MEMORANDUM

DATE: July 29, 2022

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FROM: Kayson Shurtz, P. E.
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SUBJECT: Springville City Annexation
Drinking Water System Review

PROJECT NO.: 344.224.200

INTRODUCTION

A 320-acre industrial development is proposed located near the intersection of 4000 South (Highway 77) between 800 West and 1300 West (Spanish Fork City addressing). Springville City (the City) requested a feasibility analysis to identify adequate water resources, level of service, and needed infrastructure for this area. The City also requested that the scope of the study be augmented to include approximately 720 additional acres out to Springville City's Annexation Declaration Policy Boundary as shown in Figure 1. The additional developments are north of 4000 South between approximately 700 West and 800 West (160-acre parcel) and north of 4000 South between approximately 1300 West and 2000 West (560-acre parcel). These developments are bordered on the north by Provo Bay of Utah Lake. Additionally, an approximately 477-acre area within City boundaries that was not included in the 2060 Master Plan, as it was expected to be built out after 2060, was included in this analysis because of its proximity to the study area ("West-side buildout"). Any additional areas of the City that are expected to develop after 2060 were not included in this analysis.

As requested, HAL has performed a review of the effects that the proposed developments will have on the City's public water system. This includes a hydraulic modeling analysis of the proposed drinking water infrastructure for the development. The analysis assumes that the development types are light industrial and the development density will be within the range of 2-3 ERCs per acre depending on the parcel in question shown in Figure 1, as provided to HAL in communication with Springville City. This analysis is based on the Utah Division of Drinking Water requirements and the criteria included in the Springville City Drinking Water Master Plan and Capital Facility Plan dated August 2020 (Master Plan).

This analysis includes a discussion of the effects of the proposed developments on the existing system, as well as a discussion of the effects of adding this development to the future scenarios of the Master Plan.

