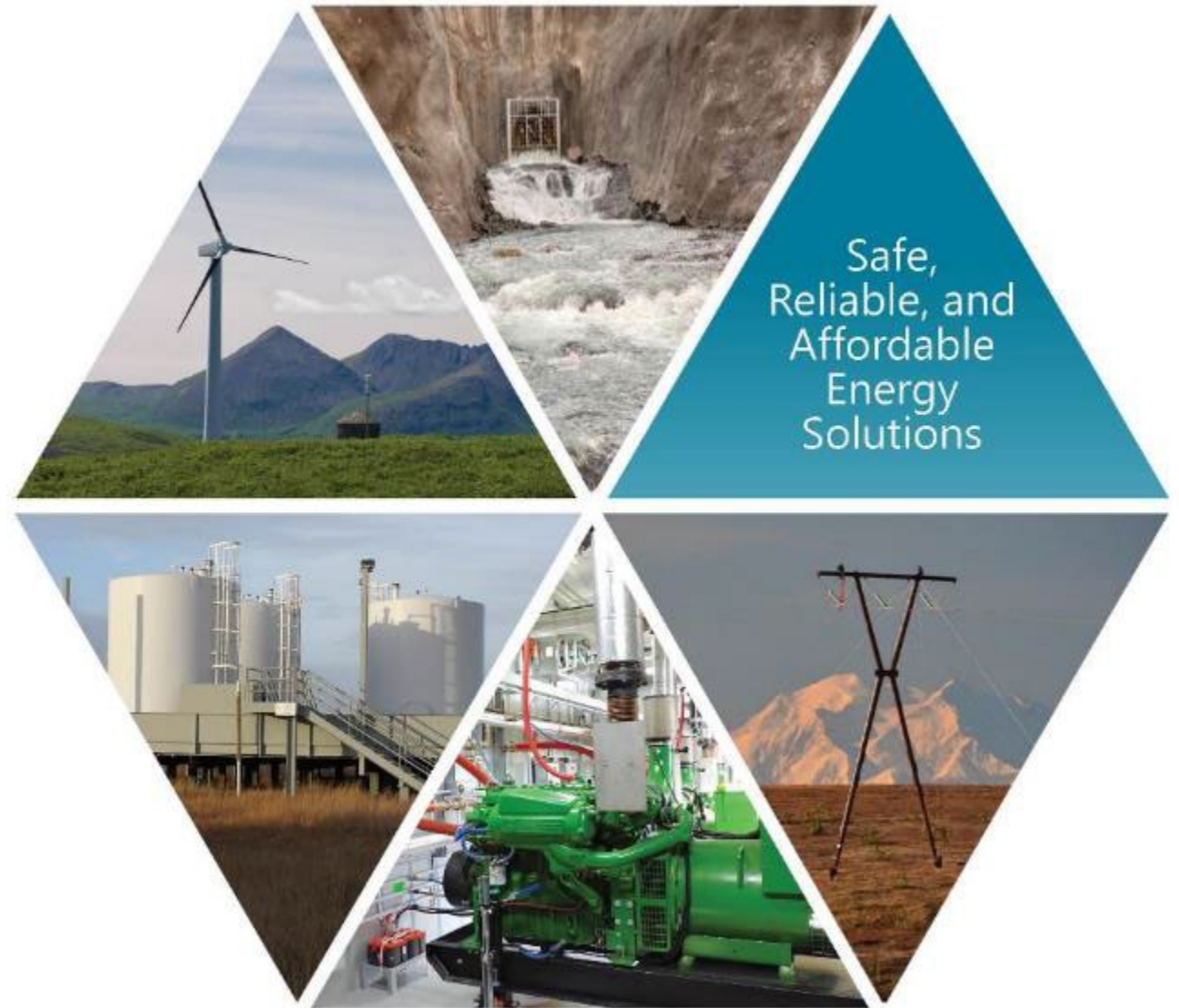


ALASKA ENERGY AUTHORITY

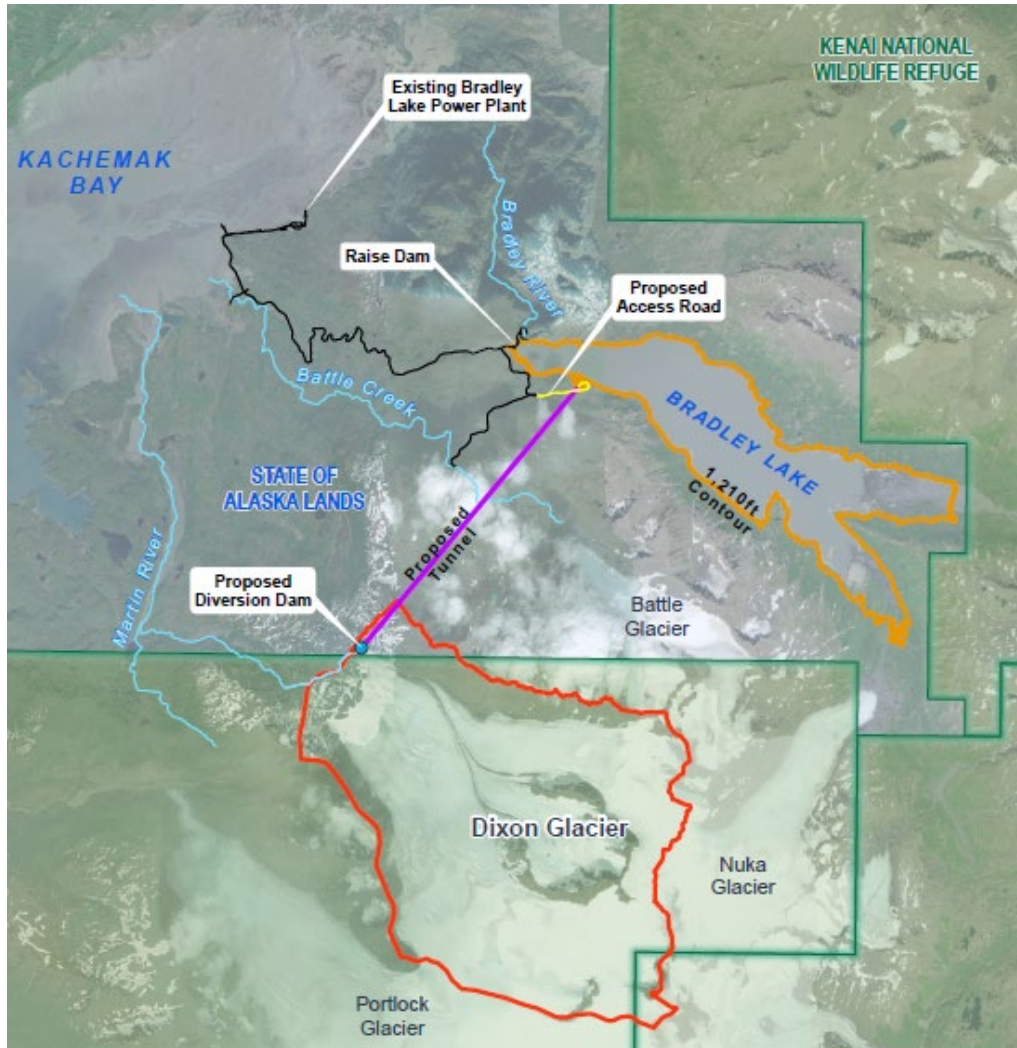
DIXON DIVERSION

Bryan Carey, P.E.
Director of Owned Assets

Joint Agency and Public Meeting
March 5, 2024



Project Overview



Project Elements:

- Raise Bradley Dam and Lake
 - Up to 28 feet
- New Dixon Diversion Dam
 - ~25 feet high
- Diversion Tunnel to Bradley Lake
 - 4.7 miles long
- New Access Road from Battle Creek road to tunnel outlet
 - ~1-mile-long
- Underground Power Line

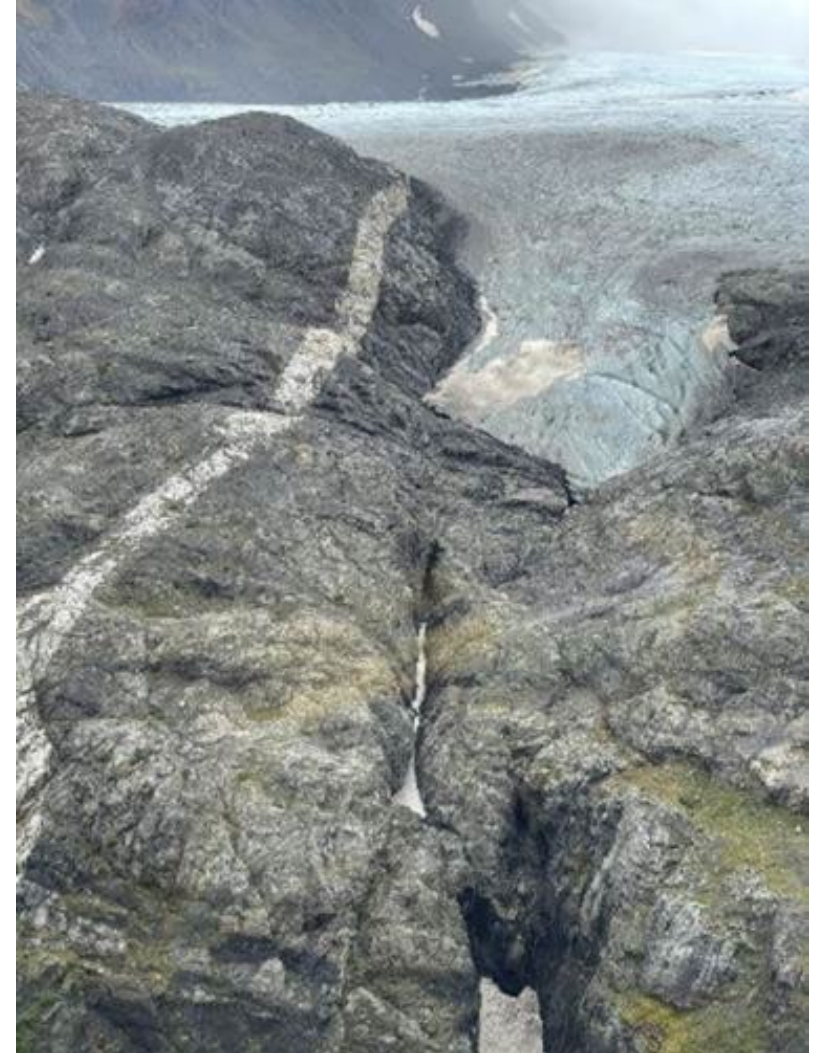
Project Overview



Removed Elements:

- Martin River Alternative
 - New MR power plant
 - Diversion to new MR power plant
 - New road to new MR power plant
- Road to Dixon Diversion Dam
- New overhead transmission lines

Dixon Glacier Source

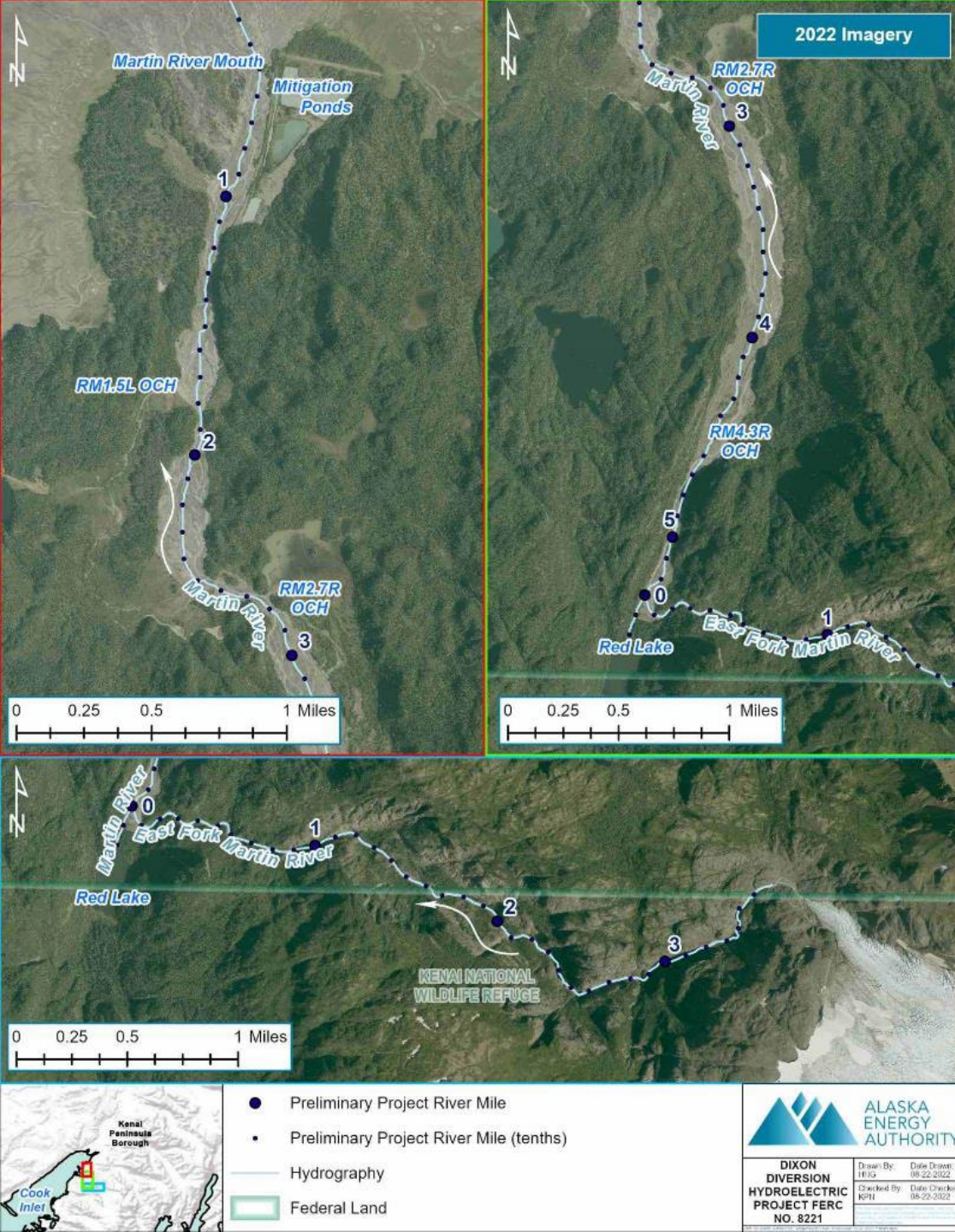


Diversion and Intake

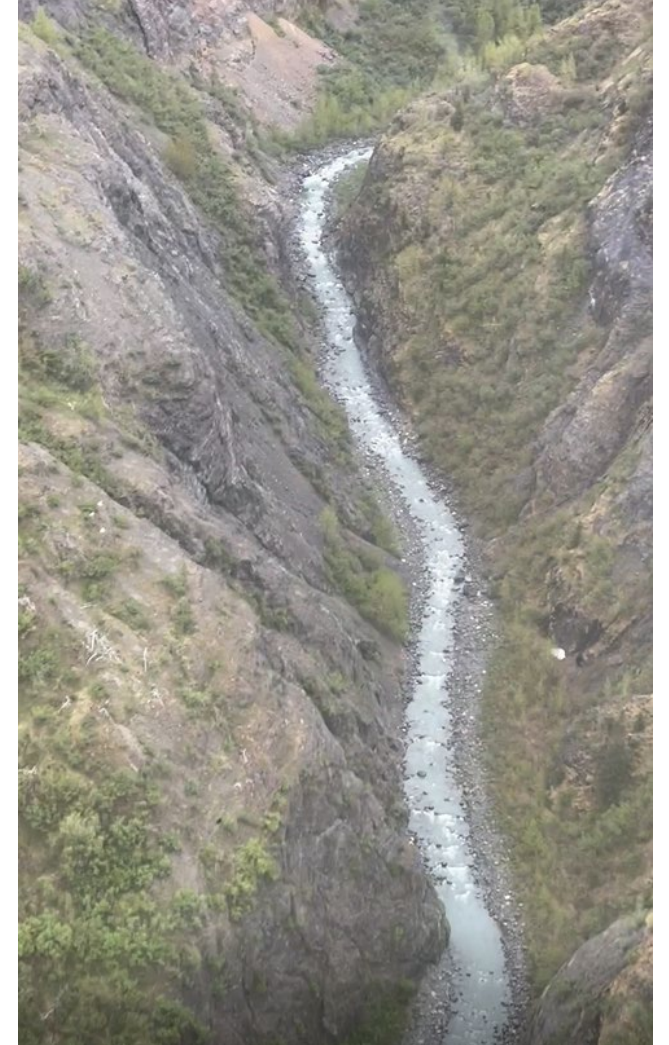


Martin River Sections

- **East Fork Martin River (Canyon)**
 - 3.8 miles from Dixon Glacier to Martin River
- **West Fork Martin River (Red Lake)**
- **Middle Martin River**
 - 2.75 miles from EF/WF to RM 2.55
- **Lower Martin River**
 - RM 2.55 to mean high tide



East Fork Martin River Canyon



East Fork Martin River Tributary (South Fork)



Confluence of East Fork and West Fork Martin River



Martin River Middle Section



River starts to slow and spread. Velocity can be high.

