Report to

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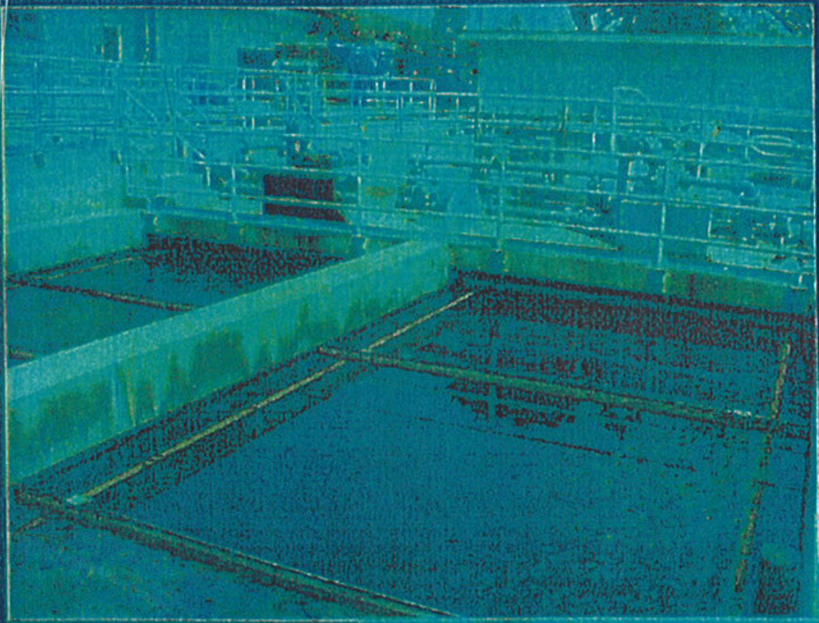
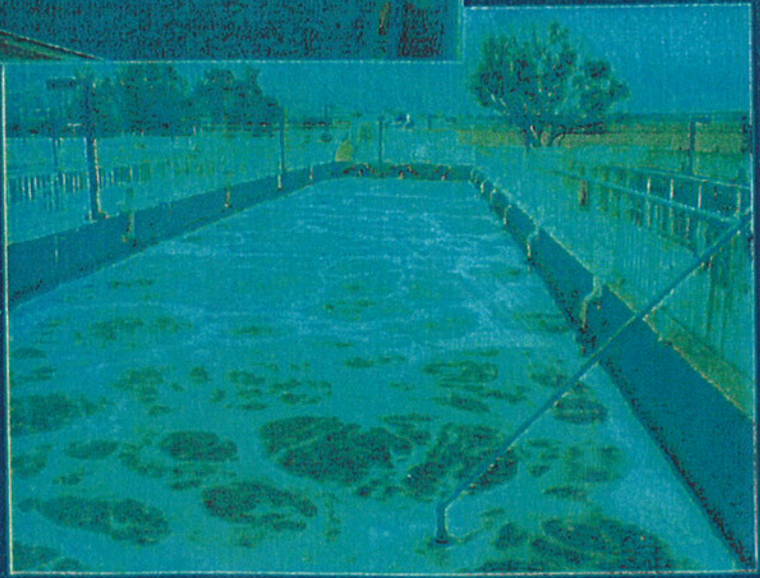
Cost of Tertiary Wastewater Treatment for Southern Santa Barbara County





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August 2001

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August 31, 2001

Heal the Ocean
Post Office Box 90106
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Attention: Hillary Hauser, Executive Director

Subject: Cost of Upgrading Wastewater Treatment Plants to Tertiary Treatment

Metcalf & Eddy is pleased to submit this Report on our assessment of the Cost to Upgrade the Wastewater Treatment Plants in Southern Santa Barbara County to Tertiary Treatment. The findings and conclusions described in this brief report are based on a single interview with each of the plant's operational managers, the review of available information from engineering design documents, and last year's annual reports as prepared for the Regional Water Quality Control Board. Additional data was derived from vendor quotations and conceptual designs prepared by our staff.

Of the area's five wastewater treatment plants, only the Summerland Sanitary District plant provides tertiary treatment at this time. Even that plant does not meet the full reliability standards of the California Department of Health Services' guidelines so as to be defined as a tertiary plant. This of course is to be expected because none of these plants are required to meet such stringent requirements. Each discharges into the ocean and each has a discharge permit based on the Ocean Plan, adopted November, 2000. Further, each plant is meeting their obligations under their respective permits. Two of the plants, El Estero and Goleta SD, produce reclaimed water from a portion of their effluent. The addition of tertiary treatment can be built around an expansion of these systems. The remaining districts must begin with their basic secondary plants and add the needed components.

From the conclusions of the report, you can find our opinion of capital and increased operating costs for each of the plants. Each plant is different and each requires different additions to achieve tertiary treatment.

Metcalf & Eddy wishes to thank each of the plant managers for their cooperation and their candor in describing their plants, and supplying relevant information without reservation. Without their assistance this report would not have been possible.

Respectfully submitted,

Charles E. Pound, PE
Senior Vice President
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Report on Cost of Tertiary Wastewater Treatment in Southern Santa Barbara County

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List of abbreviations used in this document

- mg/L — milligram per liter
- ppm — parts per million by weight
- BOD — biological oxygen demand after 5 days
- mg — million gallons
- mgd — million gallons per day
- gpcd — gallons per capita per day
- TSS — total suspended solids
- TDS — total dissolved solids
- NPDES — a permit to operate a wastewater treatment plant issued pursuant to Public law 92-500, 1972, known as the National Pollutant Discharge Elimination System (NPDES)
- CA DOHS — California Department of Health Services
- EDU — equivalent dwelling unit
- VSS — that portion of the TSS that can be combusted in a muffle furnace at 600 deg. F
- DAF — dissolve air flotation
- USEPA — United States Environmental Protection Agency
- UV — ultra violet light
- kW — kilowatt (1000 watts)
- gal — gallon
- ADWF — average dry weather flow
- PDWF — peak dry weather flow
- PWWF — peak wet weather flow

Chapter 1 Introduction

Background

The residents of the South Santa Barbara County coastal communities are provided wastewater collection and treatment services by five distinct agencies or districts. These five agencies are:

- City of Santa Barbara
- Carpinteria Sanitary District
- Goleta Sanitary District, also serving the Goleta West Sanitary District and the Embarcadero Municipal Improvement District
- Summerland Sanitary District
- Montecito Sanitary District

Each of these agencies own their own wastewater treatment plants and collection systems. Each agency operates their system under the authority of and in compliance with regulations promulgated by the State of California.

Each of these local service agencies is sensitive to the costs to be born by their constituents. Each prides its self in meeting the regulatory constraints with the lowest possible cost to their customers. For this reason, the idea of increasing the level of treatment at the plants before discharging the water to the ocean raises a number questions. The most obvious question is why should we increase the cost to our customers?

The Heal the Ocean group, a not for profit corporation based in Santa Barbara, is of the opinion that the citizens of these service areas may well be prepared to request additional treatment levels and be prepared to pay for the associated costs. In order to test their belief, the concept must be presented to the residents of each community. Before presenting the idea to the community, the Heal the Ocean group needs incremental cost data for each service area.

Purpose

The purpose of this study is to develop sufficient cost data for tertiary treatment to allow the Heal the Ocean group to present their idea to the public. These data are to be based on at least one conceptual set of improvements at each of the five wastewater-renovation plants capable of producing tertiary-level effluent. Using these conceptual improvements, develop the additional capital and annual operating and maintenance (O&M) costs for each plant. The capital and annual O&M costs are to be reduced to typical monthly costs for a residential unit in the respective city or district.

The scope of the assessment does not provide for developing justification for tertiary levels of treatment, such as a benefit to cost ratio.

Authorization

On May 3, 2001, Heal the Ocean contracted with Metcalf & Eddy, Inc. to conduct a conceptual-level survey of the five south coastal water renovation plants in Santa Barbara County for the purpose of identifying and costing the improvements required to achieve full tertiary treatment. For purposes of this assessment, the term tertiary treatment means "**Disinfected tertiary recycled water**" as defined in California Administrative Code of Regulations, Title 22, Division 4, Chapter 3, Article 1, Section 60301.230. The definition includes both Quality and Reliability guidelines. Reliability is intended to consider each facility as though it was producing unrestricted irrigation quality water without the ability to divert effluent to the ocean outfall at a lower water quality. The terms of this definition are presented in Appendix B of this report.

Chapter 2 Summary of Findings and Conclusions

The following paragraphs are intended to provide a summary of the findings identified during the conduct of this survey.

- There are five independent wastewater treatment plants that serve the greater Santa Barbara area of southern Santa Barbara County. These plants are owned by the Goleta Sanitary District, City of Santa Barbara, and the Sanitary Districts of Carpinteria, Montecito, and Summerland.
- All five of these plants fully comply with the terms of their NPDES discharge permits and two plants have established water reclamation facilities including storage and distribution systems. One plant is treating to tertiary quality now but does not meet the full redundancy guidelines of the CA DOHS.
- Four of the five plants provide full secondary treatment. The Goleta Sanitary District plant provides a combination of primary and secondary treatment to the outfall. Although in full compliance with their present discharge permit, this plant must be first upgraded to secondary treatment and then be upgraded to tertiary treatment.
- Three of the five plants have sufficient space available to upgrade to tertiary treatment. The other two must take special steps to accomplish the upgrade, such as convert existing plant to a new process or simply build the next phase of construction early so as to increase the number of process units to enhance reliability.
- Sewer service charges vary dramatically among the service areas. Some are based on a flat annual or monthly charge, and others are based on a flat service fee plus a charge based on water consumption. The monthly rates calculated on an average basis for an EDU range from $13.86 to $33.17.
- The increase in service charge that will be required for upgrading to tertiary treatment is acceptable to the treatment authorities so long as the majority of the public they serve is convinced of the need and is fully prepared to support the additional cost.

The following paragraphs are intended to outline the conclusions reached during the course of this study.

- The Goleta Water Reclamation Plant can be upgraded by expanding the processes presently in use at the plant. The major change proposed is that of equalizing storage after primary treatment in order to optimize the treatment train by reducing the impact of wet weather flow variations.
- The El Estero Water Reclamation Plant, City of Santa Barbara, is extremely limited in available land area. The conclusion is to convert the disinfection process to UV (which does not require a long contact time) and use the land made available for building the effluent filters. This requires a two-phase construction approach so that the land can be made available for demolition of the existing chlorine contact channels and the construction of filters. The existing filters can be used in conjunction with the new filters to meet the full plant design capacity.
- The Carpinteria Wastewater Treatment Plant also has an extremely small site in view of the future growth anticipated in the service area. Different approaches are presented that may be feasible, but the alternative chosen to develop for costing is to expand the present plant to provide process redundancy. With that issue solved, the tertiary process facilities can be added. These would consist of continuously back-washed filters and a new UV system for disinfection before releasing the water to the outfall. The existing chlorine contact channels would be demolished, thereby making that land available for other purposes.
- The Montecito Wastewater Treatment Plant is a full secondary plant that can be upgraded with the addition of filters and expanded chlorine contact channels. The solids handling facilities appear to be undersized for the present solids load. The additional solids from the filter backwash water will increase the loading, hence a parallel solids thickener and an aerobic digester was included in the process train.

- The Summerland Wastewater Treatment Plant already produces a filtered effluent before discharge to the outfall. The redundancy of processes is the only issue of substance here. By adding a continuous backwash filter and re-arranging the direction of flow, this plant can be considered a tertiary plant with full redundancy.
- Each of the plants must also add the appropriate sensors and alarm systems in addition to major process units so as to comply with the reliability standards.
- The following table sets forth the opinion of cost for proposed systems and their probable increase in operating and maintenance costs. These values are then converted to annualized costs so that a monthly increase in sewer service charges can be developed. These monthly increases are outlined as follows:

Item Description	Treatment Plant				
	El Estero WRP Santa Barbara	Goleta WRP	Carpinteria WWTP	Montecito WWTP	Summerland WWTP
Approximate population served	91400	64500	17000	11900	1,500
Estimated No of EDU	36,560	25,800	7,765	4,485	450
Present annual average flow (mgd)	8.22	5.80	1.53	1.07	0.15
Monthly Charges -					
- Present Sewer Service Charge/EDU	$19.94	$13.86	$33.17	N/A	N/A
- Proposed Additional Charge/EDU	**$12.56**	**$24.65**	**$33.01**	**$15.53**	**$39.16**

Chapter 3 Existing Conditions

Each of the five wastewater renovation plants was visited during the course of this survey. Generally, all of the plants are well kept and consist of modern wastewater technology. Figure 3-1 is a location map for each of the five plants. The findings during those visits is presented in the following paragraphs.

Santa Barbara's El Estero Wastewater Reclamation Plant

The El Estero Water Reclamation Plant process is of the conventional activated sludge type with the main liquid process units constructed in a compact, unit-construction. The ancillary facilities are located judicially on the remainder of the site. The solids are stabilized in anaerobic digesters and dewatered on belt presses. The dewatered solids are hauled off-site for agricultural uses in Kern County. After secondary treatment, a portion of the plant's flow is coagulated with polymer and filtered through granular anthracite media. This portion of the flow is then disinfected with sodium hypochlorite and distributed for irrigation uses at a variety of locations. The water reclamation system only uses about 10% of the total flow even though a significant investment in distribution piping has been made. That portion of the flow that is not reclaimed is disinfected with sodium hypochlorite and sent to the ocean outfall that extends out to a depth of about 89 feet before discharging through a series of ports designed to enhance uniform distribution. After chlorination, the water is dechlorinated with sodium bisulfite before discharge to the outfall.

The design and present operating parameters for this plant are shown on Table 3-1 and a simplified process schematic is shown in Figure 3-2. Plate 3-1 serves to help visualize portions of the plant.

A serious impediment to water recycling is the total dissolved solids (TDS). In order to reduce the reclaimed wastewater to less than 1300 mg/L, some potable water must be added. This reduces the full impact of water reclamation. In other areas of California the goal is to limit the TDS to 1000 mg/L, even a more strenuous standard than is being practiced by Santa Barbara.

