SPF WATER ENGINEERING

DRAFT TECHNICAL MEMORANDUM

DATE: May 19, 2020

TO: Brian Yeager, P.E., P.L.S., City of Hailey

FROM: Scott McGourty, P.E., Mike Boeck, P.E. - SPF Water Engineering

PROJECT NO: 330.0380

RE: New Water Supply Well Location Study

Executive Summary

This memorandum presents an evaluation of proposed locations for a new water supply well for the City of Hailey's water system. This memo follows a previous study of low water pressure in the Northridge Area (SPF, 2020), which provided three recommendations to the City including construction of a new water supply well. The Northridge study recommended that the City begin the planning and permitting process for a new water supply well during the spring of 2020 in anticipation of continued population growth and development, with the additional objectives of increasing system pressures and improving tank operating levels where possible. The objective of this study is to identify candidate locations for a new well and to evaluate the estimated impact on the City's water system of a new well at each location. The purpose of this memo is to assist stakeholders and policy makers in selecting a new well from the stand point of providing the most hydraulically beneficial location.

The following four potential well sites were evaluated:

1. The northern end of the Northridge Area near W Meadow Drive
2. Highway 75 south of W Meadow Drive (near the proposed 2-IT Ranch development)
3. The southwest corner of the proposed Sunbeam development
4. Fox Acres Drive north of the Wood River High School track

Based on the screening criteria developed during this study, well location #3 (Sunbeam) is anticipated to offer the best performance relative to the City's goals for the new well. SPF has identified opportunities to optimize piping from the Sunbeam well location to Quigley Tank through two proposed developments (Sunbeam and Quigley Farms) in order to maximize the impact of the new well on filling Quigley Tank. Additional construction of new piping in Quigley Drive could be implemented at a later date to further optimize the ability of the new well to fill Quigley tank. Additional improvements are required to avoid over flowing Turbine Tank or over pressurizing some areas of the distribution system. The additional improvements include a new pump on the outlet line from Turbine Tank with a bypass line and control valve, and control modifications to the Northridge and 3rd Ave pumps (separate from control upgrades recommended for the Northridge pumps without a new well construction in Sunbeam and a new pump at Turbine Tank [SPF, 2020a]).

Adding a new well to the City's potable water system will require water right approval, either by approved permit or transfer, pending well capacity.

Screening Criteria and Peformance Goals

The location siting process was guided by the following screening criteria:

- **Estimated aquifer productivity** - The well should be located within areas of the valley likely to offer a highly productive aquifer. Based on the general geological setting, the local aquifer is expected to be the most productive in the lowest topographic elevation areas with thicker alluvium deposits (away from mountain slopes).
- **Relative east of land acquisition –** Land currently vacant, or unoccupied land within new proposed developments may present fewer obstacles for a new well and piping such as existing buildings, utilities, or encumbrances.
- **Location relative to existing city piping** – The location of the new well should be located close to large distribution mains if possible, or in areas of the system where new large diameter pipe can be constructed with the shortest length possible to connect to the existing system.
- **Simulated impact on tank operating levels –** The location of the new well should in general be as close as possible to the Quigley Tank (if other factors are not considered) in order to improve the rate of fill at the tank.
- **Simulated effects on system pressure –** The effect of the new well on the existing city water system is highly dependent on where the new well ties in to the existing system, and sizes and existing flows through nearby pipes. Siting a well near the Northridge Area would improve the pressure for Northridge Area customers, however a new well in this area also has the potential to decrease outflow from Turbine tank, which could result in overflow conditions and wasting the opportunity to capture flow from Indian Creek Springs which is the City's lowest cost source of supply.
- **Maximize flow from Indian Creek Spring –** As stated above, maintaining flow from Indian Creek Spring into Turbine Tank is cost effective and should be maximized to largest extent possible.

The performance goals identified for the new water supply well are as follows:

1. **Increase the fill rate of Quigley** - The City's latest Water Master Plan (SPF, 2015) identified improvements to piping connecting Quigley Tank as Capital Improvement #9. The new well should be constructed at a location in the system that allows for high flow from the new well to Quigley Tank.
2. **Provide backup capacity for filling Quigley tank in the event the Woodside facility is out of service** - Currently the City of Hailey relies heavily on the existing Woodside well house to maintain operating water levels in the Quigley. During the irrigation season, the ability of the existing system to maintain Quigley tank operating

levels can become strained. The new well should be constructed at a location in the system that allows for high flow from the new well to Quigley Tank.

