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DEPARTMENT OF
WATER RESOURCES

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IN THE DISTRICT COURT OF THE FIFTH JUDICIAL DISTRICT
OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF TWIN FALLS

In Re SRBA

Case No. 39576

Subcase Nos. 63-02529 63-03323
63-03324 63-10435

AFFIDAVIT OF SCOTT N. KING, P.E.

STATE OF IDAHO)
) ss.
County of Ada)

Scott N. King, P.E., having been duly sworn upon oath, deposes and states as
follows:

1. I have a Bachelor of Science degree in General Engineering from Idaho
State University, and a Master of Science Degree in Civil Engineering from the University of

Idaho. I am a certified Professional Engineer by the State of Idaho (No. 7914, 1995), and a certified Water Right Examiner by the State of Idaho (No. 9-133).

2. I have over 18 years of professional and academic experience in water resource engineering. I am currently a Supervising Engineer with SPF Water Engineering, LLC, where I have worked from 2005 to the present, and where I specialize in water right issues, water flow measurement, pumping system design, water well design, and geographic information systems (GIS). Prior to my employment with SPF, I worked at DHI, Inc. from 2004 to 2005, where I was responsible for the development of various surface water models, and at the Idaho Department of Water Resources from 1990 to 2004, where I worked in a variety of positions, including Technical Engineer in the Adjudication Bureau, Staff Engineer in the Water Distribution Section, in the Western Region's Safety of Dams Unit, and in the Energy Division.

3. I believe that my academic background and professional experiences provide me with the knowledge and expertise necessary to understand and analyze IDWR's development and application of its standard of 4.5 acre-feet per acre per year for the irrigation of crops in Basin 63, and the annual diversion volumes that are based on that standard.

4. Precipitation deficit is the appropriate consumptive use parameter for calculation of annual irrigation water requirement. Precipitation deficit is equivalent to net consumptive irrigation requirement, and is the amount of additional water (beyond natural precipitation) that a healthy, vigorous, well fertilized crop without moisture stress will evaporate or transpire if the water is made available at the right time during the growing season.

5. For purposes of determining annual irrigation requirement, the 20% exceedance value is a reasonable statistical variation. A 20% exceedance indicates that, based on statistical analysis of weather data, the precipitation deficit in 80 years out of 100 years will

be less than or equal to the 20% exceedance value. Accordingly, the precipitation deficit in 20 years out of 100 years will be greater than or equal to the 20% exceedance value.

6. Irrigation efficiency is the ratio of the amount of irrigation water used to satisfy the precipitation deficit for the crop to the amount of water applied through the irrigation system. Annual irrigation water supply volume is therefore determined by dividing the precipitation deficit by irrigation efficiency. For example, supplying an annual precipitation deficit crop requirement of 3.0 acre-feet per acre utilizing an irrigation system with an irrigation efficiency of 75% requires an annual irrigation supply volume of 4.0 acre-feet per acre ($3.0 \div 0.75 = 4.0$).

7. Attached hereto as Exhibit A is a true and correct copy of relevant excerpts from IDWR's "Report Regarding Evaluation of Irrigation Diversion Rates," submitted to the SRBA District Court in 1999. According to that report, irrigation efficiencies for gravity irrigation systems (furrow or graded border) can range from 30% to 80%, and irrigation efficiencies for sprinkler irrigation systems can range from 50% to 87%.

8. Based on personal observation and experience, common crops grown in the area served by the water rights in question include alfalfa, pasture or grass hay, sugar beets, field corn, and grass turf (lawn). A crop that is less common but still present in the area is poplar trees. Attached hereto as Exhibit B is a document depicting the 20% exceedance value of growing season precipitation deficit for these crops, which I obtained from the ET Idaho website, and which are based on the Caldwell NOAA, Kuna NOAA, and Nampa Agrimet weather stations. It is my understanding that the ET Idaho data are the most up-to-date determinations of precipitation deficit available, and that these data are utilized and accepted by the Idaho Department of Water Resources.

9. Also listed on Exhibit B, are (1) the required irrigation efficiency to supply the 20% exceedance precipitation deficit given an annual diversion volume limit of 4.5 acre-feet per acre, (2) the annual volume required to supply 20% exceedance precipitation deficit given a typical sprinkler irrigation efficiency of 75%, and (3) the annual volume required to supply 20% exceedance precipitation deficit given a typical gravity irrigation efficiency of 60%.

