MCES White Bear Lake Comprehensive Planning Study

Study 7A – Surface Water Quality Study
Phase 1 Summary

Subworking Group Meeting

April 22, 2025

BARR

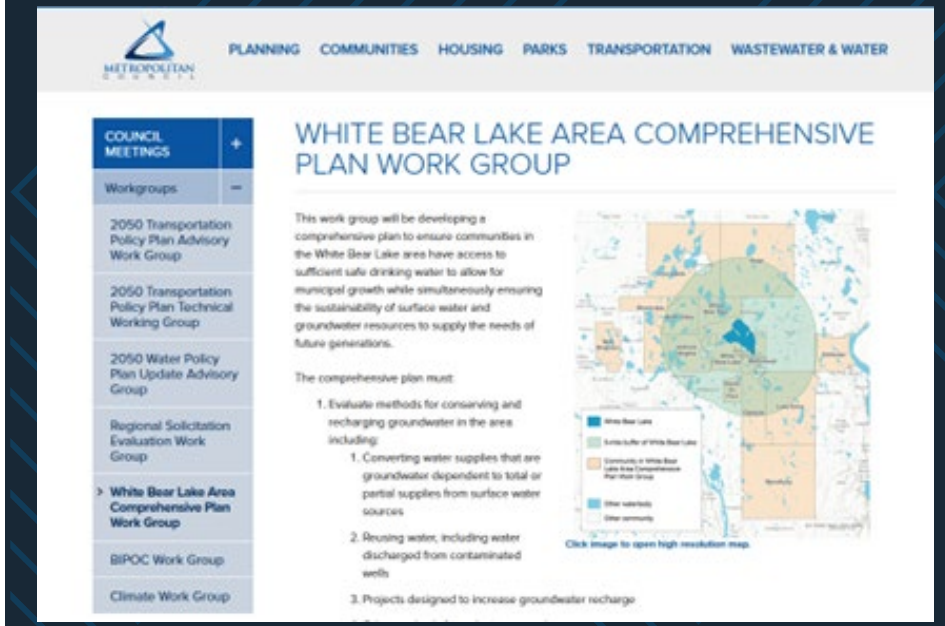
METROPOLITAN COUNCIL

Agenda

1. Overview of MCES Planning Study
2. Review Study 7A scope & study lakes/system
3. Discuss existing monitoring data inventory
4. Review existing goals/standards/thresholds & possible site-specific criteria
5. Outline feedback stakeholders and agency staff
6. Discuss 2025 recommended monitoring and planning level costs
7. Review revisions to Study 7A Phase 2 scope of work

MCES White Bear Lake Comprehensive Plan Work Group

Goal: Develop a comprehensive plan to ensure communities in the White Bear Lake area have access to sufficient safe drinking water to allow for municipal growth while simultaneously ensuring the sustainability of surface water and groundwater resources to supply the needs of future generations.



Current Studies	Upcoming Studies
Study No. 1 – Redirect stormwater to augment White Bear Lake Study No. 3 – Reuse of treated wastewater for industrial & agricultural users Study No. 5 – Reuse water discharged from contaminated wells Study No. 6 - Treat wastewater and aquifer injection to raise groundwater elevations ***Study No. 7A – Water quality study as it relates to lake augmentation study (Study No. 7B to follow)*** Study No. 8 – Stormwater collection and infiltration for raise groundwater elevations	Study No. 2 – Convey treated surface water from SPRWS, a regional surface water treatment, or both to NE communities Study No. 9A – Raise outlet elevation of White Bear Lake – evaluation of potential flood impacts Study No. 14A – Future community impacts from PFAS groundwater contamination

