Preliminary Engineering Report

Southeast Regional Wastewater Treatment Plant Expansion

Manatee County

FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION
AUG 2 2 2001
SOUTHWEST DISTRICT
TAMPA

November, 1998

McKIM & CREED

RECEIVED
AUG 2 2 2001
Department of Environmental Protection
SOUTHWEST DISTRICT
BY

Preliminary Engineering Report

Southeast Regional Wastewater Treatment Plant Expansion

Prepared For

Manatee County

November, 1998

McKIM & CREED
601 Cleveland Street, Suite 205
Clearwater, FL 33772

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

LIST OF CHARTS

1.0 INTRODUCTION

Manatee County operates a regional wastewater treatment facility located south of SR 64 and east of I-75. The facility is at the end of Lena Road and serves the Southeast service area of Manatee County. This facility is designed and permitted for 5.4 million gallons per day (MGD) and operates under a operating permit from Florida Department of Environmental Protection (FDEP) FLA012618-01 which was issued April 15, 1998, and expires April 1, 2000

Growth and development in the County has resulted in a tremendous increase in population over the last 50 years. More recently, population has increased 14.5% from 1990 to 1997. Growth in the area served by the Southeast Regional Wastewater Treatment Plant (SERWTP) is growing at a rate that exceeds that of the County as a whole. Planned developments indicate that the rate of growth will continue at or above the recent growth rates seen in the County. The future growth which is projected will lead to continued increases in wastewater flows to be treated by the SERWTP. In the first quarter of 1998, the wastewater flows averaged greater than 50% of the permitted capacity of the treatment facility, and in February exceeded 3.8 MGD (70% of permitted capacity). Considering that a significant expansion in treatment capacity typically requires several years to plan, design, construct and place into operation, the County must move forward to expand the treatment capacity. This will insure that the County can adequately accommodate the continued increase in population in the Southeastern segment of the County.

McKim & Creed has been authorized by Manatee County to provide design services for the expansion of the capacity of the SERWTP from its current 5.4 MGD capacity to 11.0 MGD. This preliminary report is intended to provide a background of the existing facility components and critical size parameters, the expanded and/or new component or processes needed to provide adequate capacity for future expanded flows to the facility and the decisions recommended for the sizing, configuration and critical components of the expanded facility.

This report serves as the Basis of Design Report for the proposed expansion of the existing Southeast Regional Wastewater Treatment Plant for Manatee County, Florida.

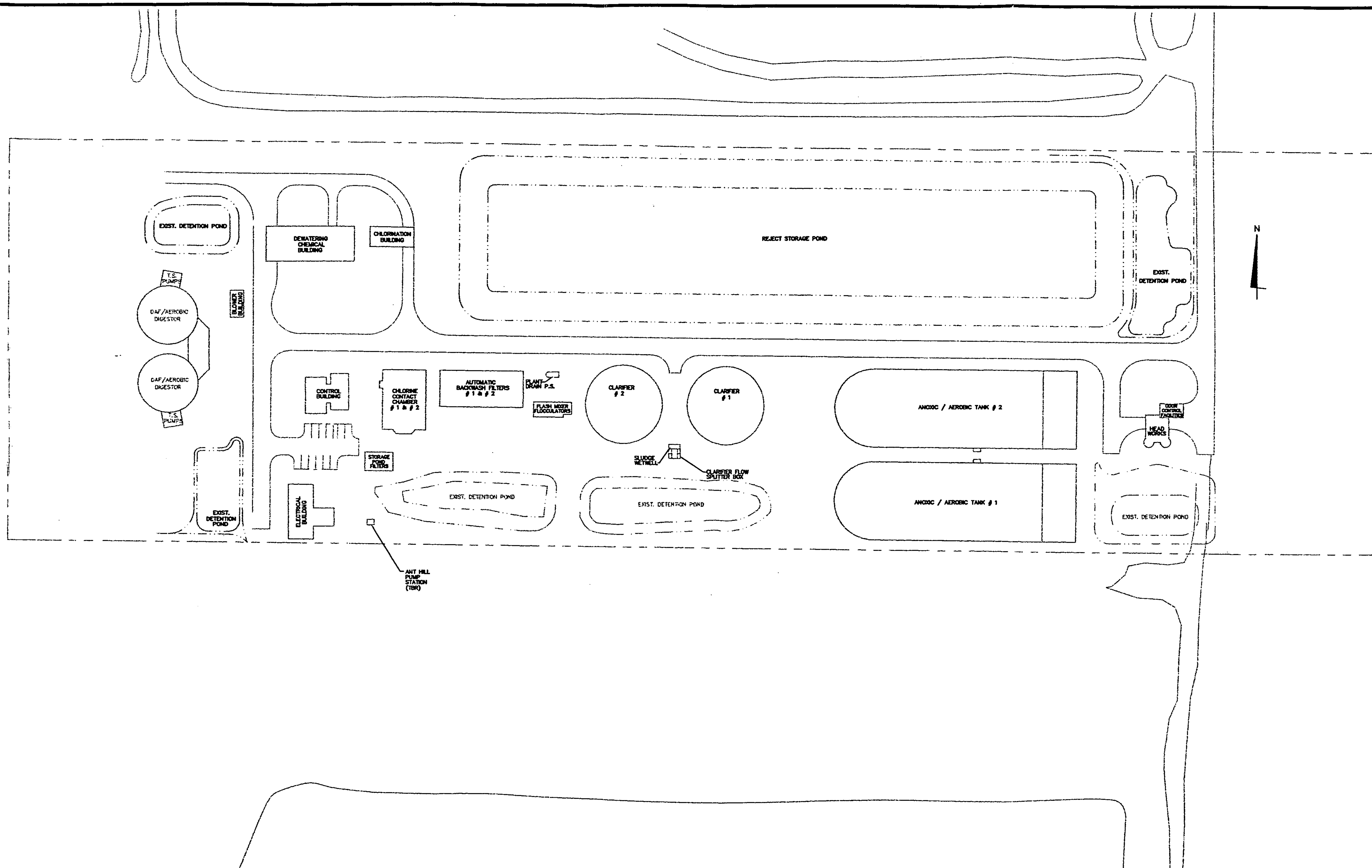
2.0 EXISTING FACILITIES

The existing Southeast Regional Wastewater Treatment Plant began operation in February of 1988. The existing facility consists of two parallel Carrousel oxidation ditch process systems each equipped with a pre-anoxic basin and a return mixed liquor (RML) pumped recycle. Figure 1 shows a site arrangement of the existing plant. A listing of the existing treatment components and size information is provided in Table 1. Table 2 shows a limiting parameter, individual capacity summary of various steps within the existing plant process based on current regulatory and standard design guidelines.

The existing facility was designed for an average daily flow (ADF) capacity of 5.4 MGD with the effluent to be beneficially reused by a public access effluent irrigation system. There is no other outfall with this plant, therefore, all of the effluent has to be reused. During periods of lower demand for reclaimed water, the treated reclaimed water is stored in a series of holding ponds adjacent and to the south and east of treatment facility.

The existing headworks structure includes the functions of flow metering, screening , and grit removal. Three existing channels are available to convey the plant influent through the headworks. Two channels are equipped with self cleaning mechanical fine screens, while the third channel includes a manual bar screen.

The two existing oxidation ditches are coupled with anoxic basins to provide a measure of nitrogen removal beyond that necessary for normal irrigation. The process has been designed around an extended aeration process that completely nitrifies the incoming wastewater. Each anoxic basin was designed with a total volume of 0.576 million gallons and provides a detention time of one hour at the full design capacity of 2.7 MGD per basin when considering the recycle flows which return to the anoxic tank. An internal re-circulation loop sends approximately four times the incoming flow back to the anoxic tanks to remove approximately 70 % of the oxidized nitrogen as nitrogen gas. The remainder of the nitrate goes through the process and is land applied with the effluent. Each oxidation ditch was designed with a volume of 3.09 million gallons and provides a solids retention time (SRT) of 14 days to achieve complete nitrification.



McKIM & CREED

CLEARWATER FLORIDA

MANATEE COUNTY

EXISTING FACILITY SITE PLAN

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE:	6/11/98
MCE PROJ. #	1024-0008
DWG FILE #	CSITE1.DWG

SCALE

HORIZONTAL: NTS

VERTICAL: N/A

CLIENT DWG NUMBER

FIGURE NO. 1

3.3.2 Flow Projections/Southeast Service Area

Table 8 presents the projected annual average daily flow and the maximum three-month average daily flow on a yearly basis through 2015. Projected annual average daily flows are based on the population projections presented in Table 8 and a per capita wastewater flow of 100 gallons per day. The 100 gallons per capita per day (gpcd) flow rate is being proposed by the Public Works Department for future planning and is based on a comparison of historic flows and population estimates for all three of the County's wastewater service areas. The average ratio of the yearly maximum three-month average daily flow to the annual average daily flow, as determined in the previous sections on average flows and seasonal variations in flow, was used to project the maximum three-month average daily flows for each year.

Table 8
Manatee County SERWTP
Projected Wastewater Flows

Year	Projected Annual Average Daily Flows (MGD)	Projected Maximum Three-Month Average Daily Flows (MGD)
1998	3.88	4.35
1999	4.11	4.60
2000	4.33	4.85
2001	4.55	5.10
2002	4.78	5.35
2003	5.00	5.60
2004	5.22	5.85
2005	5.44	6.09
2006	5.67	6.35
2007	5.89	6.60
2008	6.11	6.84
2009	6.34	7.10
2010	6.56	7.35
2011	6.82	7.64
2012	7.09	7.94
2013	7.38	8.27
2014	7.67	8.60
2015	7.98	8.94

4.0 PROJECTED WASTEWATER CHARACTERISTICS FOR BASIS OF DESIGN

The flow capacity of the expanded facility is proposed to be 11.0 MGD average day flow (12.65 MGD maximum month day). This flow is based on a doubling of existing capacity to extend plant utilization beyond the year 2015. Capacity expansion must, at a minimum, position the County to comply with FDEP requirements for scheduled plant capacity expansions ahead of flow increases. The County must be in a planning and design mode for increased capacity when flows are projected to equal or exceed the current permitted capacity within five years per the capacity analysis report projections as outlined in F.A.C. 62-600.405. This proposed expansion will provide the County sufficient capacity through at least the year 2012 when planning and design of additional capacity may be warranted. A lesser expansion will not provide the County with adequate time between projects to plan, design and construct the systems. In addition, many of the process components that make up this capacity expansion are required to meet Class I reliability for safe operation.

The proposed modifications for this facility shall be based on an influent wastewater strength of:

CBOD = 250 mg/l
TSS = 250 mg/l
TKN = 40 mg/l

This design criteria matches the original plant design criteria. Based on 1997 flow records the average BOD and TSS concentrations have been 198 mg/l and 212 mg/l respectively. Trend analyses of organic concentrations show a slight increase over the ten year historical time frame. Increases have been witnessed in similarly developing areas. The proposed criteria is expected to provide ample design capacity for organic treatment through the design year based on flow projections.

The proposed effluent quality produced shall be equal to or better than:

CBOD = 20 mg/l
TSS = 5 mg/l
NO_3-N = 12 mg/l

This water quality criteria is based on the current permitted limits on effluent from this facility.

5.0 PROPOSED FACILITY MODIFICATIONS

5.1 Proposed Site Layout

Figure 2 is included to show an overall schematic diagram of the SERWTP site and surrounding area. This figure shows the location of the proposed access road to route future traffic out of the landfill area, the location of the proposed reject water storage facility, the conceptual location of stormwater control systems, and the location of the effluent metering station. Figure 3 shows a layout of the existing wastewater facility with the proposed expanded process treatment units superimposed on the site. A summary of the revised design criteria and standards for the expanded facility is included in Appendix A.

Proposed major additions include a third mechanical screen, a flow splitter box, flow equalization tank, anoxic/aerobic tanks, two clarifiers, two automatic backwash sand filters, two chlorine contact chambers, two sludge storage tanks, and two sludge thickeners. The proposed additions will increase the plant capacity to 11 MGD average daily flow, 12.65 MGD maximum daily flow, and hydraulic peak flow of 33 MGD.

Figure 4 shows the proposed major site piping to the new treatment units. The proposed splitter box can be connected to the headworks via an existing 42-inch pipeline and gate valve. The splitter box will have three 36-inch effluent pipes, each feeding its own anoxic/aerobic tank. The 42-inch discharge line from the proposed anoxic/aerobic tank will be connected to the existing clarifier splitter box, which has been constructed to service four clarifiers. Two existing capped 36-inch effluent pipes from the splitter box will be connected to each new clarifier (No. 3 and No. 4). The overflow from the two new clarifiers will flow via a new 36-inch pipeline to the flash mix tanks. Effluent from the flocculation tanks will flow to the two proposed automatic backwash sand filters (No. 3 & No. 4) via a 36-inch pipeline. A proposed 36-inch discharge pipeline from the proposed sand filters will connect to the existing and new chlorine contact tanks. This will allow effluent from the proposed chlorine contact chambers to be pumped through the existing effluent pumps to current reclaimed water customers. In the future, the effluent from the new chlorine contact tanks will be pumped to irrigation areas in the Manatee Agricultural Reuse System (MARS).

Anoxic Basins	
Number	2
Volume, MG, each	.576
Mixer type	Mechanical
Number of mixers per basin	2
Motor horsepower, each	15
Aeration Basins	
Number	2
Volume, MG, each	3.09
Aeration type	Two speed, surface
Number of aerators per basin	2
Motor horsepower, each	125/93.75
Number of internal recycle pumps/ basin	2
Motor horsepower, each	50
Secondary Clarifiers	
Number	2
Diameter, ft., each	110
Side water depth, ft.	14
Weir type	V-Notch
Sludge removal mechanism	Draft tube
Scum removal system	Ducking skimmer
Scum handling system	Pneumatic ejector
ADF Capacity, each, MGD	3.8
Return Activated Sludge Pumps	
Number	3
Type	Centrifugal
Capacity, gpm, each	2,400
Motor horsepower, each	25
Flash Mixing Basins	
Number	2
Volume, gal., each	2,566
Mixers	
Number	2
Motor horsepower, each	10/4.4
Flocculation Basins	
Number	2
Volume, gal., each	13,464
Flocculators	
Number	2
Motor horsepower, each	1

Flow from both oxidation ditches enters a common splitter box that has been set up to feed four parallel clarifiers. The original plant construction installed two of four planned clarifiers. Pipe fitting connections are in place to add two more clarifiers in the future. Each of the existing clarifiers was designed at 110 foot diameter with rapid suction solids return. The design overflow rate of each clarifier at average daily flow is 284 gpd/ft^2 of clarifier area. The clarifiers' return activated sludge (RAS) and waste activated sludge (WAS) are pumped to various steps within the process. RAS is pumped back to the influent flow just before the anoxic zones. WAS is pumped to the existing aerobic digestors and dissolved air flotation thickeners (DAFTs).

Clarified effluent flows by gravity to a flash mixing and flocculating area where various coagulants can be added if suspended solids are a problem. After the flash mixing tank, clarified effluent flows into two traveling bridge sand filters. Each filter was designed at 16 feet wide by 90 feet long with an effective filter area of 1,440 ft^2. Each filter has a capacity of 4.15 MGD at a loading rate of less than 2 gpm/ft^2 at ADF.

After filtration, the effluent is chlorinated in one of two parallel chlorine contact tanks. The contact tanks were originally designed for 16 minutes detention time at a peak flow of 12.4 MGD. Attached to the contact tanks is an effluent pumping station capable of transferring all of the reclaimed water to distribution or holding ponds.

Table 1

Existing Process Equipment Capacities

Liquid Treatment Facilities

Bar Screens	
Number	2 - Mechanical
Type	1 - Manual
Peak Capacity, MGD, each	12
Opening size, inches	.25 - Mechanical
	1.0 - Manual
De-gritting Equipment	
Number	2
Type	Vortex
Diameter, ft., each	16
Peak Capacity, MGD, each	20

Sand Filters	
Number	2
Type	Traveling bridge automatic backwash
Filter Area, S.F., each	1,440
Average design flow rate, MGD, each	4.15
Maximum design flow rate, MGD, each	8.3
Chlorine Contact Basins	
Number	2
Capacity, MG, each (with IFT above weir)	0.0807
Combined capacity, MG	0.1615
Peak flow capacity at 15 min. detention time, MGD	15.5
Chlorinators	
Number	2
Total capacity, ppd	4,000
Chlorine feeder No. 1, ppd	2,000
Chlorine feeder No. 2, ppd	2,000

Effluent Reuse System

Variable Speed Effluent Distribution Pumps	
Number	3
Type	Vertical turbine
Capacity, gpm, each	4,000
Motor horsepower, each	300

Solids Treatment Facilities

Waste Activated Sludge Pumps	
Number	2
Type	Centrifugal
Capacity, gpm, each	250
Motor horsepower, each	10
Dissolved Air Flotation Thickener	
Number	2
Diameter, ft., each	38
Aerobic Digestors	
Number	2
Volume, Cu. Ft., each	62,400
Capacity, MG, each	.420
Blowers	
Number	3
Motor horsepower, each	100

Belt Filter Press Feed Pumps	
Number	4
Type	Moyno Progressing Cavity
Capacity, gpm, each	150
Motor horsepower, each	10
Belt Filter Presses	
Number	2*
Belt width, meters	2
Loading rate, lbs/hr, each	1,200
Capture percent	95
Cake solids, percent	16

* The County is currently planning to purchase a third belt filter press for the SERWTP.

Table 2

Manatee County SERWTP

Existing Available Capacity

PROCESS	EXISTING AVAILABLE CAPACITY (MGD)
Headworks (overall)	8.0
Screening	24 (peak)
Grit Removal	40 (peak)
Anoxic Basin	7.5
Oxidation Ditch	7.3
Clarifiers[1]	7.6
RAS Pumping	7.5
Effluent Filters[1]	8.3
Disinfection	
Chlorinators	11
Contact Tanks[2]	5.4
WAS Pumping	11
DAF Thickeners	7.5
Aerobic Digestors/Blowers[3]	5.4
Belt Press (with increased operating hours)	11

(1) The existing clarifiers and filters have the hydraulic and/or loading capacity indicated above, however, these processes do not meet current FDEP Class I Reliability Requirements.

(2) The existing chlorine contact was designed to meet requirements in effect at the time of original design.

(3) The existing aerobic digestor capacity was designed based on criteria in effect in 1988. Current regulations will require this system to be upgraded at the time of plant modification.

3.0 EXISTING FLOW CONDITIONS

3.1 Monthly Average Daily Flows, Three-Month Average Daily Flows, And Annual Average Daily Flows

This section of the report presents the historical flow data for influent wastewater entering the Southeast Regional Treatment Plant. The data was obtained and reported in the recent Initial Capacity Analysis Report completed for the facility. The historical flow records have been questioned due to the discovery of slight errors in the metering of influent flows. The information is useful in establishing relationships of monthly averages to three month averages and seasonal flow variations.

Monthly Average Daily Flow is defined as the total volume of wastewater flowing into a wastewater facility during a calendar month, divided by the number of days in that month and expressed in units of MGD.

Three-month Average Daily Flow is the total volume of wastewater flowing into a wastewater facility during a period of three consecutive months, divided by the number of days in this three-month period and expressed in units of MGD. The three-month average daily flow also can be calculated by adding the three monthly average daily flows observed during this three-month period and dividing by three. The three-month average daily flow is a rolling average that is to be assessed for each month of the year.

Annual Average Daily Flow is the total volume of wastewater flowing into a wastewater facility during any consecutive 365 days, divided by 365 and expressed in units of MGD.

Tables 3, 4 and 5 present the monthly average daily flows, three-month average daily flows, and annual average daily flows, respectively for the SERWTP.

Table 3

Manatee County SERWTP

Monthly Average Daily Flows (MGD) [1]

Month/Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
January		0.93	1.31	1.65	1.54	1.99	1.81	2.41	2.43	2.40	3.49
February		0.98	1.34	1.76	1.67	2.00	1.85	2.31	2.48	2.53	3.88
March	0.94	1.02	1.60	1.78	1.83	1.97	1.94	2.28	2.72	2.49	3.29
April	0.98	0.92	1.15	1.69	1.56	1.95	1.79	2.12	2.59	2.42	2.72
May	0.78	0.87	1.21	1.62	1.47	1.75	1.70	2.01	2.23	2.34	2.40
June	0.71	0.88	1.06	1.56	1.82	1.74	1.66	2.33	2.34	2.19	2.32
July	0.78	1.08	1.23	1.61	1.81	1.64	1.83	2.23	2.23	2.31	
August	0.86	1.08	1.36	1.63	1.82	1.64	1.89	2.55	2.06	2.45	
September	0.97	1.36	1.24	1.46	1.63	1.76	1.87	2.66	2.11	2.46	
October	0.82	1.65	1.44	1.50	1.73	1.80	2.08	2.74	2.42	2.61	
November	0.88	1.38	1.52	1.44	1.74	1.86	2.24	2.67	2.45	2.94	
December	0.88	1.19	1.40	1.56	1.75	1.81	2.32	2.50	2.41	3.45	

(1) Influent flows for 1988 and 1989 based on original package plant.

Table 4

Manatee County SERWTP

Three-Month Average Daily Flows (MGD) [1]

Month/Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
January		0.90	1.29	1.52	1.52	2.00	1.83	2.32	2.53	2.42	3.29
February		0.93	1.28	1.60	1.59	1.97	1.83	2.35	2.47	2.45	3.61
March		0.98	1.41	1.73	1.68	1.99	1.87	2.33	2.55	2.47	3.55
April		0.97	1.36	1.74	1.69	1.97	1.86	2.24	2.60	2.48	3.29
May	0.90	0.93	1.32	1.69	1.62	1.89	1.81	2.14	2.51	2.43	2.80
June	0.82	0.89	1.14	1.62	1.62	1.81	1.72	2.15	2.38	2.32	2.48
July	0.76	0.94	1.17	1.59	1.70	1.71	1.73	2.19	2.26	2.28	
August	0.79	1.01	1.22	1.60	1.82	1.67	1.79	2.37	2.21	2.32	
September	0.87	1.17	1.28	1.57	1.75	1.68	1.86	2.48	2.13	2.41	
October	0.88	1.36	1.35	1.53	1.73	1.73	1.95	2.65	2.20	2.51	
November	0.89	1.47	1.40	1.47	1.55	1.81	2.06	2.69	2.33	2.67	
December	0.86	1.41	1.45	1.50	1.74	1.82	2.21	2.64	2.43	3.00	

(1) Influent flows for 1988 and 1989 based on original package plant.

