APPENDIX A

EXISTING TREATMENT SYSTEM DESCRIPTION

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1. Description of the Treatment/Outfall System [40 CFR 125.62(a) and 125.62(e)]

a. Provide detailed descriptions and diagrams of the treatment system and outfall configuration which you propose to satisfy the requirements of section 301(h) and 40 CFR Part 125, Subpart G. What is the total discharge design flow upon which this application is based?

Response:

The existing Sand Island Wastewater Treatment Plant (SIWWTP) is a primary treatment plant, designed to treat an average daily flow of 82 million gallons per day (mgd) and is the largest in the State of Hawaii. The present average daily flow is roughly 65.6 mgd, or about 80 percent of the plant design capacity.

This section will focus on the current treatment process. To address projected flows of 90 mgd, for the year 2025, the plant is under expansion; see Appendix B for more information.

Current Treatment Process

A site plan of the existing Sand Island WWTP (Tax Map Key: 1-5-41-5) is shown on Figure A-1. The plant is situated on a 50-acre site that is surrounded by State of Hawaii property. The existing treatment facilities occupy the western portion of the site. The eastern portion is largely vacant land reserved for secondary facilities, if it becomes necessary at some future time.

Liquid Stream Processes

The plant liquid stream flow diagram under gravity flow conditions in the clarifier is shown on Figure A-2. Design criteria of the SIWWTP liquid stream treatment facilities are presented in Table A-1.

