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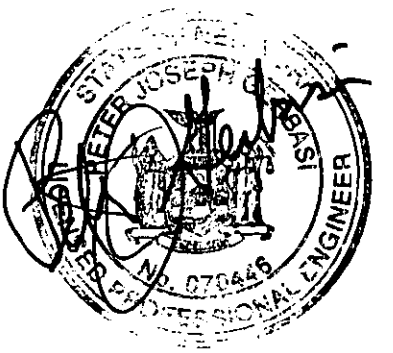
ENGINEERING REPORT FOR WASTEWATER SETTLING PONDS

SYRACUSE CHINA LANDFILL
Town of Salina, Onondaga County, New York

July 10, 2000

Prepared for:

THE PFALTZGRAFF CO.
AND
SYRACUSE CHINA/LIBBEY, INC.



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1.0 INTRODUCTION

This Engineering Report for Wastewater Settling Ponds (Report) has been prepared by Remedial Engineering, P.C. (Remedial Engineering) on behalf of The Pfaltzgraff Co. (Pfaltzgraff) and Syracuse China/Libbey, Inc. (Syracuse China) to describe the settling pond design at the Syracuse China site. This Report has been prepared in accordance with the New York State Department of Environmental Conservation (NYSDEC) Bureau of Water Permits guidance document titled *Industrial Wastewater Treatment Facilities*. A letter of endorsement from Syracuse China has been included as Appendix A. Syracuse china reserves the right, with NYSDEC approval, to modify the details of pond construction as site conditions allow.

1.1 Site Description

The Syracuse China manufacturing plant (facility) is located in the Town of Salina, Onondaga County, New York, which is located north of the City of Syracuse. A site location map is included as Figure 1. The settling ponds are located within the Syracuse China Landfill (site). The Syracuse China Landfill and settling ponds are located north of the facility. The site is bordered by wetlands and Factory Avenue to the north, CSX rail lines and the facility border the site to the south, and undeveloped Syracuse China property lie to the east and west. A site plan is included as Figure 2.

1.2 Regulatory History

The Syracuse China facility was constructed in the 1920's and has been manufacturing china since that time. Pfaltzgraff purchased the Syracuse China facility in 1989. The NYSDEC listed the site on the Registry of Inactive Hazardous Waste Disposal Sites with a classification of 2 in March 1991. Pfaltzgraff sold the property to a subsidiary of Libbey, Inc. in 1995. Based on the results of a Remedial Investigation and Focused Feasibility Study (RI/FS), a Record of Decision (ROD) was issued for the site in March 1996. Pfaltzgraff is required by the ROD to perform remediation of the landfill, wetlands north of the landfill and the existing settling ponds as well as the "reconstruction of the settling ponds, as necessary to maintain the current wastewater discharge." The final design for existing settling pond and landfill remediation was approved (in March 2000) with the exception of the design for new settling ponds, which is required to be designed in accordance with NYSDEC State Pollutant Discharge Elimination System (SPDES) guidelines. Wastewater discharges from the settling ponds are regulated by SPDES permit number NY0100137 issued to Syracuse China. The SPDES permit was renewed April 1, 1999 and expires on April 1, 2004. A copy of the current SPDES permit is included in Appendix B.

2.0 DESCRIPTION OF INDUSTRY AND SOURCES OF WASTEWATER

The two main sources of flow into the settling ponds are storm water and facility wastewater. Each of these sources is described in further detail below.

2.1 Storm Water

Storm water flows to the settling ponds from the facility, the landfill, and from a sewer from the Village of Lyncourt. Facility storm water is carried by a series of culverts and catch basins to two main storm-water lines, a 24-inch concrete pipe and a 36-inch vitreous clay pipe. These two pipes discharge into a manhole north of the facility. A 36-inch pipe carries storm water from this manhole under the CSX tracks to a swale that flows into the existing settling ponds. This storm-water collection system provides drainage for approximately 22 acres of the manufacturing facility located south of the CSX tracks. The facility stormwater drainage area consists of largely impermeable surfaces such as paved parking lots and the building roof. The new settling ponds will continue to accept storm-water flow from the facility area.

Some storm water flow from the landfill enters the settling ponds via overland flow. This flow originates from the east face of the western portion of the landfill and from the eastern portion of the landfill which surrounds the settling ponds. The area of the landfill which currently drains to the settling ponds is estimated to be no more than 7 acres. Subsequent to closure of the landfill and construction of the new settling ponds, storm-water runoff from the landfill will no longer flow to the settling ponds. Landfill runoff will be decreased due to vegetation, and diversion swales will be constructed to carry storm water to the north side of the landfill and discharge under Factory Avenue via a drainage swale which runs through the wetlands. The new settling ponds will be constructed with a perimeter berm above the new grade in the eastern portion of the site and therefore, the new ponds will not receive overland flow from that area.

Stormwater flow is also received from a Village of Lyncourt sewer. The quality and volume of stormwater from this culvert is not well defined but the drainage area of this sewer consists of residential property and impermeable surfaces such as paved roads. However, please note that the Village of Lyncourt, Onondaga County and New York State are working toward separation

of the sewer from Syracuse China's system. Until it has been physically separated, the new settling ponds will continue to accept storm-water flow from this source.

2.2 Description of Manufacturing Processes and Facility Wastewater

Syracuse China manufactures dinnerware (ware) for domestic and commercial use at its facility. Activities conducted as part of the primary manufacturing processes includes:

- raw material batching;
- ware forming, finishing and drying;
- ware firing;
- ware cleaning;
- decal application;
- glaze batching and application; and
- overglaze decorating.

Activities conducted as part of the secondary manufacturing processes include:

- decorative design studio;
- decal production;
- color preparation and ware decorating;
- analytical laboratory activities;
- plaster mold making;
- operation of building utility systems (boilers, air-conditions, vacuum pumps, etc.);
- equipment cleaning and washdown;
- personnel activities (cafeteria, restrooms, showers, etc.); and
- storm water collection and drainage.

Nearly all of these operations and activities result in wastewater discharges.

Wastewater discharged from the facility enters through the metered municipal water supply, or as precipitation. Figure 3 is a schematic which shows the types and approximate amounts of

Syracuse China's wastewater. Approximately 234,000 gallons per day (gpd) of water enters the facility through the metered municipal water supply. Of this quantity, approximately 29,750 gpd are discharged from various processes and activities to the sanitary sewer through the metered sanitary sewer outfall. Approximately 197,200 gpd of water, which enters the facility from the municipal water system, are discharged through Outfall 001. In addition to the portion of the municipal water supply which is discharged though Outfall 001, approximately 150,000 gpd of storm water and ground water are discharged through Outfall 001. A total of approximately 380,000 gpd of water are discharged and carried off site.

The processes which discharge to the storm sewer through Outfall 001 include:

- raw material batching;
- ware forming and finishing;
- ware cleaning;
- plaster mold making; and
- utility systems (non-contact water from air-conditioners and vacuum pumps).

Wastewater from these operations (except for non-contact cooling water from utility systems which will be discharged directly to Outfall 001) drains to the wastewater treatment system for removal of total suspended solids (TSS) prior to discharge to SPDES Outfall 001. The wastewater from these processes is currently filtered in one of the two primary filter presses which remove clay, calcined alumina, and aluminum hydrate (suspended solids). The filtrate from these filter presses is then discharged through a three-stage effluent tank and to the settling ponds. The discharge (overflow point) from the settling pond is SPDES Outfall 001.

The following includes a brief description of the processes which discharge water to the settling ponds and/or SPDES Outfall 001.

Plaster Mold Making: Plaster molds are formed at Syracuse China as the original patterns for the ware to be produced. In the mold making shop, water is used to mix the plaster, form the molds, and to clean equipment. The plaster mold making shop is equipped with a settling basin which is used as a source for recycle water, as well as a point for the settling of suspended solids

prior to discharge of the wastewater to the wastewater treatment system for the removal of suspended soils. Approximately 1,450 gpd of water are used in the plaster mold making shop and an average of 1,200 gpd are discharged through the wastewater treatment system located in the facility and to the settling ponds.

Raw Material Batch Filter Press: In the raw material batching area, raw materials including calcined alumina, ground quartz, clay and feldspathic rock are brought in on railcars and loaded into raw material silos. Wastewater generated from the batching area results from minor leaks of precipitation into the batching area around the railcar garage, leaks to floor drains inside the batch storage area, and from water sealed pumps inside the batching area. The outside area drains discharge directly to the facility storm sewer which leads to SPDES Outfall 001. The floor drain and pump sealing waters are directed back to the facility's wastewater treatment system.

The raw materials are transferred from the raw material silos into batch mixing facilities where they are blended. The blended materials are then filter pressed to form a moldable clay raw material. The filtrate from the raw material filter presses is discharged to the wastewater treatment system. Of 14,700 gpd of water from the municipal water system typically used in the batching operations, approximately 4,700 gallons remain in the raw clay. Approximately 10,000 gpd are discharged through the wastewater treatment system located in the facility and to the settling ponds.

Ware Forming, Finishing and Drying: In the ware forming and finishing area, the moldable clay raw material is extruded and cut into shapes which are then rolled to form the dinnerware shapes (plates, bowls, saucers, etc.). After the ware is formed, the edge of the ware is scraped with steel scrapers. The formed ware then passes through a dryer which heats the dinnerware shapes in order to evaporate moisture. As the ware leaves the dryer, it is placed on racks and allowed to air dry for a period of time.

On a typical day, approximately 20,000 gallons of water are used in the ware forming and finishing area. Of the water (20,000 gpd from wet finishing plus 4,700 gpd in the raw clay) which enters the ware forming and finishing area, approximately 3,550 gpd are evaporated in the ware dryer, and approximately 1,000 gpd remain in the ware transferred to the firing kilns.

Wastewater from one automated flatware forming and finishing system and several manual-finishing stations is discharged directly to a central cistern where it is collected from treatment in the wastewater treatment system. Seven manual cup edge finishing stations in the finishing area are equipped with water recycling clarifiers which allow reuse of the edge finishing water. The water in these recycle systems is returned to the process in-feed once each shift. Approximately 20,000 gpd of wastewater are discharged from the ware forming and finishing area through the wastewater treatment system located in the facility and to the settling ponds.

Biscuit Ware Cleaning: In the biscuit ware cleaning area, the fired ware is cleaned with water in a vibratory finisher to remove calcined alumina which was applied to the surface of the ware to prevent it from sticking to other pieces of ware during firing.

Approximately 26,500 gpd of water are used in the biscuit ware cleaning area. The water is passed through a hydrocyclone to remove the calcined alumina (course solids). The wastewater from the hydrocyclone is discharged through the wastewater treatment system located in the facility and to the settling ponds.

Building Utilities: Building utilities at the Syracuse China facility which discharge wastewater include boiler systems, air-conditioning systems, air compressors, and vacuum pumps. The boiler systems are used for heating and drying. Boiler blowdown is discharged to the sanitary sewer.

Vacuum pumps which are used in decorating systems and in ware forming account for approximately 30 percent of the 140,000 gpd non-contact cooling water flow. The remaining non-contact cooling water was used to cool air-conditioners and air compressors throughout the plant. The waste cooling water from the air-conditioners, air compressors and vacuum pumps is discharged to the settling ponds and SPDES Outfall 001 without passing through the wastewater treatment system located in the facility.

Storm and Ground-Water Collection: An average of approximately 150,000 gpd of storm water and ground water are discharged through the settling ponds and SPDES Outfall 001 without

passing through the wastewater treatment system located in the facility. This flow is seasonally variable.

Equipment Cleaning and Washdown: As part of system operations, manufacturing equipment is periodically rinsed with water from utility hoses to remove accumulations of dust and dirt. Flows of wastewater generated in this manner have been included in the wastewater discharges associated with each activity described above.

Facility wastewater will continue to be discharged to the new settling ponds at the same rates, the same quality, and with the same pre-treatment (filter press) as current operations.

3.0 TREATMENT OBJECTIVE

The treatment objective for wastewater effluent from the settling ponds is dictated by compliance with the current SPDES permit as provided in Appendix B for Outfall 001. The current SPDES permit (#NY0100137) was issued on April 1, 1999 and includes the following discharge limits:

Parameter	Discharge Limit
flow	monitor only
temperature	90 degrees Fahrenheit
total dissolved solids (TDS)	600 milligrams per liter (mg/ℓ)
total suspended solids (TSS)	20 mg/ℓ
5-day biochemical oxygen demand (BOD5)	21 mg/ℓ (monitoring action level only)
oil and grease	15 mg/ℓ
total boron	840 micrograms per liter (µg/ℓ) (monitoring action level only)
total lead	70 µg/ℓ

The primary design consideration for the new settling ponds will be TSS under high flow or facility upset conditions. Under normal facility operating conditions, the existing data shows that the current discharge meets the monitored SPDES limits prior to discharge into the settling ponds as can be seen in Table 1. There are no other discharge limits or reported constraints on the settling pond operations beyond those specified in the SPDES permit.

As described in Section 5.0, Remedial Engineering collected settling pond influent samples between May 18, 1998 and June 15, 1998. Table 1 provides a summary of this data.

4.0 EXISTING TREATMENT FACILITIES

The existing wastewater treatment system located in the facility is designed to remove TSS from the wastewater before it is discharged to the settling ponds and through SPDES Outfall 001. The wastewater streams which were described in Section 2.2, vary with regard to flow and TSS concentration. All wastewater which discharges through SPDES Outfall 001 must have a TSS concentration equal to or less than 20 milligrams per liter (mg/ℓ). A schematic of the wastewater treatment system located in the facility is included in Figure 4.

The treated plant wastewater leaves the facility and flows directly to the settling ponds. There are four former and existing settling ponds and one out of service "sludge pond" at the site. Figure 2 is a site plan which shows the layout of the settling ponds and Figure 5 includes a schematic of the current settling pond treatment scenario. Settling Ponds 2, 3 and 4 are currently in use. Settling Pond 1 and the Sludge Pond were formerly used to polish wastewater, and store sludge, respectively, but are currently inactive. All settled material in each of the settling ponds and the sludge pond will be excavated and placed under the landfill cap as part of the site remediation.

A 36-inch pipe carries facility wastewater and stormwater under the CSX tracks to a swale which flows into the existing settling ponds. Wastewater currently flows through Settling Pond 3, into Settling Pond 4, and into Settling Pond 2, all of which are interconnected with 15-inch diameter pipe. The effluent water from Settling Pond 2 discharges through a 15-inch pipe (SPDES Outfall 001) and then flows through a natural channel within the northern wetlands and then off-site through a culvert under Factory Avenue.

The settling ponds are excavated into native soil below existing grade and currently contain a significant volume of sediment. Volumes were estimated based on reports and data obtained from Syracuse China and site surveys. The maximum original volumes (prior to accumulation of sediment) of the currently active settling Ponds 2, 3 and 4 are approximately 450,000 gallons, 400,000 gallons, and 385,000 gallons, respectively, totaling approximately 1.2 million gallons. The current conditions of Settling Ponds 2, 3 and 4 are estimated to be:

- Settling Pond 2: 8 feet of sludge located below approximately 5.5 feet of standing water;
- Settling Pond 3: 10 feet of sludge located below approximately 0.5 feet of standing water; and
- Settling Pond 4: 6 feet of sludge located below approximately 6.5 feet of standing water.

5.0 WASTEWATER CHARACTERISTICS

Remedial Engineering performed a wastewater evaluation in May-June 1998 to characterize quality of wastewater entering the settling ponds. Wastewater flow quantities were collected from May to August 1998. A portable sampler and flow monitor were installed inside a 36-inch diameter pipe in the effluent manhole. Historical data and other information pertaining to wastewater flow and quality was also obtained from Syracuse China personnel. Characteristics of the wastewater flow are described below.

5.1 SPDES Sampling Results Provided by Syracuse China

SPDES Outfall 001 sampling results were provided by Syracuse China for the period from January 1990 to December 1999. The parameters analyzed included: flow, lead, pH, TSS and TDS. Table 2 is a summary of Syracuse China's SPDES sampling results. It should be noted that the limits for certain parameters in the previous SPDES permit (effective date September 1, 1985) have been modified. The previous SPDES permit limits were as follows:

Parameter	Discharge Limit
flow	monitor only
total dissolved solids (TDS)	600 milligrams per liter (mg/ℓ)
total suspended solids (TSS)	30 mg/ℓ
total lead	0.2 mg/ℓ

5.2 Flow Data

Wastewater flow recorded by Remedial Engineering (May - August, 1998) was generally in the range of 300 to 400 gallons per minute (gpm) which is consistent with historical flow data received from Syracuse China personnel. Syracuse China's flow data indicate flows ranging from less than 100 gpm to over 400 gpm with flows generally falling in the 200 to 400 gpm range.

Storm-water flow from the facility, the Village of Lyncourt sewer and the landfill area can make a significant contribution to the total flow entering the Settling Ponds. The storm water flows for 1-year and 10-year storms (used in calculations) were estimated using flow data and rainfall data collected by Remedial Engineering. Daily rainfall data was obtained during the study period

from the National Oceanic and Atmospheric Administration (NOAA) for the Syracuse area. The rainfall data was plotted against the daily maximum recorded flow and a best-fit line was applied to the data. The 24-hour rainfall for various frequency storms was obtained from *Urban Hydrology for Small Watersheds*. The design frequency storm 24-hour rainfall was correlated to a maximum flow (on the basis of the data collected May - August, 1998) using a best-fit line for the 1-year and 10-year storms. Appendix C includes rainfall and storm flow data.

A copy of Remedial Engineering's flow data collected between May 15, 1998 and August 24, 1998 is included in Appendix D and flow data provided by Syracuse China is included in Table 2.

5.3 Chemical Analysis

Settling pond influent samples collected with the portable sampler installed by Remedial Engineering were analyzed for TSS, TDS, total lead and dissolved lead. Table 1 summarizes the results of the chemical analysis of the influent wastewater during this limited time period.

5.4 Facility Upset

Another consideration for the settling pond design was the potential for facility "upset." An upset condition could occur should one of the filter presses in the facility fail and wastewater discharged to the settling ponds without prior treatment. Data for two upset scenarios were provided by Syracuse China personnel.

The first scenario was the failure of the process wastewater filter press which treats process wastewater from ware forming, finishing, and drying; biscuit ware cleaning; and plaster mold making and general facility wastewater from equipment cleaning, spillage and some minor wet processes. This sample was collected in November 1998 and the TSS concentration in the sample was 23,811 mg/ℓ. A second upset sample was described to simulate the failure of the production filter press. This scenario was provided by Syracuse China personnel in March 2000 which indicated a TSS concentration of 407,810 mg/ℓ suspended solids and was used for the calculations as the "worst-case scenario."

5.5 Particle Size

A particle distribution curve developed from a simulated facility upset sample provided by Syracuse China indicated a mean particle diameter of 14.5 micrometers (μm). Another particle distribution curve provided by Syracuse China personnel indicated a mean particle diameter of 1.3 μm. Particles smaller than 10 μm are generally considered unsettleable (Metcalf & Eddy, 1972). Approximately 55% of the facility flow particles were considered unsettleable for the design calculations based on the particle size distributions. Wastewater particle size distributions are included in Appendix E. The settling ponds adequately remove TSS associated with storm water.

The settling pond influent data collected during the recent field activities and the historical effluent data provided by Syracuse China indicate that treatment in the settling ponds is not necessary to meet the discharge limits in the SPDES permit for routine facility discharges; however, the ponds provide for the necessary polishing of plant wastewaters that may occasionally contain higher suspended solid concentrations as a result of production upsets and/or wastewater processing equipment breakdowns. The settling pond design parameters and calculations are discussed in detail in the following sections.

6.0 DESIGN PARAMETERS

The intent of this new settling pond design is to meet current design standards with volumes similar to the existing settling ponds. The new settling ponds are designed to treat combined wastewater/storm water flow from the sources described in Section 2.0. In accordance with discussions held with NYSDEC's Bureau of Water Permits, two scenarios were evaluated for the settling pond design:

Case 1: base facility discharge and a 10-year storm flow; and

Case 2: base facility discharge with a facility upset and 1-year storm flow.

The data for storm water and facility wastewater were discussed in Section 5.0. The following parameters were used to evaluate the projected performance of a pond design similar in volume to the existing ponds.

Parameter	Value
base facility flow	264 GPM;
base facility flow TSS concentration	7 mg/ℓ;
facility upset flow	25 GPM (for 1.25 hours);
facility upset flow TSS concentration	407,810 mg/ℓ (for failure of the production wastewater filter press);
1-year storm flow	4,450 GPM;
1-year storm flow TSS concentration	45 mg/ℓ;
10-year storm flow	7,179 GPM;
10-year storm flow TSS concentration	45 mg/ℓ;
average particle size (facility upset)	1.3 to 14.5 µm;
average particle size (typical storm water)	1.0 to 2,000 µm

An average of 2.25 feet of freeboard is provided for design conditions and the design allows for the removal of one settling pond from service for maintenance at any time.

Calculations performed using the above parameters result in failure under facility upset conditions as shown in Table 3. The results of Table 3 are discussed in Section 7.3.

7.0 TREATMENT SYSTEM DESIGN

As discussed in Section 3.0, the treatment objectives for the new settling ponds are compliance with the existing SPDES permit (# NY0100137) under normal, facility upset and storm flow conditions. Calculations were performed with consideration to meeting the SPDES limits as well as handling the production upset flows as requested by the Bureau of Water. The important parameters for the calculations were described in Section 6.0. A general settling pond description is provided below. Pond treatment performance calculations are discussed in Section 7.2. Section 7.3 details the facility's operational response requirements for facility upset conditions. The evaluations of the ponds treatment performance in this section are based on a 3-pond configuration in which one settling pond can always be taken out of service for maintenance, with an approximate maximum volume of 1.25 million gallons, similar to the existing settling pond system.

7.1 General Settling Pond Description

The new settling pond system consists of 3 settling ponds connected by pipes with effluent weirs and downstream headwalls. Each settling pond is approximately 170 feet long by 60 feet wide at the bottom with a maximum water depth of 6.5 feet. The operating water level is 4.25 feet with an average of 2.25 feet of freeboard. The approximate particle flow path is 160 feet in each settling pond. A perforated floating baffle will be installed in each of the three ponds to evenly distribute flow through the ponds and maximize settling of TSS. The baffles will each be approximately 60 feet wide and 4 feet in depth. They will be capable of floating within a 1 foot range. The baffles will have the manufacturer's standard perforations, which allow 30 gpm of flow per square foot of baffle beyond which the baffles would be overtopped. Each baffle will be installed 1/3 the length of the pond from the inlet (approximately 60 feet). A concrete weir structure will be installed in each of the three ponds to evenly distribute effluent flow and control pond water levels. The weirs will be installed at the effluent of each pond and will flow to the 24-inch HDPE pipes which carry wastewater to the next pond or to the outfall swale. The settling ponds will be constructed into native soils, however, the depth of excavation will be limited by depth of groundwater. The bottom of the settling ponds will start one foot above mean high ground-water elevation and will be underlain with a geogrid and a 12-inch sand

drainage subbase and geosynthetic clay liner overlain by 12-inches of gravel. The side slopes of the settling ponds will be lined with a geosynthetic clay mat overlain by 6-inches of gravel. Each settling pond has a 15-foot wide emergency spillway which discharges to a swale carrying wastewater out to the SPDES outfall. If wastewater flows through all three settling ponds under normal conditions, it will flow out of Settling Pond 3 into an effluent swale which carries the pond discharge to the SPDES outfall 001. Bypass piping will be installed for Settling Ponds 1 and 2 so any pond can be removed from service for maintenance. If Settling Pond 3 is removed from service, water will flow out of the bypass headwall (Headwall No. 4) in Settling Pond 2 and flow into the spillway swale to SPDES outfall 001. A schematic of the new settling ponds is shown on Figure 6. Table 4 includes a list of the equipment/structures required for the new settling ponds design. Appendix F includes a description of the possible flow scenarios for the new settling ponds and it also contains Drawings 5 and 12 from the *Final Remedial Design Syracuse China Landfill* dated April 2000 which show the latest design revision for proposed settling ponds including the appropriate construction details. Appendix G includes the specifications for the significant elements of the new settling ponds.

7.2 Settling Pond Design Calculations

Initially, a calculation was performed to determine the smallest particle which can settle 100% in the proposed settling ponds. This calculation is included in Table 5. The settling velocity of the smallest particle which will settle 100%, assuming two-pond operation, is 0.00056 feet per second (fps) or 0.017 centimeters per second (cm/sec). Using Figure 3.2, the settling velocity vs. particle diameter chart in *Unit Operations and Processes in Environmental Engineering* (Reynolds, 1982) included as Appendix H, particles ranging in size from 0.001 cm to 0.06 cm (10μm to 600 μm) will settle at this velocity depending on the specific gravity of the particle. Therefore, the smallest particle which would theoretically settle in the settling ponds has a diameter of 10 μm. This is consistent with the *Wastewater Engineering* reference also included in Appendix H which indicates that particles smaller than 10 μm in diameter are generally unsettleable. As discussed in Section 5.0, average particle size in a facility upset discharge appears to range from 1.3 to 14.5 μm, based on samples and data provided by Syracuse China. Stormwater particles generally range in size from 1.0 to 2,000 μm based on published data.

The TSS concentrations were calculated for Case 1 and Case 2, as defined in Section 6.0. The final TSS concentrations were calculated by using a mass balance equation and assuming the sample is collected as a 6-hour composite as required by the SPDES permit. The TSS calculations are included as Table 3. The calculated TSS concentrations at the SPDES outfall in 6-hour composite samples were as follows:

- Case 1: 11 mg/ℓ; and
- Case 2 (failure of one of the facility production wastewater filter presses): 257 mg/ℓ;

These calculations indicate that the SPDES permit limit for TSS of 20 mg/ℓ can be met for the conditions in Case 1. However, the SPDES permit limit for TSS cannot be met for the facility upset condition (Case 2) without additional treatment.

The weir loading rate was calculated by dividing the flow rate by the length of the weir. Average flow into the ponds is approximately 468,000 gpd and the weir length is equal to the width of the pond (65 feet). The calculated overflow rate is approximately 7,200 gpd per foot of weir. Recommended weir loading rates are 15,000 to 20,000 gpd per foot (Reynolds, 1982), therefore, the weir length is more than adequate for normal facility flow. This calculation is included as Table 6.

The flow capacity of the emergency spillways was calculated to confirm that the spillways can pass the 25-year storm. The emergency spillways are 6 inches deep and 15 feet wide and can carry a flow of 8,734 gpm which is greater than the 25-year storm flow of 8,680 gpm. This calculation is included as Table 7.

The pond piping was designed to carry the 25-year storm (8,680 gpm). Calculations indicate that a 24-inch diameter HDPE pipe will carry 16,515 gpm which is adequate for the 25-year storm. The head loss due to friction for the pipe was also calculated and was nearly negligible at 0.35 feet. These calculations are included on Table 8.

7.3 Facility Operational Response Requirements for Upset Condition

Since the solids in the Syracuse China wastewater are generally unsettleable and mixing is not adequate to meet the SPDES TSS limits during any significant plant upset, additional treatment is necessary to achieve compliance with the SPDES permit. If a facility upset occurred, Settling Pond 1 has a detention time of approximately 3 hours which would allow Syracuse China operations personnel to isolate Settling Pond 1 so facility upset wastewater could be contained to receive additional treatment. Once Settling Pond 1 is isolated by closing stop gates located in Distribution Boxes 1 and 2, normal facility flow can be diverted into Settling Ponds 2 and 3. During a facility upset, a flocculant would be added to the isolated settling pond to aid in settling of TSS in the wastewater. Syracuse China's current SPDES permit includes the use of an approved flocculant, Amerfloc, 482 manufactured by Ashland Chemical Company. During a facility upset, a flocculant would be added either in the facility effluent tank and/or the isolated pond. Addition of flocculant will be performed by Syracuse China as they are obligated to operate the new settling ponds, in accordance with the SPDES permit, at the completion of pond construction.

8.0 EFFLUENT CHARACTERISTICS

The anticipated settling pond effluent concentrations are as follow:

Parameter	Anticipated Concentration	Permit Limit
TSS (Case 1)	11 mg/ℓ	20 mg/ℓ
TSS (Case 2)	20 mg/ℓ	20 mg/ℓ
TDS	200 - 300 mg/ℓ	600 mg/ℓ
Total lead	0 - 0.024 mg/ℓ	.07 mg/ℓ

TSS is the only SPDES parameter of concern for the settling pond effluent. The other parameters currently meet the SPDES limits prior to discharge into the settling pond under all operating conditions. The addition of flocculant will be necessary to meet the TSS limits in Case 2. If a filter press fails, Settling Pond 1 could be isolated so the upset wastewater containing high TSS concentrations would be retained until sufficient settling occurred. Normal facility flow could be diverted to Settling Ponds 2 and 3 while upset wastewater would be retained in Settling Pond 1. Diversion of flows and the addition of the appropriate flocculant would be the responsibility of Syracuse China operations personnel as they will operate the new settling ponds once the pond construction is complete.

9.0 OPERATIONS AND MAINTENANCE

Pond operations and maintenance will entail three distinct elements:

- effluent sampling;
- pond inspections; and
- sludge removal.

Each of these three elements is described below.

Pond effluent sampling will occur on a weekly basis in accordance with the facility's SPDES permit which was issued April 1, 1999. Samples will be collected from a new Outfall 001 which will be located at the discharge from newly constructed Pond No. 3.

Formal pond inspections will be performed on a routine basis (every three months initially, but not less than annually thereafter) by Syracuse China to prevent any deterioration to the ponds or the associated pond structures. Inspections will include visual observations of soil berms, pond inlet and outlet structures, pond stop gates, floating baffles and pond piping. Any deterioration of these pond elements will be documented and repaired as soon as possible. Completed pond repairs will also be documented.

After the ponds have been operational for a sufficient period of time, sludge will accumulate within the ponds and will require removal. Sludge removal may be facilitated by the isolation of each individual pond to allow safe access. Future cleaning will be performed by Syracuse China, as required, utilizing an outside contractor utilizing a hydraulic dredge or other suitable device. If appropriate, removed sediments will be dewatered on site, chemically characterized, and appropriately disposed.

10.0 CONCLUSIONS

Remedial Engineering has prepared this engineering to present the design of new settling ponds similar in volume to existing settling ponds at the Syracuse China site in the Town of Salina, Onondaga County, New York. This report has been prepared in accordance with the NYSDEC's Bureau of Water guidelines as well as discussions with Bureau of Water personnel. This report satisfies the requirements of a Phase 1 submission as well as a Phase 2 submission since the engineering design drawings (Appendix F) and appropriate specifications (Appendix G) are included.

The conclusions of this report are as follows:

- the new settling ponds have approximately the same volume as the existing operating settling ponds;
- the primary means of treatment of the pond influent is sedimentation;
- wastewater effluent from the settling ponds will meet SPDES limits under "normal" flow conditions (Case 1) which includes a 10-year storm plus base facility flow; and
- wastewater effluent from the settling pond will meet SPDES limits under facility upset conditions if the upset flow is retained in Settling Pond 1 and/or flocculant is added to the wastewater by the operator to settle additional TSS.

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Table 1. Summary of Pond Influent Samples Collected by Remedial Engineering, P.C., Pfaltzgraff Co., Syracuse China Landfill; Town of Salina, New York.

Day	Influent TDS (mg/ℓ)	Influent TSS (mg/ℓ)	Effluent TSS (mg/ℓ)	Influent Toal Lead (mg/ℓ)	Influent Dissolved Lead (mg/ℓ)
05/18/1998	280	20	-	0.009	0.006
05/18/1998	250	10	-	0.009	0.004
05/18/1998	250	3	-	0.008	0.005
05/19/1998	220	2	-	0.009	0.005
05/19/1998	300	5	-	0.007	0.007
05/19/1998	250	3	-	0.042	0.006
05/19/1998	240	1	-	0.013	0.005
05/20/1998	320	2	-	0.012	0.008
05/21/1998	260	14	-	0.008	0.002
05/21/1998	190	5	-	0.007	<0.001
05/21/1998	260	3	-	0.007	0.006
05/22/1998	240	4	-	0.006	0.004
05/22/1998	260	5	-	0.006	0.005
05/23/1998	270	1	-	0.006	0.005
05/24/1998	270	2	-	0.004	0.005
05/25/1998	280	4	-	0.007	0.007
05/26/1998	260	5	-	0.008	0.005
05/27/1998	230	6	3	0.008	<0.001
05/28/1998	210	5	-	0.003	0.003
05/29/1998	200	10	-	0.012	<0.001
05/30/1998	220	<1	-	0.004	0.001
05/31/1998	220	52	-	0.004	0.005
06/01/1998	230	7	-	0.006	<0.001
06/02/1998	210	9	-	0.024	0.002
06/03/1998	240	6	-	0.007	0.002
06/04/1998	480	3	-	0.006	<0.001
06/05/1998	*320*	*15*	-	*0.005*	*0.004*
06/06/1998	260	3	-	0.13	0.003
06/07/1998	270	3	-	0.005	0.003
06/08/1998	270	1	-	0.002	0.003
06/10/1998	350	3	-	0.004	<0.001
06/11/1998	250	4	-	<0.001	<0.001
06/12/1998	250	5	-	0.002	<0.001
06/13/1998	200	7	-	<0.001	<0.001
06/14/1998	190	4	-	<0.001	<0.001
06/15/1998	220	4	-	<0.001	0.001
	SPDES limit = 600 mg/ℓ	SPDES limit = 20 mg/ℓ		SPDES limit = 0.07 mg/ℓ	

Notes:
SPDES = State Pollutant Discharge Elimination System
TDS = Total Dissolved Solids
TSS = Total Suspended Solids
mg/ℓ = Milligrams per liter
- = Sample not collected on that date by Syracuse China.

1. Effluent TSS information supplied by Syracuse China Company. Detection limit for lead is 0.001 mg/ℓ.
2. SPDES limits from permit effective 4/1/99.

