Rebuttal Report of Christian R. Petrich

In the Matter of Application for Transfer No. 73811 (Shekinah Industries); Application for Transfer No. 73834 (Orchard Ranch); Application for Permit No. 63-32499 (Mayfield Townsite); Application for Permit No. 61-12095 (Nevid-Corder); Application for Permit No. 61-12096 (Nevid); Application for Permit No. 63-32703 (Orchard Ranch); Application for Permit No. 61-12256 (Intermountain Sewer & Water); Application for Permit No. 63-33344 (ARK Properties-Mayfield Townsite) before the Idaho Department of Water Resources

Prepared on behalf of

Nevid LLC
1349 Galleria Drive, Suite 200
Henderson, NV 89014-8624

ARK Properties LLC
11204 N Bar 21 Drive
Glenns Ferry, ID 83623-5033

PROFESSIONAL ENGINEER
REGISTERED
9011
STATE OF IDAHO
CHRISTIAN R. PETRICH

REGISTERED PROFESSIONAL GEOLOGIST
CHRISTIAN R. PETRICH
1088
STATE OF IDAHO

1/30/2013

January 30, 2013

SPF Water Engineering, LLC
300 East Mallard, Suite 350
Boise, Idaho 83706
(208) 383-4140

SPF WATER ENGINEERING

Summary

This document summarizes a review of two reports submitted by ERO Resources Corporation and Brockway Engineering, PLLC. Conclusions from this review include the following:

1. Contrary to ERO's assertions, the study area defined for this matter by the Idaho Department of Water Resources (IDWR) is appropriately sized and technically defensible. Constraining study-area dimensions to hydrogeologic features such as faults or geologic contacts (as ERO suggests) would require extending the study area to include the entire western Snake River Plain, an unwieldy and impractical study area for answering the specific water-budget questions at hand.
2. ERO uses the Theis (1935) method to show hydraulic connection between the consolidated cases study area and the adjacent comparison area, suggesting that IDWR's boundaries were therefore invalid. However, use of the Theis method to project impacts over a 20-or 40-year timeframe is inappropriate.
3. ERO uses Figure 5 of the IDWR Staff Memo to suggest that a 20-mile diameter area of groundwater-level decline stemming from pumping in the Cinder Cone Butte Critical Ground Water Area (CGWA) extends substantially into the consolidated cases study area. However, the IDWR depictions of groundwater-level declines outside of the CGWA are based on software interpolation unsupported by actual groundwater-level data.
4. ERO suggests that processing of the pending applications and transfers should be delayed until current studies and data-gathering efforts are complete. However, it appears unlikely that current studies (Indian Creek Reservoir seepage analysis, groundwater chemistry analysis, and ongoing groundwater-level and streamflow measurements) will change IDWR's water-budget estimates. Ultimately, additional groundwater development, and the monitoring of groundwater-level responses to new withdrawals, will confirm current estimates of water availability.
5. Inclusion of a portion of the Blacks Creek drainage within the consolidated cases study area is appropriate. IDWR staff correctly subtracted surface water flowing out of this portion of the study area from the study-area water budget.
6. IDWR slightly underestimated the amount of recharge generated within the "non-recharge" area. Using the same approach used by IDWR staff, the total recharge in the "non-recharge" area was calculated to be approximately 3,000 AF/year (approximately 340 AF more per year than the 2,660 AF listed in the IDWR Staff Memo).
7. Although it may be difficult to capture all of the recharge generated in IDWR's "non-recharge" area under the proposed applications and transfers, most of the recharge

generated in this "non-recharge" area occurs in portions of the study area where capture is more likely.

8. ERO comments that existing permits authorizing the use of ground water within the study area were approved without regard to trust-water impacts. However, all of the points of diversion for these permits – and PODs for the pending applications and transfers in this matter – are outside of the trust-water area.

9. ERO alleges that approval of the pending applications/transfers will injure existing water rights. ERO presumably refers to hydropower rights held by the Idaho Power Company authorizing hydroelectric generation Swan Falls Dam. However, these Idaho Power rights are subordinate to junior-priority upstream uses as long as Snake River flows remain above established minimum flows. Furthermore, ERO has provided no data suggesting that approval of all, or some, of the pending applications/transfers will cause Snake River flows to dip below established minimum flows.

10. ERO provides multiple photographs of springs in the Snake River Canyon. ERO does not quantify the amount of water (if any) that actually reaches the Snake River from these springs. It appears from the photographs that much of the spring discharge in this area is lost to evapotranspiration. As such, long-term withdrawals under pending applications and transfers (if approved) could lead to reduced evapotranspiration in the vicinity of these Snake River Canyon springs, not necessarily a reduction in discharge to the Snake River.

11. Denial of the proposed consolidated-case applications and transfers because Snake River flows may dip below an established minimum sometime in the future would preclude the full economic development of an available groundwater resource.

12. The usefulness of a computer model developed by Brockway Engineering on behalf of Shekinah Industries for the purposes of evaluating pumping effects within or around the consolidated study area is limited. The model pre-dates the IDWR Staff Memo, and therefore does not incorporate the results of recent groundwater-level measurements, stream-monitoring data, and water-budget analyses. Also, the 2-dimensional discretization cannot adequately describe groundwater flow in perched, unconfined, semi-confined, or confined aquifers present in the study area, especially in the northern portion of the study area.

Table of Contents

List of Figures

List of Tables

1. INTRODUCTION

The Idaho Department of Water Resources (IDWR) combined various protested applications and transfers in the Interstate 84 (I-84) corridor in eastern Ada County and western Elmore County[1] for a consolidated hearing focusing on available water supply. IDWR staff prepared a memorandum (Tesch, 2012, referred to herinafter as the IDWR Staff Memo) regarding the sufficiency of water supply for this area. Expert reports were submitted on behalf of the Idaho Power Company (Shaw and Young, 2012), Shekinah Industries (Powell and Brockway, 2009), Nevid LLC (Petrich, 2012), and ARK Properties LLC (Petrich, 2012).

This report provides responses to certain assertions and conclusions in the following two reports submitted on behalf of the Idaho Power Company and Shekinah Industries:

1. Water Supply Evaluation for Proposed Projects along the I-84 Corridor, prepared by David B. Shaw and Norman C. Young (ERO Resources Corp.) on behalf of the Idaho Power Company (referred to hereinafter as the ERO Report).
2. Shekinah Industries Groundwater Model Development and Transfer Scenario Runs, prepared by G. Erick Powell, PhD., P.E., and Charles E. Brockway, PhD., P.E. on behalf of Shekinah Industries (referred to hereinafter as the Brockway Report).

2. RESPONSES TO THE ERO REPORT

The ERO Report makes three general assertions. First, ERO suggests that the study area proposed by IDWR is incorrectly drawn. Second, ERO argues that there is an insufficient water supply for any of the proposed applications/transfers. Finally, even if there is sufficient water, ERO argues that IDWR approval of the proposed

[1] January 24, 2012 Order Creating Contested Case and Consolidating Protested and unprotested Applications in the Matter of Application for Transfer 7381 (Shekinah Industries); Application for Transfer 73834 (Orchard Ranch); Application for Permit No. 63-32499 (Mayfield Townsite); Application for Permit No. 61-12095 (Nevid-Corder); Application for Permit No. 61-12096 (Nevid); Application for Permit No. 63-32703 (Orchard Ranch); Application for Permit No. 61-12256 (Intermountain Sewer and Water); Application for Permit No. 63-3344 (Ark Properties-Mayfield Townsite).

applications/transfers will cause injury to Idaho Power. The following paragraphs rebut these assertions.

- **IDWR Study Area Boundaries are Defensible**

1. *ERO argues that the "size and location of the study area are arbitrary and not supported by technical analysis" (ERO, page 14).*

   Response. The study area designated by IDWR for evaluating groundwater supply is appropriately sized and technically defensible. The study area encompasses all of the proposed points of diversion and proposed places of use. The study area is defined by defensible boundaries.

   The up-gradient boundary was defined as a surface-water flow divide (e.g., the ridge separating the Snake River and South Fork Boise River drainages). Similarly, the down-gradient boundary was established at the Snake River, which clearly is a groundwater-flow divide based on regional groundwater-level contours (Lindholm et al., 1988). There does not appear to be any disagreement regarding the use of these up-gradient and down-gradient boundaries.

   The southwest-northeast study-area boundaries are based on groundwater flow lines. Groundwater flow lines can be used to represent no-flow hydraulic boundaries (Anderson and Woessner, 1992), as long as cones of depression from the proposed pumping do not substantially impact groundwater levels at the boundary. In this case, there is no evidence that existing pumping inside or outside of the study area has materially impacted groundwater levels within the study area.

   That said, the southwest-northeast study-area boundaries are not entirely perpendicular to IDWR's groundwater-level contours (see Figure 4 of the IDWR Staff Memo) in the southern portion of the study area. As such, the study boundaries appear to not be aligned along regional flow lines in this area. However, Lindholm et al. (1988) defined regional groundwater-level contours using a much larger (and more regional) data set. Figure 1 shows (a) Lindholm et al.'s groundwater-level contours, (b) IDWR groundwater-level contours presented in Figure 4 of the IDWR Staff Memo, and (c) IDWR water-level contours that SPF reinterpreted based on the previous Lindholm et al. contours. Inferred groundwater flow lines based on the IDWR contours and Lindholm et al. regional groundwater-level contours represent a reasonable basis for IDWR's southwest-northeast study-area boundaries.

   It is conceivable that pumping in excess of recharge from within the study area could someday reach the study-area boundaries. However, the focus of this consolidated hearing is not whether – or under what conditions – impacts from pumping could reach the study boundaries, but one of water supply within the study area[2]. As such, the study area defined by IDWR for purposes of computing a water budget and evaluating water supply is reasonable.