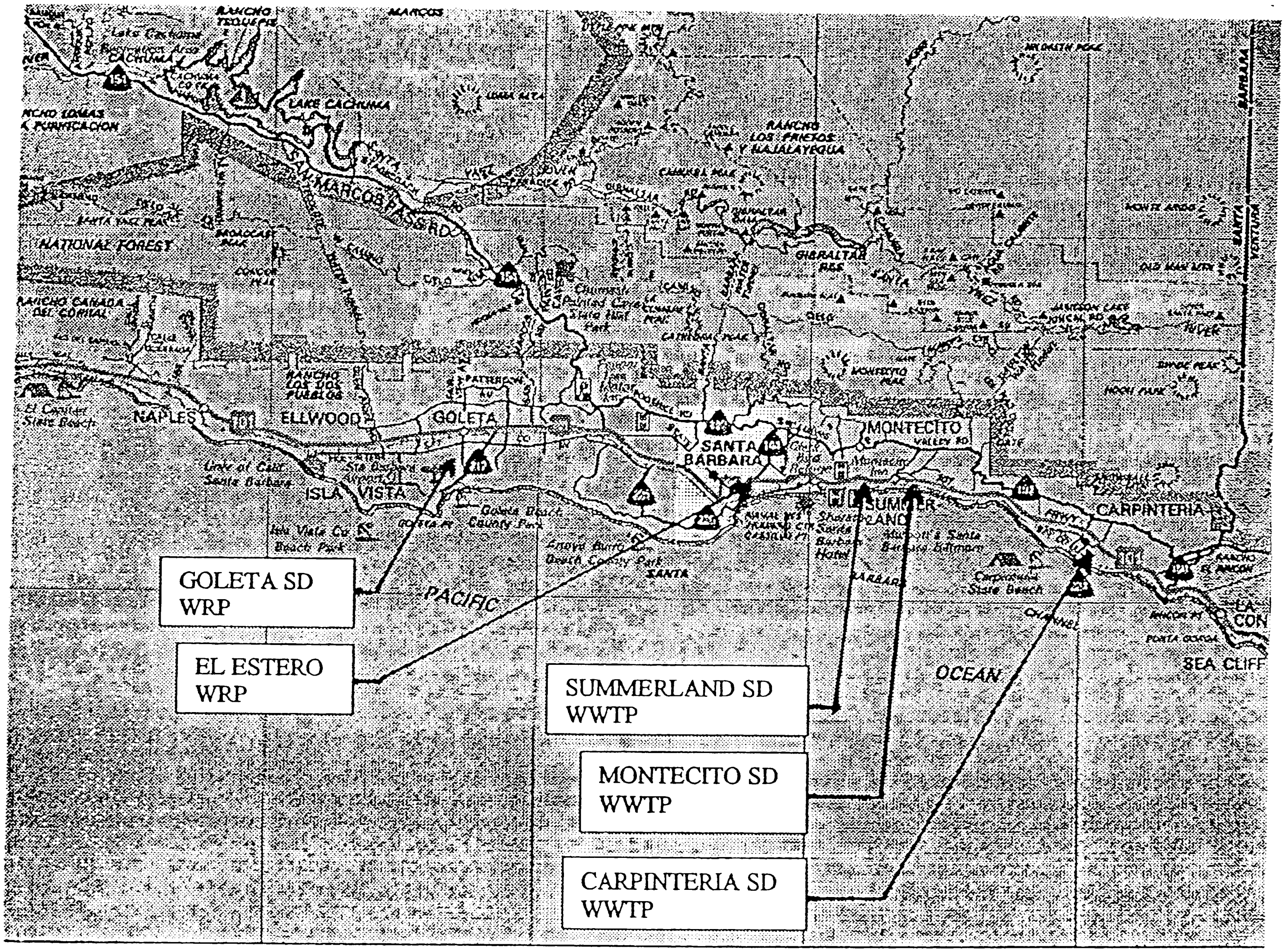
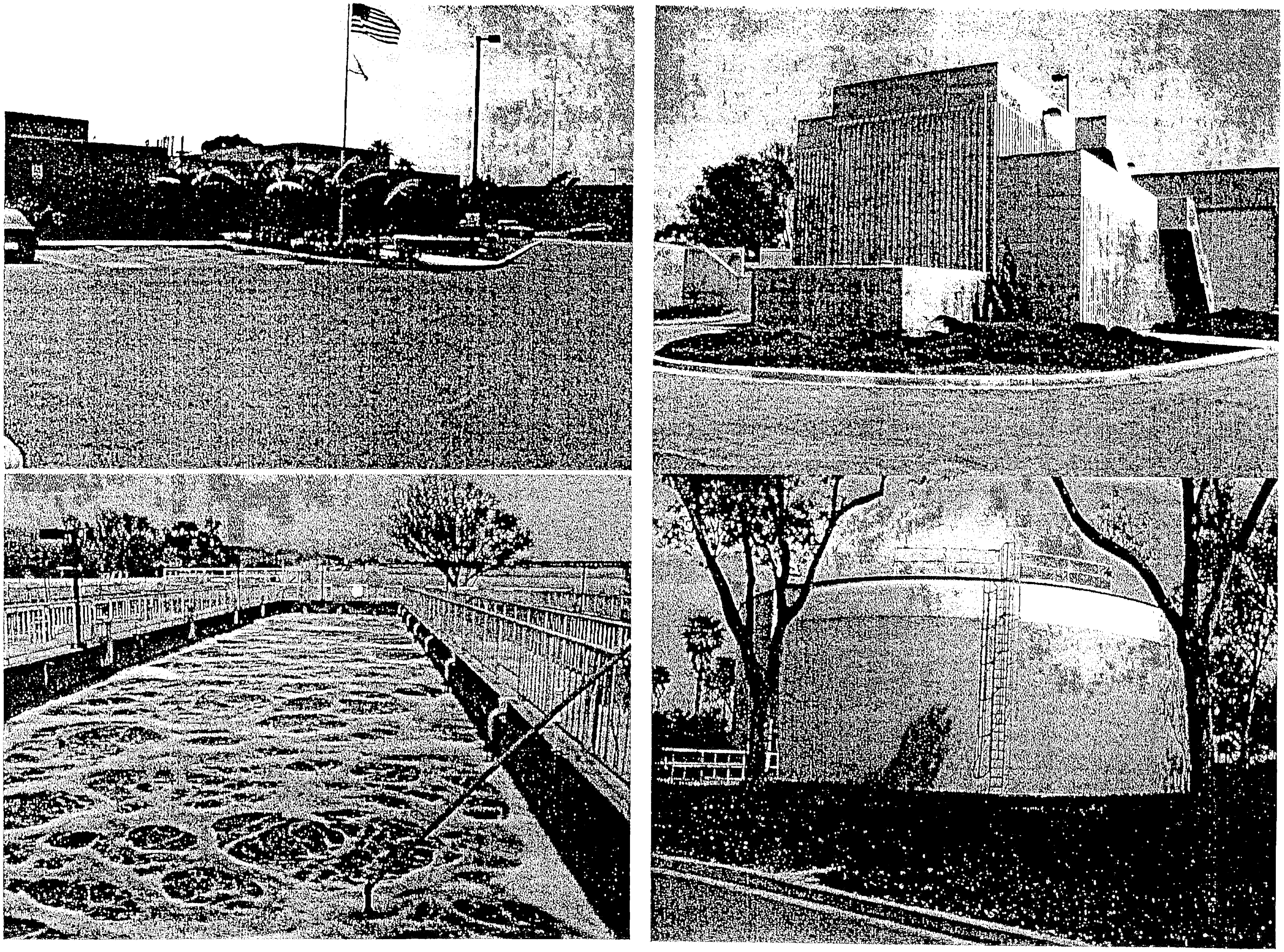


FIGURE 3-1
LOCATION MAP

Table 3-1 El Estero Water Reclamation Plant General Design Parameters

Parameter	Design	Present	Remarks
Design Population	104,000	96,000	
Design Flow Rates-			
- Avg.of total annual flow, mgd	11.0	8.22	
- Peak wet weather flow, mgd	28.0	19	
Design BOD and TSS, mg/L	260/300	260/300	
Primary Clarifiers - Number of units	5	5	
- Avg overflow rate, gpd/sf	589	440	
- Peak overflow rate, gpd/sf	1499	1017	
- Peak overflow rate, less one unit-gpd/sf	1874	1271	
Aeration Tanks - Number of units	6	6	
- Bod Loading, lbs BOD/day/lb MLVSS	0.3	0.2	
- Avg detention time, hrs.	7.5	10.5	
- Peak detention time, hrs.	2.9	4.5	
- Peak detention time less one unit, hrs.	2.5	3.8	
Secondary Clarifiers - Number of units	7	7	
- Avg overflow rate, gpd/sf	616	460	
- Peak overflow rate, gpd/sf	1568	1063	
- Peak overflow rate, less one unit-gpd/sf	1829	1240	
Chlorine Contact Tank - Number of units	1	1	
- Avg.Contact time, mins.	33.9	47.7	
- Peak Contact time, mins.	13.3	20.6	
Dechlorination Units - Number of units	1	1	
Gravity Thickener - Number of units	1	1	
- Solids Loading, lbs/day/sq ft	22.4	15.9	
Dissolve Air Flotation Thickener - Units	1	1	
- Solids Loading, lbs/day/sq ft	18.2	12.9	
Anaerobic Digesters - Number of units	2	2	
- Peak Detention time, days	~25	~25	
Dewatering Belt Filter Presses - Units	2	2	
Effluent Filtration Units - Number of units	4	4	
- Avg. Filtration Rate, gpm/sf	3.8	2.7	

Plate 3-1 El Estero Water Reclamation Plant



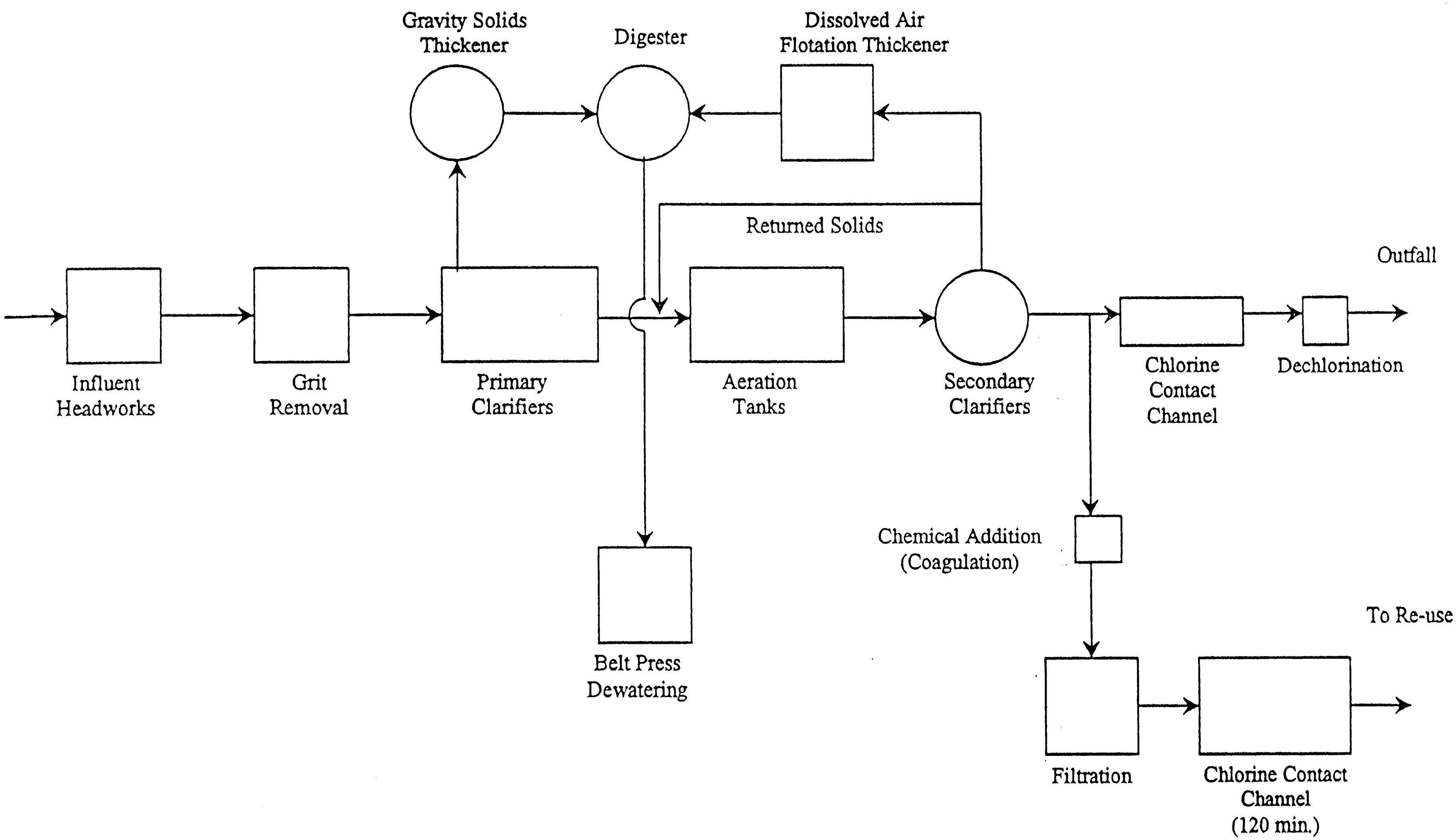


Figure 3-2 Process Block Diagram of El Estero WRP

The City has one 670,000 gal. reservoir on site for finished tertiary water storage. They do not have equalization storage or storage for holding the effluent that does not meet full secondary quality. These two types of reservoirs can provide process redundancy for meeting the reliability standards associated with tertiary treatment. Because of site constraints, these holding tanks would be nearly impossible to fit on the site without the purchase of additional land.

The plant has only one source of commercial electrical power supply, hence is required to have standby generating capacity. The plant has one 900 kW generator and a second 2000 kW engine-driven generator is being installed. These engines are fueled with diesel. These two generators should be sufficient to meet the total plant demand during power outages.

The most difficult issue for upgrading this plant is the area-constraint. The site is bordered on two sides by a creek and wetland or habitat, and on the other two sides by a road and industrial properties. Adding sufficient filters of the present type for the entire plant flow will be difficult because of the space required.

Goleta Sanitary District's Water Reclamation Plant

The Goleta plant consists of conventional sedimentation for primary treatment. From that process the flow is split into two streams. One stream is treated to secondary level and then rejoins the first stream and both are disinfected and discharged to the ocean. Secondary treatment is provided by a trickling filter, solids contact process (TF/SC). The liquid is treated in a plastic media trickling filter followed by an aeration tank and then a sedimentation tank or clarifier with an internal flocculation zone. The settled solids are then returned to the flow as it enters the aeration tank and some of the solids are wasted to the anaerobic digesters. A portion of the secondarily treated water is further processed for reclamation. The remainder joins the primary effluent and is discharged to the outfall to the ocean.

The combined primary/secondary effluent is disinfected before discharging through the outfall. The chlorine contact basin for ocean discharge is separate from the reclamation water contact basin. After chlorination, the water is dechlorinated with sodium bisulfite before discharge to the outfall.

The water treated for reclamation passes through coagulation/flocculation and then to direct filtration on conventional anthracite-media. The filtered water is disinfected with sodium hypochlorite. The water is then stored in an underground tank waiting delivery to the recycled-water customers.

The solids residue from the process units is stabilized in anaerobic digesters, held in sludge lagoons for further stabilization, and dewatered on sand drying beds. Until recently, the sand beds were the only means of dewatering biosolids available to the District. Now they have installed one belt filter press and are in the process of installing a second. Because of the length of time the solids are held in the lagoons, the sludge is considered Class A with respect to pathogens (USEPA 40 CFR 503). For that reason, some of the finished biosolids have been given away to local soil blenders and landscapers. The remainder is hauled offsite for disposal or use.

The design and present operating parameters for this plant are shown on Table 3-2 and a simplified process schematic is shown in Figure 3-3. Plate 3-2 may help visualize the plant.

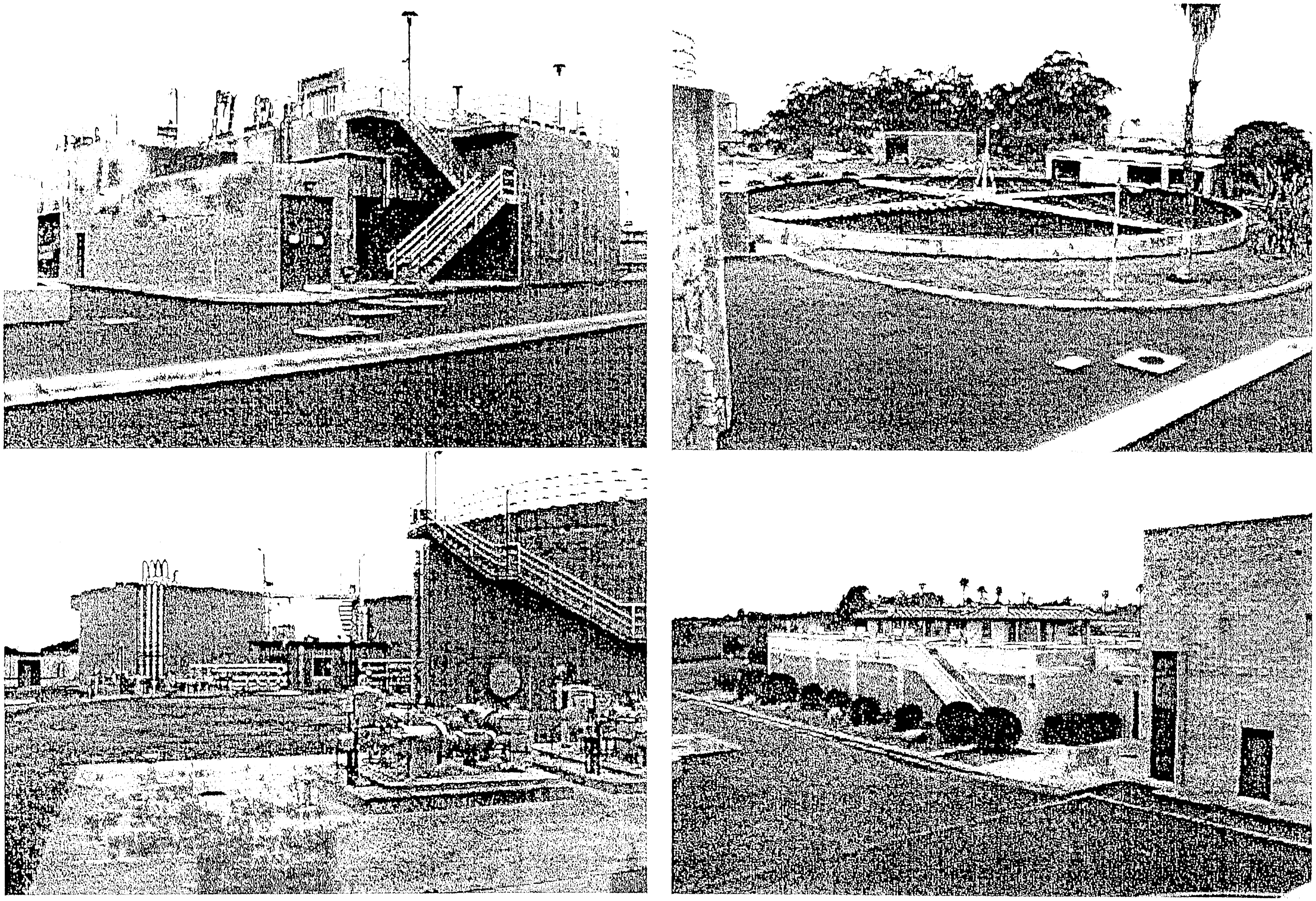
That portion of the flow that is not reclaimed is disinfected and sent to the ocean outfall that extends out to a depth of about 92 feet before discharging through a series of ports designed to enhance uniform distribution and dispersion.

The plant has only one source of commercial electrical power supply, hence is required to have standby generating capacity. They have one 200 kW and one 400 kW engine-driven generators. These engines are fueled with diesel. The District has a storage tank capable of holding a 14-day supply of diesel. These two generators are not quite sufficient to meet the total plant demand, hence a combination of temporary generator rental and short-term load shedding must be practiced.

