

# APPENDIX A

## SELLERS ROAD SURFACE WATER AVAILABILITY ASSESSMENT

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## INTRODUCTION

This appendix summarizes the assessment of available water from the Sellers Road Springs and associated surface water for the City of Banks (City) as part of their ASR feasibility assessment. The City of Banks has water rights for, and diverts water from, two spring sources at Green Mountain in the hills to the north as shown in Figure 1. The water is treated in a slow sand filter water treatment plant (WTP) near the springs before being conveyed to reservoirs near the City.

This report presents an assessment of the following four issues in relation to the springs, the associated water rights, the WTP, and if some of that water could be used for ASR:

- How much water is available from the catchments of the West and East Spring? How does this relate to the City's current diversions and existing water rights?
- With regard to the West and East Spring, are there any infrastructure restrictions/deficiencies that limit the amount of spring water available for utilization by the City? Specifically, what is the existing capacity of the WTP that would limit the amount or rate of water available for utilization? And, how much water could be conserved with improvements to the conveyance pipeline from the WTP to Banks?

To estimate yields from the springs and their respective catchments, a hydrologic model was developed and calibrated. Additionally, the hydrologic model and water availability assessment considered the protection of systems supported by the stream including habitat for critical species (instream water rights).

The following sections describe in detail the hydrologic model, water availability assessment, and brief infrastructure evaluation. The final determination of this appendix is the total water yield from the Sellers Road study area that is available for utilization by the City.

# EXISTING SPRING WATER RIGHTS AND WATER USE

## Spring Water Rights

The City has two certificated surface water rights that draw from springs in the hills approximately 4 miles to the north (Figure 1):

- Certificate 5353 – for primary municipal use of no more than 0.42 cubic feet per second (cfs), or 188.5 gallons per minute (gpm), with a priority date of 10/3/1923. The period of diversion and use is from 1/1 to 12/31. This spring is referred to as the West Spring; and
- Certificate 83138 – for primary municipal use of no more than 0.18 cfs (80.8 gpm) with a priority date of 8/25/1923. The period of diversion and use is from 1/1 to 12/31. This water right has two points of diversion, two springs, with an individual maximum diversion rate of 0.09 cfs (~40 gpm). The period of diversion and use is from 1/1 to 12/31. While there are two springs (points of diversion) associated with this water right, they are referred to as the East Spring.

Spring flow is captured behind and diverted from impoundments (concrete walls) a few hundred feet below where water daylights. The West Spring impoundment is large consisting of a wall approximately 10 feet high and 50 feet long. The East spring impoundments are much smaller with walls 2-4 feet high and 5-10 feet long.

## Spring Water Diversions

While the City has surface water rights for the two springs, actual diversion and treatment is less than the total amount allowed in the certificates. Examination of the most recent five-years (2013-2017) of diversion data from the West and East Spring indicated mean monthly diversions of 4.9 and 0.7 million gallons of water from the West and East Spring respectively and mean annual diversions of 58.3 and 8.3 million gallons respectively. The diverted volumes amount to 59% and 19% of the possible water rights being used on an annual basis.

Table 1 highlights the apparent difference in the City's water rights and what is effectively diverted. The reasons for the lower rates of production are due to two main factors:

- **Dry Season Low-Flows:** Diversions from the West Spring have been limited during summer months to a little as 4.7 million gallons (110 gpm); and
- **High Turbidity Events:** Water yields from the East Spring are significantly lower than its water right allows because wet season flows, particularly during storm events, have high sediment concentrations which the WTP cannot filter effectively. -Additionally, decreasing yields during the dry season limit the overall production of the East Spring. Therefore, the East Spring is currently diverting as much water as currently feasible throughout the year at 8.3 MGY.

Because the East Spring yield is effectively maximized, and dry season yield of the West Spring limits its production, then any additional water must come from flows from the West Spring.

# HYDROLOGIC MODEL AND WATER AVAILABILITY ASSESSMENT

This section assesses the quantity of water that drains from the West Spring catchment. As previously stated, yields from the East Spring are considered maximized due to turbidity events. Therefore, this section and the remainder of the appendix only assesses the quantity of water available from the West Spring catchment for utilization by the City.

## Catchment Physiography

This section presents an overview of the geophysical characteristics of the West Spring catchment that influence hydrology and spring yield. The West Spring catchment is presented on Figure 2 and includes an area of approximately 46 acres. The general physiographic characteristics of the catchment is as follows.

### Geomorphology

The lowest elevations in the West Spring catchment is 850 feet above Mean Sea Level (MSL)<sup>1</sup>. These low elevations correspond to where the impoundments are located. The top of the catchment off Sellers Road (headwaters) is at 1250 feet MSL. The gradient of the upper portions of the catchment is relatively gentle with slopes from 0 to 30%, while the lower reaches of the catchment is steep forming a scarp with slopes from 30 to 75%. The catchment is located on the southern side of the range, facing south by southwest to south to south by southeast.

### Geology

Gannett and Caldwell (1998) provide a summary of the surface geology in this area at a scale of 1 to 250,000. The upper portion of the catchment is composed of basalt, while the lower reaches of the catchment consist of marine sediments.

### Soils

The soils of the catchment are generally well drained, especially in the upper reaches<sup>2</sup>. These soils are silt loams of hydrologic group B or silt clay loams of hydrologic group C. The Laurelwood silt loam makes up almost 82% of the soil composition within the catchment. J ory Silty Clay Loam, Melbourne Silty Clay loam, Saum Silt Loam comprise the remainder of the soils in the area.

