Instream Flow Technical Working Group
Pebble Project
February 4, 2009
Atwood Building Room 602

Draft Minutes Recorded by Charlotte MacCay/Pebble Partnership (PLP)

I. PRESENT:

Charlotte MacCay (PLP)
Ken Taylor (PLP)
Dudley Reiser (R2 Resource Consultants)
Phil Brna (USFWS)
Jason Mouw (ADF&G)
Scott Maclean (ADF&G)
Doug Limpinsel (NMFS)
Cecil Rich (ADF&G)
Dan Young (NPS)

Dave Erickson (URS/Mitsubishi)
Tim Troll (TNC)
Doug Wachob (TNC)

II AGENDA

Introductions

General Discussion of Hydraulic Data Transmitted by PLP

Habitat Suitability Curve Discussion

- Review of Literature Based HSC curves
- Presentation of Draft Site Specific Curves
- Schedule for Detailed Review

Schedule for Completion of Other PHABSIM Transect Data Analysis

Update on Temperature Modeling

Update on Off-Channel Habitat Modeling

Next Meeting

III. HABITAT SUITABILITY CURVES

(R2) Habitat Suitability Curves (HSC) are a component of Physical Habitat Simulation (PHABSIM) instream flow modeling that links to the hydraulic flow model to create a habitat-flow relationship. HSC curves consist of an X-Y graph, with the X axis representing a range of water velocity, water depth, and substrate characteristics, while the Y axis represents the probability of use for a given value. Separate HSC curves are typically developed for each species by life stage and for each parameter; i.e. separate curves are developed for Velocity, Depth, and Substrate. In practice, physical measurements of

depth, velocity and substrate are taken at specified intervals across transects at different flows, which are then linked with the HSC criteria in the PHABSIM models to generate habitat : flow relationships. Example Habitat Suitability Curves from other sites and studies are shown in Appendix A of these minutes.

(Agency) The Instream Flow Model can scare some people; it is complex but can be boiled down.

(Agency) Today we will discuss input into the model. If we are comfortable with the inputs and comfortable with the PHABSIM model, then we are in a good place.

(R2) Physical and hydraulic data and calibration details from 72 of the 92 transects that were originally established by HDR, have previously been sent to resource agencies for review and comment. Data from the remaining 20 transects are undergoing further review and calibration. In addition, data analysis and model calibration is not yet complete for the 46 new transects that were established by R2 in 2008. Model results and calibration details are worthy of a separate discussion with the agencies and was not on the meeting agenda. The hydraulic modelers should get together at some time to go through the calibration details.

(Agency) Will the model predict where fish will be?

(R2)The PHABSIM model is used to establish habitat-flow relationships that allow one to estimate how habitats within the channel change under different flow conditions. If the HSC models are reliable, then it is reasonable to assume that the model should be able to predict areas within the channel (based on the transect information) where conditions are suitable for certain fish species and lifestages, and hence where one might expect to find fish. However, it is not a predictor of where fish will actually be, since there are many other factors besides flow that influence fish distributions at any given time. For example, other factors like groundwater upwelling often dictate where fish will be.

(Agency) What defines success and prediction accuracy?

(R2) I think it is important to consider the purpose of PHABSIM as it is being applied on the Pebble Project. And that it is being applied as a means to evaluate the effects of potential mine operations and associated flow changes on existing fish habitats within each of the three systems. Other factors will also be considered including fish distributions, changes in water temperature, and geomorphologic changes.

(Agency) It's not perfect, it gives us an idea.

(R2) You can validate hydraulic models with point measurements at spots that were not measured during model set-up. Biological validation would be more complex.

(Agency) What does it tell us about fry habitat and incubation?

(R2) The traditional application of PHABSIM doesn't explicitly consider incubation. There is a general rule of thumb when considering instream flow needs of fish and that is that 2/3 of the spawning flow should be adequate for incubation. At Pebble we will be using PHABSIM as an impact assessment and mitigation planning tool, that will consider wet, average and dry year conditions and how and how spawning, adult, and juvenile salmonid habitats change over time. While fry are also considered in the modeling, because they generally like slow moving water, they typically are not one of the key lifestages for evaluating impacts.

(Agency) How does it address the issue of need for peak flows for flushing, to cleanse the gravels?

(R2) There is a separate study of fluvial geomorphology that will be integrated with this study. Off-channel habitat is also important and being evaluated.

(Agency) There is a diverse complex of habitats within off channel areas. Will this method include all that?

(R2) Not fully. Some of the PHABSIM transects span selected side channel areas, but there is a more focused study that is specifically considering off-channel areas.

(Agency) I have seen underestimations of habitat at other projects, and some with overestimates (Columbia River)

(Agency) Those studies were keying into inter-gravel flow showing that there are other variables influencing habitat selection that PHABSIM is not accounting for.

