MEMO

State of Idaho
Department of Water Resources
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Date: March 29, 2016

To: Tim Luke, Water Compliance Bureau Chief

From: Jennifer Sukow, P.E., P.G., Hydrology Section

Subject: Post audit of 2015 aquifer enhancement activities

This memorandum describes model simulations of aquifer enhancement activities performed by the Idaho Ground Water Appropriators, Inc. (IGWA), Southwest Irrigation District (SWID), and A & B Irrigation District (ABID). The purpose of the model simulations was to evaluate the impacts of aquifer enhancement activities on discharge from Curren Tunnel and flow in the Snake River between Kimberly and King Hill. The Enhanced Snake Plain Aquifer Model Version 2.1 (ESPAM2.1) was used to simulate aquifer enhancement projects and predict impacts to aquifer discharge. Simulations were limited to aquifer enhancement projects located within the Great Rift trim line.

Methods used to simulate the impacts of aquifer enhancement activities are described in this memorandum. Detailed results are presented in Attachment A. Tables 1 and 2 summarize results relevant to mitigation plans for the Rangen water delivery call and the Magic Springs water right transfer. Table 1 summarizes the predicted steady state impact by organization. Table 2 summarizes the total predicted impact of aquifer enhancement activities performed by IGWA and SWID[1] for the past year and upcoming year.

[1] SWID is a participant in IGWA's mitigation plan for the Rangen delivery call. ABID has a separate mitigation plan for the Rangen delivery call.

Entity	Volume of 2015 aquifer enhancement projects	Predicted increase in Curren Tunnel discharge	Predicted contribution to flow in the Snake River between Kimberly and King Hill
IGWA	22,113 AF	0.44 cfs	> 4.4 cfs
SWID	62,218 AF	1.05 cfs	> 12.3 cfs
ABID	4,324 AF	0.07 cfs	not applicable[2]
Total	88,655 AF	1.56 cfs	> 16.7 cfs

Table 1. Predicted steady state impacts by organization.

Time period	Predicted increase in Curren Tunnel discharge	Predicted contribution to flow in the Snake River between Kimberly and King Hill
4/2015 – 3/2016[3]	1.2 cfs	> 13.8 cfs
4/2016 – 3/2017[3]	1.1 cfs	> 12.3 cfs
Steady state[4]	1.5 cfs	> 16.7 cfs

Table 2. Summary of predicted impacts of IGWA and SWID aquifer enhancement project on aquifer discharge at selected locations.

ESPAM2.1 simulations

The impact of aquifer enhancement activities on discharge in the Rangen model cell and other model cells tributary to the Snake River between Kimberly and King Hill was simulated using ESPAM2.1. Impacts to discharge from Curren Tunnel are calculated as 63% of the predicted impact to the Rangen model cell. Impacts to flow in the Snake River between Kimberly and King Hill are predicted to exceed the sum of the impacts to baseflow[5] and impacts to spring discharge in Devil's Washbowl model cell, Devil's Corral model cell, and Box Canyon reach[6].

Aquifer enhancement activities were simulated using both steady state and transient analyses. The steady state analyses simulate the long term effect aquifer enhancement projects performed

[2] ABID is not a participant in IGWA's mitigation plan and was not an applicant on the water right transfer for the Magic Springs pipeline.

[3] Predicted impact of documented past aquifer enhancement projects from 2005 through 2015, assuming no projects performed in 2016.

[4] Predicted impact of 2015 aquifer enhancement activities at steady state, assuming 2015 activities continue into future years.

[5] Baseflow is subsurface discharge to the Snake River and is unavailable to surface water users. The baseflow between Kimberly and King Hill is represented in ESPAM2.1 using general head boundaries.

[6] The Devil's Washbowl, Devil's Corral, and Box Canyon reaches do not contain springs diverted for irrigation use. Spring discharge is represented in ESPAM2.1 using drains.

in 2015 would have on spring discharge if the projects are continued at the same locations and rates in future years. The transient analyses simulated the effect of documented and approved aquifer enhancement activities that occurred between 2005 and 2015. For each year, the volume of aquifer enhancement activities was input into ESPAM2.1 at a constant rate distributed over a one-year stress period beginning on April 1. Model inputs for 2005 through 2014 were obtained from previous analyses of aquifer enhancement projects within the Great Rift trim line[7]. The transient analyses do not consider potential impacts of aquifer enhancement activities that may occur in 2016 or future years.

Simulation of Conservation Reserve Enhancement Program (CREP)

The CREP reduces withdrawals from the Eastern Snake Plain Aquifer (ESPA) by removing groundwater irrigated land from production. The volume of benefit to the aquifer was calculated using ESPAM2.1 data for the average annual crop irrigation requirement from November 1998 through October 2008 (Figure 1). If a parcel is irrigated to establish a cover crop, 1/3 foot per acre is deducted from the average annual crop irrigation requirement during the year irrigated. For 2015, IGWA CREP lands were obtained from a shapefile, updated February 2, 2016 by Paula Dillon, Idaho Department of Water Resources (IDWR). CREP data are submitted to IDWR by Chuck Pentzer, Idaho Soil and Water Conservation Commission. Mr. Pentzer stated no fields were watered to establish cover crops in 2015 to his knowledge.

For 2015, a shapefile of IGWA CREP lands was created by removing lands outside of the area of common groundwater supply, outside of the Great Rift trim line, lands within SWID or Goose Creek Irrigation District (GCID), and lands enrolled by ABID as identified in Exhibit C to *A&B Irrigation District's Rule 43 Mitigation Plan* dated March 7, 2014. In 2015, there were 4,753 acres of IGWA CREP located within the area of common groundwater supply and Great Rift trim line (Figure 2). The simulated reduction of consumptive use was 11,696 AF/year.

In 2015, there were 572 acres of CREP lands located within both the area of common groundwater supply and SWID or GCID (Figure 2). All of the SWID/GCID CREP lands were located within the Great Rift trim line. The simulated reduction in consumptive use was 1,260 AF/year.

In 2015, there were 98 acres of CREP lands enrolled by ABID (Figure 2) as identified in Exhibit C to *A&B Irrigation District's Rule 43 Mitigation Plan* dated March 7, 2014. The simulated reduction in consumptive use was 242 AF/year.

[7] http://idwr.idaho.gov/files/legal/CM-MP-2014-001/CM-MP-2014-001_20150226_Supporting_Data_2014AqEnhPostAudit.zip

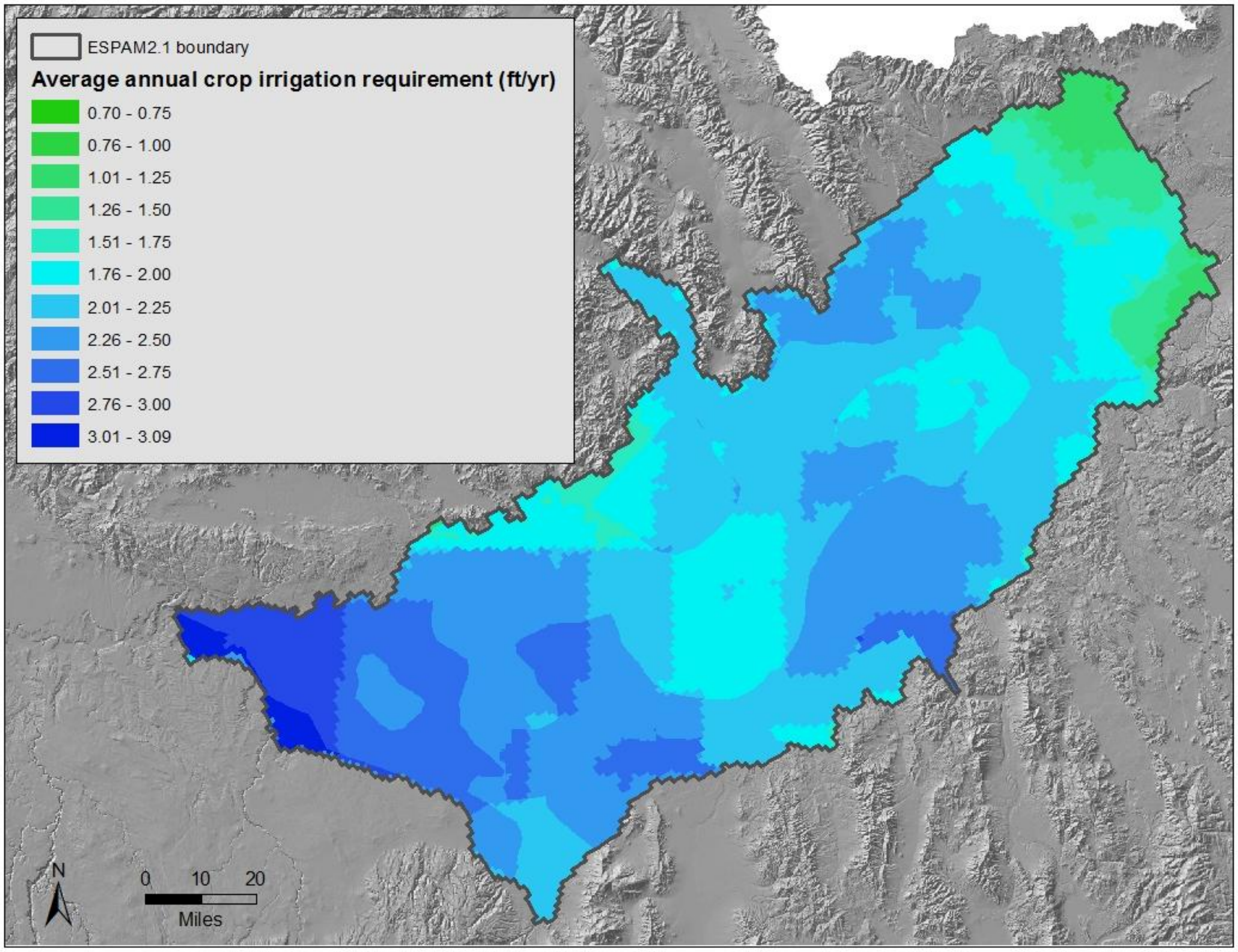


Figure 1. Average annual crop irrigation requirement from November 1998 through October 2008.

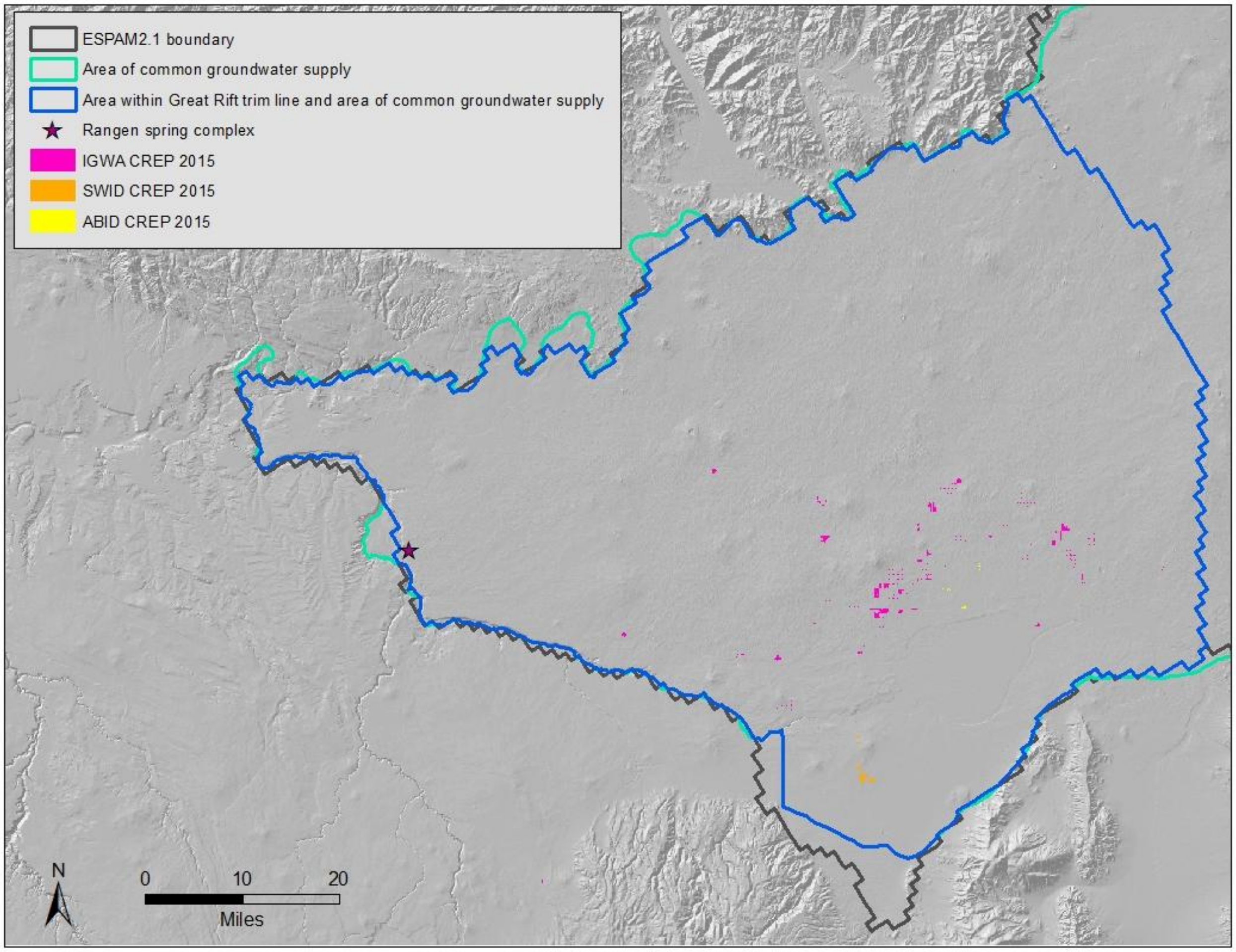


Figure 2. CREP lands in 2015.