Study 7A Water Quality Study related to Lake Augmentation: Overview of Scope

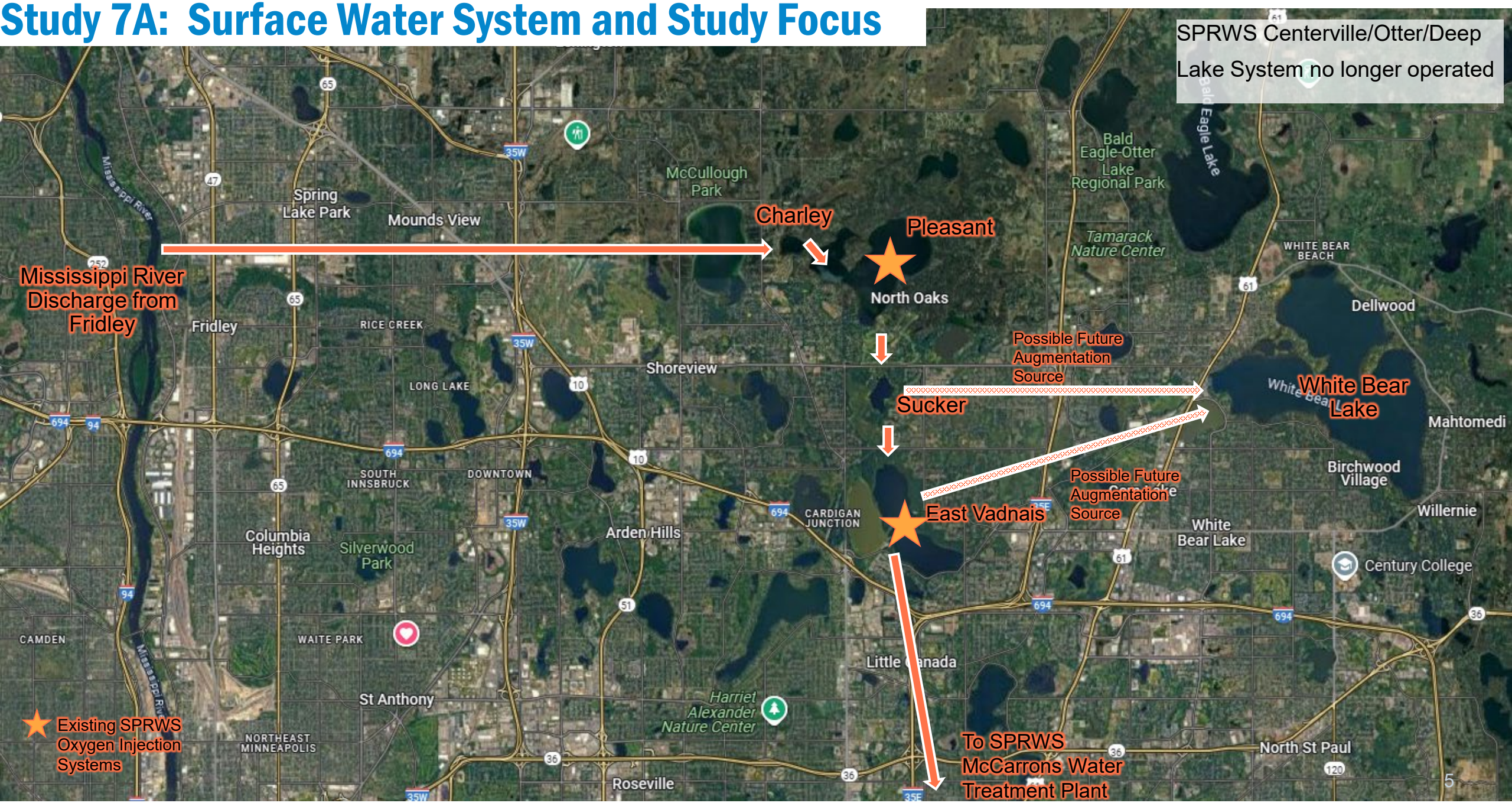
Study 7A, Phase 1 - Data Review and Goal Summary

