EXHIBIT 13

SPRINGFIELD, MASSACHUSETTS

BONDI ISLAND TREATMENT PLANT

FUNCTIONAL DESIGN FEATURES

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SPRINGFIELD, MASSACHUSETTS
BONDI ISLAND WASTEWATER TREATMENT PLANT

FUNCTIONAL DESIGN FEATURES

Design Flows and Loadings[1]	Present	1990	2020
Minimum Flow, mgd	10.0	25.0	40.0
Average Daily, mgd	36.0	64.0	94.0
Maximum Daily, mgd	45.0	120.0	174.0
Peak Rate, mgd	69.0	174.0	236.0
BOD, lbs/day	78,300	133,000	184,000
Suspended Solids, lbs/day	55,100	112,000	161,000
Equivalent Population (based on 0.2 lbs BOD/day)	391,500	665,000	920,000

DESCRIPTION OF PLANT HYDRAULICS

The influent pipes, screen channels, metering facilities and outfall have been sized to handle the 2020 peak flow of 236.0 mgd. (However, until after the 1990 plant expansion only 174.0 mgd will be allowed into the plant as indicated above.) All other pipes and structures have been designed for the 1990 flows with provisions for expansion in the future to 236.0 mgd.

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(1) Flows and loadings are established by contractural agreement between the users and the City of Springfield.

The influent sewers and force mains are designed to convey the peak 2020 dry weather flow (236.0 mgd) to the treatment plant. Since the sewerage systems of several of the contributing municipalities are combined, it is anticipated that flows in excess of the 1990 peak dry weather flow (174.0 mgd) may be received at the plant at times of heavy rains.

With the exception of the overflow at Locust Street, the existing combined systems can relieve themselves of all flows in excess of the 1990 peak design flow through existing regulators. However, at Locust Street, the regulator is restricted and must allow the entire 2020 peak dry weather flow to continue through the new interceptor sewer to the plant.

The difference between the 1990 peak flow and the 2020 peak flow for the sewer is approximately 35.0 mgd. (This quantity will be reduced as the combined system is separated.) The effect of this 35.0 mgd will be to potentially increase the 1990 peak flow, during heavy rains, to 209.0 mgd (174.0 + 35.0).

An influent structure has been provided to receive the flows from the various plant influent lines. The flows from the contributing municipalities (excluding the City of Springfield) will be measured by Parshall flumes prior to discharge into this structure. An overflow weir has been included in this structure to provide a means to overflow all flow in excess of the agreed contractual 1990 peak dry weather sanitary flow of 174.0 mgd. Thus the excess stormwater (35 mgd) can, by throttling the influent sluice gates, be discharged directly to the Connecticut River.

The influent will flow by gravity through four (4) parallel influent pipes, screening channels, Parshall flumes, and influent channels. Each of the four (4) parallel systems is designed hydraulically for 80 mgd flow.

The four (4) parallel influent channels discharge into an influent distribution chamber which will be used to feed the influent channels to the primary sedimentation basins. This distribution chamber will feed the two (2) primary distribution channels from either one or both ends, depending on the flow to plant and the setting of the distribution gates.

The screened influent will be distributed uniformly to the four primary sedimentation basins through multiple influent control orifices. Each orifice will be equipped with a discharge baffle to dissipate the inlet velocity and further distribute the flow uniformly along the width of each basin.

Settled wastewater will pass over effluent finger weirs into effluent collection channels and pipes to the secondary treatment facilities by gravity.

The screen facilities and primary sedimentation basins (including grit removal) will receive the entire 174.0 mgd, which represents an additive dry weather peak of the contributing users. The probability of receiving this flow as a peak dry weather sanitary flow, except during periods of heavy rain or infiltration, is extremely low. Therefore, the peak flow used for the hydraulic design of the secondary units (aeration tanks and settling basins) has been established at 128.0 mgd (2 x Q_{ave}). The flow will be split prior to the aeration tanks, with any flows in excess of 128.0 mgd being by-passed directly to the chlorine contact chamber. The by-pass line will be sized to handle approximately 50 mgd. A Venturi Meter will be provided on this line to measure this flow.

Flow will be conducted by closed conduit to the aeration basins where distribution to the four basins will be made by means of an open channel for minimizing the head losses. This open channel will discharge into two step-feed channels, each feeding settled sewage to two aeration basins. The channels are gated so that it will be possible to introduce all flow at the influent end of the basin, or at the quarter points along the length of the basin. It will be possible to operate one aeration basin in a step-feed manner and the adjacent basin with full flow at the influent end, both basins being fed by the same influent channel.

The aeration basin water surface will be regulated by an adjustable weir as described below. The aeration basin effluent will pass over the weir and into a cross-flow channel. This channel normally will conduct the flow from the aeration basin to its following flocculation basin. However, if it is desired (or necessary) to take one or more aeration basins (or secondary clarifiers) out of service and still use all secondary clarifiers (or aeration basins), the cross-flow channel will distribute the flow laterally as necessary to allow this flow pattern.

Mixed liquor will pass through gated ports into the flocculation chambers and thence through large ungated ports into the final clarifiers. Settled effluent will pass over finger weirs to a secondary effluent collection channel and flow to the chlorine contact tank in a closed conduit.

When river levels allow it, the flow will pass through the chlorine contact tank and outfall by gravity for dispersion into the river. When the river level rises to elevation 52.2, the contact tank effluent will be pumped through this same outfall for dispersion into the river. The plant hydraulic profile is appended.

