



**Report on Biological & Water Quality  
Monitoring in the West Branch DuPage  
Watershed: 2006-2015**

**DuPage River-Salt Creek Work Group  
August 30, 2017**

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Columbus, OH**

# **2015 West Branch DuPage Watershed Biological & Water Quality Assessment**

**Standardized biological, chemical, and physical monitoring and assessment techniques were employed to meet three major objectives:**

- Determine the extent to which biological assemblages are impaired (using Illinois EPA guidelines);**
- Determine the categorical stressors and sources that are associated with those impairments; and,**
- Add to the broader databases for the DuPage River and Salt Creek watersheds to track and understand changes through time in response to abatement actions or other influences.**



A photograph of a river with fallen logs and bare trees in the background. The text is overlaid on the image.

# **The Development of a Biological Assessment Plan for the DuPage and Salt Creek Watersheds**

**DuPage-Salt Creek Work Group  
March 7, 2006**

**Chris O. Yoder  
Center for Applied Bioassessment and Biocriteria  
Midwest Biodiversity Institute  
Columbus, OH**

**Legend**

- Sample Sites
- 🌸 Spring Brook Dam
- 🗑️ Removed Dam
- 🏭 WWTP Discharge
- 📏 West Branch Page R.
- 🌳 C12 Watershed



*Spatial sampling design is critical for accurately detecting impairments and providing data at the same scale at which restoration is applied.*



# W. Branch DuPage Bioassessment: 2015 Follow-up Survey

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- **21 mainstem & 24 tributary sites sampled for fish, macroinvertebrates, and QHEI – reference sites in adjacent subbasins**
- **Fish sampled with MBI methods – pulsed D.C. methods; 3 person crew**
- **Macroinvertebrates sampled with IEPA methods at all sites.**
- **Water chemistry at all sites; sediment chemistry at 23 sites; continuous D.O. at 4 mainstem sites.**
- **Data analyzed using IEPA indices and current “biocriteria” per 303[d] methodology.**



# What is a Bioassessment?

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- **Bioassessment – a systematic assessment of the aquatic resource using biological indicators AND chemical/physical**

**Bioassessment is the essential**

- **implementation tool for a TALU based approach**

- ***Reasonably available* tools and criteria exist to assess and evaluate this for all waterbody types.**

**GOOD**

Natural  
Channel,

**Habitat  
Structure**

**POOR**

Altered  
Channel,

The biota reflect and integrate the aggregate effects of alterations to one or more of these factors under all conditions.

The biota are a reflection of the aggregation of prior events and in essence are a reflection of “what gets left behind”.

A TALU based approach and the attendant chemical/physical tools & indicators provide the technology to better implement the CWA.

Native  
Species  
Flourish

**Factors**

Invasive  
Aliens  
Established

**Invertebrate organisms contribute vital functions in an aquatic ecosystem including energy flow, conversion, and production.**



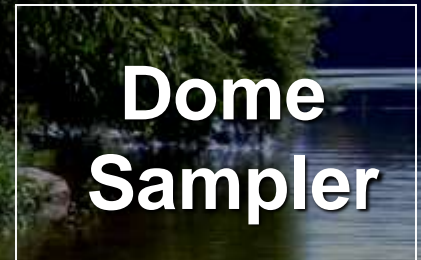
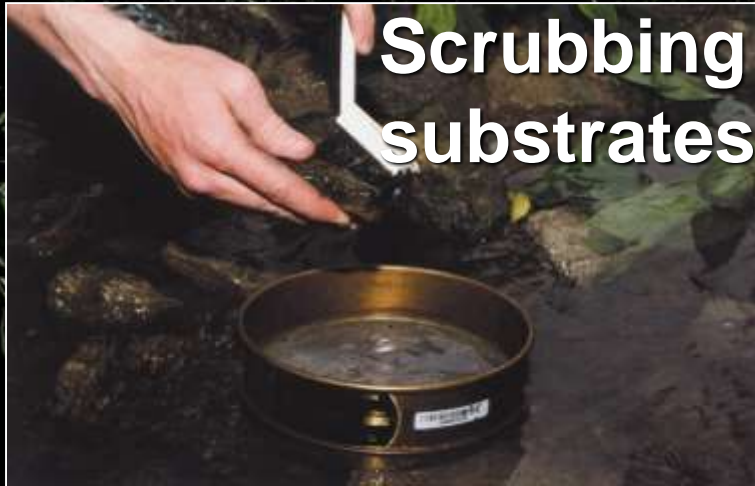
**This assemblage is the longest used indicator group. Numerous techniques and approaches have been developed.**



# Benthic Macroinvertebrates

## Active Sampling Methods Examples

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**Net-based methods  
(including kicks,  
dips, jabs, sweeps,  
& picks)**







# IEPA methods for field collections & lab processing



**Fish are a widely identifiable component of aquatic systems and are valued for their recreational uses. Most species, however, are more obscure, and comprise the second most endangered group.**





# Illinois DNR "electric seine"



# MBI pulsed D.C. electrofishing methods



# Illinois EPA Fish Index of Biotic Integrity

Table 3. Ten metrics selected for inclusion in revised Illinois IBIs. Metrics in **bold type** are new to Illinois IBIs; four others are slight variants of previous metrics.

<b>Metric Name</b>	<b>Description</b>
<i>Species-richness metrics</i>	
NFSH	Number of native fish species
NSUC	Number of native sucker species (i.e., in family Catostomidae)
NSUN	Number of native sunfish species (i.e., in family Centrarchidae)
INTOL	Number of native intolerant species
<b>NMIN</b>	<b>Number of native minnow species (i.e., in family Cyprinidae)</b>
<b>NBINV</b>	<b>Number of native benthic invertivore species</b>
<i>Trophic- or reproductive-structure metrics</i>	
<b>SBI</b>	<b>Proportion of individuals of species that are specialist benthic invertivores</b>
<b>GEN</b>	<b>Proportion of individuals of species that are generalist feeders</b>
<b>LIT0T</b>	<b>Proportion of individuals of species that are obligate coarse-mineral-substrate spawners and not "tolerant" (i.e., excludes creek chub and white sucker)</b>
<i>Tolerance metric</i>	
<b>PRTOL</b>	<b>Proportion of tolerant species</b>

# Illinois EPA IBI Narrative Evaluations

Prior IBI-score Range	Class	Description
51 - 60	A	Unique Aquatic Resource (Exceptional)
41 - 50	B	Good Aquatic Resource (Good)
31 - 40	C	Moderate Aquatic Resource (Fair)
21 - 30	D	Limited Aquatic Resource (Poor)
< 21	E	Restricted Aquatic Resource (Very Poor)

**General Use Attainment Threshold**



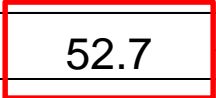
# Illinois EPA Macroinvertebrate Index of Biotic Integrity

<b>Metric</b>	<b>Response to Stress</b>	<b>Best Value</b>
Coleoptera taxa	Decrease	5
Ephemeroptera taxa	Decrease	10.2
Total Taxa	Decrease	46
Intolerant taxa	Decrease	9
MBI	Increase	4.9
Percent Scraper	Decrease	29.6
Percent EPT	Decrease	74

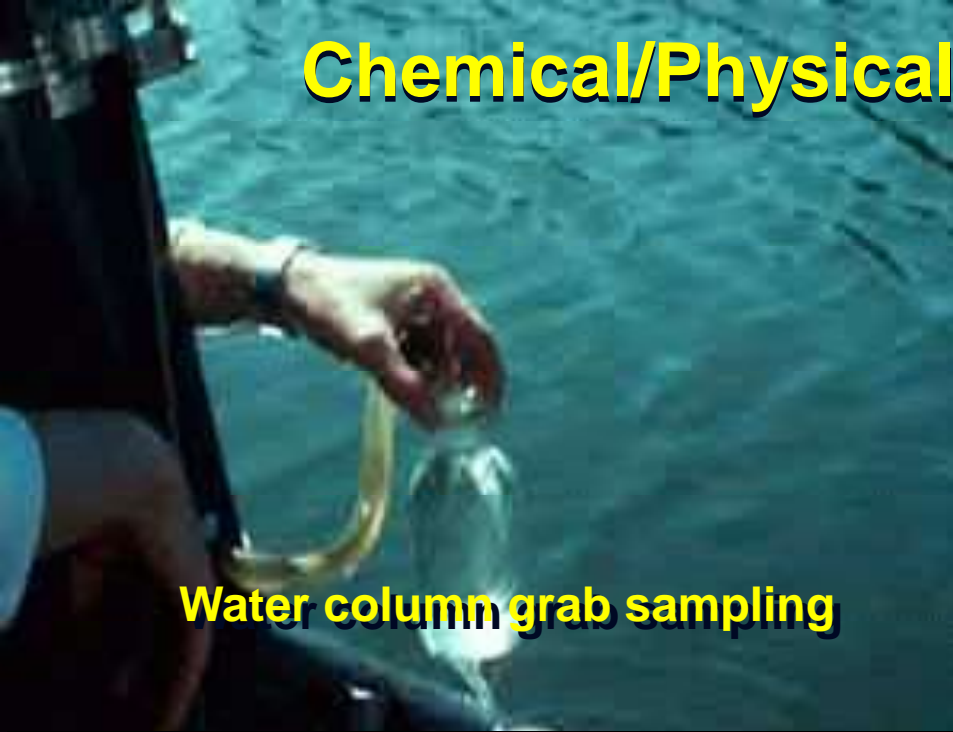
# Illinois EPA Macroinvertebrate IBI Narrative Ranges

Index Score			
Lower Boundary	Upper Boundary	Comparison to Reference	Narrative
73		95th percentile	Exceptional
52.7		75th percentile	Good
26.4		25th percentile (upper)	Fair
0	26.3	bisect 25th percentile (lower)	Poor