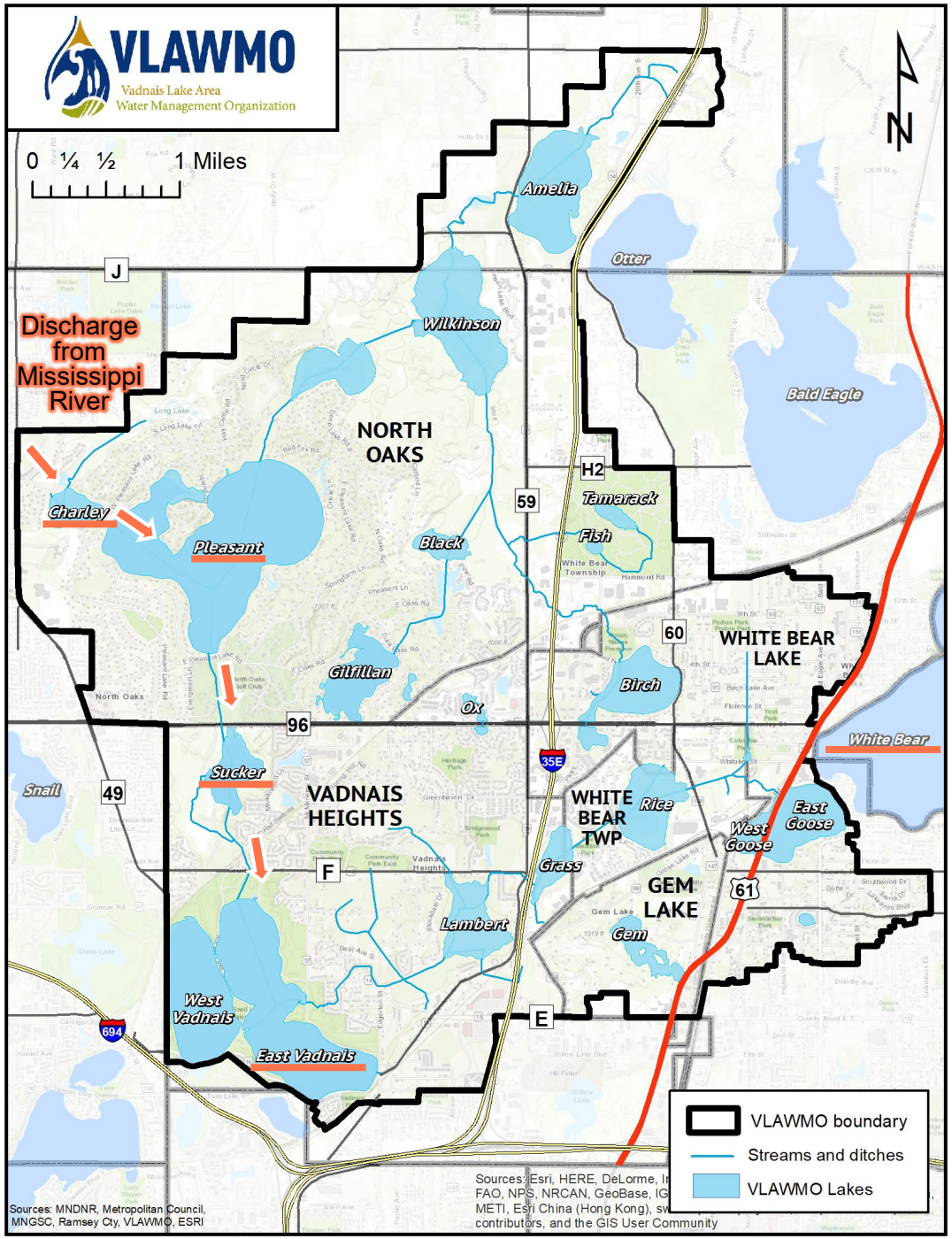
- Inventory existing monitoring data
- Recommendations for 2025 monitoring to support model development (Phase 2)
- Summarize existing surface water and drinking waters goals/standards/thresholds
- Stakeholder/Agency review meeting including feedback request to inform monitoring and Phase 2 scope (4/10/2025)
- Meetings with monitoring organizations to discuss draft 2025 recommended monitoring (4/17/2025 & 4/18/2025)
- Recommended revisions to 2025 monitoring & draft MCES Study 7A phase 2 scope of work
- Meeting with Subworking Group (4/22/2025)
- Meeting with Working Group (4/29/2025)

Study 7A, Phase 2 – Calibrated Surface Water Model Development and Evaluation of Future Use Scenarios & Lake Augmentation (*DRAFT Scope*)

- Watershed modeling to generate runoff volume and estimated pollutant loads to lakes (in combination with other lake monitoring and river pumping and loads)
- Develop calibrated surface (lake) water quality models for chain of lakes and WBL (considering AEM3D or CEQUAL W2)
- Summarize available water quality monitoring data and compare to goals/standards/thresholds & develop site-specific standards
- Review/use projected demands for current (2025), 2050, and ultimate development conditions to evaluate impact on lake water quality, including augmentation of WBL
- Sensitivity analysis of higher assumed loading to the lakes
- Conduct a risk assessment for toxics, pesticides, organics, and other toxic substances using Mississippi River data along with injections of ferric chloride by SPRWS
- Develop a mitigation plan to prevent/treat/address contaminants of concern in the chain of lakes prior to augmenting and pumping to WBL
- Reporting and public outreach

Study 7A: Surface Water System and Study Focus





Existing Monitoring Data Review

- Mississippi River (SPRWS)
  - Anoka (use data to fill any gaps)
  - Fridley (main intake)

- VLAWMO Lakes (SPRWS/VLAWMO)
  - Charley Lake (1 station)
  - Pleasant Lake (2 stations)
  - Sucker Lake (1 station)
  - East Vadnais Lake (2 stations)

- RCWD Lakes (Ramsey County)
  - White Bear Lake (4 stations – 2 comprehensive, 2 surface only)

