BUTLER, FAIRMAN & SEUFERT, INC.

Civil Engineers
8450 Westfield Boulevard, Suite 300 ● Indianapolis, Indiana 46240-8302
317 713-4615 ● FAX 317 713-4616
email: BFS@BFSEngr.com

MEMO ◊ LETTER

TO: Heidi Nassiri, IDEM
FROM: Brian Martin BMartin@bfsengr.com
CC: Colin Dale CDale@bfsengr.com
Dan Gemmecke Battle Ground Conservancy District

DATE: February 4, 2019 **BFS Job No.: 6207/6299**

SUBJECT: Battle Ground Water Tower Modeling Summary

BF&S was tasked to model the Town of Battle Ground's existing water system and to evaluate the removal of the existing 40,000 gallon tank and the addition of a 100,000 – 200,000 gallon elevated storage tank located at the existing wellfield where Well No. 1 and No. 2 are located. Battle Ground Conservancy District, which manages the system, would like to additionally increase the system pressure by 8 to 14 PSI.

This proposed site appears to be suitable for construction of a new tank based on the survey of the site, potential site grading for overflow drainage, access and utility conflicts.

System

The Battle Ground Conservancy serves is comprised of roughly 100,000 feet of water main. The majority of Downtown Battle Ground is served by 4-inch water main and newer construction such as Hawk's Nest and River Bluff subdivision are a minimum diameter of 8-inches.

Diameter (in)	Length (ft)	Volume (gal)	% of Length
4	16,564	10,813	16.6%
6	24,866	36,523	24.9%
8	54,278	141,731	54.3%
12	4,221	24,799	4.2%
All Diameters	99,929	213,867	--

Table 1: Existing Water Main by Diameter

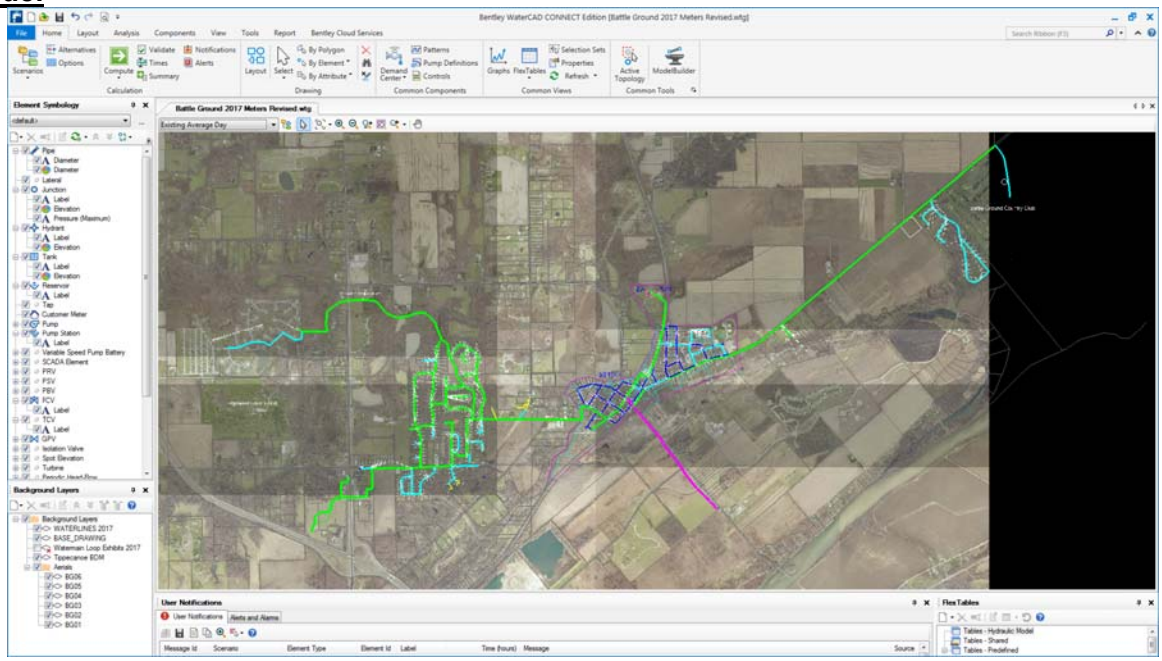
Located in the Town's Historic District, Well No. 1 and Well No. 2 operate in the Lower System and serve as the Historic District's primary source of drinking water. Well No. 1 was developed in 1960 and is located northeast of the Town. It is capable of delivering approximately 406 gallons per minute to the distribution system. Well No. 2 is located 150 feet northwest of Well No. 1 and was developed in 1962. Well No. 2's reported pumping capacity is also 406 gallons per minute.

A Booster Station, located off Prophets Street near the WWTP, pushes flow from Lower System to Upper System. Each pump can contribute approximately 450 - 500 GPM to the Upper System.

Well No. 3 is located near the Upper Tower in the Hawk's Nest subdivision and can withdraw water at a rate of 605 GPM. This well is not always contributing to the system but can be called to run at any time. The Upper Tower is a 75,000 gallon pedesphere style tank constructed by Chicago Bridge and Iron, (Contract # 56502) in 1950.

Construction of the water distribution system within the historic district dates back to the 1920s with 50% of the mains being replaced in the 1960s and over 95% of the water main is made of cast iron. The historic district distribution system contains a 40,000 gallon elevated storage tank that was erected in 1927. Field investigation revealed the existing 40,000 gallon elevated tank was constructed by Chicago Bridge and Iron Company (CB&I) in 1927. The tank is located downtown at the north end of Winans Street.

