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DEPARTMENT OF
WATER RESOURCES

BEFORE THE DIRECTOR
OF THE DEPARTMENT OF WATER RESOURCES
OF THE STATE OF IDAHO

IN THE MATTER OF THE PETITION FOR DELIVERY CALL OF A&B IRRIGATION DISTRICT FOR DELIVERY OF GROUND WATER AND FOR THE CREATION OF A GROUND WATER MANAGEMENT AREA	**SPRONK WATER ENGINEERS, INC. EXPERT REBUTTAL REPORT DATED AUGUST 27, 2008 PREPARED FOR THE CITY OF POCATELLO**

PROFESSIONAL ENGINEER
REGISTERED
8387
8/27/08
STATE OF IDAHO
GREGORY K. SULLIVAN

Spronk Water Engineers, Inc.
1000 Logan Street
Denver, Colorado 80203

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Spronk Water Engineers, Inc.
Expert Rebuttal Report
Dated August 27, 2008
Prepared For The
City of Pocatello

1. <u>**Introduction**</u>

   a. This rebuttal report was prepared by Gregory K. Sullivan, P.E., senior water resources engineer, and the staff of Spronk Water Engineers, Inc. ("SWE"), Logan Street, Denver, Colorado, 80203.

   b. I have reviewed the July 16, 2008 report prepared on behalf of A&B Irrigation District ("A&B") entitled <u>A&B Irrigation District Expert Report</u> ("A&B Expert Report"). The report was prepared by HDR Engineering, Inc., Brockway Engineering, Inc., and ERO Engineering, Inc.

   c. I have reviewed the pre-filed written expert testimony of the following expert witnesses:

      i. Charles E. Brockway, P.E., PhD
      ii. John S. Koreny,
      iii. David B. Shaw, P.E.

   d. I have reviewed the deposition of Dan Temple, manager of A&B, taken on June 24 and 25, 2008.

   e. The opinions described in this rebuttal report are based on our review of the expert report and written testimony, our work since the early 1990s in Idaho, our experience in the review and analysis of irrigation systems, and our experience in conjunctive management and administration of ground water and surface water supplies and water rights. These rebuttal opinions supplement the opinions originally provided in the expert report by SWE dated July 16, 2008 (corrected July 24, 2008).

   f. The focus of this rebuttal report is on the analysis performed by the A&B experts of the irrigation water requirements of Unit B of the A&B Irrigation District, and the alleged water shortages that have been suffered by the Unit B water users. The format used in this rebuttal report is to describe or quote the opinion contained in the A&B Expert Report and/or testimony of A&B's experts (in italics), followed by the rebuttal response.

2. **<u>Separate Analysis of Each Well System</u>**

<u>A&B Opinion (p.4-1)</u>

A&B's irrigation requirements analysis methodology includes a separate analysis for each well system. A&B states "Evaluation of irrigation requirements at individual well systems is necessary, because, with few exceptions, water cannot be shared between well systems. This is a critical aspect of the analysis"

<u>Response</u>

As stated in SWE's Expert Report (p.5), A&B holds a water right for 1,100 cfs with 178 points of diversion to irrigate 62,604.3 acres. In addition, Reclamation's planning documents in 1949 and 1955 both reflect that the A&B water right is appurtenant to all of the lands in the District rather than having separate water rights for individual wells appurtenant to particular parcels of lands. The purpose of adjudicating the water right in this manner was to "permit a more satisfactory distribution of water to lands and maximum over-all development."(USBR, 1949, pp. 70 and USBR, 1955, pp. 73).

The A&B District Manager acknowledged the foregoing nature of the A&B water right during his deposition. Mr. Temple was asked about a water rights transfer application that was approved by IDWR to add points of diversion to A&B's water rights as follows:

> *Q [By Mr. Budge]. And then when you look through the document beyond page 1, there's multiple pages under the added point of diversion. And it would appear to me that the purpose of the transfer application, then, is to add all of your points of diversion for all of your wells as being available points of diversion under each of the water rights so you could pump any quantity that you could out of any point of diversion?*
>
> *A [By Mr. Temple]. That is <u>not</u> my understanding of this. I've always had this understanding from counsel that the district's 1100 cfs was for the whole project.*

It wasn't tied to the lands. It was for the 62,000 or whatever it was. That's always been my understanding.

Q. So it's your understanding that the original 1948 ride (sic) as well as any of the subsequent rides (sic) that you have list all 177 wells as your points of diversion?

A. This lists them, yes. And I believe it's actually more than 177.

(Temple Deposition at 232, emphasis added).

A&B's manager acknowledged that A&B's 1948 water right (and all of the subsequent junior enlargement water rights) are appurtenant to all of A&B's lands. There are not separate water rights for each individual well system for which A&B can make a delivery call.

3. **Other Sources of Water to A&B Lands**

A&B Opinion (p. 4-30)

[Analyses of private wells] show a small percentage (about 3 percent) of the A&B Project lands are covered by supplemental private water. The existence of supplemental private water does not relieve A&B of the responsibility of delivering a full water supply to the water users of the District pursuant to A&B's water rights. Nor does the existence of supplemental private water relieve A&B of taking reasonable efforts to protect its senior water right form injury by junior water users.

Response

Rule 42 of the Idaho Conjunctive Management Rules describes the factors to be considered by IDWR in evaluating material injury in a delivery call. Among these factors are the following:

42.01.g. The extent to which the requirements of the holder of a senior-priority water right could be met with the user's existing facilities and water supplies by employing reasonable diversion and conveyance efficiency and conservation practices.

42.01.h. The extent to which the requirements of the senior-priority surface water right could be met using alternate reasonable means of diversion or alternate *points of diversions, including the construction of wells or the use of existing wells to divert and use water from the area having a common ground water supply under the petitioner's surface water right priority.*

The foregoing factors make it clear that all sources of water available to the water user making the delivery call should be considered in assessing whether the user is short of water. The following are among the sources of water that are available to meet the irrigation water requirements of the Unit B lands:

- <u>Excess supplies from existing Unit B wells</u> - With an adequate water distribution system, water could be distributed from wells with surplus pumping capacity to wells with inadequate pumping capacity.
- <u>Private wells</u> - Certain A&B users own private irrigation wells, and the contribution from these wells in meeting A&B's irrigation demands should be considered.
- <u>New supplemental wells</u> - A&B could construct additional wells to provide supplemental water supplies for well systems that it claims are short.
- <u>Conversions of surface water supplies (e.g., from Unit A)</u> - A&B has converted certain well systems in the southwest portion of the Unit B service area to use surface water pumped from the Snake River through the Unit A delivery system. Deliveries of surface water to these users should be considered in an analysis of water supply adequacy.
- <u>Drain/Re-lift Pumping</u> - The water supply that A&B pumps from drains for irrigation use should be considered in evaluating Unit B shortages.

4. **<u>Cropping Pattern</u>**

<u>A&B Opinion (p. 4-2)</u>

The current average crop mix across the District during the study period was obtained from Table 1-4, page 10, A&B Water Management and Conservation Plan, 2002. Based on conversations with Dan Temple, A&B's Manager, it is reasonable to assume that this crop mix represents the average current crop distribution for the study period. The major crops grown on A&B include barley, potatoes, wheat, alfalfa, sugar beats, and beans. The crop mix percentages used are shown on Table 4-3.

Response

A&B performed a separate water supply adequacy analysis for each of 124 well systems (certain of the 135 well systems in Unit B were combined for analysis purposes by the A&B experts). The same systemwide crop distribution was used in each well system analysis. In any particular year, it is obvious and intuitive that the farmers under each well system would not plant the same crops in the same proportions. Similarly, the crop distribution under each well system would not be the same from one year to the next. Farmers typically rotate their crops from one year to the next to enhance soil fertility, manage pests, and to maximize profits depending on crop prices.

Use of a set cropping distribution by the A&B experts in their analysis of the individual well systems will increase the magnitude of the irrigation shortages they compute because of mismatches between the reported pumping and the irrigation demands for the assumed constant cropping distribution. For example, the operator(s) of a particular well system might have a contract to grow all grain (or predominantly grain). Grain is typically harvested in July and the grain fields would not be irrigated during July or August. Irrigation may commence again in September when another grain crop is planted, or possibly not until the succeeding year if another crop is planted. Use of the district-wide average cropping pattern in analysis of a well system planted predominantly in grains would show irrigation water demands in July and August that do not exist in reality. Comparison of the actual reported pumping to the demand would result in computed shortages in July and August that are not real.

An example of this mismatch in actual supply and computed demand is evident in the analysis by the A&B experts for Well System 24A825 in 2007. **Figure 1** shows the monthly supply demand for this system for 2007 taken from Appendix M of the A&B expert report. The reduced pumping in July, and absence of pumping in August, is likely due to the reduced irrigation demand (e.g., because the crop had been harvested) in those months, and not because the wells were somehow unable to deliver water to meet the computed demand.

As the above example illustrates, reliance on a district-wide cropping pattern as in input to a well-system-by-well-system analysis has real potential for shortages to be computed because of mismatches between the computed irrigation demand and the reported pumping. Any differences between the actual cropping distribution for individual well systems and the district-wide distribution has the potential to create artificial water shortages. **Figure 2** was prepared to show the differences in amount and timing of the irrigation requirements of the various crops that are raised in the Unit B service area.

If the system-by-system analysis concept proposed by the A&B experts was determined to be appropriate, notwithstanding the argument for a District-wide analysis due to the nature of the A&B water right, the use of a set cropping pattern for each system across all years is inappropriate and renders the results of the analysis by the A&B experts meaningless.

5. **Soil Moisture**

The A&B experts did not include soil moisture in their crop irrigation requirements analysis for several reasons. The following are the opinions advanced by the A&B experts as a basis to exclude soil moisture accounting in their analysis, along with our rebuttal to those opinions.

A&B Opinion (p. 4-4)

Unit B was designed and is operated as an on-demand system using individual wells without storage, meaning that the individual wells are operated and must be maintained to provide the supply necessary to meet the irrigation demand when it is needed.

Response

Crop roots extract water from the soil column to meet the crop ET requirements. In arid areas such as Idaho, water enters the soil column primarily through irrigation, and to a lesser extent from precipitation. The purpose of irrigation is to refill the soil column within the root zone of the crop after it has been depleted over a number of days or weeks by the crop evapotranspiration processes. If farmers did not or could not use the soil moisture column as a water storage reservoir, it would be necessary to apply irrigation water continuously and in daily varying amounts to meet the crop ET requirements. Attempting to exactly match the daily crop ET would be impractical and wasteful because it would be impossible to match the daily irrigation application with the uncertain daily ET variability. In addition, most Unit B sprinklers are moved manually (e.g. side-rolls) or automatically (e.g., center pivots) over a period of days across the irrigated fields, and therefore cannot apply irrigation water continuously.

Based on testimony from farmers and operators of the irrigation systems of the members of the Surface Water Coalition ("SWC"), the hearing officer in the SWC delivery call case found that analysis of soil moisture is a factor to be considered in analysis of irrigation systems and water supply adequacy (2008 Order at XIV.6.d; p. 52).

There is no evidence cited in the A&B report or testimony from Mr. Temple's deposition that all of the A&B well systems have sufficient capacity to deliver water at the peak demand rate determined by the A&B experts, even if the water was physically available.

Given the high cost of irrigation supply and distribution systems, irrigation systems may be designed to deliver water at less than the rate of the peak crop irrigation water requirement. These systems are designed to utilize water stored in the soil moisture along with the water pumped to meet the peak irrigation water demands. Sizing the irrigation system to deliver less than the peak irrigation demand can result in substantial cost savings.

<u>A&B Opinion (p. 4-4)</u>

Storing water in the soil column so that only a portion of it may be used later imposes a risk of A&B incurring additional pumping costs. In order to use the soil moisture zone efficiently and not waste water, A&B would need to only apply enough water to fill the AW capacity of the soil. If A&B applies excess water, and it rains the next week and the soil moisture column is filled and water drains below the root zone the efficiency of the applied water to meet the crop demand is reduced.

