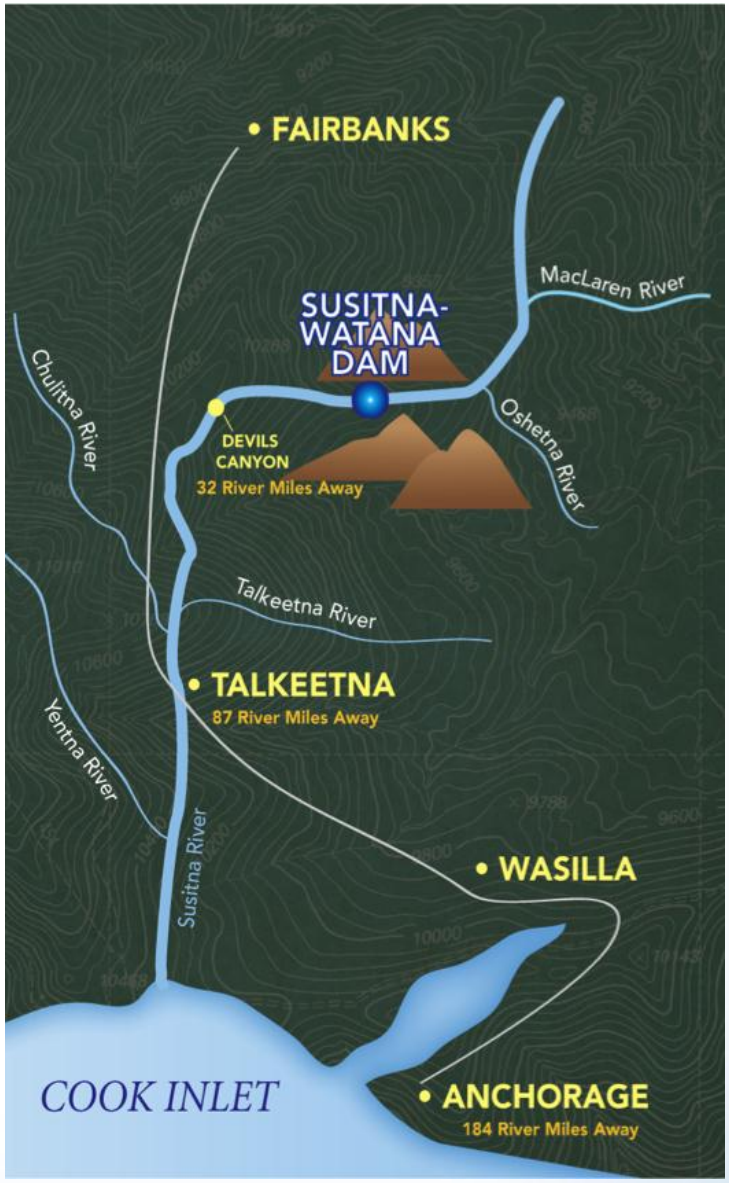
Technical Workgroup Meeting
Water Resources Studies

Geomorphology Presentation

October 23, 2012

Prepared by: Tetra Tech and URS



Presentation Topics

- Review of Consultation Issues / RSP Updates
  - Study integration
    - Schedule
    - Study Interdependencies
  - Focus area selection – role of Geomorphology Study
  - Geomorphologic aspects of the stratification system
  - Sediment movement / balance
  - Downstream study limit
  - Geomorphology Study field data
  - 1D modeling clarifications
  - 2D modeling clarifications

Integration of Studies

USFWS Comment: Instream Flow, Habitat Utilization, Geomorphology PSPs do not fully address USFWS' resource mgmt. concerns. During 3 days of ILP study meetings, sequencing and integration of proposed biological resource studies and physical processes was not described; significant outstanding info needed.

