POST, BUCKLEY, SCHUH & JERNIGAN, INC.
889 NORTH ORANGE AVENUE
ORLANDO, FLORIDA 32801-1088
305/423-7275

PM
5:12:87
Orlando, FL

File Copy

DER

MAY 14 1987

BAQM

May 12, 1987

Mr. Bill Thomas
Florida Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, Florida 32301

Re: City of Orlando - Easterly WPCF
Sludge Handling Facility
Odor Control

Dear Mr. Thomas:

In response to the telephone conversation on May 11, 1987, between Mike Harley and myself, we understand that an air permit may also be required for the digester gas flare system. It is, therefore, necessary to withdraw the air pollution permit application on sludge handling facility submitted to FDER on April 21, 1987. This will allow a new permit application to be made for both sludge handling facility and digester gas system.

We appreciate your effort and advice on this matter.

Sincerely,

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

Phillip K. Feeney, P.E.
Project Manager

PKF:mv

07-155.03

/047-1

AC 59-133924

ENGINEERING DESIGN REPORT
SLUDGE HANDLING FACILITY
EASTERLY WATER POLLUTION CONTROL FACILITY
(IRON BRIDGE WPCF)
CITY OF ORLANDO

APRIL 1987

ENGINEERING DESIGN REPORT

SLUDGE HANDLING FACILITY

EASTERLY WATER POLLUTION CONTROL FACILITY

CITY OF ORLANDO

APRIL 1987

Prepared For

CITY OF ORLANDO
DEPARTMENT OF PUBLIC WORKS

Prepared by

POST, BUCKLEY, SCHUH & JERNIGAN, INC.
Consulting Engineers and Planners
889 North Orange Avenue
Orlando, Florida 32801-1088

07-155.19

TABLE OF CONTENTS

LIST OF ATTACHMENTS

Section 1

SUMMARY

Modification and replacement of the existing sludge recovery system with the new sludge handling facility are summarized as follows:

1. The existing sludge recovery system will be removed from the existing building. (Parkson belt filter presses; screw conveyors, FRP tanks, wet cake hoppers, sludge cake dryers, pelletizers, bagger and associated accessories, control panel and chemical feed system.)

2. Next, the building will be divided into two sections: one for sludge thickening and the other for sludge dewatering. Odor control using the modified existing wet scrubbers and fans will be provided for the sludge thickening area. Both the sludge thickening and dewatering areas will be vented to remove moisture from the building.

3. A new sludge handling system, including ten sludge thickening belt filter presses and eight sludge dewatering belt filter presses, belt conveyors, sludge loading stations, polymer feed system, pumps, and associated accessories, will be installed in the aforementioned building.

4. Sludge disposal will be handled separately from this project, via contract hauling of thickened or dewatered sludges. Ultimate dispo-

sal will be by landspreading (or by landfill during in inclement weather).

Section 2

BACKGROUND

The existing sludge handling system at the Easterly Water Pollution Control Facility (WPCF) consists of sludge dewatering and sludge cake pelletizing. This system has been out of operation for about four years due to the extensive maintenance needs of the equipment, the uneconomical end products and the odor problems associated with the system. The location of Eastern WPCF is presented in Attachment 1. A site plan presenting the Eastern WPCF layout and sludge recovery system is given in Attachment 2.

As part of Phase II expansion design process, the City determined that a long-term solution to the sludge handling problem should be incorporated into the Phase II expansion. The City requested and received approval from the Environmental Protection Agency (EPA) "to dismantle the existing equipment as necessary to reuse the existing building as a sludge thickening and dewatering facility . . ." (see Attachment 3). Post, Buckley, Schuh & Jernigan, Inc. (PBS&J) was authorized by the City to design a new sludge handling system which retained the existing sludge handling building (see Attachment 4). As a means of equipment disposal, the City intends to sell the existing sludge recovery equipment.

Section 3

MODIFICATION OF SLUDGE HANDLING FACILITY

As stated, the existing sludge handling equipment, as shown in Attachment 5, will be removed from the building to provide room for the proposed system. Although some of the existing equipment will be used in the new facility, the Parkson belt filter presses, screw conveyors, FRP tanks, wet cake hoppers, rotary kiln dryers, cyclones, rotary coolers, dry product bins and baggers, recycle binds, control panel and chemical feed system, etc. will be stored in the plant's warehouse until its sale or disposal.

The existing building will be divided into two sections: one for sludge thickening and the other for sludge dewatering. A central operation and control room will be provided. Odor control will be provided for the sludge thickening area using the modified existing wet scrubbers. The proposed system will consist of the belt filter presses for sludge thickening only, eight additional belt filter presses for sludge dewatering (four of which can be used for either thickening or dewatering separately), a polymer feed system, sludge pumps and sludge belt conveyors. The layout of the proposed sludge facility is shown in Attachment 6.

Some renovation of the sludge handling building will be required. Due to corrosion, poor insulation and leaks, a new roof will be provided. The existing structural beams and frames will be sandblasted and coated with cementatious material. A four-foot concrete block wall will be built around the existing corroded building wall. Ventilation will be provided to remove moisture from the building.

Section 4

PROCESS DESCRIPTION

There are three sources of sludges from the Eastern WPCF: primary sludge, rotating biological contactor (RBC) sludge, and nutrient (Bardenpho process) sludge. Both primary and RBC sludges are from the existing plant (Phase I). The nutrient sludge will be from the new expansion plant (Phase II). The existing plant with the new expansion plant will have a design capacity of 40 mgd at average daily flow (ADF) and 80 mgd at peak flow. The projected total capacity with the addition of Phase III is 52 mgd ADF and 104 mgd at peak.

The sludge processes described below are based on Phase I and Phase II flows.

4.1 PRIMARY SLUDGE

The primary sludge production, including plant recycle flow, is 360,000 gpd and 60,000 lb/day solids (2 percent solids). Sludge from the existing clarifiers will be pumped to a new 205,000-gallon primary sludge holding tank. The sludge will then flow by gravity to the sludge feed pumps of the nutrient sludge belt filter presses for sludge thickening (to 5 percent solids) prior to anaerobic digestion (see Attachment 7).

4.2 RBC SLUDGE

The RBC sludge production, including plant recycle flow, is 860,000 gpd and 57,000 lb./day solids (0.8 percent solids). Sludge from the existing secondary

clarifiers is pumped to two of the existing 840,000-gallon sludge holding tanks. As with the primary sludge, the RBC sludge will then flow by gravity to the sludge feed pumps of the belt filter presses designated for RBC sludge for sludge thickening (to 5 percent solids) prior to anaerobic digestion (see Attachment 7).

4.3 NUTRIENT SLUDGE

The nutrient sludge production from the new plant is 620,000 gpd and 26,000 lb./day solids (0.5 percent solids). Due to their different characteristics, the nutrient and RBC sludges must be kept separate. Therefore, this sludge will be pumped from the new clarifiers to the existing 840,000-gallon sludge holding tanks. Sludge will flow by gravity to the sludge feed pumps of the nutrient sludge belt filter presses for sludge thickening (to 5 percent solids) or dewatering prior to land disposal (see Attachment 7).

4.4 DIGESTED SLUDGE

Both the primary and RBC sludges are thickened to 5 percent solids prior to anaerobic digestion. The sludges will be digested anaerobically in the complete mixed digesters with an average retention time of 30 days at 95 degrees Farenheit. It is anticipated that 40 percent of the volatile solids will be destroyed and the sludge will be biologically stabilized under these conditions. These digester facilities have already been permitted as part of construction permit No. DC59-125636.

4.5 FILTRATE AND WASHWATER RECYCLE

Filtrate and washwater from the belt filter presses will flow by gravity to the existing lift station located south of the existing sludge handling building. The recycle flows are about 2 mgd at normal operation and 2.4 mgd at alternate operation (further described in Section 5) during Phase I and Phase II. The flow will increase to 2.7 mgd at normal operation and 3.3 mgd at alternate operation with the addition of Phase III. Nutrients from sludge dewatering will be added to the recycle streams. Therefore, all recycle flows from sludge thickening and dewatering will be pumped to the existing plant (Phase I) head works.

Section 5

OPERATION DESCRIPTION

In order to provide flexibility and reliability in the operation of the system (as requested by the City), the proposed operation scheme is as follows:

5.1 MODES OF OPERATION

5.1.1 Normal Operation

Both the primary and RBC sludges will be thickened by the belt filter presses and then pumped to the anaerobic digesters. The digested and stabilized sludge will then be pumped to a tank truck for disposal as liquid sludge by land spreading. The nutrient sludge will be thickened by belt filter presses and also pumped to the tank truck for disposal as liquid sludge by land spreading.

5.1.2 Alternate Operation

In the alternate operation mode, both the primary and RBC sludge will be handled as described for normal operation. The nutrient sludge, however, will be dewatered and disposed of as sludge cake.

5.1.3 Emergency Operation

In an emergency, such as inclement weather, anaerobic digested primary and RBC sludge will be pumped to the belt filter presses for dewatering. The nutrient

sludge will also be dewatered to form a sludge cake. The additional flow and nutrients contained in the recycles from this process will increase the load to the existing (Phase I) facility. To avoid some of the increased loading on the Phase I facility, the sludge can also be thickened and pumped back to the sludge storage tank to mix with the incoming dilute sludge.

5.2 SLUDGE THICKENING

Sludge thickening for primary, RBC and nutrient sludge is accomplished by belt filter presses. There are ten presses required for normal operation at 14 hours per day and 7 days per week during Phase I and Phase II. Sludge thickening and dewatering data is presented in Attachment 8. The operation time of the belt presses will be increased to 20 hours per day, 7 days per week with the addition of Phase III flows. However, four standby belt presses are provided which are thickening/dewatering combination belt filter presses as (back-up). All sludge will be thickened to 5 percent solids. Polymer will be used as a flocculation aid at a design dosage of 10 pounds per ton of dry solids.

5.3 SLUDGE DEWATERING

Sludge dewatering for digested sludge and nutrient sludge is also accomplished by belt filter presses. There are 8 belt presses required for the dewatering operation (see Attachment 6) at 14 hours per day and 7 days per week during Phase I and Phase II. The operation time of the belt presses will be increased to 20 hours per day, 7 days per week with the addition of Phase III flows. Four of the 8 belt presses are equipped with thickened liquid sludge removal mechanism and intended to be used as backup for sludge thickening operation. All

sludge can be dewatered to 16 percent solids prior to disposal. Polymer will be used as a flocculation aid at a design dosage of 10 pounds per ton of dry solids. Ventilation will also be provided to remove moisture from the sludge dewatering area.

5.4 SLUDGE LOADING STATIONS

Thickened sludge will be pumped to the tank truck through the liquid sludge loading station. Dewatered sludge will be transported through the belt conveyors to the sludge loading building where the sludge will be loaded onto tank trucks. The dewatered sludge production is estimated at 19,000 gpd (2,500 cubic feet per day) of nutrient sludge cake produced during alternate operation and 76,000 gpd (10,000 cubic feet per day) of sludge cake at emergency operation during Phase I and Phase II.

Section 6

ODOR CONTROL

Designed to remove particulates and odor from the sludge pelletizing process, the original odor control system (FDER Permits AC59-59312 and AC59-59313) consisted of cyclones collectors, venturi scrubbers, and packed tower absorbers. The odor control unit was operated with recirculated potassium permanganate as the scrubbing medium. This system, however, has not been in operation since 1984 due to the termination of the pelletizing process.

The Easterly WPCF expansion (Phase I and Phase II) involves the thickening of primary and RBC sludges prior to anaerobic digestion, liquid disposal of primary and RBC sludges and thickening or dewatering nutrient sludge for disposal. Due to the biological processes involved, the RBC, nutrient and digested sludge are considered stabilized. Therefore, odor control for these sludges is not necessary. The primary sludge, however, is not stabilized and will be subject to odor control. A flow diagram for the proposed odor control system is shown in Attachment 9.

The design air rise rate of 500 fpm and H_2S concentration of 50 ppm (ranges from 5 to 50 ppm) are based on field tests (see Attachment 10). This represents 10,000 scfm of air per press to be scrubbed through the wet scrubbers. Four of the belt presses are assigned for primary sludge thickening (one of which is a standby). These four belt presses are provided with hoods for odor control. The 2 existing fans and scrubbers are each designed to handle 30,000 scfm. The design provides for removal of odor from the entire sludge thickening area for treatment.

The existing 2 fans and scrubbers will be relocated within the existing building, and modified to meet the design requirements. Modifications to the odor control system are as follows:

a. The 2 cyclone collectors are no longer required since there are no particulates present in the air stream from the sludge thickening. The collectors will be removed and stored until the City can sell or dispose of them.

b. The existing fan, damaged by corrosive gases, will be replaced by two new fans of stainless steel. However, the existing motors, each rated 200 hp, will be reused for the new fans.

c. Modification of the two wet scrubbers will include a two-stage air scrubbing process using the venturi scrubbers as first stage and packed tower units for the second stage.

   A new chemical spray system will be provided for each venturi scrubber and packed tower absorber to replace the existing spray system. New packing media will also be provided.

d. A new chemical feed system will be provided to replace the existing system. This system will include a venturi recycle tank and pumps, packed tower recycle tank and pumps, sodium hypochlorite storage tank and pumps, caustic pumps, controls and associated accessories.

Section 7

SLUDGE DISPOSAL

The City intends to contract out sludge disposal through a local firm. An operation permit will be required by either the City or Contractor from related government regulatory agencies.

The sludge will be disposed of in liquid sludge form (5 percent solids) by land application. Under emergency conditions, the sludge will be disposed of as sludge cake (16 percent solids). However, both liquid sludge and sludge cake are considered stabilized from the process of the treatment plant. A proposed sludge disposal operation plan from a local firm is provided in Attachment 11. The City is currently negotiating for these services.

