



Metropolitan Water Reclamation District of Greater Chicago

**Welcome to the August Edition
of the 2024
M&R Seminar Series**

NOTES FOR SEMINAR ATTENDEES

- Remote attendees' audio lines have been muted to minimize background noise.
For attendees in the auditorium, please silence your phones.
- A question and answer (Q/A) session will follow the presentation.
- For remote attendees, please use “**Chat**” only to type questions for the presenter. For other issues, please email Pam to SlabyP@mwrdd.org.
For attendees in the auditorium, please raise your hand and wait for the microphone to ask a verbal question.
- The presentation slides will be posted on the MWRD website after the seminar.
- This seminar has been approved the ISPE for one PDH and pending approval by the IEPA for one TCH. Certificates will be issued only to participants who attend the entire presentation.

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Senior Engineer
Geosyntec Consultants



Rishab Mahajan is a Board-Certified water resources engineer focused on providing clients with affordable solutions to meet their regulatory obligations through a combination of numerical modeling and data analysis. Over a career spanning more than 15 years, he has worked on and led detailed studies for floodplain permitting, effective stormwater management designs, Clean Water Act compliance, dam safety permits and designs, and Total Maximum Daily Load (TMDL). He served as the Project Manager for Phosphorus Assessment and Reduction Plan Study for Metropolitan Water Reclamation District of Greater Chicago.



