October 9, 2007

Expert Rebuttal Report of Joel R. Hamilton

INTRODUCTION

1) My address for consulting purposes is; Joel R. Hamilton, Hamilton Water Economics, 1102 Orchard Avenue, Moscow, Idaho 83843.

2) I received a BS degree in Agricultural Economics from the University of Wisconsin – Madison in 1966, and a PhD in Agricultural Economics from the University of California – Berkeley in 1971. I was Professor of Agricultural Economics and Statistics at the University of Idaho from 1970 to 2002. Since retiring from the University of Idaho in 2002, I have worked as a private consultant on a range of economics topics. I also hold the rank of Adjunct Professor at Washington State University, which allows me to work with WSU graduate students, and to participate in WSU international projects in Jordan and Uzbekistan.

3) During my 32 years at the University of Idaho my research activities focused on economics of water use for irrigation, and on regional economics and the economics of rural communities. A list of my publications and other activities from my UI tenure is available at http://www.webpages.uidaho.edu/~joelh/CVita/UICVLong.htm. UI projects took me to Pakistan on five trips where I worked on economic issues related to water and irrigation. I also taught for a semester at China Agricultural University in Beijing, and spent a sabbatical year in Brisbane, Australia, working on applied regional economic methods including Input-Output modeling.

4) Working as a private consultant, I have served as an expert witness for the US Department of Justice in five cases in the US Court of Claims involving Tribal land and water claims. I have also served as an expert witness in two US Supreme Court cases; Texas v. New Mexico involving a dispute over Pecos River water, and Kansas v. Colorado involving a dispute over Arkansas River water. The use of Input-Output models based on IMPLAN methodology was central to both cases.

5) My recent consulting activities, in addition to issues related to southern Idaho water include; a project funded by the US Trade and Development Agency to look at the economic feasibility of irrigation system rehabilitation in Uzbekistan, and work with the Idaho Department of Water Resources to develop economic models of water use in the Boise basin. A major focus of my work with IDWR was to explore the role of externalities in water allocation. I am starting my tenth year as a member of the Independent Economic Analysis Board of the Northwest Power Planning Council which provides advice to the Council on the economics of its fish and wildlife activities

REVIEW OF OTHER ECONOMIC REPORTS

6) It is the position of the spring water users in this case that this conflict should be governed by the priority doctrine rules in the Idaho Constitution and not by economic issues and studies. However, the groundwater users have invoked the "full economic development" language in the IDWR Rules for Conjunctive Management of Surface and Ground Water Resources, and have presented economic arguments claiming that curtailment of groundwater pumping

would severely damage the Idaho economy. Given that the groundwater users have presented economic arguments and economic studies in this case, I have been asked to respond to these studies.

7) This section reviews three earlier reports dealing with economic aspects of the dispute among surface water, spring water and ground water users in the upper Snake River Basin. These three reports are the short 2004 paper by Hazen and Ohlensehlen, the study by Snyder and Coupal commissioned by the Natural Resources Interim Committee in 2005, and the expert testimony and affidavit prepared by Church for the Idaho Ground Water Appropriators.

8) Note that the Hazen/Ohlensehlen and the Snyder/Coupal studies are broad based, entire aquifer, studies whereas in the Thousand Springs hearings the rights are not senior to all groundwater rights. The Hazen/Ohlensehlen study used a 1967 priority cutoff date, while the Snyder/Coupal study used both 1949 and 1961 cutoff dates. In contrast, the Thousand Springs rights that are the focus of these hearings have priority dates of 1955, 1964, and 1973 (not nearly as senior as the rights held by the Twin Falls Canal Company). Therefore the results of these studies can only be taken as suggestive of the impact that a groundwater pumping curtailment based solely on Thousand Springs water rights would have.

Hazen and Ohlensehlen Paper

9) Bill Hazen and Bob Ohlensehlen, UI Extension Educators for Gooding and Jerome Counties, prepared their report in 2004, soon after the first call for water. They based their numbers on an economic model for the four county (Twin Falls, Jerome, Gooding and Lincoln Counties) region. The Magic Valley model they used was one developed by Garth Taylor at the UI Agricultural Economics Department. Details of the Magic Valley model are included as Appendix B.

10) Hazen and Ohlensehlen modeled two scenarios of curtailment, focusing on the curtailment acreage effects in the Magic Valley Groundwater District and the North Snake Groundwater District. Scenario 1 curtailed some dairies plus the farms that supply them with feed, and scenario 2 kept the dairies, but curtailed low valued crops on the affected farms. In both scenarios they included the offsetting positive impacts that curtailment should have on springflows, allowing some expansion of the presently water-restricted aquaculture industry. They did not address any benefits that might accrue to surface water irrigators. They estimated that the net change in exports from the region would be $251 million for their scenario 1 and $4 million for scenario 2. These export changes are conceptually similar to the change in crop value figures that I used in my 2004 report. It was when they looked at this net change in sales of products and services by water users and the supporting sectors that they got the $777 million total sales number for scenario 1 that was widely quoted in the press at that time. The corresponding net change in sales from all directly and indirectly affected sectors for scenario 2 of $16.8 million, the more relevant number, was largely ignored by the press.

11) Of course, sales are a rather poor measure of economic impact. It is really the effect on net incomes that matter, and net income changes are typically only 30 to 40 percent of sales changes. All farmers clearly understand that you can have lots of gross sales, but not much of it translates into net income. Hazen and Ohlensehlen reported that scenario 1 would result in a

net income loss of $117 million for groundwater users, springwater users, and supporting sectors, and scenario 2 would result in a $2.9 million net income loss. These more relevant net income numbers, especially for the most plausible scenario 2, also received little attention in the press.

12) Hazen and Ohlensehlen note that limiting their analysis to the MVGD and NSGD only accounts for a portion, albeit a large portion, of the groundwater lands that could be curtailed. Curtailing these other lands outside the modeled area would result in proportionate additional impacts on sales and incomes.

13) The Magic Valley model used by Hazen and Ohlensehlen was an appropriate model given the very limited conceptualization of their study, where they cast the issue as one of trout farms versus dairies and crop farms using groundwater, and limited their scope of analysis to the Magic Valley.

14) Summarizing, the study by Hazen and Ohlensehlen effectively makes three points:
    a) Changes in net income are a better measure of the economic impact of curtailment than changes in the value of production.
    b) If some form of mitigation can assure a continued water supply for the dairies, this greatly reduces the impacts of curtailment.
    c) If the dairies continue to get the water they need, the Hazen/Ohlensehlen estimate of the net income effect of curtailing lands in MVGD and NSGD is $2.9 million.

Snyder and Coupal Report

15) The report "Assessment of Relative Economic Consequences of Curtailment of Eastern Snake Plain Aquifer Ground Water Irrigation Rights" was prepared by Donald Snyder and Roger Coupal for the Natural Resources Interim Committee in February 2005.

16) The Snyder/Coupal report, and the Church report reviewed below, make reference to and critique my earlier report "Economic Importance of ESRPA-Dependant Springflow to the Economy of Idaho", prepared in December 2004 for a group of surface and springflow dependant water users.

17) The Snyder/Coupal study was mostly well-done, and I am in agreement with most of the methodology used. However I do have differences with some of the assumptions used, and with the specifics of how the methodology was applied and interpreted.

18) The study properly focuses on changes in income (measured as changes in value added). In my report I focused on changes in gross output because it was beyond the scope of my study to build an input-output model to convert output value to value added. (I discuss this issue in Text Box 3 on page 18 and on pages 33 and 34 of my 2004 report) The IMPLAN models used by Schneider and Coupal are appropriate tools for this task, and their use of IMPLAN seems to be generally correct. I have several times made use of IMPLAN-based models in my own work. As Schneider and Coupal appropriately point out, the impact of curtailment measured as change in gross output would be expected to be two to three times the numeric value of the impact measured as change in value added. (That was the point of the last

column in Table 8 of my 2004 report.) Keeping in mind the difference between gross output and value added, the numbers in my 2004 report are quite comparable to those in the Schneider/Coupal report.

19) We also agree on a number of other key assumptions, including the key assumption that regional livestock industry would be mostly unaffected by curtailment, because they will surely find a way to secure the water they need. Thus we agree that most of the direct impacts in the curtailment area would be on crop production, not dairies. My roughly $500 per acre crop value is also close to their number.

20) One of the key places where we differ is on the list of other affected parties enumerated on their page 11:
    a) Domestic, municipal and industrial users
    b) Livestock (beef and dairy) producers
    c) Sugarbeet and potato processing
    d) ESPA area electric power industry
    e) Down-river, main stem Snake River junior priority water right holders
    f) Public uses

    which they acknowledge will be affected, but then call "externalities" and exclude from further analysis. While I concede that most of these parties are not included as contesting parties in the water call, any effects on these parties will be just as real for the economy of the state and region as the effects on the three classes of water users included in the Schneider/Coupal analysis:
    a) ESRPA senior surface/spring irrigation water right holders
    b) ESRPA area aquaculture industry senior water right holders
    c) ESRPA junior irrigation ground water right holders

    I cannot agree with the implication that Schneider and Coupal leave – that it is often uncertain whether the effects of curtailment on these other uses are positive or negative. I believe that many of these uses would clearly benefit from curtailment. The biggest issue concerns hydropower, which I discuss below.

21) The decision by Snyder and Coupal to exclude these "externality" effects such as hydropower from their analysis is perplexing in light of their decision to use input-output analysis to estimate the income effects of groundwater curtailment. While their report does not provide enough detail to be certain, it appears that their methodology estimated the total income effect as the direct income effect plus the indirect and induced income effects. That relationship is illustrated in Figure B-1 of their report. The important point is that including the indirect and induced income effects includes income accruing to a wide range of other economic sectors not "directly" affected by the curtailment – fertilizer dealers, banks, transportation, farm machinery, grocery stores, etc. Even the effects on governments are included in the Snyder/Coupal income effect numbers because of their decision to include indirect business taxes in the calculation. Including these indirectly affected sectors in the estimates of the income effects of groundwater curtailment, and then excluding directly affected sectors such as hydropower and recreation, cannot be justified based on economics. All of these sectors would be impacted by groundwater curtailment, and it would be legitimate from an economics point of view to include the income effects to all of these

sectors in the analysis. Snyder and Coupal were correct when they included indirect and induced effects in their analysis, but there is no economic justification for their exclusion of the sectors they label "externalities" – especially hydropower.

22) To me, as an economist, this is one of the central points in this dispute. If the issue is cast as a pure case of applying the priority doctrine, then economic analyses of whether water has more economic value or less economic value in this use or that use have little relevance. However, if economics is going to be considered in the administration of surface water, a practice which historically has not happened, then the case must address the "full economic development" of ALL beneficial uses.