3. **Increase the firm capacity of the City's water supply system (water supply with the largest pump out of service)** - The City's latest Water Master Plan (SPF, 2015) identified a new supply well as Capital Improvement #12 in order to address future daily production requirements. The Water Master Plan identified a firm capacity of 7.3 million gallons per day (MGD). The Northridge Area Study identified a maximum day demand of 6.0 to 6.6 MGD from 2013-2017, indicating the water supply for the City is approaching firm capacity. The target productivity goal for the new well was estimated to be 800 gpm or 1.1 MGD.
4. **Increase system pressures in the vicinity of Northridge/Old Cutters/Sunbeam** – The Northridge Area Study (SPF, 2020) identified a new water supply well as one improvement with the potential to contribute to increased pressures in targeted areas throughout the City, depending on the location of the new well.

Table 1 presents the results of evaluating the simulated performance of each potential well location versus the City's goals for the new well. The Sunbeam well location is the only location to advance all four of the City's goals. The proposed Quigley well site, while already owned by the City, is located further upslope from the other well sites in a location more likely to be outside of the most productive aquifer zone lower in the valley.

Table 1. Goal Evaluation for Potential New Well Locations

	Goals	Quigley Well	Sunbeam Well	Sunbeam Well w/12" Main	2-IT Well	Northridge Well
1	Improve piping connection to Quigley Tank	No	Yes	Yes	No	No
2	Redundancy for Woodside	Yes	Yes	Yes	Yes	Yes
3	Increase City Firm Capacity	Lower chance of productive aquifer. Test well required.	High chance of productive aquifer.	High chance of productive aquifer.	High chance of productive aquifer.	High chance of productive aquifer.
4	Increase NR Pressure	+2 psi (46 psi min)	+3 psi (47 psi min)	+5 psi (49 psi min)*	+5 psi (49 psi min)	+6 psi (50 psi min)
5	Maximize use of Indian Creek Spring	Yes	Yes	Yes	No	No

* 52 psi with addition of a new pump on the outlet from Turbine Tank.

Hydraulic Modeling

SPF conducted hydraulic modeling of the a new well at the proposed Sunbeam development through an iterative process of evaluating incremental changes to the piping from the new well to Quigley Tank. Through evaluation of 16 scenarios, the proposed transmission main depicted in Figure 3 evolved as an optimal solution that achieves large improvements in the fill rate to Quigley Tank at a relatively small marginal cost of upsizing pipes already planned for construction as part of the Quigley Farms and Sunbeam developments.

Figure 1 depicts flow rates through the City's distribution system including the proposed Quigley Farms and Sunbeam developments with the existing sources of supply in service. Pipe flow rates correspond to color scheme, while pipe line thicknesses correspond to pipe diameters. If the City's distribution system is updated with new pipelines as currently proposed by the Sunbeam and Quigley Farms developments, and no new well is constructed, the fill rate to Quigley Tank is estimated to be 884 gpm under average daily demand conditions (ADD).