Model



The model was created using Bentley WaterCAD CONNECT Edition v10.00.00.50. Monthly Operating Reports, Well/Pump Daily Logs and Customer Usage Data were provided. The model was calibrated using estimated daily system patterns adjusted from previous models. Elevations for nodes were imported from GIS data.

Location	Ground Elevation (ft)	Base Elevation (ft)	Max Elevation (ft)
Well No. 1	585.10	--	--
*40,000 Gal. Tower	586.00	677.38	703.25
75,000 Gal. Tower	660.00	750.00	775.50
*Proposed Tower	593.00	703.00	725.50

*Elevations will be based on final design and site conditions.

Table 2: Elevations of Wells and Towers

The highest point of the system is located at Naschette Pkwy/CR 600N and the low spot of the system is located downtown along Jewett St. The elevation of the proposed tower was set above the levels of the existing 40,000 gallon tank to add to the system pressure. The proposed tank would have a base storage elevation of approximately 110 feet above ground to reach the pressures in Table 3.

At this elevation the Downtown Zone would increase by 13 psi and Rivers Bluff would increase by 13 psi as well. The Upper System would not see a large influence by the levels of this tank. Most plumbing codes require water pressure reducing valves on domestic systems where the municipal water main's pressure exceeds 80psi. Higher pressures could rupture pipes and damage fixtures.

Location	Node	Elevation (ft)	Existing Max (psi)	Proposed Max (psi)
River Bluff	J-2	605.83	37	50
Middle School	J-84	602.91	39	52
Jewett St	J-115	563.23	56	69
Naschette Pkwy/CR 600N	J-66	664.00	47	47
McDonald's	J-52	651.35	52	53
Wood's Edge	J-145	644.59	55	57

Table 3: Pressure and Elevations of Key Junctions

Distribution System Limitations

The existing water main distribution system is largely undersized to handle typical fire flows, and upsizing should be considered in the future with a minimum of 6-inch water main size. The size and elevation of the proposed water tower will not significantly impact the performance of the existing distribution piping.

The Town's distribution system was installed in the 1920s and the majority of water main in the historic district is 4-inch diameter. The relatively small size reduces water pressure and can limit fire suppression capabilities. It is recommended that the 4-inch water main be upgraded to 6-inches to improve the distribution system as an overall long-term goal of the system.

Tank Sizing

The American Water Works Association (AWWA) recommends that a water storage facility provide adequate volume for equalization, fire protection, and emergencies. Insurance Services Office (ISO) recommends that a water system be capable of operating at the maximum 24 hour average daily rate plus a fire flow rate for a minimum of one to two hours. The Needed Fire Flow used to determine the noted fire flow rate typically varies based on the size, type, and classifications of the structures located within the boundaries of the water system.

Although an ISO report was not available for review in preparing this document, it is reasonable to base preliminary estimates of the Needed Fire Flow for Battle Ground in the range of 500 to 1,500 gallons per minute. Over a two hour duration, such results in a required volume range of 60,000 to 180,000 gallons. This is the amount of flow that would be delivered over the two hour period. For Battle Ground, this could be accomplished between the capabilities of the proposed

water tower, wellfields with back-up power, and additional capacity provided by the 75,000 gallon tower at the Hawk's Nest neighborhood.

The yearly average system water consumption is about 199,400 gallons. The new tower, combined the existing tower, will provide system elevated storage capacity of 175,000 to 275,000 gallons. Additional capacity is included with the project with the addition of back-up generators at the wells, which will be able to sustain the system further. Currently there are no back-up power facilities installed at the well locations.

Even though the distribution system has limitations, it can still be expected to get sufficient flows and pressures from the new tower from the system hydrants. Battle Ground's hydrants typically deliver somewhere from 500 to 1,000 gallons per minute of flow. The table below describes some of the existing system's capabilities to produce flows for towers of various sizes. It is noted that these numbers are assuming one well pump running and that the capacity will be greater after the back-up power improvements are complete.

Tank Size (Gallons)	Demand for 1 Hour				Demand for 2 Hours			
	+500 gpm	+750 gpm	+1000 gpm	+1500 gpm	+500 gpm	+750 gpm	+1000 gpm	1500 gpm
50,000	Pass	Pass	X	X	Pass	X	X	X
100,000	Pass	Pass	Pass	Pass	Pass	Pass	Pass	X
150,000	Pass	Pass	Pass	Pass	Pass	Pass	Pass	X
200,000	Pass	Pass	Pass	Pass	Pass	Pass	Pass	X
250,000	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Table 4: Storage Fire Capacity

Project Impact and Future Considerations

Construction of a new tower is one step of several that will be taken to increase overall system conveyance and capacity. The proposed water tower project will have a number of impacts on the water main system.

1. Pressure will be increased in the range desired by the Conservancy District, which will have some impact on increasing flow rates.

2. Permanent backup power will be installed at well locations. There is currently no back-up power, and installation of generators will greatly increase flow conveyance capacity during power outages since the well pumps will now automatically be called to run during those periods.

3. The new tower will provide an increase in elevated storage capacity for the distribution system.

4. It is noted that the Battle Ground Conservancy District plans to construct another well at the existing wellfield in the future. This will serve to increase system conveyance capacity.