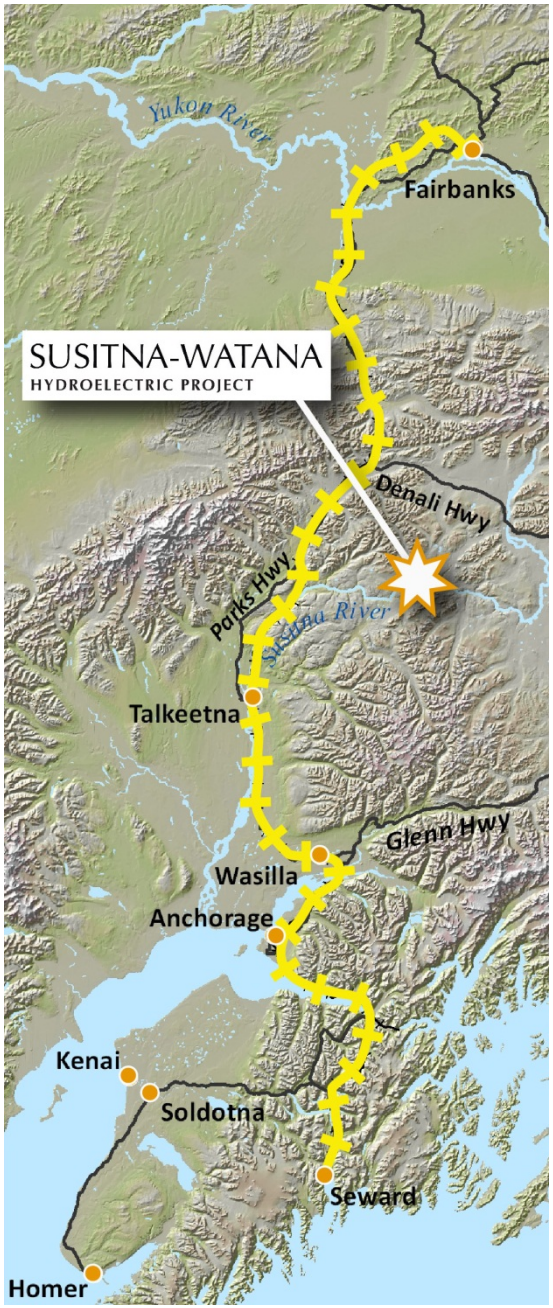

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Formal ILP Proposed Study Plan Review

August 17, 2012

URS and Tetra Tech, Inc.

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Water Resources Proposed Studies

- Section 5.5 Baseline Water Quality Study
- Section 5.6 Water Quality Modeling Study
- Section 5.12 Mercury Assessment and Potential for Bioaccumulation Study