Section 8

COST

The total cost of the sludge thickening and dewatering facility for Phase I and Phase II is approximately six million dollars. A breakdown of the cost is as follows:

Belt Presses	$2,800,000
Belt Conveyors	270,000
Pumps and Seal Water	358,000
Polymer Feed System	225,000
Sludge Loading Stations	94,000
Control Rooms	60,000
Odor Control System	256,000
Structure and Concrete	623,000
Piping and Valving	250,000
Instrumentation	430,000
Electrical	300,000
HVAC	130,000
Accessories	204,000
Total	**$6,000,000**

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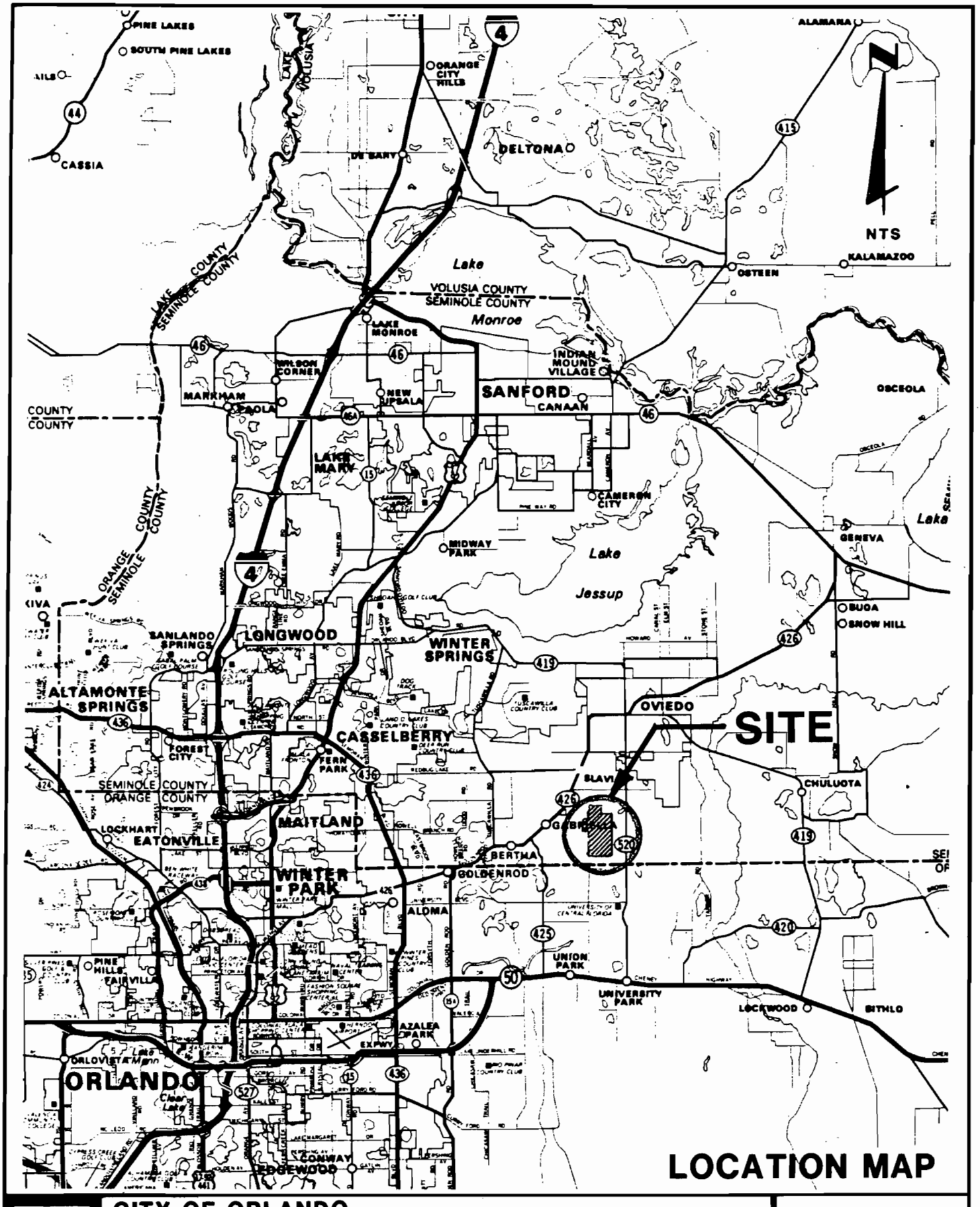
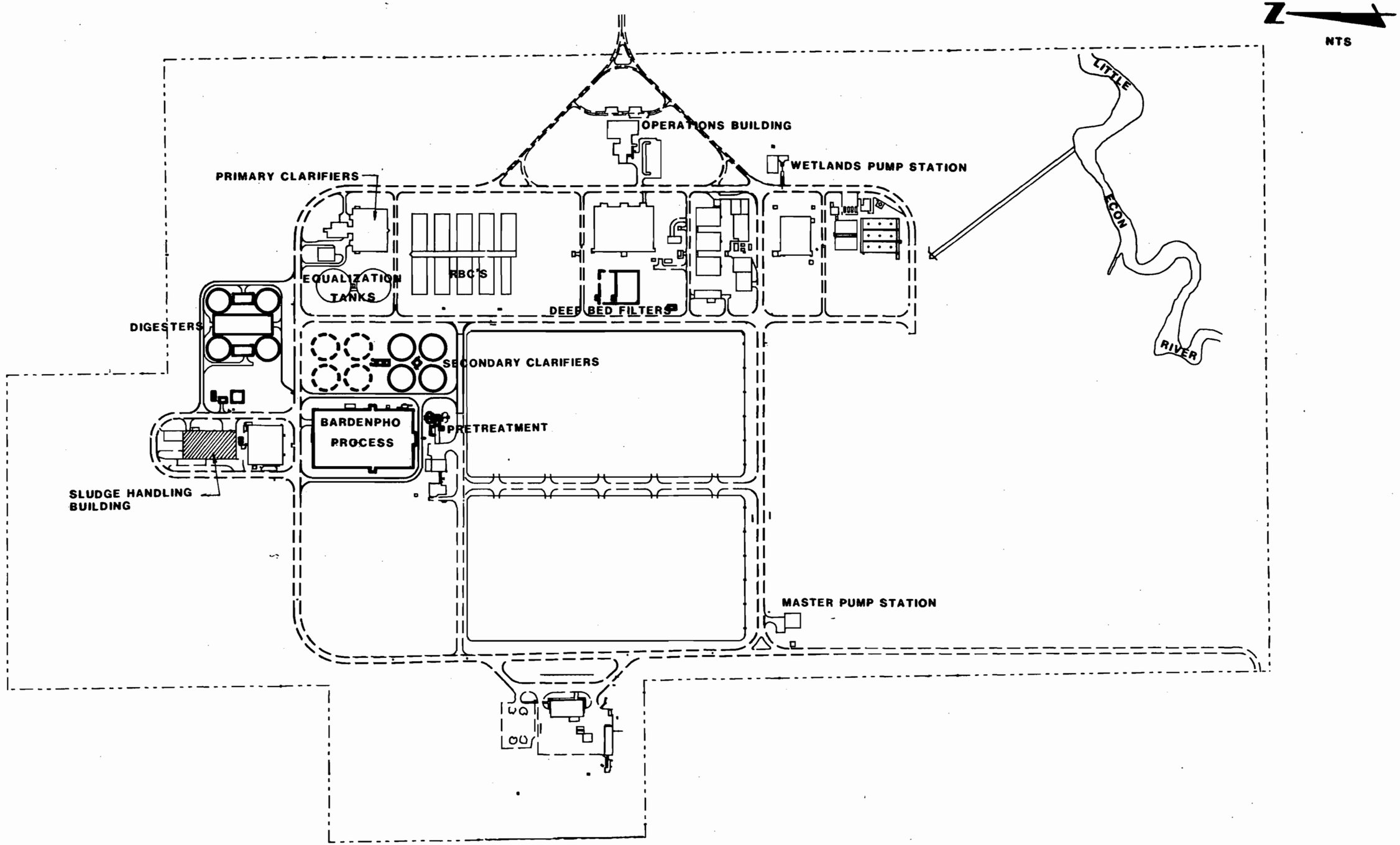


PBS&J

CITY OF ORLANDO
EASTERLY WATER POLLUTION CONTROL FACILITY
(IRON BRIDGE WPCF)

ATTACHMENT #1

N67547

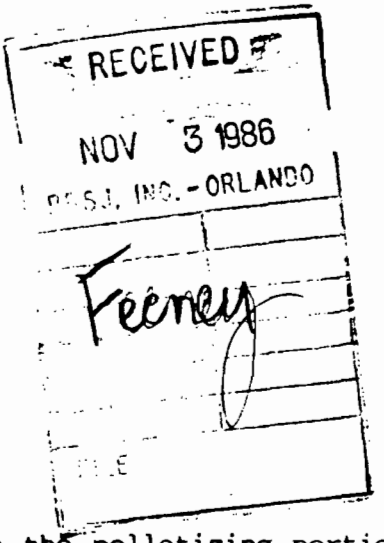


CITY OF ORLANDO EASTERLY WATER POLLUTION CONTROL FACILITY (IRON BRIDGE WPCF)	**SITE LAYOUT**	ATTACHMENT #2

N77416

ATTACHMENT #3

100



AUG 28 1986

REF: 4RA

Honorable Bill Frederick, Mayor
City of Orlando
City Hall
Orlando, FL 32801

Re: Orlando
C120399-03-0

Dear Mayor Frederick:

The City of Orlando requested EPA approval to abandon the pelletizing portion of the sludge recovery system funded under the referenced grant in a letter dated July 28, 1986. The City also requested approval to dismantle the existing equipment as necessary to reuse the existing building as a sludge thickening and dewatering facility in a letter dated August 6, 1986. The Florida Department of Environmental Regulation (FDER), in a letter dated August 8, 1986, supported the City's request to abandon a Federally funded facility.

In accordance with EPA guidance entitled "Abandonment of Wastewater Treatment Works Funded by the Municipal Treatment Works Construction Grants Program," the City of Orlando has met the appropriate criteria for their situation. EPA has confirmed that the grantee selected the cost-effective, environmentally acceptable alternative in the original cost-effectiveness analysis, and the grantee experienced operational problems that were not expected and beyond their control. These included odor problems which prevented the City from obtaining an operating permit and operation and maintenance costs which greatly exceeded the original projections.

Therefore, the City's request for abandonment is hereby approved, contingent upon the following:

1. The grantee must request disposition instructions for the abandoned facilities in accordance with 40 CFR Part 30. That request should be sent through FDER to EPA.

2. The replacement facilities must have the equivalent capability of the installed system and meet State and Federal requirements for the disposal of sludge as well as obtaining an operating permit from FDER.

3. The plans and specifications for the replacement facilities must be submitted to FDER for approval prior to construction.

4. No Federal funds will be used in the construction of the facility.

If you have any questions, please feel free to contact me or my staff.

Sincerely yours,

Jack E. Ravan
Regional Administrator

cc: FDER

MAR 9 1987

REF: 4PM-PC Cooper Handle.

Mr. Richard W. Smith, P. E., Chief
Bureau of Wastewater Management and Grants
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32301

RECEIVED

Re: Orlando
C120399-03-0

Dear Mr. Smith

In our August 26, 1986, letter EPA approved the City's request to abandon its pelletizing portion of the sludge recovery system funded under the referenced grant. A condition of the approval was that the City request disposition instructions from the Florida Department of Environmental Regulation (FDER) and EPA.

In a letter dated January 27, 1987, FDER concurred with the disposition procedure contained in the City's December 30, 1986, letter. The method proposed by the City for disposition of its equipment is acceptable to EPA. However, the City's proposed use of the money which may be generated through disposition of the sludge equipment is not allowed in accordance with 40 CFR, Part 30.

As stated in our August 26, 1986, letter, the approval for abandonment was contingent upon no Federal funds being used for the replacement facilities. The City must compensate EPA for its share (grant percent), less the City's expenses, of the funds obtained through disposition of the sludge equipment.

The City should re-submit its request to the State for disposition instructions. That request should state the City's intent to reimburse EPA its share, less the City's expenses, of the proceeds obtained from the sale or salvage of its sludge equipment.

If you have any questions, please feel free to contact us.

Sincerely yours,

Harold W. Hoskins, Chief
Facilities Construction Branch
Water Management Division

cc: Orlando

ATTACHMENT #4

City of Orlando

PUBLIC WORKS DEPARTMENT

400 S. ORANGE AVENUE
ORLANDO, FLORIDA
32801

PROJECT MANAGEMENT
TELEPHONE
(305) 849-2547

August 14, 1986

Mr. Phil Feeney
POST, BUCKLEY, SCHUH & JERNIGAN
889 N. Orange Avenue
Orlando, FL 32801

Re: Iron Bridge Expansion - Phase II

Dear Phil:

In confirming our discussions in the July 31, 1986 meeting, it is the City's desire to remove the Parkinson presses and replace them with more efficient presses requiring considerable less maintenance as a part of Phase II expansion. We also want to get EPA approval to abandon the pelletizer so that the existing building can be utilized for sludge handling in a more reliable manner than is currently available. Please proceed accordingly with your design efforts and requests to EPA.

