

ESHMC Meeting Notes January 8th, 2013

Item 1 - Introductions were made, and an attendance list was circulated. The following were present at the meeting:

- Rick Raymondi
- Allan Wylie
- Jennifer Sukow
- David Hoekema
- Mike McVay
- Sean Vincent
- Dave Colvin
- David Blew
- Jay Ryu
- Chuck Brockway
- Mat Weaver
- Harvey Walker
- Willem Schreuder

Greg Sullivan, Stacey Taylor, Jennifer Johnson, Bryce Contor, and Chuck Brendecke joined the meeting via polycom.

Item 2 - Allan Wylie began the meeting and announced a synoptic ground water level measurement of the ESPA would take place this spring. He said that 800 plus wells had previously been measured although some of the early measurements included upwards of 1,100 wells. Allan said there were approximately 300 wells in the near rim area that were narrowed down to 150 and determined to be sufficient for the synoptic. Willem observed and mentioned that there is a large open space in the middle of the plain where no wells are measured. Allan said there are a few wells in that area, but they are hard to reach. Willem said that it is an important area.

Chuck Brockway commented on the monitoring in near rim area and recommended going further upstream along the rim and said there was a well drilled in 1994 above the rim on the Blue Lakes road. IDWR agreed to present the sentinel well network to the committee during the next meeting. Rick Raymondi reported on new return flow monitoring sites that have been added to the network.

Item 3 - Allan Wylie presented the updated validation runs using the 2009 and 2010 data which were added to the model data set. He ran the model with no adjustments to see how 2009 and 2010 matched the model output. He said that the validation fell within the “cloud” of calibration while presenting a graph of the root mean squared error (RMSE) and the mean absolute deviation (MAD). Chuck Brockway commented that it appeared that Allan obtained the same results as Maxine Dakins, and Allan said he used the approach that she recommended. He said that he performed the analysis for both ESPAM version 2 and version 2.1.

Allan presented the results for well data, Snake River gains, Group A & B target springs, and spring reaches with weighted and un-weighted targets. Greg Sullivan commented that the observed data plotted lower. Allan said that sometimes he obtained a better fit between the modeled and observed in the wet years, and sometimes the drier years fit better. He said that 2009/2010 are considered average years. Allan went on to say that the validation data plotted higher for the Snake River gains and the Group A and B target springs and lower for the spring reaches.

Allan discussed the Blue Lakes data and the difficulty with obtaining a good fit. He showed that the validation data for the weighted A&B Springs plotted more closely to the modeled data when the Blue Lakes data were not included. He said that Cindy Yenter had recommended a change in the procedure for maintaining the Blue Lakes weir that may have impacted the data. Chuck Brockway said that the flows at the new weir can be measured more accurately than at the current upstream location where IDWR measures. Chuck said he would recommend a new approach to obtaining spring discharge measurements at Blue Lakes.

Allan then began to discuss the 1900 validation and his comparison of model output with observations collected around 1900 by the USGS and the Office of the Idaho State Engineer. He indicated that the data were not sufficient to support a transient representation, there were fewer irrigated acres at that time, and American Falls Reservoir was removed from the model. Chuck Brockway asked how many acres were irrigated at that time, and Jennifer Sukow said about 230,000 acres. Willem asked when the Northside Canal Company, Milner-Gooding Canal Company, and Twin Falls Canal Company were established, and Chuck Brockway said between 1900 and 1910. David Hoekema said Milner Dam was completed in 1905.

After Allan showed the distribution of irrigated acres for the 1900 validation, Chuck Brendecke asked if there were any acres on the Big Wood. Jennifer Sukow said that some of the acres on the Little Wood could be “spread” into the Big Wood area. Chuck Brockway said that there were some acres irrigated on the Big Wood above Picabo in the early years. David Blew said he is not sure how much of the Big Wood flow could have reached the Shoshone area.

