

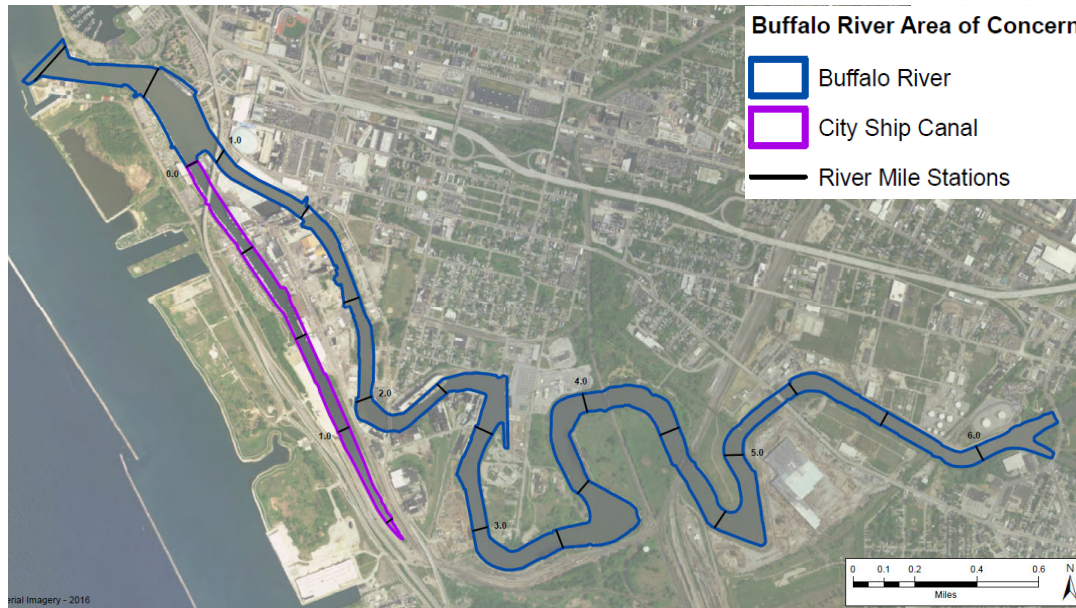
POST-REMEDIATION MONITORING OF THE BUFFALO RIVER

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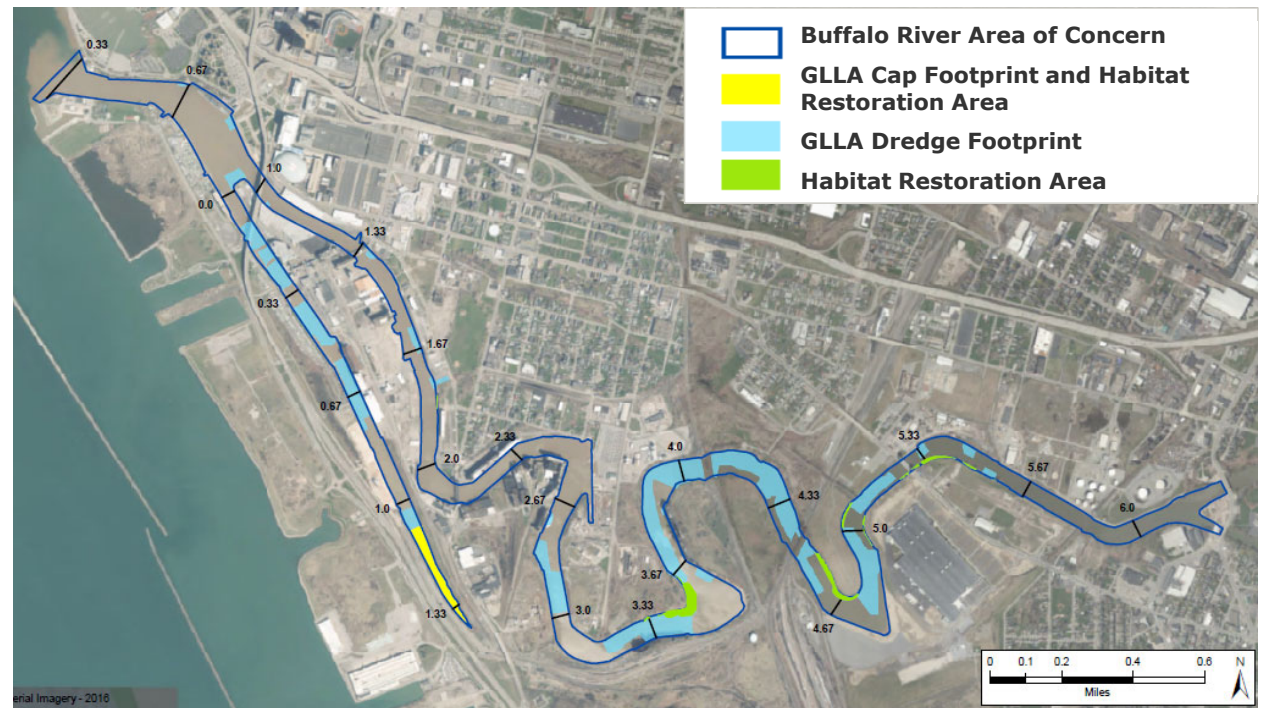
SITE BACKGROUND

