MEMORANDUM

FROM: Jennifer Sukow, IDWR

TO: ESHMC

DATE: November 4, 2011

RE: Transient Spring Target for cell 1041013 (Three Springs, Weatherby Springs, Hoagland Tunnel, and Spring Creek Spring)

During the September 13, 2011 ESHMC meeting, the committee requested that model cell 1041013 be changed from a Group C to a transient spring target for calibration of ESPAM2.0. This memorandum describes data reviewed for the four springs in this cell during the model calibration period (1980-2008), and provides a transient data series for use as a calibration target. The calibration target is the sum of five self-reported diversions, one estimated diversion, one estimate of undiverted flow, and one irrigation diversion with annual volume estimated by power consumption. The calibration target will be classified as a Group B target.

Three Springs, Weatherby Springs, and Hoagland Tunnel Complex

Based on data reviewed, spring flow from Three Springs, Weatherby Springs, and Hoagland Tunnel is diverted by the Jones Hatchery and for irrigation, domestic, and other fish propagation uses. Diversions are measured by the water users and reported to Water District 36A. Diversion records include sites 360410067 (Jones Hatchery), 360410066 (Pipe from Three/Weatherby), 360410069 (Hoagland Tunnel Ditch), 360410005 (Bar S), and 101173 (Jones Pumps). Sites 36041066 and 360410069 are diverted upstream of the Jones Hatchery. Sites 360410005 and 101173 are diverted from the hatchery tailwater.

Some water reported in 360410066 is used in the Jones Hatchery and is included in the total hatchery diversions. This water is subtracted during calculation of total spring flow. Some undiverted spring discharge is known to occur at the Lower Weatherby Spring, although most of this flow can be diverted to the Jones Hatchery via a pump. A map showing the collection and distribution facilities in 2005 is provided in Figure 1.

Records of total diversions to the Jones Hatchery and hatchery inflow from site 360410066 were provided to IDWR by the Jones Hatchery and HDR, Inc on October 7, October 16, and October 17, 2011. Records provided also indicate when the Lower Weatherby pump was in operation. Diversion records for the other sites were obtained from an IDWR database of diversions reported by water users in Water District 36A. The total discharge of the spring complex was calculated using the following equation.

Three Springs Complex discharge = 360410067 (Total Jones Hatchery diversions) + 360410066 (Pipe from Three/Weatherby) – Hatchery inflow from 360410066 + 360410069 (Hoagland Tunnel Ditch) + Lower Weatherby undiverted flow