Allan showed the measured vs. modeled head match from observations at 5 wells. He said that he believed that something was wrong with the Bliss well, the modeled head was 216 higher than the observed value and the observed water level in the Bliss well was lower in elevation than the springs in the model cell containing the Bliss well. He indicated that the match for the data at Gooding was poor with a residual of 183 feet. The matches were better at Owinza, Kamima, and Minidoka. Bryce asked if there was a spring near the well at Bliss in 1900, and Allan said he was not sure and that he felt that the hydrology changed in that area since Russell published his report because the area is prone to landslides.

Allan compared the modeled head with land surface elevation, and the results indicated that the modeled head was low in the Mud Lake area. He said he believed that the Mud

Lake area always was a wetland. Chuck Brockway asked what the difference in head meant in terms of the volume of water in the aquifer, and Jennifer said about 80,000 acre feet. Bryce said that Mud Lake was not a wetland in 1900, and between 1925 and 1939 water levels in the Mud Lake area increased, and the increase was attributed to irrigation on the Egin Bench. Chuck Brockway said that according to the Stearns report, farmers in the Mud Lake area were happy when irrigation was initiated on the Egin Bench because more water became available. Willem asked how it was determined that more water was available, and Chuck Brockway said that Camas Creek flowed better, and this was anecdotal evidence. David Hoekema asked if the Egin Bench was included in the validation, and Allan said that some acreage was included. Jennifer said that she would compare the acreage. Bryce said that it was mentioned in a 1939 report that sagebrush was dying and water seeped into basements in the Egin area. Allan said he would look at the report. Chuck Brockway said there might be useful information regarding the timing of irrigation on the Egin Bench in a book titled "Daughters of the Mormon Pioneers".

Allan then discussed the spring discharge match in the 1900 validation. He said that most observations were collected by Stannard and recorded in the 1902 Biennial Report of the State Engineer. He showed the modeled versus reported spring discharges, and indicated that no field observations were available for Three Springs or Rangen. Willem asked when the Curren Tunnel was dug. Jennifer said some of the water rights were established in the 1880's, but there are no records indicating whether or not the tunnel had been developed at that time. Chuck Brockway said that there was an international decree for the Hagerman area which confirmed mining rights that were eventually transferred to agriculture. Allan then said the model results indicated a low discharge for Sand Springs, and the modeled head was 5 feet below the upper Sand Springs drain.

Allan summarized the validation effort indicating that the evaluation of the 1900 validation is more qualitative than the 2009-2010 validation, and the spring discharges and head observations from 1900 match the model results reasonably well. He concluded by saying that ESPAM version 2.1 is not invalidated. Chuck Brockway said that this evaluation can only determine if the model is not invalidated, and Allan agreed.

Item 4 - Allan Wylie began a discussion of the predictive uncertainty analysis for ESAPM version 2.1 and indicated that the report was posted on the web page on December 18, 2012. He showed a table of the completed runs with values for the calibrated impact, maximized impact, minimized impact, and the range for each. He indicated that there are several versions of the model water budget in the table.

Willem said that the response at Clear Lakes is pretty well constrained and that there is not much that PEST can adjust. Allan said the most significant difference in the model is that the base flow was not broken out in earlier versions. Willem responded that the weights were adjusted, but the calibrations stayed pretty close. Allan said that the greatest difference in impact for the model versions (ESPAM2.0 vs. ESPAM2.1) was

for the stress applied at the centroid of Water District 34 and realized at the nr Blackfoot to Minidoka reach.

Chuck Brendecke pointed out that the Heise to Shelley reach changed a fair amount between the model versions. Chuck Brockway added that the Heise to Shelley reach took the biggest hit in the maximized impact. Allan then discussed the response of the stress applied at the WD 130 centroid on Clear Lakes and compared the previous calibration to the new calibration. He said in the minimized version 2.1 run, PEST adjusted a number of parameters, and the results showed the parameters are not as well constrained in this prediction although the prediction is stable.

The next set of slides in Allan's presentation concerned a test on Snake River gains using filtered and unfiltered data entered into ESPAM version 2.0. He focused the impact of the stress (minimized and maximized) applied at the centroid of Water District 34 on the impact on the nr Blackfoot-Minidoka reach, and concluded that filtering decreased the range in impact on river gains. Chuck Brendecke said that when filtered gains were added, there were more targets, and he asked how much of the decrease was the result of having more targets. Allan said he reduced the weights on both filtered and unfiltered data runs, but he kept the total sum of contribution to the objective function the same.

