ($)
Solids Stabilization				
Aerobic Digesters- Concrete	80,000	gal	1.5	120,000
Aeration Difussers	ls			75,000
Piping & Valves	ls			75,000
Aeration Blower- 500 scfm	2	ea	15,000	30,000
Electrical	ls			100,000
GBTs	2	ea	75,000	150,000
Belt Press	2	ea	100,000	200,000
Sludge Cake Conveyors	50	lf	1,000	50,000
Sludge Cake Loading	ls			100,000
Building Superstructure	1,500	ft^2	200	300,000
Electrical	ls			200,000
Support Mechanical	ls			200,000
Total				1,600,000
Biofilter				
Site Work	ls			75,000
Fans	3	ea	3,000	9,000
Duct Work	ls			75,000
Media	400	cy	50	20,000
Electrical	ls			50,000
Total				229,000
O&M Building				
Control Room	400	ft^2	150	60,000
SCADA System	ls			100,000
Locker & Showers	400	ft^2	200	80,000
Process Lab Area	400	ft^2	400	160,000
Maintenance Shop	500	ft^2	125	62,500
Total				462,500
Site Landscaping	ls			150,000
Site Yard Piping	ls			300,000
Electrical Service and Distribution	ls			300,000
Construction Subtotal				**8,694,500**
Contingency at 20%			0.2	1,738,900
Estimated Construction Cost				**10,433,400**
Engineering and Admin at 27.5%			0.275	2,869,185
Total Estimated Base Capital Cost				**13,302,585**

Notes:

Assumes 1.3 mgd

All estimates are for conceptual sizing of facility.

Includes costs for back-up power.

Total Estimated Base Capital Cost does not include additional site-specific costs. Please refer to Table 4-4.

Annual O&M Cost Estimate: Sequencing Batch Reactor

Facility	Quantity	Units	Unit Price ($)	Item Cost ($)
Influent Pump Station				
Pumping Power	90,000	kwhr/yr	0.08	7,200
HVAC & Lighting	45,000	kwhr/yr	0.08	3,600
Parts & Materials	ls			5,000
Chemicals	ls			1,500
Total				17,300
SBRs				
Aeration Power	500,000	kwhr/yr	0.08	40,000
Parts & Materials	ls			5,000
Total				45,000
RAS Pump Station				
RAS Pumps Power	100,000	kwhr/yr	0.08	8,000
Parts & Materials	ls			5,000
Total				13,000
Filter				
Power	50,000	kwhr/yr	0.08	4,000
Chemical	ls			5,000
Total				9,000
UV System				
UV Lamp Power	140,000	kwhr/yr	0.08	11,200
Lamp Replacement	200	lamps/yr	40	8,000
Total				19,200
Solids Stabilization				
ATAD Power	208,000	kwhr/yr	0.08	16,640
ATAD Parts	ls			5,000
Belt Press Power	40,000	kwhr/yr	0.08	3,200
Belt Press Parts	ls			5,000
Sludge Cake Conveyors Power	10,000	kwhr/yr	0.08	800
Sludge Cake Loading Power	5,000	kwhr/yr	0.08	400
Building HVAC & Lighting	75,000	kwhr/yr	0.08	6,000
Chemicals	ls			15,000
Total				52,040
Biosolids Disposal	2,080	wet tons/yr	30	62,400
Biofilter				
Fan Power	100,000	kwhr/yr	0.08	8,000
Parts & Materials	ls			1,500
Total				9,500
O&M Building				
HVAC and Lighting	75,000	kwhr/yr	0.08	6,000
Total				6,000
Site Landscaping	ls			15,000
Site Yard Lighting	40,000	kwhr/yr	0.08	3,200
O&M Labor	6,000	hrs/yr	40	240,000
Laboratory Analysis	ls			10,000
Total Estimated Annual O&M				**501,640**

Notes:

Cost estimate for O&M labor assumes 3 full-time employees.

APPENDIX F

EVALUATION CRITERIA AND SUBCRITERIA

Regulatory

Includes water quality, environmental impact, and extent of land. This criterium captures the ability to obtain regulatory approval of the project so as to remove Cease and Desist orders and obtain low cost financing.

Water Quality

- Ability to meet regulatory water quality requirements.
- Reliability and proven track record for the process to meet 7 mg/l N.
- Emergency spill potential and retention capability.
- Treatment level capability at peak capacities.
- Positive aquifer maintenance and management for build-out.
- Flood control, drainage enhancement.
- Measure of risk to schools, properties occupied by children/families.
- Public/Private community partnerships.
- Water supply, potable, improved for build-out of community.

Environmental Impact

- Site-specific impacts to endangered species, cultural and natural resources.
- Environmental requirements of agencies such as the US Fish & Wildlife Service, National Marine Fisheries Service, California Dept. of Fish & Game, US Environmental Protection Agency, and US Army Corps of Engineers.
- Coastal zone impacts and ability to gain regulatory approval from California Coastal Commission (Land use only), especially on prime agricultural land.
- Additional studies required (EIR, geotechnical, percolation).
- Long-term air quality impacts.
- Disposal requirements for biosolids.
- Potential negative environmental impacts in emergencies.
- Seismic risks.

Extent of Land

- Amount of land in acres required for the treatment system.
- Land potentially needed for mitigation is not included.

Cost

Affordability to ratepayers. Includes construction, capital and operating costs including the following: land acquisition, power, pipelines, facility construction, and biosolids disposal. Includes operator staff levels and training level requirements. Includes costs associated with redundancy. Provides cost preference for innovative, alternative technology projects. Costs with energy and inflation considered. Cost of land, inflation considered. Market value of publicly owned land not used for WW treatment. O&M costs, current annual dollars (fixed). Cost of system component replacement. Present worth at 20 and 50 years. Cost, reserve capacity consideration.

Capital

- Upfront costs for construction (facilities, equipment, etc.), and land acquisition.
- If converted to an annual basis, will also include finance costs.

Long-Term

- Recurring costs associated with capital facilities.
- Includes normal operation and maintenance costs plus periodic replacement of equipment during the life of the project as defined by the SWRCB (20 years).

Resource Sustainability	
Ability of treatment system to sustain and reduce nitrate in groundwater basin without importing water from somewhere else, and flexibility to augment water supply (sustainable resource). Ability of system to limit growth to critical sustainable resources (water, land use). Compatibility with water conservation goals. Difficulty and frequency of biosolids handling and ability to reduce biosolids generation and use biosolids locally. Emphasis on low energy/solar energy systems. Includes consideration of green house gas emissions and hazardous chemicals required for operation. Construction complexity of treatment system.	
Water Supply	• Ability to sustain and reduce nitrate in groundwater basin without importing water from elsewhere. • Flexibility of system to augment water supply in the future. • Limit growth to critical sustainable resources (water, land use). • Compatibility with water conservation goals.
Byproducts	• Impact or value of byproducts. • Byproducts include biosolids and greenhouse gases.
Community Acceptance	
Refers to the aesthetics of the system and its ability to be a community resource. System should be an example to other communities of an innovative approach to achieve wastewater treatment and meet environmental requirements. Should be visually pleasing, have no odor, and be a hub of the community based on location and final construction. Noise was not considered a differentiating factor amongst alternatives as buildings and other engineering measures would reduce noise of permanent facility. Positive community economic/political/social impacts. Community "ownership" of innovative facility/project.	
Open Space Enhancement and Accessibility	• Amount of open space or parkland located at readily accessible locations. • Community enhancement - environment. Potential of enhanced bike, pedestrian, and park amenities.
Aesthetic Factors	• Does it add or subtract to the aesthetic amenity of the community? (i.e, can it be "drop dead gorgeous?") Visual enhancement to the community. • Community enhancement-positive affect on property values.
Nuisance Factors	• Tendency to generate odors as determined by distance from source to receptor, intensity, character, and frequency. • Noise generated by facility operations and truck/vehicle traffic.
Construction Impacts	• Length of construction period (i.e., most efficient construction sequence, shortest construction period); disruption to the public, traffic, emergency services; environmental impacts during construction (noise, dust, runoff, BMP). • Other environmental impacts captured in Regulatory-Environmental Impact.
Future Flexibility	
Flexibility to meet future conditions, and environmental regulations. Includes level of treatment for water reuse, drinking water, or more stringent requirements. Mechanical complexity and dependency.	

APPENDIX G

EFFLUENT REUSE/RECYCLING REGULATIONS

Title 22

Code of Regulations

(UNOFFICIAL VERSION – FOR REFERENCE PURPOSES ONLY)

November 2000

DIVISION 4. ENVIRONMENTAL HEALTH

CHAPTER 3 WATER RECYCLING CRITERIA

ARTICLE 1 DEFINITIONS

Section 60301. Definitions

Section 60301.100. Approved Laboratory.

"Approved laboratory" means a laboratory that has been certified by the Department to perform microbiological analyses pursuant to section 116390, Health and Safety Code.

Section 60301.160. Coagulated Wastewater.

"Coagulated wastewater" means oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated upstream from a filter by the addition of suitable floc-forming chemicals.

Section 60301.170. Conventional Treatment.

"Conventional treatment" means a treatment chain that utilizes a sedimentation unit process between the coagulation and filtration processes and produces an effluent that meets the definition for disinfected tertiary recycled water.

Section 60301.200. Direct Beneficial Use.

"Direct beneficial use" means the use of recycled water that has been transported from the point of treatment or production to the point of use without an intervening discharge to waters of the State.

Section 60301.220. Disinfected Secondary-2.2 Recycled Water.

"Disinfected secondary-2.2 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period.

Section 60301.225. Disinfected Secondary-23 Recycled Water.

"Disinfected secondary-23 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 23 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30 day period.

Section 60301.230. Disinfected Tertiary Recycled Water.

"Disinfected tertiary recycled water" means a filtered and subsequently disinfected wastewater that meets the following criteria:

(a) The filtered wastewater has been disinfected by either:

(1) A chlorine disinfection process following filtration that provides a CT (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or

(2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque-forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.

(b) The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.

Section 60301.240. Drift.

"Drift" means the water that escapes to the atmosphere as water droplets from a cooling system.

Section 60301.245. Drift Eliminator.

"Drift eliminator" means a feature of a cooling system that reduces to a minimum the generation of drift from the system.

Section 60301.250. Dual Plumbed System.

"Dual plumbed system" or "dual plumbed" means a system that utilizes separate piping systems for recycled water and potable water within a facility and where the recycled water is used for either of the following purposes:

(a) To serve plumbing outlets (excluding fire suppression systems) within a building or

(b) Outdoor landscape irrigation at individual residences.

Section 60301.300. F-Specific Bacteriophage MS-2.

"F-specific bacteriophage MS-2" means a strain of a specific type of virus that infects coliform bacteria that is traceable to the American Type Culture Collection (ATCC 15597B1) and is grown on lawns of E. coli (ATCC 15597).

Section 60301.310. Facility.

"Facility" means any type of building or structure, or a defined area of specific use that receives water for domestic use from a public water system as defined in section 116275 of the Health and Safety Code.

Section 60301.320. Filtered Wastewater.

"Filtered wastewater" means an oxidized wastewater that meets the criteria in subsection (a) or (b):

(a) Has been coagulated and passed through natural undisturbed soils or a bed of filter media pursuant to the following:

(1) At a rate that does not exceed 5 gallons per minute per square foot of surface area in mono, dual or mixed media gravity, upflow or pressure filtration systems, or does not exceed 2 gallons per minute per square foot of surface area in traveling bridge automatic backwash filters; and

(2) So that the turbidity of the filtered wastewater does not exceed any of the following:

(A) An average of 2 NTU within a 24-hour period;

(B) 5 NTU more than 5 percent of the time within a 24-hour period; and

(C) 10 NTU at any time.

(b) Has been passed through a microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membrane so that the turbidity of the filtered wastewater does not exceed any of the following:

(1) 0.2 NTU more than 5 percent of the time within a 24-hour period; and

(2) 0.5 NTU at any time.

Section 60301.330. Food Crops.
"Food crops" means any crops intended for human consumption.

Section 60301.400. Hose Bibb.
"Hose bibb" means a faucet or similar device to which a common garden hose can be readily attached.

Section 60301.550. Landscape Impoundment.
"Landscape impoundment" means an impoundment in which recycled water is stored or used for aesthetic enjoyment or landscape irrigation, or which otherwise serves a similar function and is not intended to include public contact.

Section 60301.600. Modal Contact Time.
"Modal contact time" means the amount of time elapsed between the time that a tracer, such as salt or dye, is injected into the influent at the entrance to a chamber and the time that the highest concentration of the tracer is observed in the effluent from the chamber.

Section 60301.620. Nonrestricted Recreational Impoundment.
"Nonrestricted recreational impoundment" means an impoundment of recycled water, in which no limitations are imposed on body-contact water recreational activities.

Section 60301.630. NTU.
"NTU" (Nephelometric turbidity unit) means a measurement of turbidity as determined by the ratio of the intensity of light scattered by the sample to the intensity of incident light as measured by method 2130 B. in Standard Methods for the Examination of Water and Wastewater, 20th ed.; Eaton, A. D., Clesceri, L. S., and Greenberg, A. E., Eds; American Public Health Association: Washington, DC, 1995; p. 2-8.

Section 60301.650. Oxidized Wastewater.
"Oxidized wastewater" means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

Section 60301.660. Peak Dry Weather Design Flow.
"Peak Dry Weather Design Flow" means the arithmetic mean of the maximum peak flow rates sustained over some period of time (for example three hours) during the maximum 24-hour dry weather period. Dry weather period is defined as periods of little or no rainfall.

Section 60301.700. Recycled Water Agency.
"Recycled water agency" means the public water system, or a publicly or privately owned or operated recycled water system, that delivers or proposes to deliver recycled water to a facility.

Section 60301.710. Recycling Plant.

"Recycling plant" means an arrangement of devices, structures, equipment, processes and controls which produce recycled water.

Section 60301.740. Regulatory Agency.

"Regulatory agency" means the California Regional Water Quality Control Board(s) that have jurisdiction over the recycling plant and use areas.

Section 60301.750. Restricted Access Golf Course.

"Restricted access golf course" means a golf course where public access is controlled so that areas irrigated with recycled water cannot be used as if they were part of a park, playground, or school yard and where irrigation is conducted only in areas and during periods when the golf course is not being used by golfers.

Section 60301.760. Restricted Recreational Impoundment.

"Restricted recreational impoundment" means an impoundment of recycled water in which recreation is limited to fishing, boating, and other non-body-contact water recreational activities.

Section 60301.800. Spray Irrigation.

"Spray irrigation" means the application of recycled water to crops to maintain vegetation or support growth of vegetation by applying it from sprinklers.

Section 60301.830. Standby Unit Process.

"Standby unit process" means an alternate unit process or an equivalent alternative process which is maintained in operable condition and which is capable of providing comparable treatment of the actual flow through the unit for which it is a substitute.

Section 60301.900. Undisinfected Secondary Recycled Water.

"Undisinfected secondary recycled water" means oxidized wastewater.

Section 60301.920. Use Area.

"Use area" means an area of recycled water use with defined boundaries. A use area may contain one or more facilities.

ARTICLE 2. SOURCES OF RECYCLED WATER.

Section 60302. Source Specifications.

The requirements in this chapter shall only apply to recycled water from sources that contain domestic waste, in whole or in part.

ARTICLE 3. USES OF RECYCLED WATER.

Section 60303. Exceptions.

The requirements set forth in this chapter shall not apply to the use of recycled water onsite at a water recycling plant, or wastewater treatment plant, provided access by the public to the area of onsite recycled water use is restricted.

Section 60304. Use of Recycled Water for Irrigation.

(a) Recycled water used for the surface irrigation of the following shall be a disinfected tertiary recycled water, except that for filtration pursuant to Section 60301.320(a) coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2 NTU, the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU for more than 15 minutes and never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes:

(1) Food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop,

(2) Parks and playgrounds,

(3) School yards,

(4) Residential landscaping,

(5) Unrestricted access golf courses, and

(6) Any other irrigation use not specified in this section and not prohibited by other sections of the California Code of Regulations.

(b) Recycled water used for the surface irrigation of food crops where the edible portion is produced above ground and not contacted by the recycled water shall be at least disinfected secondary-2.2 recycled water.

(c) Recycled water used for the surface irrigation of the following shall be at least disinfected secondary-23 recycled water:

(1) Cemeteries,

(2) Freeway landscaping,

(3) Restricted access golf courses,

(4) Ornamental nursery stock and sod farms where access by the general public is not restricted,

(5) Pasture for animals producing milk for human consumption, and

(6) Any nonedible vegetation where access is controlled so that the irrigated area cannot be used as if it were part of a park, playground or school yard

(d) Recycled wastewater used for the surface irrigation of the following shall be at least undisinfected secondary recycled water:

(1) Orchards where the recycled water does not come into contact with the edible portion of the crop,

(2) Vineyards where the recycled water does not come into contact with the edible portion of the crop,

(3) Non food-bearing trees (Christmas tree farms are included in this category provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting or allowing access by the general public),

(4) Fodder and fiber crops and pasture for animals not producing milk for human consumption,

(5) Seed crops not eaten by humans,

(6) Food crops that must undergo commercial pathogen-destroying processing before being consumed by humans, and

(7) Ornamental nursery stock and sod farms provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting, retail sale, or allowing access by the general public.

(e) No recycled water used for irrigation, or soil that has been irrigated with recycled water, shall come into contact with the edible portion of food crops eaten raw by humans unless the recycled water complies with subsection (a).

Section 60305. Use of Recycled Water For Impoundments.

(a) Except as provided in subsection (b), recycled water used as a source of water supply for nonrestricted recreational impoundments shall be disinfected tertiary recycled water that has been subjected to conventional treatment.

(b) Disinfected tertiary recycled water that has not received conventional treatment may be used for nonrestricted recreational impoundments provided the recycled water is monitored for the presence of pathogenic organisms in accordance with the following:

(1) During the first 12 months of operation and use the recycled water shall be sampled and analyzed monthly for *Giardia*, enteric viruses, and *Cryptosporidium*. Following the first 12 months of use, the recycled water shall be sampled and analyzed quarterly for *Giardia*,

enteric viruses, and *Cryptosporidium*. The ongoing monitoring may be discontinued after the first two years of operation with the approval of the department. This monitoring shall be in addition to the monitoring set forth in section 60321.

(2) The samples shall be taken at a point following disinfection and prior to the point where the recycled water enters the use impoundment. The samples shall be analyzed by an approved laboratory and the results submitted quarterly to the regulatory agency.

(c) The total coliform bacteria concentrations in recycled water used for nonrestricted recreational impoundments, measured at a point between the disinfection process and the point of entry to the use impoundment, shall comply with the criteria specified in section 60301.230 (b) for disinfected tertiary recycled water.

(d) Recycled water used as a source of supply for restricted recreational impoundments and for any publicly accessible impoundments at fish hatcheries shall be at least disinfected secondary-2.2 recycled water.

(e) Recycled water used as a source of supply for landscape impoundments that do not utilize decorative fountains shall be at least disinfected secondary-23 recycled water.

Section 60306. Use of Recycled Water for Cooling.

(a) Recycled water used for industrial or commercial cooling or air conditioning that involves the use of a cooling tower, evaporative condenser, spraying or any mechanism that creates a mist shall be a disinfected tertiary recycled water.

(b) Use of recycled water for industrial or commercial cooling or air conditioning that does not involve the use of a cooling tower, evaporative condenser, spraying, or any mechanism that creates a mist shall be at least disinfected secondary-23 recycled water.

(c) Whenever a cooling system, using recycled water in conjunction with an air conditioning facility, utilizes a cooling tower or otherwise creates a mist that could come into contact with employees or members of the public, the cooling system shall comply with the following:

(1) A drift eliminator shall be used whenever the cooling system is in operation.

(2) A chlorine, or other, biocide shall be used to treat the cooling system recirculating water to minimize the growth of *Legionella* and other micro-organisms.

Section 60307. Use of Recycled Water for Other Purposes.

(a) Recycled water used for the following shall be disinfected tertiary recycled water, except that for filtration being provided pursuant to Section 60301.320(a) coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2 NTU, the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU for more than 15 minutes and never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes:

(1) Flushing toilets and urinals,

(2) Priming drain traps,

(3) Industrial process water that may come into contact with workers,

(4) Structural fire fighting,

(5) Decorative fountains,

(6) Commercial laundries,

(7) Consolidation of backfill around potable water pipelines,

(8) Artificial snow making for commercial outdoor use, and

(9) Commercial car washes, including hand washes if the recycled water is not heated, where the general public is excluded from the washing process.

(b) Recycled water used for the following uses shall be at least disinfected secondary-23 recycled water:

(1) Industrial boiler feed,

(2) Nonstructural fire fighting,

(3) Backfill consolidation around nonpotable piping,

(4) Soil compaction,

(5) Mixing concrete,

(6) Dust control on roads and streets,

(7) Cleaning roads, sidewalks and outdoor work areas and

(8) Industrial process water that will not come into contact with workers.

(c) Recycled water used for flushing sanitary sewers shall be at least undisinfected secondary recycled water.

ARTICLE 4. USE AREA REQUIREMENTS.

Section 60310. Use Area Requirements.

(a) No irrigation with disinfected tertiary recycled water shall take place within 50 feet of any domestic water supply well unless all of the following conditions have been met:

(1) A geological investigation demonstrates that an aquitard exists at the well between the uppermost aquifer being drawn from and the ground surface.

(2) The well contains an annular seal that extends from the surface into the aquitard.

(3) The well is housed to prevent any recycled water spray from coming into contact with the wellhead facilities.

(4) The ground surface immediately around the wellhead is contoured to allow surface water to drain away from the well.

(5) The owner of the well approves of the elimination of the buffer zone requirement.

(b) No impoundment of disinfected tertiary recycled water shall occur within 100 feet of any domestic water supply well.

(c) No irrigation with, or impoundment of, disinfected secondary-2.2 or disinfected secondary-23 recycled water shall take place within 100 feet of any domestic water supply well.

(d) No irrigation with, or impoundment of, undisinfected secondary recycled water shall take place within 150 feet of any domestic water supply well.

(e) Any use of recycled water shall comply with the following:

(1) Any irrigation runoff shall be confined to the recycled water use area, unless the runoff does not pose a public health threat and is authorized by the regulatory agency.

(2) Spray, mist, or runoff shall not enter dwellings, designated outdoor eating areas, or food handling facilities.

(3) Drinking water fountains shall be protected against contact with recycled water spray, mist, or runoff.

(f) No spray irrigation of any recycled water, other than disinfected tertiary recycled water, shall take place within 100 feet of a residence or a place where public exposure could be similar to that of a park, playground, or school yard.

(g) All use areas where recycled water is used that are accessible to the public shall be posted with signs that are visible to the public, in a size no less than 4 inches high by 8 inches wide, that include the following wording : "RECYCLED WATER - DO NOT DRINK". Each sign shall display an international symbol similar to that shown in figure 60310-A. The Department may accept alternative signage and wording, or an educational program, provided the applicant demonstrates to the Department that the alternative approach will assure an equivalent degree of public notification.

(h) Except as allowed under section 7604 of title 17, California Code of Regulations, no physical connection shall be made or allowed to exist between any recycled water system and any separate system conveying potable water.

(i) The portions of the recycled water piping system that are in areas subject to access by the general public shall not include any hose bibbs. Only quick couplers that differ from those used on the potable water system shall be used on the portions of the recycled water piping system in areas subject to public access.

Water Recycling Criteria

FIGURE 60310-A

ARTICLE 5. DUAL PLUMBED RECYCLED WATER SYSTEMS.

Section 60313. General Requirements.

(a) No person other than a recycled water agency shall deliver recycled water to a dual-plumbed facility.

