BUFFALO RIVER, NY

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Project Coordination

Great Lakes Legacy Act Project Sponsors

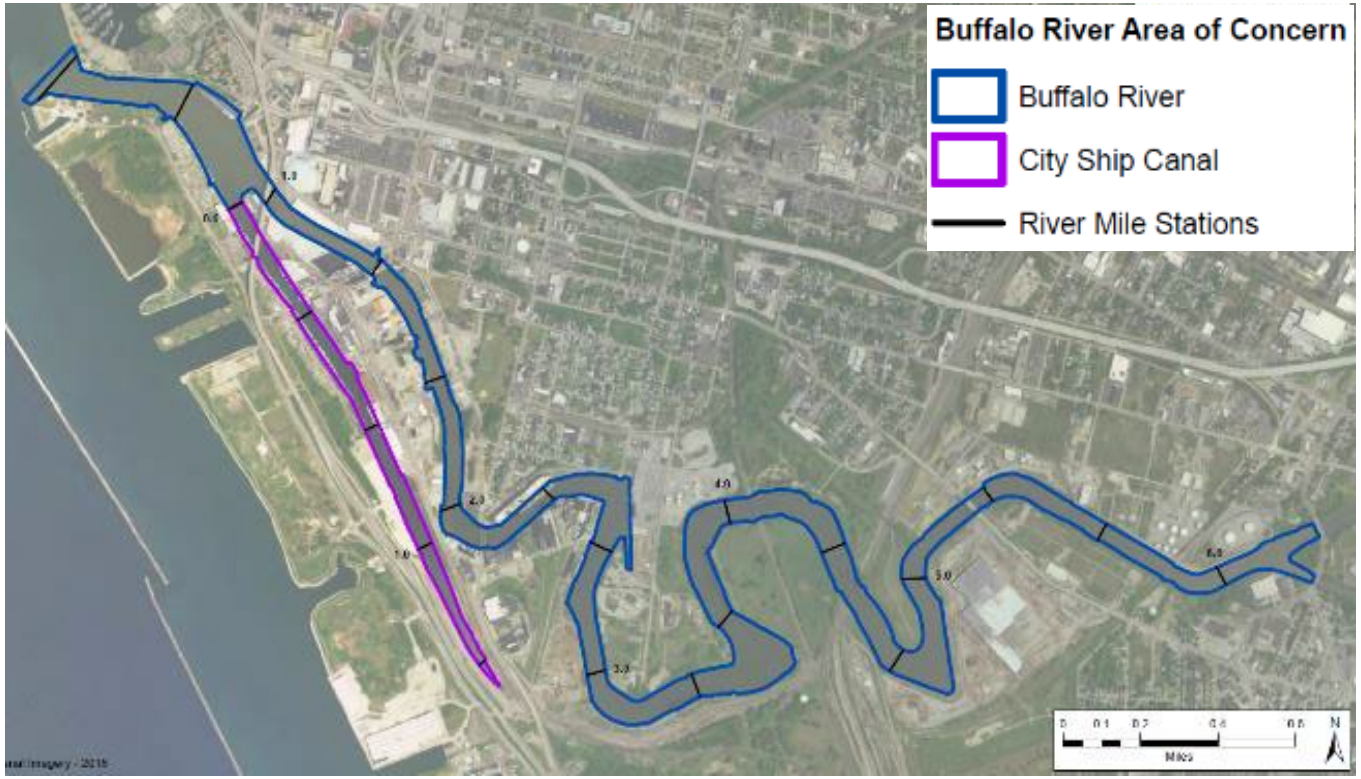
- Federal: USEPA GLNPO
- Non-Federal: Honeywell
- Non-Federal: Buffalo Niagara Waterkeeper

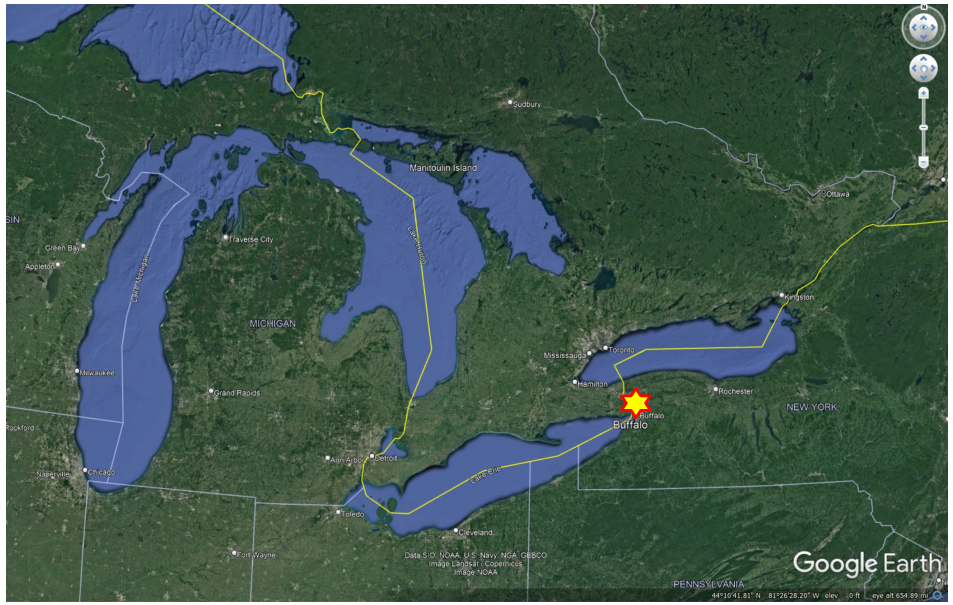
Project Coordination Team Members

- USEPA Region 2
- NY State Department of Environmental Conservation (NYSDEC)
- USACE Buffalo District
- US Fish & Wildlife

Site Setting

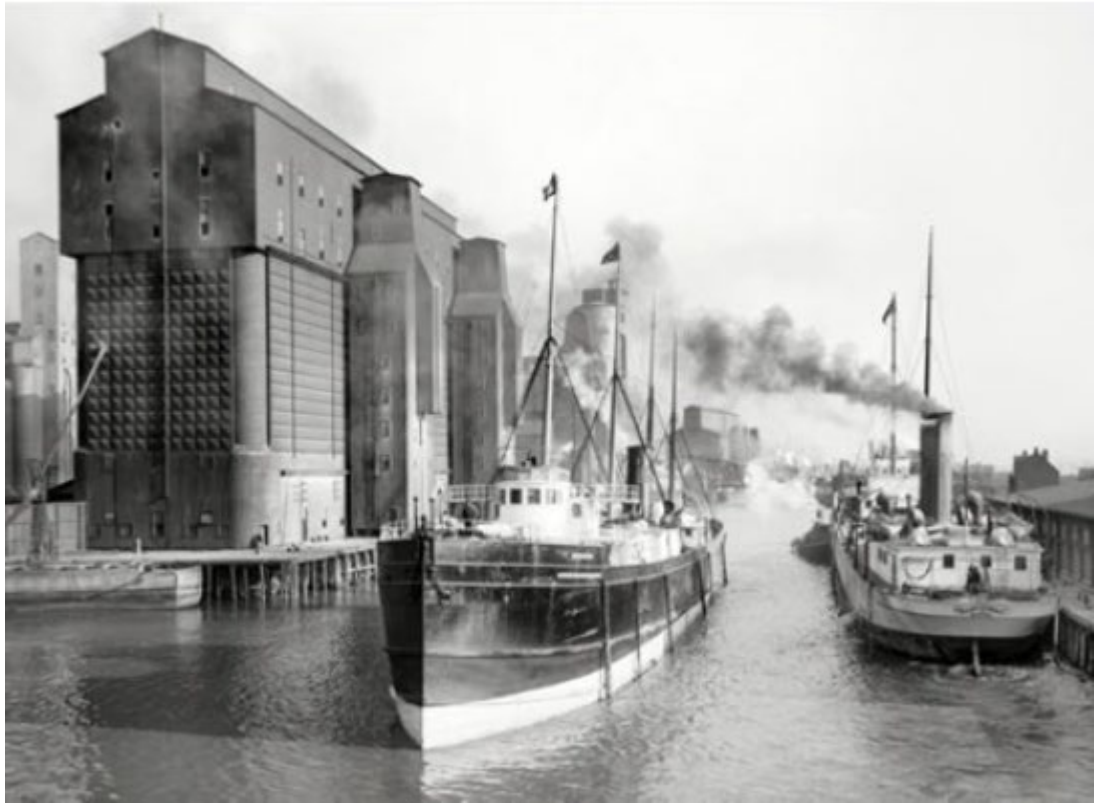
- Buffalo River, Buffalo, New York, drains into Lake Erie
- Urban river system, significantly altered over time
- Area of concern (AOC) = lower 6.2 miles of Buffalo River + 1.2 miles of City Ship Canal





