

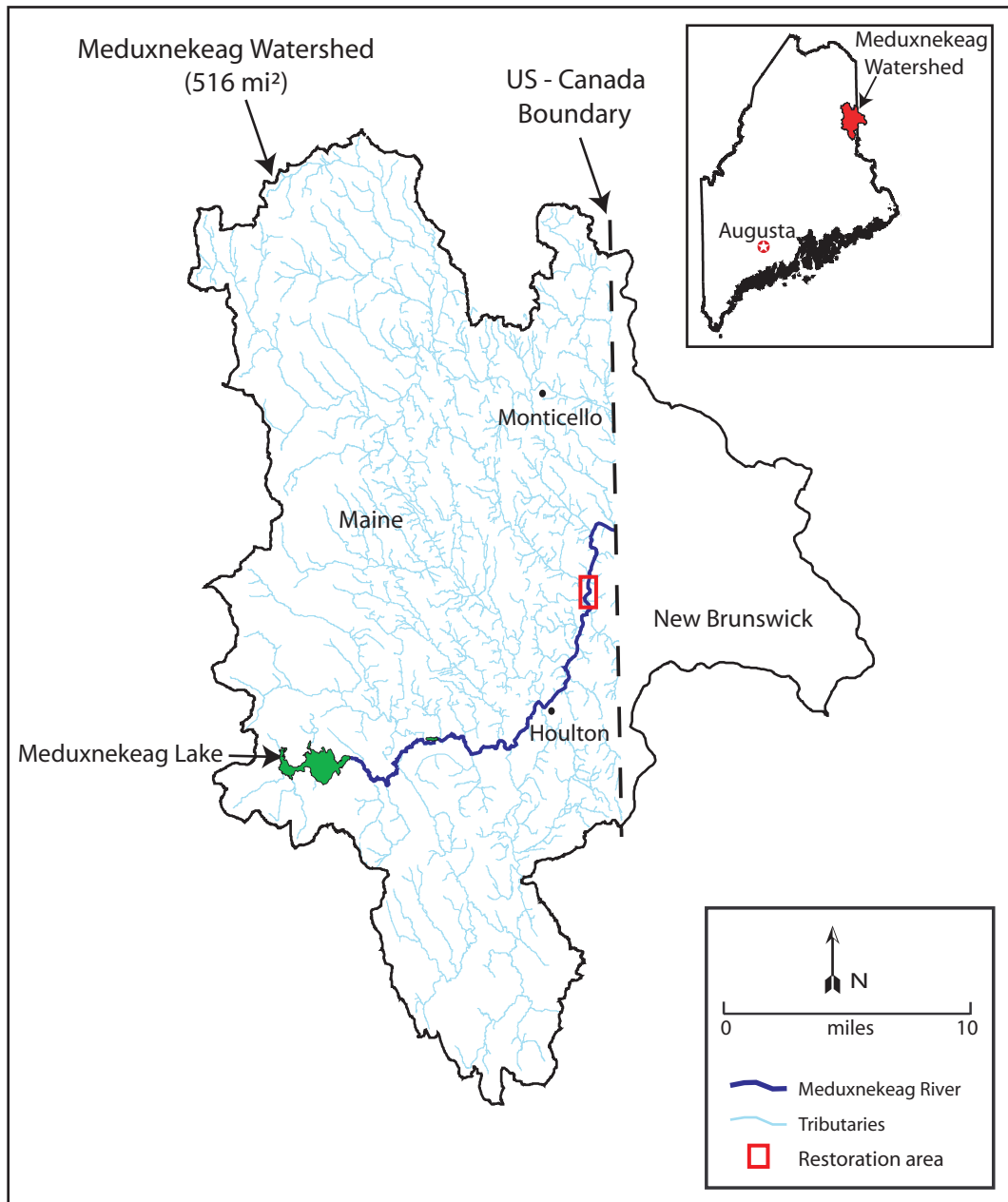
Meduxnekaeg River

Lowery Bridge to Covered Bridge

Stream Restoration Plan

Houlton, Maine and Littleton, Maine

Aroostook County



Watershed Map

Index

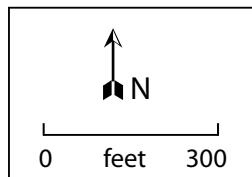
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- Sheet 11- Structure types, Isolated Log construction sequence
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Notes

- The Houlton Band of Maliseet Indians is responsible to obtain all necessary permits.

