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July 19, 2013

RECEIVED

JUL 22 2013

Department of Water Resources
Eastern Region

Idaho Dept. of Water Resources
900 North Skyline Drive, Suite A
Idaho Falls, ID 83402-1718

RE: *Transfer No. 77610 / Parkinson Farms*

Dear IDWR:

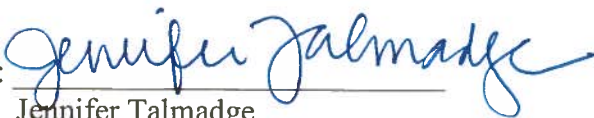
Enclosed please find the originals and one copy each of a List of Potential Witnesses for Supplemental Hearing and a List of Exhibits for Supplemental Hearing. Please receipt date-stamp the copies and return them to us in the enclosed self-addressed, postage prepaid envelope provided for that purpose.

Please call me if you have any questions. Thank you.

Sincerely yours,

SPECK & AANESTAD
A Professional Corporation

By:



Jennifer Talmadge

Asst. to James P. Speck

Enclosures

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Attorneys for Protestant Darrell E. McDonald

RECEIVED
JUL 22 2013
Department of Water Resources
Eastern Region

BEFORE THE IDAHO DEPARTMENT OF WATER RESOURCES

IN THE MATTER OF APPLICATION	)	
FOR TRANSFER NO. 77610 IN THE	)	
NAME OF PARKINSON FARMS	)	LIST OF POTENTIAL WITNESSES
	)	FOR SUPPLEMENTAL HEARING
Parkinson Farms, Applicant.	)	
_____	)	

Protestant Darrell E. McDonald submits the following list of witnesses he may call to testify at the supplemental hearing in this matter:

1. Dr. Charles G. Brockway
2. Darrell E. McDonald
3. Dennis Owsley, Idaho Department of Water Resources
4. Any of the other Protestants
5. Any witness identified as a witness by the Applicant

Dated this 19th day of July, 2013.

SPECK & AANESTAD
A Professional Corporation
Attorneys for Protestant Darrell E. McDonald

By 
James P. Speck

CERTIFICATE OF SERVICE

I hereby certify that on the 19th day of July, 2013, I served a true and correct copy of the foregoing LIST OF POTENTIAL WITNESSES on the following persons in the manner designated below:

Idaho Dept. of Water Resources
900 North Skyline Drive, Suite A
Idaho Falls, ID 83402-1718

☒ United States Mail, Postage Prepaid
☐ Hand Delivery
☐ Facsimile

Darrell L. McDonald
P.O. Box 246
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☐ Hand Delivery
☐ Facsimile

Kirby A. Jensen
2781 N 3375 W
Moore, Idaho 83255

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Parkinson Farm
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Arco, ID 83213

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James Cefalo
Idaho Dept. of Water Resources
900 North Skyline Drive, Suite A
Idaho Falls, ID 83402-1718

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☐ Hand Delivery
☐ Facsimile



JAMES P. SPECK

RECEIVED

AUG 05 2013

Department of Water Resources
Eastern Region

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August 2, 2013

Ms. Sharla Cox
Idaho Dept. of Water Resources
900 North Skyline Drive, Suite A
Idaho Falls, ID 83402-1718

RE: *In the Matter of Application for Transfer No. 77610 in the Name of Parkinson Farms*

Dear Sharla:

Enclosed please find the original and one copy of *Rebuttal Reports: Transfer No. 77610-Parkinson Farms*. Please receipt date-stamp the copy and return it to me in the postage-prepaid self-addressed envelope I have included for that purpose. Thank you.

Sincerely yours,

SPECK & AANESTAD
A Professional Corporation

By: _____

James P. Speck

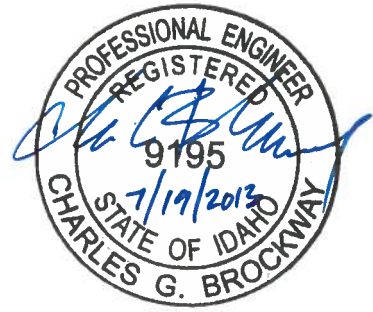
Enclosures

CC w/ Enclosure: Client
Darrell L. McDonald
Kirby Jenson
Parkinson Farms





Memo



To: Jim Speck
From: Charles G. Brockway, Ph.D., P.E.
Cc:
Date: July 19, 2013
Re: Application for Transfer No. 77610 / Parkinson Farms

This memo was prepared to provide comment on a staff memorandum prepared by Dennis Owsley of IDWR, in response to questions from the hearing officer in the case of Application for Transfer No. 77610.

In general the staff memorandum is thorough, technically sound, and responsive to the hearing officer's specific questions, which center around the likely impact of the proposed point of diversion change on surface supply in the Big Lost River and tributaries due to "rising water," i.e. water which arises in a surface source from a subsurface source. Rising water in the subject area from Moore to below Arco can occur in the Big Lost River channel or in a number of spring-fed streams and sloughs. Comments below refer to each section by question number.

Question 1

The intermittent clay units likely cause perched conditions on a local scale, but there does not appear to be a valley-wide perched aquifer. The lower units of sand and gravel are the true source of irrigation and domestic wells in the valley.

p.5. The similarity of hydrographs of wells with differing depths is an important fact, indicating communication between strata even if semi-confined conditions exist locally. The cause of the similarity being communication between the strata due to wells without sealing seems less likely, since the flow which could occur by this mechanism is much smaller than the aquifer discharge, but it is still a factor.

pp. 6-7. Potential sources affecting variability in groundwater levels are correctly identified, with an additional factor being natural recharge from precipitation. These factors were investigated by Brockway (2012) who found using statistical techniques that groundwater pumping was the largest factor affecting groundwater levels since 1988. The correlation between groundwater levels and groundwater pumping for this period was found to be strong (r -squared = 0.92), and the slope of the regression line much steeper than for the period prior to 1988. Water levels at present do not return to historic equilibrium levels when a series of wet years are experienced, as they did prior to about 1988.



Question 2

The history of reach gain changes is a good overview and the report provides a good description and qualitative analysis of the two potential mechanisms leading to “rising water,” or reach gain, in the Big Lost River area. As noted, insufficient data exists to confirm or disconfirm the operation of each mechanism at any particular time. However, the assessment that both mechanisms are plausible is reasonable. Both mechanisms have operated in the past to a greater degree than they do today, and the point of connection between the regional aquifer and the river has moved upstream due to declining groundwater levels, as demonstrated by the studies cited in both the staff memorandum and Brockway (2012).