(b) No recycled water agency shall deliver recycled water for any internal use to any individually-owned residential units including free-standing structures, multiplexes, or condominiums.

(c) No recycled water agency shall deliver recycled water for internal use except for fire suppression systems, to any facility that produces or processes food products or beverages. For purposes of this Subsection, cafeterias or snack bars in a facility whose primary function does not involve the production or processing of foods or beverages are not considered facilities that produce or process foods or beverages.

(d) No recycled water agency shall deliver recycled water to a facility using a dual plumbed system unless the report required pursuant to section 13522.5 of the Water Code, and which meets the requirements set forth in section 60314, has been submitted to, and approved by, the regulatory agency.

Section 60314. Report Submittal.

(a) For dual-plumbed recycled water systems, the report submitted pursuant to section 13522.5 of the Water Code shall contain the following information in addition to the information required by section 60323:

(1) A detailed description of the intended use area identifying the following:

(A) The number, location, and type of facilities within the use area proposing to use dual plumbed systems,

(B) The average number of persons estimated to be served by each facility on a daily basis,

(C) The specific boundaries of the proposed use area including a map showing the location of each facility to be served,

(D) The person or persons responsible for operation of the dual plumbed system at each facility, and

(E) The specific use to be made of the recycled water at each facility.

(2) Plans and specifications describing the following:

(A) Proposed piping system to be used,

(B) Pipe locations of both the recycled and potable systems,

(C) Type and location of the outlets and plumbing fixtures that will be accessible to the public, and

(D) The methods and devices to be used to prevent backflow of recycled water into the public water system.

(3) The methods to be used by the recycled water agency to assure that the installation and operation of the dual plumbed system will not result in cross connections between the recycled water piping system and the potable water piping system. This shall include a description of pressure, dye or other test methods to be used to test the system every four years.

(b) A master plan report that covers more than one facility or use site may be submitted provided the report includes the information required by this section. Plans and specifications for individual facilities covered by the report may be submitted at any time prior to the delivery of recycled water to the facility.

Section 60315. Design Requirements.

The public water supply shall not be used as a backup or supplemental source of water for a dual-plumbed recycled water system unless the connection between the two systems is protected by an air gap separation which complies with the requirements of sections 7602 (a) and 7603 (a) of title 17, California Code of Regulations, and the approval of the public water system has been obtained.

Section 60316. Operation Requirements.

(a) Prior to the initial operation of the dual-plumbed recycled water system and annually thereafter, the Recycled Water Agency shall ensure that the dual plumbed system within each facility and use area is inspected for possible cross connections with the potable water system. The recycled water system shall also be tested for possible cross connections at least once every four years. The testing shall be conducted in accordance with the method described in the report submitted pursuant to section 60314. The inspections and the testing shall be performed by a cross connection control specialist certified by the California-Nevada section of the American Water Works Association or an organization with equivalent certification requirements. A written report documenting the result of the inspection or testing for the prior year shall be submitted to the department within 30 days following completion of the inspection or testing.

(b) The recycled water agency shall notify the department of any incidence of backflow from the dual-plumbed recycled water system into the potable water system within 24 hours of the discovery of the incident.

(c) Any backflow prevention device installed to protect the public water system serving the dual-plumbed recycled water system shall be inspected and maintained in accordance with section 7605 of Title 17, California Code of Regulations.

ARTICLE 5.1. GROUNDWATER RECHARGE

Section 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.

ARTICLE 5.5. OTHER METHODS OF TREATMENT

Section 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.

ARTICLE 6. SAMPLING AND ANALYSIS

Section 60321. Sampling and Analysis.

(a) Disinfected secondary-23, disinfected secondary-2.2, and disinfected tertiary recycled water shall be sampled at least once daily for total coliform bacteria. The samples shall be taken from the disinfected effluent and shall be analyzed by an approved laboratory.

(b) Disinfected tertiary recycled water shall be continuously sampled for turbidity using a continuous turbidity meter and recorder following filtration. Compliance with the daily average operating filter effluent turbidity shall be determined by averaging the levels of recorded turbidity taken at four-hour intervals over a 24-hour period. Compliance with turbidity pursuant to section 60301.320 (a)(2)(B) and (b)(1) shall be determined using the levels of recorded turbidity taken at intervals of no more than 1.2-hours over a 24-hour period. Should the continuous turbidity meter and recorder fail, grab sampling at a minimum frequency of 1.2-hours may be substituted for a period of up to 24-hours. The results of the daily average turbidity determinations shall be reported quarterly to the regulatory agency.

(c) The producer or supplier of the recycled water shall conduct the sampling required in subsections (a) and (b).

ARTICLE 7. ENGINEERING REPORT AND OPERATIONAL REQUIREMENTS

Section 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.

Section 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.

Section 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.

Section 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.

Section 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

Section 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.

Section 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.

Section 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. RELIABILITY REQUIREMENTS FOR PRIMARY EFFLUENT

Section 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. RELIABILITY REQUIREMENTS FOR FULL TREATMENT

Section 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.

Section 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.

Section 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.

Section 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.

Section 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.

Section 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.

Section 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.

Section 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.

AMENDMENTS TO TITLE 17

DIVISION 1

CHAPTER 5

Subchapter 1

Group 4

EFFECTIVE DECEMBER 2, 2000

ARTICLE 2.

Section 7604. Type of Protection Required.
The type of protection that shall be provided to prevent backflow into the public water supply shall be commensurate with the degree of hazard that exists on the consumer's premises. The type of protective device that may be required (listed in an increasing level of protection) includes: Double check Valve Assembly--(DC), Reduced Pressure Principle Backflow Prevention Device--(RP) and an Air gap Separation--(AG). The water user may choose a higher level of protection than required by the water supplier. The minimum types of backflow protection required to protect the public water supply, at the water user's connection to premises with various degrees of hazard, are given in Table 1. Situations not covered in Table 1 shall be evaluated on a case-by-case basis and the appropriate backflow protection shall be determined by the water supplier or health agency.

TABLE 1
TYPE OF BACKFLOW PROTECTION REQUIRED

Degree of Hazard	***Minimum Type of Backflow Prevention***
(a) Sewage and Hazardous Substances	
(1) Premises where there are waste water pumping and/or treatment plants and there is no interconnection with the potable water system. This does not include a single-family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.	AG
(2) Premises where hazardous substances are handled in any manner in which the substances may enter the potable water system. This does not include a	AG

single-family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.

(3) Premises where there are irrigation systems into which fertilizers, herbicides, or pesticides are, or can be, injected. RP

(b) Auxiliary Water Supplies

(1) Premises where there is an unapproved auxiliary water supply which is interconnected with the public water system. A RP or DC may be provided in lieu of an AG if approved by the health agency and water supplier. AG

(2) Premises where there is an unapproved auxiliary water supply and there are no interconnections with the public water system. A DC may be provided in lieu of a RP if approved by the health agency and water supplier. RP

(c) Recycled Water

(1) Premises where the public water system isused to supplement the recycled water supply. AG

(2) Premises where recycled water is used, other than as allowed in paragraph (3), and there is no interconnection with the potable water system. RP

(3) Residences using recycled water for landscape irrigation as part of an approved dual plumbed use area established pursuant to sections 60313 through 60316 unless the recycled water supplier obtains approval of the local public water supplier, or the Department if the water supplier is also the supplier of the recycled water, to utilize an alternative backflow protection plan that includes an annual inspection and annual shutdown test of the recycled water and potable water systems pursuant to subsection 60316(a). DC

(d) Fire Protection Systems

(1) Premises where the fire system is directly supplied from the public water system and there is an unapproved auxiliary water supply on or to the premises (not interconnected). DC

(2) Premises where the fire system is supplied from the public water system and interconnected with an unapproved auxiliary water supply. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.	AG
(3) Premises where the fire system is supplied from the public water system and where either elevated storage tanks or fire pumps which take suction from private reservoirs or tanks are used.	DC
(4) Buildings where the fire system is supplied from the public water system and where recycled water is used in a separate piping system within the same building.	DC
(e) Dockside Watering Points and Marine Facilities	
(1) Pier hydrants for supplying water to vessels for any purpose.	RP
(2) Premises where there are marine facilities.	RP
(f) Premises where entry is restricted so that inspections for cross-connections cannot be made with sufficient frequency or at sufficiently short notice to assure that they do not exist.	RP
(g) Premises where there is a repeated history of cross-connections being established or re-established.	RP

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New and Improved Draft Groundwater Recharge Criteria in California

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Abstract: The California Department of Health Services began the process of developing comprehensive groundwater recharge criteria for both surface spreading and injection projects in the late 1980s. Draft regulations have gone undergone several iterations. The most recent draft criteria are more flexible than previous versions and eliminate previously used groundwater recharge project categories, require reverse osmosis as the organics removal process, include provisions to allow increasing the percentage of reclaimed water in extracted water beyond 50%, and allow alternatives to the stated criteria. Some issues remain to be resolved, e.g., nitrogen limits, criteria to identify impairment of groundwater suitable for use as drinking water sources, and unregulated organics.

Introduction

The state of California initially considered developing regulations to address groundwater recharge with reclaimed water in the mid-1970s. The state's current water reuse criteria allow groundwater recharge by surface spreading when the quality "fully protects public health"[1]. The California Water Code allows groundwater recharge by direct injection (hereinafter called subsurface injection) when it "will not impair the quality of water in the aquifer as a source of water supply"[2]. These open-ended standards are awkward to use both by the project proponent and the regulatory agency. As interest in indirect potable reuse via groundwater recharge grew, the California Department of Health Services (DHS) formed a Groundwater Recharge Committee in the late 1980s to begin the process of developing comprehensive groundwater recharge criteria.

In recent years, priority was given to adopting revised regulations for nonpotable uses of reclaimed water. Those revised regulations[3] are scheduled for adoption in late 2000. While aspects of that regulatory development process have been protracted, DHS has now intensified its efforts to develop and adopt groundwater recharge criteria. The proposed regulations have undergone several iterations and, when adopted, will replace the more general recharge criteria that are included in the state's current Wastewater Reclamation Criteria[1].

The proposed groundwater recharge criteria will address both surface spreading and subsurface injection projects. The draft criteria are designed to assure a groundwater supply that meets all the drinking water standards and other requirements deemed necessary to assure that the water is safe for potable purposes. The draft criteria address—among other things—wastewater source control, treatment processes, water quality, dilution, recharge methods, operational controls, time in the underground, distance between the points of recharge and extraction of the groundwater, and monitoring wells.

Draft criteria have been used as guidelines for the last 10 years to evaluate and approve groundwater recharge projects in California. Several projects are under permit or in the final stage of state approval based on compliance with the draft criteria. This experience has been a thorough field test of the criteria and has driven their evolution. Several important features of the criteria described herein were developed as alternatives to the draft criteria for specific projects.

In order to facilitate the use of these criteria, the original system of groundwater recharge project categories used in previous drafts of the proposed criteria has been replaced by flexible site requirements. Attempts to use the category designations proved to be awkward and confusing to groundwater recharge project proponents, because proposed projects often do not fit neatly into specific categories. For example, based on economic reasons, a proposed project may attempt to make use of existing geographical features as a recharge area, such as an ephemeral riverbed. Use of such an existing conveyance would preclude the necessity to excavate new spreading basins. While this may be a safe recharge project, no single project category covered the project's unique features.

As a result of several project proposals, DHS began revising how the previously proposed groundwater recharge criteria were applied by eliminating the project categories and looking at the range of possible site specific conditions that would result in acceptable groundwater recharge projects. To this end the flow chart in Figure 1 was developed in an effort to distinguish between surface spreading and subsurface injection projects, citing those specific requirements that would "define" the different projects. Figure 1 deals only with the requirements to control unidentified and unregulated contaminants.

The proposed criteria apply only to planned indirect potable reuse projects that are intended to augment groundwaters that are used, or are suitable for use, as potable water supply sources. California law requires reclamation criteria be complied with where wastewater is treated and put to "a direct beneficial use or a controlled use that would not otherwise occur"[2]. Therefore, the criteria do not apply to all situations where discharged wastewater, or even reclaimed water being used for some other purpose, reaches the groundwater. They clearly do apply to a project that is planned, designed, and operated to recharge groundwater with treated wastewater. More work needs to be done to distinguish those waste-handling activities that must comply from those that do not.

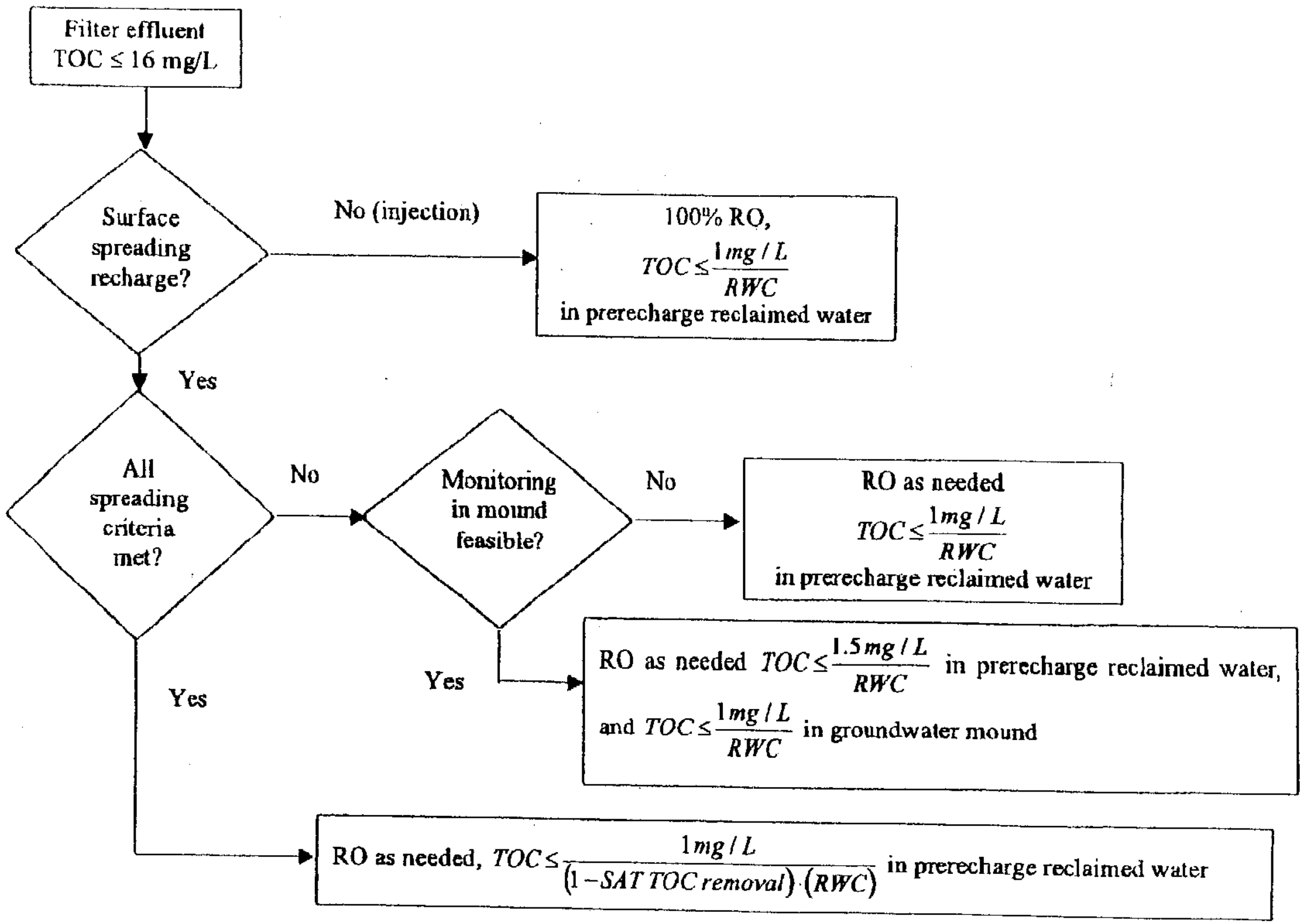

Figure 1. Groundwater Recharge Criteria for Control of Unregulated Organic Chemicals (RWC = percent reclaimed water contribution in groundwater extracted by drinking water wells)

Rationale

It is clear that municipal wastewater is not the most desirable source water for potable purposes; untreated municipal wastewater contains significantly higher concentrations of both microbial and chemical contaminants than natural protected sources of supply. The Safe Drinking Water Act (SDWA) requirements assure a safe drinking water when relatively uncontaminated, protected water sources are used. Drinking water regulations are not intended to address the issues raised by indirect potable reuse and cannot be relied on as the sole standard of safety. Similarly, the federal Clean Water Act (CWA) is intended to eliminate pollution and maintain the chemical, physical, and biological integrity of the nation's waters; its water quality limits are not reflective of drinking water standards.

Even when the contribution of wastewater discharges to a drinking water source exceed some threshold compliance with the CWA and SDWA requirements, the provisions of these acts are insufficient to address all the public health concerns with municipal wastewater contaminants. This is because neither the CWA nor the SDWA establish standards for all harmful contaminants present in wastewater. The level of wastewater contribution that triggers additional contaminant controls has not been identified in law or in the literature. The threshold level in any particular case depends on a number of factors: the industrial, commercial, research, and medical contributions to the sewage that may present unique problems; and the natural barriers to contaminant transport that exist between the waste discharge(s) and the drinking water system surface intake or well. Thus, reclaimed water used for planned indirect potable reuse may have to meet additional water quality criteria for known or suspected harmful microbial and chemical constituents than those that normally apply to drinking water and wastewater discharges.

With increased pressure to utilize dwindling water resources, greater pressure is being placed on existing supplies. The previously noted limitations of the CWA must be recognized. Secondary wastewater treatment facilities are only capable of removing certain classes of organic compounds and may achieve only limited removal due to nutritional or biochemical limitations. Generally, secondary treatment systems have not been designed to handle the range of organic compounds and the attendant concentrations that comprise human waste loads. One has to also wonder if the standard coliform requirements are adequate to ensure the production of a microbiologically safe water from municipal wastewater treatment plants. The existing disinfection literature indicates that the response of pathogens to disinfectants, such as chlorine and UV, may be quite different, with coliforms being the easiest microbiological organism to inactivate.

Certain literature addressing potable reuse states that any domestic use of a water source with a waste discharge component can be considered as indirect potable reuse[4]. It is most useful to address the issues, principles and recommendations found in the literature when the normal controls of the CWA and SDWA become insufficient.

Most contaminants found in municipal wastewater are present at concentrations that are only of concern with chronic exposure. These contaminants are of concern where wastewater contributions are relatively high for long averaging periods (seasonal, annual, or multi-year). The concern is lessened when there are relatively low contributions and short averaging periods.

This is usually the case for carcinogens. Contaminants found in high levels in wastewater relative to safe drinking water levels are of acute exposure concern and may have a threshold at relatively low contributions for all averaging periods. This would be the case for pathogenic microorganisms and nitrate. Contaminants that effect fetal development (perhaps some disinfection byproducts) at critical periods in a pregnancy may have intermediate thresholds in a contribution dependent on the averaging period used.

California DHS has been using a five percent wastewater contribution in surface waters and any planned contribution of reclaimed water to groundwater to indicate the need for a high degree of microbiological control. Unidentified contaminants have become a special concern at wastewater contributions of five to ten percent in surface supplies and any planned contribution of reclaimed water to groundwater.

DHS is also concerned about the presence of chemicals in the recycled water that are not present in the groundwater basins. The California Water Code[2] (Division 7, Article 6, Section 13540, Waste Well Regulation) states that "No person shall construct, maintain or use any waste well extending to or into a subterranean water-bearing stratum that is used or intended to be used as, or is suitable for, a source of water supply for domestic purposes. Notwithstanding the foregoing, when a regional board finds that water quality considerations do not preclude controlled recharge of such stratum by direct injection, and when the State Department of Health Services, following a public hearing, finds the proposed recharge will not impair the quality of the water in the receiving aquifer as a source of water supply for domestic purposes, reclaimed water may be injected be a well into such stratum". Although this statutory requirement only pertains to direct injection through wells into the underlying aquifer, DHS cannot set different public health standards for different types of groundwater recharge projects using recycled municipal wastewater.

There is very little guidance on criteria that might be used to identify a severely impaired source. DHS has the opportunity to develop these criteria in a manner that is protective of public health while not jeopardizing the economic well being of water short areas, e.g., southern California. At present, a stakeholders group of drinking water purveyors, wastewater dischargers, groundwater managers, consulting engineers, and consumer advocates is addressing this issue in an attempt to develop recommendations that will provide DHS with guidance on the water quality objectives groundwater recharge projects must meet to avoid drinking water source impairment.

Recharge Criteria

As previously mentioned, the proposed groundwater recharge criteria have undergone several iterations in recent years, and, while several refinements have been made to improve the criteria, many of the requirements specified in earlier drafts remain unchanged (see Table 1). Some of the requirements included in previous drafts of the proposed groundwater recharge regulations that have not been changed (e.g., treatment reliability, constituent monitoring frequency, and engineering report) will not be discussed in this paper.

Table 1. Proposed Requirements for Groundwater Recharge with Reclaimed Water.

	Type of Recharge	
Contaminant Type	**Surface Spreading**	**Subsurface Injection**
Pathogenic Microorganisms		
Secondary Treatment	SS ≤ 30 mg/L	
Filtration	≤ 2 NTU	
Disinfection	4-log virus inactivation, ≤ 2.2 total coliform per 100 mL	
Retention Time Underground	6 mos.	12 mos.
Horizontal Separation	500 ft.	2000 ft.
Regulated Contaminants	Meet all drinking water MCLs	
Unregulated Contaminants		
Secondary Treatment	BOD ≤ 30 mg/L, TOC ≤ 16 mg/L	
Reverse Osmosis	Four options available, see Figure 1	100% treatment to $TOC \leq \frac{1 mg/L}{RWC}$
Spreading Criteria for SAT 50% TOC Removal Credit	Depth to Groundwater at Initial Percolation Rates of: <0.2 in/min = 10 ft. <0.3 in/min = 20 ft.	NA
Mound Monitoring Option	Demonstrate Feasibility of the Mound Compliance Point	NA
Reclaimed Water Contribution	≤ 50 %	

Source Control

Concerns have been raised regarding the discharge of industrial pollutants not normally removed by municipal wastewater treatment processes. A well operated and strictly enforced source control program will contain these pollutants on-site at the point of generation for proper disposal. This will prevent these contaminants from entering the municipal wastewater treatment plant by severely limiting, restricting, or prohibiting the discharge of these compounds into municipal wastewater treatment plants. The proposed criteria require a comprehensive program for the control of toxic wastes from point sources, which must be approved by the Regional Water Quality Control Board.

Treatment Processes

The definition of "filtered disinfected wastewater" in the proposed revisions to the existing regulations for nonpotable uses of reclaimed water now includes the use of membranes to meet the filtration requirements. This includes and does not distinguish between microfiltration, ultrafiltration, nanofiltration, and reverse osmosis. Although the performance requirement for membranes is more stringent than that for media filters (average 0.2 NTU versus 2 NTU), the work done by the City of San Diego[5] indicates that a filtered wastewater turbidity of greater than 0.1 NTU signals a breach in the integrity of the membranes. An extra 0.1 NTU performance margin was given to allow for variations in turbidity measurements and associated sources of interference, e.g., sloughing from pipe walls.

Also included in the definition of filtered disinfected wastewater is the requirement that the wastewater be oxidized to a total organic carbon (TOC) concentration of 16 mg/L or less. The current Wastewater Reclamation Criteria defines "oxidized wastewater" as "wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen." The TOC requirement of 16 mg/L is a performance based water quality standard. A survey of several existing wastewater treatment plants associated with groundwater recharge projects indicated that a TOC concentration not exceeding 16 mg/L should be easily met by a well operated wastewater treatment plant.