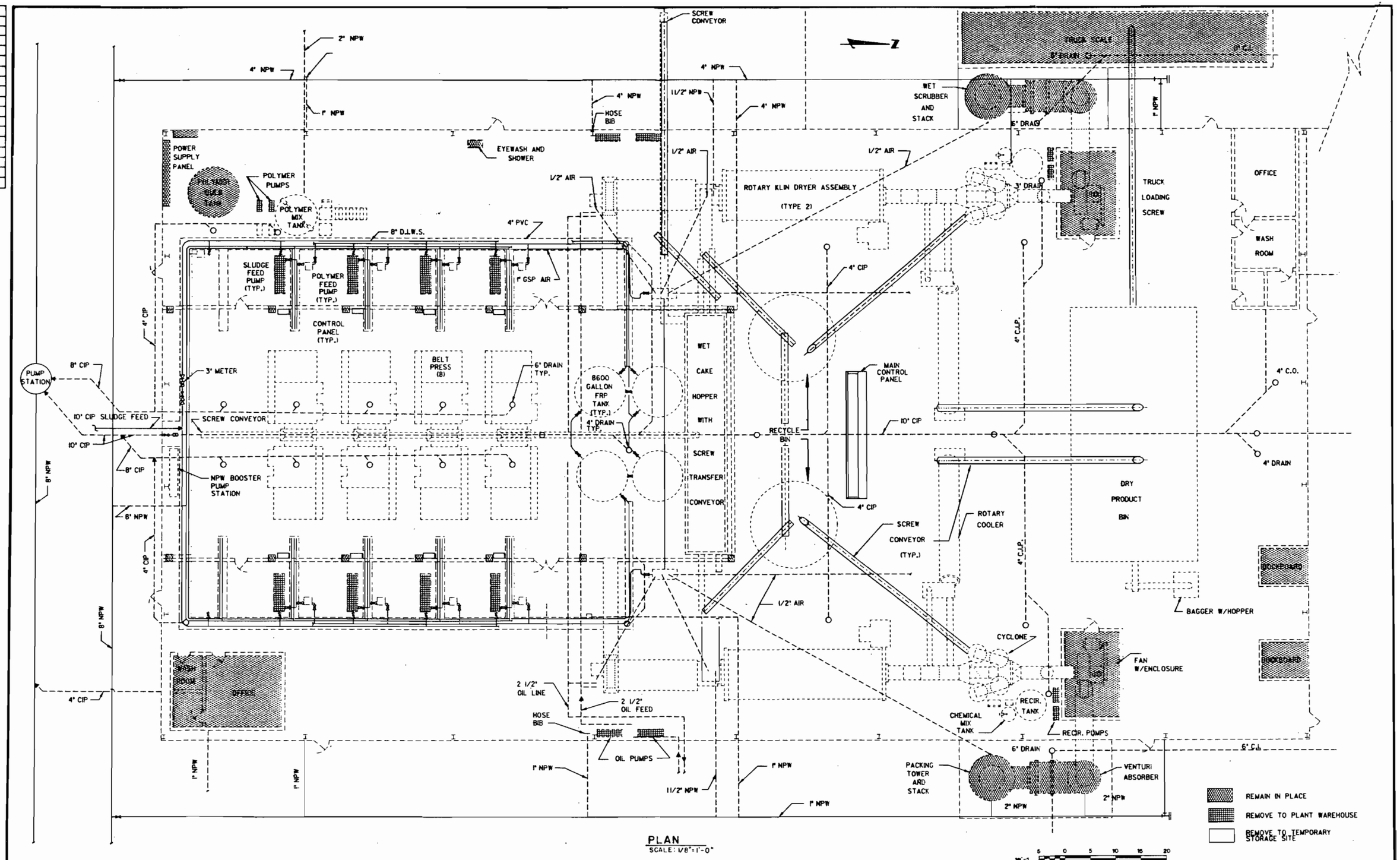
Very truly yours,

Cooper E. Curtis

Cooper E. Curtis, P.E.
Project Manager

CEC/sjh

cc: Keith C. Rice
Tom Lothrop



PLAN
SCALE: 1/8"=1'-0"

ATTACHMENT #5

DESIGN CCC
DRAWN
CHECKED
QC

NOT VALID FOR CONSTRUCTION UNLESS SIGNED IN THIS BLOCK

Post, Buckley, Schuh & Jernigan, Inc.
CONSULTING ENGINEERS and PLANNERS

MUNICIPAL SEWER UTILITY
CITY OF ORLANDO, FLORIDA
DEPARTMENT OF PUBLIC WORKS
EASTERLY WATER POLLUTION CONTROL FACILITIES

EXISTING EQUIPMENT PLAN

NO	DATE	REVISION	APP'D BY
5			
4			
3			
2			
1			

JOB NO. 07-155
F.B. NO.
DATE

M-19

SHT. ___ OF ___

NOTES: 1. ALL EXPOSED PIPING INSIDE THE BUILDING SHALL BE PVC, SCH 80 OR OTHERWISE AS NOTED

2. ALL BURIED PIPING SHALL BE DUCTILE IRON OR OTHERWISE AS NOTED

N

10" D.I.P. NUTRIENT SLUDGE

2" PW

4" NPW

1" NPW

2" PW, PVC SCH-80

HOSE BIB

11/2" NPW

1" NPW

3" NPW

10" DIP

TAPPED INTO EXISTING NPW LINES

SEE DETAIL 3 M-6

SLUDGE LOADING BUILDING SEE DWG M-9

CONCRETE PAVEMENT

ACCESS HATCH (TYP)

EXIST. TRUCK SCALE

WEATHER PROTECTION COVER

SCALE ALARM & BLIMP LIGHT

ELECTRIC POWER ROOM ENCLOSURE SEE STRUCT. DWG.

TAPPED INTO EXISTING 2" PW LINE

24'x15' ROLL-UP DOOR

H.B.

CONNECT TO EXIST. 2" FILL LINE

SEAL WATER UNIT SEE DWG. M-17

EMERGENCY SHOWER & EYEWASH (EXISTING)

2" PW SEAL WATER FOR ALL PUMPS

24'x18' ROLL-UP DOOR

H.B.

12' R

POWER SUPPLY PANEL (EXISTING)

2" PW SEAL WATER ROUTED APPROPRIATELY TO ALL PUMPS. SEE DWG. M-17

EXIST. TANK (RELOCATE)

POLYMER BULK TANK (NEW)

CONCRETE RETAINING WALL SEE STRUCTURAL DWG.

AIR COMPRESSOR

LADDER

POLYMER RECIR. PUMPS SEE DETAIL 10 M-16

C M-2

10" DIP

DET. 2 M-6

6" NUTRIENT SLUDGE

2" NPW

5/8" POLYMER

FRP HANDRAIL

5/8" POLYMER

11/2" NPW

14 M-18

POLYMER SOLUTION

11 M-18

SLUDGE FEED PUMP (TYP.)

POLYMER DILUTION UNIT SHELTER (TYP)

EXIST. COL.

POST DILUTION UNIT (TYP)

DETAIL 3 M-3

REMOVABLE FRP WALKWAY (TYP)

CONVEYOR

CONC. PLATFORM (TYP)

F M-3

10'-2" ±

22'x15' ROLL-UP DOOR

8" S.S.

8" NPW

4" CIP

16'x15' ROLL-UP DOOR

PUMP STATION

12 M-16

8" CIP

10" CIP

10" CIP

10" CIP

8" CIP

DISCONNECT AND BLIND FLANGED EXISTING PIPE

8" NPW

TAPPED INTO EXISTING NPW LINES

4" CIP

8" SS.

13 M-16

4" SS

W/RM

OFFICE

SEE DETAIL 1 M-6

3'-0" LONG CHCK'D PLATE GALV. STEEL COVER (TYP) (EXISTING CUT TO SUIT)

EXISTING TRENCH TO BE COVERED WITH NEW FIBERGLASS GRATING (TYP)

SLUDGE THICKENING

H.B.

24' x 15' ROLL-UP DOOR

10" DIP RBC

1" PW

1" NPW

8" NPW

ODOR CONTROL UNIT

SEE DWG M-15

4" NPW

EXISTING CENTRIFUGAL FAN W/ENCLOSURE (RELOCATE)

CONTROL PANEL

CONC. PAD

EXISTING TOWER (RELOCATE)

H.B.

N RBC

N RBC

N (NUTRIENT SLUDGE)

N BELT THICKENING PRESS (TYP)

N

P RBC

P RBC

P PRIMARY SLUDGE

P

(4) GAS EXHAUST HOOD, SEE DETAIL 8 M-5

FRP HANDRAIL

OPERATION AND CONTROL RM

CONTROL PANEL

SCALE METER

FRP HANDRAIL

16 M-18

SEE DETAIL 4 M-6

CHCK'D & GALV. STL COVER

4"

4"-2"

6" PVC

GRINDER DET. 9 M-18

17 M-18

1½" NPW

1" NPW

8" DIP PRIMARY

4" DIP RBC

10" DIP DIGESTED SLUDGE

4" DIP PRIMARY

10" DIP NPW

4" DIP NUTRIENT

8" DIP DRAIN

1" NPW

DS N

DS N

DS (DIGESTED BLUDGE)

DS

A M-2

E M-3

DETAIL 3 M-3

BELT DEWATERING PRESS (TYP)

POST DILUTION UNIT (TYP)

CONTROL PANEL (TYP)

POLYMER DILUTION UNIT SHELTER (TYP)

CONVEYOR

CONVEYOR

SLUDGE FEED PUMP (TYP)

FLOC. TANK (TYP)

57'-4"

22' x 15' ROLL-UP DOOR

1" PW

18'x 15' ROLL-UP DOOR

B M-2

BELT THICKENING/ DEWATERING PRESS (TYP)

THICKENED SLUDGE PUMP (TYP)

EXISTING DOCKBOARD

1" TEE W/PLUG AT ONE END (TYP)

8" W/PLUG

3" W/PLUG

CONC. PLATFORM (TYP)

CONVEYOR

SEE DET 6 M-6

SEE DET 5 M-6

FUTURE BELT PRESS (TYP.)

FRP HANDRAIL (TYP)

SLUDGE DEWATERING

24'x 15' ROLL-UP DOOR

H.B.

24'x 15' ROLL-UP DOOR

1" NPW

PLAN

SCALE: 1/8"=1'-0"

ATTACHMENT #6

5 0 5 10 15 20

1/8"=1' scale feet

DESIGN CGK	NOT VALID FOR CONSTRUCTION UNLESS SIGNED IN THIS BLOCK	**Post, Buckley, Schuh & Jernigan, Inc.** CONSULTING ENGINEERS and PLANNERS	MUNICIPAL SEWER UTILITY CITY OF ORLANDO, FLORIDA DEPARTMENT OF PUBLIC WORKS EASTERLY WATER POLLUTION CONTROL FACILITIES
DRAWN J.C.			
CHECKED			
D C			

SLUDGE THICKENING AND DEWATERING PLAN

NO.	DATE	REVISION	APP'D BY
5			
4			
3			
2			
1			

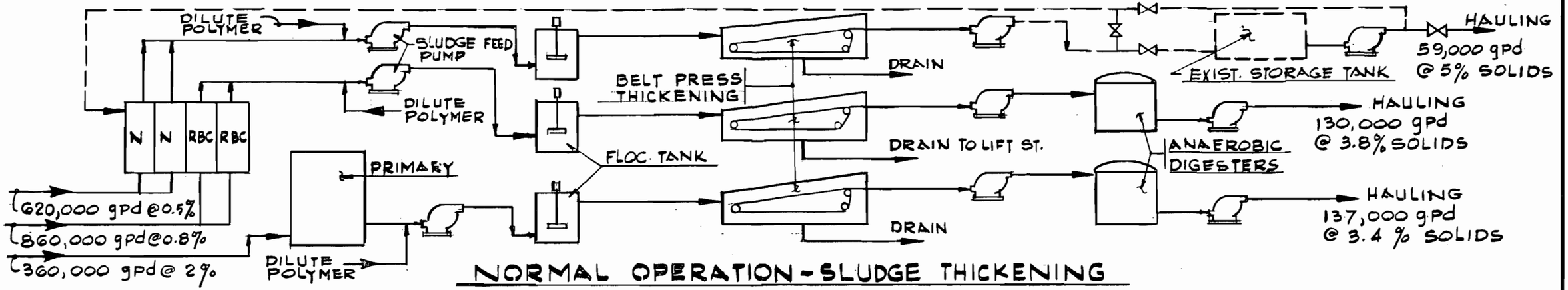
JOB NO. 07-155

F B NO.

