2012 Technical Memorandum:

Mapping of Aquatic Macrohabitat Types at Selected Sites in the Middle and Lower Susitna River Segments from 1980s and 2012 Aerials

Technical Workgroup Meeting
March 28, 2013

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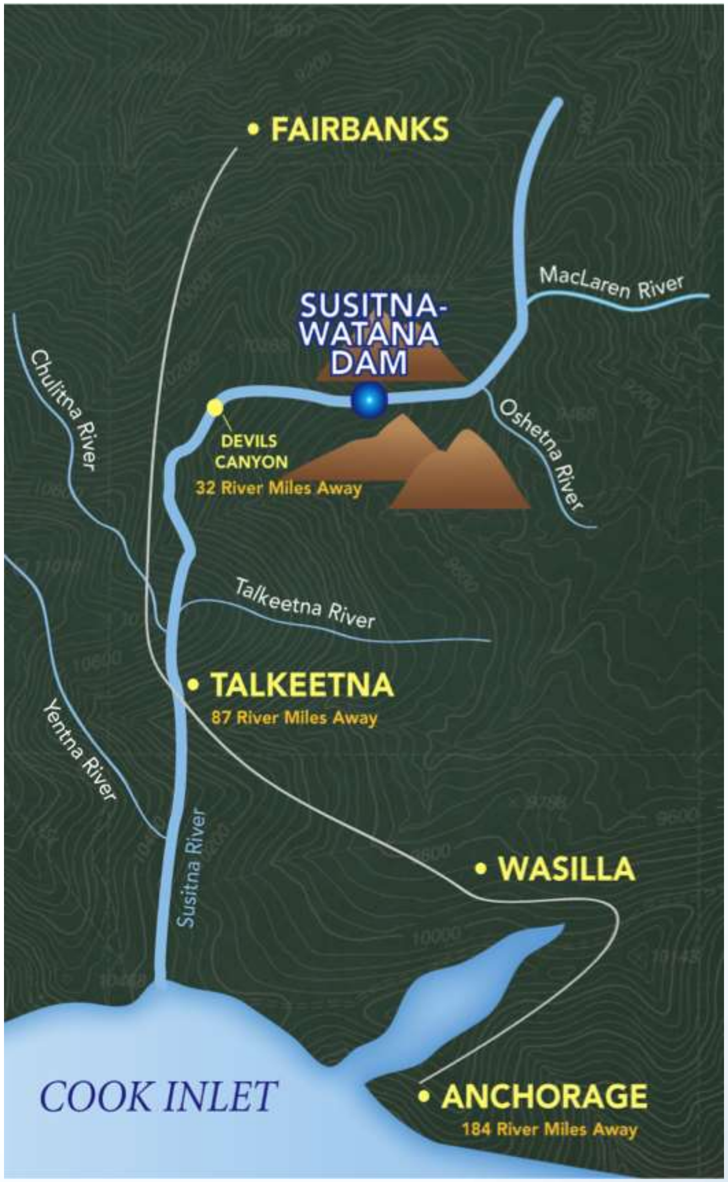
Prepared for: Alaska Energy Authority



2012 Study Technical Memorandum: *Mapping of Aquatic Macrohabitat Types at Selected Sites in the Middle and Lower Susitna River Segments from 1980s and 2012 Aerials*

- Part of 2012 Study – G-S2: Aquatic Habitat and Geomorphic Mapping of the Middle river using Aerial Photography
- Part of 2012 Study - G-S4: Reconnaissance-Level geomorphic and Aquatic Habitat Assessment of Project Effects on Lower River Channel

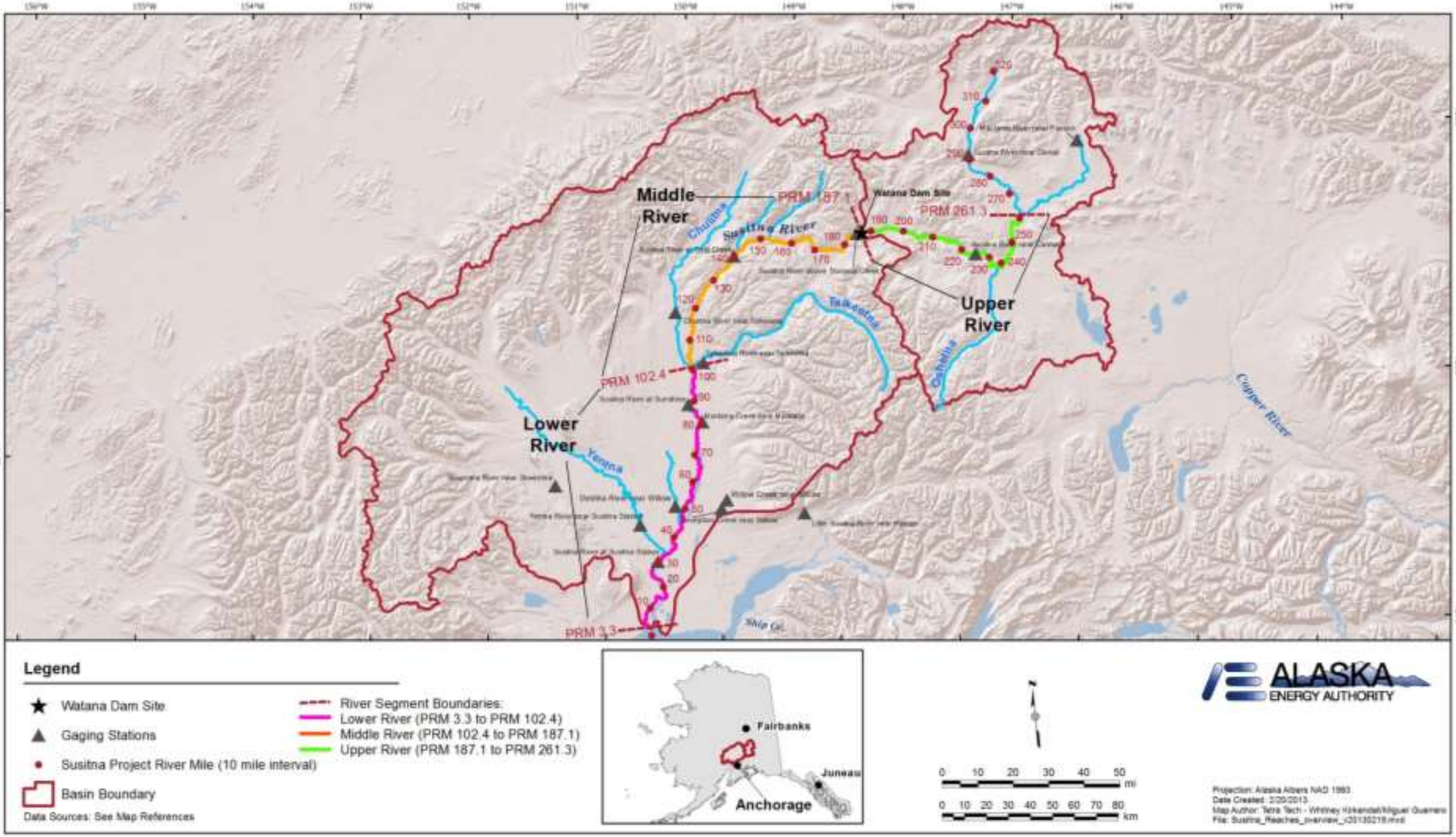
- Date Filed with FERC: March 2013
- Date Posted to AEA website: March 2013

Study Objectives

- Overall Goal: Quantify aquatic macrohabitat types at selected sites in the Middle and Lower River
- Objectives:
  - Identify wetted surface area of various macrohabitat types for 1980s & 2012 conditions
  - Compare changes in aquatic macrohabitat areas
  - Assess applicability of 1980s data sets to describe and supplement current data