In order to address the issue of unregulated organics, the previous drafts of the proposed criteria allowed the use of granular activated carbon (GAC) or reverse osmosis (RO) for organics removal. While it was recognized that GAC and RO could be complementary with respect to the fractions of organics removed by the processes, GAC is generally regarded as not being as efficient as RO for organics removal. While RO provides a physical barrier to restrict the passage of molecules, GAC depends on the interaction between the solute and the GAC surface in order to affect removal. While both depend on water chemistry and solute properties (ionic radius, hydrophobicity of the solute or membrane, or conformation) for organics removal, the interaction between the solute and GAC surface is more dependent on the interaction between solute and adsorbent than providing a physical barrier to transport. In addition, RO provides the additional benefit of providing inorganics removal that GAC does not. Consequently, the proposed groundwater recharge regulations reflect the conclusion that GAC alone is not deemed to be an effective process for controlling unregulated organics.

Disinfection

The disinfection requirement in the proposed California regulations for nonpotable reuse where a high degree of public exposure is expected is also required for all groundwater recharge projects. This is because it assures a substantial log virus reduction, which is the only pathogenic microorganism not effectively removed by the aquifer. Many groundwater recharge projects also provide nonpotable water for other urban uses, and the disinfection requirement is readily achievable with reclamation technologies commonly in use in California. The two options for compliance are: (1) filtration followed by chlorination with a modal chlorine contact time multiplied by the chlorine residual of 450 mg-min/L; or (2) any combination of filtration and disinfection that has been demonstrated, and is operated, to achieve a 5-log virus reduction.

Water Quality

While the application of an organics removal requirement would appear to solve a plethora of water quality issues, several water quality issues remain. For example, the nitrogen requirement remains under discussion. A proposed total nitrogen standard of 10 mg-N/L was developed in conservative manner to ensure that, should all ammonia forms of nitrogen be converted to nitrate, the effluent nitrate concentration would approach, but never exceed the nitrate maximum contaminant level (MCL). Dilution underground is not considered to be a reliable method for controlling the nitrogen content of the water for a chemical that poses such acute public health threat. Therefore, the total nitrogen standard must be met above ground.

At issue is the nitrite drinking water MCL of 1 mg-N/L. Since biological nitrification and denitrification processes produce nitrite as an intermediate product, it is not known how protective the 10 mg-N/L standard would be of the nitrite MCL. As the environmental conditions (oxidizing/reducing environment) under which nitrite is formed and allowed to persist in the environment appears to be relatively narrow, this is not anticipated to be major issue. However, the current literature provides very little information on the microbial ecology and environmental conditions that might lead to a potential nitrite problem. It is difficult to develop specific criteria to ensure that such conditions are prevented from occurring or excluded from potential recharge sites. This is an issue that is currently under investigation.

Dilution and Unregulated Organics

The draft criteria use the percent of the drinking water supply that comes from reclaimed municipal wastewater as a factor in determining the required degree of unregulated organic removal. This fraction is the reclaimed water contribution (RWC). The previous drafts set separate organic chemical removal requirements for subsurface injection and surface spreading projects going to a 20% RWC and those going to a 50% RWC. Four treatment goals for organics removal have been provided—one goal for subsurface injection projects and three goals for surface spreading operations.

In Figure 1, subsurface injection projects are required to treat 100% of the reclaimed water by RO to provide organics removal. The goal of organics removal is to achieve a TOC concentration that is equal to or less than:

$$\frac{1\,mg\,TOC/L}{RWC} \qquad \text{(equation 1)}$$

where: RWC = the percent reclaimed water contribution in groundwater extracted by drinking water wells.

For all surface spreading operations the degree of organics removal that is required prior to recharge is dictated by the project sponsor's ability to meet all the spreading criteria before the recharged water reaches the native groundwater (see Figure 1). If all the spreading criteria are not met and monitoring in the groundwater mound (before the reclaimed water is mixed with the native groundwater) is not possible, a project sponsor could provide RO treatment that would produce a reclaimed water meeting a TOC performance concentration that is less than or equal to the TOC concentration resulting from equation 1. However, if a project sponsor could develop a program to monitor the TOC concentration in the groundwater mound before the reclaimed water reached the native groundwater, then RO treatment to produce a reclaimed water that contains a TOC concentration that is less than or equal to:

$$\frac{1.5\, mg\, TOC / L}{RWC} \qquad \text{(equation 2)}$$

prior to recharge would be acceptable. In addition, the reclaimed water leaving the groundwater mound would be required to contain a TOC concentration that was equal to or less than the TOC concentration given by equation 1.

The final unregulated organics treatment option is used if a proposed project meets all the recharge criteria for surface spreading. In this case, the treatment train would apply RO treatment as needed to provide a TOC concentration equal to or less than:

$$\frac{1\, TOC\, mg / L}{(1 - SAT\, TOC\, removal) \cdot (RWC)} \qquad \text{(equation 3)}$$

where: SAT TOC removal = the percent TOC removal credit given to the soil aquifer system.

For surface spreading projects meeting all the criteria, the soil aquifer system is given credit for 50% removal of TOC, as discussed later in this paper.

The proposed criteria now contain one set of requirements (in a continuum) for projects with a reclaimed water concentration up to 50%. Although there are provisions for allowing up to a 100% RWC, the criteria establish, in effect, a dilution requirement for most groundwater recharge reuse projects. The rationale for maintaining this dilution requirement has not changed.

An alternative to the 50% maximum RWC criterion is proposed that will assure an equal level of public health protection. The project must demonstrate the effectiveness of the alternate criterion in reducing all the potentially harmful components of wastewater TOC. It must also demonstrate the practically of the criterion as a regulation to support its eventual inclusion in the criteria. There must be objective measures for determining when a project is or is not in compliance. A regulation must also be designed such that all projects in compliance are providing the intended public health protection. During the demonstration phase the project must provide evidence that the public is not at risk. Some combination of water quality monitoring and incremental increases in the RWC may accomplish this.

While it is acknowledged that the 50% dilution requirement does not provide an order of magnitude reduction in the long-term risk of chemical exposure, it does ameliorate the impact of variations in effluent water quality. There is no treatment process for organic chemical removal that effectively removes all classes of potentially harmful organics. Dilution is an effective barrier to all the unidentified contaminants in wastewater. Dilution also provides a margin of safety against the discharge of unknown and unwanted organics, e.g., pharmaceutically active compounds (PHACs), whose impacts on the microbial ecology and potential human health implications was not considered by a science advisory panel (SAP) in its 1987 report to the State of California[6].

In their summary report the SAP acknowledged that analytical chemistry was not capable of routinely identifying organic substances in the part per trillion levels that might occur. In addition, the SAP acknowledged that the toxicology of those compounds could not and probably would never be precisely characterized in the part per trillion range. The SAP also concluded that dissolved organic carbon would be removed to "...below 1 mg/L by reverse osmosis and *essentially* [emphasis added] all identifiable trace organic compounds of significance should be absent in detectable concentrations."

While this may be adequate for most organic compounds that produce an adverse impact on humans, the observation does not provide any consideration of a class of compounds of growing concern that may not produce a recognized (e.g., carcinogenic, mutagenic, or teratogenic) toxicological health effect on humans. This group of compounds, referred to as pharmaceutically active compounds (PHACs), may contain antibiotics, hormones, anti-inflammatories, endocrine homologs, or other constituents. Of these compounds, the antibiotics that do not produce a recognized toxicological effect on humans because of the low concentrations discharged to the environment may pose the greatest health concern. At the low concentrations found in discharges, the antibiotics may allow microorganisms—some of which may be opportunistic pathogens—to adapt to the presence of these compounds, thus creating microorganisms that have increased resistance to these drugs. In fact, researchers are beginning to use bacterial resistance to antibiotics (multiple antibiotic resistance) as a means of associating bacteria with potential sources. Anecdotally, it has been observed that bacteria isolated in the environment near wastewater treatment plant discharges appear to be resistant to a greater range of antibiotics than those located some distance from the discharges. While the cause and long-term consequences have not been evaluated, the observation does raise the issue of the long-term impacts of low level PHAC discharges on the microbial ecology, which may in turn lead to potential human health problems.

Soil Aquifer Treatment

Percolation Rates

In order to ensure the control of unregulated organics in surface spreading operations, the initial percolation rates are still tied to a required depth-to-groundwater, i.e., the unsaturated soil between the bottom of the spreading basin and the top of the groundwater mound. Based on a preliminary review of work underway and historical information, the removal of organics by the soil mantle is credited with 50% TOC removal and is not applicable to subsurface injection projects.

The proposed use of streambeds in one proposed surface spreading operation raised issues with respect to percolation rates. Drop structures disturb the streambed, and percolation rates in the region immediately downstream of the drop structures was higher than allowed due to scouring of the streambed bottom by the water falling over the drop structure. Consequently, concerns were raised that the nonhomogenous percolation rates in these areas were too great to provide adequate soil treatment, which had been demonstrated only at the lower percolation rates. As an alternative, the project proponents will be allowed to monitor in the groundwater mound when surface spreading reclaimed municipal wastewater to ensure compliance with the organics removal requirement before the water leaves the mound.

Groundwater Mound Monitoring

Originally, based on work conducted by the County Sanitation Districts of Los Angeles County, the soil mantle was credited with organics removal in surface spreading projects. There have been concerns that there were no means of evaluating the performance of the soil mantle in in-situ treatment. As noted previously, mound monitoring is allowed as a compliance point to meet the organics removal requirement. However, project proponents must provide physical evidence that the sampling system is capable of providing a representative sample of the groundwater mound. Based on a preliminary review of new groundwater monitoring systems, DHS will allow the use of continuous low-flow sampling for the collection of compliance samples from the mound. The DHS stakeholders group has recommended that any anticipated soil aquifer treatment should be verified by monitoring.

Continuous low-flow dedicated bladder pump systems have been designed and built for groundwater monitoring specifically to avoid sample collection and handling problems that have plagued the traditional purge, pump, and collect systems. It is presumed that, due to water quality differences between the recharge water applied and the native groundwater, the elevated water surface will be comprised exclusively of water from the spreading basin. Using the new sampling technology it is possible to collect water quality samples from the mound above the point at which it mingles with the native groundwater. This allows for compliance with TOC and other water quality standards at a point within the groundwater basin without interference from the native groundwater.

Time in the Underground and Horizontal Separation

The distance between the edge of a recharge basin or point of injection and any water supply well is defined as the horizontal separation. The term "retention time underground" refers to the period of time the recharged water remains underground en route to the well. The purpose of establishing these two criteria was to ensure minimal migration of viruses through the soil system and to allow time for the natural die-off or attenuation of viruses to take place. A minimum residence time underground was established with a minimum horizontal separation distance to control those cases where the time of travel calculation showed a short distance was sufficient. While studies have shown that natural attenuation of viruses in the environment takes place in subsurface systems, other studies have shown viruses to be capable of migrating long distances in the underground. When the observed attenuation of viruses is based primarily on environmental samples, it is not known whether the attenuation was due to some form of inactivation or dilution from extraneous underground water sources. As outlined in Table 1, the horizontal separation and retention time requirements have been simplified to 500 feet and 6 months for surface spreading projects and 2000 feet and 12 months for injection projects, eliminating the horizontal separation requirement of 1000 feet and the retention time requirement of 12 months specified in earlier versions of the draft regulations for some categories of surface spreading operations.

Monitoring Wells

The proposed regulations require the installation of monitoring wells between the groundwater recharge project and the nearest potable water supply well. The monitoring wells are to be located at ¼ and ½ of the distance between a spreading basin or injection well and the closest water supply well (as determined by physical distance). This will allow for the collection of water quality samples to assess the impact of previously unknown water quality problems from constituents such as N-nitrosodimethylamine.

Alternatives

DHS recognizes that there may be methods of achieving the public health goals of the groundwater recharge criteria that were not considered and are not allowed by the specific requirements. A section will be included in the criteria that authorizes alternatives for many of the criteria when it has been demonstrated that the alternative is as effective and reliable in reducing the public exposure to contaminants. In addition, while DHS recognizes the value of toxicological testing, it concurs with the finding in a recent National Research Council report[4] on potable reuse that states "The requirements for toxicological testing of water derived from an alternative source should be inversely related to how well the chemical composition of the water has been characterized. If very few chemicals or chemical groups or concern are present, and the chemical composition of the water is well understood, the need for toxicological characterization is lowered and may be safely neglected altogether." Thus, although DHS supports toxicological testing, the current draft criteria do not require that a toxicological study be performed.

Conclusion

The draft California groundwater recharge criteria have been changed to address problems identified in applying the previous drafts to proposals that have been presented to DHS in recent years. While the approach to the groundwater recharge criteria remains fundamentally unchanged, the purpose of the changes discussed above is to facilitate the use of the proposed groundwater recharge criteria. As acceptable proposed projects were not fitting into proposed project categories identified in previous drafts of the regulations, removal of the project category designations has made the criteria easier to use. The groundwater recharge criteria may still not fit some proposed projects that DHS might find acceptable; however, eliminating the project category classification scheme should more easily accommodate a greater range of projects.

The revised draft regulations improve the proportionality of the required treatment to the public exposure (fraction of the drinking water supply that comes from reclaimed water) and identifies specific requirements by contaminant of concern, i.e., pathogenic microorganisms, regulated chemicals, and unidentified contaminants. This approach makes it easier to interpret the requirements and identify when an alternative may satisfy the regulatory intent. As the requirements are now more specific, the ability to develop alternatives that can be demonstrated to achieve specific endpoints becomes less problematic.

While the draft groundwater recharge criteria presented in this paper reflect the latest thinking by DHS, there undoubtedly will be changes and refinements made to these draft regulations.

References

1. State of California. 1978. *Wastewater Reclamation Criteria.* California Code of Regulations, Title 22, Division 4, California Department of Health Services, Sacramento, California.

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5. EOA, Inc. 1997. *Microbial Challenge Studies at the Aqua 2000 Research Center and Estimation of Process Train Performance with Respect to Microbial Agents.* EOA, Inc. Oakland, California.

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

APPENDIX H

LETTER FROM SOUTHERN CALIFORNIA WATER COMPANY

SOUTHERN CALIFORNIA WATER COMPANY
A SUBSIDIARY OF AMERICAN STATES WATER

COASTAL DISTRICT
1140 LOS OLIVOS AVENUE • LOS OSOS, CA 93402 • (805) 528-6157 • FAX (805) 528-6442

December 12, 2000

Mr. Bruce Buel
General Manager
Los Osos Community Service District
2122 Ninth Street
Los Osos, California 93402

Subject: Shallow Zone Groundwater Harvesting in Western Los Osos.

Dear Mr. Buel:

Thank you for the opportunity to discuss the Los Osos Community Services District's proposal for actively managing the upper shallow groundwater basin in western Los Osos. As I understand your intentions, managing the basin is a major part of the over-all wastewater collection, treatment, and disposal plan. The Southern California Water Company supports your Board's efforts in eliminating the discharge of individual septic systems into the groundwater basin and shares your concerns to protect and improve the water quality of the basin. As you know, SCWC has two wells in Los Osos that are currently inactive as a result of nitrate concentrations at or above the drinking water standard.

The proposed Los Osos CSD wastewater project would recharge the upper zone of the western part of the groundwater basin by discharging 600,000 gpd of treated wastewater through leach fields. Your assurance that the treated wastewater will meet drinking water standards prior to disposal coupled with the elimination of the septic tank discharge leads me to believe that significant improvement to the groundwater quality can be achieved. I also understand that it will be necessary to harvest water from the upper shallow basin to prevent hydraulic problems within the basin.

I agree in concept with the CSD's groundwater management plan, which involves the harvesting of the groundwater for domestic uses. Southern California Water Company has the financial and technical ability to move forward with the implementation of the plan upon its acceptance by the community and others.

However, the Company has an obligation to its customers to ensure that they benefit from participation in the proposed groundwater basin management plan. Prior to a commitment from SCWC, the California Department of Health Services will need to approve the plan. I would also request that SCWC be an active participant in the further development of the groundwater basin plan. SCWC has significant in-house technical expertise that can be a great benefit to the community of Los Osos.

Thank you for the opportunity to participate in this significant project. I feel that this project has the potential to dramatically improve the water quality of the basin. If you have any questions or would like to discuss this project further, please call me at 805-528-7231.

Sincerely,

W Morgan

Warren Morgan
District Manager

cc:
J. Brady
B. Gedney
R. Hanford
H. Szopinski
File Copy

APPENDIX I

HYBRID TREATMENT FACILITY
SRF FLOW AND LOAD ATTRIBUTIONS

Estimated Capital Costs: Hybrid Treatment Facility

SRF Flow and Load Attributions

Facility	Quantity	Units	Unit Price ($)	Item Cost ($)	SRF Split Solids Based	SRF Split Flow Based
Influent Pump Station						
Excavation and Shoring	ls			25,000		25,000
Wet Well & Dry Pit	ls			50,000		50,000
Pumping Equipment	ls			50,000		50,000
Piping	ls			50,000		50,000
Screenings Equipment	ls			75,000		75,000
Electrical Equipment	ls			75,000		75,000
Building Superstructure	600	ft^2	125	75,000		75,000
Septage Receiving	ls			200,000	200,000	
Grit Facilities	ls			200,000	200,000	
Aeration Splitter Box	ls			75,000		75,000
Aeration Basins						
Excavation and Levees	12,000	cy	7	84,000	42,000	42,000
Liners	55,000	ft^2	2	110,000	55,000	55,000
Aeration Diffusers	ls			300,000	150,000	150,000
Aeration Piping	ls			300,000	150,000	150,000
MLSS Splitter Box	ls			125,000	125,000	
Secondary Clarifiers	2	ea	350,000	700,000	350,000	350,000
RAS /Blower Building						
RAS Pumps- 700 gpm,10hp	2	ea	3,000	6,000	6,000	
WAS Pumps	2	ea	1,000	2,000	2,000	
Blowers- 2000cfm, 60hp	3	ea	20,000	60,000	60,000	
Electrical	ls			125,000	125,000	
Building Superstructure	1,000	ft^2	125	125,000	125,000	
Filter						
Site Work	ls			75,000		75,000
Equipment- Dynasand	ls			300,000		300,000
Piping	ls			50,000		50,000
Electrical	ls			100,000		100,000
UV System						
Site Work	ls			100,000		100,000
Equipment	256	lamps	1,000	256,000		256,000
Piping	ls			75,000		75,000
Electrical	ls			150,000		150,000
Effluent Pump Station						
Site Work & Concrete	ls			50,000		50,000
Pumps - 500 gpm, 25 hp	3	ea	12,500	37,500		37,500
Piping	ls			50,000		50,000
Electrical	ls			75,000		75,000
Effluent Storage Basin	2	mgal	250,000	500,000		500,000

Estimated Capital Costs: Hybrid Treatment Facility

SRF Flow and Load Attributions

Facility	Quantity	Units	Unit Price ($)	Item Cost ($)	SRF Split Solids Based	SRF Split Flow Based
Solids Stabilization						
Gravity Belt Thickener	1	ea	100,000	100,000	100,000	
Belt Press- 1 meter, 3 belt	2	ea	100,000	200,000	200,000	
Sludge Cake Conveyors	40	lf	1,000	40,000	40,000	
Sludge Cake Loading	ls			75,000	75,000	
Polymer System	ls			50,000	50,000	
Aerobic Digester	70,000	gal	3	210,000	210,000	
Building Superstructure	1,500	ft^2	200	300,000	300,000	
Electrical	ls			200,000	200,000	
Support Mechanical	ls			200,000	200,000	
Treatment Process Subtotal				**6,005,500**	**2,965,000**	**3,040,500**
% Split Solids/Liquids					49%	51%
Biofilter						
Site Work	ls			50,000		
Fans	3	ea	3,000	9,000		
Duct Work	ls			75,000		
Media	400	cy	50	20,000		
Electrical	ls			50,000		
O&M Building						
Control Room	400	ft^2	150	60,000		
SCADA System	ls			100,000		
Locker & Showers	400	ft^2	200	80,000		
Process Lab Area	400	ft^2	400	160,000		
Maintenance Shop	500	ft^2	125	62,500		
Site Landscaping	ls			150,000		
Site Yard Piping	ls			300,000		
Electrical Service and Distribution	ls			300,000		
Non-Treatment Process Subtotal				**1,416,500**	**699,346**	**717,154**
Construction Subtotal				**7,422,000**	**3,664,346**	**3,757,654**
Contingency at 20 %			0.2	1,484,400	732,869	751,531
Estimated Construction Cost				**8,906,400**	**4,397,215**	**4,509,185**
Engineering and Admin at 27.5%			0.275	2,449,260	1,209,234	1,240,026
Total Estimated Base Capital Cost				**11,355,660**	**5,606,449**	**5,749,211**

Notes:

Assumes 1.3 mgd.

All estimates are for conceptual sizing of facility.

Includes back-up power costs.

Total Estimated Base Capital Cost does not include site-specific costs. Please refer to Table 4-4.

Estimated Annual O&M Costs: Hybrid Treatment Facility

SRF Flow and Load Attributions

Facility	Quantity	Units	Unit Price ($)	Item Cost ($)	SRF Cost Split	
					Solids Based	Flow Based
		Influent Pump Station				
Pumping Power	90,000	kwhr/yr	0.08	7,200		7,200
HVAC & Lighting	45,000	kwhr/yr	0.08	3,600		3,600
Parts & Materials	ls			5,000		5,000
Chemicals	ls			1,500		1,500
Total				17,300		
		Aeration Basins				
Aeration Power	750,000	kwhr/yr	0.08	60,000	30,000	30,000
Parts & Materials	ls			5,000	2,500	2,500
Total				65,000		
		Secondary Clarifiers				
Power	10,000	kwhr/yr	0.08	800	400	400
		RAS Pump Station				
RAS Pumps Power	156,000	kwhr/yr	0.08	12,480	12,480	
Parts & Materials	ls			5,000	5,000	
Total				17,480		
		Filter				
Power	40,000	kwhr/yr	0.08	3,200		3,200
Chemical	ls			5,000		5,000
Total				8,200		
		UV System				
UV Lamp Power	140,000	kwhr/yr	0.08	11,200		11,200
Lamp Replacement	200	lamps	40	8,000		8,000
Total				19,200		
		Solids Stabilization				
Aeration Power	170,000	kwhr/yr	0.08	13,600	13,600	
Belt Press Power	30,000	kwhr/yr	0.08	2,400	2,400	
Sludge Cake Conveyors Power	10,000	kwhr/yr	0.08	800	800	
Sludge Cake Loading Power	5,000	kwhr/yr	0.08	400	400	
Building HVAC & Lighting	75,000	kwhr/yr	0.08	6,000	6,000	
Parts & Materials	ls			5,000	5,000	
Chemicals	ls			12,000	12,000	
Total				40,200		
Biosolids Disposal	2,080	wet tons/yr	30	62,400	62,400	
		Biofilter				
Fan Power	90,000	kwhr/yr	0.08	7,200	3,528	3,672
Parts & Materials	ls			1,500	735	765
Total				8,700		
		O&M Building				
HVAC and Lighting	75,000	kwhr/yr	0.08	6,000	2,940	3,060
Total				6,000		
Site Landscaping	ls			15,000	7,350	7,650
Site Yard Lighting	50,000	kwhr/yr	0.08	4,000	1,960	2,040
O&M Labor	5,600	hrs/yr	40	224,000	110,000	114,000
Laboratory Analysis	ls			10,000	4,900	5,100
Total Estimated Annual O&M				**498,280**	**284,393**	**213,887**

Notes:

Cost estimate for O&M labor assumes 2.7 full-time employees.