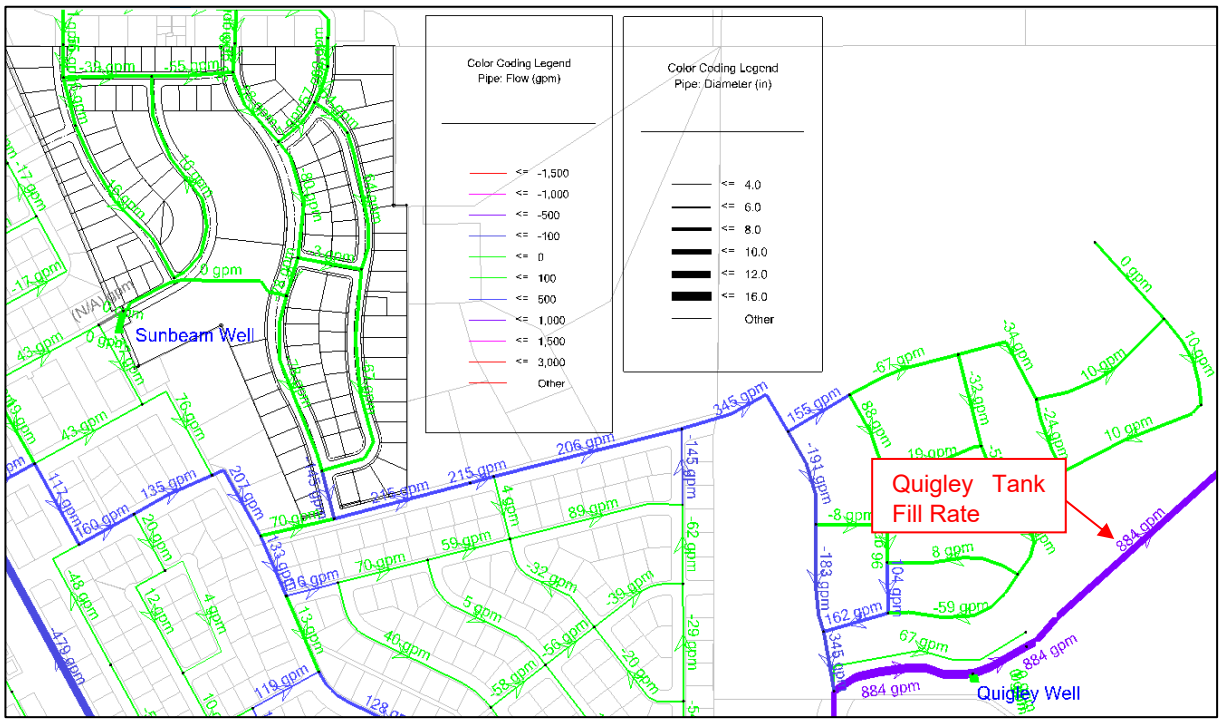

Figure 1 – Baseline ADD System Flows with 8-inch Quigley Farms & Sunbeam Distribution Piping

Figure 2 depicts flows through the City's distribution system including the proposed Quigley Farms and Sunbeam developments with a new supply well constructed in the proposed Sunbeam development. If the City's distribution system is updated with new pipelines as currently proposed by the Sunbeam and Quigley Farms developments, the fill rate to Quigley Tank is estimated to be 1,040 gpm under ADD conditions, an improvement of 156 gpm over the baseline condition.