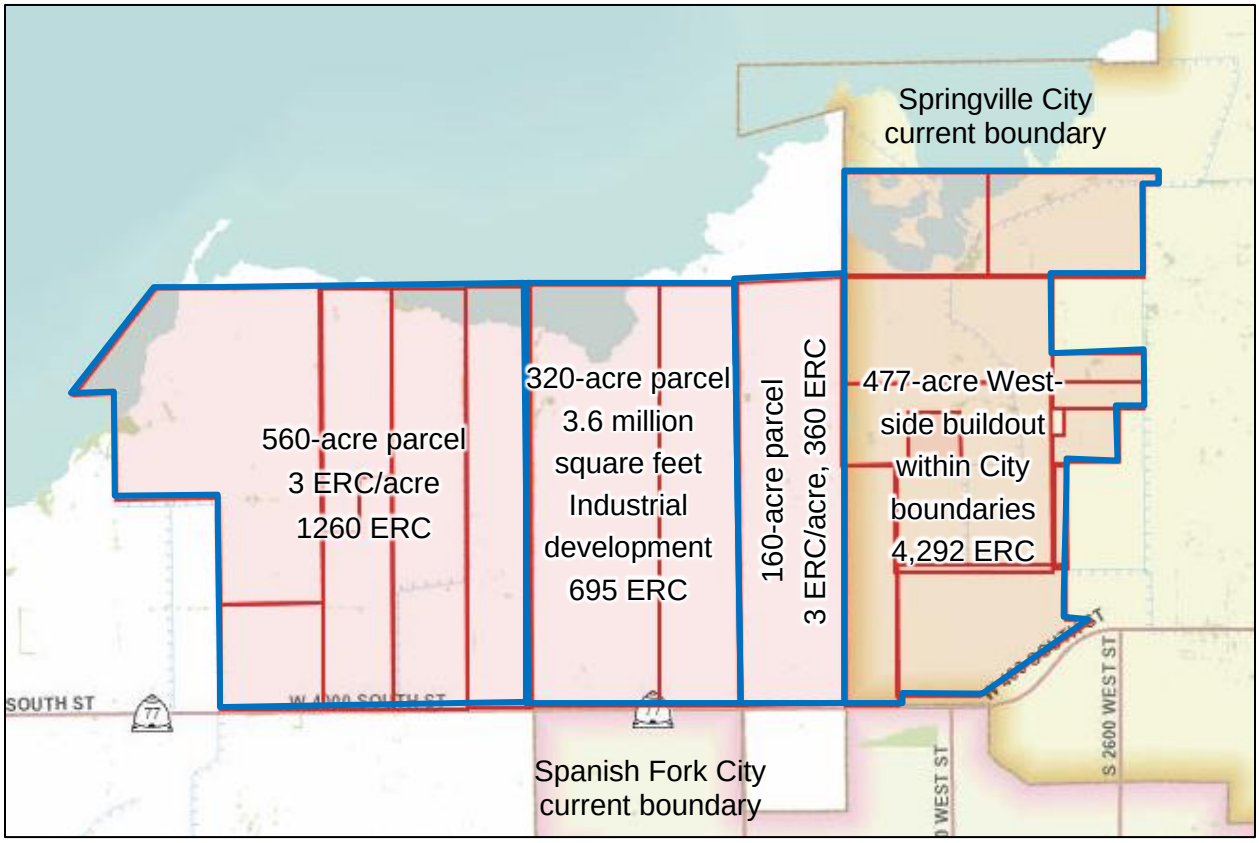

FIGURE 1: ANNEXATION STUDY BOUNDARY AND ERC ASSIGNMENTS

DRINKING WATER SYSTEM

The proposed developments border the current west boundary of Springville City. The development includes 3.6 million square feet of industrial warehouse on 320 acres and other unspecified industrial development on the remaining 720 acres. The 477-acre West-side buildout area (area shown in Figure 1) is assumed to be medium-low to medium density residential (9 ERC/acre). It is assumed that the potential annexation and West-side buildout would be included in the Westfields pressure zone.

Figure 2 shows a schematic of the Master Plan (year 2060) drinking water pipelines and our assumption of major drinking water transmission pipelines to the development area. Highway 77 (4000 South) is a major street included in Mountainland Association of Governments (MAG), Utah County, and Springville City transportation Master Plans, but there are no other major planned roads within the study area which would provide for utility access. MAG plans a new freeway which would cross the westernmost portion of the annexation study area. We assume a looped pipeline design to provide redundancy in case a water main goes out of service.