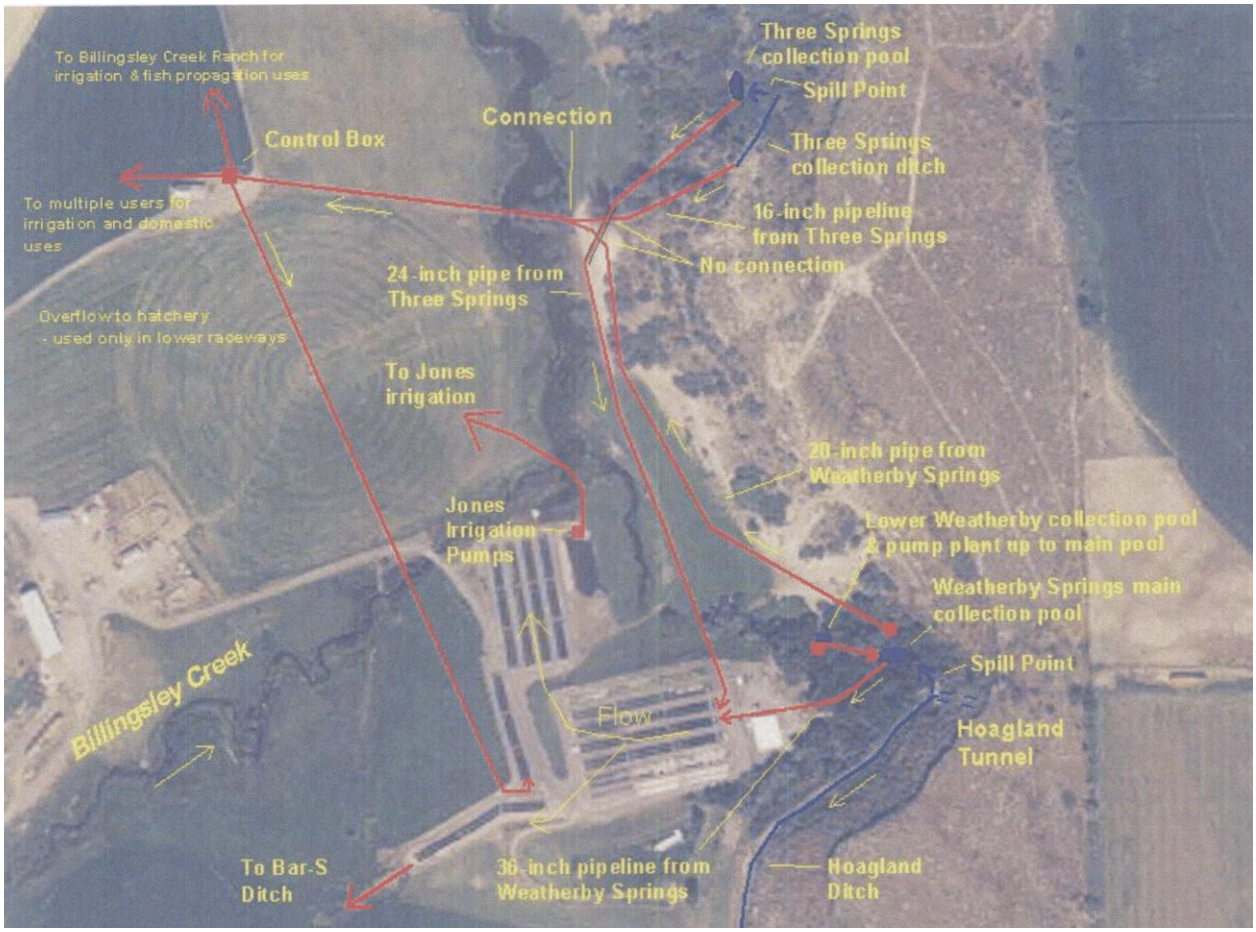

Figure 1. Conceptual layout of spring discharge collection and conveyance facilities from July 29, 2005 order[1].

The diversion works at this spring complex were modified sometime in 2010 and new measurement site 100058 (Weatherby Springs Pipeline) was added. Calculation of total spring discharge from diversion records may require use of a different equation beginning in 2010.

A few miscellaneous measurements were made by IDWR staff during the model calibration period. On August 26, 1993, IDWR staff measured 34.79 cfs at the Jones hatchery raceways, 8.95 cfs at the pipe from Three/Weatherby Springs, and 6.05 cfs at the Hoagland Tunnel Ditch. During this site visit, the pipe from Three/Weatherby Springs provided 3.12 cfs to the hatchery.

[1] IDWR, 2005, *Order in the Matter of Distribution of Water to Water Right No. 36-07071,* http://www.idwr.idaho.gov/apps/ExtSearch/DocsImages/9xqd01_.PDF.

The memo[2] indicates that there was an additional 3 to 3.5 cfs from a lower spring that Jones was able to pump to the hatchery, but it was not being diverted at this time. The memo indicates that total spring flow was 46.67 cfs (34.79 + 8.95 – 3.12 + 6.05) plus the unmeasured 3 to 3.5 cfs from the lower spring. Total spring flow on this date was approximately 50 cfs.

On July 13, 2004, IDWR staff measured 27.21 cfs at the Jones hatchery raceways, 6.86 cfs at the pipe from Three/Weatherby Springs, and 5.09 cfs at the Hoagland Tunnel Ditch. During this site visit, the pipe from Three/Weatherby Springs provided 1.66 cfs to the hatchery. Estimated spring flow based on these measurements was 37.5 cfs (27.21 + 6.86 + 5.09 -1.66). For comparison, records submitted by the water users report diversions of 28.9 cfs at the Jones Hatchery (including 1.69 cfs delivered through the Three/Weatherby pipe), and 6.9 cfs at the pipe from Three/Weatherby Springs on July 15, 2004. Records of the Hoagland Tunnel Ditch diversion are not available for this date.