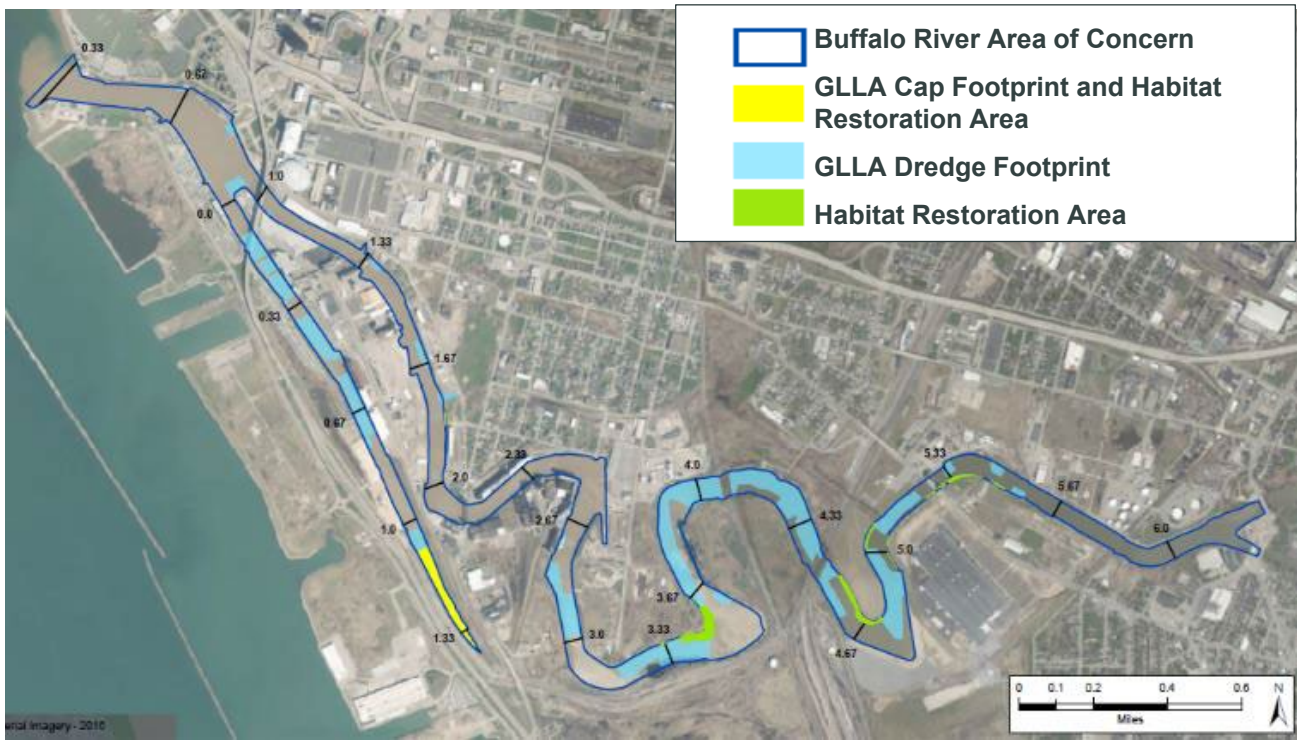
Control of External Contaminant Sources

- Buffalo River sediment contamination resulted from a legacy of industrial operations along the river
- Much of the industrial activity has declined in the last 40 years
- Prior to remediation an evaluation was conducted to demonstrate contaminant sources to the river had been eliminated or controlled



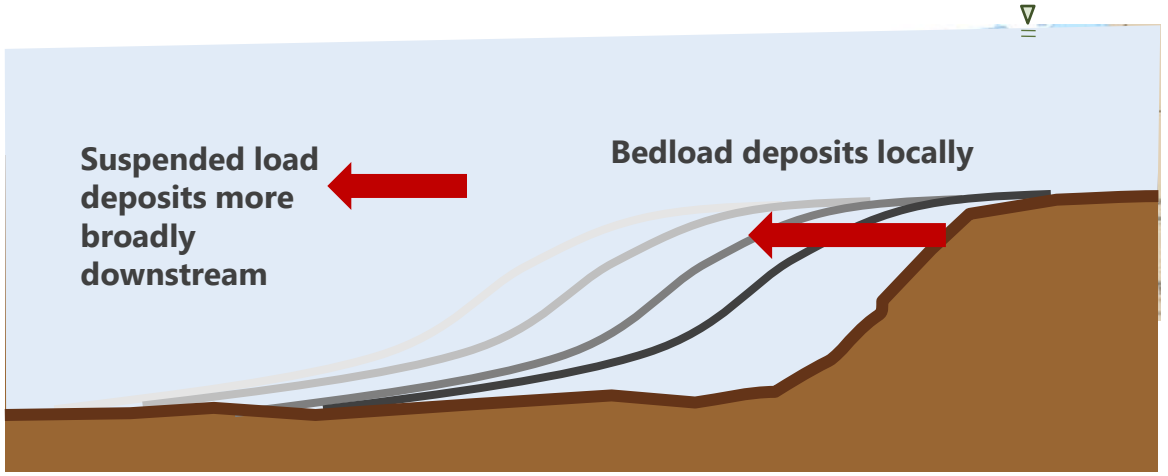
Sediment Remediation

- Objectives
  - Achieve surface sediment remedial goals for the protection of benthos, fish, and wildlife
  - Support the removal of AOC beneficial use impairments (BUIs)
- Sediment remediation was conducted under the GLLA program, 2013-2015
  - 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



Management of Dredge Residuals

- Buffalo River AOC is a low-energy, net-depositional system
- Natural deposition, rather than backfilling, was selected for the management of dredge residuals
- Verification monitoring was conducted to determine if remedial goals were achieved
  - Year 2 (2017)
  - Year 5 (2020)