To the extent that the second mechanism operates, i.e. leakage from the river to upper perching layers followed by down-gradient migration of water and ultimate reappearance of a portion of it in the river, upstream movement of the regional aquifer-river connection would tend to exacerbate the decline of the second mechanism because a diminution of water in the river due to regional reach gain leads to less leakage into perched zones, and subsequently less reach gain from this source. I believe this phenomenon is what is being described in the first paragraph of p. 13.

Question 3

One ramification of the Parkinson well construction is that pumping of the well will induce a drawdown in all of the strata to which it is open, i.e. perforated, from 30 to 150 feet below ground. The well is not constructed in order to draw from only deeper water-bearing zones. Therefore, pumping the well will reduce the magnitude of the rising water from both mechanisms described above and negatively impact river flows.

Question 4

Data on hydraulic properties for each specific sub-unit is not available. The pumping test conducted by Clearwater Geosciences and the analyses performed by Brockway (2012), yielded estimates of aquifer transmissivity that are best interpreted as composite estimates of the entire aquifer profile. These estimates may be used to infer an impact on the aquifer as a whole, as was done by both Clearwater and Brockway. In addition to Clearwater’s analysis, the Brockway (2012) analysis resulted in a predicted drawdown at 0.25 miles from the pumping well of 3.85 feet after 215 days of pumping, which corroborates the Clearwater result.

Question 5

The indirect effect on rising water from the proposed well pumping would occur as described in the staff memorandum. However, another effect would also occur. The regional water table has historically been connected with the Big Lost River in the Moore area as recently as 1998, corresponding with the period during which the groundwater levels last approached historic levels due to the wet years of the late 1990s. With proper management of groundwater and an extended period of wet years, the connection near Moore might be reestablished. This reestablishment could be delayed or prevented due to the drawdown caused by the proposed pumping as shown in Brockway (2012), Figure 5.

Groundwater pumping in the basin has resulted in a real depletion of the surface source and a reduction in surface supply relied upon to fill numerous senior water rights. Johnson et al. (1991) estimated the magnitude of this “diversion depletion” to be 20,000 to 30,000 acre-feet per year in low water years and 13,000 acre-feet per year in normal years. Additional groundwater depletion proposed by Transfer No. 77610 would increase the diversion depletion.

Although a portion of the water proposed to be pumped would return to the aquifer via canal seepage, the net impact would remain negative and this seepage would only partially mitigate for the impact on surface supply. The Big Lost Canal Company generally charges a significant “loss assessment” for conveying groundwater, e.g. up to 50%. In reality, the proposed 4 cfs injected into the canal would simply augment water already in the canal and cause only a marginal increase in wetted perimeter and water depth. Thus, the actual incremental increase in seepage would be minimal.

Question 6

The regional water table near the current point of diversion is clearly below the river and has been historically. Therefore, any rising water in this reach must come from the second mechanism described in the staff memorandum. The well depicted on Figure 10 as being one of the Parkinson points of diversion is shown as 78 feet deep, which appears to correspond to a record for a domestic well located near the Parkinson wells in SENE Sec. 11, T3N, R26E. If so, it may not be one of the irrigation wells. If it does represent one of the points of diversion, the analysis regarding impact to rising water would still be sound, since the first water encountered and static water level are below the level of the adjacent Big Lost River and below the top of the potential “sand and clay” perching layer which is 14 feet below ground surface. Thus, pumping this well and lowering the water table would not affect water perched on this layer since there is no hydraulic connection between the two at this location.

A better indicator of the effect of the current well pump would be the drilling record for the well listed on 34-2490 (NESE Sec. 14, T3N, R26E). The lithology consists almost entirely of basalt, with minor interbeds described as “clay” with thickness of 4 to 5 feet. The first water was encountered at 297 and the static water level at the time of drilling was 290 feet. The total well depth is 360 feet. The lithology confirms that this well clearly draws from the Eastern Snake Plain Aquifer and pumping it would have no effect on rising water in the Big Lost River.

Records for the two other wells listed as points of diversion for 34-4008 and 34-2497 (NESW and NESE Sec. 11) could not be found in IDWR files.

Surface Water Rights in Moore-Arco Reach

To the extent a depletion of rising water or reach gain occurs due to the proposed transfer or any other mechanism, water rights relying on this source would be impacted. Some water rights may rely exclusively on rising water, e.g. those rights in spring-fed streams, sloughs, or groundwater-fed ponded areas. Some rights may rely partially on rising water, e.g. those diverting from the Big Lost River channel, in which may exist a comingling of physical sources – natural runoff, storage releases, and rising water or reach gain.

A search of the IDWR database was made for surface water rights with points of diversion within the subject area, from Moore downstream to below Arco. A total of 199 rights were found. All have been decreed in the Snake River Basin Adjudication, with the exception of a 530 cfs permit for recharge in the name of Water District 34. Disregarding this permit, the gross diversion rate authorized from the Big Lost River is 212.8 cfs (the actual diversion rate limit will undoubtedly be less than this amount due to combined-use conditions on related rights). These rights have historically relied to some extent on reach gain to supply a portion of the physical water supply.

There are 29 water rights with points of diversion from sources likely fed by rising water exclusively. These rights total 14.5 cfs with priority dates ranging from 5/1/1886 to 10/19/1973. Sources for these rights include unnamed springs, unnamed streams, Ferris Slough, Spring Creek, Boyle Creek, Bricker Springs, and Arco City Drain. These rights are shown in the following table:

Right No.	Priority Date	Div Rate (cfs)	Source	Water Use	Owner
34-10112	4/1/1950	0.1	Spring	Irrigation	Pettet, Terry
34-10486	4/28/1925	0.02	Spring	Stockwater	Sherman, Bob; Sherman, Carole
34-10678	3/16/1923	0.2	Ferris Slough	Stockwater	Quist, Larry A
34-10858	3/16/1923	0.05	Spring	Stockwater	Beck, Lora Lee; Beck, Wilbert R
34-12390	6/1/1957	0.12	Pond	Irrigation	Moore, Edythe
34-13413	3/16/1923	2	Ferris Slough	Irrigation	Thornton, Barbara V; Thornton, Robert M
34-13414	3/16/1923	2	Ferris Slough	Irrigation	Quist, Larry A
34-13626	05/01/1892	0.02	Spring Creek	Stockwater	Ned Reese Walker & Reva Waite Walker Trust
34-13649	3/16/1923	0.02	Spring Creek	Stockwater	Boyack, Ray Milton
34-13650	3/16/1923	0.02	Spring Creek	Stockwater	Wheeler, G Alvin
34-13706	8/2/1946	0.02	Unnamed Stream	Stockwater, Stockwater Storage	United States Of America Acting Through
34-14297	3/16/1923	1.9	Ferris Slough	Irrigation	Rindfleisch, James A
34-14298	3/16/1923	0.1	Ferris Slough	Irrigation	Hayward, Greg; Hayward, Julie
34-2354	9/14/1959	0.85	Unnamed Stream	Irrigation	Sowards, Leota M; Sowards, William T
34-2355	12/18/1959	1	Arco City Drain	Diversion To Storage, Irrigation From Storage, Irrigation Storage, Stockwater	Walker, Young Harvey
34-2491H	5/8/1944	0.2	Spring Creek	Irrigation	Reva W Walker Trust
34-2500A	1/30/1966	0.066	Spring	Irrigation	Bell, Cynthia A; Bell, Kenneth O
34-2500B	11/30/1966	0.133	Spring	Irrigation	Wood, Howard; Wood, Sheila
34-4006	3/16/1923	2	Bricker Springs	Diversion To Storage, Irrigation From Storage, Irrigation Storage, Stockwater	Walker, Young Harvey
34-4033	3/16/1923	0.02	Ferris Slough	Irrigation From Storage, Irrigation Storage, Stockwater	Walker, Young Harvey

34-4087	5/1/1927	0.38	Unnamed Stream	Irrigation, Stockwater	Reva W Walker Trust
34-4138	6/1/1950		Unnamed Stream	Stockwater From Storage, Stockwater Storage, Wildlife From Storage, Wildlife Storage	United States Of America Acting Through
34-4149	6/28/1934	0.02	Unnamed Stream	Stockwater	United States Of America Acting Through
34-4165	6/28/1934	0.02	Unnamed Stream	Stockwater	United States Of America Acting Through
34-503A	06/01/1898	0.8	Spring Creek	Aesthetic Storage, Diversion To Storage, Recreation Storage, Stockwater	Traughber, Charles P (John); Traughber, Elsie F
34-542	10/31/1898	0.6	Spring Creek	Irrigation	Rosenkrance, Mimi L G
34-557	05/01/1886	0.4	Boyle Creek	Irrigation	P U Ranch Ltd
34-7048	10/19/1973	0.4	Unnamed Stream	Irrigation	Bell, Cynthia A; Bell, Kenneth O
34-971	3/1/1939	1	Unnamed Stream	Irrigation	Andersen, Belva E; Andersen, Joel S
	TOTAL	14.46 CFS			

Conclusions

The proposed pumping under transfer 77610 would further separate the aquifer from the Big Lost River and the various spring-fed streams and sloughs which are tributary to the river, reducing the likelihood that “rising water” will appear and resulting in a real additional depletion of the surface sources. Numerous rights rely upon rising water as a primary or secondary source of water supply and would be impacted by the proposed transfer. Additionally, the data indicates current groundwater pumping in the valley is the primary factor that has resulted in the loss of surface supply, and that active management of groundwater depletions would be a necessary component of any reestablishment of a hydrologic connection. Pumping at the current points of diversion (wells) does not impact the magnitude of rising water and therefore the proposed transfer would amount to a new depletion of both groundwater and surface water sources.

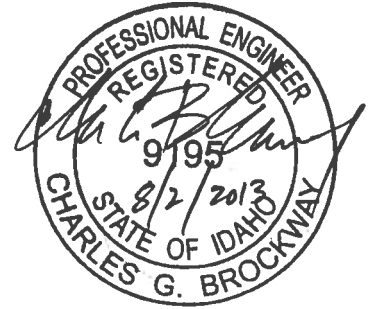
References

- Brockway, Charles G. (2012). Evaluation of Hydrologic Impacts of Additional Pumping from a Well in the Lower Big Lost River Valley.
- Johnson, Gary S., Dale R. Ralston, and Leland L. Mink (1991). Ground-Water Pumping Impacts on Surface Water Irrigation Diversions From Big Lost River. Idaho Water Resources Research Institute, December, 1991.

Rebuttal Reports

Transfer No. 77610 – Parkinson Farms

Charles G. Brockway, Ph.D., P.E.
Brockway Engineering, PLLC
August 2, 2013

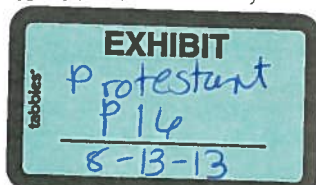


Part A – Rebuttal to report entitled “Technical Response to the IDWR Director Remand and the Owsley Report ‘Application for Transfer No. 77610 in the Name of Parkinson Farms’ by Tom Wood

Available data does indicate the presence of numerous clay “sub-units” within the primary matrix or gravel and sand, which influence the lateral and vertical movement of water. The clay layers do not appear to be continuous across the valley, the possible exception being the clay layer identified by Crosthwaite (1970) at approximately 250 feet. This layer is extant in a number of deeper well logs, and is assumed to form the bottom of the regional aquifer. Owsley’s Figure 2 was developed based on 17 well logs and adequately shows the clay layers reported on these logs. The only major liberty taken in the interpretation is the delineation of a continuous clay layer at 200 to 250 feet below ground between the USGS monitoring well and the City of Arco well, as noted by Wood. This is the layer identified by Crosthwaite and assumed to be relatively continuous and acting effectively as the bottom of the primary aquifer within which wells in the valley are generally completed. It may or may not be completely continuous, but whether it is or is not continuous would not appear to affect Owsley’s conclusions.

The steepening of the hydraulic gradient as the alluvial system merges with the ESPA aquifer is in fact clearly apparent in the spring 2008 groundwater levels on Owsley’s Figure 1. The contour lines become progressively closer moving southward down the valley. To illustrate this fact, a longitudinal profile of the contours lines shown in Owsley’s Figure 1 was prepared and is shown in Figure 1 below. The profile in Figure 1 begins at the top of Owsley’s Figure 1, about 2 miles north of Moore, and runs perpendicular to the contour lines, south-southeasterly to the bottom of his figure.