On June 22, 2005[3], IDWR staff measured 28.05 cfs at the Jones hatchery raceways, 6.46 cfs at the pipe from Three/Weatherby Springs, 4.4 cfs at the Hoagland Tunnel Ditch, and 0.5 cfs of undiverted flow. During this site visit, the pipe from Three/Weatherby Springs provided 0.7 cfs to the hatchery. A site diagram was provided in this memorandum. Estimated spring flow based on these measurements was 38.71 cfs (28.05 + 6.46 + 4.4 – 0.7 + 0.5). For comparison, records submitted by the water users report diversions of 29.32 cfs at the Jones Hatchery (including 0.88 cfs delivered through the Three Weatherby pipe), 8.0 cfs at the pipe from Three/Weatherby Springs, and 4.4 cfs at the Hoagland Tunnel Ditch on June 24, 2005.

On July 10, 2009, IDWR staff measured 19.8 cfs at the Jones hatchery discharge to Billingsley Creek, 7.81 cfs at the Jones irrigation pumps, 5.15 cfs at the Hoagland Tunnel Ditch, and 5.99 cfs in the Three Springs/Weatherby pipeline. The Three Springs/Weatherby pipeline was measured with a polysonic meter at a point below the split to the hatchery. IDWR staff did not measure the Bar S diversion during this site visit. The water user reported 5.71 cfs at the Bar S on this date. Estimated spring flow based on these measurements was 44.46 cfs. For comparison, water users report 32.65 cfs at the Jones Hatchery (including water delivered through the Three Weatherby pipe), and 7 cfs at the Three/Weatherby pipe. Note that the record for the Jones Hatchery includes water rediverted by the Bar S and Jones irrigation pumps.

Available diversion records between 1980 and 2008 are summarized in Table 1**.**

[2] Luke, 1993, Memorandum to Norm Young, dated August 27, 1993, Re: Visit & Measurements at Jones Fish Hatchery. http://www.idwr.idaho.gov/apps/ExtSearch/DocsImages/4q8z01_.PDF

[3] Patton and Yenter, 2005, Memorandum to Karl Dreher, dated June 28, 2005, Re: Jones Hatchery – Conjunctive Administration Call Field Investigation Report.

Site	Dates	Frequency
Total Jones Hatchery diversions	5/1975 – 9/2011 8/26/1993; 7/13/2004; 6/22/2005; 7/10/2009	Weekly Miscellaneous
360410066 (Pipe from Three/Weatherby)	8/26/1993; 7/13/2004; 6/22/2005; 7/10/2009 5/30/1996 – 12/31/2009	Miscellaneous Weekly
Hatchery inflow from 360410066	11/1980 – 11/2006 8/26/1993; 7/13/2004; 6/22/2005	Weekly Miscellaneous
360410069 (Hoagland Tunnel Ditch)	8/26/1993; 7/13/2004; 6/22/2005; 7/10/2009 5/16/2005 – 12/31/2008	Miscellaneous Weekly
Undiverted spring discharge	8/26/1993; 6/22/2005	Miscellaneous
360410005 (Bar S)	3/1/1995 – 12/31/2009	Weekly
101173 (Jones Irrigation Pumps)	1995 – 2008	Annual volume

Table 1. Available diversion records for Three Springs, Weatherby Springs, and Hoagland Tunnel

Estimated spring discharge can be calculated for the time period between June 1996 and December 2009 using available data and the following assumptions (Figure 2).

- Spring complex discharge = 360410067 (Total Jones Hatchery diversions) + 360410066 (Pipe from Three/Weatherby) – Hatchery inflow from 360410066 + 360410069 (Hoagland Tunnel Ditch) + Lower Weatherby undiverted flow
- Records available from IDWR databases are assumed to be a reasonably accurate representation of diversions, with the exception of site 360410067. Records of total hatchery diversions were provided to IDWR by the Jones Hatchery and HDR, Inc. IDWR is in the process of correcting database records for site 360410067 using the data recently submitted.
- Hatchery inflow from 360410066 is based on measured values recorded by the Jones Hatchery through November 2006. After November 2006, this quantity was not recorded, and average monthly values were used in the calculation of total spring discharge.
- Hatchery inflow pumped from Lower Weatherby Spring is included in total hatchery diversions.

- Undiverted spring discharge at Lower Weatherby Spring is assumed to be 3.5 cfs when the pump is not operating and 0.5 cfs when the pump is operating. Other undiverted spring discharge is assumed to be insignificant.
- Hoagland Tunnel Ditch diversions between June 1996 and April 2005 are assumed, based on the average monthly diversion reported between May 2005 and December 2008.
- Records 360410005 and 101173 are rediversions of water reported in total hatchery diversions.

