DETERMINING SOURCE OF IRRIGATION WATER FOR RECHARGE CALCULATION

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Eastern Snake Plain Aquifer Model Enhancement Project Scenario
Document DDW-017 Final As-built

DESIGN DOCUMENTS

Design documents are a series of technical papers addressing specific design topics on the eastern Snake River Plain Aquifer Model upgrade. Each design document will contain the following information: topic of the design document, how that topic fits into the whole project, which design alternatives were considered and which design alternative is proposed. In draft form, design documents are used to present proposed designs to reviewers. Reviewers are encouraged to submit suggested alternatives and comments to the design document. Reviewers include all members of the Eastern Snake Hydrologic Modeling (ESHM) Committee as well as selected experts outside of the committee. The design document author will consider all suggestions from reviewers, update the draft design document, and submit the design document to the SRPAM Model Upgrade Program Manager. The Program Manager will make a final decision regarding the technical design of the described component. The author will modify the design document and publish the document in its final form in .pdf format on the SRPAM Model Upgrade web site. This revision reports on the water-source data derived from the sources and methods proposed in the original version of Design Document DDW-017.

The goal of a draft design document is to allow all of the technical groups which are interested in the design of the SRPAM Model Upgrade to voice opinions on the upgrade design. The final design document serves the purpose of documenting the final design decision. Once the final design document has been published for a specific topic, that topic will no longer be open for reviewer comment. Many of the topics addressed in design documents are subjective in nature. It is acknowledged that some design decisions will be controversial. The goal of the Program Manager and the modeling team is to deliver a well-documented, defensible model which is as technically representative of the physical system as possible, given the practical constraints of time, funding and manpower. Through the mechanism of design documents, complicated design decisions will be finalized and documented. Final model documentation will include all of the design documents, edited to ensure that the “as-built” condition is appropriately represented. This is the final as-built document describing determination of the source of irrigation water.

INTRODUCTION

Recharge from surface-water irrigation is the largest component of aquifer recharge, and a large source of model uncertainty. The second-largest component of aquifer discharge is net withdrawals (calculated as consumptive use, or evapotranspiration) due to ground-water irrigation. The source of water for individual parcels must be identified so that diverted volumes of surface water are applied to the appropriate spatial locations. The source of water also affects the calculation of consumptive use, which depends in part on evapotranspiration (ET) adjustment factors, application method (sprinkler or gravity), and the reduction factor for non-irrigated inclusions within irrigated lands. For an individual parcel, the ET adjustment factor and sprinkler percentage from the local surface-water irrigation entity or the local ground-water irrigation polygon are applied, depending on the water source identified for the parcel. The reduction factor assigned is a weighted average of the sprinkler and gravity reduction factors, depending on the sprinkler percentage assigned to the parcel. Assigning these parameters for calculation purposes requires information on the water source for the individual parcel. An additional need to identify the source of irrigation by parcel is in use of the model, when a hypothetical scenario representing curtailment of irrigation may be tested.

Many irrigated lands are either 100% surface-water irrigated or 100% ground-water irrigated. However, some irrigated lands have mixed ground water and surface water sources. This has typically occurred where surface water sources were inadequate, and supplemental ground water sources have been developed. This paper describes the method used to determine the source of irrigation water, the method used to calculate recharge on mixed-source lands, and the potential effects of errors in determining the mix ratio.

REPRESENTATION OF SOURCE IN THE MODEL

Irrigated lands are represented as polygon feature classes in GIS. A unique data set may be applied to as few or as many model stress periods as desired. Design Document DDW-015 describes the GIS data used in model calibration. During use of the model for scenario testing, the same or different GIS data may be utilized.

The irrigated lands data set contains geometric polygons that represent individual parcels of irrigated land. These data also contain an attribute table which describes characteristics of the polygons. The attribute “Entity ID” assigns each irrigated parcel to a surface-water irrigation entity (as described in Design Document DDW-008) or a ground-water irrigation polygon (as described in Design Document DDW-009). The Entity ID value allows linkage to the adjustment factor, sprinkler data, water source, and diversion volumes (see Design Documents DDW-012 and DDW-025) associated with the entity or polygon. The attribute “Source Fraction” is a decimal number between zero and one that represents the fraction of “full irrigation” that occurs in this polygon from the identified irrigation entity or ground water polygon. For model calibration, “full irrigation” is assumed on all parcels identified as irrigated. For single-source polygons, the source fraction for calibration will be set to one. Source fractions for mixed-source lands and for scenario testing are described below.

In the GIS recharge tool, the areas of all the irrigated polygons within each cell are multiplied by their respective source fractions, summed by irrigation entity or ground-water polygon and reported to the FORTRAN recharge program. The FORTRAN program applies the irrigated-agriculture recharge calculations to the irrigated area, then subtracts irrigated area from the area of the cell and applies the non-irrigated recharge depth to the non-irrigated lands.

Parcels having a mixed source are represented by two identical overlapping polygons. One polygon is associated in the attribute table with the surface water irrigation entity that provides the surface water source for the parcel, and the other polygon is associated with the local ground water polygon. The source fractions for the two overlapping polygons sum to one for model calibration.

Any scenario involving a change of irrigated acreage requires the user to decide upon appropriate adjustments to irrigated lands, source fractions, diversion and return volumes, discount for non-irrigated inclusions, ET adjustment factors, sprinkler percentages, and offsite ground-water pumping. A scenario involving increased irrigation requires construction of a new GIS data set representing the hypothetical parcels. The source fractions cannot simply be adjusted to numbers greater than one because this could result in irrigated area within a cell exceeding the total area of the cell. If a scenario involves reduced irrigation on existing irrigated lands, the source fractions for selected polygons may be adjusted to less than one for single-source parcels, or to sum to less than one for mixed-source parcels. Reduced irrigation that evolves over time may be represented by making multiple copies of the GIS data set, assigning different source fractions for each set, and assigning the data sets to appropriate stress periods.

DATA SOURCES

Previous Work

Garabedian (1992) based his map of irrigation water source on “unpublished irrigated-acreage maps compiled by the U.S. Bureau of Reclamation.” Lands are identified only by the primary water source. Goodell’s (1988) map identifies lands of mixed source, based on U.S. Bureau of Reclamation and U.S. Soil Conservation Service data. The Garabedian and Goodell maps represent approximately the year 1980, which is the beginning of the current model calibration period.

Idaho Department of Water Resources (IDWR 1997) produced maps that illustrated the ratio of ground water to surface water by five-kilometer grid cell. These maps represent 1980 and 1992. The mix ratio was calculated according to the ratio of total acres of ground water and surface water irrigation rights within each quarter-quarter section (Lindgren 2002). The water rights database reflects changes that honored the statutory transfer and permit processes, but not the many “accomplished changes” that occurred during the 1960s, ‘70s, and ‘80s. One of the purposes of the Snake River Basin Adjudication was to identify these changes.

New Tools and Data Sources

Geographic Information Systems (GIS) technology unavailable to earlier investigators, and Water Measurement District and Ground Water District records of actual well diversion volumes have recently become available. These sources are used in conjunction with Snake River Basin Adjudication data base records, which reflect varying degrees of resolution in the adjudication process. The adjudication data reflects accomplished changes not shown in water rights data. The adjudication also represents legitimate "beneficial use" rights perfected before the statutory requirement to obtain a state permit for a water right. Adjudication claims are the users' representations of water use, and exist for the entire plain. Recommendations are Idaho Department of Water Resources' findings from investigation of claims. These exist for about 2/3 of the study area. The court's determination of the adjudicated water right is called a *partial decree*.[1] Partial decrees exist for a much smaller portion of the study area. Not all the partial decree data were available for automated electronic querying. Figure 1 shows the GIS map of water source used in model calibration. It is a composite of data as described below.

