DESIGN CRITERIA
as of November 13, 1991

DYERSBURG WASTEWATER TREATMENT PLANT

1. Design Parameters

Average flow = 9.45 MCD
Peak flow = 17.0 MCD

Influent BOD = 200 mg/l
Effluent BOD = 10 mg/l

Influent NH_3(N) = 30 mg/l
Effluent NH_3(N) = 1.5 mg/l

Influent SS = 220 mg/l
Effluent SS = 30 mg/l

2. Headworks

a. Influent force main = 36"

b. Parshall flume = 30" throat
27.1 MGD capacity

c. Fine Screens
2 - ¼" hydraulicly driven fine screens with a capacity of 20 MGD each. Solids are moved by hydraulic auger to the truck bay. Hydraulic drive units are 2 hp each, with interconnect piping so either drive unit can drive either screen.

d. Grit Removal
1 - circular swirl-type unit, 2 hp drive, 16' diameter, 20 MGD flow capacity with 2 Wemco type horizontal grit slurry pumps, 15 hp variable speed drive, 220 - 350 gpm.

e. Bypass to Detention Basin
Flow controlled gate and 24" throat parshall flume with a capacity of 20 MGD. 30" pipe to detention basin.

f. Flow Measurement to Plant
30" throat, 27.1 MGD capacity.

g. Flow Distribution
Weir box for distribution of flow to the clarifiers, 3' weir & 25% of flow to Clarifiers #1 and 2 each; 6' weir and 50% of flow to Clarifier #3.

3. Primary Clarifiers

a. Existing: 2 - 75' diameter, 10 SWD Lakeside scrapper clarifiers.

New: 1 - 100' diameter, 13 SWD Lakeside scrapper clarifier.

50% of flow to existing units
Area = 4,418 sq. ft. each
Vol = 330,500 gal each
SOR = 535 gpd/sq. ft. at Peak SOR-- 962 gpd/sq. ft.
HDT = 3.36 hrs.

50% of flow to new unit
Area =7,854 sq. ft.
Vol = 763,723 gal.
SOR = 601 gpd/sq. ft. at Peak SOR --1,082 gpd/sq. ft.
HDT = 3.88 hrs.

b. Primary Sludge Pumping
Existing return is by gravity in a 4" line or by pumping with 2 - 100 gpm Wemco Model EV pumps.

A new pump station is provided for the new 100' ø primary. It has 2 - 100 gpm Wemco Model EV pumps. An 8" gravity force main replaces the existing 4" as a common gravity pumping line for both pump stations.

4. Aeration Tanks

a. Design Factors
3 aeration tanks --2 existing, 1 new
125 x 30 x 15SWD
Total Volume = 168,750 $ft.^3$

Assume 30% BOD reduction in primary clarifiers
BOD loading = 140 mg/l

Assume 50 mg/l BOD from aeration tanks
BOD loading = 90 mg/l x 8.34 x 9.45 = 7,093 lb/day
7,093/169 = 42 lb. BOD/l,000 cu. Ft.
HDT = $\frac{168,750 \times 7.48}{9.45}$ – 0.1336 day = 3.21 hr.

Air required = 7,093 x 1.2 lb. O_2/lb. BOD
= 8,512 lb. O_2 = 4,600 cfm for fine bubble aeration

Air provided 2,000 - 10,000 cfm

Sufficient return sludge capability exists to maintain the MLSS and F/M ratio in the desired ranges for the aeration tanks.

b. Fine bubble aeration will be used, final decisions have not yet been made on the exact system.

c. Return sludge system
Existing pumps are for 800, 1,500 and 2,400 gpm.
A 5,000 gpm pump will be provided in place of the existing 800 gpm pump.

Parallel force mains and flow meters will allow aeration return sludge rates of 1,500 gpm, 23% to 7,500 gpm, 114%

5. Intermediate Clarifiers
The intermediate clarifiers are identical to the primaries in all the design criteria. The sludge system is a suction system piped directly to the return pumping system discussed above.

6. Nitrification Tanks

a. Design factors
3 tanks- -2 existing, 1 new
121 x 30 x 15 SWD
Total Vol. = 163,350 $ft.^3$
BOD loading @ 50 mg/l = 3,941 lb. BOD
3,941/163.35 = 24.1 lb. BOD/1,000 cu. ft.
HDT = $\frac{163,350 \times 7.48}{9.45}$ = 0.129 day = 3.1 hrs.

Air required = (3,941 x 1.2) + (2,246 x 4.6)
=15,061 lb. O_2 = 8,120 cfm

Air provided = 2,000 - 10,000 cfm with a 10,000 cfm blower in reserve.

Sufficient return sludge capability exists to maintain the MLSS and F/M ratio in the desired ranges in the aeration tanks.

NOTE: It should be pointed out that preliminary aeration system designs by Sanitaire and FMC show air requirements of approximately 6,000 scfm

in the aeration tanks and 2,000 to 6,000 scfm in the nitrification tanks. The difference is dependent upon the removals projected for the aeration tanks. In order to provide maximum operator flexibility, the aeration system in both the aeration and nitrification tanks will be essentially the same. This is good engineering judgement and will allow the operator the widest range of treatment schemes to meet the effluent requirements.

b. Fine bubble aeration will be used, final decisions have not been made on the exact system.

c. The calculations and plans are the same as for the aeration return sludge system.

7. Final Clarifiers

Existing: 2 - 75' diameter, 10 SWD Lakeside suction return clarifiers.

New: 1 - 120' diameter, 14 SWD Lakeside suction return clarifier.

40% of flow to existing units
Area = 4,418 sq. ft. each
Vol = 330,500 gal each
SOR = 428 gpd/sq. ft. at Peak SOR =770 gpd/sq. ft.
HDT = 4.17 hrs.

Solids Loading Rate = $*\frac{287.13 \times .2}{4{,}418}$ = 13 lb./day/sq. ft.

* From the 201 Amendment

60% of flow to new unit
Area = 11,310 sq. ft.
Vol = 1,184,383 gal.
SOR = 501 gpd/sq. ft. at Peak SOR = 902 gpd/sq. ft.
HDT = 5.01 hrs.
Solids Loading Rate $*\frac{287.130 \times .6}{11{,}310}$ = 15 lb./day/sq. ft.

8. Chlorination

Install 1 - 5 hp jet mixer in each chlorine contact tank. Capacity is 4-7 mgd each with a peak of 12.5 mgd. This takes approximately 10% of each basin.

Detention time remaining at design flow =15.94 minutes

Detention time at peak flow = 9.6 minutes

9. Cascade Aeration

Raise DO to 6 mg/l
Assume 2 mg/l influent DO

Drop required (by EPA formula) = 10'
Design is 10' drop, 16' wide with 15 8" drop x 2' run steps.
Depth of flow at 9.5 MGD is approximately 3-4 inches.
Depth of flow at 17.0 MGD is approximately 6 inches.

10. Digesters

3 - 160 x 33.5 x 15 SWD tanks
Volume = 1,804,176 gallons

Solids Production = 9.5 x (200-10) x .85 x 8.34
= 12,795 lb/day

$$\frac{12.795 \text{ lb/day}}{.03 \times 8.34 \text{ lb/gal.}} = 51{,}142 \text{ gpd}$$

Detention time = 1,804,176 gal/51,142 gpd = 35 days

Air required = 241.2 cf at 30 cfm = 7,236 cfm
or at peak air demands
Air required = 241.2 cf at 60 cfm = 14,472 cfm

Use the existing blowers
5,250 scfm @ 8.2 psi each

Air from 2,500 - 15,000 cfm is available