23) Because Snyder and Coupal do not provide the necessary detail, it is not possible to say what part of the income effects they show for surface water users, aquaculture, and groundwater users is due to these indirect and induced effects. An estimate of this can be made using the Magic-Valley input-output model that Hazan and Ohlensehlen used to estimate the impacts of groundwater curtailment in their 2004 memo. (I obtained a copy of this IMPLAN-based model from Professor Garth Taylor at the University of Idaho.) The indirect income effects account for slightly more than half of the total estimated income effects for the relevant economic sectors. If it is necessary in the legal context of this case to omit the economic impact of hydropower because it is an "externality", or because it is not a party to the dispute, then from an economics perspective it would be logical and consistent to also reduce the Snyder/Coupal income estimates by about half, because the other half is only indirectly related to groundwater curtailment, and consists of economic impacts on sectors that are also not parties to this dispute.

Table 1: Direct & Indirect Income from Magic Valley I-O Model

	Direct Income		Indirect Income		Total Income
Fish Farming	0.1825	55.5%	0.1462	44.5%	0.3287
Food Grains	0.1485	45.5%	0.1782	54.5%	0.3267
Feed Grains	0.1747	48.2%	0.188	51.8%	0.3627
Hay and Silage	0.1675	46.1%	0.1959	53.9%	0.3634
Vegetables	0.2702	52.8%	0.2419	47.2%	0.5121
Sugar Beets	0.1376	44.9%	0.1686	55.1%	0.3062
Average:		48.8%		51.2%	

Source: Magic Valley Model, Ag Economics Department, University of Idaho

24) The hydropower impacts from groundwater curtailment can be estimated using information from the ESPA groundwater model runs and the relationships shown in Table A-4 in my 2004 report. Table 1 of the Cosgrove, et al, "Curtailment Scenario Version 1.1" report dated March 2006, shows that reach gains from post-1961 curtailment, would total 1,633 cfs, or 1,182 kaf. For the moment we will also adopt the Schneider/Coupal assumption (page 20) that 1,015,500 acres of surface irrigated land would be able to divert an additional 0.82 acre feet of water per acre. Of this they say (on page 18) that between 0.3 and 0.6 acre-feet per

acre would actually be "delivered to the crop". (Note that Snyder/Coupal do not explain where they got the 0.3 and 0.6 numbers.) If all the water delivered to the crop were actually consumptively used by the crop, this implies that crop consumptive use on these 1,015,500 acres would increase by 305 kaf to 609 kaf.

25) For the sake of discussion, we will assume this number is 405 kaf – 100 kaf to irrigators diverting above Milner, 300 kaf to irrigators diverting at Milner, and 5 kaf for the farms using Thousand Springs water. This leaves 795 kaf of reach gains under the post-1961 scenario that are not consumptively used by the crops, and are free to run downstream (possibly via a side-trip through the aquifer) where they can be used for hydropower generation at the existing on-river hydropower facilities. Using the power values from my Table 2, and locating the net reach gains as appropriate, the increased power value would be \$40.5 million on the US Bureau of Reclamation and Idaho Power Company systems, and \$21.6 million for the downstream federal BPA system.

26) Note that running more water through existing hydropower facilities to generate more electricity involves very little additional input cost by either IPC or the feds. Thus a very large part of this increased power value translates directly into increased value added – which should (in a regulated industry such as electric power) show up as lower rates to electricity consumers. Thus there will be two routes for additional multiplier impacts on the Idaho economy. The relatively small increases in other inputs required to generate and distribute this increased hydropower production will generate some increased income among the suppliers of these inputs. The much more important route is through the lower rates consumers will pay for electricity. If they pay less for electricity, they will have more to spend on other things, thus generating income effects in a variety of sectors in the Idaho economy. The hydropower impacts of curtailment, both direct and through their multiplier effects are potentially very important, and that their exclusion by Schneider and Coupal is a major omission from their study. Note that this also applies to some extent for the electricity that could be generated at federal dams lower on the Snake and Columbia. More water should translate into lower BPA rates to those utilities receiving BPA power, and ultimately into lower power costs to customers, including both groundwater and surface water users, especially those outside the IPC service area.

27) My 2004 report listed a number of other economic sectors in addition to on-river hydropower that would benefit from augmented springflow. These include off-river small hydropower plants; domestic, commercial, municipal and industrial users; non-commercial aquaculture users; recreation users; and endangered species concerns. While I did not model their economic impacts in my 2004 report, this does not mean that their economic impacts are small. Their economic impacts are real, could be modeled and estimated, and are undoubtedly a significant piece of the regional economy. These sectors would be significant beneficiaries if curtailment of groundwater pumping could restore and preserve their water supplies. If Idaho is seriously trying to maximize the economic returns from its water, then it can't afford to ignore the impacts of policy decisions on any of the users of this water.

Table 2: Potential Value of Columbia-Snake Basin Water for Hydropower

	At Each Dam: Developed Head feet	Potential Generation kwh / af [1]	Value at $0.045/kwh	Modeled Reach Gains kaf [4]	Assume Water Use kaf [5]	Net Reach Gain kaf	Reach Power Gain $
Lower Columbia							
Bonneville	59	51	$2.31			776.36	$1,793,280
The Dalles	83	72	$3.25			776.36	$2,522,750
John Day	100	87	$3.92			776.36	$3,039,457
McNary	74	64	$2.90			776.36	$2,249,198
Upper Snake							
Ice Harbor	98	85	$3.84			776.36	$2,978,668
Lower Monumental	100	87	$3.92			776.36	$3,039,457
Little Goose	98	85	$3.84			776.36	$2,978,668
Lower Granite	98	85	$3.84			776.36	$2,978,668
						Federal Total:	$21,580,146
Hells Canyon	210	183	$8.22			776.36	$6,382,860
Oxbow	120	104	$4.70			776.36	$3,647,349
Brownlee	272	237	$10.65			776.36	$8,267,324
Swan Falls	26	23	$1.02			776.36	$790,259
C.J. Strike	88	77	$3.45			776.36	$2,674,722
Bliss	70	61	$2.74			776.36	$2,127,620
Lower Salmon Falls	59	51	$2.31			776.36	$1,793,280
Upper Salmon Falls A	46	40	$1.80			776.36	$1,398,150
Upper Salmon Falls B	37	32	$1.45	254.8	5	776.36	$1,124,599
Shoshone Falls	214	186	$8.38			526.56	$4,411,556
Twin Falls	147	128	$5.76			526.56	$3,030,368
Milner - TFCC [2]	140	122	$5.48		300	526.56	$2,886,064
Minidoka [3]	48	42	$1.88	663.8		826.56	$1,553,268
American Falls	58	50	$2.27	262.8	100	162.77	$369,593
						Idaho Power & USBR Total:	$40,457,011
						Total:	$62,037,158

Footnotes:

[1] These hydropower amounts are based on physical relationships and typical plant efficiencies, where an acre foot of water falling through a foot of developed head can generate about 0.87 kilowatt-hours of electricity. This assumes that the powerplants have capacity to handle the changed flow. In the long run, of course, capacity can be changed.

[2] This is based on power generation at the powerplant on the TFCC canal about a mile below the diversion at Milner Dam. The smaller powerplant located at Milner Dam would generate less power.

[3] Minidoka Dam is a US Bureau of Reclamation project.

[4] These numbers come fron Cosgrove, et al, Curtailment Scenario, Version 1.1, March 2006.

[5] These numbers are taken from the Cnyder/Coupal report, February 2005.

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28) The value of additional streamflow for endangered salmon deserves a few more words. Both the Federal agencies and the State of Idaho have spent large amounts of time and money in recent years to locate, lease, and purchase water to fulfill the current 427 kaf downstream flow augmentation commitment for endangered anadromous fish. As Church and Snyder/Coupal point out, much of the reach gain from groundwater curtailment would not be

consumed, but would augment downstream flows. Given the uncertainty about ongoing litigation, it remains uncertain what commitment the upper Snake projects will have to make to future downstream fish flows.

29) It is a principle of economic theory that producers will economize on their use of the most limited resource. If it is land that is restricted, farmers will tend to use their available land for the highest value use. If water is restricted, most farmers will, within reason, continue to farm all their land, but allocate water to maximize profits even if this means somewhat reduced yields or growing lower valued crops that use less water. (This is what the surface water users have indeed been forced to do.) Any groundwater curtailment is likely to be implemented as a restriction on the land area that can be irrigated from wells – a land restriction. The surface water users should see more water – the relaxation of a water constraint.

30) My 2004 report assumed that the junior groundwater users would tend to cut back acreage of lower-valued crops, and concentrate their restricted land base on higher-valued crops. In contrast, Schneider and Coupal assumed that curtailing the acreage of groundwater pumping would affect high and low valued crops equally. Adopting my assumption would substantially reduce the estimate of damage to the curtailed junior groundwater users. It is curious why Schneider and Coupal made their assumption that curtailment would affect high and low valued crops equally, since they did assume that surface water users, given their fixed land base, would use their increased water supply to grow higher valued crops. Note that they did not mention the possibility that more water would result in higher yields for these surface water users – another way they underestimated the benefits to these irrigators.

31) Many of the junior groundwater users, especially if they are pumping from some depth, incur high pumping costs – often higher than the water charges paid by surface water users. The costs of groundwater pumping include the cost of the well and pump amortized over their multi-year lives, the costs of operation and maintenance of the pump and well, plus the cost of the pumping electricity itself. Partly offsetting these high pumping costs, it is important to recognize that using groundwater has some advantages. Groundwater irrigators have more flexibility in matching irrigation schedules to crop needs and management dictates, and they don't have the problems that come with dirty canal water. Modeling pumping costs is not a simple matter, since the costs vary by which utility serves the area, and depend on whether the farmer participates in one of the special interruptible or off-peak irrigation rate schedules that are available. The BPA "irrigation credits" further complicate the picture. Working through these issues was beyond the scope of this analysis, but is a topic that might be worthwhile addressing later.