DESCRIPTION OF PROCESS[2]

SCREENINGS REMOVAL

Four mechanically-cleaned bar screens have been provided; each will be 12 ft wide by 5 ft deep, will have 1-in clear openings, and will have a hydraulic capacity of 80 mgd. Average screenings quantities are estimated to be 4.0 cu ft per million gallons; peak loading is estimated at 8.0 cu ft per mg. Screenings removed by the mechanisms will be discharged onto a belt conveyor system which will convey the screenings to hoppers which discharge into ten cu yd containers. The containers will be trucked to the City's solid waste disposal area.

GRIT REMOVAL

Grit will be removed from the primary sedimentation basins with dilute primary sludge. Average grit quantities are estimated to be 1.7 cu ft per mg; peak grit loading is estimated to be 54 cu ft per mg. Grit will be removed from primary sedimentation basins as described below. Grit handling will be by a four cyclone degritting system, with three units capable (in an emergency) of handling the peak grit load. Handling of grit will be by conveyor system to containers. The containers will be trucked to the City's solid waste disposal area. The system will be designed for continuous operation. Primary sludge separated by this process will be thickened as described below.

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(2) A schematic of the plant process is appended.

METERING

Metering will be by four (4) parallel Parshall flumes. Flows will be transmitted to a data logger for recording and totalizing.

PRIMARY SEDIMENTATION BASINS

Four basins, each 80 ft-8-in wide by 250 ft long with a 9 ft SWD, have been provided. The inlet zone (the first 40 ft of the basin) of each basin will be provided with longitudinal baffle walls dividing the basin into four sub-basins, each approximately 20 ft wide, to aid in flow distribution and minimize transverse currents.

The sedimentation basins will meet the following criteria at the following conditions (with all four basins in operation):

	1990 Design	
	Q_{ave}	Q_{peak}
Detention time (hours)	2.0	0.8
Surface overflow rate (gpd/sf)	800	2170

Each basin will be equipped with a heavy-duty traveling bridge sludge scraping and skimming mechanism. The mechanism will both skim and scrape from the effluent end to the influent end of the basin.

Skimmings will be carried up an inclined beaching plate for discharge into the skimmings trough. Flushing water provided by small air-lift pumps will flush skimmings from the trough into hoppers for withdrawal by pumps. The dilute skimmings will be pumped by non-clog, vortex pumps to the flotation thickener tanks for thickening and disposal with the waste activated sludge.

Primary sludge and grit will be scraped to a series of small steep-walled sludge hoppers along the influent wall of the basin. Air-lift pumps will operate continuously to provide a system of continuous removal of dilute sludge with grit from the hoppers. The traveling bridges will be equipped with variable speed drives and automatic controls for operation of the bridge at different speeds depending on the bridge position, direction of travel, and quantity of grit and sludge. During the final few feet of the scraping cycle the bridge speed will be decreased sufficiently to provide gradual discharge of the collected sludge and grit into the hoppers.

The air-lift pumps will discharge into a collection flume, located immediately adjacent to the service walkway, which will provide for continuous inspection of the nature of the discharge and the performance of each pump.

The steeply inclined flume will discharge into a suction well above a vortex pump located in the gallery below. Each basin will have its own pump; all pumps will be interconnected to provide balanced feed and discharge. Each pump discharge will be carried by an individual sludge pipe to feed one cyclone grit separator.

The air required by the air-lift pumps will be supplied by three (3) blowers (two plus one standby) located in the gallery. The quantity of air supplied will be varied automatically to provide the quantities of air required to balance the discharge of the air-lift pumps to that of the vortex pumps under all possible operating conditions. Normally, one blower will provide the required amount of air. Under conditions of heavy grit load two blowers will be required.

Any component of the primary system can be serviced or repaired without dewatering the basin. Therefore, all four basins will be in use continuously except for possible (but infrequent) brief periods of shutdown required for repair.

AERATION BASINS AND FACILITIES

The process employed may be either conventional activated sludge with all settled sewage and return activated sludge introduced at the influent end of the aeration basin or step-feed activated sludge where settled sewage and return sludge are introduced at quarter points along the basin. Individual basins may be operated either way. The aeration process is single stage, the throughput passes once through an aeration basin.

Four aeration basins are provided, each is 600 ft long by 100 ft wide and has 15 ft-0-in side water depth. The volume of each basin is about 900,000 cu ft. The detention time, based upon average daily flow (16 mgd) plus 25 percent return activated sludge, is 8.08 hours. Design loading is 36.9 lbs of BOD_5 per day per 1,000 cu ft of basin capacity or a daily capacity of 33,250 lbs for each basin and 133,000 lbs for four basins.

Aeration is of the mechanical type. Each basin is equipped with seven 100 hp aeration mechanisms having a guaranteed capacity of 3.0 lbs of oxygen per input horsepower hour. Peak oxygen supply per aeration basin can be 50,400 lbs of oxygen daily based upon an input of 100 hp per unit and 24 hour operation at optimum submergence of the mechanism. Actual oxygen supply will be controlled by means of a dissolved oxygen sensor located at the effluent end of each basin. The sensor will control the setting of a motorized adjustable weir which establishes the water level in the basin. A low level of dissolved oxygen will cause the weir to increase the height of the water surface with respect to the aerator blades, resulting in more blade submergence and increased supply of oxygen. After adjustment to a preset level of dissolved oxygen, the control will be automatic.