Response

The A&B experts claims that storing irrigation water in soil column increases the risk that the subsequent precipitation events will percolate below the root zone because the soil column is already filled with irrigation water. In arid regions like the Snake River Plain, farmers cannot depend on future precipitation events to satisfy future irrigation demands because the precipitation is infrequent and unpredictable. If a farmer waits for rain that does not occur, then it may be too late to irrigate given the number of days that it takes to irrigate a large field (e.g., it may take a large center pivot a week to circumnavigate a field). Even if the rain could be accurately forecast in advance, there typically is very little of it during the peak irrigation demand periods on the Snake River Plain. The effective precipitation on the Snake Plain averages less than 1.5 inches during the three month period from June through August.

The discussion in the A&B expert report suggests that deep percolation losses are somehow avoidable if they operate "on-demand" without using soil moisture. Such operation would imply that the A&B farmers were capable of delivering water with irrigation application efficiencies approaching 100 percent. However, application efficiencies at such a high level are not possible on a consistent basis, and some deep percolation losses are unavoidable, even with careful management of sprinkler systems.

The A&B experts have assumed sprinkler application efficiencies ranging from 60 percent in the shoulder months to 80 percent in the peak demand months. This means that application losses range from 20 percent to 40 percent of the water applied. The assertion that filling soil moisture may result in avoidable deep percolation losses is not consistent with the application efficiency assumptions made by the A&B experts.

A&B Opinion (p. 4-5)

There is also a practical limit to the ability of a farmer to schedule and provide manpower for "overwatering" since it must be scheduled around tilling, planting and under optimal weather conditions and other factors that influence the farmer's decisions on when to apply irrigation water.

Response

Providing adequate water to the crop is the first priority of irrigation, for if the water supply is not provided on a timely basis, then there may be no crop to harvest. Because the peak irrigation demands in Unit B do not typically occur until July, there is plenty of time available in the early irrigation season to fill the soil moisture reservoir in advance of the peak demand period.

A&B Opinion (p. 4-5)

From a practical standpoint, it is unlikely that the District could require its farmers to bear the extra costs of running sprinklers longer than needed in the spring in attempt to store extra water in the soils. A&B should not be required to bear the cost of scheduling water delivery for distribution to soil moisture storage that may or may not occur (depending on whether farmers can actually apply the water within the current crop planting and weather schedules) and which may or may not be used (depending on unpredictable future weather, climate, crop demand and planting and harvest schedules coincide to create crop ET demands to use the water stored in the soil).

Response

Common sense dictates that users of a irrigation delivery system that is not quite capable of delivering water to meet the peak crop water demands would make sure that the soil moisture reservoir is full at the start of the peak irrigation demand period. That way, the combination of the applied water plus the stored soil moisture can be used to meet the peak water requirements. This results in gradual depletion of the soil moisture column through the peak demand period. Later in the year or at the beginning of the subsequent year when crop demands are lower, the soil moisture column can be refilled in advance of the next peak demand.

The A&B experts claim that the District cannot force farmers to bear the extra costs of running sprinklers longer in the spring to store water in the soils. Nobody is suggesting that A&B must force farmers to operate to fill their soil moisture in the spring. However, farmers will fill their soil moisture in the spring if it helps them to meet their peak demands simply because it is a sensible way to operate. The slight added cost of filling the soil moisture prior to the peak demand period provides valuable insurance against potential crop loss resulting from greater than normal water demands that could outstrip the capacity of their pumping systems.

A&B Opinion (p. 4-6)

There may be extra water being applied now at some times early or late in the season but if that is happening it is not part of A&B's normal operational practices. A&B's (sic) attempts to schedule pumping to meet the demand. Therefore, the evaluation of the irrigation diversion requirements should assume that A&B will only pump ground water on demand (as needed to meet the irrigation requirement when it occurs).

Response

Based on the above described rebuttal points, soil moisture storage should be considered in evaluating the adequacy of farm irrigation systems to meet peak irrigation demands.

6. **Peak Irrigation Requirements**

A&B Opinion (Koreny testimony p. 9)

The peak July demand during the period (1995-2007) was in 2007, when the peak irrigation diversion requirement was 1.09 acre-ft/acre (0.89 miner's inch/acre or 1,107 cfs for the sum of individual well systems.

Response

The peak irrigation requirement of 0.89 miners inches per acre determined by the A&B experts is defined as a pumping requirement before delivery losses. The A&B experts assumed that delivery losses average 3 percent of pumping. Reducing the pumping requirement by 3 percent for delivery losses results in an equivalent peak farm delivery requirement of 0.86 miners inches per acre. This compares to a peak delivery requirement computed by the Pocatello experts of 0.65 miners inches per acre.

In order to assess the reasonableness of these figures, they were compared to other relevant farm delivery information, including data developed during the SWC delivery call case. The following is a summary of various data and information to which the Unit B delivery requirements may be compared.

a. Letter from A&B Manager in 1984 - In a May 24, 1984 letter to the Bureau of Reclamation, the A&B Manager, Elmer G. McDaniels, stated the design criteria for the A&B District was set at 0.75 miner's inch per acre (**Appendix A**). He noted in the letter that there was *"concern amoung (sic) A&B irrigators that for gravity irrigation this flow is inadequate or 'tight' during the peak demand period, although there has been no noticeable restriction in crop yields."* Mr. McDaniels also noted that the farm efficiencies will be considerably higher with sprinklers, but advocated using the 0.75 miner's inch per acre delivery rate for new lands proposed to be developed as an Extension of the original project so for consistency of managing the project.

b. 2007 Motion to Proceed - In 2007, A&B filed a Motion to Proceed with IDWR to recommence its delivery call. In that motion, A&B claimed that a diversion of 0.75 miner's inches per acre was necessary during peak demand periods. Based on an average delivery loss of 3 percent, this diversion requirement would translate to a farm delivery requirement of 0.73 miner's inches per acre.

c. TFCC Delivery Requirements - The Hearing Officer in the SWC delivery call case ruled that the full headgate delivery for the Twin Falls Canal Company ("TFCC") should be 5/8 miners inch per acre (0.625 miners inch per acre) (2008 Order at XIV.7.g; p. 53). This figure was determined based on internal documents of the TFCC. It was developed when the TFCC was under 100 percent gravity irrigation.

d. SWC Experts Computation of A&B Unit A Peak Irrigation Demands - The experts for the SWC computed monthly irrigation demands for the A&B Unit A in the SWC delivery call case over a study period from 1995 through 2007. The maximum monthly farm headgate delivery requirement for A&B from that analysis was 0.52 miner's inches per acre. This is a weighted average delivery requirement for an irrigation system comprised of 73% sprinklers and 27% gravity irrigation.

7. **Differences Between Expert's Computation of Peak Irrigation Requirements**

The differences between the peak delivery requirement computed by the A&B experts (0.86 miner's inches per acre) and the Pocatello experts (0.65 miner's inches per acre) was evaluated by review of the different assumptions and data used in their respective analyses. The assumptions used in A&B's irrigation requirements analysis are described on page 4-1 through 4-6 of the A&B expert report, and the analysis by the Pocatello experts is described in Appendix A of the 2008 Pocatello expert report. The following is a summary of the key input data and assumptions used by the experts to compute the peak irrigation requirements of the Unit B lands.

a. Crop Irrigation Requirements - The analysis by the A&B experts utilized Agrimet data published by Reclamation to determine monthly crop evapotranspiration. Effective precipitation was determined using a scaling factor using precipitation data which was subtracted from crop evapotranspiration to determine the crop irrigation requirement. The analysis by the Pocatello experts utilized crop irrigation requirement determined by Allen and Robison (Allen and Robison, 2007) for 1990 to 2005 and Reclamation's Agrimet data for 2006 and 2007[1]. There are also some differences in cropping pattern, most notably that the A&B experts assumed that summer grains comprised 49 percent of the lands irrigated, while the Pocatello experts use a cropping pattern with 27 percent of the lands in summer grains and 20 percent in winter grains.

b. Farm Irrigation Efficiency - The farm irrigation efficiency utilized by the A&B experts was estimated by tabulating the percentage of lands served by gravity and sprinkler

[1]The Allen and Robison crop evapotranspiration and irrigation requirement data is published through 2005 for the Rupert National Weather Station, therefore Agrimet data was used for 2006 and 2007.

methods and assigning an assumed monthly irrigation efficiency to each application method. The A&B farm irrigation efficiencies assumed by the A&B experts are reported in Table 4-7 of the A&B Expert Report, and ranged from 60% to 80% for sprinklers and 55% to 60% for gravity methods. The 2007 weighted average peak season farm irrigation efficiency for the assumptions used by the A&B experts was approximately 79 percent (96% sprinklers and 4% gravity). The weighted average seasonal farm irrigation efficiency used in the analysis by the Pocatello experts was more conservative at 71 percent.

c. <u>Soil Moisture Storage</u> - The A&B experts simulated no soil moisture storage in determining peak season irrigation delivery requirements. The Pocatello experts simulated a soil moisture reservoir of 3.25 inches of water storage capacity that could be carried from one month to the next to help meet peak irrigation demands.

In order to determine the differences between the expert analyses, the analysis by the Pocatello experts was repeated using the CIR data, the farm efficiencies and the soil moisture assumptions used by the A&B experts. The results of this alternative analysis are shown in **Table 1**, and show a peak farm delivery requirement for the Unit B lands 0.86 miner's inch per acre, which is the same result determined by the A&B experts in their analysis.

Changing the assumptions in the alternative analysis to simulate a soil moisture reservoir of the 3.25 inch capacity used by the Pocatello experts results in a peak farm irrigation requirement of 0.58 inches, as shown in **Table 2**. Comparison of the results of the two alternative analyses shown in **Tables 1 and 2** indicates that the major difference between the analyses by the A&B experts and the Pocatello experts lies in the assumption regarding the use of soil moisture.

8. **Irrigation Water Shortages**

A&B Opinion (p. 4-6 - 4-7)

The A&B experts computed the monthly irrigation diversion requirements for each of the Unit B well systems and compared the results to the monthly pumped amounts for each well system. Monthly irrigation shortages were computed for each individual well system by subtracting monthly amount pumped by the system from the computed monthly irrigation requirement for that system. The total annual and monthly computed shortages are presented in the A&B expert report on Tables 4-8 and 4-9, respectively. A&B's results indicate that, *"the total annual shortages for Unit B ranged from about 16,315 acre feet to 43,208 acre-feet per year, which is about 10 to 21 percent (average 17 percent) of the total irrigation diversion requirement."*

Response

As noted earlier in this report and in SWE's Expert Report, A&B's claim of shortages for individual wells or well systems does not appear to be consistent with how A&B's water right was decreed. Notwithstanding the inappropriateness of a well-system-by-well-system approach, the A&B experts compared the reported monthly pumping volumes for each well system to the estimated monthly irrigation water requirements. Shortages were computed for each well system during all months in which the reported pumping was less than the estimated irrigation water demand. Examples of the results of the A&B analyses for various well systems are shown in **Figure 3**. These graphs were developed from the shortage analysis prepared by the A&B experts for 2007 with the results converted to consisten units of miner's inches per acre. A&B's analysis includes similar comparisons between monthly supply and demand for each of the well systems during each year of a 1995 - 2007 study period. The analysis methodology used by the A&B experts overstates the irrigation shortages for the following reasons:

a. Cropping pattern - As described above in Section 4, A&B's use of the same district-wide cropping pattern for analysis of individual well systems results in computed shortages to irrigation demands that do not exist in reality. In order to perform a system-by-system analysis, the A&B experts would need to use system-by-system and year-by-year cropping patterns, rather than a single district-wide cropping pattern.

b. Soil moisture reservoir - As described above in Section 5, the A&B experts did not consider the ability of irrigators to use soil moisture storage as a means to help meet crop water needs during peak demand periods. If they had considered soil moisture, then the computed shortages would have been less.

c. Monthly volume pumped - The A&B experts computed shortages during any month in which the amount pumped was less than the estimated irrigation demand. For many well systems, this resulted in computed shortages not only during the peak demand months of July and August, but also during the shoulder months of the irrigation season. This results in shortages computed in the shoulder months when A&B's own production records show that the well systems actually pumped much greater volumes in other months of the same year. This result doesn't make any sense because the maximum monthly pumping volume typically occurs during mid-summer, and this volume could be pumped during other months if desired by the A&B users.