Availability of Existing Data is Variable

- Most comprehensive data: Mississippi River, Pleasant Lake, East Vadnais, and White Bear Lake (WBL)
  - Does not fully capture all eutrophication/profile data needed for modeling
  - Does not capture all metals, PFAS, parameters with drinking water criteria, contaminants of emerging concern (CEC)
  - Pumping data available for Mississippi River/East Vadnais and water level data available for lakes; some outlet information available
  - WBL has most comprehensive ecological data, including phytoplankton monitoring
- Limited data: Charley and Sucker Lakes
  - Primarily surface nutrient/chlorophyll *a*/Secchi depth data – no profile data available
  - Limited/no metals, PFAS, parameters with drinking water criteria, contaminants of emerging concern
  - No lake level data or outlet information
- All water bodies have:
  - Bathymetric data, macrophyte surveys, fishery surveys, AIS (zebra mussels, Eurasian Watermilfoil (except Charley))

Water Body	SPRWS	VLAWMO	Ramsey County
Mississippi (Fridley)	X (2019-2024)	N/A	
Charley	X (2023-2024)	X (2019-2024)	
Pleasant	X (2019-2024)	X (2020-2024)	
Sucker	X (2023-2024)	X (2019-2024)	
East Vadnais	X (2018-2024)	X (2020-2024)	
White Bear Lake			X (1988-2024)

Minnesota State Standards, Thresholds, Guidelines – Lakes/Surface Waters

- MPCA MN Rule Chapters 7050 and 7052 Eutrophication Standards & Physiochemical Parameters
- MPCA Tiered Aquatic Life Uses (TALU) Framework for Lakes

- MNDNR Fish Index of Biotic Integrity (FIBI) Thresholds for Lakes
- MNDNR Plant Eutrophication Index of Biological Integrity (Plant IBI) Thresholds for Lakes
- MNDNR Aquatic Invasive Species Infested Waters List

- WHO Cyanobacteria Thresholds
- MPCA Cyanotoxin Levels for Swimming Advisories

- MPCA PFAS protective values
- MDH Fish Consumption Guidance

World Health Organization

MINNESOTA POLLUTION CONTROL AGENCY

DEPARTMENT OF NATURAL RESOURCES

DEPARTMENT OF HEALTH

Water Quality Goals – Lakes/Surface Waters

Lake	Deep vs. Shallow (Use Class)	Official Public Access	Eutrophication Standards	FIBI	Aquatic Plants	AIS	PFAS Status
Charley	Shallow (1C/2Bd)	N/A	Slightly above standard	*Not evaluated*	Degraded, below threshold	Zebra mussels	*Not evaluated*
Pleasant	Deep (1C/2Bd)	N/A	On MPCA Impaired Waters List	*Not evaluated*	Degraded, below threshold	Zebra mussels, EWM	*Not evaluated*
Sucker	Shallow (1C/2Bd)	N/A	Slightly above standard	*Not evaluated*	At threshold	Zebra mussels, EWM	*Not evaluated*
East Vadnais	Deep (1C/2Bd)	N/A	Well below standard	*Not evaluated*	Degraded, below threshold	Zebra mussels, EWM	*Pending – Low PFAS Lake*
White Bear	Deep (2B)	Beach/Boat Ramp	Well below standard	Above impairment threshold	High biological significance	Zebra mussels, EWM	Designated Low PFAS Lake

Site Specific Considerations – East Vadnais and White Bear Lake

- Eutrophication site-specific standards
  - Leverage historic water quality data records to develop water quality relationships to inform the more stringent/site specific standards to support nondegradation
    - Consider zebra mussel impacts on water quality record and relationships
  - Consideration of calibrated model results

National/Minnesota Standards, Advisories, Health Risk Limits – Drinking Water

- National Primary Drinking Water Regulations and Implementation - Title 40, Code of Federal Regulations, Part 141 and Part 142
  - EPA Drinking Water Standards (MCLs and SMCLs) and Health Advisories
- Minnesota rules governing public water systems - Minnesota Rules, chapter 4720
- MDH Health Risk Limit Rules (HRLs) for Drinking Water

*** No feedback received from SPRWS suggesting there are any water quality parameters/thresholds specific to infrastructure and water treatment system operations that need to be considered*

Preliminary Feedback from Stakeholders/Agency Staff (9 responses received)