- Buffalo River is located in Buffalo, New York and drains into Lake Erie
- Urban river system, significantly altered over time
- Area of concern (AOC) = lower 6.2 miles of Buffalo River + 1.2 miles of City Ship Canal



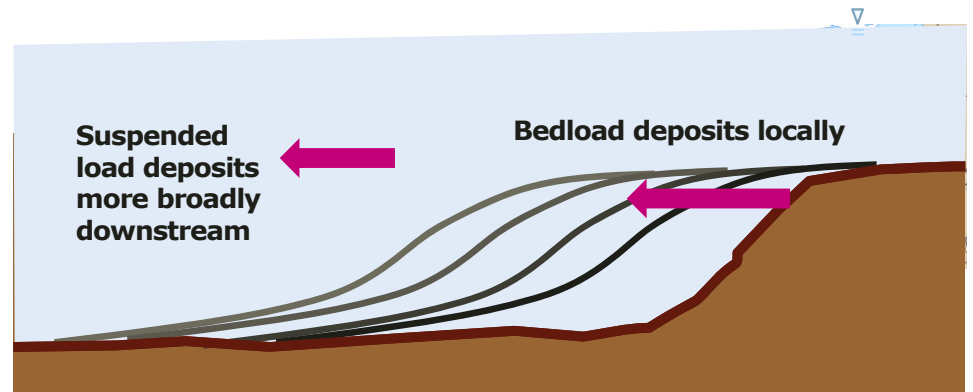
SEDIMENT REMEDIATION

- Sediment remediation was conducted under the Great Lakes Legacy Act (GLLA) program
 - COCs: PAHs, mercury, lead, PCBs
 - Removal of ~450,000 CY of contaminated sediment
 - 5-acre cap in the City Ship Canal
 - 5 habitat restoration areas
 - Total GLLA project cost = \$48.5MM



MANAGEMENT OF DREDGE RESIDUALS

- The Buffalo River is low-energy, net-depositional system
- Natural depositional processes, rather than backfilling, was selected for the management of dredge residuals
- Post-remediation verification monitoring is being conducted to determine if remedial goals are being achieved
 - Year 2 (2017)
 - Year 5 (2020)



SUMMARY OF YEAR 2 MONITORING ACTIVITIES

01

Bathymetric Surveys

- Sedimentation rates
- Cap monitoring

02

Surface Sediment Chemistry

- Discrete samples (total PAHs)
- Composite samples (mercury, lead and total PCBs)