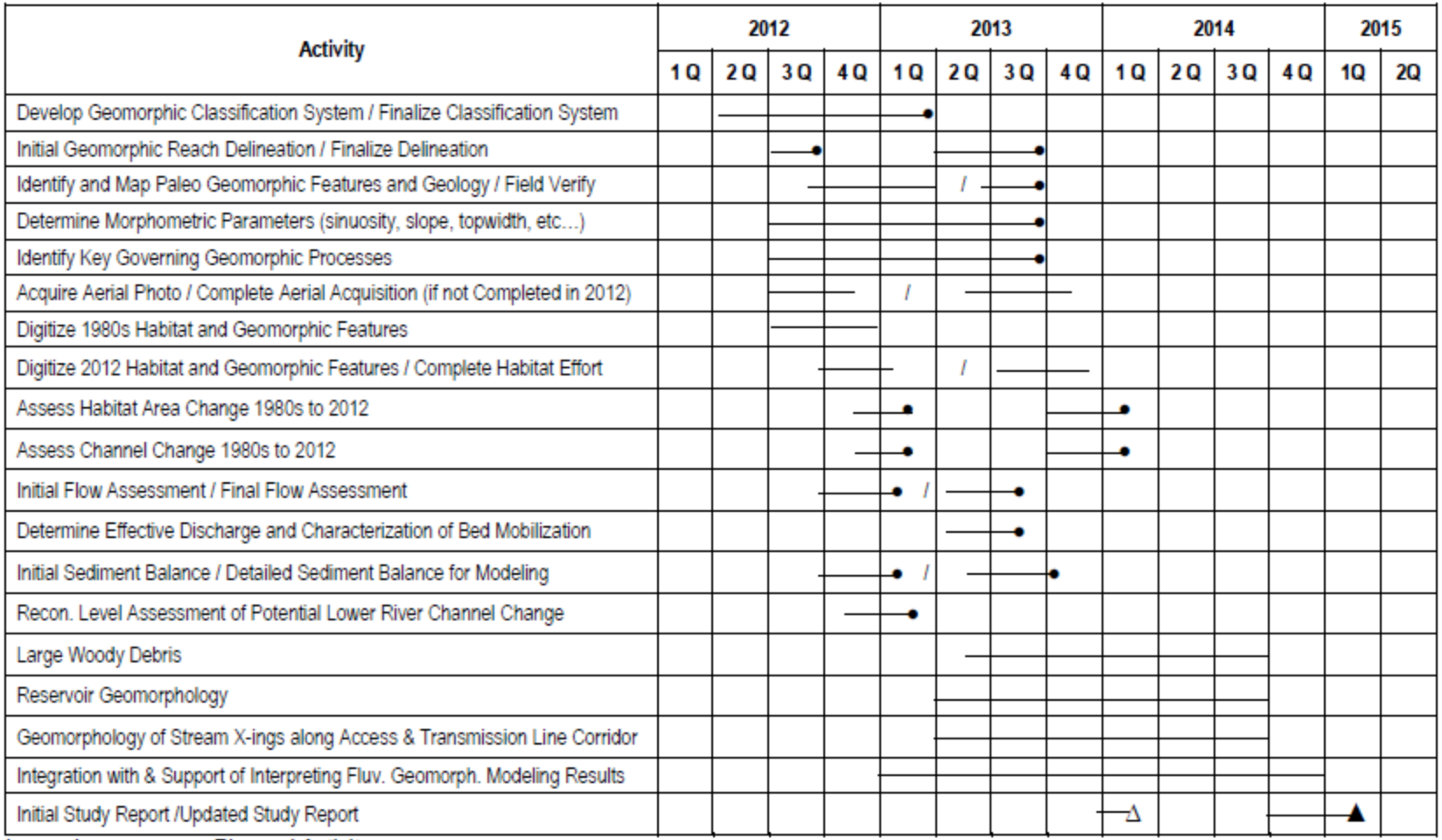
Source: Betsy McCracken, USFWS, 9/7/2012 email

Integration of Studies

AEA Response

Source: RSP Sections 6.5.6 Schedule (Geomorphology Study) and 6.6.6 Schedule (Fluvial Geomorphology Modeling Study). Additional information in 6.6.4.1.2.2 Coordination with Other Studies

Geomorphology Study Schedule



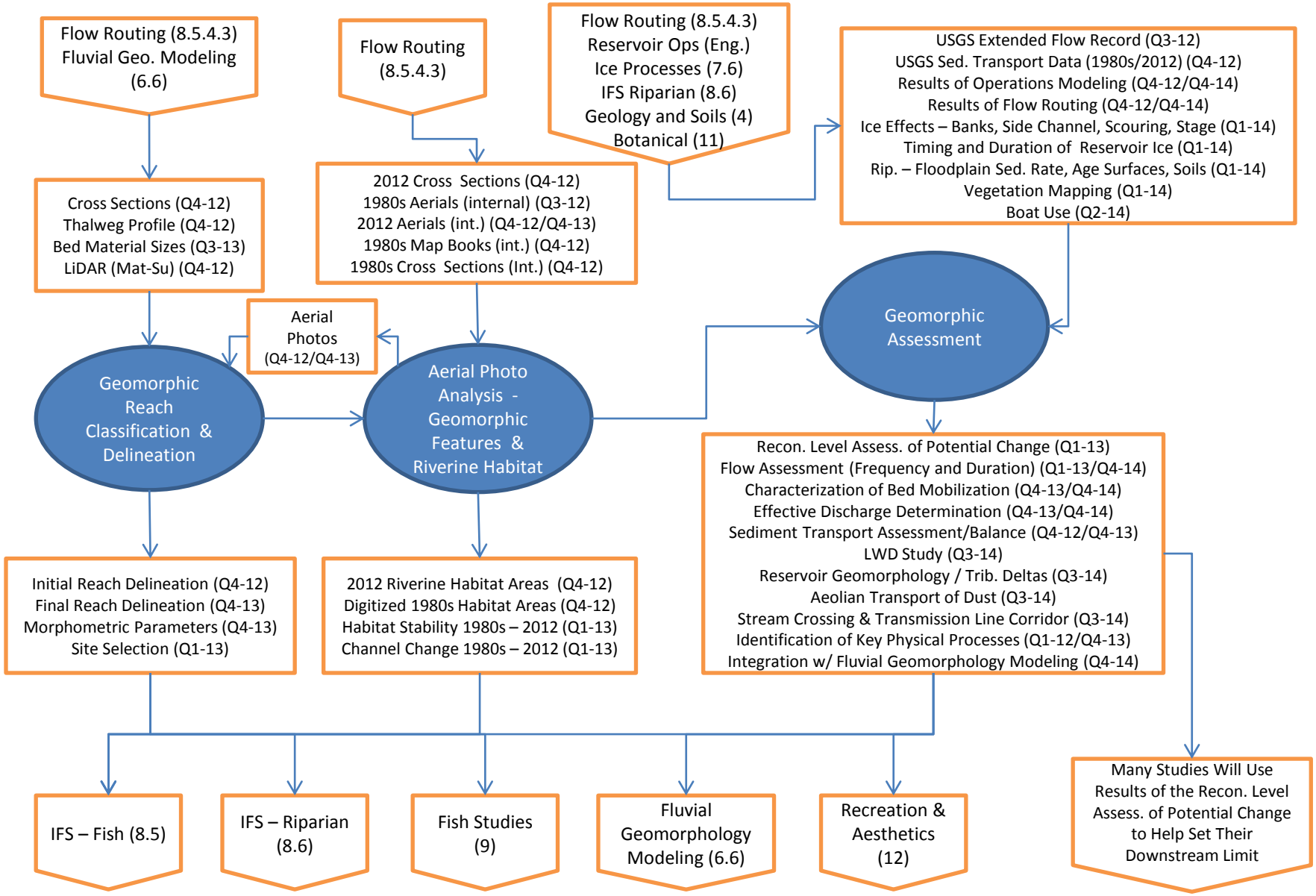
Legend:
- —— Planned Activity
- • Technical Memorandum or Interim Product
- Δ Initial Study Report
- ▲ Updated Study Report

