EXPANSION REPORT

for

CITY of GREENFIELD

WASTEWATER TREATMENT PLANT

September 2003

Under the Direction of:

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Wastewater Expansion Report
City of Greenfield

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Section 1 - Purposes of this Report

The wastewater treatment plant of the City of Greenfield was originally constructed to treat and dispose of about 0.5 MGD (million gallons per day) of domestic strength wastewater. Subsequent improvements increased the capacity of the treatment plant to about 1.0 MGD. Current wastewater flows to the plant have been steadily increasing and are now averaging about 0.9 MGD. The City of Greenfield wishes to increase the capacity to 2.0 MGD to accommodate the expected growth of the city during the next 10 years.

Therefore, the purposes of this report are the following:

1. Review and discuss the existing wastewater treatment plant system.
2. Suggest improvements for a proposed expansion plan.
3. Estimate the costs for the proposed expansion.
4. Delineate the steps and schedule for completion of the proposed expansion.

Section 2 - Description of the Existing Facility

The City of Greenfield's Wastewater Treatment Plant was reconstructed and completed in 1978. Additional plant improvements completed in 1993 increased the primary clarification capacity to 1.0 MGD. The plant provides treatment and disposal of sanitary wastewater contributed by the residents of the City. **Figure 1** is a **City of Greenfield Location Map**. **Figure 2** is a **Treatment Plant Vicinity Map**.

Wastewater treatment and disposal is accomplished in accordance with the **Waste Discharge Requirements Order No. R3-2002 - 0062** that has been established by the California Regional Water Quality Control Board, Central Coast Region. A copy of this order is included as **Appendix A** of this report. This order allows the capacity of the facility to be increased upon submittal by the City and approval by the board of documentation that sufficient improvements have been made to the facility.

The treatment process, generally considered primary treatment, is to remove a portion of the solids in the wastewater through a settling process. The solids collected are transferred to a basin in which they are reduced in a process know as aerobic digestion. After digestion, the solids are dried in a lagoon and then buried. **Figure 3** shows the existing plant layout. **Figure 4** is a schematic of the treatment process.

The basic disposal concept is to percolate all the wastewater into the ground in a manner that protects the public health, maintains or enhances the existing groundwater quality and does not create a visual or odor nuisance. No wastewater effluent is discharged to any of the adjacent surface waters. The wastewater quantities are such that with the ample amount of land available, treatment and disposal of wastewater is quite simple and straightforward.

The major portion of the settleable solids are removed by settling in the primary sedimentation tank and then decomposed by aerobic digestion. The settled wastewater is then conveyed to a series of ponds where treatment of dissolved organic matter through a natural oxidation process

occurs. Final effluent disposal is accomplished by percolation through the sandy soil into the ground, eventually reaching the groundwater underlying the area. In addition, a spray irrigation system with an estimated capacity of 1.0 MGD has been added to the disposal facilities.

Therefore, the treatment facilities provide primary treatment for solids removal followed by oxidation and percolation. Criteria applicable to this plant for the present design conditions are summarized below. As previously stated, the general plant layout is shown in **Figure 3** and **Figure 4**.

Design Criteria

Wastewater Flows and Loads

Average flow	1.00 mgd
Peak flow, process	3.00 mgd
Peak flow, hydraulic	5.0 mgd
Biochemical Oxygen Demand BOD	240 mg/l = 2000 lb/day
Suspended Solids SS	240 mg/l = 2000 lb/day

Primary Treatment

Headworks Channel	0.1 to 2.5 MGD
Grinder Screen	0.1 to 2.5 MGD
Flow Measuring	0.1 to 2.5 MGD
Primary Sedimentation	
Removal Rate	60% of SS
Removal Lbs	1,200 lbs
Number of Units	2
Surface Loading	707 gal/sf per day
Detention Time	2.2 hours
Weir Overflow	5,300 gal/lf per day

Sludge Digestion and Disposal

Aerobic Sludge Digesters	
Volatile SS (75% of SS)	900 lbs per day
Removal Rate	40%
Volume Treated	347 cubic feet per day
Number	1
Size	30 ft. Ø x 13.5 ft. depth
Volume	9600 cubic feet
Solids Retention Time	30 days
Rotary Lobe Blower	10 HP
Blower Capacity	500 CFM
Loading Rate	0.04 lb. VSS/cf. per day
Sludge Drying Lagoons	
Loading	315,360 lbs per year
Number	6
Area	62,500 sf
Volume	125,000 cubic feet
Loading Rate	2.52 lb/cf per year

Effluent Disposal

Oxidation	
Number	3
Area	6.25 ac
Depth	5 ft
Detention Time	5.1 days
BOD loading	200 lb/acre per day
Percolation Ponds	
Number	2
Area	4.21 ac
Depth	5 ft
Percolation Rate	47,850/gal/ac/day
Capacity	0.21 MGD
Spray Irrigation Fields	
Acreage	13 ac
Application	0.8 MGD
Application Rate	2.3 inches per day

The design of the major plant units generally follows conventional practice. The treatment structures are constructed of reinforced concrete and the pond embankments are constructed of compacted native soil. All wastewater flow through the plant is by gravity and the only process pumping used is for transferring sludge and scum from the sedimentation tank into the digestion tank. The plant water system includes a well on the plant site. Well water is pumped into a hydropneumatic tank.

