Report of Observations – October 5, 2022
Stranding Study of West Branch of the Penobscot River below McKay Station

Stephen G. Heinz, Maine TU Council FERC Coordinator, October 19, 2022

Introduction

A stranding study was conducted by Brookfield Renewable (Brookfield) on October 5, 2022 to comply with the Federal Energy Regulatory Commission (FERC) Study Plan Determination.[1] Brookfield announced the study by email[2] to a small distribution of stakeholders about three weeks before the study asking for comments by September 28, a week prior to the event. The draft study plan concentrated most of the effort on the Big Eddy and the Nesowadnehunk Deadwater, areas that were unlikely to contain stranded fish, and included provision for data collection by drones. Maine Council of Trout Unlimited submitted comments disagreeing with this approach calling for "boots on the ground" and filed them to the FERC docket.[3] When it was confirmed a week prior to the event that it would go as scheduled, Maine TU Council sent out an "Action Alert" email to the Maine TU membership, and forwarded it to other organizations with possible interest. Despite the short notice, enough volunteers were recruited to man five two-person teams to observe the conduct of the study and record what they saw in a structured manner. TU received no final study plan prior to the event.

Methods

Volunteers were instructed to assemble at Big Eddy Campground at 8:30 on the morning of October 5, 2022. A briefing was presented that covered safety, data collection, team composition and area assignment. All volunteers arrived on time, took the briefing, and signed hold harmless/photo authorization forms. Randy Dorman, assigned Brookfield licensing manager for the project, came into the briefing while in progress and expressed welcome for our presence.

Safety Instructions:

Work in pairs, keep buddy within sight and sound

Primary hazards are slipping and tripping

Take your time and do a thorough search – it's safer and more effective

If someone is injured and you have to go for help, get them out of the watercourse first

[1] Study Plan Determination for the Ripogenus Hydroelectric Project and the Penobscot Mills Hydroelectric Project dated May 13, 2022.

[2] Email from Cate Russell HDR, Subject - Ripogenus Project: Draft Fish Stranding Study Plan, September 13, 2022 at 5:04 p.m.

[3] Maine TU Council letter dated September 23, 2022, Subject: Comments of Maine Council of Trout Unlimited on the Draft Fish Stranding Study Plan.

Nearest hospital is Millinocket Regional Hospital, 200 Somerset St, Millinocket, ME 04462. This is off Route 11 just past and north of where it is joined by the Golden Road

Event set for 9:30 to 1:30. Pick a watered rock in your vicinity and check for water level periodically - everyone headed to shore at 1:00.

Brookfield may deploy drones to look for strandings. If they do, go to shore until they pass.

Don't get stuck on far bank below the Big Eddy

Water and a snack recommended

Check out before you leave – everyone must be accounted for

Data Collection Instructions:

Take an initial photo (and others if needed) showing the extent of the dewatering that the event causes.

Photo document anything alive that you find in unconnected pools - if in doubt, document

Key information: time, location, brief description*, photo #

*fish species, macro-invertebrate species, other

Use the data sheet provided if you can't keep this all on your phone

It is more important to cover area well than to cover more area

Be prepared to show what area you covered at the end of the day

Give the Brookfield crews a wide berth, do not get in their way, muddy waters, engage them, etc.

Team Composition:

Team #	**members**	**affiliation**	**reach**
1	David Bean	NOAA Fisheries	Holbrook side channel
	Max Tritt	NOAA Fisheries	Holbrook side channel
2	Mike Enos	TU	Holbrook South
	Jim Hayes	Penobscot Fly Fishers	Holbrook South
3	Charlie Spies	TU	Cribworks
	Steve Heinz	TU	Cribworks
4	Julie Puleio		Little A Falls
	PJ Smith	TU	Little A Falls
5	Rory Hannon	UMO	Big A Falls
	Angela Hannon	UMO	Big A Falls
N/A	Sarah Sindo	Big Eddy Campground	n/a - volunteer coordination

Team members were given the opportunity to review this report.

Area:

TU indicated its general areas of concern in its draft study plan comments, and Figure 1[4] indicates in red those areas that stretch from the tail of the Little Eddy to the head of Nesowadnehunk Deadwater. This (including side channels) encompassed some 5 river miles more or less. Complete coverage could not be accomplished due to the limited number of volunteers available on the short notice provided for the Brookfield study.