Fluvial Geomorphology Modeling Study Schedule

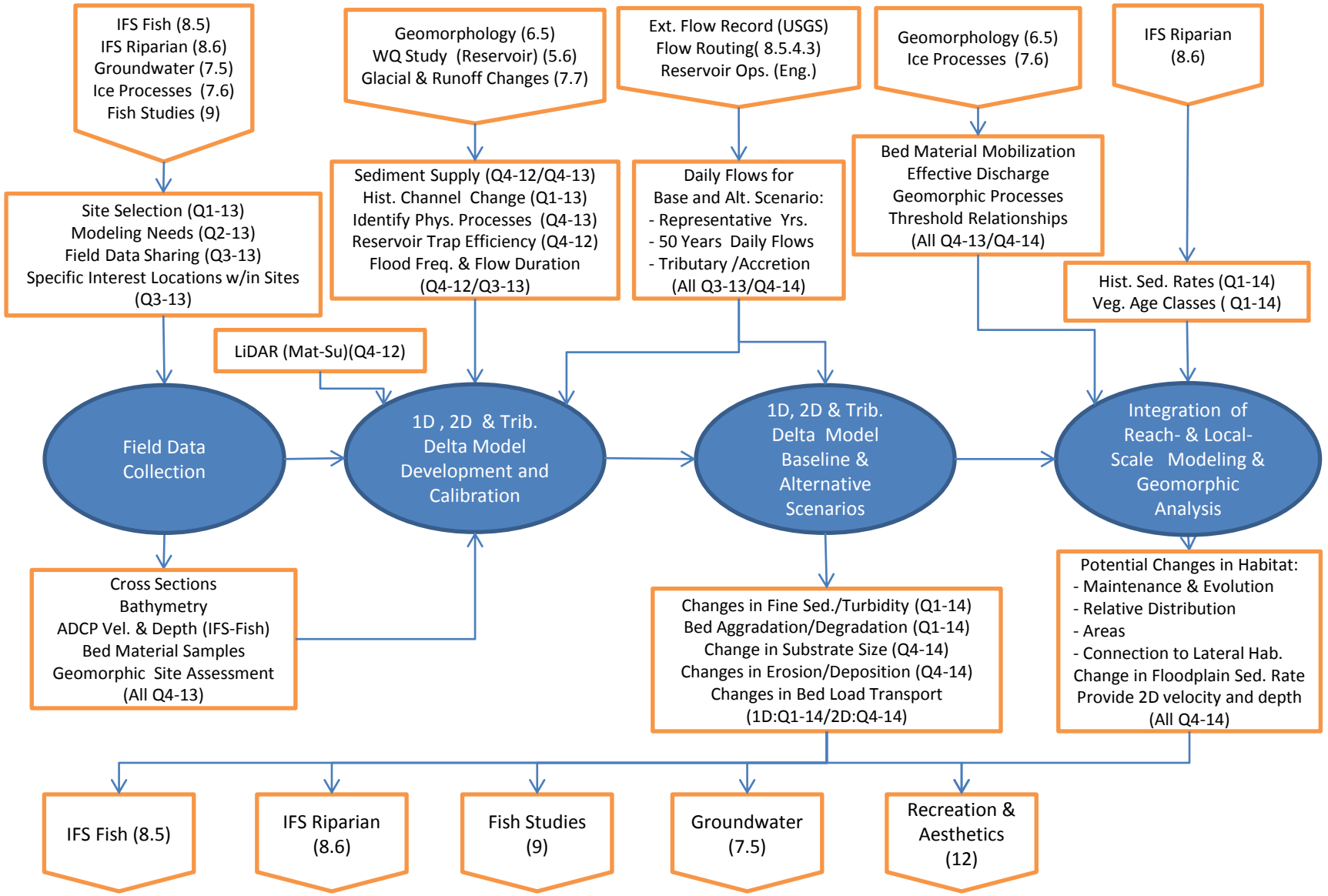
Activity	2012				2013				2014				2015	
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
Selection of 1D and 2D Models														
Selection of Focus Sites														
Coordination w/ Other Studies on Modeling Needs Including Focus Sites														
2013 Field Data Collection / Supplemental Field Data Collection 2014									/					
Coordinate with Other Studies on Processes Modeled														
1D Model Development and Calibration														
Perform 1D Modeling of Existing Conditions and Initial Project Run														
Reevaluate Downstream Study Limits Based on 1D Results														
2D Model Development and Calibration														
Perform 2D Modeling of Existing Conditions														
Perform 1D Modeling of Alternative Scenarios														
Perform 2D Modeling of Alternative Scenarios														
Post Process and Provide Model Results to Other Studies														
Interpretation of Channel Change and Integration with Other Studies														
Initial Study Report /Updated Study Report														