Phosphorus
Assessment &
Reduction
Plan

Phosphorus Assessment Reduction Plan (PARP) for Chicago Area Waterway System

August 23, 2023



**Metropolitan Water
Reclamation District
of Greater Chicago**

Agenda

1 PARP Overview

2 Methodology

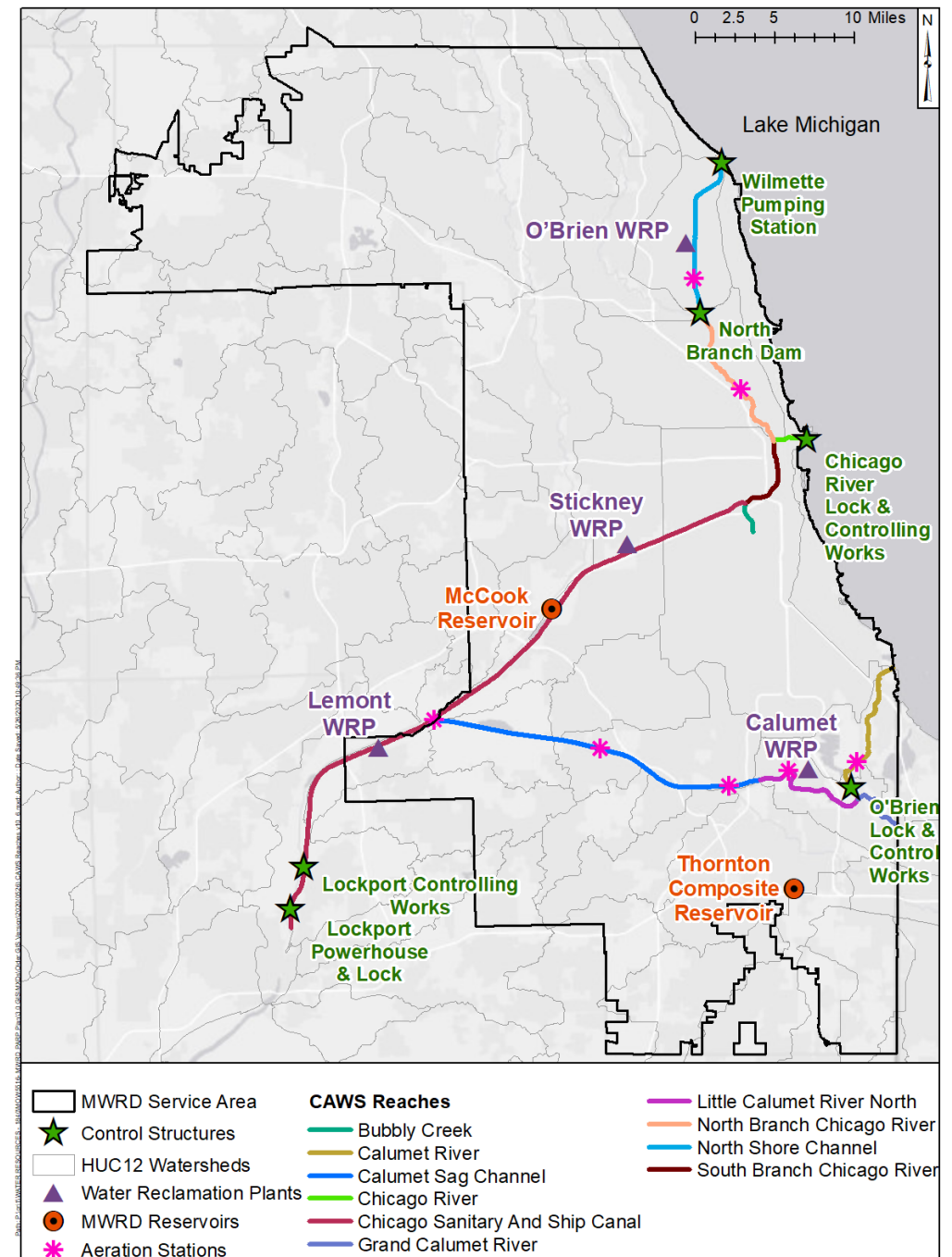
3 Implementation Plan

4 Additional Studies

PARP Overview and Methodology

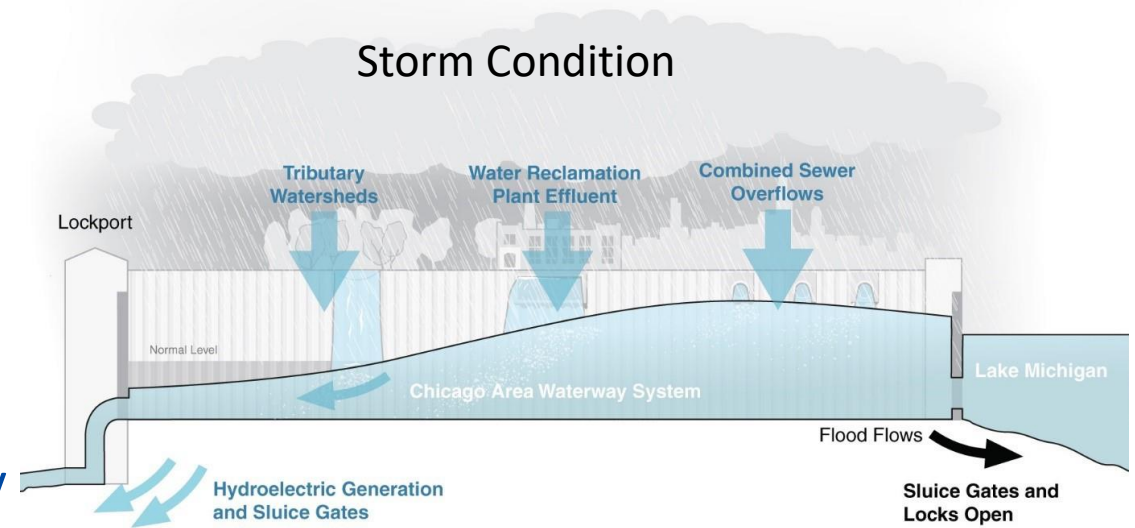
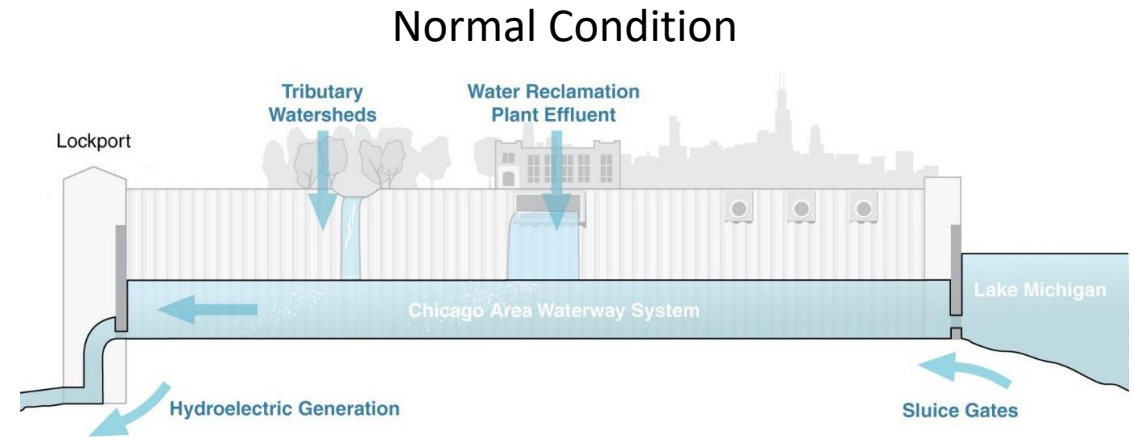
Background

- Negotiated settlement between MWRD, Environmental Groups, and Illinois EPA
- Develop a Phosphorus Assessment Reduction Plan to eliminate *unnatural growth* in the Chicago Area Waterway System (CAWS)
- Project Oversight by Nutrient Oversight Committee
 - MWRD
 - Illinois EPA
 - Environmental Groups



Unique Nature of CAWS

- Flow direction controlled by MWRD through locks and dams
- Relatively low levels of algae (>7.5 ug/L) can cause large swings in dissolved oxygen (DO)
- Growing season
 - March to September
 - December to April in North Shore Channel Upper
- Limited aquatic plant growth except in Grand Calumet River
- Flow reversals have limited impacts on water quality



Graphic courtesy MWRD website

PARP Objectives and Approach



- Determine which reaches of the CAWS have offensive conditions associated with unnatural plant or algal growth
- Develop a Plan to eliminate unnatural growth conditions