(R2) I believe those studies were applying a different model that considered groundwater upwelling. PHABISM only models surfaced flow. However, we know where there are gaining and losing reaches in certain portions of the streams in the Pebble Project for consideration. To some extent PHABSIM will capture some of the gaining and losing reaches, but not the specific spots within those reaches that fish would key in on.

(Agency) Groundwater models could show vertical exchanges. It would be interesting to try and lay spawning distribution over the groundwater information. Have we looked at how much we can get from these studies?

(R2) We have done a fair amount of that. Ultimately, PHABSIM will have groundwater data hydrology input. All of that will be factored into the PHABSIM flows.

(Agency) We should also link in what the fish are doing. In Alaska, the importance of groundwater/surface water exchange can be the driving variable. If we can't get depth and velocity to correlate with where fish are spawning it is typically related to groundwater/surface water exchange.

(Agency) Curves should be discussed at a subsequent meeting including discussion of whether to use site curves for Pebble or reference curves. Before we have that discussion we need to discuss: when the data were collected, the range of flows, bi-modal systems, were data observations made at sufficient range of flows. There are limitations because you can't be out in raging floods or when there is water on top of the ice.

(Agency) The models are not addressing these situations.

(Agency) Following break-up and the seasonal high flow period, there is a descending hydrograph through August which is typically the summertime low flow period. It is hard to get out there and collect data over a sufficient range of flows, however this is important. It's not just what is being collected, but when it is being collected.

(R2) The redd data for August 8th through September 21st shows quite a flow variation.

(Agency) Juveniles use floodplain habitat.

(Agency) When observing redds – how often are you out surveying?

(R2) Sometimes daily over a two week period,

(Agency) Tend to sample redds over a period of time, not just that two week period, but are you making observations early and late in the spawning season?

(R2) Regardless of flows, we are sampling active redd locations, letting fish pick the combination of flow and velocity. The number one goal is to pick active redds. In the end we can apply the curve to cover the full time period. From a modeling standpoint it doesn't matter if you sample early or late.

(Agency) Different fish spawn in different streams, at different times, selecting for different reasons. Are we validating the curves with site specific data over a range of flow conditions and seasons?

(R2) Yes.

(R2) There are three distinct flows, low/medium/high in the hydraulic model and we did get a good range.

(R2) There is always the comparison with reference curves to see if the curves make sense – that's a discussion for another meeting. For some species there will not be enough real observations and we will need input from reference curves.

(Agency) Cooper Lake exercise - PHABSIM was used in that situation, but there is a concern based on what we know about sockeye salmon in the lower 48 and hatcheries being applied to a wild system. These fish are finely adapted to these streams. There is concern that we can't even compare between the South Fork Koktuli and Upper Talarik or maybe even between the lower and upper reaches of the Upper Talarik.

(R2) A lot of sockeye observed in the streams were found near groundwater upwelling for spawning. We will have the opportunity to segregate out the distribution data for redds and complete some spatial analyses within and between river systems.

(Agency) It depends on the stream. One curve for many streams seems inappropriate, curves should be developed for different streams and habitat types if there are different patterns of habitat use.

(Agency) PHABSIM may also not be appropriate for all species if the variables used to model habitat as a function of flow are not influential to habitat selection. For example, main channel sockeye curves cannot be used to represent off-channel sockeye spawning.

(R2) We can consider developing different curves for different streams – we are not locked into a plan yet.

(Agency) There is concern about applying a curve from elsewhere out side the project area.

(Agency) As long as we know and understand the assumptions – we don't always understand the complexity and interaction of the variables – that is a limitation.

(Agency) There are aggregations of fish in the area that when you look at a map you do not see a connection with sinuosity of the channel, it could be hyporheic flow at that spot. If that is the case, and you took depth and velocity readings at that site it could lead to overestimation.

(Agency) Maybe sockeye don't work with the model due to groundwater preference. Chinook and Coho seem to be consistent with deep, fast water.

(R2) Keep in mind the end product of the analysis. It is an assessment tool for how the mine will influence flow regimes and what changes it might make to the fish habitat. PHABSIM may not be as applicable for impact analysis for some species as for others.

(Agency) You may use it to a lesser degree for sockeye, but surface flow is still some component of their habitat use.

(Agency) We also need to look at other parameters for fish species besides depth and velocity.

(Agency) This is where we use professional judgment, it's just how much professional judgment do we use?

(Agency) We are not saying we are not going to refine curves with site specific data but we need to evaluate whether or not the variables for which curves are developed actually influence habitat selection.

(R2) A good example is where depth isn't a limiting factor – do we have a descending limb? We need site specific data to evaluate that.

(Agency) We have a list of target species but probably won't collect this much data for all species.

(R2) We have touched upon the target species at agency meetings.

