Die Festwoche der Abfallwirtschaft und Altlasten der TU Dresden: 26.-30. September 2005

1. Fachtagung "Perspektiven von Deponien – Stilllegung und Nachnutzung nach 2005" am 26.-27. September 2005
2. Mischen oder Trennen ? –Grenzen der Technik und Nachweisführung nach ElektroG und VerpackV" am 28.September 2005
3. Festakt zur 10-Jahres-Feier (29.September 2005) Altlasten-rechtlicher Rahmen und regionale Praxis (30. September 2005)

Composting and Wastewater Treatment Facilities in İzmir

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Introduction

Izmir is one of the biggest cities in Turkey with its 3 million populations. In such big cities, one of the main problems is the treatment of wastewater prior to discharge and disposal of solid waste generated. In Izmir, solid waste disposal is achieved in two facilities, Uzundere Composting Plant and Harmandali Landfill Site. 300 tones of solid waste generated in south part of Izmir is composted at Uzundere Composting Plant and about 2200-2300 tones is landfilled in Harmandali and Uzundere landfills site (Coban, 2004, 2005).

Two wastewater treatment plants were constructed recently in Izmir. Cigli wastewater treatment plant is a great investment and it treats about 600000 m^3 wastewater every day (WEB_2, 2004). Wastewaters from Guzelbahce and Narlidere Military Area are treated at Guneybati wastewater treatment plant. In the wastewater treatment plants, about 350-700 tones/day of sludge, disposal of which is also a problem, is generated. In this paper, some information is given about the composting plant and wastewater treatment plants.

1.Eskiizmir-Uzundere Composting Plant

Solid waste generated in south part of Izmir is processed at Uzundere Composting Plant which has a capacity of 500 tones / day. The compost product is usually used for parks by municipality and some part is sold to farmers for agricultural utilization. Flow diagram of Uzundere Composting Plant is given in Figure 1.

Trucks are weighed for recording at the entrance of plant using a weighbridge. Weighed trucks dump their load to garbage acceptance area. The waste is carried to drum sieve with a diameter of 45 mm via a conveyor. The waste is separated into two fractions, smaller and larger than 45mm size. Larger fraction is transported to hand separation unit where recyclable materials like paper, cardboard, plastics, glass and metals are separated. Metals are separated using a magnet. Smaller fraction is transported to second drum sieve with a diameter of 15 mm. In this sieve, materials smaller than 15 mm, especially inorganic materials like soil and sand, are removed. Materials from second sieve and hand separation unit come to homogenization unit then they are conveyed to fermentation area (windrow area). After intensive composting period which takes about 6-8 weeks, the compost is conveyed to temporary storage area where it matures. Mature compost is sorted for marketing in sorting units. Sorted fine compost is stored in a storage area (Erdin, 1989, p.5). All events are shown at the pictures:

Photo shows sieve with 45 mm diameter.