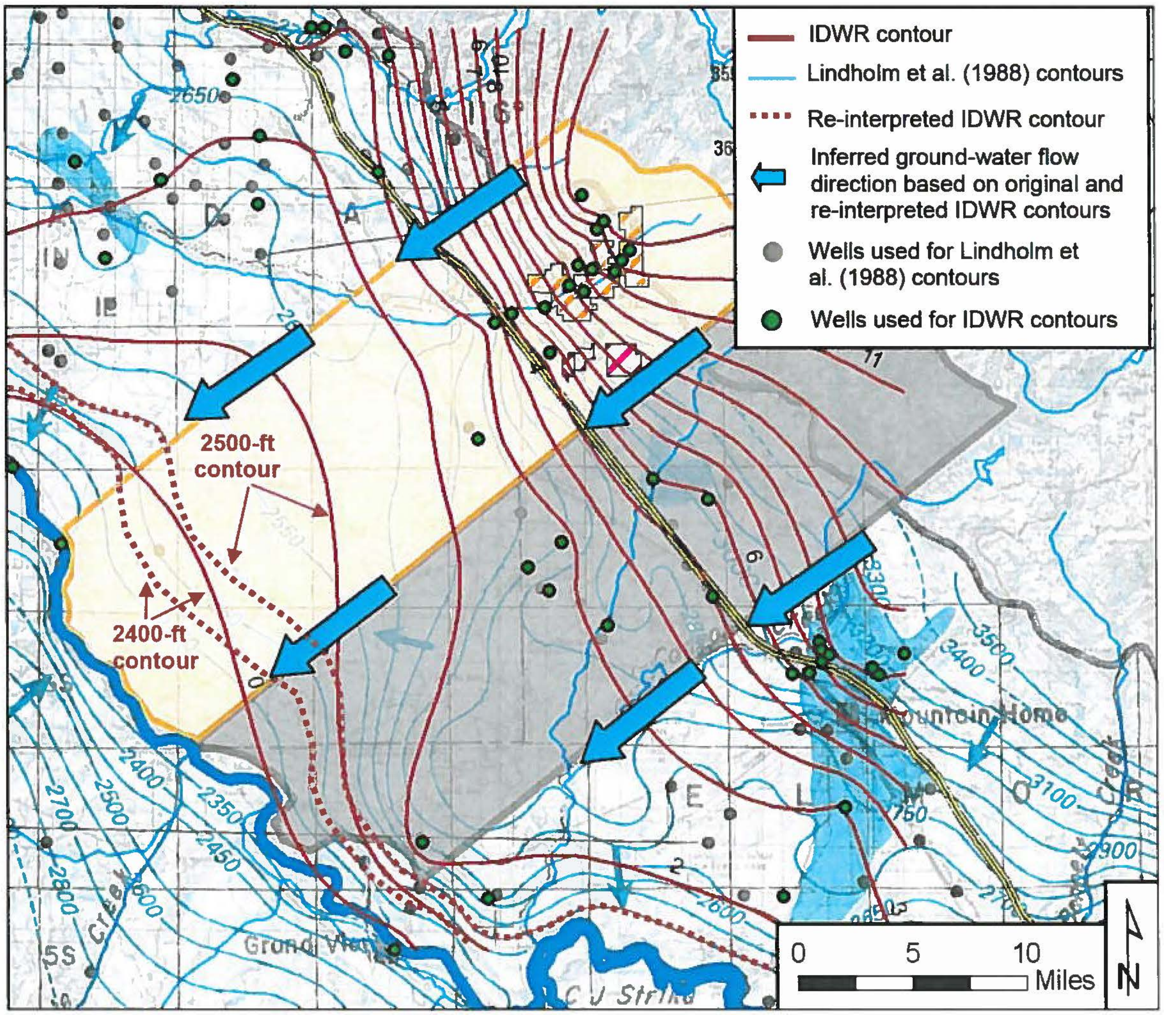


Figure 1. Inferred groundwater flow directions at study-area boundaries.

2. *ERO states that the IDWR Staff Memo "does not identify a fault or other discontinuity in the regional aquifer oriented to provide a basis for concluding*

---

[2] Director Spackman's January 24, 2012 Order consolidating protested applications specified that the hearing will focus on "the limited issue of sufficiency of ground water supply."

that the study area and comparison area are hydrologically separate" (ERO Report, page 15), and that the study area and comparison area should have been considered as one (ERO Report, page 18).

Response. A fault or other hydrogeologic discontinuity is not needed to draw a study-area boundary for the purposes of computing a water budget. If a hydrogeologic discontinuity were needed to define a water-budget area, the only logical alternative study-area boundary would be the entire western Snake River Plain, as there are no distinct structural or geologic features that would spatially divide sediments within the western Snake River Plain. Including such a large area (i.e., entire western Snake River Plain) is unwieldy and unnecessary for assessing groundwater supply in the area of these pending consolidated-case applications and transfers. Instead, IDWR staff correctly sought to define the study area such that it includes points of diversion, places of use, and likely impact area.

3. *ERO argues that "The diameter of the water level decline attributed to pumping in the CCBCGWA is approaching 20 miles" based on Figure 5 in the IDWR Staff Memo (ERO review, page 15), implying that pumping from the Cinder Cone Butte CGWA has materially impacted groundwater levels in the study area, rendering the boundary separating the study area and the comparison area invalid.*

   ERO's argument appears to be based on a map of purported groundwater-level declines stemming from Cinder Cone Butte CGWA pumping (see Figure 5, IDWR Staff Memo). However, the IDWR depictions of groundwater-level declines outside of the CGWA are based on software interpolation unsupported by actual groundwater-level data. Furthermore, Figure 4 of the IDWR Staff Memo also does not appear to indicate groundwater-level declines within the study area stemming from Cinder Cone Butte CGWA pumping. Thus, neither Figures 4 nor 5 of the IDWR Staff Memo support the concept of a 20-mile diameter water-level decline attributable to pumping in the Cinder Cone Butte CGWA.

4. *ERO used a Theis analysis to show 8 feet of drawdown after 20 years of pumping and about 23 feet of drawdown after 40 years of pumping at the study area boundary. ERO then projects that all of the requested new diversions and existing diversions would lead to 47 feet of drawdown after 40 years. ERO recognizes that the "Theis analysis is a simplification of the actual conditions that may exist in both the study area and the comparison area" but then goes on to say that this analysis points to "the potential interconnection between the two areas" (ERO Review, page 19), and thereby implies that IDWR's study-area boundary is incorrectly drawn.*

ERO's use of the Theis (1935) solution to project drawdown over 20-year and 40-year periods is insufficiently documented and inappropriately applied. ERO's use of this method to draw inferences about the study area boundary is therefore invalid.

First, ERO does not provide relevant information used in its analysis, such as (1) the locations of simulated pumping well(s) and (2) simulated pumping rate. These are important components, without which ERO's analysis cannot be verified.

Second, and more importantly, ERO's analysis violates basic assumptions inherent to the Theis solution. The Theis solution is based on several assumptions: the aquifer is homogeneous and isotropic, uniform in thickness and areal extent, the aquifer receives no recharge, the pumping well penetrates the full aquifer thickness, water removed by discharge is removed instantaneously, the pumping well is 100 percent efficient, laminar flow exists throughout the aquifer, and the water table or potentiometric surface has no slope (Theis, 1935).

The Theis solution is a widely accepted method for evaluating hydraulic responses to pumping even though the Theis assumptions are not often satisfied under field conditions. However, use of this method to project pumping for 20 or 40 years – ignoring all recharge – is a substantial violation of the Theis assumptions. Results from ERO's 20- or 40-year Theis projections are therefore invalid.

Perhaps more telling is that approximately 40 years of pumping in the Cinder Cone Butte area has not resulted in the type of water-level decline projected by ERO's Theis results. IDWR Figure 5(d) suggests that there has been zero water-level decline since 1981 in the vicinity of the proposed applications and transfers as a result of Cinder Cone Butte area pumping over the past several decades. Thus, although ERO's Theis analysis might predict widespread water-level decline within the study area as a result of proposed pumping, monitoring data from actual pumping in the Cinder Cone Butte area demonstrate otherwise.

5. *ERO concludes that "The diversion and use of water under the applications, if approved, will cause impacts that cross administrative and study boundaries" (ERO report, page 4).*

Other than the incorrectly applied Theis analysis (described above), ERO has provided no information to support this conclusion. Whether or not impacts from the proposed pumping reach administrative or study boundaries depends on factors such as average diversion rates and proximity to the boundaries, none of which have yet been definitively established.

This administrative process focuses on sufficiency of supply within the study area identified by IDWR[3]. Even if the effects of extended pumping under some conditions could reach administrative or study boundaries, the study-area "volume" nonetheless represents a valid basis for estimating aquifer inflows, outflows, and water supply.

- **Water is Available for Appropriation**

6. *ERO writes that "several studies now underway could provide data and information to refine the estimate of water availability in the aquifer. Even so, the staff memorandum [IDWR Staff Memo] does not suggest delaying consideration of the applications until the information's from these studies is available" (ERO Report, page 17). ERO appears to imply that processing of pending applications should be delayed pending the outcome of these studies.*

Three studies pertaining to geologic mapping and hydrogeology (Liberty, 2012; Phillips et al., 2012; Welhan, 2012) have recently been completed. The IDWR Staff Memo (page 8) indicates that the USGS is conducting a water-balance study of the Indian Creek Reservoir and that the USGS will release its report soon[4]. However, IDWR staff assumed little or no seepage from Indian Creek reservoir in their analysis, so delaying consideration of the pending applications based the completion of this USGS report is not necessary.

The IDWR Staff Memo (page 10) also describes USGS geochemical analyses being conducted on groundwater samples from 14 wells to determine the relative timing of recharge to area aquifers. It is unlikely that this analysis will impact IDWR's water-budget calculations, as the analysis relates to timing of recharge not quantity of recharge. IDWR anticipates that this USGS report will be released later this spring (e.g., April or May)[5]. Again, it is not necessary to delay consideration of pending applications based on the completion of this study.

Finally, IDWR, the USGS, and private entities are engaged in ongoing streamflow and in groundwater-level measurements. These ongoing efforts should not be a basis for delaying consideration of pending applications. On

---

[3] Director Spackman's January 24, 2012 Order consolidating protested applications specified that the hearing will focus on "the limited issue of sufficiency of ground water supply."

[4] Sean Vincent, personal communication, January 2, 2013.

[5] *Ibid.*

the contrary, ongoing monitoring will provide valuable insight regarding the effects of groundwater development in this area.

Ultimately, additional groundwater development, and the monitoring of groundwater-level responses to new withdrawals, will confirm current estimates of water availability. Thus, groundwater development with water-level monitoring under approved permits is precisely what is needed to refine estimates of available water supply in this area.

7. *ERO suggests that IDWR should have considered maximum volumes authorized under existing rights, not estimates of "'actual' consumptive use" (ERO Report, page 16).*

   Nearly all water rights in the State of Idaho authorize volumes in excess of what is consumptively used, especially for rights authorizing stock water, wildlife, and aesthetic uses, and for most rights authorizing commercial uses (Petrich, 2012). It would be unreasonable to assume that all currently irrigated land is planted with the most water-intensive crops every year, and that these water-intensive crops receive the maximum authorized volume every year. Although the maximum consumptive use assumed by IDWR for processing new irrigation applications is 3.0 feet/acre/year throughout most of the study area[6], it reasonable to assume that typical crop rotations, influenced in part by high pumping costs, result in less than the maximum volume of use on a multi-year basis. Thus, IDWR's use of typical volume requirements for existing irrigated area is reasonable and appropriate.

8. *ERO states that "inclusion of a portion of the Blacks Creek drainage in the area used for the recharge estimate is an unwarranted complication in the water budget because there is no information indicating the direction of groundwater flow in the Blacks Creek basin is different than observed regionally" (ERO Report, page 15).*

   Inclusion of a portion of the Blacks Creek drainage within the consolidated cases study area is not, in my view, an unwarranted water-budget complication. On the contrary, it is only reasonable to assume that groundwater flow within the study area remains within the study area.

   The general direction of groundwater flow from this portion of the Blacks Creek drainage is towards the southwest (see Figure 4 in the IDWR Staff

---

[6] IDWR "consump_irr.shp" shapefile.