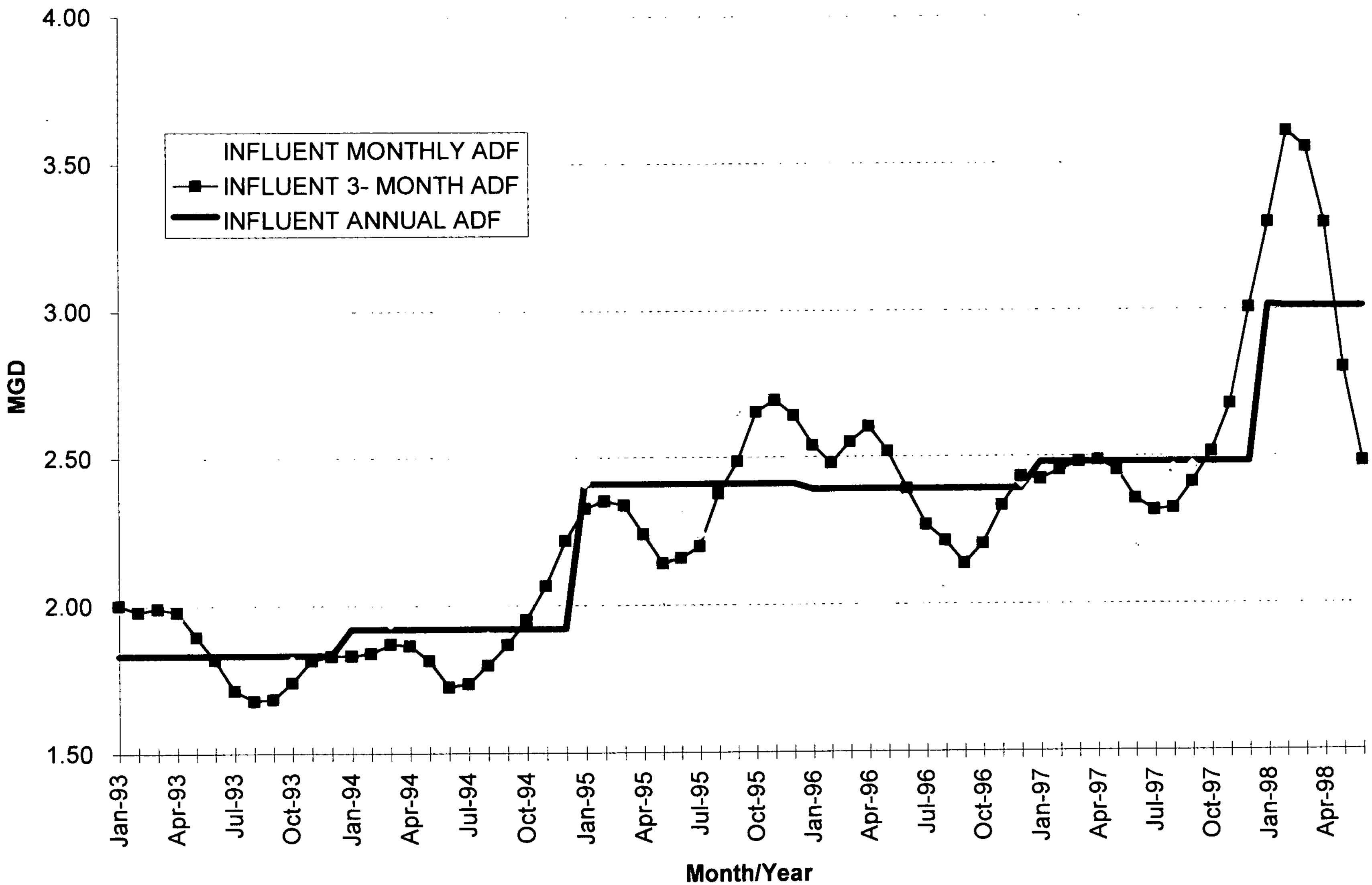
Table 5
Manatee County SERWTP
Annual Average Daily Flows (MGD) [1]

Year	Annual Average Daily Flows (MGD)
1988	0.86
1989	1.11
1990	1.33
1991	1.61
1992	1.70
1993	1.83
1994	1.92
1995	2.41
1996	2.39
1997	2.48
1998	3.01

(1) Influent flows for 1988 and 1989 based on original package plant.

The SERWTP monthly average daily flows, three-month average daily flows, and annual average daily flows for the past five years are presented graphically in the following chart.

SERWTP Monthly ADF, 3-Month ADF & Annual ADF



3.2 Seasonal Variation

The Manatee County SERWTP experiences significant seasonal variations in flow. The seasonal variation(s) were determined by comparing the maximum three-month average daily flow with the annual average daily flow for each of the past ten years. Table 6 presents the annual average daily flow, the maximum three-month average daily flow and the average ratio of the yearly maximum three-month average daily flow to the annual average daily flow for the past ten years. The table also identifies the month(s) of the year when the three-month average daily flow was maximum. The factor of Maximum Three Month ADF to Annual ADF is 1.12.

Table 6
Manatee County SERWTP
Seasonal Variations in Flows

Year	Annual ADF (MGD)	Max 3-MADF (MGD)	Max 3-MADF: Annual ADF	Max 3-MADF Month
1988	0.86	0.90	1.05	May
1989	1.11	1.47	1.32	November
1990	1.33	1.45	1.09	December
1991	1.61	1.74	1.08	April
1992	1.70	1.82	1.07	July
1993	1.83	2.00	1.09	January
1994	1.92	2.21	1.15	December
1995	2.41	2.69	1.12	November
1996	2.39	2.60	1.09	April
1997	2.48	3.00	1.20	December
Average			**1.12**	

3.3 Future Conditions

3.3.1 Population Projections/Southeast Service Area

The Southeast service area is bordered by the Manatee River on the north; Rye Road and the western two-thirds of Township 35 South, Range 19 East on the east; Sarasota County on the south; and a line extending approximately up the Braden River to 34th Avenue East, thence west to US 301 and south to the Sarasota County line on the west. Tallevast and portions of Samoset and Oneco are also within the service area. The Southeast service area encompasses approximately 65,000 acres. The area is experiencing relatively rapid growth as rural agricultural land is converted to residential uses.

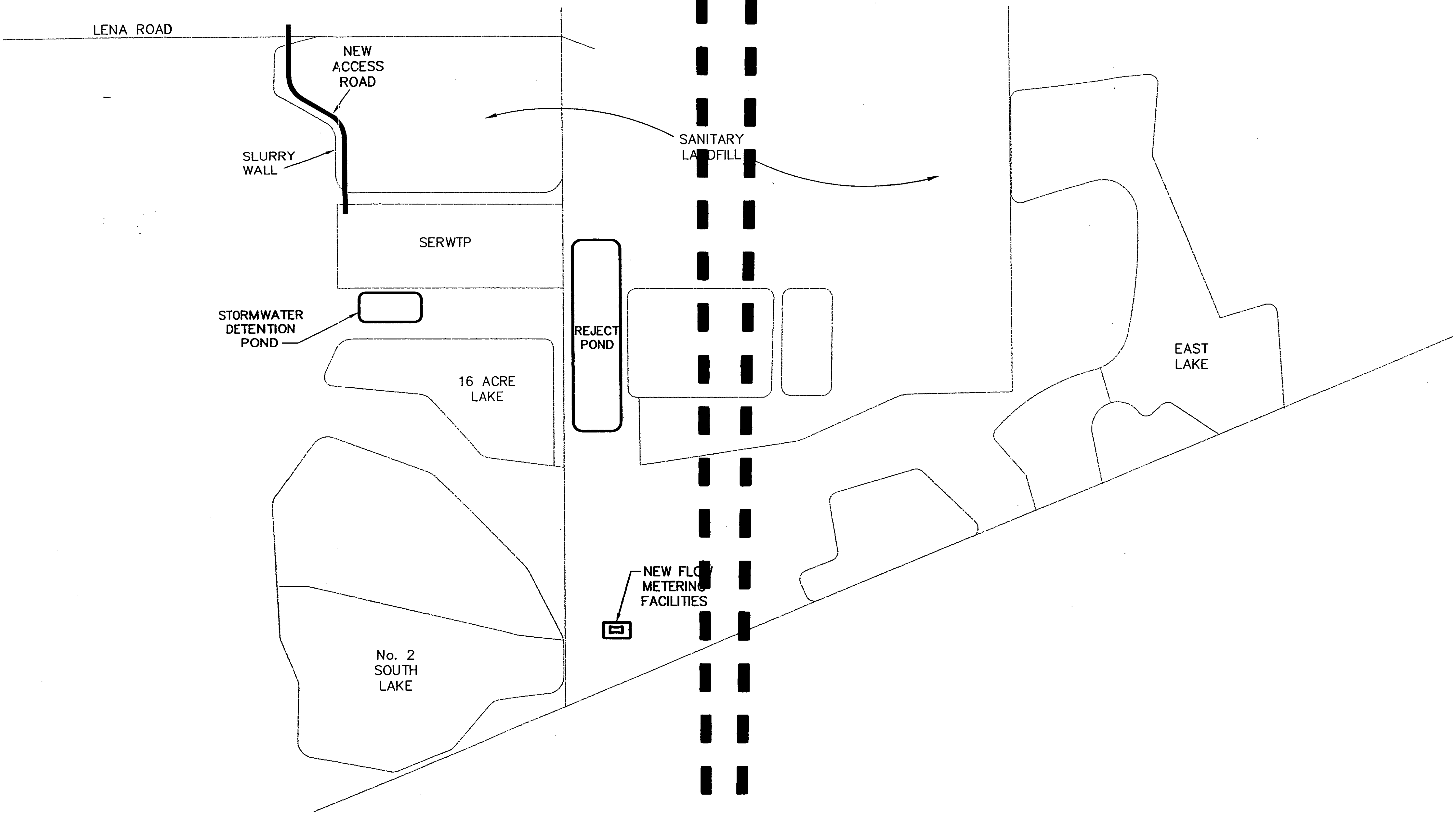
Population projections from 1999 to 2010 for the service area were developed by the Manatee County Planning Department in December 1997, 2011 through 2015 was calculated by McKim & Creed based on a 1.04 percentage increase. Table 7 presents the projected resident service area population on a yearly basis through 2015.

Table 7

Manatee County SERWTP

Projected Resident Service Area Population

Year	Projected Population
Current	38,835
1999	41,065
2000	43,294
2001	45,523
2002	47,752
2003	49,981
2004	52,210
2005	54,439
2006	56,668
2007	58,897
2008	61,126
2009	63,355
2010	65,584
2011	68,207
2012	70,935
2013	73,772
2014	76,723
2015	79,792



McKIM & CREED

CLEARWATER FLORIDA

MANATEE COUNTY

GENERAL SITE PLAN

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE: 6/11/98

MCE PROJ. # 1024-0008

DWG FILE # GENSITE.DWG

SCALE

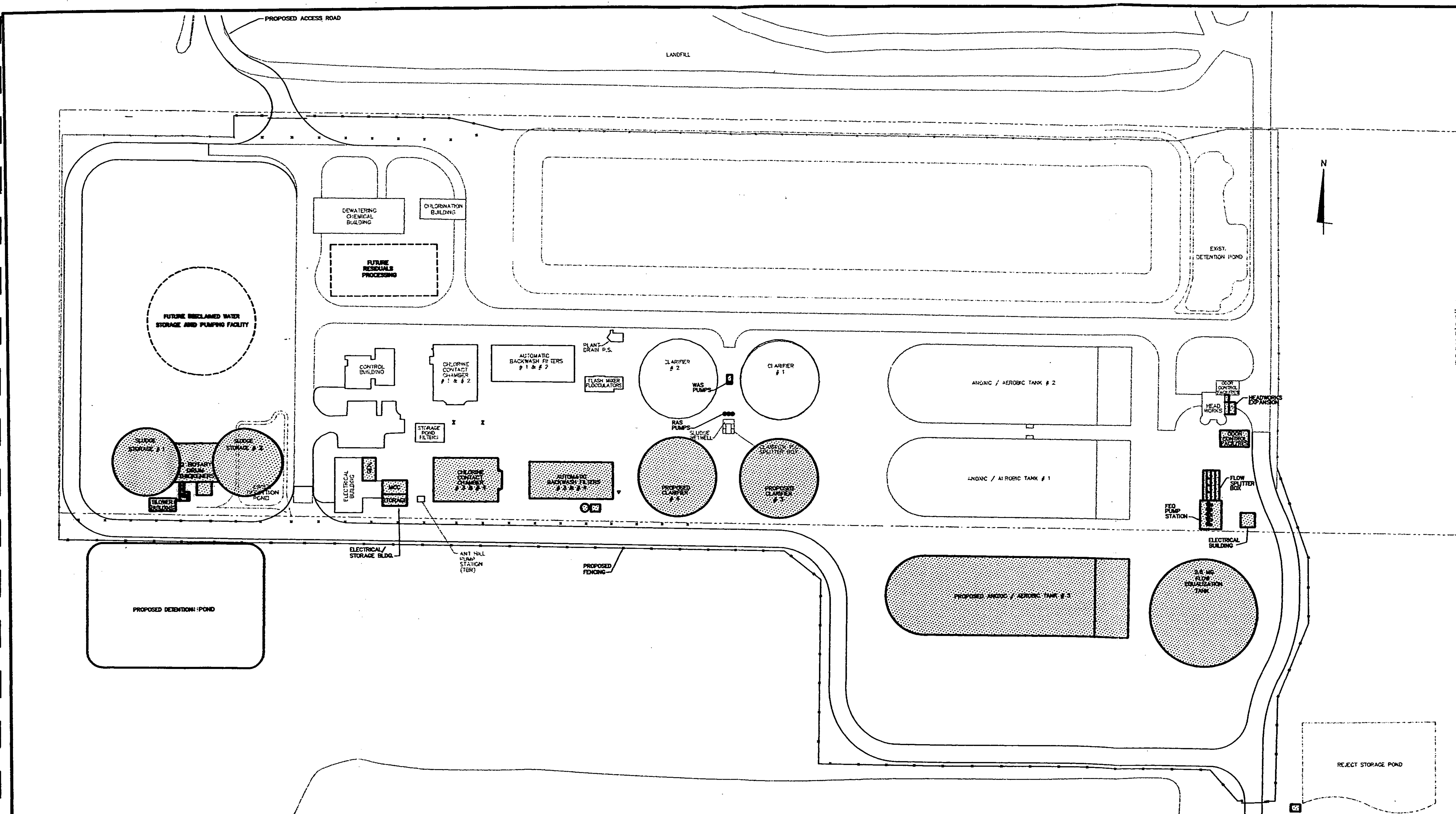
HORIZONTAL:

VERTICAL:

CLIENT DWG NUMBER

FIGURE NO.

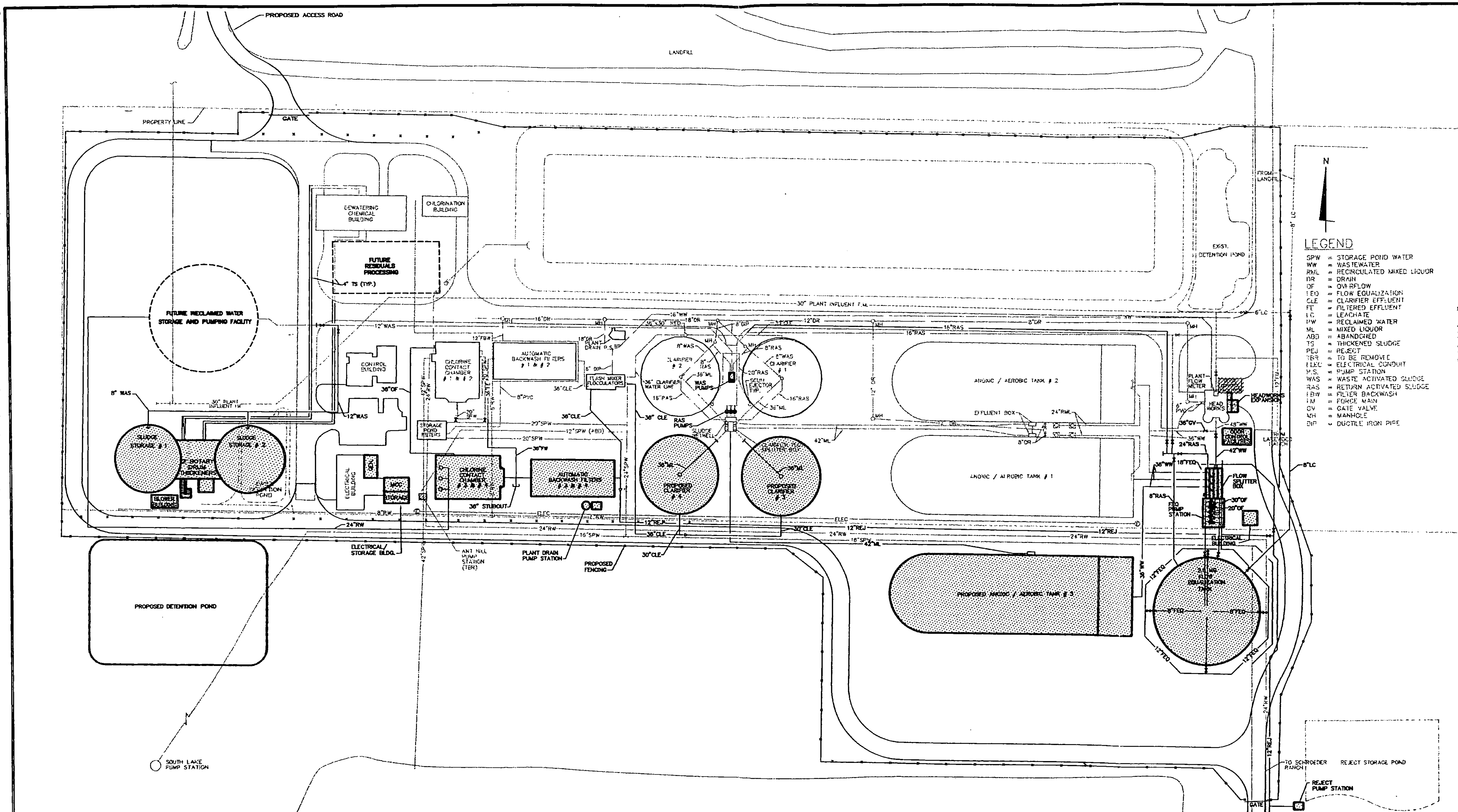
2



McKIM & CREED CLEARWATER FLORIDA	MANATEE COUNTY	PROPOSED SITE LAYOUT SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION	DATE: 6/11/98 MCE PROJ. # 1024-0008 DWG FILE # CSITE.DWG	SCALE HORIZONTAL: NTS VERTICAL: N/A

CLIENT DWG NUMBER

FIGURE NO. 3



McKIM & CREED

CLEARWATER FLORIDA

MANATEE COUNTY

PROPOSED SITE PIPING

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE:	6/11/98
MCE PROJ. #	1024-0008
DWG FILE #	CSITE.DWG

SCALE
HORIZONTAL: NTS
VERTICAL: N/A

CLIENT DWG NUMBER

FIGURE NO. 4

5.1.1 Site Security

The existing treatment plant site is fenced along all sides to prevent unauthorized entry into the process treatment areas. The treatment area is expanding beyond the existing fenced area, primarily to the south of the existing fence line. The fencing along the northern and western sides of the site can remain virtually intact. The expansion of the plant capacity will require the fencing along the south side to be relocated further south to encompass the added treatment units. In addition to expanding fencing to enclose the treatment process, fencing will also be required around the proposed reject storage pond.

The existing entrance to the treatment plant is at the northeast corner. This gated entrance will remain as a secondary access to the plant site. The new main entrance will be at the northwest corner due to proposed construction of a new access road along the northern perimeter of the landfill from Lena Road. A controlled access gate will be located at this entrance. A motorized gate will be included with provisions made for remotely controlling the gate from the administration building. The gate area will be equipped with video cameras to monitor access to the site.

Fencing is not included for the reclaimed water storage ponds. This is not required by FDEP, however, the County should take appropriate steps to sign, buffer and/or fence these ponds from adjacent property.

5.1.2 Site Lighting

Site lighting is provided currently along the roadway inside the plant site. Lighting fixtures are also existing at critical locations on process tankage where personnel access the equipment. Lighting of the new roadway areas will be provided by pole mounted 250W luminares located at spacings of approximately 160 feet. Additional pole mounted lighting will be provided on the new process tankage where personnel will be accessing equipment and other critical areas. Exterior lights will be provided near access doors on new MCC/Blower Buildings using wall mounted fixtures.

5.1.3 Reject Pond

Expansion of the plant capacity to 11.0 MGD will require increasing the existing 6.5 MG reject pond capacity to at least 11.0 MG per F.A.C. 62-610.464(3). The proposed solution is to construct a second reject pond adjacent to the east side of the plant area. The second pond will have sufficient volume (7.2 MG) to bring the total reject volume to 13.7 MG. The total volume was derived by subtracting the existing 6.5 MG from 12.65 MG plus the 100 year storm volume to the proposed pond with approximately 0.2 MG of excess storage due to dimensioning.

Design criteria of the new reject pond shall include: the exterior slope of the reject pond shall be 3:1; the interior slopes of the reject pond shall be 2:1; the reject pond shall be lined with a HDPE liner (or equivalent); the operating depth shall be 8 feet; a minimum maintenance water level of 1.5 feet will remain in the bottom of the reject pond and is not included in the operating volume; the crest of the overflow weir which contains the required operating volume shall be located at 1 foot below the top of bank of the pond for a minimum 1 foot of operating freeboard; the weir of the reject pond will be sized such that it will overflow the larger of the Maximum Average Daily Flow to the plant or the peak flow of a second consecutive 100 year 24 hour storm while maintaining a freeboard of 0.5 feet under peak flow condition; a flow path away from the existing reclaimed water storage ponds will be provided in the event that a discharge were to occur.

5.2 Proposed Hydraulic Profile

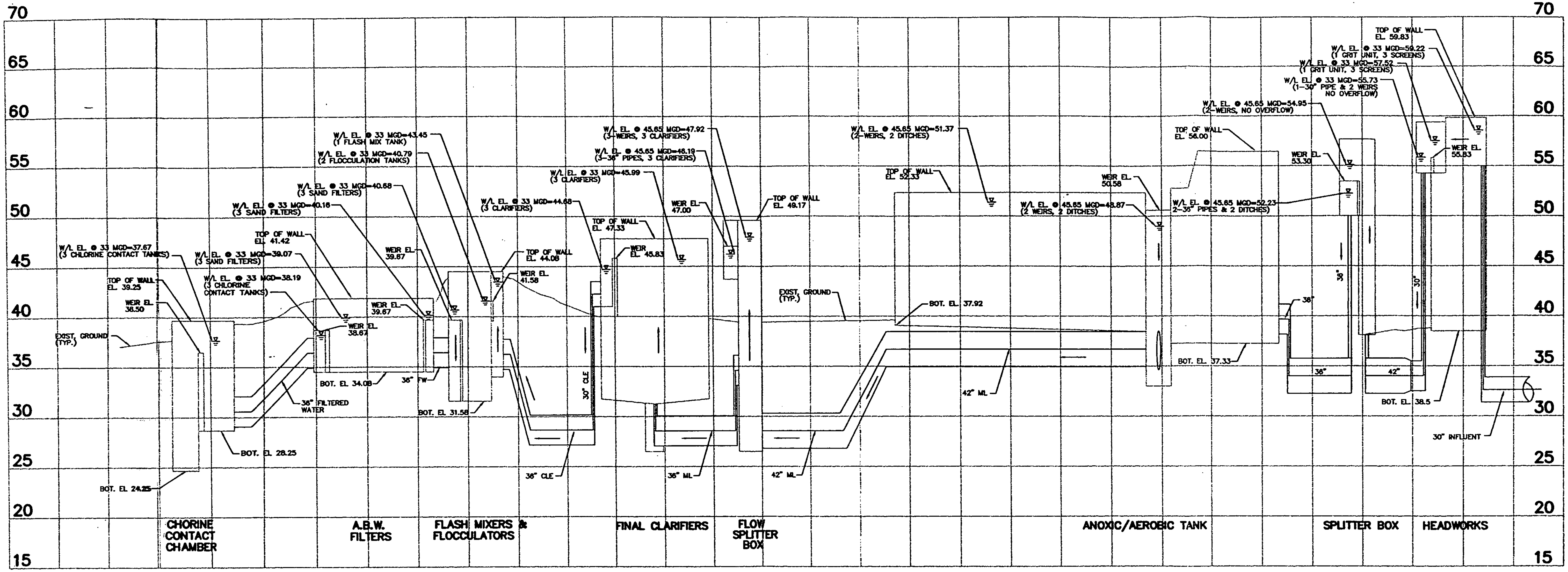
Figure 5 summarizes the proposed hydraulic profile for the expanded plant. The profile has been calculated assuming a peak flow of 33 MGD with the following units in operation:

1. Three mechanical screens.
2. One out of two grit removal units.
3. Two out of the three rectangular weirs in the flow splitter box.
4. Two out of the three anoxic basins.
5. Two out of three aeration basins.
6. Three out of four rectangular weirs in the flow splitter box.
7. Three out of four clarifiers.
8. Two flash mixers.
9. Two flocculation tanks.