Table 3-2 Goleta Sanitary District Reclamation Plant General Design Parameters

Parameter	Design	Present	Remarks
Design Population			Data not readily available
Design Flow Rates-			
- Avg.dry weather flow, mgd	9	5.5	
- Peak seasonal dry weather flow, mgd	9.7		
- Peak dry weather flow, mgd	17.00		
- Peak wet weather flow, mgd	25.40		
Design BOD and TSS, mg/L	220/220	230/234	
Primary Clarifiers - Number of units	3		
- Design flow basis of total flow			
- Avg overflow rate(peak season), gpd/sf	730		
- Peak dry weather overflow rate, gpd/sf	1280		
- Peak wet weather overflow rate, gpd/sf	1912		
Chlorine Contact Tank - Number of units	2		
- Avg.Dry Weather Contact time, mins.	78.5		
- Peak Wet Weather Contact time, mins.	30		
Dechlorination Units - Number of units	2		
Secondary Treatment Facilities			
- Design flow , constat rate, mgd	3.8		
Trickling Filters - Number of units	1		
- Hydraulic loading, gpm/sf	0.46		
- Organic loading rate, lbs BOD/ 1000 cu ft	59.7		
Aerated Solids Contact Tank			
- Length of Channel, lin ft	106		
- Hydraulic Detention time, min	22.8		
- Air Supply total, scfm	609		
- Air supply per foot of channel, scfm/lf	5.75		
Secondary Clarifiers - Number of units	2		
- Avg overflow rate, gpd/sf	672		
- Peak overflow rate, gpd/sf			
- Peak overflow rate, less one unit-gpd/sf			
Tertiary Filtration Units - Number of Units	4		
- Avg. Filtration Rate, gpm/sf	3.6		
- Avg Filtration Rate with one unit out, gpm/sf	4.8		
Reclamation Disinfection Facilities - Units	2		Coverted to hypochlorite
- Chlorine mixing tanks	1		
- Passes per contact tank	2		
- Detention Time, mins	123		
Solids Management			
Anaerobic Digesters - Number of units	3		
- Peak Detention time, days	~ 25		
Dewatering Belt Filter Presses - Units	2		Now being installed
Solids Stabilization Basins - Number of Units	3		
- SSB 1 Surface area, 1000 sq ft	54.7		
- SSB 2 Surface area, 1000 sq ft	111.6		
- SSB 3 Surface area, 1000 sq ft	107.7		
- Depth of SSB's, ft	11.5		
Sludge Drying Beds - Number of Units	12	11	One bed removed to add effluent chlorination facilities.
- Width, ft	50		
- Average length, ft	175		

Plate 3-2 Goleta Water Reclamation Plant



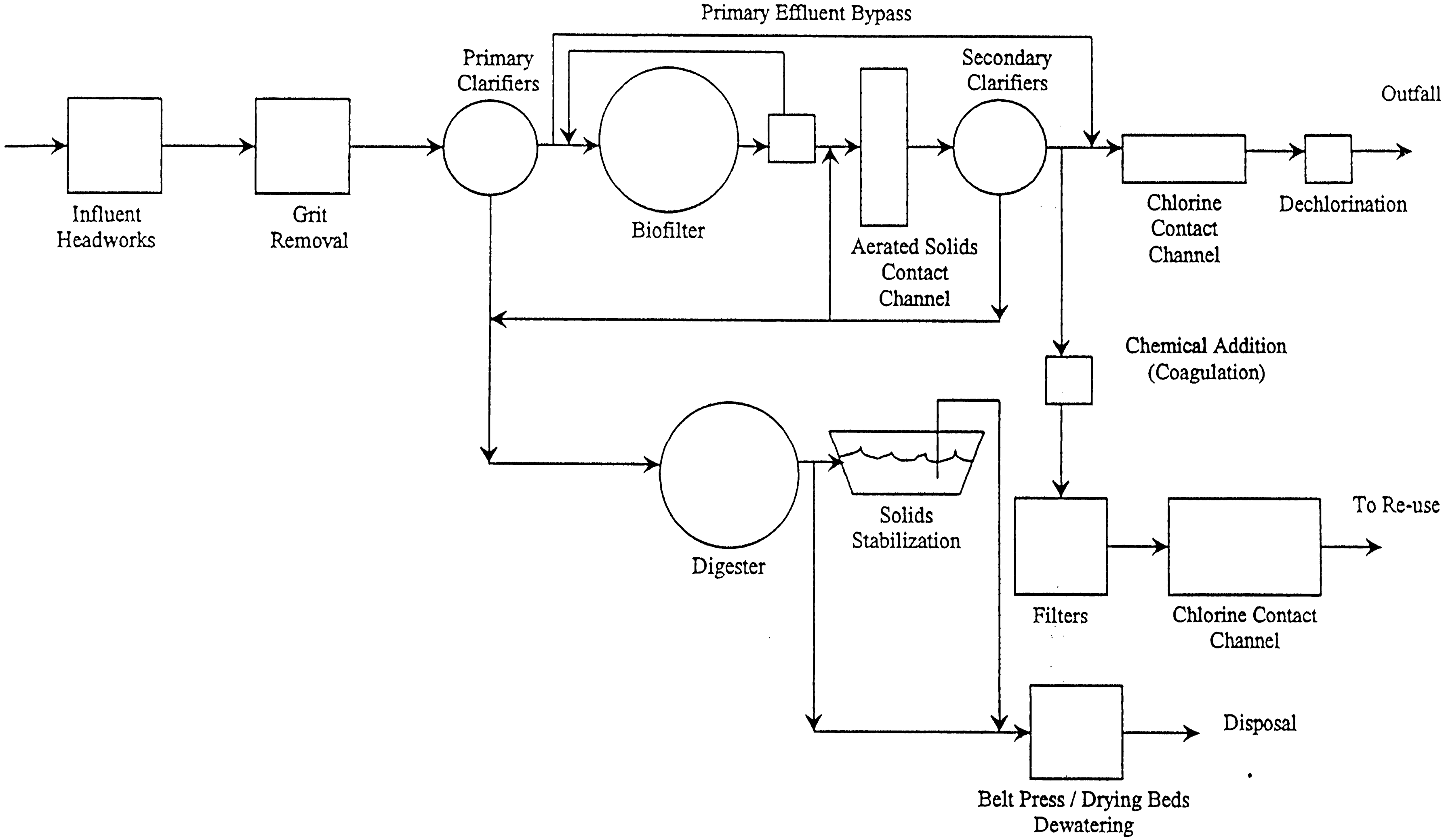


Figure 3-3 Process Block Diagram of Goleta WRP

The district has one 3-mg reservoir for finished reclaimed water storage. The plant does not have equalization storage or storage for holding the effluent that does not meet full secondary quality. These two types of reservoirs could provide process redundancy for meeting the reliability standards associated with tertiary treatment.

Carpinteria Sanitary District's Wastewater Treatment Plant

The Carpinteria wastewater treatment plant provides secondary treatment using a conventional activated sludge process and is followed by disinfection with sodium hypochlorite and discharge to the ocean outfall. After chlorination, the water is dechlorinated with sodium bisulfite before discharge to the outfall. Solids residue is stabilized in aerobic digesters, and the solids are dewatered on belt filter presses. Dewatered solids are hauled offsite to a composting facility in Kern County.

The design and present actual parameters for this plant are shown on Table 3-3 and a simplified process schematic is shown in Figure 3-4. Plates 3-3 may serve to help visualize the plant.

As with many plants, the site is small and severely restricted. All of the presently available space will be consumed when the plant is expanded to meet future growth expectations. Further, an apartment building is immediately adjacent to the plant on one side and a state park on the other.

The plant has a 1000 kW generator set which is sufficient to run the entire plant. In fact only about 20-30% of the capacity is used under present conditions. The plant does not have equalization storage or storage for holding effluent that does not meet full secondary quality.

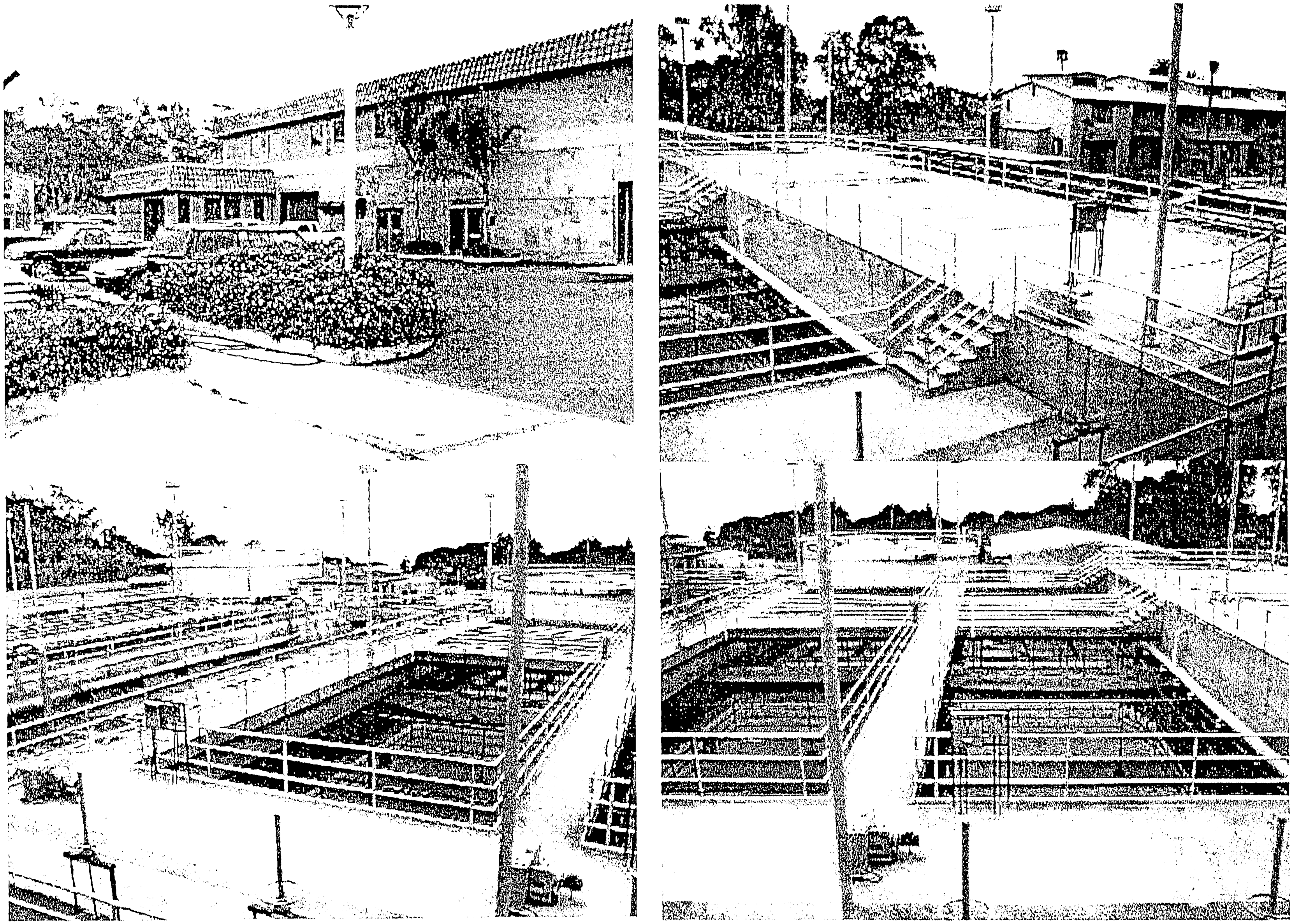
Montecito Sanitary District Wastewater Treatment Plant

This is an extended aeration, activated sludge plant that has been modified to include separate aerobic digestion of solids. The plant has no primary clarifiers and no grit removal facilities. The secondary clarifiers serve as the only solids removal facility in the plant. The effluent from the secondary clarifiers is disinfected with sodium

Table 3-3 Carpinteria Sanitary District Wastewater Treatment Plant General Design Parameters

Parameter	Design	Present	Remarks
Design Population			
Design Flow Rates-			
- Avg.dry weather flow, mgd	2.5	.	Recently rerated from 2.0 mgd
- Peak wet weather flow, mgd	7.00		
Design BOD and TSS, mg/L			
Primary Clarifiers - Number of units	1		Primaries may not be critical.
- Avg overflow rate, gpd/sf	1000		
- Peak overflow rate, gpd/sf	2800		
- Peak overflow rate, less one unit-gpd/sf	N/A		There is no bypass available
Aeration Tanks - Number of units	2		
- Bod Loading, lbs BOD/day/lb MLVSS	0.3		
- Avg Detention time, hrs.	3.5		
- Peak Detention time, hrs.	1.25		
- Peak Detention time less one unit, hrs.	0.625		
Secondary Clarifiers - Number of units	2		
- Avg overflow rate, gpd/sf	500		
- Peak overflow rate, gpd/sf	1400		
- Peak overflow rate, less one unit-gpd/sf	2800		
Chlorine Contact Tank - Number of units	1		
- Avg.Flow Contact time, mins.	46		
- Peak Flow Contact time, mins.	16.5		
Dechlorination Units - Number of units	1		
Aerobic Digesters - Number of units	2		
- Peak Detention time, days			
Dewatering Belt Filter Presses - Units	1		
Effluent Filtration Units - Number of units	None		
- Avg. Filtration Rate, gpm/sf			

Plate 3-3 Carpinteria Wastewater Treatment Plant



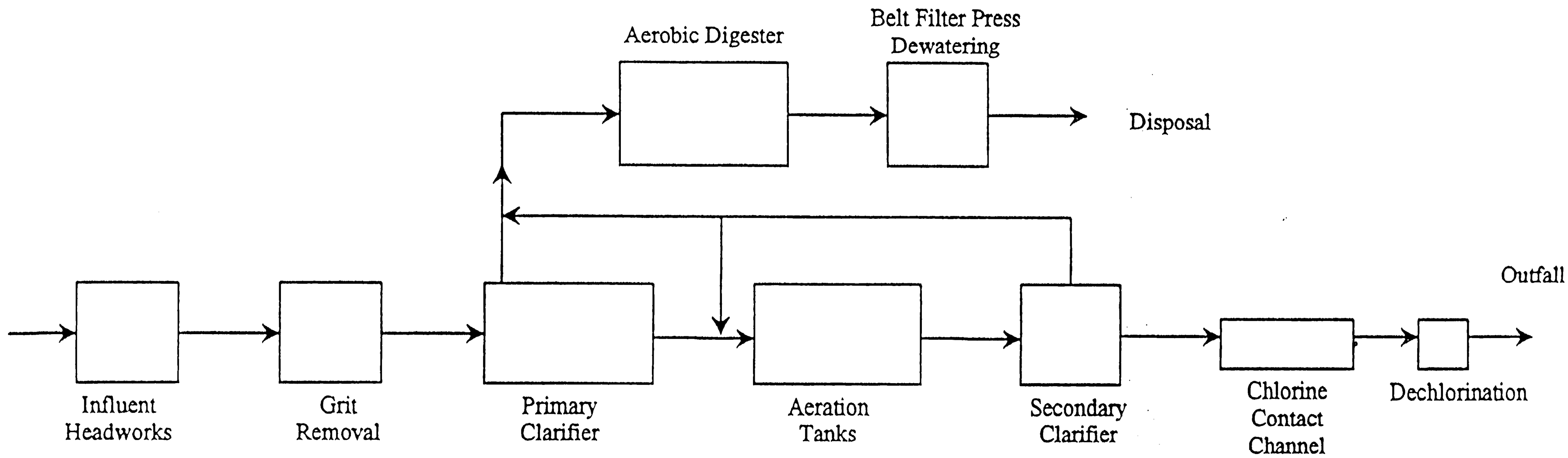


Figure 3-4 Process Block Diagram of Carpenteria WWTP

hypochlorite and then dechlorinated with sodium bisulfite. The solids from the secondary clarifiers are screened through a drum screen prior to returning active solids to the aeration tanks or waste solids to the dissolved air flotation thickener and then to the aerobic digester. After digestion the solids are dewatered on a belt filter press. Dewatered solids are then stored on a concrete pad until sufficient quantity has accumulated to fill a semi-truck and trailer. The solids are then delivered to Kern County for composting.

The design and present operating parameters for this plant are shown on Table 3-4 and a simplified process schematic is shown in Figure 3-5. Plate 3-4 may serve to help visualize the plant.

The plant has only one source of commercial electrical power supply, hence is required to have standby generating capacity. They have one 250 kW engine-driven generator. The engine is fueled with diesel. The fuel tank holds a 14-day supply of diesel. This generator has sufficient capacity to automatically restart and energize the entire plant with the exception of the aerobic digester blower motors. These blower motors have a high in-rush power demand, requiring a manual startup sequence.

The effluent from the plant is discharged to the ocean via an 18-inch diameter outfall that extends 1550 feet into the surf and is released through a series of orifices to enhance rapid dispersion of the effluent water.