32) Rather than modeling pumping costs, another approach is to think of the issue in terms of land values. In a recent personal communication with Bob Morrison, Senior Appraiser with the Idaho Falls office of the Farm Credit Service, Morrison offered the judgment that for comparable quality land, a southern Idaho parcel with a 300 foot well and a parcel with surface water delivery would have about the same land value. Both economists and appraisers think of land value as being the compounded value of the stream of future profits from that land. If a parcel with groundwater from a 300 foot well and a parcel with surface water have the same land value, then it follows that they have the same income potential. It

also follows that farms with wells deeper than 300 feet have higher water costs and less income potential than surface irrigated farms. There are many wells that are candidates for curtailment that exceed 300 feet. While Snyder and Coupal do not present enough model details to be sure, it appears that this water cost difference is not recognized in their I-O model. If one assumes that the I-O model represents the average situation in the region – somewhere between the two extremes of groundwater and project water costs, Snyder and Coupal's failure to recognize this distinction would sharply overestimate the income loss to the groundwater users, and underestimate the net income gain to the surface water users. To the extent that the CREP program succeeds in voluntarily curtailing groundwater irrigated acreage over the ESRPA, farmers with the highest lifts will be among those most willing to sign up, because the income they will loose by not irrigating will be small compared to the CREP payment.

33) There are factors in addition to water pumping costs that distinguish the post-1961 groundwater irrigated farms from the lands supplied with surface water. At the beginning of the last century when irrigation started in south central Idaho, the lands which were developed first were the best soils and the lands which were easiest to reach with water. This land is the area now irrigated by the surface irrigation projects. As deep well pumping became feasible in the late 1940s and 1950s, the first lands served by groundwater were again the areas that offered the best combination of soils, climate and low pumping cost -- generally land with low pump lift. By 1961, groundwater development had to make do with the land that was left – poorer soils, less favorable climate, and higher lift. Even more recently in areas served by center pivots, the corners which were often originally ignored as uneconomic, were later irrigated at considerable capital and labor expense. All of these are reasons why the post-1961 groundwater-served land would be expected to produce lower incomes per acre than surface irrigated land.

34) An I-O model of the kind used by Snyder and Coupal inherently assumes that industries expand and contract proportionally and symmetrically. Irrigated agriculture, however, does not behave that way. If groundwater irrigation acreage is curtailed, the sector may in fact contract proportionately. For the reduced acreage, much of the machinery and equipment can be salvaged. The retired acreage will not have to be tilled, seeded, irrigated, sprayed or harvested. On the other hand, the surface irrigated land, which might have its full quota of water restored if groundwater pumping were constrained, is already being farmed. It has in place its full complement of irrigation infrastructure. The land is already being tilled, planted, irrigated, weed controlled and harvested. The main difference that more water will cause is higher yields, and perhaps a change to higher valued crops. Because of many of the fixed production costs are already being incurred, a very large portion of the increased value of crop production will translate directly into net income. Again, because the Snyder/Coupal input-output model assumes proportionality and symmetry, this results in an overestimate of the costs of curtailment to the groundwater pumper and an underestimate of the benefits to the surface water users.

35) For aquaculture, Snyder and Coupal follow pretty much the methodology of Hazen and Ohlensehlen. They estimate the additional water that would be available to fish farms, use a formula to translate that into additional pounds of fish, apply prices to translate that into additional value of production, and insert that number into their input-output model. This

allows them to estimate the net income in the fish production itself; plus the net income in all of the sectors from which fish farms buy inputs such as feed, labor, transportation, etc; plus the induced effect as this income gets spent in the wider community. This is the conventional approach to estimating economic impact with an input-output model. However, in the case of Idaho trout production, this approach may miss a significant part of the actual income effect. Much of the trout from Idaho receives further processing before being exported from the state, generating additional income. If the added production results in increased value added processing, then this would be additional income above that estimated by Snyder and Coupal.

36) Schneider and Coupal note that the benefits and the costs of curtailment have different time paths. The costs to junior groundwater users will be immediate, but the reach gain benefits will be delayed by the aquifer response time. Note however, that while it is true that it takes decades to nearly a century for the curtailment response to completely work its way through the aquifer, some of the response occurs in the first year, and typically about one half occurs within the first decade following curtailment (Cosgrove, et al, "Curtailment Scenario Version 1.1", March 2006). It is not the case that the benefits to spring and surface water users is deferred so far into the future that they count for nothing.

37) I would also note that the costs to the curtailed junior groundwater users also have a time path – they diminish with time as the idled production inputs find other employment or depreciate. The reach gain benefits to surface water users, aquaculture and hydropower are ongoing.

38) Summarizing, I reach the following conclusions from my review of the report by Snyder and Coupal;

   a) It remains the position of the Thousand Springs water users in this case that the issue should be decided based on the priority doctrine not on estimates of economic impacts. However, since the groundwater users have tried to cast the case in terms of the "full economic development" language found in the IDWR Rules for Conjunctive Management of Surface and Ground Water Resources, then the discussion must address the economic effects on all of the affected parties, whether or not they would have standing in an ordinary water call case.
   b) This means that hydropower impacts count, and the increased value of hydropower production would offset a significant part of the losses suffered by the curtailed acreage. Using the post-1961 curtailment scenario, the increased streamflows have a potential to generate electricity worth $45.5 million at Idaho Power and Bureau of Reclamation facilities, plus $21.6 million at downstream federal dams. The income effects of this could be huge, especially if the multiplier effects of lower electricity prices are included.
   c) In addition to hydropower, there are a number of other sectors that will benefit from increased flows. These include off-river small hydropower plants; domestic, commercial, municipal and industrial users; non-commercial aquaculture users; recreation users; and endangered species concerns.
   d) The Snyder/Coupal study overestimates the income losses for the curtailed acres, and underestimates the income gains to the surface irrigated land, for a number of reasons, including:

i) Omission of the likely changes in crop mix -- where curtailed groundwater users are likely to move their high valued crops to the land they can still use, and surface water users are likely to use their increased water supply to increase cropping intensity and achieve higher yields.
ii) Omission of the differences in water costs between groundwater and surface water farms. The cost of pumping groundwater is very significant, especially for land with well depths in excess of 300 feet.
iii) Failure to account for other differences between groundwater and surface water irrigated lands, such as land quality and topography.
iv) Omission of the likely effects of expanded fish production on fish processing.
v) The inherent problem of using an input-output model that assumes proportionality and symmetry, when in fact the curtailed groundwater farms are likely to react quite differently from the surface irrigated farms that have an increased water supply.

Church Reports

39) This section reviews the expert witness report prepared for the Groundwater Pumpers by John Church, which includes by reference his earlier affidavit dated March 22, 2005.

40) Both the Church expert report and his March 22nd affidavit misrepresent the purpose of my 2004 report. Church then criticizes my report for failing to achieve the objectives that he sets for it. The purpose of my report was stated:

> "The purpose of this report is to document this big picture view of how springflows fit into the hydrology of the Eastern Snake River Basin and the economy of all of Idaho. To a lesser extent this report provides insight regarding potential impact of curtailment on junior ground water right holders that rely on the ESPA and on the curtailment that senior water right holders have already experienced because of out-of-priority diversions." (Hamilton, 2004, page 5)

41) Despite this limited objective, which intentionally did not include a complete analysis of the costs or benefits of any groundwater curtailment scheme, Church's affidavit concludes that:

> "Consequently, in my opinion the Hamilton Study does not offer meaningful estimates of the probable economic impact on the Idaho economy of a curtailment of groundwater supplies to ESPA irrigators. Its flaws make it of little relevance in this matter, and I could not rely on it as an accurate depiction of the economic costs or benefits of the proposed curtailment of ground water rights on the ESPA." (Church Report, paragraph 18)

42) Church charges me with assuming that water shortages have forced surface water users to "dry up" land:

> "In making its calculations, the Hamilton Study assumes that ESPA groundwater withdrawals have had a direct effect on the availability of surface water supplies and

have caused water users to forgo production (and thus income) and to dry up irrigated lands. Hamilton Study at p. 2." (Church Report , paragraph 10)

And again:

"I have seen no documentation that any surface water users receiving their water supply from the Coalition members actually have dried up acreage in the recent drought of 2004, or in 2005. However, these assertions are again made without data or the specific information that would support this position." (Church Report, paragraph 12)

"There is no concrete evidence that surface-irrigated lands in Twin Falls, Jerome, and Gooding Counties have been taken out of irrigation due to lack of water since 1990, and there appears to be no correlation between water supply and farm production in these counties." (Church Report, paragraph 13)

What I did say was:

"Irrigators in each of these three river reaches have suffered some loss in crop production because they have not had enough irrigation water. This report documents that groundwater pumping caused damages to spring-dependant irrigation that sum to as much as $260 million per year in crop value They have also incurred additional costs to make their water delivery and application systems more efficient so they could get by with less water. An unintended consequence of these efficiency improvements has been a further reduction in aquifer recharge, with cascading effects lower down in the ESRPA." (Hamilton, 2004, page 2)

43) In fact my report makes no reference to any surface water irrigators actually being forced to "dry up" irrigated land, although I do note on page 15 of my report that idling some of the poorest land is one among several options that farmers might consider. I did say that:

"In 2004, water supplies to both Twin Falls and North Side projects were restricted, and the irrigation season ended early. Farmers in the area report significant effects from this water shortage, including shifts to lower water using and lower valued crops, lost last cuttings of alfalfa, lower sugar levels in immature beets, problems digging dry potato fields, and excess nitrogen problems in water shorted corn silage." (Hamilton, 2004, page 16)

44) These indications of damage were collected at a meeting with farmers and irrigation officials in Twin Falls in September, 2004. My report continues on, discussing the ways that farmers can respond to water shortages:

"The biggest effect from water shortages caused by springflow declines is probably not on the crops grown in this region, but how they are grown. If there are regular, persistent water shortages, then the irrigation projects and the farmers themselves are forced to emphasize efficiency of water use. Farmers have an incentive to do a better job of applying water to their fields, they use irrigation scheduling, they install sprinklers, and they use pump-back systems. Leaky canals are lined, and delivery scheduling refined. While all these practices help stretch the declining water supplies in the area (which would seem like a good thing) they also reduce the amount of water that infiltrates to recharge the lower end of the ESRPA (which aggravates the problems at Thousand Springs and downstream). Thus the costs due to declining springflows in the American Falls reach have three parts -- first the reduced production from any water-short crops, second the very significant costs of irrigation system improvements and changes in irrigation practices needed to stretch the available water, and third the externality costs imposed lower down the ESRPA as reduced recharge results in declining water tables and reduced springflow." (Hamilton, 2004, page 16)

45) Church apparently asserts that actions by farmers to improve irrigation efficiency should have been and would have been adopted as a matter of course, and were not related to water shortage:

> "Similarly, Hamilton claims that the surface water users have had to adapt and be creative to deal with what Hamilton infers are groundwater pumping-induced water shortages, and as a result they have incurred a significant expense to install sprinkler systems to make more efficient use of water. Hamilton then concludes that this is a cost already borne by the economy that is somehow balanced or offset by shutting down groundwater-irrigated acres. This is illogical. A rational economic view is that each water user would take, and has taken, those economically-appropriate measures to increase efficient use of the water resource, and thereby maximize his own economic output per unit of water. Doing so would tend to maximize economic outputs from all those dependent on the resource. If an irrigator can make his diversion or delivery system more efficient, doing so presumably provides its own economic benefits to that farmer, and in any event was not done in the context of a counterbalancing requirement that ground water rights be curtailed." (Church Affidavit, paragraph 12)

46) This indicates a fundamental misunderstanding of basic microeconomics. When an input (water in this case) becomes scarce, profit-maximizing behavior makes it worthwhile to take cost-effective measures to extend the use of that resource. It is true that farmers adopt water-saving practices (lining ditches, more careful attention to irrigation, land leveling, irrigation scheduling, sprinkler conversion, etc) for a wide range of reasons. However, they adopt these practices faster when pushed by water shortage, and while they do so to maximize profits, the profits achieved will be less than if they had a full water supply.

