Agency	Comment	Additional Detail Location (pg.)	HEA Comment Response
Aquatic Resources Study Plan			
NOAA-NMFS	*4.6 Grant Creek Aquatic Habitat Mapping* The habitat delineation will be conducted at a mesohabitat level, with the following categories: fastwater pools; fastwater riffles; margins with undercut bank; margins without undercut bank; large woody debris dams; margin shelves associated with large wood debris; backwater pools; sloughs; and pockets. We request that each of the mesohabitat categories be defined in the revised study plan. It appears from the draft study plan that the mesohabitats will be mapped from remote imagery at one flow, it is unclear if changes in habitat delineation with flow will be accounted for, or if it is necessary to assess project effects on habitat distribution and size. Ground truthing of the mesohabitat mapping may provide some insight into the need to correct the classification and if accounting for changes in habitat area with flow is necessary. Study plan revisions should discuss the need and methods for quantifying habitat availability over a range of discharges and be able to predict habitat availability under project operation scenarios. Understanding the range of habitats available over the range of baseline and operating flows will be necessary to assess project effects.	Pg. 22	Aquatic Habitat Mapping has already been conducted by HEA and has been prepared as a GIS layer. HEA will also conduct an aerial reconnaissance in 2013 to determine if these mesohabitat types and locations have changed. This mapping will be ground truthed during the 2013 field season at low – medium flows; at higher flows, habitat characteristics tend to "wash out" and it is not possible to differentiate habitat types with any level of precision at higher flows. Any changes in mesohabitat types noted through the ground truthing effort will be noted and maps will be revised to reflect these changes. Transects for this instream flow study were selected through extensive consultation with the natural resource agencies to measure those habitats that were most important for spawning and rearing life history stages. The calibrated model for each of these transects will show changes in habitat associated with flows for each of target species and life history stages.

NOAA-NMFS	*4.6 Grant Creek Aquatic Habitat Mapping* *The study component to "Analyze and identify the factors that may influence fish use of the key habitats over those habitat units not occupied by fish in Grant Creek"* appears to utilize the mesohabitat mapping effort and fish observations to identify fish habitat use and make inferences as to what factors influence habitat use. The methodology to achieve this task should identify how factors will be determined, as many of the factors may be microhabitat features that are not identifiable through remote imagery. The results of the aquatic habitat mapping and fish observations should be a baseline understanding of species and lifestage habitat use, and then use this information to inform the effort to development site specific habitat criteria (as discussed in the instream flow section).	Pg. 22	See previous comment. Measurement of depth, velocity, substrates, cover, distance to cover, and temperature will be taken for those fish sampled. Habitat types will be ground-truthed to ensure that any changes in habitat types since the previous mapping effort will be noted and the maps revised.
NOAA-NMFS	*4.7 Grant Creek Instream Flow Study* Two modes of operations are likely for the Project: block loading or level control (run-of-river). The primary operational mode will be block loading at specific output level, level control of Grant Lake will occur during periods of low inflow to Grant Lake. The revised study plan should include a description of how project operations likely to occur in a dry, average, and wet year will be assessed in the instream flow study to adequately analyze project effects to fish habitat.		Comment noted. The instream flow study will provide WUA, an index of useable habitat, for each target species and life history stage, at any simulated range within the calibration limits of the model. The potential effects on target species and life history stages for differing flow regimes for wet, dry, and average years can be analyzed with the model results.
NOAA-NMFS	*4.7 Grant Creek Instream Flow Study*		HEA concurs.

	Due to the nature of Grant Creek we believe a series of single transect analysis, in combination with the mesohabitat mapping and site specific understanding of the microhabitat factors that influence habitat use, should be sufficient to understand the flow habitat relationships for spawning and rearing areas.		
NOAA-NMFS	*4.7 Grant Creek Instream Flow Study* We see little value in the wetted perimeter analysis, as many of the habitats utilized for rearing will probably occur near margins, woody debris, or other pocket habitats. We agree that modeling flow effects to lateral connectivity to margins, areas of thermal refugia, side-channel, off-channel, and undercut bank habitats will be an important component of the instream flow study.		HEA concurs.
NOAA-NMFS	*4.7 Grant Creek Instream Flow Study* The proposed egg incubation component lacks the detail to determine if it is appropriate or sufficient to assess project effects on spawning success. After identification of spawning locations by species the analysis should consider factors that influence spawning success under baseline conditions and then assess how the project may change those conditions, including habitat availability and quality (structure, substrate, access, temperature, etc.). Additional factors including surface/groundwater exchange, proximity to rearing habitat (if applicable), and biologic factors should be consider.	Pg. 27	A detailed revised methodology has been provided in the study plan. This approach has been used and accepted on FERC-related hydropower licensing and relicensing efforts by McMillen staff.
NOAA-NMFS	*4.7 Grant Creek Instream Flow Study* Additionally, the revised study plan for instream flow should include:		Table 1 in the Study Plan summarizes the 18 locations that have been agreed to for the study; a map indicating the location of these transects has