Remedy Effectiveness Monitoring Elements

01

Bathymetric Surveys

- Sedimentation rates
- Cap monitoring

02

Surface Sediment Chemistry

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

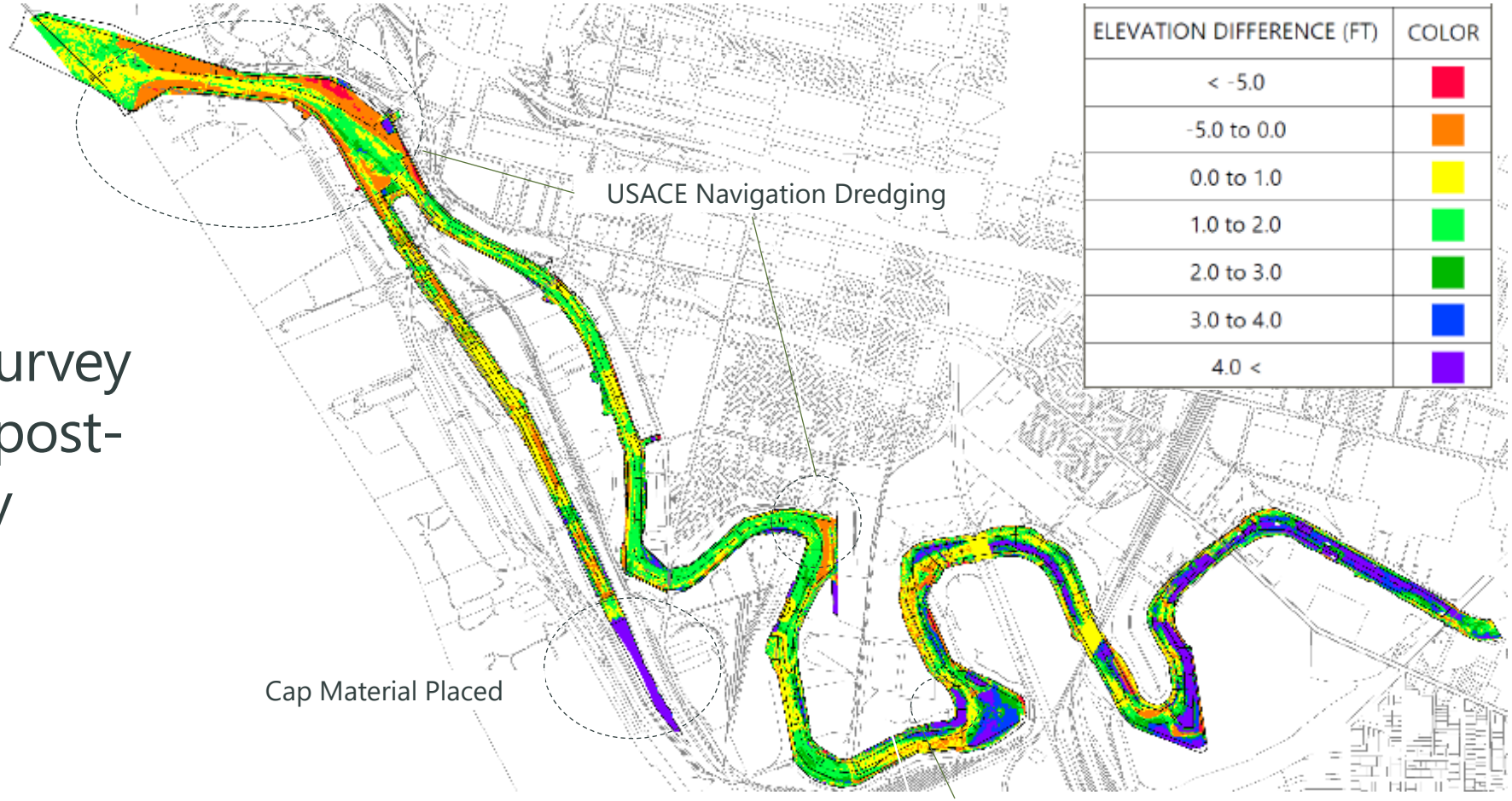
03

Biological Monitoring

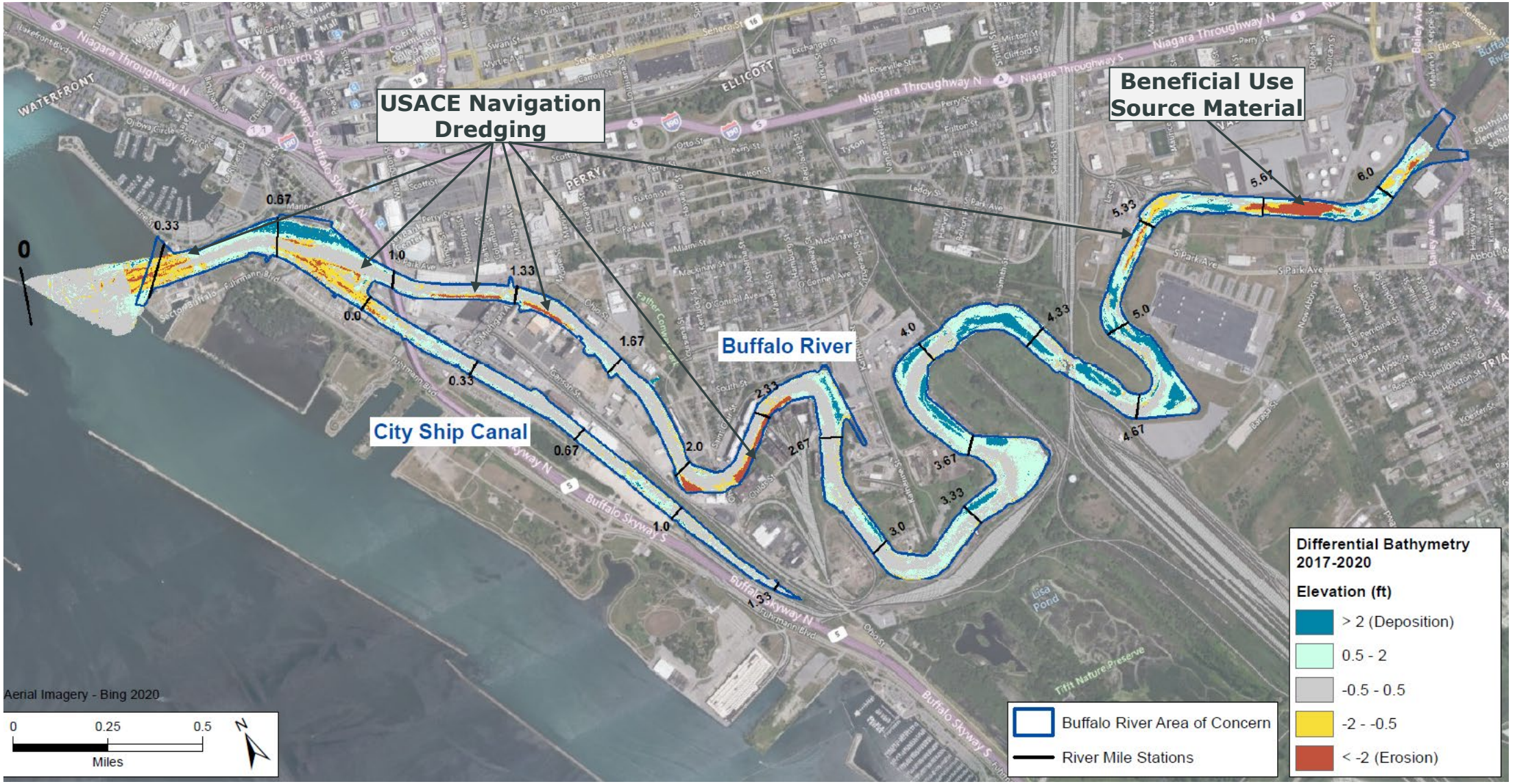
- Benthic community surveys
- Fish community surveys

Differential Bathymetry – Post Construction vs. Year 2

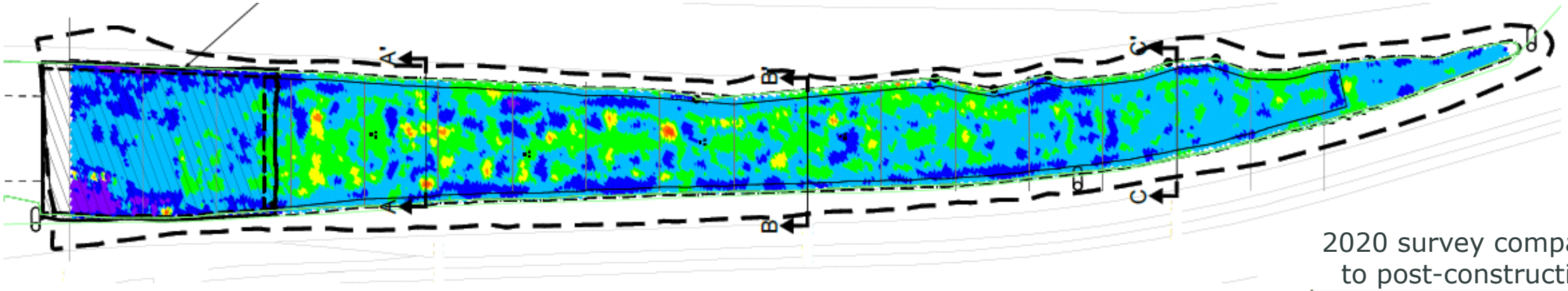
- Year 2 (2017) bathymetric survey compared to post-dredge survey (2013–2015)



Differential Bathymetry – Year 2 (2017) vs. Year 5 (2020)



