crossroads ventures llc

DRAFT
Environmental Impact Statement

Appendix 8

Conceptual Design Report for
Wastewater Treatment and Disposal

The Belleayre Resort at Catskill Park

THE
BELLEAYRE RESORT
AT
CATSKILL PARK

CONCEPTUAL DESIGN REPORT

BIG INDIAN PLATEAU WASTEWATER TREATMENT AND DISPOSAL

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1.0 INTRODUCTION

1.1 General

Crossroads Ventures, LLC (Crossroads Ventures) owns approximately 1,960 acres in the Catskill Mountains, located south of New York Route 28 on lands on either side of Belleayre Mountain Ski Center, in New York State. Crossroads Ventures is proposing to develop the area and create a recreation-oriented resort development. Consistent with numerous economic and land use studies that have been prepared for the region, it is the intent of Crossroads Ventures to provide recreational and lodging facilities that will enhance the tourism attractiveness of the area as a four-season recreation destination. Development plans include a mixture of recreational and lodging facilities.

The overall project proposed by Crossroads Ventures is entitled, *Belleayre Resort at Catskill Park.* Of the 1,960 acres, approximately 573 acres would be affected by the development of the project while the remaining 1,387 acres would remain undeveloped.

There are several alternatives available for the treatment and disposal of wastewater from the resort developments. Delaware Engineering, P.C. (Delaware Engineering) has prepared this report to address the disposal of wastewater from two areas of the project. These areas are collectively referred to as *Big Indian Plateau.* Individually, they are referred to as *Big Indian Resort and Spa/Big Indian Country Club* and *Belleayre Highlands.* This report presents a number of alternatives and plans for wastewater treatment and disposal; included is a preferred plan for the treatment of all wastewater, except the wastewater from the gatehouse, through an on-site wastewater treatment plant that has a surface discharge to Birch Creek and a secondary outfall to irrigation ponds located within the development. The small amount of wastewater to be discharged from the gatehouse will be treated with a subsurface system.

1.2 Project Description

The overall project site lies within two non-contiguous tracts of land, one tract located on either side of the Belleayre Mountain Ski Center. **Drawing 1 (Exhibit A)** depicts the size and location of the project site.

The smaller of the two tracts is located to the west of the Ski Center. The boundary line between Ulster and Delaware counties bisects this property, which includes acreage in the Towns of Shandaken and Middletown. These lands are located north of County Route 49A, south of NYS Route 28, and on either side of Gunnison Road. Specifically, the lands include the former Highmount Ski Area, Marlowe Mansion, lands directly to the west on Galli Curci Road (County Route 49A) and lands between County Route 49A and County Route 49. Of the approximate 718 acres described, 242 acres will be developed and about 476 acres will remain undeveloped and preserved. Water supply,

treatment and disposal for this area is not the subject of this plan and will be discussed under separate cover.

The larger tract of land for this project will be approximately 1,242 acres (**Drawing 2** in **Exhibit A**). It is located in Ulster County to the east of the Belleayre Mountain Ski Center and extending from Lost Clove on the southeastern boundary to Woodchuck Hollow on the western boundary. These lands are primarily second growth forests but there is a large house known as the Brisbane Mansion and a few smaller seasonal dwellings located on this land. Currently, none of the residences are inhabited. Development of this tract, entitled *Big Indian Plateau*, will largely be confined to 331 acres and consist of two areas, designated the *Big Indian Resort and Spa/Big Indian Country Club* and the *Belleayre Highlands*.

The *Big Indian Resort and Spa/Big Indian Country Club* area will encompass the easternmost portion of land and is planned to include an eighteen-hole championship golf course; a driving range and golf course clubhouse (Big Indian Country Club) with a pro shop, locker room with both steam and sauna, and a 40-seat snack bar; 95 club membership units; and a 150-room hotel which will include a full service spa with lap pool, ballroom, offices/meeting space, two restaurants with a combined total capacity of 225 patrons, and a 50-seat beverage lounge. Adjacent to these facilities and moving toward the Ski Center and across Giggle Hollow will be the *Belleayre Highlands* area. This will include the existing restored Brisbane (formerly known as Turner) Mansion (containing a game room, 25-seat snack bar, and offices) and the existing Caretaker's House, plus the Carriage Barn, around which is planned 88 club membership units, a pool, and tennis courts. A gatehouse is also proposed for the main entrance to *Big Indian Plateau* and the *Belleayre Highlands*.

The development projection described above takes into account all foreseen future expansions of the *Big Indian Plateau*. The approximate 911 acres will remain undeveloped.

2.0 ESTIMATED WASTEWATER PRODUCTION

This section provides an estimate of the anticipated hydraulic and organic loading from wastewater discharged from the *Big Indian Plateau* developments. Since the proposed developments will be primarily residential in nature, (i.e. hotel rooms and detached lodging units) with limited commercial facilities (e.g. restaurants, hotel laundry), the quality of the wastewater will be similar to that currently generated by the neighboring Hamlet of Pine Hill.

The unit flow rates utilized in these estimates are from standards established by the New York State Department of Environmental Conservation, entitled *Design Standards for Wastewater Treatment Works (1988).* Since the sewage collection system for the proposed developments will be new construction, little or no infiltration/inflow is anticipated. In determining anticipated average daily loadings, it was assumed that the usage or occupancy of the facilities would be at capacity for each day of the year. Even though the proposed developments are intended to be a "four-season" resort, the level of occupancy will vary during the year. For this reason, the following estimates are considered conservative.

2.1 Hydraulic Loading

The estimated average daily hydraulic loading from the *Big Indian Plateau* resort was determined by multiplying the number of planned development units (e.g. club membership units, restaurant seats, etc.) by the NYSDEC unit flow rate standard. The loading from the main entrance gatehouse was listed separately from the other development units because it is sufficiently distance from the other units and has a relatively minor estimated loading to justify its waste being handled separately from the other development units. **Table 1** provides an estimate of the hydraulic loading from all development units, including the gatehouse.

The total average daily hydraulic loading from both portions of the development is estimated to be 108,465 gallons or 75 gallons per minute (gpm), excluding the main entrance gatehouse. The estimated average daily hydraulic loading from the gatehouse is 75 gpd (0.05 gpm). In accordance with Section 15-0314 of the NYS Environmental Conservation Law, all of the planned development units will be constructed with water-saving plumbing facilities. This would result in an approximately 20-percent reduction in the estimated average daily flow, for a total of 86,772 gpd (60 gpm). The commonly accepted method for estimating water usage and wastewater generation is to use literature values for usage per unit (e.g. per capita, per bedroom, per restaurant seat, floor area, etc.). These literature values were generally developed prior to the advent of the manufacture and widespread use of water-saving plumbing fixtures. For example, current building code requirements specify the use of toilets, which use a maximum of 1.6 gallons per flush. Prior to this requirement, which was adopted within the last 5 to 8 years, toilets used 3.5 gallons per flush. This alone is a reduction in water usage of more than 54-percent. Similar reductions in water usage can be attributed to other common plumbing fixtures such as sink faucets, shower heads and appliances (e.g. dish washers).

Considering this, assuming a 20-percent reduction in usage through water-saving fixtures is conservatively low and actual reductions are most likely much greater than 20-percent.

The maximum day hydraulic loading was determined by assuming it to be 2 times the average daily flow. At an average daily loading of 108,465 gpd, the maximum day loading is approximately 216,930 gpd. Assuming a 20-percent reduction in flow from the use of water-saving fixtures, the design maximum day hydraulic loading would be 173,544 gpd.

The peak hourly hydraulic load, assuming an average population of 500 for this development, is 4 times the average hourly loading, per Figure 1 of the *Recommended Standards for Wastewater Facilities* by the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (Ten States). This would compensate for those times of the day when there is abnormally high water usage (e.g. morning showers, etc.). At an average daily loading of 108,465 gpd, the peak hourly loading is approximately 433,860 gpd. Assuming a 20 percent reduction in flow from the use of water-saving fixtures, the design peak hourly hydraulic loading would be 347,088 gpd.

The design peak instantaneous loading is 520,632 gpd, which is 6 times the design average loading.

Based on the above estimates, greater that 80-percent of the anticipated hydraulic loading will be from residential-type facilities (e.g. detached lodging and club membership units). The remainder will be from restaurant usage and the laundry facilities located at the hotel.

2.2 Organic Loading

The estimated average daily organic loading (biochemical oxygen demand (BOD) and suspended solids (SS)) was determined by estimating the daily occupancy of the different development areas and multiplying by a per capita loading that was derived from literature values. Since the majority of the wastewater will be generated at residential-type facilities (hotel and detached lodging units), the composition of the wastewater is expected to be of a nature similar to a typical municipal wastewater. **Table 2** provides an estimate of the organic loading and indicates the means in which the loadings were determined.

The total average daily organic loading from the developments is estimated to be 329.3 lb/day BOD and 399.9 lb/day SS. At the estimated average daily flow of 108,465 gallons, the estimated BOD and SS concentrations are 364 mg/l and 442 mg/l, respectively. Due to the method used to estimate the organic loading, the values derived are conservatively high. Typical BOD and SS values for residential-type developments are 200 mg/l, however, food service facilities (restaurant, club house lounge, etc.) will typically generate a wastewater with a higher concentration of BOD and SS. To

compensate for this and to ensure that the proposed wastewater disposal facilities are designed for the "worst case", the above values have been reported.

3.0 WASTEWATER DISPOSAL ALTERNATIVES

Several alternatives have been evaluated for the disposal of wastewater from these proposed developments. These alternatives included: individual subsurface disposal systems; a regional subsurface disposal system to accommodate the wastewater from both portions of the developments; treatment systems to serve specific areas of the developments; preliminary treatment to be used in combination with other disposal means; a combination of the above; or installing a collection network to convey all of the wastewater to the New York City owned and operated Pine Hill Wastewater Treatment Plant (PHWWTP)(See 3.4 below, Consolidated Discharge) or an on site wastewater treatment plant.

Subsurface Disposal Systems

Subsurface disposal systems would be designed and constructed in accordance with NYCDEP regulations stated in, *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources*, NYSDEC standards set forth in *Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988)* as well as *Recommended Standards for Individual Sewage Systems* by the Ten States Standards. They would most likely include a grease trap (if wastewater was from a source such as restaurants), septic tank, dosing tank or distribution box and absorption fields. These systems would vary in size based on the anticipated hydraulic loading. Individual subsurface disposal systems, while technically viable, were eliminated from consideration due to higher environmental and financial costs.

Subsurface treatment systems designed to accommodate proximal groups of buildings were evaluated and found a viable option. Preliminary treatment of the wastewater prior to subsurface disposal utilizes a variety of treatment technologies or methods to partially treat wastewater to remove specified compounds or contaminants. A pre-treatment system would be selected to supplement other treatment or disposal methods. Pre-treatment systems are available for a variety of technologies and can be constructed from pre-engineered (package) systems or assembled from components.

For this project, a specific concern is the introduction of high amounts of nitrogen into the subsurface and the inability of subsurface disposal systems to adequately assimilate the nitrogen. A pre-treatment system could be used to reduce the nitrogen loading to the absorption trenches by using biological processes to breakdown the nitrogen to nitrates and nitrites.

Pre-treatment systems require regular operation and maintenance. Electric power is required to operate pumps and controls, which adds to the capital and operation and maintenance costs and the degree of difficulty and complexity of operation.

On-Site Treatment System

An on-site wastewater treatment system would be designed and constructed in accordance with NYCDEP regulations stated in, *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources*, NYSDEC standards set forth in *Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988)* and the *Recommended Standards for Wastewater Facilities* by the Great Lakes – Upper Mississippi River Board of State Public Health and Environmental Managers. Treatment of the wastewater in an on-site treatment system would likely involve the following processes: preliminary treatment to remove large solids and oil and grease; primary treatment to remove settleable solids; secondary or biological treatment to reduce the organic loading; tertiary treatment to remove suspended solids, phosphorus, nitrogen and pathogens; and disinfection. The size of such a treatment system would vary depending on the hydraulic loading and the level of treatment necessary would vary depending on the effluent discharge permit requirements. The options for discharge of the wastewater effluent include, surface discharge to a receiving stream, subsurface discharge to an absorption field, or surface discharge to a holding area for spray irrigation. The option selected will dictate the effluent quality as specified in the State Pollution Discharge Elimination System (SPDES) permit issued by the NYSDEC. This alternative could entail the construction of one or more on-site treatment facilities. Considerations for the construction and operation of a single or multiple facilities include but are not limited to: the availability of acceptable plant locations, permitting and permit compliance, availability of licensed operations staff, effluent discharge, and capital and operation and maintenance costs. Since these considerations would be multiplied by the number of treatment facilities, it would be preferable to limit the number of facilities. The construction of a single facility was evaluated against other alternatives. An important consideration for this development is a reliable source of non-potable water for irrigation. Effluent from a wastewater treatment facility could provide such a reliable source as well as provide a means to conserve water in the watershed through recycling.

Consolidated Discharge

The Hamlet of Pine Hill utilizes a state-of-the-art wastewater treatment plant (WWTP) (owned and operated by the NYCDEP) to treat their wastewater. The permitted capacity of this facility is believed to be approximately 500,000 gpd. Of this 500,000-gpd flow capacity, the Hamlet of Pine Hill utilizes approximately 50,000 gpd while the Belleayre Ski Center utilizes a peak flow of approximately 35,000 gpd for a total of 85,000 gpd. The PHWWTP is located 800 feet down-gradient and 2,000 feet away from the proposed *Big Indian Plateau* development. Given the close proximity and the fact the PHWWTP is designed and permitted to treat wastewater of the same nature as would be generated by the proposed resort developments, discharging all the development generated wastewater to the PHWWTP is a viable alternative from an engineering and regulatory perspective. Sewer collection systems would be designed and constructed in accordance with NYCDEP regulations stated in, *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its*

Sources, NYSDEC standards set forth in *Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988)* as well as *Recommended Standards for Individual Sewage Systems* by the Great Lakes – Upper Mississippi River Board of State Sanitary Engineers. Informal requests to the NYCDEP for approval to discharge wastewater to the PHWWTP have been met with a negative response, citing liability concerns as the primary reason. Given its location and available capacity, discharge to the PHWWTP appears to be a logical alternative.

3.1 Evaluation Considerations

Some of the factors to consider in the evaluation and selection of an alternative for the disposal of wastewater from these developments are:

- Estimated hydraulic and organic loadings (Section 3.1.1)
- Loading fluctuations
- Influent wastewater quality
- Effluent quality requirements (Section 3.1.2)
- Surface/subsurface discharge points
- Site conditions (Section 3.1.3)
- Constructability

The following sections provide a more detailed discussion of some of the evaluation considerations. By utilizing the information presented in these sections, the treatment alternatives can be compared and assessed for applicability.

3.1.1 Estimated Hydraulic and Organic Loading

Based upon the calculated estimates of the hydraulic and organic loading, the proposed wastewater treatment alternative must be capable of handling influent flow, from the *Big Indian Plateau* development, at a design average flow of 86,772 gpd with a design average BOD_5 of 329.3 lb/dy.

3.1.2 Estimated Effluent Quality Requirements

The following are estimated SPDES permit limits. These limits are comparable to other wastewater treatment facilities of similar size. This list was prepared in consultation with the NYSDEC. These parameters would be the design basis if a wastewater treatment plant were proposed.

PERMIT PARAMETER	PERMIT LIMIT
Design Ave. Flow (gallons per day)	86,772
BOD5 (mg/l)	5
Suspended Solids (mg/l)	10
pH	6.5-8.5
Temperature (°F)	70

Solids, Settlable (ml/l)	0.1
Ammonia (mg/l as NH3)	1.1
Dissolved Oxygen (mg/l)	7
Phosphorus, Total (mg/l)	0.5
Turbidity (95% of the time)	0.5
Turbidity (maximum value)	5

3.1.3 Site Conditions

Big Indian Plateau is located in the Town of Shandaken. Per Shandaken Code, these lands are primarily zoned Residential District R5 with some sections of R1.5. R5 is described in Article III Section 116-5 C1 and R1.5 is described in Article III, Section 116-5c3 of the Town of Shandaken Code. Also see the DEIS Section 1.4.1.

Wetlands are present on the proposed *Big Indian Resort and Spa/Big Indian Country Club* site. The aggregate surface area of the individual ACOE non-isolated wetlands within or near the 331 acres of development are approximately 6 acres. For more complete information see Appendix 17A, "Federal Wetlands Preconstruction Notification".

The topography of the lands that make up the proposed *Big Indian Plateau* resort have local variations in slope greatness and direction. However, in general *Big Indian Resort and Spa/Big Indian Country Club* is located on a plateau at the crest of a hill and the ground surface decreases in elevation to the north, east, and south. The southwest portion of the site is located at the highest elevation, 2,720 feet amsl. The lowest elevation of developed land will be to the northeast at an elevation of approximately 2,000 feet amsl. *Belleayre Highlands* will occupy lands ranging in elevations of 2,175 feet amsl in the north to and 2,350 feet amsl in the south.

Based on the soil survey done for this DEIS, the *Big Indian Plateau* site is mostly areas of shallow and moderately deep, very stony soils formed in glacial till soils that are derived from red shale and sandstone. The *Big Indian Plateau* site currently contains rock outcrops. Those that are present in the *Big Indian Resort and Spa/Big Indian Country Club* primarily are positioned from the west to east. The Ulster County Soil Survey was published in 1979. The field work for the Ulster County Soil Survey was done in the seventies, sixties and probably as far back as the fifties. The Delaware County Soil Survey is still in progress.

In the interim between the Ulster County published soil survey and the contemporary mapping being done in Delaware County, there has been some new soil classification conventions introduced. Soil temperature regimes were recognized in the early 1980's and most of the soils in the Adirondack and Catskill Mountains were determined to have "frigid" temperature regimes. Previously all soils in New York were classified as having mesic temperature regimes. The soils at the assemblage fall into the frigid temperature criteria.

While the physical properties of the soils did not change, entire new suits of soil were identified for the Catskills because the temperature regime has an effect on the agricultural productivity of similar soils in locations that have differing lengths of growing season. It seems appropriate to use the most recent and accurate soil mapping conventions for the soil maps for the assemblage. For that reason some of the soils named in the soil survey are not consistent with soils named in the Ulster County Soil Survey, they are, however, currently being mapped in Delaware County. For further details, see DEIS Section 3.6.

Twenty test pits and twelve percolation tests were conducted in November 2000 in various locations throughout the proposed *Big Indian Plateau* development to further characterize the subsurface conditions. The findings indicated that at every test pit location, the typical boundary condition was an impervious layer (fragipan) at 25 to 35 inches below the surface. The upper layers of soil are made of browner glacial soils that are loamier and "perced". Deeper percolation tests revealed that the underlying soils were made of redder glacial till. These soils are derived from red shale and silt and contain more clay. Flagstone and boulders can be witnessed in the bottom of a majority of the test pits. Seasonal high groundwater elevations could be inferred in three of the twenty test pits (one on *Big Indian Resort and Spa/Big Indian Country Club* and two on *Belleayre Highlands*). The shallowest depth to groundwater measurement was 27 inches in *Big Indian Resort and Spa/Big Indian Country Club*.

Other conditions of the development that influence the alternatives analysis for wastewater treatments methods include the nature of the proposed development and the sources and uses of water resources.

The site layout for Big Indian Resort and Spa, the Big Indian Country Club and Belleayre Highlands encompasses 331 acres of land. The Big Indian Plateau provides a natural boundary to the primary golf-related development and the existing Brisbane Mansion provides a location for the clustering of club membership units. The layout is uncluttered and is designed to follow the natural spaciousness of the plateau. Given this layout, significant green space is planned between and around the facilities

The source of water for the Big Indian Plateau is ground water, with two sources that will be owned and operated as a private water company, serving only the Resort, Country Club and Highlands. This is an important consideration in the evaluation of alternatives for wastewater treatment as some alternatives provide direct recharge to the ground water system, while others provide less direct, but equally important opportunities for reuse of treated wastewater for irrigation. With private water supplies, there are no other users of the water supply, therefore, the resources could be used for irrigation without restriction beyond the demands of the Resort and the NYSDEC water supply permit total taking. If the water supply were to be purchased from a public water supply with many users, the use of the groundwater for irrigation would likely be limited or restricted to avoid any impact on other users of the same water supply.

3.2 Subsurface Disposal Systems

To evaluate whether or not subsurface treatment was a feasible option, site reconnaissance and preliminary soil percolation tests were performed at potential absorption system locations throughout *Big Indian Plateau* in November 2000. The tests were conducted according to the standards of the New York State Department of Conservation (NYSDEC) and witnessed by a representative of the NYCDEP. An average percolation rate of more than 15.75 minutes per inch was calculated from the test results. The fastest percolation rate was 5.25 minutes per inch and the slowest was 27.0 minutes per inch. **Exhibit B** contains the test pit logs and percolation test results.

Based on the NYSDEC standards set forth in *Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988)* and the NYCDEP regulations stated in, *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources*, the range of percolation results of 5.25 to 27.0 minutes per inch fall within the allowable range set by the NYCDEP of 3 to 60 minutes per inch. However, when deeper percolation tests were conducted at some of these same locations, percolation rates exceeding 60 minutes per inch resulted. Soil conditions on the site vary both in terms of composition and depth. It is possible that the actual locations for the absorption systems may have less than adequate soil conditions. In this event, it may be necessary to move acceptable soil from other areas of the site or import them, which provide an acceptable percolation rate.

Wastewater would be gravity or pressure fed to localized septic tanks then to dosing tanks. The wastewater would accumulate in a dosing tank until the dose volume was reached and a high level sensor activated a pump. The dosing tank pumps would distribute the wastewater to the absorption systems constructed in accordance with the capacity required by NYSDEC standards, NYCDEP regulations, and EPA guidelines.

The absorption fields would be constructed by placing a layer of soil three-foot thick that extends beyond the field perimeter by five feet on all sides. If acceptable fill were moved from other areas of the site, it would be selected to have a percolation rate of less than 10 minutes per inch. If not, the fill would be imported. Prior to constructing the trenches, test pads would be prepared under controlled conditions, and a construction quality control plan developed to assure that the trenches constructed satisfy the design percolation rates.

Under this alternative, the three feet of soil under the trench and a five-foot perimeter buffer zone would act as the treatment zone. As the treated wastewater percolates downward from the bottom of the soil treatment zone it would enter the more permeable native soils beneath and enter the local groundwater system. Due to the higher permeability of the underlying soils, groundwater mounding due to disposal is very unlikely.

If the average flow of 108,465 gpd were used, a total of 120,517 square feet of primary absorption fields would be required to treat the site wastewater by subsurface treatment. In addition to the 120,517 square feet required for the primary absorption fields, an

additional 120,517 square feet would be required as a reserve or back up. The average flow and area required for absorption trenches can be reduced by 20 percent, since water saving plumbing fixtures will be used. It should be noted that no single trench system would receive more than 30,000 gpd of wastewater to avoid triggering additional treatment requirements.

Pre-treatment prior to subsurface discharge is also considered part of this alternative as it may be required by regulatory agencies. The pre-treatment for the Big Indian Plateau would consist of the installation of BioClere or similar biological units after grease separators and septic tanks and prior to discharge to subsurface trenches. BioClere treatment units are packaged trickling filters and would serve to breakdown nitrogen into nitrates and nitrites prior to final treatment through the subsurface fields. The fields would be designed the same as specified for disposal without pre-treatment. The pre-treatment units would add a significant level of conservatism to the wastewater treatment, and would increase the operation and maintenance costs of the overall facilities. In addition, given the potential fluctuations in seasonal flows, operational challenges will exist with maintaining any biological treatment system. The challenges are not insurmountable as proven by the use of BioClere units at many seasonal private camps and homes in the Adirondacks.

3.3 Wastewater Treatment Plant

It is the intent of Crossroads Ventures to minimize the impact that the project has on the environment by limiting the areas of disturbance. This will limit the space available for the construction of a treatment system(s). However, construction of on-site treatment is feasible. All of the streams within the developments are considered intermittent. Birch Creek is the closest non-intermittent stream and it is located approximately 2,000 feet from the nearest point in the development, except for the access road that crosses the creek on a bridge.

To minimize land use, collection piping, and treatment equipment, a single treatment system to handle the flow from both developments is the best approach. This would also facilitate the collection of effluent for recycling as irrigation water. Since the irrigation water would be used at the golf course on the *Big Indian Resort and Spa/Big Indian Country Club* portion of the development, the *Big Indian Resort and Spa/Big Indian Country Club* development area is the best location for a regional treatment system.

The proposed golf course at the *Big Indian Resort and Spa/Big Indian Country Club* will require irrigation water both during initial turf establishment and during normal operation. The amount of water required will vary depending on weather conditions, particularly temperature and rainfall. Larger quantities of water will be required during the period when the turf is being established. The recycling of effluent from a wastewater treatment plant could provide substantial quantities of water for irrigation. As described in the Water Supply, Treatment, and Distribution report for this development, irrigation needs can be met by the utilization of the well R1, surplus

potable water when Resort capacity allows, and collected precipitation and stormwater. Further, during the high demand golf course construction phase of the project, potable water needs will be at a minimum. Therefore, more than enough water will be available for irrigation needs between the wells and potable supplies without the use of recycled effluent for irrigation. However, the potential use of recycled effluent for irrigation is considered an environmental benefit of this alternative.

3.4 Consolidated Discharge

Another consideration is the proximity of existing publicly-owned treatment works (POTW) and the availability of treatment capacity at these facilities. The Pine Hill WWTP is located approximately 2,000 feet away and 800 feet down gradient from the *Big Indian Resort and Spa/Big Indian Country Club* development. The Pine Hill WWTP is designed and permitted to treat wastewater of the same nature as would be generated by the proposed Resort developments. The NYCDEP owned and operated plant discharges treated wastewater to Birch Creek. Under a SPDES permit issued by the NYSDEC, the plant is permitted to discharge up to 500,000 gallons per day. Currently, the WWTP is discharging approximately 85,000 gallons per day. If the plant were to accept the design average flow of 86,772 gpd from the *Big Indian Plateau*, it would still have an excess capacity of approximately 333,228 gpd.

Further, effluent generated by the plant could be used by Crossroads for irrigation purposes during the months of April through October. Although sufficient quantities of water are available to the development to serve the irrigation needs, the use of effluent from the PHWWTP for irrigation is considered an option as it offers an environmental benefit, as does reuse of effluent from an on-site plant. Effluent would be pumped to the proposed ponds where it would be distributed throughout the golf course. If agreements could be reached with the operators of the Belleayre Mountain Ski Center, this effluent could also be provided to the Ski Center for snow making during the winter months. In discussions with the NYCDEP, Crossroads proposed to pay for the equipment and operation/maintenance costs to pump effluent from the City plant to the golf course irrigation ponds at Big Indian Plateau.

Discussions with the NYCDEP during the preparation of this report resulted in the City of New York stating that consolidation of the wastewater flow from the Big Indian Plateau development with the Pine Hill wastewater is not allowable at this time due to liability concerns (See Exhibit D). Nevertheless, in conformance with section 105-21G3e of the Shandaken Code, as a subdivision contiguous with a public treatment plant district boundary, Crossroads must and will formally apply for connection to the NYCDEP Waterwater Treatment Plant.

4.0 WASTEWATER DISPOSAL PLANS

In this section, four plans for the disposal of wastewater are discussed. Alternative #1 involves the discharge and disposal of all wastewater to subsurface disposal systems, which would be constructed in accordance with NYSDEC, NYCDEP and Ulster County Health Department requirements. These systems would consist of septic tanks and absorption fields. Alternative #2 involves the installation of subsurface disposal systems with the addition of pre-treatment systems to reduce nitrogen levels prior to discharge to the larger absorption fields. Alternative #3 consists of the collection and conveyance of all wastewater to the NYCDEP owned and operated PHWWTP. Alternative #4 entails the construction of an on-site wastewater treatment plant for the sanitary waste from all of the development units except the gatehouse at the main entrance, the wastewater from which would be discharged to a subsurface disposal system.

4.1 Wastewater Disposal Alternative #1 – Subsurface Disposal Systems

4.1.1 Wastewater Disposal

Considering all of the factors associated with the treatment and disposal of wastewater from the *Big Indian Plateau* developments, along with the probability of approval, the discharge of all of the wastewater generated by the developments to localized community absorption fields is a viable alternative. Each separate absorption field will receive less than 30,000 gpd of wastewater.

The advantages of utilizing the absorption fields are the following: relatively inexpensive to construct and operate; can accommodate intermittent low-flow or no-flow operations by requiring no start-up and little maintenance; promotes recycling of water within the drainage basin; and there is an adequate amount of property available for the fields.

4.1.2 Collection and Transmission System

In order to reduce piping and eliminate the need for sanitary sewer pumping stations, the various lodging and recreational facilities were grouped according to location, local topography and hydraulic loading. Each grouping would discharge its wastewater to a single absorption field made up of a series of trenches. **Drawing 2, Exhibit A** provides an overview of the ten absorption field locations.

In all, approximately 14,000 linear feet of eight-inch diameter, polyethylene, sanitary sewer main would primarily gravity feed wastewater generated from the *Belleayre Highlands* and *Big Indian Resort and Spa/Big Indian Country Club* developments to their affiliated subsurface treatment systems. Manholes would be spaced every 400 feet, at all points of change of grade, size or alignment, and at the end of all lines. Piping and manholes would be installed according to the *NYSDEC- Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988).*

Portions, as detailed on the drawings, of the sewer collection system would operate under pressure. At these locations, sewage would be collected at duplex grinder pump stations and pumped through polyethylene pipe to the appropriate absorption system. Cleanouts would be spaced every 500 feet throughout the pressure system. Piping and cleanouts would be designed and installed according to the *NYSDEC- Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988).*

Sanitary sewer service lines would be installed with the necessary fittings and laterals. The sizing of these items varies with the type of service needed. Generally, the single lodging units would require four-inch appurtenances, the quadraplex and triplex club membership units would require six-inch appurtenances, and the lodge would also require six-inch appurtenances. For facilities such as restaurants, clubhouses, and snack bars, grease traps would be installed on the sink effluent lines prior to the waste entering the sanitary sewer main. Grease traps are sized according to the NYSDEC standards. **Exhibit C** contains the calculations used to size the grease traps for *Big Indian Plateau.*

Drawings 3 through 7 in **Exhibit A** provide plan views of the service area described above. **Drawings 8 and 9** in **Exhibit A** contains details of example service connections, manholes, grinder pumps, cleanouts, septic tanks, dosing tanks, and grease traps.

All piping would be installed below the frost zone and on continuous, uniform, and adequately compacted bedding. Prior to backfill placement, the piping would receive pressure and leakage testing in compliance with the standards. Backfill material would then be placed in tamped layers to a determined height above the pipe for protection and support. Native soils and/or finished grade materials can then be placed.

In instances where it is necessary for wastewater piping to cross or border the potable system, the minimum separation distances given in Part 8.6 of the *Recommended Standards For Water Works-Great Lakes Upper Mississippi River Board of State Public Health & Environmental Managers* and the *NYSDEC- Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988)* would be adhered to. Surface water crossings would also be designed to adhere to the standards above.

4.1.3 Absorption Trench Systems - Design and Sizing

As noted previously, twenty test pits and twelve percolation tests were conducted in November 2000. The tests were conducted according to the standards of the NYSDOH and witnessed by a representative of the NYCDEP. An average percolation rate of 15.75 minutes per inch was calculated from the test results with a range of 5.25 to 27.0 minutes per inch. The NYCDEP prescribes a maximum and minimum of 3 and 60 minutes per inch percolation rate, respectively, for conventional subsurface disposal systems.

Absorption fields would be constructed as conventional absorption trenches (as described in NYSDEC- *Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988))* but a five-foot perimeter and three-foot base comprised of site soils would be placed around the absorption fields. The soils would provide a 10-minute per inch percolation rate. The five-foot perimeter and three-foot base would act

as the treatment/buffer zone prior to the treated wastewater entering the local groundwater system.

Utilizing the average flow and the percolation rate, the following cumulative absorption area would be required:

Sewage Flow (per DEC regs) = 108,465 gpd / 0.9 gpd/sq ft = 120,517 sq. ft.

Applying the 20 percent reduction due to water saving devices, the daily flow would be reduced to 86,772 gpd and subsequently; the primary cumulative absorption field area would equal 96,413 sq. ft. As required, the reserve areas will also equal 96,413 square feet.

The NYSDEC standards for absorption system design requirements including separation distance from waterways, potable water conduit, bedrock and groundwater could be satisfied by applying the calculated rates above with the locations of the absorption fields located throughout *Big Indian Plateau*.

The NYSDEC standards require a maximum of 100 foot long lateral piping and a total of 1,000 feet of all piping per absorption system section. Therefore, the largest section would cover 4,725 sf (9-100 foot laterals, 105 feet long by 45 feet wide, which includes a 2.5-foot soil buffer on all sides of the field). This would equate to approximately 20 sections (40 including reserve) each receiving 4,337 gpd to handle the total flow. Typical design details are illustrated in elevation and profile view on **Drawing 8**. The NYSDEC requires that all fields containing more than 500 feet of pipe have the wastewater pressure distributed to the absorption field network. To accomplish this, after the wastewater passes through the septic tank it would enter a dosing chamber. The dosing chamber fitted with level controls and two submersible pumps would receive the gravity fed wastewater from the sanitary sewer mains and dose the absorption fields when the dose volume is achieved. Valving would be installed on the header pipes leading to each section of the absorption system. This will allow the various sections to be utilized on a rotational basis.

Adhering to the *EPA-Onsite Wastewater Treatment and Disposal Systems Design Manual*, the pressure distribution networks for eight of the ten absorption systems were designed (the ninth and tenth fields are gravity fed systems). **Table 3A** provides details of the ten systems. **Exhibit C** contains the associated calculations.

4.2 Wastewater Disposal Alternative #2 – Subsurface Disposal Systems w/Pre-Treatment

The addition of a pre-treatment system to eight larger subsurface disposal systems, except for the gatehouse system, and the golf maintenance system will aid in the reduction of the ammonia nitrogen loading to the subsurface. Pre-fabricated units are available that utilize biological processes such as fixed film media to reduce biochemical oxygen demand

(BOD), total suspended solids (TSS), and nitrogen levels to meet NYSDEC and USEPA standards. Such units function as trickling filters and could be constructed in modules that also contain a clarifier.

Wastewater from the septic tanks is trickled through the biological media of the unit where organic matter is absorbed into the biological mass forming on the media surface. Sludge created by the sloughing of the biomass is collected in the clarifier where it is returned to the septic tank to promote additional biological activity. Clarified wastewater from the filters is conveyed to the absorption fields for final subsurface disposal.

Bioclere™ is an example of a pre-fabricated modular system, which is self-contained and installed below ground level, eliminating the need for an enclosure or other protective structure. Bioclere units are manufactured in specific sizes so units are installed in parallel to accommodate varying flow requirements. **Drawings 10 through 13** in **Exhibit A** provide plan views of the subsurface disposal systems with the pre-treatment units. The absorption fields are located as depicted in Wastewater Disposal Alternative #1. **Drawing 14** provides detailed views (plan, cross-section and isometric) of the pre-treatment (Bioclere) units.

Operation of the Bioclere units is relatively minor, requiring power for pump operation and periodic removal and disposal of sludge; however, the capital costs for Bioclere and similar units can be substantial.

4.3 Wastewater Disposal Alternative #3 – Treatment at PHWWTP

This alternative would involve the construction of a wastewater collection and transmission system to convey all wastewater from *Big Indian Plateau* to the NYCDEP owned and operated PHWWTP.

The collection system would consist of a combination of 8-inch gravity sewers and forcemain. Manholes would be spaced every 400 feet, at all points of change in grade, size or alignment and at the end of all gravity sewer lines. Cleanouts would be placed in the forcemains, every 500 feet throughout the system. Grinder pumps would be installed at all units, which are at a lower elevation than the sewer. For facilities such as restaurants, clubhouses, and snack bars, grease traps would be installed on all sink drain lines prior to the waste entering the sanitary sewer lines. Grease traps would be sized according to NYSDEC standards.

Wastewater would flow from *Belleayre Highlands*, across Giggle Hollow to the *Big Indian Resort and Spa/Big Indian Country Club* where it would ultimately flow down to Friendship Manor Road to a connection with the existing sewer system. Two pump stations would be installed, one on *Belleayre Highlands*, adjacent to Club Membership Unit #3 and the second on the *Big Indian Resort and Spa/Big Indian Country Club*, adjacent to Club Membership Unit # 13. These pump stations would be pre-fabricated underground units with duplex pumps. The stations would be connected to the emergency

power supply to provide for operation during power outages. **Drawings 15 through 19** in **Exhibit A** provide plan views of the collection system described above. All piping, manholes, cleanouts, and pumps would be designed and installed according to the *NYSDEC – Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988).*

Once collected, the wastewater would be conveyed through the existing gravity sewer system located on Friendship Manor Road and Route 28 to the WWTP for treatment and discharge to Birch Creek under the facility's SPDES permit.

This alternative would also include the installation of a pipeline to pump effluent from the PHWWTP to the *Big Indian Plateau* where it would be used for non-potable irrigation purposes. Effluent would be pumped from the PHWWTP to a wetwell located at the entrance to the development, adjacent to Rosenthal Well R1. Rosenthal Well R1 is planned as a non-potable supply for irrigation. From the wetwell, the irrigation water would be pumped to one of the irrigation ponds for distribution by the golf course irrigation system.

4.4 Wastewater Disposal Alternative #4 – On-Site Wastewater Treatment

This alternative would involve the treatment and disposal of wastewater from all *Big Indian Plateau* development units, except the gatehouse, at a single on-site treatment facility. The gatehouse at the main entrance would utilize a subsurface disposal system. The wastewater treatment facility could be located east of the Golf Maintenance Facility as shown on **Drawing 25** in **Exhibit A**. The treated effluent would be discharged primarily to Birch Creek from an outfall located downstream of the bridge over the creek on Friendship Manor Road. A secondary discharge would be to on-site, storage ponds having a capacity of 7.4 million gallons of storage, as shown on **Drawing 22 in Exhibit A**. The pond outfall would be used during the growing season when effluent would be needed for irrigation on the golf course.

The irrigation ponds would have a five to 10 foot wide shelf installed around their perimeter. The sidewalls would then slope away from the shelf at a ratio of 3:1 to a maximum depth of approximately eight feet. The base would be constructed by compacting the native soils and the installation of a geosynthetic liner. The ponds would be designed to include measures to prevent accidental discharge, seepage, or overflow of treated wastewater.

4.4.1 Collection and Transmission System

The sewage collection and transmission system would consist of a combination of gravity and pressure sewers. In low lying areas, booster pump stations and duplex grinder pump stations would be installed. Cutsheets of the duplex grinder pump stations that could be utilized can be referenced in **Exhibit E**. All piping, pumping stations and associated equipment would be designed and installed according to the *NYSDEC- Design Standards*

for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988). All piping would be installed below the frost zone and on continuous, uniform, and adequately compacted bedding. Prior to backfill placement, the piping would receive pressure and leakage testing in compliance with the standards. Backfill material would then be placed in tamped layers to a determined height above the pipe for protection and support. Native soils and/or finished grade materials would then be placed.

In instances where it is necessary for wastewater piping to cross or border the potable water system, the minimum separation distances given in Part 8.6 of the *Recommended Standards For Water Works*-Great Lakes Upper Mississippi River Board of State Public Health & Environmental Managers, the *NYSDEC-Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988),* and the *NYCDEP Rules and Regulations* would be maintained. Surface water crossings would be suspended under the bridge and also designed to adhere to the referenced regulatory standards.

Drawings 20 through 24 in **Exhibit A** provide plan views of the service area for the on-site wastewater treatment plant. **Drawings 8 and 9** in **Exhibit A** contain details of example service connections, grinder pumps, cleanouts, and grease traps.

4.4.2 Wastewater Process and Treatment

The wastewater treatment system under consideration includes Intermittent Cycle Extended Aeration (ICEAS)-NDN: Biological Nutrient Removal basins with filtration and disinfection that would consist of the following facilities:

1. Manually Cleaned Bar Screens and Comminutor
2. Flow Measurement
3. ICEAS-NDN Basins
4. Flow Equalization
5. Sand Filtration
6. Disinfection
7. Surface or On-Site Pond Effluent Disposal
8. Sludge Digestion/Off-Site Disposal

The process flow sequence is illustrated on **Figure 1**. **Drawings 27 through 29** in **Exhibit A** provide plan and elevation views of the conceptual plant, plant layout, and equipment. **Exhibit F** contains cutsheets and manufacturers literature about the equipment detailed in this section. The proposed wastewater treatment system would be designed and installed in accordance with NYSDEC, Ten States, and NYCDEP regulations.

Influent Sewage

The sewage from the gravity sanitary sewer main would flow through a flume where a flow meter would calculate and record the flow rate. A bar screen and a comminutor sized to handle peak hourly flow would precede the flume to remove untreatable solids.

A grit sump may also be installed to permit additional solids to be removed prior to the wastewater entering the ICEAS-NDN basins.

ICEAS-NDN Basins

Subsequent to preliminary treatment the wastewater would enter a flow splitter. The flow splitter would divide the flow such that each of the ICEAS-NDN units would receive equal flow. The concrete flow splitter would contain a collection vault; lift pumps, and a piping manifold to transfer the wastewater to one or all of the ICEAS-NDN basins. Valving to direct the flow and provide flow control would be installed on the manifold. This would provide flexibility in operation and allow the use a specific unit if one required servicing. Each pump would have the ability to operate at 160 gpm with 25 feet of head. Activation/deactivation of the pumps would be controlled by level sensors or floats in the collection vault.

The basins are specifically called Intermittent Cycle Extended Aeration System (ICEAS)-NDN basins. ICEAS basins allow continuous inflow as a single, two chamber unit carries out primary clarification, aeration, nitrification/denitrification, phosphorus removal, and secondary clarification. The biological nutrient removal is enhanced by incorporating alternating phases of oxic-anoxic/anaerobic (air-on/ air-off) conditions in the operating cycle.

Each ICEAS unit contains two zones: the Pre-React Zone and the Main React Zone. The Pre-React Zone baffles the incoming flow and prevents short-circuiting. It also provides pre-treatment before the waters enter the Main React Zone. Therefore, the Pre-React Zone acts as a bioselector and encourages the proliferation of the most desirable organisms for treatment. This, in turn, minimizes the growth of filamentous bacteria that cause sludge bulking and poor settling.

Three, time-based phases occur during one four and a half-hour cycle in the Main React Zone:

1. Air On/ Air Off – 2.8 hours - The basin is alternately aerated/ non-aerated in 0.4-hour increments while filling. The aerobic phases promote BOD removal, nitrification, and phosphorus uptake. The anoxic/anaerobic phases promote denitrification and phosphorus release.
2. Settling/ Denitrification – 1 hour - Aeration is stopped and the solids settle to the bottom of the basin leaving clear water on top. The basin continuously receives influent.
3. Decant – 1 hour - Clear water is discharged from the top of the basin, while the basin continuously receives influent. The sludge can be wasted during this phase.

A three and a half-hour storm cycle operational sequence is possible with the ICEAS basins. The duration of each phase is shortened by 25 percent. This only affects the duration per cycle while the overall aeration, settle, and decant times per day remain constant.

Exhibit F contains cutsheets and literature about the ICEAS-NDN. As can be seen from the cutsheets and **Drawing 27**, each basin is 18 feet high, 18 feet wide, and 51 feet long to accommodate an average flow of approximately 123,600 gallons per day. The basins would be installed utilizing common wall construction to minimize the footprint needed for the units. Utilizing multiple units would meet the NYCDEP 100 percent redundancy requirement.

Each unit would be fitted with waste sludge pumps to transfer the sludge during the decant phase to the adjacent sludge holding tank. Blowers would be used to supply air to the ICEAS fine bubble aeration system of each basin during the air-on phase of the cycle.

Sand Filtration

Filtration would be through continuously backwashed upflow dual sand filtration (CBUDSF) units. Specifically, the DualSand™ System would be utilized. The DualSand™ System chemical filtration process uses two CBUDSF units in series. An oxidant (sodium hypochlorite) and coagulant (PASS) are added prior to the first stage filter. This is accomplished by utilizing 2 gph chemical feed pumps (2 per chemical system) fitted with positive flow sensors. An in-line static mixer in the influent pipe provides proper mixing. The coagulant used in the process hydrolyzes immediately in water thus no flocculent tank is required. Actual dosage will depend on the quality of influent water.

The first stage filter contains coarse sand that is able to handle high solids loading and exceptional removal. The addition of the oxidant helps to keep the sand clean and free from any biological growth. The oxidant also improves the performance of the coagulant.

The second stage filter contains fine sand. This fine sand is not subject to solids fouling because the first stage filter removes approximately 99% of the solids in the water. The reject from the filter is returned to the treatment system influent. The returned reject enhances the performance of the system and provides economical use of the chemicals.

According to the NYCDEP Technical Bulletin No. 1, the CBUDSF unit application rate cannot exceed 3 gpm/sf of treatment surface area. Therefore, based on the estimated peak decant rate of 600 gallons per minute for 45 minutes, that must be transferred through the filter units in 3.5 hours, the CBUDSF units must have surface areas of 45 square feet. NYCDEP also requires that three trains be utilized for flows greater than 50,000 gallons per day. Therefore, three 19 square foot CBUDSF trains would be installed. This would satisfy the NYCDEP requirement of three trains with capacities to handle half the average day flow (79 gpm) since each train can handle 57 gpm. The total application rate the three trains could handle is 171 gpm (including reject water (10% of flow)) at the required 3 gpm/sf. The backwash or reject water from the units would be returned to the flow splitter influent vault.

Since it has been shown that the CBUDSF system works more efficiently and effectively when it receives water continuously, an equalization tank would be installed prior to the DualSand™ CBUDSF units. The 33,662-gallon equalization tank (18 feet high by 25 feet long by 10 feet wide) would collect the decanted effluent from the ICEAS basins and be fitted with two pumps capable of 150 gpm at 25 TDH to feed the effluent to the DualSand™ units. The pumps would operate off of level switches installed in the equalization tank.

Turbidity monitors and recorders would be installed on the common influent and effluent lines of the CBUDSF Units. A particle counter and recorder on the common effluent line and a flow measuring devices on the influent line of each vessel shall also be provided.

Drawing 28 provides plan and elevation views of the proposed CBUDSF units.

Phosphorus Removal

It is anticipated that the majority of the phosphorus present in the wastewater would be removed in the ICEAS basins such that effluent concentration of less than 2 mg/l (conservative) are present. The remainder of the phosphorus would then be removed by the addition of the coagulant prior to the sand filters and the subsequent filtration. A final concentration of less than 0.05 mg/l phosphorus (conservative) is anticipated. However, as a contingency, provisions could be made to add up to a 50 mg/l dosage of alum to the Main React Zone of the ICEAS basins, via 0-5.0 gph chemical feed pumps, to precipitate and remove phosphorus. The effluent from the wastewater treatment will be monitored (i.e. sampled) to ensure that any coagulants used in the treatment process do not introduce any undesirable contaminants.

Disinfection

Pursuant to NYCDEP Technical Bulletin No. 2, disinfection would be achieved through the use of ultraviolet light with controls for operation and for the automatic back-up system. The effluent from the filters would be directed to three Infilco Degremont, Inc. Model No. 6SH ultraviolet disinfection units. Each unit has a capacity of 54 gpm. This capacity is sufficient even though the capacity of each CBUDF is 57 gpm since a portion of the flow will be lost as reject water.

Sludge Digestion/Off-Site Disposal

The 1.7 hp, 45 gpm waste sludge pumps would transfer the sludge in the Main React Zone to a sludge holding tank during the decant phase of the ICEAS operational cycle. The sludge tank would share a common wall with an ICEAS basin. The sludge holding tank would be 18 feet high, 11 feet wide and 53 feet long. The tank would be aerated by a 134 scfm at 7.5 psig, 7.5 HP blower. The tank would also be fitted with a cover. The holding tank would have the capacity to contain 20 days worth of sludge. At that time, the sludge would be hauled to an off-site facility for disposal.

Odor Control

The treatment system proposed is designed to avoid the creation of objectionable odors. The sludge holding tank and CBUD system would be covered and housed, respectively. Additionally, contingent measures such as chlorine addition; activated carbon filters on the ventilation systems, wet scrubbers, and biofilters can be incorporated to control odors should such measures be required by regulatory agencies.

The prevailing winds are from the west/southwest. The closest receptor in this direction is approximately 2,600 feet away. These distances should provide adequate separation for dissipation if a malodorous event were to occur.

Noise Control

The treatment system proposed is designed to avoid the creation of objectionable noise. To eliminate excessive sound generated by the treatment equipment, a portion of the equipment would be located within a treatment building. The building would be insulated with sound dampening boards on the inside walls. In addition, each blower and compressor would be fitted with silencers and flexible vibration padding for the blower skids to reduce noise generated due to vibration.

4.4.3 Treatment Building

Drawing 25 in **Exhibit A** illustrates the proposed location of the wastewater treatment system. **Drawing 26** illustrates the plan view details for the system layout. A building is proposed to house the DualSand™ System, laboratory facilities, chemicals, office and motor control room, and certain pieces of equipment. The building would be a concrete block structure with color and decor to blend in with the surroundings and to present an inconspicuous structure. **Drawings 27 through 29** provide elevation and plan views of the building and equipment layout.

As stated above, an office room, motor control center (MCC) room, and general equipment area would be located in the treatment building. The general equipment room would accommodate the CBUDSF units, UV disinfection system, blowers, compressor, and lab facilities. The chemical feed pumps and chemical drums would also be stored on containment pallets in this area. A sink would be located in the laboratory area with its discharge drained (along with the floor drain discharge) through PVC piping to the influent to the treatment system. The office/computer area would contain visual meter panels that would display the influent and effluent flow, turbidity, and pH. Visual alarms, autodialers, and automatic high water shut-offs would safeguard against accidental sewage discharge. The MCC room would contain the power and control panels. The generator located outside this room would provide power in the event of power failure.

4.4.4 Wastewater Characteristics

The treatment facility will treat the wastewater to meet stringent discharge standards The following provides an estimate of the wastewater influent and effluent characteristics as well as the anticipated effluent discharge standards:

Parameters	Influent	Effluent	Discharge Standard
BOD_5	364 mg/l	>5 mg/l	5 mg/l
Suspended Solids	442 mg/l	>10 mg/l	10 mg/l
NH_3	60 mg/l	>1.1 mg/l	1.1 mg/l
Phosphorous	10 mg/l	>0.5 mg/l	0.5 mg/l
Dissolved Oxygen		>7 mg/l	7 mg/l
pH		6.5-8.5	6.5-8.5

The system would require a NYS licensed operator to monitor the facility and sign Discharge Monitoring Reports (DMRs), and would require a SPDES permit from the NYSDEC.

4.4.5 Effluent Discharge

The primary means of discharge for the effluent from the treatment facility would be a surface discharge to Birch Creek. The discharge point would be immediately downstream of the bridge crossing the creek from Friendship Manor Road, as shown on **Drawing 24 in Exhibit A.** Effluent will be conveyed to this discharge outfall through a 6-inch diameter pipe installed underground within the disturbance envelope of the main entrance road into the development. **Drawing 26** provides a detail of the outfall construction.

A secondary discharge for the effluent would be to irrigation ponds located within the *Big Indian County Club* **(Drawing 22)**. Effluent would be pumped from the treatment facility to the ponds, which would be lined with a geosynthetic liner to prevent infiltration into the groundwater. This secondary discharge would be used during periods when irrigation water is needed for the golf course or other areas of the development.

4.4.6 Gatehouse Wastewater Disposal

Wastewater from the gatehouse at the main entrance to the development will be discharged to a subsurface disposal system as shown on **Drawing 24 in Exhibit A. Drawing 8 in Exhibit A** provides a detail of the construction of the system. **Table 3B** provides information relating to the sizing of the surface disposal system.

5.0 DISPOSAL ALTERNATIVE EVALUATION

This section provides an evaluation of the wastewater disposal alternatives discussed in Section 4.0. The four wastewater disposal alternatives developed were compared against each other based on effectiveness, implementability and cost. The following provides a more detailed discussion of the evaluation criteria.

5.1 Evaluation Criteria

The criteria used to evaluate each of the disposal alternatives were: effectiveness, implementability (both technical and administrative), and cost, which are described below:

- **Effectiveness:** this criterion relates to the ability of the alternative to achieve its intended purpose. In the case of a wastewater disposal alternative, one of the intended purposes is to achieve all NYS, Federal and local regulations for treatment and effluent discharge.

- **Implementability:** this criterion relates to the technical and administrative feasibility of the alternative. Technical implementability is a measure of the feasibility, taking into account such factors as: site conditions, regulatory requirements, needed materials and equipment, availability of contractors, and complexity of construction. Administrative implementability refers to: compliance with applicable rules, regulations and statutes, the ability to obtain approvals, and the availability of treatment or disposal services and facilities.

- **Cost:** this criterion relates to relative project costs for each alternative. The costs include capital as well as operation and maintenance costs.

5.2 Wastewater Disposal Alternative #1 – Subsurface Disposal Systems

Subsurface disposal systems are a widely used and accepted means for the disposal of sanitary sewage. The composition of the wastewater from the development will be that of a typical domestic sewage, in terms of its BOD and suspended solids levels. Preliminary soil percolation tests have shown that acceptable soil exists on the site for the installation of absorption fields. The difficulty may arise in finding suitable quantities of acceptable soil in all locations where absorption fields would be installed. This would necessitate the placement of acceptable soil moved from other locations on the site or imported. For those absorption fields that would be placed on golf course fairways, regrading and the placement of soils may occur as part of the fairway construction.

From the standpoint of effectiveness, the installation of subsurface disposal systems for the type of wastewater that would be generated at the development has a proven ability to

treat the wastewater to regulatory requirements. A total of ten (10) subsurface disposal systems would be required for the total hydraulic loading of the development. One system would have an estimated hydraulic loading of less than 100 gpd, one system would be less than 1,000 gpd, five systems would be between 1,000 and 10,000 gpd, two systems would be between 10,000 and 14,000 gpd and one system would have an estimated hydraulic loading of 28,500 gpd. These systems would be distributed around the development in such a pattern and spacing as to minimize the influence one system may have on another.

The construction of the subsurface disposal systems is not complex and is highly feasible. A potential difficulty posed by the site conditions is finding a sufficient quantity of suitable soil in all locations for the construction of the absorption fields. However, if necessary, suitable soil would be imported from other locations. Prior to construction of the absorption fields, percolation tests would be performed on the proposed locations for the fields to demonstrate the suitability of the existing soil.

As a widely accepted means of wastewater disposal, this plan should be highly implementable from the administrative standpoint provided it can be demonstrated that regulatory requirements will be met. This plan will require long-term monitoring of each of the disposal systems.

Of the plans presented, this has the most reasonable capital costs and will require the least operation and maintenance costs. Absorption fields will require replacement at a frequency dependent on use and hydraulic loading but provision would be made for the location of reserve areas where replacement fields would be constructed.

5.3 Wastewater Disposal Alternative #2 – Subsurface Disposal Systems w/Pre-Treatment

This alternative is identical to Alternative #1 with the exception that wastewater pre-treatment units would be installed on all subsurface disposal systems except for the systems planned for the Main Entrance gatehouse and the golf maintenance building. The purpose of the pretreatment is to reduce the ammonia nitrogen loading to the subsurface. The pre-treatment system that would be installed uses biological processes to reduce BOD, TSS and nitrogen levels prior to discharge of the wastewater to the absorption fields. Packaged biological treatment systems are widely available and have a proven ability to effectively treat sanitary wastewater. Pre-fabricated systems are available which are not complex to install or operate but these systems do have electric power requirements to operate recirculation pumps. Periodically, it may be necessary to remove accumulated sludge from the units.

The pre-treatment units discussed add to the cost of subsurface treatment systems and will require trained staff to operate and maintain.

5.4 Wastewater Disposal Alternative #3 – Treatment at PHWWTP

From the standpoint of effectiveness, this alternative is comparable to an on-site wastewater treatment plant but superior to alternatives 1 and 2, as it would utilize an existing, permitted wastewater treatment facility with ample excess capacity for the treatment of waste from the developments. Furthermore, this alternative would utilize an existing surface discharge, eliminating the need for a new surface discharge or ten new subsurface discharge points.

The construction of the sewage collection system would be similar to the construction of a collection system for each alternative that involved collection of wastewater from more than one structure in terms of needed materials, equipment and its complexity.

This alternative is also favored for its technical implementability or feasibility, as it would eliminate the need to construct and operate an on-site WWTP or ten wastewater absorption fields. The added hydraulic and organic loading to the PHWWTP from the developments would improve the operability of a facility that is currently hydraulically underutilized, while added organic loading could improve the plant's biological process efficiency. The recycling of effluent from the PHWWTP for use as irrigation water would reduce effluent discharge to Birch Creek; mitigating any minor adverse effect such a discharge has on a surface water body.

Discharge of the wastewater from the Big Indian Plateau to the PHWWTP would eliminate the need for a second outfall to Birch Creek which would be required if an on-site WWTP were to be constructed (Alternative #4). This alternative would also utilize wastewater treatment plant capacity for which environmental impacts have been previously assessed, presumably during the permitting of the construction of the PHWWTP.

The difficulties with this alternative is its administrative implementability, yet to be determined operating costs and the NYCDEP's indication that the discharge of wastewater from the developments to the facility would not be allowed. (See Exhibit D)

5.5 Wastewater Disposal Alternative #4 – On-Site Wastewater Treatment

An on-site wastewater treatment plant designed in compliance with Federal, State and New York City regulations would be highly effective in the treatment of the wastewater generated at the development. The treatment technologies proposed are proven and reliable. The treatment facility would be constructed of readily available materials and equipment, utilizing labor from the local area.

An on-site WWTP would require an outfall for discharge of the effluent to Birch Creek. This would be in addition to the outfall at the nearby PHWWTP.

Construction of an on-site WWTP would require permits and approvals to construct and would be regulated and monitored throughout its operating life. This facility would also require full-time qualified and licensed operations and maintenance staff.

Of the alternatives considered, this alternative is the most costly from both a capital and an operating cost standpoint. It will also require several months for construction, shakedown, and startup, prior to its full-scale operation.

5.6 Proposed Wastewater Disposal Alternative

Given the preceding discussion and evaluation of wastewater disposal alternatives. *Wastewater Disposal Alternative #4 – On-Site Wastewater Treatment* is chosen as the preferred alternative. Weighing factors associated with effectiveness and technical implementability, this alternative is judged superior to alternatives 1 and 2 and second to Alternative #3as the PHWWTP has been built and is currently in operation whereas an on-site WWTP has not. When considering cost, this alternative is also second to Alternative #3 as it will be far more costly to construct and operate an on-site WWTP as it would to construct and maintain the pipeline necessary to convey wastewater to the PHWWTP.

The most critical and overriding factor in determining which alternative is favored, is the administrative implementability, specifically the indication by the NYCDEP that discharge to the PHWWTP would not be allowed (See Exhibit D). Without this approval, the implementation of Alternative #3 is not possible and for this reason, Alternative #4 is judged the most favored and is therefore the proposed alternative.

Construction and operation of an on-site wastewater treatment plant is supported as the preferred wastewater disposal alternative for the *Big Indian Plateau* by:

1. Collection and conveyance piping can be design and constructed to meet regulatory requirements with a minimum of adverse construction challenges;
2. The technologies proposed for use in the treatment train are demonstrated as effective in treating wastewater with the characteristics anticipated for the resort;
3. There is adequate land controlled by Crossroads Ventures, LLC that is located downgradient from the primary development to be used as the site of the wastewater treatment facility eliminating the need for extensive pumping and forcemain to convey wastewater to the treatment facility;
4. Several outfall options are available for effluent, including a surface discharge and irrigation water storage ponds, providing operational flexibility; and
5. Even though greater care, skill and operator certification is required to operate the WWTP, effluent quality is most assured.

6.0 CONSTRUCTION EROSION CONTROL

During construction, the work would be required to comply with all NYSDEC erosion control measures including siltation fence, straw bales, placement of spoils on upper side of trenches, siltation ponds, if necessary, and seeding. Federal and local regulations would also be adhered too as required. An Erosion Control Specialist, certified by the International Erosion Control Association, will be hired, independent from any contractors, to oversee the maintenance, repair and upgrade of erosion control devices. Refer to Sections 2 and 3 and Appendices 9, 10 and 11 of the DEIS for more a detailed discussion of construction erosion control.

7.0 OPERATION AND MAINTENANCE

A detailed O&M Plan would be assembled which would describe the required operation and maintenance of the proposed on-site WWTP as well as the collection and distribution components. The plan would at a minimum include technical specification cut sheets of equipment including operation requirements, standard operating procedures for sample collection and analysis of influent and effluent, program for solids and other waste disposal, electrical schematic, and other engineering details. It would also describe the frequency of maintenance for grinder pumps and booster pump stations and potential cleanout of gravity and pressure sewers.

The following provides an outline of a typical operation and maintenance plan:

1.0 Introduction
- 1.1 Plan User Guide
- 1.2 Operation and Managerial Responsibilities
- 1.3 Plant Description

2.0 Permits and Standards
- 2.1 General
- 2.2 Water Quality Standards
- 2.3 Discharge Permit
- 2.4 Monitoring Requirements

3.0 Process Description and Operation of Facilities
- 3.1 General
- 3.2 Description of Operation and Control of Project Facilities
- 3.3 Routine Operating Procedures

4.0 Maintenance
- 4.1 General
- 4.2 Preventative Maintenance and Inspection
- 4.3 Lubrication
- 4.4 Non-Scheduled Maintenance
- 4.5 Housekeeping
- 4.6 Maintenance Equipment
- 4.7 Warranty Provisions
- 4.8 Detailed Maintenance Instructions

5.0 Emergency Operation and Response Program
- 5.1 Emergency Program
- 5.2 Response to Emergencies
- 5.3 Potential Emergency Conditions
- 5.4 Emergency Plans

6.0 Laboratory Testing

TABLES

Table 1:

Big Indian Plateau Estimated Hydraulic Loading

Facility Type	Units	Number	Daily Flow [1] (gal/unit/day)	Flow [2] (gpd)
Big Indian Resort and Spa/ Big Indian Country Club				
Hotel	Rooms	150	120	18,000
Golf Course Clubhouse	Members	154	25	3,850
** w/ 40 Seat Snack Bar	Seats	40	20	800
** Sauna/Steam Rooms	Patrons	75	5	375
Restaurant (2 rest; 225 seats total; 4 seatings)	Seats	225	35	7,875
50 Seat Beverage Lounge	Seats	50	20	1,000
Spa with 15 Treatment Rooms and Lap Pool	Patrons	150	12	1,800
Ballroom	Seats	200	3	600
Offices/Meeting Space	SF	22,300	0.1	2,230
35-4 Bdrm Club Membership Units	4-Bedrooms	35	475	16,625
60-3 Bdrm Club Membership Units	3-Bedrooms	60	400	24,000
**20 Triplex Buildings				
Golf Maintenance	SF	8,500	0.1	850
Satellite Golf Maintenance	SF	1,500	0.1	150
			Subtotal	78,155
Belleayre Highlands				
Club Membership Units (88-2 Bdrm)	2-Bedrooms	88	300	26,400
Caretakers Offices	SF	100	0.1	10
Brisbane Mansion Clubhouse	Members	88	25	2,200
** w/ 25 Seat Snack Bar, Pool, and	Seats	25	20	500
Cabana Buildind w/ Lockers and Showers	Swimmers	60	10	600
Reception/ Sales/ Operational Offices	SF	6,000	0.1	600
			Subtotal	30,310
Gate House	SF	750	0.1	75
			Total (w/o Gate House)	108,465
			Total (w/ Gate House)	108,540

[1] All hydraulic loading rates taken from *Design Standards for Wastewater Treatment Works Intermediate Sized Sewage Facilities-1988 (A NYSDEC Div. of Water Publication)-Table 3*

[2] Flow (gpd)='Number' Value *Daily Flow (gal/unit/day)

Table 2:

Big Indian Plateau Estimated Organic Loading

Facility Type	Persons	No. Persons	BOD Rate [1] (lb/dy/cap)	SS Rate [2] (lb/dy/cap)	BOD [3] (lb/dy)	SS [4] (lb/dy)
Big Indian Resort and Spa/ Big Indian Country Club						
Hotel	Patrons	300	0.2	0.24	60	72
	Employees	15	0.1	0.12	1.5	1.8
Restaurant (2 Rest; 225 Seats; 4 Seatings)	Patrons [5]	900	0.07	0.084	63	75.6
	Employees	45	0.1	0.12	4.5	5.4
50 Seat Beverage Lounge (3 Seatings)	Patrons [5]	150	0.07	0.084	10.5	12.6
	Employees	5	0.1	0.12	0.5	0.6
Golf Course Clubhouse [6]	Patrons	150	0.04	0.048	6	7.2
	Employees	8	0.1	0.12	0.8	0.96
Snack Bar (40 Seats; 4 seatings)	Patrons [5]	160	0.07	0.084	11.2	13.44
	Employees	6	0.1	0.12	0.6	0.72
Sauna/ Steam Rooms [6]	Patrons	75	0.04	0.048	3	3.6
	Employees	5	0.1	0.12	0.5	0.6
Spa with 15 Treatment Rooms and Lap Pool [6]	Patrons	150	0.04	0.048	6	7.2
	Employees	18	0.1	0.12	1.8	2.16
Ballroom	Seats	200	0.02	0.048	4	9.6
Offices/Community Areas	Persons	200	0.05	0.06	10	12
Club Membership Units	Residents	175	0.2	0.24	35	42
-(35, 4 bdrm)						
-(60, 3 bdrm)		240	0.2	0.24	48	57.6
				Subtotal	**266.9**	**325.1**
Belleayre Highlands						
Brisbane Mansion Clubhouse [6]	Patrons	88	0.04	0.048	3.52	4.224
-Pool and Cabana Bldg w/ Lockers & Showers	Employees	10	0.1	0.12	1	1.2
Snack Bar (25 Seats; 2 seatings)	Patrons [5]	50	0.07	0.084	3.5	4.2
	Employees	5	0.1	0.12	0.5	0.6
Caretakers House	Residents	4	0.2	0.24	0.8	0.96
-(1, 3 bdrm)						
Club Membership Units	Residents	264	0.2	0.24	52.8	63.36
-(88, 2 bdrm)						
Reception/ Sales/ Operational Offices	Persons	5	0.05	0.06	0.25	0.3
				Subtotal	**62.4**	**74.8**
				Total	**329.3**	**399.9**
					BOD [7] (mg/l)	**SS [8] (mg/l)**
		@ est. ave. flow [9] (gpd)	**108,465**		**364.0**	**442.1**

[1] All BOD Rates taken from *Water and Wastewater Technology Second Edition* by Mark Hammer-*Table 9-1*
[2] SS Rate (lb/dy/cap) is typically 1.2*BOD Rate
[3] BOD (lb/dy)=BOD Rate (lb/dy/cap)*'No. Persons' Value
[4] SS Rate (lb/dy)=SS Rate (lb/dy/cap)*'No. Persons' Value
[5] BOD and SS Rates for Restaurant Patrons combine the patron value and the meal served value.
[6] The BOD and SS Rates for Restaurants are assumed to be the same for Club Houses/Spas/Retail Stores.
[7] BOD (mg/l)=Total BOD Rate (lb/dy)/(Flow (mil gpd)*8.34)
[8] SS (mg/l)=Total SS Rate (lb/dy)/(Flow (mil gpd)*8.34)
[9] Average Flow value is the 'Total' hydraulic loading value from Table 1 (this document).

Table 3A:

Big Indian Plateau
Absorption System Sizing
Alternatives #1 and #2

Field #	Facilities/ Lodging Served	Hydraulic Load (gpd)	Grease Trap Sizing (gal)	Septic Tank Sizing (gal)	Area of Absorption Fields (SF)	# of Fields Required	Lateral/ Piping Details*
1	4-2 Bdrm Quadplex Units	3,840	NA	8,000	4,267	1- 4725 SF Field plus 100% Reserve	9-100 ft
2	Brisbane Mansion Clubhouse; Caretaker's House; 5-2 Bdrm Quadplex Units	7,600	1,500 for Clubhouse Snackbar	13,000	8,500	1- 4725 SF Field; 1- 3675 SF Field; 100% Reserve	1 Field w/ (9) 100 ft laterals; 1 Field w/ (7) 100 ft laterals
3	6-2 Bdrm Quadplex Units	5,760	NA	11,000	6,400	1- 4725 SF Field; 1- 1575 SF Field; 100% Reserve	1 Field w/ (9) 100 ft laterals; 1 Field w/ (3) 100 ft laterals
4	7-2 Bdrm Quadplex Units	6,720	NA	12,000	7,500	1- 4725 SF Field; 1- 3,150 SF Field; 100% Reserve	1 Field w/ (9) 100 ft laterals; 1 Field w/ (6) 100 ft laterals
5	Big Indian Resort and Spa/ Clubhouse/ Restaurants	28,500	5,000 and 8,000 for Restaurants in Lodge; 2,500 for Bar in Clubhouse; 2,000 for Snackbar	40,000	33,333	7- 4725 SF Fields plus 100% Reserve	7 Fields w/ (9) 100 ft laterals
6	11 Triplex Units; 3 Single Units	11,700	NA	18,000	13,000	2- 4725 SF Fields; 1- 3675 SF Field; 100% Reserve	2 Fields w/ (9) 100 ft laterals; 1 Field w/ (7) 100 ft laterals
7	9 Triplex Units; 14 Single Units	13,960	NA	20,000	15,511	3- 4725 SF Fields; 1- 1575 SF Field; 100% Reserve	3 Fields w/ (9) 100 ft laterals; 1 Field w/ (3) 100 ft laterals
8	18 Single Units	6,840	NA	12,000	7,600	1- 4725 SF Field; 1- 3150 SF Field; 100% Reserve	1 Field w/ (9) 100 ft laterals; 1 Field w/ (6) 100 ft laterals
9	Golf Maintenance	945	NA	1,200	1,050	1- 1050 SF Field; 100% Reserve	(4) 50 ft laterals
10	Main Entrance Gatehouse	75	NA	900	85	1- 85 SF Field; 100% Reserve	(2) 10 ft laterals

* All laterals are 2" diameter pipe spaced 5' on-center with 1/4" holes spaces 5' on-center. Manifold headers are 4" diameter pipe.

Table 3B:

Big Indian Plateau
Absorption System Sizing
Alternative #4

Facilities/ Lodging Served	Hydraulic Load (gpd)	Grease Trap Sizing (gal)	Septic Tank Sizing (gal)	Area of Absorption Fields (SF)	# of Fields Required	Lateral/ Piping Details*
Main Entrance Gatehouse	75	NA	900	85	1- 85 SF Field; 100% Reserve	(2) 10 ft laterals

FIGURES

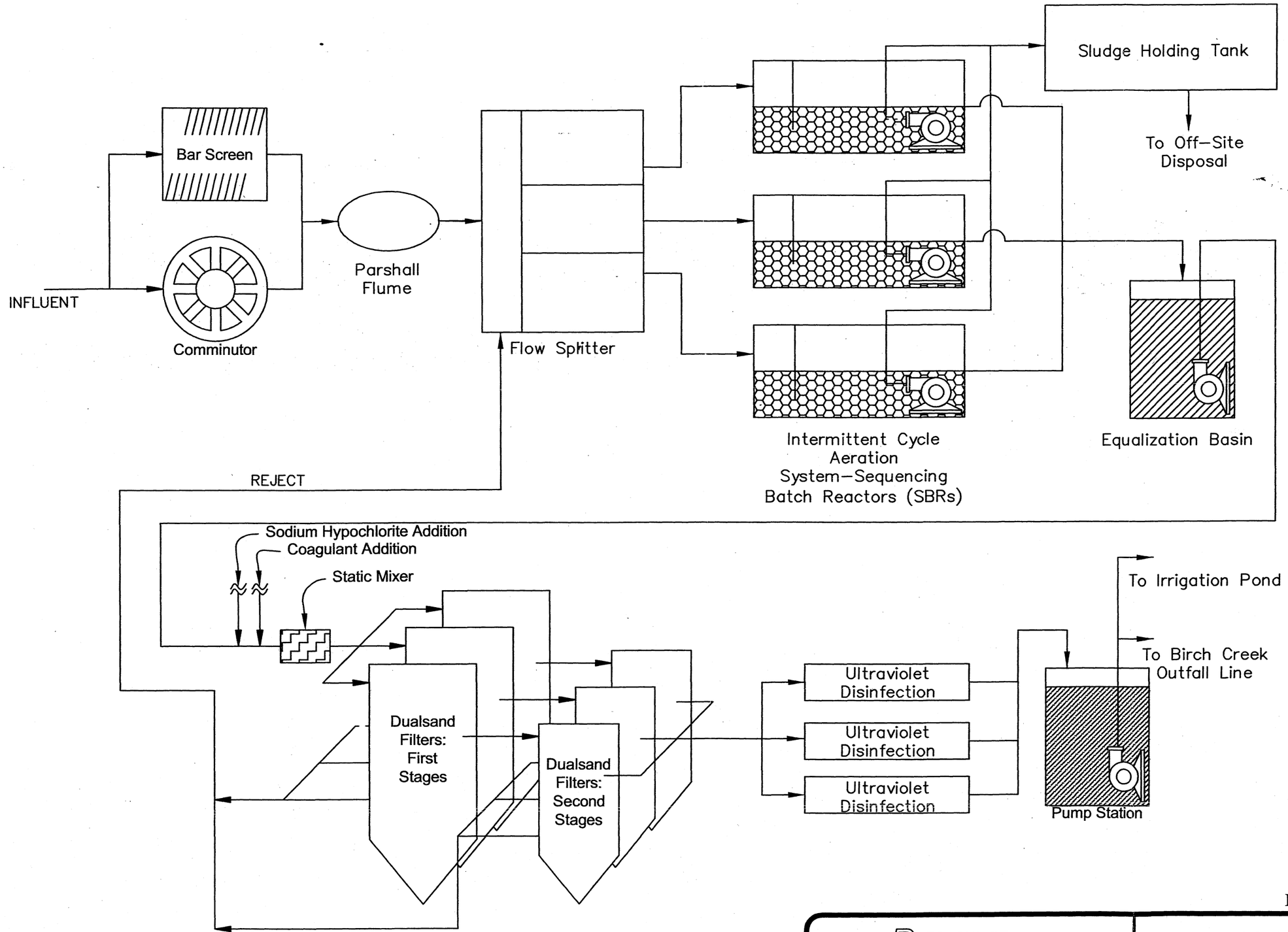


FIGURE 1

DELAWARE ENGINEERING, P.C.
28 Madison Avenue Extension
Albany, New York 12203
Phone 518–452–1290
FAX 518–452–1335

PROCESS FLOW DIAGRAM

BIG INDIAN PLATEAU

DECEMBER 2002

FILENAME: CROSSROADS–PROPOSED FLOW THRU.DWG

EXHIBITS

Exhibit A

Drawings
(Separate Attachment)

Exhibit B

Test Pit and Percolation Test Results

THE L A GROUP
40 LONG ALLEY, SARATOGA SPRINGS, NEW YORK 12866

TO: KEVIN FRANKE

FROM: ROGER J. CASE, SOIL SCIENTIST

DECEMBER 11, 2000

RE: DEEP SOIL TEST PITS AND PERCOLATION TESTS @
BELLAYRE CROSSROADS VENTURE PROPERTIES
HIGH MOUNT/PINE HILL, NY

These deep soil test pits observations were made November 2000. Present at the time were Roger Case, soil scientist, cpss, cpsc, LA Group and representatives from the New York City DEP.

There are three parcels involved with the project. The deep test pits are typically identified with the prefix representing the parcel in which they are located. WA prefix is for pits at Wild Acres. The prefix R is for pits at the Ridge parcel and T represents pits described at the Turner Mansion parcel.

The following test pit observations were are from Wild Acres.

Test pit WA119:

Oe horizon: 0 to 2 inches, black (10YR2/1) mucky silt loam duff layer
E horizon: 2 to 3 inches, light gray (10YR7/2) gravelly silt loam
Bw1 horizon: 3 to 10 inches, (5YR4/6) yellowish red channery* silt loam with common small flagstones.
Bw2 horizon: 10 to 16 inches, brown (7.5YR 4/4) very channery silt loam with common flagstones of varying sizes.
Bw3 horizon: 16 to 38 inches, firm, dark yellowish brown (10YR 4/4) very channery silt loam with many flagstones.
Bx horizon**: 38 to 72 inches, very firm, brown (7.5YR 4/4) very channery silt loam, many flagstones.
R horizon: 72+ fractured sandstone and silt stone over hard bedrock.

*channers are elongated thin gravel fragments derived from shale and silt and sandstone, as opposed to typical gravel which is rounded or at least irregularly shaped.
**The Bx horizon designates the beginning of the fragipan.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. A deep "perc" test exceeded one hour.
Percolation rate @ 26 inches is: 5 minutes 35 seconds (5:35)
Soil Series: Lewbeach

Test pit WA120:

Oe horizon: 0 to 1 inches, black (10YR2/1) mucky silt loam duff layer
E horizon: 1 to 2 inches, light gray (10YR7/2) gravelly silt loam (discontinuous)
Bw1 horizon: 2 to 12 inches, (7.5YR6/8) reddish yellow channery silt loam with common small flagstones.
Bw2 horizon: 12 to 24 inches, dark yellowish brown (10YR 4/4) very channery silt loam with many flagstones of varying sizes.
Bx horizon: 24 to 54 inches, very firm, brown (7.5YR 4/4) very channery silt loam, many flagstones.
R horizon: 54+ fractured sandstone and silt stone over hard bedrock.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious.
Percolation rate @ 22 inches is: 7 minutes 45 seconds (7:45)
Soil Series: Lewbeach

Test pit WA122:

Ap horizon: 0 to 5 inches, dark brown (10YR3/3) very channery silt loam, with common flagstones and boulders.
Bw1 horizon: 5 to 19 inches, brown (7.5YR4/4) very channery silt loam with common flagstones.
Bw2 horizon: 19 to 34 inches, dark yellowish brown (10YR 4/4) very channery silt loam with many flagstones of varying sizes.
Bx horizon: 34 to 58 inches, very firm, brown (7.5YR 4/4) very channery silt loam, many flagstones and boulders.
Cd horizon: 58 to 84 inches, very firm layers of sand and gravel.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious.
Percolation rate @ 18 inches is: 9 minutes 30 seconds (9:30)
Soil Series: Lewbeach

Test pit WA Pond 3:

Oe horizon: 0 to 4 inches, black (10YR2/1) mucky silt loam duff layer
E horizon: 4 to 6 inches, light gray (10YR7/2) gravelly silt loam
Bw1 horizon: 6 to 16 inches, (7.5YR 6/8) reddish yellowish very channery fine sandy loam with common small boulders.
Bw2 horizon: 16 to 26 inches, yellowish brown (10YR 5/4) very channery fine sandy loam with some small boulders.
Bx horizon: 26 to 42 inches, very firm, grayish brown (2.5Y 5/2) very bouldery loam
Cd horizon: 42 to 86+ inches, very firm, brown (2.5Y 5/2) very channery loam.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. This location was investigated as a future location for pond construction, no percolation test was run. These impervious hardpan soils should make successful ponds.
Soil Series: Lewbeach

Test pit WA117001:

Oe horizon: 0 to 2 inches, black (10YR2/1) mucky silt loam duff layer
Bw1 horizon: 2 to 10 inches, (10YR 6/8) brownish yellowish channery loam.
Bw2 horizon: 10 to 24 inches, brown (7.5YR 6/4) very channery loam.
Bx horizon: 24 to 48 inches, very firm, brown (7.5YR 4/4) very channery silt loam with a few small boulders.
C horizon: 48 to 84 inches, firm, brown (7.5YR 6/4) very gravelly sandy loam.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. This test pit was excavated to confirm soil mapping. The test pit confirms the map unit for Lewbeach soils which are deep, well drained soils formed in coarse textured glacial till soils. This particular area of Lewbeach is not quite a red as typical Lewbeach soils.

Test pit WA117:

Ap horizon: 0 to 7 inches, dark brown (10YR3/3) silt loam, very stony
Bw1 horizon: 7 to 16 inches, yellowish brown (10YR3/6) very gravelly silt loam.
Bw2 horizon: 16 to 28 inches, brown (7.5YR 5/4) very gravelly silt loam
Bx horizon: 28 to 52 inches, very firm, reddish brown (5YR 5/3) very channery silt loam with many mixed flagstones.
C horizon: 52 to 84 inches, very firm, very flaggy silt loam.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. No percolation test was run, this area was investigated as a proposed pond site and should be successful.
Soil Series: Lewbeach

Test pit WA117002:

Oe horizon: 0 to 1 inches, black (10YR2/1) mucky silt loam duff layer
E horizon: 1 to 2 inches, light gray (10YR7/2) gravelly silt loam (discontinuous)
Bw1 horizon: 2 to 12 inches, (7.5YR6/8) reddish yellow channery silt loam with common small flag stones.
Bw2 horizon: 12 to 24 inches, dark yellowish brown (10YR 4/4) very channery silt loam with many flagstones of varying sizes.

BC horizon: 24 to 38 inches, firm, brown (7.5YR 4/4) very channery silt loam, many flagstones.
R horizon: 38+ fractured sandstone and silt stone over hard bedrock.

The depth to bedrock varied in the pit from 38 inches at one end to 72 inches at the other end. There are no seeps and no mottles, however there is a very firm Bx horizon at the deeper end of the pit and it is essentially impervious.
Soil Series: Vly (slightly brown phase)

Test pit #WA116:

This test pit was excavated in the lawn, west of the existing motel on the property. The soil consists of old stable fill excavated from the hillside behind the motel.

Ap horizon: 0 to 6 inches, dark reddish brown (5YR 3/2) silt loam.
C horizon: 6 to 84 inches, reddish brown (5YR 5/4) very gravelly/channery silt loam.

This area is intended for construction. No percolation tests were run. There were no seeps or mottles.
Udorthents, smoothed

Test pit WA117003:

Oe horizon: 0 to 25 inches, black (10YR2/1) fibrous organic duff layer mixed in a near pavement of large flagstones and boulders.
Bw1 horizon: 25 to 41 inches, reddish brown (5YR 4/4) very channery silt loam with common mixed flagstones.
Bw2 horizon: 41 to 60 inches, reddish brown (5YR 5/4) very channery loam, slightly firm, with many flagstones of varying sizes.
C horizon: 60 to 72 inches, slightly firm, reddish brown (7.5YR 4/4) very channery silt loam, many flagstones and boulders.

There are no seeps and no mottles. No perc test was run.
Soil Series: Elka

Test pit WA117004:

Ap horizon: 0 to 9 inches, dark brown (10YR3/3) channery silt loam.
Bw1 horizon: 9 to 19 inches, reddish brown(5YR 4/6) channery loam.
Bw2 horizon: 19 to 35 inches, reddish brown (7.5YR 4/3) very channery silt loam.
Bx horizon: 35 to 84 inches, very firm, light reddish brown (5YR 6/3) very channery silt loam with thick beds of flag stone in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. This test pit was excavated to confirm soil mapping. The test pit confirms

the map unit for Lewbeach soils which are deep, well drained soils formed in coarse textured glacial till soils.

Test pit WA115:

Oe horizon: 0 to 1 inches, black (10YR2/1) fibrous organic duff layer
A horizon: 1 to 6 inches, dark grayish brown (10YR3/2) gravelly silt loam
Bw1 horizon: 6 to 9 inches, dark brown (10YR 3/3) channery silt loam
Bw2 horizon: 9 to 16 inches, yellowish brown (10YR 5/6) very channery silt loam with many flagstones of varying sizes.
R horizon: 16+ fractured sandstone and silt stone over hard bedrock.

There are no seeps and no mottles. This is an area confirmed as Halcott soils, however there is not the extensive areas of Halcott first predicted.

The following test pits and percolation test results are from the Ridge parcel.

Test pit #R118001:

Ap horizon: 0 to 2 inches, dark reddish brown (5YR 3/2) channery silt loam.
Bw1 horizon: 2 to 11 inches, reddish brown(5YR 4/4) channery loam.
Bw2 horizon: 11 to 16 inches, reddish brown (5YR 5/3) very channery silt loam.
Bx horizon: 16 to 84 inches, very firm, light reddish brown (5YR 6/3) very channery silt loam with thick beds of flag stone in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 27 minutes (27:00)
The soil type is Lewbeach.

Test pit #R118002:

Oe horizon: 0 to 2 inches, black (5YR 2/1) fibrous duff layer.
Bw1 horizon: 2 to 8 inches, reddish brown(5YR 4/6) channery loam.
Bw2 horizon: 8 to 16 inches, reddish brown (5YR 4/6) channery silt loam.
Bw3 horizon: 16 to 26 inches, reddish brown (5YR 5/3) very channery silt loam.
Bx horizon: 26 to 90 inches, very firm, light reddish brown (5YR 6/3) very channery silt loam with thick beds of flag stone in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 15 minutes (15:00)
The soil type is Lewbeach.

Test pit #R118003:

Oe horizon: 0 to 1 inches, black (5YR 2/1) fibrous duff layer.
Bw1 horizon: 1 to 12 inches, dark yellowish brown (10YR 4/4) channery loam.
Bw2 horizon: 12 to 17 inches, light yellowish brown (10YR 6/4) channery silt loam.
BC horizon: 17 to 27 inches, light yellowish brown (10YR 6/4) very channery fine sandy loam with some small flagstones.
C horizon: 27 to 36 inches, firm, pale brown (10YR 6/3) very channery silt loam, with common fine faint dark yellowish brown (10YR 4/6) mottles.
R horizon: 36 inches, hard sand stone bedrock.

The boundary condition is perched seasonal high water table at 27 inches below the surface. The C horizon is firm and essentially impervious. The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 12 minutes (12:00)
The soil type is Vly.

Test pit R118004:

Oe horizon: 0 to 2 inches, black (10YR2/1) fibrous organic duff layer
E horizon: 2 to 4 inches, gray (5YR 6/2) fine sand
Bw horizon: 4 to 16 inches, reddish yellow (7.5YR 6/8) channery silt loam
R horizon: 16+ fractured sandstone and silt stone over hard bedrock.

There are no seeps and no mottles. This is an area proposed for a pond. Typically, deeper soils are better suited to pond construction.
The soil type is Halcott rock outcrop.

Test pit R118005:

Oe horizon: 0 to 2 inches, black (10YR2/1) fibrous organic duff layer
E horizon: 2 to 4 inches, gray (5YR 6/2) fine sand
Bw horizon: 4 to 18 inches, reddish yellow (7.5YR 6/8) channery silt loam
R horizon: 18+ fractured sandstone and silt stone over hard bedrock.

There are no seeps and no mottles. This is an area proposed for a pond. Typically, deeper soils are better suited to pond construction.
The soil type is Halcott rock outcrop.

Test pit R118006:

Oe horizon: 0 to 2 inches, black (10YR2/1) fibrous organic duff layer
E horizon: 2 to 4 inches, gray (5YR 6/2) fine sand
Bw horizon: 4 to 12 inches, reddish yellow (7.5YR 6/8) channery silt loam
R horizon: 12+ fractured sandstone and silt stone over hard bedrock.

There are no seeps and no mottles. This is an area proposed for a hotel construction.
The soil type is Halcott rock outcrop.

Test pit R118007:

Oe horizon: 0 to 2 inches, black (10YR2/1) fibrous organic duff layer
E horizon: 2 to 7 inches, gray (5YR 6/2) fine sand
Bw1 horizon: 7 to 16 inches, yellowish brown (10YR 4/6) channery silt loam
Bw2 horizon: 16 to 27 inches, yellowish brown (10YR 4/4) very channery silt loam.
Bx horizon: 27 to 90 inches, very firm, light reddish brown (5YR 6/3) very channery silt loam with thick beds of flag stone in the lower part.

There are no seeps and no mottles. This is an area proposed for a pond. Typically, deeper soils are better suited to pond construction.
The soil type is Lewbeach (slightly brown phase).

Test pit R118008:

Oe horizon: 0 to 3 inches, black (10YR2/1) fibrous organic duff layer
E horizon: 3 to 5 inches, gray (5YR 6/2) fine sand
Bw1 horizon: 5 to 14 inches, yellowish brown (10YR 4/6) channery silt loam
Bw2 horizon: 14 to 53 inches, ***rubble.*** rubble consists of massive piles of flagstones and boulders with large voids and spaces too large to fill with soil material. Typically rubble occurs at the base of steep bedrock ledges.

There are no seeps and no mottles. No percolation test was performed. The area is proposed for hotel construction.
The soil type is Lewbeach, extremely rocky

Test pit R118009:

Oe horizon: 0 to 2 inches, black (10YR2/1) fibrous organic duff layer
E horizon: 2 to 4 inches, gray (5YR 6/2) fine sand
Bw1 horizon: 4 to 23 inches, yellowish brown (10YR 4/6) channery silt loam

Bw2 horizon: 23 to 60 inches, ***rubble,*** mostly flagstones and boulders approaching bedrock ledge near the bottom of the test pit.

There are no seeps and no mottles. No percolation test was performed. The area is proposed for hotel construction.
The soil type is Lewbeach, extremely rocky

Test pit #R1180010:

Oe horizon: 0 to 2 inches, black (5YR 2/1) fibrous duff layer.
Bw1 horizon: 2 to 10 inches, reddish brown (5YR 4/4) channery loam.
Bw2 horizon: 10 to 24 inches, reddish brown (5YR 4/4) very channery, very flaggy silt loam.
R horizon: 24 inches, hard sand stone bedrock.

The boundary condition is hard bedrock at 24 inches below the surface.
The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 5 minutes 10 seconds (5:10)
The soil type is Vly.

Test pit #R1180011:

Oe horizon: 0 to 2 inches, black (5YR 2/1) fibrous duff layer.
Bw1 horizon: 2 to 8 inches, reddish brown(5YR 4/6) channery loam.
Bw2 horizon: 8 to 23 inches, reddish brown (7.5YR 5/6) channery silt loam.
Bx horizon: 23 to 90 inches, very firm, light reddish brown (5YR 6/3) very channery silt loam with thick beds of flag stone in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 22 inches below the surface.
The stabilized percolation rate is: 10 minutes 15 seconds (10:15)
The soil type is Lewbeach.

The following test pits and percolation test results are from the Turner Mansion parcel.