47) A study that I completed 1981 for the UI Water Resources Research Institute looked back at the 1977 drought and how it affected irrigated farming. While this report is over 25 years old, it is not outdated, because the response to drought by irrigators that it describes in 1977 is exactly the kind of response to water shortage that one would expect from farmers today.

> "Chapter 3 addressed what farmers actually did during the 1977 drought. While crop changes, variety changes, and idled land were observed, their magnitude was quite small as a percentage of irrigated cropland in the study areas. The crop and variety changes that did occur were concentrated in the Ada-Canyon County area, a

diversified area with a wide variety of potential crops for farmers to select from. Much of the idled land was in Blaine and Lincoln Counties, which have fewer potential crops and are subject to chronic water shortage. Water conserving crops are the norm in this area, so one of the few options when water is acutely short is to idle cropland."

"While some farmers did adopt these cropping pattern strategies, most farmers proceeded with their usual cropping pattern, even when faced with a high probability of water shortage. As a result, the primary effect of drought was to cause yield declines, crop quality problems, and non-harvest rather than acreage changes." (Hamilton, J.R., D.J. Walker, D.L. Grant, and P.E. Patterson, "The 1977 Drought in Idaho: Economic Impacts and the Response of Irrigators and Water Delivery Organizations", IWRRI, May 1981, page 186)

And:

"The farmer interviews did suggest that water was being managed much more carefully than usual during the summer of 1977. Many crops got less water, but didn't suffer corresponding yield declines. Farmers made many irrigation system changes and improvements in 1977. How many of these were changes that had been needed for some time, but were finally prompted by the dry year and/or the availability of financial aid is uncertain. It is certain that these changes helped farmers to better control their use of water, and thus improve their efficiency. The ability to make such efficiency improvements means that some water shortage can be endured with not too much impact on crops. However this has a disturbing implication--the long term movement to improve irrigation efficiency by sprinkler conversion, lining canals, irrigation scheduling, etc., means that much of this cushion may be lost. Idaho irrigated agriculture may become more vulnerable to drought. The effect of improvements in water use efficiency on this drought cushion depends very much on how Idaho water law interprets a farmer's rights to the water saved by efficiency improvements. The effects of these system changes and efficiency improvements on return flows and groundwater levels are uncertain -- but should be of concern to those farmers who rely on such sources for their irrigation water." (Hamilton, et al, 1981, pages 187, 188)

48) Church seems to dismiss farmer and irrigation efficiency improvements done in response to water shortage as of no consequence. It is apparently Church's view that, if efficiency improvements are made, and these avoid most crop losses, then water shortage caused no economic damages. My 1977 drought report documents that these improvements usually come at a cost. Sometimes they may be capital investments for equipment and infrastructure. Sometimes they come in the form of more careful irrigation, with an increased labor cost attached.

49) However, the most important impact of efficiency improvements caused by water shortage may be the impacts lower down in the system. If farmers are forced by water shortage to increase the efficiency with which they use water, this will reduce the amount by which they recharge the local Twin Falls Aquifer, and the lower Snake Plain Aquifer – further

aggravating the aquifer problems which are the basis for the water calls in this region. It does not appear that the ESRPA aquifer model accounts for this insidious compounding of the effects of water shortage as one moves down-gradient in the basin. (Fully doing so was beyond the scope of the IWRRI modeling effort, and would have entailed modeling not only the physical behavior of the aquifer system, but also the daunting task of predicting the behavior of farmers as they respond to varying water supplies.) However, this does suggest that the ESRPA modeling effort may have underestimated the effects of past groundwater depletions, and may underestimate the effect that curtailment would have had on spring and surface flows.

50) Much of Church's expert report and the appendix material that accompanies it consist of a discussion of the dire current economic conditions of irrigated agriculture in southern Idaho, and the dismal future prospects for regional potato production – all from the perspective of 2005. I don't necessarily disagree with this assessment of the present or future. Clearly, in 2005 rising input prices and stagnant output prices were squeezing the profits of Idaho irrigators. However, one consequence of this is to call into question the accuracy of the income impact estimates computed by the Snyder/ Coupal I-O model. The IMPLAN modeling framework uses production coefficients that represent relatively long-run and geographically aggregated production relationships unless these IMPLAN-provided production relationships are overridden by local information about production relationships provided by the IMPLAN user. Neither Church nor Snyder/Coupal indicates that any attempt was made to adjust the model for the economic circumstances that Church documents. If the present and future conditions of Idaho irrigated agriculture are as dire as Church implies, then the I-O model would overestimate the 2005 income effects of groundwater curtailment.

51) Church also includes a discussion of efforts to reduce potato acreage and production in order to increase potato price. As Church correctly observes, if groundwater curtailment serves to help reduce potato acreage, then the resulting higher prices should be a benefit to other Idaho potato producers, a partial offset to the costs of curtailment. Church implies that this is the intent of the water call:

> "However, one of the consequences of a widespread curtailment of groundwater pumping likely would be that thousands of acres of groundwater irrigated potatoes would be kept out of production, market supply would decrease, and the market price would increase for those potato producers who remain in operation, such as the surface water users represented by the Coalition." (Church, paragraph 38)

52) It is my understanding that falling water supplies, not a quest for higher potato prices was what motivated the Surface Water Coalition water call. However, Church is right that higher prices for some crops may be an externality effect of any curtailment of groundwater pumping. The same argument should hold for some crops other than just potatoes. The acreage and production reductions inherent in curtailed groundwater should strengthen prices of these crops also. This externality effect of higher prices would accrue not just to SWC farmers, but to all producers of these crops across Idaho, and beyond – even to farmers producing these crops with groundwater.

53) It is important to note that the economics of agriculture have changed considerably in the two years since Church completed his report, and since the Snyder/Coupal report was done. While input prices have continued their climb, many output prices have also surged. One of the biggest drivers is the run up of corn prices caused by the growing use of corn for fuel alcohol production. The resulting demand and acreage shifts have affected the prices of most crops. Given the uncertainty of world events, US energy policy, and US farm policy, it is hard to predict what the future may bring. What one can say is that if crop and energy prices continue at these high levels, then all of the economic effects of groundwater curtailment are likely to increase – both increased costs to the curtailed farmers, and increased offsetting benefits to the surface/spring water users, including hydropower.

54) Summarizing, I reach the following conclusions from my review of the expert testimony and affidavit presented by John Church:

a) Church miss-casts the purpose of my 2004 paper, and then criticizes it because it doesn't accomplish the purposes he set for it.

b) He criticizes the paper for saying without documentation that farmers dried up land in response to water shortage. What I did say was that farmers experienced a range of damages from water shortage (not including drying up land) and that these resulted in costs to farmers.

c) Church misunderstands the role of water shortage in driving efficiency improvements. He claims that efficiency improvements are independent of water shortage, so the costs can't be attributed to shortage.

d) Church misses the cascading effects that result as water shortage forces efficiency improvements, thus reducing aquifer recharge, and resulting in greater water shortage lower in the basin.

e) Much of Church's report consists of a description of the dire condition of crop agriculture in southern Idaho. If things were this bad (as of 2005) then the economic model used by Snyder/Coupal, based on less dire economic conditions would have to be an overestimate of the effects of curtailment.

OTHER OBSERVATIONS

55) The following are a number of other observations that may be helpful

The Role of Carryover Water

56) It appears that the amount of carryover water is an issue. The documents in this case have focused on the legitimate role of carryover as a way that storage owners can insure themselves against a dry year. However, carryover water also plays other significant roles. Carryover is an important source of water for the Upper Snake Rental Pool, which helps to insure water users in the wider basin against drought. The rental pool has also served as one source for the 427 kaf flow augmentation water budget to assist with endangered salmon recovery. To the extent that the 427 kaf water budget is a requirement, if the water is not available from the rental pool, then it will have to be made up from some other source.

57) Even sitting in a reservoir, the carryover water serves an economic purpose. Either that water is eventually released downstream, or it reduces the need for refill and allows other water to flow downstream. Either way that additional water downstream can produce valuable hydropower. If the result of this case is to reduce allowable carryover so that more groundwater pumping can be retained, the effect is to lose these rental pool and hydropower benefits of carryover.

Mitigation

58) Mitigation has been an important element of this discussion. Hazen and Ohlensehlen dealt with the issue with their two scenarios. Scenario 1 curtailed dairies, plus the cropland needed to provide feed to the dairies and scenario 2 assumed that the dairies would self-mitigate by getting alternative water rights from other groundwater irrigators. Their results illustrate the importance of mitigation – with the dairies closing in scenario 1 they estimated a net income loss of $117 million, while scenario 2 with the dairies mitigated had a $2.9 million estimated net income loss.

59) Snyder and Coupal followed the lead of the Hazen and Ohlensehlen scenario 2, assuming that beef and dairy producers would be able to acquire alternative supplies of water. With the dairies assumed to self-mitigate, Snyder and Coupal proceeded to estimate the effects of curtailed pumping on crop production only.

60) Given the importance of mitigation, a number of parties to this case have made major efforts to assure that the water use of the dairies and the water use of several other food processing plants that could be subject to curtailment are mitigated. The result of this are two agreements, one between the dairies and the surface/springwater users that would avoid curtailment for the participating dairies, and another between three large food processors and the surface/ springwater users that would avoid curtailment of the food processor's wells.

61) As Hazen and Ohlensehlen have demonstrated, unless agreements such as these are implemented, the impacts of curtailment would be much larger than the estimates from Snyder and Coupal.