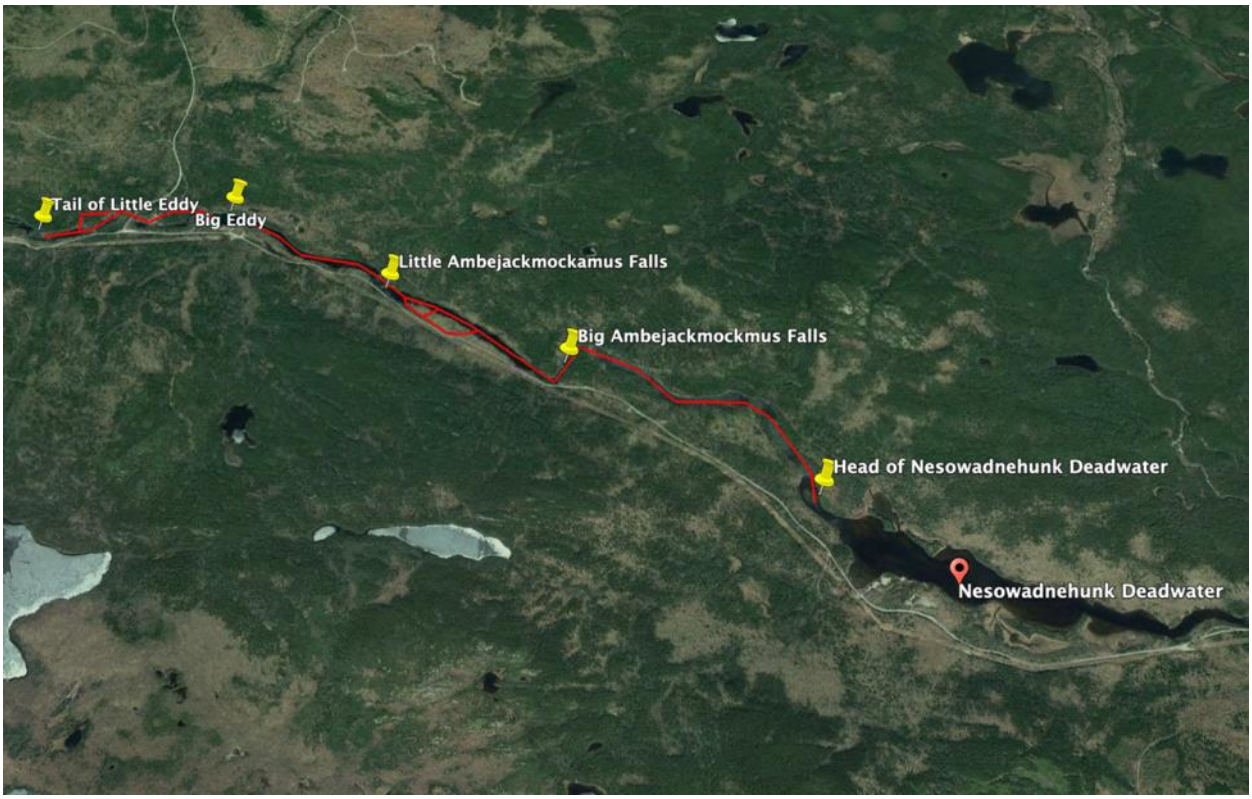


Figure 1

General. Each team was given a black and white paper map showing desired observation areas. These areas were based on a best guess of where strandings would be most likely to occur based on past strandings and cursory analysis of the topography. White lines indicated general areas of interest. Please note that these areas differed significantly from the areas that Brookfield proposed in its draft study plan[5] that devoted most of its area coverage to the Big Eddy and the Nesowadnehunk Deadwater, areas that were unlikely to contain stranded fish due to their topography which is predominately composed of deep runs and large pools of

[4] Id., Attachment C.

[5] Draft Stranding Study Plan forwarded by Email from Cate Russell HDR, Subject - Ripogenus Project: Draft Fish Stranding Study Plan, September 13, 2022 at 5:04 p.m.

significant depth that could be dewatered per the study parameters but still retain several feet of water depth. Specific TU observation area descriptions follow, corresponding maps are included as attachments due to size. The white line indicates areas of general interest, yellow shading indicated general areas each team was able to actually cover and make first-hand observations, red areas indicate those where a relatively high incidence of strandings were observed. Assigned coverage areas were less than those shown in Figure 1, actual coverage by the teams within assigned areas was less than the entire reach as teams tended to cover areas that showed the most potential for strandings as the water receded. Team 3 was not able to cover an area of likely strandings due to the rugged character of the dewatered terrain. The teams furthest downstream started latest waiting for the water levels to drop, but were required to leave the water course by 1:00 PM. This put them at a time disadvantage, but they found significant numbers of dead and stranded fish and stranded macro-invertebrates.

Holbrook side channel. The Holbrook side channel and portions on the north bank between the tail of the Little Eddy and where the side channel rejoins the main stem of the river. The map is included as attachment A.

Holbrook South. The south bank of the main channel between the tail of the Little Eddy and Telos Bridge. The map is included as Attachment D.

Cribworks. Area from Telos Bridge to the head of the Big Eddy. The map is included as Attachment G.

Little A Falls. South bank and side channels of the area below Little A Falls. The map is included as Attachment J.

Big A Falls. The east and south banks of Big A Falls and area downstream of the falls to the first riffle. The map is included as Attachment M.

Results

Flows prior to the event appeared to be consistent with the representative 2200 cfs TU had requested in its comments of the draft study plan. The event appeared to commence on time – 9:30. There were noticeable differences in time lags required for flows and levels to drop at the various areas downstream where the volunteers were prepositioned. Vertical drops in water levels varied between areas based on bottom topography. By 2:30, levels and flows at the Big Eddy appeared consistent with the 1700 cfs post-event target flow. Subsequent reporting by Brookfield[6] showed restoral of target flows at 1:57 p.m., a 4 hour and 28 minute outage. It should also be noted that the initial trip flow was reported as 12 cfs but went to 400 cfs quickly.

[6] Brookfield letter dated October 12, 2022, Subject: Ripogenus Project (FERC No. 2572); Planned Minimum Flow Modification.

A significant number of strandings occurred that resulted in observed fish mortality. All five teams reported fish and macroinvertebrate strandings, four teams reported dead fish, including salmon parr, brook trout, dace, sculpin and unidentified minnows; Team 1 did not report dead fish, but uploaded a short movie showing a fish in a drying pool that could not have survived. The good news was that the Holbrook side channel functioned as designed and remained watered from bank to bank. This is a constructed feature designed to provide spawning and nursery habitat for salmonids. This was a remediation measure included in the current license that MDIFW and Brookfield share credit for making work effectively to improve the greatly modified resource that the West Branch of the Penobscot represents.

Team	Fish*	Minnows#	Dead fish & minnows	Invertebrates
1	8	12	0	Many
2	2 - 3	12	9	100s of nymphal insects, 12 crayfish
3	14	2	1	Too numerous to count
4	45	30	15	Countless
5	10	35	35 (all the fish, 25 minnows)	95 counted
Total	79-80	91	60	Much too numerous to count

* Fish were defined as all salmonids and others over 2 inches in length

Minnows were defined as fish under 2 inches in length

Fish. Landlocked salmon parr were the predominant fish species stranded. Brook trout were observed as well.

Invertebrates. Macro-invertebrates were present in tremendous abundance. Species included golden stonefly nymphs (Perlidae), black stonefly nymphs (Pteronarcyidae), green rock worm (Rhyacophila), dragon fly nymphs (possibly family gomphidae genus hagenius and family cordulegastridae, genus cordulegaster), hellgrammites, crayfish, leeches and others.

Minnows. Species included black-nose dace, sculpin, and others.

Photography. Selected team imagery is included with the attachments that are organized by teams. Additional imagery is available for viewing online at
https://drive.google.com/drive/folders/1ssnvwFOlQhT_fn93gN1Vk1la1chPv53S?usp=sharing

Team 1 included a short movie of a landlocked salmon trying to escape from a disconnected pool and another in a pool that was drying up. Team 2 offered a Power Point presentation describing the images it contained. Team 3 included short videos of multiple salmon parr stranded in a small pool and another of a salmon parr struggling on ledge trying to reach water. Team 4 included 8 movies, mostly of stranded fish in pools. The remainder of the images are still images.

Discussion

Area Coverage. The actual area that the 5 volunteer teams was relatively small compared to the area specified in the FERC Study Plan Determination[7] or as defined in TU comments on the draft stranding study plan.[8] The teams deployed furthest downstream could have stayed on task longer due to the time lag required for water levels to rise, but this course was not taken in the interests of safety. A ballpark figure for the actual coverage was 5 to 10 % of the area FERC specified in the SPD.

Substrates. Three substrate scenarios where strandings occurred when dewatered were noted: ledge with depressions, mixed boulder and gravel, porous gravel. Sloping banks were not generally conducive to strandings regardless of substrate.

Predation. Predation was likely higher during the event. Besides strandings, such a precipitous water level drop causes disorientation and stress to aquatic species. Team 2 observed a merganser consuming a salmon parr in a pool of reduced size, Team 3 observed crows on the banks likely consuming stranded macro-invertebrates.