Lower Martin River



River is more spread out and velocity decreases.

QUESTIONS?

FERC Amendment Status

- Kleinschmidt Associates:
Betsy McGregor



Process Status

- Stage 1: Initial Consultation Document
- Stage 2: Study Planning and Implementation

We are here



Responsible Party	Activity	Dates
AEA/Stakeholders	Initial Agency Consultation	Jan - Mar 2022
AEA	Conduct 2022 Preliminary Studies	Summer 2022
Stage 1: Initial Consultation Document (ICD)		
AEA	File and Distribute ICD, Request for Non-federal Representative, and Newspaper Notice	Apr 2022
FERC	FERC Issues Notice of Amendment Accepted	May 2022
AEA	Provide Agencies/Public with Notification of Joint Meeting Location and Timing	May 2022
AEA/Stakeholders	Hold Joint Agency/Public Meeting and Site Visit	Jun 14-15, 2022
FERC/Stakeholders	Comments on ICD/ Proposed Studies Due	Aug 14, 2022
Stage 2: Study Planning and Implementation		
AEA	Distribute Draft Study Plans	Nov 2022
Stakeholders	Comments on Draft Study Plans	Dec 2022
AEA	File Notice to Pause Amendment Process	Mar 2023
AEA	2023 Project Design and Data Collection	2023
AEA	File Intent to Restart Amendment Process	Feb 2024
AEA/Stakeholders	Hold Project Update and Study Plan Meeting	Mar 5, 2024
AEA/Stakeholders	Hold Terrestrial Study Planning Meeting	Mar 2024
AEA/Stakeholders	Hold NHPA Section 106 Consultation Meeting	Mar 2024
AEA	File Final Study Plan	Apr 2024

Dixon Diversion Project Aquatic Study Plans

- Martin River Streamflow Gaging
- Hydraulic Modeling, Geomorphology, and Aquatic Habitat Connectivity
- Water Quality Monitoring
- Aquatic Habitat Characterization
- Martin River Fish Use



Streamflow Gaging

- DOWL:
 - Euan-Angus MacLeod



Comments to the DSP

- Synopsis of Comments:
 - *Request for gaging on the East Fork Martin River before it joins with the outflow of Red Lake (USFWS)*
 - *Request for isotopic analysis to quantify how much water in the smaller glacial outflow channel is glacial versus snowmelt (USFWS)*
 - *What are the limitations with the alternate discharge methods?*
 - *Recommendation to employ alternate methods so the discharge datasets are comparable should continuous gaging discontinue. (USFWS)*
 - *Recommendation that gage installation be timed to capture the highest peak flow periods. (USFWS)*

Comments to the DSP

- Synopsis of Comments:
 - *Given the relatively low cost of pressure transducers and the value of the data, it is highly recommended that the transducers remain operational over the winter to capture spring break-up timing. (ADF&G)*
 - *Suggestion to installing the Red Lake tributary stream gage within the lake itself, near the outlet stream. (ADF&G)*
 - *Highlight the importance of a continuous stream gage located on the mainstem Martin River (ADF&G)*
 - *Peak flows are essential for setting-up a rating curve and it usually takes at least 3 years of peak flow data to obtain an accurate rating curve. (WPC)*

2023 Data Collection

- Field Season: April – November
 - 9 Site visits completed
- Peak break-up flows captured (~mid May) in Red Lake and RM4.3R OCH Outlet
- Observations of mainstem of Martin River
 - Cold
 - High velocity at RM1.9 (max ~14ft/s)
 - Highly mobile bed
 - High turbidity

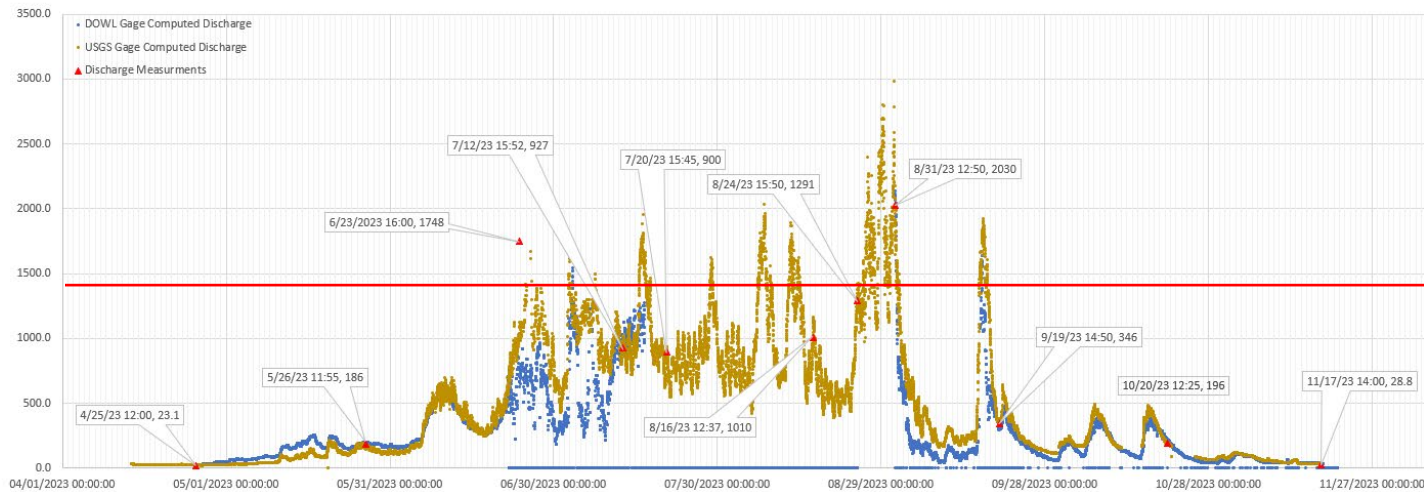


2023 Data Collection

- During high flows, sensors in the main stem of the Martin River sustained damage due to turbulent, abrasive flows
- Initiated data sharing with USGS

Martin River 2023 Discharge Record with DOWL and USGS Stage Data

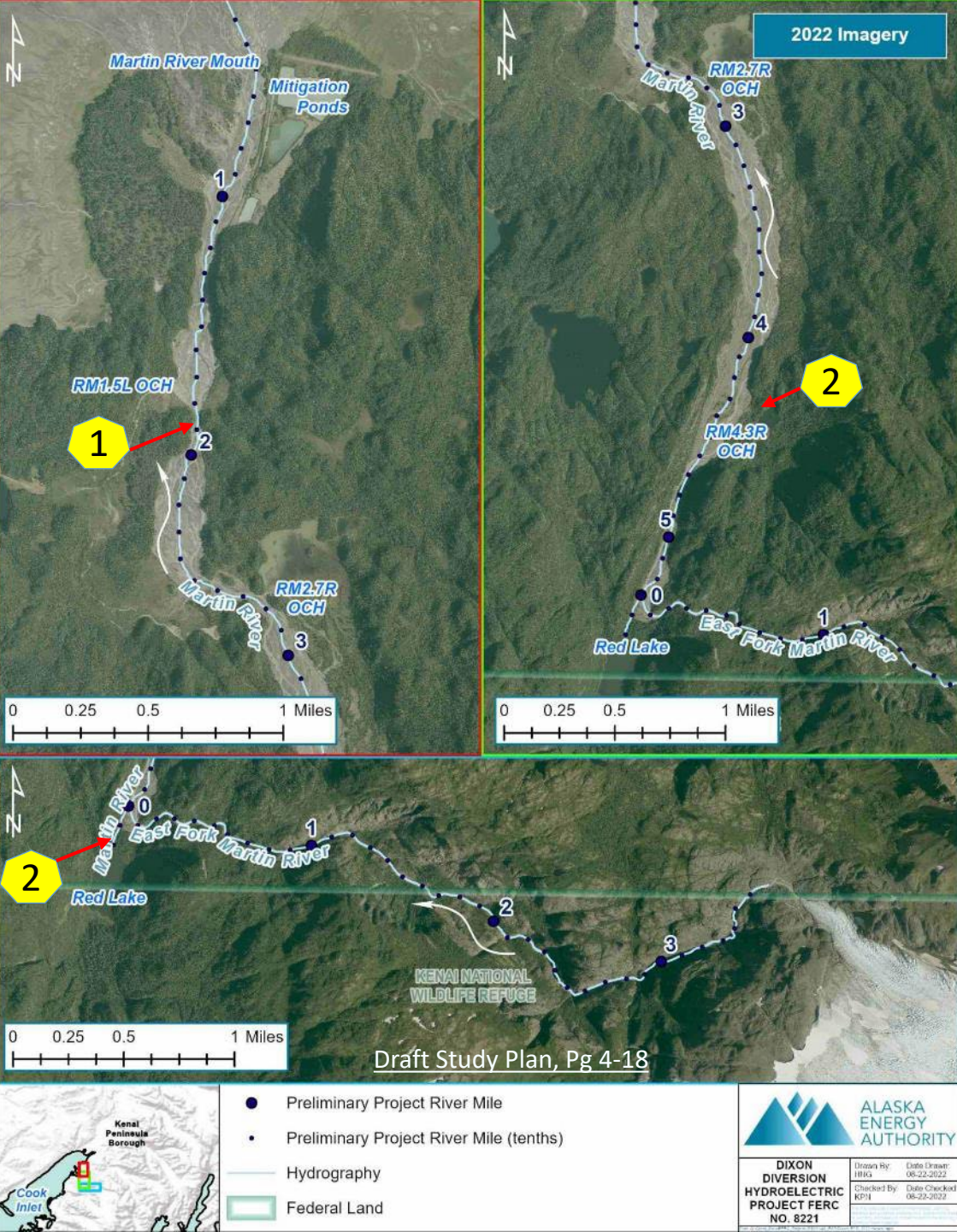
USGS Gage #15238950



Revisions to DSP

- Monitoring period extended:
 - Now April through November
- Ultrasonic water surface elevation sensor to be installed at RM1.9 (the constriction) to supplement existing sensors
 - Reduce the risk of damage to sensor/data loss
- Site visits will be increased in frequency from July to October to better capture peak flows





2024 Methods and Analysis

- Deploy Water Level Loggers
 - 15 min sampling frequency
 - Non-vented PT in water with barometric sensor and logger on bank
 - Ultrasonic Sensor at Constriction
- Quantify Discharge
 - Measurements taken more frequently than monthly at each location from July to October
 - Use ADCP, ADV or dilution method
- Prepare Rating Curve
 - Continue to collect discharge data
 - Complete for each gage location



Deliverables and Schedule

- Annual Study Reports
 - 2023 and 2024: Summarizes annual field activities and data
 - 2025: Final cumulative report summarizing all field activities and data
- 2024 and 2025 Schedule
 - Data collection during open-water season (April-November)
 - Monthly maintenance, observation and discharge measurement
 - Field schedule and data acquisition plan to be periodically reassessed and updated based on data quantity and quality

Hydraulic Modeling, Geomorphology, and Aquatic Habitat Connectivity Evaluation

Kleinschmidt Associates:
Mike Gagner

Watershed GeoDynamics:
Kathy Dubé



- **Comments to the DSP**

- USFWS: Will the information provided be sufficient to estimate the size and frequency of flows necessary for channel maintenance and habitat diversity?
- USFWS: Consider Upstream migration for Sockeye Salmon and outmigration for both Coho and Sockeye Salmon in the analysis.
- USFWS: Will the analysis consider the amount of flow necessary to saturate the substrate before surface flow occurs, and how that might change if the stream bed is elevated?
- ADFG: Recommend study to assess mainstem instream flow protection needs for riverine resources and values.
- ADFG: Can the 2D hydraulic model be used to assess instream flow needs for identified fish resources?

Background (continued)

- **2023 Field Reconnaissance (Geomorphology)**
 - May 16, May 22-24, and November 2, 2023
- **Revisions to DSP**
 - Add installation of timelapse cameras and collect images May to Oct/Nov 2024



Goals and Objectives

Goal

- Evaluate potential changes in aquatic habitat connectivity

Objectives

- Develop hydraulic and sediment dynamics models
- Estimate changes in channel morphology and water depth
- Model potential changes to habitat connectivity



Methods – Hydraulic Modeling and Habitat Connectivity

- Collect new topobathymetric data
- Collect supplemental transect data
- Develop hydraulic model
 - HEC-RAS 2D
 - Integrate substrate composition
- Select focus species and life stages
- Define life stage phenology
- Define fish passage criteria
- Obtain daily flow values
- Evaluate operational scenarios



Species	Life Stage	Depth Criteria	
		Feet	References
Arctic Grayling	adult	0.6	ADFG (2001)
	juvenile	0.4	ADFG (2001)
Chinook Salmon	adult	0.8-0.9	CDFG (2013)
	juvenile	0.3	CDFG (2013)
Coho Salmon	adult	0.6-0.7	CDFG (2013)
	juvenile	0.3	CDFG (2013)
Chum Salmon	adult	0.6-0.8	CDFG (2013)
	juvenile	0.3	CDFG (2013)
Pink Salmon	adult	0.6-0.8	CDFG (2013)
	juvenile	0.3	Nordlund B. (2008)
Sockeye Salmon	adult	0.6-0.7	Bates et al. (2003)
	juvenile	0.3	CDFG (2013)

Life Stage	Species	Month											
		J	F	M	A	M	J	J	A	S	O	N	D
Adult Migration	Coho												
	Chinook												
	Sockeye												
Adult Spawning	Coho												
	Chinook												
	Sockeye												
Egg Incubation and Emergence	Dolly Varden												
	Coho												
	Chinook												
Juvenile Outmigration (smolts)	Sockeye												
	Coho												
	Chinook												
Rearing (Fry, parr, resident adult)	Sockeye												
	Coho												
	Chinook												
	Dolly Varden												

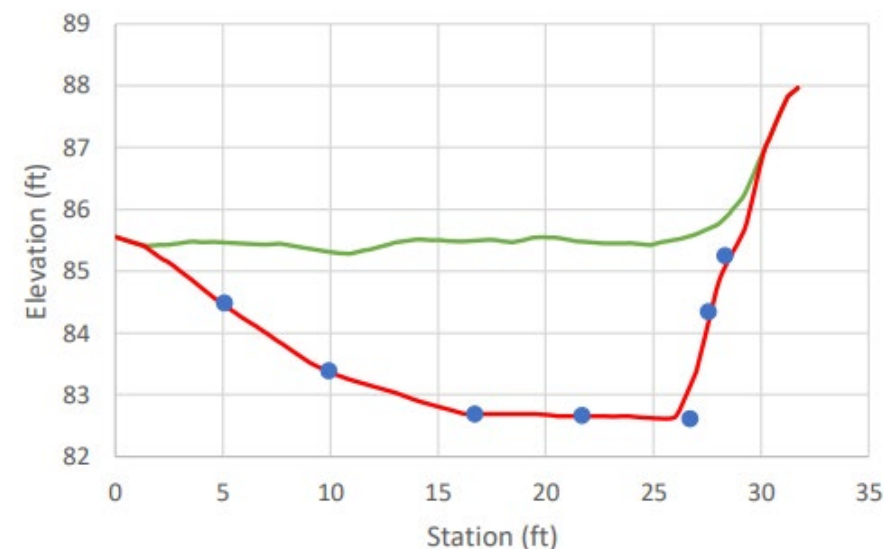
Topobathymetric

Topography (Dry Surface)