Task 1

Identify CAWS reaches with unnatural plant or algal growth

Task 2

Identify the measures to eliminate the unnatural algal growth

Task 3

Develop implementation plan and schedule for measures identified

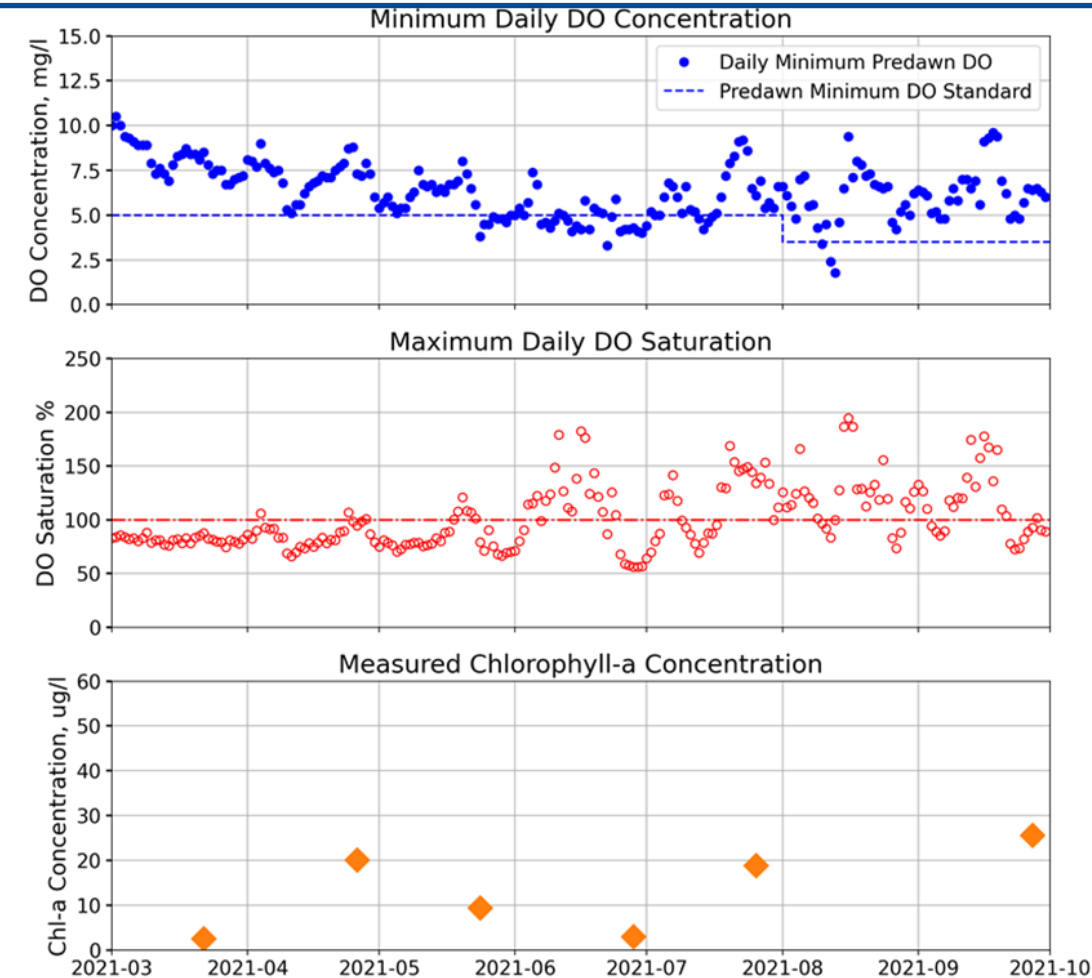
Methodology

Task 1 – Unnatural Growth Determination

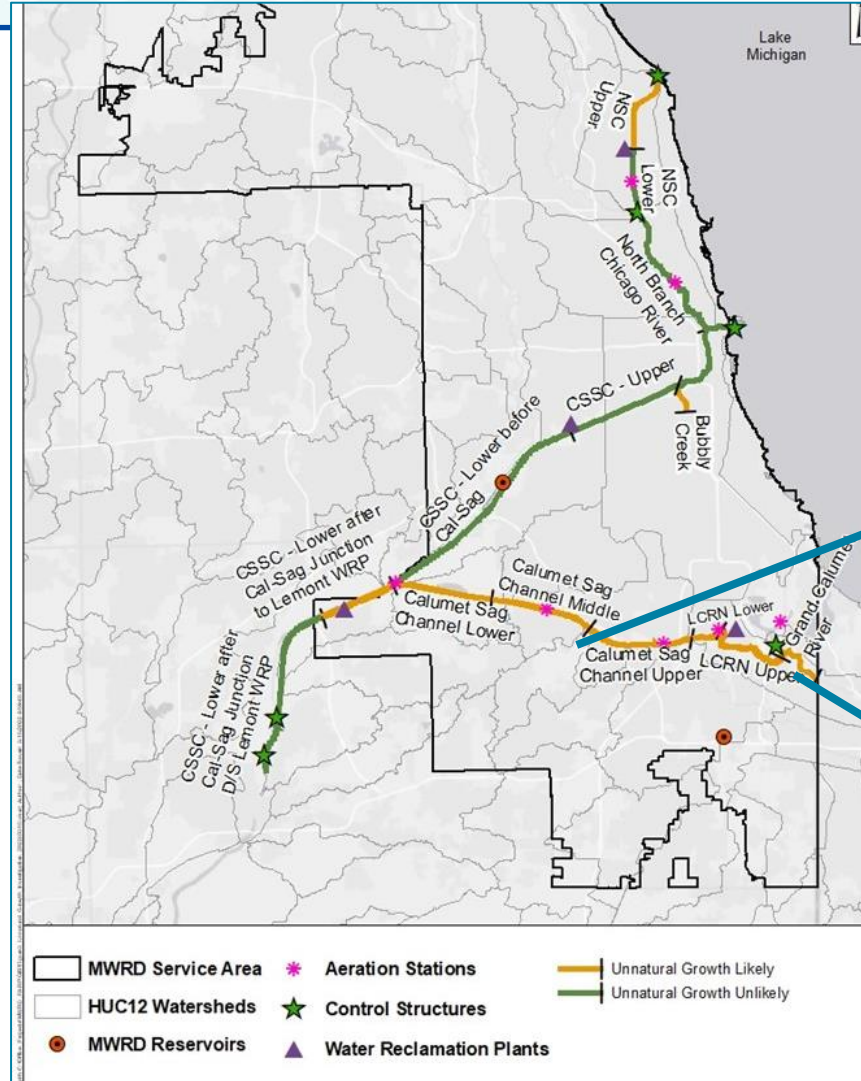


Station: Cicero Ave. Year: 2021
Reach: Calumet Sag Channel

- Unnatural growth for CAWS is defined as recurring
 - Pre-dawn dissolved oxygen (DO) excursions
 - DO oversaturation
 - Relatively high chlorophyll-a (Chl-a) levels
- Analyzed MWRD data from 19 monitoring stations over multiple years