Mortality Factors. Conditions were relatively benign during the event with air and water temperatures mostly in the 60s. Dead fish were observed by all but one team, and this would have likely been more severe if conditions during the event more closely resembled those expected to cause an unplanned trip event: a thunderstorm during the hottest part of the summer, a northeast storm during the coldest part of the winter. It remains unknown how far downstream the effects of the event persisted. The furthest downstream observations were taken about four miles downstream from McKay Station. One would expect for the effects to continue at least another mile downstream to the head of the Nesowadnehunk Deadwater. It would be difficult to determine mortality in the deadwater because dead fish tend to sink and the pool is deep. Adverse effects could continue further downstream to the next impoundment, North Twin. Fish size also seemed to be a significant factor: smaller salmonids and minnows were less likely to survive than larger fish. Duration of the event would also play a major role in mortality rates of stranded fish: the longer the event, the higher the mortality.

Larger Ecological Effects. Few dead macro-invertebrates were observed. Again, relatively benign conditions likely contributed to this. Had the event occurred during sub-freezing or extremely hot weather, it is safe to assume more macroinvertebrate mortality would have been observed. For example, and there are many, one stranded dragonfly nymph was found 20 feet from any water, that may have perished in the event. It is safe to assume that the trip event did not benefit any of the aquatic species, the magnitude of the harm is difficult to determine. Dewatering of aquatic vegetation also occurred. Again, this could have no positive effect, the magnitude of the harm is difficult to determine.

[7] SPD, page B-4: "...downstream from the McKay Station discharge to Nesowadnehunk Falls."
[8] Maine TU Council letter dated September 23, 2022, Subject: Comments of Maine Council of Trout Unlimited on the Draft Fish Stranding Study Plan, page 2.

Conclusion

The observations conducted by TU teams deployed during the October 5, 2022 trip event demonstrate that significant fish stranding and mortality occur downstream from McKay Station when flows are reduced abruptly from 2200 cfs to 400 cfs. The incidence of mortality could be expected to increase further during dewatering events that occur in extremely hot or cold weather conditions when exposure to very warm or freezing air temperatures will more immediately impact the body temperature of stranded organisms.

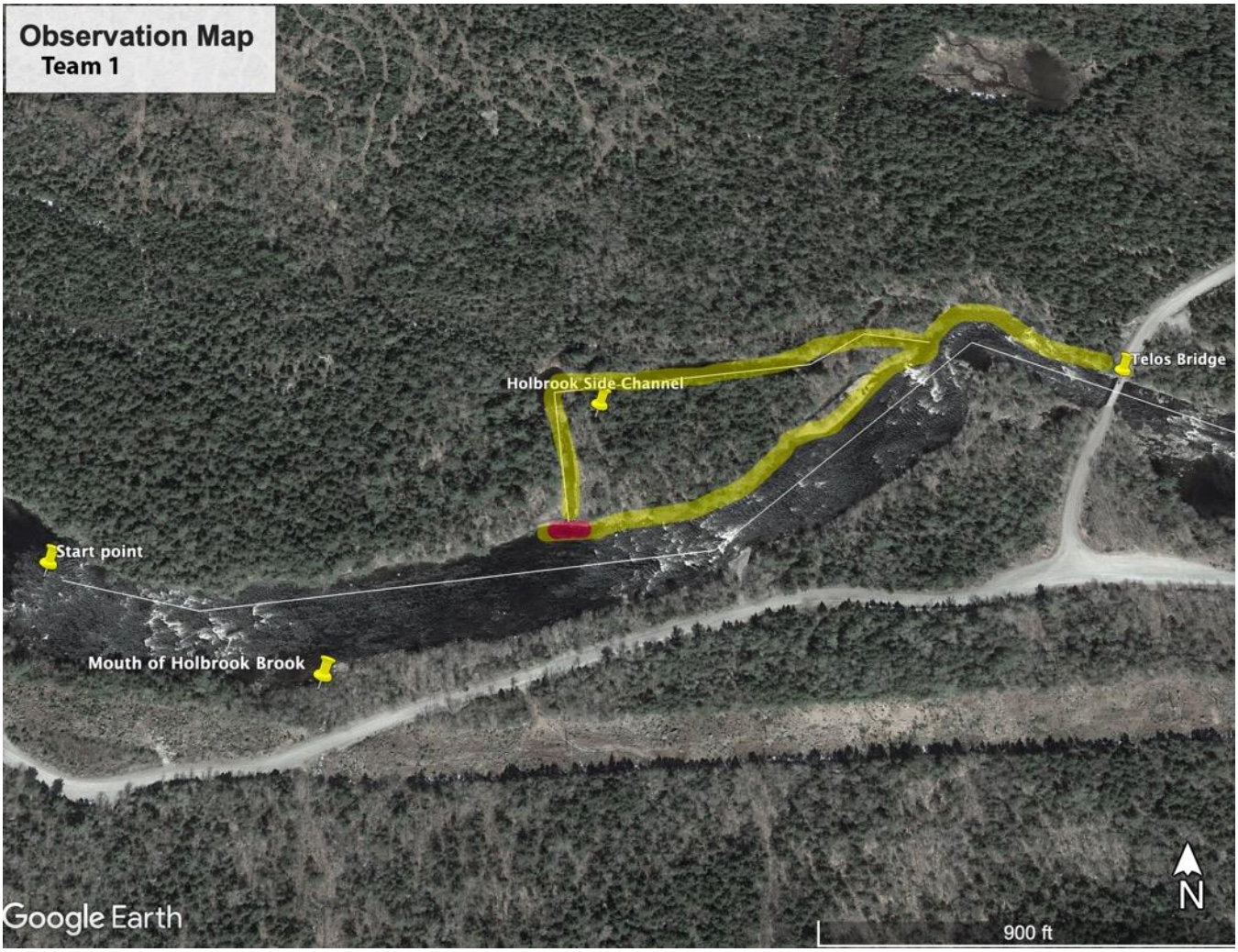
Clearly, further data beyond what are contained in this report are required to determine the minimum flow required to prevent these strandings or if ramping flows would be less harmful to the aquatic life in the affected reach. The Initial Study Report from Brookfield is not due until May 13, 2023.[9] We trust that it will be consistent with our observations, and if it does not include empirical data indicating flows and duration of dewatering required to prevent future mass strandings, that Brookfield will propose additional studies to determine that.

[9] Brookfield letter dated October 12,2022, Subject: Ripogenus Project (FERC No. 2572); Planned Minimum Flow Modification, page 2.