- LiDAR

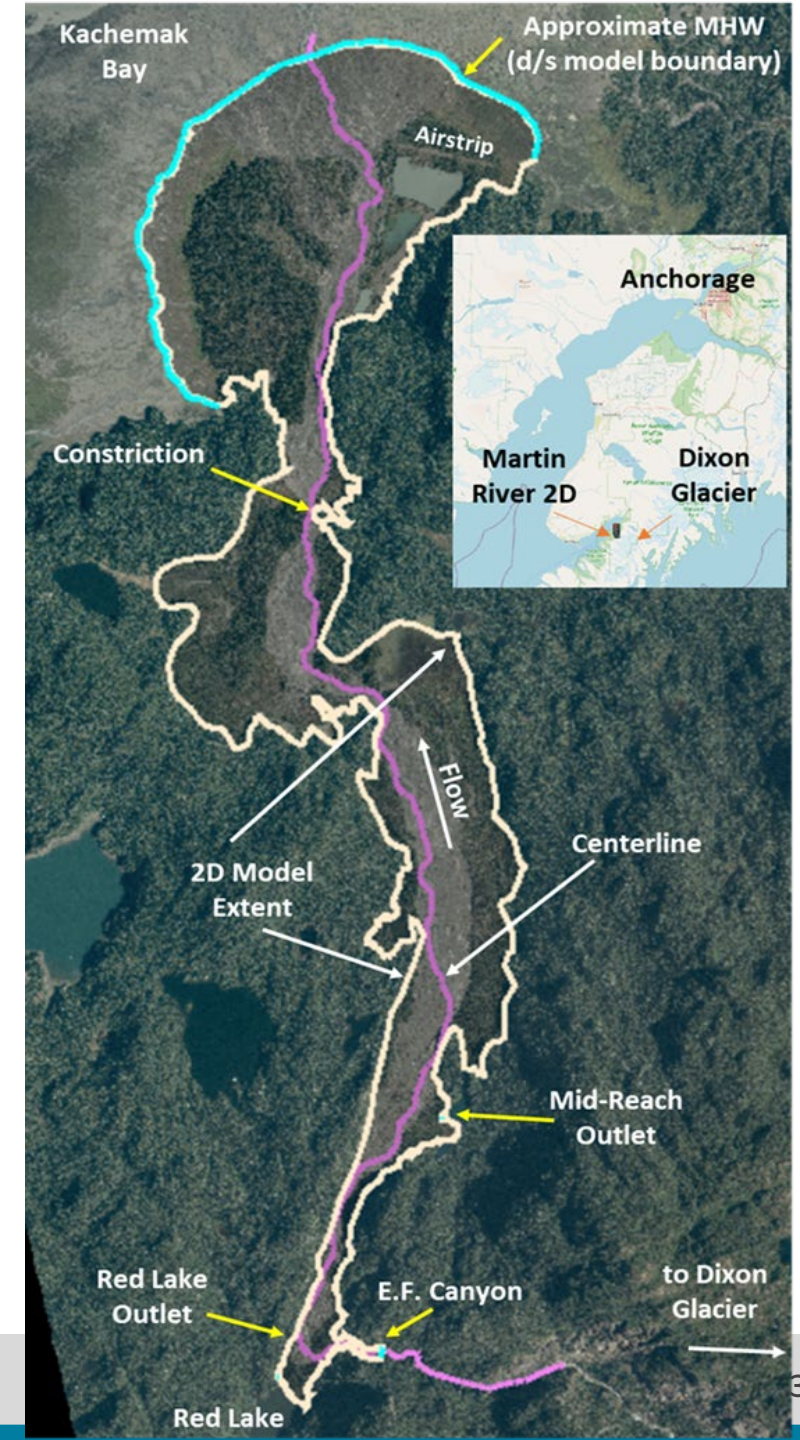
Bathymetry (Wet Surface)

- Green LiDAR or
- Hydro-enforced Digital Terrain Model + transect survey to approximate for channel bathymetry



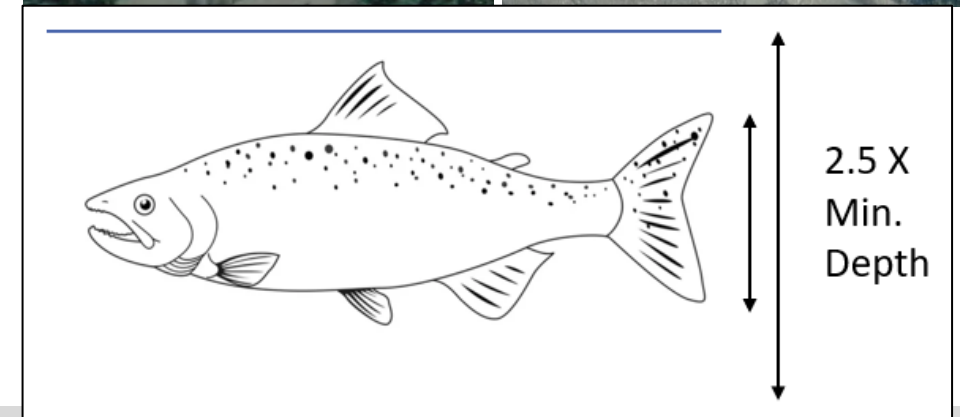
Model Development & Simulations

1. Updated Digital Terrain Model (Topobathy)
2. HEC-RAS 2D hydraulic modeling
3. Establish Boundary Conditions
 - Tide at Kachemak Bay – Mean High Water
 - WF Martin River Red Lake Outlet
 - EF Martin River Canyon
4. Incorporate Surface Roughness (Geomorphology)
 - Landcover Polygons
 - Pebble Counts
5. Discharge (DOWL)
 - Inflow Source – WF MR, EF MR, Mid-reach outlet
 - Accretion
6. Model Simulations
 - Multiple flow scenarios



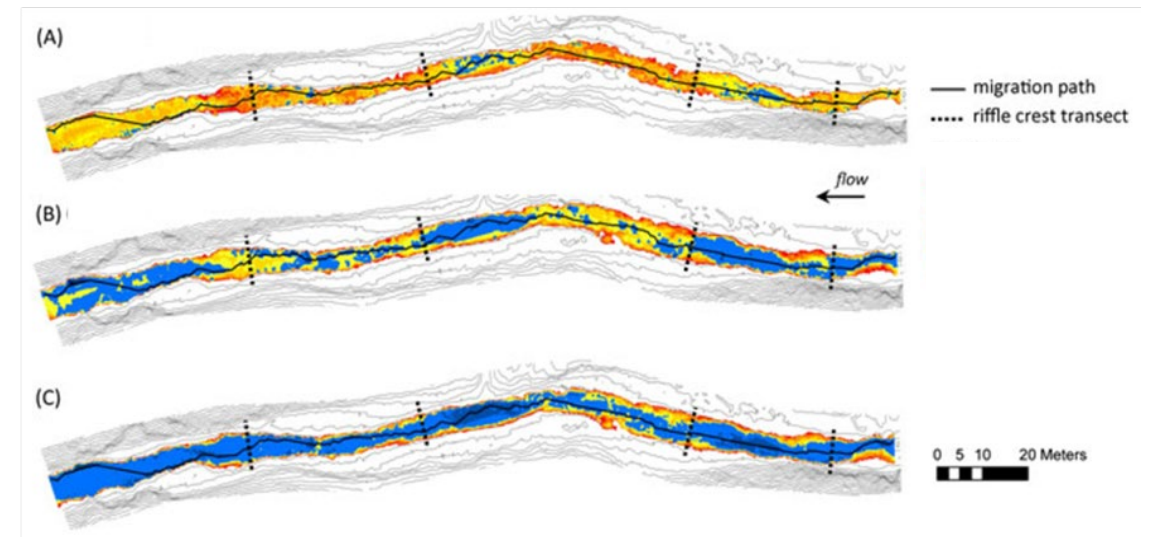
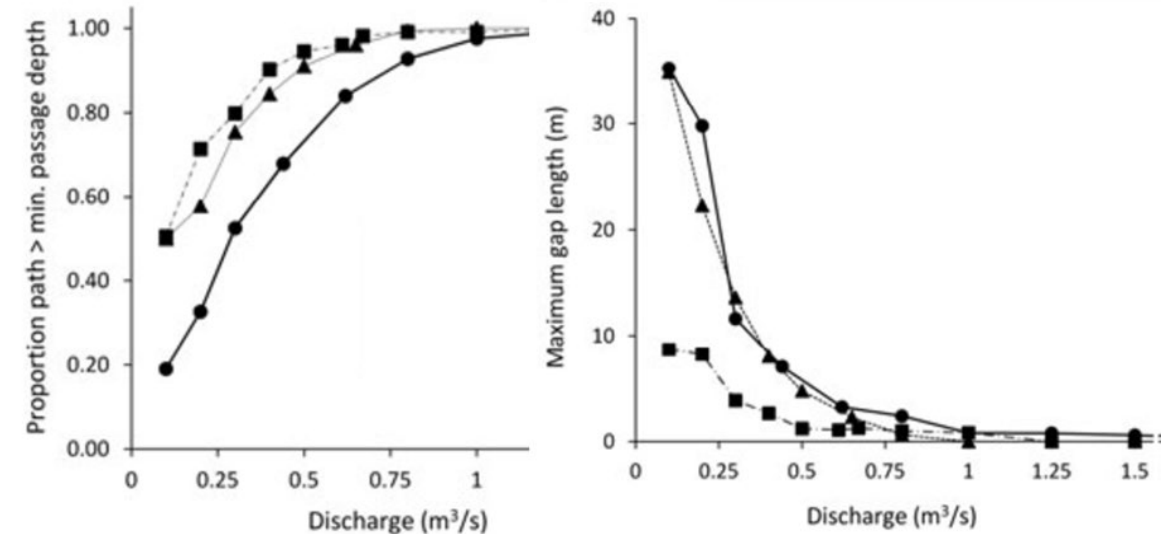
Proposed Passage Criteria

1. Focus Fish Species
 - Sockeye
 - Coho
 - Dolly Varden
2. Passage Route/Connectivity
 - Main channel
 - Off-channel
3. Proposed Passage Depth & Length
 - Water Depth
 - a. Depth 0.33 ft (4") or less (unsuccessful)
 - b. Depth 0.33 - 0.7 ft (successful with difficulty)
 - c. Depth 0.7 - 1.5 ft (successful)
 - d. Depth >1.5 ft (holding/resting)
 - Length
 - a. Contiguous channel length
 - b. Identify dead ends



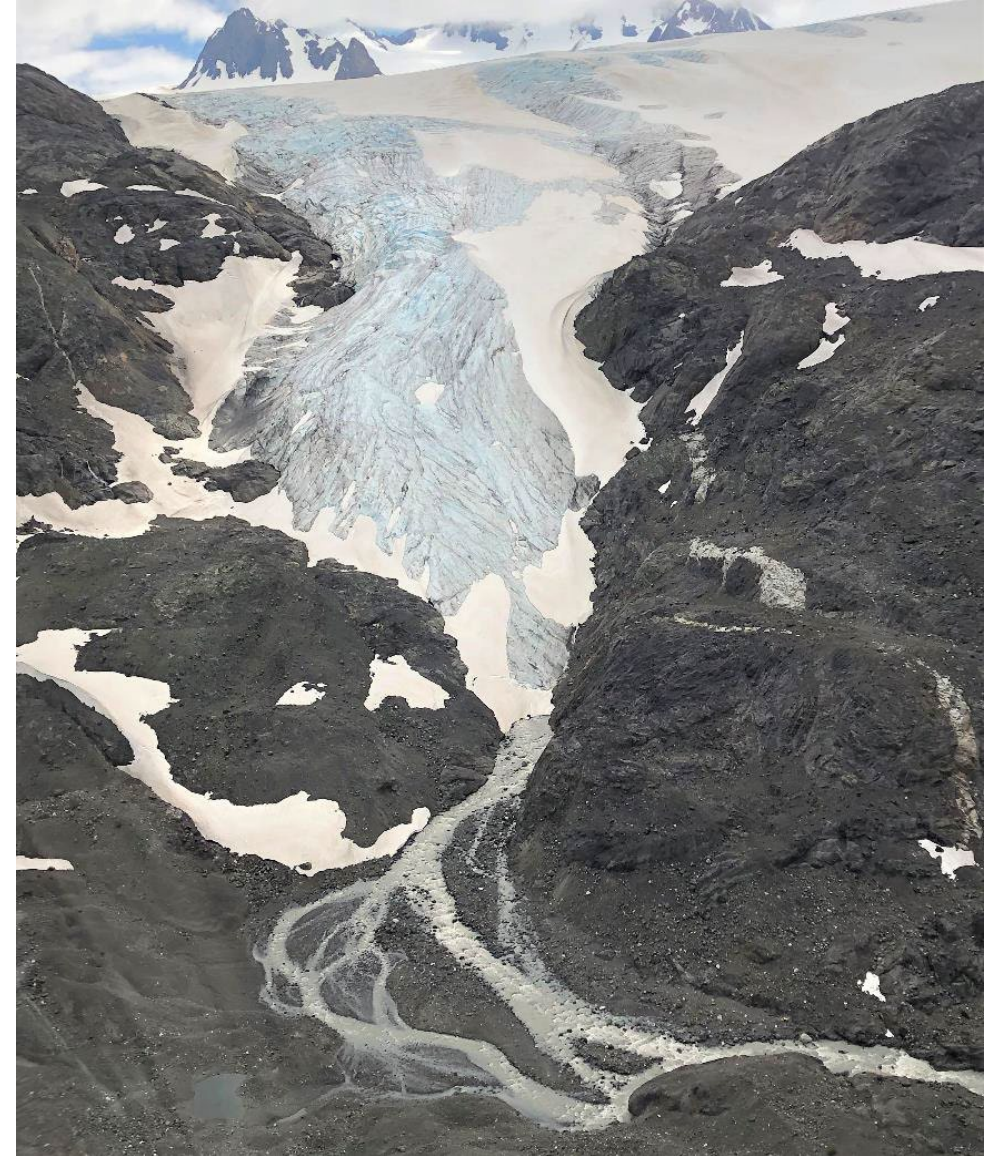
Deliverables

- ✓ Field data and maps
- ✓ Hydraulic modeling results
- ✓ *Predicted changes in substrate size and distribution*
- ✓ *Sediment transport and geomorphology analysis*
- ✓ Predicted habitat connectivity
 - Current and Proposed Operations



Schedule

- 2024
 - May - field data collection
 - Jun - Nov – hydraulic modeling, sediment transport analysis, and habitat connectivity modeling
 - 2024 Report



2022-2023 Geomorphology Reach Delineations, Data Collection and Field Observations

Watershed GeoDynamics:
Kathy Dubé



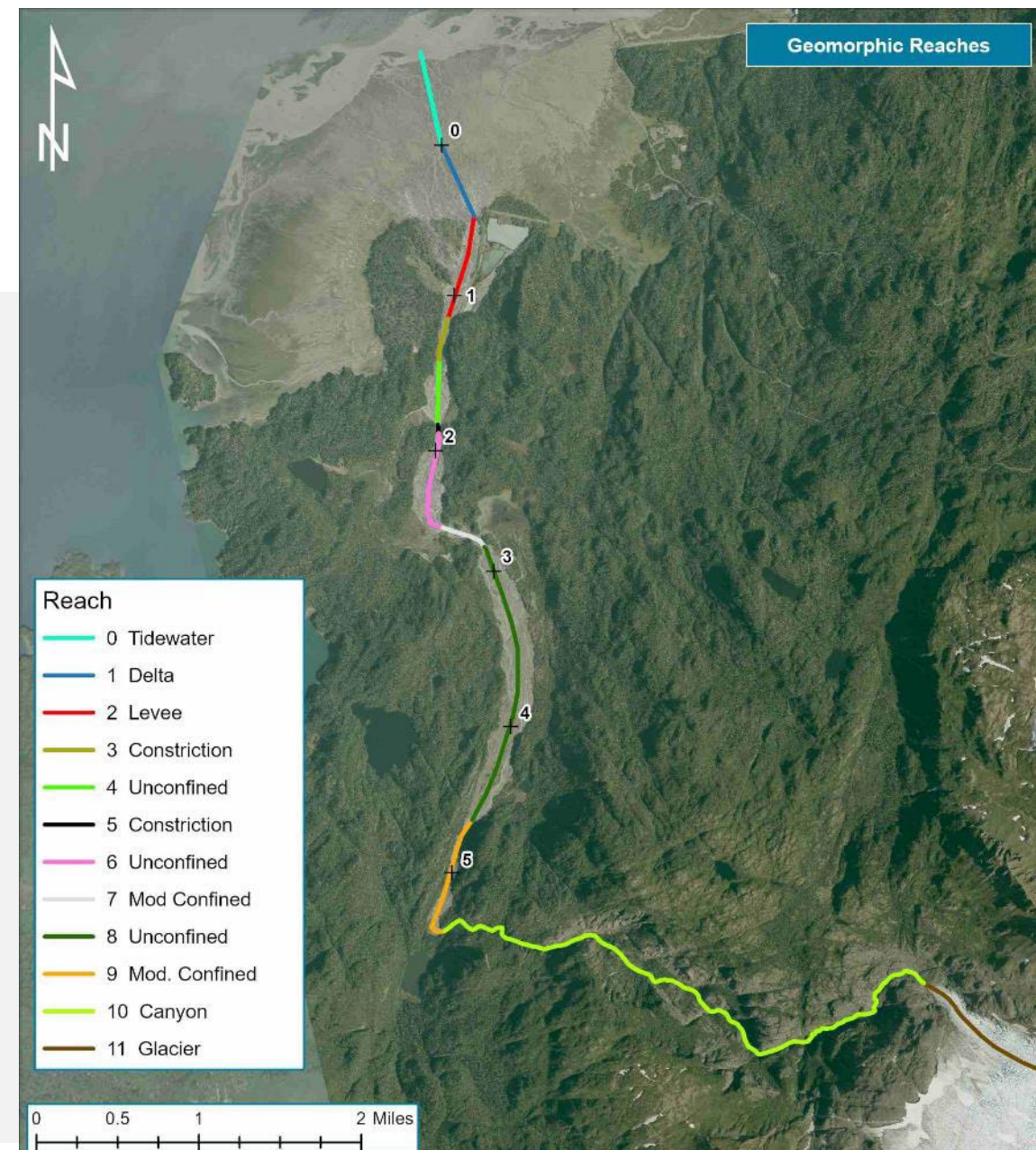
Methods – Geomorphology and Sediment Transport Analysis