### Landcover and Vegetation

According to the US Geologic Survey National Landcover database (2011) vegetation in the area is mostly shrub with young regrowth (< 5.0 meters) of historically forested lands. This includes a possible tree farm in the upper portions of the catchment, zoned as EFC (Exclusive Forest and Conservation). Of this forested green space, more than 30% is comprised of Evergreen (conifer) forest, and almost 20% of mixed deciduous and conifer forest with trees greater than 5 meters tall. The remainder of the catchment is grassland, open space or barren, each less than 2% of the total area.

### Climate

The broad climate classification of the Pacific Northwest corridor between the coastal ranges to the Cascade ranges falls under the Mediterranean climate (Koppen classification system; Peel *et al* 2007) characterized by dry summers and cool, rainy winters.

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<sup>1</sup> National Elevation Dataset (NED), 10x10m on 7.5x7.5' quadrangles; U.S. Department of Agriculture (USDA) Natural Resources Conservation Services version 2.7.33 on 4/07/2017

<sup>2</sup> Soil Survey Geographic (SSURGO), U.S. Department of Agriculture, Natural Resources Conservation Service

Climate data from the Hillsboro Airport<sup>3</sup> indicate mean minimum and maximum temperatures 33 and 53 respectively in the winter, and 45 to 82 in summer months. Analysis of rainfall data from the Buxton-Mountindale rain gage<sup>4</sup> indicates mean annual rainfall of more than 50 inches with a maximum average rainfall of 8.8 inches occurring in December. Mean annual potential evapotranspiration (PET)<sup>5</sup> is estimated at 32.5 inches, with a maximum PET value of 6 inches in July. Figure 3 shows the mean monthly values for temperature, precipitation and PET.

## Data Collection

This section summarizes the instrumentation and data collection activities for the West Spring. Historically, the spring catchments have not been gaged. To assess the available yield of the West Spring catchment, a flow monitoring system was installed to collect baseline spring flow data for utilization in a hydrologic model.

### Instrumentation

A gaging station was installed at the West Spring impoundment to measure flows spilling across the weir. The data was collected to aid in the development of a hydrologic model for estimating flows generated by the catchment. The data was also used for calibration and uncertainty analysis. When the impoundment was constructed, it was fitted with a compound v-notch/sharp crested weir which allows for flow estimates to be made based on the height of the water behind the weir.

An In-Situ Rugged Troll 200 pressure transducer was installed behind the weir along with a graduated staff gage to measure the elevation of the water in the impoundment relative to the elevation of the weir. A rating curve (flow versus water level) was developed for the weir based on the dimensions of the v-notch (Shen 1981). Anecdotal observations of the weir indicate that the flow rarely, if ever, completely tops the triangular section, though during the summer months, water typically ceases spilling over. The staff gage was installed at the transducer to provide redundancy in measurement and to allow for minor calibration of the system. Manual measurement of water levels taken from the gage were conducted weekly.

The gage was installed on 3/9/2017 and recorded water level measurements at 15-minute intervals. At the time this assessment was conducted, approximately two months of data had been collected.

### Flow Monitoring Results

At the time this assessment was drafted, more than two months of data had been collected. For each recorded measurement, the flow across the weir was added to the City's records of daily diversions from the impoundment to estimate the total flow draining from the West Spring catchment, including the spring flow. Figure 4 shows the average daily flows over the weir combined with the diversions from the West Spring. Included in the figure are the range of flows observed for each day and the daily precipitation amounts (in inches). Summary of the collected data demonstrate the following:

- Stream flow and rainfall both diminished from the beginning of the collection period to 5/15/2017.

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<sup>3</sup> Portland Hillsboro Airport Weather Station, KHIO, Station ID USW00094261

<sup>4</sup> Buxton, Oregon, Station ID USC00351222

<sup>5</sup> Potential Evapotranspiration is the total possible amount of water from the lands surface transformed to water vapor. This includes evaporation from standing water and soil moisture to transpiration, or expiration, of water from the leaves of plants (Dingman 2002).

- Approximately 22.2 million gallons of precipitation fell on the West Spring catchment. This equates to 17.7 inches averaged over the whole catchment, including an event that on 5/15/2017 that resulted in almost 2 inches of rain.
- Approximately 25.1 million gallons of water was discharged from the spring at the gage (20.1 inches of runoff and baseflow<sup>6</sup> from the catchment).
- This indicates a net loss of water of 2.9 million gallons leaving the system.
- The “peak” flow observed was 0.76 cfs on 3/15/2017 and the minimum flow of 0.46 cfs on 5/14/2017. The average flow over the entire period of record was 0.571 cfs.

## Catchment Modeling

This section discusses how the collected data from the installed streamflow gage was used to develop a long-term hydrologic model for the West Spring catchment. The modeling process generally involves an initial data collection period followed by establishing, calibrating and running the model for the desired period.

### Modeling Method

For catchments with no or limited data such as that of the West Spring (2 months of gaged data), hydrologic calibrations are often made to other catchments that have a robust dataset from which relationships between the two catchments can be made.