Legend:
- —— Planned Activity
- • Technical Memorandum or Interim Product
- Δ Initial Study Report
- ▲ Updated Study Report

STUDY INTERDEPENDENCIES FOR THE GEOMORPHOLOGY STUDY



STUDY INTERDEPENDENCIES FOR THE FLUVIAL GEOMORPHOLOGY MODELING STUDY



Site Selection

FERC Staff Comment: During the general discussion on site selection, it was indicated that AEA will need to justify use of 6 sites (or whatever number).

Source: Matt Cutlip (FERC), 8/17/2012, TWG Meeting

Site Selection

AEA RESPONSE

Source: RSP Section 6.6.4.1.2 Focus Area Selection added to discuss role of geomorphology study in focus area selection. Focus area process, schedule and criteria provided in Section 8.5.4.2 River Stratification and Study Area Selection of the Fish IFS

Role of the Geomorphology Study in Candidate Focus Area Selection

- Delineate river segments and geomorphic reaches for stratification (4/12 initial, update 12/12)
- Identify channel types for reaches (4/12 initial, update 12/12)
- Consider potential project effects (4/12 initial, update 1/13)
  - Downstream limit
  - Variation w/ distance below Project
- Extent of focus areas for hydraulic and bed evolution modeling (initial 10/12, update 2/13)

Stratification

Stillwater FERC Comment: It would be useful to further define the stratification system on a local & reach scale.

Source: Jay Stallman (Stillwater /FERC), 8/17/2012 TWG Meeting

USFWS Comment: The Service specifically requested hierarchically nested habitat mapping (e.g., Frissell et al, 1986).