Test pit #T119001:

Ap horizon: 0 to 6 inches, dark grayish brown (10YR 3/2) silt loam.
Bw1 horizon: 6 to 15 inches, brown (7.5YR 5/ 4) channery silt loam.
Bw2 horizon: 15 to 29 inches, brown (7.5YR 5/4) very channery silt loam.
Bx horizon: 29 to 63 inches, very firm, light reddish brown (5YR 6/3) very channery silt loam with thick beds of flag stone in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 20 inches below the surface.
The stabilized percolation rate is: 21 minutes 45 seconds (21:45)
The soil type is Lewbeach.

Test pit #T119002:

Ap horizon: 0 to 6 inches, dark grayish brown (10YR 3/2) silt loam.
Bw1 horizon: 6 to 21 inches, reddish brown (7.5YR 5/6) channery silt loam.
Bw2 horizon: 21 to 32 inches, reddish brown (7.5YR 4/4) channery silt loam.
C horizon: 32 to 36 inches, very firm light brownish gray (10YR 6/2) channery silt loam.
R horizon: 36 inches, hard sand stone bedrock.

The boundary condition is hard bedrock at 36 inches below the surface.
The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 14 minutes 2 seconds (14:02)
The soil type is Vly.

Test pit #T119003:

Ap horizon: 0 to 5 inches, dark grayish brown (10YR 3/2) silt loam.
Bw1 horizon: 5 to 28 inches, brown (7.5YR 5/ 4) channery silt loam.
Bw2 horizon: 28 to 40 inches, pale brown (10YR 6/3) very channery silt loam, with few fine faint yellowish brown (10YR 4/6) mottles.
Bx horizon: 40 to 61 inches, very firm, light brownish gray (10YR 6/2) very channery silt loam with flagstones in the lower part.

The boundary condition is perched seasonal high water table, indicated by mottling at 28 inches below the surface. The percolation test was run at 16 inches below the surface.
The stabilized percolation rate is: 24 minutes 30 seconds (24:30)
The soil type is Willowemoc.

Test pit #T119004:

Ap horizon: 0 to 11 inches, grayish brown (10YR 4/2) silt loam.
Bw1 horizon: 11 to 28 inches, reddish brown (5YR 5/ 4) channery silt loam.
Bx horizon: 28 to 42 inches, very firm, light brownish gray (10YR 6/2) very channery silt loam with medium, faint yellowish brown (10YR 5/6) mottles, flagstones in the lower part.

The boundary condition is perched seasonal high water table, indicated by mottling at 28 inches below the surface. The percolation test was run at 16 inches below the surface. (A percolation test at 30 inches was in excess of one hour).

The stabilized percolation rate is: 13minutes 10 seconds (13:10)
The soil type is Willowemoc.

Test pit #T119005:

Ap horizon: 0 to 1 inches, dark grayish brown (10YR 3/2) silt loam.
Bw1 horizon: 1 to 25 inches, brown (5YR 4/ 4) channery silt loam.
Bw2 horizon: 25 to 36 inches, pale brown (5YR 5/4) very channery silt loam
Bx horizon: 36 to 50 inches, very firm, light brownish gray (5YR 6/3) very channery silt loam with flagstones in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 20 inches below the surface.
The stabilized percolation rate is: 17 minutes 30 seconds (17:30)
The soil type is Lewbeach.

Test pit #T119006:

Ap horizon. 0 to 3 inches, dark grayish brown (10YR 3/2) silt loam.
Bw1 horizon: 3 to 14 inches, strong brown (5YR 5/ 8) channery silt loam.
Bw2 horizon: 14 to 27 inches, brown (7.5YR 5/6) very channery silt loam
Bx horizon: 27 to 48 inches, very firm, light brownish gray (5YR 6/3) very channery silt loam with flagstones in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 10 minutes 00 seconds (10:00)
The soil type is Lewbeach.

Test pit R119007:

Oe horizon: 0 to 2 inches, black (10YR2/1) fibrous organic duff layer
Bw horizon: 2 to 18 inches, strong brown (7.5YR 5/6) silt loam
BC horizon: 18 to 22 inches, reddish yellow (7.5YR 6/8) channery silt loam with fractured sandstone and silt stone over hard bedrock.
R horizon: 22+ hard bedrock.

The soil type is Halcott rock outcrop.

Test pit #T119008:

Ap horizon: 0 to 6 inches, dark grayish brown (10YR 3/2) silt loam.
Bw1 horizon: 6 to 17 inches, strong brown (5YR 5/ 8) silt loam.

Bw2 horizon: 17 to 20 inches, brown (7.5YR 5/6) silt loam
Bt1 horizon: 20 to 32 inches, firm, light brown(7.5YR 6/4)silty clay loam.
Bt2 horizon: 32 to 44 inches, very firm, pinkish gray (7.5YR 6/2) silty clay loam.
BC horizon: 44 to 72 inches, very firm, pinkish gray (7.5YR 6/2) silt loam.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 20 minutes 00 seconds (20:00)
The soil type is Lewbeach.

Test pit R119009:

Oe horizon: 0 to 4 inches, black (10YR2/1) fibrous organic duff layer
Bw horizon: 4 to 20 inches, strong brown (7.5YR 5/6) silt loam
BC horizon: 20 to 24 inches, reddish yellow (7.5YR 6/8) channery silt loam with fractured sandstone and silt stone over hard bedrock.
R horizon: 24+ hard bedrock.

The soil type is Vly rock outcrop.

THE L A GROUP

40 LONG ALLEY, SARATOGA SPRINGS, NEW YORK 12866

TO: KEVIN FRANKE

FROM: ROGER J. CASE, SOIL SCIENTIST

NOVEMBER 27, 2000

RE: BELLAYRE/CROSSROADS VENTURES

Fourteen percolation tests were performed on soil areas within the three parcels that comprise the Crossroads Ventures properties juxtaposition to the existing New York State operated Bellayre ski center.

The percolation tests were performed adjacent to deep soil test pits excavated specifically to determine the suitability of that particular location for septic disposal. Each area is located and identified on the Crossroads Ventures topographic maps by parcel.

The test pits at the Wild Acres parcel have the prefix WA. The test pits at the Turner Mansion parcel have the prefix T and the pits at the Ridge have the prefix R. The percolation tests are identified as the "perc" test at the designated deep soil test pit.

Every test pit observed for septic disposal exhibited a boundary condition. Typically, the boundary condition was an impervious layer (fragipan) at 25 to 35 inches below the surface. A couple of the designated septic areas were unsuited because of shallowness to bedrock.

The following stabilized percolation test results in minutes and seconds were observed:

PERC @ WA119: 5: 35 (@ 26 inches below the surface)

PERC @ WA120: 7:45 (@ 22 inches below the surface)

PERC @ WA122: 9:30 (@ 18 inches below the surface)

PERC @ R118001: 27:00 (@ 18 inches below the surface)

PERC @ R118002: 15:00 (@ 18 inches below the surface)

PERC @ R118003: 12:00 (@ 18 inches below the surface)

PERC @ R1180010: 5:15 (@ 16 inches below the surface)
Bedrock at this location is in places <24 inches below the surface. It is probably not suitable.

PERC @ R1180011: 10:30 (@ 22 inches below the surface)

PERC @ T119001: 21:45 (@ 20 inches below the surface)

PERC @ T119002: 14:02 (@ 18 inches below the surface)

PERC @ T119003: 24:30 (@ 16 inches below the surface)

PERC @ T119004: 13:10 (@ 16 inches below the surface)

PERC @ T119005: 17:30 (@ 16 inches below the surface)

PERC @ T119006: 10:00 (@ 18 inches below the surface)

PERC @ T119008: 20:00 (@ 26 inches below the surface)

At a couple of location deeper percolation tests were performed. In each instance the percolation rate exceeded one hour either in the first or second revolution.

As predicted the browner glacial soils, which are loamier "perced" more rapidly than the redder glacial till soils which are derived from red shale and silt stone have more clay.

These tests were done according to the standards of the NYSDOH, each test was witnessed by a representative from the NYC, DEP and the results are replicable.

Exhibit C

Absorption System Calculations

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Crossroads-
DESCRIPTION: - South Lodge/ Bellevue Highlands Grease Traps

DATE 10/13/00
SHEET 1 OF 1
BY MTD Ck'ed

GREASE TRAP SIZING in Hotel:

ASSUMPTIONS:

- 2 Rest.
- (1) 150 (1) 75 seats / Rest (D)
- 5 gal WW / meal (GL)
- LF = 1.0 Loading Factor
- ST = 1.7 Storage Factor
- Hours Open 7AM - 11PM = 16 HR

TRAP SIZE (gal) = D · GL · ST · (HR/2) · LF

$= (75 \cdot 5 \cdot 1.7 \cdot \frac{16}{2} \cdot 1)$ (150)

5,100 gal — 75-seat rest

10,200 gallons — 150 seat

+ Clubhouse Trap.

ASSUMPTIONS:

- 40 seats
- 5 gal WW / meal
- LF = 1
- ST = 1.7
- HR 6 - 6

Trap (gal) = $40 \cdot 5 \cdot 1.7 \cdot (\frac{12}{2}) \cdot 1$

= 2040 gallons

Bar

Assume: 50 seats, 5 gal/ww, LF=1, ST=1.7, Hr = 11AM - 11PM

$= \frac{12.5 \cdot 1.7 \cdot 50 \cdot 1}{2}$

≈ 2500 gal

Turner Mansion Trap · 25 seats · 5 gal WW / meal · LF = 1 ST = 1.7 · HR - 8-8

Trap (gal) = $25 \cdot 5 \cdot 1.7 \cdot (\frac{12}{2}) \cdot 1$

= 1275 gallons

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Crossroads - Ridge
DESCRIPTION: Septic Tank Sizing / Grease Traps

DATE 12/12/00
SHEET 1 OF 3
BY MTA Ck'ed

Grease Traps

Lodge

Rest #1 - 75 | - 5000 gal
Rest #2 - 150 | - 8000 gal

Clubhouse - Golf Course

Bar - 2500 gal

Snack Bar - 2050 ~2000 gal

Brisbane Mansion

Snack Bar - 1,300 gallon ~1500 gal

Septic Tanks - using Equations from NYS DEC Sizing Calcs from 1988 Standards

Lodge

30,000 gal

27 TH ± 14 Single

13,960 gpd

∴ Q = 3750 + 0.75 (13,960) = X + 33X
= 18912 ≈ 20,000 gal

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Crossroads Lodge
DESCRIPTION: Septic Tank Sizing

DATE 12/2/00
SHEET 2 OF 3
BY HTD Ck'ed

18 Singles

6840 gpd

Size = 3750 + 0.75 (6840) = 8880

Size = 8880 + .33(8880)

= 11,810.4 gals

3B TH = 2 singles

11,700 gpd

Size = 3750 + 0.75 (11,700) = 12,525

Size = 12,525 (.33) + 12,525

= 16658

≈ 17,000 gal

Maintenance - Golf

Q = 5000 - 800 gpd

Size = 1.5 Q

= 1200 gal

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

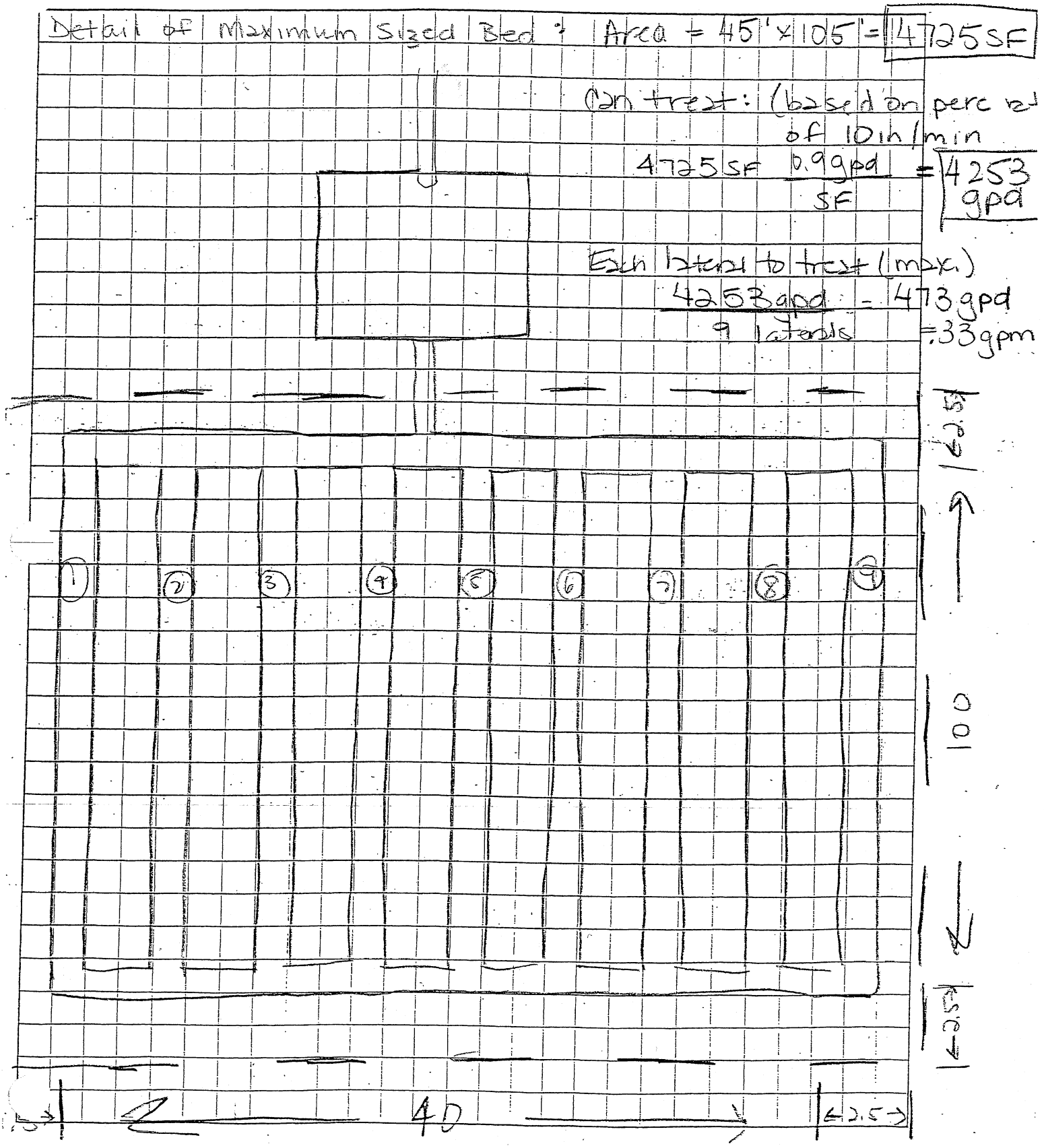
PROJECT: Crossroads - Vista
DESCRIPTION: Absorption Bed

DATE 12/12/00
SHEET 3 OF 3
BY MTD Ck'ed

Detail of Maximum Sized Bed: Area = 45' x 105' = 4725 SF

Can treat: (based on perc of 10 in/min
4725 SF × 0.9 gpd/SF = 4253 gpd

Each lateral to treat (max.)
4253 gpd / 9 laterals = 473 gpd = .33 gpm



DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Belleaire Highlands
DESCRIPTION: Absorption Systems
BED #1

DATE 12/18/00
SHEET 1 OF 1
BY MTD Ck'ed

#1 16 - 2 bedroom units

(16 · 300 gpd/unit) 0.8 = 3,840 gpd flow

Septic tank sizing for under 5000 gpd per DEC

Size = 1.5Q

5760 gal = 1.5 (3,840)

Add 0.33Q for disposals ∴ 5760 + 0.33 (5760)

= 7660.8 gals (20ft tank)

bed sizing = 3840 gpd / 0.9 gpd/sf = 4267 sf

@ 105' length width (ft) = 4267 / 105 = 41 ft ∴ use (1) 45 x 105' bed

(9) - 100' laterals
1/4" holes
2" ø Pipe,
5' hole spacing

Min Dose =

= 100 · (1/12)² · π · 7.48 gal/ft³ = 16.3 gal/lateral

@ 9 lat ⇒ see Figure 7-30 x 5

Min Dose = 735 gal/dose

Dose Frequency: 3,840 gpd / 735 gpdose = 5.25 doses/day

Min Discharge rate:

= 9 · 23.4 gpm/lateral = 210 gpm

Pump Run time = 735 / 210 = 3.5 min

Time Between Doses = 735 / (3,840 gpd / 2.67 gpm (DK flow)) = 275 min = 4.5 hours

Dose chamber cap. ≈ 750 gal (Min) → 1,000 gal

graph.xls Pump size = 210 gpm @ ~ 30 TDH ← PSSWR
2/2/2000

1:17 PM

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Belhaven Highlands
DESCRIPTION: Absorption Beds
Bed #2

DATE 12/18/00
SHEET 1 OF 1
BY MTD Ck'ed

Bristowe mansion duplexes + 5 guests + Caretakers

Qmo = [3100 + (5.4 · 300) + 400] 0.8 = 7,600 gpd
(5.3 gpm)

Septic Tank sizing : 5,000 - 15,000

Size = 3750 + 0.75Q
= 3750 + 0.75 (7,600)
= 9450

add .33Q ∴ 12,568 gal septic (1 tank)

Grease Trap - 1,300 gal

Bed Sizing = 7,600 / 0.9 = 8500 SF

8500 SF / 105' L = 81 width 81 / 45 = 1.8 beds

(1) beds w/ 9 - 100' laterals (45 x 105)
(1) bed w/ 7 - 100' laterals (35 x 105)

MIN DOSE:
= 735 gal/dose for 1 bed
= 7,100 · (1/2)² π · 7.48 = 714 gal multiplied by 5 = 570 gals/dose

Total dose = 735+570 = 1305 gal/dose

Dose Reach 7600 / 1305 = 5.8 doses/day

Min discharge = 16 · 23.4 = 375

Pump Run Time = 1305 gal/dose / 375 gpm = 3.5 min

Time Between Doses:
1305 / 5.3 gpm = 246 min ~ 4 hours

Dosing chamber ≈ 1500 gal

Pump Cap ≈ 375 gpm

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Belleaire Highlands
DESCRIPTION: Absorption Beds Bed #3

DATE 1/8/01
SHEET 1 OF 1
BY MTD Ck'ed

#3 + 16 Quadplex units

0.8 (16 quads · 4 units/quad · 300 gpd/unit) = 5760 gpd (4 gpm)

Septic Tank Sizing for Q = 5,000 - 15,000 gpd

size = 3750 + 0.75Q
= 3750 + .75(5760)
= 8070

add 33% for disposals

size = 8070 ÷ (.33)8070

size of tank = 10,733 gallons

bed sizing: 5760 gpd / 0.9 gpd/sf = 6400 sf

6400 sf / 105' length = 60' width

60' width / 45' max width = 1.33 bed sections

(1) + 9 laterals (45 · 105)

(1) + 3 laterals (15 · 105)

MIN DOSE

= 735 gal/dose for 1 bed

= 3 · 100 · $(\frac{1}{12})^2$ π · 7.48 = 49 · 5 (storage) = 245 gal/dose

TOTAL Dose = 735 + 245 = 980 gal/dose

Dose Frequency = 5760 gpd / 980 gal/dose = 5.9 doses/day

MIN Discharge = 2.23 gpm/lat · 126 lat = 281 gpm

Pump Run Time = 980 gal / 281 gpm = 3.5 min

Retention Time = 980 gal/dose / 4 gpm = 245 min

Dosing chamber = 1250 gallons

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Belleaire Highlands
DESCRIPTION: Absorption Beds #4

DATE 11/8/21
SHEET 1 OF 1
BY MTD Ck'ed

#4 – 7 2-bedroom units

0.8(7 · 4 · 300) = 6,720 gpd (4.7 gpm)

Septic tank sizing for 5000 < Q < 15000
size (gal) = 3750 + 0.75Q
= 3750 + 0.75 (6720)
= 8790 gallons
add 33% for dispossals
= 8790 + (0.33) 8790
= 11,690 gal

bed sizing: $\frac{6720 \text{ gpd}}{0.9 \text{ gpd/SF}}$ = 7,467 SF

$\frac{7,467 \text{ SF}}{105' \text{ length}}$ = 71' width $\frac{71' \text{ width}}{45' \text{ max width}}$ = 1.6 bed sections

(1) – 9 laterals (45 · 105)
(1) – 6 laterals (30 · 105)

MIN DOSE: 735 gal/dose for 1 bed
lat: 100' · (π(1/12)²) · 5.7 gal/ft³ = 490 gal/dose for 1 bed

Total Dose: 735 + 490 = 1225 gal/dose

DOSE FREQ: 6720 / 1225 = 5.5 doses/day

MIN DISCHARGE: 35.1 gpm = 15 lat · 23.4 gpm/lat

Pump Run Time: 1225 / 35.1 = 3.5 MIN

Detention Time = 1225 / 4.7 = 261 MIN

Dosing Chamber = 1250 gal

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Bellezure Ridge
DESCRIPTION: Bed Sizing for the lodge
Bed #5

DATE 12/15/00
SHEET 1 OF 3
BY MTA Ck'ed

Ave. Flow: 38925 gpd | 20% reduction: ≈ 30,000 gpd
septic = 40,000 gal (190 ft tank)

SF required: 30,000 gpd / 0.9 gpd/SF = 33,333 SF

1. Length of beds are 105 ft assuming (9) 100ft laterals and 2.5' of gravel on all sides.

2. Therefore, total width is 33333 SF / 105 SF = 318 ft

3. Width can only be 45' before the total amt of pipe used in each bed exceed 1,000 ft @ 1000 ft of pipe used - a new distribution box is needed (each)

Total Distribution System needed (for running beds)
= 318 ft / 45 ft = 7 distribution systems

each bed is made up of (9) 100'-laterals seperated by 5' on center w/ the 5 of fill all around perimeter of bed and 3' below

Wet well to hold = 1,000 gallons & rotate between beds 1 - 7.

Average Daily flow = 30,000 gpd (20.8 gpm)
min discharge rate (210 gpm) Pump run = 735 gal / 210 gpm = 3.5 min

Detention time between doses = 735 gal / 20.8 gpm = 35.3 min

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Belleayre Ridge
DESCRIPTION: — Lodge
Absorption Bed Design

DATE 12/15/00
SHEET 2 OF 3
BY MTD Ck'ed ____

Assume: 1. 100 ft lateral length
2. 9 laterals
3. 1/4" diameter holes
4. holes spaced 5' apart ≈ 60"

1. Select lateral diameter – For 1/4" hole dia, 60" hole spacing, 100 ft length + use Figure 7-28 in EPA Onsite WWT and Disposal Systems Design Manual.

Appears 2" dia pipe would be necessary if you interpolated the graphics

2. Calc lateral discharge rate

$$\#\text{ of holes/lateral} = \frac{100\text{ ft}}{5\text{ ft}} = 20\text{ holes}$$

$$\text{lateral discharge rate} = \left(20\ \text{holes}/_{\text{lat}}\right) \times (1.16\text{ gpm/hole})$$

$$= 23.2\ \text{gpm}/_{\text{lat}}$$

1.16 gpm/hole ← TABLE 7-13 in EPA Design Manual for 2.5 psi (Acc Regs)

3. Select Manifold Size

(9) laterals spaced 5' apart. A manifold length of 40' is required. End manifold

From Figure 7-29 a 4" manifold size is required

4. Det Min Dose Figure 7-30

$$= 9 \times 100\text{ ft} \times (1/12)^2 \times \pi \times 7.48\ \text{gal/ft}^3 = 147\text{ gal}$$

Min dose volume = 5 × 147 = 735 gal/dose

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT:
DESCRIPTION: Bellevue Ridge Lodge Absorption Bed Design

DATE 12/15/00
SHEET 3 OF 3
BY HTD Ck'ed

Total Dose Cycle (All beds) for Lodge:

7 · 735 gal/dose = 5145 gal/dose ≈ 4,120 gal/day

Dosing Freq: 30,000 gpd / 5145 = 5.8 doses/day

Minimum Discharge Rate (1 Bed)

= 9 lat × 23.4 gpm/lateral = 210 gpm

Ave daily flow = 30000 gpd = 21 gpm

At min discharge rate (210 gpm): Pump min-time each bed = 735 gal / 210 gpm = 3.5 min

Det. time between doses = 735 / 21 gpm = 35.0 min

Select Pump:

Use 4" ϕ force main
(V = 4.2 ft/s @ 210 gpm

Assume ↓
Friction Loss (500 ft. 4" ϕ) = 16 ft
Elev. head = 20 ft
Pressure Maintained = 2.5
V Driving = 5
43.5 ft

Pump cap. of 210 gpm @ 40' of head

Vol per bed = 735 gal

For 4' × 6' × 5' box = 120 · 7.48 gal = 897.6 gal

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Belleaire Ridge
DESCRIPTION: 33 TH EE Singles
#6

DATE 12/15/00
SHEET 1 OF 2
BY MTD Ck'ed ____

Ave. Flow = 33 · 400 = 13,200 = 14,685
3 x 475 = 1,425

20% Reduction = 11,700 gpd

Septic Tank = 16,650 gal (40 ft tank)

11,700 gpd / 0.9 gpd/SF = 13,000 SF

13,000 SF / 105 SF L = 124 SF Widen

124 SF / 45 SF = 2.75 distribution systems

Beds	L	W	Area	Laterals (#)
1	105	45	4725	9
2	105	45	4725	9
3	105	35	3675	7

Hole (DIA.) — 1/4" (ALL)

Lateral Spacing — 5 ft (ALL)

hole spacing — 5 ft (ALL)

Min Dose

For Beds w/:

9 laterals — 735 gal/dose

7 laterals — 114 (5) = 570 gal/dose

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Bellemere Ridge -
DESCRIPTION: Absorp. Beds
33 TH & 3 Singles

DATE 12/15/00
SHEET 2 OF 2
BY MTD Ck'ed

Total dose:

(9 bt) 2 · 735 = 1470 ≈ ~~1200~~ gal / dose

(14 bt) 570 = 570 gal / dose

2040 gal / dose

Dose frequency:

= 11,700 gpd / 2040 = 5.7 doses / day

MIN. Discharge Rate:

= 9 bt × 23.4 gpm / bt = 210 gpm

= 7 bt × 23.4 = 163.8 gpm

Ave daily flow = 8 gpm

At min discharge rate (210 gpm), pump run time (max) = 735/210 = 3.5 min

= 570/163.8 = 3.5 min

Dist: time between doses = 735/8 = 90 min

= 570/8 = 63 min

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Bellevue Ridge
DESCRIPTION: 27 TH + 14 Single
#7

DATE 12/15/00
SHEET 1 OF 1
BY MTD Ck'ed ____

Ave. Flow = (27 · 400) + (14 · 475) = 17,450 gpd
20% Reduction = 13,960
Septic Tank = 19,000 gal (45 ft tank)
13,960 gpd / 0.9 gpd/SF = 15511 SF

15511 SF / 105 FT = 148 SFW
148 / 45 = 3.3 bed widths

Beds	L	W	Area	Lat	Holes 1/4"	Hole Sp	Lat Space
1, 2, 3	105	45	4725	9	1/4"	5' oc	5' oc
4	105	15	1575	3	1/4"	5' oc	5' oc

MIN. DOSE

9 lat 735 gal / dose
3 lat = 3 lat · 100' × π(1/12)² × 7.48 gal/CF · .5 = 245 gal dose

Total dose
3(735) + 245 = 2450 gal / dose

Dose Freq
= 13,960 gpd / 2450 = 5.7 doses / day

MIN Discharge
= 9 · 23.4 = 210
= 3 × 23.4 = 70.2

Ave Flow = 10 gpm

Pump Run Time
= 735 / 210 = 3.5
= 245 / 70.2 = 3.5

Dose Time
735 / 10 = 73.5 min
245 / 10 = 24.5 min

If dosed all at same time
Pump Run: 990 gal / 210 gpm = 4.7 min
Dose time: 95 gal / 10 gpm = 95 min

graph.xls 2/2/2000 1:17 PM

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Bellesure Ridge
DESCRIPTION: Absorpt. Beds - 18

DATE 12/15/00
SHEET 1 OF 1
BY MTD Ck'ed

#8

Ave Flow = 18 · 475 = 8550 gpd

20% Red. = 6840 gpd

Septic = 11,810 gal (27 ft tank)

6840 gpd / 0.9 gpd = 7600 SF

7600 SF / 105 = 72.4 LF

72.4 / 45 = 1.6 bed widths

Beds	L	W	Area	Laterals	Holes	Hole Space	Lat Spac
1	105	45	4725	9	1/4"	5' oc	5' oc
2	105	30	3150	6	1/4"	5' oc	5' oc

Min Dose

9 lats 735 gal/dose

6 lats: 6 · 100 · π(1/12)² · 5 · 7.48 = 439 gal/dose

Total Dose

(9 lat) 735
(6 lat) 490
~1225 gal/dose

Dose Freq

= 6840 gpd / 1225 = 5.6 doses/day

Min discharge

= 9 × 23.4 = 210.6 gpm
= 6 × 23.4 = 140 gpm

15 · 23.4 / 351

Ave. Flow = 5 gpm

Pump Run Time = 735/210 = 3.5 min

= 490/140 = 3.5 min

combined

1225/351 = 3.5 min

Det. Time 735/5 = 147 min
490/5 = 98 min

1225/5 = 245 min

graph.xls 2/2/2000 1:17 PM

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Belleayre Ridge
DESCRIPTION: Golf Maintenance

DATE 12/15/00
SHEET 1 OF 1
BY MTO Ck'ed

#9

Assume - 1180 gpd Flow
- 20% Red 944 gpd 1200 gal tank

944 gpd / 0.9 gpd/SF = 1050 SF

Using 50' long lateral spaced 5' oc
- length would be 55'

Width = 1050 SF / 55 FT = 19 FT

∴ need 4 laterals → gravity system

Pipe total - 215 FT < 500' ∴ gravity OK

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Belleayre Ridge
DESCRIPTION: Main Entrance Gate House #10

DATE 2/2/01
SHEET 1 OF 1
BY MTD Ck'ed

Assume:

- 90 gpd flow
- -20% reduction +75 gpd

$$75 \text{ gpd} \times \frac{\text{SF}}{0.9 \text{ gpd}} = 83.3 \text{ SF}$$

using 10' long laterals spaced 5' OC
∴ length would be 15'

$$\text{width} = \frac{83.3 \text{ FT}^2}{15 \text{ FT}} = 6 \text{ feet}$$

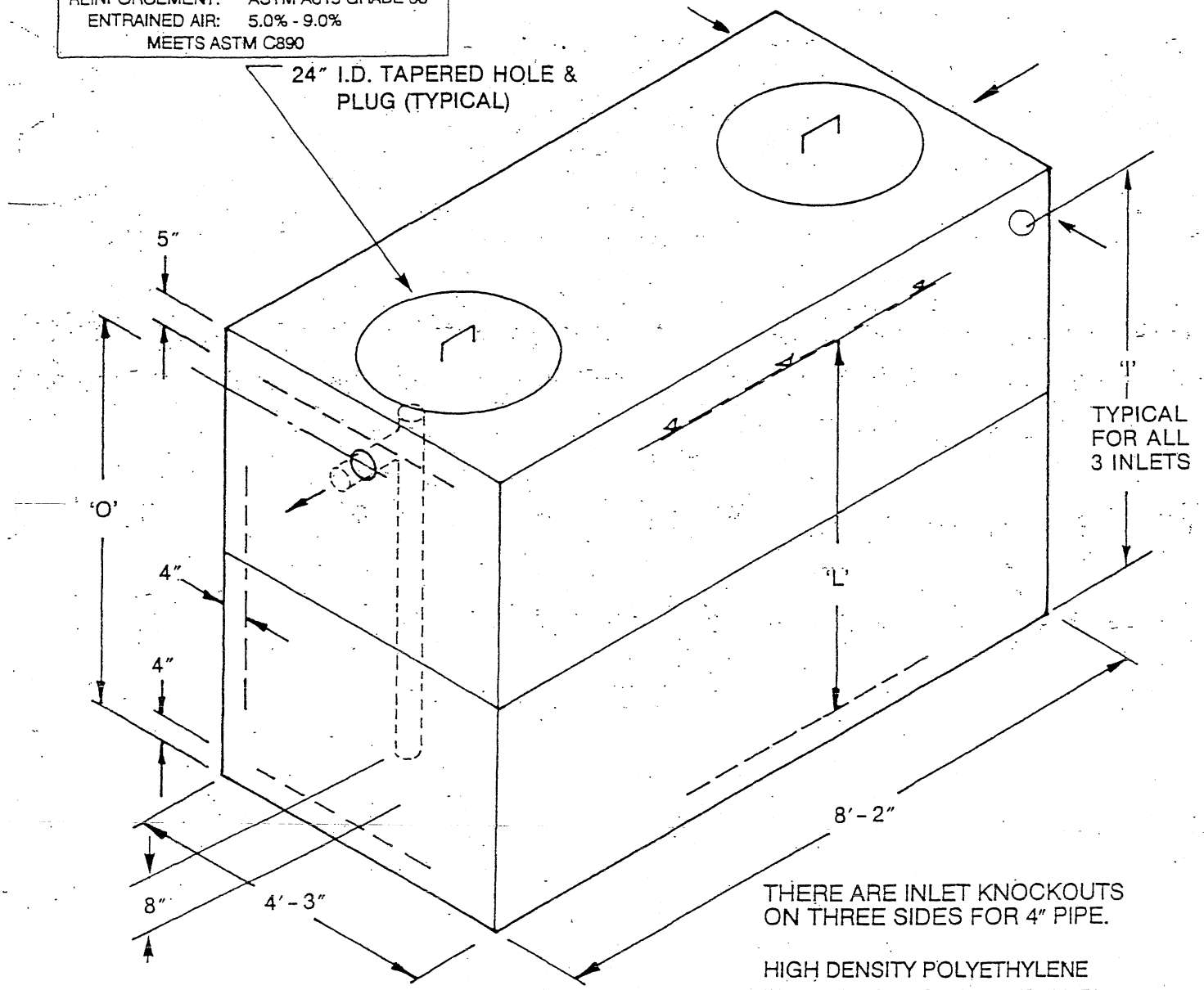
∴ need 2 laterals

Pipe total = 25 FT @ 2% ∴ gravity OK

FORT MILLER
THE FORT MILLER CO., INC.

750-1000-1200 Gallon Heavy Duty Grease Trap

CONCRETE:	4000 PSI
REINFORCEMENT:	ASTM A615 GRADE 60
ENTRAINED AIR:	5.0% - 9.0%
MEETS ASTM C890	



THERE ARE INLET KNOCKOUTS ON THREE SIDES FOR 4" PIPE.

HIGH DENSITY POLYETHYLENE PIPE SEALS PROVIDED AT ALL PIPE CONNECTIONS SHOWN.

INLET AND OUTLET TEES SUPPLIED BY CONTRACTOR.

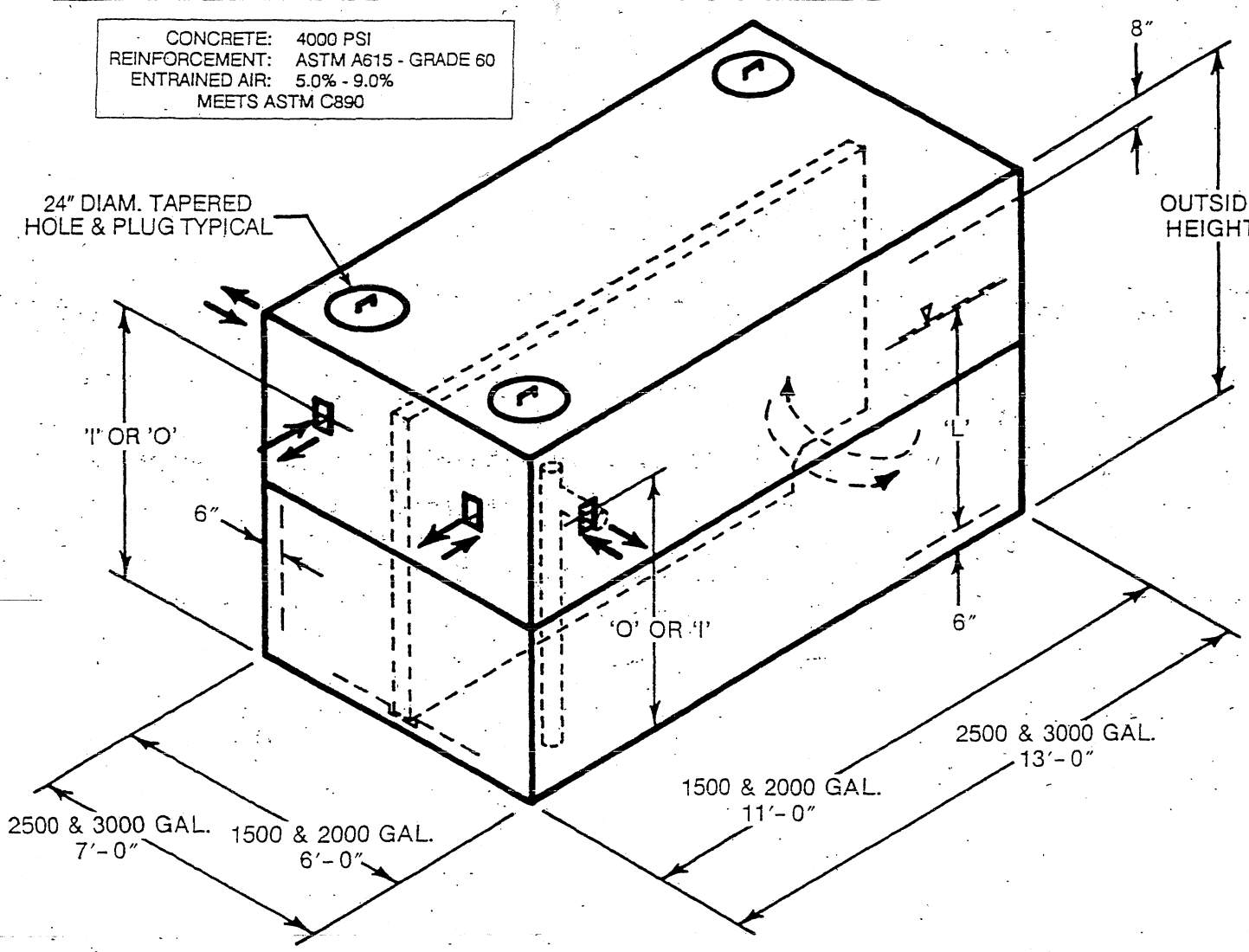
DESIGN CASE 3 (TRAFFIC)

TANK SIZE GALS.	OUTSIDE HEIGHT	LIQUID LEVEL 'L'	'O'	'I'	TANK WEIGHT, LBS		
					TOP SECTION	BOTTOM SECTION	TOTAL WEIGHT
750	5'-8"	4'-0"	4'-6"	4'-9"	4502	5214	9716
1000	6'-8"	5'-0"	5'-6"	5'-9"	5683	5214	10897
1200	7'-5"	5'-9"	6'-3"	6'-6"	6061	5592	11866

FORT MILLER
THE FORT MILLER CO., INC.

1500 to 3000 Gallon Heavy Duty Grease Trap

CONCRETE:	4000 PSI
REINFORCEMENT:	ASTM A615 - GRADE 60
ENTRAINED AIR:	5.0% - 9.0%
	MEETS ASTM C890



ELONGATED KNOCKOUTS TO ACCOMMODATE 6″ PIPE IN 4 LOCATIONS. ALLOW VARIOUS COMBINATIONS FOR INLET & OUTLET TO BE USED.
PIPE TO BE 8″ OFF BASE, PIPING SHOWN NOT INCLUDED WITH TANK.

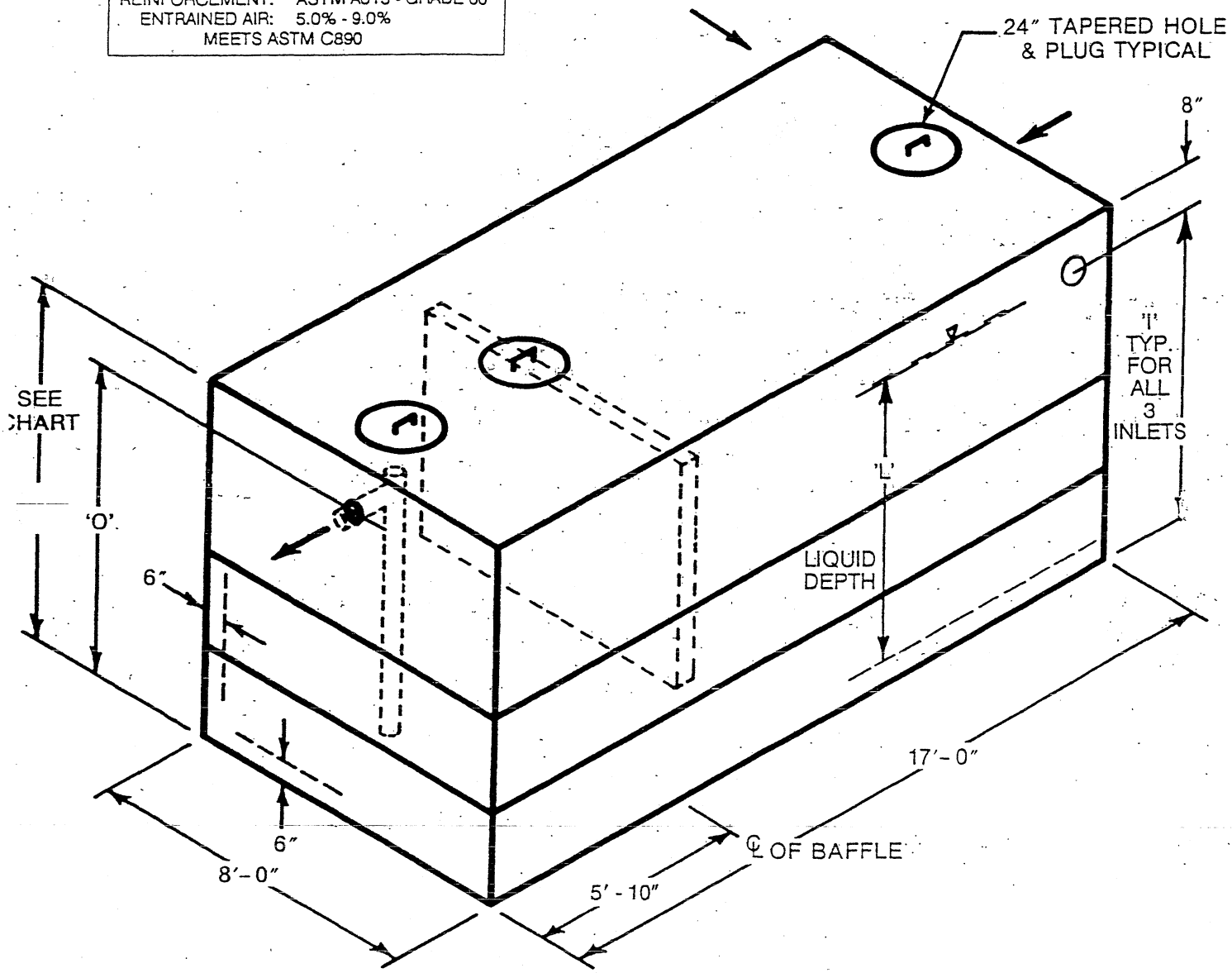
DESIGN CASE 3 (TRAFFIC)

TANK SIZE GALS.	OUTSIDE HEIGHT	LIQUID LEVEL 'L'	'O'	'I'	TANK WEIGHT, LBS			BAFFLE WEIGHT
					TOP SECTION	BOTTOM SECTION	TOTAL SECTION	
1500	6′ - 2″	4′ - 0″	4′ - 6″	4′ - 9″	10,833	12,750	26,835	3252
2000	7′ - 8″	5′ - 6″	6′ - 0″	6′ - 3″	14,433	12,750	31,483	4300
2500	6′ - 11″	4′ - 9″	5′ - 6″	5′ - 9″	16,042	16,316	37,032	4674
3000	7′ - 11″	5′ - 9″	6′ - 6″	6′ - 9″	18,892	16,316	40,718	5510

FORT MILLER
THE FORT MILLER CO., INC.

3000 to 8000 Gallon Heavy Duty Grease Trap

CONCRETE:	4000 PSI
REINFORCEMENT:	ASTM A615 - GRADE 60
ENTRAINED AIR:	5.0% - 9.0%
MEETS ASTM C890	



PIPE TO BE 8" OFF BASE, PIPING SHOWN NOT INCLUDED WITH TANK.
INLET & OUTLET OPENINGS TO ACCOMMODATE 6" PIPE.

DESIGN CASE 3
(TRAFFIC)

SEE TABLE D-1 IN SECTION A.

FOR WEIGHTS, SEE FACING PAGE

10/88

FORT MILLER
THE FORT MILLER CO., INC.

3000 to 8000 Gallon Heavy Duty Grease Trap

SIZE GALS.	LIQUID LEVEL	INLET HEIGHT	OUTLET HEIGHT	INTEGRAL TOP HEIGHT	INTER-MEDIATE HEIGHT	BASE HEIGHT	OVERALL HEIGHT		TOTAL WEIGHT EXCL BAFFLES		TOTAL WEIGHT INCL BAFFLES	
							INSIDE	OUTSIDE	LBS	TONS	LBS	TONS
3,000	4'-0"	5'-1"	4'-10"	2'-0"	—	3'-0"	5'-0"	6'-2"	41,800	20.9	44,163	22.1
3,500	4'-3"	5'-4"	5'-1"	2'-3"	—	3'-0"	5'-3"	6'-5"	42,700	21.4	45,194	22.6
4,000	5'-0"	6'-1"	5'-10"	3'-0"	—	3'-0"	6'-0"	7'-2"	45,400	22.7	48,288	24.1
4,500	5'-5"	6'-6"	6'-3"	3'-6"	—	3'-0"	6'-6"	7'-8"	47,200	23.6	50,350	25.2
5,000	6'-3"	7'-4"	7'-1"	3'-0"	—	4'-3"	7'-3"	8'-5"	49,900	25.0	53,444	26.7
5,500	6'-9"	7'-10"	7'-7"	3'-6"	—	4'-3"	7'-9"	8'-11"	51,700	25.9	55,506	27.8
6,000	7'-3"	8'-4"	8'-1"	4'-0"	—	4'-3"	8'-3"	9'-5"	53,500	26.8	57,569	28.8
6,500	7'-9"	8'-10"	8'-7"	3'-9"	2'-0"	3'-0"	8'-9"	9'-11"	56,350	28.2	59,631	29.8
7,000	8'-3"	9'-4"	9'-1"	3'-0"	2'-0"	4'-3"	9'-3"	10'-5"	58,150	29.1	61,694	30.8
7,500	9'-0"	10'-1"	9'-10"	3'-9"	2'-0"	4'-3"	10'-0"	11'-2"	60,850	30.4	64,787	32.4
8,000	9'-6"	10'-7"	10'-4"	4'-3"	2'-0"	4'-3"	10'-6"	11'-8"	62,650	31.3	66,850	33.4

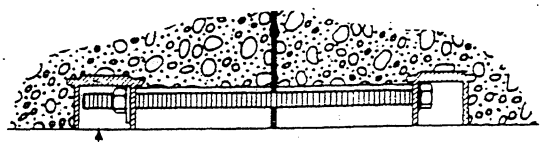
SECTION WEIGHTS, LBS

	HEIGHT	SECTION	BAFFLE	TOTAL		HEIGHT	SECTION	BAFFLE	TOTAL
INTEGRAL TOP	2'-0"	20,800	788	21,588	INTEGRAL BASE	3'-0"	21,000	1,575	22,575
	2'-3"	21,700	919	22,619		4'-3"	25,500	2,231	27,731
	3'-0"	24,400	1,313	25,713					
	3'-6"	26,200	1,575	27,775					
	3'-9"	27,100	1,706	28,806	INTERMEDIATE	2'-0"			8250*
	4'-0"	28,000	1,838	29,838					
	4'-3"	28,900	1,969	30,869					

*INCLUDES WEIGHT OF BAFFLE-BEAM

FORT MILLER
THE FORT MILLER CO., INC.

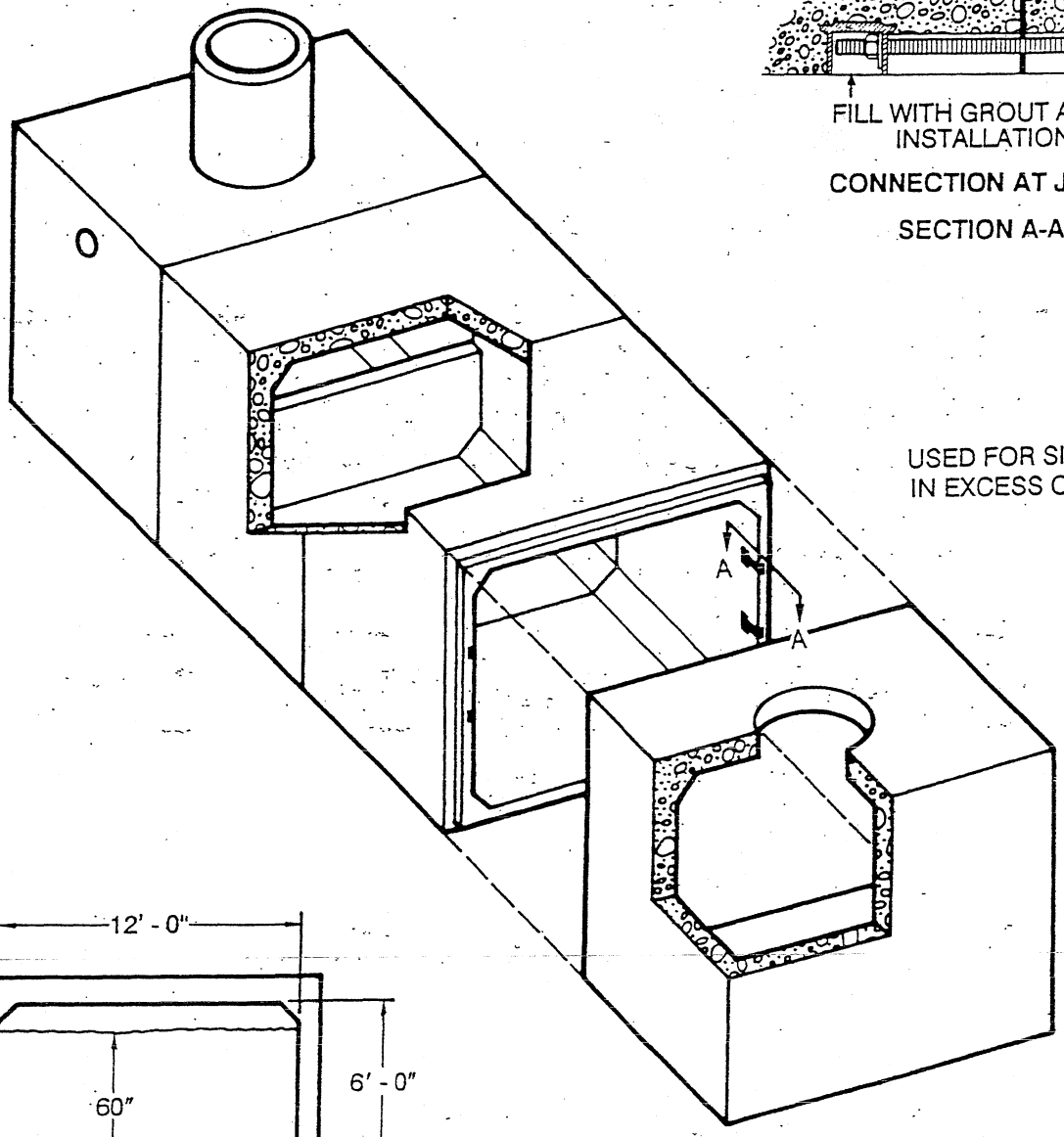
Horizontally Extended Septic Tank



FILL WITH GROUT AFTER INSTALLATION

CONNECTION AT JOINT

SECTION A-A



USED FOR SINGLE TANKS IN EXCESS OF 4000 GALLONS.

TYPICAL SECTION

CAPACITY = 445 GAL./L.F.

CONFORMS TO LATEST N.Y.S. D.E.C. SPECIFICATIONS.

DESIGN CASE 7

Exhibit D

June 21, 2002 Correspondence from Jeffrey Graf to Alexander Ceisluk

M 10

The City of New York
Department of Environmental Protection

71 Smith Avenue
Kingston, New York
12401

Christopher O. Ward
Commissioner

Bureau of Water Supply

Michael A. Principe, Ph.D.
Deputy Commissioner

Tel (845) 340-7500
Fax (845) 340-7504

June 21, 2002

Alexander F. Ciesluk, Jr.
Deputy Regional Permit Administrator
NYS Department of Environmental Conservation
21 S. Putt Corners Road
New Paltz, NY 12561-1696

Re: Belleayre Resort At The Catskill Park
(T) Middletown/Shandaken
NYSDEC No. 3-9903-00059/00001

Dear Mr. Ciesluk:

This letter is a follow-up to your letter of May 15, 2002 to Mr. Gary Gailes of Crossroads Ventures, LLC on DEC's determination of incompleteness of the DEIS of the above referenced project.

DEP agrees with DEC's determination that the Crossroads DEIS is incomplete. And we concur with many of the points raised in your letter and its attachments. However, we are concerned that your letter did not specifically address some of the concerns that we raised in my letter to you of March 1, 2002.

I note that in your letter of May 15, 2002, you said:

> The Department [DEC] has received several comment letters from other agencies and members of the public regarding acceptance of the DEIS. Copies of these letters were provided to Crossroads and responses to these comments were provided by Crossroads. Where Crossroads indicated that additional analyses and revisions will be done, these additions and revisions should be included in the DEIS.

I requested copies of Crossroads' responses to DEP's comments and on May 21, 2002 you sent them. They consist of letters from various consultants to Dean Gitter of Crossroads Ventures, each dismissing concerns raised by DEP in our letter of March 1, 2002. We disagree with the substance of those dismissals and hereby reaffirm our concerns on these matters. For the benefit of the applicant, it should be recognized that the concerns we raised in our letter of March 1, 2002 are substantive and need to be fully addressed in the EIS in order for DEP's approval, which as an Involved Agency, is required.

I also note in your letter of May 15, 2002 that, concerning DEP's Pine Hill Wastewater Treatment Plant (WWTP), you ask the applicant for "more specific information as to why this facility cannot be used." As the owner of the Pine

NEW YORK CITY DEPARTMENT OF DEP ENVIRONMENTAL PROTECTION
www.nyc.gov/dep

Hill WWTP, DEP has consistently and unequivocally made clear to both the applicant and to DEC that ***DEP will not allow the use of the Pine Hill WWTP to service the proposed project.*** We've made that clear at every opportunity: at meetings and in writing (e.g. my letter to you of July 12, 2000). In the DEIS (p. xi) the applicant stated "discussions with NYCDEP during the preparation of this report resulted in the City of New York stating that treatment of the wastewater flow from Big Indian Plateau is not allowable at this time..." We would simply reiterate that we have no intention of allowing such a connection for the proposed project. We believe no further discussion of this issue is required in the EIS.

Thank you for your consideration.

Sincerely,

Jeffrey D. Graf
Program Manager
West of Hudson Community Planning

xc: Gary P. Gailes, Crossroads Ventures ✓
Michael A. Principe, DEP Deputy Commissioner
DEP Crossroads Reviewers

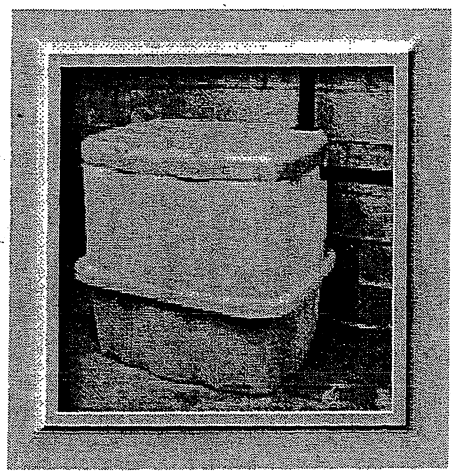
Exhibit E

Grinder Pump Systems

Products : Indoor Unit

Indoor Unit

General Applications



For years, E/One grinder pumps have set the standard in low-pressure sewer system technology. They worked harder. Lasted longer. And required virtually no maintenance.

Once again, we're going places. A place where other grinder pumps just can't go. Inside. With an indoor unit that installs in a matter of minutes, has a clean design, and seems at home with other household appliances.

Introducing the E/One 2010-IDU. It's quiet. Clean. Efficient. Safe. Easy to install. And easy to live with.

It can be used as part of a new E/One Sewer System or retrofit into an existing low-pressure or gravity system.

If you're ready to take your construction new places, don't settle for the status quo. Go new places. With the E/One 2010-IDU Home Wastewater Disposal System.

Specifications

Description

The E/One 2010-IDU was specifically designed for indoor installation in a basement mechanical room or on a slab foundation. Its clean look fits unobtrusively into any environment. While the E/One Indoor Unit is completely enclosed for safety and appearance, it is easy to access should it need servicing.

Applications

Indoor installation in all single family homes built on any kind of terrain — hilly, rocky, wet, or flat. Ideally suited for new residential communities.

Installation

Designed for speed and ease of installation. Installs like other major household appliances and requires only a 240-volt outlet to install and operate.

Click here to download the illustrated PDF version (116K).

Features and Benefits
E/One 2010-IDU indoor grinder pump is a complete unit ready for installation that includes grinder pump, check valve, controls, and a tough, noncorrosive tank made of high-density polyethylene.

Lake any major appliance, the E/One indoor unit requires only a 240-volt outlet to install and operate. Requires only a pipe in/pipe out simple plumbing connection.

The grinder pump within the tank is state-of-the-art, grinding all solids into fine particles for easy, reliable disposal through small-diameter pipes to a central treatment plant.

The grinder pump is automatically activated and runs infrequently for very short periods.

1 1/4-inch discharge connection is adaptable to any piping requirement, thereby meeting local codes.

91-gallon tank capacity is based on water usage patterns and more than adequate to meet the needs of single-family homes.

Internal check valve assembly is custom designed for non-clog, trouble-free operation.

Typical electric power costs for a single-family home is between $15 and $20 a year.

Designed with sound insulating properties.

Operational Information

Motor:
1 hp, 1725 rpm, high torque, capacitor start, thermally protected, 240V, 60Hz, 1 phase

Inlet Connection:
4-inch PVC socket weld

Discharge Connection:
Pump discharge terminates in 1 1/4-inch NPT female thread. Can be adapted to 1 1/4-inch PVC pipe or any other material required by local codes.

Discharge*:
15 gpm at 0 psig

11 gpm at 40 psig
9 gpm at 60 psig
*Discharge data includes loss through check valve, which is minimal

Overload Capacity:
The maximum pressure that the pump can generate is limited by the motor's characteristics. The motor generates a pressure well below the rating of the piping and appurtenances. The automatic reset feature does not require manual operation following overload.

Alarm Display:
An audio/visual alarm with a battery backup indicates any loss of power to the unit.

Dimensions:
29" x 37" x 35"

Environment One Corporation
2773 Balltown Road, Niskayuna, NY 12309-1090
Voice: (518) 346-6161 Fax: (518) 346-6188
eone@worldnet.att.net

▲ Top

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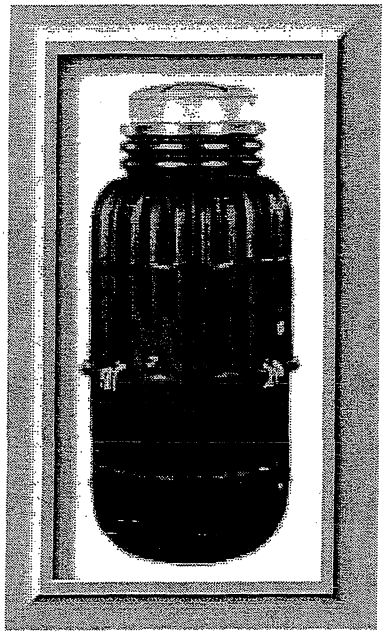
Products : GP 2014

Model GP 2014 Grinder Pump



Contents:

Downloads:

GP 2014 drawings (640K PDF)
GP 2014 drawings (self-extracting DXF)

General Applications

Its size, efficiency and operating economy make the GP 2014 your best choice for multiple dwellings, waterfront property, subdivision developments and marinas. It is ideally suited for both new and existing communities.

Features

The GP 2014 is a complete unit, including grinder pump, check valve, tank and all necessary controls packaged into a single unit, ready to connect.

All solids are ground into fine particles to pass easily through the pump, check valve and small diameter pipe lines ... even objects that should not be in sewage (plastic, rubber, fiber, wood, etc.). The 1 1/4" discharge connection can be adapted to any piping materials which meets local code requirements.

A tough, corrosion resistant tank of HDPE, sized on the basis of computer studies of water usage patterns, provides optimum holding capacity.

An internal check valve assembly in the Grinder Pump is custom designed for non-clog, trouble-free operation.

The Grinder Pump is automatically activated and, because it runs infrequently and for very short periods, its annual electric energy consumption is typically that of a 40 watt light bulb.

Units are available for indoor and outdoor installations. Outdoor units accommodate a wide range of depths.

Operational Information

Motors:
1 HP, 1725 rpm, high torque, capacitor start, thermally protected, 240 or 120 volt, 60 hertz, 1 phase

Inlet Connections:
4" inlet grommet standard for DWV pipe. Other inlet configurations available from factory.

Discharge Connections:
Pump Discharge terminates in 1 1/4" NPT female thread. Can easily be adapted to 1 1/4" PVC pipe or any other material required by local codes.

Discharge:*
15 gpm at 0 psig
11 gpm at 40 psig
9 gpm at 60 psig

Overload Capacity:
Maximum pressure which pump can generate is limited by motor characteristics to a value well below the rating of the piping and appurtenances. Automatic reset feature does not require manual operation following overload.

US and foreign patents issued and pending.

*Discharge data includes loss through check valve which is minimal.
**CSA certification applies only to Grinder Pumps bearing the "C" in the model number.

Installation

The Environment One Grinder Pump is a well-engineered, reliable and proven product: proper installation will assure years of trouble-free service. The following instructions define the recommended procedure for installing the Model 2010 Grinder Pump. These instructions cover the installation of units with and without accessways.

This is a sewage-handling pump and must be vented in accordance with local plumbing codes. This pump is not to be installed in locations classified as hazardous in accordance with National Electric Code, ANSI / NFPA 70. All piping and electrical systems must be in compliance with applicable local and state codes.

1. REMOVE PACKING MATERIAL

The User Instructions must be given to the homeowner. Hardware supplied with the unit, if any, will be used at installation.

2. TANK INSTALLATION

The tank is supplied with a standard grommet for connecting the 4" DWV (4.50" outside diameter) incoming sewer drain. Other inlet types and sizes are optional (caution 4" DR-35 pipe is of smaller diameter and won't create a watertight joint with the standard grommet). Please confirm that you have the correct inlet before continuing. If a concrete ballast is attached to the tank lift only by the lifting eyes, (rebar) embedded in the concrete. Do not drop, roll, or lay tank on its side. This will damage the unit and void the warranty.

If the tank has no accessway (Indoor Installation) (Fig. 1b):
The pump may be installed on or in the basement floor (see Fig. 1b). If the tank is to be set on the floor it must be a flat and level bearing surface. If the tank is to go into the basement floor, it must be anchored to prevent unit from floating due to high ground water (see Chart 1, page 8 for weight).

If the tank is to go in the floor:
A hole of the correct width and depth should be excavated. The tank must be placed on a 6" bed of gravel made up of naturally rounded aggregate, clean and free flowing, with particle size not less than 1/8" or more than 3/4" in diameter. The wet well should be leveled and filled with water prior to pouring the concrete to prevent the tank from shifting. If it's necessary to pour the concrete to a level above the inlet, the inlet must be sleeved with an 8" tube before pouring.

There must be a minimum clearance of three feet directly above the tank to allow for removal of the pump core.

If the tank has an accessway (Fig. 1a):
Excavate a hole to a depth, so that the removable cover extends above the finished grade line. The grade should slope away from the unit. The diameter of the hole must be large enough to allow for a concrete anchor. Place the unit on a bed of gravel, naturally rounded aggregate, clean and free flowing, with particles not less than 1/8" or more than 3/4" in diameter. The concrete anchor is not optional. The amount of concrete required varies for each respective unit. (See Chart 1 on page 8 for specific requirements for your unit)

The unit should be leveled and the wet well filled with water to the bottom of the inlet to help prevent the unit from shifting while the concrete is being poured. The concrete must be vibrated to ensure there are no voids.

If it is necessary to pour the concrete to a higher level then the inlet, the inlet must be sleeved with an 8" tube before pouring.

If your unit is a model taller than 93" it may be shipped in two sections, requiring field assembly. See Field Joint Assembly Instructions on

page 6 for additional information.

3. INLET PIPE INSTALLATION
Mark the inlet Pipe 3 1/2" from the end to be inserted. Inlet pipe should be chamfered and lubricated with a soap solution. Lubricate the inlet grommet with soap solution as well. Insert the pipe into the grommet up to the 3 1/2" mark. Inspect to ensure the grommet has remained intact and in place.

4. DISCHARGE
The use of 1-1/4" PVC pressure pipe Schedule 40 and polyethylene pipe SDR 11 or SIDR 7 are recommended. If polyethylene is chosen use compression type fittings to provide a smooth inner passage. It is recommended that a Redundant Check Valve Assembly (E/One part no. PB0104GXX) be installed between the pump discharge and the street main on all installations. Never use a ball type valve as a check valve. We recommend the valve be installed as close to the public right-of-way as possible. Check local codes for applicable requirements.

CAUTION: Redundant check valves on station laterals and anti-siphon/check valve assemblies on grinder pump cores should not be used as system isolation valves during line tests.

If the tank has no accessway (Indoor Installation):
The discharge connection is a 1-1/4" male NPT. The discharge piping must incorporate a shut-off valve and a union with a minimum pressure rating of 160 PSI, or a suitable piping disconnect to allow for removal of the pump core. The valve should be of the type that provides a full-ported passage (i.e. a ball or gate valve). A standard 1-1/4" union or a compression type coupling should be used as a disconnect joint.

If the tank has an accessway:
There is a ball valve and a quick disconnect pre-installed in the accessway. There is a 1-1/4" female NPT discharge connection on the outside of the tank 41" above the bottom of the tank.

5. BACKFILL REQUIREMENTS
Proper backfill is essential to the long term reliability of any underground structure. Several methods of backfill are available to produce favorable results with different native soil conditions.

The most highly recommended method of backfilling is to surround the unit to grade using Class I or Class II backfill material as defined in ASTM 2321. Class 1A and Class 1B are recommended where frost heave is a concern, Class 1B is a better choice when the native soil is sand or if a high, fluctuating water table is expected. Class I, angular crushed stone offers an added benefit in that it needs minimal compaction. Class II, naturally rounded stone, may require more

compactive effort, or tamping, to achieve the proper density.

If the native soil condition consist of clean compactable soil, with less than 12% fines, free of ice, rocks, roots, and organic material it may be an acceptable backfill. Such soil must be compacted in lifts not to exceed one foot to reach a final Proctor Density of between 85% and 90%. Non-compactable clays and silts are not suitable backfill for this or any under-ground structure such as inlet or discharge lines. If you are unsure of the consistency of the native soil it is recommended that a geotechnical evaluation of the material be obtained before specifying backfill.

Another option is the use of a flowable fill (i.e., low slump concrete). This is particularly attractive when installing grinder pump stations in augured holes where tight clearances make it difficult to assure proper backfilling and compaction with dry materials. Flowable fills should not be dropped with more than four feet between the discharge nozzle and the bottom of the hole since this can cause separation of the constituent materials.

6. VENTING
The unit must be properly vented to assure correct operation of the pump. If you have an indoor unit it can be vented through the 2" port supplied at the top of the wet well or through the incoming sewer line with a 2" pipe (the vent must be within four feet of the grinder pump, and before the first change of direction fitting).

The outdoor units are supplied with a vent pipe from the wet well to the top of the accessway.

Failure to properly vent the tank will result in faulty operation and will void the warranty.

7. ELECTRICAL CONNECTION (Supply panel to E/One control panel) Before proceeding verify that the service voltage is the same as the motor voltage shown on the nameplate. An alarm device is to be installed in a conspicuous location where it can be readily seen by the homeowner. An alarm device is required on every installation. There shall be no exceptions.

Wiring of supply panel and Environment One Control Panel shall be per Figure 2a and 2b, control panel wiring diagrams and local codes.

8. ELECTRICAL CONNECTION (Pump to Panel) (Fig. 4)
The Environment One GP2000 grinder pump station is provided with a cable for connection between the station and the control panel, (The Supply Cable). The supply cable is shipped inside the station with a small portion fed through the cable connector mounted on the wall of the fiberglass shroud. The supply cable, a six-conductor tray cable, meets NEC requirements for direct burial as long as a minimum of 24"

burial depth is maintained. Those portions of the cable which have less than 24" of cover must be contained in suitable conduit. This includes the vertical portion dropping to a 24" depth at the station and the length rising out of the ground at the control panel. NOTE: Wiring must be installed in compliance with local codes.

8a. Procedure for installing E/One supply cable

1. Open the lid of the station, Locate the cable and the feed-thru connector on the wall of the shroud. If the station has a field joint and was delivered in two pieces be sure the 2 halves of the EQD are securely assembled together. Loosen the nut on the connector and pull the supply cable out through the connector until it hits the crimped on stop feature on the cable, approximately 24" from the EQD.
   IMPORTANT: All but 24" of the cable must be pulled out of the station, and the portion of the cable between the EQD and the molded in cable breather should be secured in the hook provided to ensure that the pump functions properly. Do not leave the excess cable in the station.
2. Retighten the nut. This connection must be tight or ground water will enter the station.
3. Feed the wire through the length of conduit (contractor provided) which will protect it until it is below the 24" burial depth.
4. Position the conduit vertically below the cable connector along side of the station reaching down into the burial depth. Attach the small fiberglass guard (Protective Shroud) provided with the station to protect the exposed cable where it enters the station. Four self-tapping screws are provided.
5. Run the cable underground, in a trench or tunnel, to the location of the E/One panel. Leave a 6-12 inch loop of cable at each end to allow for shifting and settling. Connections made at the panel are shown in the panel wir-ing diagram (Fig. 2a and 2b).

9. DEBRIS REMOVAL

Prior to start-up test procedure, the core must be removed and the incoming sewer line flushed to force all miscellaneous debris into the tank. Next, all liquid and debris must be removed. Once tank is clean, re-install the pump and proceed with the test.

10. TEST PROCEDURE

When the system is complete and ready for use, the following steps should be taken to verify proper installation and operation:

a. Make sure that the discharge shutoff valve is fully open. This valve must not be closed when the pump is operating. In some installations there may be a valve, or valves, at the street main that must also be open.
b. Turn ON the alarm power circuit breaker.
c. Fill tank with water until the alarm turns ON. Shut off water.

d. Turn ON pump power circuit breaker Pump should immediately turn on. Within one minute the alarm will turn off. Within three minutes the pump will turn off.

Field Joint Assembly Instructions

It is extremely important that the joint is sealed properly before backfilling. Excavating a unit for repair is very expensive and can be easily avoided by using proper caution during the following procedure.

Parts included in Field Joint Kit:
Identify all parts before proceeding with installation.

(16) 3/8-16 x 1-1/2 Long screws
(16) 3/8-16 Elastic Stop Nuts
(32) Flat Washers
(1) Length Sealant (Sika) Tape
(1) Hole Punch
(1) Vent Pipe Extension

1. Carefully clean and dry both accessway flanges with solvent. IMPORTANT: Sealing surfaces must be dry to ensure the sealant adheres correctly.

2. Apply Sika tape twice around the perimeter of the flange that is attached to the tank, start at one hole and go all the way around just inside the bolt circle. Remove the backing paper as you lay the adhesive on the flange. Do not stretch Sika tape during application, it may result in a leak. The tape should overlap at the end by approximately 1/2 inch, as shown in Fig. 5a. If a section of Sika Tape is misapplied, the bad section may be cut out and replaced. Cut away the poorly laid portion cleanly with a knife and be sure to over lap the tape at each end about 1/2 inch.

3. Using the tool provided, punch a hole through the tape at each of the 16 existing bolt holes in the flange. Be careful to keep the exposed sealant clean and dry.

4. Insert three of the sixteen 3/8-16 x 1-1/2" long bolts, with a flat washer, into the flange attached to the upper part of the accessway. These will act as guides while aligning the bolt pattern of the two flanges.

5. Support the upper access-way section a few inches over the tank with the green stripes on each lined up. Once aligned, lower the upper section onto the mating flange using the three bolts to guide it to the proper position. See Fig. 5b.

6. Insert the remaining 13 bolts with flat washers into the flanges. Place a flat washer and elastic stop nut on the end of each bolt,

turning the nut on just enough to hold the washer in place.

7. Tighten up the bolts until the sealant begins to squeeze out from between the flanges. To ensure a consistent, sturdy seal tighten them in the following sequence: 1, 9; 5, 13; 3, 11; 7, 15; 2, 10; 4, 12; 6, 14; 8, 16. Always be sure to tighten one bolt and then the bolt at the position 180* from it, see Figure 1 for position numbers.

8. Using the same sequence as in step 7 tighten each bolt to 60 in-lbs. Visually inspect the joint, each bolt and each nut should have a flat washer between it and the flange, and a uniform amount of sealant should be protruding from the seam along the entire perimeter.

In the event that there are any voids in the sealant, the joint may leak. Take corrective actions if necessary and be sure that the joint is leak free before continuing.

9. Install the vent pipe extension piece which was shipped inside the upper piece of the accessway. Push the extension pipe into the bell mouth fitting on the pipe installed in the wet well tank. Be sure the pipe is seated correctly. Slide the top end of the extension pipe into the receptacle on the bottom of the lid.

Lifting Instructions

Failure to follow these instruction completely will void warranty.

1. Transporting unit to installation site:
Always lift a unit from the bottom for the purpose of transportation. The station should be received attached to a pallet for this purpose. Never roll a station or move it on its side.

2. No Ballast (to be poured in place):
If the concrete anchor is to be poured while the station is in place lift the unit using 2 nylon straps wrapped around the accessway making a sling, as shown below. Keep station oriented vertically to avoid any damage. Only lift from the accessway to put unit in hole, not for moving any distance.

3. Precast Ballast:
Never lift a station that has a ballast attached by any means except the rebar. The weight of the concrete will damage the station if you attempt to lift it from any part of the station.

Ballast Calculations

A ballast, or concrete anchor, of proper volume and weight is required on all in-ground installations. The following explains how to arrive at the correct size ballast:

The amount of ballast needed is equal to the weight it would take to counterbalance the buoyant forces that would be present if the station were being installed in water. Therefore:

STATION VOLUME x THE WEIGHT OF WATER PER CUBIC FOOT (62.4 LBS/CU FT) = BUOYANT FORCES

$F_{BUOYANT}$

BUOYANT FORCES - STATION WEIGHT = FORCE REQUIRED FROM BALLAST

$F_{BALLAST}$

BALLAST FORCE ÷ WEIGHT OF CONCRETE PER CUBIC FOOT IN WATER (87.6 LBS/CU FT) = VOLUME OF CONCRETE REQUIRED

$V_{CONCRETE}$

VOLUME OF CONCRETE x WEIGHT OF CONCRETE PER CUBIC FOOT IN AIR = WEIGHT OF CONCRETE REQUIRED

$W_{CONCRETE}$

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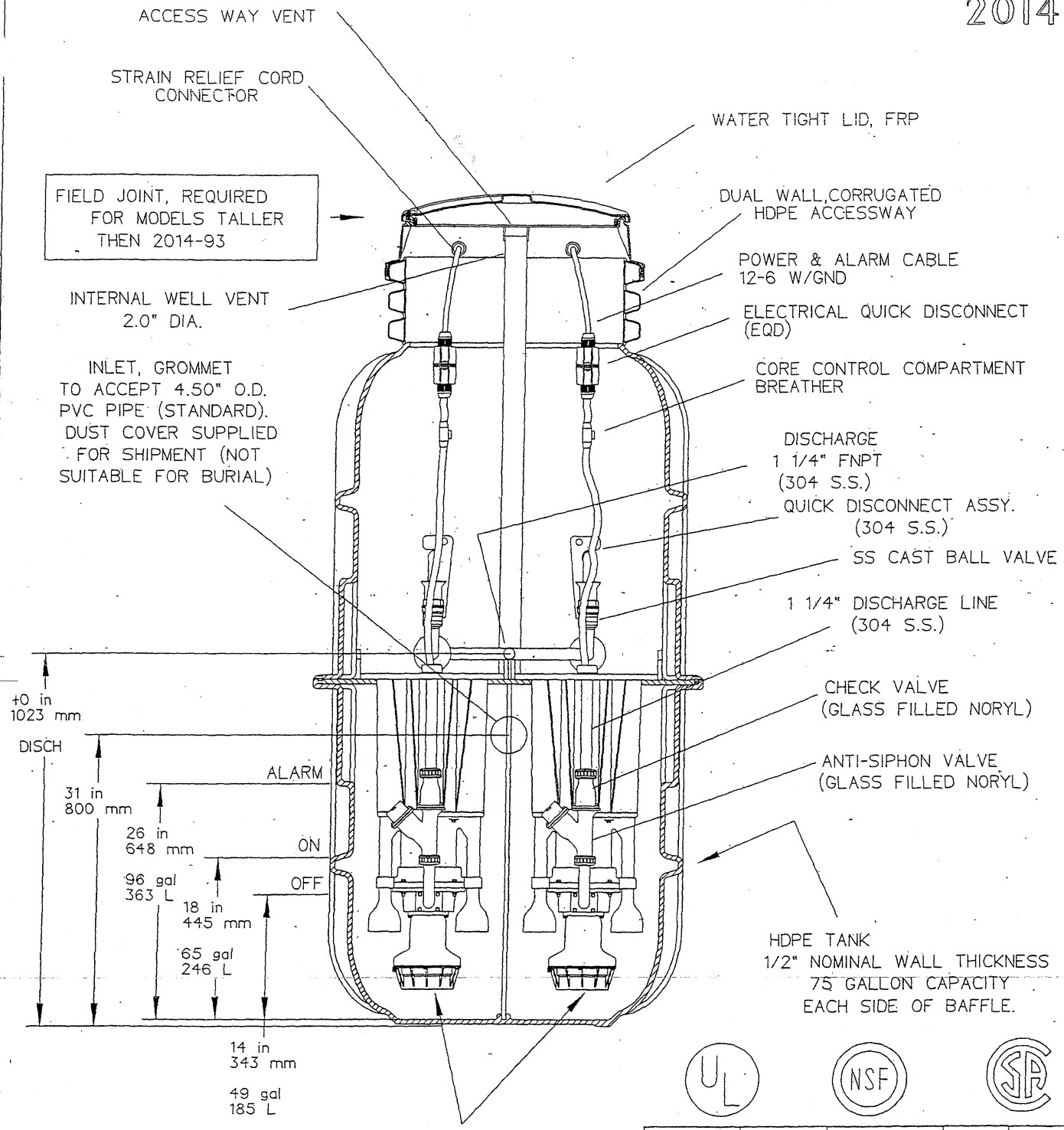
2014



SEMI-POSITIVE DISPLACEMENT TYPE PUMP
DIRECTLY DRIVEN BY A 1 HP MOTOR
CAPABLE OF DELIVERING 9 gpm AT 138' T.D.H.
(34 lpm AT 42m T.D.H.)

NOTE: A CONCRETE ANCHOR IS REQUIRED TO PREVENT THE TANK FROM FLOATING. SEE INSTALLATION INSTRUCTIONS OR SPECIFIC CUT SHEET FOR SIZE AND WEIGHT OF ANCHOR

SGS	CAH	01/25/99	G	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

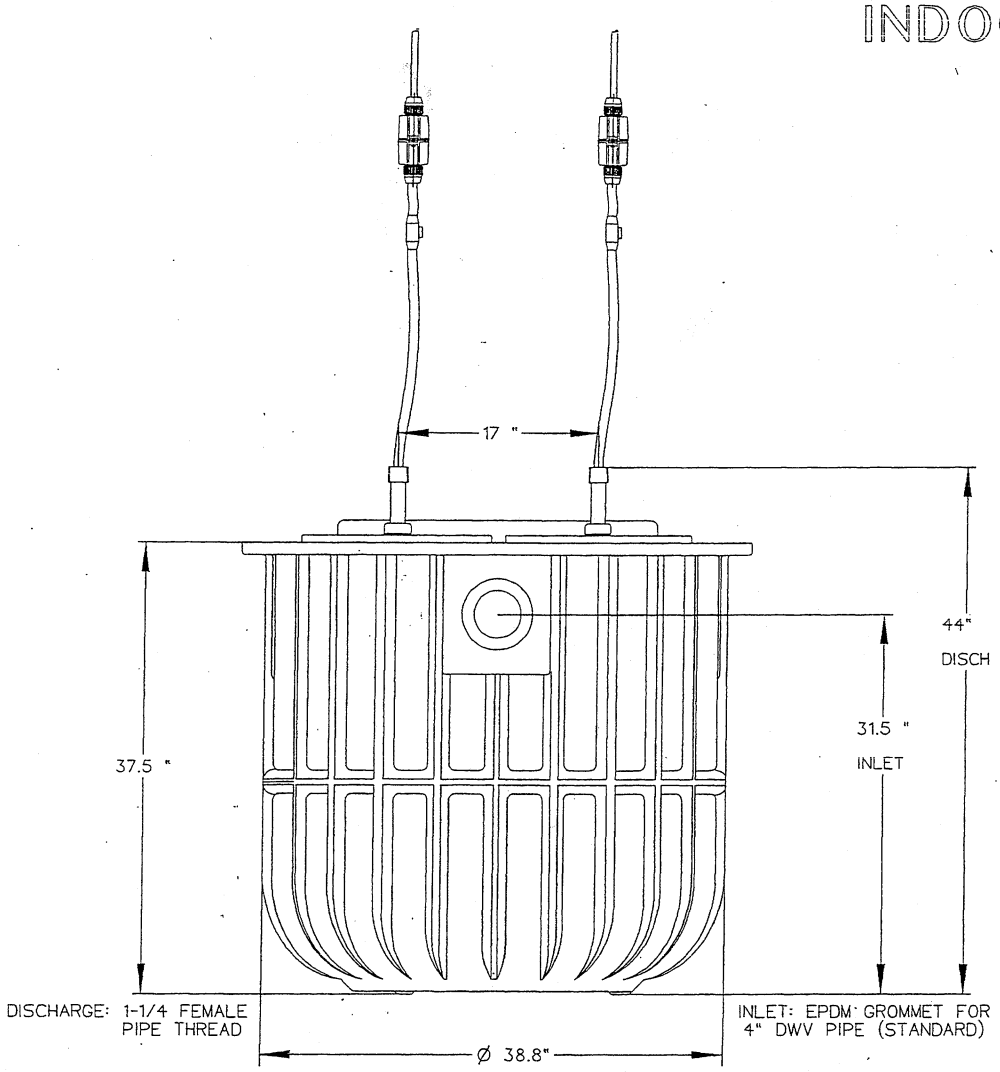
SEWER SYSTEMS

MODEL 2014, DETAIL SHEET

PA 0910 P01

2014-38

INDOOR UNIT



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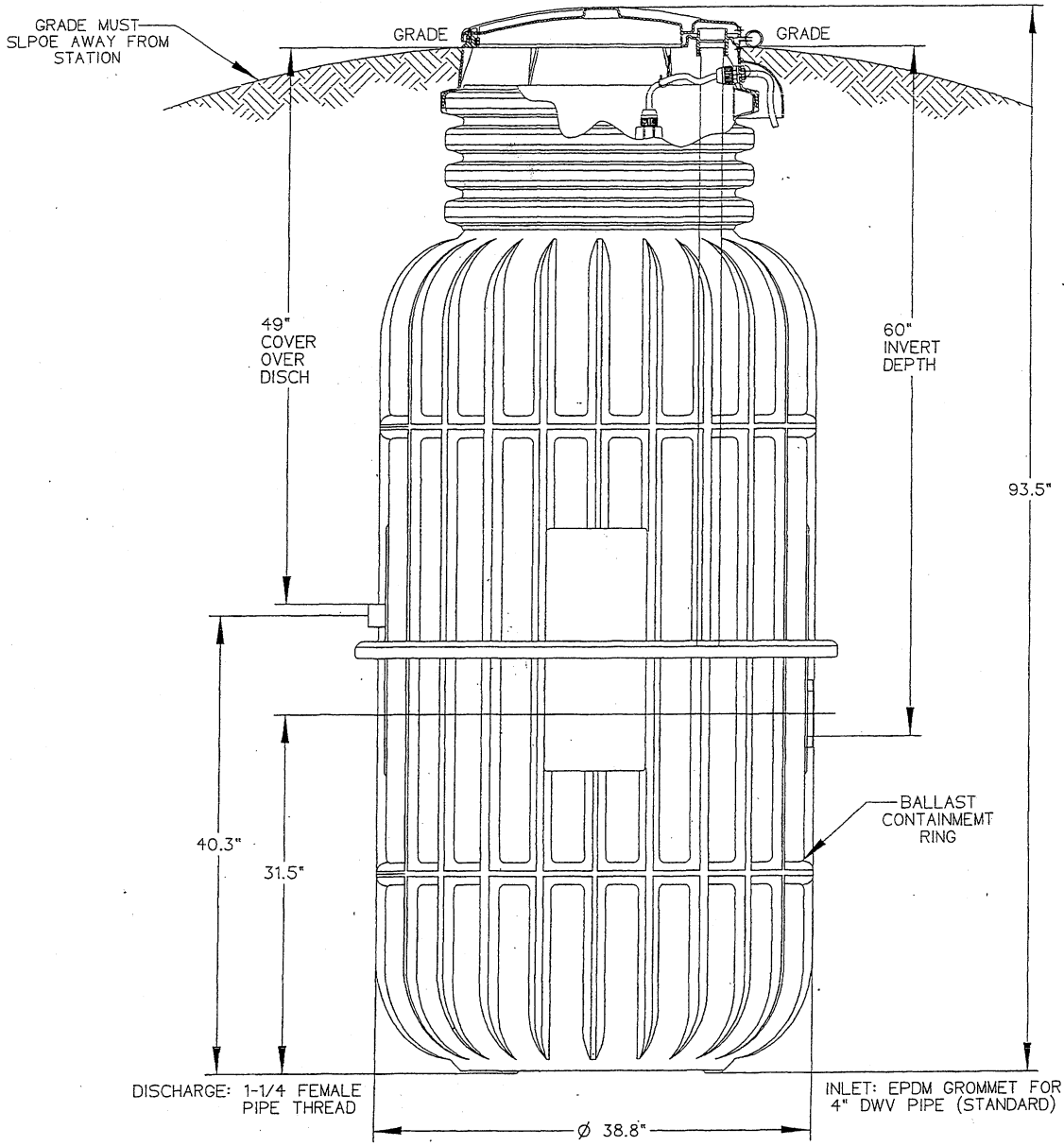
SEWER SYSTEMS

MODEL 2014-38

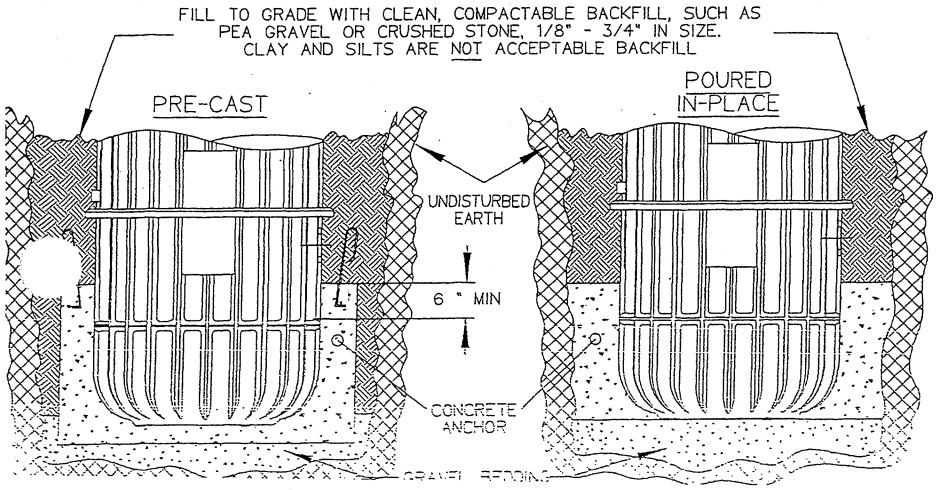
PA 1337 P01

2014-93



**SEE INSTALLATION INSTRUCTIONS FOR SPECIFIC DIAMETERS AND HEIGHTS REQUIRED FOR PROPER CONTAINMENT WHEN USING 2014 PRE-CAST BALLASTS

NOTE: A CONCRETE ANCHOR OF 4500 lbs (29.9 cu ft) IS REQUIRED ON ALL MODEL 2014 93" STATIONS.



