

**VIRGINIA DEPARTMENT OF HEALTH  
ENGINEERING DESCRIPTION SHEET  
WATER**

**DATE:** November 7, 2006

**CERTIFIED CLASS:** IV

**WATERWORKS NAME:** The Retreat Waterworks

**COUNTY / CITY:** Franklin County

**LOCATION:** Located off Ivy Lane (SR 1440), approximately 0.7 miles north of the intersection of Ivy Lane and Rock Cliff Road (SR 938).

**OWNER:** Plyler Development, Inc.  
13709 Booker T. Washington Highway  
Moneta, VA 24121

**OPERATOR:** Petrus Environmental Services

**PERMIT NUMBER:** 5067786

**DATE OF ISSUE:** November 7, 2006

**TYPE OF TREATMENT:** Iron and Manganese Removal

**SOURCE:** Three Drilled Wells

**DESIGN CAPACITY:** 74,800 gpd

**DESCRIPTION OF SYSTEM:**

The Retreat water system supplies potable water to 125 single family lots in The Retreat and The Coves subdivisions. The combined service area will consist of 75 lots in the Retreat subdivision and 50 lots in the Coves subdivision. The waterworks consists of three drilled wells, iron and manganese removal treatment system, Booster pumps with high pressure zone, a 2,500 gallon hydropneumatic storage tank, a 0.076-MG atmospheric-type storage tank and distribution system that includes 8-inch and 6-inch waterlines with associated appurtenances.

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**Well No. 1:** This Class IIB well is located at the intersection of Ivy Lane and Veranda Drive associated with The Retreat development. The well was drilled on March 29, 2002 to a total depth of 500 feet and is cased and pressure grouted to a depth of 95 feet. The well is provided with 6-inch steel casing. During the yield and drawdown test performed during June 2002 simultaneously with well No. 3, the well yielded 8.5 gpm at a drawdown depth of 351 feet. A submersible well pump is provided in the well capable of delivering 8 gpm @ 460 feet TDH. The well is provided with a 6 ft X 6 ft X 6 in concrete pad with 4-inch floor drain. A pitless adapter and well cap with vent and drawdown gauge is provided. Water is pumped from the well to the treatment building where the independent 2-inch diameter line is provided with a check valve, water meter, sample tap, pressure gauge, screened blowoff, and isolation valve, prior to combining with the well discharge line from wells No. 2 and No. 3 where the combined raw water is treated and then enters the atmospheric storage tank. HOA switches are provided for control of the well pump. Water level electrodes in the 0.076-MG storage tank control the activation of the well pump.

**Well No. 2:** This Class IIB well is located within the Retreat development on the east side of Stillwater Drive approximately 300 feet south of the intersection of Stillwater Drive and Pinnacle Point Circle. The well was drilled on April 10, 2002 to a total depth of 400 feet and is cased and pressure grouted to a depth of 70 feet. The well is provided with 6-inch steel casing. During the yield and drawdown test performed during June 2002, the well yielded 38 gpm at a drawdown depth of 100 feet. A submersible well pump is provided in the well capable of delivering 38 gpm @ 253 feet TDH. The well is provided with a 6 ft X 6 ft X 6 in concrete pad with 4-inch floor drain. A pitless adapter and well cap with vent and drawdown gauge is provided. Water is pumped from the well to a "doghouse" type building where the independent 3-inch diameter line is provided with a check valve, water meter, sample tap, pressure gauge, screened blowoff, and isolation valve, prior to combining with well No. 3. The combined water from wells No. 2 and No. 3 then enter the treatment building where the raw water from Wells No. 1, No. 2 and No. 3 are combined and treated before entering the atmospheric storage tank. HOA switches are provided for control of the well pump. Water level electrodes in the 0.076-MG storage tank control the activation of the well pump.

**Well No. 3:** This Class IIB well is located within the Retreat development at the intersection of Pinnacle Point Circle and Tranquility Bay Drive. The well was drilled on April 15, 2002 to a total depth of 325 feet and is cased and pressure grouted to a depth of 68 feet. The well is provided with 6-inch steel casing. During the yield and drawdown test performed with well No. 1 during June 2002, the well yielded 47 gpm at a drawdown depth of 196 feet. A submersible well pump is provided in the well capable of delivering 38 gpm @ 370 feet TDH. The well is provided with a 6 ft X 6 ft X 6 in concrete pad with 4-inch floor drain and 36-inch diameter pipe section enclosure. Water is pumped from the well to a "doghouse" type building where the independent 3-inch diameter line is provided with a check valve, water meter, sample tap, pressure gauge, screened blowoff, and isolation valve, prior to combining with well No. 2. The combined water from wells No. 2 and No. 3 then enter the treatment building where the raw water from Wells No. 1, No. 2 and No. 3 are combined and treated before entering the atmospheric storage tank. HOA switches are provided for control of the well pump. Water level electrodes in the 0.076-MG storage tank control the activation of the well pump.

