Instream Flow Technical Working Group
Pebble Project
January 20, 2010
Atwood Building Room 602

Minutes Recorded by Charlotte MacCay/Pebble Partnership (PLP)

I. PRESENT:

Charlotte MacCay (PLP)
Dudley Reiser (R2 Resource Consultants)
Phil Brna (USFWS)
Jason Mouw (ADF&G)
Doug Limpinsel (NOAA)
Kate Malloy (ADF&G)
Ron Benkert (ADF&G)
Dan Young (NPS) - by teleconference
Andrea Meyer (ADNR)
Nellie Williams (Trout Unlimited)
Kendra Zamzow (CSP2)

II. AGENDA

1. Introductions
2. Brief Review of Target Species and Periodicities
3. Review of Options Available for HSC Criteria Development
4. Application of HSC in Modeling
5. Summary of Pebble HSC Data
6. Review of June 25, 2009 HSC Curves

III. INTRODUCTIONS AND GENERAL DISCUSSION

(Agency) The team leader distributed a list of information that had been identified by some agency members of the instream flow technical working group as information that will assist them in the review of ongoing flow-habitat studies for the Pebble Project. The list includes information that will be necessary for a full evaluation. To whatever extent that PLP can provide any of this information at today's meeting will be helpful. We will start by following the agenda proposed by the consultant (listed above). We may not get to discussing each of the curve sets. We would like to focus on background information up to and supporting the curves. It is recognized there will be some repetition of the past meetings.

(R2 Consultant) Regarding the information request, particular studies are underway to address many of these issues. Not everything on the list, but much of the information will be forthcoming in the Mainstem Flow Study technical report.

(Agency) When will the technical report be available?

(R2 Consulting) It is underway, but I am not in a position to say when it will be finished, most likely several months from now. From my perspective, if I were in your shoes, I would be interested in the same kind of information listed. In addition to the report that is underway, we have already submitted hydraulic model data decks for the majority of transects, which will be used in conjunction with the HSC curves for developing habitat-flow relationships for different fish species and life stages. These relationships will be helpful for defining baseline conditions, quantifying potential impacts, and evaluating and comparing mitigation measures. Because we are in the process of preparing the Mainstem Flow Study report, we will be developing initial habitat – flow relationships based on the HSC curves presented in the June 2009 HSC

document and that are the focus of today's discussion. Nevertheless, I believe it would still be good to have a more focused discussion on each of the HSC curves with a small working group comprised of biologists familiar with the ecology and habitat requirements of the target species. I am unsure when this could be done, but we are open to discussions with a more focused group.

(Agency) We do not have the right people here right now to do that.

(Agency) As we go through the outline today we can point out additional information needed to get to that discussion. Information such as habitat maps, distribution of upwelling areas, fish periodicity information, and examples of certain cases will be needed prior to discussing the curve sets. Some species are influenced by things other than depth and velocity, such as temperature, and/or substrate, and/or groundwater.

(R2 Consultant) We are certainly aware that the applicability of Habitat Suitability Curves (HSC) and PHABSIM models may vary depending on what factors species key on for selecting certain habitats. For example, sockeye may be more influenced by locations of groundwater upwelling rather than particular surface flow velocity/depth mixes. Thus, it may be that for certain segments of stream and species that you do not apply the PHABSIM model for that segment or species, but rather deal more with the surface and groundwater interactions that are occurring. . However, from my perspective it remains important to first reach agreement on the shapes of the HSC curves for each of the target species and lifestages, and then determine where it makes sense to apply the curves. Not having determined if a given HSC curve is applicable for a given species does not preclude developing the curves.

(Agency) The temperature and groundwater interface is probably closely related; just supporting the earlier comment about needing information. We need to know the rationale or methodology used to select sites; was it random down to the selection of transects? What off channel habitats were or were not included and why? Was any statistical reasoning used in the selection of sites and transects. If information that addresses these questions will be in the technical reports, that will be fine.