10. Three out of four sand filters.
11. Three out of four chlorine contact tanks.

Flow through the two flow splitter boxes, the anoxic basins, and the aeration tanks includes an additional 12.65 MGD of return activated sludge as well the 33 MGD peak flow.

The hydraulic profile shows that the peak flow of 33 MGD can be conveyed through the wastewater treatment plant without flooding out any of its components with one of each unit out of service except for the mechanical screens in the headworks.



NOTES:

1. DESIGN AVERAGE DAILY FLOW = 11 MGD
2. DESIGN MAXIMUM DAILY FLOW = 12.65 MGD
3. DESIGN PEAK PLOW = 33 MGD
4. DESIGN RETURN ACTIVATED SLUDGE RATE = 12.65 MGD
5. HEADWORKS, FLOW SPLITTER BOX, CLARIFIER EFFLUENT, FLASH MIX TANK, FLOCCULATION TANK, SAND FILTERS, AND CHLORINE CONTACT TANKS DESIGNED FOR HYDRAULIC LOADING OF 33 MGD PEAK FLOW.
6. FLOW SPLITTER BOX, OXIDATION DITCH, AND CLARIFIER INFLUENT DESIGNED FOR A HYDRAULIC LOADING OF 45.65 MGD PEAK FLOW (12.65 MGD RETURN ACTIVATED SLUDGE PLUS 33 MGD PEAK FLOW)

McKIM & CREED
CLEARWATER FLORIDA

MANATEE COUNTY

HYDRAULIC PROFILE

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE: 6/11/98
MCE PROJ. # 1024-0008
DWG FILE # HD-PROFILE

SCALE
HORIZONTAL: NTS
VERTICAL: 1"=5'

CLIENT DWG NUMBER

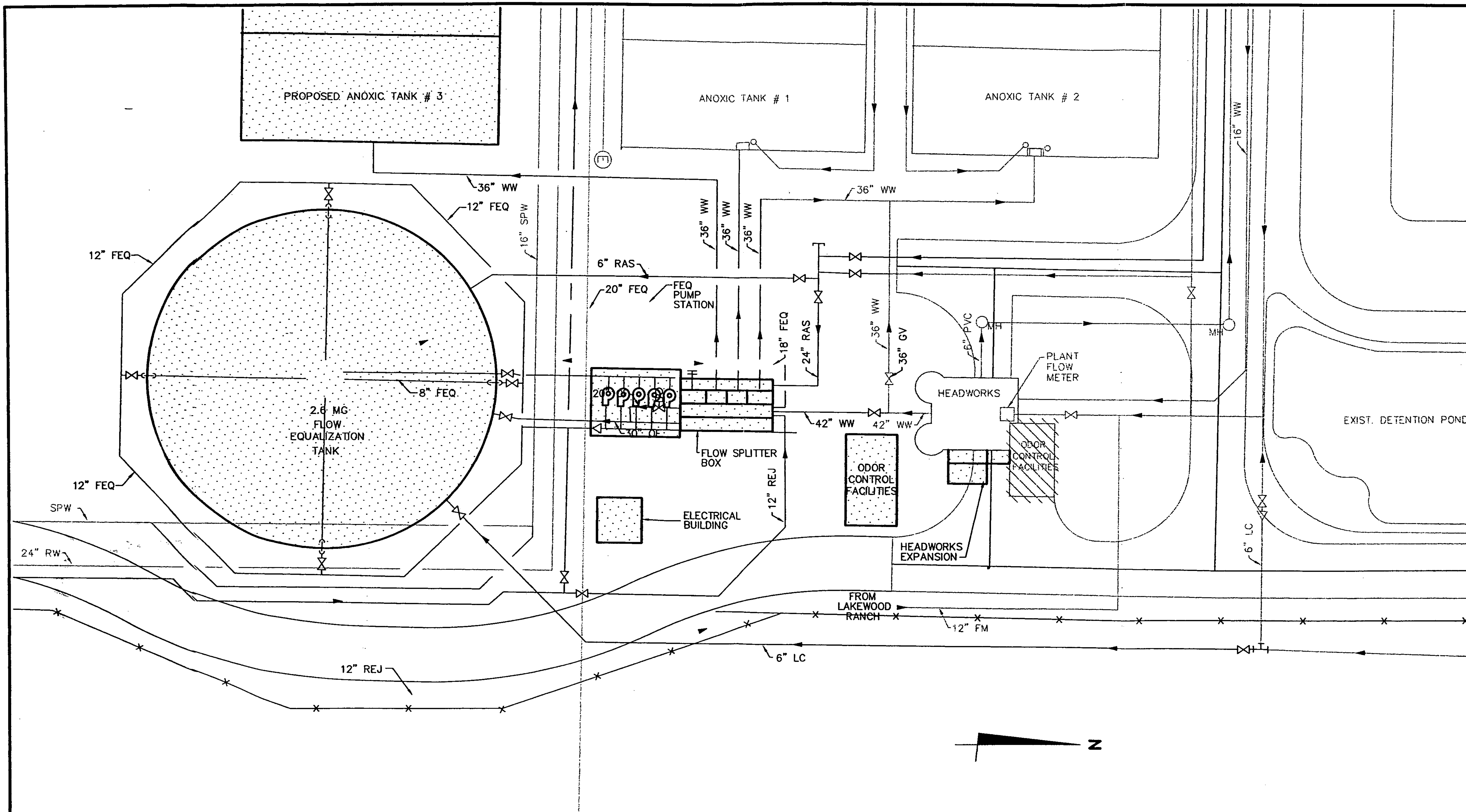
FIGURE NO. 5

5.3 Proposed Flow Equalization Tank

Peak wastewater flows to the SERWTP will be diverted to a 2.6 MG flow equalization tank after flowing through the headworks structure. Overflow weirs in the proposed splitter box will allow the peak flows to discharge to the flow equalization tank. In addition, a motorized valve on a pipeline connected to the influent section of the splitter box will allow wastewater flow to be diverted to the flow equalization tank during normal flow periods. This option will provide for operational flexibility.

The 2.6 MG capacity will provide volume for peak wastewater, leachate and RAS flows. The capacity needed for flow equalization on a maximum day (12.65 MGD) was determined using an inflow mass diagram and a typical diurnal flow pattern for influent flows. The resultant storage volume required for influent wastewater was determined to be 1.3 MG. An additional 1.3 MG of capacity will provide the County with the needed volume to divert leachate from the landfill to the equalization storage through a metered diversion pipeline and to manage peak inflow due to stormwater events. The leachate will normally be pumped to the headworks and combined with raw influent. The diversion is necessary in order to control leachate and stormwater pond levels at the solid waste facility to the required levels and to prevent heavy inflows of leachate to the treatment units which could upset plant processes. A small metered flow of RAS will be recycled to the equalization tank to acclimate the organisms to the leachate prior to being pumped into the proposed splitter box. The volume of the equalization tank also provides operational flexibility for handling unusual influent flow events.

A dedicated submersible pump station will be constructed to serve two purposes. The first purpose will be to pump the contents of the flow equalization tank back to the plant flow splitter box. The second purpose will be to recirculate a portion of the equalization tank contents for mixing and aeration purposes. Wastewater will be withdrawn from a sump in the center of the equalization tank and returned to four (4) radial headers. The proposed equalization pump station will have five (5) single speed pumps, each with a capacity of 2,000 GPM. Each header will have air eductors to provide air to meet minimal oxygen demands. Additional mechanical aerator capacity will be provided to meet higher oxygen demands created with leachate inflow. Figure 6 shows a general arrangement of this facility.



McKIM & CREED

CLEARWATER FLORIDA

MANATEE COUNTY

EQUALIZATION TANK CONFIGURATION

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE:	6/11/98
MCE PROJ. #	1024-0008
DWG FILE #	EQTANK1.DWG

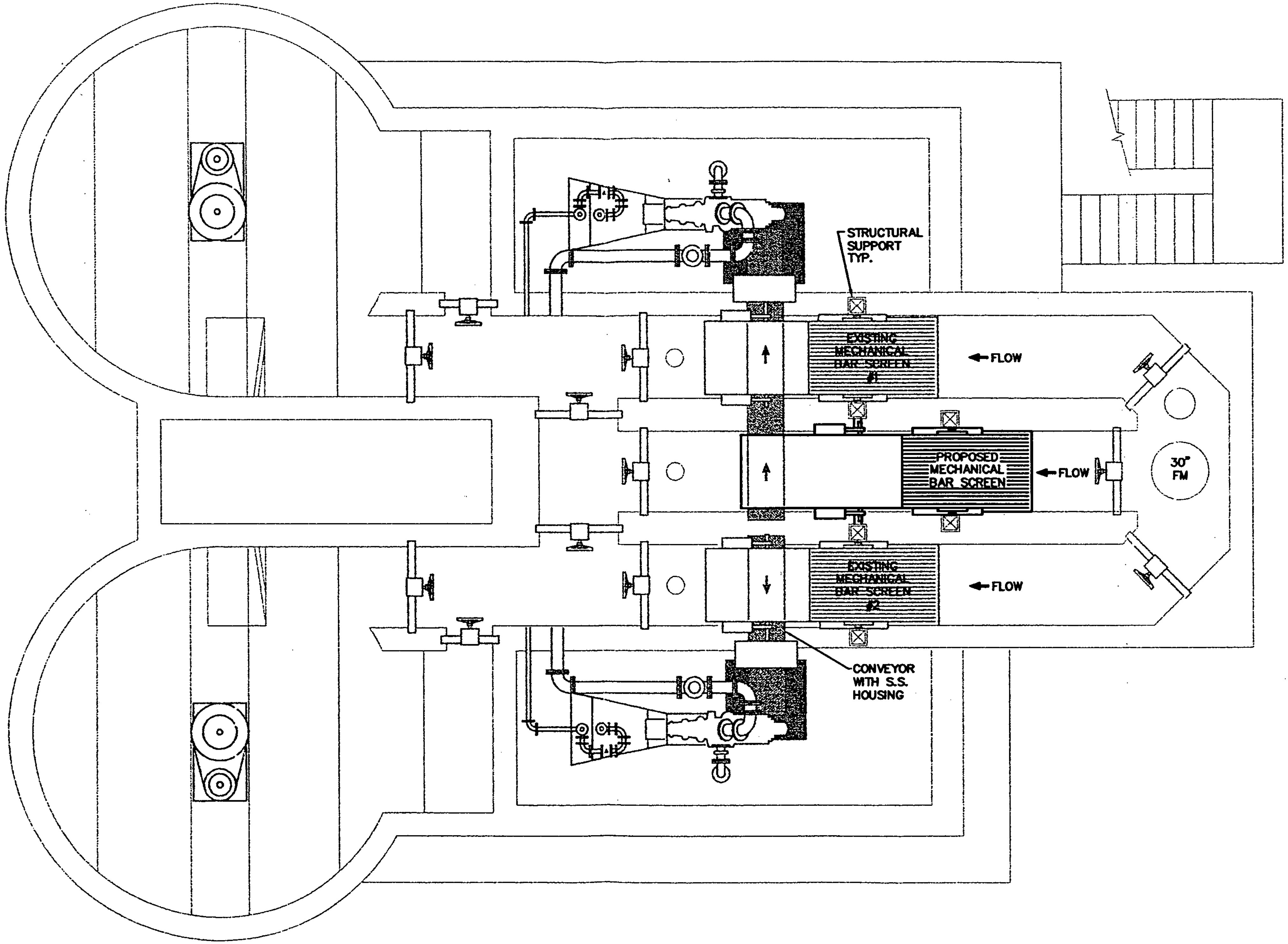
SCALE	
HORIZONTAL:	
VERTICAL:	

CLIENT DWG NUMBER	
FIGURE NO.	6

5.4 Proposed Influent Structure Modifications

The existing influent structure receives wastewater flow through a 30-inch wastewater force main and a 16-inch plant drain pump station force main. The existing structure has three parallel flow channels, two of which are equipped with self-cleaning Parkson Aquaguard screens. The third channel is equipped with a manually cleaned barscreen, which is used as a bypass if the mechanical screens are out of service or clogged during high flows. The existing influent structure also has two grit removal units, each of which has a maximum flow capacity of 20 MGD. The peak capacity of each mechanical screen is 12 MGD.

As part of this project, we propose to add a third mechanical screen to provide for a peak flow capacity greater than 33 MGD. The existing grit removal units are sufficient for the proposed peak flow. Shown in Figures 7 and 8 are two options for installing the proposed third mechanical screen which have different capital costs and reliability factors. Option A provides for the installation of a mechanical screen in the existing bypass channel. The manual screen would have to be removed and the existing auger conveyor system extended to serve the third screen. The new mechanical screen may have to be offset several feet upstream of the existing two in order to avoid structural conflicts. The new mechanical screen will have to be extended higher than the other two in order to locate its discharge chute over the auger conveyer. The angle of the discharge chute with the horizontal cannot be reduced due to conveyance requirements for the screenings. Option A would require less capital expense and less time to implement, but it has lower reliability since there would be no bypass. If a mechanical screen breaks down, the only option is to tilt the screen out of the channel or remove it entirely. On the other hand, Option A is sufficient if an entirely new headworks structure is to be built for future treatment plant expansion.



McKIM & CREED

CLEARWATER FLORIDA

MANATEE COUNTY

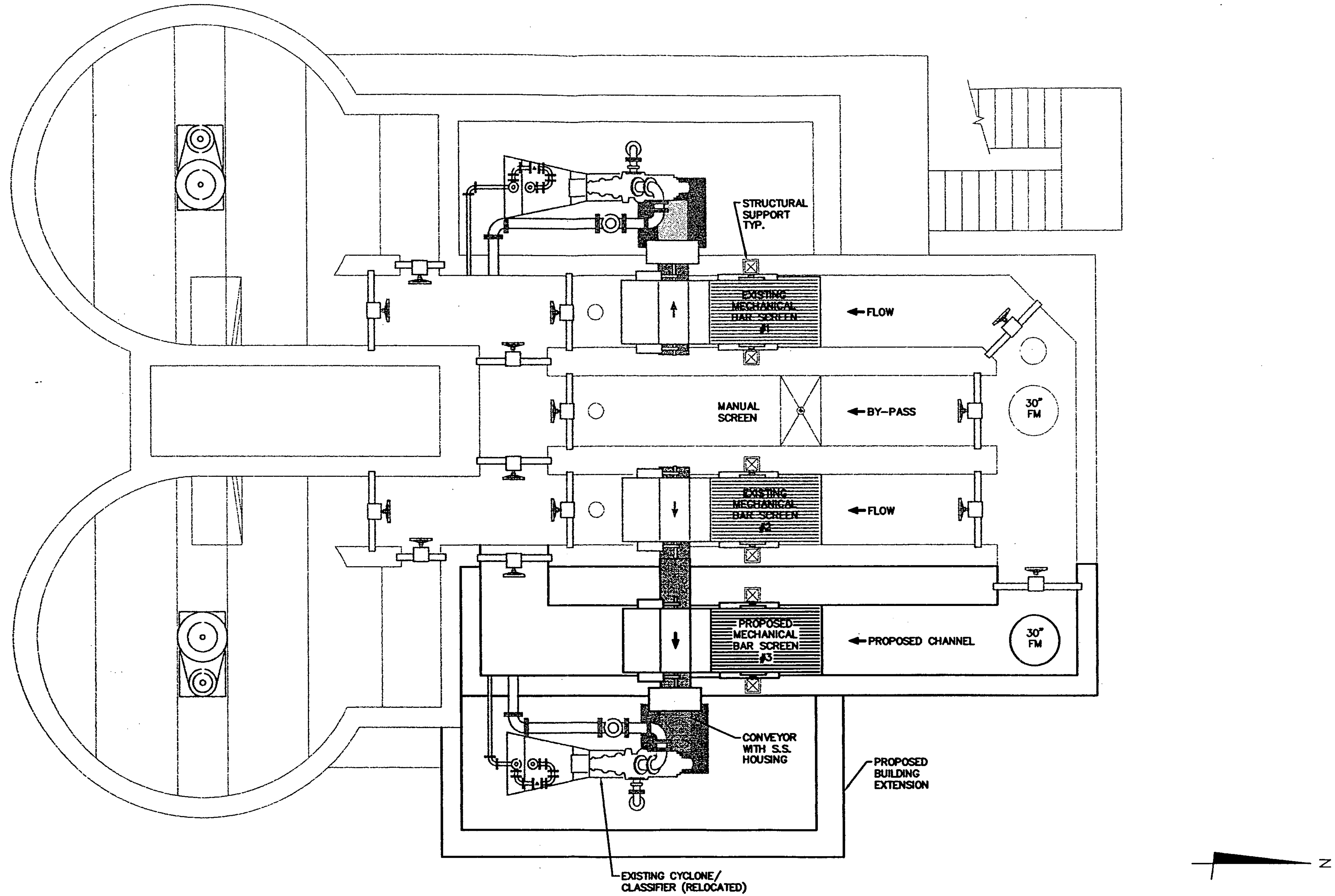
INFLUENT STRUCTURE MODIFICATIONS 'OPTION A'

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE:	6/11/98
MCE PROJ. #	1024-0008
DWG FILE #	

SCALE	
HORIZONTAL:	
VERTICAL:	

CLIENT DWG NUMBER	
FIGURE NO.	7



McKIM&CREED
CLEARWATER FLORIDA

MANATEE COUNTY

INFLUENT STRUCTURE MODIFICATIONS 'OPTION B'
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE:	6/11/98
MCE PROJ. #	1024-0008
DWG FILE #	

SCALE
HORIZONTAL: 3/16"=1'-0"
VERTICAL: N/A

CLIENT DWG NUMBER

FIGURE NO. 8

Option B provides for constructing a new fourth channel for the proposed third mechanical screen. The existing bypass channel would remain. The existing cyclone/classifier would be relocated further to the east in a new building extension, which would also house the dumpster that collects the screenings and grit. Otherwise, the cyclone/classifiers are adequately sized for the increase in screenings. The existing auger conveyor system would have to be modified to serve the third screen. Option B is more costly because of its structural requirements, however, it is more reliable because it provides for the bypass channel and because the screens are more accessible. This options provides the County with a reasonable opportunity to construct a parallel force main and connect into the headworks in the future as well as possibly add a fourth mechanical screen to provide a total screen capacity of 48 MGD at some time in the future.

The new channel and an extended portion of the top slab and lower wall enclosure will be added along the east side of the structure. The top slab will provide support for the bar screen and extended screw conveyor system. The walls under the top slab will provide support to the slab and channel and will provide an enclosure for the lower level of the influent structure.

A portion of the existing top slab and masonry walls will be removed to accommodate construction of the new channel and top slab. The existing odor control equipment and concrete slab at grade near the northeast side of the influent structure will also be removed. The existing odor control system has to be replaced with a larger system under either option.

The reinforced concrete channel will be supported by a system of new spread footings and walls which will be tied into the existing structure by drilling and grouting reinforcing bars into the existing structure. The channel will be connected to the existing channel system by using short sections (3 feet long) of 36 inch diameter pipes. The pipes will bridge between the existing and new portions of the structure and will accommodate any differential movements between the new and old structures through use of link seal flexible wall connectors. The existing channel walls will be core drilled with a 40 inch core to provide room for the elastomeric seals which will be inserted between the outside of the pipe walls and the inside diameter of the cored concrete wall. Cost for the structural modifications are estimated to be $20,000 for demolition and $40,000 for the new construction.

5.4.1 Odor Control

A new odor control system is proposed that will serve the Headworks and the new Flow Splitter Box. Three alternative systems have been reviewed. These include 1) Packed Chemical Scrubbers, 2) Activated Carbon Scrubbers, and 3) Bio-filtration Systems. The assumptions made to evaluate each of these alternatives includes an air flow requirement of 3000 cubic feet per minute with a hydrogen sulfide concentration of 75 mg/l. These parameters should provide a conservative estimate of air scrubber system costs.

The capital costs for the packed scrubber are the lowest of the alternatives, in the range of $100,000 for an easily maintained system like the system operated at the County's Southwest plant. This system will utilize sodium hydroxide and sodium hypo-chlorite for reacting with the hydrogen sulfide in the exhaust air stream. This will increase the operational costs and require the handling of these chemicals on the site.

The capital costs for the carbon systems range from $125,000 up to $200,000, not including the cost of new carbon. The 75 mg/l sulfide concentration estimate would require a conventional adsorber to regenerate every month, whereas the newer systems as manufactured by Phoenix would operate for 6 to 12 months before regeneration is required. Nevertheless, the assumption of 75 mg/l hydrogen sulfide concentration makes carbon the highest present worth cost of the three.

Biofilters are developed in two ways predominantly. The first is an arrangement of prefabricated biocubes which requires more piping and valves than the other alternatives, but work well if you can get even air distribution across all the media. The second style is a single filter on a concrete slab, built on-site by the contractor. The difficulty with this approach is uniform air distribution and humidity control in the device. This option will require operational staff to monitor and maintain the system closely for continued effective operation. Typical hydrogen sulfide removal rates are only about 90%. All biofilters experience a degree of bleed through over time. The media will have to be replaced in roughly 3 to 5 years. Typical costs for a 3,000 cfm biofilter will be from $200,000 to 300,000.

Based on the lower capital costs and the reliability of operation, we recommend a packed scrubber and the County has concurred with this recommendation.

5.5 Proposed Flow Splitter Box

A flow splitter box will be constructed to meter out the incoming wastewater and return activated sludge equally to the three anoxic/aeration basins. The flow splitter box will have six adjustable rectangular weirs, three each 5-feet in length, and three each 10 feet in length. Each of the 5-foot weirs will discharge to its specific anoxic/aeration basin.

The 10-foot weirs will act as an overflow when peak flows are experienced at the plant. The 10-foot weirs will discharge to the flow equalization tank. Ideally, the six weirs will be adjusted to allow peak flow to be diverted to the flow equalization tank, providing a more uniform flow rate through the plant both day and night.

