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May 13, 2019

Board of Directors
Harris County WCID 99

Re: HCWCID 99 WWTP Upgrade Evaluation Report

Dear Board:

The purpose of this letter is to report the findings and recommendation for alternate improvements to the HCWCID 99 Wastewater Treatment Plant (WWTP). The existing WWTP is a mixture of process units that are aged and mismatched for current Texas Commission on Environmental Quality (TCEQ) Chapter 217 Design Criteria.

The District's WWTP operates under TCEQ TPDES Discharge Permit WQ0011444001 which limits average daily flow to 0.225 mgd, peak 2-hour flow rate to 1.125 mgd (781 gpm) with 10 mg/l CBOD, 15 mg/l TSS, 3 mg/l NH3-N, and 63 MPN/100 ml E coli bacteria. The WWTP does a good job of meeting effluent quality at this time.

Existing average monthly flows discharged from the WWTP are in the range of 0.08 to 0.120 mgd, depending on rainfall and infiltration/inflow. Figure 1 shows the process schematic for the WWTP. The process units are currently comprised of the following:

- A original wastewater treatment plant (Plant 1) which includes an aeration basin, secondary clarifier and aerobic digester in a concentric circular structure with a 52-foot diameter concrete outer wall and a 26-foot diameter fabricated carbon steel inner wall for the clarifier. There are steel divider walls separating aeration and digestion. It appears that there was originally a chlorine contact basin in the outer ring which has subsequently been converted to additional digestion capacity. The steel walls are severely corroded and are expected to fail within the next two years.
- An additional separate 25-foot diameter steel clarifier (Clarifier 2) with a chlorine contact mixing basin (Chlorine Basin 1) attached to the outer wall. The steel structure is in relatively good condition at this time.
- An additional separate 27-foot diameter steel digester (Digester 2) which is in relatively good condition at this time.
- A separate 11-foot diameter steel chlorine contact chamber (Chlorine Basin 1) which is in relatively good condition at this time.

Plant 1 was originally constructed using the Contact Stabilization process which divided the aeration basin into a return sludge reaeration zone and a contact aeration zone. When effluent quality standards changed to required ammonia reduction, the process was changed by piping the influent sewage from the head of the contact aeration zone to the reaeration zone, which converted the process to Conventional Activated Sludge with Nitrification. At that time the Plant 1 clarifier

was found to be too small, requiring the addition of Clarifier 2. Mixed liquor flow from the aeration basin was split between Clarifier 1 and Clarifier 2. Since both clarifiers are constructed of steel, their structural integrity either is currently or will in the future be compromised by corrosion.

Currently the aerobic digestion process is divided between the digester basin (Digester 1) within Plant 1 and a separate circular steel tank (Di9gester 2) adjacent to Plant 1. Overall sludge loadings are within TCEQ Design Criteria. Disinfection volume is presently provided with a Chlorine Contact Basin 1 which is attached to the side of Clarifier 2 and Chlorine Contact Basin 2, a separate round steel tank. Although not currently visible, high concentrations of chlorine solution accelerate corrosion of steel. In the long-term replacement of the steel tankage with concrete or fiberglass will provide a longer life.

It should be noted that the plant is set up so that Plant 1 can be taken off line with influent from the lift station being pumped to Digester 2 (which becomes the aeration basin) working in conjunction with Clarifier 2. An evaluation of the treatment capacity under this scenario is that it can handle 0.10 to 0.12 mgd, depending on the BOD concentration of the influent flow, with a maximum two-hour peak flow of 409 gpm. Therefore, in this mode the treatment units can handle flows in the range of 50% to 55% of the permitted discharge.

Currently, the area of most concern is the extreme corrosion of the metal in Plant 1, which affects aeration, clarification and aerobic digestion. An additional area of concern is that operation of the plant is currently made more difficult by having two separate clarifiers, as the splitting of mixed liquor flows to each is done manually by throttling the influent valve to Clarifier 2. This presents special problems during high influent flow situations where there is a high amount of infiltration/inflow.

Three possible alternatives to resolve these problems have been identified.