Simulation of conversion projects

Conversion projects deliver surface water for irrigation of lands historically irrigated by groundwater. The volume of benefit to the aquifer includes the volume of water delivered to conversion project sites and canal seepage associated with conveyance of the water delivered to conversion project sites.

The volume of water delivered to IGWA conversion sites is compiled and reviewed by the Watermaster of Water District 130. Delivery volumes are reported to the Watermaster by canal companies. The volume of water delivered is simulated at the location of the conversion project (Figure 3), unless excess water is delivered. If excess water is delivered, the volume of excess water is distributed evenly across model cells with centroids intersected by irrigated lands within the canal company service area. Canal seepage ratios assessed by North Side Canal Company (NSCC) and American Falls Reservoir District No. 2 (AFRD2) were used to calculate the total volume of canal seepage associated with conversion projects in each canal system. The volume of canal seepage in each system was distributed evenly across model cells intersected by the delivery system (Figure 3). In 2015, 8,956 AF of surface water was delivered to IGWA conversion projects. No excess delivery was made in 2015. Canal seepage associated with conveyance of the surface water was calculated to be 1,461 AF (1,246 AF in NSCC canals and 215 AF in AFRD2 canals).

Additional water (5,336 AF) was delivered to IGWA conversion projects which failed to comply with groundwater measurement requirements in 2015, and was thus not included in mitigation credits recommended by the Watermaster. Surface water deliveries and canal seepage associated with non-compliant projects were excluded from this analysis.

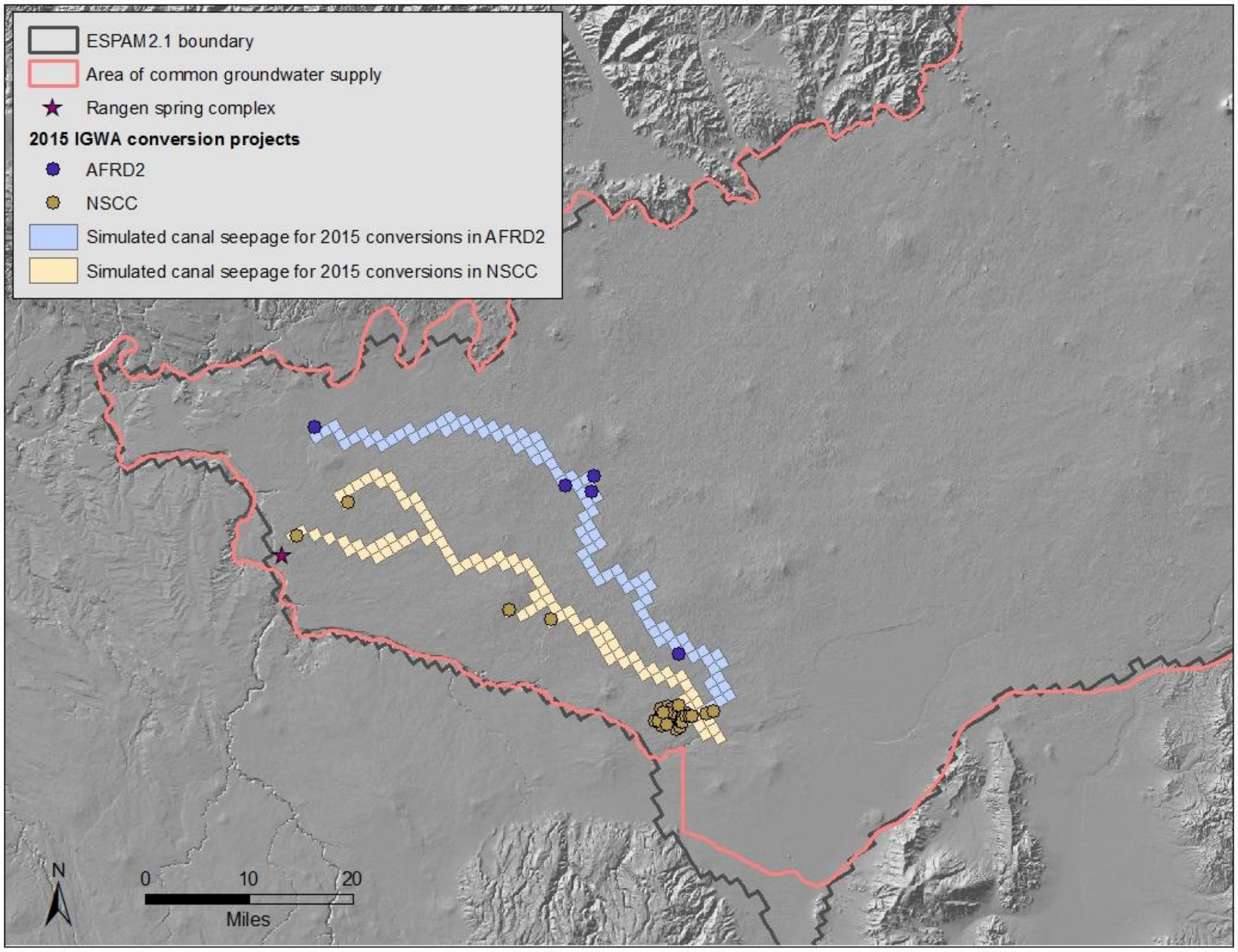


Figure 3. Locations of 2015 IGWA conversion projects and modeled distribution of canal seepage.

In past years, IGWA conversion projects have also included voluntary idle projects. Water users participating in these projects irrigated with both surface water and groundwater prior to participating in the conversion project. The water users agree not to divert groundwater and irrigate using only surface water, but do not purchase additional surface water. The volume of mitigation provided to the aquifer is calculated as 30% of the annual diversion volume authorized by groundwater rights. The Watermaster only approves mitigation credit if the wells are idled the entire year. Because additional surface water is not delivered to voluntary idle projects, canal seepage is not included in the analysis. No voluntary idle projects were documented in 2015.

The volume of surface water delivered to SWID conversion projects was compiled by the Watermaster of Water District 140 and reviewed by Tim Luke, IDWR. The volume of water delivered is simulated at the location of the conversion project (Figure 4). For SWID conversion projects delivered via the J Canal, canal seepage was calculated at a rate of 38% of diversions. For SWID conversions delivered via the West Cassia Pipeline, conveyance loss is assumed to be negligible. The volume of canal seepage was distributed evenly across model cells intersected by the delivery system (Figure 4). In 2015, 11,741 AF of water was delivered to West Cassia Pipeline conversion projects and 28,523 AF of water was delivered to J Canal conversion projects. Canal seepage in the J Canal was calculated to be 17,482 AF.

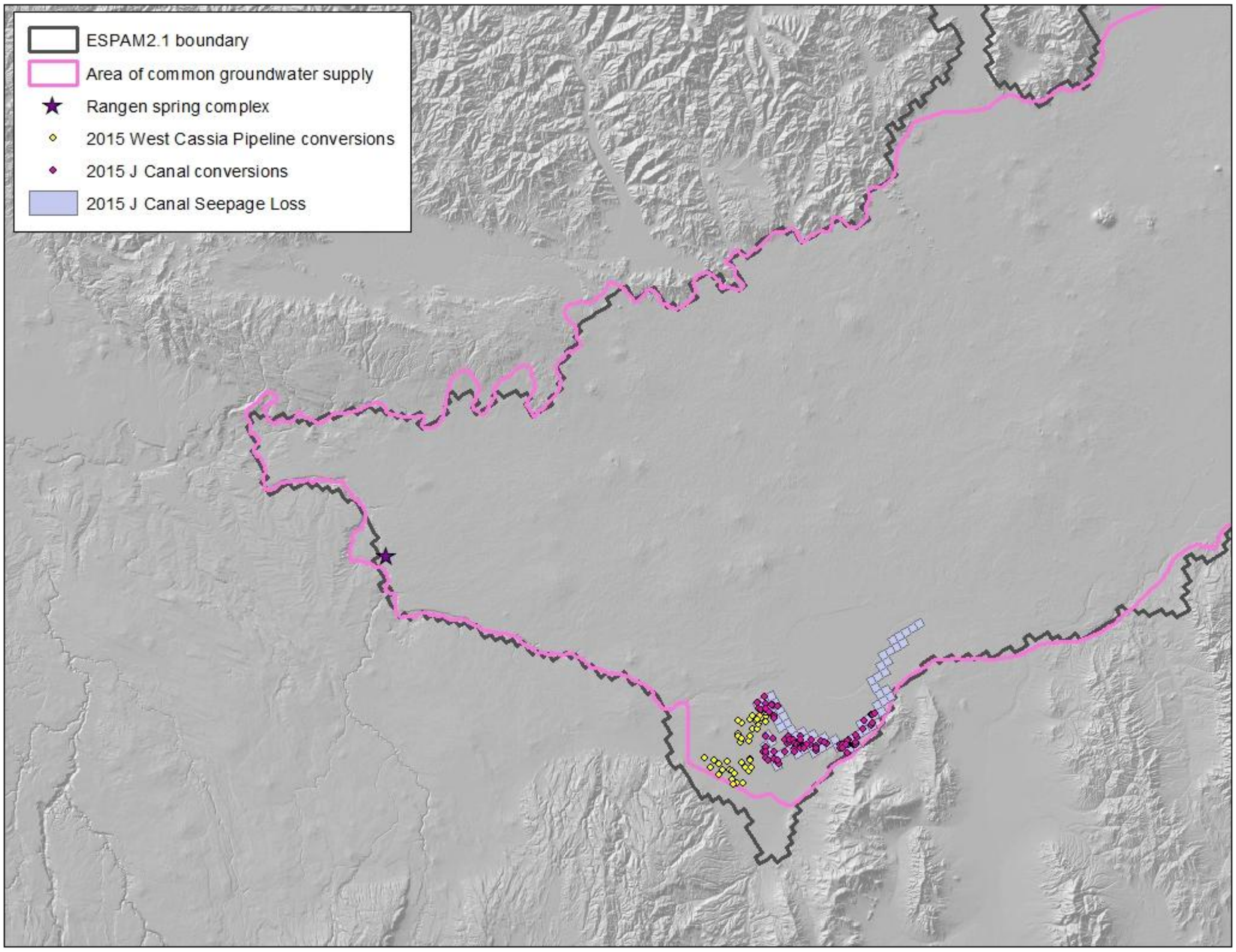


Figure 4. SWID conversion projects in 2015.