In **Figure 3**, the maximum monthly pumping volume for each well system is plotted as an orange-dashed line on the charts. The orange-colored area shows the amount of additional pumping, up to the estimated demand that could be pumped from each well system if the well produced up to the maximum monthly pumping volume in any month, as needed. The orange-shaded portion of the shortage computed by the A&B experts is clearly unreasonable as it results from the pumping that is less than what the well system was able to produce during other portions of the year (typically during the peak demand period). The shortages estimated by the A&B experts are overstated by the amounts illustrated by the orange-shaded areas in the charts. This error plagues the analyses of all well systems by the A&B experts.

d. Reported pumping capacity - The analysis by the A&B experts also does not consider the actual capacity of the A&B well systems to deliver irrigation water. In assessing the shortages that may have occurred to the Unit B water users, it is not reasonable to compare calculated demand to actual pumping, if the actual pumping is less than what could have been pumped. If actual pumping is less than well production capacity, such differences suggest management decisions by individual farmers rather than insufficient supply.

The A&B Annual Pump Reports tabulate the low discharge rate and the high discharge rate during the year for each well system. According to A&B information and the testimony of Dan Temple, the low discharge rate represents the lowest discharge that each well system was capable of producing during each year. Comparison of the low discharge rate and the monthly volume pumped during the peak demand month shows that many well systems were operated at less than the low discharge rate. These well systems could have produced more irrigation water during the peak demand period had they been operated at the level of the low discharge rate. The low discharge rate should represent a conservatively low estimate of the amount of water that each well system is capable of producing since the the reported high discharge rate is typically significantly greater, indicating that the well can, at times, produce greater amounts.

The low discharge rate for each well system is plotted on the 2007 supply and demand charts provided in **Figure 3** from the analysis by the A&B experts. The charts show that the low discharge rate is above the maximum monthly pumping for most of the well systems. The violet-colored areas in the charts represent the amount of additional pumping, up to the estimated irrigation delivery demand that could be pumped from each well system if the well was operated continuously at the low discharge rate. The violet-colored areas represent further overstatement of the shortages computed by the A&B experts (in additional to the overstated shortages represented by the orange shaded areas). Over 90 percent of the well systems analyzed by the A&B experts have additional overstated shortages due to the low discharge rate being greater than the monthly pumping during the peak demand period.

Figure 4 was prepared to further illustrate the mismatches between pumping and demand. Daily pumping data were obtained from A&B for the individual well systems. These daily pumping data are plotted in Figure 4 for each of the Item G well systems, along with (a) the monthly diversion demands computed for 2006 by the A&B experts, and (b) the reported low discharge rate reported by A&B. Similar to Figure 3, the charts in Figure 4 show the unreasonableness of the well-system-by-well-system analysis arising from mismatches in pumping and demand. The charts also show how the various well systems are operated. Some wells are operated relatively continuously, as would be expected during peak demand periods, while other well systems are turned on and off.

e. <u>Shortages for converted well systems</u> - Review of the charts of monthly supply and demand provided by the A&B experts revealed five well systems in which there was little or no pumping during portions of the study period. Supply and demand charts for 2007 for these systems are shown in **Figure 5**. Investigation of the well systems shown in **Figure 5** indicated that these were well systems that were converted from ground water to surface water supplies. The surface water supply was obtained from the Unit A surface water distribution system which is adjacent to the southwest boundary of the Unit B service area. Except for a small amount of pumping in one month, the 2007 shortage for the converted well systems was equal to the entire irrigation delivery demand of these systems because the A&B experts did not consider the surface water supplies that were delivered to these users. This is contrary to Rule 42.01.g which requires that all supplies be considered in an injury determination.

f. <u>Accuracy of water demand estimates</u> - In addition to the error in the water demand analysis resulting from not determining the cropping pattern for each well system, there are other potential errors the may cause the water demand estimates for the individual well systems to be inaccurate. These errors include the following:

i. Climate data - Crop irrigation requirements are based on climate data from weather stations that may not accurately represent the climate in all portions of the Unit B service area.

ii. Farm irrigation efficiency - The farm irrigation efficiencies assumed by the A&B experts may understate the efficiencies actually achieved by certain users.

iii. Conveyance losses - The 3% conveyance loss assumed by the A&B experts may overstate the delivery losses for users that have fully piped delivery systems.

iv. Irrigated area - Any mismatch in assignment of irrigated area to the various Unit B well systems has the potential to increase the computed shortages for particular well systems. The A&B analysis shows some instances where the irrigated area used to compute the irrigation demand does not match the irrigated area described for their description of the acres associated with the 1948 water right (see Item B of the 12/14/2007 response to request for information from IDWR).

g. Summary of overstated shortages in A&B shortage analysis - Two tables were prepared to summarize the shortage estimates computed the A&B experts. **Table 3** shows the total annual shortage computed by the A&B experts (col. 1), and the portions of the total shortage attributed to various categories of well systems. Columns (2) through (5) show the annual shortages attributed to well systems that reportedly receive supplemental water. The amount of supplemental water that these systems receive has not been quantified by A&B. Obviously, any additional water that is used within these systems would reduce the computed shortage. The annual shortage computed by the A&B experts for systems that reportedly receive supplemental water averages approximately 11,829 af/y, or about 40 percent of the total average annual shortage. Of the remaining approximately 17,500 af/y average annual shortage, 12,986 af/y is for Item G wells claimed by A&B as being short (col. 6), and 4,469 af/y is for non-Item G wells.

Table 4 summarizes the adjustments that would be appropriate to make to the shortage calculations by the A&B experts to consider (a) the shortages attributed to well systems converted to surface water, (b) consideration the maximum amount pumped by each well system each year, and (c) the pumping that could occur up to the reported low discharge rate. Column (1) shows the total combined annual demand for all well systems, which averages 173,203 af/y. The computed total annual shortage is shown in column (2), and averages 29,284 af/y. The shortage for well systems converted to surface water averages 4,382 af/y as shown in column (3). The remaining shortage for wells not converted to surface water averages 24,901 af/y as seen in column (4). The remaining shortage was adjusted for the amount of pumping that was less than the maximum reported pumping in each year under each well system as described in Section 8.c above. This adjustment reduced the computed shortage by 14,888 af/y, leaving a remaining shortage of 10,013 af/y as shown in column (5). Another adjustment was made to consider the additional pumping that could occur up to the reported low discharge rate for each well system as described in Section 8.d above. This adjustment further reduced the computed shortage by an average of 6,098 af/y, leaving a net remaining shortage averaging 3,915 af/y shown in column (6). The net remaining shortage averages 2.1 percent of the total annual demand.

9. **<u>Changes in Crop ET</u>**

A&B Opinion (pp 4-10)

The Agrimet crop ET data shows a significant increase over the 1955 DPR crop ET. The difference between Agrimet crop ET and the 1955 DPR crop ET is due to transition to higher water-demand crops, a shift to more-intensive cropping and farming practices to achieve higher yields and a long-term increasing trend to hotter, dryer summer temperatures.

Response

The A&B experts provide only suppositions and generalizations to support the above statements. There is no data or analysis presented to support the claim on page 4-10 of the

A&B expert report that higher water-demand crops are being irrigated by the A&B users, that the users employ more intensive agricultural practices with more frequent cuttings and plantings.

10. **Trends in Crop ET**

A&B Opinion (pp 4-10)

It is apparent from the Agrimet data for 1990 through 2007 (shown in Figures 4-11 through 4-14) that crop ET has increased significantly (up to 1 to 2 inches/month) over the past 18 years.

Response

While crop ET may have increased between 1990 and the present, this is likely due to the fact that the 1990s were generally cooler and wetter than the 2000s. Review of long term ET data do not show a long-term trend in ET. **Figure 6** plots the monthly Allen and Robison CIR[2] for June, July, and August for the Rupert climate station over the period of record (1907 - 2002) (Allen and Robison, 2006, revised 2007). Trend lines plotted through the data are relatively flat, showing no substantial long-term trend.

11. **Curtailment to Meet Peak Demands**

A&B is seeking curtailment of junior ground water users to restore pumping capacity in certain of its wells that it claims are unable to produce 0.89 miner's inches per acre. As described in Section 5, this peak demand does not consider the extent to which this peak demand could be reduced by considering the amount of soil moisture that could be used to reduce the peak delivery requirement from the wells. Further, this peak demand represents the maximum demand occurring during the 13 year study period analyzed by the A&B experts. The pumping water requirement in other years would be less, as shown in **Table 5.**

[2] IDWR has endorsed the use of the Allen and Robison ET and CIR data (see IDWR Administrative Memo No. 15).

The Idaho Conjunctive Management Rules provide for considering maximum utilization of the resource in implementing administration of the prior appropriation doctrine. While we do not agree with the 0.89 miner's inch per acre pumping requirement determined by the A&B experts, even if this figure was found to be appropriate, it is unreasonable to curtail vast quantities of junior pumping to restore pumping to a few wells that may be incapable of pumping at the 0.89 miner's inch per acre rate. Further, as described in the SWE expert report, A&B's 1948 water right is a single water right with multiple points of diversion. To the extent there are problems with the capacity of a few wells, the nature of A&B's water right dictates that A&B distribute water from wells that have sufficient capacity to the areas that may be experiencing a shortage.

12. **August 18, 20, 2008 Field Visit**

Greg Sullivan of Spronk Water Engineers, Inc. performed site visits to Unit B lands on August 18 and 20, 2008. The visits entailed driving through the service area to observe the general conditions of the crops and fields. Photographs were taken of the fields throughout the service area. Copies of the photographs and a map showing their location are exhibits to this report. On the day the photographs were taken, the reported high temperature in Rupert was 92 degrees F. and it was fairly windy. Despite the conditions, the crops and the fields were in generally excellent condition. The overall appearance of the Unit B service area was comparable to the excellent conditions that were observed in the service areas of the SWC members during site visits of those areas performed in 2005. It appeared that virtually all of the fields were under irrigation, except some pivot corners.

13. References

1. A&B Irrigation District, Information from A&B in Response to Order Requesting Information for A&B Delivery Call, December 14, 2007.

2. A&B Irrigation District, Motion to Proceed, March 16, 2007.

3. Allen, R., & C. Robison, Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho, University of Idaho, September 2006, revised April 2007.

4. Idaho Department of Water Resources, Amended Order, May 2, 2005

5. Idaho Department of Water Resources, Miscellaneous Memo No. 16, Crop Consumptive Use Data For Water Right Review, February 11, 2008 .

6. University of Idaho, Idaho Crop Irrigation Water Requirements, 2007 http://www.kimberly.uidaho.edu/ETIdaho/

7. Surface Water Coalition, Letter to Director: Request for Water Right Administration in Water District 120 (portion of the Eastern Snake Plain Aquifer) / Request for Delivery of Water to Senior Surface Water Rights, January, 14, 2005.

8. Schroeder, G., Opinion Constituting Findings of Fact, Conclusions of Law and Recommendation, April 29, 2008.

9. Temple, 2008, Deposition of Dan Temple, Volume I and II, June 24 and 25.

10. United States Bureau of Reclamation, 2007 Agrimet Irrigation Water Requirements, 2007. http://www.usbr.gov/pn/agrimet/webarcread.html

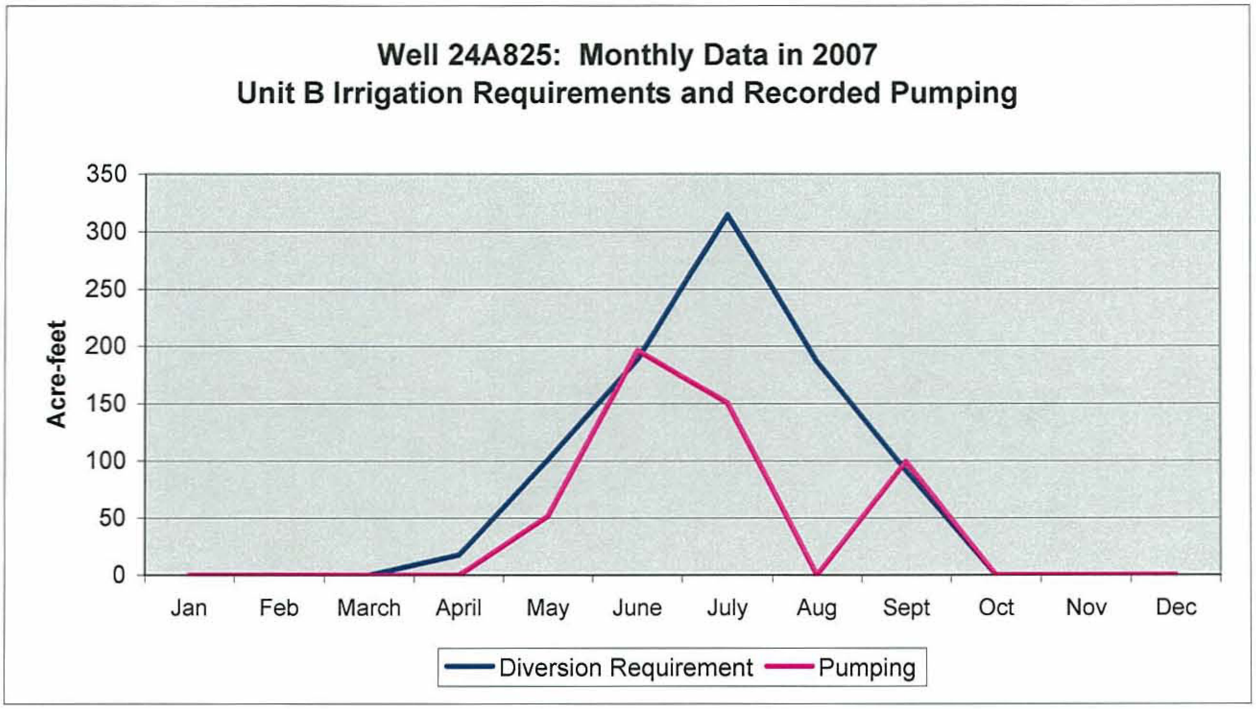
11. United States Bureau of Reclamation, 1955, , Minidoka Project, North Side Pumping, Idaho, Definite Plan Report, Volume 1 - General Plan.