- **Delineate geomorphic reaches**
- **Map channel connectivity and braiding through time using historic aerial photographs/LiDAR**
- Estimate average annual coarse-sediment input
- **Collect pebble counts/sub-surface data**
- Use 2-D hydraulic model output to analyze sediment transport/deposition under current and proposed flow and sediment input conditions
- Analyze future riparian/aquatic habitat



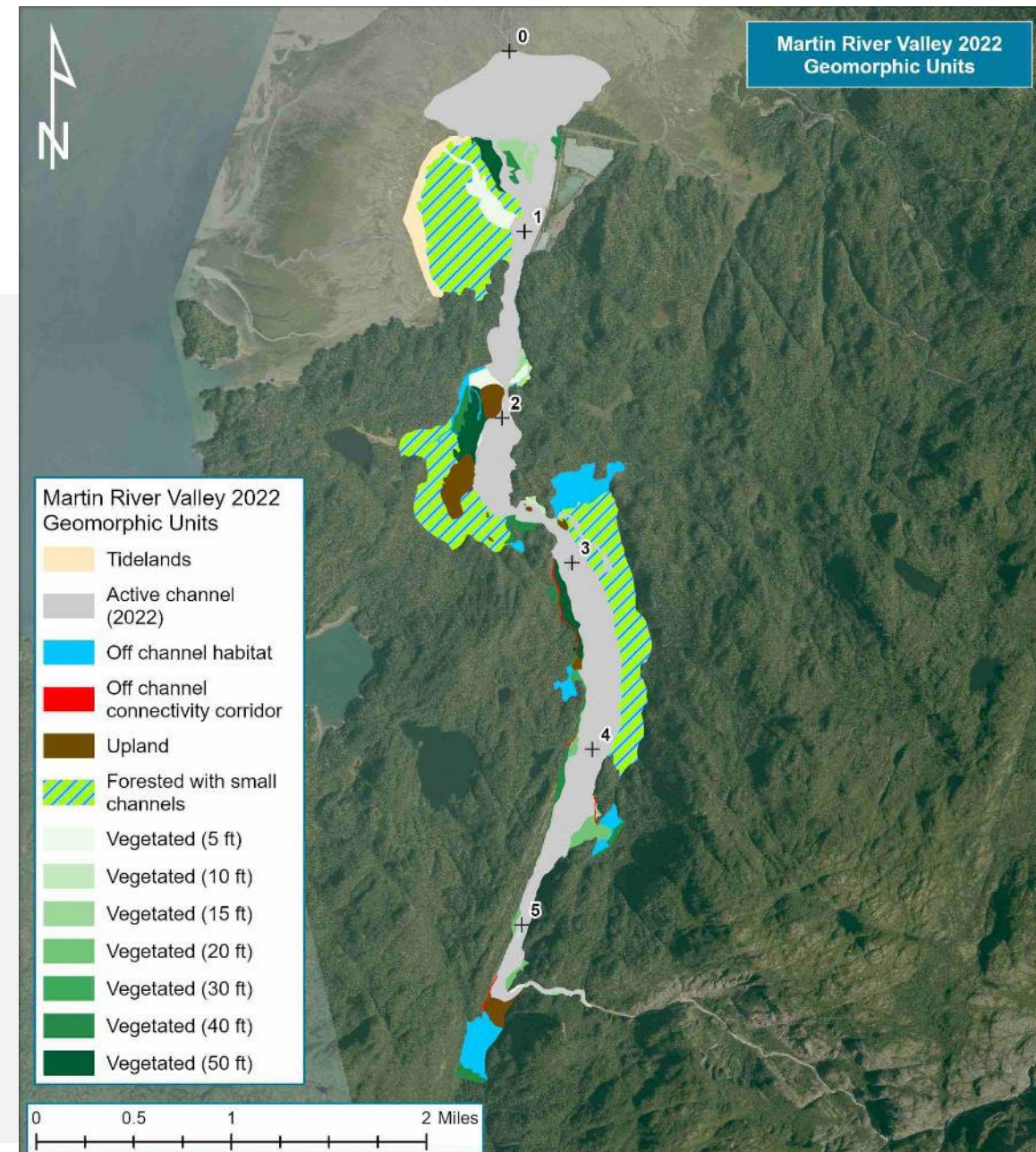
Geomorphic Reaches

- 11 Geomorphic Reaches delineated based primarily on confinement, single/multi-channel characteristics
- Average valley gradient fairly consistent (0.7-0.8 percent) from mouth to Reach 7
- Gradient gradually increases upstream from Reach 7 (1.2-1.5 percent)
- Canyon is higher gradient (6.7 percent)

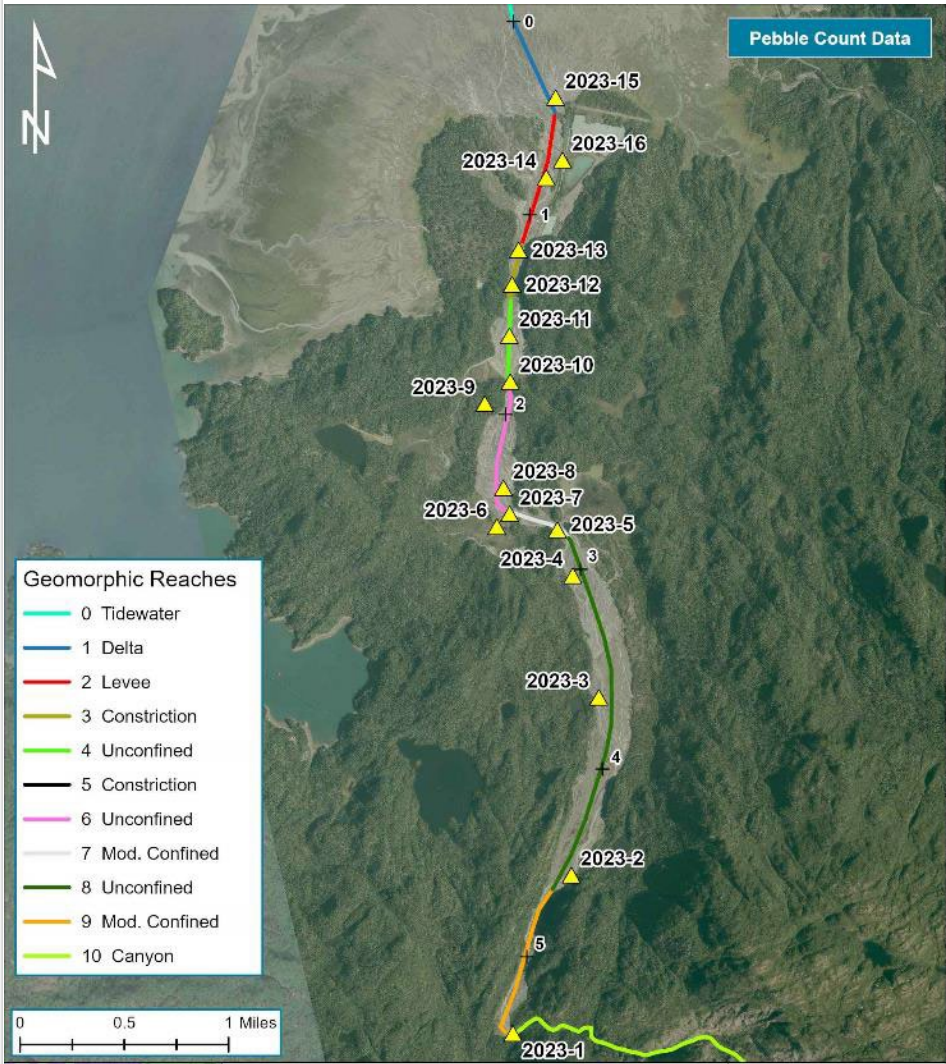
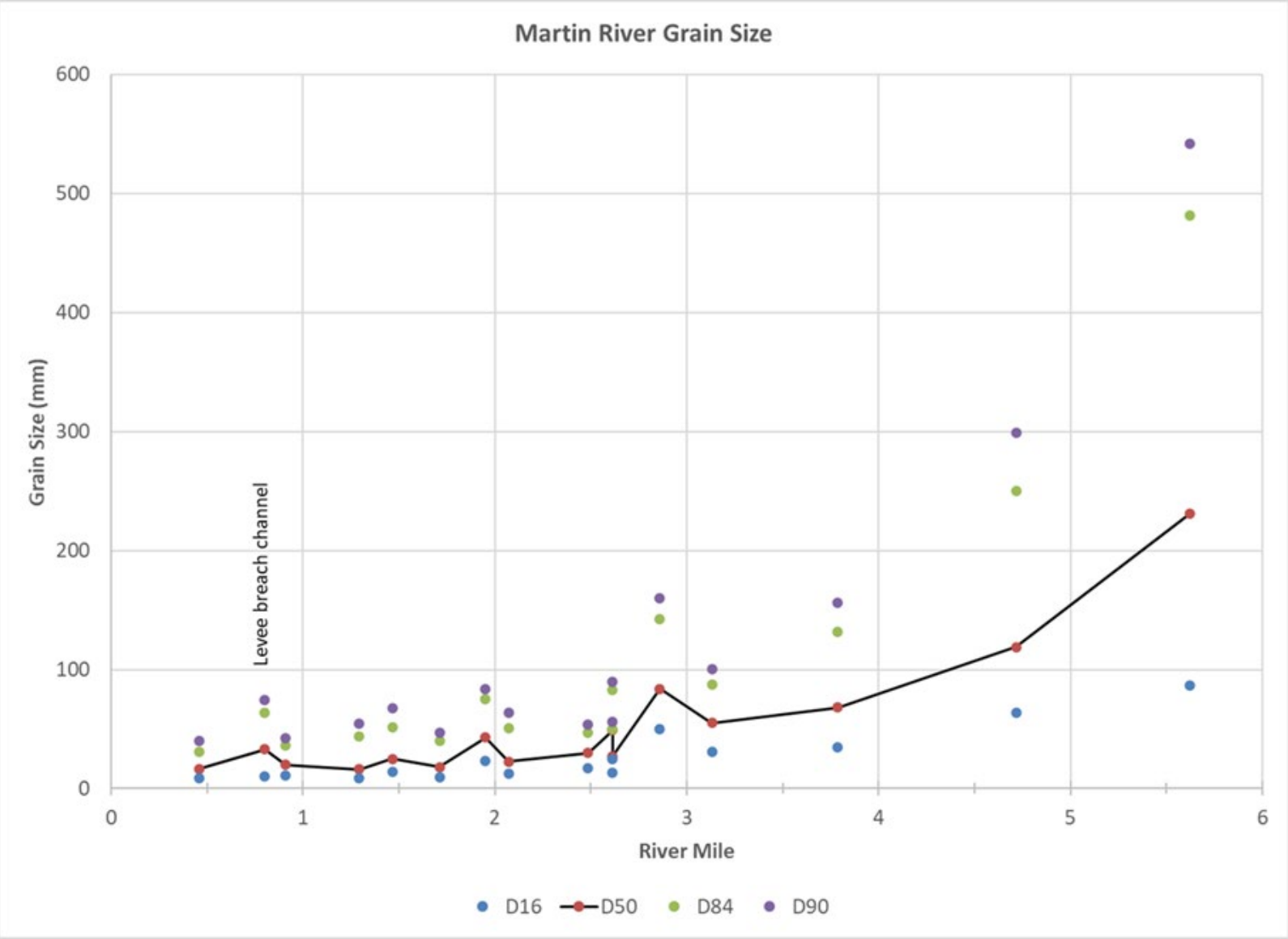


Geomorphic Unit Mapping

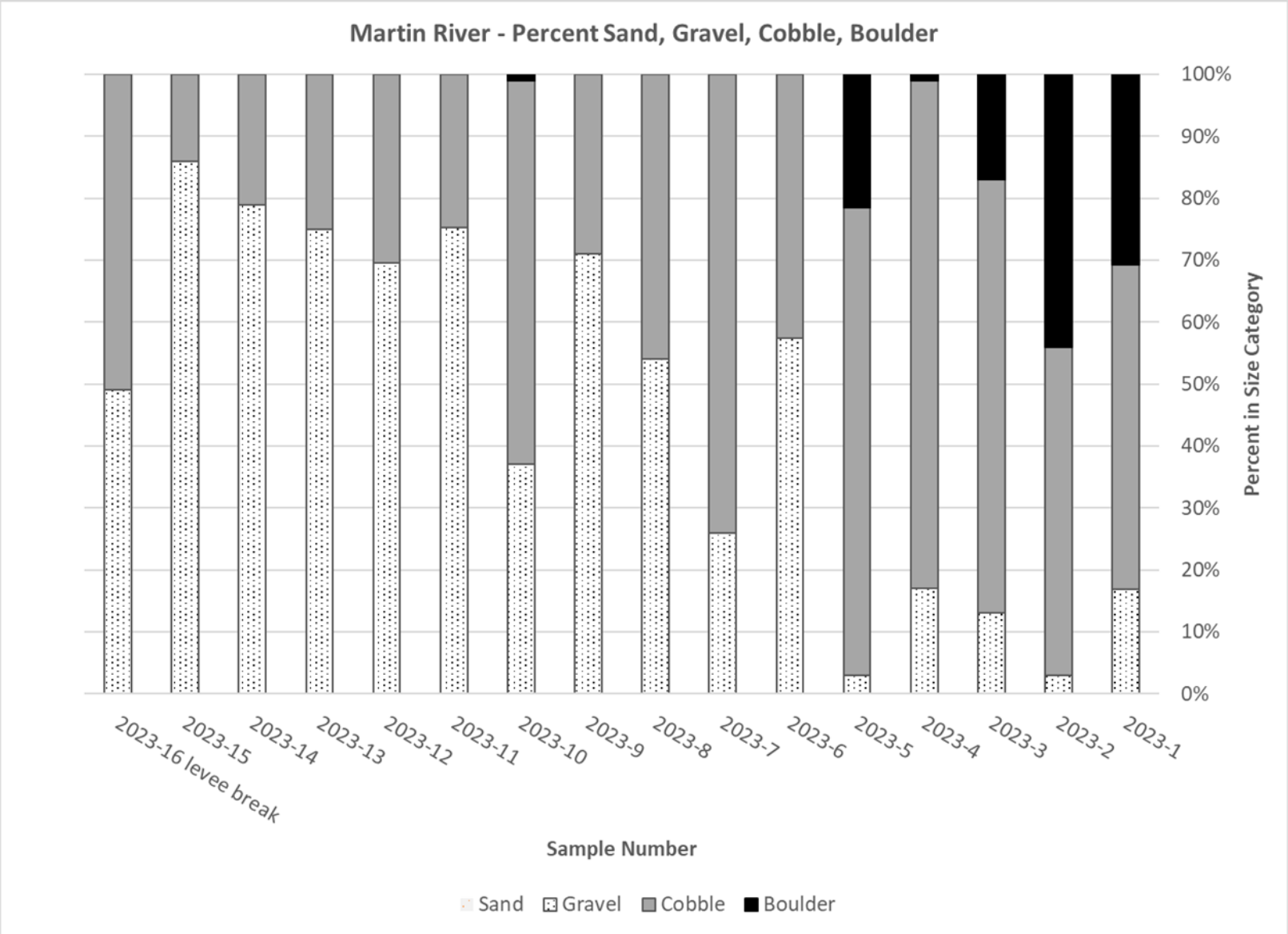
- Mapping of similar geomorphic process units in Martin River valley
 - Active channel
 - Off-channel/tributary habitat
 - Off-channel/tributary connectivity corridors
 - Forested with high flow channels
 - Vegetated (varying veg. heights/species – indicate time since river occupied these areas)