03

Biological Monitoring

- Benthic community surveys
- Fish community surveys

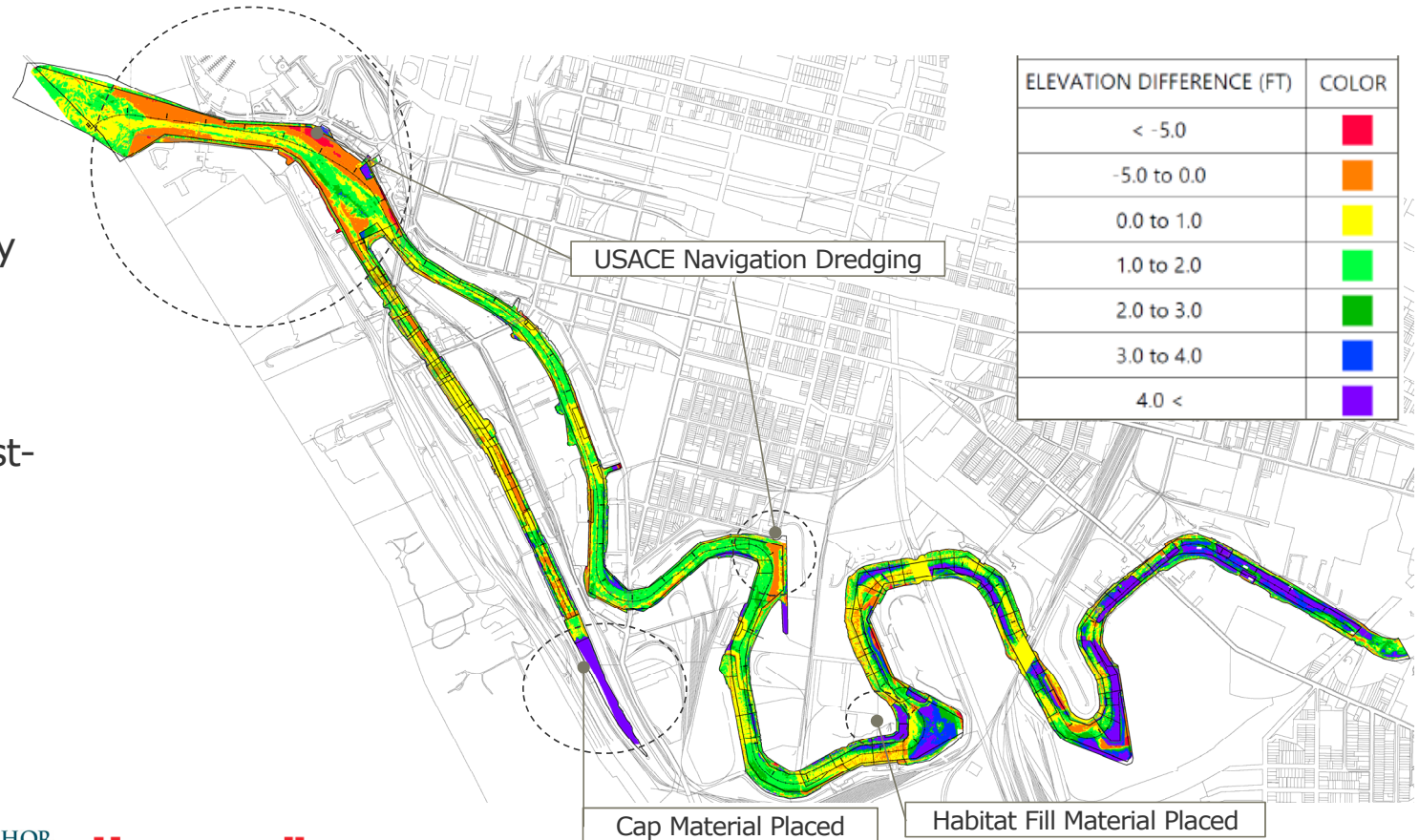
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Habitat Restoration

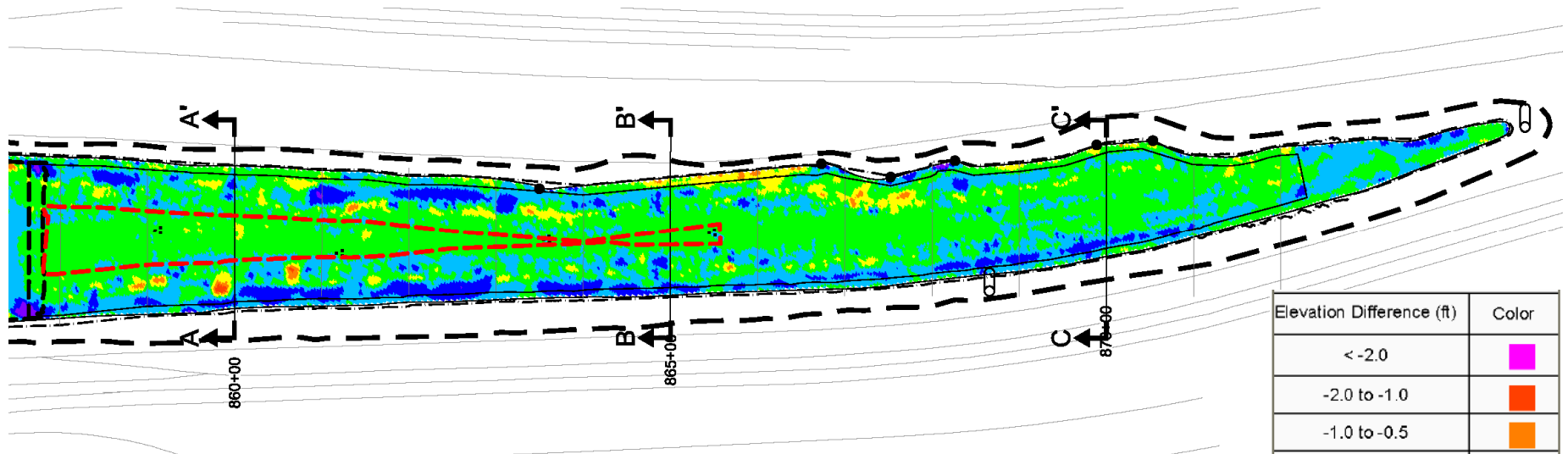
- Permit monitoring event

BATHYMETRY/SEDIMENT DEPOSITION

- Full river multibeam survey, supplemented by single beam (2017)
- 2017 survey compared to post-dredge survey (2013–2015)