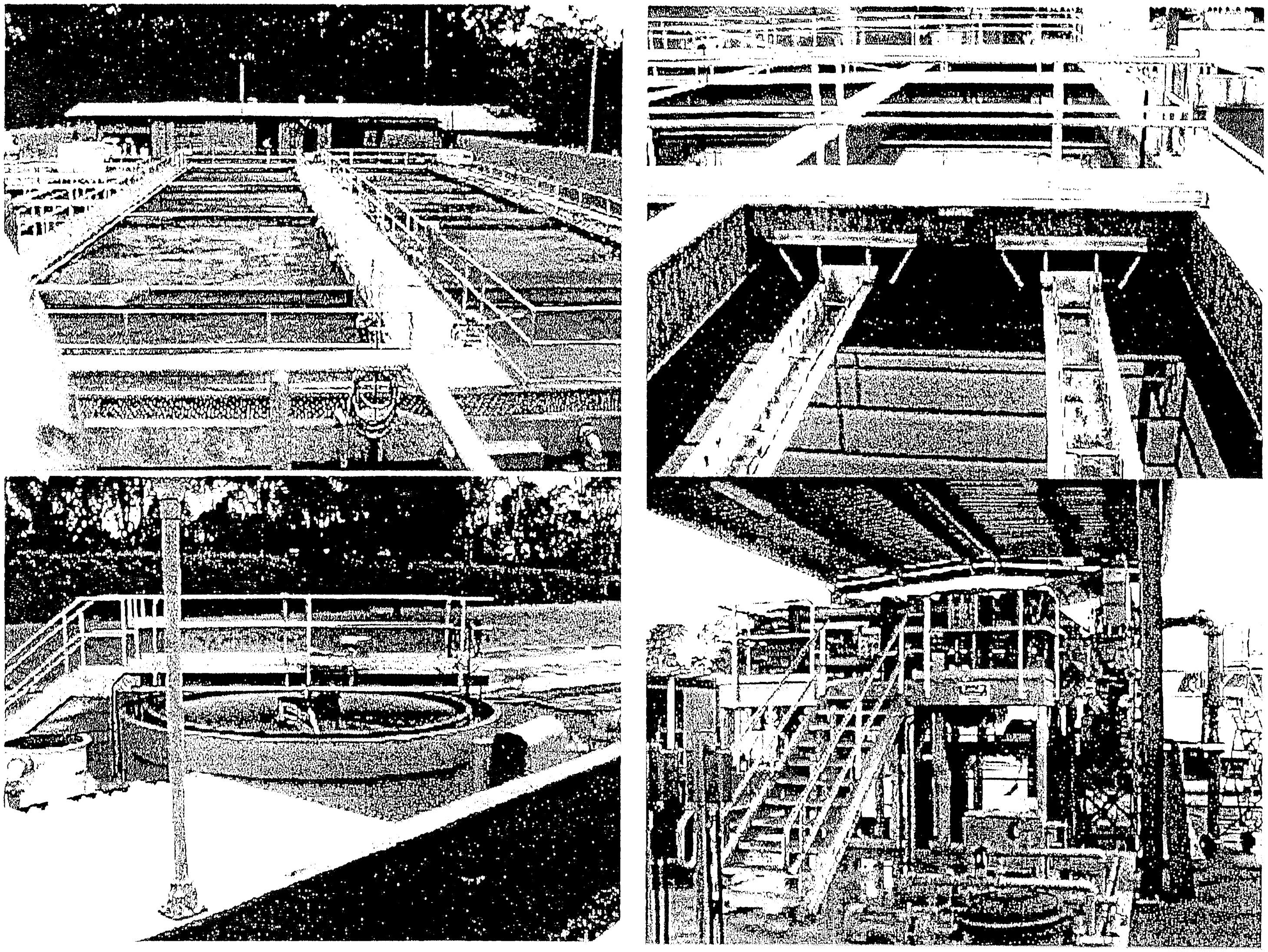
Summerland Sanitary District Wastewater Treatment Plant

The Summerland wastewater treatment plant is a conventional activated sludge plant enhanced by diurnal equalization for uniform feed to the process units. This aerated holding tank serves to allow some of the daytime flow to be held for the night hours when there is essentially no flow into the plant, thereby sustaining the activated sludge process throughout the day. After primary settling of solids the flow enters the aeration tanks and then passes to the secondary clarifiers. After secondary clarification, the water is disinfected with sodium hypochlorite, filtered through granular anthracite media, and then dechlorinated with sodium bisulfite. The effluent is then discharged via an 800-foot long outfall into the ocean.

Table 3-4 Montecito Sanitary District Wastewater Treatment Plant General Design Parameters

Parameter	Design	Present	Remarks
Design Population		11,000	
Design Flow Rates-			
- Avg.dry weather flow, mgd	1.5	1.07	
- Peak wet weather flow, mgd	3.00	2.3	Design PWWF estimated
Design BOD and TSS, mg/L	392/365	200/240	
Primary Clarifiers - Number of units	N/A		
- Avg overflow rate, gpd/sf			
- Peak overflow rate, gpd/sf			
- Peak overflow rate, less one unit-gpd/sf			
Aeration Tanks - Number of units	2		
- Bod Loading, lbs BOD/day/lb MLVSS			
- Avg Detention time, hrs.			
- Peak Detention time, hrs.			
- Peak Detention time less one unit, hrs.			
Secondary Clarifiers - Number of units	4		
- Avg overflow rate, gpd/sf			
- Peak overflow rate, gpd/sf			
- Peak overflow rate, less one unit-gpd/sf			
Chlorine Contact Tank - Number of units	1		
- Avg.Contact time, mins.			
- Peak Contact time, mins.			
Dechlorination Units - Number of units	1		
Gravity Thickener - Number of units	N/A		
- Solids Loading, lbs/day/sq ft			
Dissolve Air Flotation Thickener - Units	1		
- Solids Loading, lbs/day/sq ft			
Aerobic Digesters - Number of units	1		
- Peak Detention time, days			
Dewatering Belt Filter Presses - Units	1		
Effluent Filtration Units - Number of units	N/A		
- Avg. Filtration Rate, gpm/sf			

Plate 3-4 Montecito Wastewater Treatment Plant



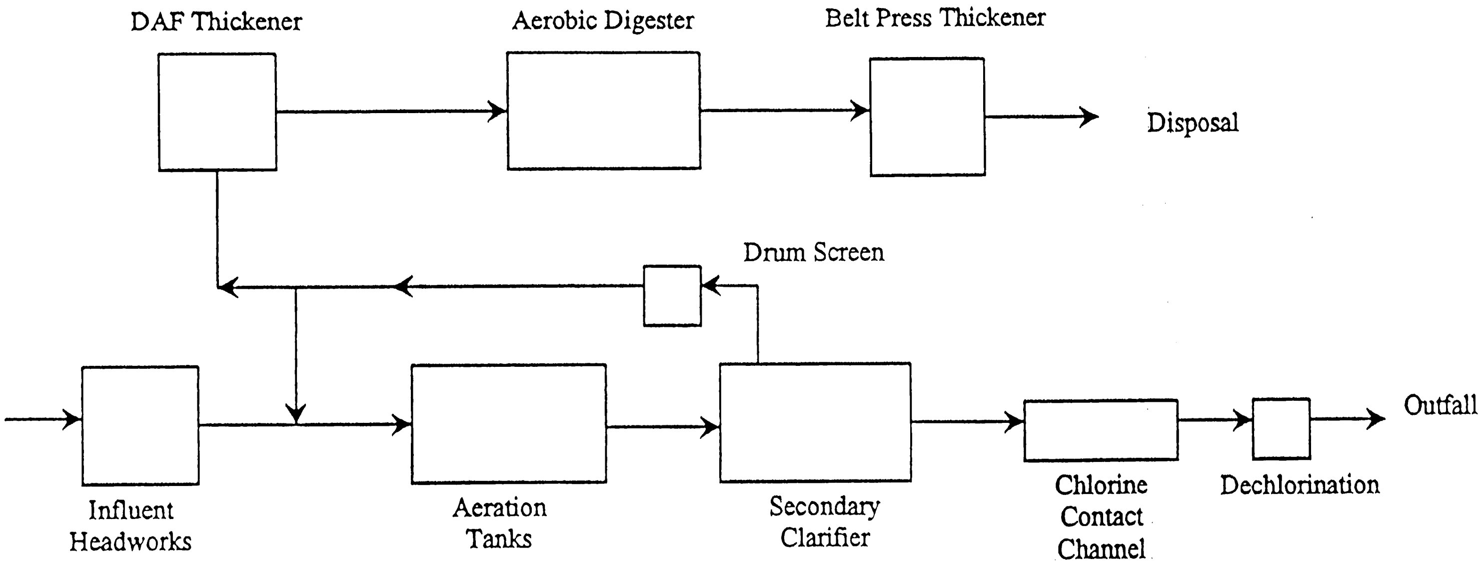


Figure 3-5 Process Block Diagram of Montecito WWTP

The design and present operating parameters for this plant are shown on Table 3-5 and a simplified process schematic is shown in Figure 3-6. Plate 3-5 may help visualize the plant.

The solids from both the primary and the secondary clarifiers are transferred to an aerobic digester. After stabilization, the solids are dewatered on a belt press and stored on a concrete pad that is outfitted with floor drains plumbed to discharge to the wet well. The solids are accumulated until there are sufficient to fill a semi-trailer for hauling offsite to a landfill or to Kern County for composting and disposal.

The plant has a single source of commercial electricity, hence requires standby power. The plant has been recently outfitted with a 150 kW diesel-driven engine-generator set. There is sufficient fuel storage for about 3 weeks of operation. The generator controls include full automatic transfer from commercial power to standby power and can run the entire plant.

Effluent Requirements (NPDES)

Each of the five wastewater treatment plants in this survey receive their effluent discharge requirements from the Central Coast Regional Water Quality Control Board with offices in San Luis Obispo, CA. Each of the plants discharge through an ocean outfall of various lengths and terminal depths. Their NPDES permit is based on the latest version of the California Ocean Plan, adopted November 16, 2000. If there are differences in their present discharge permits because of earlier versions, they will be adjusted at their next permit renewal.

A typical ocean discharge permit is included in Appendix B. It should be noted that all plants presently meet or exceed the required quality criteria.

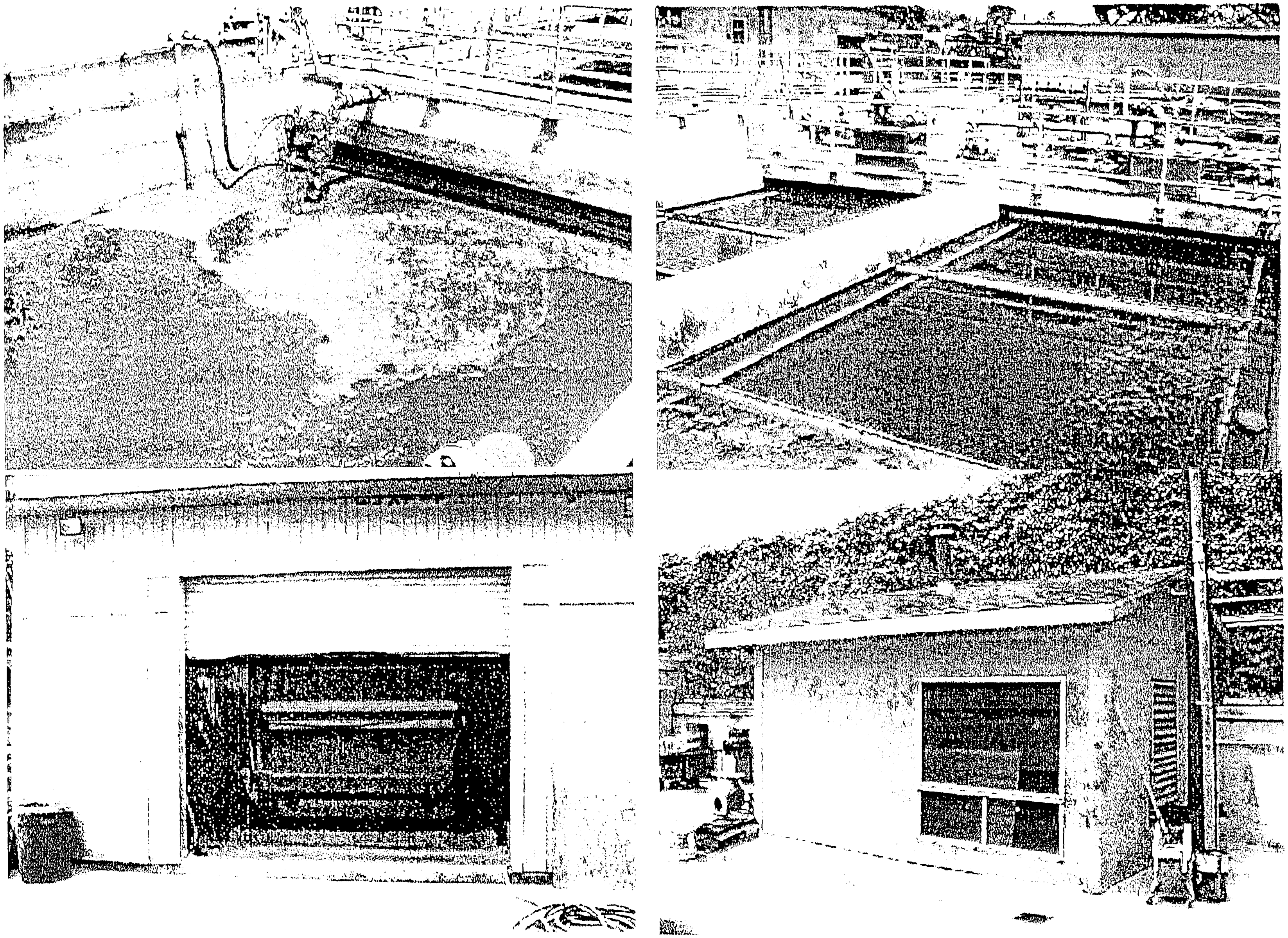
Service Area and Services

Each of the plants serves a unique set of service conditions that requires recognition. The Summerland SD serves the classical bedroom community, hence the flow nearly comes to a stop at night, causing the continuous operation of a conventional activated sludge plant to be difficult without equalizing storage. Santa Barbara has more commercial and

Table 3-5 Summerland Sanitary District Wastewater Treatment Plant General Design Parameters

Parameter	Design	Present	Remarks
Design Population	~1600		Approximately 450 connections
Design Flow Rates-			
- Avg.dry weather flow, mgd	0.15	0.15	This value based on Disch.Permit
- Peak wet weather flow, mgd	0.30		
Design BOD and TSS, mg/L	234/166		
Primary Clarifiers - Number of units			
- Avg overflow rate, gpd/sf	294		
- Peak overflow rate, gpd/sf	588		
- Peak overflow rate, less one unit-gpd/sf	1176		
Aerated Flow Equalization Basin	1	1	
- Volume, fraction of ADW Flow, %	17	17	
Aeration Tanks - Number of units			
- Bod Loading, lbs BOD/day/lb MLVSS	0.34		
- Avg Detention time, hrs.	20.68		
- Peak Detention time, hrs.	10.34		
- Peak Detention time less one unit, hrs.	5.17		
Secondary Clarifiers - Number of units			
- Avg overflow rate, gpd/sf	208		
- Peak overflow rate, gpd/sf	416		
- Peak overflow rate, less one unit-gpd/sf	832		
Chlorine Contact Tank - Number of units	1		
- Avg.Contact time, mins.	300		
- Peak Contact time, mins.	150		
Dechlorination Units - Number of units	1		
Gravity Thickener - Number of units	N/A		
- Solids Loading, lbs/day/sq ft			
Dissolve Air Flotation Thickener - Units	N/A		
- Solids Loading, lbs/day/sq ft			
Aerobic Digesters - Number of units	2		
- Peak Detention time, days			
Dewatering Belt Filter Presses - Units	1		
Effluent Filtration Units - Number of units	1		
- Avg. Filtration Rate, gpm/sf	1.73		

Plate 3-5 Summerland Wastewater Treatment Plant



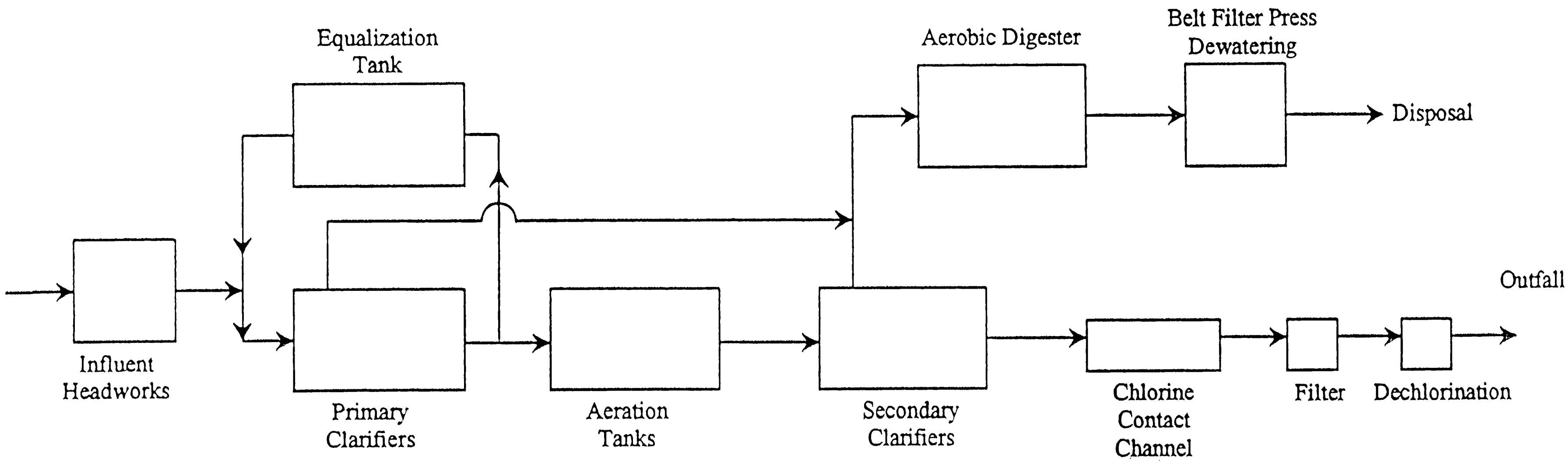


Figure 3-6 Process Block Diagram of Summerland WWTP

industrial contributors than the others, requiring a vigilant monitoring for potential industrial pollutants. Goleta serves two large college campuses and two other districts, each with their mix of services. Montecito serves some commercial area, a college campus, and the remaining is residential. The mix of wastes for the Carpinteria plant is similar to that of the City of Santa Barbara, except smaller.

Table 3-6 shows the services and the estimated monthly sewer charge for the typical single-family-house sewer connection. It should be noted that the typical charges for each district or city is not necessarily exact, but does represent a value that is sufficiently accurate to calculate the increase that will occur if tertiary treatment were to be instituted in that respective service area.