FLOCCULATION AND CHEMICAL FEED FACILITIES

Flocculation and chemical feed facilities have been included (pilot plant studies indicated that the activated sludge may be light, ie, high sludge volume index). Facilities for feeding up to 100 mg/l alum or up to 5 mg/l polyelectrolyte have been included. These chemicals will be stored and metered in the basement of the Sludge Conditioning and Filter Building and will be piped as water solutions or suspensions to the effluent end of the aeration basins. Here they will be further diluted and fed. The alum is expected to add weight to the light sludge for better settling and the polyelectrolyte is expected to decrease carry-over of the light floc into the clarifier effluent. Under normal operating conditions it is expected that chemicals will not be needed.

Flocculation, or light stirring of the mixed liquor prior to settling, is expected to result in more contact of sludge particles and result in better settling characteristics. Gentle mechanical stirring by means of blade turbine mixers has been provided in two stages. Variable speed control of the mixers can vary the mixing afforded to obtain the optimum condition of the sludge.

The flocculation basins are four in number, each about 100 ft wide by 50 ft long (in direction of flow) and 15 ft deep. Detention time is as follows.

Flow	Detention Time
Average 1990 + 25% Return Sludge	30 minutes
Peak 1990 + 100% Qavg Return Sludge	12.5 minutes

Eight mechanisms are placed in each basin, four in the first stage compartment and four in the second stage compartment. A baffle wall separates the two stages. Basin effluent ports are large for low velocities of flow so that the developed floc will not be dispersed.

SECONDARY CLARIFIER FACILITIES

4 finals = 1.48 x 7.5 Vol. = 11.1

The secondary clarifiers are rectangular in plan with flow in the longitudinal direction. Four clarifiers have been provided, each 300 ft long by about 100 ft wide and having a side water depth averaging 12.40 ft. The surface overflow rate with all four clarifiers in operation will be:

Avg daily flow (64.0 mgd)	533 gals/day/ft²
Avg daily + 25% Return Sludge (80.0 mgd)	~~667~~ 537 gals/day/ft² — WRONG
Peak flow + 25% Return Sludge (144 mgd)	1200 gals/day/ft² — WRONG

The detention time, based upon average daily flow plus 25% return activated sludge, will be 3.34 hours.

Each clarifier is divided longitudinally to form two compartments. The compartment at the inlet end is 14.0 ft deep and will be scraped and skimmed by a travelling bridge type of mechanism. The sludge will be scraped in the direction of flow to a series of hoppers located across the tank at its center. The skimmings will be pushed to the inlet end of the tank where they will be withdrawn by a motorized rotating collector. The second, or effluent end compartment is 10.4 ft deep (average) and is divided laterally into 5 sub-compartments. Each sub-compartment will be scraped by a chain and flight mechanism which will push the settled sludge to the same series of hoppers in the center of the tank. Effluent finger weirs extend into this second compartment to provide 1760 lin ft of weir, affording a weir overflow rate of 9,100 gals per day per ft based upon average daily flow.

It is expected that density currents caused by the energy of the settling solids will occur in the first compartment. This density current energy will be removed by withdrawal of the sludge at the centrally located hoppers. A lateral sludge collection channel above the hoppers also will act as a baffle to turn back the return current and prevent currents in the second compartment. Most of the sludge will be removed in the first compartment while the second compartment will remove the slow-to-settle finer particles.

The traveling bridge sludge scraper in the first compartment will operate intermittantly to remove the shoaling solids which may settle. The major portion of the solids will be carried to the hoppers by the density current. Similarly, the chain and flight scrapers in the second compartment will be operated intermittantly for decreased wear. The volume of sludge produced in the second compartment is expected to be low. Both types of scrapers will be automatic with a wide range of operation available.

RETURN SLUDGE FACILITIES

The return activated sludge system is designed hydraulically to return up to 120 percent of the average daily flow, giving wide operating latitude to cope with a light sludge, should it occur. Metering by means of Parshall Flumes is provided.

The sludge will be removed from the secondary clarifier hoppers by hydrostatic head through ten 12-in diameter telescoping valves located across each tank. The valves are motorized and operate with equal vertical adjustment for uniform withdrawal across the tank. The valves will discharge into a lateral gravity channel thence into a longitudinal gravity channel to the pump station.

The return activated sludge pumps are contained in two stations, each station serving two aeration basin-clarifier units. Each station contains four pumps, three of which have the design capcity and one is standby. The pumps are vertical "even-flo" pumps designed to pump at the rate of station inflow (up to their design capacity) with relatively constant pumping level in the wetwell. Each pump has a capacity of 9,200 gpm at 10 ft of head. Pump discharge will be into another gravity open channel which conducts the sludge to the aeration basins. Gated ports are located along the channel to allow either (1) all sludge to be conveyed to the influent end, or (2) sludge to be discharged at quarter points along the aeration basin. The return sludge will be metered at the pump stations.

Waste activated sludge will be removed at the pump station by means of an adjustable overflow gate. The overflowing waste sludge will be conveyed by gravity to the Oxidized Sludge Tank Gallery, where it will be pumped to the flotation units. The collected scum will be conveyed to the Oxidized Sludge Tank Gallery with the waste activated sludge.