**General Use  
Attainment  
Threshold**



# Chemical/Physical Field Procedures



**Water column grab sampling**



**Depth integrated sampler**



**Automatic composite samplers**



**Time-of-travel dye injection**

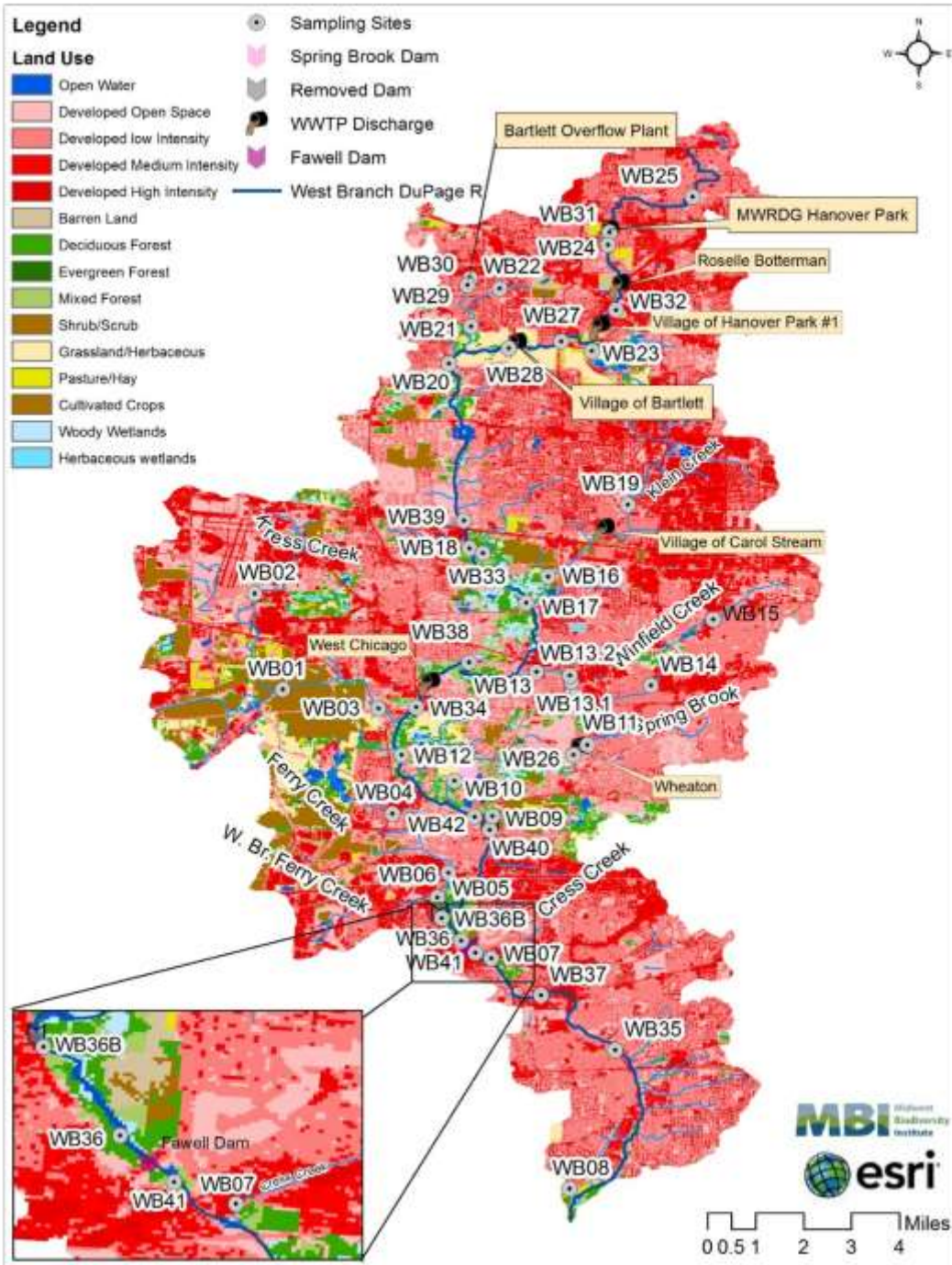


# Types of Environmental Indicators: How Each is Used Makes a Difference

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1. **Stressor Indicators** (pollutant loadings, land use, habitat) – *best used to indicate impacts*
2. **Exposure Indicators** (e.g., chemical-specific, biomarkers, toxicity tests) – *best used to indicate risk of harm or undesirable changes*
3. **Response Indicators** (e.g., biological community condition) – *best used to indicate whole effects and as a performance end-point*

*Problems occur when indicators are used as surrogates outside their most appropriate role*



***The West Branch DuPage River watershed is urbanized and the mainstem is dominated by wastewater flows.***



## **Fawell Flow Control Structure**

**McDowell & Warrenville Dams Removed in  
2008 & 2011**

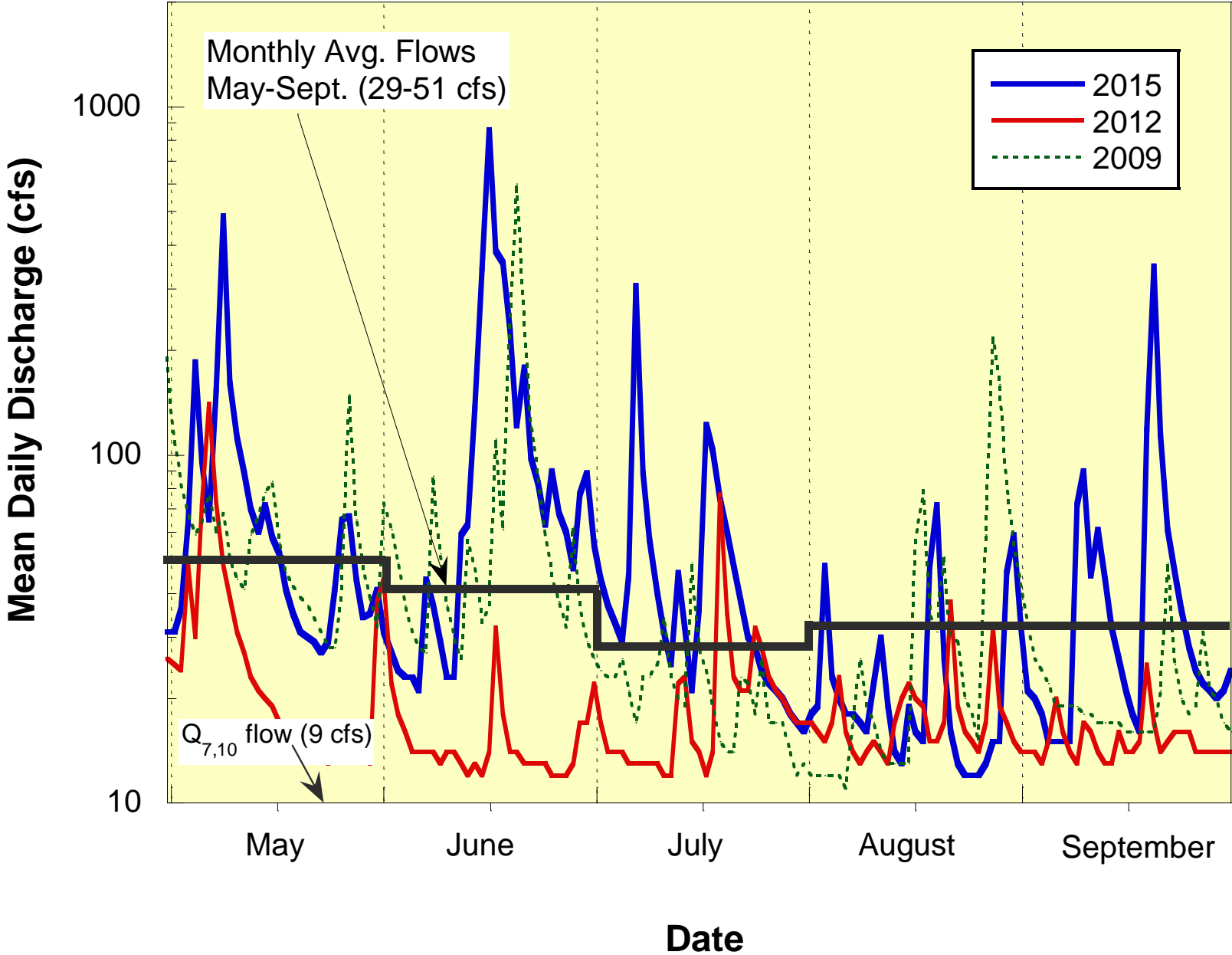


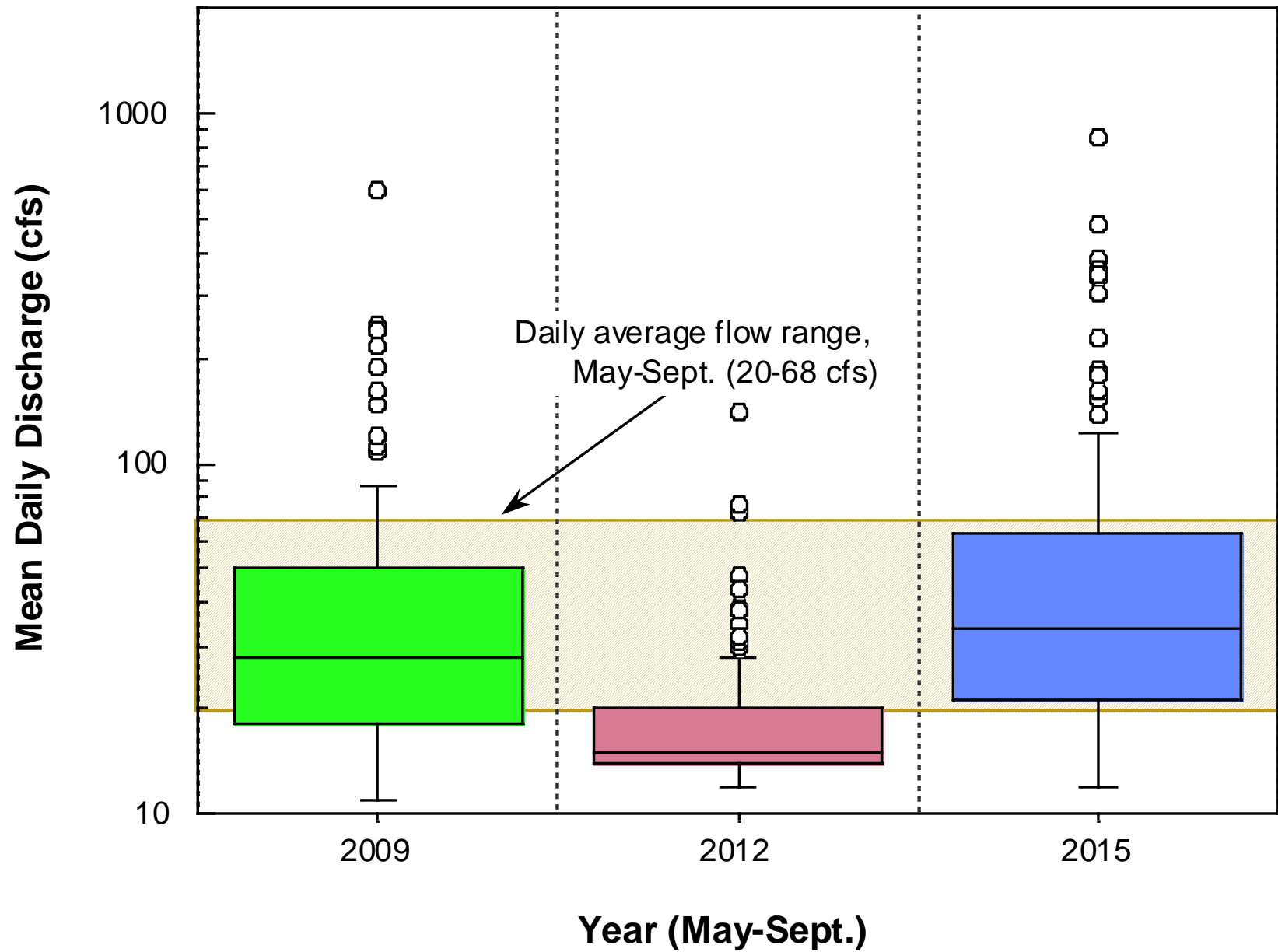
# W. Branch Point Sources: Design Capacity

NPDES	WWTP	ADF (MGD)	MDF (MGD)	Receiving Stream	Latitude	Longitude
IL0036137	MWRDGC Hanover Park	12	22	West Branch	42.0008	-88.1361
IL0048721	Roselle-J. Botterman	1.22	4.6	West Branch	41.9822	-88.1139
IL0034479	Hanover Park #1	2.42	8.68	West Branch	41.9722	-88.1386
IL0027618	Bartlett	3.68	13.0	West Branch	41.546944	-88.183333
IL0023469	West Chicago	7.64	20.3	West Branch	41.551667	-88.141667
IL0031739	Wheaton S.D.	8.9	19.1	Spring Brook	41.8447	-88.1450
IL0026352	Carol Stream	6.5	13.0	Klein Creek	41.9094	-88.1353

**42.4 MGD ADF – 87% of  $Q_{7,10}$  flow**

# West Branch Dupage River nr. West Chicago







***West Branch 2015 Chemical Water  
Quality***

**Table 7.** Chemical parameter concentrations (mg/L) in violation<sup>a</sup> of Illinois water quality standards in chemical grab samples from the West Branch DuPage River watershed in 2015 and 2012.