APPENDIX J

HYDROGEOLOGIC INVESTIGATION OF THE BRODERSON SITE

HYDROGEOLOGIC INVESTIGATION

OF

THE BRODERSON SITE

PHASE 2 - IMPACTS ASSESSMENT

Prepared for the

LOS OSOS COMMUNITY SERVICES DISTRICT

NOVEMBER 2000

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EXECUTIVE SUMMARY

Cleath & Associates has completed the second phase of a two-part hydrogeologic investigation of the Broderson site, a 40-acre parcel south of Highland Drive in Los Osos. The purpose of the investigation was to evaluate the amount of community wastewater the Broderson site could accept for disposal. This investigation includes a re-evaluation of prior dry well testing, an evaluation of the potential for perched water in the vadose zone to daylight, a presentation of the results of ground water flow modeling, wastewater travel time calculations, and a discussion of mitigation options for potential surfacing of shallow ground water near the bay.

The recommended rate of wastewater disposal at the site is 800,000 gallons per day. Daylighting will not occur at this disposal rate between Highland Drive and Los Osos Valley Road due to mounding or lateral movement of perched water along the shallowest perching horizon. There will be an increased potential for liquefaction beneath residences immediately downslope of the infiltration area, however, due to the saturation of potentially liquefiable material.

Ground water flow modeling using the MODFLOW code shows that an 800,000-gallon per day disposal rate at the site would cause ground water to mound to approximately 195 feet elevation, or 40 to 50 feet beneath ground surface, at the proposed infiltration area. Perched water above the modeled ground water mound will bring the depth of saturation at the infiltration area to approximately 25 feet below ground surface. The infiltration area should cover at least 7 acres to avoid mounding issues on Horizon A, be as long as practical (east to west, parallel to the slope), and should be setback to the south away from Highland Avenue at least 450 feet.

Wastewater particles will take at least 1 year to move offsite, and 14 years to reach the bay in the upper aquifer. Movement of particles from the site to the Rosina Well (30S/10E-13J01) will take at least 16 years, of which an estimated 11 years is spent moving through a regionally confining clay layer into the lower aquifer.

Rising water to disposal activities will potentially result in surfacing or near surface ground water within about 1,000 feet of the bay, between Pecho Road and the Sweet Springs fault splay. Several conceptual approaches can be taken to mitigate surfacing water, including diversions of shallow ground water or altered land uses. A monitoring program may be implemented to focus appropriate mitigation in the affected areas.

INTRODUCTION

Cleath & Associates has completed the second phase of a two-part hydrogeologic investigation of the Broderson site, a 40-acre parcel south of Highland Drive in Los Osos (Figure 1). The purpose of the investigation was to evaluate the amount of wastewater that the site could accept, and to include mitigation options as needed for surfacing water. Wastewater particle travel times for various distances and depths away from the site were also evaluated.

The first phase of the Broderson site hydrogeologic investigation identified higher and lower permeability layers from ground surface to the base of the first regional aquitard. These fine grained horizons were labeled A through D (shallow to deep). Information obtained from Phase 1 was used extensively for Phase 2.

The Phase 2 hydrogeologic investigation consists of two impact evaluation sections, a discussion of results, a mitigation options section, and final conclusions. The first section is a technical evaluation of the potential for perched water in the vadose zone to daylight. The second section presents the results of ground water modeling and travel time calculations. A discussion of the results follows, with a recommended wastewater disposal quantity at the Broderson site. The mitigation options section focuses on ways to control rising ground water near the bay.

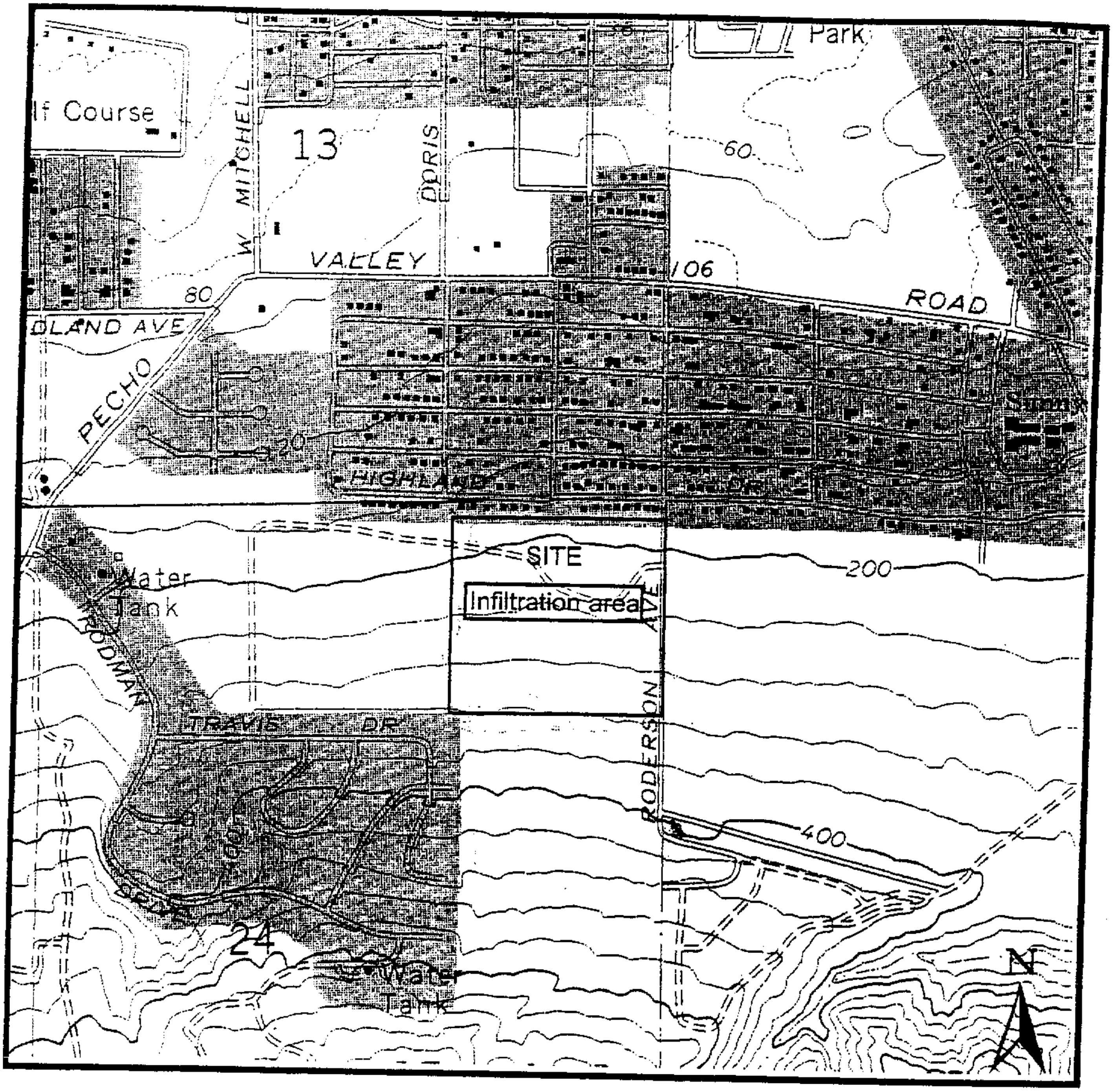
VADOSE ZONE ANALYSES

The critical finer grained horizon for lateral migration of wastewater in the vadose zone is Horizons A, an approximate 2 foot thick clayey sand at depths between 35 and 50 feet beneath the site (Cleath & Associates, June 2000). The analytical evaluation of potential daylighting impacts from percolating wastewater perching on Horizon A is presented in three parts, vadose zone flow, dry well testing, and potential daylighting.

Vadose Zone Flow

The movement of percolating water in the vadose zone occurs as both saturated and unsaturated flow. Unsaturated flow is controlled by capillary and gravitational forces. For moisture content above a threshold value, gravitational force exceeds capillary force and flow occurs. In general, unsaturated flow conforms to Darcy's Law, but with a lower hydraulic conductivity than for saturated conditions. Approximations for the relationship between saturated and unsaturated hydraulic conductivity have been developed experimentally and are summarized by Todd (1959).

According to Todd, the first evidence of unsaturated flow through a soil profile is the arrival of the wetting front, which is dominated by capillary forces. A wetting zone follows that is variably saturated



Base map: USGS Topo, Morro Bay South
Photorevised 1978

Base map scale: 1 inch = 1,000 feet

Figure 1
Site Location
Broderson Hydrogeologic Investigation
Los Osos CSD

Cleath & Associates

above the threshold value for flow, and finally, a flow transmission zone is established at a constant moisture content.

Dry Well Tests

The results of the dry well tests were cause for concern based on the semi-perching ability of the finer grained horizons. The purpose of reviewing the dry well study is to illustrate how unsaturated flow plays an important role in the movement of water through the vadose zone at the site, and that the inferred laterally extensive finer grained horizons do transmit water vertical down, although at a lower flow rate per square foot compared to the amount of water that was being pumped into the ground above.

Metcalf & Eddy (M&E, 1997) identified finer grained horizons at the dry well testing locations D1 and D2 (Figure in Appendix A). Fine sands were logged in the subsurface at D1 with increased silt and clay content locally at 15 feet (D1), 35 feet (soil boring B1), 35-45 feet (D1), 70 feet (neutron probe sites P1 and P2), and 100 feet depth (P1/P2). Fine sands were also logged at dry well D2, with a finer grained horizon of increased silt and clay content identified at 80 feet depth (from probe sites P3 and P4).

The 70-foot and 80-foot depth finer-grained horizons logged at the dry well sites by M&E correlate with Cleath & Associates' Horizon B. The 100-foot depth zone at D1 is part of Horizon C. Horizon A is correlated to a depth of 35 feet at D1 based on the log soil boring B1, and at a depth of approximately 48 feet in the vicinity of D2 based on the neutron probe logs.

According to the principals of unsaturated flow, the finer grained horizons beneath the site would become saturated first during the advance of a moisture plume, as they require a higher threshold of saturation to transmit water. These fine grained clayey and silty sands also have higher capillary potential and can readily absorb water. The flow restriction through the finer grained horizons will cause saturated, perched water zones above, while below the finer grained horizons, leakage will begin a new unsaturated flow regime.

During dry well tests conducted by Metcalf & Eddy, the early development of saturated transmission and unsaturated flow transmission zones are documented. For example, at monitoring point P4, approximately 40 feet north of D2, a saturation developed along an approximate 3-foot interval between about 45 and 48 feet on the second day of testing (neutron probe Graph 1, Appendix A). This particular interval is interpreted as occurring in and immediately above the shallowest significant fine grained horizon, which would correlate with Horizon A.

Over the next 10 days, the lower permeability Horizon A perches water above it (saturated flow), while an unsaturated transmission zone develops below it. Establishment of a deeper saturated transmission zone at P4 occurs after 14 days (three days after discharges in D2 have ceased), and identifies the second significant fine grained horizon at 80 feet, corresponding to Horizon B (Graph 2, Appendix A). The same general development of saturated and unsaturated transmission zones is seen at neutron probe P3.

The development of the moisture plume at dry well D1 indicates that there are finer grained horizons at approximately 35 feet, 53 feet, and 75 feet (Graph 3). Cleath & Associates' Horizons A and B are correlated with the 35 and 75 feet deep increased moisture zones, while the 53-foot deep horizon is an intermediate horizon.

At neutron probe site P1 (10 feet south of dry well D1), a saturated zone is developed from above Horizon A to the base of the intermediate horizon at 53 feet depth, followed by an unsaturated transmission zone (fed by leakage) through Horizon B. As the test progresses, Horizon B becomes a saturated transmission zone and an unsaturated transmission zone develops below Horizon B. At the same time as the wetting front is moving downward from the base of Horizon B, a wetting front is climbing upward from the bottom of the borehole (Graphs 4 and 5).

The explanation for the rising wetting front is debatable. According to M&E, the probe annulus was backfilled with native materials, not a conventional gravel pack. This being the case, it would appear unlikely for water to move down the outside of the casing wall without being pulled into the native backfill by capillary forces and being detected by the neutron probe. In fact, it would be impossible to create rising capillary movement from the base of the borehole by percolating water down the annular space from above. However, it is equally unlikely for percolating water to have found a pathway in the subsurface between the base of D1 (50 feet) and 120 feet depth that did not create saturated transmission zones along Horizons B and C at P1. The anomaly at P1 may be due to increased condensate collecting inside the neutron probe casing, which would be possible if left open in humid conditions. A similar, less pronounced effect is seen at P4, but not at P2 or P3.

Despite the problem at P1, unsaturated flow clearly develops below Horizon B and results in the saturation of the finer grained horizon at 100 feet depth. The subsequent development of an unsaturated transmission zone below 100 feet is partially masked by the anomaly at the base of P1, but reaches at least 105 feet depth before the conclusion of monitoring (Graph 6).

At neutron probe site P2, saturated flow is developed along Horizon A and the intermediate finer grained horizon at 53 feet depth. An unsaturated transmission zone is slowly developing beneath the intermediate horizon but does not reach Horizon B through the conclusion of monitoring (Graph 7).

The above examples of how water moves in the vadose zone show how important unsaturated flow is. It is also important to acknowledge that the 40-50 gpm flow into the dry wells was creating a perched zone up to 20 feet thick above Horizon A. This perched layer was moving laterally, and the potential for its daylighting downslope is the focus of the impacts analysis on Horizon A.

Potential for daylighting due to Horizon A

The potential for daylighting downslope due to lateral migration of percolating water along finer grained horizons in the vadose zone was a concern expressed by Cleath & Associates (1999, 2000) and others. The following evaluation of this potential impact considers the local geology, principals of vadose zone flow, groundwater hydraulics, and regional topography.

The orientation of bedding in the subsurface is roughly subparallel to ground surface, at approximately 7 percent slope (4 degrees from horizontal). This orientation was documented in the Phase 1 Hydrogeologic Investigation (Cleath & Associates, July 2000). The distribution of finer grained horizons was also characterized in the prior work and reviewed above.

Percolating wastewater from surface infiltration facilities will follow the scenario described by the dry well tests; the establishment of saturated perched water in and immediately above the finer grained horizons, with unsaturated flow transmission zones immediately below these horizons. Percolating wastewater will spread out along Horizon A, as seen in the dry well testing, until it covers a sufficiently large area to transmit the full percolating volume through it, or until it daylights, at which point the saturated zone above Horizon A will stop growing.

To determine the surface area required to transmit a proposed volume of wastewater through Horizon A, Darcy's Law can be used: $Q = KiA$, where Q = flow, K = saturated vertical hydraulic conductivity, i = hydraulic gradient, and A = area. The critical values to estimate are K and i, since Q is selected and A is solved for.

K is the vertical saturated hydraulic conductivity of Horizon A. Several laboratory permeameter tests were performed across the site by M&E (1996). The lowest value reported for hydraulic conductivity was 0.04 ft/day (B5-50.5 feet). The depth of sampling correlates to Horizon A, based on Cleath & Associates' deep boring TH3 at the same location (C&A, 2000). The laboratory methodology used forces water through samples collected with brass rings (tubes) that are driven vertically into the ground, and measures vertical permeability, which typically ranges from 2 to 10 times less than the horizontal permeability for individual sedimentary beds. A falling head permeability test conducted at the same location yielded a K estimate of 0.12 ft/day, about three times the laboratory value for vertical K. For the purpose of this analysis, the vertical saturated hydraulic conductivity of Horizon A is assumed to be 0.04 ft/day.

The hydraulic gradient (i) in the case of vertical leakage through Horizon A is equivalent to the hydraulic head divided by the Horizon A thickness. Below Horizon A, vadose zone flow becomes unsaturated. The hydraulic head on Horizon A will vary depending on the height of the saturated mound beneath the infiltration area. Development of this perched mound is independent of the development of the larger and deeper mound on ground water, and it is assumed for this shallow zone analysis that the deeper groundwater mound does not rise into the base of Horizon A. In addition, the perched mound on Horizon A will not be allowed to rise above of 20 feet in height (approximately 20 feet below ground surface. The thickness of Horizon A, as defined in the Phase 1 hydrogeologic investigation, is 2 feet. Therefore, the effective vertical hydraulic gradient on Horizon A beneath the center of the infiltration area would be a maximum of 10 feet. This head would not be constant, but would drop off away from the center of the mound.

The shape of the perched mound would be affected by the dimensions of the infiltration area, the slope of Horizon A, and the rate of wastewater application , and the amount of leakage through Horizon A. For practical purposes, the shape of the mound on Horizon A is assumed to be similar to the shape of the underlying ground water mound beneath the infiltration area, which was modeled using MODFLOW. The larger ground water mound also builds on a sloped, leaking base (the AT2 Clay), has a similar infiltration area shape, and the same rate of wastewater application.

Beneath the edges of an infiltration area at the Broderson site, the perched mound would be spreading outward, and traveling in a down dip direction (north) along the surface ofHorizon A. The minimum size of the surface infiltration area needed to percolate a given flow would include both the infiltration area and the area of lateral spreading. By maximizing the infiltration area in an east-west direction at the site, the amount of available percolating area on Horizon A per foot of lateral spread to the north (toward Highland Drive) would also be maximized. The maximum east-west length for infiltration at the site is assumed to be 1,200 feet (out of 1,320 total). Some residences along Sea Horse Lane will be closer to the west edge of the infiltration area than those along Highland Drive, but potential daylighting impacts will be greatest to the north.

Without considering any downslope flow (for the moment), an infiltration area of 1,200 ft x 310 ft (8.5 acres) would percolate 1 million gallons per day (mgd) through Horizon A, and a 1,200 ft x 250 ft area (6.9 acres) would percolate at least 800,000 gallons per day without allowing water to rise more than 20 feet above Horizon A (an 18-foot average head is used). These would be the minimum recommended areas for disposal at the respective rates. These areas do not represent the active contact area required for hydraulic loading, but represent the area over which the infiltration facilities should be spread to avoid mounding impacts on Horizon A.

As mentioned above, the mound would not be constant throughout, but would decrease away from the center of the area. The proportions for the modeled ground water mound are as follows:

- The average height of the mound beneath the infiltration area is approximately four times the average height of the mound north of the infiltration area.
- The effective lateral extent of the mound (to 0.5 feet thickness or less) north of the edge of the infiltration area is approximately 34 times the average height beneath the infiltration area.

Based on these proportions over the recommended infiltration area above, the average height of perched water beneath the infiltration area needed to percolate 1 mgd, including consideration for lateral flow, would be 13.5 feet. The lateral extent of the mound (in excess of about 0.5 feet thickness) north of the infiltration area would be 460 feet, and would average 3.5 feet in thickness.

Maximum setback of the infiltration area to the south will increase the available infiltration area before lateral movement can progress beneath residences along Highland Drive. Using the 1,200 foot x 250 foot infiltration area and 800,000 gallons per day disposal, a maximum setback distance of 450 feet from residences to the edge of the infiltration area would be possible on the lower (and flatter) half of the site. Therefore, exclusive of the applications area, there would be 540,000 square feet (12.4 acres) of infiltration area for water to move below Horizon A before reaching the closest home to the north.

The following table summarizes the pertinent information on the potential daylighting impacts for various flow rates, and assumes that the maximum setback from the residences to the back (south edge) of the infiltration area is 700 feet, which is the southerly extent of the eucalyptus and roughly the break in slope (steeper to the south).

Table 1
Results of Potential Daylighting Analysis
Horizon A

Infiltration area dimensions in feet			Perched mound on Horizon A (average 40 feet depth)		
Volume (mgd)	Minimum recomm. area* (ft)	Available setback (ft)	Thickness at Highland Drive (ft)	Lateral extent from infiltration area (up to 0.5 ft thick); (ft)	Maximum mound height (ft)
0.6	1000 x 200	500	<0.5	390	11.5
0.8	1200 x 250	450	0.5	430	12.5
1	1200 x 300	400	1.4	460	13.5
1.3	1200 x 350	350	2.0	530	15.5

*Notes: The total active percolation area can be smaller, but should be distributed over the recommended area. Daylight potential assumes no interference from the principal ground water mound below.

Daylighting should not occur between Highland and Los Osos Valley Road due to mounding or lateral movement of perched water along the Horizon A slope for disposal rates up to at least 1.3 mgd. The added impact of precipitation on perched conditions (up to about 0.4 feet per year) would not change the daylighting analysis conclusions. There were no observed perched water tables on Horizon A during site investigations beneath the site in 1996, indicating percolation of precipitation does not accumulate from year to year. There would be insufficient deep percolation in the site vicinity to cause daylighting.

The lateral extent of perched water movement less than approximately 0.5 feet thick is difficult to estimate, and may extend as sheet flow or a series of individual down the slope toward Los Osos Valley Road. Almost all of the flow will percolated beneath the site.

Prior to this analysis, it was noted that during the dry well testing a saturated head of up to 20 feet developed above Horizon A at well D2 (Graph 2; Appendix A). This is higher than the estimated head developing on Horizon A with 1.3 mgd flows, yet the dry well test results are consistent with the approach taken above. The reason for this is the area being used for project disposal is much greater compared to the flow rate than the dry well testing. The dry wells were being operated at disposal rates of 40-50 gpm, equivalent to 57,600 - 72,000 gallons per day. Dry well D2 was drilled to 40 feet, therefore all the disposal was being injected above Horizon A. By the end of the test, 35-feet of head had developed on top of Horizon A at the well and 18 feet of head at P4 (40 feet north). Using the above methods of analysis, a 40' x 40' plot at 72,000 gallons per day would require a head of 32 feet beneath the application area and would need to extend 1,000 feet north with an average head of 8 feet to percolate all the water through Horizon A.

GROUND WATER MOUNDING ANALYSIS

Below Horizon A, the analysis of ground water mounding has been address by using a ground water flow model. John Nadolski (Nadolski Technical Services) performed the model construction and operation. Cleath & Associates provided hydrogeological input. The model components, calibration, and results of scenarios are reported herein.

Hydrogeologic Framework

Several ground-water models have been prepared for the Los Osos Valley. One of the first successfully completed models was prepared in 1988 (Yates and Wiese, 1988). The hydrogeologic framework prepared in this 1988 model was adopted in subsequent studies, and portions of the original hydrogeologic framework have been used in this model.

In summary, the Los Osos Valley is a relatively small, shallow basin, draining Los Osos Creek and Warden Creek into Morro Bay. The valley is located between the Irish Hills to the south, the Estero Bay to the north, and the Pacific Ocean to the west. The valley trends to the west, north-west, following the trend of the basin syncline and parallel to the structural trend of the Irish Hills. For the purpose of the ground water model, the southern edge boundary was assumed to be the main strand of the Los Osos fault zone.

In the Los Osos area, much of the land surface is covered by wind-blown sands and underlain by unconsolidated deposits assigned to the Paso Robles Formation. The basin is underlain and surrounded by consolidated rocks associated with the Franciscan Formation and Pismo Formation.

Key to the ground-water model construction is the hydrogeologic framework of the basin. Most of Los Osos-Baywood Park is located over the trough of the basin. To the north, the syncline rises gradually at approximately 0.5 degrees beneath the Morro Bay estuary. The southern limb of the syncline is rising at roughly 4 degrees. The hydraulic gradient is much steeper in the southern portion of the basin. Water purveyor production wells and community monitoring wells are generally located in the central and/or southern portions of the basin.

Three layers were used to define the original U.S.G.S. model. Layer 1 represented the material between the ground surface and the top of first regional aquitard (commonly referred to as the AT2 Clay), including the shallow aquifer. Layer 2 represented the confined aquifer below the AT2 Clay. Layer 3 represented the material below the AT3 Clay and above the basement rock material (to a depth of 640 feet below sea level). These three layers were carried through to a second version of the U.S.G.S. model as revised by URS and TEAM Engineering.