Attachments:

A. Team 1 Map
B. Team 1 Debrief Sheet
C. Team 1 Photos
D. Team 2 Map
E. Team 2 Debrief Sheet
F. Team 2 Photos
G. Team 3 Map
H. Team 3 Debrief Sheet
I. Team 3 Photos
J. Team 4 Map
K. Team 4 Debrief Sheet
L. Team 4 Photos
M. Team 5 Map
N. Team 5 Debrief Sheet
O. Team 5 Photos

Attachment A



yellow: coverage area; red: high stranding area

Attachment B

Debrief Sheet – Team 1

Team Members: David Bean and Max Tritt

Reach: Holbrook side channel

Percent Coverage: 70 %

Shot showing dewatered area: Yes, outside of the side channel

Number of stranded fish: 20 plus

Number of stranded invertebrates: many, mostly stonefly nymphs

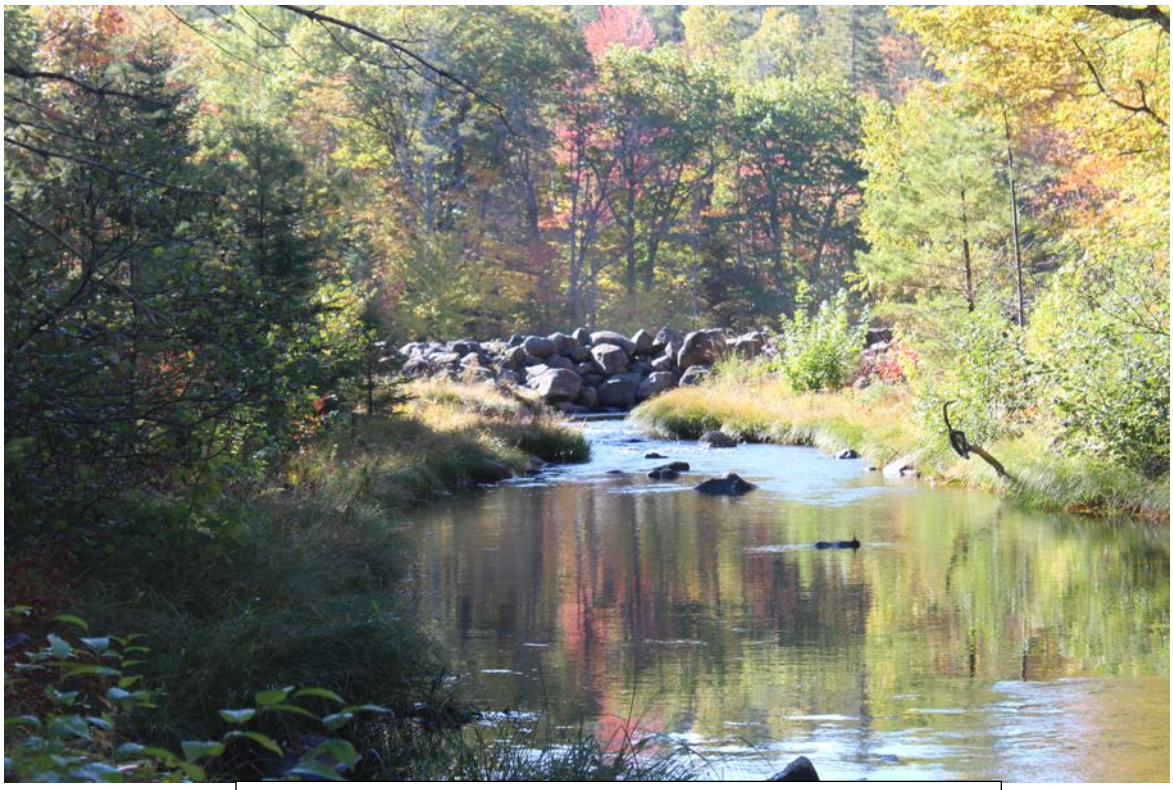
Number of stranded others: minnows including common shiner, and black nose dace

Narrative: The team started their observations on the lower Holbrook reach at 9:33 and went upstream from Telos Bridge to the entrance of Holbrook side channel arriving at 10:00. Around the entrance to the side channel, we observed over 20 fish stranded in pocket water, mostly common shiner, black nose dace, brook trout and landlocked salmon parr – mostly young of the year but one salmon was over 7 inches in length. The flow in the Holbrook side channel was bank to bank and all of the stream habitat there was wetted and continuous, no stranded fish were observed in the Holbrook back channel. While no dead fish or minnows was observed, it was assumed that some would have succumbed in time. The team returned to the campground at 1:00.

The short movies may be viewed at –
https://drive.google.com/drive/folders/1ssnvwFOlQhT_fn93gN1Vk1la1chPv53S?usp=sharing

Attachment C

Selected photos, additional available at https://drive.google.com/drive/folders/1ssnvwFOlQhT_fn93gN1Vk1la1chPv53S?usp=sharing



Holbrook side channel remained watered bank to bank

400 cfs provided adequate water to the intake pipes

Strandings occurred in main river beyond the side channel

Stranded brook trout parr

Stranded stonefly nymph

Stranded crayfish

Stranded blacknose dace

Attachment D

yellow: coverage area; red; high stranding area

Attachment E

Debrief Sheet – Team 2

Team Members: Mike Enos and Jim Hayes

Reach: Holbrook South

Percent Coverage: 55%

Shot showing dewatered area: yes

Number of stranded fish: 2 or 3 landlocked salmon parr (overhanging rock prevented a sure count)

Number of stranded invertebrates: hundreds of nymphal insects, 12 crayfish

Number of stranded others: 12 minnows

Narrative: After arriving at our area at about 9:30, we took GPS coordinates at three access points to the river on the south bank.

The furthest access point upstream was where Holbrook Brook joins the river. There was a small island that formed when flows dropped and numerous unconnected pools. All pools contained stranded animals and plants. This section of our reach included:

2 or 3 salmon. Note: a merganser was photographed consuming a disoriented fish in a shallow but connected pool.

3 crayfish

100s of nymphal insects

Several minnows including one dace and other chub-like ones

We then proceeded to the access point furthest downstream. This section of the reach contained stranded minnows, nymphal larvae, and crayfish.

The area nearest the middle access was checked last. Not as many pools formed there. The drop to the river was steeper along this shore and not much was seen for stranded type pools and no fish or crayfish were seen here along this shore. A few insect nymphs, but no crayfish, minnows, salmon, etc. No Photos were taken here of organisms. Just a photo showing the view along the river.

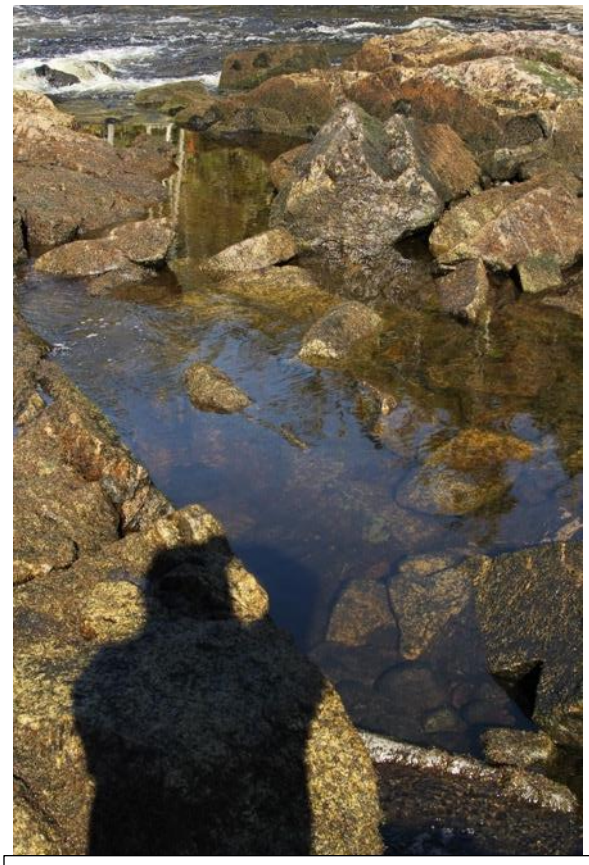
We left the area at noon, and returned to the campground area. A Brookfield field crew and drone were observed in this reach.