5.6 Proposed Process Schematic

The existing process flow design will be maintained in this expansion with three equal, parallel anoxic/aerobic treatment trains. Figure 9 summarizes the proposed arrangement.

5.7 Proposed Oxidation Ditch Expansion

The existing two oxidation ditches will be rehabilitated with concrete repair in selected points. The existing aerators will not be replaced at this time, but new 125 Hp aerators will be installed in the open third aerator position of each basin. A new third Carrousel train will be constructed to the south of the existing two trains as part of the expansion. The new Carrousel will be constructed in the modern De-NitR configuration where internal recycle will be pumped by the action of the aerator, rather than by an external pump. The resulting ditch will be more process efficient, having a greater proportion of nitrate recycle, while being lower in energy demand. The new third train will have three two-speed, 125 Hp aerators similar to the existing basins.

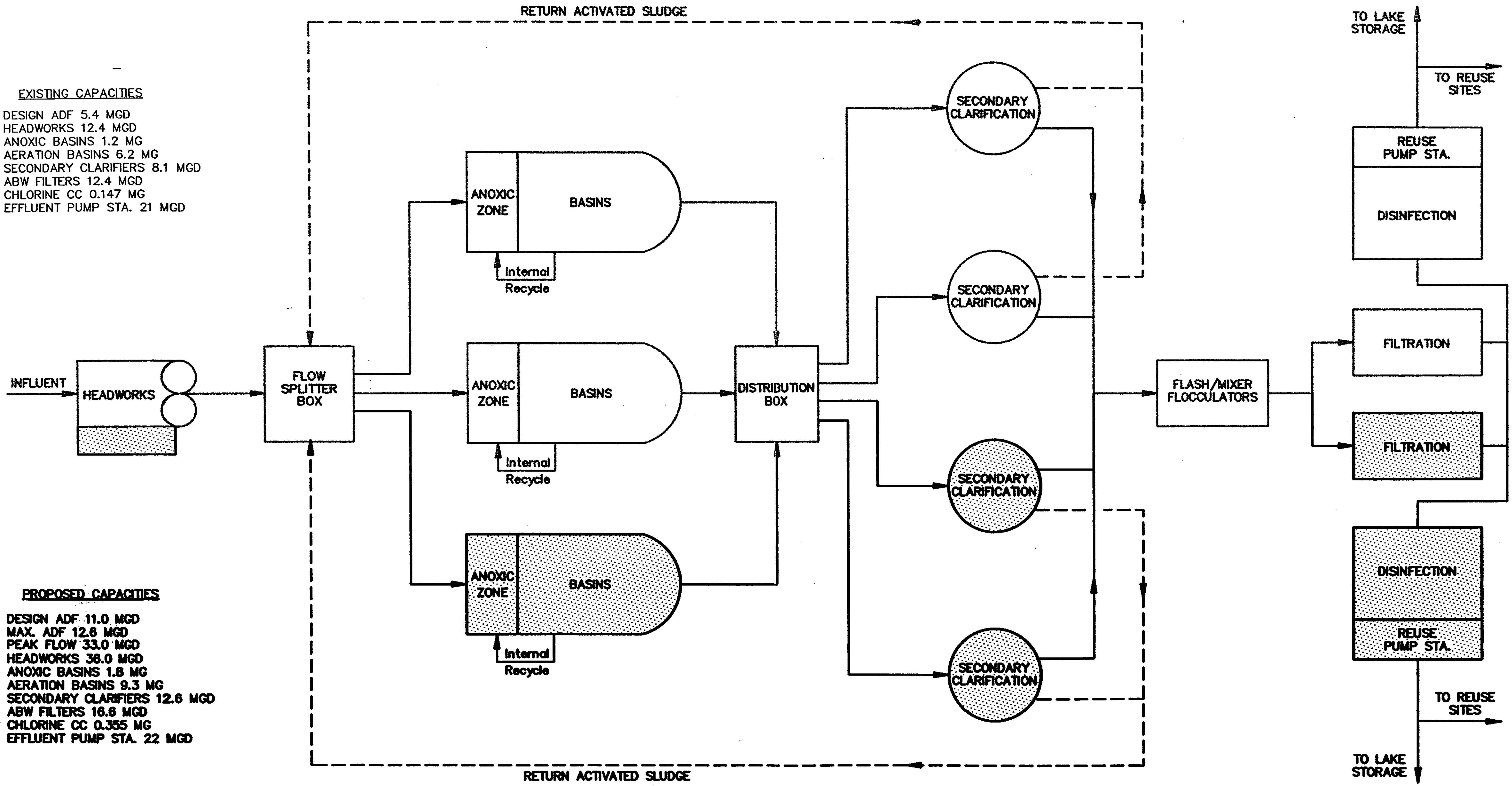
The revised and expanded facility will be designed for equal flow through all three process trains, for a total design maximum ADF of 12.65 MGD or 4.22 MGD per train. Each train will have its companion anoxic basin with no interconnection between the trains. The existing trains will continue to use the existing RML pumps for the internal recycle flow. The existing mechanical aerators use an older style single turbine design.

EXISTING CAPACITIES

DESIGN ADF 5.4 MGD
HEADWORKS 12.4 MGD
ANOXIC BASINS 1.2 MG
AERATION BASINS 6.2 MG
SECONDARY CLARIFIERS 8.1 MGD
ABW FILTERS 12.4 MGD
CHLORINE CC 0.147 MG
EFFLUENT PUMP STA. 21 MGD

PROPOSED CAPACITIES

DESIGN ADF 11.0 MGD
MAX. ADF 12.6 MGD
PEAK FLOW 33.0 MGD
HEADWORKS 36.0 MGD
ANOXIC BASINS 1.8 MG
AERATION BASINS 9.3 MG
SECONDARY CLARIFIERS 12.6 MGD
ABW FILTERS 16.6 MGD
CHLORINE CC 0.355 MG
EFFLUENT PUMP STA. 22 MGD



McKIM & CREED
CLEARWATER FLORIDA

MANATEE COUNTY

PROCESS SCHEMATIC

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE: 6/11/98
MCE PROJ. # 1024-0008
DWG FILE #

SCALE
HORIZONTAL:
VERTICAL:

CLIENT DWG NUMBER

FIGURE NO.
9

The new oxidation ditch will include mechanical aerators equipped with a dual turbine design that will be substantially more efficient process-wise and lower in energy consumption. Compared to the older style single turbine impeller design, the new dual turbine will allow a power turndown capability of nearly 80% of the connected horsepower, thus allowing substantial energy conservation potential.

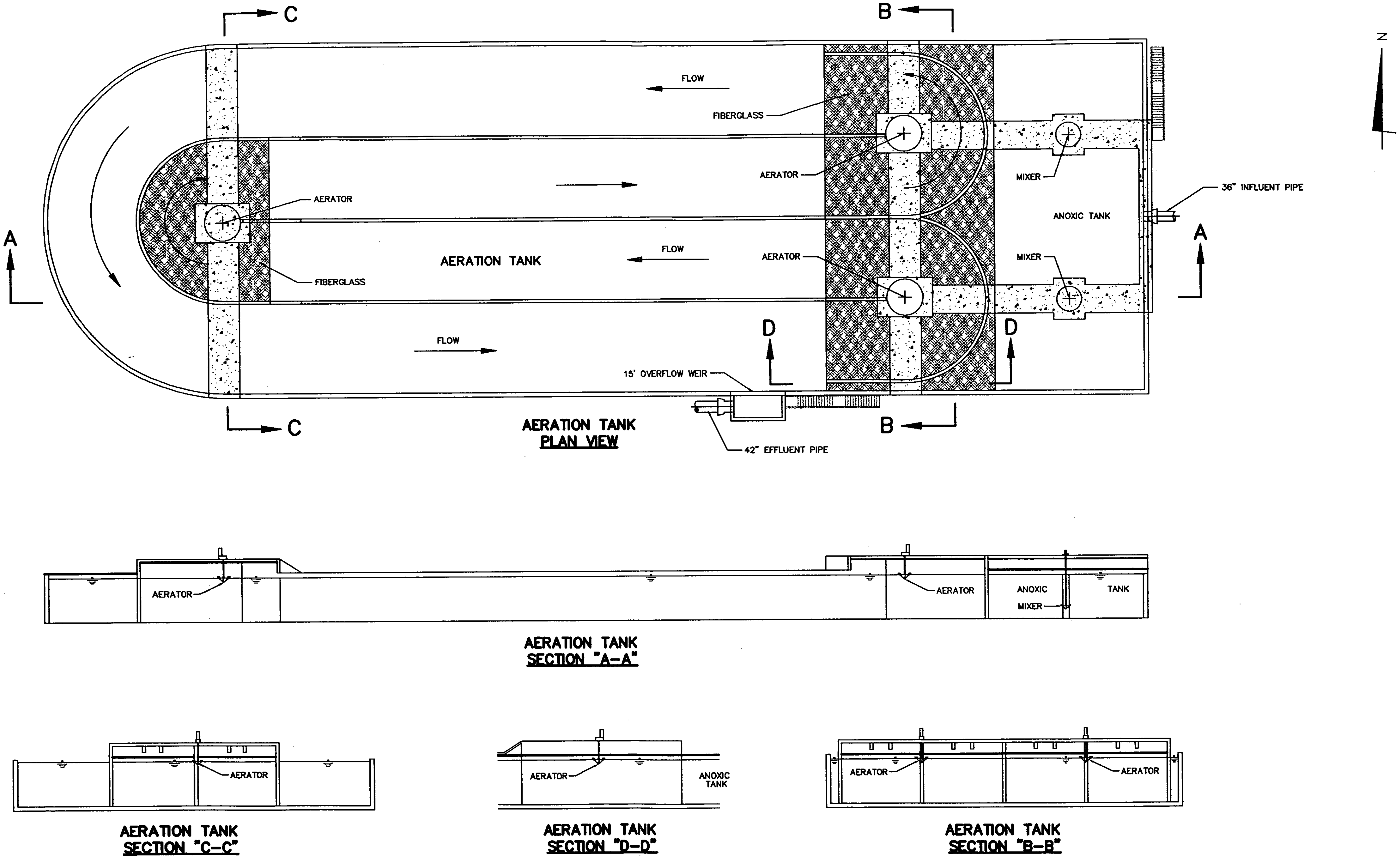
Figure 10 shows a plan view of the proposed layout of the new oxidation ditch and anoxic tank.

5.7.1 Splash Covers

The existing basins have solid concrete decks to contain splashing and aerosol formation. We recommend the use of high density, high impact fiberglass splash covers in both the vertical opening, as well as the horizontal splash area for the new oxidation ditch. The segmented fiberglass covers offer better splash and aerosol protection due to the ability to place a vertical segment of the cover over the aeration channel opening on the discharge side of the mechanical aerator. The fiberglass covers will provide more flexibility and access to equipment under the covered area. The constructed cost of both types of covers is similar, but the sectioned fiberglass covers offer substantially more flexibility to the operators.

5.8 Proposed Clarifier Expansion

Two new 110 foot diameter rapid suction clarifiers will be installed and connected to the existing flow splitter box and piping connections. The new clarifiers will be constructed with dual inboard weirs and troughs to increase the available weir area beyond that available in the existing units. The new clarifiers will be constructed with full radius scum troughs with surface mounted scum skimmer in lieu of the ducking type mechanism. Once constructed, all clarifiers will be cross-connected to all three treatment trains. The design loading rate of all four clarifiers at ADF will be less than 300 gpd/ft^2. With one clarifier out of service, the remaining clarifiers will have a capacity of 11.4 MGD at an overflow rate of 400 gpd/ft^2.



McKIM & CREED

CLEARWATER FLORIDA

MANATEE COUNTY

WASTEWATER TREATMENT PLANT EXPANSION
AERATION TANK

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE: 6/11/98

MCE PROJ. # 1024-0008

DWG FILE #

SCALE

HORIZONTAL: 1/32"=1'-0"

VERTICAL:

CLIENT DWG NUMBER

FIGURE NO. 10

5.9 Proposed RAS and WAS Pumping

5.9.1 Return Activated Sludge Pumps

The existing clarifiers are piped to a sludge pumping station for returning activated sludge to the oxidation system. Three vertical centrifugal pumps, each with a capacity of 2,400 gpm, return RAS by a 16" pipeline to the pipe header system carrying screened wastewater to the anoxic tanks. The wet well structure that exists was provided with two connection pipes stubbed out for future clarifier additions.

We propose to utilize this existing sludge wet well for the two new clarifiers in addition to the existing clarifiers. The existing pumps, motors and variable speed magnetic drive controls will be removed. Three new 4,400 gpm pumps and motors will be installed to gain the additional capacity required. An additional 16" RAS pipeline will be constructed to connect to a proposed distribution box following the headworks structure. The proposed pumps will be variable speed using variable frequency drives. To address the control of sludge draw-off flows from the four clarifiers, we will incorporate modifications to the existing valve and piping arrangement at the two existing clarifier sludge wells.

The existing structure which covers the RAS pumps limits the ability to remove and maintain the motors and pumps in their current configuration. We propose to modify the existing structure to allow for better access to the pumping units which will include a monorail for removal/replacement of the pumping units and transferring them to a location accessible by a flat bed truck. The monorail system will be supported by the existing structure overhead until the rails extends beyond the building line where new structural steel columns will support the rails to the offloading point between clarifiers. The cost for the structural modifications associated with this option are estimated to be $5,000 for demolition and $70,000 for the new construction.

5.9.2 Waste Activated Sludge Pumps

The two existing waste activated sludge pumps pull sludge from either the sludge wet well or off the bottoms of the clarifiers and pump it to the existing sludge thickeners/hold tanks. Each constant speed pump has a capacity of 250 gpm and is normally operated on a timed basis. The existing WAS piping has stubouts for two additional pumps and the two proposed clarifiers. We propose to add two WAS pumps at the locations provided. Each pump will have a capacity of 250 gpm and will be variable speed using variable frequency drives. The existing WAS pumps will be converted to variable speed as well.

5.10 Proposed Filter Expansion

Two new filter units will be constructed on the south side of the existing filters. Each shall be sized for a comparable, equal flow load distribution, as with the other parts of the process. The filter influent troughs and effluent channels will be connected to give common connections with every unit operating in parallel. Each filter will have an area of 1,440 ft^2 with an average flow loading rate of less than 2 gpm/ft^2 at a maximum daily flow of 12.65 MGD. Total filter area on site would then be 5,760 ft^2. With one cell out of service, the remaining filters will have a capacity of 12.4 MGD at a surface loading rate of 2 gpm/ft^2. At peaking conditions of up to 5 gpm/ft^2, the three filters will be capable of processing up to 31.1 MGD of peak flow.

The existing filters are low head polishing units based on a traveling bridge design. They include a dual media design with a water only backwash mechanism. This represents technology that is available from several manufacturers. There is also more modern technology available that we propose to design upon.

In the Florida climate, the potential for algae growth in shallow surficial filters is very high. This is particularly true if a pond water recycle is implemented. We recommend an improved version of the traveling bridge filter be utilized as the basis of design. The newer traveling hood filters combines the best features of the older style traveling bridge design, without the shortcomings that time and experience have shown us. For example, it can be designed with an end discharge arrangement that allows for a smaller concrete basin, with fewer channels and lower overall capital cost. Biological growth within the media has long been a problem in our climate. The new filters can include an air scour mechanism in addition to the traditional water backwash. There is an incremental cost difference to provide this feature. The combination of the two is far more efficient at keeping the filters clean than the existing design. Finally, the newer designs provide for better cell dividers that greatly reduce media loss through the underdrains and vastly reduce unit maintenance requirements.

We recommend that the basis of design be the traveling hood to get the best technical approach, but include in the bid package an option for the Contractors to bid a traditional traveling bridge filter as an alternate to provide a competitive bidding approach for this item.

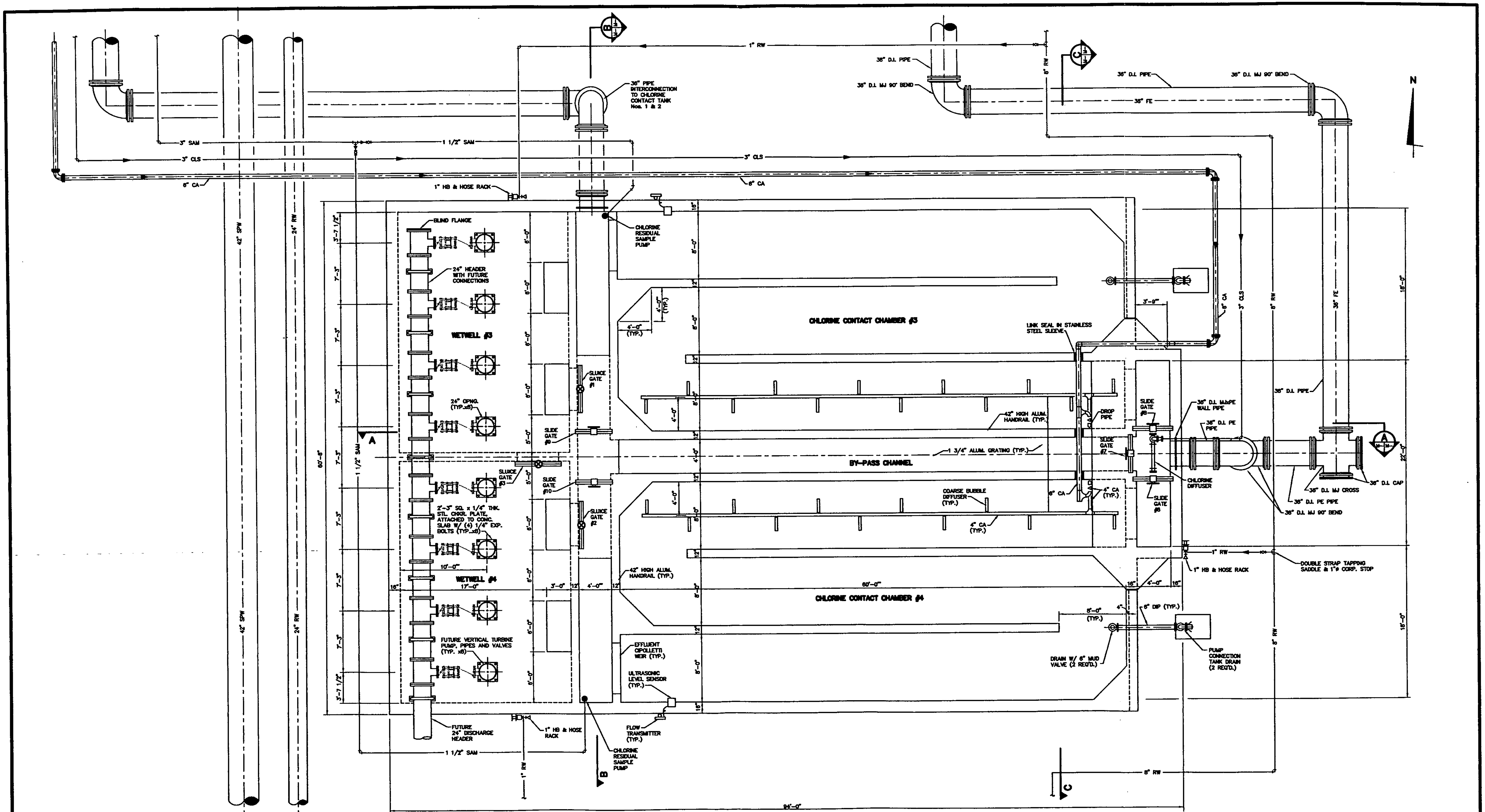
5.11 Proposed Chlorine Contact Tank Expansion

The FDEP requires that chlorine contact tanks have a minimum detention time of 15 minutes at peak flow. Normal engineering practice requires a detention time of 30 minutes at average daily flow. The existing chlorine contact tanks were designed for a capacity of 5.4 MGD average daily flow. The existing tanks have a volume of 161,590 gallons which provide a detention time of 42 minutes at average daily flow and 14.4 minutes at peak flow. The proposed chlorine contact tank expansion has to be slightly larger than the existing in order to meet the peak flow detention time requirements.

The proposed chlorine contact tank expansion will be 10 feet longer than the existing, providing a new maximum operating volume of 193,910 gallons. The existing and proposed chlorine contact tanks will have a total volume of 355,500 gallons providing 40.5 minutes of detention at the maximum daily flow of 12.65 MGD and 15.5 minutes at the peak flow of 33 MGD. Figures 11 and 12 provide plan and section layout of the proposed structure.

Cipolletti weirs will be provided in the new chlorine contact tanks in order to proportion more flow to the new tanks than the existing. The new weirs will be slightly longer than the weirs in the existing contact tanks. At the design flow of 11 MGD ADF, the Cipolletti weirs will allow 5 MGD to flow through the existing contact tanks and 6 MGD to flow through the proposed contact tanks. The existing and proposed chlorine contact tanks will be interconnected with a 36-inch overflow pipe which will allow chlorinated water to flow to either of the wet wells.

The proposed chlorine contact tanks will be located to the south of the newly constructed mechanical filters and to the east of the existing 24-inch reclaimed water main to the Schroeder Manatee Ranch. The proposed contact tanks will be turned 90 degrees to better fit into an area bounded by numerous pipelines.



