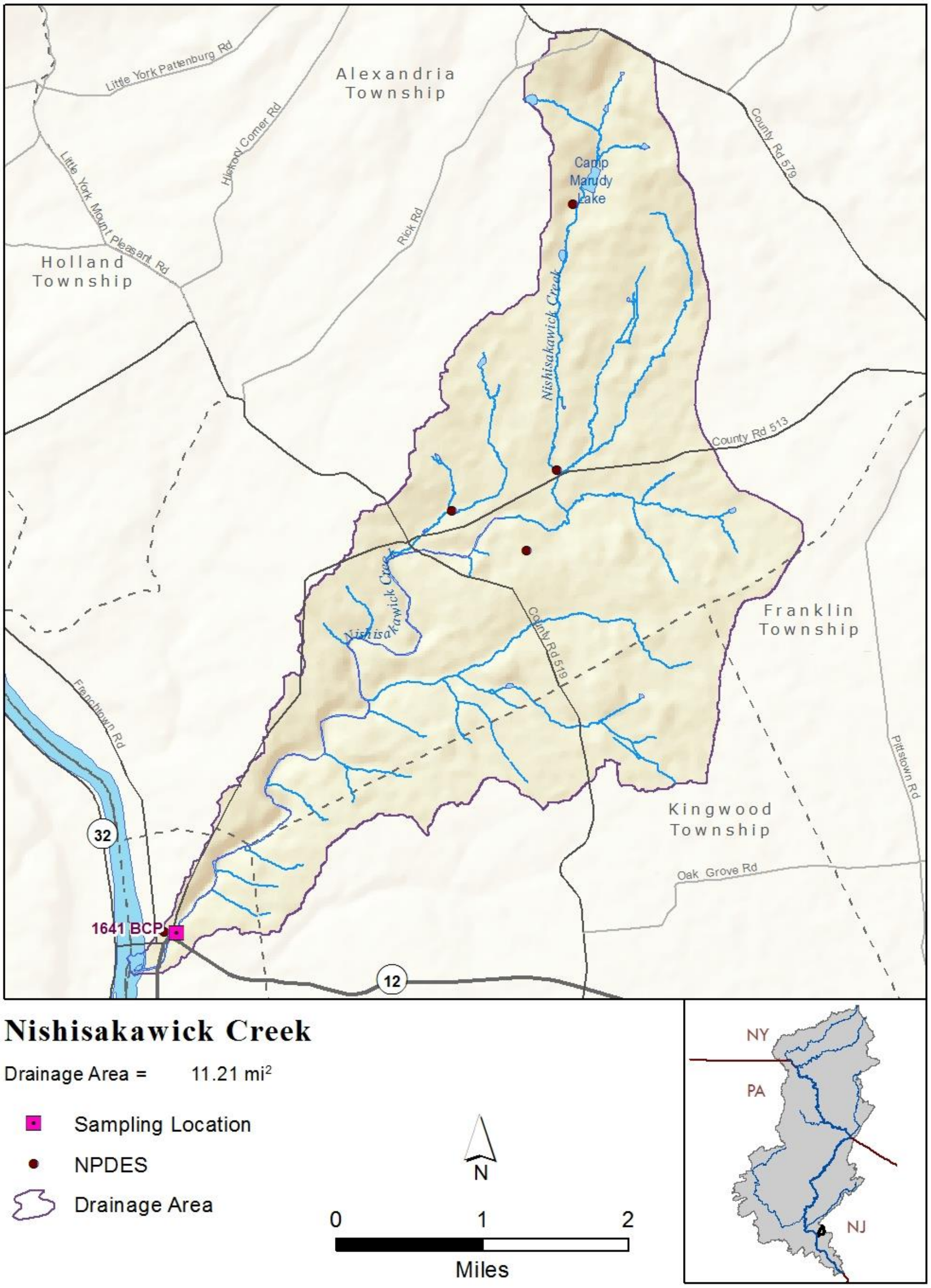
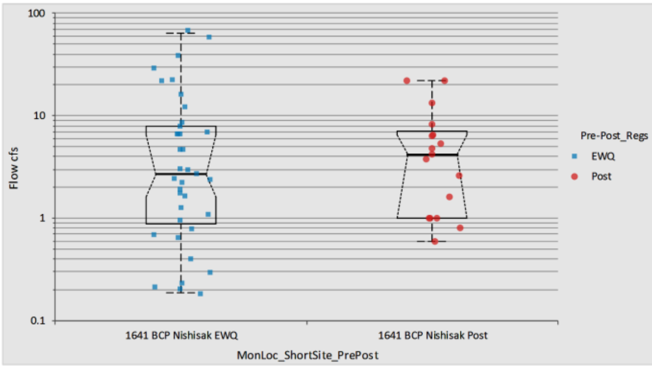

Alexandria Township
Holland Township
Franklin Township
Kingwood Township
Little York Pattenburg Rd
Hickory Corner Rd
Little York Mount Pleasant Rd
Rick Rd
County Rd 579
Camp Marudy Lake
Nishisakawick Creek
County Rd 513
County Rd 519
Frenchtown Rd
Pittstown Rd
Oak Grove Rd
32
12
1641 BCP
Nishisakawick Creek
Drainage Area = 11.21 mi^2
Sampling Location
NPDES
Drainage Area
N
0 1 2
Miles
NY
PA
NJ

Analysis of flow differences between the EWQ and post-EWQ periods:



N | 54

Flow cfs by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	0.18	0.883	2.680	7.987	66.43	7.103
1641 BCP Nishisak Post	0.60	1.000	4.200	7.100	22.07	6.100

Flow was roughly the same between the EWQ and post-EWQ periods. Fewer samples were collected in the post-EWQ period, and the range of flow conditions sampled was narrower. Flow is plotted on logarithmic scale.

Kruskal-Wallis test

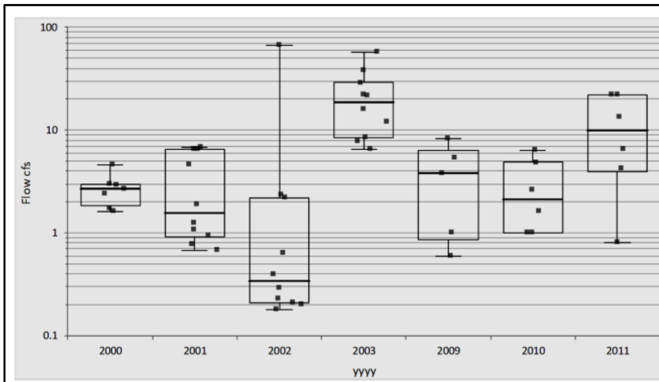
Flow cfs by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	37	10.3	0.28
1641 BCP Nishisak Post	17	22.4	1.32

H statistic	0.13
X^2 approximation	0.13
DF	1
p-value	0.7164 [1]

H0: $\theta_1 = \theta_2 = \theta$...
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Do not reject the null hypothesis at the 5% significance level.

The 11.2 square mile Nishisakawick Creek watershed is about 30% forested and contains about 2.8% urban land cover. There is no underlying carbonate bedrock in the watershed, so water quality is expected to be typical of a Piedmont stream with some agricultural influences.

Upstream ICP: Delaware River at Milford 1677 ICP
Downstream ICP: Delaware River at Bulls Island 1554 ICP



N | 54

Flow cfs by yyyy	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
2000	1.62	1.847	2.680	2.973	4.63	1.127
2001	0.67	0.926	1.570	6.510	6.76	5.584
2002	0.18	0.209	0.340	2.204	66.43	1.995
2003	6.46	8.366	18.690	29.400	57.65	21.034
2009	0.60	0.867	3.800	6.367	8.30	5.500
2010	1.00	1.000	2.100	4.933	6.40	3.933
2011	0.80	3.917	9.950	22.070	22.07	18.153

Annual May to September flow statistics associated with water quality measurements are plotted above. Flow is plotted on logarithmic scale. These are flow measurements or sometimes estimates associated with the time of each water quality sample. Mean annual flow is about 16.7 cfs; and harmonic mean flow is about 4.53 cfs (USGS StreamStats retrieval February 2014) which is more typical of summer flow conditions. Though DRBC sampled a wide range of flows, these data sets appear most representative of low to low-normal flow conditions except for high-flow years of 2003 and 2011. Flows corresponding to each water quality sample were estimated using either a gage-discharge rating constructed by DRBC or a Delaware River Basin adaptation of the USGS BaSE*program. There was an excellent correspondence between sample flows determined by the DRBC gage and BaSE-derived estimates, so DRBC intends to use the BaSE program for future flow estimates. DRBC's gages have too often been disrupted by storms, and maintaining a gage at DRBC's monitoring site is not economically viable. DRBC continues to use bridge benchmark readings to relate and check with BaSE estimates.

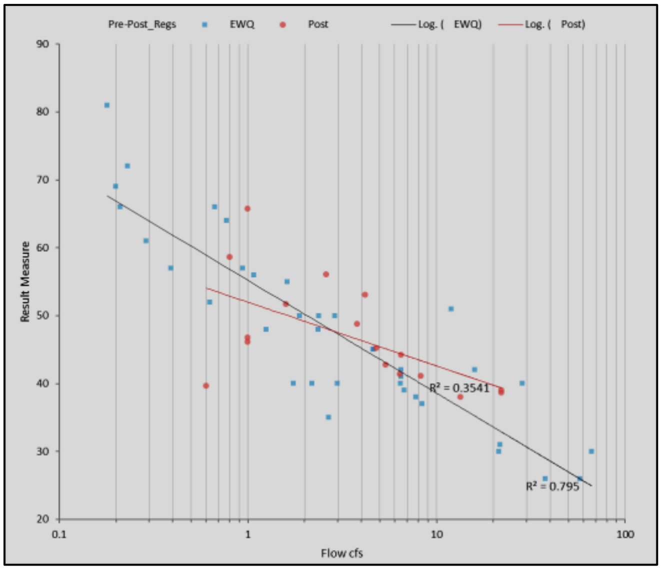
*Stuckey, M.H., Koerkle, E.H., and Ulrich, J.E., 2012, Estimation of baseline daily mean streamflows for ungaged locations on Pennsylvania streams, water years 1960–2008: U.S. Geological Survey Scientific Investigations Report 2012–5142, 61 p.)