Source: Betsy McCracken (USFWS), 9/7/2012, email

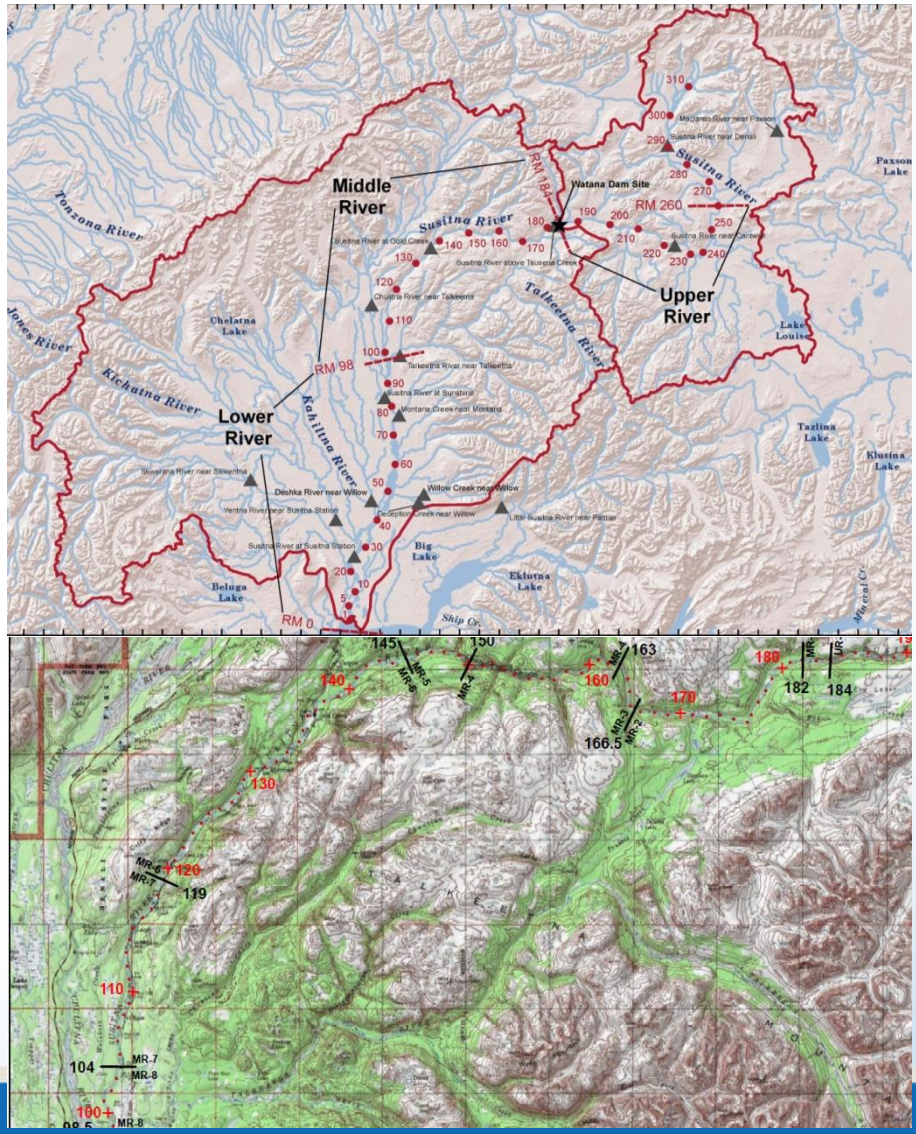
Stratification

AEA RESPONSE

Source: First two levels of the stratification system are described in Section 6.5.4.1 of the Geomorphology Study. The remaining three levels are described in the Study 9 Fish and Aquatic Resources

Levels / Hierarchy of Stratification

1. **Segments**
2. **Geomorphic Reaches**
3. Mainstem Habitats (Main Channel & Lateral)
4. Main Channel Mesohabitat (Pool / Riffle / Run)
5. Edge Habitat Length



Geomorphic Reach Types

- **Single Channel**
  - SC1: Laterally confined w/ no sediment storage in bars, islands or floodplain
  - SC2: Laterally confined with limited sediment storage in mid-channel bars and non-continuous bank-attached floodplain segments
  - SC3: Laterally confined with sediment storage in mid-channel bars, vegetated islands and continuous floodplain segments
- **Multiple Channels**
  - MC1: Moderately wide floodplain with significant sediment storage in braid bars and vegetated islands
  - MC2: Wide floodplain with significant sediment storage in braid bars and vegetated islands
  - MC3: Wide floodplain width with vegetated floodplain segments separated by anastomosed channels with downstream base level controls
  - MC4: Delta Distributary channels

Middle River Reach Classification

Reach	U/S (RM)	D/S (RM)	Reach Type	Slope (ft/mi)	Lateral Constraints
MR-1	184	182	SC2	9	Gneiss
MR-2	182	166.5	SC2	10	Quaternary Basin Fill
MR-3	166.5	163	SC2	17	Granites
MR-4	163	150	SC1	30	Granites
MR-5	150	145	SC2	12	Moraine and Turbidites
MR-6	145	119	SC3	10	Moraines
MR-7	119	104	SC2	8	Moraines
MR-8	104	98.5	MC1	8	Holocene Lacustrine and Alluvial Terrace Deposits

Lower River Reach Classification

Reach	U/S (RM)	D/S (RM)	Reach Type	Slope (ft/mi)	Lateral Constraints
LR-1	98.5	84	MC1	5	Upper Pleistocene Outwash, Moraine and Lacustrine deposits
LR-2	84	61	MC1	5	Upper Pleistocene Outwash, Moraine and Lacustrine deposits
LR-3	61	40.5	MC3	4	Glaciolacustrine and Moraine deposits
LR-4	40.5	28	MC3	2	Glaciolacustrine and Moraine deposits
LR-5	28	20	SC2	2	Glaciolacustrine and Moraine deposits
LR-6	20	0	MC4	1.4	Glaciolacustrine and Holocene Estuarine deposits

Sediment Movement

ARRI Comment: Will the studies be able to identify how sediment passed out of Middle effects the Lower River?

Source: Jeff Davis (ARRI), 8/17/2012, TWG meeting

Sediment Movement

AEA RESPONSE

Source: RSP Section 6.5.4.3 Sediment Supply and Transport Middle and Lower River addresses the sediment balance. The 1D model of Study 6.6 will provide 1D modeling of sediment transport from the Middle River to RM 75 of the Lower River.

