COLORADO
Division of Water Resources
Department of Natural Resources

1313 Sherman Street, Room 818
Denver, CO 80203

MEMORANDUM

TO: San Luis Valley Notification List

FROM: CDWR Modeling and Decision Support System Team
Office of the Colorado State Engineer

DATE: June 30, 2016

SUBJECT: Composite Water Head for Confined Aquifer Response Areas in Division 3: July 1 2016 Requirement of Division 3 Groundwater Rules Section 8.1.4

This memorandum is submitted to comply with Section 8.1.4 of the Division 3 Groundwater Rules which states that:

> *No later than July 1 of each year after 2015, the State Engineer must update the Composite Water Head for each of the Response Areas subject to this Rule 8.1 for the areas depicted in Exhibit C to reflect the most recent annual water level measurements collected during February and March (outside of the Irrigation Season) and display the update in graph form.*

Water levels were collected by the Rio Grande Water Conservation District, the US Geological Survey, and the Colorado Division of Water Resources (CDWR) during the non-irrigation season from monitoring network wells identified by CDWR[1]. Monitoring network wells are listed in Table 1.

The water level data from the monitoring wells are briefly discussed in the following section. Monitoring well data and composite water head calculations are summarized in Table 2. As detailed in a memo describing the monitoring plan[2], composite water head is calculated as a change in water level from the 2015 year baseline. The annual composite water head for each of the confined aquifer response areas through the current year 2016 is shown in Table 3 and Figure 1.

[1] Kelley Thompson (CDWR Modeling/DSS), May 6, 2015, "Ground Water Sustainability Rules for Water Division 3: Identification of Proposed Monitoring Network Wells", Memorandum to Dick Wolfe (Colorado State Engineer/CDWR Director) and Mike Sullivan (CDWR Deputy State Engineer)

[2] Kelley Thompson and Mary Halstead (CDWR Modeling/DSS), May 6, 2015, "Ground Water Sustainability Rules for Water Division 3: Confined Aquifer Monitoring Plan", Memorandum to Dick Wolfe (Colorado State Engineer/CDWR Director) and Mike Sullivan (CDWR Deputy State Engineer)

Discussion of Monitoring Well Data

2015

Most 2015 measurements were taken in February and March. Water levels from BACA wells DW-4 and DW-5 were measured by the USGS in May and December, respectively, and two other wells were measured by the USGS in January. Transducer issues limited measurement from Well RGDSS P03 until April, and a graph of the well data suggests the April data is not representative of maximum water levels in the non-irrigation season. The well is located very close to well CON2, and the minimum depth to water in CON2 was nearly identical between 2014 and 2015. Therefore, the baseline water level in RGDSS P03 for use in the composite water head was assumed equal to the maximum non-irrigation season water level in 2014.

2016

All 2016 measurements were taken in February and March with the exception of three wells which were measured in late January. In the San Luis Creek Response Area, BACA wells DW-4 and DW-5 have erratic water level monitoring data from years prior to 2011, but measurements taken since that time had appeared to stabilize. In review of data for DW-4 the USGS determined that February and April 2016 reported data were bad due to a faulty transducer. The December 2015 data and the June 2016 data were determined to be good and were similar and consistent with previous good data. Since the December 2015 value was free from immediate pumping influence, that value from well DW-4 was considered in the composite water head for 2016.