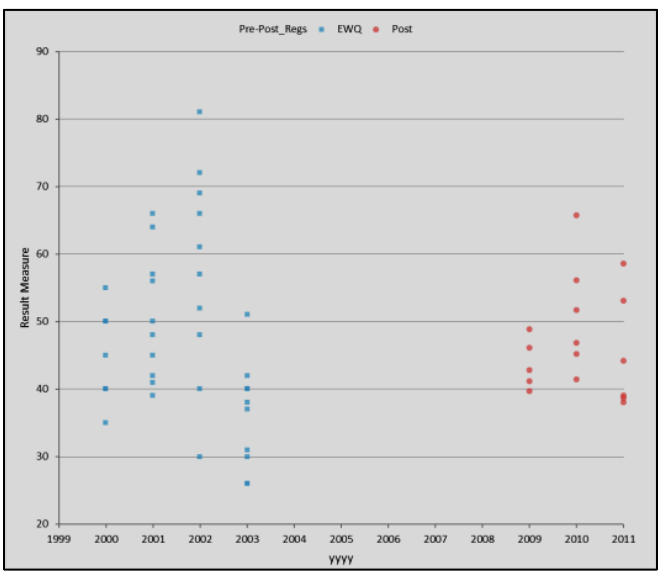
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

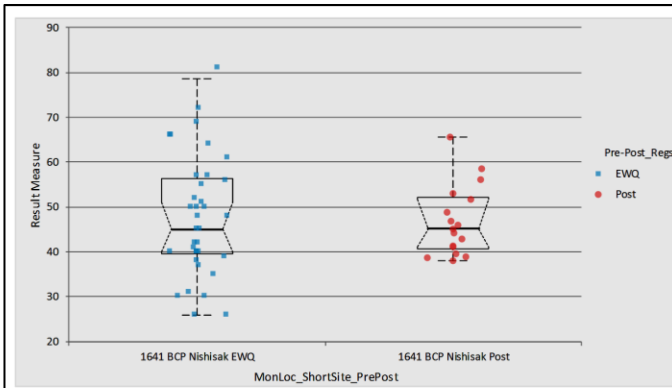
Alkalinity as CaCO3, Total mg/l

Existing Water Quality (Table 2P):

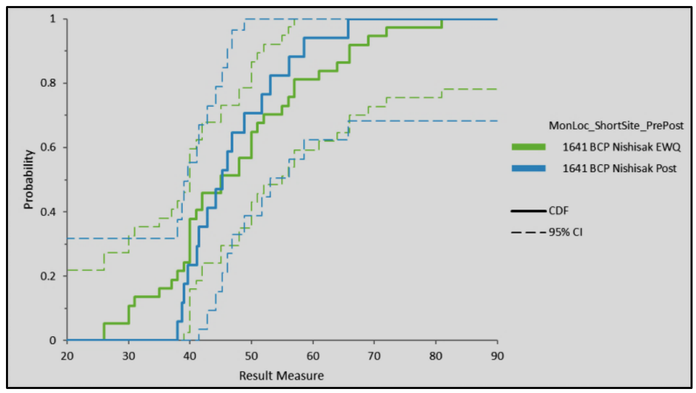
Median 45 mg/l
Lower 95% Confidence Interval 40 mg/l
Upper 95% Confidence Interval 51 mg/l
Defined in regulations as a flow-related parameter







N	54					
Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	26.0	39.67	45.00	56.33	81.0	16.67
1641 BCP Nishisak Post	38.0	40.63	45.20	52.17	65.7	11.53



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	37	0.1	0.00
1641 BCP Nishisak Post	17	0.1	0.01

H statistic	0.00
X² approximation	0.00
DF	1
p-value	0.9777 [1]

H0: $\theta_1 = \theta_2 = \theta_{...}$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Do not reject the null hypothesis at the 5% significance level.

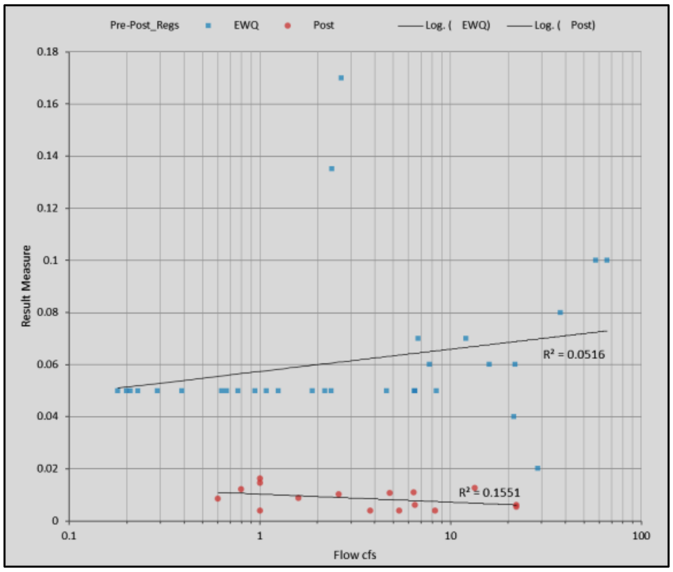
No water quality degradation is evident here. Alkalinity did not measurably change between the EWQ and post-EWQ periods. Sources of analytical uncertainty included potential laboratory artifacts and insufficient post-EWQ sampling (n=17). Alkalinity is inversely related to flow in both data sets. Post-EWQ median alkalinity fell within EWQ 95% confidence intervals. Flow is plotted on logarithmic scale.

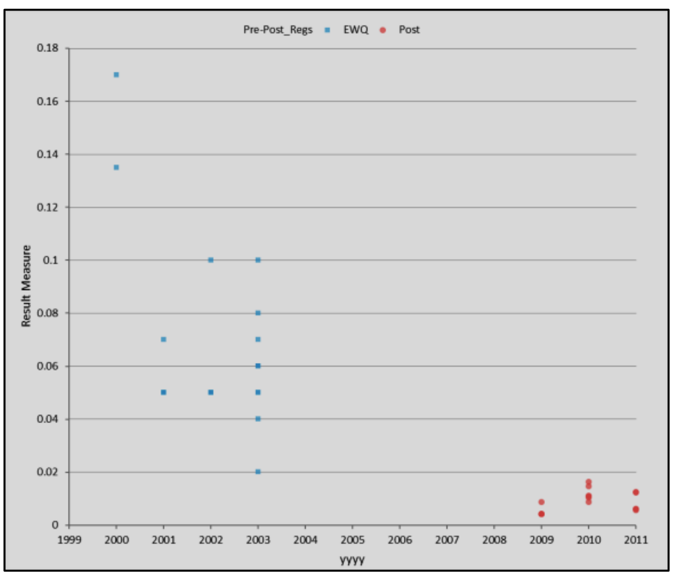
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

Ammonia Nitrogen as N, Total mg/l

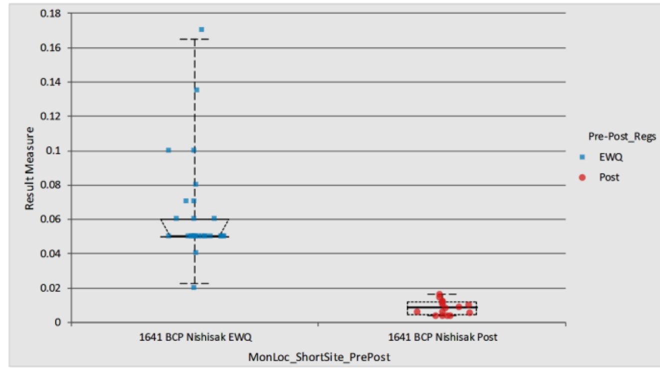
Existing Water Quality (Table 2P):

Median <0.05 mg/l
Lower 95% Confidence Interval <0.05 mg/l
Upper 95% Confidence Interval 0.06 mg/l



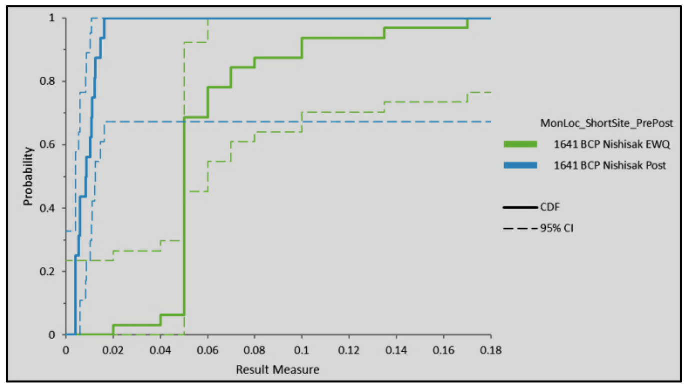


No water quality degradation is evident here. Ammonia concentrations apparently declined. However, different detection limits, potential laboratory artifacts, insufficient post-EWQ sampling frequency, and under-representation of the post-EWQ flow conditions introduced analytical uncertainty. Post-EWQ median ammonia concentration was below the EWQ lower 95% confidence interval.



N 48

Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	0.020	0.050	0.050	0.060	0.170	0.010
1641 BCP Nishisak Post	0.004	0.005	0.009	0.012	0.016	0.007



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	32	2048.0	64.00
1641 BCP Nishisak Post	16	4096.0	256.00

H statistic	33.82
X^2 approximation	33.82
DF	1
p-value	<0.0001[1]

H0: $\theta_1 = \theta_2 = \theta$...
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

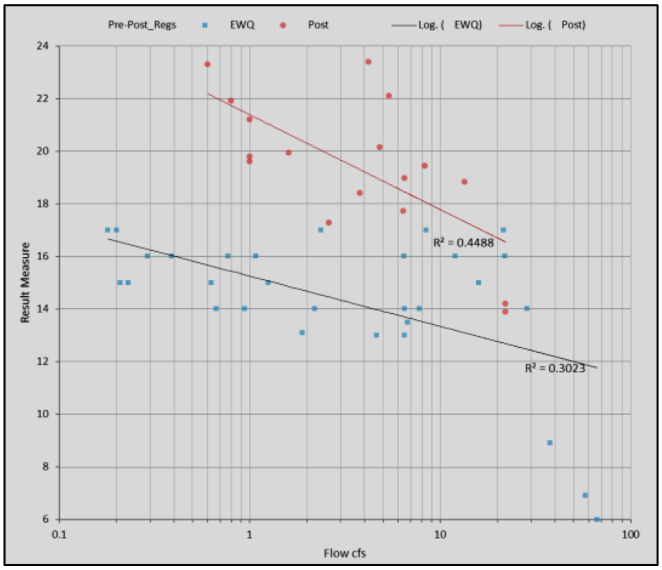
EWQ data possessed numerous non-detect results (22 of 32 samples) that interfered with calculation of the median. Thus EWQ was established as <0.05 mg/l, the detection limit at the time. Under 2009-2011 lower detection levels there still were 6/16 undetected results. So DRBC post-EWQ results show actual concentrations. Some water quality improvement possibly took place, as the post-EWQ data contained no concentrations greater than 0.016 mg/l. Flow is plotted on logarithmic scale. Too few independent data were available to validate results.