10. An analysis of Exhibit B demonstrates that the annual growing-season crop precipitation deficit for alfalfa with frequent cuttings will require approximately 5.1 acre-feet per acre under sprinkler irrigation at 75% irrigation efficiency and 6.4 acre-feet per acre under gravity irrigation at 60% irrigation efficiency. A 4.5 acre-foot per acre annual diversion volume limit will require an irrigation efficiency of approximately 86% in order to meet the 20% exceedance irrigation deficit. An 86% efficiency is outside the range of reasonably achievable irrigation efficiency for gravity irrigation. It is also outside the range for all sprinkler systems listed in Exhibit A except for moving lateral (linear) systems.

11. Review of Exhibit B demonstrates that the annual growing-season crop precipitation deficit for grass hay will require approximately 4.9 acre-feet per acre under sprinkler irrigation at 75% irrigation efficiency and 6.1 acre-feet per acre under gravity irrigation at 60% irrigation efficiency. A 4.5 acre-foot per acre annual diversion volume limit will require an irrigation efficiency of approximately 82% in order to meet the 20% exceedance irrigation deficit. An 82% irrigation efficiency is outside the range of reasonably achievable irrigation for gravity systems and at the high range of achievable efficiency for sprinkler systems.

12. Review of Exhibit B demonstrates that the annual growing-season crop precipitation deficit for sugar beets will require approximately 4.6 acre-feet per acre under sprinkler irrigation at 75% irrigation efficiency and 5.7 acre-feet per acre under gravity irrigation

at 60% irrigation efficiency. A 4.5 acre-foot per acre annual diversion volume limit will require an irrigation efficiency of approximately 76% in order to meet the 20% exceedance irrigation deficit. A 76% irrigation efficiency is within the range of reasonably achievable irrigation efficiencies for sprinkler irrigation and gravity irrigation, but may not be achievable in many situations.

13. Review of Exhibit B demonstrates that the annual growing-season crop precipitation deficit for poplar trees will require approximately 5.5 acre-feet per acre under sprinkler irrigation at 75% irrigation efficiency and 6.9 acre-feet per acre under gravity irrigation at 60% irrigation efficiency. A 4.5 acre-foot per acre annual diversion volume limit will require an irrigation efficiency of approximately 92% in order to meet the 20% exceedance irrigation deficit. A 92% irrigation efficiency is not within the range of reasonably achievable irrigation efficiencies for sprinkler irrigation or gravity irrigation. An efficiency of 92% may be achievable with drip irrigation.

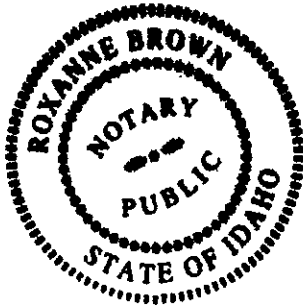
14. Recent crop water requirement information provided by the University of Idaho indicates that in the Nampa-Caldwell-Kuna area, alfalfa hay and other commonly grown highly-consumptive crops, have annual consumptive irrigation requirements approaching and potentially exceeding 4 acre-feet per acre. Provided that typical irrigation efficiency of sprinkler irrigation systems can range from 50% to 87%, total annual diversion water requirements for alfalfa and other highly-consumptive crops when irrigated with typical sprinkler systems could range from 4.6 to 8 acre-feet per acre.

15. Based on the analysis described above, there are common situations where annual diversion volumes of more than 4.5 acre-feet per acre can be beneficially used while maintaining reasonable irrigation efficiencies.

Further your affiant sayeth naught.

Scott N. King
Scott N. King, P.E.

SUBSCRIBED AND SWORN to before me this 11TH day of March, 2009.