Table 1. Monitoring Network Wells

RA	Name	Model UID	USGS Alias	WDID	Permit	Measured	UTMX	UTMY
Alamosa La Jara	ALA 4	372550105455001	NA03701122CCC1 ALA 4	2006000	6420R	RGWCD	432310	4142957
	ALA 6	372403106000901	NA03700933CCC1 ALA 6	2011058	809R	RGWCD	411281	4139810
	ALA 7	372403106000902	NA03700933CCC2 ALA 7	2011057	810R	RGWCD	411280	4139804
	ALA 8	372506106004201	NA03700929DCB ALA 8			RGWCD	410473	4141775
	ALA 10	373457106003801	NA03900932BCC ALA 10	2010420	6265F	RGWCD	409873	4159849
	ALA 12	372950105580801	NA03800934ADB ALA 12			RGWCD	414304	4150475
	CON 1	371705106021501	NA03500907CCC CON 1	2105055	10543R	RGWCD	407980	4126964
	CON 2	371745105501001	NA03501012BBC CON 2	2205111	20111R	RGWCD	425788	4127870
	RIO 2	373227106030301	NA03800813BDB RIO 2	2014378	15095F	RGWCD	407166	4155390
	6192R	373405106112501	NA03800703ABB	2008878	6192R	USGS	394594	4159277
	P03	RGDSSP03	RGDSSP03		223816	RGWCD	424125	4126845
	P08	RGDSSP08	RGDSSP08		228923	RGWCD	411365	4139762
	P09	RGDSSP09	RGDSSP09		231269	RGWCD	398634	4147181
	P10	RGDSSP10	RGDSSP10		229397	RGWCD	398416	4159268
	4865F	*372046106021901*		2010441	4865F	CDWR	408015	4133773
Conejos	CON 2	371745105501001	NA03501012BBC CON 2	2205111	20111R	RGWCD	425788	4127870
	P03	RGDSSP03	RGDSSP03		223816	RGWCD	424125	4126845
	P07	RGDSSP07	RGDSSP07		228924	RGWCD	415943	4118608
	P12	RGDSSP12	RGDSSP12		229399	RGWCD	412608	4101681
	20WCB	*371118105543501*		2205126	20WCB	CDWR	419255	4116148
	6747F	370324105561201	NA03300936DBB	2205062	6747F	CDWR	416666	4101583
	24316F	*370446105582701*		2205978	24316F	CDWR	413400	4104118
	22258F	*371108106005101*		2205018	22258F	CDWR	409973	4115953
	3416F	371030105585001	NA03400922BCC	2205074	3416F	CDWR	412817	4114667
	296046	*370843106021001*			296046	CDWR	408005	4111476
Saguache	SAG 2	375310106021501	NA04200907CCC SAG 2	2706027	11218F	RGWCD	408831	4193716
	SAG 3	380045106044501	NA04300803ABB SAG 3	2605001	12859R	RGWCD	405341	4207897
	SAG 9	375255106084401	NA04200818CCB SAG 9			RGWCD	399209	4193336
	SAG 10	375310106050001	NA04200815ACC SAG 10	2705295	4589F	RGWCD	404915	4193766
	SAG 12	380047106024801	NA04300801BBA SAG 12			RGWCD	408070	4207781
	SAG 13	375820106052001	NA04300815CBB SAG 13	2605614	9541F	RGWCD	404390	4203427
	SAG 18	375918106063601	NA04300808ADC SAG 18			RGWCD	402528	4205102
	P01	RGDSSP01	RGDSSP01		223817	RGWCD	407731	4207973
	RG05	380537106004801	NA04400906DAA RG05	2605422	11030F	CDWR	411096	4216705
	19513Z	SAG18		2605042	19513Z	CDWR	400613	4211376
San Luis Creek	RG02	380941105545501	RG02			RGWCD	419670	4223904
	RG03	380601105505201	RG03			RGWCD	425620	4217242
	11010F	380855105553501	NA04500913DCA	2505083	11010F	USGS	419056	4222618
	1725R	380640105510001	NA04501034DAA	2505400	1725R	USGS	425706	4218035
	P14	RGDSSP14	RGDSSP14		231876	RGWCD	421705	4206978
	DW-1	375842105473701	BACA DW-1			USGS	430319	4203720
	DW-3	375828105432501	BACA DW-3		195248	USGS	436459	4203233
	DW-4	375428105472501	BACA DW-4			USGS	430536	4195889
	DW-5	375507105505901	BACA DW-5			USGS	425306	4197138
	2760FR	*380652105552101*		2505260	2760FR	CDWR	419163	4218954

Table 2a. 2015 Monitoring Well Data Summary and Composite Water Head Calculations