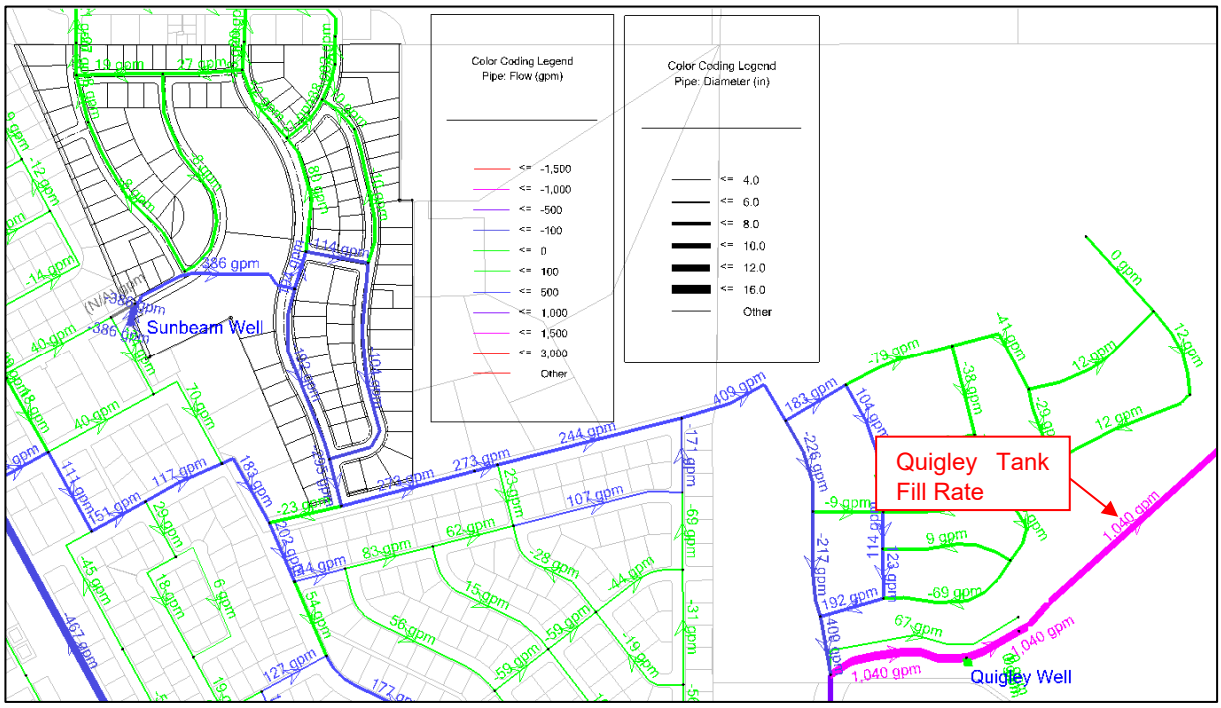

Figure 2 – ADD System Flows with New Sunbeam Well & 8-inch Quigley Farms & Sunbeam Distribution Piping

Figure 3 depicts flows through the City's distribution system including the proposed Quigley Farms and Sunbeam developments with a new supply well constructed in the proposed Sunbeam development. Figure 3 reflects the results of modeling a 12-inch transmission main through Quigley Farms and the Sunbeam development, with no improvements to the existing 8-inch pipe in Quigley Drive. The fill rate to Quigley Tank is estimated to be 1,128 gpm under ADD conditions, an improvement of 244 gpm over the baseline condition.

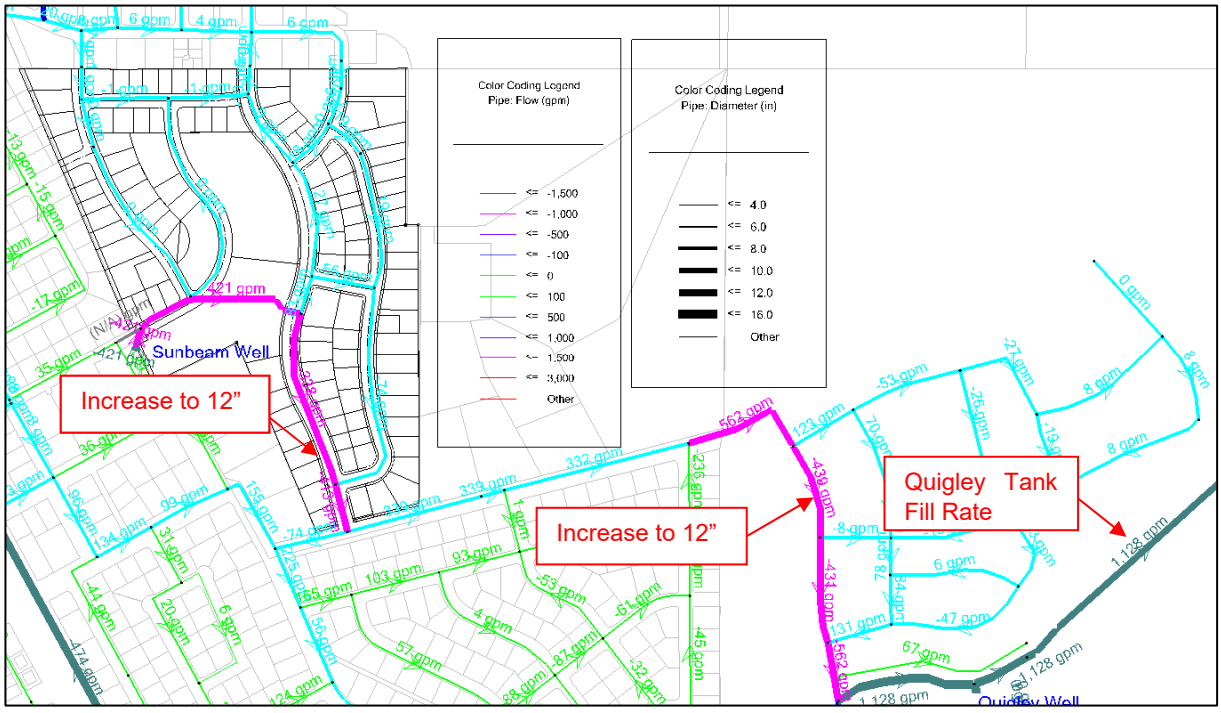

Figure 3 – ADD System Flows with New Sunbeam Well & 12-inch Quigley Farms & Sunbeam Distribution Piping

Figure 4 depicts flows through the City's distribution system including the proposed Quigley Farms and Sunbeam developments with a new supply well constructed in the proposed Sunbeam development. This scenario reflects the results of modeling a 12-inch transmission main from a new supply well in Sunbeam through the Sunbeam and Quigley Farms developments to the existing 16-inch transmission main in Fox Acres Drive. With the 12-inch transmission main, the fill rate to Quigley Tank is estimated to be 1,220 gpm under ADD conditions, an improvement of 336 gpm over the baseline condition.