**Iron and Manganese Removal:** The treatment system is located adjacent to well No. 1 and the 0.076 MG storage tank at the intersection of Ivy Lane and Veranda Drive associated with The Retreat development. Raw water is combined from each well within the treatment building and is delivered to the 0.076-MG storage tank after treatment. The design includes pretreatment chemical addition of potassium permanganate and sodium hypochlorite solutions by chemical feed pumps with associated solution tanks. The sodium hypochlorite, and potassium permanganate dosing pumps have capacities of 12 gpd and 5 gpd respectively, and are added from separate 35, and 15 gallon solution tanks respectively. The chemical feed pumps are activated simultaneously with the well pumps. The chemically treated water is delivered directly to the two 42-inch diameter manganese greensand pressure filters. Appurtenances for each filter includes sample taps at the points between the anthracite, the manganese treated greensand, and the midpoint of the manganese greensand; pressure gauge at each inlet/outlet line flow; water meter on each inlet line; ball valves; and air release valves on top of each filter, and two 11 in x 15 in manways per filter. The normal filtration rate is 3 gpm/ft<sup>2</sup> for a total capacity of 58 gpm. Each filter is backwashed from the 0.076 MG storage tank based on its water level. The backwash supply line is provided with a water meter and appropriate valving. The backwash rate design is 100 gpm for approximately 10.4 gpm/ft<sup>2</sup> rate. Additional sample taps are provided on the combined well discharge line, after addition of sodium hypochlorite, the treated line after all chemical addition prior to filtration, the finished water line prior to atmospheric storage tank and on the backwash line from the atmospheric storage tank. Each chemical feed is provided with static mixer at the point of chemical injection. Air release valves are provided on waterlines at all high points within the treatment building. The backwash waste is directed outside the treatment building to a septic tank/on-site disposal drainfield system. A laboratory sink and bench is provided, as well as test equipment for pH, chlorine residual, and iron and manganese analysis. The treatment building is provided with heating, lighting, and ventilation. A heat pump is provided for the building.

**0.076-MG Storage Tank:** The atmospheric-type tank is located adjacent to the treatment building. The base of the tank is at elevation 906.5 feet with an overflow elevation of 961.8 feet. The tank has a diameter of 15 feet 4 inches. Appurtenances for the tank includes a screened vent, roof access hatch, 4-inch diameter overflow, 6-inch diameter drain with valve, 3-inch diameter inlet rising to the top of the tank, separate 8-inch diameter outlet line, water level indicator and access ladder (cut off at 10 feet from the base of the tank with safety climb device and cage).

**Booster Pumps:** Two centrifugal pumps are provided and rated at 158 gpm at 115 feet TDH each and are driven by 5-HP electric motors. The combined capacity of two pumps is 316 gpm at 115 feet TDH. The pumps deliver finished water from the atmospheric-type storage tank to the hydropneumatic tank and distribution system. The booster pumps have the following appurtenances: compound gauges on pump suction lines, pressure gauges and check valves on pump discharge lines and gate valves and sample taps on pump suction and discharge lines.

**Hydropneumatic Storage Tank:** The hydropneumatic tank is a 2,500-gallon tank fitted with a site glass, pressure gauge, a vacuum relief and pressure relief valves provided with automatic/manual air volume control, 11"x15" access manhole, air blow-off, protected tank drain and tank by-pass line. The normal operating range is 30 to 50 psi, with the second pump engaging at 25 psi.

**Distribution System:** The distribution system consists of approximately 5,980 linear feet of 8-inch waterlines, 2,600 linear feet of 6-inch waterlines and 1,650 linear feet of 4-inch waterlines with associated appurtenances.

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**Design Basis:** Based on 2003 Commonwealth of Virginia *Waterworks Regulations*.  
One Equivalent Residential Connection (ERC) = water usage of 400 gpd

**Source Capacity:**

Well No. (Yield Rate gpm)	Well Yield (gpm÷0.5gpm/ERCx400gpd/ERC) gpm gpd		Pump Capacity - gpd (gpm x 1440 min/day)	Effective Capacity gpd
1 (8.5)	8.5	6,800	8 gpm 11,520	6,800
2 (38)	38	30,400	38 gpm 54,720	30,400
3 (47)	47	37,600	38 gpm 54,720	37,600
<b>TOTAL</b>	93.5	74,800	84 gpm 120,960	74,800

$$74,800 \text{ gpd} \div 400 \text{ gpd/ERC} = 187 \text{ ERCs}$$

**Treatment Capacity:** Two 42-inch diameter filters @ 3 gpm/ft<sup>2</sup>

Each filter has 9.6 ft<sup>2</sup> of filter area

$$2 \text{ filters} \times 9.62 \text{ ft}^2 \times 3 \text{ gpm/ft}^2 = 58 \text{ gpm}$$

$$58 \text{ gpm} \times (1440 \text{ min/day} - 25 \text{ min/day for backwash}) = 82,070 \text{ gpd produced}$$

$$\text{Daily backwash losses } (115 \text{ gpm} \times 15 \text{ min}) + (29 \text{ gpm} \times 10 \text{ min}) = 2,015 \text{ gpd}$$

$$\text{Effective Treatment Production: } 82,070 \text{ gpd} - 2,015 \text{ gpd} = 80,055 \text{ gpd}$$

$$80,055 \text{ gpd} \div 400 \text{ gpd/ERC} = 200 \text{ ERCs}$$

**Booster Pumps:**

Booster Pumps rated at 158 gpm each

Estimated Combined Capacity of 316 gpm

**Maximum hour domestic demand flow:**  $Q = 11.4N^{0.544}$  N = 125 ERCs

$$Q = 157.6 \text{ gpm (each pump)}$$

$$250 \text{ ERCs} \times 400 \text{ gal/ERC} = 100,000 \text{ gpd}$$