CHLORINATION FACILITIES

Chlorine solution will be diffused into the plant effluent as it leaves the clarifiers. Four 8,000 lb per day chlorinators and evaporators and a chlorine residual analyzer have been provided. Chlorine storage facilities include 2 - 50 ton truck scales for weighing and storage of 2 - 17 ton chlorine tank trucks. Three chlorinators and evaporators will be capable of feeding 16 mg/l at 174 mgd. One chlorinator and evaporator will serve as standby. Facilities have also been provided to feed chlorine into the influent wastewater at the inlet structure for odor control.

Normally, the chlorine will be fed at a preset rate based upon the flow indicated by the Parshall flumes. However, if the chlorine residual drops below a preset limit, the analyzer will override the system and increase the rate of feed. Rate of feed for preclorination will be manually controlled.

The four chlorine contact chambers are approximately 180 ft x 28 ft x 10.5 ft sidewater depth. Detention times are as follows:

	Present Flow		1990 Flow	
	Average Daily	Peak	Average Daily	Peak
Total Detention Time, minutes (4 basins)	64	33	36	13

Additionally, two minutes detention will be provided in the outfall pipe during peak 1990 flow.

STANDBY POWER

No appreciable standby power generation equipment has been provided. Two individual lines, directly from Western Mass. Electric Co. generation station, will provide two separate sources of power to the plant. Thus, it is anticipated that power for the plant will always be available. A 250 kw generator will be included to insure safety at the plant during periods of failure of one source of power.

SLUDGE PROCESSING

The estimated sludge quantities used for selection of sludge processing equipment are as indicated below:

	Present		1990	
	Dry Solids (lbs/day)	Dry Solids (lbs/week)	Dry Solids (lbs/day)	Dry Solids (lbs/week)
Primary Sludge	33,000	231,000	67,200	470,400
Waste Activated Sludge	40,600	144,200	69,000	483,000
Combined Thickened Sludge	73,600	375,200	136,200	953,400
Oxidized Sludge	55,200	281,500	102,000	715,000

All sludge processing equipment will normally operate without the use of chemicals.

Primary Sludge Thickening and Storage

Three (3) 50-ft diameter, 10 ft sidewater depth, primary sludge thickeners have been provided to thicken the sludge to approximately 6 to 8 percent and to store the sludge prior to its being fed to the sludge conditioning unit. The volume of the three sludge tanks is 70,000 cu ft. The tanks will have capacity for storing thickened sludge for approximately 1-1/2 days in the design year. The design loading rate for the thickeners is approximately 11 lbs/sf/day with three thickeners operating and 17 lbs/sf/day with two thickeners operating.

Waste Activated Sludge Thickening

The activated sludge flotation thickeners consist of six (6) 1510 sq ft units installed in concrete tanks. Appurtenant equipment includes pressure regulating tanks and control devices. The flotation units will be located in the Thickener Building. Compressed air will be furnished by the Plant Air System located in the Sludge Conditioning & Filter Building. Water supply will be furnished by the Plant Water System.

The six flotation thickener units will operate as indicated below:

	Present	1990
Dry solids (lbs/week)	144,200	483,000
Hours per week operating (based on 9.0 lbs per sq ft per day loading rate with 6 units operating)	48	144
Hours per day - 6 day week	8	24

The operation can be modified to operate 7 days per week if this is found to be more advantageous.

The thickened sludge will normally be pumped to holding tanks. The piping, however, has been arranged so that the sludge can be pumped directly to the vacuum filters (from either the thickeners or the holding tanks) if the wet oxidation process is not in operation.

Thickened Waste Activated Sludge Storage Tanks

Four (4) 50 ft diameter, 10 ft sidewater depth covered tanks will be provided for storing thickened waste activated sludge prior to being fed to the sludge conditioning unit. The volume of the four sludge tanks is 93,400 cu ft, which represents approximately two days storage (1990 sludge production). Facilities have been provided to inject air into the tanks to mix and aerate the sludge during storage.

Sludge Conditioning

The sludge conditioning facilities consist of two (2) 200 gpm low oxidation, heat treatment units. High pressure pumps, heat exchangers, reactors, pressure control valves and air compressors will be located in the Sludge Conditioning and Filter Building. The two units will be capable of processing 190,600 lbs of sludge per day.

The sludge conditioning facilities will operate as indicated below with both units operating:

	Present	1990
Dry Solids (lbs/wk)	375,200	953,400
Hours per week operating	65	120

Oxidized Sludge Tanks

Two (2) 50 ft diameter, 10 ft sidewater depth, covered, oxidized sludge tanks have been provided to thicken the conditioned sludge to approximately 10 to 12 percent solids prior to its being fed to the filters. The tanks will contain stirring mechanisms and provisions for decanting the overflow. Oxidized sludge overflow will be fed back to the aeration basins. Gas generated by the oxidized sludge will be drawn off to gas incinerators (mounted on top of the tanks), incinerated, and discharged to the atmosphere. The volume of the two tanks is 46,700 cu. ft, which is approximately one day storage of the estimated 1990 sludge production.

Vacuum Filtration

The sludge dewatering equipment consists of three (3) new 300 s.f. coil filters with conditioning tanks and vacuum and filtrate assemblies and one (1) existing 300 s.f. coil filter. The four units will be located in the Sludge Conditioning and Filter Building.

Four variable-speed, positive displacement type pumps have been provided in the Oxidized Sludge Tank Gallery to pump oxidized sludge from the tanks to the filters. The amount of sludge pumped to each filter will be metered, indicated and recorded. The total amount of filter cake discharge to the conveyor belt will also be measured.