Memo). Alluvial sediments at the granitic bedrock contact (Figure 2) provide a pathway for downward groundwater movement along flow lines in Figure 4 of the IDWR Staff Memo toward deeper sedimentary zones. Similarly, infiltration into granitic joints and fractures in upper portions of the Blacks Creek drainage also likely migrates basinward within study boundaries, as illustrated in Figure 18 of the Welhan report (Welhan, 2012).

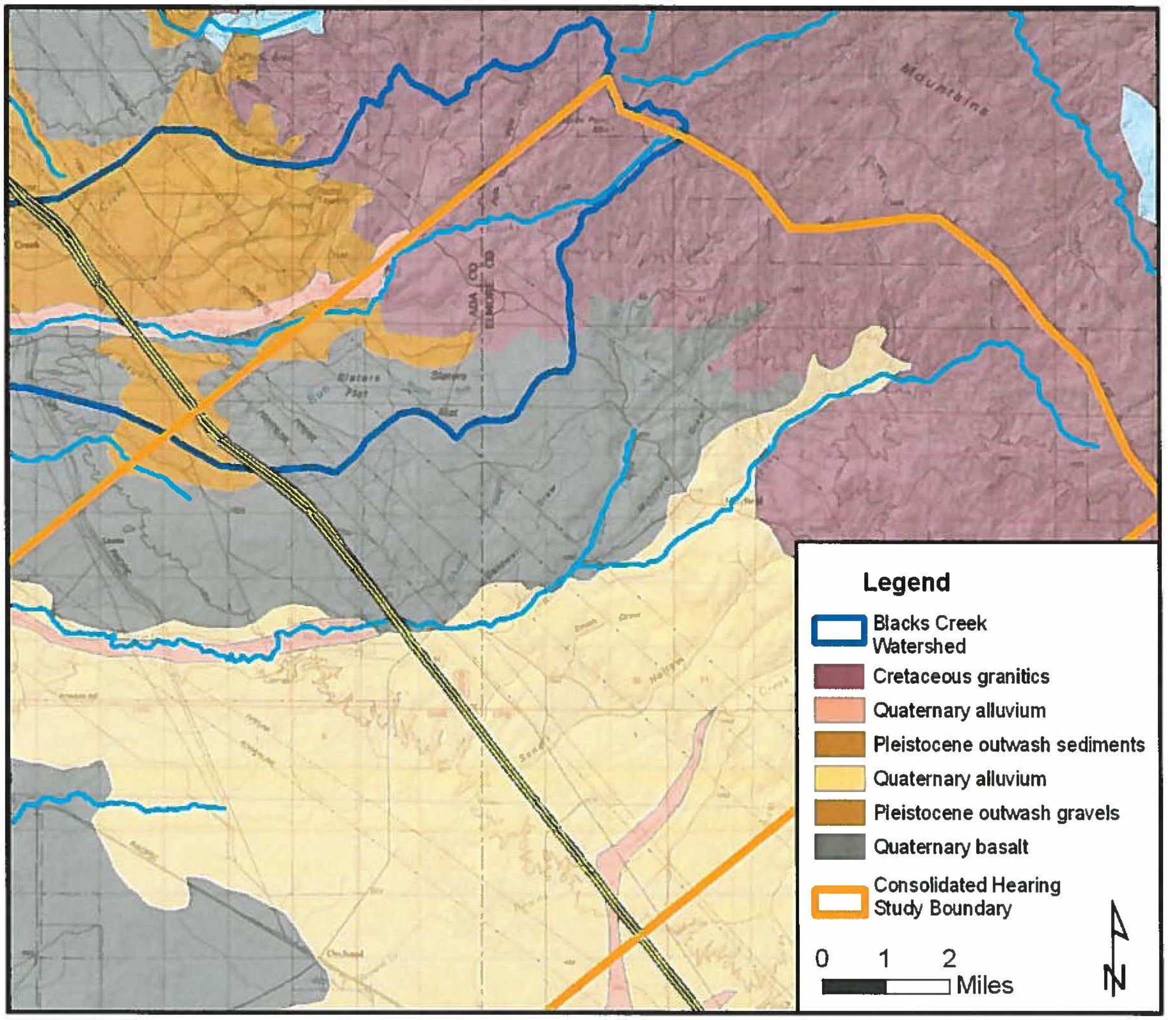


Figure 2. Surficial geology in the vicinity of the upper Blacks Creek drainage.

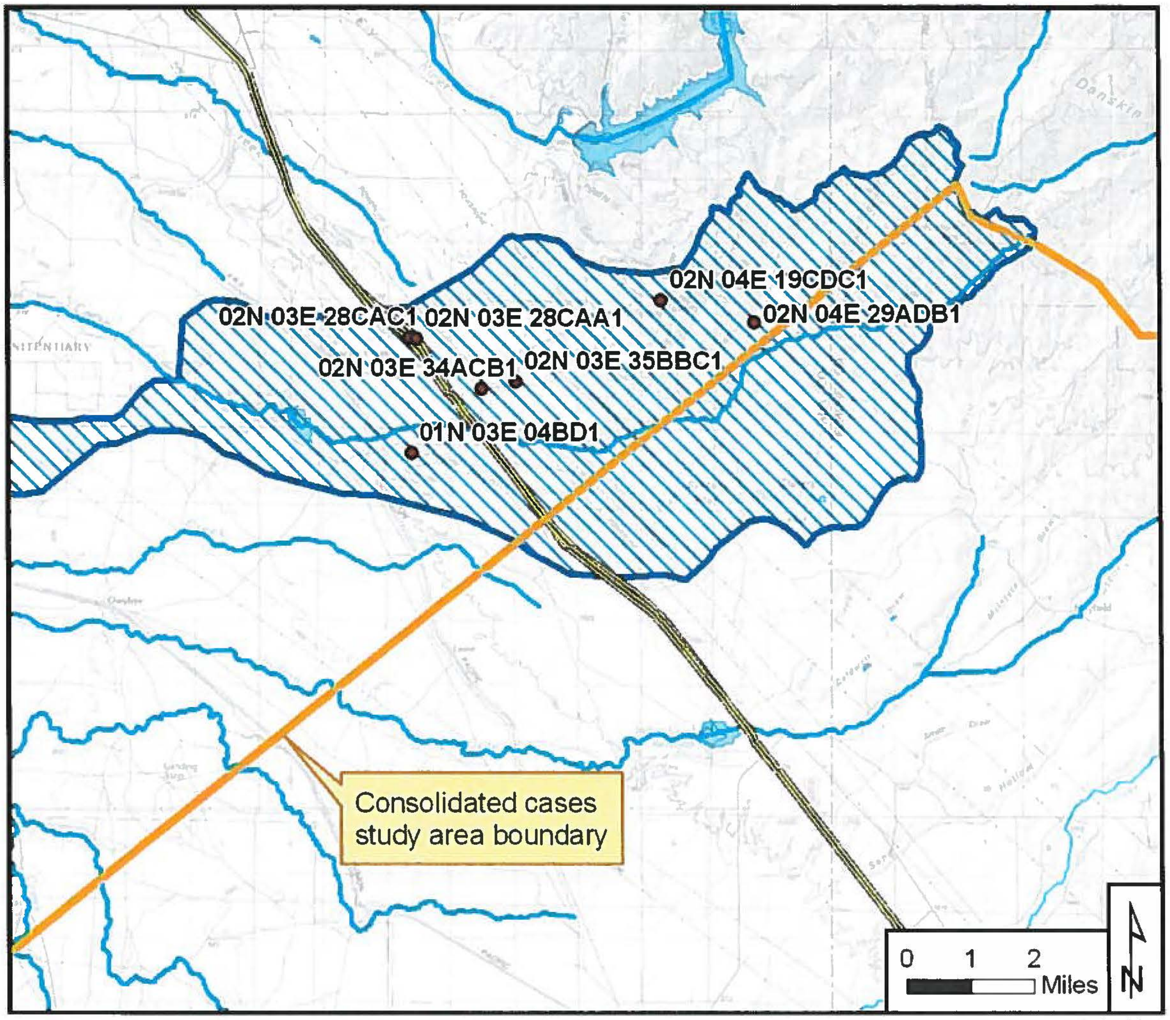
9. *ERO also argues that "long-term effects of pumping in the Blacks Creek drainage just outside of the study area" should be included in IDWR's analysis (ERO Report, page 15).*

The only water right within the upper Blacks Creek drainage near the study-area boundary authorizing substantial diversions is water right 63-11540, which authorizes a maximum diversion of 3.1 cfs for the irrigation of 287 acres approximately 2.5 miles outside of the study-area boundary. This water right was fully exercised by 2006 (permit proof was made on September 29, 2006), and the right was licensed on November 1, 2010. There is no evidence that pumping under this right has or will create regional groundwater-level declines.

Locations of wells in the upper Blacks Creek drainage with publicly-available groundwater-level data are shown in Figure 3. Hydrographs from these wells (Figure 4 and Figure 5), including a well within ¼-mile from the point of diversion for water right 63-11540, show no groundwater-level declines, indicating that diversions authorized under water right 63-11540 have not created (and therefore likely will not create) groundwater-level declines in the upper Blacks Creek drainage area. Thus, it appears that ERO's concerns about long-term effects of pumping outside this portion of the study area are unfounded.

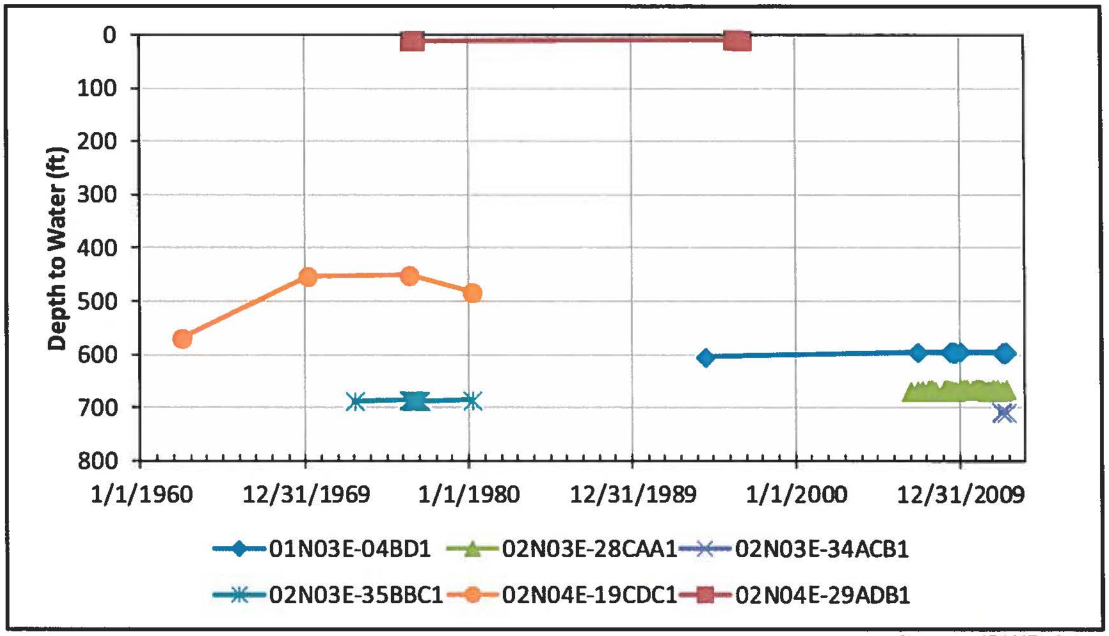
10. *ERO argues that IDWR estimates of recharge from the "non-recharge" area (2,656 AFA) should be excluded from the water budget for three reasons: (1) the amount of potential evapotranspiration on the non-recharge area significantly exceeds precipitation (and therefore "little if any water is lost to deep percolation"); (2) impermeable zones prevent precipitation from reaching the regional water table; and (3) portions of the non-recharge area are "outside of and down gradient of the 'reach' of the proposed wells" (ERO Report, page 16). These three assertions are addressed below.*

    <u>Response, Part 1</u>: ERO refers to a comment in a previous USGS report that suggests "little recharge" occurs in "lowlands of the plateau" (Young, 1977, page 11). However, it seems unlikely that Young was referring to all portions of the Mountain Home plateau between the Danskin Foothills and the Snake River in making this statement. In a more recent USGS study, Newton was more specific: he assumed recharge from precipitation to be negligible only in non-irrigated lands with precipitation of less than 9 inches per year (Newton, 1991, page G16).