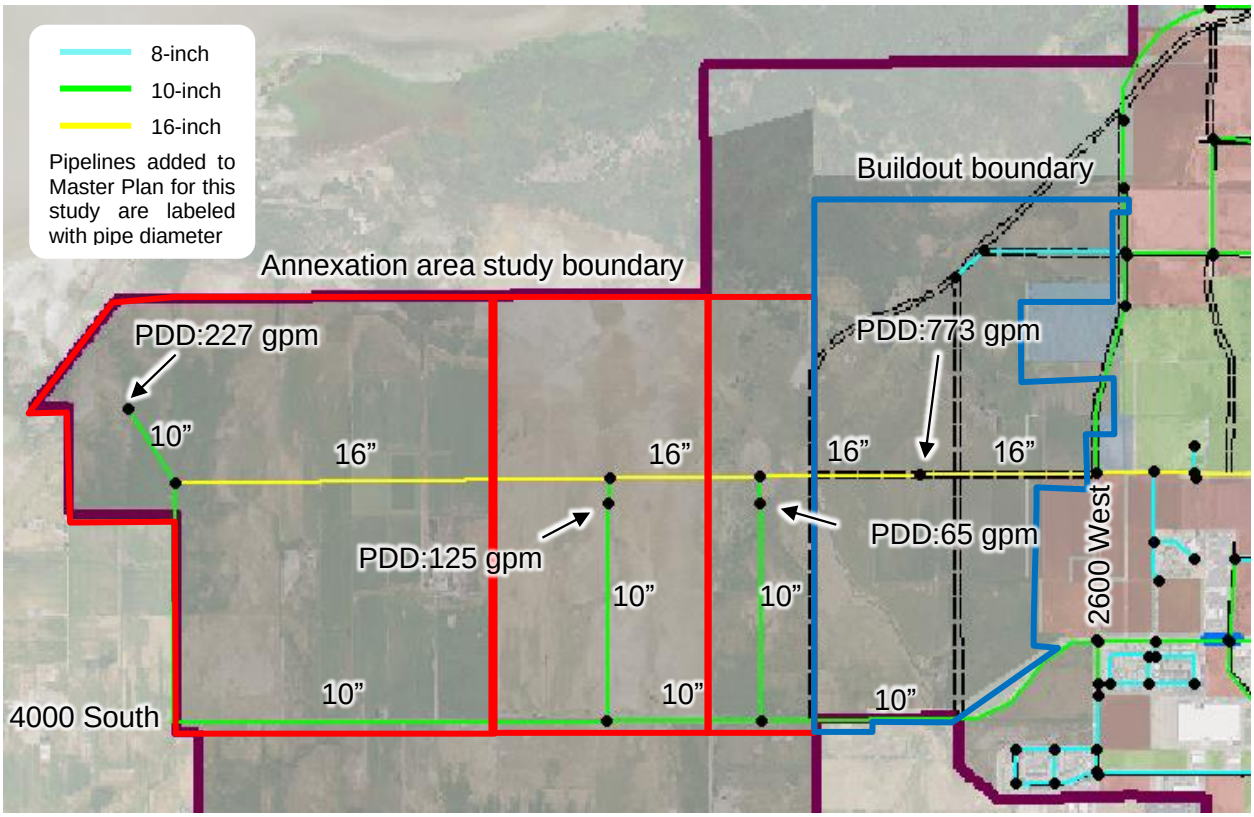

FIGURE 2: DRINKING WATER SYSTEM PIPE SIZE AND PEAK DAY DEMAND (PDD)

Estimated Water Demand

The number of equivalent residential connections (ERCs) per parcel was calculated on assumptions of 3 ERCs/acre for industrial development as per the Master Plan and 25% of unspecified industrial development being unavailable due to wetlands for the 560-acre and 320-acre parcels. Springville provided City data for average industrial water usage of 1.5 gallons per month per square foot for the 3.6 million square foot warehouse, which was used instead of a land-based ERC calculation. Therefore, the total ERCs for the entire annexation study boundary was 2,315 ERCs (Figure 1, Table 1).

Some area within Springville City boundaries had not been included in the Master Plan as it was not expected to be built out by 2060. A portion of this land is included in this assessment for planning purposes because it is adjacent to the potential annexation area. This development is expected to be medium-low to medium density residential, so 9 ERCs/acre were assumed as requested by the City. The 25% reduction in usable land area was not applied to this area. The total ERCs for this area was 4,292 ERCs (Figure 1, Table 1).

Peak day water demand for the development was calculated using the Level of Service from the Master Plan. Estimated indoor demands are calculated as shown in Table 1. It is assumed that all outdoor demands will be supplied from the pressurized irrigation system.

TABLE 1: DRINKING WATER PEAK DAY DEMAND AND STORAGE VOLUME FOR DEVELOPMENT

Development	Development Density	ERCs	Source Peak Day Demand Flow[1] (gpm)	Source Demand Volume[1] (AF/year)	Storage[2] (gal)
160 Acre Parcel	3 ERC/acre	360	65	108	82,800
320 Acre Parcel	3,600,000 sf	695	125	208	160,000
560 Acre Parcel	3 ERC/acre	1,260	227	378	290,000
Total Annexation		2,315	417	694	533,000
West-side buildout	9 ERC/acre	4,292	773	1,288	988,000
Grand Total		6,607	1,190	1,982	1,530,000

1. Peak Day Level of Service is 0.18 gpm per ERC (Springville City Drinking Water Master Plan, 2020). The peak instantaneous demand is found by multiplying the peak day demand by a peaking factor of 1.5. The average annual demand is 0.3 AF per ERC.
2. The water storage Level of Service is 230 gallons per ERC (Springville City Drinking Water Master Plan).