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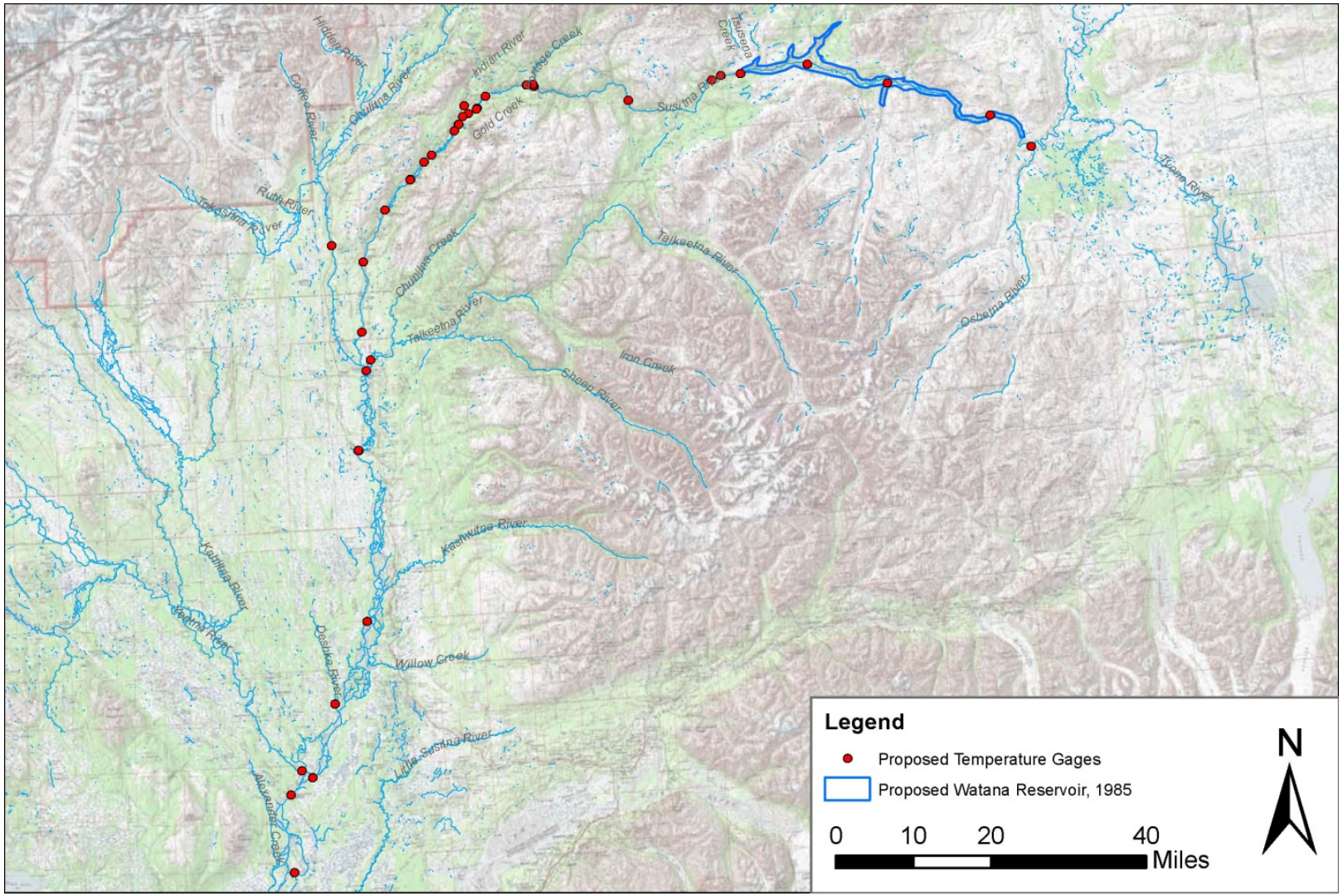
Baseline Water Quality Goals and Objectives

- Document historical water quality data and combine with data generated from this study. The combined data set will be used in the water quality modeling study to predict Project impacts under various operations (Section 5.6).
- Add three years of current stream temperature and meteorological data to the existing data.
- Develop a monitoring program to adequately characterize surface water physical, chemical, and bacterial conditions in the Susitna River within and downstream of the proposed Project area.
- Measure baseline metals concentrations in sediment and fish tissue for comparison to state criteria.

Baseline Water Quality Study Area



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Baseline Water Quality Methods

- Water Quality Monitoring Strategy
  - 39 sites from RM 10.1 to RM 233.4
  - Monthly site visits: June 2013- September 2013, December 2013, and March 2014
  - Parameter groups include: continuous temperature, in-situ, general water quality, and one-time surveys (e.g., bacteria, petroleum hydrocarbons, sediment, radionuclides, and toxic metals).
  - Media analyzed will include: surface water, sediment, and fish tissue

Baseline Water Quality Methods

- Winter Water Quality Sampling
  - December 2013/March 2014 winter season sampling is proposed
  - Ice formation and motorized access to sites during all months of the year an issue
- Thermal Imaging Study
  - A test area is proposed in 10 miles of the Middle River
  - Interpretation of aerial/satellite images calibrated and verified by field measurements collected during imaging
  - Use images to determine thermal characteristics throughout the river

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Baseline Water Quality Methods

- Water Quality Sampling Frequency (year-round, monthly)
  - 2013 sampling frequency will inform on how modifications to 2014 field effort will benefit aquatic resource assessment
  - Ability to calibrate the water quality model with 2013 water quality monitoring results will determine if/how revisions to sampling are required
- Expand MET Station coverage
  - Current network is expected to provide adequate data for describing physical dynamics in a simulated reservoir
  - Comparison of results between successive stations will determine if more MET stations are needed
  - MET station parameters include the following requested: solar radiation, snow depth, and evapotranspiration