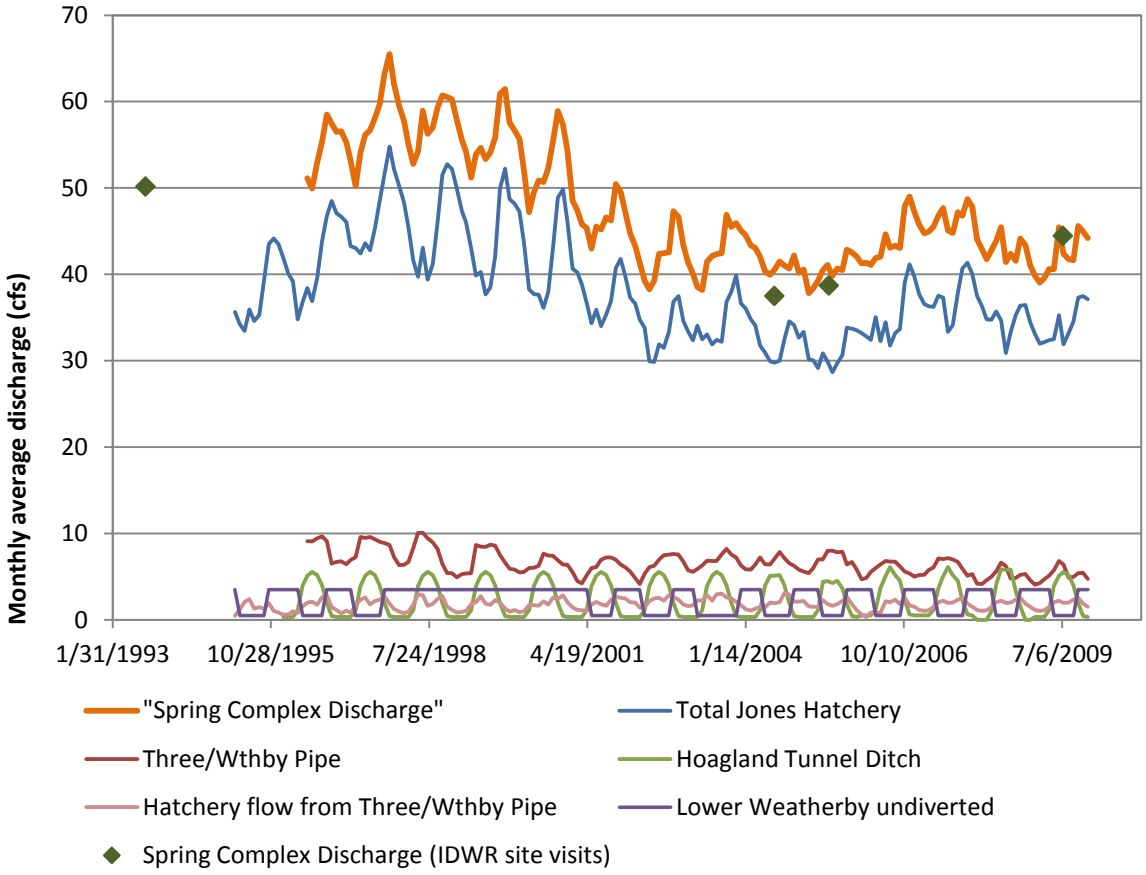

Figure 2. Estimated spring discharge at Three Springs, Weatherby Springs, and Hoagland Tunnel.

Spring Creek Spring

Based on data review, flow from Spring Creek Spring is diverted by the Lee Hatchery, residential users, and an irrigator. Diversions are measured by the water users and reported to Water District 36A. Diversions include sites 36010072 (Lee Hatchery), 410074 (Spring Creek Spring Pipeline), and 410037 (Musser Pump). Sites 410074 and 410037 are diverted upstream of the hatchery. Total spring discharge for these three springs can be estimated by the following equation. If there is any undiverted spring discharge, it will not be included in this estimate.

Spring Creek Spring discharge = 360410072 (Lee Hatchery) + 410074 (Spring Creek Spring Pipe) + 410037 (Musser Pump at Spring Creek)

The week of July 12, 2004, IDWR staff measured 2.11 cfs at the Lee Hatchery raceway, 0.25 cfs at the Spring Creek Spring Pipeline, and 0.64 cfs at the Musser Pump. Estimated spring flow based on these measurements was 3.00 cfs. For comparison, records submitted by the water users report diversions of 2 cfs at the Lee Hatchery. Water users do not submit daily diversion records for the pipeline or the irrigation pump.