A catchment with similar geophysical characteristics and a robust dataset was identified for hydrologic calibration near the West Spring catchment, being the East Fork Dairy Creek catchment. The East Fork catchment is on the other side of Green Mountain to the north, and their boundaries at their closest are less than ½-mile apart. Figure 5 shows the East Fork catchment boundary relative to the West Spring catchment along with gage location and general topography. A summary of the East Fork catchment’s physiographic characteristics are as follows:

- The stream flow gage is located off NW Dairy Creek Road. The area upstream of the gage is approximately 21,600 acres and the length of the East Fork is 9.8 miles.
- The catchment headwaters are at approximately 2,200 ft MSL, and the elevations of the lower reaches 300 ft MSL. Catchment slopes are more gradual than the West Spring catchment; approximately 75% of the catchment has a slope of less than 20%. The East Fork drains from north to south.
- Geology is similar with basalt comprising the shelves and range tops and marine sediments in the lower elevations and valleys.
- Soils are moderately well drained, made up of Hydrologic Group B (60%) and Hydrologic Group C (40%). Soils are primarily Silt Loams, with remainder comprise of loams or silt clay loams.
- Landcover and vegetation consist of 34% shrub/scrub, 34% conifer forests, 20% mixed forest, and the remainder grass/open space, barren lands, pasture, and deciduous forest. Less than 1% of the land is rural residential or occupied developed land.
- The climates of the two catchments are similar, however, the East Fork catchment typically receives more rain due to the higher elevations in the catchment. The East Fork catchment receives some snow, but does not have any significant snow pack.

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<sup>6</sup> Baseflow is an expression of groundwater that discharges into streams and rivers via springs, seeps or through the streambed itself.

The East Fork gage collects flow measurements every 15 minutes, like the West Spring gage, and has been operational since 5/7/2002, a record 15 years. The East Fork and the West Spring catchments have more than 6000 concurrent data points.

Due to the size and topography of the East Fork catchment, there is likely to be more lag time between storm precipitation and when the peak flows discharge compared to the response time for the West Spring catchment. The soils, landcover and geology of the East Fork is similar to the West Spring catchment, and the most important similarity between the two catchments is their proximity. That is, while the amount of rainfall the East Fork catchment receives is likely slightly different than that of the West Springs catchment, it is an appropriate assumption that when it is raining in the East Fork catchment, it is also raining in the West Spring catchment, and hence runoff characteristics are assumed to be similar.

### **Model Regression Analysis**

The hydrologic model selected to estimate daily flows for the West Spring catchment based on calibration with the East Fork catchment is a simple linear regression. A linear regression is a model that establishes a linear relationship between two independent variables based on minimizing the error between the measured values and the estimated values.

Several combinations of data transformations and time shifts were tested, which was synonymous in modeling “calibration”. The strongest relationship was between the log-transformed East Fork flows and the normal West Spring catchment flows. A least-squares line between the data yielded the following equation:

$$Q_{WS} = 0.217 \log Q_{EF} + 0.094, R^2 = 0.637$$

*Where:*

- $Q_{WS}$  is the West Spring catchment flows; and
- $\log Q_{EF}$  is the logarithm of East Fork Dairy Creek flows (base 10).

*Analysis of the regression demonstrated:*

- The coefficient of determination,  $R^2$ , is 0.637, which means 64% of the variance of flows in the estimated West Spring data is explained by  $\log Q_{EF}$ .
- T-test statistics on the regression coefficients are:
  - Slope,  $m = 0.217$ , t-stat = 103.3, with a two-tailed  $\alpha = 0.05$
  - Intercept,  $b = 0.094$ , t-stat = 20.4, with a two-tailed  $\alpha = 0.05$
  - These statistics indicate both the slope,  $m$ , and intercept,  $b$ , are significant and not equal to 0.

Figure 6 shows that the scatter plot of the log-transformed East Fork flows (horizontal axis), West Spring flows (vertical axis), and the line of best fit between the two variables. Inspection of the graph indicates that the variance in the estimated West Spring flows is not random but is dependent on the log-transformed East Fork catchment flows. Figure 7 compares the accuracy of the hydrologic model to the collected two month dataset for the West Spring catchment, and shows a fairly strong accuracy.

### **Model Results**

After the West Spring catchment hydrologic model was developed and calibrated, it was executed for the period of record of East Fork catchment flows (5/7/2002 to present). This hydrologic model allows for the estimate of West Spring flows for the period of record of the East Fork flows. Or, a 15-year record of daily East Fork flows was used to estimate a 15-year record of flows in the West Spring catchment.

Assessment of the estimated 15-year West Spring flows showed the following characteristics in available water yield:

- The monthly variation in yield is from an average of 6.2 million gallons in September to an average of 11.4 million gallons in January.
- The mean annual water yield from the West Spring is approximately 105.5 million gallons.

Table 2 presents the estimated average monthly yields for the West Spring catchment based on the results of the hydrologic model.

### **Modeling Considerations and Assumptions**

A statistical analysis of the modeling demonstrates a robust means of estimating daily flows from the West Spring catchment allowing for reliable estimation of monthly and annual catchment yields. Statistical examination of the predictive intervals surrounding the line-of-best-fit indicate a model uncertainty of  $\pm 10\%$ . Therefore, the range of expected yield during an average year would be 105.5 million gallons  $\pm 10.5$  million gallons.

Other considerations from the modeling exercise include the following items:

- The model calibration is not based a full year of data and only captures the spring season. The model could be improved by leaving the stream gage in the West Spring impoundment for the remainder of the year to provide a larger seasonally inclusive data set.
- The scatter plot demonstrates that the model doesn't represent different flow ranges in the same way. For example, East Fork catchment flows between 125 and 200 cfs show a slight underprediction of flows in the West Spring catchment, or for East Fork flows between 250 and 315 cfs the model tends to overpredict flows in the West Spring catchment.

## **Available Flow Determinations**

This section evaluates what portion of the estimated flows of the West Spring catchment from Section 2.3 can be utilized based on the protection of systems supported by the stream including habitat for critical species (instream water rights). Oregon Senate Bill 839 calls for the protection of seasonally varying flows when certain water supply projects seek surface water for storage. OWRD has established a technical advisory committee to set the guidance for projects that seek to appropriate surface water (e.g., streams and rivers) for storage.