Source and Storage

The effects of the potential annexation on the City's source and storage were evaluated for the existing system and for the future (2060) scenario as described in the Master Plan. Demands for the potential annexation area and adjacent areas within City boundaries were not originally included in the Master Plan because they were outside 2060 growth scenario. This analysis includes adding these demands to the Master Plan scenarios.

Source and Storage – Existing System

A summary of the anticipated source flow and volume demands, including the potential annexation development, is included in Table 2 below.

TABLE 2: CITY WATER SOURCE SUMMARY – EXISTING SYSTEM

Description	Indoor ERCs		Source Flow (gpm)		Source Volume (AF/yr)	
	This Item	Cumulative	This Item	Cumulative	This Item	Cumulative
2020 Master Plan	18,250	18,250	12,870[1]	12,870	9,890[1]	9,890
Potential Annexation	2,315	20,565	417	13,287	694	10,584
West-side buildout within City boundaries	4,292	24,857	773	14,060	1,288	11,872
Current Water Rights	-	-	-	15,375	-	15,381
Current Potential Excess (+) or Deficit (-) Water Rights	-	-	-	+1,315	-	+3,509
Current Estimated Physical Capacity	-	-	-	16,986	-	15,445
Current Potential Excess (+) or Deficit (-) Physical Capacity	-	-	-	+2,926	-	+3,573

1. Source flow and source supply contain some water for outdoor irrigation in areas of the City that do not have pressurized irrigation.

As shown in Table 2, Springville City currently has sufficient total source flow capacity (water rights capacity and physical capacity) to accept the potential annexation. The Westfields pressure zone can be served by any of Springville City's water sources, so there is not a concern about source availability.

As shown in Table 2, Springville City currently has sufficient total source volume capacity to accept the potential annexation.

If one of Springville City's largest wells, 400 South Well #1 or #2 (4,000 gpm capacity each), were out of service, there would be a shortfall of 1,074 gpm. Another source is required to provide full redundancy for this well.

As shown in Table 2, the City currently owns water rights to 15,375 gpm and 15,831 AF/year, which is sufficient for existing development, West-side buildout, and the annexation.

Based on the City's storage Level of Service of 230 gallons of storage per ERC, the proposed

development will require 533,000 gallons of equalization storage and the West-side buildout area within City boundaries will require an additional 988,000 gallons of equalization storage, for a total of 1,530,000 gallons of equalization storage, as shown in Table 1. The required storage for existing development at the time of the 2020 Master Plan, including storage for fire flow and emergency, is estimated to be 12.67 MG. Currently, the City's total storage capacity is 12.65 million gallons (MG). With existing storage, West-side buildout, and the potential annexation included, the required storage is estimated to be 14.2 MG. This means that there would be a deficit of 1.55 MG if the annexation were approved. The City is currently constructing a new 3 MG tank at the existing Lower Spring Creek tank site which would provide a current surplus of 1.45 MG when put into service. The master plan specifies additional storage required to meet future demands that could be upsized from what is reported to account for 1.53 MG of additional storage the areas included in this study will require.

Source and Storage – Additions to Master Plan System

The West-side buildout area within City boundaries and the potential annexation area were not included in the 2020 Master Plan projections for the year 2060. A summary of the anticipated source flow and volume demands in 2060, including the potential annexation development, is included in Table 3 below.