Table 3-6 Summary of Available EDU and Service Charges

Item Description	Treatment Plant				
	El Estero WRP Santa Barbara	Goleta WRP	Carpinteria WWTP	Montecito WWTP	Summerland WWTP
Approximate population served	91400	64500	17000	11900	1,500
Estimated No of EDU	36,560	25,800	7,765	4,485	450
Present annual average flow (mgd)	8.22	5.80	1.53	1.07	0.15
Present Sewer Service Charge/EDU	$19.94	$13.86	$33.17	N/A	N/A

Chapter 4 Improvements to Meet Tertiary Treatment

The purpose of this chapter is to develop the process modifications that will satisfy the requirements of effluent quality and reliability for tertiary treatment. One of the critical issues is available site area, hence the need to understand how the new facilities can be located on the site. In developing these alternative process schemes and site layouts, it must be remembered that the purpose of this study is to develop cost estimates that are reasonably accurate. It is not the intent to develop all of the alternatives and conduct thorough cost analyses in order to choose the least cost alternative. The procedure in this case is to choose a set of acceptable processes that could be constructed on site. These processes may actually represent only one of several alternatives available and may not be the least cost alternative. A full preliminary engineering study should be conducted to determine the process combination that would actually be designed and implemented.

If the conventional tertiary processes of gravity filters and sodium- hypochlorite disinfection can not be constructed on site, then alternative processes will be used to accommodate full tertiary treatment on site and for the same design flow rate as now exists.

The definition of tertiary treatment used for this study is "Disinfected tertiary recycled water" and is taken from California Code of Regulations Title 22, Div. 4, Chapter 3, Article 1, Sec. 60301.230. The definition is extracted and included here for clarification.

> "**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."

"**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.

"**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." [A modal contact time of 90 mins. meets the criteria but the computed value of 120 mins is commonly used for design]

Reliability standards for design are those included in the Code of Regulations, Title 22, Div. 4, Chapter 3, Articles 8 and 10. These standards of reliability and their options are summarized in Table 4-1 and are applicable to the plans developed in this chapter. The actual wording is included in Appendix B. There are two basic areas of concern in reliability provisions: power failure and process failure. Table 4-1 includes both concerns. It should be understood that these two provisions can be additive because they are not necessarily derived from the same event.

For purposes of this cost study, it is assumed that the processes must comply with **quality** standards for Disinfected Tertiary Reclaimed Water [Sec. 60301.230] and **reliability** standards that comply with those of Secs. 60341(a) and 60343–60353. This means that the only effluent quality acceptable would be that of Tertiary Recycled Water. In order for this approach to be practical, it must provide treatment capacity for peak wet weather flows. The filters and disinfection facilities must meet these as a minimum. It should be noted that achievement of this level of treatment is a matter of self-policing because the recycled water quality is substantially better than that of ocean discharge standards. So long as the ocean discharge standards are being included in operating permits, this condition can prevail.

A less costly approach would be to design for the same quality standards but not the same reliability standards. It is clear from the reliability standards [Article 10, Section 60341 (c)] that because each of the five plants has an existing ocean outfall, reliability could be achieved by reverting to the ocean discharge quality-level during periods when the water does not fully meet "recycled water quality". Also, in this case the design would be for Peak Dry Weather flows and not for Peak Wet Weather Flows. Basically this would mean adding, coagulation, filtration and improved disinfection to secondary wastewater treatment plants. All quality excursions during wet weather flows would be expected to meet the present ocean discharge requirements as a minimum. This would apparently meet the reliability standards of Section 60341 (c) and (d). This would be an

Table 4-1 Summary of Reliability Guidelines For Tertiary Treatment

Function or Process	Provision for reliablility	Remarks
Energy Reliability		
Power Supply	a. Alarm and full standby power supply b. Alarm plus automatic short term (24 hr.) retention of flow c. Automatic long term (20 day) storage	Because of space limitations, the choice of full and automatic standby power will be most effective.
Process Reliability		
Primary Treatment	a. Multiple units meeting effluent criteria with one unit out of operation b. Standby power c. Long term storage	Large plants with more than 3 clarifiers easily fit the first provision.
Aeration Tanks & Secondary Clarifier Units	a. Multiple units meeting effluent standards with one unit out of operation b. Short term retention & standby replacement equipment c. Long term storage	Another alternative for b. and c. is to have an allowable discharge at lower quality that can be achieved under any condition. That is the present reliability provision available to both Goleta and Santa Barbara for their reclaimed water systems.
Secondary Clarifiers	a. Multiple units capable of treating the entire flow with one unit out of operation b. A standby unit c. Long term storage	
Coagulation	a. Multiple units capable of treating the entire flow with one unit out of operation b. A standby unit c. Short term retention & standby replacement equipment d. Long term storage	
Filtration	a. Multiple units capable of treating the entire flow with one unit out of operation b. A standby unit c. Short term retention & standby replacement equipment d. Long term storage	
Disinfection with chlorine or hypochlorite	a. Multiple units capable of treating the entire flow with one unit out of operation b. A standby unit c. Short term retention & standby replacement equipment d. Long term storage e. Multiple point chllorination,each with independant power, seperate chlorinator and separate chlorine supply.	
Disinfection with Ultra Violet Light	a. Multiple units capable of treating the entire flow with one unit out of operation b. A standby unit c. Short term retention & standby replacement equipment d. Long term storage	Large UV systems should have their own separate standby power unit.

Foot Notes: 1. In all cases of reliability provisions, the flow means the maximum flow rate for the period in question, eg., maximum 24 hour period, etc.

2. The provision for UV reliability is not specifically provided for in the CA Title 22 Code of Regulations. This was added by the author based on guidance published December 2000 by the CA DOHS.

enhancement of the effluent presently being discharged, during all but wet weather periods. The Summerland plant basically follows this concept, providing a higher quality effluent but maintaining its discharge permit based on ocean discharge criteria.

Meeting the full intent of reliability is an expensive part of upgrading to tertiary treatment. This alternative approach would significantly reduce the cost for both Summerland and Carpinteria. There would be relatively less change for El Estero, Goleta and Montecito.

For the water that has been and will continue to be recycled, the existing designs and reliability standards will apply. This scenario applies to both the El Estero and the Goleta plants. In both cases, reliability is now achieved via discharge to the outfall.

Table 4-2 presents a summary of the proposed upgrades for each plant to meet full tertiary recycled water criteria adopted for this cost study.

Santa Barbara Wastewater Reclamation Plant

The City of Santa Barbara's El Estero Water Reclamation Plant is designed to provide full secondary treatment for an average daily flow of 11.0 mgd and has the capability to treat up to 3.8 mgd of that flow to tertiary level for water reclamation purposes. If the site area was more generous, the upgrading of this plant to full tertiary treatment would be relatively easy. Unfortunately that is not the case. The site is so restricted that the only way new facilities can be added is to replace one for another, or build them in vertical layers. There may be an opportunity to secure more land but it would likely require the exercise of eminent domain, which is usually not very palatable. The search for additional land area is beyond the scope of this report, hence will be limited to an alternative that fits within the site.

In view of the site restrictions, the following concept for upgrading was developed: install new filters and coagulation equipment and convert to UV disinfection before the outfall. The footprint of the proposed filter building is very close to that of the existing chlorine contact channels, suggesting that the new facilities could be built on that same site. In

Table 4-2 Summary of Required Improvements for Tertiary Treatment

Required Plant Improvements	Wastewater Treatment Plants				
	Santa Barbara	Goleta SD	Carpinteria SD	Montecito SD	Summerland SD
Primary Clarifiers					
Equalizing Reservoir		X			
Aeration Tanks		X	X		
Trickling filters		X	X		
Secondary Clarifiers		X	X		
Coagulation system	X	X	X	X	X
Filters	X	X	X	X	X
Disinfection (NaOCl or UV)	X	X	X	X	
Dechlorination		X		X	
Solids Holding Lagoon		X			
Digesters		X		X	
I&C Improvements	X	X	X	X	
Standby Power	X	X		X	

Note: If water reclamation is now being practiced, the coagulation and filtration part of that system will be included in this plan and operated on a continuous basis. The existing disinfection equipment will continue to be used as it is presently.

outline form, the plan involves the temporary installation of UV disinfection units to replace the main disinfection contact channels so that space can be used for construction of a new bank of filters. The new facility would be designed so that the UV units can then be transferred to the new location under or adjacent to the new filter building so as not to interrupt the plant's normal operation.

The existing four filters would be used in conjunction with the new. The existing chlorination facility for the reclamation plant would be maintained in service.

The use of UV facilities in lieu of sodium hypochlorite and contact channels is a choice strongly encouraged by site limitations. If land could be secured either adjacent to the existing site or somewhere down stream along the land–portion of the outfall, chlorine contact channels could be constructed and the use of UV avoided. A detailed analysis of this option is recommended before a final decision is made. For this study the UV system appears constructable and will be used to estimate the cost of the plan.

The UV units are not as effective on secondary effluent as with tertiary treated water. However, the level of disinfection for ocean discharge is not as stringent as for reclaimed water. This should allows the UV units to be satisfactory until the filters are completed. Upon completion of the filters, the UV units can be moved to the filter building as noted above, and be cleaned and rechecked for performance with filtered water.

Standby generation is now being improved for the main plant, bringing the generating capacity to a total of 2900 kW. In the planning for the UV facilities, a separate generator set is included just for the UV system. The filtration plant standby-power needs were assumed to be available from the main power generation units.

The filter units are assumed to be conventional filters, in other words they are not continuous back wash units, hence some volume must be allowed as a clear well for pumping the backwash water. Also, volume must be allowed for equalizing the backwash water before pumping the water back to the head works. It was assumed that the solids thickeners would not require expansion for this upgrade, nor would the digesters and belt filter presses.

The additional facilities and their basic design parameters are shown in Tables 4-2 and 4-3.

Goleta Sanitary District

The Goleta Sanitary District water reclamation plant is the only plant of the five that has sufficient additional land to be flexible. The District operates their plant under a Section 301.h waiver. This waiver allows for more flexibility than the typical NPDES permit. In this case, however, limitations on both effluent quality and maximum mass emissions apply. At this time, the plant can operate with only a portion of the flow being treated to secondary levels and the remainder as primary. As the emissions approach the limit, the District will be required to install more and more secondary treatment facilities. The quality of the effluent at present essentially meets the definition of secondary treatment, but without full biological treatment facilities.

Because a portion of the plant is only to primary level, the cost of upgrading to full tertiary treatment will be more expensive than for the other four plants that are presently at full secondary. The present secondary treatment elements of the plant have performed well, and have been easy to operate on a daily basis. However, because design peak wet weather flow rates of 25.4 mgd are relatively high compared to average dry weather flow of 9.0 mgd, the introduction of flow equalization will help to optimize the operation and performance of the system, especially during wet weather flows. Equalization of the dry weather flows will become more beneficial as the design flow rate is approached. Introduction of equalization storage is best introduced after primary sedimentation, similar to that of the Summerland plant.

In order to estimate the amount of storage needed to accommodate diurnal flow variations, the hourly flow characteristics are needed so that mass balance plots can be made. Absent that data, the volume can be estimated based on classical variations in flow. The most difficult estimate is that of when a storm event adds a significant and extended flow to the plant. Under dry weather conditions the diurnal flow can be equalized with a storage and pump-back system having a volume of about 15-20% of the average day flow. If the wet weather occurs at the time the basin is full because of

Table 4-3 El Estero Water Reclamation Plant General Design Parameters

Parameter	Design	Proposed Design	Remarks
Design Population	104,000		
Design Flow Rates-			
- Avg.dry weather flow, mgd	11.0	11.0	
- Peak dry weather flow, mgd	19.0	19.0	
- Peak wet weather flow, mgd	28.0	28.0	
Design BOD and TSS, mg/L	260/300	260/300	
Primary Clarifiers - Number of units	5	5	
- Avg dry weather overflow rate, gpd/sf	589	589	
- Peak wet weather overflow rate, gpd/sf	936	936	
- Peak overflow rate, less one unit, gpd/sf	1092	1092	
Aeration Tanks - Number of units	6	6	
- Bod Loading, lbs BOD/day/lb MLVSS	0.3	0.3	
- Avg Detention time, hrs.	7.5	7.5	
- Peak Flow Detention time, hrs.	2.9	2.9	
- Peak Flow Detention time, less one unit, hrs.	2.5	2.5	
Secondary Clarifiers - Number of units	7	7	
- Avg overflow rate, gpd/sf	616	616	
- Peak overflow rate, gpd/sf	1568	1568	
- Peak overflow rate, less one unit, gpd/sf	1829	1829	
Chlorine Contact Tank - Number of units	1	--	Destroy the contact basins for room to build the filters
- Avg.Contact time, mins.	33.9		
- Peak Contact time, mins.	13.3		
Dechlorination Units - Number of units	1	--	No longer necessary.
Gravity Thickener - Number of units	1	1	
- Solids Loading, lbs/day/sq ft	22.4	22.4	
Dissolve Air Flotation Thickener - Units	1	1	
- Solids Loading, lbs/day/sq ft	18.2	18.2	
Anaerobic Digesters - Number of units	2	2	
- Peak Detention time, days	~25	~25	
Dewatering Belt Filter Presses - Units	2	2	
Effluent Filtration Units - Number of units	4	21	Filter surface area =196 sq ft/each (14x14), 17 new filters
- Avg. Filtration Rate, gpm/sf	3.8	1.9	Based on 21 filters in operation
- Peak WWF rate, gpm/sf	N/A	4.7	Based on 21 filters in operation
- Peak WWF rate, one unit down, gpm/sf	N/A	5.0	Based on 20 filters in operation
UV Disinfection Facilities - Number of Units		5	Convert to UV in-line units, Aquionics # 35000
- mgd/unit at average flow		2.2	Each in-line unit has 3 active units and 1 standby
- mgd/unit at peak dry weather flow		3.8	
- mgd/unit at peak wet weather flow		5.6	
- mgd/unit at peak wet weather flow		7.0	One complete unit out of service

dry weather contributions, the wet weather flow must have an additional volume to fill. If in those events the plant average flow is allowed to increase to 18 mgd, the peak of the influent hydrograph must be provided for. This suggests a volume of about 2.0-2.5 mg. Adding these values together, the required volume is likely between 4 and 5 mg. If the Solids Stabilization Basin No.1 is removed from service and converted to an aerated and mixed equalization basin, the volume would be about 4.7 million gallons. With some deepening, paving and adding of pumping sumps and cleaning devices, this basin could serve the purpose. Aeration would be provided by suspended aeration devices with blowers housed in a nearby sound-reducing building.

It may be possible that one sludge lagoon could be permanently removed from service because the plant is converting from solids drying beds only, to a combination of belt filter presses and solids drying beds. However, the benefit of stabilization basins is that the long holding time allows the sludge to achieve a Class A status with respect to pathogens. The loss of one lagoon reduces the holding capacity to the point that the desired level of stabilization is jeopardized. Additional sludge holding capacity should be constructed, especially in view of the increased solids generated from the expanded biological process. One possible location for this basin is directly north of the existing aeration channel and secondary clarifiers. The cost for this sludge lagoon will be included in this study, but its location and configuration should be studied in detail before a final decision on plant configuration is made.

The other features of this plan include expansion of the existing secondary treatment process, solids handling facilities, filtration facilities, and appropriate chlorine contact chambers and de-chlorination equipment. Each process added to the plant is planned to mirror the existing facilities, in so far as possible.

The additional facilities and their basic design parameters are shown in Tables 4-1 and 4-4.

Carpinteria Sanitary District

The Carpinteria Waste water treatment plant is a relatively new secondary treatment plant, constructed in 1995 for an ADW flow of 2.0 mgd. Since the plant was put into

Table 4-4 Goleta Sanitary District Reclamation Plant General Design Parameters

Parameter	Design	Proposed Design	Remarks
Design Population			Data not readilty available
Design Flow Rates-			
- Avg.dry weather flow, mgd	9.0	9.0	
- Peak seasonal dry weather flow, mgd	9.7	9.7	
- Peak dry weather flow, mgd	17.0	10.0	based on primary diurnal equalizing storage
- Peak wet weather flow, mgd	25.4	18.0	based on dampening discrete storm events
Design BOD and TSS, mg/L	220/220	230/234	
Primary Clarifiers - Number of units	3	3	
- Avg dry weather overflow rate, gpd/sf	677	677	
- Avg overflow rate(peak season day), gpd/sf	730	730	
- Peak dry weather overflow rate, gpd/sf	1280	752	
- Peak wet weather overflow rate, gpd/sf	1912	1355	
Primary Effluent Equalizing Storage Basin	N/A	1	Use variable speed pumps to match demand
- Volume of Basin, mg		5	Adapt SSB-1 for this purpose
Chlorine Contact Tank - Number of units	2	4	Each new basin equals total volume of first two
- Avg.Dry Weather Contact time, mins.	78.5	254	
- Peak Wet Weather Contact time, mins.	30	127	
Dechlorination Units - Number of units	2	4	
Secondary Treatment Facilities			
- Design flow (constant rate), mgd	3.8	10	
Trickling Filters - Number of units	1	3	1 unit at 130 ft diam.& 2 units at 118 ft diam.
- Circulated flow, mgd	5	13.2	
- Hydraulic loading, gpm/sf	0.46	0.46	
- Organic loading rate, lbs BOD/ 1000 cu ft	59.7	59.7	
Aerated Solids Contact Tank	1	3	
- Length of Channel, lin ft	106	286	New Channels are two at 90 lin ft
- Hydraulic Detention time, min	22.8	23.04	
- Air Supply total, scfm	609	1645	
- Air supply per foot of channel, scfm/lf	5.75	5.75	
Secondary Clarifiers - Number of units	2	4	New Clarifiers are two at 76 ft Diam.
- Avg overflow rate, gpd/sf	672	677	
- Peak WW overflow rate, gpd/sf	N/A	1218	
- Peak WW overflow rate, less one unit-gpd/sf	N/A	1761	One new clarifier out of service.
Tertiary Filtration Units - Number of Units	4	16	Filter unit surface areas are 160 sq ft
- Avg. Filtration Rate, gpm/sf	3.6	2.7	
- Avg Filtration Rate with one unit out, gpm/sf	4.8	4.9	
Reclamation Disinfection Facilities - Units	2	2	Coverted to hypochlorite from gaseous CL2
- Chlorine mixing tanks	1	1	
- Passes per contact tank	2	2	
- Detention Time, mins	123	123	Maintain in service for reclamation.
Solids Management			
Anaerobic Digesters - Number of units	3	4	
- Total solids to Digester at PDW flow, lbs/day	14125	20044	New tank SWD=29 ft and Diam = 52ft
- Peak Detention time, days	~25	~25	Average sludge solids at 4 %
Dewatering Belt Filter Presses - Units	2	2	Two now being installed
Solids Stabilization Basins - Number of Units	3	2	
- SSB 1 Surface area, 1000 sq ft	54.7	–	
- SSB 2 Surface area, 1000 sq ft	111.6	111.6	
- SSB 3 Surface area, 1000 sq ft	107.7	107.7	
- New SSB 4 Surface area, 1000 sq ft		85.0	Additional lagoons to accommodate more
- New SSB 5 Surface area, 1000 sq ft		85.0	biological sludge.
- Depth of SSB's, ft	11.5	11.5	
Sludge Drying Beds - Number of Units	12	10	Two beds removed to add effluent
- Width, ft	50		chlorination facilities.
- Average length, ft	175		

operation, it has been re-rated to a capacity of 2.5 mgd. We understand that the wet weather peak flow remained at 7.0 mgd. In keeping with the assumptions being used in this study for reliability, the design of the tertiary treatment system must be capable of treating the peak wet weather flow. This is critical because it complicates the achieving of reliability standards for the existing secondary plant. For example, when one of the two unit processes is out of service during periods of wet weather flow, the process units can not be expected to meet the performance criteria required for tertiary treatment. The reliability is further complicated because of plant space limitations.