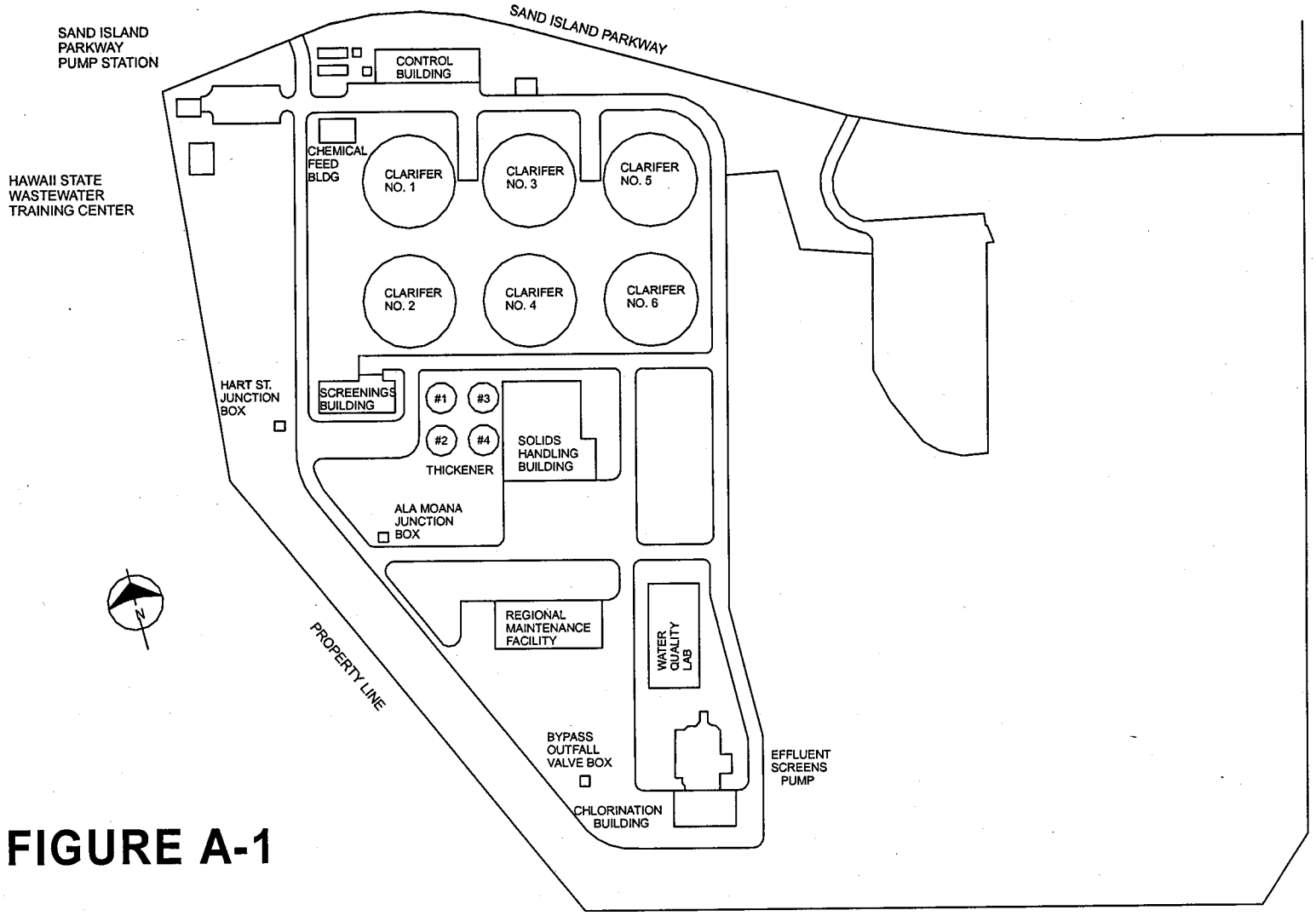

FIGURE A-1

EXISTING SAND ISLAND WASTEWATER TREATMENT PLANT

TABLE A-1

SAND ISLAND WASTEWATER TREATMENT PLANT
LIQUID TREATMENT PROCESS COMPONENTS

Design population [in the thousands]	451
Flow [mgd]	
Average Dry Weather	75
Average Daily Design	82
Peak Dry Weather	89
Peak Wet Weather	173
Influent Sewer Diameter [inches]	
Ala Moana Force main	
Original	60
Current	66
Hart Street Force main	48
Sand Island Parkway Force main	12
Screening	
Influent Bar Screens	
Number	4
Openings [inches]	1
Channel width [feet]	6
Effluent Screens	
Number	3
Openings [inches]	0.25
Degritting	
Cyclones	
Number	4
Size (Throat diameter) [inches]	18
Classifiers	
Number	2
Average Grit Removal Rate [yd^3/day]	9
Primary Clarifiers	
Number	6
Diameter [feet]	150
Average Sidewater Depth [feet]	12
Detention Time [hours] (average flow + DAF recycle)	2.12
Overflow rate, [gal/sf/day] (average flow + DAF recycle)	1,100
Maximum Hydraulic Capacity per clarifier [mgd]	30
Effluent Pumps	
Number	3
Design Flow per pump	
Capacity [mgd]	87
Total Head [feet]	29
Maximum Flow per pump	
Capacity [mgd]	102
Total Head [feet]	16
Reference II.A(3)	

Influent to the plant is received from two major and two smaller pump stations and force mains. The Ala Moana (55 mgd) and Hart Street (18 mgd) pump stations serve the eastern and western areas of Honolulu, respectively. The Sand Island Parkway Pump Station (0.5 mgd) serves a small area on Sand Island, near the plant, and the Fort Shafter Pump Station (1.5 mgd), which is owned and operated by the U.S. Army, serves the Fort Shafter Military Reservation, U.S. Army Hospital and Military Housing Subdivisions. Influent flow to the plant is measured by summing the pumping rates from each of the four influent pump stations.

The influent force mains end at two junction boxes, from which the combined influent flows by gravity to the influent screens. There are four mechanically cleaned bar screens, with two screens normally operating. Each bar screen is six feet wide and consists of 3/8-inch bars with a one-inch clear opening between bars. The capacity of the system is approximately 127 mgd with two screens operating. Screened debris is transferred via conveyor belts and is collected in a storage hopper for ultimate disposal in a sanitary landfill. Pipes that were intended to convey screened debris to the incinerator are now being used to convey wastewater from the incinerator scrubber system to the influent channels.