The process flow through the plant to the disposal area is represented schematically in **Figure 4.** The flow enters the plant headworks through a 14 inch diameter cast iron pipe which conveys the raw wastewater from the collection system to the plant. At the headworks the wastewater passes through dual grinders installed in 1998 which shred the solids, and through a 6 inch Parshall flume which measures the flow.

The wastewater then passes into the primary sedimentation tank where quiescent settling occurs. Here most of the settleable and much of the suspended solids settle to the bottom of the tank and are pumped to the digester. Scum is also removed from the surface of the sedimentation tank to a scum pit from which the scum is periodically pumped to the digester.

The effluent from the sedimentation tank flows over weirs and in the 18 inch diameter effluent pipe which conveys the wastewater to the pond area.

Sludge and scum pumped from the sedimentation tanks into the digesters are decomposed aerobically and stabilized. A diffused aeration piping is installed which is designed to operate 24 hours per day. Supernatant and overflow pipes are connected which allow a simple, manually controlled process to be maintained.

Aerobic digestion is used for three principal reasons; ease of operation, cost advantage, and minimal odor potential. The Greenfield wastewater has a high sulfur content with a resulting

hydrogen sulfide odor problem when operating under anaerobic conditions; thus through the use of the aerobic digestion process, the possible generation of hydrogen sulfide is minimized.

The digesters can be operated either on a continuous or a fill and draw basis. Waste digested sludge can be piped to either the upper or lower drying beds and then removed and used on adjacent fields or may be buried after drying.

The three disposal ponds provide oxidation which supports biological activity to further treat the wastewater. Two percolation ponds serve as disposal ponds.

Transfer piping between all the ponds is provided which enables removing any one pond from service for scarifying or maintenance without preventing use of the remaining ponds. The transfer piping is arranged so a number of combinations of series and parallel operation of the oxidation and percolation ponds may be accomplished.

The oxidation ponds normally are operated in parallel with the flow divided approximately equally to each pond.

Maintenance requires that the percolation ponds be occasionally taken out of service. When this occurs the entire flow is diverted to another pond. This operating condition normally lasts approximately two days when it occurs.

The existing spray irrigation system consists of a pump station building with two booster pumps with a capacity of about 600 gpm. The spray irrigation system is composed of above ground portable farm type distribution piping with riser mounted spray heads. About 13 acres are irrigated in this manner. Periodically the above ground pipes are moved and the spray fields disked to cut vegetation.

Section 3 – Proposed Expansion

The proposed expansion would need to double the treatment plant capacity from 1.0 MGD to 2.0 MGD. Although several other wastewater treatment processes could provide primary treatment for Greenfield's wastewater, the treatment process chosen for this report is the same existing primary processes and treatment equipment that are at the treatment plant. These processes have been working well for the City of Greenfield. These processes and equipment would fit on existing City of Greenfield property and would not require purchase of additional property. Wherever possible, the same design criteria would be used for new facilities as the existing facilities.

Increasing the capacity to 2.0 MGD would include installation of the following:

1. Installation of a new 1 MGD 45 foot diameter circular clarifier.
2. Installation of a new 30 foot diameter aerobic digester.
3. Installation of a new small pump building for the new sludge and scum pumps.
4. Installation of new interconnecting piping.

5. Expansion of the existing spray irrigation fields to accommodate increased disposal of the generated effluent.

Using this equipment would allow the expansion to occur without interrupting the existing treatment plant and it capacity of 1.0 MGD.

The 1 MGD 45 foot diameter circular clarifier would be the similar to the existing clarifiers only a larger diameter. The clarifyer mechanism would be installed in a 12 foot deep circular concrete basin. The clarifyer would be a continuously operating mechanically cleaned device. Wastewater would be piped into a central, semi submerged influent well. Wastewater would flow downward and then outward to the periphery of the tank where effluent is collected in a continuous peripheral trough. Settled solids are racked toward the center of the tank and into a discharge sump. Floating scum is removed by a floating skimmer mechanism.