(R2 Consultant) If there are more questions be sure to ask and we will try to cover them. Regarding temperature, the SNTEMP model is in the draft review for use during ice-free periods for each basin. It can link in with flow and generate how different flow regimes will affect surface water temperature. It can also link groundwater nodes with temperature influxes. We know that groundwater inflow can influence the model based on longitudinal temperatures upstream and downstream from known groundwater sources. We are also developing a River ID ice model since we know that the quantity of streamflow can influence ice formation. If changes are made to flow regimes we want to understand how that may potentially change where, and the extent to which ice-formation occurs, as well as estimate how flow changes might influence the timing of ice breakup.

(Agency) Will you address lack of ice and temperature?

(R2 Consultant) We believe the model will be useful for characterizing baseline conditions under different hydrological regimes and should be able to estimate where ice forms, the thickness of the formation, and the timing of breakup and ice-out in each of the systems.

(Agency) Will you look at under ice conditions for overwintering habitat; presence or lack of ice and why, and if it is related to groundwater?

(R2 Consultant) We will move forward with the model. To what extent changes in the flow regime will impact ice formation, thickness, movement, and temperature under the ice. These are important pieces of information that can influence the extent of overwintering habitats in the three river systems.

(Agency) The model you use for the mainstem flow study is one dimensional – how does it compare to the new state-of-the-art two dimensional models?

(Agency) At a recent workshop many of us attended it was stated that R2 was one of only a few firms who were still using one-dimensional models anymore.

(R2 Consultant) Although you can get more information with a two dimensional model including spatial depictions of how habitats change with flow, when it comes to what it tells you, both one dimensional models and two-dimensional models end up with depictions of habitat-flow relationships by species and life stage. Some relatively recent comparative studies between one and two-dimensional models have shown general similarity in the shapes of resulting habitat-flow relationships (Waddle et al. 2000; FERC 2006; Gard2008 I was involved in a comparative study conducted on the Oak Grove Fork, Oregon, in which both 1-d and 2-d models had been applied, along with a Demonstration Flow Analysis. The general shapes of the habitat – flow relationships were the same for all three methods. However, for certain stream segments that might have special biological significance, a two dimensional model might be useful for providing more detail regarding habitat-flow interactions.

(Agency) Agreed. However, it would likely not be practical to apply two dimensional modeling up and down these entire systems.
(Agency) How useful is any of this if temperature and groundwater are driving these systems not flow?

(R2 Consultant) Streamflow doesn't drive the systems, but it does create the habitats within. In the study streams, we are looking at a combination of surface and groundwater flows that in combination serve to create a variety of fish habitats. The value of the model is that it includes both in computing habitat-flow relationships.
(Agency) It is often confusing if it is the groundwater or the surface water hydraulics that affect the habitat space.

(Agency/R2 Consultant) Some points for consideration related to this include:

- There are some reaches that appear to be heavily used by a species and other reaches that are not – what are the reasons for this?
- Spawning concentrations of certain species (e.g. sockeye) appear to be aligned in some reaches with areas of known groundwater upwelling.
- Groundwater/surface water interactions could drive large scale spawning distributions
- In reaches where upwelling is important the species are obviously selecting hydraulic conditions within those reaches that may not be directly linked with surface flow characteristics (i.e. depth and velocity).
- Surface water hydraulics are modeled by PHABSIM. However, it will be important to limit the application of the model to species and reaches that appear to be influenced by surface flow conditions, or to otherwise account for the influence of groundwater – surface flow interactions in the making habitat predictions. Otherwise, there would be tendency to overestimate habitat availability.

There is a concern that if we collect that information before we develop the curves it limits the review of curves within the context of upwelling and important habitat. One concern is that if we develop the curves before we understand the linkages to groundwater, then the curves may not be representative of conditions that certain fish species are actually seeking.

(R2 Consultant) In general, for selection of areas in 2008 we were looking at obtaining as many redd measurements as possible. For this, we reviewed aerial escapement counts, and concentrated our sampling effort on areas where the fish were. The counts allowed us to see the spawning distribution fairly well and focus on areas where the concentration of fish was high. Our goal was to collect sufficient microhabitat data to allow the development of site specific HSC curves rather than rely on literature based curves. However, there are a number of considerations relative to how we apply the data in developing the flow – habitat relationships. For example, we need to decide whether to separate the data by basin so that each basin has its own set of HSC curves, or whether to combine all data to generate a project site set of HSC curves. For certain species we also need to determine the applicability of HSC curves throughout the reach. In the end, we want HSC curves that can be reliably used in deriving the habitat -flow relationships.