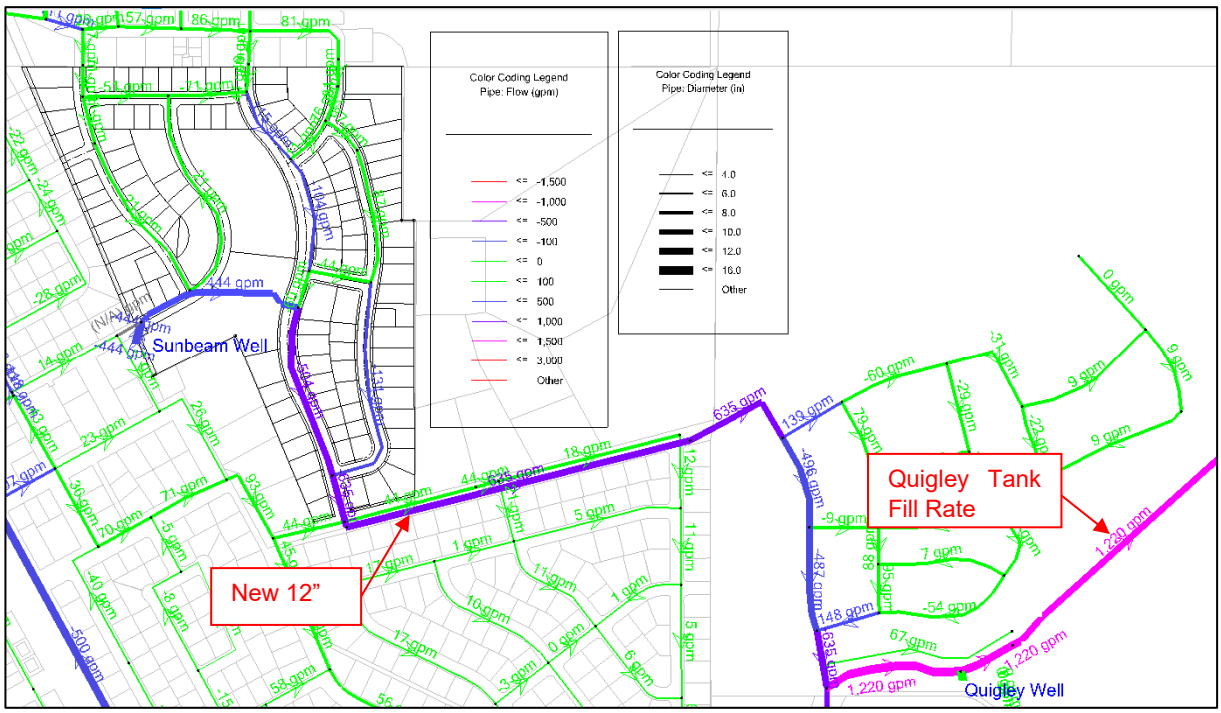

Figure 4 – System Flows with New Sunbeam Well, New 12-in Transmission Main & 12" Transmission through Sunbeam & Quigley Farms under ADD

Impacts to Indian Creek Spring

Indian Creek Spring is located upstream from the Turbine Tank and contributes high quality water to the City's water system via gravity. The lack of need for pumps involved with Indian Creek Spring make it the City's lowest cost source of supply. Currently the spring supplies approximately 1,100 gpm, with total water rights available for up to 1,516 gpm. The spring only contributes to the City's system when Turbine Tank is not full; when the tank is full, flow from the spring results discharge of water from the tank overflow ("wasted opportunity" water). The addition of the Sunbeam well has the potential to reduce the outflow from Turbine Tank by meeting demand in the City otherwise served by the tank. In some cases, the Sunbeam well when operated in conjunction with other City wells during periods of low demand, could result in overflows at Turbine Tank or wasting low cost spring water that otherwise would have served the system. One potential solution to avoid wasting water from

the spring, while increasing the ability of the system to fill Quigley tank via the Sunbeam well, could be to install a low-head pump on the outlet of Turbine Tank.