Table 2. Summary of SPDES Sampling Results (Pond Effluent) Provided by Syracuse China. Pfaltzgraff Co., Syracuse China Landfill; Town of Salina, New York

Sample Date	Flow (GPD)	Lead (mg/ℓ)	pH	TSS (mg/ℓ)	TDS (mg/ℓ)
SPDES Permit Limits Effective 9/1/85	No Limit	0.2	6.0-9.0	30	600
1/2/90	465,100	0.056	7.6	5	570
1/9/90	472,800	0.024	8.3	47	340
1/16/90	458,200	0.008	8.2	5	370
1/23/90	442,500	0.021	7.9	7	360
1/31/90	488,200	0.015	7.3	25	280
2/6/90	515,500	0.034	8.0	13	540
2/13/90	490,900	0.008	8.5	12	390
2/20/90	435,300	0.014	7.7	2	440
2/27/90	491,100	0.003	8.3	9	390
3/6/90	411,200	0.012	7.8	19	380
3/13/90	505,900	0.023	8.1	45	400
3/20/90	540,800	0.037	7.7	25	370
3/27/90	445,300	0.037	8.1	43	300
4/3/90	---	0.071	7.8	14	300
4/11/90	---	0.025	8.0	10	360
4/17/90	---	0.049	7.8	10	580
4/24/90	---	0.030	8.0	2	360
5/1/90	---	0.010	7.9	17	390
5/8/90	---	0.023	7.7	23	310
5/15/90	---	0.005	7.9	25	330
5/22/90	---	0.006	8.0	7	350
5/29/90	---	0.006	7.4	22	480
6/5/90	---	0.004	8.0	9	380
6/12/90	---	0.007	7.9	6	300
6/19/90	---	0.007	7.7	5	320
6/26/90	---	0.014	7.8	5	130
7/10/90	---	0.012	7.9	3	260
7/17/90	---	0.026	7.8	16	340
8/7/90	---	0.02	7.4	2	350
8/14/90	387,400	0.024	8.4	2	310
8/21/90	---	<0.001	7.8	7	310
9/4/90	---	0.014	7.4	7	400
9/11/90	---	0.016	7.6	4	250
9/18/90	469,500	0.008	7.5	3	350
9/25/90	---	0.006	7.2	7	290
10/2/90	---	0.005	7.5	3	250
10/9/90	---	0.008	7.7	2	270
10/16/90	348,200	0.007	7.8	7	340
10/23/90	443,953	0.023	6.8	9	220
10/30/90	362,300	0.039	7.6	18	300
11/6/90	381,300	0.022	6.5	10	200
11/14/90	358,900	<0.001	8.0	8	400
11/20/90	388,400	0.003	7.9	7	290
11/27/90	363,100	0.015	7.5	4	280
12/4/90	386,200	0.097	7.7	30	240
12/11/90	356,500	0.015	8.9	3	200
12/18/90	---	0.019	8.1	7	580
1/8/91	369,600	0.017	8.3	4	370
1/17/91	406,600	0.004	7.7	4	330

Table 2. Summary of SPDES Sampling Results (Pond Effluent) Provided by Syracuse China. Pfaltzgraff Co., Syracuse China Landfill; Town of Salina, New York

Sample Date	Flow (GPD)	Lead (mg/ℓ)	pH	TSS (mg/ℓ)	TDS (mg/ℓ)
SPDES Permit Limits Effective 9/1/85	No Limit	0.2	6.0-9.0	30	600
1/22/91	380,400	0.020	7.7	6	400
1/29/91	369,600	<0.001	9.0	3	360
2/7/91	295,000	0.016	7.7	5	460
2/15/91	369,600	0.007	7.7	<1	340
2/20/91	490,697	0.005	7.9	9	580
2/27/91	410,900	<0.001	7.8	3	350
3/6/91	---	0.003	8.1	9	370
3/12/91	329,800	0.005	7.8	3	360
3/19/91	380,400	0.014	8.1	6	340
3/26/91	266,278	<0.100	---	7	374
4/4/91	---	0.011	8.1	6	410
4/10/91	353,200	0.072	---	18	274
4/17/91	369,000	0.002	7.6	<1	220
4/24/91	396,232	0.010	7.2	<1	310
5/1/91	359,000	<0.020	8.3	8	323
5/7/91	329,400	0.014	7.5	5	250
5/14/91	287,200	<0.020	7.6	6	372
5/21/91	259,300	0.011	7.8	3	370
5/28/91	286,800	<0.020	8.0	6	296
6/5/91	286,800	0.009	7.8	4	320
6/13/91	280,000	---	---	---	---
6/18/91	344,500	---	---	---	---
6/19/91	338,700	<0.020	8.1	9	308
6/20/91	353,400	0.038	8.4	10	280
6/26/91	342,400	<0.020	8.4	2	279
7/3/91	271,700	0.014	8.0	3	240
7/9/91	283,000	<0.020	8.2	<1.0	287
7/16/91		0.010	8.0	1	160
7/25/91	155,900	<0.020		5	281
8/8/91	384,000	0.028	8.3	<1.0	285
8/13/91	410,300	0.024	7.8	4	180
8/20/91	401,600	<0.020	8.1	4	276
8/28/91	358,700	0.110	7.8	2	180
9/5/91	---	0.020	8.0	6	277
9/10/91	---	0.004		5	220
9/18/91	---	<0.020	7.3	1	273
9/27/91	390,000	0.011	7.8	2	210
10/2/91	---	<0.020	7.7	<0.5	247
10/9/91	---	0.060	7.6	3	300
10/15/91	---	<0.020		<0.5	255
10/23/91	---	0.005	8.1	15	140
10/29/91	390,000	<0.020	7.9	7	277
11/6/91	---	0.020	7.9	21	250
11/13/91	---	<0.020	7.7	12	260
11/19/91	---	0.020	7.9	39	160
11/27/91	380,000	0.024	7.6	9	259
12/4/91	---	0.027	7.4	3	340
12/12/91	---	<0.020	7.7	6	320
12/18/91	---	0.020	7.5	4	340

Table 2. Summary of SPDES Sampling Results (Pond Effluent) Provided by Syracuse China. Pfaltzgraff Co., Syracuse China Landfill; Town of Salina, New York

Sample Date	Flow (GPD)	Lead (mg/ℓ)	pH	TSS (mg/ℓ)	TDS (mg/ℓ)
SPDES Permit Limits Effective 9/1/85	No Limit	0.2	6.0-9.0	30	600
12/23/91	380,000	0.060	7.8	9	352
1/3/92	---	0.011	7.9	13	240
1/7/92	---	<0.020	8.4	13	285
1/17/92	---	0.037	7.7	12	320
1/21/92	---	0.034	7.8	3	243
1/30/92	207,300	---	---	---	---
1/30/92	---	0.018	7.8	14	290
2/5/92	306,150	---	---	---	---
2/6/92	---	0.021	7.8	13	280
2/18/92	396,000	0.026	7.9	9	512
2/18/92		0.100	7.5	1	240
2/26/92	295,800	---	---	---	---
2/27/92	340,200	<0.020	7.8	13	453
3/4/92	267,750	---	---	---	---
3/5/92	---	0.015	7.7	<1	360
3/25/92	454,742	---	---	---	---
3/27/92	---	0.013	7.5	<1	400
4/3/92	---	0.026	8.0	11	370
4/10/92	---	0.008	7.4	<1	300
4/24/92	---	0.005	---	2	310
4/30/92	---	0.037	---	7	290
5/8/92	---	<0.020	8.0	<0.5	330
5/15/92	---	0.001	8.3	9	280
5/22/92	416,900	---	7.7	<0.5	283
5/29/92	---	0.008	8.5	5	220
6/5/92	412,210	---	---	---	---
6/10/92	---	0.017	8.0	<1	310
6/11/92	411,500	---	---	---	---
6/16/92	408,300	---	---	---	---
6/18/92	---	0.008	8.2	4	300
6/18/92	421,940	---	---	---	---
6/25/92	472,000	---	---	---	---
7/2/92	470,200	<0.005	8.3	5	332
7/8/92	---	0.044	7.7	3	480
7/9/92	432,000	---	7.8	---	---
7/15/92	194,500	0.023	7.6	10	150
7/30/92	354,500	0.004	---	1	310
7/31/92	---	---	7.8	---	---
8/11/92	375,900	0.011	7.6	<1	200
8/18/92	425,100	0.094	7.9	4	296
8/26/92	327,500	0.009	8.2	<1	280
9/4/92	415,900	0.012	---	3	291
9/9/92	382,300	0.018	8	2	340
9/18/92	323,100	---	---	---	---
9/24/92	311,300	0.011	8	5	290
10/1/92	---	0.007	8.1	<1	270
10/6/92	378,900	---	---	---	---
10/7/92	---	0.008	---	4	334
10/14/92	347,800	0.004	7.6	1	260

Table 2. Summary of SPDES Sampling Results (Pond Effluent) Provided by Syracuse China. Pfaltzgraff Co., Syracuse China Landfill; Town of Salina, New York

Sample Date	Flow (GPD)	Lead (mg/ℓ)	pH	TSS (mg/ℓ)	TDS (mg/ℓ)
SPDES Permit Limits Effective 9/1/85	No Limit	0.2	6.0-9.0	30	600
10/15/92	---	---	7.6	---	---
10/21/92	395,000	0.007	8	4	200
10/29/92	362,000	0.010	7.9	7	250
11/5/92	---	0.011		2	316
11/6/92	371,000	---	7.8	---	---
11/10/92	---	0.004	---	4	200
11/11/92	382,400		7.8	---	---
11/19/92	---	0.008	---	2	570
11/20/92	---	---	7.8	---	---
11/24/92	---	0.007	8.1	<1	380
11/25/92	402,100	---	7.6	---	---
12/1/92	427,300	0.007	8.1	3	320
12/15/92	370,200	0.008	8.02	2	288
1/5/93	462,500	0.026	7.8	12	320
1/13/93	417,400	---	---	---	---
1/19/93	381,500	0.010	7.5	<1	360
1/27/93	414,700	---	---	---	---
2/2/93	371,200	0.011	7.9	3	290
2/9/93	380,400	---	---	---	---
3/4/93	421,700	0.001	7.6	3	320
3/23/93	444,800	0.006	7.9	27	370
4/1/93	394,300	0.018	7.8	7	340
4/6/93	394,300	0.003	7.7	5	470
4/14/93	468,100	0.005	8	4	460
5/5/93	492,900	0.032	8.1	7	320
5/12/93	415,400	0.005	8.3	<1	290
5/25/93	387,280	0.012	7.9	5	290
6/8/93	387,200	0.007	8.1	8	180
6/22/93	467,600	0.004	8	1	260
7/7/93	430,300	<0.015	7.9	3	200
7/28/93	389,600	0.004	8.2	1	220
8/19/93	505,000	<0.003	8	<1	250
9/2/93	---	0.010	7.8	2	290
9/21/93	408,900	0.007	7.7	<1	260
10/5/93	445,300	0.011	7.8	3	260
10/20/93	---	0.007	8.1	2	250
11/16/93	435,800	0.018	7.3	4	240
12/16/93	419,608	---	---	---	---
12/21/93	---	0.007	7.9	<1	300
1/13/94	398,500	0.010	7.71	8.0	207
2/17/94	462,400	0.016	7.77	4.0	262
3/24/94	515,314	0.005	7.68	5.3	542
3/31/94	385,812	0.006	7.69	4.3	479
4/22/94	417,400	0.016	7.96	5.3	414
4/28/94	386,300	0.007	8.1	8.0	328
5/12/94	378,500	0.008	8.15	10.5	360
5/26/94	371,100	<0.1	7.91	7.0	263
6/1/94	403,500	<0.1	7.98	9.0	237
6/15/94	444,200	0.006	8.1	3.5	229

Table 2. Summary of SPDES Sampling Results (Pond Effluent) Provided by Syracuse China. Pfaltzgraff Co., Syracuse China Landfill; Town of Salina, New York

Sample Date	Flow (GPD)	Lead (mg/ℓ)	pH	TSS (mg/ℓ)	TDS (mg/ℓ)
SPDES Permit Limits Effective 9/1/85	No Limit	0.2	6.0-9.0	30	600
6/21/94	415,500	0.005	7.5	3.5	258
7/14/94	489,000	0.008	7.82	<1	276
8/9/94	423,700	0.057	7.87	3.5	260
8/17/94	400,500	---	---	---	---
9/15/94	392,000	0.002	7.88	2.5	262
9/28/94	376,400	0.020	7.62	2.5	206
10/11/94	396,400	<0.1	7.81	6.0	226
10/18/94	---	<0.1	7.68	<1	279
11/9/94	463,023	0.008	7.53	1.3	281
11/29/94	408,314	0.012	7.97	5.3	280
1/95	392,862	0.008	8.0	5.1	514
2/95	388,460	0.007	8.2	6.8	357
3/95	408,006	0.007	7.8	3	347
4/95	424,841	0.007	7.8	6	288
5/95	415,800	0.008	7.6	<1	258
6/95	394,824	0.003	7.8	3	266
7/95	381,200	0.002	8.0	2.67	293
8/95	405,900	0.029	8.0	3.3	257
9/95	396,200	0.010	7.9	2	248
10/95	374,100	0.035	8.0	<1	226
11/95	428,300	0.010	7.9	1.5	338
12/95	399,700	0.019	7.9	1.75	410
01/96	580,400	0.011	7.6	8	796
02/96	398,400	0.078	7.8	2	530
03/96	405,558	0.011	7.8	4	460
04/96	423,400	0.032	7.8	8	290
05/96	387,458	0.005	7.8	1	440
06/96	432,800	0.005	8	<1	340
07/96	387,300	0.009	7.7	3	210
08/96	393,100	0.015	7.6	5	210
09/96	398,400	0.018	7.8	4	220
10/96	410,200	0.015	7.6	2	250
11/96	392,300	0.011	7.7	2	400
12/96	302,100	0.017	7.6	1	460
01/97	389,800	0.015	7.2	<1	560
02/97	377,200	0.011	7.4	2	310
03/97	390,000	0.01	7.3	3	350
04/97	402,600	0.024	7.4	4	290
05/97	399,800	0.035	7.6	7	270
06/97	374,900	0.011	7.6	5	290
07/97	308,200	0.006	7.4	2	250
08/97	384,700	0.021	7.6	5	250
09/97	400,100	0.012	7.6	3	170
10/97	398,400	0.018	7.5	4	220
11/97	378,600	0.01	7.6	7	360
12/97	388,800	0.017	7.5	2	240
01/98	390,000	0.014	7.7	3	420
02/98	403,200	0.016	7.8	5	270
03/98	396,700	0.01	7.6	<1	400

Table 2. Summary of SPDES Sampling Results (Pond Effluent) Provided by Syracuse China. Pfaltzgraff Co., Syracuse China Landfill; Town of Salina, New York

Sample Date	Flow (GPD)	Lead (mg/ℓ)	pH	TSS (mg/ℓ)	TDS (mg/ℓ)
SPDES Permit Limits Effective 9/1/85	No Limit	0.2	6.0-9.0	30	600
04/98	363,400	0.014	7.5	3	340
05/98	352,100	0.011	7.4	3	180
06/98	399,400	0.011	7.6	4	230
07/98	402,300	0.025	7.6	4	230
08/98	401,100	0.017	7.5	6	240
09/98	379,400	0.009	7.4	4	220
10/98	399,100	0.003	7.1	6	250
11/98	401,200	0.016	7	7	170
12/98	389,000	0.033	6.9	5	270
01/99	400,000	0.011	6.5	3	630
02/99	348,000	0.011	7.5	12	340
03/99	402,500	0.008	7.6	3	580
SPDES Permit Limits Effective 4/1/99	No Limit	0.07	6.5-8.5	20	600
04/99	436,845	0.016	7.3	7	370
05/99	412,301	0.012	7.2	6	280
06/99	494,389	0.026	7.5	4	230
07/99	404,654	0.026	7.8	4	300
08/99	356,511	0.011	7.6	4	250
09/99	358,530	0.015	6.9	7	220
10/99	380,269	0.011	7.1	6	240
11/99	420,700	0.054	7.4	5	240
12/99	437,072	0.021	7.4	9	280

GPD = Gallons per day.
mg/ℓ = Milligrams per liter.
pH is given in standard units.
TSS = Total suspended solids.
TDS = Total dissolved solids.
--- = Parameter not tested.

Table 3. Calculation of Final Concentrations for Pond Effluent. Pfaltzgraff Co., Syracuse China Landfill; Salina, New York.

Case 1 Base Facility Flow, 10-Year Storm		Case 2 Base Facility Flow, 1-Year Storm, Facility Upset (Production Upset)	
Base Plant Flow (gpm)	264	Base Plant Flow (gpm)	264
Base Plant Flow TSS Concentration (mg/ℓ)	7	Base Plant Flow TSS Concentration (mg/ℓ)	7
Non-Settable Percentage TSS	55	Non-Settable Percentage TSS	55
TSS Concentration After Pond Settling	3.9	TSS Concentration After Pond Settling	3.9
10-Year Storm Flow (gpm)	7,179	1-Year Storm Flow (gpm)	4,450
10-Year Storm Flow TSS Concentration (mg/ℓ)	45	1-Year Storm Flow TSS Concentration (mg/ℓ)	45
Non-Settable Percentage TSS	25	Non-Settable Percentage TSS	25
TSS Concentration After Pond Settling	11	TSS Concentration After Pond Settling	11
		Plant Upset Flow (gpm) for 1.25 Hours	25
		Plant Upset Flow TSS Concentration (mg/ℓ)	407,810
		Non-Settable Percentage TSS	55
		TSS Concentration After Pond Settling	224,296
Concentration of Flow Exiting Ponds (mg/ℓ) when Base and 10-Year Flows Contribute (Mass Balance of 2 Flows)	11	Concentration of Flow Exiting Ponds (mg/ℓ) when Base, 1-Year and Plant Upset Flows all Contribute (First 1.25 Hours) *(Mass Balance of 3 Flows)*	1,194
		Concentration of Flow Exiting Ponds (mg/ℓ) when Base and 1-Year Flows all Contribute (Final 4.75 Hours) (Mass Balance of 2 Flows)	11
6-Hour Composite Concentration (mg/ℓ) (Base and 10-Year Storm Flow Contribute entire 6 Hours)	11	6-Hour Composite Concentration (mg/ℓ) (Upset Flow Only Contributes for 1.25 Hours, the 1-Year and Base Flow Contribute for the Remaining 4.75 Hours)	257
SPDES TSS Limit	20	SPDES TSS Limit	20

1-year storm flow extrapolated from existing storm flow data (Appendix C).
10-year storm flow taken from existing storm flow data (Appendix C).
Storm flow TSS concentration taken from 5/31/98 storm (minus the average plant flow TSS) (see Table 1).
Non-settable percentage of TSS in stormwater estimated based on typical storm water particle size distributions.
Upset flow and time based on information provided by Syracuse China in 3/00.
Upset flow TSS concentrations taken from samples collected by Syracuse China in 3/00.

Table 4. List of Structures and Equipment for New Wastewater Settling Ponds. Pfaltzgraff Co., Syracuse China Landfill; Town of Salina, New York

Quantity (approximate)	Unit	Equipment or Structure	Size
360	feet	High density polyethylene (HDPE) SDR 32.5 pipe	36-inch diameter
3	ponds	Wastewater settling ponds (includes fill materials, geotextiles, geosynthetic clay liner and rip rap)	417,000 gallons (approximate) each 1.25 million gallons total
450	feet	High density polyethylene (HDPE) pressure pipe	24-inch diameter
5	headwalls	Concrete headwalls	headwall for 24-inch pipe
3	weirs	Concrete overflow weirs	65 feet long
3	baffles	Floating baffles	65 feet long
3	spillways	Emergency spillways (includes geotextile and riprap)	15 feet wide, 6 inches deep
2	swales	Swales to carry water from emergency spillways and Pond 3 outlet to SPDES outfall	2 feet deep at center and 8 feet wide at top (approximate)

Table 5. Calculation of Smallest Particle which can Settle 100%. Pfaltzgraff Co.; Syracuse China Landfill, Town of Salina, New York.

	Units	Formula	
Length of Settling Basin (L)	feet	given	315
Width of Settling Basin (W)	feet	given	60
Depth of Settling Basin (average) (H)	feet	given	6.50
Flow into Settling Basin (Q)	cfs	given	10.5
Horizontal Velocity of Particles (V_h)	fps	$V_h=Q/(H*W)$	0.0269
Detention Time (t)	*seconds*	$t=L/V_h$	*11,700*
Settling Velocity (V_O)	fps	$V_O=H/t$	0.00056

Length of settling basin taken from Roux Associates, Inc. Drawing no. 57701034- the particle flow path through the basin.

Width of settling basin taken from Roux Associates, Inc. Drawing no. 57701034- the dimension perpendicular to the particle flow path through the basin.

Depth of settling basin taken from Roux Associates, Inc. Drawing no. 57701034.

The flow into the settling basin is the 1-year storm flow plus the average daily facility flow. 1-year storm flow taken from "Daily Precipitation vs. Maximum Flow Data" graph is included in Appendix C. The 1-year, 24-hour rainfall for Syracuse extrapolated from a graph based on data in TR-55 Manual- Urban Hydrology for Small Watersheds. The maximum daily facility flow taken from data obtained from Syracuse China.

cfs = Cubic feet per second.

fps = Feet per second.

Assumptions:

1. Ideal rectangular settling basin.
2. Settling of discrete particles occurs.
3. Even distribution of flow entering and leaving basin.
4. Settling basin zones consist of entrance, outlet and sludge zones.
5. Uniform distribution of particles throughout the depth of entrance zone.
6. Particles that enter sludge zone remain there and particles that enter outlet zone are removed.

Reference: Unit Operations and Processes in Environmental Engineering, Tom D. Reynolds, 1982 (included in Appendix H.).

Table 6. Weir Loading Rate Calculation. The Pfaltzgraff Co., Syracuse China Landfill; Salina, New York.

Weir Calculation				
Name	**Variable**	**Unit**	**Equation**	**Facility Flow**
Facility Flow	Q	gpd	Given	468,000
Weir Length	L	feet	Given	65
Weir Loading Rate	W	gpd/foot	Q / L	7,200

65 feet of weir (width of pond) is adequate for normal facility flow. Recommended weir loading is 15,000-20,000 gpd/foot.

Table 7. Emergency Spillway Flow Capacity Calculation. The Pfaltzgraff Co, Syracuse China Landfill; Salina, New York.

Emergency Spillway Calculation				
Name	Variable	Unit	Formula	Result 6-inch deep 15 feet wide weir
Height of Water Flowing Over Wier	H	feet	Given	0.5
Height of Weir	Y	feet	Given	0.5
Rehbock Coefficient	C_1	-	$C_1=[0.6035+0.08138(H/Y)+(0.000295/Y)]*[1+(0.00361/H)]^{3/2}$	0.686
Width of Weir	b	feet	Given	15
Acceleration of Gravity	g	feet/sec^2	Constant	32.2
Flow Over the Weir	Q_{cfs}	cfs	$Q=(2/3)*C1*b*(2g)^{1/2}*(H)^{3/2}$	19
Flow Over the Weir	Q_{gpm}	gpm	$Q_{gpm}=Q_{cfs}*448.831$	8,734

The spillway must be able to pass the 25-year storm flow which is 8,680 gpm, so the spillway size is adequate.

feet/sec^2 = feet per second squared.
cfs = cubic feet per second.
gpm = gallons per minute.
Spillway equations from the *Civil Engineering Reference Manual, Sixth Edition*, Michael Lindeburg, P.E., 1997, pages 5-7 and 5-8.

Table 8. Pipe Flow and Friction Loss Calculations. The Pfaltzgraff Co, Syracuse China Landfill; Salina, New York.

Pipe Flow Calculation

Name	Variable	Unit	Formula	Result (24-inch)	Result (18-inch)	Result (19-inch)
Inside Diameter of the Pipe	D	feet	Given	2	1.5	1.583
Hazen Williams Coefficient	C_1	-	Reference 1, page 21-24	130	130	130
Slope of the Pipe	S	ft/ft	Given (Pond Grading Plan)	0.016	0.016	0.016
Flow	Q	cfs	$Q=0.432*C_1*D^{2.63}*S^{0.54}$	36.796	17.267	19.894
Flow	Q	gpm	$Q_{gpm}=Q_{cfs}*448.831$	16,515	7,750	8,929

The pipe must be able to pass the 25-year storm flow which is 8,680 gpm.
A 19-inch inside diameter pipe is needed to pass the 25-year storm. A 24-inch (inside diameter) pipe is proposed to be conservative.

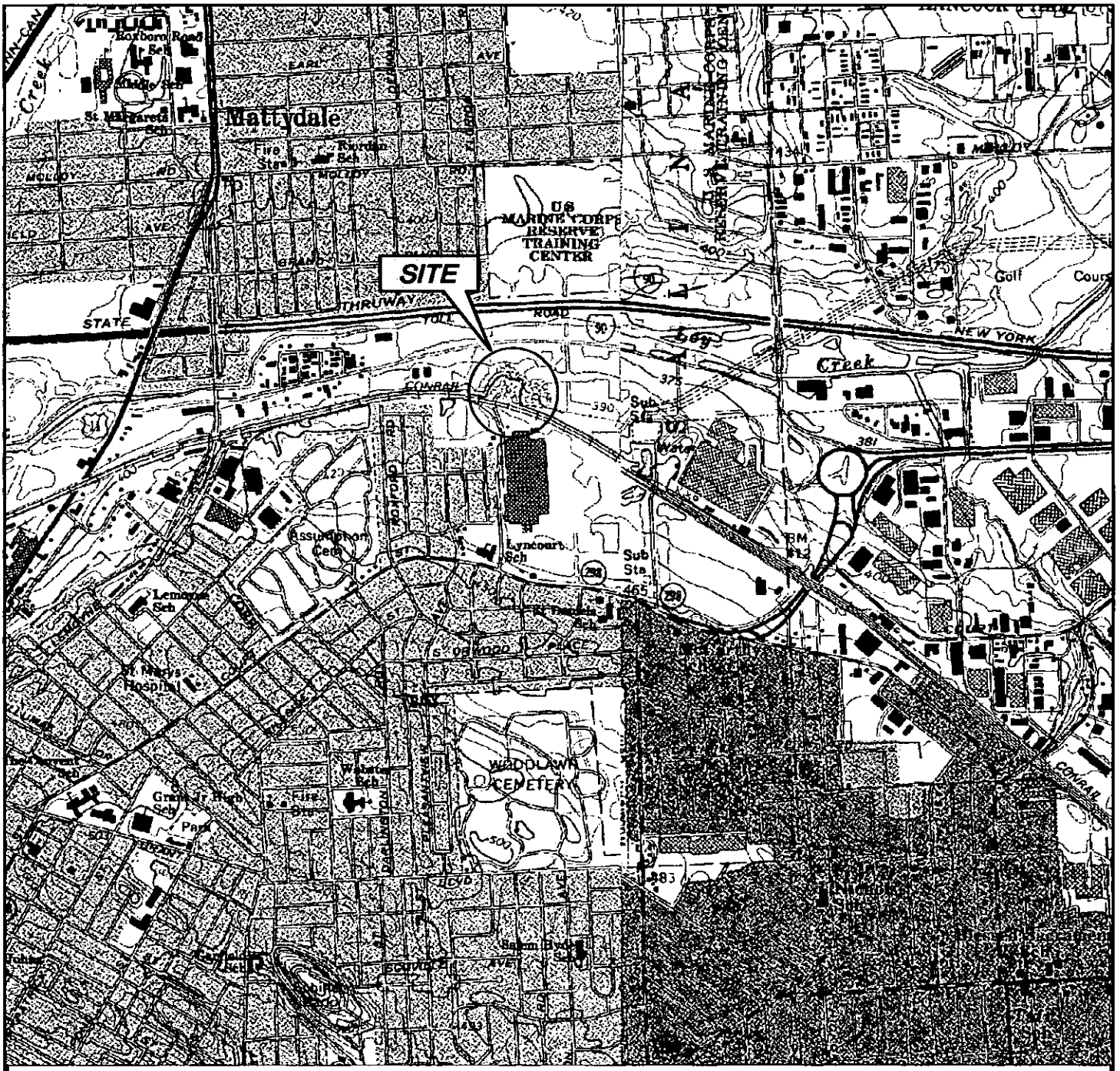
Friction Loss Calculation

Name	Variable	Unit	Formula	Result (24-inch)
Length of Pipe	L	feet	Given (Pond Grading Plan)	32
Flow	Q	cfs	Given (25-Year Storm)	19
Hazen Williams Coefficient	C	-	Reference 1, page 21-24	130
Inside Diameter of the Pipe	D	feet	Given (pipe sizing calculation)	1.686
Head Loss Due to Friction	h_f	feet	$h_f=(4/727/D^{4.87})*(L)*(Q/C_1)$	0.35

sf = square feet.
ft/ft = foot per foot.
cfs - cubic feet per second.
gpm = gallons per minute
The equations for pipe flow and friction loss (Hazen Williams) is taken from the Civil Engineering Handbook, page 21-24.

FIGURES

FIGURES



SOURCE

U.S.G.S. SYRCAUSE EAST AND WEST, NEW YORK QUADRANGLES
7.5 MINUTES SERIES (TOPOGRAPHIC)

Title:

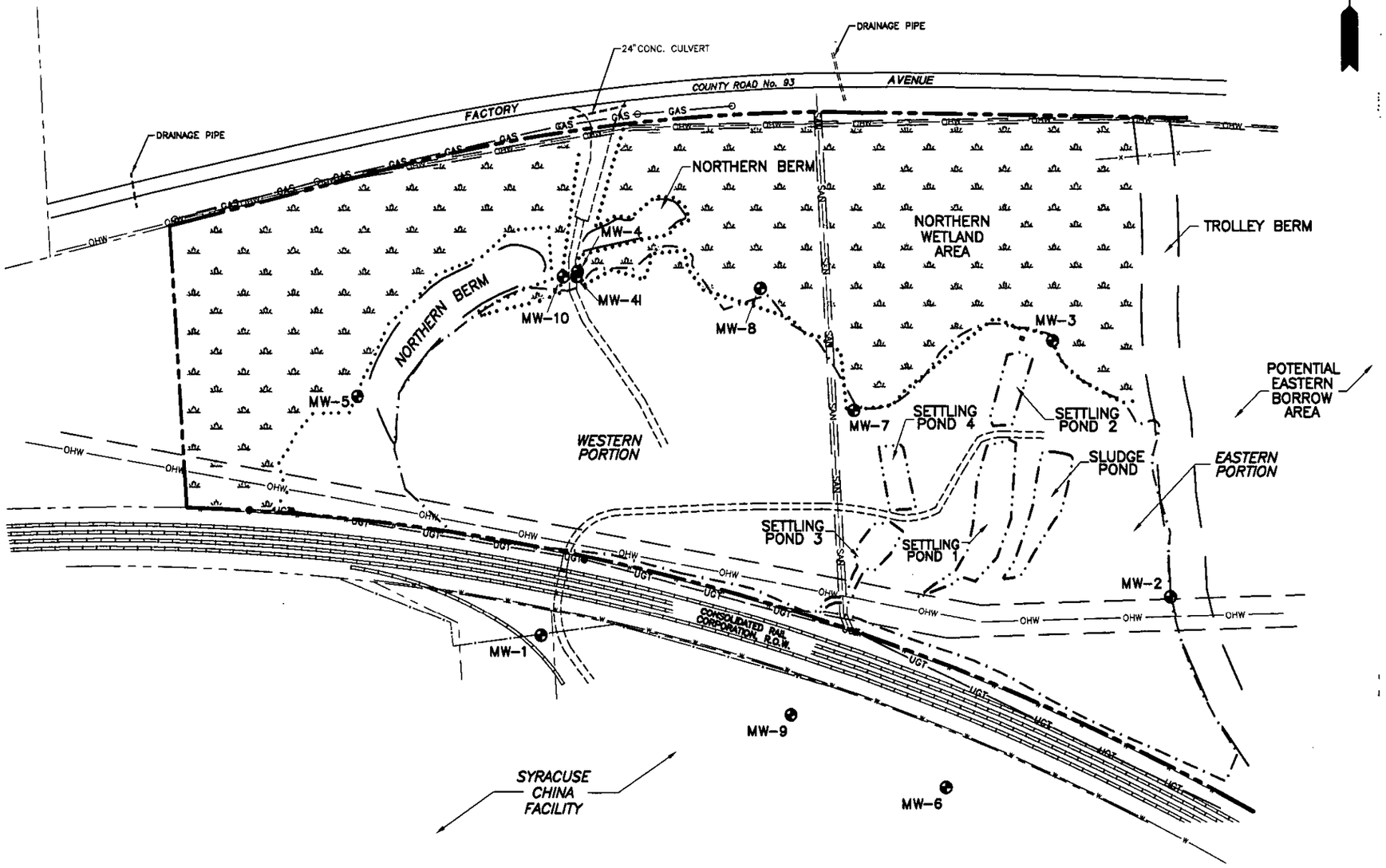
SITE LOCATION MAP

SYRACUSE CHINA LANDFILL
TOWN OF SALINA, ONONDAGA COUNTY, NEW YORK

Prepared For:

PFALTZGRAFF CO.

REMEDIAL ENGINEERING, P.C. *ENVIRONMENTAL ENGINEERS*	Compiled by: MMH	Date: 08/23/00	FIGURE 1
	Prepared by: JSG	Scale: AS SHOWN	
	Project Mgr: PC	Office: NJ	
	File No: 57701070	Project: 57701E	



LEGEND

- PROPERTY LINE
- EXISTING LANDFILL LIMIT
- EDGE OF POND
- WETLAND BOUNDARY
- EASEMENT
- WETLANDS
- EXISTING ACCESS ROAD
- BERM LIMIT
- FENCE
- RAILROAD TRACKS
- APPROXIMATE WATERLINE LOCATION
- OVERHEAD ELECTRICAL TRANSMISSION WIRES
- SUBSURFACE SANITARY SEWER
- MARKED GAS LINE LOCATION
- MARKED UNDERGROUND TELEPHONE LINE (FIBER OPTIC) LOCATION
- MW-3 GROUND-WATER MONITORING WELL LOCATION AND DESIGNATION

NOTES

1. BASE MAP INFORMATION BASED ON PLAN ENTITLED:, "MAP OF PARTIAL BOUNDARY & TOPOGRAPHIC SURVEY", PARCEL OF LAND, PART OF MILITARY LOT 19, TOWN OF SALINA, JANUARY 20, 1998, SCALE 1=50', PROJECT 90006, PREPARED BY RYAN SURVEY, PORTER BUILDING, NORTHERN LIGHTS OFFICE PARK, SYRACUSE, NY 13220-3225.
2. WETLAND BOUNDARIES LOCATED AS FLAGGED BY TERRESTRIAL ENVIRONMENTAL SPECIALISTS, INC. (DECEMBER, 1990) REGULATED WETLANDS EXIST NORTH OF DELINEATION LINE.
3. SUBSURFACE SANITARY SEWER IS DIVIDING LINE BETWEEN EASTERN AND WESTERN PORTIONS OF LANDFILL.