Unnatural Growth Determination



Task 2 – Identify Measures to Eliminate Unnatural Growth

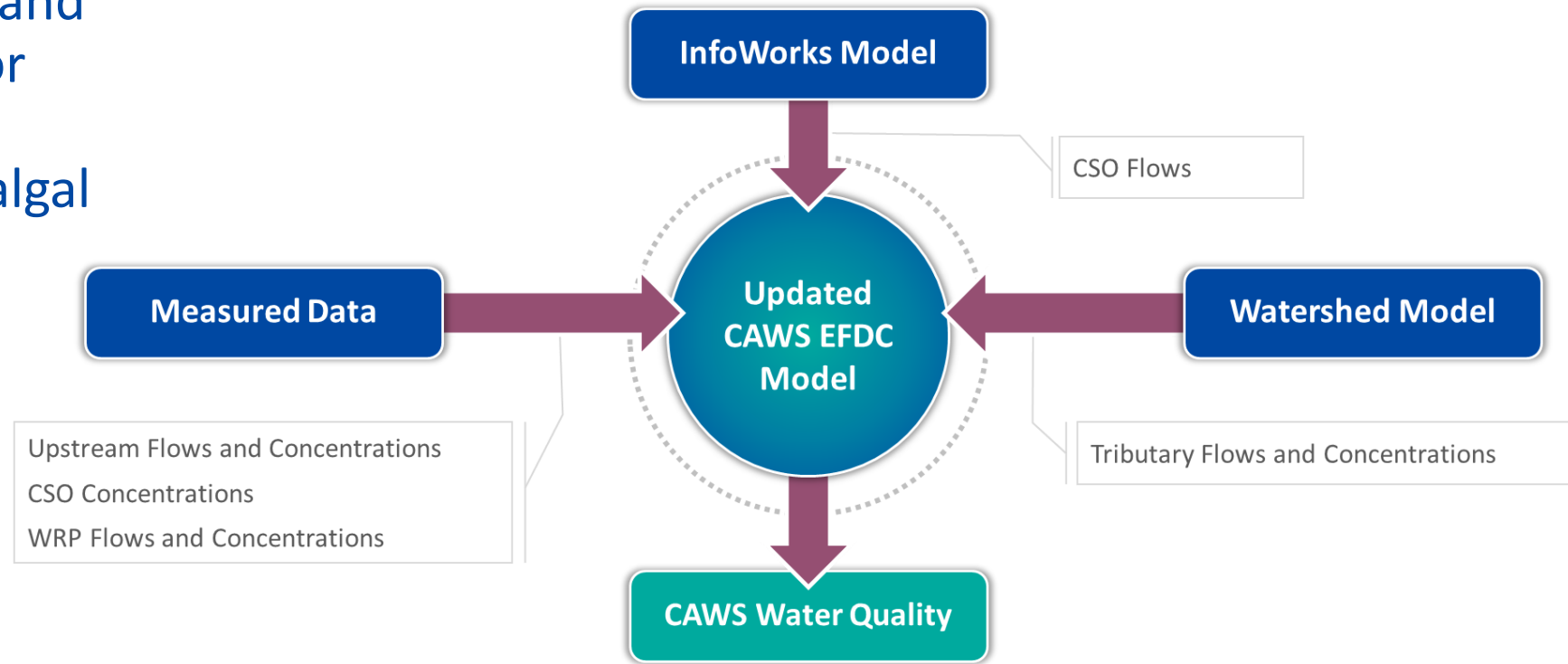


Objective

Identify P-input reductions and other measures to reduce or eliminate the conditions causing unnatural plant or algal growth