The volume of water delivered to ABID conversion projects was compiled by ABID and reviewed by Cindy Yenter, IDWR. The volume of water delivered is simulated at the location of the conversion project (Figure 5). For ABID conversion projects, canal seepage was calculated at a rate of 15% of diversions. The volume of canal seepage was distributed evenly across model cells intersected by the delivery system (Figure 5). In 2015, 3,470 AF of water was delivered to ABID conversion projects. Canal seepage was calculated to be 612 AF.

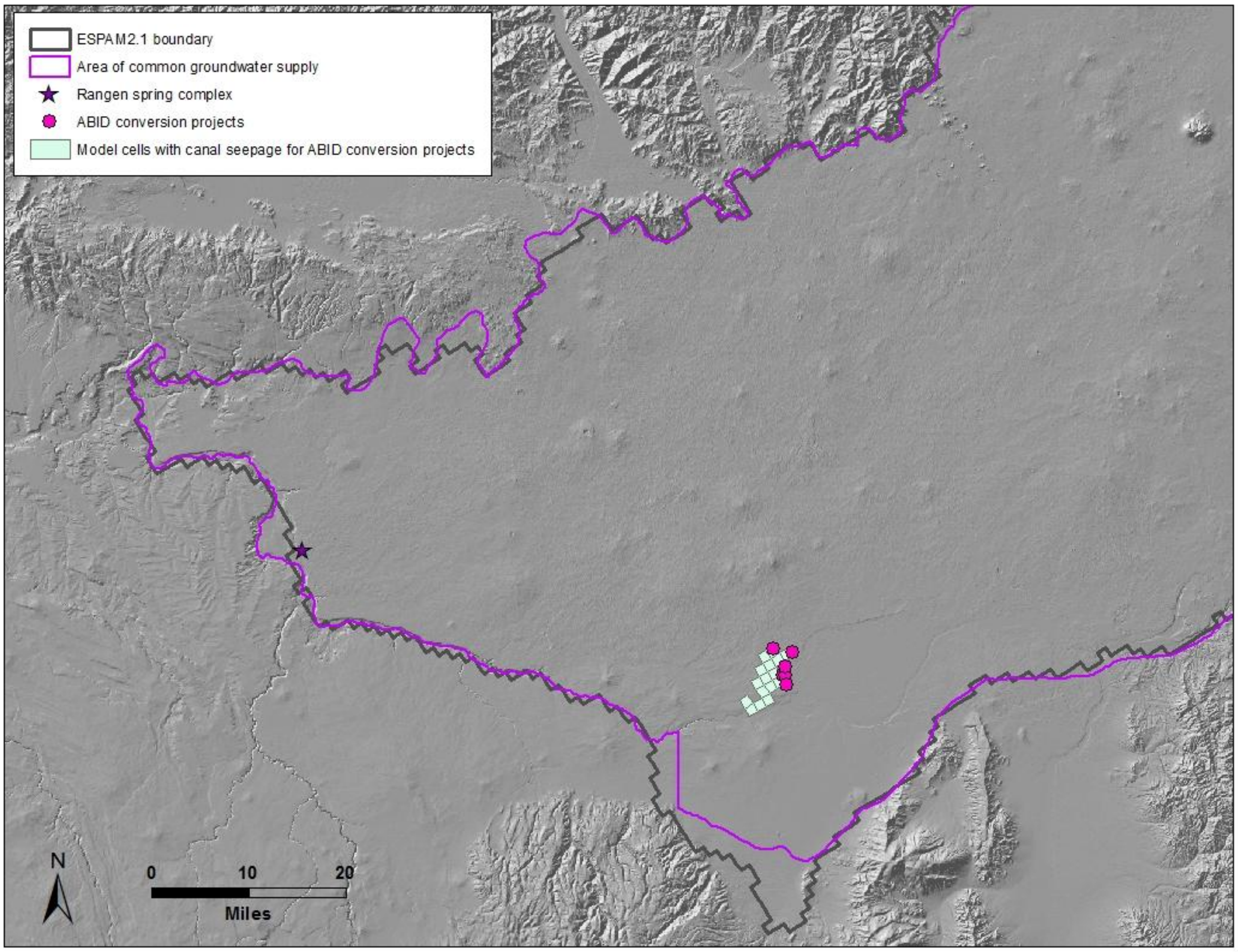


Figure 5. ABID conversion projects in 2015.

Simulation of voluntary curtailment

Voluntary curtailment projects reduce withdrawals from the ESPA by removing groundwater irrigated land from production. SWID is the only entity with voluntary curtailment projects. The locations of SWID voluntary curtailment projects were compiled by Brian Higgs, Watermaster, Water District 140 and reviewed by Tim Luke, IDWR (Figure 6). The volume of benefit to the aquifer was calculated using ESPAM2.1 data for the average annual crop irrigation requirement from November 1998 through October 2008 (Figure 1). If a parcel was historically irrigated by groundwater supplemental to surface water, the area and volume of benefit are multiplied by 0.88[8]. In 2015, SWID voluntary curtailment projects included 1,477 acres. After adjusting for projects with supplemental groundwater, the volume of benefit was calculated for 1,447 acres. The simulated reduction in consumptive use was 3,211 AF.

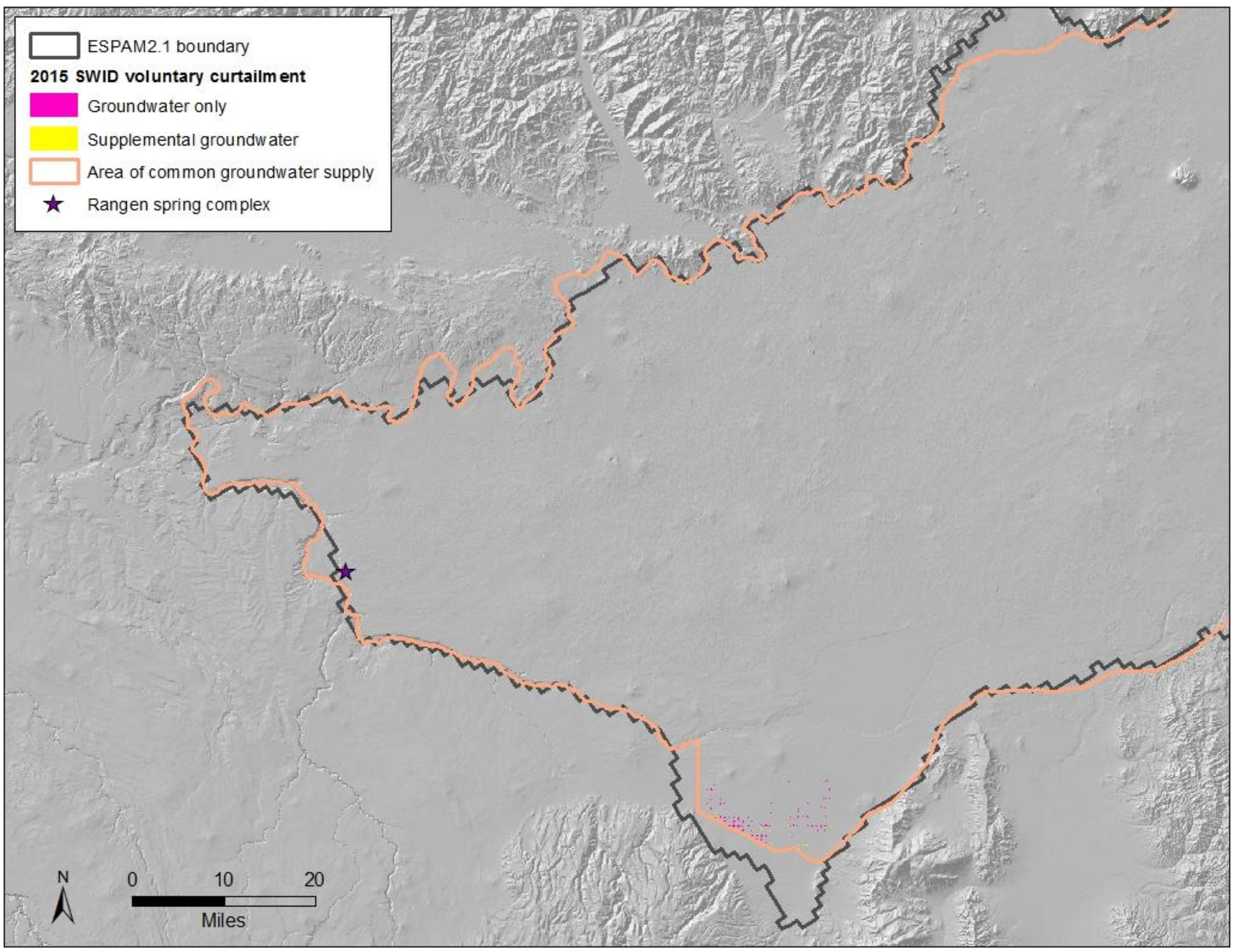


Figure 6. SWID voluntary curtailment projects in 2015.

[8] The average groundwater source fraction for SWID/GCID in ESPAM2.1 is 0.88.

Simulation of managed recharge

Managed recharge not sponsored by the Idaho Water Resource Board (IWRB) is included in IGWA and SWID mitigation plans. To my knowledge IGWA did not perform private recharge within the Great Rift trim line in 2015. SWID did not report any recharge performed in 2015 to the Underground Injection Control (UIC) program as required by permit conditions. Residual benefits of managed recharge performed by IGWA and SWID in prior years are included in the transient simulation results in Attachments A-1 and A-2.

Modeling results

ESPAM2.1 simulation results are provided in Attachment A. Model files are available in the zip folder, 2015AqEnhPostAudit.zip.

ATTACHMENT A.
ESPAM2.1 SIMULATION RESULTS

A-1. Predicted impact of 2005 through 2015 aquifer enhancement projects on discharge from Curren Tunnel.

Mitigation project	Volume (AF/yr) [8]												Predicted average benefit to Curren Tunnel (cfs) [10]					
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Future years [9]**	**Year 1 (4/2014-3/2015)**	**Year 2 (4/2015-3/2016)**	**Year 3 (4/2016-3/2017)**	**Year 4 (4/2017-3/2018)**	**Year 5 (4/2018-3/2019)**	**Impact of 2015 projects at steady state**
IGWA Conversions [1]	29,161	35,250	36,915	35,967	13,562	17,210	23,307	30,144	24,335	30,480	10,417	0	0.54	0.46	0.28	0.18	0.13	0.26
SWID Conversions [2]	0	0	0	0	0	47,138	47,189	58,909	47,350	45,622	57,746	0	0.44	0.51	0.57	0.54	0.45	0.97
ABID Conversions [3]	4,553	4,553	4,553	4,553	3,884	3,240	3,271	4,772	3,930	3,715	4,082	0	0.06	0.06	0.06	0.05	0.04	0.07
SWID Voluntary Curtailment [4]	0	0	0	0	0	4,211	4,015	4,015	3,946	3,946	3,211	0	0.04	0.04	0.04	0.04	0.03	0.06
IGWA CREP [5]	0	0	11,624	16,443	19,787	14,258	14,258	12,266	12,376	11,853	11,696	0	0.17	0.17	0.15	0.12	0.09	0.18
SWID CREP [5]	0	0	0	0	0	1,588	1,588	1,588	1,588	1,588	1,260	0	0.01	0.02	0.02	0.02	0.01	0.02
ABID CREP [5]	0	0	0	0	0	0	0	0	0	242	242	0	0.0002	0.0009	0.0012	0.0009	0.0007	0.003
IGWA Recharge [6]	0	0	27,360	0	13,687	0	0	0	0	0	0	0	0.02	0.02	0.01	0.01	0.01	0
SWID Recharge [7]	0	0	0	0	0	0	0	1,195	1,169	453	0	0	0.005	0.007	0.006	0.005	0.004	0
IGWA	29,161	35,250	75,899	52,410	47,036	31,468	37,565	42,410	36,711	42,334	22,113	0	0.73	0.64	0.45	0.31	0.23	0.44
SWID/GCID	0	0	0	0	0	52,936	52,792	65,706	54,053	51,609	62,218	0	0.49	0.57	0.64	0.60	0.50	1.05
ABID	4,553	4,553	4,553	4,553	3,884	3,240	3,271	4,772	3,930	3,956	4,324	0	0.06	0.06	0.06	0.05	0.04	**0.07**
Total IGWA/SWID	29,161	35,250	75,899	52,410	47,036	84,405	90,357	108,116	90,764	93,943	84,331	0	1.22	1.22	**1.09**	0.91	0.73	1.49
Total	33,714	39,803	80,452	56,963	50,920	87,644	93,628	112,888	94,694	97,899	88,655	0	1.28	1.28	1.15	0.96	0.78	1.56

Notes:

1. IGWA conversion volume includes water delivered to conversion projects, excess water delivered to conversion projects, canal seepage within NSCC and AFRD2 delivery systems, and voluntary idle projects. For 2005-2013, canal seepage was assumed to be 30% of diversions for NSCC and 42% of diversions for AFRD2. Beginning in 2014, canal loss ratios reported to the watermaster by the canal companies were used to calculate canal seepage within the NSCC and AFRD2 delivery systems.