Downstream from the bar screens, the influent flows by gravity through two side-by-side influent channels which are interconnected at each end. The two channels are used to convey the screened wastewater from the headworks and to distribute it to the primary clarifiers. By using isolation valves, either channel can be isolated for cleaning and maintenance. At this point, polymer can be added to the screened wastewater, either directly or as a mixture with the return flow.

Although there are six 150-foot diameter primary clarifiers, five are normally in use. The sixth clarifier is only operated during peak wet weather flow periods. The 12-foot side wall depth clarifiers have conventional mechanical scraper arms for removal of both settled solids from the clarifier bottoms and floatables from the water surface.

Each clarifier is also designed and equipped so that it can be operated as a dissolved air flotation (DAF) unit, the normal operating configuration. The DAF system includes the following major components:

- Air Compressors
- Effluent Recycle Pumps
- Retention Tanks
- Backpressure Valves (in clarifier center column)
- Float Progressive Cavity Pumps

The DAF process involves the introduction of compressed air into recycled effluent in a pressurized retention tank, creating a solution that is saturated with air. The WWTP liquid stream flow diagram under DAF flow conditions in the clarifier is shown in Figure A-2.

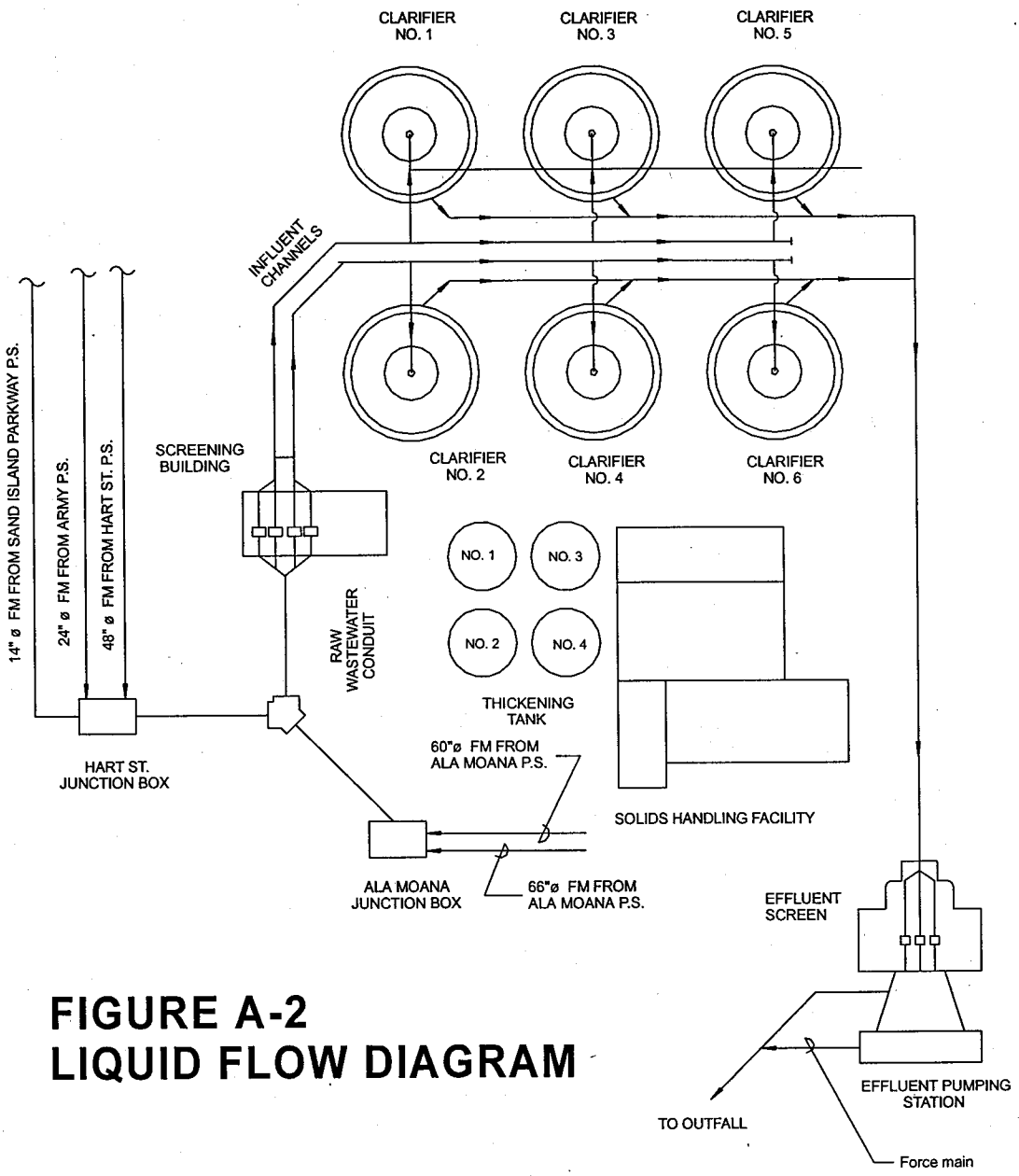

FIGURE A-2
LIQUID FLOW DIAGRAM

Recycled effluent is saturated with compressed air at 100 psi and when the pressure is released as the effluent solution passes through the back pressure valves, the liquid, under the reduced pressure condition, is supersaturated with air. The dissolved air is released from solution and forms bubbles that adsorb to the suspended solids in the clarifier and lift them to the surface. The floatable solids (a.k.a float) and scum are skimmed to troughs and pumped to downstream processes by the float progressive cavity pumps. The original intent of these units was to prevent surface slicks in the receiving waters by increasing the removal of scum and floatable solids.