In evaluating the fraction of impact by reach for ESPAM2.0 vs. ESPAM2.filt, Willem said it looks like PEST shifted some of the impact from nr Blackfoot to Minidoka to Shelley to nr Blackfoot in the unfiltered run. Allan agreed adding that PEST shifted the impact using pilot points in the middle of the eastern Snake Plain which is an area with few wells. Willem said the area is poorly constrained, and PEST is trying to funnel impact from Water District 34 to the nr Blackfoot to Minidoka reach. Chuck Brockway said that we know what PEST did but not why, and Allan responded that sometimes we know.

- Item 5 -** Jennifer Sukow provided an overview of the Curtailment Scenario using ESPAM version 2.1. She began by showing the groundwater irrigated lands that would be curtailed with water rights that are junior to 1949. She compared the modeled benefit from curtailment to the river and spring reaches for ESPAM versions 1.1, 2.0, and 2.1. Willem said the output for 2.0 and 2.1 should be the same. Jennifer responded that they are almost the same, and the difference is that PEST can adjust the ET adjustment factors. Jennifer said the total difference between versions 2.0 and 2.1 in terms of spring and river gains was 10 cfs (2858 vs. 2868 cfs).

Jennifer moved on to the 1973 and 1985 curtailment dates and commented that as the curtailment date gets closer to the present, there is a marked decrease in ground water irrigated lands that are subject to curtailment. She discussed the transient simulations that show the predicted response for each reach and mentioned that an important point is the time to reach steady state. Jennifer said that when you get below Blackfoot, the time to reach steady state decreases significantly for the spring reaches. Willem commented that the decrease in time reflects the change in specific yield between the

new and old model versions. Allan said the new model is calibrated to more data that reflect the seasonality in the aquifer system.

Jennifer also showed a series of slides with the predicted long term transient head response for the three model versions at certain locations for the various curtailment dates. She commented that the new models (ESPAM2.0 and 2.1) approach steady state faster, and there is more response in ESPAM2.0 and 2.1 because there is greater curtailed consumptive use. She also showed the predicted short term seasonal response to curtailment for the various reaches.

David Hoekema asked if the change in the timing of the response to curtailment was logical, and Jennifer said yes because there is more data to calibrate S_y and that there was a greater change in S_y in the western part of the model. She added that with better targets, the new model better matches the seasonal amplitude of the springs. Willem said the new model relies more on transient targets. Chuck Brendecke reflected on expressing the way to characterize the relative amount of attention PEST has directed toward calibrating above and below Milner. He asked if the weight of the targets below Milner affects PEST and if the impacts below Milner increased as a result of there being more targets. Allan responded that the committee decided that 1/3 of the contribution to the objective function would be aquifer heads, 1/3 would be from river gains, and 1/3 would be from spring discharges. He added that the spring discharges (spring reach gains, measured spring discharges, and base flow) all sum up to the 1/3. Willem concluded that the emphasis should be equal. Allan said he attempted to design version 1.1 of the model in this manner, but he did not have as many transient targets.

Willem commented that when you re-adjust the weights, the contribution to the objective function remains the same. He added that because the spatial resolution below Milner is better, there is more information, more points to match, the model matches the data better, but the total contribution is the same. Chuck Brendecke said since there are more targets below Milner, the result is more weight is given in that area. Allan said he tried to compensate for the greater number of observations, but there is so much noise in the river reaches that the result became diluted. Willem said that if you filter the data from the upper part of the model, you will get an overall improvement to the model. Allan said model uncertainty will also be reduced.

Chuck Brockway asked why there is a general head boundary in the spring reaches. Allan said that we use the general head boundary to represent water that discharges from the aquifer to the river without day lighting as surface springs. Chuck Brockway asked if it adds up when you add the discharge from the general head boundary to the spring discharges. Jennifer said that the base flow was calculated as a difference between the spring discharges and the spring reach gains.