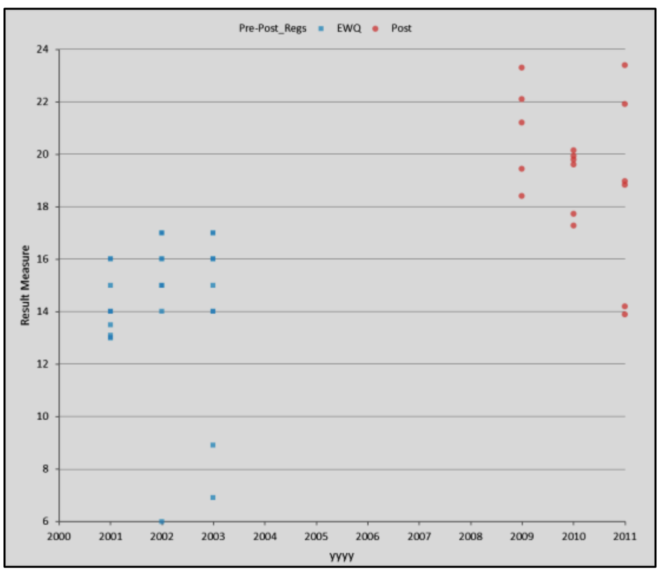
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

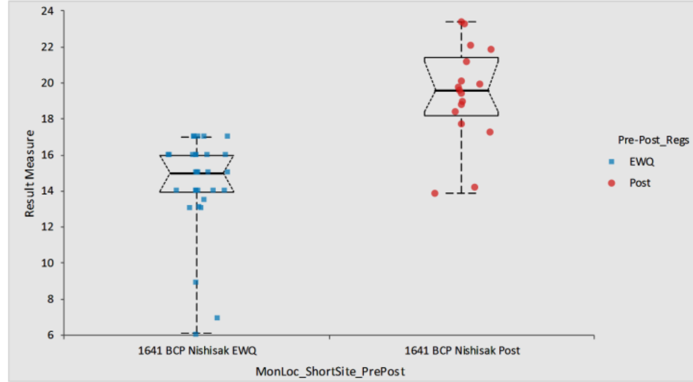
Chloride, Total mg/l

Existing Water Quality (Table 2P):

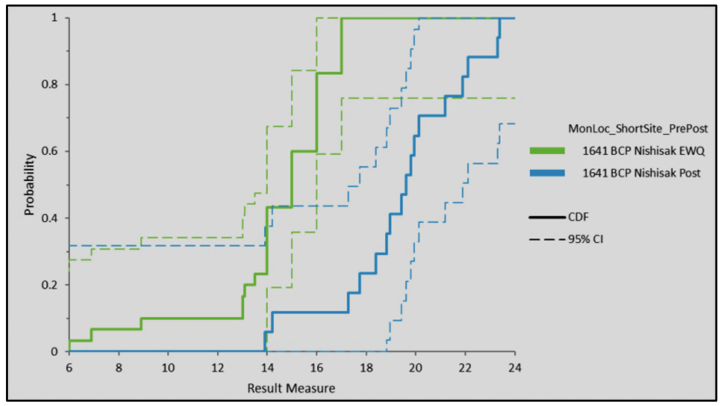
Median 15 mg/l
Lower 95% Confidence Interval 14 mg/l
Upper 95% Confidence Interval 16 mg/l







N	47					
Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	6.0	14.0	15.0	16.0	17.0	2.0
1641 BCP Nishisak Post	13.9	18.2	19.6	21.4	23.4	3.3



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	30	1540.8	51.36
1641 BCP Nishisak Post	17	2719.1	159.95

H statistic	22.83
X^2 approximation	22.83
DF	1
p-value	<0.0001 [1]

H0: $\theta_1 = \theta_2 = \theta ...$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

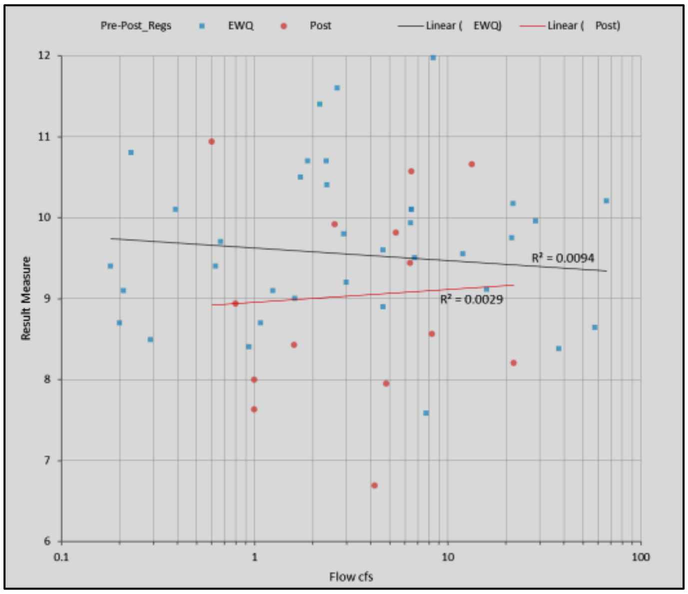
Water quality degradation is evident here. Chloride concentrations measurably rose between the two periods. Potential laboratory artifacts and insufficient post-EWQ sampling introduced analytical uncertainty. Post-EWQ median concentration rose above the EWQ upper 95% confidence interval. Flow is plotted on logarithmic scale.

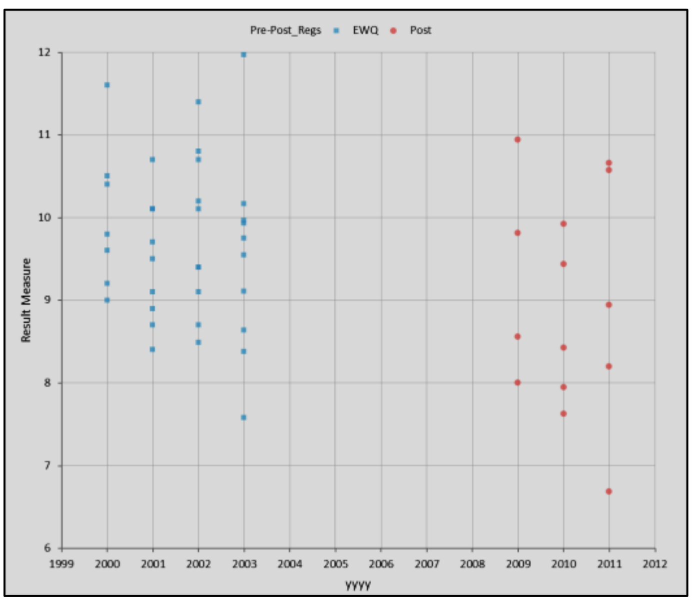
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

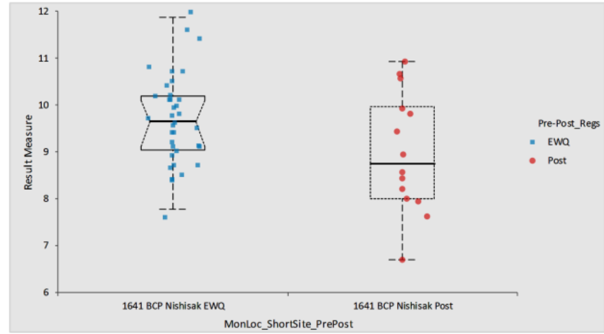
Dissolved Oxygen (DO) mg/l

Existing Water Quality (Table 2P):

Median 9.65 mg/l
Lower 95% Confidence Interval 9.11 mg/l
Upper 95% Confidence Interval 10.10 mg/l

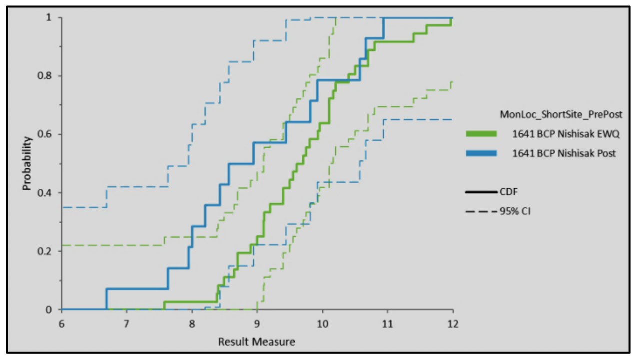






N 50

Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	7.58	9.04	9.65	10.19	11.97	1.15
1641 BCP Nishisak Post	6.69	8.00	8.75	9.97	10.94	1.98



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	36	191.4	5.32
1641 BCP Nishisak Post	14	492.1	35.15

H statistic	3.22
X² approximation	3.22
DF	1
p-value	0.0729 [1]

H0: $\theta_1 = \theta_2 = \theta_{\dots}$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Do not reject the null hypothesis at the 5% significance level.