12. United States Bureau of Reclamation, 1946, Minidoka Project, North Side Pumping, Idaho, Project Planning Report No. 1-5.53.I-1.

13. United States Bureau of Reclamation, 1985, Minidoka Project, Idaho-Wyoming North Side Pumping Division Extension, Hydrology Appendix.

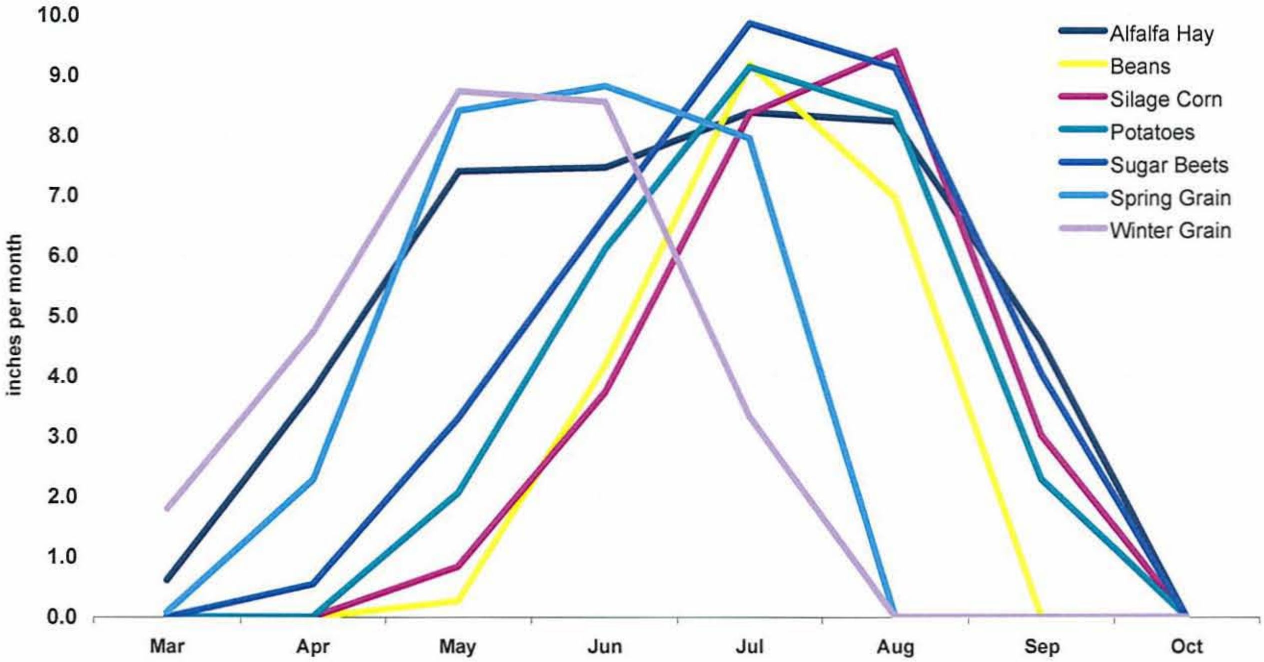
Figures

Figure 1



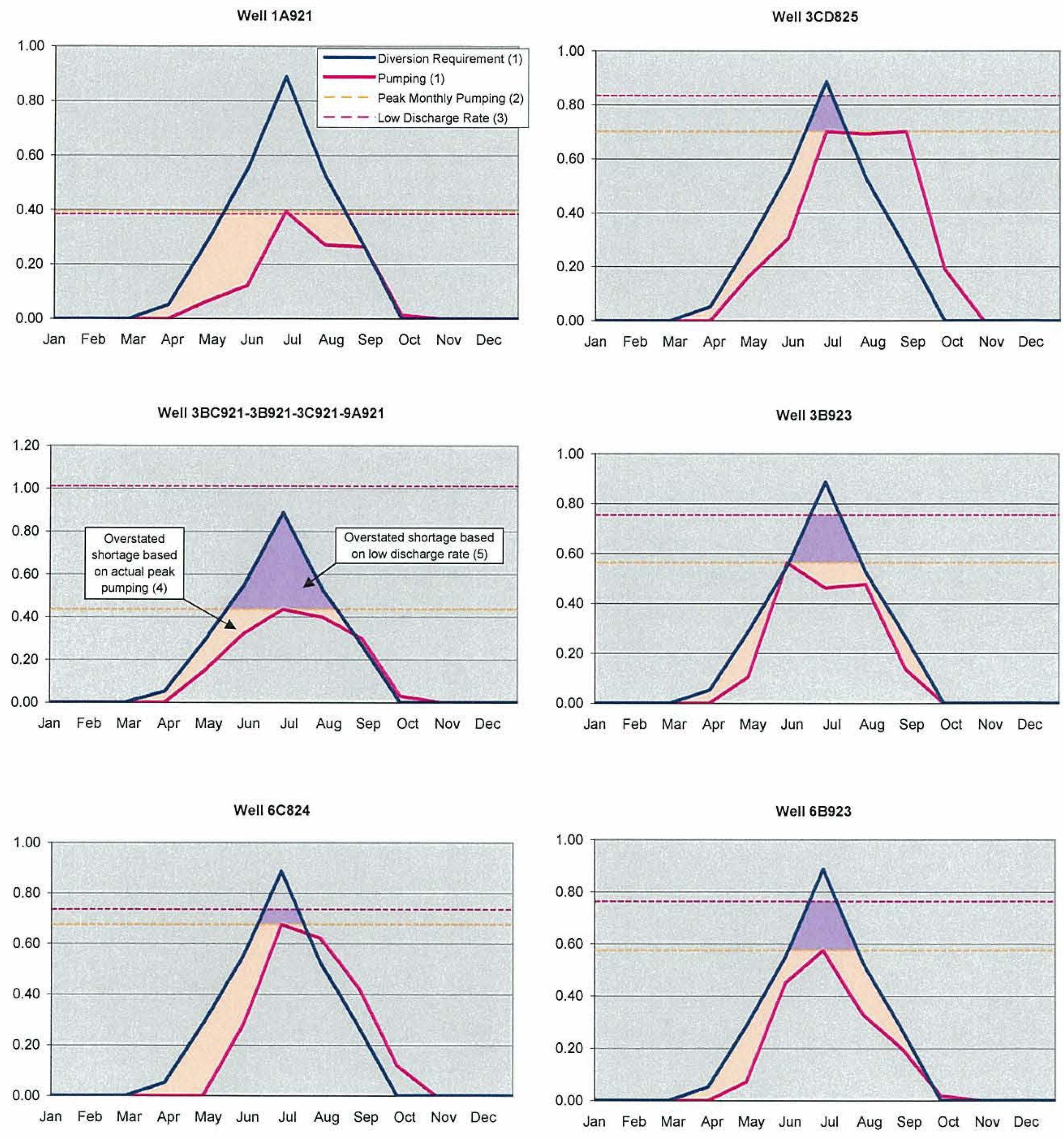
Source: Appendix M of the A&B Irrigation District Expert Report dated July 16, 2008
A&B spreadsheet: Irrigation Diversion Requirement Well System Graphs.xls

Figure 2
2007 Monthly Agrimet Crop Irrigation Requirements
(inches per month)



Source: Crop Irrigation Requirement computed using Agrimet crop evaportranspiration data adjusted for effective precipitation using TR 21.

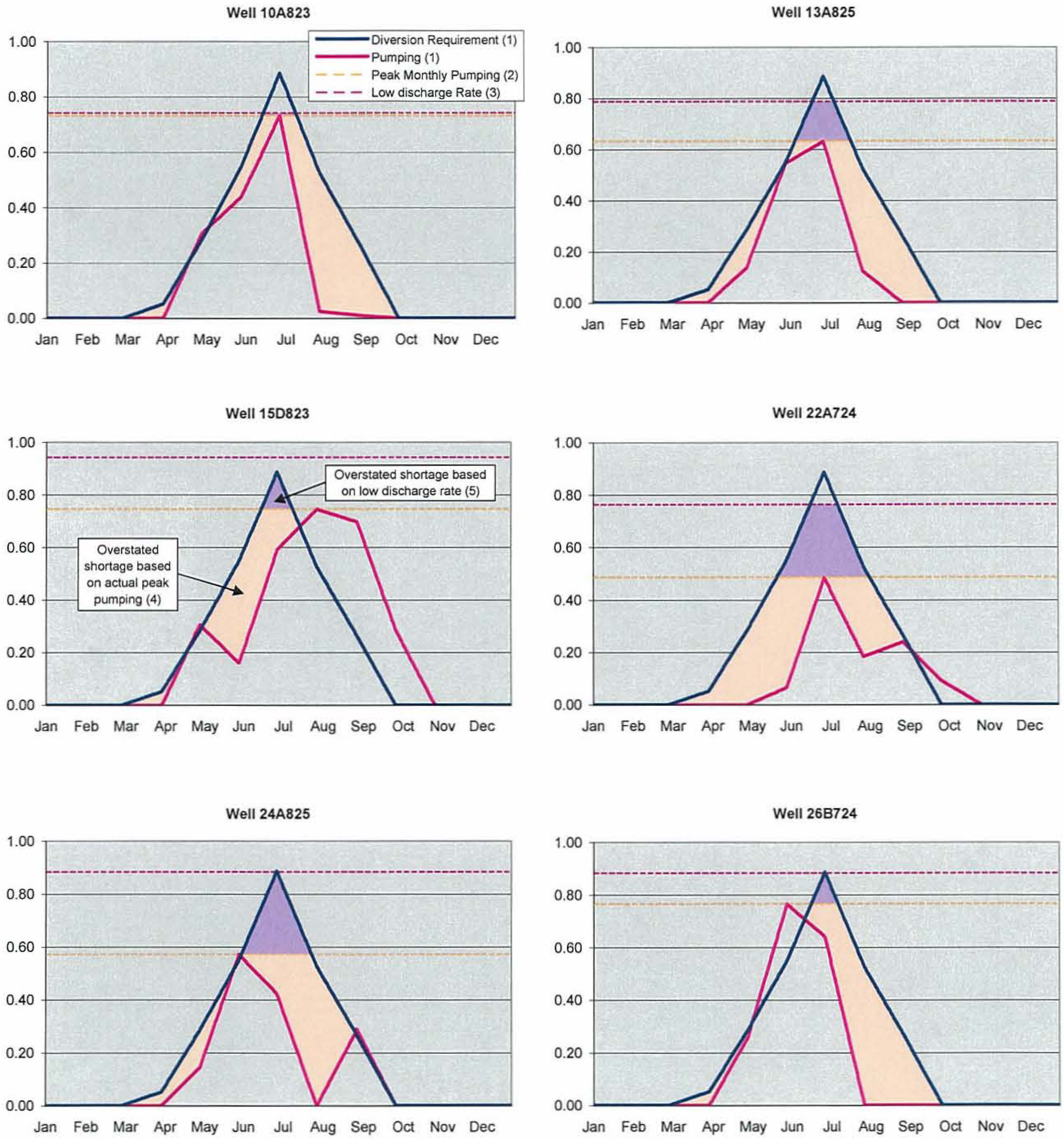
Figure 3
2007 Irrigation Diversion Requirement and Pumping for Selected Unit B Systems
Computed by A&B Experts
(miner's inches / acre)



Notes

(1) Monthly diversion requirements and pumping from A&B experts Irrigation Diversion Requirement Well System Graphs.xls and converted to miner's inches per acre.
(2) Horizontal line representing the peak monthly pumping volume converted to miner's inches per acre.
(3) Horizontal line representing the reported low discharge rate from the A&B 2007 Annual Pump Report.
(4) Overstated shortage assuming that the peak monthly pumping could be produced in any month.
(5) Overstated shortage assuming that the reported low discharge rate could be produced in any month.