There are some limitations to these data. The ground-water diversion volume data only cover the years 1997 through 2002, and may have missing values, especially for the earlier years. The adjudication claims are uninvestigated representations of water users. Recommendations and partial decrees reflect the legal authorization to use water, not necessarily the actual practice. Because of the common occurrence of overlapping water rights, the ratio of ground-water to surface-water rights in a quarter-quarter section will not be useful to determine the mix ratio on mixed-source lands.

Comparison of Data Sources

Visual comparisons of the adjudication claims data set with other maps show general agreement, as illustrated in Figures 2, 3, and 4. The 1992 IDWR map and adjudication data confirm Goodell's report that her data may have under-estimated the extent of mixed-source lands.

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[1] The decrees are called "partial" because each decreed right is only part of the final Snake River Basin Adjudication. Partial decrees are final determinations of place of use and source for individual decreed rights.

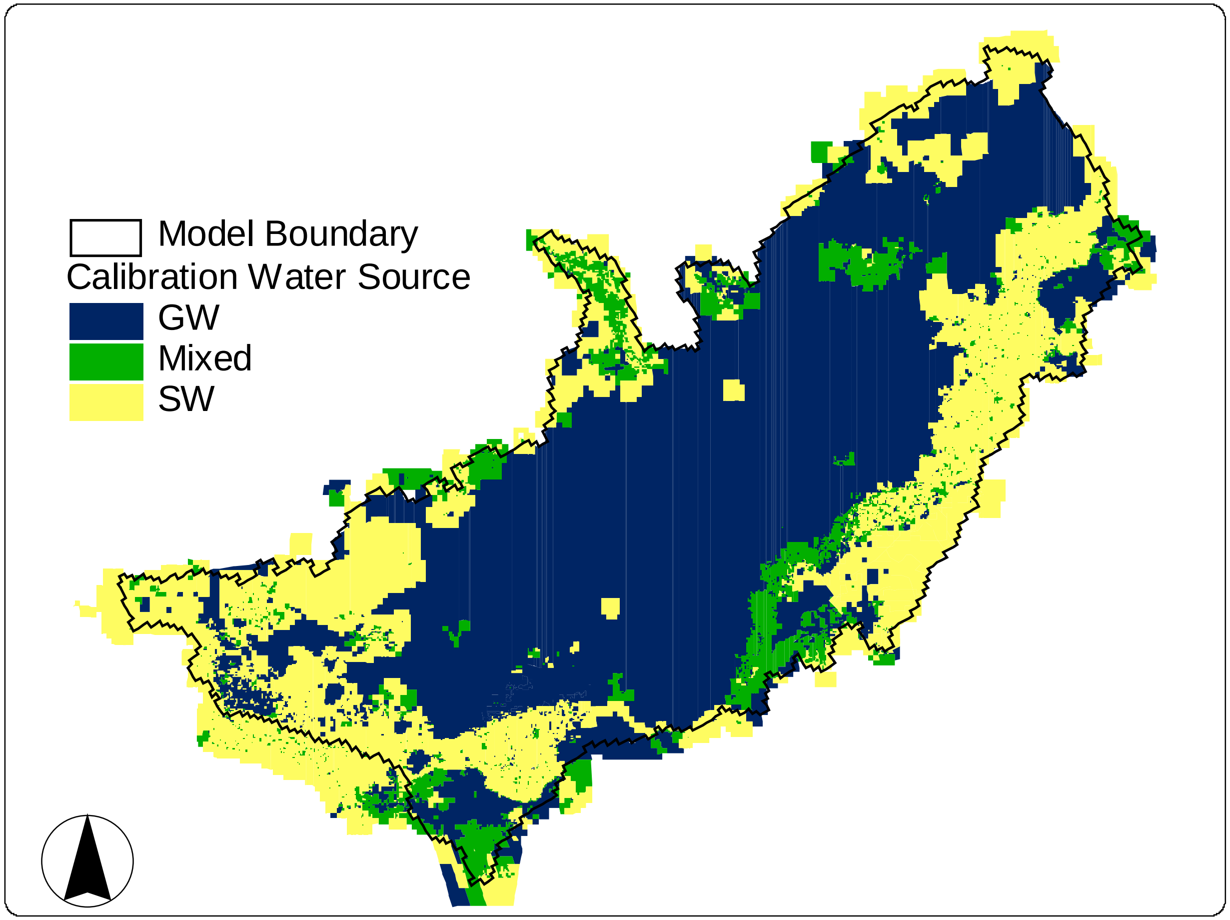

Figure 1. Water Source Map Used In Model Calibration

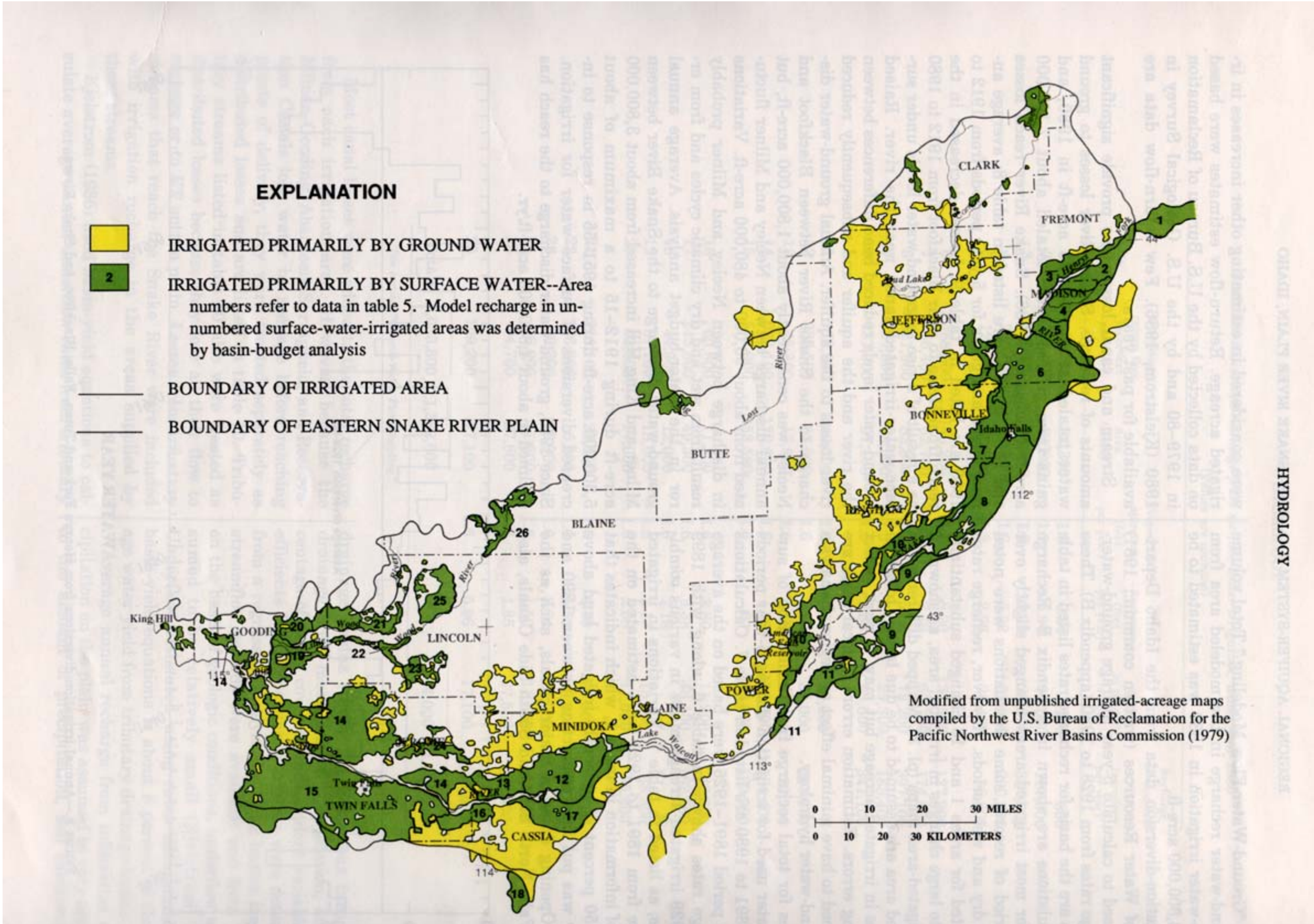

FIGURE 7.—Irrigated lands, 1979, and numbered surface-water-irrigated areas.