An interim metal salts injection system is being installed to service clarifiers 5 and 6, until the refurbishment of clarifiers 1 through 6 has been completed. We anticipate final installation will be done by the end of August 2003. Following the installation, the City will institute a process to evaluate the treatment contributions (bench tests, clarifier monitoring, etc.) and will use the system as needed to ensure permit compliance until the expansion phase is completed.

Effluent from the clarifiers flows over V-notched weirs into effluent launders and then flows into the effluent channels and conduits to the effluent pump station. The inlet forebay of the effluent pump station is equipped with three self-cleaning, 1/4-inch mesh traveling water screens. These screens, which were installed in 1993, have 1/4-inch openings to capture any large solids passing the clarifiers. The effluent pump station has three dual drive (i.e., 200-hp electric and 900-hp, diesel driven) effluent pumps. Although the treated effluent normally flows by gravity to the outfall, these pumps can be used when gravity flow cannot accommodate all of the flows such as during periods of high flow and/or high tide. These periods seldom exceed one to two hours per day, but may be extended during extreme rainfall events.

The SIWWTP treats primary treated effluent for in-plant uses, such as washdown water, using a hypochlorite disinfection system. This system has a variable capacity pump, capable of supplying a maximum of 240 gallons of hypochlorite per day. For the majority of the primary treated effluent, the City is committed to provide standby effluent UV disinfection; see Appendix B.

Solids Stream Processes

The flow diagram for wastewater solids removal under DAF conditions in the clarifier is shown on Figure A-3. Design criteria for the Sand Island WWTP solids stream processes are presented in Table A-2.

Sludge collected in the primary clarifiers underflow is pumped to four degritting cyclones. Grit is then washed by two rake-type grit classifiers and conveyed to storage hoppers prior to disposal at a sanitary landfill.

Degritted sludge then flows to one of two 50-foot diameter gravity sludge thickeners. A mechanical screen was installed in 1994 just upstream of the thickeners to remove stringy solids that cause clogging of pipes and pumps. The sludge thickeners increase the sludge concentration from about one to five percent solids.