The four vacuum filter units will operate as indicated below:

	Present	1990
Dry solids (lbs/week)	281,500	715,000
Hours per week operation (based on 7.0 lbs per sq ft loading rate with 4 units operating)	35	85
Hours per day - 5 day week	7	17

The sludge filter cake will be deposited on conveyor belts which will convey the cake to the garage for truck loading. The truck will haul the filter cake to a location off-site for burial.

CHEMICAL FEED SYSTEMS

All sludge processing equipment has been designed to operate without the use of chemical aids. However, chemical facilities have been provided in the plant design for use as an aid for flocculation and settling of secondary sludge, for aid in filtering non-oxidized sludge, as an aid to increase the loading rate on the flotation thickeners if a unit is out of service, and for pH adjustment of oxidized sludge decant prior to feeding it to the aeration basins.

Lime

Lime will be delivered to the plant as quickline for storage in a 12 ft diameter lime silo. The quicklime will be fed to lime slakers where it will be diluted with water to approximately 8 percent solution. The lime slurry will then be transferred to mixing tanks from which it will be pumped by feed pumps into the oxidized sludge decant for pH adjustment. In addition, lime can be pumped to the vacuum filter conditioning tanks when non-oxidized sludge is filtered.

Ferric Chloride

Ferric chloride will be delivered to the plant at a concentration of approximately 3? percent and stored in storage tanks. The ferric chloride will be mixed with dilution water as it is pumped from the tanks to the filter conditioning tanks.

Alum

Liquid alum will be delivered to the plant at a concentration of 48 percent for storage in three tanks. The alum will be pumped by alum/polymer feed pumps to the flocculation basins.

Polymer Systems

Polymers can be used for secondary sludge flocculation in place of alum and/or as an aid for thickening waste activated sludge by air flotation. The polymer feed system is set up so that liquid or dry polymers can be delivered to the plant. The system also has facilities for storage of 6,000 gal of polymer in bulk form or 55 gallon drums of polymer.

The polymer system will have the capacity to prepare 1 to 5 percent solutions of polymer for feeding to the air flotation thickeners or flocculation tanks.

Dry polymer systems will include a dry feeder and a vortex-mixer-eductor for preparing and transferring solution to polymer dissolving tanks. Following aging to produce a 1 percent uniform solution, the solution will be fed to the flocculation tanks and/or the air flotation thickeners.

Polymer in 2-3000 gallon tanks will be transferred from the tanks by transfer pumps to mixing tanks. Liquid polymer will also be transferred from drums to mixing tanks by transfer pumps.

PLANT WATER SYSTEMS

The plant's potable water supply (City Water) will be supplied from the Town of West Springfield's system. Process water will be obtained from two sources: (1) settled plant effluent (plant water), and (2) the Town of West Springfield's system (domestic water). A backflow preventer will be provided in the Town system to prevent siphonage. The settled plant effluent system will be a constant pressure system with booster pumps to isolated service systems requiring higher pressures.

STORM DRAINAGE

Stormwater will flow by gravity through the drainage system into one of two stormwater pumping stations. The existing stormwater pump station will utilize one existing and two (2) new horizontal centrifugal pumps to pump stormwater to the river through the overflow chamber located in the plant influent structure. A new pumping station, which pumps stormwater from most of the new plant areas, will contain three (3) vertical, propeller pumps which will discharge into the plant outfall. All controls for both system are automatic.

MISCELLANEOUS PUMPS

There are pumps for various processes discussed above. Tabulated below are the pumps, uses and capacities;

PUMPS	USE	CAPACITY
PRIMARY THICKENER GALLERY		
4 - Plunger pumps (heavy-duty type with variable speed controls)	Feed thickened primary sludge to sludge conditioning equipment	120 gpm @ 152 ft TDH
THICKENER BUILDING		
3 - Bottom waste-activated sludge pumps (horizontal torque-flow, vortex type with belt drive)	Pump bottom sludge from flotation thickeners to primary thickeners	50 gpm @ 14 ft TDH
3 - Thickened waste activated sludge pumps (horizontal, centrifugal type with variable speed controls)	Pump thickened waste activated sludge to holding tanks or sludge conditioning equipment	120 gpm @ 154 ft TDH
WASTE ACTIVATED SLUDGE HOLDING TANK GALLERY		
4 - Thickened waste activated sludge pumps (horizontal, centrifugal type with variable speed controls)	Pump thickened waste activated sludge out of holding tanks to sludge conditioning equipment	120 gpm @ 154 ft TDH
2 - Plunger pumps (heavy-duty type with variable speed controls)	Feed thickened waste activated sludge to sludge dewatering equipment	120 gpm @ 50 ft TDH