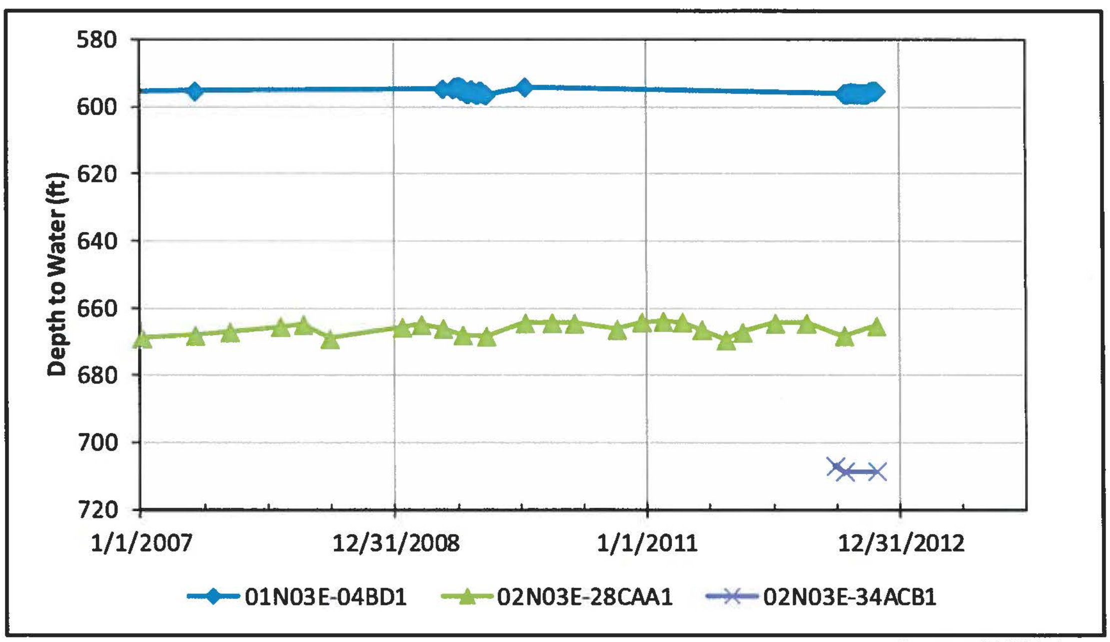
Source: IDWR

Figure 3. Locations of wells in the upper Blacks Creek drainage with groundwater-level data.



Source: IDWR data.

Figure 4. Groundwater levels in upper Blacks Creek wells (1960-2012).



Source: IDWR data.

Figure 5. Groundwater levels in upper Blacks Creek wells (2007-2012).

The "non-recharge" portion[7] of the consolidated cases study area ranges in elevation from approximately 2,300 feet (at the Snake River, or approximately 2,800 feet at the canyon rim above the Snake River) to 3,600 feet[8]. Low-elevation portions of the "non-recharge" area receiving an average of 8 to 10 inches (or less) of annual precipitation (Figure 6) represent a relatively small portion of the "non-recharge" area. However, higher-elevation portions of the "non-recharge" area receive 14-16 inches of precipitation per year (or more).

Newton (1991) recognized that greater amounts of precipitation generate greater amounts of aquifer recharge. He divided the western Snake River Plain into subareas – several of which coincide with the consolidated cases study area – having different recharge characteristics. Newton estimated that 3% of the precipitation falling in Subarea 4 (which covers higher-elevation portions of the "non-recharge" area) becomes aquifer recharge, 1.29% of the precipitation in Subarea 8 becomes aquifer recharge, and 0.74% of the precipitation in Subarea 10 becomes aquifer recharge[9] (Figure 6). IDWR used these percentages to estimate recharge the non-recharge area (IDWR Staff Memo, page 13).

Higher recharge rates in proximity to the Danskin Front are to be expected based on greater precipitation rates. Alluvial sediments in the "non-recharge" area – especially near the Danskin Front – are clearly capable of accepting deep percolation from precipitation. By example, these alluvial sediments typically accept the entire flow from Indian Creek and Bowns creeks as seepage within a few miles of the Danskin Front. Similarly, any overland flow in ephemeral channels within the "non-recharge" area following substantial precipitation events likely becomes deep percolation.

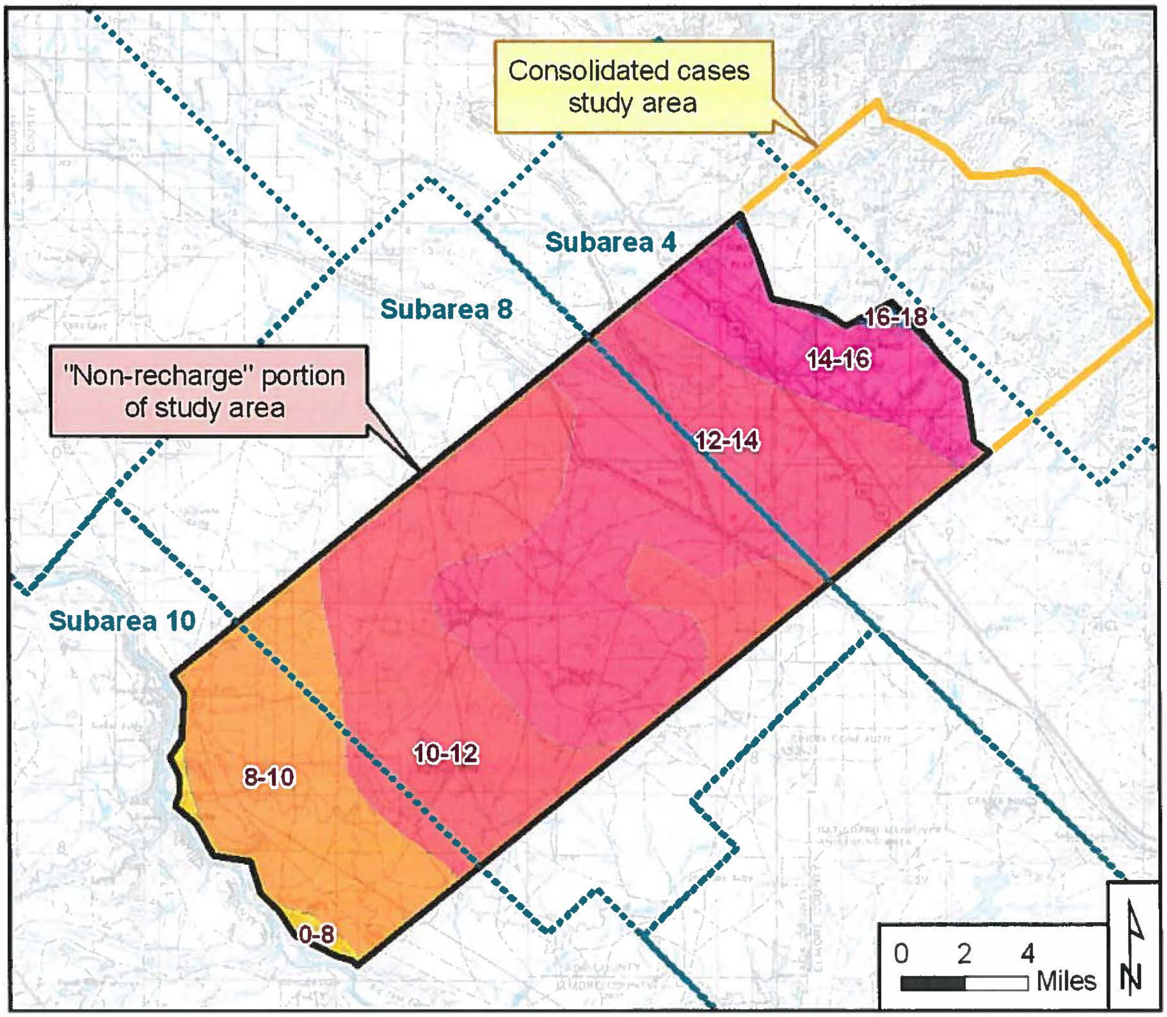
Response, Part 2: ERO suggests that "impermeable zones above the regional water table described in drillers' reports for wells constructed in Townships 2 and 3 South and Ranges 4 and 5 East prevent precipitation from reaching the regional water table" (ERO Report, page 16), and argues that this is another reason that recharge from precipitation in the "non-recharge" area should not

[7] The "non-recharge" portion of the study area is inappropriately named by IDWR in its staff memo, because recharge in this portion of the study area does, in fact, occur.

[8] The 3,600-foot contour is used to define the boundary between the "recharge" and "non-recharge" portions of the IDWR study area (IDWR Staff Memo, page 5).

[9] Based on percentages calculated from precipitation and recharge estimates in Newton (1991), Table 6, page G31.

be included in the water budget. However, the wells to which ERO refers are in the Cinder Cone Butte comparison area, not the study area (see Figure 7). Lithologic descriptions from these Cinder Cone Butte CGWA wells do not adequately describe stratigraphy in the consolidated cases study area.



Source: IDWR

Figure 6. Average annual precipitation (in inches) in the consolidated cases "non-recharge" area.

Cross-sections C-C' and D-D' in Appendix A of the IDWR Staff Memo illustrate a greater prevalence of sedimentary layers (especially sand) in the study area than in the comparison area. Many drillers' reports from wells used to generate hydrographs and water-level contours plots (IDWR Discovery

Response #9), especially drillers' reports with detailed lithologic descriptions, list clay layers no greater than 5 or 10 feet in thickness. Some wells list thicker clay or basalt layers, but none of these thicker, ostensibly less impermeable zones appear to have great areal extent. Thus, it is difficult to identify areally-extensive impermeable zones within the study area that would prevent recharge from reaching the regional aquifer.