In addition to the two thickeners dedicated to raw sludge from the clarifiers, two other thickeners are available to thicken or decant heat treated sludge prior to dewatering. These units were found not to be necessary. While these units were in service, it was found that the head treated sludge thickened so well (up to 8% solids) that it could not be pumped. Scum skimmed from the surface of the clarifiers is pumped directly to wet sludge storage tanks that receive heat treated sludge. The warm sludge liquefies the solid scum for further processing with sludge.

Following thickening, the sludge is pumped to wet sludge storage tanks (WSST) No.1 and No. 2, which act as storage reservoirs ahead of the thermal conditioning units. Sludge from WSST No. 1 and 2 are passed through a grinder into high-pressure pumps, which feed one of two Zimpro thermal conditioning units. The other Zimpro unit serves as a standby facility. These units condition the sludge for dewatering. The thermally conditioned sludge is then directed into either WSST No.3 or 4. Because of the combination of high heat and pressure in the thermal conditioning unit, the thermal-conditioned sludge is sterilized, but bacteria rapidly multiply during storage in the WSST.

The thermally conditioned sludge is pumped from WSST No.3 and 4 to the dewatering centrifuges. One centrifuge is normally in use continuously, while the other two serve as standby units. Thermal conditioning significantly improves sludge dewatering characteristics. The centrifuges increase the sludge solids concentration from about 3 to 5 percent to 28 to 35 percent solids.

The sludge cake produced by the centrifuges is then directed either to incinerators or to a storage hopper prior to hauling by truck to a sanitary landfill. The sludge cake is hauled to the Waimanalo Gulch landfill for disposal.

The two identical multiple hearth incinerators are sized to incinerate 5.5 wet tons per hour of 30 percent solids sludge cake (i.e., 1.35 dry tons per hour). The incineration units are capable of completely oxidizing the sludge volatiles, resulting in ash that is hauled to the sanitary landfill at

Waimanalo Gulch. The incinerators have been modified to comply with the requirements of the 40 CFR Part 503 sludge regulations promulgated in February 1993.

Figure A-4 shows the combined liquid and solid flow schematic.