Available diversion records between 1980 and 2008 are summarized in Table 2**.**

Site	Dates	Frequency
360410072 (Lee Hatchery)	7/2004 (IDWR) 3/1/1995 – 12/31/2009 (water users)	Miscellaneous Weekly
410074 (Spring Creek Spring Pipeline)	7/2004 (IDWR)	Miscellaneous
410037 (Musser Pump)	9/1995; 7/1998; 7/2004 (IDWR) 1995 – 2010 (power consumption)	Miscellaneous Annual volume

Table 2. Available diversion records for Spring Creek Spring

Estimated spring discharge can be calculated for the time period between March 1995 and December 2009 using available data and the following assumptions (Figure 3).

- Spring Creek Spring discharge = 360410072 (Lee Hatchery) + 410074 (Spring Creek Spring Pipe) + 410037 (Musser Pump at Spring Creek)
- Records available from the database are an accurate representation of diversions.
- Spring Creek Spring Pipeline diversion is assumed to be 0.25 cfs from May through October and 0.1 cfs from November through April.
- Musser Pump diversion is assumed to be a constant rate from April through October, based on the reported annual volume divided by 214 days.
- Undiverted spring discharge is assumed to be insignificant.

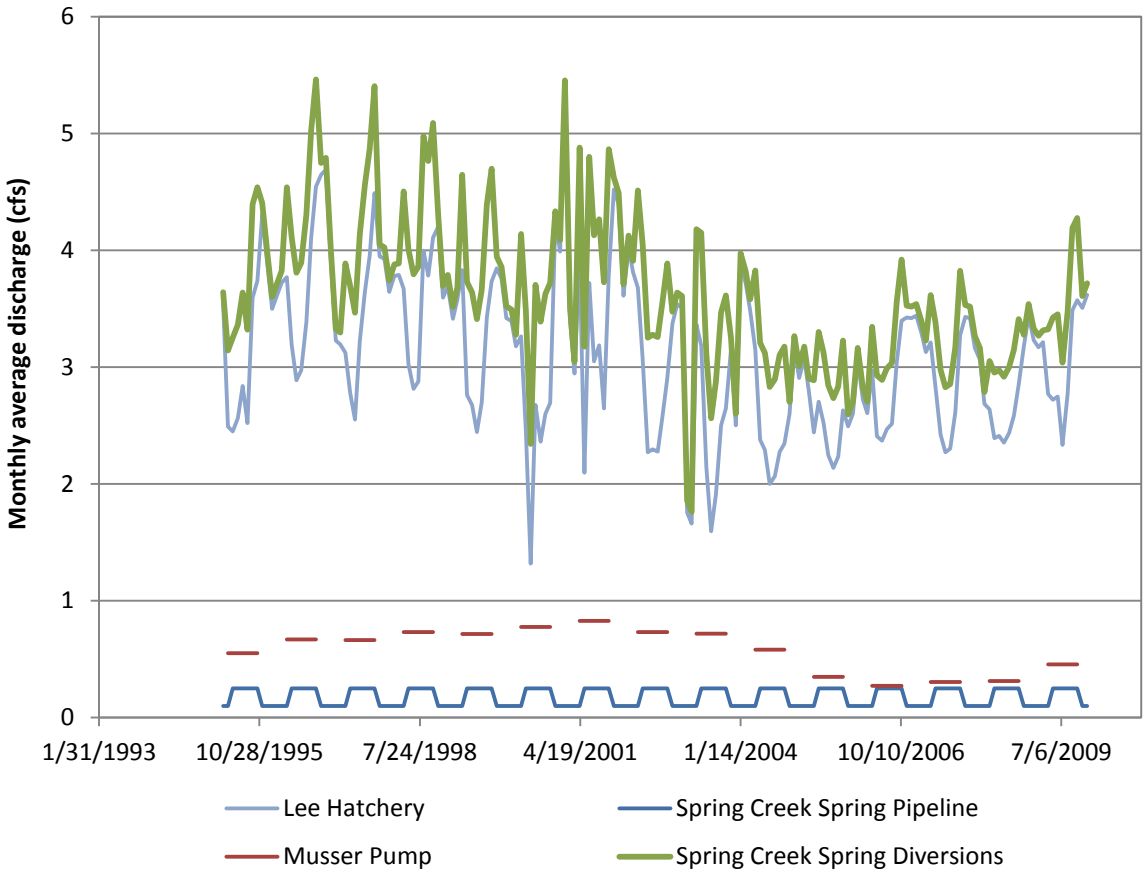

Figure 3. Estimated spring discharge at Spring Creek Spring.