TABLE 3: CITY WATER SOURCE SUMMARY FOR 2060

Description	Indoor ERCs		Source Flow (gpm)		Source Volume (AF/yr)	
	This Item	Cumulative	This Item	Cumulative	This Item	Cumulative
2020 Master Plan Projection for 2060	29,050	29,050	15,250[1]	15,250	13,350[1]	13,350
West-side buildout within City boundaries	4,292	33,342	772.6	16,023	1,287.6	14,638
Potential Annexation	2,315	35,657	416.6	16,440	694.3	15,332
Current Water Rights	-	-	-	15,375	-	15,381
2060 Potential Excess (+) or Deficit (-) Water Rights	-	-	-	-1,065	-	+49
Current Estimated Physical Capacity	-	-	-	16,986	-	15,445
2060 Potential Excess (+) or Deficit (-) Physical Capacity	-	-	-	+546	-	+113

1. Source flow and source supply contain some water for outdoor irrigation in areas of the City that do not have pressurized irrigation.

As shown in the table, there is sufficient source flow and volume available for the year 2060 with the potential West-side buildout area and annexation added. However, if one of the City's largest wells, 400 South #1 or #2 (4,000 gpm capacity each), went out of service, there would be a deficit of 3,454 gpm peak day demand. Another source is required to provide full redundancy for this well, as is discussed in the Master Plan.

The City has just sufficient volume of water rights, but will have a deficit of 1,065 gpm of water right allowable flow for 2060. The City needs to obtain additional water flow rights with the annexation.

By 2060, Springville is predicted to need 18.1 MG of equalization, fire flow, and emergency storage. The Master Plan recommends Springville construct 6 MG new storage between 2018 and 2060 for a total of 18.65 MG storage. With the West-side buildout and the potential

annexation, an additional 1.53 MG of equalization storage above the Master Plan are needed for a total of 19.63 MG storage. Springville City could accomplish this need by enlarging one of the next two planned future tanks by at least 1 MG, and probably more considering that the City has other buildout areas expected to develop after 2060.

Source and Storage – Master Plan Capital Facility Projects

The Master Plan indicates that in the 2018-2028 period, an additional or expanded source is needed for redundancy of 400 South Well #2, and new storage of about 3 MG is required. The annexation and development of this property would accelerate this need. The Master Plan also calls for a second new 3 MG tank would need to be completed by 2038. As stated, one of the two future tanks needs to be enlarged by 1 MG or more.

Transmission

Springville City maintains a water network computer model so that the system performance, including transmission capacity, can be evaluated. The proposed development was added to the model so that the effects of the development on the City system could be assessed. Node elevations were identified using Google Earth.

Pressure Zone

The proposed annexation would be served by the water lines from Center Street and 400 South. The annexation would fall into the Westfields pressure zone and there is no ambiguity about which pressure zone would be more optimal.

Master Plan Capital Facility Projects

The Master Plan projects are shown in Figure 4-1 of the Master Plan. The Master Plan indicates these projects (aside from the second storage tank) should be constructed by 2028. The Master Plan identifies 7 transmission projects and 21 fire flow projects. In particular, projects 15, 18, and 23 which are summarized in Table 4, are most important to transmit water to the annexation study area. We verified that transmission in 400 South is sufficient for West-side buildout and annexation demands. However, as is noted in the Master Plan, the location of the next tank or source may dictate a new major transmission project that was not included in the Master Plan.

TABLE 3: MASTER PLAN CAPITAL FACILITY PROJECTS – TRANSMISSION

Master Plan Project	Description	Year When Required
15	Upsize 2200’ of Center Street line to 16”	2028
18	Add 1350’ of 12” line under I-15 at 1000 North	2028
23	Extend 16” line in Center Street as far west as development	2028

Master Plan Project 15 is an upsize of existing 6-inch to 8-inch waterlines in Center Street from I-15 to 2400 West to improve fire flows. Master Plan Project 23 continues this 16-inch waterline west as far as development goes, which would include the annexation area.

Master Plan Project 18 would connect 1750 West and 2000 West at 1000 North with a 12-inch waterline under I-15. This project improves fire flow in a commercial area and provides redundancy if one of the other three lines under I-15 is out of service.