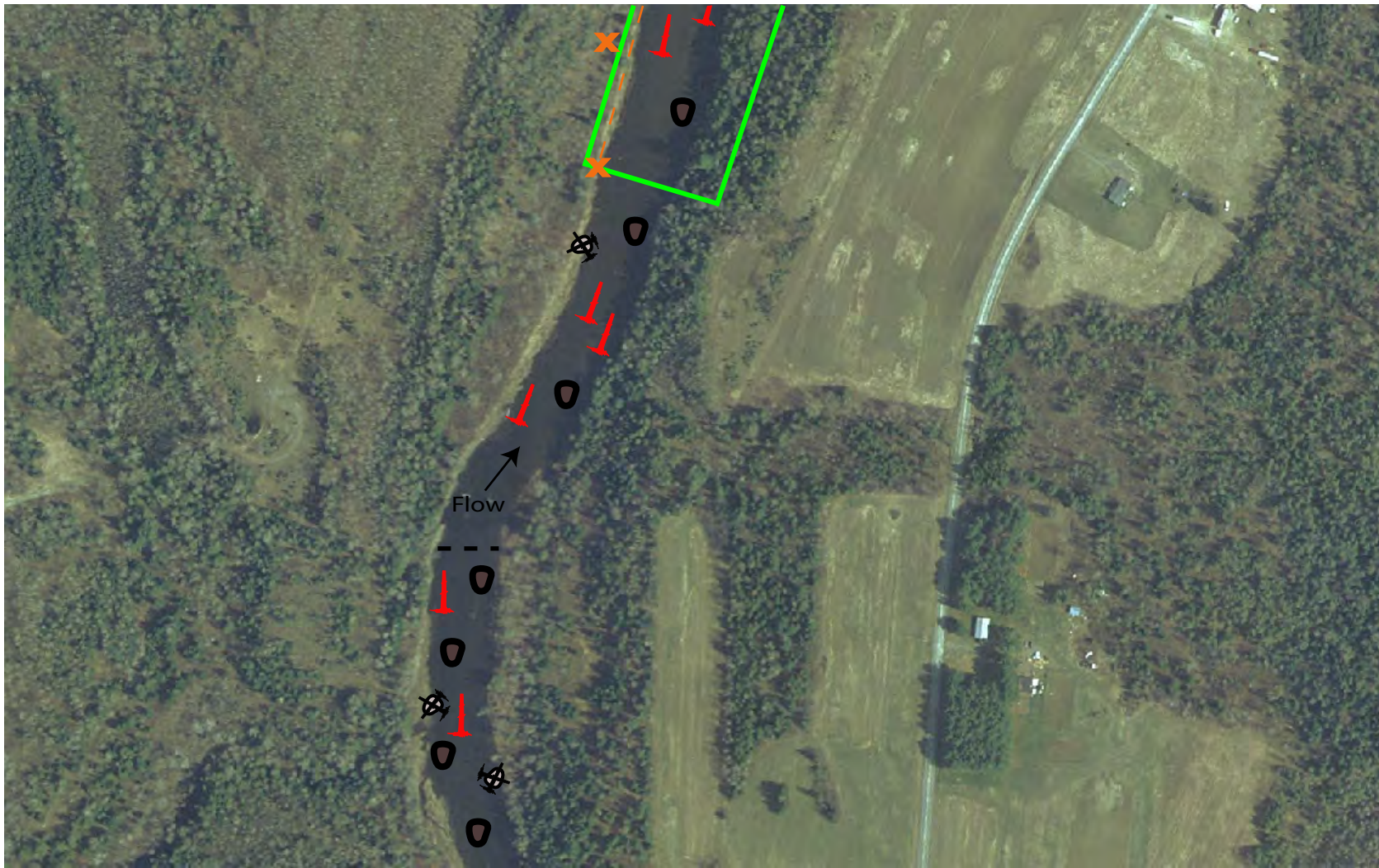


Sheet 3. Conceptual restoration design planview for the Covered Bridge Geomorphic Assessment Site (1 of 7).

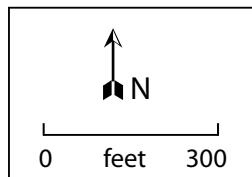


Note: Structures not to scale

Legend	
	Boulder cluster
	Isolated log
	Potential access point
	Access path
	Boulder supported log jam
	Area surveyed in detail
	Top of riffle



Sheet 4. Conceptual restoration design planview for the Covered Bridge Geomorphic Assessment Site (2 of 7).

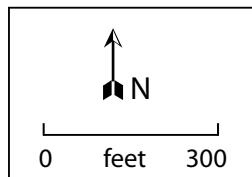


Note: Structures not to scale








Legend	
	Boulder cluster
	Isolated log
	Potential access point
	Access path
	Boulder supported log jam
	Area surveyed in detail
	Top of riffle



Sheet 5. Conceptual restoration design planview for the Covered Bridge Geomorphic Assessment Site (3 of 7).

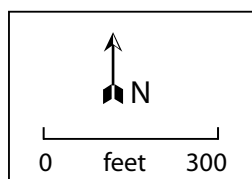


Note: Structures not to scale

Legend	
	Boulder cluster
	Isolated log
	Potential access point
	Access path
	Boulder supported log jam
	Area surveyed in detail
	Top of riffle