Figure 3
2007 Irrigation Diversion Requirement and Pumping for Selected Unit B Systems
Computed by A&B Experts
(miner's inches / acre)



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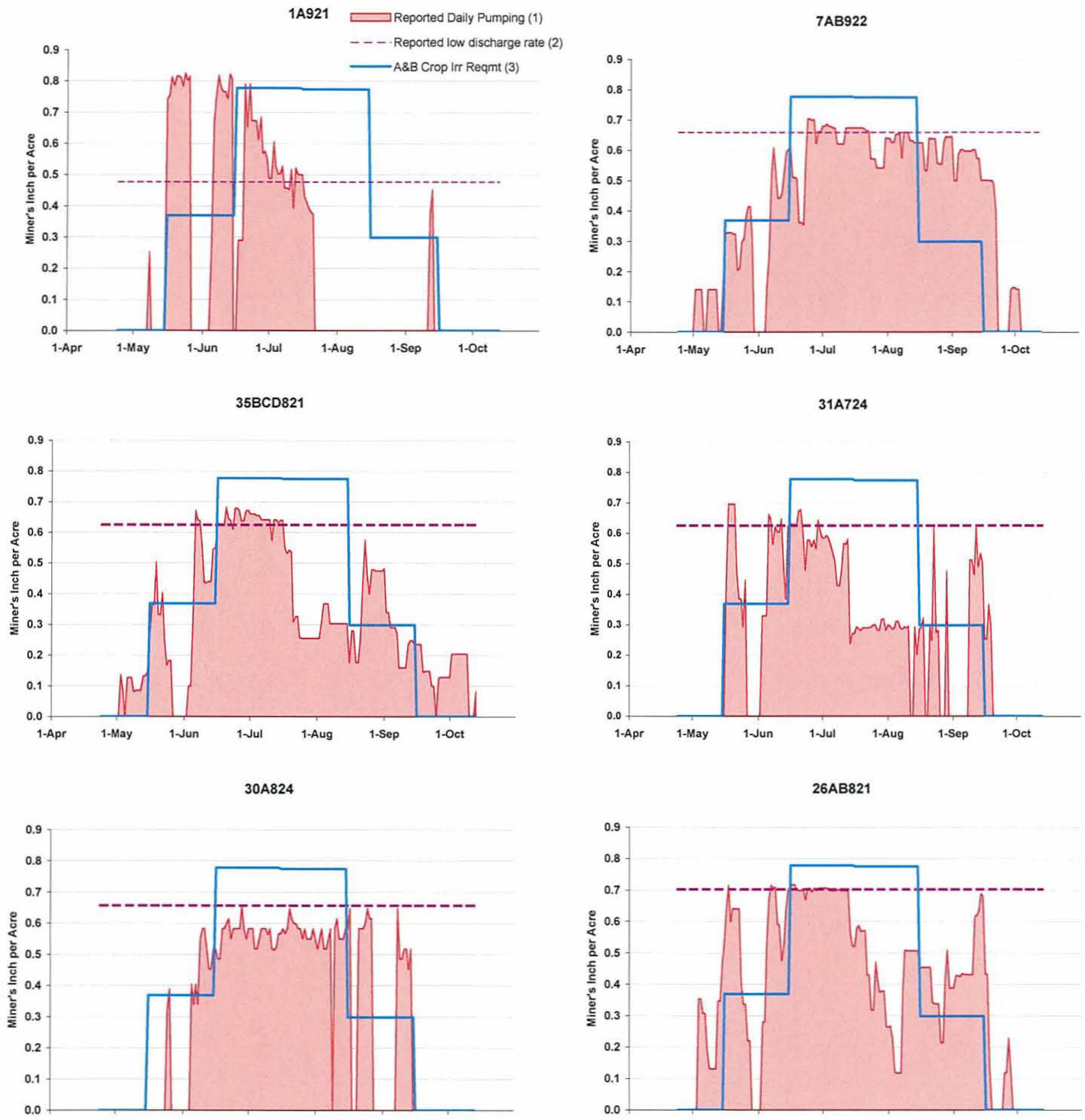
(1) Monthly diversion requirements and pumping from A&B experts Irrigation Diversion Requirement Well System Graphs.xls and converted to miner's inches per acre.
(2) Horizontal line representing the peak monthly pumping volume converted to miner's inches per acre.
(3) Horizontal line representing the reported low discharge rate from the A&B 2007 Annual Pump Report.
(4) Overstated shortage assuming that the peak monthly pumping could be produced in any month.
(5) Overstated shortage assuming that the reported low discharge rate could be produced in any month.

Figure 4
Daily Pumping for Selected Unit B Well Systems
2006



Notes:
(1) Reported daily pumping rate from daily pumping system status sheets converted to miner's inch per acre.
(2) Reported Low Pump(s) Rate Under Full Discharge (Typical of Mid-Season Pumping Rates) from WellSystemsWithDeliveryShortagesByYear.xls, provided by A&B 12/14/2007 in response to request for information by IDWR.
(3) Monthly 2006 crop irrigation requirement used in shortage analysis by A&B experts (Total Div Req_A&B-FINAL.xls).

Figure 4
Daily Pumping for Selected Unit B Well Systems
2006

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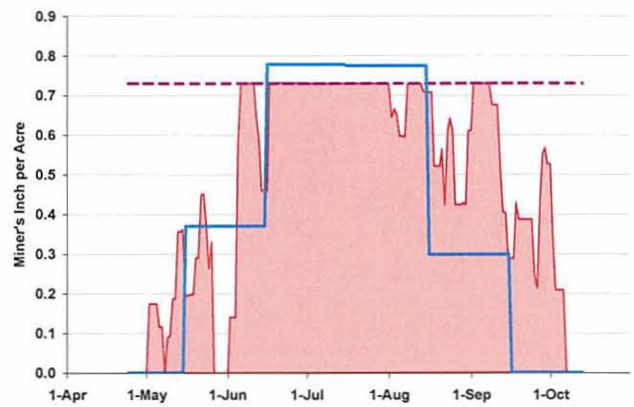
15AB825



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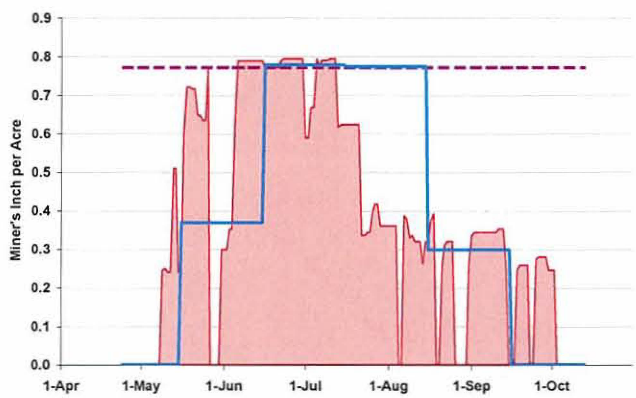

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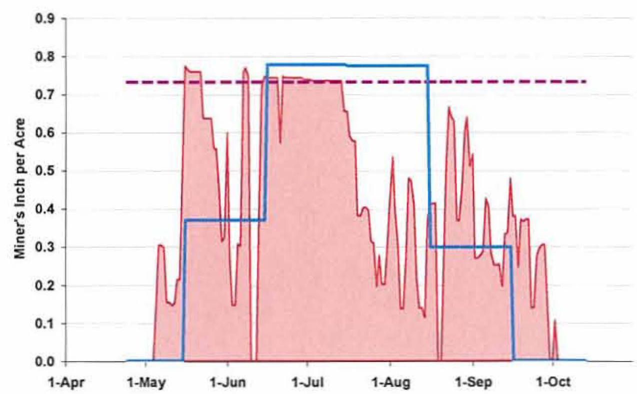

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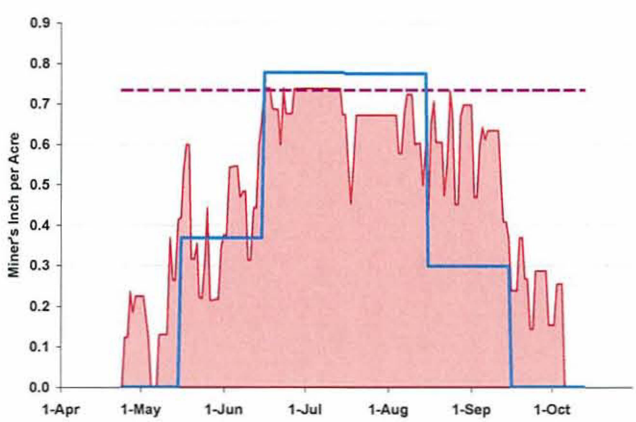

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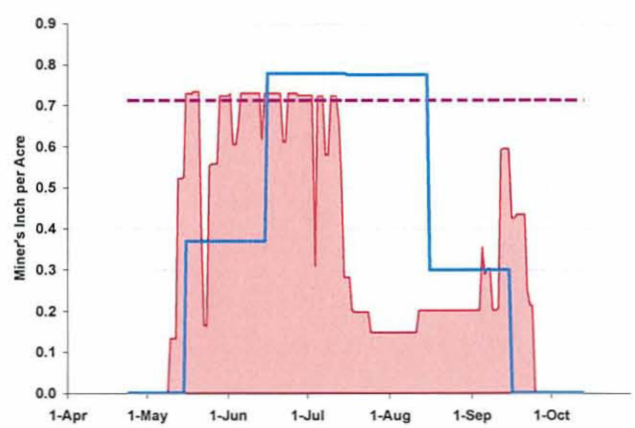