CAP MONITORING



- City Ship Canal cap remains stable
- Cap and habitat restoration area has experienced deposition since construction (2014)



SURFACE SEDIMENT CHEMISTRY

- Year 2 (2017) surface sediment chemistry
 - 260 discrete samples for total PAHs
 - 12 composite samples for PCBs, lead, mercury
 - 40 total organic carbon samples
 - 40 grain size samples
- Sediment chemistry results are compared to Buffalo River remedial goals

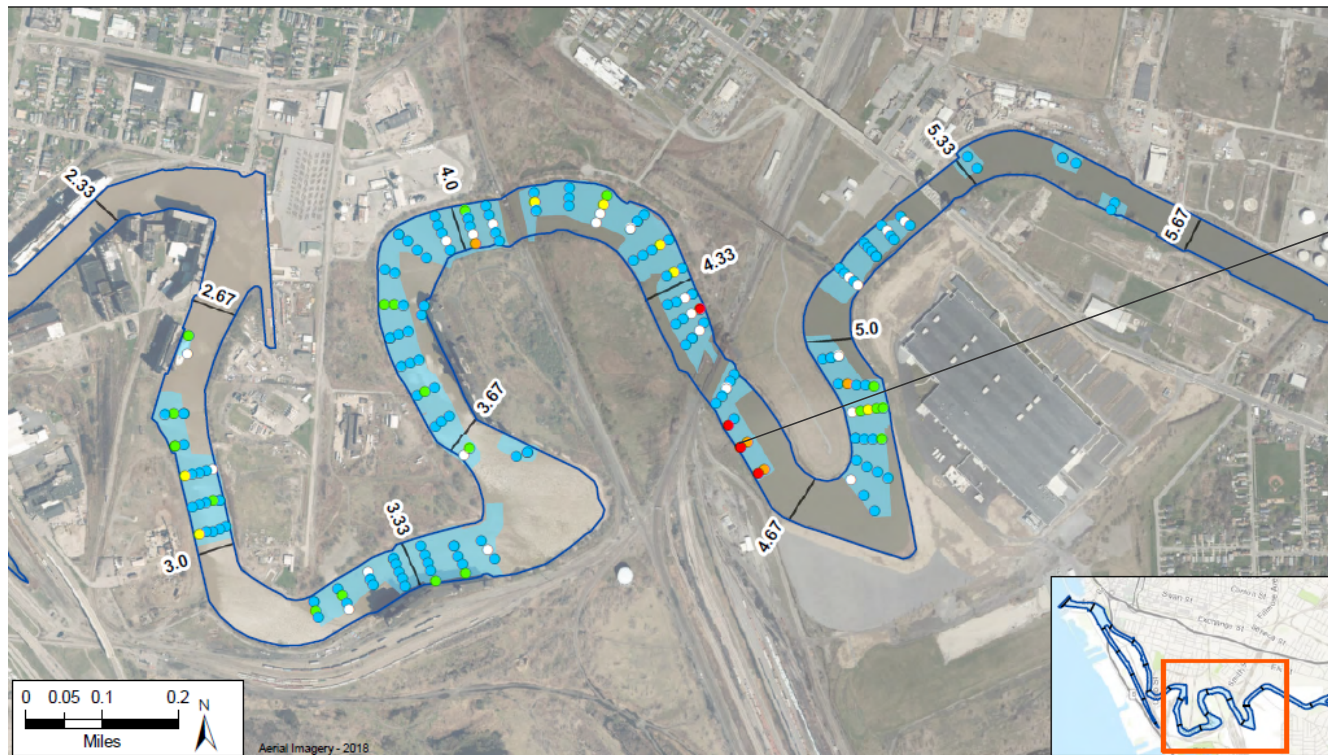


Chemical	Buffalo River Remedial Goals
Total PAHs	1 toxicity unit (16 mg/kg)
Lead	90 mg/kg SWAC
Mercury	0.44 mg/kg SWAC
Total PCBs	0.20 mg/kg SWAC



SEDIMENT CHEMISTRY

TOTAL PAH CONCENTRATIONS



PAH(mg/kg)

- < 16 (<1×RG)
- 16-32 (1-2×RG)
- 32-80 (2-5×RG)
- 80-160 (5-10×RG)
- >160 (>10×RG)
- Abandoned Sample Location
- GLLA Dredge Footprint
- Buffalo River Area of Concern