Model Results for the Proposed Development

Peak day and peak instantaneous minimum and maximum pressures within the West-side buildout and annexation areas are shown in Table 4, Figure 2, and Figure 3.

Fire suppression flow was modeled at 2,000 gpm, as specified for commercial areas in the Master Plan, at the furthest west node. The model predicts that the water system is capable of providing 2,000 gpm for fire suppression while maintaining a pressure of 20 psi throughout the system.

TABLE 4: DRINKING WATER HYDRAULIC MODELING RESULTS WITHIN THE PROPOSED DEVELOPMENT

Condition	Pressure	
	Minimum	Maximum
Peak Day	88 psi	94 psi
Peak Instantaneous	85 psi	90 psi
Diurnal Pressure Variation	About 5 psi	
Fire Suppression Flow	2,000 gpm @ 68 psi	

The proposed drinking water piping meets the criteria set by the Utah Division of Drinking Water and Springville City for minimum pressures.

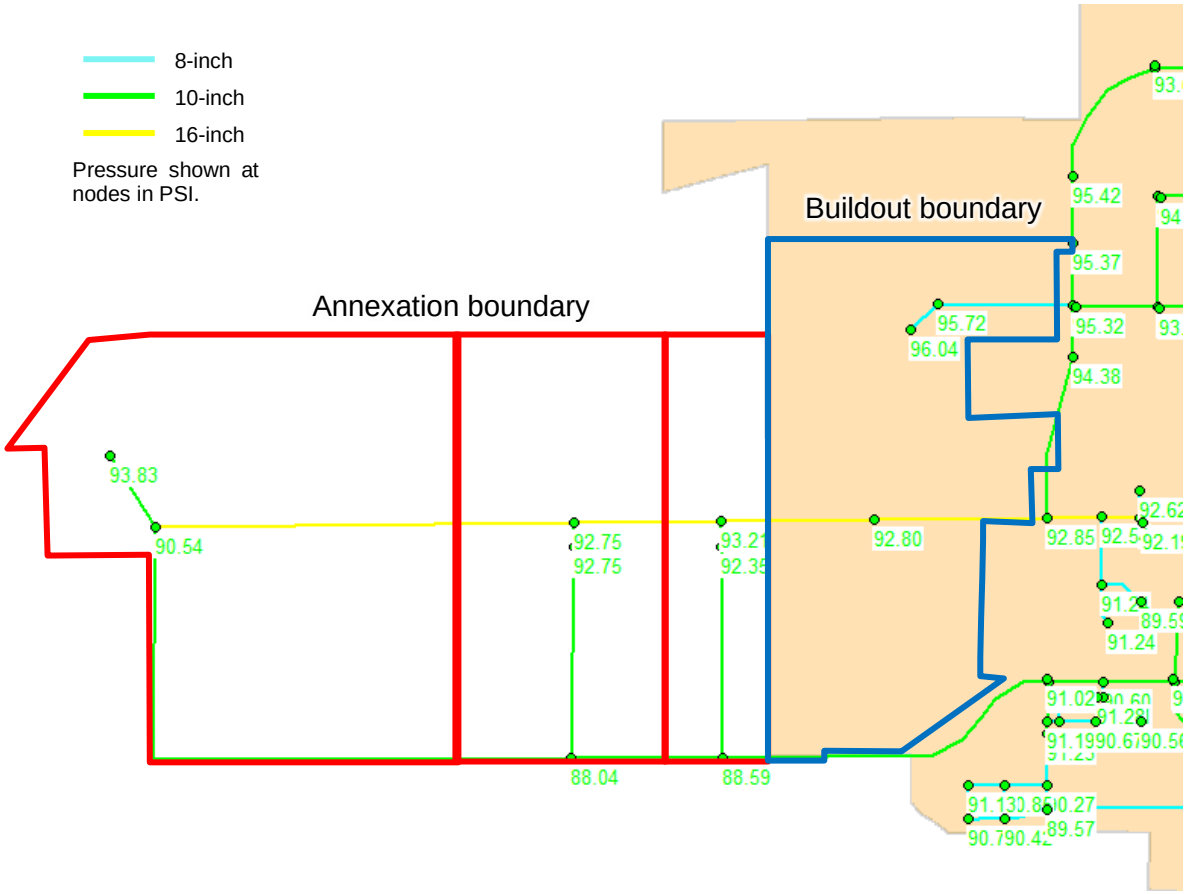

FIGURE 2: DRINKING WATER SYSTEM PEAK DAY PRESSURE

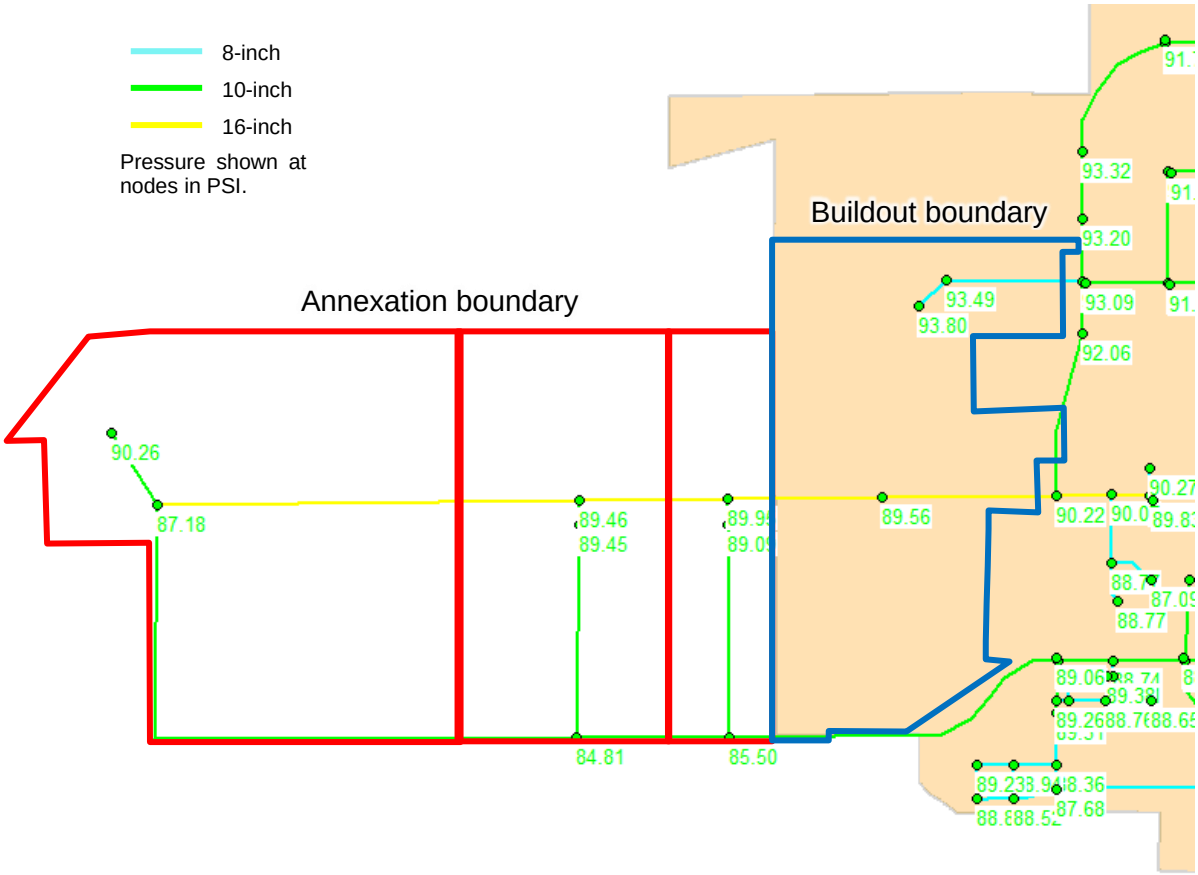

FIGURE 3: DRINKING WATER SYSTEM PEAK INSTANTANEOUS PRESSURE

EFFECTS OF THE PROPOSED DEVELOPMENT ON THE EXISTING SYSTEM

The drinking water model was used to evaluate effects on the existing system from the potential annexation and West-side buildout area in the 2060 model. The 2060 model includes Master Plan projects and future demands up to 2060, but only existing sources and tanks. This model was edited to include new demands for West-side buildout and annexation.

Existing locations with modeled minimum pressures below 50 psi, in the upper portion of the Hobble Creek zone as well as the Upper Spring Creek zone, were evaluated at peak instantaneous conditions to determine if construction of the new development will reduce pressure at these locations. The model predicts that adding the new development will cause decreases of 0-2.5 psi at these locations, and did not result in any service connection in the existing system not meeting the minimum pressures specified in Utah Administrative Code rule R309-105-9, including:

