

RECIRCULATING SAND FILTER
SPECIFICATIONS

HARVEST-MONROVIA WATER, SEWER, AND FIRE
PROTECTION AUTHORITY

JULY 2004

TABLE OF CONTENTS

SECTION	PAGE
RECIRCULATING SAND FILTER, EFFLUENT SYSTEM, AND DRIP IRRIGATION	3
DESIGN REQUIREMENTS	6
SITE WORK	10
RECIRCULATING SAND FILTER EQUIPMENT	13
CONCRETE SEPTIC TANKS, PUMP TANKS, AND RECIRCULATING TANKS	27
SEPTIC TANK EFFLUENT SEWER LINES	31
SEPTIC TANK EFFLUENT PUMP AND CONTROLS	38
DRIP IRRIGATION EQUIPMENT	42
DISPOSAL AREA	46
BACK-UP GENERATOR	47
ULTRAVIOLET EQUIPMENT BUILDING	49

RE-CIRCULATING SAND FILTER, EFFLUENT SYSTEM, AND DRIP IRRIGATION

A. SCOPE OF WORK

1. SCOPE

This project shall consist of furnishing of all material, equipment, machinery, labor, etc. necessary for the construction of the facilities more particularly described on the plans and in these Specifications. Work shall include all necessary items of construction and equipment within the limits shown on the plans in order to provide finished installations complete in every respect in accordance with the plans and Specifications.

2. The word "AUTHORITY" shall refer to the Harvest-Monrovia Water, Sewer and Fire Protection Authority, Inc.
3. Prior to start of construction, a pre-construction conference will be held at the job site on a date set by the AUTHORITY.

B. MISCELLANEOUS REQUIREMENTS

1. CONTRACTOR'S UTILITIES

CONTRACTOR shall furnish his own utilities including electricity, water, telephone and he shall provide these during construction, start-up and testing of facilities.

2. SPECIAL EQUIPMENT REQUIRED

CONTRACTOR must provide any special equipment required during construction including pipe locators, pipe cutters, tapping machines, etc.

3. CONTRACTOR'S RESPONSIBILITY FOR EQUIPMENT, ETC.

The CONTRACTOR shall keep all equipment properly lubricated prior to formal acceptance by the AUTHORITY, and upon acceptance shall turn over to the AUTHORITY full instructions for lubrication together with at least a two months supply of lubricant and any grease guns or accessories required for proper lubrication.

4. SERVICES OF MANUFACTURER'S REPRESENTATIVE

The extent to which services of manufacturer's representatives will be required will be generally as follows:

- A. Manufacturer's representatives shall make one visit to the job site prior to installation of equipment to check shipment and advise the CONTRACTOR's representative, in the presence of the AUTHORITY's Representative, concerning proper installation of the equipment.
- B. Manufacturer's representative shall make a second visit to the job site to inspect, test and adjust the installed equipment in the presence of the AUTHORITY's representative.
- C. The services of manufacturer's representatives shall also be provided as required for investigation of difficulties or correction of defects concerning the equipment during the warranty period.

WARRANTY

The CONTRACTOR shall guarantee all equipment and work for a period of one (1) year after acceptance by the AUTHORITY unless extended in the following Specifications. The AUTHORITY reserves the right to negotiate directly with sub-contractors, equipment suppliers and others concerning warranty matters.

C. WORK COMPLETION

1. CLEAN-UP

Upon completion of construction, the CONTRACTOR shall remove all boxes, forms, leftover materials, etc., and shall leave the entire area in a neat and orderly condition.

2. TESTING OF PIPING AND EQUIPMENT

Before the work under this project is accepted, the CONTRACTOR must subject the various components of the system to the tests as required to prove the system. All tests must be scheduled in advance, and shall be performed at a time acceptable to the AUTHORITY. The tests must be

made in a manner acceptable to the AUTHORITY.

All piping shall be pressure tested for a period of six (6) hours at a pressure of 150 psi. A loss of more than 5 lbs. constitutes failure. All obvious leaks shall be repaired before acceptance.

All tanks, basins, sumps, or other water containing structures shall be field tested for watertightness by filling the structure and the attached riser with water to a level of two inches (2") into the riser and allowing it to stand for twenty four (24) hours. Any drop in liquid level shall be taken as evidence of a leak and must be eliminated before acceptance.

Tests of pumps, control system, meters, etc., must be made by or in the presence of the manufacturer's representative, and any defects noted shall be corrected before acceptance.

3. START-UP

Before acceptance of the project by the AUTHORITY, the CONTRACTOR Shall fill basins with water as necessary and perform a start-up of the system to demonstrate that all equipment and processes are functioning properly. Start-up shall be performed in the presence of the AUTHORITY.

DESIGN REQUIREMENTS

A. APPROVAL

Developers shall submit to the AUTHORITY a topographic map showing the complete layout of the subdivision, the proposed location of the sand filter and the drip field, and all easements. A detailed soils report shall be submitted for the areas considered for the drip field. This information should be submitted a minimum of fourteen (14) days before a Board meeting in order for it to be considered by the Board. Once it is determined that service can be provided a detailed set of construction plans shall be submitted.

B. DESIGN STANDARDS

1. FLOWS

The average daily flow shall be 300 gallons per day per lot.

2. SEPTIC TANKS

Septic tanks shall be 1500-gallon tanks.

Tank shall be watertight and field-tested in the presence of the AUTHORITY.

Tank shall be located in the front yard and installed after house is constructed.

All tanks shall have a high/low level audible alarm and light. Alarm shall be mounted on the side of the house in plain view from the street.

3. RECIRCULATION TANK

The effective volume of the tank shall be 150% of the daily wastewater design flow.

The number of pumps shall be consistent with the division of the filter with a minimum of three (3) pumps required.

A spare pump shall be provided.

The recirculating ratio shall range from 3:1 and 5:1.

4. SAND FILTER

The sand filter shall be sized based on a loading rate of 5.0 gallons per square foot of filter area per day.

Dosing time shall be 3 to 5 minutes in duration and occur 48 or more times per day.

The frequency shall allow for complete draining of the media in order to re-aerate the filter.

The sand filter and control building shall be enclosed in a fence.

Sufficient space shall be allowed around the filter and control building for maintenance. A minimum of 30 feet should be allowed between the fence and structures.

5. SOIL REPORT

A detailed soil survey shall be done by a certified soil scientist or a qualified engineer. This report is to be submitted to the AUTHORITY. The soils shall be mapped based on the boundaries where conditions abruptly change. At a minimum, the following items must be contained in the report:

- Property Boundaries
- Existing / Proposed Structures
- Existing / Proposed Wastewater Systems
- Soil Investigation Points
- Contour Elevations
- Surface Water Features (Including Drainage Ditches)
- Existing Water Supply Wells Within 500 Foot Radius
- Location of Suitable Soils
- Slope Aspect & Percent
- Soil Testing Results
- Depth To Seasonal Saturation & Permanent Water Table

- Depth To Restrictive Layer

The AUTHORITY may require additional testing of the site.

6. DISPOSAL AREA

The disposal area shall be sized based on a hydraulic loading rate of 0.2 gallons per square foot per day. Soils that have a loading rate of less than 0.2 gallons per square foot per day will require an additional expansion area as determined by the AUTHORITY.

An in depth soil report shall be performed by a qualified individual and submitted to the AUTHORITY.

Drip tubing shall have orifices located on 24-inch centers and shall deliver a maximum 0.61 gallons/hour/orifice.

Drip tubing shall be installed at a depth of 8 to 10-inches and spaced no closer than 2-foot apart. Other spacing may be approved by the AUTHORITY.

Drip field shall operate at a minimum 20 psi.

Disposal area shall be protected from construction activities.

The minimum width of any disposal area shall be 60 feet. Utility and drainage easements shall not be contained within a disposal area.