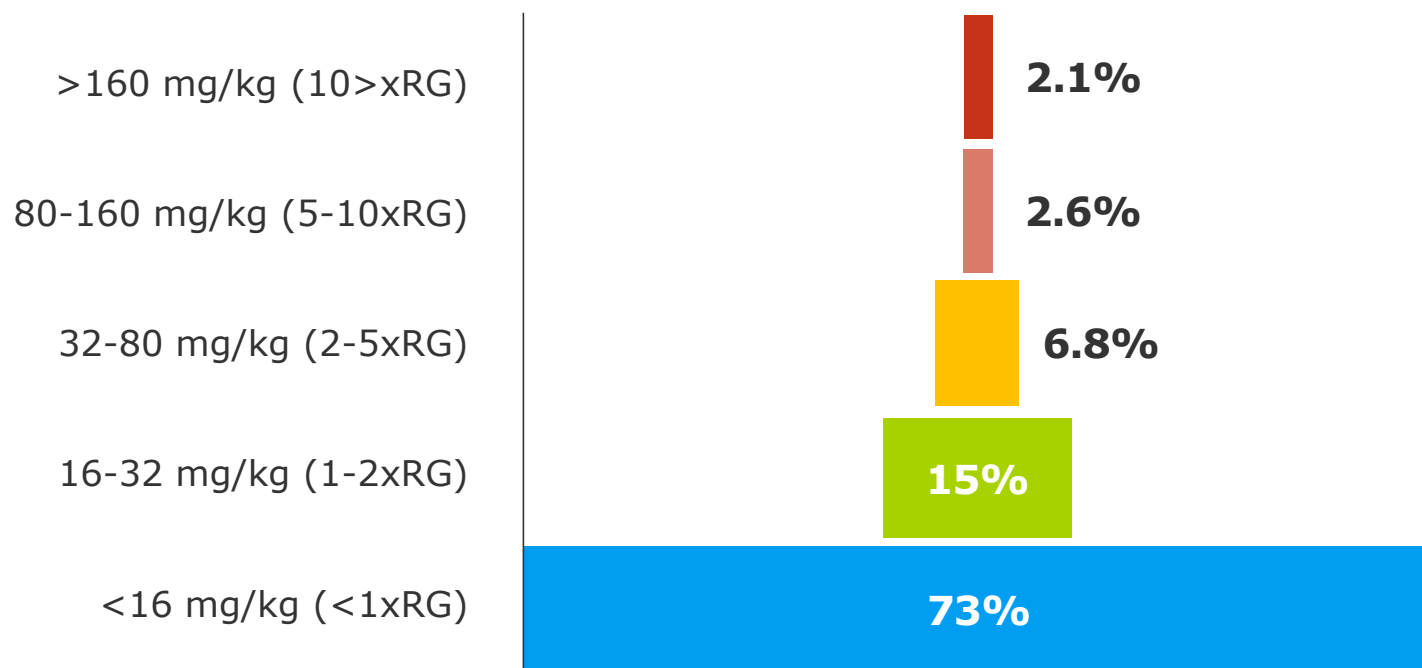


SEDIMENT CHEMISTRY

TOTAL PAH CONCENTRATIONS

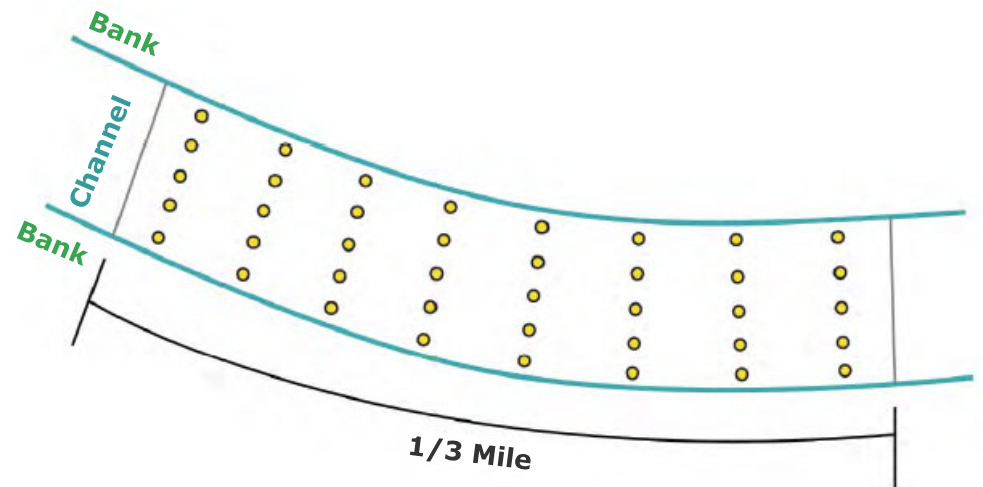


DISTRIBUTION OF TOTAL PAH CONCENTRATIONS

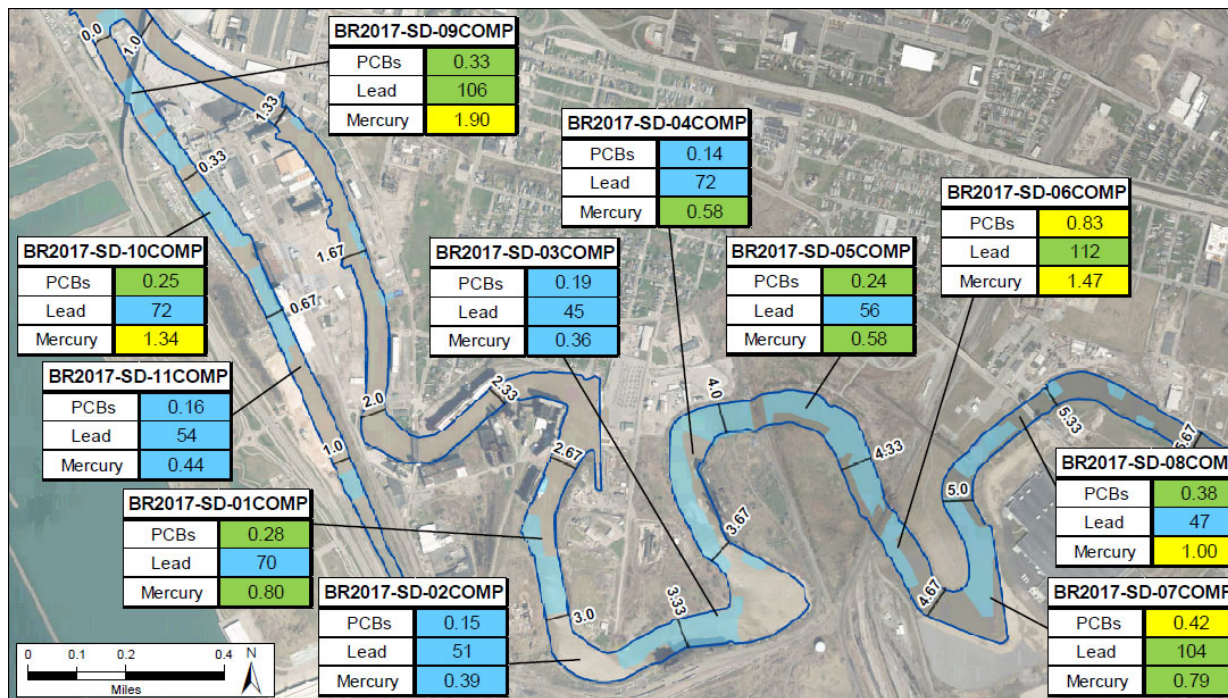


COMPOSITE SAMPLE APPROACH

- Each composite sample analyzed for:
 - Lead
 - Mercury
 - Total PCBs
- Composite samples were collected from 11 areas
- Composite areas = 1/3 mile segments of the river, bank to bank
- 40 samples targeted per composite
 - 8x5 grid



SEDIMENT CHEMISTRY COMPOSITE SAMPLE RESULTS



GLLA Dredge Footprint
Buffalo River Area of Concern

SWAC RG	
PCBs (mg/kg)	0.2
Lead (mg/kg)	90
Mercury (mg/kg)	0.44

<1×RG
1-2×RG
2-5×RG

DISTRIBUTION OF COMPOSITE SAMPLE RESULTS

	PCB	Lead	Mercury	Total	Total, %
<1×RG	4	8	3	15	46%
1–2×RG	5	3	4	12	36%
2–5×RG	2	0	4	6	18%
Total No. of Samples	11	11	11	33	100%



SURFACE SEDIMENT RECOVERY IN YEAR 5 (2020)

