

VIRGINIA DEPARTMENT OF HEALTH  
ENGINEERING DESCRIPTION SHEET

DATE: March 19, 2007

WATERWORKS NAME: Fork Union Sanitary District

CERTIFIED CLASS: IV

COUNTY/CITY: Fluvanna County

TYPE: Community

LOCATION: Fork Union, Virginia

OWNER: Fork Union Sanitary District

Contact: Mr. ~~John Robins~~ J. Wayne Stephens  
197 Main Street  
P.O. Box 540  
Palmyra, VA 22963  
Phone: 434-591-1925

OPERATOR: Certified Class IV Operator Required

PERMIT NUMBER: 201904; 2065300 Amended

EFFECTIVE DATE: ~~May 6, 2004~~ Dec 3 1968; September 7, 1977, January 31, 1980, June 30, 1982, July 6, 1984, April 18, 1993, September 7, 1998, March 19, 2007

TYPE OF TREATMENT: Iron and manganese removal, phosphate feed and chlorination for Morris and Omohundro wells. Phosphate feed at Melton Well, Phosphate feed and soda ash at West Bottom and Owens Well. No treatment at the Bremono well.

SOURCE: Six Drilled Wells

DESIGN CAPACITY: 419,520 gpd

DESCRIPTION OF THE WATERWORKS

This waterworks consists of six drilled wells; each individually and manually operated which discharge into a common, un-looped, distribution system. The system is pressurized by the continuous pumping of selected wells and the buffering effect of the two elevated storage tanks riding on the system.

**Bremno Well:** The Bremno well is located on State Route 657 approximately 0.2 mile southeast of the intersection of State Route 657 and U.S. Route 15 near Bremno Bluff. The well is 12 inches in diameter to a depth of 84 feet and 6 inches in diameter from a depth of 84 feet to 450 feet, its total depth. It is cased and grouted to a depth of 84 feet with 6-inch casing and cement grout. The well casing terminates 12 inches above a 6-foot by 7-foot by 6-inch concrete pad and is provided with a sanitary seal, screened vent, and pressure gauge. A sample tap is provided on the well discharge line. Water is

pumped from the well by a 5 hp submersible pump which delivers 32 gpm against system pressure into the distribution system, with excess going to the elevated storage tanks. The well pump controls and exposed piping are enclosed in a 10-foot by 10-foot concrete block pump house equipped with a concrete floor, 4-inch floor drain, electric heater, and ventilation fan. Total water production is metered. The reported yield from the well is 30 gpm after a 48-hour yield and drawdown test. No treatment is provided.

**Omohundro Well:** The Omohundro well is located approximately 50 feet northeast of the 150,000 gallon elevated storage tank along Route 6 near State Route 671 west of Fork Union. The well is 12 inches in diameter from 0 to 77 feet and 8 inches in diameter from 77 to 305 feet, the total depth of the well. The well is cased with 8-inch casing and cement grouted to a depth of 77 feet. The 8-inch casing extends 12 inches above a 6-foot by 6-foot by 6-inch thick concrete pad and is equipped with a pitless adapter assembly, sanitary well seal, casing vent, and ¼ inch plastic air hose to monitor static water level. The well is equipped with a 25 hp submersible pump, which delivers 82 gpm through the treatment facility, and into the adjacent elevated storage tank. The yield of the well was determined to be 250 gpm based on a 48-hour pump test. A meter to measure total water production is located on the well discharge line. Treatment consists of iron and manganese treatment and phosphate corrosion inhibitor feed.