McKIM & CREED

CLEARWATER FLORIDA

MANATEE COUNTY

PROPOSED CHLORINE CONTACT CHAMBER

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE: 6/11/98

MCE PROJ. # 1024-0008

DWG FILE #

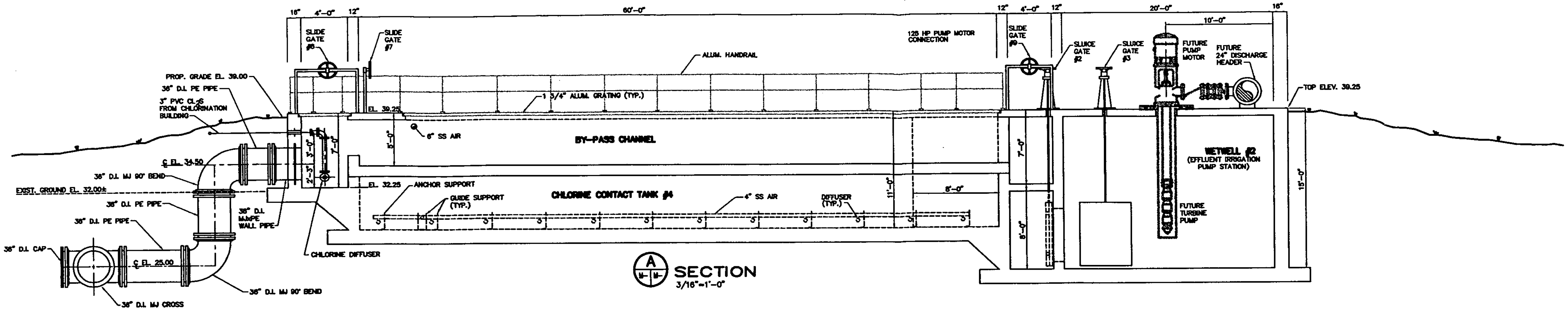
SCALE

HORIZONTAL: 3/32"=1'-0"

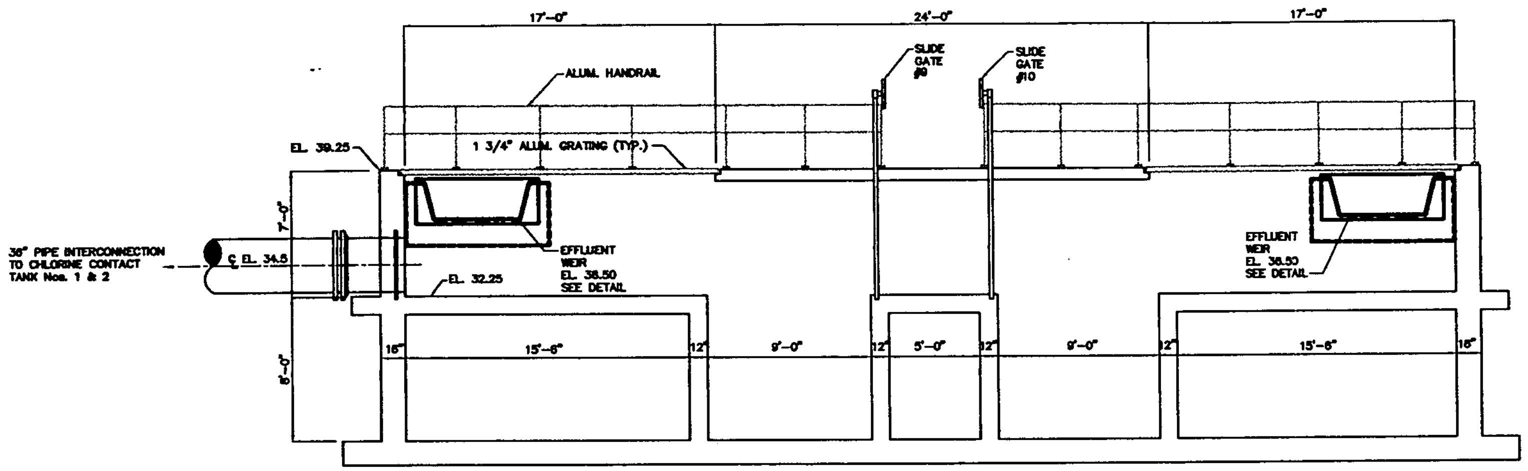
VERTICAL: N/A

CLIENT DWG NUMBER

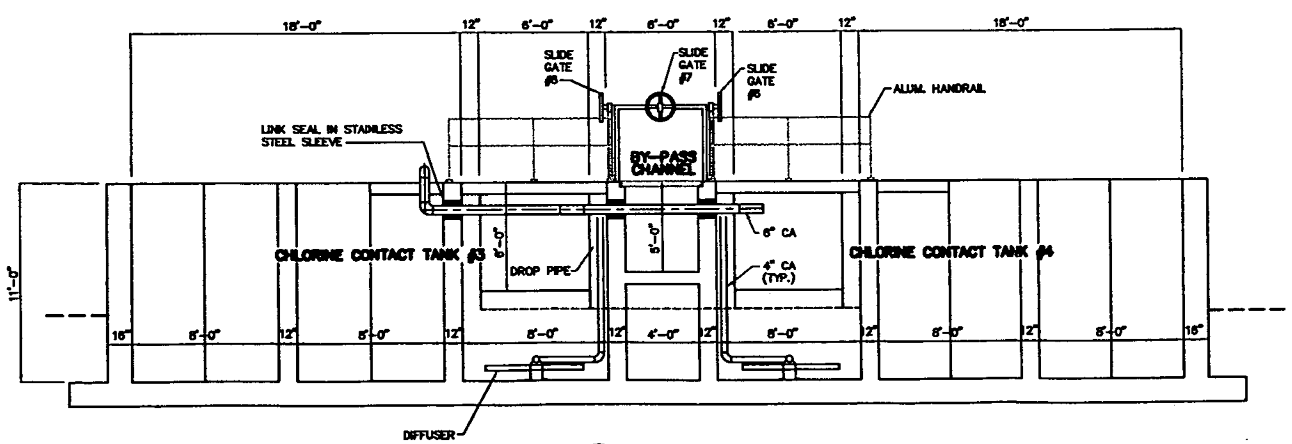
FIGURE NO. 11



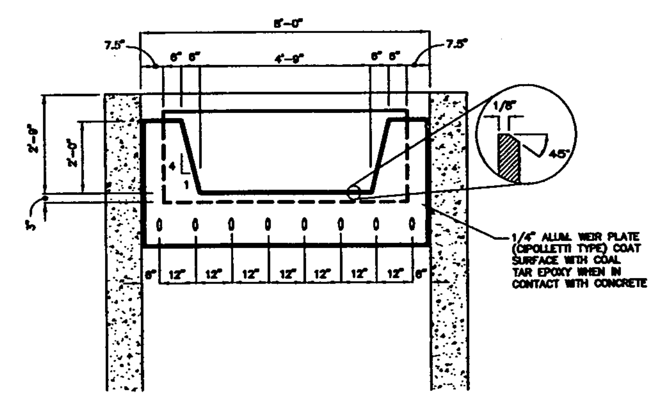
A SECTION
3/16"=1'-0"



B SECTION
3/16"=1'-0"



C SECTION



1 WEIR DETAIL
1/2"=1'-0"

McKIM&CREED
CLEARWATER FLORIDA

MANATEE COUNTY

CHLORINE CONTACT TANK SECTIONS

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE: 6/11/98
MCE PROJ. # 1024-0008
DWG FILE #

SCALE
HORIZONTAL:
VERTICAL:

CLIENT DWG NUMBER

FIGURE NO.
12

5.12 Proposed Disinfection Modifications

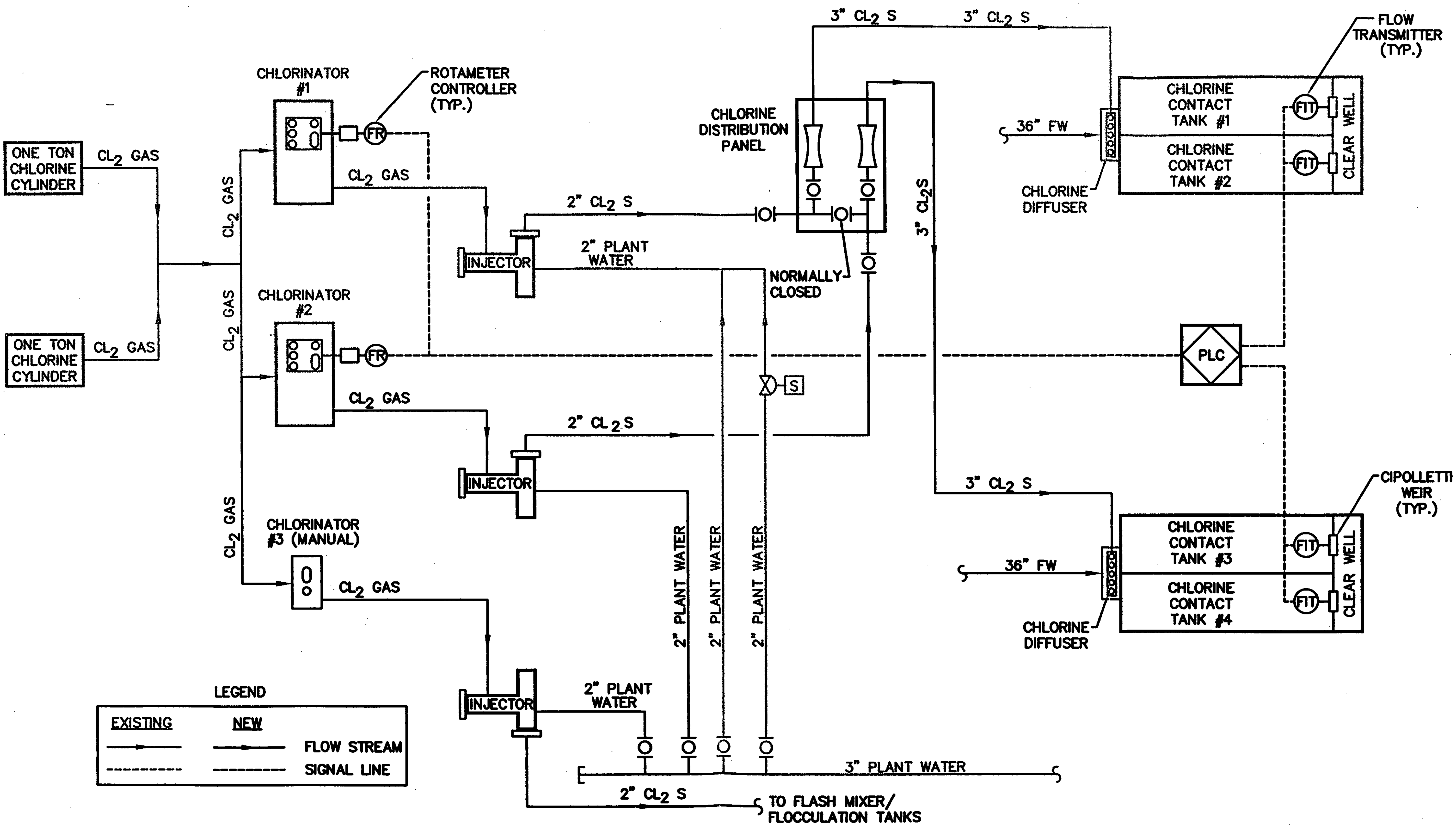
The chlorination system presently consists of two 2,000 pound per day chlorinators, a 2-inch injector, and a solution distribution panel. The chlorine gas is stored in one ton cylinders, metered through the chlorinators, and combined with water at the injector. The chlorine solution flows out to the existing parallel chlorine contact channels and is diffused into the water as it enters the chlorine contact chamber.

The addition of two new chlorine contact tanks of a different size will result in an unbalanced flow pattern. At ultimate design capacity, more filter effluent will be flowing through the new chlorine contact tanks than the old.

The chlorine solution has to be proportioned between the existing and the new chlorine contact tanks. The ratio of the split is not 50-50 since the contact tanks are not the same size, and the proportioning would change if any tank was out of service. Proposed for the proportioning system is a Programmable Logic Controller (PLC) which will accept flow signals from each of the four chlorine contact tanks. Currently, there are two 2000 pounds per day Chlorinators. One is a spare. The County is purchasing and installing two new chlorinators as part of an existing purchase order. We propose to dedicate one chlorinator to the existing Chlorine Contact tank and the other to the proposed chlorine contact tank. In this manner, the chlorine feed to each contact tank can be paced separately. In order to maintain total redundancy between the chlorinators, we propose to provide a solution panel as a backup, as shown in Figure 13.

Normally, the cross-over valve is closed. However, if one of the chlorinators is out of service, the cross-over valve would be opened and the solution would be proportioned in the solution panel.

This approach is recommended pending the County completing a concurrent evaluation of the long term disinfection strategy which may alter the system described above. Assuming the worst case chlorine feed concentration of 10 mg/l, the amount of chlorine gas needed will be 917 pounds per day at 11 MGD ADF, 1,055 pounds per day at 12.65 MGD maximum daily flow, and 2,752 pounds per day at 33 MGD peak flow. Each of the existing chlorinators has a capacity of 2,000 pounds per day, which should be quite adequate until a different disinfection strategy has been established for the treatment plant.



McKIM&CREED

CLEARWATER FLORIDA

MANATEE COUNTY

CHLORINATION SCHEMATIC

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE: 6/11/98

MCE PROJ. # 1024-0008

DWG FILE #

SCALE

HORIZONTAL:

VERTICAL:

CLIENT DWG NUMBER

FIGURE NO.

13

5.13 Proposed Aerobic Sludge Holding and Thickening

The existing circular steel tanks being utilized for aerobic digestion and sludge thickening were the main component of the original package type treatment plant located at this site. The original plant was replaced by the construction of the existing 5.4 MGD facility in operation today. At the time of the construction of the 5.4 MGD facility, the existing plant tankage was converted to sludge digestion and thickening. The regulatory requirements at the time of this conversion allowed the County to minimize the volume of sludge digestion tankage by including the sludge retention time which occurs in the oxidation ditch. Today, sludge regulations require a holding time of 45 days if sludge is stabilized by aerobic digestion to meet Environmental Protection Agency (EPA) 503 requirements for Class B. The existing tanks can not meet this requirement for even the 5.4 MGD plant capacity. Long term sludge handling at the higher volumes will be more cost effectively accomplished by stabilizing with lime/heat addition or by thermal drying in lieu of aerobic digestion. Therefore, we are approaching the design of liquid sludge handling assuming the County will elect to implement one of these alternatives or the many variants thereof. This project will be designed to thicken and hold waste sludge prior to dewatering at the existing belt filter press facility.

The existing SERWTP holding tanks use dissolved air flotation thickeners (DAFT) to increase solids content in the tanks and prior to dewatering. DAFT devices are old technology that are relatively inefficient. They are batch devices that require extensive operator attention to keep at optimum performance. Polymer consumption and maintenance are items for DAFT devices.

We have proposed rotary screen thickeners for the expanded facility. The rotary screen thickeners represent newer technology. They are simpler and less expensive than replacement DAFTs. They are continuous flow, highly efficient devices at thickening WAS from 2% solids to 8% solids with little or no adjustment by the operator. Once the flow has been set at a continuous rate, with the appropriate polymer dosage, the rotary thickeners will run unattended as long as the conditions are not changed. Maintenance should be minimal for these devices. We recommend that WAS be continuously pumped to either of two thickeners. We propose to install each of the two thickeners above the sludge holding tanks. Thickened sludge will be discharged directly to the respective sludge tanks.

Based on the design parameters outlined in earlier sections of this report, the anticipated production of liquid sludge will be approximately 240,000 gallons per day of 1% solids waste activated sludge. The thickened sludge averaging approximately 3% solids will translate to a volume of 75,000 gallons per day. We are proposing two new tanks, each with a capacity of 1 MG to store thickened sludge. This will provide ample operational flexibility to store up to 25 days of sludge generated at average flows of 11.0 MGD. This will allow the County to suspend land spreading of sludge during extreme wet weather conditions, allow for downtime of the belt presses for repairs and take one sludge tank down for cleaning and maintenance. This proposed improvement will not achieve a Class A or AA product without further processing.

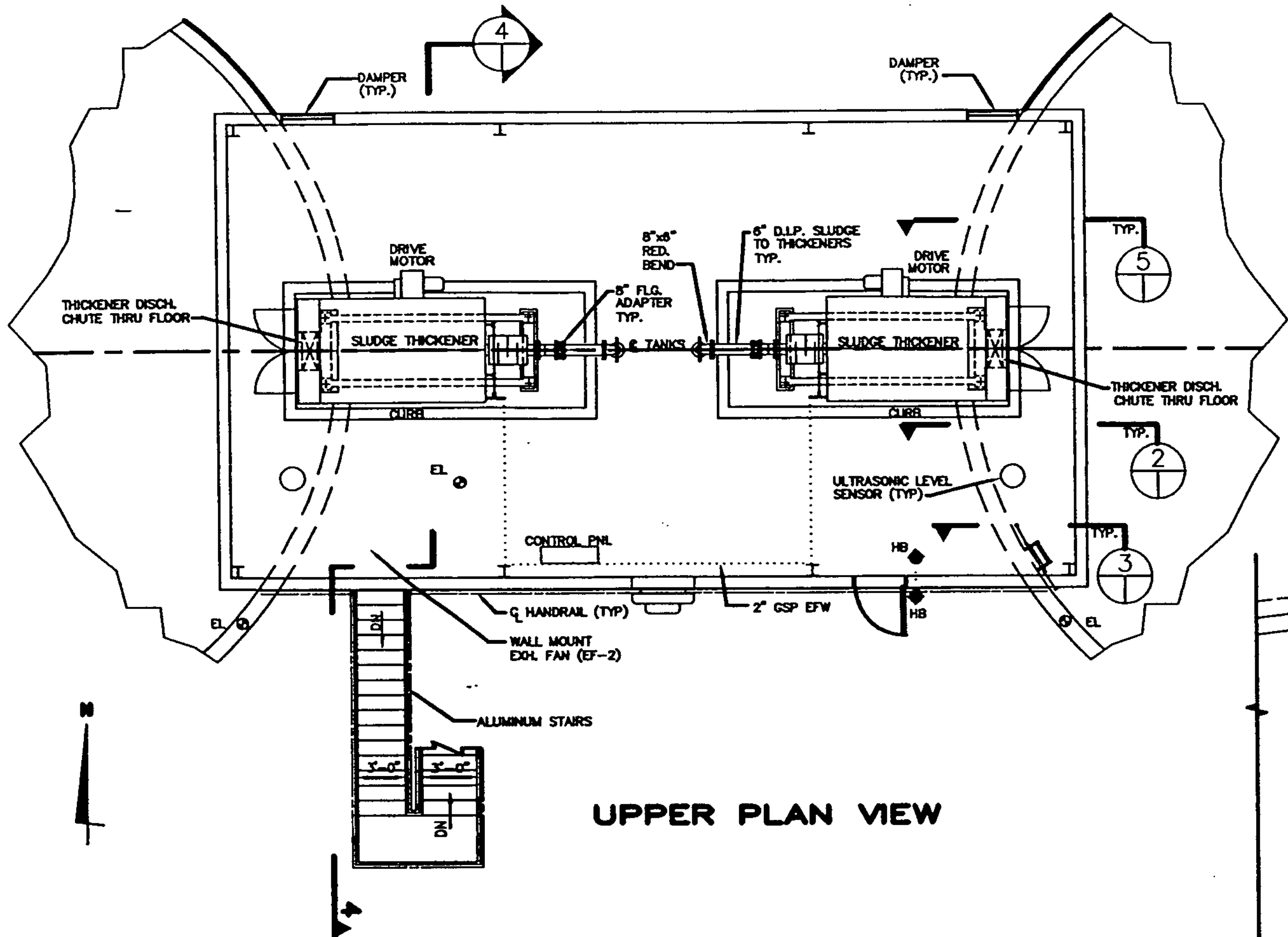
Each tank will be equipped with a rotary drum sludge thickener to allow more control over optimum solids concentration. Each storage tank will be equipped with coarse bubble diffusion. Refer to Figure 14 for a plan layout of the proposed sludge thickeners and storage tank systems including a new building to house the blowers and motor controls. The existing tanks and appurtenances will be removed after the new system is operational.

5.14 Proposed Tank Materials of Construction

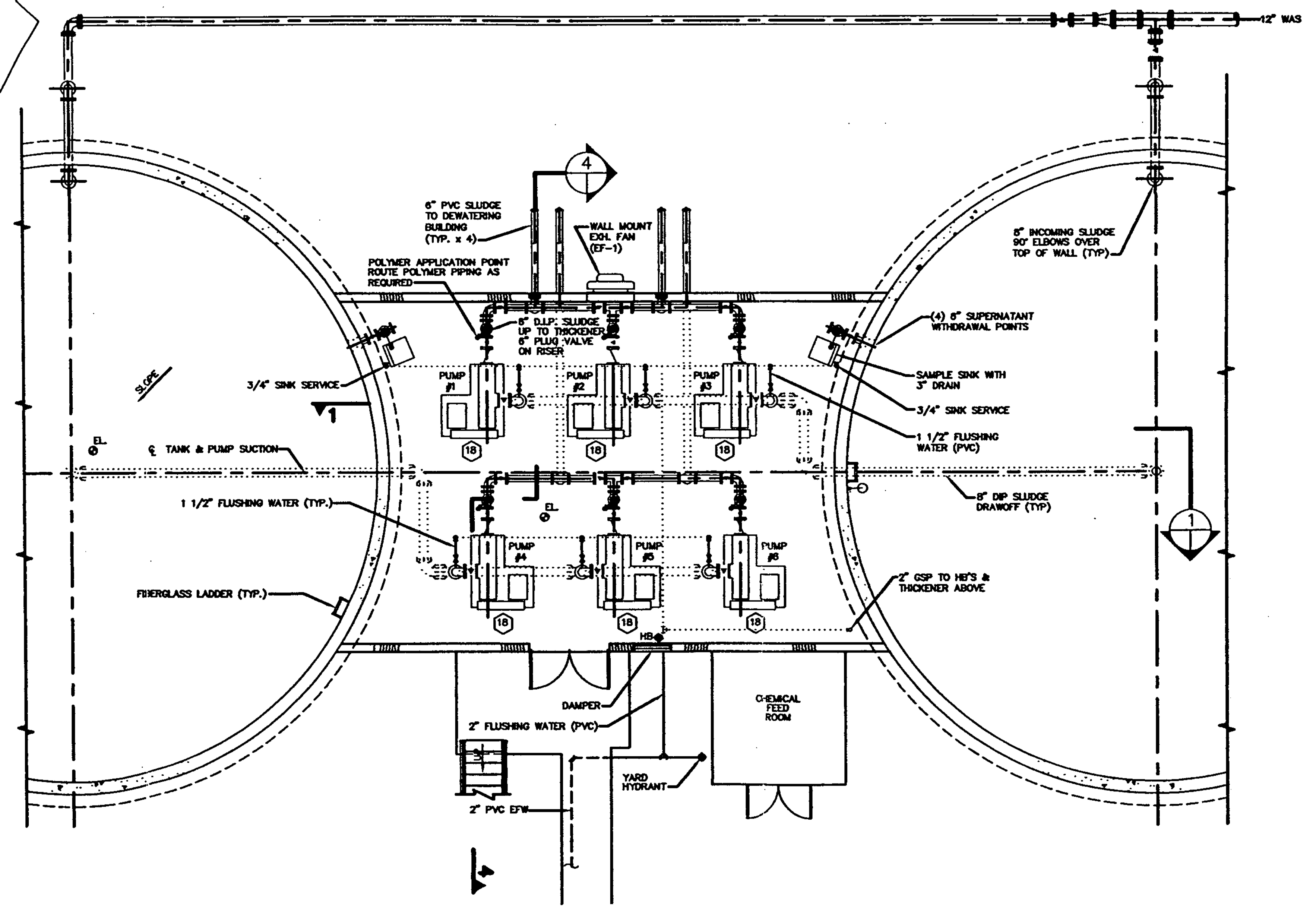
We have compared tank construction assuming both cast-in-place and pre-stressed concrete from a standpoint of constructed cost, construction times, and tank quality. The existing facility has both cast-in-place concrete and pre-stressed concrete composite tankage. For the pre-stressed concrete composite tank pricing, we have obtained budget quotations from a constructor of these types of tanks. Concrete has been estimated at $425 per cubic yard placed including elevated work platforms for walkways and platforms such as will be designed on the Carrousel structure. The following table summarizes the structure, the estimated concrete quantity, estimated cast-in-place cost, and the budget cost for pre-stressed concrete:

STRUCTURE	CONCRETE QUANTITY	CAST-IN-PLACE COST	PRE-STRESSED CONCRETE COST
Carrousel	4,730 cyds	$ 2,010,000	$ 1,778,000
Equalization	1,450 cyds	$ 620,000	$ 420,000
Clarifiers	1,850 cyds	$ 786,000	$ 534,000
Sludge Holding	1,350 cyds	$ 574,000	$ 394,000

On a capital cost comparison, it appears less expensive to use pre-stressed concrete tankage than cast-in-place.