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SEWER SYSTEMS

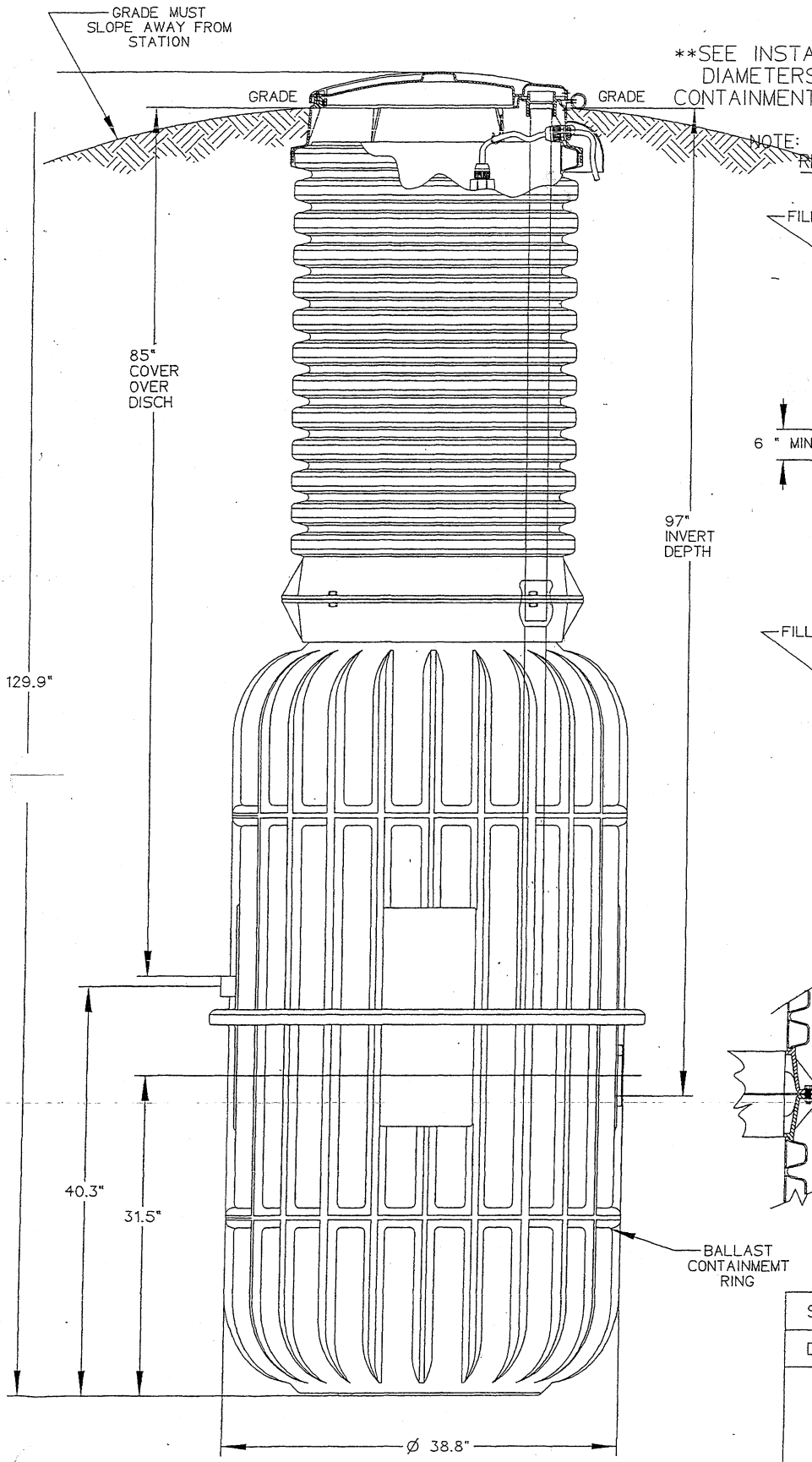
MODEL 2014-93

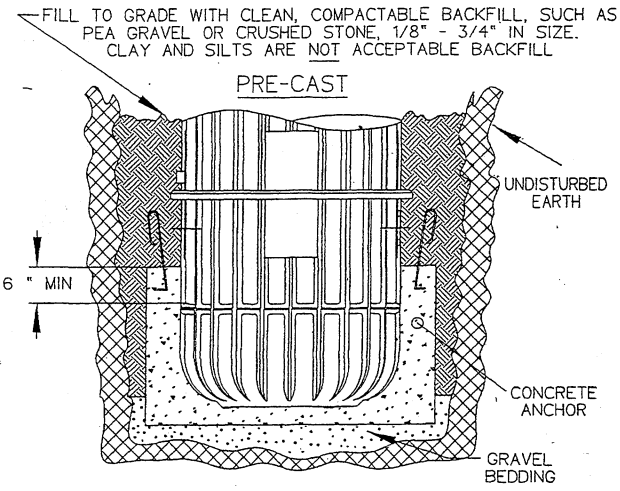
PA 1337 P03

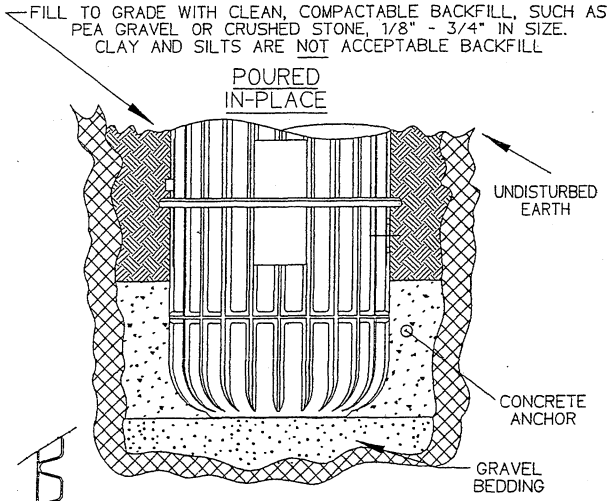
2014 -129

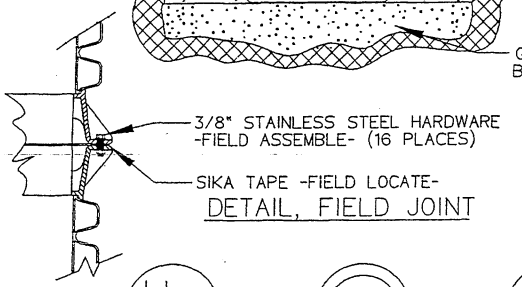
**SEE INSTALLATION INSTRUCTIONS FOR SPECIFIC DIAMETERS AND HEIGHTS REQUIRED FOR PROPER CONTAINMENT WHEN USING 2014 PRE-CAST BALLASTS

NOTE: A CONCRETE ANCHOR OF 5700 lbs (37.6 cu ft) IS REQUIRED ON ALL MODEL 2014 129" STATIONS.









DETAIL, FIELD JOINT

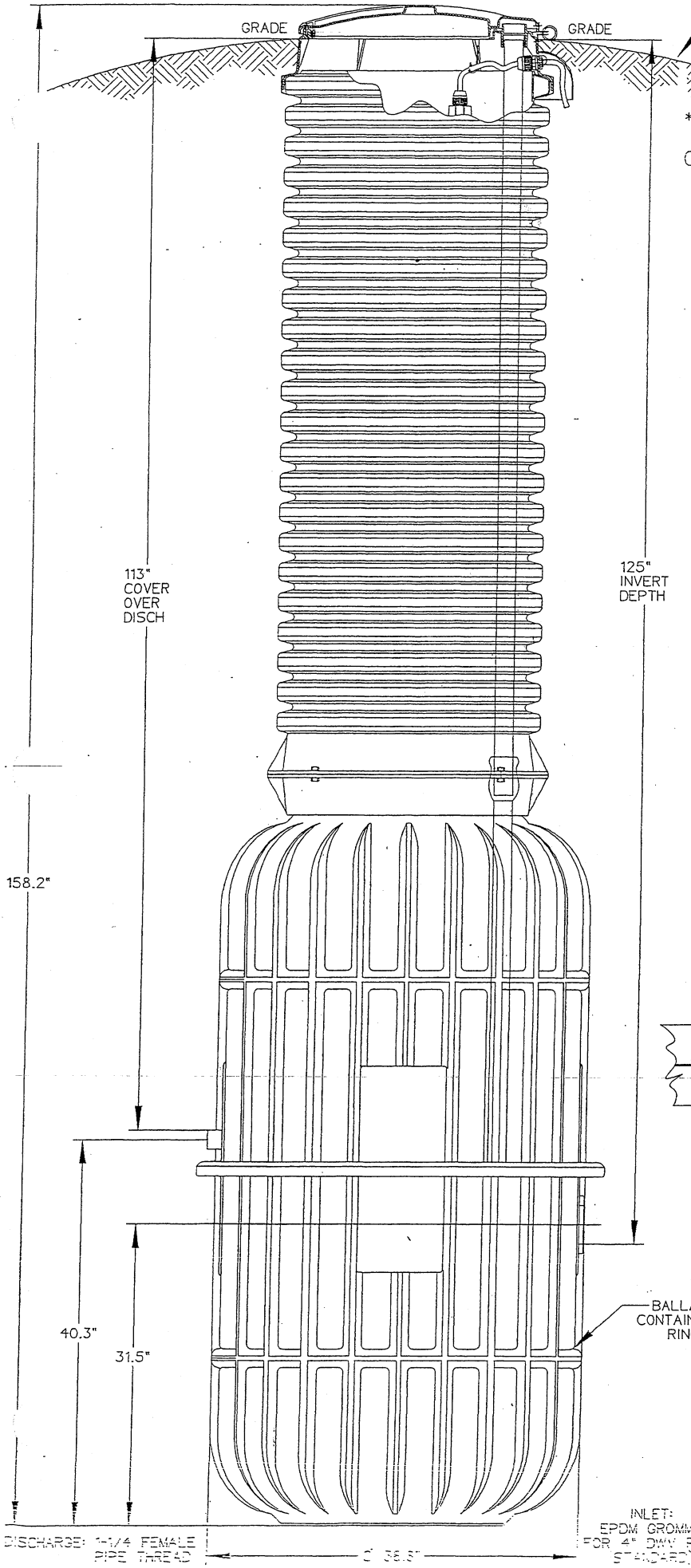
SGS	CAH	1/25/99	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

MODEL 2014-129

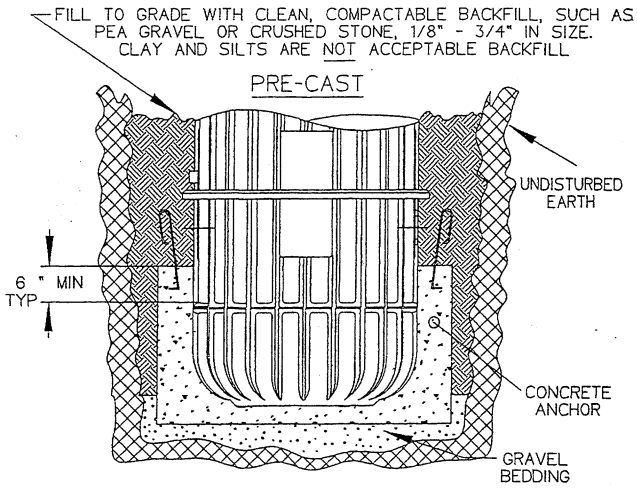
PA 1337 P04

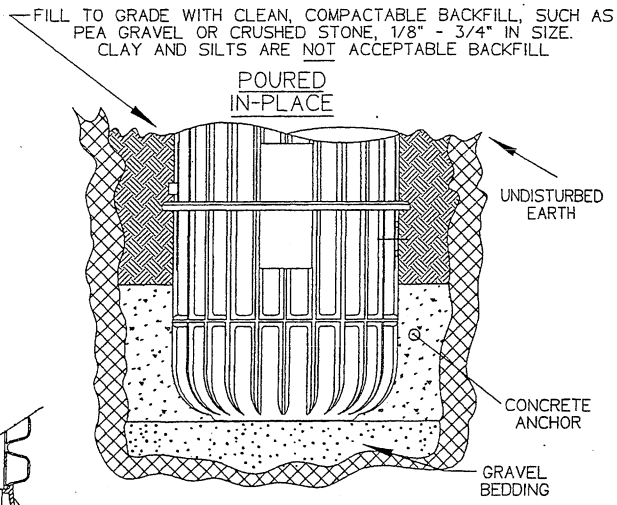
2014 -160

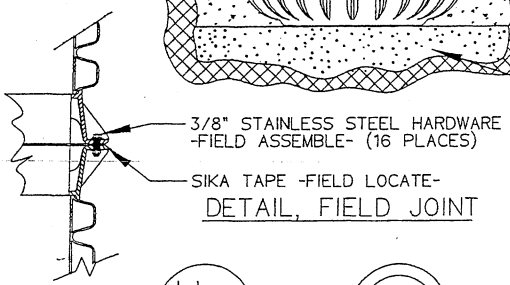


**SEE INSTALLATION INSTRUCTIONS FOR SPECIFIC DIAMETERS AND HEIGHTS REQUIRED FOR PROPER CONTAINMENT WHEN USING 2014 PRE-CAST BALLASTS

NOTE: A CONCRETE ANCHOR OF 6700 lbs (44.4 cu ft) IS REQUIRED ON ALL MODEL 2014 160" STATIONS.







DETAIL, FIELD JOINT

SGS	CAH	1/25/99	A	1/16
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SEWER SYSTEMS

MODEL 2014-160

PA 1337 P05

MOD 260 Duplex Alarm/Disconnect Panel

Downloads:
MOD 260 drawings (112K PDF)
MOD 260 drawings (self-extracting DXF)

Description

The MOD 260 Electrical Panels are custom designed for use with Environment One Duplex Grinder Pumps. They are specified for installations that require an electrical disconnect separate from the residence distribution panel.

MOD Panels can be supplied with audible, visual or combination alarms. They are easily installed in accordance with relevant national and local codes. Standard MOD Alarm Panels are listed by Underwriters Laboratories to assure high quality and safety.

Please consult factory for special applications.

Standard Features

- Corrosion-proof fiberglass enclosure
- NEMA 4X-rated enclosure
- Hinged access panel
- Lockable latch with padlock
- Circuit breakers
- Terminal blocks and ground lugs

Optional Features

- Audible alarm with silence
- Red alarm light
- Audible alarm with silence and lamp
- 120 VAC or 240 VAC Service

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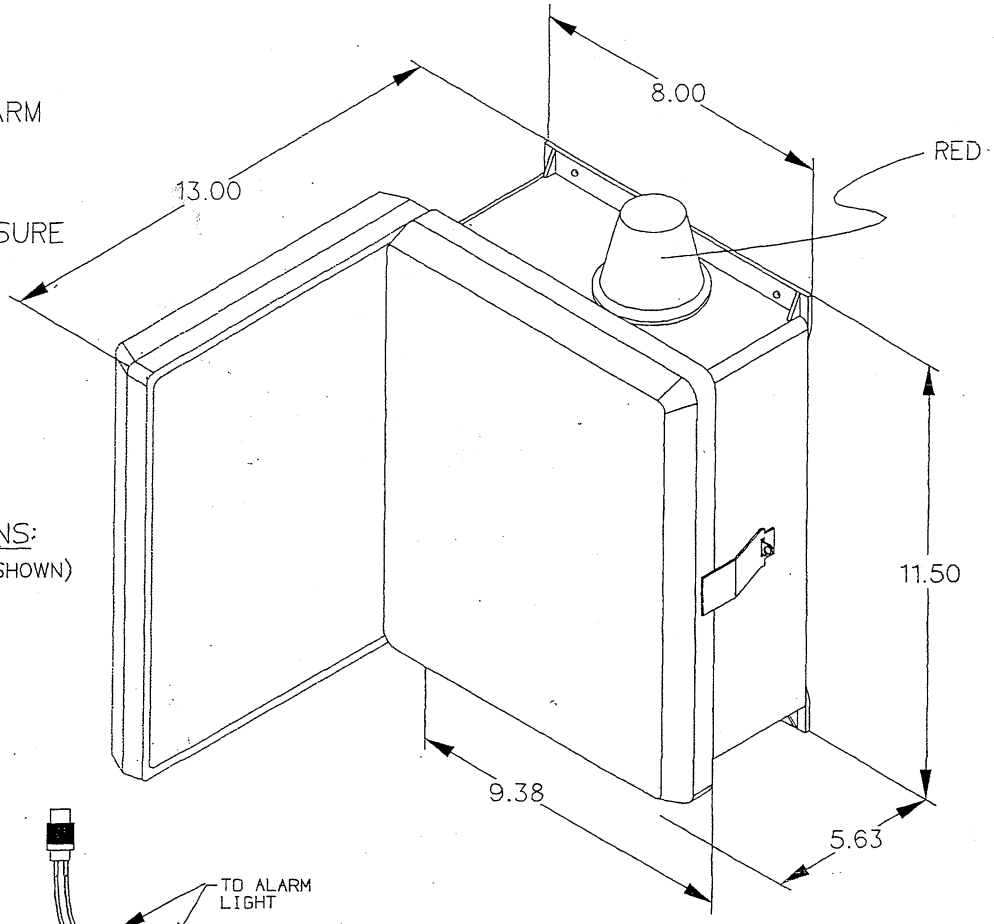
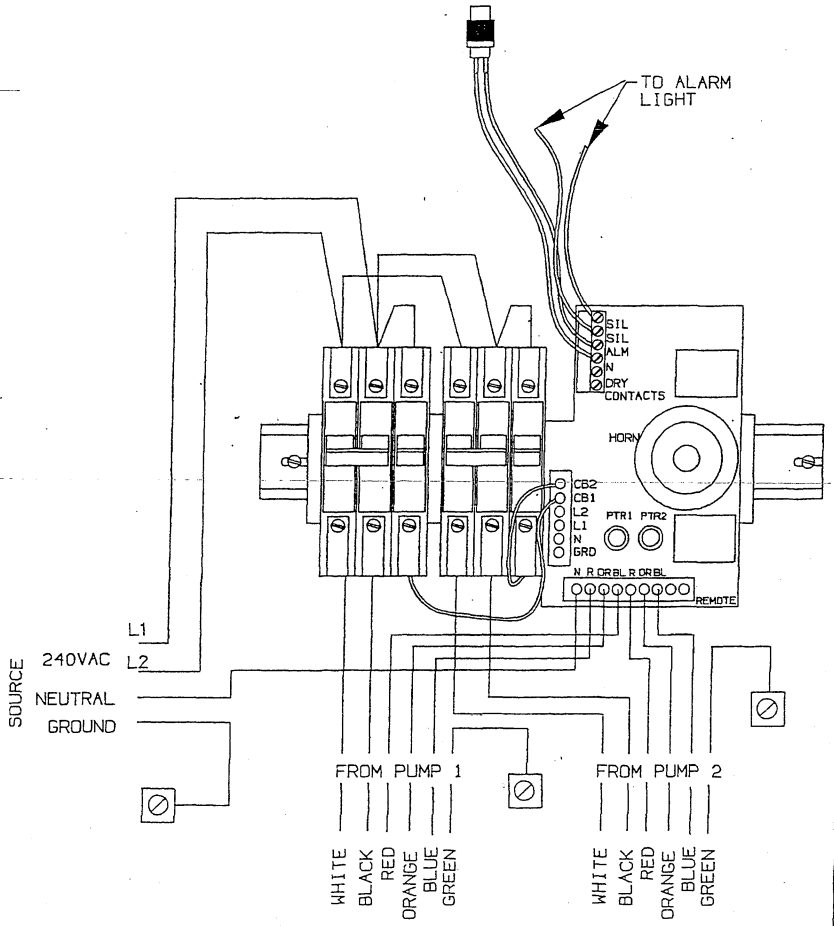
DUPLEX
MOD 260

VISUAL & AUDIBLE ALARM
MANUAL SILENCE
MANUAL RUN
240VAC
4X FIBERGLASS ENCLOSURE



AVAILABLE CONFIGURATIONS:
G01 - 240V, STANDARD (SHOWN)
G02 - 120V



CONTROL CABLE:

TYPE TC; DIRECT BURIAL, 12AWG, SIX CONDUCTOR.

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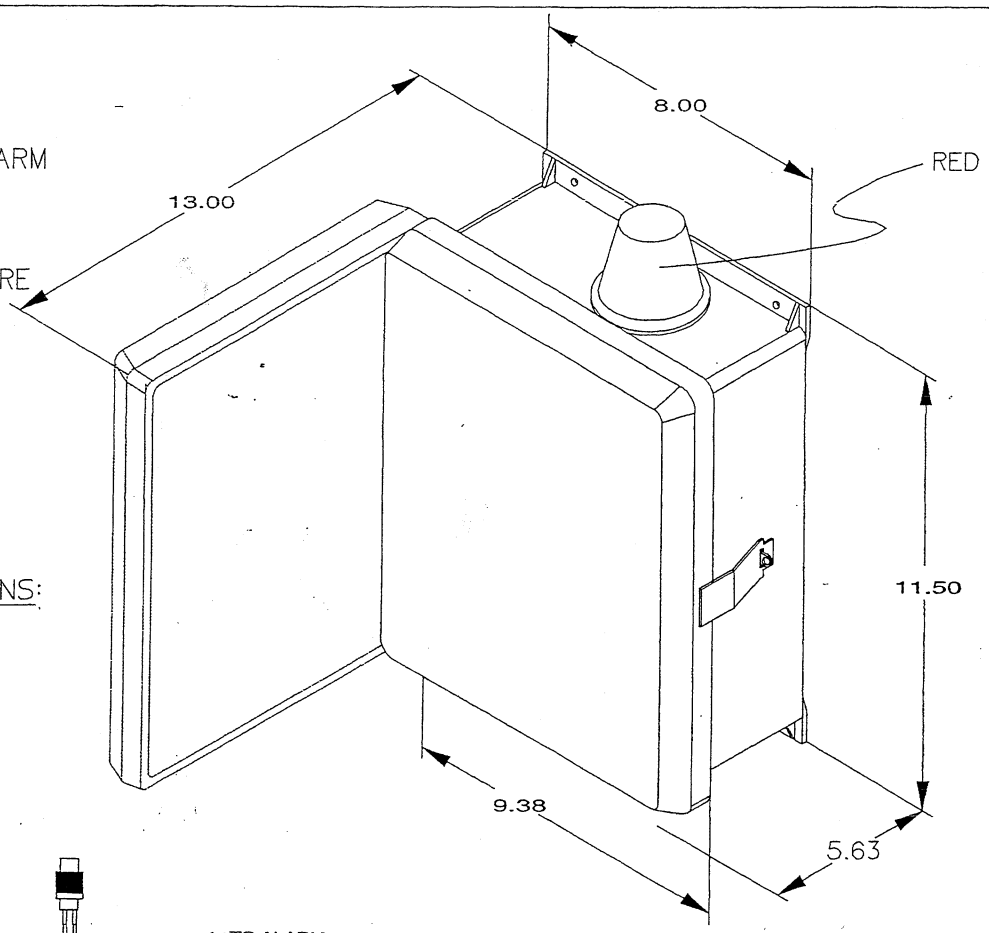
SEWER SYSTEMS

PANEL, 4X DUPLEX, 240V

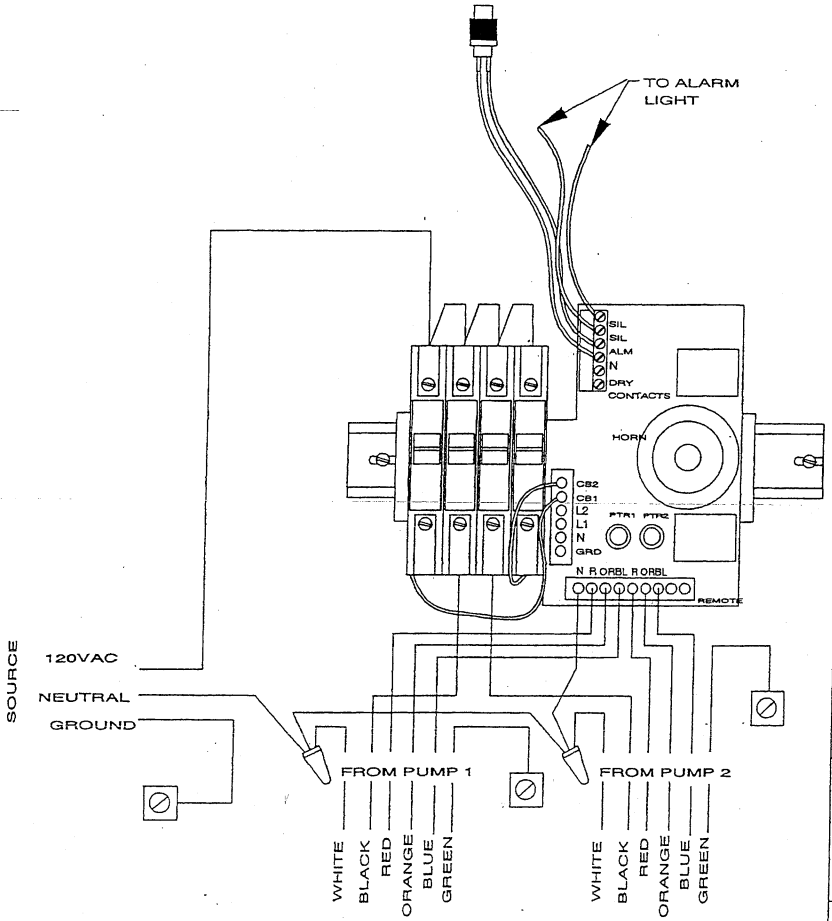
LM000153

DUPLEX
MOD 260

VISUAL & AUDIBLE ALARM
MANUAL SILENCE
MANUAL RUN
120VAC
4X FIBERGLASS ENCLOSURE



AVAILABLE CONFIGURATIONS:
G01 - 240V, STANDARD
G02 - 120V (SHOWN)



CONTROL CABLE:

TYPE TC; DIRECT BURIAL, 12AWG, SIX CONDUCTOR.

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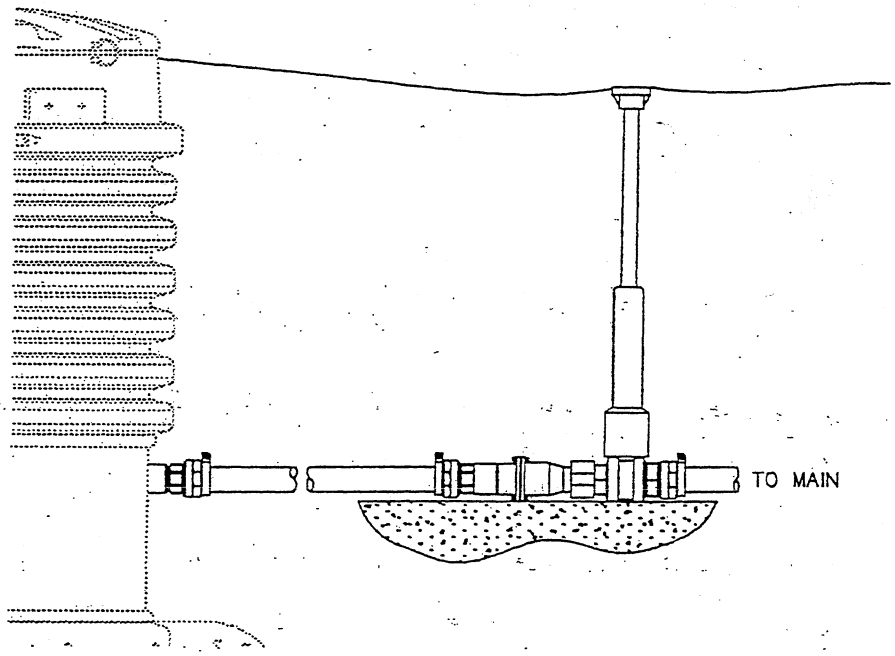
SEWER SYSTEMS

PANEL, 4X DUPLEX, 120V

LM000157

Forced Sewer Main Service Lateral Kits
SDR 7 HDPE Pipe featuring valve components from Ford Meter Box Company



Thank you for considering E|ONE's Forced Sewer Main Lateral Kits. As you review the following information, please note that we have included order instructions on the last page of this section, for your convenience.

Description

These kits feature all components commonly needed to connect an Environment One Series 2000 grinder pump station to the corporation stop/ saddle tap on a sewer main. The kit is designed to be used with SDR 7 HDPE Pipe, high density polyethylene pipe, (provided by others) and includes compression fittings for fast, easy field installation. The curb stop assembly integrates a robust ball valve curb stop from the Ford Meter Box Company and Environment One's field proven swing check valve. Curb boxes can be supplied in either Arch pattern or Minneapolis pattern.

Standard Features

- Pack Joint Couplings for 1-¼" SDR 7 HDPE Pipe
- All brass fittings meet ASTM B62-63-B505Q, AWWA Standard C800 and ANSI B16.26
- Factory assembled, Integrated Ball Valve Curb Stop and Check Valve Assembly
- Check Valve made from glass-filled PVC with fabric reinforced elastomeric flapper.
- Arch pattern curb boxes in heights from 3 ft. to 8 ft. in 1 foot increments
- Curb boxes made from cast iron and steel pipe heavily coated with asphalt based paint and labeled "sewer". Rated for 200 psi.

Optional Features

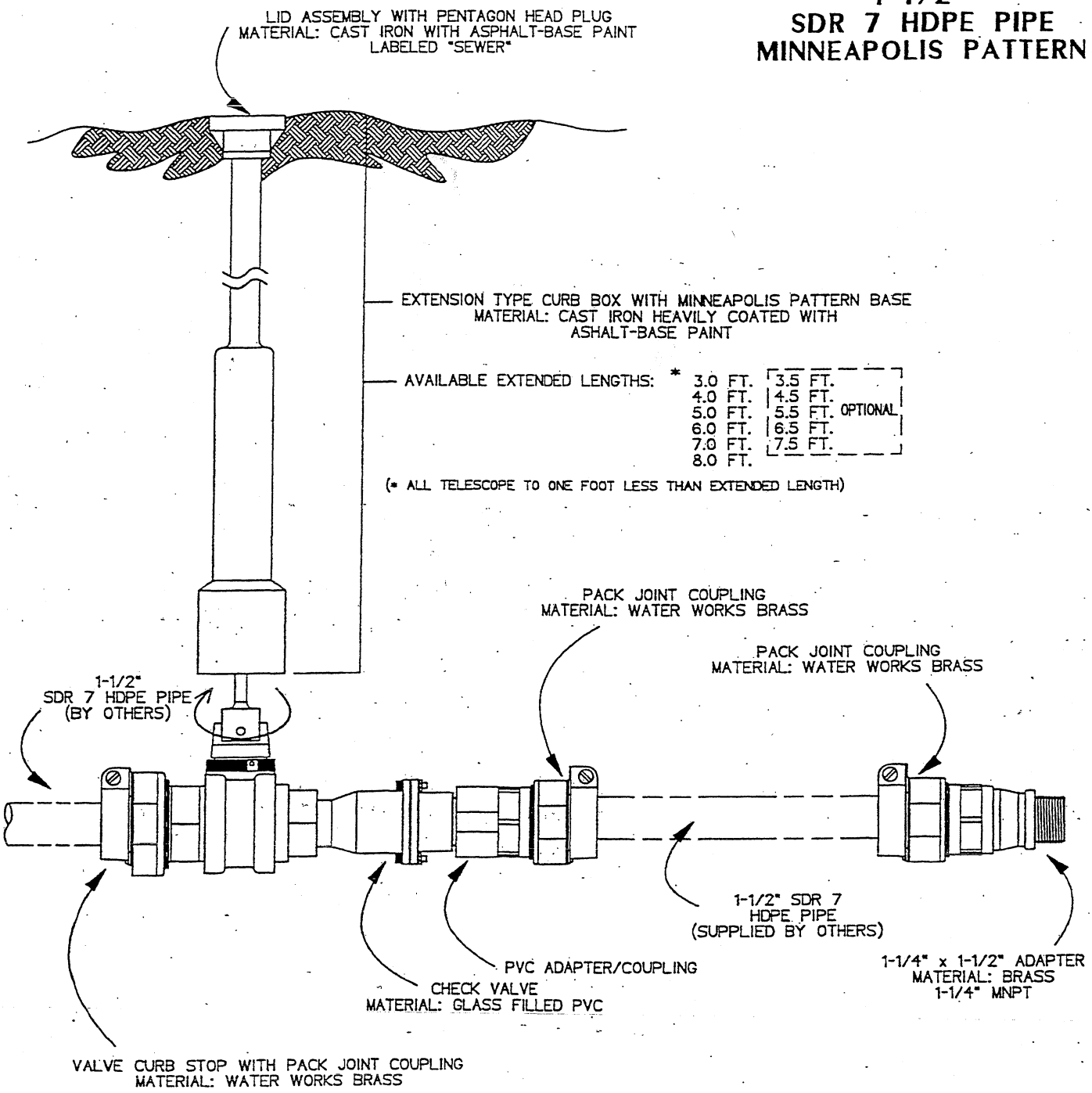
- Pack Joint Couplings for 1-½" SDR 7 HDPE Pipe
- Curb stops for 1-½" SDR 7 HDPE Pipe
- Minneapolis Pattern Curb Boxes
- Curb boxes in ½ foot size increments

Printed in USA on Recycled Paper

PA1362P01 Rev. -, 2/97

For Ordering Information see PA1372P01 Lateral Order Code

LATERAL ASSEMBLY 1-1/2" SDR 7 HDPE PIPE MINNEAPOLIS PATTERN



PRESSURE RATING: 150 psi

ALL PACK JOINT COUPLINGS SUPPLIED WITH INSERT STIFFENERS

ASSEMBLY TO BE USED WITH 1-1/2"SDR 7 PIPE ONLY

*FOR ORDERING INFORMATION SEE PA1372P01 LATERAL ORDER CODE

APS	WRS	01/06/97	-	3/16
DR BY	CHK'D	DATE	ISSUE	SCALE

environment | one
CORPORATION

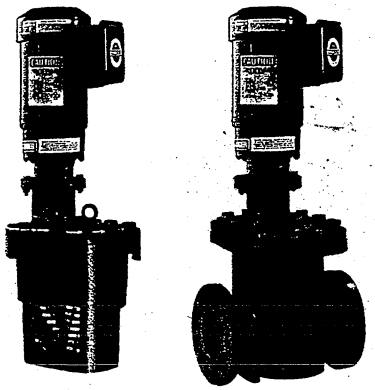
LATERAL ASSEMBLY 1-1/2"
SDR 7 HDPE PIPE MINNEAPOLIS PATTERN

PA 1332 P01

Exhibit F

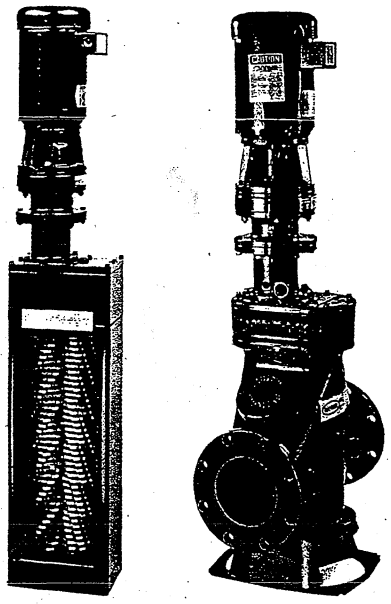
Wastewater Treatment System Equipment

GRINDERS



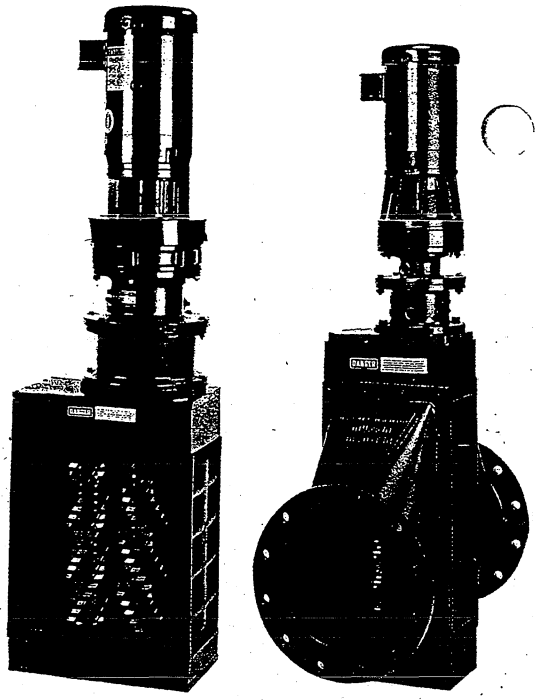
Mini Monster®
Model 20000

- proven dual-shafted technology to reduce solids in low flow, light duty and sanitary waste applications
- ilizes 1 horsepower motor with 29:1 speed reducer
- 2-inch 4140 steel hexagonal shafts
- varied cutter options to optimize each application
- cantilevered shaft design for ease of maintenance



Muffin Monster®
Model 30000

- proven dual-shafted technology to reduce solids in standard wastewater and industrial applications
- utilizes 3 or 5 horsepower motor with 29:1 speed reducer
- hydraulic motor option available with 5 horsepower power pack
- 2-inch 4140 steel hexagonal shafts
- varied cutter options to optimize performance and particle size
- provides protection of downstream pumps and processing equipment
- features in-line or in-channel cutter stack tightening capabilities
- optional clean-out combs available for processing fibrous/difficult materials



Macho Monster®
Model 40000

- proven dual-shafted technology to reduce solids in high-volume, heavy-duty wastewater and industrial applications
- utilizes 10 horsepower motor with 43:1 or 87:1 speed reducer
- hydraulic motor option available with a 10 horsepower power pack
- 2 ½-inch 4140 steel hexagonal shafts
- varied cutter options to optimize performance and particle size
- provides the performance needed for screenings grinding
- optional clean-out combs available for processing fibrous/difficult materials

Model 20000 Specifications*

In-Channel Stack Height, in. (mm)	Flow, GPM (l/s)**	Overall Height, in. (mm)	Net Weight, lb. (kg)
4 3/4 (121)	80 (5)	32 1/4 (819)	225 (102)
In-Line Unit Flange Size, in. (mm)			
4 (100)	150 (10)	33 (838)	275 (125)

Nominal Measurements
** Flow based on optimum channel conditions. Consult f or final analysis of application.*

Model 30000 Series Specifications*

In-Channel Units Stack Height, in. (mm)	Flow, GPM (l/s)**	Overall Height, in. (mm)	Net Weight, lb. (kg)
8 (203)	275 (17)	48 (1219)	330 (150)
12 (305)	425 (27)	52 1/8 (1324)	370 (168)
18 (457)	725 (46)	58 (1473)	425 (193)
24 (610)	1000 (61)	63 3/4 (1619)	480 (218)
32 (813)	1500 (95)	71 1/2 (1816)	540 (245)
40 (1016)	2000 (126)	79 1/2 (2019)	610 (277)
50 (1270)	2750 (174)	89 1/2 (2273)	700 (318)
60 (1524)	3250 (205)	99 7/8 (2537)	805 (366)
In-Line Units Flange Size, in. (mm)			
4 (100)	400 (25)	56 1/4 (1429)	415 (189)
6 (150)	600 (38)	56 1/4 (1429)	425 (193)
8 (200)	800 (50)	56 1/4 (1429)	435 (198)
10 (250)	1000 (63)	67 3/4 (1721)	650 (295)
12 (300)	1200 (76)	67 3/4 (1721)	675 (307)

Nominal Measurements
** Flow based on optimum channel conditions. Consult factory for final analysis of application.*

Model 40000 Series Specifications*

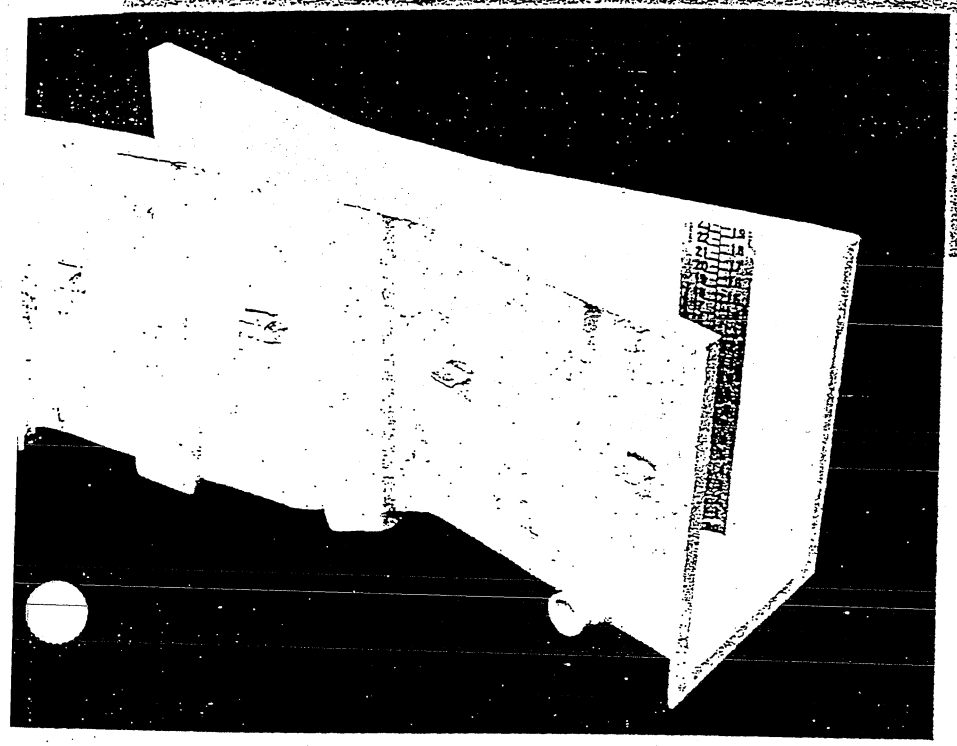
In-Channel Units in. (mm)	Flow, GPM (l/s)**	Overall Height, in. (mm)	Net Weight, lb. (kg)
18 (457)	1100 (69)	69 1/4 (1759)	1175 (533)
24 (610)	1500 (95)	75 5/8 (1921)	1365 (619)
32 (1016)	2250 (142)	82 1/8 (2086)	1560 (708)
In-Line Units Flange Size, in. (mm)			
12 (300)	2500 (158)	69 1/4 (1759)	1520 (689)
16 (400)	3500 (221)	75 5/8 (1921)	1895 (860)
18 (450)	4000 (252)	75 5/8 (1921)	2095 (95

**Nominal Measurements*
*** Flow based on optimum channel conditions. Consult factory for final analysis of application.*

PLASTI-FAB®

FIBERGLASS REINFORCED POLYESTER

PARSHALL FLUMES



- Maintenance free
- Dimensionally stable
- Easily installed
- Lightweight
- Accurate
- Economical

CORROSION RESISTANT
polyester affords protection from chemical attack by corrosive wastes.

DIMENSIONALLY STABLE
prefabricated Plasti-Fab Parshall flumes assure accurate dimensions.

EASY INSTALLATION
light weight – high strength. Plasti-Fab Parshall flumes are heavily ribbed for free standing installation. They may also be installed as liners in concrete.

CLEAN WHITE SMOOTH SURFACES
minimize any build-up of organisms.

RUGGED CONSTRUCTION
2" flanges on ends and top, with heavy angle bracing across top flanges.

LOWER COST
and more rugged than stainless.

MORE DURABLE
and more accurate than concrete.

2" THREADED CONNECTION
is available on either side for connection to a separate floatwell or bubbler system.

FLOATWELLS ATTACHED
to the side of the flume are 12"; 8" is also available. They can be mounted on either side.

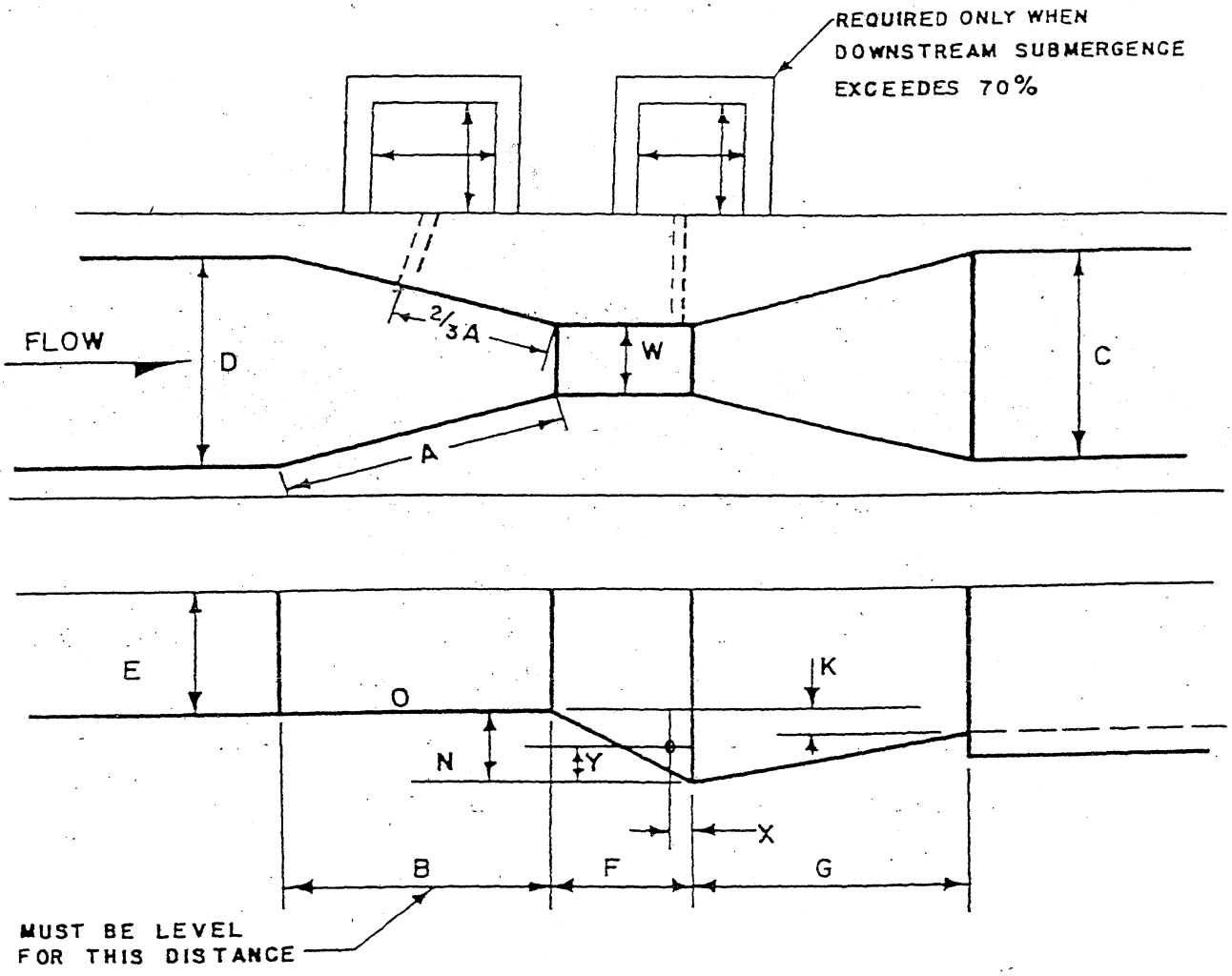
REMOTE FLOATWELLS
are also available. A 2" threaded tap on the flume and the floatwell is provided for interconnecting piping. A 1" blow-out connection is also provided on the well.

HEAD GAUGES
are supplied on all Plasti-Fab Parshall flumes. The gage is molded in the side of the flume in the first stage of construction, retaining a smooth surface on the sidewall.

CONTACT
YOUR LOCAL REPRESENTATIVE OR .....

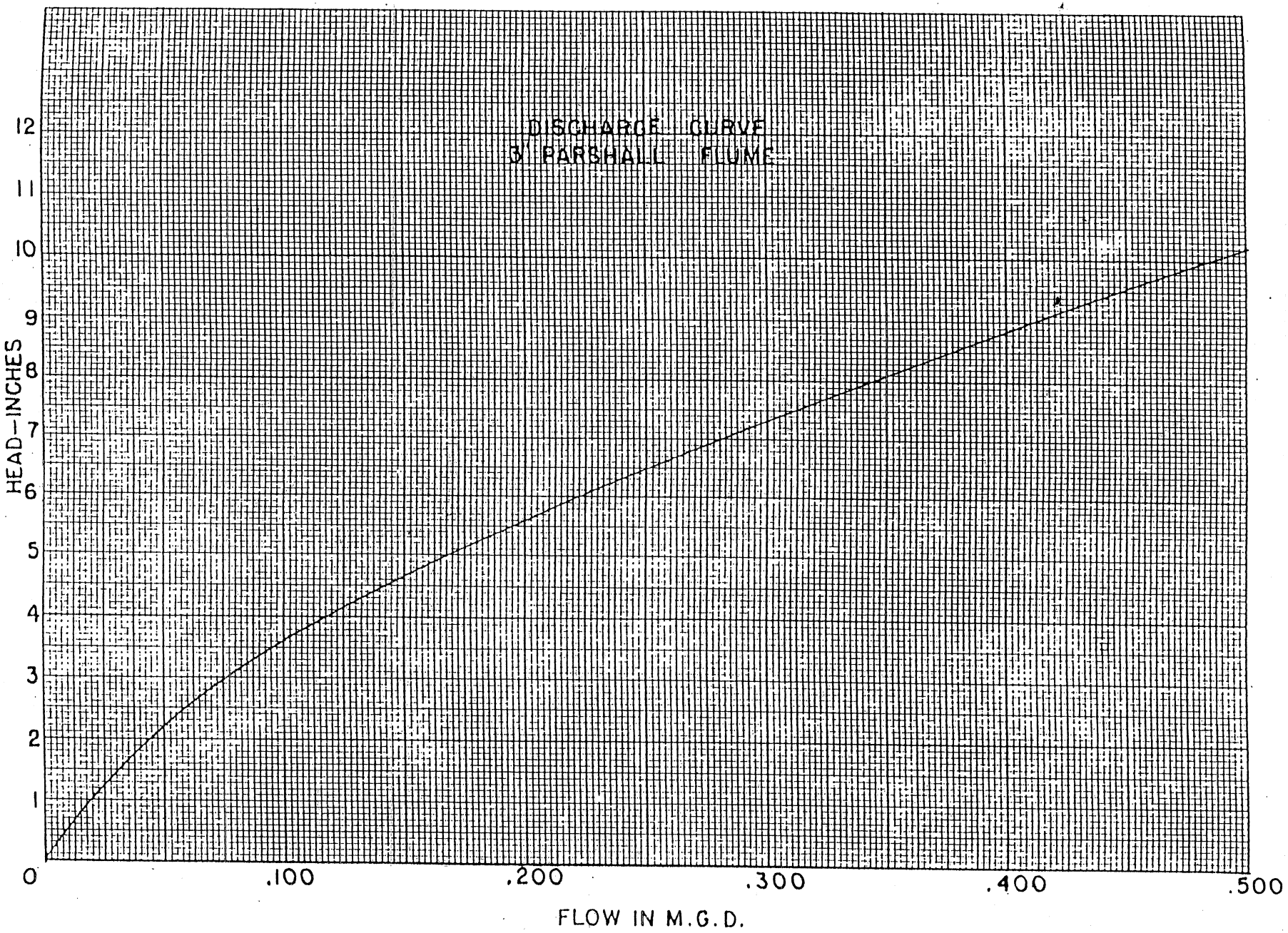
DIRECT TO . . .

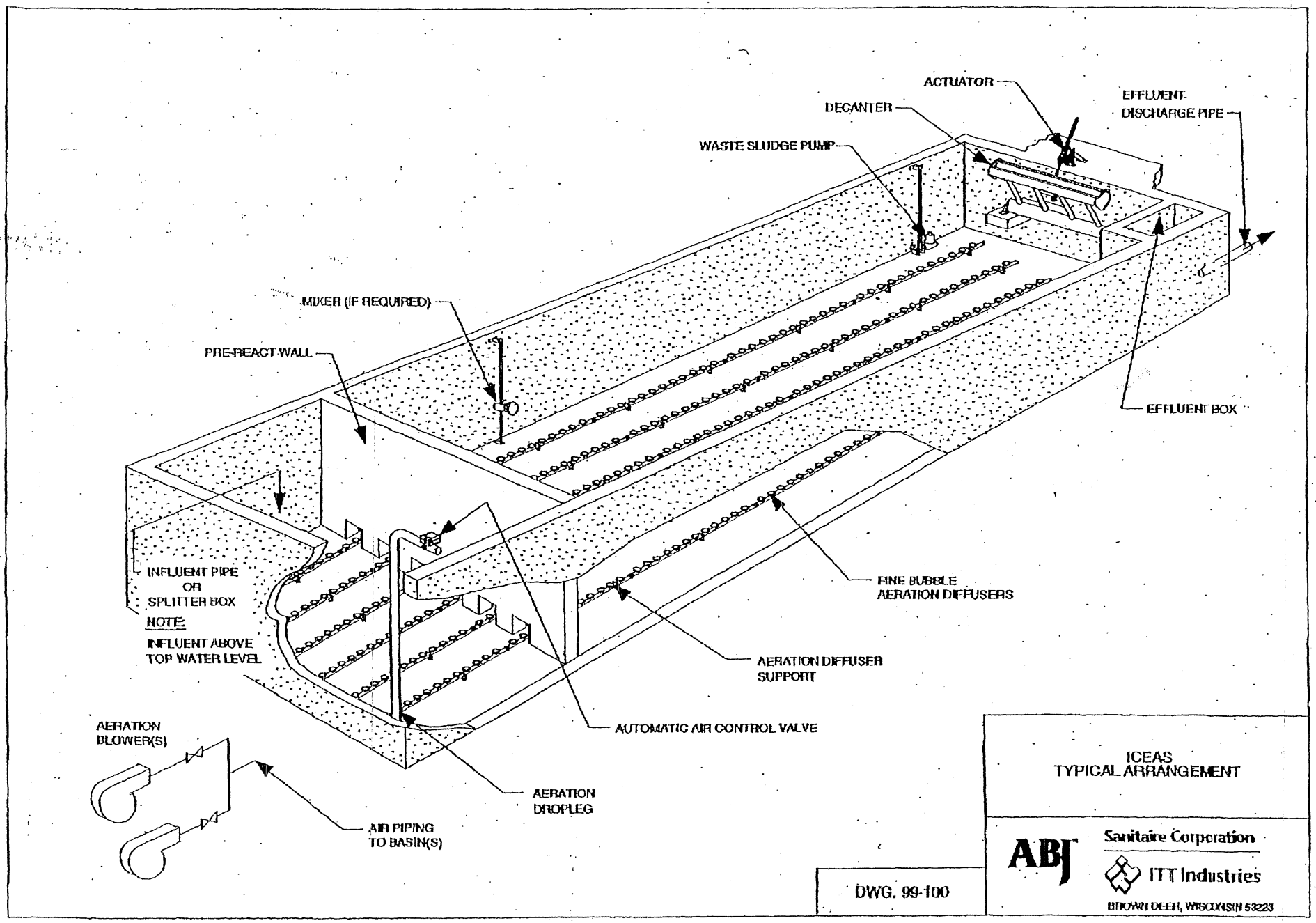
PLASTI-FAB, INC.
P.O. Box 100
Tualatin, Oregon 97062
Phone (503) 692-5460

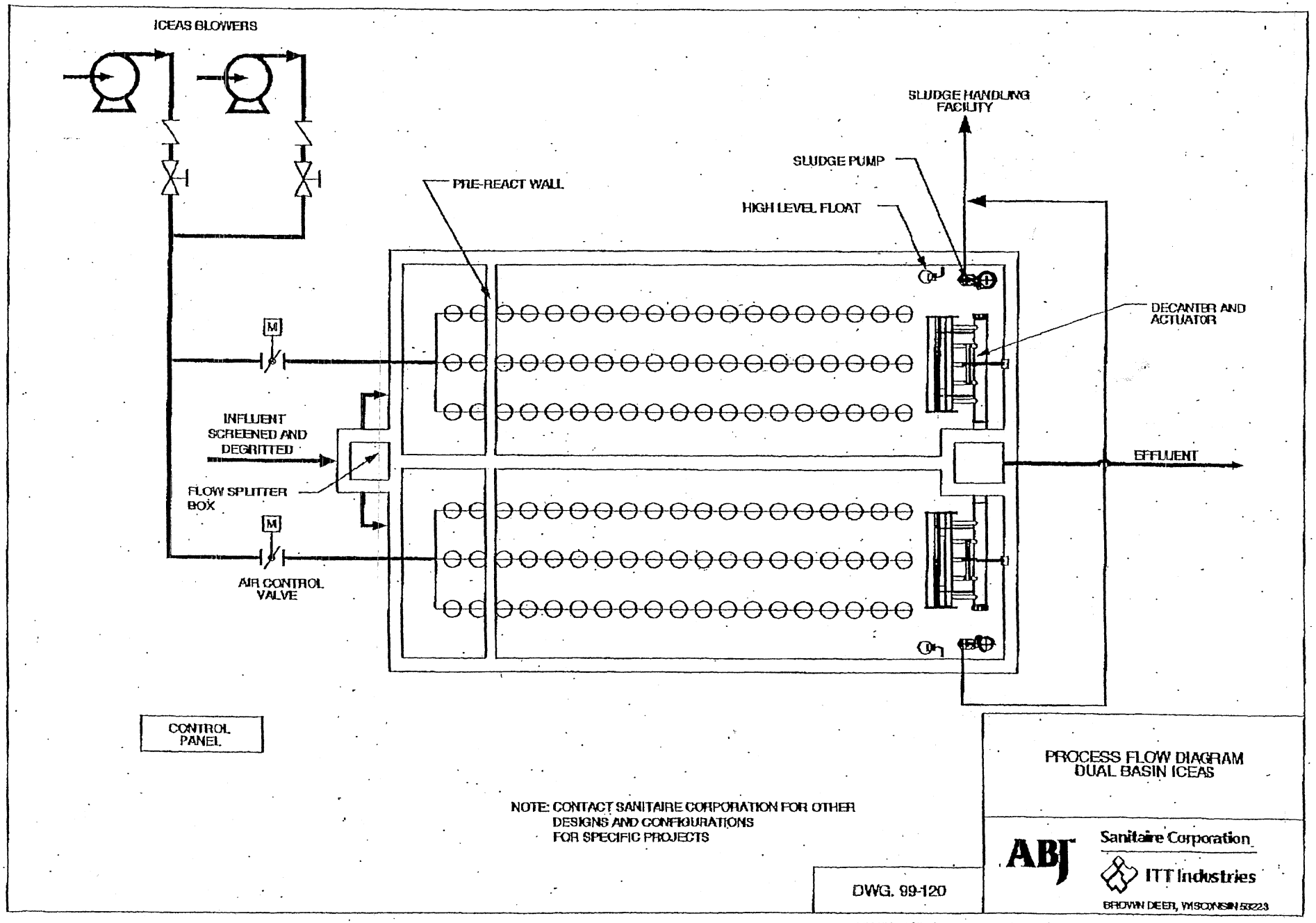


Dimensions of Parshall Flumes

Throat Width													Free Flow Capacity			
													Maximum		Minimum	
W	A	2/3 A	B	C	D	E	F	G	K	N	X	Y	Head	Discharge	Discharge	Head
3"	1'-6 3/8"	1'-0 1/4"	1'-6"	7"	10 3/16"	1'-3"	6"	1'	1"	2¼"	1"	1½"	1.125	1/2 Sec.Ft. 0.777 M.G.D.	0.03 Sec.Ft. 19400 G.P.D.	0.
6"	2'-0 7/16"	1'-4 5/16"	2'-0"	1'-3½"	1'-3 1/2"	1'-6"	12"	2'	3"	4½"	2"	3"	1.24	2.9 Sec.Ft. 1.87 M.G.D.	0.05 Sec.Ft. 32300 G.P.D.	0.
9"	2'-10 5/8"	1'-11 1/8"	2'-10"	1'-3"	1'-10 5/8"	2'-0"	12"	1'-6"	3"	4½"	2"	3"	1.5'	5.7 Sec.Ft. 3.69 M.G.D.	0.10 Sec.Ft. 64700 G.P.D.	0.
1'-0"	4'-6"	3'-0"	4'-4 7/8"	2'	2'-9 1/4"	3'-0"	2'	3'	3"	9"	2"	3"	2.5'	16.1 Sec.Ft. 10.4 M.G.D.	0.35 Sec.Ft. .226 M.G.D.	0.2'
1'-6"	4'-9"	3'-2"	4'-7 7/8"	2'-6"	3'-4 3/8"	3'-0"	2'	3'	3"	9"	2"	3"	2.5'	24.6 Sec.Ft. 15.9 M.G.D.		
2'-0"	5'-0"	3'-4"	4'-10 7/8"	3'	3'-11 1/2"	3'-0"	2'	3'	3"	9"	2"	3"	2.5'	33.1 Sec.Ft. 21.45 M.G.D.	066 Sec.Ft. .427 M.G.D.	0.2'
3'-0"	5'-6"	3'-8"	5'-4 3/4"	4'	5'-1 7/8"	3'-0"	2'	3'	3"	9"	2"	3"	2.5'	50.4 Sec.Ft. 32.6 M.G.D.	0.97 Sec.Ft. .627 M.G.D.	0.2'
4'-0"	6'-0"	4'-0"	5'-10 5/8"	5'	6'-4 1/4"	3'-0"	2'	3'	3"	9"	2"	3"	2.5'	67.9 Sec.Ft. 44.0 M.G.D.	1.26 Sec.Ft. .815 M.G.D.	0.2'
'-0"	7'-0"	4'-8"	6'-10 3/8"	7'	8'-9"	3'-0"	2'	3'	3"	9"	2"	3"	2.5'	103.5 Sec.Ft. 66.9 M.G.D.	2.63 Sec.Ft. 1.70 M.G.D.	0.25'
-0"	8'-0"	5'-4"	7'-10 1/8"	9'	11'-1 3/4"	3'-0"	2'	3'	3"	9"	2"		2.5'	139.5 Sec.Ft. 90.2 M.G.D.	4.62 Sec.Ft. 2.99 M.G.D.	0.3'


DISCHARGE CURVE
3" PARSHALL FLUME
HEAD—INCHES
0
1
2
3
4
5
6
7
8
9
10
11
12
.100
.200
.300
.400
.500
FLOW IN M.G.D.





NOTE: CONTACT SANITAIRE CORPORATION FOR OTHER DESIGNS AND CONFIGURATIONS FOR SPECIFIC PROJECTS

PROCESS FLOW DIAGRAM
DUAL BASIN ICEAS

DWG. 99-120

ABJ

Sanitaire Corporation

ITT Industries

BROWN DEER, WISCONSIN 53223

FAX TRANSMISSION

Koester Associates, Inc.

From: Peter J. Radosta, P.E.

Phone (315)697-3800
Fax (315)697-3888
E-Fax (425)977-7994
Mobile (315)952-2400
E-mail peter@koesterassociates.com
Address Suite 7, Madison Blvd.
Canastota, NY 13032

Date: August 22, 2001

This fax contains (5) pages, including this page.

Name: Marie Dowd
Company: Delaware Engineering, P.C.
[fax:]

Subj: Crossroads WWTP

Marie,

Attached are ABJ Design Proposal and Sketch for the subject project. We have revised the layout to a two-basin ICEAS to treat the ultimate capacity. During the initial low flow periods, the system can be operated with a single basin in service. Overall, this will minimize the concrete and site work, which will have an overall favorable effect on the project budget.

You will note that we have also revised our process to the "ICEAS-NDN". In order to achieve biological phosphorus removal, we must use a cycle that incorporates periods of anaerobic mixing. Based on the high influent BOD concentration, bio-P removal down to 1 mg/l may be possible in the ICEAS. However, we recommend the inclusion of a chemical feed system to supplement biological removal during periods when the BOD concentration is less than the design concentration or the TP concentration is greater than the design concentration. We would recommend sizing the chemical feed system for a minimum of 50 mg/l alum dosage.

The SBR decant rate has been substantially reduced , utilizing a 4.5x peaking factor as a Peak Hourly Flow. As we discussed, since the 4.5x peaking factor is an instantaneous rate, not to exceed one hour, there is no need to size the ICEAS to treat this flow on a sustained basis. We have sized the system based on a sustained flow of 360,000 GPD, which will facilitate treatment of the Peak Hourly Flow of 498,438 GPD.

$$PWWF = \frac{(PHF \times 1\ hr) + ((ADWF + PHF)/2 \times 2.6\ hr)}{3.6\ hr}$$

$$PWWF = \frac{(498{,}438\ gpd \times 1\ hr) + ((110{,}764\ gpd + 498{,}438\ gpd)/2 \times 2.6\ hr)}{3.6\ hr}$$

PWWF = 358,445 gpd ~ 360,000 gpd

Koester Associates, Inc.

FAX TRANSMISSION
PAGE 2

The revised budgetary price for equipment as listed in TABLE D of the design proposal, including freight and ten days of field service is $210,000.

Please give me a call to discuss if you have any questions.

Thank you.

Pete

8/22/01

CROSSROADS WWTP
DESIGN PROPOSAL

TABLE A
INFLUENT WASTEWATER CHARACTERISTICS AND SITE CONDITIONS

Average Dry Weather Flow	110,764 GPD
Peak Dry Weather Flow	221,528 GPD
Peak Hourly Flow (4.5x ADWF)	498,438 GPD
BOD5 (20°C)	462 mg/l
BOD5 (20°C)	427 lb/day
Suspended Solids	546 mg/l
TKN	45 mg/l
Total Phosphorus	10.00 mg/l
Alkalinity	111 mg/l
Wastewater Temperature	20 °C
Ambient Air Temperature	20 - 90 °F
Site Elevation	500 ft

TABLE B
ICEAS™ EFFLUENT QUALITY (MONTHLY AVERAGE)

BOD5 (20°C)	10.00 mg/l ~~⟶~~ 5.0
Suspended Solids	10.00 mg/l
NH3-N	1.10 mg/l
Total Phosphorus	1.00 mg/l

Notes:
1. Tertirary treatment will be required to produce the required effluent quality of 5 mg/l BOD and 0.5 mg/l TP.
2. Back-up chemical feed is recommended to supplement bio-P removal.

TABLE C
ICEAS PROCESS DESIGN CRITERIA

F / M	0.065 lb BOD5/ lb MLSS / day
SVI (after 30 minutes settling)	150 ml/g
MLSS at Bottom Water Level	4,979 mg/l
Waste Sludge Produced (Approx.)	376 lb/day
Volume of Sludge Produced (Approx., 0.85% solids)	5,304 GPD
Normal Decant Rate	433 GPM
Peak Decant Rate	600 GPM
Hydraulic Retention Time	1.59 Days
Sludge Age	17.07 Days

CYCLE	MIXING	AERATION	SETTLE	DECANT	TOTAL
Normal	48 min	120 min	60 min	60 min	4.8 hour
Storm	36 min	90 min	45 min	45 min	3.6 hour

8/22/01

TABLE D
KEY ICEAS DESIGN DETAILS

Number of ICEAS Basins	2
Top Water Level	15.00 ft
Basin Width	17.00 ft
Basin Length	53.00 ft
Bottom Water Level	11.81 ft
No. of Sludge Holding Tanks	1
SHT Top Water Level	15.00 ft
SHT Width	11 ~~16.00 ft~~
SHT Length	53 ~~35.00 ft~~
Sludge Storage Time	20 days

ICEAS EQUIPMENT			Motor HP	No. Req.
Decanter Mechanism	4.0 ' Weir length		1 /Basin	2
Decanter Drive Unit			1/2	2
ICEAS Blower	240 SCFM	7.2 PSIG	15	2
ICEAS Fine Bubble Aeration System				2
Air Control Valve	4 "			2
Waste Sludge Pump	45.0 GPM		1.7	2
Submersible Mixer			4.0	2
ICEAS Controls				1
D.O. Control				2
SHT Blower	134 SCFM	7.5 PSIG	7.5	2
SHT Aeration System				1

ICEAS POWER REQUIREMENTS	(At Average Aeration Depth)				Kwh/Day
Decant Drive Unit	0.4 BHP	2 run	@	5 Hrs/day	2.98
ICEAS Air Blower	9.9 BHP	1 run	@	20 Hrs/day	147.00
Waste Sludge Pump	1.4 BHP	2 run	@	5 Hrs/day	10.15
Submersible Mixer	3.2 BHP	2 run	@	4 Hrs/day	19.10
				KWH/DAY	179.23
			AVERAGE	KWH/HR	7.47

SHT power requirements are dependent on actual operation.

ICEAS-NDN PROCESS: BIOLOGICAL NUTRIENT REMOVAL (BNR)

Designed for the Removal of:

- BOD
- TSS
- Ammonia
- Total Nitrogen
- Total Phosphorous

Typically Used for:

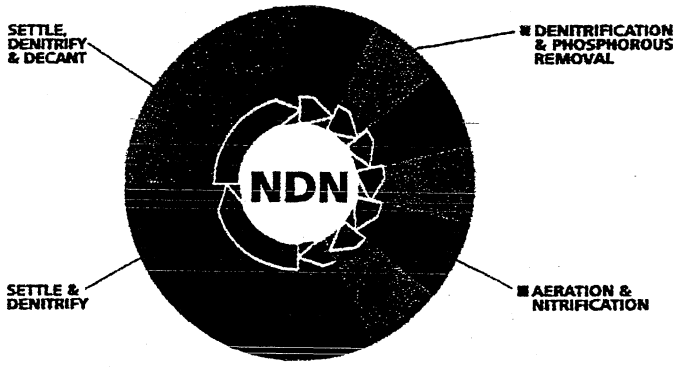
- Municipal Wastewater
- Industrial Wastewater

Biological nutrient removal is accomplished in the ICEAS-NDN process by incorporating alternating phases of oxic-anoxic/anaerobic (air on-air off) conditions in the cycle as shown in Figure 13. The ICEAS basin is sized to ensure complete nitrification, denitrification and to maximize the total biological phosphorus removal.

Typical normal and storm cycles using 2 basins for the ICEAS-NDN process are shown in Figure 14 and 15. The aerobic phases promote BOD removal, nitrification and phosphorus uptake. The anoxic/anaerobic (air off) phases promote denitrification and phosphorus release. Nitrification rates and sludge age requirements for the nitrification process are calculated based on the temperature range and pH of the influent wastewater.

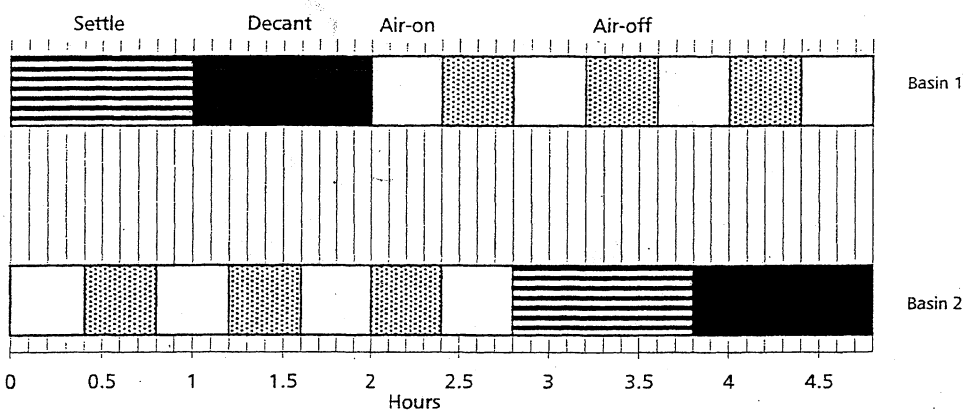
The degree of denitrification and phosphorus removal achieved by the ICEAS-NDN process is dependant on the influent BOD/TN and BOD/TP ratios. The typical blower control for the ICEAS-NDN process involves a D.O. control system with blower output control.

Figure 13



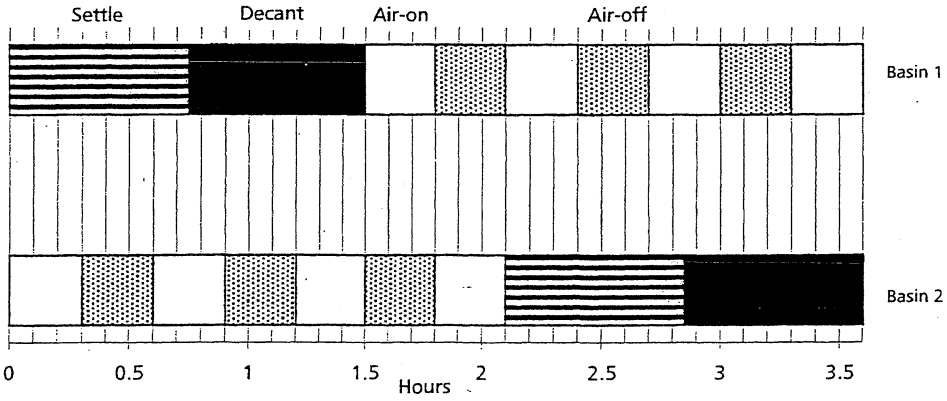
Normal Cycle Operational Sequence of ICEAS-NDN Process

Figure 14



Storm Cycle Operational Sequence of the ICEAS-NDN Process

Figure 15



ABJ™

AERATION SYSTEMS
FINE BUBBLE MEMBRANE DISC

DESIGN

The SANITAIRE® Membrane Disc Aeration System provided for an ABJ ICEAS or SBR installation is a complete package, including all in-basin pipe, diffuser assemblies, supports and anchor bolts. Typically, ABJ facilities include a single aeration grid in each basin. Although some larger facilities do employ the use of multiple grids in each basin, an aeration grid is defined as a group of diffusers that is serviced by a single aeration dropleg.

The SANITAIRE Membrane Disc Aeration System makes use of only the highest quality materials. All PVC materials contain a minimum of 2+% titanium oxide to prevent UV degradation. All supports and anchors are constructed of 18-8 stainless steel, with an option for 316 stainless steel. Finally, the membrane diffusers themselves are produced with an advanced EPDM material, promoting extended diffuser life.

The SANITAIRE Membrane Disc Diffuser Assembly consists of:

- A saddle-type diffuser holder which is factory solvent welded to the crown of the air distributor
- A convex baseplate which supports the membrane when air is not being delivered
- A membrane element
- A mason jar type retainer ring

The diffuser assembly uses an integral check valve to prevent the intrusion of mixed liquor into the piping system during periods when the air is turned off. When air is discontinued to the aeration grid, the membrane element collapses onto the baseplate. The non-perforated, inner portion of the membrane element covers the hole in the center of the baseplate forming a watertight seal.

ADDITIONAL FEATURES

Performance/Experience – Efficiency of a SANITAIRE Fine Bubble Aeration System is unparalleled by any other fine bubble technology. Considering the significance of aeration in the overall power demands of a wastewater treatment plant, use of a highly efficient aeration system can save a significant amount of money over the life of the plant. Estimated performance of a SANITAIRE brand aeration system is substantiated by actual clean water oxygen transfer test data from the most extensive database in the industry. All Sanitaire test data is based on full conformance with the American Society of Civil Engineers (ASCE) Clean Water Oxygen Transfer Testing Method, the most rigorous testing standard in the world. No other aeration manufacturer can offer this level of experience and expertise.

Advanced Engineered Membrane Material – The technologically advanced SANITAIRE *Silver Series* membrane diffuser has been engineered to provide long membrane life and high efficiency, reducing both operation and maintenance costs. The design and formulation is based on over fifteen years of research and development. Side-by-side, in-waste field-testing has demonstrated that this premium quality material is more resistant to chemical attack and the physical forces encountered during long term operation in a wastewater treatment environment. While many diffusers may be similar in appearance, none provide the consistent performance of the SANITAIRE Engineered Membrane.

Piping/Support System – One of the primary design considerations for a PVC piping system is how to deal with expansion and contraction. PVC has a high coefficient of expansion and can be expected to

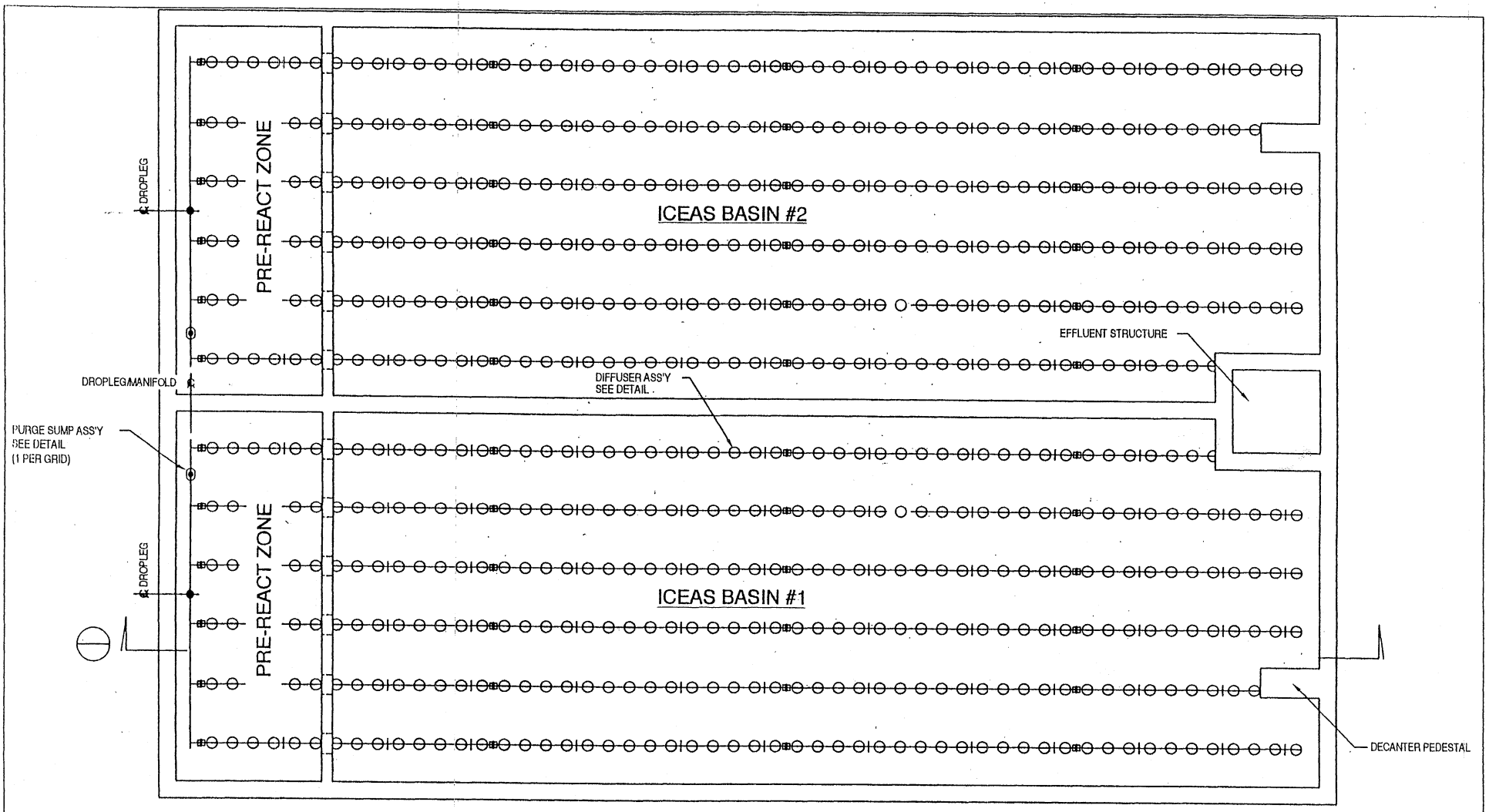
expand and contract up to 4" in a 100-foot length, over a temperature range of 100° F. SANITAIRE Fine Bubble Aeration Systems employ a design philosophy, which minimizes the use of expansion joints in the piping system. Expansion and contraction is accommodated through the use of fixed joints and guide-type supports, which do not grip the pipe. While expanding and contracting, the PVC pipe is allowed to freely slide through the support clamps. This type of support system has been field proven to be superior to the alternate method of using expansion joints and fixed supports. This alternate type of support system allows movement to take place inside the expansion joint and is prone to "blow apart". Numerous competitive aeration systems have been replaced with SANITAIRE Aeration Systems due to piping system failure.

POWER CONSIDERATIONS

In addition to mechanical integrity and system longevity, prudent engineering practice requires consideration of the efficiency of the aeration system. The evaluation must consider the total power required to make the aeration system functional. For example, the power evaluation for a jet aeration system must include the power required to operate the motive pumps as well as the aeration blowers.

In a typical Activated Sludge application, the energy required for aeration can account for 50 to 80 percent of the plants' total consumption. Use of a highly efficient aeration system can yield substantial cost savings.

The following comparison of various types of aeration in an SBR application illustrates the importance of aeration system efficiency.



PLAN VIEW

FINE BUBBLE AERATION LAYOUT

DWG. 99-200

ABJ™ Sanitaire Corporation
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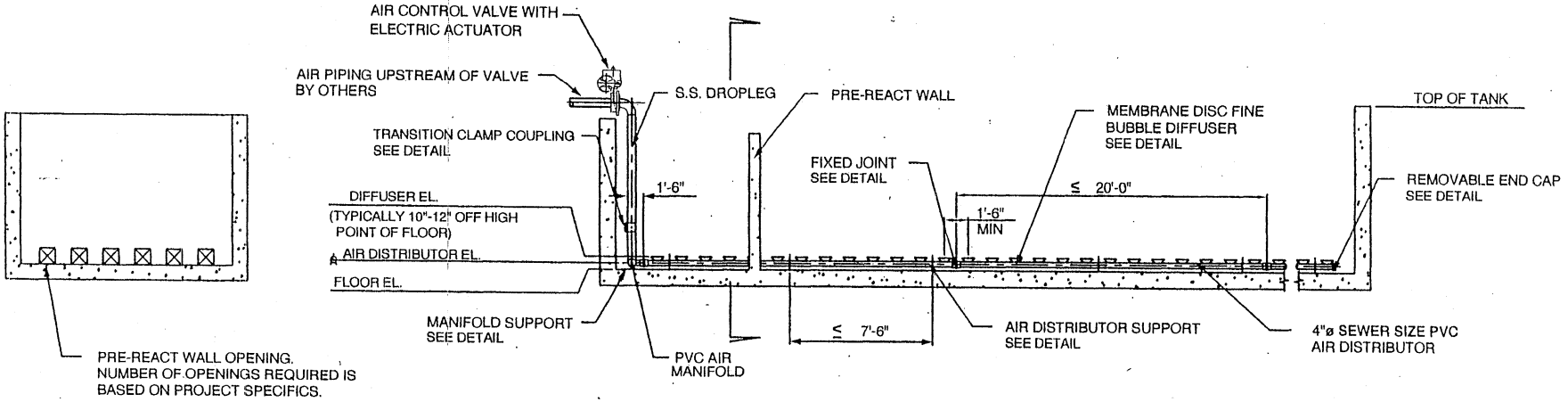
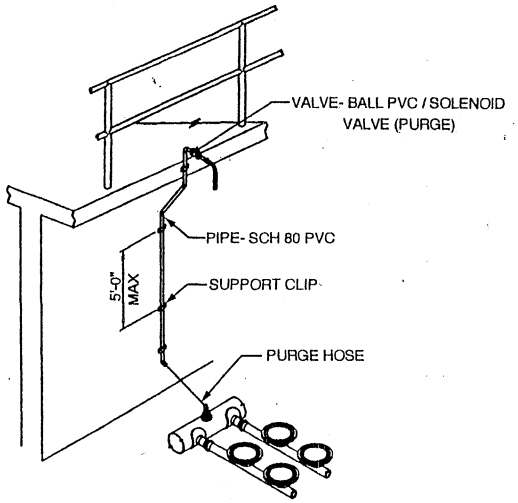


SECTION



PURGE SUMP ASSEMBLY

FINE BUBBLE AERATION SYSTEM
SECTION AND DETAILS

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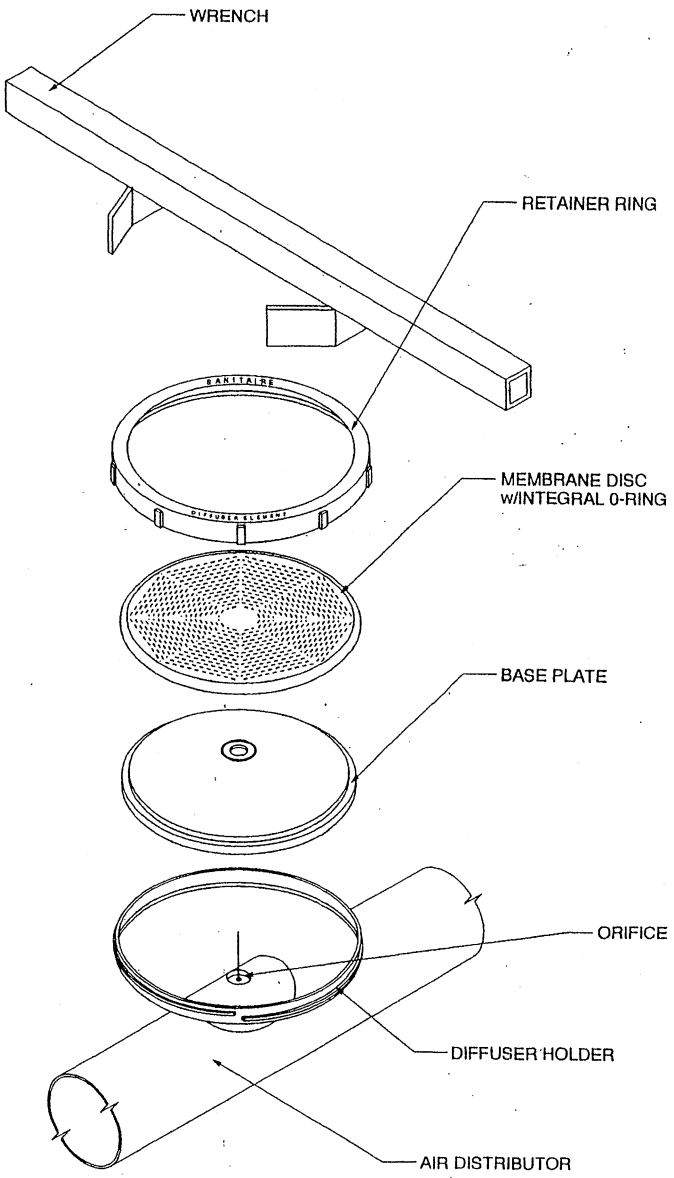
DWG. 99-210



MEMBRANE DISC FINE BUBBLE DIFFUSER

FINE BUBBLE DIFFUSER
ASSEMBLY

DWG. 99-220

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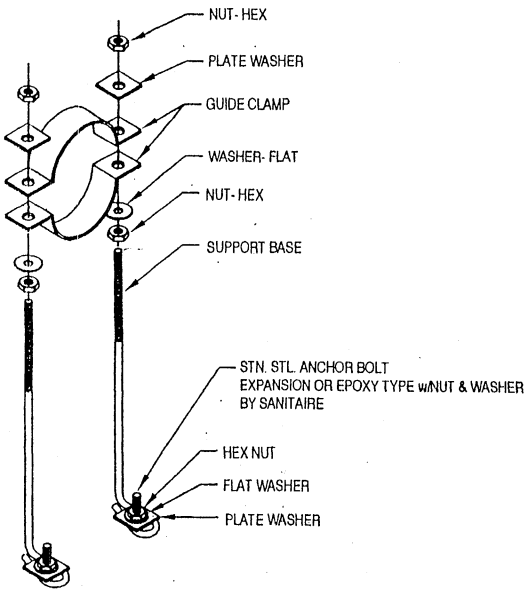
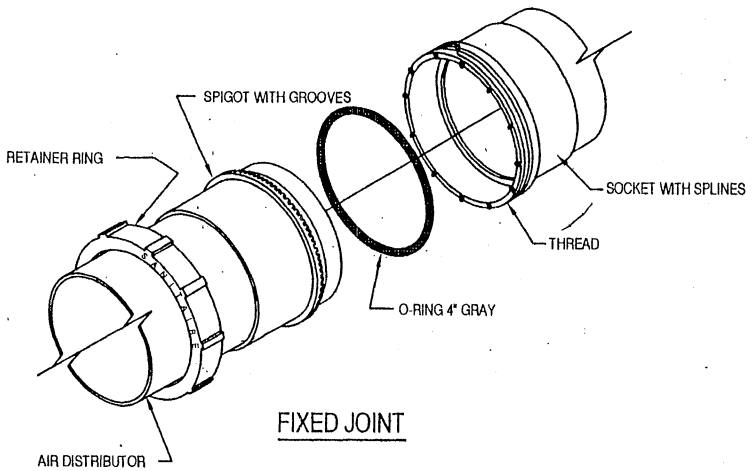
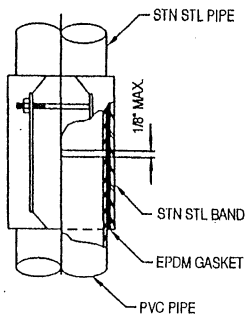


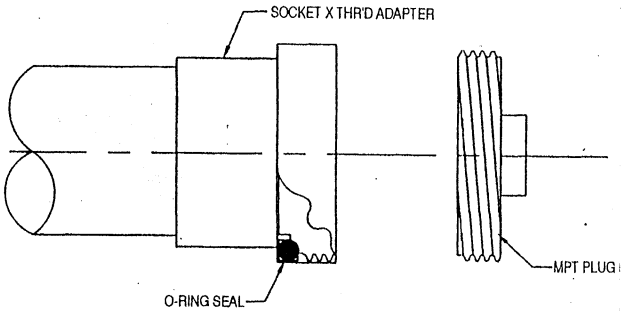
MANIFOLD SUPPORT
(STAINLESS STEEL)



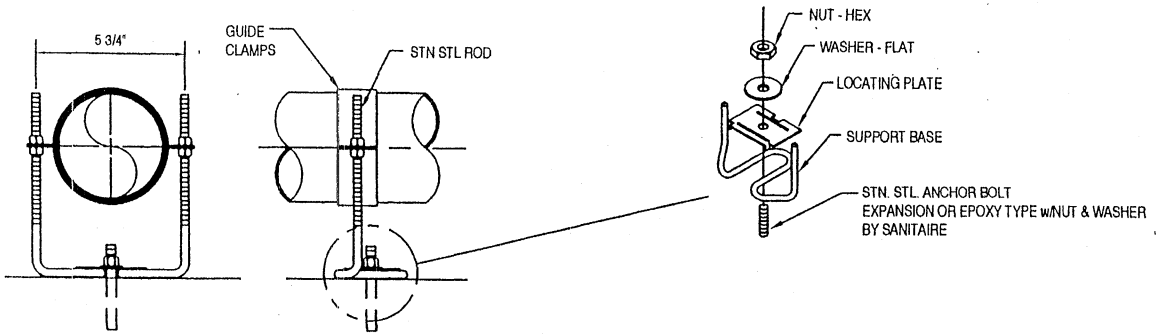
FIXED JOIN



TRANSITION CLAMP COUPLING
(FOR DROPLEG)



REMOVABLE END CAP



AIR DISTRIBUTOR SUPPORT
(STAINLESS STEEL)

FINE BUBBLE AERATION SYSTEM
TYPICAL DETAILS

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DWG. 99-230

ABJ™

DECANTER

DESIGN

A key piece of equipment in any SBR system is the decanter. Through years of experience, we have developed a high quality, advanced engineered decanter mechanism. The basic components of the ABJ decanter include:

- Effluent collection trough with integral overflow weir
- Scum exclusion float
- Seal and bearing assemblies
- Electromechanical actuator

The decanter is fabricated of stainless steel. The stainless steel construction provides a prolonged life with little or no maintenance. The decanters are passivated after welding to retain the stainless steel's corrosion resistance. The rugged construction has been field proven to operate dependably in harsh conditions. All seals and bearings are constructed of synthetic materials for prolonged service life, do not require lubrication and ship factory assembled, simplifying installation. Stainless steel is used in lieu of alternatives such as fiberglass reinforced plastic (FRP) due to its high resistance to degradation from ultraviolet rays and its ability to withstand temperature changes.