Photo : hand separation unit

Composting pils


Compost products

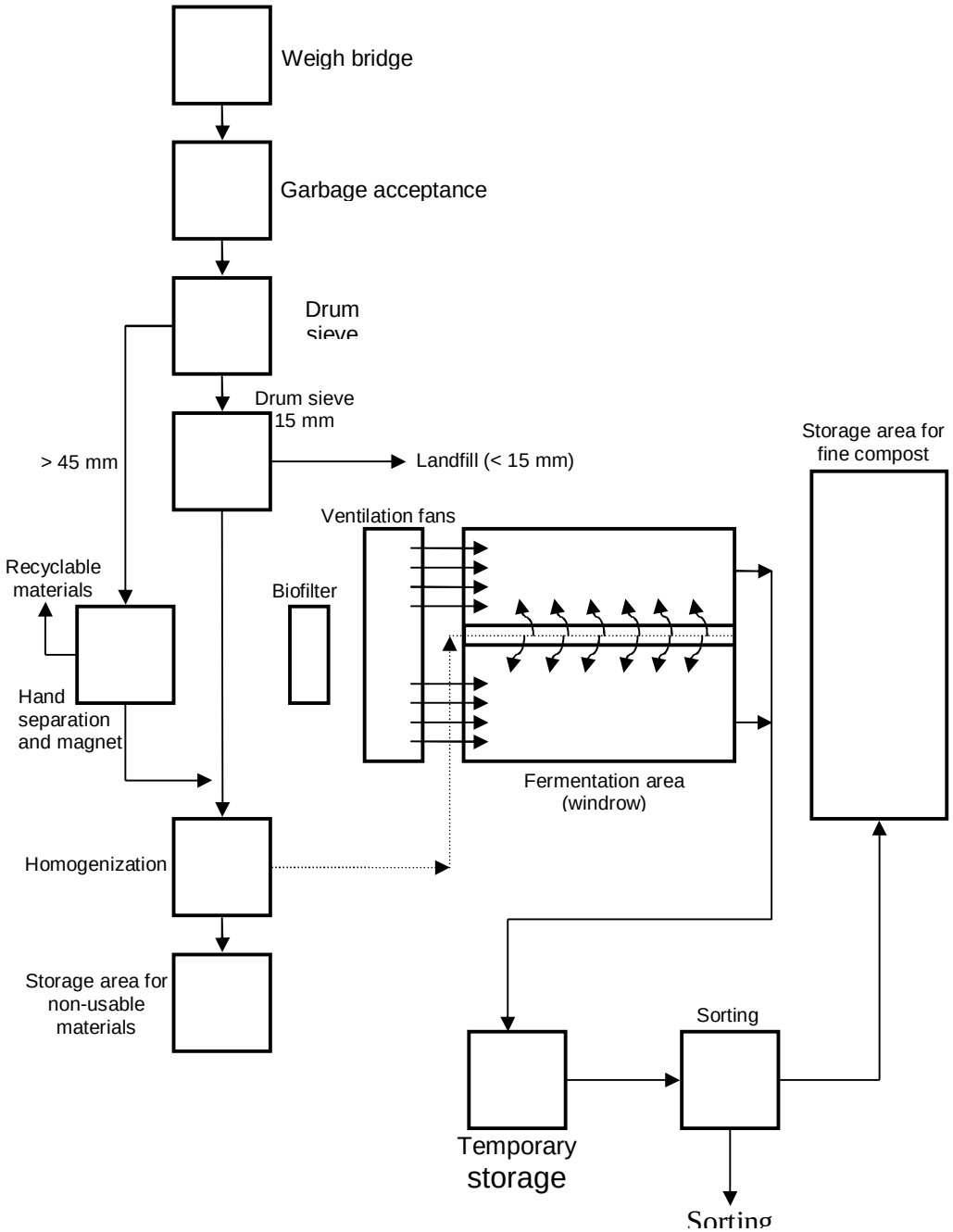

Figure 1 Flow diagram of Uzundere Composting Plant

2 .İZMİR-Cigli Wastewater Treatment Plant

“Cigli Wastewater Treatment Plant was designed using average dry weather flowrate of 7 m^3 / sec and maximum wet weather flowrate of 12 m^3 / sec” (WEB_2, 2004). The flow diagram of Cigli Wastewater Treatment Plant is given in Figure 2. Description of plant operation is given below.

Inlet Works: The sewage coming from the pumping station is received in an inlet chamber and is distributed into 3 parallel running screen channels through motorized penstocks. Each channel equipped with fine screen that works for removing fine particles in the wastewater. The screens are cleaned automatically under level control or timer control. The raked screenings drop onto a belt conveyor which carries them into a screenings press. Dewatered screenings from the screenings press are collected in containers for removal off site for disposal. Screened effluent flows into a distribution chamber and from there it is distributed into 4 parallel running aerated grit channels through motorized penstocks. Separated grit at the bottom of the grit channels is pumped out into grit through by submersible grit pumps mounted on to the traveling bridges. The grit pumped into the grit through flows into the grit washer / classifier units. Organic substances washed away from the grit are returned to the works inlet and the separated grit is collected in containers for disposal. Degritted effluent from the grit channels passes through 3 parallel running Parshall flumes for flow measurement and is then collected in a distribution chamber. The inlet works were sized for 12 m^3/sec maximum wet weather flow.

“By using the total flow value obtained from the 3 Parshall flumes and the flow distributed into each of the 3 lines it is possible to accept the a.m. flows automatically into the biological treatment section of the plant. Additional quantities above these values are passed by means of automatic penstocks” (WEB_2, 2004).