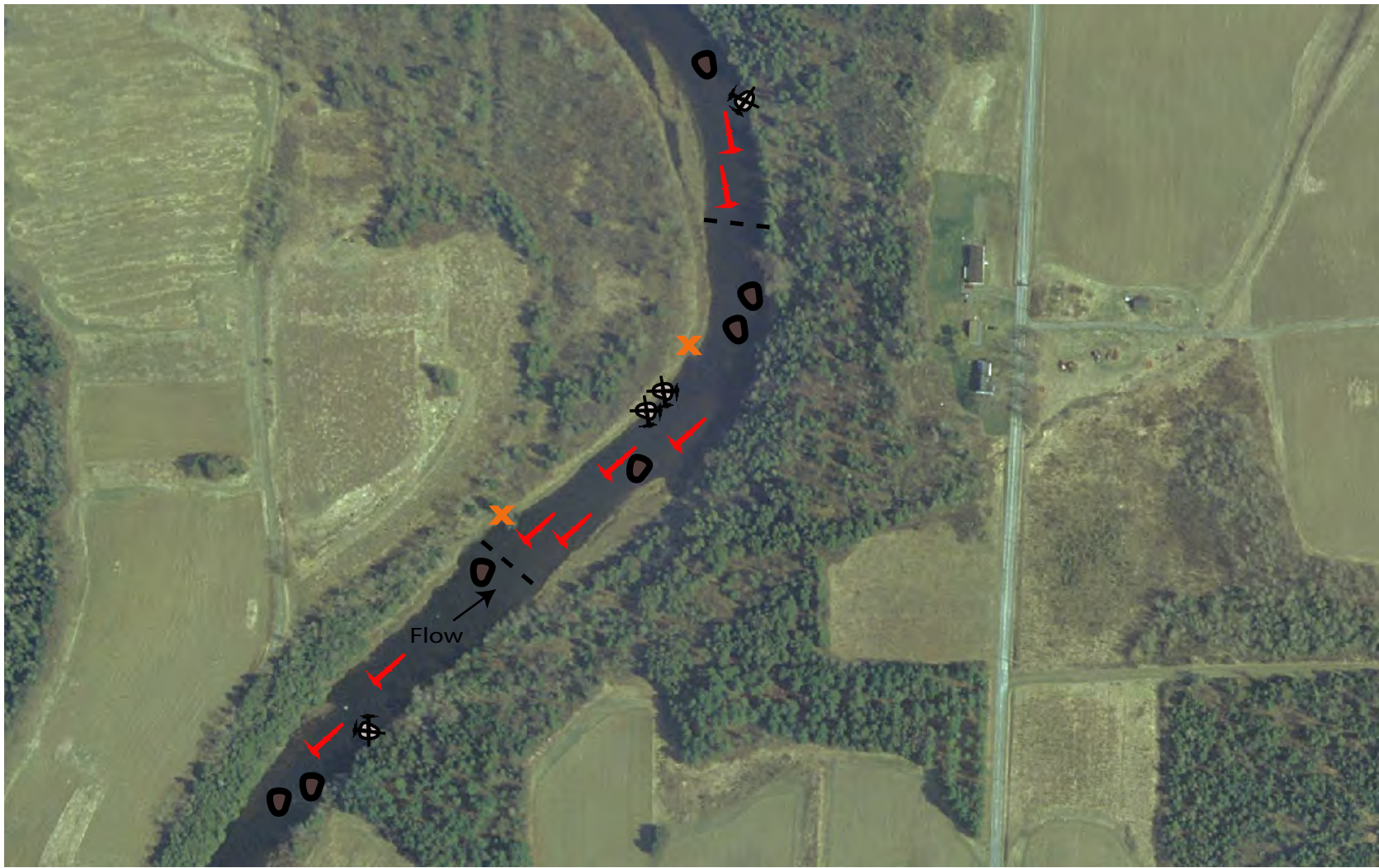


Sheet 6. Conceptual restoration design planview for the Covered Bridge Geomorphic Assessment Site (4 of 7).

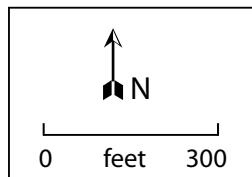


Note: Structures not to scale

Legend	
	Boulder cluster
	Isolated log
	Potential access point
	Access path
	Boulder supported log jam
	Area surveyed in detail
	Top of riffle



Sheet 7. Conceptual restoration design planview for the Covered Bridge Geomorphic Assessment Site (5 of 7).

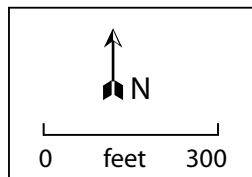


Note: Structures not to scale

Legend	
	Boulder cluster
	Isolated log
	Potential access point
	Access path
	Boulder supported log jam
	Area surveyed in detail
	Top of riffle