200' 0' 200'

Title:

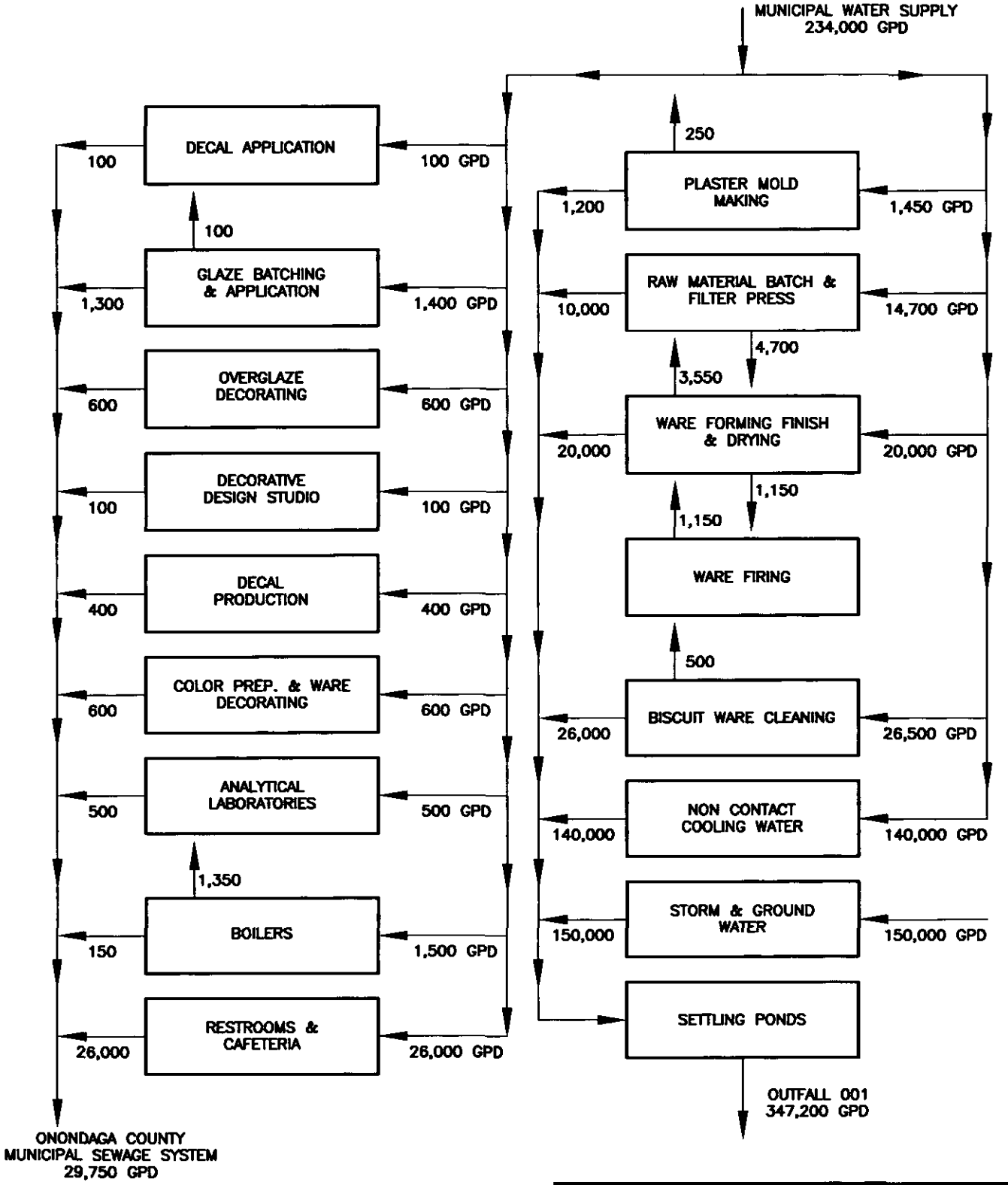
SITE PLAN

SYRACUSE CHINA LANDFILL
TOWN OF SALINA, ONONDAGA COUNTY, NEW YORK

Prepared For:

PFALTZGRAFF CO.

REMEDIAL ENGINEERING, P.C. *ENVIRONMENTAL ENGINEERS*	Compiled by: M.M.H.	Date: 06/22/00	FIGURE 2
	Prepared by: J.S.G.	Scale: AS SHOWN	
	Project Mgr: P.G.	Office: NJ	
	File No: 57701009	Project: 57701E	



NOTES

1.) TAKEN FROM C&H ENGINEERS, MAY 1997

2.) ALL FLOWS ARE APPROXIMATE

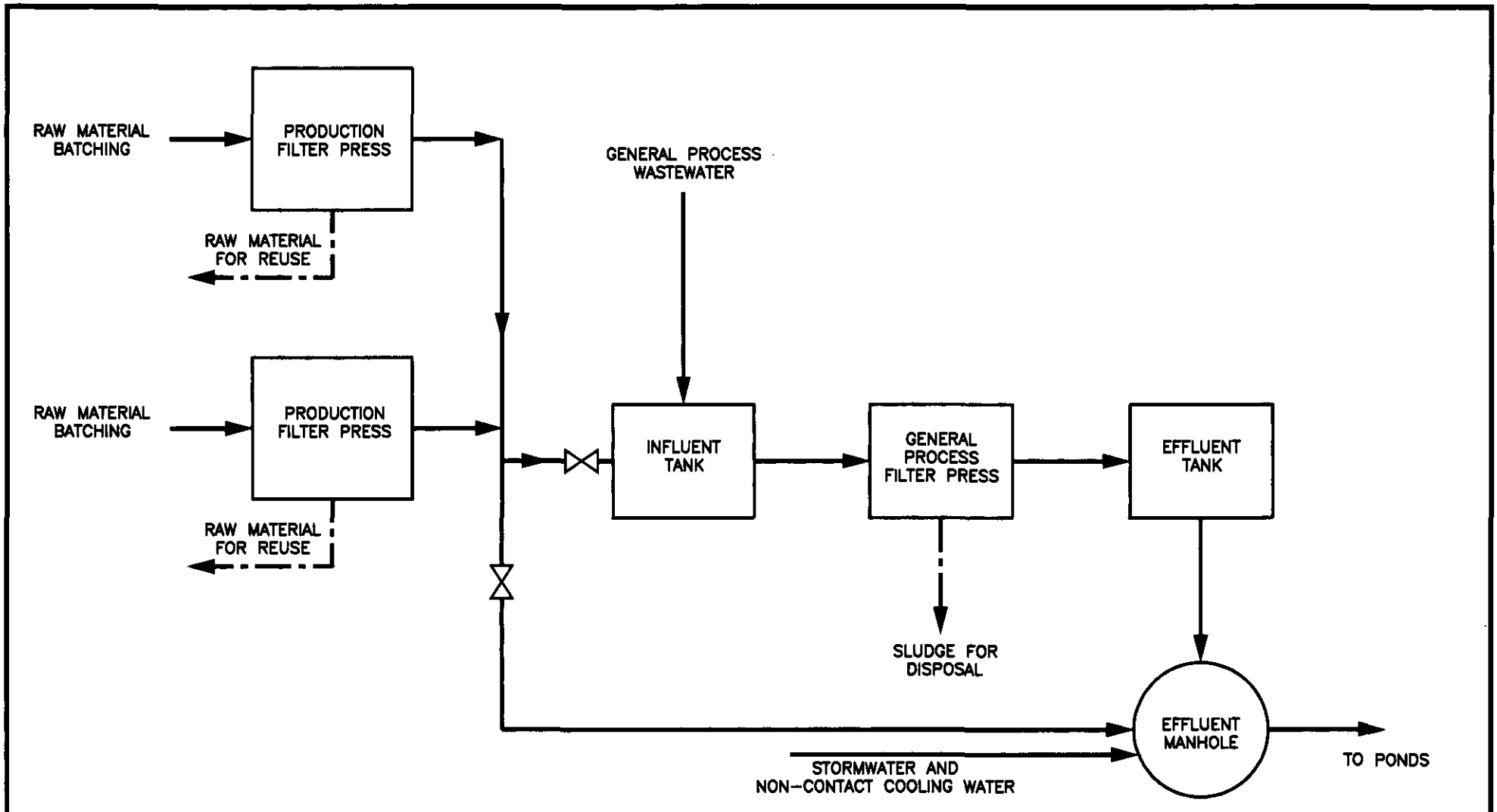
Title:

SYRACUSE CHINA
WATER FLOW SCHEMATIC

SYRACUSE CHINA LANDFILL
TWON OF SALINA, ONONDAGA COUNTY, NEW YORK

Prepared For:
PFALTZGRAFF CO.

REMEDIAL ENGINEERING, P.C. *ENVIRONMENTAL ENGINEERS*	Compiled by: M.H.	Date: 05/22/00	FIGURE 3
	Prepared by: A.T.S.	Scale: N/A	
	Project Mgr: P.G.	Office: NY	
	File No: 57701074	Project: 57701E	



LEGEND

PRIMARY PROCESS FLOW

SLUDGE FLOW

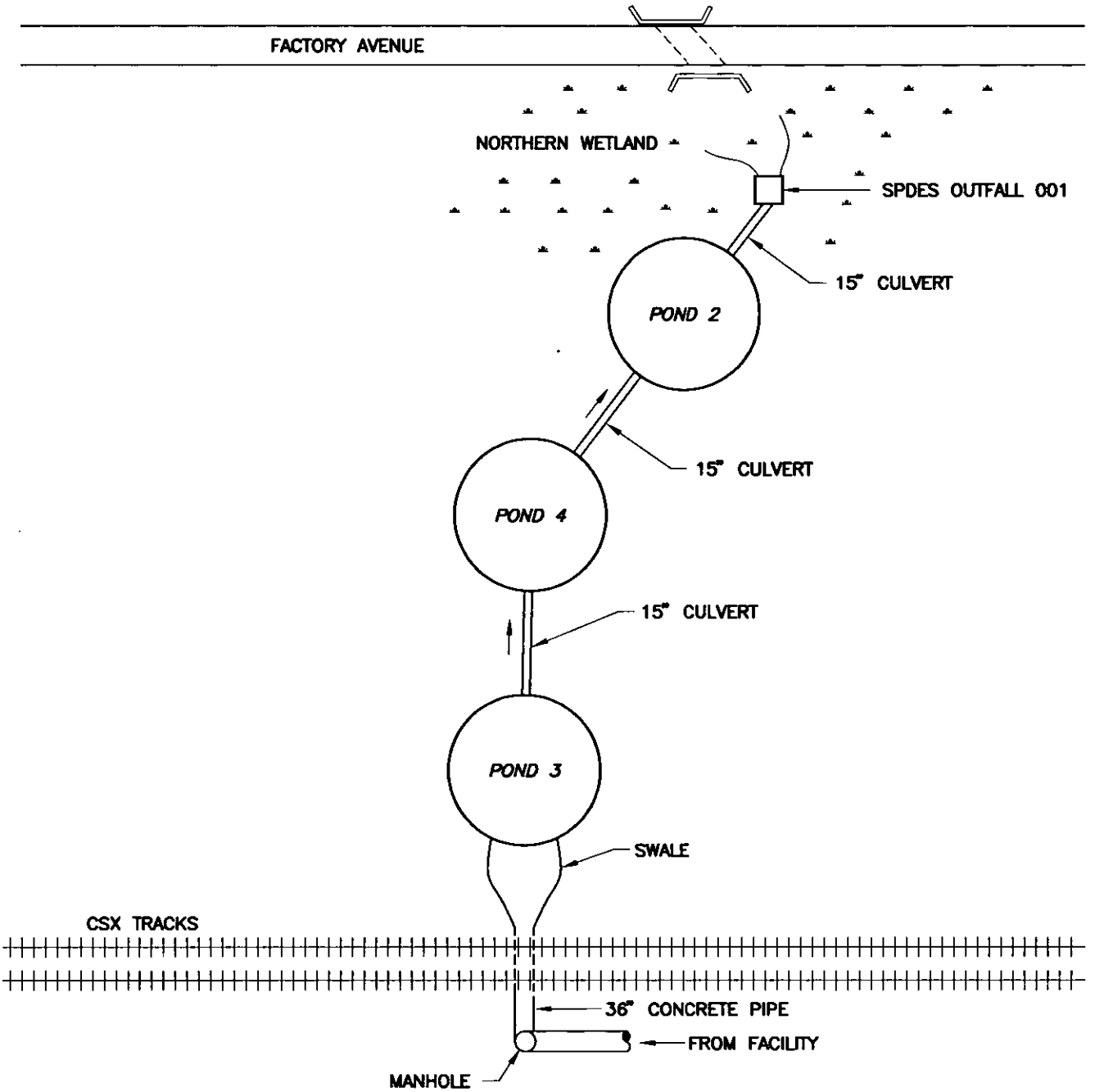
Title:

SOURCES OF WASTEWATER FLOW TO PONDS

SYRACUSE CHINA LANDFILL
TOWN OF SALINA, ONONDAGA, NEW YORK

Prepared For: PZALTZGRAFF CO.

REMEDIAL ENGINEERING, P.C. *ENVIRONMENTAL ENGINEERS*	Compiled by: M.M.H.	Date: 06/22/00	FIGURE 4
	Prepared by: A.T.S.	Scale: NONE	
	Project Mgr: P.G.	Office: NY	
	File No: 57701071	Project: 57701E	



Title:

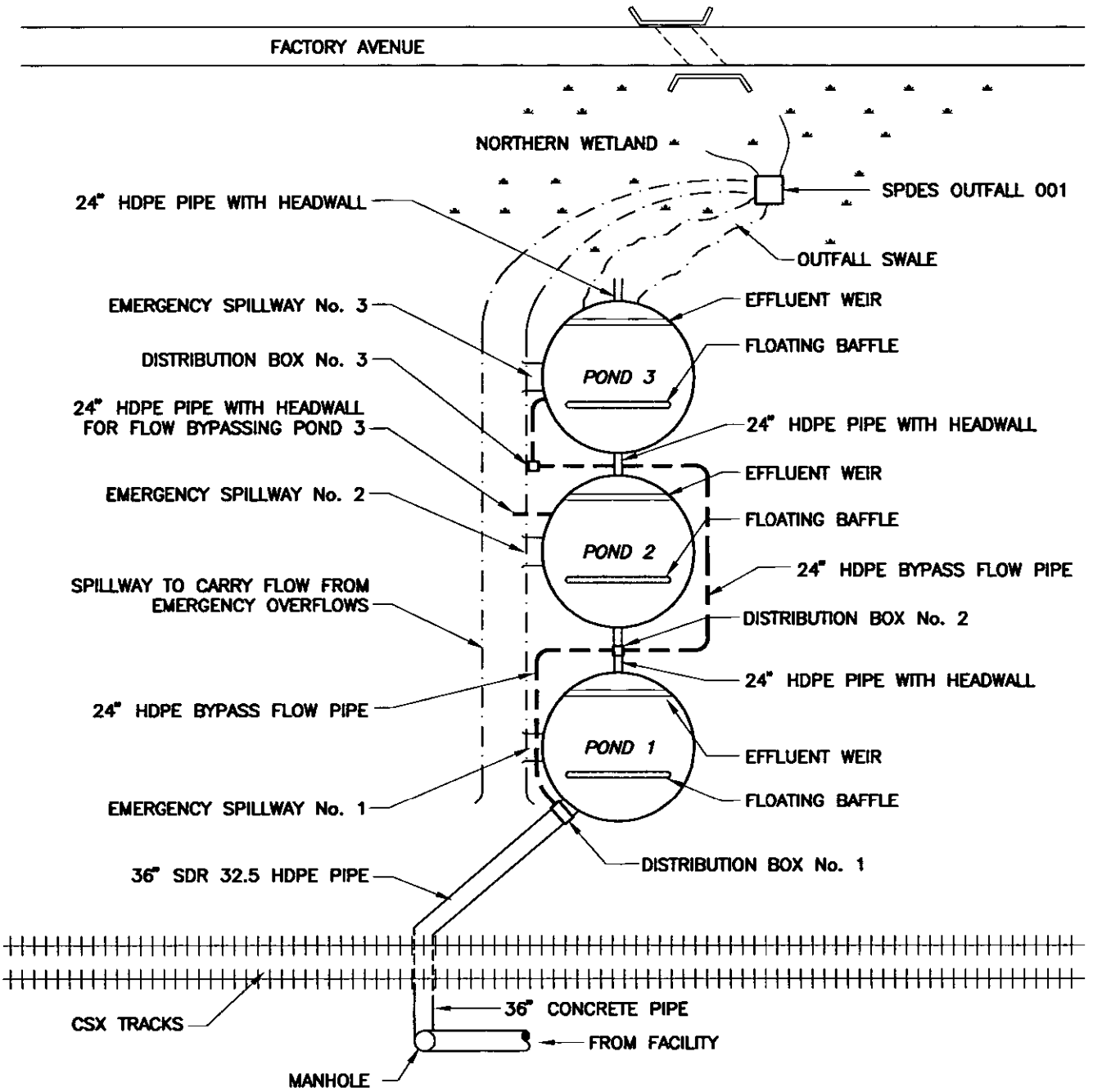
EXISTING WASTEWATER FLOW DIAGRAM

SYRACUSE CHINA LANDFILL
TOWN OF SALINA, ONONDAGA COUNTY, NEW YORK

Prepared For:

PFALTZGRAFF CO.

REMEDIAL ENGINEERING, P.C. *ENVIRONMENTAL ENGINEERS*	Compiled by: M.M.H.	Date: 06/22/00	FIGURE 5
	Prepared by: J.R.M.	Scale: NONE	
	Project Mgr: P.G.	Office: NY	
	File No: 57701068	Project: 57701E	



Title:

PROPOSED WASTEWATER FLOW DIAGRAM

SYRACUSE CHINA LANDFILL
TOWN OF SALINA, ONONDAGA COUNTY, NEW YORK

Prepared For:

PFALTZGRAFF CO.

REMEDIAL ENGINEERING, P.C. *ENVIRONMENTAL ENGINEERS*	Compiled by: M.M.H.	Date: 06/22/00	FIGURE 6
	Prepared by: J.R.M.	Scale: NONE	
	Project Mgr: P.G.	Office: NJ	
	File No: 57701069	Project: 57701E	

APPENDIX A

LETTER OF ENDORSEMENT FROM SYRACUSE CHINA

Libbey®

Robert D. St. John, CIH, CHMM
Manager – Environment, Health and Safety

July 20, 2000

Mr. Shayne A. Mitchell
Environmental Engineer
NYSDEC
Division of Water
Bureau of Water Permits, Room 314
50 Wolf Road
Albany, New York 11788

Re: **Remedial Engineering P.C.**
Engineering Report for Wastewater Settling Ponds

Dear Mr. Mitchell:

Syracuse China Company, a Unit of Libbey Inc. has reviewed the submittal "Engineering Report for Wastewater Settling Ponds" prepared by Remedial Engineering, P.C., and endorses the design concept. The report details the proposed upgrading/reconstruction of Syracuse China's existing wastewater settling ponds (SPDES Permit Number NY0100137) as part of the remedial action at the Syracuse China Landfill Inactive Hazardous Waste Disposal Site (Site No. 7-34-053). The report describes the construction of three lined settling ponds, with a total capacity of approximately 1.25 million gallons. Please note that the detailed design drawings present the proposed design concept, however, Syracuse China Company reserves the right, with NYSDEC approval, to modify the details of pond construction as site conditions allow.

If you require additional information, please call me at (419) 727-2493.

Very truly yours,

Robert D. St. John CIH, CHMM
Manager – Environment, Occupational Safety and Health

Post Office 919 Toledo Ohio 43697-0919 Phone 419 727-2493 FAX 419 727-2306 Internet Address stjohrd@libbey.com

APPENDIX B

SPDES PERMIT

New York State Department of Environmental Conservation
Division of Environmental Permits, Region 7
615 Erie Boulevard West, Syracuse, New York 13204-2400
Phone: (315) 426-7438 FAX: (315) 426-7425

John P. Cahill
Commissioner

April 1, 1999

Philip Harvard Env. Manager
Syracuse China Company
P.O. Box 4820
Syracuse, NY 13221-4820

RE: State Pollutant Discharge Elimination System (SPDES) NY 0100137
DEC #7-3115-00160/00011

Dear Mr. Harvard:

Enclosed please find your permit with the effective date changed to April 1, 1999.

Included is a SPDES Permit fact sheet.

Unless otherwise specified this permit will become effective immediately unless you petition, pursuant to ECL Section 17-0907, that you be given an opportunity to be heard in connection with this determination and where applicable.

Should you have any questions feel free to call.

Sincerely,

Robert A. Torba
Deputy Permit Administrator

RAT/eab
Harvard

cc: Robert Hannaford, Albany
Steve Eidt, Region 7
Shayne Mitchell, Albany

91-20-2 (1/89)

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

State Pollutant Discharge Elimination System (SPDES)

DISCHARGE PERMIT

Special Conditions (Part I)

Industrial Code: 3262
Discharge Class (CL): 01
Toxic Class (TX): T
Major Drainage Basin: 07
Sub Drainage Basin: 02
Water Index Number: O-66-12-P154-3
Compact Area:

SPDES Number: NY-0100137
DEC Number: 7-3115-160/1-0
Effective Date (EDP): 4/01/99
Expiration Date (ExDP): 4/01/2004
Modification Date(s):
Attachment(s): General Conditions (Part II) Date: 11/90

This SPDES permit is issued in compliance with Title 8 of Article 17 of the Environmental Conservation Law of New York State and in compliance with the Clean Water Act as amended, (33 U.S.C. Section 1251 et. seq.) (hereafter referred to as "the Act").

PERMITTEE NAME AND ADDRESS Attention: Vice President of Mfg.

Name: Syracuse China Company
Street: PO Box 4820
City: Syracuse State: NY Zip Code: 13221-4820
is authorized to discharge from the facility described below:

FACILITY NAME AND ADDRESS

Name: Syracuse China Company
Location (C,T,V): Syracuse (C) County: Onondaga
Facility Address: 2900 Court Street
City: Syracuse State: NY Zip Code: 13221
NYTM - E: NYTM - N: 4
From Outfall No.: 001 at Latitude: 43° 05′ 33″ & Longitude: 76° 07′ 49″
into receiving waters known as: Ley Creek Class: B
and; (list other Outfalls, Receiving Waters & Water Classifications)
002 - Ley Creek, Class: B

in accordance with the effluent limitations, monitoring requirements and other conditions set forth in Special Conditions (Part I) and General Conditions (Part II) of this permit.

DISCHARGE MONITORING REPORT (DMR) MAILING ADDRESS

Mailing Name: Syracuse China Company
Street: P.O. Box 4820
City: Syracuse State: NY Zip Code: 13221-4820
Responsible Official or Agent: Philip Harvard, Env. Manager Phone: (315)455-6763

This permit and the authorization to discharge shall expire on midnight of the expiration date shown and the permittee shall not discharge after the expiration date unless this permit has been renewed, or extended pursuant to law. To be authorized to discharge beyond the expiration date, the permittee shall apply for a permit renewal no less than 180 days prior to the expiration date shown above.

DISTRIBUTION:

Permit Administrator: Robert A. Torba	
Address: 615 Erie Blvd. W., Syracuse, NY 13204	
Signature: Robert A. Torba	Date: 4/01/99

Received Time Apr. 12. 10:38AM Print Time Apr. 12. 10:45AM

PERMIT LIMITS, LEVELS AND MONITORING DEFINITIONS

OUTFALL	WASTEWATER TYPE	RECEIVING WATER	EFFECTIVE	EXPIRING
	This cell describes the type of wastewater authorized for discharge. Examples include process wastewater, storm water, non-contact cooling water.	This cell lists classified waters of the state to which the listed outfall discharges.	The date this page starts in effect.	The date this page is no longer in effect

PARAMETER	MINIMUM	MAXIMUM	UNITS	SAMPLE FREQ.	SAMPLE TYPE
pH	The minimum level that must be maintained at all times.	The maximum level that may not be exceeded at any time.	SU		

PARA-METER	CALCULATED LIMIT	COMPLIANCE LEVEL	ACTION LEVEL	UNITS	MDL AND PQL	SAMPLE FREQUENCY	SAMPLE TYPE
	Daily Avg. and Daily Max. are defined below. The calculated limit is the limit that has been derived based on the assumptions and rules in place at the time the permit is written. Examples of these assumptions include receiving water hardness, pH and temperature; *rates of other discharges to the receiving stream;* conservatism of substances in the environment; etc. If the assumptions or rules change, the calculated limit may, after due process, change. The Calculated Limit is developed without consideration of what level is technologically achievable or what can be quantitated analytically. If a calculated limit is not included in this column, but a compliance level is included in the next column, the calculated limit is the compliance level.	Daily Max. and Daily Avg. are defined below. All determinations of compliance with substance specific discharge limits are made by *comparing monitoring results* to the compliance level. The compliance level is developed considering what can be quantitated analytically or what level is technologically achievable in the permittee's discharge at the time the permit is written.	Type I or Type II Action Levels are monitoring *requirements,* as defined below, that trigger additional monitoring and permit review when exceeded.	This can include units of flow, pH, Temperature, mass or *concentration.* Examples include SU, °F, µg/l, lbs/d, etc.	The method detection limits and practical quantitation limits that the permittee must make all *reasonable efforts* to achieve when measuring the parameter in the wastewater, including using a more sensitive approved analytical procedure.	Examples include Daily, 3/week, weekly, 2/month, monthly, quarterly, 2/yr and yearly.	Examples include grab, 24 hour composite and 3 grab samples collected over a 6 *hour period.*

DAILY DISCHARGE.: The discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for the purposes of sampling. For pollutants *expressed in units of mass, the 'daily discharge' is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the 'daily* discharge' is calculated as the average measurement of the pollutant over the day.

DAILY MAX.: The highest allowable daily discharge.

DAILY AVG.: The highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

ACTION LEVELS: Routine Action Level monitoring results, if not provided for on the Discharge Monitoring Report (DMR) form, shall be appended to the DMR for the period during which the sampling was conducted. If the additional monitoring requirement is triggered as noted below, the permittee shall undertake a short-term, high-intensity monitoring program for the parameter(s). Samples identical to those required for routine monitoring purposes shall be taken on each of at least three consecutive operating and discharging days and analyzed. Results shall be expressed in terms of both concentration and mass, and shall be submitted no later than the end of the third month following the month when the additional monitoring requirement was triggered. Results may be appended to the DMR or transmitted under separate cover to the same address. If levels higher than the Action Levels are confirmed, the permit may be reopened by the Department for consideration of revised Action Levels or effluent limits. The permittee is not authorized to discharge any of the listed parameters at levels which may cause or contribute to a violation of water quality standards.

TYPE I: The additional monitoring requirement is triggered upon receipt by the permittee of any monitoring results in excess of the stated Action Level.

TYPE II: The additional monitoring requirement is triggered upon receipt by the permittee of any monitoring results that show the stated action level exceeded for four of six consecutive samples, or for two of six consecutive samples by 20 % or more, or for any one sample by 50 % or more.

FINAL

PERMIT LIMITS, LEVELS AND MONITORING

OUTFALL NUMBER	WASTEWATER TYPE	RECEIVING WATER	EFFECTIVE	EXPIRING
001	Outfall 01A, noncontact cooling water, storm water runoff and groundwater.	Ley Creek	EDP	EDP + 5 Years

PARAMETER	MINIMUM	MAXIMUM	UNITS	SAMPLE FREQUENCY	SAMPLE TYPE	FOOTNOTES
pH	6.5	8.5	SU	2/Week	Grab	

PARAMETER	CALCULATED LIMIT		ENFORCEABLE COMPLIANCE LEVEL		MONITORING ACTION LEVEL		UNITS	MDL (µg/l)	PQL (µg/l)	SAMPLE FREQUENCY	SAMPLE TYPE
	Daily Avg.	Daily Max.	Daily Avg.	Daily Max.	TYPE I	TYPE II					
Flow			Monitor	Monitor			GPD			Continuous	Recorder
Temperature			Monitor	90			°F			2/Week	Grab
Total Dissolved Solids			Monitor	600			mg/l			Weekly	6 hr. composite
Total Suspended Solids			Monitor	20			mg/l			Weekly	6 hr. composite
BOD5					21		mg/l			Quarterly	6 hr. composite
Oil & Grease			Monitor	15			mg/l			Monthly	Grab
Boron, Total					840		µg/l			Quarterly	6 hr. composite
Lead, Total			Monitor	50			µg/l			2/Month	6 hr. composite

SPECIAL CONDITION:
The permittee must report both the concentration (in mg/l or µg/l) and the mass loading (in lbs/day) on the Discharge Monitoring Reports for all parameters except flow, pH, temperature and set solids. This requirement applies to all outfalls.

DEFINITIONS:
Recorder - A flow measurement system that continuously measures and displays the instantaneous flow rate, and records the cumulative discharge volume versus time on paper and/or electron

Totalizer - A flow measurement system that continuously measures and displays the instantaneous flow rate and the cumulative discharge volume.

FINAL91-20-2aa(3/98)

PERMIT LIMITS, LEVELS AND MONITORING

OUTFALL NUMBER	WASTEWATER TYPE	RECEIVING WATER	EFFECTIVE	EXPIRING
01A	Dinnerware production contact wastewaters - raw material batching, ware forming and firing, ware cleaning and plaster mold making.	Outfall 001	July 1, 1999	EDP + 5 years

PARAMETER	MINIMUM	MAXIMUM	UNITS	SAMPLE FREQUENCY	SAMPLE TYPE	FOOTNOTES (FN)
pH	Monitor	Monitor	SU	Monthly	Grab	

PARAMETER	CALCULATED LIMIT		ENFORCEABLE COMPLIANCE LEVEL		MONITORING ACTION LEVEL		UNITS	MDL (µg/l)	PQL (µg/l)	SAMPLE FREQUENCY	SAMPLE TYPE	FN
	Daily Avg.	Daily Max.	Daily Avg.	Daily Max.	TYPE I	TYPE II						
Flow			Monitor	Monitor			GPD			Weekly	Totalizer	
Total Dissolved Solids			Monitor	Monitor			mg/l			Monthly	Grab	
Total Suspended Solids					40		mg/l			Monthly	Grab	

FINAL

PERMIT LIMITS, LEVELS AND MONITORING

OUTFALL NUMBER	WASTEWATER TYPE	RECEIVING WATER	EFFECTIVE	EXPIRING
01B	Ceramic material preparation contact wastewaters.	Outfall 001	July 1, 1999	EDP + 5 years

PARAMETER	MINIMUM	MAXIMUM	UNITS	SAMPLE FREQUENCY	SAMPLE TYPE	FOOTNOTES (FN)
pH	Monitor	Monitor	SU	Monthly	Grab	

PARAMETER	CALCULATED LIMIT		ENFORCEABLE COMPLIANCE LEVEL		MONITORING ACTION LEVEL		UNITS	MDL (µg/l)	PQL (µg/l)	SAMPLE FREQUENCY	SAMPLE TYPE	FN
	Daily Avg.	Daily Max.	Daily Avg.	Daily Max.	TYPE I	TYPE II						
Flow			Monitor	Monitor			GPD			Weekly	Totalizer	
Total Dissolved Solids			Monitor	Monitor			mg/l			Monthly	Grab	
Total Suspended Solids					40		mg/l			Monthly	Grab	

FINAL

PERMIT LIMITS, LEVELS AND MONITORING

OUTFALL NUMBER	WASTEWATER TYPE	RECEIVING WATER	EFFECTIVE	EXPIRING
002	Storm water runoff.	Storm sewer trib. to Ley Creek	EDP	EDP + 5 Years

PARAMETER	MINIMUM	MAXIMUM	UNITS	SAMPLE FREQUENCY	SAMPLE TYPE	FOOTNOTES (FN)
pH	6.0	9.0	SU	Monthly	Grab	

PARAMETER	CALCULATED LIMIT		ENFORCEABLE COMPLIANCE TYPE		MONITORING ACTION LEVEL		UNITS	MDL (µg/l)	PQL (µg/l)	SAMPLE FREQUENCY	SAMPLE TYPE	FN
	Daily Avg.	Daily Max.	Daily Avg	Daily Max	TYPE I	TYPE II						
Flow			Monitor	Monitor			GPD			Monthly	Estimate	
Settleable Solids			Monitor	10			ml/l			Monthly	Grab	
Oil & Grease			Monitor	15			mg/l			Monthly	Grab	

COMPsch2.99

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SCHEDULE OF COMPLIANCE

a) The permittee shall comply with the following schedule.

Action Code	Outfall Number(s)	Compliance Action	Due Date
96299	001, 01A, 01B and 002	A short term monitoring program shall be performed to determine the presence of the following parameters: Outfall 001 - dissolved oxygen, total aluminum, ammonia (as N) and MBAS. Outfall 01A - total lead and phthalates (EPA 625). Outfall 01B - total lead and phthalates (EPA 625). Outfall 002 - TDS, TSS and total lead. *This program must include, at a minimum, the collection and analysis of one* representative effluent sample per day for 3 consecutive discharge days. Analytical methodologies shall achieve detection limits comparable to those utilized by this Department.	October 1, 1999

The above compliance actions are one time requirements. The permittee shall comply with the above compliance actions to the Department's satisfaction once. When this permit is administratively renewed by NYSDEC letter entitled "SPDES NOTICE/RENEWAL APPLICATION/PERMIT", the permittee is not required to repeat the submission. The above due dates are independent from the effective date of the permit stated in the letter of "SPDES NOTICE/RENEWAL APPLICATION/PERMIT."

b) The permittee shall submit a written notice of compliance or non-compliance with each of the above schedule dates no later than 14 days following each elapsed date, unless conditions require more immediate notice under terms of the General Conditions (Part II), Section 5. All such compliance or non-compliance notification shall be sent to the locations listed under the section of this permit entitled RECORDING, REPORTING AND ADDITIONAL MONITORING REQUIREMENTS. Each notice of non-compliance shall include the following information:

1. A short description of the non-compliance;
2. A description of any actions taken or proposed by the permittee to comply with the elapsed schedule requirements without further delay and to limit environmental impact associated with the non-compliance;
3. A description or any factors which tend to explain or mitigate the non-compliance; and
4. An estimate of the date the permittee will comply with the elapsed schedule requirement and an assessment of the probability that the permittee will meet the next scheduled requirement on time.

c) The permittee shall submit copies of any document required by the above schedule of compliance to NYSDEC Regional Water Engineer at the location listed under the section of this permit entitled RECORDING, REPORTING AND ADDITIONAL MONITORING REQUIREMENTS **and to the Bureau of Water Permits, Room 314, 50 Wolf Road, Albany, N.Y. 12233-3505,** unless otherwise specified in this permit or in writing by the Department.

BMPinit2.99

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SPECIAL CONDITIONS - BEST MANAGEMENT PRACTICES

1. The permittee shall develop a Best Management Practices (BMP) plan to prevent, or minimize the potential for, release of significant amounts of toxic or hazardous pollutants to the waters of the State through plant site runoff; spillage and leaks; sludge or waste disposal; and storm water discharges including, but not limited to, drainage from raw material storage. Completed BMP plans shall be submitted by **October 1, 1999** to the Regional Water Engineer at the address shown on the Recording, Reporting and Additional Monitoring Requirements. The BMP plan shall be implemented within 6 months of submission, unless a different time frame is approved by this Department.

2. Subsequent modifications to or renewal of this permit does not reset or revise the deadline set forth in (1) above, unless a new deadline is set explicitly by such permit modification or renewal.

3. The permittee shall review all facility components or systems (including material storage areas; in-plant transfer, process and material handling areas; loading and unloading operations; storm water, erosion, and sediment control measures; process emergency control systems; and sludge and waste disposal areas) where toxic or hazardous pollutants are used, manufactured, stored or handled to evaluate the potential for the release of significant amounts of such pollutants to the waters of the State. In performing such an evaluation, the permittee shall consider such factors as the probability of equipment failure or improper operation, cross-contamination of storm water by process materials, settlement of facility air emissions, the effects of natural phenomena such as freezing temperatures and precipitation, fires, and the facility's history of spills and leaks. For hazardous pollutants, the list of reportable quantities as defined in 40 CFR, Part 117 may be used as a guide in determining significant amounts of releases. For toxic pollutants, the relative toxicity of the pollutant shall be considered in determining the significance of potential releases.

   The review shall address all substances present at the facility that are listed as toxic pollutants under Section 307(a)(1) of the Clean Water Act or as hazardous pollutants under Section 311 of the Act or that are identified as Chemicals of Concern by the Industrial Chemical Survey.

4. Whenever the potential for a significant release of toxic or hazardous pollutants to State waters is determined to be present, the permittee shall identify Best Management Practices that have been established to minimize such potential releases. Where BMPs are inadequate or absent, appropriate BMPs shall be established. In selecting appropriate BMPs, the permittee shall consider typical industry practices such as spill reporting procedures, risk identification and assessment, employee training, inspections and records, preventive maintenance, good housekeeping, materials compatibility and security. In addition, the permittee may consider structural measures (such as secondary containment and erosion/sediment control devices and practices) where appropriate.