62) The word "mitigation" has several possible meanings in this case. As used above it refers to actions that offset the effects of pumping by the dairies and food processors, so they can avoid curtailment and continue to pump from their wells. Mitigation can also mean actions that offset the potential income loss faced by irrigators if their wells are curtailed. The most obvious way that farmers could mitigate the effects of groundwater curtailment would be to participate in the USDA Conservation Reserve Enhancement Program (CREP). The following is a description of the Idaho CREP program from the USDA web page:

"Overview

The Conservation Reserve Enhancement Program (CREP) is a federal-state cooperative conservation program that addresses targeted agricultural-related environmental concerns. CREP participants voluntarily enroll in 14- to 15-year Conservation Reserve Program (CRP) contracts with USDA's Commodity Credit Corporation (CCC). Participants receive financial incentives, cost-share assistance and rental payments in exchange for removing cropland and marginal pastureland from agricultural production. Converting enrolled land to native grasses, trees and other vegetation improves soil retention and water, air and wildlife habitat quality. CRP and CREP are authorized by the Food Security Act of 1985, as amended.

The Idaho Eastern Snake Plain Aquifer CREP targets the enrollment of up to 100,000 acres of eligible irrigated cropland to reduce irrigation water use, increase water quality, reduce soil erosion and sedimentation and increase wildlife populations. The CREP agreement is a partnership between USDA/CCC and the State of Idaho. In addition to CREP payments, Idaho State water authorities will enter into State Water Use Contracts with participants on CREP-enrolled land to help ensure that irrigation water is conserved during the 14- to 15-year CRP contract periods.

Benefits

Enrolling up to 100,000 acres of eligible cropland will significantly reduce irrigation water consumption. The CREP will improve water quantity and quality in the Snake River and its tributaries by reducing agricultural chemicals and sediments. Establishing permanent vegetative cover will provide wildlife habitat for terrestrial and aquatic species.

Goals

The goals of the Idaho Eastern Snake Plain Aquifer CREP, when fully enrolled, include:

- Reducing irrigation water use by up to 200,000 acre-feet annually by reducing or ceasing water application on up to 100,000 irrigated cropland acres;
- Improving the Snake River's water quality and flow by increasing the aquifer's ground- water levels and tributary spring water discharge by up to 180 cubic feet per second. ......"

(http://www.fsa.usda.gov/FSA/newsReleases?area=newsroom&subject=landing&topic=pfs&newstype=prfactsheet&type=detail&item=pf_20060501_consv_en_idaho06.html)

63) To the extent that more senior groundwater pumpers not threatened by curtailment participate in CREP they mitigate for the effects of the more junior pumpers, making it less likely that curtailment will be needed. To the extent that CREP participants are the more threatened junior pumpers, they are self-mitigating. In either case, their participation is voluntary. And since the payment they receive is in most cases more than the income potential of the land, their participation reduces or offsets the costs of groundwater curtailment to the region.

64) In fact, sign up for CREP has not met expectations for several reasons. There has been a failure of both "carrot and stick". The stick, the threat of curtailment of groundwater pumping, has faltered because of the uncertainty over the results of the ongoing legal filings and appeals. Apparently farmers have been waiting to see what happens before deciding to enroll. The carrot, the payments and incentives for signing up are looking less attractive relative to the recent increases in commodity prices. As of August 1, 2007, the USDA Farm Service Agency had approved only 17,754 CREP acres. The USDA approval process requires that the applications receive prior approval from IDWR to confirm their water right status. As of October 1, 2007, IDWR has approved only 32,789 CREEP acres:

Table 3: IDWR Processing of CREP Applications, Update as of October 1, 2007

County	Total Offers	Acres Offered	Contracts Approved	Acres Approved	Contracts Returned	Acres Returned	Contracts Ineligible	Acres Ineligible
Bingham	114.0	15,990.9	99.0	13,632.9	3.0	371.9	2.0	829.5
Blaine	3.0	202.8	1.0	102.7	0.0	0.0	0.0	0.0
Bonneville	3.0	274.9	1.0	153.9	1.0	65.9	0.0	0.0
Cassia	36.0	3,919.7	13.0	2,821.8	13.0	347.8	2.0	150.8
Elmore	1.0	213.1	1.0	213.1	0.0	0.0	0.0	0.0
Gooding	4.0	189.6	2.0	141.3	0.0	0.0	1.0	14.8
Jefferson/Clark	38.0	5,239.9	25.0	3,039.7	7.0	1,476.2	4.0	502.1
Jerome	28.0	3,546.3	18.0	2,699.1	3.0	305.0	2.0	208.7
Lincoln	17.0	3,241.7	8.0	1,522.0	3.0	711.1	1.0	61.8
Minidoka	108.0	10,768.9	73.0	8,322.3	16.0	1,339.4	4.0	56.6
Twin Falls	18.0	3,684.8	2.0	139.7	8.0	2,561.2	6.0	653.7
Totals	**370.0**	**47,272.6**	**243.0**	**32,788.5**	**54.0**	**7,178.5**	**22.0**	**2,478.0**

IDWR staff has:

- Reviewed over 370 CREP offers for approximately 47,272.6 acres
- Approved 243 contracts for 32,788.5 acres
- Returned 54 contracts for revisions totaling 7,178.5 acres
- Determined that 22 contracts totaling 2,478 acres were ineligible

Source: Neeley Miller, **Idaho Department of Water Resources, October 3, 2007**

65) If the CREP program were to enroll anywhere near its goal of 100,000 acres, the payments would offset a significant part of the costs to groundwater users whose pumping is curtailed, but if farmers wait until they have lost their water supplies through curtailment, they will no longer meet the requirements for CREP enrollment.

Comments on Hydrologic and Economic Modeling

66) In my comments above, I have pointed out shortcomings of both the input output models used by Snyder and Coupal and the ESRPA models used by Cosgrove et. al. These comments should not be taken as criticisms of the research that used these models – in both cases the approaches used are state-of-the-art. What I am saying is that the real world is in fact more complicated than the idealized picture presented in these models.

67) This means that the standard input-output modeling as done by Snyder and Coupal misses some very important details. It misses the fact that the impacts on the curtailed groundwater pumpers are not mirror images of the impacts to surface water users who have more water. It misses the fact that water costs and hence net incomes are likely to differ between the ground and surface water users. It misses the fact that fish processing is likely to increase along with fish production. Even if Snyder and Coupal had included hydropower in their modeling, they would have missed the fact that most of the impact to hydropower translates directly into a change in incomes. While these omissions are real and important, it remains an open question whether any methodology exists that would accurately model these effects.

68) Similarly, the state-of-the-art ESRPA model focuses on the physical behavior of the aquifer. It does not, and really cannot look at the human factor – how irrigators react to changes in water supply at various points in the basin, and how this affects water use efficiency and aquifer recharge at these locations. The likely result of this omission is that the effects of water shortages cascade down the system, ultimately aggravating shortfalls in the Thousand Springs reach. It may not be either practical or feasible to include these human factors in an aquifer model, but it is important to remember that these factors may cause the model to underestimate the true hydrologic consequences of water shortages.

Issues Affecting Long-Term Sustainability of Water Supplies

69) The ESRPA Version 1.1 base case model results (Cosgrove, et. al., December 2005) show that the ESRPA is being over-drafted by an average of 150,000 acre feet per year. While the estimated overdraft shows considerable year to year variability, it also shows a disturbing upward trend in the last decade. It is this overdraft of the aquifer, caused by a combination of groundwater pumping, efficiency improvements, and dry weather that has led to the current problems of declining spring and surface water supplies. Unless the overdraft is stopped, the situation will undoubtedly worsen. Groundwater recharge is proposed as a way to restore balance to the basin water budget, but recharge will entail a number of costs, including the cost to hydropower generation. The present discussion is about curtailing groundwater pumping to address the current depleted condition of the aquifer – but if the aquifer overdraft continues, even the current curtailment proposals will be inadequate to address future problems.

70) There is a near complete scientific consensus that climate change is real and that it is happening now (Intergovernmental Panel on Climate Change, 2007). The likely effects of climate change on the ESRPA could be significant over the coming decades. The likely effects on precipitation are uncertain, but the projected increases in temperature, especially winter temperatures are more certain. Warmer temperatures will mean that more winter

precipitation will fall as rain rather than snow, the snow line will be higher up the mountains, and the result will be less winter snow pack. Snow melt is likely to begin earlier in the spring. All of this means that the reservoir system will be less effective in storing water for irrigation use. On the demand side of the equation, higher temperatures and longer growing seasons will increase the demand for irrigation water. Since both groundwater pumpers and surface water irrigators are likely to want to use more water, the result is likely to be more aquifer depletions and less recharge. These climate change effects should not become critical in the short-term, but will come on gradually over the coming decades. This is mainly a factor that Idaho needs to consider as it thinks about the long-term sustainability of water policy decisions.

71) An important shorter-term issue to think about is the impact of current commodity market disruptions caused by use of corn for biofuels production. US corn prices have stayed in the $2 per bushel range for years, until the recent push to use corn to produce fuel ethanol. Corn prices reached a 10 year high of $4.50 in February, but more recently have retreated to under $4. The volatility in corn markets has spilled over into other commodity markets, especially those that can be alternative feed sources for hard pressed livestock producers. Recent wheat prices have also reached record levels, as a result of smaller than usual crops in several countries, smaller than usual end of season carryover stocks, and spillover effects from the turbulent corn market. Many farmers can be expected to expand wheat, corn and other feedgrain acreage in coming seasons. The picture is not all rosy for grain producers, since many farm input prices, especially fuel and fertilizer, are increasing along with commodity prices. The effects of all this in the ESRPA area is far from clear. If more corn is grown for grain, this could increase water demand for both surface and groundwater users.

72) These high crop prices seem to be one factor that has discouraged farmers from participating in the CREP program, with signup falling well short of the 100,000 acre goal. Thus CREP's goal of reducing aquifer depletions by 200,000 acre feet will apparently not be achieved. Idaho also has a large acreage reaching the end of its CRP contracts, and there is concern that favorable economic conditions will result in that land returning to production, meaning more acres demanding water and more aquifer depletions.

73) The Farm Bill is due to be rewritten later this year. Present US farm policies have come under sharp criticism from the World Trade Organization and from a number of other countries -- for providing unfair production subsidies, and for being overly protectionist. It is uncertain at this time what changes will be made and what the consequences will be for the ESRPA area. Two things that might be important are proposals to reduce the funding available for CPR and CREP and proposals to allow farmers to opt out of CRP contracts before the end of their contract period. Both of these could increase water demand and aquifer depletion.

Full Economic Development

74) In his prefiled expert testimony, John Church concludes that curtailing irrigation based on groundwater pumping is inconsistent with the full economic development of Idaho's groundwater resources. I do not agree.