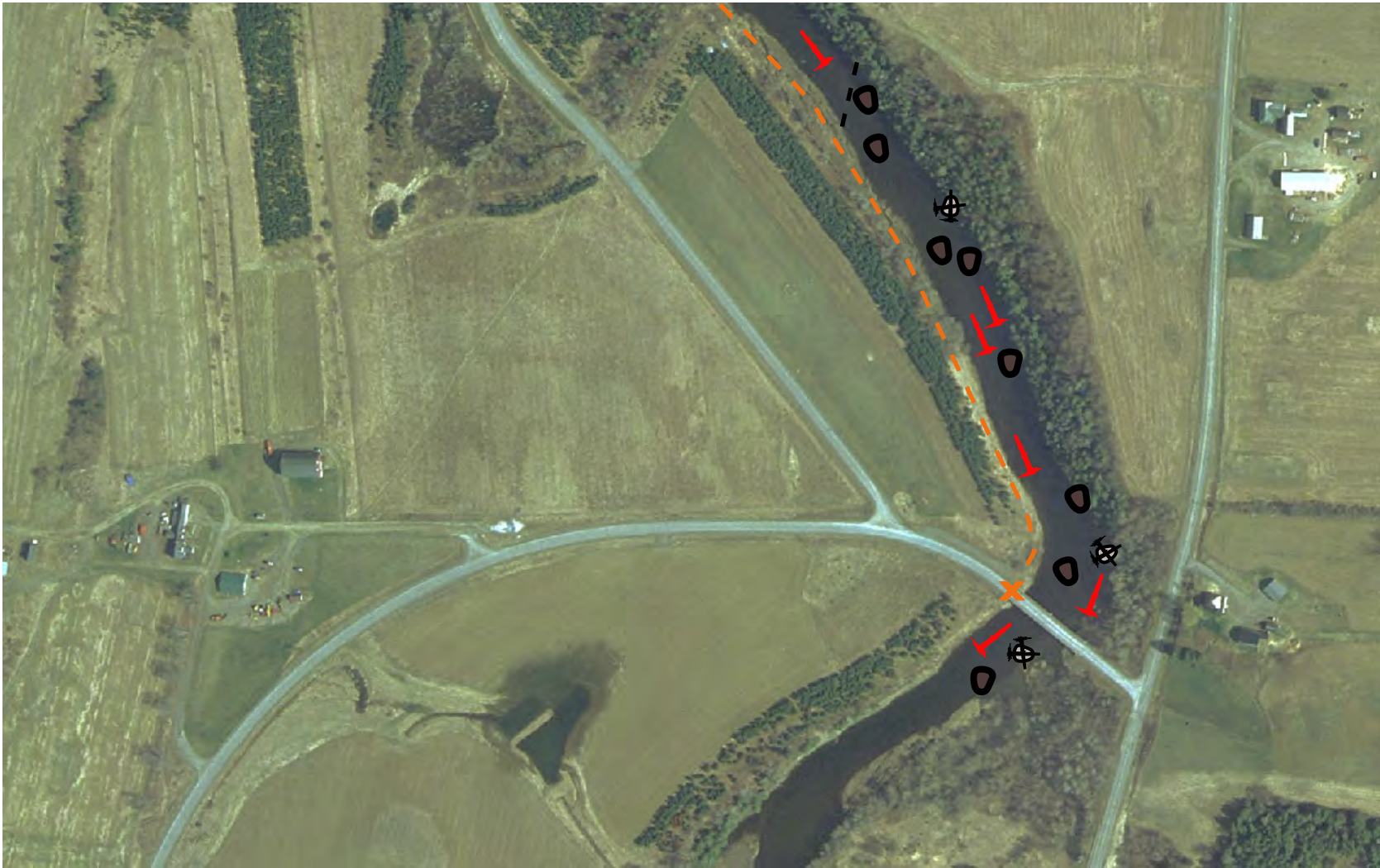


Sheet 8. Conceptual restoration design planview for the Covered Bridge Geomorphic Assessment Site (6 of 7).

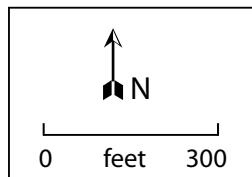


Note: Structures not to scale

Legend	
	Boulder cluster
	Isolated log
	Potential access point
	Access path
	Boulder supported log jam
	Area surveyed in detail
	Top of riffle

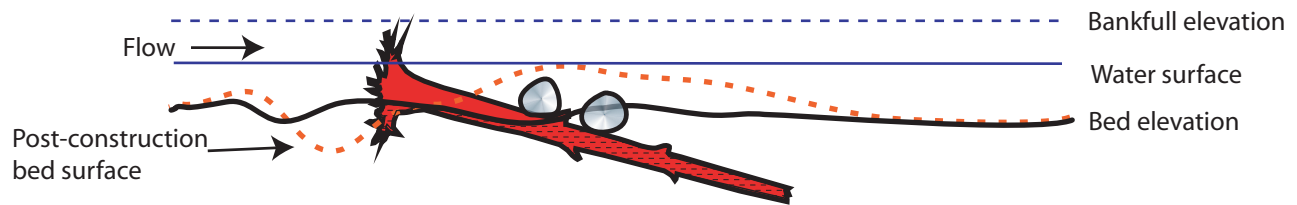
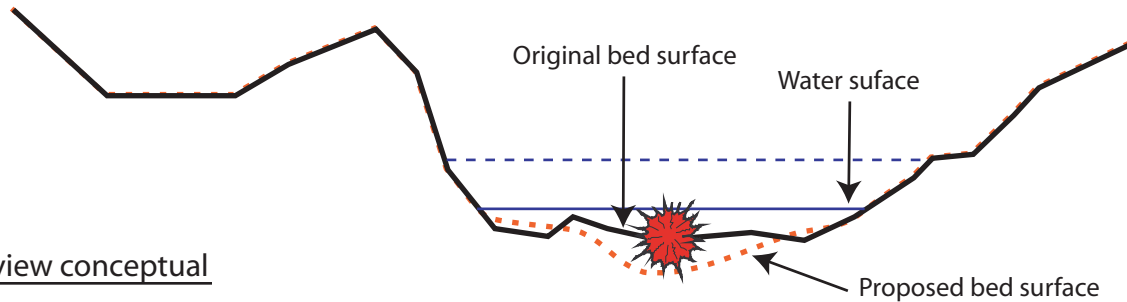
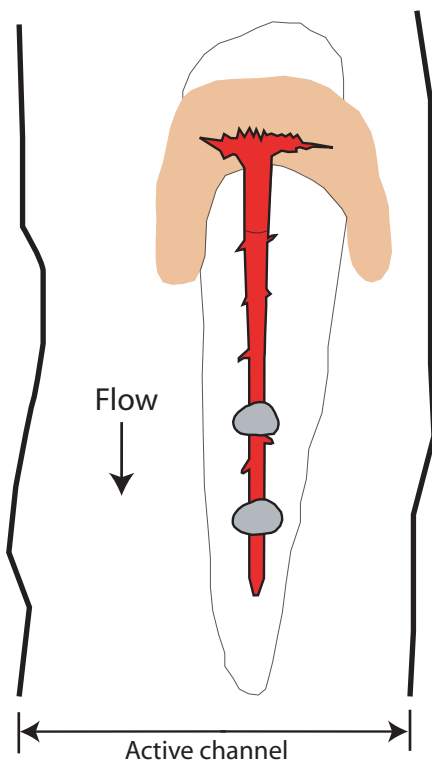


Sheet 9. Conceptual restoration design planview for the Covered Bridge Geomorphic Assessment Site (7 of 7).