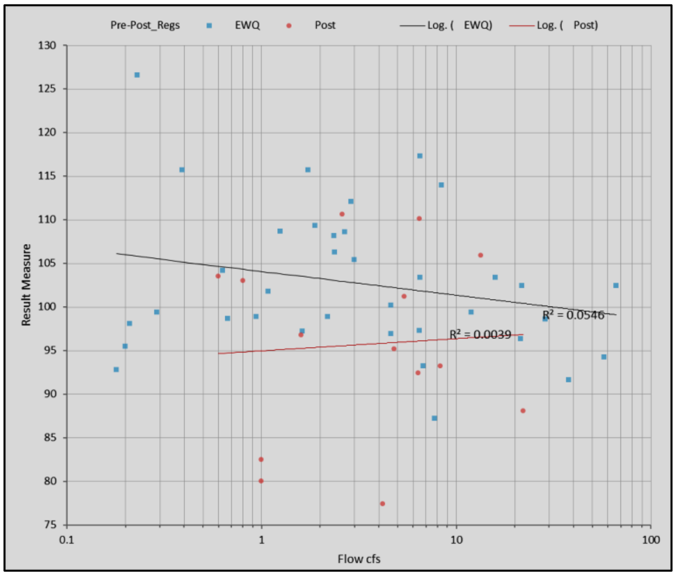
Slight evidence of water quality degradation is indicated. No measurable change took place between the EWQ and Post-EWQ periods. Post-EWQ median DO concentration fell below the EWQ 95% lower confidence interval, but the difference insignificant due to insufficient post-EWQ data (n=14). Flow is plotted on a logarithmic scale. DO concentration is unrelated to flow in both data sets.

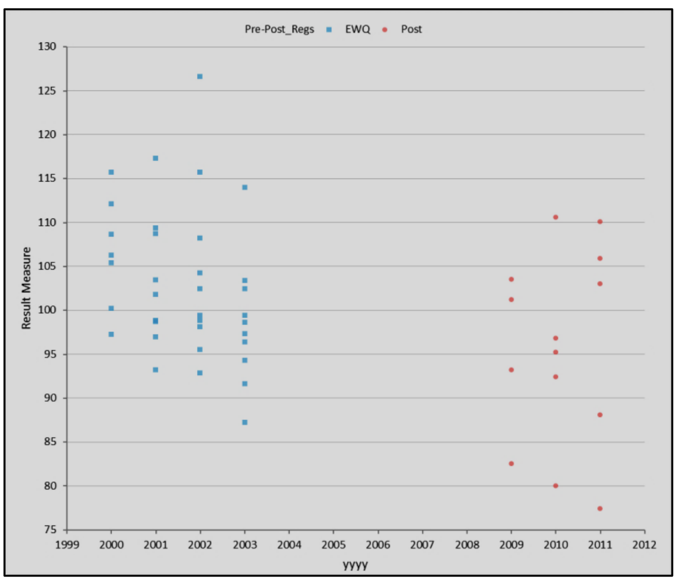
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

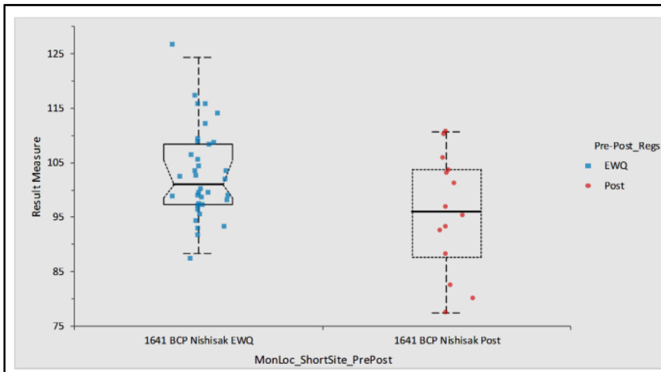
Dissolved Oxygen Saturation %

Existing Water Quality (Table 2P):

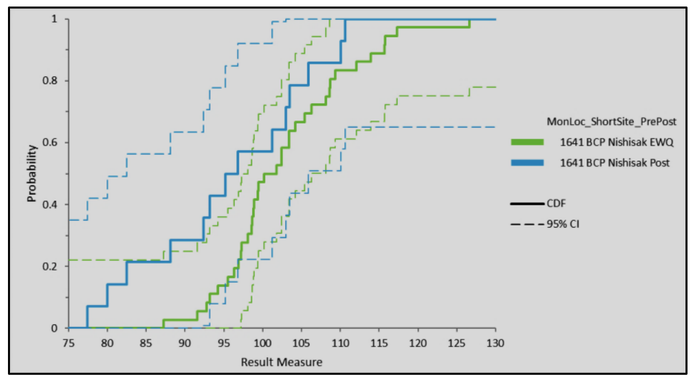
Median 101%
Lower 95% Confidence Interval 99%
Upper 95% Confidence Interval 105%







N	50					
Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	87.2	97.2	101.0	108.4	126.6	11.2
1641 BCP Nishisak Post	77.4	87.6	96.0	103.7	110.6	16.1



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	36	205.4	5.71
1641 BCP Nishisak Post	14	528.3	37.73

H statistic	3.45
X^2 approximation	3.45
DF	1
p-value	0.0631[1]

H0: $\theta_1 = \theta_2 = \theta$...
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Do not reject the null hypothesis at the 5% significance level.

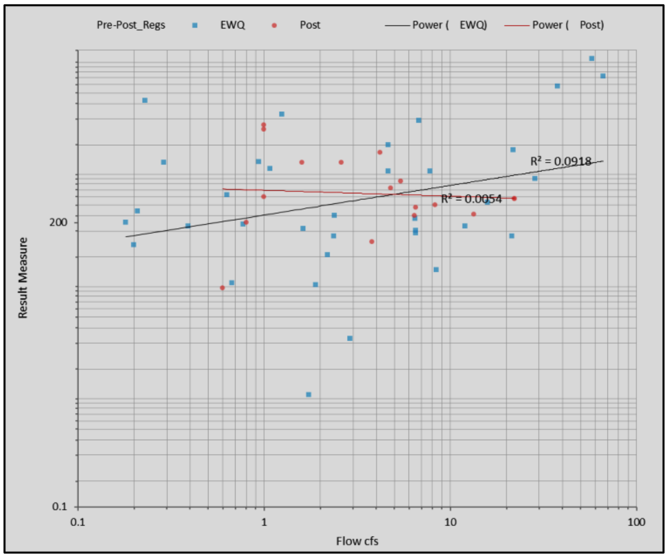
Some evidence of water quality degradation is indicated. Dissolved Oxygen Saturation is unrelated to flow, and did not measurably change between the EWQ and post-EWQ periods. Post-EWQ median DO saturation fell below the lower EWQ 95% confidence interval, though the difference was insignificant due to insufficient post-EWQ data (n=14). Post-EWQ data contain four values of DO saturation below 90%, where EWQ data contained one value below 90%. There may be a source of oxygen demand in the watershed that did not previously exist.

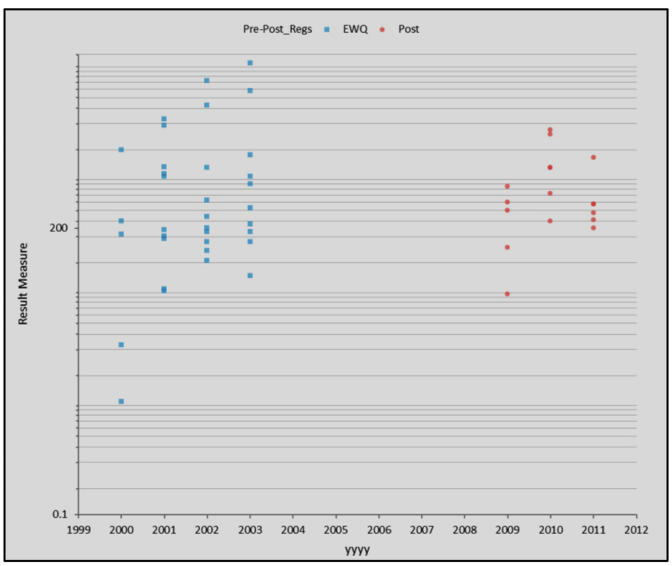
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

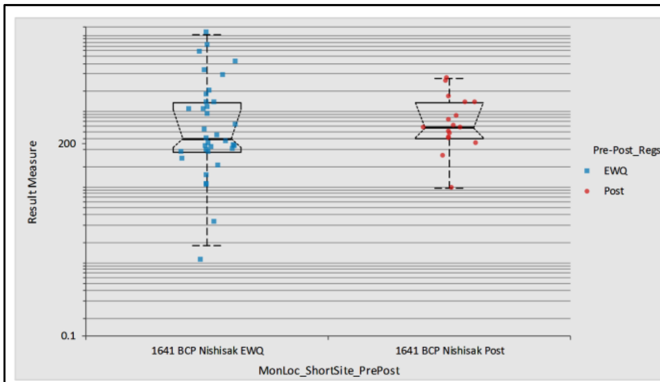
Enterococcus colonies/100 ml

Existing Water Quality (Table 2P):

Median 240/100 ml
Lower 95% Confidence Interval 170/100 ml
Upper 95% Confidence Interval 790/100 ml

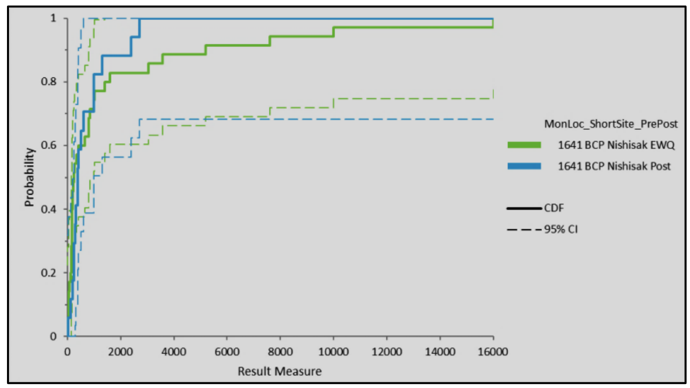






N | 52

Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	2	142	240	1,008	16,000	866
1641 BCP Nishisak Post	35	247	380	1,000	2,700	753



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	35	42.4	1.21
1641 BCP Nishisak Post	17	87.2	5.13

H statistic	0.56
X² approximation	0.56
DF	1
p-value	0.4525 [1]

H0: $\theta_1 = \theta_2 = \theta\ldots$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Do not reject the null hypothesis at the 5% significance level.