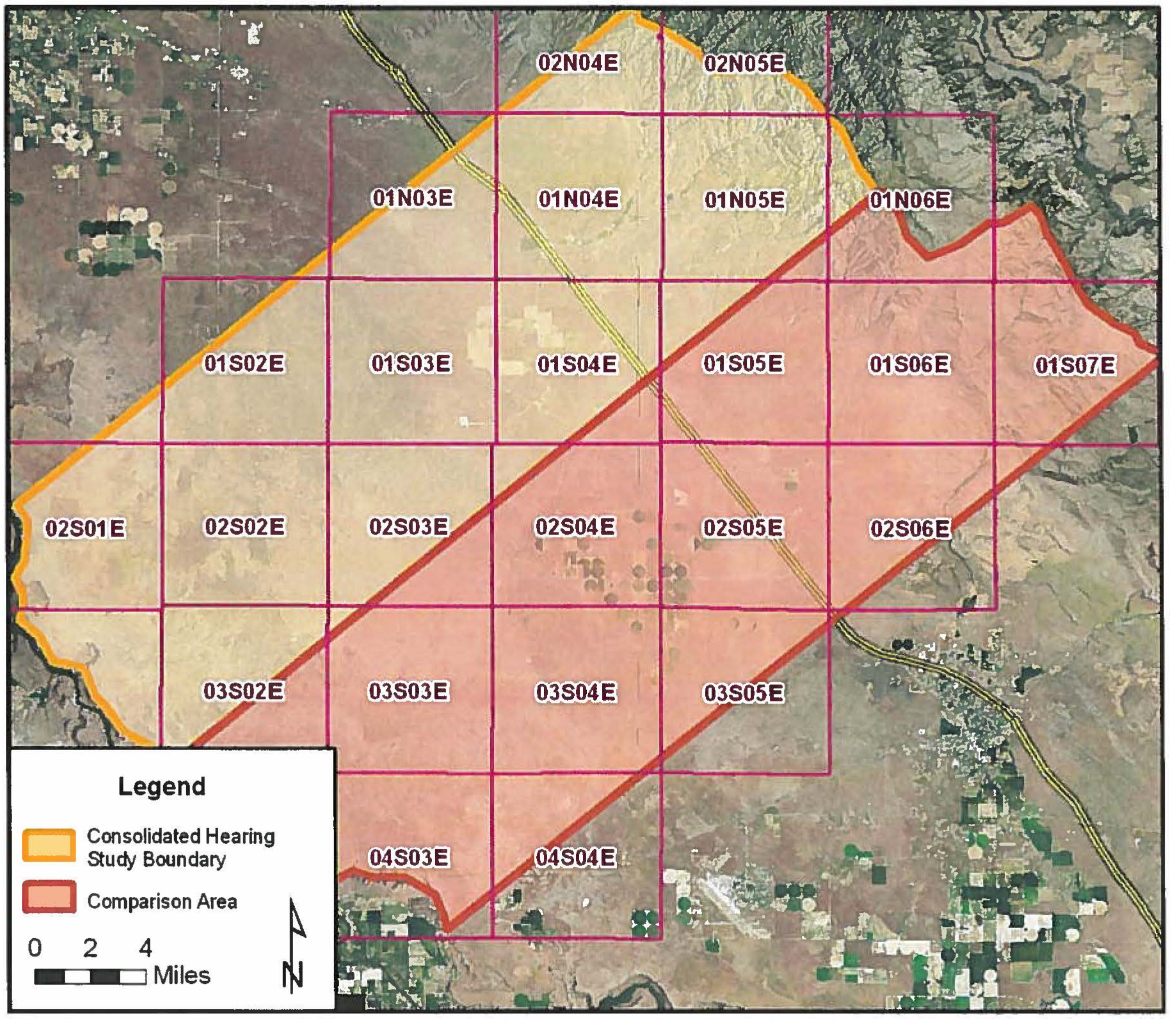


Figure 7. Townships in the consolidated cases study area and adjacent comparison area.

While clay and basalt layers may have low permeability, no geologic layers are truly impermeable. If precipitation can initially infiltrate a few feet below the root zone or capillary zone, the infiltrated water will continue to move downward to the water table over time, provided that the annual rate of recharge does not exceed the average permeability of the most limiting layer. Given the low amounts of estimated recharge within the "non-recharge" area, the average permeability of any clay and basalt layers should be adequate to allow recharge to reach the water table.

Areally-extensive, extreme low-permeability layers throughout the study area that truly prevented surface infiltration from reaching the regional aquifer would lead to the creation of widespread perched aquifer zones in the study area. Such perched zones, if present, would be noted in drillers' reports, which is not the case. Thus, one can only surmise that stratigraphic layers of low permeability are not entirely impermeable and/or are not areally extensive.

Response, Part 3: ERO maintains that portions of the non-recharge area are "outside of and down gradient of the 'reach' of the proposed wells" (ERO Report, page 16). However, there is no basis for concluding that recharge from the entire "non-recharge" area cannot be captured. On the contrary, it is quite likely that wells proposed under pending applications/transfers can capture recharge originating as precipitation infiltration within the northern portion of the "non-recharge" area.

Figure 8 illustrates a portion of the "non-recharge" area with greater potential of capturing recharge originating from the "non-recharge" area and an area with reduced capture potential. The line separating these two portions of the "non-recharge" area is approximately 3 miles down-gradient of the Orchard Ranch wells, which presumably could develop an approximate 3-mile capture radius.

The amount of average annual recharge generated within the portion of the "non-recharge" area having greater capture potential was estimated using the same estimated USGS recharge percentages (Newton, 1991) and PRISM data that IDWR used in developing a recharge estimate for the "non-recharge" area. Using this approach, the amount of recharge within the portion of the "non-recharge" area having greater capture potential is approximately 1,950 acre-feet per year (Table 1).

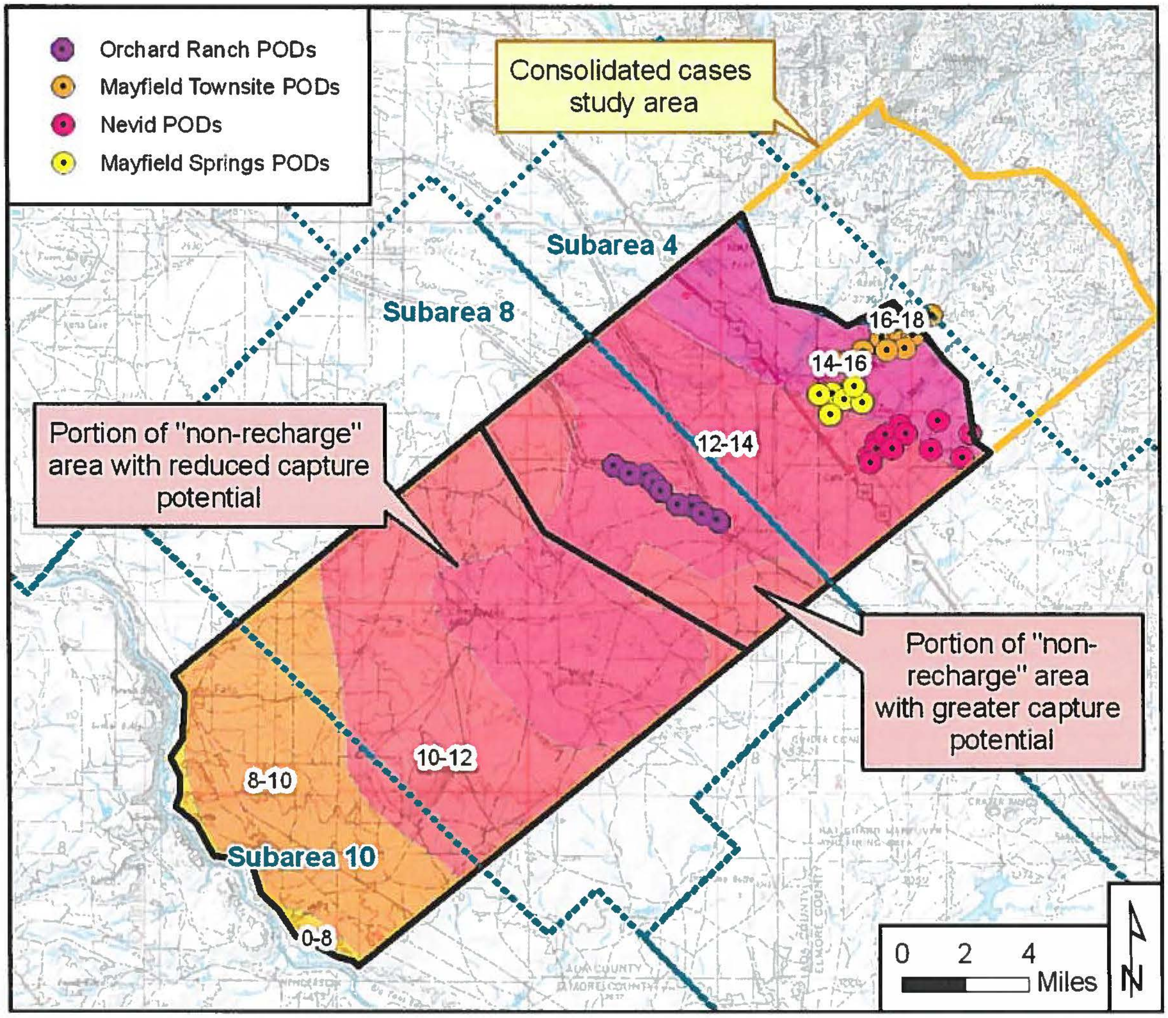


Figure 8. Portion of "non-recharge area" from which recharge capture is likely.

In calculating recharge for the "non-recharge" area using USGS subareas we found a discrepancy in IDWR's geo-referencing of the Newton (1991) subarea map. Correcting this discrepancy resulted in a recharge estimate of 3,000 AF for the "non-recharge" area, which is approximately 340 AF greater than the 2,660 AF recharge volume estimate presented in the IDWR Staff Memo (Table 2).

Recharge in "Capture Portion" of "Non-Recharge" Area				
USGS Subarea	Study Area within USGS Subarea (acres)	Study Area Annual Precipitation Volume	USGS Estimated Recharge Percentage	Estimated Average Annual Recharge (AF, rounded)
4	44,836	51,748	3.00%	1,550
8	31,733	31,307	1.29%	400
Total	0	0		1,950

Table 1. Estimated recharge volume in portion of the "non-recharge" areas having greater capture potential.