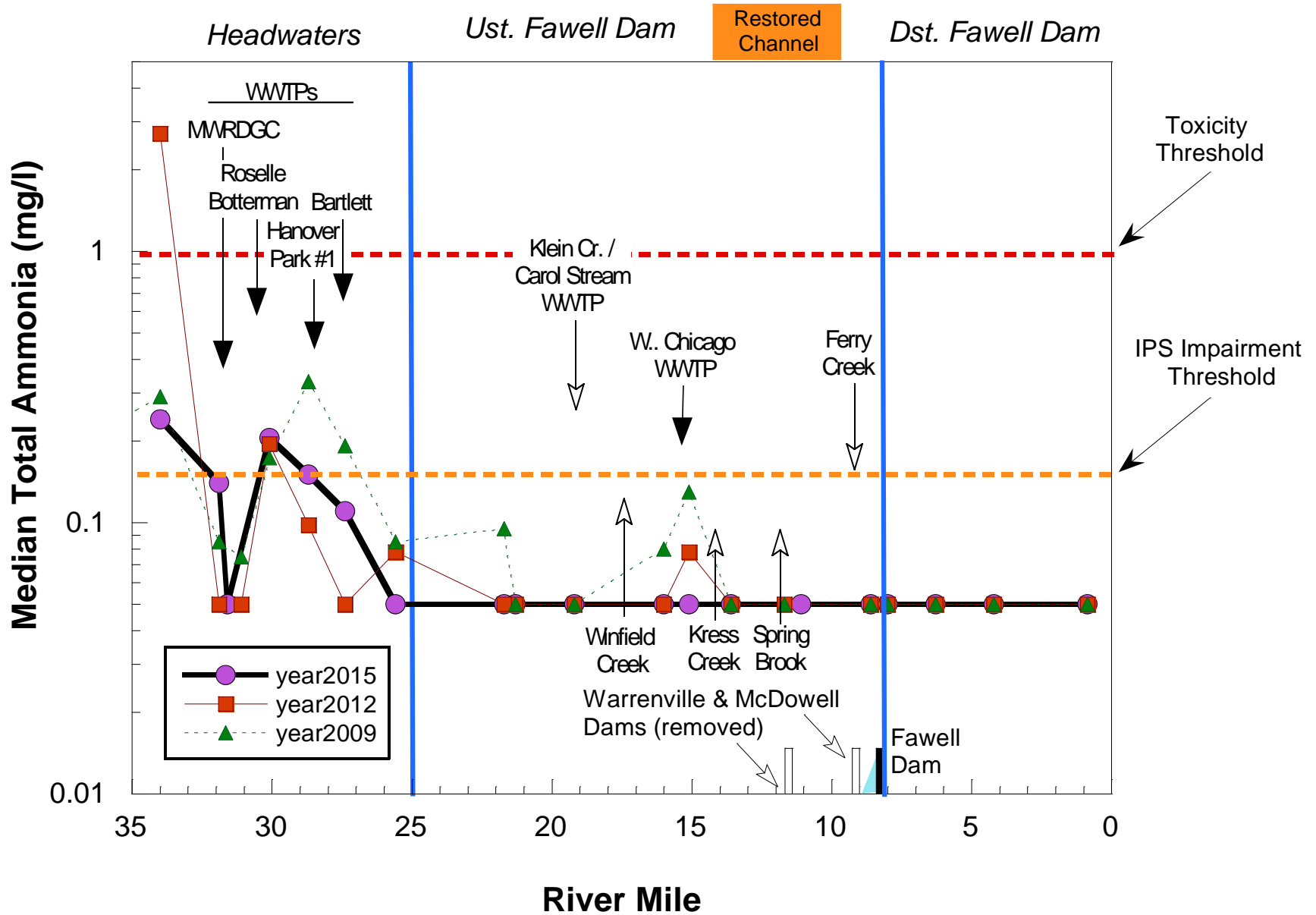
Site ID	Basin	Stream	River Mile	Exceedance or Parameter of Interest	
				2015	2012
<b>West Branch DuPage River</b>					
WB25	95	900	34.0	D.O. (1.28)	T. Ammonia (3.24)
WB31	95	900	31.9	--	D.O. (2.57)
WB24	95	900	31.6	--	--
WB32	95	900	30.1	--	--
WBAD	95	900	29.0	¥ D.sonde D.O. violations (Table 7)	¥ D.sonde D.O. violations (Table 7)
WB27	95	900	28.7	--	--
WB28	95	900	27.4	--	--
WB20	95	900	25.6	Zn (195)	--
WB39	95	900	21.7	--	--
WB33	95	900	21.3	--	--
WB17	95	900	19.2	--	Cu (72.40)
WB38	95	900	16.0	--	--
WB34	95	900	15.1	--	--
WB12	95	900	13.6	--	Cd (43.70); Cu (44.70); Pb (41.60)
WB42	95	900	11.6	--	D.O. (3.80)
WBBR	95	900	11.6	¥ D.sonde D.O. violations (Table 7)	¥ D.sonde D.O. violations (Table 7)
WB40	95	900	11.1	D.O. (4.77)	D.O. (4.60)
WBWD	95	900	11.1	¥ D.sonde D.O. violations (Table 7)	¥ D.sonde D.O. violations (Table 7)
WB36	95	900	8.6	--	D.O. (3.80)
WB41	95	900	8	--	--
WB37	95	900	6.3	--	--
WB35	95	900	4.2	--	--
WB08	95	900	0.85	--	--

**Table 9.** Median concentrations of key nutrient parameters including total ammonia, nitrate, TKN, and phosphorus in the West Branch DuPage River watershed in 2015. Shading represents exceedances of various criteria or thresholds for nutrient parameters (see footnotes). Where more than one target was used, the most stringent criteria is red and least stringent is yellow.

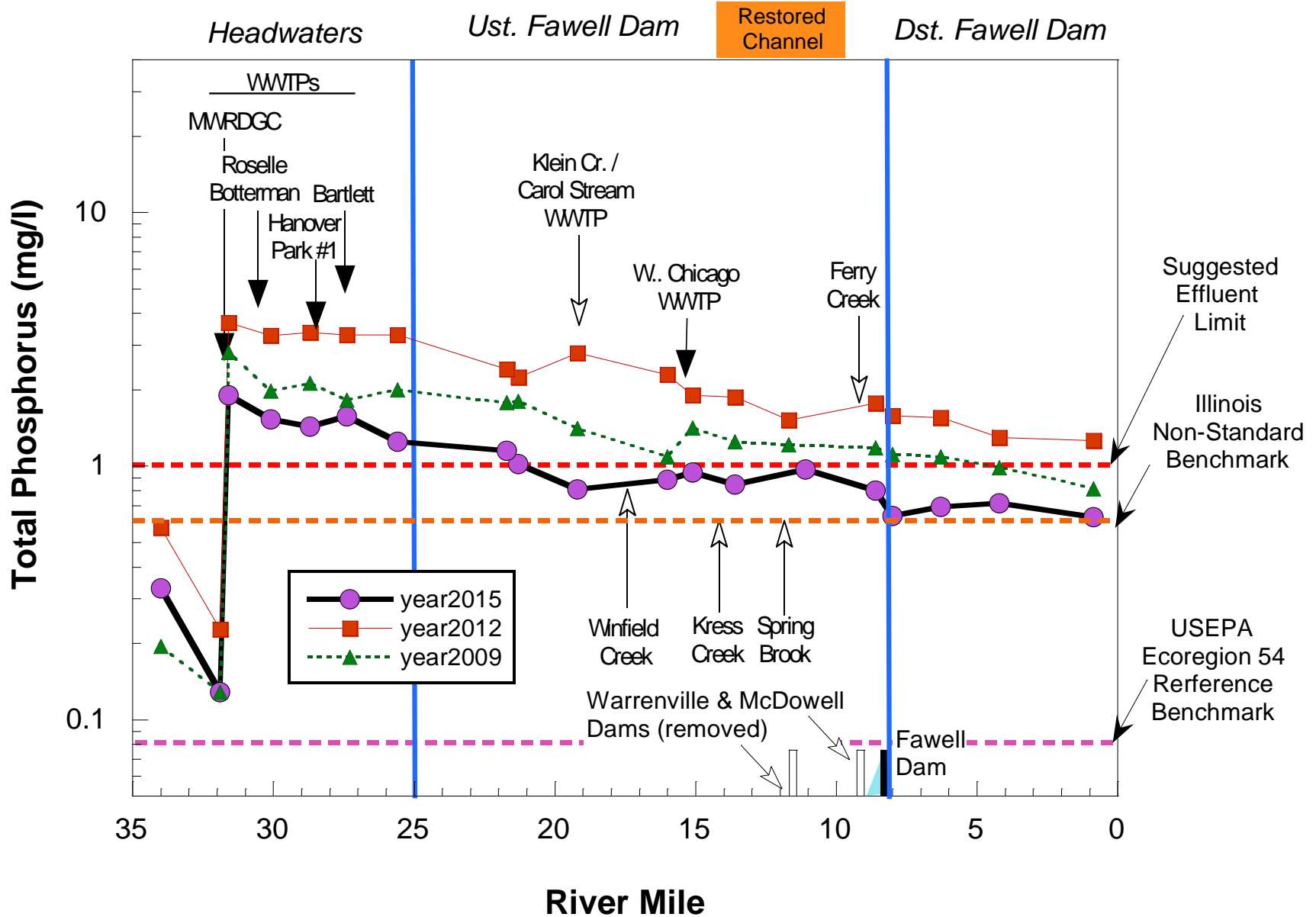
Site ID	Basin code	Stream Code	RM	Ammonia <sup>1</sup> (mg/L)	Nitrate <sup>2,3,4</sup> (mg/L)	TKN <sup>5</sup> (mg/L)	T - Phosphorus <sup>6,7,8</sup> (mg/L)
<b>95-900 West Branch DuPage River</b>							
WB25	95	900	34.0	0.24	0.17	1.82	0.33
WB31	95	900	31.9	0.13	0.39	1.08	0.13
WB31 Dup.	95	900	31.9	0.15	0.3	1.54	0.12
WB24	95	900	31.6	0.05	9.63	0.9	1.66
WB32	95	900	29.3	0.21	7.83	1.5	1.49
WB27	95	900	27.7	0.15	6.84	1.36	1.27
WB28	95	900	27.4	0.15	6.94	0.71	1.53
WB20 Dup.	95	900	25.6	0.05	5.22	1.12	1.03
WB17	95	900	19.2	0.05	2.99	1.07	0.57
WB33 Dup.	95	900	18.0	0.05	4.8	0.8	0.66
WB34	95	900	15.1	0.05	3.93	0.99	0.68
WB12	95	900	13.6	0.05	4.38	0.99	0.71
WB12 Dup.	95	900	13.6	0.08	4.8	0.58	0.68
WB40	95	900	11.1	0.05	6.21	0.96	0.79
WB36	95	900	8.3	0.05	5.59	0.96	0.76
WB41	95	900	8.0	0.05	4.2	0.8	0.66
WB37	95	900	6.3	0.05	4.19	0.84	0.73
WB35	95	900	4.2	0.05	4.6	0.93	0.7
WB08	95	900	0.85	0.05	4.05	0.63	0.64
WB08 Dup.	95	900	0.85	0.05	3.75	0.25	0.58