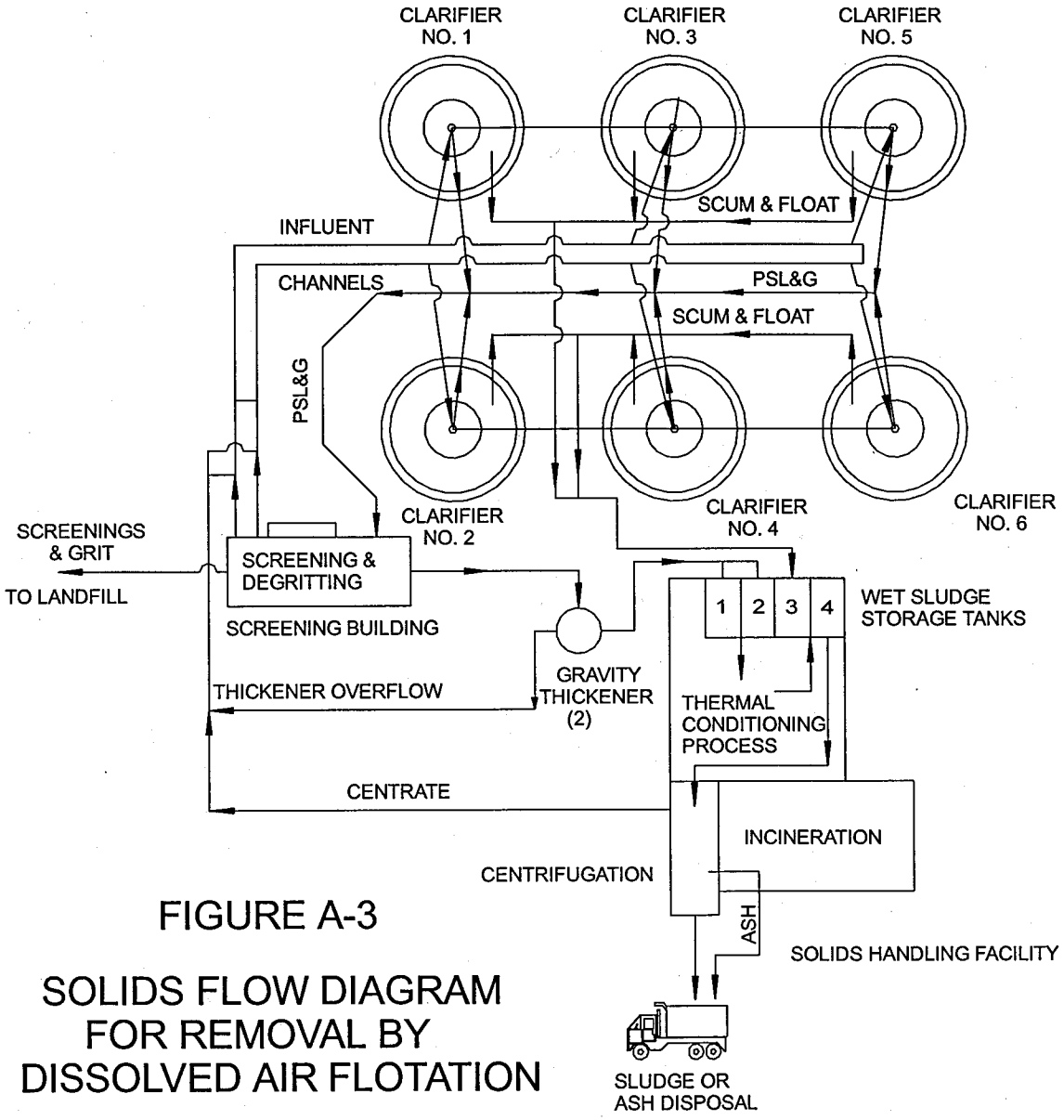

FIGURE A-3

SOLIDS FLOW DIAGRAM FOR REMOVAL BY DISSOLVED AIR FLOTATION

TABLE A-2 SAND ISLAND WASTEWATER TREATMENT PLANT SOLIDS HANDLING PROCESS COMPONENTS	
Sludge Thickening	
Gravity and Decant Thickening Tanks	
Number	4
Diameter [feet]	50
Solids Loading [lb/sf/day]	
Maximum	29.7
Average	15.6
Sludge Pumps	
Number	4
Capacity per pump [gpm]	35-110
Thermal Conditioning	
Heat Treatment Units	
Number	2
Capacity per unit [gal/hr]	5,000
Number of Storage Tanks	4
Effective Storage Volume per unit [ft^3]	10,550
Grinders	
Number	3
Capacity per unit [gpm]	100
High Pressure Pumps	
Number	5
Capacity per unit [gpm]	85-110
Sludge Dewatering	
Centrifuges	
Number	3
Capacity per unit [gpm]	
Maximum	80
Average	45-65
Solids Loading per unit [lbs/hr]	
Two Units in Operation	1,950
One Unit in Operation	2,050
Centrifuge Feed Pumps	
Number	3
Capacity per unit [gpm]	35-80
Sludge Incineration	
Multiple Hearth Furnaces	
Number	2
Inside Diameter [feet]	16.5
Number of Hearths	9
Total Hearth Area per Furnace [ft^2]	1,591
Wet Solids Loading (Sludge) [lbs/sf/hr]	

TABLE A-2 SAND ISLAND WASTEWATER TREATMENT PLANT SOLIDS HANDLING PROCESS COMPONENTS (CONTINUE)	
Two Units in Operation	4.7
One Unit in Operation	5.5
Volatile Solids Loading (Sludge) [lbs/sf/hr]	
Two Units in Operation	0.95
One Unit in Operation	1.1
Emergency Standby Power System	
Engine-Generator Unit	
Number	1
Alternator Rating [kva]	600
Reference II.A(3)	