Study Areas

Middle & Lower River Segments



Middle River Methodology

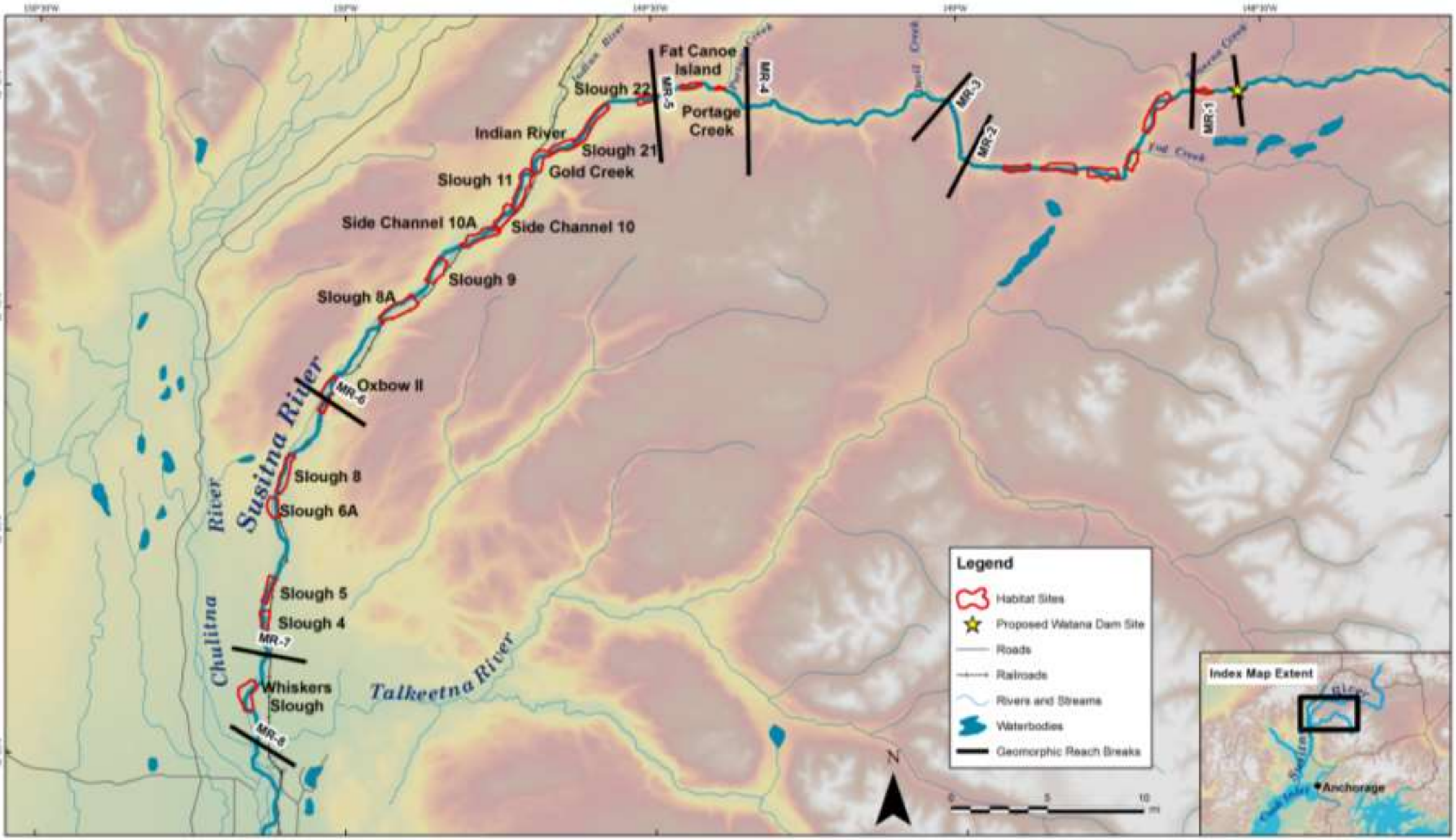
- Acquire 2012 aerials (12,900 cfs & 17,000 cfs)
- Obtain 1980s aerials (12,500 cfs)
- Delineate aquatic macrohabitat types
  - Delineate within 17 selected habitat sites, 6 additional
  - All wetted habitat / must have wetted connection
  - Calculate areas
  - Scale 2012 areas to target flow (1980s discharge)
- Macrohabitat Type Area Tabulation
  - Site
  - Reach

Middle River Site Selection

- 17 selected sites in Middle River for temporal comparison between PRM 104 to PRM 153
- Sites total 27.2 miles (> 50 %) of 49-mile total length
- 6 additional site above Devils Canyon

Habitat Site		Project River Mile (*River Mile*)[1]		Site Length (miles)	Geomorphic Reach
Number	Name	Upstream	Downstream		
Middle Susitna River Segment					
23	Below Dam	185.7	184.7	1	MR-1
22	MR-2 Island Bend	183.5	180.8	2.7	MR-2
21	MR-2 Tributary	179.7	178.7	1	MR-2
20	MR-2 Straight	177.8	176.1	1.7	MR-2
19	MR-2 Wide	175.4	173.6	1.8	MR-2
18	MR-2 Narrow	173	171.6	1.4	MR-2
17	Portage Creek	152.3	151.8	0.5	MR-5
16	Fat Canoe Island	151.0	149.9	1.1	MR-5
15	Slough 22	148.3	147.4	0.9	MR-6
14	Slough 21	145.8	143.1	2.7	MR-6
13	Indian River	143.1	141.7	1.4	MR-6
12	Gold Creek	141.6	140	1.6	MR-6
11	Slough 11	140	137.6	2.4	MR-6
10	Side Channel 10	137.6	136.3	1.3	MR-6
9	Side Channel 10A	136.1	134.1	2	MR-6
8	Slough 9	132.8	131.3	1.5	MR-6
7	Slough 8A	130.2	128	2.2	MR-6
6	Oxbow II	124	122.7	1.3	MR-6
6	Oxbow II	122.7	121.9	0.8	MR-7
5	Slough 8	119	116.9	2.1	MR-7
4	Slough 6A	116.5	115.5	1	MR-7
3	Slough 5	112.1	110.7	1.4	MR-7
2	Slough 4	110.2	108.7	1.5	MR-7
1	Whiskers Slough	105.9	104.4	1.5	MR-8

Study Sites – Middle River



Methodology - Area Scaling

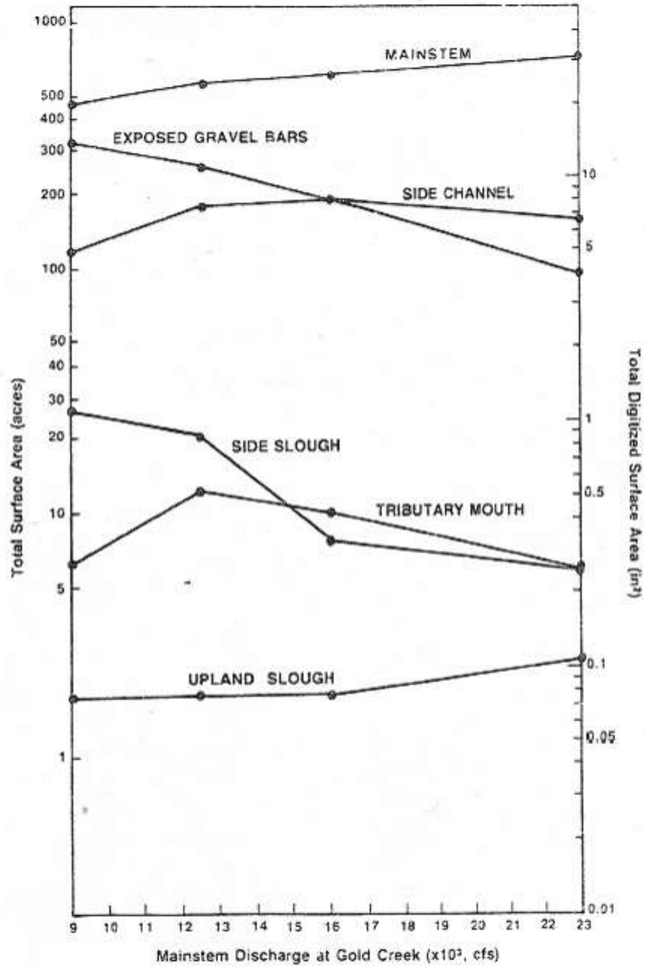


FIGURE 8 Surface area responses to mainstem discharge in the Gold Creek-to-Devil Canyon reach of the Susitna River (RM 138 to 149).