**Omohundro Well Iron and Manganese Treatment:** The Omohundro Well treatment facility consists of a manganese greensand unit process for removal of iron and manganese. Chemical feed equipment includes three flow-proportioned chemical feed systems injecting sodium hypochlorite for disinfection, caustic soda for pH adjustment, and potassium permanganate for continuous filter media regeneration into the raw water from the Omohundro well. A fourth chemical feed system injects a blended phosphate for corrosion control into the filter effluent. Following sodium hypochlorite, caustic, and potassium permanganate addition, the water flows into a 5,000-gallon pressure tank, providing 20 minutes of detention time to allow for iron and manganese oxidation and a limited amount of settling to occur. From this detention step, the flow passes through dual 71 gallon per minute, 66-inch diameter (3 gpm/ft<sup>2</sup> filtration rate) pressure filters containing a 30-inch layer of 0.32 mm manganese greensand underlying an 8-inch layer of 0.44 mm anthracite coal. Each filter is equipped with a sample tap, 71 gpm maximum flow control valve, pressure gauge, air release valve, access manhole, and backwash control valves. Following filtration, treated water flows into the adjacent 150,000 gallon elevated storage tank and into the distribution system. A solution metering pump with a maximum capacity of 6 gpd injects a blended phosphate for corrosion control into the filter effluent prior to distribution. Total water production is metered.

Filter backwash is accomplished manually and controlled by head loss through the pressure filters. Backwash water is obtained from the 150,000 elevated storage tank. Backwash wastewater and detention tank blowoff wastewater is discharged into dual 40-foot by 30-foot wide by 6-foot deep waste settling basins with 6-inch influent and effluent lines. The settling basins are designed to provide approximately 7.0 days total detention time and can be operated in series or parallel.

**Morris Well:** The Morris well is located approximately 500 feet off the west side of State Route 651, ¾ mile north of its intersection with State Route 6. The well is 10 inches in diameter from 0 to 68 feet

and 8 inches in diameter from 68 to 505 feet, the total depth of the well. The well is cased with 8-inch casing to a depth of 68 feet and cement grouted to the same depth. The 8-inch casing extends 18 inches above a 6-foot by 8-foot by 6-inch concrete pad with a 4-inch floor drain. The well casing is provided with a sanitary seal, screened vent and a plastic airline to monitor the water level. The well is equipped with a 20 hp submersible pump discharging 143 gpm at system pressure. The well discharge line is equipped with a sample tap, screened vacuum breaker, pressure gauge, pressure relief valve, check valve, flow meter, blowoff and a gate valve. Water is pumped directly into the distribution system. The equipment is housed in an insulated fiberglass enclosure and the pipe fittings are heat-taped to prevent freezing. The yield of the well was determined to be 210 gpm based on a 48-hour pump test. Treatment consists of iron and manganese treatment and a blended phosphate corrosion inhibitor feed system.

**Morris Well Iron and Manganese Treatment:** The Morris Well treatment facility consists of a manganese greensand unit process for removal of iron and manganese. The manganese greensand unit process consists of dual pressure filters each measuring 72 inches in diameter by 98 inches high. Filter media consists of an 18-inch layer of anthracite and an 18-inch layer of manganese greensand with a graded gravel underdrain system. The system design capacity is equal to 164 gpm based upon a total filtration area of 56.54 ft<sup>2</sup> and a filtration rate of 2.9 gpm/ft<sup>2</sup>. Backwash is accomplished by an air/water wash with a hydraulic wash rate of 15 gpm/ft<sup>2</sup>. The backwash pump draws water from a 28,200-gallon aluminum backwash storage tank and delivers 425 gpm at 60 feet TDH. The unit process is operated in the continuous regeneration (CR) mode with continuous potassium permanganate feed paced off of the raw water flow meter.

Chemical feed equipment includes three chemical feed systems injecting sodium hypochlorite, potassium permanganate, and a blended phosphate. Chlorine feed equipment consists of a solution metering pump with maximum capacity of 3.0 gph or 72 gallons per day. The chlorine injection point is into the well discharge prior to a 1000-gallon pre-settling tank. Potassium permanganate is fed following the pre-settling tank and prior to the manganese greensand filters by a solution metering pump with maximum capacity of 3.0 gph or 72 gallons per day. The potassium permanganate feed pump is paced off of raw water flow. A blended phosphate (for corrosion control) is injected into the filter effluent prior to distribution by a solution metering pump with a maximum capacity of 6 gpd.

Finished water is pumped from the treatment plant by dual, horizontal split case, centrifugal pumps each rated at 165 gpm at 70 feet TDH. The system pumps are designed to operate in series with the existing Morris well pump to deliver water to the elevated storage tank operating elevation of 528 feet.