7. ULTRA VIOLET CONTROL BUILDING

Building shall be a minimum of 140 square feet in size. It shall be built so that it will blend into the architecture of the development.

All controls shall be located inside the building.

Building shall have a drive for all weather access.

SITE WORK

A. SCOPE

This section includes site staking, clearing, grading, landscaping, and fencing.

B. STAKING

All control points are to be established before construction begins. This includes, but not limited to, centerline stakes, property stakes, easements, and benchmarks. The CONTRACTOR is to take care not to disturb or damage any reference points.

All benchmarks are to be on a USGS datum; no assumed elevations will be allowed.

C. CLEARING

Site is to be cleared as indicated on the plans, or as directed by the AUTHORITY.

Remove trees, brush, and stumps within 100 feet of sand filter.

D. GRADING

Sand filter site should drain away from filter.

All surface water shall be diverted around the treatment system and drip disposal fields. This shall be accomplished by using swales and/or berms or other approved means. The intent is for no surface water from above the designated disposal area to flow across the disposal area.

E. LANDSCAPING

All disturbed areas that are not to be surfaced shall be seeded, fertilized, and mulched in accordance with these specifications.

1. SOIL PREPARATION

Prepare four inches (4") minimum topsoil by cutting, discing, raking, harrowing and other means for sowing seed. Topsoil shall be free from excess stones.

Apply fertilizer at the following rates:

340 pounds (8-10-10) fertilizer per acre;
3000 pounds standard ground limestone per acre.

2. SEEDING

Sow 70 pounds of fescue and 4 pounds of white clover per acre.

All disturbed areas to be seeded.

Cover seeded area with clean straw uniformly distributed.

Water the seeded area for 14 days using sprinklers.

F. FENCE

Sand filter, ultra violet building, and drip field must be enclosed by a six foot (6') high chain link fence in accordance to these specifications. Other types of fences shall require approval from the AUTHORITY.

MATERIALS

Chain link fence fabric shall be galvanized steel wire with a continuously bonded vinyl coating with a finished size (i.e., size after coating) of 8 gauge, and shall comply with ASTM F 668. Mesh shall be vertically woven diamond mesh, with a nominal distance of 2 inches between parallel wires. The color of the vinyl shall be black.

Line post shall be 2.375" O.D. with a standard weight of 3.65 lbs/ft.

End, corner, and gate posts shall be 2.875" O.D. with a standard weight of 5.79 lbs/ft.

Top rail shall be 1.625" O.D. with a standard weight of 1.83 lbs/ft.

Gates shall have a 1.9" O.D. frame and be covered in the same fabric as the fence. The minimum open for a drive gate is twelve feet. Walk gates shall be similar in construction.

Installation to be done in general conformity with the recommendations of the Chain Link Fence Manufacturer's Institute.

RECIRCULATING SAND FILTER EQUIPMENT

A. FILTER MEDIA

1. SAND MEDIA

Filter sand shall be composed of hard and durable grains, either sharp or rounded, substantially free from clay, loam, dust or other foreign matter and flat particles. When the sand, crushed and powdered, is digested for 24 hours in strong warm hydrochloric acid, without stirring, at least 95% shall remain insoluble.

The sand shall not contain more than 2% of calcium and magnesium taken together and calculated as calcium carbonate (CaCO_3). The sand shall have an effective size D_{10} of not less than 1.5 millimeter or more than 2.5 millimeter and a uniformity coefficient (Cu) of 1.5 to 2.5. The sand shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8	100
4	60 - 100
8	7 - 75
16	0 - 5
30	0 - 3
50	0 - 2

Care must be exercised during placement of the sand so that segregation does not occur. The moisture content of the sand must be sufficient to ensure adequate compaction.

The diameters of sand grains shall be computed as the diameters of spheres of equal volumes and all percentages shall be calculated by weight.

Filter sand that has been tested and approved is available from Blue Ridge Sand and Gravel, Brilliant, Alabama.

2. FILTER GRAVEL

Filter gravel shall be thoroughly washed river or crushed stone and must

be obtained from an approved source.

Gravel shall consist of hard rounded stones with a specific gravity of not less than 2.5. Not more than 1% by weight shall have a specific gravity of 2.25 or less. More than 2% by weight of thin, flat or elongated particles weight when immersed in dilute hydrochloric acid (four volumes concentrated hydrochloric acid to 10 volumes distilled water) for a period of 24 hours at 65 to 75 F.

3. TESTING OF MEDIA

The suppliers of the sand and gravel shall submit certified copies of tests made of representative samples of media they propose to furnish. Samples of the material shall also be submitted to the AUTHORITY. The CONTRACTOR will also perform tests on the material to be used before it leaves the plant and submit copies to the AUTHORITY. All material shall be approved by the AUTHORITY prior to placing. A certified independent laboratory shall do testing.

Filter sand and gravel shall meet size and gradation requirements shown on the Plans.

Filter sand and gravel shall be thoroughly washed before placing and each layer shall be hand leveled. Workmen shall walk on boards, which will support their weight without displacing the gravel.

B. PIPING & VALVES

The CONTRACTOR shall furnish all materials and Equipment, and provide all labor necessary to install all piping, valves and fittings as shown on the plans, specified herein, and directed by the AUTHORITY.

1. PLANT PIPING AND FITTINGS

On-site treatment plant piping shall be SDR21 PVC unless otherwise shown on the Plans. Piping inside buildings shall be Sch. 40 PVC. Fittings for PVC shall be Sch. 80 PVC with solvent weld joints. The Pipe shall conform to standards for the National Sanitation Foundation, ASTM D-2241, and ASTM D-1784-60T. Fittings shall be as manufactured by Nibco Manufacturing or equal.

2. PVC SEWER PIPE

PVC sewer collection system pipe and force main shall be manufactured of Polyvinyl chloride meeting the requirements for ASTM D-2241 and be SDR-21. The pipe color shall be green for collection lines and purple for effluent from the sand filter.

Joints shall be of bell and spigot type. The bell shall contain an elastomeric gasket, which is firmly retained. Solvent weld joints will not be permitted except where indicated on the Plans or approved by the AUTHORITY in an engineering situation.

Fittings and Plugs shall be supplied by pipe suppliers with equivalent joints. Plugs shall be suitable to withstand test pressures.

Pipe lengths shall not exceed twenty feet (20') in length. Shorter lengths will be required if the CONTRACTOR experiences difficulty in maintaining proper pipe alignment.

3. VALVES

PVC ELECTRIC BALL VALVES

PVC electric actuated ball valve shall be Chemtrol Series EA Series, Model Mar 25 or Equal. Valve shall have a permanently Lubricated module gear train and mechanical Visual output shaft position indicator. Two (2) SPDT switches useable or position light indication shall be provided.

The electric actuator shall include main heavy Duty enclosure, motor, reduction gearing, scotch Yoke final output drive, position limit Switches, manual hand rank, declutch mechanism, Valve position indicator, heater. The actuator shall be capable of mounting in any direction.

BRASS ELECTRIC SOLENOID REMOTE CONTROL VALVES

Electric solenoid remote control valve shall utilize the double-chambered actuator and a Three-way solenoid to alternately apply upstream Pressure to the upper control chamber to close And vent to drain to open. Valve body shall be Brass with plastic cover. Valve shall be Bermad Model 310 or approved equal.

DISTRIBUTING VALVES

Distributing valves shall be pre-assembled units constructed of high strength non-corrosive ABS polymer and stainless steel. Units shall consist of distributing valve, section of clear pipe for each lateral, ball valve, elbows, unions, and couplings. Fittings, ball valves, and clear pipe shall be a minimum Schedule 40 PVC.

The valve shall rotate by cam to each lateral by means of hydrostatic pressure differential, initiated by stoppage of flow of effluent to the valve.

Distributing valves shall be "Hydrotek" as Manufactured by Orenco Systems, Inc. or approved Equal.