2. SWID conversion volume includes water delivered to conversion projects and canal seepage of 38% within the J Canal delivery system.
3. ABID conversion volume includes water delivered to conversion projects and canal seepage of 15% within the delivery system.
4. SWID voluntary curtailments on mixed source lands where groundwater irrigation is supplemental to surface water irrigation were assigned a groundwater fraction of 0.88 for calculation of idled acres and volume of benefit to the aquifer.
5. 2007-2009 IGWA CREP may include land located within SWID/GCID. Beginning in 2010, CREP land located within SWID/GCID is simulated separately. 2007-2013 IGWA CREP may include lands enrolled by ABID. Beginning in 2014, CREP lands enrolled by A&B Irrigation Distict are simulated separately. IGWA CREP lands outside of the Great Rift trim line were excluded from this analysis.
6. IGWA recharge does not include recharge sponsored by IWRB or recharge outside of the Great Rift trim line.
7. SWID recharge is not intended to include recharge sponsored by IWRB. Unable to verify whether or not SWID recharge claimed for 2012 and 2013 was sponsored by IWRB. It may not be appropriate to provide mitigation credit for recharge modeled in 2012 or 2013. Non-IWRB recharge in 2015 may have been performed, but was not documented by SWID in compliance with UIC permit conditions. UIC permits for the Wrigley and Searle sites expired on 10/1/2015 and had not been renewed as of 3/10/2016.
8. Mitigation volumes were modeled at an average constant rate distributed over a one-year period beginning April 1.
9. Predicted average benefit does not consider potential benefits of aquifer enhancement activities that may occur in future years.
10. Predicted benefits to the Rangen spring model cell were calculated using transient and steady state, superposition versions of ESPAM2.1. Predicted benefits to Curren tunnel were calculated as 63% of the benefits to the Rangen spring model cell using a linear regression model adopted by the Director in the Rangen proceeding.

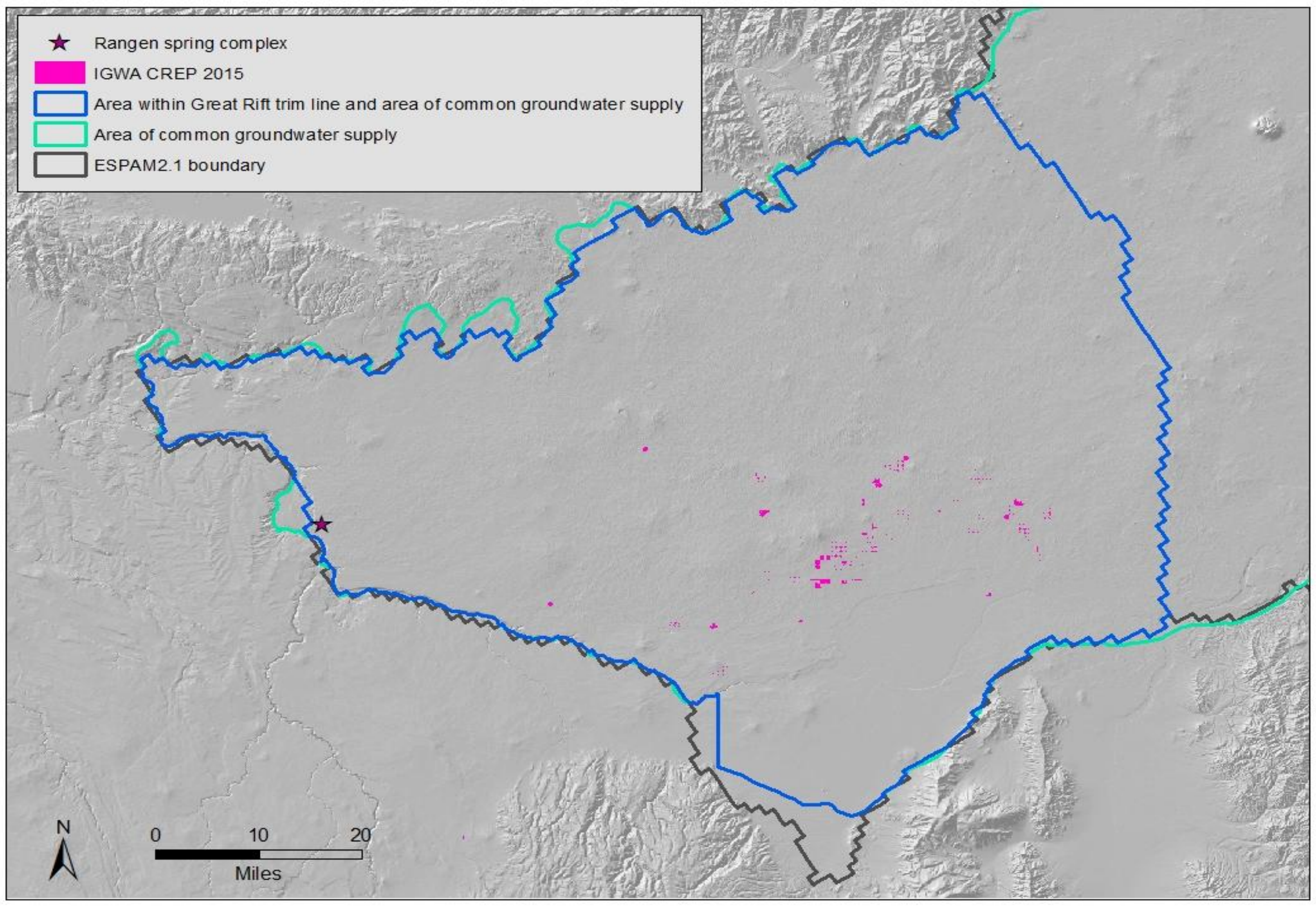
A-2. Predicted impact of 2005 through 2015 aquifer enhancement projects on baseflow and spring discharge tributary to the Snake River between Kimberly and King Hill.

Mitigation project	Volume (AF/yr) [8]												Predicted average benefit to baseflow & spring cells with no irrigation use (cfs) [10]						Predicted average benefit to Kimberly to King Hill reach [11]					
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Future years [9]**	**Year 1 (4/2014-3/2015)**	**Year 2 (4/2015-3/2016)**	**Year 3 (4/2016-3/2017)**	**Year 4 (4/2017-3/2018)**	**Year 5 (4/2018-3/2019)**	**Impact of 2015 projects at steady state**	**Year 1 (4/2014-3/2015)**	**Year 2 (4/2015-3/2016)**	**Year 3 (4/2016-3/2017)**	**Year 4 (4/2017-3/2018)**	**Year 5 (4/2018-3/2019)**	**Impact of 2015 projects at steady state**
IGWA Conversions [1]	29,161	35,250	36,915	35,967	13,562	17,210	23,307	30,144	24,335	30,480	10,417	0	5.39	4.63	2.89	1.84	1.35	2.59	19.98	17.39	11.04	7.08	5.21	9.65
SWID Conversions [2]	0	0	0	0	0	47,138	47,189	58,909	47,350	45,622	57,746	0	5.67	6.43	6.93	6.11	4.90	11.36	19.20	22.05	24.20	22.19	18.22	40.63
SWID Voluntary Curtailment [4]	0	0	0	0	0	4,211	4,015	4,015	3,946	3,946	3,211	0	0.48	0.54	0.55	0.46	0.37	0.66	1.62	1.85	1.92	1.68	1.36	2.33
IGWA CREP [5]	0	0	11,624	16,443	19,787	14,258	14,258	12,266	12,376	11,853	11,696	0	1.71	1.69	1.53	1.15	0.87	1.80	6.66	6.58	5.99	4.51	3.41	7.00
SWID CREP [5]	0	0	0	0	0	1,588	1,588	1,588	1,588	1,588	1,260	0	0.19	0.22	0.22	0.18	0.14	0.26	0.65	0.74	0.77	0.67	0.54	0.92
IGWA Recharge [6]	0	0	27,360	0	13,687	0	0	0	0	0	0	0	0.24	0.19	0.15	0.12	0.09	0	0.94	0.73	0.57	0.45	0.36	0
SWID Recharge [7]	0	0	0	0	0	0	0	1,195	1,169	453	0	0	0.08	0.08	0.07	0.06	0.04	0	0.26	0.29	0.26	0.21	0.17	0
IGWA	29,161	35,250	75,899	52,410	47,036	31,468	37,565	42,410	36,711	42,334	22,113	0	7.35	6.51	4.57	3.11	2.32	4.39	27.59	24.70	17.60	12.05	8.98	16.65
SWID/GCID	0	0	0	0	0	52,936	52,792	65,706	54,053	51,609	62,218	0	6.43	7.28	7.76	6.81	5.46	12.28	21.73	24.93	27.15	24.76	20.29	43.87
Total	29,161	35,250	75,899	52,410	47,036	84,405	90,357	108,116	90,764	93,943	84,331	0	**13.78**	**13.79**	**12.33**	**9.92**	**7.77**	**16.66**	**49.32**	**49.63**	**44.74**	**36.81**	**29.27**	**60.53**

Notes:

1. IGWA conversion volume includes water delivered to conversion projects, excess water delivered to conversion projects, canal seepage within NSCC and AFRD2 delivery systems, and voluntary idle projects. For 2005-2013, canal seepage was assumed to be 30% of diversions for NSCC and 42% of diversions for AFRD2. Beginning in 2014, canal loss ratios reported to the watermaster by the canal companies were used to calculate canal seepage within the NSCC and AFRD2 delivery systems.
2. SWID conversion volume includes water delivered to conversion projects and canal seepage of 38% within the J Canal delivery system.
3. ABID conversion volume includes water delivered to conversion projects and canal seepage of 15% within the delivery system.
4. SWID voluntary curtailments on mixed source lands where groundwater irrigation is supplemental to surface water irrigation were assigned a groundwater fraction of 0.88 for calculation of idled acres and volume of benefit to the aquifer.
5. 2007-2009 IGWA CREP may include land located within SWID/GCID. Beginning in 2010, CREP land located within SWID/GCID is simulated separately. 2007-2013 IGWA CREP may include lands enrolled by ABID. Beginning in 2014, CREP lands enrolled by A&B Irrigation Distict are simulated separately. IGWA CREP lands outside of the Great Rift trim line were excluded from this analysis.
6. IGWA recharge does not include recharge sponsored by IWRB or recharge outside of the Great Rift trim line.
7. SWID recharge is not intended to include recharge sponsored by IWRB. Unable to verify whether or not SWID recharge claimed for 2012 and 2013 was sponsored by IWRB. It may not be appropriate to provide mitigation credit for recharge modeled in 2012 or 2013. Non-IWRB recharge in 2015 may have been performed, but was not documented by SWID in compliance with UIC permit conditions. UIC permits for the Wrigley and Searle sites expired on 10/1/2015 and had not been renewed as of 3/10/2016.
8. Mitigation volumes were modeled at an average constant rate distributed over a one-year period beginning April 1.
9. Predicted average benefit does not consider potential benefits of aquifer enhancement activities that may occur in future years.
10. Predicted benefit to baseflow between Kimberly and King Hill and spring discharge in the Devil's Washbowl cell, Devil's Corral cell, and Box Canyon reach.
11. Predicted benefit to baseflow and springs tributary to the Snake River between Kimberly and King Hill. Some of the predicted increases in spring discharge may be diverted for consumptive use, therefore the increase in flow in the Snake River between Kimberly and King Hill is expected to be less than the increase in aquifer discharge.