Figure 2. Water Source from RASA (Garabedian 1992)

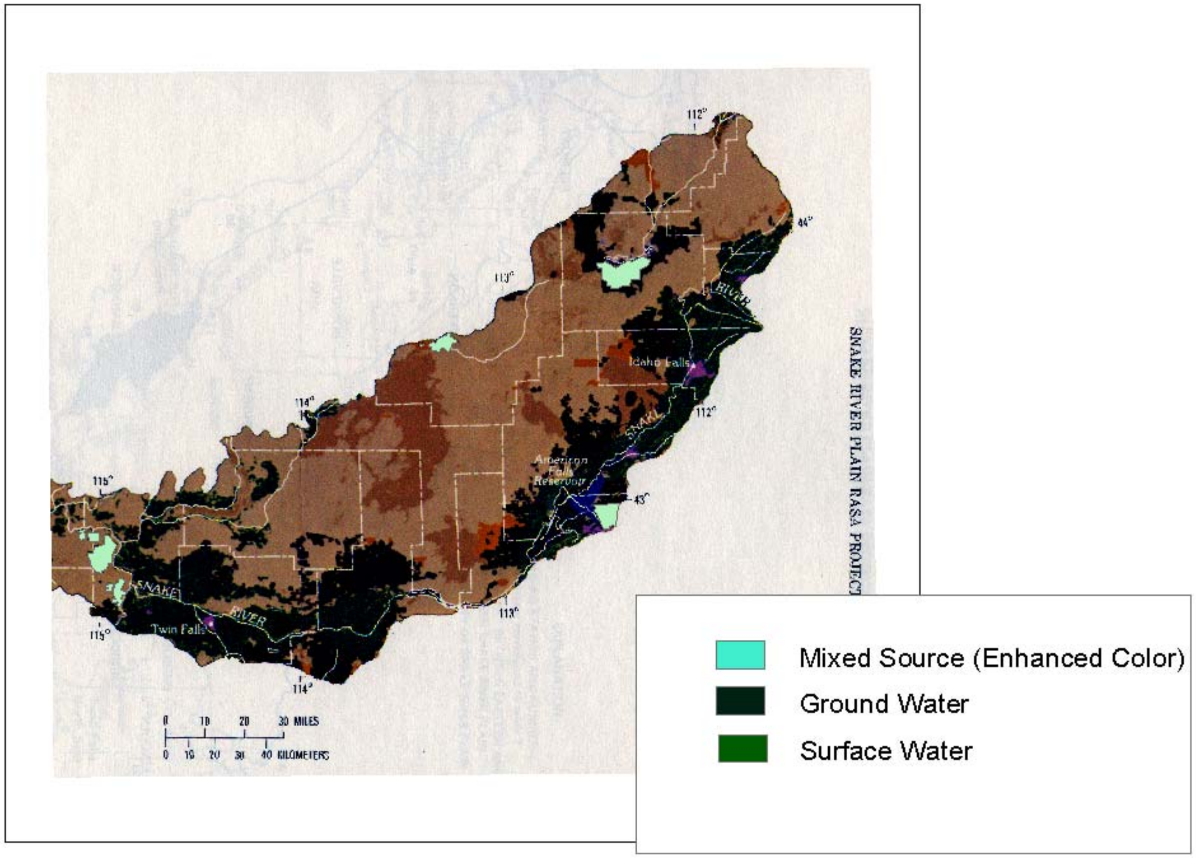

Figure 3. Water Source from RASA (Goodell 1988)[2]

[2] Colors were difficult to distinguish in the original and scanned images. Delineation of mixed-source lands was enhanced by GIS analysis of the spectral mix of colors in the scanned image.

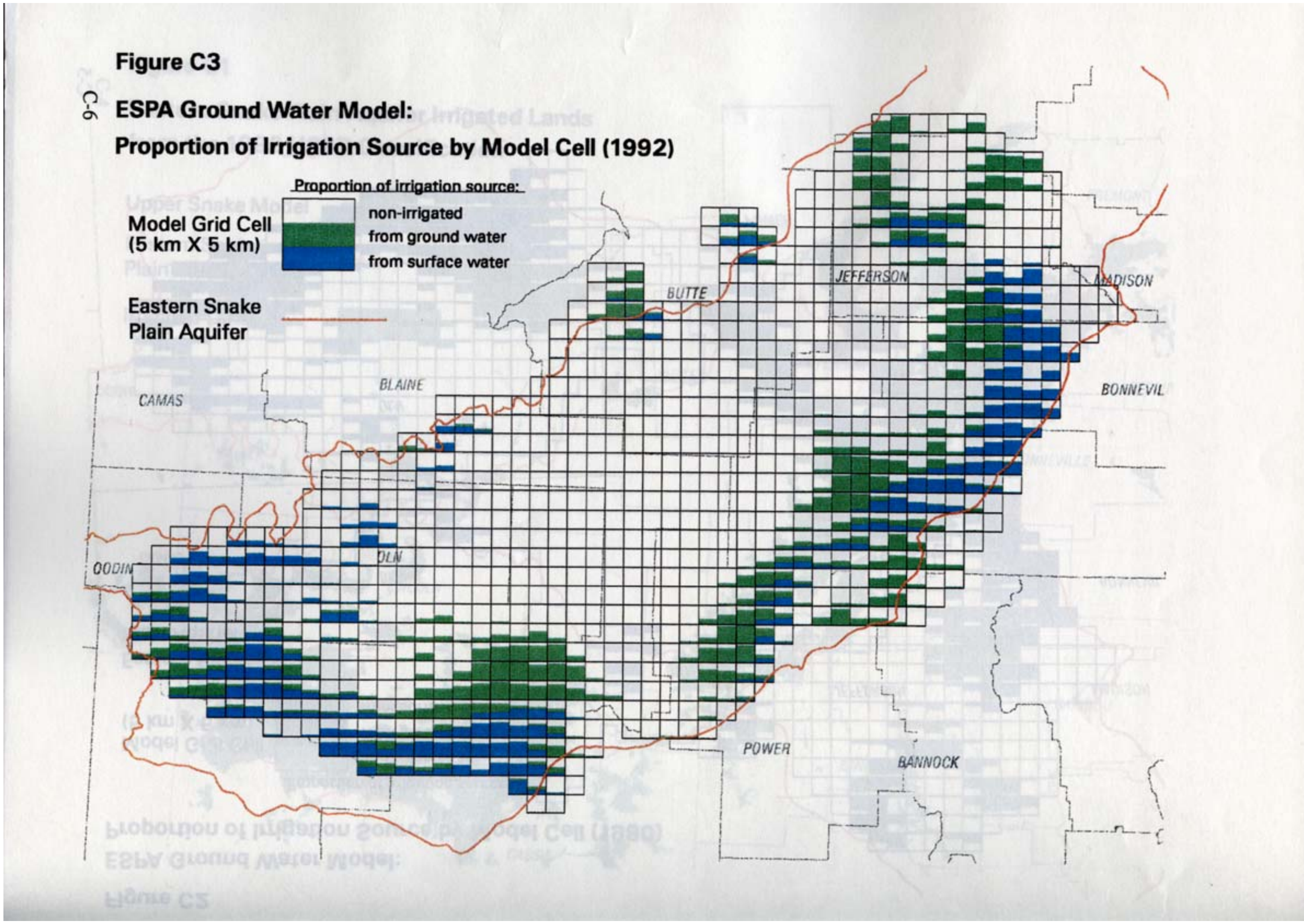

Figure 4. Water Source from IDWR (1997)

