State of Idaho
DEPARTMENT OF WATER RESOURCES
1301 North Orchard Street, Boise, ID 83706 - P.O. Box 83720, Boise, ID 83720-0098
Phone: (208) 327-7900 Fax: (208) 327-7866 Web Site: www.idwr.state.id.us

DIRK KEMPTHORNE
Governor

KARL J. DREHER
Director

October 9, 2002

Mr. Chuck Brendecke
Hdyrosphere Resource Consultants
1002 Walnut, Suite 200
Boulder, CO 80302

Dear Chuck,

We very much appreciate the time and effort which have gone into your comments regarding the March, 2002 review of the Snake River Plain Model Upgrade project. Many of the design issues are of sufficient complexity that it is difficult to adequately cover them in a two-day meeting. We appreciate the amount of thought that you have applied towards improving the model development and data collection phases. We urge you, and all other participants, to continue to review the detailed design documents as they are released in draft form. We would also like to note that many of the issues raised in your letter are not addressable given the current data and time constraints. We think that this process of model building and calibration should serve multiple purposes including: providing the best technical tool possible given data, schedule, and money constraints; providing a coherent picture of where the model uncertainty resides; and identifying the greatest needs for future data refinement and collection.

Regarding inclusion of the Oakley Fan in the model area (page 1, last paragraph), our current intention is to include the Oakley Fan in the model assuming that the data are available to support this inclusion. If sufficient data are not available it is our thinking that the calibration of the Oakley Fan area would be meaningless and that it should be excluded. Similarly, if inclusion of the Oakley Fan area increases model complexity to a degree which threatens successful project completion, we would advocate removal of the Oakley Fan area. We will keep the entire review committee apprised of any changes in model boundary.

Page 2, paragraph 1 requests a map of aquifer thickness. Aquifer thickness will remain uncertain, regardless of which estimation method is used. As discussed in the March meeting, we are currently planning on using a map generated by Whitehead for the bottom of the aquifer. For model calibration, we are planning to run the model as a confined model, thus allowing aquifer transmissivity to represent the combined effects of hydraulic conductivity and aquifer thickness. A confined representation will be more stable than an unconfined representation, which will be an important factor when using automated calibration tools. After model calibration, aquifer thickness can be calculated and a map generated. We agree that the linearity assumption should be regularly tested.

Page 2, paragraph 2 suggests sensitivity analysis of the boundary condition assumptions in the Shelley to Neeley reach. We are currently conducting a hydrologic analysis of the river/aquifer interconnection above American Falls to assess our boundary condition assumptions. The results of this analysis will be presented at the October project review meetings. We feel that this approach is preferable to conducting sensitivity analyses, especially sensitivity analyses which would be conducted using the original model. The model cell size in the old model is sufficiently large (5 km) to require exclusion of many water level measurements near the river as calibration targets. The refined model cell size (1 mi) will allow use of more water level measurements of wells near the river and facilitate better calibration in those areas. If time allows, during the final calibration phase, we will assess how sensitive the river response above American Falls is to various parameterizations.

Page 2, paragraph 3 comments on the ability of the recharge tool to generate scenarios that discern the difference between impacts due to ground water development and impacts due to changes in irrigation practices. We would like to re-state that it is our thinking that the best method for sorting out river reach impacts due to various causes is through the use of response functions, which allow prediction of impacts to river reach gains and losses due to any individual stress, in isolation of all other stresses. A second method for discerning differences in the impacts due to ground water development from other changes in recharge or discharge is through model scenario generation using the recharge tool. The interdependence of many of the elements which are required for scenario building (land use, irrigation practices, etc.) will cause scenario-building to be a rather complicated undertaking. It is possible using the recharge tool; however, the user must be intimately familiar with the model assumptions and use of the recharge tool in order to build scenarios. That being said, the recharge tool will enable the user to test various assumptions of recharge and discharge calculation, for example:

- Remove all ground-water development to look at the combined impacts due to all of the other components of recharge and discharge (similar to the 'no ground water' scenarios generated for the Upper Snake Basin Study)
- Hold ground-water development steady and investigate the impacts of various surface water irrigation assumptions such as efficiency or rate of conversion from gravity irrigation to sprinkler irrigation
- Adjust evapotranspiration (ET) on ground water irrigated acres using the ET adjustment factors, to test assumptions on the efficiency of ground water irrigation
- Adjust return flow lag factors based on diversion rates, or enter pre-estimated return flows to test assumptions about changes in return flows during wet or dry seasons

We would like to reiterate that, during the model development and calibration, the only scenarios which will be built are model calibration scenarios. There are no plans to build scenarios such as those mentioned above. These would be generated after model calibration if resources become available.

Page 2, paragraph 4 points out that recharge from surface water irrigation is being deduced as the residual from water budget calculations. This is absolutely true and is a necessity given the measurable and estimated water budget elements. As each component of the water budget is calculated, we are attempting to quantify the measurement or estimation uncertainty in that component. We know of no other way to address uncertainty in the water budget. Some of the larger elements of uncertainty will be included in generation of different recharge and discharge calibration data sets resulting in different parameterizations.

Page 2, paragraph 5 expresses concern regarding estimation of return flows for years for which measurements are not available. As you pointed out in paragraph 5, a two-year effort is currently underway to measure return flows, which provides a current picture of the relationship between return flows and diversions. Our intent is to look for funding to carry this effort out into the future. As to estimation of return flows for previous years, other than the period of 1985-1988, during which some return flow work was done, we feel that the best way to estimate return flows is to assume that the relationships between irrigation diversions and return flows calculated based on the available measured data are valid for years for which return flows have not been measured. We acknowledge that this situation is not ideal, however it appears to be the best option, given the available data. As discussed above, other assumptions about the relationship between return flows and diversions could be tested through scenario generation.

Page 2, paragraph 6 addresses the question of how canal seepage is handled in the model. Canal seepage is currently calculated by the recharge tool as a percentage of the diversions for the associated irrigation entity (canal company or grouping of companies). The percentages can be easily adjusted to generate new scenarios. If a seepage option other than a linear percentage of diversion is required, the seepage could be estimated independently of the recharge program and the seepage numbers could be added in via the recharge program as either point or line source data for each model stress period.

Page 3, paragraph 1 suggests that we start thinking about which recharge parameters PEST should be allowed to modify, and in what order. The design of the Recharge Program (specifically the Fortran component of the Recharge Program) was done with the intention of making certain parameters available to PEST during model calibration. For example, the canal seepage percentages discussed in the previous paragraph of this letter would be available to PEST as a calibration parameter. We have started work on a design document which states the calibration plan for the model. We will present this topic at the October meetings for review and discussion by the whole committee. It is probable that the tight delivery schedule for the project would preclude a model calibration/parameterization which includes individual parameterization of all possible variables, however, our modeling team is making every effort to structure the recharge program design and the calibration plan to make the best use of current parameterization tools. Just to clarify a point, the number of adjustable parameters is so large that it is unlikely that PEST could estimate all of the parameters in a single run. The calibration plan will be a building process where the most critical parameters are estimated first. If time allows, estimation of some of the less critical parameters will be done using PEST. This would provide some insight into how sensitive the model results are to some of these seemingly less critical parameters.

As we previously stated, we appreciate the amount of time and thought which you have put into your comments. We share your frustration that not all of the required data is available for the whole modeling period; however, we feel that the most critical components are reasonably available or estimable. We look forward to seeing you at our October project review meeting.

Sincerely,

Paul

Paul M. Castelin, Chief
Technical Services Bureau

cc: Hal Anderson
Donna Cosgrove
Garth Newton