City Ship Canal Cap Monitoring



2020 survey compared to post-construction

Elevation Difference (ft)	Color
< -2.0	
-2.0 to -1.0	
-1.0 to -0.5	
-0.5 to 0.0	
0.0 to 0.5	
0.5 to 1.0	
1.0 to 2.0	
> 2.0	

- City Ship Canal cap remains stable
- Cap and habitat restoration area experienced deposition since construction (2014)
- Cap area designed as project aquatic vegetation restoration area
- Over 5 acres SAV bed successfully established by Year 5

Surface Sediment Chemistry

- Year 2 (2017) and Year 5 (2020) surface sediment chemistry
  - Discrete locations for total PAHs
  - Composite areas for PCBs, lead, mercury
  - Total organic carbon
  - Grain size
- Sediment chemistry results are compared to Buffalo River remedial goals

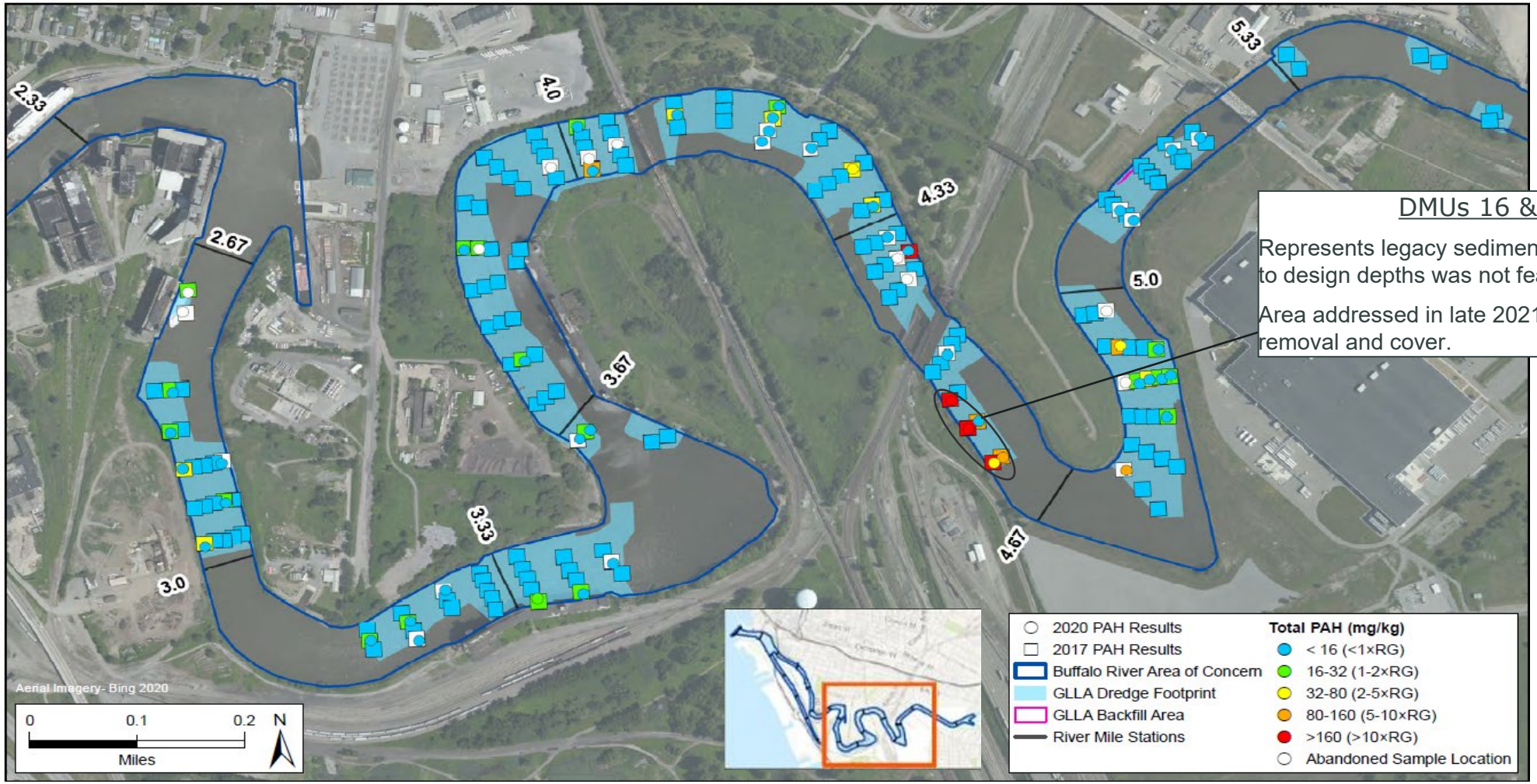
Chemical	Buffalo River Remedial Goals
Total PAHs	1 toxicity unit (16 mg/kg)
Lead	90 mg/kg SWAC
Mercury	0.44 mg/kg SWAC
Total PCBs	0.20 mg/kg SWAC

Verification Monitoring, Surface Sediment Samples

	Number of Samples Collected[1]		
Year	PAHs	Composites[2] for PCBs, Lead, Mercury	TOC and Grain Size
Year 2 (2017)	260	12	40
Year 5 (2020)	87	9	19
Total (Year 2 + Year 5)	**347**	**21**	**59**