(Agency) Have we ever been provided with a list of all tributaries and streams surveyed, transect locations, and data collected?

(R2) ADF&G has been provided with data decks with all the information for 72 transects; another 20 are under further review.

(Agency) These were sent out by e-mail. We will probably have a meeting on the hydraulic modeling at a later date.

(R2) You have not received the data of microhabitat measurements because it is not QCd yet.

(Agency) You keep on touching on site specific data – what is it?

(R2) HDR did work on the South Fork Koktuli and Upper Talarik. R2 sampled within each system with over 400 redd measurements.

(R2) We can show the amount of data collected and later look at what the data are telling us, what candidate curves might look like, and how the curves compare with others. We are not looking for confirmation or selection of curves in what we will show you today - that is for a detailed discussion later.

(Agency) When HDR had the program there was an HDR instream flow team and a fish study team. We still don't know how those were related and whether or not the data from the fish study is going to be utilized in the instream flow study.

(R2) Correct, and they collected a lot of data. We (R2) likewise had a fish team and flow team that were coordinating field data collection efforts as needed to support both study elements.

IV. TARGET SEPCIES

- (R2) Here is a list of the proposed target fish species and a general assessment of available microhabitat data:
    - Chinook (good selection of data for spawning, juveniles, and fry)
    - Coho (abundant data)
    - Chum (Less data)
    - Sockeye (abundant data)
    - Rainbow Trout (Few data, some juvenile data, no spawning data). Rainbow spawning conditions are turbid and it will be difficult, if not impossible to collect redd data. No data associated with the rainbow tagging study. May need to go to the literature for HSC curves for this species.
    - Dolly Varden (few data)
    - Grayling (few data)

- (Agency) Regarding Rainbow trout: Could you use Didson to conduct these studies, moving it around as a mobile unit?

- (R2) There are lots of rainbow data in the literature. The question is whether it is necessary to have lots of site specific data for rainbow?

- (Agency) Conditions would require very sophisticated equipment. We need to look at the objectives and see if we need that site specific data for this species.

- (Agency) There is local interest in Whitefish

- (R2) Whitefish are being considered – there are a couple of observations.

- (Agency) Grayling might be used as a surrogate.
- (Agency) Subsistence wise, it's not the same use for humpback whitefish as it is for round whitefish (some call these candlefish)
- (Agency) Iliamna uses whitefish a lot.
- (Agency) People predominantly use humpback whitefish – not seen data on these yet in the project area data – but it's not surprising. Kaskanak Creek is a more likely area to find them. Round Whitefish are more likely to be in the project area. Most data on subsistence use has been collected in Bristol Bay.
- (Agency) Ask Steve Braund about whitefish species use in these villages and see if it is different for villages downstream of Southfork Koktuli than it is in Iliamna.
- (Agency) Craig Schwanke and Jason Dye at ADF&G can provide additional expertise on whitefish.
- (Agency) The species list does cover the range of seasons i.e., Coho are fall spawners etc.
- (R2) Rainbows in the Northfork Koktuli and Southfork Koktuli are river fish and they are a different stock than the fish in the Upper Talarik (i.e., adfluvial).
- (Agency) Most rainbows in the Koktuli River seem to be in the mainstem.
- (R2) Which species, which system, timing, life stages are all considerations. In the Upper Talarik you have a full suite. In the Northfork Koktuli and the Southfork Koktuli, rainbows appear to be much less significant.
- (Agency) What other large species are present?
- (R2) Need to ask Mary Louise Keefe about which suckers have been captured in the fish surveys. Pike are present in the lakes.
- (R2) In considering the target species, we factored in their importance according to commercial fisheries, sport fisheries, and subsistence usage.
- (Agency) This is the list the TWG hurried to set for last year's studies. Whitefish could be on the list as a placeholder, but may be covered by use of a surrogate such as grayling

V. PERIODICITY

- (R2)Ultimately the TWG needs to discuss and agree upon periodicity for modeling purposes, i.e. which months to assign to sockeye spawning, Chinook spawning etc.
- (Agency) It could be helpful to separate the chart into drainages too.
- (Many) Good point.
- (Agency) Coho spawning selection of habitat varies between what they choose early in the season and late in the season, i.e. late season they tend to select deeper areas for predator protection.
- (Agency) Will habitat suitability curves capture the difference in early and late season preferences?