	▯ The number and location of instream flow cross-sections, or how they will be determined based on the habitat mapping and fish observations. ▯ Methods for analyzing project effect from operations downstream for instream flow, temperature, and bedload transport. ▯ Detailed methodologies describing what the egg incubation study component will consist of, what data is necessary, and why the methods are appropriate.	Pg. 29	been inserted into the study plan. The instream flow study will produce 18 calibrated transects that will be modeled over a wide range of flows. The outputs will include transect and station-specific depths, velocities, and substrate types over this range of flows. Velocity/flow data from the transects will be provided for the geomorphology study to examine which flows will initiate and maintain bedload transport. See previous comment re: incubation study.
Water Resources Study Plan			
NOAA-NMFS	*4.2.1 Water Quality and Temperature* The objectives for the water quality and temperature include collection of baseline data to provide basis for environmental assessment and allow comparison with future study years; and obtain baseline information on the seasonal temperature regime to provide input data required for modeling of potential Project impacts to stream temperatures under various operational scenarios. It is unclear how the baseline data would be used to model stream temperature effects associated with project operations or if the proposed data collection is sufficient to meet the modeling needs.	Pgs. 5-6 and 8	A temperature model such as Heat Source or SNTEMP requires a sampling node from an upstream location to predict changes downstream. Water temperature data will be collected at Grant Lake, as well as 6 sampling nodes downstream in Grant Creek. For a stream with no tributaries, the baseline temperature sampling array is adequate. Additional information on climatological conditions, channel hydraulics, and shading can be collected at a later date if a temperature model is necessary.
NOAA-NMFS	*4.2.1 Water Quality and Temperature* Monitoring of temperature and flows at multiple locations (including and understanding of winter flow and temperature) in Grant Creek should provide a good baseline understanding of longitudinal temperature. Temperature data	Pgs. 6 and 9; 11-12; 19	In an effort to assist Aquatic Resource studies with degree day calculations, 2 continuous temperature loggers were deployed at site GC 200 in mid-December of 2012. Therefore, the 2013 water temperature study will include winter temperature

	collection, Page 8 and 9, proposed to collected temperature data throughout the year, this is important but it is unclear how many years of winter temperature data is available? We also encourage that thermal refugia be examined in habitats used by spawning and rearing fish. Although baseline conditions will be captured it is unclear how project operations will be routed downstream to conduct the instream flow and temperature analysis of project operation effects. There is mention of quantifying seepage and/or accretion of flow for a few time periods. For hydraulic analysis it may be appropriate, in the case of Grant Creek except for ramping analysis, to assume operation flows are translated downstream instantaneously, but this assumption would not be applicable for assessment of water quality and temperature effects associated with operations. Rather a routing of flow and water quality parameters (temperature) downstream would be necessary to assess project effects.		data in Grant Creek. Prior to this deployment, no winter water temperature data have been collected at Grant Creek or Grant Lake. Thermal refugia are relevant when temperatures exceed a specified criterion. Although it is not known if Grant Creek exceeds temperature criteria for the spawning or rearing fish species present, an active search for thermal refugia will be conducted throughout the 2013 study season. If detected, a maximum of 3 thermal refugia locations will be continuously monitored to assess temperature conditions.
NOAA-NMFS	*4.2.1 Water Quality and Temperature* Additional temperature data loggers will be placed at 2-3 selected off channel sites, and will emphasize locations that may be influenced by groundwater. We encourage additional sites selected by the Aquatic Resources study team at locations of biological significance, both spawning and rearing locations with the goal of characterizing the temperatures of habitats chosen by spawning fish and to characterize thermal heterogeneity.	Pg. 9	The need for water quality and temperature modeling will be discussed with stakeholders following the assessment of 2013 monitoring data. However, temperature models such as SNTEMP and Heat Source inherently have a routing component to predict temperature changes downstream (e.g. velocity and slope). With a calibrated temperature model, a variety of operational scenarios can be run to determine their effect on water temperatures.