1. Rebuild the inside of Plant 1 replacing all the steel walls including the existing 26-ft diameter steel clarifier wall with a 26-ft diameter concrete wall. Use all of the peripheral area for aeration (removing the digester capacity). Divide the peripheral volume into two separate basins so that high efficiency fine bubble diffusers can be installed. Separate basins are necessary so that basins can be taken out of service separately when diffuser membrane replacement is required. A new 26-foot diameter concrete aerobic digester would need to be constructed to replace the volume being removed from Plant 1 and to bring the volume up to current TCEQ Chapter 217 Design Criteria. The Clarifier 2 would continue to operate in parallel with the rebuilt Clarifier No. 1 and the Chlorine Basins would remain in service, requiring maintenance or replacement in the future. Construction of the rebuild would take 12 – 16 weeks.

2. Rebuild the inside of Plant 1 replacing all steel walls with reinforced concrete. The interior clarifier wall would be 35 feet inside diameter. The 35-foot diameter clarifier would be sufficient for all clarification requirements. The remaining peripheral area would be aeration, divided into two basins to allow installation of high efficiency air diffusers. Since all of the required clarification volume would be met in the rebuilt Clarifier 1, Clarifier 2 would be converted to an Aerobic Digester. The existing Chlorine Basins would remain in service, requiring maintenance or replacement in the future. Construction of the rebuild would take 12 – 16 weeks.

3. Construct a new rectangular concrete aeration basin and aerobic digester basin facility adjacent to Plant 1. Demolish all the interior steel walls of Plant 1 and convert it into a 52-foot diameter clarifier. Convert Clarifier 2 to a Tertiary Clarifier. The existing Chlorine Basins would remain in service and would require maintenance or replacement in the future. Overall construction would take 10 months, but rebuilding Plant 1 into a clarifier would take 12 – 16 weeks.

During the time of the reconstruction of all three alternatives, there would be no separate digester, requiring about 14,000 gallons of mixed liquor sludge to be removed from the aeration process each week at a cost of $5,000/month.

Construction cost estimates for the three alternatives are included in Tables 1, 2, and 3 include a 15% contingency factor and are tabulated following:

1. Alternative 1 - $604,268
2. Alternative 2 - $613,755
3. Alternative 3 - $1,528,293

Capital costs including an engineering allowance of 10% of construction costs are tabulated below:

4. Alternative 1 - $664,694
5. Alternative 2 - $675,131
6. Alternative 3 - $1,681,122

We recommend Alternative 2 for providing economy, simplicity of operation and low-cost operation and maintenance. If you have any questions, please call me at 281-373-0500.

Sincerely,
WaterEngineers, Inc.