Comparison of Recharge Estimates for "Non-Recharge" Area					
	USGS Subarea	Study Area within USGS Subarea (acres)	Study Area Annual Precipitation Volume (AF)	USGS Estimated Recharge Percentage	Estimated Average Annual Recharge (AF, rounded)
SPF Estimates	4	44,836	51,748	3.00%	1,550
	8	98,293	96,847	1.29%	1,250
	10	34,309	27,429	0.74%	200
	Total	177,438	176,023		3,000
IDWR Estimates	4	30,196	36,515	3.00%	1,100
	8	97,153	97,281	1.29%	1,250
	10	50,089	41,866	0.74%	310
	Total	177,438	175,662		2,660

Table 2. Comparison of IDWR and SPF recharge estimates for "non-recharge" area.

The geo-referencing discrepancy is illustrated in Figure 9. SPF scanned Figure 17 in the Newton (1991) report and geo-referenced this map using county shapefile polylines (6 points) as reference points. IDWR's geo-referencing was off by distances of 1.8 to 3.3 miles at four representative corner points (Figure 9). Examples of SPF's geo-referencing points are shown in Figure 10. The net result is that there is a larger portion of USGS subarea 4 and a smaller portion of Subarea 10 in the consolidated cases study area than calculated by IDWR.

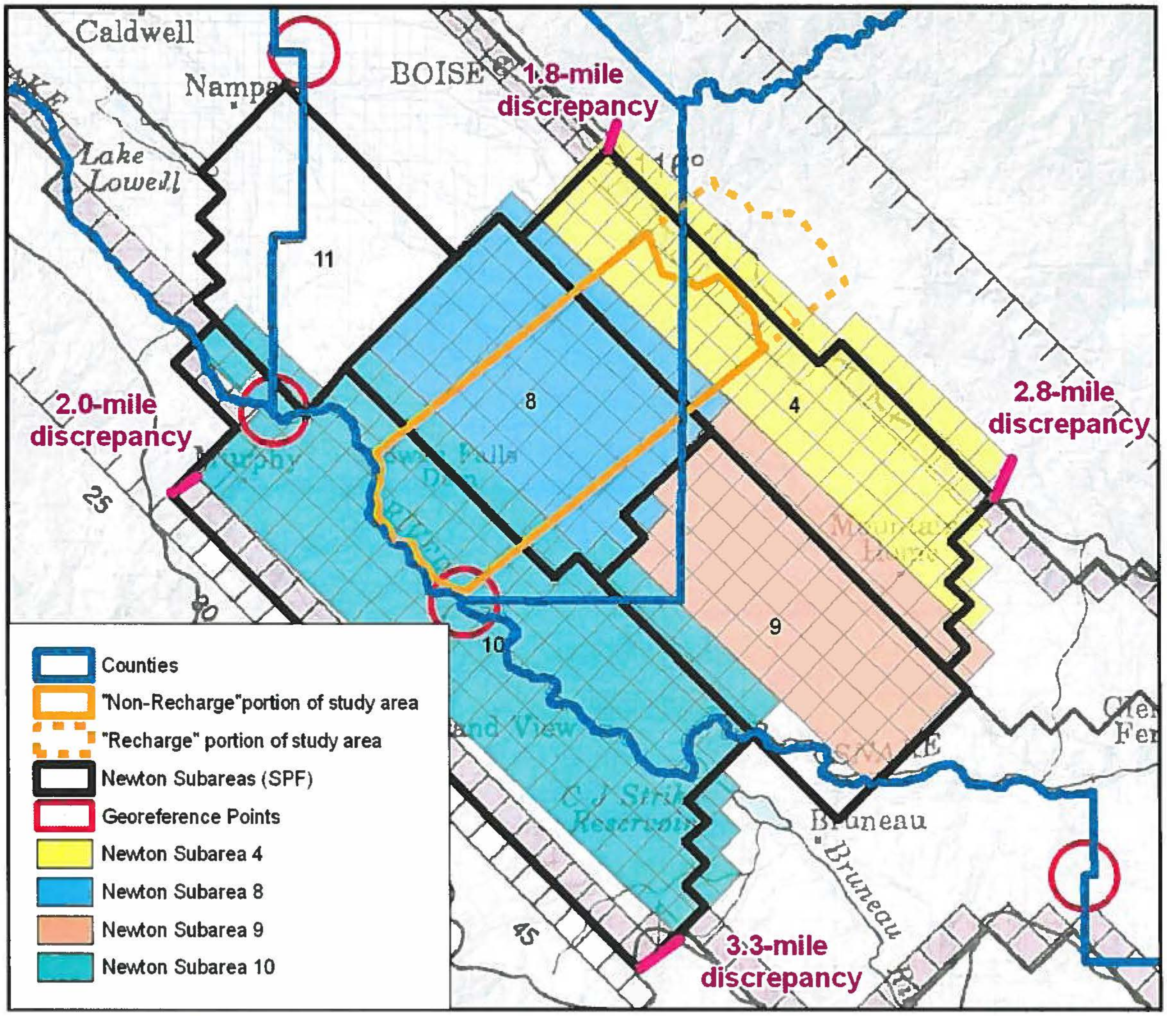


Figure 9. Comparison of Newton (1991) model zone locations interpreted by IDWR and SPF.

Recharge was recalculated using IDWR's PRISM dataset and the revised subarea acreages within the consolidated cases study area (PRISM raster data were converted to point shapefiles to simplify analysis in ArcGIS v9.2). Points lying within the boundaries of the "non-recharge" area and Newton subarea were selected and precipitation summed. Recharge was computed based on the recharge ratios presented by Newton (1991, Table 6). This resulted in a recharge estimate for the "non-recharge" area that is 340 AF (13%) greater than that calculated by IDWR.

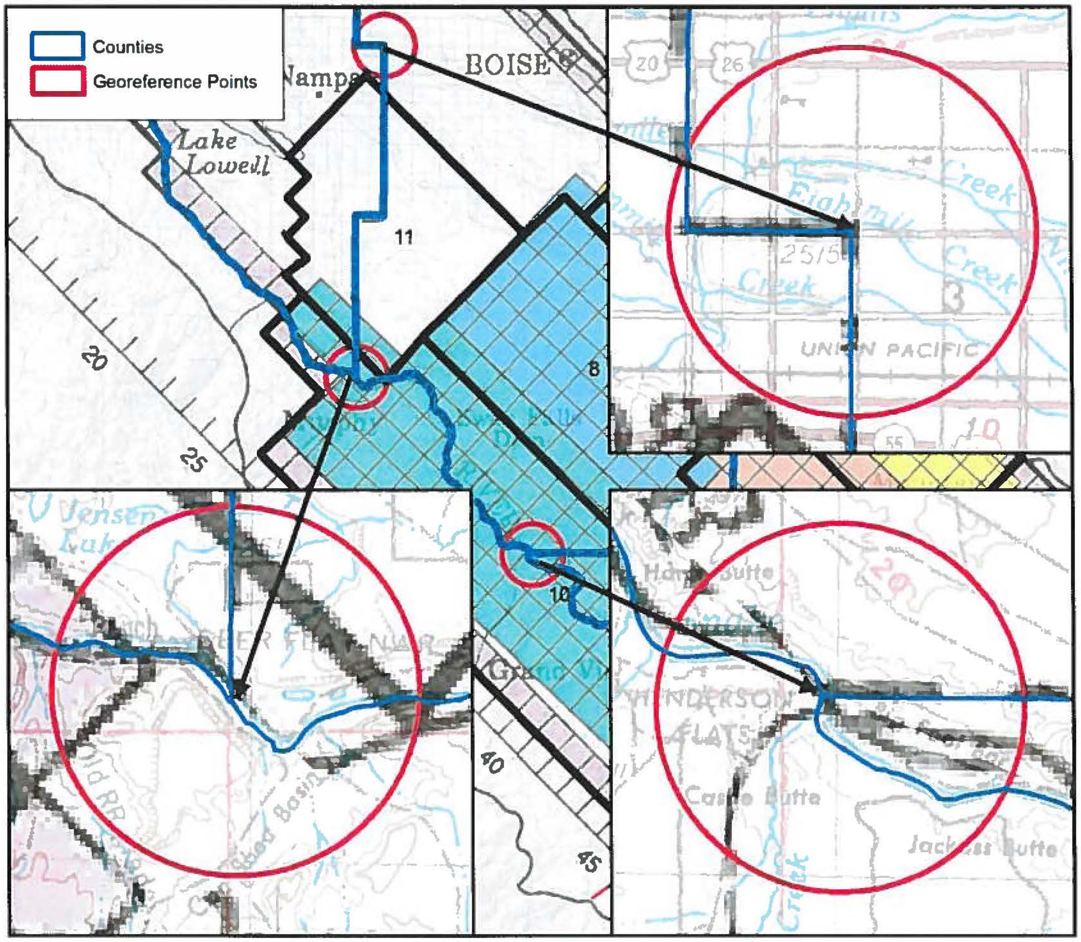


Figure 10. Representative geo-referencing points.

11. *ERO argues that "water pumped from the regional aquifer is unlikely to return to the regional aquifer at a location or within a time interval to make water available for re-diversion and should not be included in the estimate of volume available in the water budget" (ERO report, page 17).*

    IDWR used crop irrigation requirement (CIR) values in estimating irrigation withdrawals. Implicit in the use of CIR values is the assumption that growers will pump no more water than is necessary to adequately irrigate crops, which is a reasonable assumption given typical pumping lifts within the study area. IDWR made no assumptions regarding the percentage of pumped irrigation water returning to the regional aquifer. However, it is logical to assume that water pumped for domestic purposes and discharged via septic systems, or water withdrawn under commercial rights for heating and cooling purposes (e.g., 63-11524), eventually returns to the aquifer.

12. *ERO notes that groundwater levels "in and around the Cinder Cone Butte Critical Ground Water Area continue to decline indicating the reasonably anticipated rate of future natural recharge is being exceeded" (ERO Report, page 4).*

    Groundwater levels have declined in portions of the Cinder Cone Butte CGWA, indicating that groundwater pumping has not yet reached equilibrium with recharge in this area. However, groundwater levels in the study area remain stable, indicating water available for appropriation.

- **No Injury to Idaho Power Water Rights**

13. *ERO states that "Diversion and use of ground water as proposed in the applications will injure existing water rights" (ERO Report, page 4).*

    ERO does not identify specific water rights that it believes will be injured by the proposed applications. Because ERO's report was prepared for Idaho Power, it can be assumed that ERO is concerned about multiple Idaho Power water rights authorizing water use for hydroelectric generation at Swan Falls Reservoir. However, these Idaho Power hydropower rights are subordinate to "subsequent beneficial upstream uses" (such as uses represented by the pending applications/transfers in these consolidated cases) as long as Snake River flows remain above established minimum flows.[10]

    Minimum streamflow rights held by the Idaho Water Resource Board establish a minimum flow of 3,900 cfs between April 1 and October 30 and 5,600 cfs between November 1 and March 31) at the USGS Gaging Station 13172500 near Murphy, Idaho. Idaho Power's Swan Falls hydropower rights cannot be injured as long as Snake River flows remain above these minimums.