RECIRCULATING SPLITTER VALVES

Recirculating splitter valves shall be constructed Of Sch. 40 PVC and rubber component and provide an 80% recirculation when the buoy is seated and 100% recirculation when the buoy is not seated. An inspection port shall be provided for routine maintenance. Splitter valve shall be manufactured by Orenco Systems, Inc. or approved equal.

4. FROST PROOF HYDRANTS

Frost proof hydrants shall be as manufactured by Murdock, or equal, of the size indicated on the plans and is designed for three foot (3') bury depth. Hydrants shall be equipment with a vacuum breaker set screwed to the nozzle. Hydrants shall be located near sand filter and equipment building, or as directed by the AUTHORITY.

5. VALVE BOXES

Valve boxes shall be 18"X 14" plastic meter box sections with lid labeled "SEWER". Box shall be as manufactured by Dallas Specialty & Manufacturing Co., Model DS 12000-S.

C. PUMPS, PUMP VAULTS, AND CONTROLS

DRIVES

All pumps to be furnished with electric motor drives either direct connected, unless otherwise indicated in Part 3 below, motors shall be submersible, 1 phase, 60 cycle, A.C., 1.15 Service Factory @ 40 C. Ambient. Motors shall be suitable for use intended with regard to both driven load characteristics and service proposed.

GUARANTEE

CONTRACTOR shall guarantee pumps as part of guarantee on all work from one (1) year of date of acceptance as certified by the AUTHORITY . Pump shall be provided with a non-prorated five (5) year warranty.

1. TURBINE EFFLUENT PUMPS

PUMP: Turbine effluent pumps shall be single-phase Effluent pumps that utilize a floating stack design to minimize sand and particle interference. Pumps shall be UL listed and CSA certified for use in screen effluent applications from septic tanks and shall be corrosion resistant. Pumps shall include a bronze check valve, bypass, and orifice.

MOTOR: Pump motors shall be constructed of 100% Corrosion resistant stainless steel and have constant lubrication through water filled design. Motor shall be hermetically sealed and rated for continuous duty. Motors shall be protected against thermal overload and equipped with surge arrestors.

IMPELLER PUMP: Impellers to be construction of thermoplastic with a stainless steel ring.

POWER CORD: Motor power chord 16/3 SO type cable. Cable jacket shall be seated at the motor entrance by use of a rubber compression washer and nut. A molded rubber tube filled with epoxy shall seal the outer cable jack and individual leads. Cords are not to be spliced without the approval of the AUTHORITY.

Pumps to be manufactured by ORENCO Systems, Inc., or approved equal.

2. PUMP VAULT

SCREENED PUMP VAULT: Screened pump vault to be Orenco Systems, Inc. Biotube Effluent Filter or approved equal of the height indicated on the plans, or equal, with flow inducer to house the pump. Vault to be composed of a PVC cylinder with an ABS base, a screen cartridge, and two support pipes. Filter to be constructed of polypropylene. The fiberglass base shall be injection-molded fiberglass. Support pipe shall be Schedule 80 PVC. Vault to be a minimum of 12 inches in diameter.

3. CONTROLS

MERCURY FLOAT SWITCHES: Mercury Float Switches shall be single throw, single pole mercury-to-metal contacts for reliable sensory switching suitable for the operating levels indicated in the plans. The number of switches shall be as indicated on the plans. Cord length to be sufficient for operation and maintenance of system. Each float switch shall be secured with a nylon strain relief bushing. Floats are to be adjustable without removing the screened pump vault, and the high/low alarm function shall be preset as shown on the plans.

SPLICE BOX: Splice box to be equipped with watertight cord grips, heat shrink connectors, a neoprene sealing gasket and four (4) stainless steel lid screws. Splice box to be mounted above the grade.

PUMP DISCHARGE ASSEMBLY: Hose and valve pump discharge assemblies shall be corrosion resistant and adjustable for proper fit. All parts shall be either solvent welded or threaded and sealed with Teflon paste. High head style shall be designed for 150 psi working pressure and include discharge stem, flexible hose, union and ball valve.

RSF CONTROL PANEL: RSF Control panel to be UL listed "SMART" panel as manufactured by Orenco Systems, Inc. Panel to include pre-programmed Program Logic Controller {PLC} and telephone telemetry to monitor and control the recirculating sand filter system remotely and record and store data with time-and-date-stamping.

Panel to be compatible with the latest existing panels and software operated by the AUTHORITY. Panel to include audible and visible alarm light and manual H-O-A switches and times for field settings, if necessary. Panel enclosure to be NEMA-X stainless steel. Install panel in ultraviolet equipment building with lockable disconnect on outside of building nearest pumps. Panel shall interface with zone control panel in the drip field.

Panel will operate recirculation pumps using a Programmable Timer.

When the level transducer in the bottom of the filter is activated (the level in the chambers is in normal range), the Programmable Timer will go through an On cycle and then an Off cycle. The Programmable Timer can be overridden by the level transducer if the level in the tank continues to rise. If the timer is overridden, pumps will run continuously until the level drops to the normal range settings. If the level keeps rising, a High Level activated audible alarm will sound and an illuminated pushbutton will be activated. A float activated Redundant Off/low level alarm feature shall be included to protect the pumps from pumping dry should failure of the transducer occur.

Panel will operate effluent pump station using a Programmable timer. A pump on/high level alarm float will override the timer should the level in the tank continue to rise. A redundant off/low level alarm float will protect the pumps from pumping dry. Pumps will alternate operation.

D. ULTRAVIOLET DISINFECTION EQUIPMENT

1. QUALITY ASSURANCE

- 1) System Performance Guarantee: The system must be guaranteed to perform bacteriological in accordance with this Specification. The UV dose produced shall not be less than 60,000 uwatts-sec/cm² and have a kill rate of 99.99%. Manufacturer must have documentation at least three of its units operating successfully for two years in a recirculating sand filter environment with fecal coliform effluent limits of 200/100 ml for thirty(30) days.
- 2) Manufacturer's Warranty: The manufacturer must guarantee the Product against defects in material and workmanship for a period of one (1) year from the shipment date.

2. PRODUCTS

- 1) Each chamber shall be totally self-contained including lamps, quartz jackets, ballasts, wiper systems, and all electronic monitoring.
- 2) Each chamber shall be designed so that lamps may be easily replaced without draining the chamber.

3. DESIGN, CONSTRUCTION AND MATERIALS

- 1) All wetted components shall be stainless steel Type 304, quartz, Teflon, or Neoprene.
- 2) All electronics and electrical components shall Be protected in a housing, mounted directly to the disinfection chamber.
- 3) The exterior surfaces of the chamber shall be electropolished and passivated.
- 4) The chamber head shall be removable at one end of the chamber to allow access to the interior purpose of visual inspection and flushing any accumulated solids.
- 5) The maximum allowable operating pressure shall be 100 psi.
- 6) Each chamber shall provide a minimum contact time of 4 seconds.
- 7) The ultraviolet lamps are to be protected from contact with the effluent by a quartz jacket with a minimum transmission at 2537 Angstroms of 90%.

4. LAMP ARRAY CONFIGURATION

Lamp shall be centered within the chamber to provide a balanced and uniform dosage throughout the chamber.

5. ULTRAVIOLET LAMPS

- 1) The lamps shall be low pressure, instant start, mercury are germicidal lamps.
- 2) Lamps shall produce ultraviolet light with at least 90% of the ultraviolet output at 253.7 nm.
- 3) The arc length of each lamp shall be 37-15/16 inches.

- 4) Lamps shall produce a minimum ultraviolet output of 45 watts.
- 5) Lamps shall be rated to produce minimum levels of ozone.
- 6) The number of ultraviolet lamps required shall be determined and guaranteed to be sufficient by the manufacturer.
- 7) Lamp ballast shall be of the high power factor type with internal automatic reset thermally protected, 120 volt @ 60 cycles, single phase.
- 8) Manufacturer: The lamps shall be manufactured by Atlantic Ultraviolet Corporation.