The scum exclusion float is located in front of the decanter overflow weir and is designed to act as a baffle, preventing scum and floatables from entering the effluent collection trough. See drawing 99-410 for details of this component.

A linear drive actuator slowly drives the decanter into the clarified liquid. The actuator motor is mounted at the basin walkway, not in the basin. This allows access and service from the walkway without the need to enter the basin full of sewage. ***Floating decanters do not offer this option.*** The actuator used for the ABJ decanter incorporates redundant limit switches at the top and bottom of travel to ensure reliable operation. See drawing 99-450 for specific details.

The ABJ decanter does not require effluent valves, controls, valve vaults, troublesome flex (knee) joints, throttling arrangements or dewatering supports. This eliminates the capital and maintenance costs of these components and the risks associated with valve failures (i.e. solids carryover and effluent quality deterioration).

OPERATION

The decanter is raised and lowered using an electromechanical actuator. The decanter sits in the "park" position located above the top water level (TWL) during the aeration and settle phases of the operating cycle, thereby eliminating any possibility of solids carryover during these periods. During the decant phase, the decanter travels from the top "park" position to the bottom water level position (BWL), generally 3 to 6 feet and consistently withdraws only the uppermost supernatant from the basin.

Since the decanter draws liquid from the top down, it does not entrain solids that are settling. The scum float mounted in front of the weir also prevents floatables from entering the effluent. When the decanter enters the liquid, the scum float and scum plate is in contact with one another preventing flow into the effluent trough. The float then separates from the scum plate after the bottom of the

float is submerged. The clear supernatant is then allowed into the trough (a couple inches below the surface) between the float and the scum plate. The slow descent of the decanter does not disrupt the sludge blanket in front of the float.

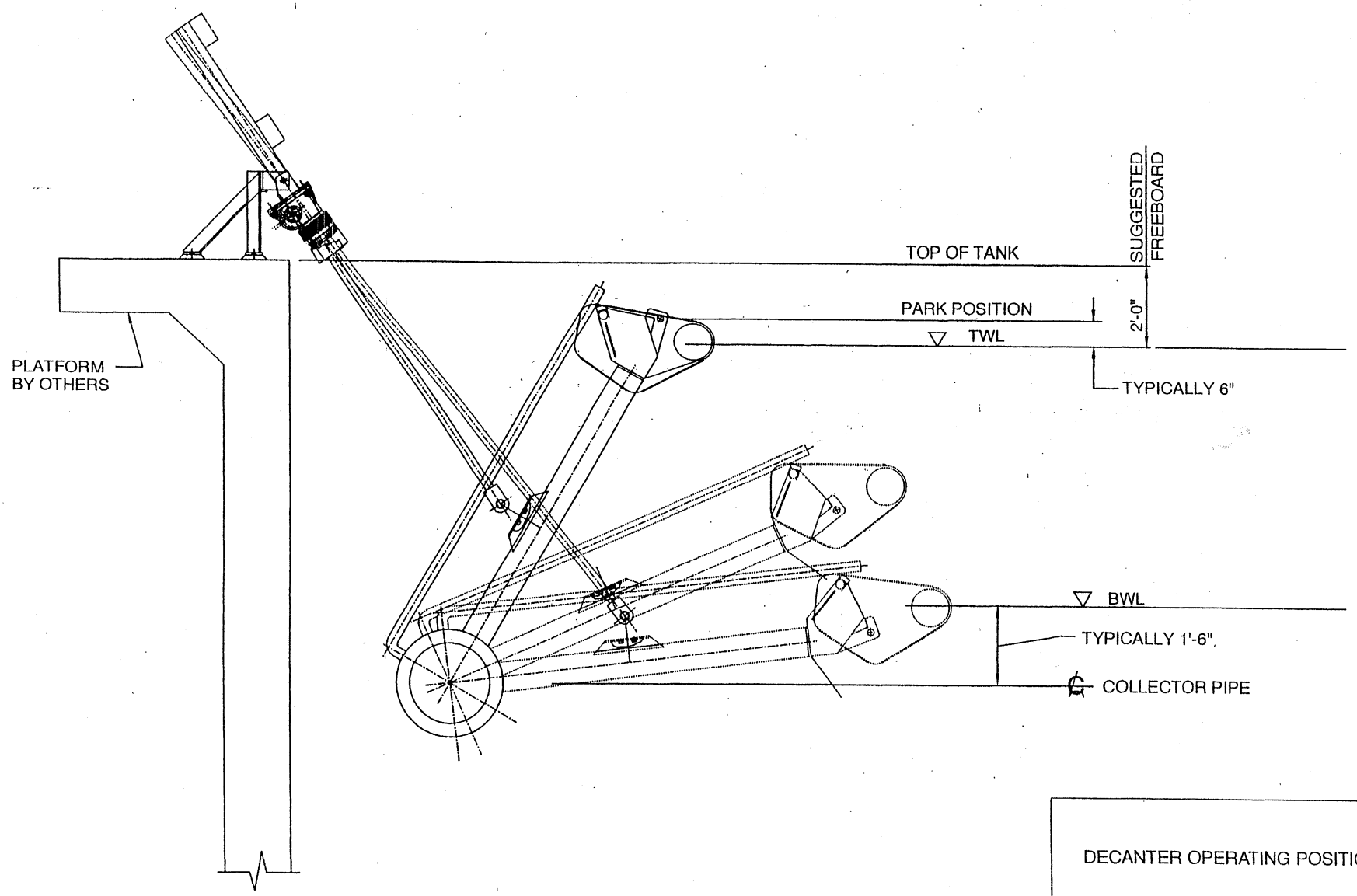
In the park position, the decanter is located above the TWL and below the top of the basin wall, which provides "fail safe" overflow protection in the event of a power failure or severe flood. The decanter scum exclusion float will prevent the carry over of any floatables during such emergency periods. In addition, the park position eliminates the need for air seal or valves to prevent leaking and/or solids entry.

The decanter speed is controlled by a series of pulses or through the use of a variable frequency drive (VFD). As a result, the decanter discharge rate is relatively constant from the time the decanter enters the water to the time it reaches the bottom water level (BWL). In the case of storm flows, the speed is automatically adjusted to accommodate these flows. The flexibility to adjust the decant rate facilitates treatment of high flows without compromising the total aeration or settling time in the system. ***Systems using floating or fixed decanters do not have the ability to adjust the decant rate.*** With these types of decanters, the only way to accommodate higher flows is to increase the decant time, thus decreasing the time allotted for aeration and settling. This ultimately leads to deterioration of the effluent quality.

The limit switches are fully integrated with process control time overrides and interlocks, thereby eliminating the potential for blower activation during decant.

SPECIAL ATTRIBUTES

- Stainless Steel Construction – Provides a corrosion resistant, long lasting decanter mechanism.
- Visible Effluent – This open trough decanter design allows the plant staff to observe the effluent at all times during the decant phase ("If it looks good, it's operating good"). Floating decanters do not offer this option.
- Maintenance – All maintenance can be performed without entering the basin.
- Emergency Overflow – The park position of the decanter prevents liquid from overflowing the tank in case of flooding and/or power outages. ***Again, floating decanters do not offer this option.***
- Uniform Discharge Rate – The ABJ decant system provides a uniform discharge rate, minimizing downstream process requirements and simplifying the design.
- Installation – The decanters are shipped with all of the major components pre-assembled.
- Time Proven – The ABJ decanter has been installed and is operating successfully in hundreds of facilities around the world in a wide range of climatic conditions.



DECANTER OPERATING POSITIONS

ABJ™ Sanitaire Corporation
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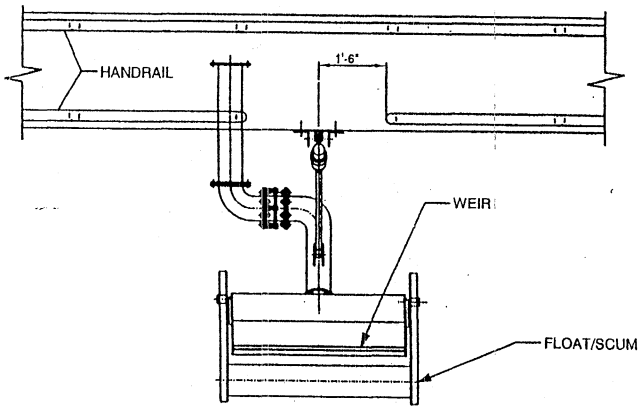
BROWN DEER, WISCONSIN 53223

DWG. 99-400

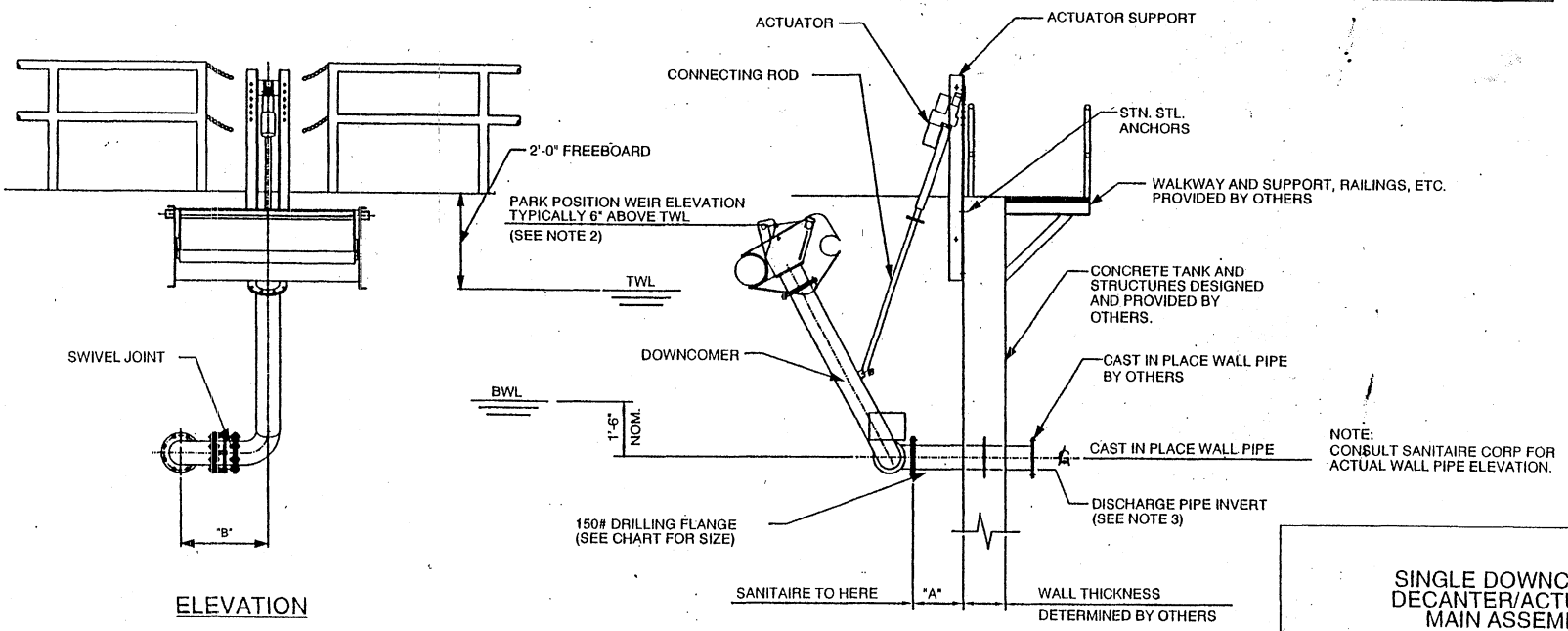


PLAN VIEW

NOTES:

1. ALL SUBMERGED MATERIALS ARE STAINLESS STEEL.
2. PARK POSITION IS USED TO KEEP THE FLOAT ABOVE THE WATER LEVEL DURING AERATION.
3. DOWNSTREAM WATER LEVEL SHOULD NOT EXCEED THIS INVERT ELEVATION.
4. ACTUATOR EQUIPMENT PLATFORM SHOULD BE LARGE ENOUGH TO ALLOW FOR INSPECTION AND SERVICE AND PROPERLY GUARDED FOR SAFETY AS NEEDED.

WEIR LENGTH	"A"	"B"	CAST IN PLACE PIPE SIZE
1'-6"	4"	18"	4"ø
3'-0"	11 3/4"	24 1/2"	6"ø
4'-0"	11 3/4"	24 1/2"	6"ø
5'-0"	11 3/4"	32 1/2"	8"ø
6'-0"	11 3/4"	32 1/2"	8"ø



ELEVATION

SINGLE DOWNCOMER DECANTER/ACTUATOR MAIN ASSEMBLY

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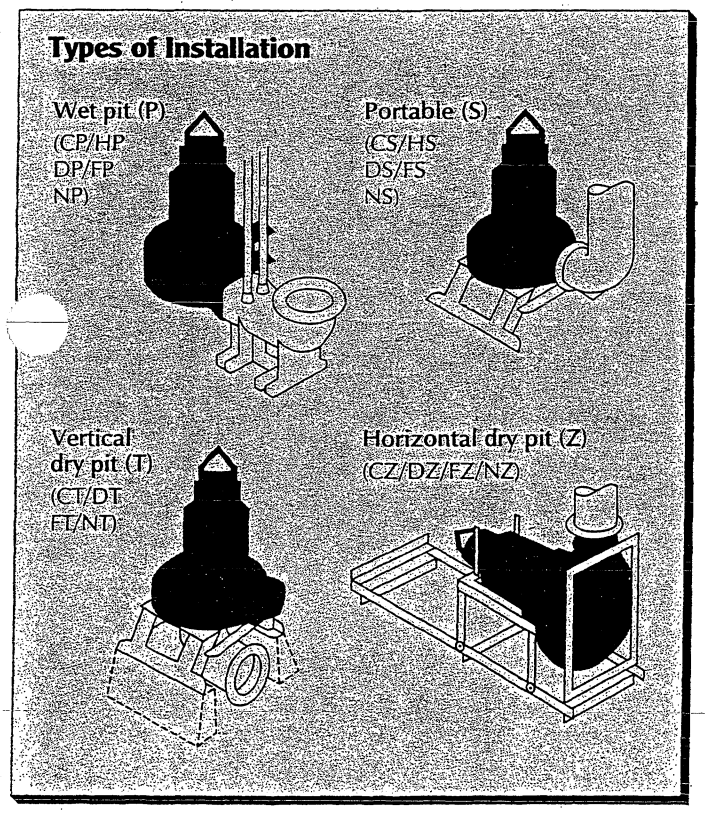
DWG. 99-410

Flygt Submersible Pumps



On the cover: One of the four Flygt model CP 3231, 250HP wastewater pumps installed in lift station at Duckett Creek Sanitary District, St. Charles County, MO. This pump installation along with a state of the art Treatment plant, is part of an EPA award-winning project to spur development in the fastest growing county in the state.

Engineers and operators appreciate the compact, heavy-duty design of Flygt submersible pumps. It's a fact, that much of our reputation results from years of successful operation in difficult applications, often after replacing equipment which didn't live up to expectations. With over 50 years of experience in the design and application of heavy duty submersible pumps, we don't mind the challenge. Today, well over 1.5 million Flygt installations around the world give testimony to the dependability of our products.

In new installations, compact Flygt units can be installed directly on the floor of the wet pit using a simple automatic discharge connection and guidebars. The single pit "P" style mount eliminates the need for a separate dry pit, which reduces construction costs by 60% in concrete and excavation work alone.

With its "T" stand, the pump mounts in the vertical centrifugal dry pit configuration, in-line with the piping system. The inherent flood-proof design and close coupling of motor to wet end makes this the ideal replacement choice for vertically mounted, close coupled or long shaft pumps located in existing dry pits. The pump can also be provided for non-submerged operation in the "Z" configuration, mounted in the horizontal dry pit configuration for easy "back pull-out" inspection and maintenance.

The "S" style mount, utilizes a heavy duty stand and elbow for easy hose or pipe connection, making it perfect for emergency bypass and other temporary pumping applications.

Flygt offers the broadest, most complete range of heavy duty submersible pumps available... pumps with the size, capacity and characteristics to fit any solids handling application.

- Six different impeller types:
  1. Semi-open non-clog solids handling (N).
  2. Closed, non-clog solids handling (C).
  3. Closed or semi-open for abrasive slurry (H).
  4. Vortex for abrasive and difficult solids handling (D).
  5. Open, chopper for fibrous waste/difficult applications (F).
  6. Semi-open grinder impeller with hardened cutter (M).
- Cast iron, stainless steel or aluminum bronze models.
- Capacities to 50,000 GPM, heads to 400 ft.
- Discharge sizes: 1.5"-36", motors to 1,000 HP.
- Factory Mutual approval for use in hazardous locations.
- Standard operation to 105°F (40°C) ambient or warm liquid option to 195°F (90°C).

All major components of every Flygt pump... seals, electric motor, impeller, etc. are manufactured by Flygt to our own rigid standards. When long term dependability and total evaluated costs are important, specify the best... specify Flygt.

TYPICAL PUMP FEATURES

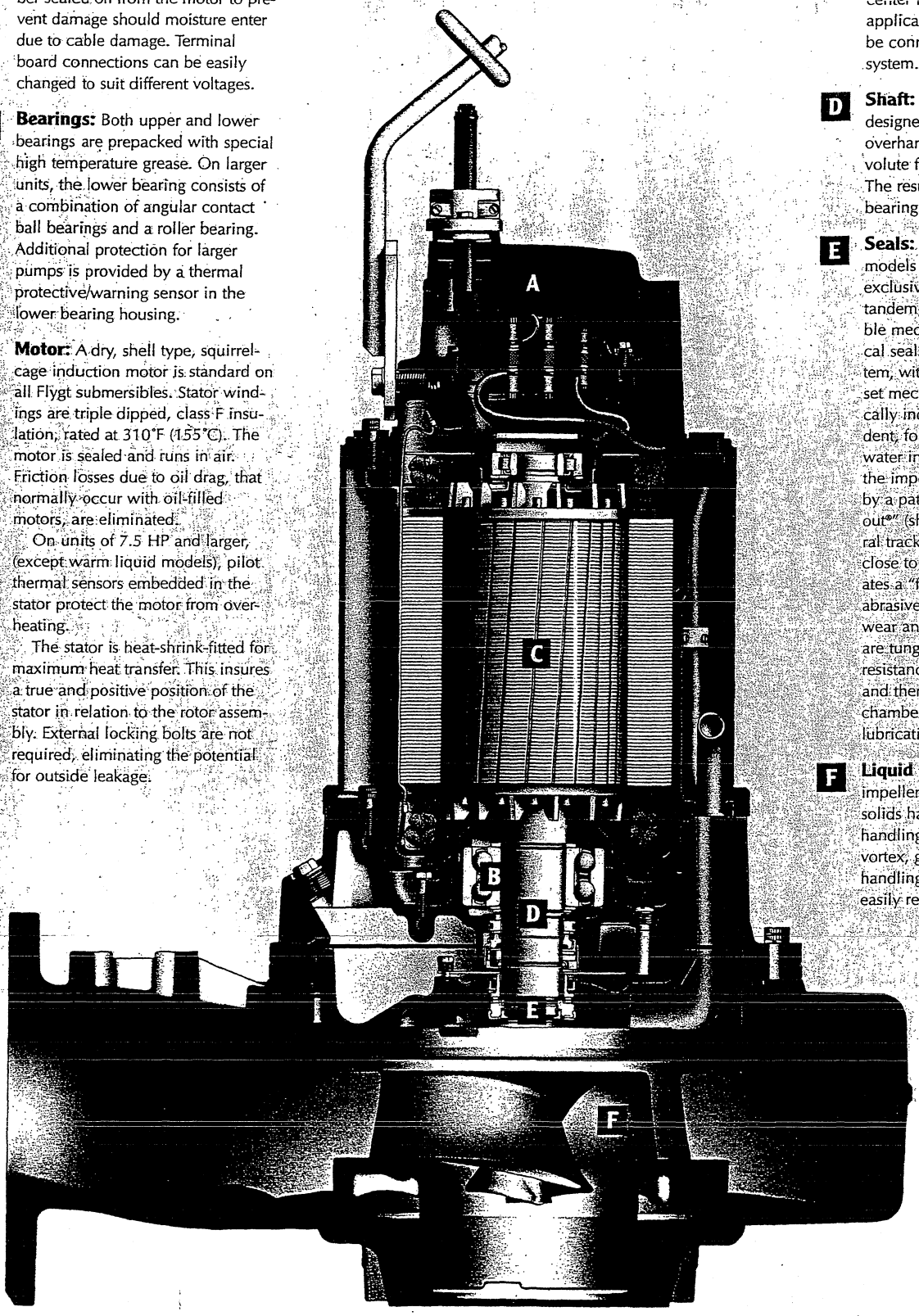
A **Junction Chamber:** All electric cables enter through a patented sealing gland, with junction chamber sealed off from the motor to prevent damage should moisture enter due to cable damage. Terminal board connections can be easily changed to suit different voltages.

B **Bearings:** Both upper and lower bearings are prepacked with special high temperature grease. On larger units, the lower bearing consists of a combination of angular contact ball bearings and a roller bearing. Additional protection for larger pumps is provided by a thermal protective/warning sensor in the lower bearing housing.

C **Motor:** A dry, shell type, squirrel-cage induction motor is standard on all Flygt submersibles. Stator windings are triple dipped, class F insulation, rated at 310°F (155°C). The motor is sealed and runs in air. Friction losses due to oil drag, that normally occur with oil-filled motors, are eliminated.

On units of 7.5 HP and larger, (except warm liquid models), pilot thermal sensors embedded in the stator protect the motor from overheating.

The stator is heat-shrink-fitted for maximum heat transfer. This insures a true and positive position of the stator in relation to the rotor assembly. External locking bolts are not required, eliminating the potential for outside leakage.



Model N-3201, 47 HP

Pumps of 15HP and larger have an integral cooling jacket system, that allows unit to pump down to the center line of the volute. For special applications, the cooling jacket can be connected to an external cooling system.

D **Shaft:** Every Flygt pump is designed with a very short shaft overhang. Shaft deflection due to volute forces is virtually eliminated. The result is a dramatic increase in bearing and seal life.

E **Seals:** All models use an exclusive dual tandem, double mechanical seal system, with each set mechanically independent, for added protection against water intrusion. The set closest to the impeller is now also protected by a patented feature called "Spin-out®" (shown above). A unique spiral track in the seal chamber wall, close to the spinning impeller, creates a "flushing" action, forcing abrasive particles away, to reduce wear and extend seal life. Seal faces are tungsten carbide for maximum resistance to corrosion, abrasion and thermal shock, and operate in a chamber filled with FDA approved lubrication.

F **Liquid end:** Six distinct types of impellers are available: standard solids handling, semi-open solids handling (shown), heavy duty slurry, vortex, grinder and fibrous waste handling chopper. Wear rings are easily replaceable.

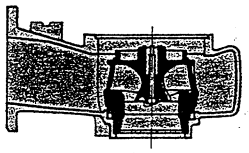
MODELS

HYDRAULIC ENDS

Flygt submersibles are available in a variety of liquid ends, materials and special purpose models for wet pit and dry pit installation.

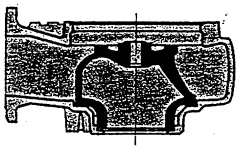
Solids Handling (N)

Semi-open non-clog impeller for large solids.



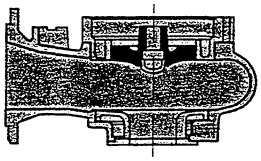
Solids Handling (C)

Closed non-clog solids handling impeller.



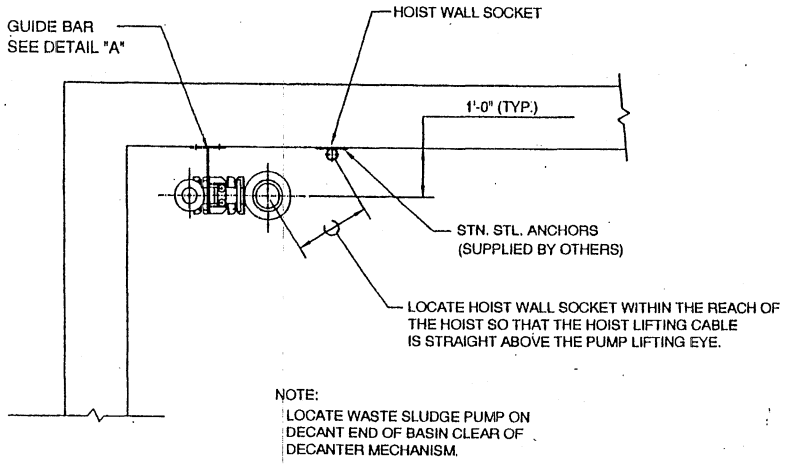
Vortex (D)

Semi-open vortex impeller for abrasive large solids handling capability.

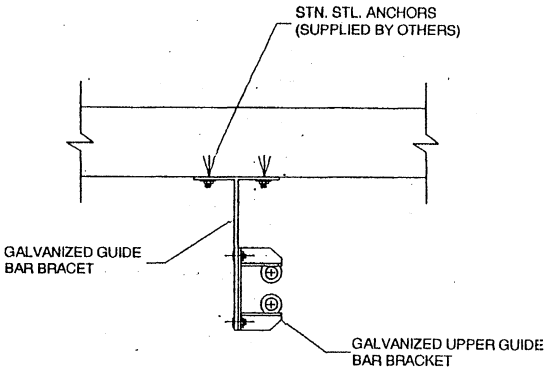


Model No.	Discharge Size (inches)	Max. Power Output (HP)	NP	NT	NZ	NS	CP	CT	CZ	CS	DP	DT	DZ	DS
3060	3	3.7					■			■	■	■	■	■
3067	2, 3	2.0					■			■	■			■
3075	3	1.7					■			■				
3080	3	9.0					■			■	■			■
3085	3	4.0					■			■	■			■
3085/82	3, 4	3.0					■	■	■	■				
3102	4, 6, 8	5.0					■	■	■	■	■[1]			■
3126	4	10												
3127	4, 6, 8	10	■	■	■	■	■	■	■	■	■[1]			■
3140	4, 6, 10	15	■	■	■	■	■			■	■[1]			■[1]
3152	4, 6, 8, 10, 12	23	■	■	■	■	■	■	■	■	■[1]			■
3170	4, 6, 8, 10, 12	30	■	■	■	■	■	■	■	■				
3201	6, 8, 10, 12	47	■	■	■	■	■	■	■	■				
3231	8	335					■	■	■	■				
3300	6, 8, 10, 12, 14	160	■	■	■	■	■	■	■	■				
3306	12, 14	215					■	■	■	■				
3312	12, 14	470					■	■	■	■				
3351	14	1000					■	■	■	■[1]				
3356	14	280					■	■	■	■[1]				
3400	16	470					■	■	■	■[1]				
3501	20	325					■	■	■	■[1]				
3531	20	720					■	■	■	■[1]				
3602	24	500					■	■	■	■[1]				
3800	32	800					■	■	■	■[1]				

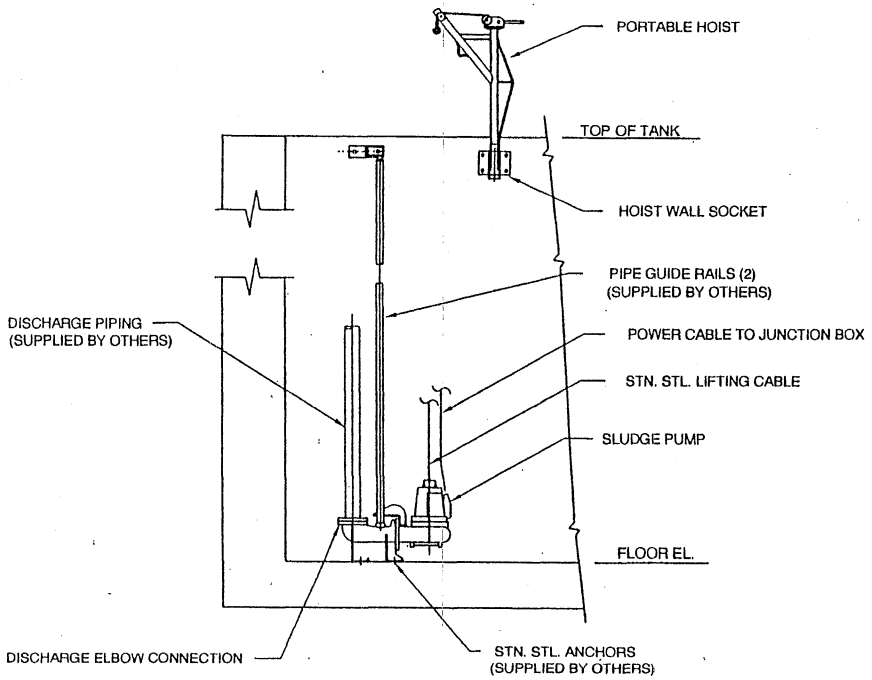
[1] Special order

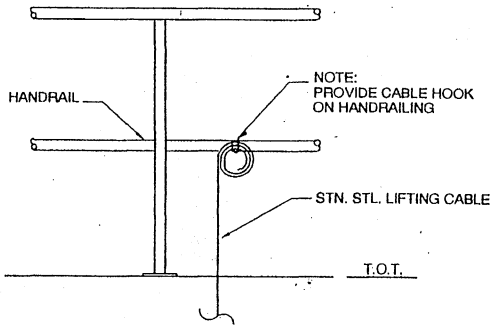


NOTE:
LOCATE WASTE SLUDGE PUMP ON DECANT END OF BASIN CLEAR OF DECANTER MECHANISM.



DETAIL (A)





DETAIL (B)

WASTE SLUDGE PUMP TYPICAL ARRANGEMENT

DWG. 99-500

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ABJ™

AERATION BLOWERS

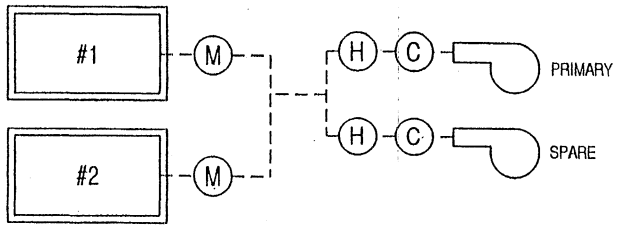
DESIGN

The blower system is designed to provide sufficient airflow to meet the system process requirements. Blower systems are available with either positive displacement (PD) or centrifugal type units. Typically, PD units are used for plants having smaller air volume requirements. Output airflow from a PD blower remains relatively constant with varying discharge pressure. Output airflow from a centrifugal blower varies with varying discharge pressure. Centrifugal blower systems are generally equipped with additional controls to regulate the flow as the discharge pressure varies.

FEATURES

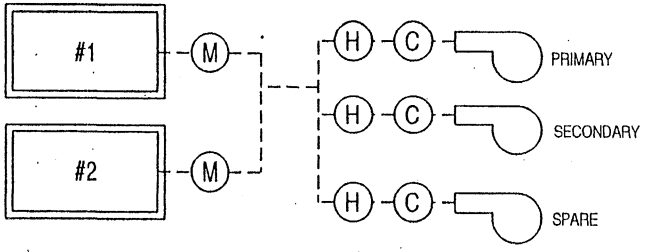
Positive displacement blower systems are generally equipped with the following items: blower, motor, inlet filter, inlet silencer, flexible connectors, discharge silencer, pressure relief valve, isolation butterfly valve, check valve, discharge pressure gauge, temperature gauge and inlet filter pressure gauge. The are assembled as a prepackage at the factory prior to shipment. For additional levels of safety, pressure, temperature and motor cutout switches can be provided. If reduced noise levels are necessary for environmentally sensitive areas, an encompassing sound enclosure can be provided.

Centrifugal blower systems are generally equipped with the following items: blower, motor, inlet filter, automatic inlet butterfly valve, flexible connectors, check valve, discharge pressure gauge, temperature gauge, inlet filter gauge and an independent control/ monitoring panel for surge and overload. Additional levels of equipment can include bearing and vibration monitoring devices as a means of protecting the investment.



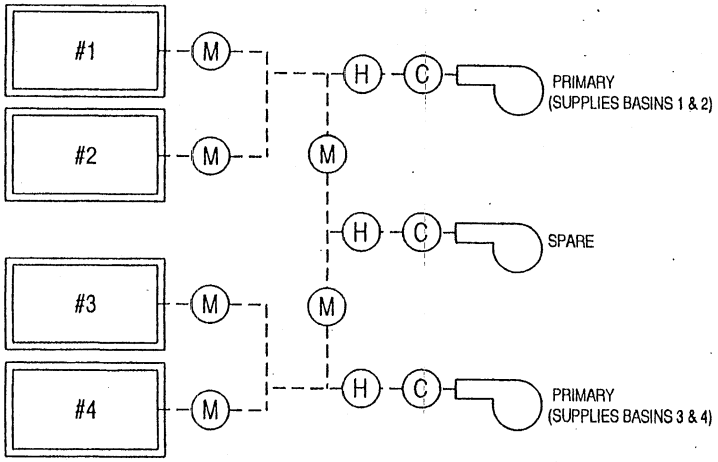
2 BASINS - 2 BLOWERS

(TWO BLOWERS DESIGNED AT 100% CAPACITY EACH)



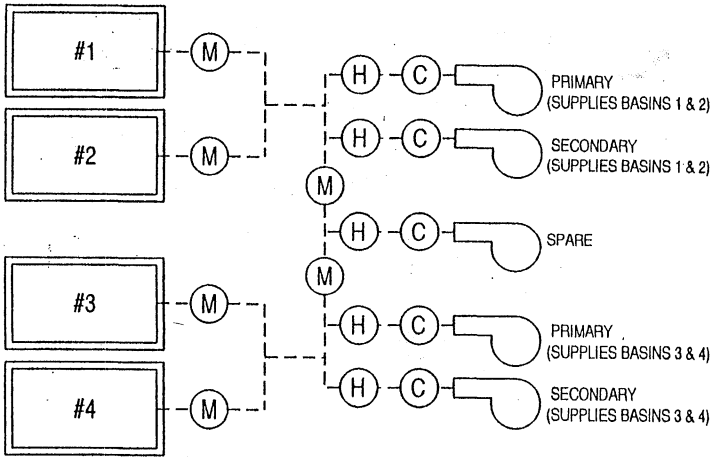
2 BASINS - 3 BLOWERS

(THREE BLOWERS DESIGNED AT 50% CAPACITY EACH)



4 BASINS - 3 BLOWERS

(THREE BLOWERS DESIGNED AT 100% CAPACITY EACH)



4 BASINS - 5 BLOWERS

(FIVE BLOWERS DESIGNED AT 50% CAPACITY EACH)

NOTES:

1. BLOWER CAPACITY (50% OR 100%) REFERS TO THE AIR REQUIRED FOR ONE BASIN.
2. THE BASINS OPERATE IN PAIRS WITH THE BLOWERS ALTERNATING BACK AND FORTH.
3. SPARE BLOWERS SHOULD BE REGULARLY ROTATED INTO THE SYSTEM FOR EXERCISE. THIS CAN BE ACCOMPLISHED MANUALLY OR AUTOMATICALLY.

LEGEND

- (M) - MOTORIZED VALVE
- (H) - HAND OPERATED VALVE
- (C) - CHECK VALVE

TWO & FOUR BASIN BLOWERS/PIPING ARRANGEMENT EXAMPLES

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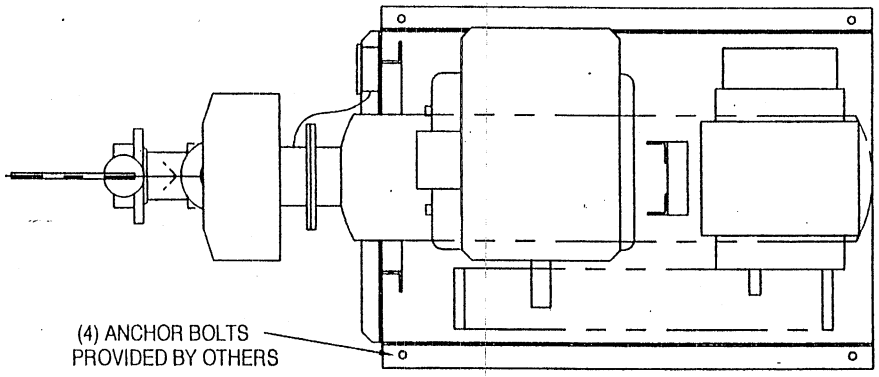
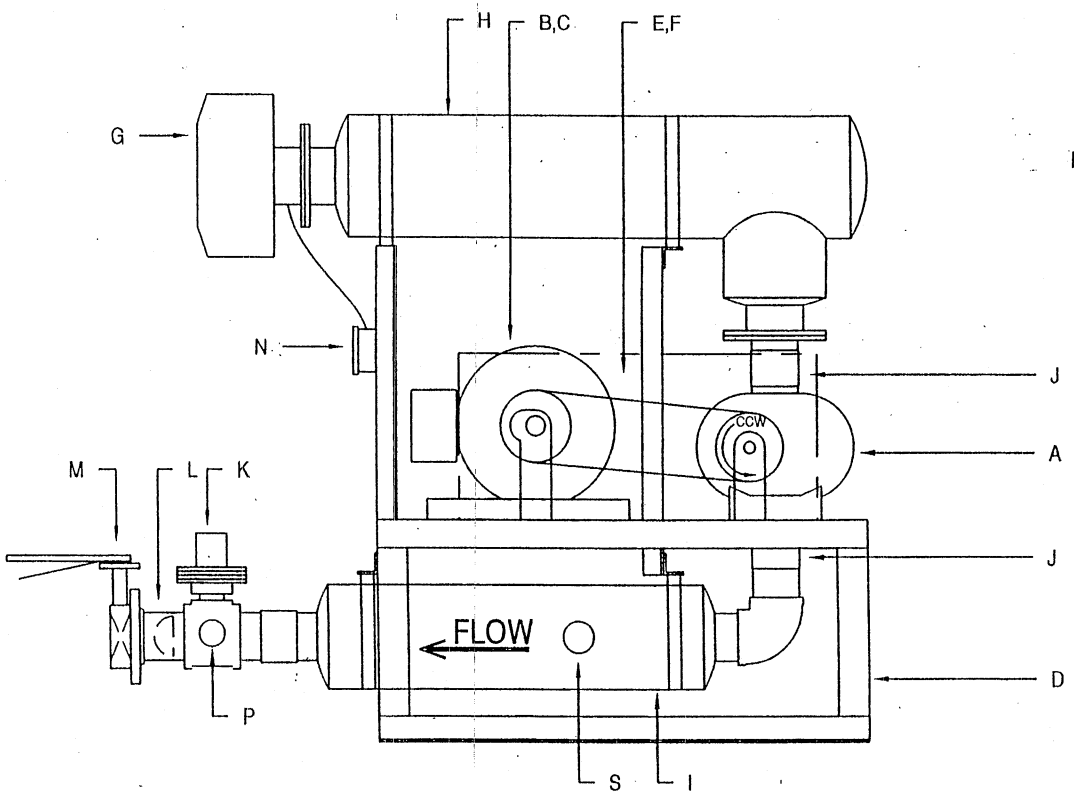
DWG. 99-700





A BLOWER
B MOTOR
C MOTOR SLIDE BASE
D ELEVATED STEEL BASE
E V-BELT DRIVE:
F BELT GUARD
G INLET FILTER
H INLET SILENCER
I DISCH SILENCER
J FLEXIBLE PIPE CONNECTOR
K PRESSURE RELIEF VALVE
L CHECK VALVE
M BUTTERFLY VALVE
N DIFFERENTIAL PRESSURE GAUGE
P PRESSURE GAUGE
S THERMOMETER

NOTES:

1) THIS EXAMPLE BLOWER INCLUDES THE MAJORITY OF ACCESSORIES TYPICALLY UTILZED ON AN ABJ PD BLOWER SYSTEM. VARIATIONS DO OCCUR WITH ENGINEER/OWNER DESIGN PREFERENCE.

2) FOR MOUNTING PURPOSES, BLOWER PADS SHOULD BE A MINIMUM 8 INCHES LONGER AND WIDER TO ACCOMODATE ANCHOR BOLT CENTERLINE TO EDGE OF CONCRETE REQUIREMENTS.

3) AIR FILTERS ARE COMMONLY FOUND OUTSIDE WITH MULTIPLE BLOWER PACKAGES MANIFOLDED TOGETHER ON ONE COMMON INTAKE LINE.

TYPICAL POSITIVE DISPLACEMENT (PD) BLOWER

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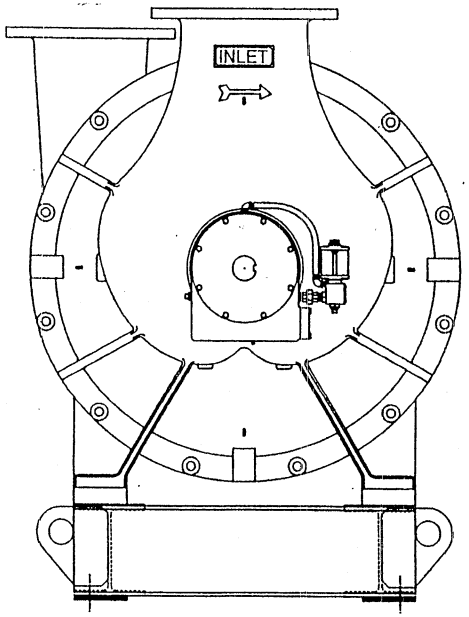
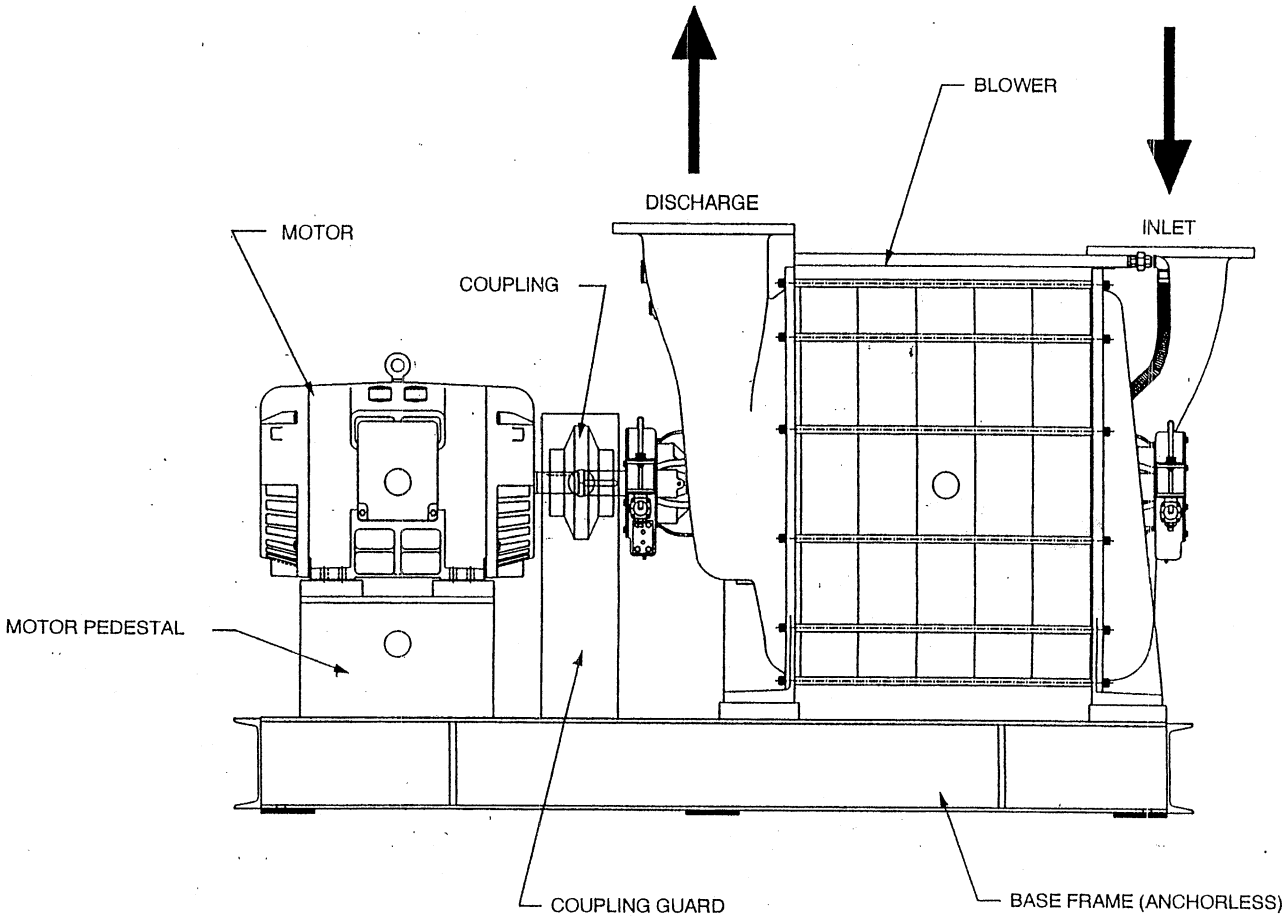
DWG. 99-710





TYPICAL ACCESSORIES (NOT SHOWN HERE)

- INLET AIR FILTER (WITH PRESSURE GAUGE)
- INLET BUTTERFLY VALVE (MANUAL OR AUTOMATIC)
- FLEXIBLE CONNECTORS
- DISCHARGE CHECK VALVE
- DISCHARGE PRESSURE GAUGE
- DISCHARGE TEMPERATURE GAUGE
- LOCAL CONTROL/MONITORING PANEL (FOR SURGE & OVERLOAD)

TYPICAL CENTRIFUGAL BLOWER

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ITT Industries
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DWG. 99-720

AIR VALVES, DO PROBES, FLOAT SWITCHES

AIR VALVES

The automatic air control valve consists of a wafer style butterfly valve with a top mounted electric actuator. The actuator is equipped with end position (open/close) limit switches, over torque limit switches and an anti-condensation heater. The valves are designed for full open (90-degrees) or full closed. There is no need for modulation.

D.O. PROBES

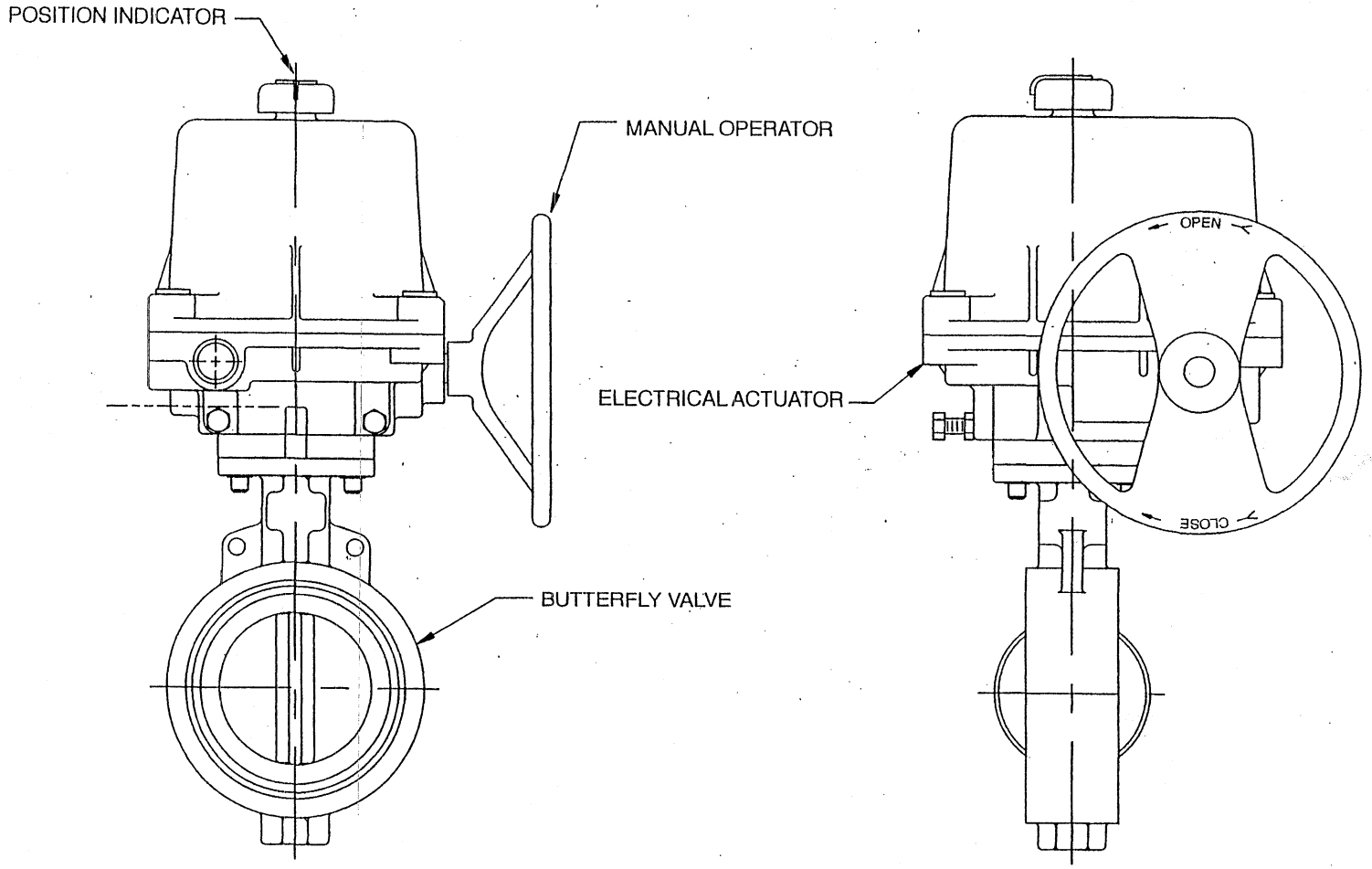
Dissolved Oxygen (D.O.) Control can be used with the ABJ ICEAS or SBR processes to optimize blower and aeration system operation. D.O. concentration in the basin is reported to the PLC in the form of a 4-20 mA signal. Output from the aeration blowers is adjusted to match process oxygen demand resulting in significant energy savings.

A transmitter in a floating NEMA 6P enclosure is used to accommodate the fluctuating water level inherent to the process. D.O. control systems are available in self-calibrating models. A self-cleaning sensor minimizes maintenance requirements.

FLOAT SWITCHES

A direct acting float switch encased in a high-impact, corrosion resistant polypropylene housing is used to indicate periods of high flow and initiate the storm cycle.

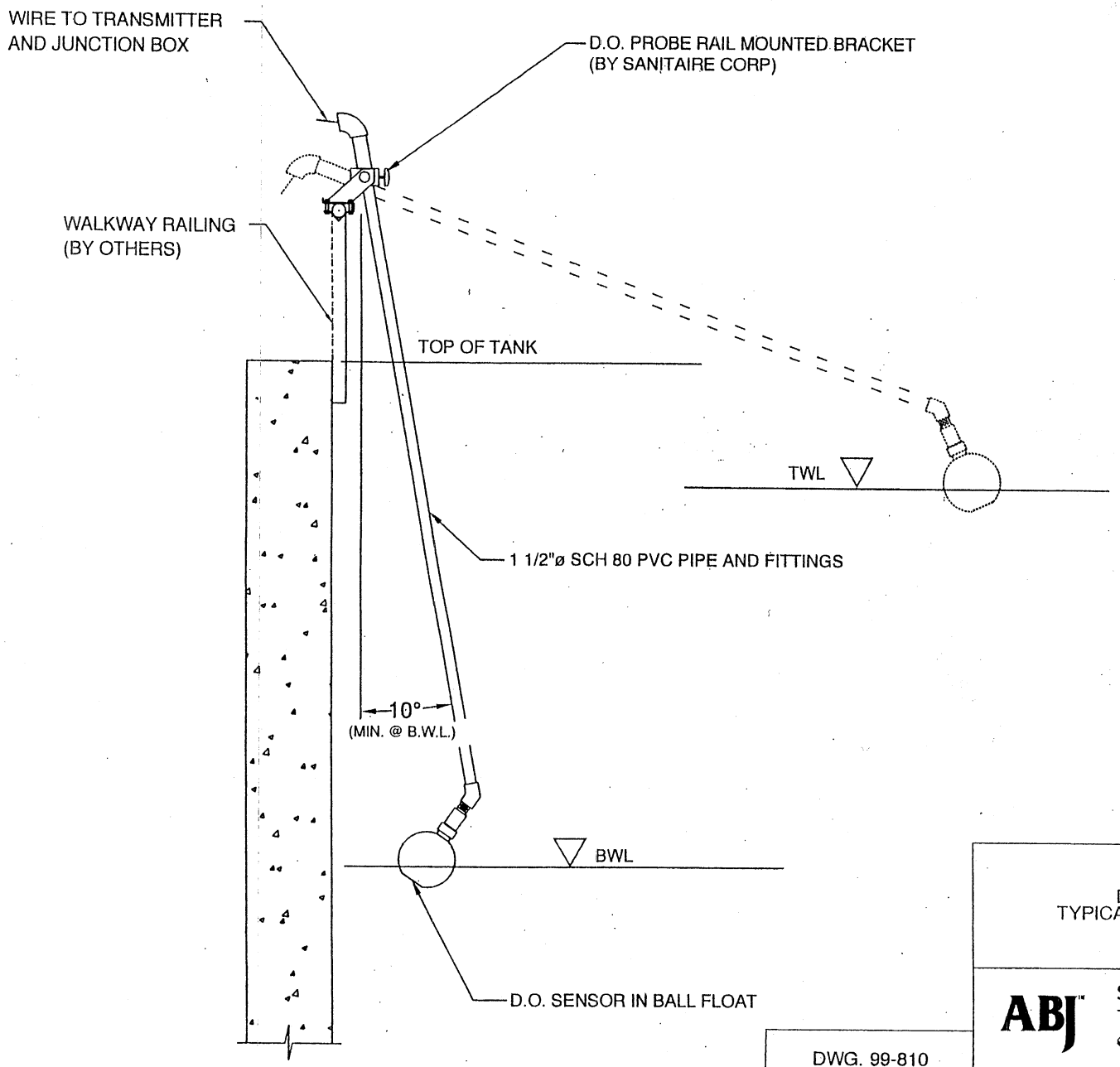
The float contains a single pole mercury switch, which activates when the longitudinal axis of the float is horizontal and deactivates when the liquid level falls to 1" below the activation level.



AIR CONTROL VALVE
W/ ELECTRICAL ACTUATOR

ABJ™ Sanitaire Corporation
ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. 99-800



D.O. PROBE
TYPICAL ARRANGEMENT

DWG. 99-810

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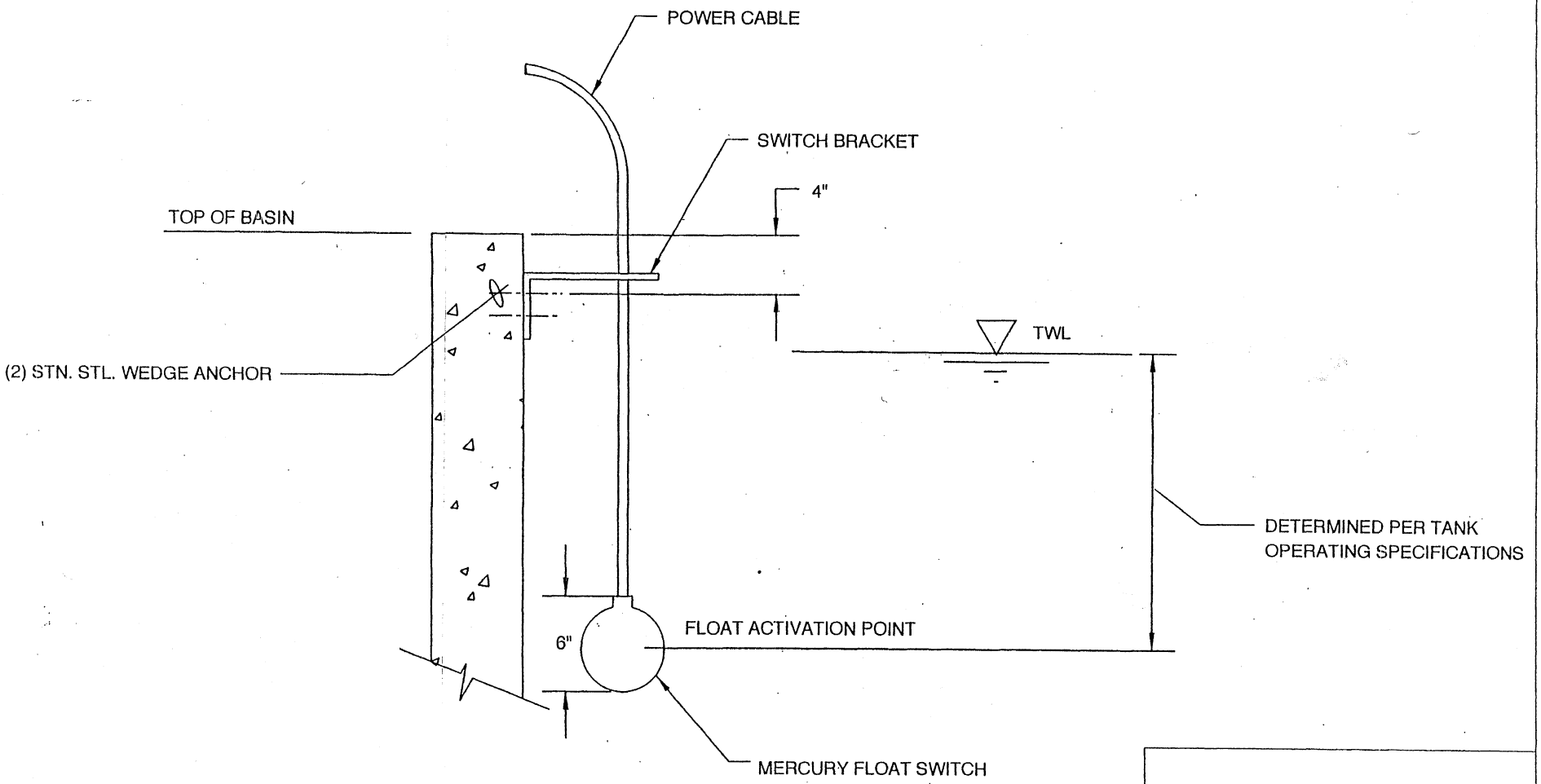

FLOAT SWITCH
TYPICAL ARRANGEMENT

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ITT Industries
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DWG. 99-820

ABJ™

CONTROL SYSTEM

INTRODUCTION

The ABJ control system is the nucleus of the process. The control system is "time-based" rather than "flow-based" and typically operates the following equipment:

- Decanters
- Process and Sludge Holding Tank blowers
- Air Control Valves
- Influent Valves (for SBR systems only)
- Waste Sludge Pumps
- Submersible Mixers
- D.O. System

The control system consists of a control panel including a Human Machine Interface (HMI), programmable logic controller (PLC), control switches, pilot lights and motor starters.

The control system is designed by Sanitaire Corporation and is assembled in a UL, C/UL approved shop. The control panel and the PLC program are factory tested prior to shipment. During the start-up of the ABJ system, the authorized field representative will check the installation, place the system into operation and make necessary field settings and program adjustments.

After the system has been placed into service, there are minimal adjustments required by the operator such as sludge pump start and wasting times and blower run time. These adjustments are made through the HMI interface.

PROGRAMMABLE LOGIC CONTROLLER (PLC)

The PLC contains a microprocessor, memory and input/output devices. It controls all of the process operations, monitors equipment status and alarm conditions. A backup battery protects RAM memory with further memory protection from an EEPROM or flash memory. The PLC has LED indicators showing Run, Fault and Battery Low status. Typical scan time is 1 ms/1k ladder logic. The PLC is equipped with a RS232 port for direct modem communications.

SCADA SYSTEM

The ABJ process uses a SCADA (Supervisory Control and Data Acquisition) system for graphical representation and monitoring of all plant alarms and events. The SCADA system consists of a computer, printer, UPS, Windows NT or 98, Cimplicity HMI software and other software as needed. The SCADA software allows the operator to make changes to setpoints and displays the cycle time, phase of each tank and the time remaining in each phase. If level transmitters are installed in the tanks, the screen can display the depth of water in each tank. (See Basin Setpoint Screen following this section).

The alarm viewer provided with the SCADA system allows the operator to see what alarm has occurred and tell the operator if it is a high, medium or low priority alarm. All alarms displayed are date stamped so the operator can see the time and day that the alarm occurred. The operator can print the alarm page on the provided printer. The operator can also acknowledge and clear alarms at this screen.

The SCADA system is also equipped with trend charts. The trend charts allow D.O. levels and other process related items to be displayed and charted. This gives the operator the ability to monitor the levels over a period of time. The values are also exported to a .csv file so the plant personnel can use a spreadsheet program, such as Excel to view the values and print them out.

CONTROL SWITCHES AND PILOT LIGHTS

Control switches and indicating lights are provided on the control panel for ABJ furnished equipment motors. In addition, a local control box at the basin permits the manual raising or lowering of the decanter in the tank.

During normal operation, equipment selector switches are placed in the "Auto" mode. Manual operation is also possible but does not provide the process interlocks that are incorporated with automatic operation.

If a component is not used or has failed, it can be switched to the "Off" position and the control system will continue without the function of that item.

MOTOR CONTROL CENTER (MCC)

The Motor Control Center (MCC) contains all the starters and overload protection devices for the various motors in the system. The MCC is separate from the control panel enclosure, which houses the PLC, control switches and pilot lights.

PROCESS AND EQUIPMENT INTERLOCKS

The control system includes switches and sensors that provide information to the PLC to prevent process upsets and equipment damage. Additionally, circuit breakers and motor control circuits are used to protect the motors from electrical overloads.

The decanter actuators include end position limit switches that verify that the decanter has reached the bottom water level or has returned to the "park" position. The air control valves have end position limit switches.

- If a valve fails to open, the blower is stopped.
- If the air valve fails to close, decanting is inhibited.
- If the decanter fails, the air valve is inhibited from opening.

A high water float switch is provided in each basin to detect flows greater than the peak dry weather conditions. Based on the float switch signal, the PLC will then evaluate whether to remain in the normal cycle or switch to the storm cycle.

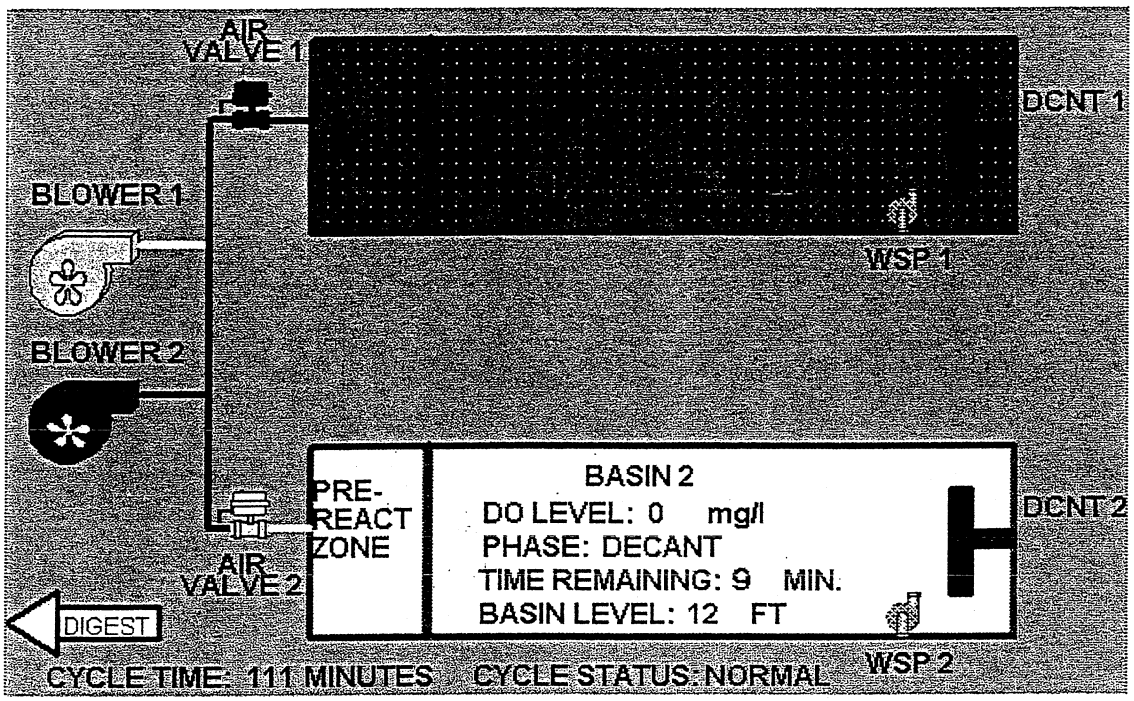
MODEM

A modem is installed as standard equipment in the control panel to allow the PLC to be accessed by telephone. The PLC program can be monitored and /or modified in real time from remote locations.

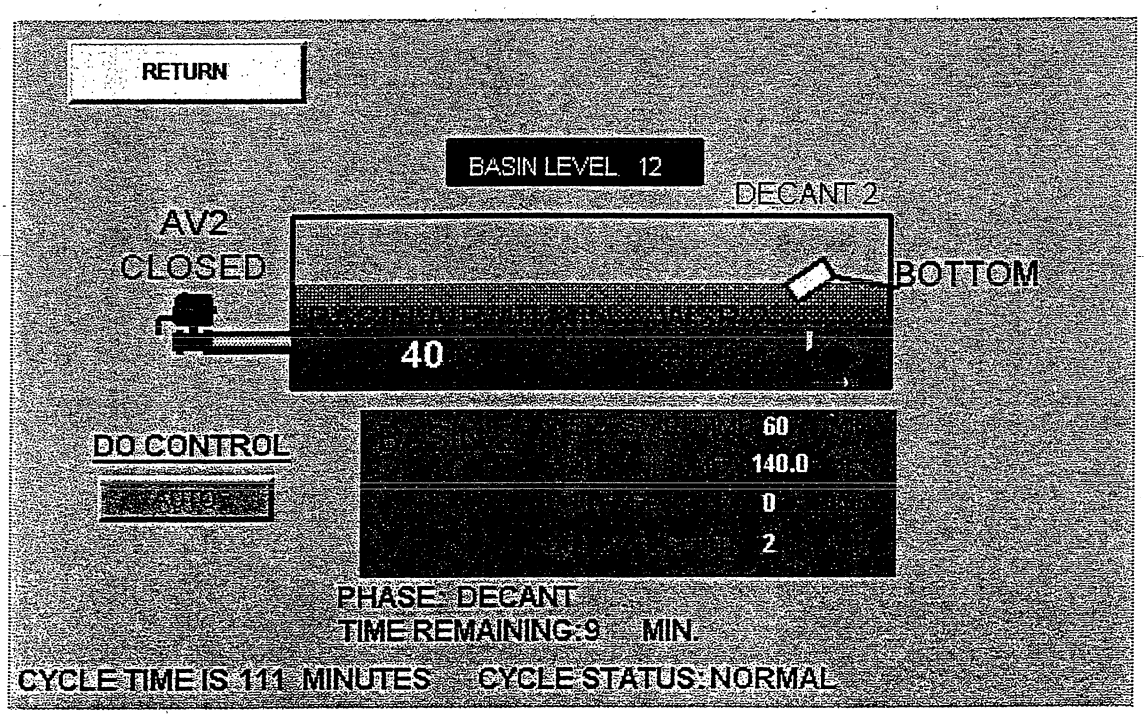
REMOTE ACCESS

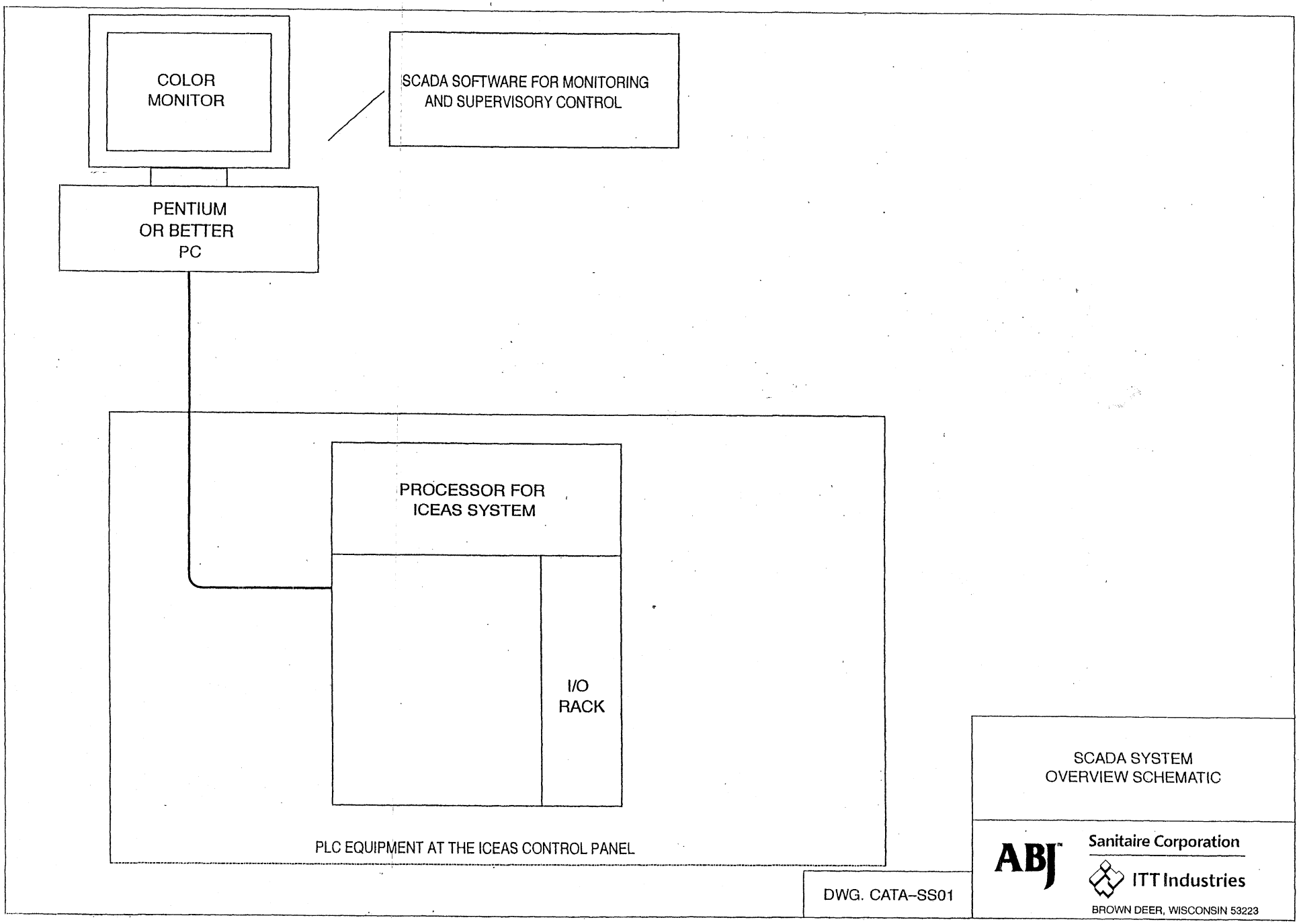
Sanitaire Corporation can provide a SCADA package for the ABJ system that would allow remote monitoring of the plant. This is useful for small plants that are not staffed during evening or weekend hours. With remote access, the operator uses a PC and modem to interface with the PLC from an offsite location. The operator is able to view and acknowledge alarms and monitor plant equipment without having to go to the plant.

SCADA System Overview



Basin Setpoints

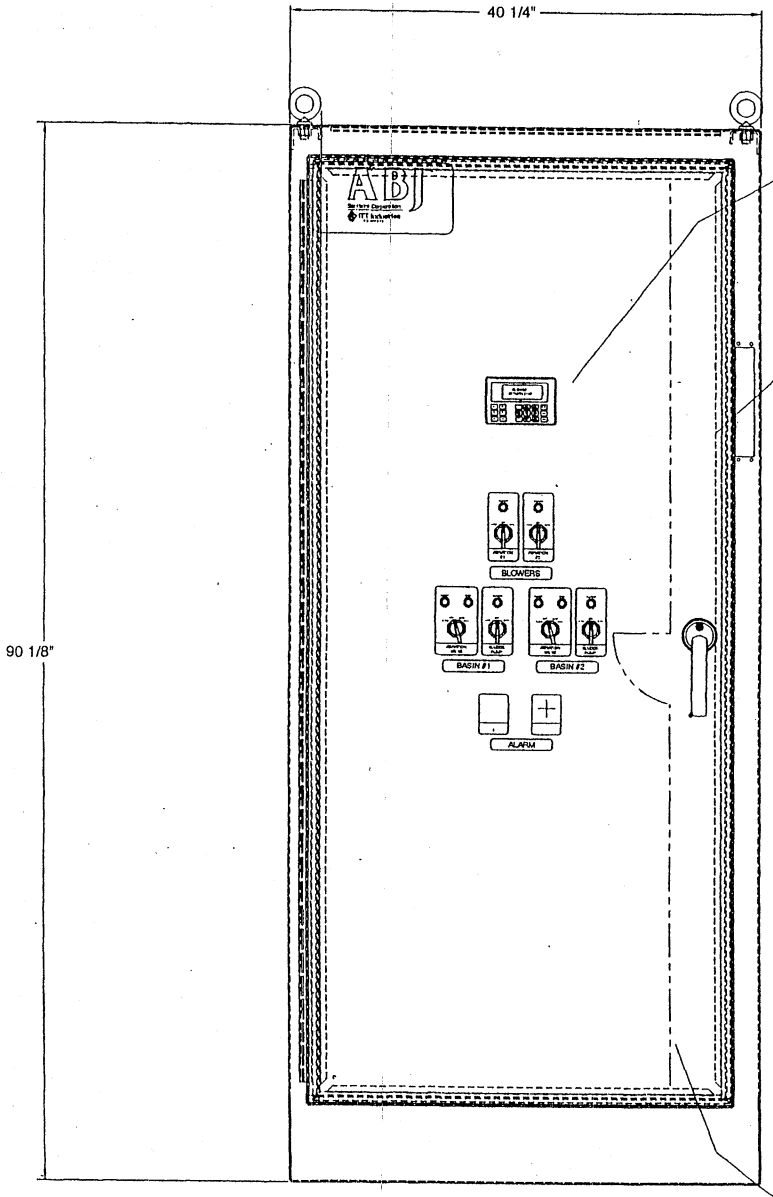


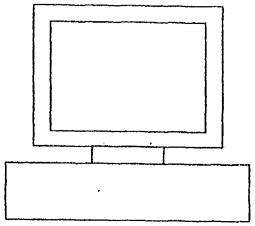


SCADA SYSTEM
OVERVIEW SCHEMATIC

DWG. CATA–SS01

ABJ™ Sanitaire Corporation
ITT Industries
BROWN DEER, WISCONSIN 53223



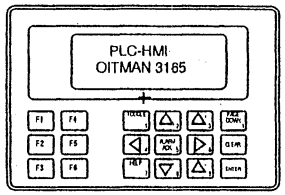


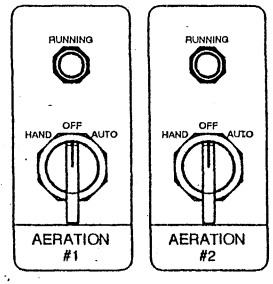
SCADA SYSTEM

CONTROL PANEL
2–BASIN (OIT3165)

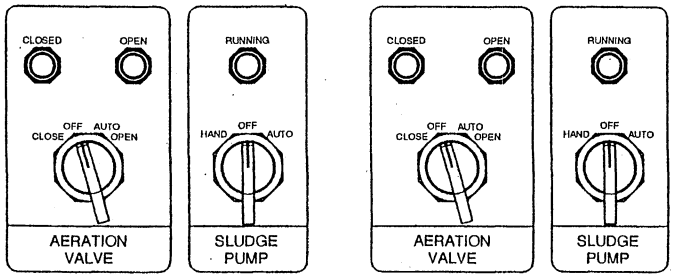
ABJ™ Sanitaire Corporation
ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. CATA–CP03



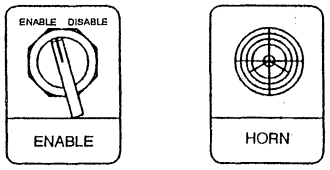


BLOWERS



BASIN #1

BASIN #2



ALARM

CONTROL PANEL
2–BASIN (OIT3165)
NAMEPLATE CLARIFICATION

ABJ™

Sanitaire Corporation

ITT Industries

BROWN DEER, WISCONSIN 53223

DWG. CATA-CP04

August 29, 2001

Marie Dowd
Delaware Engineering, P.C.
28 Madison Avenue Extension
Albany, NY 12203

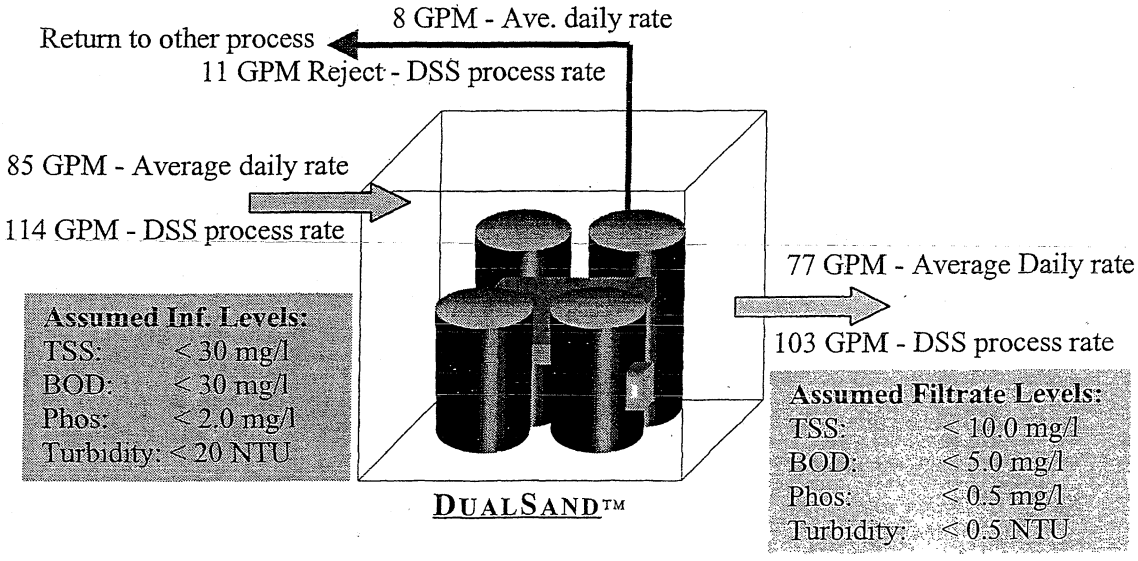
Ref: DualSand™ – NYC Watershed Upgrade Program - Crossroads / Wild Acres - Rev 2

As per our telephone conversations, we understand that this project is no longer being built in phases. The entire plant will be installed and sized to handle the future flow of 110,880 GPD (77 GPM) + 10% reject = 121,968 GPD.

DualSand™ Sizing:

- **Average Daily Flow:** 110,880 GPD/1440 = 77 GPM + 8 GPM $_{reject}$ = 85 GPM
- **Max. Daily Capacity of DualSand™:** 114 GPM - 8 GPM =103 GPM x 1440 = 148,320 GPD
- **Redundancy:** Per NYC DEP–(3) trains each capable of 50% of flow
- **Maximum Loading Rate:** **3.00** GPM / SF as per NYC DEP

We have selected a DSS 33000 Series that has (2) 19 SF filter trains in operation + (1) 19 SF redundant filter train. The maximum flow capacity of this DSS System is [(2) x 19 SF] x 3.00 GPM / SF = 114 GPM < 85 GPM.



Percent Operating Time: 77 GPM (Ave. flow) / 103 GPM process rate = 75 %

The selected DSS Environmental Series 33000 consists of the following equipment and services:

(6) Parkson DynaSand filters with 304 SS tank construction, sand, controls, covers and freight
(1) Ingersoll-Rand (2) head air compressor with reservoir and dryer
(1) Influent duplex package pump station w/ controls
(4) Chemical feed pumps with controls for automatic back up - Can add (2) pumps for Dechlorination - not incl.
(2) Chemical day tanks (Double wall so no containment req'd) - Can add (1) tank for Dechlorination - not incl.
(1) Static mixer
(4) Turbidimeters
(1) Air pressure sensor
(1) Residual chlorine monitor and chart recorder
(1) Particle counter
(1) Filter headloss gauge
(3) Flow meters
(1) Computer for data storage and management (NO SCADA included)
(1) Alarm Panel with contacts (low air pressure, high filter head, high turbidity, high water, low chlorine)
(1) Piping – All piping of influent, reject, filtrate, air, chlorine and polymer, mixer.
(1) Electrical wiring & conduit to pumps, filter controls, air compressor
(1) Freight to job site is included for sand and all equipment described herein
(1) Engineering of DualSand™ system, piping, etc.
(1) Start-up and training – [(1) month or (26) working days
(1) Mobilization for DSS crew and equipment

Budget pricing for the above **installed** DualSand™ Series 33000 is… **$ 770,000**

* Site, building foundation and slab, building / enclosure, utilities, piping outside of 2' construction limit, and any item not specifically described above, are not included in the above price. Pricing depends on date of purchase, site conditions and miscellaneous options not yet defined.

As per our conversation, NYC DEP has been making requests for additional features and components that naturally increase the scope and thus the price. As your project nears finalization we should sit down and discuss options and operational details.

Enclosed is a revised O & M sheet and standard drawings of a DSS 33000. Please note that you may arrange the filters and add stairs and platforms as desired. DSS can provide assistance with these items at your request.

Thanks you for considering the DualSand™ technology. If you should have any questions, please feel free to give us a call.

With kind regards,
Siewert Equipment Co., Inc.

Terry L. Wright

Encl:

Xc: Matt Marko, DSS Environmental Inc.

Introduction to the DualSand™ System

The DualSand™ System is a proprietary filtration process for wastewater, potable water and water reuse applications. The technology is protected by US Patent Number 5,843,308 and other patents pending. The DualSand™ System has documented performance of:

Phosphorous removal to:	< 0.02 mg/l
Crypto & Giardia removal:	7-log
$TSS_{eff.}$:	< 1.0 mg/l
$BOD_{eff.}$:	< 1.0 mg/l
$Iron_{eff.}$	< 0.05 mg/l
$Manganese_{eff.}$:	< 0.02 mg/l
$Color_{eff.}$:	< 5 cpu

August 1998, under U.S. EPA Contract 68-D4-0091, the CBUDSF (Continuous-Backwash-Upflow, Dual-Sand Filtration) technology was recognized as an equivalent to microfiltration for the treatment of wastewater in the NYC Watershed. This equivalency was based on a head-to-head pilot test against the leading microfiltration product from May – October 1997. A paragraph from the document prepared by NYC / EPA for public review and comment is as follows;

> "NYC DEP contends that continuous-backwash-upflow, dual-sand (CBUDS) filtration is as efficient as microfiltration for removing the pathogens Giardia and Cryptosporidium. In addition, they have maintained that CBUDSF is also less expensive, simpler to operate, and more reliable."

Process Description:

The DualSand™ System is a patented chemical filtration process that uses two (2) continuous backwash upflow sand filters in series.

An oxidant and coagulant are added prior to the first stage filter. An in-line static mixer in the influent pipe provides proper mixing. The coagulant used in the process hydrolyzes immediately in water thus no floc tank is required.

The first stage filter contains coarse sand that is able to handle high solids loading and provide exceptional removal. The addition of the oxidant helps to keep the sand clean and free from any biological growth. The oxidant also improves the performance of the coagulant.

The second stage filter contains fine sand. This fine sand is not subject to solids fouling because the first stage filter removes approximately 99% of the solids in the water. The reject from the second stage filter is returned to the first stage filter influent. This returned reject enhances the performance of the system and provides economical use of the chemicals.

On installations that require disinfection, a residual chlorine monitor and intermediate chlorination for the second stage filter is provided. The second stage filter has been approved for CT thus removing the need entirely or reducing the size of the chlorine contact chamber.

Equipment Description:

The DualSand™ System is supplied on an installed basis to insure quality and retain proprietary knowledge.

Flow Control:

The DualSand™ has a total of approximately 3' of headloss through the entire system.

The filters may be placed on grade or below grade in a concrete vault.

If it is necessary to pump to the DualSand™, pumps and controls to operate these pumps are provided in the DualSand™ package. This is done to insure proper flow to the filters, pacing of the chemical feed systems and monitoring of the flow.

In some cases an internal circulation loop will be used to keep the sand flow in motion versus a stop-start operation. Again these pumps and controls will be provided in the DualSand™ package.

Chemical System:

The DualSand™ system will include appropriately sized storage crocks/tanks for the oxidant and coagulant. The level of chemicals in these tanks can be determined via visual inspection, load cells, and or liquid level indicators. If automated, a low-level alarm will be provided.

Chemical metering pumps, piping, and injectors are provided in the DualSand™ system. A redundant pump is provided for each chemical.

Controls to pace the metering pump with varying flows will be provided if necessary.

The DualSand™ system includes an In-line mixer in the influent pipe to the filters.

Filter System:

A DualSand™ filter train consists of (2) filters in series. The 1st stage filter uses coarse sand of a size determined by the solids loading and biological process in front of the DualSand™. The filtrate from the 1st stage filter is piped to the inlet of the 2nd stage filter and flows by gravity.

Reject from the 1st stage filter is sent to the secondary clarifier, digester, sewer, head of the plant, etc. DualSand™ will provide the sump, pumps and controls when necessary to pump the reject.

The 2nd stage reject is piped to the influent pump station or DualSand™ provides a sump with pumps to return this to the influent to the 1st stage filter.

When more than one filter train is required, DualSand™ provides a flow splitter box, piping, and valves to insure proper flow distribution and equipment isolation.

The DualSand™ system includes stairs, platforms, and handrails necessary to gain access to the top of the filters.

Compressed Air System:

The DualSand™ system includes a dual head air compressor with a large reservoir, air dryer (if necessary), piping to the air control panels and from these panels to the filters.

The air panels allow the sand movement to be adjusted and thus the degree of filtration. The air system is interlocked to shut off when the water flow stops. Electrical power to these panels is part of the DualSand™ system.

A low air pressure alarm is provided.

Instrumentation and Control:

The DualSand™ system may include these components if necessary and appropriate:

- PLC based integrated instrumentation and control package (SCADA)
- Particle Counters
- Turbidimeters
- Flow meters
- Chlorine monitors
- Computer and printer
- Telemetry

Hardware, software, sensors/meters and the control wiring between sensors and computer is in the DualSand™ package. Telephone line to PC is by others.

Installation:

The DualSand™ system includes the installation of the filters, platforms with handrails; walkway to the filters; air compressor, air piping and control panels; influent, effluent, reject pump systems and controls; chemical feed pumps and piping; wire and conduit connecting the control/power panel(s) to the equipment; internal piping and valves within the construction limits; instrumentation, probes and associated wiring.

The installation is provided for quality control and to retain intellectual property.

Start-up:

The DualSand™ system includes start-up and training of the operator in the use and maintenance of the DualSand™ filtration equipment and process.

Extended training is available. This consists of a fully trained operator visiting the installation every 2-3 weeks. The DualSand™ certified operator will work with the plant operator to clean the turbidimeters, particle counters, check particle counts, optimize the chemical dosing rates, address any questions that the operator may have, check the levels and inventory of the chemicals, clean metering pumps when necessary, run through maintenance on the pumps and air compressor, etc.

Guarantee:

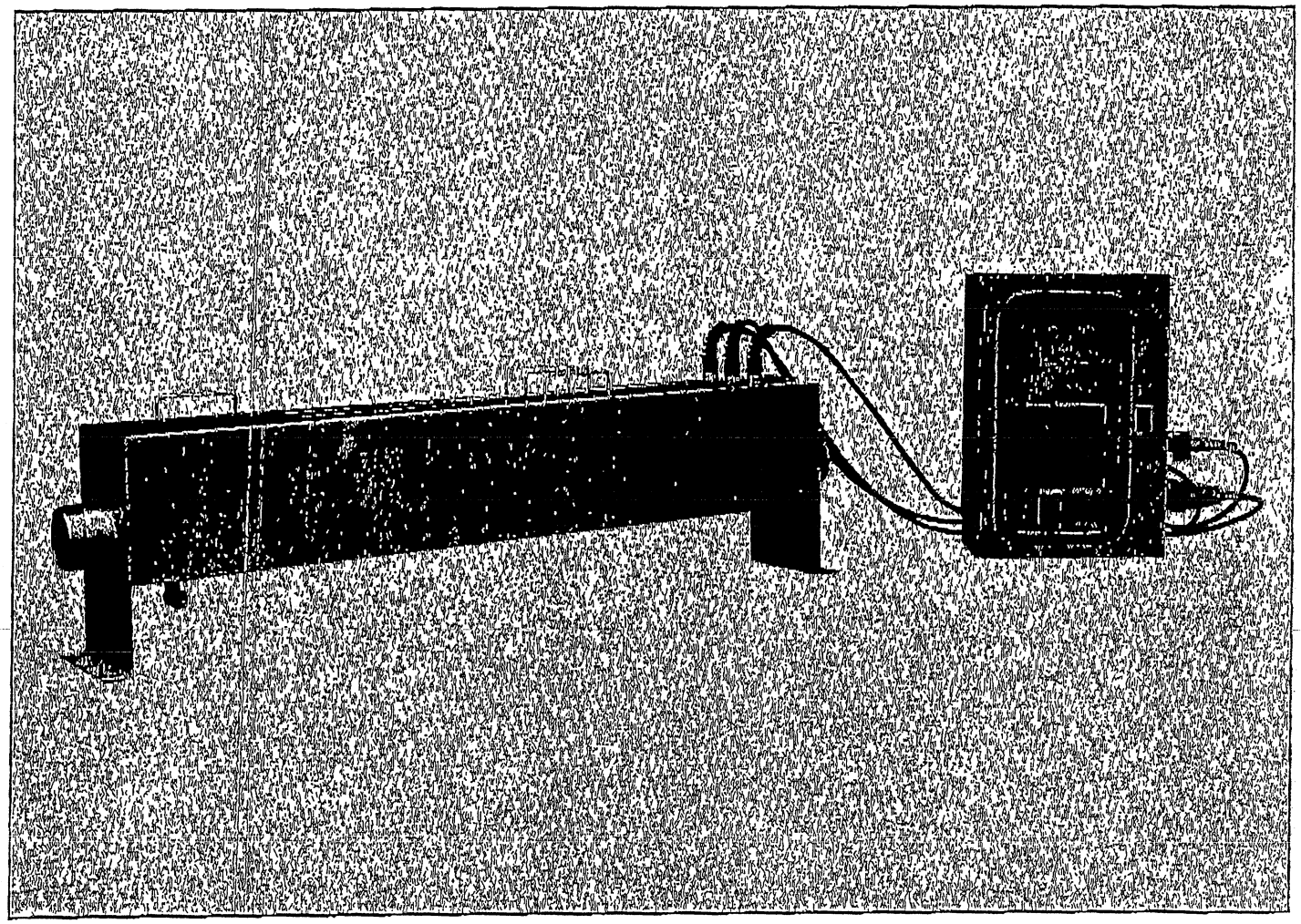
With the above extended training, an acceptable process guarantee that is based upon stated influent characteristics and SPDES permit effluent limitations can be provided.