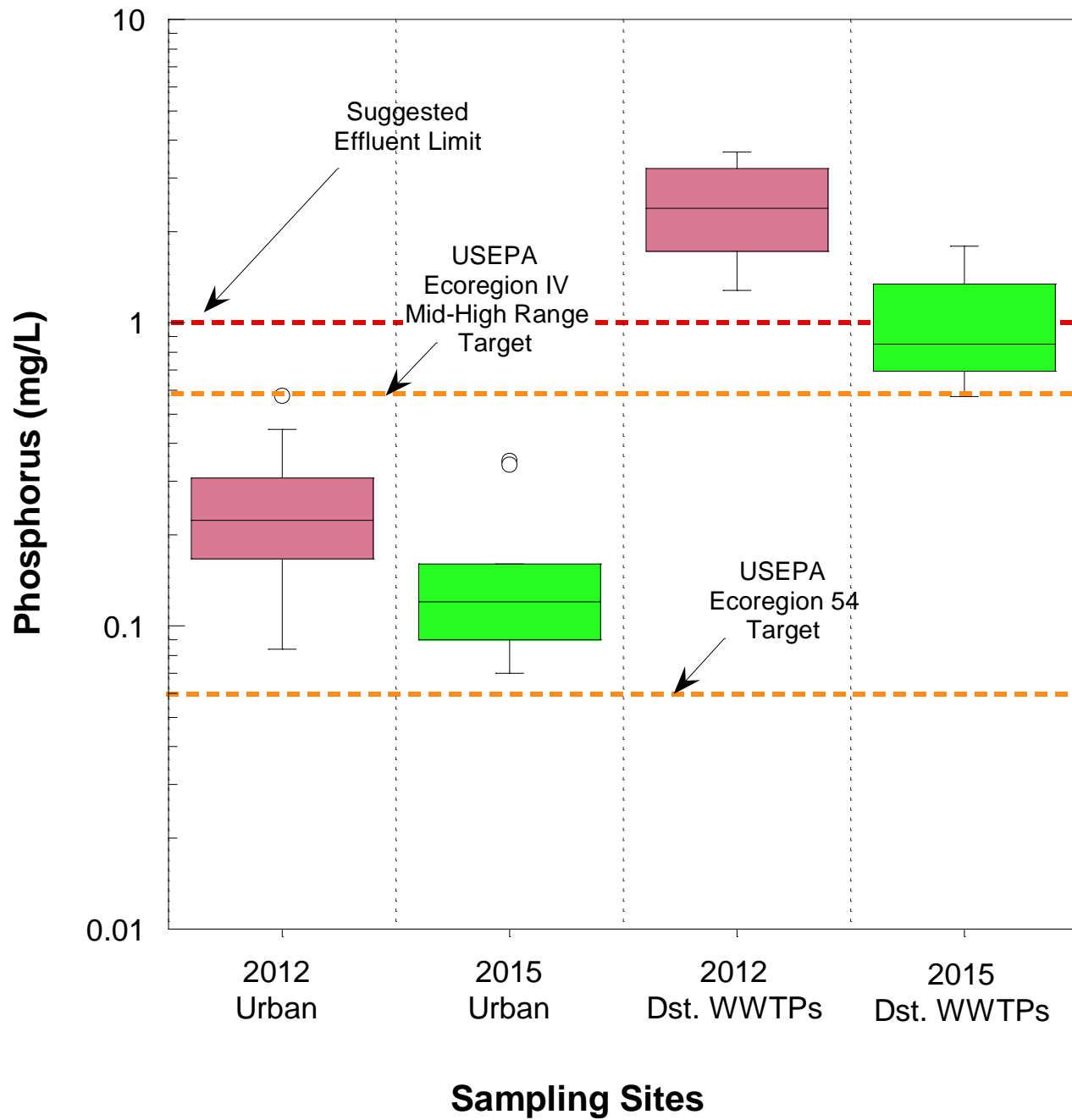
**Effect thresholds based on field relationships between parameters and biological end points**