The Outcome of the OWRD advisory committee to date is the guidance manual *A Proposed "Percent of Flow" Approach for Water Storage Projects in Oregon* (OWRD 2014), which outlines the steps to determine if and when water is available for diversion and storage. This primary goal of this process is to help maintain at a minimum enough water to support the ecological, biological and physical functions of a stream or river. The following subsections discuss the process of determining necessary in-stream flows and how this process was applied to the West Spring catchment to determine the availability of water for utilization by the City.

### **OWRD Guidance**

The *"Percent of Flow" Approach* guidance provides four main steps in a simplified approach to determining if, when and how much water is available. These steps are:

1. Find the "typical" amount of flow in the surface water source for each month, referred to as the median exceedance criteria.

2. Subtract off the existing water rights from the monthly median exceedance criteria to determine if and when water is available.
3. Establish a protective base flow as the lower diversion threshold. This step is conducted by the Oregon Department of Fish and Wildlife (ODFW) and is not included in this analysis. This step should be addressed if additional flows from the West Spring catchment are found to be a feasible source of water for ASR.
4. Use a “Percentage of Flow” approach to estimate how much water could be diverted at any given time when water is available. The OWRD guidance recommends allowing up to 15% for diversion when conditions (1), (2) and (3) are satisfied. This keeps 85% of the “natural flows” in the stream or river. If conditions (1), (2) and (3) indicated no water is available, then the allowable diversion would be 0% of the flow.

### **Resulting Water Availability**

The *Percent Flow* approach outlined above was conducted for the West Spring catchment based on the estimated yields from the hydrologic model. Results showed that water from the West Spring catchment was available for utilization in excess of the City’s water rights for the months of December through May.

Or put differently, the result of *Percent Flow* approach shows that the City is able to fulfill their entire water right for the West Spring between December and May, with some “untaken/unclaimed” water being leftover. To utilize this “untaken/unclaimed” water, an entity would need to obtain a new water right from the state. Based on the hydrologic model and the *Percent Flow* approach, the volume of “untaken” water between December and May equates to approximately 8.3 to 10.1 million gallons per year, depending on the variability of climate, runoff, and modeling.

## **SPRING INFRASTRUCTURE LIMITATIONS**

This section provides analysis on the water supply infrastructure related to the springs to determine if there are any infrastructure limitations on the availability of water from the West Spring catchment.

### **Water Treatment Plant**

Water diverted from the springs is treated via slow sand filters prior to conveyance to the Carsten Reservoirs near the City. Filtered water is temporarily stored in a clear well and disinfected in a chlorine contact chamber.

The slow sand filter consists of two 55 x 30 feet basins of 6 to 12 feet depth. According to the City of Banks Engineer (Kennedy/Jenks, *pers. comm* 2018), the individual basin average treatment rate is approximately 60 gpm, for a cumulative average treatment rate of 120 gpm. According to the City of Banks Public Works Supervisor (Tom Tuski, *pers. comm* 2017) the individual basin maximum treatment rate observed is approximately 92 gpm. Therefore, the maximum effective treatment capacity of both basins is 184 gpm, which is 68% of the water rights of both the West Spring (188.5 gpm) and East Spring (80.8 gpm).

Based on the West Spring hydrologic model and availability assessment completed in Sections 2 and 3, the WTP capacity limits the City from utilizing available water for eight months (November through June). During this eight month period, the combined yields of the West and East Springs exceed the treatment capacity of the WTP by an average of 21.1 gpm, resulting in an unutilized annual volume of 7.3 million gallons.

The capacity of the WTP is presented in Table 3 in terms of infiltration rate, million gallons per day (MGD), gallons per minute (gpm), and million gallons (MG) for annual treatment volume. To summarize, the WTP currently has capacity to treat of the water from the existing water rights of the springs.

### **Pipeline to City**

One of the main focuses of the improving the reliability of the City's water supply system has been reducing losses in transmission of water from the WTP to the Carsten Reservoirs near the City. The Water Master Plan estimates that the conveyance pipe loses approximately 25-30% of the water coming from the WTP (Kennedy/Jenks 2009). Generally new, well-managed water systems can reduce losses to 10% or less, whereas older systems typically demonstrate losses of 20% or more (AWWA 2005). If upgrades to the system are implemented, it is possible losses can be reduced to 10-15%. Subsequent analysis herein assumes a 10% conveyance loss. Overall, the volume of water that could be conserved from pipeline improvement and leakage reduction amounts to approximately 6.1 million gallons per year.

## CONCLUSIONS

The section summarizes the results of the West Spring hydrologic model (Section 2), and brief infrastructure evaluation (Section 3) to determine the volume of water available from the West Spring. As discussed, the East Spring was not included in this analysis due to limitation in stream flow in the summer months and high turbidity events during winter months.

The following conclusions are noted:

1. A hydrologic model was developed for the West Spring to estimate spring yields. The average annual water yield from the West Spring is approximately 105.5 million gallons. Monthly water yield from the West Spring is presented on Table 2. The West Spring hydrologic model shows that on average, the City should be able to meet their full water right for the West Spring (188.5 gpm) between November and June.
2. Based on the West Spring hydrologic model and OWRD *Percent Flow* approach to protecting instream water rights, there is approximately 8.3 to 10.1 million gallons per year of “untaken/unclaimed” water. To utilize this “untaken/unclaimed” water, an entity would need to obtain a new water right from the state. Based on the hydrologic model and the *Percent Flow* approach, this volume of “untaken” water is available between December and May.
3. The current treatment capacity of the WTP (184 gpm) is a limitation to spring diversions, and results in an average annual volume of 7.3 million gallons of water left unutilized by the City. The treatment capacity of the WTP limits available spring diversions for eight months (November through June).
4. Improvements to the conveyance pipeline from the WTP to the City from current losses of 25-50% to 10% would result in approximately 6.7 million gallons of conserved water based on the City’s current usage of the springs.