Data Sources Used

Completion of map of source for entire plain. The final map of water source comes from three data sources: 1) A GIS shapefile of claimed water source by quarter-quarter section for irrigated claims, from IDWR records (ESPAM_AJ_Claim.shp, IDWR 2002). 2) A GIS shapefile which includes partially decreed and recommended (where complete) water source, as well as claims, by quarter-quarter section, from IDWR records (ESPAM_AJ_Rcmd.shp). 3) A GIS shapefile of water source by section, obtained from the IDWR website by manual query (ESPAM_Internet.shp, Eldridge 2002). The first source includes almost all the plain, though there are small omissions where there are irregularities in the public land survey data that define quarter-quarter sections. There is an unexplained omission southeast of American Falls, Idaho, and there are omissions in the Big Lost, Oakley Fan and Rexburg Bench areas, which were outside an earlier proposed model boundary. The second source omits canal companies and districts whose rights are now reported on a "service area" basis and also has an unexplained omission near American Falls. Source three covers only the parts of the American Falls omission for which data were available on the internet. The coverage of these data sources is illustrated in Figure 5 through Figure 7

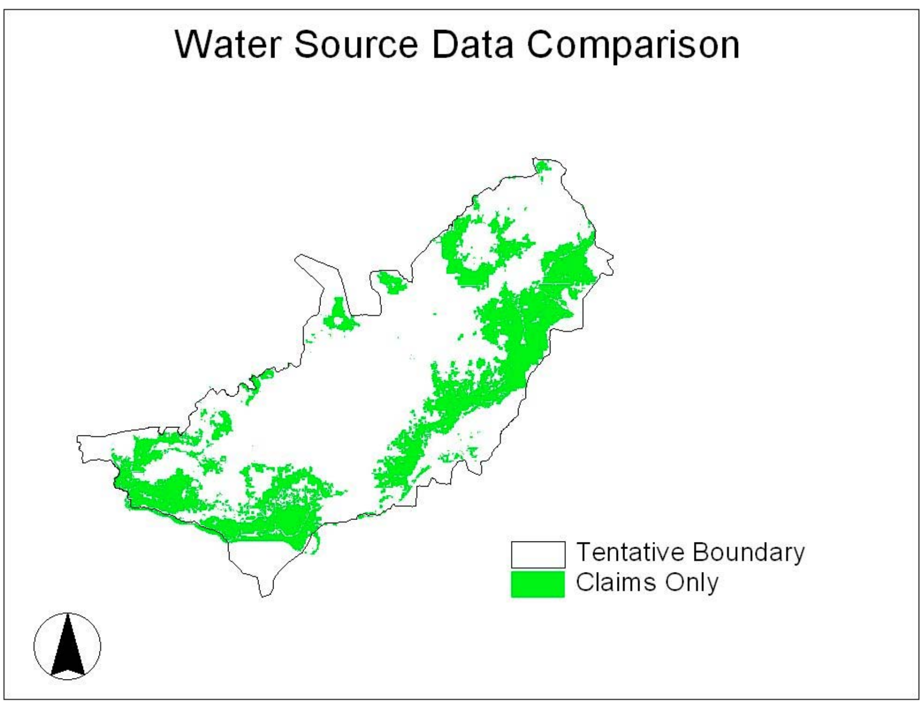

Figure 5. Data Coverage of ESPAM_AJ_Claim.shp

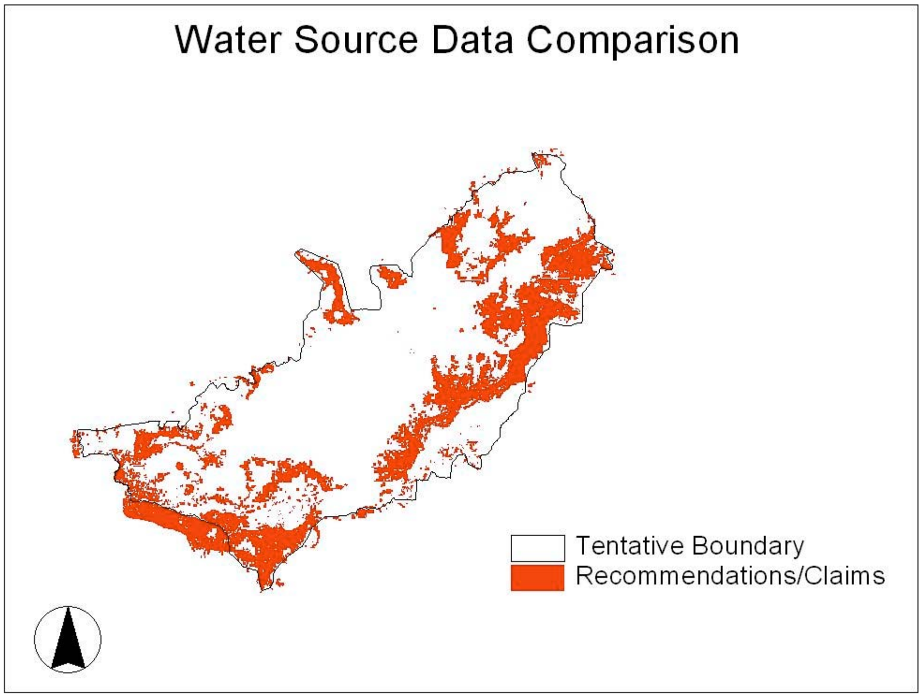

Figure 6. Data coverage of ESPAM_AJ_Rcmd.shp

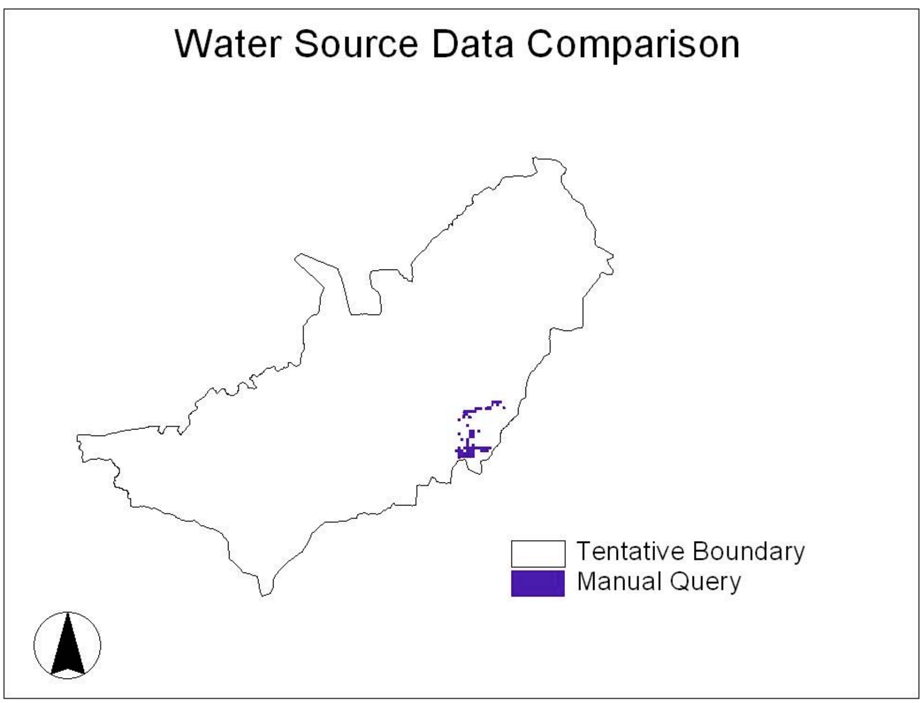

Figure 7. Data Coverage of ESPAM_Internet.shp

Using GIS, the source of irrigation water was set according to the recommendations/partial decrees shapefile, wherever these data were available. The claims shapefile was used to set the source for remaining lands for which claims data were obtained. Finally, the shapefile from the manual query of the IDWR claims from the internet site was used to set the source for the remaining lands which it covered. The result was a single shapefile of lands whose water source was based on one of these data sets. Using GIS, the source of a one-mile buffer around this shapefile, in one-mile by one-mile blocks, was set equal to the source in the adjacent shapefile of identified sources. A second one-mile buffer was set beyond this buffer, this time with the source set equal to adjacent calculated sources. The “surface water” query was performed last, so any calculated block adjacent to both surface water and another source will be shown as surface source. This two-mile buffer will accommodate all lands expected to be shown as irrigated during the calibration period. All other lands were set to a default ground-water source.