Note: Structures not to scale

Legend	
	Boulder cluster
	Isolated log
	Potential access point
	Access path
	Boulder supported log jam
	Area surveyed in detail
	Top of riffle

Longitudinal view conceptualSide view conceptualPlan view conceptualLegend

- Expected deposition
- Expected scour

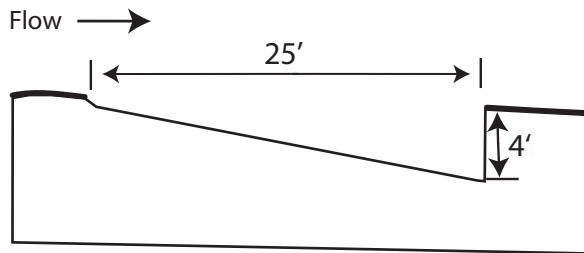
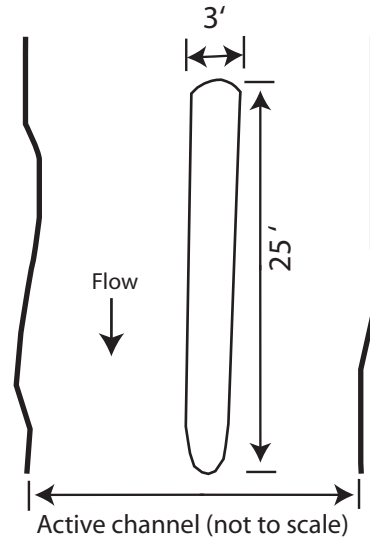
Treatment: Isolated logs

The isolated logs are a treatment where individual logs are added and naturally anchored within the low flow channel. The root wad of each log is faced upstream and remains above the channel bed while most of the attached log (at least 15 ft long) is placed in a trench excavated into the channel bed. The log is anchored when the trench is backfilled over the log with a couple of boulders added for extra stability. The isolated log treatment provides additional roughness and alters the flow velocities to create distinct zones of scour and deposition with pools generally forming upstream of the root wad face and sand/gravel bars downstream along the length of the buried portion of the log.

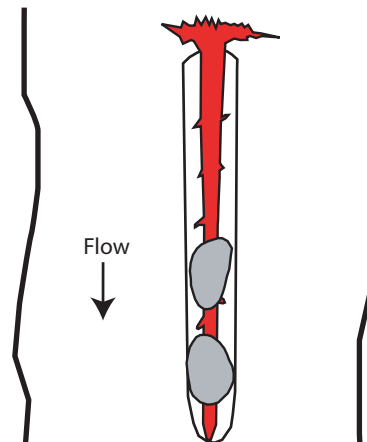
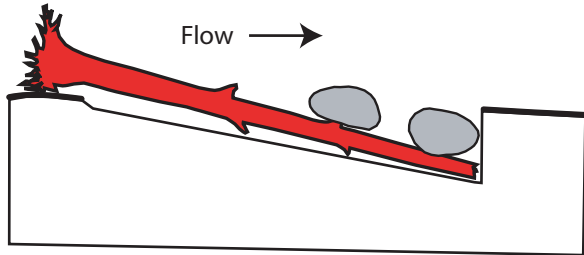
Note: Drawings are not to scale

Longitudinal view detail

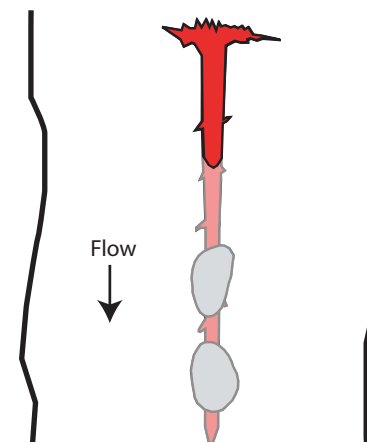
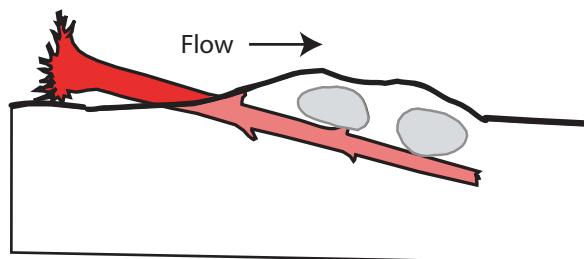
1. Excavate a trench 25' long, 3' wide, with a depth that slopes from channel bed elevation at upstream end to 4' deep at downstream end.