**

DB-185-1

Ultraviolet Disinfection

Package Horizontal Open Channel System
Disinfecting flows up to 2 MGD



Infilco Degremont Inc

March 1999
Supersedes January 1993

ɔen Channel Units

Ultraviolet disinfection, a safe and effective way to disinfect water and wastewater for over 80 years, is now available in package open channel units provided by Infilco Degremont Inc.

Package units provide convenient disinfection for a wide range of flows (up to 2 MGD).

Each system is designed to exceed health department water quality standards with units in operation throughout the United States, Canada and world wide.

Ultraviolet Disinfection

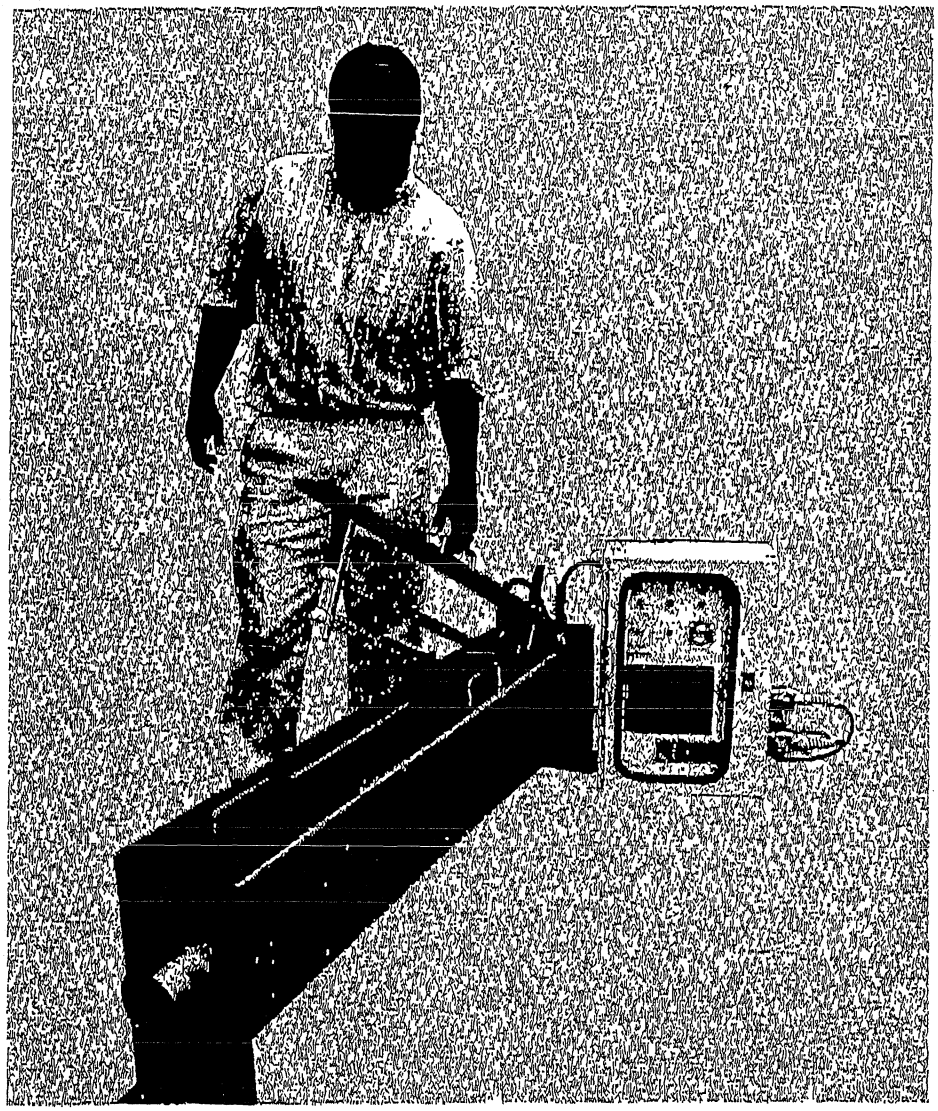
Exposure to UV light destroys the reproductive abilities of a wide variety of potentially harmful microorganisms, rendering them inactive and unable to cause disease.

Unlike chlorination, ultraviolet light does not significantly alter the physical or chemical properties of the effluent. There are no dangerous chemicals or ~~ges~~ for workers to handle. There are no ~~wn~~ carcinogenic compounds created in the disinfection process. As a result, no harm is presented to people, fish, wildlife, or vegetation downstream from the plant.

The heart of any UV disinfection process is the ultraviolet lamp, developed in 1901. A stable and reliable producer of ultraviolet light, the typical lamp has an average life 9000 hours of use.

The peak effectiveness for inactivation of microorganisms occurs at the UV radiation wavelength of 260 nanometers. This figure closely coincides with the resonance line of ultraviolet lamps used in the disinfection process, 253.7 nanometers.

Access to the lamps is made both simple and safe with the use of clear tubes called "quartz jackets" to house each lamp. The jacket isolates the lamp from the water while allowing maximum transmission of ultraviolet rays. Open at one end, the jacket holds the lamp using spacers which prevent the lamp from ~~v~~rating during flow. This arrangement allows for easy cleaning of quartz jackets and replacement of the lamps.



Individual lightweight modules are easily removed for cleaning or replacement of lamps.

Package Open Channel Wastewater Units

These completely self-contained wastewater disinfection units are designed to treat flows from 2 GPM to 2 MGD of effluent. Flows from 1 to 2 MGD can be accommodated using multiple package units in series or parallel.

Each unit consists of a stainless steel channel with one or more horizontal two-lamp or four-lamp modules. The channel is fabricated with an internal weir, providing a reliable level control and a continuous minimum UV contact time as effluent flows through the channel. This exposure allows for maximum disinfection of the effluent.

Package open channel wastewater units are available with up to forty lamps per unit. Lamps are available in either a 30-inch or 58-inch arc length.

Each lamp module is equipped with a shield to eliminate casual exposure to ultraviolet light when the system is in operation.

Continuous Monitoring

A separate remote instrumentation and control panel provides the necessary information to determine the status of the system at all times.

All electrical components are housed in a remote weatherproof corrosion-

resistant enclosure. Any component in the enclosure maybe replaced by simply installing a new part in its place.

The control panel has an individual indicator for every ultraviolet lamp in the system, identifying any lamp failures with as-it-happens precision. The UV intensity is continuously monitored with both visual and audible alarms for low intensity levels. The system is equipped with an elapsed time meter to accurately record lamp depreciation.

The control panel is equipped with forced ventilation to provide continuous cooling of all electrical equipment.

Easy Maintenance and Cleaning

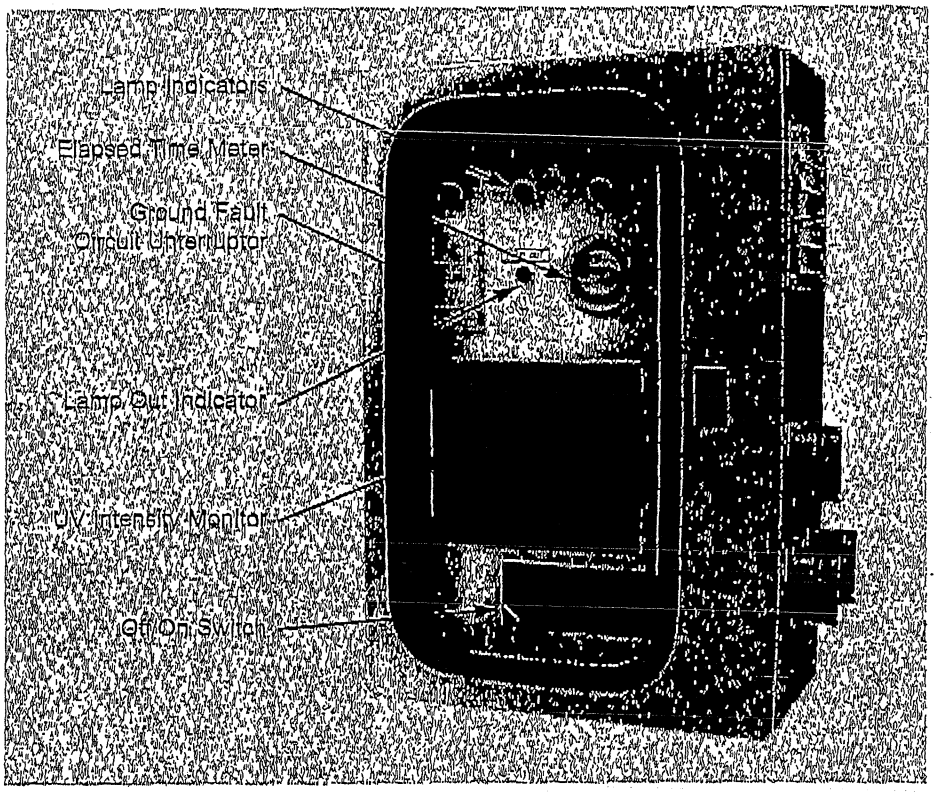
Maintenance of the system consists of annual lamp replacement and periodic cleaning of the quartz jackets.

Individual lamps are easily removed and replaced from the ends of the module. No disassembly of the unit itself is required to change a single lamp.

Similarly, cleaning the package wastewater unit is quick and easy, with no disassembly required. After removing the module, the quartz jackets are cleaned or lamps replaced in a matter of minutes.

Systerm Features

- Continous monitoring of UV intensity
- Remote UV intensity monitoring
- Individual lamp status indicators
- Lamp out indicators
- Elapsed time indicators for tracking UV lamp life
- Light weight 304 stainless steel UV lamp modules
- Channels and level control made of 304 stainless steel
- Ground fault protection for each lamp module
- Totally factory assembled and functionally tested as a system prior to delivery
- Available and easy-to-install spare parts



Remote Instrument and control panel

Benefits:

- Cost-effective
- Effective disinfection without chemicals
- Exceeds health department standards
- Low maintenance and easy cleaning

Water Characteristics:

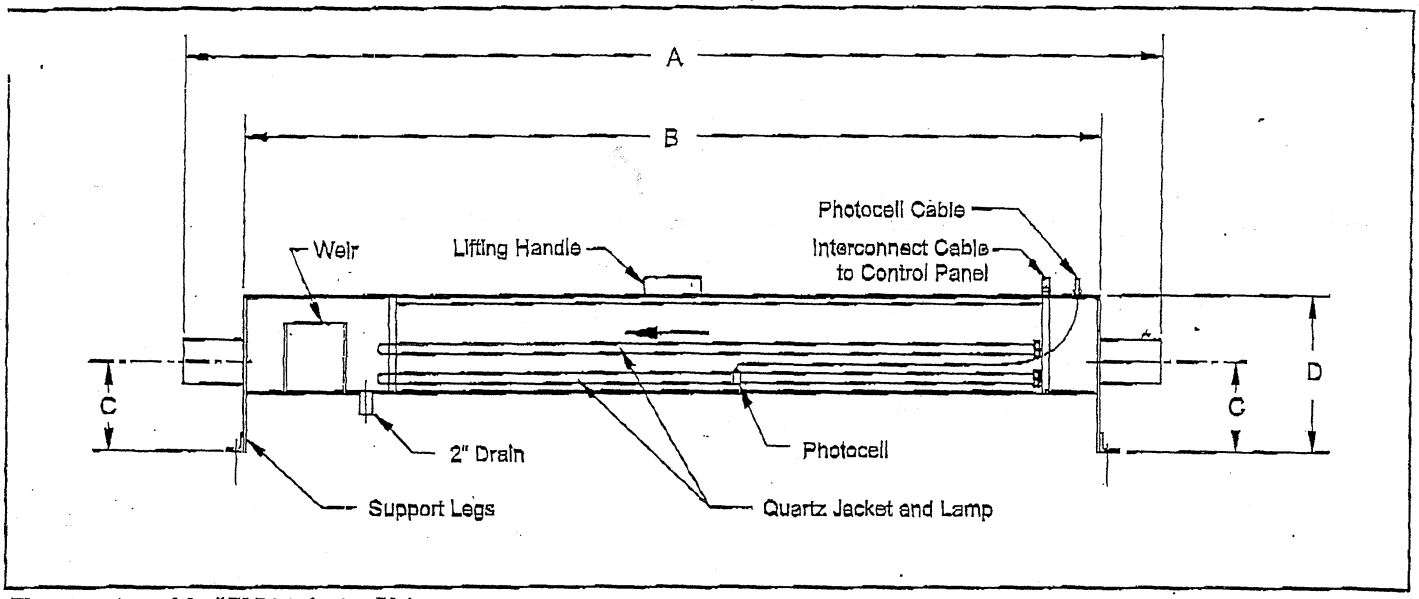
- BOD and suspended solids should be below 30 mg/l each.
- Designed for UV transmittance of 65% or greater at 253.7 nm through 1 cm.
- Operates at a water temperature range of 33 to 90 degrees Farenheit.

Infilco Degremont Inc. provides a range of disinfection equipment for a wide variety of flow and application requirements.

- Standard Closed Chamber Units for 2 GPM up to 2 GPD.
- Package Open Channel Units for 2 GPM up to 2 MGD.
- Vertical UV Systems to handle over 2 MGD.

For more information on package open channel wastewater units or the ultraviolet disinfection process, contact:

Infilco Degremont Inc.
Telephone 804-756-7600
Toll Free 1-800/446-1130
Telefax 804-756-7643

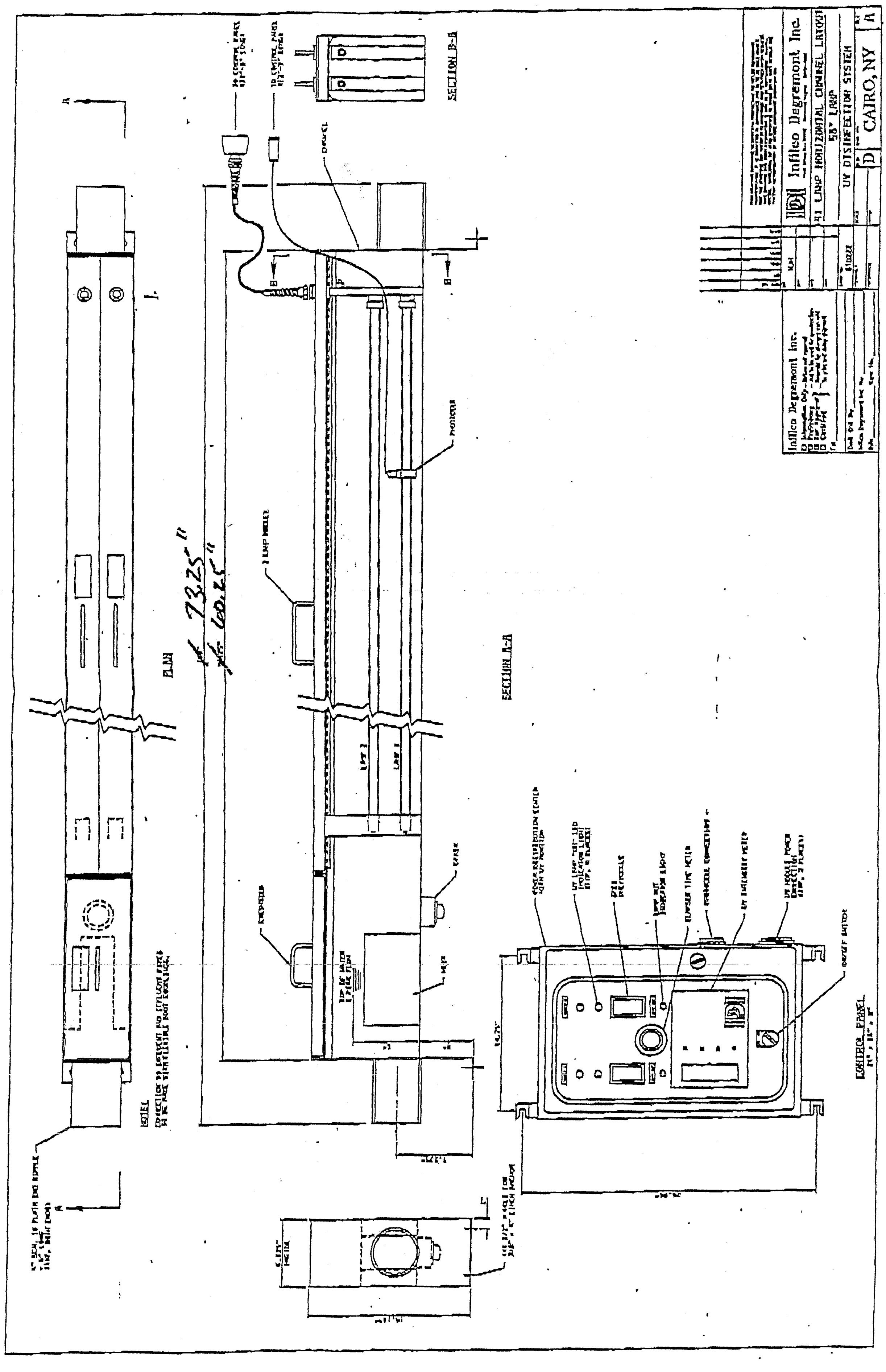


Elevation view of the UV Disinfection Unit

Model No.[1]	Peak Flow GPM	No. of Lamps	No. of Lamps/ Module	Control Panel[2] Inches	All Channel Dimensions in Inches					
					A	B	Overall Width	C	D	Pipe Diameter[3]
2SH	18	2	2	24x16x9	74.50	62.75	9.00	5.25	15.25	4.00
2LH	36	2	2	24x16x9	97.00	85.00	9.00	5.25	15.25	4.00
4SH	36	4	2	24x16x9	73.25	60.25	6.25	7.50	15.25	4.00
4LH	72	4	2	24x16x9	108.00	96.00	6.25	7.50	15.25	4.00
6SH	54	6	2	33x25x12	70.00	58.00	9.25	8.25	15.25	6.00
6LH	108	6	2	33x25x12	108.00	96.00	9.25	8.25	15.25	6.00
8SH	72	8	2	33x25x12	71.00	59.00	12.50	8.25	15.25	6.00
8LH	144	8	2	33x25x12	108.00	96.00	12.50	8.25	15.25	6.00
10SH	90	10	2	33x25x12	73.50	73.50	15.50	8.25	15.25	6.00
10LH	180	10	2	33x25x12	108.00	96.00	15.50	8.25	15.25	6.00
12LH	216	12	4	40x32x12	124.00	112.00	9.50	9.25	21.25	8.00
14LH	250	14	2	40x32x12	108.00	96.00	18.50	9.25	15.25	8.00
16LH	288	16	4	40x32x12	132.00	120.00	12.50	9.25	21.25	8.00
20LH	360	20	4	40x32x12	135.00	123.00	15.50	11.25	21.25	12.00
24LH	420	24	4	40x32x12	166.00	144.00	18.50	11.25	21.25	12.00
28LH	490	28	4	48x36x12	156.00	144.00	21.50	11.25	21.25	12.00
32LH	560	32	4	48x36x12	156.00	144.00	24.50	11.25	21.25	12.00
36LH	625	36	4	60x48x12	156.00	144.00	27.50	11.25	21.25	12.00
40LH	700	40	4	60x48x12	156.00	144.00	30.50	11.25	21.25	12.00

1. "S" refers to 30" arc length lamps.
   "L" refers to 58" arc length lamps.
2. Height x Width x Depth
3. Options Available:
   - Channel Liner
   - Inlet and Outlet Flanges

Infilco Degremont Inc
P.O. Box 71390 Richmond, VA 23255-1390
Tel: (804) 756-7600 Fax: (804) 756-7643


Infilco Degremont Inc.
UV DISINFECTION SYSTEM
CAIRO, NY
SECTION A-A
SECTION B-B
PLAN
CONTROL PANEL

THE
BELLEAYRE RESORT
AT
CATSKILL PARK

CONCEPTUAL DESIGN REPORT

THE WILDACRES RESORT and HIGHMOUNT GOLF CLUB/ HIGHMOUNT ESTATES WASTEWATER TREATMENT AND DISPOSAL

August 2003

Prepared for:

Crossroads Ventures, LLC
72 Andrew Lane Road
Mt. Tremper, New York 12457

Prepared by:

Delaware Engineering, P.C.
28 Madison Avenue Extension
Albany, New York 12203

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Tables

Figures

Exhibits

1.0 INTRODUCTION

1.1 General

Crossroads Ventures, LLC (Crossroads Ventures) owns approximately 1,960 acres in the Catskill Mountains, located south of New York Route 28 and on lands on either side of Belleayre Mountain Ski Center, in New York State. Crossroads Ventures is proposing to develop the area and create recreation-oriented resort developments. Consistent with numerous economic and land use studies that have been prepared for the region, it is the intent of Crossroads Ventures to provide recreational and lodging facilities that would enhance the tourism attractiveness of the area as a four-season recreation destination. Development plans include a mixture of recreational and lodging facilities.

The overall project proposed by Crossroads Ventures is entitled, *Belleayre Resort at Catskill Park.* Of the 1,960 acres, approximately 573 acres would be affected by the development of the project while the remaining 1,387 acres would remain undeveloped.

There are several alternatives available for the treatment and disposal of wastewater from the resort developments. This plan has been prepared for Crossroads Ventures by Delaware Engineering, P.C. (Delaware Engineering), to address the disposal of wastewater from two areas of the project, collectively titled, *Wildacres Resort.* Individually, these areas are referred to as the *Wildacres Resort and Highmount Golf Club (WRHGC)* and *Highmount Estates* developments. The preferred alternative is the conveyance of all site wastewater to an on-site wastewater treatment plant for treatment with discharge to either groundwater (irrigation ponds) or surface water (unnamed tributary to Emory Brook). The need for non-potable irrigation water during irrigation season will be satisfied by utilizing the effluent from the wastewater treatment plant. The effluent will be pumped from the treatment plant to a lined pond within the development for storage until it is distributed for irrigation purposes. If necessary, stormwater, on-site localized wells, and raw drinking water in excess of the potable demand will be utilized to supplement the irrigation water needs. During initial grow-in, excess potable water will be used for irrigation to augment rain and stormwater detention. This will be possible since the detached lodging units and the subdivision homes will not be fully constructed or occupied, leaving ample water for both the limited potable demand and irrigation. This plan to use highly (tertiary) treated effluent as irrigation water will be environmentally beneficial by reducing the overall demand for both potable and non-potable water. For a more complete description of the irrigation system, see Section 2 and Appendix 16, "Treated Wastewater for Golf Course Irrigation" of the DEIS.

1.2 Project Description

The overall project site lies within two non-contiguous tracts of land, one tract located on either side of the Belleayre Mountain Ski Center. **Drawing 1 (Exhibit A)** depicts the size and location of the project site.

The larger tract of land for this project is approximately 1,242 acres. It is located in Ulster County to the east of the Belleayre Mountain Ski Center and extending from Lost Clove on the eastern boundary to Woodchuck Hollow on the western boundary. These lands are primarily second growth forest except for Brisbane (Turner) Mansion and a few smaller seasonal dwellings located on this land. Currently, none of the residences are inhabited. Development of this tract would largely be confined to 331 acres and consist of two resort areas, designated the *Big Indian Country Club* and *Belleayre Highlands.* The balance of the parcel, 911 acres, will remain undeveloped. Wastewater treatment and disposal for this area is not the subject of this plan and will be discussed under separate cover.

The smaller of the two tracts is located to the west of the Ski Center **Drawing 2 (Exhibit A)**. The boundary line between Ulster and Delaware counties bisects this property, which includes acreage in the Towns of Shandaken and Middletown. These lands are located along County Route 49A and on either side of Gunnison Road. Additionally, they include the former Highmount Ski Area, the Marlowe Mansion, lands directly to the west on Galli Curci Road (County Route 49A) and lands between County Route 49A and County Route 49. Of the approximately 718 acres described, 242 acres will be developed and about 476 acres will remain undeveloped and preserved in its natural state. The lands described above have been designated the *WRHGC* and *Highmount Estates* developments.

The *WRHGC* section of the *Wildacres Resort* area will encompass the easternmost portion of land and is planned to include an eighteen-hole championship golf course, a driving range, a golf course clubhouse with a 40-seat snack bar, pro shop, locker rooms with both steam and sauna, maintenance and receiving buildings, 168 two bedroom detached lodging units with their own clubhouse (containing a 40-seat snack bar, game room, pool, health club, and offices), a Children's Center, and a 250-room hotel. The hotel will be located across from the existing NYS Belleayre Mountain Ski Center and contain 250 rooms (50 with kitchens), 2 restaurants of 450 seats, a 100-seat beverage lounge, shops, 500-seat ballroom/auditorium, 200-seat ballroom, offices/meeting space, a full service spa with 15 treatment rooms and a lap pool, an indoor pool, and an interfaith chapel. Marlowe Mansion (currently the closed Wildacres Hotel) will be renovated and converted to a 150-seat restaurant. Adjacent to these facilities and moving west past the former Highmount Ski Center will be the *Highmount Estates* resort area. This will include a 21 residential lot subdivision. Also, the former Highmount Ski Center will become the *Wilderness Activity Center*. The *Center* will contain a café with a library and lounge area, locker rooms, and athletic facilities (rock climbing walls, ice climbing walls, etc.). It will also be the home base for the outdoor activities on the Highmount section of Belleayre Mountain.

The development projection described above takes into account all foreseen future expansions of the *Wildacres Resort*. The approximate 476 acres will remain undeveloped.

2.0 ESTIMATED WASTEWATER PRODUCTION

This section provides an estimate of the anticipated hydraulic and organic loading from wastewater discharged from the *Wildacres Resort*. The proposed developments will be primarily residential, in nature, (i.e.: hotel rooms and detached lodging units along with 21 homes) with limited commercial facilities (e.g. restaurants, hotel laundry).

The unit flow rates utilized in these estimates are from standards established by the New York State Department of Environmental Conservation, entitled *Design Standards for Wastewater Treatment Works (1988)*. Since the sewage collection system for the proposed developments will be new construction, little or no infiltration/inflow is anticipated. In determining anticipated average daily loadings, it was assumed that the usage or occupancy of the facilities would be at capacity for each day of the year. Even though the proposed developments are intended to be a "four-season" resort, the level of occupancy will vary during the year. For this reason, the following estimates are conservative and reflect maximum potential usage.

2.1 Hydraulic Loading

The estimated average daily hydraulic loading from *Wildacres Resort* was determined by multiplying the number of planned development units (e.g. detached lodging units, restaurant seats, homes, etc.) by the NYSDEC unit flow rate standard. **Table 1** provides an estimate of the hydraulic loading.

The total average daily hydraulic loading from all portions of the development is estimated to be 140,435 gallons or 98 gallons per minute (gpm). In accordance with Section 15-0314 of the NYS Environmental Conservation Law, all of the planned development units will be constructed with water-saving plumbing facilities. This would result in an approximately 20-percent reduction in the estimated design average daily flow, for a total of 112,348 gpd (78 gpm). The commonly accepted method for estimating water usage and wastewater generation is to use literature values for usage per unit (e.g. per capita, per bedroom, per restaurant seat, floor area, etc.). These literature values were generally developed prior to the advent of the manufacture and widespread use of water-saving plumbing fixtures. For example, current building code requirements specify the use of toilets that use a maximum of 1.6 gallons per flush. Prior to this requirement, which was adopted within the last 5 to 8 years, toilets used 3.5 gallons per flush. This alone is a reduction in water usage of more than 54-percent. Similar reductions in water usage can be attributed to other common plumbing fixtures such as sink faucets, shower heads and appliances (e.g. dish washers). Considering this, assuming a 20-percent reduction in usage through water-saving fixtures is conservatively low and actual reductions are most likely much greater than 20-percent.

The maximum day hydraulic loading was determined by assuming it to be 2 times the average daily flow. At an average daily loading of 140,435 gpd, the maximum day

loading is 280,870 gpd. Assuming a 20-percent reduction in flow from the use of water-saving fixtures, the design maximum day hydraulic loading would be 224,696 gpd.

The peak hourly hydraulic load, assuming an average population of 700 for this development, is 3 times the average hourly loading, per Figure 1 of the *Recommended Standards for Wastewater Facilities* by the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (Ten States). This would compensate for those times of the day when there is higher water usage (e.g. morning showers, etc.). At an average daily loading of 140,435 gpd, the peak hourly loading is approximately 421,305 gpd. Assuming a 20 percent reduction in flow from the use of water-saving fixtures, the peak design hourly hydraulic loading would be 337,044 gpd.

The peak instantaneous loading is 674,088 gpd, which is 6 times the design average loading.

Based on the above estimates, approximately 65 percent of the anticipated hydraulic loading will be from detached lodging units. The remainder will be from recreational/entertainment venues, restaurant usage and the laundry facilities located at the hotel.

2.2 Organic Loading

The estimated average daily organic loading (biochemical oxygen demand (BOD) and suspended solids (SS)) was determined by estimating the daily occupancy of the different development areas and multiplying by a per capita loading derived from literature values. Since the majority of the wastewater will be generated at residential-type facilities (private homes and lodging rooms), the composition of the wastewater is expected to be of a nature similar to a typical domestic wastewater. **Table 2** provides an estimate of the organic loading and indicates the means in which the loadings were determined.

The total average daily organic loading from the developments is estimated to be 534.8 lb/day BOD and 638.4 lb/day SS. At the estimated average daily flow of 140,435 gallons, the estimated BOD and SS concentrations are 457 mg/l and 545 mg/l, respectively. Due to the method used to estimate the organic loading, the values derived are conservatively high. Typical BOD and SS values for residential-type developments are 200 mg/l, however, food service facilities (restaurant, clubhouse lounge, etc.) will typically generate a wastewater with a higher concentration of BOD and SS. To compensate for this and to ensure that the proposed wastewater disposal facilities are designed for the "worst case", the above values have been reported.

3.0 WASTEWATER DISPOSAL ALTERNATIVES

Several alternatives have been evaluated for the disposal of wastewater from these proposed developments. These alternatives included: individual household subsurface disposal systems; a regional subsurface disposal system to accommodate the wastewater from both developments; treatment systems to serve specific areas of the developments; and a combination of the above.

Subsurface Disposal Systems

Subsurface disposal systems would be designed and constructed in accordance with NYCDEP regulations stated in, *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources*, NYSDEC standards set forth in *Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988)* as well as *Recommended Standards for Individual Sewage Systems* by the Great Lakes – Upper Mississippi River Board of State Public Health and Environmental Managers (Ten States Standards). They would most likely include a grease trap (if wastewater was from sources such as restaurants and snack bars), septic tank, dosing box and absorption fields. These systems would vary in size based on the anticipated hydraulic loading. Individual subsurface disposal systems, while technically viable, were eliminated from consideration due to higher environmental requirements and financial costs.

On-Site Treatment Systems

On-site wastewater treatment systems would be designed and constructed in accordance with NYCDEP regulations stated in, *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources*, NYSDEC standards set forth in *Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988)* and the *Recommended Standards for Wastewater Facilities* by the Great Lakes – Upper Mississippi River Board of State Public Health and Environmental Managers. Treatment of the wastewater in on-site treatment system(s) would likely involve the following processes: preliminary treatment to remove large solids and oil and grease; primary treatment to remove settleable solids; secondary or biological treatment to reduce the organic loading; tertiary treatment to remove suspended solids, phosphorus, nitrogen and pathogens; and disinfection. The size of such a treatment system would vary depending on the hydraulic loading and the level of treatment necessary would vary depending on the effluent discharge permit requirements. The options for discharge of the wastewater effluent are, surface discharge to a receiving stream, subsurface discharge to an absorption field, or surface discharge to a holding area for spray irrigation. The option selected will dictate the effluent quality as specified in the State Pollution Discharge Elimination System (SPDES) permit issued by the NYSDEC. This alternative is retained for further consideration as an on-site treatment facility is a viable option for the processing and disposal of wastewater generated at the

facility. The use of effluent from the treatment facility for irrigation purposes has the added benefit of reducing the need to obtain irrigation water from other sources.

Consolidated Discharge

The neighboring Village of Fleischmanns historically and currently utilizes individual subsurface absorption systems for their sewage disposal/treatment needs. However, the Village has submitted a Facility Plan to the NYSDEC and New York City Department of Environmental Protection (NYCDEP) for review and approval to construct a wastewater treatment plant (WWTP) with a capacity to meet the Village's needs, on a parcel of land that has no room for an enlarged facility. This facility does not include enough excess treatment capacity to accommodate the wastewater generated by the development. However, discharging all the development-generated wastewater to the Village's WWTP could be a viable option if the planned capacity of the WWTP could be increased to accommodate the development and if a larger parcel of land can be made available and if the facility could be constructed and fully operational in a timeframe consistent with the construction and opening of the development. An additional opportunity for consolidated discharge may exist at the New York City owned Pine Hill Wastewater Treatment Plant.

3.1 Evaluation Considerations

Some of the factors to consider in the evaluation and selection of an alternative for the disposal of wastewater from these developments are:

- Estimated hydraulic and organic loading (Section 3.1.1)
- Influent wastewater quality
- Effluent quality requirements (Section 3.1.2)
- Surface/subsurface discharge points
- Site conditions (Section 3.1.3)
- Constructability

The following sections provide a more detailed discussion of some of the evaluation considerations. By utilizing the information presented in these sections, the treatment alternatives can be compared and assessed for applicability.

3.1.1 Estimated Hydraulic and Organic Loading

Based upon the calculated estimates of the hydraulic and organic loading, the proposed wastewater treatment alternative must be capable of handling influent flow from the *Wildacres Resort* at a design average flow of 112,348 gpd with an average BOD of 534.8 lb/dy.

3.1.2 Estimated Effluent Quality Requirements

The following are estimated SPDES permit limits. These limits are comparable to other wastewater treatment facilities of similar size. This list was prepared in consultation with the NYSDEC. These parameters as determined in a SPDES permit would be the design basis if a wastewater treatment plant were proposed.

PERMIT PARAMETER	PERMIT LIMIT
Flow (average gallons per day)	112,435
BOD5 (mg/l)	5
Suspended Solids (mg/l)	10
PH	6.5-8.5
Temperature (°F)	70
Solids, Settlable (ml/l)	0.1
Ammonia (mg/l as NH3)	1.1
Dissolved Oxygen (mg/l)	7
Phosphorus, Total (mg/l)	0.5
Turbidity (95% of the time)	0.5
Turbidity (maximum value)	5

3.1.3 Site Conditions

The northeastern portion of *Wildacres Resort,* which encompasses 128 detached lodging units, clubhouse (including a pool, game room, health club, reception, sales and operational offices, and snack bar), the Children's Center, and 12 holes of the golf course, lie in Delaware County in the Town of Middletown. Pursuant to Middletown Code, these lands are currently zoned Rural V (R-5) with the exception of the northern strip of land in *WRHGC*, which is zoned Rural III (R-3). R-5 is described in Section 405 and R-3 is described in Section 404 of the Code. Also see the DEIS Section 1.4.1.

The southern and western portion of *Wildacres Resort,* which encompasses the remainder of the development, is located in Ulster County in the Town of Shandaken. Pursuant to Shandaken Code, these lands are currently zoned Residential District R3 and R5 with the exception of the far southeast portion of WRHGC, which is zoned Residential District R1.5. R5 is described in Article III Section 116-5 C1, R3 is described in Article III; Section 116-SC2 of the Code and R1.5 is described in Article III Section 116-5 C3 of the Shandaken Code. Also see the DEIS Section 1.4.1.

Wetlands are present at a handful of locations throughout the proposed *WRHGC* site. The aggregate surface area of the individual ACOE non-isolated wetlands are approximately 11.5 acres of the 242-acre development. No regulated wetlands will be disturbed during the construction of the wastewater treatment facility. For more complete information see Appendix 17A "Federal Wetlands Preconstruction Notification".

The topography of the land proposed for the *Wildacres Resort* generally slopes in varying degrees from the south to the north. Specifically, *WRHGC* development will occupy land

that slopes from an approximate elevation of 2,300 feet amsl in the southern lands adjacent to County Route 49A to 1,800 feet amsl to the north along NYS Route 28. The proposed *Highmount Estates* development slopes radially out from an elevation of 2,800 feet amsl at its southern most point to 2,400 feet amsl at the limits of the western most planned lot.

Based on the soil survey prepared for this DEIS. The *WRHGC* site is mostly areas of shallow and moderately deep, very stony soils formed in glacial till soils that are derived from red shale and sandstone. There are some areas of deep glacial till soils that have a very firm fragipan. A few areas of the deep till do not have fragipan. The deep soils with fragipan are well drained Lewbeach and moderately well drained Willowemoc soils. The deep glacial till soil without fragipan is well drained Elka. At the base of steep slopes along the outlet of small streams coming off the mountain there are some broad areas of very gravelly glacial outwash. The *Highmount Estates* development is comprised of mostly shallow Halcott and moderately deep Vly soils.

The Ulster County Soil Survey was published in 1979. The field work for the Ulster County Soil Survey was done in the seventies, sixties and probably as far back as the fifties. The Delaware County Soil Survey is still in progress.

In the interim between the Ulster County published soil survey and the contemporary mapping being done in Delaware County, there has been some new soil classification conventions introduced. Soil temperature regimes were recognized in the early 1980's and most of the soils in the Adirondack and Catskill Mountains were determined to have "frigid" temperature regimes. Previously all soils in New York were classified as having mesic temperature regimes. The soils at the assemblage fall into the frigid temperature criteria.

While the physical properties of the soils did not change, entire new suits of soil were identified for the Catskills because the temperature regime has an effect on the agricultural productivity of similar soils in locations that have differing lengths of growing season. It seems appropriate to use the most recent and accurate soil mapping conventions for the soil maps for the assemblage. For that reason some of the soils named in the soil survey are not consistent with soils named in the Ulster County Soil Survey, they are, however, currently being mapped in Delaware County. See DEIS Section 3.6 for further information.

Eleven test pits and three percolation tests were conducted in November 2000 in various locations throughout the proposed *WRHGC* development to further characterize the subsurface conditions. The findings indicated that at every test pit location the typical boundary condition was an impervious layer (fragipan) at 25 to 35 inches below the surface. The upper layers of soil are made of browner glacial soils that are loamier and "perced". Deeper percolation tests revealed that the underlying soils were made of firm layers of glacial till. These soils are derived from shale and silt and contain more clay. Bedrock was overlain by flagstone anywhere from 16 to 72 inches below ground surface.

No seasonal high groundwater elevations could be inferred from the eleven test pits. Further, no groundwater was encountered during test pit procedures.

Other conditions of the development that influence the alternatives analysis for wastewater treatments methods include the nature of the proposed development and the sources and uses of water resources.

The site layout for the Wildacres Resort encompasses only 242 acres of land. The large wetland and sloped areas of the former Highmount Ski Center provide a natural boundary for the primary golf-related and detached lodging unit developments. The layout is therefore compact, with facilities in close proximity to each other, wrapped by the golf course.

The source of water for the Wildacres Resort is proposed to be ground water from the neighboring Village of Fleischmanns. The Village operates a public water supply for which excess capacity has been established. The water supply to be used by the Wildacres Resort would serve not only the Resort, but the Village as well. This is an important consideration in the evaluation of alternatives for wastewater treatment as some alternatives provide direct recharge to the ground water system, while others provide less direct, but equally important opportunities for reuse of treated wastewater for irrigation. With private water supplies, there are no other users of the water supply; therefore, the resources could be used for irrigation without restriction beyond the demands of the Resort and the NYSDEC water supply permit total taking. Since the water supply is to be purchased from a public water supply with many users, the use of the groundwater for irrigation would likely be limited or restricted to avoid any impact on other users of the same water supply. This fact then favors reuse of treated wastewater effluent for irrigation over direct use of groundwater.

3.2 Subsurface Disposal Systems

To evaluate whether or not subsurface treatment was a feasible option, site reconnaissance and preliminary soil percolation tests were performed at potential absorption system locations in the northeastern corner of *WRHGC,* on lands located in Delaware County, in November 2000. The tests were conducted according to the standards of the New York State Department of Health (NYSDOH) and witnessed by a representative of the NYCDEP. An average percolation rate of 7.5 minutes per inch was calculated from the test results. The fastest percolation rate was 5.5 minutes per inch and the slowest was 9.5 minutes per inch. **Exhibit B** contains the test pit logs and percolation test results.

Based on the NYSDEC standards set forth in *Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988)* and the NYCDEP regulations stated in, *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources*, the range of percolation results of 5.5 to 9.5 minutes per inch fall within the allowable range set by

the NYCDEP of 3 to 60 minutes per inch. Soil conditions on the site vary both in terms of composition and depth. It is possible that the actual locations for the absorption systems may have less than adequate soil conditions. In this event, it may be necessary to move acceptable soil from other areas of the site or import them, which provide an acceptable percolation rate.

Wastewater would be conveyed to an untreated wastewater wet well. A duplex pump station would then transfer the wastewater to localized septic tanks. After leaving the septic tank the wastewater would accumulate in a dosing tank until the dose volume was reached and the high level sensor activated the pumps. The dosing tank pumps would distribute the wastewater to the absorption systems constructed in accordance with the capacity required by NYSDEC standards, NYCDEP regulations, and EPA guidelines.

The absorption fields would be constructed by placing a layer of soil three feet thick that extends beyond the field perimeter by five feet on all sides. If acceptable soil is moved from other areas of the site, it would be selected to have a percolation rate of less than 10 minutes per inch, if not, the soil would be imported. Prior to constructing the fields, test pads would be prepared under controlled conditions, and a construction quality control plan developed to assure that the trench bases constructed satisfied the design percolation rates.

Under this alternative, the three feet of soil under the trench and the five-foot thick buffer zone would act as the treatment zone. As the treated wastewater percolates downward from the bottom of the soil treatment zone it would enter the native soils beneath and enter the local groundwater system.

If the average flow of 140,435 gpd were used, a total of 156,039 square feet of primary absorption area would be required to treat the site wastewater by subsurface treatment. In addition to the 156,039 square feet required for the primary absorption fields, an additional 156,039 square feet would be mandatory for the reserve area. The average flow and area required for absorption fields can be reduced by 20 percent, since water saving plumbing fixtures will be used. It should be noted that no one field would receive more than 30,000 gpd of wastewater to avoid enacting additional treatment requirements.

The proposed golf course at the *WRHGC* will require irrigation water, both during turf establishment and during normal operation. The amount of water necessary will vary depending on weather conditions, particularly temperature and rainfall. Larger quantities will be required during the period when the turf is being established. The recycling of effluent from a wastewater treatment plant could provide substantial quantities of water for irrigation. Subsurface disposal systems would not provide treated wastewater that could be used for irrigation purposes.

3.3 Wastewater Treatment Plant

To minimize piping, equipment, space requirements, and outside water supply sources for irrigation, a single treatment system to handle the flow from both of the Wildacres developments is the best approach. This would also facilitate the collection of effluent for recycling as irrigation water during the growing season. Since the irrigation water would be used at the golf course on *WRHGC*, the *WRHGC* is the best location for a regional treatment system. Additionally, when the effluent is not needed for irrigation (rain storms, late fall, winter, early spring), the water could be discharged to an unnamed tributary to Emory Brook. The wastewater treatment plant would be designed and constructed per Ten States, NYSDEC, and NYCDEP standards. The wastewater treatment plant would be designed, constructed and operated to comply with tertiary treatment standards set by the NYSDEC.

4.0 PROPOSED WASTEWATER DISPOSAL PLAN

Considering all of the factors associated with the treatment and disposal of wastewater from *Wildacres Resort*, the wastewater generated by the developments should be collected and conveyed to a single regional treatment facility. The facility could be located in the northeast corner of the *WRHGC* development **(Drawing 7** in **Exhibit A)**. The treated effluent may be discharged to either an on-site, 7.3 million gallon storage pond during the growing season or to a surface outfall at a tributary to Emory Brook.

The pond mentioned above would have a five to 10 foot wide shelf installed around its perimeter. The sidewalls would then slope away from the shelf at a ratio of 3:1 to a maximum depth of approximately eight feet. The base would be constructed by compacting the native soils and then putting in place a geosynthetic liner. The pond would be designed to include measures to prevent accidental discharge, seepage, or overflow of treated wastewater.

The advantages of utilizing the single treatment facility in combination with both a discharge to groundwater (irrigation) and surface discharge to manage the wastewater are the following: ability to recycle the effluent as irrigation water or to a surface outfall as conditions warrant (low flow conditions, rain events, golf off-season); equipment, operation and maintenance activities would primarily be located and occur at one location; and there is an adequate amount of relatively remote property available for the facility.

4.1 Collection and Transmission System

A majority of the sewer collection system would operate under pressure. The sewage from the 21 single family housing units on *Highmount Estates*; the Wilderness Activity Center; the hotel including the Conference Center and golf clubhouse; the Marlowe Mansion Restaurant; the 40-two bedroom detached lodging units along Fairways #16 and #17; and the Children's Center, would be collected into duplex grinder pump stations and pumped through polyethylene pipe to the eastern portion of the WRHGC development. The force main would then continue along the Resort road and collect sewage generated by 16 additional octoplex units (128 detached lodging units), and the octoplexs' clubhouse. The force main would end at a termination manhole installed approximately 470 feet southeast of the green of Hole #4 **(Drawing 7 and 8** of **Exhibit A)**. Clean-outs would be spaced every 500 feet throughout the system. Piping and clean-outs would be designed and installed according to the *NYSDEC- Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988)*. Cutsheets of the duplex grinder pump stations that could be utilized can be referenced in **Exhibit C**.

The diameter of the polyethylene force main would increase from two and one half-inches to six-inches in size as service connections from the facilities are added and the force main proceeds east. Sanitary sewer service connections would be installed with the

necessary fittings and laterals. The sizing of these items would vary with the type of service needed. Generally, the single family units will require 1-1/4 inch appurtenances; the Wilderness Activity Center, the Children's Center, the 168 detached lodging units, clubhouses, snack bars, and Marlowe Mansion Restaurant will require two-inch appurtenances; and the hotel with the conference center will require six-inch appurtenances. For facilities such as restaurants, clubhouses, and snack bars, grease traps will be installed on the sink effluent lines prior to the waste entering the sanitary sewer lines. Grease traps are sized according to the NYSDEC standards. **Exhibit D** contains the calculations used to size the grease traps.

Drawings 3 through 8 in **Exhibit A** provide plan views of the service area described above. **Drawings 9 and 10** in **Exhibit A** contain details of example service connections, grinder pumps, cleanouts, and grease traps.

The gravity collection portion of the sanitary sewer system would originate at the force main termination manhole and travel across Fairway #4 to the proposed wastewater treatment plant via an eight-inch diameter, polyethylene, sanitary sewer main. Manholes would be spaced every 400 feet, at all points of change of grade, size or alignment, and at the end of all lines. Piping and manholes would be installed according to the *NYSDEC-Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988).*

All piping would be installed below the frost zone and on continuous, uniform, and adequately compacted bedding. Prior to backfill placement, the piping would receive pressure and leakage testing in compliance with the standards. Backfill material would then be placed in tamped layers to a determined height above the pipe for protection and support. Native soils and/or finished grade materials can then be placed.

In instances where it is necessary for wastewater piping to cross or border the potable water system, the minimum separation distances given in Part 8.6 of the *Recommended Standards For Water Works*-Great Lakes Upper Mississippi River Board of State Public Health & Environmental Managers, the *NYSDEC- Design Standards for Wastewater Treatment Works – Intermediate Sized Sewerage Facilities (1988),* and the *NYCDEP Rules and Regulations* would be followed. Surface water crossings would also be designed to adhere to the standards above.

4.2 Wastewater Process and Treatment

The wastewater treatment system under consideration includes Intermittent Cycle Extended Aeration (ICEAS)-NDN: Biological Nutrient Removal basins with filtration and disinfection that would consist of the following facilities:

1. Manually Cleaned Bar Screens and Comminutor
2. Flow Measurement
3. ICEAS-NDN Basins
4. Flow Equalization

5. Sand Filtration
6. Disinfection
7. Subsurface, Surface or On-Site Pond Effluent Disposal (discussed in Section 4.5)
8. Sludge Digestion/Off-Site Disposal

The process flow sequence is illustrated on **Figure 1. Drawings 9 through 14** in Exhibit A provide plan and elevation views of the conceptual plant, plant layout, and equipment. **Exhibit E** contains cutsheets and manufacturers literature about the equipment detailed in this section. The proposed wastewater treatment system would be designed and installed in accordance with NYSDEC, Ten States, and NYCDEP regulations.

Influent Sewage

The sewage from the gravity sanitary sewer main would flow through a flume where a flow meter would calculate and record the flow rate. A bar screen and a comminutor sized to handle peak hourly flow would precede the flume to remove untreatable solids. A grit sump may also be installed to permit additional solids to be removed prior to the wastewater entering the ICEAS-NDN basins.

ICEAS-NDN Basins

Subsequent to preliminary treatment the wastewater would enter a flow splitter. The flow splitter would divide the flow such that each of the ICEAS-NDN units would receive equal flow. The concrete flow splitter would contain a collection vault; lift pumps, and a piping manifold to transfer the wastewater to one or all of the ICEAS-NDN basins. Valving to direct the flow and provide flow control would be installed on the manifold. This would provide flexibility in operation and allow the use a specific unit if one required servicing. Each pump would have the ability to operate at 160 gpm with 25 feet of head. Activation/deactivation of the pumps would be controlled by level sensors or floats in the collection vault.

The basins are specifically called Intermittent Cycle Extended Aeration System (ICEAS)-NDN basins. ICEAS basins allow continuous inflow as a single, two chamber unit carries out primary clarification, aeration, nitrification/denitrification, phosphorus removal, and secondary clarification. The biological nutrient removal is enhanced by incorporating alternating phases of oxic-anoxic/anaerobic (air-on/ air-off) conditions in the operating cycle.

Each ICEAS unit contains two zones: the Pre-React Zone and the Main React Zone. The Pre-React Zone baffles the incoming flow and prevents short-circuiting. It also provides pre-treatment before the waters enter the Main React Zone. Therefore, the Pre-React Zone acts as a bioselector and encourages the proliferation of the most desirable organisms for treatment. This, in turn, minimizes the growth of filamentous bacteria that cause sludge bulking and poor settling.

Three, time-based phases occur during one four and a half-hour cycle in the Main React Zone:

1. Air On/ Air Off – 2.8 hours - The basin is alternately aerated/ non-aerated in 0.4-hour increments while filling. The aerobic phases promote BOD removal, nitrification, and phosphorus uptake. The anoxic/anaerobic phases promote denitrification and phosphorus release.
2. Settling/ Denitrification – 1 hour - Aeration is stopped and the solids settle to the bottom of the basin leaving clear water on top. The basin continuously receives influent.
3. Decant – 1 hour - Clear water is discharged from the top of the basin, while the basin continuously receives influent. The sludge can be wasted during this phase.

A three and a half-hour storm cycle operational sequence is possible with the ICEAS basins. The duration of each phase is shortened by 25 percent. This only affects the duration per cycle while the overall aeration, settle, and decant times per day remain constant.

Exhibit E contains a potential design proposal, cutsheets and literature about the ICEAS-NDN. As can be seen from the cutsheets and **Drawing 12**, each basin is 18 feet high, 18 feet wide, and 51 feet long to accommodate an average flow of approximately 123,600 gallons per day. The basins would be installed utilizing common wall construction to minimize the footprint needed for the units. Utilizing multiple units would meet the NYCDEP 100 percent redundancy requirement.

Each unit would be fitted with waste sludge pumps to transfer the sludge during the decant phase to the adjacent sludge holding tank. Blowers would be used to supply air to the ICEAS fine bubble aeration system of each basin during the air-on phase of the cycle.

Sand Filtration

Filtration would be through continuously backwashed upflow dual sand filtration (CBUDSF) units. Specifically, the DualSand™ System would be utilized. The DualSand™ System chemical filtration process uses two CBUDSF units in series. An oxidant (sodium hypochlorite) and coagulant (PASS) are added prior to the first stage filter. This is accomplished by utilizing 2 gph chemical feed pumps (2 per chemical system) fitted with positive flow sensors. An in-line static mixer in the influent pipe provides proper mixing. The coagulant used in the process hydrolyzes immediately in water thus no flocculent tank is required. Actual dosage will depend on the quality of influent water.

The first stage filter contains coarse sand that is able to handle high solids loading and exceptional removal. The addition of the oxidant helps to keep the sand clean and free from any biological growth. The oxidant also improves the performance of the coagulant.

The second stage filter contains fine sand. This fine sand is not subject to solids fouling because the first stage filter removes approximately 99% of the solids in the water. The reject from the filter is returned to the treatment system influent. The returned reject enhances the performance of the system and provides economical use of the chemicals.

According to the NYCDEP Technical Bulletin No. 1, the CBUDSF unit application rate cannot exceed 3 gpm/sf of treatment surface area. Therefore, based on the estimated peak decant rate of 600 gallons per minute for 45 minutes, that must be transferred through the filter units in 3.5 hours, the CBUDSF units must have surface areas of 45 square feet. NYCDEP also requires that three trains be utilized for flows greater than 50,000 gallons per day. Therefore, three 19 square foot CBUDSF trains would be installed. This would satisfy the NYCDEP requirement of three trains with capacities to handle half the average day flow (79 gpm) since each train can handle 57 gpm. The total application rate the three trains could handle is 171 gpm (including reject water (10% of flow)) at the required 3 gpm/sf. The backwash or reject water from the units would be returned to the flow splitter influent vault.

Since it has been shown that the CBUDSF system works more efficiently and effectively when it receives water continuously, an equalization tank would be installed prior to the DualSand™ CBUDSF units. The 33,662-gallon equalization tank (18 feet high by 25 feet long by 10 feet wide) would collect the decanted effluent from the ICEAS basins and be fitted with two pumps capable of 150 gpm at 25 TDH to feed the effluent to the DualSand™ units. The pumps would operate off of level switches installed in the equalization tank.

Turbidity monitors and recorders would be installed on the common influent and effluent lines of the CBUDSF Units. A particle counter and recorder on the common effluent line and a flow measuring devices on the influent line of each vessel shall also be provided.

Drawing 13 provides plan and elevation views of the proposed CBUDSF units.

Phosphorus Removal

It is anticipated that the majority of the phosphorus present in the wastewater would be removed in the ICEAS basins such that effluent concentration of less than 2 mg/l (conservative) are present. The remainder of the phosphorus would then be removed by the addition of the coagulant prior to the sand filters and the subsequent filtration. A final concentration of less than 0.05 mg/l phosphorus (conservative) is anticipated. However, as a contingency, provisions could be made to add up to a 50 mg/l dosage of alum to the Main React Zone of the ICEAS basins, via 0-5.0 gph chemical feed pumps, to precipitate and remove phosphorus. The effluent from the wastewater treatment will be monitored (i.e. sampled) to ensure that any coagulants used in the treatment process do not introduce any undesirable contaminants.

Disinfection

Pursuant to NYCDEP Technical Bulletin No. 2, disinfection would be achieved through the use of ultraviolet light with controls for operation and for the automatic back-up system. The effluent from the filters would be directed to three Infilco Degremont, Inc. Model No. 6SH ultraviolet disinfection units. Each unit has a capacity of 54 gpm. This capacity is sufficient even though the capacity of each CBUDF is 57 gpm since a portion of the flow will be lost as reject water.

Post Treatment / Effluent Storage Tank

Treated water would gravity flow to a wet well. A duplex pump station, with a capacity of 350 gpm at 70 TDH, would transfer the effluent to the subsurface distribution devices and subsequent infiltration fields or the on-site, lined pond for irrigation needs or to the surface outfall for discharge to an unnamed tributary to Emory Brook. A flowmeter would monitor and record the flows entering either of the discharge options.

Sludge Digestion/Off-Site Disposal

The 1.7 hp, 45 gpm waste sludge pumps would transfer the sludge in the Main React Zone to a sludge holding tank during the decant phase of the ICEAS operational cycle. The sludge tank would share a common wall with an ICEAS basin. The sludge holding tank would be 18 feet high, 11 feet wide and 53 feet long. The tank would be aerated by a 134 scfm at 7.5 psig, 7.5 HP blower. The tank would also be fitted with a cover. The holding tank would have the capacity to contain 20 days worth of sludge. At that time, the sludge would be hauled to an off-site facility for disposal.

Odor Control

The treatment system proposed is designed to avoid the creation of objectionable odors. The sludge holding tank and CBUD system would be covered and housed, respectively. Additionally, contingent measures such as chlorine addition; activated carbon filters on the ventilation systems, wet scrubbers, and biofilters can be incorporated to control odors should such measures be required by regulatory agencies.

The prevailing winds are from the west/southwest. The closest receptor in this direction is approximately 400 to 650 feet away. These distances should provide adequate separation for dissipation if a malodorous event were to occur.

Noise Control

The treatment system proposed is designed to avoid the creation of objectionable noise. To eliminate excessive sound generated by the treatment equipment, a portion of the equipment would be located within a treatment building. The building would be insulated with sound dampening boards on the inside walls. In addition, each blower and compressor would be fitted with silencers and flexible vibration padding for the blower skids to reduce noise generated due to vibration.

4.3 Treatment Building

Drawing 7 in **Exhibit A** illustrates the proposed location of the wastewater treatment system. **Drawing 11** illustrates the plan view details for the system layout. A building is proposed to house the DualSand™ System, laboratory facilities, chemicals, office and motor control room, and certain pieces of equipment. The building would be a concrete block structure with color and decor to blend in with the surroundings and to present an inconspicuous structure. **Drawings 11 through 14** provide elevation and plan views of the building and equipment layout.

As stated above, an office room, motor control center (MCC) room, and general equipment area would be located in the treatment building. The general equipment room would accommodate the CBUDSF units, UV disinfection system, blowers, compressor, and lab facilities. The chemical feed pumps and chemical drums would also be stored on containment pallets in this area. A sink would be located in the laboratory area with its discharge drained (along with the floor drain discharge) through PVC piping to the influent to the treatment system. The office/computer area would contain visual meter panels that would display the influent and effluent flow, turbidity, and pH. Visual alarms, autodialers, and automatic high water shut-offs would safeguard against accidental sewage discharge. The MCC room would contain the power and control panels. The generator located outside this room would provide power in the event of power failure.

4.4 Wastewater Characteristics

The estimated wastewater characteristics would be as follows:

Parameters	Influent	Effluent	Discharge Standard
BOD_5	457 mg/l	5 mg/l	5 mg/l
Suspended Solids	545 mg/l	10 mg/l	10 mg/l
NH_3	60 mg/l	1.1 mg/l	1.1 mg/l
Phosphorous	10 mg/l	0.5 mg/l	0.5 mg/l
Dissolved Oxygen		7 mg/l	7 mg/l
pH		6.5-8.5	6.5-8.5

The effluent will be treated to meet the intermittent stream standards stated above.

The system would require a NYS licensed operator to monitor the facility and sign Discharge Monitoring Reports (DMRs), and would require a SPDES permit from the NYSDEC.

4.5 Effluent Discharge

4.5.1 Irrigation Pond

Effluent can be discharged from the tertiary treatment plant to a pond used to hold irrigation water. The wastewater would be conveyed under pressure to the pond and discharged to the pond's surface. The outfall structure would incorporate measures to secure the outfall piping to the bank of the pond, and some ornamental rip rap to provide an aesthetically pleasing means to disperse and aerate the effluent. The area around the outfall would be landscaped in a way to preserve the pond/golf course aesthetics while allowing access for sampling and maintenance as necessary. The outfall is shown on **Drawing 7**.

4.5.2 Surface Discharge

An alternative for the discharge of effluent from the treatment plant is a direct discharge to the unnamed intermittent stream located approximately 1,100 feet west of the treatment plant. A 6-inch diameter discharge pipe would be installed along the cart path shown on **Drawing 6**. Erosion control measures would be constructed at the discharge end of the pipe to prevent scouring and erosion of sediment in the stream. The wastewater treatment system will be designed and constructed to achieve intermittent stream standards and the effluent discharge would be monitored in accordance with a SPDES permit issued by the NYSDEC.

5.0 EMERGENCY OPERATION

The wastewater treatment plant would be equipped with standby power sufficient to run the entire plant in order to ensure uninterrupted, reliable operation in the event of utility power failure. Additionally, the aeration system, blowers, sludge blowers, air control valves, waste sludge pumps, transfer pumps, and controls would be fitted with alarms and automatic start-up capabilities.

A generator would be utilized for the standby power needs. As stated previously, it would be located adjacent to the treatment building **(Drawing 11)**.

6.0 CONSTRUCTION EROSION CONTROL

During construction, the work would be required to comply with all NYSDEC and NYCDEP erosion control measures including siltation fence, straw bales, placement of spoils on upper side of trench, siltation ponds, if necessary, and seeding. Federal and local regulations would also be adhered to as required. An Erosion Control Specialist, certified by the International Erosion Control Association, will be hired, independent from any contractors, to oversee the maintenance, repair and upgrade of erosion control devices. Refer to Sections 2 and 3 and Appendices 9, 10 and 11 of the DEIS for more a detailed discussion of construction erosion control.

7.0 OPERATION AND MAINTENANCE

A detailed O&M Plan would be assembled which would describe the required operation and maintenance of the treatment system as well as the collection and distribution components. The plan would at a minimum include technical specification cut sheets of equipment including operation requirements, program for solids and other waste disposal, electrical schematic, and other engineering details.

The following provides an outline of a typical operation and maintenance plan:

1.0 Introduction
- 1.1 Plan User Guide
- 1.2 Operation and Managerial Responsibilities
- 1.3 Plant Description

2.0 Permits and Standards
- 2.1 General
- 2.2 Water Quality Standards
- 2.3 Discharge Permit
- 2.4 Monitoring Requirements

3.0 Process Description and Operation of Facilities
- 3.1 General
- 3.2 Description of Operation and Control of Project Facilities
- 3.3 Routine Operating Procedures

4.0 Maintenance
- 4.1 General
- 4.2 Preventative Maintenance and Inspection
- 4.3 Lubrication
- 4.4 Non-Scheduled Maintenance
- 4.5 Housekeeping
- 4.6 Maintenance Equipment
- 4.7 Warranty Provisions
- 4.8 Detailed Maintenance Instructions

5.0 Emergency Operation and Response Program
- 5.1 Emergency Program
- 5.2 Response to Emergencies
- 5.3 Potential Emergency Conditions
- 5.4 Emergency Plans

6.0 Laboratory Testing
- 6.1 General
- 6.2 Purpose and Importance

TABLES

Table 1:

Wildacres Resort and Highmount Golf Club/ Highmount Estates Estimated Hydraulic Loading

Facility Type	Units	Number	Daily Flow [1] (gal/unit/day)	Flow [2] (gpd)
Wildacres Resort and Highmount Golf Club				
Hotel	Rooms	250	120	30,000
Restaurant (3 rest; 600 seats; 4 seatings)	Seats	600	35	21,000
** (2 rest. in Hotel, 1 at Marlowe Mansion)				
** 100 Seat Beverage Lounge	Seats	100	20	2,000
Retail Stores (10)	SF	13,000	0.1	1,300
** Public Bathrooms	Toilets	4	400	1,600
Indoor Pool	Swimmers	250	10	2,500
Spa	Patrons	150	10	1,500
** w/ 15 Treatment Rooms and Lap Pool				
Offices/Meeting Space (Total in Wildacres)	SF	7,300	0.1	730
Lodging Units (168-2 Bdrm)	2-Bedrooms	168	300	50,400
Lodging Unit Clubhouse--				
Pool/Health Club	Swimmers	168	10	1,680
40 Seat Snack Bar	Seats	40	20	800
Conference Center	SF	51,000	0.1	5,100
-Ballroom/Auditorium	Seats	700	3	2,100
Golf Course Clubhouse	Members	154	25	3,850
** w/ 40 Seat Snack Bar	Seats	40	20	800
Interfaith Chapel	Seats	250	3	750
Maintenance Shops/Storage Areas/Children's Center	SF	17,500	0.1	1,750
			Subtotal	127,860
Highmount Estates				
Single-Family Home (21-4 Bdrm)	4-Bedrooms	21	475	9,975
Wilderness Activity Center				
Café with Lounge and Library	Seats	20	20	400
Locker Rooms	Toilets	4	400	1,600
Sauna/ Steam Room/ Jacuzzi	Patrons	60	10	600
			Subtotal	12,575
			Total	140,435

[1] All hydraulic loading rates taken from *Design Standards for Wastewater Treatment Works Intermediate Sized Sewage Facilities-1988 (A NYSDEC Div. of Water Publication)-Table 3*

[2] Flow (gpd)='Number' Value *Daily Flow (gal/unit/day)

Table 2:

Wildacres Resort and Highmount Golf Club/ Highmount Estates Estimated Organic Loading

Facility Type	Persons	No. Persons	BOD Rate [1] (lb/dy/cap)	SS Rate [2] (lb/dy/cap)	BOD [3] (lb/dy)	SS [4] (lb/dy)
Wildacres Resort and Highmount Golf Club						
Lodge	Patrons	500	0.2	0.24	100	120
	Employees	25	0.1	0.12	2.5	3
Restaurant (3 Rest; 600 Seats; 4 Seatings)	Patrons [5]	2,400	0.07	0.084	168	201.6
	Employees	75	0.1	0.12	7.5	9
100 Seat Beverage Lounge (3 Seatings)	Patrons [5]	300	0.07	0.084	21	25.2
	Employees	18	0.1	0.12	1.8	2.16
Retail Shops [7]	Customers	500	0.04	0.048	20	24
	Employees	25	0.1	0.12	2.5	3
Indoor Pool [6]	Patrons	250	0.05	0.06	12.5	15
	Employees	12	0.1	0.12	1.2	1.44
Spa with 15 Treatment Rooms and Lap Pool [6]	Patrons	150	0.04	0.048	6	7.2
	Employees	18	0.1	0.12	1.8	2.16
Offices/Community Areas	Persons	200	0.05	0.06	10	12
Lodging Units	Residents	504	0.2	0.2	100.8	100.8
-(168, 2 bdrm)					0	0
Lodging Unit Clubhouse--						
Pool/Health Club [6]	Patrons	168	0.05	0.06	8.4	10.08
	Employees	8	0.1	0.12	0.8	0.96
Snack Bar (40 Seats; 2 seatings)	Patrons [5]	80	0.07	0.084	5.6	6.72
	Employees	4	0.1	0.12	0.4	0.48
Golf Course Clubhouse [6]	Patrons	250	0.04	0.048	10	12
	Employees	12	0.1	0.12	1.2	1.44
Snack Bar (40 Seats; 4 seatings)	Patrons [5]	160	0.07	0.084	11.2	13.44
	Employees	8	0.1	0.12	0.8	0.96
Conference Center/Ballroom/Auditorium	Seats	700	0.02	0.048	14	33.6
				Total	**508.0**	**606.2**
Highmount Estates						
Single-Family Homes	Residents	84	0.2	0.24	16.8	20.16
-(21, 4 bdrm)						
Wildacres Activity Center						
Community Area	Persons	200	0.05	0.06	10	12
				Combined Total	**534.8**	**638.4**
					BOD [8] (mg/l)	**SS [9] (mg/l)**
		@ est. ave. flow (combined) [10] (gpd)	**140,435**		**457**	**545**

[1] All BOD Rates taken from *Water and Wastewater Technology Second Edition* by Mark Hammer-*Table 9-1*
[2] SS Rate (lb/dy/cap) is typically 1.2*BOD Rate
[3] BOD (lb/dy)=BOD Rate (lb/dy/cap)*'No. Persons' Value
[4] SS Rate (lb/dy)=SS Rate (lb/dy/cap)*'No. Persons' Value
[5] BOD and SS Rates for Restaurant Patrons combine the patron value and the meal served value
[6] The BOD and SS Rates for Restaurants are assumed to be the same for Club Houses/Spas
[7] The BOD and SS Rates for Offices are assumed to be the same for Retail Shops
[8] BOD (mg/l)=Total BOD Rate (lb/dy)/(Flow (mil gpd)*8.34)
[9] SS (mg/l)=Total SS Rate (lb/dy)/(Flow (mil gpd)*8.34)
[10] Average Flow value is the 'Total' hydraulic loading values of Wildacres and Leach from Table 1 (this document).

Table 3:

Absorption System Details

Fields #	Facilities/ Lodging Served	Hydraulic Load (gpd)	Grease Trap Sizing (gal)	Septic Tank Sizing (gal)	Area of Absorption Fields (SF)	# of Fields Required	Lateral/ Piping Details*
1	ALL FACILITIES	30,000	750 gal trap for the Activity Center; 2000 gal traps for the 40-seat snack bars in the clubhouses; 3000 gal trap for 100-seat beverage lounge; and (6) 8000 gal traps for the conference center, ballroom, Marlowe Mansion rest., and rest(s) in hotel.	40,000	33,333	7- 4725 SF Fields plus 50% Reserve	7 Fields w/ (9) 100 ft laterals
2		30,000		40,000	33,333	7- 4725 SF Fields plus 50% Reserve	7 Fields w/ (9) 100 ft laterals
3		30,000		40,000	33,333	7- 4725 SF Fields plus 50% Reserve	7 Fields w/ (9) 100 ft laterals
4		22,688		40,000	25,208	5- 4725 SF Fields plus 50% Reserve	5 Fields w/ (9) 100 ft laterals

* All laterals are 2" diameter pipe spaced 5' on-center with 1/4" holes spaces 5' on-center. Manifold headers are 4" diameter pipe.

FIGURES

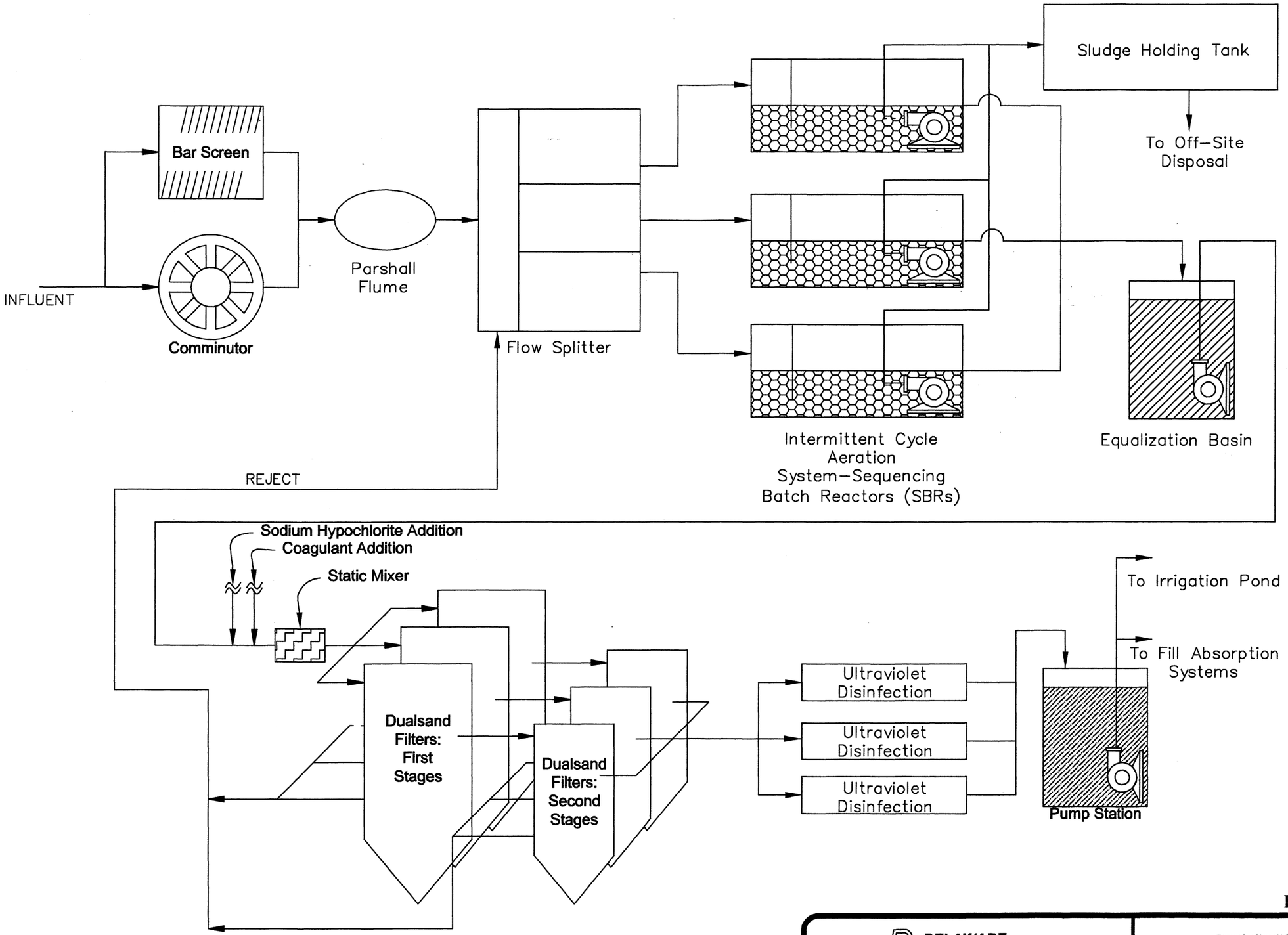


FIGURE 1

DELAWARE ENGINEERING, P.C.
28 Madison Avenue Extension
Albany, New York 12203
Phone 518–452–1290
FAX 518–452–1335

PROCESS FLOW DIAGRAM

WILDACRES RESORT / HIGHMOUNT GOLF COURSE / HIGHMOUNT ESTATES

JANUARY 2002

FILENAME: CROSSROADS–PROPOSED FLOW THRU.DWG

EXHIBITS

Exhibit A

Drawings
(Separate Attachment)

Exhibit B

Test Pit and Percolation Test Results

THE L A GROUP

40 LONG ALLEY, SARATOGA SPRINGS, NEW YORK 12866

TO: KEVIN FRANKE

FROM: ROGER J. CASE, SOIL SCIENTIST

DECEMBER 11, 2000

RE: DEEP SOIL TEST PITS AND PERCOLATION TESTS @
BELLAYRE CROSSROADS VENTURE PROPERTIES
HIGH MOUNT/PINE HILL, NY

These deep soil test pits observations were made November 2000. Present at the time were Roger Case, soil scientist, cpss, cpsc, LA Group and representatives from the New York City DEP.

There are three parcels involved with the project. The deep test pits are typically identified with the prefix representing the parcel in which they are located. WA prefix is for pits at Wild Acres. The prefix R is for pits at the Ridge parcel and T represents pits described at the Turner Mansion parcel.

The following test pit observations were are from Wild Acres.

Test pit WA119:

Oe horizon: 0 to 2 inches, black (10YR2/1) mucky silt loam duff layer
E horizon: 2 to 3 inches, light gray (10YR7/2) gravelly silt loam
Bw1 horizon: 3 to 10 inches, (5YR4/6) yellowish red channery* silt loam with common small flagstones.
Bw2 horizon: 10 to 16 inches, brown (7.5YR 4/4) very channery silt loam with common flagstones of varying sizes.
Bw3 horizon: 16 to 38 inches, firm, dark yellowish brown (10YR 4/4) very channery silt loam with many flagstones.
Bx horizon**: 38 to 72 inches, very firm, brown (7.5YR 4/4) very channery silt loam, many flagstones.
R horizon: 72+ fractured sandstone and silt stone over hard bedrock.

*channers are elongated thin gravel fragments derived from shale and silt and sandstone, as opposed to typical gravel which is rounded or at least irregularly shaped.
**The Bx horizon designates the beginning of the fragipan.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. A deep "perc" test exceeded one hour.
Percolation rate @ 26 inches is: 5 minutes 35 seconds (5:35)
Soil Series: Lewbeach

Test pit WA120:

Oe horizon: 0 to 1 inches, black (10YR2/1) mucky silt loam duff layer
E horizon: 1 to 2 inches, light gray (10YR7/2) gravelly silt loam (discontinuous)
Bw1 horizon: 2 to 12 inches, (7.5YR6/8) reddish yellow channery silt loam with common small flagstones.
Bw2 horizon: 12 to 24 inches, dark yellowish brown (10YR 4/4) very channery silt loam with many flagstones of varying sizes.
Bx horizon: 24 to 54 inches, very firm, brown (7.5YR 4/4) very channery silt loam, many flagstones.
R horizon: 54+ fractured sandstone and silt stone over hard bedrock.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious.
Percolation rate @ 22 inches is: 7 minutes 45 seconds (7:45)
Soil Series: Lewbeach

Test pit WA122:

Ap horizon: 0 to 5 inches, dark brown (10YR3/3) very channery silt loam, with common flagstones and boulders.
Bw1 horizon: 5 to 19 inches, brown (7.5YR4/4) very channery silt loam with common flagstones.
Bw2 horizon: 19 to 34 inches, dark yellowish brown (10YR 4/4) very channery silt loam with many flagstones of varying sizes.
Bx horizon: 34 to 58 inches, very firm, brown (7.5YR 4/4) very channery silt loam, many flagstones and boulders.
Cd horizon: 58 to 84 inches, very firm layers of sand and gravel.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious.
Percolation rate @ 18 inches is: 9 minutes 30 seconds (9:30)
Soil Series: Lewbeach

Test pit WA Pond 3:

Oe horizon: 0 to 4 inches, black (10YR2/1) mucky silt loam duff layer
E horizon: 4 to 6 inches, light gray (10YR7/2) gravelly silt loam
Bw1 horizon: 6 to 16 inches, (7.5YR 6/8) reddish yellowish very channery fine sandy loam with common small boulders.
Bw2 horizon: 16 to 26 inches, yellowish brown (10YR 5/4) very channery fine sandy loam with some small boulders.
Bx horizon: 26 to 42 inches, very firm, grayish brown (2.5Y 5/2) very bouldery loam
Cd horizon: 42 to 86+ inches, very firm, brown (2.5Y 5/2) very channery loam.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. This location was investigated as a future location for pond construction, no percolation test was run. These impervious hardpan soils should make successful ponds.
Soil Series: Lewbeach

Test pit WA117001:

Oe horizon: 0 to 2 inches, black (10YR2/1) mucky silt loam duff layer
Bw1 horizon: 2 to 10 inches, (10YR 6/8) brownish yellowish channery loam.
Bw2 horizon: 10 to 24 inches, brown (7.5YR 6/4) very channery loam.
Bx horizon: 24 to 48 inches, very firm, brown (7.5YR 4/4) very channery silt loam with a few small boulders.
C horizon: 48 to 84 inches, firm, brown (7.5YR 6/4) very gravelly sandy loam.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. This test pit was excavated to confirm soil mapping. The test pit confirms the map unit for Lewbeach soils which are deep, well drained soils formed in coarse textured glacial till soils. This particular area of Lewbeach is not quite a red as typical Lewbeach soils.

Test pit WA117:

Ap horizon: 0 to 7 inches, dark brown (10YR3/3) silt loam, very stony
Bw1 horizon: 7 to 16 inches, yellowish brown (10YR3/6) very gravelly silt loam.
Bw2 horizon: 16 to 28 inches, brown (7.5YR 5/4) very gravelly silt loam
Bx horizon: 28 to 52 inches, very firm, reddish brown (5YR 5/3) very channery silt loam with many mixed flagstones.
C horizon: 52 to 84 inches, very firm, very flaggy silt loam.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. No percolation test was run, this area was investigated as a proposed pond site and should be successful.
Soil Series: Lewbeach

Test pit WA117002:

Oe horizon: 0 to 1 inches, black (10YR2/1) mucky silt loam duff layer
E horizon: 1 to 2 inches, light gray (10YR7/2) gravelly silt loam (discontinuous)
Bw1 horizon: 2 to 12 inches, (7.5YR6/8) reddish yellow channery silt loam with common small flag stones.
Bw2 horizon: 12 to 24 inches, dark yellowish brown (10YR 4/4) very channery silt loam with many flagstones of varying sizes.

BC horizon: 24 to 38 inches, firm, brown (7.5YR 4/4) very channery silt loam, many flagstones.
R horizon: 38+ fractured sandstone and silt stone over hard bedrock.

The depth to bedrock varied in the pit from 38 inches at one end to 72 inches at the other end. There are no seeps and no mottles, however there is a very firm Bx horizon at the deeper end of the pit and it is essentially impervious.
Soil Series: Vly (slightly brown phase)

Test pit #WA116:

This test pit was excavated in the lawn, west of the existing motel on the property. The soil consists of old stable fill excavated from the hillside behind the motel.

Ap horizon: 0 to 6 inches, dark reddish brown (5YR 3/2) silt loam.
C horizon: 6 to 84 inches, reddish brown (5YR 5/4) very gravelly/channery silt loam.

This area is intended for construction. No percolation tests were run. There were no seeps or mottles.
Udorthents, smoothed

Test pit WA117003:

Oe horizon: 0 to 25 inches, black (10YR2/1) fibrous organic duff layer mixed in a near pavement of large flagstones and boulders.
Bw1 horizon: 25 to 41 inches, reddish brown (5YR 4/4) very channery silt loam with common mixed flagstones.
Bw2 horizon: 41 to 60 inches, reddish brown (5YR 5/4) very channery loam, slightly firm, with many flagstones of varying sizes.
C horizon: 60 to 72 inches, slightly firm, reddish brown (7.5YR 4/4) very channery silt loam, many flagstones and boulders.

There are no seeps and no mottles. No perc test was run.
Soil Series: Elka

Test pit WA117004:

Ap horizon: 0 to 9 inches, dark brown (10YR3/3) channery silt loam.
Bw1 horizon: 9 to 19 inches, reddish brown(5YR 4/6) channery loam.
Bw2 horizon: 19 to 35 inches, reddish brown (7.5YR 4/3) very channery silt loam.
Bx horizon: 35 to 84 inches, very firm, light reddish brown (5YR 6/3) very channery silt loam with thick beds of flag stone in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. This test pit was excavated to confirm soil mapping. The test pit confirms

the map unit for Lewbeach soils which are deep, well drained soils formed in coarse textured glacial till soils.

Test pit WA115:

Oe horizon: 0 to 1 inches, black (10YR2/1) fibrous organic duff layer
A horizon: 1 to 6 inches, dark grayish brown (10YR3/2) gravelly silt loam
Bw1 horizon: 6 to 9 inches, dark brown (10YR 3/3) channery silt loam
Bw2 horizon: 9 to 16 inches, yellowish brown (10YR 5/6) very channery silt loam with many flagstones of varying sizes.
R horizon: 16+ fractured sandstone and silt stone over hard bedrock.

There are no seeps and no mottles. This is an area confirmed as Halcott soils, however there is not the extensive areas of Halcott first predicted.

The following test pits and percolation test results are from the Ridge parcel.

Test pit #R118001:

Ap horizon: 0 to 2 inches, dark reddish brown (5YR 3/2) channery silt loam.
Bw1 horizon: 2 to 11 inches, reddish brown(5YR 4/4) channery loam.
Bw2 horizon: 11 to 16 inches, reddish brown (5YR 5/3) very channery silt loam.
Bx horizon: 16 to 84 inches, very firm, light reddish brown (5YR 6/3) very channery silt loam with thick beds of flag stone in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 27 minutes (27:00)
The soil type is Lewbeach.

Test pit #R118002:

Oe horizon: 0 to 2 inches, black (5YR 2/1) fibrous duff layer.
Bw1 horizon: 2 to 8 inches, reddish brown(5YR 4/6) channery loam.
Bw2 horizon: 8 to 16 inches, reddish brown (5YR 4/6) channery silt loam.
Bw3 horizon: 16 to 26 inches, reddish brown (5YR 5/3) very channery silt loam.
Bx horizon: 26 to 90 inches, very firm, light reddish brown (5YR 6/3) very channery silt loam with thick beds of flag stone in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 15 minutes (15:00)
The soil type is Lewbeach.

Test pit #R118003:

Oe horizon: 0 to 1 inches, black (5YR 2/1) fibrous duff layer.
Bw1 horizon: 1 to 12 inches, dark yellowish brown (10YR 4/4) channery loam.
Bw2 horizon: 12 to 17 inches, light yellowish brown (10YR 6/4) channery silt loam.
BC horizon: 17 to 27 inches, light yellowish brown (10YR 6/4) very channery fine sandy loam with some small flagstones.
C horizon: 27 to 36 inches, firm, pale brown (10YR 6/3) very channery silt loam, with common fine faint dark yellowish brown (10YR 4/6) mottles.
R horizon: 36 inches, hard sand stone bedrock.

The boundary condition is perched seasonal high water table at 27 inches below the surface. The C horizon is firm and essentially impervious. The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 12 minutes (12:00)
The soil type is Vly.

Test pit R118004:

Oe horizon: 0 to 2 inches, black (10YR2/1) fibrous organic duff layer
E horizon: 2 to 4 inches, gray (5YR 6/2) fine sand
Bw horizon: 4 to 16 inches, reddish yellow (7.5YR 6/8) channery silt loam
R horizon: 16+ fractured sandstone and silt stone over hard bedrock.

There are no seeps and no mottles. This is an area proposed for a pond. Typically, deeper soils are better suited to pond construction.
The soil type is Halcott rock outcrop.

Test pit R118005:

Oe horizon: 0 to 2 inches, black (10YR2/1) fibrous organic duff layer
E horizon: 2 to 4 inches, gray (5YR 6/2) fine sand
Bw horizon: 4 to 18 inches, reddish yellow (7.5YR 6/8) channery silt loam
R horizon: 18+ fractured sandstone and silt stone over hard bedrock.

There are no seeps and no mottles. This is an area proposed for a pond. Typically, deeper soils are better suited to pond construction.
The soil type is Halcott rock outcrop.

Test pit R118006:

Oe horizon: 0 to 2 inches, black (10YR2/1) fibrous organic duff layer
E horizon: 2 to 4 inches, gray (5YR 6/2) fine sand
Bw horizon: 4 to 12 inches, reddish yellow (7.5YR 6/8) channery silt loam
R horizon: 12+ fractured sandstone and silt stone over hard bedrock.

There are no seeps and no mottles. This is an area proposed for a hotel construction.
The soil type is Halcott rock outcrop.

Test pit R118007:

Oe horizon: 0 to 2 inches, black (10YR2/1) fibrous organic duff layer
E horizon: 2 to 7 inches, gray (5YR 6/2) fine sand
Bw1 horizon: 7 to 16 inches, yellowish brown (10YR 4/6) channery silt loam
Bw2 horizon: 16 to 27 inches, yellowish brown (10YR 4/4) very channery silt loam.
Bx horizon: 27 to 90 inches, very firm, light reddish brown (5YR 6/3) very channery silt loam with thick beds of flag stone in the lower part.

There are no seeps and no mottles. This is an area proposed for a pond. Typically, deeper soils are better suited to pond construction.
The soil type is Lewbeach (slightly brown phase).

Test pit R118008:

Oe horizon: 0 to 3 inches, black (10YR2/1) fibrous organic duff layer
E horizon: 3 to 5 inches, gray (5YR 6/2) fine sand
Bw1 horizon: 5 to 14 inches, yellowish brown (10YR 4/6) channery silt loam
Bw2 horizon: 14 to 53 inches, ***rubble.*** rubble consists of massive piles of flagstones and boulders with large voids and spaces too large to fill with soil material. Typically rubble occurs at the base of steep bedrock ledges.

There are no seeps and no mottles. No percolation test was performed. The area is proposed for hotel construction.
The soil type is Lewbeach, extremely rocky

Test pit R118009:

Oe horizon: 0 to 2 inches, black (10YR2/1) fibrous organic duff layer
E horizon: 2 to 4 inches, gray (5YR 6/2) fine sand
Bw1 horizon: 4 to 23 inches, yellowish brown (10YR 4/6) channery silt loam

Bw2 horizon: 23 to 60 inches, ***rubble,*** mostly flagstones and boulders approaching bedrock ledge near the bottom of the test pit.

There are no seeps and no mottles. No percolation test was performed. The area is proposed for hotel construction.
The soil type is Lewbeach, extremely rocky

Test pit #R1180010:

Oe horizon: 0 to 2 inches, black (5YR 2/1) fibrous duff layer.
Bw1 horizon: 2 to 10 inches, reddish brown (5YR 4/4) channery loam.
Bw2 horizon: 10 to 24 inches, reddish brown (5YR 4/4) very channery, very flaggy silt loam.
R horizon: 24 inches, hard sand stone bedrock.

The boundary condition is hard bedrock at 24 inches below the surface.
The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 5 minutes 10 seconds (5:10)
The soil type is Vly.

Test pit #R1180011:

Oe horizon: 0 to 2 inches, black (5YR 2/1) fibrous duff layer.
Bw1 horizon: 2 to 8 inches, reddish brown(5YR 4/6) channery loam.
Bw2 horizon: 8 to 23 inches, reddish brown (7.5YR 5/6) channery silt loam.
Bx horizon: 23 to 90 inches, very firm, light reddish brown (5YR 6/3) very channery silt loam with thick beds of flag stone in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 22 inches below the surface.
The stabilized percolation rate is: 10 minutes 15 seconds (10:15)
The soil type is Lewbeach.

The following test pits and percolation test results are from the Turner Mansion parcel.

Test pit #T119001:

Ap horizon: 0 to 6 inches, dark grayish brown (10YR 3/2) silt loam.
Bw1 horizon: 6 to 15 inches, brown (7.5YR 5/ 4) channery silt loam.
Bw2 horizon: 15 to 29 inches, brown (7.5YR 5/4) very channery silt loam.
Bx horizon: 29 to 63 inches, very firm, light reddish brown (5YR 6/3) very channery silt loam with thick beds of flag stone in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 20 inches below the surface.
The stabilized percolation rate is: 21 minutes 45 seconds (21:45)
The soil type is Lewbeach.