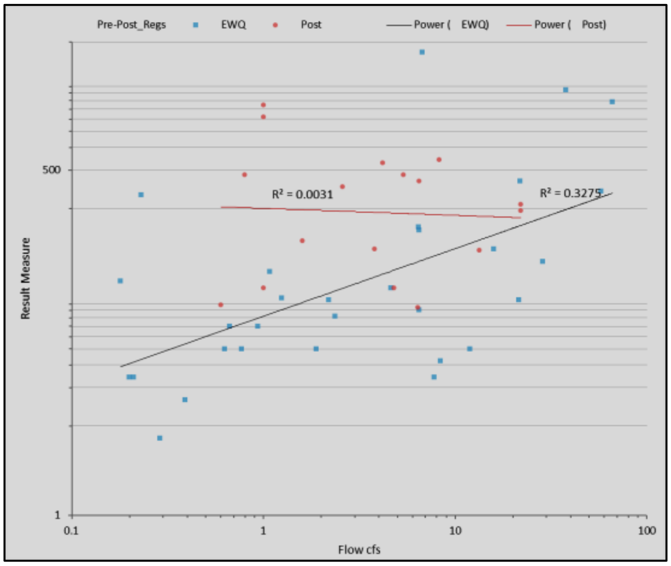
No water quality degradation is evident here. Enterococci apparently did not measurably change between the EWQ and Post-EWQ periods. Potential laboratory artifacts and insufficient post-EWQ sampling introduced analytical uncertainty. Enterococcus concentrations are unrelated to flow in both data sets. Note that concentrations and flows are plotted on a logarithmic scale. Post-EWQ median enterococcus concentrations were within the EWQ 95% confidence intervals.

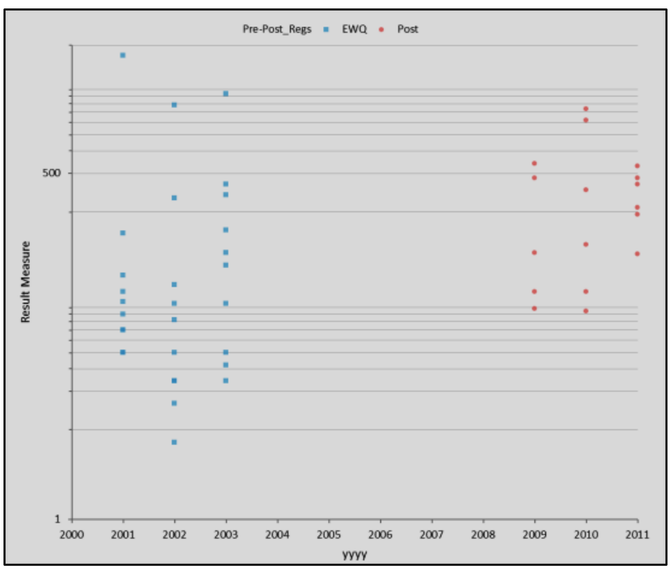
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

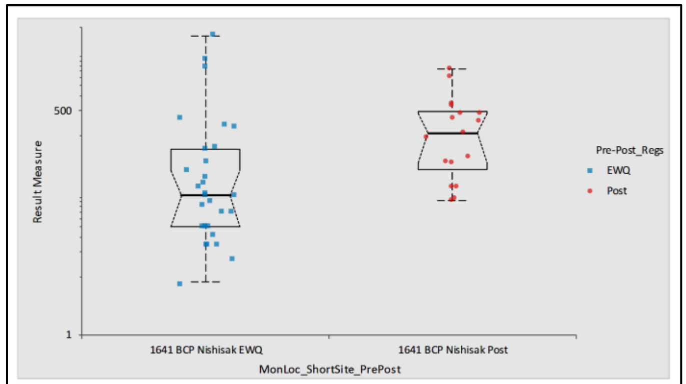
Escherichia coli colonies/100 ml

Existing Water Quality (Table 2P):

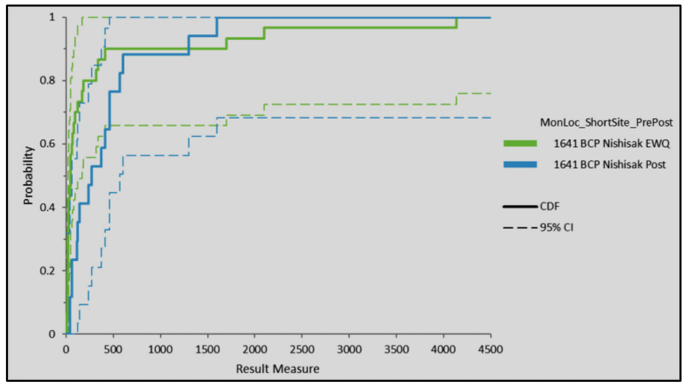
Median 48/100 ml
Lower 95% Confidence Interval 20/100 ml
Upper 95% Confidence Interval 96/100 ml
Defined in regulations as a flow-related parameter







N	47					
Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	4	20	48	171	4140	151
1641 BCP Nishisak Post	42	99	270	497	1600	398



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	30	607.5	20.25
1641 BCP Nishisak Post	17	1072.1	63.06

H statistic	8.95
X^2 approximation	8.95
DF	1
p-value	0.0028 [1]

H0: $\theta_1 = \theta_2 = \theta\ldots$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

Evidence of water quality degradation is indicated. E. coli concentrations apparently increased between the EWQ and Post-EWQ periods. Post-EWQ median E. coli rose above the EWQ upper 95% confidence interval. Potential laboratory artifacts may introduce uncertainty into conclusions.

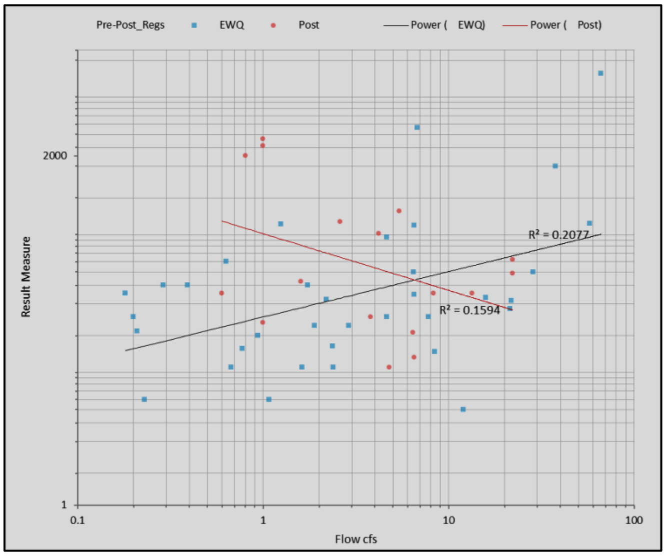
E. coli concentrations were positively but weakly related to flow in the EWQ data set, but unrelated to flow in the post-EWQ data set – possibly due to insufficient post-EWQ sampling frequency (n=17). No independent data were available at this site to validate DRBC's conclusion. The increase in E. coli concentrations may be related to the decline in dissolved oxygen saturation noted earlier if there is a source in the watershed.

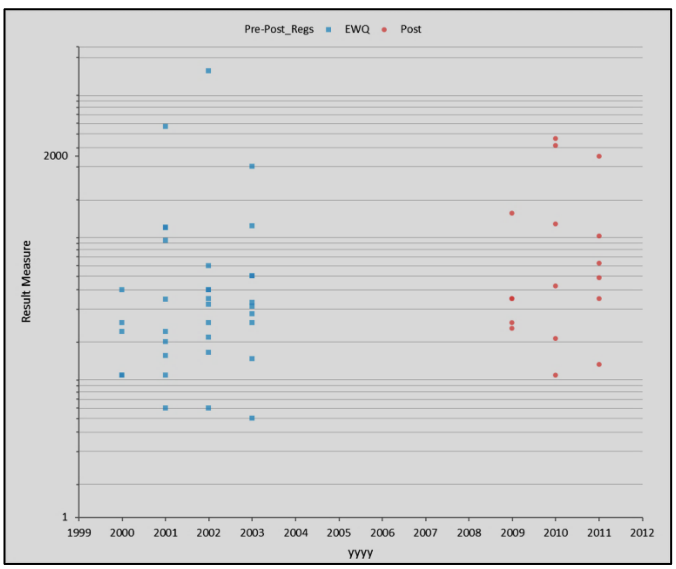
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

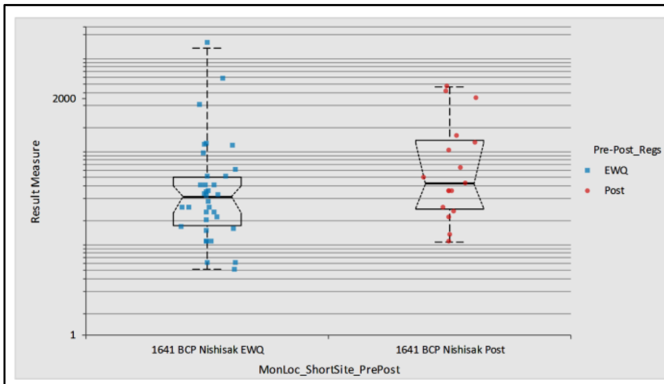
Fecal coliform colonies/100 ml

Existing Water Quality (Table 2P):

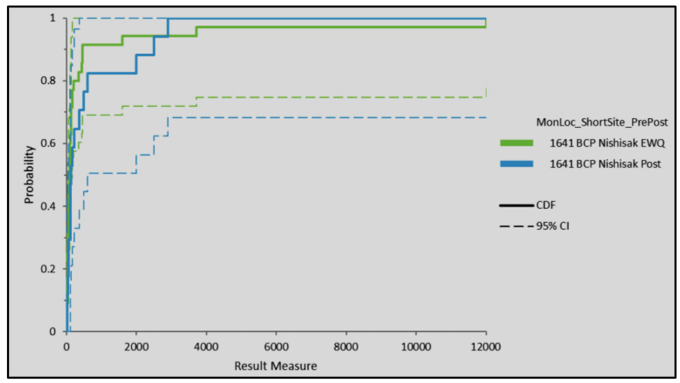
Median 85/100 ml
Lower 95% Confidence Interval 50/100 ml
Upper 95% Confidence Interval 120/100 ml







N	52					
Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	8	33	85	160	12000	127
1641 BCP Nishisak Post	20	58	130	520	2900	462



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	35	206.4	5.90
1641 BCP Nishisak Post	17	425.0	25.00

H statistic	2.75
X² approximation	2.75
DF	1
p-value	0.0970 [1]

H0: $\theta_1 = \theta_2 = \theta$...
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Do not reject the null hypothesis at the 5% significance level.