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Baseline Water Quality Methods

- Additional Water Quality/Sediment Analytes
  - Alkalinity
  - Barium
  - Beryllium
  - Cobalt
  - Magnesium
  - Manganese
  - Molybedenum
  - Thallium
  - Vanadium
- Characterization of Mercury Levels in the Proposed Project Area
  - Discussed in a subsequent presentation (PSP, Section 5.12)

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Baseline Water Quality Expected Results

- Continuous temperature data collection in 2012
  - 39 proposed sites (20 installations completed by July 30, 2012)
  - 19 remaining installations planned for end of August 2012
  - Download of data from first 20 sites deployed in July 2012
- Surface Water Quality Results (2013)
  - Determine parameter(s) that do not exceed criteria; reduce frequency of collection
  - Determine parameter(s) that exceed criteria; consider increasing frequency and site locations to determine source(s)
  - Describe how water quality (sediment quality) conditions may be the limiting factor for support of fisheries (other aquatic life)

Baseline Water Quality Expected Results

- Sediment Quality Results
  - Determine toxics that exceed criteria
  - 2014 focus on additional sample collection upstream/downstream of exceedance location
- Characterize Background Water Quality Conditions
  - Sampling during and after snowmelt runoff and beginning of rainy season
  - Sampling at beginning and end of winter season (2 months)
- Purpose for Baseline Water Quality Monitoring
  - Data used to calibrate the Water Quality Model (PSP, Section 5.6)
  - Generate continuous temperature and meteorological data for use in calibrating the Ice Processes model
  - Determine if any changes from 1980s data

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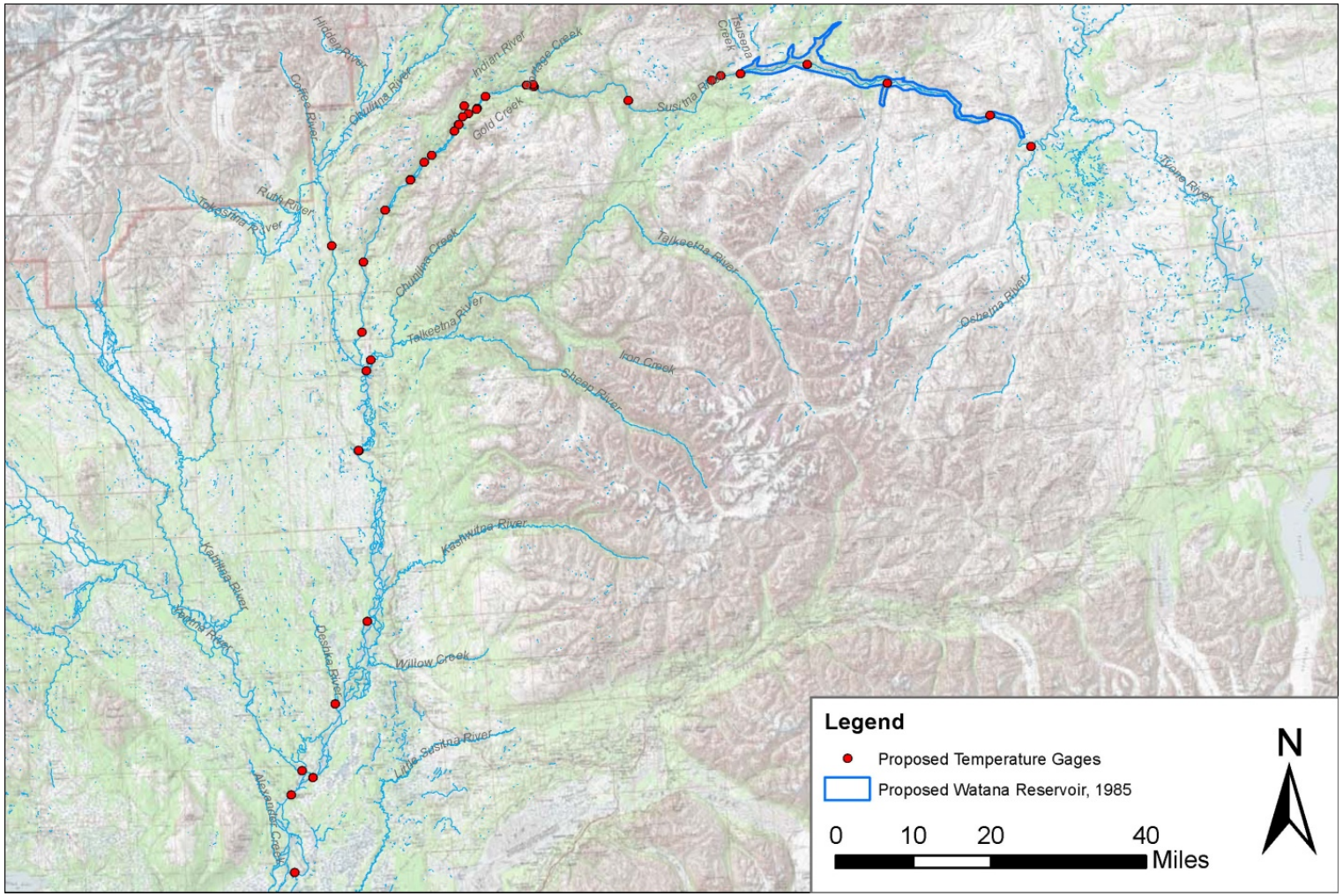
Baseline Water Quality Relationship to other Studies