Test pit #T119002:

Ap horizon: 0 to 6 inches, dark grayish brown (10YR 3/2) silt loam.
Bw1 horizon: 6 to 21 inches, reddish brown (7.5YR 5/6) channery silt loam.
Bw2 horizon: 21 to 32 inches, reddish brown (7.5YR 4/4) channery silt loam.
C horizon: 32 to 36 inches, very firm light brownish gray (10YR 6/2) channery silt loam.
R horizon: 36 inches, hard sand stone bedrock.

The boundary condition is hard bedrock at 36 inches below the surface.
The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 14 minutes 2 seconds (14:02)
The soil type is Vly.

Test pit #T119003:

Ap horizon: 0 to 5 inches, dark grayish brown (10YR 3/2) silt loam.
Bw1 horizon: 5 to 28 inches, brown (7.5YR 5/ 4) channery silt loam.
Bw2 horizon: 28 to 40 inches, pale brown (10YR 6/3) very channery silt loam, with few fine faint yellowish brown (10YR 4/6) mottles.
Bx horizon: 40 to 61 inches, very firm, light brownish gray (10YR 6/2) very channery silt loam with flagstones in the lower part.

The boundary condition is perched seasonal high water table, indicated by mottling at 28 inches below the surface. The percolation test was run at 16 inches below the surface.
The stabilized percolation rate is: 24 minutes 30 seconds (24:30)
The soil type is Willowemoc.

Test pit #T119004:

Ap horizon: 0 to 11 inches, grayish brown (10YR 4/2) silt loam.
Bw1 horizon: 11 to 28 inches, reddish brown (5YR 5/ 4) channery silt loam.
Bx horizon: 28 to 42 inches, very firm, light brownish gray (10YR 6/2) very channery silt loam with medium, faint yellowish brown (10YR 5/6) mottles, flagstones in the lower part.

The boundary condition is perched seasonal high water table, indicated by mottling at 28 inches below the surface. The percolation test was run at 16 inches below the surface. (A percolation test at 30 inches was in excess of one hour).

The stabilized percolation rate is: 13minutes 10 seconds (13:10)
The soil type is Willowemoc.

Test pit #T119005:

Ap horizon: 0 to 1 inches, dark grayish brown (10YR 3/2) silt loam.
Bw1 horizon: 1 to 25 inches, brown (5YR 4/ 4) channery silt loam.
Bw2 horizon: 25 to 36 inches, pale brown (5YR 5/4) very channery silt loam
Bx horizon: 36 to 50 inches, very firm, light brownish gray (5YR 6/3) very channery silt loam with flagstones in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 20 inches below the surface.
The stabilized percolation rate is: 17 minutes 30 seconds (17:30)
The soil type is Lewbeach.

Test pit #T119006:

Ap horizon. 0 to 3 inches, dark grayish brown (10YR 3/2) silt loam.
Bw1 horizon: 3 to 14 inches, strong brown (5YR 5/ 8) channery silt loam.
Bw2 horizon: 14 to 27 inches, brown (7.5YR 5/6) very channery silt loam
Bx horizon: 27 to 48 inches, very firm, light brownish gray (5YR 6/3) very channery silt loam with flagstones in the lower part.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 10 minutes 00 seconds (10:00)
The soil type is Lewbeach.

Test pit R119007:

Oe horizon: 0 to 2 inches, black (10YR2/1) fibrous organic duff layer
Bw horizon: 2 to 18 inches, strong brown (7.5YR 5/6) silt loam
BC horizon: 18 to 22 inches, reddish yellow (7.5YR 6/8) channery silt loam with fractured sandstone and silt stone over hard bedrock.
R horizon: 22+ hard bedrock.

The soil type is Halcott rock outcrop.

Test pit #T119008:

Ap horizon: 0 to 6 inches, dark grayish brown (10YR 3/2) silt loam.
Bw1 horizon: 6 to 17 inches, strong brown (5YR 5/ 8) silt loam.

Bw2 horizon: 17 to 20 inches, brown (7.5YR 5/6) silt loam
Bt1 horizon: 20 to 32 inches, firm, light brown(7.5YR 6/4)silty clay loam.
Bt2 horizon: 32 to 44 inches, very firm, pinkish gray (7.5YR 6/2) silty clay loam.
BC horizon: 44 to 72 inches, very firm, pinkish gray (7.5YR 6/2) silt loam.

There are no seeps and no mottles, however the Bx horizon is very firm and essentially impervious. The percolation test was run at 18 inches below the surface.
The stabilized percolation rate is: 20 minutes 00 seconds (20:00)
The soil type is Lewbeach.

Test pit R119009:

Oe horizon: 0 to 4 inches, black (10YR2/1) fibrous organic duff layer
Bw horizon: 4 to 20 inches, strong brown (7.5YR 5/6) silt loam
BC horizon: 20 to 24 inches, reddish yellow (7.5YR 6/8) channery silt loam with fractured sandstone and silt stone over hard bedrock.
R horizon: 24+ hard bedrock.

The soil type is Vly rock outcrop.

THE L A GROUP

40 LONG ALLEY, SARATOGA SPRINGS, NEW YORK 12866

TO: KEVIN FRANKE

FROM: ROGER J. CASE, SOIL SCIENTIST

NOVEMBER 27, 2000

RE: BELLAYRE/CROSSROADS VENTURES

Fourteen percolation tests were performed on soil areas within the three parcels that comprise the Crossroads Ventures properties juxtaposition to the existing New York State operated Bellayre ski center.

The percolation tests were performed adjacent to deep soil test pits excavated specifically to determine the suitability of that particular location for septic disposal. Each area is located and identified on the Crossroads Ventures topographic maps by parcel.

The test pits at the Wild Acres parcel have the prefix WA. The test pits at the Turner Mansion parcel have the prefix T and the pits at the Ridge have the prefix R. The percolation tests are identified as the "perc" test at the designated deep soil test pit.

Every test pit observed for septic disposal exhibited a boundary condition. Typically, the boundary condition was an impervious layer (fragipan) at 25 to 35 inches below the surface. A couple of the designated septic areas were unsuited because of shallowness to bedrock.

The following stabilized percolation test results in minutes and seconds were observed:

PERC @ WA119: 5: 35 (@ 26 inches below the surface)

PERC @ WA120: 7:45 (@ 22 inches below the surface)

PERC @ WA122: 9:30 (@ 18 inches below the surface)

PERC @ R118001: 27:00 (@ 18 inches below the surface)

PERC @ R118002: 15:00 (@ 18 inches below the surface)

PERC @ R118003: 12:00 (@ 18 inches below the surface)

PERC @ R1180010: 5:15 (@ 16 inches below the surface)
Bedrock at this location is in places <24 inches below the surface. It is probably not suitable.

PERC @ R1180011: 10:30 (@ 22 inches below the surface)

PERC @ T119001: 21:45 (@ 20 inches below the surface)

PERC @ T119002: 14:02 (@ 18 inches below the surface)

PERC @ T119003: 24:30 (@ 16 inches below the surface)

PERC @ T119004: 13:10 (@ 16 inches below the surface)

PERC @ T119005: 17:30 (@ 16 inches below the surface)

PERC @ T119006: 10:00 (@ 18 inches below the surface)

PERC @ T119008: 20:00 (@ 26 inches below the surface)

At a couple of location deeper percolation tests were performed. In each instance the percolation rate exceeded one hour either in the first or second revolution.

As predicted the browner glacial soils, which are loamier "perced" more rapidly than the redder glacial till soils which are derived from red shale and silt stone have more clay.

These tests were done according to the standards of the NYSDOH, each test was witnessed by a representative from the NYC, DEP and the results are replicable.

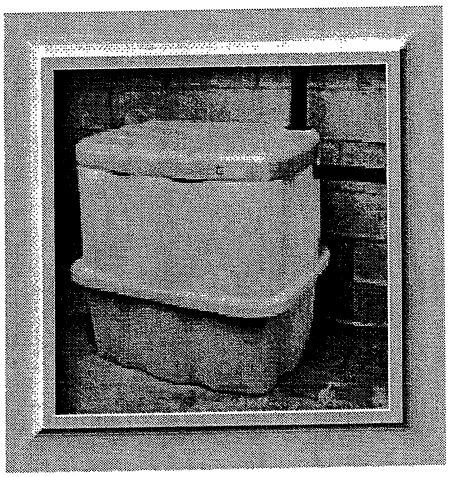
Exhibit C

Grinder Pump Stations

Products : Indoor Unit

Indoor Unit

General Applications



For years, E/One grinder pumps have set the standard in low-pressure sewer system technology. They worked harder. Lasted longer. And required virtually no maintenance.

Once again, we're going places. A place where other grinder pumps just can't go. Inside. With an indoor unit that installs in a matter of minutes, has a clean design, and seems at home with other household appliances.

Introducing the E/One 2010-IDU. It's quiet. Clean. Efficient. Safe. Easy to install. And easy to live with.

It can be used as part of a new E/One Sewer System or retrofit into an existing low-pressure or gravity system.

If you're ready to take your construction new places, don't settle for the status quo. Go new places. With the E/One 2010-IDU Home Wastewater Disposal System.

Specifications

Description
The E/One 2010-IDU was specifically designed for indoor installation in a basement mechanical room or on a slab foundation. Its clean look fits unobtrusively into any environment. While the E/One Indoor Unit is completely enclosed for safety and appearance, it is easy to access should it need servicing.

Applications
Indoor installation in all single family homes built on any kind of terrain — hilly, rocky, wet, or flat. Ideally suited for new residential communities.

Installation
Designed for speed and ease of installation. Installs like other major household appliances and requires only a 240-volt outlet to install and operate.

Click here to download the illustrated PDF version (116K).

Features and Benefits
E/One 2010-IDU indoor grinder pump is a complete unit ready for installation that includes grinder pump, check valve, controls, and a tough, noncorrosive tank made of high-density polyethylene.

Lake any major appliance, the E/One indoor unit requires only a 240-volt outlet to install and operate. Requires only a pipe in/pipe out simple plumbing connection.

The grinder pump within the tank is state-of-the-art, grinding all solids into fine particles for easy, reliable disposal through small-diameter pipes to a central treatment plant.

The grinder pump is automatically activated and runs infrequently for very short periods.

1 1/4-inch discharge connection is adaptable to any piping requirement, thereby meeting local codes.

91-gallon tank capacity is based on water usage patterns and more than adequate to meet the needs of single-family homes.

Internal check valve assembly is custom designed for non-clog, trouble-free operation.

Typical electric power costs for a single-family home is between $15 and $20 a year.

Designed with sound insulating properties.

Operational Information

Motor:
1 hp, 1725 rpm, high torque, capacitor start, thermally protected, 240V, 60Hz, 1 phase

Inlet Connection:
4-inch PVC socket weld

Discharge Connection:
Pump discharge terminates in 1 1/4-inch NPT female thread. Can be adapted to 1 1/4-inch PVC pipe or any other material required by local codes.

Discharge*:
15 gpm at 0 psig

11 gpm at 40 psig
9 gpm at 60 psig
*Discharge data includes loss through check valve, which is minimal

Overload Capacity:
The maximum pressure that the pump can generate is limited by the motor's characteristics. The motor generates a pressure well below the rating of the piping and appurtenances. The automatic reset feature does not require manual operation following overload.

Alarm Display:
An audio/visual alarm with a battery backup indicates any loss of power to the unit.

Dimensions:
29" x 37" x 35"

Environment One Corporation
2773 Balltown Road, Niskayuna, NY 12309-1090
Voice: (518) 346-6161 Fax: (518) 346-6188
eone@worldnet.att.net

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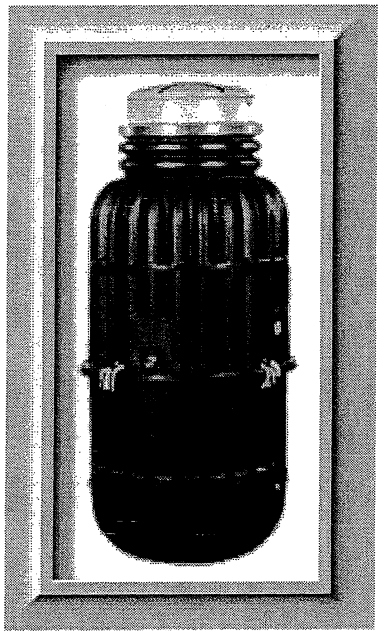
Products : GP 2014

Model GP 2014 Grinder Pump



Contents:

Downloads:

GP 2014 drawings (640K PDF)
GP 2014 drawings (self-extracting DXF)

General Applications

Its size, efficiency and operating economy make the GP 2014 your best choice for multiple dwellings, waterfront property, subdivision developments and marinas. It is ideally suited for both new and existing communities.

Features

The GP 2014 is a complete unit, including grinder pump, check valve, tank and all necessary controls packaged into a single unit, ready to connect.

All solids are ground into fine particles to pass easily through the pump, check valve and small diameter pipe lines ... even objects that should not be in sewage (plastic, rubber, fiber, wood, etc.). The 1 1/4" discharge connection can be adapted to any piping materials which meets local code requirements.

A tough, corrosion resistant tank of HDPE, sized on the basis of computer studies of water usage patterns, provides optimum holding capacity.

An internal check valve assembly in the Grinder Pump is custom designed for non-clog, trouble-free operation.

The Grinder Pump is automatically activated and, because it runs infrequently and for very short periods, its annual electric energy consumption is typically that of a 40 watt light bulb.

Units are available for indoor and outdoor installations. Outdoor units accommodate a wide range of depths.

Operational Information

Motors:
1 HP, 1725 rpm, high torque, capacitor start, thermally protected, 240 or 120 volt, 60 hertz, 1 phase

Inlet Connections:
4" inlet grommet standard for DWV pipe. Other inlet configurations available from factory.

Discharge Connections:
Pump Discharge terminates in 1 1/4" NPT female thread. Can easily be adapted to 1 1/4" PVC pipe or any other material required by local codes.

Discharge:*
15 gpm at 0 psig
11 gpm at 40 psig
9 gpm at 60 psig

Overload Capacity:
Maximum pressure which pump can generate is limited by motor characteristics to a value well below the rating of the piping and appurtenances. Automatic reset feature does not require manual operation following overload.

US and foreign patents issued and pending.

*Discharge data includes loss through check valve which is minimal.
**CSA certification applies only to Grinder Pumps bearing the "C" in the model number.

Installation

The Environment One Grinder Pump is a well-engineered, reliable and proven product: proper installation will assure years of trouble-free service. The following instructions define the recommended procedure for installing the Model 2010 Grinder Pump. These instructions cover the installation of units with and without accessways.

This is a sewage-handling pump and must be vented in accordance with local plumbing codes. This pump is not to be installed in locations classified as hazardous in accordance with National Electric Code, ANSI / NFPA 70. All piping and electrical systems must be in compliance with applicable local and state codes.

1. REMOVE PACKING MATERIAL

The User Instructions must be given to the homeowner. Hardware supplied with the unit, if any, will be used at installation.

2. TANK INSTALLATION

The tank is supplied with a standard grommet for connecting the 4" DWV (4.50" outside diameter) incoming sewer drain. Other inlet types and sizes are optional (caution 4" DR-35 pipe is of smaller diameter and won't create a watertight joint with the standard grommet). Please confirm that you have the correct inlet before continuing. If a concrete ballast is attached to the tank lift only by the lifting eyes, (rebar) embedded in the concrete. Do not drop, roll, or lay tank on its side. This will damage the unit and void the warranty.

If the tank has no accessway (Indoor Installation) (Fig. 1b):
The pump may be installed on or in the basement floor (see Fig. 1b). If the tank is to be set on the floor it must be a flat and level bearing surface. If the tank is to go into the basement floor, it must be anchored to prevent unit from floating due to high ground water (see Chart 1, page 8 for weight).

If the tank is to go in the floor:
A hole of the correct width and depth should be excavated. The tank must be placed on a 6" bed of gravel made up of naturally rounded aggregate, clean and free flowing, with particle size not less than 1/8" or more than 3/4" in diameter. The wet well should be leveled and filled with water prior to pouring the concrete to prevent the tank from shifting. If it's necessary to pour the concrete to a level above the inlet, the inlet must be sleeved with an 8" tube before pouring.

There must be a minimum clearance of three feet directly above the tank to allow for removal of the pump core.

If the tank has an accessway (Fig. 1a):
Excavate a hole to a depth, so that the removable cover extends above the finished grade line. The grade should slope away from the unit. The diameter of the hole must be large enough to allow for a concrete anchor. Place the unit on a bed of gravel, naturally rounded aggregate, clean and free flowing, with particles not less than 1/8" or more than 3/4" in diameter. The concrete anchor is not optional. The amount of concrete required varies for each respective unit. (See Chart 1 on page 8 for specific requirements for your unit)

The unit should be leveled and the wet well filled with water to the bottom of the inlet to help prevent the unit from shifting while the concrete is being poured. The concrete must be vibrated to ensure there are no voids.

If it is necessary to pour the concrete to a higher level then the inlet, the inlet must be sleeved with an 8" tube before pouring.

If your unit is a model taller than 93" it may be shipped in two sections, requiring field assembly. See Field Joint Assembly Instructions on

page 6 for additional information.

3. INLET PIPE INSTALLATION
Mark the inlet Pipe 3 1/2" from the end to be inserted. Inlet pipe should be chamfered and lubricated with a soap solution. Lubricate the inlet grommet with soap solution as well. Insert the pipe into the grommet up to the 3 1/2" mark. Inspect to ensure the grommet has remained intact and in place.

4. DISCHARGE
The use of 1-1/4" PVC pressure pipe Schedule 40 and polyethylene pipe SDR 11 or SIDR 7 are recommended. If polyethylene is chosen use compression type fittings to provide a smooth inner passage. It is recommended that a Redundant Check Valve Assembly (E/One part no. PB0104GXX) be installed between the pump discharge and the street main on all installations. Never use a ball type valve as a check valve. We recommend the valve be installed as close to the public right-of-way as possible. Check local codes for applicable requirements.

CAUTION: Redundant check valves on station laterals and anti-siphon/check valve assemblies on grinder pump cores should not be used as system isolation valves during line tests.

If the tank has no accessway (Indoor Installation):
The discharge connection is a 1-1/4" male NPT. The discharge piping must incorporate a shut-off valve and a union with a minimum pressure rating of 160 PSI, or a suitable piping disconnect to allow for removal of the pump core. The valve should be of the type that provides a full-ported passage (i.e. a ball or gate valve). A standard 1-1/4" union or a compression type coupling should be used as a disconnect joint.

If the tank has an accessway:
There is a ball valve and a quick disconnect pre-installed in the accessway. There is a 1-1/4" female NPT discharge connection on the outside of the tank 41" above the bottom of the tank.

5. BACKFILL REQUIREMENTS
Proper backfill is essential to the long term reliability of any underground structure. Several methods of backfill are available to produce favorable results with different native soil conditions.

The most highly recommended method of backfilling is to surround the unit to grade using Class I or Class II backfill material as defined in ASTM 2321. Class 1A and Class 1B are recommended where frost heave is a concern, Class 1B is a better choice when the native soil is sand or if a high, fluctuating water table is expected. Class I, angular crushed stone offers an added benefit in that it needs minimal compaction. Class II, naturally rounded stone, may require more

compactive effort, or tamping, to achieve the proper density.

If the native soil condition consist of clean compactable soil, with less than 12% fines, free of ice, rocks, roots, and organic material it may be an acceptable backfill. Such soil must be compacted in lifts not to exceed one foot to reach a final Proctor Density of between 85% and 90%. Non-compactable clays and silts are not suitable backfill for this or any under-ground structure such as inlet or discharge lines. If you are unsure of the consistency of the native soil it is recommended that a geotechnical evaluation of the material be obtained before specifying backfill.

Another option is the use of a flowable fill (i.e., low slump concrete). This is particularly attractive when installing grinder pump stations in augured holes where tight clearances make it difficult to assure proper backfilling and compaction with dry materials. Flowable fills should not be dropped with more than four feet between the discharge nozzle and the bottom of the hole since this can cause separation of the constituent materials.

6. VENTING
The unit must be properly vented to assure correct operation of the pump. If you have an indoor unit it can be vented through the 2" port supplied at the top of the wet well or through the incoming sewer line with a 2" pipe (the vent must be within four feet of the grinder pump, and before the first change of direction fitting).

The outdoor units are supplied with a vent pipe from the wet well to the top of the accessway.

Failure to properly vent the tank will result in faulty operation and will void the warranty.

7. ELECTRICAL CONNECTION (Supply panel to E/One control panel) Before proceeding verify that the service voltage is the same as the motor voltage shown on the nameplate. An alarm device is to be installed in a conspicuous location where it can be readily seen by the homeowner. An alarm device is required on every installation. There shall be no exceptions.

Wiring of supply panel and Environment One Control Panel shall be per Figure 2a and 2b, control panel wiring diagrams and local codes.

8. ELECTRICAL CONNECTION (Pump to Panel) (Fig. 4)
The Environment One GP2000 grinder pump station is provided with a cable for connection between the station and the control panel, (The Supply Cable). The supply cable is shipped inside the station with a small portion fed through the cable connector mounted on the wall of the fiberglass shroud. The supply cable, a six-conductor tray cable, meets NEC requirements for direct burial as long as a minimum of 24"

burial depth is maintained. Those portions of the cable which have less than 24" of cover must be contained in suitable conduit. This includes the vertical portion dropping to a 24" depth at the station and the length rising out of the ground at the control panel. NOTE: Wiring must be installed in compliance with local codes.

8a. Procedure for installing E/One supply cable

1. Open the lid of the station, Locate the cable and the feed-thru connector on the wall of the shroud. If the station has a field joint and was delivered in two pieces be sure the 2 halves of the EQD are securely assembled together. Loosen the nut on the connector and pull the supply cable out through the connector until it hits the crimped on stop feature on the cable, approximately 24" from the EQD.
   IMPORTANT: All but 24" of the cable must be pulled out of the station, and the portion of the cable between the EQD and the molded in cable breather should be secured in the hook provided to ensure that the pump functions properly. Do not leave the excess cable in the station.
2. Retighten the nut. This connection must be tight or ground water will enter the station.
3. Feed the wire through the length of conduit (contractor provided) which will protect it until it is below the 24" burial depth.
4. Position the conduit vertically below the cable connector along side of the station reaching down into the burial depth. Attach the small fiberglass guard (Protective Shroud) provided with the station to protect the exposed cable where it enters the station. Four self-tapping screws are provided.
5. Run the cable underground, in a trench or tunnel, to the location of the E/One panel. Leave a 6-12 inch loop of cable at each end to allow for shifting and settling. Connections made at the panel are shown in the panel wir-ing diagram (Fig. 2a and 2b).

9. DEBRIS REMOVAL

Prior to start-up test procedure, the core must be removed and the incoming sewer line flushed to force all miscellaneous debris into the tank. Next, all liquid and debris must be removed. Once tank is clean, re-install the pump and proceed with the test.

10. TEST PROCEDURE

When the system is complete and ready for use, the following steps should be taken to verify proper installation and operation:

a. Make sure that the discharge shutoff valve is fully open. This valve must not be closed when the pump is operating. In some installations there may be a valve, or valves, at the street main that must also be open.
b. Turn ON the alarm power circuit breaker.
c. Fill tank with water until the alarm turns ON. Shut off water.

d. Turn ON pump power circuit breaker Pump should immediately turn on. Within one minute the alarm will turn off. Within three minutes the pump will turn off.

Field Joint Assembly Instructions

It is extremely important that the joint is sealed properly before backfilling. Excavating a unit for repair is very expensive and can be easily avoided by using proper caution during the following procedure.

Parts included in Field Joint Kit:
Identify all parts before proceeding with installation.

(16) 3/8-16 x 1-1/2 Long screws
(16) 3/8-16 Elastic Stop Nuts
(32) Flat Washers
(1) Length Sealant (Sika) Tape
(1) Hole Punch
(1) Vent Pipe Extension

1. Carefully clean and dry both accessway flanges with solvent. IMPORTANT: Sealing surfaces must be dry to ensure the sealant adheres correctly.

2. Apply Sika tape twice around the perimeter of the flange that is attached to the tank, start at one hole and go all the way around just inside the bolt circle. Remove the backing paper as you lay the adhesive on the flange. Do not stretch Sika tape during application, it may result in a leak. The tape should overlap at the end by approximately 1/2 inch, as shown in Fig. 5a. If a section of Sika Tape is misapplied, the bad section may be cut out and replaced. Cut away the poorly laid portion cleanly with a knife and be sure to over lap the tape at each end about 1/2 inch.

3. Using the tool provided, punch a hole through the tape at each of the 16 existing bolt holes in the flange. Be careful to keep the exposed sealant clean and dry.

4. Insert three of the sixteen 3/8-16 x 1-1/2" long bolts, with a flat washer, into the flange attached to the upper part of the accessway. These will act as guides while aligning the bolt pattern of the two flanges.

5. Support the upper access-way section a few inches over the tank with the green stripes on each lined up. Once aligned, lower the upper section onto the mating flange using the three bolts to guide it to the proper position. See Fig. 5b.

6. Insert the remaining 13 bolts with flat washers into the flanges. Place a flat washer and elastic stop nut on the end of each bolt,

turning the nut on just enough to hold the washer in place.

7. Tighten up the bolts until the sealant begins to squeeze out from between the flanges. To ensure a consistent, sturdy seal tighten them in the following sequence: 1, 9; 5, 13; 3, 11; 7, 15; 2, 10; 4, 12; 6, 14; 8, 16. Always be sure to tighten one bolt and then the bolt at the position 180* from it, see Figure 1 for position numbers.

8. Using the same sequence as in step 7 tighten each bolt to 60 in-lbs. Visually inspect the joint, each bolt and each nut should have a flat washer between it and the flange, and a uniform amount of sealant should be protruding from the seam along the entire perimeter.

In the event that there are any voids in the sealant, the joint may leak. Take corrective actions if necessary and be sure that the joint is leak free before continuing.

9. Install the vent pipe extension piece which was shipped inside the upper piece of the accessway. Push the extension pipe into the bell mouth fitting on the pipe installed in the wet well tank. Be sure the pipe is seated correctly. Slide the top end of the extension pipe into the receptacle on the bottom of the lid.

Lifting Instructions

Failure to follow these instruction completely will void warranty.

1. Transporting unit to installation site:
Always lift a unit from the bottom for the purpose of transportation. The station should be received attached to a pallet for this purpose. Never roll a station or move it on its side.

2. No Ballast (to be poured in place):
If the concrete anchor is to be poured while the station is in place lift the unit using 2 nylon straps wrapped around the accessway making a sling, as shown below. Keep station oriented vertically to avoid any damage. Only lift from the accessway to put unit in hole, not for moving any distance.

3. Precast Ballast:
Never lift a station that has a ballast attached by any means except the rebar. The weight of the concrete will damage the station if you attempt to lift it from any part of the station.

Ballast Calculations

A ballast, or concrete anchor, of proper volume and weight is required on all in-ground installations. The following explains how to arrive at the correct size ballast:

The amount of ballast needed is equal to the weight it would take to counterbalance the buoyant forces that would be present if the station were being installed in water. Therefore:

STATION VOLUME x THE WEIGHT OF WATER PER CUBIC FOOT (62.4 LBS/CU FT) = BUOYANT FORCES

$$F_{BUOYANT}$$

BUOYANT FORCES - STATION WEIGHT = FORCE REQUIRED FROM BALLAST

$$F_{BALLAST}$$

BALLAST FORCE ÷ WEIGHT OF CONCRETE PER CUBIC FOOT IN WATER (87.6 LBS/CU FT) = VOLUME OF CONCRETE REQUIRED

$$V_{CONCRETE}$$

VOLUME OF CONCRETE x WEIGHT OF CONCRETE PER CUBIC FOOT IN AIR = WEIGHT OF CONCRETE REQUIRED

$$W_{CONCRETE}$$

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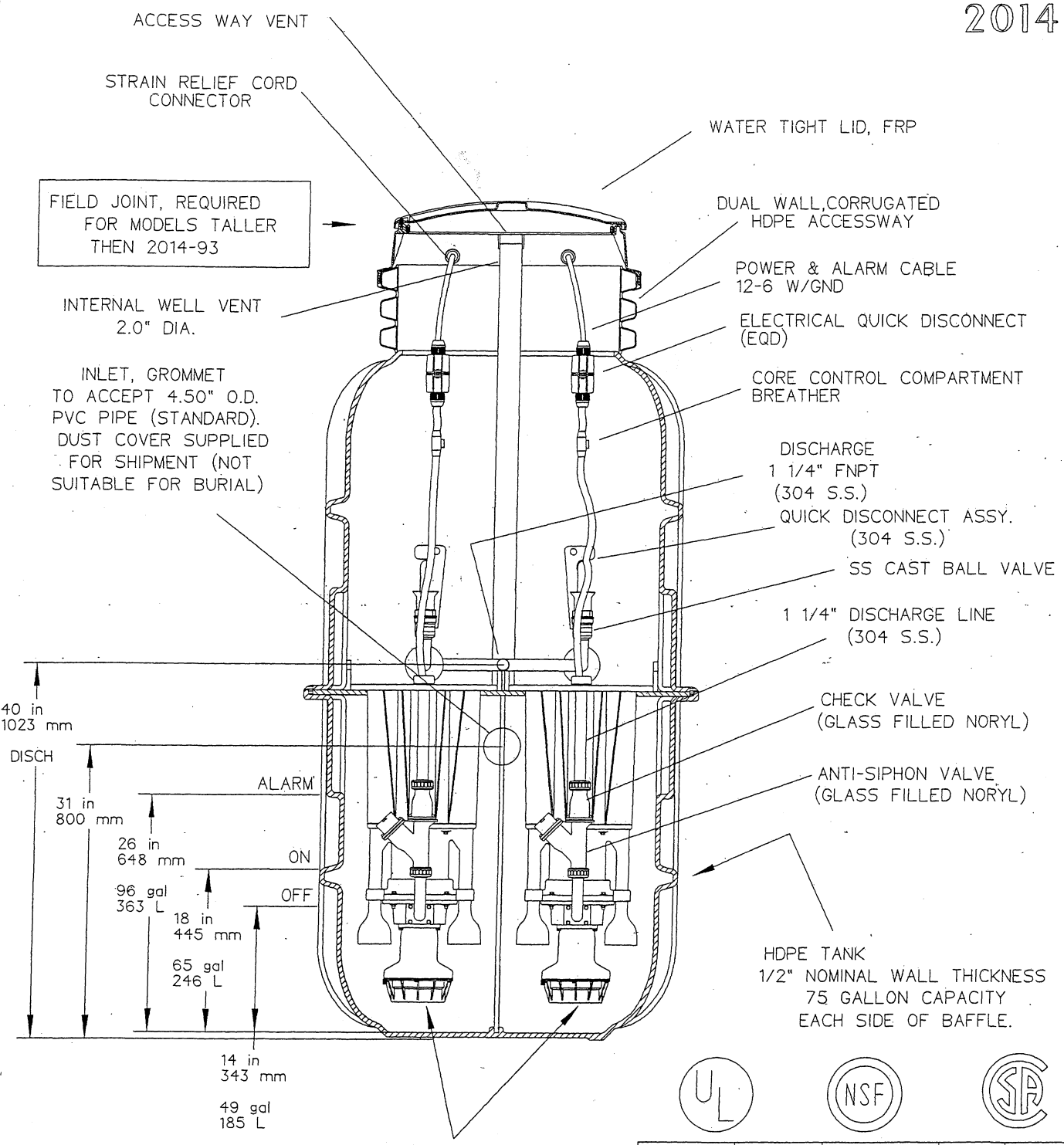
2014



SEMI-POSITIVE DISPLACEMENT TYPE PUMP
DIRECTLY DRIVEN BY A 1 HP MOTOR
CAPABLE OF DELIVERING 9 gpm AT 138' T.D.H.
(34 lpm AT 42m T.D.H.)

NOTE: A CONCRETE ANCHOR
IS REQUIRED TO PREVENT THE TANK FROM FLOATING.
SEE INSTALLATION INSTRUCTIONS
OR
SPECIFIC CUT SHEET
FOR SIZE AND WEIGHT OF ANCHOR

SGS	CAH	01/25/99	G	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

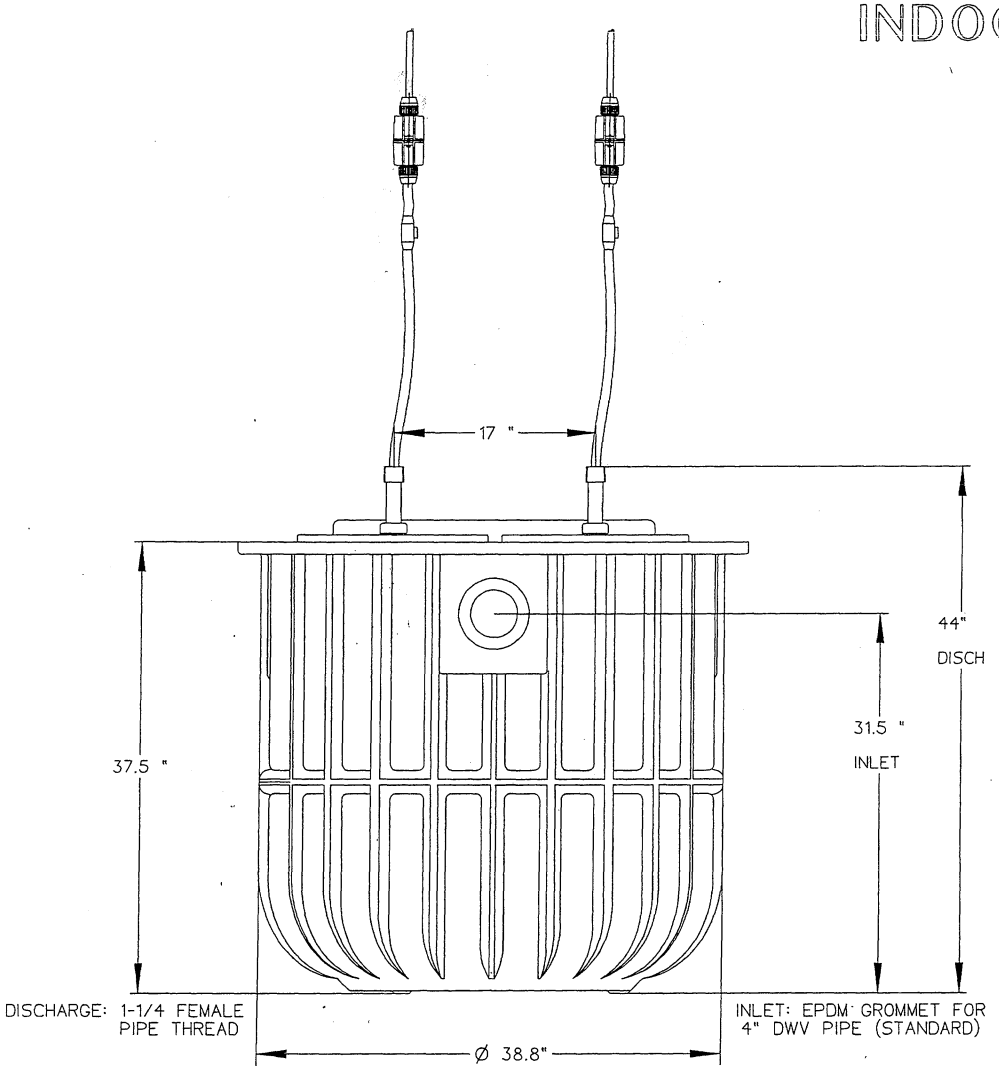
SEWER SYSTEMS

MODEL 2014, DETAIL SHEET

PA 0910 P01

2014-38

INDOOR UNIT



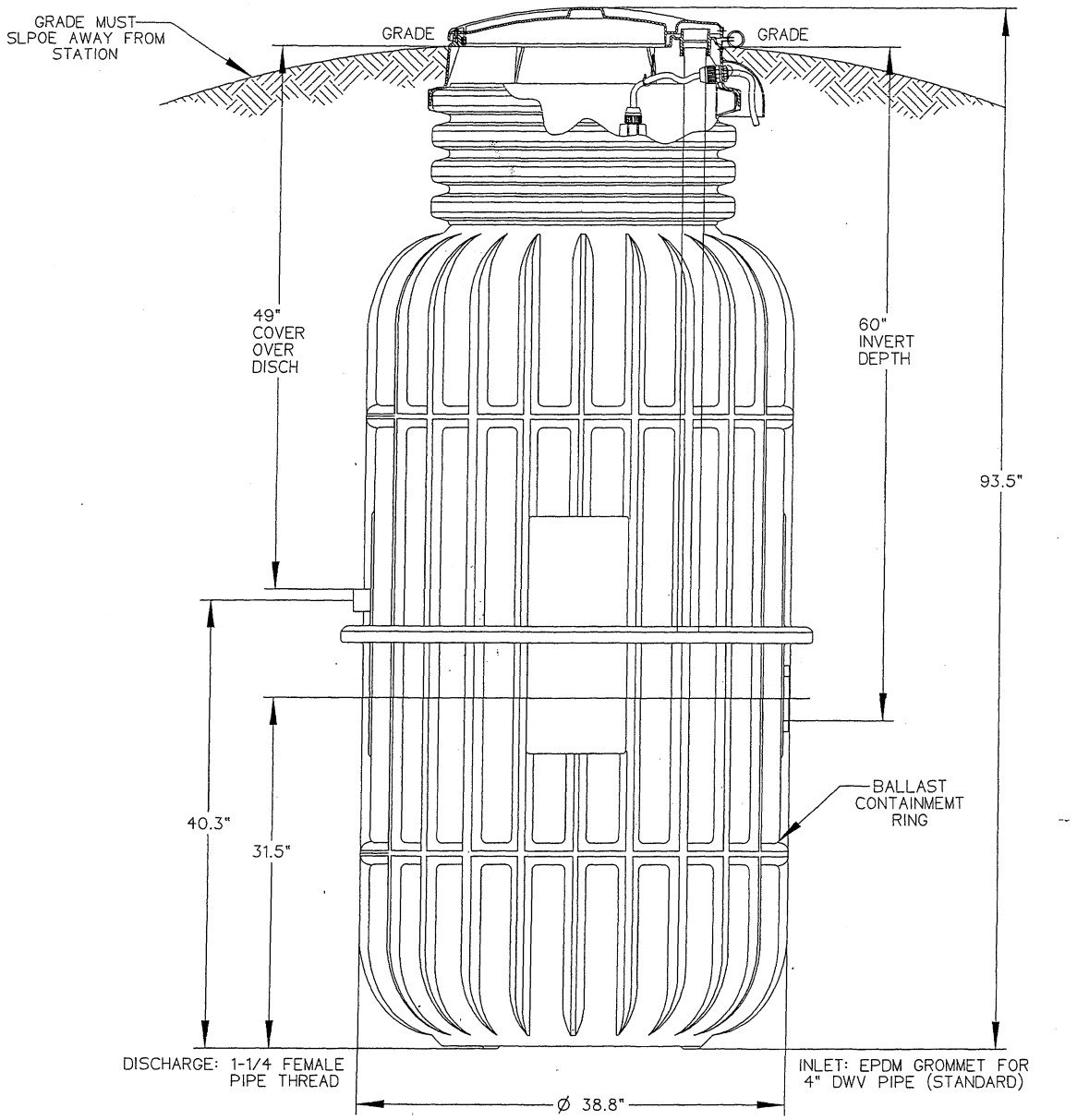
SGS	CAH	01/27/99	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

MODEL 2014-38

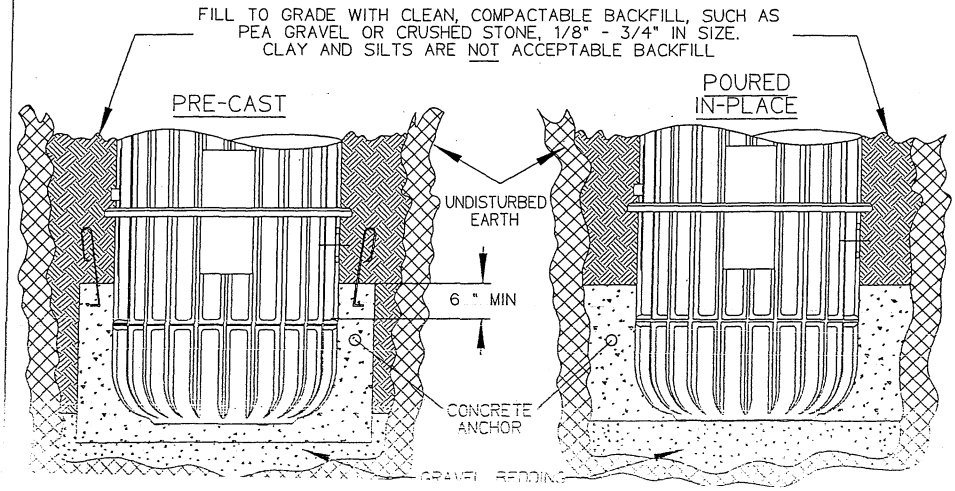
PA 1337 P01

2014-93



**SEE INSTALLATION INSTRUCTIONS FOR SPECIFIC DIAMETERS AND HEIGHTS REQUIRED FOR PROPER CONTAINMENT WHEN USING 2014 PRE-CAST BALLASTS

NOTE: A CONCRETE ANCHOR OF 4500 lbs (29.9 cu ft) IS REQUIRED ON ALL MODEL 2014 93" STATIONS.



SGS	CAH	1/25/99	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

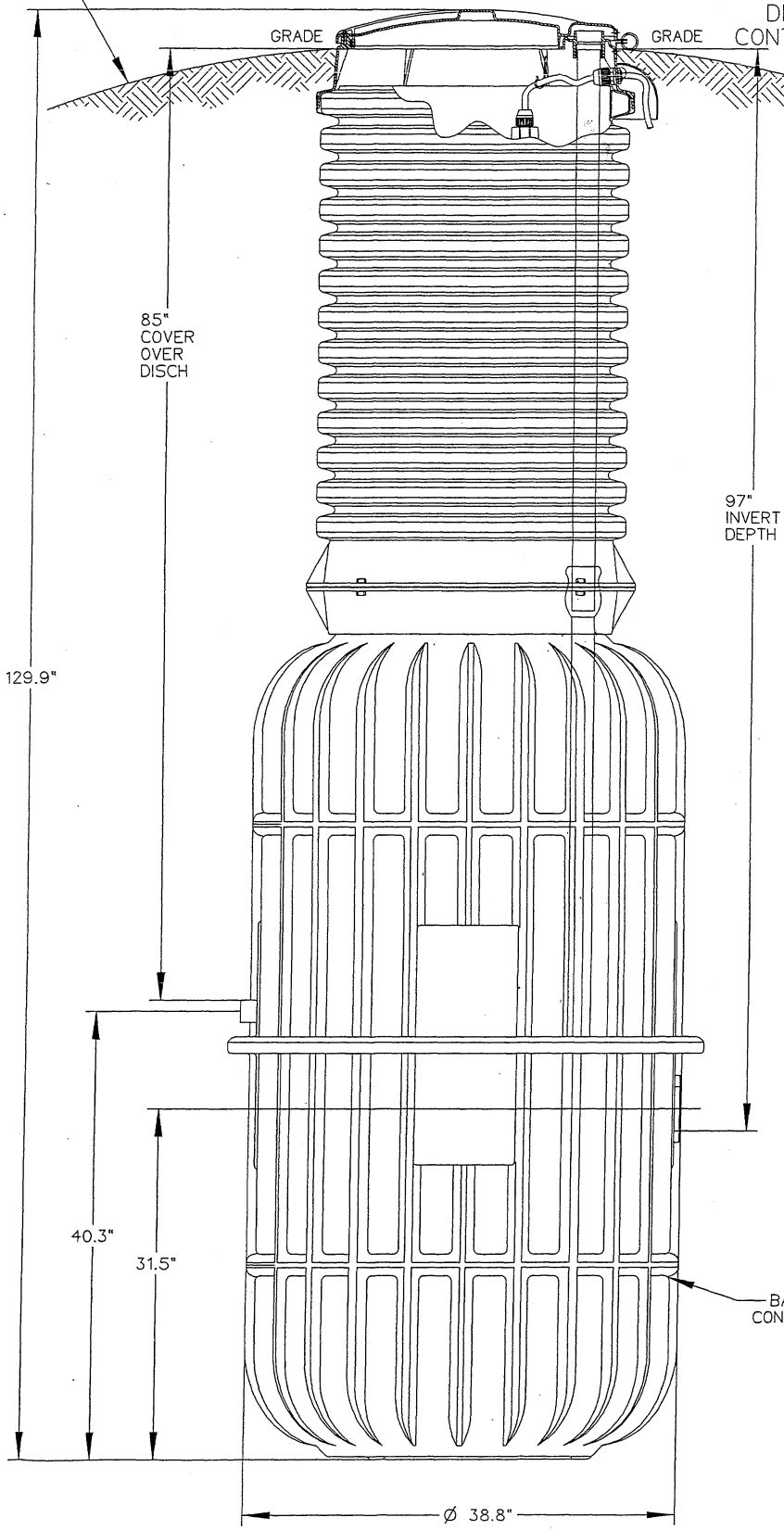
MODEL 2014-93

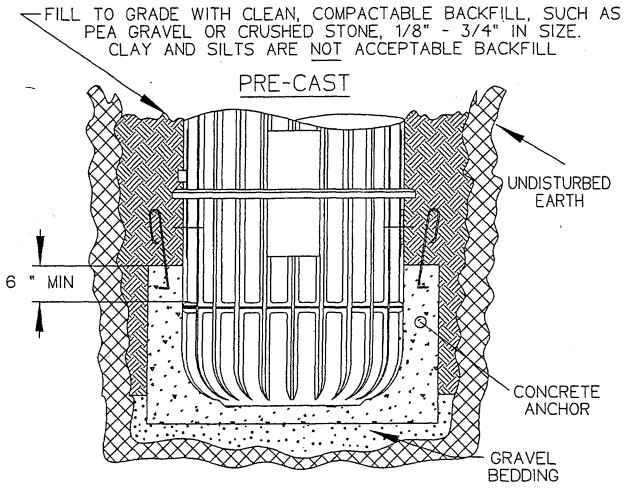
PA 1337 P03

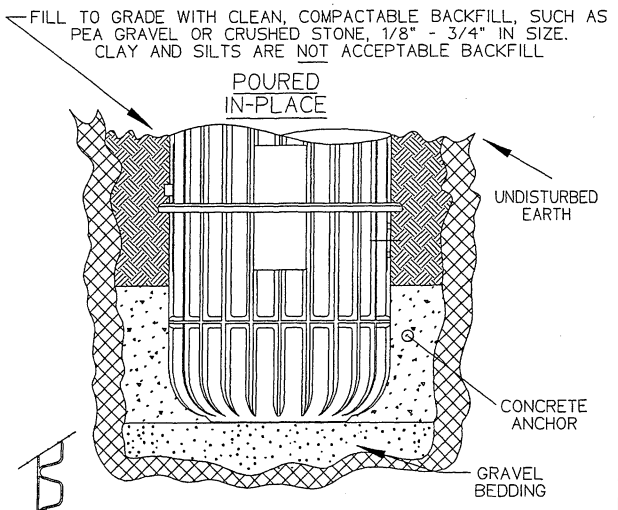
2014-129

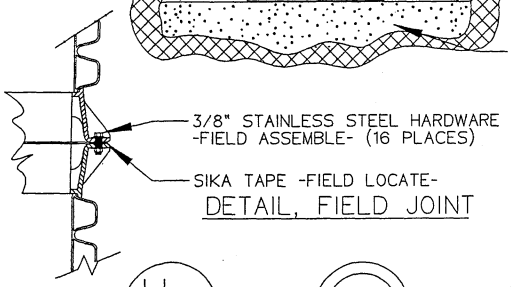
**SEE INSTALLATION INSTRUCTIONS FOR SPECIFIC DIAMETERS AND HEIGHTS REQUIRED FOR PROPER CONTAINMENT WHEN USING 2014 PRE-CAST BALLASTS

NOTE: A CONCRETE ANCHOR OF 5700 lbs (37.6 cu ft) IS REQUIRED ON ALL MODEL 2014 129" STATIONS.









DETAIL, FIELD JOINT

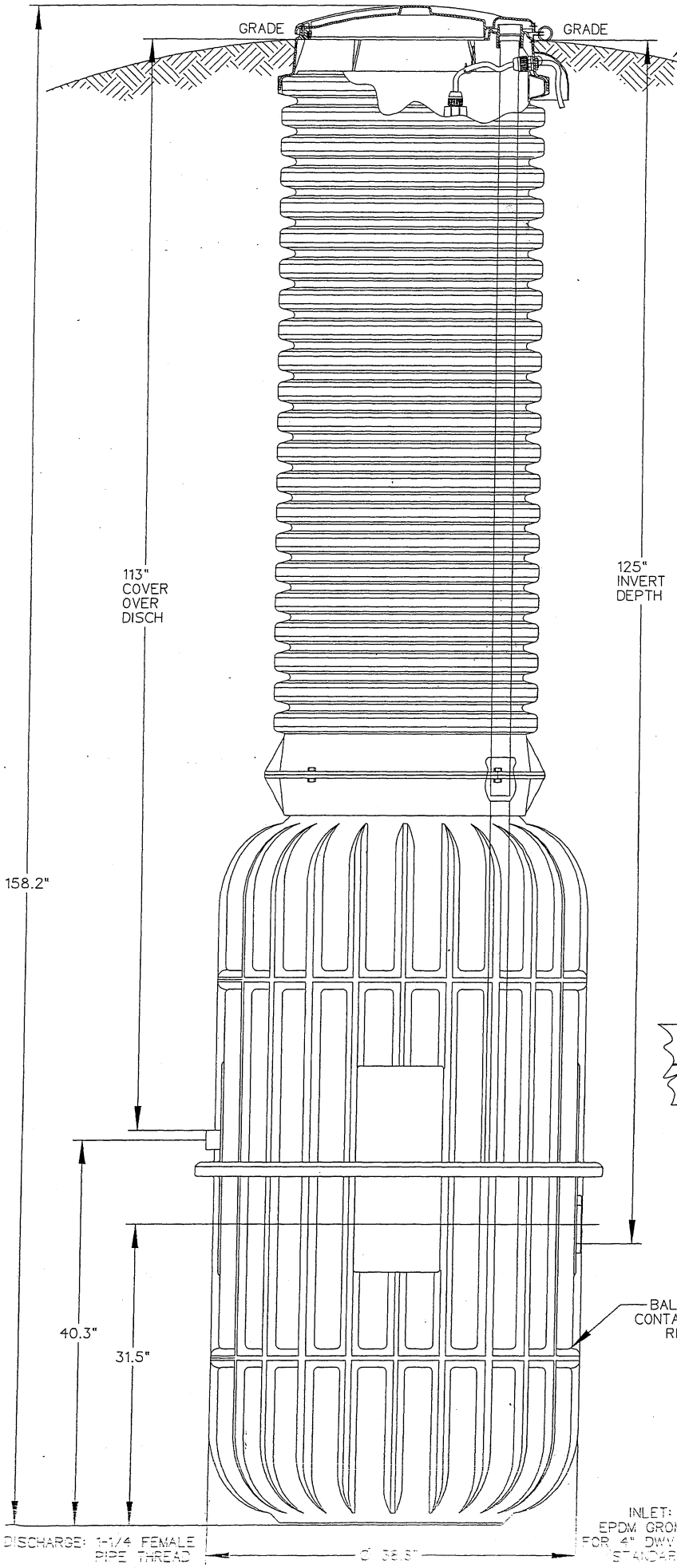
SGS	CAH	1/25/99	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

MODEL 2014-129

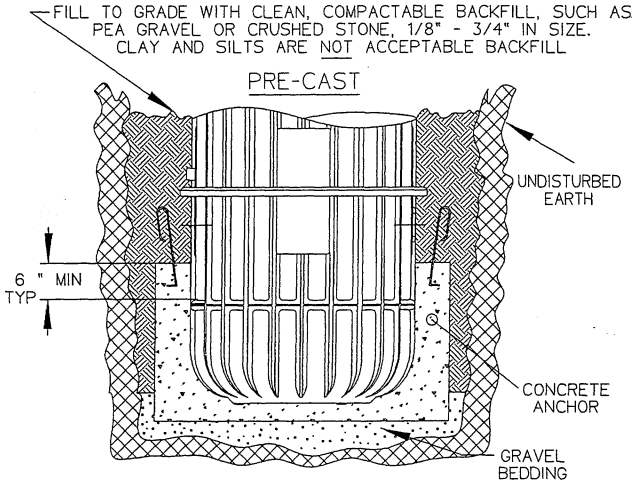
PA 1337 P04

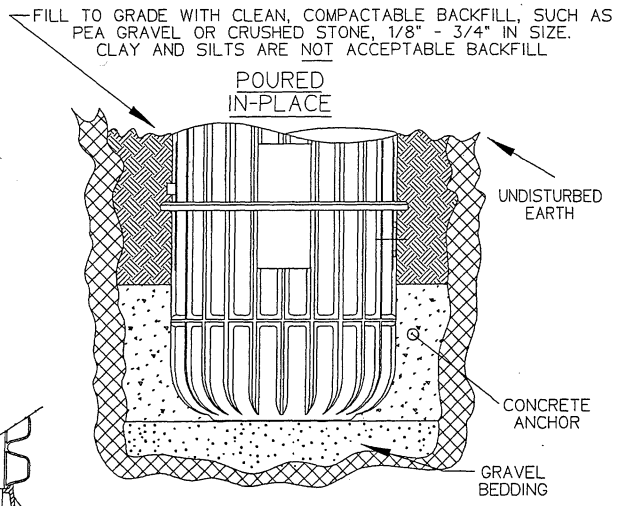
2014 -160

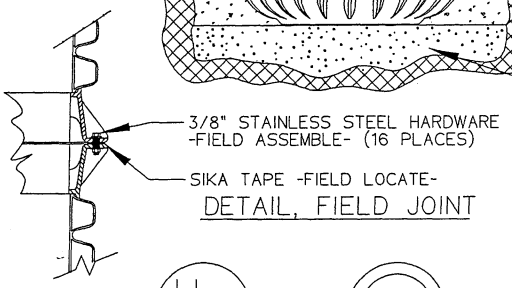


**SEE INSTALLATION INSTRUCTIONS FOR SPECIFIC DIAMETERS AND HEIGHTS REQUIRED FOR PROPER CONTAINMENT WHEN USING 2014 PRE-CAST BALLASTS

NOTE: A CONCRETE ANCHOR OF 6700 lbs (44.4 cu ft) IS REQUIRED ON ALL MODEL 2014 160" STATIONS.







DETAIL, FIELD JOINT

SGS	CAH	1/25/99	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

MODEL 2014-160

PA 1337 P05

MOD 260 Duplex Alarm/Disconnect Panel

Downloads:
MOD 260 drawings (112K PDF)
MOD 260 drawings (self-extracting DXF)

Description

The MOD 260 Electrical Panels are custom designed for use with Environment One Duplex Grinder Pumps. They are specified for installations that require an electrical disconnect separate from the residence distribution panel.

MOD Panels can be supplied with audible, visual or combination alarms. They are easily installed in accordance with relevant national and local codes. Standard MOD Alarm Panels are listed by Underwriters Laboratories to assure high quality and safety.

Please consult factory for special applications.

Standard Features

- Corrosion-proof fiberglass enclosure
- NEMA 4X-rated enclosure
- Hinged access panel
- Lockable latch with padlock
- Circuit breakers
- Terminal blocks and ground lugs

Optional Features

- Audible alarm with silence
- Red alarm light
- Audible alarm with silence and lamp
- 120 VAC or 240 VAC Service

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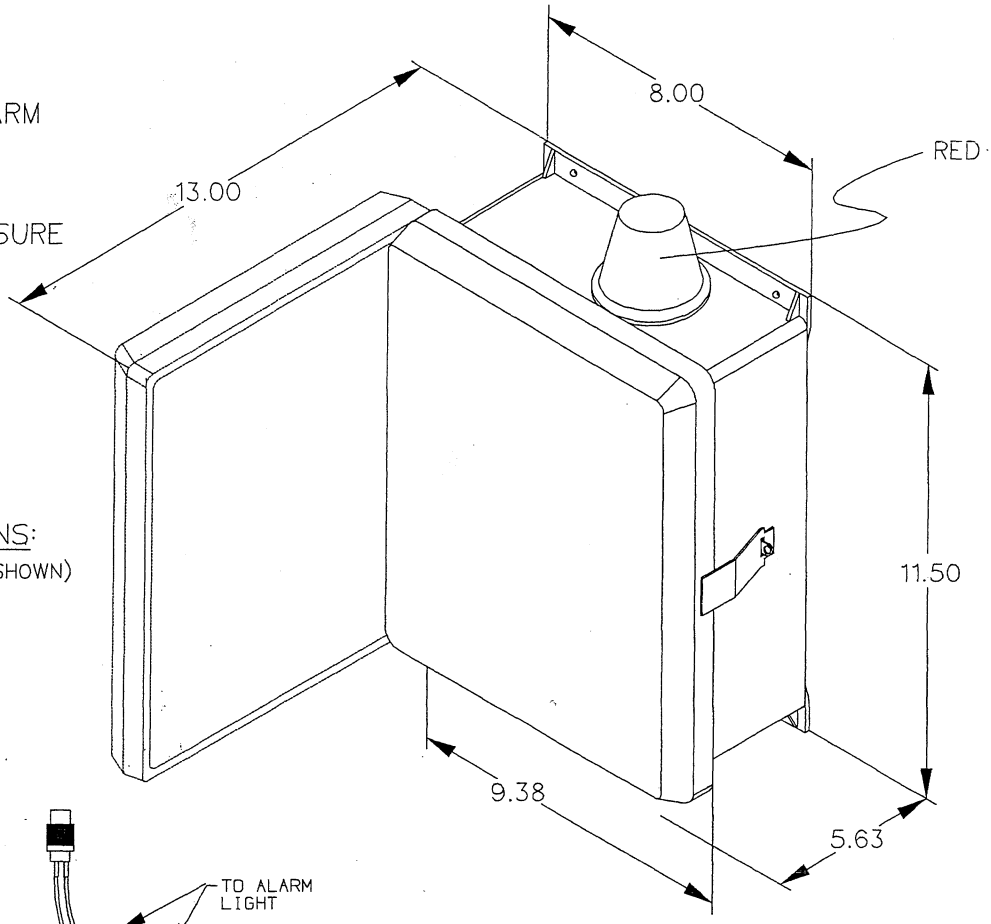
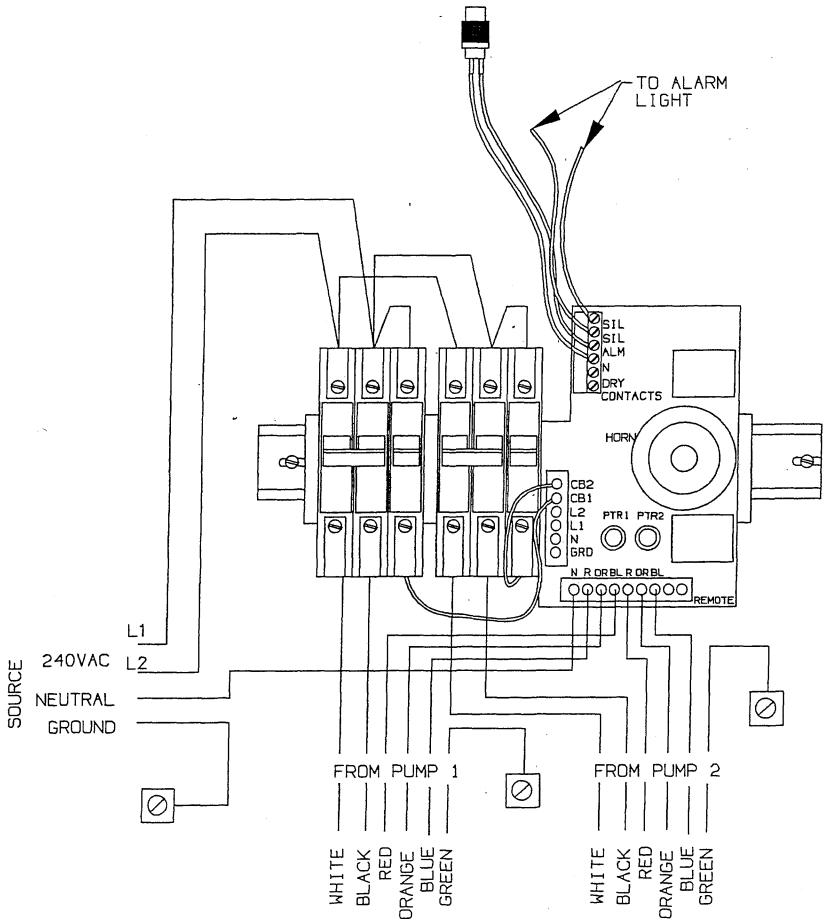
DUPLEX
MOD 260

VISUAL & AUDIBLE ALARM
MANUAL SILENCE
MANUAL RUN
240VAC
4X FIBERGLASS ENCLOSURE



AVAILABLE CONFIGURATIONS:
G01 - 240V, STANDARD (SHOWN)
G02 - 120V



CONTROL CABLE:

TYPE TC; DIRECT BURIAL, 12AWG, SIX CONDUCTOR.

SGS	CAH	9/5/00	B	5/32
DR BY	CHK'D	DATE	ISSUE	SCALE

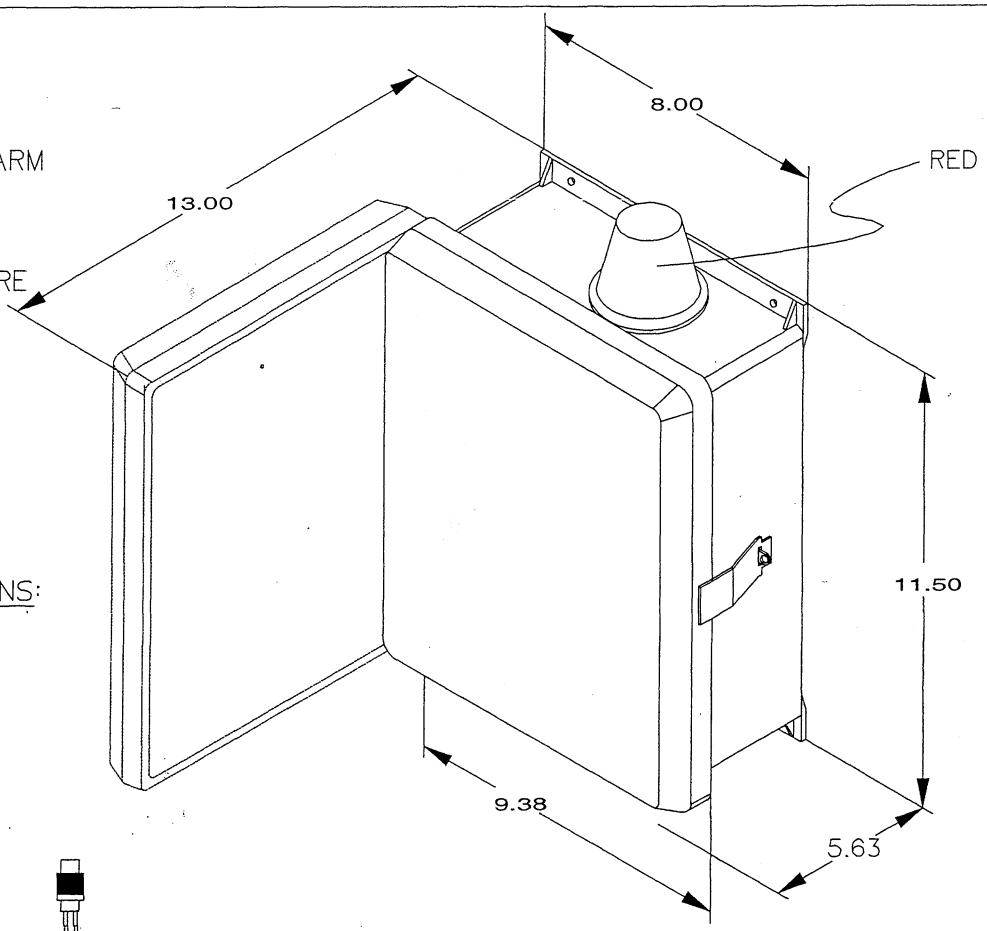
SEWER SYSTEMS

PANEL, 4X DUPLEX, 240V

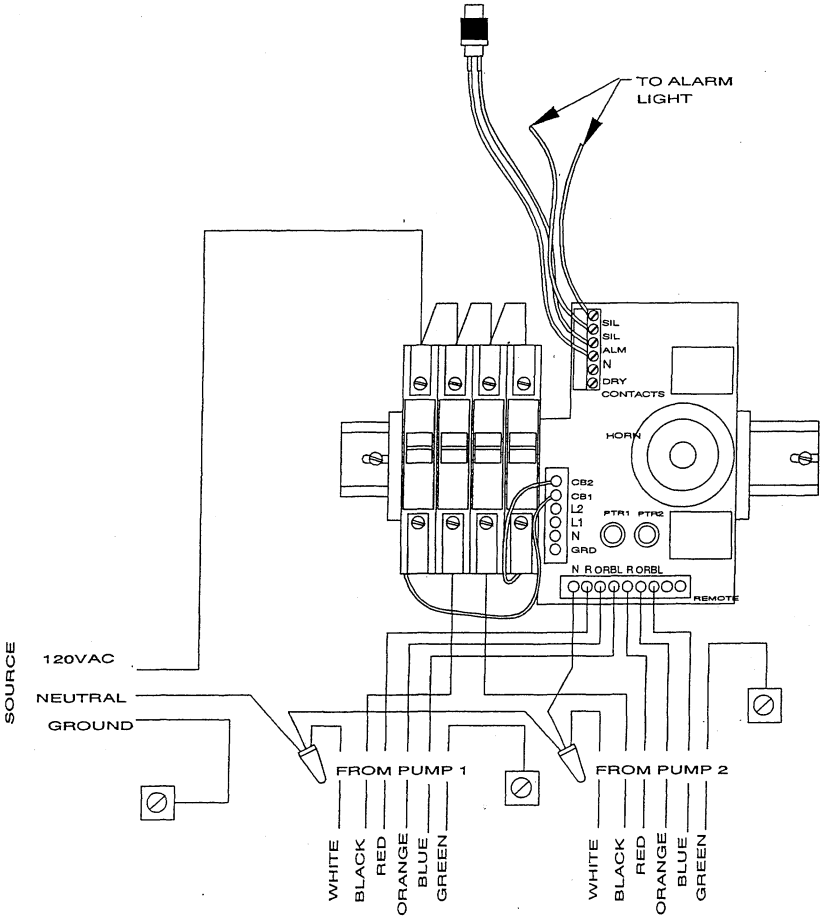
LM000153

DUPLEX
MOD 260

VISUAL & AUDIBLE ALARM
MANUAL SILENCE
MANUAL RUN
120VAC
4X FIBERGLASS ENCLOSURE



AVAILABLE CONFIGURATIONS:
G01 - 240V, STANDARD
G02 - 120V (SHOWN)



CONTROL CABLE:

TYPE TC; DIRECT BURIAL, 12AWG, SIX CONDUCTOR.

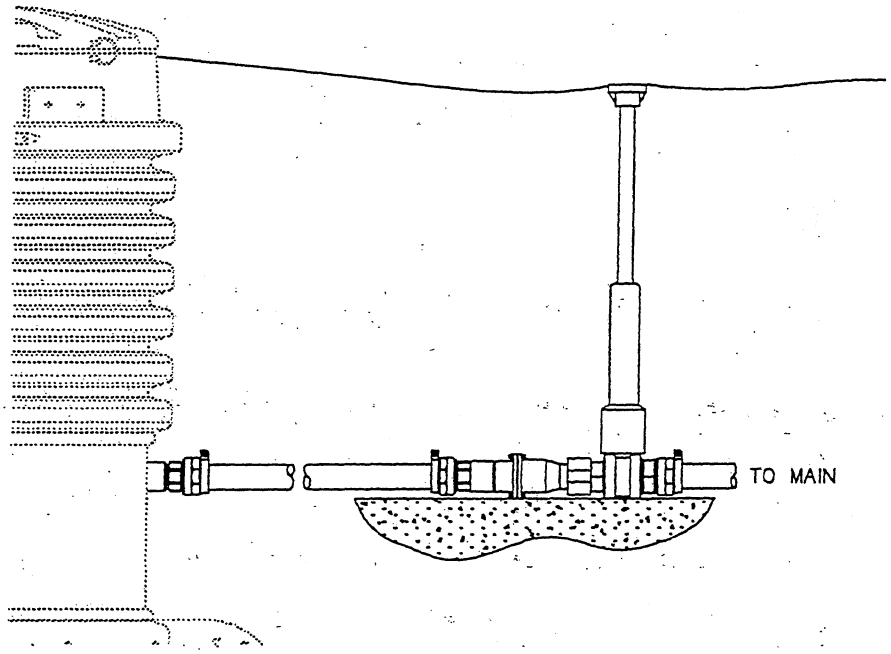
SGS	CAH	9/5/00	A	5/32
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

PANEL, 4X DUPLEX, 120V

LM000157

Forced Sewer Main Service Lateral Kits SDR 7 HDPE Pipe featuring valve components from Ford Meter Box Company



Thank you for considering E|ONE's Forced Sewer Main Lateral Kits. As you review the following information, please note that we have included order instructions on the last page of this section, for your convenience.

Printed in USA on Recycled Paper

PA1362P01 Rev. -, 2/97

Description

These kits feature all components commonly needed to connect an Environment One Series 2000 grinder pump station to the corporation stop/ saddle tap on a sewer main. The kit is designed to be used with SDR 7 HDPE Pipe, high density polyethylene pipe, (provided by others) and includes compression fittings for fast, easy field installation. The curb stop assembly integrates a robust ball valve curb stop from the Ford Meter Box Company and Environment One's field proven swing check valve. Curb boxes can be supplied in either Arch pattern or Minneapolis pattern.

Standard Features

- Pack Joint Couplings for 1-¼" SDR 7 HDPE Pipe
- All brass fittings meet ASTM B62-63-B505Q, AWWA Standard C800 and ANSI B16.26
- Factory assembled, Integrated Ball Valve Curb Stop and Check Valve Assembly
- Check Valve made from glass-filled PVC with fabric reinforced elastomeric flapper.
- Arch pattern curb boxes in heights from 3 ft. to 8 ft. in 1 foot increments
- Curb boxes made from cast iron and steel pipe heavily coated with asphalt based paint and labeled "sewer".

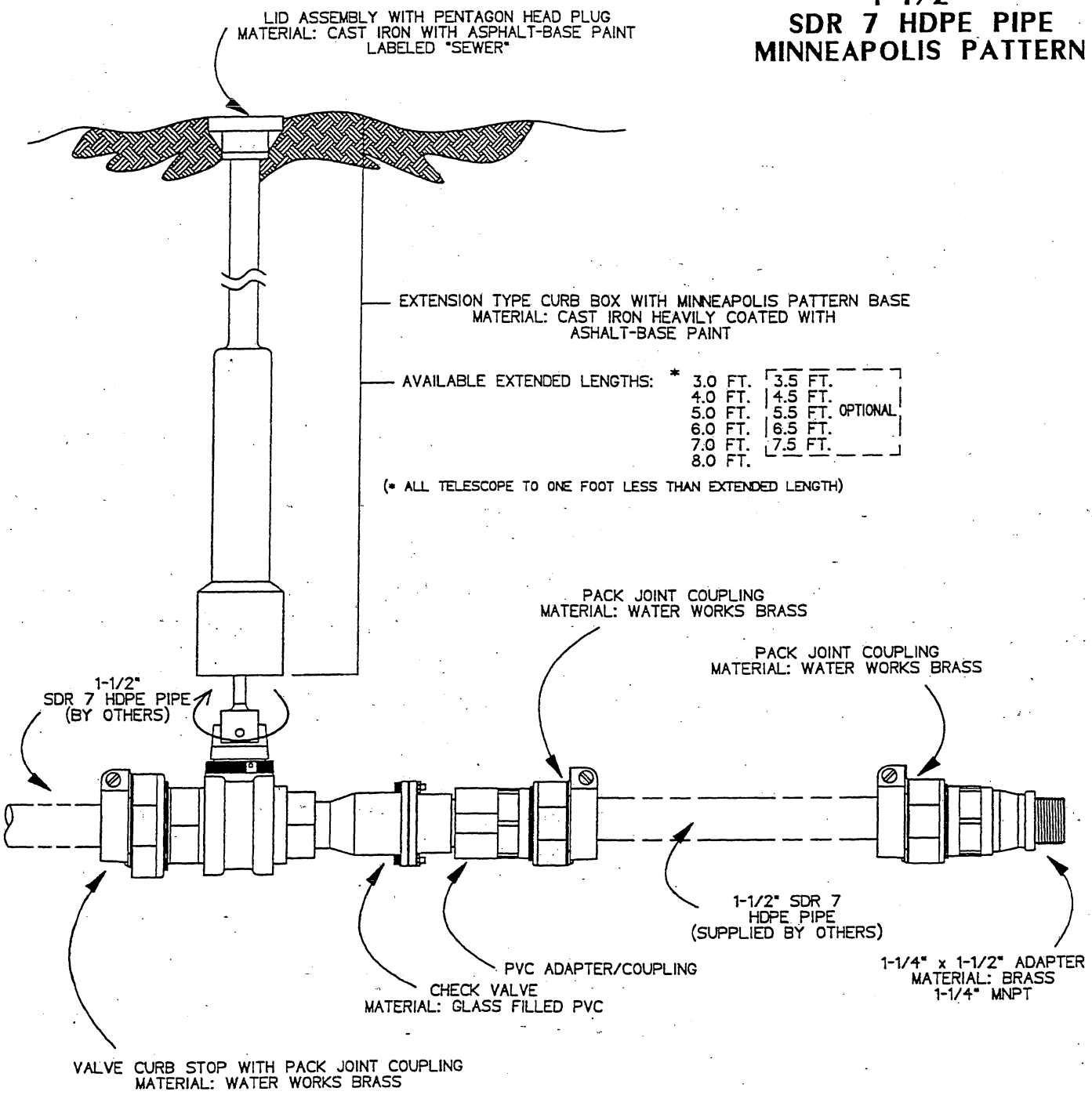
Rated for 200 psi.

Optional Features

- Pack Joint Couplings for 1-½" SDR 7 HDPE Pipe
- Curb stops for 1-½" SDR 7 HDPE Pipe
- Minneapolis Pattern Curb Boxes
- Curb boxes in ½ foot size increments

For Ordering Information see PA1372P01 Lateral Order Code

LATERAL ASSEMBLY
1-1/2"
SDR 7 HDPE PIPE
MINNEAPOLIS PATTERN



PRESSURE RATING: 150 psi

ALL PACK JOINT COUPLINGS SUPPLIED WITH INSERT STIFFENERS

ASSEMBLY TO BE USED WITH 1-1/2"SDR 7 PIPE ONLY

*FOR ORDERING INFORMATION SEE PA1372P01 LATERAL ORDER CODE

APS	WRS	01/06/97	-	3/16
DR BY	CHK'D	DATE	ISSUE	SCALE

environment | one
CORPORATION

LATERAL ASSEMBLY 1-1/2"
SDR 7 HDPE PIPE MINNEAPOLIS PATTERN

PA 1332 P01

Exhibit D

Grease Trap Sizing Calculations

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Crossroads
DESCRIPTION: Wildacres Resort – Grease Trap Sizing

DATE 1/3/00
SHEET 1 OF 2
BY MTD Ck'ed

EQU.

Grease Trap (gal) = D · GL · ST · HR/2 · LF

D = # OF SEATS
GL = 5 gal WW/MEAL → per pg. 34 OF NYSDEC standards
ST = storage factor = 1.7
HR = hours of operation
LF = Loading Factor = 1.0

① RESTAURANTS IN HOTEL
1. 150 seats } HR = 12
2. 300 seats }
3. 100 seats HR = 13 hrs GL = 2.5 (bev. lounge)

∴ 300 seat → 15,300 gal
150 seat → 7650 gal
100 seat → 2763 gal

② Myriad Mansion Restaurant
- 150 seat
- HR = 12

∴ 7650 gal

③ Conference Center (500 seat) & ballroom (200 seat)
- 500 people
- 5 Hr events

∴ 10,625 gal ∴ 5,000 gallon

④ 2 - 40 seat snack bars at each clubhouse
HR - 12 hours

∴ (2) 2040 gal

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Crossroads
DESCRIPTION: Wildacres Resort - Grease Trap Sizing

DATE 1/3/00
SHEET 2 OF 2
BY MTD Ck'ed

(5) Activity Center ~ Assume - 500 gal - 750 gal tank

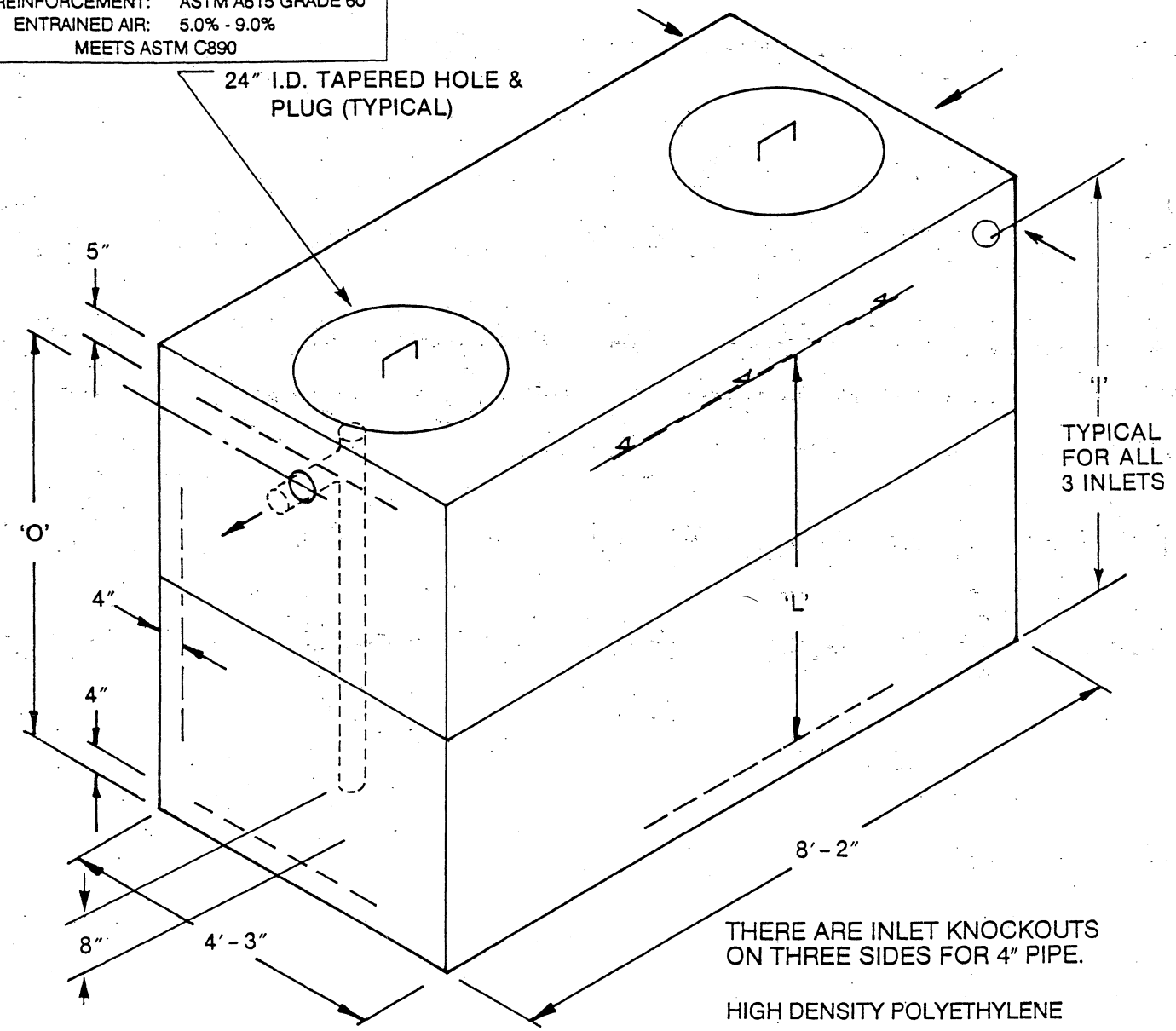
Total

				INSIDE HT.	
(2)	2000	gallon	- 6' x 11' x 5'6"	H	(40-seat snack)
~~(1)~~	~~4000~~	~~gallon~~	~~- 8' x 17' x 6'~~	~~H~~	~~(80-seat snack)~~
(1)	3000	gallon	- 7' x 13' x 7'11"	H	(100 seat lounge)
(2)	8000	gallon	- 8' x 17' x 10'6"	H	(300 seat rest)
(4)	8000	gallon	- 8' x 17' x 10'6"	H	(150 seat rest's, conference center & ballroom
(1)	750	gallon	- 8'2" x 4'3" x 5'8"	H	(Activity Center)

FORT MILLER
THE FORT MILLER CO., INC.

750-1000-1200 Gallon Heavy Duty Grease Trap

CONCRETE:	4000 PSI
REINFORCEMENT:	ASTM A615 GRADE 60
ENTRAINED AIR:	5.0% - 9.0%
MEETS ASTM C890	



THERE ARE INLET KNOCKOUTS ON THREE SIDES FOR 4" PIPE.

HIGH DENSITY POLYETHYLENE PIPE SEALS PROVIDED AT ALL PIPE CONNECTIONS SHOWN.

INLET AND OUTLET TEES SUPPLIED BY CONTRACTOR.

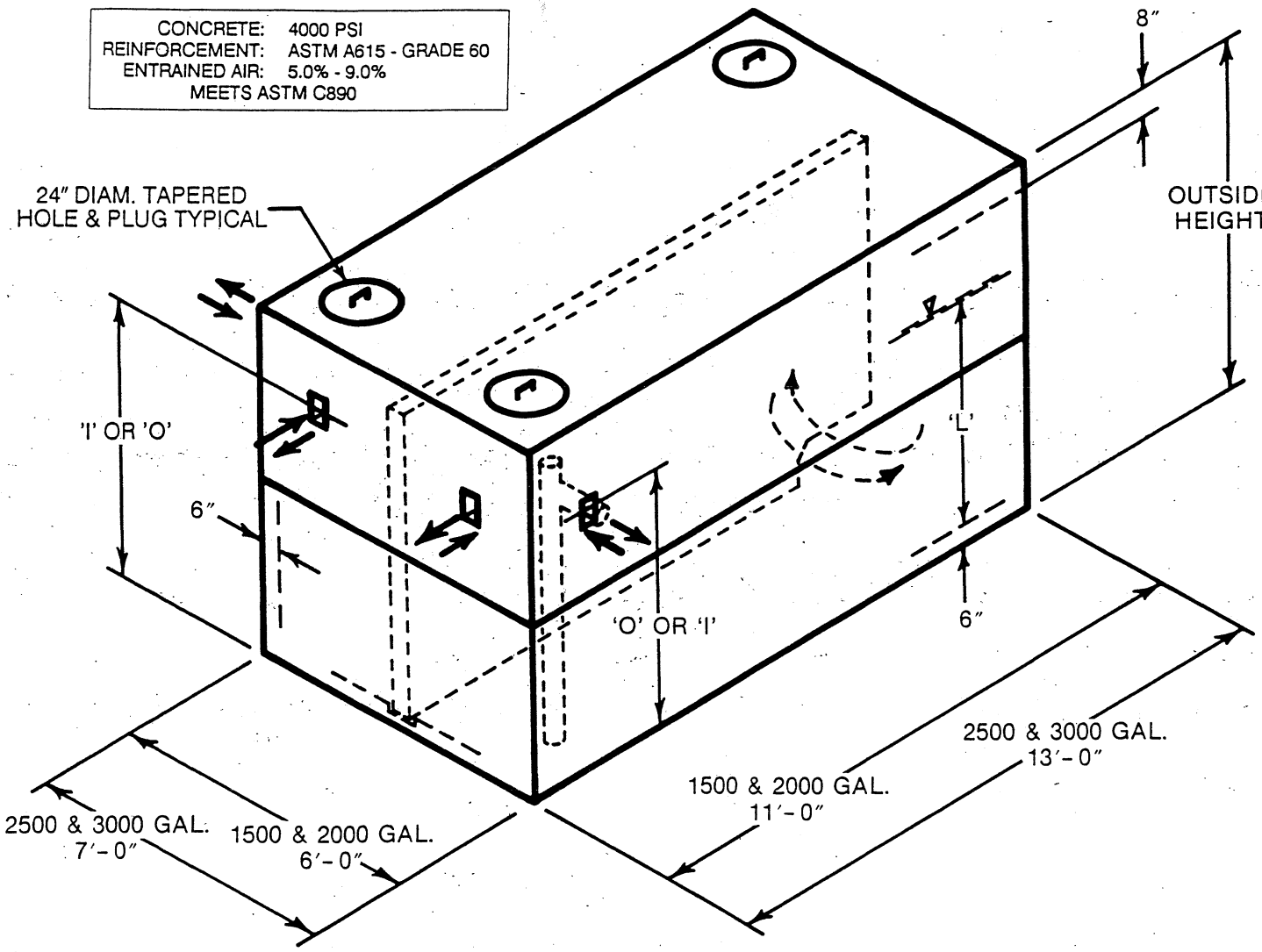
DESIGN CASE 3 (TRAFFIC)

TANK SIZE GALS.	OUTSIDE HEIGHT	LIQUID LEVEL 'L'	'O'	'I'	TANK WEIGHT, LBS		
					TOP SECTION	BOTTOM SECTION	TOTAL WEIGHT
750	5'-8"	4'-0"	4'-6"	4'-9"	4502	5214	9716
1000	6'-8"	5'-0"	5'-6"	5'-9"	5683	5214	10897
1200	7'-5"	5'-9"	6'-3"	6'-6"	6061	5592	11866

FORT MILLER
THE FORT MILLER CO., INC.

1500 to 3000 Gallon Heavy Duty Grease Trap

CONCRETE: 4000 PSI
REINFORCEMENT: ASTM A615 - GRADE 60
ENTRAINED AIR: 5.0% - 9.0%
MEETS ASTM C890



ELONGATED KNOCKOUTS TO ACCOMMODATE 6″ PIPE IN 4 LOCATIONS. ALLOW VARIOUS COMBINATIONS FOR INLET & OUTLET TO BE USED.
PIPE TO BE 8″ OFF BASE, PIPING SHOWN NOT INCLUDED WITH TANK.

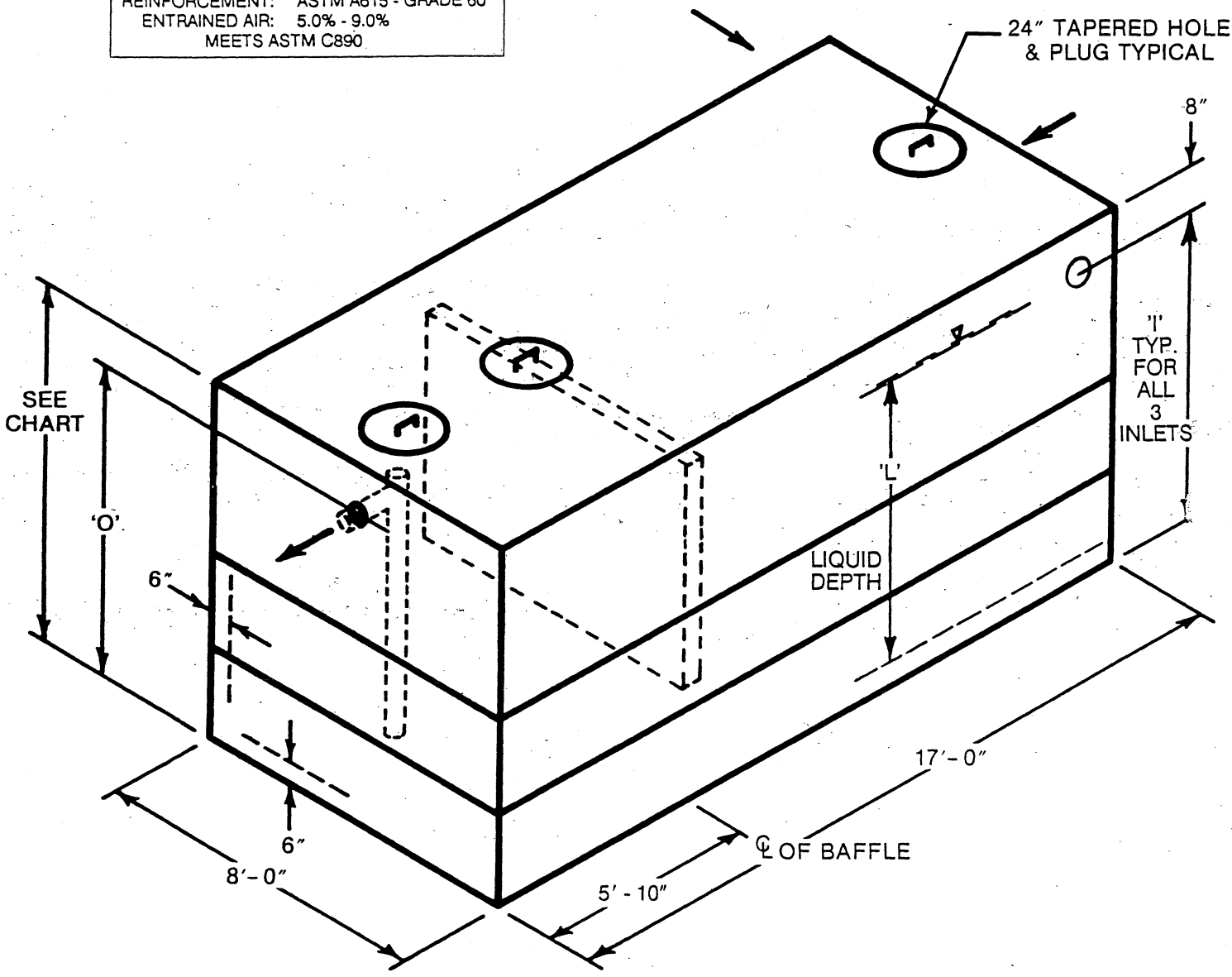
DESIGN CASE 3 (TRAFFIC)

TANK SIZE GALS.	OUTSIDE HEIGHT	LIQUID LEVEL 'L'	'O'	'I'	TANK WEIGHT, LBS			BAFFLE WEIGHT
					TOP SECTION	BOTTOM SECTION	TOTAL SECTION	
1500	6′ - 2″	4′ - 0″	4′ - 6″	4′ - 9″	10,833	12,750	26,835	3252
2000	7′ - 8″	5′ - 6″	6′ - 0″	6′ - 3″	14,433	12,750	31,483	4300
2500	6′ - 11″	4′ - 9″	5′ - 6″	5′ - 9″	16,042	16,316	37,032	4674
3000	7′ - 11″	5′ - 9″	6′ - 6″	6′ - 9″	18,892	16,316	40,718	5510

FORT MILLER
THE FORT MILLER CO., INC.