RA	Name	Model UID	Thiessen Weight (a)	2015 DTW Baseline (ft) (b)	2015 DTW (ft) (c)	2015 DTW Date (d)	2015 ΔDTW (ft) (e)	2015 ΔDTW Weighted (f)
Alamosa La Jara	ALA 4	372550105455001	16.888%	-35.39	-35.39	3/9/2015	0.00	0.00
	ALA 6	372403106000901	2.410%	-10.75	-10.75	3/19/2015	0.00	0.00
	ALA 7	372403106000902	2.410%	-10.13	-10.13	3/18/2015	0.00	0.00
	ALA 8	372506106004201	5.461%	-15.02	-15.02	3/19/2015	0.00	0.00
	ALA 10	373457106003801	2.817%	-17.81	-17.81	3/17/2015	0.00	0.00
	ALA 12	372950105580801	14.208%	-4.18	-4.18	3/26/2015	0.00	0.00
	CON 1	371705106021501	9.582%	53.73	53.73	3/18/2015	0.00	0.00
	CON 2	371745105501001	5.730%	-15.64	-15.64	3/24/2015	0.00	0.00
	RIO 2	373227106030301	5.567%	-0.97	-0.97	3/24/2015	0.00	0.00
	6192R	373405106112501	3.516%	52.48	52.48	1/22/2015	0.00	0.00
	P03	RGDSSP03	2.909%	-2.74	-2.74	4/28/2015	0.00	0.00
	P08	RGDSSP08	2.410%	-13.37	-13.37	3/31/2015	0.00	0.00
	P09	RGDSSP09	10.619%	37.54	37.54	2/10/2015	0.00	0.00
	P10	RGDSSP10	4.690%	19.39	19.39	2/10/2015	0.00	0.00
	4865F	*372046106021901*	10.783%	32.48	32.48	2/27/2015	0.00	0.00
Conejos	CON 2	371745105501001	8.700%	-15.64	-15.64	3/24/2015	0.00	0.00
	P03	RGDSSP03	8.233%	-7.77	-7.77	2/13/2014	0.00	0.00
	P07	RGDSSP07	10.749%	0.53	0.53	3/3/2015	0.00	0.00
	P12	RGDSSP12	16.939%	166.04	166.04	3/3/2015	0.00	0.00
	20WCB	*371118105543501*	10.968%	4.00	4.00	2/27/2015	0.00	0.00
	6747F	370324105561201	10.371%	100.42	100.42	2/27/2015	0.00	0.00
	24316F	*370446105582701*	9.104%	144.61	144.61	2/27/2015	0.00	0.00
	22258F	*371108106005101*	6.886%	61.37	61.37	2/27/2015	0.00	0.00
	3416F	371030105585001	6.804%	63.41	63.41	2/27/2015	0.00	0.00
	296046	*370843106021001*	11.246%	160.91	160.91	3/29/2015	0.00	0.00
Saguache	SAG 2	375310106021501	17.494%	-39.14	-39.14	3/26/2015	0.00	0.00
	SAG 3	380045106044501	3.607%	5.95	5.95	3/30/2015	0.00	0.00
	SAG 9	375255106084401	11.398%	-4.25	-4.25	3/30/2015	0.00	0.00
	SAG 10	375310106050001	8.230%	-28.93	-28.93	3/25/2015	0.00	0.00
	SAG 12	380047106024801	14.626%	-7.04	-7.04	3/30/2015	0.00	0.00
	SAG 13	375820106052001	8.507%	-11.98	-11.98	3/25/2015	0.00	0.00
	SAG 18	375918106063601	9.324%	3.34	3.34	3/30/2015	0.00	0.00
	P01	RGDSSP01	2.518%	-1.31	-1.31	3/28/2015	0.00	0.00
	RG05	380537106004801	14.135%	46.37	46.37	3/3/2015	0.00	0.00
	19513Z	SAG18	10.160%	58.08	58.08	3/3/2015	0.00	0.00
San Luis Creek	RG02	380941105545501	13.117%	65.28	65.28	3/4/2015	0.00	0.00
	RG03	380601105505201	9.758%	29.10	29.10	3/4/2015	0.00	0.00
	11010F	380855105553501	3.261%	65.20	65.20	1/20/2015	0.00	0.00
	1725R	380640105510001	7.611%	55.59	55.59	2/17/2015	0.00	0.00
	P14	RGDSSP14	14.205%	-32.87	-32.87	3/31/2015	0.00	0.00
	DW-1	375842105473701	11.410%	-38.10	-38.10	2/10/2015	0.00	0.00
	DW-3	375828105432501	17.029%	24.41	24.41	2/10/2015	0.00	0.00
	DW-4	375428105472501	9.348%	-84.96	-84.96	5/27/2015	0.00	0.00
	DW-5	375507105505901	5.497%	-142.08	-142.08	12/16/2014	0.00	0.00
	2760FR	*380652105552101*	8.765%	28.21	28.21	3/3/2015	0.00	0.00

Table 2b. 2016 Monitoring Well Data Summary and Composite Water Head Calculations

