TECHNICAL MEMORANDUM

DATE: April 30, 2014

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SUBJECT: City of Santa Rosa, Pump Station S9B Evaluation

The purpose of this technical memorandum (TM) is to summarize the hydraulic evaluation results for the new booster pump station (BPS) S9B that will provide emergency supply reliability and operation flexibility for Pressure Zone R9.

BACKGROUND

In February 2014, the City requested that West Yost evaluate whether the City should continue to operate or abandon Reservoir R9C, and to evaluate alternative locations for a new S9B booster pump station in Pressure Zone R9. The hydraulic evaluation for Reservoir R9C was completed and results were documented in a February 26, 2014 Technical Memorandum – City of Santa Rosa, Reservoir R9C Storage Evaluation. The evaluation of the S9B booster pump station location is presented in this technical memorandum.

During a February 2014 meeting, City staff indicated the need for a new booster pump station located in the far western side of Pressure Zone R9 to accommodate future growth in the Farmers Lane Extension area, which is part of the Southeast Plan Study Area. This new BPS, S9B, will provide operation flexibility and emergency supply reliability to Pressure Zone R9 which would be supplied by two existing storage reservoirs (R9A and R9B) and one existing booster pump station (S9). These existing facilities are located on the eastern side of Pressure Zone R9. To serve the future growth in the Farmers Lane Extension area, there is a single 16-inch diameter supply line (approximately 10,500 lineal feet) along Bennett Valley Road and Bethards Road that

1 Based on West Yost evaluation for Reservoir R9C documented in February 26, 2014 Technical Memorandum – City of Santa Rosa, Reservoir R9C Storage Evaluation, Reservoir R9C could be taken out of service.
conveys water from the existing facilities on the eastern side of the system to the Farmers Lane Extension area on the western side of the system.

Based on discussion with City staff, three locations in the Farmers Lane Extension area were evaluated using the City’s hydraulic model under buildout demand conditions to determine the optimum location for this new S9B BPS. These three locations are:

Location 1: West of Woodsage Way, downstream of Reservoir R11;
Location 2: Aston Avenue, southwest of Brookwood Avenue and northeast of Linwood Avenue; and
Location 3: Northeast of Allan Way and southeast of Cooper Drive.

Figure 1 shows these three potential locations for the new S9B BPS.

Details of our hydraulic evaluation and results for each location are described below.

**HYDRAULIC EVALUATION RESULTS UNDER BUILDOUT AVERAGE DAY DEMAND CONDITION**

Four hydraulic simulations were conducted using the hydraulic model under buildout average day demand conditions. These simulations are:

- Base Condition – hydraulic simulation without the new S9B BPS
- Alternative 1 – hydraulic simulation with S9B BPS at Location 1
- Alternative 2 – hydraulic simulation with S9B BPS at Location 2
- Alternative 3 – hydraulic simulation with S9B BPS at Location 3

All hydraulic simulations assumed that Reservoir R9C and Pump Station S9 were offline. Additionally, Reservoirs R9A and R9B levels were 50 percent full.

**Base Condition**

The City’s buildout average day demand condition was simulated using the City’s hydraulic model to establish a base condition. Under this Base Condition, the 16-inch diameter pipeline (approximately 1,805 feet) along Farmers Lane Extension, between Bennett Valley Road to Ashton Avenue, was assumed to be constructed.

Table 1 and Figure 2 present system pressures at selected nodes in Pressure Zones R9 and R11, and in the Aqueduct Pressure Zone (A6).
### Table 1. Summary of System Pressure for Selected Nodes in Aqueduct Zone (A6), R9 and R11

<table>
<thead>
<tr>
<th>ID</th>
<th>Zone</th>
<th>Buildout Average Day Demand Condition</th>
<th>Base Condition (Existing S9 BPS and R9C Reservoir assumed to be offline)⑴</th>
<th>Alternative 1 New S9B BPS ⑴</th>
<th>Alternative 2 New S9B BPS ⑵</th>
<th>Alternative 3 New S9B BPS ⑵</th>
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⑴ Hydraulic results for these selected nodes are discussed in the Technical Memorandum

Hydraulic model was simulated based on the following assumptions:
- At new emergency pump station, only 2 pumps were operating.
- Existing S9 pump station was offline.
- R9C reservoir was offline.

### Critical node in Pressure Zone A6 that is located on Brookwood Avenue and Moldavite Lane
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**Alternative 1**

Under Alternative 1, the new S9B BPS was added to the hydraulic model. This new pump station was configured to convey water from Pressure Zone R11 to Pressure Zone R9. The new S9B pump station was simulated in the hydraulic model at a firm capacity of 3,500 gpm (2 pumps operated) and at 260 feet of total dynamic head (TDH). For Alternative 1, the 16-inch diameter pipeline along Farmers Lane Extension, between Bennett Valley Road to Ashton Avenue, was assumed to be constructed.