Development of Broderson Site Model Revision

The electronic URS model delivered with the URS 95% Draft Report was used as the starting point for the Broderson site model revision. The grid spacing was approximately 500 feet by 500 feet with 53 rows, 46 columns and three layers. A fault (the Sweet Springs fault splay of the Los Osos Valley Fault) divided the basin study area into two sections, east and west. The ground water flow model used in this mounding analysis modified only the western section of the previous URS model. For convenience, the western section was cut from the previous model and revised as a stand-alone project. However, to preserve the ability for the two sections be combined in the future, the grid and coordinate system was unchanged, whenever possible.

One exception to this rule is in the area of the disposal cells. A higher degree of resolution was needed in this area, and cell grid spacing was divided in half (i.e. new grid cells in disposal area were 250 ft. by 250 ft). The study was represented with 57 rows and 29 columns, with a total area of 11.88 square miles. As with the previous model, the grid is rotated counterclockwise 25° 48'40" from North with an offset of 11,600 feet from the California State Plane Coordinate System.

Initially, 12 layers were used in the revision, representing the layers as established in an earlier study (Cleath & Associates, 2000). The layers represented included finer grained Horizons A, B, C, and D, the sandy inter-horizon material, the AT2 Clay, the AQ2 production zone, and a lower layer representing AT3 and deeper horizons (see Table 2). After the initial construction, Layer 1 proved too thin, resulting in cyclic convergence problems for the model. Therefore, Layers 1, 2 and 3 were combined as Layers 1 and 2, resulting in 11 layers for the model. Layer 2, which represented the shallowest fine-grained horizon (Horizon A) was essentially removed, and a separate, detailed analytical treatment was developed for this critical horizon.

There were several major revisions to the URS model for use in the mounding analysis. The first revision was a detailed definition of finer grained lithologies present in the original Layer 1. Ground water will move slower through finer grained layers, although these layers do not provide a barrier to flow. Changes in grain size were used to define the revised layering for the model. The (relatively) coarser grained material was given a hydraulic conductivity value of between 4 and 20 feet per day, and the fine-grained material was given a hydraulic conductivity value of 0.13 feet per day. The first regional aquitard is the AT2 Clay, and the hydraulic conductivity for this layer was estimated at 0.01 feet per day.

A revision of the base of the AT2 Clay and the top of the AT3/AQ3 was the second major step in preparing the model for the mounding analysis. The AT2 Clay is interpreted as the primary confining layer that separates the shallow aquifer from the lower aquifer and is very important to basin dynamics. All of the layers are defined in Table 2 along with a comparison of the previous layering system with the current system.

Table 2
Layers Used in Model

Layers Used in Broderson Site Model	Layers Used in Previous Models	Average depth above AT2 Clay (ft.)	Average Thickness (ft.)	Horizontal K (Ft/day)	S
1	1	203	25	6	0.15
2	1	178	33	4	0.05
3	1	145	2	0.13	0.05
4	1	143	23	4	0.15
5	1	120	25	0.13	0.05
6	1	95	50	4	0.15
7	1	45	5	01.3	0.05
8	1	40	40	20	0.18
9 AT2 Clay	2	0	70	0.01	0.05
10	2	-70	110	4-6	5.0 E-4
11	3	-180	350	4-6	5.0 E-4

Note: Ratio of horizontal to vertical K was 3:1.

Hydrologic and Hydrogeologic Data

Well production data through October 1996 was taken from previous studies (URS, 2000). Additional production and water level data was obtained for the period through October 1999 and this data was added to the model. All available data was used on the hydrographs to compare observed vs. predicted data.

The third major model revision was surface topography. Surface topography and layer elevation data were re-calculated for this model. The model grid was drawn on a surface topographic map and the elevation for each cell was checked against the earlier models. Where needed, the surface elevation was changed to match the information from the USGS topographic map. An elevation contour map on the top of the AT2 Clay (i.e. layer 9) was made. From this base, bottom elevations for the other layers were obtained (Table 3).

Geologic control for the AT2 Clay beneath the study area is good. Five deep boreholes were drilled in the site and vicinity to fill gaps in the existing database (Cleath and Associates, June 2000). Correlations were made based on drill penetration rates, cuttings and geophysical logs. The AT2 Clay is a pronounced, competent clay layer and it is used as the top of Layer 9 for the model. Layer 10 is considered to be the main water production zone for the area.

Boundary Flow Conditions

Predicted water levels did not correctly reflect the upper layers, and additional general head boundaries were added on the south end of the grid. These general head boundaries helped improve the agreement between observed vs. predicted water levels. In addition, the general head boundaries reduce the oscillations in predicted water levels.

Model Setup

Modeling is a mathematical estimate of existing and future field conditions. One of the most widely accepted ground-water models used in the last 15 years is MODFLOW (McDonald and Harbaugh, 1988 and later). MODFLOW is a finite-difference, quasi, three-dimensional model developed by the US Geological Survey. It is one of the most widely used and accepted ground-water models, and it was the model used in the previous studies (Yates and Weise, 1988, Cleath and Associates, 1992, and URS, 2000). In addition, Groundwater Vistas was used in the most recent study (URS, 2000). Groundwater Vistas is a separate software package, and it integrates a preprocessor as well as a postprocessor with MODFLOW. Groundwater Vistas (v. 2.4) was used in this study.

Sensitivity Test Results

GW Vistas has a built in sensitivity procedure that allows a comparison of predicted water levels with target values. Sensitivity analyses were prepared for the following parameters: horizontal hydraulic conductivity (by zone), vertical hydraulic conductivity (by zone), general head boundary conductivity (by reach), and wells head (boundary condition). General head boundaries were tested during the model calibrations stage; however, general head boundaries were only used where needed to stabilize specific areas. Water levels changes were most sensitive to changes in hydraulic conductivity, therefore, all attempts were made to stay true to estimated hydraulic conductivities. The main parameters used to calibrate were general head boundaries (conductivity, cell width and cell depth) and well boundaries.

Model Calibration

Two rules were established to determine if the model was properly calibrated: a small mass-balance error and good comparison of observed vs. predicted water levels. A small mass balance error indicates that the model is mathematically stable. Mass balances can be measured as a model summary, by layers, or through a zone-budget analysis of a windowed area. Both approaches were used at different times. Over 20 separate scenarios where prepared to determine the best solution for the model. The mass balance of the model summary is 0.0 percent. The mass balance results are presented in Table 3. In addition, the mass balance for each layer was always less than 0.1 percent.

Table 3
Mass Balance Results
Model Calibration

	Input (ft/day)	Output (ft/day)	
Storage	127,589	7,595	
Well	900	168,307	
General Head	1,473	30,045	
Recharge	80,344	0	
Evapotranspiration	0	4,358	
			% Difference
Total	210,306	210,306	0.00

Note: Units are in feet per day. These results are for stress period 22. Other stress periods showed similar results.

Hydrographs of observed vs. predicted water levels for key wells under calibration are similar to hydrographs presented in the previous ground-water model for the area (URS, 2000, 95% report). A summary of the results is shown in Table 4.

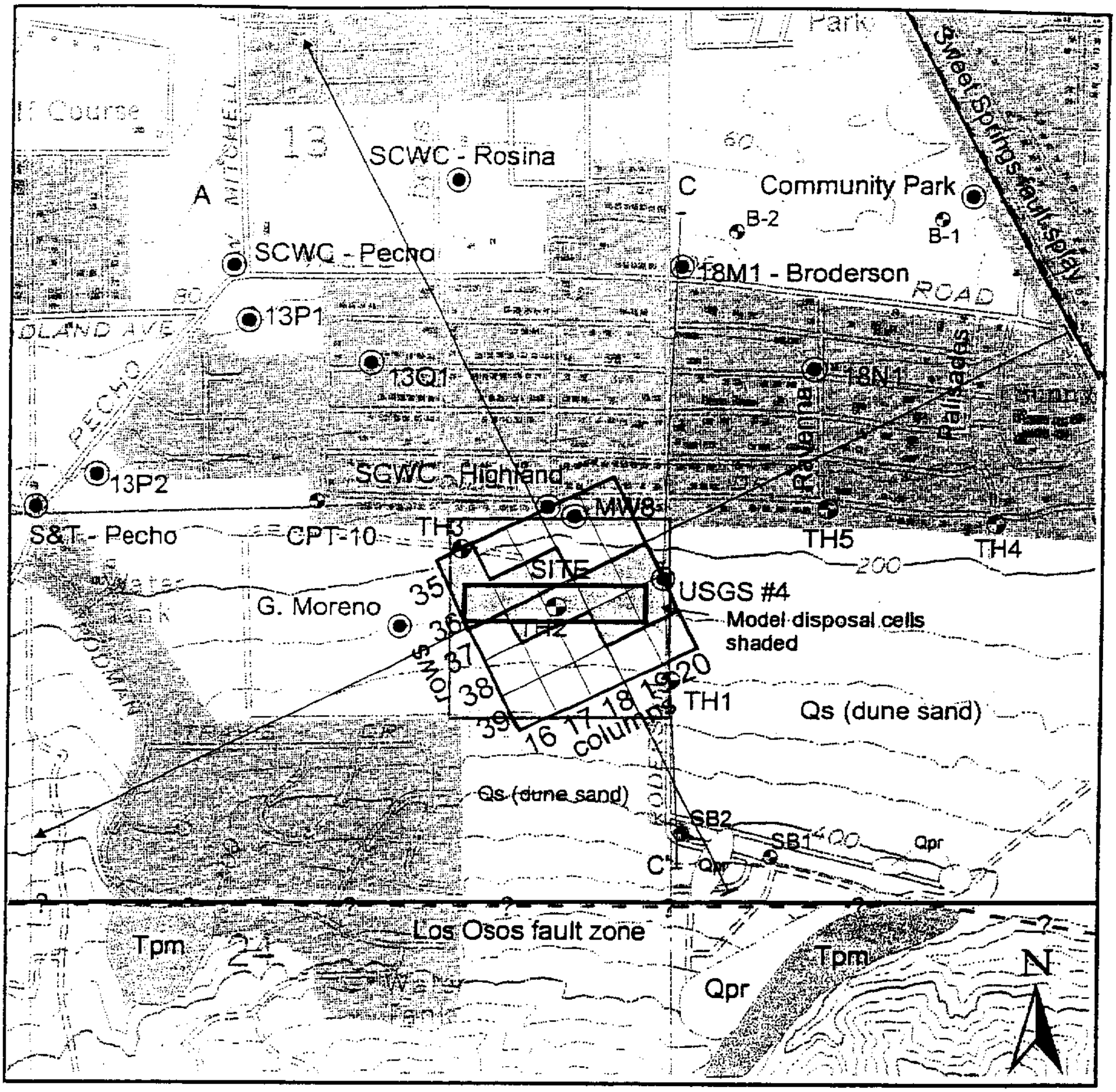
Table 4
Summary of Observed vs. Predicted Water Levels
Positive if computed > observed

Layer 1	+/-	Layer 6	+/-	Layer 10	+/-	Layer 11	+/-
18E1	-5	13K1	-10	2A1	0	13L5 H	-5
18L4	-18	13L1	0	11A1	+3	13P2	0
		13P1	-8	13J1	-8	18M1	-9
Layer 2		13Q1	-8	13L6	-12		
11A2	+3	18L8	-18	13M2	0		
13A7	+10	18N1	-35	14B2	+8		
13L5 DN	-5			18L6	0		
18L3	0	**Layer 8**					
		18L7	-6				
Layer 4							
13H1	+7	**Layer 9**					
18D2	0	18K1	-20				

Note: difference is for stress period 22 or last stress period of available data

Mounding Analysis Results

Five different scenarios were simulated ranging from 600,000 gallons per day to 1,600,000 gallons per day (see Table 5). Water was added to the model through the disposal cells, and 10 cells were used, with each cell being 250 feet by 250 feet (see Figure 2). Wastewater disposal was modeled for all 22 stress periods and the results were viewed for the last stress period. As a conservative measure, the production wells were pumped at historical pumping rates.



Base map: USGS Topo, Morro Bay South
Photorevised 1978

Base map scale: 1 inch = 1,000 feet

Surface geology from The Morro Group, 1989

Legend:
Qs - Dune sand
Qpr - Paso Robles Formation
Tpm - Pismo Formation (shale)

Geological cross-section orientation

Well

Test hole for investigation

Other test hole

Figure 2
Model Orientation
Broderson Hydrogeologic Investigation
Los Osos CSD

Cleath & Associates

Table 5
Mounding Depths for Different Disposal Rates

Disposal Rate (gallons per day)	Mounding Depth (feet below ground surface)
600,000	50 to 60
800,000	40 to 50
1,000,000	20 to 40
1,300,000	10 to 20
1,600,000	At surface

*Note: average ground surface for infiltration area is assumed to be 235 feet above sea level.

Results were viewed for cross-sections along rows and columns, and plots of a representative row and column for the 1 mgd and 0.8 mgd scenarios are presented in Appendix B (Figures B1 through B8). A projection of the perched mound and the ground water mound at 0.8 mgd disposal is shown in Figure 3. The results of other modeling efforts using MODFLOW models to assess the Broderson site are reported below:

- Metcalf & Eddy 1996 analysis: 80 feet depth to water beneath site at 1.13 mgd
- Metcalf & Eddy 1996 analysis: 40 feet depth to water beneath site at 1.85 mgd
- URS-TEAM 2000 analysis: 55 feet depth to water beneath site at 1 mgd.
- URS-TEAM 2000 analysis: 44 feet depth to water beneath site at 1 mgd (all wells off).

The Broderson model shows much greater mounding than the original Metcalf and Eddy study, and a slightly higher mound than the URS model. The modeling run of 11 years was sufficient to stabilize the mounding height beneath the site, based on a comparison of 1 mgd runs at 8 years and 11 years. (Figures B2 and B3, Appendix B).

Travel Time

Average linear flow velocities and travel times for wastewater were estimated based on a representative model cross-section showing the hydraulic gradient and the generalized lithology (model layering) between the Broderson site and the bay. The cross-section selected for the analysis was 1.0 mgd disposal, column 21, which begins on the east side of the site and runs straight through domestic water supply well 30S/10E-13J1 (Rosina Well, Southern California Water Company) and into the bay at the north end of Pecho Road (Figure B5; Appendix B).

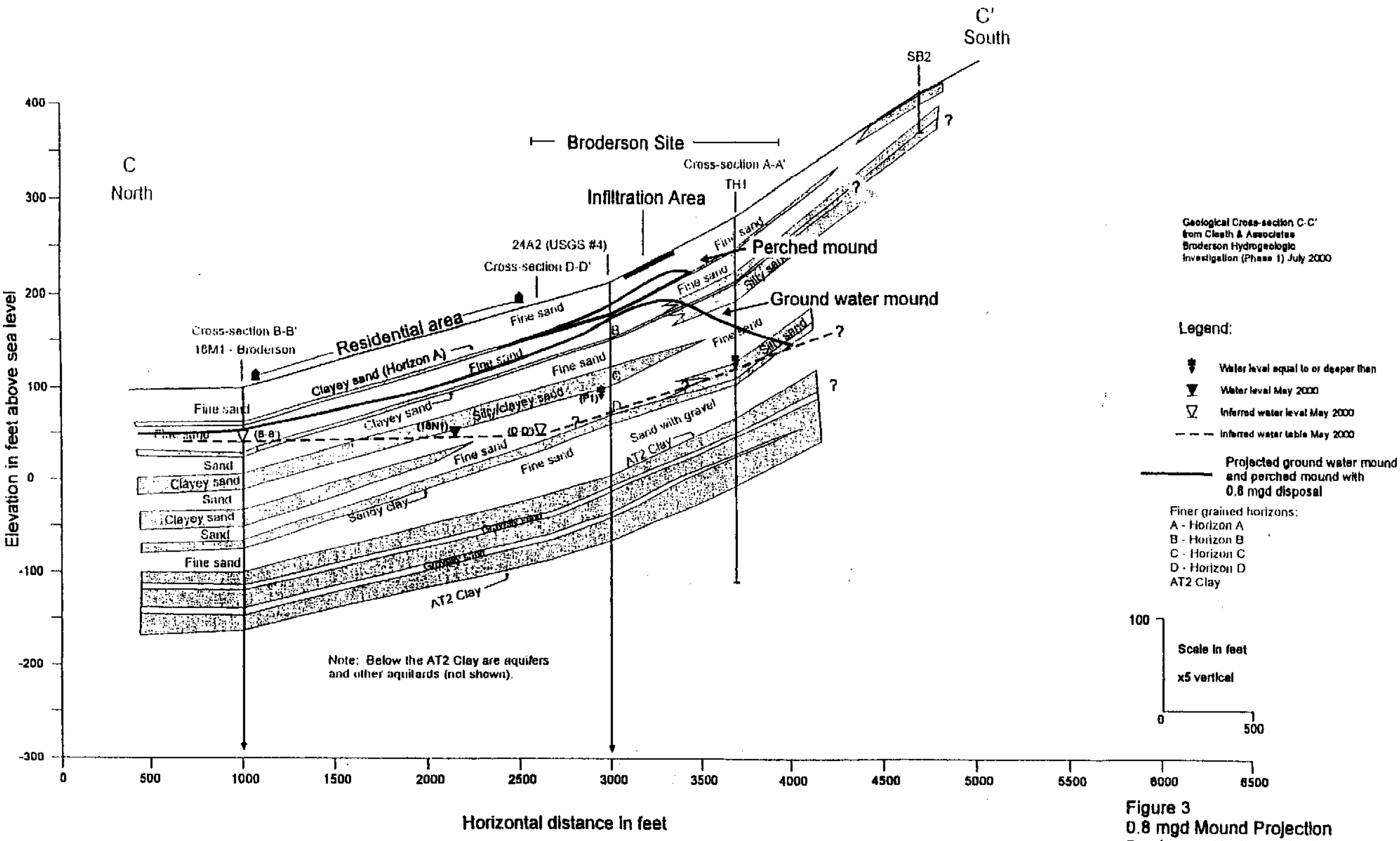


Figure 3
0.8 mgd Mound Projection
Broderson Hydrogeologic Investigation
Los Osos CSD

Cleath & Associates

Travel time velocities were estimated by visually selecting the path of least resistance in the cross-section, and then calculating velocities over discrete segments using Darcy's Law, with adjustment for porosity. Two travel times were calculated, one along the fastest pathway to the closest production well completed below the AT2 Clay (Rosina), and the other for the fastest pathway above the AT2 Clay to the bay, which can be used to judge travel times at various distances from the site to shallow wells.

The Rosina Well is about 2,500 feet north of the Broderson site (allowing a 400-foot infiltration area setback on the site). It taps the lower aquifer below the AT2 Clay. The AT2 Clay can be seen on the electric log from the original borehole between approximately 225 feet and 285 feet depth (60 feet thick). In the Broderson model, the AT2 Clay is positioned between 220 feet and 290 feet depth, a good match with the actual condition. This clay, by virtue of its thickness and low hydraulic conductivity, will require the greatest amount of travel time than any other layer. The fastest pathway through the AT2 Clay would be straight through it (least possible distance) at the location of maximum pressure differential. This location would be directly adjacent to the pumping well, which induces a pressure differential by drawing down the water level. The fastest pathway to reach the Rosina Well (above the clay) would be along the top of the clay, in the basal gravels, which is also the fastest pathway to reach the bay.

The average linear velocity for particles of water traveling underground is equal to the difference in pressure head times the hydraulic conductivity of the aquifer/ aquitard, divided by the porosity of the aquifer/aquitard and by the length of the average linear flowpath traveled. Travel time would be the flowpath divided by the velocity. The velocity formula and a table of results for the various reaches of each pathway are presented in Table 6 below and shown in Figure 5B (Appendix B).

$V = K(dh/dl)/n$

where:

V = average linear velocity

K = hydraulic conductivity

dh = difference in hydraulic head between the beginning and the end of the flow path

dl = difference in location between the beginning and the end of the flow path

Table 6
Travel Times

Description	Flow pathway from Broderson site (Figure 4B, Appendix B)			
	Site to top of AT2 Clay (Segment 1)	Along basal gravel to Rosina (Segment 2)	Through AT2 Clay at Rosina (Segment 3)	From Rosina to bay above AT2 Clay (Segment 4)
K (ft/day)	4	20	0.01	20
n	0.35	0.35	0.45	0.35
dh (ft)	100	60	40	30
dl (ft)	1020	2003	60	2300
i (ft/ft)	0.098	0.03	0.667	0.013
v (ft/day)	1.12	1.714	0.015	0.743
Segment travel times / flowpath distance				
days	911	1169	4000	3096
years	2.5	3.2	11	8.5
feet	1020	2003	60	2300
Cumulative times /flowpath distance				
days	911	2080	6080	5176
years	2.5	5.7	16.7	14.2*
feet	1020	3023*	3083	5323

*Notes: 1) the travel time to the bay does not go through the AT2 Clay
2) the computed distance to the Rosina Well along Column 21 is farther than the shortest distance on a map because the grid is rotated.

Wastewater particles will take at least 1 year to move offsite, and 14 years to reach the bay in the upper aquifer. Movement from the site to the Rosina Well will take at least 16 years, of which 11 years is spent moving through the AT2 Clay into the lower aquifer. The average horizontal distance traveled by wastewater in one year's time from the edge of the infiltration area is estimated at 400 feet. This does not include time to percolate through the soils to the top of the mound. The wastewater undergoes additional treatment as it filters through the sands and moves towards the bay. Adequate residence time occurs such that the wastewater has been sufficiently filtered to remove pathogens prior to the water reaching the edge of the Broderson site on the northern boundary adjacent to Highland Drive.

Travel times of actual water particles should not be confused with movement of pressure fronts and associated rising or declining water levels. Although it will take an estimated1year for water particles to move off site and at least 14 years to reach the bay, it will take less time for the ground water mound to begin developing for rising water levels to spread out from the site to the bay. The effect is similar to ocean waves, which travel along much faster than actual particles of sea water.

RECOMMENDED MAXIMUM DISPOSAL RATE

The results of the Horizon A analysis indicates that flows of at least 1.3 mgd, given enough area at the surface (13 acres), will percolate through Horizon A without daylighting at the site or downslope in the vadose zone. A critical assumption is made, however, that no interference occurs from the larger ground water mound created on top of the AT2 Clay. This is because if the deeper mound moves up into the perched zone, the amount of available head to drive the water through Horizon A will drop, causing the perched mound to rise. Therefore, the maximum height of the larger ground water mound rising beneath the site should not be designed to rise higher than the bottom of Horizon A, an average of about 40 feet beneath the site.

The disposal rate that meets the criteria for not rising into Horizon A would be **800,000 gallons per day (0.8 mgd)**. This rate would not be expected to cause the major ground water mound to rise to above 40 to 50 feet beneath ground surface (Figure3). The infiltration area should cover at least 7 acres to avoid mounding issues on Horizon A, and be as long as possible (east to west, parallel to the slope).

IMPACTS AND MITIGATIONS

Liquefaction Potential

Liquefaction occurs when a cohesionless soil temporarily becomes fluid due to a sudden rise in pore pressure, often associated with seismic waves from earthquakes. The result of liquefaction is that buildings and other structures can become unstable and cause damage. Prior work by Fugro West (1996) identified potentially liquefiable soils in the subsurface, both at the Broderson site and other areas in the community. All of the 17 cone penetrometer tests performed reported soils subject to liquefaction if saturated. The 1996 Fugro study reports:

"The Phase 1 modeling by M&E indicates that ground water levels should not rise above a depth of about 80 feet below ground surface in the vicinity of the Broderson spreading site. However, during the recharge process, there is water in transit between the point of spreading and the ground water table surface. If the rate of infiltration locally exceeds the soil permeability, then localized perched water conditions could result. If that perched water condition occurs at depth that is susceptible to liquefaction, there may be an associated hazard for structures positioned above that location."