**West Bottom Well:** The West Bottom Well is located on the north side of State Route 656 between State Route 642 and State Route 655 approximately 2 miles east of Brems Bluff. The well is 8 inches in diameter from 0 to 80 feet and 6 inches in diameter from 80 to 305 feet, the total depth of the well. The well is cased with 6-inch casing to a depth of 80 feet and cement grouted to the same depth. The 6-inch casing extends 18 inches above a 6-foot by 8-foot by 6-inch concrete pad equipped with a 4-inch floor drain. The well casing is provided with a sanitary seal, screened vent and a plastic airline to

pad equipped with a 4-inch floor drain. The well casing is provided with a sanitary seal, screened vent and a plastic airline to determine the water level. The well is equipped with a 5 hp submersible pump that delivers 39 gpm against system pressure. The well discharge line is equipped with a sample tap, screened vacuum breaker, pressure gauge, pressure relief valve, check valve, flow meter, blowoff and a gate valve. Water is pumped directly to the distribution system. The yield of the well was determined to be 36 gpm based on a 48-hour pump test. Treatment consists of soda ash and blended phosphate injection for corrosion control. Soda ash is fed by a solution metering pump with maximum capacity of 24 gpd. The blended phosphate is fed by a solution metering pump with a maximum capacity of 6 gpd. The well casing and metering pumps are located in a 6-foot by 8-foot by 8-foot tall heated, insulated, wooden building.

**Melton Well:** The Melton Well is located on the east side of U.S. Route 15 less than ½ mile south of State Route 612 near Fork Union. The well is 10 inches in diameter to a depth of 50 feet, 8 ¾ inches in diameter from 50 feet to 52 feet and 6 inches in diameter from 52 feet to 345 feet, the total depth of the well. The well is cased with 6-inch casing and cement grouted to a depth of 53 feet. The casing extends 12 inches above a 6-foot by 8-foot by 6-inch concrete pad equipped with a 4-inch floor drain. The well casing is equipped with a sanitary seal, casing vent, sample tap and totalizing water meter. Water is pumped from the well by means of a 7.5 hp submersible pump capable of delivering 31 gpm at system pressure. Water is transferred into the existing distribution and storage facilities through 1,500 feet of 3-inch PVC water line. The 48-hour yield and drawdown test indicated a yield of 164 gpm. Treatment consists of a blended phosphate feed system for corrosion control. The blended phosphate solution metering pump has a maximum capacity of 6 gpd. The well casing and metering pump are located in a 6-foot by 8-foot by 8-foot tall heated, insulated, wooden building.

**Owens Well:** The Owens well is located on U.S. Route 15 approximately 1 mile south of Fork Union at the south end of a strip mall. The well is owned by Mr. E. W. Owens who leases the well to the Fork Union Sanitary District with an open-end contract. It was drilled in 1963 to a total depth of 180 feet with 50 feet of 6-inch casing and grouting, and is equipped with a 5 hp submersible pump that delivers 33 gpm against system pressure. The casing terminates 12 inches above a concrete slab floor and is provided with a sanitary seal, screened vent and a 2-inch meter. The well discharges directly into the system main. Treatment consists of soda ash and blended phosphate feed systems for corrosion control. Soda ash feed consists of a solution metering pump with maximum capacity of 24 gpd. The blended phosphate feed consists of a solution metering pump with a maximum capacity of 6 gpd. The well casing and metering pumps are located in a 6-foot by 8-foot by 8-foot tall heated, insulated, wooden building. No 48-hour yield test results are available however historical water production has demonstrated a reliable yield of 36,000 gpd.

#### **Storage Facilities:**

The Omohundro elevated water storage tank is located adjacent to the Omohundro well and treatment building. The elevated tank is 32 feet in diameter, of welded steel, double ellipsoidal construction with a 24-inch diameter wet riser, and provides 150,000 gallons of effective storage capacity. The tank is equipped with a 12-inch inlet pipe, 12-inch outlet pipe, external tower

ladder with safety system, a 24-inch external balcony with 42-inch handrail, an internal ladder, a 24-inch square shoebox type roof hatch, 6-inch diameter overflow pipe, screened roof vent and a 6-inch drain line. The tank overflow elevation is 584 feet. The normal high water level is 583 feet is regulated by an altitude valve.