One reliability option is to use short-term storage. The planning for the site calls for the second process-unit building to be constructed as a mirror image of the first. If this is done, it will consume the bulk of the available site. Hence, the construction of a storage tank with a volume equal to a 24-hour flow of the plant, i.e., 7 mg, would not be practical. Even a tank equal to 2.5 mg would be very difficult and expensive. It would likely have to be built as a substructure to the next phase of plant expansion.

There appears to be several options for achieving a fully reliable tertiary plant through redundancy. Two alternatives are outlined as follows:

1. Construct the next phase of construction earlier than anticipated. This doubles the number of process units so that when one is out of service the increase in load on the remaining units is 33% rather than 100%. This would be an investment in anticipation of the community's continuing growth.
2. Change the basic process to a Membrane Bioreactor. This process consists of immersed strands of tubular membrane within the aeration tanks so that the water is "sucked" out of the tank through the walls of these membranes, assuring a high quality effluent and one that that can go immediately to disinfection without need of a secondary clarifier. In fact, both the aeration tanks and the secondary clarifiers could be converted to the bioreactor process, increasing the plant capacity from 2.5 mgd up to 5.0 mgd with very little new construction. Coupling this process with

either UV or hypochlorite disinfection, or both, completes the tertiary process. The redundancy is obtained by using additional modules of membranes, thus allowing extra units to be on-line in case of emergency.

For purposes of this study, the first alternative will be assumed because it would not construct any unplanned treatment facilities. Further, the filtration units may be constructed as part of these facilities and be designed and constructed in the most efficient manner. The filters will be of the continuous backwash type, and the disinfection agent can be either UV or sodium hypochlorite. Because the site is limited in area and the new chlorine contact channels would be very large, UV was chosen as the process for costing. Because the added treatment units are for redundancy and reliability only, the solids handling portion of the plant need not be expanded at this time. When the flow rate has reached the respective design capacity of the solids handling facilities, they can be enlarged or modified as needed at that time.

Table 4-5 shows the changes of proposed design parameters versus the existing. Inherent in the design criteria is the assumption that new sewer construction will result in a much lower ratio of wet weather flow in the sewer system. For example, today the ratio of PWWF to ADWF is given as 7/2 = 3.5. Assuming the new construction will be done with a ratio of about 2, the combined ratio at an ADWF of 5.0 mgd is 2.6. On that basis, the ADWF will be 5.0 mgd and the PWWF will be 13.0 mgd. Under present conditions the projected peak flow would approach 17.5 mgd.

The plant already has a standby generator set capable of producing 1000 kW, which is adequate for both the present and the expanded plant. Hence will not be a cost item. There will be certain process alarms that must be added and those are provided in the costing.

Montecito Sanitary District

The Montecito Sanitary District wastewater treatment plant is a full secondary plant utilizing the extended aeration, activated sludge process that has been modified to include a dissolved air flotation (DAF) thickener and an aerobic sludge digester. The solids are

Table 4-5 Carpinteria Sanitary District Wastewater Treatment Plant General Design Parameters

Parameter	Design	Proposed Design Phase 1	Proposed Design Phase 2	Remarks
Design Population				
Design Flow Rates-				Proposed Design, Phase 1 is used for
- Avg.dry weather flow, mgd	2.5	2.5	5.0	estimating the costs.
- Peak wet weather flow, mgd	7.0	7.0	13.0	
Design BOD and TSS, mg/L				
Primary Clarifiers - Number of units	1	2	2	
- Avg dry weather overflow rate, gpd/sf	1000	500	1000	
- Peak wet weather overflow rate, gpd/sf	2800	1400	2600	
- Peak overflow rate, less one unit-gpd/sf	N/A	2800	5200	
Aeration Tanks - Number of units	2	4	4	
- Bod Loading, lbs BOD/day/lb MLVSS	0.3	0.2	0.3	
- Avg Detention time, hrs.	3.5	7	3.5	
- Peak Detention time, hrs.	1.25	2.5	1.35	
- Peak Detention time less one unit, hrs.	0.63	1.9	1.0	
Secondary Clarifiers - Number of units	2	4	4	
- Avg overflow rate, gpd/sf	500	250	500	
- Peak overflow rate, gpd/sf	1400	700	1300	
- Peak overflow rate, less one unit-gpd/sf	2800	933	1733	
Chlorine Contact Tank - Number of units	1			Maintain chlorination facilities
- Avg.Flow Contact time, mins.	46			for reclaimed water purposes only.
- Peak Flow Contact time, mins.	16.5			
- Peak Flow Contact time, unit out, mins	N/A			
Dechlorination Units - Number of units	1	N/A	N/A	Dual feeders
Aerobic Digesters - Number of units	1	1	2	
- Peak Detention time, days				
Dewatering Belt Filter Presses - Units	1	1	2	
Effluent Filtration Units - Number of units	None	5	8	
- Avg. Filtration Rate, gpm/sf		1.36	1.7	
- Peak WWF rate, gpm/sf		3.8	4.41	
- Peak WWF rate, one unit down, gpm/sf		4.75	5	16x16 filter box
UV Disinfection Facilities - Number of Units	None	3	5	Convert to UV in-line units,
- mgd/unit at average flow		0.8	1.0	Aquionics # 7500.
- mgd/unit at peak flow		2.3	2.6	
- mgd/unit at peak flow, one unit out		3.5	3.3	

dewatered on a belt filter press and hauled off site. This plant is compact and has some room for expansion or upgrading.

The proposed plan for adding tertiary treatment to this plant is to use continuously cleaning sand filters followed by the required 120 minutes of chlorine contact time. Both the chlorination and the de-chlorination chemical storage are adequate for this upgrade. Because there will be additional solids generated and because the return flow will decrease the aeration time, there may be a need to add a second aerobic digester and DAF solids thickener. This addition may not be necessary but will be included until a more detailed analysis can determine otherwise. Standby power capability is marginal and will require additional capacity, especially if a new aerobic digester and a DAF solids thickener is added.

Tables 4-1 and 4-6 sets forth the proposed design parameters for the required new facilities.

Summerland Sanitary District

The Summerland wastewater treatment plant is the smallest but most complete plant of the five plants being studied. This plant is designed for 300,000 gallons per day of peak dry weather flow. The peak wet weather design flow is not known, but recent data suggests that the average daily flow during the maximum month is 0.234 mgd and the annual average daily flow is 0.15 mgd, which includes any wet weather contributions. The plant serves only residential connections that exhibit the normal diurnal flow variations of nearly zero during the early morning hours. Because of these flow variations, the plant has an aerated equalizing storage tank that allows the activated sludge process to be maintained throughout the night, thereby simplifying the process operation.

The plant has the unit processes needed for tertiary treatment, but not the process reliability features. The standby power appears adequate for the entire plant and has a fully automatic transfer switch. The transfer to standby power takes place automatically upon failure of the commercial supply.

Table 4-6 Montecito Sanitary District Wastewater Treatment Plant General Design Parameters

Parameter	Design	Proposed Design	Remarks
Design Population		11,000	
Design Flow Rates-			
- Avg.dry weather flow, mgd	1.5	1.5	
- Peak wet weather flow, mgd	3.0	3.0	Design PWWF estimated
Design BOD and TSS, mg/L	392/365	220/260	
Primary Clarifiers - Number of units	N/A	N/A	
- Avg overflow rate, gpd/sf			
- Peak overflow rate, gpd/sf			
- Peak overflow rate, less one unit-gpd/sf			
Aeration Tanks - Number of units	2	2	
- Bod Loading, lbs BOD/day/lb MLVSS			
- Avg Detention time, hrs.			
- Peak Detention time, hrs.			
- Peak Detention time less one unit, hrs.			
Secondary Clarifiers - Number of units	4	4	
- Avg overflow rate, gpd/sf			
- Peak overflow rate, gpd/sf			
- Peak overflow rate, less one unit-gpd/sf			
Chlorine Contact Tank - Number of units	1	1	
- Avg.Contact time, mins.		240	
- Peak Contact time, mins.		120	
Dechlorination Units - Number of units	1	1	
Dissolve Air Flotation Thickener - Units	1	2	Marginal capacity at present
- Solids Loading, lbs/day/sq ft			
Aerobic Digesters - Number of units	1	2	Marginal capacity at present
- Peak Detention time, days			
Dewatering Belt Filter Presses - Units	1	1	
Effluent Filtration Units - Number of units	N/A	4	12x12 ft filter box
- Avg. Filtration Rate, gpm/sf		2.4	One filter bed in standby mode
- Peak WWF rate, gpm/sf		3.6	
- Peak WWF rate, one unit down, gpm/sf		5.0	

Presently, the flow passes from the secondary clarifiers to the chlorine contact chamber, then to the anthracite-media filter, then to de-chlorination and into the outfall. This arrangement works well because the residual chlorine entering the filter tends to maintain the media in a clean state without the growth of alga slimes. In a DOHS-approved process train, the primary disinfection must occur after the filtration step. Also, the contact will increase to 120 minutes. Further, the plant only has one filter so that if it is out of service for any reason, the plant can not comply with the reliability standards.

There are at least two ways in which the plant can be upgraded to full, reliable tertiary treatment. One is to design and construct a new filtration and disinfection section for the plant that has multiple units. A second way is to provide for short-term storage of water that does not meet quality specification for that point in the process. The latter option will still require a 120-minute contact time for chlorination, chlorination must follow filtration in the treatment train, chemical coagulation must be added, and the filter must have standby replacement equipment. In all cases the de-chlorination process must be continued. Because the option of adding the short-term storage may be more onerous than simply rebuilding the back-section of the plant, the alternative of redesigning and rebuilding will be used for costing the upgrade.

A pre-manufactured continuous filtration unit is proposed. The secondary effluent can be diverted too the present filtration chamber, serving as a wet well. The water can then be pumped up to the filters that would be constructed on a concrete slab. The water would return to the existing chlorination and de-chlorination systems before release to the outfall. The typical alarms and sensors would complete the upgrade as envisioned.

Because equalizing storage is part of the present plant design, the secondary treatment portion of the plant can arguably meet the intent of the reliability standards. The standby power facilities are adequate for that element of reliability. Also, there would be no additional solids introduced into the process train, hence no additional solids handling equipment is required.

Table 4-7 sets forth the proposed design parameters for the required new facilities.

Table 4-7 Summerland Sanitary District Wastewater Treatment Plant General Design Parameters

Parameter	Design	Proposed Design	Remarks
Design Population	~1500		Approximately 450 connections
Design Flow Rates-			
- Avg.dry weather flow, mgd	0.15	0.15	This value based on Disch.Permit
- Peak wet weather flow, mgd	0.30	0.3	
Design BOD and TSS, mg/L	234/166	234/166	
Primary Clarifiers - Number of units			
- Avg overflow rate, gpd/sf	294	294	
- Peak overflow rate, gpd/sf	588	588	
- Peak overflow rate, less one unit-gpd/sf	1176	1176	
Aerated Flow Equalization Basin	1	1	
- Volume, fraction of ADW Flow, %	17	17	Estimated based on Clarifier vol.
Aeration Tanks - Number of units			
- Bod Loading, lbs BOD/day/lb MLVSS	0.34	0.34	
- Avg Detention time, hrs.	20.68	20.68	
- Peak Detention time, hrs.	10.34	10.34	
- Peak Detention time less one unit, hrs.	5.17	5.17	
Secondary Clarifiers - Number of units			
- Avg overflow rate, gpd/sf	208	208	
- Peak overflow rate, gpd/sf	416	416	
- Peak overflow rate, less one unit-gpd/sf	832	832	
Chlorine Contact Tank - Number of units	1	1	
- Avg.Contact time, mins.	300	300	
- Peak Contact time, mins.	150	150	
Dechlorination Units - Number of units	1	1	
Aerobic Digesters - Number of units	2	2	
- Peak Detention time, days			
Dewatering Belt Filter Presses - Units	1	1	
Effluent Filtration Units - Number of units	1	2	6x7 filter box
- Avg. Filtration Rate, gpm/sf	0.9	1.3	
- Peak WWF rate, gpm/sf	1.7	2.5	
- Peak WWF rate, one unit down, gpm/sf	N/A	5.0	

Chapter 5 Cost of Improvements

The feasibility cost estimates for this study relied heavily on Metcalf &Eddy's internal cost curves. These values were then adjusted to an ENR Construction Cost Index of 7300. These estimating tools were coupled with vendors' budgetary estimates for their respective items of equipment and with estimates for yard piping. The estimates for electrical and instrumentation (I&C) were developed from their respective fractions of total construction common in the industry. Miscellaneous items were estimated separately or were considered covered within the 30% installation allowance factor applied to major cost items.

To reach the probable construction cost, a contingency factor of 30% was applied to the subtotal of all identified costs. This factor is appropriate for the level of estimating detail available at this time. The ENR Construction Cost Index is published quarterly in the Engineering News Record Magazine. The index value used in this study is for Los Angeles and is projected forward to the beginning of year 2002.

Most yard piping was estimated at $15/inch-diam./lin ft. Pipes were sized based on an average velocity of 4 ft/sec.

There are several areas in which costs may vary. One of these involves the UV systems. The budget includes one additional unit that the design standards may not require. The additional unit was included because there is limited experience with the California Department of Health Services Guidelines published in December, 2000. Although UV has been used for disinfection for the past 30 or more years, there may be some uncertainty on the part of some regarding these guidelines. A second area involves the trickling filter at the Goleta plant. Only one trickling filter is required that is 166 feet in diameter. Although this diameter is large, it is certainly within the normal parameters. However, if the large trickling filter was out of service, the plant would have to rely on the short-term holding pond to relieve the hydraulic load on the smaller filter. This procedure may be possible, but it appears better to install two 118-ft. diameter units and avoid the potential problem. This change in design concept to a single unit would likely impact the cost, but would be relatively minor. A third area is at the Carpinteria plant where the concept is to simply build the expansion phase of the plant early in order to meet the reliability standards now. The concept shows the cost of a new primary clarifier in the budget. It may be advisable to have only one primary clarifier and keep the space open for other needed facilities. Many plants of this size do not have primary clarifiers, hence it would not be an unusual design and would save both space and cost. This unit cost will appear inordinately high until there are more connections to the district's sewer system, allowing more people to support the cost, thereby reducing the unit cost.

Annual costs for these proposed plant improvements are only the added costs resulting from building and operating these facilities, they do not include the existing plant costs. In developing these budgets, a number of assumptions were made that can be summarized as follows.

- The Total Capital Cost is 90% above the probable Construction Cost Budget.
- The average annual flow of the plant was used to estimate the cost of energy and chemicals for operating and maintaining the plant, which includes both dry and wet weather conditions.
- Electrical energy is assumed to be 15 cents per kilowatt-hour. The lack of transmission facilities for gas and electricity may maintain the high cost of energy for several years.
- The cost of sodium hypochlorite is $0.45 per gal at 12.5% concentration and sodium bisulfite is $0.45 per gal at a concentration of 22%.
- The cost of polymer is based on $1/lb and alum is based on $0.48 per gal at a concentration of 47%.
- The cost of O&M labor is based on $25/hr plus a benefit package of 36%, amounting to $34/hr.
- Replacement and maintenance parts and materials is based on a budget of 2% of the construction cost.
- The service population was used based on the numbers provided during the interview. If not provided, these values were estimated based on 90 gallons per capita per day and then rounded up to the nearest thousand.

- The EDU was estimated based on an average household occupancy of 2.5, unless a value was provided. The EDU is derived by dividing the population-served by 2.5.
- The annualized cost allocation from Capital Cost is derived from a capital recovery factor based on a 20-year financing period and an interest rate of 5.7%, the anticipated cost of money.
- The monthly sewer charge increase for the EDU is based on dividing the annualized cost by 12 and by the number of EDU.