(R2 Consultant) For example, some of the data we collected from sockeye redds on the South Fork Koktuli River included velocity measurements that were very low (< .50 fps). Such low values suggest that velocity was not a big determinant in the selection of spawning areas. These areas were located proximal to known areas of groundwater upwelling suggesting

that the selection of sites was more dictated by groundwater inflow rather than surface velocity. In those cases, it would not make biological sense to include those measurements in the development of HSC curves for sockeye spawning, nor to rely on habitat-flow relationships for evaluating sockeye spawning habitat in those areas. However, in other stream segments, velocity measurements over sockeye redds were much higher and indicative of being influenced by velocity. Those data would be included in developing HSC curves and would logically be used in evaluating habitat-flow relationships for sockeye spawning within those reaches. (Agency) So how valuable is the surface flow model?

(R2 Consultant) I believe the model will be quite useful for defining baseline habitat-flow relationships and for evaluating impacts and mitigation alternatives. However, it will be important to define up front where it is applicable and where it is not – i.e. may not be applicable for defining surface flow dependent spawning habitat relationships in areas where species (e.g. sockeye) appear to key in on groundwater inflows. (Agency) Bristol Bay has a large diversity of habitat – each stream has species that have adapted to these habitats in diverse ways. PHABSIM cannot address all these nuances; it is a tool with select applicability.

(R2 Consultant) Agreed. Certainly groundwater issues are one of the big items in the different systems that will need to be considered. PHABISM alone can't address the groundwater piece. Two-dimensional modeling might be useful to assist in addressing surface flow-groundwater interactions and could be applicable for certain reaches. (Agency) I would propose that PHABSIM be used in areas where appropriate. In areas that have more complex channels we may need to use other approaches.

(R2 Consultant) PHABSIM is useful for evaluating habitat-flow relationships over large stream segments. In addition, it will be important to address groundwater influences in some stream areas.

(Agency) Will groundwater models predict where there could be spatial changes in where groundwater surfaces and the amount of groundwater flow?

(R2 Consultant) That is not my area of expertise. My understanding is that a groundwater model should provide some spatial resolution of where changes are likely to occur in areas where groundwater influence is clearly defined. However, I am not clear on the resolution of the groundwater models: how much, where, etc. , were…

(Agency) At some point, we need integration of groundwater modeling output with surface water hydraulic modeling and off channel studies.

(R2 Consultant) Data analysis of the off-channel study is underway and a report will subsequently be prepared. That document is likely several months away but it should give you a better idea of what was done and the supporting rationale. The overall goal of the study was to understand the mechanisms of flow connectivity to the channels, whether it be from surface flow, groundwater flow, or combinations thereof. For channels dependent on surface flow connections, the objective was to be able to determine the linkages between surface flow and off-channel habitats, so that it would be possible to determine the amounts of off channel habitat provided by certain amounts of surface flow. . This will give us an idea of these off channel areas function over time.

(Agency) How do you distinguish if the off channel area is groundwater fed, if it is from groundwater outside of the system, or hyporheic flow within the system? Do you look to see if the hydrographs track one another?

(R2 Consultant) Yes. We installed and monitored pressure transducers at selected locations (e.g. beaver complexes, overflow channels, etc.) within the area we studied in the North Fork Koktuli system. The transducers recorded water surface elevations over time, which we could then compare with surface flows in the mainstem river. We found that some systems appeared to track with flows in the mainstem, some remained stable in spite of changes in mainstem flows. Results from these studies will be used in conjunction with GIS to extrapolate to other areas.

There is also a fluvial geomorphology report that has been prepared which addresses another element that can be influenced by flows. The studies look at how sediment moves through the system based on existing flow regimes and what that means to fish habitat.

(Agency) When will those data be available?

(Agency) I recently got a response to a letter asking for data related to the transportation corridor and it stated that data would be available in early 2011.

(PLP) That sounds about right. At this point we are aiming for some time in 2011. It depends on what happens with the project; that is always subject to change. I can say that we are focusing on working up data that have been collected more than focusing on collecting more data.