Area-Discharge relationships from the 1980s study were used to scale the habitat areas in 2012 to the target flows

Macrohabitat Type Classifications: Middle River

- Main Channel
- Side Channel
- Side Slough
- Upland Slough
- Tributary
- Tributary Mouth
- Vegetated Island

Main Channel

- Turbid water
- Convey > 10 % flow (approx.)
- Exposed substrate **not** included

Side Channel

- Turbid water
- Convey < 10 % flow (approx.)
- Exposed substrate **not** included

Side Slough

Whiskers Slough, PRM 104.4-105.9, 2012 aerial

- Clear water
- Non-vegetated upper thalwegs
- When overtopped at moderate to high mainstem discharge, conveys turbid water and classified as side channels

Upland Slough

- Clear water
- Vegetated upper thalwegs
- Rarely overtopped by mainstem discharge

Tributary

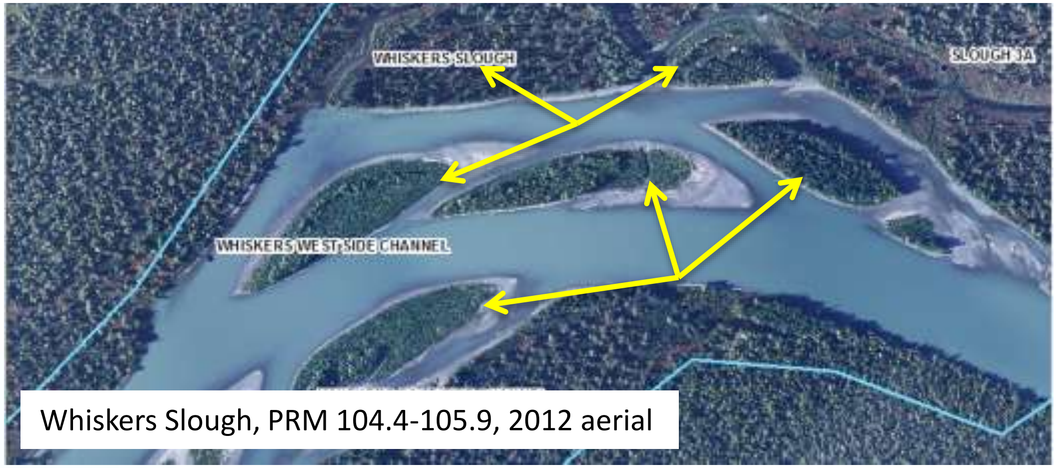
- Clear water
- Portion of tributary channel flowing across floodplain

Tributary Mouth

Indian River, PRM 141.7-143.1, 2012 aerial

- Clear water
- Areas where tributary flows into main or side channel habitats
- Includes backwater

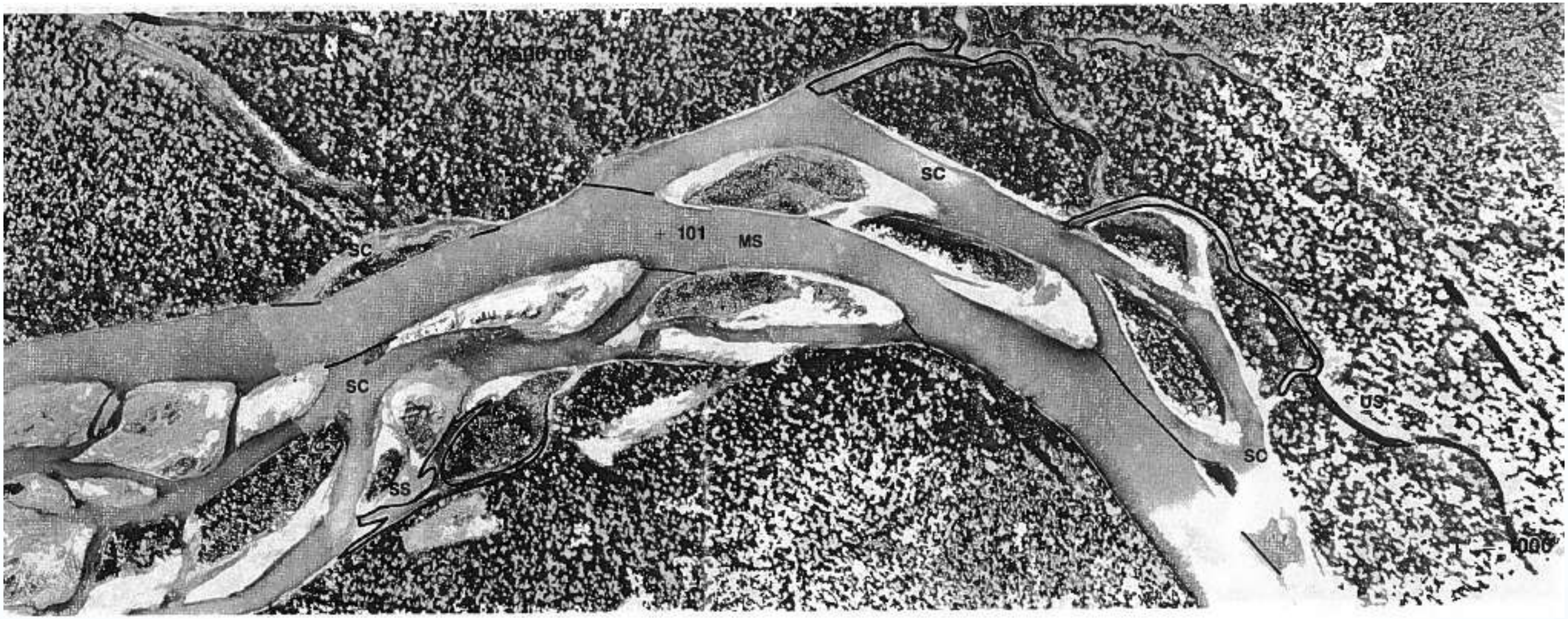
Vegetated Island



Whiskers Slough, PRM 104.4-105.9, 2012 aerial

- Discrete, large vegetated island
- Have perimeters of perennial vegetation edges

Original Delineations (1980s)