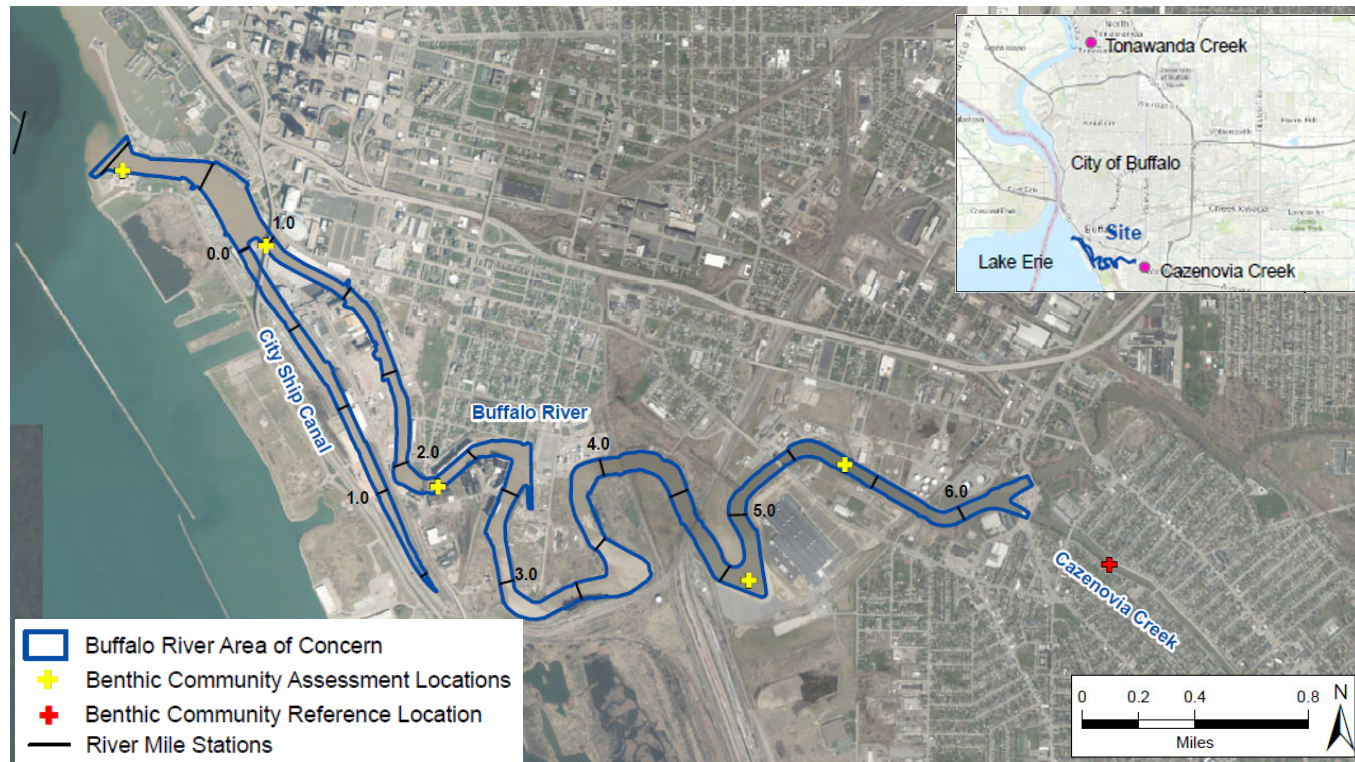
- Areas that did not achieve the sediment RGs in Year 2 will be monitored in Year 5
- Surface sediment concentrations were estimated for Year 5, based on:
 - Year 2 surface sediment concentrations
 - Sedimentation rates
 - COC concentrations of incoming sediments
 - Depth of mixing
- In general, locations that did not achieve the RGs are predicted to meet the RGs in Year 5
- Areas that do not achieve RGs at Year 5 may be subject to additional monitoring or remediation measures



BIOLOGICAL MONITORING

BENTHIC COMMUNITY SURVEYS

- 5 BR locations
- 2 reference locations
 - Cazenovia Creek
 - Tonawanda Creek



BENTHIC COMMUNITY MONITORING APPROACH

Sample areas	Sediment grab locations	Hester-Dendy locations	Total number of replicates per sample	Total number of samples
Buffalo River	5	5	3	30
References	2	2	3	12
Total				42

- Evaluated 2017 data using both NYSDEC and USEPA approaches
- Compared the 2017 results to baseline conditions (2008)