The transition zone between the Big Lost alluvial aquifer and the ESPA is hydrogeologically complex, and no single conceptual model can likely capture the true situation with accuracy and there is insufficient data to characterize it completely. Due to the presence of multiple lenses of potentially perching layers in the vicinity of Arco, water trapped on these layers likely cascades into the deeper basalts, while water in the regional aquifer, as shown on Figure 1, appears to steepen and join the ESPA in a continuous fashion. Contours in Bassick and Jones (1992) reflect “altitude of first encountered water,” rather than the water table elevation of the regional aquifer. The first



encountered water would reflect water existing on top of localized clay layers, to the extent it exists, and may not represent the regional system.

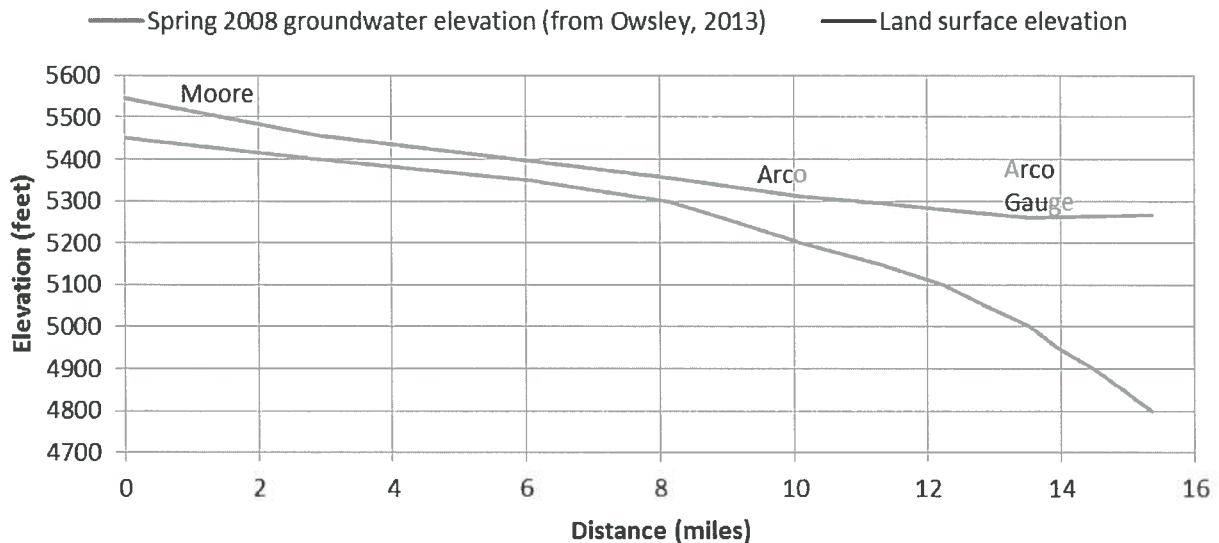


Figure 1. Longitudinal profile of spring 2008 groundwater level as shown on Owsley (2003), Figure 1. Land surface elevation taken from the USGS DEM is also shown.

Which conceptual model is correct has little bearing on the question as to whether water at the existing point of diversion affects “rising water” in the Big Lost River. Based on the only drilling record confirmed for one of the existing points of diversion (NESE Sec. 14, T3N, R26E), the well is unequivocally developed in the basalts of the ESPA and draws water solely from the ESPA; the first water was encountered at 297 feet and the static water level at the time of drilling was 290 feet. The northern points of diversion in Section 11 have no logs known to exist. Available logs close to that location indicate mixtures of alluvial and basalt layers, confirming the transition zone between the Big Lost and ESPA. If “upper water” is being diverted to some degree at the northern points of diversion, the Owsley report demonstrates that these water levels are below the level of the Big Lost River and pumping from that stratum would likely not affect rising water. In discussing Owsley’s Figure 8, Wood affirms that in the vicinity of Arco, regional groundwater levels have been more than 40 feet below the river since the 1940s. Since this is the case, pumping the regional aquifer at the existing points of diversion west of Arco will not impact rising water.

The cumulative diversion rate of groundwater appropriations is a general indicator of overall development, but only represents the potential maximum instantaneous pumping rate that would be allowed if every single right were pumped at the same time. This is not a good indicator to examine when evaluating whether water levels are related to groundwater pumping. The appropriate approach is to examine the relationship between actual groundwater diversion volume and groundwater levels. As demonstrated in Brockway (2012), a close relationship exists: groundwater pumping has a direct effect on

aquifer levels, and this effect appears to have become more pronounced and direct in the years after 1987 as annual pumping volume has increased significantly. It appears that the aquifer reached a critical point in the late 1980s beyond which it can no longer sustain the levels of groundwater pumping without significant declines and/or large fluctuations in aquifer levels. Scatterplots of groundwater pumping vs. aquifer levels confirms a statistically-significant relationship between the two, but this relationship is much stronger after the later 1980s. (Brockway, 2012, Figures 14 and 15).

Groundwater pumping is not the only factor affecting water levels. Wood correctly notes that drought plays a significant role. As shown in Brockway (2012), there is a mild relationship between annual precipitation at Mackay and aquifer levels. However, prior to the late 1980s aquifer levels always recovered to historic levels after a drought period. Since that time, this has not been the case. The near-normal levels of precipitation occurring since 2003 have not brought water levels back to historic levels (Brockway, 2012, Figure 12). The most likely explanation of the change in response to drought is the decreased net yield of the basin due to factors including reduction in irrigation recharge, stream seepage, and groundwater pumping, which have caused an increase in the sensitivity of aquifer levels to any stress on the aquifer, including drought, reduced streamflow, or pumping.

Wood also correctly notes that streamflow has an influence on aquifer levels. As shown in Brockway (2012), there is a considerable relationship between the two. However, it is not correct to state unequivocally that “during periods of below average flow in the Big Lost River aquifer water levels decline and during periods of above average flow water levels increase to historic levels.” Since the late 1980s, aquifer levels have not recovered to historic levels even though periods of above-normal streamflow or near-normal streamflow have been experienced (Brockway, 2012, Figure 13). The aquifer has become more sensitive since that time; for example, during 2003 and 2004, the streamflow was not much lower than it was in the early 1960s and the early 1990s but the groundwater levels were extremely low, reaching their lowest levels on record. This confirms that there must be other factors than streamflow which affect aquifer levels.