Table 1 and Figure 3 present system pressures on selected nodes. As shown on Table 1, the system pressure in Pressure Zone R9, near the discharge side of the new S9B pump station (Junction ID J-R9-50100) is 166 psi. The system pressure in Pressure Zone R11 near the suction side of the new pump station (Junction ID J-R11-12130) is 57 psi. Under this Alternative 1 system configuration, the new S9B pump station withdraws water from Pressure Zone R11 which causes the system pressure near the suction side of the new pump station dropped approximately 12 psi, compared to the system pressures under the Base Condition.

Under buildout average day demand conditions with Station S9 offline, the new S9B pump station with a 3,500 gpm firm capacity could meet the Pressure Zones R9 and R9R demands while filling the Reservoirs R9A and R9B at a flowrate of 1,566 gpm.

**Alternative 2**

The new S9B BPS in Alternative 2 is located on Aston Avenue, northeast of Linwood Avenue. The system configuration of this new pump station will allow water to be pumped from the City’s Aqueduct Pressure Zone (A6) to Pressure Zone R9. The new pump station was configured to simulate two pumps at a total firm capacity of 3,500 gpm and at TDH of 380 feet. Under Alternative 2, there are few new pipelines which need to be constructed. These pipelines still required are:

- New 12-inch diameter pipeline along Farmers Lane Extension (1,805 feet);
- New 16-inch diameter pipeline (730 feet, R9 Pressure Zone) along Allan Way to Alternative 2 pump station location;
- New 16-inch diameter pipeline (465 feet, A6 Pressure Zone) along Allan Way to Alternative 2 pump station location; and
- New 12-inch diameter pipeline (330 feet) along Meda Avenue, from Tokay Street to Sonata Avenue.

Table 1 and Figure 4 present system pressures at selected nodes. As shown on Table 1, the system pressure in Pressure Zone R9, near the discharge side (Junction ID J-R9-50100) of the new pump station is 168 psi. The system pressure in Aqueduct Pressure Zone near the suction side of the new station is 35 psi (Junction ID J-A6-11914). Based on these hydraulic results, system pressures in the Aqueduct Pressure Zone near the suction side of the new pump station under the Alternative 2 system configuration would be approximately 8 psi lower, as compared to the Base Condition.
At Alternative 2 location, the new pump station could meet the Pressure Zone R9 and R9R demands while filling the Reservoirs R9A and R9B at a flowrate of 1,556 gpm.

**Alternative 3**

Under Alternative 3, the new S9B pump station will be located between Allan Way and Copper Drive. The new station was configured to pump water from Pressure Zone R11 to R9. The pump station was configured to simulate a 3,500 gpm (firm capacity) flowrate at a TDH of 290 feet. For the Alternative 3 S9B pump station location, the new 16-inch diameter pipeline along Farmers Lane Extension was assumed to be constructed.

Table 1 and Figure 5 present system pressures at selected nodes. Table 1 indicates system pressure in Pressure Zone R9 near the discharge side (Junction ID J-R9-50100) of the new pump station to be 163 psi. The system pressures within Pressure Zone R11 are all above 40 psi. The system pressures in Pressure Zone R11 under the Alternative 3 pump station location is slightly lower than system pressures under the Alternative 1 location, because the Alternative 3 location would take suction from the Pressure Zone 11 system network, whereas under Alternative 1, the pump station would directly take suction from Reservoir R11 which is located very close to the Alternative 1 location.

Based on these hydraulic results, Alternative 3 provides the City with the flexibility to operate the new S9B pump station and optimize the design of this new S9B. Alternative 3 is located near existing pipelines that serve four different City’s pressure zones, Pressure Zones R9, R9R, R11 and A6 (Aqueduct Pressure Zone). With these existing pipelines in the ground near the Alternative 3 pump station S9B location, the City could design the new S9B pump station to identically match the existing S9 Station. Station S9 has two set of pump stations: 1) one set of pumps to serve R9; and 2) one set of pumps to serve R9R. This new S9B pump station could also be designed with the operational flexibility to either pump water from the Pressure Zone R11 or from the Aqueduct Pressure Zone (A6).

Because the timing of the Farmers Lane Extension pipeline is unknown, West Yost also included a hydraulic evaluation for the new S9B pump station at the Alternative 3 location under existing system configurations (no availability of the proposed 16-inch Farmers Lane extension pipeline). The results are presented in Figure 6. Under the existing system configuration, without the Farmers Lane Extension pipeline, the required TDH for the new S9B pump station at the Alternative 3 location is 375 feet, or about 85 feet higher. This additional head is required because the existing pipeline along Cooper Drive in Pressure Zone R9 where the discharge side of the new S9B pump station would be connected is an existing 12-inch diameter pipeline. The decrease in the discharge transmission pipeline diameter from pump station S9B is the reason for this increased of TDH.
CONCLUSION