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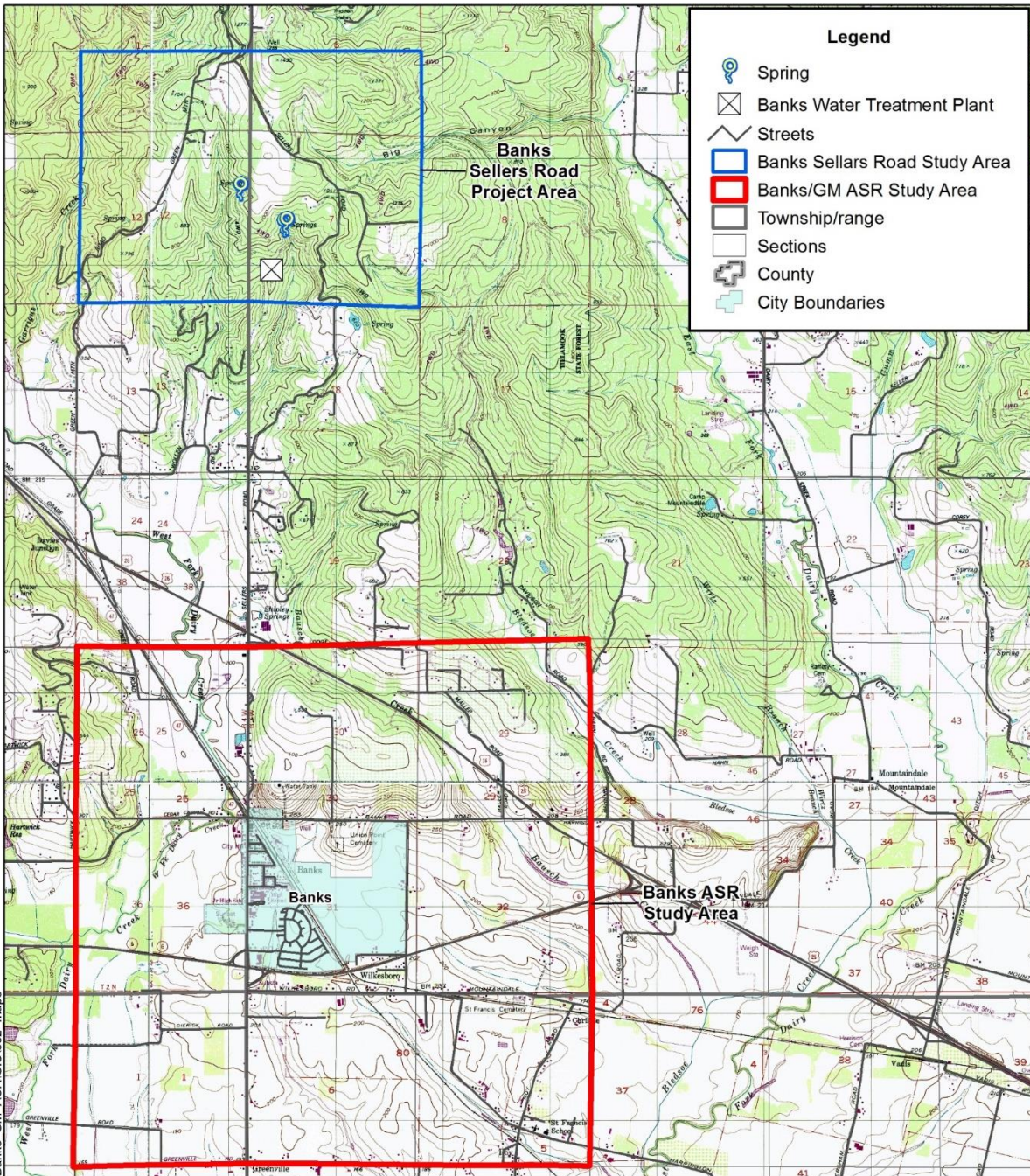
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# FIGURES

Figure 1. Location of Sellers Road Study Area and Green Mountain Springs



C:\001 Cwm\Projects\1501002 Banks GM ASR\GIS\002 maps

<p><b>CWM-H2O</b> Complete Water Management</p> <p>415 Colony Drive Portland, Oregon 97219 (503) 893-5937</p>	<p><b>FIGURE 1</b> Sellers Road and Banks Green Mountain ASR Green Mountain Study Area</p>		<p>2,000 0 2,000 4,000 ft</p> <p>1 inch = 4,000 ft</p>											
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">1</td> <td style="width: 15%;">05/15/17</td> <td style="width: 15%;">RMS</td> <td style="width: 15%;">DRAFT</td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td>No.</td> <td>Date</td> <td>By</td> <td>Revisions</td> </tr> </table>	1	05/15/17	RMS	DRAFT					No.	Date	By	Revisions	<p><b>Proj #: 1501002; Banks Green Mountain ASR</b> City of Banks 13680 NW Main Street Banks, OR 97106</p>
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Figure 2. West Spring and East Spring Catchments