5. Development of the BMP plan shall include sampling of waste stream segments for the purpose of toxic "hot spot" identification. The economic achievability of effluent limits will not be considered until plant site "hot spot" sources have been identified, contained, removed or minimized through the imposition of site specific BMPs or application of internal facility treatment technology. For the purposes of this permit condition a "hot spot" is a segment of an industrial facility; including but not limited to soil, equipment, material storage areas, sewer lines etc.; which contributes elevated levels of problem pollutants to the wastewater and/or storm water collection system of that facility. For the purposes of this definition, problem pollutants are substances for which treatment to meet a water quality or technology requirement may, considering the results of waste stream segment sampling, be deemed unreasonable. For the purposes of this definition, an elevated level is a concentration or mass loading of the pollutant in question which is sufficiently higher than the concentration of that same pollutant at the compliance monitoring location so as to allow for an economically justifiable removal and/or isolation of the segment and/or B.A.T. treatment of wastewaters emanating from the segment.

6. The BMP plan shall be documented in narrative form and shall include any necessary plot plans, drawings or maps. Other documents already prepared for the facility such as a Safety Manual or a Spill Prevention, Control and Countermeasure (SPCC) plan may be used as part of the plan and may be incorporated by reference. USEPA guidance for development of storm water elements of the BMP is available in the September 1992 manual "Storm Water Management for Industrial Activities," USEPA

BMPinit2.99

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SPECIAL CONDITIONS - BEST MANAGEMENT PRACTICES

Office of Water Publication EPA 832-R-92-006 (available from NTIS, (703)487-4650, order number PB 92235969). A copy of the BMP plan shall be maintained at the facility and shall be available to authorized Department representatives upon request. As a minimum, the plan shall include the following BMP's:

a. BMP Committee
b. Reporting of BMP Incidents
c. Risk Identification & Assessment
d. Employee Training
e. Inspections and Records
f. Preventive Maintenance
g. Good Housekeeping
h. Materials Compatibility
i. Security
j. Spill prevention & response
k. Erosion & sediment control
l. Management of runoff

7. The BMP plan shall be reviewed annually and shall be modified whenever: (a) changes at the facility materially increase the potential for significant releases of toxic or hazardous pollutants, (b) actual releases indicate the plan is inadequate or (c) a letter from the Regional Water Engineer highlights inadequacies in the plan.

WTCpg2.99

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WATER TREATMENT CHEMICAL (WTC) REQUIREMENTS

New or increased use of a WTC requires Department review and authorization before it can be used and discharged. At a minimum, the permittee must notify the Department in writing of its intent to change WTC use. The Department will review that submittal and determine if a formal SPDES permit modification is necessary or whether WTC review and authorization may proceed outside of the formal permit administrative process. **The majority of WTC authorizations do not require formal SPDES permit modification.** WTCs which are used in closed systems and cannot contact wastewater effluents or WTCs which are discharged to municipal STP are not subject to SPDES permit review. WTCs include, but are not limited to, conditioners, corrosion or scale inhibitors, flocculants, biocides, fungicides, molluscicides, and sequestrants. **Questions** concerning the use in discharge of a new WTC or increased levels of an authorized WTC should be directed to the Department staff person who developed your SPDES permit. If you are not sure who that is, contact the Department staff person who normally inspects your facility.

Generic WTC Usage Requirements

- WTC usage shall not exceed the usage rate reported by the permittee or authorized below, whichever is less.
- The permittee shall maintain a logbook of all WTC use, noting for each chemical the time, amount and location of each dosage. Additional guidance concerning necessary logbook content and other applicable requirements can be found in the general conditions (Part II) of the SPDES permit. The logbook must also document that adequate process controls are in place to ensure that excessive levels of WTCs are not used and subsequently discharged.
- The permittee shall provide an annual report, attached to the December DMR, containing the following information for each outfall: the current list of WTCs authorized for use and discharge by the Department, for each WTC the amount in pounds used during the year, and any other pertinent information.
- The discharge shall not cause or contribute to a violation of water quality or an exceedance of AWQC.

Generic Prohibitions

WTCs which contain measurable levels of phosphorus are not permitted for discharge within the Great Lakes Basin or tributary to ponded waters outside the Basin unless the permittee can clearly demonstrate that no acceptable alternative exists. WTCs containing microorganisms cannot be approved unless a formal SPDES permit modification application is submitted.

List of WTCs Authorized for Use and Discharge*

WTC Manufacturer, Name & Function : Ashland Chemical Company, Drew Division, Amerfloc, 482, Flocculant	
Affected Outfall(s) : 001	Avg/Max Daily Dosage : 19 / lbs/day

* - Authorized WTCs must either be identified above or in a letter sent to the permittee by the Department. In cases where a WTC is listed above and in a letter from the Department, the more recent document will control.

MONloc2.99

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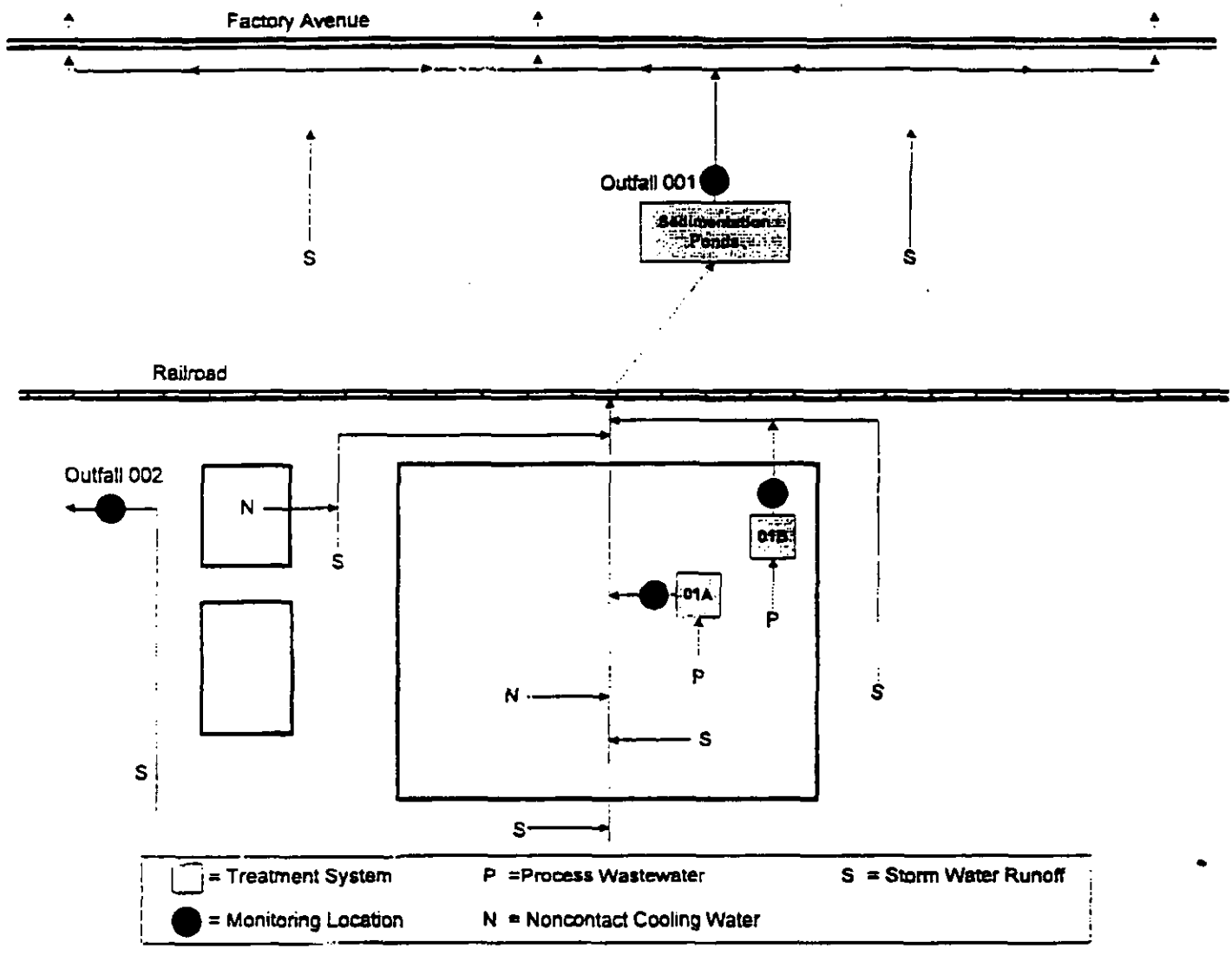
MONITORING LOCATIONS

The permittee shall take samples and measurements, to comply with the monitoring requirements specified in this permit, at the location(s) specified below:



91-20-21 (5/94)

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RECORDING, REPORTING AND ADDITIONAL MONITORING REQUIREMENTS

a) The permittee shall also refer to the General Conditions (Part II) of this permit for additional information concerning monitoring and reporting requirements and conditions.

b) The monitoring information required by this permit shall be summarized, signed and retained for a period of three years from the date of the sampling for subsequent inspection by the Department or its designated agent. Also;

[X] (If box is checked) monitoring information required by this permit shall be summarized and reported by submitting completed and signed Discharge Monitoring Report (DMR) forms for each 1 month reporting period to the locations specified below. Blank forms are available at the Department's Albany office listed below. *The first reporting period begins on the effective date of this permit and the reports will be due no later* than the 28th day of the month following the end of each reporting period.

Send the **original** (top sheet) of each DMR page to:

Department of Environmental Conservation
Division of Water
Bureau of Watershed Compliance Programs
50 Wolf Road
Albany, New York 12233-3506

Phone: (518) 457-3790

Send the **first copy** (second sheet) of each DMR page to:

Department of Environmental Conservation
Regional Water Engineer
Region 7
615 Erie Boulevard West
Syracuse, New York 13204-2400

c) A monthly "Wastewater Facility Operation Report..." (form 92-15-7) shall be submitted (if box is checked) to the [ ] Regional Water Engineer and/or [ ] County Health Department or Environmental Control Agency listed above.

d) **Noncompliance** with the provisions of this permit shall be reported to the Department as prescribed in the attached General Conditions (Part II).

e) Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

f) If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR Part 136 or as specified in this permit, the results of this monitoring shall be included in the calculations and recording on the Discharge Monitoring Reports.

g) Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this permit.

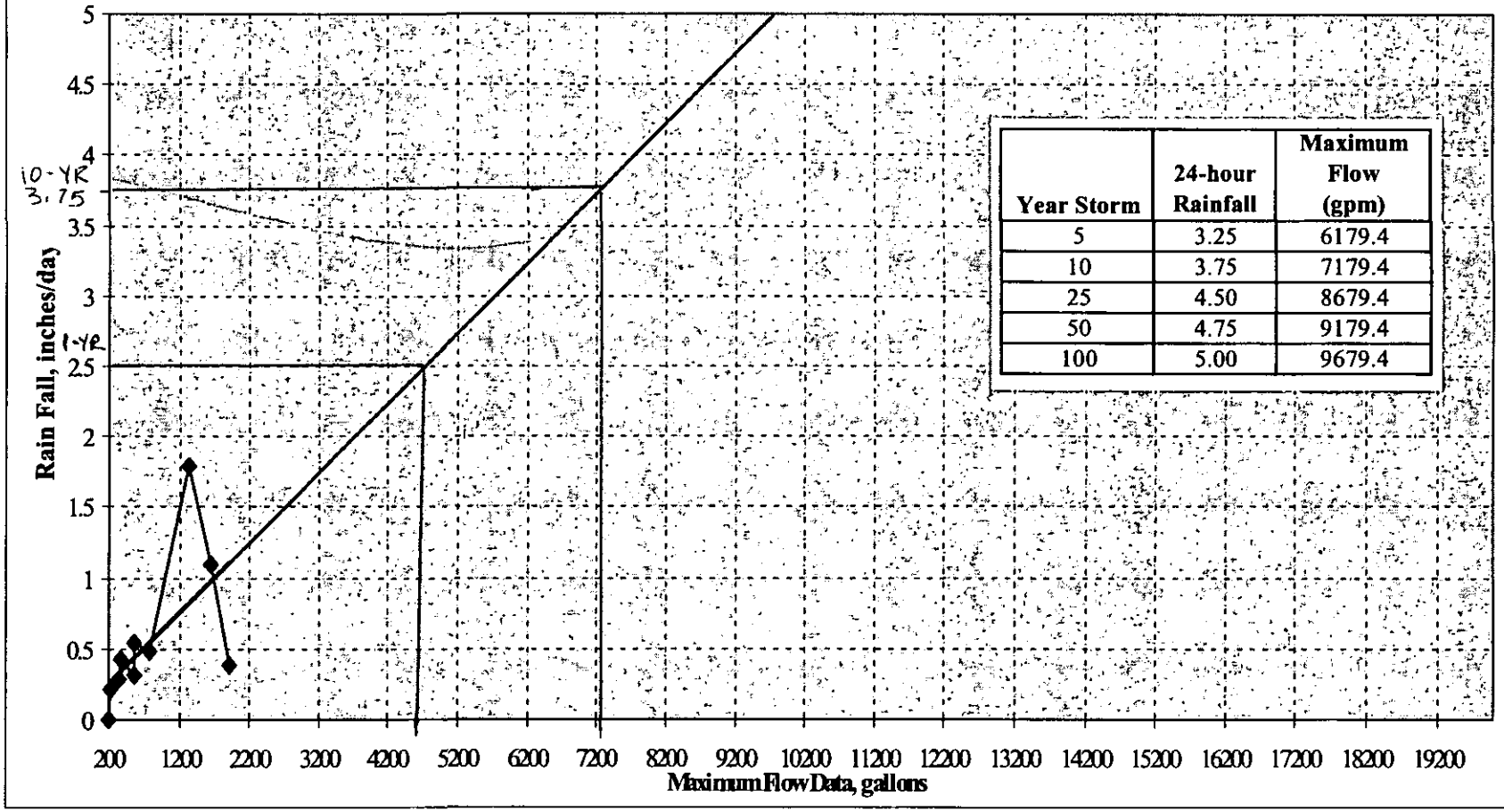
h) Unless otherwise specified, all information recorded on the Discharge Monitoring Report shall be based upon measurements and sampling carried out during the most recently completed reporting period.

i) Any laboratory test or sample analysis required by this permit for which the State Commissioner of Health issues certificates of approval pursuant to section five hundred two of the Public Health Law shall be conducted by a laboratory which has been issued a certificate of approval. Inquiries regarding laboratory certification should be sent to the Environmental Laboratory Accreditation Program, New York State Health Department Center for Laboratories and Research, Division of Environmental Sciences, The Nelson A. Rockefeller State Plaza, Albany, New York 12201.

APPENDIX C

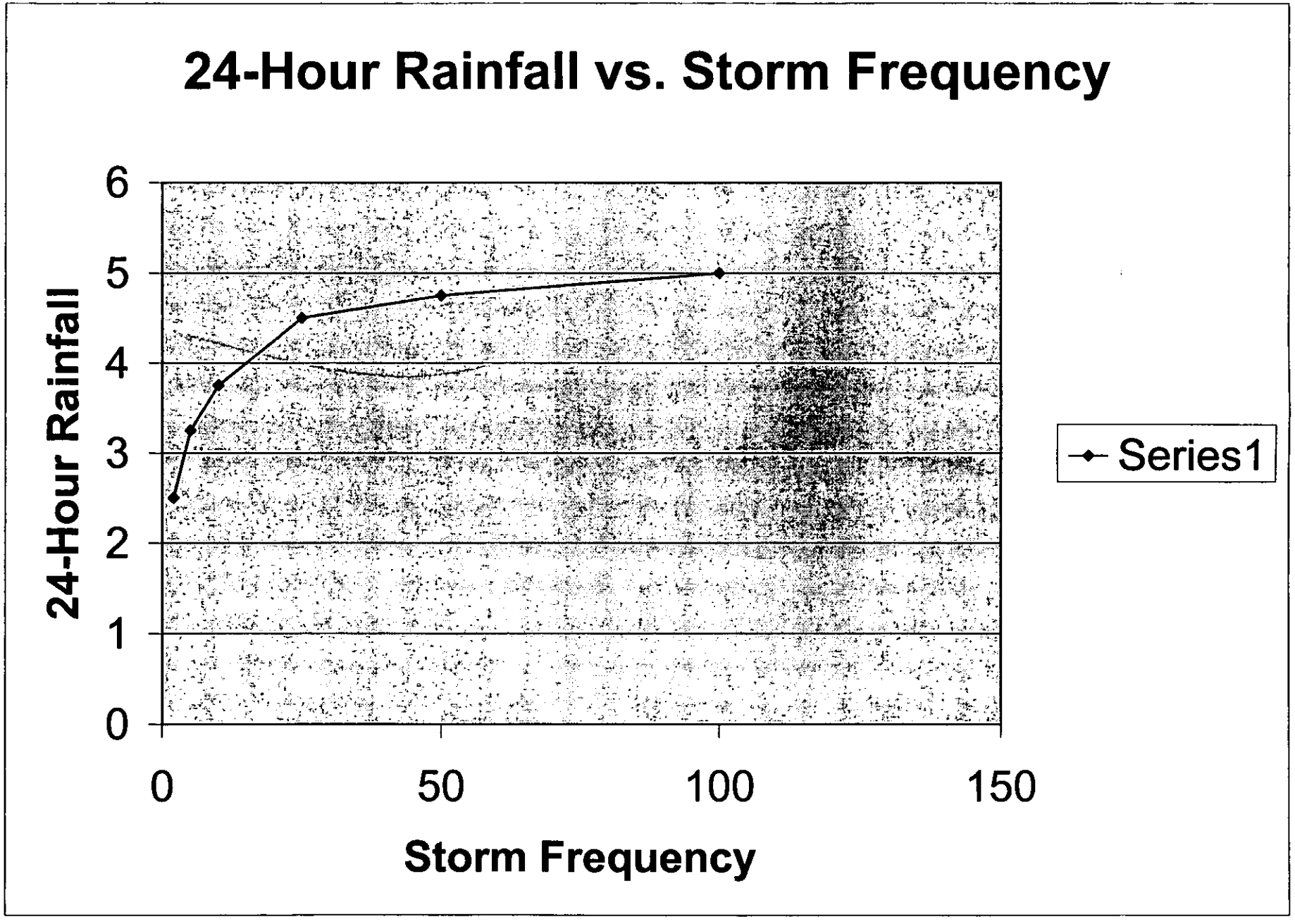
RAINFALL AND STORM WATER FLOW INFORMATION

Daily Precipatation vs. Maximum Flow Data
Pfaltzgraff, Syracuse China



Year Storm	24-hour Rainfall	Maximum Flow (gpm)
5	3.25	6179.4
10	3.75	7179.4
25	4.50	8679.4
50	4.75	9179.4
100	5.00	9679.4

ROUX


24-Hour Rainfall vs. Storm Frequency
24-Hour Rainfall
6
5
4
3
2
1
0
0
50
100
150
Storm Frequency
Series1

APPENDIX D

FLOW DATA COLLECTED BY REMEDIAL ENGINEERING BETWEEN MAY 1998 AND AUGUST 1998

Flow Data
Syracuse China
Facility
5/15/98 – 5/25/98

American Sigma InSight 3.040

Date	Time	Flow 1 (gpm)
15/MAY/98	05:00p.m.	408.441
15/MAY/98	06:00p.m.	426.767
15/MAY/98	07:00p.m.	408.786
15/MAY/98	08:00p.m.	341.430
15/MAY/98	09:00p.m.	402.331
15/MAY/98	10:00p.m.	424.686
15/MAY/98	11:00p.m.	397.539
16/MAY/98	12:00a.m.	399.993
16/MAY/98	01:00a.m.	331.516
16/MAY/98	02:00a.m.	320.931
16/MAY/98	03:00a.m.	338.472
16/MAY/98	04:00a.m.	323.962
16/MAY/98	05:00a.m.	313.236
16/MAY/98	06:00a.m.	313.717
16/MAY/98	07:00a.m.	304.089
16/MAY/98	08:00a.m.	256.789
16/MAY/98	09:00a.m.	247.171
16/MAY/98	10:00a.m.	238.818
16/MAY/98	11:00a.m.	223.659
16/MAY/98	12:00p.m.	295.174
16/MAY/98	01:00p.m.	304.102
16/MAY/98	02:00p.m.	309.793
16/MAY/98	03:00p.m.	306.385
16/MAY/98	04:00p.m.	310.975
16/MAY/98	05:00p.m.	301.497
16/MAY/98	06:00p.m.	313.159
16/MAY/98	07:00p.m.	315.770
16/MAY/98	08:00p.m.	320.776
16/MAY/98	09:00p.m.	298.077
16/MAY/98	10:00p.m.	265.843
16/MAY/98	11:00p.m.	266.931
17/MAY/98	12:00a.m.	267.304
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17/MAY/98	02:00a.m.	272.645
17/MAY/98	03:00a.m.	317.430
17/MAY/98	04:00a.m.	330.177
17/MAY/98	05:00a.m.	326.515
17/MAY/98	06:00a.m.	313.904
17/MAY/98	07:00a.m.	266.562
17/MAY/98	08:00a.m.	273.669
17/MAY/98	09:00a.m.	254.336
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17/MAY/98	11:00a.m.	292.932
17/MAY/98	12:00p.m.	293.568
17/MAY/98	01:00p.m.	295.685
17/MAY/98	02:00p.m.	300.974
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17/MAY/98	05:00p.m.	305.165
17/MAY/98	06:00p.m.	305.159
17/MAY/98	07:00p.m.	256.985
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17/MAY/98	09:00p.m.	240.921
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17/MAY/98	11:00p.m.	256.748
18/MAY/98	12:00a.m.	278.082

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21/MAY/98	03:00p.m.	0.000
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21/MAY/98	07:00p.m.	0.000
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22/MAY/98	02:00a.m.	0.000
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22/MAY/98	04:00p.m.	365.761
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22/MAY/98	06:00p.m.	369.133
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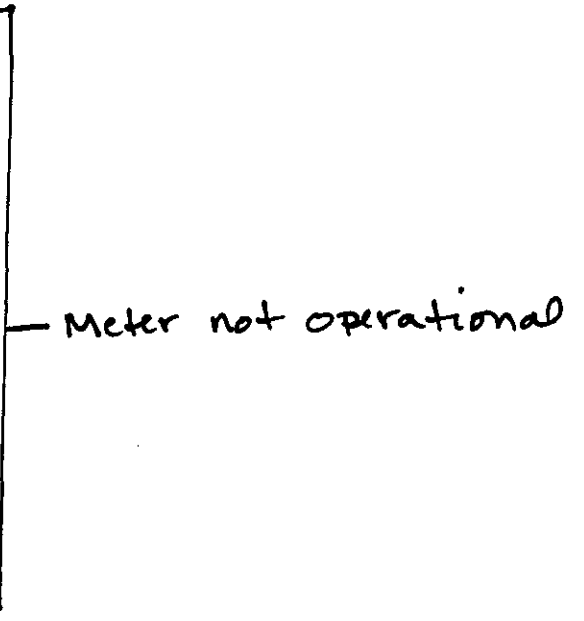

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23/MAY/98	04:00a.m.	235.404
23/MAY/98	05:00a.m.	235.661
23/MAY/98	06:00a.m.	225.531
23/MAY/98	07:00a.m.	220.675
23/MAY/98	08:00a.m.	217.246
23/MAY/98	09:00a.m.	251.433
23/MAY/98	10:00a.m.	215.065
23/MAY/98	11:00a.m.	213.517
23/MAY/98	12:00p.m.	208.224
23/MAY/98	01:00p.m.	204.380
23/MAY/98	02:00p.m.	206.850
23/MAY/98	03:00p.m.	206.741
23/MAY/98	04:00p.m.	229.141
23/MAY/98	05:00p.m.	222.660
23/MAY/98	06:00p.m.	219.847
23/MAY/98	07:00p.m.	225.486
23/MAY/98	08:00p.m.	208.889
23/MAY/98	09:00p.m.	204.685
23/MAY/98	10:00p.m.	205.276
23/MAY/98	11:00p.m.	203.747
24/MAY/98	12:00a.m.	204.043
24/MAY/98	01:00a.m.	203.368
24/MAY/98	02:00a.m.	204.759
24/MAY/98	03:00a.m.	215.990
24/MAY/98	04:00a.m.	241.534
24/MAY/98	05:00a.m.	237.180
24/MAY/98	06:00a.m.	242.341
24/MAY/98	07:00a.m.	231.922
24/MAY/98	08:00a.m.	230.917
24/MAY/98	09:00a.m.	225.917
24/MAY/98	10:00a.m.	218.421
24/MAY/98	11:00a.m.	218.610
24/MAY/98	12:00p.m.	220.595
24/MAY/98	01:00p.m.	226.145
24/MAY/98	02:00p.m.	216.218
24/MAY/98	03:00p.m.	214.233
24/MAY/98	04:00p.m.	213.880
24/MAY/98	05:00p.m.	219.548
24/MAY/98	06:00p.m.	221.970
24/MAY/98	07:00p.m.	222.477
24/MAY/98	08:00p.m.	222.824
24/MAY/98	09:00p.m.	224.417
24/MAY/98	10:00p.m.	223.209
24/MAY/98	11:00p.m.	209.502
25/MAY/98	12:00a.m.	207.678
25/MAY/98	01:00a.m.	206.423
25/MAY/98	02:00a.m.	242.581
25/MAY/98	03:00a.m.	247.527
25/MAY/98	04:00a.m.	258.209
25/MAY/98	05:00a.m.	250.321
25/MAY/98	06:00a.m.	257.930
25/MAY/98	07:00a.m.	228.830
25/MAY/98	08:00a.m.	198.191
25/MAY/98	09:00a.m.	194.087
25/MAY/98	10:00a.m.	180.232
25/MAY/98	11:00a.m.	195.474
25/MAY/98	12:00p.m.	208.183

25/MAY/98	01:00p.m.	212.974
25/MAY/98	02:00p.m.	219.972
25/MAY/98	03:00p.m.	220.839
25/MAY/98	04:00p.m.	227.195
25/MAY/98	05:00p.m.	226.774
25/MAY/98	06:00p.m.	223.742
25/MAY/98	07:00p.m.	227.275
25/MAY/98	08:00p.m.	223.537
25/MAY/98	09:00p.m.	215.547
25/MAY/98	10:00p.m.	213.626
25/MAY/98	11:00p.m.	219.786
26/MAY/98	12:00a.m.	225.223
26/MAY/98	01:00a.m.	356.736
26/MAY/98	02:00a.m.	372.046
26/MAY/98	03:00a.m.	275.278
26/MAY/98	04:00a.m.	237.311
26/MAY/98	05:00a.m.	215.768
26/MAY/98	06:00a.m.	227.779
26/MAY/98	07:00a.m.	243.147
26/MAY/98	08:00a.m.	390.798
26/MAY/98	09:00a.m.	397.608
26/MAY/98	10:00a.m.	403.769
26/MAY/98	11:00a.m.	380.270
26/MAY/98	12:00p.m.	366.380
26/MAY/98	01:00p.m.	384.127
26/MAY/98	02:00p.m.	344.423
26/MAY/98	03:00p.m.	391.437
26/MAY/98	04:00p.m.	380.643
26/MAY/98	05:00p.m.	351.620
26/MAY/98	06:00p.m.	382.233
26/MAY/98	07:00p.m.	414.464
26/MAY/98	08:00p.m.	370.401
26/MAY/98	09:00p.m.	405.070
26/MAY/98	10:00p.m.	372.495
26/MAY/98	11:00p.m.	376.796
27/MAY/98	12:00a.m.	333.212
27/MAY/98	01:00a.m.	285.228
27/MAY/98	02:00a.m.	382.085
27/MAY/98	03:00a.m.	322.360
27/MAY/98	04:00a.m.	326.705
27/MAY/98	05:00a.m.	308.274
27/MAY/98	06:00a.m.	272.876
27/MAY/98	07:00a.m.	346.327
27/MAY/98	08:00a.m.	420.627
27/MAY/98	09:00a.m.	430.178
27/MAY/98	10:00a.m.	412.418
27/MAY/98	11:00a.m.	417.624
27/MAY/98	12:00p.m.	347.699
27/MAY/98	01:00p.m.	352.073
27/MAY/98	02:00p.m.	337.589
27/MAY/98	03:00p.m.	373.905
27/MAY/98	04:00p.m.	417.210
27/MAY/98	05:00p.m.	396.804
27/MAY/98	06:00p.m.	432.214
27/MAY/98	07:00p.m.	459.021
27/MAY/98	08:00p.m.	369.695
27/MAY/98	09:00p.m.	438.396
27/MAY/98	10:00p.m.	442.067
27/MAY/98	11:00p.m.	438.647
28/MAY/98	12:00a.m.	406.001

28/MAY/98	01:00a.m.	318.535
28/MAY/98	02:00a.m.	330.218
28/MAY/98	03:00a.m.	305.358
28/MAY/98	04:00a.m.	297.110
28/MAY/98	05:00a.m.	270.984
28/MAY/98	06:00a.m.	257.200
28/MAY/98	07:00a.m.	323.368
28/MAY/98	08:00a.m.	419.429
28/MAY/98	09:00a.m.	370.591
28/MAY/98	10:00a.m.	372.887
28/MAY/98	11:00a.m.	372.855
28/MAY/98	12:00p.m.	386.485
28/MAY/98	01:00p.m.	369.110
28/MAY/98	02:00p.m.	334.654
28/MAY/98	03:00p.m.	358.936
28/MAY/98	04:00p.m.	381.491
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28/MAY/98	08:00p.m.	442.819
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28/MAY/98	11:00p.m.	418.806
29/MAY/98	12:00a.m.	389.459
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29/MAY/98	06:00a.m.	297.165
29/MAY/98	07:00a.m.	317.979
29/MAY/98	08:00a.m.	430.807
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29/MAY/98	07:00p.m.	415.151
29/MAY/98	08:00p.m.	380.768
29/MAY/98	09:00p.m.	394.331
29/MAY/98	10:00p.m.	423.199
29/MAY/98	11:00p.m.	391.090
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30/MAY/98	01:00a.m.	234.142
30/MAY/98	02:00a.m.	233.130
30/MAY/98	03:00a.m.	288.828
30/MAY/98	04:00a.m.	312.767
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30/MAY/98	07:00a.m.	268.772
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31/MAY/98	03:00a.m.	215.450
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01/JUN/98	07:00a.m.	305.416
01/JUN/98	08:00a.m.	470.872
01/JUN/98	09:00a.m.	426.950
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01/JUN/98	09:00p.m.	410.465
01/JUN/98	10:00p.m.	441.377
01/JUN/98	11:00p.m.	399.206
02/JUN/98	12:00a.m.	346.266

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02/JUN/98	09:00a.m.	385.040
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02/JUN/98	11:00a.m.	437.873
02/JUN/98	12:00p.m.	382.628
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02/JUN/98	03:00p.m.	400.192
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02/JUN/98	05:00p.m.	384.134
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10/JUN/98	10:00p.m.	404.187
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11/JUN/98	02:00a.m.	223.691
11/JUN/98	03:00a.m.	232.844
11/JUN/98	04:00a.m.	211.722
11/JUN/98	05:00a.m.	204.113
11/JUN/98	06:00a.m.	228.544
11/JUN/98	07:00a.m.	354.186
11/JUN/98	08:00a.m.	428.803
11/JUN/98	09:00a.m.	408.911
11/JUN/98	10:00a.m.	341.896
11/JUN/98	11:00a.m.	382.968
11/JUN/98	12:00p.m.	384.291
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11/JUN/98	03:00p.m.	381.481
11/JUN/98	04:00p.m.	389.879
11/JUN/98	05:00p.m.	399.032
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11/JUN/98	08:00p.m.	432.815
11/JUN/98	09:00p.m.	430.843
11/JUN/98	10:00p.m.	426.096
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16/JUN/98	10:00p.m.	0.000
16/JUN/98	11:00p.m.	0.000
17/JUN/98	12:00a.m.	0.000

Meter not operational

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— Meter not operational

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21/JUN/98	02:00p.m.	0.000
21/JUN/98	03:00p.m.	0.000
21/JUN/98	04:00p.m.	0.000
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21/JUN/98	08:00p.m.	0.000
21/JUN/98	09:00p.m.	0.000
21/JUN/98	10:00p.m.	0.000
21/JUN/98	11:00p.m.	0.000
22/JUN/98	12:00a.m.	0.000

Meter not operational

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24/JUN/98	12:00p.m.	0.000

- Meter not operational

24/JUN/98	01:00p.m.	0.000
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26/JUN/98	10:00p.m.	0.000
26/JUN/98	11:00p.m.	0.000
27/JUN/98	12:00a.m.	0.000

- Meter not operational

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27/JUN/98	03:00p.m.	0.000
27/JUN/98	04:00p.m.	0.000
27/JUN/98	05:00p.m.	0.000
27/JUN/98	06:00p.m.	0.000
27/JUN/98	07:00p.m.	0.000
27/JUN/98	08:00p.m.	0.000
27/JUN/98	09:00p.m.	0.000
27/JUN/98	10:00p.m.	0.000
27/JUN/98	11:00p.m.	0.000
28/JUN/98	12:00a.m.	0.000
28/JUN/98	01:00a.m.	0.000
28/JUN/98	02:00a.m.	0.000
28/JUN/98	03:00a.m.	0.000
28/JUN/98	04:00a.m.	0.000
28/JUN/98	05:00a.m.	0.000
28/JUN/98	06:00a.m.	0.000
28/JUN/98	07:00a.m.	0.000
28/JUN/98	08:00a.m.	0.000
28/JUN/98	09:00a.m.	0.000
28/JUN/98	10:00a.m.	0.000
28/JUN/98	11:00a.m.	0.000
28/JUN/98	12:00p.m.	0.000
28/JUN/98	01:00p.m.	0.000
28/JUN/98	02:00p.m.	0.000
28/JUN/98	03:00p.m.	0.000
28/JUN/98	04:00p.m.	0.000
28/JUN/98	05:00p.m.	0.000
28/JUN/98	06:00p.m.	0.000
28/JUN/98	07:00p.m.	0.000
28/JUN/98	08:00p.m.	0.000
28/JUN/98	09:00p.m.	0.000
28/JUN/98	10:00p.m.	0.000
28/JUN/98	11:00p.m.	0.000
29/JUN/98	12:00a.m.	0.000
29/JUN/98	01:00a.m.	0.000
29/JUN/98	02:00a.m.	0.000
29/JUN/98	03:00a.m.	0.000
29/JUN/98	04:00a.m.	0.000
29/JUN/98	05:00a.m.	0.000
29/JUN/98	06:00a.m.	0.000
29/JUN/98	07:00a.m.	0.000
29/JUN/98	08:00a.m.	0.000
29/JUN/98	09:00a.m.	0.000
29/JUN/98	10:00a.m.	0.000
29/JUN/98	11:00a.m.	0.000
29/JUN/98	12:00p.m.	0.000