An imperfect analogy that may help illustrate the behavior of the Big Lost aquifer would be a bathtub with inflow from various sources, outflow from groundwater pumping, and “overflow” via seepage to surface streams and discharge to the ESPA. If the bathtub is full and overflowing, then changes in inflow or pumping have little effect on the water level in the tub. If the water levels drop below the overflow (for any reason), then changes in inflow or pumping cause large changes in water level, and the necessary action to restore the stability would be to increase inflow or reduce outflow. The data indicates that the aquifer was generally in the first state until the late 1980s, and has been in the second state since that time.

It is not correct to state that “It is unreasonable to expect that aquifer levels will rebound to ‘pre-1985’ levels by curtailing ground water pumping.” As demonstrated by the data analysis described in Brockway (2012), a clear breakpoint in aquifer sensitivity occurs when groundwater pumping is about 45,000 acre-feet per year. Pumping has exceeded

this amount almost every year since the late 1980s. If groundwater pumping were to be curtailed from its present range of 60,000 to 90,000 acre-feet per year to 45,000 acre-feet per year, aquifer levels would rise and likely reach their historic equilibrium levels, on average. If additional pumping were allowed to occur, such as that proposed by the Parkinson transfer, the amount of curtailment needed to restore equilibrium would increase.

Based on physical observation of the datasets, Brockway (2012) concluded that aquifer levels were most influenced by annual groundwater pumping and annual streamflow. A multiple-regression was performed to characterize the relative influence of each. An extremely strong relationship between average annual aquifer levels and these two factors was found. R-squared in this regression was 0.94, which means that 94% of the variability in aquifer levels can be explained by these two factors.

According to IDWR studies, the aquifer between Moore and Arco was last connected to the Big Lost River in 1998, or about 15 years ago. Owsley (2013) presents defensible qualitative arguments considering how rising water may be caused by localized perched water, regional water table intersecting the river bed, or a combination of both. In either case, the proximate cause of the decline in rising water is lower groundwater levels. The causes of lower groundwater levels, as discussed above, are groundwater pumping, reduced streamflow, and to a lesser extent, reduced precipitation. Wood answers the question by stating “precipitation and runoff from the mountains surrounding the Big Lost Valley are the source of the rising waters.” It is axiomatic that precipitation and runoff are the source of all of the water in the Big Lost basin, both groundwater and surface water, but this does not address the specific question of the source of rising water in the Big Lost River. Owsley’s interpretations are reasonable.

Regarding the question of the construction of the Parkinson Well (proposed point of diversion), the fact that the well is open to all of the water-bearing aquifer units means that pumping of the well will affect the entire aquifer. The effect of the proposed pumping on groundwater levels or surface water will not be mitigated as it might be if the well were completed in a confining layer. As Wood notes, the clay layers in the Parkinson well log likely do not act as confining layers providing clear separation between aquifer sub-units. Owsley states this opinion as well, characterizing the clay units as “discontinuous.” He does not, as Wood indicates, state that “every clay layer is a ‘major’ clay layer acting as a confining layer providing hydraulic separation in the aquifer.”

Wood argues that pumping at the proposed point of diversion will not adversely affect rising waters, because the connection has already been broken below Moore and therefore further pumping cannot deplete what does not exist. While this may be true, it has been shown that groundwater pumping is one factor – likely the largest factor – which has resulted in the decline in groundwater levels, subsequent upstream migration of the connection point between the regional aquifer and the river, and a depletion of surface water flow.

IDWR's analysis of groundwater pumping impacts by Johnson et al. (1991) concluded that depletion of surface water diversion by groundwater pumping was occurring and was a significant effect. They estimated the depletion by pumping to be 13,100 acre-feet in a normal year. They further estimated that the ratio of depletion to groundwater pumpage was 0.28 in a normal year, i.e. 28% of the pumpage was realized as a surface water diversion depletion.

The regional aquifer and river near Moore have been connected as recently as 1998 (Owsley's Figure 5), a condition which occurred during periods of above-average streamflow and below-average groundwater pumping. This shows that it is possible, even with post-1985 conditions, for such a connection to recur. Further, the recurrence would be more likely with proper groundwater management. It is not the case that the disconnection is a permanent feature of the basin forever. Pumping at the proposed point of diversion would impair this connection.

The regional aquifer near Arco as shown in Owsley's Figure 8 is indeed well below the river level, has been since water levels have been recorded. However, historically and currently (in 2011 based on the Watermaster report), rising water occurred in the vicinity of the Arco gauge and Ferris Slough. This fact supports the notion that rising water in the Arco area and southward is due to perching conditions on the uppermost clay layer(s). Owsley's Figure 2 shows these layers clearly. To the extent the proposed groundwater pumping depletes the regional aquifer so that it can no longer saturate the uppermost sub-units to the previous level, this mechanism by which rising water occurs would be impaired, and the depletion would be real and actual.

Wood argues that pumping at the proposed point of diversion will have "no measurable impact" on rising waters. It should be noted that IDWR has determined in previous cases that the impact need not be measurable in order to be an injury.

The fact that the State of Idaho has established, under Rule 50, mitigation schedules or financial obligations that are uniform in nature whether the water is pumped from the current or proposed points of diversion is an administrative issue, not a technical one. It may be that the State should modify the mitigation scheme to better reflect the hydrologic reality that some wells affect surface water to a greater degree than others.

Wood argues that there has been shift in climate since 1985, although no data is presented or analyzed to justify the claim. This hypothesis was tested by looking at annual precipitation and temperature (the two primary indicators of climate conditions) at the Mackay Ranger Station. Figures 2 and 3 show the annual data, separated into the periods 1950-1984 and 1985-2012. Dashed lines are the averages for each period. Standard, accepted statistical techniques were applied to the data to test whether the averages of each period were significantly different (Devore, 1987). Specifically, the z-test for difference between two population means was applied. The average annual precipitation for the two periods was 9.85 inches and 9.47 inches, respectively. At a confidence level of 95%, these two values were found to be not significantly different. The average annual temperature for the two periods was 41.51 and 41.95 degrees F, respectively.

With a confidence level of 95%, these two values were found to be not significantly different. The same analysis was applied to the data from the Chilly Barton Flat weather station, located above Mackay Reservoir, with the same results.

In short, in terms of annual precipitation, which Wood (p. 11) suggests is the primary force behind the reduction in groundwater levels, there is no statistically-significant difference between the climate of the two periods. The data does not support the hypothesis that there has been a significant shift in temperature or precipitation between pre-1985 and post-1985 conditions.