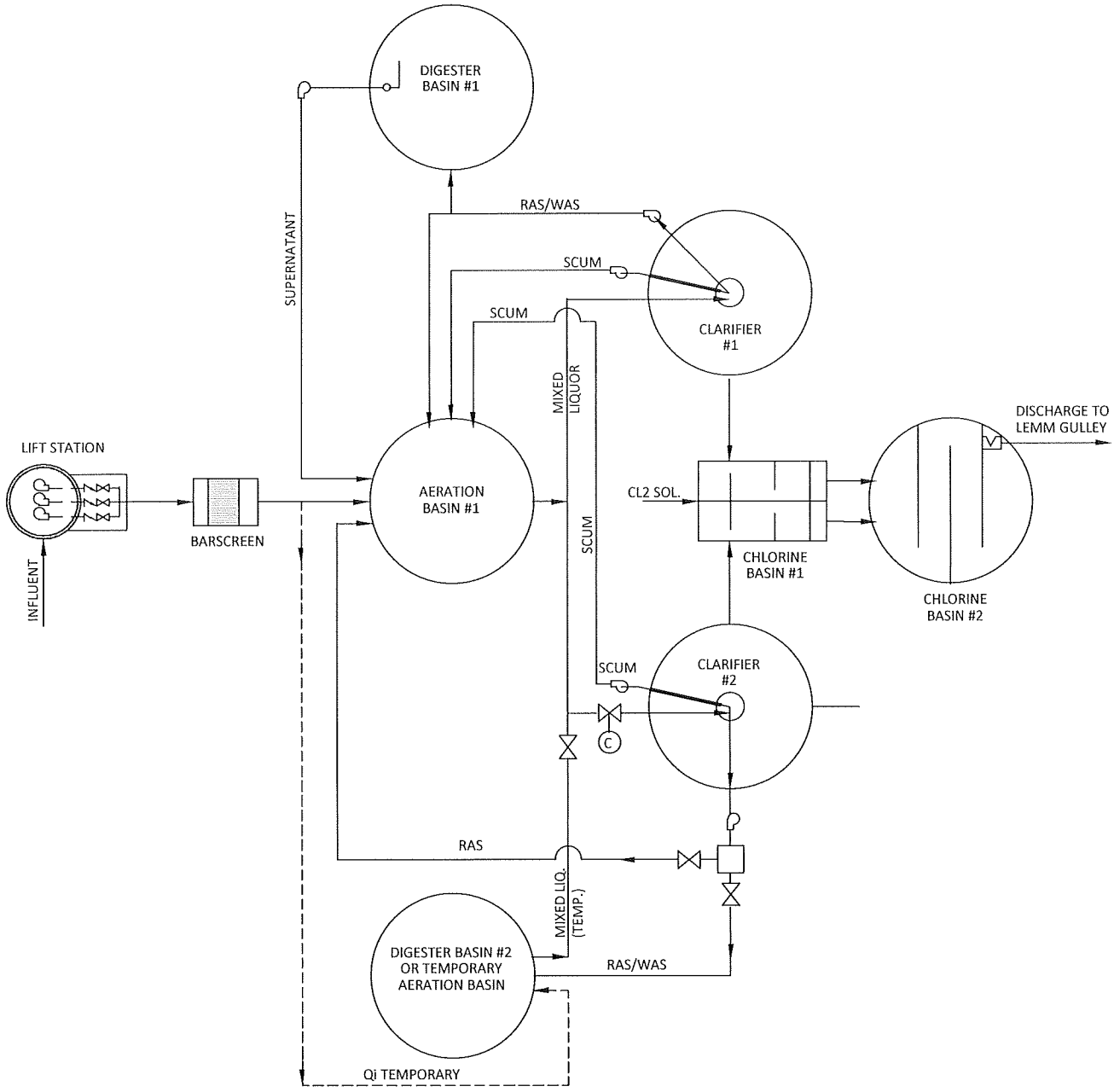
D. Ray Young

D. Ray Young, P.E.
Principal Engineer

WaterEngineers, Inc.
TBPE FIRM No. 2066

D. Ray Young
5-13-2019

Enclosures: Figure 1 – Existing Process Schematic
Table 1 – Alternative 1 Design & Loading Criteria
Table 2 – Alternative 2 Design & Loading Criteria
Table 3 – Alternative 3 Design & Loading Criteria
Table 4 – Alternative 1 Cost Estimate
Table 5 – Alternative 2 Cost Estimate
Table 6 – Alternative 3 Cost Estimate



PROJECT NAME: **HCWCID 99 WASTEWATER TREATMENT PLANT**	DRAWING NAME: **PROCESS SCHEMATIC**
DRAWN BY: GCP APPROVED BY: DRY SCALE: AS NOTED DATE: 5/2/2019 JOB No.:	WATERENGINEERS, INC. *Water & Wastewater Treatment Consultants* *TEXAS BOARD OF PROFESSIONAL ENGINEERS FIRM No. 2066* 17230 HUFFMEISTER ROAD CYPRESS, TEXAS 77429 TEL: 281-373-0500 FAX: 281-373-1113 	DRAWING NO.: **1 of 1**

