

Des Plaines River Monitoring Programs



NORTH SHORE SANITARY DISTRICT

October 28, 2014

DesPlaines River Monitoring

- Three Major Monitoring Programs:
 - Water Quality Sampling (Analytical)
 - D. O. Sondes (Continuous/24 hour Sampling)
 - Biological Assessment
 - Fish
 - Macroinvertebrates
 - Habitat

Water Quality Sampling Program

- Sampling Period
 - 1986 – Present
- Started with 15 Sample Locations
- Currently 8 Sample Locations
- Analytical Parameters Monitored Quarterly

Water Quality Sampling Program

■ Analytical Parameters

■ Heavy Metals

- Cd, Pb, Cr, Cu, Ni, Zn, etc.
- Compared to Water Quality Stds. when existing.

■ Inorganics

- Chloride, Fluoride, TDS, Cyanide,

■ Nutrients

- Phosphorus, Ammonia, Nitrate, TKN

■ Bacterial Analyses

- Fecal Coliform , E. Coli

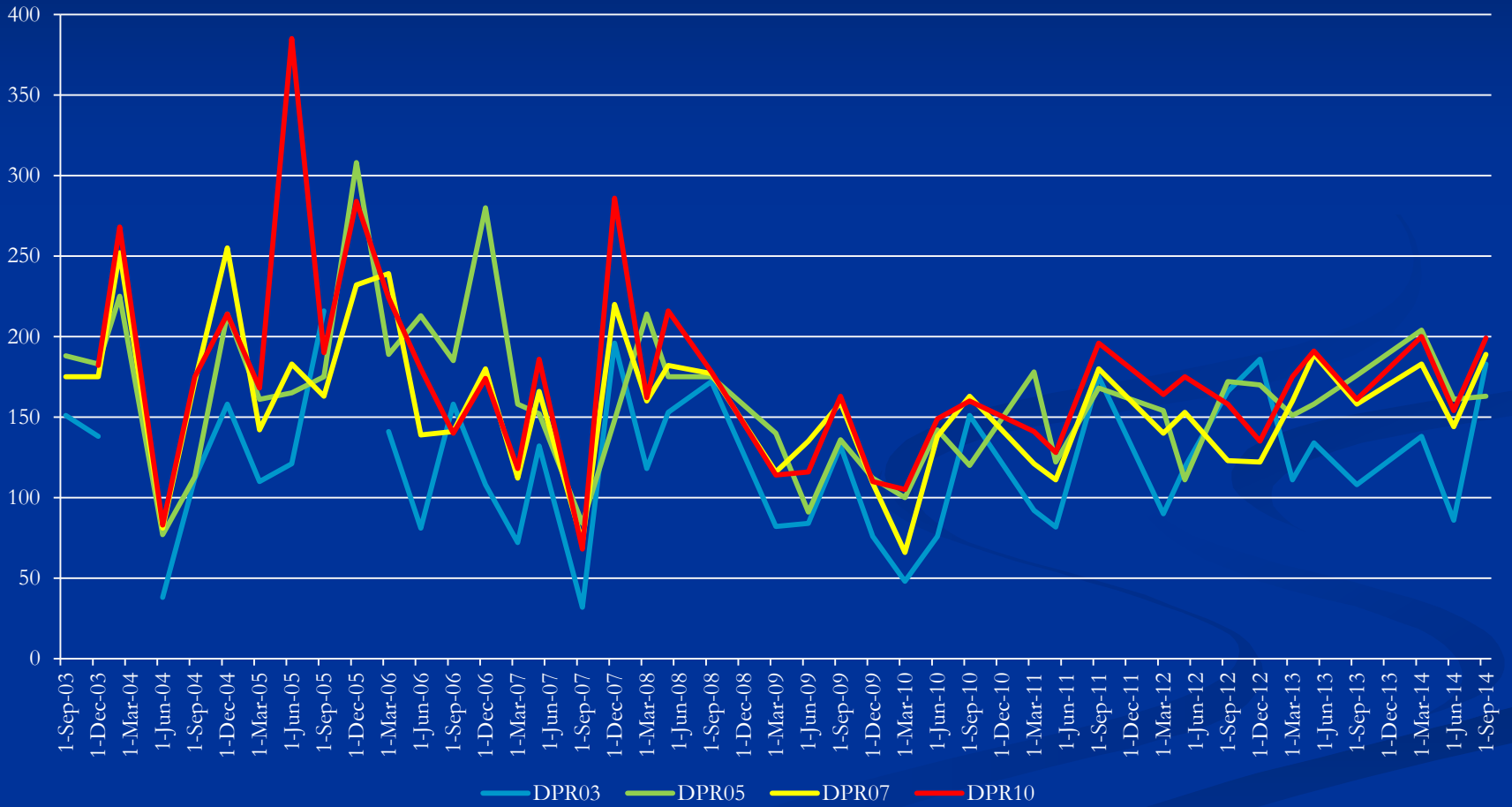
9/2/2014		Illinois Water	9/2/2014	9/2/2014	9/2/2014	9/2/2014	9/2/2014	9/2/2014	9/2/2014	9/2/2014
River Flow (ft³/sec)		Quality Stds	Wadsworth Rd	Dilley's Rd	Wauk. Outfall	Washington ST	Gurnee Outfall	Rte. 120	Oak Spring Rd	Rte. 60
104		(chronic*)	DPR03	DPR05	WKOUTF	DPR06	GROUTF	DPR07	DPR09	DPR10
Silver	ug/L	5.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dis. Arsenic	ug/L	190	<2.50	2.63	12.4	4.38	<2.50	4.43	3.52	3.65
Barium	ug/L		BNA	BNA	BNA	BNA	BNA	BNA	BNA	BNA
Beryllium	ug/L		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
BODC	mg/L		<3	<3	<3	<3	<3	<3	<3	<3
Total Hardness	mg/L CaCO3		304	275	279	281	235	283	273	281
Dis. Cadmium	ug/L	2.2	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Total Chloride	mg/L	500	183	163	166	173	243	189	191	199
Dis. Chromium	ug/L	415	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
Dis. Copper	ug/L	27	<2.50	7.39	5.50	3.94	6.96	2.51	3.74	5.10
Dissolved Oxygen	mg/L	5.0 min	5.4	7.4	8.4	6.1	7.8	6.1	6.1	6.7
E. coli	col/100ml	235	48	66	<2	138	<2	186	77	147
Total Fluoride	mg/L	4.0	0.33	0.37	0.73	0.42	0.83	0.47	0.48	0.48
Fecal Coliforms (MF)	col/100ml	400	50	CBC	2	140	2	150	120	260
Dissolved Iron	ug/L	1000	<150	<150	<150	<150	<150	<150	<150	<150
Total Potassium	mg/L		5.17	4.34	8.80	5.40	14.8	6.78	7.45	8.83
Total Manganese	ug/L	3846	103	197	<50	83.8	<50	61.3	<50	<50
Total Sodium	mg/L		85.4	86.5	97.3	89.7	159	100	105	105
Ammonia Nitrogen	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dis. Nickel	ug/L	12	<2.50	<2.50	<2.50	<2.50	5.04	<2.50	2.62	<2.50
Nitrate & Nitrite	mg/L		<0.50	<0.50	15.8	3.06	19.2	6.54	5.35	5.16
Dis. Lead	ug/L	48	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
pH, field	SU	6.5 - 9.0	7.40	8.05	7.75	7.70	7.60	7.60	7.65	7.80
Total Phenols	mg/L	0.10	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Selenium	ug/L	1000	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
Total Sulfate	mg/L	500	62	56	67	59	82	59	63	60
Total Dissolved Solids	mg/L	1000	634	558	638	654	820	662	642	654
Temperature, F	DEG F		75	74	70	73	74	73	73	73
Total Kjehldahl Nitrogen	mg/L		0.61	2.03	0.61	BNR	0.86	2.00	1.06	1.22
Total Phosphorus	mg/L		0.35	0.39	2.46	0.71	2.43	0.93	0.85	0.87
Total Suspended Solids	mg/L		13	76	2	21	2	15	13	22
T.Vol. Suspended Solids	mg/L		9	14	<1	7	<1	<3	<3	<3
Weak Acid Diss. Cyanide	mg/L	0.0052	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Zinc	ug/L	75	<25.0	<25.0	<25.0	<25.0	<25.0	<25.0	<25.0	<25.0
Total Nitrogen	mg/L		<1.2	<2.6	16.4	BNA	20.1	8.54	6.41	6.38
Turbidity	NTU		3	60	<1	14	<1	11	7	5