The potentially liquefiable intervals identified at the Broderson site corresponded to the first 6 to 10 feet of dune sand and to Horizon A. Despite a maximum setback, there will be an increase potential for liquefaction beneath residences immediately downslope of the infiltration area, based on the possibility for Horizon A to saturate as perched water moves offsite. The value for estimated maximum saturated thicknesses using the modeled mound is less than one foot of saturation at an average 40 feet depth beneath the closest residences, however, Horizon A will become saturated offsite, and the potential for liquefaction of this horizon will exist in an area where it did not before. Even if greater setbacks were used or lower disposal rates were used, Horizon A will still potentially be saturated off-site to the north.

Surfacing Ground Water near the Bay

Water levels near the bay downslope from the Broderson site are expected to rise in response to disposal operations. The area where surfacing ground water may increase as a result of the proposed project and the mitigation measures which could be enacted are discussed below.

<u>Surfacing Water Impact Area</u>

As the wastewater migrates from the site, ground water levels will rise along and in front of its flow path. The rising ground water level remains below ground surface for most of the distance to the bay, but can be expected to reach ground surface or within 5 feet of ground surface about 1,000 feet from the bay. This line approximately follows the 20 foot ground surface elevation above mean sea level contour at a distance of about 3,500 feet from the Broderson property disposal field. Historic water levels in shallow wells in the area between the 20 foot contour and the bay have been less than 10 feet below ground surface. Therefore, mitigation measures should be considered to prevent ground water from surfacing in this area.

Down gradient from the Broderson site, there are several water wells used for ground water production from the shallow aquifer above the AT2 clay layer. These wells are located along Pecho Road from Los Osos Valley Road to Skyline Drive. Two private wells are immediately adjacent to the intersection of Pecho and Los Osos Valley Road. North of Los Osos Valley Road, S& T Mutual Water Company and California Cities Water Company have shallow wells (S&T Well #1 and the Cal Cities Skyline well). The golf course also has a shallow well. The operation of these wells should be capable of maintaining low water levels in this portion of the downstream area. This water level depression already exists as evidenced by ground water levels measured in the shallow wells and contoured in the depth to water and ground water elevation contour maps in the draft Project Report.

One well in this area, S&T Well #1, originally produced 500 gallons per minute when the shallow ground water levels did not have a history of being drafted, but since then, pumping at this well has been reduced to less than 200 gpm with lower static and pumping water levels. As water levels rise, the pumping capacities of this well and the other shallow wells may increase.

On the eastern side of the down-gradient flow from the Broderson site, the Sweet Springs fault splay of the Los Osos fault zone is interpreted to be a barrier to flow so that the rising ground water would not extend beyond the fault. Therefore, the area where additional mitigation for project-related rising water is appropriate would be from Pecho Road to the Sweet Springs splay of the Los Osos fault zone and from the 20 foot ground surface elevation contour line to the bay.

Conceptual Mitigation Approaches

Several conceptual approaches can be taken to mitigate the project related rising water. Some approaches involve diversions of shallow ground water up-gradient from the anticipated rising water area. Other approaches are to alter land uses in the affected area.

Diversions of water from the shallow aquifer up-gradient from the potential rising water area could not only prevent project related rising water but also rising water related to other causes. One type of diversion would be a dewatering well system following Henrietta Avenue, north along Pine Avenue, east along Mitchell Drive and north along Broderson Avenue to Ramona Avenue. Another would be a dewatering trench with sump pumps along the same alignment. A third type of diversion system would be a series of wells located along Skyline Drive spaced at even intervals from Pecho Road to Broderson Avenue. The ground water produced from these diversion could be disposed of to the bay (and would be otherwise be draining to the bay) or used.

The amount of water which would need to be diverted to avoid rising water impacts would be less than that disposed of at the Broderson site (or the cumulative west-side disposal) because the project displaces existing on-site wastewater disposal systems in this area, some water passes below the AT2 clay layer, and some of the mounded water is produced by the existing shallow wells along Pecho Road. Assuming 1.3 mgd (1,460 acre-feet per year; afy) disposal over the west side of the basin replaces about 560 afy of existing septic flows, there would be an additional 900 afy percolating over the current condition. Assuming half of that were moving out to the bay between Pecho Road and Sweet Springs, this additional amount to mitigate would be 400,000 gallons per day, or half of the discharge at the Broderson site.

The well system along Skyline Drive would be comprised of about four wells in addition to those existing wells along Pecho Road. Based on the productivity of the wells over by Pecho Road, these new wells could produce more than 100 gpm and create a ground water depression along Skyline Drive which could be controlled such that sea water intrusion is avoided and rising water is eliminated. Other well configurations could be selected to take advantage of available property and proximity to points of use or disposal for the produced water.

Alternatively, land use modifications could allow the surfacing water to occur while removing the impacted land uses. Land use changes would necessarily involve significant impositions on existing land owners, however. Wetland areas could be established with high water consumption plants. Surface water channels could be constructed out to the bay within the rising water area.

Another conceptual approach would be to monitor water levels while allowing the water to rise and implement an appropriate mitigation at specific problem areas. An active monitoring program could be implemented such that an appropriate action could betaken before actual impacts to residences.

Cleath & Associates does not advocate any of these solutions at this time. All of these approaches have pros and cons associated with them. Some have significant benefits, not the least of which is the potential for use of the produced ground water.

CONCLUSIONS

The conclusions of the hydrogeologic investigation at the Broderson Site are summarize as follows:

- The recommended wastewater disposal rate for the Broderson Site is 800,000 gallons per day and will not daylight at the site or beneath the residences between Highland Drive and Los Osos Valley Road.

- An area of approximately 7 acres should be used to infiltrate the wastewater. The area should be as long as practical east to west and should be set back as far as practical to the south from Highland Avenue.

- Percolating wastewater will perch on Horizon A and move laterally offsite to the north. The maximum thickness of the saturated perched horizon would be approximately 12.5 feet beneath the infiltration area (27+ feet below ground surface) and less than one foot thick (34+ feet below ground surface) offsite.

- The potential for liquefaction of the finer grained sediments in Horizon A will exist beneath residences north of the site.

- The maximum height of the larger ground water mound (under the perched mound) beneath the site at 800,000 gallons per day disposal is estimated at 40-50 feet below ground surface.

- Land within approximately 1,000 feet from the bay, between Pecho Road and the Sweet Springs fault splay, is likely to have surfacing or near-surfacing ground water due to the increased disposal on the west side of the basin.

- Mitigation options for surfacing water include various dewatering systems or land use changes. A selection of the mitigation option may be postponed until monitoring of actual impacts to water levels show the area and level of mitigation needed.

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Cleath & Associates, July 2000, Hydrogeolgic Investigation of the Broderson Site (Phase 1).

McDonald, M.G. & A.W. Harbaugh, 1988, A modular three-dimensional finite-difference ground-water flow model, USGS TWRI Chapter 6-A1.

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Todd, 1959, Ground Water Hydrology, John Wiley & Sons, New York.

URS Greiner Woodward Clyde, July 9, 2000, 95% Baseline Report of the Los Osos Valley Groundwater Basin, Los Osos, California.

URS Greiner Woodward Clyde, August 14, 2000, Final Baseline Report of the Los Osos Valley Groundwater Basin, Los Osos, California.

Appendix A

Neutron Probe Graphs
(From Metcalf & Eddy, 1997)

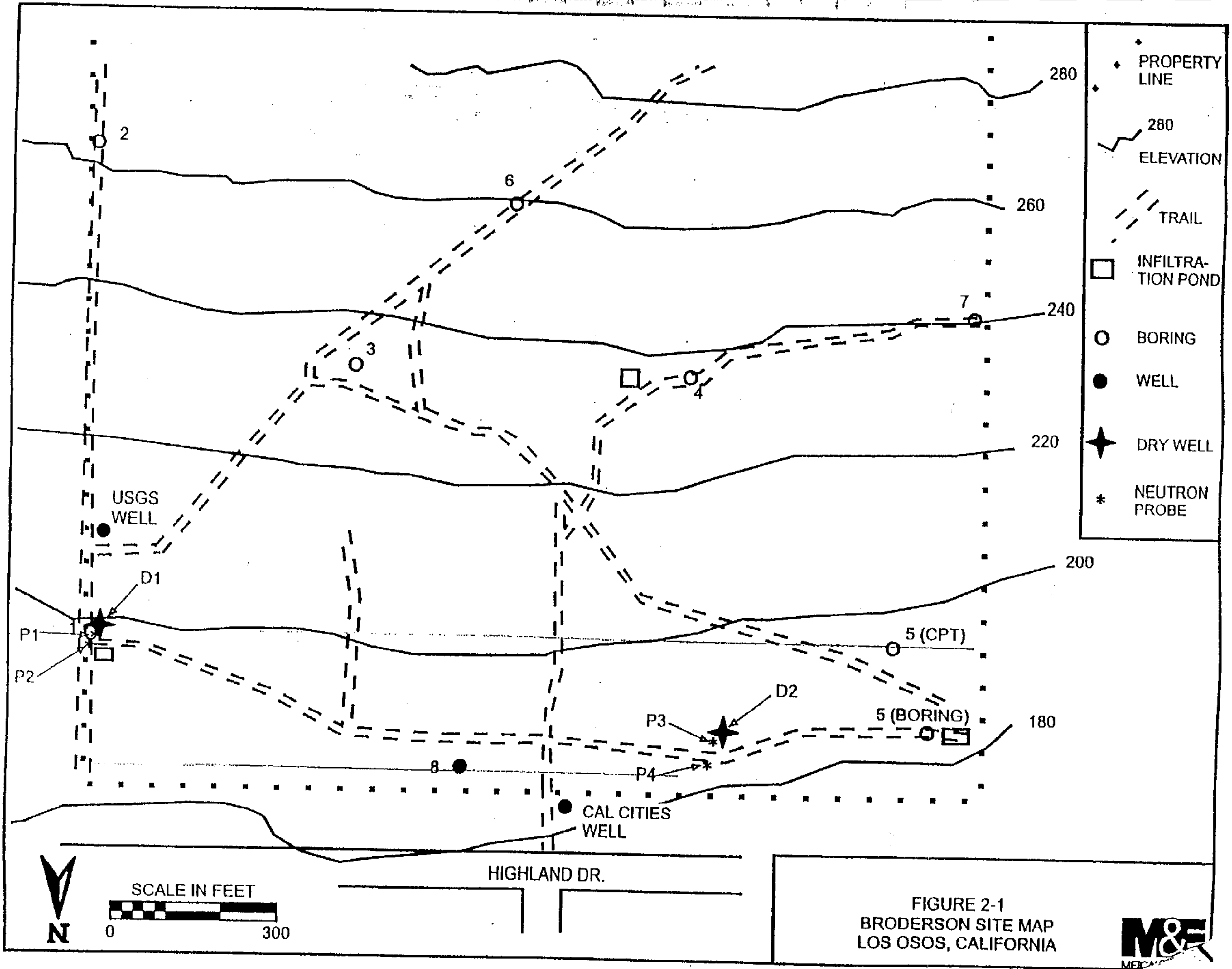
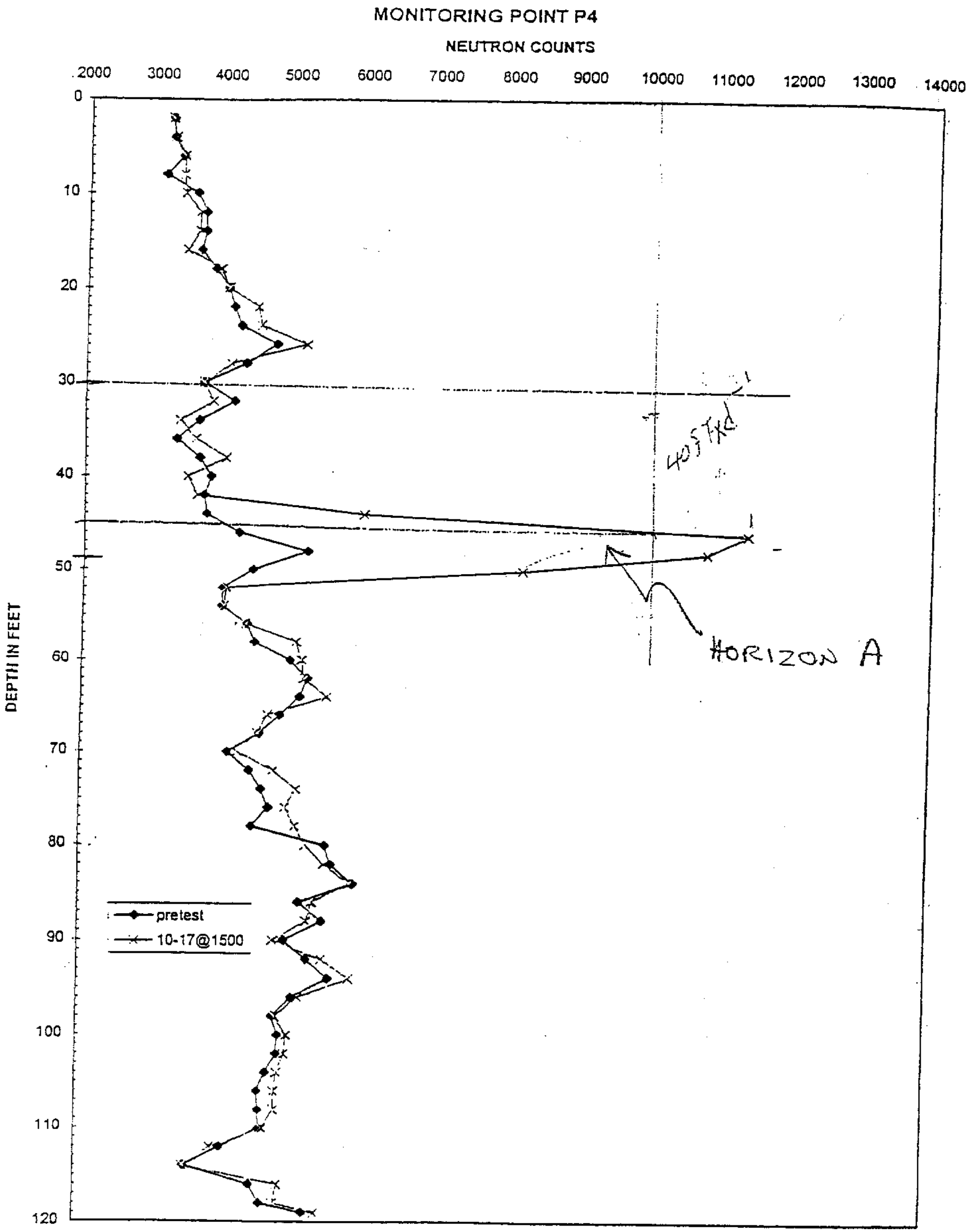
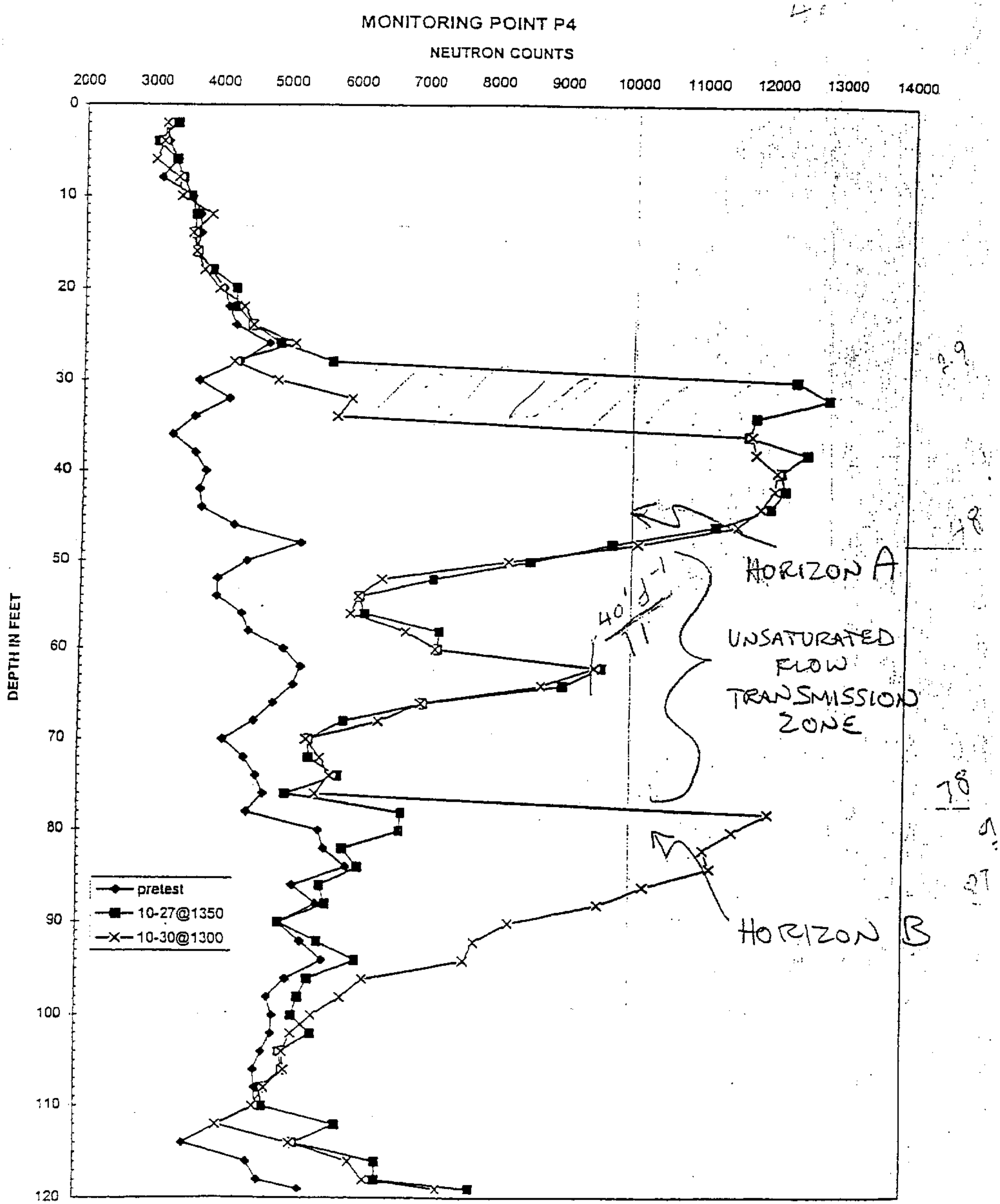


FIGURE 2-1
BRODERSON SITE MAP
LOS OSOS, CALIFORNIA



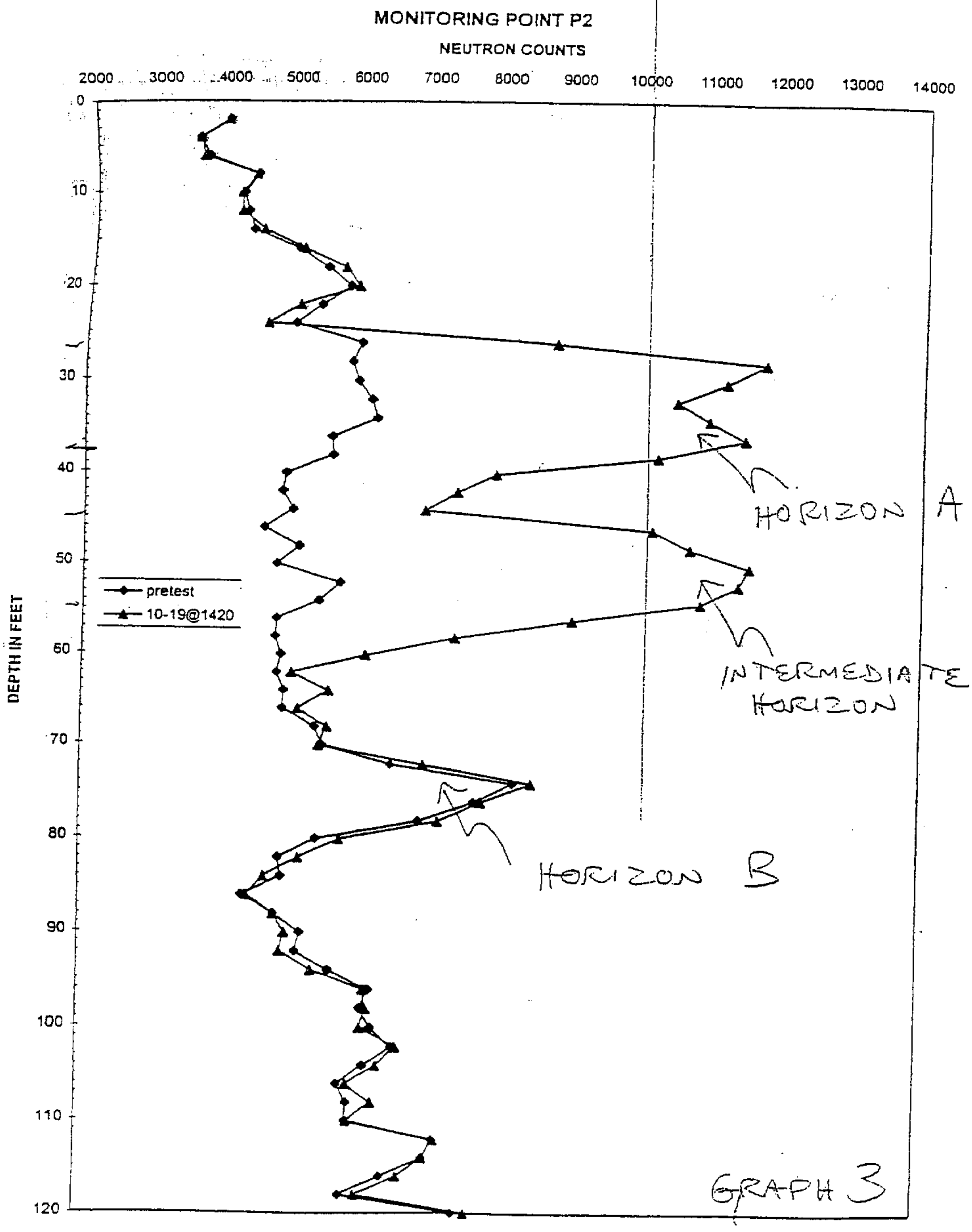
MONITORING POINT P4
NEUTRON COUNTS
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
DEPTH IN FEET
0
10
20
30
40
50
60
70
80
90
100
110
120
pretest
10-17@1500
405 Fxd
HORIZON A