LEGEND

MS	MAINSTEM	TM	TRIBUTARY MOUTH
SC	SIDE CHANNEL	T	TRIBUTARY
SS	SIDE SLOUGH	+	RIVER MILE
US	UPLAND SLOUGH		

MIDDLE SUSITNA RIVER

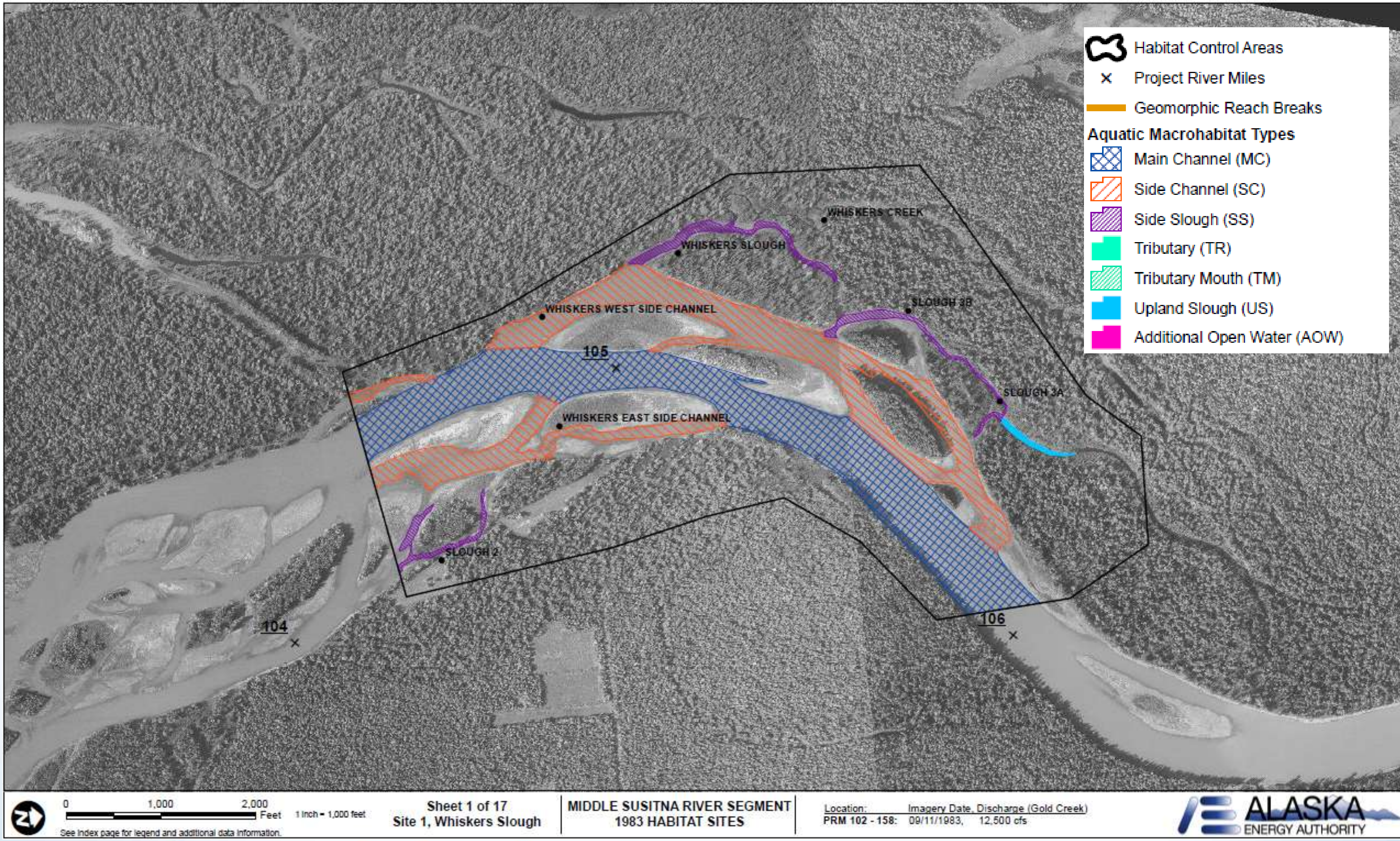
PLATE 18 OF 18 RIVERMILE 101 TO 102

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

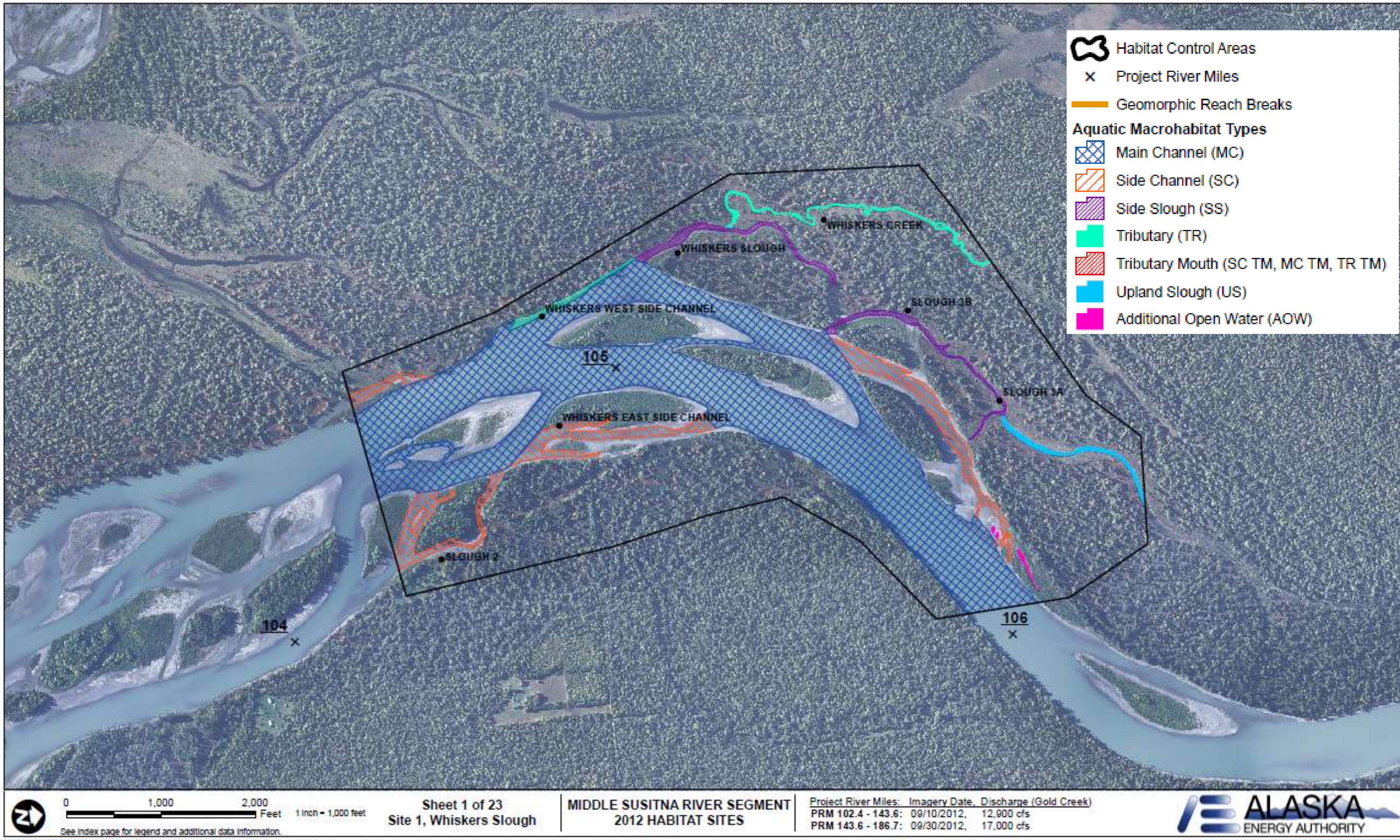
Trihey & Associates
Aquatic Resource Specialists

HARZA-EBASCO
SUSITNA JOINT VENTURE

Habitat Area Delineations (1983)



Habitat Area Delineations (2012)