* Chronic standard not to be exceeded by the average of at least four consecutive samples collected over any period of at least four days.

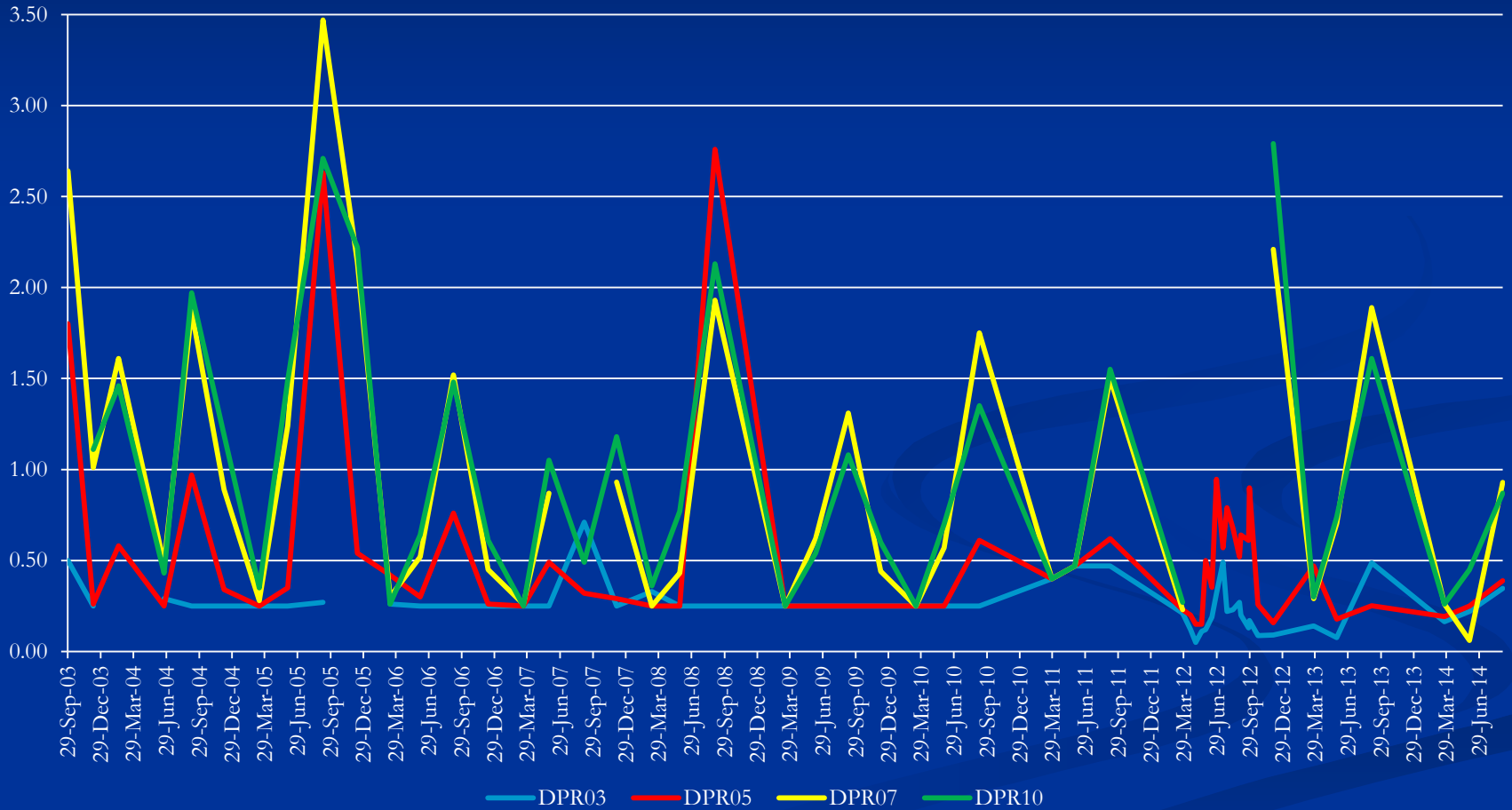
Parameters of Interest

- Chloride
 - Water Quality Standard = 500 mg/l
- Total Phosphorus
 - Water Quality Standard
 - Lakes = 0.05 mg/l
 - Streams = pending
- E. Coli
 - Water Quality Standard = 235 cfu/100ml