Figure 4
Daily Pumping for Selected Unit B Well Systems
2006

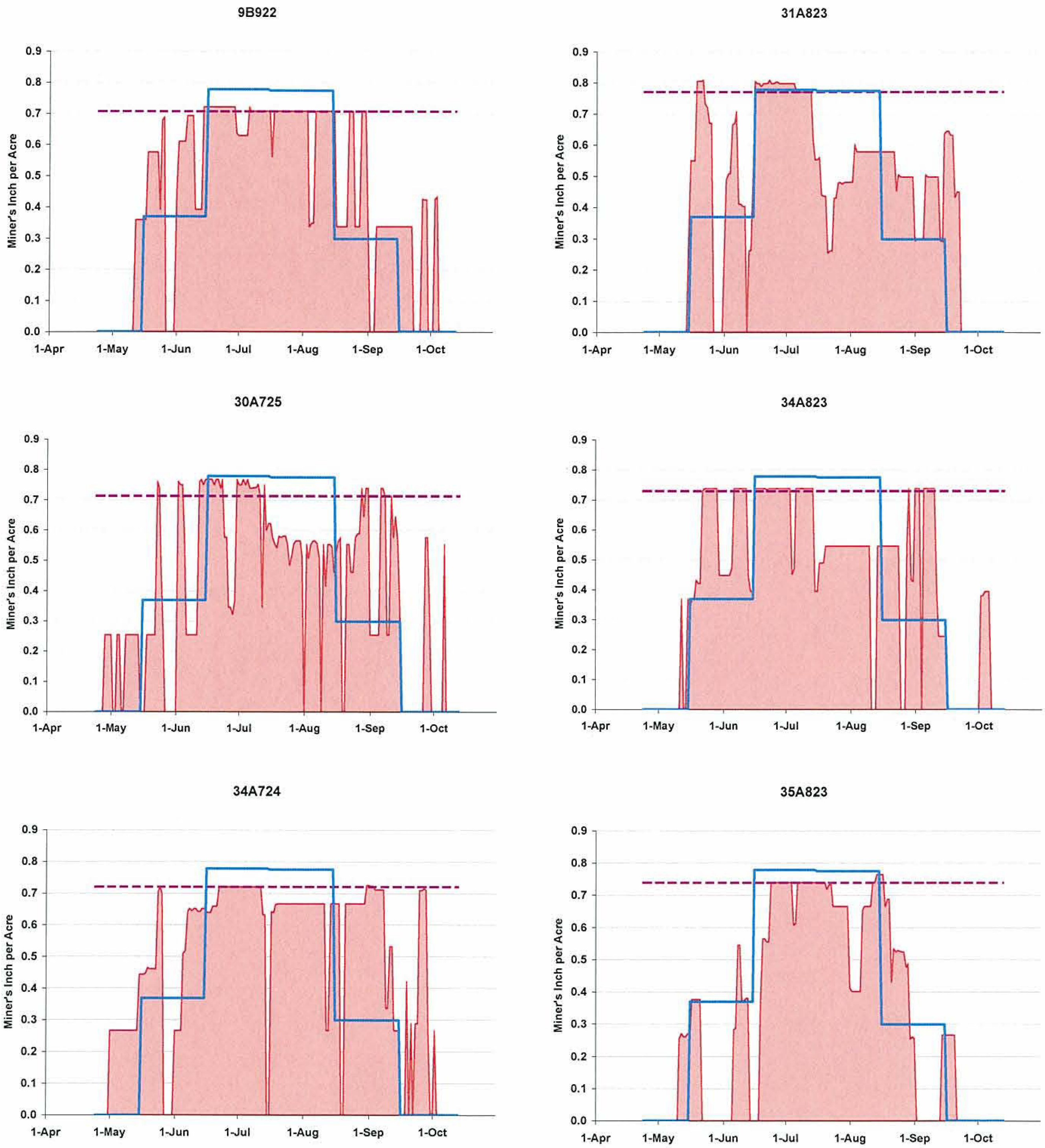

Figure 4
Daily Pumping for Selected Unit B Well Systems
2006

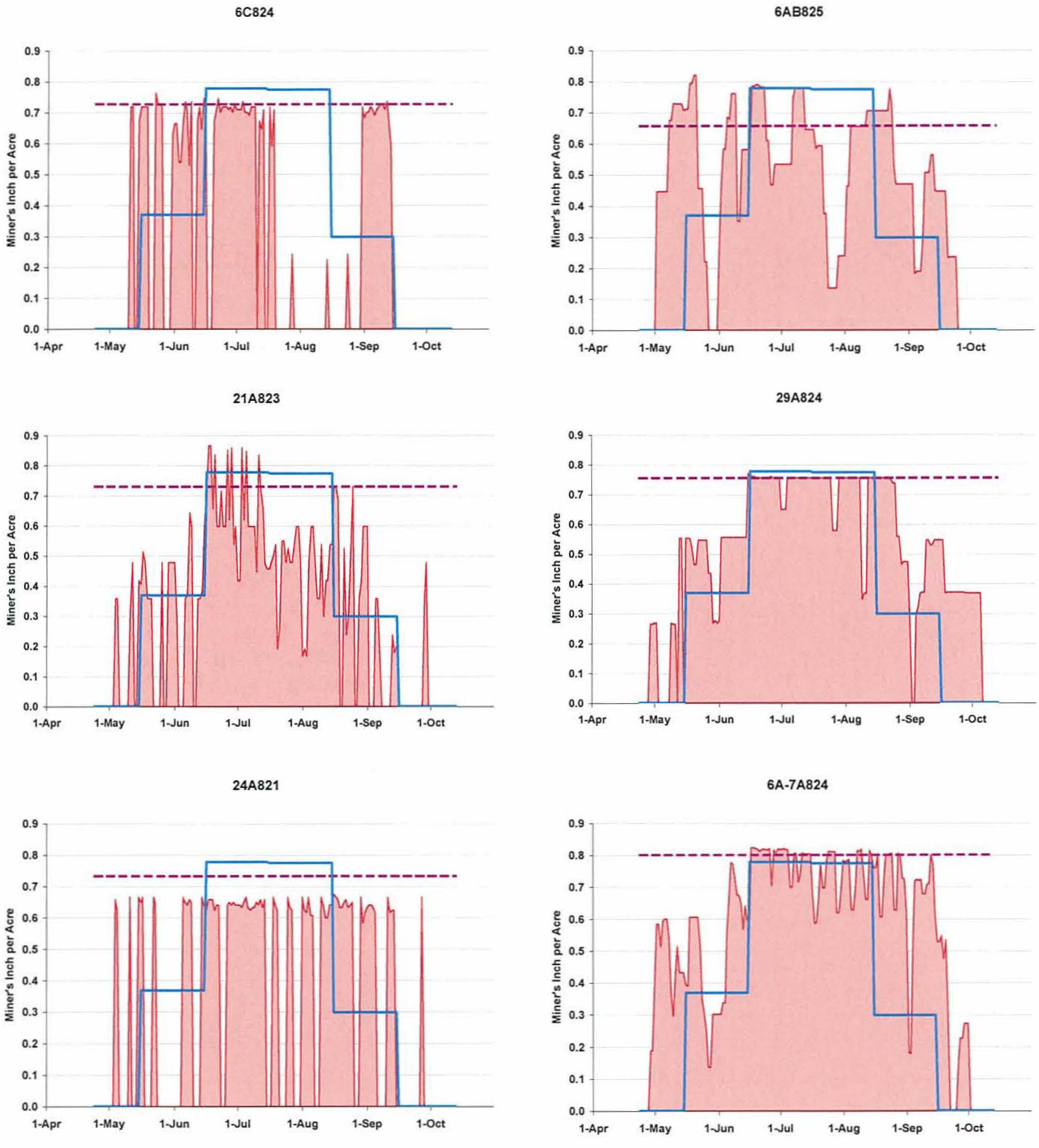

Figure 4
Daily Pumping for Selected Unit B Well Systems
2006

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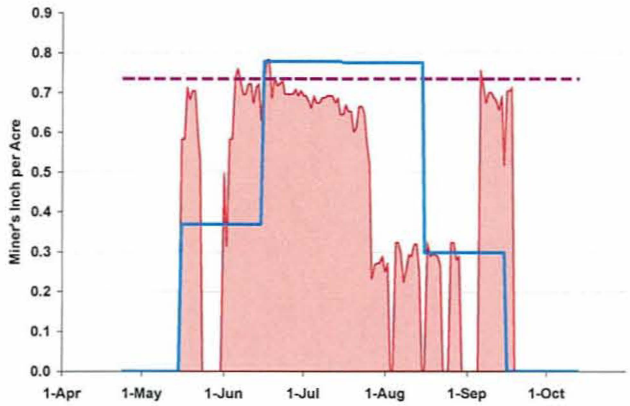

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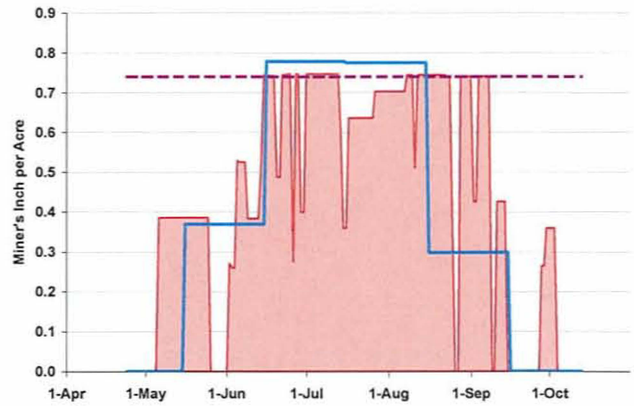

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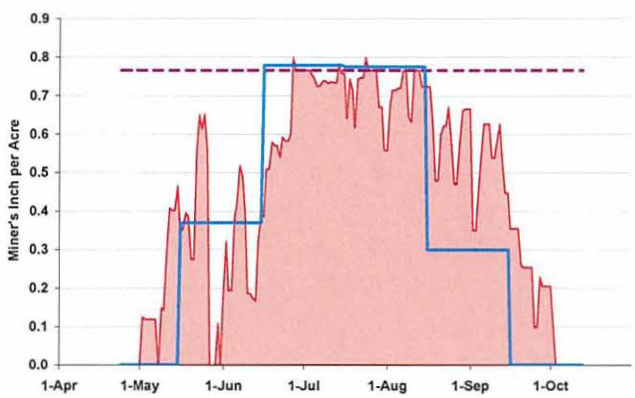

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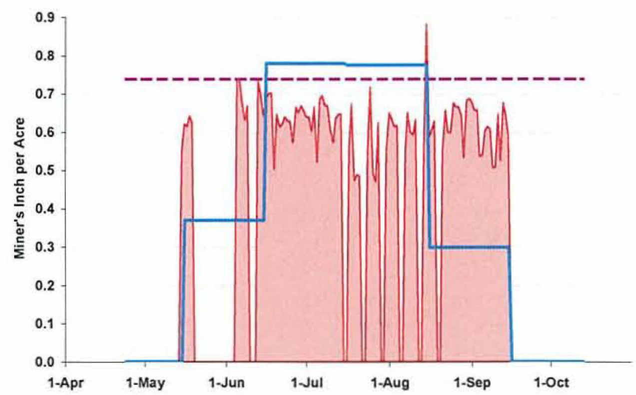

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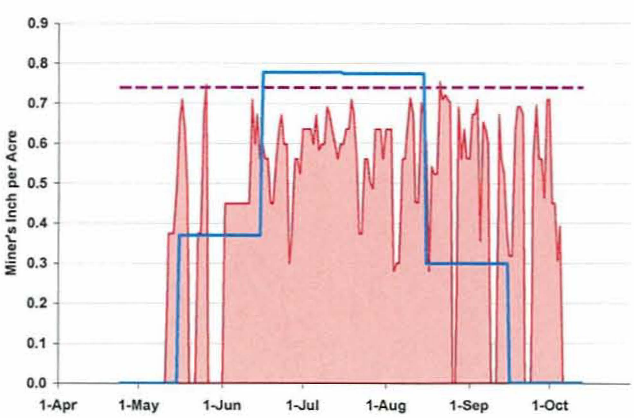

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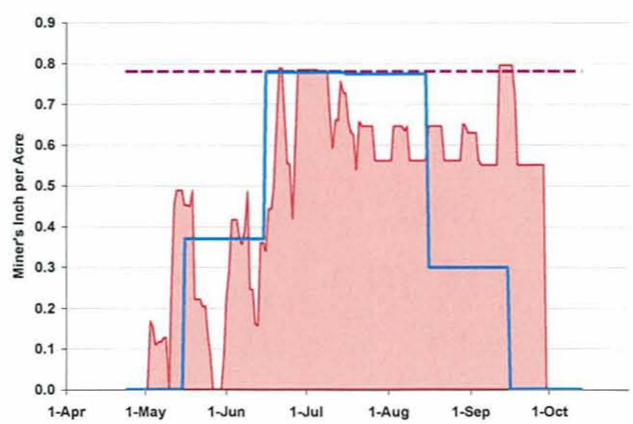