75) Based on the discussion above, the following table (Table 4) summarizes the available number for the income effects to the state for the scenario of curtailing the post-1961 irrigators. The table also presents my comments on the validity of these numbers. Certainly, those groundwater users whose water supplies are curtailed would suffer a significant economic loss. However, I have argued above that the Snyder/Coupal estimate of this loss is an overestimate because of the assumptions that are implicit in the input-output model that was used to make the estimate. I also note that a significant part of this loss could be mitigated by CREP and other measures.

76) Table 4 also lists a number of likely beneficiaries of a groundwater pumping curtailment. The most significant of these is mainstem hydropower. The $40.5 million benefit shown in the table is certainly an underestimate of the total hydropower benefits, since it excludes the multiplier effects of this additional Idaho income, and it also excludes the benefits of downriver BPA generation that would accrue to Idaho BPA customers. If one wants to talk seriously about full economic development, then the impacts to hydropower must be included, not ignored as was done by Snyder/Coupal and Church.

77) Table 4 also includes the Snyder/Coupal benefit estimates for aquaculture and surface/ springwater irrigators. As noted above, both of these are likely to be significantly underestimated because of the assumptions that are implicit in the input-output model that was used to make the estimates.

78) The table also includes a number of other economic sectors that would be beneficiaries of a groundwater pumping curtailment. The magnitude of these benefits are simply indicated by a "+" in the table, since Snyder and Coupal dismissed these sectors as "externalities" and did not make estimates of these impacts. The magnitude of these other benefits should be significant, especially when one includes their multiplier effects.

79) My conclusion from looking at table 4 it that Church's opinion that curtailing irrigation based on groundwater pumping is inconsistent with the full economic development of Idaho's groundwater resources is not clearly supported by the numbers. If one is to talk about full economic development, then it is inconsistent to ignore the impacts on hydropower, and to dismiss the impacts on all these other affected sectors as mere externalities.

80) While input-output analysis, as done by Snyder and Coupal is a valuable tool for analyzing economic impacts, it as also a blunt tool because it sometimes oversimplifies the real world. The assumptions implicit in the input-output model are likely to overestimate the loss to the curtailed groundwater pumpers, and underestimate the gains to surface/springwater irrigators and aquaculture. Credibly using input-output models to estimate the impacts to the other sectors of the table would be a daunting task. I conclude that it is not unambiguously clear which is greater -- the costs, or the benefits of curtailment. Given this uncertainty, the path forward should be approached cautiously.

81) In thinking about full economic development of Idaho's groundwater resources, one must take a long-term perspective. The appropriation doctrine was developed by the western states expressly to encourage economic development. Reacting to the free-for-all water

development in the mid 19th century, the western states developed the appropriation doctrine to assure the long term security of water rights, and make it possible for miners and farmers to make long-term investments in water using activities, secure in the knowledge that the water they needed would be there. The appropriation doctrine also increased the security of third party water users.

Table 4: State Income Effect Numbers
(from post-1961 Curtailment Scenario)

Effected Sector	Source	State Income Effects ($million)	Comments
Groundwater Irrigators	Snyder/Coupal	(157.70)	This is an over-estimate. A significant part of this cold be offset if affected irrigators sign up for CREP program.
Surface/Spring Irrigators	Snyder/Coupal	23.1	This is an under-estimate.
Aquaculture	Snyder/Coupal	4.5	This is an under-estimate.
Mainstem Hydropower	Hamilton	40.5	This estimate excludes $21.6 million BPA impact and the large multiplier impacts on the Idaho economy.
Other Hydropower	Hamilton	+	Various small hydro and spring-dependant hydro would benefit.
DCMI Users of Springflow and Groundwater	Hamilton	+	Most of these depend on wells, which curtailment would help protect. Proposed agreements would mitigate impacts on dairies.
Senior Irrigation Groundwater Users	Hamilton	+	Curtailment should help avoid further groundwater declines.
Recreation Users of Surface & Springflow	Hamilton	+	Enhanced flows should provide a significant benefit.
Research & Other Non-Commercial Fish Facilities	Hamilton	+	These are significant, and depend on healthy springflow.
Environment & Endangered Species Concerns	Hamilton	+	Enhanced flows should provide a significant benefit.

82) Using the full economic development arguments to justify weakening the water rights of senior priority water users could have serious consequences. Economic development could

be a shifting target. This year corn and wheat prices are good. Does this mean that irrigation water should be shifted from other users to corn and wheat farmers? Yields of many crops are higher in southwestern Idaho because of its more favored climate, than they are in southeastern Idaho. Does that mean that water should be shifted from southeast to southwest? Some argue that some of Idaho's water would be more valuable for instream energy, environmental or endangered species use than it is for irrigation. Are we ready to face that implied change of use? True economic development must be based on stability, not on the volatile patterns of the commodities markets, or the shifting vagaries of public attitudes and preferences.

83) The Snake River Basin Aquifer is currently being over-drafted. There are a number of reasons, including climate change, that suggest that the overdraft is likely to get worse rather than better. These water calls are not likely to be the end of the matter. If we proceed down the path of weakening existing senior water rights, giving preference to junior rights, the result can only be a severely depleted aquifer. We risk "chasing the water down" as farmers are currently doing with the Ogallala Aquifer in Texas. If we proceed down that path, then many of the surface and springflow dependent activities on the ESRPA are in serious jeopardy. A whole lot of economic activity and lifestyles based on these senior water rights are also in jeopardy.

84) It is my opinion that the full economic development objective will be best served by preserving and enforcing the appropriation doctrine.

SUPPORTING DOCUMENTS

A. Hamilton Joel R., "Economic Importance of ESRPA-Dependant Springflow to the Economy of Idaho" Hamilton Water Economics, December 2, 2004.

B. Hamilton, J.R., D.J. Walker, D.L. Grant, and P.E. Patterson, "The 1977 Drought in Idaho: Economic Impacts and the Response of Irrigators and Water Delivery Organizations", IWRRI, May 1981.

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Signed:
October 9, 2007
Moscow, Idaho

Joel R Hamilton

Joel R. Hamilton

Magic Valley I-O Model

Taylor, Garth
University of Idaho
Department of Agricultural Economics.

Four County Magic Valley	Dairy	Cattle	Sheep	Misc Livestock	Fish Farming	Nursery and Fruits
Dairy	250,299	205,364	5,950	4,941	20,504	31,617
Cattle	40,017	16,131,256	143	267	3,376	5,055
Sheep	1,089	134	315,756	7	92	139
Misc Livestock	813	100	3	51,102	68	103
Fish Farming	73,348	9,374	272	496	1,657,936	50,562
Nursery and Fruits	15,257	6,763	196	193	5,040	424,400
Food Grains	55,864	16,118	467	621	20,317	1,914
Feed Grains	5,234,720	1,469,815	20,769	13,795	209,579	1,052
Hay and Silage	60,991,058	3,553,357	102,951	68,379	1,038,861	5,217
Vegetables	56,962	15,609	452	541	18,053	7,195
Sugar Beets	32,796	4,005	116	218	2,687	4,143
Meat Packing Plants	8,020	41,256	1,195	4,710	215,470	47
Milk & Cheese Processing	6,149	4,484	130	343	24,672	1
Canned Fruits and Vegetables	196	39	1	2	60	8
Frozen Fruits, Juices and Vegetables	4,500	793	23	43	1,324	40
Lvstk Feed	65,731,511	127,857	3,704	6,994	116,795	156
Sugar Proc	6,057,369	2,004,756	138	227	18,165	0
Fresh or Frozen Fish	751	3,901	113	476	21,555	0
Const & Mine	4,052,869	1,102,864	31,953	26,662	133,549	436,282
Manuf	28,273	13,233	383	337	4,928	1,589
High Tech	16,670	4,244	123	109	1,976	1,817
Trans & Comm & Util	16,932,892	2,972,841	86,132	80,166	1,965,569	806,191
Trade	23,557,838	4,290,549	124,310	99,677	1,634,090	1,304,996
FIRE	6,643,273	2,830,317	82,003	58,088	574,736	1,048,215
Owner-occupied Dwellings	0	0	0	0	0	0
Service-non Prof	17,013,018	2,151,499	62,335	111,955	1,418,738	2,089,719
Service-Prof	993,655	530,134	15,360	13,114	168,748	46,756
HOUSEHOLDS (Wages plus Prop Income)	109,287,298	16,794,205	459,979	266,981	7,626,092	9,783,376
Federal Gvt - Military	0	0	0	0	0	0
Federal Gvt - Non-Military	0	0	0	0	0	0
State & Local Gvt - Education	0	0	0	0	0	0
State & Local Gvt - Non-Ed	0	0	0	0	0	0
Inventory Valuation Adjustment	0	0	0	0	0	0
Other Property Income	17,949,585	2,723,913	65,505	63,223	2,209,878	5,294,799
Indirect Business Taxes	1,510,024	2,083,294	50,099	33,852	389,442	284,782
Households	0	0	0	0	0	0
Federal Gvt NonDefense	41,423	6,915	200	153	2,178	712
Federal Gvt Defense	0	0	0	0	0	0
Federal Gvt Investment	0	0	0	0	0	0
State/Local Govt NonEducation	350,224	93,934	2,722	3,094	40,024	37,130
State/Local Govt Education	0	0	0	0	0	0
State/Local Govt Investment	0	0	0	0	0	0
Enterprises (Corporations)	0	0	0	0	0	0
Capital	0	0	0	0	0	0
Inventory Additions/Deletions	813,915	247,115	6,571	3,208	49,394	1,544
IMPORTS	117,346,760	40,184,531	1,270,055	1,341,964	22,194,186	7,066,699
COLUMN TOTAL	455,098,437	99,624,569	2,710,111	2,255,940	41,788,082	28,736,250
ROW TOTAL	455,098,434	99,624,562	2,710,111	2,255,940	41,788,080	28,736,250
DIFFERENCE	3	7	0	0	1	0
JOBS	**1,654**	**824**	**116**	**18**	**831**	**312**
Employment Coef	0.0000036340	0.0000082715	0.0000428822	0.0000078098	0.0000198763	0.0000108492
Income Coef	0.24013991	0.16857493	0.169727	0.118345645	0.182494435	0.3404542
	3.63397205					