- Meter not operational

29/JUN/98	01:00p.m.	0.000
29/JUN/98	02:00p.m.	0.000
29/JUN/98	03:00p.m.	0.000
29/JUN/98	04:00p.m.	0.000
29/JUN/98	05:00p.m.	0.000
29/JUN/98	06:00p.m.	0.000
29/JUN/98	07:00p.m.	0.000
29/JUN/98	08:00p.m.	0.000
29/JUN/98	09:00p.m.	0..000
29/JUN/98	10:00p.m.	0.000
29/JUN/98	11:00p.m.	0.000
30/JUN/98	12:00a.m.	0.000
30/JUN/98	01:00a.m.	0.000
30/JUN/98	02:00a.m.	0.000
30/JUN/98	03:00a.m.	0.000
30/JUN/98	04:00a.m.	0.000
30/JUN/98	05:00a.m.	0.000
30/JUN/98	06:00a.m.	0.000
30/JUN/98	07:00a.m.	0.000
30/JUN/98	08:00a.m.	0.000
30/JUN/98	09:00a.m.	0.000
30/JUN/98	10:00a.m.	0.000
30/JUN/98	11:00a.m.	0.000
30/JUN/98	12:00p.m.	0.000
30/JUN/98	01:00p.m.	0.000
30/JUN/98	02:00p.m.	0.000
30/JUN/98	03:00p.m.	0.000
30/JUN/98	04:00p.m.	0.000
30/JUN/98	05:00p.m.	0.000
30/JUN/98	06:00p.m.	0.000
30/JUN/98	07:00p.m.	0.000
30/JUN/98	08:00p.m.	0.000
30/JUN/98	09:00p.m.	0.000
30/JUN/98	10:00p.m.	0.000
30/JUN/98	11:00p.m.	0.000
01/JUL/98	12:00a.m.	0.000
01/JUL/98	01:00a.m.	0.000
01/JUL/98	02:00a.m.	0.000
01/JUL/98	03:00a.m.	0.000
01/JUL/98	04:00a.m.	0.000
01/JUL/98	05:00a.m.	0.000
01/JUL/98	06:00a.m.	0.000
01/JUL/98	07:00a.m.	0.000
01/JUL/98	08:00a.m.	0.000
01/JUL/98	09:00a.m.	0.000
01/JUL/98	10:00a.m.	0.000
01/JUL/98	11:00a.m.	0.000
01/JUL/98	12:00p.m.	0.000
01/JUL/98	01:00p.m.	0.000
01/JUL/98	02:00p.m.	0.000
01/JUL/98	03:00p.m.	0.000
01/JUL/98	04:00p.m.	0.000
01/JUL/98	05:00p.m.	0.000
01/JUL/98	06:00p.m.	0.000
01/JUL/98	07:00p.m.	0.000
01/JUL/98	08:00p.m.	0.000
01/JUL/98	09:00p.m.	0.000
01/JUL/98	10:00p.m.	0.000
01/JUL/98	11:00p.m.	0.000
02/JUL/98	12:00a.m.	0.000

— Meter not operational

02/JUL/98	01:00a.m.	0.000
02/JUL/98	02:00a.m.	0.000
02/JUL/98	03:00a.m.	0.000
02/JUL/98	04:00a.m.	0.000
02/JUL/98	05:00a.m.	0.000
02/JUL/98	06:00a.m.	0.000
02/JUL/98	07:00a.m.	0.000
02/JUL/98	08:00a.m.	0.000
02/JUL/98	09:00a.m.	0.000
02/JUL/98	10:00a.m.	0.000
02/JUL/98	11:00a.m.	0.000
02/JUL/98	12:00p.m.	0.000
02/JUL/98	01:00p.m.	0.000
02/JUL/98	02:00p.m.	0.000
02/JUL/98	03:00p.m.	0.000
02/JUL/98	04:00p.m.	0.000
02/JUL/98	05:00p.m.	0.000
02/JUL/98	06:00p.m.	0.000
02/JUL/98	07:00p.m.	0.000
02/JUL/98	08:00p.m.	0.000
02/JUL/98	09:00p.m.	0.000
02/JUL/98	10:00p.m.	0.000
02/JUL/98	11:00p.m.	0.000
03/JUL/98	12:00a.m.	0.000
03/JUL/98	01:00a.m.	0.000
03/JUL/98	02:00a.m.	0.000
03/JUL/98	03:00a.m.	0.000
03/JUL/98	04:00a.m.	0.000
03/JUL/98	05:00a.m.	0.000
03/JUL/98	06:00a.m.	0.000
03/JUL/98	07:00a.m.	0.000
03/JUL/98	08:00a.m.	0.000
03/JUL/98	09:00a.m.	0.000
03/JUL/98	10:00a.m.	0.000
03/JUL/98	11:00a.m.	0.000
03/JUL/98	12:00p.m.	0.000
03/JUL/98	01:00p.m.	0.000
03/JUL/98	02:00p.m.	0.000
03/JUL/98	03:00p.m.	0.000
03/JUL/98	04:00p.m.	0.000
03/JUL/98	05:00p.m.	0.000
03/JUL/98	06:00p.m.	0.000
03/JUL/98	07:00p.m.	0.000
03/JUL/98	08:00p.m.	0.000
03/JUL/98	09:00p.m.	0.000
03/JUL/98	10:00p.m.	0.000
03/JUL/98	11:00p.m.	0.000
04/JUL/98	12:00a.m.	0.000
04/JUL/98	01:00a.m.	0.000
04/JUL/98	02:00a.m.	0.000
04/JUL/98	03:00a.m.	0.000
04/JUL/98	04:00a.m.	0.000
04/JUL/98	05:00a.m.	0.000
04/JUL/98	06:00a.m.	0.000
04/JUL/98	07:00a.m.	0.000
04/JUL/98	08:00a.m.	0.000
04/JUL/98	09:00a.m.	0.000
04/JUL/98	10:00a.m.	0.000
04/JUL/98	11:00a.m.	0.000
04/JUL/98	12:00p.m.	0.000

— Meter not operational

04/JUL/98	01:00p.m.	0.000
04/JUL/98	02:00p.m.	0.000
04/JUL/98	03:00p.m.	0.000
04/JUL/98	04:00p.m.	0.000
04/JUL/98	05:00p.m.	0.000
04/JUL/98	06:00p.m.	0.000
04/JUL/98	07:00p.m.	0.000
04/JUL/98	08:00p.m.	0.000
04/JUL/98	09:00p.m.	0.000
04/JUL/98	10:00p.m.	0.000
04/JUL/98	11:00p.m.	0.000
05/JUL/98	12:00a.m.	0.000
05/JUL/98	01:00a.m.	0.000
05/JUL/98	02:00a.m.	0.000
05/JUL/98	03:00a.m.	0.000
05/JUL/98	04:00a.m.	0.000
05/JUL/98	05:00a.m.	0.000
05/JUL/98	06:00a.m.	0.000
05/JUL/98	07:00a.m.	0.000
05/JUL/98	08:00a.m.	0.000
05/JUL/98	09:00a.m.	0.000
05/JUL/98	10:00a.m.	0.000
05/JUL/98	11:00a.m.	0.000
05/JUL/98	12:00p.m.	0.000
05/JUL/98	01:00p.m.	0.000
05/JUL/98	02:00p.m.	0.000
05/JUL/98	03:00p.m.	0.000
05/JUL/98	04:00p.m.	0.000
05/JUL/98	05:00p.m.	0.000
05/JUL/98	06:00p.m.	0.000
05/JUL/98	07:00p.m.	0.000
05/JUL/98	08:00p.m.	0.000
05/JUL/98	09:00p.m.	0.000
05/JUL/98	10:00p.m.	0.000
05/JUL/98	11:00p.m.	0.000
06/JUL/98	12:00a.m.	0.000
06/JUL/98	01:00a.m.	0.000
06/JUL/98	02:00a.m.	0.000
06/JUL/98	03:00a.m.	0.000
06/JUL/98	04:00a.m.	0.000
06/JUL/98	05:00a.m.	0.000
06/JUL/98	06:00a.m.	0.000
06/JUL/98	07:00a.m.	0.000
06/JUL/98	08:00a.m.	0.000
06/JUL/98	09:00a.m.	0.000
06/JUL/98	10:00a.m.	0.000
06/JUL/98	11:00a.m.	0.000
06/JUL/98	12:00p.m.	0.000
06/JUL/98	01:00p.m.	0.000
06/JUL/98	02:00p.m.	0.000
06/JUL/98	03:00p.m.	0.000
06/JUL/98	04:00p.m.	0.000
06/JUL/98	05:00p.m.	0.000
06/JUL/98	06:00p.m.	0.000
06/JUL/98	07:00p.m.	0.000
06/JUL/98	08:00p.m.	0.000
06/JUL/98	09:00p.m.	0.000
06/JUL/98	10:00p.m.	0.000
06/JUL/98	11:00p.m.	0.000
07/JUL/98	12:00a.m.	0.000

- Meter not operational

07/JUL/98	01:00a.m.	0.000
07/JUL/98	02:00a.m.	0.000
07/JUL/98	03:00a.m.	0.000
07/JUL/98	04:00a.m.	0.000
07/JUL/98	05:00a.m.	0.000
07/JUL/98	06:00a.m.	0.000
07/JUL/98	07:00a.m.	0.000
07/JUL/98	08:00a.m.	0.000
07/JUL/98	09:00a.m.	0.000
07/JUL/98	10:00a.m.	0.000
07/JUL/98	11:00a.m.	0.000
07/JUL/98	12:00p.m.	0.000
07/JUL/98	01:00p.m.	0.000
07/JUL/98	02:00p.m.	0.000
07/JUL/98	03:00p.m.	0.000
07/JUL/98	04:00p.m.	0.000
07/JUL/98	05:00p.m.	0.000
07/JUL/98	06:00p.m.	0.000
07/JUL/98	07:00p.m.	0.000
07/JUL/98	08:00p.m.	0.000
07/JUL/98	09:00p.m.	0.000
07/JUL/98	10:00p.m.	0.000
07/JUL/98	11:00p.m.	0.000
08/JUL/98	12:00a.m.	0.000
08/JUL/98	01:00a.m.	0.000
08/JUL/98	02:00a.m.	0.000
08/JUL/98	03:00a.m.	0.000
08/JUL/98	04:00a.m.	0.000
08/JUL/98	05:00a.m.	0.000
08/JUL/98	06:00a.m.	0.000
08/JUL/98	07:00a.m.	0.000
08/JUL/98	08:00a.m.	0.000
08/JUL/98	09:00a.m.	0.000
08/JUL/98	10:00a.m.	0.000
08/JUL/98	11:00a.m.	0.000
08/JUL/98	12:00p.m.	0.000
08/JUL/98	01:00p.m.	0.000
08/JUL/98	02:00p.m.	0.000
08/JUL/98	03:00p.m.	0.000
08/JUL/98	04:00p.m.	0.000
08/JUL/98	05:00p.m.	0.000
08/JUL/98	06:00p.m.	0.000
08/JUL/98	07:00p.m.	0.000
08/JUL/98	08:00p.m.	0.000
08/JUL/98	09:00p.m.	0.000
08/JUL/98	10:00p.m.	0.000
08/JUL/98	11:00p.m.	0.000
09/JUL/98	12:00a.m.	0.000
09/JUL/98	01:00a.m.	0.000
09/JUL/98	02:00a.m.	0.000
09/JUL/98	03:00a.m.	0.000
09/JUL/98	04:00a.m.	0.000
09/JUL/98	05:00a.m.	0.000
09/JUL/98	06:00a.m.	0.000
09/JUL/98	07:00a.m.	0.000
09/JUL/98	08:00a.m.	0.000
09/JUL/98	09:00a.m.	0.000
09/JUL/98	10:00a.m.	0.000
09/JUL/98	11:00a.m.	0.000
09/JUL/98	12:00p.m.	0.000

Meter not operational

09/JUL/98	01:00p.m.	0.000
09/JUL/98	02:00p.m.	0.000
09/JUL/98	03:00p.m.	0.000
09/JUL/98	04:00p.m.	0.000
09/JUL/98	05:00p.m.	0.000
09/JUL/98	06:00p.m.	0.000
09/JUL/98	07:00p.m.	0.000
09/JUL/98	08:00p.m.	0.000
09/JUL/98	09:00p.m.	0.000
09/JUL/98	10:00p.m.	0.000
09/JUL/98	11:00p.m.	0.000
10/JUL/98	12:00a.m.	0.000
10/JUL/98	01:00a.m.	0.000
10/JUL/98	02:00a.m.	0.000
10/JUL/98	03:00a.m.	0.000
10/JUL/98	04:00a.m.	0.000
10/JUL/98	05:00a.m.	0.000
10/JUL/98	06:00a.m.	0.000
10/JUL/98	07:00a.m.	0.000
10/JUL/98	08:00a.m.	0.000
10/JUL/98	09:00a.m.	0.000
10/JUL/98	10:00a.m.	0.000
10/JUL/98	11:00a.m.	0.000
10/JUL/98	12:00p.m.	0.000
10/JUL/98	01:00p.m.	0.000
10/JUL/98	02:00p.m.	0.000
10/JUL/98	03:00p.m.	0.000
10/JUL/98	04:00p.m.	0.000
10/JUL/98	05:00p.m.	0.000
10/JUL/98	06:00p.m.	0.000
10/JUL/98	07:00p.m.	0.000
10/JUL/98	08:00p.m.	0.000
10/JUL/98	09:00p.m.	0.000
10/JUL/98	10:00p.m.	0.000
10/JUL/98	11:00p.m.	0.000
11/JUL/98	12:00a.m.	0.000
11/JUL/98	01:00a.m.	0.000
11/JUL/98	02:00a.m.	0.000
11/JUL/98	03:00a.m.	0.000
11/JUL/98	04:00a.m.	0.000
11/JUL/98	05:00a.m.	0.000
11/JUL/98	06:00a.m.	0.000
11/JUL/98	07:00a.m.	0.000
11/JUL/98	08:00a.m.	0.000
11/JUL/98	09:00a.m.	0.000
11/JUL/98	10:00a.m.	0.000
11/JUL/98	11:00a.m.	0.000
11/JUL/98	12:00p.m.	0.000
11/JUL/98	01:00p.m.	0.000
11/JUL/98	02:00p.m.	0.000
11/JUL/98	03:00p.m.	0.000
11/JUL/98	04:00p.m.	0.000
11/JUL/98	05:00p.m.	0.000
11/JUL/98	06:00p.m.	0.000
11/JUL/98	07:00p.m.	0.000
11/JUL/98	08:00p.m.	0.000
11/JUL/98	09:00p.m.	0.000
11/JUL/98	10:00p.m.	0.000
11/JUL/98	11:00p.m.	0.000
12/JUL/98	12:00a.m.	0.000

—Meter not operational

12/JUL/98	01:00a.m.	0.000
12/JUL/98	02:00a.m.	0.000
12/JUL/98	03:00a.m.	0.000
12/JUL/98	04:00a.m.	0.000
12/JUL/98	05:00a.m.	0.000
12/JUL/98	06:00a.m.	0.000
12/JUL/98	07:00a.m.	0.000
12/JUL/98	08:00a.m.	0.000
12/JUL/98	09:00a.m.	0.000
12/JUL/98	10:00a.m.	0.000
12/JUL/98	11:00a.m.	0.000
12/JUL/98	12:00p.m.	0.000
12/JUL/98	01:00p.m.	0.000
12/JUL/98	02:00p.m.	0.000
12/JUL/98	03:00p.m.	0.000
12/JUL/98	04:00p.m.	0.000
12/JUL/98	05:00p.m.	0.000
12/JUL/98	06:00p.m.	0.000
12/JUL/98	07:00p.m.	0.000
12/JUL/98	08:00p.m.	0.000
12/JUL/98	09:00p.m.	0.000
12/JUL/98	10:00p.m.	0.000
12/JUL/98	11:00p.m.	0.000
13/JUL/98	12:00a.m.	0.000
13/JUL/98	01:00a.m.	0.000
13/JUL/98	02:00a.m.	0.000
13/JUL/98	03:00a.m.	0.000
13/JUL/98	04:00a.m.	0.000
13/JUL/98	05:00a.m.	0.000
13/JUL/98	06:00a.m.	0.000
13/JUL/98	07:00a.m.	0.000
13/JUL/98	08:00a.m.	0.000
13/JUL/98	09:00a.m.	0.000
13/JUL/98	10:00a.m.	0.000
13/JUL/98	11:00a.m.	0.000
13/JUL/98	12:00p.m.	0.000
13/JUL/98	01:00p.m.	0.000
13/JUL/98	02:00p.m.	0.000
13/JUL/98	03:00p.m.	0.000
13/JUL/98	04:00p.m.	0.000
13/JUL/98	05:00p.m.	0.000
13/JUL/98	06:00p.m.	0.000
13/JUL/98	07:00p.m.	0.000
13/JUL/98	08:00p.m.	0.000
13/JUL/98	09:00p.m.	0.000
13/JUL/98	10:00p.m.	0.000
13/JUL/98	11:00p.m.	0.000
14/JUL/98	12:00a.m.	0.000
14/JUL/98	01:00a.m.	0.000
14/JUL/98	02:00a.m.	0.000
14/JUL/98	03:00a.m.	0.000
14/JUL/98	04:00a.m.	0.000
14/JUL/98	05:00a.m.	0.000
14/JUL/98	06:00a.m.	0.000
14/JUL/98	07:00a.m.	0.000
14/JUL/98	08:00a.m.	0.000
14/JUL/98	09:00a.m.	0.000
14/JUL/98	10:00a.m.	0.000
14/JUL/98	11:00a.m.	0.000
14/JUL/98	12:00p.m.	0.000

Meter not operational

14/JUL/98	01:00p.m.	0.000
14/JUL/98	02:00p.m.	0.000
14/JUL/98	03:00p.m.	0.000
14/JUL/98	04:00p.m.	0.000
14/JUL/98	05:00p.m.	0.000
14/JUL/98	06:00p.m.	0.000
14/JUL/98	07:00p.m.	0.000
14/JUL/98	08:00p.m.	0.000
14/JUL/98	09:00p.m.	0.000
14/JUL/98	10:00p.m.	0.000
14/JUL/98	11:00p.m.	0.000
15/JUL/98	12:00a.m.	0.000
15/JUL/98	01:00a.m.	0.000
15/JUL/98	02:00a.m.	0.000
15/JUL/98	03:00a.m.	0.000
15/JUL/98	04:00a.m.	0.000
15/JUL/98	05:00a.m.	0.000
15/JUL/98	06:00a.m.	0.000
15/JUL/98	07:00a.m.	0.000
15/JUL/98	08:00a.m.	0.000
15/JUL/98	09:00a.m.	0.000
15/JUL/98	10:00a.m.	0.000
15/JUL/98	11:00a.m.	0.000
15/JUL/98	12:00p.m.	0.000
15/JUL/98	01:00p.m.	0.000
15/JUL/98	02:00p.m.	0.000
15/JUL/98	03:00p.m.	0.000
15/JUL/98	04:00p.m.	0.000
15/JUL/98	05:00p.m.	0.000
15/JUL/98	06:00p.m.	0.000
15/JUL/98	07:00p.m.	0.000
15/JUL/98	08:00p.m.	0.000
15/JUL/98	09:00p.m.	0.000
15/JUL/98	10:00p.m.	0.000
15/JUL/98	11:00p.m.	0.000
16/JUL/98	12:00a.m.	0.000
16/JUL/98	01:00a.m.	0.000
16/JUL/98	02:00a.m.	0.000
16/JUL/98	03:00a.m.	0.000
16/JUL/98	04:00a.m.	0.000
16/JUL/98	05:00a.m.	0.000
16/JUL/98	06:00a.m.	0.000
16/JUL/98	07:00a.m.	0.000
16/JUL/98	08:00a.m.	0.000
16/JUL/98	09:00a.m.	0.000
16/JUL/98	10:00a.m.	0.000
16/JUL/98	11:00a.m.	0.000
16/JUL/98	12:00p.m.	0.000
16/JUL/98	01:00p.m.	0.000
16/JUL/98	02:00p.m.	0.000
16/JUL/98	03:00p.m.	0.000
16/JUL/98	04:00p.m.	0.000
16/JUL/98	05:00p.m.	0.000
16/JUL/98	06:00p.m.	0.000
16/JUL/98	07:00p.m.	0.000
16/JUL/98	08:00p.m.	0.000
16/JUL/98	09:00p.m.	0.000
16/JUL/98	10:00p.m.	0.000
16/JUL/98	11:00p.m.	0.000
17/JUL/98	12:00a.m.	0.000

- Meter not operational

17/JUL/98	01:00a.m.	0.000
17/JUL/98	02:00a.m.	0.000
17/JUL/98	03:00a.m.	0.000
17/JUL/98	04:00a.m.	0.000
17/JUL/98	05:00a.m.	0.000
17/JUL/98	06:00a.m.	0.000
17/JUL/98	07:00a.m.	0.000
17/JUL/98	08:00a.m.	0.000
17/JUL/98	09:00a.m.	0.000
17/JUL/98	10:00a.m.	0.000
17/JUL/98	11:00a.m.	0.000
17/JUL/98	12:00p.m.	0.000
17/JUL/98	01:00p.m.	0.000
17/JUL/98	02:00p.m.	0.000
17/JUL/98	03:00p.m.	0.000
17/JUL/98	04:00p.m.	0.000
17/JUL/98	05:00p.m.	0.000
17/JUL/98	06:00p.m.	0.000
17/JUL/98	07:00p.m.	0.000
17/JUL/98	08:00p.m.	0.000
17/JUL/98	09:00p.m.	0.000
17/JUL/98	10:00p.m.	0.000
17/JUL/98	11:00p.m.	0.000
18/JUL/98	12:00a.m.	0.000
18/JUL/98	01:00a.m.	0.000
18/JUL/98	02:00a.m.	0.000
18/JUL/98	03:00a.m.	0.000
18/JUL/98	04:00a.m.	0.000
18/JUL/98	05:00a.m.	0.000
18/JUL/98	06:00a.m.	0.000
18/JUL/98	07:00a.m.	0.000
18/JUL/98	08:00a.m.	0.000
18/JUL/98	09:00a.m.	0.000
18/JUL/98	10:00a.m.	0.000
18/JUL/98	11:00a.m.	0.000
18/JUL/98	12:00p.m.	0.000
18/JUL/98	01:00p.m.	0.000
18/JUL/98	02:00p.m.	0.000
18/JUL/98	03:00p.m.	0.000
18/JUL/98	04:00p.m.	0.000
18/JUL/98	05:00p.m.	0.000
18/JUL/98	06:00p.m.	0.000
18/JUL/98	07:00p.m.	0.000
18/JUL/98	08:00p.m.	0.000
18/JUL/98	09:00p.m.	0.000
18/JUL/98	10:00p.m.	0.000
18/JUL/98	11:00p.m.	0.000
19/JUL/98	12:00a.m.	0.000
19/JUL/98	01:00a.m.	0.000
19/JUL/98	02:00a.m.	0.000
19/JUL/98	03:00a.m.	0.000
19/JUL/98	04:00a.m.	0.000
19/JUL/98	05:00a.m.	0.000
19/JUL/98	06:00a.m.	0.000
19/JUL/98	07:00a.m.	0.000
19/JUL/98	08:00a.m.	0.000
19/JUL/98	09:00a.m.	0.000
19/JUL/98	10:00a.m.	0.000
19/JUL/98	11:00a.m.	0.000
19/JUL/98	12:00p.m.	0.000

– Meter not operational

19/JUL/98	01:00p.m.	0.000
19/JUL/98	02:00p.m.	0.000
19/JUL/98	03:00p.m.	0.000
19/JUL/98	04:00p.m.	0.000
19/JUL/98	05:00p.m.	0.000
19/JUL/98	06:00p.m.	0.000
19/JUL/98	07:00p.m.	0.000
19/JUL/98	08:00p.m.	0.000
19/JUL/98	09:00p.m.	0.000
19/JUL/98	10:00p.m.	0.000
19/JUL/98	11:00p.m.	0.000
20/JUL/98	12:00a.m.	0.000
20/JUL/98	01:00a.m.	0.000
20/JUL/98	02:00a.m.	0.000
20/JUL/98	03:00a.m.	0.000
20/JUL/98	04:00a.m.	0.000
20/JUL/98	05:00a.m.	0.000
20/JUL/98	06:00a.m.	0.000
20/JUL/98	07:00a.m.	0.000
20/JUL/98	08:00a.m.	0.000
20/JUL/98	09:00a.m.	0.000
20/JUL/98	10:00a.m.	0.000
20/JUL/98	11:00a.m.	0.000
20/JUL/98	12:00p.m.	0.000
20/JUL/98	01:00p.m.	0.000
20/JUL/98	02:00p.m.	323.959
20/JUL/98	03:00p.m.	341.478
20/JUL/98	04:00p.m.	307.998
20/JUL/98	05:00p.m.	306.119
20/JUL/98	06:00p.m.	316.951
20/JUL/98	07:00p.m.	306.170
20/JUL/98	08:00p.m.	256.638
20/JUL/98	09:00p.m.	304.372
20/JUL/98	10:00p.m.	314.973
20/JUL/98	11:00p.m.	327.781
21/JUL/98	12:00a.m.	304.507
21/JUL/98	01:00a.m.	206.972
21/JUL/98	02:00a.m.	205.726
21/JUL/98	03:00a.m.	202.806
21/JUL/98	04:00a.m.	209.727
21/JUL/98	05:00a.m.	213.199
21/JUL/98	06:00a.m.	258.890
21/JUL/98	07:00a.m.	272.327
21/JUL/98	08:00a.m.	340.678
21/JUL/98	09:00a.m.	333.089
21/JUL/98	10:00a.m.	300.216
21/JUL/98	11:00a.m.	391.350
21/JUL/98	12:00p.m.	399.604
21/JUL/98	01:00p.m.	354.594
21/JUL/98	02:00p.m.	346.279
21/JUL/98	03:00p.m.	350.849
21/JUL/98	04:00p.m.	326.349
21/JUL/98	05:00p.m.	382.631
21/JUL/98	06:00p.m.	328.038
21/JUL/98	07:00p.m.	389.757
21/JUL/98	08:00p.m.	304.590
21/JUL/98	09:00p.m.	358.570
21/JUL/98	10:00p.m.	360.715
21/JUL/98	11:00p.m.	336.625
22/JUL/98	12:00a.m.	303.672

Meter not operational

22/JUL/98	01:00a.m.	233.721
22/JUL/98	02:00a.m.	304.748
22/JUL/98	03:00a.m.	307.157
22/JUL/98	04:00a.m.	388.842
22/JUL/98	05:00a.m.	298.902
22/JUL/98	06:00a.m.	341.064
22/JUL/98	07:00a.m.	334.246
22/JUL/98	08:00a.m.	435.711
22/JUL/98	09:00a.m.	355.641
22/JUL/98	10:00a.m.	333.719
22/JUL/98	11:00a.m.	346.713
22/JUL/98	12:00p.m.	329.708
22/JUL/98	01:00p.m.	337.049
22/JUL/98	02:00p.m.	350.734
22/JUL/98	03:00p.m.	367.495
22/JUL/98	04:00p.m.	339.015
22/JUL/98	05:00p.m.	390.737
22/JUL/98	06:00p.m.	395.268
22/JUL/98	07:00p.m.	355.224
22/JUL/98	08:00p.m.	377.499
22/JUL/98	09:00p.m.	351.148
22/JUL/98	10:00p.m.	402.215
22/JUL/98	11:00p.m.	1912.418
23/JUL/98	12:00a.m.	487.551
23/JUL/98	01:00a.m.	352.905
23/JUL/98	02:00a.m.	318.763
23/JUL/98	03:00a.m.	288.009
23/JUL/98	04:00a.m.	287.562
23/JUL/98	05:00a.m.	358.223
23/JUL/98	06:00a.m.	546.014
23/JUL/98	07:00a.m.	613.303
23/JUL/98	08:00a.m.	403.001
23/JUL/98	09:00a.m.	778.165
23/JUL/98	10:00a.m.	444.238
23/JUL/98	11:00a.m.	354.032
23/JUL/98	12:00p.m.	309.134
23/JUL/98	01:00p.m.	345.868
23/JUL/98	02:00p.m.	283.073
23/JUL/98	03:00p.m.	0.000
23/JUL/98	04:00p.m.	0.000
23/JUL/98	05:00p.m.	0.000
23/JUL/98	06:00p.m.	0.000
23/JUL/98	07:00p.m.	0.000
23/JUL/98	08:00p.m.	0.000
23/JUL/98	09:00p.m.	0.000
23/JUL/98	10:00p.m.	0.000
23/JUL/98	11:00p.m.	0.000
24/JUL/98	12:00a.m.	0.000
24/JUL/98	01:00a.m.	0.000
24/JUL/98	02:00a.m.	0.000
24/JUL/98	03:00a.m.	0.000
24/JUL/98	04:00a.m.	0.000
24/JUL/98	05:00a.m.	0.000
24/JUL/98	06:00a.m.	0.000
24/JUL/98	07:00a.m.	0.000
24/JUL/98	08:00a.m.	0.000
24/JUL/98	09:00a.m.	0.000
24/JUL/98	10:00a.m.	0.000
24/JUL/98	11:00a.m.	0.000
24/JUL/98	12:00p.m.	0.000

- Meter not operational

24/JUL/98	01:00p.m.	0.000
24/JUL/98	02:00p.m.	0.000
24/JUL/98	03:00p.m.	0.000
24/JUL/98	04:00p.m.	0.000
24/JUL/98	05:00p.m.	0.000
24/JUL/98	06:00p.m.	0.000
24/JUL/98	07:00p.m.	0.000
24/JUL/98	08:00p.m.	0.000
24/JUL/98	09:00p.m.	0.000
24/JUL/98	10:00p.m.	0.000
24/JUL/98	11:00p.m.	0.000
25/JUL/98	12:00a.m.	0.000
25/JUL/98	01:00a.m.	0.000
25/JUL/98	02:00a.m.	0.000
25/JUL/98	03:00a.m.	0.000
25/JUL/98	04:00a.m.	0.000
25/JUL/98	05:00a.m.	0.000
25/JUL/98	06:00a.m.	0.000
25/JUL/98	07:00a.m.	0.000
25/JUL/98	08:00a.m.	0.000
25/JUL/98	09:00a.m.	0.000
25/JUL/98	10:00a.m.	0.000
25/JUL/98	11:00a.m.	0.000
25/JUL/98	12:00p.m.	0.000
25/JUL/98	01:00p.m.	0.000
25/JUL/98	02:00p.m.	0.000
25/JUL/98	03:00p.m.	0.000
25/JUL/98	04:00p.m.	0.000
25/JUL/98	05:00p.m.	0.000
25/JUL/98	06:00p.m.	0.000
25/JUL/98	07:00p.m.	0.000
25/JUL/98	08:00p.m.	0.000
25/JUL/98	09:00p.m.	0.000
25/JUL/98	10:00p.m.	0.000
25/JUL/98	11:00p.m.	0.000
26/JUL/98	12:00a.m.	0.000
26/JUL/98	01:00a.m.	0.000
26/JUL/98	02:00a.m.	0.000
26/JUL/98	03:00a.m.	0.000
26/JUL/98	04:00a.m.	0.000
26/JUL/98	05:00a.m.	0.000
26/JUL/98	06:00a.m.	0.000
26/JUL/98	07:00a.m.	0.000
26/JUL/98	08:00a.m.	0.000
26/JUL/98	09:00a.m.	0.000
26/JUL/98	10:00a.m.	0.000
26/JUL/98	11:00a.m.	0.000
26/JUL/98	12:00p.m.	0.000
26/JUL/98	01:00p.m.	0.000
26/JUL/98	02:00p.m.	0.000
26/JUL/98	03:00p.m.	0.000
26/JUL/98	04:00p.m.	0.000
26/JUL/98	05:00p.m.	0.000
26/JUL/98	06:00p.m.	0.000
26/JUL/98	07:00p.m.	0.000
26/JUL/98	08:00p.m.	0.000
26/JUL/98	09:00p.m.	0.000
26/JUL/98	10:00p.m.	0.000
26/JUL/98	11:00p.m.	0.000
27/JUL/98	12:00a.m.	0.000

- Meter not operational

27/JUL/98	01:00a.m.	0.000
27/JUL/98	02:00a.m.	0.000
27/JUL/98	03:00a.m.	0.000
27/JUL/98	04:00a.m.	0.000
27/JUL/98	05:00a.m.	0.000
27/JUL/98	06:00a.m.	0.000
27/JUL/98	07:00a.m.	0.000
27/JUL/98	08:00a.m.	0.000
27/JUL/98	09:00a.m.	0.000
27/JUL/98	10:00a.m.	0.000
27/JUL/98	11:00a.m.	0.000
27/JUL/98	12:00p.m.	0.000
27/JUL/98	01:00p.m.	0.000
27/JUL/98	02:00p.m.	333.868
27/JUL/98	03:00p.m.	370.273
27/JUL/98	04:00p.m.	325.134
27/JUL/98	05:00p.m.	358.265
27/JUL/98	06:00p.m.	360.696
27/JUL/98	07:00p.m.	367.774
27/JUL/98	08:00p.m.	296.202
27/JUL/98	09:00p.m.	357.061
27/JUL/98	10:00p.m.	358.820
27/JUL/98	11:00p.m.	356.434
28/JUL/98	12:00a.m.	355.599
28/JUL/98	01:00a.m.	250.553
28/JUL/98	02:00a.m.	255.328
28/JUL/98	03:00a.m.	262.978
28/JUL/98	04:00a.m.	258.475
28/JUL/98	05:00a.m.	252.646
28/JUL/98	06:00a.m.	266.720
28/JUL/98	07:00a.m.	275.253
28/JUL/98	08:00a.m.	338.347
28/JUL/98	09:00a.m.	354.154
28/JUL/98	10:00a.m.	335.848
28/JUL/98	11:00a.m.	344.234
28/JUL/98	12:00p.m.	318.551
28/JUL/98	01:00p.m.	315.863
28/JUL/98	02:00p.m.	340.438
28/JUL/98	03:00p.m.	355.933
28/JUL/98	04:00p.m.	342.037
28/JUL/98	05:00p.m.	373.523
28/JUL/98	06:00p.m.	352.060
28/JUL/98	07:00p.m.	357.555
28/JUL/98	08:00p.m.	330.938
28/JUL/98	09:00p.m.	378.838
28/JUL/98	10:00p.m.	380.036
28/JUL/98	11:00p.m.	364.042
29/JUL/98	12:00a.m.	335.113
29/JUL/98	01:00a.m.	238.972
29/JUL/98	02:00a.m.	218.415
29/JUL/98	03:00a.m.	241.551
29/JUL/98	04:00a.m.	287.245
29/JUL/98	05:00a.m.	348.537
29/JUL/98	06:00a.m.	321.159
29/JUL/98	07:00a.m.	561.019
29/JUL/98	08:00a.m.	399.194
29/JUL/98	09:00a.m.	367.903
29/JUL/98	10:00a.m.	321.637
29/JUL/98	11:00a.m.	331.792
29/JUL/98	12:00p.m.	305.037