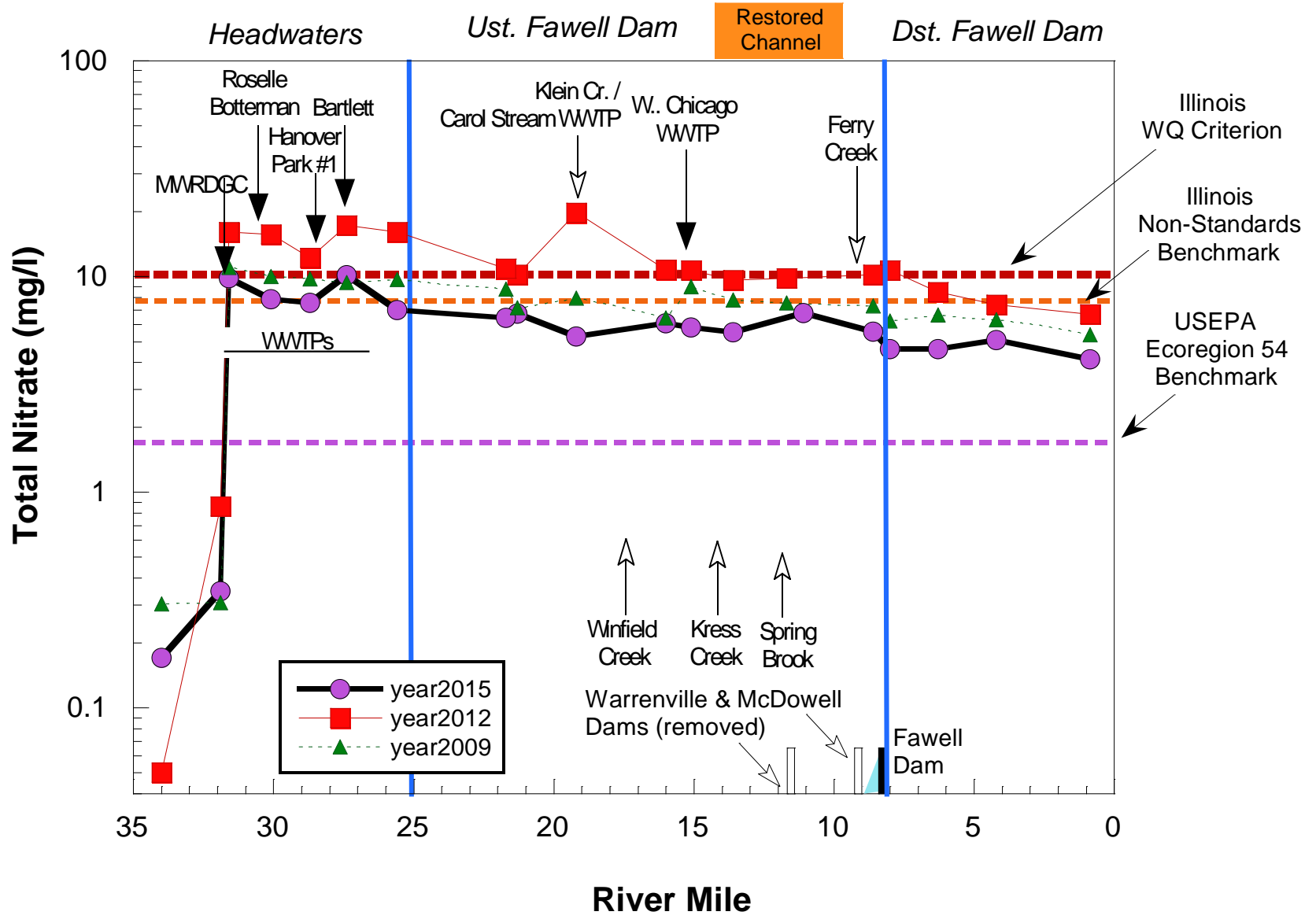


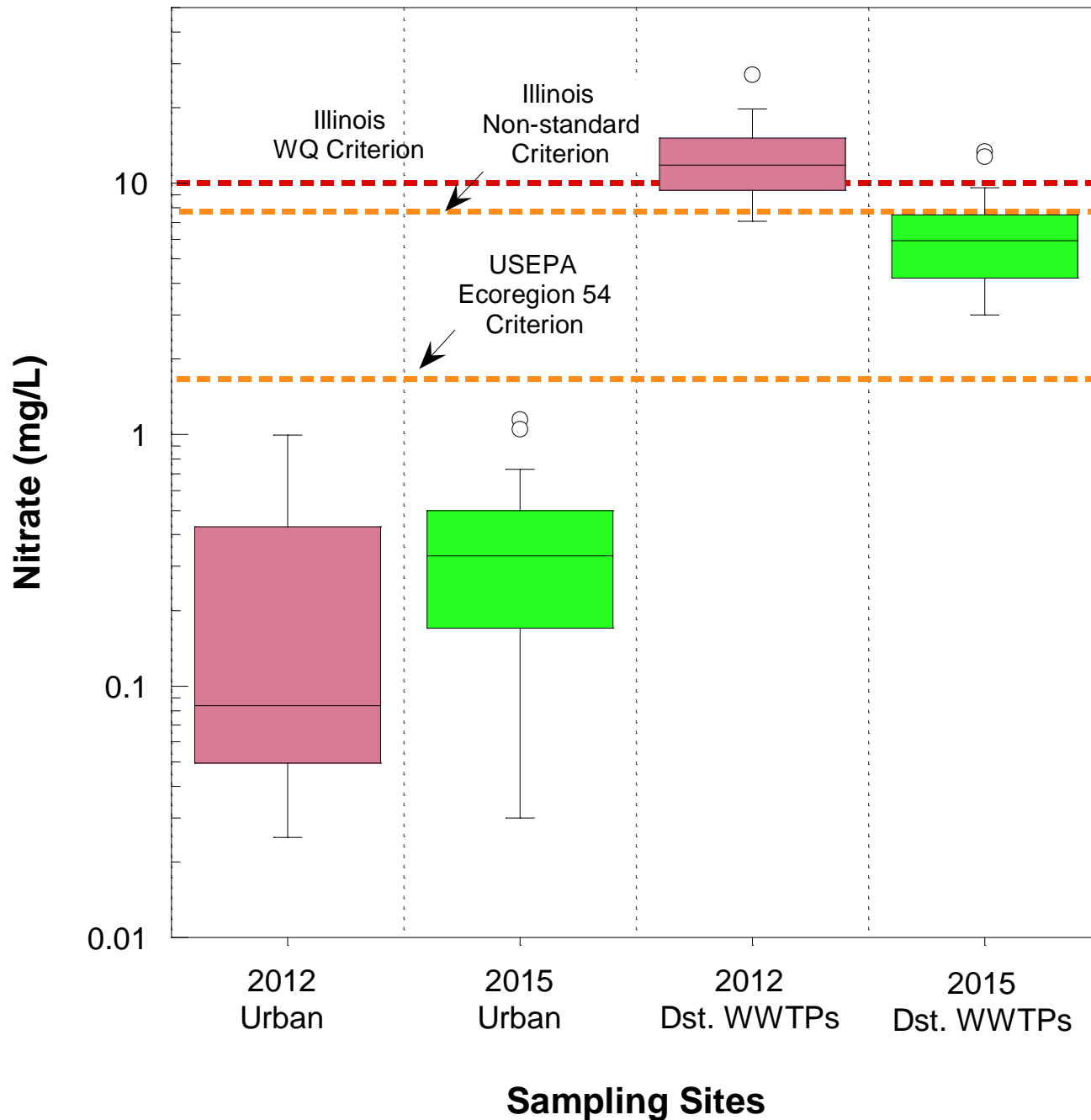
# West Branch DuPage River











**Table 8.** Dissolved oxygen concentrations (mg/L) in violation of Illinois water quality standards from the West Branch DuPage River at Arlington Drive (WBAD), Butternut Road (WBBR), downstream from the former Warrenville Grove Dam (WBWD), and **WBMG ??**, in 2008-2015.

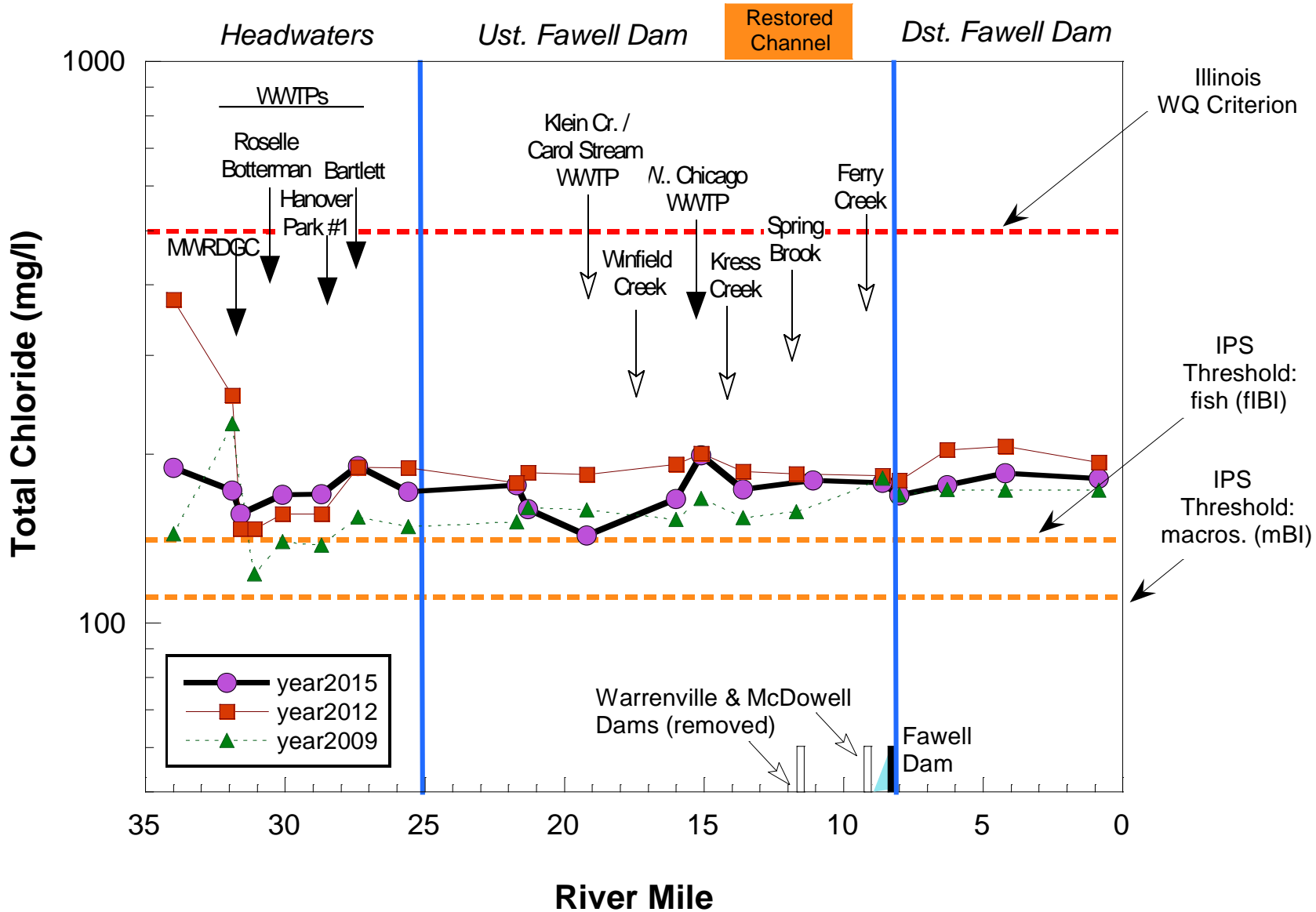
Site ID	River	Year	Date(s)	Parameter	Criteria	Standard
WBAD (RM 29.0)	W. Branch DuPage R.	2015	April – 23-27	D.O.	<6.0 mg/L	7-day Average
			June – 11-20	D.O.	<6.0 mg/L	7-day Average
			June 23	D.O.	<6.0 mg/L	7-day Average
			June 25-July 1	D.O.	<6.0 mg/L	7-day Average
			July 15-30	D.O.	<6.0 mg/L	7-day Average
			April – 23-27	D.O.	<4.0 mg/L	7-day Minimum
			Aug 4-Sept. 6	D.O.	<4.0 mg/L	7-day Minimum
			Sept. 17-19	D.O.	<4.0 mg/L	7-day Minimum
			June (2 days)	D.O.	<5.0 mg/L	Not to exceed
			Aug. (6 days)	D.O.	<3.5 mg/L	Not to exceed
		Sept. 2-3	D.O.	<3.5 mg/L	Not to exceed	
		Sept. 15-17	D.O.	<3.5 mg/L	Not to exceed	
		2012	June 28-July 1	D.O.	<6.0 mg/L	7-day Average
			July 27-31	D.O.	<6.0 mg/L	7-day Average
			Sept. 27-31	D.O.	<6.0 mg/L	7-day Average
			Aug 5-10	D.O.	<4.0 mg/L	7-day Minimum
			Sept. 3-7	D.O.	<4.0 mg/L	7-day Minimum
			Sept. 17-19	D.O.	<4.0 mg/L	7-day Minimum
			July 20	D.O.	<5.0 mg/L	Not to exceed
			July 25-27	D.O.	<5.0 mg/L	Not to exceed
Sept. 2-3	D.O.		<3.5 mg/L	Not to exceed		
Sept. 15-17	D.O.	<3.5 mg/L	Not to exceed			
2009	June – 27-27	D.O.	<6.0 mg/L	7-day Average		



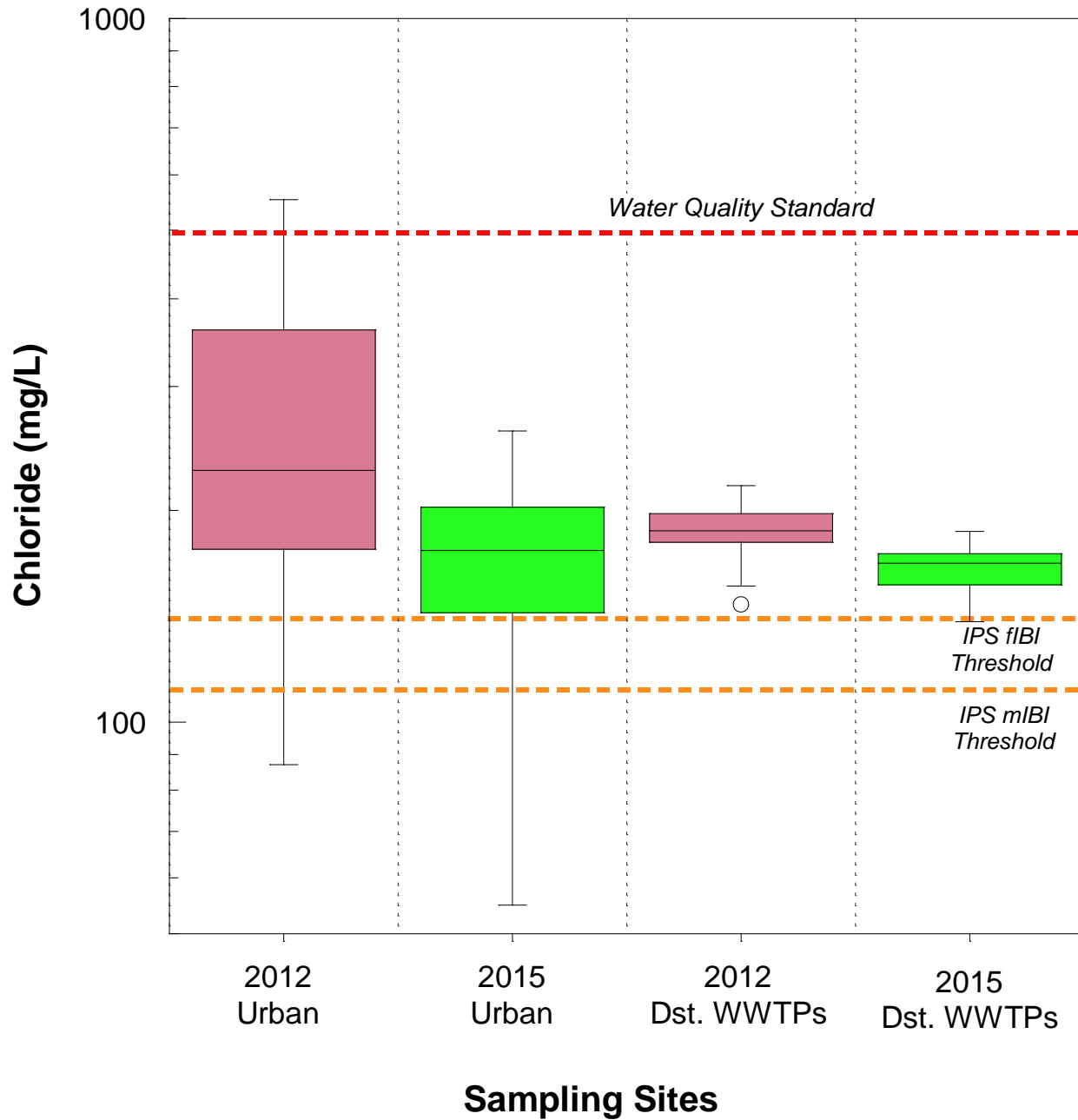
**Table 10.** Urban parameter sampling results in the West Branch DuPage River watershed, summer 2015. Values above applicable reference targets are highlighted in yellow. Individual metals sample concentrations that exceed Illinois WQS are in **bold red font** (**NOTE: METALS AND TARGETS TO BE CORRECTED**).