RA	Name	Model UID	Thiessen Weight (a)	2015 DTW Baseline (ft) (b)	2016 DTW (ft) (c)	2016 Date (d)	2016 ΔDTW (ft) (e)	2016 ΔDTW Weighted (f)
Alamosa La Jara	ALA 4	372550105455001	16.888%	-35.39	-39.09	3/14/2016	3.70	0.62
	ALA 6	372403106000901	2.410%	-10.75	-11.64	3/16/2016	0.89	0.02
	ALA 7	372403106000902	2.410%	-10.13	-11.35	3/16/2016	1.22	0.03
	ALA 8	372506106004201	5.461%	-15.02	-15.97	3/16/2016	0.95	0.05
	ALA 10	373457106003801	2.817%	-17.81	-19.38	2/18/2016	1.57	0.04
	ALA 12	372950105580801	14.208%	-4.18	-4.61	3/24/2016	0.43	0.06
	CON 1	371705106021501	9.582%	53.73	53.05	3/31/2016	0.68	0.07
	CON 2	371745105501001	5.730%	-15.64	-16.13	3/23/2016	0.49	0.03
	RIO 2	373227106030301	5.567%	-0.97	-3.21	3/24/2016	2.24	0.12
	6192R	373405106112501	3.516%	52.48	53.90	1/27/2016	-1.42	-0.05
	P03	RGDSSP03	2.909%	-2.74	-8.39	3/30/2016	5.65	0.16
	P08	RGDSSP08	2.410%	-13.37	-14.33	3/29/2016	0.96	0.02
	P09	RGDSSP09	10.619%	37.54	35.72	2/24/2016	1.82	0.19
	P10	RGDSSP10	4.690%	19.39	17.86	2/24/2016	1.53	0.07
	4865F	*372046106021901*	10.783%	32.48	30.84	3/8/2016	1.64	0.18
Conejos	CON 2	371745105501001	8.700%	-15.64	-16.13	3/23/2016	0.49	0.04
	P03	RGDSSP03	8.233%	-7.77	-8.39	3/30/2016	0.62	0.05
	P07	RGDSSP07	10.749%	0.53	0.39	2/22/2016	0.14	0.02
	P12	RGDSSP12	16.939%	166.04	166.48	3/8/2016	-0.44	-0.07
	20WCB	*371118105543501*	10.968%	4.00	3.48	3/7/2016	0.52	0.06
	6747F	370324105561201	10.371%	100.42	101.14	3/10/2016	-0.72	-0.08
	24316F	*370446105582701*	9.104%	144.61	145.34	3/10/2016	-0.73	-0.07
	22258F	*371108106005101*	6.886%	61.37	63.44	3/7/2016	-2.07	-0.14
	3416F	371030105585001	6.804%	63.41	62.77	3/7/2016	0.64	0.04
	296046	*370843106021001*	11.246%	160.91	160.81	3/8/2016	0.10	0.01
Saguache	SAG 2	375310106021501	17.494%	-39.14	-41.52	3/29/2016	2.38	0.42
	SAG 3	380045106044501	3.607%	5.95	4.23	3/31/2016	1.72	0.06
	SAG 9	375255106084401	11.398%	-4.25	-8.71	3/30/2016	4.46	0.51
	SAG 10	375310106050001	8.230%	-28.93	-31.62	3/30/2016	2.69	0.22
	SAG 12	380047106024801	14.626%	-7.04	-8.27	3/29/2016	1.23	0.18
	SAG 13	375820106052001	8.507%	-11.98	-13.43	3/29/2016	1.45	0.12
	SAG 18	375918106063601	9.324%	3.34	1.55	3/31/2016	1.79	0.17
	P01	RGDSSP01	2.518%	-1.31	-2.38	3/29/2016	1.07	0.03
	RG05	380537106004801	14.135%	46.37	44.07	3/8/2016	2.30	0.33
	19513Z	SAG18	10.160%	58.08	54.17	3/8/2016	3.91	0.40
San Luis Creek	RG02	380941105545501	13.117%	65.28	62.18	3/8/2016	3.10	0.41
	RG03	380601105505201	9.758%	29.10	26.74	3/8/2016	2.36	0.23
	11010F	380855105553501	3.261%	65.20	53.22	1/26/2016	11.98	0.39
	1725R	380640105510001	7.611%	55.59	51.64	1/26/2016	3.95	0.30
	P14	RGDSSP14	14.205%	-32.87	-35.43	3/29/2016	2.56	0.36
	DW-1	375842105473701	11.410%	-38.10	-40.81	2/10/2016	2.71	0.31
	DW-3	375828105432501	17.029%	24.41	23.86	2/10/2016	0.55	0.09
	DW-4	375428105472501	9.348%	-84.96	-73.68	12/8/2015	-11.28	-1.05
	DW-5	375507105505901	5.497%	-142.08	-137.22	2/10/2016	-4.86	-0.27
	2760FR	*380652105552101*	8.765%	28.21	26.19	3/8/2016	2.02	0.18

Table 2. Column Calculation Notes

(a) Thiessen weight = Thiessen polygon area / total polygon areas for Response Area (rounded to 5 digits)
(b) minimum annual depth to water during non-irrigation season for 2015 baseline year (minimum DTW in February-March or progressively in other months if February/March DTW not available)
(c) minimum annual depth to water during non-irrigation season for year (minimum DTW in February-March or progressively in other months if February/March DTW not available)
(d) date of minimum annual depth to water during non-irrigation season measurement
(e) change in depth to water calculated as baseline depth to water less year depth to water (a negative value indicates a falling water table)
(f) change in depth to water multiplied by Thiessen weight used in calculation of composite water head. The composite water head for a Response Area equals the sum of these values by Response Area for the year.