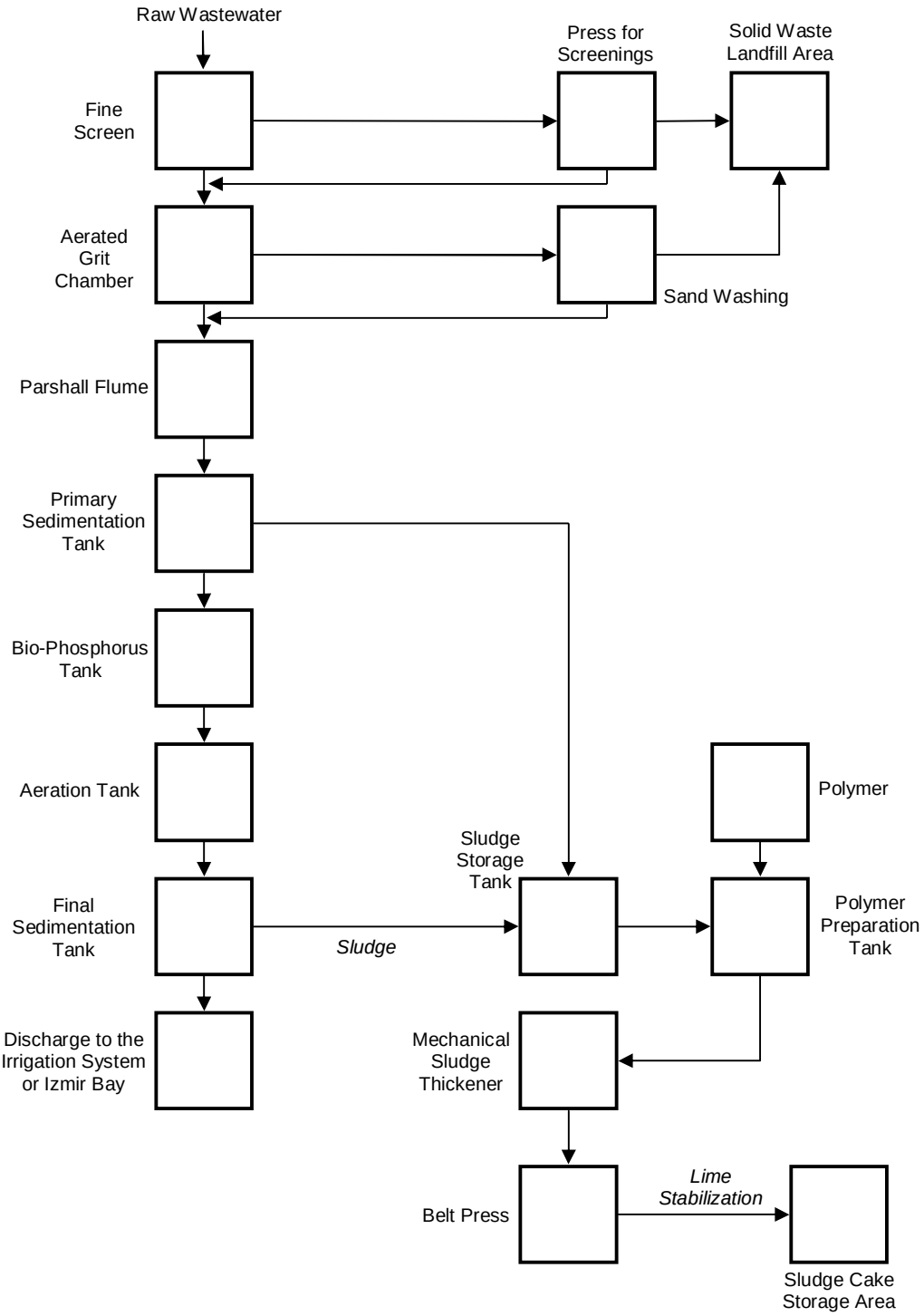

Figure 2 Flow diagram of Cigli Wastewater Treatment Plant (Filibeli et al., 2002, p.42)

Primary Settlement: The effluent from the distribution chamber is equally distributed into 3 parallel running lines. The flow into each line is monitored by ultrasonic flow meters and received into 3 distribution chambers before each line and from where it is distributed

into 4 circular settlement tanks in each line. According to the season, operation mode is changed. At winter operation (nutrient removal is required) the complete wastewater flow is directed to 2 of the 4 primary sedimentation tanks. The tanks out of operation are emptied by primary sludge pumps. In summer, these tanks are taken into operation to achieve the highest possible removal efficiency with respect to organic pollution load. Settled sludge in each settlement tank is pumped out by a dedicated sludge pump under timer control and sent to the sludge treatment plant. Sludge suction lines are flushed automatically by high pressure wash water after each desludging period to avoid blockages in pipework. Roding eyes will be provided at appropriate locations in the sludge pipework to internee manually in the event of blockages occurring. There will be a electro - magnetic type flowmeters in each of the 3 sludge discharge main to monitor the quantity of sludge produced. The flowmeters are also used to protect sludge pumps against dry running by shutting down pumps when no flow is detected after a preset time from the start of desludging. Scum developed at the surface of the settlement tanks is swept out by the descumming devices and collected in a sump. Submersible scum pumps installed in each of the 3 scum pumps pump the scum into the sludge holding tank. Clarified effluent gravitates into the biological treatment system.