- (Agency) It depends on when you do the surveys.
- (R2) It could be a turbidity issue; you can cover this by determining a minimum depth that serves as cover. It may also be a temperature issue or a photoperiod issue that is influencing their selection.
- (Agency) DO, temperature regime and intergravel flow are essential; only depth and velocity are explicitly in the model.
- (Agency) Often we collect only those data that are easy to collect. (Agency) Temporally, how confident are we in using the data collected? (R2) I believe we have a large amount of data, but we will still need to make some assumptions as we move forward in developing the HSC curves.
- (Agency) Given that there are different populations within a species, taking a HSC curve from a summer chum and applying it to a fall population is probably not a valid application, i.e. as was done with Kenai Chinook.
- (R2) These are all worthwhile things to consider in the curve development process. (Agency) Do we have adequate data?
- (R2)
    - Rainbows – as mentioned, spawning data is problematic
    - Grayling – difficult to sample, difficult to find
- (Agency) Grayling telemetry data can be helpful.
- (R2) There are about 7 or 8 grayling observations
- (Agency) We assume there are grayling in the Upper Talarik and in the Koktulis.
- (R2) We know they are in the Koktulis.
- (Agency) There was a grayling radio telemetry project in the Koktuli River.
- (Agency) There are also lots of interior grayling data.
- (Agency) There is less likely to be diversity in spawning habitat for short spawning periods, i.e. Chinook, whereas Coho may have greater diversity.
- (R2) Sometimes there is a well defined range within the tails of the curve and will need to use best professional judgment in defining the shapes.
- (Agency) Long time period is probably an indicator of variety of habitat preferences within that species.
- (Agency) Can diversity within habitat use for spawning be a driver in the amount of data collected to define variability?
- (R2) Not really. It's been more that we identify where they are spawning and take measurements over that time period, recognizing that there will generally be a range of habitat conditions in which spawning occurs. We are trying to define the habitat suitability curve for application with PHABSIM.

VI. POWER POINT PRESENTATION DISCUSSION PRESENTATION ATTACHED IN APPENDIX B

Slide -Site Specific data

(Agency) What is Focal velocity?

(R2) Focal velocity is the velocity measured at the location in the water column occupied by the fish. (Agency) Do you recordwhat the fish is doing when focal velocity is taken?

(R2) No, we are just trying to pinpoint where it is before it is startled and moves to a different location.

(Agency) If you had influenced the behavior and they were hiding it would be different than if it was feeding behavior.

(R2) If it is apparent that the fish observed have already become startled, then we would not take measurements at that location.

Slide - Habitat Suitability Curve Observations

(R2) This is a summary table of target species, and number of observations. There are lots of sockeye, Chinook and coho data, and more grayling data than I had remembered in our previous discussion - - there are approximately 40 observations and about 10 whitefish. No spawning rainbow trout data. Overall, there are a total of 1300 observations.

(Agency) We want a table of observations over time and drainage.

(Agency) What in your professional judgment is the ideal sample size?

(R2) In general, we shoot for between 75- 100 observations by life stage in a given system (75-100 redds, 75-100 juveniles etc). However, it is not always possible to get that many observations of every life stage. That is the reason we often consider HSC curves and data from other sites and streams. Often it is a combination of empirical and calculated data, coupled with best professional judgment that is used in deriving HSC curves.

(Agency) Can you make subsets and compile a list to see if there is a difference between drainages?

(R2) Not typically done – but we could.

(Agency) It goes back to the objectives.

(Agency) There is a robust data set for some of the species.

(R2) What are 'the objectives' are they different from what R2 has?

(Agency) The issue is that agencies are sitting down and talking about what kind of questions they want answered with a focus on developing statistically valid objectives around that.

(R2) The objective of this study was to develop a tool for assessing impacts and mitigation potential.

(Agency) You can be a splitter or a lumper in applying data. Are the fish so different amongst systems that we want different curves for different systems? If we are keying in on different groundwater influences we may want separate curves, i.e. First Creek (low flow) may need a different curve from mainstem Upper Talarik where velocity is a key component. These factors are important to consider.

(Agency) Can we set quantitative criteria for when are systems different enough for separate curves?

(Agency) Could be professional judgment too.

(Agency)When I think back on the hydro discussion earlier – it focused on one stream, it was relatively simple compared to this project with three different systems and other elements. We will address off-channel habitat, but may not be through PHABISM, but through other studies.

(Agency) What's an observation? A single redd site where you collected depth and velocity etc?

(R2) Yes, one observation consists of a single set of measurements consisting of a depth, velocity and substrate characterization made for each redd. We identified locations of redds based in part on the weekly aerial escapement surveys that served to pinpoint locations of congregating fish. We have latitude and longitude for every redd.

(R2) We look at the range of depths and velocities of different systems to see if systems need to be addressed separately. There are sampling limitations, i.e. timing, flow conditions and, and in the case of snorkel observations, visibility.

(Agency) It's one thing to collect data during a year when the fish populations are within their normal range, but if you get a year with a phenomenal population increase, the best habitat is used up and fish use other habitats that are not always utilized –how does the model account for that?

(R2) It doesn't directly address that.

(Agency) Bristol Bay Sockeye – environmental conditions change and some habitats become more optimal than others, which can change habitat use areas. Sustainability of fish changes by basin over time.