The center shaft bridge supported unit would rotate two rake arms mounted on the lower end of a center vertical shaft. Tank bottom rake blades move sludge on the tank bottom to the discharge sump. Floating skimmer arms moves floating material to the edge scum trough. The bridge spans the tank and supports the drive unit, rake mechanism, and influent well. On the bridge, a walkway provides easy access to the center drive mechanism.

The 30 foot diameter aerobic digester would be the same as the existing aerobic digester. Sludge and scum pumped from the new circular clarifyer are decomposed aerobically and stabilized. A diffused aeration piping would be installed which is designed to operate 24 hours per day. Supernatant and overflow pipes would be connected which allow a simple, manually controlled process to be maintained.

A new pump building for the new sludge pump. This new 10 foot by 10 foot building will contain the new sludge pump required for the new clarifier and the electrical system components to power and control the new equipment.

Interconnecting piping consisting of wastewater influent pipe, effluent pipe, raw sludge pipe, scum pipe, digested sludge pipe, and supernatant overflow pipe will connect all the new treatment components to the existing pipelines.

Expansion of the existing spray irrigation fields will consist of grading the existing city owned fields, enlarging the existing spray irrigation pump station, and installing permanent buried spray irrigation distribution piping, control valves and spray heads.

These improvements are shown on **Figure 4** and **Figure 5**.

Section 4 – Estimated Cost for Proposed Expansion

Shown below is the estimated cost for the proposed expansion:

Engineer's Estimate
Wastewater Treatment Plant Expansion
Greenfield, CA

Item #	Description	Quantity	Unit	Unit Cost	Total Cost
Treatment Plant Site					
1	Existing Facility Demolition	1	LS	$ 10,000.00	$ 10,000.00
2	Site Grading	1	LS	$ 15,000.00	$ 15,000.00
3	Structure Excavation	1,200	CY	$ 20.00	$ 24,000.00
4	Structural Concrete	200	CY	$ 600.00	$ 120,000.00
5	Miscellaneous Buried Pipe	1	LS	$ 35,000.00	$ 35,000.00
6	45' Dia. Clarifyer Mechanism	1	LS	$ 120,000.00	$ 120,000.00
7	30' Dia. Digester Concrete	150	CY	$ 600.00	$ 90,000.00
8	30' Dia. Digester Aerator	1	LS	$ 15,000.00	$ 15,000.00
9	Pump Building	100	SF	$ 150.00	$ 15,000.00
10	Scum Pump Station	1	Ea	$ 25,000.00	$ 25,000.00
11	Sludge Pump	1	Ea	$ 20,000.00	$ 20,000.00
12	Painting	1	LS	$ 50,000.00	$ 50,000.00
13	Electrical & Control System	1	LS	$ 150,000.00	$ 150,000.00
Treatment Plant Site Subtotal					**$ 689,000.00**
Irrigation Site					
1	Site Grading and Earthwork	1	LS	$ 20,000.00	$ 20,000.00
2	Pump Building	225	SF	$ 150.00	$ 33,750.00
3	Pumps & Motors	3	Ea	$ 12,500.00	$ 37,500.00
4	Electrical & Control System	1	LS	$ 30,000.00	$ 30,000.00
5	8" Suction Pipe	1,800	LS	$ 40.00	$ 72,000.00
6	6" Distribution Pipe	7,000	LF	$ 30.00	$ 210,000.00
7	Spray Heads	175	Ea	$ 30.00	$ 5,250.00
8	Control Valves	16	Ea	$ 1,500.00	$ 24,000.00
Irrigation Site Subtotal					**$ 432,500.00**
Subtotal for Construction					**$ 1,121,500.00**
Contractor Profit and Construction Contingencies				**15.00%**	**$ 168,225.00**
EIR, Engineering & Inspection				**15.00%**	**$ 168,225.00**
Total Project					**$ 1,457,950.00**

The estimate for the spray irrigation field will be rounded up to $1,500,000.

The recommended improvements are shown on **Figures 5 and 6.**

Section 5 – Steps to Complete Expansion and Completion Time Schedule

The following steps and a preliminary time of completion of this wastewater treatment plant expansion project are shown below:

1. Review and approval of this report by the Greenfield staff and City Council. Completion of this step could be September 2003.
2. Preparation, submittal, and approval of a Wastewater Disposal Report to the Regional Water Quality Control Board, Central Coast Region. Completion of this step could be November 2003.
3. Preparation and approval of CEQA environmental document (most probably a Negative Declaration). Completion of this step could be February 2004.
4. Preparation of construction documents. Completion of this step could be May 2004.
5. Construction of the new facilities. Completion of this step could be December 2004.

APPENDIX A

WASTE DISCHARGE REQUIREMENTS