Finally, three manual adjustments were made based on inspection of the irrigation entity maps. All lands within A and B irrigation entity (near Rupert and Minidoka, Idaho) and within the Falls irrigation entity (near American Falls, Idaho) were set based on practices of the districts within those entities. A small tract of currently non-irrigated land in western Northside irrigation entity was changed from “ground water” to “mixed” based on its proximity to lands currently irrigated by surface water. Figure 8 shows the data sources used for various geographical regions. The resulting map of irrigation water source is displayed in Figure 1 above.

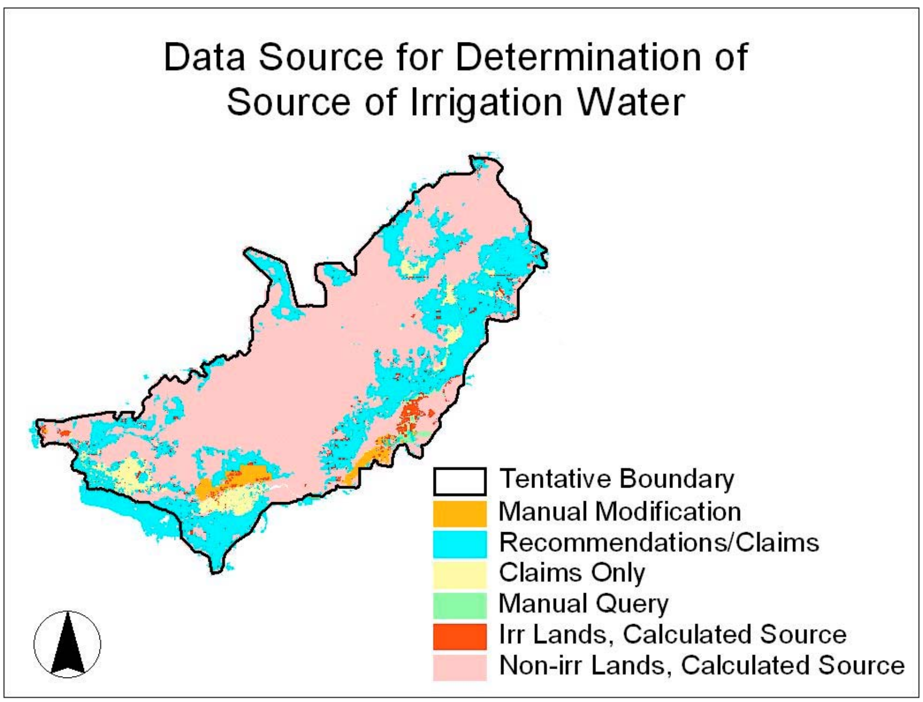

Figure 8. Data Source Used for Construction of Water-source Map.

It is important to remember that the buffer calculations were performed only for lands not identified in any of the data sources. If data exist, the final map reflects the known data. The source map can be adjusted in the future for scenario generation, as desired. This may be particularly important for analyzing proposed new irrigation in areas for which current data do not identify a source.

Adequacy of Adjudication Data. Concern has been expressed that adjudication data may not adquately express the actual spatial distribution of water source in the Northside and Aberdeen-Springfield entities. In the Northside entity, this was checked by comparing a map of lands identified by the Northside Irrigation District as being irrigated but not having a district assessment (presumed to be ground-water-only) with the completed Source of Irrigation Water map. Figure 9 shows good general agreement with lands identified as mixed-source or ground-water-source in the adjudication data:

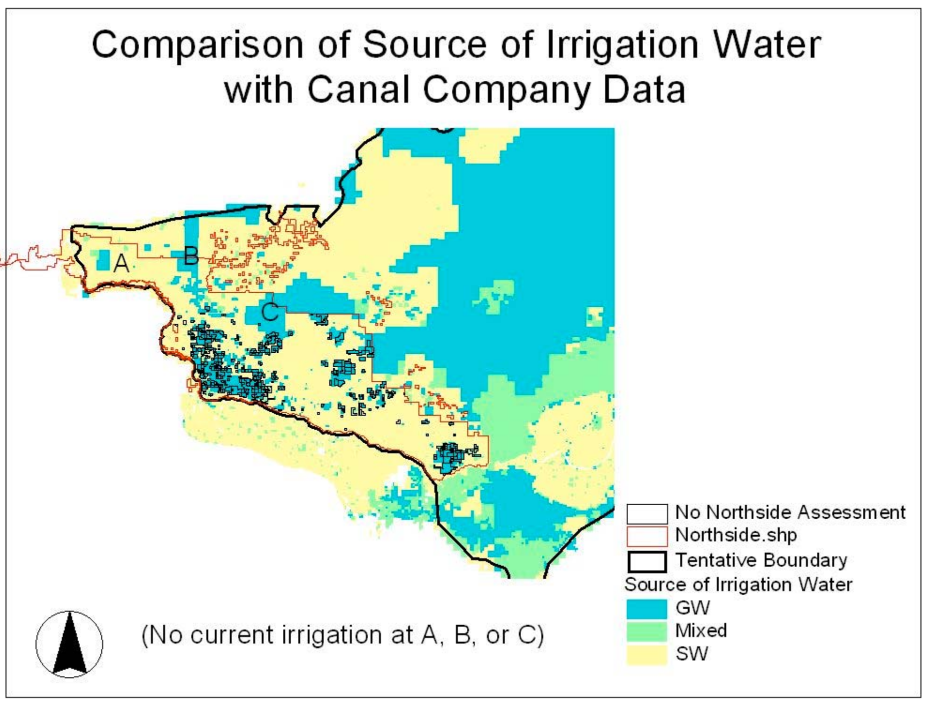

Figure 9. Comparison of Adjudication and Canal Company Data

A second comparison was made using volumes of ground-water pumpage from Water Measurement District and Ground Water District data. This test was applied to both the Northside and Aberdeen-Springfield entities. In the figures below, each dot represents 500 acre feet of pumping volume for water rights with *points of diversion* (the authorized physical location of the wells) in a given public-land-survey section. The irrigation water source on the map represents the claimed source of water for *places of* *use* (the authorized lands to which water is supplied) by public-land-survey quarter-quarter section. Generally these are reasonably near to one another. Figure 10 shows that in the Northside entity, pumping is spatially concentrated in the areas shown by adjudication data to be ground-water or mixed-source supplied lands. Figure 11 shows that pumping is approximately distributed across the Aberdeen-Springfield entity, again agreeing with the adjudication data.