Figure 4
Daily Pumping for Selected Unit B Well Systems
2006

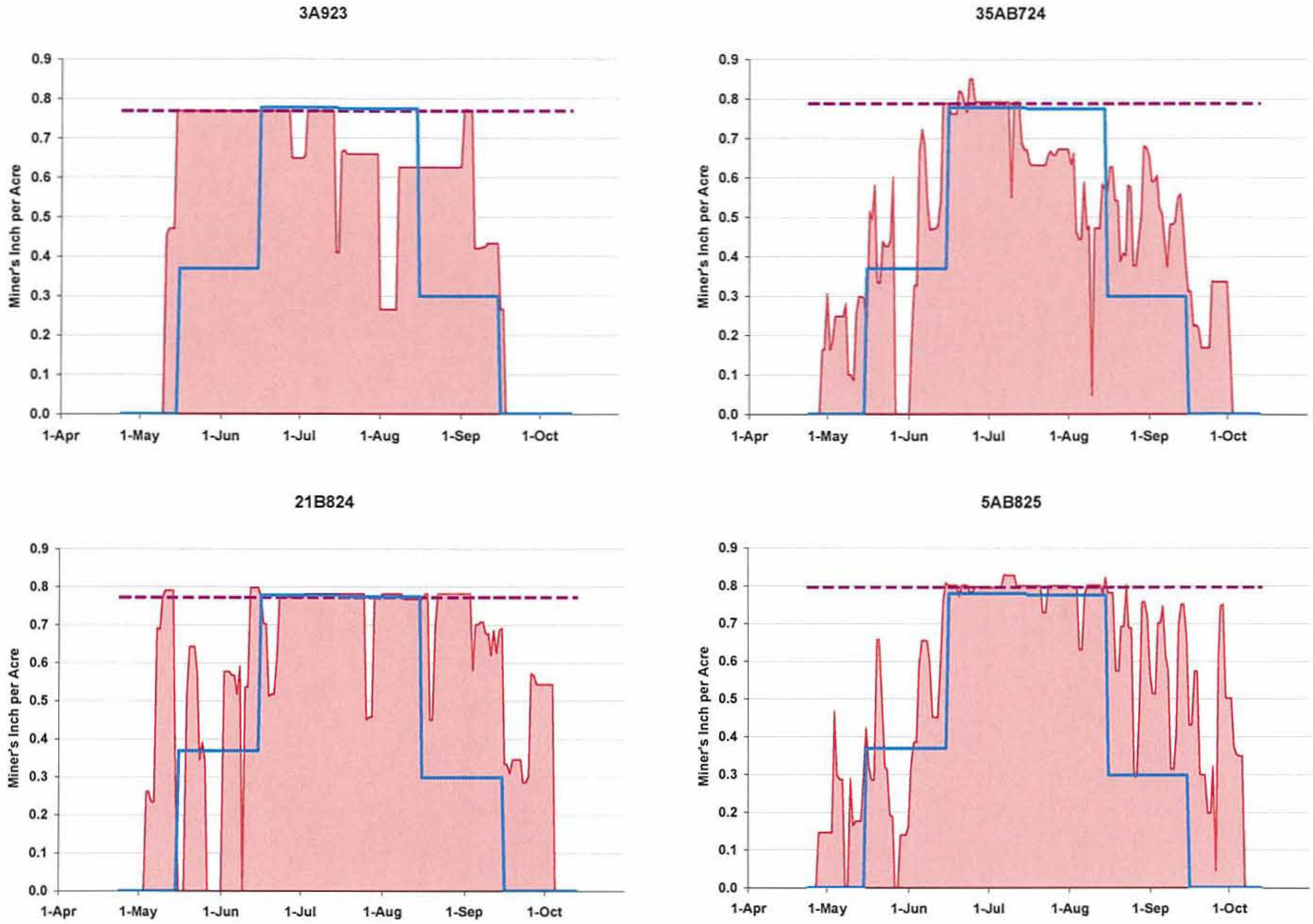
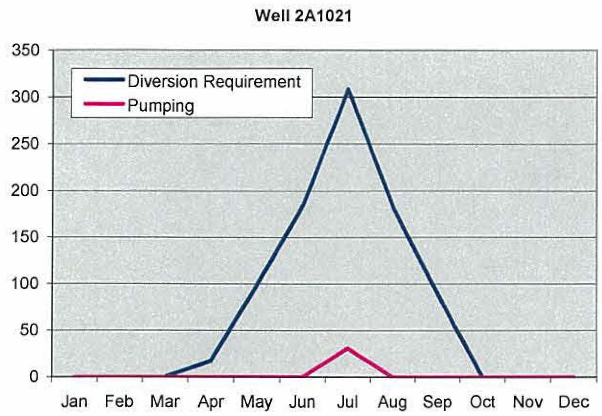
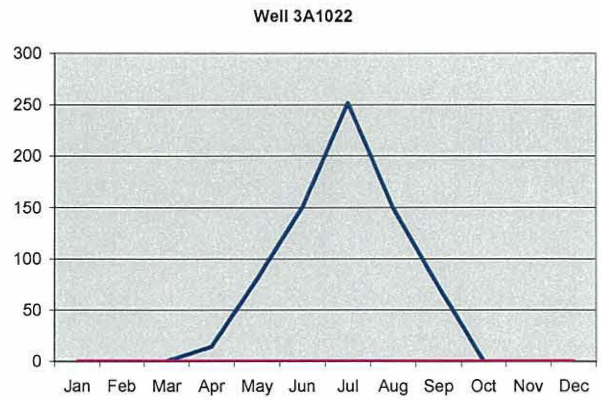
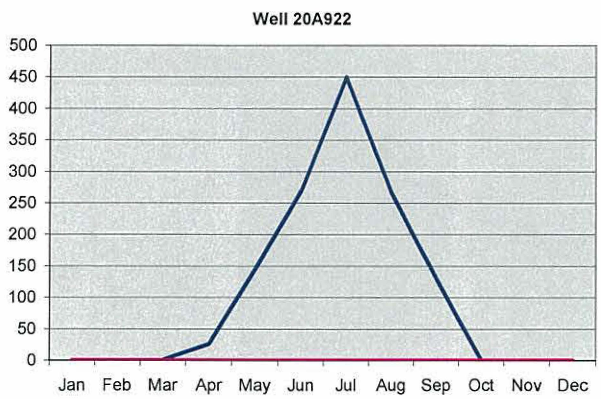
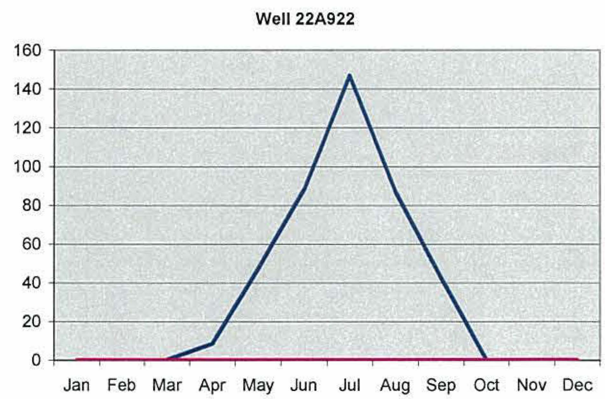


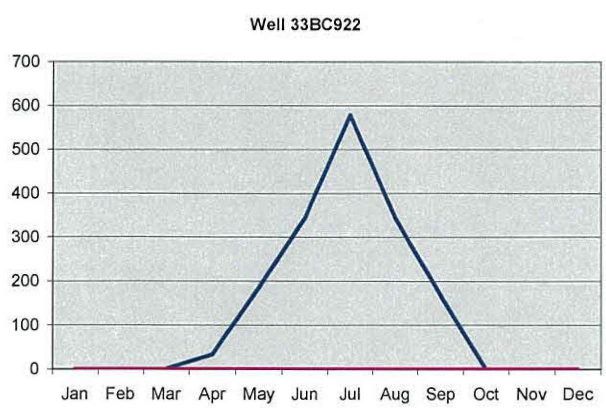
Figure 5
2007 Irrigation Diversion Requirement and Pumping for Systems Converted to Surface Water
Computed by A&B Experts
(acre-feet)











Tables

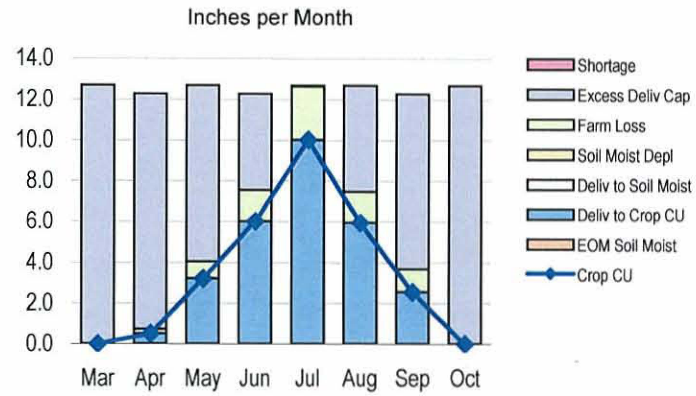
Table 1

Analysis of Farm Delivery Requirements With A&B's Experts' Assumptions
A&B Irrigation District Unit B

Current Conditions Scenario

(1)	Farm Delivery Capacity (miners inch per acre)		**0.86**
(2)	CIRYear		**2007**
(3)	Soil Moisture Reservoir Capacity (inches)		**0.00**

	Reasonable Farm Efficiency (FE)	Acres	% Acres
(4)	Gravity	**1,916**	3.1%
(5)	Sprinkler	**60,688**	96.9%
		62,604	100.0%



		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
(8)	**CIR (in)**	0.00	0.50	3.20	5.99	10.02	5.94	2.55	0.00	28.20
	Sprinkler Est FE	60%	70%	80%	80%	80%	80%	70%	60%	
	Gravity Est FE	55%	60%	60%	60%	60%	60%	60%	55%	
	Supply (inches)									
(9)	Beginning Soil Moisture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
(10)	Farm Delivery Capacity	12.69	12.28	12.69	12.28	12.69	12.69	12.28	12.69	100.30
(11)	Beneficial Farm Delivery	0.00	0.71	4.03	7.55	12.62	7.48	3.66	0.00	36.05
(12)	To Crop CIR	0.00	0.50	3.20	5.99	10.02	5.94	2.55	0.00	28.20
(13)	To Soil Moisture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(14)	To Farm Loss	0.00	0.22	0.83	1.56	2.60	1.54	1.11	0.00	7.86
(15)	Excess Delivery Capacity	12.69	11.57	8.66	4.73	0.07	5.21	8.62	12.69	64.25
(16)	Supply Available to Crop	0.00	0.50	3.20	5.99	10.02	5.94	2.55	0.00	
									Balance	*0.00*
	Crop CU and Soil Moisture (inches)									
(17)	Crop Consumptive Use	0.00	0.50	3.20	5.99	10.02	5.94	2.55	0.00	28.20
(18)	Crop Shortage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(19)	Ending Soil Moisture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
(20)	Soil Moisture Depletion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes

(1) Farm Delivery Capacity assumed for Unit B to meet CIR.
(2) Year for monthly CIR data used in analysis.
(3) Soil Moisture Reservoir Capacity available for carryover from one month to the next.
(4) Farm Efficiency and Irrigated Area for gravity irrigated lands.
(5) Farm Efficiency and Irrigated Area for center pivot irrigated lands.
(6) Farm Efficiency and Irrigated Area or other sprinkler irrigated lands (solid set, hand-moved, etc).
(7) Weighted Average Farm Efficiency (weighted by irrigated area).
(8) CIR for each month depending on option selected in (2).
(9) Beginning Soil Moisture for each month; set to zero in March, and end of month soil moisture from (19) in other months.
(10) Farm Delivery Capacity computed as (1) / 50 miner's inch per cfs x 1.9835 af/d per cfs x 12 in/ft x no. days per month.
(11) Beneficial Delivery to Farm determined as the portion of Farm Delivery Capacity (10) to satisfy crop demand or fill soil moisture plus associated farm losses, computed as MIN [(10), [(8) + (3) - (9)] / (7)].
(12) Amount of Beneficial Farm Delivery to Crop CIR computed as MIN [(8), (11) x (7)].
(13) Amount of Beneficial Farm Delivery to Soil Moisture computed as MIN [(11) x (7) - (12), (3) - (9)].
(14) Amount of Beneficial Farm Delivery to Farm Loss (runoff and deep percolation) computed as (11) - (12) - (13).
(15) Amount of Farm Delivery Capacity in excess of Beneficial Farm Delivery computed as (10) - (11).
(16) Supply Available to Crop computed as (9) + (12) + (13).
(17) Crop Consumptive Use computed as MIN [(8) , (16)].
(18) Crop Shortage computed as (8) - (17).
(19) Ending Soil Moisture computed as (16) - (17).
(20) Soil Moisture Depletion to meet CIR computed as MAX [(9) - (19), 0].