Biological Treatment: The aeration tanks are arranged in 3 lanes each consisting of 2 lines. One line of aeration tanks consist of 2 oxidation ditch tanks operating in series (cascade - I and cascade - II). Clarified effluent is firstly let into ditch type anaerobic tanks for biological phosphorus removal. Recycled activated sludge from the final sedimentation tank is directed to the first Bio - P tank. The clarified effluent from the primary sedimentation tank also enters this tank. Mixing in the anaerobic tanks is achieved by submersible mixers. Phosphorus present in the effluent is metabolized under anaerobic conditions by the microorganism in the recycled sludge. Effluent from the anaerobic tanks flows into a distribution chamber. From this distribution chamber the wastewater flows to 2 aeration lanes consisting of 2 race track oxidation tanks operating in series. Horizontal mixing in the oxidation ditches (process tanks) is achieved by 6 submersible mixers installed from the fixed bridges. Air blowers

provide the necessary dissolved oxygen in the system. There is a blower building for a total of 5 blowers of which one unit as stand-by. Membrane type high efficiency fine bubble diffusers are used to provide dissolved oxygen from pressurized air delivered by the blowers. The necessary diffusers are arranged 40% in the first aeration tank whereas 60% are located in the second tank of the lane. This facilitates alternating compartments (oxic and anoxic) within the same tank and providing simultaneous denitrification effect. With the effective internal recycling between the 2 tanks the nitrate rich effluent of the second tank is denitrified in the first cascade where the concentration of carbon source is higher due to influent from the Bio - P tank. For the internal recycling 2 submersible propeller pumps are installed for each line of the 3 lanes. Effluent from oxidation ditches flows over weirs and is collected in a distribution chamber in each line before let into final settlement.

“A significant portion of the electrical energy used in the plant is consumed by the aeration system. In order to economize energy consumption by the aeration system, a dissolved oxygen control system is provided to control the level of dissolved oxygen in the tanks and thereby adjusts the blowers output“ (WEB_2, 2004).

Final Settlement: Effluent from the distribution chambers is distributed into 4 circular final settlement tanks in each line. Settled activated sludge in final settlement tanks is desludged into a sludge sump by motorized valves. Sludge from the sumps gravitates into the return sludge pumping station and from there it is returned to the first Bio - P tank. Surplus sludge generated is pumped to the sludge mixing compartment of the sludge mixing and equalization tank by 2 (1 duty + 1 stand-by) submersible pumps. Any scum accumulating on tank surfaces is collected by descumming arms into a scum sump in each line. There are 2 submersible scum pumps operating under level control (1 duty + 1 stand-by) in each scum sump to pump scum into the sludge holding tank. Final effluent from the final settlement tanks is collected and discharged into the sea through a discharge channel .

Sludge Treatment System: The primary sludge obtained from the primary sedimentation tanks with dry matter content of approximately

2% is collected in the sludge holding tank 9/A. The second sludge holding tank (9/B) is used as sludge mixing and equalization tank and consists of 2 compartments. 1 small mixing compartment serves for the mixing and homogenizing of primary sludge and surplus activated sludge. The second compartment is used for storing the mixed sludge for a short time in case of a short term excess amount of the sludge. The primary sludge holding tank 9/A is equipped with two submersible mixers which homogenize the sludge and prevent the dry substance from settling. Also in 9/A two submersible pumps are located which transfer primary sludge to the mixing compartment of 9/B in such an amount, that a constant DS-content of the mixed sludge is achieved. The mixing compartment of 9/B is equipped with diffusers. These diffusers are supplied with compressed air by two blowers. The air is used for mixing and homogenizing the primary and excess sludge and to keep the sludge under aerobic conditions to avoid biological phosphorus release. Homogenized sludge from the sludge equalization tank is pumped into mechanical sludge thickeners by 10 positive displacement progressive cavity type pumps.