A-3. Simulated steady state impact of 2015 CREP for lands enrolled by IGWA within the Great Rift trim line and area of common groundwater supply

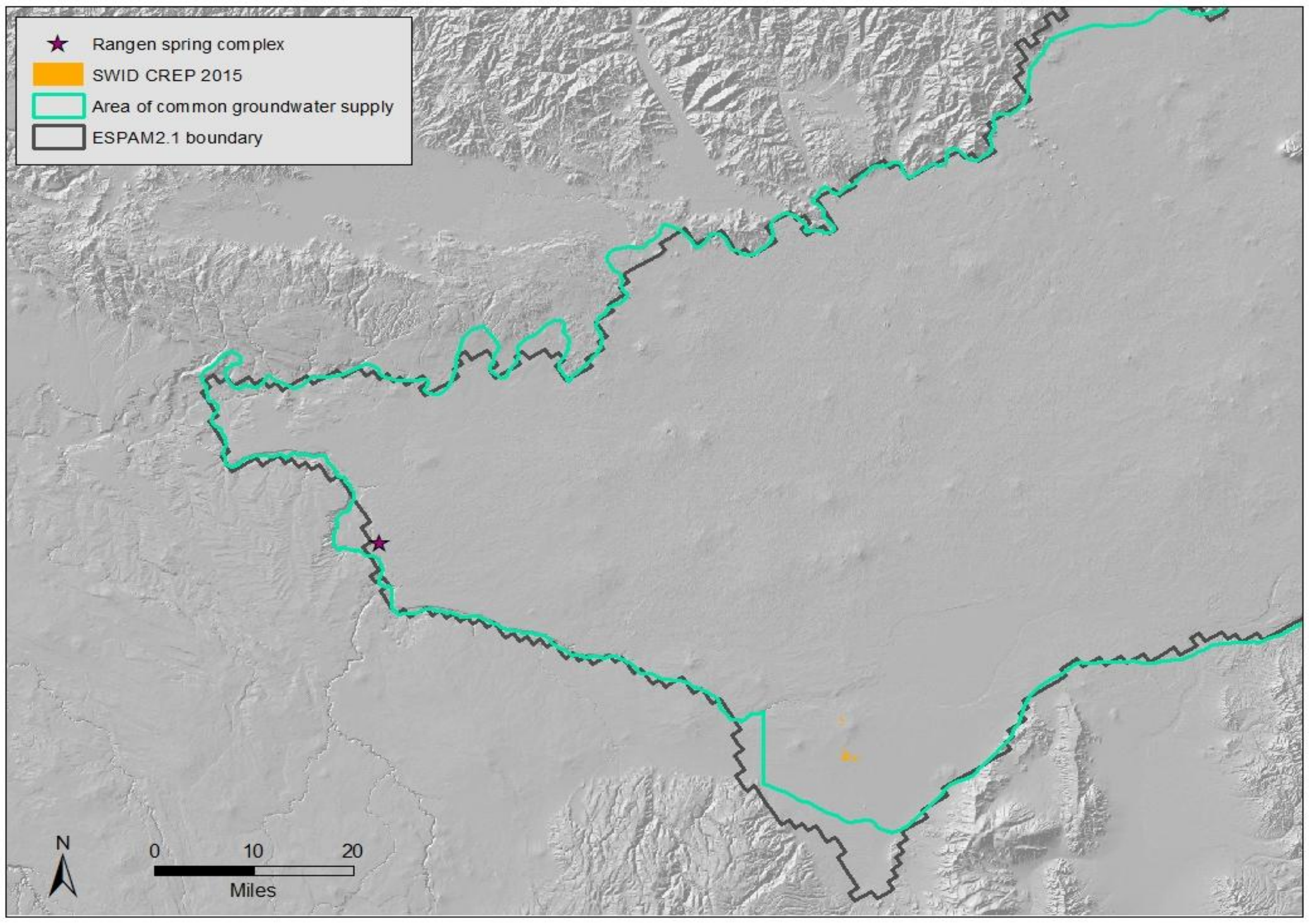


Simulated volume:	4,753	acres
	11,696	AF/yr
	16.14	cfs
	2.46	AF/ac

Predicted response:

Reach	Response (cfs)	Response (AF/yr)
Ashton to Rexburg	0.22	158
Heise to Shelley	0.64	462
Shelley to Near Blackfoot	1.91	1,382
Near Blackfoot to Minidoka	6.38	4,624
Kimberly to Buhl	2.38	1,724
Buhl to Lower Salmon Falls	3.96	2,872
Lower Salmon Falls to King Hill	0.65	474
Total	16.14	11,696
Group A&B Spring Reaches		
Devil's Washbowl	0.13	91
Devil's Corral	0.17	121
Blue Lakes	0.49	357
Crystal	0.81	585
Niagara	0.54	395
Clear Lake	0.70	509
Briggs	0.02	14
Box Canyon	1.16	839
Sand	0.31	223
Thousand	0.80	579
National Fish Hatchery	0.18	129
Rangen	0.28	203
Three	0.20	147
Malad	0.57	415
Curren Tunnel	0.18	128
Baseflow and selected spring cells without irrigation use		
Devil's Washbowl	0.13	
Devil's Corral	0.17	
Box Canyon	1.16	
Baseflow , Kimberly to King Hill	0.35	
Total	1.80	
Kimberly to King Hill total	7.00	

A-4. Simulated steady state impact of 2015 CREP for lands enrolled by Southwest Irrigation District

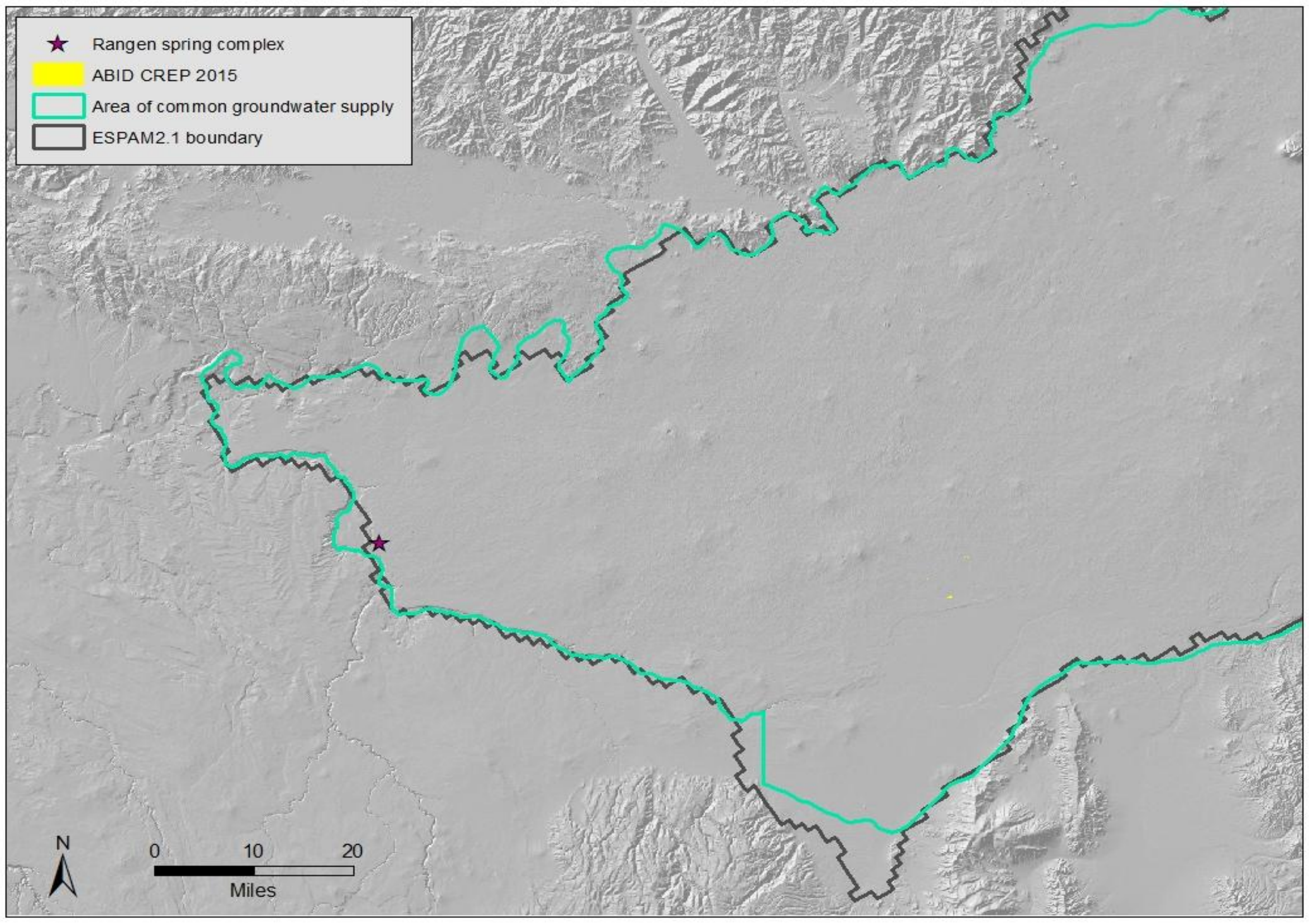


Simulated volume:	572	acres
	1,260	AF/yr
	1.74	cfs
	2.20	AF/ac

Predicted response:

Reach	Response (cfs)	Response (AF/yr)
Ashton to Rexburg	0.02	14
Heise to Shelley	0.06	41
Shelley to Near Blackfoot	0.17	124
Near Blackfoot to Minidoka	0.57	415
Kimberly to Buhl	0.35	252
Buhl to Lower Salmon Falls	0.49	357
Lower Salmon Falls to King Hill	0.08	59
Total	1.74	1,260
Group A&B Spring Reaches		
Devil's Washbowl	0.03	19
Devil's Corral	0.03	24
Blue Lakes	0.07	53
Crystal	0.10	74
Niagara	0.07	49
Clear Lake	0.09	63
Briggs	0.00	2
Box Canyon	0.14	104
Sand	0.04	28
Thousand	0.10	72
National Fish Hatchery	0.02	16
Rangen	0.03	25
Three	0.03	18
Malad	0.07	51
Curren Tunnel	0.02	16
Baseflow and selected spring cells without irrigation use		
Devil's Washbowl	0.03	
Devil's Corral	0.03	
Box Canyon	0.14	
Baseflow , Kimberly to King Hill	0.06	
Total	0.26	
Kimberly to King Hill total	0.92	