Several modeling scenarios were run based on the piping shown in Figure 4 to evaluate the effects of a new pump on the outlet of Turbine Tank. The results of hydraulic modeling are presented in Table 2. Hydraulic modeling was conducted with the following goals in mind:

- Maintain a minimum outflow of 1,100 gpm out of Turbine Tank under ADD conditions to avoid overflowing supply from Indian Creek at Turbine Tank. Outflows are shown in Table 2 as negative values.
- Maintain positive flow into Quigley Tank to take advantage of the proximity of the proposed new Sunbeam well to Quigley Tank.
- Limit maximum pressure in the system to 100 psi or less.

Table 2 Tank Fill Rate and System Pressure Analysis

No.	Demand	Woodside	River St	NRBPS (East /West)	3rd Ave	Sunbeam Well	Turbine Outlet Pump	Turbine (-Drain/+Fill)	Quigley (-Drain/+Fill)	Bullion St /Little Indio Ln (psi)	NRBPS (psi)
1	ADD	On	On	On	Off	On	Off	+467	+579	100	83
2	ADD	On	On	On	On	On	On	-1084	+2050	113	94
3	ADD	On	On	On	Off	On	On	-1304	+1342	105	88
4	ADD	On	On	Off	Off	On	Off	-863	-148	100	81
5	ADD	On	On	Off	Off	Off	Off	-925	-447	97	78
6	ADD	Off	Off	Off	Off	Off	Off	-1308	-1230	95	77
7	ADD	On	On	W-On	Off	On	On	-1376	+1240	103	85
8	ADD	On	Off	On	Off	On	On	-1291	+1440	106	89
9	ADD	On	On	Off	Off	On	On	-1437	+400	100	81
10	Static	Off	Off	Off	Off	Off	Off	0	0	94	77
11	PHD	On	On	On	On	On	Off	-577	-300	101	81
12	PHD	On	On	On	On	On	On	-1434	-295	101	81

The results shown in Table 2 demonstrate the following:

- Operating all pumps in addition to a new well at Sunbeam, and a new pump on the outlet of Turbine Tank results in increased system pressure (113 psi) which exceeds the acceptable operating limit of 100 psi during low demand periods (ADD), and to a lesser extend during PHD,
- The condition of Turbine Tank draining at a rate of at least 1,100 gpm, while Quigley Tank is filling is only achievable with a new pump on the outlet of Turbine Tank on, a condition which most often occurs when the system is over pressurized near Bullion St and Little Indio Ln, with the exception of scenarios where certain other pumps in the system are off,
- Under ADD conditions, when the Northridge and 3rd Ave booster pump station are off, the Sunbeam and Woodside wells can be run to fill Quigley Tank, while a pump on the outlet of Turbine Tank maintains outflows from Turbine Tank above 1,100 gpm (scenario No. 9), with acceptable system pressures.

Not shown in Table 2 is a new minimum pressure at Northridge residences of 52 psi under scenario No. 12 as a result of adding a pump on the outlet of Turbine Tank. To avoid over pressurizing customers in the area bounded by Bullion St, and Chestnut St west of Main St under scenario No. 2 (all pumps on), the Northridge Booster Pumps and 3rd Ave pump controls will need to be adjusted to turn off based on a pressure signal instead of tank levels. Under scenario No. 2, the risk of overflow at Turbine Tank is managed by the Turbine Tank Outlet pump.

The operational goals for the Turbine Tank outlet pump are as follows:

- Force Turbine Tank to discharge at 1,100 gpm or greater whenever tank level approaches the tank overflow level,
- Allow the supply wells to fill the tank when needed (in addition to Indian Creek),
- If the Turbine Tank outlet pump is off (due to power outage or maintenance, etc.), the tank should be able to drain freely to supplement fire flow to the system.

To achieve these operational goals a bypass line around the outlet pump is required. Control could be accomplished by a SCADA operated control valve with a logic tree that accounts for; 1) water level in Turbine Tank, 2) system pressure at the Turbine Tank outlet, and 3) the Turbine Tank outlet pump status (on or off). In general, the bypass valve should be closed when the pump is on and Turbine Tank is at risk of overflowing, and open when the pump is off; either when tank levels are low and tank inlet pressure is high to facilitate filling by the system, or when inlet pressures are low to facilitate draining during potential fire flow conditions regardless of tank level. A more detailed logic control scheme should be developed prior to construction. Alternatively, controls not operated by SCADA (using a system of check and/or altitude valves), may potentially be an option.