(a) 20 psi during conditions of fire flow and fire demand experienced during peak day demand;
(b) 30 psi during peak instantaneous demand; and
(c) 40 psi during peak day demand.

The lowest overall pressure observed under peak instantaneous conditions was about 40 psi in one small localized area of the Hobble Creek zone.

The same locations were also evaluated at peak day conditions, with and without fire flow in the Westfields zone. The model predicts that adding the new development will cause decreases of 0-0.4 psi at these locations, and very few locations experienced pressures under 50 psi under these conditions compared to peak instantaneous conditions even with the new development.

COST ESTIMATES

The proposed annexation will require more infrastructure than was included in the Master Plan, but will not require upgrades to existing Master Plan facilities. Therefore, the cost estimates presented here in Table 6 are in addition to those from the Master Plan. As noted previously the master planned sources for the drinking water system are sufficient including the areas from this study. However, depending on how much redundancy the City desires additional sources could be merited. Typical cost of drilling a new well is about $1 million per well. The transmission cost estimates assume an average of four feet depth to pipe and include fire hydrants, valves, fittings, and service lateral connections. These costs are master planning level and it would be anticipated that the true costs could be +-50% from the numbers presented. It should be noted that these costs do not include the acquisition of water rights. The City should actively review and acquire water rights that would be of benefit to the City as development occurs.