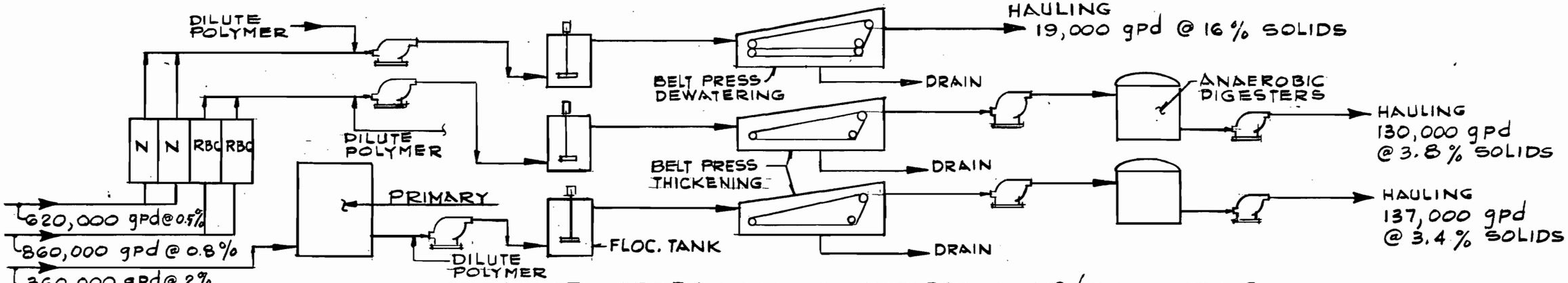
DATE

M-1

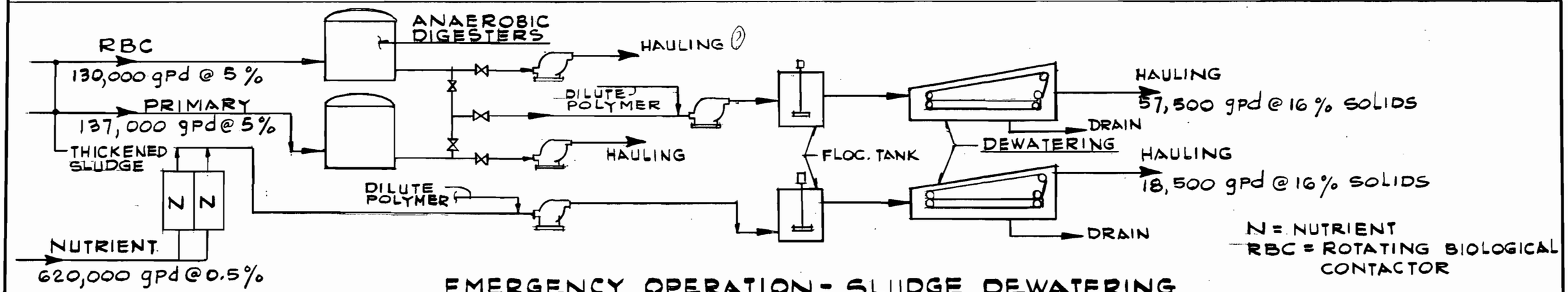
SHT ____ OF ____



NORMAL OPERATION - SLUDGE THICKENING



ALTERNATE OPERATION - SLUDGE THICKENING / DEWATERING



EMERGENCY OPERATION - SLUDGE DEWATERING

PBS&J CITY OF ORLANDO, FLORIDA EASTERLY WATER POLLUTION CONTROL FACILITIES	SLUDGE THICKENING & DEWATERING	ATTACHMENT #7

N77416

ATTACHMENT 8

SLUDGE THICKENING AND DEWATERING DATA

	Design Flow (mgd)	Operation Flow (gpm)	Flow Per Press (gpm)	No. of Presses*
I. Phase I and II				
A. Sludge Thickening				
1. Primary Sludge at 2%	0.36	430	150	2.9(3)
2. RBC Sludge at 0.8%	0.86	1,030	300	3.5(4)
3. Nutrient Sludge at 0.5%	0.62	740	300	2.5(3)
Total				8.9(10)
B. Sludge Dewatering				
1. Digested Sludge at 3.6%	0.27	320	140	2.3(2)
2. Nutrient Sludge at 0.5%	0.62	740	150	5.0(5)
Total				7.3(7)
II. Phase I, II, III				
A. Sludge Thickening				
1. Primary Sludge at 2%	0.38	320	150	2.1(2)
2. RBC Sludge at 0.8%	0.89	740	300	2.5(3)
3. Nutrient Sludge at 0.5%	1.24	1,030	300	3.4(3)
Total				8.0(8)
B. Sludge Dewatering				
1. Digested Sludge at 3.6%	0.28	230	140	1.6(2)
2. Nutrient Sludge at 0.5%	1.24	1,030	150	6.9(7)
Total				8.5(9)

Note: Operation flow based on 14 hours/day, 7 days/week for Phases I and II, and 20 hours/day, 7 days/week for Phases I, II and III.

* Actual number of presses.

NPW
660 gpm

VENTURI RECYCLE TANK

RECYCLE PUMPS

660 gpm.

PH and ORP PROBES

PACKED TOWER STANDBY

310 lb/hr H_2S
0.25 mg/l H_2S
50" ϕ STACK

VENTURI SCRUBBER

NPW
990 gpm.

DRAIN

FLOW METER

ABSORBER RECYCLE TANK

RECYCLE PUMPS

990 gpm

Ph and ORP PROBES

FAN

6,170 lb./h H_2S

FAN

CAUSTIC PUMPS

110 gph @ 20% NaOH

70 gph @ 10% NaOCl

SLUDGE THICKENING AREA ROOM VENT

30,000 cfm

3,000 cfm

PRIMARY SLUDGE HOLDING TANK

30,000 cfm @ 50 mg/L H_2S

DRAIN

FLOW METER

HOODS

137,000 gpd @ 5%

THICKENEND SLUDGE TO ANAEROBIC DIGESTERS

SODIUM HYPOCHLORITE PUMPS

POLYMER

DRAIN TO LIFT STATION

BELT FILTER PRESSES

Na OH DRUM

SODIUM HYPOCHLORITE TANK

PRIMARY SLUDGE
360,000 gpd
@ 2% SOLIDS

PBS&J

CITY OF ORLANDO, FLORIDA
EASTERLY WATER POLLUTION CONTROL FACILITIES

ODOR CONTROL FLOW DIAGRAM

ATTACHMENT #9

N77416

ATTACHMENT #10

CROSS/TESSITORE & ASSOCIATES, P.A.

REGISTERED PROFESSIONAL ENGINEERS

ENVIRONMENTAL ENGINEERS

CROSS / TESSITORE & ASSOCIATES, P.A.

4759 S. CONWAY ROAD

ORLANDO, FLORIDA 32812

ENGINEERING CALCULATIONS FOR SIZING AND RETROFITTING SCRUBBING SYSTEMS EASTERLY POLLUTION CONTROL FACILITY (IRON BRIDGE ROAD REGIONAL WATER POLLUTION CONTROL FACILITY)

CITY OF ORLANDO, FLORIDA

Prepared for

Post, Buckley, Schuh & Jernigan, Inc.
Orlando, Florida

January 5, 1987

CROSS/TESSITORE & ASSOCIATES, P.A.
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ODOR LEVELS AND CONTROL

The basic background data relevant to odor types, levels, flows and control are presented in C/TA's report to Post, Buckley, Schuh & Jernigan (draft) dated 6 November 1986. Several of the parameters were changed in the course of refining the new primary sludge thickening press system and as a result some of the odor control conditions and assumptions are slightly modified. Current conditions for the odor control systems are based on a gas flow total to each of the scrubbing system fans of 30,000 acfm from press hoods plus 3,000 acfm from external exhaust system or 33,000 acfm at 80°F and 6 inches water negative pressure. This is nearly twice that assumed for the presses in our previous report referenced above. The odors are assumed to consist of hydrogen sulfide and unknown odorous organic compounds. A maximum H_2S level of 50 ppm is also assumed. The water vapor content will be slightly less than 3.3% as these gases will not be fully saturated. Molecular weight of this gas mixture will be close to 29.

As described in the previous report, an exit H_2S level of 0.25 ppm is desired at the stack. This is 10 times the normal odor detection level and will be diluted by normal atmospheric dispersion upon leaving the stack. The required control efficiency to achieve this is 99.5% which is 4 times greater than the existing odor control arrangement provided.

ODOR CONTROL SYSTEM AND SPECIFICATIONS

These new modified conditions make the odor removal requirements more demanding. It is no longer possible to reduce gas velocities in the absorption portions of this system. It therefore is only possible to increase the gas-liquid contact surface area and attempt to optimize the liquid-to-gas (L/G) ratios, contact arrangement and chemistry.

It is necessary to slightly remodify the system proposed in the C/TA 6 November 1986 report. With the increased gas flow rate it is too fast for the proposed Venturi cross flow packed absorber shown in Figures 7 and 8 of that report. Instead, the Venturi tank will be kept empty and used as a cross flow spray absorber.

The packings in the tower absorber must be changed to 2" type K polypropylene tellerettes. These have knobs to provide extra surface area and can provide 99.8% of the H_2S control with the 100 inch depth of packing specified with proper liquid rates and chemical additions. Because of the unknowns in the feed gas, gas conditioning and some additional odor control are provided in the Venturi and Venturi cross flow spray absorber.

Design conditions for this system as currently developed are summarized in Table 1. Note that these differ from those previously presented in Table 2 of the 6 November 1986 C/TA report. At all locations in this system, the gases are considered to be air at standard conditions.

TABLE 1

CURRENT DESIGN CONDITIONS FOR PRESS ODOR CONTROL SYSTEM

(per each of the two control systems)

Fan	
Volumetric flow rate	33,000 ACFM @80°F
Venturi (each of two)	
Throat L/G	5 gal/1,000 ACF
Spray Bars L/G	5 gal/1,000 ACF
Recycle Loop Liquid	330 gpm maximum
Spray Absorber Volume	192 ft^3
Gas Contact Time	Approximately 1/3 Second
ΔP	5.1" H_2O
Recycle Tank*	2,938 gal
Recycle Tank Liquid Residence Time	4 min minimum
Recycle Liquid ORP	800 mv
Recycle Liquid Cl_2 conc.	80 ppm
Recycle Liquid Bleed Rate	10 gpm
10% NaOCl Feed Rate	10 gph
20% NaOH Feed Rate	5 gph
Packed Tower Absorber (each of two)	
Counter Current L/G	15 gal/1,000 ACF max (10.6 nominal)
Recycle Loop Liquid	495 gpm max (380 nominal)
ΔP	4.5" H_2O
Recycle Tanks**	2,000 gal
Recycle Tank Liquid Residence Time	2 min minimum
Recycle Liquid ORP	800 mv
Recycle Liquid Cl_2 conc.	80 ppm
Recycle Liquid Bleed Rate	10 gpm (to Venturi tank)
10% NaOCl Feed Rate	10 gph
20% NaOH Feed Rate	5 gph
Outlet Temperature	80°F
Tower Gas Velocity	8.7 ft/sec
Tower Gas Contact Time	1.0 sec
Packing Height	8 ft 4" (100")
Packing Volume	530 ft^3
Tower Diameter	9 ft
Mist Eliminator Water Spray	(intermittent) 100 gpm for 2 min every 8 hrs or when ΔP >.75" H_2O
Other Make Up H_2O Rate	9.6 gpm
Stack	
Exit Velocity	38.8 ft/sec

* One Recycle Tank for both units
**Two ganged tanks for both units

CACULATIONS FOR SIZING AND RETROFITTING SYSTEM

Calculations for this odor absorption system are presented here. They are developed on the requirement that the existing scrubbing system be used to the greatest possible extent and the odor control and flow requirements noted previously in this report. Both systems must be designed to handle 33,000 acfm.

Venturi Scrubber --

Existing inlet duct = 42" ID

$$\text{Inlet duct gas velocity} = \left(\frac{33{,}000\ \text{ft}^3}{\text{min}}\right)\frac{(4)144}{\pi 42^2\ \text{ft}^2}\ \frac{\text{min}}{60\ \text{sec}}$$

$$= 57.2\ \text{ft/sec}$$

Existing Venturi throat = 14" x 42" rectangular

$$\text{Throat area} = \frac{(14)(42)}{144} = 4.08\ \text{ft}^2$$

$$\text{Venturi throat gas velocity} = \frac{33{,}000}{4.08}\left(\frac{\text{min}}{60\ \text{sec}}\right) = 135\ \text{ft/sec}$$

Venturi minimum L/G for gas conditioning and any large particle removal = 5 gal/1,000 acf

Venturi recycle liquid rate = 165 gpm max

$$\text{Venturi pressure drop} = \frac{(135)^2(7.49\times10^{-2})(4.08)^{0.133}(5)^{0.78}}{1270}$$

$$= 4.6"\ H_2O$$

Venturi recycle line ID based on 6 ft/sec liquid velocity

$$= \left[\left(\frac{165\ \text{gpm}}{6\ \text{ft/sec}}\right)\left(\frac{\text{min}}{60\ \text{sec}}\right)\left(\frac{\text{ft}^3}{7.48\ \text{gal}}\right)\frac{4}{\pi}\right]^{\frac{1}{2}}\frac{12\ \text{in}}{\text{ft}} = 3\ 1/3\ \text{inch}$$

Venturi Cross Flow Spray Absorber --

Effective gas velocity after baffles

$$= \frac{33{,}000}{(6')(6')}\left(\frac{1}{60}\right) = 15\tfrac{1}{4}\ \text{ft/sec}$$

$$\text{Total cross flow volume} = \frac{(64)(72)(72)}{12^3} = 192\ \text{ft}^3$$

$$\text{Gas nominal residence time} = \frac{192}{33{,}000}\left(\frac{60\ \text{sec}}{\text{min}}\right) = 0.35\ \text{sec.}$$

Recycle line ID @ 165 gpm max = 3 1/3 inch

Spray nozzle = 16 @ 10.3 gpm each

Pressure drop = 0.5" water

Venturi Recycle Tank

One tank is used for both systems and assume both are operating.

Tank size = 10' diameter x 5' high, flat bottom

Tank volume = 2,938 gal to top; use working capacity of 2,640 gal

Liquid residence time in tank = $\frac{2,640 \text{ gal}}{(330 \text{ gpm})(2)}$ = 4 min

Tower Absorber

Existing tower diameter = 9" (i.e. 108")

Superficial gas velocity = $\frac{33,000 \text{ cfm}(4)}{\pi 9^2 \text{ ft}^2} \frac{\text{min}}{60 \text{ sec}}$ = 8.65 ft/sec

Absorber packing volume = $(\frac{\pi 9^2}{4})(\frac{100 \text{ ft}}{12})$ = 530 ft^3

Gas residence time = (530/33,000)60 = 0.96 seconds.