ESPAM2.0 Calibration Target for Cell 1041013

The calibration target for cell 1041013 is the sum of estimated spring discharges at the Three Springs, Weatherby Springs, Hoagland Tunnel complex and at Spring Creek Spring. The calibration target is shown in Figure 4.

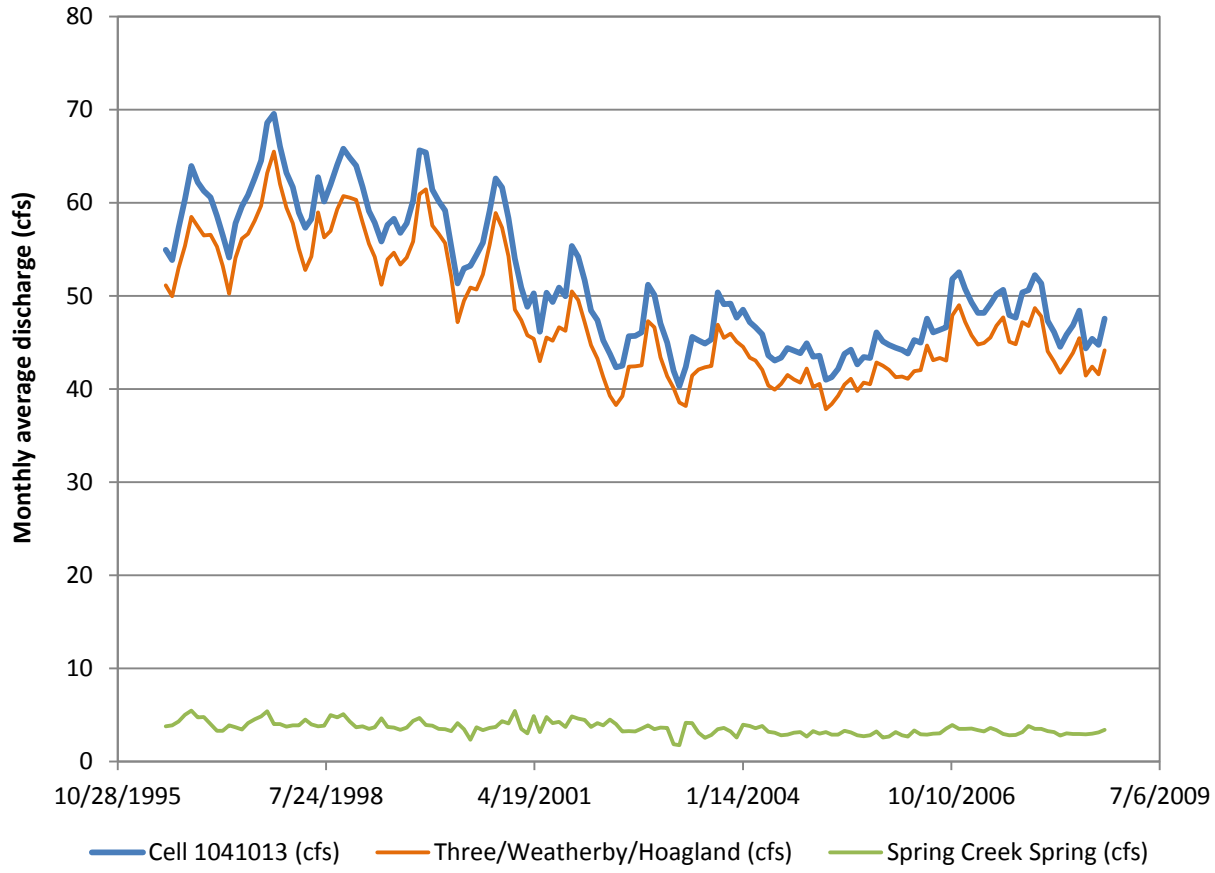

Figure 4. Transient calibration target for spring discharge in cell 1041013.