- Meter not operational

29/JUL/98	01:00p.m.	320.436
29/JUL/98	02:00p.m.	286.471
29/JUL/98	03:00p.m.	314.626
29/JUL/98	04:00p.m.	301.742
29/JUL/98	05:00p.m.	312.632
29/JUL/98	06:00p.m.	340.312
29/JUL/98	07:00p.m.	375.643
29/JUL/98	08:00p.m.	309.253
29/JUL/98	09:00p.m.	370.517
29/JUL/98	10:00p.m.	357.035
29/JUL/98	11:00p.m.	376.625
30/JUL/98	12:00a.m.	326.291
30/JUL/98	01:00a.m.	251.741
30/JUL/98	02:00a.m.	236.480
30/JUL/98	03:00a.m.	255.922
30/JUL/98	04:00a.m.	332.261
30/JUL/98	05:00a.m.	286.448
30/JUL/98	06:00a.m.	311.434
30/JUL/98	07:00a.m.	305.949
30/JUL/98	08:00a.m.	349.231
30/JUL/98	09:00a.m.	320.237
30/JUL/98	10:00a.m.	350.056
30/JUL/98	11:00a.m.	319.434
30/JUL/98	12:00p.m.	334.837
30/JUL/98	01:00p.m.	300.849
30/JUL/98	02:00p.m.	332.794
30/JUL/98	03:00p.m.	320.015
30/JUL/98	04:00p.m.	315.760
30/JUL/98	05:00p.m.	315.410
30/JUL/98	06:00p.m.	309.825
30/JUL/98	07:00p.m.	309.411
30/JUL/98	08:00p.m.	288.298
30/JUL/98	09:00p.m.	343.925
30/JUL/98	10:00p.m.	325.889
30/JUL/98	11:00p.m.	323.060
31/JUL/98	12:00a.m.	327.983
31/JUL/98	01:00a.m.	262.586
31/JUL/98	02:00a.m.	267.872
31/JUL/98	03:00a.m.	258.042
31/JUL/98	04:00a.m.	260.887
31/JUL/98	05:00a.m.	257.904
31/JUL/98	06:00a.m.	337.952
31/JUL/98	07:00a.m.	321.297
31/JUL/98	08:00a.m.	325.488
31/JUL/98	09:00a.m.	323.448
31/JUL/98	10:00a.m.	293.363
31/JUL/98	11:00a.m.	324.203
31/JUL/98	12:00p.m.	283.747
31/JUL/98	01:00p.m.	297.428
31/JUL/98	02:00p.m.	320.503
31/JUL/98	03:00p.m.	332.772
31/JUL/98	04:00p.m.	282.206
31/JUL/98	05:00p.m.	322.334
31/JUL/98	06:00p.m.	314.703
31/JUL/98	07:00p.m.	302.718
31/JUL/98	08:00p.m.	261.607
31/JUL/98	09:00p.m.	289.178
31/JUL/98	10:00p.m.	274.463
31/JUL/98	11:00p.m.	265.868
01/AUG/98	12:00a.m.	246.313

01/AUG/98	01:00a.m.	195.857
01/AUG/98	02:00a.m.	203.015
01/AUG/98	03:00a.m.	263.559
01/AUG/98	04:00a.m.	254.175
01/AUG/98	05:00a.m.	265.730
01/AUG/98	06:00a.m.	261.103
01/AUG/98	07:00a.m.	257.464
01/AUG/98	08:00a.m.	244.666
01/AUG/98	09:00a.m.	213.941
01/AUG/98	10:00a.m.	239.251
01/AUG/98	11:00a.m.	230.371
01/AUG/98	12:00p.m.	235.866
01/AUG/98	01:00p.m.	245.350
01/AUG/98	02:00p.m.	238.872
01/AUG/98	03:00p.m.	257.708
01/AUG/98	04:00p.m.	245.950
01/AUG/98	05:00p.m.	276.187
01/AUG/98	06:00p.m.	232.019
01/AUG/98	07:00p.m.	220.762
01/AUG/98	08:00p.m.	209.836
01/AUG/98	09:00p.m.	218.199
01/AUG/98	10:00p.m.	207.893
01/AUG/98	11:00p.m.	207.836
02/AUG/98	12:00a.m.	207.887
02/AUG/98	01:00a.m.	206.776
02/AUG/98	02:00a.m.	227.619
02/AUG/98	03:00a.m.	225.702
02/AUG/98	04:00a.m.	218.273
02/AUG/98	05:00a.m.	230.291
02/AUG/98	06:00a.m.	239.049
02/AUG/98	07:00a.m.	222.134
02/AUG/98	08:00a.m.	206.031
02/AUG/98	09:00a.m.	199.142
02/AUG/98	10:00a.m.	193.262
02/AUG/98	11:00a.m.	215.460
02/AUG/98	12:00p.m.	241.078
02/AUG/98	01:00p.m.	235.365
02/AUG/98	02:00p.m.	236.081
02/AUG/98	03:00p.m.	250.177
02/AUG/98	04:00p.m.	261.844
02/AUG/98	05:00p.m.	240.115
02/AUG/98	06:00p.m.	208.025
02/AUG/98	07:00p.m.	210.533
02/AUG/98	08:00p.m.	215.209
02/AUG/98	09:00p.m.	200.757
02/AUG/98	10:00p.m.	195.507
02/AUG/98	11:00p.m.	209.724
03/AUG/98	12:00a.m.	204.380
03/AUG/98	01:00a.m.	275.905
03/AUG/98	02:00a.m.	337.069
03/AUG/98	03:00a.m.	271.325
03/AUG/98	04:00a.m.	266.684
03/AUG/98	05:00a.m.	277.298
03/AUG/98	06:00a.m.	290.915
03/AUG/98	07:00a.m.	347.477
03/AUG/98	08:00a.m.	332.990
03/AUG/98	09:00a.m.	350.287
03/AUG/98	10:00a.m.	323.896
03/AUG/98	11:00a.m.	333.700
03/AUG/98	12:00p.m.	290.254

03/AUG/98	01:00p.m.	308.560
03/AUG/98	02:00p.m.	321.984
03/AUG/98	03:00p.m.	301.944
03/AUG/98	04:00p.m.	280.764
03/AUG/98	05:00p.m.	325.411
03/AUG/98	06:00p.m.	343.848
03/AUG/98	07:00p.m.	366.840
03/AUG/98	08:00p.m.	300.740
03/AUG/98	09:00p.m.	300.820
03/AUG/98	10:00p.m.	356.704
03/AUG/98	11:00p.m.	343.623
04/AUG/98	12:00a.m.	282.729
04/AUG/98	01:00a.m.	236.046
04/AUG/98	02:00a.m.	268.206
04/AUG/98	03:00a.m.	347.805
04/AUG/98	04:00a.m.	304.054
04/AUG/98	05:00a.m.	363.506
04/AUG/98	06:00a.m.	284.849
04/AUG/98	07:00a.m.	337.762
04/AUG/98	08:00a.m.	347.696
04/AUG/98	09:00a.m.	335.591
04/AUG/98	10:00a.m.	301.517
04/AUG/98	11:00a.m.	315.394
04/AUG/98	12:00p.m.	288.102
04/AUG/98	01:00p.m.	278.605
04/AUG/98	02:00p.m.	324.982
04/AUG/98	03:00p.m.	321.306
04/AUG/98	04:00p.m.	279.280
04/AUG/98	05:00p.m.	311.967
04/AUG/98	06:00p.m.	333.616
04/AUG/98	07:00p.m.	322.459
04/AUG/98	08:00p.m.	286.419
04/AUG/98	09:00p.m.	332.193
04/AUG/98	10:00p.m.	327.366
04/AUG/98	11:00p.m.	338.546
05/AUG/98	12:00a.m.	285.562
05/AUG/98	01:00a.m.	247.787
05/AUG/98	02:00a.m.	247.739
05/AUG/98	03:00a.m.	258.774
05/AUG/98	04:00a.m.	235.060
05/AUG/98	05:00a.m.	262.111
05/AUG/98	06:00a.m.	268.364
05/AUG/98	07:00a.m.	305.489
05/AUG/98	08:00a.m.	332.656
05/AUG/98	09:00a.m.	348.601
05/AUG/98	10:00a.m.	322.973
05/AUG/98	11:00a.m.	339.779
05/AUG/98	12:00p.m.	311.813
05/AUG/98	01:00p.m.	306.446
05/AUG/98	02:00p.m.	330.048
05/AUG/98	03:00p.m.	330.231
05/AUG/98	04:00p.m.	276.935
05/AUG/98	05:00p.m.	308.338
05/AUG/98	06:00p.m.	315.872
05/AUG/98	07:00p.m.	334.133
05/AUG/98	08:00p.m.	280.706
05/AUG/98	09:00p.m.	292.765
05/AUG/98	10:00p.m.	315.792
05/AUG/98	11:00p.m.	281.595
06/AUG/98	12:00a.m.	338.077

06/AUG/98	01:00a.m.	253.796
06/AUG/98	02:00a.m.	355.236
06/AUG/98	03:00a.m.	288.625
06/AUG/98	04:00a.m.	268.865
06/AUG/98	05:00a.m.	280.629
06/AUG/98	06:00a.m.	255.768
06/AUG/98	07:00a.m.	343.495
06/AUG/98	08:00a.m.	335.193
06/AUG/98	09:00a.m.	324.409
06/AUG/98	10:00a.m.	313.772
06/AUG/98	11:00a.m.	354.135
06/AUG/98	12:00p.m.	298.739
06/AUG/98	01:00p.m.	319.444
06/AUG/98	02:00p.m.	342.698
06/AUG/98	03:00p.m.	322.478
06/AUG/98	04:00p.m.	303.511
06/AUG/98	05:00p.m.	355.224
06/AUG/98	06:00p.m.	324.351
06/AUG/98	07:00p.m.	355.583
06/AUG/98	08:00p.m.	324.836
06/AUG/98	09:00p.m.	292.579
06/AUG/98	10:00p.m.	347.124
06/AUG/98	11:00p.m.	343.630
07/AUG/98	12:00a.m.	300.351
07/AUG/98	01:00a.m.	265.403
07/AUG/98	02:00a.m.	300.113
07/AUG/98	03:00a.m.	309.385
07/AUG/98	04:00a.m.	305.438
07/AUG/98	05:00a.m.	268.537
07/AUG/98	06:00a.m.	264.118
07/AUG/98	07:00a.m.	327.864
07/AUG/98	08:00a.m.	335.450
07/AUG/98	09:00a.m.	334.856
07/AUG/98	10:00a.m.	321.563
07/AUG/98	11:00a.m.	325.953
07/AUG/98	12:00p.m.	297.435
07/AUG/98	01:00p.m.	334.531
07/AUG/98	02:00p.m.	336.998
07/AUG/98	03:00p.m.	336.895
07/AUG/98	04:00p.m.	275.050
07/AUG/98	05:00p.m.	266.052
07/AUG/98	06:00p.m.	332.820
07/AUG/98	07:00p.m.	260.900
07/AUG/98	08:00p.m.	247.974
07/AUG/98	09:00p.m.	238.496
07/AUG/98	10:00p.m.	231.614
07/AUG/98	11:00p.m.	227.876
08/AUG/98	12:00a.m.	216.851
08/AUG/98	01:00a.m.	223.964
08/AUG/98	02:00a.m.	213.376
08/AUG/98	03:00a.m.	222.223
08/AUG/98	04:00a.m.	214.570
08/AUG/98	05:00a.m.	228.438
08/AUG/98	06:00a.m.	229.498
08/AUG/98	07:00a.m.	217.714
08/AUG/98	08:00a.m.	238.583
08/AUG/98	09:00a.m.	232.109
08/AUG/98	10:00a.m.	215.489
08/AUG/98	11:00a.m.	207.319
08/AUG/98	12:00p.m.	195.227

08/AUG/98	01:00p.m.	211.487
08/AUG/98	02:00p.m.	203.272
08/AUG/98	03:00p.m.	211.715
08/AUG/98	04:00p.m.	202.267
08/AUG/98	05:00p.m.	220.753
08/AUG/98	06:00p.m.	218.203
08/AUG/98	07:00p.m.	214.952
08/AUG/98	08:00p.m.	227.086
08/AUG/98	09:00p.m.	210.463
08/AUG/98	10:00p.m.	215.042
08/AUG/98	11:00p.m.	212.637
09/AUG/98	12:00a.m.	202.293
09/AUG/98	01:00a.m.	206.233
09/AUG/98	02:00a.m.	206.763
09/AUG/98	03:00a.m.	196.798
09/AUG/98	04:00a.m.	234.549
09/AUG/98	05:00a.m.	248.982
09/AUG/98	06:00a.m.	245.032
09/AUG/98	07:00a.m.	247.007
09/AUG/98	08:00a.m.	226.893
09/AUG/98	09:00a.m.	208.838
09/AUG/98	10:00a.m.	201.975
09/AUG/98	11:00a.m.	208.250
09/AUG/98	12:00p.m.	214.875
09/AUG/98	01:00p.m.	226.797
09/AUG/98	02:00p.m.	229.051
09/AUG/98	03:00p.m.	243.847
09/AUG/98	04:00p.m.	235.355
09/AUG/98	05:00p.m.	215.893
09/AUG/98	06:00p.m.	224.176
09/AUG/98	07:00p.m.	225.104
09/AUG/98	08:00p.m.	223.951
09/AUG/98	09:00p.m.	215.996
09/AUG/98	10:00p.m.	217.448
09/AUG/98	11:00p.m.	338.642
10/AUG/98	12:00a.m.	313.470
10/AUG/98	01:00a.m.	254.911
10/AUG/98	02:00a.m.	294.939
10/AUG/98	03:00a.m.	296.616
10/AUG/98	04:00a.m.	275.041
10/AUG/98	05:00a.m.	275.815
10/AUG/98	06:00a.m.	304.057
10/AUG/98	07:00a.m.	337.178
10/AUG/98	08:00a.m.	347.140
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10/AUG/98	10:00a.m.	302.727
10/AUG/98	11:00a.m.	339.108
10/AUG/98	12:00p.m.	276.267
10/AUG/98	01:00p.m.	313.220
10/AUG/98	02:00p.m.	336.686
10/AUG/98	03:00p.m.	326.702
10/AUG/98	04:00p.m.	336.221
10/AUG/98	05:00p.m.	355.583
10/AUG/98	06:00p.m.	438.236
10/AUG/98	07:00p.m.	1640.658
10/AUG/98	08:00p.m.	570.316
10/AUG/98	09:00p.m.	346.112
10/AUG/98	10:00p.m.	328.022
10/AUG/98	11:00p.m.	318.034
11/AUG/98	12:00a.m.	308.344

11/AUG/98	01:00a.m.	312.953
11/AUG/98	02:00a.m.	572.496
11/AUG/98	03:00a.m.	354.825
11/AUG/98	04:00a.m.	320.240
11/AUG/98	05:00a.m.	319.277
11/AUG/98	06:00a.m.	288.169
11/AUG/98	07:00a.m.	333.684
11/AUG/98	08:00a.m.	349.992
11/AUG/98	09:00a.m.	335.052
11/AUG/98	10:00a.m.	340.617
11/AUG/98	11:00a.m.	355.535
11/AUG/98	12:00p.m.	360.699
11/AUG/98	01:00p.m.	349.199
11/AUG/98	02:00p.m.	294.291
11/AUG/98	03:00p.m.	306.623
11/AUG/98	04:00p.m.	294.573
11/AUG/98	05:00p.m.	328.430
11/AUG/98	06:00p.m.	369.605
11/AUG/98	07:00p.m.	300.367
11/AUG/98	08:00p.m.	268.129
11/AUG/98	09:00p.m.	275.163
11/AUG/98	10:00p.m.	320.413
11/AUG/98	11:00p.m.	345.309
12/AUG/98	12:00a.m.	273.281
12/AUG/98	01:00a.m.	349.790
12/AUG/98	02:00a.m.	279.450
12/AUG/98	03:00a.m.	259.953
12/AUG/98	04:00a.m.	358.156
12/AUG/98	05:00a.m.	312.285
12/AUG/98	06:00a.m.	277.636
12/AUG/98	07:00a.m.	328.744
12/AUG/98	08:00a.m.	380.197
12/AUG/98	09:00a.m.	342.904
12/AUG/98	10:00a.m.	314.623
12/AUG/98	11:00a.m.	305.367
12/AUG/98	12:00p.m.	320.751
12/AUG/98	01:00p.m.	311.492
12/AUG/98	02:00p.m.	290.161
12/AUG/98	03:00p.m.	302.214
12/AUG/98	04:00p.m.	276.926
12/AUG/98	05:00p.m.	316.389
12/AUG/98	06:00p.m.	353.444
12/AUG/98	07:00p.m.	276.788
12/AUG/98	08:00p.m.	253.870
12/AUG/98	09:00p.m.	263.026
12/AUG/98	10:00p.m.	267.098
12/AUG/98	11:00p.m.	268.781
13/AUG/98	12:00a.m.	262.795
13/AUG/98	01:00a.m.	268.858
13/AUG/98	02:00a.m.	347.012
13/AUG/98	03:00a.m.	255.344
13/AUG/98	04:00a.m.	318.239
13/AUG/98	05:00a.m.	342.361
13/AUG/98	06:00a.m.	263.129
13/AUG/98	07:00a.m.	263.469
13/AUG/98	08:00a.m.	303.511
13/AUG/98	09:00a.m.	269.138
13/AUG/98	10:00a.m.	272.436
13/AUG/98	11:00a.m.	281.955
13/AUG/98	12:00p.m.	303.553

13/AUG/98	01:00p.m.	318.454
13/AUG/98	02:00p.m.	291.609
13/AUG/98	03:00p.m.	293.591
13/AUG/98	04:00p.m.	326.756
13/AUG/98	05:00p.m.	332.123
13/AUG/98	06:00p.m.	325.947
13/AUG/98	07:00p.m.	331.721
13/AUG/98	08:00p.m.	306.703
13/AUG/98	09:00p.m.	320..224
13/AUG/98	10:00p.m.	322.138
13/AUG/98	11:00p.m.	303.293
14/AUG/98	12:00a.m.	266.909
14/AUG/98	01:00a.m.	227.834
14/AUG/98	02:00a.m.	227.972
14/AUG/98	03:00a.m.	324.656
14/AUG/98	04:00a.m.	343.922
14/AUG/98	05:00a.m.	226.549
14/AUG/98	06:00a.m.	270.355
14/AUG/98	07:00a.m.	308.393
14/AUG/98	08:00a.m.	286.329
14/AUG/98	09:00a.m.	286.959
14/AUG/98	10:00a.m.	277.770
14/AUG/98	11:00a.m.	256.436
14/AUG/98	12:00p.m.	296.764
14/AUG/98	01:00p.m.	277.453
14/AUG/98	02:00p.m.	274.973
14/AUG/98	03:00p.m.	296.712
14/AUG/98	04:00p.m.	277.944
14/AUG/98	05:00p.m.	272.661
14/AUG/98	06:00p.m.	266.623
14/AUG/98	07:00p.m.	258.764
14/AUG/98	08:00p.m.	238.843
14/AUG/98	09:00p.m.	243.603
14/AUG/98	10:00p.m.	281.319
14/AUG/98	11:00p.m.	281.300
15/AUG/98	12:00a.m.	231.980
15/AUG/98	01:00a.m.	225.088
15/AUG/98	02:00a.m.	221.045
15/AUG/98	03:00a.m.	223.020
15/AUG/98	04:00a.m.	219.217
15/AUG/98	05:00a.m.	222.114
15/AUG/98	06:00a.m.	227.506
15/AUG/98	07:00a.m.	299.012
15/AUG/98	08:00a.m.	229.523
15/AUG/98	09:00a.m.	213.408
15/AUG/98	10:00a.m.	235.709
15/AUG/98	11:00a.m.	239.556
15/AUG/98	12:00p.m.	238.744
15/AUG/98	01:00p.m.	241.685
15/AUG/98	02:00p.m.	244.165
15/AUG/98	03:00p.m.	238.410
15/AUG/98	04:00p.m.	249.942
15/AUG/98	05:00p.m.	246.085
15/AUG/98	06:00p.m.	248.404
15/AUG/98	07:00p.m.	249.480
15/AUG/98	08:00p.m.	234.636
15/AUG/98	09:00p.m.	232.385
15/AUG/98	10:00p.m.	232.237
15/AUG/98	11:00p.m.	228.120
16/AUG/98	12:00a.m.	233.952

16/AUG/98	01:00a.m.	225.926
16/AUG/98	02:00a.m.	236.724
16/AUG/98	03:00a.m.	242.209
16/AUG/98	04:00a.m.	239.116
16/AUG/98	05:00a.m.	245.038
16/AUG/98	06:00a.m.	237.806
16/AUG/98	07:00a.m.	236.258
16/AUG/98	08:00a.m.	233.326
16/AUG/98	09:00a.m.	229.472
16/AUG/98	10:00a.m.	227.015
16/AUG/98	11:00a.m.	232.096
16/AUG/98	12:00p.m.	227.821
16/AUG/98	01:00p.m.	245.019
16/AUG/98	02:00p.m.	248.468
16/AUG/98	03:00p.m.	257.306
16/AUG/98	04:00p.m.	246.153
16/AUG/98	05:00p.m.	260.046
16/AUG/98	06:00p.m.	255.563
16/AUG/98	07:00p.m.	253.799
16/AUG/98	08:00p.m.	247.855
16/AUG/98	09:00p.m.	251.291
16/AUG/98	10:00p.m.	248.060
16/AUG/98	11:00p.m.	240.973
17/AUG/98	12:00a.m.	237.636
17/AUG/98	01:00a.m.	325.199
17/AUG/98	02:00a.m.	357.767
17/AUG/98	03:00a.m.	312.780
17/AUG/98	04:00a.m.	307.179
17/AUG/98	05:00a.m.	308.926
17/AUG/98	06:00a.m.	315.314
17/AUG/98	07:00a.m.	299.240
17/AUG/98	08:00a.m.	369.277
17/AUG/98	09:00a.m.	308.142
17/AUG/98	10:00a.m.	297.644
17/AUG/98	11:00a.m.	338.421
17/AUG/98	12:00p.m.	306.006
17/AUG/98	01:00p.m.	315.291
17/AUG/98	02:00p.m.	304.645
17/AUG/98	03:00p.m.	344.262
17/AUG/98	04:00p.m.	324.868
17/AUG/98	05:00p.m.	307.092
17/AUG/98	06:00p.m.	296.635
17/AUG/98	07:00p.m.	277.902
17/AUG/98	08:00p.m.	263.100
17/AUG/98	09:00p.m.	301.086
17/AUG/98	10:00p.m.	325.883
17/AUG/98	11:00p.m.	255.909
18/AUG/98	12:00a.m.	241.589
18/AUG/98	01:00a.m.	244.107
18/AUG/98	02:00a.m.	259.574
18/AUG/98	03:00a.m.	236.817
18/AUG/98	04:00a.m.	276.923
18/AUG/98	05:00a.m.	313.030
18/AUG/98	06:00a.m.	315.201
18/AUG/98	07:00a.m.	276.650
18/AUG/98	08:00a.m.	354.742
18/AUG/98	09:00a.m.	336.028
18/AUG/98	10:00a.m.	371.449
18/AUG/98	11:00a.m.	356.197
18/AUG/98	12:00p.m.	339.782

18/AUG/98	01:00p.m.	316.730
18/AUG/98	02:00p.m.	312.375
18/AUG/98	03:00p.m.	303.553
18/AUG/98	04:00p.m.	277.470
18/AUG/98	05:00p.m.	265.599
18/AUG/98	06:00p.m.	307.580
18/AUG/98	07:00p.m.	258.655
18/AUG/98	08:00p.m.	296.118
18/AUG/98	09:00p.m.	232.956
18/AUG/98	10:00p.m.	217.107
18/AUG/98	11:00p.m.	218.938
19/AUG/98	12:00a.m.	230.040
19/AUG/98	01:00a.m.	214.731
19/AUG/98	02:00a.m.	207.662
19/AUG/98	03:00a.m.	207.932
19/AUG/98	04:00a.m.	233.563
19/AUG/98	05:00a.m.	220.663
19/AUG/98	06:00a.m.	199.858
19/AUG/98	07:00a.m.	264.031
19/AUG/98	08:00a.m.	332.405
19/AUG/98	09:00a.m.	279.755
19/AUG/98	10:00a.m.	312.853
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19/AUG/98	12:00p.m.	286.862
19/AUG/98	01:00p.m.	286.853
19/AUG/98	02:00p.m.	295.376
19/AUG/98	03:00p.m.	274.437
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19/AUG/98	08:00p.m.	264.170
19/AUG/98	09:00p.m.	227.677
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19/AUG/98	11:00p.m.	225.358
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20/AUG/98	04:00a.m.	239.087
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20/AUG/98	09:00a.m.	310.445
20/AUG/98	10:00a.m.	278.111
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20/AUG/98	07:00p.m.	307.599
20/AUG/98	08:00p.m.	363.291
20/AUG/98	09:00p.m.	304.564
20/AUG/98	10:00p.m.	253.902
20/AUG/98	11:00p.m.	256.728
21/AUG/98	12:00a.m.	254.117

21/AUG/98	01:00a.m.	251.503
21/AUG/98	02:00a.m.	268.309
21/AUG/98	03:00a.m.	295.508
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21/AUG/98	10:00a.m.	269.934
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21/AUG/98	12:00p.m.	253.253
21/AUG/98	01:00p.m.	272.314
21/AUG/98	02:00p.m.	254.085
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23/AUG/98	05:00a.m.	202.350
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23/AUG/98	11:00a.m.	207.197
23/AUG/98	12:00p.m.	229.504

23/AUG/98	01:00p.m.	229.141
23/AUG/98	02:00p.m.	228.364
23/AUG/98	03:00p.m.	225.043
23/AUG/98	04:00p.m.	240.783
23/AUG/98	05:00p.m.	233.576
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23/AUG/98	08:00p.m.	223.386
23/AUG/98	09:00p.m.	228.775
23/AUG/98	10:00p.m.	235.901
23/AUG/98	11:00p.m.	233.554
24/AUG/98	12:00a.m.	235.558
24/AUG/98	01:00a.m.	251.901
24/AUG/98	02:00a.m.	245.286
24/AUG/98	03:00a.m.	255.746
24/AUG/98	04:00a.m.	262.606
24/AUG/98	05:00a.m.	256.960
24/AUG/98	06:00a.m.	292.332
24/AUG/98	07:00a.m.	323.206
24/AUG/98	08:00a.m.	482.739
24/AUG/98	09:00a.m.	318.596
24/AUG/98	10:00a.m.	300.630
24/AUG/98	11:00a.m.	302.271
24/AUG/98	12:00p.m.	317.285
24/AUG/98	01:00p.m.	312.834
24/AUG/98	02:00p.m.	292.659
24/AUG/98	03:00p.m.	307.683
24/AUG/98	04:00p.m.	276.897
24/AUG/98	05:00p.m.	325.603
24/AUG/98	06:00p.m.	293.048
24/AUG/98	07:00p.m.	316.762
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24/AUG/98	09:00p.m.	1133.954
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25/AUG/98	08:00a.m.	38.539
25/AUG/98	09:00a.m.	38.539
25/AUG/98	10:00a.m.	38.539
25/AUG/98	11:00a.m.	38.539
25/AUG/98	12:00p.m.	38.539

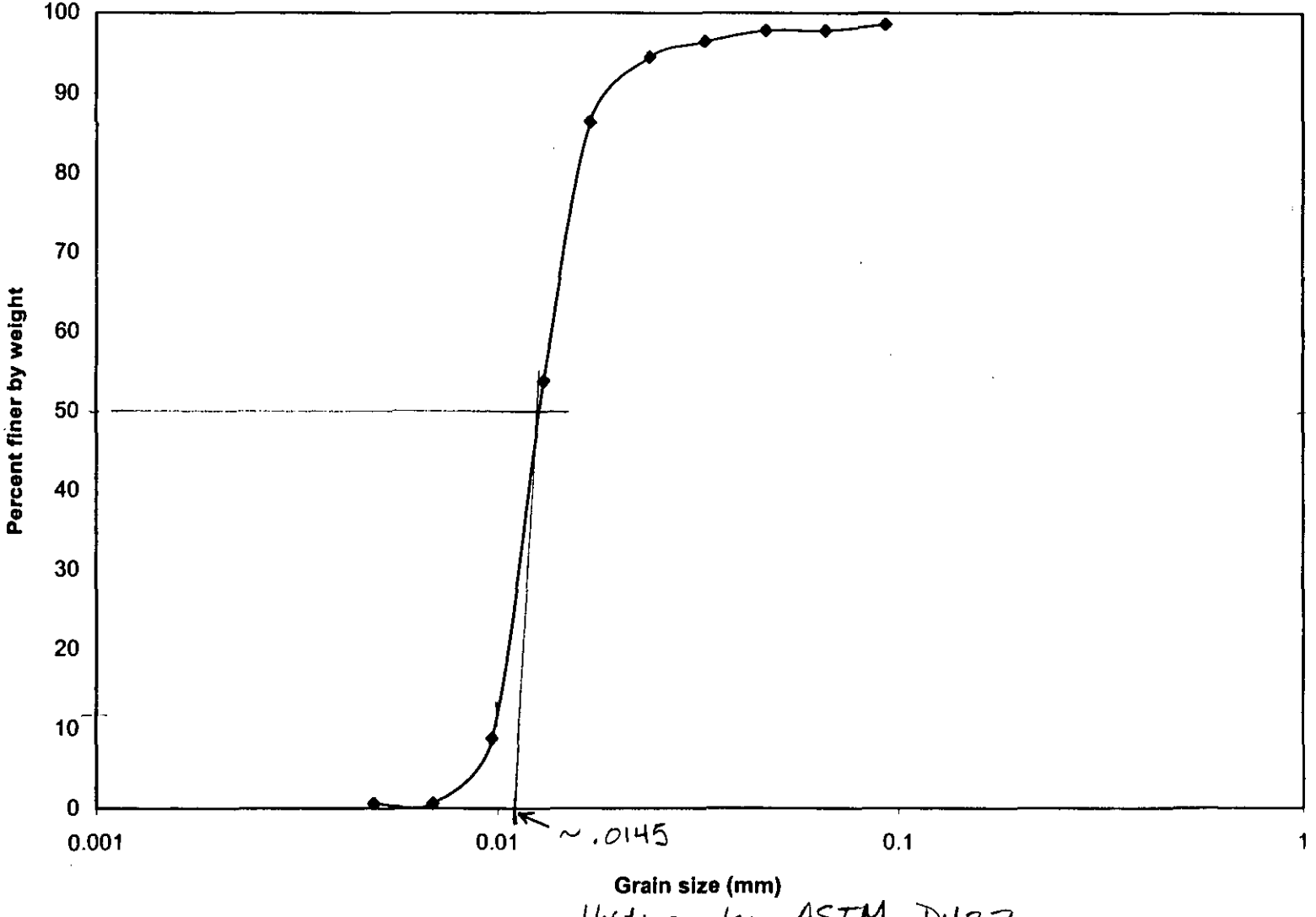
Inaccurate Readings
Meter dislodged in channel

APPENDIX E

WASTEWATER INFLUENT PARTICLE SIZE DISTRIBUTIONS

Particle distribution curve (Sample B)

from sample provided by Syracuse China



Hydrometer ASTM D422

.0145 MM = 14.5 µm

Hydrometer Analysis

Mass in suspension = 24 g
Assumed specific unit weight Gs = 2.75

Time (min)	Hydrometer Reading, R	Temperature (°C)	Percent finer by weight	Grain size (mm)
0.25	24	20	98.6	0.0930
0.5	23.8	20	97.8	0.0660
1	23.8	20	97.8	0.0467
2	23.5	20	96.4	0.0330
4	23	20	94.5	0.0240
8	21	20	86.4	0.0170
15	13	20	53.7	0.0130
30	2	20	8.8	0.0097
60	0	20	0.6	0.0069
120	0	20	0.6	0.0049

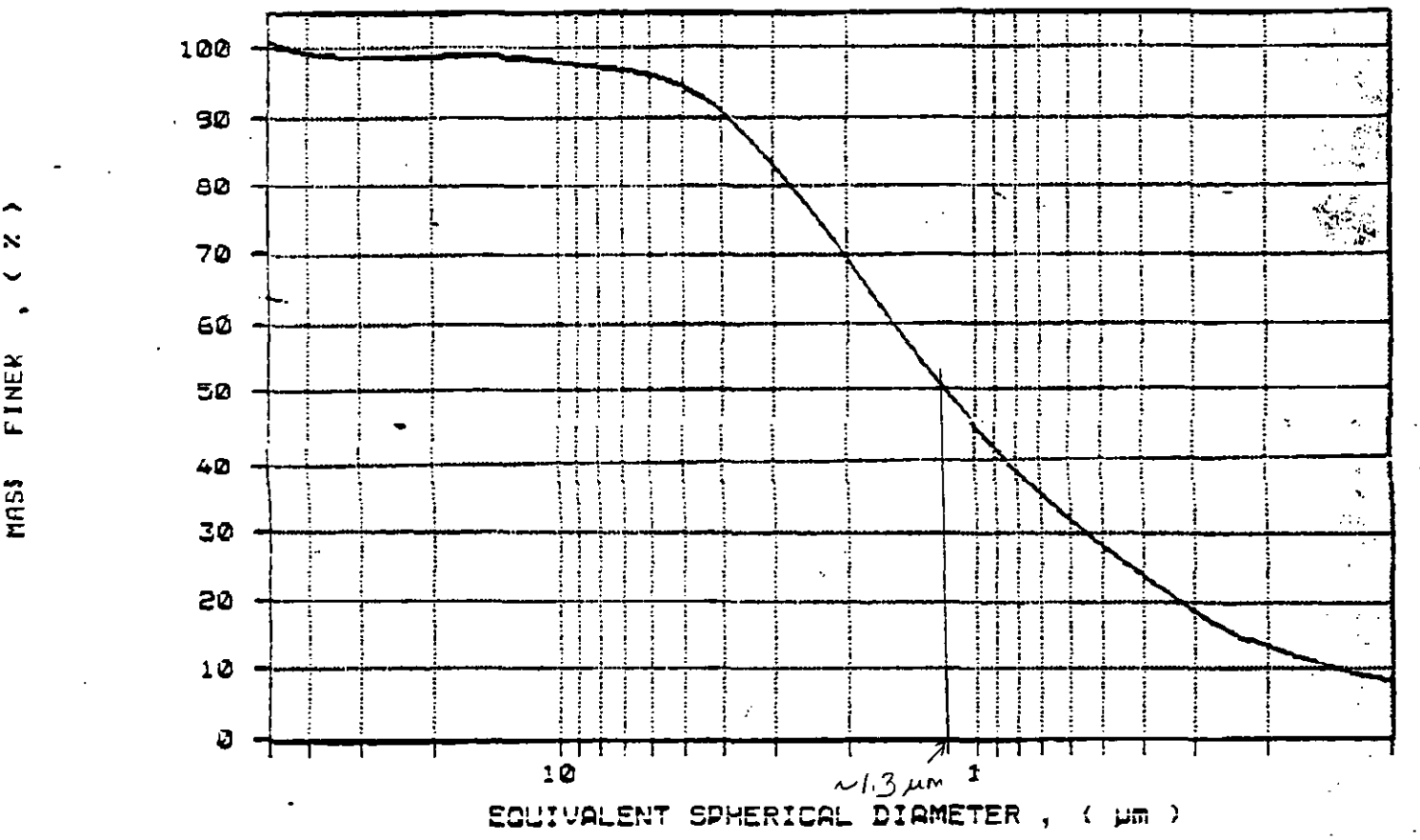
sample for phil

SediGraph 5100 V3.07 PAGE 2

SAMPLE DIRECTORY/NUMBER: RAWMATLS/133
SAMPLE ID: waste water solids
SUBMITTER: SYRACUSE CHINA
OPERATOR: Cary Casler
SAMPLE TYPE: ALUMINA
LIQUID TYPE: Water
ANALYSIS TEMP: 34.9 deg C
BASELINE/FULL SCALE: 140/ 102 kilocounts/sec