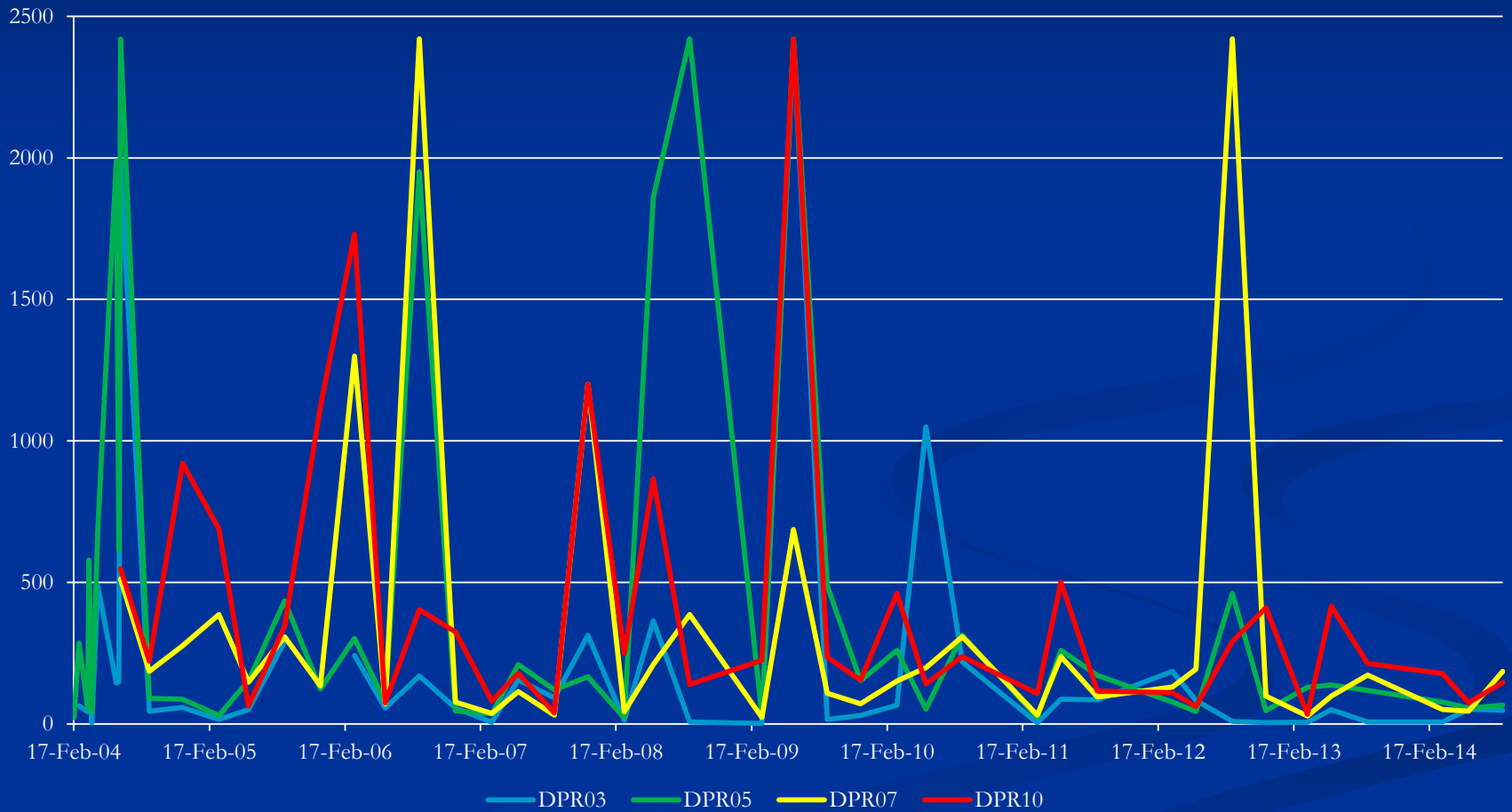
Chloride



Phosphorus



E. Coli

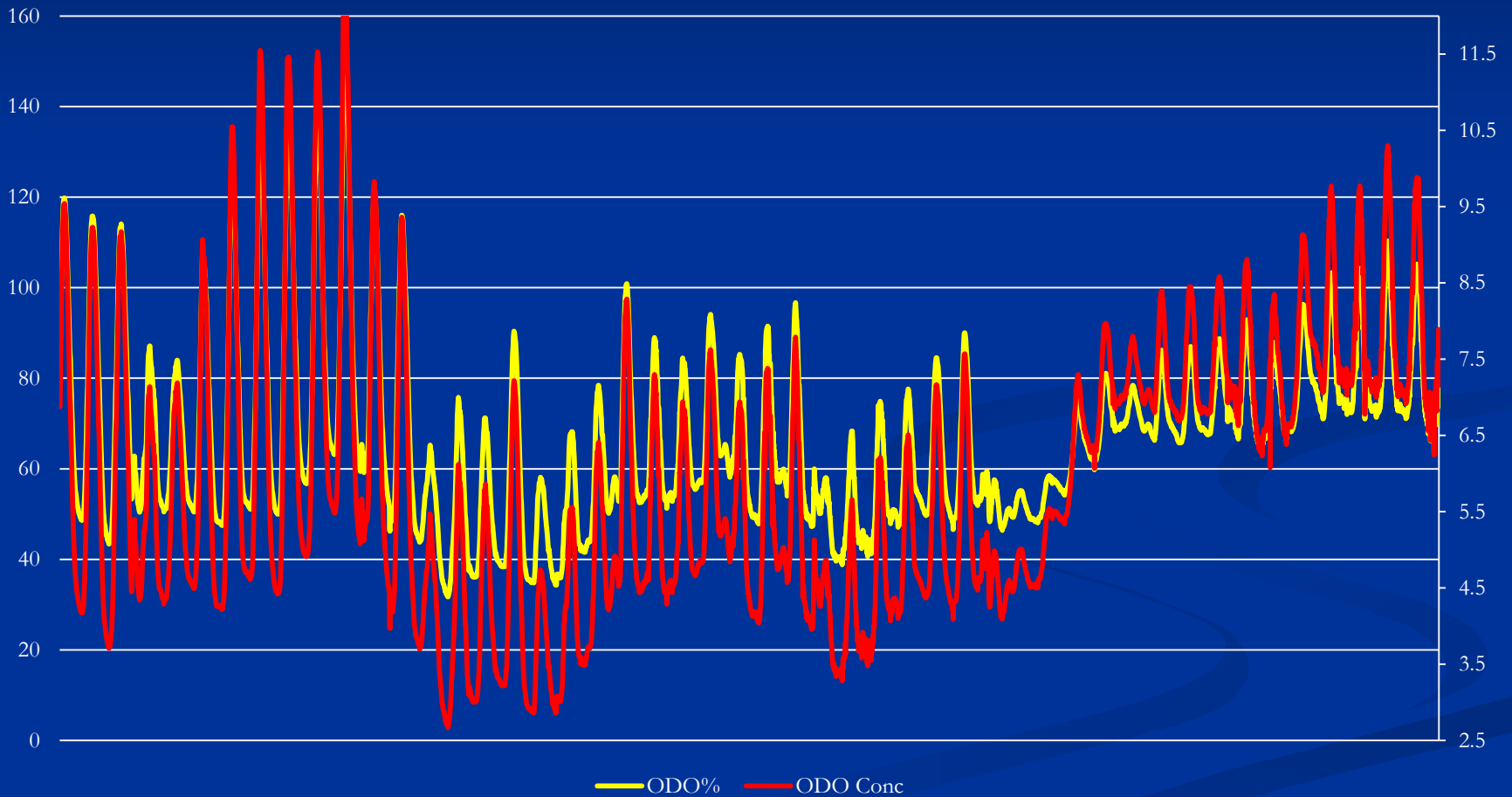


Diurnal DO Studies

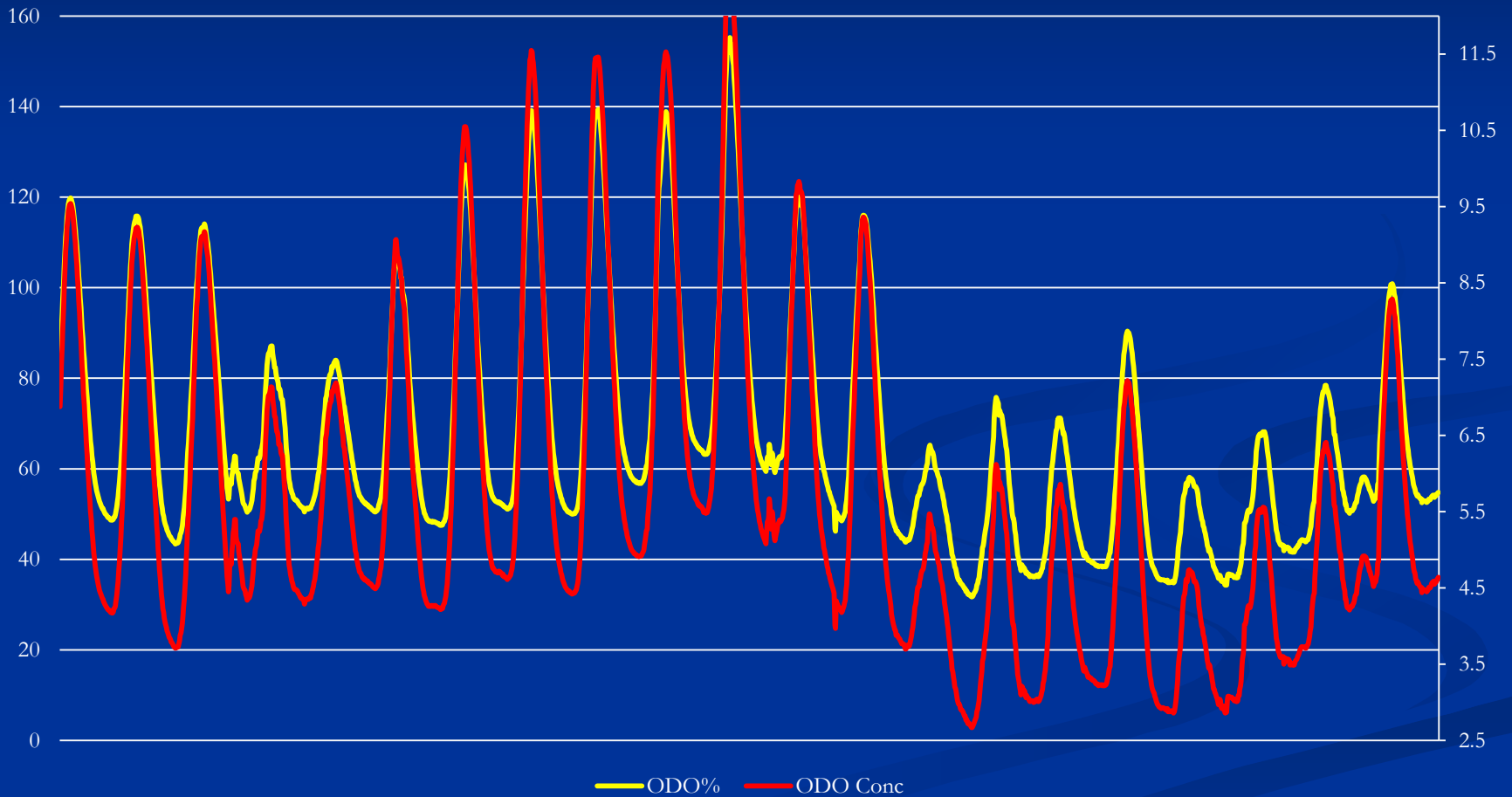
- DO Sondes placed at Biological Sample Stations
 - Upstream of Highway 41 and Highway 120
 - Deployed for 7 – 14 day periods
- Continuous data collection
 - Dissolved Oxygen
 - Temperature
 - Conductivity
- IEPA Definition of Nuisance Algae

Upstream D.O.