TABLE 6: ADDITIONAL INFRASTRUCTURE COSTS FOR STUDY AREA

New Project Description	Cost
Extend 16” line in Center Street as far west as annexation edge -About 11,400 feet of 16-inch pipe mostly out of street	$2,650,000
Construct 10” line under 4000 South to west annexation edge, including three parcel laterals -About 20,700 feet of 10-inch pipe mostly in street	$4,560,000
Increase size of future planned water tank by 1.0 MG	$1,600,000
Total	$8,810,000

CONCLUSIONS AND RECOMMENDATIONS

- The City presently has sufficient source capacity to provide peak day demand and average yearly volume, but the remaining capacity does not provide full redundancy in the event a well is out of service. The City should continue efforts to pursue new sources of water promptly. If the proposed annexation is approved, it will consume some of the available source capacity for 2060.

- The City only has sufficient storage for existing development. The City should continue efforts to complete the new 3 MG tank. If the proposed annexation is approved, one of the

next two future tanks needs to be enlarged by 1 MG or more.

- The development is expected to cause small reductions in pressure in the existing drinking water system; however, the system will continue to meet the criteria set by the Utah Division of Drinking Water and Springville City. The model predicts that the system can supply 2,000 gpm for fire suppression within the annexation study area.

- The proposed annexation area must be served from the Westfields pressure zone. The design should be a looped design to provide redundancy. In a looped system, the minimum pipe diameter to achieve required results is 10”. The City should also follow Master Plan recommendations to install a 16” line on Center Street from the freeway as far west as development continues.