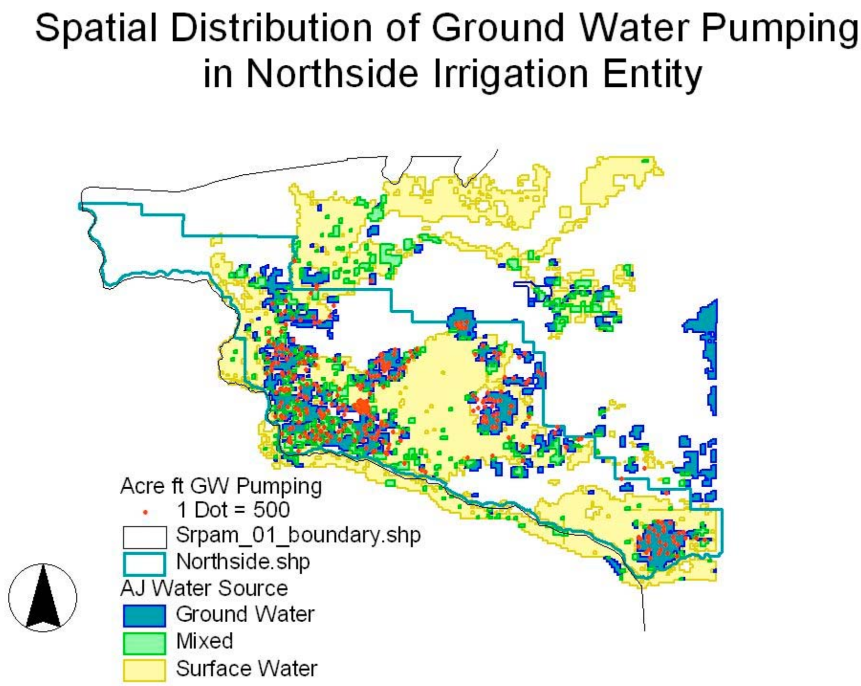

Figure 10. Spatial Distribution of Ground Water Pumping in Northside Entity

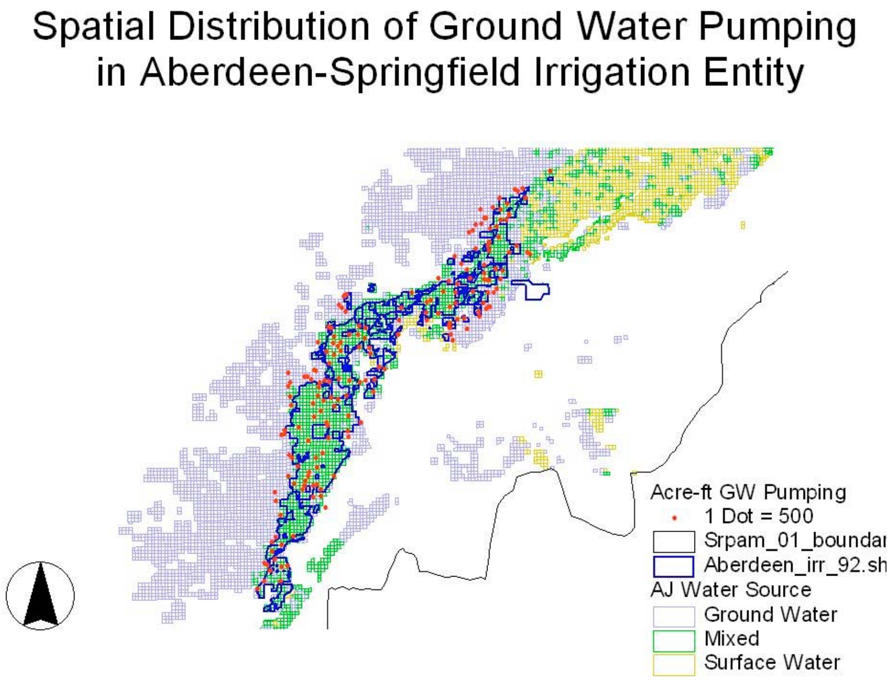

Figure 11. Spatial Distribution of Ground Water Pumping in Aberdeen-Springfield Entity

CALCULATION OF MIX RATIO

Effect of Potential Errors on Recharge Calculations

Potential errors in the mix ratio apply only to the 13% of the quarter-quarters identified as mixed-source in the adjudication data. The first error analysis examined the recharge calculation equations, and the second analysis constructed a hypothetical irrigation entity and compared calculations based on “known” parameters to calculations based upon gross errors. It appears that the effect of calculation errors on recharge is minor.

The mathematical analysis starts with the proposed calculation for net recharge from surface-water irrigation:

$$\text{Net Recharge (surface)} = (\text{Field Delivery} + \text{Precipitation}) - (\text{ET} \times \text{Adjustment Factor}) \quad (1)$$

If the source is ground water, field delivery of surface water is zero. It follows that the calculation for net recharge from surface-water irrigation is really the same as the calculation of net withdrawal from ground-water irrigation:

Net Recharge (ground) =
Precipitation - (ET x Adjustment Factor) (2)

Since the calculation is actually the same, for a given irrigated area and surface-water diversion volume, the calculated net recharge within a geographical region will be the same regardless of errors in identifying the water source of specific parcels of land.

As a further test, a hypothetical irrigation entity was assumed to be 2,000 acres of mixed-source irrigation with a 50% ground-water supply. Recharge was calculated using "known" parameters, then repeated assuming first a gross over-estimate and then a gross under-estimate of ground-water fraction. When the ground-water fraction was over-estimated, the net withdrawal from ground-water lands was highly exaggerated, but exactly offset by an exaggeration of net recharge from the surface-water lands. When the fraction was under-estimated, the too-low ground-water withdrawal was exactly offset by a too-low recharge from surface-water recharge. The net withdrawal from the aquifer does not change. This result holds as long as ground water and surface water calculations use the same ET adjustment factor. However, ground-water and surface-water ET adjustment factors could differ, perhaps by as much as ten percentage points. If the difference were ten percentage points, and the ground-water fraction were in error by twenty percentage points on the thirteen percent of irrigated lands identified as mixed source, the potential error could be:

2,000,000 acres x 2 acre feet x 0.10 x 0.20 x 0.13 = 10,400 acre feet (3)

This is about half of a percent of irrigation recharge, and less than two tenths of one percent of the annual aquifer budget. In model calibration, identical ET adjustment factors were used for surface-water and ground-water supplied lands, so there is no effect on ET calculations. During use of the model, surface-water and ground-water lands may have different ET adjustment factors.

Effect of Differences in Crop Mix by Water Source

It has been suggested that the crop mix (and therefore the ET rate) may vary by water source, because of economic response to ground-water pumping costs. Though field observation suggests that cropping differences are more dependent upon application method (sprinkler vs. gravity) and soil type, application method does vary by water source. Analysis of actual crop mix in a selected area, reported in Design Document DDW-022 Method of Irrigation Water Application, suggests that the base ET on sprinkler-irrigated lands may be one to six percent lower than on gravity-irrigated lands. This may be offset by the possibility that sprinkler-irrigated crops more nearly approach "well-watered, disease free" conditions and have higher ET adjustment factors (see Design Document DDW-021). If there is a change in crop mix due solely to pumping costs, the expectation would be to find more high-value crops on ground-water irrigated lands. Potatoes are the highest value crop in the study area, and barley is the lowest-value crop with significant acreage. The ET rate for potatoes at Idaho Falls is 2.10 ft/year, and the barley ET is 2.22

ft/year (Allen and Brockway 1983). If potatoes displace barley so that the potato fraction on ground-water-irrigated lands is thirty percentage points higher than on surface-irrigated lands, the difference in crop-weighted-average ET would be about 0.04 ft/year, or roughly two percent. These potential differences are small relative to other uncertainties in the water budget.

Effect of Dry Years

The mathematical equations and hypothetical calculations show that the primary driving factor in net recharge calculations is the surface-water diversion volume. The temporal resolution of the diversion data to be used is adequate to reflect the effect of dry and wet years. While it is acknowledged that wet and dry years might also affect ET adjustment factors, adequate data were not found to calculate unique factors for individual years. Scenario generation will allow re-setting of the adjustment factor to test hypotheses.