If a booster pump is not added to the outlet of Turbine Tank, operation of existing pumps in the system and the proposed Sunbeam well will need to be coordinated more closely to avoid overflows at Turbine Tank; some pumps will only run when demands are high.

Water Rights

The combined authorized groundwater diversion rate for the City of Hailey is 14.23 cfs (6,390 gpm) for municipal use in the potable water system. SPF prepared a Beneficial Use Field Exam for permit 37-8837 in late 2009 including groundwater capacities for individual wells based on pump curves (SPF, 2020a). Total pumping capacity is 5,700 gpm. These values were based on pump curves only, are over ten years old, and were not confirmed by flow measurements during the exam or review of City records. Current pumping capacity should be confirmed. Based on these values, the City's portfolio of groundwater (6,390 gpm) exceeds system capacity (5,700 gpm) by about 690 gpm.

Adding a new well to the City's potable water system will require water right approval, either by approved permit or transfer. If a new well is expected to increase total groundwater pumping capacity by 690 gpm or less, a transfer application adding a new well to the existing water rights may be the preferred approach. If the new well is expected to increase system capacity beyond 6,390 gpm, an application for new water right permit is required.

Well Setbacks

Minimum setback requirements for public water system wells are shown in Figure 5 (taken from IDAPA 58.01.08.900). Final well location must be coordinated to maintain 50-ft from the proposed well to wastewater lines proposed as a part of the Sunbeam development. Other setbacks from features listed in Figure 5 may be relevant. A screening analysis for the features shown in Figure 5 must be completed prior to selecting a well location.

Minimum Distances from a Public Water System Well	
Gravity wastewater line	50 feet
Any potential source of contamination	50 feet
Pressure wastewater line	100 feet
Class A Municipal Reclaimed Wastewater Pressure distribution line	50 feet
Individual home septic tank	100 feet
Individual home disposal field	100 feet
Individual home seepage pit	100 feet
Privies	100 feet
Livestock	50 feet
Drainfield - standard subsurface disposal module	100 feet
Absorption module - large soil absorption system	150 - 300 feet, see IDAPA 58.01.03
Canals, streams, ditches, lakes, ponds and tanks used to store non-potable substances	50 feet
Storm water facilities disposing storm water originating off the well lot	50 feet
Municipal or industrial wastewater treatment plant	500 feet
Reclamation and reuse of municipal and industrial wastewater sites	See IDAPA 58.01.17
Biosolids application site	1,000 feet

Figure 5 – IDAPA 58.01.08.900 Public Water System Well Setbacks

Summary

The hydraulic model of the proposed new well at Sunbeam can meet the City of Hailey's performance goals for a new water supply well. Certain additional improvements are required to avoid over pressurizing some areas of the distribution system including a new pump and bypass with control valve on the outlet line from Turbine Tank (potentially located in the existing regulator building), and control modifications to the Northridge and 3rd Ave pumps (separate from control upgrades recommended for the Northridge pumps without a new well construction in Sunbeam and a new pump at Turbine Tank).

Hydraulic modeling demonstrates the new Sunbeam Well is able to increase the fill rate to Quigley Tank under average day demand conditions by taking advantage of the pipe network currently planned for the Quigley Farms and Sunbeam developments. Additional gains in the Quigley Tank fill rate can be achieved by upsizing the transmission mains in the proposed developments (Figure 3), and by also upsizing the existing 8-inch main in Quigley Drive (Figure 4). This provides the City with a phased approach such that proposed piping can be upsized prior to construction. Additional upsizing of the existing 8-in in Quigley Road can be either constructed during development or added at a later date. This additional section could be designed as a "remove and replace" or a secondary line added within Quigley Road to provide a backup line for redundancy.

References

SPF, 2015. Water System Master Plan. Prepared for the City of Hailey, May 2015.

SPF, 2020a. Northridge Area Pressure Study. Prepared for the City of Hailey, January 2020.

SPF, 2020b. Municipal Potable System Water Rights and System Capacity. Prepared for the City of Hailey, April 2020.