- Quantify all sources of pollutants for lake model: There is a **minimum amount of data needed to develop and calibrate the lake models**
- Concern about **potential water quality effects to the chain of lakes from increased flows and the reduction in water quality in WBL and the underlying Jordan aquifer**
- Introducing **new sources of contamination risk to White Bear Lake is a concern**. **All possible pollutants/contaminants should be considered to evaluate lake health, drinking water supply, aeration system, and treatment system**. Primary concerns include **eutrophication parameters (P & N), but heavy metals, iron, chloride, PFAS, pharmaceuticals, and microplastics.** Lakes should be tested **for all drinking water parameters to establish baseline concentrations (See Table 2 from Draft Memo) and add any parameters that MnDNR/MDH lab can offer for contaminants of emerging concern (CEC)**
- Ecological concerns include **increased likelihood of HABs** and the impact on SPRWS intake, **introduction of new AIS genotypes (e.g. EWM) and changes to food sources (chl *a*) and pH levels on the zebra mussel carrying capacity of White Bear Lake**, changes in non-eutrophication parameters (not related to nutrients/clarity - water color, lake sediment chemistry) **altering the White Bear Lake the macrophyte community**
- Questions about level of treatment required: What is the **impact if no treatment**? What is the **minimum level of treatment needed** for augmentation water to maintain water quality and/or prevent AIS transfer? What level of water treatment (i.e. incoming concentrations) would be required **to ensure zero impact to eutrophication parameters**? What is the impact of **adding "too clean" of water** into White Bear Lake?
- **Watershed analysis of the VLAWMO/Chain of Lakes** is important due to its significant contribution to total pumped water to SPRWS (~40% in 2024); also need to consider watershed to WBL.
- Questions related to impact of increased flows on shoreline erosion, travel time from the Mississippi River to the Chain of Lakes and White Bear Lake, water residence time in each lake, reaction time for augmentation of White Bear Lake.

2025 Eutrophication monitoring recommendations – Key model input parameters

WQ Profile Data*

- Grab Samples
  - Phosphorus *(TP, TDP, OP)*
  - Nitrogen *(TKN, N-N, Ammonia)*
  - Chlorophyll-*a*
- Probe Data
  - Temperature
  - Dissolved Oxygen
  - Specific Conductance
  - pH

WQ Surface Data

- Secchi Disk
- Grab Samples
  - Organic Carbon *(total, dissolved)*
  - Suspended solids *(total, volatile)*
  - Turbidity
  - Alkalinity
  - Hardness
  - Chloride
- Phytoplankton Identification

Lake Bottom Sediment

- Optional: Cores and Fractionation *(only completed in Pleasant Lake, recommended for others)*

Lake Bathymetry

- Historic data available for all water bodies (MnDNR/VLAWMO)

Lake Levels

- Historic data limited to WBL, Pleasant, & East Vadnais *(recommended water level monitoring in all basins)*
- Weekly at a minimum; Daily or continuous preferred

Outlet/Discharge

- Survey/rating curve available for WBL and outlet drawings available for Pleasant Lake *(recommended outlet survey for other lakes)*

Flow/Pumping

- Historic data available for pumping from Mississippi River and to SPRWS treatment plant

* River sampling at intakes can be grab samples, profiles in lakes capturing at least 5 samples from surface to bottom

2025 Drinking water/Aquatic life monitoring recommendations

Metals

- Aluminum
- Antimony
- Arsenic
- Barium
- Bromide
- Cadmium
- Calcium
- Chromium (total and hexavalent)
- Copper
- Fluoride
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Nickel

Metals (cont.)

- Selenium
- Sulfur (as sulfate, sulfide and total sulfur)
- Thallium
- Zinc

Synthetic Organics & Other Trace Chemicals

- *PFAS (PFOA, PFOS, PFBS, PFHxS, PFNA, GenX (EPA PFAS hazard index chemicals))*
- ***PCBs***
- ***PAHs***
- ***Pesticides***
- ***Pharmaceuticals***
- ***Estrogen Disruptors***
- ***Microplastics***
- ***Others***

Bacteria

- Total coliform
- Fecal coliform
- *E. coli*.