Completed Delineations

Oxbow II, PRM 122-124, 2012 aerial

- Habitat Site boundary (control area) identified by light blue line

Lower River Methodology

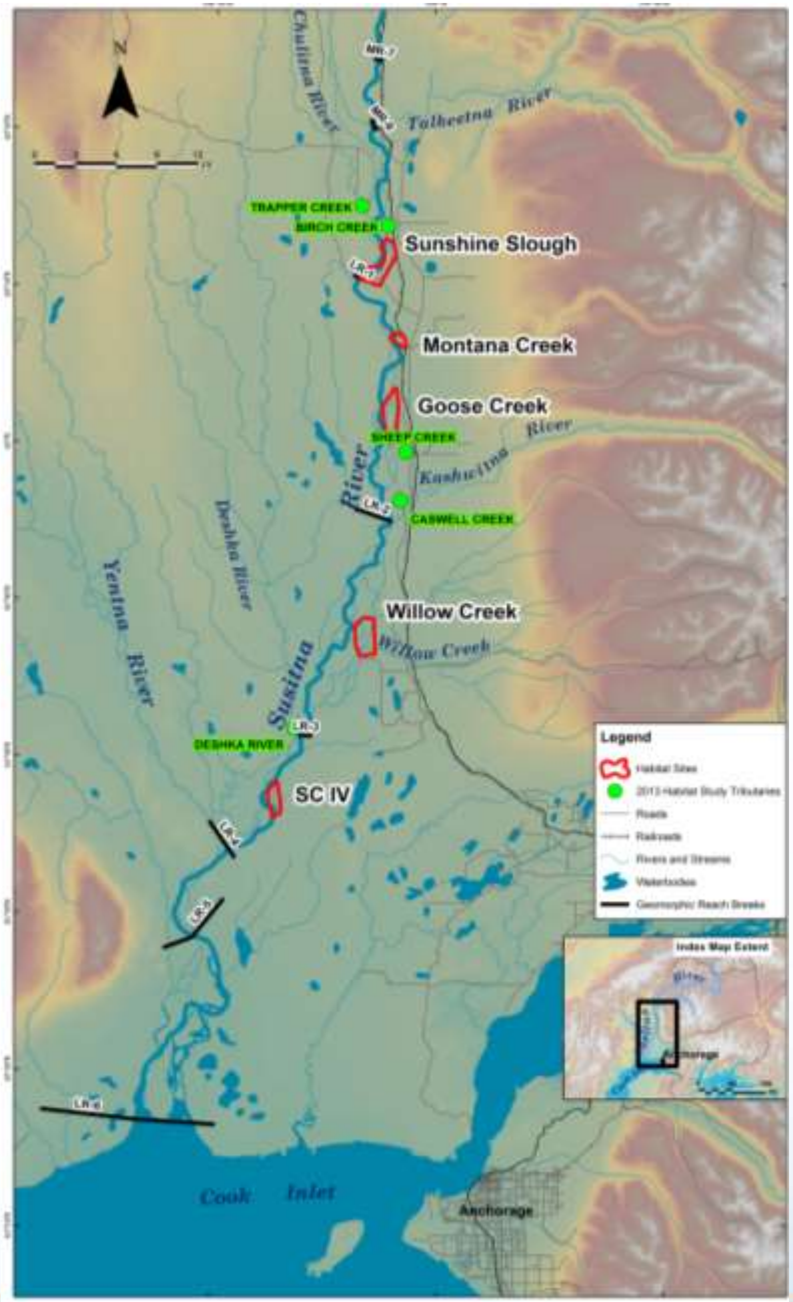
- Acquire 2012 aerials (**36,600 cfs**)
- Obtain 1980s aerials (**38,200 to 55,000 cfs**)
- Delineate aquatic macrohabitat types
  - ***Delineate within 5 selected habitat sites***
  - All wetted habitat / must have wetted connection
  - Calculate areas
  - Scale 2012 areas to target flow (1980s discharge)
- Macrohabitat Type Area Tabulation
  - **Site only**

Lower River Site Selection

- 5 selected sites in Lower River for temporal comparison
- Sites total > 50 % habitat sites mapped in Lower River in 1980s

Control Areas		Project River Mile		Geomorphic Reach
Number	Name	Upstream	Downstream	
Lower Susitna River Segment				
5	Sunshine Slough	91.7	87.9 [1]	LR-1
4	Montana Creek	82.1	80.5 [1]	LR-2
3	Goose Creek	77 [1]	72.5 [1]	LR-2
2	Willow Creek	56 [1]	53.5 [1]	LR-3
1	SC IV-4	40 [1]	36.8	LR-4

Study Sites – Lower River

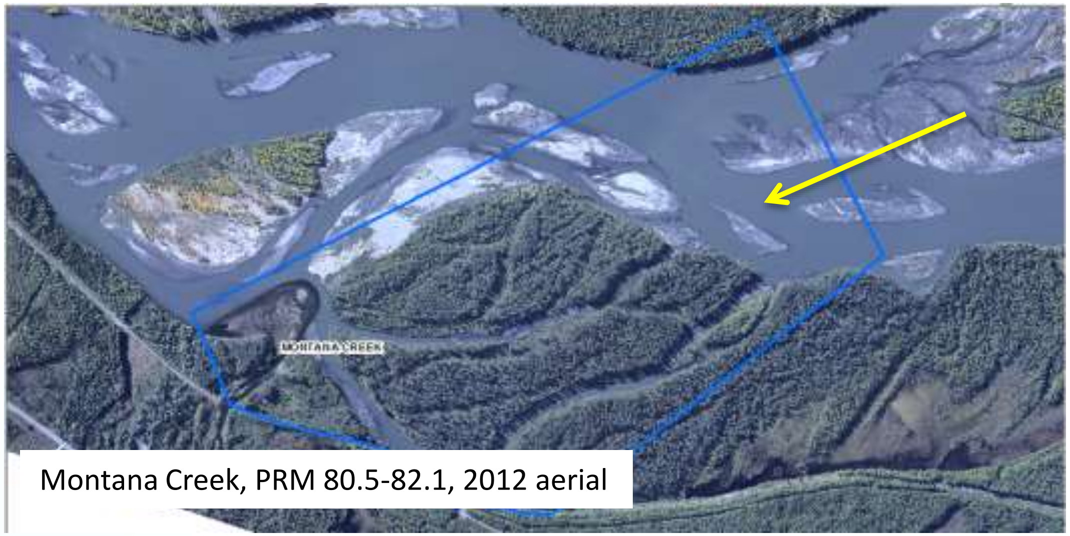


Macrohabitat Type Classifications: Lower River

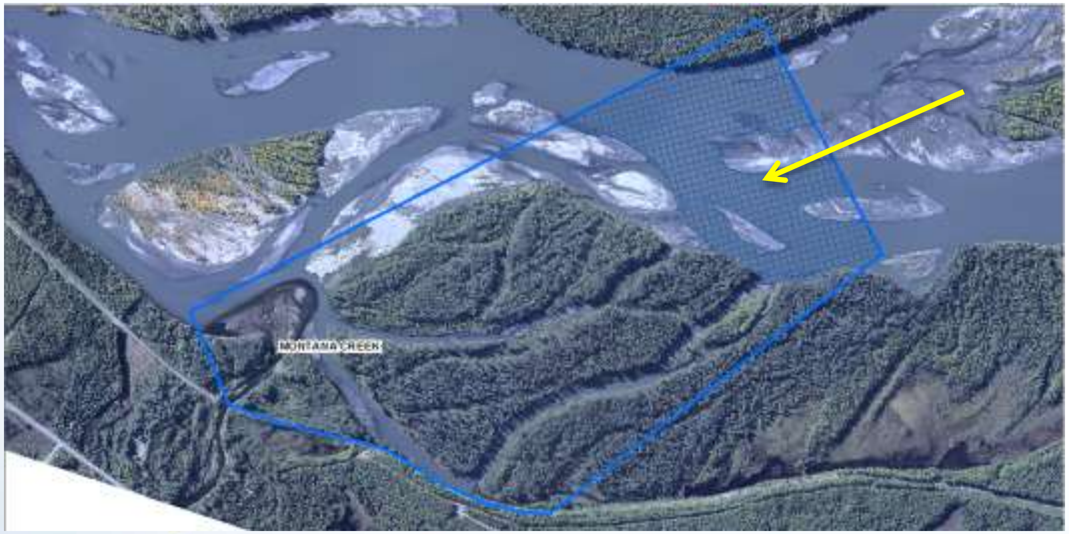
- Main Channel
- Primary Side Channel (none present at 36,600 cfs)
- Secondary Side Channel
- Clearwater Side Slough
- Turbid Backwater
- Tributary
- Tributary Mouth
- Vegetated Island