Roxanne Brown
NOTARY PUBLIC FOR IDAHO
Residing at Boise, ID
My Commission Expires 5/16/2014

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on this 11th day of March, 2009, I caused a true and correct copy of the foregoing AFFIDAVIT OF SCOTT N. KING, P.E. to be served by the method indicated below, and addressed to the following:

Representing: State of Idaho
David J. Barber
Office of the Attorney General
STATE OF IDAHO
700 West State Street, 2nd Floor
P.O. Box 83720
Boise, ID 83720-0010

☒ U.S. Mail, Postage Prepaid
☐ Hand Delivered
☐ Overnight Mail
☐ Facsimile

Director
IDAHO DEPARTMENT OF WATER RESOURCES
P.O. Box 83720
Boise, ID 83720-0098

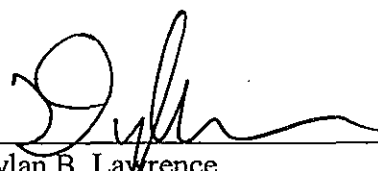
☒ U.S. Mail, Postage Prepaid
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☐ Overnight Mail
☐ Facsimile

Natural Resources Division Chief
OFFICE OF THE ATTORNEY GENERAL
P.O. Box 44449
Boise, ID 83711-4449

☒ U.S. Mail, Postage Prepaid
☐ Hand Delivered
☐ Overnight Mail
☐ Facsimile

UNITED STATES DEPARTMENT OF JUSTICE
Environment & Natural Resources
MSC 033
550 West Fort Street
Boise, ID 83724

☒ U.S. Mail, Postage Prepaid
☐ Hand Delivered
☐ Overnight Mail
☐ Facsimile



Dylan B. Lawrence

EXHIBIT A

TO AFFIDAVIT OF SCOTT N. KING, P.E.

REPORT REGARDING EVALUATION OF IRRIGATION DIVERSION RATES

In Re SRBA

Twin Falls County Civil Case No. 39576

Sub-Case No.: 00-00000

Report to the SRBA District Court

Prepared by the Idaho Department of Water Resources

Karl J. Dreher, Director

David R. Tuthill Jr., Adjudication Bureau Chief

January 14, 1999

REPORT REGARDING EVALUATION OF IRRIGATION DIVERSION RATES

FIELD APPLICATION EFFICIENCY

The field application efficiency (FAE) is defined as an "expression in percent of the amount of water applied to a field that becomes available to the crop" (Hubble Engineering and Associated Earth Sciences, 1991b, p. 60). After an irrigation, the gross irrigation application is not entirely available to the crop. Some of the water is lost to deep percolation, runoff or other losses. These losses are not stored in the crop root zone and are not available to satisfy the ET requirements of the crop. The net irrigation application, as explained earlier in this report, is that portion of the total amount of water applied during an irrigation that is available to satisfy the ET requirements of the crop. FAE can be calculated by dividing the net irrigation application by the gross irrigation application and then multiplying by 100.

Typical or expected values of FAE can be found in existing literature. Some typical FAE values for various systems are as follows: 30 to 80 percent for furrow irrigation systems, 35 to 75 percent for graded border systems, and 50 to 87 percent for sprinkler systems (Idaho Irrigation Water Conservation Task Force, 1994, p. 38). The higher values for each of the ranges given are typical for well designed and properly managed irrigation systems.

The FAE is used, along with the ET requirements of the crop, to determine the field irrigation requirements. The FAE depends on the irrigation system type, system design, and management. Many other factors can influence the FAE such as soil characteristics and field dimensions.

Reasonable Efficiency

The determination of the necessity of an irrigation diversion rate greater than 0.02 cfs per acre must include the determination of reasonable field application efficiencies based on acceptable irrigation practices. IDWR has strived to balance the needs of individual water users with the needs of all water users in order to provide for the greatest benefit from the resource while maintaining seniority protection. Designation of a minimum acceptable FAE was considered as one option to apply to all irrigation systems but that option does not consider the unique combination of conditions that may exist for each individual system on a farm or for various locations around the state.

Economic feasibility plays a large part in the selection of irrigation methods used by a farmer. Other factors include water availability, physical limitations of the land, crop types and water requirements, and local customs and practices, to name a few. These factors need to be considered when determining reasonable efficiencies. "The Department [IDWR] does not intend to place an insurmountable financial burden upon

REPORT REGARDING EVALUATION OF IRRIGATION DIVERSION RATES

downstream because the losses end up back in the stream. Upstream water users, if they exist, generally share the same practices and operate under the same local customs or understandings. In these cases, where no impacts or potential injury to other water users can be identified, the diversion rates required under the existing systems and conditions are considered reasonable and necessary.