Ecological Parameters (Lakes)

- Fisheries *(historic data available for all lakes, no additional monitoring recommended)*
- ***Phytoplankton (limited primarily to WBL, recommended for all lakes)***
- ***Cyanotoxin testing (limited to testing at East Vadnais, recommended for all lakes)***
- Zooplankton *(historic data limited to WBL, no additional monitoring recommended)*
- Aquatic plants *(historic surveys completed on all lakes, no additionally monitoring recommended)*
- Aquatic Invasive Species (AIS) *(MnDNR data indicates all lakes have zebra mussels, and EWM (except Charley))*

Chemical Parameters – with Drinking Water Standards (EPA/MDH) (+100 parameters)

Table 2. Summary of Drinking Water Quality Standards/Limits

Category	Category Details	Drinking Water		
		National Primary Drinking Water Regulations (NPDWR) EPA Maximum Contaminant Levels (MCLs)	National Secondary Drinking Water Standards EPA Secondary Maximum Contaminant Levels (SMCLs)	Minnesota Department of Health (MDH) Human Health-Based Water Guidance HRL = Health Risk Limits; HBV = Health-Based Values
Other Parameters with Drinking Water Standards	Acrylamide (mg/L)	TT		0.002 (HRL)
	Alachlor (mg/L)	0.002		0.009 (HRL)
	Aldicarb (mg/L)	0.003		0.001 (HRL)
	Asbestos (MFL)	7		
	Atrazine (mg/L)	0.003		0.003 (HRL)
	Benzene (mg/L)	0.005		0.002 (HRL)
	Benzo(a)pyrene (PAHs)(mg/L)	0.0002		0.0001 (HRL)
	Bromate (mg/L)	0.01		
	Bromodichloromethane (mg/L)	0.08		0.003 (HRL)
	Bromoform (mg/L)	0.08		0.04 (HRL)
	Carbofuran (mg/L)	0.04		
	Carbon tetrachloride (mg/L)	0.005		0.001 (HRL)
	Chloramines (as Cl2) (mg/L)	4.0 (Maximum Residual Disinfectant Level)		
	Chlordane (mg/L)	0.002		
	Chlorine (as Cl2) (mg/L)	4.0 (Maximum Residual Disinfectant Level)		
	Chlorine dioxide (as ClO2) (mg/L)	0.8 (Maximum Residual Disinfectant Level)		
	Chlorite (mg/L)	1		
	Chlorobenzene (mg/L)	0.1		0.1 (HRL)
	Chloroform (mg/L)	0.08		0.02 (HRL)
	2,4-D (mg/L)	0.07		0.03 (HRL)
	Dalapon (mg/L)	0.2		
	1,2-Dibromo-3-chloropropane (DBCP) (mg/L)	0.0002		
	o-Dichlorobenzene (mg/L)	0.6		
	p-Dichlorobenzene (mg/L)	0.075		
	1,2-Dichloroethane (mg/L)	0.005		0.001 (HRL)
	1,1-Dichloroethylene (mg/L)	0.007		0.2 (HRL)
	cis-1,2-Dichloroethylene (mg/L)	0.07		
	trans-1,2,Dichloroethylene (mg/L)	0.1		
	Dichloromethane (mg/L)	0.005		0.01 (HRL)
	1,2-Dichloropropane (mg/L)	0.005		0.003 (HRL)
	Di(2-ethylhexyl)adipate (mg/L)	0.4		
	Di(2-ethylhexyl)phthalate (mg/L)	0.006		0.007 (HRL)
	Dinoseb (mg/L)	0.007		0.008 (HRL)
	Dioxin (2,3,7,8-TCDD) (mg/L)	0.00000003		
	Diquat (mg/L)	0.02		
	Endothall (mg/L)	0.1		
	Endrin (mg/L)	0.002		
	Ethylbenzene (mg/L)	0.7		0.04 (HRL)
	Ethylene dibromide (mg/L)	0.00005		0.000004 (HRL)
	Glyphosate (mg/L)	0.7		0.5 (HRL)
	Haloacetic acids (HAA5) (mg/L)	0.06		
	Heptachlor (mg/L)	0.0004		0.00008 (HRL)
	Heptachlor epoxide (mg/L)	0.0002		0.00004 (HRL)

Chemical Parameters – CECs based on 2018 MPCA/USGS Study (+45 parameters)