14. *ERO notes that "Permits to use ground water have previously been issued to allow the initial phases for two of these projects without regard for trust water impacts" (ERO report, page 2), implying that trust water impacts should have*

---

[10] Swan Falls Settlement Paragraph 7(B); Idaho Code § 42-203B.

been considered to avoid injury to Idaho Power water rights authorizing hydroelectric generation at Swan Falls Dam.

Points of diversion and places of use for the two referenced permits (63-32225 and 61-12090) are not within the trust area boundary defined under IDAPA 37.003.008 (Figure 11). These applications were not protested based on concerns regarding trust water impacts. Consideration of trust water impacts was therefore not required for the processing of these permits. Furthermore, points of diversion and or places of use for applications that are part of this consolidated administrative process (Applications 63-32499, 61-12095, 61-12096, 63-32703, 61-12256, and 63-33344) also lie outside of the trust area (Figure 11).

15. *ERO conducted an analysis of Snake River flows "to evaluate the current conditions of the Snake River at Murphy" (ERO Report, page 22). ERO provides three graphs of Snake River discharge at Murphy less all flow passing Milner Dam. ERO states that "In order to evaluate the water supply defined as trust water, the discharge measured at Murphy must first be reduced by subtracting the flow passing Milner Dam" (ERO report, page 22).*

The pending applications and transfers in this consolidated case are not in the trust area, so the trust-area analysis of Snake River flows does not apply. If the trust-area analysis did apply, calculating average daily discharge for the purposes of monitoring compliance with established minimum flows and the Swan Falls Agreement does not require subtracting all flows passing Milner Dam. "Average daily flow" was defined in the Swan Falls Agreement to mean "actual flow conditions" and excluded "fluctuations" resulting from Idaho Power operations[11]. Idaho Power occasionally conveys water leased, purchased, or otherwise owned through the Snake River reach between Milner and Swan Falls. The Swan Falls Agreement specifies that "Such flows shall be considered fluctuations resulting from operation of Company facilities."[12] Thus, only water leased, purchased, or released from storage owned by Idaho Power passing Milner Dam is relevant to a trust-water analysis of Snake River flows.

ERO may have assumed that the discharge measured at Murphy must be reduced by the flow passing Milner Dam based on its reference to Idaho Code § 42-203B(2), which reads, "For the purposes of the determination and

---

[11] Swan Falls Agreement, Paragraph 7(B), page 4.

[12] Swan Falls Agreement, Paragraph 7(E), page 4.

administration of rights to the use of the waters of the Snake River or its tributaries downstream from Milner Dam, no portion of the Snake River or surface or ground water tributary to the Snake River upstream from Milner Dam shall be considered" (ERO Report, page 22). However, this sentence does not appear to preclude the assessment of flows not associated with Idaho Power operations in an evaluation of water supply in the Milner to Swan Falls reach of the Snake River, especially of flows in excess of generating capacity (8,400 cfs) at Swan Falls Dam.

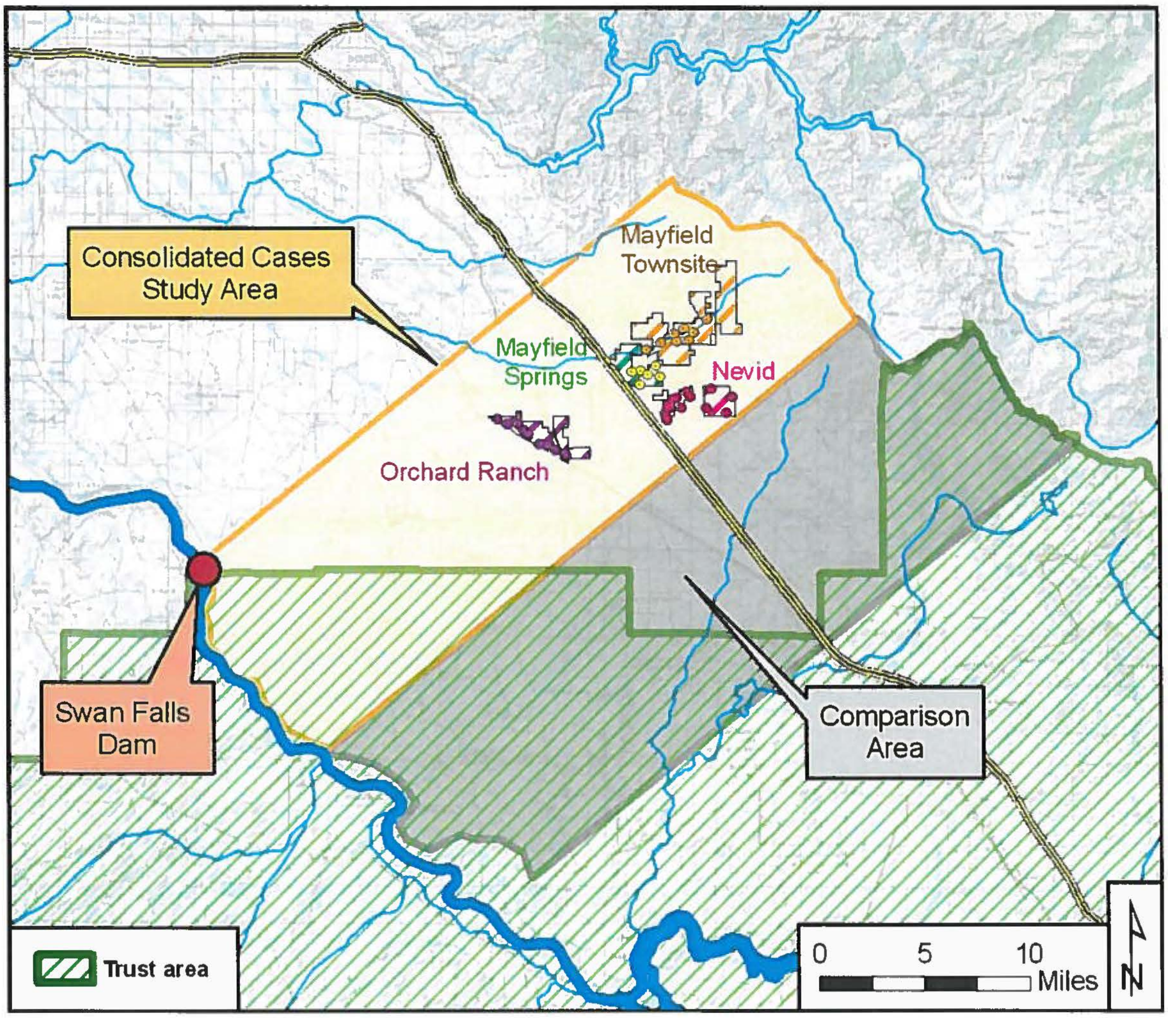


Figure 11. Trust area and places-of-use for consolidated applications.

16. *ERO presents graphs showing a downward trend in Snake River flows based on average flows between November-March, April-October, and July 1-July 10 (ERO Report, Figures 3, 4, and 5).*

The squared correlation coefficient (R^2) for each of the graphs prepared by ERO is low (Table 3). The R^2 value is often used to characterize the variability explained by the straight-line regression model. For example, an R^2 value of 0.30 suggests that only 30% of the variability in a data set is explained by a given regression line (trend line). Most of the variability observed in the average flow values graphed by ERO is not explained by the trend line. This makes multi-year projections of future flow values based on these data tenuous.

Coefficients of Determination (R^2) in ERO Report Figures 3-5		
ERO Report Figure Number	Graph	R^2
3	Murphy minus Milner Discharge, November-March	0.49
4	Murphy minus Milner Discharge, April-October	0.27
5	Murphy minus Milner Discharge, July 1-10 mean	0.30

Table 3. Coefficients of Determination (R^2) in ERO Report Figures 3-5.

Most of the "base flow" in the Milner-to-Murphy reach of the Snake River is present as a result of eastern Snake Plain Aquifer discharge at Thousand Springs. Historical decreases in average Snake River flows have been attributed to several factors, including conversions of gravity surface-water irrigation systems to sprinklers (resulting in less aquifer recharge as a result of more efficient irrigation), extended drought conditions, and historical increases in groundwater pumping. However, drought conditions and increases in groundwater pumping may be moderating, although efficiency improvements in surface-water irrigation continue.

The bottom line is this: multi-year straight-line projections based on relatively weak correlations are not very reliable. In fact, Snake River discharge in the last decade (e.g., since about 2000 – see Figures 3 and 4 in the ERO Report) show relatively consistent average year-to-year flows. This recent pattern of consistent average flows is noteworthy because it better reflects the current management of the Eastern Snake River Plain Aquifer.

17. *ERO provides multiple photographs of springs in the Snake River Canyon between CJ Strike Dam and Falls Dam (Appendix A, ERO Report), and implies that these springs represent discharge from the study area.*

ERO provides no measurements of discharge rates from the springs shown in these photographs, and does not quantify the amount of water (if any) that actually reaches the Snake River from these springs. It appears from ERO's photographs that much of the spring discharge in this area is lost to evapotranspiration.

18. *ERO implies with its flow characterizations (ERO Report, pages 22-27) that approval of pending consolidated-case applications will cause declines in Snake River flows, thereby injuring (or contributing to injury of) existing Idaho Power water rights.*

    The ERO Report explicitly or implicitly argues that (a) aquifers in the study area discharge to the Snake River, (b) average Snake River flows are decreasing, (c) future Snake River flows may dip below established minimum flows (d), new diversions under pending applications will reduce the discharge to the Snake River, (e) and, when this occurs, Idaho Power water rights will be injured by approval of the pending consolidated-case applications. However, ERO does not explain specifically how approval of all or a portion of the consolidated-case pending applications/transfers will injure Idaho Power. Injury is not a foregone result of approving consolidated-case applications/transfers.

    Any potential impacts to the Snake River as a result of diversions under the pending consolidated-case applications and transfers cannot be expressed in terms of maximum diversion rates. Instead, because of the distance between the proposed points of diversion and the Snake River, any impact would be in the form of a uniform rate reflecting annual volumetric withdrawals (approximately 11 cfs with annual withdrawals of an estimated net recharge rate of 7,900 AFA – see Petrich, 2012).

    Over an extended time, withdrawals under the proposed applications and transfers may result in decreased spring discharge in the Snake River Canyon. Decreases in spring discharge may result in decreased evapotranspiration from springs such as those shown in ERO's Appendix A. If springs such as those shown in the ERO report currently do not discharge to the Snake River, then reductions in discharge from the springs will not impact the Snake River.

    It is important to recognize that average Snake River flows remain well above established minimums. Average daily flows since 1984 (Figure 12) have not only been greater than established minimum flows, but during substantial portions of the year have been greater than the 8,400-cfs generating capacity at Swan Falls Dam. Approval of consolidated-case applications and transfers would represent absolutely no impact to hydroelectric generation during times of the flows greater than 8,400 cfs.

    Recent low-flow years (e.g. 2003 – see Figure 12) have seen average daily flows less than 8,400 cfs (but more than minimum flows). However, hydropower rights for authorizing electrical generation at Swan Falls Dam are subordinate to new, approved uses as long as flows remain above established minimums[13].