HESTER-DENDY SAMPLER

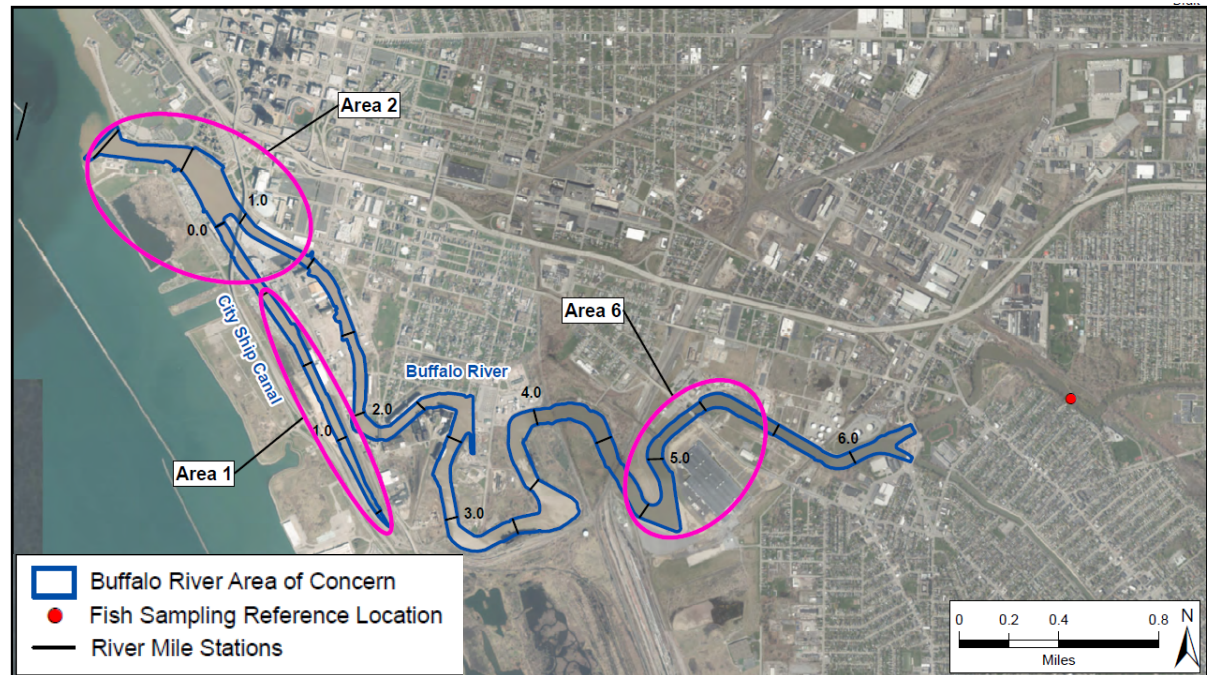
BENTHIC COMMUNITY FINDINGS

- Both NYSDEC and USEPA approaches show Buffalo River benthic community conditions are comparable to reference areas
- Slight to moderate impairment for both sediment grab samples and Hester-Dendy samples
 - Severe impairment for grab samples (NYSDEC approach)
- Over time (baseline to 2017)
 - No specific trajectory observed (improved, declined, no change)
 - Overall conditions slightly improved



FISH COMMUNITY SURVEYS

- 3 BR fish community areas + 1 BR reference
- Approaches evaluated
 - Index of Biological Integrity (IBI) approach
 - NYSDEC Fish Impairment approach
- 2017 compared to baseline (2008 and 2012)



FISH COMMUNITY FINDINGS

- NYSDEC and IBI approaches show that compared to BR reference:
 - Areas 1 and 2 fish community is similar to reference
 - Area 6 fish community shows some potential impairment (IBI poor/fair; NYSDEC severe)
- Over time (baseline to 2017)
 - Reference: Slight improvement (IBI); no change (NYSDEC)
 - Buffalo River Areas: Generally slight improvement to no change (IBI) and no change (NYSDEC)
- Snapshot in time, additional monitoring planned in 2020



HABITAT RESTORATION

- Vegetation assessments
 - Emergent vegetation (EV) struggled to establish in most planting locations
 - Additional studies using high vigor EV species and modified planting approaches have been conducted
 - Submerged aquatic vegetation populations showed improved survival and was thriving in the City Ship Canal cap area
- Habitat structure assessment
 - Presence and location of in-water habitat structures demonstrated minimal movement
- Additional monitoring events to be performed on an annual basis.



CONCLUSIONS & NEXT STEPS

CONCLUSIONS		→	NEXT STEPS
<p>Bathymetric surveys and surface sediment sampling</p> <ul style="list-style-type: none">• Demonstrate remediation and natural recovery processes are contributing to achievement of RGs• Majority of areas > RG in Year 2 are expected to achieve RG in Year 5	<p>Benthic community</p> <ul style="list-style-type: none">• Results showed slight/moderate impairment with generally no changes over time <p>Fish community</p> <ul style="list-style-type: none">• Results show no change/slight improvement over time		<p>Year 5 Monitoring (2020) will include:</p> <ul style="list-style-type: none">• Similar bathymetry, chemistry and biological monitoring• Fish tissue sampling and fish histopathology evaluations <p>Year 5 results will:</p> <ul style="list-style-type: none">• Further inform the river's natural recovery processes• Demonstrate biological community changes

THANK YOU

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