PUMPS	USE	CAPACITY
SLUDGE CONDITIONING AND FILTER BUILDING		
4 - Polymer transfer pumps (progressive cavity type)	Transfer polymer from storage tanks to day tanks	6 gpm @ 40 psi
2 - Lime feed pumps (hydraulic plunger type with automatic stroke adjustment)	Feed lime from day tanks to conditioning tanks @ vacuum filters and pH adjustment	0-15 gpm @ 100 psi
2 - Ferric chloride feed pumps (hydraulic plunger type with automatic stroke adjustment)	Feed ferric chloride from storage tank to conditioning tanks @ vacuum filters	0-40 gph @ 100 psi
2 - Polymer feed pumps (hydraulic plunger type with automatic stroke adjustment	Feed polymer to flotation units	0-30 gph 100 psi
3 - Polymer/Alum feed pumps (hydraulic plunger type with automatic stroke adjustment)	Feed polymer or alum to flocculation units	0-30 gpm 100 psi
2 - Filtrate and decant pumps (horizontal, non-clog, centrifugal type with constant speed drive)	Pump filtrate and oxidized sludge decant to aeration basins	500 gpm @ 31 ft TDH
2 - Plant water booster pumps (split-case, horizontal type with constant speed drive)	Provide pressure for spray water for vacuum filters	150 gpm @ 55 ft TDH
OXIDIZED SLUDGE STORAGE TANK GALLERY		
4 - Plunger pumps (heavy-duty type with variable speed controls)	Feed oxidized sludge to filters	120 gpm @ 55 ft TDH

PUMPS	USE	CAPACITY
3 - Waste activated sludge pumps (horizontal, non-clog centrifugal type with variable speed controls)	Pump waste activated sludge to flotation thickeners	700 gpm @ 51 ft TDH
PLANT WATER PUMPING STATION		
3 - Plant water pumps (split case horizontal type with variable speed controls)	Supply settled effluent at a constant pressure for plant use and also chlorination	1800 gpm @ 116 ft TDH
3 - Propeller pumps (vertical wet-pit type)	Pump storm drainage to plant outfall sewer	4000 gpm @ 26 ft TDH
2 - Tank drain pumps (vertical wet-pit type)	Drain process units and pump to plant inlet structure	2,800 gpm @ 49 ft TDH
CHLORINE CONTACT CHAMBERS		
4 - Effluent pump (vertical wet-pit type)	Pump plant effluent during periods of high river level	32,250 gpm @ 25 ft TDH
EXISTING PLANT WATER PUMPING STATION		
3 - Stormwater pumps (horizontal, non-clog, centrifugal type with constant speed drive)	Pump stormwater into plant overflow structure	2 new @ 5000 gpm @ 34 ft TDH 1 exist @ 4900 gpm @ 39 ft TDH

PUMPS	USE	CAPACITY
The following miscellaneous pumps will also be provided.		
2 - Portable pumps	Miscellaneous uses throughout the plant	1 @ 200 gpm @ 30 ft TDH 1 @ 700 gpm @ 40 ft TDH
3 - Submersible pumps	Draw down ground water through underdrain system for basin dewatering	
GRIT AND SCREENING BUILDING GALLERY		
1 - Recirculation pump, hot water flushing system (two-speed)	Recirculates plant water through loop of sludge piping and heat exchanger	1500 gpm @ 115 ft TDH @ high speed
1 - Make-up water pump, hot water flushing system (two-speed)	Provides cold plant water for flushing sludge pipes	1500 gpm @ 115 ft TDH @ high speed
PRIMARY SEDIMENTATION BASINS		
32 - Primary sludge and grit air-lift pumps	Lift dilute sludge with grit from sludge hoppers to collection flume approximately 17 ft above	120 gpm @ 2.5 ft lift
16 - Skimmings trough flushing water air-lift pumps	Lift wastewater from primary basin up into ends of skimmings troughs to flush out skimmings	50 gpm @ 1.0 ft lift
PRIMARY GALLERY		
6 - Primary sludge and grit and standby pumps (non-clog, vortex type, centrifugal pumps with variable speed controls)	Continuously pump dilute sludge with grit to grit separators	1150 gpm @ 70 ft TDH (maximum capacity)

PUMPS	USE	CAPACITY
4 - Skimmings pumps (non-clog, vortex type, centrifugal pumps with variable speed controls)	Intermittently pump skimmings and flushing water to flotation thickeners	200 gpm @ 30 ft TDH
1 - Cold water flushing pump (heavy-duty type with variable speed controls)	Positive displacement pump for dewatering and unplugging sludge pipes	120 gpm @ 150 ft TDH
RETURN SLUDGE PUMP STATIONS		
8 - Return activated sludge pumps	Lifts return activated sludge for gravity flow to aeration basins	9200 gpm @ 10 ft

HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS

NEW BOILER FACILITY

Two 500 hp oil fired boiler-burner units will supply low pressure steam, both directly and indirectly, for the heating and ventilating systems in all new buildings and facilities on the plant site with the exception of the Plant Water Pumping Station, Storm Water Pumping Station, and Power Control Buildings which will be heated electrically. In addition, the units will supply low pressure steam for the sludge degreasing hot water system and, during the heating season, for the domestic and process hot water systems. During the summer, domestic and process water will be heated by low pressure gas fired heaters.

Each boiler-burner unit will be sized for two-thirds of the total demand of the above systems excluding the demand of the sludge degreasing hot water system. Controls for the units will be arranged to provide lead-lag operation. During periods of peak design demand on the units, the periodic demand of the sludge degreasing hot water system will be covered by the combined spare capacity of the units. Auxiliaries for the facility will include combustion air units, boiler feed unit, fuel oil pumps, fuel oil heaters, and underground fuel oil storage tank.

Installation of the boiler-burner units will be in compliance with the air pollution control regulations of the State of Massachusetts. Units will fire low sulphur content (1/2%) No. 6 oil. Each unit will be equipped with a smoke density detecting and alarm system. Smoke stack is of a height sufficient for adequate dispersion of gases and has a separate flue for each unit. Flue outlet openings have been sized to provide minimum required gas outlet velocity when units are at high fire.