	4.2.3 Grant Lake and Grant Creek Fluvial Geomorphology "The validity of sediment transport models and their attendant assumptions will be discussed in light of project requirements". During the Dec. 2012 meeting the use Shield's Equation was proposed to assess incipient motion. Description of why Shield's equation and how it will be applied is necessary in the revised study plan. We request that the RSP discuss the methods for modeling spawning gravel recruitment and data needs, along with assumptions	Pgs. 15-16	Additional detail has been provided in the study plan related to development of the appropriate incipient motion equation, the bulk sampling regime and analysis determinations that will be made based upon field visits and associated attributes.
NOAA-NMFS	4.2.3 Grant Lake and Grant Creek Fluvial Geomorphology The three phase work plan described for the Grant Creek spawning substrate recruitment study is a solid conceptual approach but methodologies need more detail to be understood and assessed. The first phase is an assessment of the substrate at existing spawning areas including aspects of embeddedness and substrate size. This is achieved through Wolman pebble counts and embeddedness indices with the addition of bulk samples. The embeddedness indices should be described in the revised study plan with a description of why they are appropriate. Also the location and number of sampling locations should be provided in the revised study plan; the number should be sufficient to characterize spawning in each of the spawning reaches. The second phase is the quantification of material transport conditions under the existing and	Pgs. 15-16	As stated in the Objectives section of the Water Resources Study Plan, the incipient motion equation will be used to compare the existing hydrology to the anticipated decrease in peak flows under management scenarios and see if there is a decreased potential for movement of the bedform Additional detail has been provided in the study plan related to: • Embeddedness methods • Assessment and final determination of sampling sites • Development of the appropriate incipient motion equation

	project flow regimes. During the December 12, 2012 natural resources study meeting the methods were described as consisting of a desktop analysis (geomorphic mapping and characterization); field sediment characterization; field geomorphic characterization; and prediction of potential geomorphic response to stream flow under management scenarios. The applicant's contractors described using Shield's Equation, as was conducted by Inter-Fluve on Cooper Creek; with the intent to evaluate the availability of spawning gravel under proposed operating scenarios. More detail about the methodologies to predict geomorphic response to instream flow changes is needed to assess whether they are appropriate. It is unclear how Shield's equation will be applied, or where it will be applied. Shields expressed incipient grain motion as a dimensionless ratio of critical bed shear stress to grain weight per unit area; the experiments used mixed bed material that was nearly uniform; the dimensionless critical shear stresses are not grain-size specific but are derived from bulk measures of sediment movement; and a variety of bed forms and relative roughness were not accounted for (Buffington 1999[1]). Revisions and modifications of Shields curve have recognized that incipient motion of a particular grain size is a statistical problem depending on geometry, grain shape, sorting, and packing (Buffington and Montgomery 1997[2]). Will relative roughness be accounted for through shear stress partitioning,		

	to account for sorting, grain size shape, bed form, and channel shape? We request that the revised study plan for water resources describe the approach being taken to assess project effects to sediment transport for long-term maintenance of fish spawning substrate. This should include the equations used and why they are appropriate, a description of how modeling approaches or equations will be validated with baseline information; what value is used for Shields parameter (dimensionless critical shear stress) and why, and how the equation will be applied to quantify the effects associated with project operations, and limitations of the study. Additionally it is unclear how operations will be routed downstream to the spawning areas to assess transport conditions? And where will the shear stress calculations be performed? Route operations downstream and predict changes in transport as a calculation of a shear stress threshold to achieve incipient motion may be the correct approach but the equations and methods used should be described, with assumptions and why the model/equation are appropriate.		
Recreation and Visual Resources			
National Park Service	NPS would like to reiterate its request that baseline soundscape data be collected for this project so that project-related impacts on natural sounds can be assessed. For your consideration, FERC approved the Watana Aesthetics Resources study plan today, with a modification NPS had suggested, i.e. the collection of baseline sound data in all seasons. I would be happy to provide a		KHL will collect baseline background noise as part of its on-site recreation analysis in winter and summer.

	copy of the revised study plan for this resource, along with FERC staff's modifications, to you if this would be helpful. While the proposed Grant Lake project would be much smaller than Watana, project construction and operation will nonetheless generate noise that could have an impact on recreational experiences, as acknowledged in KH's response to our comment #104 in the 1-27-11 comment/response table. We can only avoid, minimize, or mitigate those impacts if we know the level of background sound, and which areas, activities, and times of year are most sensitive to noise.	Pgs. 6-8	