August 8 – Sept. 28, 2014

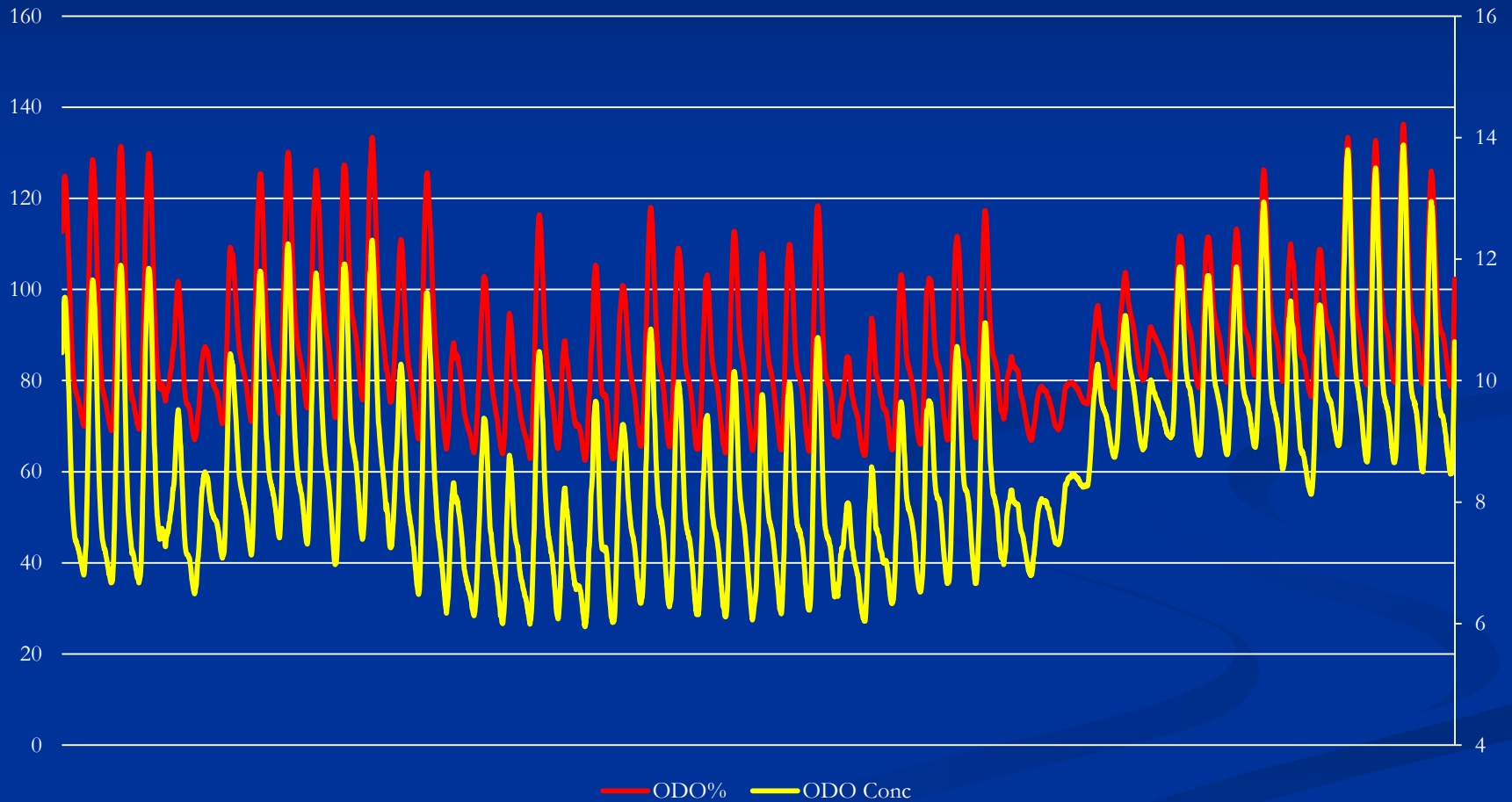


Upstream DO



Downstream DO

August 8 – Sept. 28, 2014

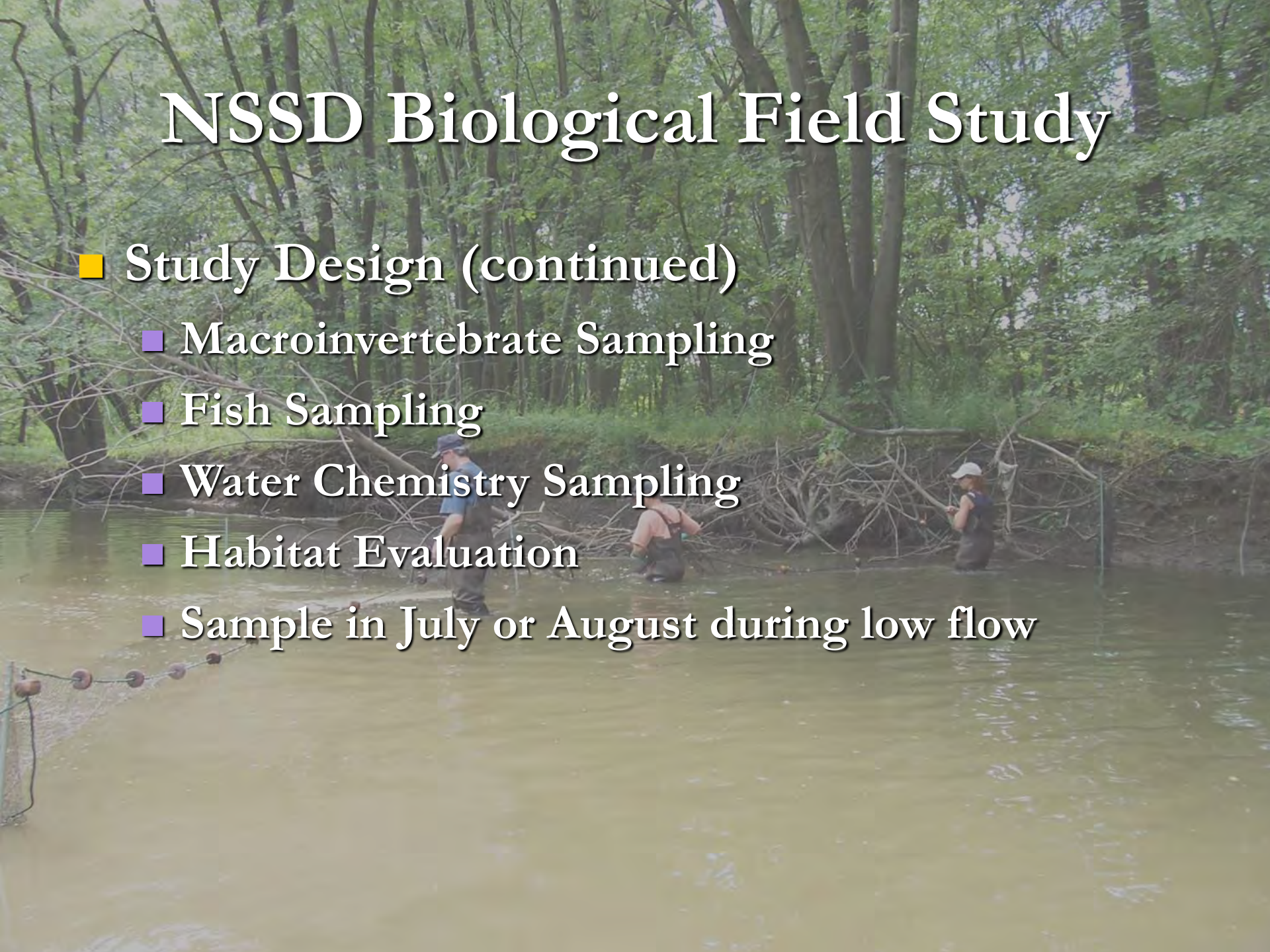


NSSD Biological Field Study

- Sampling QAPP developed
 - Based on IEPA's QAPP manual
- Study Design
 - “Upstream-downstream reference condition approach”
 - Station downstream of each STP discharge
 - Habitat characteristics similar between stations = similar biological expectations

NSSD Biological Field Study

- Study Design (continued)
 - Macroinvertebrate Sampling
 - Fish Sampling
 - Water Chemistry Sampling
 - Habitat Evaluation
 - Sample in July or August during low flow



Sample Station Selection

- Location selection relative to STP discharges
- Field recon to select stations with similar riffle, run and pool habitats
- Similar adjacent land use
- Station length approximately 100 meters
- Verify habitat comparability with QHEI Stream Habitat Assessment Procedure

Sample Stations

- **DPRBIO 01** – upstream “reference” station
- **DPRBIO 02** – 1.6 miles downstream of Waukegan STP discharge, upstream of Gurnee STP discharge
- **DPRBIO 03** – 3.5 miles downstream of Waukegan STP discharge and 0.9 miles downstream of Gurnee STP discharge

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Des Plaines River Sampling Stations