- PSP Section 5.6; Water Quality Modeling
  - Baseline water quality data used to calibrate the Water Quality Model
  - Challenges with calibration will result in identification of data needs intended to improve model performance
- PSP Section 5.10; Ice Processes
  - Air and water temperature inputs will be acquired from the 2012/2013 Baseline Water Quality Monitoring effort
- PSP Section 5.12; Mercury Assessment and Potential for Bioaccumulation
  - 2013 assessments will determine extent of focused sampling required for 2014

Water Quality Modeling Goals and Objectives

- Identify an appropriate water quality models:
  - Reservoir model under simulated conditions, and
  - Riverine model for use with past and current monitoring data
- Using the data developed in Section 5.5 and 5.10, model water quality conditions in the proposed Susitna-Watana Reservoir, including (but not necessarily limited to), temperature, DO, suspended sediment and turbidity, chlorophyll *a*, nutrients, ice, and metals.

Water Quality Modeling Study Area



Extent of modeling effort: RM 10.1 to RM 233.4

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Water Quality Modeling Methods

- Selection Process for Water Quality Model
  - Identified water quality models for use in this study
  - Compared model capability with technical requirements of this study
    - Model results for several parameters
    - Model accuracy for simulated reservoir and riverine conditions
    - Capacity to model glacial-fed river system
  - Flexibility to use existing water quality information and output from several hydraulic routing models

Water Quality Modeling Methods

- CE-QUAL-W2 versus EFDC (Environmental Fluid Dynamics Code)
  - Performance in calibrating a simulated reservoir model
  - Performance in calibrating a riverine model (below a simulated reservoir)
  - Temperature modeling will not be completed using SNTEMP or DYRESM
- Stakeholder Requirements for Model Selection
  - Model code part of the public domain
  - Model is commonly accepted by regulatory agencies
  - Available for current and future use (beyond life of the project)
  - Output can be compared to relevant ADEC water quality criteria

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Water Quality Modeling Expected Results

- Water Quality Model will be calibrated to predict conditions in the reservoir and riverine portion of the watershed for several parameters.
- Parameters that can be modeled using EFDC include:
  - Flow
  - Temperature
  - TSS
  - Dissolved Oxygen
  - Nutrients
  - Turbidity
  - Chlorophyll *a*
  - Metals

Water Quality Modeling Expected Results

- Model Output Compared with ADEC Water Quality Criteria
  - Model results that exceed criteria inform on operational scenarios that will affect aquatic life
- Output for PSP Section 5.5.4.4 (Sediment Samples for Mercury/Metals in the Reservoir Area) and 5.5.4.5 (Baseline Metals Levels in Fish Tissue)
  - Metals in surface water will modeled and results compared against sediment toxics results.
  - Factors that promote transfer of metals (e.g., low pH, low redox potential, low dissolved oxygen) from sediment to surface water will be predicted from Model results.
  - Determine potential for biaoccumulation of metals.