1. Sample count includes field duplicates
2. Each composite sample represents ~40 discrete samples

Sediment PAH Concentrations – Year 2 and Year 5

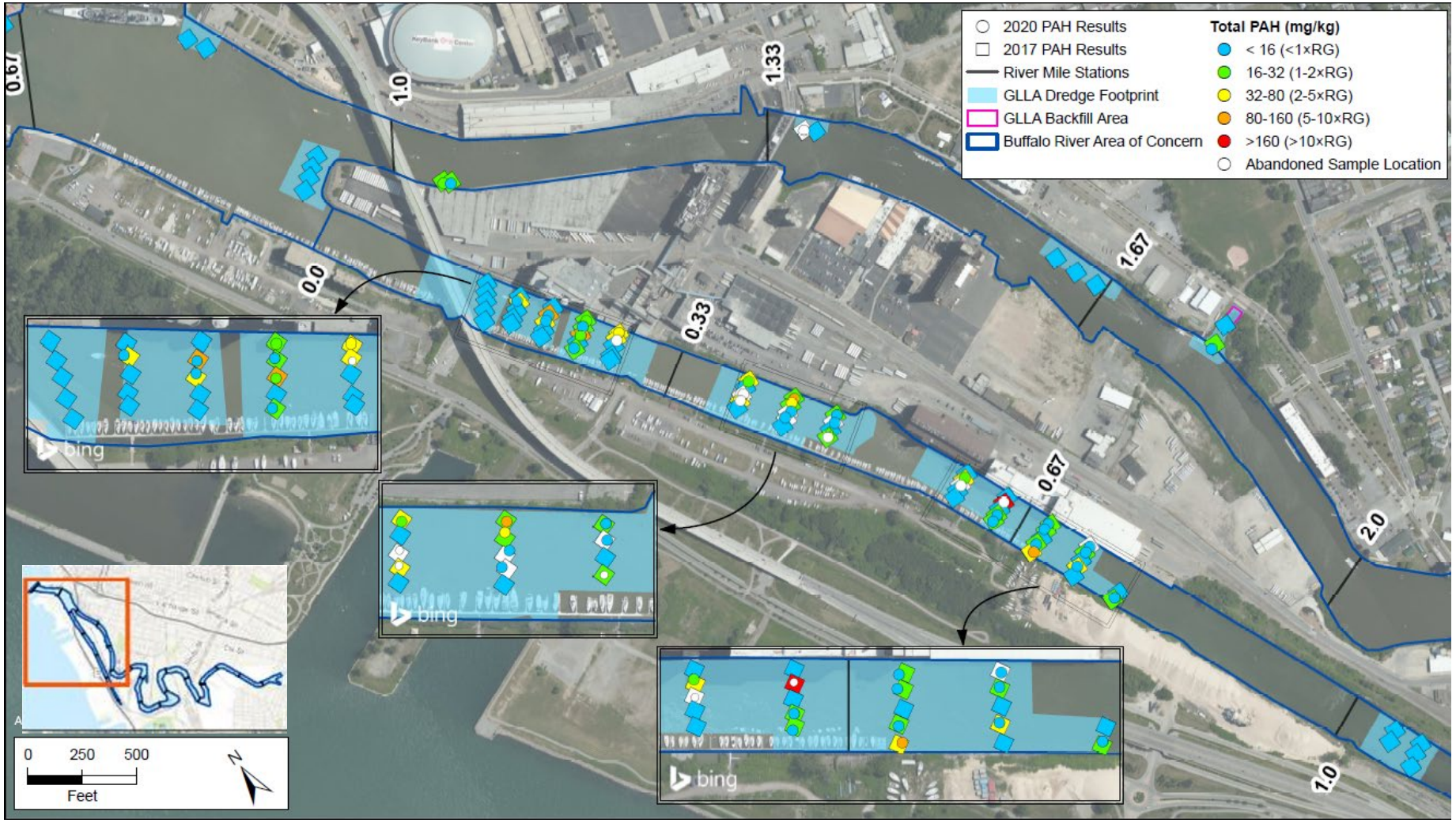


DMUs 16 & 17

Represents legacy sediment where removal to design depths was not feasible.

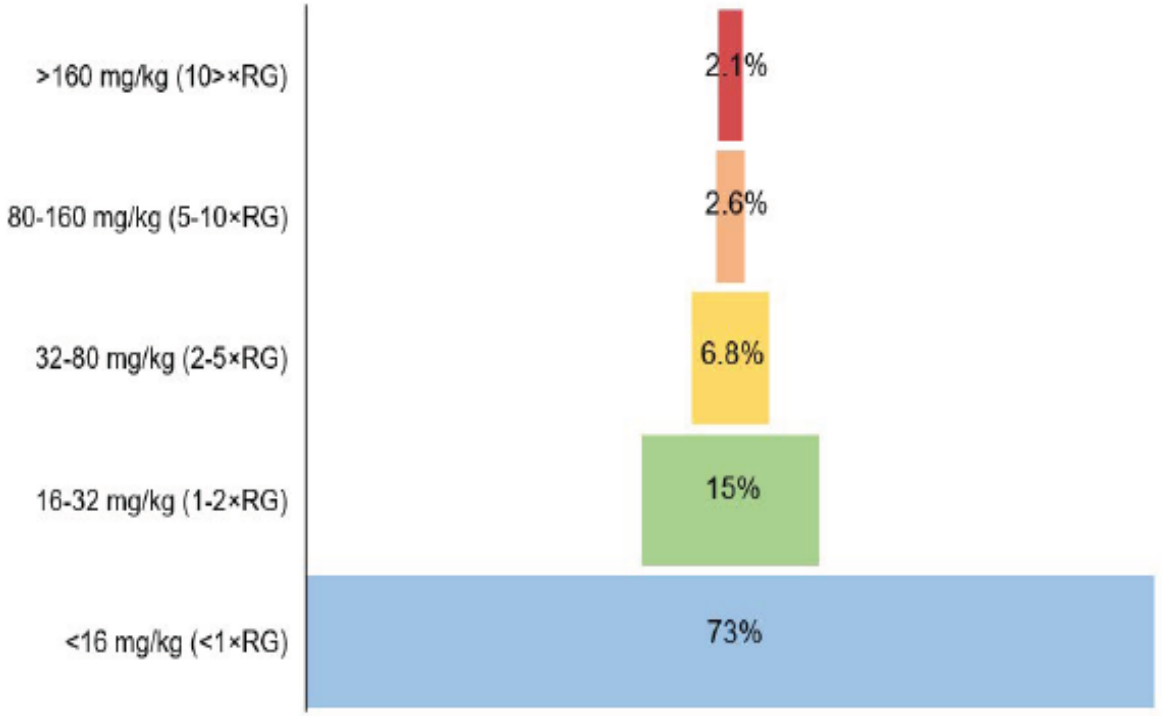
Area addressed in late 2021 with additional removal and cover.