UPPER PLAN VIEW



LOWER PLAN VIEW

McKIM & CREED

CLEARWATER FLORIDA

MANATEE COUNTY

SLUDGE HOLDING TANKS

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE:	6/11/98
MCE PROJ. #	1024-0008
DWG FILE #	

SCALE
HORIZONTAL: NTS
VERTICAL: N/A

CLIENT DWG NUMBER

FIGURE NO. 14

There is no doubt that good contractors can provide adequate cast-in-place tankage for this project, but even the best cast-in-place tankage is more susceptible to cracks and leakage than a good pre-stressed vessel. Note that the existing Carrousel number 2 has a large crack that needs to be rehabilitated as part of this project. The pre-stressed concrete tanks can be required to come with an unconditional 5-year guarantee against all cracks and leakage. Finally, since the pre-stressed tank contains much less concrete than a comparable cast-in-place vessel, the overall construction time is estimated to be much less; approximately 8 months for pre-stressed concrete versus 12 months for the cast-in-place.

Our conclusion is that the plant process tankage should be based on the pre-stressed concrete composite vessels for the reasons of cost, quality, and very importantly, construction time.

5.15 Plant Drain Pump Station

The existing plant drain pump station presently has three submersible pumps. Hydraulic analysis shows that each of the submersible pumps has a capacity of 825 GPM, for a total of 1,650 GPM when two pumps are operating. A gravity sewer system discharges to the pump station from the existing components of the treatment plant. Major contributors include the sand filter backwash, sludge thickener supernatant, belt filter press filtrate, and tank drains. The existing plant drain pump station discharges to the headworks via a 16-inch forcemain. The proposed treatment plant expansion will produce a much larger volume of plant drainage, including the following maximum rates of flow:

Sand Filter Backwash	1,920 GPM
Sludge Thickeners Filtrate	500 GPM
Belt Filter Press Filtrate	400 GPM
Miscellaneous Drainage	180 GPM
TOTAL	3,000 GPM

Proposed for the expansion is an additional plant drain pump station to augment existing capacity. The proposed station will be located south of the proposed sand filters to serve the new facilities. The proposed station will have three (3) submersible pumps, two for normal operation and one on standby. Each pump will have a capacity of 800 GPM. The station will discharge to the proposed splitter box. A gravity sewer network will be designed to collect the wastewaters and discharge to the pump station from all of the new facilities.

5.16 Proposed Instrumentation

This project will require some new components of instrumentation. These include but are not limited to the following: RAS/WAS pump controls, chemical feed, flow monitoring, level controls, effluent pump sequencing, alarms and related equipment for operation or protection of equipment and reliable process control.

Currently, the instrumentation systems at the SERWTP are minimal, but we recognize that Manatee County is planning a larger unified Supervisory Control and Data Acquisition (SCADA) project which will provide monitoring, control, reports, inventory, safety and maintenance management for all three plants, and other remote sites.

In keeping with the needs of the current project, and in view of the proposed SCADA project, we propose the following as the basis of design for the instrumentation on this project:

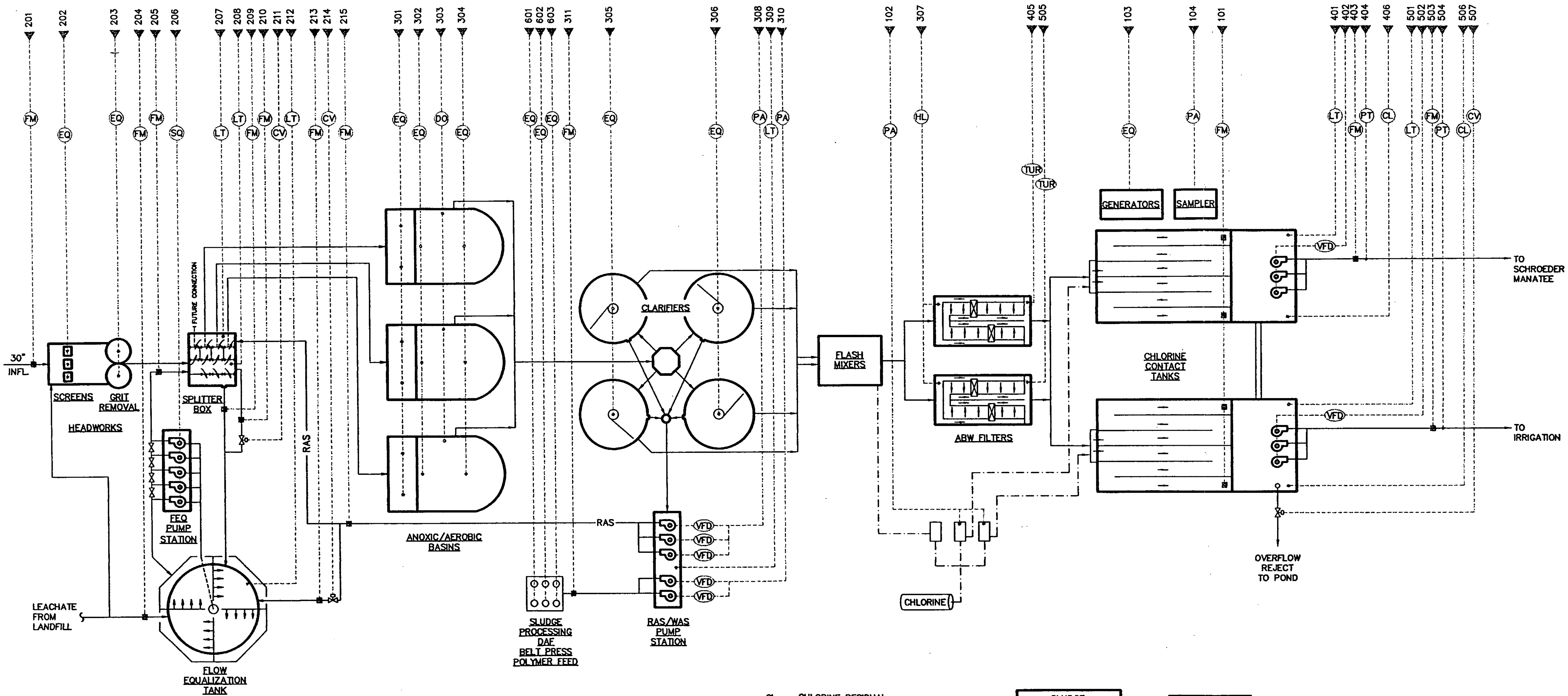
- The selection of needed equipment, instruments, and process controls will be designed to promote simplicity, and ease of use, while providing reliable operation, redundancy and easy of maintenance. Where possible, we will promote the use of equipment which has provided a good record of reliable operation and maintenance within Manatee County.
- Provide a *standardized* design for the Programmable Logic Controllers (PLCs) used in the plant. PLCs have become the dominant standard for modern process control. By using a standardized design for PLCs used throughout the plant, the project will promote ease of maintenance and troubleshooting. Also, the project will provide programming tools, training and spare parts so that the plant staff will be equipped to maintain and expand the PLC system to meet changing future needs.
- The Basis of Design for the PLC system will utilize standard "Off-the shelf" equipment in an "Open Architecture" approach. In this manner, all of the work accomplished in this project will be ready for connection to the larger planned Manatee County SCADA system. Any one of the major SCADA software suppliers would be able to communicate with the proposed PLC system. This provides an easy transition to the planned SCADA project, and minimizes any duplication of effort.
- Provide multiple, small PLCs (in lieu of fewer large PLCs) to provide "Distributed Control", so that the system is easily operated and maintained. In this manner, the failure of any one component will only effect a limited portion of the plant, and the problem can easily be addressed and corrected.

- Provide a "communications backbone" for the plant site. We have found that Fiber-Optic communications provides the best performance, while providing high immunity to damage due to lightning. The PLC network will be arranged in a "Redundant Ring" topology, so that any single break in the link will not cause a loss in communications, but instead, the PLC will automatically communicate in the reverse direction around the ring.
- Provide a small, limited purpose Operator Interface (OPI), such as a "Quick Panel" or a "Redi Panel" in lieu of a full MMI/computer implementation. This small, touch screen color graphic panel (OPI) will provide for the immediate needs for operator input, setpoints and alarms, but without the high cost and complexity of the larger MMI computer system. The MMI/Computer will be installed as part of the future SCADA project by others, and once implemented, the OPI will serve as a convenient backup to the MMI computer.
- As part of this project, we would plan to refurbish the main control console. Various instruments, totalizers, chart recorders and accessories have been re-arranged, modified or abandoned in the years since the plant was built. The control console will be re-designed to meet the current requirements. Some new equipment will be installed along with existing equipment still in service.

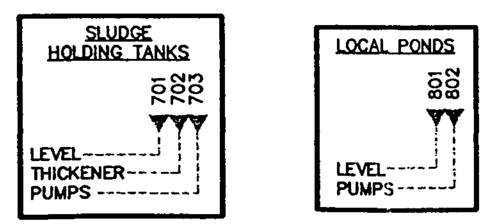
At this point, standardization would be easiest to implement and set a systematic course for future expansions. If standardization is not achieved, it is possible that each separate controller would be different from the rest, and requirements for maintenance, training, system expansion, and spare parts would be greatly complicated.

As part of this project, we propose to interface with both the proposed and the existing equipment and systems within the plant. We feel that this approach provides the best transition to the future SCADA project by providing an interface which is systematic, well ordered and complete. Figure 15 provides a preliminary process and instrumentation diagram and Figure 16 provides a diagram of the PLC based controls and fiber optic communications system.

However, if the project budget does not allow for this level of implementation, we would suggest providing the standardized PLC and installing the complete PLC backbone as a minimum, and thus allowing the future integration of existing systems such as sludge press operation, existing pump sequencing, chemical feed, pond management, reject protocol, existing equipment interface, etc, to be provided as a future implementation by others.



CL – CHLORINE RESIDUAL
CV – CONTROL VALVE
DO – DISSOLVED OXYGEN
EQ – EQUIPMENT STATUS AND ALARM
FM – FLOW METERING
HL – HIGH LEVEL ALARM
LT – LEVEL TRANSMITTER
PA – PACING SIGNAL
SQ – PUMP SEQUENCING AND CONTROL
TUR – TURBIDITY
VFD – VARIABLE SPEED PUMP CONTROL
200 – CIRCUIT NUMBERS IDENTIFYING PLC I/O
PT – PRESSURE TRANSMITTER



McKIM&CREED
CLEARWATER FLORIDA

MANATEE COUNTY

SIMPLIFIED PROCESS AND INSTRUMENTATION DIAGRAM

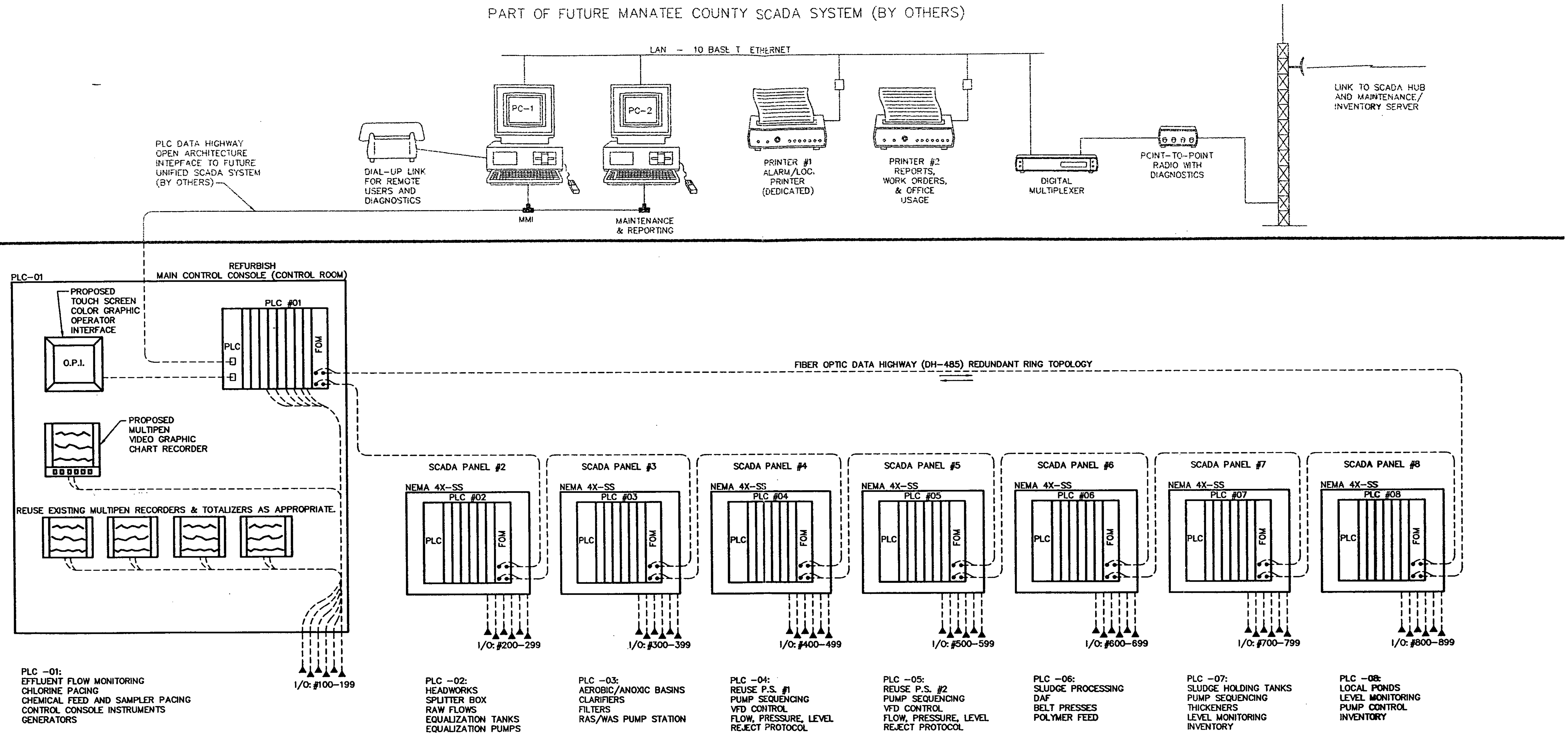
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE: 6/11/98
MCE PROJ. # 1024-0008
DWG FILE # INST-1

SCALE
HORIZONTAL:
VERTICAL:

CLIENT DWG NUMBER

FIGURE NO. 15



M.M.I. – MAN MACHINE INTERFACE
F.O.M. – FIBER OPTIC MODEM
P.L.C. – PROGRAMMABLE LOGIC CONTROLLER
I/O – INPUTS AND OUTPUTS TO FIELD EQUIPMENT
O.P.I. – OPERATOR INTERFACE (SEE PRELIMINARY DESIGN REPORT FOR DETAILS)
SCADA – SUPERVISORY CONTROL AND DATA ACQUISITION

McKIM & CREED
CLEARWATER FLORIDA

MANATEE COUNTY

PLC AND FIBER OPTIC CONFIGURATION

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE: 6/11/98
MCE PROJ. # 1024-0008
DWG FILE # INST-2

SCALE
HORIZONTAL:
VERTICAL:

CLIENT DWG NUMBER

FIGURE NO.
16

5.17 Proposed Electrical Modifications

5.17.1 Existing Electrical System

The existing electrical system is comprised of double ended 480 volt 3000 amp electrical switchgear, eight (8) 480 volt motor control centers (MCC'S) and three (3) effluent pump variable frequency drives (VFD's). The present electrical design provides EPA Class 1 Reliability for the existing treatment plant process components. This means that similar process components are fed from separate MCC's thereby insuring that a common electrical bus failure will not disrupt the treatment plant process by disabling all the components associated with that particular process function.

The existing normal power electrical system was installed in 1987. Visual inspection revealed that the existing equipment was in good operating condition. While insulation tests of the existing cabling and equipment bus systems were not conducted, the equipment appeared to be in good working order. As such, we recommend that the existing electrical equipment remain in service. Cable insulation testing of the primary 480 volt motor feeders will be performed as we move into the 30% design phase. This information will be tabulated and forwarded with our recommendations. We do not anticipate any insulation problems with the existing cables.

Three (3) 300 horsepower VFD's serve the existing effluent pumps. The VFD's are "Omega Paks" manufactured by the Square D Company. The drives have provided reliable operation to the County since their installation in the late 1980's. However, it is our understanding that the GTO front end electronics are no longer in production. As such, a replacement schedule for these items should be considered.

As detailed by Table 9 - Load Tabulation table, there is approximately 2200 horsepower of connected load served by the existing electrical system. While there is some spare capacity available, it is not sufficient to handle the proposed plant expansion.

Table 9
Load Tabulation

	Existing Plant Loads				Existing Loads to Remain				Proposed Plant Loads			
	Qty	HP	Total	FLA	Qty	HP	Total	FLA	Qty	HP	Total	FLA
Pretreatment												
Grit Pump	2	15	30	42	2	15	30	42	0	0	0	0
Grit Classifier	2	0.5	1	2.1	2	0.5	1	2.1	0	0	0	0
Recirc Pumps	2	2	4	6.8	2	2	4	6.8	0	0	0	0
Mech. screen	2	1.5	3	6	2	1.5	3	6	1	1.5	1.5	3
Odor Control Fan	1	10	10	14	0	0	0	0	3	10	30	42
Misc.	1	20	20	34	1	20	20	34	1	20	20	34
Aeration												
Aerator	4	125	500	624	4	125	500	624	5	125	625	780
Mixer	4	15	60	84	4	15	60	84	2	15	30	42
RML Pumps	4	50	200	260	4	50	200	260	0	0	0	0
Misc.	1	10	10	14	1	10	10	14	1	10	140	14
Clarifiers												
WAS	2	7.5	15	22	0	0	0	0	4	7.5	30	44
RAS	3	50	150	195	0	0	0	0	3	50	150	195
Drive Arm	2	1	2	4.2	2	1	2	4.2	2	1	4.2	4.2
Flocculator	2	1.5	3	6	2	1.5	3	6	0	0	0	0
Flash Mixer	2	25	50	68	2	25	50	68	0	0	0	0
Air Compressor	2	5	10	0	2	5	10	0	2	5	10	15.2
Effluent Pumps												
Pumps	4	300	1200	1444	4	300	1200	1444	3	300	900	1083
Dewatering/Chemical Building												
WTR Booster	4	7.5	30	44	4	7.5	30	44	0	0	0	0
Belt Filer Press	2	5	10	15.2	2	5	10	15.2	0	0	0	0
Alum. Feed	2	0.25	0.5	1.1	2	0.25	0.5	1.1	0	0	0	0
Press Feed	2	0.75	1.5	3.2	2	0.75	1.5	3.2	0	0	0	0
Press Mixing Tank	2	1	2	4.2	2	1	2	4.2	0	0	0	0
Misc.	1	20	20	34	1	20	20	34	0	0	0	0
Sludge Thickeners												
Sludge Pumps	4	10	40	56	0	0	0	0	0	0	0	0
Scrapper Drive	2	1	2	4.2	0	0	0	0	0	0	0	0
Air Compressor	2	25	50	68	0	0	0	0	0	0	0	0
Recycle Water Pump	3	30	90	120	0	0	0	0	0	0	0	0
Misc.	1	20	20	34	0	0	0	0	0	0	0	0
Air Blowers	3	75	225	288	0	0	0	0	0	0	0	0
Plant Drain Pump Station												
Pump	3	20	60	81	3	20	60	81	3	20	60	81
New Sludge Thickeners												
Sludge Thickeners	0	0	0	0	0	0	0	0	2	5	10	15.2
Recir. Pump	0	0	0	0	0	0	0	0	2	10	20	28
Press Feed Pump	0	0	0	0	0	0	0	0	4	10	40	56
Blowers	0	0	0	0	0	0	0	0	3	250	750	906
Polymer Feeds	0	0	0	0	0	0	0	0	3	0.5	1.5	3.3
ABW Filters												
Backwash Pumps	4	7.5	30	44	4	7.5	30	44	2	7.5	15	22
Blowers	0	0	0	0	1	0	0	0	1	125	125	156
Air Compressors	0	0	0	0	0	0	0	0	2	5	10	15.2
Reject Return PS	2	20	40	54	2	20	40	54	2	70	140	54
Equalization Tank												
Pumps	0	0	0	0	0	0	0	0	5	10	50	70
Blowers	0	0	0	0	0	0	0	0	2	75	150	192
Administration Bldg.												
HVAC, Ctrl. Inst., Lighting, Mech. Shop	0	0	0	50	0	0	0	50	0	0	0	50
Generator Bldg.												
Lights ,Exhaust, Fans HVAC, etc.	0	0	0	20	0	0	0	20	0	0	0	20
			HP	FLA			HP	FLA			HP	FLA
	TOTAL:		2889	3747	TOTAL:		2287	2945.8	TOTAL:		3312.2	3925.1

5.17.2 Existing Standby Power System

The original standby power system was recently upgraded and consists of two (2) 2000 KW standby diesel generators. Upon loss of the normal utility source voltage, the existing switchgear controls function to open both existing main breakers and close the tie breaker. Following this control sequence, a signal is sent to the existing generator switchgear to initiate the engine starting sequence. A manual selector switch is provided in the cover of the generator control cubical that allows plant staff to select generator 1 or 2 as the operational unit. Presently, the existing control system does not allow both generators to be run simultaneously. Upon initiation of the automatic starting sequence, the selected generator is called to run.

Either 2000 KW generator has the ability to carry the entire SERWTP plant load. As such, the existing design provides the treatment facility with a fully redundant emergency generator. The County is currently signed up for Florida Power and Light's (FP&L) load control rate schedule. As such, FP&L can automatically remove the normal feed to the existing facility. The new design will maintain this capability. This rate schedule should be saving the County a considerable amount of money based on a significant reduction in demand rate charges.

5.17.3 Proposed Electrical Systems

The approximate load additions associated with the facility expansion are outlined in the Load Tabulation table. Based on information known to date, the proposed plant expansion will add approximately 1900 horsepower of additional load. It appears that the combined facility loads will exceed 4000 horsepower. Even when taking into account the diversity of loads associated with facilities of this type, the existing 3000 amp switchgear capacity is not sufficiently sized to accommodate the additional loads with one of the existing 3000 amp main breakers out of service. Therefore, it is recommended that new facility switchgear be provided to augment the existing electrical system. The design of the new system will provide the existing SERWTP with two additional mains (3&4) and mirror the existing system's double ended design. This new electrical equipment, along with the proposed effluent pump variable frequency drives and miscellaneous motor control centers, can be located as outlined by either option 1 or 2.

Under option 1, no structural modifications would be made to the existing electrical room. Instead, the new electrical equipment would be located in a new electrical building located adjacent to the existing building. The attached Figure 17 further details this option.