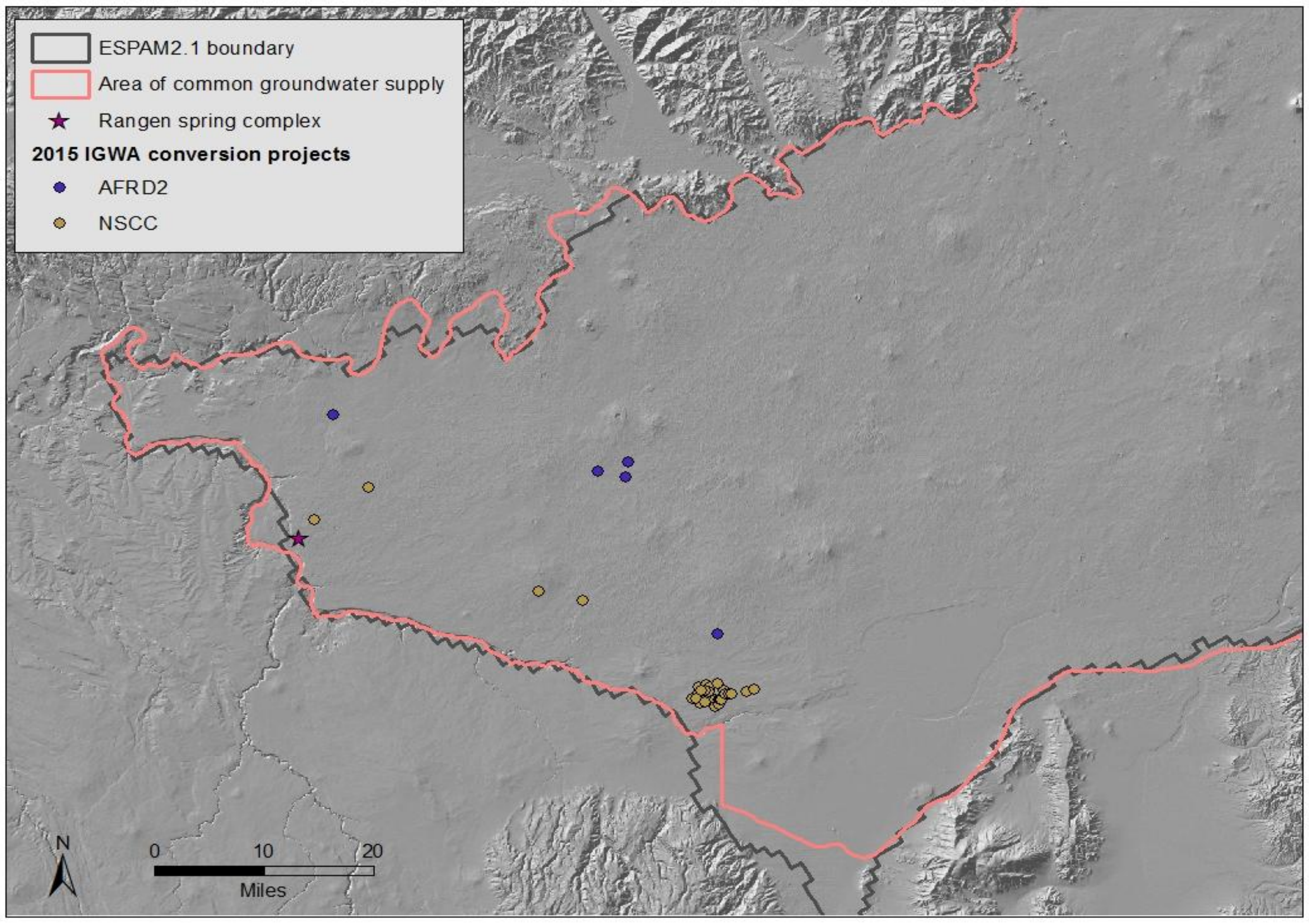
A-5. Simulated steady state impact of 2015CREP for lands enrolled by A & B Irrigation District



Simulated volume:		98	acres
		242	AF/yr
		0.333	cfs
		2.46	AF/ac

Predicted response:	**Reach**	**Response (cfs)**	**Response (AF/yr)**
	Ashton to Rexburg	0.005	4
	Heise to Shelley	0.014	10
	Shelley to Near Blackfoot	0.043	31
	Near Blackfoot to Minidoka	0.143	103
	Kimberly to Buhl	0.041	30
	Buhl to Lower Salmon Falls	0.075	55
	Lower Salmon Falls to King Hill	0.013	9
	Total	0.333	242
	Group A&B Spring Reaches		
	Devil's Washbowl	0.002	1
	Devil's Corral	0.002	2
	Blue Lakes	0.007	5
	Crystal	0.015	11
	Niagara	0.010	8
	Clear Lake	0.013	10
	Briggs	0.000	0
	Box Canyon	0.022	16
	Sand	0.006	4
	Thousand	0.015	11
	National Fish Hatchery	0.003	2
	Rangen	0.005	4
	Three	0.004	3
	Malad	0.011	8
	Curren Tunnel	0.003	2
	Baseflow and selected spring cells without irrigation use		
	Devil's Washbowl	0.002	
	Devil's Corral	0.002	
	Box Canyon	0.022	
	Baseflow , Kimberly to King Hill	0.006	
	Total	0.032	
	Kimberly to King Hill total	0.129	

A-6. Simulated steady state impact of water delivered to IGWA soft conversion projects in 2015



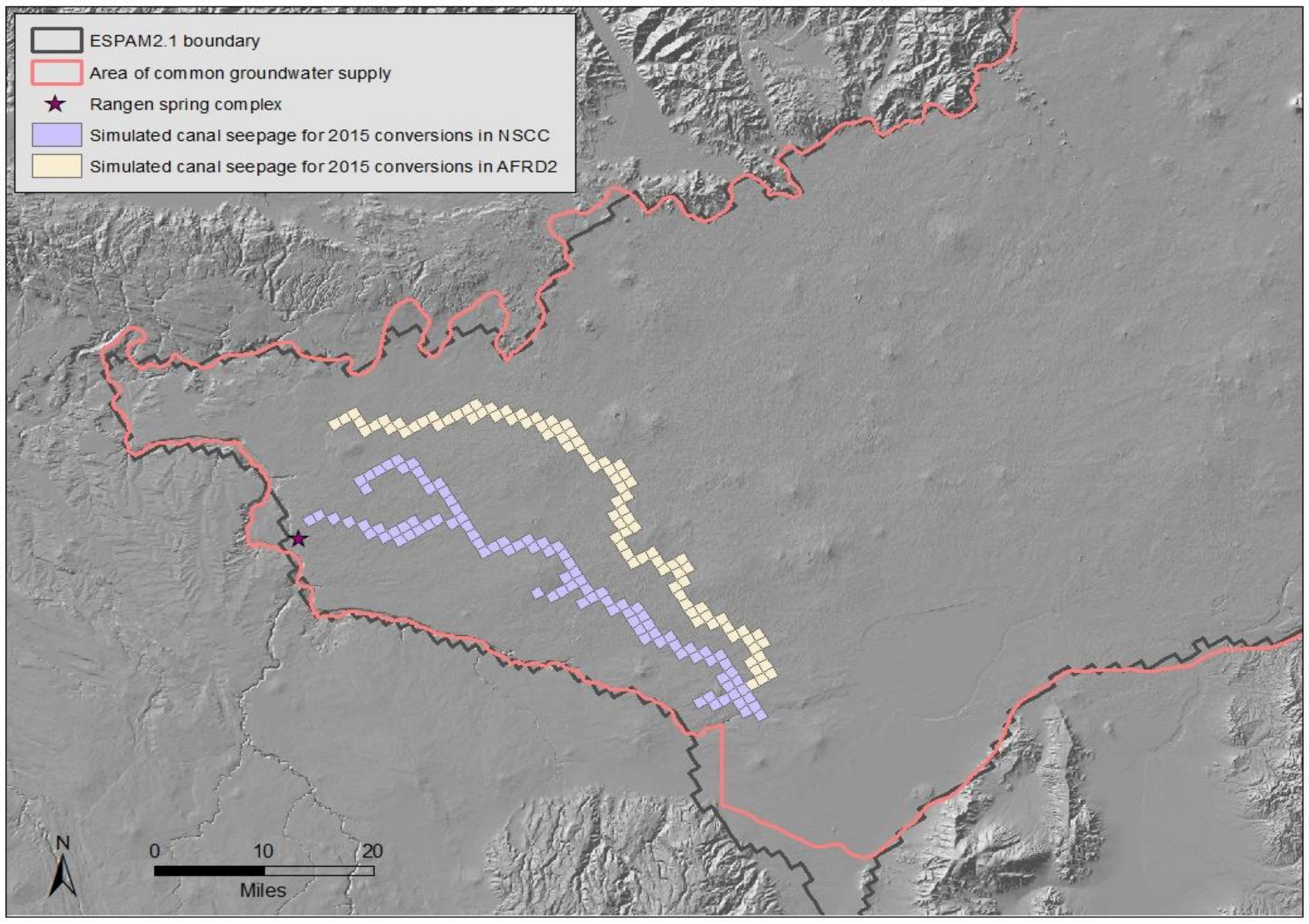
Simulated volume:

8,956 AF/yr
12.36 cfs

Predicted response:

Reach	Response (cfs)	Response (AF/yr)
Ashton to Rexburg	0.10	72
Heise to Shelley	0.29	212
Shelley to Near Blackfoot	0.87	633
Near Blackfoot to Minidoka	2.93	2,121
Kimberly to Buhl	2.86	2,069
Buhl to Lower Salmon Falls	4.45	3,227
Lower Salmon Falls to King Hill	0.86	621
Total	12.36	8,956
Group A&B Spring Reaches		
Devil's Washbowl	0.22	157
Devil's Corral	0.28	201
Blue Lakes	0.59	431
Crystal	0.83	601
Niagara	0.57	412
Clear Lake	0.74	536
Briggs	0.02	14
Box Canyon	1.23	890
Sand	0.33	240
Thousand	0.93	674
National Fish Hatchery	0.22	159
Rangen	0.35	253
Three	0.26	186
Malad	0.75	541
Curren Tunnel	0.22	159
Baseflow and selected spring cells without irrigation use		
Devil's Washbowl	0.22	
Devil's Corral	0.28	
Box Canyon	1.23	
Baseflow , Kimberly to King Hill	0.49	
Total	2.22	
Kimberly to King Hill total	8.17	

A-7. Simulated steady state impact of canal seepage for 2015 IGWA conversion projects



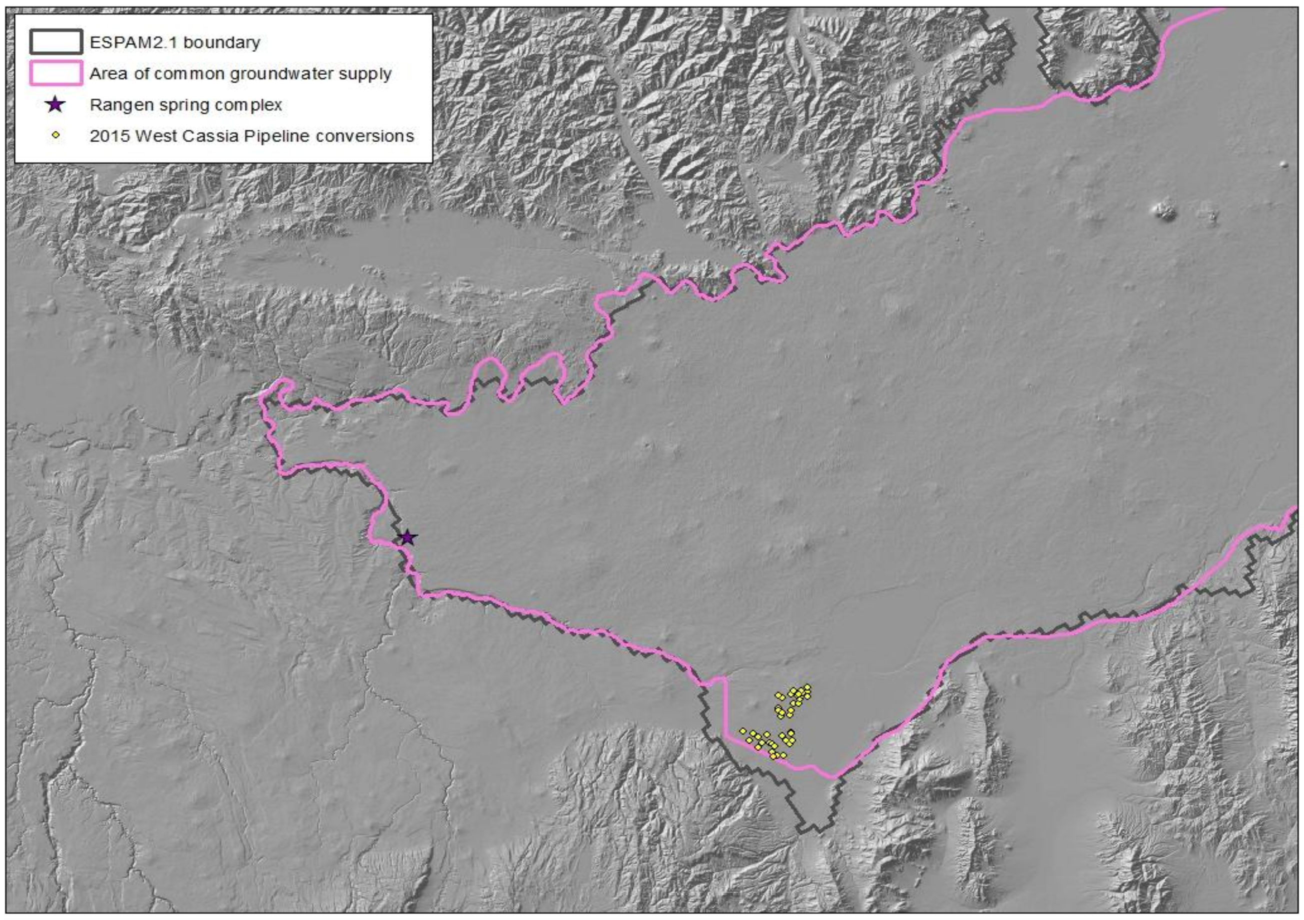
Simulated volume:

1,461 AF/yr
2.02 cfs

Predicted response:

Reach	Response (cfs)	Response (AF/yr)
Ashton to Rexburg	0.01	9
Heise to Shelley	0.04	27
Shelley to Near Blackfoot	0.11	80
Near Blackfoot to Minidoka	0.37	269
Kimberly to Buhl	0.44	317
Buhl to Lower Salmon Falls	0.89	644
Lower Salmon Falls to King Hill	0.16	116
Total	2.02	1,461
Group A&B Spring Reaches		
Devil's Washbowl	0.02	16
Devil's Corral	0.03	20
Blue Lakes	0.07	53
Crystal	0.16	114
Niagara	0.12	84
Clear Lake	0.15	110
Briggs	0.00	3
Box Canyon	0.25	182
Sand	0.07	49
Thousand	0.18	133
National Fish Hatchery	0.04	31
Rangen	0.07	48
Three	0.05	35
Malad	0.14	101
Curren Tunnel	0.04	30
Baseflow and selected spring cells without irrigation use		
Devil's Washbowl	0.02	
Devil's Corral	0.03	
Box Canyon	0.25	
Baseflow , Kimberly to King Hill	0.07	
Total	0.37	
Kimberly to King Hill total	1.49	

A-8. Simulated steady state impact of water delivered to West Cassia Pipeline conversion field headgates in 2015



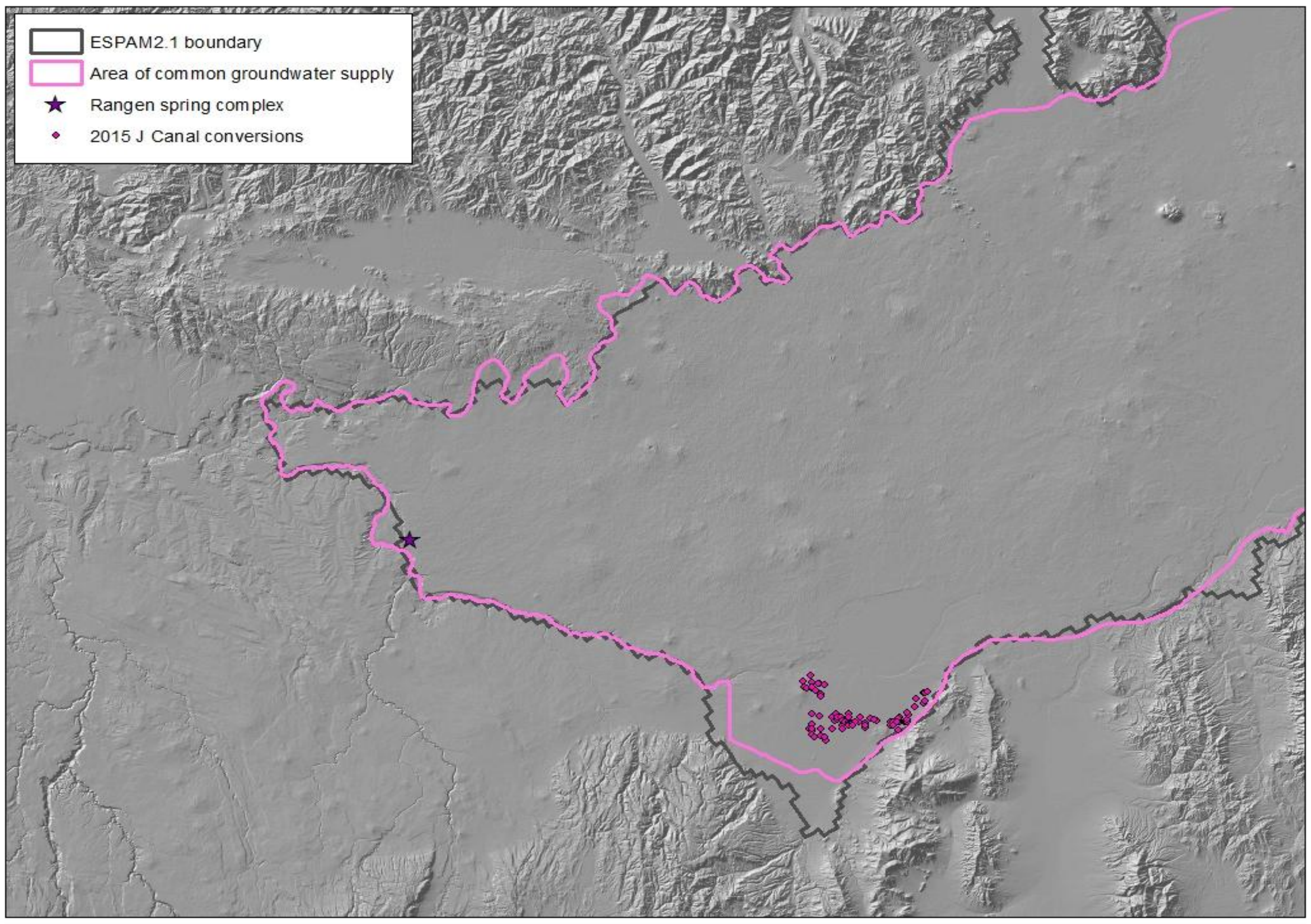
Simulated volume:

11,741	AF/yr
16.21	cfs

Predicted response:

Reach	Response (cfs)	Response (AF/yr)
Ashton to Rexburg	0.18	132
Heise to Shelley	0.53	386
Shelley to Near Blackfoot	1.60	1,157
Near Blackfoot to Minidoka	5.36	3,885
Kimberly to Buhl	3.21	2,328
Buhl to Lower Salmon Falls	4.57	3,310
Lower Salmon Falls to King Hill	0.75	543
Total	16.21	11,741
Group A&B Spring Reaches		
Devil's Washbowl	0.24	175
Devil's Corral	0.31	224
Blue Lakes	0.67	487
Crystal	0.95	685
Niagara	0.63	456
Clear Lake	0.81	588
Briggs	0.02	16
Box Canyon	1.34	968
Sand	0.36	257
Thousand	0.92	667
National Fish Hatchery	0.21	149
Rangen	0.32	233
Three	0.23	169
Malad	0.66	475
Curren Tunnel	0.20	147
Baseflow and selected spring cells without irrigation use		
Devil's Washbowl	0.24	
Devil's Corral	0.31	
Box Canyon	1.34	
Baseflow , Kimberly to King Hill	0.52	
Total	2.41	
Kimberly to King Hill total	8.53	

A-9. Simulated steady state impact of water delivered to J Canal conversion field headgates in 2015



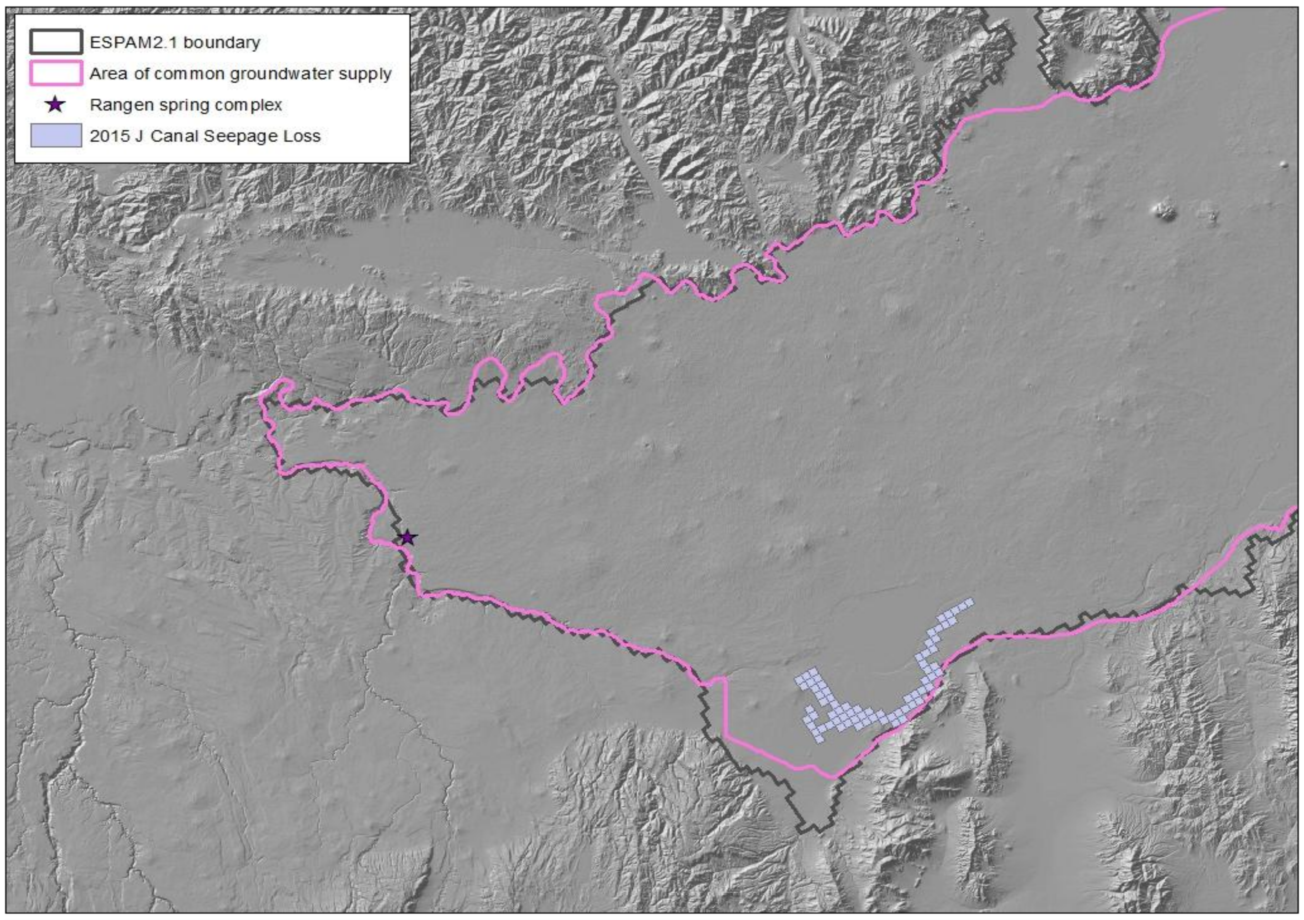
Simulated volume:

28,523 AF/yr
39.37 cfs

Predicted response:

Reach	Response (cfs)	Response (AF/yr)
Ashton to Rexburg	0.45	326
Heise to Shelley	1.32	956
Shelley to Near Blackfoot	3.95	2,863
Near Blackfoot to Minidoka	13.28	9,620
Kimberly to Buhl	7.61	5,516
Buhl to Lower Salmon Falls	10.96	7,938
Lower Salmon Falls to King Hill	1.80	1,303
Total	39.37	28,523
Group A&B Spring Reaches		
Devil's Washbowl	0.56	408
Devil's Corral	0.72	524
Blue Lakes	1.58	1,146
Crystal	2.26	1,641
Niagara	1.51	1,093
Clear Lake	1.94	1,409
Briggs	0.05	38
Box Canyon	3.20	2,320
Sand	0.85	617
Thousand	2.21	1,599
National Fish Hatchery	0.49	357
Rangen	0.77	560
Three	0.56	406
Malad	1.57	1,141
Curren Tunnel	0.49	353
Baseflow and selected spring cells without irrigation use		
Devil's Washbowl	0.56	
Devil's Corral	0.72	
Box Canyon	3.20	
Baseflow , Kimberly to King Hill	1.23	
Total	5.72	
Kimberly to King Hill total	20.37	