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TABLE 1	
DESIGN & LOADING CRITERIA	
ALTERNATIVE 1 - PROPOSED WWTP UPGRADE	
HARRIS COUNTY WCID 99 WASTEWATER TREATMENT PLANT	
PARAMETER	**VALUE**
Influent Conditions	
Average Daily Flow, gpd	225,000
Ratio Average/Peak Flow	5.0
Peak 2-Hour Flow, gpd	1,125,000
Peak 2-Hour Flow, gpm	781
BOD, mg/l	300
BOD, lb/day	563
ACTIVATED SLUDGE	
Aeration Basin	
Side Water Depth, ft	14.50
BOD Applied, #/Day	563
Maximum BOD Loading, #/1000 cu ft	30
Required Volume, cu ft	18,765
Required Aeration Area, sq ft	1,294
Actual Area Provided, sq ft	1,508
Actual Volume Provided, cu ft	21,865
Actual BOD Loading, #/1000 cu ft	25.75
O2 Req'd @ 2.2 # O2/lb BOD	1,238
Diffuser Field Submergence, ft.	13.75
CWOTE, %	23.38%
AOR/SOR Coefficient	0.45
WOTE (Field), %	10.52%
Total Air Flow Required, scfm	474
Temperature Adjustment Factor	1.27
Temperature Adjusted Air Flow Rate, scfm	601
Diffuser Air Flow Rate, scfm	9.5
No. of Diffusers Required	50
No. of Diffusers Installed	48
Theoretical Detention in Aeration Basin, Hrs (w/o RAS)	17.45
Air Mixing Rate, scm/1000 cu ft	21.7
Clarification	
Clarifer Rebuild in Plant 1 (takes half the flow)	
Average Daily Flow, gpd	112,500
Ratio Average/Peak Flow	562,500
Diameter, ft	26.00
Wall Height, ft	16.50
Side Water Depth,ft	12.00
Total Surface Area, sq. ft.	531
Total Volume, cu. ft	6,371
Avg. SOR, gpd/sq ft	212
Peak SOR, gpd/sq ft	1,059
Avg. Detention, hr	10.17
Peak Detention, hr	2.03
Return Sludge Flow, gpm (@400 gpd/sq ft)	147
R.S. Airlift Air, scfm	22
Clarifer 2 (takes half the flow)	
Average Daily Flow, gpd	112,500
Ratio Average/Peak Flow	562,500
Diameter, ft	25.00
Wall Height, ft	15.00
Side Water Depth,ft	12.54
Total Surface Area, sq. ft.	491
Total Volume, cu. ft	6,156
Avg. SOR, gpd/sq ft	229
Peak SOR, gpd/sq ft	1,146
Avg. Detention, hr	9.82
Peak Detention, hr	1.96
Return Sludge Flow, gpm (@400 gpd/sq ft)	136
R.S. Airlift Air, scfm	20
CHLORINE CONTACT CHAMBER	
Wall Height, ft	10.00
Freeboard to V-Notch, ft	1.50
Maximum Depth, ft (@Qp)	8.50
Min Peak Flow Detention, min	20
Required Volume, cu ft	2,089
Required Surface Area, sq ft	246
Actual Surface Area, sq ft	149
Actual Volume, cu ft	1,267
Detention @ Peak Flow	12.1
Air Supply Req'd, scfm (@ 10 scfm/1000 cu ft)	13
AEROBIC DIGESTION	
New Digester	
Diameter of Tank, ft	26
Maximum Operating Depth, ft	12.5
Total Surface Area, sq ft	530.9
Total Volume, cu ft	6,637
Loading, cu ft/lb BOD	12
Air Supply Req'd, scfm (@ 20 scfm/1,000 cu ft)	133
Existing Digester 2	
Diameter of Tank, ft	27
Maximum Operating Depth, ft	12.5
Total Surface Area, sq ft	572.6
Total Volume, cu ft	7,157
Loading, cu ft/lb BOD	13
Air Supply Req'd, scfm (@ 20 scfm/1,000 cu ft)	143
Total Digester Volume, cu ft	13,794
Total Digester Loading, lb BOD/	24.5
AIR SUPPLY BLOWERS	
Aeration Basin Air Supply, scfm	601
Digester 1 Air Supply, scfm	133
Digester 2 Air Supply, scfm	143
Chlorine Contact Chamber Air Supply, scfm	13
RAS Airlift 1 Air Supply, scfm	22
RAS Airlift 2 Air Supply, scfm	20
Total Air Supply Required, scfm	932
Number of Blowers	2
Capacity of Blowers, scfm	932
Blower Operating Pressure. psi	7.20