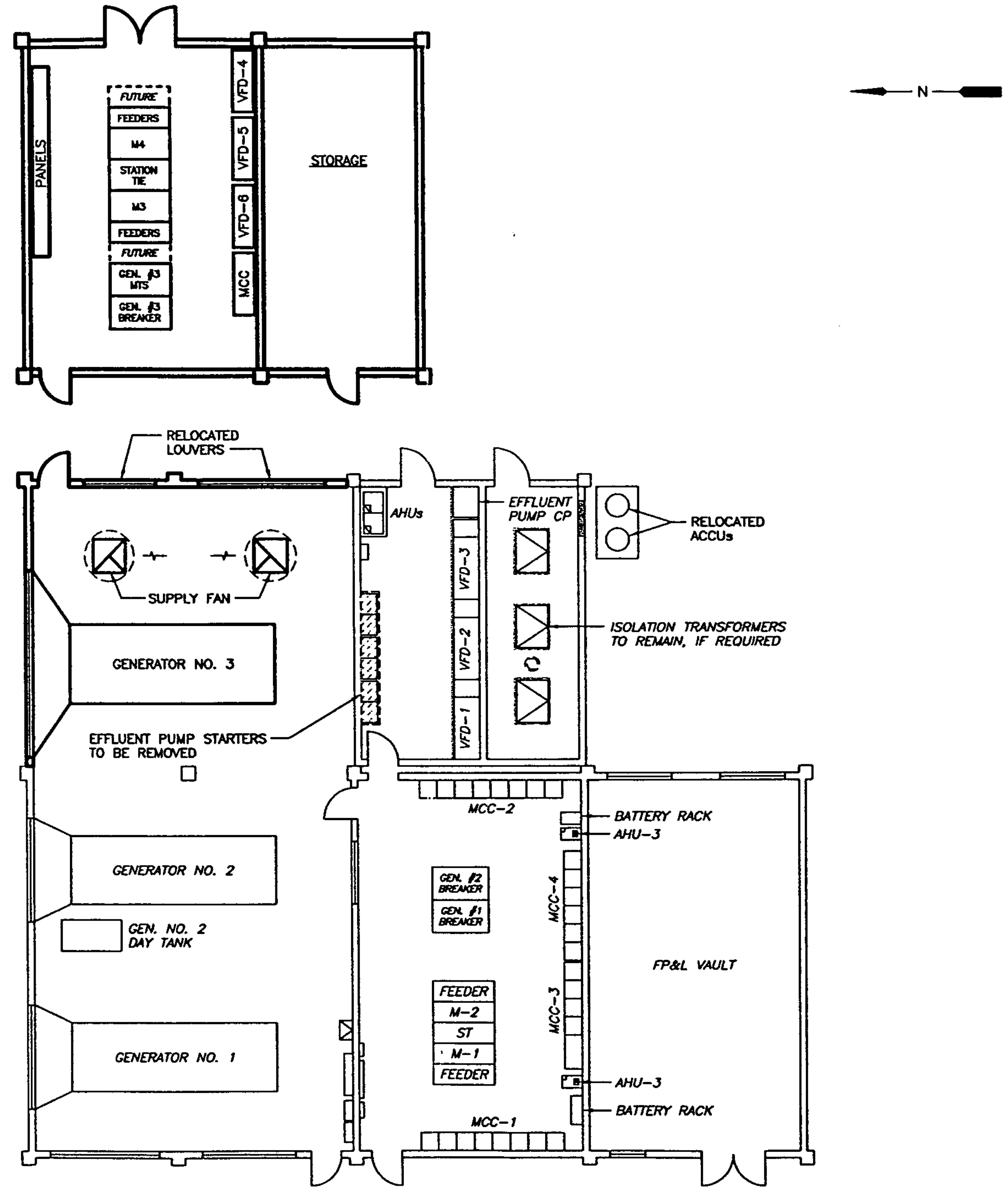
Under option 2, we propose to remove existing MCC-2 and the wall that separates the main electrical room from the VFD room. All equipment presently served from MCC-2 will be re-served from the proposed Electric Building No. 2 located at the eastern end of the site. The existing VFD's and their associated equipment would be relocated and the new switchgear installed as shown on the attached layout drawing. These modifications will allow the SERWTP's main breakers to be grouped in a common location as required by the National Electrical Code as well as maintaining visibility of the new generator from the generator breaker location. Option 2 provides a better configuration for the main electrical switchgear. The incremental cost of this option is $50,000 including electrical and buildings costs.

With either option, we are proposing that two new remote electrical buildings be provided in addition to the new main electric room modifications and/or additions being proposed. Electric Room No. 2 will be located near the new treatment train and serve the incoming liquid process loads. Electric Building No.3 will be located in the sludge thickener blower building and serve the solids processing loads in this area. All electrical rooms will be air conditioned to provide for increased system life.

The attached single line diagrams and electrical room equipment plans show our proposed options for serving the loads associated with this expansion. These are included as Figures 17 through 20.

5.17.4 Standby Power System

The existing system is comprised of two (2) 2000 KW emergency generators. The present capacity of the standby power system will serve approximately 2500 horsepower of plant load. 100% redundant capacity is designed into the system. As such, the existing system is capable of delivering the 2500 horsepower capacity with one generator unit out of service. It is recommended that the County maintain the emergency system's ability to provide 100% of the facility's load requirements with a single generator out of service. Based on this recommendation, a third generator should be provided.



ELECTRICAL POWER PLAN

ELECTRICAL – MECHANICAL
INSTRUMENTATION
2101 N. ANDREWS AVE., SUITE 100
FORT LAUDERDALE, FLORIDA 33311

BAILEY ENGINEERING CONSULTANTS

McKIM & CREED
CLEARWATER FLORIDA

MANATEE COUNTY

ELECTRICAL BUILDING MODIFICATIONS
OPTION 1

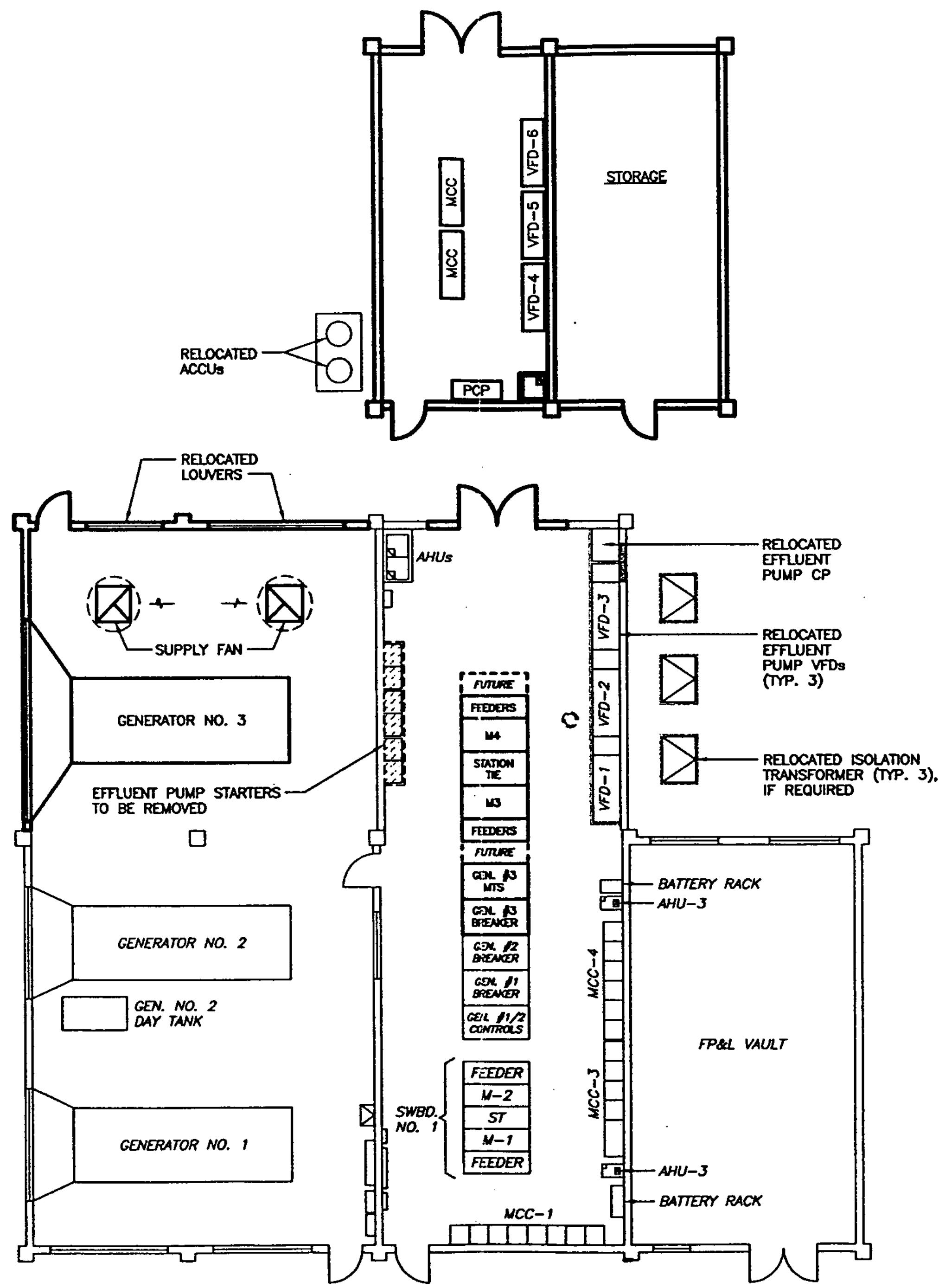
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE: 6/11/98
MCE PROJ. # 1024-0008
DWG FILE # SER-E-BLDG01

SCALE
HORIZONTAL: 1/16"=1'-0"
VERTICAL: N/A

CLIENT DWG NUMBER

FIGURE NO.
17



ELECTRICAL POWER PLAN

ELECTRICAL – MECHANICAL
INSTRUMENTATION
2101 N. ANDREWS AVE., SUITE 100
FORT LAUDERDALE, FLORIDA 33311
PHONE: (954) 564-3111
FAX: (954) 564-3040

BAILEY ENGINEERING CONSULTANTS

McKIM & CREED
CLEARWATER FLORIDA

MANATEE COUNTY

ELECTRICAL BUILDING MODIFICATIONS OPTION 2

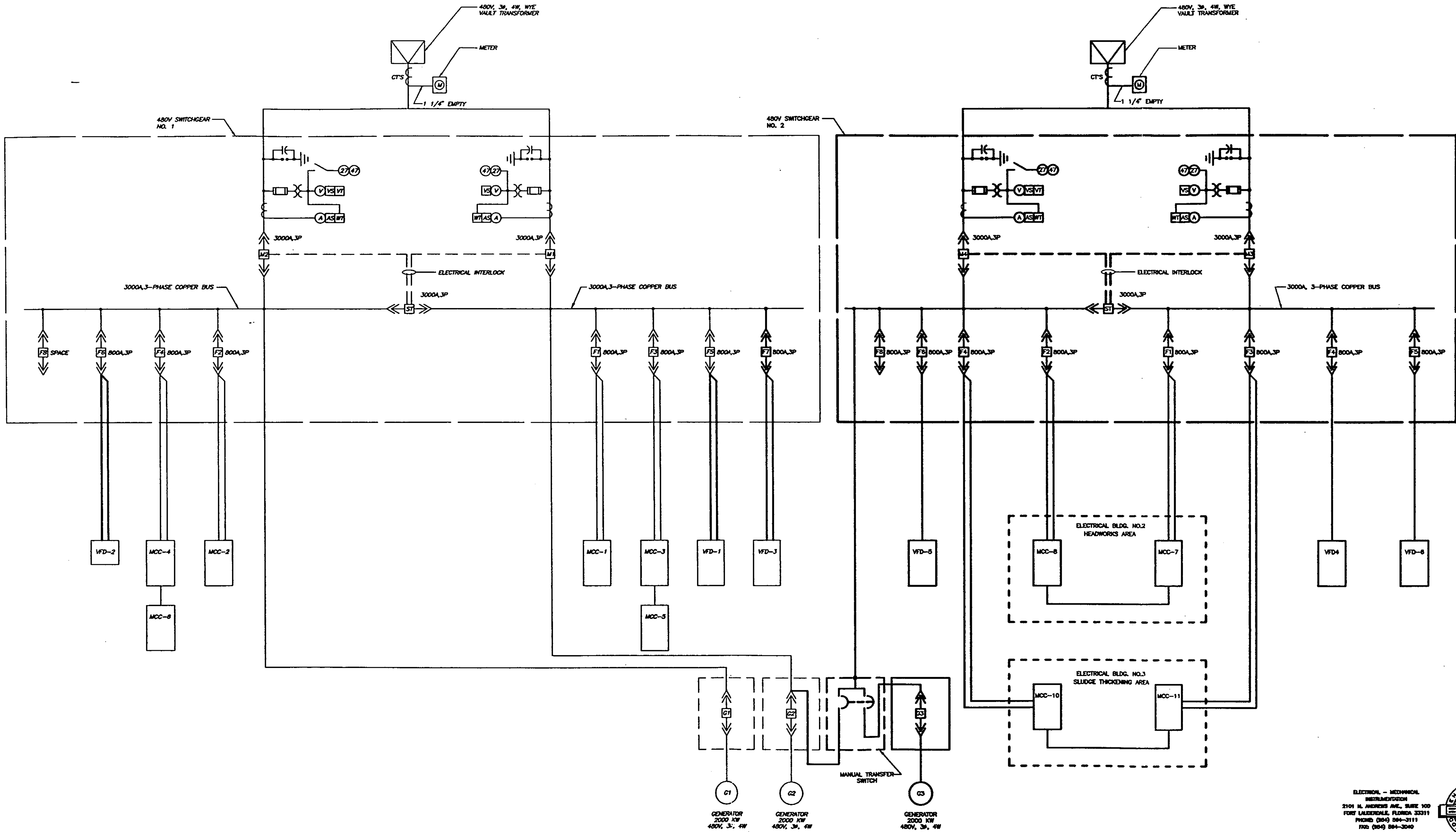
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE:	6/11/98
MCE PROJ. #	1024-0008
DWG FILE #	SER-E-BLDG02

SCALE
HORIZONTAL: 1/16"=1'-0"
VERTICAL: N/A

CLIENT DWG NUMBER

FIGURE NO.
18



ELECTRICAL – MECHANICAL
INSTRUMENTATION
2101 N. ANDREWS AVE., SUITE 100
FORT LAUDERDALE, FLORIDA 33311
PHONE (954) 564-3111
FAX (954) 564-3040

McKIM&CREED

CLEARWATER FLORIDA

MANATEE COUNTY

SINGLE LINE POWER DIAGRAM
OPTION 1

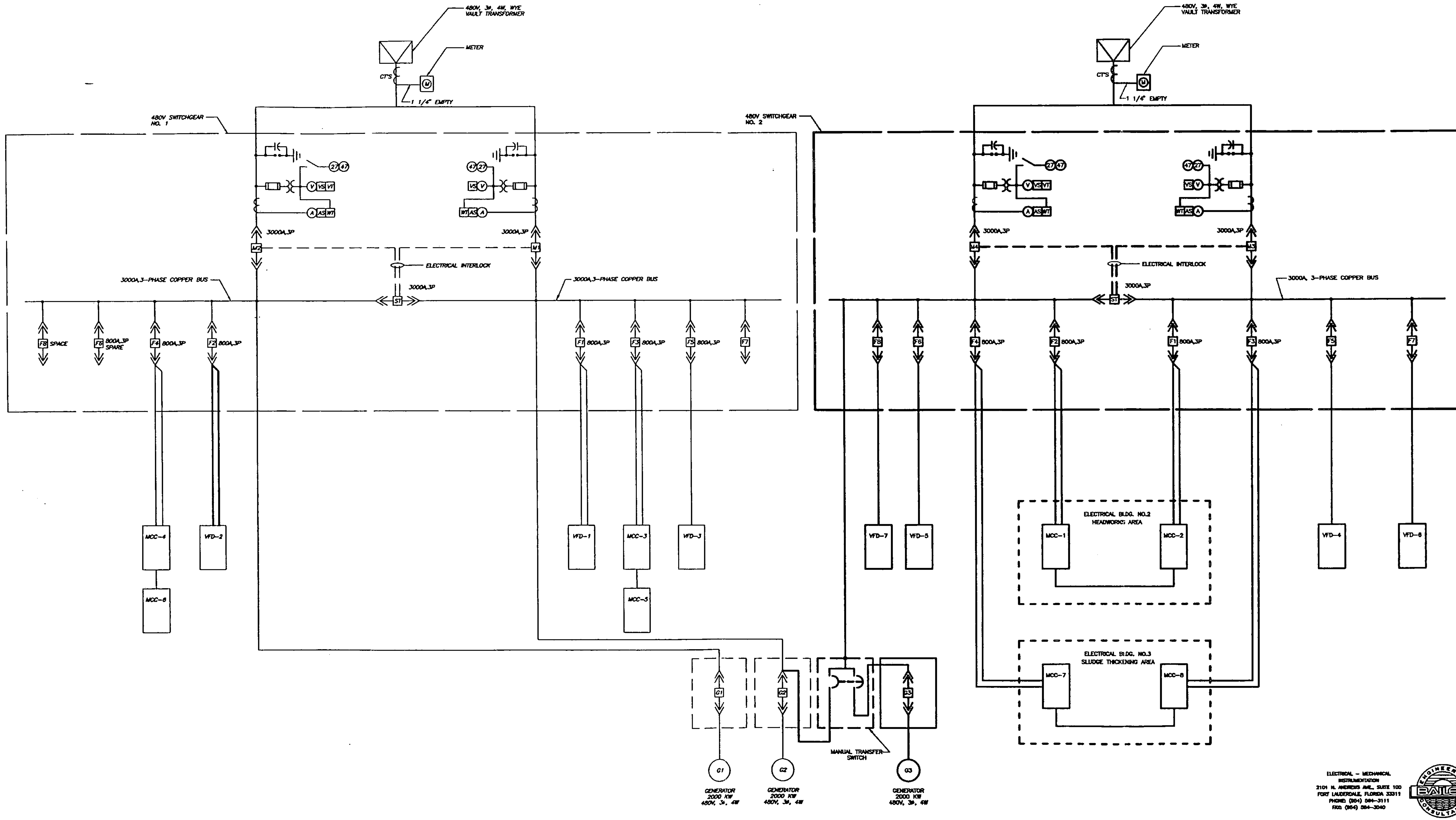
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE: 6/11/98
MCE PROJ. # 1024-0008
DWG FILE # SER-SLD02

SCALE
HORIZONTAL: N/A
VERTICAL: N/A

CLIENT DWG NUMBER

FIGURE NO.
19



ELECTRICAL - MECHANICAL INSTRUMENTATION
2101 N. ANDREWS AVE., SUITE 100
FORT LAUDERDALE, FLORIDA 33311
PHONE (954) 564-3111
FAX (954) 564-3040

BAILEY ENGINEERING CONSULTANTS

McKIM & CREED

CLEARWATER FLORIDA

MANATEE COUNTY

SINGLE LINE POWER DIAGRAM OPTION 2

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

DATE: 6/11/98

MCE PROJ. # 1024-0008

DWG FILE # SER-SLD01

SCALE

HORIZONTAL: N/A

VERTICAL: N/A

CLIENT DWG NUMBER

FIGURE NO. 20

Paralleling the new generator with the existing two generators is possible and would provide the greatest level of generator load diversifications. However, this would require paralleling equipment that is both expensive and complicated to maintain. Further, it is not known at this time if the existing generators were provided with this capacity as they are not currently operating in parallel.

As the existing generator operating scheme is simple, it is recommended that the new generator be installed to serve the new switchgear and that the owner continue with the current operation of generator's 1 & 2. In order to provide the new generator and mains 3 & 4 with redundant generator power, a manual transfer scheme will be provided that will permit existing generator No. 2 to act as a swing generator thereby serving either mains 1 & 2 or mains 3 & 4. The necessary interlocks will be provided to prevent any two generators from serving the same electrical bus simultaneously. The single line diagram for option 1 or 2 shows this control scheme.

5.17.5 Fuel System

At present, a 6000 gallon underground fuel storage tank provides fuel for the two existing 2000 KW generators. Fuel consumption for a single 2000 KW generator at 75% load is approximately 100 gallons/hour. Therefore, the existing fuel storage system provides the County with approximately 2½ days of fuel storage. It is our opinion that fuel storage should be provided as required to permit 4 days of continuous generator operation. As the operational generator capacity is doubling, it will be necessary to augment the existing fuel supply. Two (2) 2000 KW generators running at 75% load will consume approximately 200 gallons/hour of fuel. Therefore, we recommend installing two 7,500 gallon of storage tanks and that the storage tanks be located aboveground. All associated fuel piping will be installed in containment piping.

5.18 Residuals Management

As stated in Section 5.13 of the report, the project includes improvements to sludge thickening and storage systems. This approach provides for achieving a Class B residual management approach. This will limit the County's options for disposal of this material in the future.

During the development of the scope of this project, alternatives were discussed that would allow the County to reach Class A or Class AA residuals. The County has commissioned a study of residuals management alternatives for all three of the treatment facilities it operates. The conclusions of this sludge study are not available at this time.

The proposed improvements to thickening and storage systems will be compatible with future improvements in stabilization with the exception of the aerobic digestion. Aerobic digestion would require significantly larger storage volumes.

The County should make a decision on short term and long term residuals management during the course of the design phase of this project. It may be more cost effective to include stabilization system improvements in the Phase II construction contract that will be initiated in early 1999 and extend into year 2000.

6.0 NEW ACCESS ROAD

6.1 Description

A new access road will be constructed from the east-west section of Lena Road to the northwest corner of the current wastewater treatment plant area where it will connect to the existing road which runs east-west at the north side of the belt filter press building. The road will be twenty-four feet wide with 4 feet wide shoulders and have parallel running drainage swales, where necessary, within an approximately 70 feet wide right of way. The roadway will be designed to accommodate large trucks and will be constructed of asphaltic concrete. The construction drawings will require the contractor to place and maintain a temporary surface to handle construction traffic. Near the completion of construction, the roadway will be re-stabilized and re-surfaced. Stormwater drainage swales will be constructed along sides of the roadway, where necessary according to design, to collect runoff.

A paved roadway will be constructed from the new access road connection point at the northwest corner of the plant around the south side of the plant to the existing paved roadway at the east side of the plant to allow for movement of traffic through the plant area. The internal roadway will be approximately 2,500 feet long, twenty-four feet wide and will be designed to accommodate large truck traffic throughout its length.

6.2 Options

Three options for access roadway alignment have been developed. These options include:

1. Routing along the FP&L easement,
2. Routing through the wetland area between the FP&L easement and the County's Landfill, or
3. Routing along slurry wall perimeter berm in the landfill.

The following assumptions have been made in order to assess the alignments:

- The access roadway will impact an average width of 70 feet.
- Average fill depth through the Cypress Strand will be 3 feet.
- Average fill depth through the Landfill will be 1 foot.
- The centerline elevation of the roadway will be at an elevation of 1 foot above the 100 year flood elevation.

- The local 100 year flood elevation is 31.0 feet NGVD (per FEMA mapping data).
- Seasonal High Groundwater Table in the Cypress Strand is 28.0 feet NGVD.
- Top of bank elevation of the detention pond will be 31.00.
- FP&L easement contains no wetland areas.

6.2.1 Option 1: Through FP&L Easement

FP&L currently maintains a 330 foot wide strip of land for electrical easement adjacent to the west side of the Cypress Strand. This option includes constructing the access road parallel with and inside of the FP&L electrical easement between the larger power poles on the west side of the easement and smaller power lines at the east side of the easement from Lena Road to the south crossing beneath the smaller power pole lines to a point where it will curve through 90 degrees and connect into the northwest corner of the plant site. The length of roadway within the easement would be approximately 1300 feet and the total length of the roadway would be approximately 1800 feet.