The Route 15 elevated water storage tank is located on the southeast side of Route 15 just south of Fork Union. The elevated tank is 36 feet in diameter, of welded steel, double ellipsoidal construction with a 24-inch diameter wet riser, and provides 200,000 gallons of effective storage capacity. The tank is equipped with a 12-inch inlet pipe, 12-inch outlet pipe, external tower ladder with safety system, a 24-inch external balcony with 42-inch handrail, an internal ladder, a 24-inch square shoebox type roof hatch, 6-inch diameter overflow pipe, screened roof vent and a 6-inch drain line. The tank overflow elevation is 584 feet. The normal high water level is 583 feet regulated by an altitude valve.

### CAPACITY EVALUATION OF THE WATERWORKS

Design Basis: per *Waterworks Regulations* definitions for Equivalent Residential Connection (ERC):

- One ERC = 400 gpd (consumption)
- One ERC = 200 gallons (storage)
- One ERC requires 0.5 gpm (production)

1. Estimated Water Demand: Demonstrated high average daily demand is 165,702 gpd.

2. Source Capacity:

Well	Well Yield, gpd = gpd/(0.5 gpm/ERC)*400 gpd/ERC		Well Pump <sup>1</sup> , gpd = gpm*1,440 min/day		Limiting Capacity, gpd
	gpm	gpd	gpm	gpd	
Bremo	30 gpm	24,000 gpd	32 gpm	46,080 gpd	24,000 gpd
Omohundro	250 gpm	200,000 gpd	82 gpm	118,080 gpd	118,080 gpd
Morris	210 gpm	168,000 gpd	143 gpm	205,920 gpd	168,000 gpd
West Bottom	36 gpm	28,800 gpd	39 gpm	56,160 gpd	28,800 gpd
Melton	164 gpm	131,200 gpd	31 gpm	44,640 gpd	44,640 gpd
Owens	-----	36,000 gpd <sup>2</sup>	33 gpm	47,520 gpd	36,000 gpd
Total					419,520 gpd

<sup>1</sup> Well pump capacities are given against the buffered system pressure when the tanks are filled to the normal high water level of 583 feet. These pump capacities were determined empirically.

<sup>2</sup> No well yield information is available for the Owens well. Historical water production has indicated a reliable yield of 36,000 gpd. Previous operation permits have credited the Owens Well with a design capacity of 36,000 gpd.

3. Treatment Capacity:

Omohundro Well:

$$47.5 \text{ ft}^2 \text{ of filter area at } 3.0 \text{ gpm/ft}^2 = 142 \text{ gpm}$$
$$142 \text{ gpm} * 1,380^1 \text{ min/day} = 195,960 \text{ gpd}$$

Morris Well:

$$56.5 \text{ ft}^2 \text{ of filter area at } 2.9 \text{ gpm/ft}^2 = 164 \text{ gpm}$$
$$164 \text{ gpm} * 1,410^2 \text{ min/day} = 231,240 \text{ gpd}$$

4. Booster Pump Capacity: Not Applicable

5. Storage Capacity:

$$200,000 \text{ gal} + 150,000 \text{ gal} = 350,000 \text{ gallons}$$
$$350,000 \text{ gal} / 200 \text{ gal/ERC} = 1,750 \text{ ERCs}$$
$$1,750 \text{ ERC} * 400 \text{ gpd/ERC} = 700,000 \text{ gpd}$$