Table 5-1 presents the summary of costs and other data needed to develop the annualized costs and the monthly service charge increase.

The construction and capital cost development for each plant is presented in the appendix, Appendix A, Tables A-1 through A-2.

The calculation for increased monthly service charges was based on the present number of EDU, not the projected EDU at full design capacity. This method of calculating costs is somewhat difficult to interpret in a cost comparison but is more realistic when the rates have to be established to cover the costs in the near future.

It should also be noted that no credit was taken for the volume of water that is presently treated to tertiary levels at the El Estero and the Goleta plants. Typically, the volume of reclaimed water amounts to less than 10% of the annual volume of wastewater treated.

The cost for disinfection can become an issue where the plant previously only met ocean discharge requirement for coliform inactivation. The tertiary disinfection guidelines call for 5 mg/L of total chlorine residual after a 90 minute modal contact time, i.e., a CT of 450 mg mins/L. This is usually interpreted as a hydraulic retention time of 2 hours. This can be a significantly larger volume of sodium hypochlorite than is being used presently. The volume of sodium bisulfite will also increase because the chlorine residual will be higher than is now being maintained. In this budget the objective is to calculate only the additional cost of chemicals, hence the cost of sodium hypochlorite is based on a value

Table 5-1 Development of Monthly Cost for Adding Tertiary Treatment

	Treatment Plant				
Cost Item	**El Estero WRP Santa Barbara**	**Goleta WRP**	**Carpinteria WWTP**	**Montecito WWTP**	**Summerland WWTP**
Approximate population served	91,400	64,500	17,000	11,900	1,500
Estimated No of EDU	36,560	25,800	7,765	4,485	450
Design Flows					
Present annual average flow (mgd)	8.22	5.80	1.53	1.07	0.15
Average Design Flow mgd)	11.0	10.0	2.5	1.5	0.15
Peak Wet Weater (mgd)	19	18	7	3	0.3
Construction Cost	$25,494,500	$36,874,400	$14,858,000	$3,741,000	$1,087,000
Capital Cost	$48,441,500	$70,063,400	$28,232,000	$7,112,000	$2,068,000
Increased Annual O&M Cost					
No of active UV units, annual avg.	2	–	1	–	–
UV electricity (KW)	450.7	–	111.6	–	–
Elec. Cost	$592,246	–	$146,642	–	–
UV Lamp replacement at 8000 hrs	$102,492	–	$25,623	–	–
Other electricity (KW)	100	225	60	45	7.5
Elec. Cost	$131,400	$295,650	$78,840	$59,130	$9,855
Typical Effluent Ammonia (mg/L)	12.5	25	0.3	0.3	0.3
Additional Sodium hypochlorite (mg/L)	-15	10	-15	2	2
Cost	-$168,767	$79,388	-$31,413	$3,120	$437
Additional Sodium bisulfite (mg/L)	-3	12	-3	12	12
Cost	-$18,411	$51,963	-$3,427	$9,586	$1,344
Alum or other coagulant (mg/L)	15	50	15	15	15
Cost	$46,000	$108,200	$8,600	$6,000	$900
Poymer coagulant aid (mg/L)	2	2.5	2	2	2
Cost	$51,000	$45,000	$10,000	$7,000	$1,000
Added Staff	2	5	2	1	-
Operation & Maintenance (labor)	$141,440	$353,600	$141,440	$70,720	$0
Replacement/Maintenance parts	$510,000	$738,000	$298,000	$75,000	$22,000
Total Increased O&M Costs	$1,387,400	$1,671,800	$674,306	$230,556	$35,536
Annualized Capital Cost	$4,121,079	$5,960,525	$2,401,790	$605,041	$175,932
Total Increase In Annual Cost	$5,508,479	$7,632,325	$3,076,095	$835,597	$211,468
Monthly cost per EDU	$12.56	$24.65	$33.01	$15.53	$39.16
Present Sewer Service Charge	$19.94	$13.86	$33.17	N/A	N/A
New Sewer Service Charge	$32.50	$38.51	$66.18	N/A	N/A

Notes:
EDU = Equivalent residential Dwelling Units connected to the system
Goleta's peak wet weather flow is lower than the present design because of proposed equalization.

that is 10 mg/L higher than at present. The sodium bisulfite is calculated based on the required chlorine residual less the amount that is presently being used. It was assumed that that added value is 12 mg/L. Where there is significant nitrification taking place in the plant, the amount of chemical usage at present is reduced to reflect the better effectiveness of chlorine over amines. On the other hand, where UV replaces chlorine, there should be a credit for the chemicals not used. For this calculation it was assumed that sodium hypochlorite is being dosed at about 15 mg/L and the bisulfite is at 3 mg/L.

APPENDIX A

Cost Development for Each Plant

Table A-1 Opinion of Cost for Upgrading the El Estero WRP to Tertiary Treatment

Item	Quantity	Unit	Material Unit Cost	Material Subtotal	Labor Unit Cost	Labor Subtotal	Item Subtotal	Reference/Remarks
Mobilization/Demob.		LS					$25,000	
Testing & Startup		LS					$20,000	
Subtotal Mobilization		LS					**$45,000**	
Site Work								
Demolish exist. CCB (walls)	6,000	SF			$18.00	$108,000	$108,000	
Demolish exist. CCB (foundation)	5,000	SF			$4.00	$20,000	$20,000	
Demolish exist CCB (footings)	500	LF			$10.00	$5,000	$5,000	
Demolition disposal	4,300	CY			$10.00	$43,000	$43,000	
Grading/backfill/compaction	8,500	CY			$11.00	$93,500	$93,500	
Subtotal site work							**$269,500**	
Filters and UV								
Anthracite Filters (17@196 SF)	1	LS	$ 5,396,000	$ 5,396,000			$5,396,000	M&E Cost Curves
In-line UV units (Aquionics 35000)	5	units	$ 1,000,000	$ 5,000,000	$ 300,000	$1,500,000	$6,500,000	
Standby generator (600 kW)	1	unit	$ 100,000	$ 100,000	$ 30,000	$30,000	$130,000	
Filter Pumps	4	units	$ 100,000	$ 400,000	$ 30,000	$120,000	$520,000	
Temporary Installation work	1	LS	$ 1,000,000	$ 1,000,000	$ 300,000	$300,000	$1,300,000	
Filtrate return pumps	4	units	$ 100,000	$ 400,000	$ 30,000	$120,000	$520,000	
Subtotal filters							**$14,366,000**	
Yard Piping								mgd at 4 fps:
Filter to Filter Transfer Pipe	600	LF	$596	$ 358,000			$358,000	22.4
Filtrate return to Head Works	1,800	LF	$218	$ 393,000			$393,000	3
Asphalt @ 10'x(600'+1800')=	24,000	SF	$ 12	$ 288,000			$288,000	
Subtotal Filtrate return							**$1,039,000**	
Subtotal Civil Works							$15,719,500	
Electrical (10%of Constr. Subtotal)							$1,747,000	
I & C (12 %of Constr. Subtotal)							$2,144,000	
Construction Subtotal							**$19,610,500**	

Table A-1 Opinion of Cost for Upgrading the El Estero WRP to Tertiary Treatment

Item	Quantity	Unit	Material Unit Cost	Material Subtotal	Labor Unit Cost	Labor Subtotal	Item Subtotal	Reference/Remarks
Contingency (30% of Construction Subtotal)							$5,884,000	
TOTAL CONSTRUCTION							**$25,494,500**	
Engineering and Constr Services	20%						$5,099,000	
Permitting and Environmental	5%						$1,275,000	
Legal and Administrative	25%						$6,374,000	
Financing	30%						$7,649,000	
Miscellaneous services	10%						$2,550,000	
TOTAL CAPITAL COST							**$48,441,500**	

Table A-2 Opinion of Cost for Upgrading the Goleta WRP to Tertiary Treatment

Item	Quantity	Unit	Material Unit Cost	Material Subtotal	Labor Unit Cost	Labor Subtotal	Item Subtotal	Reference/Remarks
Mobilization/Demob.		LS					$75,000	
Testing & Startup		LS					$40,000	
Subtotal Startup							**$115,000**	
SiteWork								
Demolish 2 sludge drying beds	17,500	SF			$4.00	$70,000	$70,000	
Demolition disposal	400	CY			$10.00	$4,000	$4,000	
Excavation	3,000	CY			$6.00	$18,000	$18,000	
Area Backfill/compaction	6,000	CY			$5.00	$30,000	$30,000	
Grading at new clarifiers	20,000	SY			$3.00	$60,000	$60,000	Mostly shaping for landscape
Grading for new Sludge Lagoons	200,000	SF			$0.50	$100,000	$100,000	
Subtotal Site Work							**$282,000**	
Equalization Basin								
Fixed nozzle mixers	1	LS	$400,000	$400,000	$120,000	$120,000	$520,000	
Variable speed Return pumps	5	each	$100,000	$500,000	$30,000	$150,000	$650,000	1Standby , 4 @ 12mgd/4=3mgd, 60 hP each
Sludge Removal/Disposal							$0	Assumed part of existing plant O&M cost
Excavate and shape bottom	6,000	CY	--		$14.00	$84,000	$84,000	
Gravel base, 8-12" deep	1,500	CY	$8.00	$12,000	$6.00	$9,000	$21,000	
Concrete lining 6" reinforced	1,050	CY	$75.00	$79,000	$300.00	$315,000	$394,000	
PD Blowers 3 at 125 HP each	3	each	$150,000	$450,000	$45,000	$135,000	$585,000	
Perimeter Wash down facilities- 8"d	1,100	LF	$25.00	$27,500	$125.00	$137,500	$165,000	
Air manifold- 18" avg	600	LF	$55.00	$33,000	$125.00	$75,000	$108,000	
Subtotal Equalization Basin							**$2,527,000**	
Trickling Filter (2-118' diam)								
Cost from cost curve @ ENR =7300	2	Each.	$2,109,000	$4,218,000	$0	$0	$4,218,000	M&E Cost Curves
Splitter Box	1	Each.	$80,000	$80,000	$24,000	$24,000	$104,000	
Misc piping	500	LF	$500	$250,000	$850	$425,000	$675,000	
Subtotal Trickling Filter							**$4,997,000**	
Aerated Solids Contact Tank (2-90' length)								
Cost from cost curve @ ENR =7300	1	LS	$844,000	$844,000	$400	$400	$844,400	M&E Cost Curves
Return Liquor Pumps, VT, 8.2 mgd	2	Each	$100,000	$200,000	$30,000	$60,000	$260,000	
Subtotal Solids Contact & Pumps							**$1,104,400**	
Secondary Clarifiers (2-76' diam)								

Table A-2 Opinion of Cost for Upgrading the Goleta WRP to Tertiary Treatment

Item	Quantity	Unit	Material Unit Cost	Material Subtotal	Labor Unit Cost	Labor Subtotal	Item Subtotal	Reference/Remarks
Cost from cost curve @ ENR =7300	2	Each.	$648,000.00	$1,296,000	$0	$0	$1,296,000	M&E Cost Curves
Return waste sludge pumps (3)	3	Each.	$100,000	$300,000	$30,000	$90,000	$390,000	
New effluent splitter box	1	Each.	$80,000	$80,000	$24,000	$24,000	$104,000	About 100 CY+ weir& gate installation
New interstage pumps to Cl facility, VT	3	Each.	$100,000	$300,000	$30,000	$90,000	$390,000	
Subtotal Clarifiers							$2,180,000	
Anthracite Filters (12 new units)	12							
Cost from cost curve @ ENR =7300	1	LS	$4,206,000.00	$4,206,000		$0	$4,206,000	M&E Cost Curves
Subtotal Filters							$4,206,000	
Anaerobic Digester (1-52' diam)								
Cost from cost curve @ ENR =7300	1	Each	$2,272,000	$2,272,000		$0	$2,272,000	M&E Cost Curves
Biological sludge thickeners	1	Each	$1,000,000	$1,000,000		$0	$1,000,000	
Mixing Equipment & Gas collection	1	LS	$750,000	$750,000		$0	$750,000	
Subtotal Digester							$4,022,000	
Chlorination Contact Channel								
Cost from cost curve @ ENR =7300	1	Ls	$536,000	$536,000		$0	$536,000	M&E Cost Curves Use existing equipment for NaOCl
Subtotal Chlorine Contact							$536,000	
Standby Power (2000 kW)	1	each	$300,000	$300,000	$150,000	$150,000	$450,000	
Yard Piping								mgd at 4 fps:
From Splitter Box to TF	360	LF	$418	$ 151,000		$0	$151,000	11
From TF to Sec Clarifier	160	LF	$552	$ 89,000		$0	$89,000	19.2
From Sec Clarifier to Filters	900	LF	$418	$ 377,000		$0	$377,000	11
From filters (new & existing) to Chlor.	800	LF	$535	$ 428,000		$0	$428,000	18
Return line from Solids Aeration to TF	400	LF	$361	$ 145,000		$0	$145,000	8.2
WasteSolids froim Sec Clarifier to Dig	600	LF	$89	$ 54,000		$0	$54,000	0.5
Fom Primaries to Equalizing Basin	350	LF	$343	$ 120,000		$0	$120,000	7.4
Return Equal.Basin To TF Splitter Box	360	LF	$309	$ 112,000		$0	$112,000	6
Sludge From Digesters to Lagoons	1,000	LF	$178	$ 179,000		$0	$179,000	2
Subtotal Yard Piping							$1,655,000	
New Sludge Lagoons								
Two Cells at 85,000 sf surface area, ('2100 lf of dike at 22 cy/lf)	2,100	LF	$220.00	$ 462,000		$0	$462,000	

Table A-2 Opinion of Cost for Upgrading the Goleta WRP to Tertiary Treatment

Item	Quantity	Unit	Material Unit Cost	Material Subtotal	Labor Unit Cost	Labor Subtotal	Item Subtotal	Reference/Remarks
Special floor treatment	200,000	SF	$1.00	$ 200,000		$0	$200,000	
Subtotal New Sludge Lagoons							$662,000	
Subtotal Civil Works							$22,736,400	
Electrical (10%of Constr. Subtotal)							$2,527,000	
I & C (12 %of Constr. Subtotal)							$3,101,000	
Construction Subtotal							$28,364,400	
Contingency (30% of Construction Subtotal)							$8,510,000	
TOTAL CONSTRUCTION							$36,874,400	
Engineering and Constr Services	20%						$7,375,000	
Permitting and Environmental	5%						$1,844,000	
Legal and Administrative	25%						$9,219,000	
Financing	30%						$11,063,000	
Miscellaneous services	10%						$3,688,000	
TOTAL CAPITAL COST							$70,063,400	

Table A-3 Opinion of Cost for Upgrading the Carpinteria WWTP to Tertiarty Treatment

Item	Quantity	Unit	Material Unit Cost	Material Subtotal	Labor Unit Cost	Labor Subtotal	Item Subtotal	Reference/Remarks
Mobilization/Demob.		LS					$25,000	
Testing & Startup		LS					$20,000	
Subtotal Startup							**$45,000**	
Site Work								
Excavation	400	CY			$7.50	$3,000	$3,000	
Backfill/compaction	1000	CY	8.00	$8,000	$5.00	$5,000	$13,000	
Demolition of Cl2 Contact Channels	1	LS			80000	$80,000	$80,000	
Subtotal Site Work							**$96,000**	
Process Units								
Primary Clarifiers (1)	1	LS	$482,000	$482,000		0	$482,000	M&E Cost Curves
Aeration Tanks (2)	1	LS	$974,000	$974,000		0	$974,000	M&E Cost Curves
Secondary Clarifiers (2)	1	LS	$1,000,000	$1,000,000		0	$1,000,000	M&E Cost Curves
Miscellaneous Pumps & Equipt.	1	LS	$1,000,000	$1,000,000		0	$1,000,000	
Subtotal Process Units							**$3,456,000**	
Continuous Backwash Filters (5)	1	LS	$2,857,000	$2,857,000			**$2,857,000**	M&E Cost Curves
UV units	3	EA	$600,000	$1,800,000	$180,000	$540,000	**$2,340,000**	Aquionics 7500
Yard Piping								mgd at 4 fps:
Primary clarifier to aerobic digester	250	LF	$56	$15,000		$0	$15,000	0.2
Scum to aerobic digester	200	LF	$49	$10,000		$0	$10,000	0.15
Secondary clarifiers to filters	250	LF	$454	$114,000		$0	$114,000	13
Filters to UV	400	LF	$454	$182,000		$0	$182,000	13
UV to outfall	100	LF	$454	$46,000		$0	$46,000	13
Subtotal Piping							**$367,000**	
Subtotal Civil Works							**$9,161,000**	
Electrical (10%of Constr. Subtotal)							$1,018,000	
I & C (12 %of Constr. Subtotal)							$1,250,000	

Table A-3 Opinion of Cost for Upgrading the Carpinteria WWTP to Tertiarty Treatment

Item	Quantity	Unit	Material Unit Cost	Material Subtotal	Labor Unit Cost	Labor Subtotal	Item Subtotal	Reference/Remarks
Construction Subtotal							**$11,429,000**	
Contingency (30% of Construction Subtotal)							$3,429,000	
TOTAL CONSTRUCTION							**$14,858,000**	
Engineering and Constr Services	25%						$3,715,000	
Permitting and Environmental	5%						$743,000	
Legal and Administrative	25%						$3,715,000	
Financing	30%						$4,458,000	
Miscellaneous services	5%						$743,000	
TOTAL CAPITAL COST							**$28,232,000**	