Site ID	River Mile	Conductivity (uS/cm)		TDS (mg/L)		TSS (mg/L)		Chloride (mg/L)		TKN (mg/L)		Total Copper (ug/L)		Total Lead (ug/L)	
		Median	Target <sup>2</sup>	Median	Target <sup>2</sup>	Median	Target <sup>2</sup>	Median	Target <sup>1</sup>	Median	Target <sup>1</sup>	Median	Target <sup>1</sup>	Median	Target <sup>1</sup>
<b>95-900 West Branch DuPage River</b>															
WB25	34.0	1019	600	681	468	30.2	16	189	112	1.82	1.0	0.01	0	0.04	0
WB31	31.9	904	600	589	468	13.2	16	171	112	1.08	1.0	0	0	0.01	0
WB31 Dup	31.9	740	600	418	468	10.7	16	167	112	1.54	1.0	0	0	0.02	0
WB24	31.6	1024	600	654	468	4.2	16	149	112	0.9	1.0	0.01	0	0.04	0
WB32	29.3	970	600	583	468	34.8	16	157	112	1.5	1.0	0	0	0.02	0
WB27	27.7	988	600	581	468	22.4	16	161.5	112	1.36	1.0	0	0	0.02	0
WB28	27.4	1060	600	659	468	20.2	16	186.5	112	0.71	1.0	0.01	0	0.03	0
WB20	25.6	1030	600	622	468	33.9	16	174.5	112	1.17	1.0	0	0	0.03	0
WB20 Dup	25.6	902	600	564	468	43.5	16	144	112	1.12	1.0	0	0	0.02	0
WB39	21.7	1072	610	598	522	15.8	25	172.5	112	0.95	1.0	0	0	0.02	0
WB33	21.3	924	610	584	522	25.8	25	148.5	112	1.12	1.0	0	0	0.02	0
WB17	19.2	904	610	542	522	25.2	25	139	112	1.07	1.0	0	0	0.01	0
WB38	16.0	952	610	553	522	25.4	25	156.5	112	0.82	1.0	0	0	0.01	0
WB38 Dup	16.0	1098	610	631	522	20.9	25	165.5	112	0.66	1.0	0	0	0.02	0
WB34	15.1	1127	610	627	522	25.2	25	184	112	0.99	1.0	0.01	0	0.02	0
WB12	13.6	1078	610	610	522	20.5	25	182.5	112	0.99	1.0	0.01	0	0.02	0
WB12 Dup	13.6	963	610	532	522	12.3	25	139.5	112	0.58	1.0	0	0	0.02	0
WB40	11.1	1034	610	614	522	24.6	255	171	112	0.96	1.0	0	0	0.02	0
WB36	8.3	1085	610	620	522	19.4	25	168.5	112	0.96	1.0	0.01	0	0.02	0