Attachment F

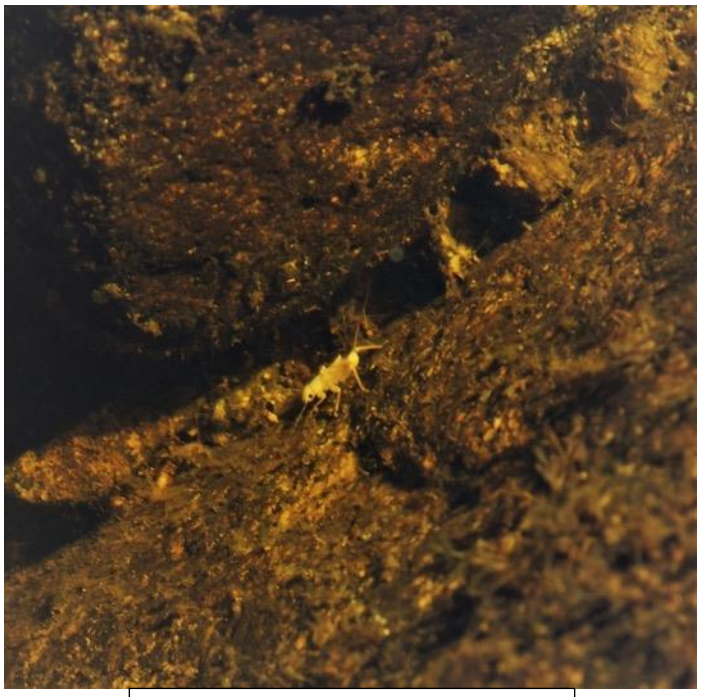
Selected photos, additional available at https://drive.google.com/drive/folders/1ssnvwFOlQhT_fn93gN1Vk1la1chPv53S?usp=sharing

Disconnected pools pool, vicinity of location 1

Stranded salmon parr, vicinity of location 1



Pool that contained stranded salmon parr, vicinity of location 1



Dislodged stonefly nymphs

Stranded dragonfly nymph

Stranded crayfish with dead minnow

Merganser consuming fish in shallow pool

Dead minnows in lower pool

Variety of stranded nymphal insects in lower pool

Attachment G

yellow: coverage area; red: high stranding area

Attachment H

Debrief Sheet – Team 3

Team Members: Charlie Spies and Steve Heinz

Reach: Cribworks

Percent Coverage: 60%

Shot showing dewatered area: multiple

Number of stranded fish: 14, included one dead YOY salmonid

Number of stranded invertebrates: too numerous to count. Macro-invertebrates included black and golden stonefly nymphs, green rockworms, dragonfly nymphs, crayfish and leeches

Number of stranded others: numerous minnows including black-nosed dace

Narrative:

Team arrived at Telos Bridge at 9:25. At 9:30 AM Brookfield Power rapidly reduced main stem river flow from MacKay Power Station to 400 Cubic Feet per Second (CFS) from 2,200 CFS. This was done to simulate minimum downstream flows when the station turbines are shut down for repairs or load leveling. It is generally assumed that this occurs approximately four times per year due to unexpected demand interruptions or repairs. By 10:00 AM our team had observed a significant drop in the river level which seems to stabilize at the Cribworks reach at approximately four vertical feet below the higher flow observed before the simulated "trip event."

1) Cribworks Area (see map Attachment G): Time in 10:00AM; Time Out 11:25AM.

During the observation period, Team 3 covered approximately 60 % of the dewatered river edge areas. Dewatered areas were readily identified by moisture on the rocks and exposed plant growth that typically occurs below water level. The color difference between freshly dewatered shoreline and normally dry shoreline was dramatic and enabled differentiation, captured by photos P1-P4: full flow conditions (9:30 AM) and dewatered views (10:00AM) from Telos Bridge on north bank and and south bank respectively.

Team 5 descended to the south bank below Telos Bridge at 10:00 AM. We immediately found stranded fish and macroinvertebrates in the dewatered area (Photo 5 – Crayfish; Photo 6 Stonefly; Photo 7 Leech - all taken at ~10:04 AM). Definition of fully isolated pools became clear as water receded further from riverbed (Photos 8 and 9 10:16 AM).

At 10:20 AM we observed fish stranded in isolated pools (confirmed salmon parr and brook trout (Photo 10) and a salmon parr that attempted escape from a small pool but returned to the pool on its own. Same fish in same pool was recorded again at 10:44AM (Photos 11-13).

Multiple isolated pools containing stranded macroinvertebrates (stoneflies, crayfish, mayflies) and salmonids were observed during the period between 10:20 and 10:45 (Photos 14-18). The team also

observe a likely high-stranding area further downstream on the south bank but deemed it too dangerous to enter (Photo 19). The team left the south shore at approximately 10:45 AM to survey the opposite (north) bank.

The team surveyed the north bank beginning at approximately 11:07 AM (Photo 20 shows a portion of the reach upstream to the Telos Bridge; Photo 21 shows downstream portion). The team found a different topography than on RR. River left was steeper and seemed to allow for water to recede without creation of isolated pools. No fish stranding was sighted. However, sightings of multiple stranded macroinvertebrates in the dewatered area were common. Very often stonefly larvae and crayfish were found on dewatered rocks and sand as far as 15 feet from the main new low-water line (Photos 22 and 23). It seems unlikely they would successfully migrate to the water line from such a distance, especially the insect nymphs which are subject to desiccation. The team also observed crows actively feeding in the dewatered area and it seems likely that they were taking advantage of the exposed food bonanza of stranded macroinvertebrates.

The team exited the Cribworks reach at approximately 11:25 AM.

Culvert Pool Reach: Time in: 11:35 AM and Time out: 12:05 PM

At approximately 11:30 AM the team drove about ¼ mile below the Telos Bridge on river left to a reach called the "Culvert Pool" (see Attachment G). The topography was flatter than the north bank upstream at the Cribworks Photos 24 and 25). Some isolated pools were observed, including on containing Black-Nosed Dace (Photo 26) and much of the dewatered area exhibited multiple stranded macroinvertebrates, including stonefly nymphs and crayfish with lesser populations of caddis fly nymphs and dragon fly nymphs (Photo 27 shows a dragon fly nymph located 20 feet from the water line). Many of these insects and crayfish were found between 15 and 20 feet from the water line. Crows were observed feeding in this area.