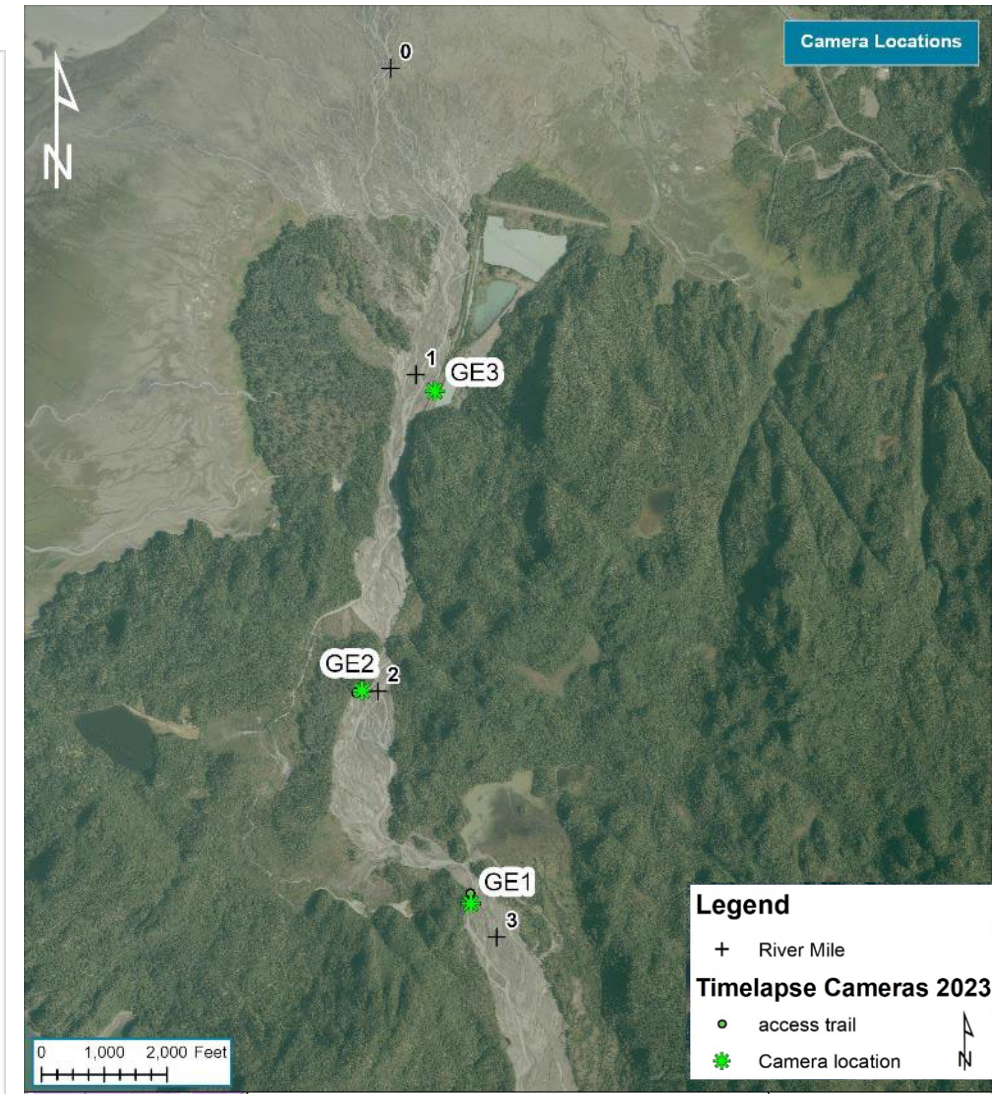
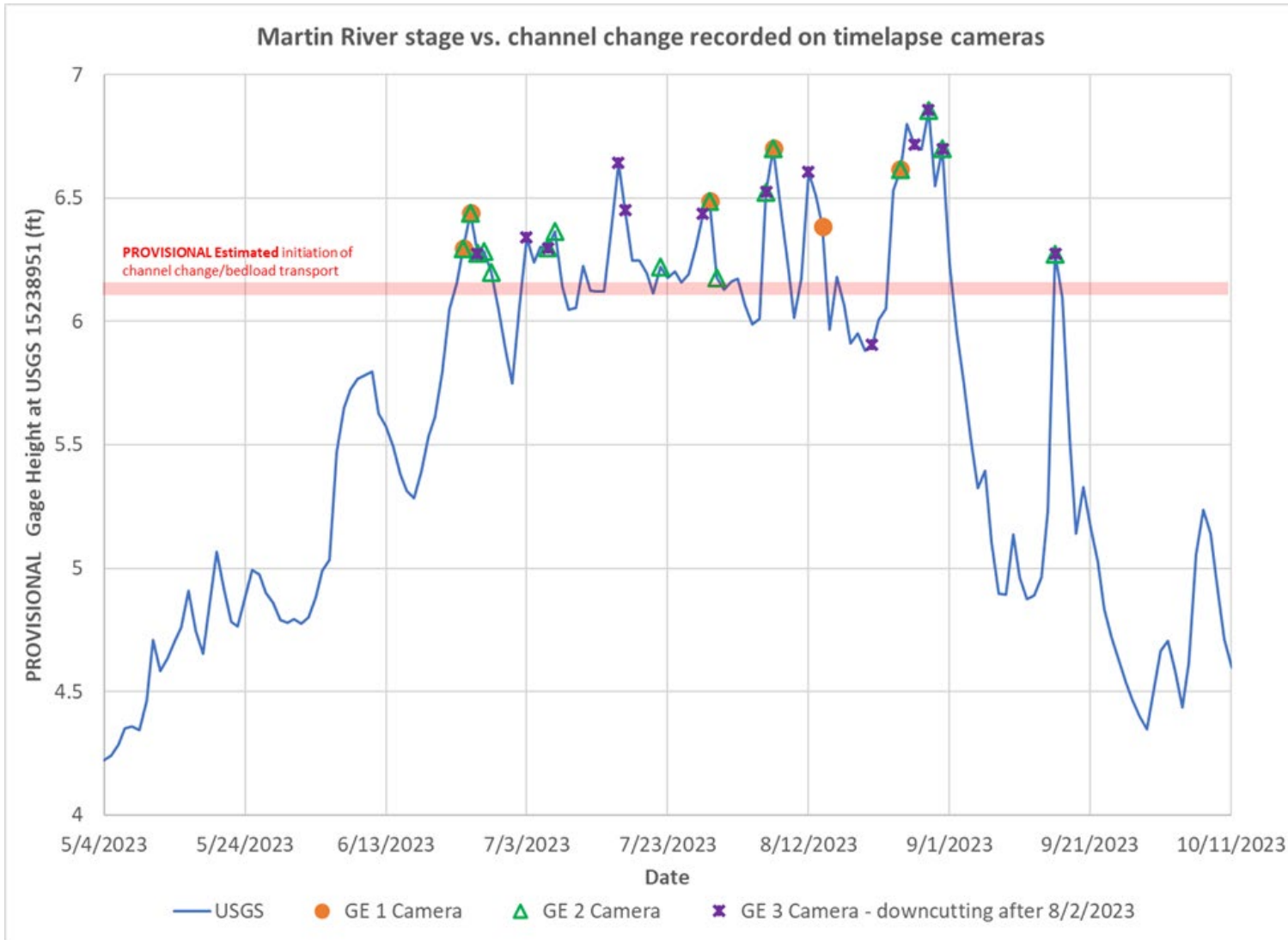
Pebble Counts



Pebble Counts



Timelapse Cameras

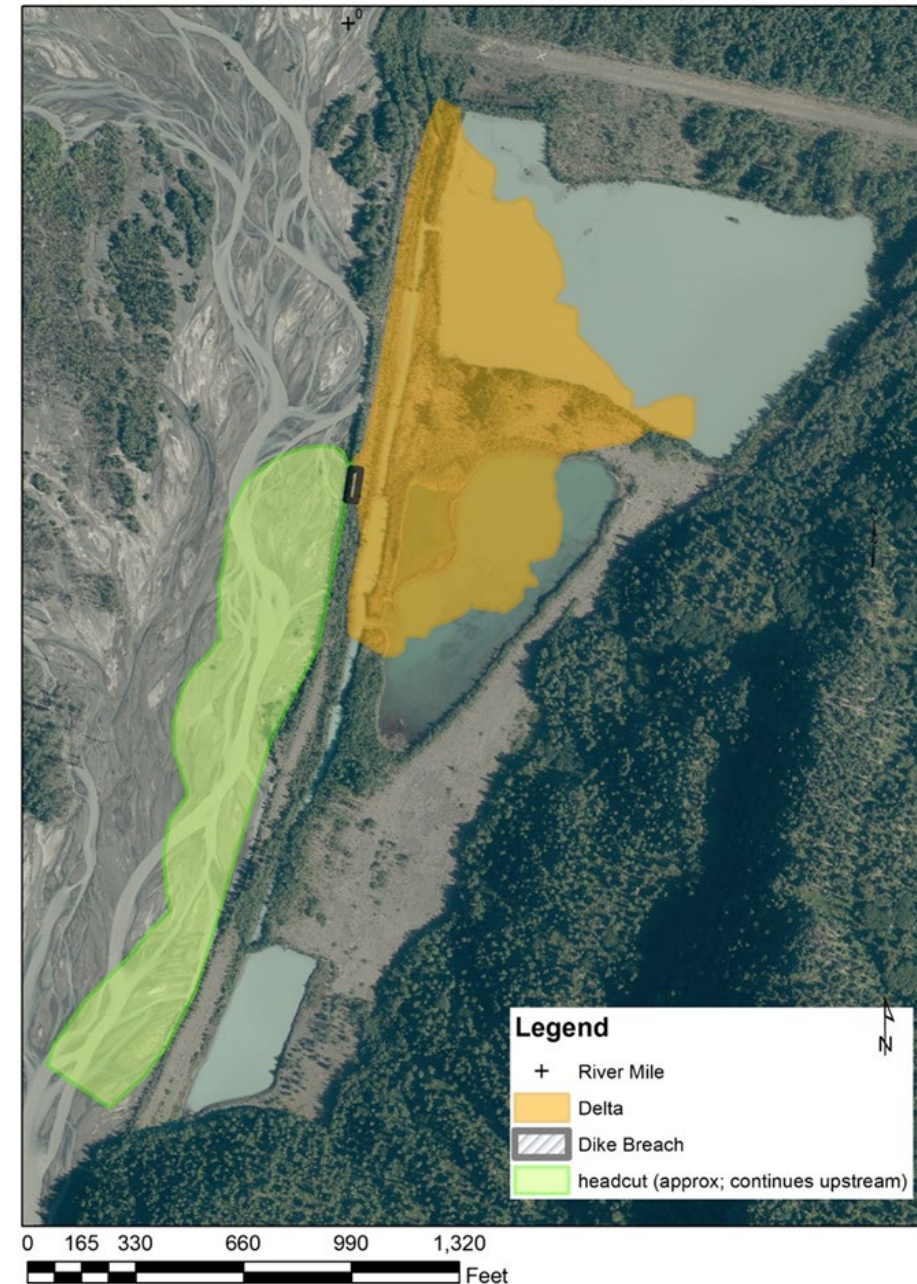


August 2023 Levee Breach at Mouth of Martin River

- River has been aggrading since levee constructed (1991). Levee was slightly overtopping during high flows in 2022
- River breached levee at beginning of August 2023
- All flow now into ponds/out northeast corner
- Progressive formation of new delta in ponds, headcutting in Martin River upstream from breach



August 2023 Levee Breach at Mouth of Martin River



Summary

- Martin River is a braided glacial river; high sediment load; rapidly aggrading system
- Substrate primarily gravel/cobble with boulder upstream from RM 4 (high sub-surface sand content)
- Braided channels migrate multiple times/year
- Current off-channel habitat areas were part of the active channel in past, will be again in future
- Channel adjustment to levee breach will continue for years to decades



Implications for 2024 Studies

- Due to the extremely active channel conditions, study results will be representative of the types of processes active in different reaches of the river rather than exact conditions in the future.
- Best to have all LiDAR/topographic surveys, aerial photography, and substrate sampling occur simultaneously so that a “snapshot in time” of river conditions can be used for hydraulic and geomorphic studies.
- Geomorphic reaches and map units will be revised at the mouth of the river to reflect the new river location resulting from the levee overtopping.
- Active headcutting and channel/base level changes should be considered when interpreting results from the stream gage in the constriction (Geomorphic Reach 5).



QUESTIONS?

BREAK



Water Quality Monitoring

- Kleinschmidt Associates:
Kai Steimle

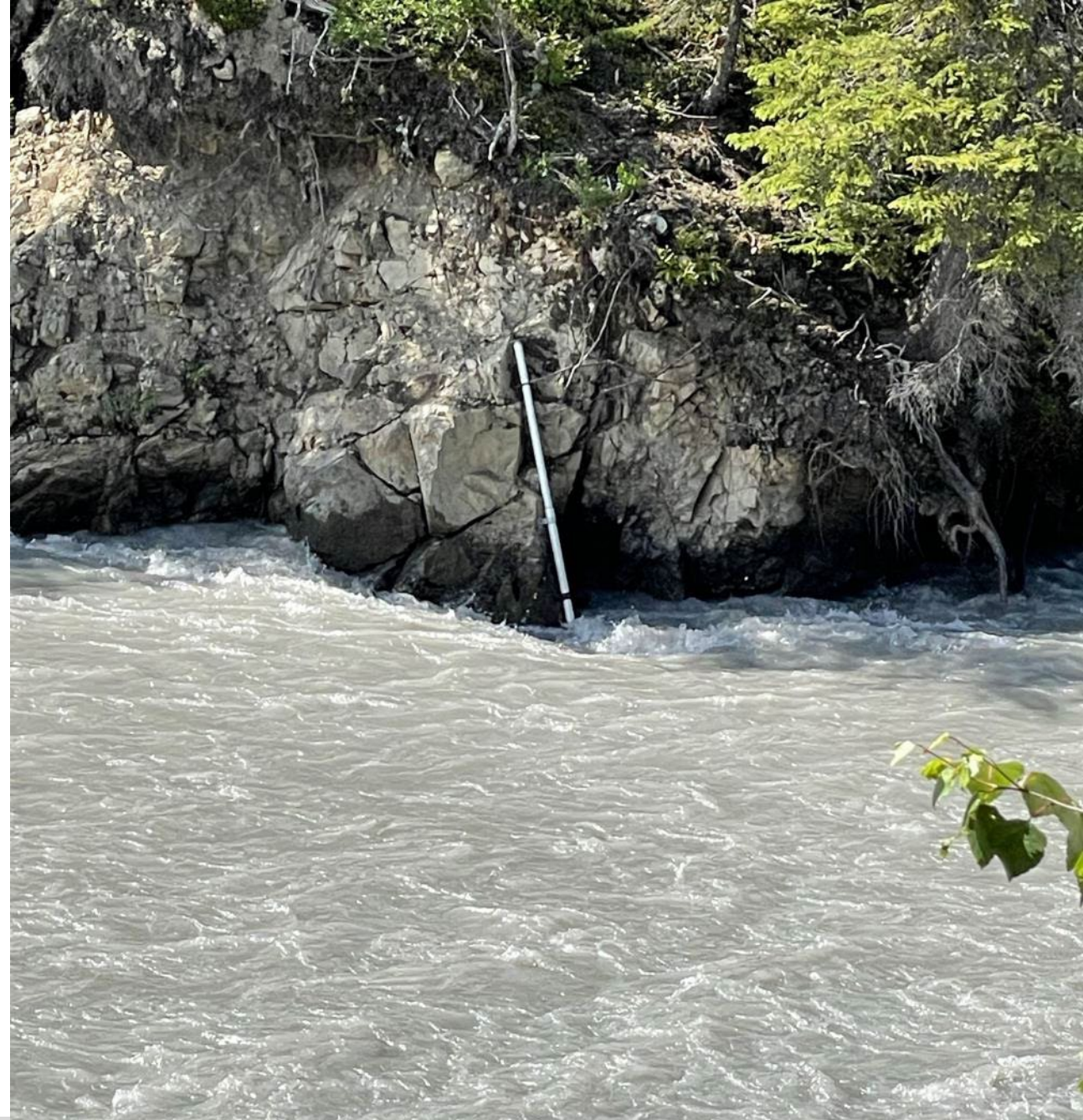


Background

- Comments to the DSP
 - USFWS: Requested year-round sampling
 - USFWS: Requested description of productive salmon runs in turbid glacial systems
- 2023 data collection
 - 2023 Water Quality Monitoring completed using study plan methods, report filed Feb 2024

Revisions to DSP

- Study area feature names and river miles updated
- Add redundant temperature loggers at monitoring sites to protect against data loss



Goals and Objectives

- Goal
 - Characterize water quality in the Martin River
- Objectives
 - Collection of water temperature, dissolved oxygen, turbidity, conductivity and pH data within the East Fork Martin River, West Fork Martin River, and Martin River mainstem and off-channel site



Study Area

- East Fork Martin River RM0.1 (Canyon mouth)
- West Fork Martin River RM0.1 (Red Lake outlet stream)
- Off-channel Outlet RM4.3R OCH
- Martin River RM 1.9