# West Branch DuPage River

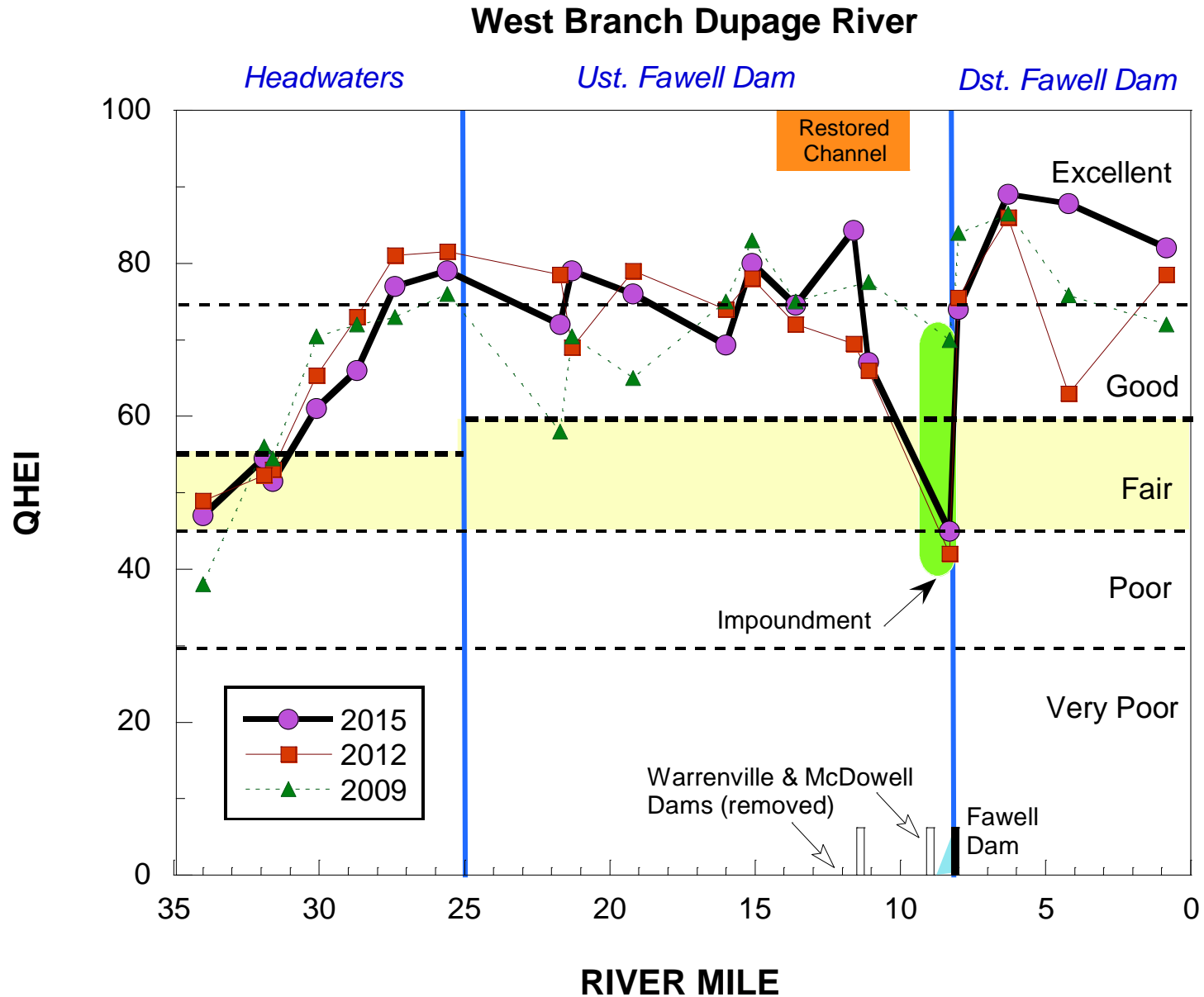


# West Branch DuPage River Watershed



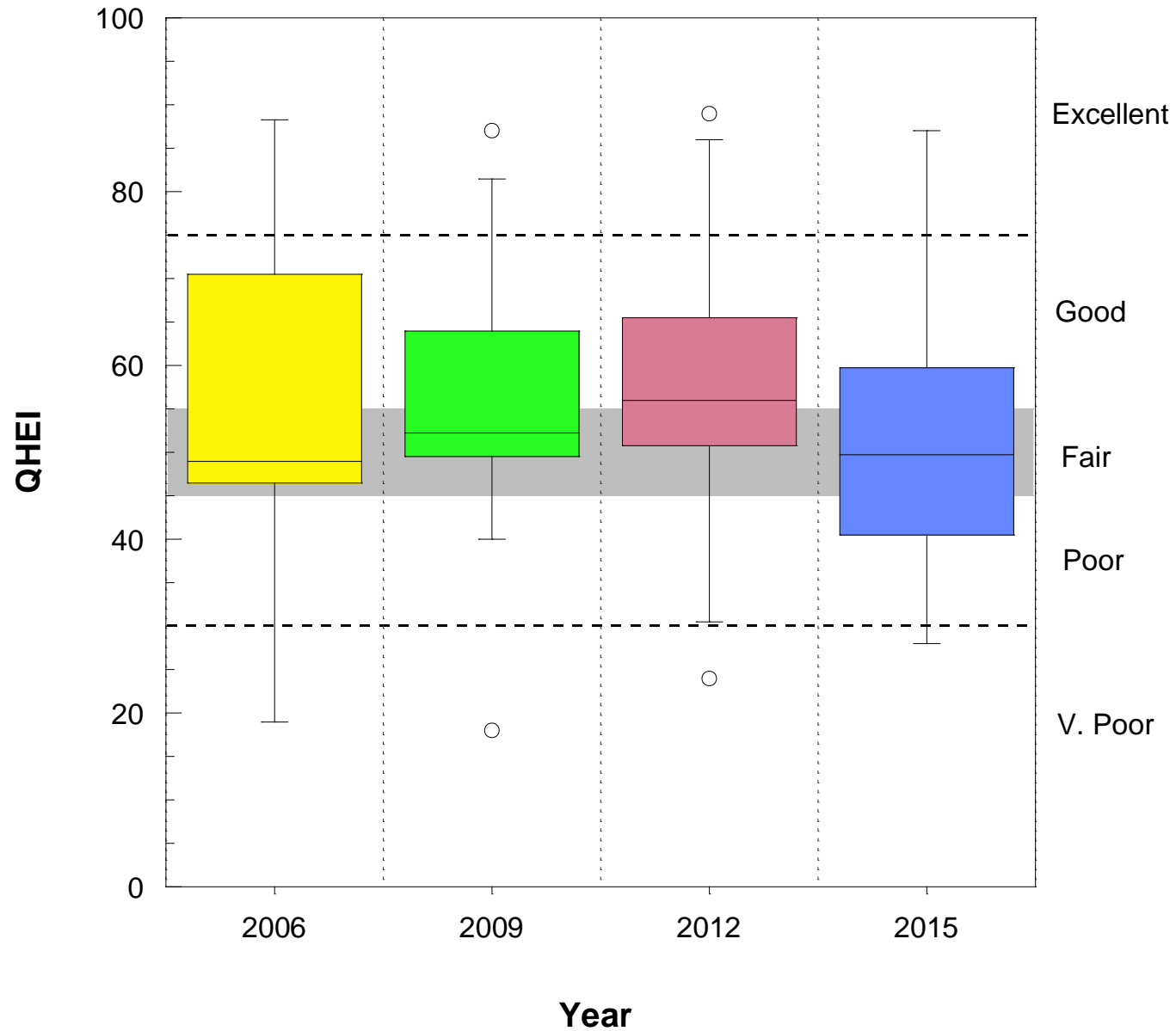


# W. Branch Mainstem QHEI: 2006 thru 2015



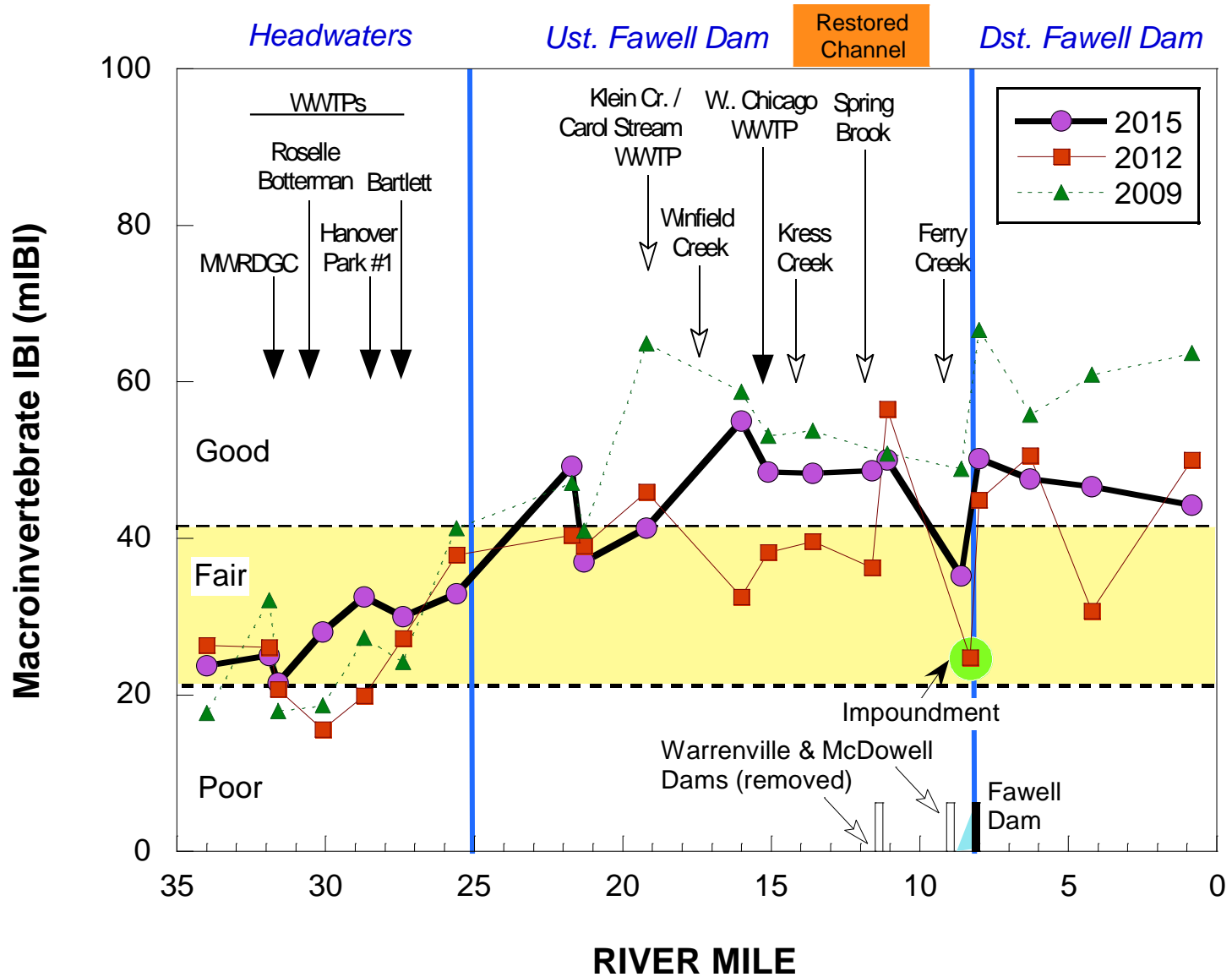
# W. Branch Tributaries QHEI: 2006 thru 2015

## West Branch Dupage River Tributaries



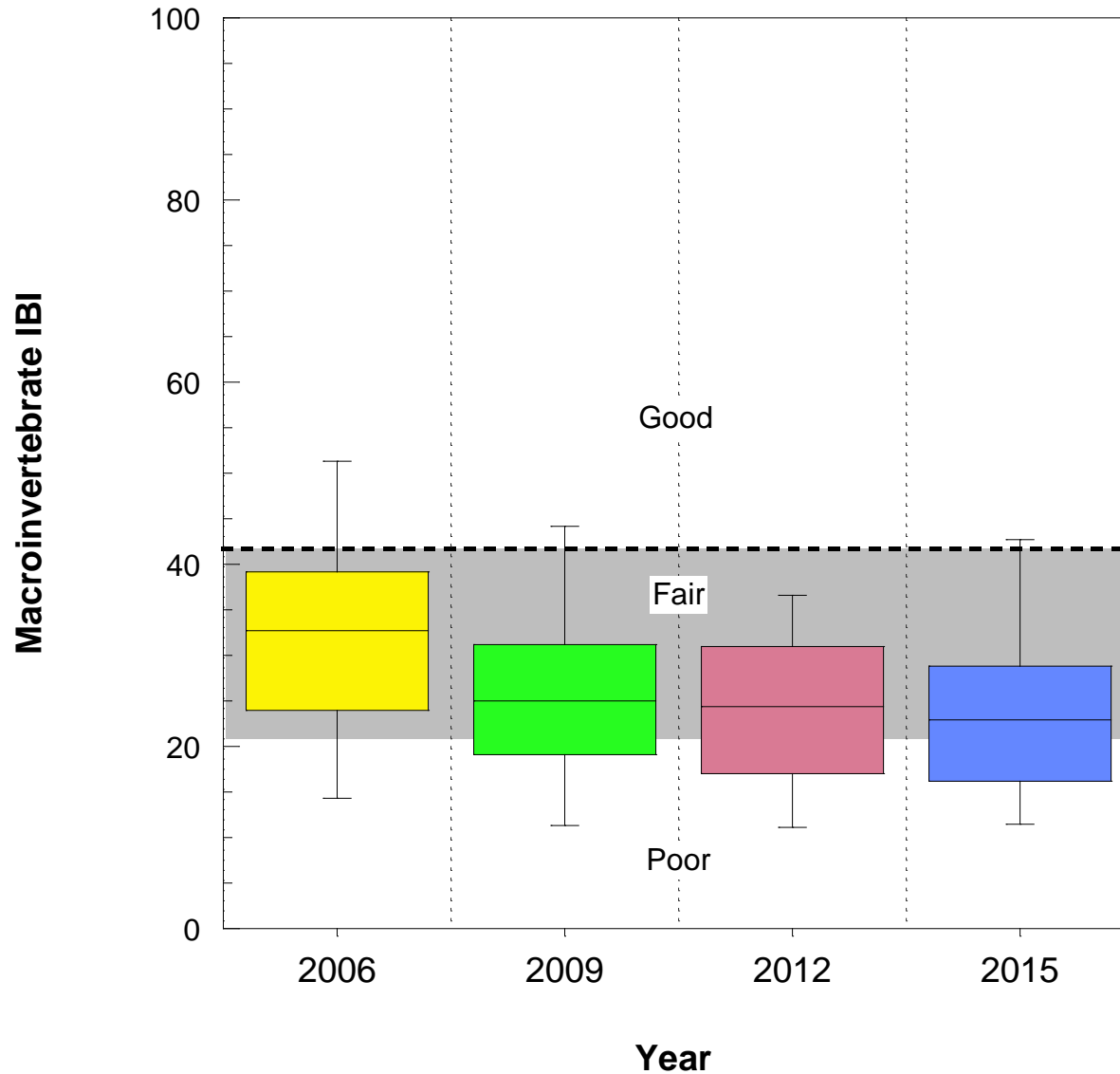
# W. Branch Macroinvertebrates: 2006 thru 2012