EXISTING BOILER FACILITY

The existing facility in the Sludge Building (Bulk Storage Building) will be retained. The facility consists of three cast iron-sectional hot water boilers which provide building heat for the Sludge Building and Gas Building and both building heat and tank heat for the Digester Facility. One boiler is fired with No. 4 oil and two boilers are fired with digester gas. The oil fired boiler supplements the gas fired boilers when gas flow is insufficient, and has the capacity to heat the three buildings if gas is unavailable.

The oil-fired boiler and its burner will be reconditioned to insure more dependable service during the period of plant construction when digester gas is unavailable. In addition, the oil burner will be adjusted for firing of No. 2 fuel oil in compliance with air pollution control regulations.

HEATING SYSTEMS

All systems in new buildings and facilities south of and including the Services Building will be steam. All systems in buildings north of the Services Building will be hot water. Systems for the Plant

Water Pumping Station, Storm Water Pumping Station and Power Control Buildings will be electric. Air conditioning reheat will be electric.

Heating hot water will be furnished by two steam-to-water heat exchangers and associated circulating pumps located in the boiler room. One heat exchanger will furnish hot water to a dual water system of fan coil units located in the Administration Building. The second heat exchanger will furnish hot water to a hot water system north of the Services Building which includes unit heaters, radiation, and coils in air conditioning units and ventilating units.

Equipment in steam heating systems will consist of unit heaters, radiation, and coils in ventilating units and dehumidifying units. Condensate will be returned to the boiler feed unit by remote pump-receiver units.

AIR CONDITIONING SYSTEMS

Areas to be air conditioned include the entire Administration Building (excluding basement) and the lunch room in the Employee Facility Building.

Equipment for the systems will consist of dual water fan coil units for exterior areas, central supply units with chilled water coils for interior areas and ventilation, exhaust fans, and electric reheat coils.

Chilled water for the above equipment will be furnished by a chiller and primary circulator located in the boiler room. A roof mounted air-cooled condenser will serve the chiller. The dual water system noted above and a secondary circulating system for chilled water coils will be fed from the primary system.

VENTILATION SYSTEMS

Equipment for the ventilation systems will consist of supply units, various types of exhaust fans, and power roof ventilators.

Air quantities and air change rates are tabulated below. Air conditioning systems have been included in the tabulation and are denoted by "(AC)".

Ventilation systems serving certain pipe galleries will also provide humidity control. This will be accomplished by incorporating a closed refrigeration system in each ventilation system which will include a direct expansion coil in the supply unit, a condensing coil in the supply duct from the unit, and a compressor unit. When humidity control is required, the ventilation system will operate with 50% recirculation air. Systems which will provide humidity control are denoted by "(D)" in the tabulation.

Exhaust air for certain areas will be passed through odor filter banks before being exhausted to outdoors. The banks will consist of prefilter and dry odor oxidant type odor filter. Systems with odor filters are denoted "(OC)" in the tabulation.

Ventilation systems for the first floor of the Grit and Screenings Building and for the Chlorine Building will be activated automatically by toxic and/or combustible gas monitoring systems described in other sections.

TABULATION OF VENTILATION RATES

ADMINISTRATION BUILDING (AM) (AC)

Room or Area	Supply (cfm)	Exhaust (cfm)	Air Changes Per Hr.
Basement	-	5,000	6
Equip. Rm. - 101	-	650	6
Lab. - 102	120	240	7
Conf. Rm. - 103	780	800	8
Oper. Off. - 105	125	-	2
Corr. - 107 & 107 (Total)	140	-	2
Control Rm. - 108	420	-	4
Lobby - 110 & Recep. - 114 (Total)	1,225	-	4
Offices (Typ. for 8)	80	-	2
Cleric. Offices	1,250	2,000	6
Eng. Area - 122	100	-	2
Storage - 120	-	120	5
Rest Rooms (Typ. for 2)	100	330	8
Lunch Rm. - 117	350	1,000	10
Corridor - 113	1,450	1,500	18
Lab. - 201	1,520	1,300 (Hoods)	8.5

ADMINISTRATION BUILDING (AM) (AC) (continued)

Room or Area	Supply (cfm)	Exhaust (cfm)	Air Changes Per Hr.
Instrument Rm. - 202	350	300 (Hood)	10
Bacteriology - 204	75	150	14
Washroom - 205	175	350	10
Sample Rm. - 206	115	230	10
Jan. Clos. - 208	-	60	8
Corridor - 210	120	-	3
Offices (Typ. for 2)	75	-	3
Storage	80	-	6
Toilets (Typ. for 2)	-	100	8

MAINTENANCE BUILDING (MT)

Room or Area	Supply (cfm)	Exhaust (cfm)	Air Changes Per Hr.
Stockroom - 102	3,850	4,000	3
Office - 103	100	-	6
Mach. Shop - 107	5,250	6,300 (Incl. Hood)	6
Elec. Shop - 108	220	220	6
Toilet - 110	-	60	8
Jan. Clos. - 111	-	60	8
First Aid - 112	220	220	6
Paint Rm. - 113	640	3,900 (Hood)	40
Carpen. Shop - 114	-	615	6
Office - 116	125	-	6
Workroom - 117	270	270	6