Plan view detail

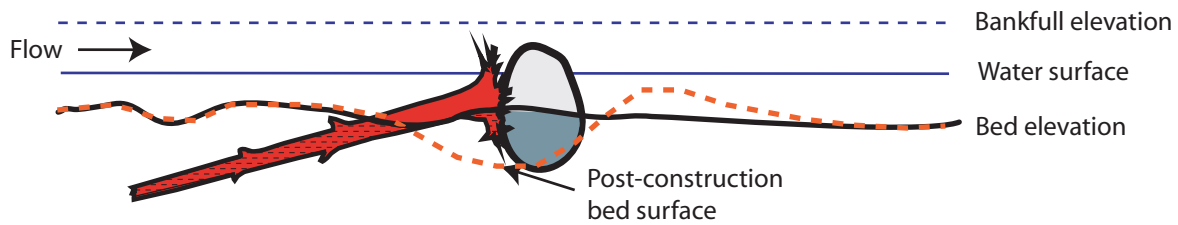
2. Place log into trench with rootwad end facing upstream. Place two 2' boulders on log.



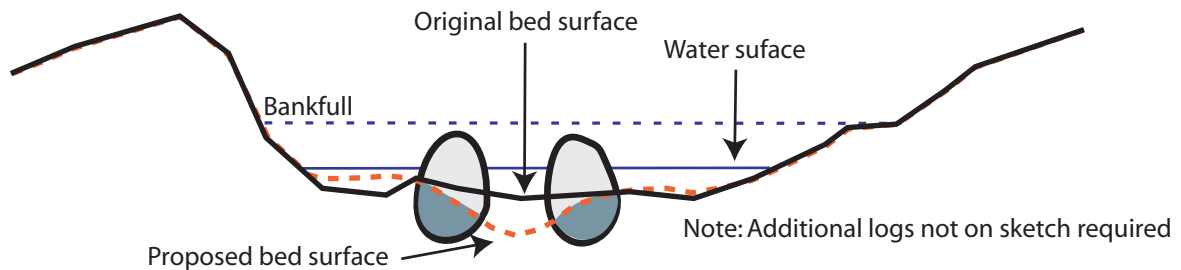
3. Backfill trench to cover downstream portion of log and both boulders.



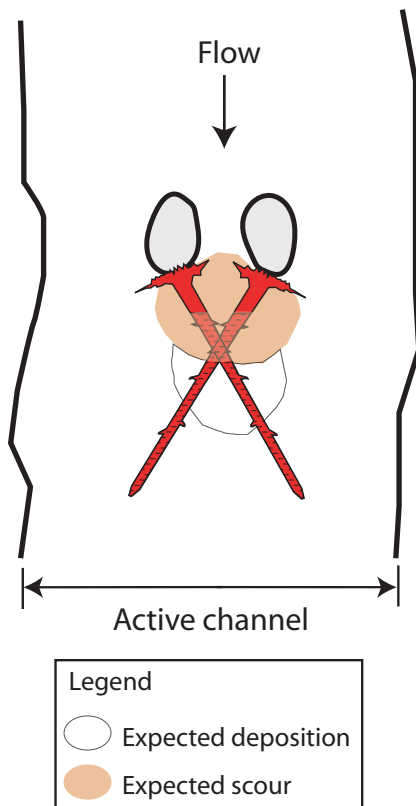
Longitudinal view conceptual



Side view conceptual



Plan view conceptual



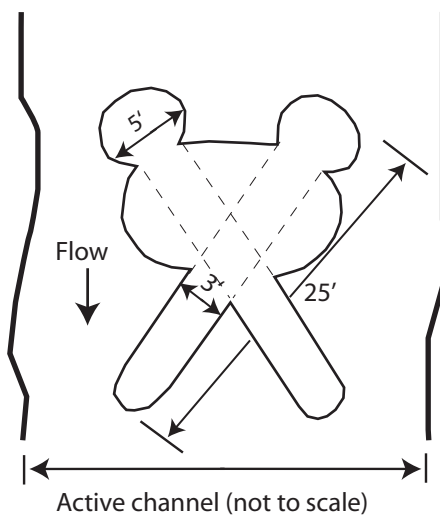
Treatment: Boulder clusters

Boulder clusters are groups of large rocks placed within the low flow channel with irregular spacing and configurations. This treatment mimics natural clusters, defined as discrete, organized groupings of particles that sit above the average elevation of the surrounding bed surface. Boulder clusters are typically built as pairs of boulders with a small gap between them where water becomes concentrated in order to help maintain pools created downstream of the boulders. Large boulders are used with more than half of the boulder buried below the bed to prevent movement during large flow events. One or two logs, installed as in the isolated log treatment, are incorporated into the boulder clusters to provide cover over the pool and additional stability to the boulders when the root wads are placed against the downstream face of the boulders.

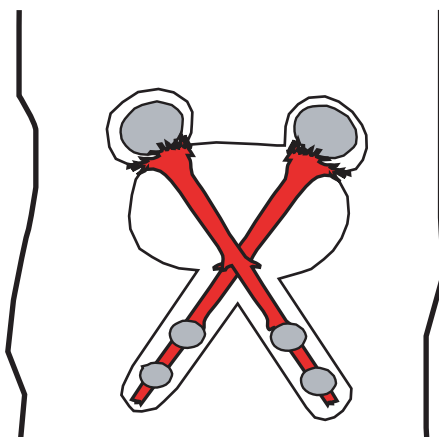
Note: Drawings are not to scale

1. Excavate two diagonal trenches 20' long, 3' wide, with a depth that slopes from channel bed elevation to 4' deep at downstream end. At upstream end of each trench excavate a 5' x 5' hole with depth of 2'. Excavate an area approximately 15' x 8' x 2' deep around the upstream half of the trenches.