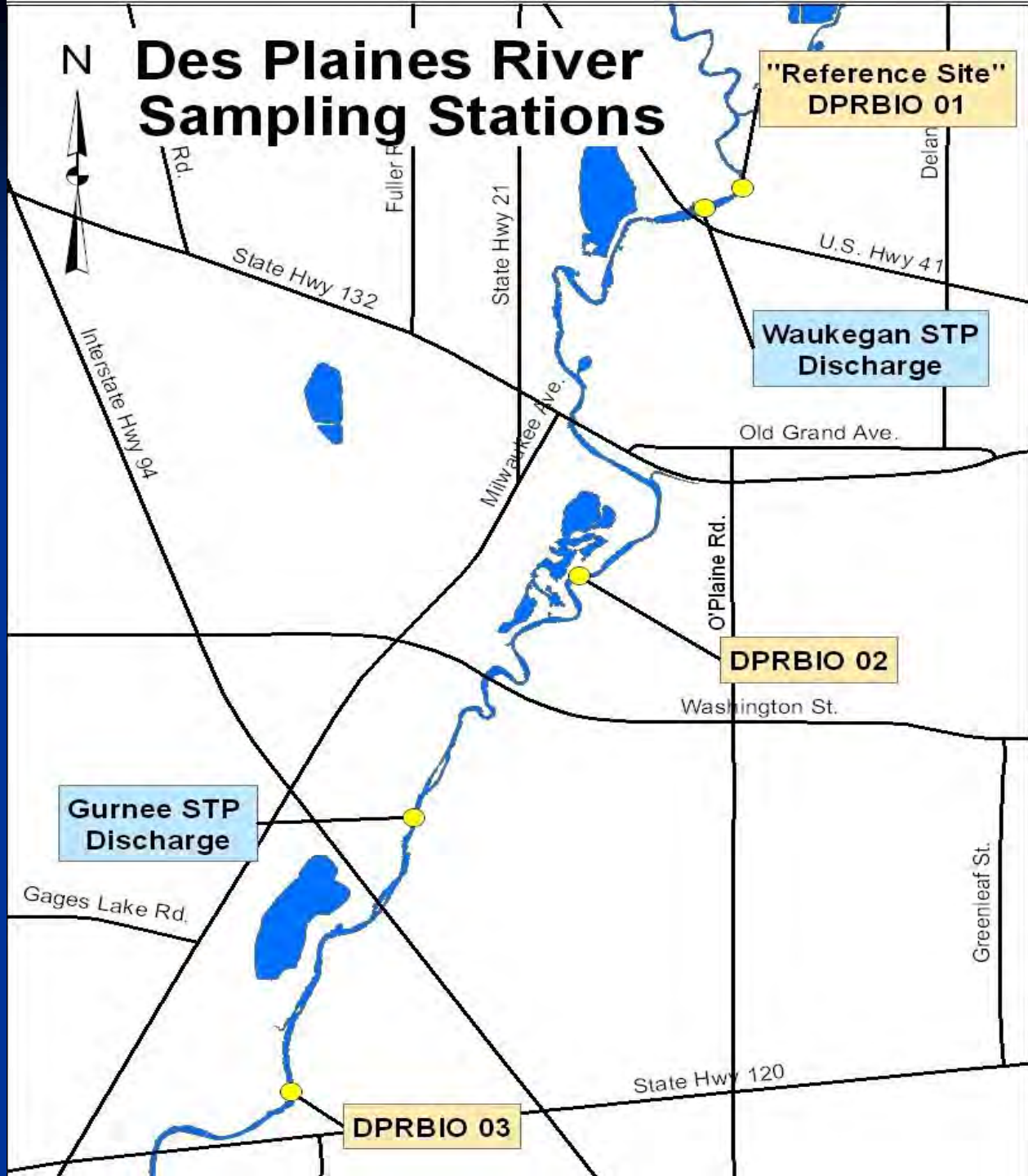
"Reference Site"
DPRBIO 01

Waukegan STP
Discharge

DPRBIO 02

Gurnee STP
Discharge

DPRBIO 03



Macroinvertebrate Collection Methods

- Sample once per year
- Two collection techniques
 - Multi-plate artificial substrate samplers
 - 4 per station
 - Six week colonization period
 - Hand Collection
- Subsample 300 organisms
- Identification to species level



Macroinvertebrate Data Analysis

- Taxa richness
- Macroinvertebrate Biotic Index (MBI)



Macroinvertebrate Biotic Index (MBI)

- Developed by IEPA for Illinois Streams
- Based on tolerance values assigned to taxa
- Average of tolerance values (1.5 to 11) weighted by organism abundance:

MBI Values and Stream Quality Index for Illinois Streams

MBI Score

<5.9

6.0-8.9

>8.9

Stream Quality

Good, No Impairment
“Fully Supporting Aquatic Life Use”

Fair, Moderate Impairment
“Non Supporting Aquatic life Use”

Poor, Severe Impairment
“Non Supporting Aquatic Life Use”

Source: IEPA

Mississippi Grass Shrimp

- *Palaemonetes kadiakensis*
- Rare in northeast IL
- Indicator of clean water



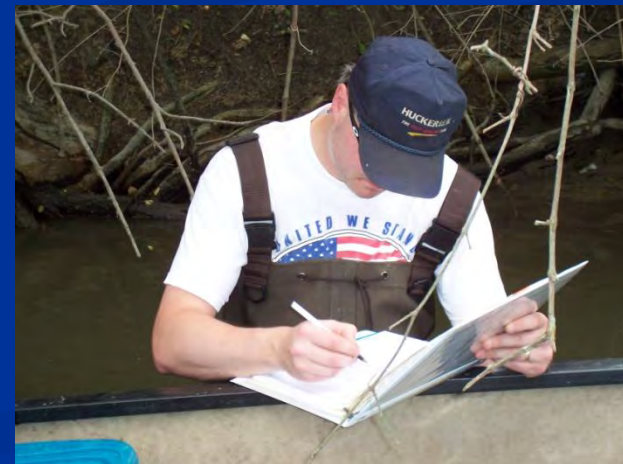
Fish Collection Methods



- Sample once per year
- Semi-quantitative
- Electrofishing
 - Use “blocking” nets
 - Similar effort at each station
- Seining
- Species level ID
 - Most identified in the field and released
 - Reference collection

Fish Data Analysis

- Species richness
- Index of Biotic Integrity (IBI)
 - Species level ID



Index of Biotic Integrity (IBI)

- Developed by IEPA for Illinois streams
- Based on ten metrics in three broad categories
 - Species richness
 - Trophic or reproductive composition
 - Tolerance
- Evaluation against expected conditions
- Value of 0 - 60 assigned based deviation from expected conditions