Figure 5 compares the ESPAM2.0 calibration target for cell 1041013 with the calibration target for nearby Curren Spring. Seasonal fluctuations in the calibration targets are generally consistent through 2004, and the general trends in spring discharge appear to be consistent through 2008. Beginning in 2005, the calibration target for cell 1041013 begins to exhibit more substantial secondary peaks in June of each year. Given that the target for cell 1041013 is the sum of seven diversions and one estimate of undiverted flow, it is not surprising that there is more variability in this target. The transient data series appears to be acceptable for use as a transient calibration target for calibration of ESPAM2.0.

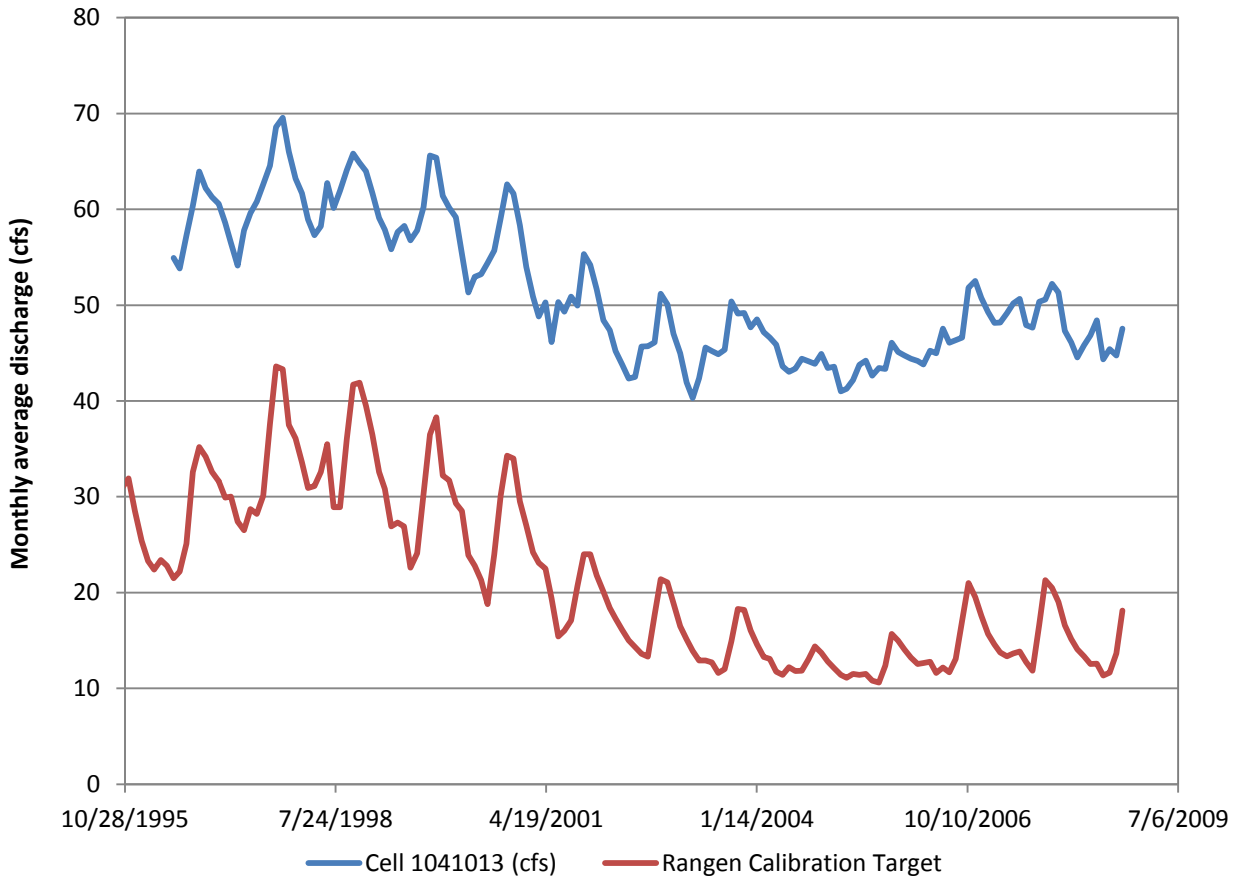

Figure 5. Comparison with Curren Spring calibration target.