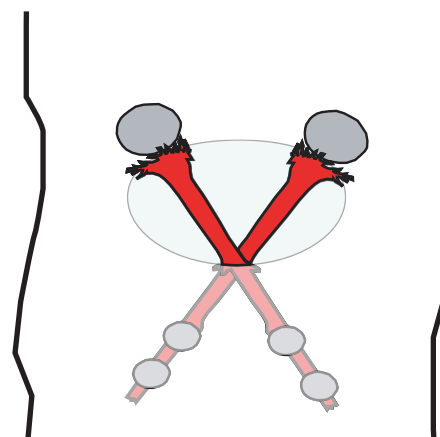
Plan view detail



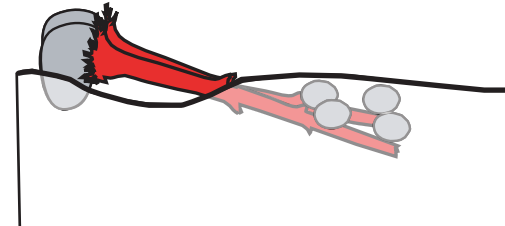
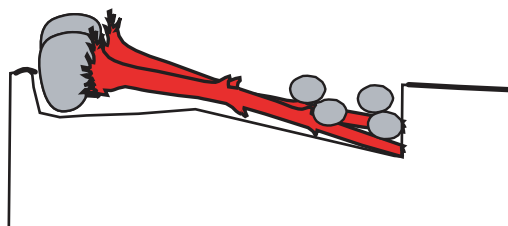
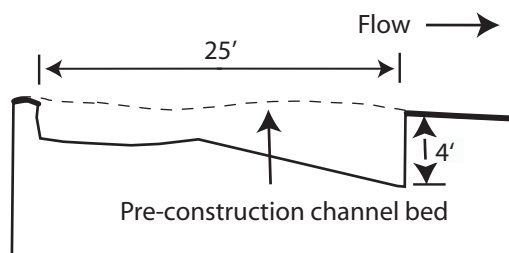
2. Place logs in trenches with rootwads facing upstream. Place two 5' boulders in 5' x 5' holes and two 2' boulders on each log.

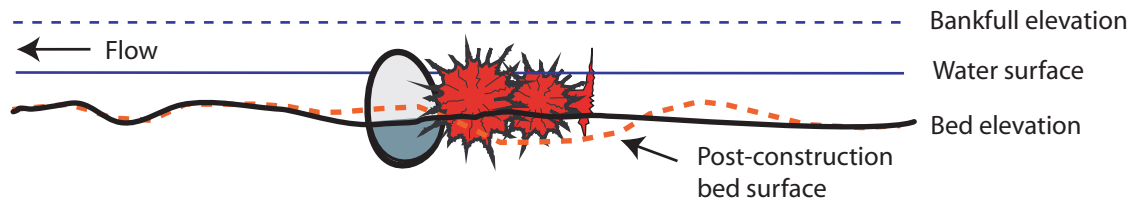
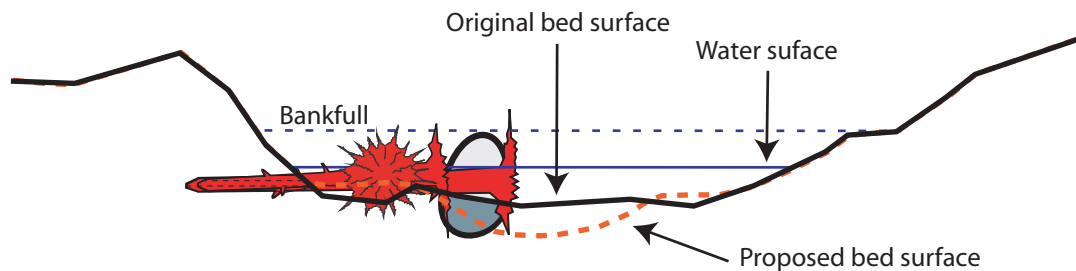
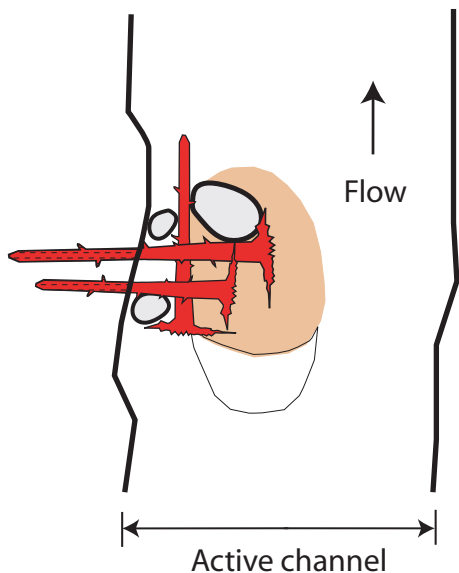


3. Backfill trenches to elevation of channel bed leaving a 2' deep pool around upstream portion of logs.



Longitudinal view detail



Longitudinal view conceptualSide view conceptualPlan view conceptualLegend

- Expected deposition
- Expected scour

Treatment: Boulder - Supported Log Jam

Boulder-supported log jams are a treatment that mimic natural features observed in the Meduxnekeag Watershed where large boulders near the margin of the channel trap logs between the boulder and the banks. Constructed boulder-supported log jams will utilize large boulders to support an anchor log placed against the upstream face of the boulders and partially buried in the bank. Extra support can be added by cabling the log to eye-bolts drilled into the boulders. The root wad of the anchor log will face the center of the channel. Additional logs could be intertwined between the boulder, anchor log, and bank, although the natural recruitment of logs floating in from upstream might also occur. The boulder-supported log jam treatment will create a pool that wraps around the boulder towards the center of the channel.