6. LAMP SLEEVES

- 1) The lamp sleeves shall be Type 214 clear fused quartz circular tubing. They shall be rated for UV transmission of 89% and not subject to Solarization.
- 2) The quartz sleeves shall be fitted to the contact chamber with compression glands.
- 3) The gland nut shall be machined from brass material. It shall provide a seat for and internal and external o-ring.
- 4) A stainless steel type 304 push-on cap shall seal against the external o-ring on the gland nut to protect the lamps and quartz sleeve from the outside environment. The cap shall permit access to the lamps and quartz sleeves for cleaning and replacing without the use of any tools.

7. INSTRUMENTATION AND CONTROLS

- 1) Each chamber shall have a minimum of one ultraviolet intensity monitor.
- 2) Each chamber shall have a minimum of one ultraviolet intensity sensor, which responds only to the germicidal portion of the light generated. The sensor shall not utilize a filter and shall not degrade after prolonged exposure to ultraviolet light. The sensor shall be easily accessed for cleaning and replacement.

- 3) Each chamber shall have a minimum of one safe indicator and one unsafe indicator with an easy to read indicating meter.
- 4) Each chamber shall have a solenoid valve installed with a two-Minute delay located in the water line prior to the chamber, which is controlled by the ultraviolet intensity monitor.
- 5) Each chamber shall have a flow control valve installed in the water line prior to the chamber to control the flow through the system.
- 6) Each chamber shall have an audio alarm, which is controlled by the ultraviolet monitor.

8. CLEANING SYSTEM

- 1) Each chamber shall contain a wiper system to allow cleaning of Quartz sleeves as often as the system requires. The system is to be completely self contained within the chamber.
- 2) Each chamber shall contain a minimum of one $\frac{1}{2}$ " NPT drain to allow the chamber to be 100% emptied.

9. SPARE PARTS

- 1) A set of spare parts shall consist of the following.
 - (a) One (1) ultraviolet lamp furnished for the system.
 - (b) One (1) ballast furnished for the system.
 - (c) One (1) quartz jacket furnished for the system.
 - (d) Two (2) gland nuts furnished for the system.
 - (e) One (1) complete gasket set for the disinfection chamber.
 - (f) Two (2) lamp sockets furnished for the system.
- 2) The UV unit shall be capable of using lamps from at least two (2) currently active lamp manufacturers without modification to the unit.

10. PERFORMANCE TEST

Testing of the ultraviolet disinfection equipment shall be performed as a field test once the installation and operation of the equipment has been certified correct. This shall be done under supervision of a manufacturer's representative.

11. MANUFACTURER

- 1) The manufacturer of the ultraviolet disinfection equipment shall be Atlantic Ultraviolet Corporation of Hauppauge, New York, "Sanitron". Model.
- 2) Alternate manufacturer will be considered as equal, providing the microbiological performance, operation and maintenance features and warranties can be provided.

E. RECIRCULATION TANK

1. PRODUCTS

- A. Materials – Tanks shall be constructed of reinforced concrete. Tanks to be watertight and of single wall construction.
- B. Quality Assurance – Tanks shall be constructed to meet the requirements of ASTM D4021-92. Tanks shall be water tested to two inches above lid.
- C. Shop Drawings – Shop drawings, including materials, dimensions, Details, and installation instructions shall be submitted to the AUTHORITY.

2. EXECUTION

- A. Installation – Tanks shall be installed according to the manufacturer's installation instructions.
- B. Testing – Tank shall be field pressure tested before backfilling. Tank shall be filled with water to a level of 2" into riser and let stand for 24 hours. Any leakage shall be repaired.
- C. Backfill – Prepare a smooth level bed, twelve inches (12") thick of backfill material. Tanks shall be backfilled to the top of the tank

with crushed stone or pea gravel conforming to ASTM C-33. Minimum clearance from the tank sidewall to the side of the excavation shall be eighteen inches (18").

- D. Anchor System – Concrete deadmans shall be provided on each side of the tank. Anchor straps shall be fiber-reinforced as recommended by tank manufacturer.

F. FLEXIBLE MEMBRANE LINER

The PVC 30 mil flexible membrane liner will conform to or exceed requirements of the current National Sanitary Foundation Standard 54 (NSF-54). Described in this section are the specifications and quality control for the geo-membrane manufacture, fabrication and delivery.

1. Manufacturing

Raw Material – Material shall be formulated to resist fungus growth, below toxicity, and contain UV inhibitors.

2. Manufacturing and Properties

- 1) The Geo-membrane Manufacturer will provide the AUTHORITY with the following:
 - A properties sheet including, at a minimum, all specified properties, within NSF-54 measures using test methods indicated in NSF-54, or equivalent for HDPE geo-membranes;
 - A list of quantities and descriptions of materials other than the base polymer, which comprise the geo-membrane; and
 - The sampling procedure and results of testing.

- 2) The PVC liner material shall have a tensile strength of 75, elongation of 350%, and density of 1.2 g/cm.

3. Rolls

Prior to shipment, the manufacturer will provide the AUTHORITY with a quality control certificate for each roll of liner provided. A responsible party employed by the Geo-membrane Manufacturer will sign the quality control certificate. The quality control certificate will include:

- Roll numbers and identification; and
- Sampling procedures and results of quality control tests – as a minimum, results will be given for thickness, tensile strength and tear resistance, evaluated in accordance with the method indicated in the specifications or equivalent methods approved by the AUTHORITY.

4. INSTALLATION

- A. Install PVC lining according to fabricators instructions.
- B. Seams for connecting rolls and panels shall be welded or glued by qualified personnel.
- C. Prepare smooth sand surface for placement of liner.
- D. After installation, inspect liner in presence of the AUTHORITY's representative and repair as needed. Take care not to damage liner during placement of piping and filter material.
- E. Where PVC piping penetrates liner, provide glued PVC boot and stainless steel clamp specially fabricated for pipe penetrations. Boot shall be watertight after installation.

G. RECIRCULATING SAND FILTER H-CHAMBERS

Furnish and install plastic chambers in the bottom of the sand filter to function as a storage tank where shown on the Plans.

1. MANUFACTURERS AND SUBMITTALS

- 1) Chambers shall be as manufactured by Infiltration Systems, Inc. or approval equal.
- 2) Submit five (5) copies of shop drawings or product data sheets to the Engineer for approval.

2. PRODUCTS

- A. Chambers shall be constructed of a blend of polyolefin or HDPE and store approximately 21.2 gallons/cu. ft of liquid.
- B. Sidewalls shall be lowered to provide maximum infiltration.
- C. Chambers shall be of heavy-duty construction.

3. EXECUTION

- A. Install units in accordance with manufacturer's instructions. Units shall be interlocked.
- B. All ends shall be capped, and any holes cut to pass piping covered or patched in a manner suitable to the AUTHORITY to prevent migration of filter stone into the chamber.
- C. Set elevations to maintain 8 inches of water depth in the chambers at the bottom of the filter.

CONCRETE SEPTIC TANKS, PUMP TANKS, AND RECIRCULATION TANKS

A. DESIGN

Precast Septic tanks, pump tanks, and recirculation tanks shall be single piece units designed to maintain structural and watertight integrity when either full or empty under the following conditions:

- 1) Cover: Maximum 2.5 feet over tank.
- 2) Water Table: Occasionally equal to or less than three feet (3') from the ground surface.
- 3) Loading Conditions: Top – 400 psf; Lateral – 62.4 pcf.

Tanks shall be designed and manufactured for use in Septic Tank Effluent Pump (STEP) systems and shall be structurally sound and watertight.

B. INTERNAL PLUMBING

The tank manufacturer shall provide long-life watertight joints where the inlet and outlet pipes pass through the tank wall. Pipe and fittings shall be Schedule 40 PVC of the diameter shown on the Plans. Inlet tee shall penetrate eighteen inches (18") into the liquid unless otherwise shown on the Plans and shall be located below the inspection port.