Effect of Errors on Deficit-irrigation Recharge Calculations

The analysis above, showing that errors in mix ratio only affect spatial distribution, requires the possibility of calculated negative net recharge on surface-water-only lands. Diversion data show that in some stress periods, some irrigation entities do not receive adequate water to satisfy full irrigation demand. The actual result is that crops are stressed and ET is reduced. Recharge drops to very low levels, but unless supplemental ground water is pumped,[3] recharge cannot be negative. Design Documents DDW-002 (Percolation, Runoff and Deficit Irrigation) and DDW-____ (Fixed Points and Offsite Points) describe adjustments made for this condition in the calibration data set.

Effect of Errors on Scenario Generation

The effect of an error in water source could be significant in construction of a scenario that involved turning irrigation on or off according to source. However, because the status-quo fraction of ground water on mixed-source lands depends on the adequacy of surface water supply relative to the cost of ground water pumping, the fraction itself would immediately change if one source or the other were curtailed. Changes would also likely occur in place of use and irrigation practices, resulting in the need for adjustments to surface diversion volumes, return flows, and ET adjustment factors. Any scenario generation will require careful examination of all the water budget components and careful sense checking.

[3] This is true as long ground water is not shallow enough to be tapped by deep-rooted crops.

Application of Original Proposed Method

The proposed calculation of mix ratio was based on Water Measurement District and Ground Water District[4] records of ground-water diversion volume, and IDWR records of surface-water diversion volume, as reported in the first version of this design document. These methods failed.

The failures prompted a reconsideration of the recharge-calculation functions of the ground-water fraction on mixed-source lands. The three functions of the source fraction are to set parameters for irrigated recharge calculation, to spatially distribute the application of surface water, and to allow for reduction of irrigated area by source during scenario testing.

The recharge calculation parameters that are directly affected by the designation of water source are the ET adjustment factor and the sprinkler percentage. The sprinkler percentage in turn affects the discount factor adjusting for non-irrigated inclusions within irrigated tracts. As discussed above, the differences in recharge introduced by the small possible differences in these parameters are likely to be small, and only affect the 13% of quarter-quarter sections designated as mixed-source. Further, while the actual parameters for mixed-source lands are likely to be related to the parameters for nearby ground-water-only and surface-water-only lands, it is not clear that they will be exact weighted averages according to the ratio of water supply.

As explained above, as long as surface-water diversion volume and total irrigated area are correct, there will be no water-budget error associated with imprecision in the source fraction on mixed-source lands. Uncertainty could translate into an error of spatial distribution if there were an entity that included a large isolated block of mixed-source lands and a large block of surface-water-only lands. Figure 12 shows that no single proposed entity contains large homogeneous blocks of both mixed-source-only lands and surface-source-only lands.

[4] These districts have data on ground-water diversion volume on irrigated parcels larger than five acres, since 1999. Partial data exist for 1997 and 1998. Water Measurement Districts also report surface-water diversion volume for rights not administered by an organized water district.

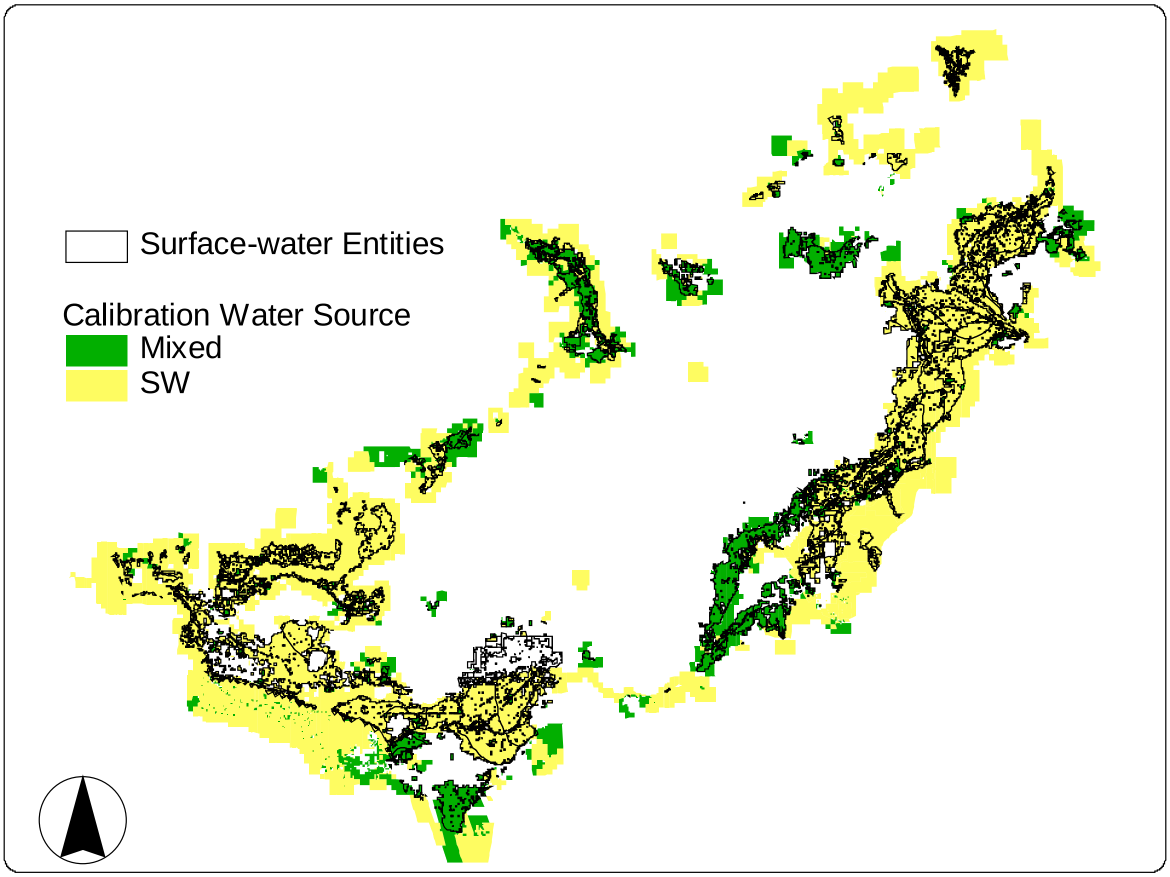

Figure 12. Spatial Distribution of Mixed-source and Surface-source lands.

The final purpose for identifying the fraction of ground-water supply on mixed-source lands is for scenario construction. For this purpose, not even an exactly correct ground-water fraction would be adequate. This is because the pre-curtailment mix is a function of the pre-curtailment availability, cost and convenience of the two supplies. Curtailment would change the relationships of these factors dramatically. For purposes of scenario construction, neither an exact determination nor an estimated mix ratio is adequate. Scenario construction will require a carefully reasoned post-curtailment mix ratio consistent with other hypothesized conditions.

Revised Method

To assess what may be a reasonable required depth for surface irrigation, depth of irrigation application for stress period one was calculated using preliminary diversion data. Twenty-one entities with very little mixed-source irrigation were examined, assuming that the lack of supplemental ground water indicates generally adequate surface-water supplies. Figure 13 shows that except for the starred value (believed to be due to incorrect assignment of diversion data files to the entity)[5], the minimum required surface-water supply is about 3.5 to 4.5 feet. Considering some allowance for canal loss, this compares well with IDWR standard field headgate requirement maps (circa 2000). This suggests that a calculation based on a four-foot required depth for surface-water only acres may provide guidance for setting the ground-water fraction on mixed-source lands.