On the other hand, applying the same statistical analysis to annual average streamflow at the Howell Ranch gauge and at the Below Mackay gauges indicates that the average annual flow has decreased by 20% and 23%, respectively between the 1950-1984 period and the 1985-2012 period, and these decreases were found to be statistically significant at the 95% confidence level. As discussed above, streamflow is one of the factors affecting aquifer levels.

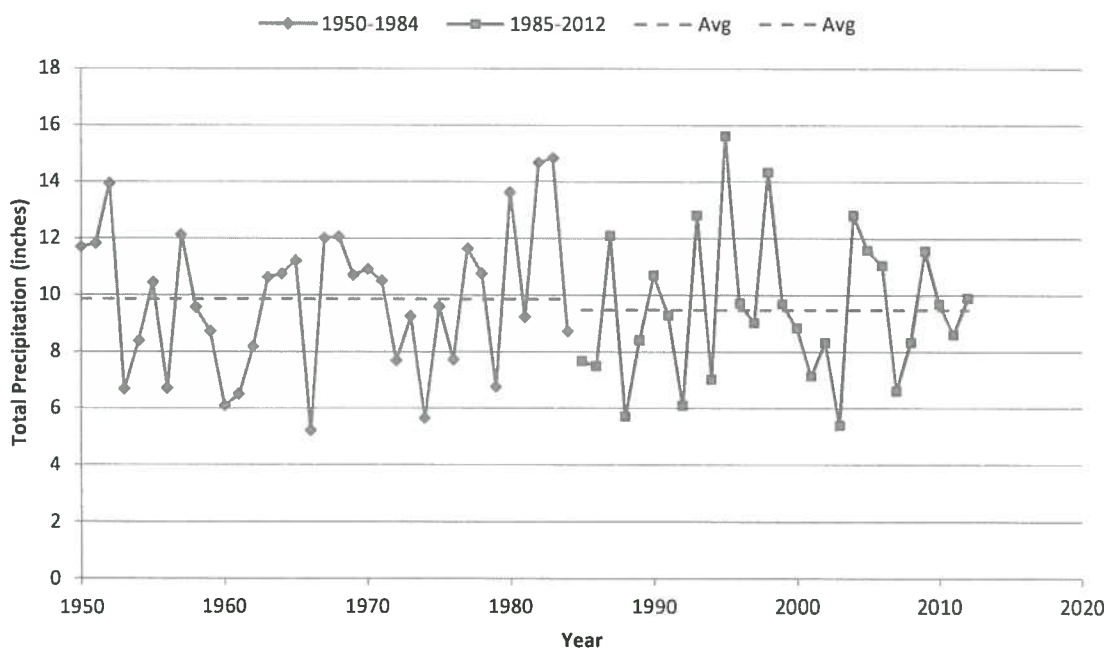


Figure 2. Annual precipitation at Mackay Ranger Station

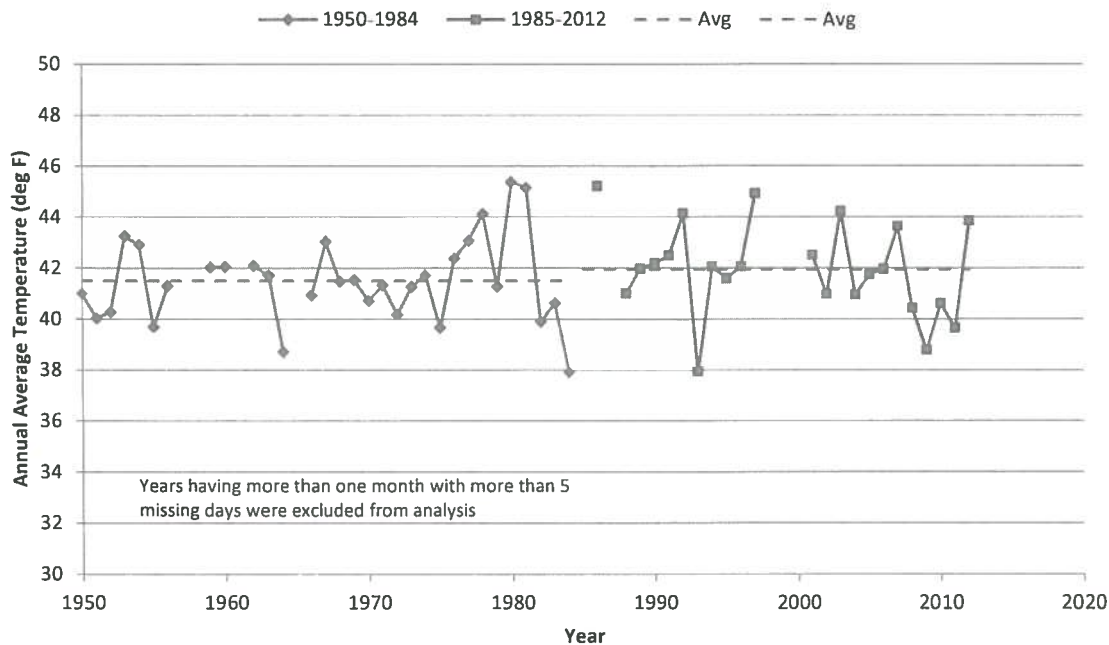


Figure 3. Annual average temperature at Mackay Ranger Station

Conclusions

Qualitative descriptions of geologic conditions and inferences based on those descriptions are important, but any assessment of impact of groundwater pumping should be based on a robust analysis of actual data, where possible. Relative to surface water impact, the data indicates that

1. Aquifer levels prior to the late 1980s were at historic equilibrium, and were robust and relatively insensitive to changes in aquifer stress. Aquifer levels since that time have been sensitive to aquifer stresses from streamflow (positive stress) and groundwater pumping (negative stress).
2. Aquifer water level declines and increased sensitivity since the late 1980s are a function of reduced net yield of the aquifer due to reduced streamflow (and associated reductions in irrigation recharge and stream seepage) and groundwater pumping. It is incorrect to attribute groundwater level changes to one factor only. A robust statistical analysis provided in Brockway (2012) and discussed later in this report, indicates that a significant relationship between aquifer levels and both streamflow and pumping exists, but that groundwater pumping is the primary factor influencing aquifer water levels.
3. The proposed pumping will reduce water levels in the regional aquifer, and will reduce the magnitude of water perched on localized clay layers in the uppermost portion of the aquifer. These effects will reduce the magnitude of “rising water” in the Big Lost River, to the extent it exists. A reduction in rising water equates to a real and actual reduction in surface water supply for water rights in the Big Lost River.