3000 to 8000 Gallon Heavy Duty Grease Trap

CONCRETE:	4000 PSI
REINFORCEMENT:	ASTM A615 - GRADE 60
ENTRAINED AIR:	5.0% - 9.0%
MEETS ASTM C890	



PIPE TO BE 8" OFF BASE, PIPING SHOWN NOT INCLUDED WITH TANK.
INLET & OUTLET OPENINGS TO ACCOMMODATE 6" PIPE.

DESIGN CASE 3
(TRAFFIC)

SEE TABLE D-1 IN SECTION A.

FOR WEIGHTS, SEE FACING PAGE

FORT MILLER
THE FORT MILLER CO., INC.

3000 to 8000 Gallon Heavy Duty Grease Trap

SIZE GALS.	LIQUID LEVEL	INLET HEIGHT	OUTLET HEIGHT	INTEGRAL TOP HEIGHT	INTER-MEDIATE HEIGHT	BASE HEIGHT	OVERALL HEIGHT		TOTAL WEIGHT EXCL BAFFLES		TOTAL WEIGHT INCL BAFFLES	
							INSIDE	OUTSIDE	LBS	TONS	LBS	TONS
3,000	4'- 0"	5'- 1"	4'- 10"	2'- 0"	—	3'- 0"	5'- 0"	6'- 2"	41,800	20.9	44,163	22.1
3,500	4'- 3"	5'- 4"	5'- 1"	2'- 3"	—	3'- 0"	5'- 3"	6'- 5"	42,700	21.4	45,194	22.6
4,000	5'- 0"	6'- 1"	5'- 10"	3'- 0"	—	3'- 0"	6'- 0"	7'- 2"	45,400	22.7	48,288	24.1
4,500	5'- 5"	6'- 6"	6'- 3"	3'- 6"	—	3'- 0"	6'- 6"	7'- 8"	47,200	23.6	50,350	25.2
5,000	6'- 3"	7'- 4"	7'- 1"	3'- 0"	—	4'- 3"	7'- 3"	8'- 5"	49,900	25.0	53,444	26.7
5,500	6'- 9"	7'- 10"	7'- 7"	3'- 6"	—	4'- 3"	7'- 9"	8'- 11"	51,700	25.9	55,506	27.8
6,000	7'- 3"	8'- 4"	8'- 1"	4'- 0"	—	4'- 3"	8'- 3"	9'- 5"	53,500	26.8	57,569	28.8
6,500	7'- 9"	8'- 10"	8'- 7"	3'- 9"	2'- 0"	3'- 0"	8'- 9"	9'- 11"	56,350	28.2	59,631	29.8
7,000	8'- 3"	9'- 4"	9'- 1"	3'- 0"	2'- 0"	4'- 3"	9'- 3"	10'- 5"	58,150	29.1	61,694	30.8
7,500	9'- 0"	10'- 1"	9'- 10"	3'- 9"	2'- 0"	4'- 3"	10'- 0"	11'- 2"	60,850	30.4	64,787	32.4
8,000	9'- 6"	10'- 7"	10'- 4"	4'- 3"	2'- 0"	4'- 3"	10'- 6"	11'- 8"	62,650	31.3	66,850	33.4

SECTION WEIGHTS, LBS

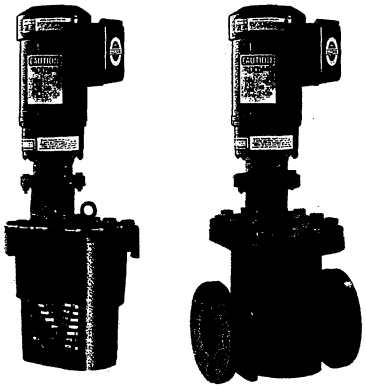
	HEIGHT	SECTION	BAFFLE	TOTAL		HEIGHT	SECTION	BAFFLE	TOTAL
INTEGRAL TOP	2'- 0"	20,800	788	21,588	INTEGRAL BASE	3'- 0"	21,000	1,575	22,575
	2'- 3"	21,700	919	22,619		4'- 3"	25,500	2,231	27,731
	3'- 0"	24,400	1,313	25,713					
	3'- 6"	26,200	1,575	27,775					
	3'- 9"	27,100	1,706	28,806	INTERMEDIATE	2'- 0"			8250*
	4'- 0"	28,000	1,838	29,838					
	4'- 3"	28,900	1,969	30,869					

*INCLUDES WEIGHT OF BAFFLE-BEAM

Exhibit E

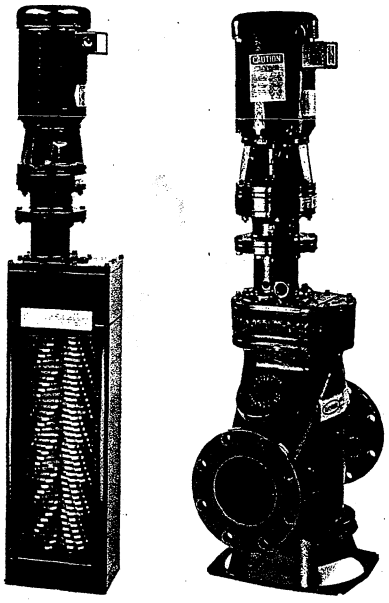
Wastewater Treatment System Equipment

GRINDERS



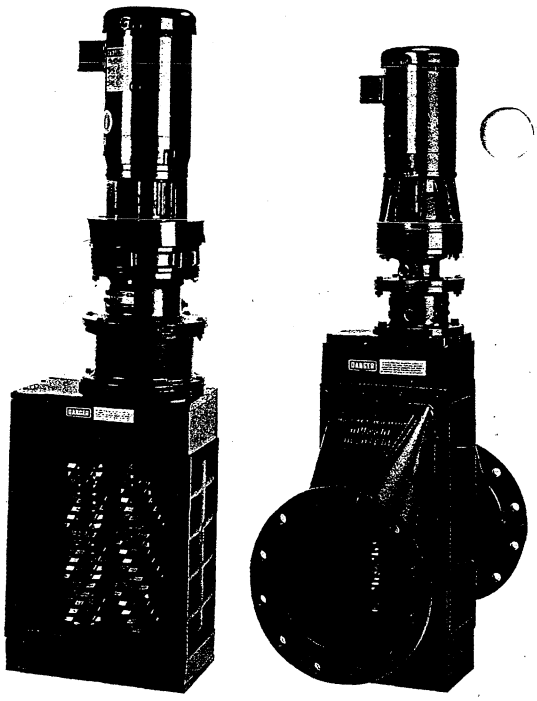
Mini Monster®
Model 20000

- proven dual-shafted technology to reduce solids in low flow, light duty and sanitary waste applications
- utilizes 1 horsepower motor with 29:1 speed reducer
- 2-inch 4140 steel hexagonal shafts
- varied cutter options to optimize each application
- cantilevered shaft design for ease of maintenance



Muffin Monster®
Model 30000

- proven dual-shafted technology to reduce solids in standard wastewater and industrial applications
- utilizes 3 or 5 horsepower motor with 29:1 speed reducer
- hydraulic motor option available with 5 horsepower power pack
- 2-inch 4140 steel hexagonal shafts
- varied cutter options to optimize performance and particle size
- provides protection of downstream pumps and processing equipment
- features in-line or in-channel cutter stack tightening capabilities
- optional clean-out combs available for processing fibrous/difficult materials



Macho Monster®
Model 40000

- proven dual-shafted technology to reduce solids in high-volume, heavy-duty wastewater and industrial applications
- utilizes 10 horsepower motor with 43:1 or 87:1 speed reducer
- hydraulic motor option available with a 10 horsepower power pack
- 2 1/2-inch 4140 steel hexagonal shafts
- varied cutter options to optimize performance and particle size
- provides the performance needed for screenings grinding
- optional clean-out combs available for processing fibrous/difficult materials

Model 20000 Specifications*

In-Channel Stack Height, in. (mm)	Flow, GPM (l/s)**	Overall Height, in. (mm)	Net Weight, lb. (kg)
4 3/4 (121)	80 (5)	32 1/4 (819)	225 (102)
In-Line Unit Flange Size, in. (mm)			
4 (100)	150 (10)	33 (838)	275 (125)

**Nominal Measurements*
*** Flow based on optimum channel conditions. Consult factory for final analysis of application.*

Model 30000 Series Specifications*

In-Channel Units Stack Height, in. (mm)	Flow, GPM (l/s)**	Overall Height, in. (mm)	Net Weight, lb. (kg)
8 (203)	275 (17)	48 (1219)	330 (150)
12 (305)	425 (27)	52 1/8 (1324)	370 (168)
18 (457)	725 (46)	58 (1473)	425 (193)
24 (610)	1000 (61)	63 3/4 (1619)	480 (218)
32 (813)	1500 (95)	71 1/2 (1816)	540 (245)
40 (1016)	2000 (126)	79 1/2 (2019)	610 (277)
50 (1270)	2750 (174)	89 1/2 (2273)	700 (318)
60 (1524)	3250 (205)	99 7/8 (2537)	805 (366)
In-Line Units Flange Size, in. (mm)			
4 (100)	400 (25)	56 1/4 (1429)	415 (189)
6 (150)	600 (38)	56 1/4 (1429)	425 (193)
8 (200)	800 (50)	56 1/4 (1429)	435 (198)
10 (250)	1000 (63)	67 3/4 (1721)	650 (295)
12 (300)	1200 (76)	67 3/4 (1721)	675 (307)

**Nominal Measurements*
*** Flow based on optimum channel conditions. Consult factory for final analysis of application.*

Model 40000 Series Specifications*

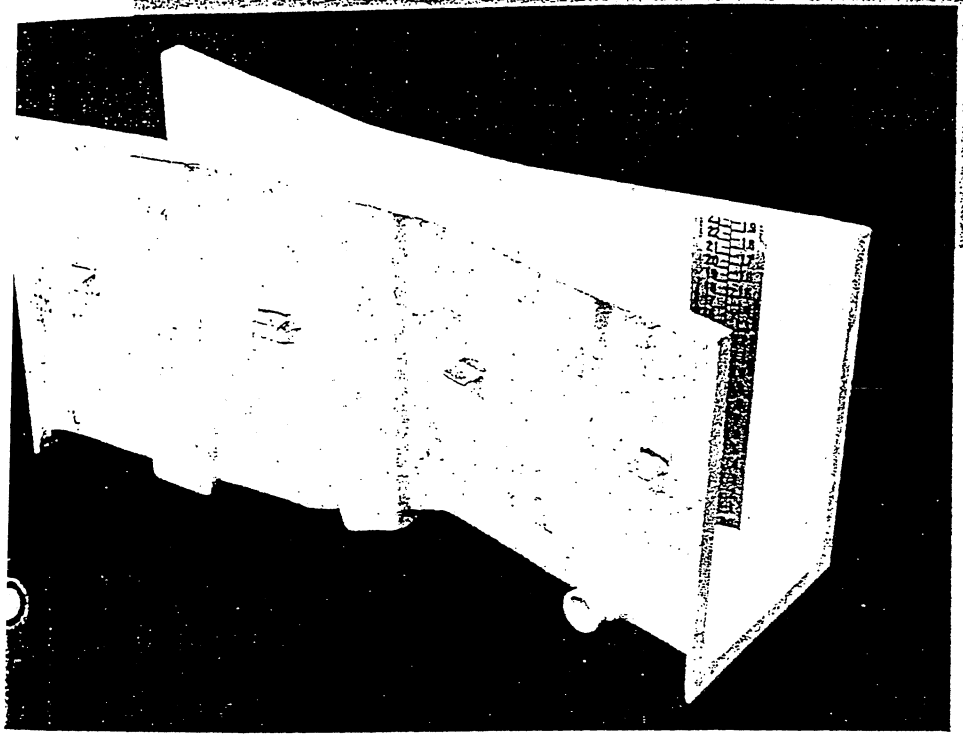
In-Channel Units in. (mm)	Flow, GPM (l/s)**	Overall Height, in. (mm)	Net Weight, lb. (kg)
18 (457)	1100 (69)	69 1/4 (1759)	1175 (533)
24 (610)	1500 (95)	75 5/8 (1921)	1365 (619)
32 (1016)	2250 (142)	82 1/8 (2086)	1560 (708)
In-Line Units Flange Size, in. (mm)			
12 (300)	2500 (158)	69 1/4 (1759)	1520 (689)
16 (400)	3500 (221)	75 5/8 (1921)	1895 (860)
18 (450)	4000 (252)	75 5/8 (1921)	2095 (950)

**Nominal Measurements*
*** Flow based on optimum channel conditions. Consult factory for final analysis of application.*

PLASTI-FAB®

FIBERGLASS REINFORCED POLYESTER

PARSHALL FLUMES



- Maintenance free
- Dimensionally stable
- Easily installed
- Lightweight
- Accurate
- Economical

CORROSION RESISTANT
polyester affords protection from chemical attack by corrosive wastes.

DIMENSIONALLY STABLE
prefabricated Plasti-Fab Parshall flumes assure accurate dimensions.

EASY INSTALLATION
light weight – high strength. Plasti-Fab Parshall flumes are heavily ribbed for free standing installation. They may also be installed as liners in concrete.

CLEAN WHITE SMOOTH SURFACES
minimize any build-up of organisms.

RUGGED CONSTRUCTION
2" flanges on ends and top, with heavy angle bracing across top flanges.

LOWER COST
and more rugged than stainless.

MORE DURABLE
and more accurate than concrete.

2" THREADED CONNECTION
is available on either side for connection to a separate floatwell or bubbler system.

FLOATWELLS ATTACHED
to the side of the flume are 12"; 8" is also available. They can be mounted on either side.

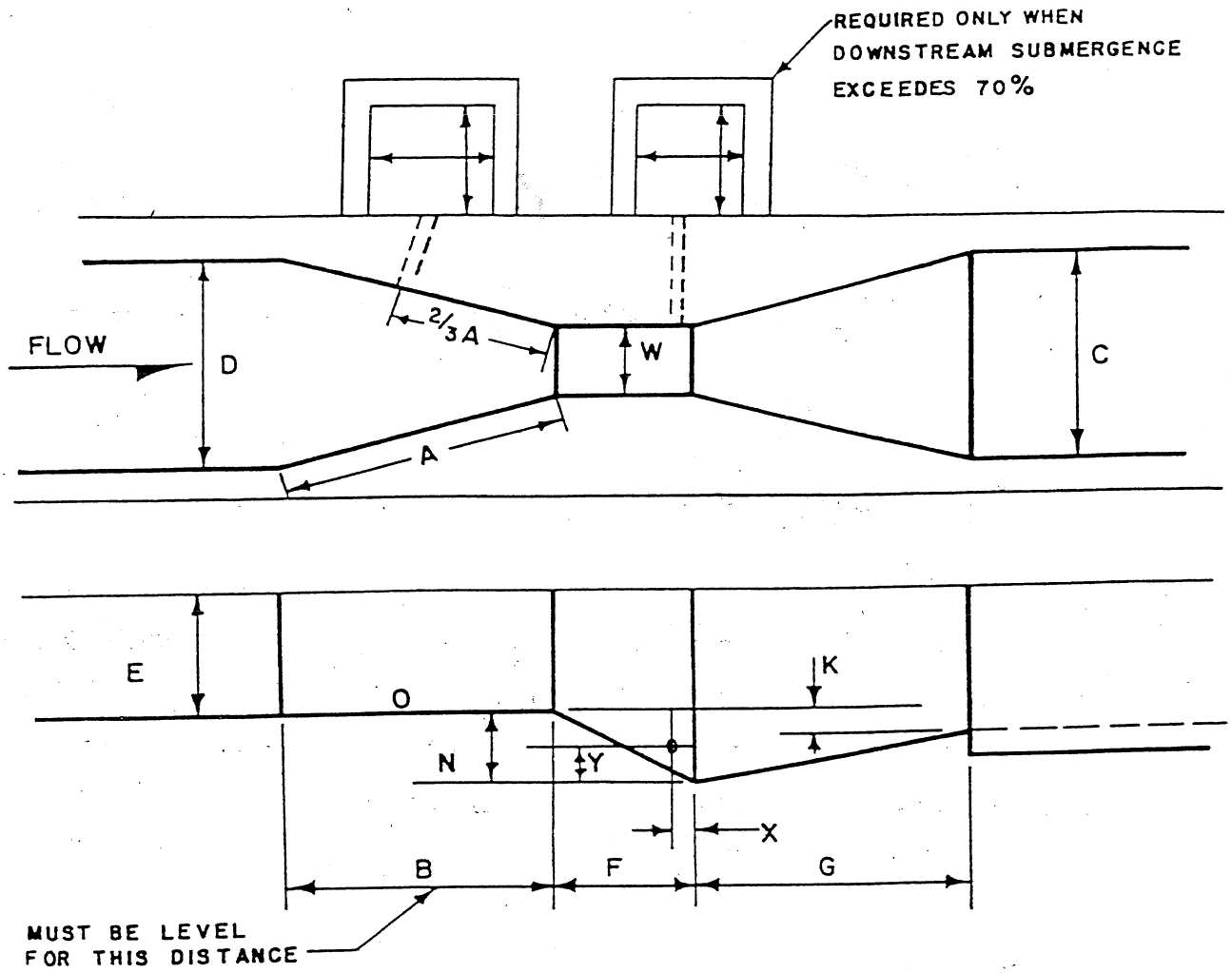
REMOTE FLOATWELLS
are also available. A 2" threaded tap on the flume and the floatwell is provided for interconnecting piping. A 1" blow-out connection is also provided on the well.

HEAD GAUGES
are supplied on all Plasti-Fab Parshall flumes. The gage is molded in the side of the flume in the first stage of construction, retaining a smooth surface on the sidewall.

CONTACT
YOUR LOCAL REPRESENTATIVE OR .....

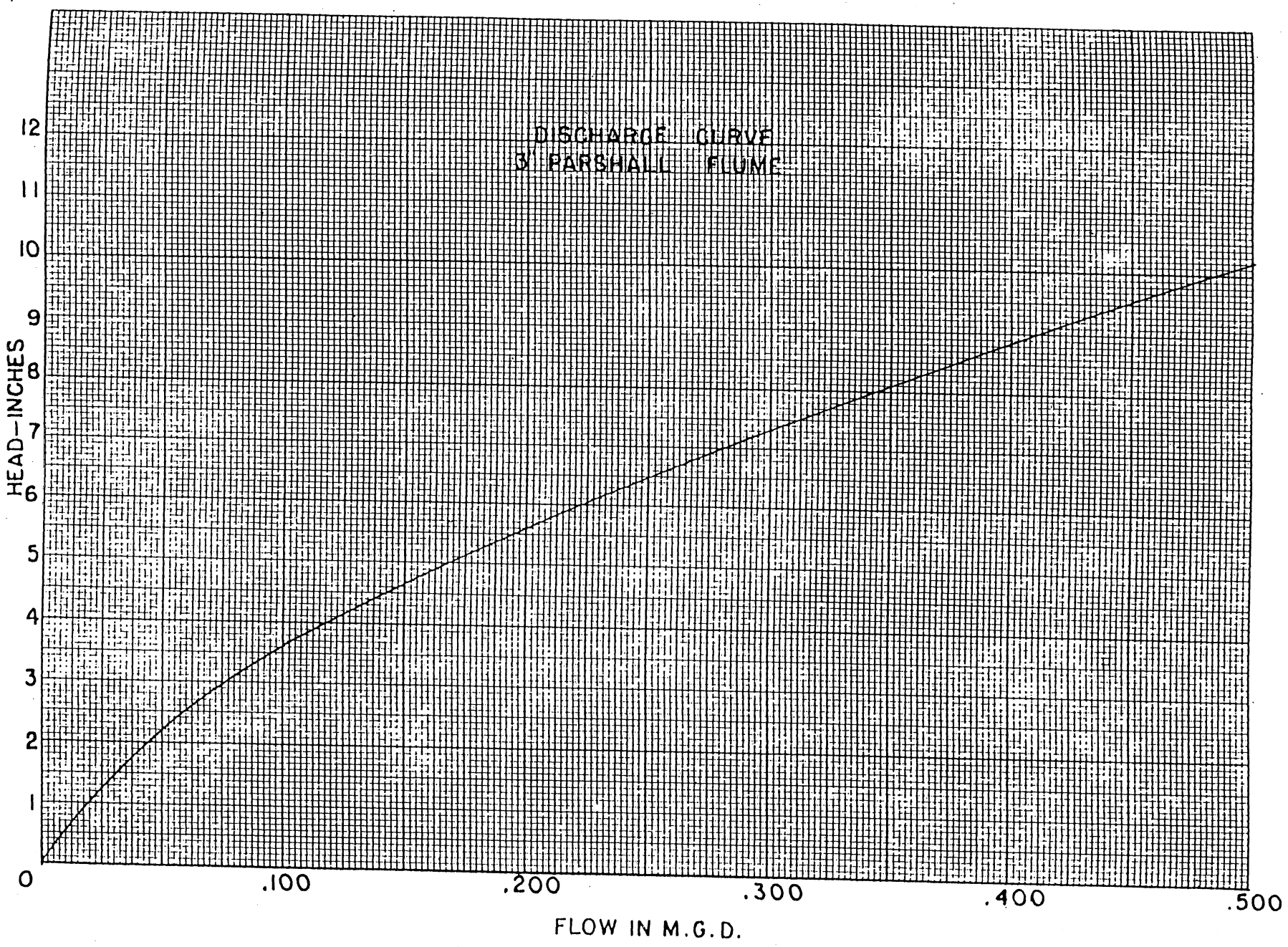
DIRECT TO . . .

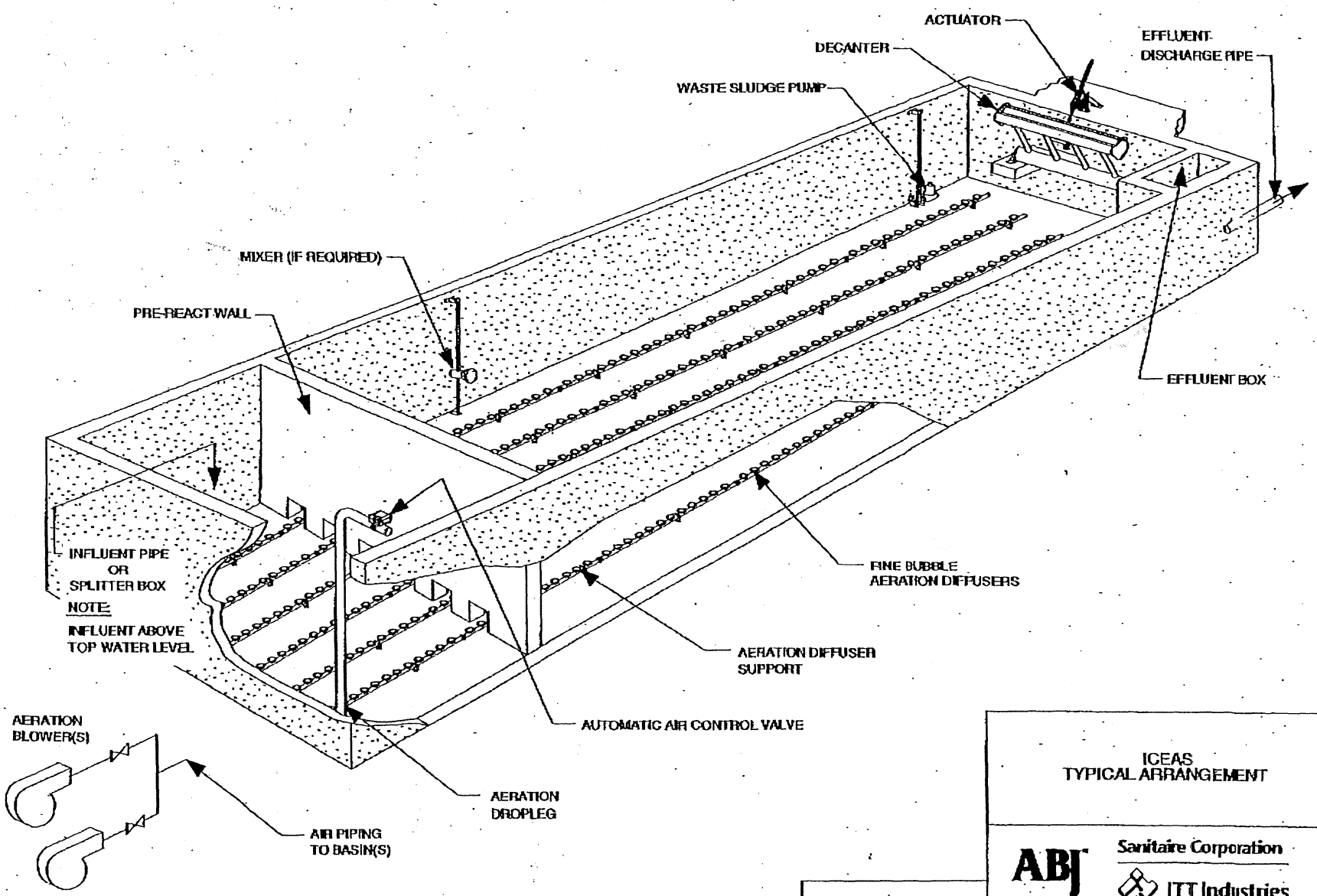
PLASTI-FAB, INC.
P.O. Box 100
Tualatin, Oregon 97062
Phone (503) 692-5460



Dimensions of Parshall Flumes

Throat Width													Free Flow Capacity			
													Maximum		Minimum	
W	A	2/3 A	B	C	D	E	F	G	K	N	X	Y	Head	Discharge	Discharge	Head
3"	1'-6 3/8"	1'-0 1/4"	1'-6"	7"	10 3/16"	1'-3"	6"	1'	1"	2¼"	1"	1½"	1.125	1/2 Sec.Ft. 0.777 M.G.D.	0.03 Sec.Ft. 19400 G.P.D.	0.
6"	2'-0 7/16"	1'-4 5/16"	2'-0"	1'-3½	1'-3 1/2"	1'-6"	12"	2'	3"	4½"	2"	3"	1.24	2.9 Sec.Ft. 1.87 M.G.D.	0.05 Sec.Ft. 32300 G.P.D.	0.
9"	2'-10 5/8"	1'-11 1/8"	2'-10"	1'-3"	1'-10 5/8"	2'-0"	12"	1'-6"	3"	4½"	2"	3"	1.5'	5.7 Sec.Ft. 3.69 M.G.D.	0.10 Sec.Ft. 64700 G.P.D.	0.
1'-0"	4'-6"	3'-0"	4'-4 7/8"	2'	2'-9 1/4"	3'-0"	2'	3'	3"	9"	2"	3"	2.5'	16.1 Sec.Ft. 10.4 M.G.D.	0.35 Sec.Ft. .226 M.G.D.	0.2'
1'-6"	4'-9"	3'-2"	4'-7 7/8"	2'-6"	3'-4 3/8"	3'-0"	2'	3'	3"	9"	2"	3"	2.5'	24.6 Sec.Ft. 15.9 M.G.D.		
2'-0"	5'-0"	3'-4"	4'-10 7/8"	3'	3'-11 1/2"	3'-0"	2'	3'	3"	9"	2"	3"	2.5'	33.1 Sec.Ft. 21.45 M.G.D.	066 Sec.Ft. .427 M.G.D.	0.2'
3'-0"	5'-6"	3'-8"	5'-4 3/4"	4'	5'-1 7/8"	3'-0"	2'	3'	3"	9"	2"	3"	2.5'	50.4 Sec.Ft. 32.6 M.G.D.	0.97 Sec.Ft. .627 M.G.D.	0.2'
4'-0"	6'-0"	4'-0"	5'-10 5/8"	5'	6'-4 1/4"	3'-0"	2'	3'	3"	9"	2"	3"	2.5'	67.9 Sec.Ft. 44.0 M.G.D.	1.26 Sec.Ft. .815 M.G.D.	0.2'
6'-0"	7'-0"	4'-8"	6'-10 3/8"	7'	8'-9"	3'-0"	2'	3'	3"	9"	2"	3"	2.5'	103.5 Sec.Ft. 66.9 M.G.D.	2.63 Sec.Ft. 1.70 M.G.D.	0.25'
8'-0"	8'-0"	5'-4"	7'-10 1/8"	9'	11'-1 3/4"	3'-0"	2'	3'	3"	9"	2"		2.5'	139.5 Sec.Ft. 90.2 M.G.D.	4.62 Sec.Ft. 2.99 M.G.D.	0.3'

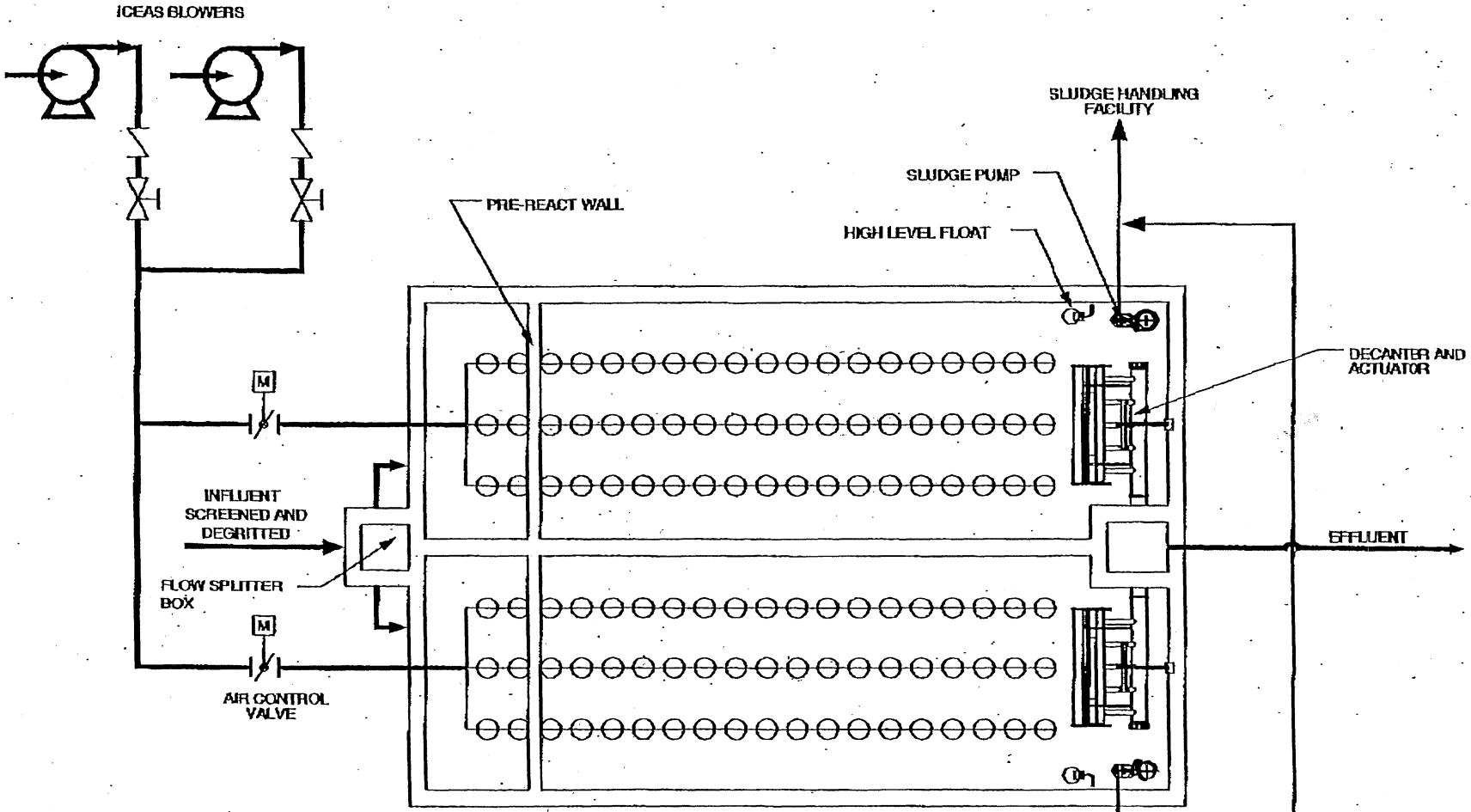

DISCHARGE CURVE
3" PARSHALL FLUME
HEAD-INCHES
0
1
2
3
4
5
6
7
8
9
10
11
12
.100
.200
.300
.400
.500
FLOW IN M.G.D.



ICEAS
TYPICAL ARRANGEMENT

ABJ Sanitaire Corporation
ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. 99-100



NOTE: CONTACT SANITAIRE CORPORATION FOR OTHER DESIGNS AND CONFIGURATIONS FOR SPECIFIC PROJECTS

PROCESS FLOW DIAGRAM
DUAL BASIN ICEAS

DWG. 99-120

ABJ Sanitaire Corporation
ITT Industries
BROWN DEER, WISCONSIN 53223

FAX TRANSMISSION

Koester Associates, Inc.

From: Peter J. Radosta, P.E.

Phone	(315)697-3800
Fax	(315)697-3888
E-Fax	(425)977-7994
Mobile	(315)952-2400
E-mail	peter@koesterassociates.com
Address	Suite 7, Madison Blvd. Canastota, NY 13032

Date: August 22, 2001

This fax contains (5) pages, including this page.

Name: Marie Dowd
Company: Delaware Engineering, P.C.
[fax:]

Subj: Crossroads WWTP

Marie,

Attached are ABJ Design Proposal and Sketch for the subject project. We have revised the layout to a two-basin ICEAS to treat the ultimate capacity. During the initial low flow periods, the system can be operated with a single basin in service. Overall, this will minimize the concrete and site work, which will have an overall favorable effect on the project budget.

You will note that we have also revised our process to the "ICEAS-NDN". In order to achieve biological phosphorus removal, we must use a cycle that incorporates periods of anaerobic mixing. Based on the high influent BOD concentration, bio-P removal down to 1 mg/l may be possible in the ICEAS. However, we recommend the inclusion of a chemical feed system to supplement biological removal during periods when the BOD concentration is less than the design concentration or the TP concentration is greater than the design concentration. We would recommend sizing the chemical feed system for a minimum of 50 mg/l alum dosage.

The SBR decant rate has been substantially reduced , utilizing a 4.5x peaking factor as a Peak Hourly Flow. As we discussed, since the 4.5x peaking factor is an instantaneous rate, not to exceed one hour, there is no need to size the ICEAS to treat this flow on a sustained basis. We have sized the system based on a sustained flow of 360,000 GPD, which will facilitate treatment of the Peak Hourly Flow of 498,438 GPD.

$$PWWF = \frac{(PHF \times 1\ hr) + ((ADWF + PHF)/2 \times 2.6\ hr)}{3.6\ hr}$$

$$PWWF = \frac{(498{,}438\ gpd \times 1\ hr) + ((110{,}764\ gpd + 498{,}438\ gpd)/2 \times 2.6\ hr)}{3.6\ hr}$$

PWWF = 358,445 gpd ~ 360,000 gpd

Koester Associates, Inc.

FAX TRANSMISSION
PAGE 2

The revised budgetary price for equipment as listed in TABLE D of the design proposal, including freight and ten days of field service is $210,000.

Please give me a call to discuss if you have any questions.

Thank you.

Pete

8/22/01

CROSSROADS WWTP
DESIGN PROPOSAL

TABLE A
INFLUENT WASTEWATER CHARACTERISTICS AND SITE CONDITIONS

Average Dry Weather Flow	110,764 GPD
Peak Dry Weather Flow	221,528 GPD
Peak Hourly Flow (4.5x ADWF)	498,438 GPD
BOD5 (20°C)	462 mg/l
BOD5 (20°C)	427 lb/day
Suspended Solids	546 mg/l
TKN	45 mg/l
Total Phosphorus	10.00 mg/l
Alkalinity	111 mg/l
Wastewater Temperature	20 °C
Ambient Air Temperature	20 - 90 °F
Site Elevation	500 ft

TABLE B
ICEAS™ EFFLUENT QUALITY (MONTHLY AVERAGE)

BOD5 (20°C)	10.00 mg/l ⟶ 5.0
Suspended Solids	10.00 mg/l
NH3-N	1.10 mg/l
Total Phosphorus	1.00 mg/l

Notes:

1. Tertirary treatment will be required to produce the required effluent quality of 5 mg/l BOD and 0.5 mg/l TP.
2. Back-up chemical feed is recommended to supplement bio-P removal.

TABLE C
ICEAS PROCESS DESIGN CRITERIA

F / M	0.065 lb BOD5/ lb MLSS / day
SVI (after 30 minutes settling)	150 ml/g
MLSS at Bottom Water Level	4,979 mg/l
Waste Sludge Produced (Approx.)	376 lb/day
Volume of Sludge Produced (Approx., 0.85% solids)	5,304 GPD
Normal Decant Rate	433 GPM
Peak Decant Rate	600 GPM
Hydraulic Retention Time	1.59 Days
Sludge Age	17.07 Days

CYCLE	MIXING	AERATION	SETTLE	DECANT	TOTAL
Normal	48 min	120 min	60 min	60 min	4.8 hour
Storm	36 min	90 min	45 min	45 min	3.6 hour

8/22/01

TABLE D
KEY ICEAS DESIGN DETAILS

Number of ICEAS Basins	2
Top Water Level	15.00 ft
Basin Width	17.00 ft
Basin Length	53.00 ft
Bottom Water Level	11.81 ft
No. of Sludge Holding Tanks	1
SHT Top Water Level	15.00 ft
SHT Width	11 ~~16.00~~ ft
SHT Length	53 ~~35.00~~ ft
Sludge Storage Time	20 days

ICEAS EQUIPMENT				Motor HP	No. Req.
Decanter Mechanism		4.0	'Weir length	1 /Basin	2
Decanter Drive Unit				1/2	2
ICEAS Blower		240 SCFM	7.2 PSIG	15	2
ICEAS Fine Bubble Aeration System					2
Air Control Valve	4 "				2
Waste Sludge Pump		45.0 GPM		1.7	2
Submersible Mixer				4.0	2
ICEAS Controls					1
D.O. Control					2
SHT Blower		134 SCFM	7.5 PSIG	7.5	2
SHT Aeration System					1

ICEAS POWER REQUIREMENTS	(At Average Aeration Depth)				Kwh/Day
Decant Drive Unit	0.4 BHP	2 run	@	5 Hrs/day	2.98
ICEAS Air Blower	9.9 BHP	1 run	@	20 Hrs/day	147.00
Waste Sludge Pump	1.4 BHP	2 run	@	5 Hrs/day	10.15
Submersible Mixer	3.2 BHP	2 run	@	4 Hrs/day	19.10
				KWH/DAY	179.23
			AVERAGE	KWH/HR	7.47

SHT power requirements are dependent on actual operation.

ICEAS-NDN PROCESS: BIOLOGICAL NUTRIENT REMOVAL (BNR)

Designed for the Removal of:

- BOD
- TSS
- Ammonia
- Total Nitrogen
- Total Phosphorous

Typically Used for:

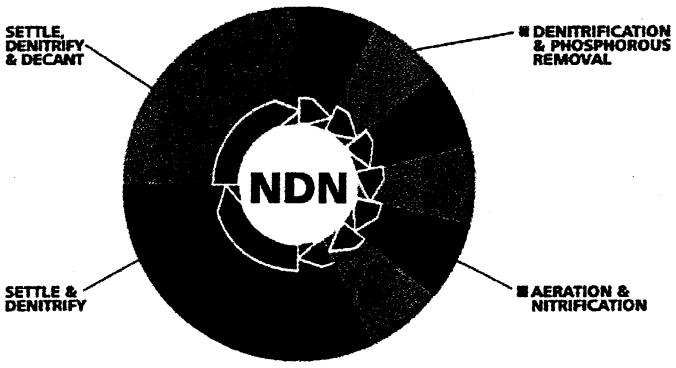
- Municipal Wastewater
- Industrial Wastewater

Biological nutrient removal is accomplished in the ICEAS-NDN process by incorporating alternating phases of oxic-anoxic/anaerobic (air on-air off) conditions in the cycle as shown in Figure 13. The ICEAS basin is sized to ensure complete nitrification, denitrification and to maximize the total biological phosphorus removal.

Typical normal and storm cycles using 2 basins for the ICEAS-NDN process are shown in Figure 14 and 15. The aerobic phases promote BOD removal, nitrification and phosphorus uptake. The anoxic/anaerobic (air off) phases promote denitrification and phosphorus release. Nitrification rates and sludge age requirements for the nitrification process are calculated based on the temperature range and pH of the influent wastewater.

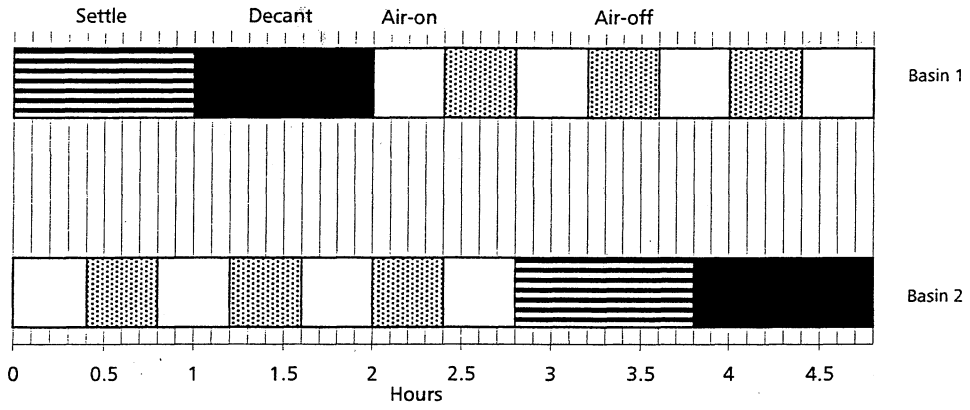
The degree of denitrification and phosphorus removal achieved by the ICEAS-NDN process is dependant on the influent BOD/TN and BOD/TP ratios. The typical blower control for the ICEAS-NDN process involves a D.O. control system with blower output control.

Figure 13



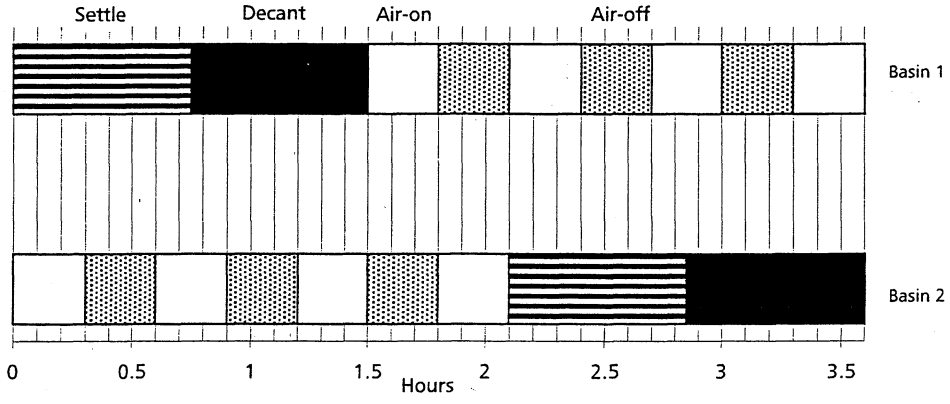
Normal Cycle Operational Sequence of ICEAS-NDN Process

Figure 14



Storm Cycle Operational Sequence of the ICEAS-NDN Process

Figure 15



ABJ™

AERATION SYSTEMS
FINE BUBBLE MEMBRANE DISC

DESIGN

The SANITAIRE® Membrane Disc Aeration System provided for an ABJ ICEAS or SBR installation is a complete package, including all in-basin pipe, diffuser assemblies, supports and anchor bolts. Typically, ABJ facilities include a single aeration grid in each basin. Although some larger facilities do employ the use of multiple grids in each basin, an aeration grid is defined as a group of diffusers that is serviced by a single aeration dropleg.

The SANITAIRE Membrane Disc Aeration System makes use of only the highest quality materials. All PVC materials contain a minimum of 2+% titanium oxide to prevent UV degradation. All supports and anchors are constructed of 18-8 stainless steel, with an option for 316 stainless steel. Finally, the membrane diffusers themselves are produced with an advanced EPDM material, promoting extended diffuser life.

The SANITAIRE Membrane Disc Diffuser Assembly consists of:

- A saddle-type diffuser holder which is factory solvent welded to the crown of the air distributor
- A convex baseplate which supports the membrane when air is not being delivered
- A membrane element
- A mason jar type retainer ring

The diffuser assembly uses an integral check valve to prevent the intrusion of mixed liquor into the piping system during periods when the air is turned off. When air is discontinued to the aeration grid, the membrane element collapses onto the baseplate. The non-perforated, inner portion of the membrane element covers the hole in the center of the baseplate forming a watertight seal.

ADDITIONAL FEATURES

Performance/Experience – Efficiency of a SANITAIRE Fine Bubble Aeration System is unparalleled by any other fine bubble technology. Considering the significance of aeration in the overall power demands of a wastewater treatment plant, use of a highly efficient aeration system can save a significant amount of money over the life of the plant. Estimated performance of a SANITAIRE brand aeration system is substantiated by actual clean water oxygen transfer test data from the most extensive database in the industry. All Sanitaire test data is based on full conformance with the American Society of Civil Engineers (ASCE) Clean Water Oxygen Transfer Testing Method, the most rigorous testing standard in the world. No other aeration manufacturer can offer this level of experience and expertise.

Advanced Engineered Membrane Material – The technologically advanced SANITAIRE *Silver Series* membrane diffuser has been engineered to provide long membrane life and high efficiency, reducing both operation and maintenance costs. The design and formulation is based on over fifteen years of research and development. Side-by-side, in-waste field-testing has demonstrated that this premium quality material is more resistant to chemical attack and the physical forces encountered during long term operation in a wastewater treatment environment. While many diffusers may be similar in appearance, none provide the consistent performance of the SANITAIRE Engineered Membrane.

Piping/Support System – One of the primary design considerations for a PVC piping system is how to deal with expansion and contraction. PVC has a high coefficient of expansion and can be expected to

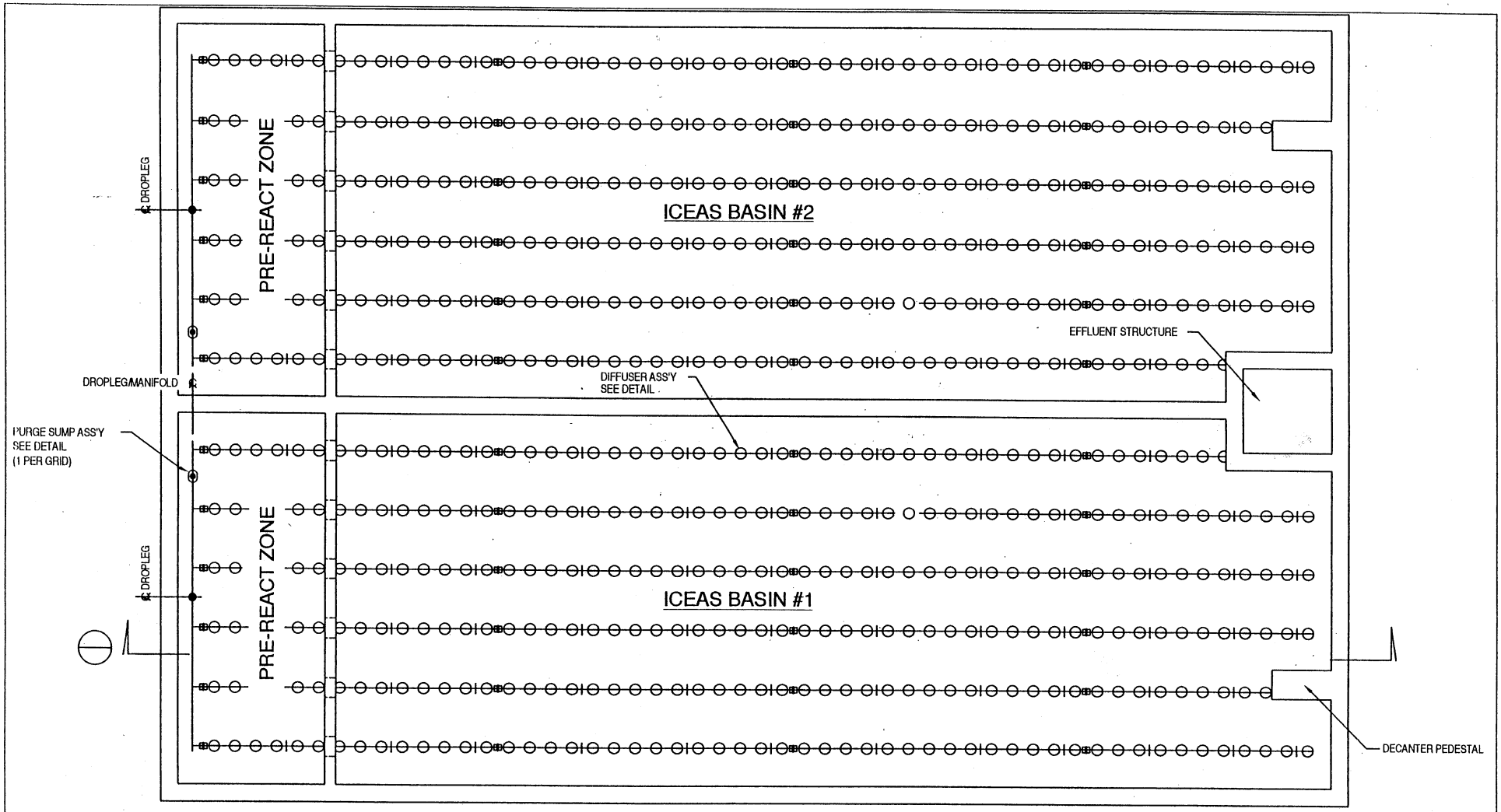
expand and contract up to 4" in a 100-foot length, over a temperature range of 100° F. SANITAIRE Fine Bubble Aeration Systems employ a design philosophy, which minimizes the use of expansion joints in the piping system. Expansion and contraction is accommodated through the use of fixed joints and guide-type supports, which do not grip the pipe. While expanding and contracting, the PVC pipe is allowed to freely slide through the support clamps. This type of support system has been field proven to be superior to the alternate method of using expansion joints and fixed supports. This alternate type of support system allows movement to take place inside the expansion joint and is prone to "blow apart". Numerous competitive aeration systems have been replaced with SANITAIRE Aeration Systems due to piping system failure.

POWER CONSIDERATIONS

In addition to mechanical integrity and system longevity, prudent engineering practice requires consideration of the efficiency of the aeration system. The evaluation must consider the total power required to make the aeration system functional. For example, the power evaluation for a jet aeration system must include the power required to operate the motive pumps as well as the aeration blowers.

In a typical Activated Sludge application, the energy required for aeration can account for 50 to 80 percent of the plants' total consumption. Use of a highly efficient aeration system can yield substantial cost savings.

The following comparison of various types of aeration in an SBR application illustrates the importance of aeration system efficiency.



PLAN VIEW

FINE BUBBLE AERATION LAYOUT

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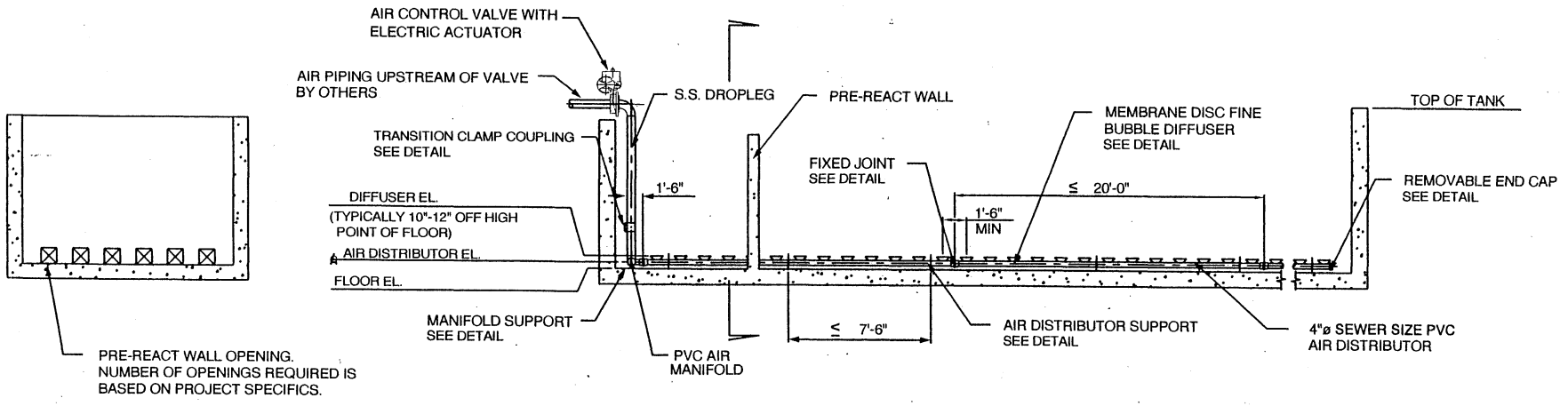
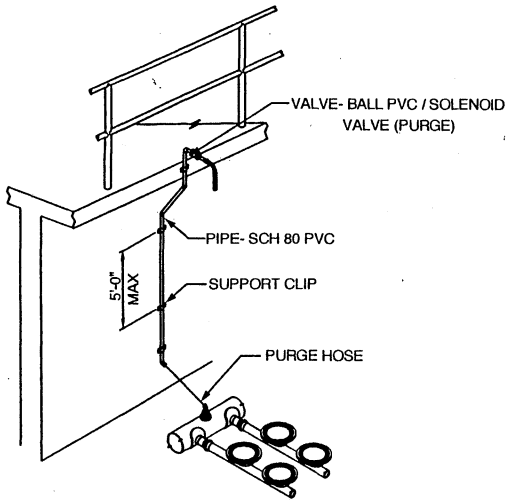
ITT Industries
BROWN DEER, WISCONSIN 53223

DWG. 99-200



SECTION



PURGE SUMP ASSEMBLY

FINE BUBBLE AERATION SYSTEM
SECTION AND DETAILS

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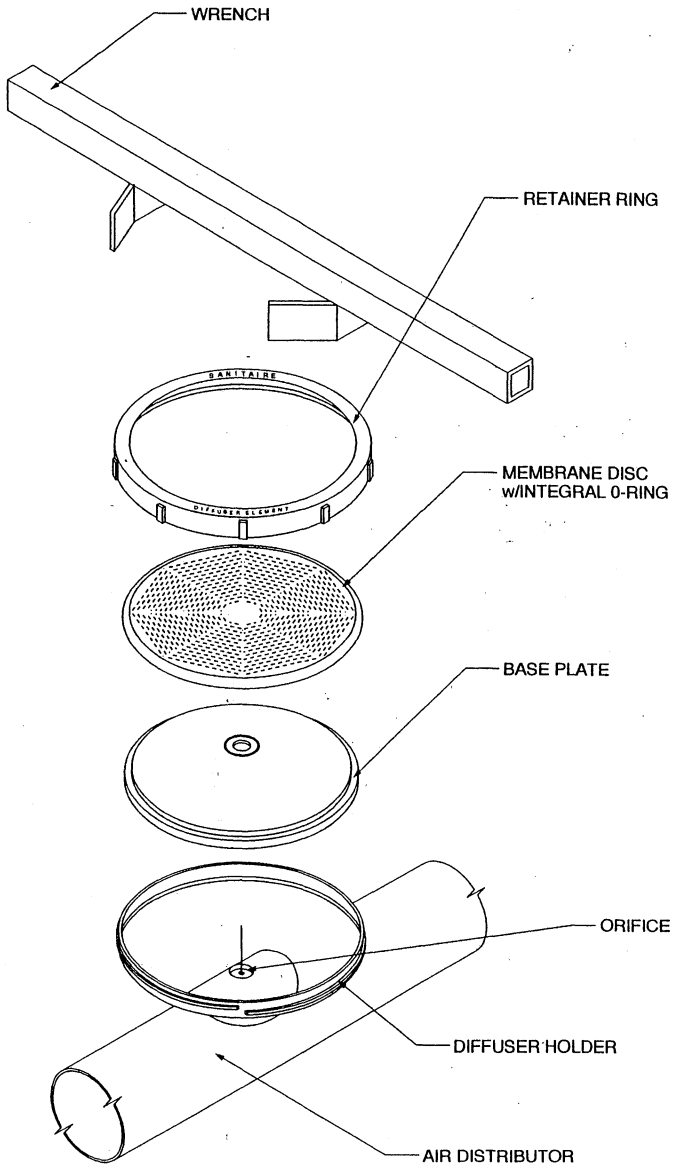
DWG. 99-210



MEMBRANE DISC FINE BUBBLE DIFFUSER

FINE BUBBLE DIFFUSER
ASSEMBLY

DWG. 99-220

ABJ™

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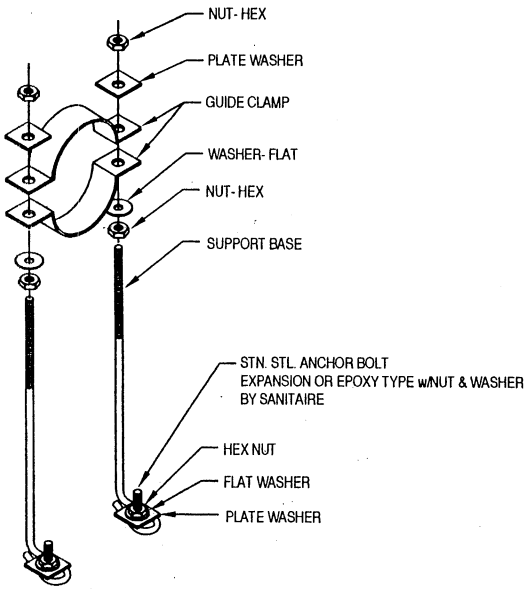
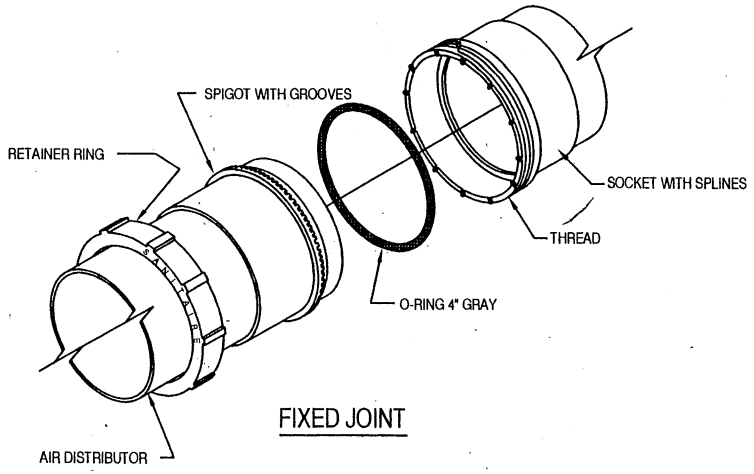
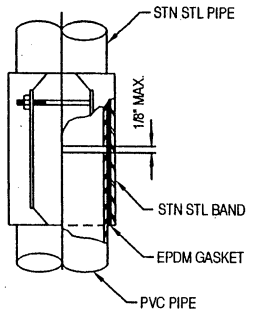


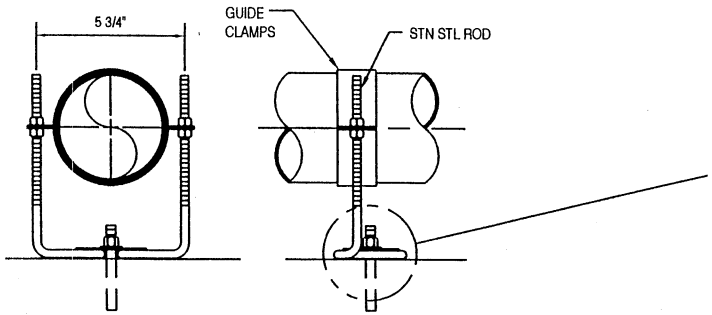
MANIFOLD SUPPORT
(STAINLESS STEEL)

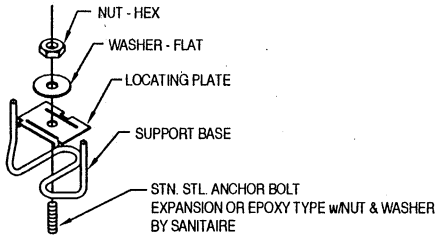


FIXED JOINT

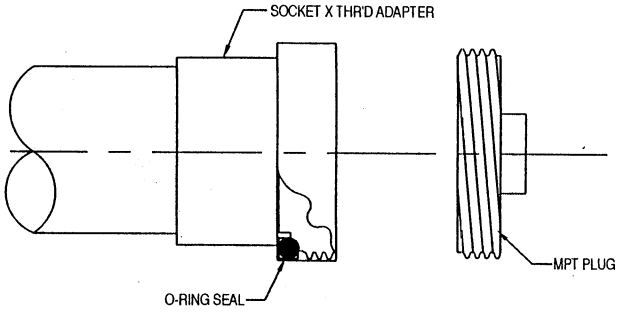


TRANSITION CLAMP COUPLING
(FOR DROPLEG)





AIR DISTRIBUTOR SUPPORT
(STAINLESS STEEL)



REMOVABLE END CAP

FINE BUBBLE AERATION SYSTEM
TYPICAL DETAILS

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DWG. 99-230

ABJ™

DECANTER

DESIGN

A key piece of equipment in any SBR system is the decanter. Through years of experience, we have developed a high quality, advanced engineered decanter mechanism. The basic components of the ABJ decanter include:

- Effluent collection trough with integral overflow weir
- Scum exclusion float
- Seal and bearing assemblies
- Electromechanical actuator

The decanter is fabricated of stainless steel. The stainless steel construction provides a prolonged life with little or no maintenance. The decanters are passivated after welding to retain the stainless steel's corrosion resistance. The rugged construction has been field proven to operate dependably in harsh conditions. All seals and bearings are constructed of synthetic materials for prolonged service life, do not require lubrication and ship factory assembled, simplifying installation. Stainless steel is used in lieu of alternatives such as fiberglass reinforced plastic (FRP) due to its high resistance to degradation from ultraviolet rays and its ability to withstand temperature changes.

The scum exclusion float is located in front of the decanter overflow weir and is designed to act as a baffle, preventing scum and floatables from entering the effluent collection trough. See drawing 99-410 for details of this component.

A linear drive actuator slowly drives the decanter into the clarified liquid. The actuator motor is mounted at the basin walkway, not in the basin. This allows access and service from the walkway without the need to enter the basin full of sewage. ***Floating decanters do not offer this option.*** The actuator used for the ABJ decanter incorporates redundant limit switches at the top and bottom of travel to ensure reliable operation. See drawing 99-450 for specific details.

The ABJ decanter does not require effluent valves, controls, valve vaults, troublesome flex (knee) joints, throttling arrangements or dewatering supports. This eliminates the capital and maintenance costs of these components and the risks associated with valve failures (i.e. solids carryover and effluent quality deterioration).

OPERATION

The decanter is raised and lowered using an electromechanical actuator. The decanter sits in the "park" position located above the top water level (TWL) during the aeration and settle phases of the operating cycle, thereby eliminating any possibility of solids carryover during these periods. During the decant phase, the decanter travels from the top "park" position to the bottom water level position (BWL), generally 3 to 6 feet and consistently withdraws only the uppermost supernatant from the basin.

Since the decanter draws liquid from the top down, it does not entrain solids that are settling. The scum float mounted in front of the weir also prevents floatables from entering the effluent. When the decanter enters the liquid, the scum float and scum plate is in contact with one another preventing flow into the effluent trough. The float then separates from the scum plate after the bottom of the

float is submerged. The clear supernatant is then allowed into the trough (a couple inches below the surface) between the float and the scum plate. The slow descent of the decanter does not disrupt the sludge blanket in front of the float.

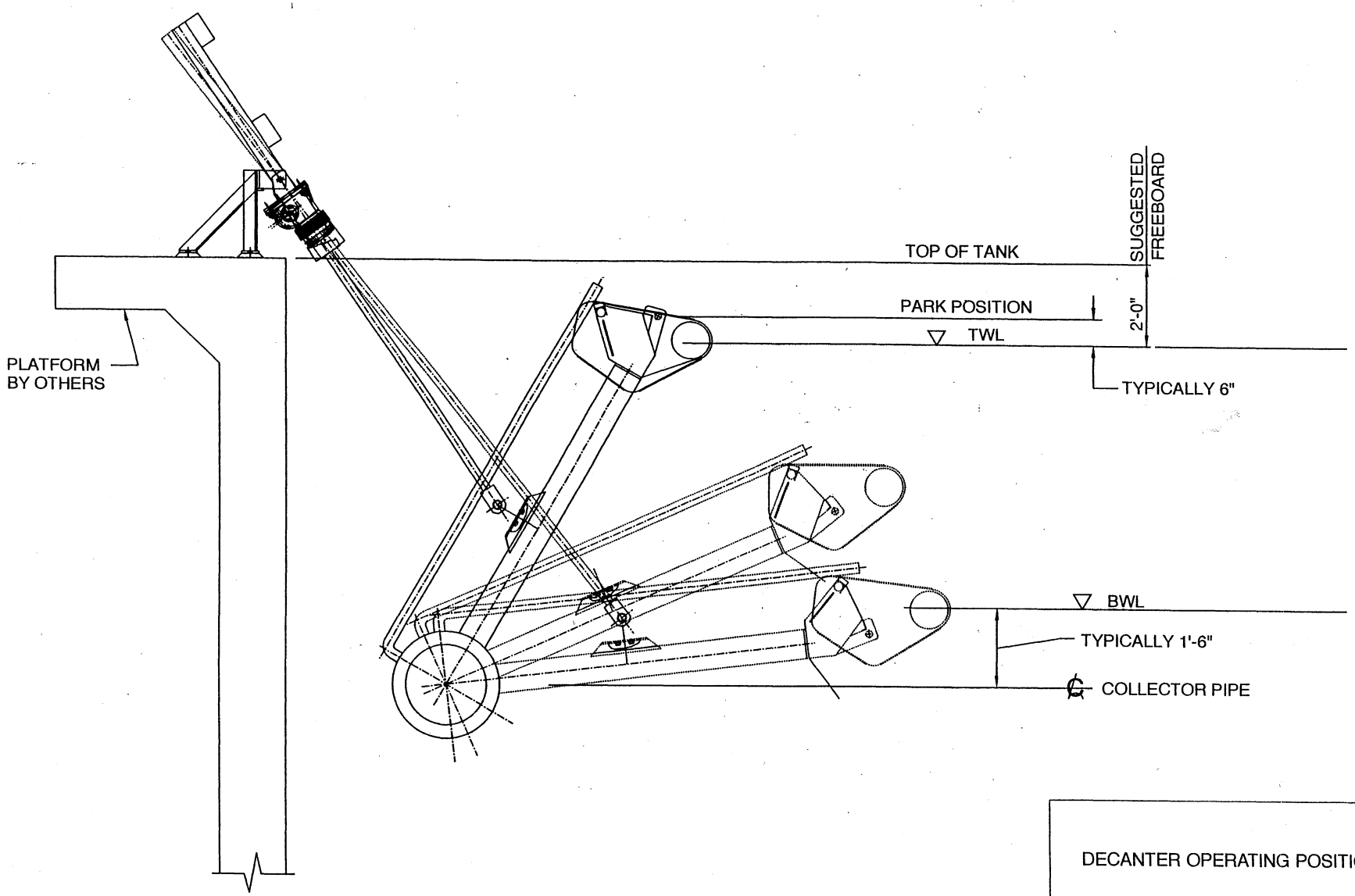
In the park position, the decanter is located above the TWL and below the top of the basin wall, which provides "fail safe" overflow protection in the event of a power failure or severe flood. The decanter scum exclusion float will prevent the carry over of any floatables during such emergency periods. In addition, the park position eliminates the need for air seal or valves to prevent leaking and/or solids entry.

The decanter speed is controlled by a series of pulses or through the use of a variable frequency drive (VFD). As a result, the decanter discharge rate is relatively constant from the time the decanter enters the water to the time it reaches the bottom water level (BWL). In the case of storm flows, the speed is automatically adjusted to accommodate these flows. The flexibility to adjust the decant rate facilitates treatment of high flows without compromising the total aeration or settling time in the system. ***Systems using floating or fixed decanters do not have the ability to adjust the decant rate***. With these types of decanters, the only way to accommodate higher flows is to increase the decant time, thus decreasing the time allotted for aeration and settling. This ultimately leads to deterioration of the effluent quality.

The limit switches are fully integrated with process control time overrides and interlocks, thereby eliminating the potential for blower activation during decant.

SPECIAL ATTRIBUTES

- Stainless Steel Construction – Provides a corrosion resistant, long lasting decanter mechanism.
- Visible Effluent – This open trough decanter design allows the plant staff to observe the effluent at all times during the decant phase ("If it looks good, it's operating good"). Floating decanters do not offer this option.
- Maintenance – All maintenance can be performed without entering the basin.
- Emergency Overflow – The park position of the decanter prevents liquid from overflowing the tank in case of flooding and/or power outages. ***Again, floating decanters do not offer this option***.
- Uniform Discharge Rate – The ABJ decant system provides a uniform discharge rate, minimizing downstream process requirements and simplifying the design.
- Installation – The decanters are shipped with all of the major components pre-assembled.
- Time Proven – The ABJ decanter has been installed and is operating successfully in hundreds of facilities around the world in a wide range of climatic conditions.



DECANTER OPERATING POSITIONS

DWG. 99-400

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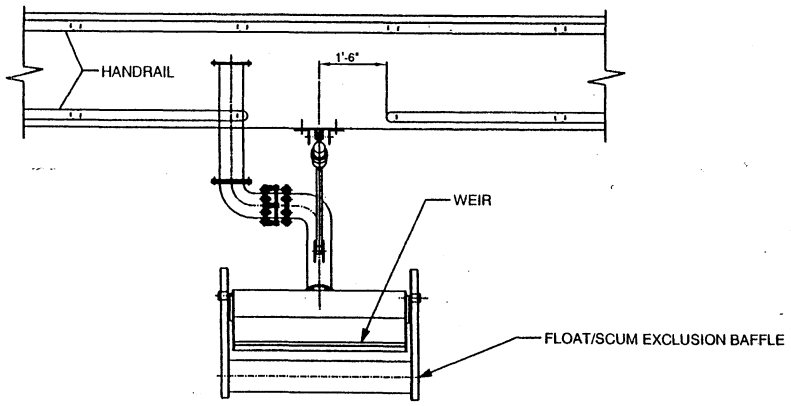
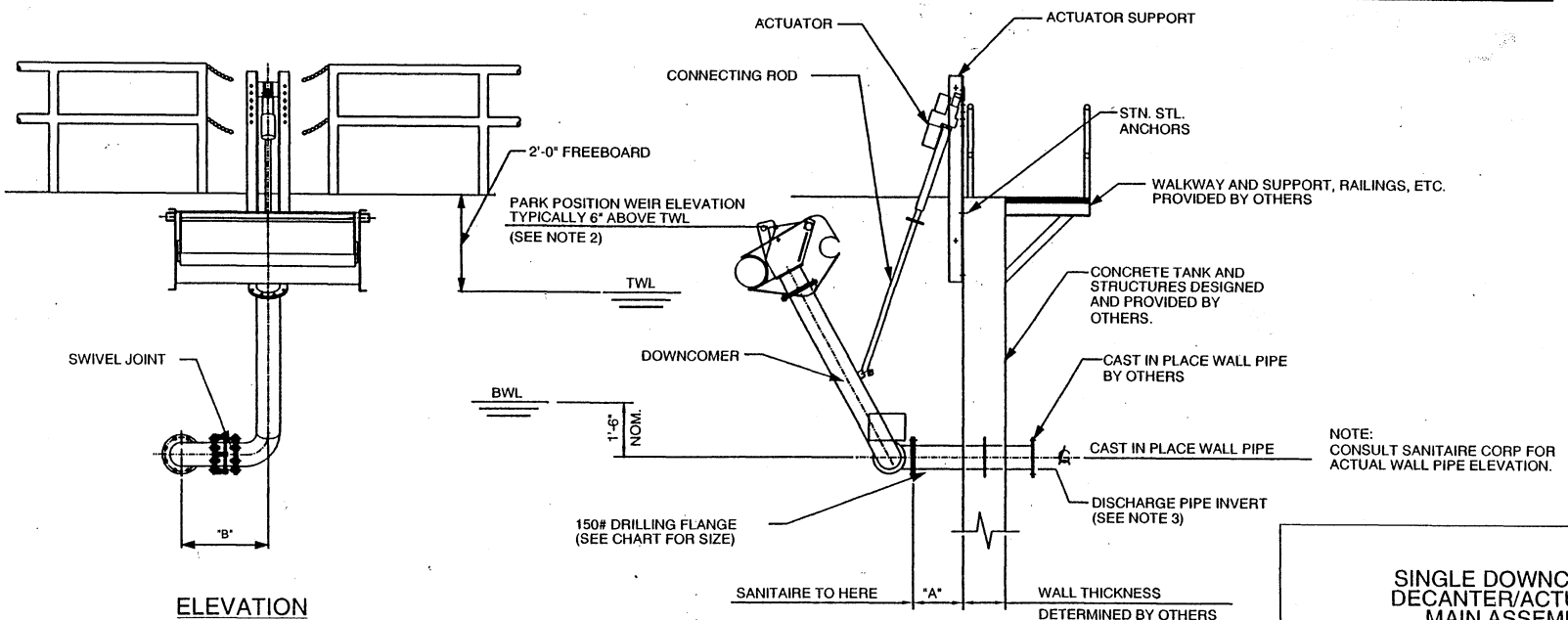


PLAN VIEW

NOTES:

1. ALL SUBMERGED MATERIALS ARE STAINLESS STEEL.
2. PARK POSITION IS USED TO KEEP THE FLOAT ABOVE THE WATER LEVEL DURING AERATION.
3. DOWNSTREAM WATER LEVEL SHOULD NOT EXCEED THIS INVERT ELEVATION.
4. ACTUATOR EQUIPMENT PLATFORM SHOULD BE LARGE ENOUGH TO ALLOW FOR INSPECTION AND SERVICE AND PROPERLY GUARDED FOR SAFETY AS NEEDED.

WEIR LENGTH	"A"	"B"	CAST IN PLACE PIPE SIZE
1'-6"	4"	18"	4"ø
3'-0"	11 3/4"	24 1/2"	6"ø
4'-0"	11 3/4"	24 1/2"	6"ø
5'-0"	11 3/4"	32 1/2"	8"ø
6'-0"	11 3/4"	32 1/2"	8"ø



ELEVATION

SINGLE DOWNCOMER DECANTER/ACTUATOR MAIN ASSEMBLY

DWG. 99-410

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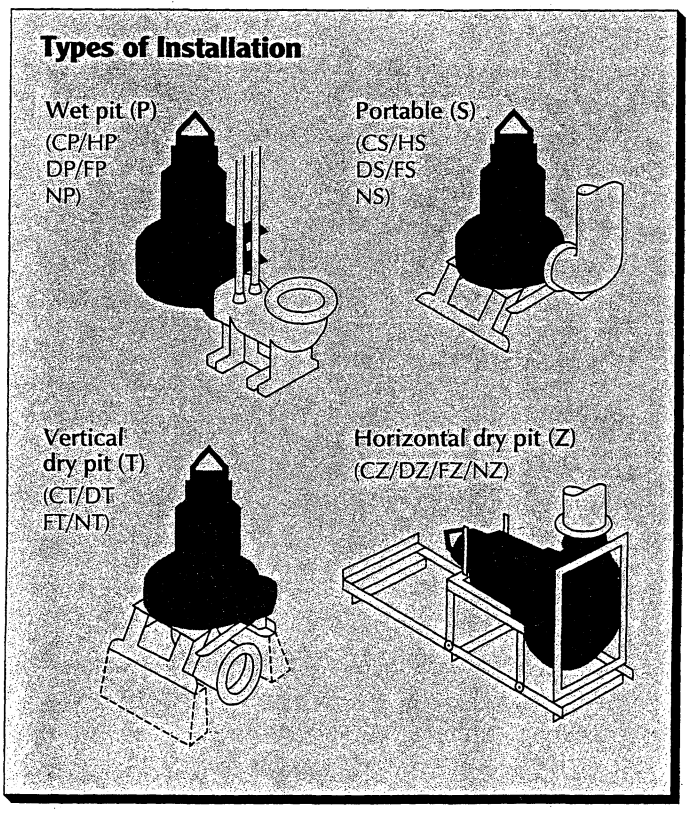
Flygt Submersible Pumps



On the cover: One of the four Flygt model CP 3231, 250HP wastewater pumps installed in lift station at Duckett Creek Sanitary District, St. Charles County, MO. This pump installation along with a state of the art Treatment plant, is part of an EPA award-winning project to spur development in the fastest growing county in the state.

Engineers and operators appreciate the compact, heavy-duty design of Flygt submersible pumps. It's a fact, that much of our reputation results from years of successful operation in difficult applications, often after replacing equipment which didn't live up to expectations. With over 50 years of experience in the design and application of heavy duty submersible pumps, we don't mind the challenge. Today, well over 1.5 million Flygt installations around the world give testimony to the dependability of our products.

In new installations, compact Flygt units can be installed directly on the floor of the wet pit using a simple automatic discharge connection and guidebars. The single pit "P" style mount eliminates the need for a separate dry pit, which reduces construction costs by 60% in concrete and excavation work alone.

With its "T" stand, the pump mounts in the vertical centrifugal dry pit configuration, in-line with the piping system. The inherent flood-proof design and close coupling of motor to wet end makes this the ideal replacement choice for vertically mounted, close coupled or long shaft pumps located in existing dry pits. The pump can also be provided for non-submerged operation in the "Z" configuration, mounted in the horizontal dry pit configuration for easy "back pull-out" inspection and maintenance.

The "S" style mount, utilizes a heavy duty stand and elbow for easy hose or pipe connection, making it perfect for emergency bypass and other temporary pumping applications.

Flygt offers the broadest, most complete range of heavy duty submersible pumps available... pumps with the size, capacity and characteristics to fit any solids handling application.

- Six different impeller types:
  1. Semi-open non-clog solids handling (N).
  2. Closed, non-clog solids handling (C).
  3. Closed or semi-open for abrasive slurry (H).
  4. Vortex for abrasive and difficult solids handling (D).
  5. Open, chopper for fibrous waste/difficult applications (F).
  6. Semi-open grinder impeller with hardened cutter (M).
- Cast iron, stainless steel or aluminum bronze models.
- Capacities to 50,000 GPM, heads to 400 ft.
- Discharge sizes: 1.5"- 36", motors to 1,000 HP.
- Factory Mutual approval for use in hazardous locations.
- Standard operation to 105°F (40°C) ambient or warm liquid option to 195°F (90°C).

All major components of every Flygt pump... seals, electric motor, impeller, etc. are manufactured by Flygt to our own rigid standards. When long term dependability and total evaluated costs are important, specify the best... specify Flygt.

TYPICAL PUMP FEATURES

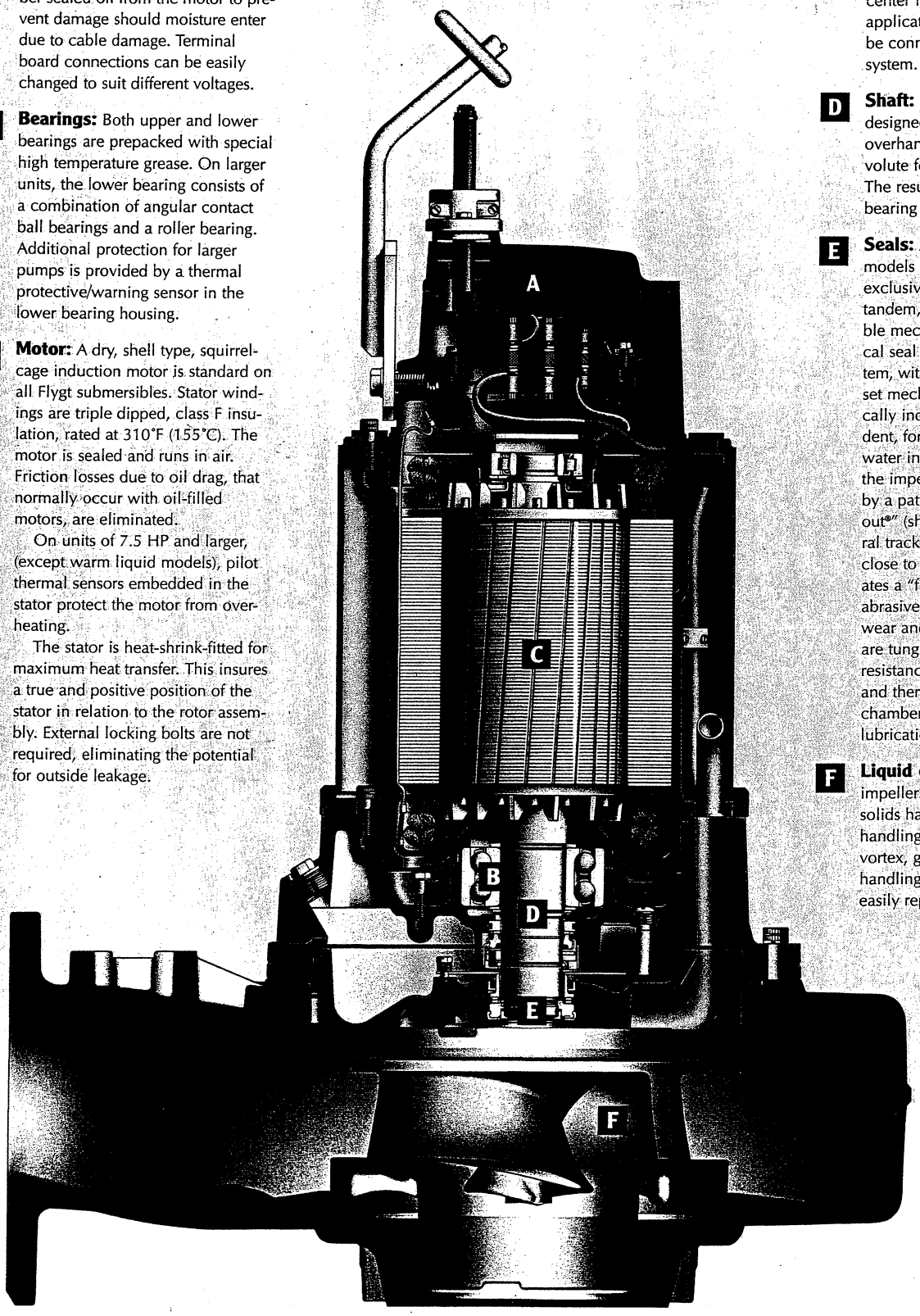
A **Junction Chamber:** All electric cables enter through a patented sealing gland, with junction chamber sealed off from the motor to prevent damage should moisture enter due to cable damage. Terminal board connections can be easily changed to suit different voltages.

B **Bearings:** Both upper and lower bearings are prepacked with special high temperature grease. On larger units, the lower bearing consists of a combination of angular contact ball bearings and a roller bearing. Additional protection for larger pumps is provided by a thermal protective/warning sensor in the lower bearing housing.

C **Motor:** A dry, shell type, squirrel-cage induction motor is standard on all Flygt submersibles. Stator windings are triple dipped, class F insulation, rated at 310°F (155°C). The motor is sealed and runs in air. Friction losses due to oil drag, that normally occur with oil-filled motors, are eliminated.

On units of 7.5 HP and larger, (except warm liquid models), pilot thermal sensors embedded in the stator protect the motor from overheating.

The stator is heat-shrink-fitted for maximum heat transfer. This insures a true and positive position of the stator in relation to the rotor assembly. External locking bolts are not required, eliminating the potential for outside leakage.

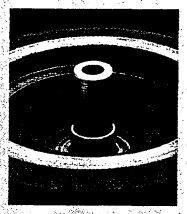


Model N-3201, 47 HP

Pumps of 15HP and larger have an integral cooling jacket system, that allows unit to pump down to the center line of the volute. For special applications, the cooling jacket can be connected to an external cooling system.

D **Shaft:** Every Flygt pump is designed with a very short shaft overhang. Shaft deflection due to volute forces is virtually eliminated. The result is a dramatic increase in bearing and seal life.

E **Seals:** All models use an exclusive dual tandem, double mechanical seal system, with each set mechanically independent, for added protection against water intrusion. The set closest to the impeller is now also protected by a patented feature called "Spin-out®" (shown above). A unique spiral track in the seal chamber wall, close to the spinning impeller, creates a "flushing" action, forcing abrasive particles away, to reduce wear and extend seal life. Seal faces are tungsten carbide for maximum resistance to corrosion, abrasion and thermal shock, and operate in a chamber filled with FDA approved lubrication.



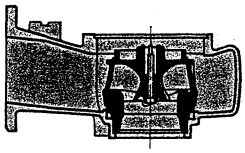
F **Liquid end:** Six distinct types of impellers are available: standard solids handling, semi-open solids handling (shown), heavy duty slurry, vortex, grinder and fibrous waste handling chopper. Wear rings are easily replaceable.

MODELS

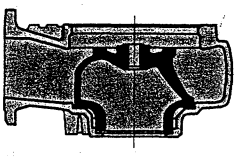
HYDRAULIC ENDS

Flygt submersibles are available in a variety of liquid ends, materials and special purpose models for wet pit and dry pit installation.

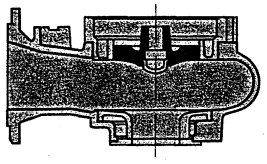
Solids Handling (N)
Semi-open non-clog impeller for large solids.



Solids Handling (C)
Closed non-clog solids handling impeller.

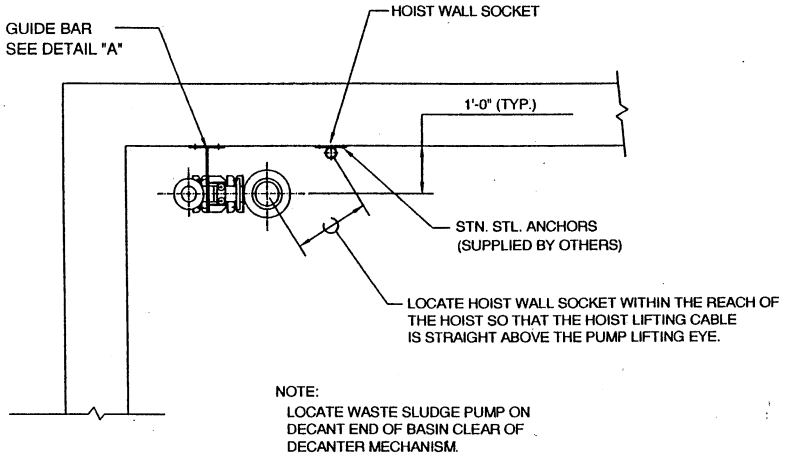


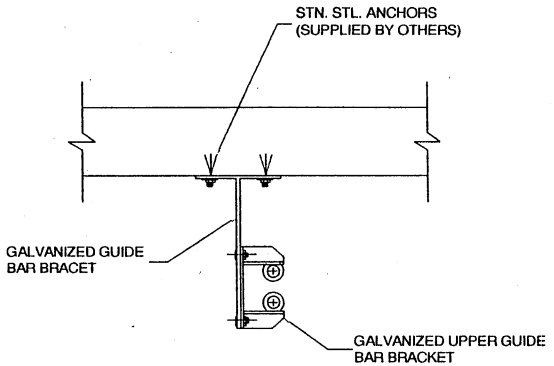
Vortex (D)
Semi-open vortex impeller for abrasive large solids handling capability.