Sediment Balance – Movement of Sediment Throughout the Study Area

- Geomorphology Study
  - Initial sediment balance – Support 2012 identification of downstream study limit
  - Detailed sediment balance supports:
    - Development and calibration of transport equations
    - Development of tributary loading
    - Check on 1D sediment transport modeling
- Fluvial Geomorphology Modeling Study: 1D Model
  - General bed response – Aggradation/degradation
  - Changes in bed material size
  - Final check on downstream study limits

D/S Limit of Study

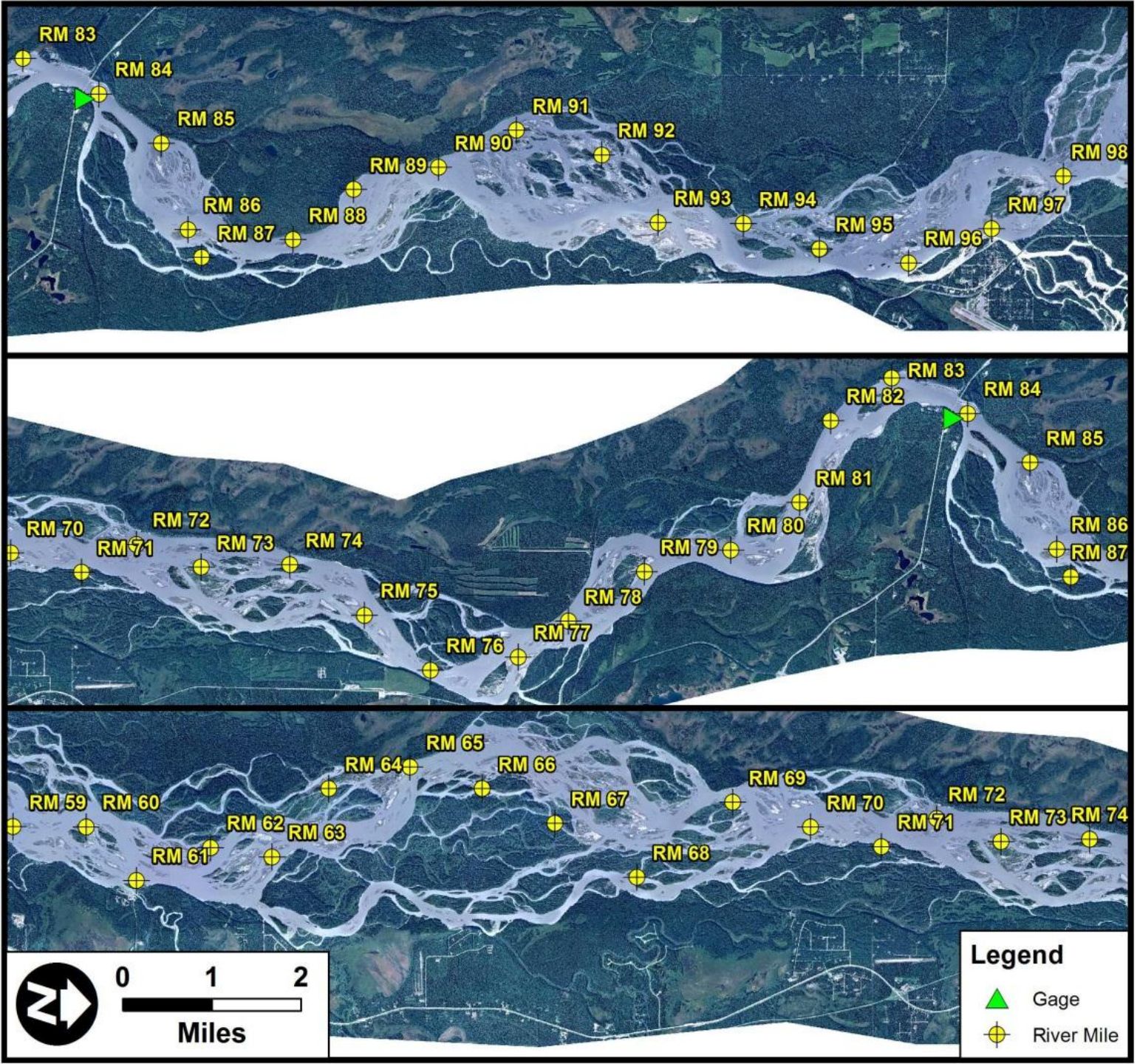
USFWS/FERC Staff Comment: What is it, how and when will it be determined. Would it be in the ISR if not reached in RSP? Each study needs to identify the D/S extent and put a mechanism in place to modify the boundaries if needed.

Source: Betsy McCracken (USFWS) & Matt Cutlip (FERC), 8/17/2012, TWG meeting

D/S Limit of Study

AEA RESPONSE

Source: RSP Section 6.6.3.2 Determination of Downstream Study Limit provides a discussion of the initially identified downstream study limit of the Geomorphology Study and describes the process, schedule and criteria for the collaborative effort to finalize and reevaluate the limit as study information is produced.



2012 Susitna River Aerials RM 98.5 to RM 61

- LR-1 RM98.5 to RM 84
- LR-2 RM 84 to RM 61

Downstream Study Limit

Downstream limit will be determined in collaboration with the TWG following a process, criteria and schedule

- RM 75 D/S geomorphology modeling limit in RSP (Dec 2012)
- Reconnaissance level assessment of Project effects and flow routing model results (Jan 2013)
- Tech memo on reconnaissance level assessment of Project effects in Lower River (Jan 2013)
- TWG meeting for confirmation of D/S geomorphology modeling limit (Feb/Mar 2013)
- 1D modeling and 2013 Geomorphology Study results and tech memo (Jan 2014)
- TWG meetings to reevaluate/confirm D/S limit (Feb/Mar 2014)
- Collect additional data if need identified (Summer 2014)

Field Data Collection

FERC Technical Consultant Comment:

- Requests more detail on specific geomorphic data to be collected at the sites.
- Based upon USFWS and NMFS requests for pebble counts in study plans requests, RSP should include more detail as to where and when AEA will do pebble counts.