(Agency) I just want to make it clear and on the record that at some point there will need to be a discussion on whether or not the data that have been collected is adequate. For the agencies to make intelligent and responsible recommendations we will need to review the data.

(Agency) It may be helpful to have a discussion with the groundwater modelers, if in the context of habitat suitability and integration of studies, it will be possible to predict or show upwelling in these systems. If a map can be created of where we expect upwelling and down-welling longitudinally and overlay another map with the distribution of spawning, that would be a good start in determining where to apply PHABSIM

(Agency) That would visually simplify the discussion.

(R2 Consultant) We've gone off on a lot of tangents this morning. I'll try to address the agenda for the rest of the meeting. I'll start with a quick snapshot of the target species, discuss periodicity focused on visual observations of spawning, some repeat of the criteria development options, the application of HSC in modeling, and a summary of HSC data. I also want to focus on, at least in a preliminary manner, a review of the June 25, 2009 HSC curves. It doesn't look like this will happen today, but maybe we can take one of the excel spreadsheets as a test run.

IV. TARGET SPECIES

(R2 Consultant) The list of target species is as follows: Chinook salmon, coho salmon, sockeye salmon, chum salmon, rainbow trout, Dolly varden, arctic grayling, and several species of whitefish.

We did not specify which species of whitefish, although we understand three species are present (round whitefish, humpback whitefish and least cisco. We also note that northern pike are a species of interest but they were not included as a target species since they exhibit a primarily lacustrine life cycle.

V. PERIODICITY

(R2 Consultant) We have created a series of spreadsheets that exhibit the periodicities of different life stages of the target fish species. Some areas such as spawning and migration show empirical data others such as incubation and emergence are more based on literature and professional knowledge.

(Agency) Isn't Coho migration periodicity more drawn out than what is shown there?

(R2 Consultants) Possibly. This was based on escapement surveys that were conducted up when ice began to form on the rivers. (Agency) There may be spawning under the ice – as occurs in other places.

(R2 Consultant) There is some little variation in migration timing and length of spawning periods between the systems. .

(Agency) That gets to the issue of developing habitat suitability curves by basin.

(R2 Consultant) Yes, and as we have presented in the HSC report, we will be looking at developing curves specific to each basin.

(Agency) Is the difference in basins related to flow or temperature?

(R2 Consultants) We haven't done that level of analysis yet. At this time, we are still working on developing the tools/models we can use to complete additional analysis.

VI. OPTIONS AVAILABLE FOR HABITAT SUITABILITY CURVE (HSC) CRITERIA DEVELOPMENT AND APPLICATION OF HSC IN MODELING

(R2 Consultant) There are different categories of habitat suitability curves termed Category 1, 2 and 3.

The Category 1 curves are based largely on published literature or curve sets that have been developed from other studies. These types of curves are used if it is not feasible to collect a sufficient number of measurements to allow development of site specific curves. A second approach (Category 2) is to collect a sufficient number of observational data to allow development of frequency distribution curves that can be used in developing site specific HSC curves. The third approach (Category 3) represents the development of habitat preference curves that account for the availability of habitat features within the stream from which microhabitat observations were made.
(Agency) It is difficult to come up with realistic representative estimates of what's available including where fish are present or not. Another way to verify is to go to spawning areas and then look at areas with no fish and compare the distribution of depth and velocity at the two sites and see if that is what's driving the selection of the site or is it some other characteristic.

(R2 Consultant) The fact that fish are not spawning at another area says they are selecting for something different such as groundwater or different substrate sizes. One approach in making comparisons is to compile a bunch of curves from different projects on one graph, then add the project curve and see if the project curve fits or if it is showing something unique or different relative to the selection of specific depth and velocities.

(Agency) I have seen binary curves that incorporate groundwater.

(R2 Consultant) It's a possibility. Binary can be applied in combination with traditional curves. Comparisons of site specific curves with others provides some confidence relative to whether the curves are responding in the same fashion as others.

(Agency) Did you collect data on proximity to cover? If so, did you see shallow shoreline as important?

(R2 Consultant) We collected some cover data and I believe we can condition how we apply HSC criteria if data show a distinct pattern of fish use.