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Water Quality Modeling Relationship to other Studies

- PSP Section 5.5; Baseline Water Quality Monitoring
  - Baseline water quality data used to calibrate the Water Quality Model
  - Challenges with calibration will prompt a review of data needs to improve model performance
- PSP Section 5.10; Ice Processes
  - Predict how water temperature is affected by ice formation and breakup
  - Predict how flow fluctuations from the reservoir influence water temperature with respect to ice formation and breakup

Water Quality Modeling Relationship to other Studies

- Section 5.12; Mercury Assessment and Potential for Bioaccumulation
  - Output from model results for metals and mercury will be used to develop a Pathways Model(s) that predicts potential for bioaccumulation in aquatic life
- PSP Section 6.5; Fish and Aquatic Instream Flow Study
  - Use Hydraulic Routing Model developed for the Instream Flow Study as part of the Water Quality model (EFDC preferred)

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Water Quality Modeling
Summary of 2012 Activities

- Water Quality Model Selection 2012 PSP
  - Discussion of capability and output from 5 Candidate Water Quality Models
  - Evaluation of models based on the following criteria:
    - Technical,
    - Regulatory, and
    - Management
- Preliminary review and comparison of candidate models
  - EFDC satisfies more of the selection criteria
  - Modeling metals conditions and sediment transport under several operational scenarios is superior

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Mercury Assessment and Potential for Bioaccumulation
Goals and Objectives

- Summary of available and historic water quality information for mercury
- Characterize the baseline water quality conditions: water, sediment pore water, sediment, and fish tissue samples for mercury.
- Gather information on the area to be flooded by the new reservoir (post impoundment surface area, mercury content of underlying bedrock, type of soil flooded, biomass quantity, etc.); potential for mercury input and degree of mercury methylation in a new reservoir.
- Assess mercury components:
  - Sources;
  - Conditions promoting methylation of mercury;
  - Conditions that mediate methylation rate;
  - Pathways analysis (Hg movement between media: sediment, water, fish, terrestrial animal) before and after dam construction; and,
  - Transport of mercury downstream from the reservoir

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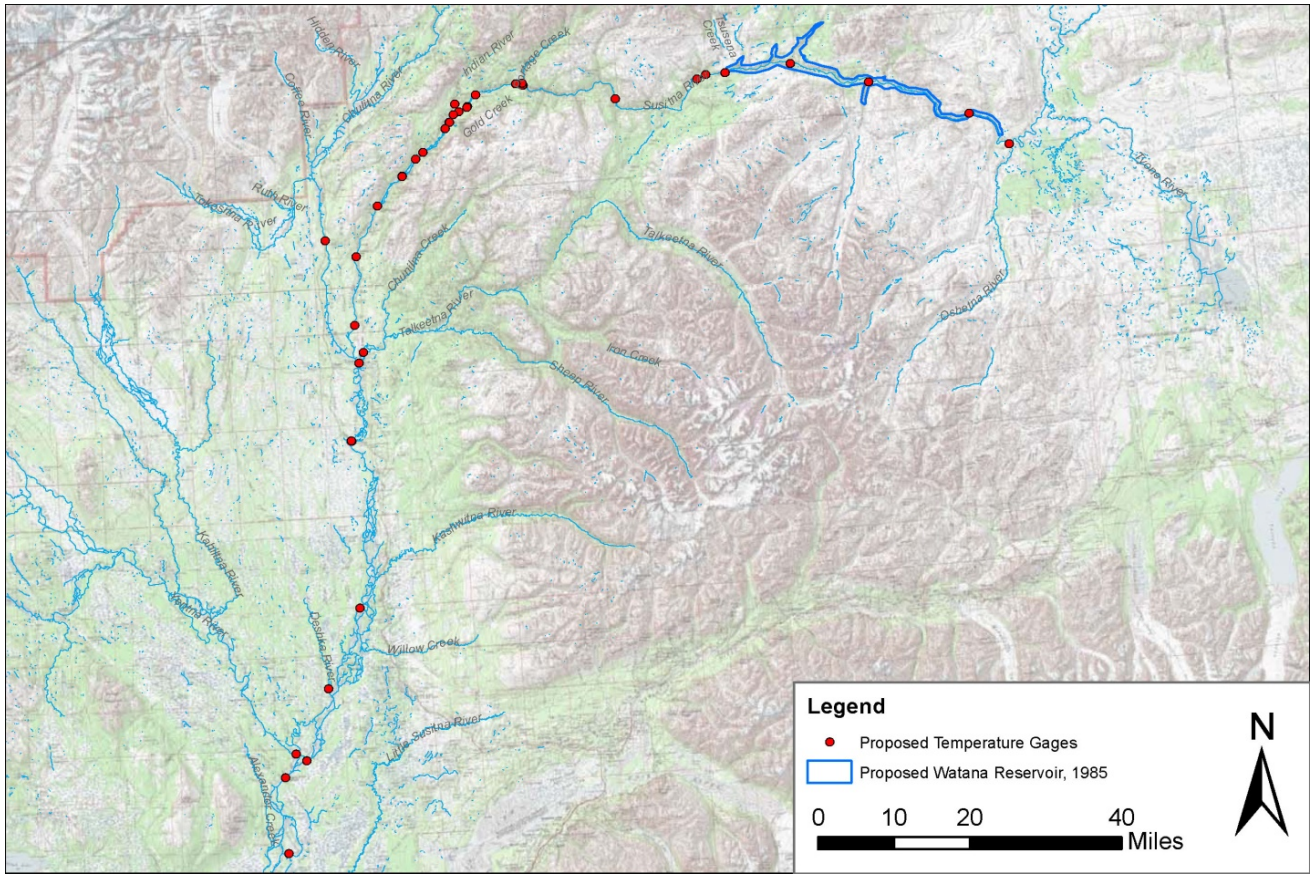
Mercury Assessment and Potential for Bioaccumulation Study Area