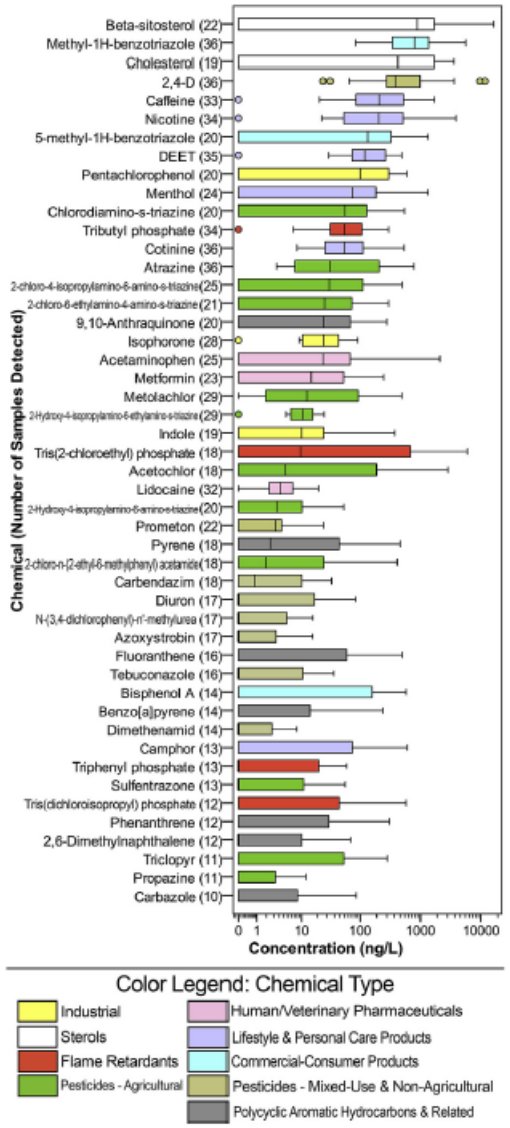


Table 2
Summary data for CECs detected in ≥25% of 36 collected stormwater samples.

Chemical Description	USGS schedule[a]	CEC type	Summaries across all samples			HLM factor significance (p-value)	
			Detection Frequency	Median Conc (ng/L)	Max Conc (ng/L)	Season	Site Type
Methyl-1H-benzotriazole	2440	Commercial-Consumer	100%	806	5550	.012	.028
Cotinine	2440	Lifestyle	100%	54	540	<0.001	.011
2,4-D	2437	Pesticide	100%	390	11600	<0.001	.204
Atrazine	2440	Pesticide	100%	40	787	<0.001	.654
N,N-Diethyl-m-toluamide (DEET)	4433	Personal Care Product	97%	120	490	<0.001	.028
Tributyl phosphate	4433	Commercial-Consumer	94%	56	299	<0.001	.008
Nicotine	2440	Lifestyle	94%	205	3890	.004	<0.001
Caffeine	2440	Lifestyle	92%	207	1710	.001	.009
Lidocaine	2440	Pharmaceutical	89%	3.94	19.9	.001	.067
2-Hydroxy-4-isopropylamino-6-ethylamino-s-triazine (OIET)	2437	Pesticide	81%	10.7	25	.015	.464
Metolachlor	2437	Pesticide	81%	17.9	489	<0.001	.544
Isophorone	4433	Other	78%	24.5	91	<0.001	.454
2-Chloro-4-isopropylamino-6-amino-s-triazine (CIAT)	2437	Pesticide	69%	31.5	499	<0.001	.857
Acetaminophen	2440	Pharmaceutical	69%	23.9	2110	.009	.016
Menthol	4433	Lifestyle	67%	75	1340	<0.001	.006
Metformin	2440	Pharmaceutical	64%	14.9	247	.166	.891
Prometon	2437	Pesticide	61%	3.10	24.4	<0.001	.901
beta-Sitosterol	4433	Sterol	61%	900	16300	<0.001	.098
2-Chloro-6-ethylamino-4-amino-s-triazine (CEAT)	2437	Pesticide	58%	25.9	298	.000	.910
5-Methyl-1H-benzotriazole	4433	Commercial-Consumer	56%	135	1340	.016	.285
9,10-Anthraquinone	4433	PAH	56%	25	280	.098	<0.001
2-Hydroxy-4-isopropylamino-6-amino-s-triazine (OIAT)	2437	Pesticide	56%	3.3	53.4	<0.001	.148
Chlorodiamino-s-triazine (CAAT)	2437	Pesticide	56%	59.7	546	<0.001	.152
Pentachlorophenol	4433	Pesticide	56%	100	600	<0.001	.188
Indole	4433	Commercial-Consumer	53%	10	380	<0.001	.097
Cholesterol	4433	Sterol	53%	450	3600	.014	.015
Tris(2-butoxyethyl) phosphate (TBEP)	4433	Commercial-Consumer	50%	55	5930	<0.001	.881
Pyrene	4433	PAH	50%	5	460	.065	.000
Carbendazim	2437	Pesticide	50%	1.19	33.4	.004	.052
2-Chloro-N-(2-ethyl-6-methylphenyl)acetamide (CEMPA)	2437	Pesticide	50%	3.51	413	<0.001	.752
Acetochlor	2437	Pesticide	50%	17.5	2840	<0.001	.735
Azoxystrobin	2437	Pesticide	47%	ND	15.6	<0.001	.210
Diuron	2437	Pesticide	47%	ND	83.8	.370	.377
N-(3,4-Dichlorophenyl)-N′-methylurea (DCMU)	2437	Pesticide	47%	ND	15.7	.790	.799
Fluoranthene	4433	PAH	44%	ND	500	.235	<0.001
Tebuconazole	2437	Pesticide	44%	ND	36	.000	.570
Bisphenol A	4433	Commercial-Consumer	39%	ND	580	.440	.001
Benzo[a]pyrene	4433	PAH	39%	ND	240	.065	.001
Dimethenamid	2437	Pesticide	39%	ND	8.13	.000	.978
Triphenyl phosphate	4433	Commercial-Consumer	36%	ND	60	.004	.025
Camphor	4433	Commercial-Consumer	36%	ND	610	.032	.065
Sulfentrazone	2437	Pesticide	36%	ND	56.6	.001	.841
Tris(dichloroisopropyl) phosphate (TDIP)	4433	Commercial-Consumer	33%	ND	580	<0.001	.491
Phenanthrene	4433	PAH	33%	ND	310	<0.001	<0.001
2,6-Dimethylnaphthalene	4433	PAH	33%	ND	70	.397	.034
Propazine	2437	Pesticide	31%	ND	12.1	<0.001	.773
Triclopyr	2437	Pesticide	31%	ND	283	.010	.878
Carbazole	4433	Industrial	28%	ND	86	.101	.012