*No instances of Primary Side Channels were delineated at the studied discharges

Main Channel



Montana Creek, PRM 80.5-82.1, 2012 aerial



- Turbid water
- Convey > 10 % flow (approx)
- Thalweg channel
- Most cases, outside boundaries of habitat sites

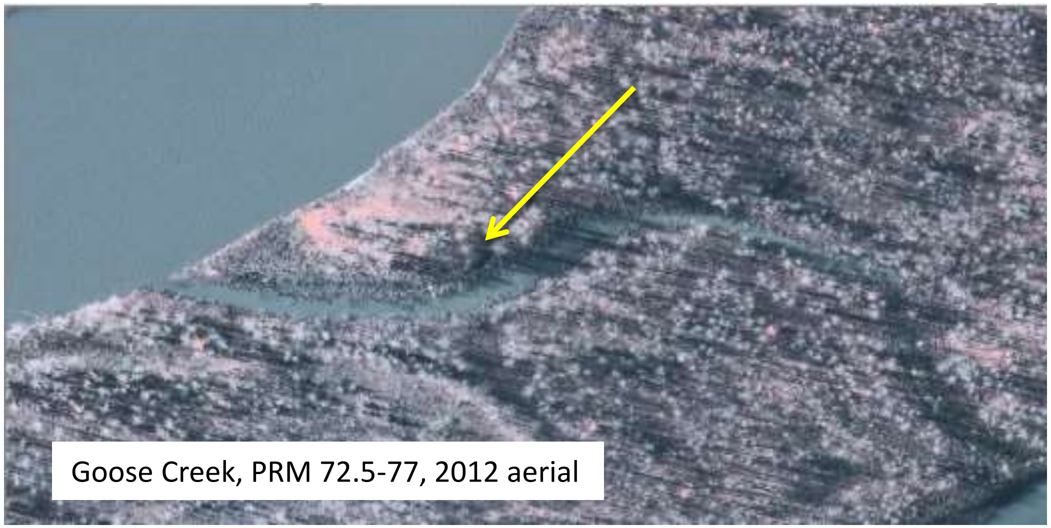
Secondary Side Channel

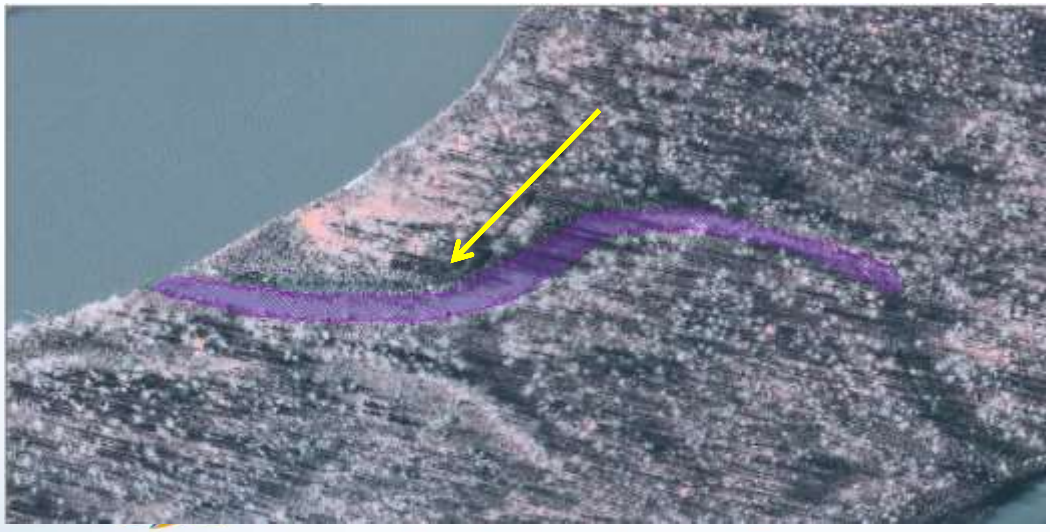
- Turbid water
- Exhibit characteristics of Middle River side channels
- Contain mid-channel gravel bars and riffles and have slower moving, shallower water

Clearwater Side Slough (combined)

- Clear water
- Non-vegetated upper thalwegs
- When overtopped at moderate to high mainstem discharge convey turbid water and classified as side channels
- Clearwater and side slough features differentiated at 13,900 cfs

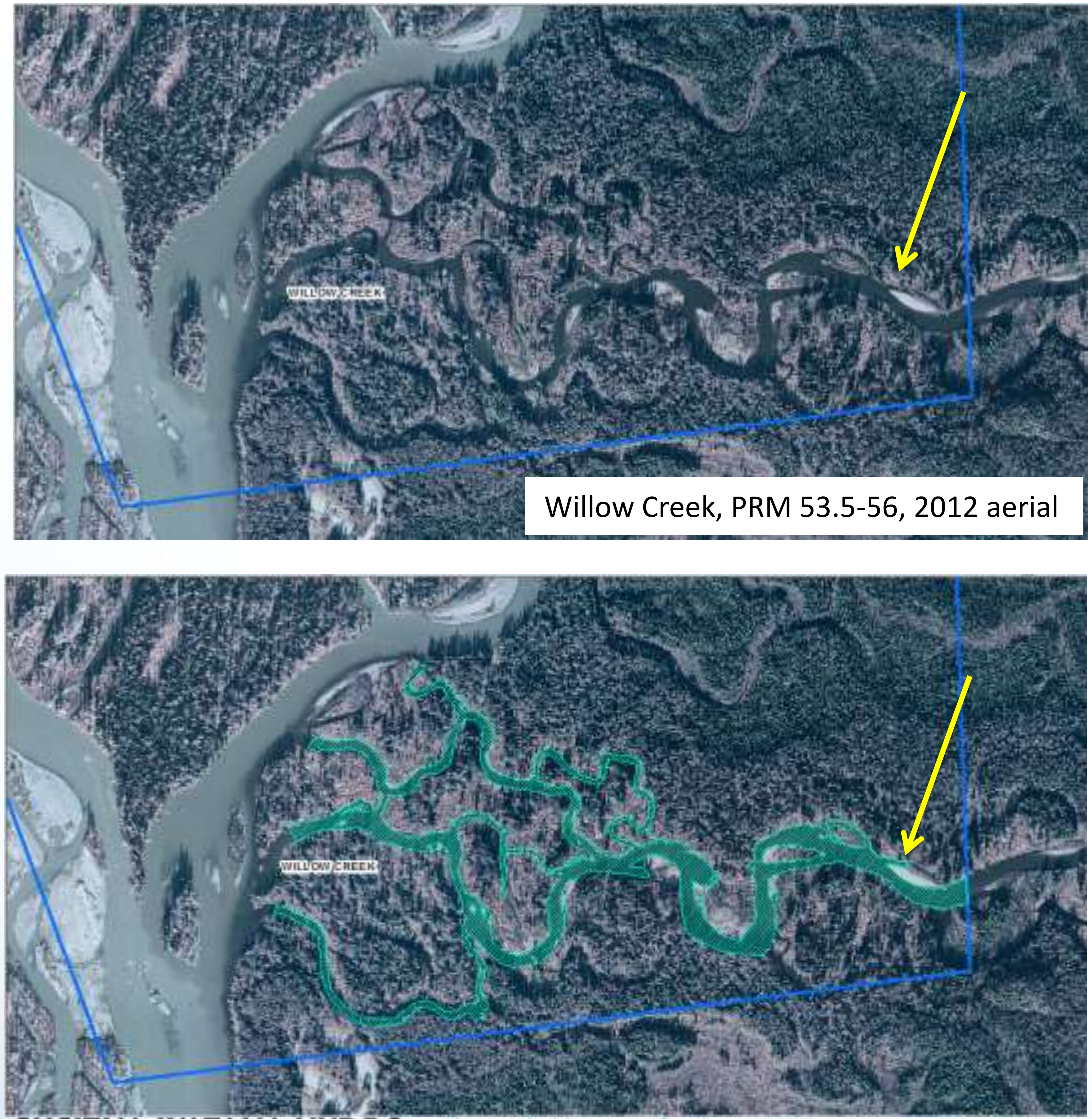
Turbid Backwater


Goose Creek, PRM 72.5-77, 2012 aerial



- Turbid water
- Non-breached channels
- Non-vegetated upper thalweg that is overtopped at moderate to high mainstem discharge
- Transitional habitat type b/w breached SSC and non-breached CWSS