Sediment PAH Concentrations – Year 2 and Year 5

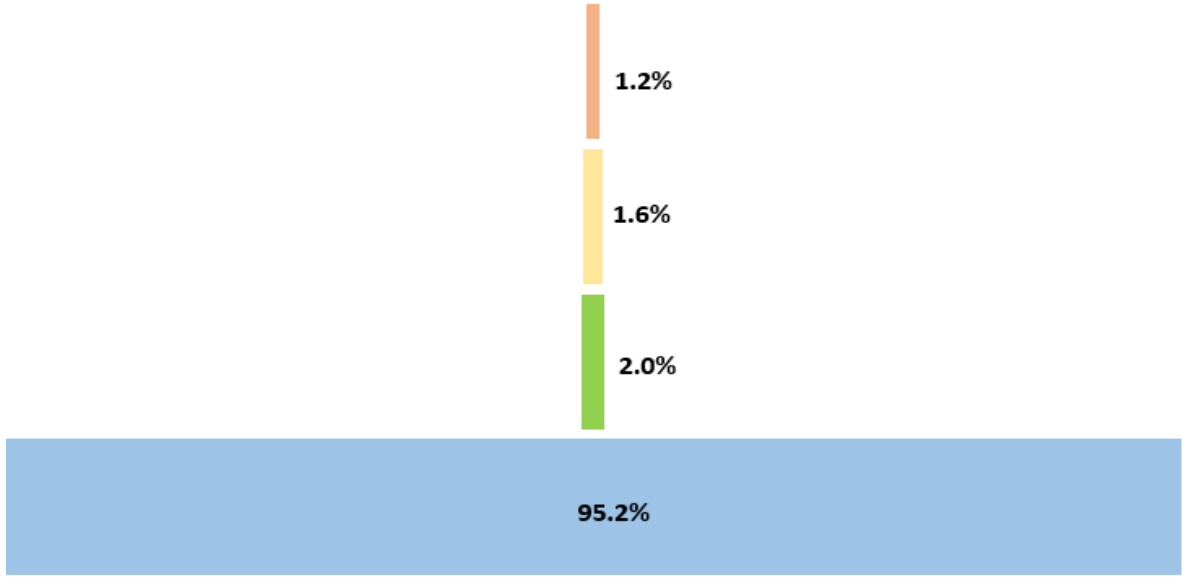


Distribution of PAH Concentrations

Year 2 Distribution

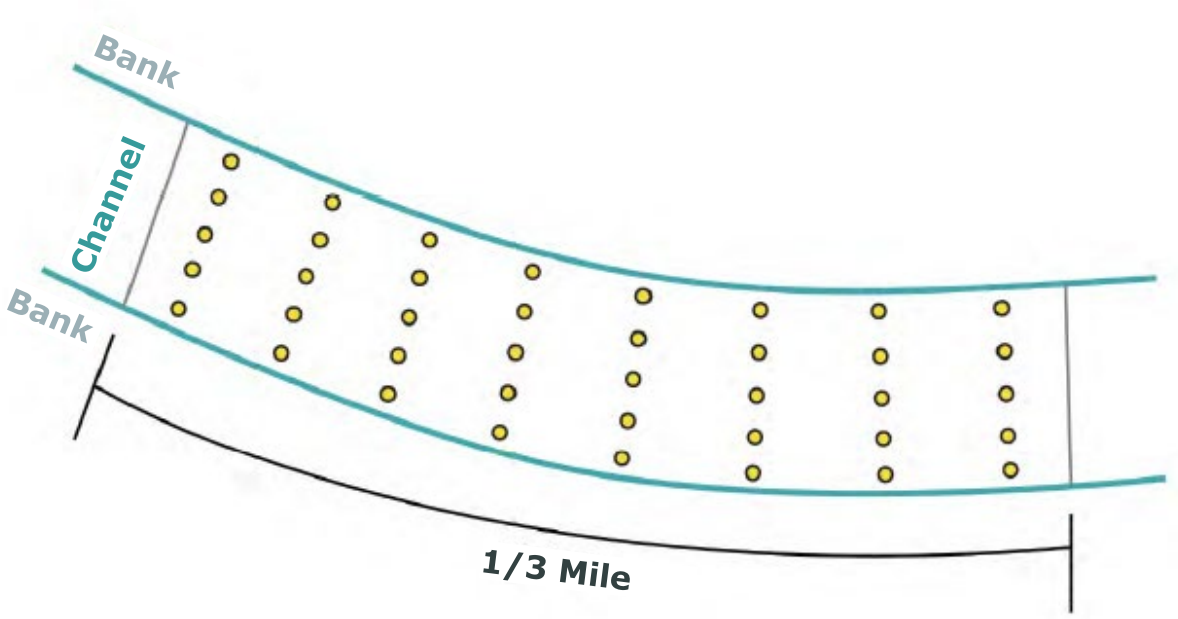


Year 5 + Address DMU 16/17

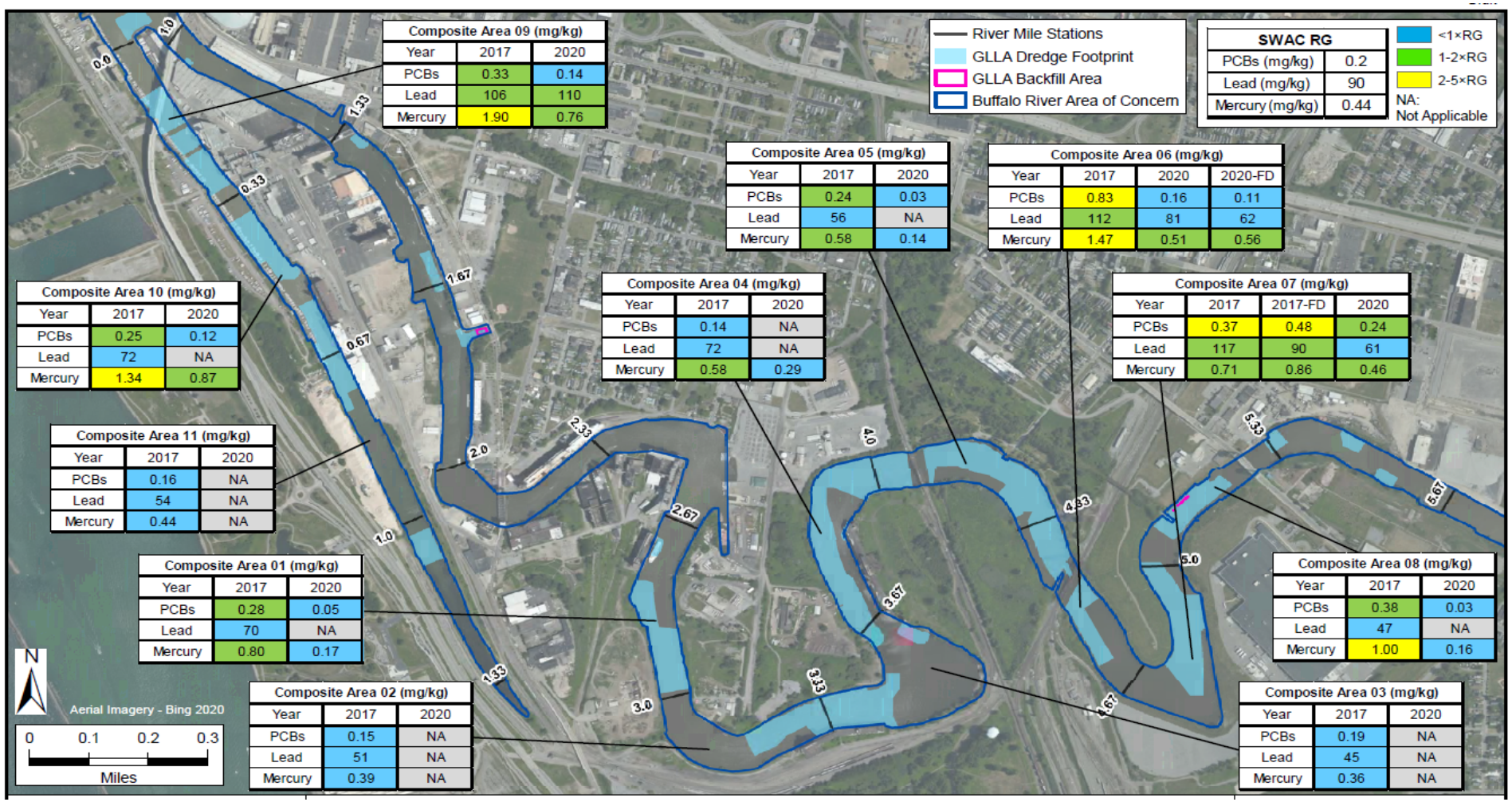


Composite Sample Approach for Area-Weighted COCs

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

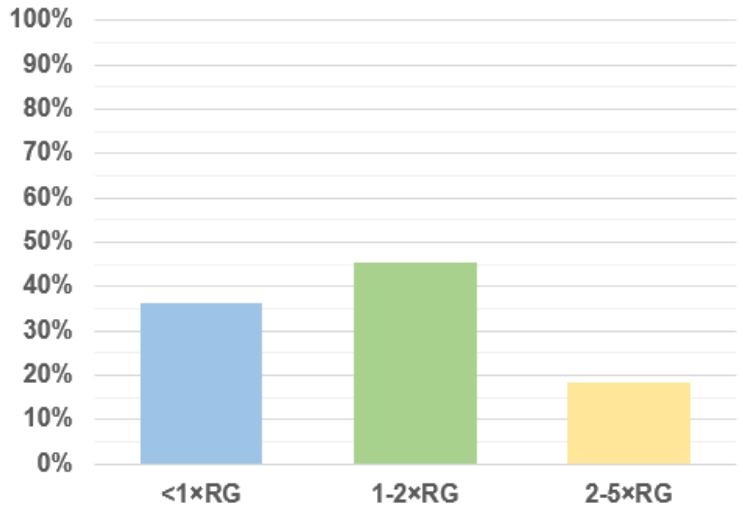


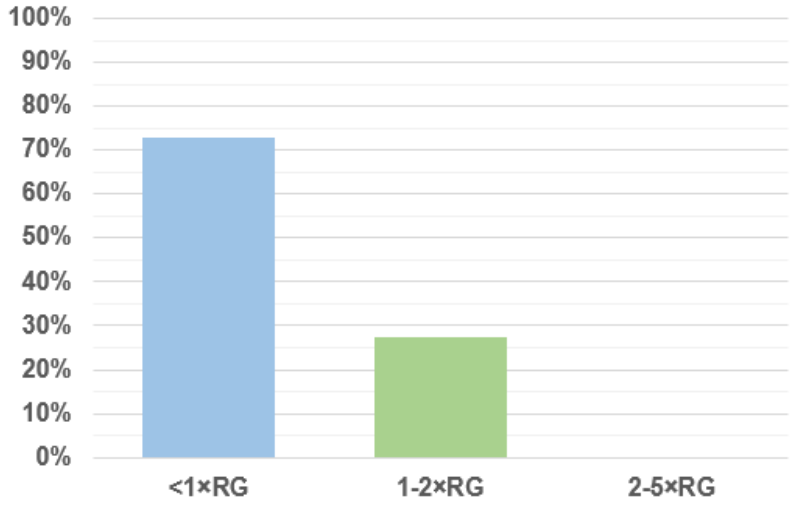
Sediment Chemistry - Composite Sample Results