Based on West Yost’s hydraulic results, the Alternative 3 location provides flexibility to operate the new S9B pump station, and design the new S9B to identically match the existing S9 pump station. Because the timing of the new 16-inch diameter pipeline along Farmers Lane Extension is unknown, the TDH required for the new S9B pump station under the existing system configuration is much higher than the TDH required under the buildout system configuration due to the existing 12-inch diameter discharge pipeline in Pressure Zone R9, compared to the future 16-inch pipeline to be installed as part of the Farmers Lane Extension project.
FIGURE 1
City of Santa Rosa S9B Evaluation

FUTURE FACILITIES AND PIPELINES
AT BUILDOUT

Notes
1. Assumed Reservoir R9C and Station 99 were offline.
2. Assumed tank level at Reservoirs R9A and R9B were 50 percent full.
3. Hydraulic evaluations were conducted under buildout average day demand condition.

LEGEND
- SCWA Reservoir
- City Reservoir
- Existing Pump Station
- Location 1 - S9B BPS
- Location 2 - S9B BPS
- Location 3 - S9B BPS
- City Well
- SCWA Aqueduct System
- Existing Pipeline Less than 12-inch
- Existing Pipeline Greater than 12-inch
- Recommended Pipeline
- Improvements for Projected Buildout System
- Farmers Lane Extension Pipeline
FIGURE 2
City of Santa Rosa
R9 Evaluation

SYSTEM PRESSURES
ON SELECTED NODES
BASE CONDITION
(Buildout Average Day Demand Condition)

Notes
1. Assumed Reservoir R9C and Station S9 were offline.
2. Assumed tank level at Reservoirs R9A and R9B were 50 percent full.

LEGEND
- SCWA Reservoir
- City Reservoir
- Existing Pump Station
- City Well
- SCWA Aqueduct System
- Existing Pipelines
- Recommended Pipeline
- Improvements for Projected Buildout System

Future Pipelines
- 12" Diameter Pipe
- 16" Diameter Pipe
- Pressure ≤ 35 psi
- 35< Pressure ≤ 40 psi
- 40< Pressure ≤ 60 psi
- 60< Pressure ≤ 80 psi
- Pressure >80 psi

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**FIGURE 3**
City of Santa Rosa
R9 Evaluation

**SYSTEM PRESSURES ON SELECTED NODES**
**ALTERNATE 1 - FUTURE S9B BPS**
(Buildout Average Day Demand Condition)

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### Notes
1. Assumed Reservoir R9C and Station S9 were offline.
2. Assumed tank levels at Reservoirs R9A and R9B were 50 percent full.

### LEGEND
- SCWA Reservoir
- City Reservoir
- Existing Pump Station
- Location 1 - S9B BPS
- City Well
- SCWA Aqueduct System
- Existing Pipelines
- Recommended Pipeline
- Improvements for Projected Buildout System

### Future Pipelines
- 12" Diameter Pipe
- 16" Diameter Pipe
  - Pressure ≤35 psi
  - 35< Pressure ≤40 psi
  - 40< Pressure ≤60 psi
  - 60< Pressure ≤80 psi
  - Pressure >80 psi
Alternative 2: New S9B pump station for R9. 3 pumps; each with 1,750 gpm and 380 feet TDH

Notes
1. Assumed Reservoir R9C and Station S9 were offline.
2. Assumed tank level at Reservoirs R9A and R9B were 50 percent full.
SYSTEM PRESSURES
ON SELECTED NODES
ALTERNATE 3 - NEW S9B BPS (WITH FUTURE FARMERS LANE EXTENSION PIPELINE)
(Buildout Average Day Demand Condition)

Notes:
1. Assumed Reservoir R9C and Station S9 were offline.
2. Assumed tank level at Reservoir R9A and R9B were 50 percent full.

ALTERNATIVE 3: New S9B pump station for R9. 3 pumps; each with 1,750 gpm and 290 feet TDH
FIGURE 6
City of Santa Rosa
R9 Evaluation

SYSTEM PRESSURES ON SELECTED NODES
ALTERNATE 3 - NEW S9B BPS
(CONNECTED TO EXISTING SYSTEM PIPELINE)
(Existing Average Day Demand Condition)

Notes
1. Assumed Reservoir R9C and Station S9 were offline.
2. Assumed tank level at Reservoir R9A and R9B were 50 percent full.

LEGEND
SCWA Reservoir
City Reservoir
Existing Pump Station
Location 3 - S9B BPS
City Well
SCWA Aqueduct System
Existing Pipelines
Pressure ≤35 psi
35< Pressure ≤50 psi
50< Pressure ≤60 psi
60< Pressure ≤80 psi
Pressure >80 psi

Melanie O Collison\City of Santa Rosa\2014-12-04\Cell Hydro\Web Version Modeling\Analysis\GIS\City\GIS\Figures\R9 C_Eval\Figure 6_Alternate 3 Results.mxd

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