Table 3. Composite Water Head by Response Area

Response Area	2015	2016
Alamosa La Jara	0.00	1.63
Conejos	0.00	-0.14
Saguache	0.00	2.43
San Luis Creek	0.00	0.77

Note: Head change in feet from 2015 baseline

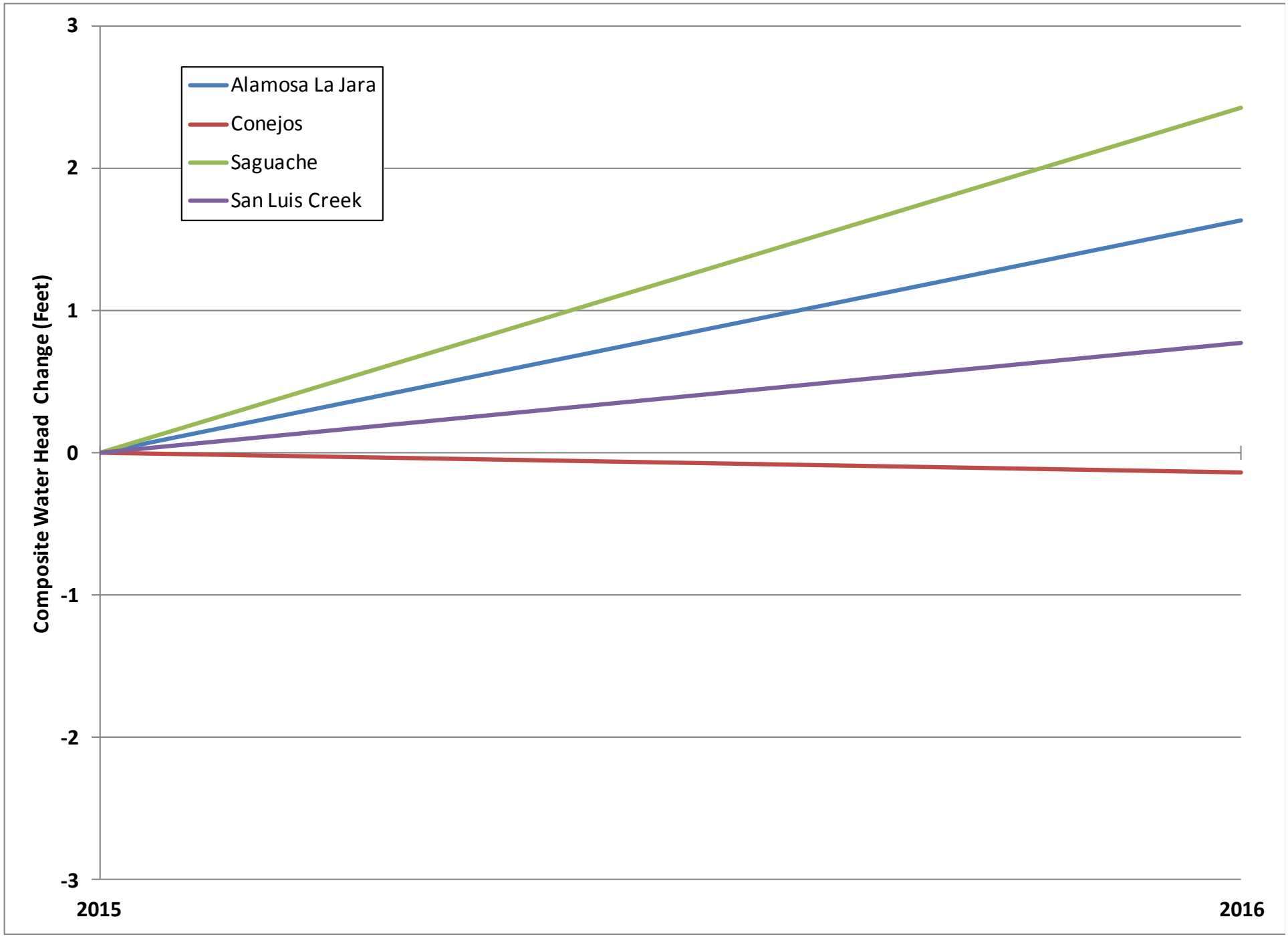

Figure 1. Composite Water Head by Response Area