C. QUALITY ASSURANCE AND TESTING

- 1) Each tank shall be permanently identified with the manufacturer's name and a serial number which shall cross-reference raw material physical properties, as well as manufacturing records, including date of manufacture.
- 2) Test for Watertight Integrity: All tanks shall be field tested for water tightness. Tests shall be performed upon installation, and prior to back filling. The water test will be performed by filling the tank and attached riser with water to a level 2-inches into the riser. Any leakage within 24 hours constitutes failure of this test. Tanks exhibiting leakage shall be repaired or replaced and re-tested.

D. STRUCTURAL DESIGN

- 1) Design shall be performed using the working stress method. Walls, bottom and top of reinforced concrete septic tanks and pump tanks shall be designed across the shortest dimension using one-way slab analysis, stress in each face may be determined by analyzing the tank section as a continuous fixed frame.
- 2) Pre-cast reinforced concrete walls shall have a minimum thickness of three inches (3").
- 3) Concrete shall have a minimum compressive strength of 4,000 psi at 28 days.
- 4) Bottom of tank to be monolithic and an integral part of the walls. Top slab to be sealed with a preformed flexible plastic gasket equal to flexible butyl resin sealant congeal as manufactured by Concrete Sealants, Inc.
- 5) Any access openings on the tank required as a result of manufacturing or for cleaning and inspection purposes shall be sealed infiltration free with Chevron Plastic Cement or comparable product.
- 6) Inlet/Outlet Connections: Inlet and outlet pipes shall be sealed watertight using a pipe boot such as a Cost-A-Seal and stainless steel clamp. Formed holes shall be perpendicular to the face of the tank wall and properly plugged so as to produce a smooth-walled hole.
- 7) Reinforcing steel shall be ASTM A-615 Grade 60. Details and placement shall be in accordance with ACI 315 and ACI 318.
- 8) Anti-Flotation: Tanks shall be designed to not float under all of the following conditions with a minimum recommended cover of one foot (1'): earth backfill above the tank, water table at ground surface, and no water in tank.

E. CONCRETE

- 1) Concrete shall be ready-mix with Portland cement conforming to ASTM C150, Type II.

- 2) The maximum water to cement ratio shall be 0.45. Concrete shall have a cement content of not less than six (6) sacks per cubic yard and a maximum aggregate size of _".
- 3) Concrete shall be consolidated during placement by vibration. Vibrators may be internal, external, or surface type.

F. QUALITY ASSURANCE

- 1) Concrete Test Cylinders: Testing of concrete strengths by means of test cylinders is a critical part of the quality control program. Concrete shall be sampled and cylinders made in accordance with the following specifications:

ASTM C31 - Specification for Making and Curing
Concrete Test Specimens in the Field

ASTM C172 - Specification for Making and Curing

ASTM C192 - Specification for Making and Curing
Concrete Test Specimens in the Field

- 2) No tanks showing cracks or poor workmanship will be accepted.

G. RISERS AND LIDS (Non-Traffic Areas)

- 1) Inlet and outlet risers shall be ribbed PVC per ASTM D-1784. Risers shall be constructed watertight.
- 2) For access risers, the tank manufacturer shall install a flanged adapter to facilitate the bonding of the access riser. The flanged tank adapter shall be made of _" thick ABS and have an overall height of not less than 3 inches (3"). When bonding to a flanged tank adapter, use a two-part epoxy consisting of an inhibited methacrylate ester component and an organic peroxide solution. Risers containing pumping assemblies shall be a minimum of 24 inches diameter and risers for inspection parts shall be a minimum of 18 inches diameter. One (1) pint required per 24-inch diameter riser and one (1) quart per 30-inch diameter riser. Risers shall extend two inches (2") above the ground surface to allow for settlement.

- 3) Electrical and discharge grommets in the riser sidewall shall be installed in the field. Grommet material shall be EPDM synthetic rubber.
- 4) One (1) lid shall be furnished with each riser. Lids shall be fiberglass with green non-skid finish and provided with a polyurethane gasket, tamper resistant stainless steel bolts, and wrench. The riser shall and lid shall be able to support a 2,500 lb. wheel load. Lid shall have a minimum 20-year ultraviolet protection.
- 5) Where lid insulation is specified, it shall be rigid closed-cell foam insulation of two-inch (2") thickness, mechanically attached to the underside of the lid. All fasteners shall be made of stainless steel. Insulation shall have an R value of not less than 10.

H. INSTALLATION AND TESTING

- 1) Install tanks in strict accordance with the manufacturer's recommendations.
- 2) Prepare a smooth level bed for tank consisting of a minimum of six inches (6") of compacted select aggregate conforming to AASHTO size 67 or 57.
- 3) All tanks shall be field tested for watertightness. Tests shall be performed upon installation prior to back filling. Tank shall be filled with water to a level of 2 inches into riser. Tank must retain this level for 24 hours. Tanks that do not retain this level for 24 hours will be considered to have leakage and must be repaired or replaced and retested.
- 4) Backfill with native soil and cover four inches (4") of topsoil free from stones and roots. Grade to allow for settlement and match existing grade of land. Seed and mulch disturbed areas in accordance with specifications.
- 5) Riser to be 2" above grade with earth backfilled to edge. Excess material not suitable for backfill shall be removed from the site.
- 6) Locate septic tank to maintain gravity service line from the house or building at a minimum of 1% slope.

SEPTIC TANK EFFLUENT SEWER LINES

A. PVC PIPE & FITTINGS

1. All plastic pipes shall be made from Class 12454-B polyvinyl Chloride plastic (PVC 1120) as defined by ASTM D1784. Pipe shall be manufactured in accordance with ASTM D2241 and shall be a minimum pressure Class 200.
2. All pipe shall be manufactured in the United States of America. All pipes for any one (1) project shall be made by the same manufacturer.
3. All pipe shall be furnished in twenty-foot (20') lengths. The pipe shall be stored away from heat or direct sunlight. All pipes shall be supported within five feet (5') of each end; in between the end supports, there shall be additional supports at least every fifteen feet (15').
4. Certain information shall be applied to each piece of pipe. At the least, this shall consist of:
 - 1) Nominal size
 - 2) Type of material
 - 3) SDR or class
 - 4) Manufacturer
 - 5) NS Seal of Approval
5. The pipe shall have push-on joints designed with grooves in which Continuous molded rubber ring gaskets can be placed. Gaskets shall be made of vulcanized natural or synthetic rubber; no reclaimed rubber shall be allowed. The gaskets shall be made of the manufacturer's standard design dimensions and of such size and shape as to provide a positive seal under all combinations of joint and gasket tolerance. The gasket and annular groove shall be designed and shaped so that when the joint is assembled, the gasket will be radially compressed to the pipe and locked in place against displacement, thus forming a positive seal.
6. The spigot end of each pipe shall be beveled so that it can be easily inserted into the gasket joint, which in turn shall be designed so that the spigot end may move in the socket as the pipe expands or contracts. The spigot end shall be striped to indicate the distance into which it is to be inserted into the socket. Each joint shall be

able to accommodate the thermal expansions and contractions experienced with a temperature of at least 75 F.

7. Enough lubricant shall be furnished with each order to provide a coat on the spigot end of each pipe. This lubricant shall be non-toxic, impart no taste or smell to the water, have no harmful effect on the gasket or pipe material, and support no bacterial growth. The lubricant containers shall be labeled with the manufacturer's name.
8. Joints shall be manufactured in accordance with ASTM D3139 except that the thickness of the bell shall be, at a minimum, equal to that of the barrel. Joints shall be integral bell and ring joints with rubber compressions gaskets.
9. Pipe for untreated water shall be green in color. Pipe for treated water shall be light purple in color.
10. Fittings shall be PVC Schedule 40 with solvent weld joints unless Otherwise noted on the plans.