Use existing baseline water quality monitoring sites as reference.

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Mercury Assessment Methods

- Mercury bioaccumulation in fish tissue co-occurs with presence of hydropower operations
  - Assessment of potential for mercury bioaccumulation in fish population(s) proposed in PSP, Section 5.12
- Examination of geology, soils, and natural background conditions for mercury in the Project area of inundation
- Sample media in which mercury may be sequestered:
  - Surface Water
  - Sediment and Sediment Pore Water
  - Fish Tissue

Mercury Assessment Methods

- Sampling locations:
  - Mainstem above/below proposed dam
  - Major tributaries surrounding the dam site
  - Proposed road crossings for dam site access
  - Sites monitored in the 1980s or where recent results showed increased concentrations of mercury
- Results
  - Mercury model results (riverine and reservoir conditions)
  - Mercury input to the reservoir
  - Estimate of mercury methylation rate(s)
  - Mercury circulation between media
  - Estimate of potential bioaccumulation in reservoir fish tissue

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Mercury Assessment
Expected Results

- Identification of mercury (Hg) concentrations in media (e.g., surface water, pore water, and sediment)
- Sampling locations will differentiate Hg concentrations in natural background conditions from human sources
- Factors that promote mobilization and methylation of mercury will explain if/how circulation of mercury is occurring or likely to occur in the proposed reservoir
- Potential for exposure of aquatic life to mercury will identify the severity of impact
  - Water Quality Model results will identify scenarios under which risk of exposure is greatest
- Mercury exposure from dam-related effects currently not addressed for wildlife and vegetation

Mercury Assessment Relationship to other Studies

- PSP Section 5.5; Baseline Water Quality Monitoring
  - Baseline water quality data used to establish natural background conditions
  - Areas in the drainage where potential for bioaccumulation of mercury is indeterminate will prompt additional sampling of surface water, sediment and sediment pore water, and fish tissue beyond the initial baseline monitoring
- PSP Section 5.6; Water Quality Modeling
  - Baseline water quality data used to calibrate the model for predicting mercury concentrations in water and sediment
  - Prediction of mercury concentrations will be focused on how hydrology and release from the reservoir will potentially effect downstream fisheries

Mercury Assessment
Summary of 2012 Activities

- Reconnaissance of proposed water quality collection sites completed during installation of temperature monitoring equipment
- Site conditions observed for logistical challenges associated with collection of sediment and pore water samples

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