(Agency) I have seen PHABSIM misapplied if it is not conditioned with factors such as cover. In one case decreases in flow showed suitable depth for habitat, but the area was in the middle of a channel with no cover.

(R2 Consultant) One option is to look at habitat suitability within individual cells. In the end, whether one dimensional or two dimensional modeling is used, habitat-flow relationships are generated by species and life stage. These can be linked with hydrology data to develop a habitat time series analyses. From this, we can estimate the availability of habitat over time, i.e. how does the amount of spawning habitat change with flow over time within a given reach. This can be done for wet, dry, or average year scenarios. The habitat time series can then be used for deriving habitat duration curves. These types of analysis are all useful for helping to understand systems and identifying impacts.

VII. SUMMARY OF PEBBLE HSC DATA PRESENTED IN POWERPOINT

(R2 Consultant) The summary statistics contained in the HSC report flagged those species and lifestages for which there were > 75 observations. s; in general, the more observations the better. However, curves can be developed from fewer observations. The State of Washington has a set of fallback curves that were developed from as few as 25 observations from one system.

(Agency) Why the lack of Chinook spawning observations in Upper Talarik Creek?

(R2 Consultant) There are not many Chinook that use that system.

(Agency) It's really a Talarik sockeye system vs. a Chinook Koktuli System.

(Agency) There are lots of Coho in the Upper Talarik, but no-one thought they were there prior to this project.

(R2 Consultant) One year a few pink salmon were seen in Upper Talarik Creek, the next year none.

(Agency) There is some speculation about how commercial fishing can affect sub stocks in certain areas.

(R2 Consultant) The point is they can be seen in one year, and not be present in other years.

(R2 Consultant) The next figure plots the dates when observations were made versus the flows occurring before, during and after the measurements. This important since it shows whether flows were relatively stable or changing during the measurement periods.

(Agency) Did you time the observations with peak spawning or did you just go when you could go?

(R2 Consultant) We would get out there when we knew spawning was occurring. We coordinated with the escapement surveys and arrived within a day or two of their notice. We focused on areas of active spawning. As can be seen from the data, we had a lot of observations for sockeye spawning, more than 450 observations.

(R2 Consultant) We recently prepared a series of maps that integrate meso-habitat features of each stream with known spawning areas. The first map is that of the North Fork Koktuli and shows data for Coho. The maps depict the habitat types by stream as summarized in pie chart insets. There is a lot of riffle and run type habitats in the North Fork; few pools. The map also shows the spawning reaches. These types of maps should fulfill some of the information needs you noted earlier. [Also showed similar maps for the South Fork Koktuli River where changes in spawning areas occur at the beginning of the ephemeral reach; and showed a similar map for Upper Talarik Creek. It was noted that Upper Talarik Creek has more deep pool habitat than the other systems.] (R2 Consultant) The process we used in constructing the HSC curves displayed in the June 2009 document first involved the creation of frequency distributions for each parameter (i.e. depth, velocity). Curves are then visually fit to the data to represent a draft HSC curve. As noted in the document, we overlaid curves from other studies for visual comparisons. The next step would be to systematically review and discuss each of the curve sets with a group of species experts with the objective of selecting final curves for use in modeling. One thing you will notice is that we bring the velocity curve down until it intersects the X axis, but for the depth curve we generally keep it as non-limiting. A question to ponder is whether too much depth will ever limit a biological function such as spawning or rearing, or is that more likely limited by velocity? Regarding spawning, if velocity and substrates are suitable – will the fish spawn regardless of depth? Or, is there a minimum depth to provide cover, but above the minimum no limit?

(Agency) In the Kenai, the fish select areas with greater depth to avoid eagle predation.

(Agency) Do you see a difference in the curves between basins?

(R2 Consultant) We can look at sets of the document and compare combined basins to the individual systems. When we do this for the North Fork you can see they are fairly similar.

(Agency) Do you see any statistically different values between the HDR data and the R2 data?

(R2 Consultant) HDR has some data where they didn't distinguish between fry and juvenile lifestages; we make that distinction in our data. However, we have not compared the data sets statistically. HDR used similar spawning measurement techniques and these data should be representative.