There is a electromagnetic type sludge flowmeters in each sludge pumping line to monitor sludge flow into the thickeners. Flowmeters is also used for pump protection against no-flow conditions. Pumps would be shut down in such cases and an alarm would be given for operators. Polyelectrolyte solution, required for sludge conditioning before thickening, is prepared by 2 package type polyelectrolyte preparation units. There are 10 (9 duty + 1 stand-by) polyelectrolyte dosage pumps. A flocculation tank with a mechanical mixer is provided in each sludge line. Conditioned sludge is thickened to approximately 6 % DM content in 10 belt type mechanical thickeners and the thickened sludge flows by gravity into the belt presses for dewatering. The mechanical thickeners are installed at an elevated position in the press building to facilitate gravity flow into belt presses. Filtrate from mechanical thickeners is collected by gravity in a filtrate sump. Thickened sludge from the thickeners is fed into 10 belt presses by gravity. Belt presses produce sludge cake at 26 - 30 % DM content. Filtrate from the belt presses flow through channels into the filtrate sump. Sludge cake produced in belt presses is transported outside the building by 2 belt conveyors into the cake storage area.

Filtrate collected in the filtrate sump is returned to the works inlet by 3 (2 duty + 1 stand-by) submersible pumps .

3. Southwest Wastewater Treatment Plant

Guneybati (**Southwest)** Wastewater Treatment Plant was completed in August 2002 as a last ring of Great Channel Project which aims to impede discharge of domestic and industrial wastewater into Izmir Bay.

"Wastewater collected from Guzelbahce and Narlidere Military Area is treated biologically at this plant and treated wastewater is discharged with marine discharge system to the Izmir Bay at elevation of -25 m. The plant was designed using the flowrate of 0.25 m^3 / sec and constructed as two parallel lines" (Izmir Guneybati Atiksu Aritim Tesisi, 2003). Flow diagram of Guneybati Wastewater Treatment Plant is given in Figure 3.

Pumping Station and Coarse Screens: Wastewaters from Guzelbahce and Narlidere Military Area is received to pumping station at the elevation of -4.90 m. Pumping station is constructed underground with its 8.00 m diameter and 9.50 m depth. Wastewater is pumped to elevation of +7.45 m after passing through the mechanically raked two coarse screens with bar openings of 50 mm. There is an aeration system in the pumping station to impede the anaerobic conditions (Izmir Guneybati Atiksu Aritim Tesisi, 2003).

10 mm. The raked screenings are dewatered and collected in containers. In aerated grit channels with 20 m length, grit is removed from wastewater and dewatered. Materials removed by screens and grit chamber are disposed of at Harmandali Landfill Site

Anaerobic Tanks: 2 anaerobic tanks with volume of 2700 m^3 were constructed to increase the solubility of phosphorus in wastewater under anaerobic conditions so that biological phosphorus removal in aeration tanks is increased. There are 8 mixers to prevent the settlement of solid matters and provide good mixing.