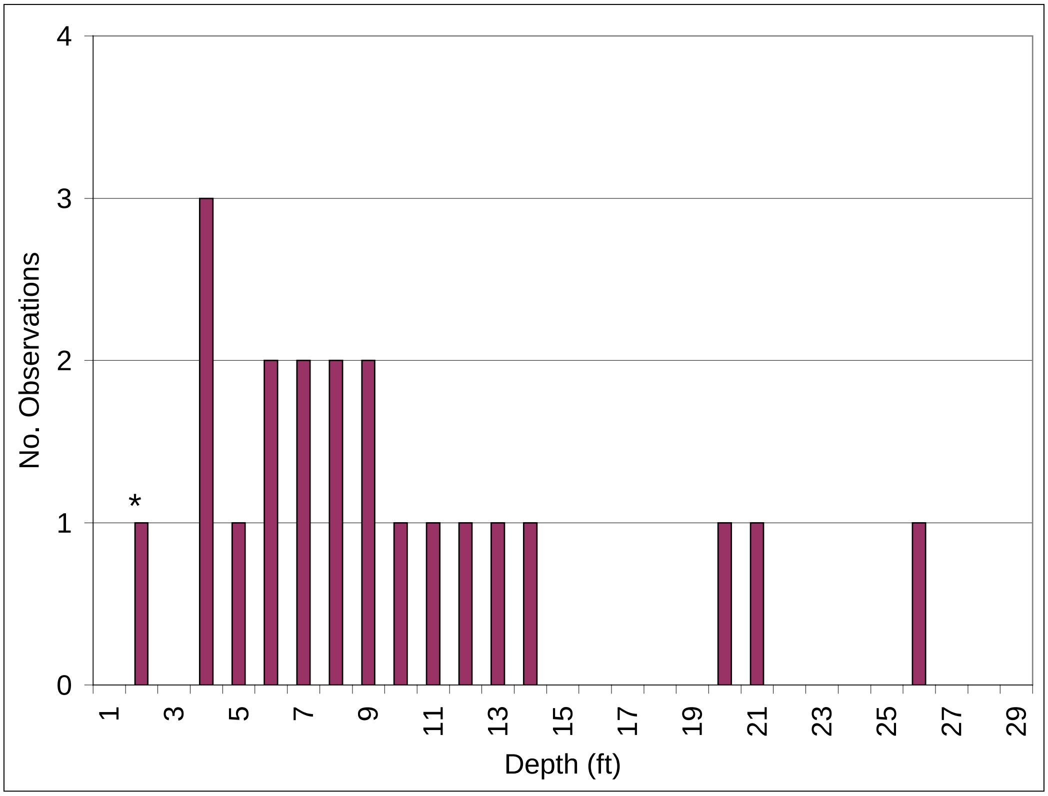

Figure 13. Summer 1980 Depth of Irrigation, Entities with Minimal Mixed-source Irrigation

Based on the four-foot depth supported by Figure 13, a volume requirement for surface-water-only irrigated lands was calculated for each irrigation entity. A three-foot depth[6] was used to calculate an approximate volume requirement for mixed-source lands. Using preliminary diversion data, a required contribution from ground water was calculated for each summer-time stress period, and an indicated ground-water fraction calculated:

Total Diversion Volume – SW-only Required Vol. = Avail. For Mixed (7)

[5] Diversions were later reassigned based on further quality-assurance work.
[6] This assumes no canal losses for the ground-water supplied portion of water needs, and is generally consistent with water-measurement district ground-water pumping volumes.

(Mixed Requirement – Avail. For Mixed)/(Mixed Requirement) = Initial GW Fraction (8)

The initial ground-water fraction calculated using equation (8) was a starting point for calculating the ground-water fraction. Since a higher ground-water fraction guards against assigning negative recharge to surface-water-only lands, the highest observed ground-water fraction during the calibration period was selected, if it was between the limits described above. If an entity had virtually no mixed-source lands, the fraction was arbitrarily set at 0.30. To preserve influence of surface-water entity parameters and ground-water polygon parameters on all mixed-source lands, a lower limit of 30% and an upper limit of 95% were set for the ground-water fraction. The lower limit assumes that presence of supplementary ground-water rights indicates occasionally short water supplies, suggesting a tendency to have similar sprinkler percentages and ET adjustment factors to the ground-water polygon. The upper limit is set assuming that the presence of surface-water rights indicates at least some fraction of supply potentially comes from surface-water. Table 1 shows the values used in model calibration. In the GIS calculation of recharge, mixed lands are represented by two identical, overlapping GIS polygons. These fractions may be reduced by the user for scenario generation.

Table 1
Ground-water Fraction of Supply on
Mixed-source Irrigated Parcels
for Model Calibration

ENTITY	NAME	GW Fraction	SW Fraction
IESW000	SW Null	0.95	0.05
IESW001	A & B SW	0.95	0.05
IESW002	Abdn Sprfld	0.70	0.30
IESW005	Big Lost River	0.71	0.29
IESW007	Big Wood	0.30	0.70
IESW008	Blaine	0.68	0.32
IESW009	Burgess	0.30	0.70
IESW010	Burley	0.30	0.70
IESW011	Butte and Market	0.95	0.05
IESW012	Canyon Creek	0.95	0.05
IESW014	Corbett	0.42	0.58
IESW015	Dewey	0.30	0.70
IESW016	Egin	0.30	0.70
IESW018	Falls	0.82	0.31
IESW019	Fort Hall	0.30	0.70
IESW020	Harrison	0.30	0.70
IESW022	Idaho	0.30	0.70
IESW025	Little Wood	0.50	0.50

ENTITY	NAME	GW Fraction	SW Fraction
IESW027	Milner	0.50	0.50
IESW028	Minidoka	0.30	0.70
IESW029	Mud Lake	0.62	0.38
IESW030	New Sweden	0.30	0.70
IESW031	North Fremont	0.30	0.70
IESW032	North Side	0.30	0.30
IESW033	Osgood	0.95	0.05
IESW034	Peoples	0.30	0.70
IESW035	Progressive	0.30	0.70
IESW036	Reid	0.30	0.70
IESW037	Reno	0.95	0.05
IESW038	Rexburg	0.30	0.70
IESW039	Silky	0.30	0.70
IESW040	Southwest	0.90	0.10
IESW041	Twin Falls	0.30	0.70
IESW044	Jefferson	0.95	0.05
IESW051	Private Basin 31	0.95	0.05
IESW052	Private Basin 32	0.81	0.19
IESW053	Private Basin 33	0.72	0.58
IESW054	Richfield	0.30	0.70
IESW055	Dry Bed	0.30	0.70
IESW056	Henrys Fork	0.30	0.70
IESW057	Blackfoot River	0.30	0.70

DESIGN DECISION

The source of irrigation water is significant for three reasons: 1) to apply unique recharge calculation parameters, 2) to spatially distribute recharge from surface-water irrigation and 3) to allow discrimination of surface- and ground-water irrigated lands for future modeling scenarios (modeling scenarios are not being generated as a part of this project).

The map identifying water source by 40-acre quarter-quarter section is compiled from IDWR adjudication data with manual adjustments. Using GIS, the map identifying water source is combined with time-period-specific maps of actual irrigated lands to produce irrigated-lands GIS data sets valid for specific model stress periods. In these data sets, GIS polygons representing irrigated parcels are associated in the GIS attribute table with individual ground-water regions or surface-water irrigation entities. This association allows linkage to data tables containing recharge parameters and diversion volumes (for surface-water entities) for the individual regions or entities. Mixed-source lands are represented by identical overlapping GIS polygons, one assigned to a ground-water region and one assigned to a surface-water entity. Each irrigated polygon carries a source-fraction attribute. This is set to 1.00 for single-source polygons, with polygons on mixed-source lands set to the values in Table 1. The fractions may be adjusted for scenario generation to reduce irrigated acreage by source or by geographical area. An increase in irrigation requires a new GIS data set, to preclude the possibility of irrigated area per cell exceeding the cell size.

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