Part B – Rebuttal to report entitled “Response to the Brockway Report ‘Evaluation of Hydrologic Impacts of Additional Pumping from a Well in the Lower Big Lost River Valley’” by Tom Wood

Same aquifer evaluation

The only available well log for one of the existing points of diversion demonstrates unequivocally that the well pumps exclusively from the basalts ESPA. This is a different aquifer than the Big Lost alluvial aquifer that would be tapped at the proposed point of diversion.

Transmissivity

Apparently a second pumping test was conducted on the Telford well, situated 222 feet north of the Parkinson well (the proposed point of diversion). A plot of the data and fitted curves was provided, but no flow rate from the pumping well was given. Therefore, the results cannot be evaluated for accuracy. The calculated transmissivity of 280,000 ft²/day is within the range measured or estimated in other studies; however, it is close to the upper limit of the range and more in line with the extremely high-permeability zone known as the well orchard, located about 1 to 1.5 miles west of the Parkinson well. Given the natural variability of transmissivity of the aquifer in the zone of influence (as evidenced by the large difference between the results from the Parkinson and Telford well tests), it is more appropriate to utilize a value close to the mean of the expected range rather than a value near the upper end. No justification was presented for utilizing the high value rather than the low value; by all accounts the tests were conducted and analyzed using standard techniques and the results from both should be valid. Utilizing a value near the upper end will tend to bias the drawdown to the low side. Furthermore, the Parkinson well is the actual well that is proposed to be used, so the data from this test should be weighted more heavily. For these reasons, the drawdowns originally calculated by Brockway (2012) and Wood (2011) are the best estimates of the drawdown from the proposed pumping.

Predicted drawdowns of 4 feet and 2 feet are characterized as “negligible.” As described in Brockway (2012), due to the generally shallow well depths and low saturated depth, decreases in aquifer levels on the order of a few feet would result in decreased well intake area, reduced yield, increased pumping lift, and increased power costs. These effects may be small, but in many cases would not be “negligible.” In particular, the effect on the McDonald well was shown to be 2.5% to 3.6% of the discharge, which is significant.

Section D

Wood does not address the straightforward calculations showing the reduction in yield from the McDonald well due to drawdown caused by the proposed pumping. Drawdown

in the McDonald well will increase the pumping lift, shift the operating point of the pump, and result in less flow and higher pumping costs. The decrease in pumping rate would be at least 2.5%, which is significant.

It is incorrect to state that recharge from canal seepage and snowmelt need to be taken into account when calculating the drawdown. A well interference calculation represents the incremental effect in aquifer level that would occur due to the cone of depression caused by pumping, everything else being equal. In other words, whatever the aquifer level is at a particular point without the pumping (which is an aggregate result of all factors affecting the aquifer including recharge), the well interference analysis calculates an incremental lowering compared to the no-pumping level. It is also incorrect to state that the analysis does not take into account the deformation of the cone of depression caused by the gradient of the water table. In fact, the analysis was performed using WinFlow, with a uniform gradient of 18 ft/mile, and boundaries as described. The calculated deformation is minimal.

Return to the aquifer via canal seepage due to the injection of the proposed water is a real effect, but it will be very small in the vicinity of the pumping well. Although the canal company generally imposes “shrink” assessments of up to 50%, the true incremental increase in seepage in a canal which is already carrying water will be due to incremental increases in depth and wetted area when the new water is injected. These increases will be very small. In terms of the well interference analysis, this will be a negligible mitigating effect.

Section E

The analysis in this section is characterized as “highly theoretical and speculative.” This characterization is wholly inappropriate. It is not theoretical; rather, it is empirical, based on actual data and widely-accepted analysis procedures. It is anything but speculative. Speculation implies making guesses based on unknown facts or minimal data. All of the work in this section involved actual data and application of standard statistical techniques used and accepted by engineers and scientists, including those at IDWR. Wood presents no new data, and no alternative analysis of existing data, to support any of his criticisms or conclusions.

Wood indicates that other wells should be evaluated for their relationship with streamflow, yet he fails to present such an analysis. In fact, other wells were evaluated in the Brockway (2012) study and a similar relationship was found. Well 05N26E23CDA1 was selected because it exhibited the strongest relationship with the variable being predicted. Standard procedure in hydrologic analysis is to evaluate many indicator variables to search for those with strong relationships. This in no way invalidates the analysis, and it does not require an assumption of aquifer homogeneity and isotropy, as Wood claims.

The utilization of the “convenience” of a backward moving average is also a standard statistical technique and not an attempt to skew the data, as Wood implies. Moving

averages are often employed to smooth variability in the data, and to investigate whether relationships between “lagged” indicators are significant or not. In this case, the backwards-averaging has an obvious physical justification: hydrologic conditions in a particular year are likely to affect aquifer conditions not only in that year, but in some number of years in the future, since the aquifer responds slowly to changes in inputs.

The use of standardized beta coefficients is a common technique employed to allow comparison of the relative effects of predictor variables which are expressed in different units. Like many statistical techniques, it is not immune to criticism (the criticism offered by Wood may be found verbatim on Wikipedia). Beta coefficients may be interpreted thus: one standard deviation change in a predictor variable results in beta standard deviations of change in the dependent variable. In the present case, standardized beta coefficients are not actually necessary since the two predictor variables have the same units (1000 acre-feet). So, it would be appropriate to directly compare their unstandardized coefficients: -0.0987 for streamflow and 0.777 for groundwater pumping. This comparison suggests an even stronger relative influence of pumping as compared to streamflow. No matter how the data is evaluated, the relationship between groundwater pumping and aquifer levels is stronger than the relationship between streamflow and aquifer levels.

The criticism that a relationship between variables is “presupposed” is meaningless. In all regression analysis, a relationship between the predictor(s) and predictand is assumed or “presupposed,” then tests are performed to see whether this relationship is real or a result of random chance. The objective of this type of analysis is to determine whether a relationship in fact exists, and if so, to quantify its magnitude.