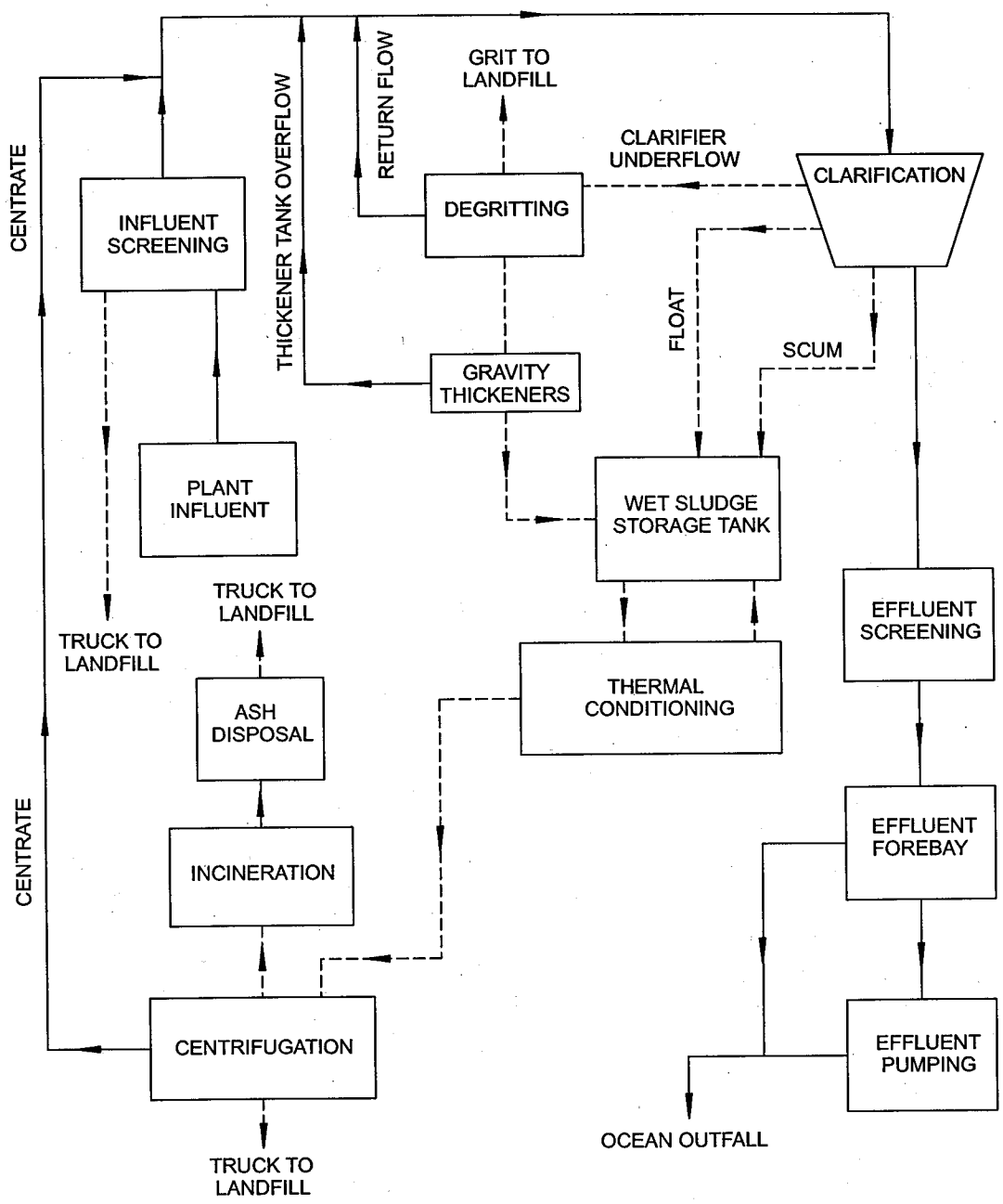

FIGURE A-4
LIQUID & SOLID FLOW SCHEMATIC