B. VALVES

1. Ball Valves

Valves on PVC pressure sewer lines 2" and smaller shall be PVC ball type. Working pressure at 70 F shall be 150 pounds psi. Valves shall be supplied with o-ring seals and shall open to the left. The valve shall be as manufactured by Asaki/America, King Brothers Industries or equal.

2. Air Release and Air and Vacuum Valve

Air release and air and vacuum valves for pressure sewer lines shall be as manufactured by Bermad, or equal, complete with two inch (2") shut off valve, one inch (1") blow off valve and backflushing attachments. Valve shall have a fiberglass and plastic body and polypropylene float. Install valve in a PVC basin.

3. Ball Check Valve

Ball valves up to 2" shall be constructed of HI-IMPACT PVC, Schedule 80. Stem seal shall be constructed of EPDM and ball shall be HMW-HDPE. Valves shall be of low-torque design and suitable for 150 psi working pressure. Ball valves shall be as manufactured by King Brothers Industries or approved equal.

4. Swing Check Valve

Check valves up to 2" shall be constructed of HI-IMPACT PVC, Schedule 40 and be of the swing type design. Only _ psi shall be required for closure. Gate shall be constructed of EPDM. Check valves shall be as manufactured by King Brothers Industries or approved equal.

5. Gate Valves (2" and larger)

All gate valves larger than 2 inches shall be resilient seated, manufactured to meet or exceed the requirement of AWWA C509 latest revision. All internal surfaces shall be coated with an approved epoxy coating to a minimum thickness of eight mils. Valves shall be furnished with mechanical joints ends accordance with ANSI A21.11 unless otherwise shown or directed. Valves shall be suitable for installation in an approximate vertical position in buried pipelines. Stem seal shall consist of o-ring seals. All valves shall open to the left (counterclockwise) with non-rising stems and shall be provided with a two-inch square-operating nut.

Valves shall be complete when shipped, and the manufacturer shall use due and customary care in preparing them for shipment so as to avoid damage in handling or in transit. Particular care shall be taken to see that all valves are completely closed before shipment.

C. SERVICE BOXES

Service boxes for service line valves shall be a standard plastic meter box with a nominal size of 18" x 14 x 12" with one (1) six inch (6") extension. The meter box shall be injection molded plastic. It shall be a rigid combination of polyolefin with inorganic component reinforcing, and UV stabilizer additive to assure resistance to material degradation from ultraviolet light. The cover shall be molded of the same material and

designed with no molded protrusions for latching. A 2 _" diameter sixteen (16) gauge steel reflector with dichromate coating shall be applied to the underside of the plastic cover for electronic detection. The cover shall be green with the words "**Sewer**" imprinted on the top. Box shall be Model DS 1200 S as manufactured by Dallas Specialty & Manufacturing Company.

D. VALVE BOXES

Valve boxes shall be manufactured in the U.S.A. of cast-iron, complete with cover. Boxes shall be the extension type with screw adjustment. The word "**Sewer**" shall be cast on the cover.

E. SERVICE PIPE

Service pipe from the septic tank to the main shall be Schedule 40 PVC or flexible vinyl PVC tubing. Flex tubing shall be iron pipe size and be spirally reinforced solvent weld base equal to Solflex as manufactured by Agriculture Products, Inc.

F. INSTALLATION OF PRESSURE SEWER LINE

1. Lay the pipe and keep it at the lines and grades required by the drawings. All fittings shall be at the required locations and spigots well centered in the bells.
2. Unless otherwise indicated by the drawings, all pipes shall have at least 36" of cover. The pipe shall slope continuously between high and low points. No departure from this policy shall be made unless approved by the AUTHORITY.
3. Provide and use tools and facilities that are satisfactory to the AUTHORITY and that will allow the work to be done in a safe and convenient manner. Use a derrick, ropes, or other suitable equipment to lower all pipe and fittings into the trench one (1) piece at a time. Carefully lower each piece so that neither it nor any protective coating or lining it may have will be damaged. Under no circumstances drop or dump pipe materials into the trench.
4. No pipes and fittings shall be lowered into the trench until they have been swabbed to remove any mud, debris, etc. that may have accumulated

within them. After the pipe has been lowered, remove all unnecessary materials from it. Before any pipe is laid, brush and wipe clean the outside of its spigot end and the inside of its bell and ensure that the pipe is dry and oil-free.

5. Take every precaution to keep foreign material from getting into the pipe while it is being placed in the line. If the crew laying the pipe cannot put it into the trench and in place without allowing earth to get inside it, then place a heavy, tightly woven canvas bag of suitable size over each end of the pipe and leave it there until it is time to connect that pipe to the one adjacent to it.
6. Place no debris, tools, clothing, or other materials in the pipe during laying operations.
7. After a length of pipe has been placed in the trench, center the spigot end of the bell of the adjacent pipe, and then insert to the depth specified by the manufacturer.
8. Bell holes shall be big enough so that there is ample room for the pipe joints to be properly made. Between bell holes, carefully grade the bottom of the trench so that each pipe barrel will rest on a solid foundation for its entire length.
9. Whenever pipe laying is not in progress, close the open ends of the pipe in the trench with a watertight plug. Caulk the joints of any pipe in the trench that cannot be completed until a later time with packing in order to make them as watertight as possible; this shall be done not only at the end of each working day but also before work is stopped for lunch periods, bad weather, or any other reason. If there is water in a trench, this seal shall remain in place until the trench has been pumped completely dry.
10. The cutting of pipe so that fittings or closure pieces can be inserted shall be done in a neat and workmanlike manner and without any damage to the pipe. Follow the manufacturer's recommendations concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis.
11. Unless otherwise directed by the AUTHORITY, lay pipe with the bell ends facing in the direction of the laying.
12. Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or

wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor that recommended by the pipe manufacturer.

13. No pipe shall be installed in water or when it is the AUTHORITY's opinion that trench conditions are unsuitable.
14. Install thrust blocks wherever the piping changes direction (e.g., at tees and bends), at dead ends, or at any other point where the manufacturer recommends and/or the AUTHORITY indicates that they are to be used.
15. All pressure sewer lines shall have a 14 THHN solid copper continuous toning wire with white coating installed at such a depth that it is detectable with the AUTHORITY's equipment.

G. SETTING VALVES AND FITTINGS

1. Valves, fittings, plugs, and caps shall be set and jointed to pipe in the manner heretofore specified for cleaning, laying and jointing pipe.
2. Locate valves where shown on the plans or as directed by the AUTHORITY.
3. A valve box shall be provided for every underground valve.
4. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the valve, with the box cover flush with the ground surface.

H. SERVICE LINE INSTALLATION

1. The service line shall have a minimum of eighteen inches (18") cover.
2. All service line shall have a 14 THHN solid copper continuous toning wire with white coating installed at such a depth that it is detectable with the AUTHORITY's equipment.

I. HYDROSTATIC TESTS OF PVC PIPING

1. After pipe has been laid and backfilled as specified above, subject all newly laid pipe or any valved section thereof to a pressure of 150 psi. All

services are to be laid prior to testing the main and tested as part of the test of the main.

2. The duration of each pressure test shall be at least 6 hours.
3. Slowly fill each valved section of pipe with water and apply the specified test pressure with a pump connected to the pipe in a manner satisfactory to the AUTHORITY. The AUTHORITY will monitor the test with a chart recorder.
4. Before applying the specified test pressure, expel all air from the pipe. Close shutoff valves at the air/vacuum release stations after all the air has been expelled.
5. If pressure does not hold, uncover pipe to locate defects. Remove any crashed or defective pipes, fittings, valves, or appurtenances discovered in consequence of the pressure test and replace with sound material in the manner specified. Repeat the test until the results are satisfactory to the AUTHORITY.
6. The CONTRACTOR will open all shutoff valves at the air/vacuum release stations at the completion of the testing.