Note: Drawings are not to scale

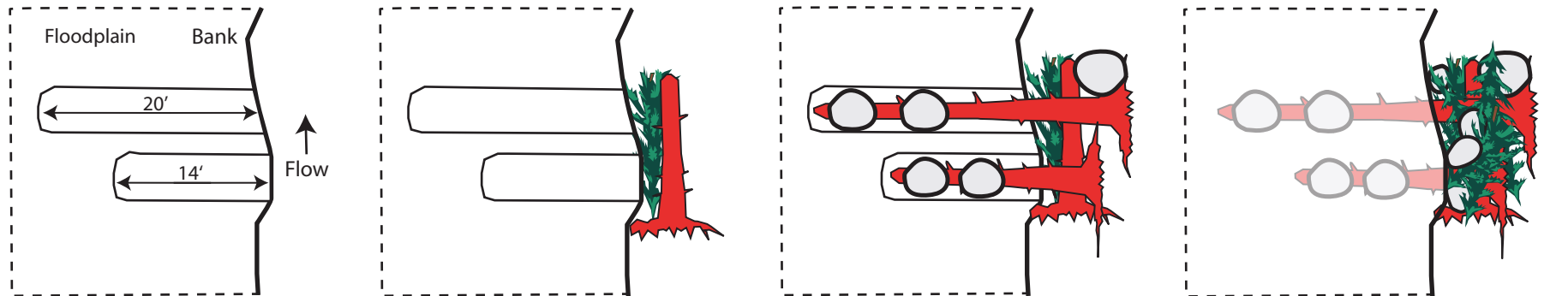
1. Excavate two parallel trenches, one 20' long, one 14' long, both 3' wide with a depth that slopes from channel bed elevation at toe of bank to 2' below channel bed elevation in bank.

2. Place a 15' log with attached root wad at the mouths of the trenches parallel to bank with the rootwad at upstream end. Place a tree top between log and bank.

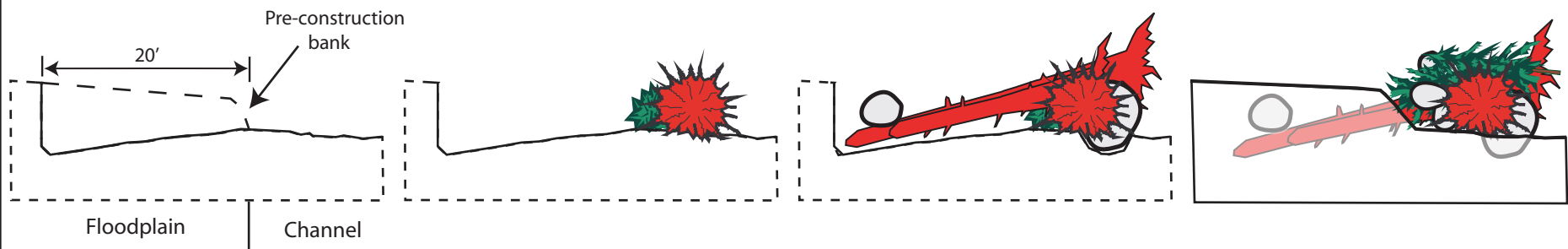
3. Place a 20' log in the upstream trench and a 30' log in the downstream trench with the rootwads protruding into channel. Place two 2' boulders on top of log in each trench. Place a 5' boulder at downstream edge of downstream log, buried 2' into channel bed.

4. Backfill trench to cover logs and boulders on bank. Fill in log jam with tree tops and small bank-run boulders if available.

Plan view detail



Cross sectional view detail



Note: Where forested bank is present logs can be wedged between standing trees instead of trenching into bank.

Sheet 15. Meduxnekeag River: Structure types, Boulder- Supported Log Jam construction sequence.

Construction Notes:

- All structures to be built with excavator that has an articulating thumb attachment.
- Materials to be brought in with boulder truck driving on bed of channel or brought into marked access points.
- All construction to be completed during low flow period.
- Work from downstream to upstream from Lowery Bridge to the Big Brook confluence.
- Work from upstream to downstream from Big Brook confluence to covered bridge.
- Structures shown on plan maps represent maximum number to be built with the final number to be decided in field.
- Structure locations are approximate with final decisions on location made in field.

Materials List:

Meduxnekeag River Main Stem: Lowery Bridge to Covered Bridge													
Type of Structure	Structures per site	15' trees per structure	20' Trees per structure	30' trees per structure	Tree tops per structure	Boulders (5')	Boulders (2')	Total 15' trees	Total 20' trees	Total 30' trees	Total tree tops	Total Boulders (5 feet)	Total Boulders (2 feet)
Isolated logs	42			1			2			42			84
Boulder cluster	43		2			2	4		86			86	173
Boulder supported log jam	22	1	1	1	3	1	4	22	22	22	66	22	88
Total													
5' Boulders	108												
2' Boulders	345												
15' tree with rootwad	20												
20' tree with rootwad	106												
30' tree with rootwad	62												
Tree tops	60												