Existing recycle tanks = 2 existing 6' diameter x 90" high tanks ganged as one unit

Tanks volume = $(2)(\frac{\pi 6^2}{4})(\frac{90}{12})(\frac{7.48 \text{ gal}}{\text{ft}^3})$ = 3,170 gal or 2,000 gal working capacity

Absorber maximum L/G = 15 gal/1,000 acf max

Absorber nominal L/G = 10.6 gal/1,000 acf at optimal absorption for this packing where G is 2546

Absorber recycle rate = $(15)(\frac{33,000}{1,000})$ = 495 gpm max or 380 gpm nominal

Tank residence time = $\frac{2,000}{(495)(2)}$ = 2.0 min minimum or 2.6 min nominal

Recycle liquid pipe = $[\frac{495}{6}(\frac{1}{60})\frac{1}{7.48}\frac{4}{\pi}]^{\frac{1}{2}}$ 12 = 5.8" or 6"

Spray bar pipe = $[\frac{495/2}{8}(\frac{1}{60})\frac{1}{7.48}\frac{4}{\pi}]^{\frac{1}{2}}$ 12 = 3½"; use 3"

Mist eliminator (4 bend chevron, gas velocity range of 6-11 ft/sec, design at optimum of 10 ft/sec) diameter = $[\frac{33,000}{10}\frac{1}{60}\frac{4}{\pi}]^{\frac{1}{2}}$ 12 = 100 inch

Mist eliminator clear water spray (@ 100 gpm from 10 nozzles)

$$\text{pipe} = \left[\left(\frac{100\ \text{gpm}}{7.48\ \text{gal/ft}^3}\right)\left(\frac{\text{sec}}{6\ \text{ft}}\right)\left(\frac{\text{min}}{60\ \text{sec}}\right)\frac{4}{\pi}\right]^{\frac{1}{2}} 12$$

$$= 2.6\text{"; use } 2\text{"}$$

Pressure drop of tower including packing

$$= \left(\frac{0.35\text{" } H_2O}{\text{ft}}\right)(8\ 1/3\ \text{ft}) + 0.5\text{" mist eliminator}$$

+ 1" entrance = 4½" water

Stack

$$\text{Exit gas velocity} = \frac{33{,}000\ (4)\ 144}{\pi\ 51^2\ 60} = 38.8\ \text{ft/sec}$$

$$\text{Reynolds No.} = \frac{(51)(38.8)(7.49\times10^{-2})}{12\ (1.21\times10^{-5})} = 1.02\times10^6$$

Therefore Fanning friction factor (f) for smooth pipe

$$= 0.0028$$

$$\Delta P \text{ loss at stack exit} = \frac{v^2P}{2g_c}$$

$$= \frac{(38.8\ \text{ft/sec})^2(7.49\times10^{-2}\ \text{lb}_m\ (\text{ft}^3)}{(2)\left(\frac{32.174\ \text{lb}_m\text{ft}}{\text{lb}_f\ \text{sec}^2}\right)(144\ \text{in}^2/\text{ft}^2)}\left(\frac{407.2\ \text{in}}{14.7\ \text{lb}_f/\text{in}^2}\right)$$

$$= 0.34\text{" } H_2O$$

$$\Delta P \text{ stack} = 2f\frac{v^2L\rho g}{g_cD}$$

$$= (2)(0.0028)\frac{(38.8)^2(23\ \text{ft})(7.49\times10^{-2})}{(32.174)(51/12)(144)}\left(\frac{407.2}{14.7}\right)$$

$$= 0.02\text{" water}$$

Ducts from Fan to Scrubbers --

$$\text{Gas velocity} = \frac{33{,}000(4)(144)}{\pi\ 42^2\ (60)} = 57.2\ \text{ft/sec}$$

$$\text{Reynolds No.} = \frac{(42)(57.2)(7.49\times10^{-2})}{(12)(1.21\times10^{-5})} = 1.24\times10^6$$

$\therefore f = 0.0028$

Equivalent length, L, at normal operation =
2 straight runs + 2 elbows + open dampers

$$= \frac{40 + 120}{12} + (2)(32)\left(\frac{42}{12}\right) + 0 = 237.3\ \text{ft}$$

Pressure drop = $(2)(.0028)\frac{(57.2)^2(237.3)(7.49 \times 10^{-2})}{(32.174)(42/12)(144)}\left(\frac{407.2}{14.7}\right)$

= 0.56 inches water

(Note: in by pass mode, $L = \frac{40 + 240}{12} + 224 + 224 + 0 = 470$ ft

and $\Delta P = \frac{470}{237.3}(0.56) = 1.10$ inches water)

Gas Flow Orifice --

Orifice Reynolds No. = 1.55×10^6

Orifice coefficient of discharge = C = 0.61

Pressure drop = $\frac{V_o^2\ [1-D_o/D_i)^4]\ \rho_f}{C^2\ 2g_c}$

$= \frac{(89.4)^2(1-0.8^4)(7.49 \times 10^{-2})}{0.61^2(2)(32.174)(144)}\left(\frac{407.2}{14.7}\right) = 2.84"$

Common Liquid Piping Sizes --

Pipe from Venturi recycle tank to pump @ 3 ft/sec

$= \left[\frac{(330)(2)}{3}\ \frac{1}{60}\ \left(\frac{1}{7.48}\right)\frac{4}{\pi}\right]^{\frac{1}{2}}\ 12 = 9"$ ID

Pipe from Venturi recycle tank pump @ 6 ft/sec

$= \left[\frac{(330)(2)}{6}\ \frac{1}{60}\ \frac{1}{7.45}\ \frac{4}{\pi}\right]^{\frac{1}{2}}\ 12 = 6.7"$; use 7" ID

Pipe to each Venturi system

$= \left[\frac{330}{6}\ \frac{1}{60}\ \frac{1}{7.48}\ \frac{4}{\pi}\right]^{\frac{1}{2}}\ 12 = 5"$ ID

Pipe between tower absorber tanks and from recycle tanks to pump = $\left[\frac{(380)(2)}{3}\ \frac{1}{60}\ \frac{1}{7.48}\ \frac{4}{\pi}\right]^{\frac{1}{2}}\ 12 = 10.2"$; use 10" ID

Pipe from absorber recycle tank pump

$= \left[\frac{(495)(2)}{6}\ \frac{1}{60}\ \frac{1}{7.48}\ \frac{4}{\pi}\right]^{\frac{1}{2}}\ 12 = 8.2"$; use 8" ID

Gas Phase Overall Pressure Drop --

Intake negative S.P. =	6.0" water
Venturi and cross flow =	5.1
Absorber tower =	4.5
Stack =	0.4
Inlet ducts =	0.6
Flow orifice =	2.9
Total =	19.5" Use 20" water

Fan --

Fan motor horsepower assuming radial tip fan blades at 70-75% efficiency = $(2.5 \times 10^{-4})(20"\ H_2O)(33{,}000)$ = 165 hp (200 hp motor available)

Chemical Feed and Bleed --

Amount of H_2S in each system based on complete removal of the 50 ppm

$$= \left(\frac{50\ ft^3\ H_2S}{10^6\ ft^3}\right)\left(\frac{33{,}000\ ft^3}{min}\right)\left(\frac{mole}{359\ ft^3}\right)\left(\frac{460 + 32}{460 + 80}\right)$$

$$= 4.19 \times 10^{-3} \text{ moles } H_2S/min$$

Maximum amount of 20% NaOH soln (FP-17°F) required for direct neutralization

$$= (4.19 \times 10^{-3})\left(\frac{2\ NaOH}{H_2S}\right)\frac{40\ lb}{mole}\left(\frac{100\ lb\ soln}{20\ lb\ NaOH}\right)\left(\frac{gal}{10.2\ lb}\right)\left(\frac{60\ min}{hr}\right)$$

= 10 gph; use 5 gph for each absorber

Amount of 10% NaOCl soln required to oxidize S^{-2} to S^{+4} $= (4.29 \times 10^{-3})\left(\frac{3\ Cl}{1S}\right)\left(\frac{74.5\ lb}{mole}\right)\left(\frac{gal}{8.5\ lb}\right)\left(\frac{60\ min}{hr}\right)$

= ~~6.61~~ 70 gph; use 10 gph max for each absorber for oxidation of mercaptans and other organics

Products buildup rate estimated for both systems

$= (4.19 \times 10^{-3})(78)(2) = 0.65$ lb/min plus inlet solids; use 2 lb/min

Average water added to both systems is from NaOH, NaOCl, mist eliminators and make up

$$= \frac{(5)(4) + (10)(4)}{60} + \frac{(100)(2)}{(8)(60)} + 8.5 = 9.92 \text{ gpm}$$

Bleed rate ≅ 10 gpm

$$\text{Products in bleed} = \frac{2\ lb/min}{2 + 10\ gal/min\ 8.35\ lb/gal} = 2.34\%$$

Pipe size for 20% NaOH feed

$$= \left[\frac{(5)(4)\ gph}{60\ min/hr}\ \frac{1}{6}\ \frac{1}{60}\ \frac{1}{7.48}\ \frac{4}{\pi}\right]^{\frac{1}{2}} 12 = 0.15" \text{ ID; use } \tfrac{1}{2} \text{ inch pipe}$$

Pipe size for 10% NaOCl feed

$$= \left[\frac{(10)(4)}{60}\ \frac{1}{6}\ \frac{1}{60}\ \frac{1}{7.48}\ \frac{4}{\pi}\right]^{\frac{1}{2}} = 0.21" \text{ ID; use } \tfrac{1}{2} \text{ inch pipe}$$

Pumps --

20% NaOH feed =	10 gph capacity at 100 psig
10% NaOCl feed =	20 gph capacity at 100 psig
Venturi recycle =	660 gpm capacity at 35 psi head
Absorber recycle =	990 gpm capacity at 60 psi head
NaOH pump motor =	$(6.86 \times 10^{-4})\left(\frac{100}{60}\right)(10) = 0.01$ hp; Use 1/5 hp
NaOCl pump motor =	$(6.86 \times 10^{-4})\left(\frac{100}{60}\right)(20) = 0.02$ hp; Use 1/5 hp
Venturi recycle pump motor =	$(6.86 \times 10^{-4})(660)(35) = 15.85$ hp; Use 15 hp
Absorber recycle pump motor =	$(6.86 \times 10^{-4})(990)(60) = 40.8$ hp; Use 40 hp.

Stack Height --

Estimate maximum downwind concentration based on existing stack height and estimated emissions:

Distance to property line	East 76.2m West 304.8m
Stack emissions:	33,000 acfm 0.25 ppm H_2S (i.e. 10x odor detection threshold of 0.025 ppm)
Stack:	27'2" high (8.3m) above absorber 51" diameter (1.3m)
Wind:	Speed = 3 m/sec Stability class 3 (i.e.D)

(Based on C/TA report of 10 Sep 83 to City of Orlando on Iron Bridge tests).

Plume rise: Assume 0'

Maximum ground level concentration occurs @

$$\sigma_z = \frac{H}{\sqrt{2}} = \frac{8.3}{\sqrt{2}} = 5.86\text{m}$$

where x = 120m or 393 feet which is outside the plant

and σ_y = 10m

Maximum ground level concentration = $C_{(x,o,o)\ max} = \frac{0.117\ Qs}{\bar{u}_s\ \sigma_y\ \sigma_z}$

Source strength = $Qs = (\frac{0.25}{10^6})(33{,}000\ \frac{ft^3}{min})H_2S(\frac{34g}{359})(\frac{min}{60\ sec})(\frac{460+32}{460+80})$

$= 1.19 \times 10^{-5}$ g/sec

$C_{(x,o,o)max} = \frac{(0.117)(1.19 \times 10^{-5})}{(3)(5.86)(10)} = 7.9 \times 10^{-9}$ g/m³ H_2S @ 3m/sec

$= 7.9 \times 10^{-3}$ µg/m³

or = $(\frac{7.9 \times 10^{-9}g}{m^3})(\frac{22.4\ell}{34g})(\frac{m^3}{1000\ell})(\frac{460 + 80}{460 + 32})(\frac{10^6}{million})$

$= 5.7 \times 10^{-6}$ ppm H_2S

Estimate maximum downwash concentration is ~0.25 ppm H_2S which is 5% of the TLV.

Therefore, existing stack height of 27'2" is adequate above absorber.

APPENDIX C

FIELD MEASUREMENTS OF H_2S

APPENDIX C

FIELD MEASUREMENTS OF H_2S

General Information

Date of Observations:	Friday, 7 November 1986
Time of Observations:	10:00 A.M. to 11:00 A.M.
Location:	Iron Bridge Wastewater Treatment Plant
Equipment Tested:	Parkson Belt Press
Sludge Tested:	Feed rate of 50-75 gpm primary sludge (after aeration)

Test Equipment

Parameter	Equipment
Hydrogen Sulfide Measurements	Detector Tubes, Drager type 0.5/a range 1-75 ppm
	Drager hand pump
Air Flow	8" pitot tube (Dwyer)
	Manometer (Dwyer)
Moisture Measurements	Fisher calibrated thermometers (wet/dry bulb)

Purpose of Test

(1) To get an indication of the H_2S concentration at the inlet structure to the belt press.

(2) To determine how much air is required to capture H_2S generated from the sludge on the press belt.

Test Procedure

A fan was located on the side of the filter and air was blown across the belt. With the fan at different distances, the gas flow was measured and the H_2S concentration measured 1" above the end of the side wall of the filter at the inlet level.

T E S T R E S U L T S

Test No.	Condition	Hydrogen Sulfide Concentration (ppm)
1	Fan off 3" above diverter channel	10-15 Note Wet Bulb = 76°F Dry Bulb = 79°F (≅2.8% H_2O Saturation H_2O 3.3%)
2	In-Feed Tank	20
3	Fan off above belt at edge of filter	14
4	Fan on air flow at filter 350 fpm above belt at edge of filter	10
5	Fan on air flow at filter 500 fpm above belt at edge of filter	4
6	Measurement of ambient air in press room 5' from press	2

ATTACHMENT #11

OPERATION PLAN

Frenz Enterprises, Inc. will operate on a liquid basis as their primary method. Stabilized cake sludge will be used only during periods of severe weather where due to the saturated soil conditions, as stated in Florida Administrative Code 17-7.51, it prevents the land application of liquid sludge.

Monday through Saturday and Sundays, where necessary, Frenz Enterprises, Inc. will utilize eight tankers pulled by trucks owned by Frenz Enterprises, Inc. to haul the liquid stabilized sludge from Iron Bridge to any one of (11) current sites.(Refer to depreciation schedule).

This requires Frenz Enterprises, Inc. plant site personnel to add and mix lime to the Iron Bridge sludge no less than one hour prior to the trucking of this sludge.

Once the sludge enters the tankers, the material will be trucked to field sites where the material will be applied either by truck or irrigation equipment depending on the site owner's specifications. This procedure will be followed throughout the day until Frenz Enterprises, Inc. runs out of sludge for the day or time as given by the plant personnel and/or contract.

Should inclement weather prevent the application of liquid sludge, Frenz Enterprises, Inc. would notify the city 24 hours in advance. Frenz Enterprises, Inc. would then employ three dump trailers, their lime feeder and conveying system. Frenz Enterprises, Inc. would accept cake sludge from the end of the city's pugmill, adding lime inline to the sludge.