Based on the hydrographs in Figure 12, it appears unlikely that a future dip below established minimum flows, if it occurs, would have a long duration. Non-approval of the proposed consolidated-case applications and transfers because Snake River flows may dip below established minimums for a short period of time sometime in the future would preclude the full economic development of the study-area groundwater resource as provided under Idaho Code § 42-226. Furthermore, attempting to prevent a dip in minimum flows by disapproval of these consolidated applications and transfers would be futile because of the relatively small amount of water involved[14].

However, even a short-term dip in Snake River flows below established minimums would have important significance to the State of Idaho and Idaho Power. That is why the recent Idaho State Water Plan (IWRB, 2012) includes implementation strategies to maintain Snake River flows above established minimums:

- Develop and implement a monitoring program to better predict the occurrence and duration of future low flows in the Snake River (Implementation Strategy #3, Policy 4D).
- Develop by 2014 management scenarios to ensure that Snake River flows at the Murphy and Weiser gages remain above established minimum stream flow levels (Implementation Strategy #3, Section 4A).

The 2012 State Water Plan (page 47) recognizes that "one of the core principles of the Swan Falls Settlement was that flow of the Snake River downstream from Milner Dam in excess of the Murphy minimum average daily flow... would be available for future development." Consequently, the 2012 State Water Plan lists implementation strategies in anticipation of additional water development under water rights held in trust by the state within the "trust-water" area:

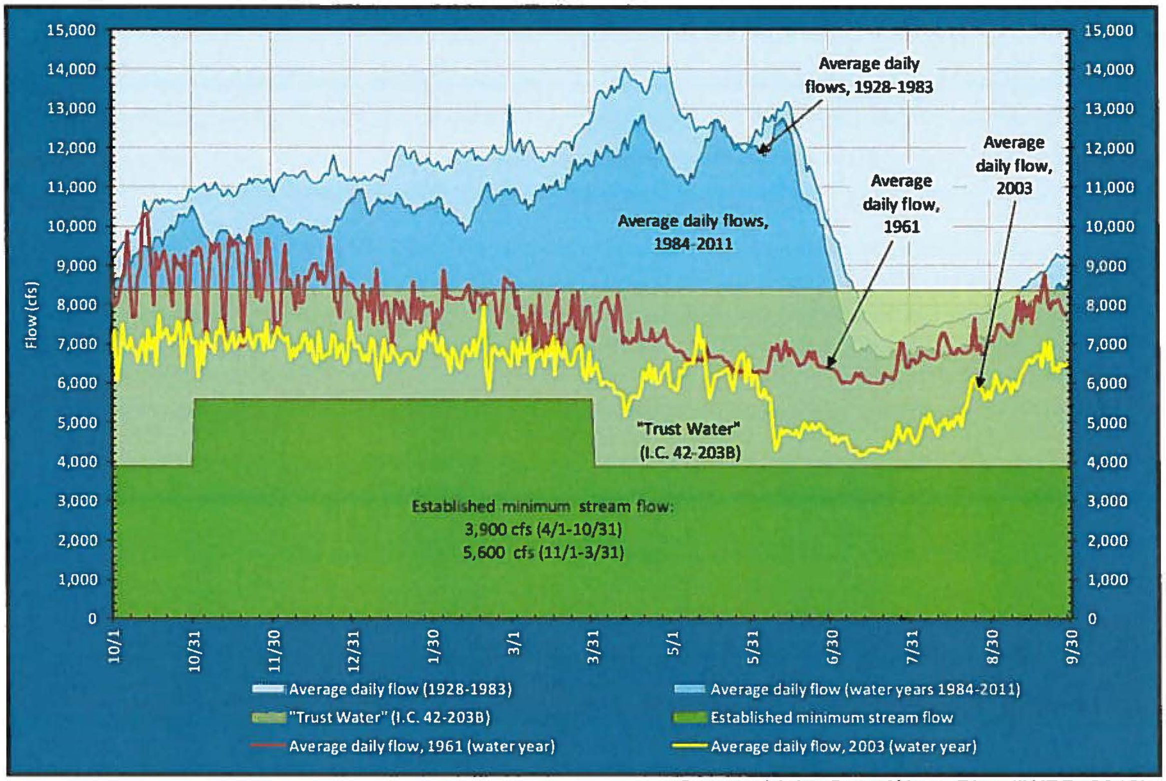
- Develop a conjunctive management plan setting forth measures necessary for future development of trust water (Implementation Strategy #2, Policy 4C).

---

[13] Swan Falls Settlement Paragraph 7(B); Idaho Code § 42-203B.

[14] The long-term uniform diversion rate consistent with an average annual net recharge of 7,900 AF is approximately 11 cfs (Petrich, 2012). Some of this impact may manifest itself as reduced evapotranspiration from springs discharging in the Snake River Canyon. Any remaining decrease in flow to the Snake River as a result of groundwater withdrawals under the pending applications and transfers is well within Snake River measurement error.

- Conduct hydrologic studies to determine the amount of additional development possible within the Murphy minimum stream flow constraint (Implementation Strategy #1, Policy 4C).



Source: Idaho State Water Plan (IWRB, 2012).

Figure 12. Snake River minimum flows.

• Other ERO Concerns

19. *Referring to "appropriate and timely curtailment of junior priority" surface-water rights, ERO states that "such direct administration is not possible for an over-appropriated aquifer" (ERO Report, page 16).*

IDWR currently administers rights authorizing the diversion of groundwater throughout the state in aquifers with varying degrees of "appropriation." Junior-priority groundwater users have been required to provide mitigation for impacts to senior-priority groundwater users or risk curtailment in times of shortage. However, aquifers are generally not managed on a "real time" basis – such administration would not be effective because of aquifer response lag times.

One approach to confirming availability – and lack of injury to existing rights – for municipal uses prior to the construction of homes and businesses within the study area would be to require a period of temporary irrigation (e.g., 3 to 5 years) under a new municipal permit prior to diverting for municipal purposes. Such temporary irrigation diversions would provide a low-risk opportunity to monitor pumping effects on local groundwater levels prior to committing to municipal development.

20. *ERO summarizes Applications for Permit and Transfer seeking groundwater in the consolidated hearing (ERO Report, Table A). The following two comments are clarifications to this ERO table.*

    First, the diversion rates reported for Permit 61-12090 and Application 61-12096 include flows dedicated to fire protection only. The rate for Permit 61-12090 is reported as 4.02 cfs, which includes 1.82 cfs for municipal use, and 2.20 cfs for fire protection. The rate for Application 61-12096 is reported as 20.48 cfs, which includes 14.91 cfs for municipal use, and 5.57 cfs for fire protection. Obviously, the fire protection flows will only be used in emergency situations. If these two fire protection flows are removed, the total on Page 31 of the ERO Report is 95.01 cfs (instead of the 102.78 cfs reported by ERO).

    Second, the irrigated acreage for Permit 61-12090 is reported as 109 acres. This figure appears to include common areas, which, by condition, can be irrigated only with recycled water. The permit limits residential lot irrigation to 1/3-acre per developed lot when the license is issued. In other words, if homes are constructed on all 176 lots, Permit 61-12090 authorizes diversion of groundwater for irrigation of a maximum of 52.8 acres.

3. Comments Regarding the Brockway Report

The Brockway Report describes the construction of – and results from – a MODFLOW computer model used to assist in the evaluation of impacts associated with proposed water right transfer 73811. The following paragraphs provide some general comments regarding aspects of this model and/or modeling results.

1. The model was built to simulate 2-dimensional groundwater flow (Brockway Report, page 11). While this approach might suffice over large portions of the Mountain Home Plateau, a 2-dimensional model does not adequately describe groundwater flow in perched, unconfined, semi-confined, and confined aquifers present especially in the northern portion of the study area.

2. Because the Brockway model (2009) was prepared several years prior to the IDWR Staff Memo (2012), the Brockway model does not incorporate the results of recent groundwater-level measurements, stream-monitoring data, and water-budget analyses. Thus, Brockway's assumed specified-head and specified-flux boundary conditions do not reflect current understanding within the consolidated cases study area.
3. Zonation used to distribute hydraulic conductivity values throughout the model domain (Brockway Report, Figure 14) does not appear to correspond with transitions in subsurface materials illustrated in the geologic cross-sections presented in the IDWR staff memo.
4. In summary, although it appears Powell and Brockway used "best available data" at the time the model was constructed, the usefulness of the model for the purposes of evaluating pumping effects within or around the consolidated study area is questionable.

4. REFERENCES

Anderson, M.P. and Woessner, W.W., 1992. Applied Groundwater Modeling - Simulation of Flow and Advective Transport. Academic Press, 381 pp.

IWRB, 2012. Idaho State Water Plan, adopted by the Idaho Water Resource Board, November 2012.

Liberty, L.M., 2012. Geophysical Characterization at the North Ada and East Ada Sites – a 2012 Idaho Department of Water Resources Report, prepared by the Center of Geophysical Investigation of the Shallow Subsurface at Boise State University.

Lindholm, G.F., Garbedian, S.P., Newton, G.D. and Whitehead, R.L., 1988. Configuration of the Water Table and Depth to Water, Spring 1980, Water-Level Fluctuations, and Water Movement in the Snake River Plain Regional Aquifer System, Idaho and Eastern Oregon., U.S. Geologic Survey Hydrologic Investigations.

Newton, G.D., 1991. Geohydrology of the regional aquifer system, Western Snake River Plain, Southwestern Idaho. U.S. Geological Survey Professional Paper 1408-G.

Petrich, C.R., 2012. Response to IDWR Staff Memo regarding the sufficiency of water supply for water right applications and transfers along the I-84 corridor, memorandum to Gary Spackman, Director, Idaho Department of Water Resources, November 15, 2012.

Phillips, W.M., Lewis, R.S., Gillerman, V.S., Garwood, D.L. and Stewart, D.E., 2012. Geologic Map of the Mayfield Area, Ada and Elmore Counties, Idaho. Idaho Geologic Survey, 1:36,000 scale.

Powell, E. and Brockway, C.E., 2009. Shekinah Industries Groundwater Model Development and Transfer Scenario Runs, consulting report prepared for Mike Preston, December 28, 2009.

Shaw, D.B. and Young, N.C., 2012. Water Supply Evaluation for Proposed Projects Along the I-84 Corridor, expert report prepared for the Idaho Power Company, November 14, 2012.

Tesch, C., 2012. Sufficiency of Water Supply for Water Right Applications and Transfers along the I-84 Corridor, IDWR memorandum addressed to Gary Spackman, Hearing Officer, May 31, 2012.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of a well using ground-water storage. Transactions, American Geophysical Union, 16: 519-524.

Welhan, J.A., 2012. Preliminary Hydrogeologic Analysis of the Mayfield Area, Ada and Elmore Counties, Idaho, staff report published by the Idaho Geological Survey, Moscow, Idaho.

Young, H.W., 1977. Reconnaissance of Ground-Water Resources in the Mountain Home Plateau Area, Southwest Idaho, Water-Resources Investigations 77-108, Open File Report, U.S. Geological Survey.