Source: Jay Stallman (Stillwater/FERC), 8/17/2012, TWG Meeting

Field Data Collection

AEA RESPONSE

Source: RSP Section 6.6.4.1.2.8 Field Data Collection Efforts describes the data collection that will be conducted to support both the Geomorphology Study (6.5) and Fluvial Geomorphology Modeling Study (6.6). This includes pebble counts as requested by USFWS & NMFS.

Field Data Collection – Focus Areas

- Prepare base map from aerials and LiDAR
  - Geomorphic features (main channel & lateral habitats)
  - Contours and existing transect locations
- Collect Topography and Bathymetry
  - Verify LiDAR
  - Cross sections
  - Thalweg profiles
  - Single & multi-beam bathymetry
- Geomorphic mapping
  - Terrace & floodplain boundaries
  - LWD location & influences
  - Accretion & erosion
  - Evidence of ice influence

Field Data Collection – Focus Areas (Cont.)

- Bed Material – Main Channel & Lateral Habitats
  - Surface and subsurface
  - Pebble count, bulk samples
  - Potential winter video sampling through ice
  - Integration with Fish IFS
- Integration with Riparian IFS
  - Vegetation mapping & dendrochronology
  - Floodplain sedimentation sequence
  - Bank material
- Hydraulic Data (integrations w/ IFS)
  - ADCP velocity measurements
  - Discharge & flow distribution
  - Level loggers and HW marks for WSEL
  - Manning's n-value estimates

1D Model Cross Sections

NMFS Comment: Will additional cross section be selected at areas that aren't hydraulic controls and added to the 1D model? This question was brought up since the hydraulic routing model data collection likely concentrated on hydraulic controls, but these may not be the best features for describing sediment transport processes.

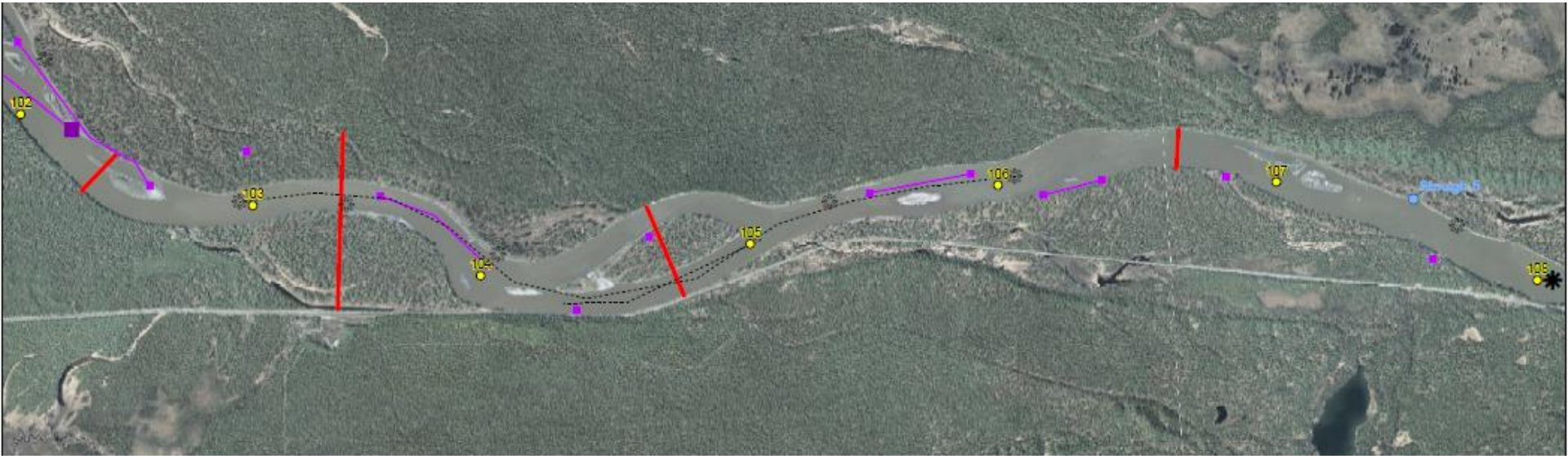
Source: Eric Rothwell, NMFS, 8/17/2012, TWG Meeting

1D Model Cross Sections

AEA RESPONSE

Source: RSP Section 6.6.4.1.2.8 describes the collection of additional cross sections in 2013 to support the 1D bed evolution model development.

1D Modeling Cross Sections



2D Model Mesh Size

- **USFWS, ARRI, ADNR, ADF&G Comment**: General discussion on the mesh size for the 2D model with questions concerning: what will the size be? Will field results influence it? When will size be selected? Will 2D modeling include side channels and sloughs within study area?