The cake sludge would continue up the Frenz Enterprises, Inc. conveyor into their dump trailers and be trucked to a Frenz Enterprises, Inc. site for field application when weather permits.

Please consider that Frenz Enterprises, Inc. operates 30+ trucks on an average in Florida and at least 10 trucks locally. We have in the past, added and deleted trucks according to demand at Iron Bridge. The additon of trucks can be accomplished anytime during the day when the need arises.

There have been numerous occassions where Frenz Enterprises, Inc. has been out of sludge one afternoon and found two days worth of sludge the next morning. This doesn't cause a problem, other than severe weather or the changing of locations, since due to weather we work towards a daily flow of 250,000 gallons per day which has been the normal demand.

Frenz Enterprises, Inc. will accept liquid sludge from Iron Bridge when pumped to the #3 thickening bay. This is also the point where lime will be added to control odor and stabilization will take place.

Frenz Enterprises, Inc.'s 1500 gpm 30 hp Gorman Rupp pump will both mix and deliver the sludge to Frenz Enterprises, Inc. transports.

Doug Belton- Division Manager-Has been responsible for the supervision and management of the Iron Bridge Project and other Orlando area projects to date. (See resume attached.)

Ronald Herndon-An employee of Frenz Enterprises, Inc.-Foreman of Orlando Division-Responsible for day to day operations for the Iron Bridge Project and other Orlando area projects. Coordinates sludge hauling and land application activities. (See resume attached.)

Tim Mielecki-Head of Environmental Department-Handles DER permitting and reports for land application sites. Coordinates with Doug Belton and Ron Herndon on a daily basis concerning land application sites. (See resume attached.)

George L. Frenz-President of Frenz Enterprises, Inc.-Coordinates with Doug Belton daily concerning Iron Bridge Project and other Orlando Division projects. (See resume attached.)

Karen P. Frenz-Vice President of Frenz Enterprises, Inc.-Coordinates with George Frenz and Division Managers concerning the day to day operation of Frenz Enterprises, Inc. Coordinates with Tim Mielecki concerning the Environmental Department. (See resume attached.)

4 laborers-Including 2 pump operators and 2 gate people. All employees of Frenz Enterprises, Inc.

8 truck drivers-All employees of Frenz Enterprises, Inc.

<u>Identification of emergency plans for operation during subcontractor or employee strike, sick-out, absenteeism or other form of work stoppage at any time during contract.</u>

There will be no stoppage of work at any time during the contract due to employee strike, sick-out, absenteeism or any other form of work disruption while Frenz Enterprises, Inc. is managing the Iron Bridge Contract.

The employees of Frenz Enterprises, Inc. are not members of a union. Frenz Enterprises, Inc. believes that we have always treated our employees fairly and we have a well-defined good working line of communication. If an employee has a problem he or she discusses it with their immediate supervisor and if not satisfied, follow the chain of command upward.

If an employee is sick and absent from work the foreman or division manager will fill that employee's position for the period of illness with another company employee from that division or will temporarily cover that employee's position themselves.

Frenz Enterprises, Inc. has never had work stoppage of a contract for the Iron Bridge Project or any other project we have handled due to employee strike, sick-out, absenteeism or any other form of work disruption.

Proof of ability to obtain approvals for disposal of sludge from all applicable regulatory agencies. Please find enclosed copies of our existing DER permits for land application of Iron Bridge sludge. (See attached permits.)

TRUCKING PROCEDURES

Plant opens: 7:30 AM
closes: 4:30 PM 9 hours operating time

Trucking distances: Average 52.45 round trip miles.

Loading time: 5 minutes.
Unloading time: 10 minutes.
Travel time: 52.45 miles - 40 miles/hr. average = 1.31 hrs. or 78 minutes

9 hours x 60 min/hr. = 540 min. available.

250,000 gallons/day - 6500 gallons/load = 38.46 loads

540 - 93 min/load = 5.8 loads/truck.

$38.46 \frac{\text{Loads needed}}{\text{day}} - 5.8 \text{ loads} = 6.63$ trucks/tankers daily.

STABILIZATION PROCEDURES

At 4:00 PM each day 35,000 gallons of sludge will be mixed with lime to produce the sludge to be hauled the next day.

Because there is no guarantee of consistence in lime (pH) nor is there a consistent pH in the sludge, the quantities can not be predetermined. Therefore, Frenz Enterprises, Inc. will start this year much the same as we are currently operating the stabilization process.

However, additional muffling equipment will be employed on the gas engine powering the blowers.

Additionally, the air relief system on the pig will be piped into

the sludge mixing line and opened when transports are filling the pig(lime storage tank).

If awarded the project, Frenz Enterprises, Inc. has an option on a silo to be located for lime storage on site. The silo will feed (by screw conveyor) lime directly into the mixing bay. This will eliminate the dust operated by the pneumatic lime conveying system and should increase lime use efficiency.

The lime silo is currently located at Southern Fruit and Frenz Enterprises, Inc. has taken an option on it pending award of the contract. (See attached pictures and receipt.)

The lime stabilization of cake sludge will remain the same as last year pending the site location of the silo.

Bag lime will be the primary method of adding the material into the lime feeder then feeding it into the pugmill and conveying the mix from the pugmill to our transports on those occasions when cake sludge is used.

Frenz Enterprises, Inc. will monitor the stabilization process with their own pH equipment and personnel to insure the meeting of standards in Chapter 6 of EPA 625/1-79-011.

CURRENT LIME SYSTEM

Lime storage tank pig. (70 ton)
Blower capacity 450 CFM (M.D. pneumatic)
HP requirements 90 HP.
Feed rate-varies.

Estimated lime usage:
1 ton lime/dry ton sludge.
Actual: Quantity to meet standards set in EPA 625/1-79-011 literature.

Primary Sludge

① Flow @ 2% solids = $\frac{(360{,}000\ gpd)(62.4\ \#/cf)}{7.48052\ g/cf}$ = 3,003,000 #/d H_2O

② 2% solids = 60,000 #/d

③ Flow @ 5% solids = $\frac{60{,}000\ \#/d}{0.05}$ − 60,000 #/d = 1,140,000 #/d H_2O

④ Thickening Loss = 3,003,000 #/d − 1,140,000 #/d = 1,863,000 #/d H_2O

⑤ Digester solids @ 3.4% solids = $\frac{(137{,}000\ gpd)(62.4\ \#/cf)}{(7.48052\ g/cf)(1-0.034)}$ − $\frac{(137{,}000\ gpd)(62.4\ \#/cf)}{7.48052\ g/cf}$

= 1,183,031 #/d − 1,142,808 #/d = 40,223 #/d solids

⑥ Solids loss:

ⓐ Converted to H_2O = 1,142,808 #/d − 1,140,000 #/d = 2,808 #/d H_2O

ⓑ Gaseous products = 60,000 #/d − 40,223 #/d = 19,777 #/d

RBC Sludge

① Flow @ 0.8% solids = $\frac{(960{,}000\ gpd)(62.4\ \#/cf)}{7.48052\ g/cf}$ = 7,173,833 #/d H_2O

② 0.8% solids = 57,000 #/d

③ Flow @ 5% solids = $\frac{57{,}000\ \#/d}{0.05}$ − 57,000 #/d = 1,083,000 #/d H_2O

④ Thickening Loss = 7,173,833 #/d − 1,083,000 #/d = 6,090,833 #/d H_2O

⑤ Digester solids @ 3.8% solids = $\frac{(130{,}000\ gpd)(62.4\ \#/cf)}{(7.48052\ g/cf)(1-0.038)}$ − $\frac{(130{,}000\ gpd)(62.4\ \#/cf)}{7.48052\ g/cf}$

= 1,127,252 #/d − 1,084,416 #/d = 42,836 #/d solids

⑥ Solids loss:

ⓐ Converted to H_2O = 1,084,416 #/d − 1,083,000 #/d = 1,416 #/d H_2O

ⓑ Gaseous products = 57,000 #/d − 42,836 #/d = 14,164 #/d

Nutrient Sludge

① Flow @ 0.5% solids = $\frac{(620{,}000\ gpd)(62.4\ \#/cf)}{7.48052\ g/cf}$ = 5,171,833 #/d H_2O

② 0.5% solids = 26,000 #/d

③ Flow @ 5% solids = $\frac{26{,}000\ \#/d}{0.05}$ − 26,000 #/d = 494,000 #/d H_2O

④ Thickening Loss = 5,171,833 #/d − 494,000 #/d = 4,677,833 #/d H_2O

⑤ Discharge = $\frac{(59{,}000\ gpd)(62.4\ \#/cf)}{7.48052\ g/cf}$ = 492,158 #/d H_2O

H_2O Removed

① Total Thickening = 1,863,000 #/d + 6,090,833 #/d + 4,677,833 #/d = 12,631,666 #/d H_2O

$$gpd = \frac{(12,631,666\ \#/d)(7.48052\ g/cf)}{62.4\ \#/cf} = 1,514,286\ gpd$$

ΔH_2O Removed (Alternate Operation)

① Nutrisene Sludge

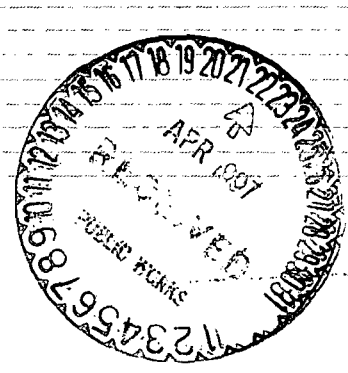
ⓐ Flow @ 16% solids = $\frac{26,000\ \#/d}{0.16}$ − 26,000 #/d = 136,500 #/d H_2O

ⓑ Thickening loss = 5,171,833 #/d − 136,500 #/d = 5,035,333 #/d

ⓒ Increased Loss = 5,035,333 #/d − 4,677,833 #/d = 357,500 #/d

$$gpd = \frac{(357,500\ \#/d)(7.48052\ g/cf)}{62.4\ \#/cf} = 42,857\ gpd$$

PBS&J
POST, BUCKLEY, SCHUH & JERNIGAN, INC.
889 NORTH ORANGE AVENUE
ORLANDO, FLORIDA 32801-1088
305/423-7275



April 21, 1987

Mr. Bill Thomas
Florida Department of Environmental Regulation
Twin Tower Office Building
2600 Blair Stone Road
Tallahassee, Florida 32301

Re: City of Orlando
Easterly WPCF
Sludge Handling Facility
Odor Control

Dear Mr. Thomas:

Enclosed are four copies of the permit application and two copies each of the design report, engineering drawings and specifications for odor control of the sludge handling facilities at the Easterly WPCF. Also enclosed is a check for the application fee of $100.

Your prompt consideration of this application is appreciated. If you have any questions or if we can be of further assistance to you in this matter, please contact us immediately.

Sincerely,

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

Phillip K. Feeney, P.E.
Project Manager

PKF:CK:ma

Enclosure

07-155.03

/008

1031

AC 59-133924

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301

BOB GRAHAM
GOVERNOR

VICTORIA J. TSCHINKEL
SECRETARY

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Sludge Thickening Belt Press [X] New[1] [ ] Existing[1]

APPLICATION TYPE: [ ] Construction [ ] Operation [X] Modification

COMPANY NAME: City of Orlando COUNTY: Seminole

Identify the specific emission point source(s) addressed in this application (i.e. Lime Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) Belt Press Hood, Venturi Scrubber and Packed Tower

SOURCE LOCATION: Street Iron Bridge Road City Oviedo

UTM: East 478250 North 3166500

Latitude 28 ° 37 ' 20 "N Longitude 81 ° 13 ' 10 "W

APPLICANT NAME AND TITLE: City of Orlando

APPLICANT ADDRESS: 400 South Orange Avenue, Orlando, Florida 32801

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of The City of Orlando (Florida)

I certify that the statements made in this application for a modification permit are true, correct and complete to the best of my knowledge and belief. Further, I agree to maintain and operate the pollution control source and pollution control facilities in such a manner as to comply with the provision of Chapter 403, Florida Statutes, and all the rules and regulations of the department and revisions thereof. I also understand that a permit, if granted by the department, will be non-transferable and I will promptly notify the department upon sale or legal transfer of the permitted establishment.

*Attach letter of authorization

Signed: _____

Robert C. Haven, Director of Public Works

Name and Title (Please Type)

Date: 4/23/87 Telephone No. (305) 849-2266

B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.)

This is to certify that the engineering features of this pollution control project have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgment, that

See Florida Administrative Code Rule 17-2.100(57) and (104)

Bruce

This is not a NESHAP source in case you are asked

Ed P.

Subpart E - Hg

the pollution control facilities, when properly maintained and operated, will discharge an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.

Signed Phillip K. Feeney

Phillip K. Feeney
Name (Please Type)

Post, Buckley, Schuh & Jernigan, Inc.
Company Name (Please Type)

889 North Orange Avenue
Mailing Address (Please Type)

Florida Registration No. 32258 Date: _____ Telephone No. (305) 423-7275

SECTION II: GENERAL PROJECT INFORMATION

A. Describe the nature and extent of the project. Refer to pollution control equipment, and expected improvements in source performance as a result of installation. State whether the project will result in full compliance. Attach additional sheet if necessary.

The modified system consists of two-stage wet scrubbers using sodium hypochlorite and caustic to scrub hydrogen sulfide from the air stream.

B. Schedule of project covered in this application (Construction Permit Application Only)

Start of Construction December 1987 Completion of Construction June 1988

C. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)

*Fans	$ 71,500
*Scrubbers	$ 39,600
Chemical feeds	$144,900
TOTAL	$256,000

D. Indicate any previous DER permits, orders and notices associated with the emission point, including permit issuance and expiration dates.

Permit No. AC 59-76662 issued April 20, 1984, expiration date: October 31, 1984

Permit No. AC 59-76663 issued April 20, 1984, expiration date: October 31, 1984

*Modifications: Change new fan. Add new spray system and packed media to scrubber and packed tower.