TABLE 2
DESIGN & LOADING CRITERIA
ALTERNATIVE 2 - PROPOSED WWTP UPGRADE
HARRIS COUNTY WCID 99 WASTEWATER TREATMENT PLANT

PARAMETER	VALUE
Influent Conditions	
Average Daily Flow, gpd	225,000
Ratio Average/Peak Flow	5.0
Peak 2-Hour Flow, gpd	1,125,000
Peak 2-Hour Flow, gpm	781
BOD, mg/l	300
BOD, lb/day	563
ACTIVATED SLUDGE	
Aeration Basin	
Side Water Depth, ft	15.00
BOD Applied, #/Day	563
Maximum BOD Loading, #/1000 cu ft	35
Required Volume, cu ft	16,084
Required Aeration Area, sq ft	1,072
Actual Area Provided, sq ft	1,049
Actual Volume Provided, cu ft	15,728
Actual BOD Loading, #/1000 cu ft	35.79
O2 Req'd @ 2.2 # O2/lb BOD	1,238
Diffuser Field Submergence, ft.	14.25
CWOTE, %	24.23%
AOR/SOR Coefficient	0.45
WOTE (Field), %	10.90%
Total Air Flow Required, scfm	457
Temperature Adjustment Factor	1.27
Temperature Adjusted Air Flow Rate, scfm	580
Diffuser Air Flow Rate, scfm	9.5
No. of Diffusers Required	48
No. of Diffusers Installed	48
Theoretical Detention in Aeration Basin, Hrs (w/o RAS)	12.55
Air Mixing Rate, scm/1000 cu ft	29.1
Clarification	
Clarifer Rebuild in Plant 1 (takes all the flow)	
Average Daily Flow, gpd	112,500
Peak 2-Hour Flow, gpd	562,500
Diameter, ft	35.00
Wall Height, ft	16.50
Side Water Depth,ft	12.13
Total Surface Area, sq. ft.	962
Total Volume, cu. ft	11,666
Avg. SOR, gpd/sq ft	234
Peak SOR, gpd/sq ft	1,169
Avg. Detention, hr	9.31
Peak Detention, hr	1.862
Return Sludge Flow, gpm (@400 gpd/sq ft)	267
R.S. Airlift Air, scfm	40
CHLORINE CONTACT CHAMBER	
Average Daily Flow, gpd	112,500
Peak 2-Hour Flow, gpd	619
Wall Height, ft	14.00
Freeboard to V-Notch, ft	2.00
Maximum Depth, ft (@Qp)	12.00
Min Peak Flow Detention, min	20
Required Volume, cu ft	2,089
Required Surface Area, sq ft	174
Actual Surface Area, sq ft	149
Actual Volume, cu ft	1,788
Detention @ Peak Flow	17.1
Air Supply Req'd, scfm (@ 10 scfm/1000 cu ft)	18
AEROBIC DIGESTION	
New Digester (Converted Clarifier 2)	
Diameter of Tank, ft	25
Maximum Operating Depth, ft	12.5
Total Surface Area, sq ft	490.9
Total Volume, cu ft	6,136
Loading, cu ft/lb BOD	11
Air Supply Req'd, scfm (@ 20 scfm/1,000 cu ft)	123
Existing Digester # 2	
Diameter of Tank, ft	27
Maximum Operating Depth, ft	12.5
Total Surface Area, sq ft	572.6
Total Volume, cu ft	7,157
Loading, cu ft/lb BOD	13
Air Supply Req'd, scfm (@ 20 scfm/1,000 cu ft)	143
Total Digester Volume, cu ft	13,293
Total Digester Loading, lb BOD/	23.6
AIR SUPPLY BLOWERS	
Aeration Basin Air Supply, scfm	580
Digester 1 Air Supply, scfm	123
Digester 21 Air Supply, scfm	143
Chlorine Contact Chamber Air Supply, scfm	18
RAS Airlift 1 Air Supply, scfm	40
Total Air Supply Required, scfm	904
Number of Blowers	2
Capacity of Blowers, scfm	904
Blower Operating Pressure. psi	7.42