## West Branch Dupage River



# W. Branch Macroinvertebrates: 2006 thru 2012

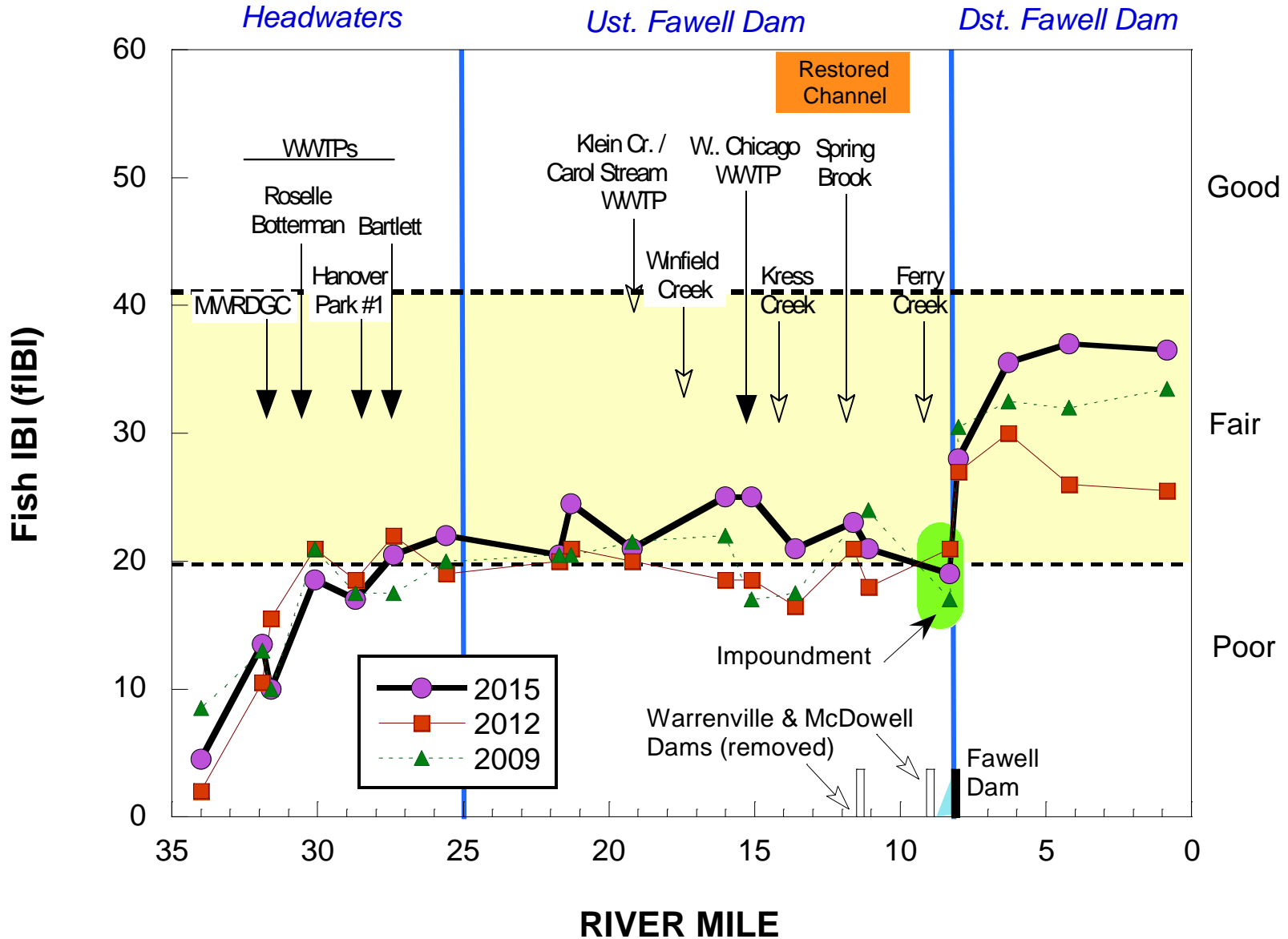
## West Branch Dupage River Tributaries



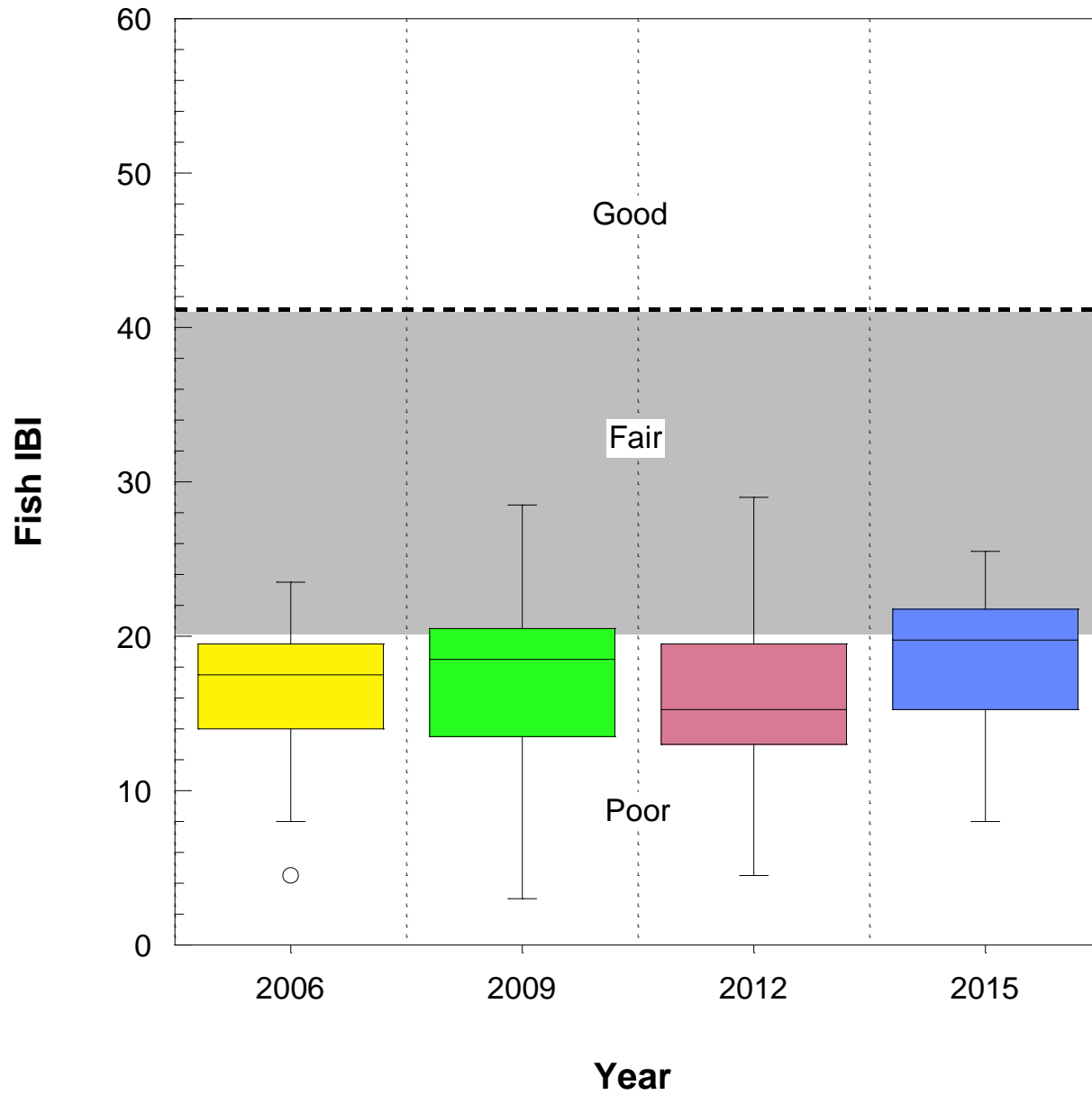


# W. Branch Fish: 2006 thru 2012

## West Branch DuPage River



# West Branch Dupage River Tributaries



**Table 1.** Status of aquatic life use support for stream segments sampled in the West Branch DuPage River watershed study area in 2012. All sites with one or more fair or poor index scores are in Non-attainment and categorized as follows: 1) sites with any index in the poor range [i.e., Non (Poor)] are shaded in red and poor scores are underlined; 2) fair quality sites [i.e., Non (Fair)] are shaded in yellow; 3) fair to good quality sites [i.e., Non (Fair/Good)] are shaded in green/dot with “good” scores in bold.

Site ID	River Mile	D.A. (sq mi)	IL IBI	Mlwb	MIBI	QHEI	Attainment Status	Causes	2012	
									fIBI	mIBI
<b>95-900 West Branch DuPage River</b>										
WB25	34.0	2.1	<u>4.5</u>	na	23.7	47.0	Non - Poor	Chloride,D.O., nutrients (NH <sub>3</sub> ,TKN, P), BOD habitat alt.	<u>2.0</u>	26.3
WB31	31.9	4.9	<u>13.5</u>	na	25.0	54.5	Non - Poor	Chloride,nutrients (NH <sub>3</sub> , TKN P, N), D.O., BOD hab. alt.	<u>10.5</u>	26.1
WB24	31.6	5.4	<u>10.0</u>	na	21.5	51.5	Non - Poor	Chloride/TDS, <u>nutrients (P, N)</u> , habitat alt.	<u>15.5</u>	<u>20.7</u>
WB32	30.1	7.4	<u>18.5</u>	na	28.0	61.0	Non - Poor	Chloride/TDS, <u>nutrients (P, N, NH<sub>3</sub>, TKN)</u> BOD	21.0	<u>15.6</u>
WB27	28.7	14	<u>17.0</u>	na	32.5	66.0	Non - Poor	Chloride/TDS, <u>nutrients (P, N, NH<sub>3</sub>, TKN)</u> BOD	<u>18.5</u>	<u>20.0</u>
WB28	27.4	14	20.5	na	30.0	77.0	Non - Fair	Chloride/TDS, <u>nutrients (P, N)</u> BOD	22.0	27.2
WB20	25.6	19.7	22.0	na	32.9	79.0	Non - Fair	Chloride/TDS, <u>nutrients (P, N, TKN)</u> , zinc, fish barrier	<u>19.0</u>	37.9
WB39	21.7	27.8	20.5	4.70	<b>49.2</b>	72.0	Non – F/G	Chloride/TDS, <u>nutrients (P, N)</u> fish barrier	<u>20.0</u>	40.4
WB33	21.3	28.1	24.5	6.94	37.0	79.0	Non - Fair	Chloride/TDS, <u>nutrients (P, N, TKN)</u> fish barrier	21.0	39.0
WB17	19.2	33.8	21.0	5.97	41.3	76.0	Non - Fair	Chloride/TDS, nutrients (P, N,TKN), fish barrier	<u>20.0</u>	<b>45.9</b>
WB38	16.0	58.4	25.0	6.49	<b>55.0</b>	69.3	Non – F/G	Chloride/TDS <u>nutrients (P, N)</u> , fish barrier	<u>18.5</u>	32.5
WB34	15.1	59.9	25.0	6.21	<b>48.5</b>	80.0	Non – F/G	Chloride/TDS nutrients (P, N), fish barrier	<u>18.5</u>	38.2
WB12	13.6	80.5	21.0	6.02	<b>48.3</b>	74.5	Non – F/G	Chloride/TDS, nutrients (P, N), fish barrier	<u>16.5</u>	39.6
WB42	11.6	89.9	23.0	6.04	<b>48.6</b>	84.3	Non – F/G	D.O, fish barrier (continuous monitor sampling/no chem.)	<u>21.0</u>	<b>36.3</b>
WB40	11.1	89.9	21.0	5.53	<b>50.0</b>	67.0	Non – F/G	Chloride/TDS, nutrients (P, N), D.O, fish barrier	<u>18.0</u>	56.5
WB36B	8.6	104.9	--	--	35.2	--	Non – (Fair)	Chloride/TDS, nutrients (P, N), D.O, fish barrier	--	--
WB36	8.3	104.9	<u>19.0</u>	5.60	--	45.0	Non – (Poor)	Chloride/TDS, nutrients (P, N), D.O, fish barrier	21.0	24.8
WB41	8.0	105.2	28.0	7.89	<b>50.2</b>	74.0	Non – F/G	Chloride/TDS nutrients (P, N)	27.0	<b>44.9</b>
WB37	6.3	109.7	35.5	7.44	<b>47.6</b>	89.0	Non – F/G	Chloride/TDS nutrients (P, N)	30.0	<b>50.6</b>
WB35	4.2	115.3	37.0	7.41	<b>46.6</b>	87.8	Non – F/G	Chloride/TDS, nutrients (P, N)	26.0	30.7
WB08	0.85	124.5	36.5	7.94	<b>44.2</b>	82.0	Non – F/G	Chloride/TDS, nutrients (P, N)	25.5	<b>50.0</b>
<b>95-902 Tributary to W. Br. DuPage River</b>										
WB18	0.5	2.7	25.0	na	<b>27.3</b>	43.0	Non - Fair	Chloride/TDS, habitat alt.	23.0	31.0

# W. Branch DuPage Watershed 2015: Summary Observations

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- **Biological assemblages mostly fair-poor.**
- **Mostly reaches of good quality habitat; modifications are localized (beaver influences).**
- **Nutrients elevated in mainstem compared to tribs. – WWTP influences & flow dilution.**
- **Elevated chlorides in 2012 & 2015 vs. 2009 & 2006 in both mainstem & tributaries.**
- **Influence of Fawell dam on fish evident in lower FBI scores upstream – a few new species upstream + higher FBIs downstream.**
- **Moderate flows in 2015 affected chemical results compared to 2012 due to >dilution in mainstem.**