E. Requested permitted equipment operating time: hrs/day 14 ; days/wk 7 ; wks/yr 52 ;

if power plant, hrs/yr _____ ; if seasonal, describe: N/A

F. If this is a new source or major modification, answer the following questions. (Yes or No)

1. Is this source in a non-attainment area for a particular pollutant? NO

   a. If yes, has "offset" been applied? N/A

   b. If yes, has "Lowest Achievable Emission Rate" been applied? N/A

   c. If yes, list non-attainment pollutants. N/A

2. Does best available control technology (BACT) apply to this source? If yes, see Section VI. NO

3. Does the State "Prevention of Significant Deterioriation" (PSD) requirement apply to this source? If yes, see Sections VI and VII. NO

4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? NO

5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? NO

H. Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? NO

   a. If yes, for what pollutants? N/A

   b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

Attach all supportive information related to any answer of "Yes". Attach any justification for any answer of "No" that might be considered questionable.

SECTION III: AIR POLLUTION SOURCES & CONTROL DEVICES (Other than Incinerators)

A. Raw Materials and Chemicals Used in your Process, if applicable:

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		
Sewage Sludge Thickening	H_2S	100	6170	Attachment VIII

B. Process Rate, if applicable: (See Section V, Item 1)

1. Total Process Input Rate (lbs/hr): N/A

2. Product Weight (lbs/hr): N/A

C. Airborne Contaminants Emitted: (Information in this table must be submitted for each emission point, use additional sheets as necessary)

Name of Contaminant	Emission[1]		Allowed[2] Emission Rate per Rule 17-2	Allowable[3] Emission lbs/hr	Potential[4] Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/yr	T/yr	
H_2S	310	790	N/A	N/A	6170	15,760	Attachment VIII

[1]See Section V, Item 2.

[2]Reference applicable emission standards and units (e.g. Rule 17-2.600(5)(b)2. Table II, E. (1) - 0.1 pounds per million BTU heat input)

[3]Calculated from operating rate and applicable standard.

[4]Emission, if source operated without control (See Section V, Item 3).

D. Control Devices: (See Section V, Item 4)

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
Ducon Venturi Scrubber w/packed tower	H_2S	90 - 98%	N/A	N/A

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
N/A			

*Units: Natural Gas--MMCF/hr; Fuel Oils--gallons/hr; Coal, wood, refuse, other--lbs/hr.

Fuel Analysis:

Percent Sulfur: _____ Percent Ash: _____

Density: _____ lbs/gal Typical Percent Nitrogen: _____

Heat Capacity: _____ BTU/lb _____ BTU/gal

Other Fuel Contaminants (which may cause air pollution): _____

F. If applicable, indicate the percent of fuel used for space heating.

Annual Average N/A Maximum _____

G. Indicate liquid or solid wastes generated and method of disposal.

Liquid will be returned to plant headworks.

Solids will be disposed of by land application.

H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack):

Stack Height: 50 ft. Stack Diameter: 4.25 ft.

Gas Flow Rate: 33,000 ACFM _____ DSCFM Gas Exit Temperature: 80 °F.

Water Vapor Content: 10 - 15 % Velocity: 38.8 FPS

SECTION IV: INCINERATOR INFORMATION

N/A

Type of Waste	Type 0 (Plastics)	Type I (Rubbish)	Type II (Refuse)	Type III (Garbage)	Type IV (Pathological)	Type V (Liq.& Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste _____

Total Weight Incinerated (lbs/hr) _____ Design Capacity (lbs/hr) _____

Approximate Number of Hours of Operation per day _____ day/wk _____ wks/yr. _____

Manufacturer _____

Date Constructed _____ Model No. _____

	Volume $(ft)^3$	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber					
Secondary Chamber					

Stack Height: _____ ft. Stack Diamter: _____ Stack Temp. _____

Gas Flow Rate: _____ ACFM _____ DSCFM* Velocity: _____ FPS

*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air.

Type of pollution control device: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner

[ ] Other (specify) _____

Brief description of operating characteristics of control devices: _____

_____

_____

_____

_____

Ultimate disposal of any effluent other than that emitted from the stack (scrubber water, ash, etc.):

_____

_____

_____

_____

NOTE: Items 2, 3, 4, 6, 7, 8, and 10 in Section V must be included where applicable.

SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]

2. To a construction applicetion, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.

3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).

4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)

5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).

6. An 8 1/2" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.

7. An 8 1/2" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Example: Copy of relevant portion of USGS topographic map).

8. An 8 1/2" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.

9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.

10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY N/A

A. Are standards of performance for new stationary sources pursuant to 40 C.F.R. Part 60 applicable to the source?

[ ] Yes [ ] No

Contaminant	Rate or Concentration

B. Has EPA declared the best available control technology for this class of sources (If yes, attach copy)

[ ] Yes [ ] No

Contaminant	Rate or Concentration

C. What emission levels do you propose as best available control technology?

Contaminant	Rate or Concentration

D. Describe the existing control and treatment technology (if any).

1. Control Device/System:
2. Operating Principles:
3. Efficiency:*
4. Capital Costs:

*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant	Rate or Concentration

10. Stack Parameters

a. Height: ft.

b. Diameter: ft.

c. Flow Rate: ACFM

d. Temperature: °F.

e. Velocity: FPS

E. Describe the control and treatment technology available (As many types as applicable, use additional pages if necessary).

1.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy [2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

[1]Explain method of determining efficiency.
[2]Energy to be reported in units of electrical power - KWH design rate.

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

3.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

4.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Costs:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

F. Describe the control technology selected:

1. Control Device:

2. Efficiency:[1]

3. Capital Cost:

4. Useful Life:

5. Operating Cost:

6. Energy:[2]

7. Maintenance Cost:

8. Manufacturer:

9. Other locations where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

[1] Explain method of determining efficiency.
[2] Energy to be reported in units of electrical power - KWH design rate.

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

b. (1) Company:

(2) Mailing Address:

(3) City: (4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

10. Reason for selection and description of systems:

[1]Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION

A. Company Monitored Data

N/A

1. _____ no. sites _____ TSP _____ ( ) SO^2 _____ Wind spd/dir

Period of Monitoring ____/____/____ to ____/____/____
month day year month day year

Other data recorded _____

Attach all data or statistical summaries to this application.

[3]Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

a. Was instrumentation EPA referenced or its equivalent? [ ] Yes [ ] No

b. Was instrumentation calibrated in accordance with Department procedures?

[ ] Yes [ ] No [ ] Unknown

B. Meteorological Data Used for Air Quality Modeling

1. _____ Year(s) of data from ____/____/____ to ____/____/____
month day year month day year

2. Surface data obtained from (location)_____

3. Upper air (mixing height) data obtained from (location)_____

4. Stability wind rose (STAR) data obtained from (location)_____

C. Computer Models Used

1. _____ Modified? If yes, attach description.

2. _____ Modified? If yes, attach description.

3. _____ Modified? If yes, attach description.

4. _____ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data

Pollutant	Emission Rate	
TSP	_____	grams/sec
SO^2	_____	grams/sec

E. Emission Data Used in Modeling

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review.

G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e., jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology.

Section 15886

ODOR CONTROL SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Relocate two existing venturi scrubber and absorber/stack odor control systems including existing framework, centrifugal fans and enclosure, and associated accessories as shown on the Drawings.

2. Furnish and install packing materials, recycle water and chemical spray system inside the scrubbers and absorbers, water recycle and chemical feed facilities as shown on the Drawings and as specified herein.

3. Testing of the odor control system.

B. Related Work Described Elsewhere:

1. Cast-In-Place Concrete: Section 00300

2. Painting: Section 09900

3. Fiberglass Reinforced Polyester Storage Tank: Section 13216

4. Plastic Pipe: Section 15064

5. Corrosion Resistant Valves and Specialties For Use in PVC Piping Systems: Section 15118

1.02 QUALITY ASSURANCE

A. Qualifications: All the equipment specified under this Section shall be furnished by a manufacturer who is fully experienced, reputable, and qualified in the design, construction and operation of the equipment. All new materials and equipment and all field fabrications shall be warranted as free from defects and to operate satisfactorily for a period of one year.

B. Modifications and Other Work: All pieces/parts field fabricated and all equipment purchased and installed shall be warranted free of defects for one year from date of acceptance by the Engineer or the City of Orlando.

1.03 SUBMITTALS

A. Materials and Shop Drawings:

1. Shop drawings and schedules shall be submitted in accordance with the General Conditions in Division 1. Shop drawings and literature describing the equipment and showing dimensions and all important details of construction shall be submitted to the Engineer for evaluation and approval. Complete master power and control wiring diagram, suitable outline drawings of the control schematics, and suitable outline drawings of the control panel shall be furnished as part of the shop drawings submittal.

2. All details on shop drawings submitted for approval shall show clearly the relations of the various parts of the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the Drawings before being submitted for approval.

B. Operating Instructions and Manufacturer's Representatives:

1. The representative provided for the various instructural and testing sequences shall have complete knowledge of proper operation and maintenance of the equipment. The Manufacturer shall allow a sufficient number of days of the representative's time for the multiple visits, if required.

2. Certificate from the Manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit shall be submitted.

3. Operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operation and maintenance personnel unfamiliar with such equipment. The number to be furnished and special requirements shall be as specified in Section 01730.

C. Scheduling: Indicate the following with the bid:

1. Submission date of shop drawings from receipt of order; and

2. Fabrication time and delivery date from receipt of approved drawings.

D. State of Experience: Furnish a statement of experience regarding number of in-place installations for similar odor control applications and confirming at least five (5) years of experience. Furnish five (5) specific customer contacts available for inquiry by the owner or engineer.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect all equipment, accessories and purchased products from damage during shipping, storage and handling. Prevent dirt and moisture from entering hoods and fittings by sealing all openings.

B. Where possible, store unassembled components inside and protect from weather.

1.05 SPECIAL TOOLS AND CRITICAL SPARE PARTS

A. One set of all special tools required for normal operation and maintenance shall be provided.

B. Critical Spare Parts: Critical spare parts shall be furnished to assure normal running and maintenance for a period of one year as recommended by the manufacturer of equipment under this Section. As a minimum, the following list shall be provided:

For each type of diaphragm metering pump:

2 - Diaphragms and seals

2 - Check seats

1 - Set of ball checks

1 - Set of foot values with strainers

For each fan:

2 - Drive belts

For pH and ORP sensors:

Electrode maintenance kits

For Spray Headers:

Spare nozzles required, one for every five (5) used

C. The Manufacturer shall recommend and supply any spare parts in addition to the aforementioned necessary for the first year of operation. Spare parts shall be marked with part numbers and equipment and packed in suitable containers also marked with the part numbers and equipment for which they are used.

D. All tools and spare parts shall be furnished by the manufacturer in containers which are clearly identified with indelible markings as to their content. Identification shall be with part numbers.

1.06 DESIGN REQUIREMENTS

A. Gas Flows: Odorous gases shall flow sequentially through the two relocated, modified scrubbing systems shown in the Drawing.

B. Design Conditions: The two systems shall be assembled and installed according to the following criteria:

		Venturi	Absorber
1.	Contact time(s)	0.3	1.0
2.	H_2S concentration	50	50
3.	Air Flow (scfm)	33,000	33,000
4.	Water flow (gpm)	330	495

PART 2 - PRODUCTS

2.01 GENERAL

A. Dual Systems: The two existing odor control systems consist of venturi with cross-flow absorber in series with tower absorber as shown in the Drawing. The existing equipment shall be relocated from the present locations to a new location centrally located on east side of the same building. The relocated equipment, new fans and new chemical feed systems are to be modified as shown in the Drawings with the entire chemical recycle area being enclosed. All products necessary to provide modifications shown with gas ducts, piping, instruments and controls shall be provided, including new exhaust fans and new electrical control panels to connect to existing motors.

Absorber vessels to be plumb.

Mist eliminators shall be level and 4 bend Noryl Chevron type supported on bottom with 4-inch wide ring, 1/4-inch as shown in the Drawing and shall be secured in place with top tie down bass.

Access shall be provided to mist eliminators for maintenance service or replacement.

Remove all existing baffles, lamalars and lamalar bases from existing venturi tanks.

Venturi tanks shall be converted to cross flow spray chambers by adding spray bars and baffles (two 22 inches each) as shown in the Drawing.

All existing packing in each absorber shall be removed.

Each absorber shall be cleaned, inspected and packed to a depth of 100 inches with 2-inch polypropylene tellerettes, Type K supplied by Ceilcote, Air Pollution Control Division (Berea, Ohio).

Existing packing supports are adequate, but new packing top tie downs shall be provided.

B. Spray Headers: A total of six (6) spray headers shall be fabricated as shown on the Drawing. These distributors shall be installed in each venturi tank (two pair of 2 bars), above each absorber tower packing (one pair of 4 bars) and below each absorber mist eliminator (one pair of 4 bars). All materials of construction shall be PVC for piping and FRP for retaining brackets on vessel walls. All headers to be capped at ends. Nozzle connections to the feeders to be pipe couplings or bushings with threads as to mate with nozzles. All distributors shall be accessible for ease of removal and disassembly for cleaning and repair or replacement.

All spray bars shall be horizontal Schedule 80 PVC on quick disconnect unions with capped ends.

All spray bars to be held by FRP supports field fabricated to vessel walls.

Stagger and space all spray nozzles as shown in the Drawing.

Venturi cross flow nozzles shall be aimed downward and at an angle of 10 degrees toward gas inlet.

Absorber tower packing nozzle shall be aimed directly downward.

Mist eliminator wash nozzle shall be aimed directly upwards.

Inline strainers with blowdowns are required before each spray nozzle assembly as shown in the Drawing.

The following spray nozzles shall be provided and installed after all lines have been thoroughly flushed clean of debris. In addition, one complete set of spare nozzles shall be provided. All nozzles shall be PVC.