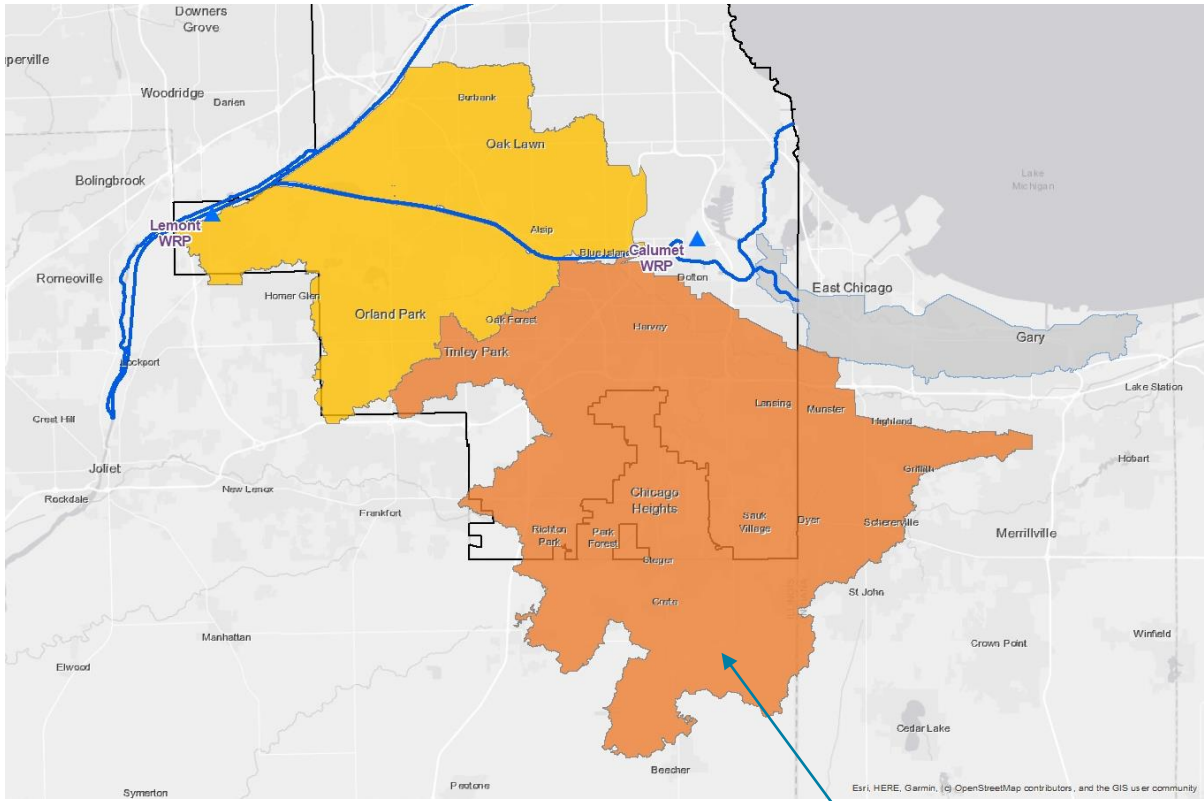
Approach

Data analysis and model development



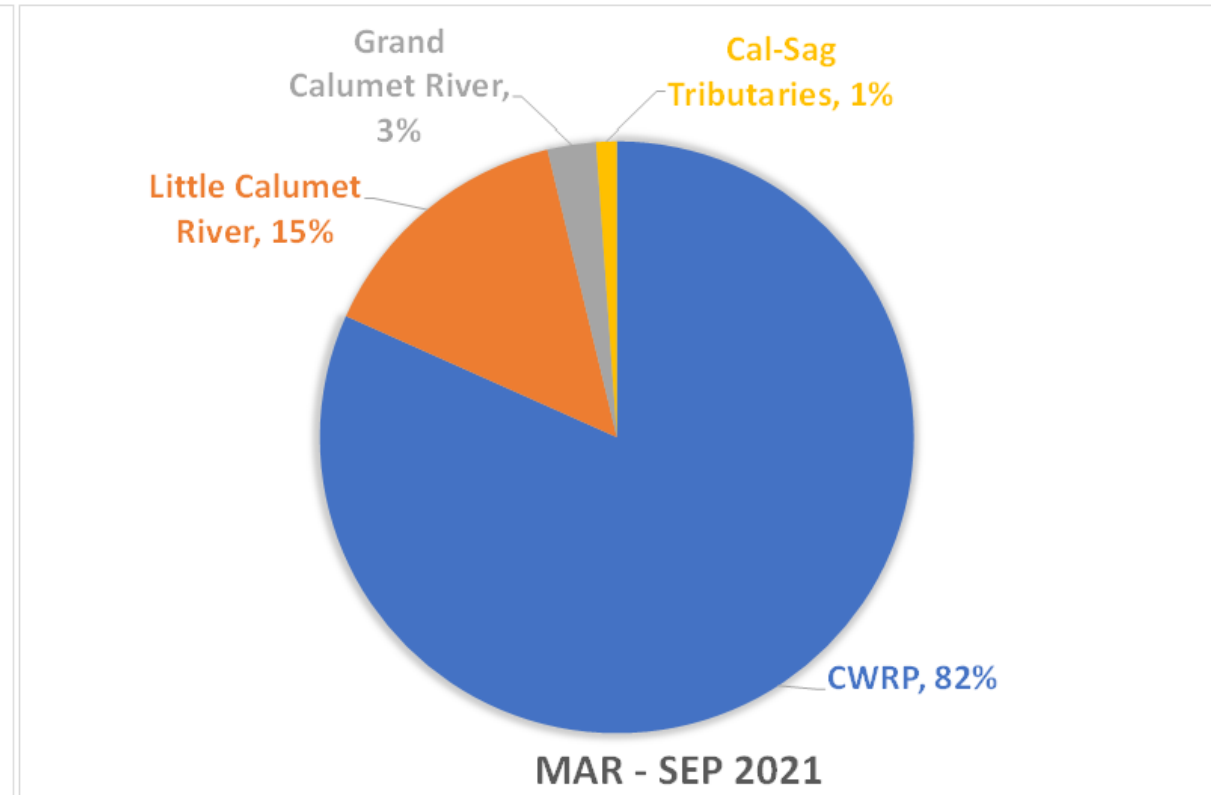
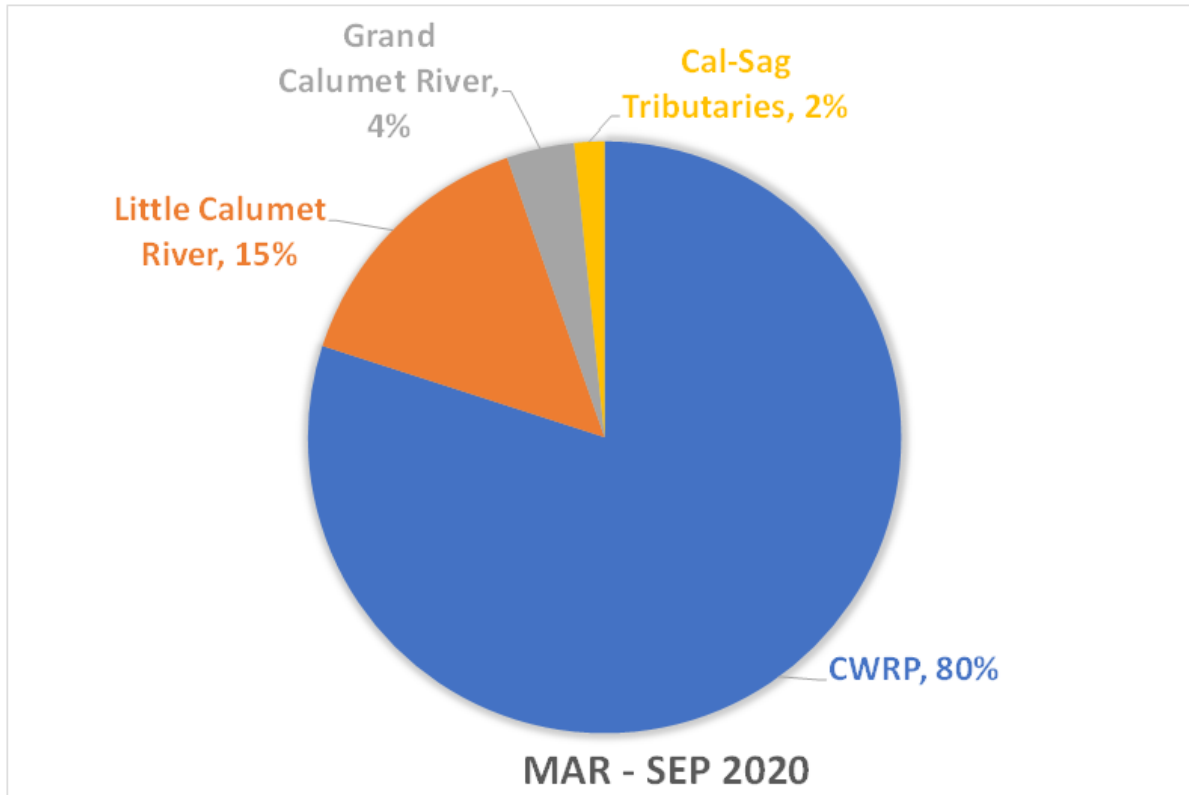
Sources of Phosphorus to Calumet River System

- Calumet Water Reclamation Plant (CWRP)
- Grand Calumet River
- Calumet Sag Watershed (Stormwater)
- Little Calumet Watershed (Stormwater)