GRAPH 1



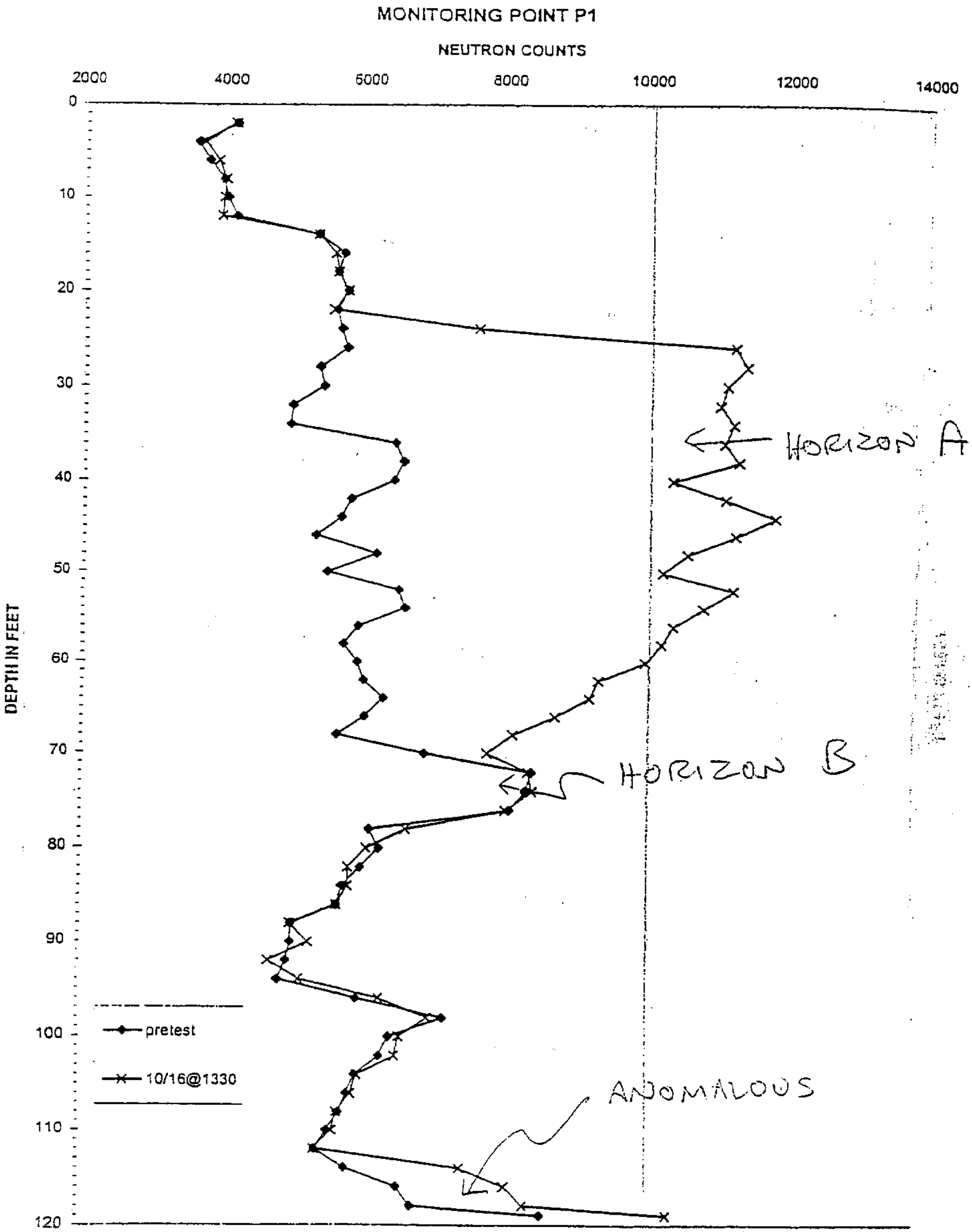
MONITORING POINT P4
NEUTRON COUNTS
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
0
10
20
30
40
50
60
70
80
90
100
110
120
DEPTH IN FEET
pretest
10-27@1350
10-30@1300
HORIZON A
UNSATURATED FLOW TRANSMISSION ZONE
HORIZON B

GRAPH 2



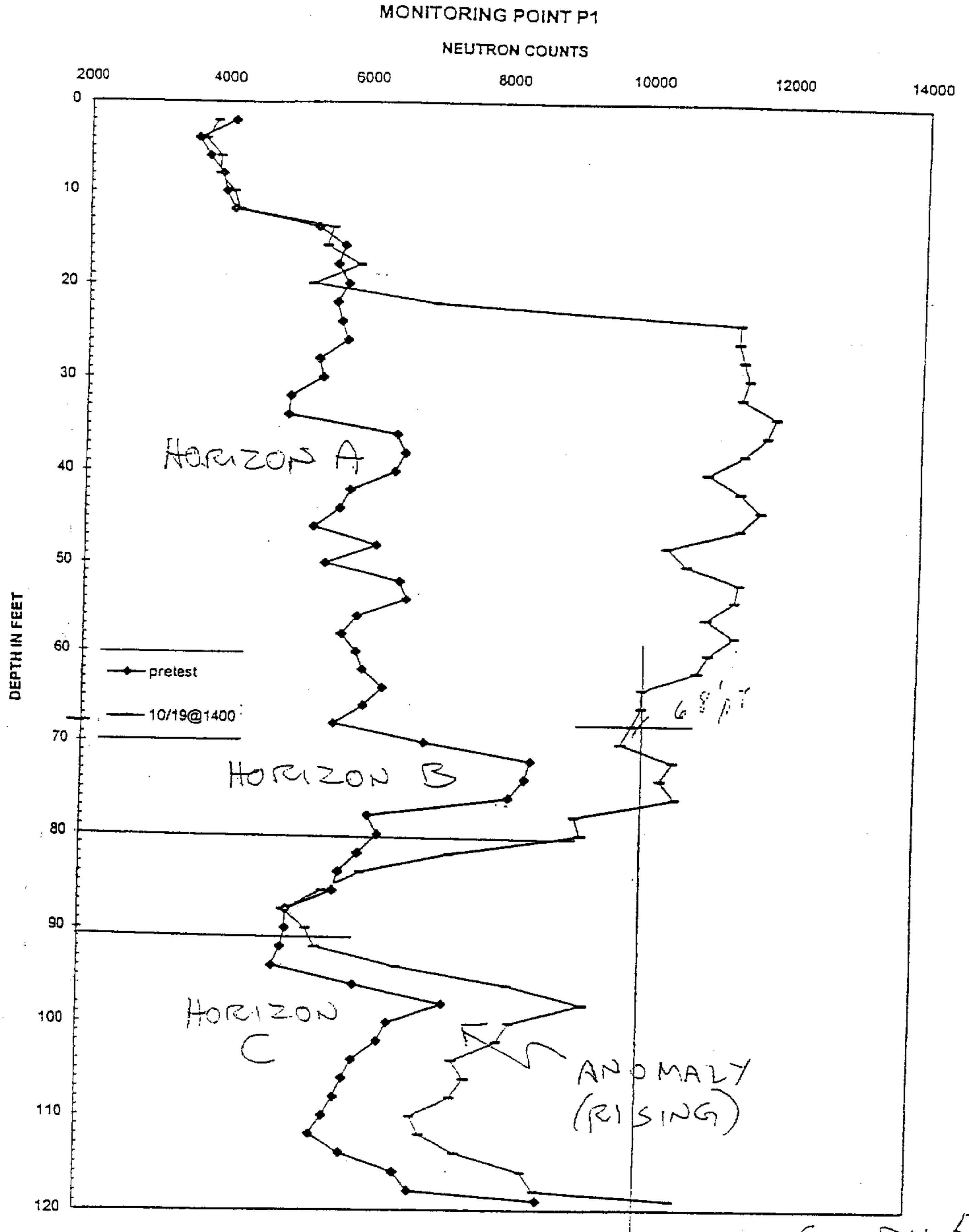
MONITORING POINT P2
NEUTRON COUNTS
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
DEPTH IN FEET
0
10
20
30
40
50
60
70
80
90
100
110
120
pretest
10-19@1420
HORIZON A
INTERMEDIATE HORIZON
HORIZON B
GRAPH 3

39


MONITORING POINT P1
NEUTRON COUNTS
2000
4000
6000
8000
10000
12000
14000
DEPTH IN FEET
0
10
20
30
40
50
60
70
80
90
100
110
120
pretest
10/16@1330
HORIZON A
HORIZON B
ANOMALOUS

14

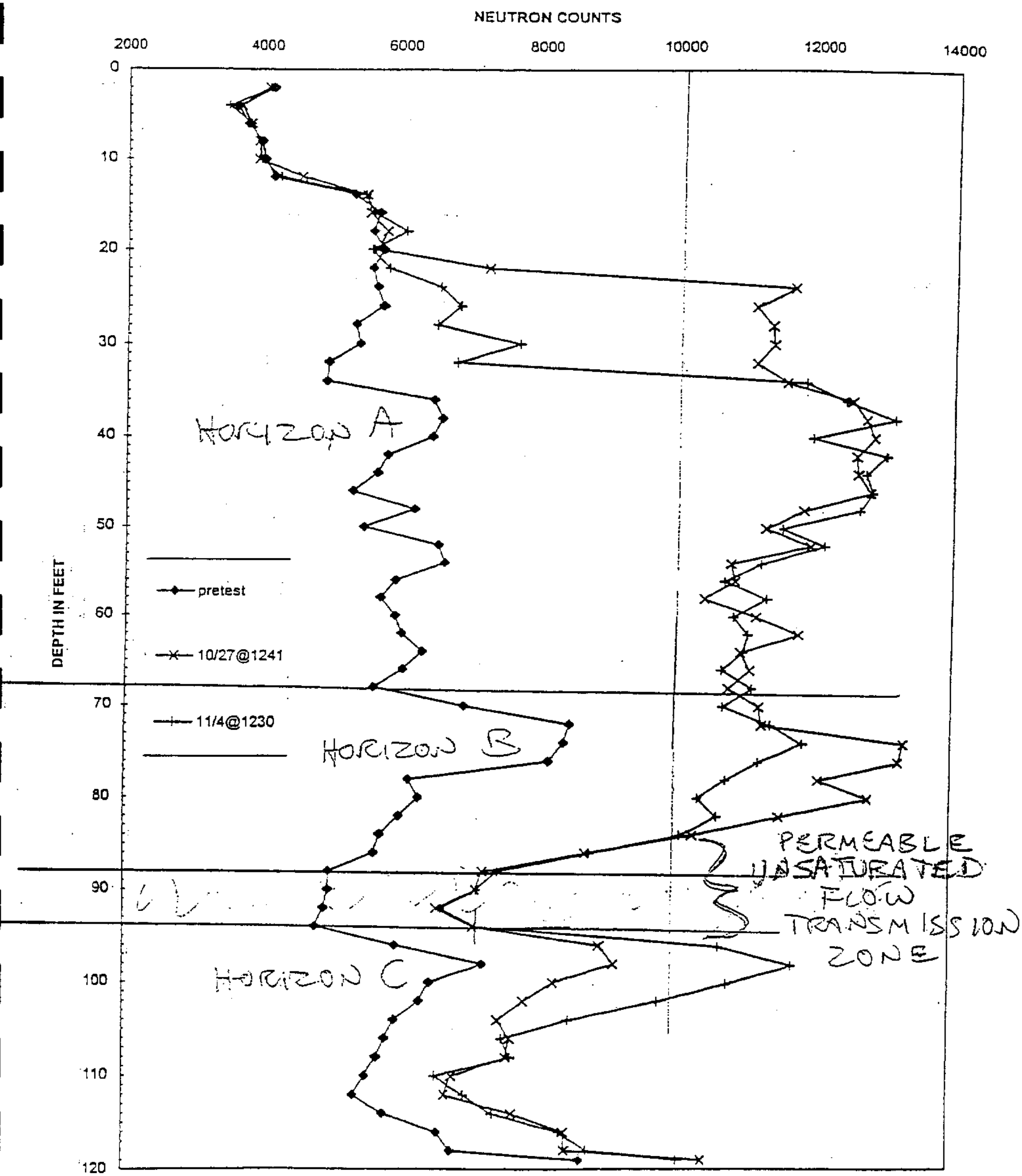
GRAPH 4



MONITORING POINT P1
NEUTRON COUNTS
2000
4000
6000
8000
10000
12000
14000
DEPTH IN FEET
0
10
20
30
40
50
60
70
80
90
100
110
120
pretest
10/19@1400
HORIZON A
HORIZON B
HORIZON C
ANOMALY (RISING)