J. CLEAN-UP

After completing each section of pressure sewer main, remove all debris and all construction materials and equipment from the work site. Then grade and smooth over the surface on both sides of the main. Seed and mulch areas in accordance with the specifications for landscaping.

SEPTIC TANK EFFLUENT PUMPS AND CONTROLS

A. MANUFACTURERS AND SUBMITTALS

Manufacturers – To assure property operation, installation, and compatibility of pump and control equipment used in STEP tanks, a single supplier or manufacturer shall supply the complete system including pumps, controls, and appurtenances. Manufacturer shall have a minimum of five years of experience in supplying equipment for effluent sewers.

B. SCREENED PUMP VAULT

1. Pump vault shall consist of a 12-inch diameter, minimum 54-inch deep PVC vault with eight (8) 1-1/8 inch diameter holes evenly spaced around the perimeter, located to allow maximum sludge and scum accumulation before requiring pumping and to draw from tank clear zone. Housed inside the PVC vault shall be a screen assembly consisting of 1/8 inch mesh polypropylene tubes and a 4-inch diameter flow inducer to accept the effluent pump. Screen area shall not be less than 16.8 square feet for single residential applications. Pump vault and screen assembly shall be "Biotube" as manufactured by Orenco Systems, Inc. or equal.
2. Vault shall be removable through the septic tank outlet riser and shall be Locking design so vault will not turn once it is positioned inside the tank.
3. Vault to have drain port at bottom with neoprene flap check.

C. DISCHARGE HOSE AND VALVE ASSEMBLY

1. Discharge assembly to consist of 1" PVC flex hose with fittings, Schedule 40 PVC pipe, PVC ball valve, and 12 inch (12") length of PVC flex hose to be installed out the riser. When pumping downhill, install anti-siphon assembly. Residential STEP systems shall have a 5-gpm flow controller at 155 feet of head.
2. Pump discharge hose shall be PVC flex hose with a working pressure rating of 100 psi.
3. PVC ball valve to be true union, rated at 150 psi working pressure. The ball type will be designed so that the ball check will be completely out of the sewage flow at rated flow and will drop back on the seat to prevent flow reversing when the flow stops.

D. EFFLUENT PUMPS

Operating Conditions:

- 1) Pump: Pump rated for flow and discharge head shown on the Plans. Pump shall possess a high cycling capability.
- 2) Motor: Single phase, 115/230V, 60 Hz, 2-wire motor with an eight-foot (8') long, extra heavy-duty (SO) electrical cord with ground to motor plug. Motor shall operate at 3450 rpm.
- 3) Solids handling capacity of 1/8 inch.

Turbine Pumps:

- 1) Pump: Turbine effluent pumps shall be single-phase effluent pumps that utilize a floating stack design to minimize sand and particle interference. Pumps shall be UL listed and CSA certified for use in screen effluent applications from septic tanks and shall be corrosion resistant.
- 2) Motor: Pump motors shall be constructed of 100% corrosion resistant stainless steel and have constant lubrication through water filled design. Motor shall be hermetically sealed and rated for continuous duty. Motors shall be protected against thermal overload and equipped with surge arrestors for added security.
- 3) Impeller Pump: Impellers to be constructed of thermoplastic with a stainless steel ring. Pumps shall include a bronze check valve, bypass, orifice, and be able to pass a 1/8" orifice.
- 4) Power Cord: Motor power cord to be 16/3 SO type cable. Cable jacket shall be seated at the motor entrance by use of a rubber compression washer and nut. A molded rubber tube filled with epoxy shall seal the outer cable jack and individual leads.
- 5) Pumps to be manufactured by ORENCO Systems, Inc. or approved equal.

E. FLOAT SWITCHES

1. A float switch assembly shall provide on/off control of the pump as well as operate a high/low level alarm. It shall consist of four (4)

polyurethane 44 mercury switch floats mounted on a PVC stem attached to the effluent screen. The floats must be adjustable without removing the screened pump vault. The high/low alarm functions shall be preset as shown on the drawings. Each float shall be secured with a nylon strain relief bushing.

2. Mercury switch floats shall be UL or CSA-listed and shall be rated 13 A at 120V.
3. All wiring shall be assembled and individually insulated and made Watertight using a UL-listed submersible heat shrink.
4. All hardware to be corrosion resistant.

F. EFFLUENT PUMP CONTROL SYSTEM

1. General: Provide an integrated UL-listed control/level system for each STEP tank.

Control/level system will include a control panel, a float switch level sensor assembly, junction box, and appurtenances. Control panel shall be fully assembled at the factory and contain sufficient underground feeder cable for each installation. Control system shall be as manufactured by Orence Systems, Inc., or equal.

2. Control panel shall be field repairable without the use of soldering irons or substantial disassembly.
3. Control panels shall meet the following requirements at a minimum:
 - a) **Redundant-Off Relay**: 115V, automatic, single pole.
 - b) **Audible Alarm**: Panel mount with a minimum of 80 db sound pressure at 24 inches as a warble tone.
 - c) **Visual Alarm**: NEMA 4, 7/8 inch diameter, oil-tight, with push-to-silence feature.
 - d) **Audio-Alarm Reset Relay**: 115V, automatic, with DIN rail mount socket base.
 - e) **Toggle Switch**: Single-pole, double-throw three (3)

positions. Manual (MAN), (Off), and Automatic (AUTO).

- f) **Fuse Disconnect:** DIN rail mount socket base with 5 amp, 10,000 AIC fuses.
- g) **Pump Circuit Breaker:** Rate for 20 amps, OFF/ON switch, DIN rail mounting with thermal magnetic tripping Characteristics.
- h) **Enclosure:** NEMA 4X, stainless steel with stainless steel or non-metallic hinges, stainless steel screws and padlockable latch. 10" high x 8" wide x 5 1/8" deep (minimum).
- i) **Alarm Circuit:** Wires separately from the pump circuit so that, if the pump internal overload switch or pump circuit breaker is tripped, the alarm system remains functional.
- j) **Motor Start Contactor:** 115 VAC: 14 FLA, _ HP, 60 Hz; 230 VAC: 14 FLA, 2 HP, 60 Hz.
- k) **Elapsed Time Meter:** 115 VAC, 7-digit, nonresettable.
- l) **Pump Run Light:** 7/8" green lens. NEMA 4, 1-watt bulb, 115 VAC.
- m) Provide with padlockable, 20 amp, horsepower rated disconnect.

G. INSTALLATION

Install pumps, wiring, and controls in accordance with state and local electrical codes and manufacturer's instructions. Wiring to be underground in approved PVC conduit.

The pump control panel shall be located on the side of the house or building nearest the tank and pump, within 50 feet, and within sight of the pump.

DRIP IRRIGATION EQUIPMENT

A. MANUFACTURERS AND SUBMITTALS

Manufacturers – Drip irrigation piping shall be as manufactured by Netafirm Irrigation, Inc or approved equal.

B. DRIP-IRRIGATION PIPING

1. Drip-irrigation piping shall be " polyethylene tubing with Pressure compensating, self-cleaning emitters located on two-foot centers. Emitter shall have a constant flow rate less than 0.61 gph regardless of system pressure between 10 psi and 60 psi and shall be resistant to plant root intrusion.
2. Piping for drip-irrigation shall be "Bioline" as manufactured by Netafirm Irrigation, Inc., or approved equal.

C. SUPPLY AND FLUSHING MANIFOLD PIPING

1. Piping used for supply line, supply manifold, and flushing manifold shall be constructed of minimum Schedule 40 PVC.
2. Fittings for piping including unions, tees, and bends shall be constructed of minimum Schedule 40 PVC.
3. Pipe shall be light purple in color.

D. GATE VALVES

Gate valves up to 2" shall be constructed of HI-IMPACT PVC, Schedule 80. Valves shall be non-rising stem suitable for 150 psi working pressure. Gate valves shall be as manufactured by King Brothers Industries or approved equal.