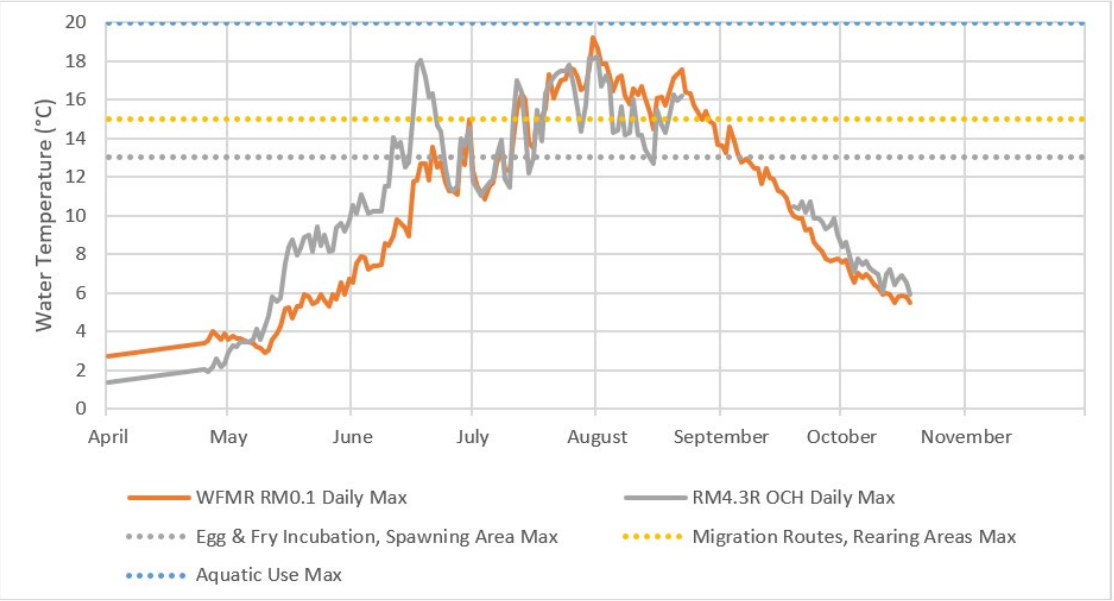
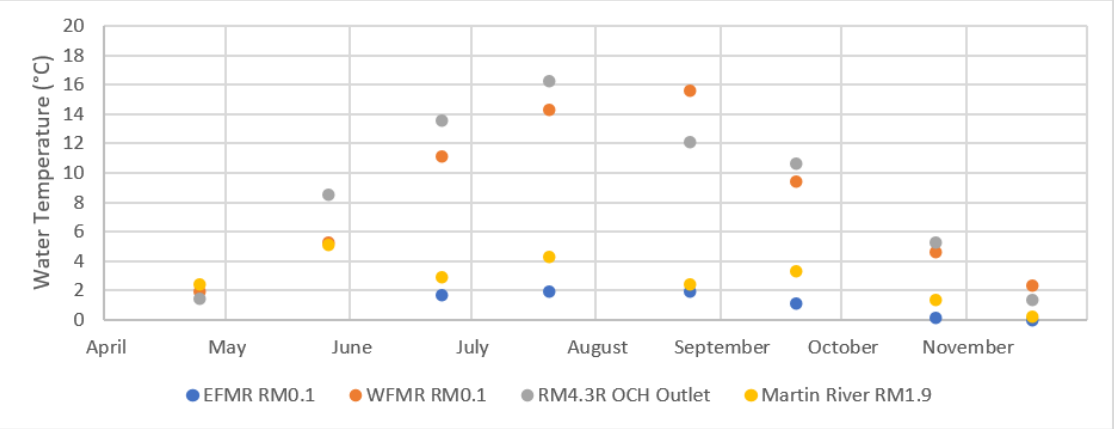


Methods

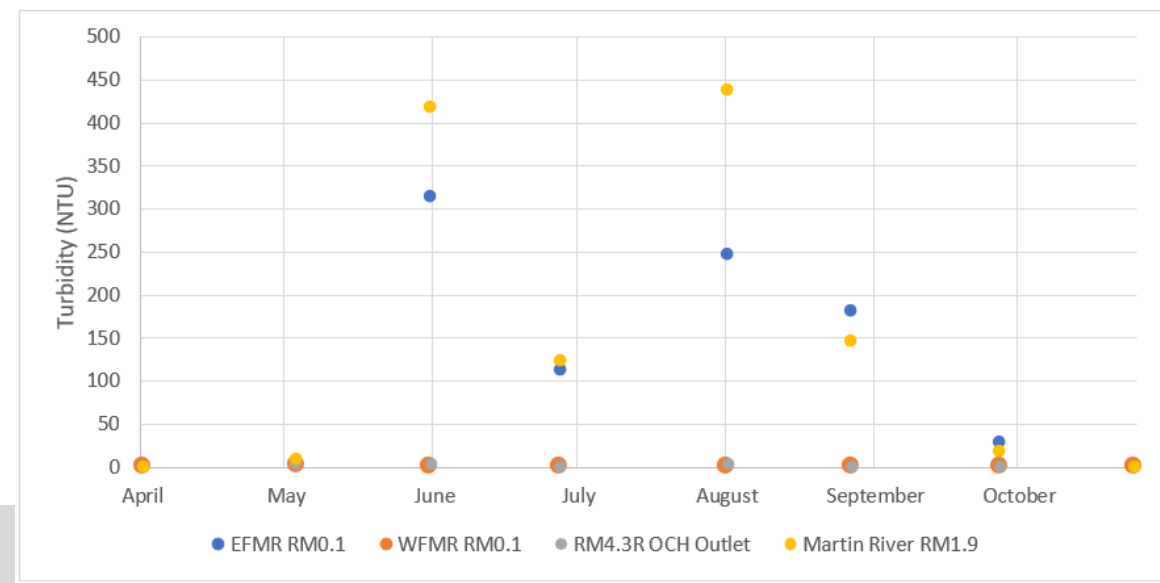
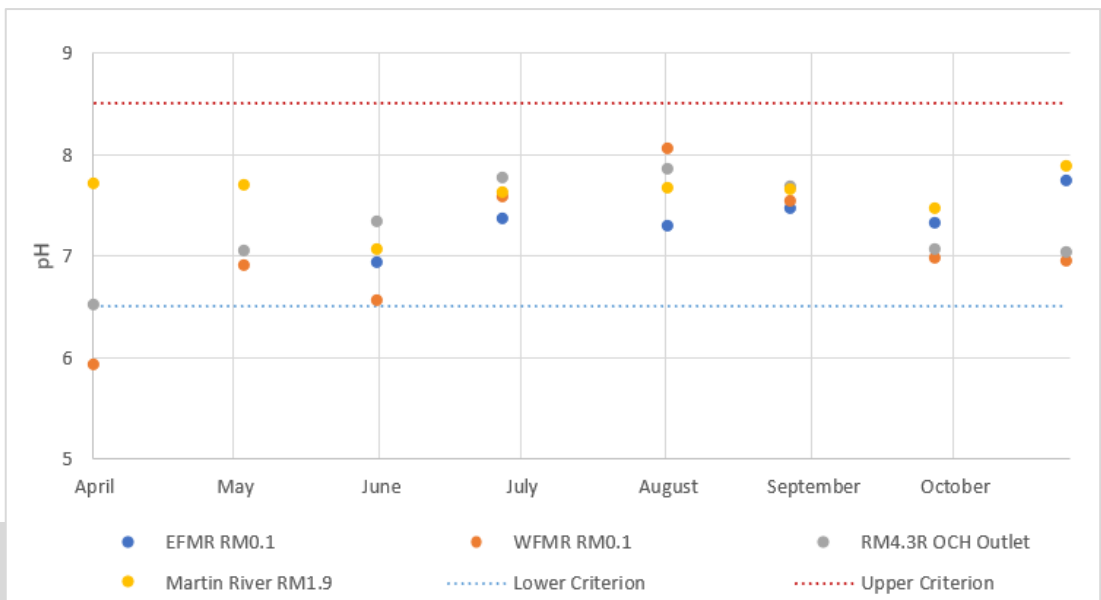
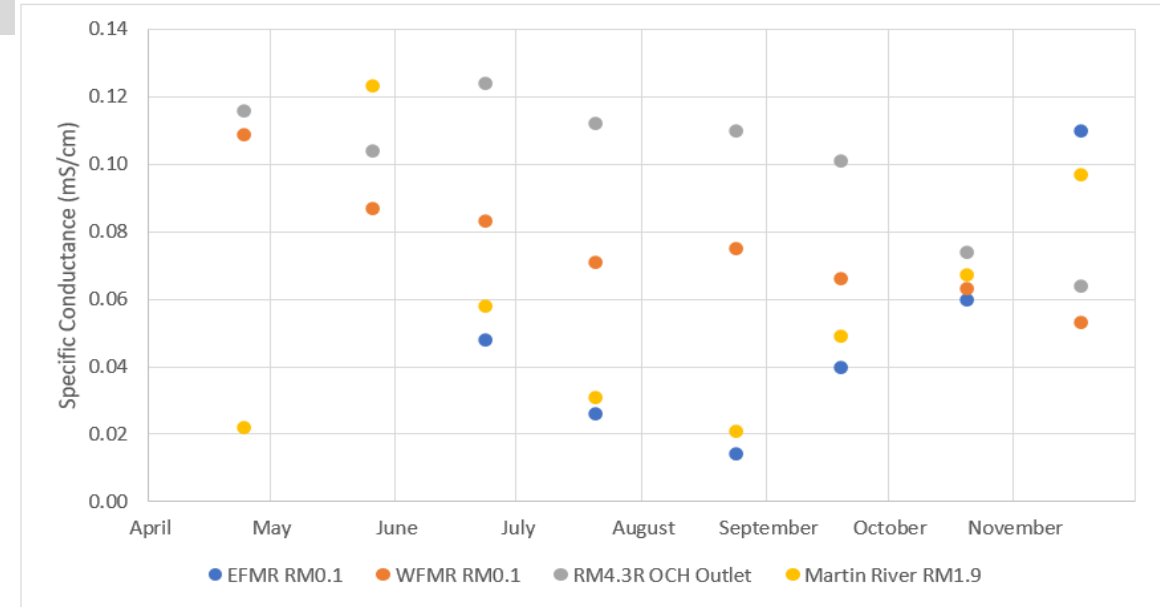
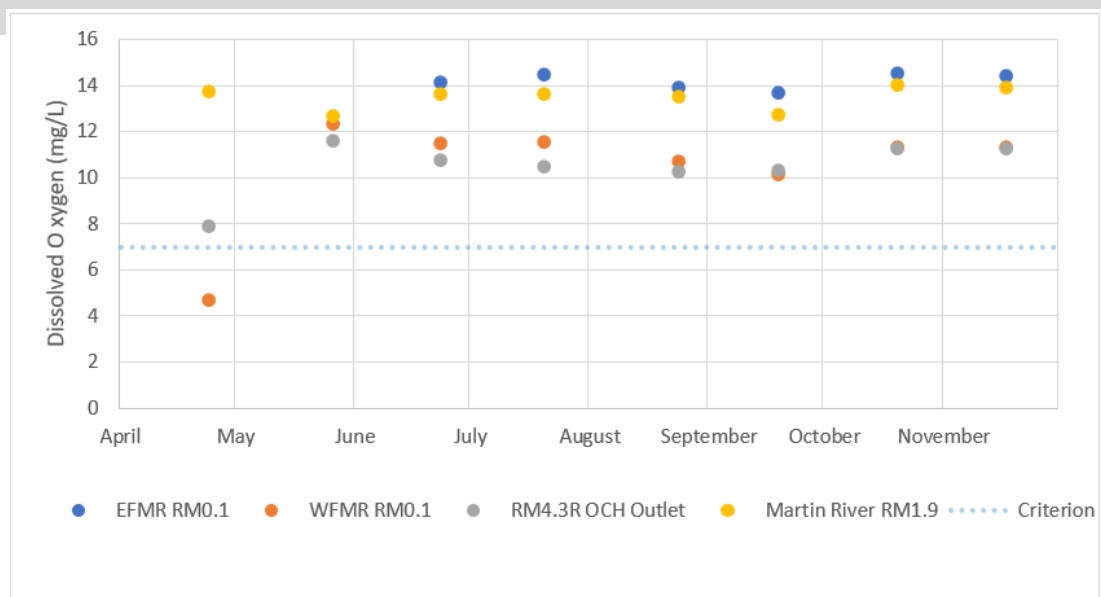
- May-October data collection
- Continuous temperature monitoring to produce daily min/max/mean summaries
- Monthly in-situ measurements of DO, turbidity, conductivity, and pH
- Sampling co-located with stream gaging sites