Our team left this area at approximately, 12:10.

Side Channel below Cribworks and feeding Culvert Pool River Right: Time in: 12:20 PM; Time Out 12:50 PM

This side channel (Attachment G) was traversed for its entire length until it emptied into the main stem above the Culvert Pool Reach on river-right. It is not a main channel in the river and is approximately 20 feet across and slow-flowing when compared to the main stem. It is separated from the main stem by an island. The channel was deep with steep sides and remained mostly well-watered. Few isolated pools were observed. No stranded fish were observed and few stranded macroinvertebrates were observed.

Summary of Team 3 Observations:

Dewatering CFS from 2,200 to 400 resulted in significant and rapid river level decline (over 30 minutes to lowest level at the Telos Bridge location). This clearly impacted both fish populations and macroinvertebrate populations. Depending on riverside topography the impacts on fish varied. Where the dewatered river's edge was relatively flat a significant number of isolated pools emerged with stranded fish. Many of these continued to drain via the porous sand/rocky river bottom and resulted in fish trying to exit over land and stranding out of water. The south bank area below Telos Bridge is a

good example. Of the number of stranded fish observed by our team, approximately 20, (some isolated pools may have held more fish than we could directly observe), we spotted several fish that were either fully stranded and dying or likely to die due to lack of water or adequately oxygenated water before stream levels recovered later in the day (after 1:30 PM). Fish mortality for those stranded is estimated to have approached 20% given our observations.

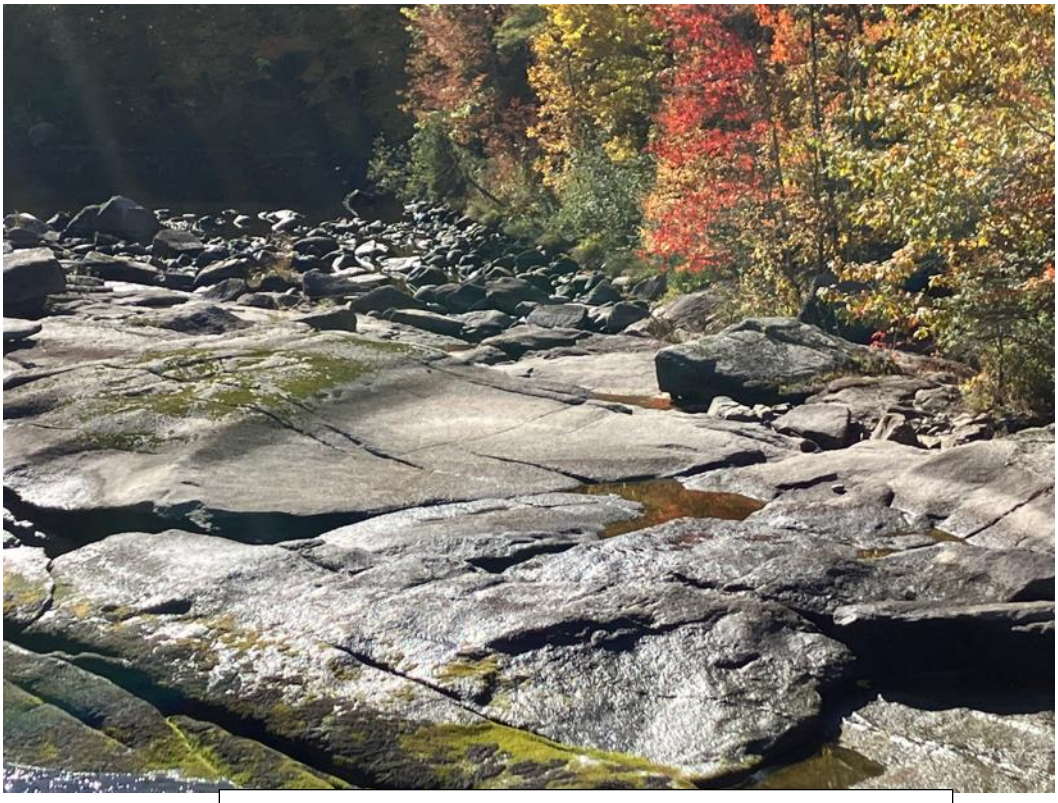
In all areas observed river level decline was significant at 3 – 6 feet depending on topography. In all observed areas stranded macroinvertebrates were common and abundant in dewatered edges. In some cases, stranded populations were observed as far as 20 feet from the river's low water edge. Mortality of insect larvae seems extremely likely. At the time our observations were made air temperature was in the low 60-degree Fahrenheit range. The incidence of macroinvertebrate mortality could be expected to increase further during dewatering events that occur in extremely hot or cold weather conditions when exposure to very warm or freezing air temperatures will more immediately impact the body temperature of stranded organisms.

Prior coverage of the north shore and area just above the Big Eddy by a Brookfield field crew may have affected our results. The crew had a dip net, they may have returned some stranded fish to flowing waters. Most of our stranding fish were discovered in the first hour of investigation in an area the Brookfield crew had not covered – we believe that most perished. We did not return them to flowing waters because we did not want to affect the results of the Brookfield study. Two short movies were recorded: one shows a disconnected pool containing multiple landlocked salmon parr, the other a landlocked salmon parr flopping on ledge trying to escape a small disconnected pool. These and photos not included in Attachment I but can be viewed at -
https://drive.google.com/drive/folders/1ssnvwFOlQhT_fn93gN1Vk1la1chPv53S?usp=sharing

Attachment I

Selected photos, additional available at https://drive.google.com/drive/folders/1ssnvwFOlQhT_fn93gN1Vk1la1chPv53S?usp=sharing