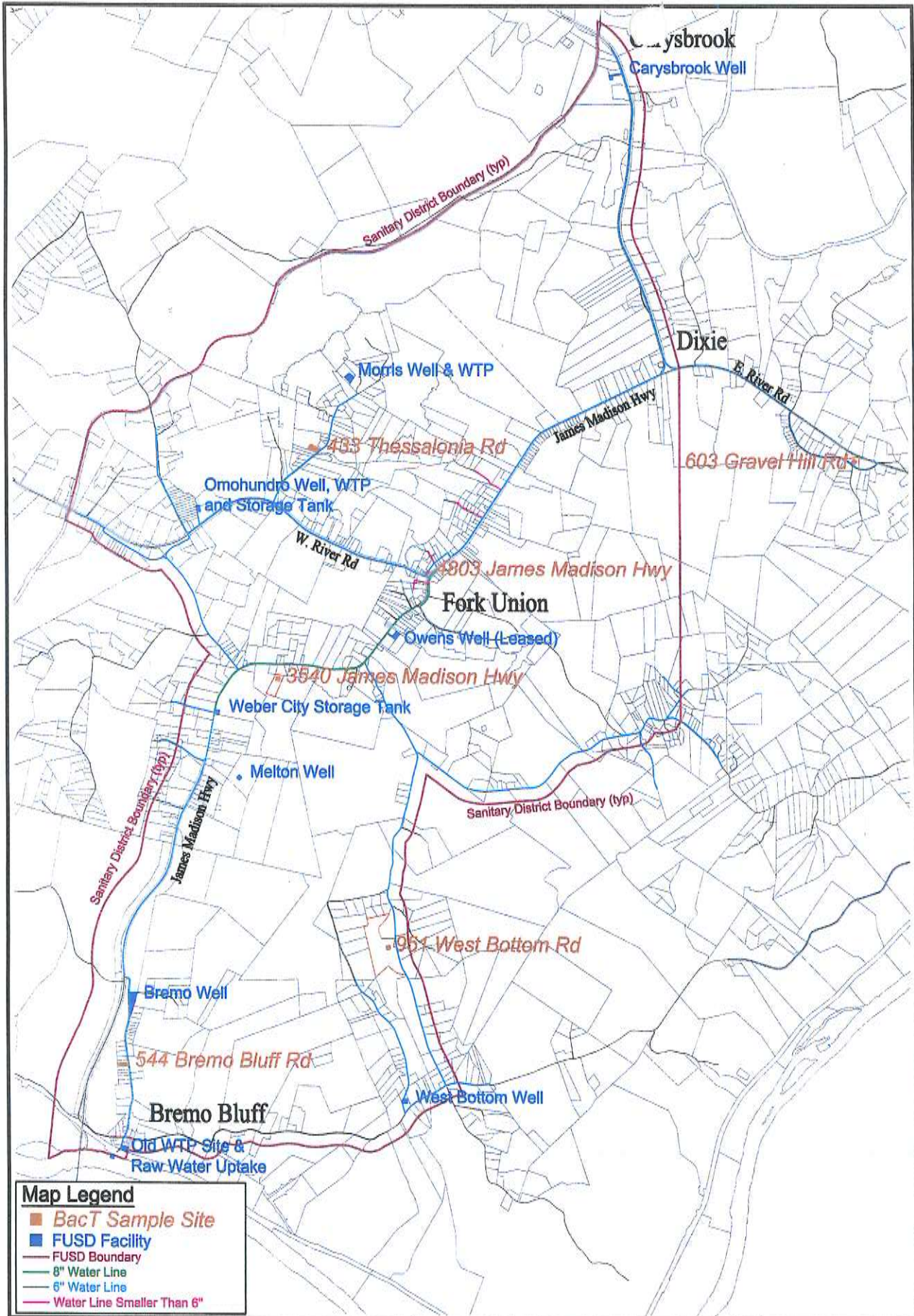
Conclusion: This waterworks is limited to a capacity of 419,520 gpd due to a combination of limited well yield and well pump capacity.

CSC/kl

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<sup>1</sup> This accounts for 60 minutes of backwash per day.

<sup>2</sup> This accounts for 30 minutes of backwash per day.



Fluvanna County Virginia

P.O. Box 540  
 Palmyra, Virginia 22963  
[www.fluvannacounty.org](http://www.fluvannacounty.org)

**Fork Union Sanitary District (FUSD)  
 Water System Map**

Showing Bacteriological Sampling Sites  
 by E911 Address

Proj No:	
Design By:	JWS
Date:	02-16-2016
Scale:	NTS
Sheet No:	1 of 1