2023 Results: Temperature



2023 Results: DO, pH, Specific Conductance & Turbidity



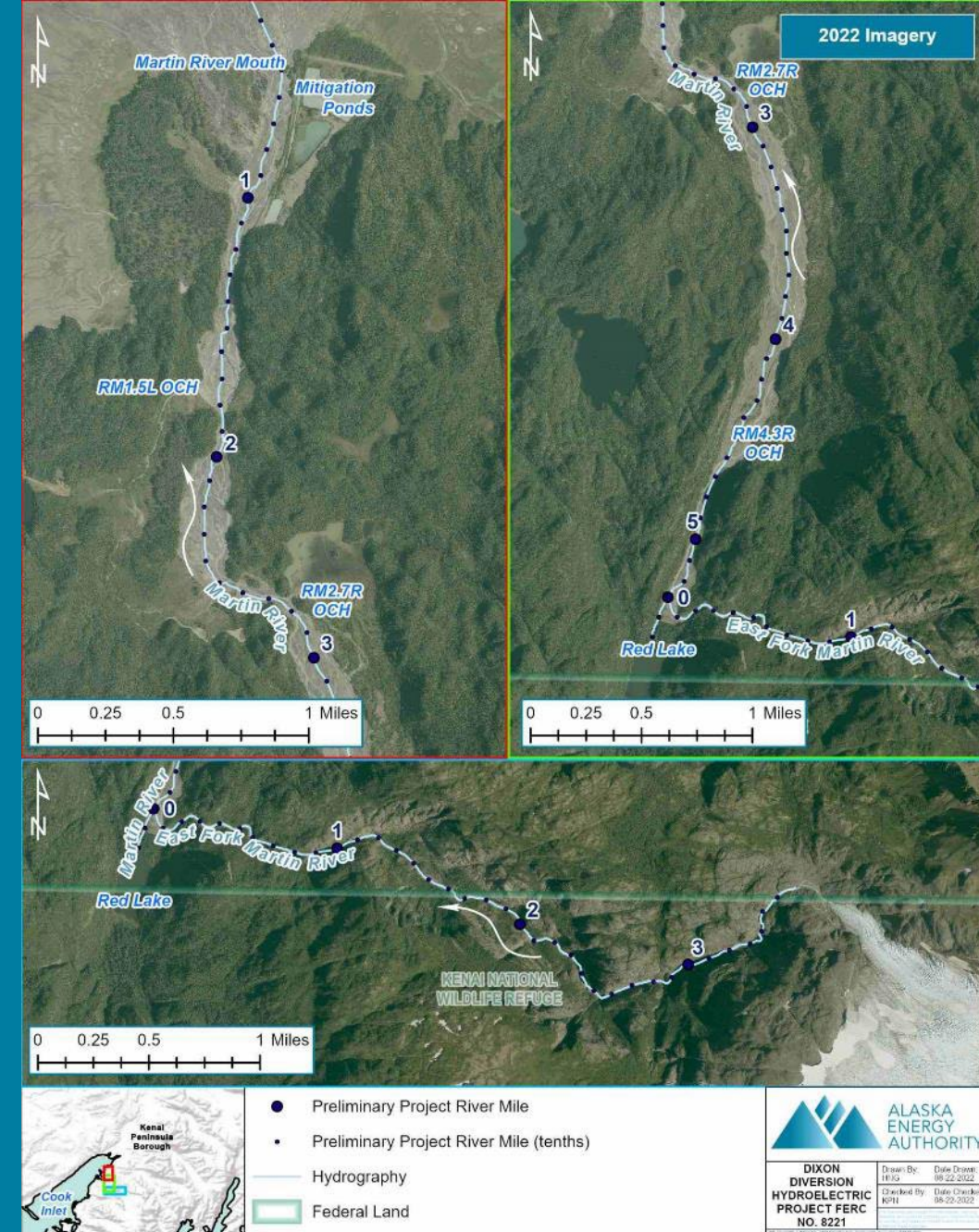
Schedule

- 2024
 - May-Oct monthly field data collection
 - 2024 Report



Aquatic Habitat Characterization

- Kleinschmidt Associates:
Kai Steimle



- Comments to the DSP

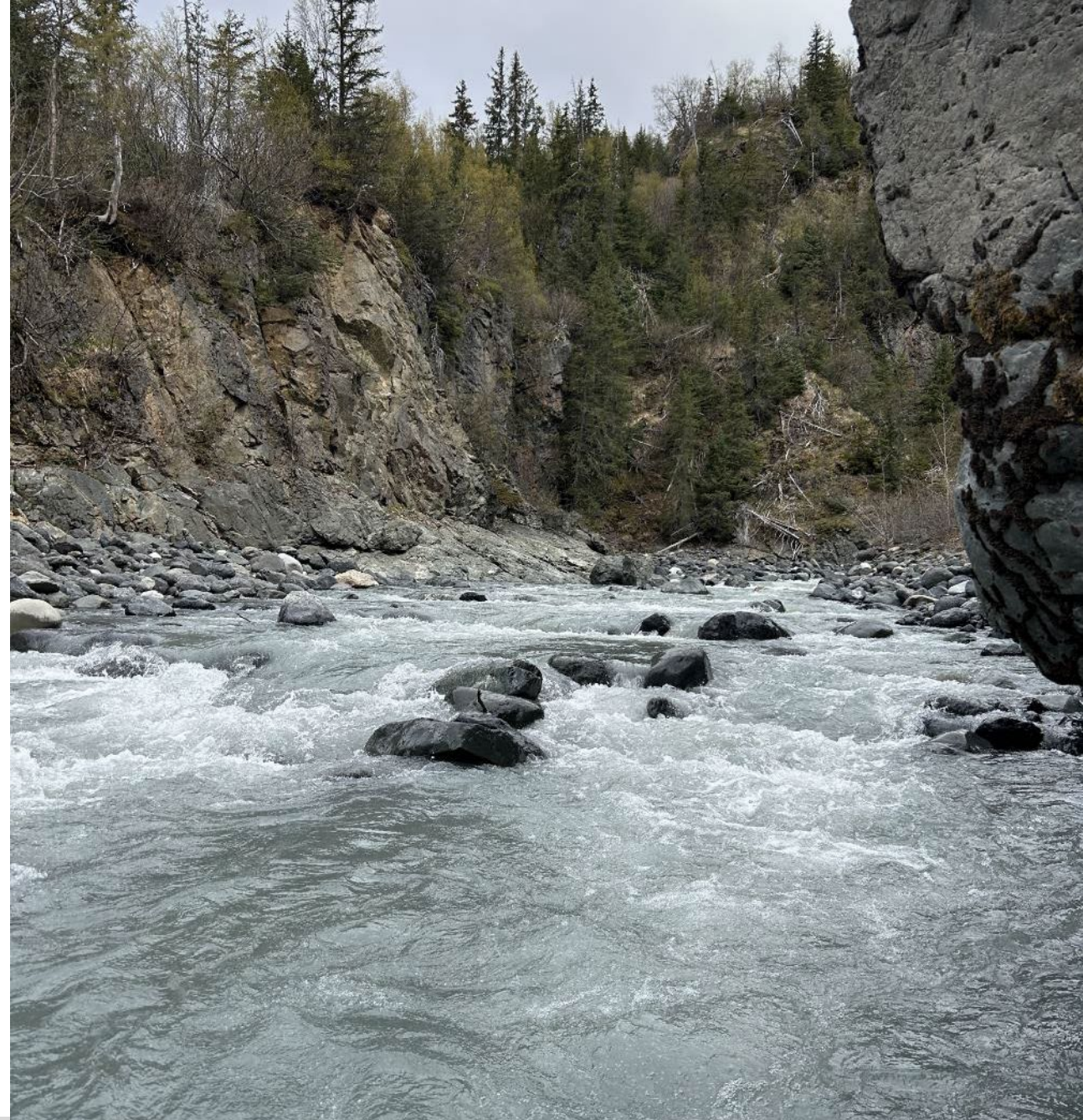
- USFWS: Use remote line mapping to delineate full extent of any tributaries or sloughs that could be fish bearing. Field verify and map until a permanent barrier is reached.
- USFWS: Identify groundwater inflow points within the main channel during field mapping.

- 2023 field reconnaissance

- Reconnaissance in East Fork Martin River canyon for potential fish barriers
- Geomorphic Reach designations

Proposed Modifications

- Study area feature names and river miles updated
- Add East Fork Martin River canyon fish passage barrier evaluation



Goals and Objectives

- Goal
 - Characterize aquatic habitat in the Martin River basin
- Objectives
 - Gather baseline data to evaluate changes in accessible aquatic habitats
 - Inform other aquatic studies

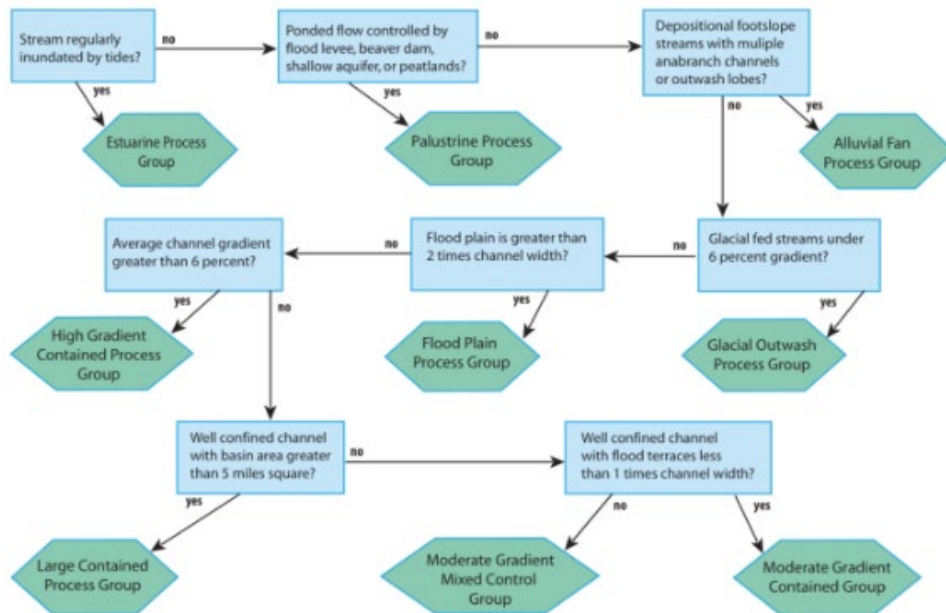


Methods – Remote Line Mapping

Hierarchically Nested Habitat Typing

- Geomorphic Reach
 - Macrohabitat Type
 - Mesohabitat Type

Key to Alaska Region Stream Process Groups



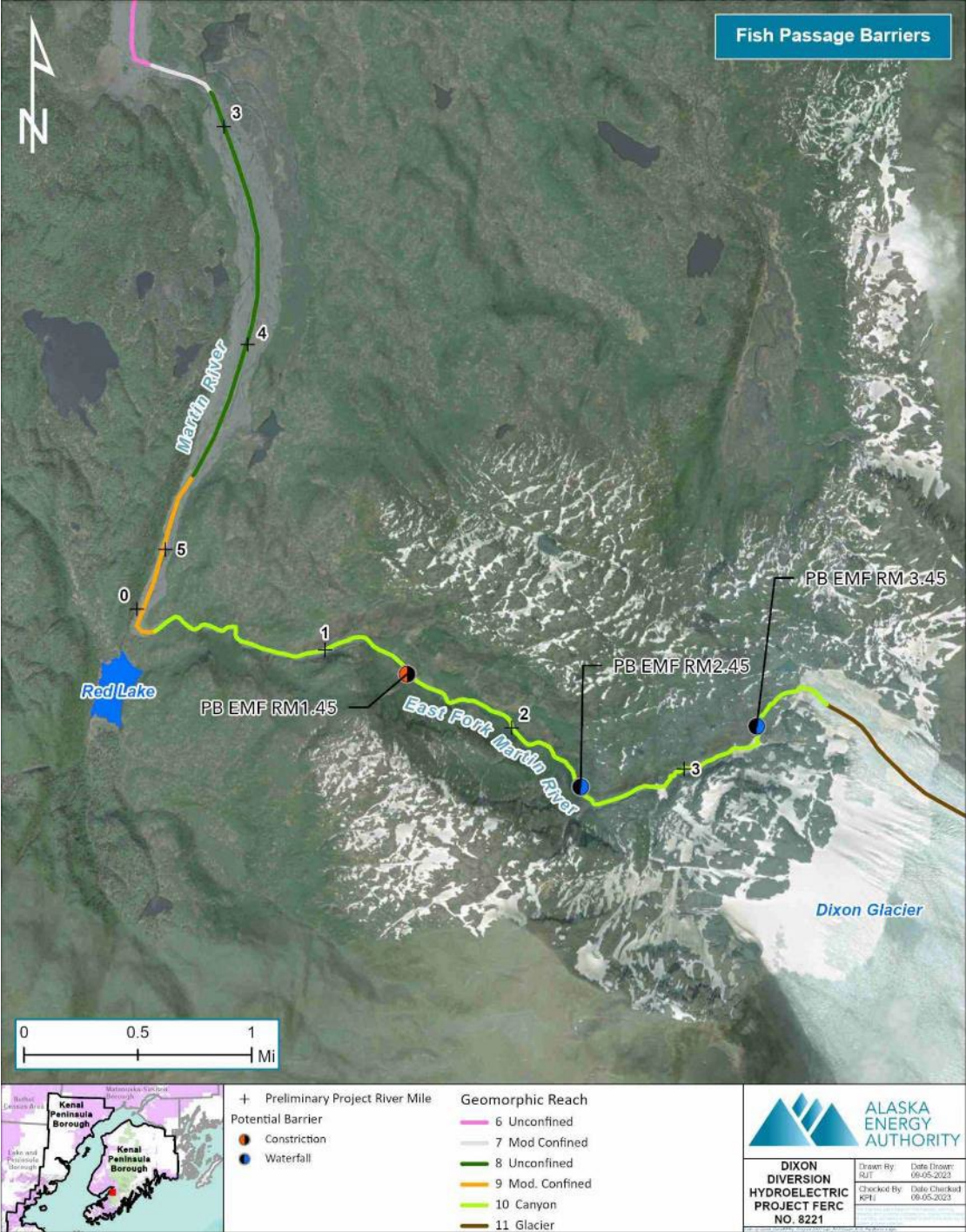
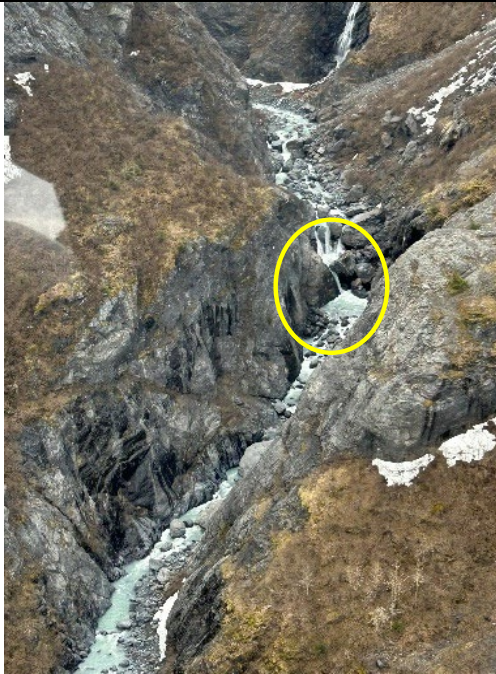
Methods – Ground Mapping

- Characterize clearwater habitats to the mesohabitat level
- Ground-truth a sample of remotely assigned macrohabitat classifications
- USFS Aquatic Habitat Surveys Protocol, Tier 1 and 2 (USFS 2001) with some modifications as needed due to flow conditions



EF Martin River: Fish Passage Barriers

POTENTIAL BARRIER NAME	PB_EFM_RM1.45	PB_EFM_RM2.45	PB_EFM_RM3.45
EAST FORK MARTIN RIVER MILE	1.45	2.45	3.45
BARRIER TYPE	VELOCITY BARRIER AT CONSTRICTION; SEASONAL OR PARTIAL	FALLS	FALLS



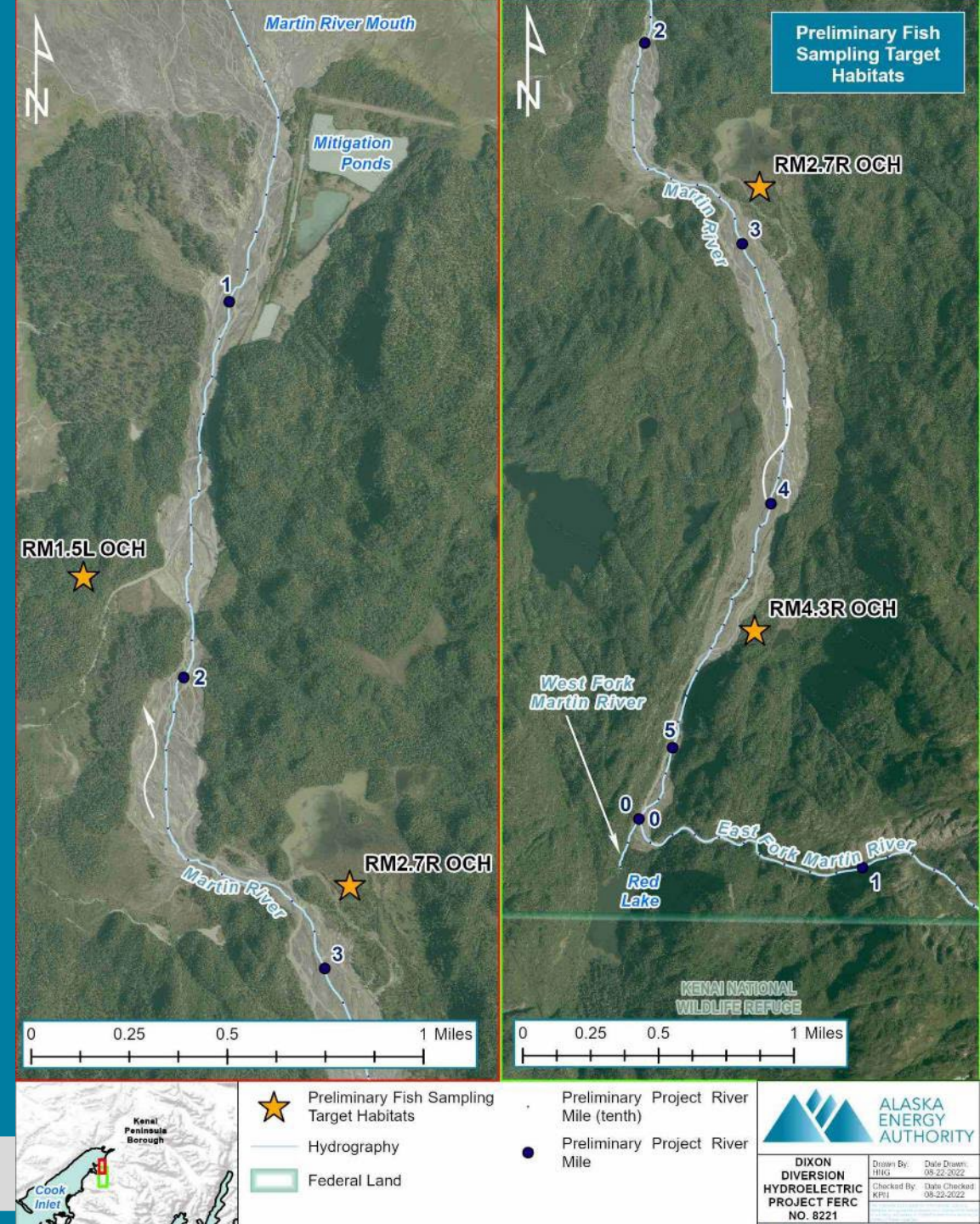
Schedule

- 2024
 - May/June 2024 – Ground Mapping Data Collection
 - July-September 2024 – Remote Line Mapping
 - October 2024 – Ground Mapping Data Collection
 - 2024 Report



Martin River Fish Use

- Kleinschmidt Associates:
Kai Steimle



Background

- Comments to the DSP (11/17/22 mtg and 12/22 filings)
 - USFWS: Document fish use November through April
 - USFWS: AVCT data represents minimum count valuable for run timing and annual variability in run strength
 - USFWS: Support extension of AVCT operation season earlier and later than 2022 season
 - USFWS: Mainstem use by adult salmon may extend beyond diversion season (May-October)
 - ADFG: Mainstem use may include adult chum

- 2023 data collection and field reconnaissance
 - Eulachon spawning habitat evaluation
 - AVCT in West Fork Martin River