This option would require the acceptance of FP&L, Environmental Resource Permit (ERP) permitting, wetland impact and mitigation, floodplain impact and mitigation, flow handling structures to minimize flow impedance of the Cypress Strand and extensive clearing and grubbing. This option causes less wetland impact than Option 2 but far more than Option 3. It also causes approximately the same floodplain impact as Option 2 but far more than Option 3. Estimated impact quantities are presented in the table of Section 6.3.

6.2.2 Option 2: Through the Cypress Strand Between FP&L Easement and Landfill

This option includes constructing the access road near the east side of the FP&L easement through the Cypress Strand. The roadway could either be constructed to follow the contour of the outside of the landfill or to run parallel to the FP&L easement. In either case, it would connect into the northwest corner of the plant site. The total length of the roadway would be approximately 1800 feet parallel to easement or 1500 feet following the contour of the landfill.

This option would require ERP permitting, wetland impact and mitigation, floodplain impact and mitigation, flow handling structures to minimize flow impedance of the Cypress Strand and extensive clearing and grubbing. This option causes the most wetland impact of all the options. It also causes approximately the same floodplain impact as Option 1 but far more than Option 3. Estimated impact quantities are presented in the table at the end of Section 6.3.

6.2.3 Option 3: Over Slurry Wall at West Side of Landfill

This option includes constructing the access road over the landfill slurry wall, following the contour of the landfill limits inside the west edge of the landfill as near as possible, crossing the east-west ditch at the north side of the reject ponds and connecting into the northwest corner of the plant site. The total length of the roadway would be approximately 1600 feet. This option is likely to cause very little wetland impact, if any at all. It also appears to cause no floodplain impact. The only place which appears to possibly be affected by impact issues is the crossing of the east-west ditch located north of the current reject ponds. This impact is relatively small in comparison with the wetland and floodplain impacts caused by Options 1 and 2.

This option may require simpler ERP permitting. The stormwater drainage could possibly be kept in the landfill area in shallow swales where it would be allowed to percolate into the ground and become part of the leachate stream. This option appears to have no effect on the flow condition of the Cypress Strand, require far less wetland and floodplain impact and mitigation and require far less fill material and construction preparation. Estimated impact quantities are presented in Table 10.

One drawback of locating the access road in the landfill area would be loss of potential landfill storage. The loss of storage in the landfill area must be weighed against the costs of permitting and construction in the Cypress Strand and the availability of mitigation areas which will be required by Options 1 and 2. It should also be noted that it is a priority of the Southwest Florida Water Management District (SWFWMD) to preserve wetland areas when equivalent function options are available to minimize wetland impacts.

6.3 Summary and Conclusions

A field meeting is scheduled with the FDEP on July 7 to discuss specific ERP permitting requirements and wetland and floodplain issues in more detail. A more defined scope is expected as a result of this meeting.

Table 10 lists the three access roadway construction options discussed in the previous section and presents estimated values for mitigation issues, material quantities and other relevant notes.

Table 10

Roadway Options Summary

Option	ERP	Wetland Impact (AC)	Wetland Mitigation (AC)	Floodplain Impact/ Mitigation (AC*FT)	Fill (CY)	Paved Area (SY)	Notes
1	Yes	3.5	10.5	3.9	8270	4800	Extensive clearing and grubbing; need permission from FP&L; extensive permitting certain; need available mitigation area; requires flow consideration for Cypress Strand
2	Yes	5.1	15.3	3.5	7350	4300	Extensive clearing and grubbing; extensive permitting certain; need available mitigation area; requires flow consideration for Cypress Strand
3	Yes	0.2	0.6	0	70	4270	Relatively little construction prep; less permitting expected; very small mitigation areas needed if required at all; may affect landfill capacity; surface runoff may not require pond areas; does not appear to affect Cypress Strand

The most appealing access road option for ease and expense of construction appears to be Option 3, over the slurry wall at west side of landfill. The two most significant issues associated with this option are 1) the possibility of reducing landfill capacity and 2) percolating local surface water runoff to the leachate system.

The impact on landfill capacity has not yet been defined. The field visit scheduled on July 7 is expected to produce information which will make this more quantifiable. Providing percolation areas for the local surface water would allow the surface runoff to enter the leachate piping system. This option may eliminate the need for ERP permitting and stormwater pond construction. The specific design requirements for this type of system will be determined at the field meeting as well.

Construction costs associated with Option 3 should be significantly less than the other two options. Much less preparation, materials and destruction of vegetation are required to implement Option 3. Providing mitigation areas for Options 1 and 2 may be extremely difficult since the majority of areas owned by the County are occupied by storage ponds and wetlands or are planned for later use. In addition, creating volume to mitigate for floodplain storage appears to be quite difficult since providing it in the Cypress Strand would cause the destruction of more wetlands requiring further wetland mitigation.

Again, it should be noted that it is a priority of the SWFWMD is to preserve wetland areas when equivalent function options are available to minimize wetland impacts. Option 3 has the potential to function as well as either of the other two options and significantly reduce environmental impacts.

7.0 STORMWATER CONTROL

This project will include updating the stormwater control facilities and permits for the expansion of the treatment facility. These areas include the new roadway area and the wastewater treatment plant area which comprise approximately 41 acres.

The existing stormwater control system at the site is covered under SWFWMD Management and Storage of Surface Water (MSSW) Individual Permit No. 408992.00. The MSSW permit was issued on August 27, 1991. The permit was issued for an area of approximately 241 acres which includes South Lake No. 2 (86 acres) and the East Lake (63 acres). A modification to the MSSW permit, MSSW Permit No. 408992.03, was issued on March 25, 1993, which included the planting of upland trees. No mention of South Lake No. 1 or any other drainage feature is made in either the permit or permit modification text.

Since the issuance of the MSSW permit, the SWFWMD has modified stormwater drainage requirements. The current permit which must be granted prior to new construction is an ERP. Since the permit will apply to a wastewater treatment facility, the drainage permit application must be submitted to and reviewed by the FDEP. In addition to obtaining an ERP from the SWFWMD, through FDEP, a drainage permit must also be obtained from Manatee County. Applications for both permits will be prepared concurrently.

Due to the presence of a seasonal high groundwater table elevation of approximately one foot below surface and prevalent wet soil types in the wastewater treatment plant and roadway areas as classified in the USGS Soil Survey, the recommended stormwater control system is a wet detention type. The new stormwater control system will include an approximate 2.3 acre wet detention pond located near the southwest corner of the wastewater treatment plant area and an approximate 2.5 acre wet detention pond near the roadway area. Figure 2 shows the location of the wet detention pond planned to control stormwater for the plant site. Various swales and culverts throughout the wastewater treatment plant and roadway areas will be placed to direct surface water to the detention ponds. Each of the detention ponds will have an outfall, through a control structure and pipe, from which the ponds will discharge to the low area west of the wastewater treatment plant and roadway areas. Topographic data and past observation indicate that surface water in this area is routed to the Cypress Strands.

Drainage regulations require that one inch of runoff from the contributing area shall be treated via a littoral zone placed in the ponds at thirty-five percent area of the pond control elevation area, treatment volume shall be available again within 72 hours after a design storm event and the post-developed offsite peak discharge rate be limited to the pre-developed offsite peak discharge rate resulting from a 25 year 24 hour storm event as defined in the SWFWMD Environmental Resource Permitting Information Manual. The rate of discharge will be controlled by an inlet type structure prior to exiting through the discharge piping. The entire stormwater control system will be modeled by software which is currently accepted by the FDEP, SWFWMD and Manatee County. Additional survey information and soils information will also be collected and considered prior to finalizing the design.

A pre-application meeting was conducted by the FDEP on June 11, 1998. Results of the pre-application meeting confirmed that the design parameters specified in the previous paragraph will apply to this project.

8.0 PROPOSED SEQUENCE OF CONSTRUCTION

The most critical component needed for continued compliant operation of the facility is the chlorine contact tank. The design and construction of this component of the facility expansion is proposed on a "fast track" schedule. A separate design and bid package will be prepared such that construction may being prior to completing the design documents for the entire plant. The targeted completion of the chlorine contact tank expansion is the spring of 1999. This will provide more than 5.4 MGD of capacity in early 1999, ahead of the projected maximum 3 month average daily flow anticipated to be reached as early as Mid 1999.

The second phase of the project will include the bulk of the construction activity to increase overall plant capacity to 11.0 MGD. There are several sequence of construction issues which will need to be identified on the project construction documents so that the Contractor has guidance in how they phase the work on site. These are outlined below and organized by major process area of the work:

<u>Headworks</u>

- The eastern most channel and bar screen will need to be out of service for a period of time while a fourth channel is added. The western channel and the manual screen channel will need to be in operation during this time.
- The existing odor control system will be demolished and a new odor system constructed prior to constructing the fourth influent channel.

<u>Equalization Tank</u>

- This tank will be scheduled as early in the construction process as possible to provide operational flexibility at the earliest possible time.
- The proposed distribution box and piping will be partially completed to allow operation of the equalization tank.

Aeration Basin

- The piping tie-ins ahead of the three aeration basins will require that the new aeration basin be completed and operational prior to completing piping between the headworks and the aeration basins.
- The new basin will need to be in operating condition prior to installation of aerators in the third position on the new aeration basins.
- Mixed liquor piping tie-in to the existing clarifier splitter box will require that the existing south aeration basin be taken out of service while a core and pipe connections are completed to the existing south side of the structure.

Clarifiers

- There are few constraints on constructing the two new clarifiers. Existing piping connections will avoid shut-downs of existing systems.

RAS/WAS Pumps

- RAS pumping units can be replaced with larger units on a sequential basis while the facility remains in operation.
- WAS pumps can be added to the existing system without disrupting operation.

Sludge Thickeners

- The new sludge thickeners, sludge storage tanks and associated equipment will be constructed and made operational prior to demolition of the existing DAFT/ Digester systems.

Access Road

- The access road will be constructed early in the construction sequence to provide the Contractor with access to the site for heavy equipment. The final grade and surface course will be completed after heavy construction is complete.

The revised project schedule is included in Section 10, Proposed Schedules for Design and Construction.

9.0 ENGINEER'S OPINION OF COST

The table below provides an opinion of the probable construction cost of the wastewater treatment plant expansion to 11.0 MGD. The estimate is based on 1998 costs of construction and equipment. The estimate also assumes the County elects to proceed based on the recommendations presented in the foregoing sections, and specifically include the following options:

- A separate bid package for the Chlorine Contact Tank.
- A third generator for the standby power system.
- The 2.6 MG equalization tank with overflow weirs and diversion valve bypass.
- The Odor Control System utilizing packed chemical scrubbers.
- The Electrical Building configuration identified as Option 2.
- The Access Road located along the slurry wall.
- Filter cost includes Traveling Hood Design with Air Scour System.

PHASE 1					
ITEM #	DESCRIPTION	UNIT	UNIT PRICE	QUANTITY	AMOUNT
1	Mobilization	LS	$50,000.00	1	$50,000.00
2	Site Preparation	LS	$50,000.00	1	$50,000.00
3	CL_2 System/Instrumentation	LS	$18,000.00	1	$18,000.00
4	Chlorine Contact Tanks	LS	$420,000.00	1	$420,000.00
	SUBTOTAL				***$538,000.00***

PHASE 2					
ITEM #	DESCRIPTION	UNIT	UNIT PRICE	QUANTITY	AMOUNT
1	Mobilization	LS	$600,000.00	1	$600,000.00
2	Site Preparation	LS	$100,000.00	1	$100,000.00
3	Grading, Drainage, Fencing	LS	$300,000.00	1	$300,000.00
4	Site Piping	LS	$500,000.00	1	$500,000.00
5	Headworks Upgrade	LS	$370,000.00	1	$370,000.00
6	Odor Control Upgrade	LS	$175,000.00	1	$175,000.00
7	Flow Splitter Box	LS	$300,000.00	1	$300,000.00
8	Flow Equalization Tank	LS	$1,050,000.00	1	$1,050,000.00
9	Anoxic/Aerobic Tank	LS	$2,500,000.00	1	$2,500,000.00
10	Clarifiers	EA	$500,000.00	2	$1,000,000.00
11	ABW Sand Filters	LS	$400,000.00	2	$800,000.00
12	RAS Pump Station	LS	$400,000.00	1	$400,000.00
13	WAS Pump Station	LS	$150,000.00	1	$150,000.00
14	Sludge Tanks & Thickeners	LS	$1,750,000.00	1	$1,750,000.00
15	Electrical Work	LS	$1,000,000.00	1	$1,000,000.00
16	Electrical MCC's/Storage Buildings	LS	$250,000.00	1	$250,000.00
17	Instrumentation & Controls	LS	$275,000.00	1	$275,000.00
18	Reject Return Pump Station	LS	$50,000.00	1	$50,000.00
19	Effluent Pump Station	LS	$350,000.00	1	$350,000.00
20	Additional Aerators	LS	$225,000.00	1	$225,000.00
21	EQ Tank Return Pump Station	LS	$200,000.00	1	$200,000.00
22	Demolition	LS	$200,000.00	1	$200,000.00
23	Access and Internal Roads	LS	$870,000.00	1	$870,000.00
24	Drainage & Detention Ponds	LS	$150,000.00	1	$150,000.00
25	Reject Pond	LS	$575,000.00	1	$575,000.00
26	Plant Drain Pump Station	LS	$100,000.00	1	$100,000.00
27	Emergency Generator	LS	$500,000.00	1	$500,000.00
	SUBTOTAL				***$14,740,000.00***
	PHASE 1 + PHASE 2				**$15,278,000.00**
	CONTINGENCY(10%)				$1,527,800.00
	TOTAL PROJECT COST				**$16,805,800.00**

10.0 PROPOSED SCHEDULES FOR DESIGN AND CONSTRUCTION

The schedule for this project has been re-evaluated based on the design parameters developed in this report. Consideration has been given to the critical sequencing items discussed in Section 8, Proposed Sequence of Construction.

The most critical item affecting the duration of the construction schedule is the concrete tankage. The schedule is based on the estimated time to construct the large aeration tankage by pre-stressed composition methods. Cast-in-place techniques would effectively increase the overall time frame by two to three months.

The updated design and construction schedule presented on the following pages is more detailed than the schedule previously prepared but the overall time frames are consistent with the preliminary schedule presented to the County. We are providing critical milestones below which the County is prepared to meet for the two phases of the work.

PHASE I - Chlorine Contact Chamber

Complete Design	8/98
Award Construction Contract	11/98
Complete Construction	7/99
Start-up, Testing and Certification	11/99

PHASE II - Capacity Expansion

Complete Design	2/99
Award Construction Contract	7/99
Complete Construction	5/01
Start-up, Testing and Certification	8/01

APPENDIX A
DESIGN DATA

Influent Flow Rate, MGD	
Average Daily	11.00
Maximum Daily	12.65
Peak	33.00

Influent Biological and Solids Loadings	
BOD, mg/l	250
TSS, mg/l	250
TKN, mg/l	40
BOD, pounds per day (max. daily)	26,375
TSS, pounds per day (max. daily)	26,375
TKN, pounds per day (max. daily)	4,220

Effluent Characteristics	
BOD, mg/l	20
TSS, mg/l	5
NO_3-N, mg/l	12
BOD, pounds per day (max. daily)	2,110
TSS, pounds per day (max. daily)	528
TKN, pounds per day (max. daily)	1,266

Headworks Flow Measurement	
Number	3
Type	1-Magnetic, 2-Strap-on Dopplers
Diameter, Inches	30" (Magnetic Meter)
Capacity Range, MGD	3.6 to 32

Mechanical Screens	
Number	3
Type	Self Cleaning
Peak Flow Capacity, Each, MGD	12.00
Screen Opening, Inches	0.25
Channel Width, Ft.	3.50
Channel Depth, Ft.	5.00

Grit Removal	
Number	2
Type	Vortex
Diameter, Each, Ft.	16
Peak Flow Capacity, Each, MGD	20.00

FLOW SPLITTER BOX	
Flow Metering Weirs	
Number of Weirs	3
Type of Weirs	Rectangular
Width of Each Weir, Feet	5
Flow, Each Weir MGD (Max. Daily)	4.22
Depth of Flow Over Weir, Feet	0.54
Flow Equalization Weirs	
Number of Weirs	3
Width of Each Weir, Feet	10
Total Width of Weir, Feet	30
Peak Flow Over Weirs, MGD	22
Depth of Flow Over Weir, Feet	0.49

BIOLOGICAL TREATMENT UNITS	
Anoxic Basins	
Number	3
Dimensions, Each Basin, Feet	107 W x 48 L x 15 SWD
Volume, Each Basin, Cubic Feet	75,117
Volume, Each Basin, Gallons	576,000
Design Max. Daily Flow, Each, MGD	4.22
Design Max. Recycle, Each, MGD	16.88
Design MDF & Rec., Each, MGD	21.10
Detention Time @ Design, MDF& Rec., Hrs.	0.64
Number of Mixers Per Basin	2
Type of Mixer	Mechanical
Mixer Horsepower, Each	15
Aeration Basins	
Number	3
Dimensions, Each Basin, Feet	286.5L x 107W x 13.5D
Volume, Each Basin, MG	3.09
Volume, Each Basin, Cubic Feet	413,102
Design Avg. Daily Flow, Each, MGD	4.22
Detention Time @ Design, ADF, Hrs	17.6
BOD Loading, lbs./day/1,000 ft^3	21.3
BOD Removed, Each Basin, lbs./day	8,623
Ammonia Oxidized, Each Basin, lbs./day	1,017
Actual Oxygen Requirement	
Lbs Oxygen/lb. BOD Removed	1.25
Lbs Oxygen/lb. Ammonia Removed	4.60
Total Oxygen Requirement, Ea. Basin, lbs./day	15,457
Standard Oxygen Reqmt, Ea. Basin, lbs./day	23,244
Mixer Liquor Suspended Solids	
Concentration, mg/l	3,500
MLSS Weight, Each Basin, Dry, pounds	90,197
BOD Loading, lb per day/lb MLSS	0.10
Sludge Production, lbs/lb of BOD Removed	0.74
Sludge Production, Each Basin, Dry, lbs/day	6,381
Solids Retention Time, Days	14.1

Aerators	
Number, Each Basin	3
Type	Mechanical
Horsepower, Each	125
Unit Aeration Capacity lbs O_2/Hr/HP	3.5
Total Oxygen Provided, Each Basin - Lbs/Hr	1,313
Total Oxygen Provided, Each Basin - Lbs/Day	31,500

Clarifier Flow Splitter Box	
Number of Weirs	4
Type of Weirs	Rectangular
Width of Each Weir, Feet	7
Max. Daily Flow Over Each Weir MGD (wastewater + RAS)	6.33
Depth of Flow Over Each Weir, Feet	0.56

Clarifiers	
Number	4
Type	Circular, Rapid Suction
Diameter, Each, Feet	110
Depth, Each, Feet	14
Area, Each, Square Feet	9,499
Volume, Gallons	994,683
Surface Loading Rate, Each, Max. Day, GPD/Sq. Ft.	333
Detention Time, Each, Max. Day, Hours	7.6
Peak Flow, Each, MGD	8.25
Overflow Weir Length, Feet	330
Max. Day Weir Overflow Rate, GPD/Ft.	9,583
Peak Weir Overflow Rate, GPD/Ft.	25,000

Flash Mix Basins	
Number	2
Dimensions, Each, Feet	7 x 7 x 7.25D
Total Volume, Gallons	5,315
Detention Time @ max. daily flow, seconds	36
Number of Mixers	2
Horsepower, Each Mixer	10 / 4.4

Flocculation Tank	
Dimensions, Feet	2@15 x 15 x 8.09D
Total Volume, Gallons	27,231
Detention Time @ max. daily flow, minutes	3.1
Number of Mixers	2
Horsepower, Each Mixer	1

Automatic Backwash Sand Filter	
Number	4
Type	Traveling Bridge
Dimensions, Each, Feet	90 x 16
Area, Each, Square Feet	1,440
Hydraulic Loading at Max Flow, GPM/ Sq. Ft.	1.53
Hydraulic Loading at Peak Flow, GPM/ Sq. Ft.	3.98

Chlorine Contact Tanks	
Number	4 (2 existing, 2 new)
Dimensions Existing, Each, Feet	150 x 8 x 9 SWD
Dimensions New, Each, Feet	180 x 8 x 9 SWD
Volume Existing, Each, Gallons	80,795
Volume New, Each, Gallons	96,954
Total Volume, Gallons	355,500
Detention Time @ Max. Flow, Minutes	40.5
Detention Time @ Peak Flow, Minutes	15.5

Chlorination System	
Number	2
Capacity, Each, lbs/day	2,000
Max. Chlorine Application Concentration, mg/l	10
Max. Chlorine Required at 11 MGD, lbs/day	917
Max. Chlorine Required at 12.65 MGD, lbs/day	1,055
Max. Chlorine Required at 33 MGD, lbs/day	2,752

Flow Equalization Tank	
Dimensions, Feet	150' diameter x 21.5' SWD
Volume, MG	2.6
Number of FEQ Pumps	5
Capacity, Each Pump, GPM	2,000
Horsepower, Each Pump	30
Tank Aeration Type	Eduction

Return Activated Sludge Pumps	
Number	3
Type	Centrifugal
Type of Drive	Variable Frequency
Capacity, Each, GPM	4,400
Horsepower, Each	50
Total Capacity (2 pumps), MGD	12.7

Waste Activated Sludge Pumps	
Max. Day WAS @ 0.35%, MGD	0.66
Max. Day WAS @ 0.35%, GPM	456
Max. Day WAS @ 1%, MGD	0.23
Max. Day WAS @ 1%, GPM	160
Number	4
Type	Centrifugal
Capacity, Each, GPM	250
Horsepower, Each	2
Total Capacity (4 pumps), MGD	1.44

Sludge Storage Tanks	
Number	2
Dimension, Each ,Ft.	94 Dia. x 19.25 SWD
Volume, Each, MG	1
Design Max. Day Sludge Production, Dry, lbs/day	19,143
Design Max. Day Sludge Volume Loading @ 3%, GPD	76,510
Detention Time, Both Tanks, Days	26
Max. Unit Aeration Requirement SCFM/1,000 ft^3	30
Max. Aeration Requirement, Each Tank, SCFM	4,000
Number of Blowers	3
Capacity, Each Blower, SCFM	4,000
Horsepower, Each Blower	250

Sludge Thickeners	
Number	2
Type	Rotary Screen
Capacity, Each, GPM	250
Horsepower, Each	1.5
Chemical Conditioning	Liquid Polymer

Thickened Sludge Pumps	
Number (Total)	6
No. of Belt Filter Press Feed Pumps	4
No. of Sludge Thickener Feed Pumps	2
Type	Progressive Cavity (4) Centrifugal (2)
Capacity, Each, BFP Pump, GPM	125
Type of Drive	Variable Frequency
Horsepower, Each	2
Capacity, Each, Thickener Pump, GPM	250
Type of Drive	Variable Frequency
Horsepower, Each	4

Plant Drain Pump Stations	
Total Pumping Capacity Required, GPM	3,000
Existing Station	
Number of Pumps	3
Type of Pumps	Submersible
Capacity, Each Pump, GPM	825
New Station	
Number of Pumps	3 (1 on standby)
Type of Pump	Submersible
Capacity, Each Pump, GPM	800