(Agency) During bumper years they spawn in sub-marginal habitat; multiple years of data are good.

(R2) Theoretically, that should be covered by the frequency distribution and the observations that comprise the tail ends of those distributions.

(PLP) Don't some species have underutilized habitat?

(R2) Chinook were spread out and not found in heavy concentrations.

(PLP) Some species only spawn in optimal habitat.

(R2) We can do some work on availability by reviewing our cross section data from the transects.If they align with the redd measurements, we can then determine what the flows were at that time and compare areas used with areas available as a means to evaluate preference. Our experience has shown that in many cases you won't find much difference between utilization and preference.

(Agency) Back to the objectives issue – impact assessment vs. project effect over the long term. How do you adapt to managing how a project is operated?

(R2) Next time we can discuss more about objectives.

(Agency) Coho spawning is currently no documented in the Anadromous Waters Catalog despite the fact that spawning coho have been repeatedly observed and counted in the Upper Talarik

(Agency) Not many chums either? From the information collected thus far, it appears that chum are less abundant.

(Agency) Data and input into anadromous waters catalog. Upper Talarik is a good Coho stream but is not currently listed for Coho spawning. It would be good for the catalog to be updated.

(Agency) Natives say there never used to be Coho in Upper Talarik.

(Agency) If you see fish while snorkeling, it's not an observation that is required by the permit, but we would like it to be incorporated into the catalog data base.

(Agency) Fish distribution data is important information regarding stream crossing decisions, evaluating alternate routes, bridges, etc…Slide - Habitat Suitability Curve Example One

(R2) In the example portrayed, we assigned the number of observations to different bins; early methodologies that rigorously followed the shapes of the curves resulted in very jagged curves. However, because these curves did not make biological sense, smoothing techniques were used. Usually there is some debate at where the HSC curve reaches zero on the X-axis.

Slide - Habitat Suitability Curve Example Two

(R2) Unless there is some reason to think that depth influences spawning, we tend to leave depth as non-limiting.

Slide - Habitat Suitability Curve Sultan River Examples

(R2) In Washington, there are a series of fallback curves everyone is required to use, unless you develop site specific curves.
Presentation Continued

(R2) Literature based curves are usually quite broad so as to be conservative in the range of habitat values considered useable by fish; site specific curves are usually narrower. If you broaden an HSC curve it might show higher flows as providing more habitat, i.e. could extend the peak of the curve, or might result in a similarly shaped curve but with a higher magnitude. (Agency) That's why we want good data and accurate site specific models.

(Agency) For a scenario – say you divert 20 cfs of water out of the North Fork Koktuli – how would we use that to assess impacts?

(R2) We have lots of North Fork data. We will develop a model for the North Fork using transects distributed throughout the reaches to determine habitat area vs. flow, linked in with groundwater hydrology. We would run the model at natural hydrology and define the amount of habitat under wet, dry, and average years for the spawning period. We would then impose the 20cfs reduction into the hydrology and recalculate effects on available habitat. We can model the system as a whole or break it out into reaches.

(Agency) So you could look at it month by month, and based on area see where habitat is increased or reduced.

(Agency) It doesn't mean that the flow may not have some other function i.e. flushing, channel maintenance

(R2) Other flow functions are being considered as part of the fluvial geomorphology studies.

(Agency) Another important part is temperature.

(Agency) Ultimately, we have a number that represent the amount of habitat, but doesn't tell us about the fish. The tool is to assess impacts, best we have for now.

(R2) It's an assessment tool/planning tool. (Agency) It appears from the comparison of Chinook curves (site specific and literature) that the site is skewed to higher flows than other projects.

(R2) We found Chinook redds in relatively fast water.

(Agency) The Washington fallback curve seems to be the most conservative curve.

(R2) Looking at other species, the curve used on Ward Creek suggests higher velocity use than for Washington.

(R2) There were no curves that stood out as greatly different from the reference curves.

(R2) Due to budgetary constraints at this time we are going forward with the data we have, with no plans for additional detailed field work.

VII. TEMPERATURE (ACCOMPANIED BY POWER POINT PRESENTATION)

(R2) There are two temperature models that are being developed: SNTemp and RIVERID (ice model – models temperature conditions during ice cover, determines ice-out, thickness of the ice)

(Agency) Are the models available to the public and not proprietary?

(R2) Both models are public models. SNTemp is widely used. RIVERID is newer; it's from the University of Alberta.

(R2) SNTemp can be downloaded from the USGS website.

(R2) We have thermister data to add to t the RIVERID model.

(Agency) 2007 was an unusually warm summer. Blips in the water temperature may also be related to groundwater upwelling or inflow from tributaries.

(R2) We need to look at all the data in numerous ways overlying fish data with temperature, flow, depth, etc…

(Agency) The temperature in August and September results in most of the temperature units fish need to hatch.