Little Calumet Watershed

Calumet River System Loading



Key Takeaways from Modeling of Calumet River System



- CWRP TP reduction would have limited impact on unnatural algae growth (pre-dawn DO excursions, DO oversaturation and Chl-a levels)
- Reduced algae levels from Grand Calumet River would result in reduction of unnatural algae growth
- Combined CWRP TP reduction (@ 0.5 mg/L) and upstream algae reduction results in slightly larger reduction in algae levels
- Reduction in tributary loading has limited on unnatural growth
- Modeled scenarios had limited impact on DO, though reduced Chl-a did result in smaller diurnal fluctuations and slightly lower average DO

Implementation Plan

PARP Recommendations



Meet limit of 0.5 mg/L annual geometric mean by January 2030 for CWRP



Collaborate with stakeholders in Indiana to address Grand Calumet River algae growth



Implement stormwater projects to reduce phosphorus loading (in general)



Conduct additional studies and evaluation

North Shore Channel Upper Monitoring

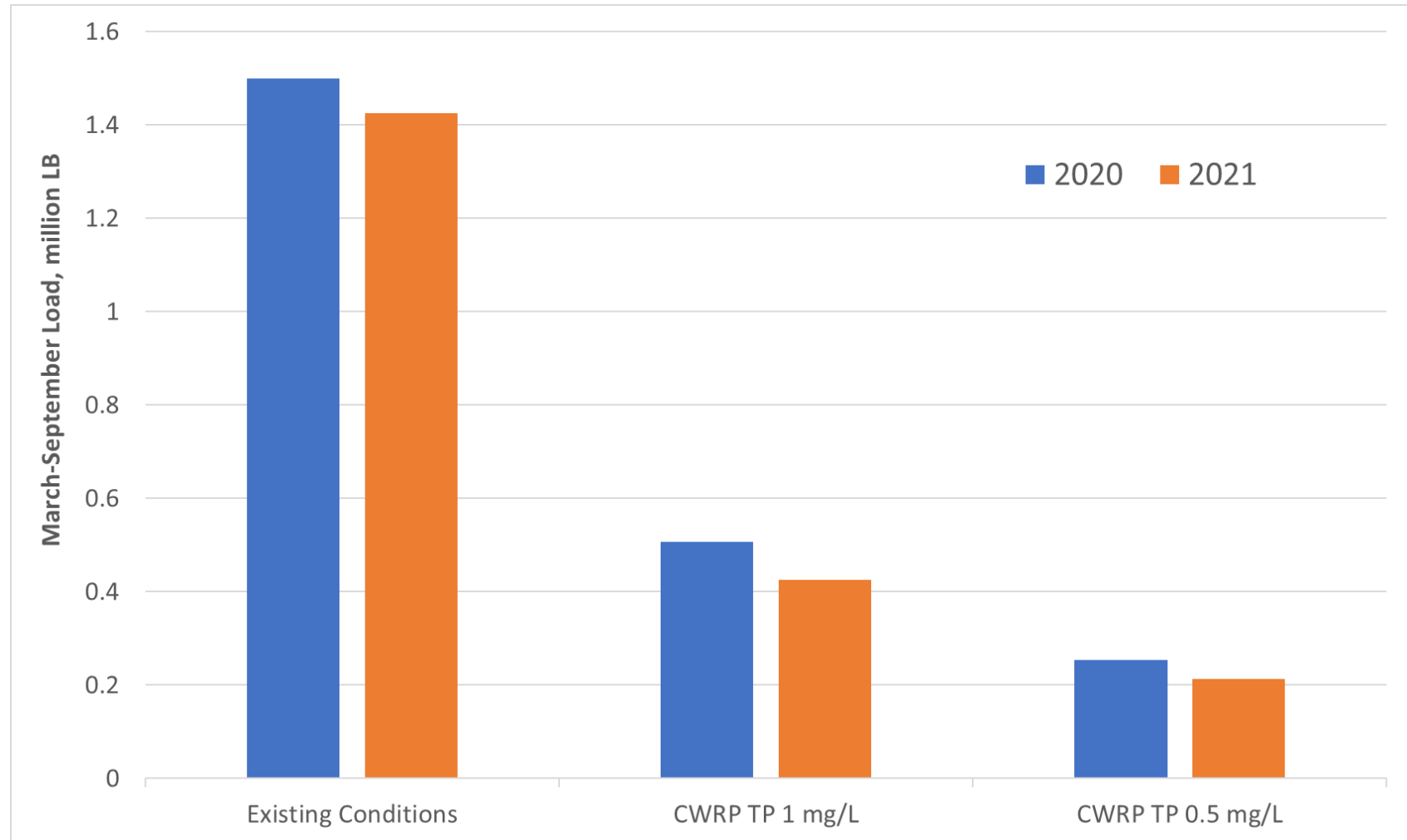
Bubbly Creek Monitoring and Modeling

CWRP TP Reduction

CWRP Loading



Meeting 0.5 mg/L TP limit will reduce TP load by 80+ percent



CWRP TP Reduction Implementation

- Feasibility study (2016 to 2017) recommended Chemical Phosphorus Removal (CPR) using ferric chloride
- Contract 18-254-3P awarded to install CPR facilities in 2022
 - Estimated Cost: \$ 16,355,850 million
- Pilot test of Side-Stream Enhanced Biological Phosphorus Removal (S2EBPR) on Battery A
 - Outperformed control battery: orthophosphate of 0.16 mg/L vs. 3 mg/L
 - Chemical addition (carbon) and significant infrastructure upgrades needed for full scale. MWRD conducting engineering evaluation
- TP source characterization study to identify sources of unaccounted TP load
- Funding: MWRD Capital Budget

Grand Calumet River Algae Reduction

Grand Calumet River Observations (2021)

- More than 50% aquatic plants coverage reported by MWRD field staff
- Pictures indicate unnatural algae growth as well



August 26 Columbia Ave.

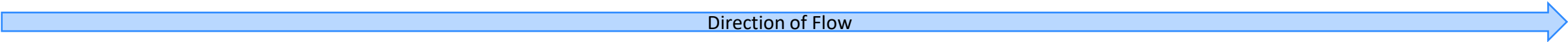


August 23, Burnham Ave.