TABLE 3
DESIGN & LOADING CRITERIA
ALTERNATIVE 3 - PROPOSED WWTP UPGRADE
HARRIS COUNTY WCID 99 WASTEWATER TREATMENT PLANT

PARAMETER	VALUE
Influent Conditions	
Average Daily Flow, gpd	225,000
Ratio Average/Peak Flow	5.0
Peak 2-Hour Flow, gpd	1,125,000
Peak 2-Hour Flow, gpm	781
BOD, mg/l	300
BOD, lb/day	563
ACTIVATED SLUDGE	
Aeration Basin	
Side Water Depth, ft	14.50
BOD Applied, #/Day	563
Maximum BOD Loading, #/1000 cu ft	30
Required Volume, cu ft	18,765
Required Aeration Area, sq ft	1,294
Actual Area Provided, sq ft	1,413
Actual Volume Provided, cu ft	20,253
Actual BOD Loading, #/1000 cu ft	27.80
O2 Req'd @ 2.2 # O2/lb BOD	1,238
Diffuser Field Submergence, ft.	13.75
CWOTE, %	23.38%
AOR/SOR Coefficient	0.45
WOTE (Field), %	10.52%
Total Air Flow Required, scfm	474
Temperature Adjustment Factor	1.27
Temperature Adjusted Air Flow Rate, scfm	601
Diffuser Air Flow Rate, scfm	9.5
No. of Diffusers Required	50
No. of Diffusers Installed	48
Theoretical Detention in Aeration Basin, Hrs (w/o RAS)	16.16
Air Mixing Rate, scm/1000 cu ft	23.4
R.S. Airlift Air, scfm	88
Clarifier	
Diameter, ft	52.00
Wall Height, ft	16.50
Side Water Depth,ft	10.92
Total Surface Area, sq. ft.	2,124
Total Volume, cu. ft	23,184
Avg. SOR, gpd/sq ft	106
Peak SOR, gpd/sq ft	530
Avg. Detention, hr	18.50
Peak Detention, hr	3.70
Return Sludge Flow, gpm (@400 gpd/sq ft)	590
CHLORINE CONTACT CHAMBER	
Wall Height, ft	10.00
Freeboard to V-Notch, ft	1.50
Maximum Depth, ft (@Qp)	8.50
Min Peak Flow Detention, min	25
Required Volume, cu ft	2,611
Required Surface Area, sq ft	307
Actual Surface Area, sq ft	149
Actual Volume, cu ft	1,267
Detention @ Peak Flow	12.1
Air Supply Req'd, scfm (@ 10 scfm/1000 cu ft)	13
AEROBIC DIGESTION	
New Digester	
Side Water Depth, ft	14.5
Surface Area, sq ft	936
Volume, cu ft	13,572
Loading, cu ft/lb BOD	24.1
Air Supply Req'd, scfm (@ 30 scfm/1,000 cu ft)	407
AIR SUPPLY BLOWERS	
Aeration Basin Air Supply, scfm	601
Digester 1 Air Supply, scfm	407
Chlorine Contact Chamber Air Supply, scfm	13
RAS Airlift Air Supply, scfm	88
Total Air Supply Required, scfm	1,109
Number of Blowers	2
Capacity of Blowers, scfm	1109
Blower Operating Pressure. psi	7.20

TABLE 4
ALTERNATIVE 1 ESTIMATED CONSTRUCTION COSTS
HCWCID 99 MUD WWTP MODIFICATIONS

Item No.	Description	Quan.	Unit	Unit Price	Line Total	Subtotal
1	**General**					
2	Bonds @ 3%	1	LS	$18,000	$18,000	
3	Mobilization	1	LS	$2,500	$2,500	
4	Sanitary Facilities	4	MO	$750	$3,000	
5	6-inch Drain Piping	100	LF	$40	$4,000	
6	Demobilization & Cleanup	1	LS	$3,500	$3,500	
	Sludge Hauling During Construction	4	MO	$5,000	$20,000	**$51,000**
7	**Temporary Treatment Preparation**					
8	Clearing, Site Preparation	1	LS	$2,500	$2,500	
9	Temporary Bar Screen at Influent to Digester 2	1	LS	$7,500	$7,500	
10	8" Force Main to Digester 2	100	LF	$40	$4,000	
11	Lift Station Discharge Alteration	1	LS	$7,500	$7,500	**$21,500**
12	**Demoltion & Disposal inside Plant 1**	1	LS	$30,000	$30,000	**$30,000**
13	**Concrete Forming, Reinforcing, Placement & Finishing**					
14	Reinf. Concrete - Clarifier Floor Grading	20	CY	$1,000	$20,000	
15	Reinf. Concrete - Clarifier & Divider Walls	60	CY	$1,250	$75,000	
16	Reinf. Concrete - Suspended Launders & Walkways	12	CY	$1,750	$21,000	
17	Reinf. Concrete - Screen Slab	4	CY	$1,750	$7,000	
18	Reinf. Concrete - Digester Slab	20	CY	$1,000	$20,000	
19	Reinf. Concrete - Digester Walls	40	CY	$1,250	$50,000	
20	Reinf Concrete - Suspended Slab Over Digester	4	CY	$1,750	$7,000	
21	Reinf. Concrete - Dumpster Slab	2	CY	$2,000	$4,000	**$204,000**
22	**Equipment Fabrication, Galvanizing & Installation**					
23	New Influent Bar Screen	1	LS	$12,000	$12,000	
24	New 26' Diameter Clarifier Equipment	1	LS	$104,000	$104,000	
25	Handrail on Tanks	300	LF	$60	$18,000	
26	SS Digester Sludge Transfer Airlift	1	LS	$3,500	$3,500	
27	6-inch Air Header w/ Couplings & Supports	60	LS	$75	$4,500	
28	4 inch Air Header w/ Couplings & Supports	90	LS	$65	$5,850	
29	4-inch Air Drops	4	EA	$1,000	$4,000	
30	2 inch SS Aeration Diffuser Drop Assemblies	4	EA	$750	$3,000	
31	1 inch SS air supply lines	1	LS	$4,000	$4,000	
32	EDI Max Air Diffusers	8	Ea	$75	$600	
33	EDI Perforated Membrane Tube Diffusers	60	EA	$250	$15,000	
34	Clarifier Drive & Connecting Couplings, Bearings, Clamps	1	Ea	$7,500	$7,500	
35	4-inch Decant Airlift in Digester	1	EA	$4,000	$4,000	
36	4-inch transfer line & valve	1	LS	$3,000	$3,000	**$188,950**
37	**Electrical Work**					
38	New Conduit, Lighting on Plant 1 & New Digester	1	LS	$22,500	$22,500	
39	Clarifier Control Panel	1	LS	$7,500	$7,500	$30,000
40	***Subtotal Budgeted Construction Cost of WWTP***				**$525,450**	**$525,450**
41	***Contingency @ 15%***				**$78,818**	
42	***Subtotal***				**$604,268**	
43	***Engineering @ 10%***				**$60,427**	
44	***Total Capital Cost***				**$664,694**	