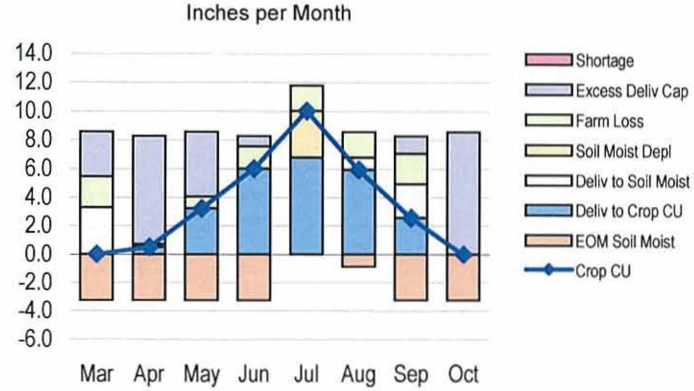
Table 2

Analysis of Farm Delivery Requirements With A&B's Experts' Assumptions (except soil moisture)
A&B Irrigation District Unit B

Current Conditions Scenario

(1)	Farm Delivery Capacity (miners inch per acre)		**0.58**
(2)	CIR Year		**2007**
(3)	Soil Moisture Reservoir Capacity (inches)		**3.25**

	Reasonable Farm Efficiency (FE)	Acres	% Acres
(4)	Gravity	**1,916**	3.1%
(5)	Sprinkler	**60,688**	96.9%
		62,604	100.0%



		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
(8)	**CIR (in)**	0.00	0.50	3.20	5.99	10.02	5.94	2.55	0.00	28.20
	Sprinkler Est FE	60%	70%	80%	80%	80%	80%	70%	60%	
	Gravity Est FE	55%	60%	60%	60%	60%	60%	60%	55%	
	Supply (inches)									
(9)	Beginning Soil Moisture	0.00	3.25	3.25	3.25	3.25	0.02	0.88	3.25	
(10)	Farm Delivery Capacity	8.56	8.28	8.56	8.28	8.56	8.56	8.28	8.56	67.65
(11)	Beneficial Farm Delivery	5.43	0.71	4.03	7.55	8.56	8.56	7.06	0.00	41.90
(12)	To Crop CIR	0.00	0.50	3.20	5.99	6.79	5.94	2.55	0.00	24.97
(13)	To Soil Moisture	3.25	0.00	0.00	0.00	0.00	0.86	2.37	0.00	6.48
(14)	To Farm Loss	2.18	0.22	0.83	1.56	1.76	1.76	2.14	0.00	10.45
(15)	Excess Delivery Capacity	3.13	7.57	4.53	0.73	0.00	0.00	1.23	8.56	25.75
(16)	Supply Available to Crop	3.25	3.75	6.45	9.24	10.04	6.82	5.80	3.25	
									Balance	*0.00*
	Crop CU and Soil Moisture (inches)									
(17)	Crop Consumptive Use	0.00	0.50	3.20	5.99	10.02	5.94	2.55	0.00	28.20
(18)	Crop Shortage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(19)	Ending Soil Moisture	3.25	3.25	3.25	3.25	0.02	0.88	3.25	3.25	
(20)	Soil Moisture Depletion	0.00	0.00	0.00	0.00	3.23	0.00	0.00	0.00	3.23

Notes

(1) Farm Delivery Capacity assumed for Unit B to meet CIR.
(2) Year for monthly CIR data used in analysis.
(3) Soil Moisture Reservoir Capacity available for carryover from one month to the next.
(4) Farm Efficiency and Irrigated Area for gravity irrigated lands.
(5) Farm Efficiency and Irrigated Area for center pivot irrigated lands.
(6) Farm Efficiency and Irrigated Area or other sprinkler irrigated lands (solid set, hand-moved, etc).
(7) Weighted Average Farm Efficiency (weighted by irrigated area).
(8) CIR for each month depending on option selected in (2).
(9) Beginning Soil Moisture for each month; set to zero in March, and end of month soil moisture from (19) in other months.
(10) Farm Delivery Capacity computed as (1) / 50 miner's inch per cfs x 1.9835 af/d per cfs x 12 in/ft x no. days per month.
(11) Beneficial Delivery to Farm determined as the portion of Farm Delivery Capacity (10) to satisfy crop demand or fill soil moisture plus associated farm losses, computed as MIN [(10), [(8) + (3) - (9)] / (7)].
(12) Amount of Beneficial Farm Delivery to Crop CIR computed as MIN [(8), (11) x (7)].
(13) Amount of Beneficial Farm Delivery to Soil Moisture computed as MIN [(11) x (7) - (12), (3) - (9)].
(14) Amount of Beneficial Farm Delivery to Farm Loss (runoff and deep percolation) computed as (11) - (12) - (13).
(15) Amount of Farm Delivery Capacity in excess of Beneficial Farm Delivery computed as (10) - (11).
(16) Supply Available to Crop computed as (9) + (12) + (13).
(17) Crop Consumptive Use computed as MIN [(8) , (16)].
(18) Crop Shortage computed as (8) - (17).
(19) Ending Soil Moisture computed as (16) - (17).
(20) Soil Moisture Depletion to meet CIR computed as MAX [(9) - (19), 0].

Table 3
Annual Shortage Computed by A&B Experts
A&B Irrigation District Unit B
(ac-ft)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Shortage for Systems Receiving Supplemental Water				Shortage for Systems without Supplemental Water		
Year	Total Computed Shortage	Systems Receiving Drain Water	Systems with Private Water	Systems Converted to Surface Water	Total	Item G Systems	Non-Item G Systems	Total
1995	16,315	1,928	4,405	2,838	9,170	5,359	1,786	7,145
1996	17,757	2,523	2,519	4,285	9,327	6,616	1,814	8,430
1997	16,726	2,064	2,079	3,454	7,596	6,956	2,173	9,129
1998	25,716	3,786	3,105	3,812	10,702	11,360	3,653	15,014
1999	27,487	4,460	3,125	4,543	12,129	10,839	4,519	15,359
2000	31,048	5,329	4,124	4,935	14,388	12,328	4,332	16,660
2001	25,645	3,669	2,606	4,980	11,255	10,958	3,432	14,390
2002	29,778	4,598	3,761	4,684	13,043	12,182	4,553	16,735
2003	43,208	7,653	6,265	5,236	19,154	18,158	5,896	24,054
2004	36,954	6,473	5,222	4,868	16,563	15,204	5,187	20,390
2005	35,943	6,221	4,310	4,142	14,673	16,022	5,248	21,271
2006	33,903	5,495	4,593	4,275	14,363	15,650	3,889	19,539
2007	40,207	6,342	5,782	4,920	17,044	18,306	4,857	23,163
Avg	29,284	4,657	3,992	4,382	13,031	12,303	3,949	16,252
Max	43,208	7,653	6,265	5,236	19,154	18,306	5,896	24,054

Notes
(1) Total computed shortage calculated by A&B experts in Total Div Req_A&B-Final.xls.
(2) Shortages calculated by A&B experts in Total Div Req_A&B-Final.xls for well systems indicated in spreadsheet as receiving relift water.
(3) Shortages calculated by A&B experts in Total Div Req_A&B-Final.xls for well systems listed in Appendix O, receiving private water.
(4) Shortages calculated by A&B experts in Total Div Req_A&B-Final.xls for well systems converted to surface water (2A1021, 3A1022, 20A922, 33BC922, 22A922).
(5) Total shortage for well systems receiveing supplemental water ((2) + (3) + (4)).
(6) Shortage calculated by A&B experts in Total Div Req_A&B-Final.xls for Item G well systems without supplemental water.
(7) Shortage calculated by A&B experts in Total Div Req_A&B-Final.xls for Non Item G well systems without supplemental water.
(8) Total shortage for well systems not receiving supplemental water ((6) + (7)).

Table 4
Annual Shortage Computed by A&B Experts with Adjustments
A&B Irrigation District Unit B
(ac-ft)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Shortages Computed by A&B Experts			Remaining Shortage After Considering		
Year	Total Annual Demand	Total Shortage	Shortage for Systems Converted to Surface Water	Shortage for Systems **Not** Converted to Surface Water	Reported Maximum Monthly Pumping	**and** Reported Low Discharge Rate	Remaining Shortage as a Percentage of Demand
1995	116,292	16,315	2,838	13,478	4,205	105	0.1%
1996	168,169	17,757	4,285	13,472	4,949	2,418	1.4%
1997	135,561	16,726	3,454	13,272	5,613	933	0.7%
1998	149,606	25,716	3,812	21,904	8,873	1,012	0.7%
1999	178,326	27,487	4,543	22,944	7,909	2,592	1.5%
2000	200,329	31,048	4,935	26,113	11,430	6,042	3.0%
2001	196,666	25,645	4,980	20,665	5,607	1,129	0.6%
2002	183,831	29,778	4,684	25,094	9,538	4,617	2.5%
2003	206,219	43,208	5,236	37,972	14,965	9,710	4.7%
2004	191,079	36,954	4,868	32,085	13,083	5,584	2.9%
2005	162,580	35,943	4,142	31,801	13,100	4,186	2.6%
2006	168,689	33,903	4,275	29,628	15,321	4,319	2.6%
2007	194,289	40,207	4,920	35,287	15,571	8,250	4.2%
Avg	173,203	29,284	4,382	24,901	10,013	3,915	2.1%
Max	206,219	43,208	5,236	37,972	15,571	9,710	4.7%

Notes
(1) Total irrigation diversion requirement calculated by A&B experts in Total Div Req_A&B-Final.xls.
(2) Total computed shortage calculated by A&B experts in Total Div Req_A&B-Final.xls.
(3) Shortages calculated by A&B experts in Total Div Req_A&B-Final.xls for well systems converted to surface water (2A1021, 3A1022, 20A922, 33BC922, 22A922).
(4) Total computed shortage (1) minus the shortage for systems converted to surface water (2).
(5) Remaining shortage assuming that the peak monthly pumping for each system could be produced in any month.
(6) Remaining shortage assuming that the reported low discharge rate for each system could be produced in any month.
(7) Percent of unmet demand after considering systems converted to surface water and assuming that the peak monthly pumping and reported low discharge rate could be produced in any month.

Table 5
A&B Annual Peak Irrigation Diversion Requirement Sorted Highest to Lowest (miner's inch / acre)

Year	Peak Monthly Irrigation Diversion Requirement	% Above (+) or Below (-) Avg Peak
2007	0.89	15%
2003	0.88	13%
2000	0.85	10%
2004	0.82	6%
2002	0.82	6%
1999	0.79	1%
2006	0.78	1%
1996	0.77	-1%
2005	0.76	-2%
2001	0.74	-4%
1997	0.70	-9%
1998	0.68	-12%
1995	0.59	-23%
Average	0.77	

Source: A&B spreadsheet: Total DiV Req_A&B_FINAL.xls

Appendix A
May 24, 1984 Letter to the Bureau of Reclamation

76,789 IRRIGABLE ACRES

A & B Irrigation District

P. O. BOX 675 RUPERT, IDAHO 83350 DIAL 436-3152

May 24, 1984

Finding #63

Mr. Larry Vinsonhaler
Regional Planning Officer
Bureau of Reclamation
Box 043, 550 West Fort St.
Boise, ID 83724

Dear Mr. Vinsonhaler:

This is in response to your request for our comments on the 0.75 miner's inch per acre design peaking criteria being proposed for the new Extension lands.

A & B Irrigation District began operation in 1960, and all existing project lands were developed under gravity irrigation and were in production by 1963. The design criteria for these lands was set at 0.75 miner's inch per acre (1 cubic foot per second per 65 acres) delivered to the farm unit. There is general concern amoung A & B irrigators that for gravity irrigation this flow is inadequate or "tight" during the peak demand period, although there has been no noticeable restriction in crop yields.

With regard to the design criteria for the new lands and considering sprinkler irrigation rather than gravity, we would support the 0.75 rate even though on farm efficiencies will be considerably higher with sprinkler. Our experience with sprinkler irrigated land is that the 0.75 rate is adequate. About 30 percent of our lands are now sprinkled. We would not advocate establishing either a lower or a higher rate that the presently served land. We view development of the Extension lands as merely completing our project. From the standpoint of efficiency in managing the district, it would be preferable to keep the same design criteria on the new lands which are intermingled with existing project lands.

Sincerely yours,

Elmer

Elmer G. McDaniels
Manager

EGM:dw

Appendix B
IDWR Administrative Memo No. 16

76,789 IRRIGABLE ACRES

A & B Irrigation District

P. O. BOX 675 RUPERT, IDAHO 83350 DIAL 436-3152

May 24, 1984

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