P3 – watered area below Telos Bridge, south bank



P4 – dewatered area below Telos Bridge, south bank

P5 – stranded crayfish

P6 – stranded stonefly nymph

P7 – stranded leech

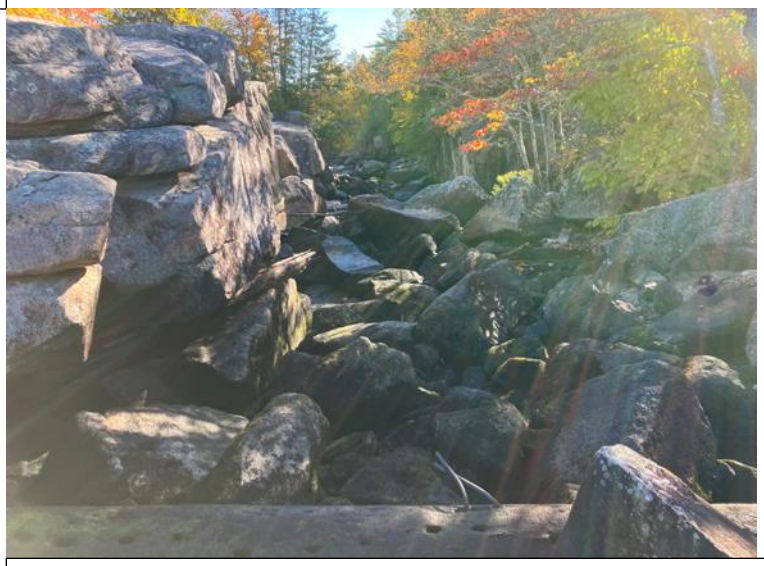
P9 – further isolated pool development

P11- salmon parr stranded on moss after jumping out of pool

P13 – live salmon parr stranded in small pool

P16 – salmon parr exiting small pool

P17 – salmon parr stranded on ledge



P19 – likely high stranding area too dangerous to access

P21 – below Telos Bridge – north bank

P22 – stranded crayfish

P23 – stonefly nymph stranded > 15’ from flowing water

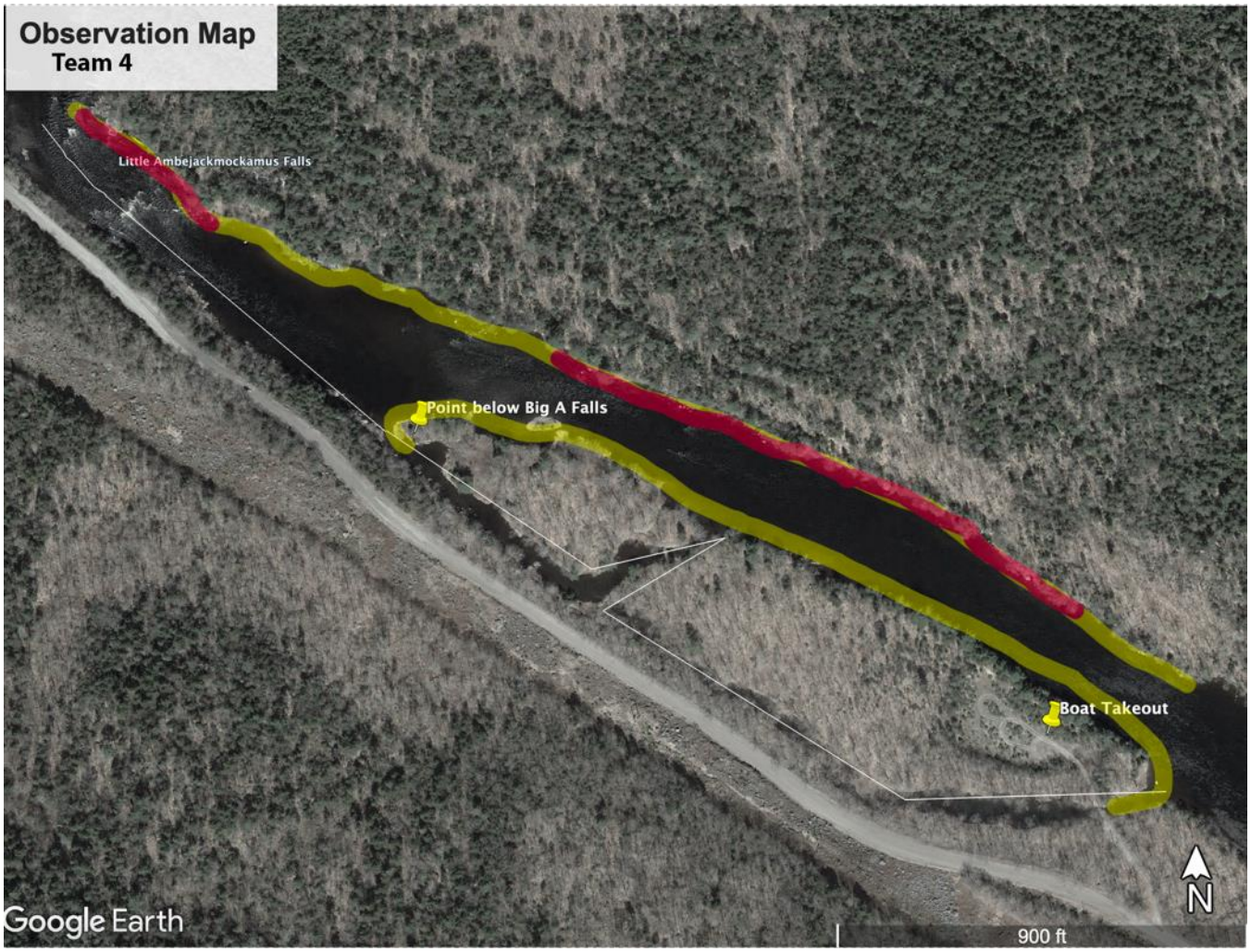
P25 – view downstream at Culvert Pool

P26 – stranded blacknose dace

P27 – dragonfly nymph stranded >20’ from flowing water

P28 – dead salmonid YOY

Attachment J



yellow: coverage area; red: high stranding area

Attachment K

Debrief Sheet – Team 4

Team Members: Julie Puleio and PJ Smith

Reach: Little A Falls

Percent Coverage: 50% plus of south shore with additional coverage of north shore, back channels were not covered.

Shot showing dewatered area: yes

Number of stranded fish: over 45, 15 dead

Number of stranded invertebrates: many including 100s of stonefly nymphs and some crayfish

Number of stranded others: ~36 shiner minnows, many other dead fry

Narrative:
The team arrived at the boat takeout at 9:40 and began to walk upstream [west], but it would be an hour before flows began to drop.

We walked to the point just downstream of Little A Falls and continued on the south shore down to the boat takeout. At 10:30am, we saw countless black and golden stonefly nymphs and approximately three dozen stranded shiners along one stretch of the shore (example images collected between 10:28am and 10:39am).

By 11:00am, low flows had exposed a wadable route to the north shore that we could see contained disconnected pools. Enroute, we found a pool with 5 stranded trout and salmon (example image 10:50am). By 11:45am, the pool had dried up and the fish had perished (example image 11:50am). In the remaining time on the opposite bank along Little A falls, we observed at least 40 stranded salmon in 8 disconnected pools; at least 10 of the salmon were dead. Multiple images and videos captured between 11:09am and 11:21am highlight this. The pools also contained hundreds of stranded stonefly nymphs and a number of crayfish.

After investigating the dried pool we returned to the north bank, this time further downstream (highlighted as the second, red high stranding area.) Here we also discovered approximately a dozen disconnected pools with one to many parr in each. Images and videos captured between 12:03pm and 12:06pm EST highlight this.