(R2 Consultant) [Discussion of velocity data] When you display a frequency distribution of velocities you will see several peaks in the data indicating fish appear to use those velocities followed by a range of velocities that appear to be little used, and then another peak where use again is high. It's hard to believe that fish would actually skip a range of velocities, which in that case may have been due to the size of bins used in the frequency analysis. This is where professional judgment is important.

(Agency) All of the outliers appear to be HDR data.

(R2 Consultant) No it's combined, it's hard to see the color coding clearly on these graphs. We haven't looked at the data to determine if there is a pattern where outliers are either predominantly HDR or R2.

(R2 Consultant) The South Fork data have a different distribution of velocity than the North Fork data. its different from the combined trend particularly on the left side of the curve; the descending limb is more similar to the combined trend, but also somewhat different.

(R2 Consultant) If we did an availability assessment on depth we might find there is not as much depth available. The trend in literature is to leave depth non-limiting; i.e. above a certain threshold depth, all depths are equally acceptable. [More curves were looked at comparing specific systems to the combined data set.]

(Agency) Is velocity typically in PHABSIM mean water column velocity, and if so why is it used instead of nose velocity?

(R2 Consultant) We try to collect both nose and mean column velocity. The issue of which velocity to use in the modeling has been the subject of many debates. Because spawning is more bottom oriented and deals with ranges of depth that are generally relatively shallow, it doesn't matter much whether you collect nose or mean column water velocities – they should both be similar. With juvenile rearing, there is a greater range in depths. However, because the actual locations of fish in the water column can vary, the distribution of nose velocities can be highly variable, making the hydraulic modeling especially difficult. That is why in most cases, we continue to use mean column water velocity for the HSC criteria and in the PHABSIM modeling.

VIII. REVIEW OF JUNE 25, 2009 HSC CURVES

(Agency) I would like to go through the process on one curve, I do not want to finalize curves in this sitting.

(R2 Consultant) [Showing an example of an excel spreadsheet for suitability criteria] The idea would be to convene a small group of species experts and to present and discuss each of the proposed curves relative to other available curves, and to potentially modify the curves based on personal knowledge of species lifestage requirements. For example, if we superimpose curve sets with the proposed curve, we could then discuss why there are differences between curve sets, and propose modifications. In doing so, it will be important to keep good documentation of all changes to the curve and the rationale behind those changes. Because HSC curves are always questioned, you need to be able to document the process

and show how you reached consensus on each of the HSC curves. The development of HSC curves and completion of hydraulic modeling are two processes that need to be especially transparent. Decisions need to be logical and scientifically based. There can still be debate on what the results mean, but the methods and types of analysis used should be agreed to by all parties. Please give some thought as to who are the right people to participate in this type of meeting.

(Agency) We have some concerns before we get to defining habitat suitability curves. We need to narrow down where this type of analysis will be most appropriate. We need to bring in people with a lot of time in the field, such as Dan Young with NPS, who have the most experience with the species in the region and what make sense to them based on their professional observations.

(Agency) I don't know how much expertise is out there regarding spawning areas and depth.

((Agency) There are some folks with instream flow modeling experience such as Jack Erickson and Cecil.

(Agency) So look at Coho in the Koktuli, there are 52 measurements, is that sufficient?

(Agency) If we tweak a number how significant a change does it make in the model?

(R2 Consultant) It is important to document the process. Tweaking does not necessarily make a significant change. You can do gaming with the data deck to see how changes in the HSC curves may influence the PHABSIM results, but you have to careful not to bias the process. There are a lot of ways to do use data distributions to come up with final curve, and still preserve the general patterns observed in the frequency distributions.

(Agency) Discussing tweaking – is there a point where enough data points are available to be able to let the data stand by itself?

(R2 Consulting) You will still need to look at each species and lifestage, per system and determine if data are stand-alone or need some modification.

(Agency) It depends on how uniformly the data are distributed.

(Agecny) The higher the N value, the more the fish are telling you. The less tweaking you do, the more you are letting the fish dictate.

(R2 Consultant) The rule of thumb for N is somewhere around 100. But even with high N, distribution may not make sense.

(Agency) You have to identify the outliers, but it doesn't matter if it makes sense. You get away from human interpretation if you let the fish dictate – maybe I am being too simplistic.