(Agency) Hyporheic flows can affect when the fish hatch, alevins can then sit in chilled water in the gravel and have mobility if peripheral ice pushes into the gravel; they can survive whereas eggs near the bank may not. Intergravel temperature is key for incubation more so than surface water temperature.

(R2) We have some data on intergravel temperature. There are recorders measuring inter-gravel temperature at depth. These are primarily located in the South Fork Koktuli; there are 1 or 2 in the North Fork and some in the Upper Talarik. By October there is not much fluctuation in temperature. In the South Fork there is a longitudinal trend where temperature

drops where the river gains flow. Temperature data will be used in developing the SNTEMP model. Upper Talarik is generally cooler in temperature, although ice comes out sooner because of the North/South orientation.

(R2) At each of the intergravel temperature sites, there are two thermisters on a chain, one at 15 cm, and one at 30 cm. The SNTEMP model incorporates hydrological data, water temperature, flow data, meteorological data, wind, solar, humidity, and channel morphology data such as depth and width, and azimuth (stream alignment). The Upper Talarik shows the effect of the azimuth with an earlier ice-out due to the southern exposure. The South Fork is rich in ground water flows coming in. Towards winter, groundwater inflow will increase. There is an interesting relationship between temperature and fish behavior in the South Fork. In August as you go upstream, the water is getting colder as you approach tributary 190, so the fish spawn here. They do not move upstream where there are warmer water temperatures. Because the temperature remains warmer near the confluence of tributary 190 during the winter, there is likely a higher survival of incubating eggs there.

(R2) The temperature nodes from the tributaries are important in the SNTEMP model.

(Agency) At Cooper Lake the air temperature of one degree was an influential factor, is that typical where one variable is so influential on the model?

(R2) Typically, there are one or two factors that make a big difference. Air temperature is often a major influence, and shade, and aspect. Precipitation can also play an important role – but it's the temperature of the precipitation that matters. We will have to break this down into reaches to pick up the ground water influence.

(R2) The data will be integrated and a preliminary SNTEMP model developed (still collecting data for RIVERID – this will come a little later). The models will be able to assess impacts of water withdrawals and flow regulation which can be integrated with egg incubation data.

(Agency) Joe Klein could review work on past transect hydraulic data.

(Agency) USFWS/USGS in Fort Collins could provide helpful review, but they need to get paid. USFWS is funded to work on refuges, they have experience to help, but need funding.

VIII. OFF CHANNEL SURVEY

(R2) Understand that PHABSIM only addresses the main channel and there are still a lot of off-channel habitat sites.

(R2) HDR conducted some earlier off channel work. In 2008 there were 6 locations on the North Fork Koktuli with ADF&G input. We used GPS to do extended transects where topography was measured from center of the stream on both sides. Also took water quality measurements. There are continuous recorders (pressure transducers) in place to get water surface elevation relationships with the mainstem water surface sites at separation and return points. We used a set of classifications that include backwater slough, beaver complex, isolated pond, overflow, side channel etc. The intent is to if possible, extrapolate the results from representative areas that have been measured to similar unmeasured areas. Fish data and juvenile sampling were collected and coordinated between the fish team and the off –channel team.

(R2) Pressure transducer data show some relationships between mainstem and the off-channel types – we are still reviewing the data. The transducers are on a post driven in to the ground, similar to a stage recorder. They provide continuous data. They are more helpful than discrete transect measurements which require a lot of effort for few measurements.

(R2) Mapping of inlet elevations has been helpful in understanding connectivity with mainstem.

(R2) PHABSIM does not handle off-channel habitat well, needs to be addressed in other ways.

(Agency) It will be interesting to compare PHABSIM flow analysis with how it compares with off-channel habitat- flow analysis.

IX. 2009 PLANS

(R2)

- Complete QA/QC
- Refine connectivity analyses

(PLP) In 2009 there is generally little field data being collected, mostly QA/QC'ing data previously collected. PLP will continue with:

- Rainbow Trout telemetry studies
- Discussing the possibility of setting up counting tower(s) in Upper Talarik to compare tower counts with aerial surveys for Sockeye. This may be extended through Coho (but not as a comparative study). WE are waiting for ADF&G to get a lease with APC to place towers and camps on their land.
- Hydrology and water quality studies are ongoing.
- There is a brown bear study to be conducted in 2009.
- Additional eider and otter surveys, dependent on MMPA permit approval.
- The moose abundance survey was deleted from this year's study plans.

(PLP) We are expecting to add another year for data collection for the Environmental Baseline Document (EBD), studies which were not necessary this year were postponed to next year. This includes the Supplemental Survey Work for Instream Flow. Initially the plan was to complete the EBD this year, those plans have been extended a year. This is not just a Pebble situation. Anglo operates around the world; they have parked other projects, but have chosen to continue on with Pebble, just at a slower pace.