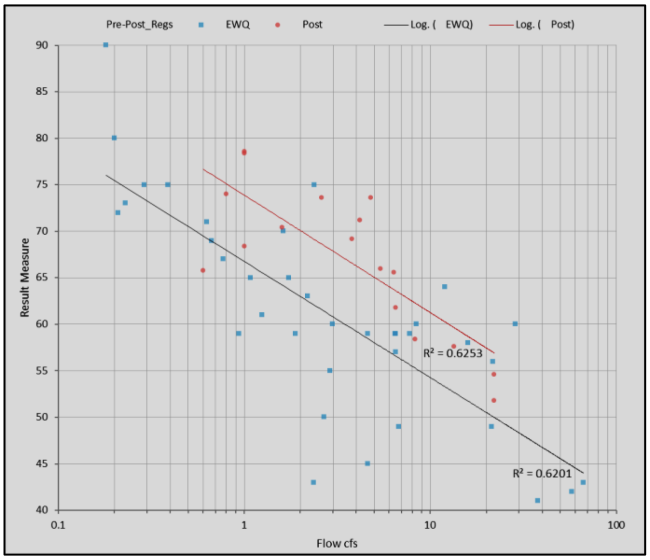
No water quality degradation is evident here. Fecal coliform concentrations apparently did not measurably change between the EWQ and post-EWQ periods. Potential laboratory artifacts and insufficient post-EWQ sampling introduced analytical uncertainty. Fecal coliform concentrations are unrelated to flow in both data sets. Post-EWQ median concentrations were within the EWQ 95% confidence intervals. Note that concentrations and flows are plotted on a logarithmic scale.

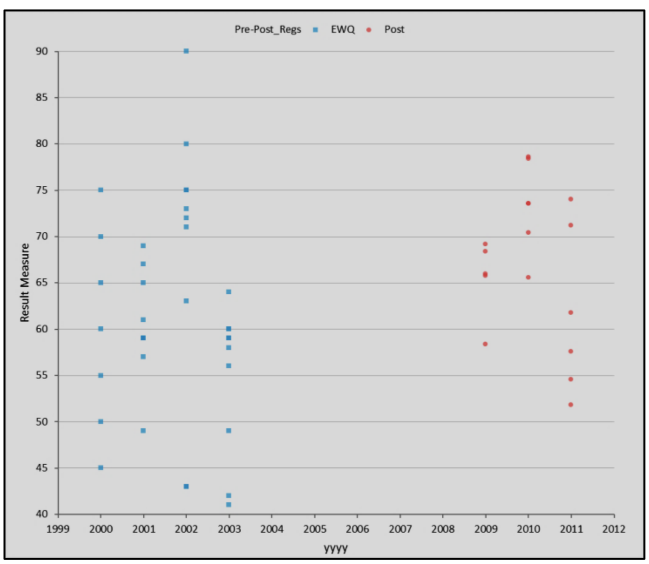
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

Hardness as CaCO3, Total mg/l

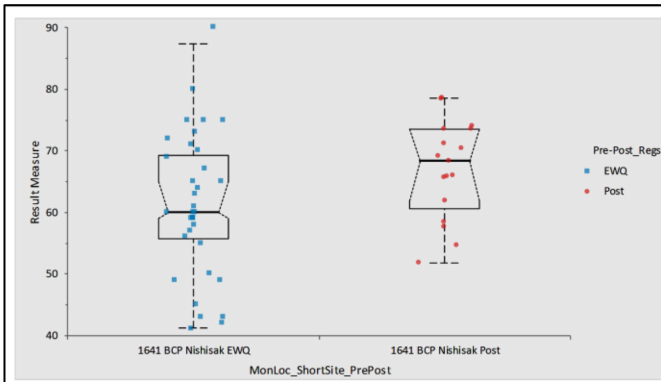
Existing Water Quality (Table 2P):

Median 60 mg/l
Lower 95% Confidence Interval 59 mg/l
Upper 95% Confidence Interval 65 mg/l
Defined in regulations as a flow-related parameter

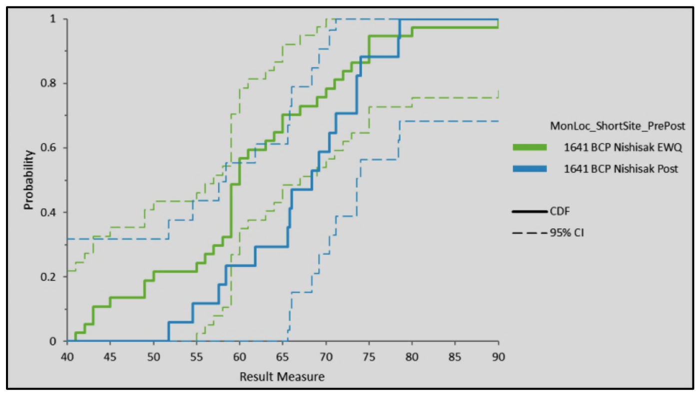




Weak evidence of water quality degradation is indicated. Hardness apparently did not measurably change between the EWQ and post-EWQ periods.



N	54					
Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	41	56	60	69	90	14
1641 BCP Nishisak Post	52	61	68	74	79	13



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	37	295.1	7.98
1641 BCP Nishisak Post	17	642.4	37.79

H statistic	3.79
X^2 approximation	3.79
DF	1
p-value	0.0514 [1]

H0: $\theta_1 = \theta_2 = \theta_{...}$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Do not reject the null hypothesis at the 5% significance level.

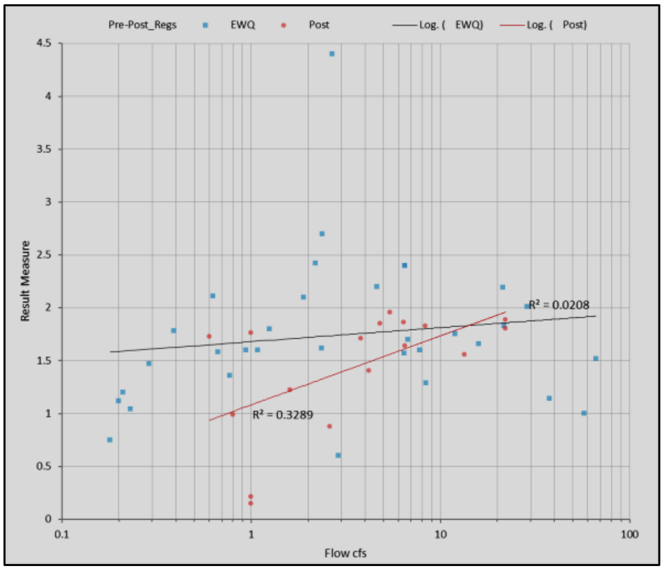
Potential laboratory artifacts and insufficient post-EWQ sampling introduced analytical uncertainty. Hardness is inversely related to flow in both data sets. Post-EWQ median hardness was above the EWQ upper 95% confidence interval, but the increase insignificant. As hardness is usually geologically sourced, the increase may be related to the flow conditions sampled unless there is an unknown new source in the watershed.

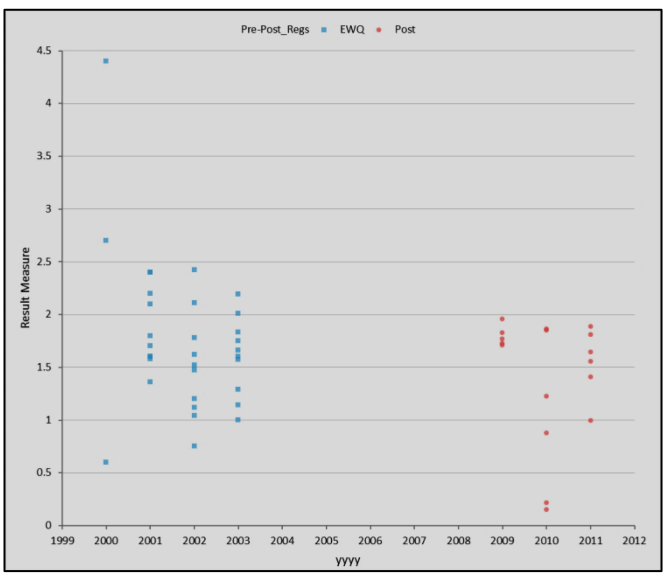
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

Nitrate + Nitrite as N, Total mg/l

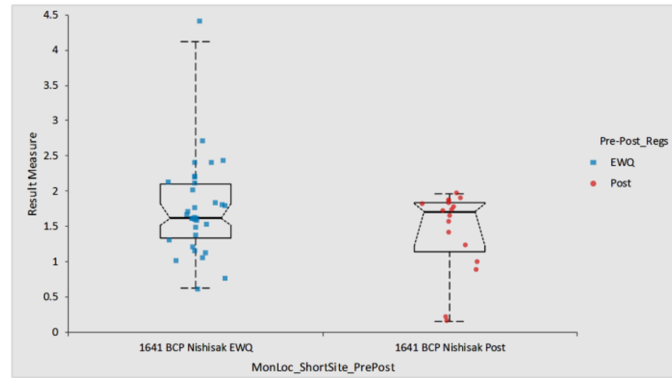
Existing Water Quality (Table 2P, as Nitrate only):

Median 1.62 mg/l
Lower 95% Confidence Interval 1.52 mg/l
Upper 95% Confidence Interval 1.83 mg/l



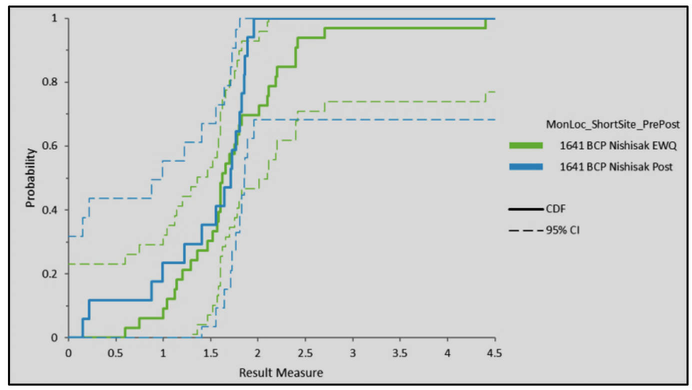


No water quality degradation is evident here. Nitrate concentrations did not measurably change between the EWQ and post-EWQ periods. Potential laboratory artifacts, insufficient post-EWQ sampling, and under-representation of post-EWQ flow conditions introduced analytical uncertainty.