TABLE 5
ALTERNATIVE 2 ESTIMATED CONSTRUCTION COSTS
HCWCID 99 MUD WWTP MODIFICATIONS

Item No.	Description	Quan.	Unit	Unit Price	Line Total	Subtotal
1	**General**					
2	Bonds @ 3%	1	LS	$18,000	$18,000	
3	Mobilization	1	LS	$2,500	$2,500	
4	Sanitary Facilities	4	MO	$750	$3,000	
5	6-inch Drain Piping	100	LF	$40	$4,000	
6	Demobilization & Cleanup	1	LS	$3,500	$3,500	
7	Sludge Hauling During Construction	4	MO	$5,000	$20,000	**$51,000**
8	**Temporary Treatment Preparation**					
9	Clearing, Site Preparation	1	LS	$2,500	$2,500	
10	Temporary Bar Screen at Influent to Digester 2	1	LS	$7,500	$7,500	
11	8" Force Main to Digester 2	100	LF	$40	$4,000	
12	Lift Station Discharge Alteration	1	LS	$7,500	$7,500	**$21,500**
13	**Demolition & Disposal inside Plant 1**	1	LS	$30,000	$30,000	**$30,000**
14	**Demolition & Disposal inside Clarifier 2**	1	LS	$10,000	$10,000	**$10,000**
15	**Concrete Forming, Reinforcing, Placement & Finishing**					
16	Reinf. Concrete - Clarifier Floor Grading	36	CY	$1,000	$36,000	
17	Reinf. Concrete - Clarifier & Divider Walls	70	CY	$1,250	$87,500	
18	Reinf. Concrete - Suspended Launders & Walkways	15	CY	$1,750	$26,250	
19	Reinf. Concrete - Screen Slab	4	CY	$1,750	$7,000	
20	Reinf. Concrete - Dumpster Slab	2	CY	$2,000	$4,000	**$160,750**
21	**Equipment Fabrication, Galvanizing & Installation**					
22	New Influent Bar Screen	1	LS	$12,000	$12,000	
23	New 35' Diameter Clarifier Equipment	1	LS	$140,000	$140,000	
24	Handrail on Tanks	350	LF	$60	$21,000	
25	SS Digester Sludge Transfer Airlift	1	LS	$3,500	$3,500	
26	6-inch Air Header w/ Couplings & Supports	60	LS	$75	$4,500	
27	4 inch Air Header w/ Couplings & Supports	90	LS	$65	$5,850	
28	4-inch Air Drops	4	EA	$1,000	$4,000	
29	2 inch SS Aeration Diffuser Drop Assemblies	4	EA	$750	$3,000	
30	1 inch SS air supply lines	1	LS	$4,000	$4,000	
31	EDI Max Air Diffusers	8	Ea	$75	$600	
32	EDI Perforated Membrane Tube Diffusers	60	EA	$250	$15,000	
33	Clarifier Drive & Connecting Couplings, Bearings, Clamps	1	Ea	$10,000	$10,000	
34	4-inch Decant Airlift in Digester	1	EA	$4,000	$4,000	
35	4-inch transfer line & valve	1	LS	$3,000	$3,000	**$230,450**
36	**Electrical Work**					
37	New Conduit, Lighting on Plant 1	1	LS	$22,500	$22,500	
38	Clarifier Control Panel	1	LS	$7,500	$7,500	$30,000
39	***Subtotal Budgeted Construction Cost of WWTP***				**$533,700**	**$533,700**
40	***Contingency @ 15%***				**$80,055**	
41	***Subtotal***				**$613,755**	
42	***Engineering @ 10%***				**$61,376**	
43	***Total Capital Cost***				**$675,131**	