GRAPH 5
19

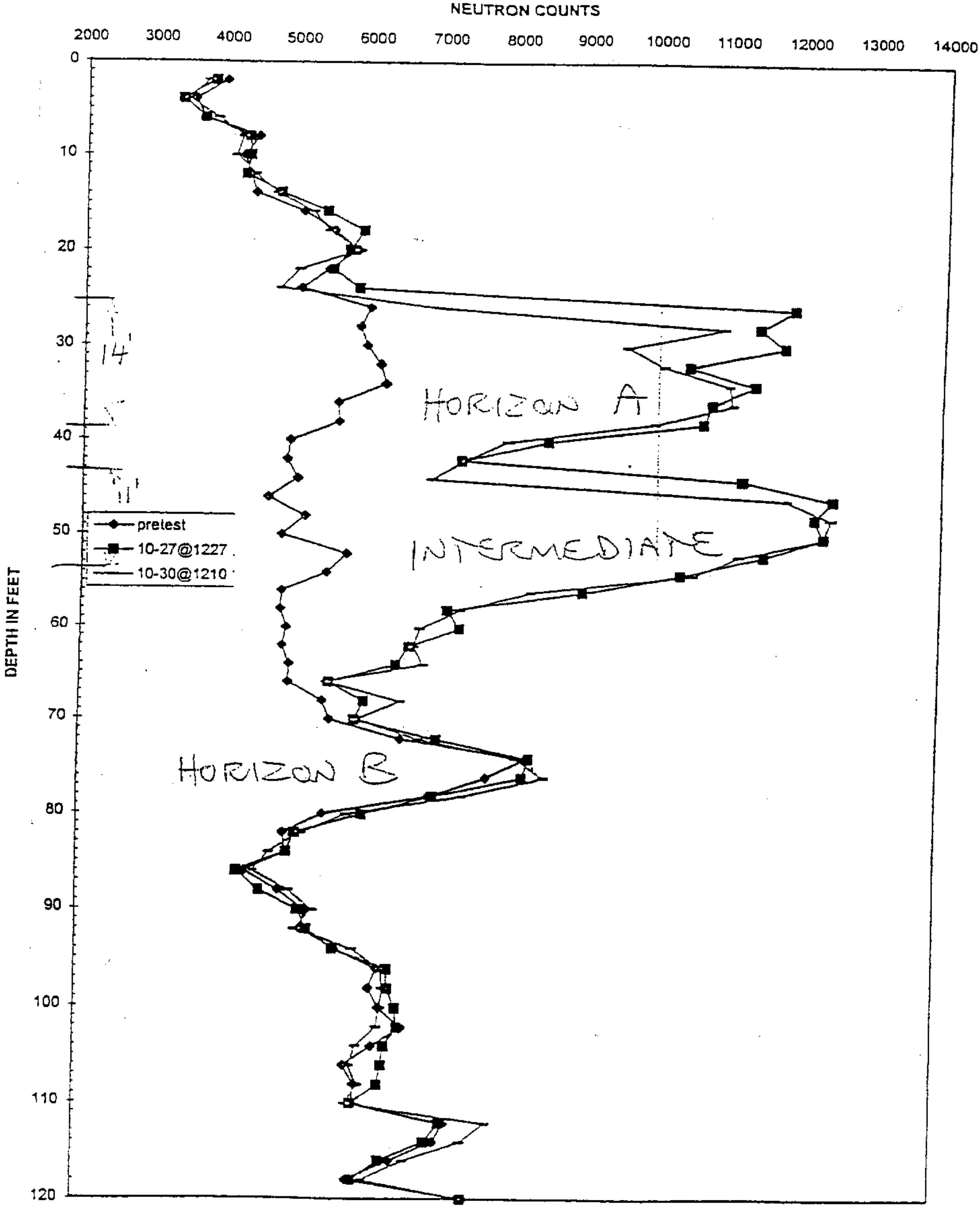
MONITORING POINT P1



26

GRAPH 6

MONITORING POINT P2



GRAPH 7

Appendix B

Modeling Results Graphics

Figure 81

Model Grid

SCALE: 1 inch = 2000 feet

Los Osos CSD - Broderson Investigation

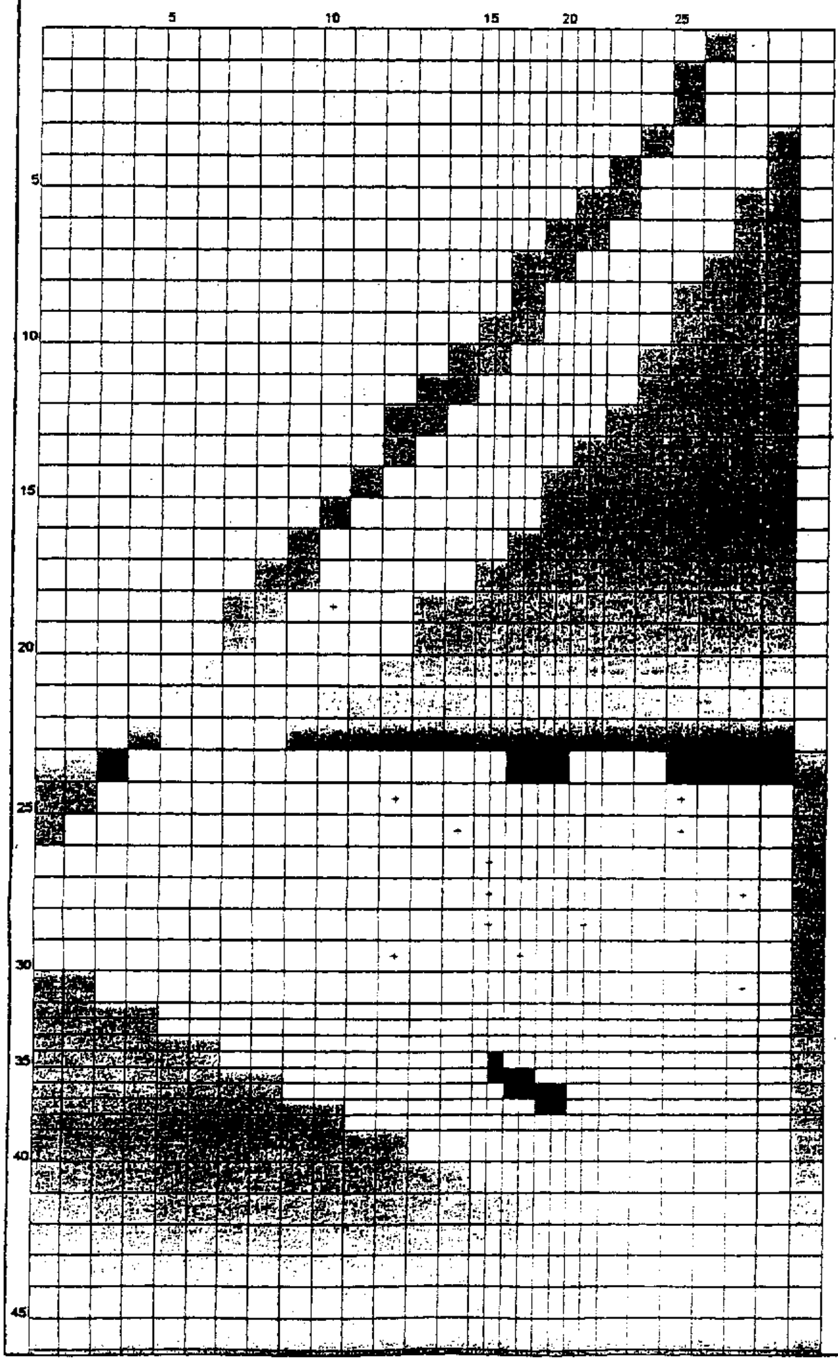


Figure B2

1.0 mgd; Column 19 ; Row — ;Stress Period 16 Years 8

Model Results - Hydraulic Gradient Countours in Feet

Los Osos CSD - Broderson Investigation

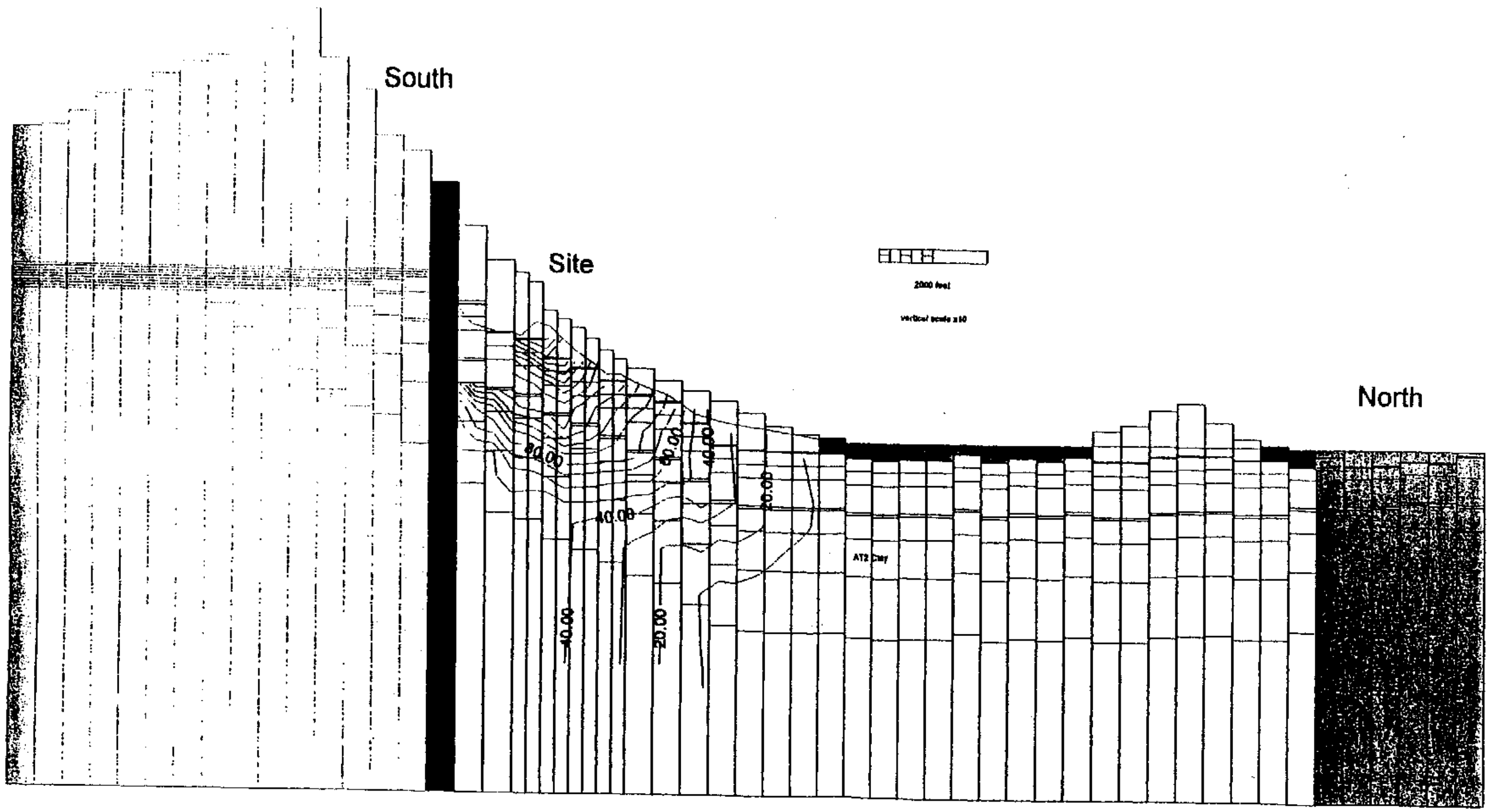


Figure B3

1.0 mgd; Column 19; Row —; Stress Period 22 Years 11

Model Results - Hydraulic Gradient Countours in Feet

Los Osos CSD - Broderson Investigation

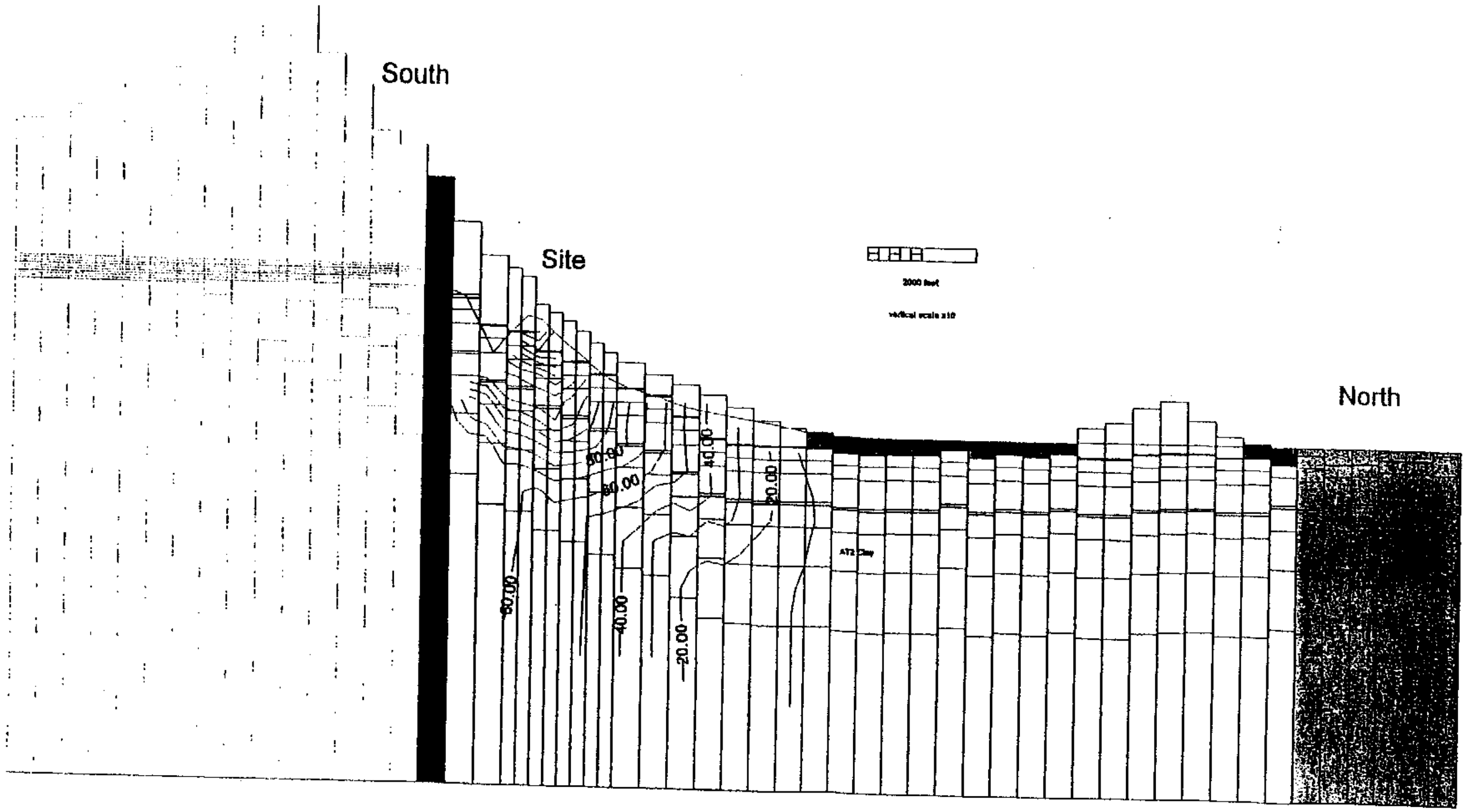


Figure B4

1.0 mgd; Column 19; Row --; Stress Period 22 Years 11

Model Results - Hydraulic Gradient Countours in Feet

Los Osos CSD - Broderson Investigation

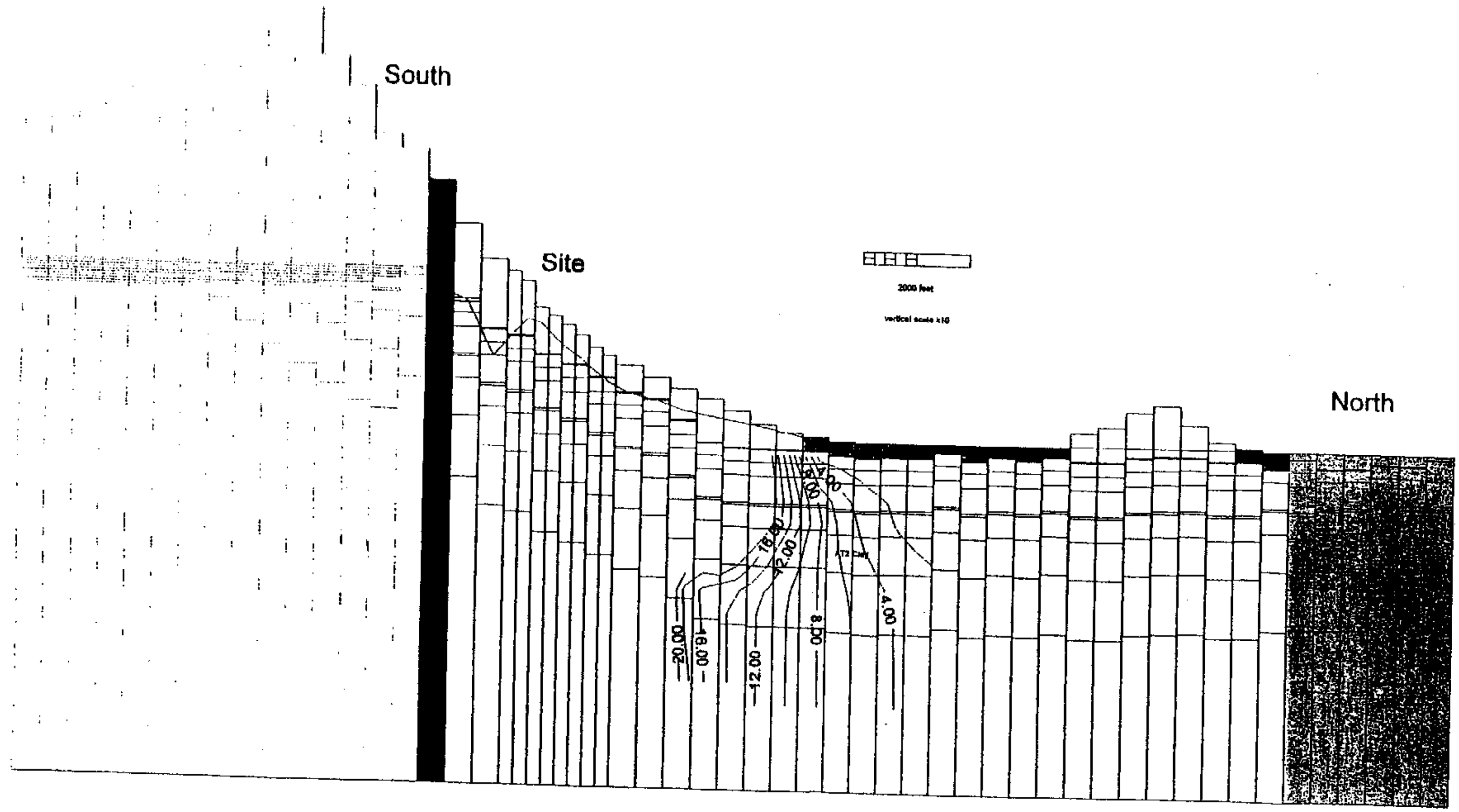


Figure B5

1.0 mgd; Column 21; Row –; Stress Period 22 Years 11

Model Results - Hydraulic Gradient Countours in Feet

Los Osos CSD - Broderson Investigation

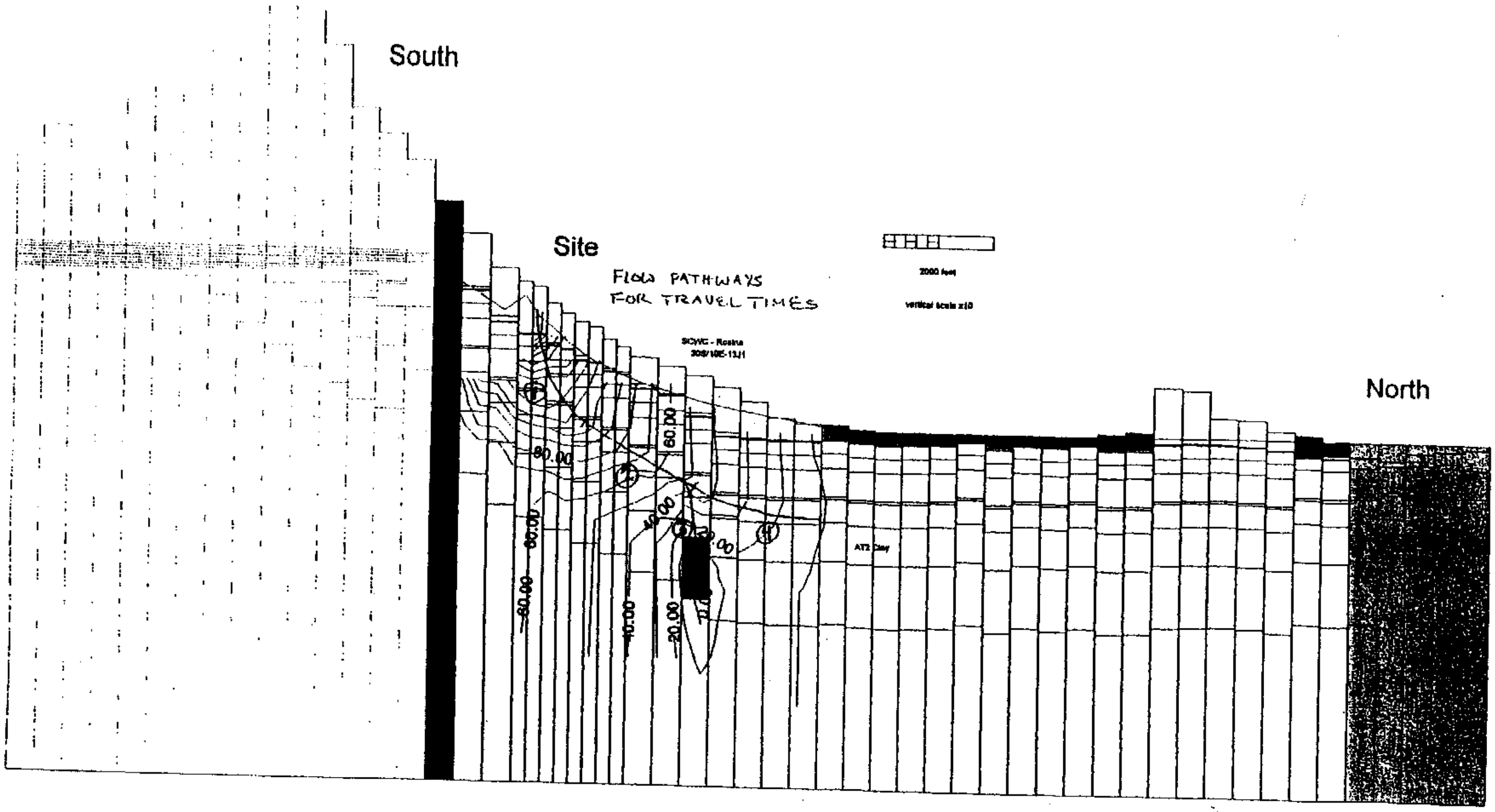


Figure 86

1.0 mgd; Column -; Row 36; Stress Period 22 Years 11

Model Results - Hydraulic Gradient Contours in Feet

Los Osos CSD - Broderson Investigation

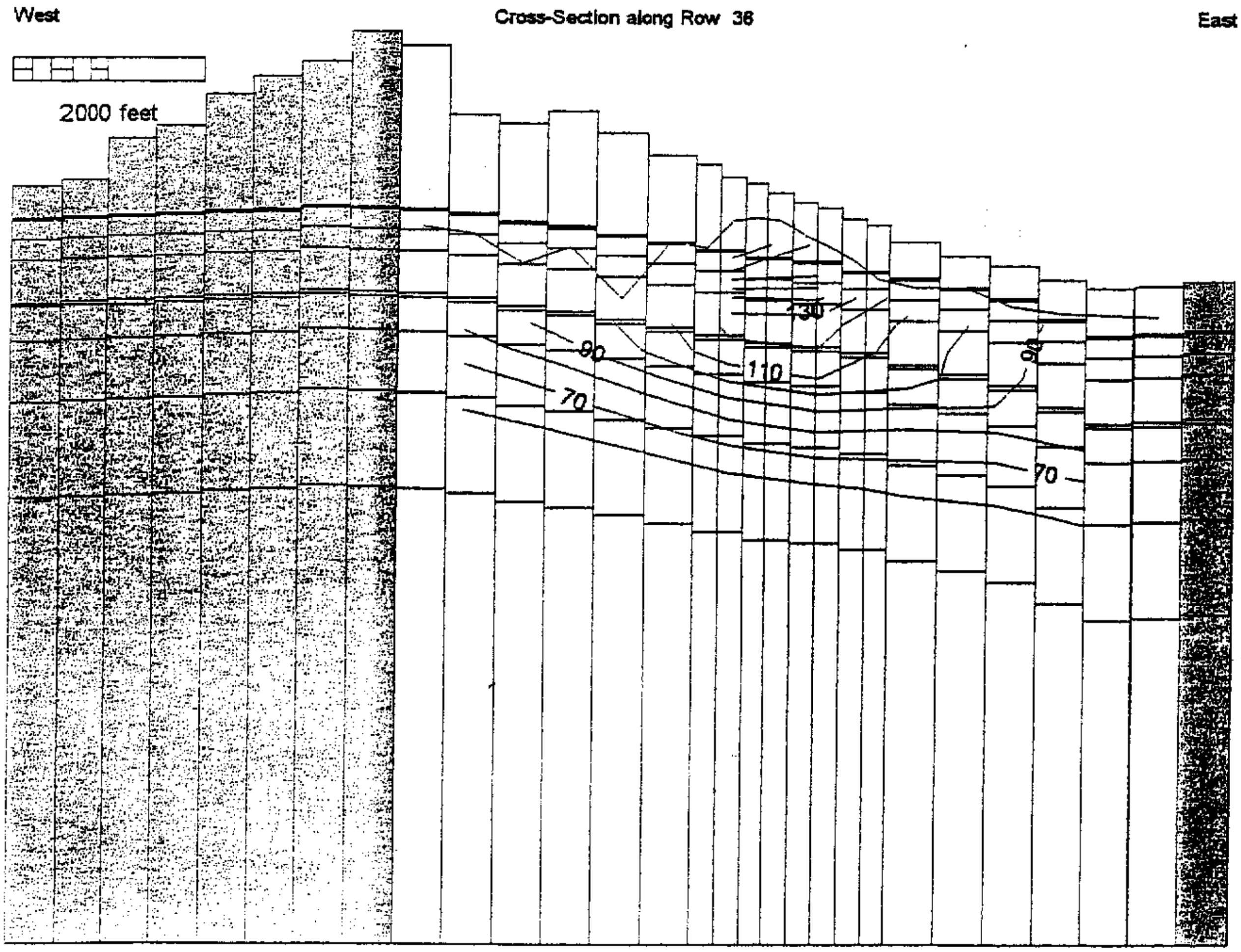


Figure B7

0.8 mgd; Column 19; Row —; Stress Period 22 Years 11

Model Results - Hydraulic Gradient Contours in Feet

Los Osos CSD - Broderson Investigation

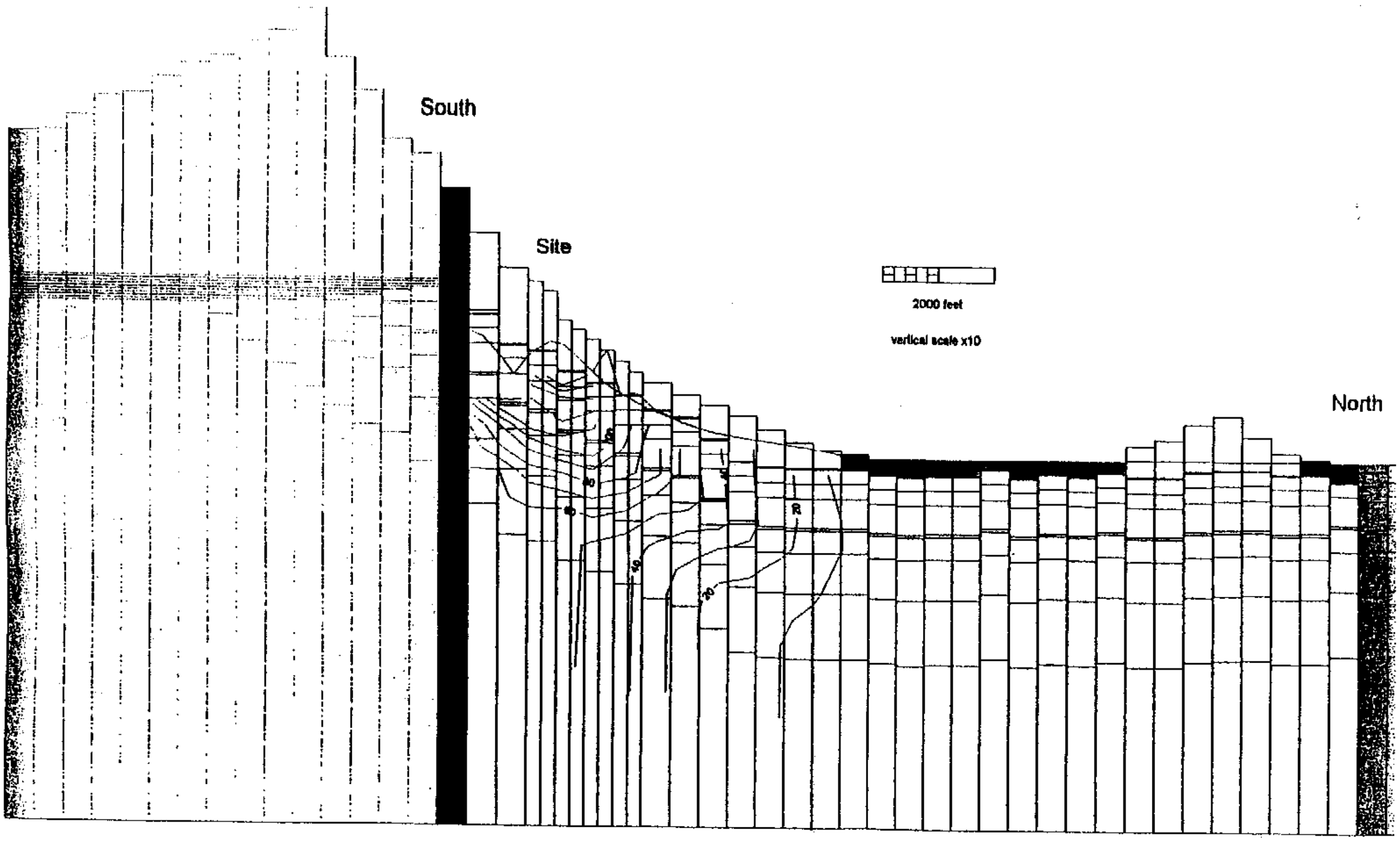
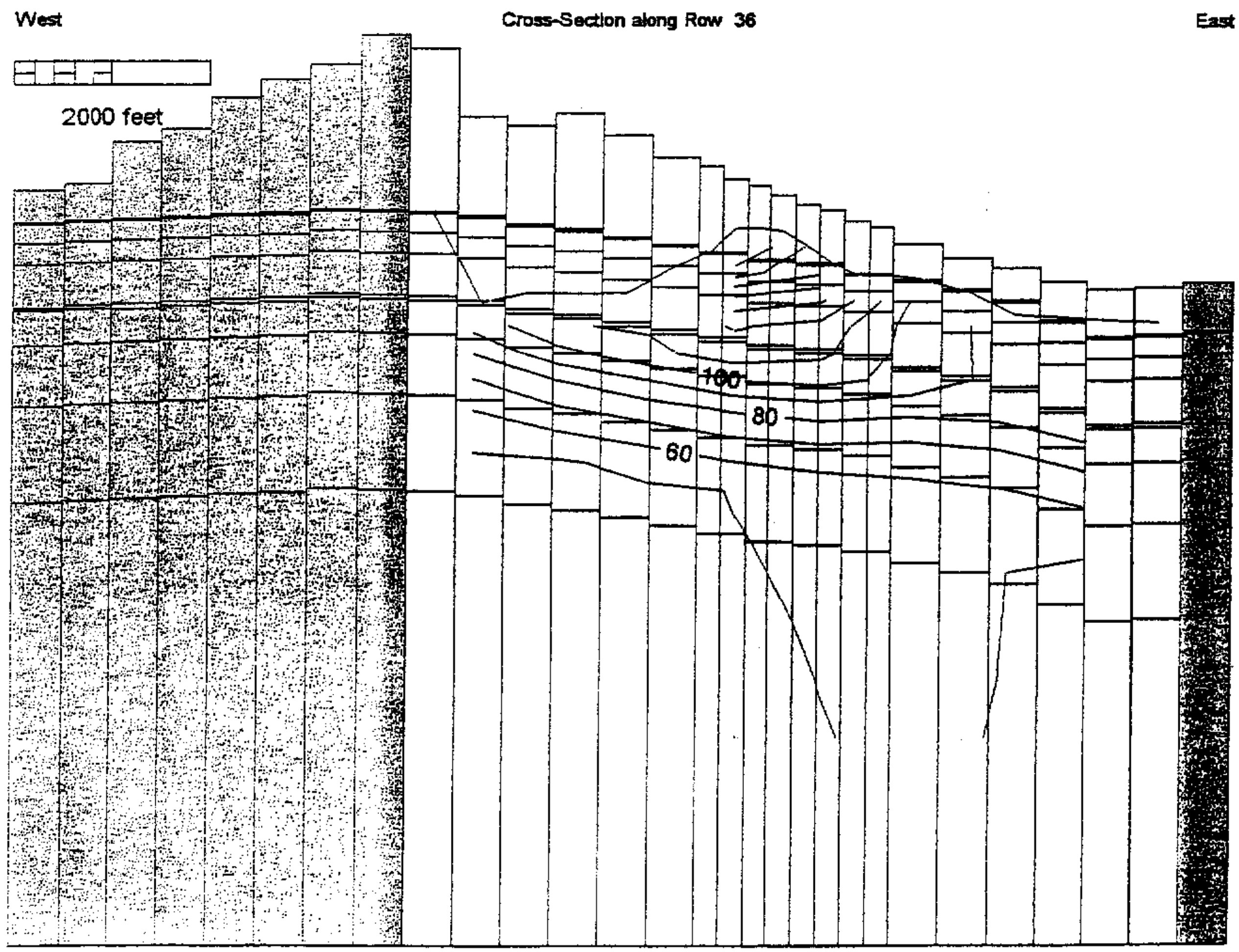


Figure B8

0.8 mgd; Column -; Row 36; Stress Period 22 Years 11

Model Results - Hydraulic Gradient Contours in Feet

Los Osos CSD - Broderson Investigation



ERRATA SHEET

March 27, 2001

The following errors have been identified in the Final Project Report for the Los Osos Wastewater Facilities Project dated March 7, 2001.

Page 4-2. The Pismo site in Figure 4-1 should be bordered to the west by South Bay Boulevard, to the east by Sage Avenue, to the north by Pismo Avenue, and to the south by Ramona Avenue.

Page 4-25. The first sentence in the last paragraph should read "........ranging from $1.89 million to $2.11 million".