N | 50

Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	0.60	1.34	1.62	2.10	4.40	0.77
1641 BCP Nishisak Post	0.15	1.15	1.71	1.84	1.96	0.69



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	33	44.9	1.36
1641 BCP Nishisak Post	17	87.2	5.13

H statistic	0.62
X^2 approximation	0.62
DF	1
p-value	0.4304 [1]

H0: $\theta_1 = \theta_2 = \theta_{...}$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Do not reject the null hypothesis at the 5% significance level.

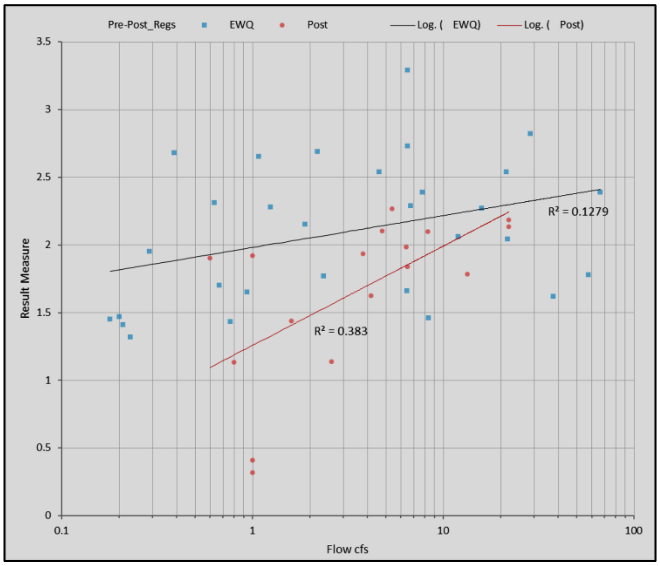
Nitrate is unrelated related to flow in the EWQ data set, but positively related to flow in the post-EWQ data set. Post-EWQ nitrate + nitrite concentrations were assumed equivalent for comparison with EWQ nitrate concentrations since EWQ nitrite concentrations were never detected. Independent data were not available for validation of DRBC data. 2001-2003 data were most comparable with post-EWQ data.

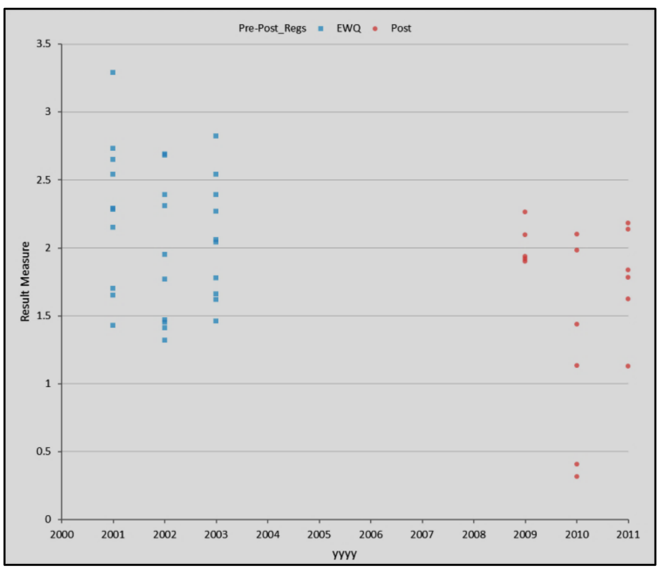
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

Nitrogen as N, Total (TN) mg/l

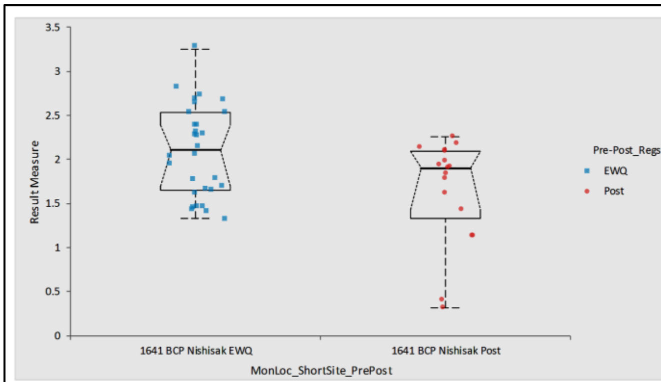
Existing Water Quality (Table 2P):

Median 2.09 mg/l
Lower 95% Confidence Interval 1.70 mg/l
Upper 95% Confidence Interval 2.39 mg/l

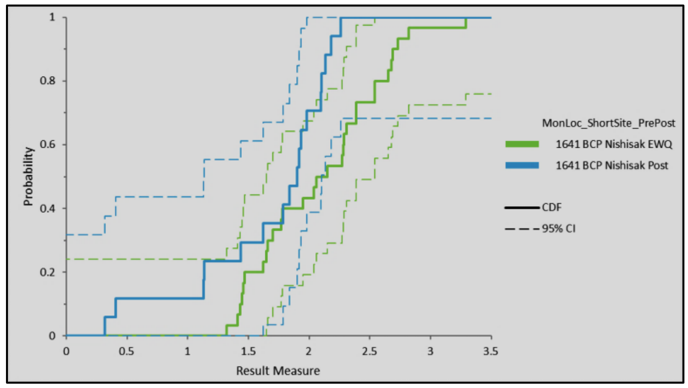




No water quality degradation is evident here. Total Nitrogen concentrations apparently declined between the EWQ and post-EWQ periods. Potential laboratory artifacts and insufficient post-EWQ sampling frequency introduced uncertainty into conclusions.



N	47					
Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	1.32	1.65	2.11	2.54	3.29	0.89
1641 BCP Nishisak Post	0.31	1.34	1.90	2.10	2.26	0.76



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	30	300.8	10.03
1641 BCP Nishisak Post	17	530.9	31.23

H statistic	4.42
X² approximation	4.42
DF	1
p-value	0.0354 [1]

H0: $\theta_1 = \theta_2 = \theta \ldots$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

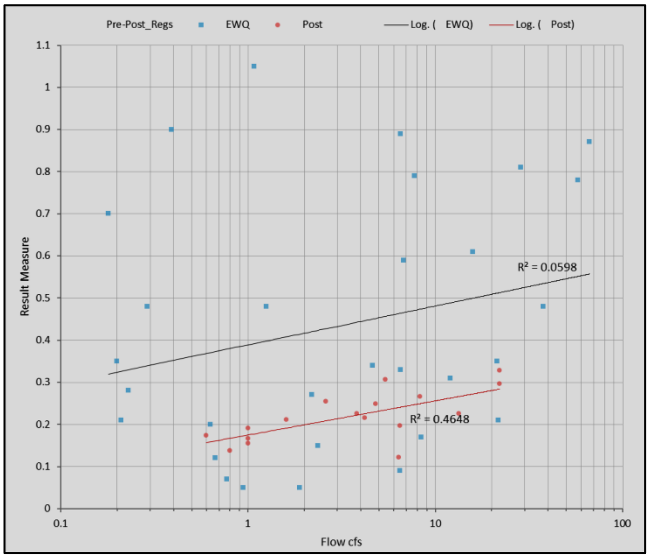
TN is positively related to flow in the post-EWQ data set, but unrelated to flow in the EWQ data set. DRBC results could not be independently validated. Post-EWQ median TN concentrations fell within the EWQ 95% confidence intervals, but the decline in concentrations was significant.

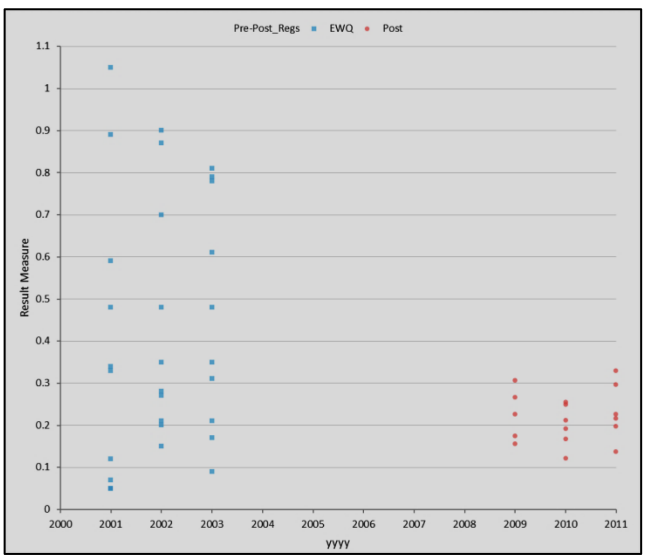
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

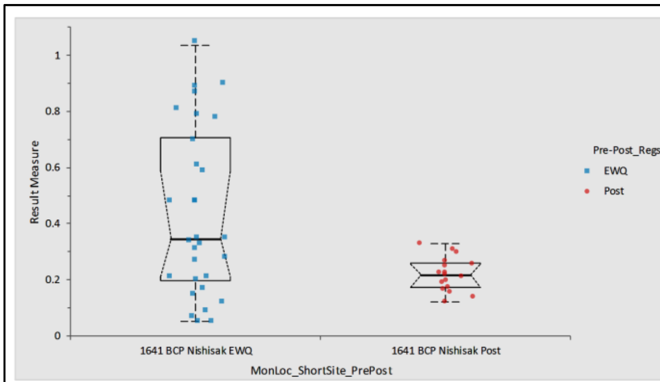
Nitrogen, Kjeldahl as N, Total (TKN) mg/l

Existing Water Quality (Table 2P):

Median 0.35 mg/l
Lower 95% Confidence Interval 0.21 mg/l
Upper 95% Confidence Interval 0.59 mg/l

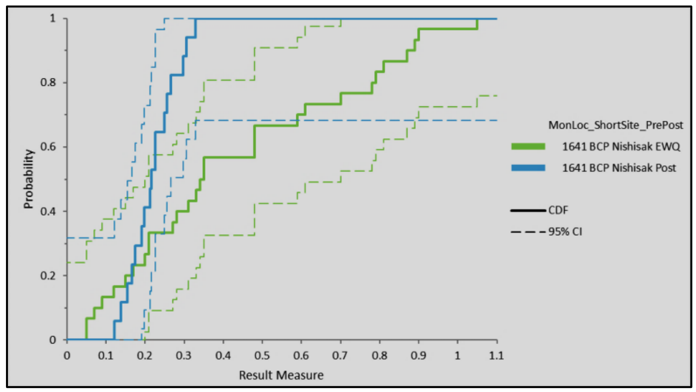






N | 47

Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	0.05	0.20	0.35	0.71	1.05	0.51
1641 BCP Nishisak Post	0.12	0.17	0.22	0.26	0.33	0.09



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	30	367.5	12.25
1641 BCP Nishisak Post	17	648.5	38.15

H statistic	5.41
X^2 approximation	5.41
DF	1
p-value	0.0201 [1]

H0: $\theta_1 = \theta_2 = \theta_{...}$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

No water quality degradation is evident here. TKN concentrations apparently declined between the EWQ and post-EWQ periods. However, potential laboratory artifacts and insufficient post-EWQ sampling frequency introduced uncertainty into conclusions.