UNIT NUMBER: 1
START 13:37:22 03/05/99
REPRT 12:26:24 02/14/00
TOT RUN TIME 0:59:32
SAM DENS: 3.9800 g/cc
LIQ DENS: 0.9941 g/cc
LIQ VISC: 0.7243 cp
RUN TYPE: High Speed

CUMULATIVE MASS PERCENT FINER VS. DIAMETER



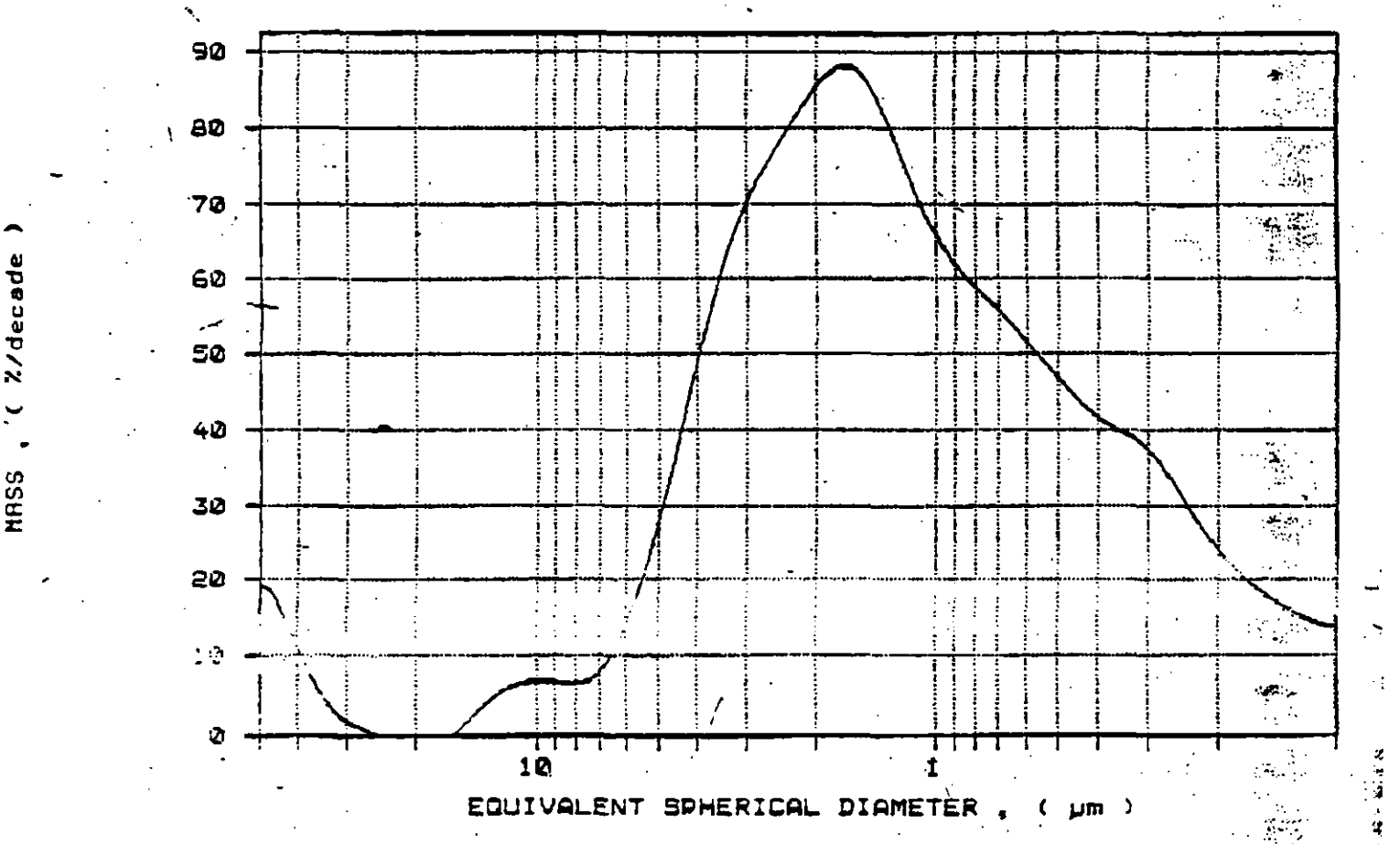
sample for phil

SediGraph 5100 V3.07 PAGE 3

SAMPLE DIRECTORY/NUMBER: RAWMATLS/133
SAMPLE ID: waste water solids
SUBMITTER: SYRACUSE CHINA
OPERATOR: Cary Casler
SAMPLE TYPE: ALUMINA
LIQUID TYPE: Water
ANALYSIS TEMP: 34.9 deg C
BASELINE/FULL SCALE: 140/ 102 kilocounts/sec

UNIT NUMBER: 1
START 13:37:22 03/05/99
REPRT 12:26:24 02/14/00
TOT RUN TIME 0:59:32
SAM DENS: 3.9800 g/cc
LIQ DENS: 0.9941 g/cc
LIQ VISC: 0.7243 cp
RUN TYPE: High Speed

MASS POPULATION VS. DIAMETER



sample for phil

SediGraph 5100 V3.07 PAGE 1

SAMPLE DIRECTORY/NUMBER: RAWMATLS/133
SAMPLE ID: waste water solids
SUBMITTER: SYRACUSE CHINA
OPERATOR: Cary Casler
SAMPLE TYPE: ALUMINA
LIQUID TYPE: Water
ANALYSIS TEMP: 34.9 deg C
BASELINE/FULL SCALE: 140/ 102 kilocounts/sec

UNIT NUMBER: 1
START 13:37:22 03/05/99
REPRT 12:26:24 02/14/00
TOT RUN TIME 0:59:32
SAM DENS: 3.9800 g/cc
LIQ DENS: 0.9941 g/cc
LIQ VISC: 0.7243 cp
RUN TYPE: High Speed

STARTING DIAMETER: 50.00 fm
ENDING DIAMETER: 0.10 fm

REYNOLDS NUMBER: 0.39
FULL SCALE MASS %: 100

MASS DISTRIBUTION

MEDIAN DIAMETER: 1.19 fm MODAL DIAMETER: 1.72 fm

DIAMETER (fm)	CUMULATIVE MASS FINER (%)
3.89	90.0
2.73	80.0
2.05	70.0
1.58	60.0
1.19	50.0
0.84	40.0
0.55	30.0
0.32	20.0
0.13	10.0

APPENDIX F

NEW WASTEWATER SETTLING POND DESIGN DRAWINGS

KEY MAP

NO.	DATE	REVISION DESCRIPTION	INT.
4	06/00	ADDED FLOATING BAFFLES AND WEIRS AND ALTERED PIPING	MMH
3	06/00	ISSUED FOR FINAL BID	MMH
2	06/00	WIDENED EXTERIOR SOIL CROWN; REGRADED SPILLWAY SWALE; REPLACED EFFLUENT PIPE WITH OUTFALL SWALE	MMH
1	04/00	FINALIZED POND DESIGN	MMH

20' 0' 20'

PROJECT ENGINEER: PJG
DESIGNED BY: PJG
DRAWN BY: JSG
CHECKED BY: MMH/PJG

PROJECT NO. 57701E
FILE NO. 57701033R3
SCALE: AS SHOWN
DATE: 04/11/00

REMEDIAL ENGINEERING, P.C.
ENVIRONMENTAL ENGINEERS
and
ROUX ASSOCIATES, INC.
1377 Motor Parkway
Suite 403
Islandia, New York 11788 (516) 232-2600

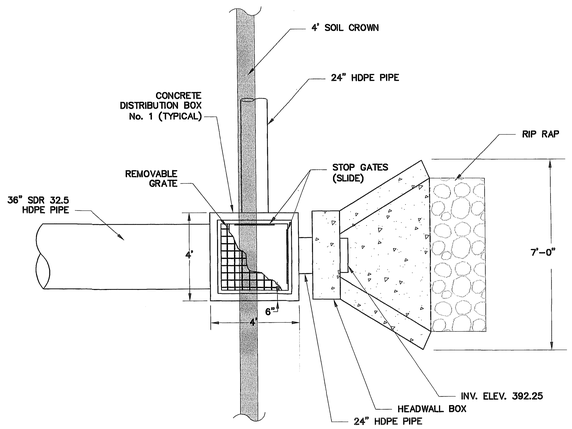
PROJECT NAME:
SYRACUSE CHINA LANDFILL
TOWN OF SALINA, ONONDAGA COUNTY, NEW YORK

PROJECT FOR:
PFALTZGRAFF CO.
YORK, PENNSYLVANIA

TITLE:
DETAILED SITE GRADING PLAN
EASTERN PORTION

DRAWING NO. 5R2
DRAWING 5 OF 14.

Date: 06/19/00 File Name: 57701033R3 Plot Scale: 1=1

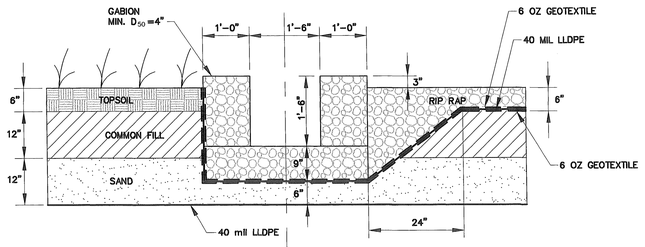


1/12 HEADWALL No. 1 AND DISTRIBUTION BOX No. 1

NOT TO SCALE

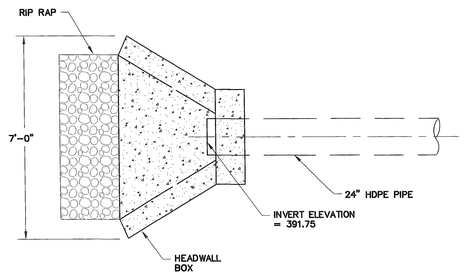
NOTE: DISTRIBUTION BOXES 1, 2, AND 3 ARE THE SAME EXCEPT THE NUMBER OF PIPE INLETS/OUTLETS AND ALUMINUM STOP GATES, WHICH VARY AS SHOWN.

BOX	INLETS/OUTLETS	INLETS/OUTLETS DIMENSIONS	STOP GATES	STOPGATE DIMENSIONS
1	3	36" (1), 24" (2)	2	24" (TYP.)
2	4	24" (TYP.)	3	24" (TYP.)
3	4	24" (TYP.)	3	24" (TYP.)



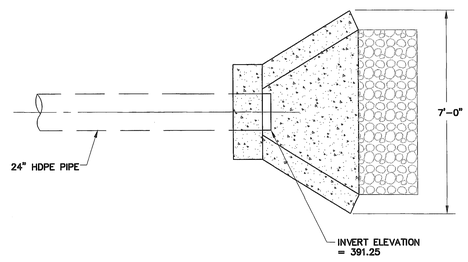
2/12 CHUTE DETAIL

NOT TO SCALE



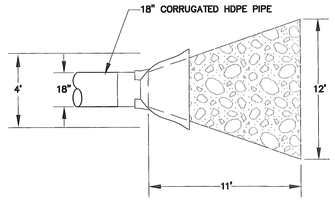
3/12 HEADWALL No. 2

NOT TO SCALE

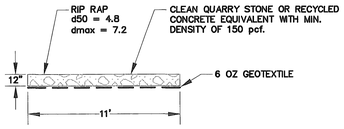


4/12 HEADWALL No. 3

NOT TO SCALE



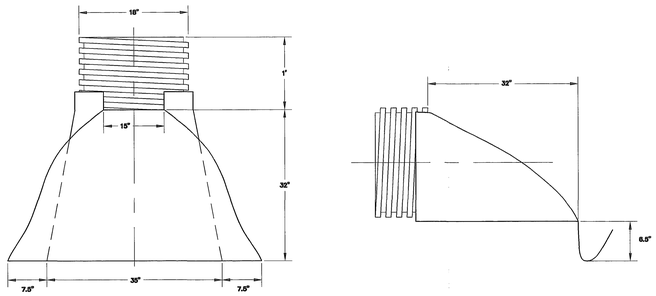
PLAN VIEW



ELEVATION VIEW

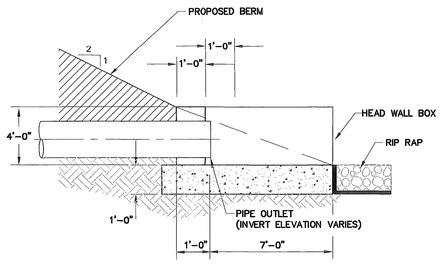
6/12 ENERGY DISSIPATER DETAIL

SCALE: 1" = 5'



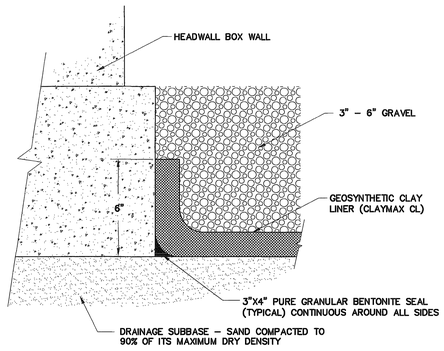
5/12 FLARED END OUTLET DETAIL

NOT TO SCALE



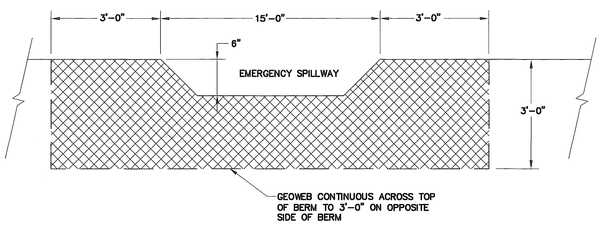
9/12 TYPICAL PIPE AND HEADWALL SECTION

NOT TO SCALE



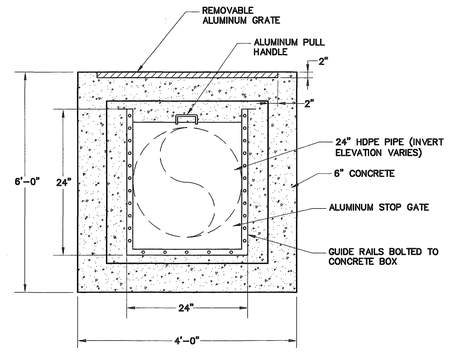
11/12 BENTONITE SEAL DETAIL

NOT TO SCALE



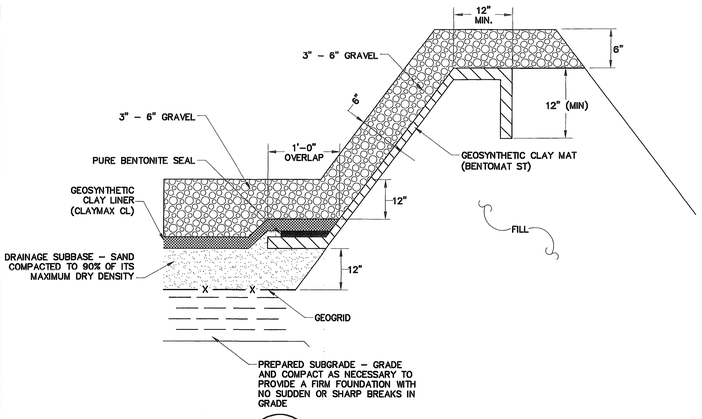
12/12 EMERGENCY SPILLWAY SECTION

NOT TO SCALE



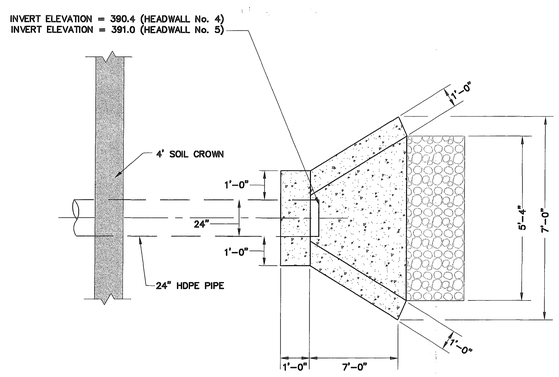
7/12 SECTION OF CONCRETE DISTRIBUTION BOX (TYP.)

NOT TO SCALE



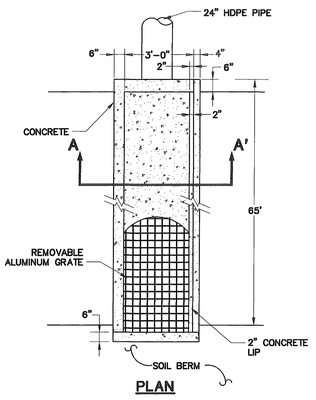
10/12 TYPICAL BERM DETAIL

NOT TO SCALE

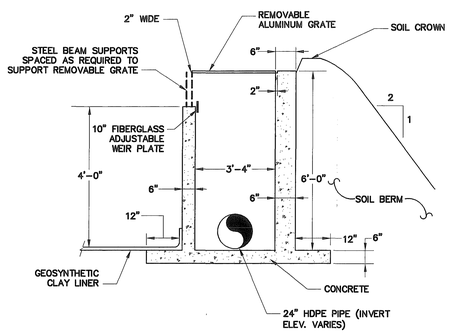


13/12 HEADWALLS No. 4 AND 5

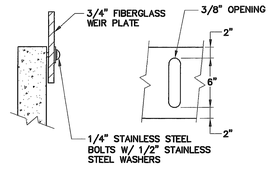
NOT TO SCALE



PLAN



SECTION A-A'



ADJUSTABLE WEIR PLATE

NOTE: 1.) ADJUSTABLE WEIR PLATE SHALL BE PROVIDED IN 8' LENGTHS AND SHALL BE SET AND LEVELED 3" ABOVE THE TOP OF CONCRETE.

2.) ADJUSTABLE WEIR PLATE BOLTS SHALL BE SPACED 18" ON CENTER OR AS REQUIRED BY THE MANUFACTURER.

14/12 EFFLUENT WEIR PLAN, SECTION AND DETAIL (TYP.)

NOT TO SCALE

NO.	DATE	REVISION DESCRIPTION	INT.
4	05/00	ISSUED FOR FINAL BID	MMH
3	05/00	WIDENED EXTERIOR SOIL CROWN; ADDED HEADWALL DIMENSION; REPLACED CHANNEL SUPPORTS WITH NOTCHES IN CONCRETE.	MMH
2	04/00	ADDED WEIR TO HEADWALL No. 4 AND PEAGRAVEL TO POND SIDE SLOPES	MMH
1	04/00	FINALIZED POND DESIGN	MMH

PETER JOSEPH GRAHAM — LICENSED PROFESSIONAL ENGINEER — STATE OF NEW YORK

PROJECT ENGINEER:	PJG
DESIGNED BY:	PJG
DRAWN BY:	JSG
CHECKED BY:	MMH/PJG
PROJECT NO.	57701E
FILE NO.	57701063R3
SCALE:	AS SHOWN
DATE:	04/11/00

REMEDIAL ENGINEERING, P.C.
ENVIRONMENTAL ENGINEERS
and
ROUX ASSOCIATES, INC.
1377 Motor Parkway
Suite 403
Islandia, New York 11788 (516) 232-2600

PROJECT NAME: SYRACUSE CHINA LANDFILL
TOWN OF SALINA, ONONDAGA COUNTY, NEW YORK

PROJECT FOR: PFALTZGRAFF CO.
YORK, PENNSYLVANIA

TITLE: MISCELLANEOUS DETAILS

DRAWING NO. 12R2

DRAWING 12 OF 14

Date: 05/19/00 File Name: 577010063 Plot Scale: 1=1

Flow Scenarios for Proposed Wastewater Settling Ponds

1. Normal Flow
   Wastewater will enter the ponds through Headwall No. 1 and flow through Pond 1, flow through Headwall No. 2 and Pond 2, flow through Headwall No. 3 and Pond 3, through Headwall No. 5 and out to SPDES Outfall 001. The stop gates to the bypass piping in Distribution Boxes 1, 2, and 3 will be closed.

2. Facility Upset Flow
   Wastewater will flow through Pond 1 for the retention time of approximately 3 hours. After approximately 3 hours, the stop gate in Distribution Box No. 1 will be closed to stop flow to Pond 1. The stop gate in Distribution Box No. 2 will be closed to stop flow from Pond 1 to Pond 2. Once the facility upset is mitigated, the stop gate in Distribution Box No. 1 for the bypass piping to Pond 2 will be opened so normal facility wastewater will flow into Pond 2 and through Pond 3 and out to SPDES outfall 001 via the outfall swale. The facility upset wastewater will remain isolated in Pond 1 until sufficient flocculent is added to aid in setting.

3. Removal of Pond 1 for Maintenance
   The stop gate in Distribution Box No. 1 controlling flow to into Pond 1 will be closed. The stop gate in Distribution Box No. 1 controlling flow into the bypass piping to Pond 2 will be open. Wastewater will flow through Headwall No. 2 into Pond 2, through Headwall No. 3, through Pond 3, through Headwall No. 5 and out to SPDES Outfall 001 via the outfall swale.

4. Removal of Pond 2 for Maintenance
   Wastewater will flow through Headwall No. 1 and through Pond 1. The stop gate in Distribution Box No. 2 controlling flow into Pond 2 will be closed and the stop gate in Distribution Box No. 2 controlling flow through the bypass piping to Pond 3 will be open. Wastewater will flow through Bypass Headwall No. 3, through Pond 3, through Headwall No. 5 and out to SPDES Outfall 001 via the outfall swale.

5. Removal of Pond 3 for Maintenance
   Wastewater will flow through Headwall No. 1, through Pond 1, through Headwall No. 2 and through Pond 2. The stop gate in Distribution Box No. 3 controlling flow into Pond 3 will be closed and effluent will flow through Headwall No. 4 into the spillway swale which carries the effluent to SPDES Outfall 001.

APPENDIX G

SPECIFICATIONS FOR POND DESIGN

SECTION 02225
OFF-SITE FILL MATERIALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes the Work activities related to the selection and use of fill materials obtained from off-site sources. In the event fill material from on-site sources are not acceptable for use as fill material or if fill material, in addition to on-site soil is required to perform the Work, fill materials from off-site sources may be utilized. Fill material from on-site sources are described in Section 02223. Off-site fill material shall meet any requirements specified in Section 02223 for on-site fill material in addition to the requirements specified herein. All fill materials shall be placed to the specified limits and grades as shown on the Drawings.

B. All off-site fill materials shall be staged (Section 01500), as necessary, in accordance with these Specifications and Section 02223, and placed as shown on the Drawings.

C. Off-Site fill materials include the following:

1. common fill;
2. crushed stone;
3. riprap;
4. pea gravel; and
5. sand.

1.02 SUBMITTALS

A. In accordance with Section 01300, Contractor shall submit the following:

1. Gradation test results and certification from suppliers, that all off-Site fill materials meet the requirements of this Specification, and that they are free from contaminants. Certification must be received and approved prior to delivery of off-Site fill materials.
2. Three five-pound samples of all off-Site fill materials, if requested by the Engineer.
3. The Contractor shall submit the results of all testing required by the CQAP prior to proceeding with subsequent work.

PART 2 - PRODUCTS

2.01 COMMON FILL

A. Common fill shall be well-graded granular material from fine to coarse, containing not more than 50 percent material passing a 200 sieve, with a maximum size of two (2) inches, obtained from approved natural deposits and unprocessed except for the removal of unacceptable material and stones larger than the maximum size permitted. It shall be substantially free from loam and other organic matter, trash, debris, and other fine substances. Vegetation, masses of roots, or individual roots debris, and other fine substances. Vegetation, masses of roots, or individual roots more than 18 inches long or more than 1/2 inch in diameter shall not be permitted.

B. Common fill shall be used for backfill in excavated areas and the landfill cap barrier protection layer as shown on the Drawings.

C. Common fill used in the landfill cap barrier protection layer shall have a permeability of less than 10^{-5} cm/sec.

D. Common fill shall be used to construct the berms of the settling ponds as shown on the Drawings.

2.02 CRUSHED STONE

A. Crushed stone shall be angular stone ranging from 1 to 3 inches in size for access roads and 3 to 6 inches in size for the settling ponds. The stone shall consist of clean, hard and durable particles free from dirt, vegetable, or other objectionable matter, and free from an excess of soft, thin elongated, laminated or disintegrated pieces.

B. Crushed stone shall be used for the construction of the permanent access roads as shown on the Drawings.

C. Crushed stone shall be placed in the interior of the settling ponds as shown on the Drawings.

2.03 RIPRAP

A. Riprap shall have a mean spherical diameter of 4.8 inches, with stone sizes ranging from one (1) inch to 7.2 inches.

B. Riprap shall consist of field stone, recycled concrete or rough unhewn quarry stone of approximately rectangular shape. The stone shall be hard and angular, of such quality that it will not disintegrate on exposure to water or weathering, and free from dirt, sand, clay and rock fines. The specific gravity of the individual stones shall be at least 2.5.

C. Riprap shall be reasonably well-graded stone composed primarily of the larger stone sizes specified above, but shall have a sufficient mixture of the smaller specified sizes to fill the progressively smaller voids between stones.

D. Riprap shall be used for the construction of drainage energy dissipation areas, drainage swales and in the Gabions installed as part of the cap drainage chute as shown on the Drawings.

E. Riprap shall be used in the drainage swale which flows from the settling pond outlet to the new SPDES Outfall 001 as shown on the Drawings.

2.04 PEA GRAVEL

A. Pea gravel for pipe bedding shall be 3/8 inch nominal diameter, naturally rounded aggregate as follows:

Standard Sieve Opening	Percent Passing by Weight
1/2"	100
1/4"	0-15
No. 200	0-1

The gravel shall consist of clean, hard, and durable particles free from dirt, vegetable, or other objectionable matter, and free from an excess of soft, thin elongated, laminated or disintegrated pieces.

B. The pea gravel shall be installed as bedding for the corrugated drainage piping beneath the Site entrance to Factory Avenue as shown on the Drawings.

2.05 SAND

A. Sand: Natural river or bank sand; washed, free of silt, clay, loam, friable or soluble materials, or organic matter; graded in accordance with ANSI / ASTM C136, within the following limits:

Sieve Size	Percent Passing
No. 4	100
No. 14	10 to 100
No 50	5 to 90
No 100	4 to 30
No. 200	0 to 1

B. Sand shall be used in the barrier protection layer and shall have a permeability of greater than 10^{-2} centimeters/second when used as the cap drainage layer shown on the Drawings.

C. Sand shall be used as the drainage subbase in the settling ponds as shown on the Drawings.

PART 3 - EXECUTION

3.01 OFF-SITE FILL MATERIALS

A. All off-site fill materials shall be placed as shown on the Drawings and tested in a qualified independent laboratory in accordance with the CQAP Test results shall then be used to perform in-place density testing in the field.

B. All off-site fill materials shall be consolidated, sloped and graded within the cap footprint as specified herein and as shown on the Drawings.

C. All off-site fill material used outside of the cap limits shall be placed in 12-inch lifts and compacted to 90 percent of the Standard Proctor Density.

D. The compaction requirements of this section are expected to minimize the amount of settlement that occurs; however, if significant settlement does occur following compaction, the Engineer may direct the Contractor to employ settlement monitoring by topographical survey methods. Refer to Section 01050 for survey requirements.

E. In accordance with the CQAP and the SAP, any fill material provided from off-Site sources shall be analyzed to certify that the materials are free from contaminants.

3.02 FINAL GRADING

A. Final grading shall be performed as indicated on the Drawings, to the lines, and grades shown or as modified during placement of the waste within $\pm 2/10$ of a foot. The tolerance for cap thickness above the geomembrane shall be $\pm 1/10$ of a foot. The grading shown in the Drawings is based upon current estimations of waste removal depths and areas. Final grading may be altered based on actual conditions encountered during remedial activities. During the process of grading, the subgrades shall be maintained in such condition that the subgrade will be well drained at all times.

(END OF SECTION)

SECTION 02275
GEOTEXTILES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall furnish all labor, equipment and materials necessary for installation of geotextiles for use in silt fences, erosion control, and reinforcement/protection of various parts of the Work including:

1. Geomembrane cushion layer;
2. Wastepiles;
3. Stabilized construction entrance;
4. Equipment decontamination pad;
5. Permanent access road;
6. Drainage swales;
7. Emergency spillways; and
8. Settling ponds.

1.02 QUALITY ASSURANCE

A. Each roll of geotextile shall be labeled by the manufacturer with the following information:

1. Manufacturer's name;
2. Product identification;
3. Lot number;
4. Roll number; and
5. Roll dimensions.

B. A competent laboratory shall be maintained by the producer of the fabric at the point of manufacture to ensure quality control for all products identified in this specification. That laboratory/manufacturer shall maintain records of its quality control results and provide, prior to shipment, a manufacturer's certificate which lists the guaranteed "minimum average roll value" properties as defined by the Federal Highway Administration and in the CQAP, for the type of geotextile to be delivered and shall provide written certification signed by a responsible party that the materials actually delivered have property "minimum average roll values" which meet or exceed all property values guaranteed for that type of geotextile. The certificate shall also include:

1. Name of manufacturer;
2. Chemical composition;
3. Product identification/description;
4. Statement of compliance to requirements of this specification section; and
5. Signature of legally authorized official attesting to the information required.

C. The Contractor shall be required to perform shear tests in accordance with the CQAP for the interface between the geotextile and the liner cushion layer soils which shall consist of northern wetland soil and overexcavated soil from beneath the waste. The minimum factor of safety resulting from these tests shall be 1.5.

1.03 SUBMITTALS:

A. In accordance with Section 01300, Contractor shall submit the following:

1. Samples and manufacturer's product literature for all geotextiles.
2. Complete written instructions for storage, handling, installation, and joining/seaming of all geotextiles.
3. Manufacturer's Quality Control/Quality Assurance manuals for all products, and any other manufacturer's literature regarding testing protocols and procedures to be followed in the field.
4. Manufacturer's Certificate as outlined in paragraph 1.02(B) of this section.
5. Results of all testing as defined in the CQAP.

PART 2 - PRODUCTS

2.01 WOVEN AND NON-WOVEN GEOTEXTILES

A. Six-ounce woven geotextile shall be provided for use in wastepiles, stabilized construction entrance, equipment decontamination pad, and permanent access road.

B. Six-ounce non-woven geotextile shall be provided for use beneath drainage swales.

C. 10-ounce non-woven geotextile shall be provided for use with the geomembrane cushion layer. The geotextile shall meet the following requirements:

1.	grab strength	257 lbs
2.	tear strength	120 lbs
3.	puncture strength	175 lbs
4.	burst strength	530 psi
5.	minimum mass per unit over	10 oz.
6.	apparent opening size	140 (U.S. Sieve)

D. The properties of the geotextiles shall be established by testing as required by the CQAP.

2.02 GEOGRID

A. The geogrid for the emergency spillways and below the sand drainage layer in the settling ponds shall be Tensar BX1100 or Engineer-approved equal.

PART 3 - EXECUTION

3.01 HANDLING AND INSTALLATION

A. The Contractor shall handle all geotextiles in a manner that they are not damaged in any way.

B. All geotextiles shall be provided in rolls wrapped with protective covering to protect from ultraviolet light, precipitation, dirt, puncture, cutting or any other damage. If any special handling of the geotextile is required, it shall be so marked on the top surface of the geotextile (e.g., "This Side Up").

C. Geotextiles shall not be exposed to precipitation prior to installation.

D. Erosion control and turf reinforcement blankets shall be installed in the ground with staples and in accordance with the manufacturer's printed installation instructions.

E. All geotextiles shall be installed, overlapped and seamed in accordance with manufacturer's printed recommendations.

F. No horizontal seams shall be allowed on side slopes (i.e., seams shall be along, not across, the slope), except as part of a patch. All sewing shall be performed using polymeric thread with chemical resistance properties equal to or exceeding those of the geotextile.

3.02 PLACEMENT OF MATERIALS OVER GEOTEXTILE

A. The Contractor shall place all materials over geotextile to prevent damage to or slippage of the geotextiles.

B. No traffic or construction equipment shall be allowed directly on the geotextiles All machinery utilized in the placement shall be low ground pressure or otherwise specifically suited for the installation of these materials.

C. During placement of the geomembrane cushion layer, a minimum thickness of one foot of material shall be placed between the geotextile materials and any construction equipment.

3.03 REPAIRS

A. Geotextiles will be rejected at any time if they are determined by the Engineer to be defective, to have deteriorated, or if they are damaged.

B. In the event that any damage occurs to the geotextiles at any time, the damaged portion shall either be repaired by methods approved by the Engineer or the geotextile replaced at no additional expense to the Owner.

(END OF SECTION)

SECTION 02623

HIGH DENSITY POLYETHYLENE (HDPE) PIPING AND ACCESSORIES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, equipment materials and appurtenances necessary to install and test piping as shown on the Drawings, and specified herein.

B. The Contractor shall be responsible for the proper connection of pipes to existing pipes, and to connecting all sections of supplied pipe.

1.02 SUBMITTALS

A. In accordance with Section 01300, Contractor shall submit information showing that the pipe and accessories to be supplied are in conformance with this Specification.

PART 2 – PRODUCTS

2.01 GENERAL

A. All pipe and fittings shall be marked with the manufacturer's name or trademark, size, class, and the date of manufacture.

B. All pipe shall be made from high density polyethylene resin compound qualified as Type III, Grade P33, Category 4, Class C by ASTM D1248 with a minimum density of 0.947 grams per cubic centimeter. The pipe shall have a long-term hydrostatic strength of 1,600 psi when tested and analyzed by ASTM D-2837. These requirements shall be certified by the pipe manufacturer.

C. The corrugated HDPE pipe to be installed for swale drainage on the north side of the landfill shall be 18-inch diameter N-12 pipe as manufactured by Advanced Drainage Systems, London, Ohio or Engineer's-approved equal. Minimum wall thickness shall be 0.035 inches.

D. The corrugated HDPE pipe to be installed from the outfall at the railroad tracks to the pond inlet shall be Model number MLSCO-ppd®/305 36-inch diameter SDR 32.5 pipe as manufactured by M.L. Sheldon Plastics Corp., New York, New York or Engineer's-approved equal.

E. The corrugated HDPE pipe to be installed inside the ponds shall be Sure-Lok® WT 24-inch diameter pipe as manufactured by Hancor, Inc. or Engineer's-approved equal.

F. Flared end outlets shall be model number 1810NP as manufactured by Advanced Drainage Systems, London, Ohio or Engineer's-approved equal. It shall fit an 18-inch diameter

corrugated HDPE pipe, be 42 inches wide at the mouth and 25 inches long from the pipe connection to the mouth end.

PART 3 – EXECUTION

3.01 GENERAL HANDLING

A. Special care in handling shall be exercised during delivery, storage and installation of pipe to avoid cutting, kinking or other damage. Damaged pipe will be rejected and shall be replaced at the Contractor's expense.