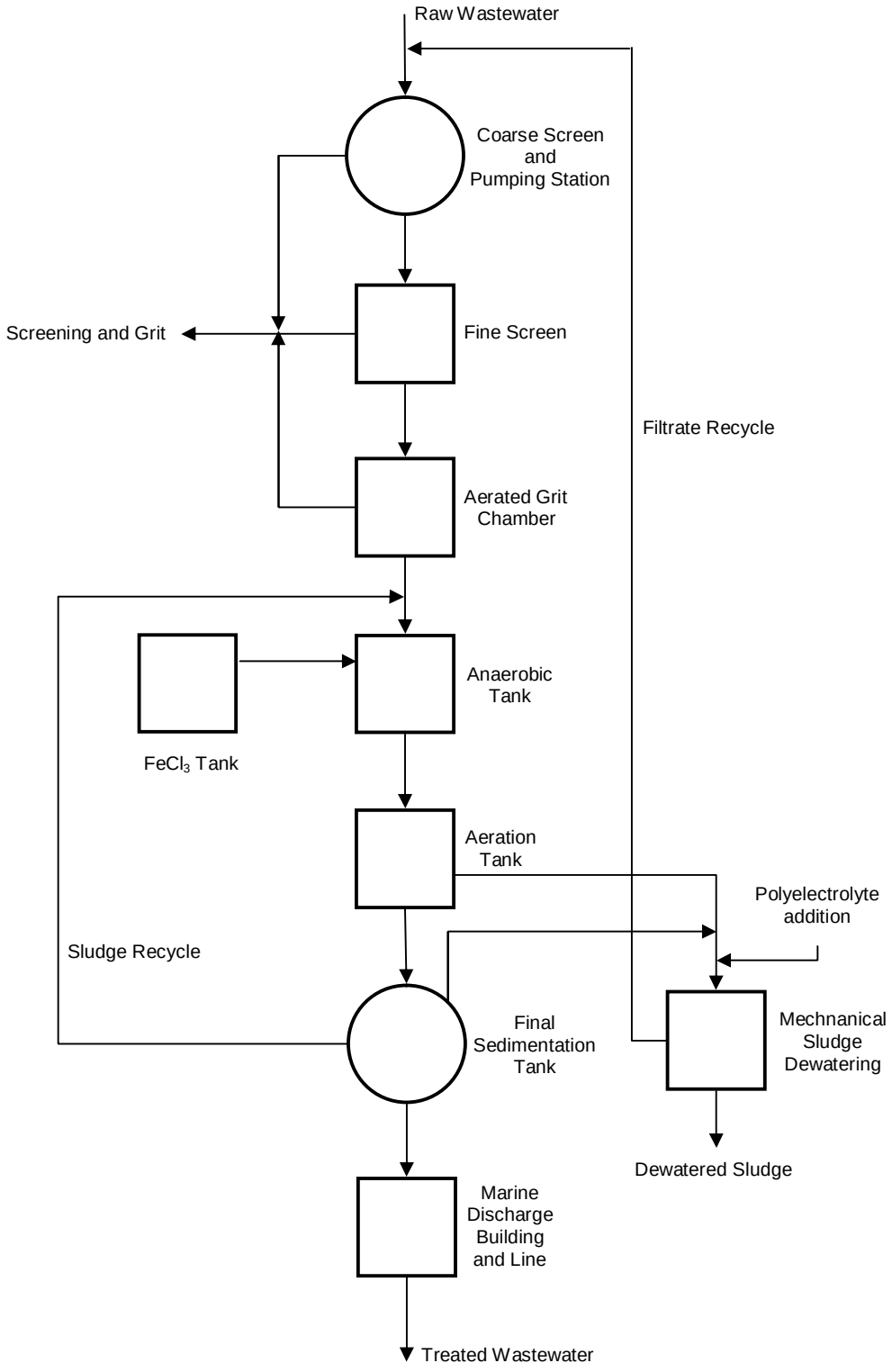

Figure 3 Flow diagram of Guneybati Wastewater Treatment Plant
(Izmir Guneybati Atiksu Aritim Tesisi, 2003)

Fine Screen and Aerated Grit Channels: Wastewater coming from pumping station passes through two fine screens with bar openings of
$FeCl_3$ Tanks: If the biological phosphorus removal is not enough in system, $FeCl_3$ is dosed and phosphorus is settled as $FePO_4$ and removed from system. A solution of 40% $FeCl_3$ is stored in 30 m^3 $FeCl_3$ tanks. $FeCl_3$ is dosed to the system from the entrance of anaerobic tank.

Aeration Tanks: 2 aeration tanks with total volume of 10900 m^3 can be operated either in serial or in parallel. In these tanks in addition to organic carbon, nitrogen is removed by nitrification-denitrification process. Aeration tanks are made up oxic and anoxic zones, 65% and 35% respectively. The required air is provided using 5 blowers with capacity of 2250 m^3 air/hour to aeration tanks where pipe type 1560 diffusers are used.

Settlement Tanks: There are two settlement tanks with 28 m diameter and total volume of 5034 m^3. Water depth is 4.09 m and hydraulic retention time is 2.7 hours. The treated wastewater flows over weirs to the marine discharge system. Settled sludge is pumped to the sludge recycling tank. Excess sludge is sent to sludge dewatering unit while recycling sludge is given into the entrance of anaerobic tank.

Sludge Dewatering: Mechanical sludge dewatering unit consist of 2 pre-thickening tray and a belt filter. Prior to pre-thickening, polyelectrolyte is added to the sludge taken from sedimentation tank. Sludge is thickened in trays and then dewatered in belt press. 30% dry matter is achieved in belt press. Depending on the organic loading, 3.5-4 tones sludge per day is generated.

Marine Discharge System: Treated wastewater is given to marine discharge system via discharge structure. Length of marine discharge system is about 600 m and last 75 m is diffuser which enforces the dilution of treated wastewater in the sea.

References

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Appendix

Some pictures of the waste water treatment plants of İZMİR –TURKEY

After large screen

Small screen

Activated sludge basins


İZSU
İZMİR ATIK SU ARITMA TESİSİ


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