Chuck Brockway then asked why the model versions were compared, and Jennifer said it was done in response to the Director's letter. Chuck asked what did we learn, and Jennifer said that there is a big difference between ESPAM 1.1 and 2.1 in terms of the results of the curtailment scenario, but not a big difference between 2.0 and 2.1. Chuck

Brendecke asked if the amplitude of the discharge from the aquifer to the river via the general head boundary reflects how the model was constructed. He then said that the large discharge and the stifled amplitude imply a confined system, and the amplitude is better matched in the springs. Allan said the base flow is a small % of the discharge. Willem said it is about 20%. He said that the base flow is not totally responsible for the lack of seasonality because some of the Group C target springs also lack significant seasonal amplitude. Allan added that PEST is asked to match the long term average discharge for the base flow targets; the seasonal amplitude in the base flow has little impact on the long term average. Willem suggested asking PEST to match a cross plot of modeled vs. observed reach gain data at a slope of 1. Allan indicated that we could do that, but we need to remove the noise in the reach gain targets first.

Sean Vincent said that ESPAM model 2.1 better represents aquifer seasonality than version 1.1, and the committee should explore ways to improve seasonality in the next version. Willem thought that the model still underestimates seasonality. Allan said the river reach gains have lots of noise that the model will never match, and the committee may need to remove the noise from the reach gains targets because PEST cannot figure out what is noise and what is real. Willem again reiterated that the model consistently under predicts seasonal variability. Jennifer said the noise may not be random error, but could be surface runoff from storm events.

Item 6 - Rick Raymondi began a discussion with the ultimate goal of receiving the committee's endorsement of ESPAM version 2.1. Willem said he did not see any problems with version 2.0, and he went back through version 2.1 to see if any other issues were evident. He said he believed that 2.1 is a better tool. Chuck Brockway said that there is not a better tool to use instead of 2.1, and he recommended changing the wording in the previous endorsement from version 2.0 to 2.1.

Greg Sullivan said he was comfortable with the recommendation with that change (2.0 to 2.1), although other tools or models may be appropriate in a given circumstance. Bryce said he would like the recommendation to be simple and short and to include the condition that was previously suggested by himself, Greg Sullivan, and Chuck Brendecke. Bryce added that despite the development of the new model version (2.1), their position (himself, Greg Sullivan, and Chuck Brendecke) had not changed. Willem said he recognized their position. Chuck Brockway said he did not agree with their statement which adds that other tools or models may be appropriate in a given circumstance. Willem said that he does not agree with the statement and that the onus should be on someone else that this is not the best model. Chuck Brendecke said we cannot know all the circumstances in which we would want to use the model. At this point, the committee agreed to the previous endorsement language while substituting 2.1 for 2.0.

Item 7 - Mike McVay began the ET subcommittee discussions by showing everyone how to find information on the web page. (See the ET Subcommittee meeting notes for full January 8th 2013 discussion in the ET Subcommittee folder).

Item 8 - Allan Wylie began a discussion of the candidate improvements for the next model version (ESPAM2.next). He said the process should begin with brainstorming possible upgrades, prioritizing the candidate upgrades while recognizing that it is the intention to roll out the next version in one or two years, conducting experimental calibration runs using the highest priority upgrades, refining the prioritization, and calibrating ESPAM2.next. Allan reviewed the candidate improvements that he gleaned from past meeting notes including:

- Include filtered and unfiltered Snake River gains
- Add Portneuf River
- Include Menan gage
 - Heise-Shelley will become Heise-Menan and Menan-Shelley
- Include multiple model layers in selected areas
- Include cross plot, slope, and R2 as calibration targets
 - Perhaps not with noisy Snake River gain data
- Incorporate more METRIC data
- Refine procedure to represent ET between METRIC years
- Extend model dataset

Allan said that the Portneuf would be connected in the same manner as is currently done with the Snake River. He also said that there are 5 areas with perched conditions within the model boundary, and layering could be added for these areas. Willem asked why, and Allan said that the model doesn't accurately represent aquifer conditions where the perched layers are. Chuck Brockway asked if this would address the fault issue at Rexburg, and Allan said no.