Food Grains	Feed Grains	Hay and Silage	Vegetables	Sugar Beets	Meat Packing Plants	Milk & Cheese Processing	Canned Fruits and Vegetables	Frozen Fruits, Juices and Vegetables
13,141	19,935	105,133	328,202	61,753	11,129	395,989,393	56,411	115,053
2,101	3,187	16,808	52,472	9,873	1,346,695	18,204	10,444	18,930
57	87	457	1,427	269	474,281	495	284	515
43	65	341	1,066	201	1,330,582	370	206	13,276
6,117	10,122	53,379	125,688	18,096	56,854	35,179	76,919	112,360
801	47,421	250,091	367,418	3,764	678	6,940	716,895	933,805
47,930	1,207	6,368	19,633	3,762	724	7,099	3,680	7,756
437	7,965	42,007	10,925	2,056	370	3,790	1,853	3,820
2,168	39,483	208,225	54,152	10,189	1,836	18,787	9,183	18,936
2,990	4,537	23,926	853,606	14,054	2,533	25,912	4,817,927	87,036,303
1,722	2,612	13,775	43,004	0	1,458	14,919	7,292	15,038
0	0	0	0	0	691,740	24,715	121,847	89,516
0	0	0	0	0	1,105	25,762,886	43,559	976,332
0	0	0	0	0	2,688	51,159	413,184	48,071
0	0	0	0	0	552	51,470	863,281	652,342
0	0	0	0	0	141	16,231	33,440	22,080
0	0	0	0	0	4	20,006	20,028	20,435
0	0	0	0	0	0	0	107	943
468,813	312,657	1,648,898	1,869,200	1,199,856	166,247	1,613,699	1,043,534	2,269,621
837	565	2,977	4,726	2,339	14,333	136,656	99,212	133,630
1,210	834	4,398	6,626	3,538	6,759	49,992	26,321	113,920
784,839	518,882	2,736,497	3,532,881	2,057,903	1,340,277	7,377,141	7,935,684	19,591,560
1,706,404	999,375	5,270,530	6,917,573	2,789,315	1,687,890	22,671,246	16,008,221	26,875,565
1,721,202	878,771	4,634,488	4,264,997	2,931,531	763,923	3,793,559	1,820,723	2,850,543
0	0	0	0	0	0	0	0	0
909,304	1,321,531	6,969,529	21,370,296	4,115,470	792,997	7,795,115	4,016,281	8,373,408
20,495	12,917	68,123	106,297	54,754	567,716	5,538,312	3,982,217	4,715,970
3,017,998	2,680,160	12,730,703	34,980,564	7,157,681	5,151,211	26,088,703	19,950,483	36,409,230
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
2,882,005	2,107,017	8,556,595	16,168,415	11,998,555	756,052	25,365,229	17,983,115	18,068,754
759,417	743,838	3,020,727	2,243,784	2,000,010	423,158	2,299,780	854,976	1,772,733
0	0	0	0	0	0	0	0	0
341	487	2,569	6,115	1,352	238	9,167	1,360	2,764
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
14,417	19,326	101,923	295,608	60,824	80,308	781,927	549,858	703,131
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
3,058	1,671	8,811	1,957	1,266	290,713	94,722	4,547	15,491
7,948,544	5,604,837	29,558,945	35,847,302	17,525,383	57,764,197	42,478,710	56,766,969	28,606,422
20,316,390	15,339,488	76,036,226	129,473,932	52,023,794	73,729,391	568,141,514	138,240,041	240,588,238
20,316,389	15,339,488	76,036,223	129,473,927	52,023,788	73,729,391	568,141,514	138,240,046	240,588,236
1	0	3	5	6	0	0	-5	1
333	**152**	**2,159**	**745**	**552**	**196**	**742**	**679**	**1,139**
0.0000163906	0.0000099402	0.0000283888	0.0000057562	0.0000106092	0.0000026516	0.0000013063	0.0000049117	0.0000047351
0.1485499	0.1747229	0.1674294	0.27017457	0.1375848	0.069866452	0.045919374	0.144317687	0.151334205

Lvstk Feed	Sugar Proc	Fresh or Frozen Fish	Const & Mine	Manuf	High Tech	Trans & Comm & Util	Trade	FIRE
25,483	79,400	14,210	195,632	89,033	536	269,235	183,013	121,644
2,848	12,694	2,272	31,277	18,009	86	43,055	29,203	19,448
77	345	62	851	438	2	1,171	794	529
58	258	46	635	403	2	874	593	395
90,998	23,267	34,614,882	84,059	104,491	157	78,926	54,054	36,328
344,620	4,840	866	326,608	555,093	34	16,867	17,659	15,438
86,767	5,684	910	12,362	7,017	33	18,524	11,320	7,493
1,382,302	2,643	473	28,149	2,964	18	8,960	6,077	4,049
1,895,032	13,101	2,345	139,534	14,690	88	44,413	30,122	20,071
3,933	18,069	3,234	44,521	20,262	122	61,953	41,547	27,683
2,264	34,214,745	1,862	25,634	11,666	70	35,270	23,921	15,939
1,110,654	0	1,519	0	53,219	0	1,565	1,574	0
167,919	0	14,797	0	1,451	0	1,969	7,464	0
241	420	0	0	87	0	634	601	0
255	0	98	0	73	0	1,204	987	0
636,114	0	317	0	2,141	0	3	1,100	0
513,262	1,147,352	0	0	1	0	0	108	0
112,783	0	110,957	0	2,109	0	78	178	0
451,814	2,685,406	170,975	23,778,070	14,545,812	13,709	32,398,769	1,964,082	4,076,968
66,830	55,601	15,371	570,185	173,450	5,652	361,687	467,618	217,202
10,594	40,499	6,941	168,206	196,683	19,906	605,619	334,292	178,526
3,511,231	19,957,222	1,402,605	16,765,125	11,635,646	37,284	52,652,058	10,992,768	6,121,451
4,060,484	12,473,653	4,439,401	38,638,836	13,727,316	80,640	5,446,633	5,254,336	500,381
560,185	2,138,865	470,045	9,753,063	3,259,298	24,745	6,870,486	9,851,212	27,099,346
0	0	0	0	0	0	0	0	0
1,297,768	6,048,719	997,359	13,690,656	6,349,370	37,023	19,773,270	12,481,387	8,528,838
2,712,538	2,033,565	611,774	23,541,393	5,604,130	46,893	9,639,437	17,400,596	7,818,265
7,284,701	17,749,319	12,877,450	137,349,876	54,522,885	1,912,378	126,902,374	220,203,463	67,811,253
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
2,363,668	5,799,393	2,445,489	22,296,978	18,537,325	153,327	100,772,118	68,200,928	114,486,473
620,202	1,075,540	559,219	3,299,146	2,104,442	41,904	29,094,290	72,166,939	16,292,475
0	0	0	0	0	0	0	0	0
3,787	2,121	292	9,344	5,147	13	12,659	3,649	3,085
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
353,910	337,138	88,358	3,071,297	778,771	6,036	1,461,043	2,294,585	1,065,586
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
79,927	30,078	25,290	14,830	8,225	69	14,408	1,860	2,168
42,583,149	76,134,951	19,674,992	205,936,803	128,566,210	982,475	102,885,463	59,324,342	46,366,793
72,336,398	182,084,886	78,554,411	499,773,074	260,897,854	3,363,203	489,475,014	481,352,372	300,837,827
72,336,396	182,084,891	78,554,412	499,773,091	260,897,856	3,363,203	489,475,009	481,352,407	300,837,800
2	-5	0	-18	-2	0	5	-35	27
185	**469**	**484**	**4,613**	**1,866**	**60**	**3,443**	**10,228**	**3,059**
0.0000025542	0.0000025761	0.0000061616	0.0000092294	0.0000071533	0.0000178107	0.0000070331	0.0000212489	0.0000101686
0.1007059	0.09747827	0.163930318	0.27482448	0.20898173	0.568618	0.25926221	0.45746832	0.225408

Owner-occupied Dwellings	Service-non Prof	Service-Prof	HOUSEHOLDS	Federal Government - Military	Federal Government - Non-Military	State & Local Government - Education	State & Local Government - Non-Education	Inventory Valuation Adjustment
59,702	389,558	197,725	4,758,550	0	0	0	0	0
9,545	103,737	32,205	691,010	0	0	0	0	0
260	2,236	876	18,798	0	0	0	0	0
194	56,658	2,923	297,709	0	0	0	0	0
17,495	167,550	71,562	1,704,841	0	0	0	0	0
3,639	574,781	13,132	3,498,503	0	0	0	0	0
3,541	21,573	12,044	187,300	0	0	0	0	0
1,987	11,743	6,541	106,466	0	0	0	0	0
9,851	58,208	32,421	527,742	0	0	0	0	0
13,587	349,603	56,703	3,807,120	0	0	0	0	0
7,823	46,075	25,747	402,153	0	0	0	0	0
0	845,214	60,087	15,303,097	0	0	0	0	0
0	1,377,082	33,072	12,758,974	0	0	0	0	0
0	150,626	8,493	2,705,968	0	0	0	0	0
0	326,146	7,846	2,048,984	0	0	0	0	0
0	5,969	1,672	223,575	0	0	0	0	0
0	7,539	256	92,235	0	0	0	0	0
0	43,383	1,211	343,344	0	0	0	0	0
8,647,695	13,106,307	1,948,994	49,609	0	0	0	0	0
58,858	451,973	655,269	4,633,629	0	0	0	0	0
3	242,680	432,785	434,840	0	0	0	0	0
165,816	15,655,761	9,066,099	118,921,188	0	0	0	0	0
354,032	8,031,355	3,072,695	227,425,345	0	0	0	0	0
16,675,329	14,932,252	8,887,696	143,817,888	0	0	0	0	0
0	0	0	140,507,157	0	0	0	0	0
4,104,737	23,650,921	13,292,227	206,531,876	0	0	0	0	0
2,564,623	17,361,450	20,298,292	200,653,750	0	0	0	0	0
0	181,077,145	187,027,119	0	7,188,543	16,399,761	116,538,223	84,359,436	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
139,326,950	35,774,910	18,588,823	0	5,002,913	3,047,855	0	24,463,264	-9,652,901
28,776,505	13,254,043	3,862,162	0	0	0	0	0	0
0	0	0	55,370,482	0	0	0	0	0
3,083	9,543	3,874	203,710,462	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
365,526	2,445,616	2,658,322	108,300,306	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	137,226,883	0	0	0	0	0
3,325	8,473	2,243	17,855	0	0	0	0	0
20,750,359	94,028,361	67,096,919	938,780,437	0	0	0	0	0
221,924,464	424,567,469	337,358,036	2,535,858,076	12,191,457	19,447,616	116,538,223	108,822,701	-9,652,901
221,924,493	424,567,491	337,358,047	###########	12,191,457	19,447,616	116,538,223	108,822,701	-9,696,695
-29	-23	-11	26	0	0	0	0	43,795
0	**13,307**	**6,551**		**419**	**428**	**3,842**	**2,916**	
0.0000000000	0.0000313417	0.0000194185	0.0000000000	0.0000343683	0.0000220178	0.0000329658	0.0000267849	
0	0.42649793	0.55438762	0	0.5898378	0.8432787	1	0.77520072	