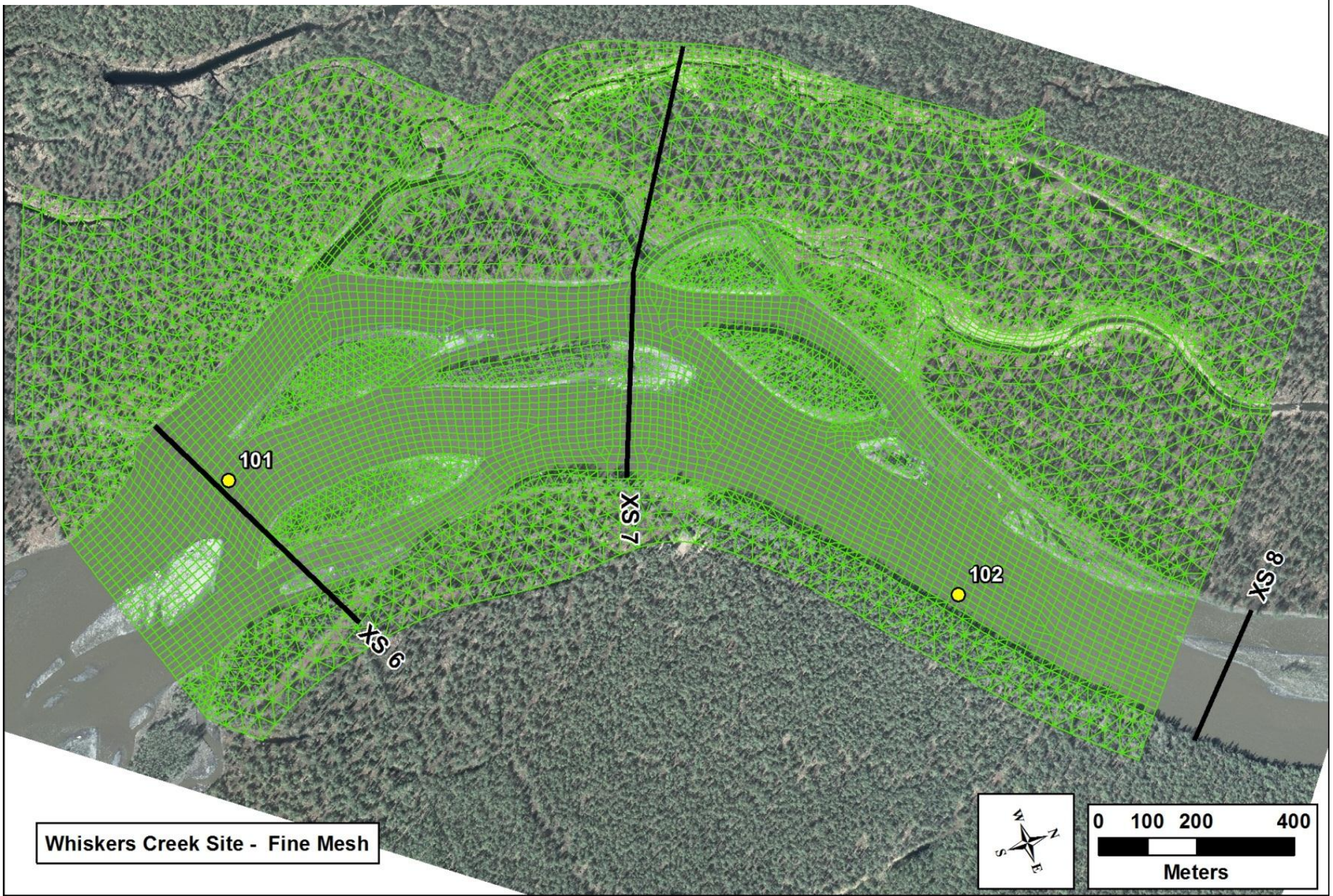
Source: Henszey (USFWS), Davis (ARRI), Steele (ADNR), Klein (ADF&G), 8/17/2012, Discussion at TWG meeting

2D Model Mesh Size

AEA RESPONSE

Source: RSP Section 6.6.4.1.2.3 Model Resolution and Mesh Size Considerations has been added to provide the requested information.

2D Modeling Mesh Size & Lateral Habitats



2D Model Calibration

FERC Consultant Comment: How will the 2D model be calibrated?

Source: Jay Stallman (Stillwater/FERC), 8/17/2012, TWG meeting

2D Model Calibration

AEA RESPONSE

Source: RSP Section 6.6.4.1.2.5 Model Calibration and Validation describes calibration of the 2D model.

2D Modeling Calibration

- Water Surface Elevations
  - Level logger data
  - Specific measurements during field data collection
- Velocity and Flow Distribution
  - ADCP measurements
  - Current meter
  - Direction of bed material imbrication
- Sediment Transport
  - Evidence of bed material motion
  - Calibration to hist. & 2012 USGS data
  - Comparison to 1D model