E. BALL VALVES

Ball valves up to 2" shall be constructed of HI-IMPACT PVC, Schedule 80. Valves shall be of low-torque design and suitable for 150 psi working pressure. Ball valves shall be as manufactured by King Brothers Industries, Inc., or approved equal.

F. CHECK VALVES

Check valves up to 2" shall be constructed of HI-IMPACT PVC, Schedule 40 and be of swing type design. Check valves shall be as manufactured by King Brothers, Inc. or approved equal.

G. AIR RELEASE AND AIR/VACUUM VALVES

Air release and air/vacuum valves shall be of fiberglass construction suitable for 150 psi working pressure. Resilient automatic valve seal shall provide smooth positive opening, closing, and leak free sealing over a wide range of pressure differentials. Air release and air/vacuum valves shall be as manufactured by Bermad or approved equal.

H. AUTOMATIC DISTRIBUTING VALVES

Automatic distributing valve shall be hydraulically operated and rotate on a cam system. Valve shall be constructed of high-strength non-corrosive ABS polymer and stainless steel. Assembly provided by manufacturer shall include valve, a clear section of pipe for each lateral, a ball valve, and all necessary elbows, unions, and couplings. Valve shall be Hydrotek as manufactured by Orenco Systems, Inc. or approved equal.

I. PRESSURE REGULATING VALVE

Pressure regulating valve to be surge resistant, constructed of high impact thermoplastics and maintain a constant outlet pressure to + or - 6% of design.

J. VALVE BOXES

Valve boxes for buried service shall be 18" x 14" plastic meter box sections. Valve box lids shall be constructed of plastic with a non-skid finish and labeled "**Sewer**". A 2_ inch diameter steel reflector with dichromate coating shall be applied to the underside of the plastic cover for electronic detection. Box shall be as manufactured by Dallas Specialty & Mfg. Co., Model DS 1200-S.

K. DISK FILTERS

Disk filters shall consist of flat, grooved polypropylene rings with a center hole, stacked to form a cylindrical filter element. Rings shall be filter to 115 microns. Filter shall be rated at a minimum of 140psi working pressure and 50 psi backwash pressure. Filter housing to be constructed of reinforced polyamide and include drive valve at bottom. Disk filters shall be "2" Arkal Filter Super" as manufactured by Netafirm Irrigation, Inc. or approved equal.

L. PRESSURE GAUGES AND TRANSMITTERS

1. Pressure gauges shall be minimum 2" diameter oil-filled, 0 – 100 psi drawn steel dial gauge with " male NPT bottom inlet and bronze ball valve shut-off.
2. A pressure transmitter shall be installed to signal pressure to the control panel so that monitoring of disk filter performance can be accomplished. Transmitter shall be as manufactured by Viatran Corp. or approved equal and be rated for 0 – 100 psi operating range.

M. INSTALLATION

1. Install drip-irrigation piping at a depth of 8" to 10" below the ground surface unless shown otherwise on the plans.
2. Spacing of drip-irrigation to be two feet on centers, or greater.
3. Emitter may be installed at any direction in the trench.
4. Connect emitter piping to manifold per manufacturer's instructions.
5. Provide extensions to valve boxes as required for bury. Place 2" of gravel in bottom of box around valve to prevent valve from being covered with soil.
6. Tubing shall be laid on contour.

7. Blank tubing (no emitters) may be required to bypass obstacles.

DISPOSAL AREA

The disposal area shall be clearly marked and protected from other construction activities. Use of the area for activities such as ingress or egress, or storage of materials may invalidate the site for use as a disposal area.

Site should be mowed and cleared of brush and small trees that are not part of the landscaping plan. Clearing is to be accomplished with minimal digging or grubbing. Large trees, boulders or other obstacles should be bypassed and left as part of the landscape.

No work shall be done in the disposal area when the soil is wet enough to easily compact or smear.

BACK-UP GENERATORS

GENERATOR

An engine-driven, natural gas fired, generator set shall be provided for the pumping to provide continuous electrical service during interruption of normal power in accordance with ISO 3046/1, DIN6271, BS 5514, AS2789, and ISO 8528. The generator set and components shall be designed and manufactured in accordance with ISO 9001. In addition, the generator set and components shall meet or exceed the following specifications: AS1359, AS2789, ABGSM TM3, BS4999, DIN6271, DIN6280, EGSA101P, JEM1359, IEC 34/1, ISO 3046/1, ISO DIS8528, and NEMA MG1-22. The Generators shall be suitably sized to properly start and run the remote pump stations and the recirculating sand filter in their normal operating sequences. The generator set shall be those that are manufactured by Generac Power Systems, Inc. or equivalent. It shall be liquid cooled, and shall be equipped as follows:

- 1) Pad mounted, weather resistant housing for outdoor location meeting NEMA 1, IP 22
- 2) Natural gas fired fuel system for 2 psi gas supply, liquid propane fired, diesel fired.
- 3) Unit mounted radiator
- 4) Shutoffs with indicators for: low pressure, high coolant temperature, overspeed, overcrank, and emergency stop pushbutton
- 5) Space heater
- 6) Critical silencer, mounted
- 7) Oil drain extension to the side of the base
- 8) Skid dress and caps
- 9) Battery rack within the generator housing
- 10) Battery cables
- 11) 24 volt starting battery

- 12) 24 volt trickle charger installed within generator housing
- 13) Electric governor
- 14) Line circuit breaker
- 15) Vibration isolators
- 16) Voltage regulation, 1% standard
- 17) Automatic Transfer Switch
- 18) Over-voltage protection
- 19) Unit-mounted engine/generator Electro-Mechanical Control Panel (EMCP) for automatic operation with the following:
 - a) AC ammeter
 - b) AC voltmeter
 - c) AC frequency meter
 - d) Phase selector switch
 - e) Engine oil pressure gauge
 - f) Engine water temperature
 - g) Running time meter
 - h) Engine control switch for Auto, Start/Run, Off/Reset, Stop
 - i) Lamp display
 - j) Voltage adjusting rheostat
- 20) Anti-freeze
- 21) Engine lube oil
- 22) After cooler, air cleaner, and crankcase breather

Conductors that connect to the individual panels shall be color-coded.

Generator set and components shall be factory designed, certified Prototype with torsional analysis, production tested with manufacturers warranty for not less than two (2) years from startup and operation or 30 months from date of delivery.

Manufacturer shall furnish detailed specifications and drawings of the unit for the AUTHORITY's approval prior to shipping.

ULTRA VIOLET EQUIPMENT BUILDING

A. SIZE

The building shall be of sufficient size to house the ultra violet equipment, disk filters, piping, and all electric panels. It shall be no smaller than 140 square feet.

B. ROOF

The roof shall be a gable-type with an overhang. The pitch shall be a minimum of 4:12. The roofing material shall be thirty (30) year dimensional shingles or twenty-six (26) gauge or heavier metal roofing. Metal roofing should have a minimum twenty-five(25) year warranty against fading.

Gable end walls and eaves shall be covered with vinyl siding.

C. EXTERIOR

The building shall be constructed of concrete block with brick venire or split faced hollow core masonry block. The AUTHORITY must approve other siding materials.

D. FLOOR

The floor shall be concrete and have a floor drain.

F. DOORS, WINDOWS, AND HARDWARE

Exterior doors and frames shall be constructed of 16 gauge steel.

G. ELECTRICAL

Indoor lighting shall be overhead fluorescent.

Outside lighting above the door shall be a photocell that is motion activated.

A ceiling mounted heater with a thermostat shall be provided.
A ceiling mounted fan for ventilation is to be provided.

Provide four (4) extra electrical plug-ins. Three (3) inside building and one (1) on the exterior wall.

All wiring to be done by a licensed electrician.

Provide additional exterior lighting as directed by the AUTHORITY.

H. WATER

Provide frost proof hydrants near the ultra violet building and the sand filter. These hydrants shall be connected to a potable water source.