EMPLOYEE FACILITIES (EF)

Room or Area	Supply (cfm)	Exhaust (cfm)	Air Changes Per Hr.
Locker Rm. - 101	3,000	2,000	12
Shower Rm. (Typ. for 2)	-	530	12
Toilet - 106	-	960	20
Jan. Clos. - 107	-	60	8
Washroom - 108	600	-	6
Lunchroom - 110 (AC)	2,850	750	4

GARAGE (G)

Room or Area	Supply (cfm)	Exhaust (cfm)	Air Changes Per Hr.
Maintenance - 101	1,000	1,000/2,000	5/10
Storage - 103	-	450	6
Office - 105	250	-	4
Service Area - 106	6,000	6,000/12,000	4/8
Vehic. Storage - 108	-	7,500/15,000	3/6

SERVICES BUILDING (SV)

Room or Area	Supply (cfm)	Exhaust (cfm)	Air Changes Per Hr.
Elec. Rm. - 102	-	8,000	12
Boiler Rm. - 103	12,000/ 6,000	-	3/6
Oil Pump Rm. - 109	-	195	12
Toilet - 105	-	60	8
Jan. Clos. - 106	-	60	8

GRIT AND SCREENINGS BUILDING (GS)

Room or Area	Supply (cfm)	Exhaust (cfm)	Air Changes Per Hr.
Bsmt. Pipe Gallery (D)	5,000	6,000/12,000	6/12
Loading Area - 101 (OC)	3,000	4,000	12
Storage Room - 104	-	700	8
Grit & Scr. Rm. - 103 (OC)	10,500	14,000	12
Fan Rm. - 105 (OC)	500	-	12

PRIMARY THICKENER (PT)

Pipe Gallery (D)	2,500	2,500/5,000	6/12

PRIMARY BASIC (PB) (D)

Pipe Gallery	10,000	8,900/17,800	6/12
Control Rm. - 101	800	800	12
Loading Area	200	-	6
Toilet - 103	-	120	8

THICKENER BUILDING (T)

Bsmt. Pipe Gallery (D)	10,500	10,500/21,000	6/12
Thickener Rm. - 102 (OC)	11,900	13,400	12
Control Rm. - 103	1,000	1,000	6
Jan. Clos. - 104	-	60	8
Toilet - 105	-	60	8

WASTE ACTIVATED SLUDGE TANKS (WH)

Room or Area	Supply (cfm)	Exhaust (cfm)	Air Changes Per Hr.
Pipe Gallery	2,800	2,800/5,600	6/12

SLUDGE CONDITIONING AND FILTER BUILDING (SF)

Room or Area	Supply (cfm)	Exhaust (cfm)	Air Changes Per Hr.
Chem. Storage - 003	4,600	3,600/7,200	6/12
Elev. Mach. Rm. - 005	-	200	12
Line Silo Rm. - 006	-	1,000/2,000	6/12
Heat Exch. Rm. - 102	7,000	7,000	6
Air Comp. Rm. - 103	7,000	7,000	6
Vac. & Filter Rm. - 104	7,000	7,000	6
Rubbish - 106	-	200	8
Fan Room - M01	-	600	6
Loading Area - 111	4,000	4,500	12
Filter Rm. - 203 (OC)	9,100	11,000	12
Control Rm. - 206	800	800	12
Fan Rm. - 207	500	-	6
Jan. Clos. (Type for 2)	-	60	8
Toilets (Typ. for 2)	-	60	8

OXIDIZED SLUDGE TANKS (OS)

Room or Area	Supply (cfm)	Exhaust (cfm)	Air Changes Per Hr.
Pipe Gallery	2,500	2,500/5,000	6/12

CHLORINE BUILDING (CB)

Room or Area	Supply (cfm)	Exhaust (cfm)	Air Changes Per Hr.
Air Hand. Rm. - 101	620	620/1,240	8/16
Office - 102	620	620/1,240	8/16
Chlorinator Rm. - 103	3,000	3,000	20
Chlor. Storage - 104	12,700	12,000	30

PLANT WATER PUMP STATION (PW)

Access Bldg.	-	600	12
Pipe Gallery	-	1,600	12

STORM WATER PUMP STATION (SWP)

Pump Room	-	3,800	12

POWER - CONTROL BUILDING (PC)

Access Building	-		12
Venturi Chamber	-		12

BULK STORAGE BUILDING (BS)

Storage Areas	-	11,700	6

DIGESTER BUILDING AND GAS BUILDING

(Existing Systems to Remain)

CONTROLS

The temperature and equipment control system will be combined pneumatic and electric.

PLANT STAFFING

The Table of Organization for the Bondi Island Treatment Plant is appended.

PLANT INSTRUMENTATION

The instrumentation and data logger have been designed as a package for ease of plant operation. Most measurements and equipment status will be brought to the Process Control Center. From this one central location the operating personnel will have a total overview of the wastewater treatment plant.

All controls will be either simple analog type or those requiring an operator's decision. These plus the controls on the effluent are the only controls on the Process Control Cabinet.

There are local control cabinets for each of the following systems: Chemical Room, Primary Basins, Grit and Screen Room, Vacuum Filter Area, Sludge Conditioning and Flotation Thickener Area. These each will have their own controls.

The data logger will have no process control functions designed into it. However, it will perform many management functions such as: maintenance routines, process evaluations and reporting. Additional space will be designed into the data logger to perform future controls.