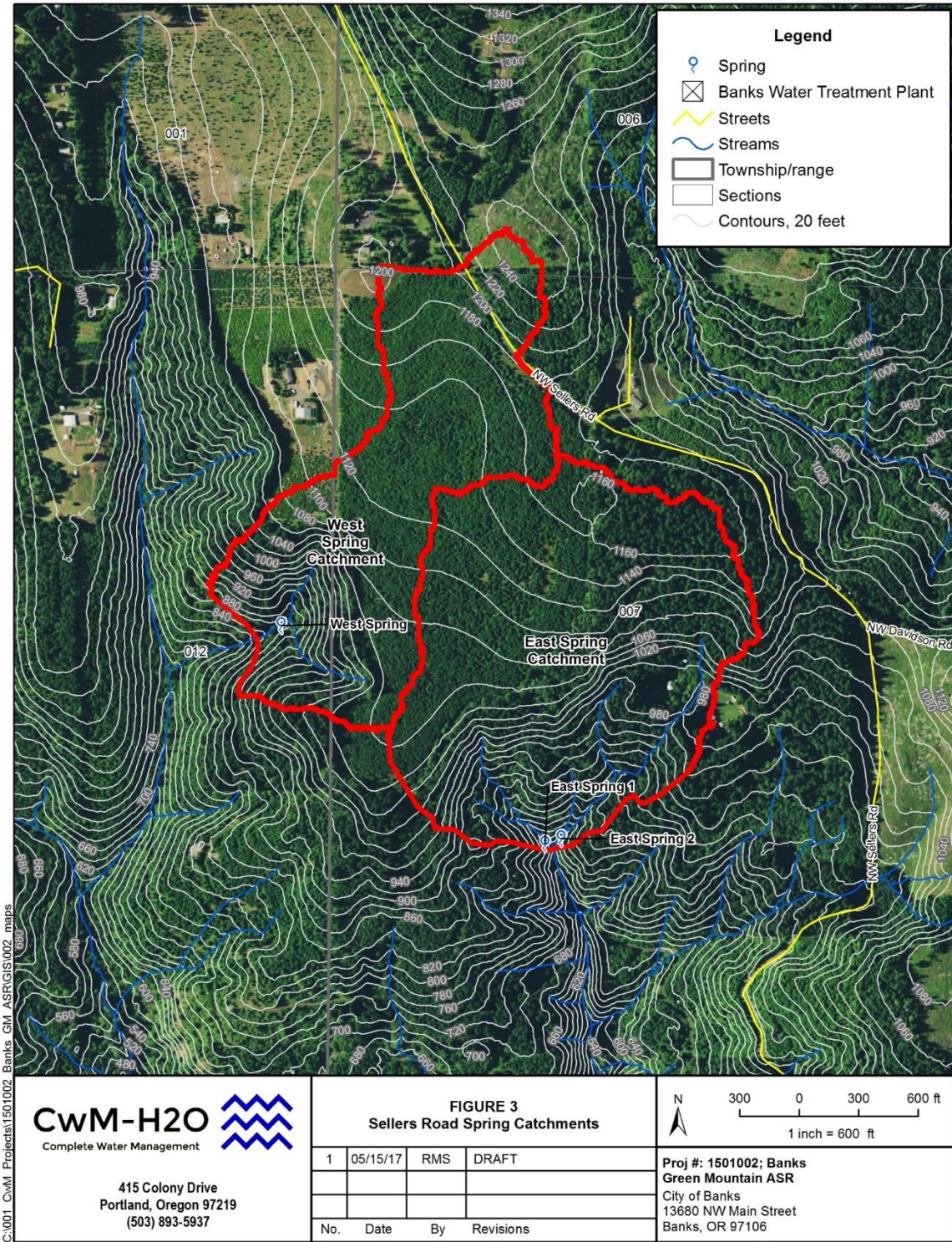


Figure 3. Precipitation, Temperature, Potential Evapotranspiration for Buxton and Hillsboro