Tributary



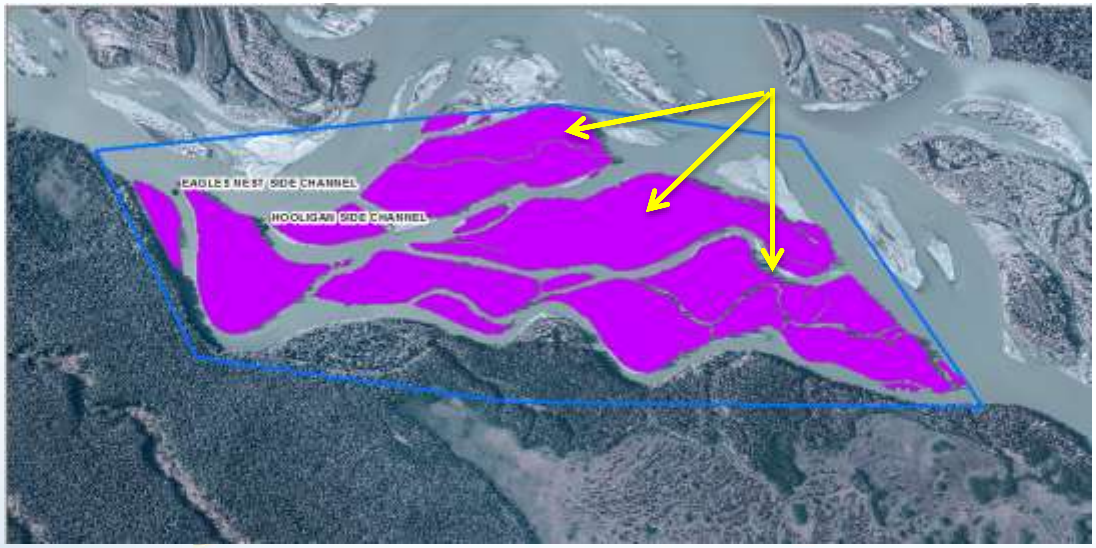
- Clear water
- Portion of tributary channel flowing across floodplain
- Above backwater

Tributary Mouth

Willow Creek, PRM 53.5-56, 2012 aerial

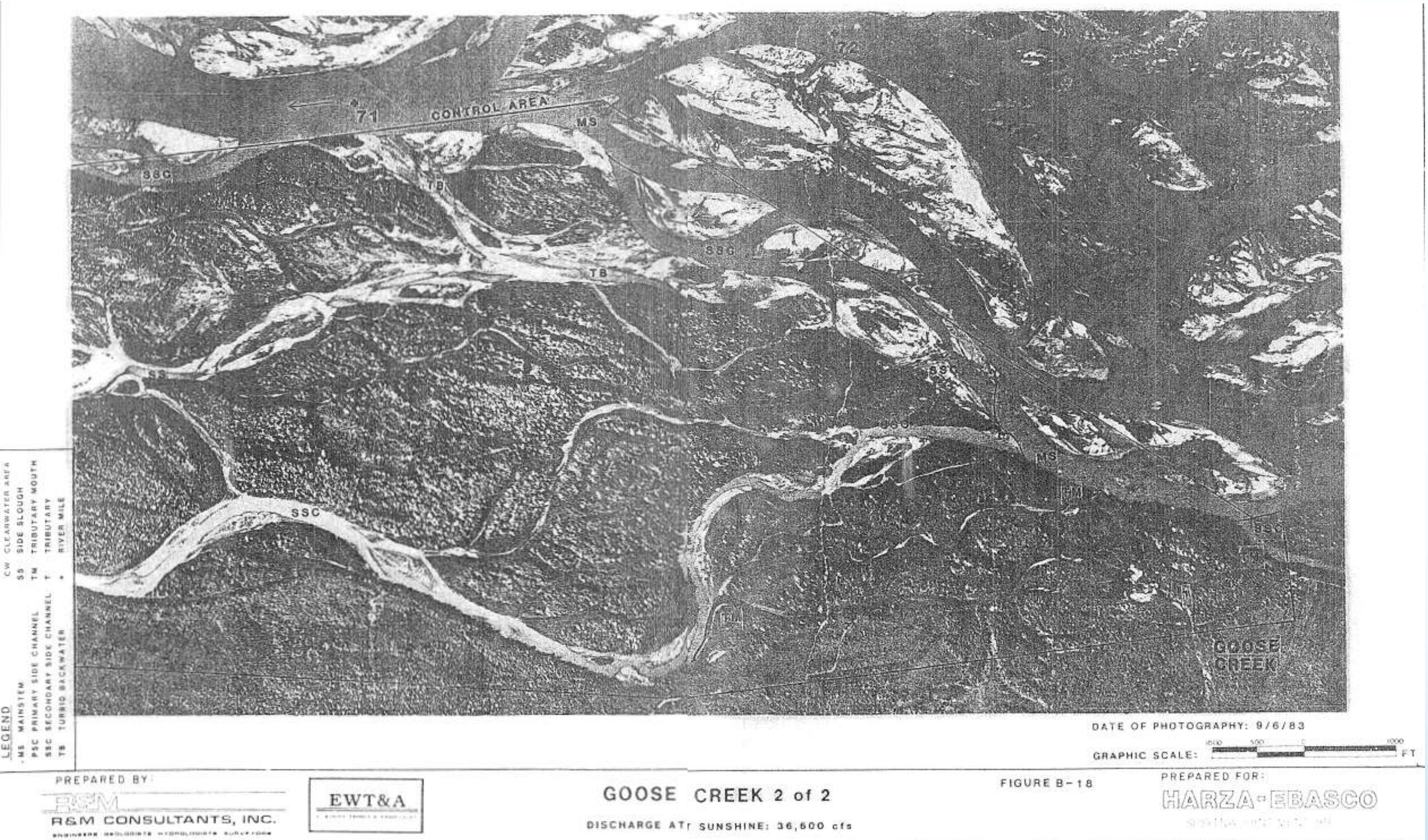
- Clear water
- Backwater area in tributary
- Plume that extends into other geomorphic features

Vegetated Island



- Discrete, large vegetated island
- Have perimeters of perennial vegetation edges

Original Delineations (1980s)



Completed Delineations

- Habitat Site boundary (control area) identified by blue line

× Project River Miles
Geomorphic Reach Breaks

Aquatic Macrohabitat Types

Main Channel (MC)
Side Channel (SC)
Side Slough (SS)
Tributary (TR)
Tributary Mouth (SC TM, MC TM, TR TM)
Upland Slough (US)
Additional Open Water (AOW)