We began walking out at 12:45pm. We did not have time remaining to investigate the side channels that were part of our assigned area, as our observations lead us to investigate the north banks more heavily.

Eight short movies were taken during the course of the team's investigation. They may be viewed at - https://drive.google.com/drive/folders/1ssnvwFOlQhT_fn93gN1Vk1la1chPv53S?usp=sharing

Attachment L

Selected photos, additional available at https://drive.google.com/drive/folders/1ssnvwFOlQhT_fn93gN1Vk1la1chPv53S?usp=sharing

Disconnected pools, south bank

Dewatered gravel bar, with dead salmon parr

Dead and dying salmon parr

Dead salmon parr

Stranded stonefly nymph, dead dace

Stranded stonefly nymph

Disconnected pool, north bank

Dead salmon parr

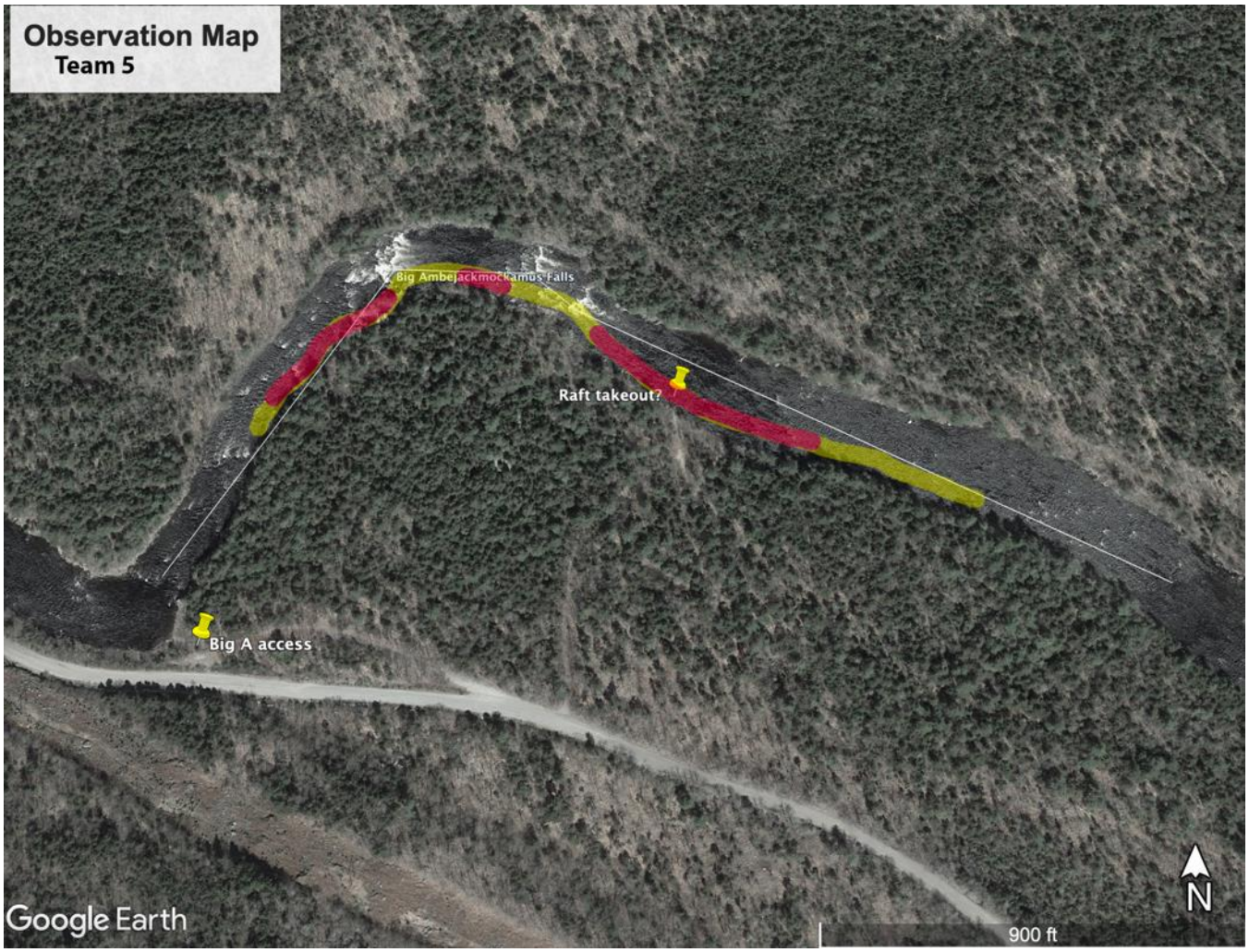
Stranded salmon parr

Stranded salmon parr

Dead salmon parr

Stranded crayfish

Attachment M



yellow: coverage area; red: high stranding area

Attachment N

Debrief Sheet – Team 5

Team Members: Rory and Angela Hannon

Reach: Big A Falls

Percent Coverage: 80%

Shot showing dewatered area: Multiple

Number of stranded fish: 10, half were dead

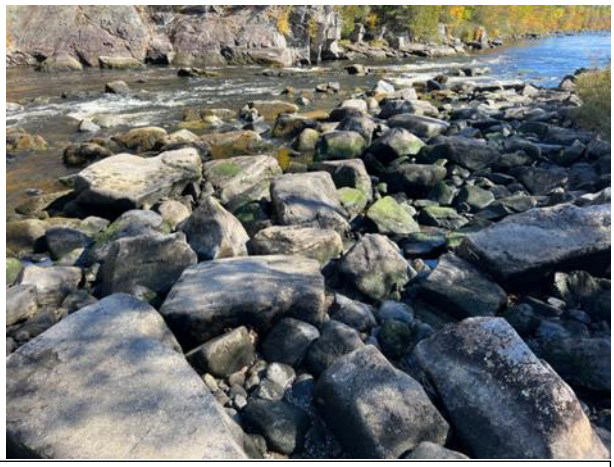
Number of stranded invertebrates: many including stonefly nymphs, dragonfly nymphs, hellgrammites, and crayfish

Number of stranded others: minnows included sculpin, black nosed dace and others.

Narrative: The team started at the raft takeout at the base of Big A Falls at 9:30 and walked downstream along the south bank and observed stranded macroinvertebrates, minnows, sculpin, crayfish and salmon parr. We then walked back to the base of the falls and started south where we also found many stranding of the above-mentioned organisms. We left the area at 1:00.

Attachment O

Selected photos, additional available at https://drive.google.com/drive/folders/1ssnvwFOlQhT_fn93gN1Vk1la1chPv53S?usp=sharing



Disconnected pools at the base of Big A Falls

Dead landlocked salmon

Multiple dead black nosed dace

Dead salmon YOY

Stranded crayfish

Stranded sculpin

Multiple dead salmon YOY

Stranded hellgrammite

Dead minnow

Dead stonefly nymph

Stranded dragonfly nymph

Multiple species stranded or dead