TABLE 6
ALTERNATIVE 3 ESTIMATED CONSTRUCTION COSTS
HCWCID 99 MUD WWTP MODIFICATIONS

Item No.	Description	Quan.	Unit	Unit Price	Line Total	Subtotal
1	**General**					
2	Bonds @ 3%	1	LS	$37,500	$37,500	
3	Mobilization	1	LS	$2,500	$2,500	
4	Sanitary Facilities	6	MO	$750	$4,500	
5	6-inch Drain Piping	100	LF	$40	$4,000	
6	Demobilization & Cleanup	1	LS	$3,500	$3,500	
7	Sludge Hauling During Construction	4	MO	$5,000	$20,000	**$72,000**
8	**Temporary Treatment Preparation**					
9	Clearing, Site Preparation	1	LS	$2,500	$2,500	
10	Temporary Bar Screen at Influent to Digester 2	1	LS	$7,500	$7,500	
11	8" Force Main to Digester 2	100	LF	$40	$4,000	
12	Lift Station Discharge Alteration	1	LS	$5,000	$5,000	**$19,000**
13	**Demoltion & Disposal inside Plant 1**	1	LS	$30,000	$30,000	**$30,000**
14	**Concrete Forming, Reinforcing, Placement & Finishing**					
15	Reinf. Concrete - Clarifier Floor Grading	80	CY	$1,000	$80,000	
16	Reinf. Concrete - Clarifier & Divider Walls	100	CY	$1,250	$125,000	
17	Reinf. Concrete - Suspended Launders & Walkways	20	CY	$1,750	$35,000	
18	Reinf. Concrete - Aeration Basin/Digester Floor	175	CY	$1,000	$175,000	
19	Reinf. Concrete - Aeration Basin/Digester Walls	330	CY	$1,250	$412,500	
20	Reinf. Concrete - Aeration Basin/Digester Suspended Slabs	12	CY	$1,750	$21,000	
21	Reinf. Concrete - Screen Slab	4	CY	$1,750	$7,000	
22	Reinf. Concrete - Dumpster Slab	2	CY	$2,000	$4,000	**$859,500**
23	**Equipment Fabrication, Galvanizing & Installation**					
24	New Influent Bar Screen	1	LS	$12,000	$12,000	
25	New 52' Diameter Clarifier Equipment	1	LS	$208,000	$208,000	
26	Handrail on Tanks	600	LF	$60	$36,000	
27	SS Digester Sludge Transfer Airlift	1	LS	$3,500	$3,500	
28	6-inch Air Header w/ Couplings & Supports	60	LS	$75	$4,500	
29	4 inch Air Header w/ Couplings & Supports	90	LS	$65	$5,850	
30	4-inch Air Drops	4	EA	$1,000	$4,000	
31	2 inch SS Aeration Diffuser Drop Assemblies	4	EA	$750	$3,000	
32	1 inch SS air supply lines	1	LS	$4,000	$4,000	
33	EDI Max Air Diffusers	8	Ea	$75	$600	
34	EDI Perforated Membrane Tube Diffusers	60	EA	$250	$15,000	
35	Clarifier Drive & Connecting Couplings, Bearings, Clamps	1	Ea	$15,000	$15,000	
36	4-inch Decant Airlift in Digester	1	EA	$4,000	$4,000	
37	4-inch transfer line & valve	1	LS	$3,000	$3,000	**$318,450**
38	**Electrical Work**					
39	New Conduit, Lighting on New Clarifier & New Aeration Basin & Diges	1	LS	$22,500	$22,500	
40	Clarifier Control Panel	1	LS	$7,500	$7,500	**$30,000**
41	***Subtotal Budgeted Construction Cost of WWTP***				**$1,328,950**	**$1,328,950**
42	***Contingency @ 15%***				**$199,343**	
43	***Subtotal***				**$1,528,293**	
44	***Engineering @ 10%***				**$152,829**	
45	***Total Capital Cost***				**$1,681,122**	