A-10. Simulated steady state impact of conveyance losses for J Canal conversions in 2015, assuming 38% seepage loss



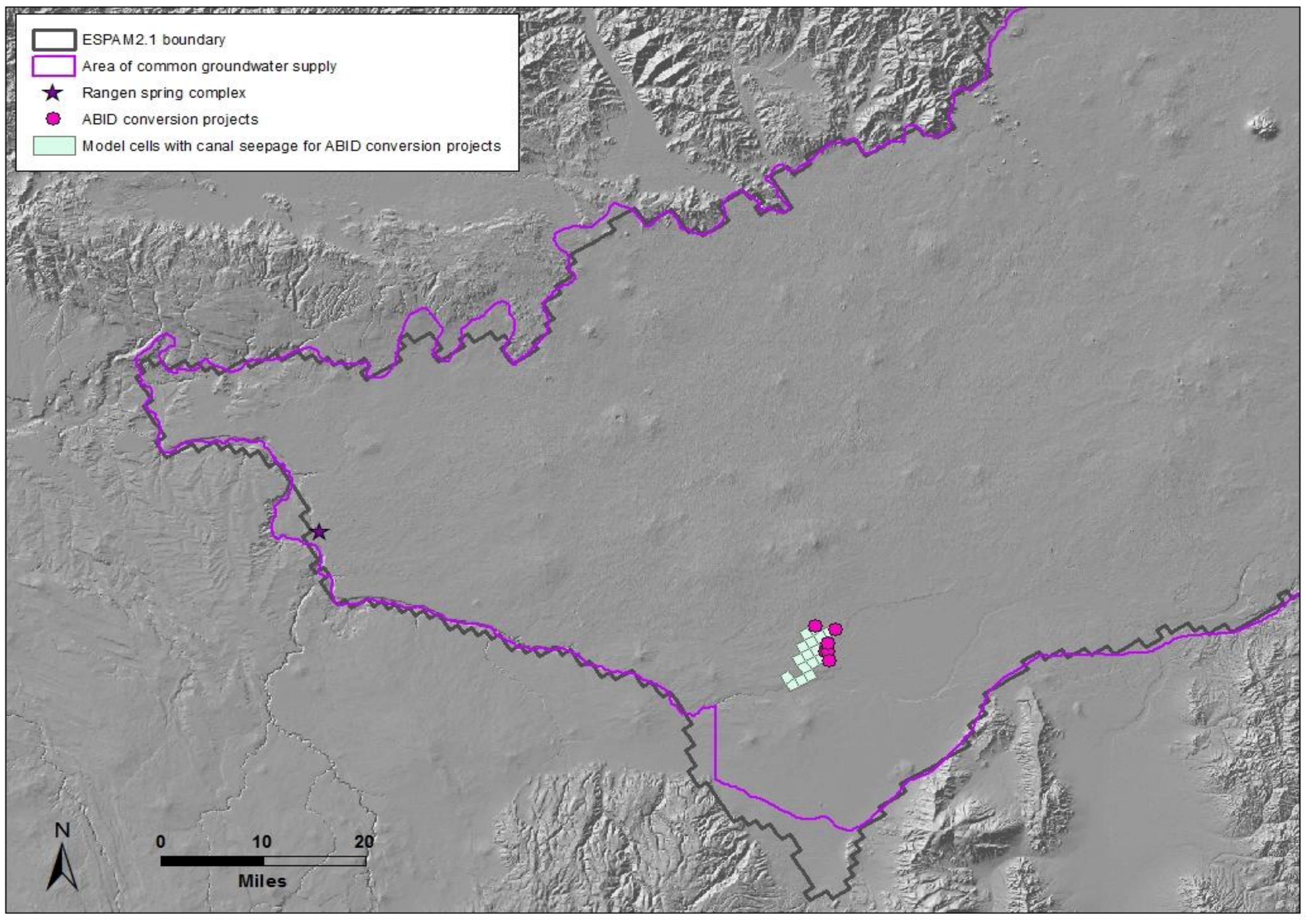
Simulated volume:

17,482 AF/yr
24.13 cfs

Predicted response:

Reach	Response (cfs)	Response (AF/yr)
Ashton to Rexburg	0.29	211
Heise to Shelley	0.85	619
Shelley to Near Blackfoot	2.56	1,855
Near Blackfoot to Minidoka	8.70	6,303
Kimberly to Buhl	4.27	3,094
Buhl to Lower Salmon Falls	6.40	4,637
Lower Salmon Falls to King Hill	1.05	762
Total	24.13	17,482
Group A&B Spring Reaches		
Devil's Washbowl	0.30	216
Devil's Corral	0.38	278
Blue Lakes	0.87	628
Crystal	1.32	954
Niagara	0.88	638
Clear Lake	1.14	823
Briggs	0.03	22
Box Canyon	1.87	1,355
Sand	0.50	360
Thousand	1.29	934
National Fish Hatchery	0.29	208
Rangen	0.45	327
Three	0.33	237
Malad	0.92	667
Curren Tunnel	0.28	206
Baseflow and selected spring cells without irrigation use		
Devil's Washbowl	0.30	
Devil's Corral	0.38	
Box Canyon	1.87	
Baseflow , Kimberly to King Hill	0.68	
Total	3.23	
Kimberly to King Hill total	11.72	

A-11. Simulated steady state impact of 2015 A & B Irrigation District conversion projects, including conveyance loss of 15%



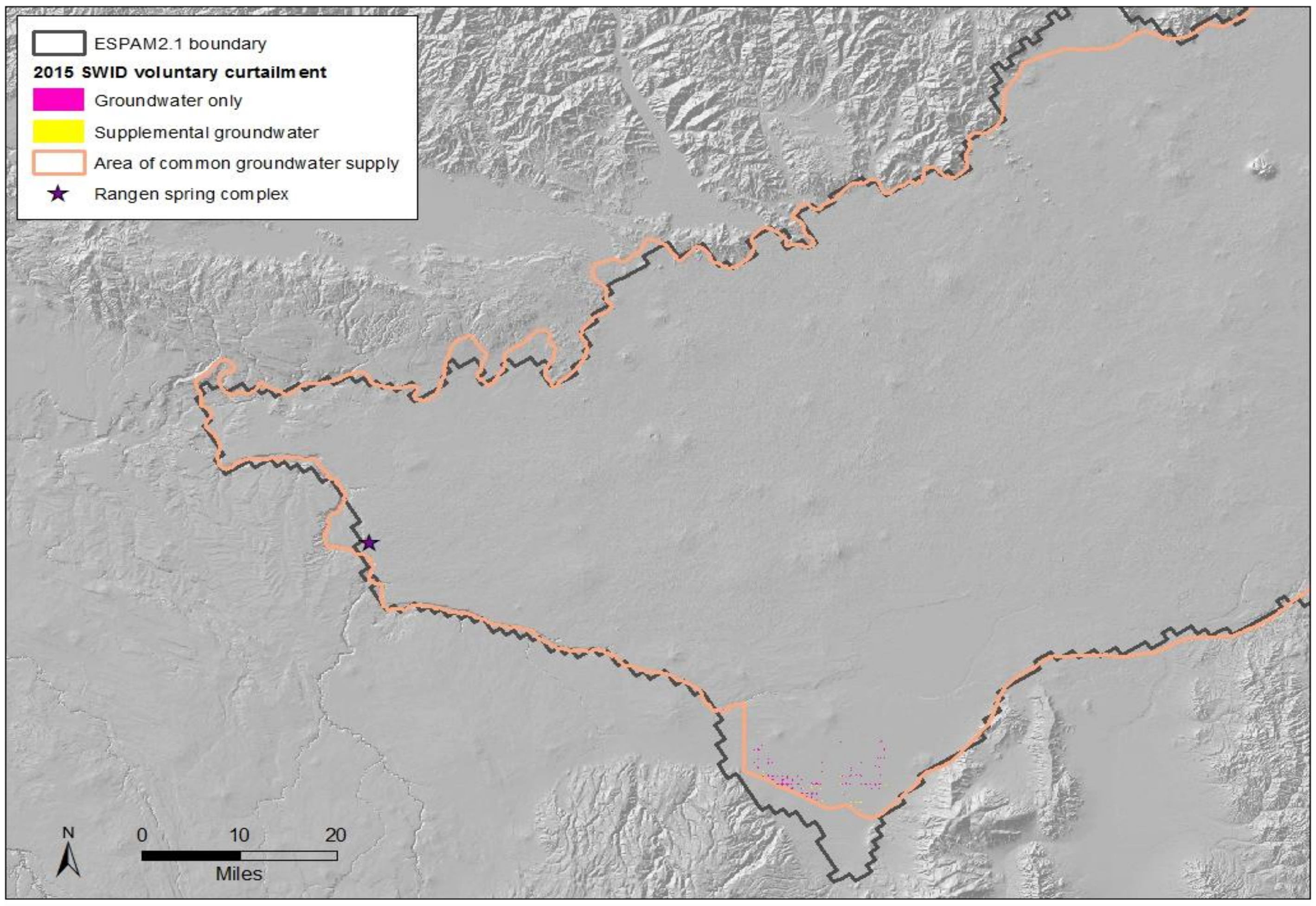
Simulated volume:

4,082 AF/yr
5.64 cfs

Predicted response:

Reach	Response (cfs)	Response (AF/yr)
Ashton to Rexburg	0.07	48
Heise to Shelley	0.19	140
Shelley to Near Blackfoot	0.58	420
Near Blackfoot to Minidoka	1.95	1,409
Kimberly to Buhl	1.05	761
Buhl to Lower Salmon Falls	1.55	1,120
Lower Salmon Falls to King Hill	0.25	184
Total	5.64	4,082
Group A&B Spring Reaches		
Devil's Washbowl	0.08	55
Devil's Corral	0.10	70
Blue Lakes	0.22	156
Crystal	0.32	231
Niagara	0.21	154
Clear Lake	0.27	199
Briggs	0.01	5
Box Canyon	0.45	327
Sand	0.12	87
Thousand	0.31	226
National Fish Hatchery	0.07	50
Rangen	0.11	79
Three	0.08	57
Malad	0.22	161
Curren Tunnel	0.07	50
Baseflow and selected spring cells without irrigation use		
Devil's Washbowl	0.08	
Devil's Corral	0.10	
Box Canyon	0.45	
Baseflow , Kimberly to King Hill	0.17	
Total	0.79	
Kimberly to King Hill total	2.85	

A-12. Simulated steady state impact of SWID voluntary curtailment in 2015



Simulated volume:	1,447	acres	1,477 acres (1,228 acres with primary groundwater rights and 249 acres with supplemental groundwater rights)
	3,211	AF/yr	
	4.43	cfs	
	2.22	AF/ac	

Predicted response:	**Reach**	**Response (cfs)**	**Response (AF/yr)**
	Ashton to Rexburg	0.05	36
	Heise to Shelley	0.15	106
	Shelley to Near Blackfoot	0.44	318
	Near Blackfoot to Minidoka	1.47	1,066
	Kimberly to Buhl	0.87	634
	Buhl to Lower Salmon Falls	1.25	903
	Lower Salmon Falls to King Hill	0.20	148
	Total	4.43	3,211
	Group A&B Spring Reaches		
	Devil's Washbowl	0.07	47
	Devil's Corral	0.08	61
	Blue Lakes	0.18	132
	Crystal	0.26	187
	Niagara	0.17	124
	Clear Lake	0.22	160
	Briggs	0.01	4
	Box Canyon	0.36	264
	Sand	0.10	70
	Thousand	0.25	182
	National Fish Hatchery	0.06	41
	Rangen	0.09	64
	Three	0.06	46
	Malad	0.18	130
	Curren Tunnel	0.06	40
	Baseflow and selected spring cells without irrigation use		
	Devil's Washbowl	0.07	
	Devil's Corral	0.08	
	Box Canyon	0.36	
	Baseflow , Kimberly to King Hill	0.14	
	Total	0.66	
	Kimberly to King Hill total	2.33	