Employee Compensation	Proprietary Income	Other Property Income	Indirect Business Taxes	Federal Govt NonDefense	Federal Govt Defense	Federal Gvt Investment	State/Local Govt NonEducation	State/Local Govt Education
0	0	0	0	6,052	0	0	141,242	84,963
0	0	0	0	968	0	0	17,325	4,176
0	0	0	0	26	0	0	471	114
0	0	0	0	20	0	0	14,408	2,976
0	0	0	0	1,774	0	0	35,044	4,115
0	0	0	0	369	0	0	85,810	5,452
0	0	0	0	409	0	1	5,305	909
0	0	0	0	201	0	0	3,267	690
0	0	0	0	999	0	0	16,196	3,421
0	0	0	0	1,377	0	0	49,747	48,536
0	0	0	0	793	0	0	11,134	1,659
0	0	0	0	0	0	0	270,212	165,995
0	0	0	0	0	12	0	373,863	200,750
0	0	0	0	4,310	2,796	0	28,660	21,531
0	0	0	0	320,255	223	0	19,826	15,966
0	0	0	0	18	0	0	3,510	388
0	0	0	0	155	0	0	932	496
0	0	0	0	565	0	0	9,148	10,647
0	0	0	0	1,634,188	0	1,314,158	8,393,226	1,635,131
0	0	0	0	125,930	0	13,260	79,221	25,745
0	0	0	0	118,350	0	56,079	86,828	21,038
0	0	0	0	1,248,410	0	15,692	5,561,387	3,255,498
0	0	0	0	177,441	0	280,969	1,411,221	575,056
0	0	0	0	1,483,527	0	0	3,701,391	163,821
0	0	0	0	0	0	0	0	0
0	0	0	0	489,292	0	1,643	5,783,457	964,860
0	0	0	0	4,390,020	0	4,664	2,571,004	917,257
0	0	0	0	0	0	0	0	0
0	0	0	0	0	12,191,456	0	0	0
0	0	0	0	13,802,160	5,645,456	0	0	0
0	0	0	0	0	0	0	0	116,538,223
0	0	0	0	0	0	0	108,822,701	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
1,036,285,298	336,010,429	216,255,912	0	304,330,994	0	0	118,431,920	0
139,198,624	16,711,531	-30,313	60,185,014	500	0	314	3,862	1,091
0	0	0	0	17,919,579	0	0	0	0
0	0	0	0	8,257,582	0	0	0	0
3,376,850	0	1,889,919	129,431,757	87,758,469	0	156	393,147	126,544
0	0	0	0	0	0	0	133,173,843	0
0	0	0	0	0	0	0	48,265,514	0
5,968	0	193,630,600	0	13,477,304	0	0	123,362	0
0	0	286,385,803	0	5,563,507	0	0	0	0
0	0	0	0	6,327	0	686	3,907	779
0	0	-14,331,740	0	17,572,333	79,636	6,569,962	25,036,070	8,376,007
1,178,866,740	352,721,960	683,800,181	189,616,771	478,694,203	17,919,579	8,257,583	462,928,164	133,173,834
1,178,866,642	352,721,947	683,800,154	189,616,779	478,694,209	17,919,579	8,257,583	462,928,141	133,173,843
97	13	27	-9	-6	0	0	22	-10

State/Local Govt Investment	Enterprises (Corporations)	Capital	Inventory changes	EXPORTS	ROW TOTAL
0	0	0	2,652	51,260,977	455,098,434
0	0	0	2,562	80,945,315	99,624,562
0	0	0	70	1,887,903	2,710,111
0	0	0	42	480,409	2,255,940
0	0	0	60	2,411,777	41,788,080
0	0	0	367	20,492,509	28,736,250
1	0	262	139	19,741,335	20,316,389
0	0	0	3	6,750,000	15,339,488
0	0	0	17	7,105,193	76,036,223
0	0	0	23	32,045,305	129,473,927
0	0	0	13	17,053,233	52,023,788
0	0	0	180,100	54,537,639	73,729,391
0	0	0	913,058	525,471,443	568,141,514
0	0	0	107,278	134,692,996	138,240,046
0	0	0	8,569	236,263,436	240,588,236
0	0	0	6,535	5,396,144	72,336,396
0	0	0	148,181	172,033,247	182,084,891
0	0	0	64,835	77,827,328	78,554,412
44,572,365	0	294,253,326	436,627	27,319,156	499,773,091
8,613	0	75,871	95	252,491,777	260,897,856
7,605	0	20,414	0	142,776	3,363,203
13,717	0	5,391,368	2,710,418	135,674,812	489,475,009
104,292	0	17,567,490	3,547,896	18,245,363	481,352,407
0	0	3,757,866	134	12,494,280	300,837,800
0	0	0	0	81,417,336	221,924,493
896	0	338,482	132,700	21,560,816	424,567,491
633	0	1,158,471	91	1,194,630	337,358,047
0	0	0	0	0	1,531,588,589
0	0	0	0	1	12,191,457
0	0	0	0	0	19,447,616
0	0	0	0	0	116,538,223
0	0	0	0	0	108,822,701
0	0	0	0	-9,696,695	-9,696,695
0	0	0	0	0	683,800,154
0	0	0	0	0	189,616,779
0	248,899,861	168,710,098	0	51,563,057	2,535,858,050
10,644	58,245,308	70,305	140	454,158	478,694,209
0	0	0	0	0	17,919,579
0	0	1	0	0	8,257,583
4,717	11,767,062	101,122,666	3,051	692,861	462,928,141
0	0	0	0	0	133,173,843
0	0	0	0	0	48,265,514
0	0	111,675,003	0	0	318,912,236
4	0	0	0	436,390,902	865,567,099
17,161	0	7,128,065	169	17,187,116	26,096,943
3,524,865	0	154,253,147	17,831,118	209,728	2,493,737,881
48,265,513	318,912,231	865,522,835	26,096,944	2,493,738,263	
48,265,514	318,912,236	865,567,099	26,096,943	2,533,737,905	
-1	-5	-44,264	1	-39,999,643	

Four County Magic Valley Multipliers	Direct ($ of output per $ of output)	InDirect ($ of output per $ of export)	Output Multiplier (change in sales per change in exports)	Direct Employment Coef (Jobs per $mill of output)	Indirect Employment (jobs per $mill exports)	EMPLOYEMNT Multiplier (change in jobs per change in $million exports)	Jobs Multiplier (change in jobs per change in jobs)	Direct Income Coef ($ income per dollar of sales)	Indirect Income Coef ($ income per dollar of exports)	INCOME Multiplier ($ income per change in export sales)	INCOME Multiplier ($ Income per change in $million export sales)
Dairy	1	1.335	2.335	3.63	13.71	17.35	4.77	0.2401	0.2346	0.4747	474,735
Cattle	1	1.093	2.093	8.27	10.26	18.53	2.24	0.1686	0.1989	0.3675	367,514
Sheep	1	0.953	1.953	42.98	13.80	56.79	1.32	0.1697	0.1771	0.3468	346,779
Misc Livestock	1	0.714	1.714	7.91	7.77	15.68	1.98	0.1183	0.1451	0.2635	263,488
Fish Farming	1	0.791	1.791	19.88	7.94	27.81	1.40	0.1825	0.1462	0.3287	328,665
Nursery and Fruits	1	1.103	2.103	10.85	9.78	20.63	1.90	0.3405	0.1975	0.5380	537,964
Food Grains	1	0.850	1.850	16.39	8.50	24.89	1.52	0.1485	0.1782	0.3267	326,729
Feed Grains	1	0.901	1.901	9.94	9.51	19.45	1.96	0.1747	0.1880	0.3628	362,768
Hay and Silage	1	0.923	1.923	28.39	9.92	38.31	1.35	0.1674	0.1959	0.3633	363,325
Vegetables	1	1.180	2.180	5.76	12.93	18.68	3.25	0.2702	0.2419	0.5121	512,070
Sugar Beets	1	0.793	1.793	10.61	8.43	19.04	1.79	0.1376	0.1686	0.3062	306,177
Meat Packing Plants	1	0.382	1.382	2.65	3.68	6.33	2.39	0.0699	0.0721	0.1420	141,976
Milk & Cheese Processing	1	2.038	3.038	1.31	15.78	17.09	13.08	0.0459	0.4141	0.4601	460,059
Canned Fruits and Vegetables	1	0.928	1.928	4.91	9.27	14.18	2.89	0.1443	0.2085	0.3529	352,862
Frozen Fruits, Juices and Vegetables	1	1.680	2.680	4.74	15.61	20.35	4.30	0.1513	0.3810	0.5324	532,368
Lvstk Feed	1	0.734	1.734	2.55	7.53	10.08	3.95	0.1007	0.1564	0.2571	257,078
Sugar Proc	1	1.061	2.061	2.58	10.66	13.23	5.14	0.0975	0.2175	0.3150	314,959
Fresh or Frozen Fish	1	1.323	2.323	6.16	16.89	23.06	3.74	0.1639	0.2445	0.4084	408,386
Const & Mine	1	1.068	2.068	9.23	9.57	18.80	2.04	0.2748	0.2131	0.4880	487,966
Manuf	1	0.853	1.853	7.15	7.49	14.64	2.05	0.2090	0.1678	0.3768	376,815
High Tech	1	1.243	2.243	17.81	8.18	25.99	1.46	0.5686	0.1768	0.7454	745,386
Trans & Comm & Util	1	1.041	2.041	7.03	8.59	15.63	2.22	0.2593	0.1956	0.4548	454,843
Trade	1	1.130	2.130	21.25	8.18	29.43	1.38	0.4575	0.1768	0.6342	634,227
FIRE	1	0.792	1.792	10.17	6.53	16.70	1.64	0.2254	0.1409	0.3663	366,296
Owner-occupied Dwellings	1	0.292	1.292	0.00	3.19	3.19	0.00	0.0000	0.0694	0.0694	69,393
Service-non Prof	1	1.301	2.301	31.34	10.60	41.94	1.34	0.4265	0.2267	0.6532	653,241
Service-Prof	1	1.424	2.424	19.42	10.67	30.09	1.55	0.5544	0.2310	0.7854	785,377
HOUSEHOLDS	1	0.885	1.885	0.00	10.61	10.61	0.00	0.0000	0.2260	0.2260	225,990