(R2 Consultant) Some of the earliest developments of HSC curves followed every point in the distribution regardless of whether point to point variations made sense. That was the reason there were a number of techniques used to smooth the data. (Agency) It is not an interpretation – it is a simplification. You are visually simplifying what the data is saying.

(Agency) It illustrates the need for background data that gives more comfort to discern if it's an artifact or real.

(Agency) Trends will eventually illustrate themselves; the picture gets clearer with more data.

(R2 Consultant) To a point that's true.

(Agency) I would argue that 500 is better than 40 or 50 [N] until you get to a point where you are doing superfluous work.

(R2 Consultant) The reality is that you can't always get unlimited data which is why other techniques have been developed. How do data we are able to collect fit when compared to other data sets? Some projects go the other extreme and don't collect any site specific data; they simply adopt from a similar system.

(Agency) I admire the way you can say the same thing in different ways. I understood all the different versions but it didn't change by opinion. We need to be as reflective as possible with what the fish are telling us.

(Agency) I do not have the skill set here to sit down and discuss the curves, but when you do discuss them I would like to watch the process. No-one in our agency right now has that expertise, unless they are from another region and then they would not be qualified to discuss the application of HSC in Alaska.

(Agency) Ultimately, it won't make any difference.

(Agency) We could increase the value of N.

(Agency) I have a general question, on the graphics about substrate - we need a color coding for the substrate types.

(Agency) That was sent out with the data decks- if you can't find it contact one of the other members of R2 for another copy.

(Agency) It would make the review of the curves easier if you could superimpose the library curves over the site specific curves.

(R2 Consultant) Yes we can do that.

(Agency) Are there any more meetings for this technical working group?

(PLP) No, the technical working groups are not continuing, they have all been suspended. We just kept this meeting because it was already set up.

(Agency) I would just as soon wait to see all the final reports together before having any more meetings. It wouldn't add much to have any further meetings at this point.

(R2 Consultant) If we had another meeting it would be with a smaller group with the expertise to go through these curves one by one with documented curve sets.

(Agency) People in my agency that we would tap to help review the curves will want to get into the details of the data first.

(Agency) We understand that you want the curve set to allow you to progress to crunching numbers, but additional data is needed before we will feel comfortable about having those discussions.

(R2 Consultant) Understood.

IX. MEETING CLOSURE

(Agency) Is there any other comment from the group [none]. Is there any public comment?

(K. Zamzow) We are just observing.

(Agency) Will PLP be typing up the minutes?

(PLP) Yes

(Agency) If you just send them to me [lead] I will distribute

(Agency) It is the general consensus of the agencies to go through the process of reviewing curves when we get to that step. We will need the kinds of information that was shown to us today to review first, the information that is listed in the request we distributed at the beginning of the meeting [attached below]. All of this information that you can get to us is needed before we can go into a meeting to review the curves. Some information on the list you may not be able to provide, but we need data to weigh out issues of sample size and distribution before we go into that process.

(R2 Consultant) We are planning a minimal field effort this summer to refine some of the transects.

(Agency) What additional information is needed to do a two dimensional model? Is that a possibility?

(R2 Consultant) You need bed profiles and topography – The effort I just mentioned relates to refinement of data from earlier transects. We have some data points collected one year, and some other data collected another year, and the goal to collect supplemental data all within the same year. If we do collect additional data it would be an opportunity for additional secondary observations. The two-dimensional model information would include detailed bathymetry over given reaches of stream. We would need to create a grid of bed elevations. Data collection activities would increase field time which would vary depending on the size of the reach.

(Agency) There is a lot of support for two-dimensional modeling in critical spawning reaches, but then again many are groundwater upwelling sites and better defining of the surface water characteristics may not be useful.

(R2 Consultant) I agree with the concept of application of two dimensional modeling to sensitive areas and understand what you are saying.

(Agency) Meeting adjourned.

Attachment A: List of Information Requests

The following information has been identified by the instream flow technical working group as information that will assist them in the review of ongoing flow-habitat studies for the Pebble Project.