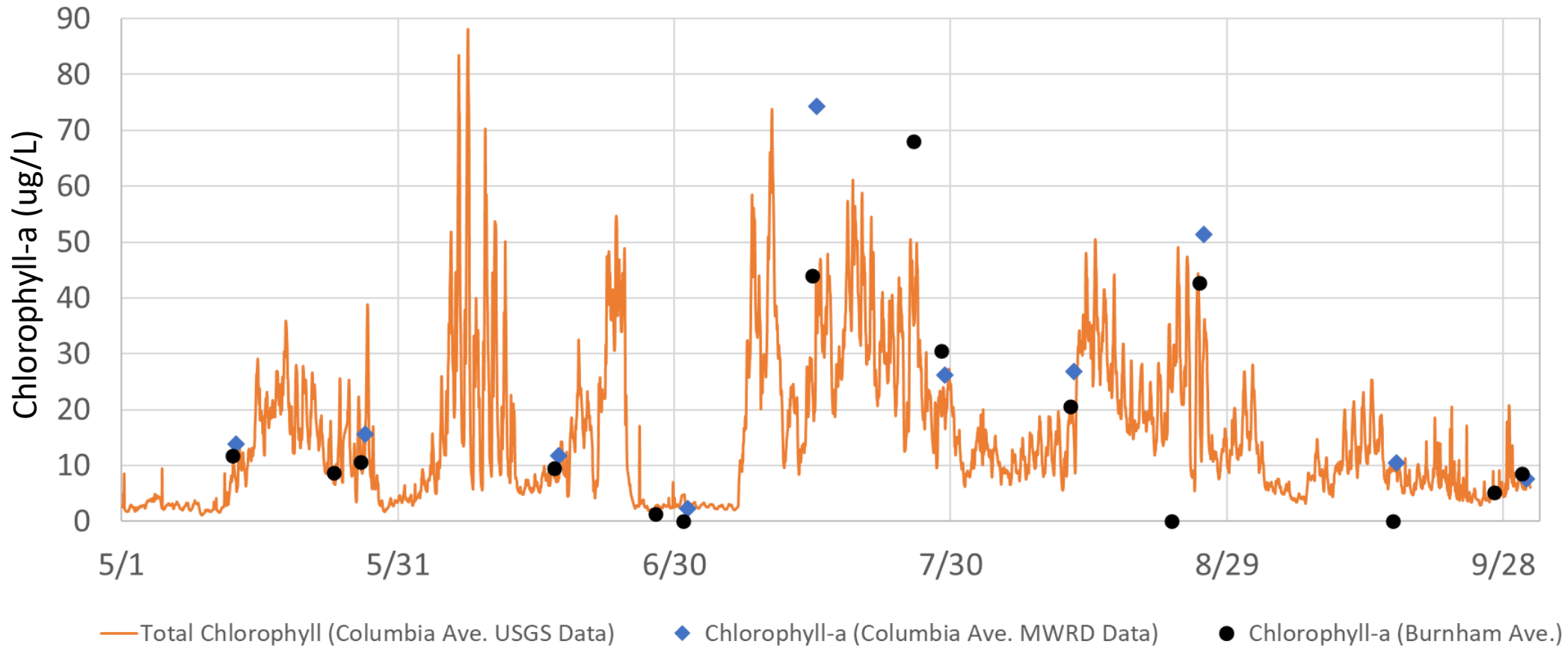


August 26, Torrence Ave.

Direction of Flow



Algae input from Grand Calumet River (2021)



Grand Calumet River Study

- Listed for algae beneficial use impairment (BUI 8) for Great Lakes Area of Concern
 - Impaired for DO and nutrients on Indiana's 303 (d) List
- Indiana Department of Environmental Management, US EPA, and U. S. Geological Survey (USGS) collaborating on a multi-year study to evaluate algae impairment conditions and establishing baseline trends
- Parameters
 - Continuous DO and Temperature – 10 sites on GCR; 3 sites on Indiana Harbor Canal
 - Continuous Chlorophyll – 4 sites
 - Continuous total algae – 1 site
- Genomic based assessment for algae species characterization - 5 sites

Grand Calumet River Implementation

- Encourage Illinois EPA to work with Indiana Department of Environmental Management (IDEM) to reduce TP loading from upstream WWTPs
 - Hammond Sanitary District
 - East Chicago Sanitary District
 - Gary Sanitary District
- Collaborate with IDEM and other stakeholders to reduce unnatural growth of algae in Indiana
 - Potentially led by environmental groups since MWRD lacks authority to work in Indiana
- Consider piloting instream algae reduction technologies at the mouth of the Grand Calumet River in Illinois
 - Look for grant funding

Stormwater Load Reduction

Priority Areas Identification



Prioritization Criteria:

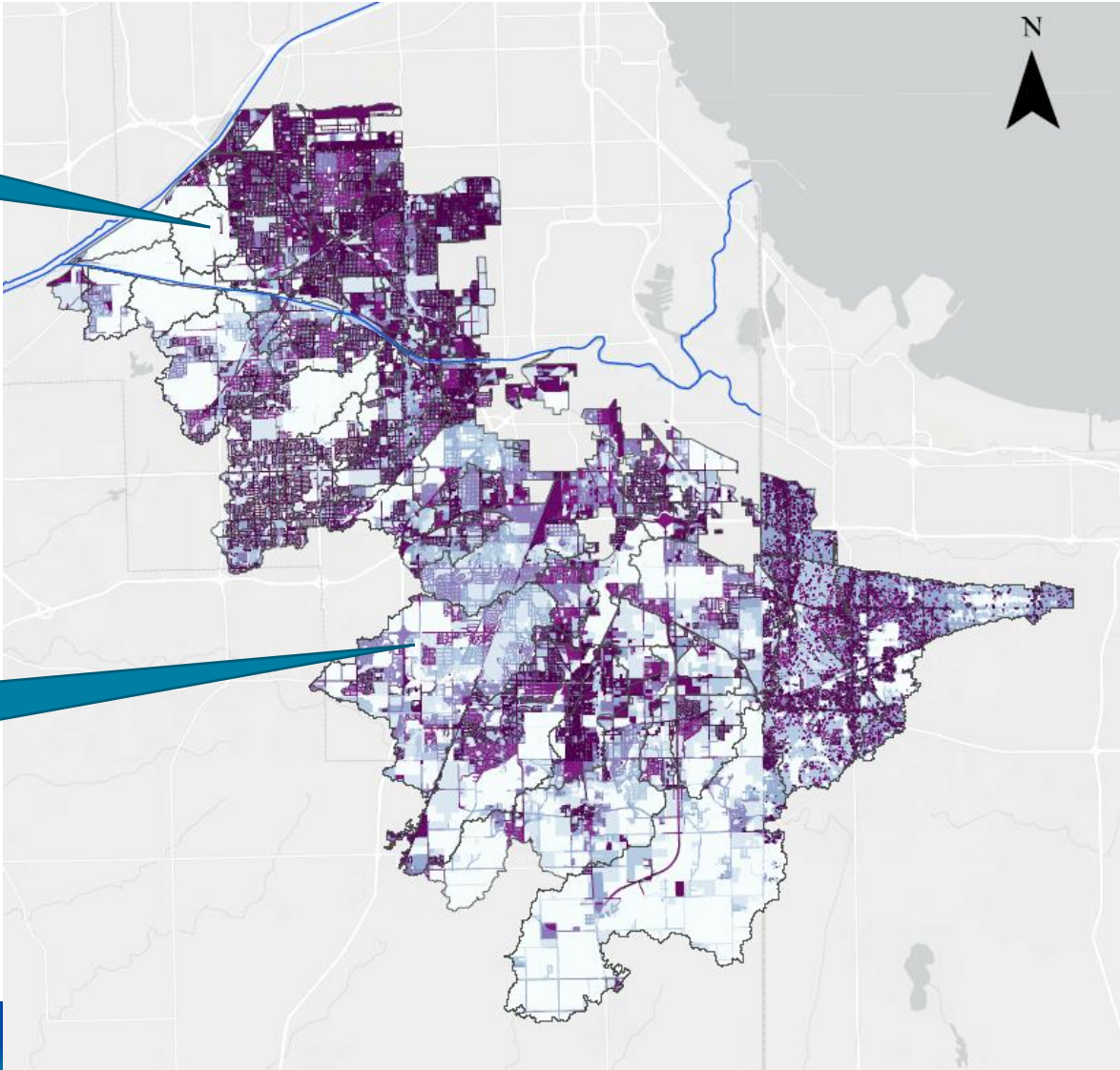
- **Total Phosphorus Loading from Stormwater Runoff**
 - Based on a watershed model developed and calibrated using monitoring data
 - Areas with high TP loading prioritized
- **Density of Existing Stormwater Facilities**
 - Existing facility information is from MWRD's Permitted Facility Database
 - Areas without a lot of existing facilities prioritized
- **Other Factors**
 - Flood-prone areas
 - Opportunities to create multi-benefit facilities (parks, trails, & education)
 - Drive equitable investments in green infrastructure

Stormwater Phosphorus Loading Map



Cal-Sag
Watershed

Little
Calumet
Watershed



Legend

- Chicago Area Waterways
- Watershed Boundaries
- TP (grams/m²-growing season)
- 0.01
- 0.03
- 0.05
- 0.07
- 0.09
- 0.10
- 0.20
- 0.30
- 1.00

Stormwater Implementation

- **Enhance programs**

- Street sweeping and leaf collection practices
- Operation and maintenance for existing facilities

- **Retrofit existing facilities**

- Convert dry ponds to wet ponds*
- Replace filtration media of existing bioretention (with high-performance P-removal media)

- **Build new facilities**

- Promote strategies and capital projects that effectively remove phosphorus and create multiple benefits in prioritized areas
- Consider phosphorus reduction benefits when identifying local partner-led projects for MWRD Stormwater Partnerships
- Incorporate design of stormwater BMPs that effectively remove phosphorus into MWRD-led projects

Natural Solution Tools

developed by Greater Chicago Watershed Alliance could be used to look at other benefits from projects

*For MWRD-permitted detention facilities, this modification requires approval under a WMO permit or permit revision

MWRD Stormwater Program Alignment



- Review opportunities to align PARP recommendations with District's Stormwater Program
- Continue to work with communities on long-term maintenance of stormwater facilities as part of MWRD Stormwater Program regulatory function
- Work with regional agencies such as CMAP on technical assistance resources for communities (e.g. guide for ordinance update)
- Promote educational material for general public (e.g., MWRD 'Green Neighbor Guide' and 'Green Neighborhood guides')

Additional Studies

North Shore Channel Upper

High DO saturation and Chl-a reported for periods of no diversion from Lake Michigan (December – April)



Photo Courtesy: Dr. Charles Melching

North Shore Channel Upper Monitoring

- Determine cause of high Chl-a and DO oversaturation
 - Recommended monitoring period: December to April
 - Detailed monitoring recommendations shared with MWRD
- Assess impact of O'Brien WRP on NSC Upper
 - Measure tracer at multiple locations upstream to determine extent of backflow

Historical dumping of animal waste from adjacent Union Stockyards



- Predawn DO below 5 mg/L
- DO drops impacted by the CSO event
- Highest Chl-a concentrations in the CAWS
- Growing season median Chl-a concentration is 39 $\mu\text{g/L}$

Bubbly Creek Restoration Plan



- US Army Corps of Engineers (USACE) feasibility study (2020) recommended
 - Riparian plant restoration
 - Substrate restoration
 - Invasive plant species removal
 - Woody debris structures
- Congress authorized construction under the Water Resources Development Act of 2020
- Waiting on agreement between USACE and City of Chicago
 - Initial funding will be used to begin the preconstruction engineering and design phases



Bubbly Creek Monitoring: March to September



- Discrete water quality sampling every two weeks at 36th Street and I-55
- Sample the RAPS effluent during CSO events
- Measure Sediment Oxygen Demand along Bubbly Creek
 - Measurements during dry weather and immediately after a CSO event
- Update sediment chemistry (nutrient content, grain size) and nutrient flux measurements
- Potential modeling to assess impact of USACE restoration on water quality

Discussion and Questions