IBI Values and Stream Quality Index for Illinois Streams

IBI Score

51-60

41-50

31-40

21-30

<21

Stream Quality

Unique Aquatic Resource

High Value Aquatic Resource

Moderate Aquatic Resource

Limited Aquatic Resource

Restricted Aquatic Resource

Source: IEPA

Macroinvertebrate Results 2004-2013

■ DPRBIO 01

- “reference site”
- Taxa richness
 - 16 – 31, mean = 23
- Macroinvertebrate Biotic Index (MBI)
 - 5.3 – 8.7, Mean = 6.2
 - “Fair” to “Good” water quality

■ DPRBIO 02

- downstream of Waukegan STP
- Taxa richness
 - 15 – 28, mean = 21
- Macroinvertebrate Biotic Index (MBI)
 - 5.2 – 5.6, Mean = 5.4
 - “Good” water quality
No Impairment, Full Support

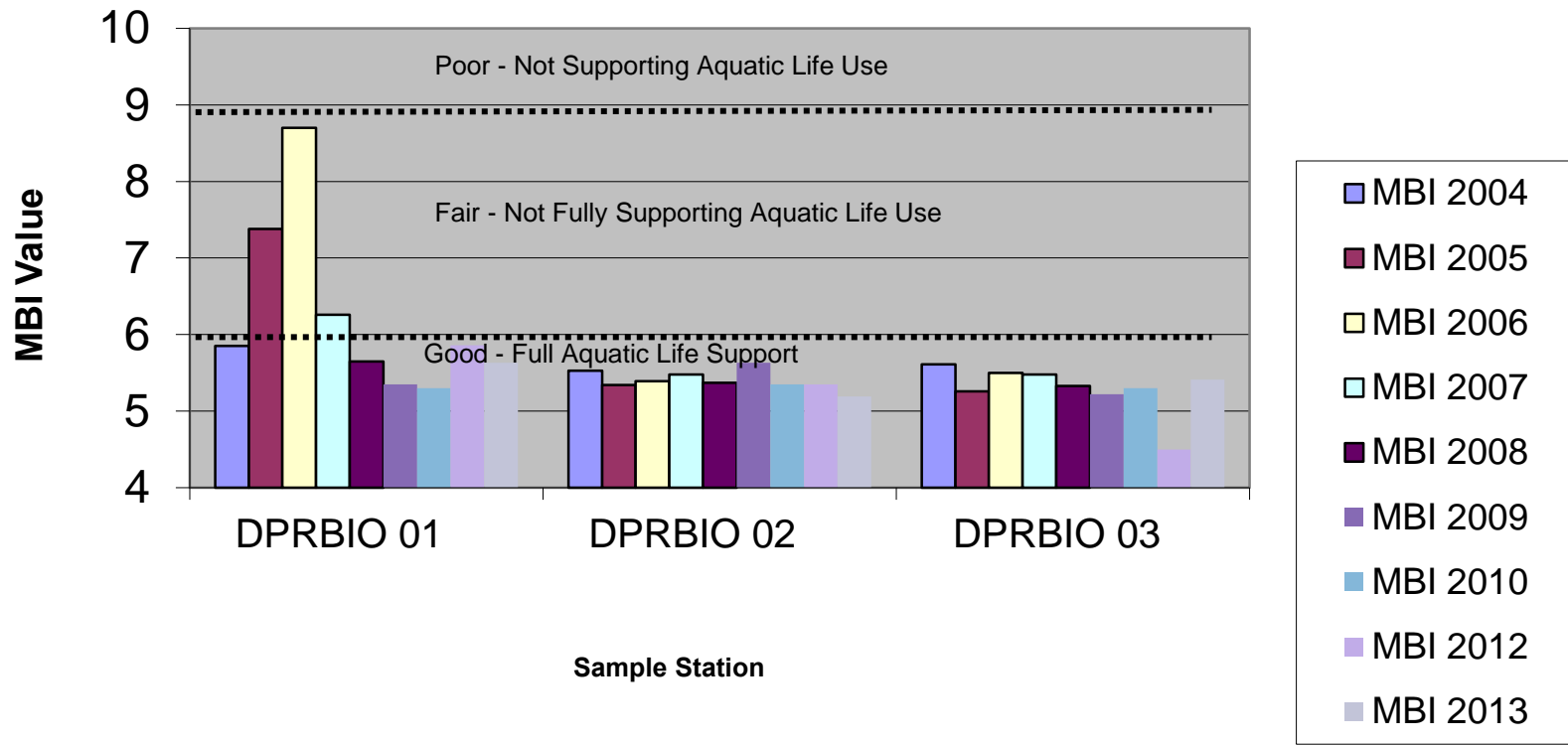
Macroinvertebrate Results 2004-2013



- DPRBIO 03
 - Downstream of Waukegan STP and Gurnee STP
 - Taxa richness
 - 19 - 30, mean = 22
 - Macroinvertebrate Biotic Index (MBI)
 - 5.2 – 5.6, Mean = 5.3
 - “Good” water quality
No Impairment, Full Support

Macroinvertebrate Biotic Index (MBI) Des Plaines River 2004-2013

**Macroinvertebrate Biotic Index (MBI)
For Multi-Plate Collection Technique
Des Plaines River Field Study 2004 - 2013**



Fish Sampling Results 2004-2013

■ DPRBIO 01

- “reference site”
- Species richness
 - 17 - 25, mean = 21
- Index of Biotic Integrity (IBI)
 - 24 – 42, Mean = 32
 - Moderate Aquatic Resource

■ DPRBIO 02

- downstream of Waukegan STP
- Species richness
 - 20 – 24, mean = 21
- Index of Biotic Integrity (IBI)
 - 33 – 42, Mean = 37
 - Moderate Aquatic Resource