Willem asked what we would be trying to represent with the layering, and Allan said the vertical head distribution. He added that the current model does not represent what happens to recharge at the Egin site. Willem then asked if there are data available, and Allan said maybe and added that there is a model as part of an M.S. thesis. Jennifer Sukow said there was more recent data in a MODFLOW model of the Henry's Fork area. She said there was quite a bit of data in the copy that she had reviewed. Willem asked if it was new data, and Jennifer said it was more complete data.

Bryce Contor said that the Freemont-Madison Irrigation District had recently reclaimed a well and installed a nested pair at an Egin Lakes recharge site. Willem asked if there was information for Mud Lake, and Allan said there are wells that show strong vertical gradients. He added that the layering in the Mud Lake area will not improve the modeled aquifer/river interactions. Willem went on to ask about the Big Lost area, and Harvey Walker said there was a 600 foot well drilled south of Arco where the driller lost circulation. He said he would be willing to share the well log with the committee.

Willem concluded that these are fairly isolated areas, but it might make a difference in model calibration at Egin or Mud Lake. Allan said he thought the areas where layering might make a difference are at Egin and north of Oakley near Burley. Bryce said there

is a shallow aquifer near Burley. Chuck Brockway said the shallow aquifer near Burley communicates with the river. He added that the shallow aquifer beneath the Rupert – Paul area seems to be a separate unit with a flow gradient toward the N/NW. Chuck said that this aquifer dumps into the regional system.

Willem said that in order to define the top of the Glens Ferry Formation in the Thousand Springs area, we will have to deal with the elevation of the model drain cells. Bryce Contor said that maybe the base flow comes out of a deep system. Chuck Brendecke said two layers below Milner should be considered. Dave Colvin said that he listened to a discussion with INL and USGS participants, and the data regarding vertical flow gradients seemed somewhat inconsistent.

Bryce said the lower part of the Teton River appears to be hydraulically connected to the aquifer. Allan asked if there are gages in the area, and Bryce said he was not sure.

Dave Colvin said that an additional evaluation of the uncertainty results should be done to see where more data could help the model. Allan said it is possible to perform the evaluation using PEST. David Hoekema asked if more pilot point should be considered, and Allan said yes.

David then asked if there was a way to incorporate the trace work into model calibration. Allan said the problem is that not many tracer tests have been performed that are at least a grid cell in length. He added that when the tracer tests are at least 3 miles long, it would be more appropriate to include them in the model calibration. Dave Blew said that particle tracking was done with 2 ¼ to 3 mile traces. Willem said that if we want to go to that level, we should use a finer scale grid close to the rim; otherwise it will not work for calibration. Willem said that regional water quality information would be useful for calibration. Dave Blew said the change in electrical conductivity measured in groundwater above the rim in the Clear Springs area has been mapped. He added that there is anecdotal evidence of the age of groundwater in that same area using CFCs and deuterium. Dave Colvin said a finer grid could be built into the model in some areas, but this should be considered for ESPAM version 3 since it is such a big change.

Greg Sullivan said that the source of water on mixed source lands is an issue that needs to be addressed. Bryce agreed with Greg's concern. Greg also said that it is important to know what would really happen if curtailment occurred on mixed source lands. Greg also suggested converting the Snake River to the STR package.

Bryce suggested the committee should use the simple algorithm implemented by Paul Hsieh (USGS) into the SVRP model that is based on the depth to water to account for the delayed movement of soil moisture from the surface to the aquifer. Chuck Brockway said the committee should consider linking the groundwater model with a routing model of the Snake River.

Final

Chuck Brendecke said that the committee has been through the wish list from previous model versions. He recommended giving members a chance to think about and prioritize the issues. Willem concluded that the committee needed to consider what would be difficult vs. easy and important vs. not important.

Item 9 - The committee agreed on March 5th, 2013 as the date for the next meeting.

DECISION POINT SUMMARY

The following was agreed upon:

- 1) The committee agreed that the next meeting should be March 5th, 2013.
- 2) Regarding ESPAM version 2.1, the committee agreed to accept the previous endorsement language while substituting 2.1 for 2.0.