Table A-4 Opinion of Cost for Upgrading the Montecito WWTP to Tertiary Treatment

Item	Quantity	Unit	Material Unit Cost	Material Subtotal	Labor Unit Cost	Labor Subtotal	Item Subtotal	Reference/Remarks
Startup								
Mobilization/Demob.		LS					$25,000	
Testing & Startup		LS					$20,000	
Subtotal Startup							**$45,000**	
Earthwork								
Excavation	250	CY			$6.00	$1,500	$1,500	
Backfill/compaction	250	CY			$6.00	$1,500	$1,500	
Subtotal Earthwork							**$3,000**	
Equipment								
Continuous Backwash Filters	1	LS	$1,191,000	$1,191,000			$1,191,000	M&E Cost Curves
Standby generator (250 kW)	1	LS	$75,000	$75,000	$22,500	$22,500	$97,500	
Aerobic Digester	1	LS	$438,000	$438,000			$438,000	M&E Cost Curves
DAF Thickener	1	LS	275000	$275,000	$82,500	$82,500	$357,500	
Subtotal Equipment							**$2,084,000**	
Yard Piping								mgd at 4 fps:
To/from DAF Thickener No. 2	250	LF	$47	$12,000			$12,000	0.14
To/from Aerobic Digester	200	LF	$56	$12,000			$12,000	0.2
To/from Filters	600	LF	$218	$131,000			$131,000	3
Miscellaneous	100	LF	$178	$18,000			$18,000	2
Subtotal Yard Piping							**$173,000**	
Subtotal Civil Works							**$2,305,000**	
Electrical (10%of Constr. Subtotal)							$257,000	
I & C (12 %of Constr. Subtotal)							$315,000	
Construction Subtotal							**$2,877,000**	
Contingency (30% of Construction Subtotal)							$864,000	

Table A-4 Opinion of Cost for Upgrading the Montecito WWTP to Tertiary Treatment

TOTAL CONSTRUCTION		**$3,741,000**
Engineering and Constr Services	25%	$936,000
Permitting and Environmental	5%	$188,000
Legal and Administrative	25%	$936,000
Financing	30%	$1,123,000
Miscellaneous services	5%	$188,000
TOTAL CAPITAL COST		**$7,112,000**

Table A-5 Opinion of Cost for Upgrading the Summerland WWTP to Tertiary Treatment

Item	Quantity	Unit	Material Unit Cost	Material Subtotal	Labor Unit Cost	Labor Subtotal	Item Subtotal	Reference/Remarks
Startup								
Mobilization/Demob.		LS					$25,000	
Testing & Startup		LS					$20,000	
Subtotal Startup							**$45,000**	
Site Work								
Excavation/grading/compact	450	CY			$11.00	$5,000	$5,000	
Demolition & Disposal	1	LS			$20,000	$20,000	$20,000	
Subtotal Site Work							**$25,000**	
Filter Equipment								
Continuous Backwash Filters	2	units	$225,000	$450,000	67500	135000	**$585,000**	
Pumps	3	units	25000	$75,000	7500	22500	**$97,500**	
Subtotal Filter Equipment							$682,500	
Piping								mgd at 4 fps:
To Filters from secondaries	100	LF	$69	$7,000		$0	$7,000	0.3
From Filters to Cl2	100	LF	$69	$7,000		$0	$7,000	0.3
Subtotal Piping							**$14,000**	
Subtotal Civil Work							$669,000	
Electrical (10%of Constr. Subtotal)							$75,000	
I & C (12 %of Constr. Subtotal)							$92,000	
Construction Subtotal							$836,000	
Contingency (30% of Construction Subtotal)							$251,000	
TOTAL CONSTRUCTION							**$1,087,000**	
Engineering and Constr Services	25%						$272,000	

Table A-5 Opinion of Cost for Upgrading the Summerland WWTP to Tertiary Treatment

Permitting and Environmental	5%	$55,000
Legal and Administrative	25%	$272,000
Financing	30%	$327,000
Miscellaneous services	5%	$55,000
TOTAL CAPITAL COST		**$2,068,000**

APPENDIX B

B-1 Typical Ocean Discharge Requirements

B-2 Draft CA DOHS Guidelines (CA Administrative Code Title 22, Div. 4, Chapter 3, Articles 1-10)

B-1 Typical Ocean Discharge Requirements

B. EFFLUENT LIMITATIONS

1. "Removal Efficiencies" for Total Non-Filterable Residue (Suspended Solids) and Biological Oxygen Demand (BOD) shall not be less than 85%. In addition, effluent shall not exceed the following limitations[A]:

Constituents	Unit of Measurement	Monthly (30-Day) Average	Weekly (7-Day) Average	Daily Maximum
B.O.D., 5-day	mg/l	30	45	90
	lbs/day	375 *	563 *	1126 *
Total Non-Filterable Residue (Suspended Solids)	mg/l	30	45	90
	lbs/day	375 *	563 *	1126 *

* For Flows less than 1.50 MGD, mass emission rates shall not exceed the "Maximum Allowable Mass Emission Rate."

2. Effluent shall not exceed the following limits:[B]*

Constituents	Unit of Measurements	Monthly (30-Day) Average	Weekly (7-Day) Average	Daily Maximum
Grease and Oil	mg/l	25	40	75
	lbs/day	313 *	500 *	938 *
Settleable Solids	ml/l	1.0	1.5	3.0
Turbidity	NTU	75	100	225
Ph	Within limits of 6.0 to 9.0 at all times.			
Acute Toxicity	TUa	1.5	2.0	2.5

* For Flows less than 1.50 MGD, mass emission rates shall not exceed the "Maximum Allowable Mass Emission Rate."

3. Effluent shall not exceed the following limits[B]:

2a.

PROTECTION OF MARINE AQUATIC LIFE

Concentration Constituent	Units	6-Month Median	Daily Maximum	InstantaneousMaximum
Arsenic	mg/L	0.45	2.61	6.93
Cadmium	mg/L	0.09	0.30	0.76
Chromium(Hex)	mg/L	0.18	0.61	1.52
Copper	mg/L	0.09	0.90	2.52
Lead	mg/L	0.18	0.61	1.52
Mercury	ug/L	3.56	14.36	35.96
Nickel	mg/L	0.45	1.52	3.80
Selenium	mg/L	1.35	4.56	11.40
Silver	ug/L	48.76	237.76	615.76
Zinc	mg/L	1.09	6.49	17.29
Cyanide	mg/L	0.09	0.30	0.76
Total Chlorine Residual	mg/L	0.18	0.61	4.56
Ammonia (as N)	mg/L	54.00	182.40	456.00
Chronic Toxicity	TUc	0.00	76.00	0.00
Phenolic Compounds(non chlorinated)	mg/L	2.70	9.12	22.80
Chlorinated Phenolics	mg/L	0.09	0.30	0.76
Endosulfan	ug/L	0.81	1.37	2.05
Endrin	ug/L	0.18	0.30	0.46
HCH	ug/L	0.36	0.61	0.91

PROTECTION OF HUMAN HEALTH - NONCARCINOGENS

Constituents	Units	30-Day Average
Acrolein	mg/L	19.80
Antimony	g/L	0.11
Bis(2 chloroethoxy) Methane	mg/L	0.40
Bis(2 chloroisopropyl) Ether	g/L	0.11
Chlorobenzene	g/L	51.30
Chromium (III)	mg/L	17.10
Di n butyl Phthalate	g/L	0.32
Dichlorobenzenes	g/L	0.46
1,1 dichloroethylene	g/L	0.64
Diethyl Phthalate	g/L	2.97
Dimethyl Phthalate	g/l	73.80
4,6 dinitro 2 methylphenol	mg/L	19.80
2,4 dinitrophenol	mg/L	0.36
Ethylbenzene	g/L	0.37
Fluoranthene	mg/L	1.35
Hexachlorocyclopentadiene	mg/L	5.22
Isophorone	g/l	13.50
Nitrobenzene	mg/L	0.44
Thallium	mg/L	1.26
Toluene	g/l	7.65
1,1,2,2 tetrachloroethane	g/L	0.11
Tributyltin	ng/l	126.00
1,1,1 trichloroethane	g/l	48.60
1,1,2 trichloroethane	g/l	3.87

PROTECTION OF HUMAN HEALTH - CARCINOGENS

Constituent	Units	30-DayAverage
Acrylonitrile	ug/L	9.00
Aldrin	ng/l	1.98
Benzene	mg/L	0.53
Benzidine	ng/l	6.21
Beryllium	ug/l	2.97
Bis(2 chloroethyl) Ether	ug/L	4.05
Bis(2 ethylhexyl) Phthalate	mg/L	0.32
Carbon tetrachloride	mg/L	0.08
Chlordane	ng/l	2.07
Chloroform	mg/L	11.70
DDT	ng/l	15.30
1,4 dichlorbenzene	mg/L	1.62
3,3 dichlorobenzidine	ug/L	0.73
1,2 dichloroethane	mg/L	11.70
dichloromethane	mg/L	40.50
1,3 dichloropropene	mg/L	0.80
dieldrin	ng/l	3.60
2,4 dinitrotoluene	mg/L	0.23
1,2 diphenylhydrazine	ug/L	14.40
Halomethanes	mg/L	11.70
Heptachlor	ng/L	64.80
Hexachlorobenzene	ng/L	18.90
Hexachlorobutadiene	mg/L	1.26
Hexachloroethane	mg/L	0.23
N nitrosodimethylamine	mg/L	0.66
N nitrosodiphenylamine	mg/L	0.23
PAHs	ug/L	0.79
PCBs	ng/l	1.71
TCDD equivalents	pg/l	0.35
Tetrachloroethylene	mg/L	8.91
Toxaphene	ng/l	18.90
Trichloroethylene	mg/L	2.43
2,4,6 trichlorophenol	ug/L	26.10
Vinyl Chloride	mg/L	3.24

- Based on California Ocean Plan criteria using a minimum initial dilution of 89:1. If actual dilution is found to be less than this value, it will be recalculated and the order revised. The chromium limit may be met as total chromium if the Discharger chooses. The cyanide limit may be met by the combined measurements of free cyanide, simple alkali metal cyanides, and weakly complexed organometallic complexes upon approval by the Regional Board and EPA.

4. The median number of total coliform organisms in effluent shall not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analysis have been completed, and the number of coliform organisms in any sample shall not exceed 2300 per 100 milliliters.[C]

5. Effluent daily dry weather flow shall not exceed a monthly average of 1.5 MGD (5680 m^3/day).

6. Effluent shall be essentially free of materials and substances that [B]:

   a. float or become floatable upon discharge.

   b. may form sediments which degrade benthic communities or other aquatic life.

   c. accumulate to toxic levels in marine waters, sediments or biota.

   d. decrease the natural light to benthic communities and other marine life.

   e. materials that result in aesthetically undesirable discoloration of the ocean surface.

C. RECEIVING 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.)

<u>The discharge shall not cause</u>[B]:

1. Floating particulates and grease and oil to be visible on the ocean surface.

2. Aesthetically undesirable discoloration of the ocean surface.

3. Significant reduction of transmittance of natural light in ocean waters outside the "zone of initial dilution."

4. Change in the rate of deposition of inert solids and the characteristics of inert solids in ocean sediments such that benthic communities are degraded.

5. The dissolved oxygen concentration outside the "zone of initial dilution" to fall below 5.0 mg/l or to be depressed more than 10 percent from that which occurs naturally.

6. The pH outside the "zone of initial dilution" to be depressed below 7.0, raised above 8.5, or changed more than 0.2 units from that which occurs naturally.

7. Dissolved sulfide concentrations of waters in and near sediments to significantly increase above that present under natural conditions.

8. Concentrations of the same substances listed in Effluent Limitation No. B.3. to increase in marine sediments to levels which would degrade indigenous biota.

9. Objectionable aquatic growth or degradation of indigenous biota.

10. Concentrations of organic materials in marine sediments to increase to a level which would degrade marine life.

11. Degradation of marine communities, including vertebrate, invertebrate, and plant species.

12. Alteration in natural taste, odor, and color of fish, shellfish, or other marine resources used for human consumption.

13. Concentrations of organic materials in fish, shellfish or other marine resources used for human consumption to bioaccumulate to levels that are harmful to human health.

14. Degradation of marine life due to radioactive waste.

15. Temperature of the receiving water to adversely affect beneficial uses.

B-2 Draft CA DOHS Guidelines (CA Administrative Code Title 22, Div. 4, Chapter 3, Articles 1-10)

Title 22 Code of Regulations

DIVISION 4. ENVIRONMENTAL HEALTH
CHAPTER 1. INTRODUCTION

ARTICLE 1. DEFINITIONS

60001. Department

Whenever the term "department" is used in this division, it means the State Department of Health Services, unless otherwise specified.

60003. Director

Whenever the term "director" is used in this division, it means the Director, State Department of Health Services, unless otherwise specified.

CHAPTER 2. REGULATIONS FOR THE IMPLEMENTATION OF THE CALIFORNIA ENVIRONMENTAL QUALITY ACT

ARTICLE 1. GENERAL REQUIREMENTS AND CATEGORICAL EXEMPTIONS

60100. General requirements

The Department of Health Services incorporates by reference the objectives, criteria, and procedures as delineated in Chapters 1, 2, 2.5, 2.6, 3, 4, 5, and 6, Division 13, Public Resources Code, Sections 21000 et seq., and the Guidelines for the Implementation of the California Environmental Quality Act, Title 14, Division 6, Chapter 3, California Administrative Code, Sections 15000 et seq.

60101. Specific activities within categorical exempt classes

The following specific activities are determined by the Department to fall within the classes of categorical exemptions set forth in Sections 15300 et seq. of Title 14 of the California Administrative Code:

(a) Class 1: Existing Facilities.

(1) Any interior or exterior alteration of water treatment units, water supply systems, and pump station buildings where the alteration involves the addition, deletion, or modification of mechanical, electrical, or hydraulic controls.

(2) Maintenance, repair, replacement, or reconstruction to any water treatment process units, including structures, filters, pumps, and chlorinators.

(b) Class 2: Replacement or Reconstruction.

(1) Repair or replacement of any water service connections, meters, and valves for backflow prevention, air release, pressure regulating, shut-off and blow-off or flushing.

(2) Replacement or reconstruction of any existing water supply distribution lines, storage tanks and reservoirs of substantially the same size.

(3) Replacement or reconstruction of any water wells, pump stations and related appurtenances.

(c) Class 3: New Construction of Small Structures.

(1) Construction of any water supply and distribution lines of less than sixteen inches in diameter, and related appurtenances.

(2) Construction of any water storage tanks and reservoirs of less than 100,000 gallon capacity.

(d) Class 4: Minor Alterations to Land.

(1) Minor alterations to land, water, or vegetation on any officially existing designated wildlife management areas or fish production facilities for the purpose of reducing the environmental potential for nuisances or vector production.

(2) Any minor alterations to highway crossings for water supply and distribution lines.

CHAPTER 3 WATER RECYCLING CRITERIA
ARTICLE 1 DEFINITIONS

60301. Definitions

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.

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.

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.

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.

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.

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.

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.

60301.240. Drift

"Drift" means the water that escapes to the atmosphere as water droplets from a cooling system.

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.

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.

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).

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.

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.

60301.330. Food crops

"Food crops" means any crops intended for human consumption.

60301.400. Hose bibb

"Hose bibb" means a faucet or similar device to which a common garden hose can be readily attached.

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.

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.

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.

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.

60301.650. Oxidized wastewater.

"Oxidized wastewater" means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

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.

60301.700. Recycled wateragency.

"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.

60301.710. Recycling plant

"Recycling plant" means an arrangement of devices, structures, equipment, processes and controls which produce recycled water.

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.

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.

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.

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.

60301.900. Undisinfected secondary recycled water.

"Undisinfected secondary recycled water" means oxidized wastewater.

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.

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.

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.

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).

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.

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.

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.

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.

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.

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.

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.

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

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

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

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

60323. Engineering report

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

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

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

60325. Personnel

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

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

60327. Maintenance

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

60329. Operating records and reports

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

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

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

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

60331. Bypass

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

ARTICLE 8. GENERAL REQUIREMENTS OF DESIGN

60333. Flexibility of design

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

60335. Alarms

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

(1) Loss of power from the normal power supply.

(2) Failure of a biological treatment process.

(3) Failure of a disinfection process.

(4) Failure of a coagulation process.

(5) Failure of a filtration process.

(6) Any other specific process failure for which warning is required by the regulatory agency.

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

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

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

60337. Power supply

The power supply shall be provided with one of the following reliability features:

(a) Alarm and standby power source.

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

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

ARTICLE 9. RELIABILITY REQUIREMENTS FOR PRIMARY EFFLUENT

60339. Primary treatment

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

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

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

Note: Use of primary effluent for recycled water is no longer allowed. [repeal of Section 60309, effective December 2000]

ARTICLE 10. RELIABILITY REQUIREMENTS FOR FULL TREATMENT

60341. Emergency storage or disposal

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

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

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

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

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

60343. Primary treatment

All primary treatment unit processes shall be provided with one of the following reliability features:

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

(b) Standby primary treatment unit process.

(c) Long-term storage or disposal provisions.

60345. Biological treatment

All biological treatment unit processes shall be provided with one of the following reliability features:

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

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

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

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

60347. Secondary sedimentation

All secondary sedimentation unit processes shall be provided with one of the following reliability features:

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

(b) Standby sedimentation unit process.

(c) Long-term storage or disposal provisions.

60349. Coagulation

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

(1) Standby feeders,

(2) Adequate chemical stowage and conveyance facilities,

(3) Adequate reserve chemical supply, and

(4) Automatic dosage control.

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

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

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

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

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

(5) Alarm and standby coagulation process.

60351. Filtration

All filtration unit processes shall be provided with one of the following reliability features:

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

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

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

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

(e) Alarm and standby filtration unit process.

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.

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.

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