Section F

The Bassick and Jones pumping test consisted of pumping one well and measuring eight observation wells. The test was entirely confined to the area known as the “well orchard,” situated about 1.5 miles west of the Parkinson well. All wells in the test were within a radius of 1,750 feet of the pumping well, or an area of 0.35 mi². The high transmissivities found confirm anecdotal evidence that the well orchard is an area of extremely high permeability. As Wood correctly notes, variability in transmissivity is very high in this aquifer; therefore utilization of only values from a single small area of the aquifer notorious for its high permeability will introduce bias. When estimating groundwater flow through an aquifer, the use of an average value calculated from wells distributed over a wide area is the preferred approach. This is what was done in Brockway (2012) to calculate an average transmissivity for 17 wells of 49,800 ft²/day, which corresponds to a hydraulic conductivity of 249 ft/day. Using the value of 35,000 ft²/day (corresponding to a hydraulic conductivity of 175 ft/day) at the Parkinson well calculated from the Wood (2011) pumping test, the groundwater discharge would be 25,700 ac-ft/year or 35 cfs. Using the transmissivity of 49,800 ft²/day calculated by Brockway (2012) using many wells over a wide area, the groundwater discharge would be 36,600 ac-ft/year or 51 cfs.

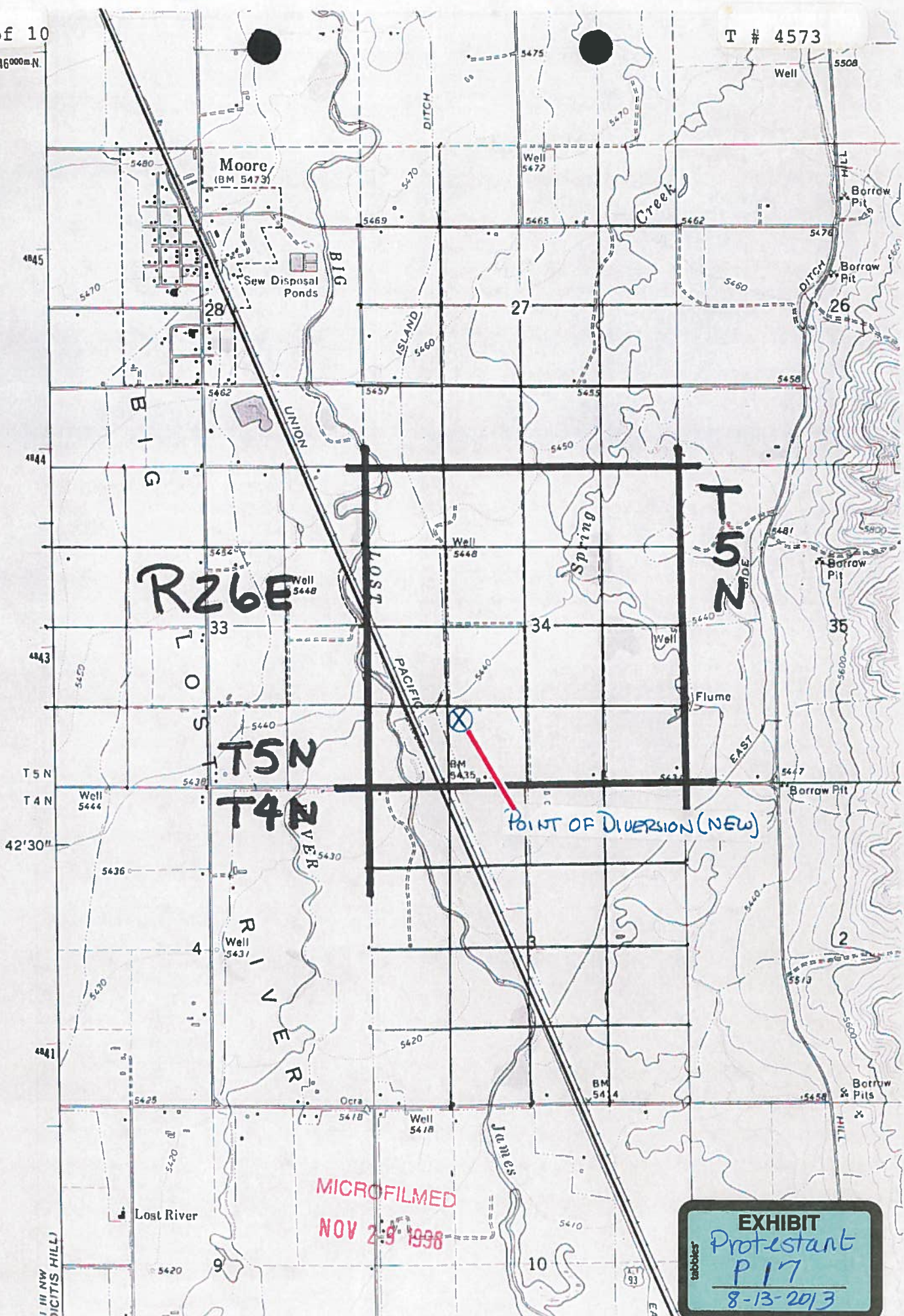
The groundwater discharge suggested by Wood of 200 cfs is likely too high. It is not in line with Crosthwaite (1970), because Crosthwaite's 325 cfs figure was derived from a basin water balance and represents the flow through the total aquifer profile at Moore which has a maximum thickness of 2,000 feet and an average thickness of about 1,000 feet, whereas the calculated values of 35 cfs and 51 cfs pertain only to the primary aquifer bounded by the clay layer at about 250 feet below ground, having a saturated thickness of 200 feet, or one-fifth the average thickness of the total profile. Furthermore, Crosthwaite states that a hydraulic conductivity of 134 ft/day is "a reasonable value for these [alluvial] deposits." He also says "it seems unlikely" that the average hydraulic conductivity of the alluvial deposit would be as large as 268 ft/day. Wood suggests 1,000 ft/day, which undoubtedly exists at specific points in the aquifer but is not supportable as an average value for the purposes of groundwater discharge calculation.

For these reasons, the values shown in Brockway (2012), Table 4 (referred to as Table 5 by Wood), are reasonable. In this table, the annual gross and net aquifer depletions ranging from 2.3% to 6.6% are shown for two possible pumping scenarios assuming a groundwater discharge of 25,700 ac-ft/year (35 cfs). Using a groundwater discharge of 36,600 ac-ft/year (51 cfs) as described above would reduce the depletions to a range of 1.6% to 4.7%. These amounts are real, actual, and quantifiable depletions.

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