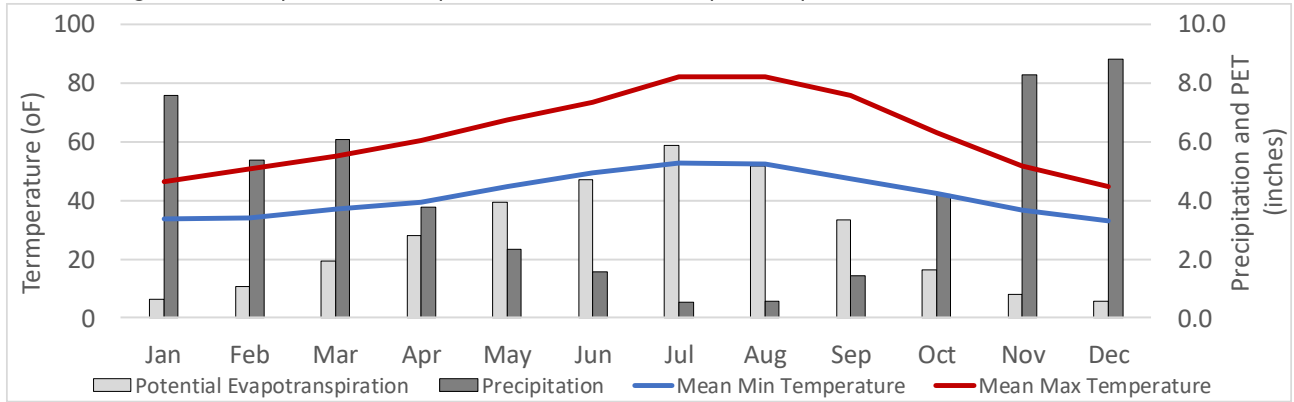


Figure 4. Measured Daily Flows from West Spring Catchment

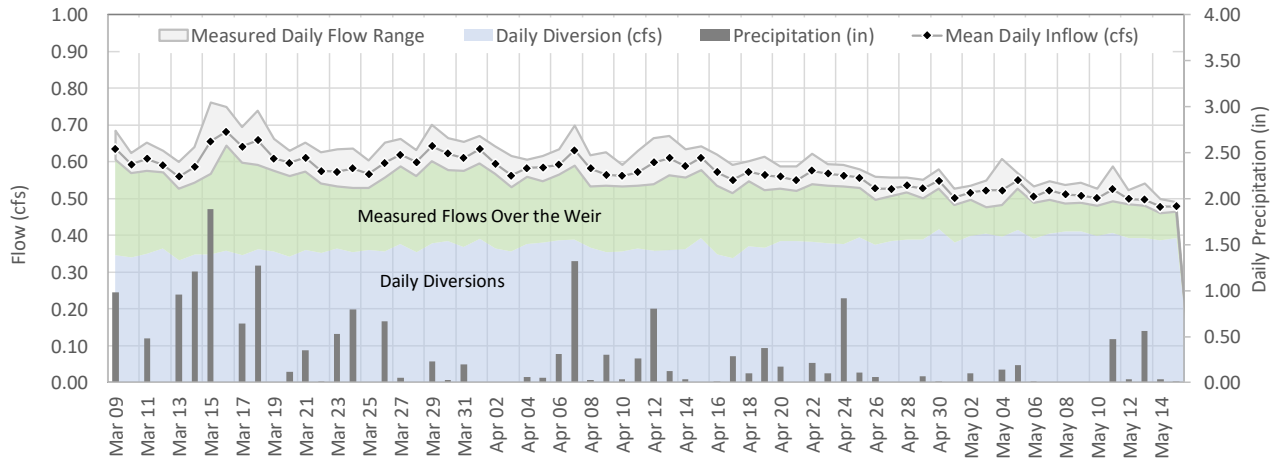


Figure 5. East Fork Dairy Creek Catchment

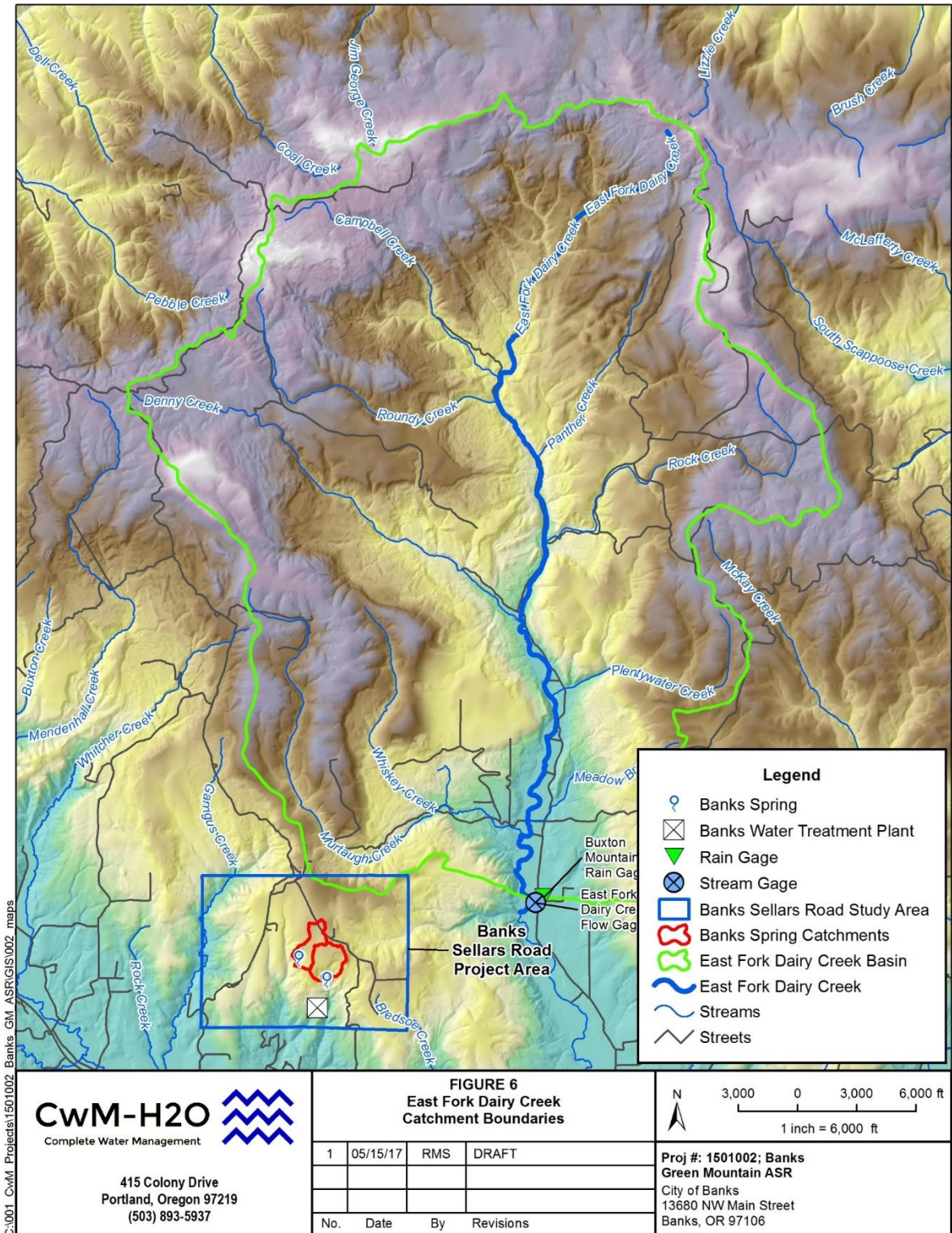


Figure 6. East Fork Dairy Creek and West Spring Regression

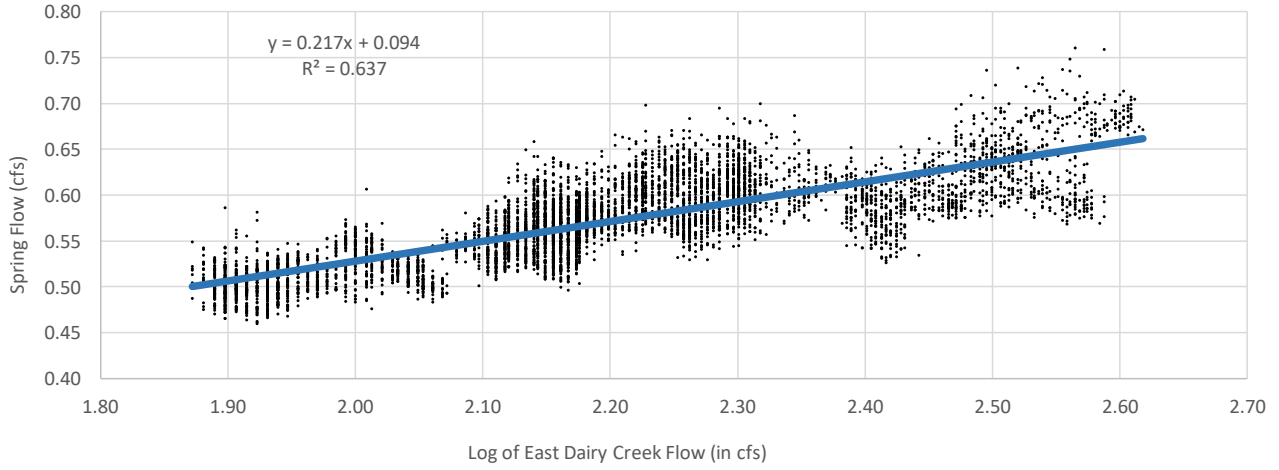
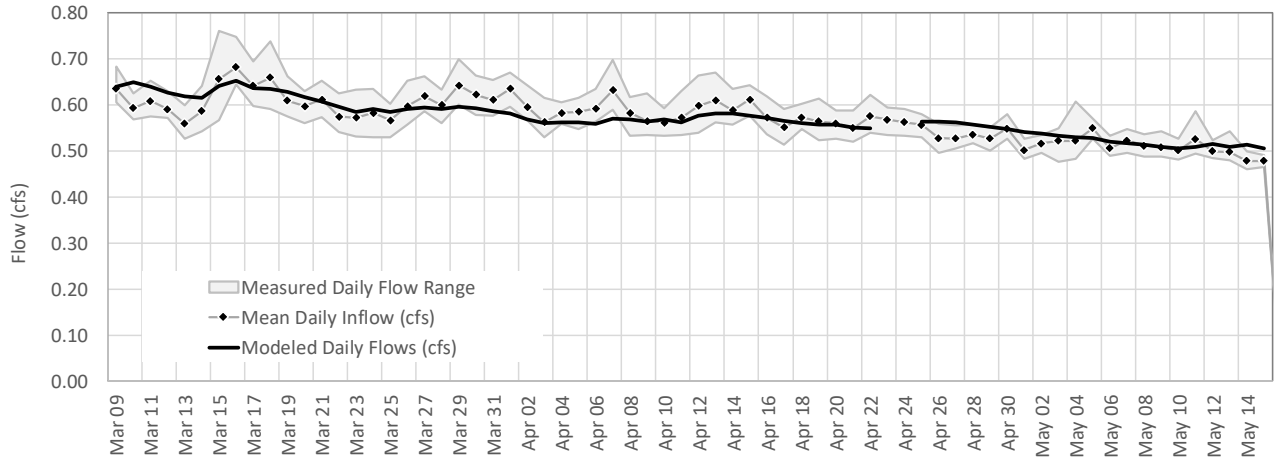


Figure 7. Comparison of Hydrologic Model Results to Gaged Flows



# TABLES

Table 1. Comparison of City's Average Spring Usage and Water Rights

Water Usage (Millions of Gallons)	West Spring	East Spring	Total
Mean Annual Usage (2013-2017)	58.3	8.3	66.5
Annual Water Right	99.1	42.5	141.5
Unused Water from Water Right	40.8	34.2	75.0

Table 2. West Spring Hydrologic Model Estimated Monthly Yield

Month	Estimated Yield (Millions of Gallons)
January	11.45
February	10.16
March	11.05
April	10.05
May	9.39
June	8.06
July	7.29
August	6.57
September	6.06
October	6.84
November	8.60
December	10.02
<b>TOTAL ANNUAL</b>	<b>105.54</b>

Table 3. Water Treatment Plant Capacity

Component / Item Description	Infiltration Rate (m/hr)	Treatment Volume (MGD)	Treatment Rate (gpm)	Annual Volume (MG)	% of Water Rights
Average WTP Treatment	0.09	0.175	120	64.0	45%
Maximum WTP Capacity	0.14	0.265	184	96.7	68%