Sprinkler Irrigation Systems

Sprinkler irrigation systems are typically more efficient than surface irrigation systems. Historically, many surface systems have been replaced by sprinkler systems. The decision to use a particular irrigation system may depend on factors beyond the control of the farmer (e.g. crop prices, energy costs). To overcome the variability of those factors, farmers should be allowed some flexibility to return to a surface system as necessary. In cases where a water right was originally developed as a surface system, the optimum FAE will be based on the surface system using acceptable irrigation practices as described earlier in this report.

For those sprinkler systems which were originally developed as sprinkler systems, the optimum FAE will be estimated based on typical or expected values found in existing literature. Sprinkler systems are very flexible in their ability to apply water at the necessary rates and time periods for various crops and soil conditions. Properly designed and managed systems will achieve these expected efficiencies under normal conditions.

The Hubble report guidelines (page 25 and Appendix A-7) provide a range of efficiencies for various types of sprinkler systems. The University of Idaho questioned the reasonableness of these efficiency values in their report to HWRO (Hazen, Gibson, and Neibling, 1994, p. 9). The University of Idaho report provided an alternative range of efficiencies for various types of sprinkler systems. These values were originally presented in a 1994 report by the Idaho Irrigation Water Conservation Task Force and are reprinted below (Idaho Irrigation Water Conservation Task Force, 1994, p. 38).

<u>sprinkler system</u>	<u>application efficiency</u>
stationary lateral (wheel or hand move)	60 - 75%
solid set lateral	60 - 85%
traveling big gun	55 - 67%
stationary big gun	50 - 60%
center pivot lateral	75 - 85%
moving lateral (linear)	80 - 87%

EXHIBIT B

TO AFFIDAVIT OF SCOTT N. KING, P.E.

Crop	ET Idaho Site		Growing Season Precipitation Deficit (mm)	Growing Season Precipitation Deficit (ft)	Required Irrigation Efficiency for 4.5 afa annual diversion volume	Annual Volume (af/ac) Required for Sprinkler Irrigation at 75% efficiency	Annual Volume (af/ac) Required for Gravity Irrigation at 60% efficiency
alfalfa - frequent cuttings	Caldwell NOAA	20% exceedance	1221	4.01	89%	5.34	6.68
alfalfa - frequent cuttings	Nampa Agrimet	20% exceedance	1160	3.81	85%	5.07	6.34
alfalfa - frequent cuttings	Kuna NOAA	20% exceedance	1154	3.79	84%	5.05	6.31
	Average		1178	3.87	86%	5.15	6.44
grass hay	Caldwell NOAA	20% exceedance	1152	3.78	84%	5.04	6.30
grass hay	Kuna NOAA	20% exceedance	1114	3.65	81%	4.87	6.09
grass hay	Nampa Agrimet	20% exceedance	1098	3.60	80%	4.80	6.00
	Average		1121	3.68	82%	4.91	6.13
lawn	Caldwell NOAA	20% exceedance	1190	3.90	87%	5.21	6.51
lawn	Nampa Agrimet	20% exceedance	1129	3.70	82%	4.94	6.17
lawn	Kuna NOAA	20% exceedance	1088	3.57	79%	4.76	5.95
	Average		1136	3.73	83%	4.97	6.21
sugar beets	Caldwell NOAA	20% exceedance	1100	3.61	80%	4.81	6.01
sugar beets	Nampa Agrimet	20% exceedance	1024	3.36	75%	4.48	5.60
sugar beets	Kuna NOAA	20% exceedance	1002	3.29	73%	4.38	5.48
	Average		1042	3.42	76%	4.56	5.70
field corn	Caldwell NOAA	20% exceedance	834	2.74	61%	3.65	4.56
field corn	Kuna NOAA	20% exceedance	813	2.67	59%	3.56	4.45
field corn	Nampa Agrimet	20% exceedance	766	2.51	56%	3.35	4.19
	Average		804	2.64	59%	3.52	4.40
Poplar Trees (third year and older)	Caldwell NOAA	20% exceedance	1347	4.42	98%	5.89	7.37
Poplar Trees (third year and older)	Nampa Agrimet	20% exceedance	1229	4.03	90%	5.38	6.72
Poplar Trees (third year and older)	Kuna NOAA	20% exceedance	1218	4.00	89%	5.33	6.66
	Average		1265	4.15	92%	5.53	6.92