B. Ropes, fabric or rubber protected clings and straps shall be used when handling pipes. Chains, cables or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe. Pipe shall not be dropped onto rocky or unprepared ground. Other proper tools and methods such as filled cutting shall be used for the handling of pipe and in accordance with manufacturer's printed installation instructions.

3.02 STORAGE OF PIPE

A. Stacking of pipe shall be limited to a height that will not cause excessive deformation of the bottom layer of pipes under anticipated temperature conditions.

B. Pipe shall be stored in such a manner as to keep the interior free from dirt, and in a location away from heavy machinery and trucks.

3.03 PLACEMENT OF PIPE

A. Placement of pipe shall be performed in accordance with the manufacturer's printed information to the lines and grades shown on the Drawings.

B. At the time of pipe placement, the pipe shall be examined carefully for defects, and should any pipe be discovered to be defective after being placed, it shall be removed and replaced with new pipe at the Contractor's expense.

C. All pipe shall be carefully lowered into the trench so as to prevent dirt and other foreign substances from entering the pipe.

D. All pipes shall be protected from ultraviolet light and from freezing conditions during placement.

E. Whenever pipe placement is stopped at the end of the day, or for any other reason, the end of the pipe shall be securely closed to prevent entrance of water or any foreign matter.

F. Piping shall be tested in accordance with Paragraph 3.01 prior to placing the backfill around the pipe unless otherwise permitted by the Engineer.

G. The Contractor shall place backfill around the pipe in a manner that will not compromise the integrity of the pipe, and the pipe shall be secured to prevent displacement of the pipe any movement of the pea gravel placement. Pipe backfill shall be in accordance with the Drawings and Section 02225 of the Specifications.

H. Underground warning tape shall read "Caution Pipeline Buried Below," and shall be buried shallow, approximately eighteen inches under final grade in all trenches where pipes have been buried.

3.04 JOINING METHODS

A. Lengths of pipe shall be assembled into suitable installation lengths with soil and water tight split couplers. All joints including tees and elbows shall be installed with soil and water tight connections. Pipe connections shall be performed in accordance with the procedures recommended by the manufacturer, by qualified personnel.

3.05 FLUSHING AND TESTING

A. Following installation of a section of pipe, the Contractor shall thoroughly clean all pipe by flushing with water or other means to remove all dirt and other obstructions which may have entered the pipe during the construction. Pipelines shall be flushed at a rate of at least 2.5 feet per second until water runs clear, and no obstructions remain. All pipes shall be secured as necessary so that pipe movement does not occur during the flushing activities.

B. After flushing is complete, in order to test the pipe to verify that no obstructions remain and also to determine that the pipe has not been crushed, the Contractor shall place a spherical object with a diameter equal to at least ninety percent of the inside diameter of the pipe, at the upgradient end of the pipe and pull the object through the length of the pipe. If the object does not exit the downgradient end of the pipe, the Contractor shall either remove the obstructions or replace the pipe at no additional cost to the Owner.

C. A pressure test shall be performed in the 36-inch diameter SDR 32.5 HDPE pipe as specific in AWWA C600. The pressure shall be maintained at 80 psi for 12 hours. Any discrepancies to the manufacturer's recommendations on test pressures shall be brought to the attention of the Engineer. Any material showing seepage or the slightest leakage shall be repaired and/or replaced as directed by the Engineer and retested at no additional expense to the Owner.

D. A pressure test shall be performed in the 24-inch diameter HDPE pipe as specific in ASTM D3212 with the exception that joints be tested using 5 psi and the test apparatus shall meet ASTM C1103 requirements.

(END OF SECTION)

SECTION 02800

GEOSYNTHETIC CLAY LINER SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This Work includes the manufacture, supply and installation of a geosynthetic clay liner (GCL) system, located as shown on the Drawings.

B. The Work includes furnishing all labor, materials, transportation, supervision, tools and construction machinery necessary to install and test the GCL as described in the Contract Documents.

C. All procedures, operations, and methods shall be in strict accordance with the Contract Documents and Manufacturer's 'Quality Assurance Manual', unless otherwise authorized in writing by the Engineer. If there is a discrepancy between the Contract Documents and the Quality Assurance Manual, the Contractor shall bring the discrepancy to the attention of the Engineer for clarification.

1.02 DEFINITIONS:

A. The following definitions are defined and capitalized for the purposes of this Section 02800 only, and shall have the meaning defined herein when used in the capitalized form only.

1. Installer: The individual or firm, retained by the Contractor, who shall be responsible for field handling, stoning, placing, seaming and all other Site aspects of the GCL installation.

2. Manufacturer: The individual or firm, retained by the Contractor, who shall be responsible for production of GCL rolls.

1.03 MISCELLANEOUS REQUIREMENTS:

A. Installation shall be performed under the direction of a single field engineer, employed by the Installer, who shall remain on Site and be in responsible charge throughout the GCL installation (including subgrade acceptance, GCL layout, and repairs) and all other activities contracted with the Installer. This field engineer shall have installed or supervised the installation of a minimum of 1,000,000 square feet of GCL.

B. Quality assurance testing shall be carried out by the Manufacturer to demonstrate that the sodium bentonite and GCL meet the criteria stated in paragraph 2.03 of this section. Quality assurance testing shall be performed for each shipment of bentonite to the Manufacturer's plant, and for every 100,000 square feet of manufactured GCL.

1.04 SUBMITTALS:

The Manufacturer shall submit the following information in accordance with Section 01300 - "Submittals":

1. Origin (bentonite supplier's name, bentonite origin) of the bentonite used in the GCL.

2. Reports on the tests conducted to verify the quality of the bentonite and geotextiles used to manufacture the GCL rolls delivered to the Site.

3. Test data demonstrating that the permeability of the GCL is not adversely influenced by multiple desiccation/rehydration cycles and multiple freeze/thaw cycles. The data provided shall be from bench scale tests so as to avoid the masking effects of artificial consolidation that occurs from flexible wall permeability testing.

4. Copies of quality control certificates for each roll of GCL. The quality control certificate shall include:

   a) Roll numbers and identification;

   b) Certification that GCL properties conform to the properties listed in paragraph 2.03 of this section, as measured using the test method specified.

   c) The signature of a responsible party employed by the GCL Manufacturer, such as the production manager.

5. Prior to installation, the Installer shall submit a panel layout drawing. Each field panel shall be given an identification code, agreed upon by the Installer and Engineer, that shall be as simple and logical as possible. The drawing shall show the location and number of all panels, and expected overlap 'seams'. The Engineer/Owner's Representative shall review the panel layout drawing and verify that it is consistent with the accepted state of practice. No panels may be placed in the field without the Engineer's approval. In addition, Installer shall not deviate from the Engineer's-approved plan without the Engineer's prior written approval.

6. Copies of the Manufacturers "Quality Assurance" manual.

7. Qualifications and Work experience of:

   a. Installer
   b. Field engineer

8. Documentation that Installer is certified by the GCL Manufacturer.

9. All written results of testing.

10. Final engineers report by Installer.

11. Record Drawings by Installer.

PART 2 - PRODUCTS

2.01 GENERAL:

A. The GCL shall consist of a layer of natural sodium bentonite clay encapsulated between two geotextiles, and shall comply with the all of the manufacturing processes and physical/chemical criteria listed in this section. For reasons of strength, performance, and integrity, the GCL shall be manufactured by mechanically bonding the geotextiles using a needlepunching or stitch-bonding process.

2.02 GCL:

A. The GCL shall be as follows or an Engineer's approved equal.

Product	Manufacturer
Settling Pond Berm: Bentomat ST	CETCO Arlington Heights, Illinois
Settling Pond Floor: Claymax 600 CL	CETCO Fairmount, Georgia

B. The Installer shall be certified by the Manufacturer for the installation of Manufacturer's GCL.

2.03 PERFORMANCE REQUIREMENTS:

A. GCL properties shall conform to the following:

Property	Test Method	Minimum Value
Bentonite Swell Index	ASTM D5890	24 ml/2g minimum
Hydrated Internal Shear Strength	ASTM D5321	500 psf typical
Bentonite mass/unit area	ASTM D5993	0.75 lb./sq. ft.
Permeability (maximum)	ASTM D5084	$5x10^{-9}$ cm/sec
Thickness	ASTM D1777	.2 in.
Grab Strength	ASTM D4632	90 lbs.
Grab elongation	ASTM D4632	15%
Wide width tensile	ASTM D4595	35 lbs./in.
Peel strength	ASTM D4632	15 lbs.
Puncture resistance	ASTM D4833	115 lbs.
GCL Index Flux	ASTM D5887	$1X10^{-8}$ $m^3/m^2/sec.$

B. Woven geotextile properties shall conform to the following:

Property	Test Method	Minimum Value
Grab strength	ASTM D4632	90 lbs.
Grab elongation	ASTM D4632	15%
Wide width strength	ASTM D4595	55 lbs./in.
Puncture Resistance	ASTM D4833	20 lbs.
Thickness	ASTM D5199	.5 mm
Mass per unit area	ASTM D5262	0.95 lb/ft^2

C. Non-woven geotextile shall conform to the following:

Property	Test Method	Minimum Value
Grab strength	ASTM D4632	6 lbs.
Grab elongation	ASTM D4632	150%
Wide width strength	ASTM D4595	15 lbs./in.
Puncture Resistance	ASTM D4833	57 lbs.
Thickness	ASTM D5199	3.5 mm
Mass per unit area	ASTM D5261	6 oz/sq. yd.

D. Bentonite properties shall conform to the following:

Property	Test Method	Minimum Value
Moisture content	ASTM D4643	25% maximum
Water absorption	ASTM E946	800% minimum
Fluid loss	ASTM D5891	18 ml. maximum
Fluid swell	ASTM D5890	24 ml. minimum

PART 3 - EXECUTION

3.01 UNLOADING AND HANDLING:

A. The Contractor shall unload the materials at the Site in accordance with the Manufacturer's instructions, shall handle the material with care, shall use adequate equipment and shall take all precautions necessary to prevent damaging the GCL.

B. Upon delivery at the Site, the Installer, in the presence of the Engineer, shall conduct a surface inspection of all rolls for defects and for damage. This inspection shall be conducted without unrolling rolls unless, in the Engineer's opinion, defects or damages are found or suspected.

C. All flaws in the materials shall be brought to the attention of the Engineer. Rolls which have severe flaws shall be rejected and shall be removed from the Site.

D. Rolls, which in the opinion of the Engineer have minor repairable flaws, shall be repaired in accordance with this section.

3.02 STORAGE:

A. The Contractor shall be responsible for providing that the material is protected from dirt, shock, theft, vandalism, passage of vehicles, moisture, and all other sources of damage. All stored GCL materials and granular bentonite shall be covered with plastic sheeting until they are used.

3.03 GENERAL INSTALLATION REQUIREMENTS:

A. The Contractor shall layout and install the GCL in accordance with the Specifications and Contract Drawings and Manufacturer's 'Quality Assurance' manual, and shall ensure that the Installer supervises all portions of the installation.

B. The Contractor shall be responsible for any damage to the GCL as a result of its Work. Repairs will be approved by the Engineer before any further installation Work is done.

3.04 FIELD PANEL PLACEMENT:

A. The Installer shall ensure that each field panel is given an identification code consistent with the layout plan.

B. GCL placement shall not proceed during precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, in the presence of excessive winds, or at an ambient temperature below 40°F.

C. The Contractor shall unwrap and install only as much GCL in one working day as can be covered with gravel. In no case shall the GCL be exposed to the elements at the end of the day.

D. The surface upon which the GCL is installed shall be prepared and compacted in accordance with the Contract Documents and the manufacturer's recommendations. All surfaces to be lined shall be smooth and free of vegetation, void spaces, ice, abrupt elevation changes, standing water, cracks larger than ¼ inch in width, debris, roots, sticks, sharp rocks and rocks larger than two inches.

E. The use of equipment capable of freely suspending the GCL roll is required. A spreader bar and core pipe are also required for supporting the roll and allowing it to unroll freely. The core bar and spreader bar shall not bend or flex excessively when a full roll is lifted.

F. If a GCL is chosen that is made up of a non-woven and woven geotextile, GCL panels shall be placed with the non-woven geotextile facing down. On sloped areas exceeding a steepness of 4H:1V, the long dimension of all panels shall be oriented parallel to the slope, and the ends of these panels shall be secured in an anchor trench. Panels shall be placed from the highest elevation to the lowest within the area to be lined, to facilitate drainage in the event of precipitation. Panels shall be placed free of tension or stress yet without wrinkles or folds. It is not permissible to stretch the GCL in order to fit a designated area. Panels shall not be dragged across the subgrade into position except where necessary to obtain the correct overlap for adjacent panels.

G. Any leading edge of panels left uncovered shall be protected at the end of the working day with a waterproof sheet which is adequately secured with sandbags or other ballast.

H. The Contractor is responsible for ensuring the following:

1. Any equipment used does not damage the GCL by handling, traffic, leakage of hydrocarbons or other means.

2. The prepared surface underlying the GCL has not deteriorated since previous acceptance, and is still acceptable immediately prior to GCL placement.

3. All personnel working on the GCL do not smoke, wear damaging shoes, or engage in other activities which could damage the GCL.

4. Adequate temporary loading and/or anchoring, not likely to damage the GCL, has been placed to prevent uplift by wind.

5. Direct contact with the GCL is minimized.

3.05 SEAMING:

A. The placement of all panels shall conform to the panel layout drawing approved by the Engineer.

B. The GCL panels shall be placed with overlaps. The overlap area shall be clean and free of moisture, dust, soil, debris of any kind and foreign material.

C. A 6-inch to 9-inch overlap shall exist at all seam locations. The edges of the GCL panels shall be adjusted to smooth out any wrinkles or creases in order to maximize contact between the overlapping panels.

D. After the overlying panel is placed, its edge shall be pulled back to expose the overlap zone. Any soil or debris present in the overlap zone or entrapped in the geotextiles shall be removed.

E. If the GCL is constructed of a woven and non-woven geotextile, the GCL seam shall be formed by executing a bentonite-enhanced overlap to ensure that a continuous seal is achieved between panels.

F. A fillet of granular bentonite shall then be placed in a continuous manner along the overlap zone at a minimum rate of one-quarter pound per linear foot. The use of a watering can or line Chalker is required to improve the uniformity and consistency of the bentonite enhancement.

G. In corners and odd-shaped geometric locations, the number of seams shall be minimized. No horizontal seam shall be less than 5 ft. from the toe of the slope, or areas of potential stress concentrations, unless otherwise authorized. On gently sloping areas (gentler than 4H:1V) where seams may be placed across the slope, overlaps shall be 'shingled' so as to prevent flow into the seam.

H. Any procedures used to temporarily bond adjacent panels together shall be in accordance with Manufacturer's instructions and shall not damage the GCL.

3.06 PENETRATIONS:

A. Penetrations shall be sealed in accordance with Manufacturer's directions. Seals shall begin with a small notch being made around the circumference of the pipe, into the subgrade.

B. Sodium bentonite shall then be packed around the pipe in the notch and on adjacent areas so that the pipe is encased by a pure bentonite seal.

C. The GCL shall then be placed over the penetration and slit into a 'pie' configuration where the pipe is to protrude. This procedure will create a snug fit between the GCL and the pipe once the laps are trimmed.

D. Sodium bentonite shall then be spread around the cut edges of the GCL against the pipe and over adjacent areas.

E. A GCL collar shall then be cut in a manner similar to that made on the main GCL panel, and fit around the pipe, with additional sodium bentonite applied into any gaps that may remain.

3.07 COVER PLACEMENT

A. The cover soil shall consist of gravel as specified in Section 02225. Cover soils shall be free of foreign matter that could damage the GCL.

B. Soil cover shall be placed over the GCL using construction equipment that minimizes stresses on the GCL. A minimum thickness of 1 foot of cover should be maintained between the equipment tires/tracks and the GCL at all times during the covering process. This thickness recommendation does not apply to frequently trafficked areas or roadways, for which a minimum thickness of 2 feet (600 mm) is required.

C. Soil cover should be placed in a manner that prevents the soil from entering the GCL overlap zones. Cover soil shall be pushed up slopes, not down slopes, to minimize tensile forces on the GCL.

3.08 DEFECTS AND REPAIRS:

A. All areas of the GCL shall be visually examined by the Installers field engineer for identification of defects, holes, undispersed raw materials, large wrinkles and any sign of contamination by foreign matter. The surface of the GCL shall be clean at the time of examination.

B. Any damage in the form of cuts or tears in the GCL and shall be identified and repaired by the Installer. The damaged area shall be cleaned of all dirt and debris. A patch of GCL shall be cut to fit over the damaged area, and shall extend one foot in all directions around the entire damaged area. Granular bentonite shall then be placed around the perimeter of the affected area at the rate of one-half pound per linear foot, and the patch shall be placed over the damage. A fast-setting adhesive such as wood glue can be used to keep the patch in position during geosynthetic membrane placement.

3.09 SYSTEM ACCEPTANCE:

A. The Installer, Manufacturer, and Contractor shall retain all ownership and responsibility for the GCL until acceptance by the Engineer. The liner system shall be accepted by the Engineer when:

1. The installation is completed;

2. Verification of the adequacy of all repairs, including associated testing is complete;

3. All documentation of installation is completed including an Engineer's final report completed by the Installer;

4. Certification, including Record Drawings, sealed by a registered professional engineer, have been received by the Engineer. Record Drawings shall identify panel layout, locations of imperfections, repairs, and any other appropriate observations.

5. Final cover material has been placed above the GCL as shown in the Drawings.

3.10 GUARANTEE:

A. Manufacturer shall guarantee the materials supplied for the installation of the GCL for a period of twenty years from the date of final installation, and shall be responsible to replace any materials which are defective during this period.

B. Installer shall guarantee the installation of the GCL for a period of ten years from the date of submittal of engineers report. Installer shall be responsible for the repair and installation of any defects which occur during this period.

(END OF SECTION)

SECTION 11282

ALUMINUM STOP GATES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install stop gates, guiderails and appurtenances as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

A. Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of Section 01300. Submittals shall include at least the following:

1. Dimensions of all components
2. Installation instructions
3. Descriptive literature, bulletins, and/or catalogs of the equipment
4. Complete assembly drawings

PART 2: PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. The stop gates shall be sized for 24-inch diameter pipe and shall be Model AR-5 as manufactured by Waterman Industries, Inc. of Memphis, Tennessee or Engineer's-approved equal.

B. Stop gates and appurtenances shall consist of the following materials:

Frames and Slides: Aluminum ASTM B-209 and ASTM B-211 Alloy 6061-T6

Fasteners and Anchor Bolts: Stainless steel ASTM A-193, 18-8 or stainless steel ASTM A-276 Type 304 or 316.

Flush Bottom Seals and "J" Bulb Seals: Rubber ASTM D-2000 BC610-615

Finish: Mill finish on aluminum with standard shopcoat paint on lift

2.02 FRAME AND GUIDES

A. The gate frame shall be a rigid, welded unit, composed of the guide rails, cross bars, and headrails with a clear opening the same size as the waterway, unless otherwise specified. They shall be flatback type.

The guides shall be of extruded aluminum incorporating a dual slot design. The primary slot will accept the plate of the slide (disc) and the secondary slot will be sufficiently wide to accept the reinforcing ribs of the disc. The guides shall be designed for maximum rigidity, having a weight of not less than three pounds per foot. The guides will be of sufficient length to support two-thirds (2/3) the height of the slide, when the gate if fully open.

On self-contained gates, where the guides extend above the operating floor, they shall be sufficiently strong so that no further reinforcing will be required.

Additional members will be added to the frame as specified for flushbottom closure, spigots, and "J" bulb seals. Holes will be provided for anchor bolts for flatback ad spigotback models.

2.03 SLIDE COVER (DISC)

A. The slide cover shall be plate reinforced with structural aluminum shapes welded to the plate. The slide cover shall not deflect more than 1/360 of the span of the gate under maximum head. Reinforcing ribs shall extend to the guides so that the seating surface of the guide is reinforced.

2.04 HANDLE

A. The slide gates shall have a slot grip handle for removal in accordance with the manufacturer's recommendations.

PART 3: EXECUTION

3.01 GENERAL

A. Prior to installation, protect stored stop gates, frames, guides and all appurtenances from damage due to exposure to sunlight, heat, dirt, debris, freezing and thawing, vandalism, etc.

B. The stop gates and appurtenances shall be installed in full accordance with the manufacturer's recommendations, by mechanics skilled in the installation of this type or work.

C. After installation, all stop gates and appurtenances shall be tested by flushing water through the system to check for leaks around stop gates in the closed position. If

any stop gate proves to be defective, it shall be replaced or otherwise made acceptable to the Engineer.

D. All materials shall be carefully inspected for defects in workmanship and materials. All operating mechanisms shall be operated to check their proper functioning, and all nuts and bolts checked for tightness. Stop gates and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the Owner.

(END OF SECTION)

SECTION 11284

FLOATING BAFFLES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install floating baffles and appurtenances as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

A. Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of Section 01300. Submittals shall include at least the following:

1. Dimensions of all components
2. Installation instructions
3. Descriptive literature, bulletins, and/or catalogs of the equipment
4. Complete assembly drawings

PART 2: PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. The floating baffles shall be custom designed factory prefabricated hydraulic barrier curtains manufactured and delivered on site in a state of completion such that no further fabrication, other than to connect individual completed sections, is required for installation. The floating baffles shall utilize virgin quality elastomeric geomembrane materials and exclusively inplant dielectric and thermal seaming processes throughout. The floating baffles shall be designed for ease of installation in a new or operating lagoon without requiring de-watering.

2.02 HYDRAULIC CURTAIN MATERIAL

A. The floating baffle shall be the Director 1™ Model as manufactured by Environetics, Inc. of Lockport, Illinois or Engineer's - approved equal. The floating baffles shall be fabricated from polyester reinforced polymeric alloy membrane material ENV-3602-12-XR-5™. Curtain materials shall possess outstanding seam strength, excellent performance in a wide range of chemicals, superior U.V. resistance and weathering qualities.

2.03 UPPER AND LOWER TENSION MEMBERS

A. The floating baffles shall have (2) two tension members consisting of a ¼" diameter vinyl coated stainless steel aircraft cable dielectrically seamed in a hem under the flotation collar and ¼" diameter galvanized proof-coil chain; dielectrically seamed in a hem at the bottom edge of the hydraulic curtain. Both tension members shall attach to ¼" x 2" x 12" (min.) stainless steel bolt-through end-connect plates with 3/8"diameter material pullout stops.

B. The floating baffles shall have means for attaching concrete weights directly to the lower tension member to achieve a total ballast weight of not less than 3.5 lbs. per linear foot. Bottom anchors shall be retrievable by means of factory installed 3/8" diameter Polypropylene anchor lifting lines which extend from each specified bottom anchor point to a brass grommet in the flotation collar above the bottom anchor. Ballast attached directly to the curtain material will not satisfy the bottom anchoring. Tension members sewn to the baffle will not be acceptable.

2.04 FLOTATION COLLAR

A. The flotation collar shall be constructed using either 6" or 10" diameter by 8' long polystyrene foam logs dielectrically sealed in a chamber of the specified baffle curtain material. The flotation material shall be closed cell polystyrene foam (1 lb. per cubic foot minimum foam density) providing a minimum buoyancy of 60 lbs. per cubic foot. External, mechanically attached flotation that may require a spare part inventory will not be acceptable.

2.04 BAFFLE SECTIONS

A. The floating baffles will be manufactured in the minimum number of sections required that allow convenient installation and efficient shipping in standard size crates. When a baffle exceeds the maximum practical size, the baffle shall be manufactured in sections which are joined together on site with a mechanical stainless steel bolt-through connector.

PART 3: EXECUTION

3.01 GENERAL

A. The floating baffles shall be installed in the locations on the contract drawings.

B. The floating baffles shall be installed in accordance with the manufacturer's drawings, instructions and recommendations.

(END OF SECTION)

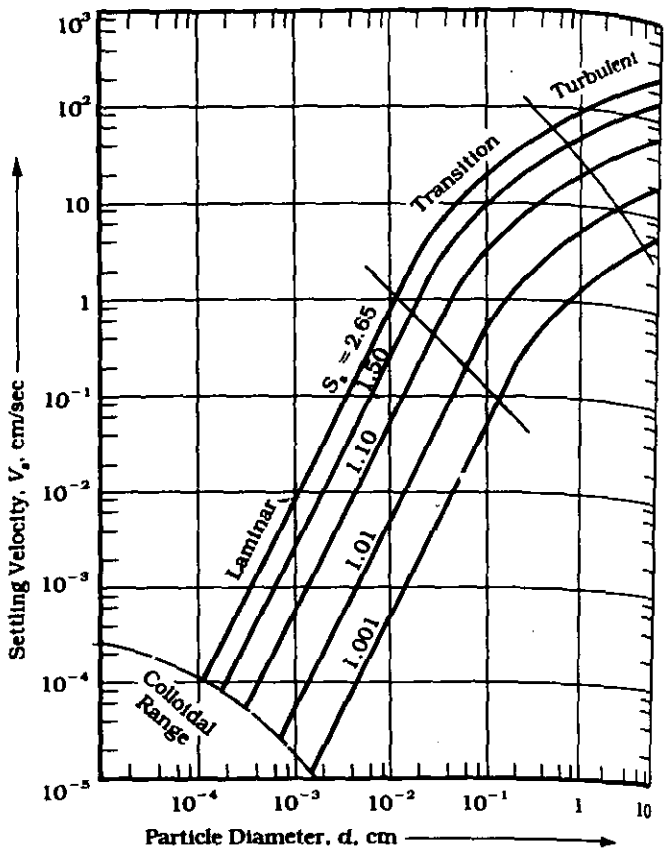
APPENDIX H

PAGES FROM *UNIT OPERATIONS AND PROCESSES IN ENVIRONMENTAL ENGINEERING* AND *WASTEWATER ENGINEERING*

Unit Operations and Processes in Environmental Engineering

Tom D. Reynolds

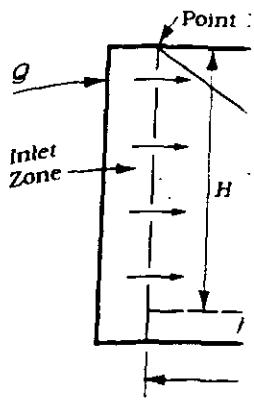
Figure 3.2. Type I Settling of Spheres in Water at 10°C
Adapted from "Water Treatment" by T. R. Camp in *Handbook of Applied Hydraulics*, 2nd ed., ed. C. V. Davis. Copyright © 1952 by McGraw-Hill Book Co., Inc. Reprinted by permission.



4. There are three zones in the basin: (1) the entrance zone, (2) the outlet zone, and (3) the sludge zone.
5. There is a uniform distribution of particles throughout the depth of the entrance zone.
6. Particles that enter the sludge zone remain there and particles that enter the outlet zone are removed.

Figure 3.3 shows an ideal rectangular settling basin of a length, L, a width, W, and a depth, H. V_0 is the settling velocity of the smallest particle size that is 100 percent removed. When a particle of this size enters the basin at the water surface, point 1, it has a trajectory as shown and

Figure 3.3. Ideal Re



intercepts the sludge
stream end. The dete
divided by the settlin

$$t = \frac{H}{V_0}$$

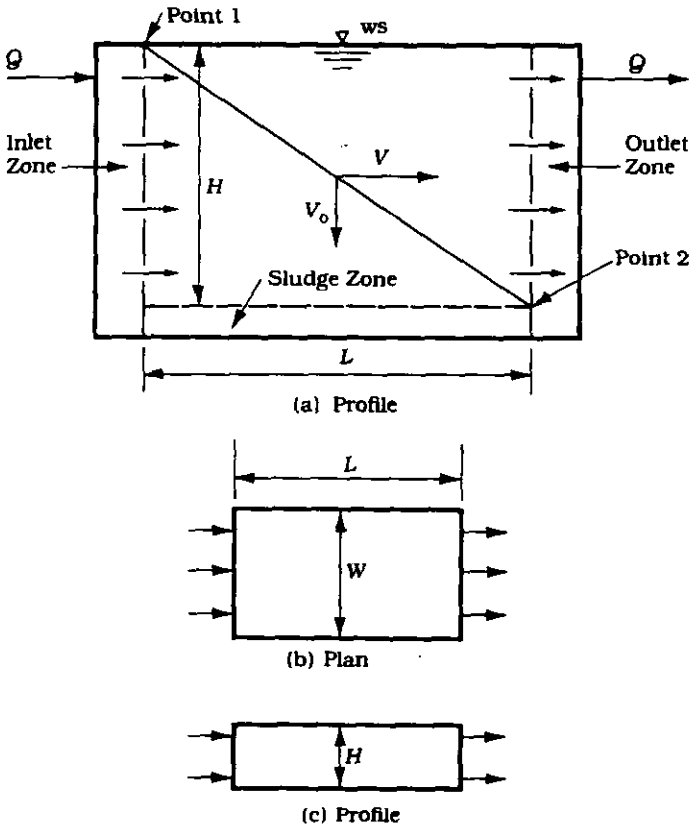
The detention time, t,
by the horizontal velo

$$t = \frac{L}{V}$$

The horizontal veloci
vided by the cross-se

$$V = \frac{Q}{HW}$$

Figure 3.3. Ideal Rectangular Settling Basin



intercepts the sludge zone at point 2, which is at the downstream end. The detention time, t, is equal to the depth, H, divided by the settling velocity, V_o, or

$$t = \frac{H}{V_o} \tag{3.13}$$

The detention time, t, is also equal to the length, L, divided by the horizontal velocity, V, or

$$t = \frac{L}{V} \tag{3.14}$$

The horizontal velocity, V, is equal to the flow rate, Q, divided by the cross-sectional area, HW, or

$$V = \frac{Q}{HW} \tag{3.15}$$

Combining Eqs. (3.14) and (3.15) to eliminate V gives

$$t = \frac{LWH}{Q} \tag{3.16}$$

Since LWH equals the basin volume, $\forall$, the detention time, t, is equal to the basin volume, $\forall$, divided by the flow rate, Q, or

$$t = \frac{\forall}{Q} \tag{3.17}$$

Equating Eqs. (3.16) and (3.13) gives

$$\frac{LWH}{Q} = \frac{H}{V_o} \tag{3.18}$$

Rearranging yields

$$V_o = \frac{Q}{LW} \tag{3.19}$$

or

$$V_o = \frac{Q}{A_p} = \text{overflow rate, gal/day-ft}^2 \tag{3.20}$$

where A_p is the plan area of the basin. Equation (3.20) shows that the overflow rate is equivalent to the settling velocity of the smallest particle size that is 100 percent removed.

The previous fundamentals also apply to an ideal circular settling basin, shown in Figure 3.4. The horizontal velocity, V, is given by

$$V = \frac{Q}{2\pi rH} \tag{3.21}$$

From inspection of Figure 3.4,

$$\frac{dh}{dr} = \frac{V_o}{V} \tag{3.22}$$

Substituting Eq. (3.21) into Eq. (3.22) gives

$$\frac{dh}{dr} = \frac{2\pi rHV_o}{Q} \tag{3.23}$$

Rearranging Eq. (3.23) and setting the integration limits yields

Figure 3.4. Ideal Cir

Entrance Zone —

Sludge Zone —

$$\int_0^H dh = \frac{2\pi HV}{Q}$$

Integrating gives

$$H = \frac{2\pi HV_o}{Q}\left[\right.$$

or

$$H = \frac{\pi HV_o}{Q}(r_o^2$$

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solids include those derived from toilets, sinks, baths, laundries, garbage grinders, and water softeners. Typical data on the daily per capita quantities of dry solid material derived from these and the aforementioned sources are reported in Table 7·5.

TABLE 7·5 ESTIMATE OF THE COMPONENTS OF TOTAL SOLIDS IN WASTEWATER

Component	Dry weight, gpcd
Water supplies and ground water, assumed to have little hardness	12.7
Feces (solids, 23%)	20.5
Urine (solids, 3.7%)	43.3
Toilet (including paper)	20.0
Sinks, baths, laundries, and other sources of domestic wash waters	86.5
Ground garbage	30.0
Water softeners	*
Total for domestic sewage from separate sewerage systems, excluding contribution from water softeners	213.0
Industrial wastes	200.0‡
Total for industrial and domestic wastes from separate sewerage system	413.0
Storm water	25.0†
Total for industrial and domestic wastes from combined sewerage system	438.0

* Variable.
† Will vary with the season.
‡ Will vary with the type and size of industries.

Analytically, the total solids content of a wastewater is defined as all the matter that remains as residue upon evaporation at 103 to 105°C. Matter that has a significant vapor pressure at this temperature is lost during evaporation and is not defined as a solid. Total solids, or residue upon evaporation, can be classified as either suspended solids or filterable solids by passing a known volume of liquid through a filter. The filter is commonly chosen so that the minimum diameter of the suspended solids is about 1 micron (μ). The suspended-solids fraction includes the settleable solids that will settle to the bottom of a cone-shaped container (called an Imhoff cone) in a 60-min period. Settleable solids are an approximate measure of the quantity of sludge that will be removed by sedimentation.

The filterable-solids fraction consists of colloidal and dissolved

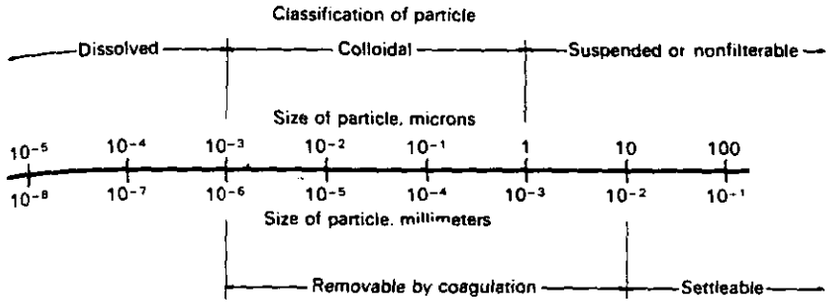

FIG. 7·2 Classification and size range of particles found in water.

solids. The colloidal fraction consists of the particulate matter with an approximate diameter range from 1 millimicron (mμ) to 1 μ (see Fig. 7·2). The dissolved solids consist of both organic and inorganic molecules and ions that are present in true solution in water. The colloidal fraction cannot be removed by settling. Generally biological oxidation or coagulation followed by sedimentation is required to remove these particles from suspension.

Each of the categories of solids may be further classified on the basis of their volatility at 600°C. The organic fraction will oxidize and be driven off as gas at this temperature, and the inorganic fraction remains behind as ash. Thus the terms "volatile suspended solids" and "fixed suspended solids" refer, respectively, to the organic and inorganic (or mineral) content of the suspended solids. At 600°C, the decomposition of inorganic salts is restricted to magnesium carbonate, which decomposes into magnesium oxide and carbon dioxide at 350°C. Calcium carbonate, the major component of the inorganic salts, is stable up to a temperature of 825°C. The volatile-solids analysis is applied most commonly to sewage sludges to measure their biological stability. The solids content of a medium-strength sewage may be classified approximately as shown in Fig. 7·3.

Turbidity, a measure of the light-transmitting properties of water, is another test used to indicate the quality of waste discharges and natural waters with respect to colloidal matter. Colloidal matter will scatter or absorb light and thus prevent its transmission.

Temperature

The temperature of wastewater is commonly higher than that of the water supply, because of the addition of warm water from households and industrial activities. As the specific heat of water is much greater

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OF

DOCUMENT