Spray Nozzles	No. Nozzles Required	Type	Model	NPT	Operate at, psig
Venturi Cross Flow	16	Fulljet	3/4 HH 71WSQ	3/4" Male	20
Absorber Parking	14	Fulljet	1 1/4 H 190WSQ	1 1/4 Female	40
Mist Eliminator Spray	10	Fulljet	3/4 HH 71WSQ	3/4 Female	20

The nozzle types listed here are supplied by Spraying Systems Company, Wheaton, Illinois.

C. Fans: Two (2) new fans shall be provided to replace the two existing fans. The fans shall be radial tip design constructed of 316L stainless steel with 44 1/2-inch wheel diameter capable of moving 33,000 cfm at 20-inch water gauge pressure drop. Typical fan is supplied by Garden City Fan (Niles, Michigan) Type 40 Rt. This fan has a 47 1/2-inch inlet diameter and a 31-inch by 55-inch rectangular outlet. Fan to be complete with bolted inspection door, drain connection, teflon shaft seal and shaft guard with split housing to facilitate wheel removal. An OSHA approved drive belt guard shall be provided for the 200 hp adjustable speed V-belt drives. New V drive belts are required. The existing two (2) 200 hp, 460/230 volt, 3 phase, 60 cycle motors shall be used.

D. Recycle Pumps: Four (4) recycle pumps with direct drive motors shall be provided. Two pumps of 660 gpm capacity each at 35 psig minimum head and of chemical resistant material shall be provided for venturi recycle. Two pumps, one main and one spare, of 990 gpm capacity each at 60 psig head and of chemical resistant material shall be provided for the absorbers recycle. Liquids will contain solutions of sodium hyprochorite - sodium hydroxide at ambient temperatures. Pumps to be packed stuffing box type with 460/230-volt, 3 phase TEFC direct drive motors of 15 hp minimum for venturi and 40 hp minimum for absorbers. Each pump to be provided with clean water packing lubrication and liquid drain off system. Water supply to include control valves and rotameters with capacity range of from 0 to 1 gpm. Pumps of this type are supplied by Wallace and Tiernan and by Durion (Dayton, Ohio) or equal.

E. Chemical Feed System:

1. Absorber Recycle Tanks: Two (2) absorber recycle tank shall be provided complete with baffle, cover and all necessary gusseted nozzles. Each tank shall be 10 feet - 0-inch-diameter by 5 feet -0-inch high of FRP construction as specified in Section 13216. All liquid feed and recycle drain lines shall enter tanks on the small volume side of baffle and shall enter and/or extend to within 4 inches of tank bottoms.

2. Sodium Hypochlorite Tank: One (1) sodium hypochlorite solution tank shall be provided in accordance with Section 13216.

3. Metering Pumps (Automatic): Six (6) chemical metering pumps shall be provided and shall be Wallace & Tiernan type positive displacement, diaphragm pumps or equivalent. Each of the two main NaOH pumps and the spare pump shall be designed to handle 10 gph each. Each of the two main NaOCl pumps and the spare pumps shall be designed to handle 70 gph each. Output volume shall be adjustable while pumps are in operation from zero to maximum capacity. Adjustment shall be by means of readily accessible dial knobs, one for changing stroke length and the other for changing stroke frequency. Both knobs are to be located opposite the liquid handling end. Control of metering pump shall be selectable between internal and

external pulsing by means of a three-position center-off switch. Chemical metering pumps shall be capable, without a hydraulically backed diaphragm, of injecting chemicals against pressures up to 100 psig.

Each pump drive shall be totally enclosed with splash proof control panel and no exposed moving parts. Solid state electronic pulser shall be fully encapsulated. Electronics shall be housed in a chemical resistant enclosure at the rear of the pump for maximum protection against chemical spillage.

Chemical metering pump housing shall be of chemically resistant glass fiber reinforced thermoplastic with a glass fiber reinforced polypropylene solenoid carrier. All exposed fasteners shall be stainless steel. Chemical metering pump valves shall be ball type, with ceramic balls seating on combination valve seat and seal ring. Valve seat and seal ring shall be renewable by replacing only the combination set-seal ring. Pump head shall be of PVC material. Fittings and connectings at pump head shall be PVC and/or polypropylene.

4. Chemical Feed Pick-Up Polyethylene tubing shall be provided for feed pickup complete with Swedgelock type compression nut and ferrule connections or equivalent. A foot valve with integral one-piece strainer shall be provided for each suction line, and an injection/anti-syphon check valve with 1/2-inch NPT male connection for each injection point. The injection check valve shall incorporate a dilating orifice.

5. Automatic pH and ORP Control: Two (2) pH and ORP controls shall be provided and shall be Leeds Northrup type or equivalent. They shall be designed for automatic metering variation of chemical flow. Each system recycle liquid shall be continously monitored and the chemical injection rate of one chemical automatically adjusted to maintain a neutral pH and chlorine residual at the setpoint. Output signals from the sensor probe shall be transmitted to the analyzer over standard signal wire. The probe unit shall be automatically temperature compensated and shall have a minimum sensitivity of 0.001 pH. The analyzer shall be compatible with the sensor signal transmission and shall be wall mounted. The analyzer shall contain a suitable meter or digital display for indication of the process variable, set point, or controller output. The unit shall contain a two-mode controller (proportional or integral) with analog for control of the chemical injection system. An auto-manual switch shall be provided for bumpless and noiseless transfer between modes. The unit shall be provided with suitable switches to increase or decrease control setpoint to allow display of the process variables, setpoint or controller output, and for setting control action. The unit shall be provided with high and low alarm relays for deviation from setpoint. Contacts shall be provided for remote alarm transmission.

6. The reaction chemical to be diluted will be provided by the Purchaser in a liquid form. The chemical feed system shall contain all parts necessary to achieve the specified flow rates for satisfactory performance of the odor control system. These are given in Section 1.06B of these Specifications.

7. The operation of the chemical feed and dilution system shall be designed to operate automatically as well as manually.

8. All parts of the two chemical feed and dilution systems shall be readily accessible for repair and maintenance, and shall be mounted on an open panel for easy access.

9. Clean water of reasonably uniform pressure, and of a minimum of 40 psig, will be supplied to the odor control systems as indicated in the Drawings. An automatic valve controlled by the electrical level control systems activates the flow for each system.

10. Pressure gauges are provided to observe line pressure in the chemical feed system as shown in the Drawings. Metering pumps, either manual or automatic, as specified, are provided to meter the chemical to be fed. Valves are required to draw samples or drain the chemical lines.

F. Electrical Control Panel:

1. The control panel shall be capable of monitoring operation of the system liquid and gas flows, pressure drops and chemical treatment system for each of the two systems as indicated in the Drawings. The electrical panel shall contain switches, status lights for all operating units such as pumps and fans. Status lights shall be provided to show the position of each of the five (5) gas flow control butterfly valves.

2. The electrical control panel shall be provided for coordinated and independent operation of the components of water supply to each tank and mist eliminator, chemical dilution system and exhaust fan. All units to be activated by a single button - and indicator lights will indicate the unit functions. Similarly, each portion of the system can be initiated by its own electrical control, with indicator lights indicating individual unit functions. Extra contacts shall be included for transmission of alarm and indicating signals to the remote control room.

3. The mist eliminator wash control shall be provided so that wash can be initiated every time mist eliminator exceeds 0.75 inch. H_2O or once every eight hours, whichever occurs first. Wash duration shall be two minutes @ 100 gpm.

4. Fan current for each fan shall be indicated.

5. Tank level shall be indicated for the venturi recycle (one indicator) and absorber recycle tanks (one indicator).

6. Electrical interlocks shall be provided so that (a) recycle tanks liquid levels are to the tank overflow baffle levels before recycle pumps can operate, (b) the absorber recycle pump must be operating before either of the fans can operate and (c) one of the two fans must be on before the filter presses can be activated.

G. Additional Accessories: The following supplement previous requirements:

1. All gas ducts elbows, Tee's and Wye's shall be 42 inches FRP between fan and venturi inlets. There shall be provided four 4-mitre, five-piece elbows; two Wye's; one Tee; and one Tee with a 16-inch side arm (42 inches by 16 inches by 42 inches).

2. Gas valves shall be FRP butterfly type. Four shall be provided. The valves shall be complete with chain operators so that valve operation from the floor is possible.

3. One 16-inch FRP butterfly valve shall be provided with one end flanged for connection to PVC and the other end to connect to the Tee with a 16-inch side arm. The valve shall be complete with chain operator.

4. The FRP gas ducts entering the venturi shall not be supported by the venturi.

5. All horizontal gas ducts slope in direction of flow 1/2-inch per 10-foot minimum.

6. Liquid supply lines shall be PVC Schedule 80 and all horizontal lines shall be sloped in direction of flow 1/2-inch per 10-foot minimum.

7. Liquid drain lines shall be PVC Schedule 80 and all horizontal lines shall be sloped in direction of flow 2 inches per 10-foot minimum.

8. All liquid carrying lines shall have a drain valve at each low spot.

9. Use two teflon diaphragm manual control valves on each liquid flow control as shown on the Drawings.

10. All pressure gauges on liquid lines shall be oil filled diaphragm type with isolating valves.

11. Gas flow orifices shall be installed in each fan discharge duct as shown in the Drawing. Orifices shall be 3/16-inch 316L stainless steel, 33.6-inch ID and sharp edge with either flange or pipe taps.

12. One-inch pressure taps are to be provided if not available from each system location for measuring pressured drops of venturi scrubber, absorber tower and mist eliminator as shown in the Drawing. Magnehelix gauges shall be provided to indicate the pressure drops for each portion of the system and shall be mounted on control panel. Magnehelix gauges are available from Dwyer Instruments, Michigan City, Indiana.

13. In line or indirect indicating liquid flow rotameters or flow meters are required in each venturi and in each absorber recycle line, in the venturi bleed to absorber, and in absorber bleed to drain. Capacities are indicated in Section 1.06B of these Specifications. These meters must be in plumb sections of line, at eye level, and accessible and with a light so they can be read. These can be Leeds & Northrup type or the mini-magnetic type supplied by Fischer & Porter Company (Warminster, PA).

14. Quarter-inch nylon pressure lines shall be provided to connect the pressure taps and the magnehelix gauges on the control panel as shown in the Drawing. The nylon lines are to be secured to framework or other equipment by nylon tabs. These connections shall be male and female Swedgelock type with nuts and ferrules. All these lines shall slope to vessel or duct tap until line drops to gauges. Leave no loops in these lines. The three-way valves shown shall be 1/4-inch stainless steel.

15. The entire system and all lines must be purged of debris and any foreign material before the installation is considered complete.

16. All open ports shall be closed with appropriate flanger, caps and/or other covers.

17. All sample valves, isolation valves and alternate passage valves shall be accessible and as close to main line as possible. Valve extension handles may be used.

18. A 42-inch-diameter stub tee with flange shall be welded to one of the existing 51-inch stainless stacks to accommodate 42-inch FRP bypass gas duct.

19. All valves and electric activator enclosure shall be of plastic construction as specified in Section 15118.

PART 3 - EXECUTION

3.01 INSTALLATION

A. It is intended that the existing system be utilized to the greatest practical extent. As a result, the existing system must be relocated, cleaned, inspected, repaired, modified and supplemented as described in the specification and in the Modified Plans of the Drawings.

3.02 SURFACE PREPARATION AND PAINTING

A. Ferrous Materials:

1. Existing ferrous materials, including scrubber tower and stack steel supports, shall be cleaned and inspected for defects. All badly corroded and defective parts must be cut out and replaced. New welds must be cleaned and ground smooth. Then all metal surfaces

shall be blast cleaned to bare metal in accordance with SSPC Specification SP6, commercial blast cleaning, providing a 2.0-mil profile.

2. All surfaces shall be metal primed and then coated with epoxy primer and finish coats, as specified in Section 09900. These paints shall be products of the same manufacturer.

B. Other Materials: Other finishes are discussed in Section 2.01 of this Specification.

3.03 INSPECTION, TESTING, SYSTEM OPERATING MANUALS AND TRAINING

A. Finished Construction: The Engineer shall inspect the new installation in cooperation with his consultans to assure that the specifications have been followed correctly and the work properly executed. Each component shall be inspected visually in dry condition and again in wet condition to assure operation safety, proper operation, direction of rotation and assembly.

B. Operation: The purchaser will provide for testing, system operating manuals and operator training. New component manuals shall be provided as discussed in Section 1.03B of these Specifications.

3.04 MISCELLANEOUS

A. Deviations: If the equipment the Contractor proposes to furnish differs from that indicated on the plans or herein specified, or requires a different arrangement, the Contractor shall prepare and submit for review detailed structural, mechanical, and electrical drawings and equipment lists showing all such changes. If accepted by the Engineer, any additional costs involved, including those for project drawing changes and changes in interfacing work, shall be the responsibility of the Contractor and there shall be no additional cost to the Owner.

END OF SECTION

PBS&J
ENGINEERING • PLANNING • ARCHITECTURE
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OPERATIONAL ACCOUNT

Dana M Hall
AUTHORIZED SIGNATURE

[redacted]

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DETACH BEFORE DEPOSITING AND RETAIN FOR YOUR RECORDS

Nº 29669

JOB NO.	ACCOUNT NO.	VOUCHER NO.	VENDOR NO.	EMPLOYEE NO.	TERM / DESCRIPTION	AMOUNT
			27128			
07-155.03	484.00				I.B. Air Pollution Permit	$100.00

gfs

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

Nº 76159

RECEIPT FOR APPLICATION FEES AND MISCELLANEOUS REVENUE

Received from City of Orlando Date May 4, 1987

Address 400 South Orange Ave, Orlando, FL 32801 Dollars $ 100.00

Applicant Name & Address Same As Above (Source located at Iron Bridge Road)

Source of Revenue ✓ # 29669

Revenue Code 001031 Application Number AC 54-133924

By K Bruce Mitchell

87 MAY 08 AM 8:27

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