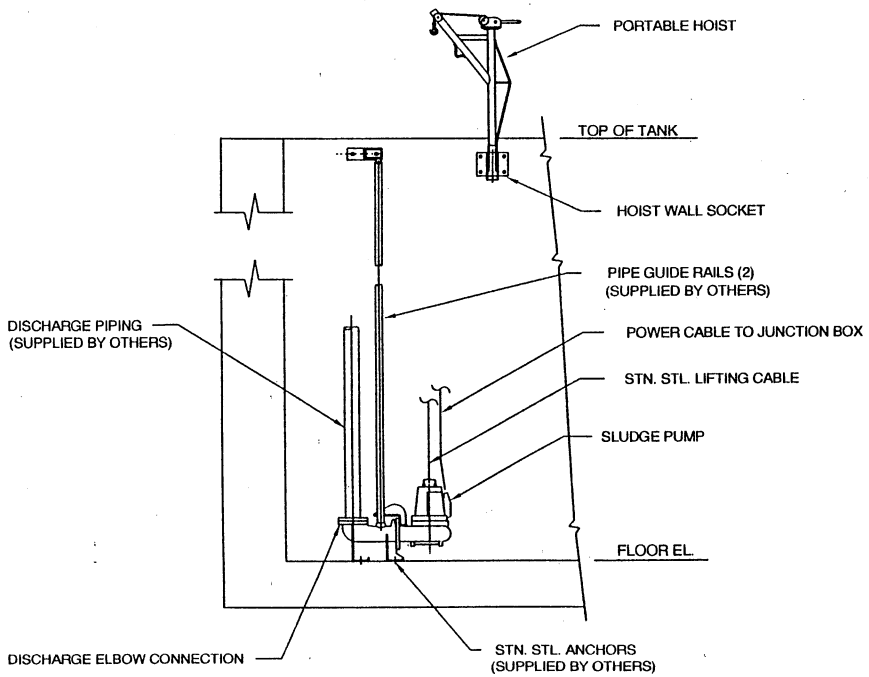
Model No.	Discharge Size (inches)	Max. Power Output (HP)	NP	NT	NZ	NS	CP	CT	CZ	CS	DP	DT	DZ	DS
3060	3	3.7					■			■	■	■	■	■
3067	2, 3	2.0					■			■	■			■
3075	3	1.7					■			■				
3080	3	9.0					■			■	■			■
3085	3	4.0					■			■	■			■
3085/82	3, 4	3.0					■	■	■	■				
3102	4, 6, 8	5.0					■	■	■	■	■[1]			■[1]
3126	4	10												
3127	4, 6, 8	10	■	■	■	■	■	■	■	■	■[1]			■[1]
3140	4, 6, 10	15	■	■	■	■	■			■	■[1]			■[1]
3152	4, 6, 8, 10, 12	23	■	■	■	■	■	■	■	■	■[1]			■[1]
3170	4, 6, 8, 10, 12	30	■	■	■	■	■	■	■	■				
3201	6, 8, 10, 12	47	■	■	■	■	■	■	■	■				
3231	8	335					■	■	■	■				
3300	6, 8, 10, 12, 14	160	■	■	■	■	■	■	■	■				
3306	12, 14	215					■	■	■	■				
3312	12, 14	470					■	■	■	■				
3351	14	1000					■	■	■	■[1]				
3356	14	280					■	■	■	■[1]				
3400	16	470					■	■	■	■[1]				
3501	20	325					■	■	■	■[1]				
3531	20	720					■	■	■	■[1]				
3602	24	500					■	■	■	■[1]				
3800	32	800					■	■	■	■[1]				

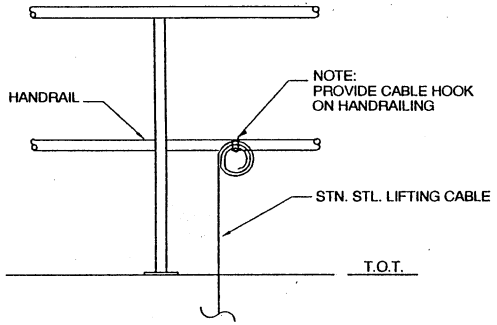
[1] Special order





DETAIL (A)





DETAIL (B)

WASTE SLUDGE PUMP
TYPICAL ARRANGEMENT

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DWG. 99-500

ABJ™

AERATION BLOWERS

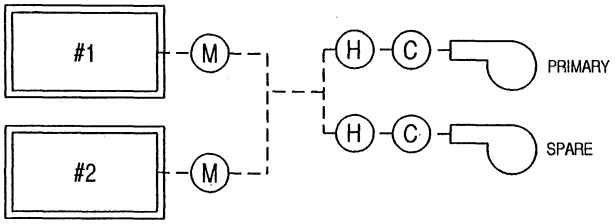
DESIGN

The blower system is designed to provide sufficient airflow to meet the system process requirements. Blower systems are available with either positive displacement (PD) or centrifugal type units. Typically, PD units are used for plants having smaller air volume requirements. Output airflow from a PD blower remains relatively constant with varying discharge pressure. Output airflow from a centrifugal blower varies with varying discharge pressure. Centrifugal blower systems are generally equipped with additional controls to regulate the flow as the discharge pressure varies.

FEATURES

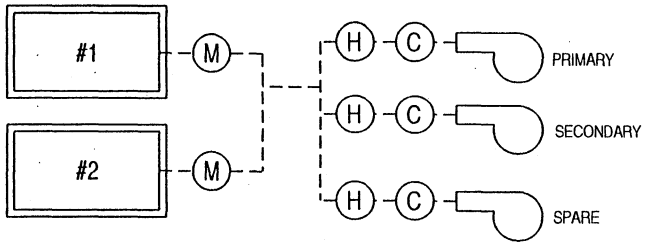
Positive displacement blower systems are generally equipped with the following items: blower, motor, inlet filter, inlet silencer, flexible connectors, discharge silencer, pressure relief valve, isolation butterfly valve, check valve, discharge pressure gauge, temperature gauge and inlet filter pressure gauge. The are assembled as a prepackage at the factory prior to shipment. For additional levels of safety, pressure, temperature and motor cutout switches can be provided. If reduced noise levels are necessary for environmentally sensitive areas, an encompassing sound enclosure can be provided.

Centrifugal blower systems are generally equipped with the following items: blower, motor, inlet filter, automatic inlet butterfly valve, flexible connectors, check valve, discharge pressure gauge, temperature gauge, inlet filter gauge and an independent control/ monitoring panel for surge and overload. Additional levels of equipment can include bearing and vibration monitoring devices as a means of protecting the investment.



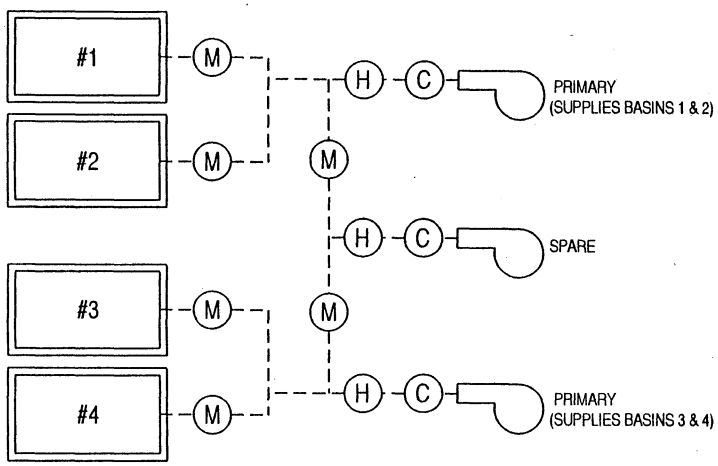
2 BASINS - 2 BLOWERS

(TWO BLOWERS DESIGNED AT 100% CAPACITY EACH)



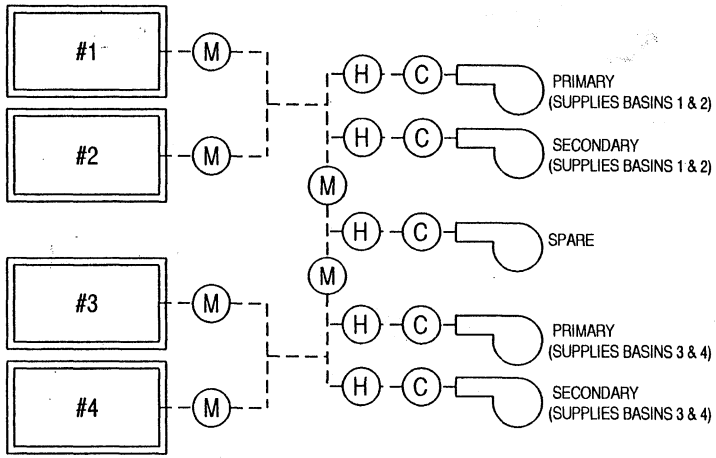
2 BASINS - 3 BLOWERS

(THREE BLOWERS DESIGNED AT 50% CAPACITY EACH)



4 BASINS - 3 BLOWERS

(THREE BLOWERS DESIGNED AT 100% CAPACITY EACH)



4 BASINS - 5 BLOWERS

(FIVE BLOWERS DESIGNED AT 50% CAPACITY EACH)

NOTES:

1. BLOWER CAPACITY (50% OR 100%) REFERS TO THE AIR REQUIRED FOR ONE BASIN.
2. THE BASINS OPERATE IN PAIRS WITH THE BLOWERS ALTERNATING BACK AND FORTH.
3. SPARE BLOWERS SHOULD BE REGULARLY ROTATED INTO THE SYSTEM FOR EXERCISE. THIS CAN BE ACCOMPLISHED MANUALLY OR AUTOMATICALLY.

LEGEND

- (M) - MOTORIZED VALVE
- (H) - HAND OPERATED VALVE
- (C) - CHECK VALVE

TWO & FOUR BASIN BLOWERS/PIPING ARRANGEMENT EXAMPLES

DWG. 99-700

ABJ™
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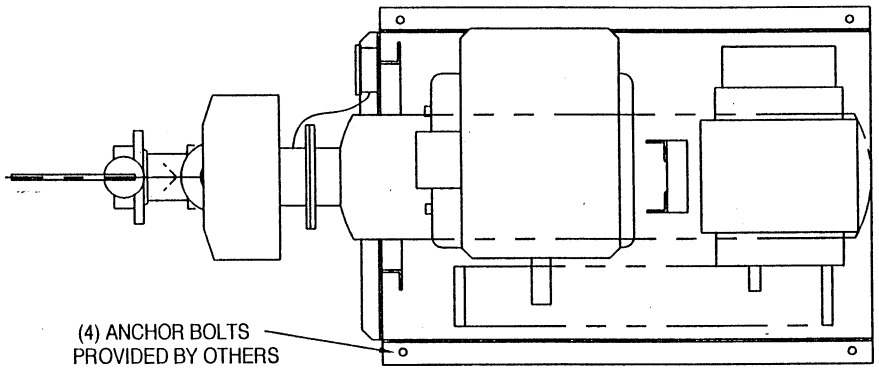
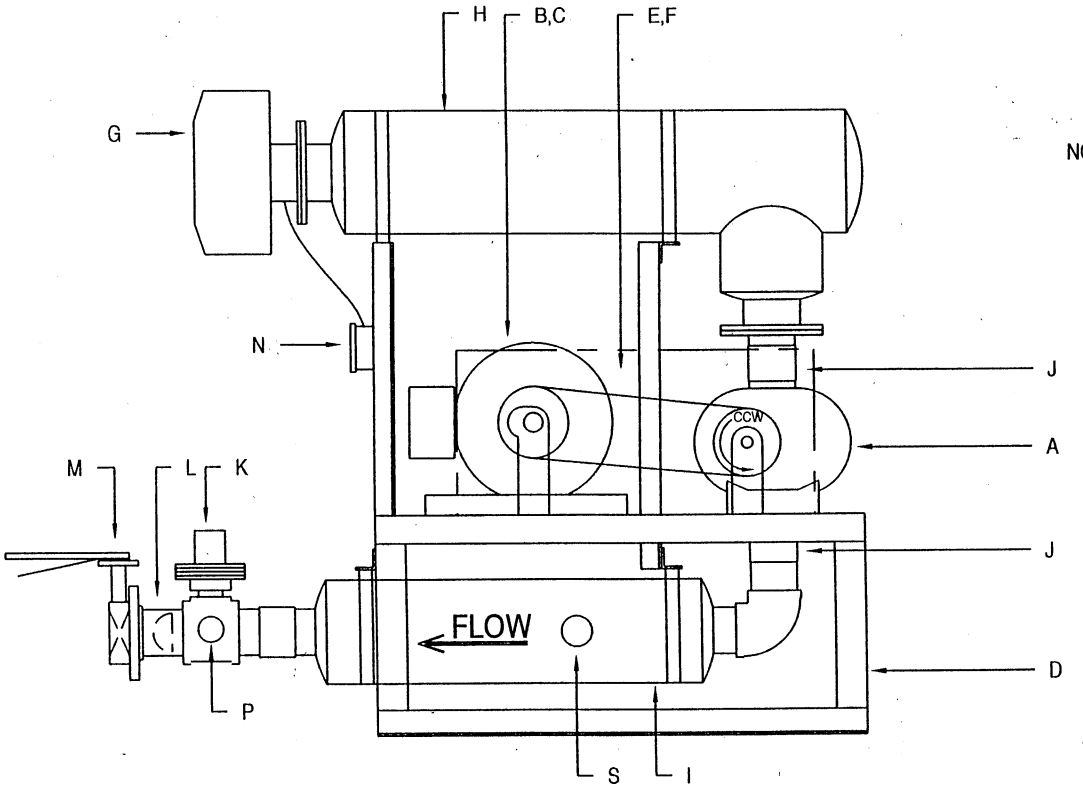
ITT Industries
BROWN DEER, WISCONSIN 53223





A BLOWER
B MOTOR
C MOTOR SLIDE BASE
D ELEVATED STEEL BASE
E V-BELT DRIVE:
F BELT GUARD
G INLET FILTER
H INLET SILENCER
I DISCH SILENCER
J FLEXIBLE PIPE CONNECTOR
K PRESSURE RELIEF VALVE
L CHECK VALVE
M BUTTERFLY VALVE
N DIFFERENTIAL PRESSURE GAUGE
P PRESSURE GAUGE
S THERMOMETER

NOTES:

1) THIS EXAMPLE BLOWER INCLUDES THE MAJORITY OF ACCESSORIES TYPICALLY UTILZED ON AN ABJ PD BLOWER SYSTEM. VARIATIONS DO OCCUR WITH ENGINEER/OWNER DESIGN PREFERENCE.

2) FOR MOUNTING PURPOSES, BLOWER PADS SHOULD BE A MINIMUM 8 INCHES LONGER AND WIDER TO ACCOMODATE ANCHOR BOLT CENTERLINE TO EDGE OF CONCRETE REQUIREMENTS.

3) AIR FILTERS ARE COMMONLY FOUND OUTSIDE WITH MULTIPLE BLOWER PACKAGES MANIFOLDED TOGETHER ON ONE COMMON INTAKE LINE.

TYPICAL POSITIVE DISPLACEMENT (PD) BLOWER

DWG. 99-710

ABJ™ Sanitaire Corporation
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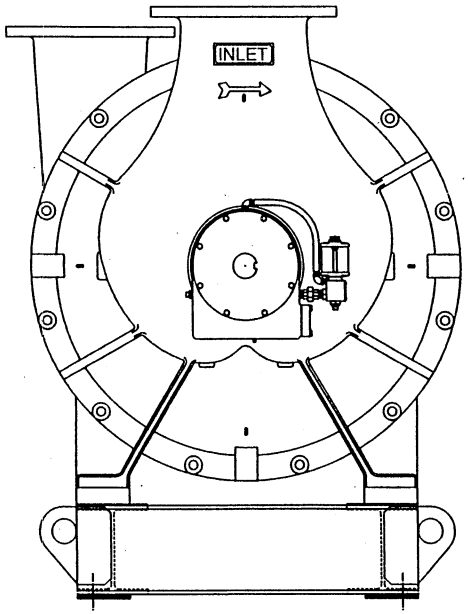

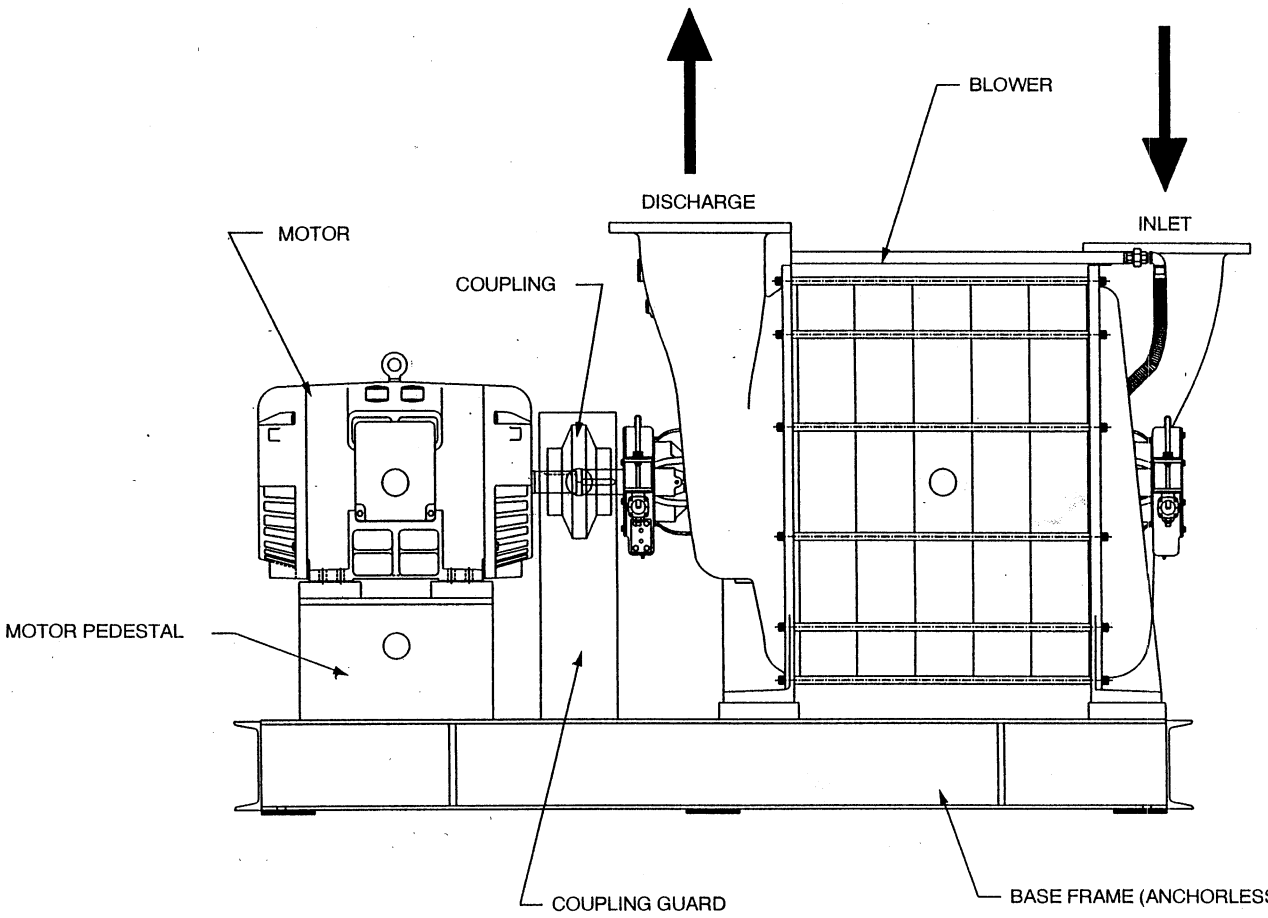

TYPICAL ACCESSORIES (NOT SHOWN HERE)

- INLET AIR FILTER (WITH PRESSURE GAUGE)
- INLET BUTTERFLY VALVE (MANUAL OR AUTOMATIC)
- FLEXIBLE CONNECTORS
- DISCHARGE CHECK VALVE
- DISCHARGE PRESSURE GAUGE
- DISCHARGE TEMPERATURE GAUGE
- LOCAL CONTROL/MONITORING PANEL (FOR SURGE & OVERLOAD)

TYPICAL CENTRIFUGAL BLOWER

DWG. 99-720

ABJ™ Sanitaire Corporation
ITT Industries
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AIR VALVES, DO PROBES, FLOAT SWITCHES

AIR VALVES

The automatic air control valve consists of a wafer style butterfly valve with a top mounted electric actuator. The actuator is equipped with end position (open/close) limit switches, over torque limit switches and an anti-condensation heater. The valves are designed for full open (90-degrees) or full closed. There is no need for modulation.

D.O. PROBES

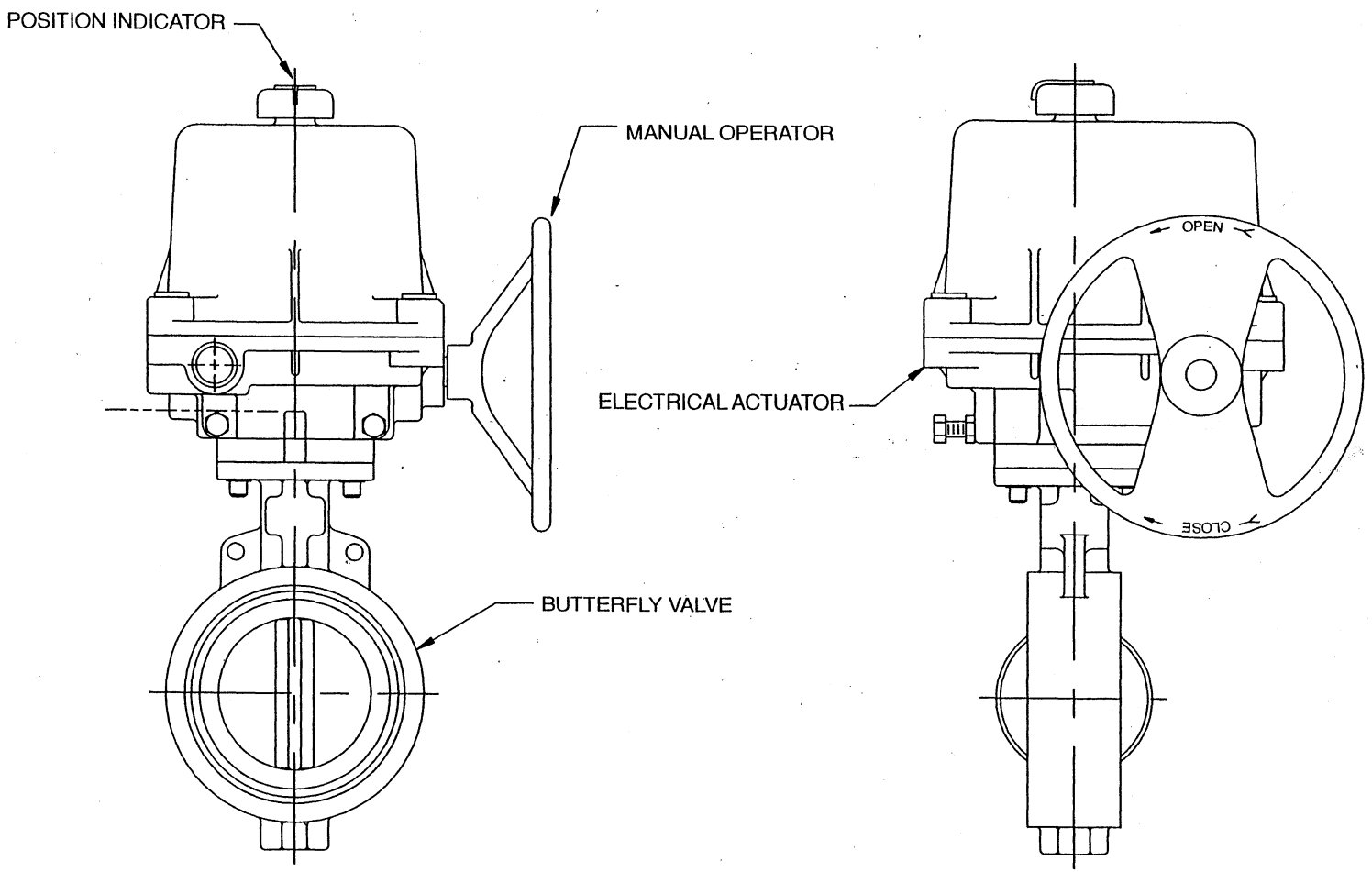
Dissolved Oxygen (D.O.) Control can be used with the ABJ ICEAS or SBR processes to optimize blower and aeration system operation. D.O. concentration in the basin is reported to the PLC in the form of a 4-20 mA signal. Output from the aeration blowers is adjusted to match process oxygen demand resulting in significant energy savings.

A transmitter in a floating NEMA 6P enclosure is used to accommodate the fluctuating water level inherent to the process. D.O. control systems are available in self-calibrating models. A self-cleaning sensor minimizes maintenance requirements.

FLOAT SWITCHES

A direct acting float switch encased in a high-impact, corrosion resistant polypropylene housing is used to indicate periods of high flow and initiate the storm cycle.

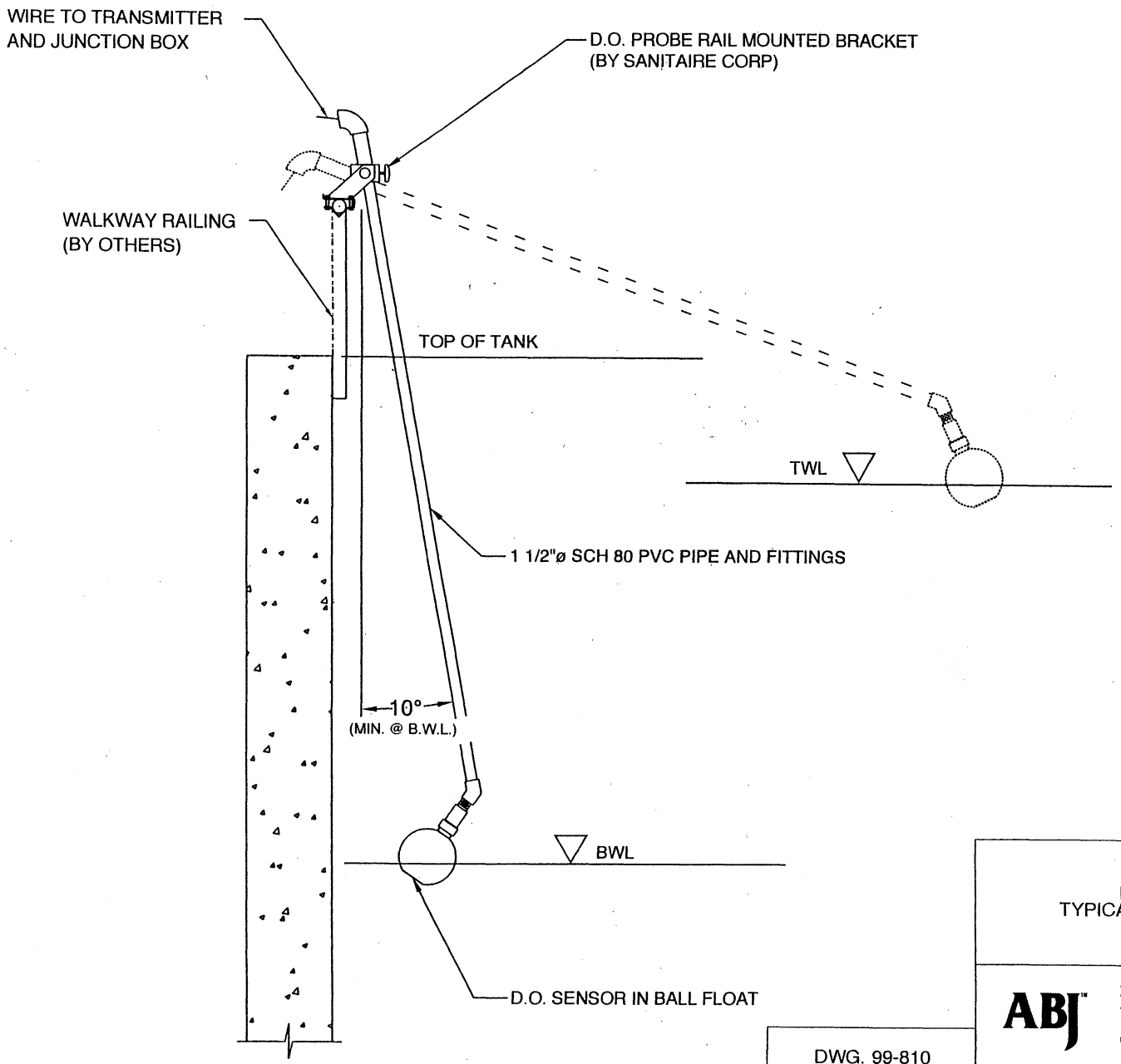
The float contains a single pole mercury switch, which activates when the longitudinal axis of the float is horizontal and deactivates when the liquid level falls to 1" below the activation level.



AIR CONTROL VALVE
W/ ELECTRICAL ACTUATOR

DWG. 99-800

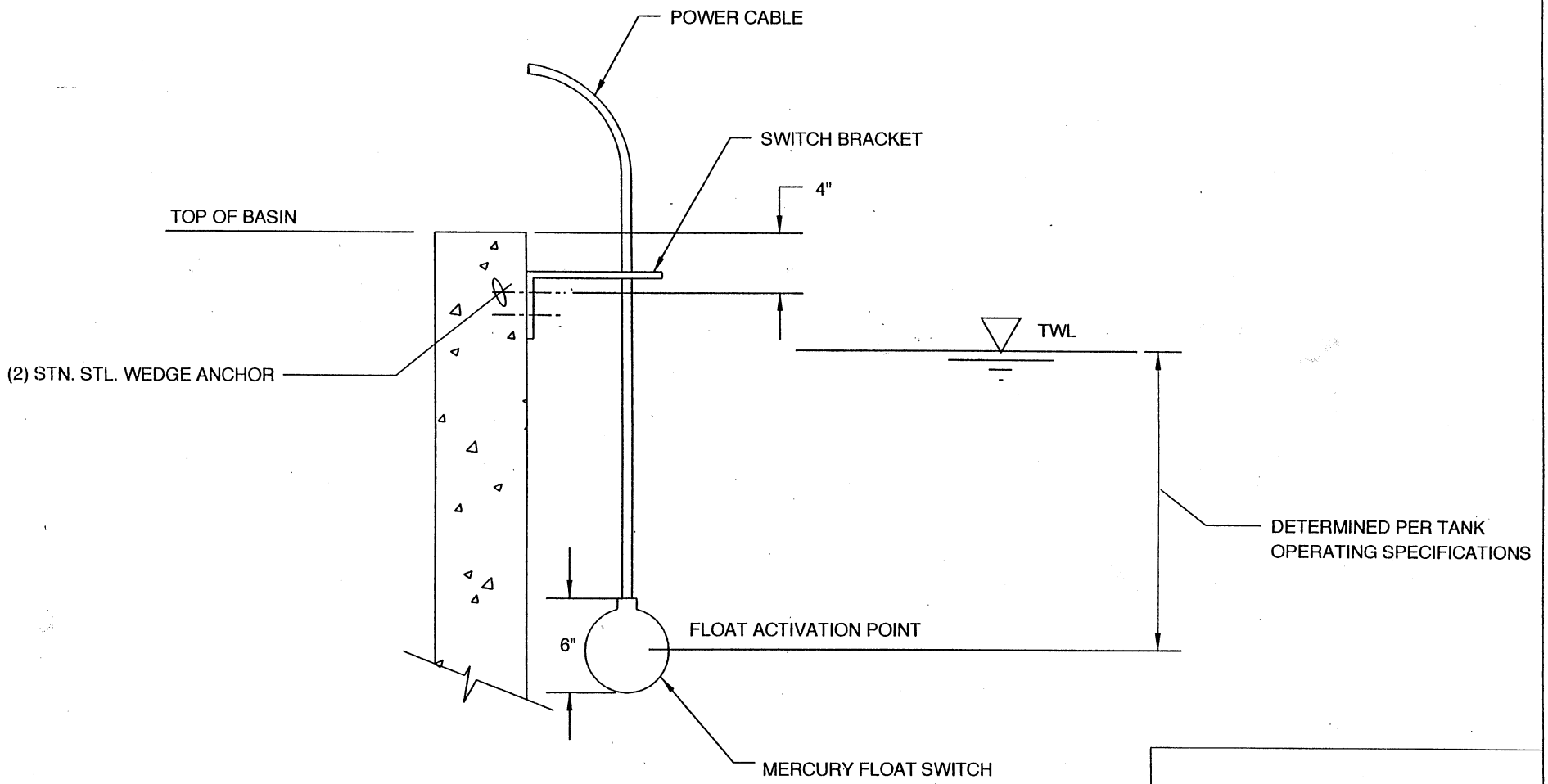
ABJ™ Sanitaire Corporation
ITT Industries
BROWN DEER, WISCONSIN 53223



D.O. PROBE
TYPICAL ARRANGEMENT

DWG. 99-810

ABJ™ Sanitaire Corporation
ITT Industries
BROWN DEER, WISCONSIN 53223



FLOAT SWITCH
TYPICAL ARRANGEMENT

DWG. 99-820

ABJ™ Sanitaire Corporation
ITT Industries
BROWN DEER, WISCONSIN 53223

ABJ™

CONTROL SYSTEM

INTRODUCTION

The ABJ control system is the nucleus of the process. The control system is "time-based" rather than "flow-based" and typically operates the following equipment:

- Decanters
- Process and Sludge Holding Tank blowers
- Air Control Valves
- Influent Valves (for SBR systems only)
- Waste Sludge Pumps
- Submersible Mixers
- D.O. System

The control system consists of a control panel including a Human Machine Interface (HMI), programmable logic controller (PLC), control switches, pilot lights and motor starters.

The control system is designed by Sanitaire Corporation and is assembled in a UL, C/UL approved shop. The control panel and the PLC program are factory tested prior to shipment. During the start-up of the ABJ system, the authorized field representative will check the installation, place the system into operation and make necessary field settings and program adjustments.

After the system has been placed into service, there are minimal adjustments required by the operator such as sludge pump start and wasting times and blower run time. These adjustments are made through the HMI interface.

PROGRAMMABLE LOGIC CONTROLLER (PLC)

The PLC contains a microprocessor, memory and input/output devices. It controls all of the process operations, monitors equipment status and alarm conditions. A backup battery protects RAM memory with further memory protection from an EEPROM or flash memory. The PLC has LED indicators showing Run, Fault and Battery Low status. Typical scan time is 1 ms/1k ladder logic. The PLC is equipped with a RS232 port for direct modem communications.

SCADA SYSTEM

The ABJ process uses a SCADA (Supervisory Control and Data Acquisition) system for graphical representation and monitoring of all plant alarms and events. The SCADA system consists of a computer, printer, UPS, Windows NT or 98, Cimplicity HMI software and other software as needed. The SCADA software allows the operator to make changes to setpoints and displays the cycle time, phase of each tank and the time remaining in each phase. If level transmitters are installed in the tanks, the screen can display the depth of water in each tank. (See Basin Setpoint Screen following this section).

The alarm viewer provided with the SCADA system allows the operator to see what alarm has occurred and tell the operator if it is a high, medium or low priority alarm. All alarms displayed are date stamped so the operator can see the time and day that the alarm occurred. The operator can print the alarm page on the provided printer. The operator can also acknowledge and clear alarms at this screen.

The SCADA system is also equipped with trend charts. The trend charts allow D.O. levels and other process related items to be displayed and charted. This gives the operator the ability to monitor the levels over a period of time. The values are also exported to a .csv file so the plant personnel can use a spreadsheet program, such as Excel to view the values and print them out.

CONTROL SWITCHES AND PILOT LIGHTS

Control switches and indicating lights are provided on the control panel for ABJ furnished equipment motors. In addition, a local control box at the basin permits the manual raising or lowering of the decanter in the tank.

During normal operation, equipment selector switches are placed in the "Auto" mode. Manual operation is also possible but does not provide the process interlocks that are incorporated with automatic operation.

If a component is not used or has failed, it can be switched to the "Off" position and the control system will continue without the function of that item.

MOTOR CONTROL CENTER (MCC)

The Motor Control Center (MCC) contains all the starters and overload protection devices for the various motors in the system. The MCC is separate from the control panel enclosure, which houses the PLC, control switches and pilot lights.

PROCESS AND EQUIPMENT INTERLOCKS

The control system includes switches and sensors that provide information to the PLC to prevent process upsets and equipment damage. Additionally, circuit breakers and motor control circuits are used to protect the motors from electrical overloads.

The decanter actuators include end position limit switches that verify that the decanter has reached the bottom water level or has returned to the "park" position. The air control valves have end position limit switches.

- If a valve fails to open, the blower is stopped.
- If the air valve fails to close, decanting is inhibited.
- If the decanter fails, the air valve is inhibited from opening.

A high water float switch is provided in each basin to detect flows greater than the peak dry weather conditions. Based on the float switch signal, the PLC will then evaluate whether to remain in the normal cycle or switch to the storm cycle.

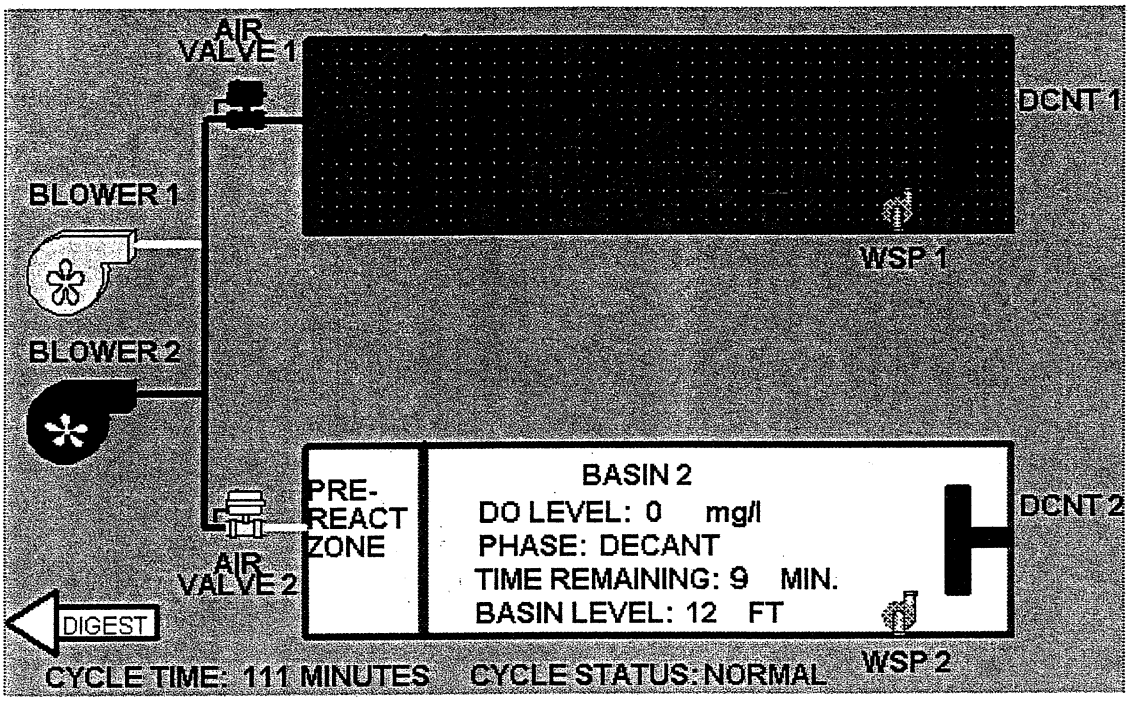
MODEM

A modem is installed as standard equipment in the control panel to allow the PLC to be accessed by telephone. The PLC program can be monitored and /or modified in real time from remote locations.

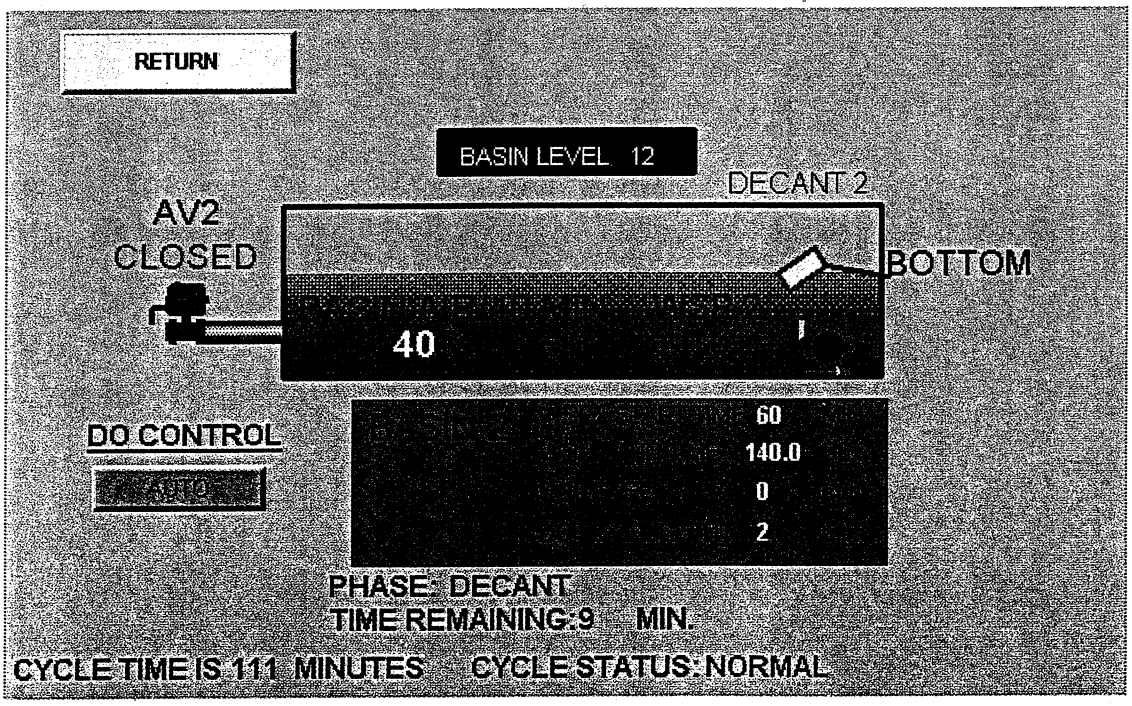
REMOTE ACCESS

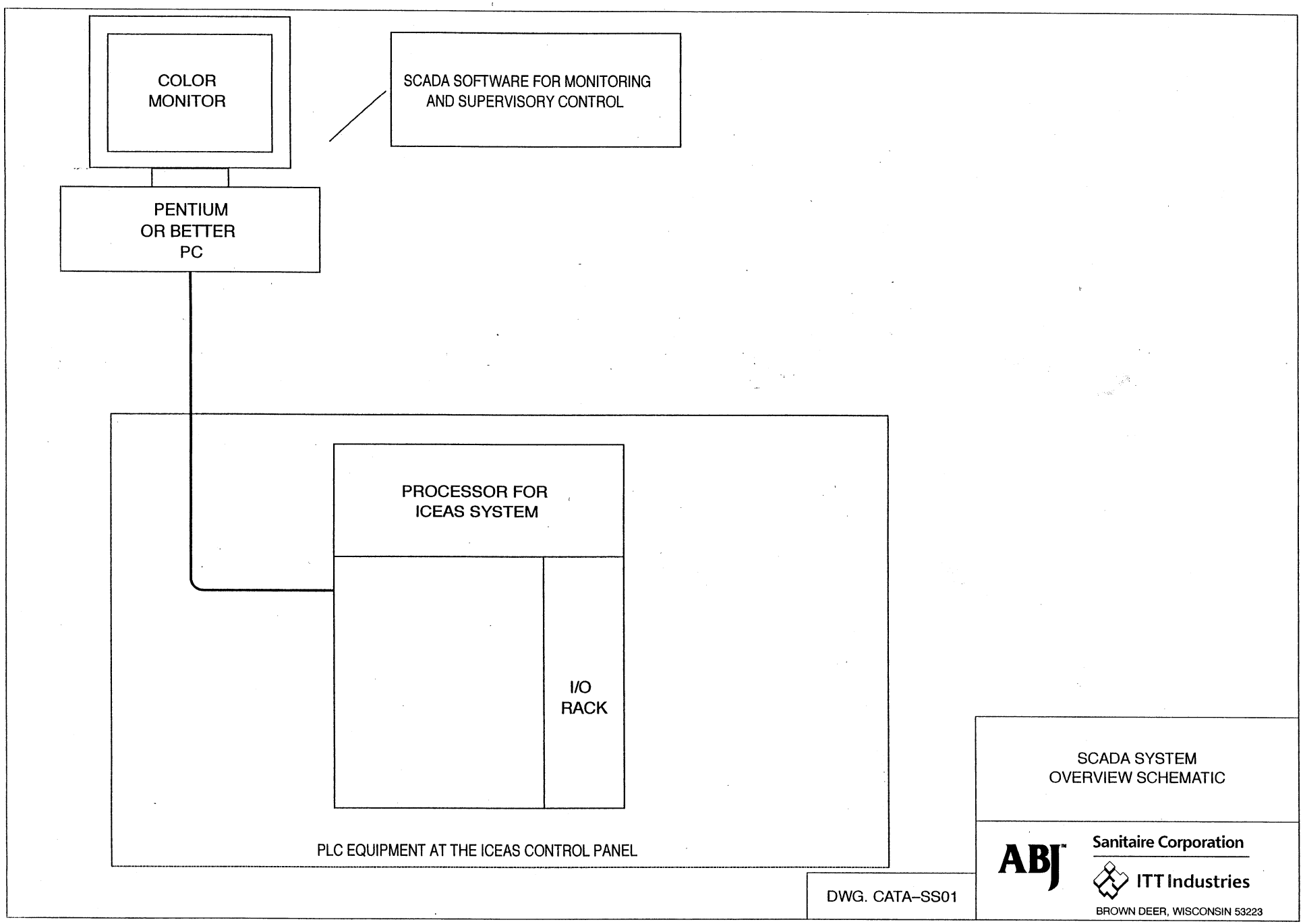
Sanitaire Corporation can provide a SCADA package for the ABJ system that would allow remote monitoring of the plant. This is useful for small plants that are not staffed during evening or weekend hours. With remote access, the operator uses a PC and modem to interface with the PLC from an offsite location. The operator is able to view and acknowledge alarms and monitor plant equipment without having to go to the plant.

SCADA System Overview



Basin Setpoints

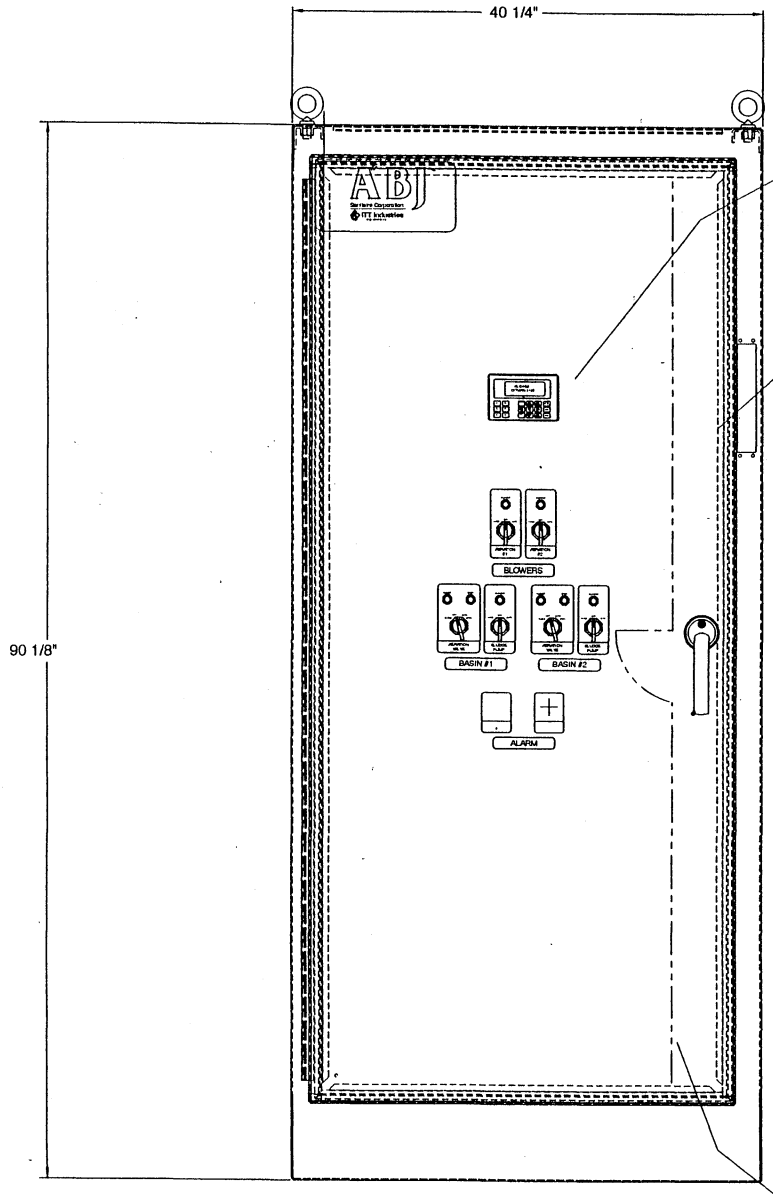


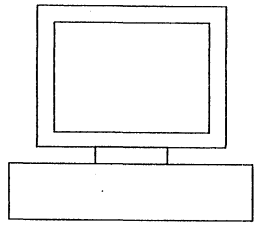


SCADA SYSTEM
OVERVIEW SCHEMATIC

DWG. CATA–SS01

ABJ™ Sanitaire Corporation
ITT Industries
BROWN DEER, WISCONSIN 53223





SCADA SYSTEM

CONTROL PANEL
2–BASIN (OIT3165)

DWG. CATA–CP03

ABJ™ Sanitaire Corporation
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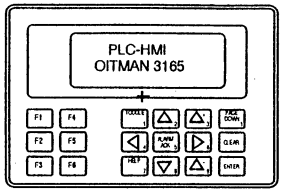
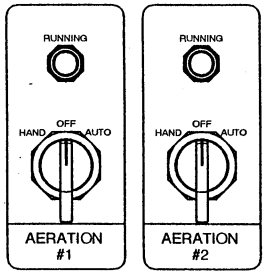
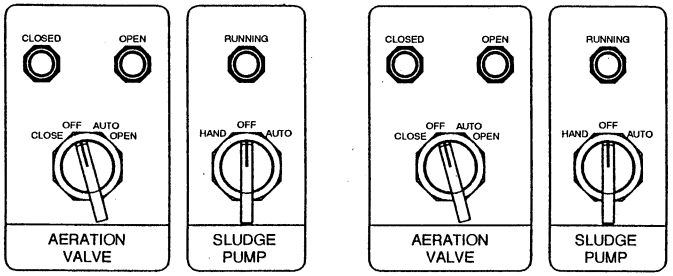


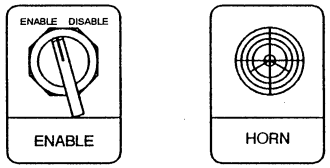


BLOWERS



BASIN #1

BASIN #2



ALARM

CONTROL PANEL
2–BASIN (OIT3165)
NAMEPLATE CLARIFICATION

DWG. CATA-CP04

ABJ™ Sanitaire Corporation
ITT Industries
BROWN DEER, WISCONSIN 53223

August 29, 2001

Marie Dowd
Delaware Engineering, P.C.
28 Madison Avenue Extension
Albany, NY 12203

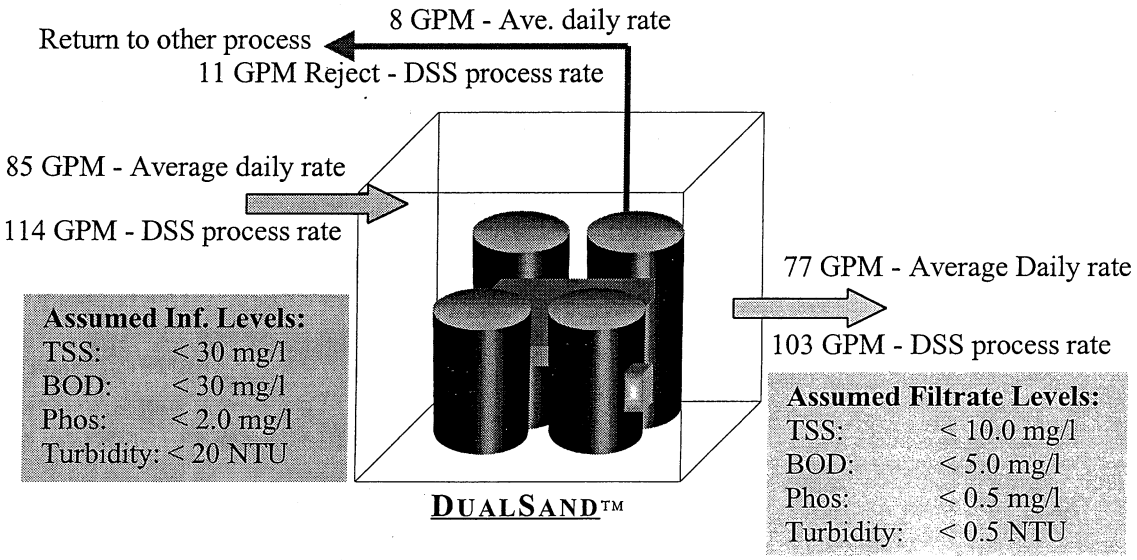
Ref: DualSand™ – NYC Watershed Upgrade Program - Crossroads / Wild Acres - Rev 2

As per our telephone conversations, we understand that this project is no longer being built in phases. The entire plant will be installed and sized to handle the future flow of 110,880 GPD (77 GPM) + 10% reject = 121,968 GPD.

DualSand™ Sizing:

- **Average Daily Flow:** 110,880 GPD/1440 = 77 GPM + 8 GPM $_{reject}$ = 85 GPM
- **Max. Daily Capacity of DualSand™:** 114 GPM - 8 GPM =103 GPM x 1440 = 148,320 GPD
- **Redundancy:** Per NYC DEP–(3) trains each capable of 50% of flow
- **Maximum Loading Rate:** **3.00** GPM / SF as per NYC DEP

We have selected a DSS 33000 Series that has (2) 19 SF filter trains in operation + (1) 19 SF redundant filter train. The maximum flow capacity of this DSS System is [(2) x 19 SF] x 3.00 GPM / SF = 114 GPM < 85 GPM.



Percent Operating Time: 77 GPM (Ave. flow) / 103 GPM process rate = 75 %

The selected DSS Environmental Series 33000 consists of the following equipment and services:

(6) Parkson DynaSand filters with 304 SS tank construction, sand, controls, covers and freight
(1) Ingersoll-Rand (2) head air compressor with reservoir and dryer
(1) Influent duplex package pump station w/ controls
(4) Chemical feed pumps with controls for automatic back up - Can add (2) pumps for Dechlorination - not incl.
(2) Chemical day tanks (Double wall so no containment req'd) - Can add (1) tank for Dechlorination - not incl.
(1) Static mixer
(4) Turbidimeters
(1) Air pressure sensor
(1) Residual chlorine monitor and chart recorder
(1) Particle counter
(1) Filter headloss gauge
(3) Flow meters
(1) Computer for data storage and management (NO SCADA included)
(1) Alarm Panel with contacts (low air pressure, high filter head, high turbidity, high water, low chlorine)
(1) Piping – All piping of influent, reject, filtrate, air, chlorine and polymer, mixer.
(1) Electrical wiring & conduit to pumps, filter controls, air compressor
(1) Freight to job site is included for sand and all equipment described herein
(1) Engineering of DualSand™ system, piping, etc.
(1) Start-up and training – [(1) month or (26) working days
(1) Mobilization for DSS crew and equipment

Budget pricing for the above **installed** DualSand™ Series 33000 is… **$ 770,000**

* Site, building foundation and slab, building / enclosure, utilities, piping outside of 2' construction limit, and any item not specifically described above, are <u>not</u> included in the above price. Pricing depends on date of purchase, site conditions and miscellaneous options not yet defined.

As per our conversation, NYC DEP has been making requests for additional features and components that naturally increase the scope and thus the price. As your project nears finalization we should sit down and discuss options and operational details.

Enclosed is a revised O & M sheet and standard drawings of a DSS 33000. Please note that you may arrange the filters and add stairs and platforms as desired. DSS can provide assistance with these items at your request.

Thanks you for considering the DualSand™ technology. If you should have any questions, please feel free to give us a call.

With kind regards,
Siewert Equipment Co., Inc.

Terry L. Wright

Encl:

Xc: Matt Marko, DSS Environmental Inc.

Introduction to the DualSand™ System

The DualSand™ System is a proprietary filtration process for wastewater, potable water and water reuse applications. The technology is protected by US Patent Number 5,843,308 and other patents pending. The DualSand™ System has documented performance of:

Phosphorous removal to:	< 0.02 mg/l
Crypto & Giardia removal:	7-log
$TSS_{eff.}$:	< 1.0 mg/l
$BOD_{eff.}$:	< 1.0 mg/l
$Iron_{eff.}$	< 0.05 mg/l
$Manganese_{eff.}$:	< 0.02 mg/l
$Color_{eff.}$:	< 5 cpu

August 1998, under U.S. EPA Contract 68-D4-0091, the CBUDSF (Continuous-Backwash-Upflow, Dual-Sand Filtration) technology was recognized as an equivalent to microfiltration for the treatment of wastewater in the NYC Watershed. This equivalency was based on a head-to-head pilot test against the leading microfiltration product from May – October 1997. A paragraph from the document prepared by NYC / EPA for public review and comment is as follows;

> "NYC DEP contends that continuous-backwash-upflow, dual-sand (CBUDS) filtration is as efficient as microfiltration for removing the pathogens Giardia and Cryptosporidium. In addition, they have maintained that CBUDSF is also less expensive, simpler to operate, and more reliable."

Process Description:

The DualSand™ System is a patented chemical filtration process that uses two (2) continuous backwash upflow sand filters in series.

An oxidant and coagulant are added prior to the first stage filter. An in-line static mixer in the influent pipe provides proper mixing. The coagulant used in the process hydrolyzes immediately in water thus no floc tank is required.

The first stage filter contains coarse sand that is able to handle high solids loading and provide exceptional removal. The addition of the oxidant helps to keep the sand clean and free from any biological growth. The oxidant also improves the performance of the coagulant.

The second stage filter contains fine sand. This fine sand is not subject to solids fouling because the first stage filter removes approximately 99% of the solids in the water. The reject from the second stage filter is returned to the first stage filter influent. This returned reject enhances the performance of the system and provides economical use of the chemicals.

On installations that require disinfection, a residual chlorine monitor and intermediate chlorination for the second stage filter is provided. The second stage filter has been approved for CT thus removing the need entirely or reducing the size of the chlorine contact chamber.

Equipment Description:

The DualSand™ System is supplied on an installed basis to insure quality and retain proprietary knowledge.

Flow Control:

The DualSand™ has a total of approximately 3' of headloss through the entire system.

The filters may be placed on grade or below grade in a concrete vault.

If it is necessary to pump to the DualSand™, pumps and controls to operate these pumps are provided in the DualSand™ package. This is done to insure proper flow to the filters, pacing of the chemical feed systems and monitoring of the flow.

In some cases an internal circulation loop will be used to keep the sand flow in motion versus a stop-start operation. Again these pumps and controls will be provided in the DualSand™ package.

Chemical System:

The DualSand™ system will include appropriately sized storage crocks/tanks for the oxidant and coagulant. The level of chemicals in these tanks can be determined via visual inspection, load cells, and or liquid level indicators. If automated, a low-level alarm will be provided.

Chemical metering pumps, piping, and injectors are provided in the DualSand™ system. A redundant pump is provided for each chemical.

Controls to pace the metering pump with varying flows will be provided if necessary.

The DualSand™ system includes an In-line mixer in the influent pipe to the filters.

Filter System:

A DualSand™ filter train consists of (2) filters in series. The 1st stage filter uses coarse sand of a size determined by the solids loading and biological process in front of the DualSand™. The filtrate from the 1st stage filter is piped to the inlet of the 2nd stage filter and flows by gravity.

Reject from the 1st stage filter is sent to the secondary clarifier, digester, sewer, head of the plant, etc. DualSand™ will provide the sump, pumps and controls when necessary to pump the reject.

The 2nd stage reject is piped to the influent pump station or DualSand™ provides a sump with pumps to return this to the influent to the 1st stage filter.

When more than one filter train is required, DualSand™ provides a flow splitter box, piping, and valves to insure proper flow distribution and equipment isolation.

The DualSand™ system includes stairs, platforms, and handrails necessary to gain access to the top of the filters.

Compressed Air System:

The DualSand™ system includes a dual head air compressor with a large reservoir, air dryer (if necessary), piping to the air control panels and from these panels to the filters.

The air panels allow the sand movement to be adjusted and thus the degree of filtration. The air system is interlocked to shut off when the water flow stops. Electrical power to these panels is part of the DualSand™ system.

A low air pressure alarm is provided.

Instrumentation and Control:

The DualSand™ system may include these components if necessary and appropriate:

- PLC based integrated instrumentation and control package (SCADA)
- Particle Counters
- Turbidimeters
- Flow meters
- Chlorine monitors
- Computer and printer
- Telemetry

Hardware, software, sensors/meters and the control wiring between sensors and computer is in the DualSand™ package. Telephone line to PC is by others.

Installation:

The DualSand™ system includes the installation of the filters, platforms with handrails; walkway to the filters; air compressor, air piping and control panels; influent, effluent, reject pump systems and controls; chemical feed pumps and piping; wire and conduit connecting the control/power panel(s) to the equipment; internal piping and valves within the construction limits; instrumentation, probes and associated wiring.

The installation is provided for quality control and to retain intellectual property.

Start-up:

The DualSand™ system includes start-up and training of the operator in the use and maintenance of the DualSand™ filtration equipment and process.

Extended training is available. This consists of a fully trained operator visiting the installation every 2-3 weeks. The DualSand™ certified operator will work with the plant operator to clean the turbidimeters, particle counters, check particle counts, optimize the chemical dosing rates, address any questions that the operator may have, check the levels and inventory of the chemicals, clean metering pumps when necessary, run through maintenance on the pumps and air compressor, etc.

Guarantee:

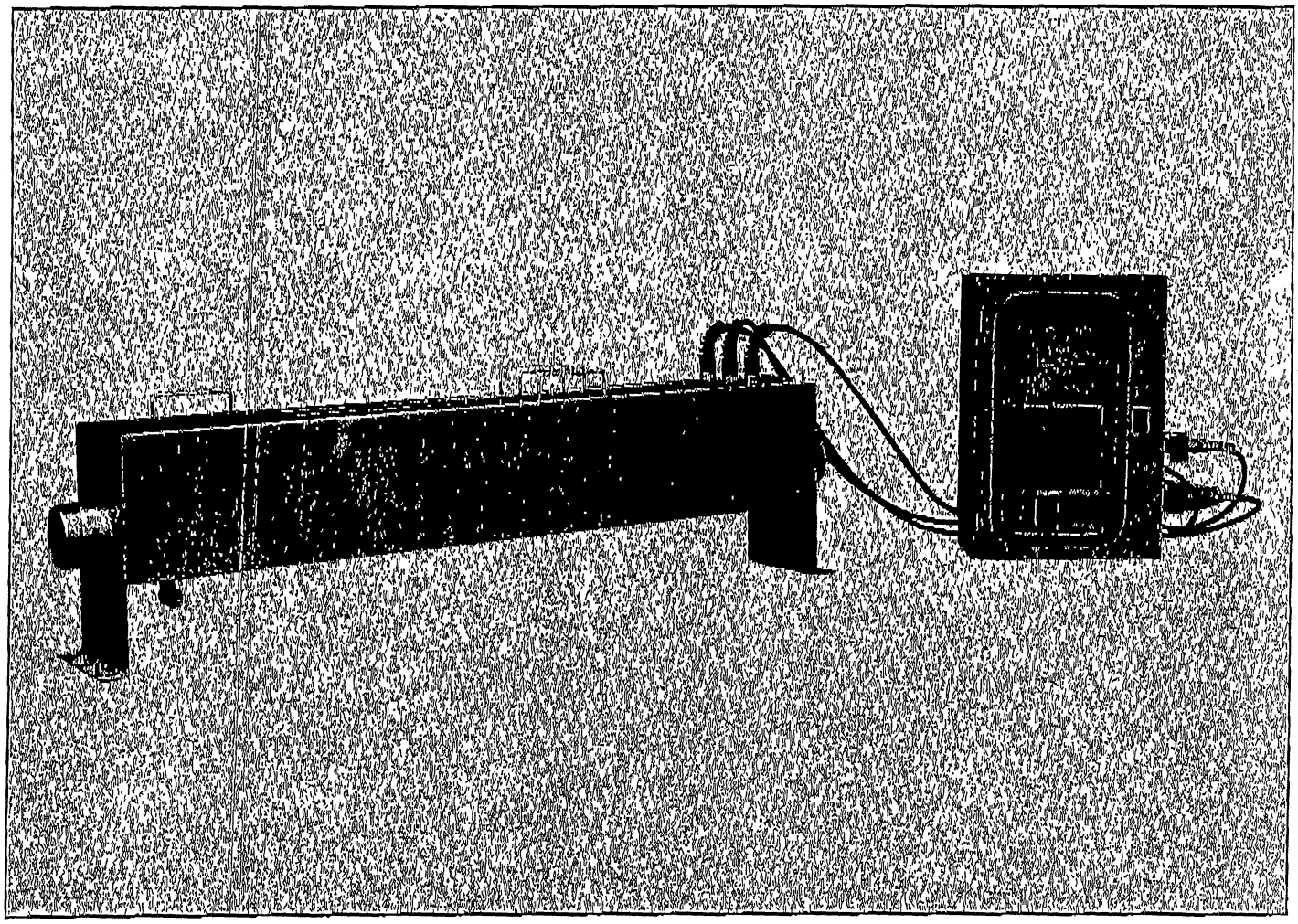
With the above extended training, an acceptable process guarantee that is based upon stated influent characteristics and SPDES permit effluent limitations can be provided.

**

DB-185-1

Ultraviolet Disinfection

Package Horizontal Open Channel System
Disinfecting flows up to 2 MGD



Infilco Degremont Inc

March 1999
Supersedes January 1993

Open Channel Units

Ultraviolet disinfection, a safe and effective way to disinfect water and wastewater for over 80 years, is now available in package open channel units provided by Infilco Degremont Inc.

Package units provide convenient disinfection for a wide range of flows (up to 2 MGD).

Each system is designed to exceed health department water quality standards with units in operation throughout the United States, Canada and world wide.

Ultraviolet Disinfection

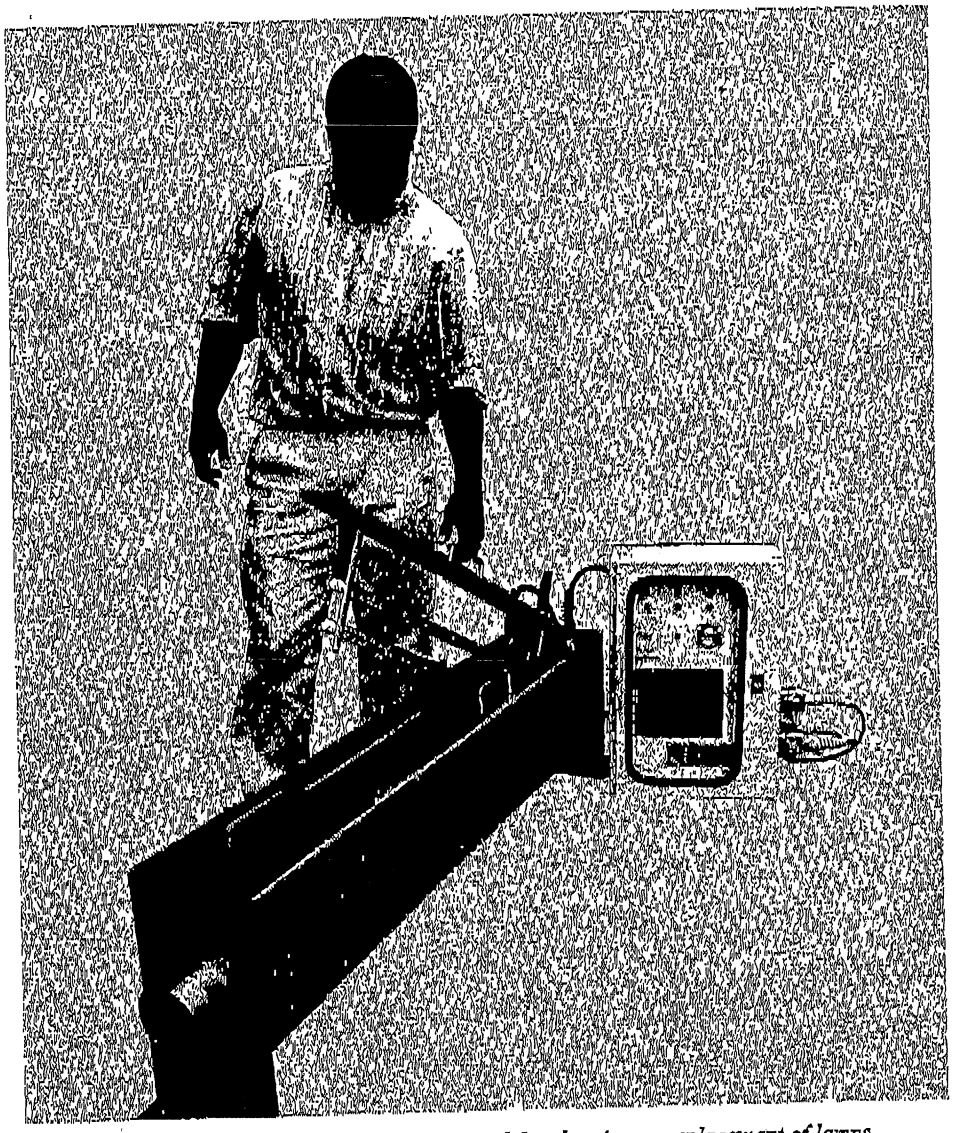
Exposure to UV light destroys the reproductive abilities of a wide variety of potentially harmful microorganisms, rendering them inactive and unable to cause disease.

Unlike chlorination, ultraviolet light does not significantly alter the physical or chemical properties of the effluent. There are no dangerous chemicals or gases for workers to handle. There are no known carcinogenic compounds created in the disinfection process. As a result, no harm is presented to people, fish, wildlife, or vegetation downstream from the plant.

The heart of any UV disinfection process is the ultraviolet lamp, developed in 1901. A stable and reliable producer of ultraviolet light, the typical lamp has an average life 9000 hours of use.

The peak effectiveness for inactivation of microorganisms occurs at the UV radiation wavelength of 260 nanometers. This figure closely coincides with the resonance line of ultraviolet lamps used in the disinfection process, 253.7 nanometers.

Access to the lamps is made both simple and safe with the use of clear tubes called "quartz jackets" to house each lamp. The jacket isolates the lamp from the water while allowing maximum transmission of ultraviolet rays. Open at one end, the jacket holds the lamp using spacers which prevent the lamp from vibrating during flow. This arrangement also allows for easy cleaning of quartz jackets and replacement of the lamps.



Individual lightweight modules are easily removed for cleaning or replacement of lamps.

Package Open Channel Wastewater Units

These completely self-contained wastewater disinfection units are designed to treat flows from 2 GPM to 2 MGD of effluent. Flows from 1 to 2 MGD can be accommodated using multiple package units in series or parallel.

Each unit consists of a stainless steel channel with one or more horizontal two-lamp or four-lamp modules. The channel is fabricated with an internal weir, providing a reliable level control and a continuous minimum UV contact time as effluent flows through the channel. This exposure allows for maximum disinfection of the effluent.

Package open channel wastewater units are available with up to forty lamps per unit. Lamps are available in either a 30-inch or 58-inch arc length.

Each lamp module is equipped with a shield to eliminate casual exposure to ultraviolet light when the system is in operation.

Continuous Monitoring

A separate remote instrumentation and control panel provides the necessary information to determine the status of the system at all times.

All electrical components are housed in a remote weatherproof corrosion-

resistant enclosure. Any component in the enclosure maybe replaced by simply installing a new part in its place.

The control panel has an individual indicator for every ultraviolet lamp in the system, identifying any lamp failures with as-it-happens precision. The UV intensity is continuously monitored with both visual and audible alarms for low intensity levels. The system is equipped with an elapsed time meter to accurately record lamp depreciation.

The control panel is equipped with forced ventilation to provide continuous cooling of all electrical equipment.

Easy Maintenance and Cleaning

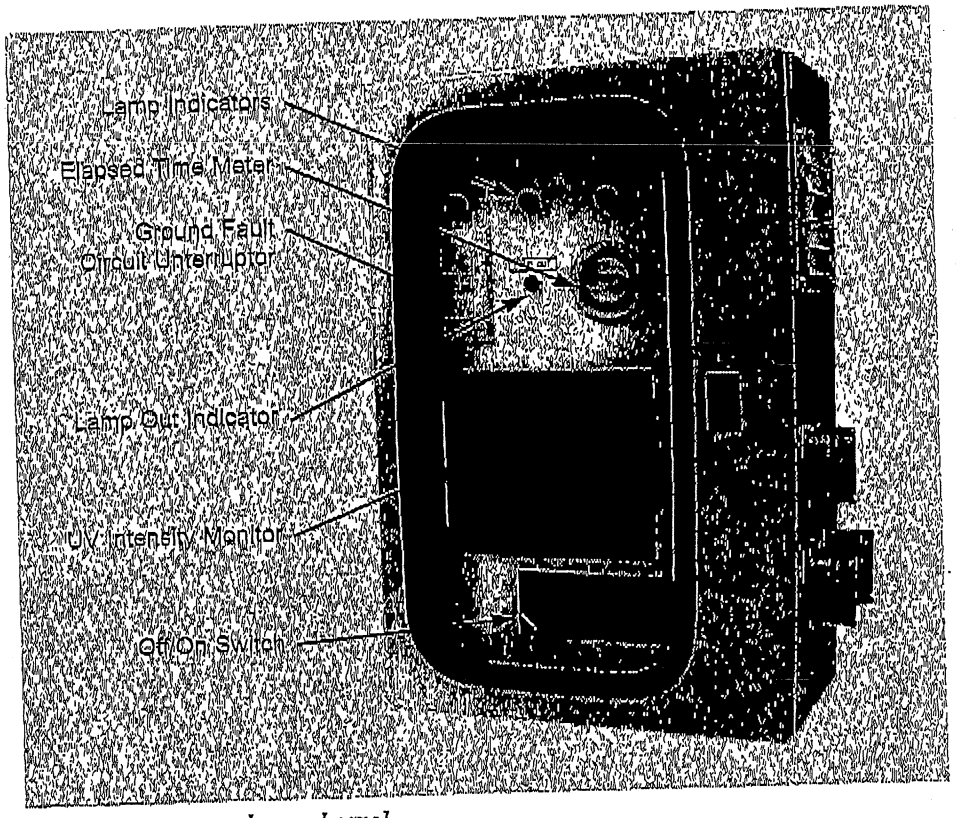
Maintenance of the system consists of annual lamp replacement and periodic cleaning of the quartz jackets.

Individual lamps are easily removed and replaced from the ends of the module. No disassembly of the unit itself is required to change a single lamp.

Similarly, cleaning the package wastewater unit is quick and easy, with no disassembly required. After removing the module, the quartz jackets are cleaned or lamps replaced in a matter of minutes.

Systerm Features

- Continous monitoring of UV intensity
- Remote UV intensity monitoring
- Individual lamp status indicators
- Lamp out indicators
- Elapsed time indicators for tracking UV lamp life
- Light weight 304 stainless steel UV lamp modules
- Channels and level control made of 304 stainless steel
- Ground fault protection for each lamp module
- Totally factory assembled and functionally tested as a system prior to delivery
- Available and easy-to-install spare parts



Remote Instrument and control panel

Benefits:

- Cost-effective
- Effective disinfection without chemicals
- Exceeds health department standards
- Low maintenance and easy cleaning

Water Characteristics:

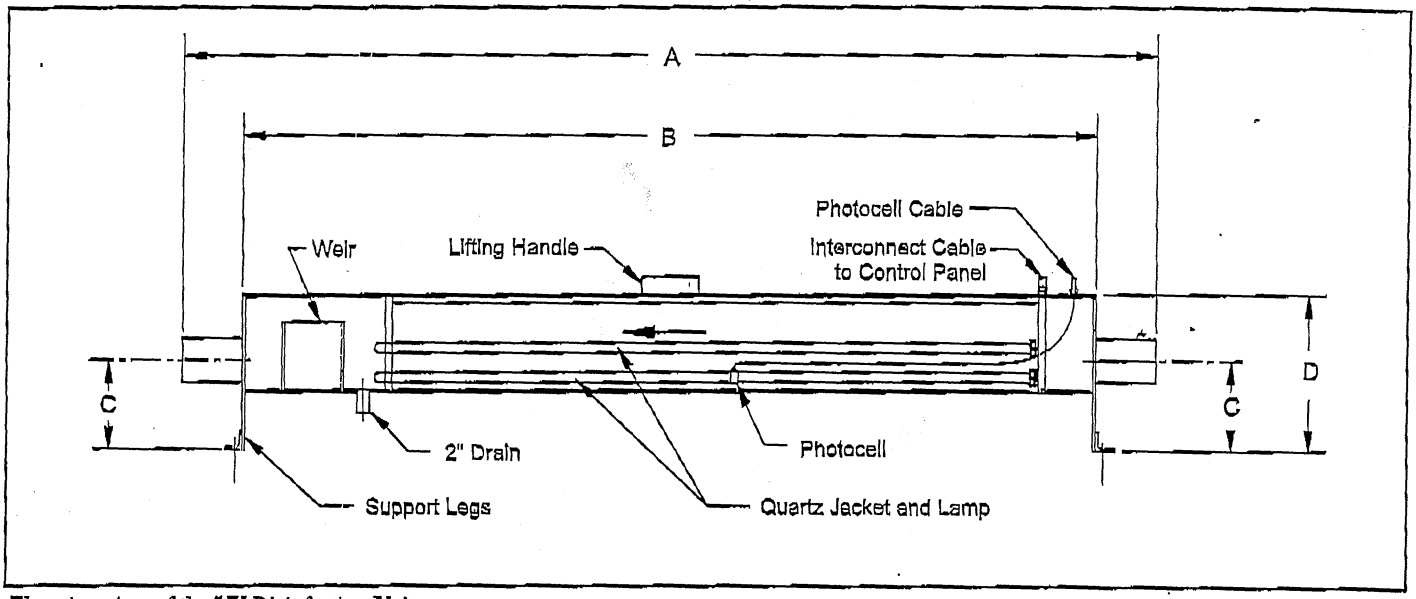
- BOD and suspended solids should be below 30 mg/l each.
- Designed for UV transmittance of 65% or greater at 253.7 nm through 1 cm.
- Operates at a water temperature range of 33 to 90 degrees Farenheit.

Infilco Degremont Inc. provides a range of disinfection equipment for a wide variety of flow and application requirements.

- Standard Closed Chamber Units for 2 GPM (7 l/s) to 2 GPD.
- Package Open Channel Units for 2 GPM (7 l/s) to 2 MGD.
- Vertical UV Systems to handle over 2 MGD.

For more information on package open channel wastewater units or the ultraviolet disinfection process, contact:

Infilco Degremont Inc.
Telephone 804/756-7600
Toll Free: 1-800/446-1130
Telefax: 804/756-7643



Elevation view of the UV Disinfection Unit

Model No.[1]	Peak Flow GPM	No. of Lamps	No. of Lamps/ Module	Control Panel[2] Inches	All Channel Dimensions in Inches					
					A	B	Overall Width	C	D	Pipe Diameter[3]
2SH	18	2	2	24x16x9	74.50	62.75	9.00	5.25	15.25	4.00
2LH	36	2	2	24x16x9	97.00	85.00	9.00	5.25	15.25	4.00
4SH	36	4	2	24x16x9	73.25	60.25	6.25	7.50	15.25	4.00
4LH	72	4	2	24x16x9	108.00	96.00	6.25	7.50	15.25	4.00
6SH	54	6	2	33x25x12	70.00	58.00	9.25	8.25	15.25	6.00
6LH	108	6	2	33x25x12	108.00	96.00	9.25	8.25	15.25	6.00
8SH	72	8	2	33x25x12	71.00	59.00	12.50	8.25	15.25	6.00
8LH	144	8	2	33x25x12	108.00	96.00	12.50	8.25	15.25	6.00
10SH	90	10	2	33x25x12	73.50	73.50	15.50	8.25	15.25	6.00
10LH	180	10	2	33x25x12	108.00	96.00	15.50	8.25	15.25	6.00
12LH	216	12	4	40x32x12	124.00	112.00	9.50	9.25	21.25	8.00
14LH	250	14	2	40x32x12	108.00	96.00	18.50	9.25	15.25	8.00
16LH	288	16	4	40x32x12	132.00	120.00	12.50	9.25	21.25	8.00
20LH	360	20	4	40x32x12	136.00	128.00	15.50	11.25	21.25	12.00
24LH	420	24	4	40x32x12	166.00	144.00	18.50	11.25	21.25	12.00
28LH	490	28	4	48x36x12	156.00	144.00	21.50	11.25	21.25	12.00
32LH	560	32	4	48x36x12	156.00	144.00	24.50	11.25	21.25	12.00
36LH	625	36	4	60x48x12	156.00	144.00	27.50	11.25	21.25	12.00
40LH	700	40	4	60x48x12	156.00	144.00	30.50	11.25	21.25	12.00

1. "S" refers to 30" arc length lamps.
   "L" refers to 58" arc length lamps.
2. Height x Width x Depth
3. Options Available:
   - Channel Liner
   - Inlet and Outlet Flanges

Infilco Degremont Inc
P.O. Box 71390 Richmond, VA 23255-1390
Tel: (804) 756-7600 Fax: (804) 756-7643

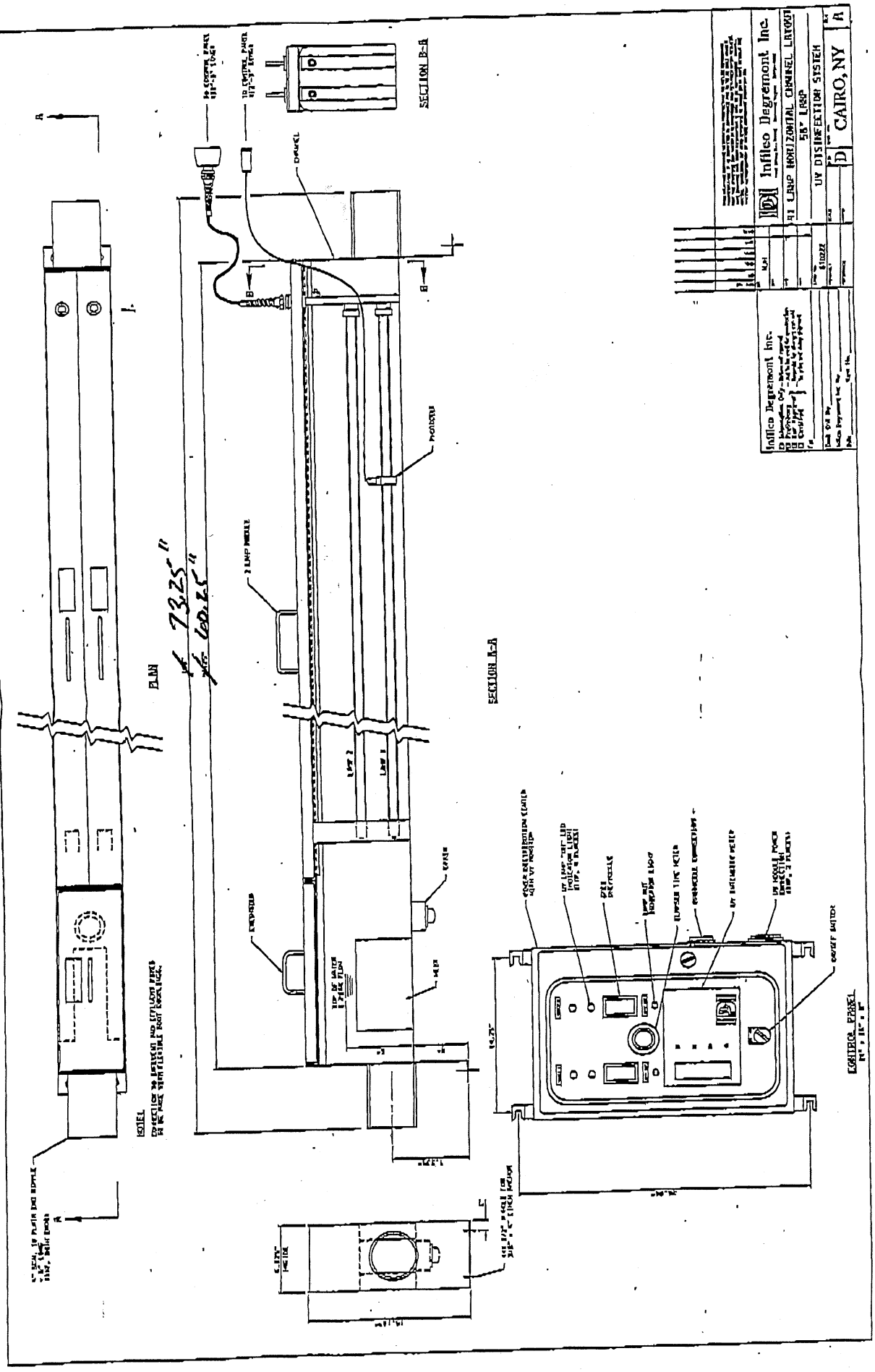

Infilco Degremont Inc.
CAIRO, NY
UV DISINFECTION SYSTEM
SECTION B-B
SECTION A-A
PLAN
CONTROL PANEL

Exhibit F

Absorption System Calculations

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Crossroads
DESCRIPTION: Wildacres Resort Absorption Systems

DATE 1/3/01
SHEET 1 OF 2
BY MTD Ck'ed

All flow from Wildacres Resort will potentially go to the subsurface systems w/ partial treatment.

If est flows = 138,455 gpd
assuming 20% reduction due to flow devices gives a design loading of 110,688 gpd

∴ to keep flows < 30,000 gpd / system
4 systems must be installed

Even though I oversize the systems slightly assume (3) beds receives 30,000 gpd ± 1~22,700 gpd

∴ (4) 40,000 gal septic tanks

1. SF of bed req. for each system $\frac{30,000}{0.9} = 33333$ SF ← 30000 gpd

$28,700/0.9 = 25,888$ SF ← 20,724 gpd

2. length of beds are 105 ft assuming (9) 100 ft laterals ± 2.5' of gravel on all sides.

3. Therefore, total width is $\frac{33,333 \text{ SF}}{105 \text{ FT}} = 318$ FT

$\frac{25,200 \text{ SF}}{105} = 240$ FT

4. Width can only be 45' before the total amt of pipe used in each bed exceeds 1,000ft @ 1,000ft of pipe used → a new distribution box is necessary

5. Total distribution systems needed (for primary bed)

$\frac{318}{45} \approx 7$ distribution systems $\frac{240}{45} = 5.3$ dist. systems

each system made up of (9) 100' laterals separated by 5'dc w/ the 5' off will fall around perimeter ± 3' below.

Primary beds
1 – 7 → 105 x 45

Reserve
1 – 3 → 105 x 45
3.5 → 105 x 25

DELAWARE ENGINEERING
28 Madison Ave. Ext.
Albany, NY 12203

PROJECT: Crossroads
DESCRIPTION: Wildacres Resort – Absorption Syst

DATE 1/3/01
SHEET 2 OF 2
BY MTL Ck'ed

MIN DOSE
= 7.100 · π · (1/12)²
= 735 gal / dose for 7 beds

TOTAL DOSE
7 · 735 = 5145 gal / dose

DOSE FREQ
$\frac{106,400}{5145}$ = 20.7 doses / day

MIN DISCHARGE = 210 gpm

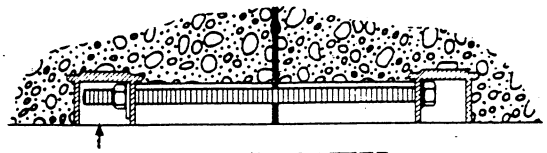
PUMP RUN TIME = 735 / 210 = 3.5 min

D&T. TIME
735 / (106,400 / 24 (60)) = 10 min

DOSING CHAMBER
≈ 1,000 gal

FORT MILLER
THE FORT MILLER CO., INC.

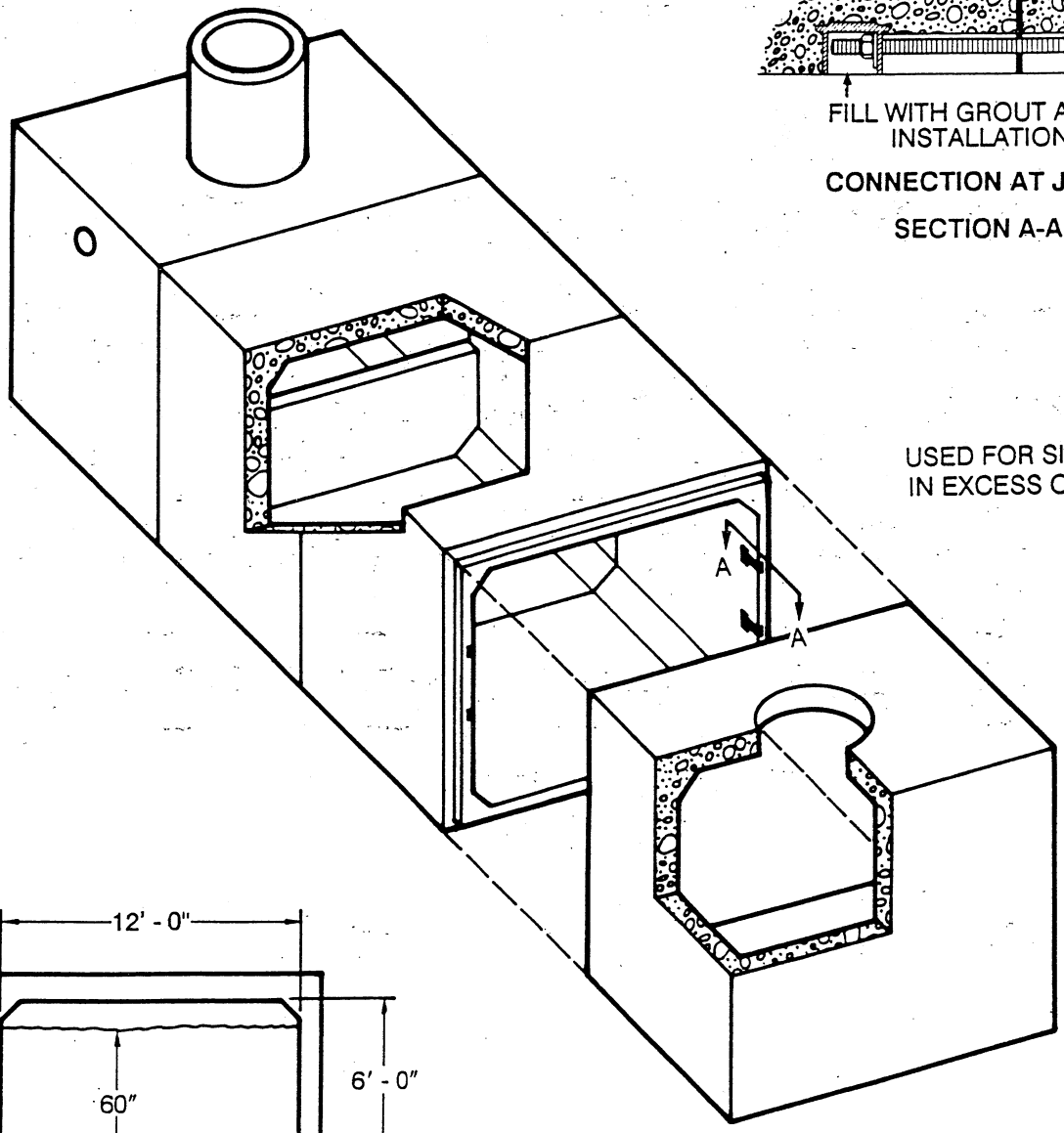
Horizontally Extended Septic Tank



FILL WITH GROUT AFTER INSTALLATION

CONNECTION AT JOINT

SECTION A-A



USED FOR SINGLE TANKS IN EXCESS OF 4000 GALLONS.

TYPICAL SECTION

CAPACITY = 445 GAL./L.F.

CONFORMS TO LATEST N.Y.S. D.E.C. SPECIFICATIONS.

DESIGN CASE 7