X. ACTION ITEMS

(Agency) PLP provide a table of observations over time and drainage.

(Agency) We would like to request more redd GPS data than just the uppermost locations.

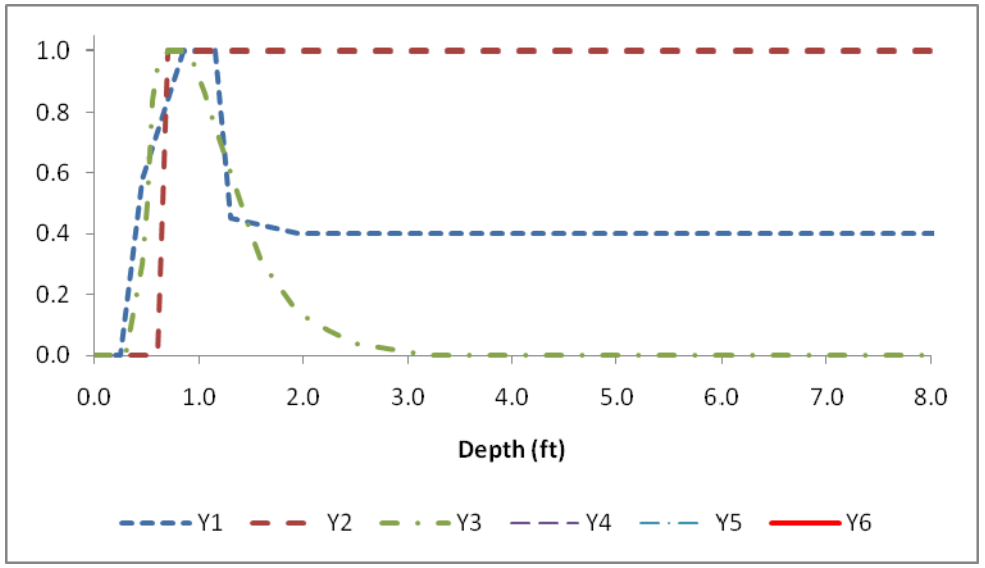
(Agency) If you see fish while snorkeling, it's not an observation that is required by the permit, but we would like it to incorporate into the catalog data base.

(Agency) We need to schedule a detailed review after R2 QA/QC's the site specific curves into final form. There are more results coming in the next couple of months then we will have more details for the next meeting.

(Agency) ADF&G needs to review the hydraulic data and then schedule a meeting on transects.

APPENDIX A EXAMPLES OF HABITAT SUITABILITY CURVES FROM OTHER SITES

			Depth (ft)			
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00	0.00	0.00			
0.25	0.00					
0.30			0.00			
0.45	0.58		0.30			
0.50			0.50			
0.55			0.84			
0.60		0.00	0.95			
0.70		1.00	1.00			
0.85	1.00					
0.90			1.00			
0.95			0.96			
1.05			0.86			
1.10			0.80			
1.15	1.00					
1.30	0.45					
1.50			0.40			
1.60			0.31			
1.90			0.16			
1.95	0.40					
2.05			0.12			
2.25			0.08			
2.50			0.04			
3.20			0.00			
8.20		1.00				
8.30		0.00				
99.00	0.40	0.00	0.00			



Source:

WDFW

Y1 - 2008

Y2 - Raleigh et al. 1984

Y3 - Bovee 1978

Y4 -

Y5 -

Y6 -

Location:

Y1 - Fallback

Y2 - Generic

Y3 - Generic

Y4 -

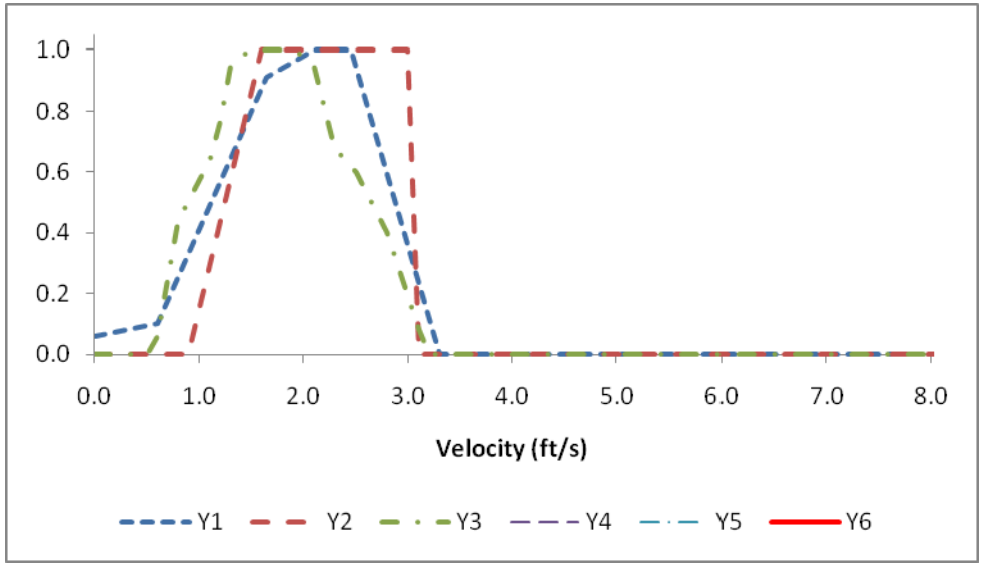
Y5 -

Y6 -

Figure X. Species: RAINBOW TROUT

Lifestage: SPAWNING

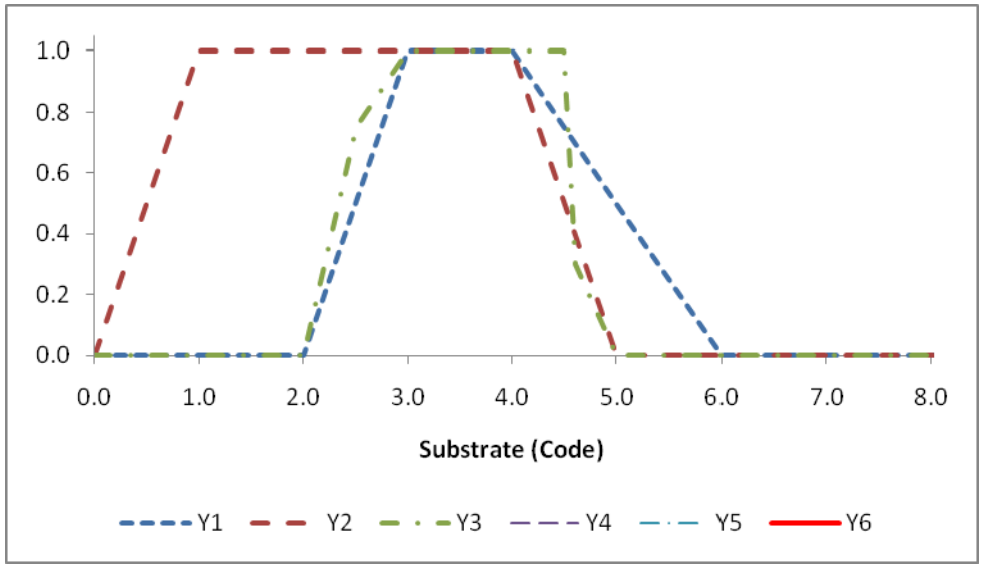
Velocity (ft/s)						
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.06	0.00	0.00			
0.50			0.00			
0.60	0.10		0.06			
0.80			0.44			
0.90		0.00				
1.10			0.64			
1.20			0.77			
1.30			0.95			
1.40			0.98			
1.50			1.00			
1.60		1.00				
1.65	0.91					
1.90			1.00			
2.00			0.98			
2.10	1.00		0.95			
2.30			0.68			
2.45	1.00					
2.50			0.60			
2.80			0.40			
3.00		1.00				
3.10		0.00	0.08			
3.20			0.00			
3.30	0.00					
99.00	0.00	0.00	0.00			



Source:		Location:	
	WDFW		
Y1 -	2008	Y1 -	Fallback
Y2 -	Raleigh et al. 1984	Y2 -	Generic
Y3 -	Bovee 1978	Y3 -	Generic
Y4 -		Y4 -	
Y5 -		Y5 -	
Y6 -		Y6 -	

Figure X. Species: RAINBOW TROUT
Lifestage: SPAWNING

			Substrate (Code)			
X	Y1	Y2	Y3	Y4	Y5	Y6
0.00	0.00	0.00	0.00			
1.00		1.00	0.00			
2.00	0.00		0.00			
2.50			0.75			
3.00	1.00		1.00			
4.00	1.00	1.00				
4.50			1.00			
4.60			0.30			
5.00	0.50	0.00	0.00			
6.00	0.00					
7.00						
8.00						
9.00	0.00	0.00	0.00			



Source:

WDFW

Y1 - 2008

Y2 - Raleigh et al. 1984

Y3 - Bovee 1978

Y4 -

Y5 -

Y6 -

Location:

Y1 - Fallback (R2 Draft Modification)

Y2 - Generic

Y3 - Generic

Y4 -

Y5 -

Y6 -

Figure X.

Species: RAINBOW TROUT
Lifestage: SPAWNING

silt	1.00
fine/sand	2.00
small gravel	3.00
med+large gravel	4.00
small cobble	5.00
large cobble	6.00
boulder	7.00
bedrock	8.00
veg	9.00