Fish Sampling Results 2004-20

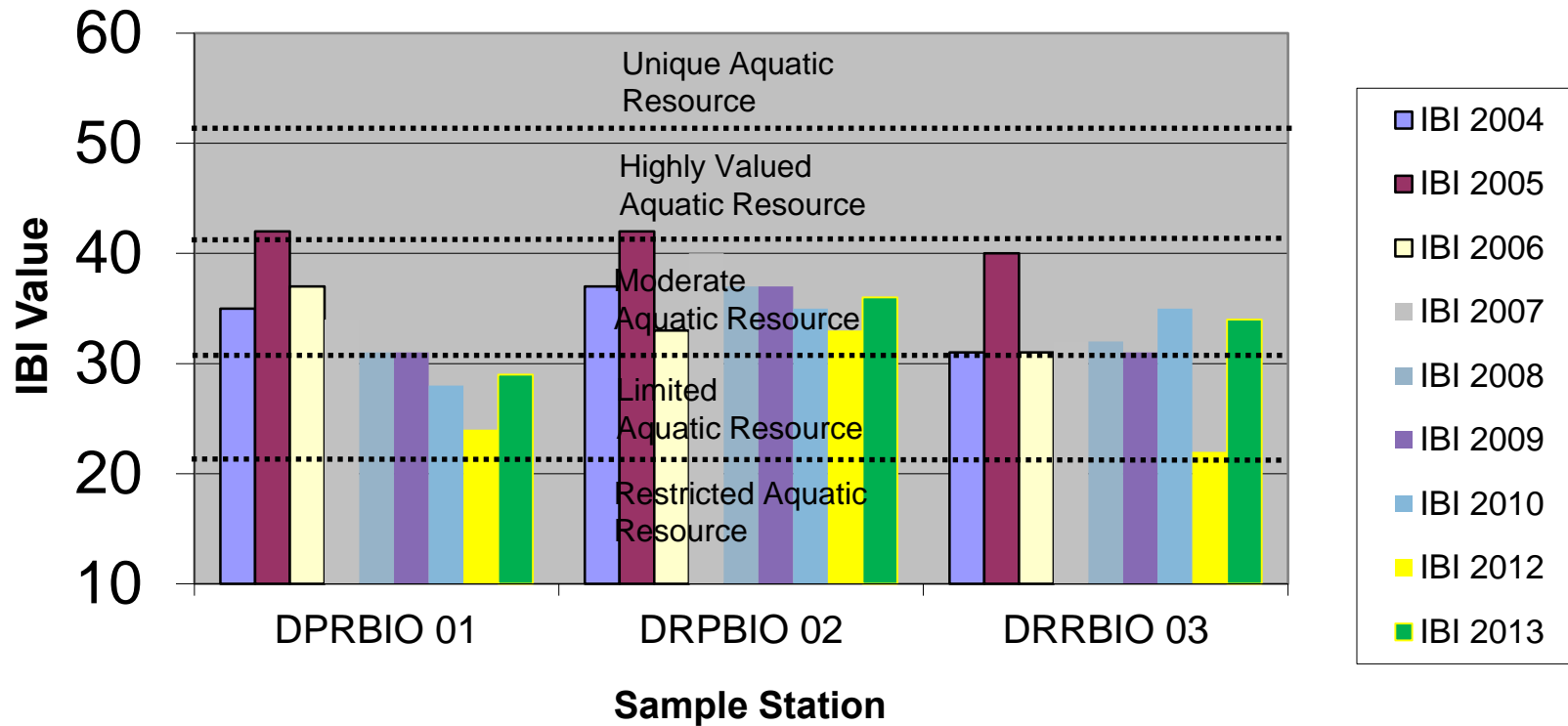
- DPRBIO 03
 - Downstream of Waukegan STP and Gurnee STP
 - Species richness
 - 11 – 23, mean = 19
 - Index of Biotic Integrity (IBI)
 - 22 – 40, Mean = 32
 - Moderate Aquatic Resource



Index of Biotic Integrity (IBI)

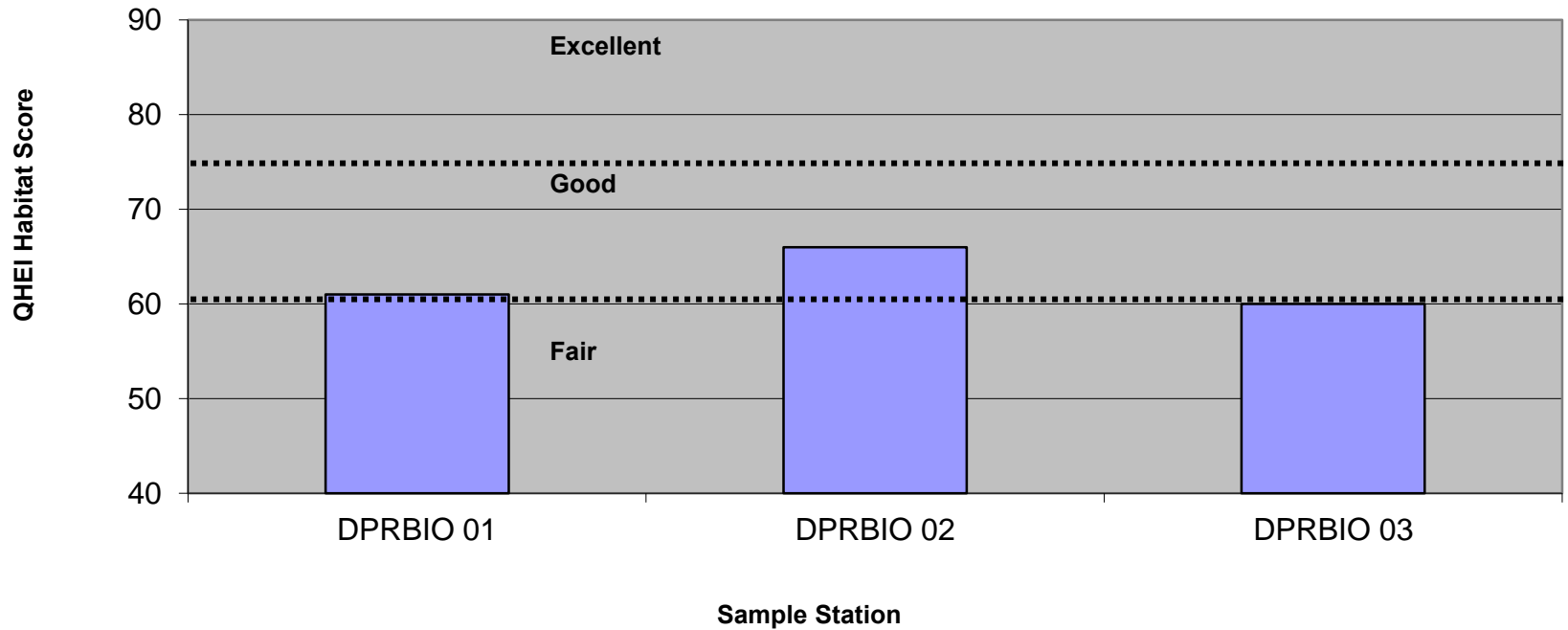
Des Plaines River 2004-2013

Fish Index of Biotic Integrity (IBI) Des Plaines River Field Study
2004 - 2013



Habitat Evaluation Results

**QHEI Habitat Index
Des Plaines River Field Study**



Secchi Disk Data

■ <u>Year</u>	<u>Site 1</u>	<u>Site 2</u>	<u>Site 3</u>
■ 2008	14"	17"	20"
■ 2009	16"	16"	18"
■ 2010	18"	19"	28"
■ 2011	No Data due to High Stream Flow		
■ 2012	18"	35"	46"
■ 2013	NA	39"	43"
■ 2014	32"	NA	NA

Questions

A scenic view of a river flowing through a dense forest. The water is calm and reflects the surrounding green trees and sky. The banks are covered in fallen leaves and branches. The word "Questions" is overlaid in white text on the left side of the image.