[a] Respective USGS schedule references are: 2437 (Sandstrom et al., 2016), 2440 (Furlong et al., 2014), and 4433 (Zaugg et al., 2006).

Revisions to Study 7A, Phase 2 Scope of Work (1 of 2)

- **Revision to deadline: Late May 2026**
  - **Assumes we receive monitoring data throughout the monitoring season**
  - Need 2025 data to calibrate the lake models
- Data Collection
  - Leverage past data/work: bathymetry (MnDNR, VLAWMO, USGS?), pumping/water levels, outlet drawings/rating curves, city storm sewer data, modeling (H&H)
  - **MCES will lead and coordinate with other monitoring organizations for 2025 monitoring program**
    - **Current monitoring organization will collect samples/deliver to lab (direction by MCES)**
    - **Additional lab costs to be covered by MCES**
  - Ramsey County staff can assist with phytoplankton sampling & species identification/counts
  - SPRWS will be able to monitor lake levels on all chain of lakes water bodies (minimum of weekly levels) & water level monitoring continues on White Bear Lake
  - Survey of outlets/channels
  - Optional: Sediment cores and phosphorus fractionation to support/confirm internal load estimates from model

Revisions to Study 7A, Phase 2 Scope of Work (2 of 2)

- Surface Water/Drinking Water Goals
  - Establish site-specific eutrophication goals for East Vadnais/White Bear Lakes – look at historic relationships but also consider pre/post-zebra mussel infestation
- Surface Water Quality Modeling and Analysis
  - Watershed Modeling/Loads – **developed to scale of lakes/larger wetland complexes (will not include all BMPs) and will leverage any available lake monitoring data**
  - Scenarios:
    - Water Demands: Current (2025), 2050, Ultimate – with Augmentation from Sucker Lake
      - **Climate impacts: Dry, Average, Wet**
      - Sensitivity to increased pollutant loads
    - Water Demands: Current (2025), 2050, Ultimate – with Augmentation from East Vadnais Lake
      - **Climate impacts: Dry, Average, Wet**
      - Sensitivity to increased pollutant loads
    - No modifications to outlets
- Treatment recommendations based on monitoring data, modeling results, **and AIS considerations**

Study 7A: Next Steps

April/Early May 2025

- Input from MCES and subwork group
- Present to larger work group
- Finalize deliverables

Spring 2025

- Develop proposal for Phase 2 scope
- MCES/Monitoring Organizations – Begin 2025 monitoring

Early Summer 2025

- Start on Phase 2 scope of work
  - Data Compilation & Collection
  - Outlet Survey
  - Watershed model development
  - Start lake model development

Later Summer 2025

- Review water demand estimates from MCES
- Develop initial water quality relationships for site specific standards
- Initial hydrodynamic runs/calibration

Thank you! Any Questions?

Brian LeMon
BLeMon@barr.com
952-832-2774

Keith Pilgrim
kpilgrim@barr.com
952-832-2793

Jennifer Koehler
jkoehler@barr.com
952-832-2750

Katie Turpin-Nagel
KTurpin-Nagel@barr.com
952-842-3690

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