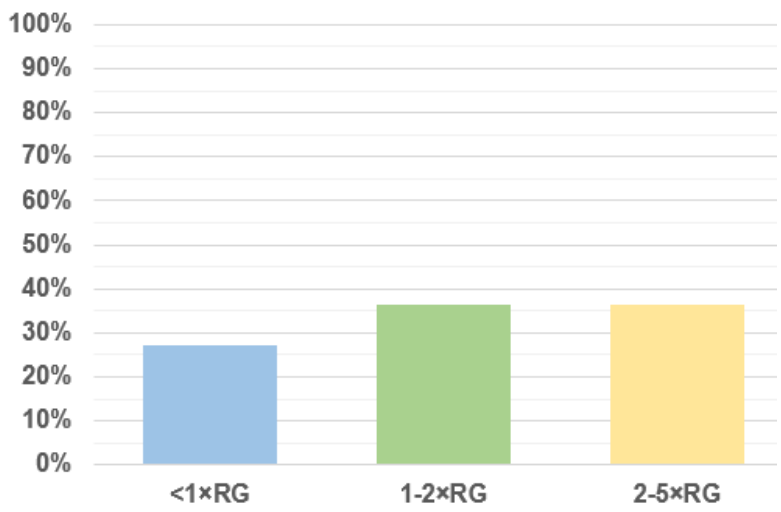


Distribution of Composite Sample Results

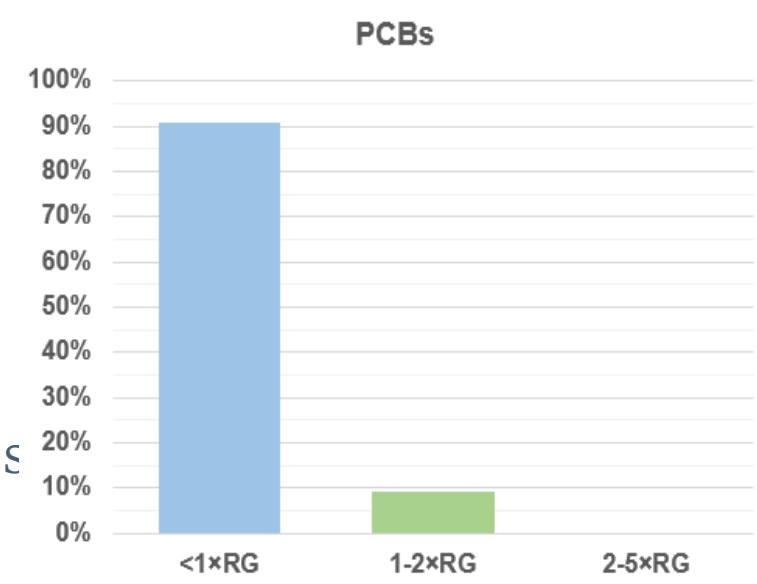
Year 2

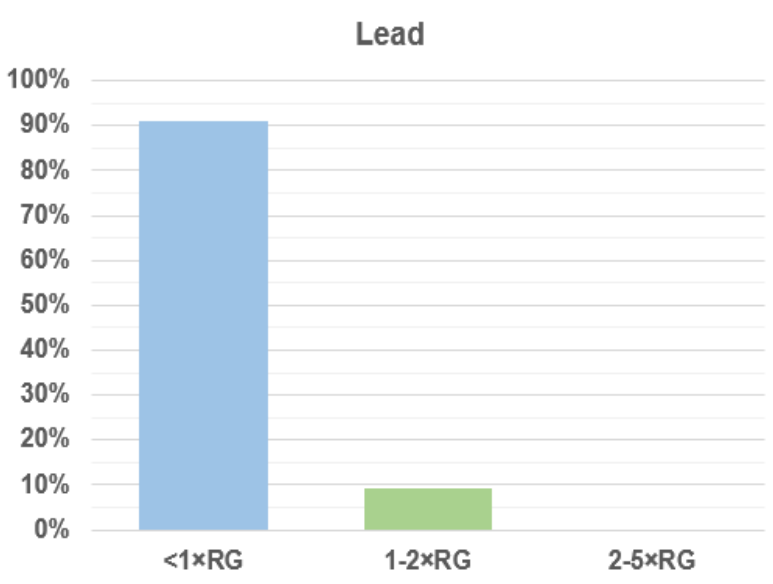


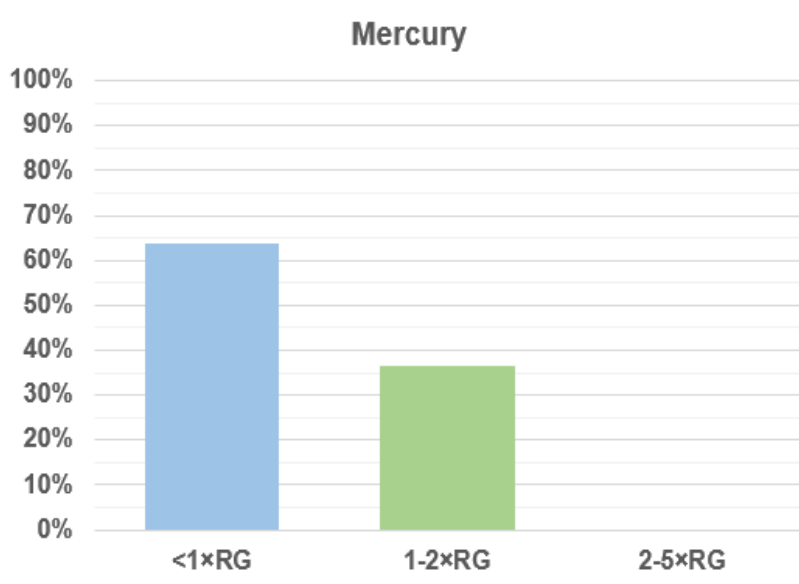




Year 5







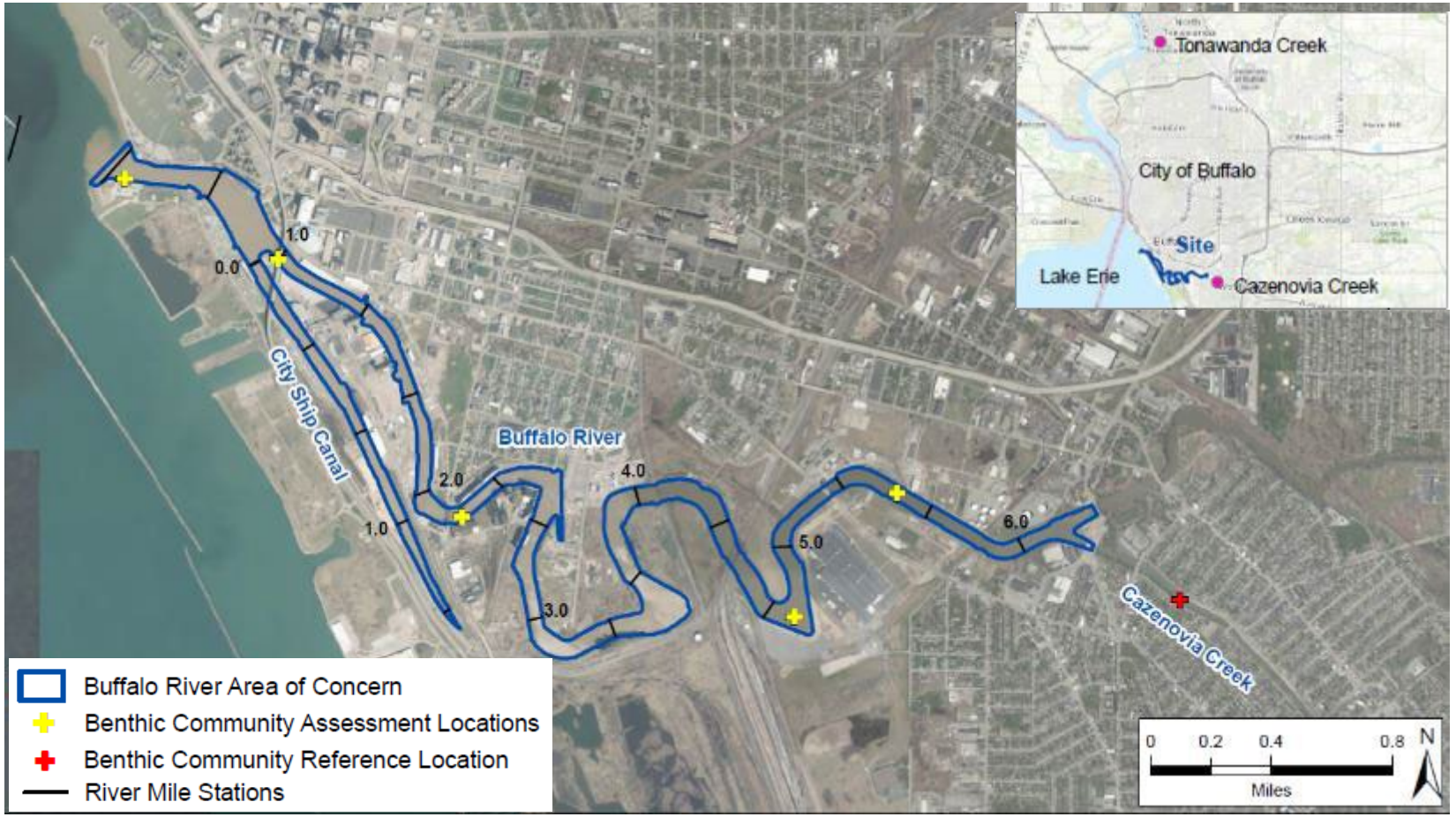
Summary – Surface Sediment Conditions

Surface sediment CoC concentrations decreased continuously from construction through Year 2 to Year 5