General information to assist reviews of all components of the flow-habitat studies

1. It would be helpful if maps of the distribution of meso-habitats and seasonal and interannual distributions of spawning and rearing for target species were provided. It would also be helpful if these maps included the full spatial and temporal distributions of the life stages and strategies of target species. For example, they could include the main channel and off-channel spawning strategies exhibited by Sockeye salmon. Ideally, the habitat and species distribution maps would be displayed on one map to assist in the identification of habitat associations. This spatial information will also assist in the evaluation of how HSC data collection accounted for the full distributions of species by life stage and strategy.
2. Maps of the distribution of the vertical hydraulic gradient (upwelling, downwelling), including the distributions of spawning and rearing for target species, would be helpful to evaluate the importance of VHG on habitat selection.
3. Fish periodicity information from each project stream would be helpful to assess whether data collection and modeling are representative of the full range of seasonal conditions utilized by the life history stages and strategies of target species.

PHABSIM study information

1. Procedures used to select the placement of transects would help assess how transects are representative of project streams.
2. Transect placement maps, ideally displayed as an additional layer on habitat/species distribution maps, would help evaluate how the distribution of transects represents the distributions of habitat and species.
3. VHG and temperature data are needed to evaluate whether or not HSC influence habitat selection or if their use needs to be conditioned by VHG or temperature. For example, if spawning Sockeye salmon tend to select the hydraulic environment associated with riffle crests, but only in reaches where groundwater is upwelling, depth and velocity data should only be used to model habitat in upwelling reaches only. If groundwater is important, yet unaccounted for, the area of suitable habitat will be greatly overestimated.
4. Proximity to shore and/or cover will also be helpful when evaluating HSC because certain depth, velocity and substrate characteristics may only be suitable if they are associated with the shoreline or cover.
5. How do ground and surface water hydraulics, substratum, cover and temperature differ between spawning and non-spawning locations? This information will help evaluate the biological meaning of the HSC. The importance of HSC cannot be ascertained by sole assessment of the availability of particular depths and velocities at transects and developing preference curves.
6. It would be helpful to consider binary HSC as an alternative form of the traditional univariate habitat suitability curves.
7. As stated in earlier TWG meetings, it would be good to consider 2-D hydraulic modeling in focused areas that are identified as important for spawning and/or rearing habitat, or in reaches with complex channel morphology. 2-D modeling may, in some cases, be the best way to model hydraulics at the scale of HSC and provides for more meaningful assessments of habitat, including interactions between HSC and associations with other important variables that condition the biological meaning of HSC.

Off-channel habitat study

HDR developed wetted perimeter transects and R2 developed three off-channel study sites. The wetted perimeter transects provide the opportunity to assess hydraulic linkages between main channel and off-channel water bodies if they are monitored frequently enough. It would be helpful to know how data collected from these transects will be integrated with the off-channel study and used to assess lateral hydrologic connectivity (ground and surface connectivity) between primary channels and spring channels and ponds embedded within the floodplain. Also, details regarding the integration of the off-channel habitat study and the PHABSIM study would help evaluate how the results of these studies will be used interactively or independently to assess flow-habitat relationships in study streams.

Channel and habitat maintenance

Flow-habitat models relate to the physical conditions present in study streams. If seasonal flow characteristics are substantially altered, these physical conditions will change and model predictions will become less relevant, depending upon the extent of change. For example, sufficient flows are needed on a seasonal basis to transport sediment and maintain river channels and habitat. If these flows are substantially reduced, channels will aggrade with relatively fine-grained sediment, and habitat area may be reduced. The issue of channel and habitat maintenance has been a component of the flow-habitat study since 2004 and it would be helpful to review how flow characteristics important to channel and habitat maintenance are being identified. It would also be helpful to see how the flow-habitat study will integrate the results of fluvial geomorphology studies that have been conducted in the project streams. This would provide the opportunity to evaluate the range of flows needed to maintain river channels so that habitat maintenance is considered along with habitat use as a function of flow.

Updated study plans

To account for recommendations and changes that have been made to the instream flow studies (PHABSIM and off-channel studies) as a result of the TWG process, it would be helpful to update study plans according to how operations were actually executed. For example, PLP has agreed to provide habitat maps for study streams and it would be helpful to include this mapping exercise in the flow-habitat study plans.