Summary of Findings: Middle River

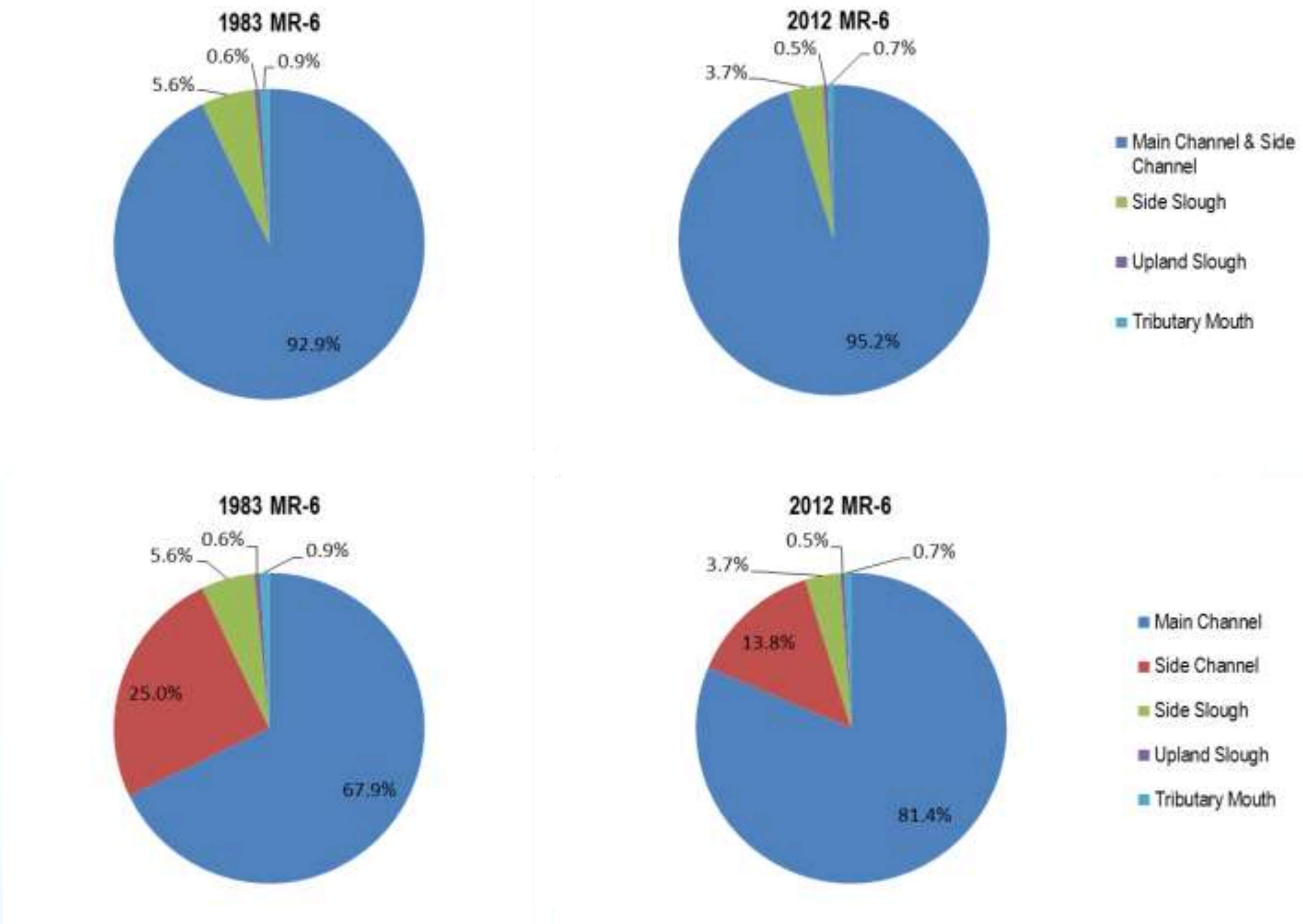
- Large scale channel changes not detected
- Relatively stable
- Increased vegetation
- Changes in macrohabitat distribution and proportions

Summary of Findings: Middle River cont.

- Relative proportion change:
  - Side Slough area = -33 % to -50 % (MR-6 through MR-8)
  - Upland Slough area = -50 % to 25 % (MR-6 through MR-8)
- These trends opposite to trends identified between 1950 to 1980 (Labelle et al, 1985) where side slough habitat types were emerging in MR
- Natural variability in lateral habitat over a period of decades

Relative Proportion of Habitat Sites in Reach MR-6

(Site 6 through Site 15)

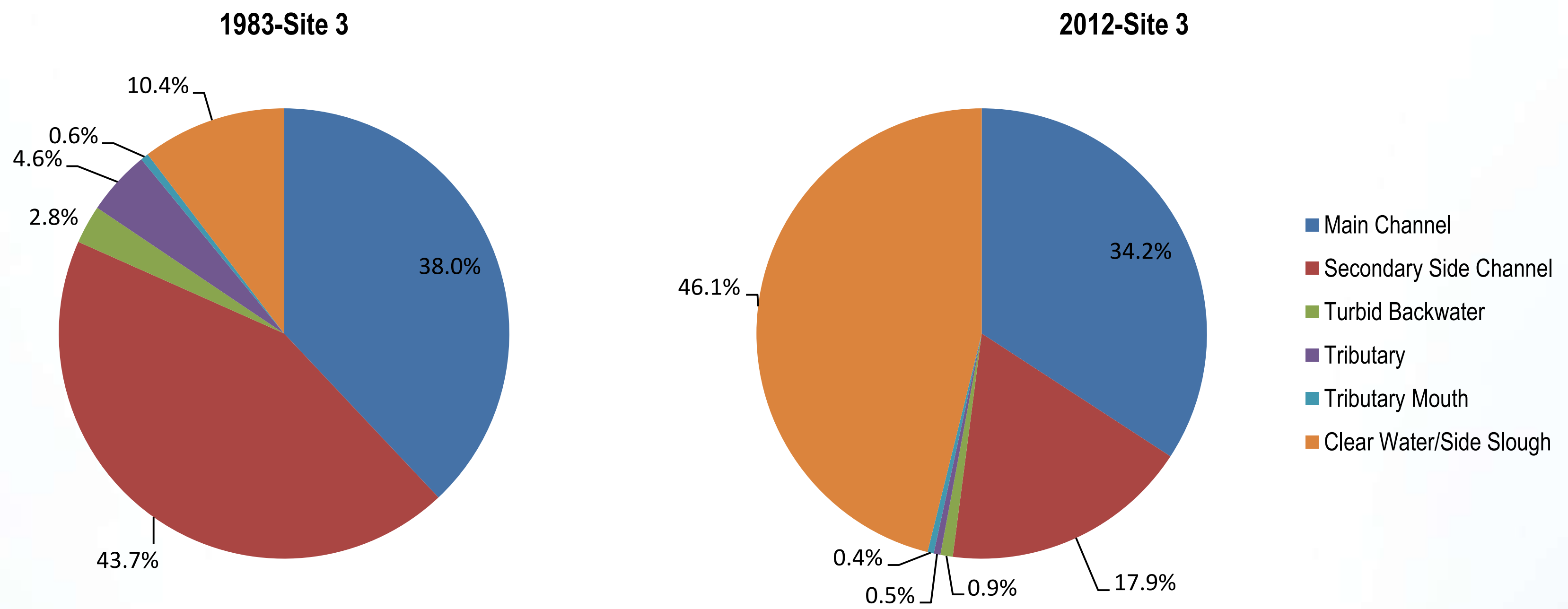


Summary of Findings: Lower River

- Increased vegetation
- More dynamic than Middle River
- Changes in macrohabitat distribution and proportions
- Relative proportion change:
  - Clearwater/side slough area = -200 % to 200 %
  - Turbid backwater & Tributary habitat = -200 % to 200 %

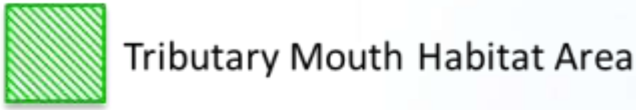
Relative Proportion of Habitat Sites in Reach LR-2

(LR Site 3)



Comparison of Tributary Mouth Habitat Area for Goose Creek

- Large scale erosion is altering locations and types of connections between main channel and lateral habitats



Conclusions and Recommendations

- The historical macrohabitat mapping is not sufficiently representative of current conditions to be used as the sole information source to either support final site selection or to quantify pre-Project or post-Project aquatic macrohabitat
- Recommended alternative to determining aquatic macrohabitat surface area based on use of:
  - Combination LiDAR and hydraulic modeling – more flexible
  - LiDAR not dependent on appropriate weather or flows
  - Not limited to specific flows of aerials
- Use of reference flows for aquatic macrohabitat type classification

END