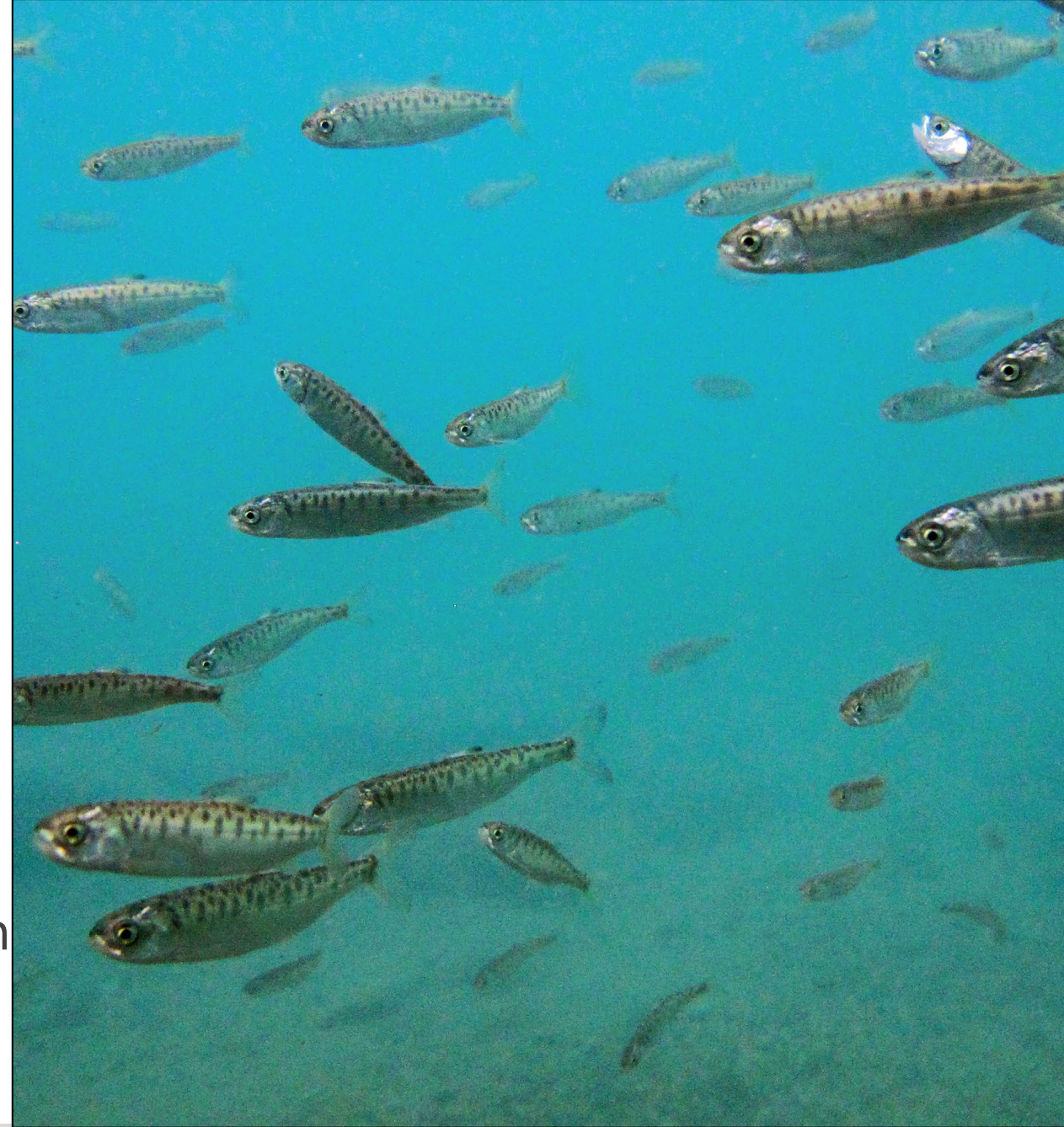
Revisions to DSP

- Study area feature names and river miles updated
- Removal of Eulachon sampling due to geomorphic changes at the mouth and higher channel gradient



Goals and Objectives

- Goal
 - Characterize fish use of Martin River basin with potential to be affected the proposed project
- Objectives
 - Characterize distribution and relative abundance in clearwater habitats
 - Estimate daily count of adult Pacific salmon at Red Lake outlet in WF Martin River
 - Document Pacific salmon and Eulachon adults



Methods

Relative Abundance in Clearwater Habitats

- Clearwater off-channel habitats and tributaries
- Fish sampling to potentially include
 - Minnow trapping
 - Electrofishing
 - Seining
- Catch per unit effort
- Water quality data: temperature (°C), dissolved oxygen (mg/L and percent saturation), conductivity, water clarity



Methods

Autonomous Video Counting Tower

- 2024 as Year 3 of study
- Above-stream remote video and digital time-lapse recording equipment record adult fish entry into Red Lake
- Installed Early June to Mid-October



Methods

Pacific Salmon Spawning

- Visual surveys of off-channel clearwater habitats and mainstem mixing zones in October
- Adults, carcasses, redds if evident
- Will include locations of any young-of-the-year observations from Objective 1
- Summer 2024 survey effort of select side channel habitats identified in Study 4.5 as having suitable substrate and the potential for upwelling, as flow conditions allow



Schedule

- 2024
 - Fish distribution and abundance
 - Red Lake outlet AVCT
 - Clearwater spawning surveys
 - 2024 Study Report
- 2025
 - Fish distribution and abundance
 - Clearwater spawning surveys and potential side channel spawning surveys
 - 2025 Study Report



Martin River Fish Use: Red Lake AVCT

- Alaska Department of Fish and Game:
Ted Otis



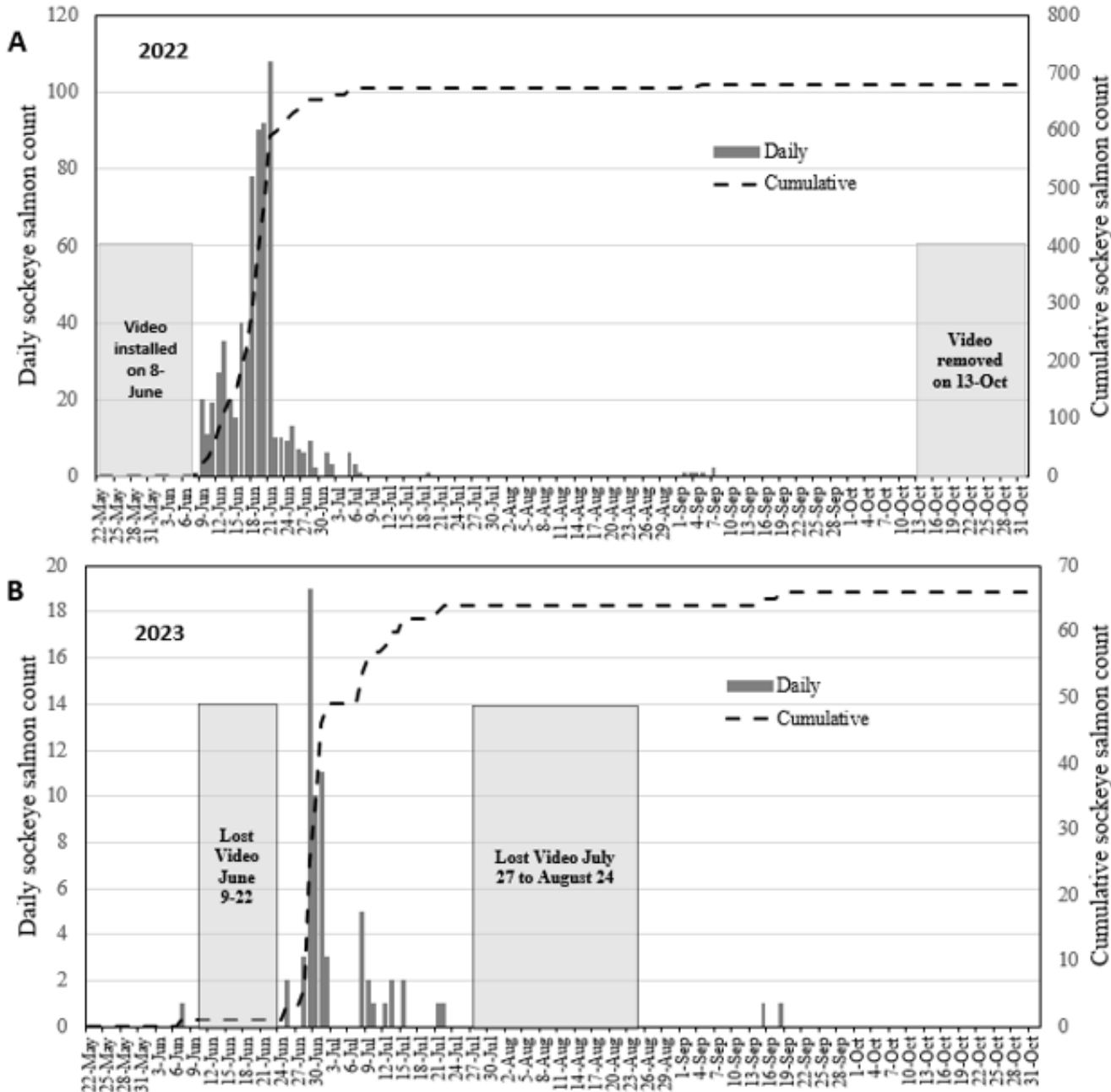


Red Lake AVCT

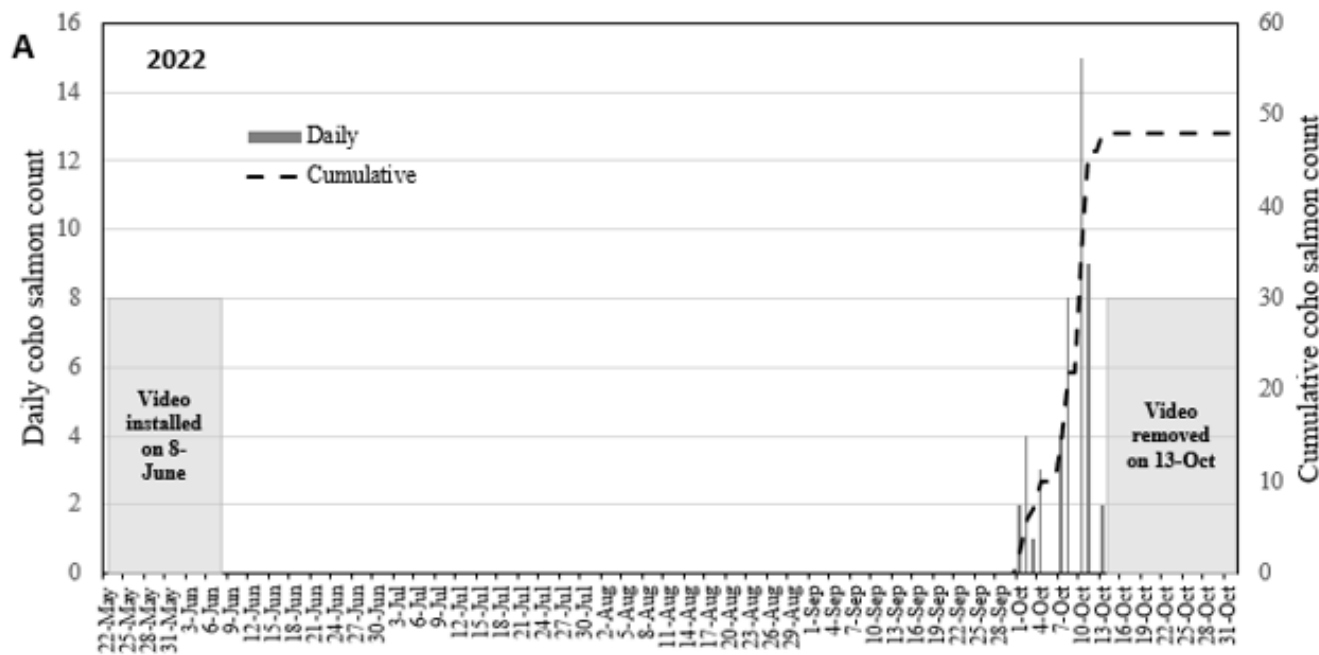
- 2023 Operations
 - Operated 22 May through 1 Nov (164 d)
 - 2,960 h of video recorded
 - 2 interruptions (9-22 Jun, 27 Jul-24 Aug)
 - Video down 42 of 164 d (26.8%)
 - UW light added for nocturnal monitoring
- 2023 Results
 - 66 adult Sockeye salmon (681 in 2022)
 - 205 adult Coho salmon (48 in 2022)
 - 97.5% of the Coho counted at night
 - 58 Dolly Varden char (53 in 2022)
 - 16 species of wildlife, including: brown and black bear, coyote, mountain goat

Red Lake Sockeye Salmon

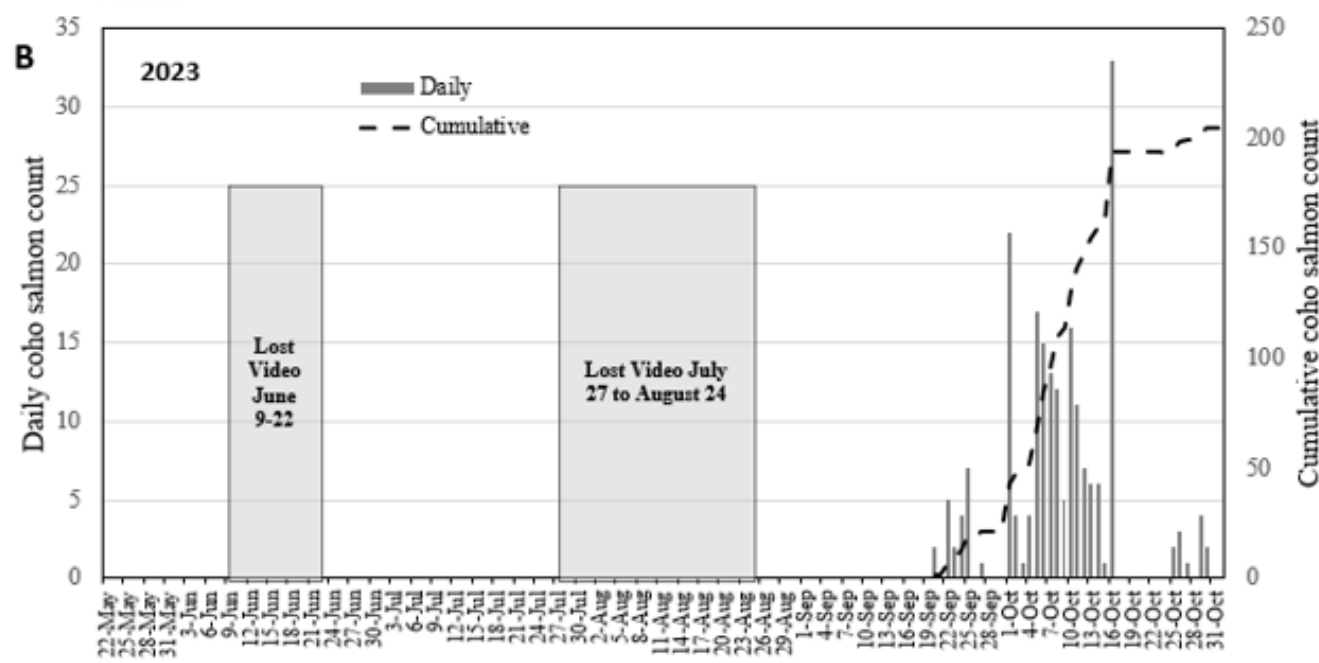
- 2022 Run Timing
 - Video installed 8 June
 - 1st fish on 8 June (install day)
 - Peak count (108) on 21 June
 - Tail of run ~ 6 July
- 2023 Run Timing
 - Video installed 22 May
 - 1st fish on 7 June
 - Peak count (19) on 29 June
 - Tail of run ~ 15-22 July



A



B



Red Lake Coho Salmon

2022 Run Timing

- Video removed on 13 October
- 1st fish on 1 October
- Peak count (15) on 10 October
- Tail of run ? (video out 13 Oct)
- No UW light/no night counts

2023 Run Timing

- Video installed 22 May
- 1st fish on 20 September
- Peak count (33) on 16 October
- Tail of run ~30 October
- 97.5% of coho passed at night

RED LAKE AVCT QUESTIONS?

OTHER AQUATIC RESOURCE QUESTIONS?

Next Steps

- Kleinschmidt Associates:
Betsy McGregor





Dixon Diversion Project Study Plans

- **Terrestrial Resources**
 - Wetlands and Vegetation Studies
 - Vegetation & Wildlife Habitat Mapping
 - Wildlife Habitat Evaluation
 - Raptor Nesting and Migration

- **Cultural Resources**

Study Plan Schedule

- Terrestrial Resources Study Planning Meeting
 - March 2024
- NHPA Section 106 Consultation Meeting
 - March 2024
- Final Study Plan
 - April 2024



Project Schedule

- Stage 2: Study Planning and Implementation

Responsible Party	Activity	Dates
AEA	Final Study Plan	April 2024
AEA	Conduct 2024 Season Studies	Spring/Summer 2024
Stakeholders	2024 Field Season Debrief Meeting	Nov/Dec 2024
AEA	2024 Study Reports	Jan 2025
Stakeholders	Comments on Study Reports	Feb 2025
Stakeholders	Pre-Field Season Meeting	Apr 2025
AEA	Conduct 2025 Season Studies	Spring/Summer 2025
Stakeholders	2025 Field Season Debrief Meeting	Nov/Dec 2025
AEA	2025 Study Reports	Jan 2026
AEA	Draft Amendment Application	Apr 2026
FERC/Stakeholders	Comments on Draft Amendment Application	Jun 2026

Project Schedule



- Stage 3: Study Planning and Implementation

Responsible Party	Activity	Dates
AEA	Final Amendment Application	September 2026
FERC	FERC Notice of Amendment	Anticipated November 2026
Stakeholders	Comments on Amendment Application	Anticipated February 2027
FERC	FERC EA/EIS	TBD
AEA	FERC Amendment Order	TBD

Thank you for your participation!