- 95% of the PAH sample locations achieved remedial goal
  - Additional locations >RG are generally isolated, noncontiguous deposits
- Composite CoC concentrations decreased in every composite area
  - Composite areas achieved RGs or were within a factor of 2 above the composite-based RGs
  - Slower recovery in City Ship Canal due to lower deposition rates
- Surface sediment concentrations continue to decrease via natural sedimentation and dilution/mixing processes

Benthic Community Surveys

- 5 BR locations
- 2 reference locations
  - Cazenovia Creek
  - Tonawanda Creek
- Sediment grab and multi-plate samplers at each location
- Findings evaluated against USEPA and NYSDEC metrics

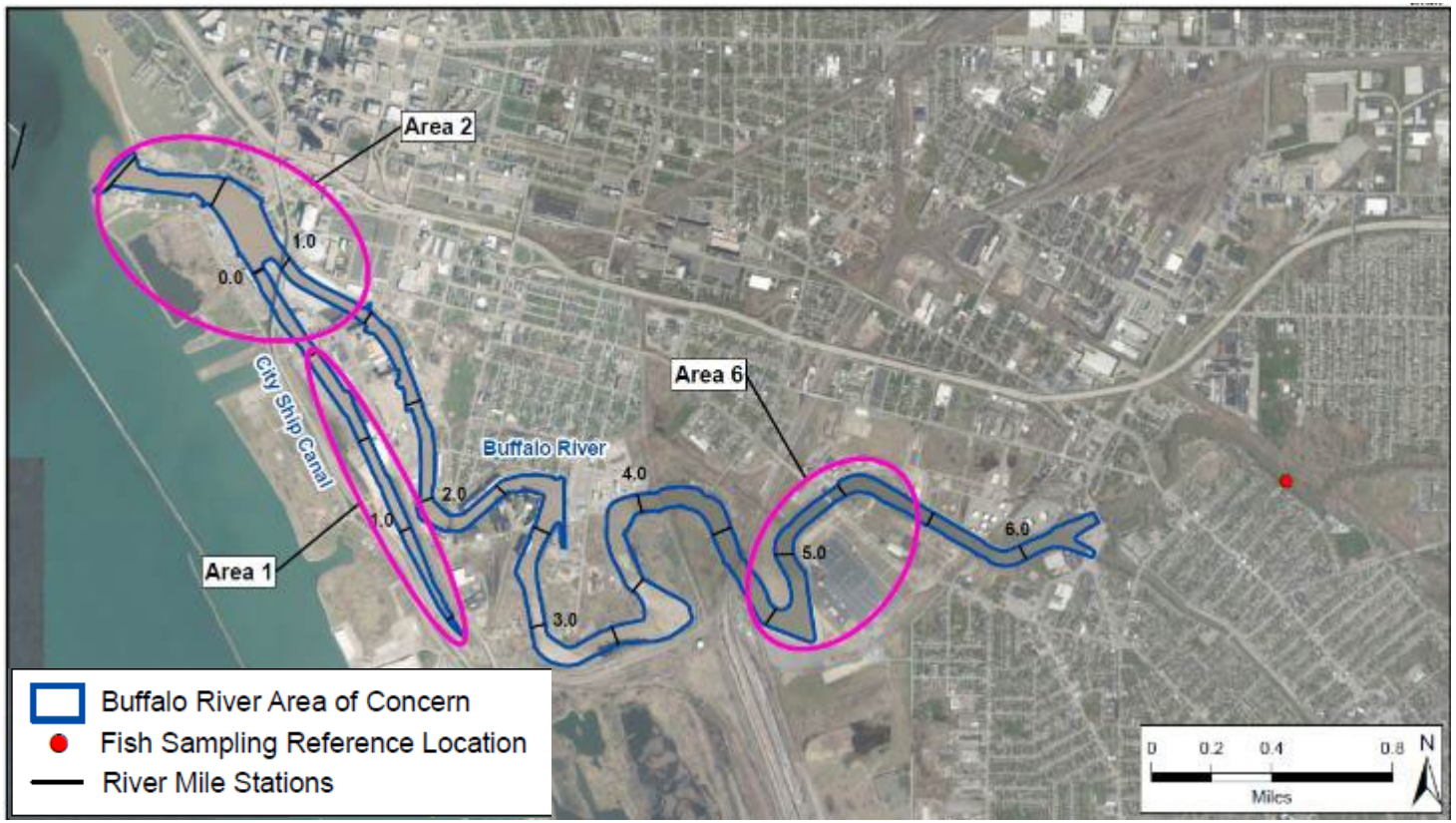


Benthic Community Findings

- Community is representative of a large-scale urban river system
- NYSDEC metrics – All locations show moderate to severe impairment for both sediment grabs and multi-plate samples
- USEPA metrics - Scores show variability across time (some higher, some lower, some unchanged)
- Reference locations (Cazenovia Creek and Tonawanda Creek) showed similar levels of impairment
- Toxicity test results from USGS showed Buffalo River sediment to be non-toxic

Fish Community Surveys

- 3 BR fish community areas + 1 BR reference
- Approaches evaluated
  - Index of Biological Integrity (IBI) approach
  - NYSDEC Fish Impairment approach
- 2017 and 2020 compared to baseline (2008 and 2012)



Fish Community Findings

Index of Biotic Integrity (IBI)

- Scores similar in all areas, including upgradient reference, except for the City Ship Canal
- Lower IBI in City Ship Canal due to increases in tolerant fish and DELT observations

NYSDEC metrics

- Scores the same in all areas, including upgradient reference, except slightly lower in Area 2
- Scores generally consistent through time




Did Remedy Achieve Remediation Objectives?

Bathymetric Surveys and Surface Sediment Chemistry

- Sediment removal and natural recovery processes achieved sediment remedial goals in large majority of Buffalo River AOC
- City Ship Canal cap remains stable and experienced deposition since construction
- Reductions in surface sediment concentrations were observed between Years 2 and 5 throughout AOC
- Surface sediment concentrations continue to decrease via natural sedimentation and dilution/mixing processes

Biological Monitoring

- Benthic and fish community survey results variable over time
- Buffalo River results similar to reference
- No sediment toxicity to benthic invertebrates based on USGS 2020 toxicity tests
- Community results indicative of a large, urban river system
- Results suggest regional-scale effects, as Buffalo River scores were generally within the range of those for reference locations

Beneficial Use Impairments

- Beneficial Use Impairments (BUIs)
  - Tainting of Fish and Wildlife Flavor – BUI removed in 2020
  - Restrictions on Dredging – BUI removal expected at end of 2022
  - Degradation of Benthos – BUI removal targeted for early 2023
  - Loss of Fish and Wildlife Habitat - BUI targeted for early 2023
- Fish tissue and histopathology data are expected early 2024
  - Data will support the evaluation of several additional BUIs

Key Take-Home Messages

- The collaborative and cost-sharing approach of the GLLA program expedites clean-up and leads to more cost-effective remedies

- Robust data sets (baseline and post-remediation), based on multiple lines of evidence, contribute to an improved understanding of remedy effectiveness

Thank You