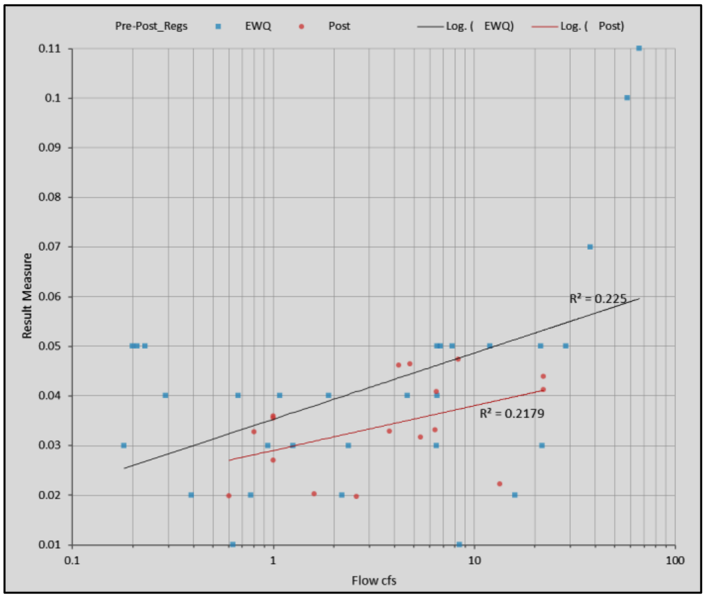
TKN concentration is unrelated to flow in the EWQ data set, but positively related to flow in the post-EWQ data set. TKN ranges much less widely and is less variable in the post-EWQ data set. Note that flows are plotted on a logarithmic scale. Post-EWQ median TKN was within the EWQ 95% confidence intervals, but the decline was significant.

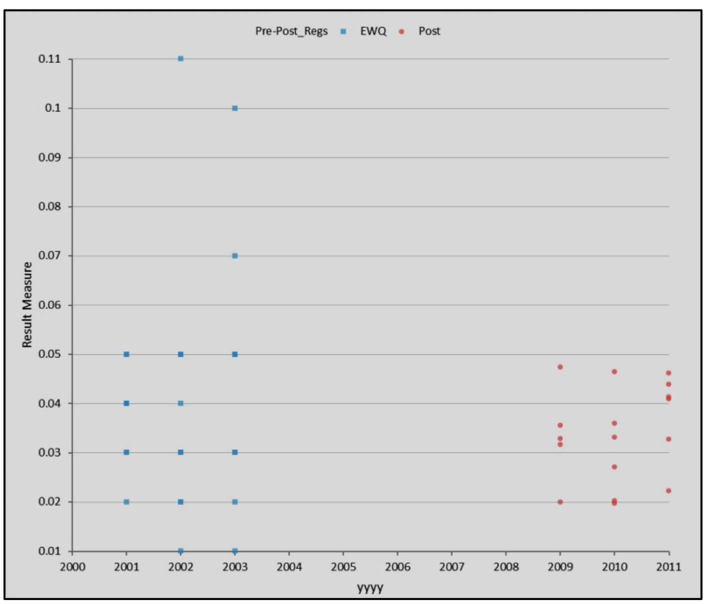
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

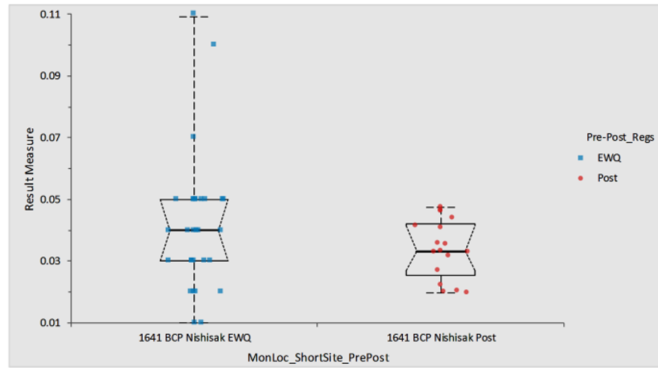
Orthophosphate as P, Total mg/l

Existing Water Quality (Table 2P):

Median 0.04 mg/l
Lower 95% Confidence Interval 0.03 mg/l
Upper 95% Confidence Interval 0.05 mg/l

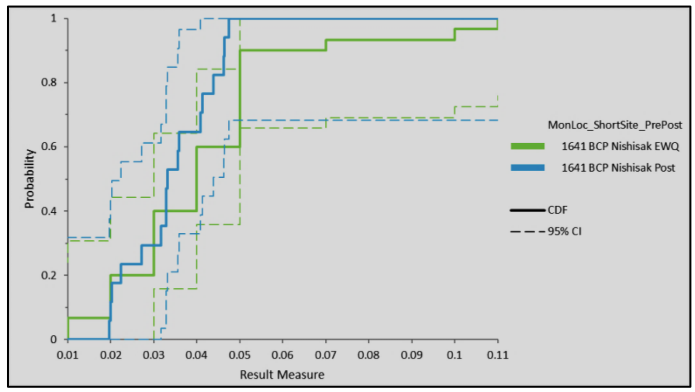






N 47

Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	0.01	0.03	0.04	0.05	0.11	0.02
1641 BCP Nishisak Post	0.02	0.03	0.03	0.04	0.05	0.02



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	30	93.6	3.12
1641 BCP Nishisak Post	17	165.2	9.72

H statistic	1.39
X² approximation	1.39
DF	1
p-value	0.2379 [1]

H0: $\theta_1 = \theta_2 = \theta_{...}$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Do not reject the null hypothesis at the 5% significance level.

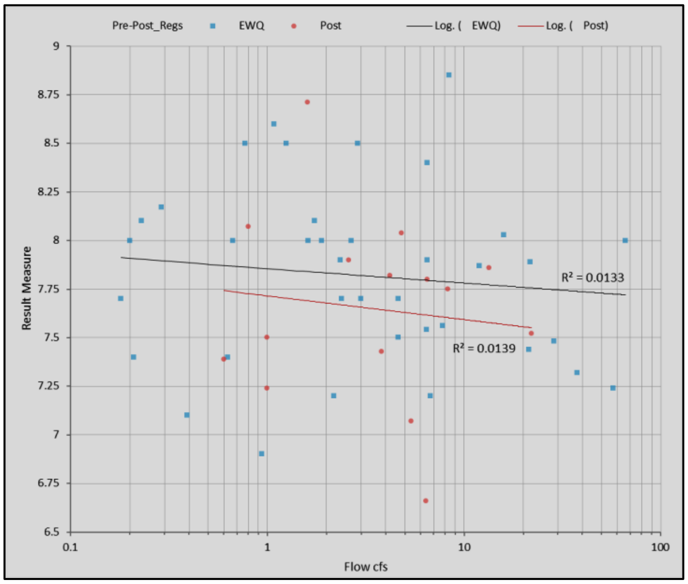
No water quality degradation is evident here. Orthophosphate apparently did not change between the EWQ and post-EWQ periods. Potential laboratory artifacts, detection limit differences, and insufficient post-EWQ sampling frequency introduced uncertainty into data comparisons. Orthophosphate is weakly related to flow in both data sets. Flows is plotted on logarithmic scale. Post-EWQ median orthophosphate fell within the EWQ 95% confidence intervals. There were no independent data to confirm DRBC results.

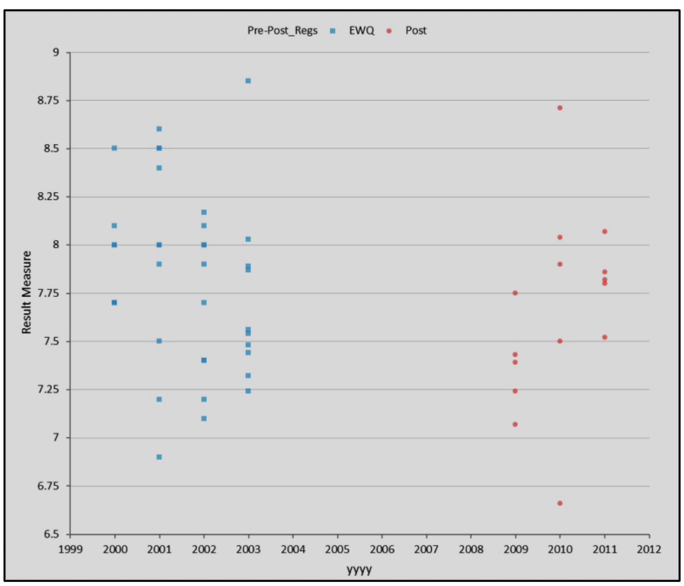
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

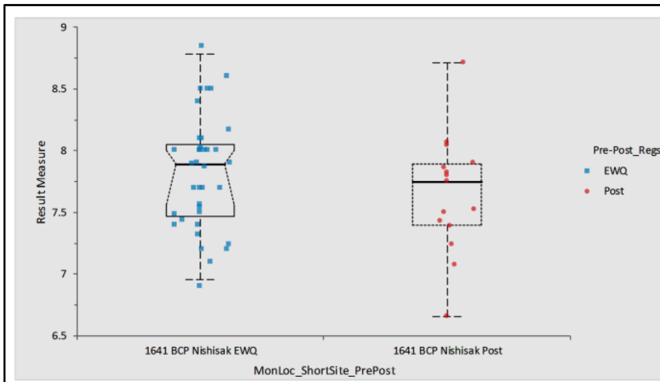
pH

Existing Water Quality (Table 2P):

Median 7.89 standard units
Lower 95% Confidence Interval 7.56 standard units
Upper 95% Confidence Interval 8.00 standard units

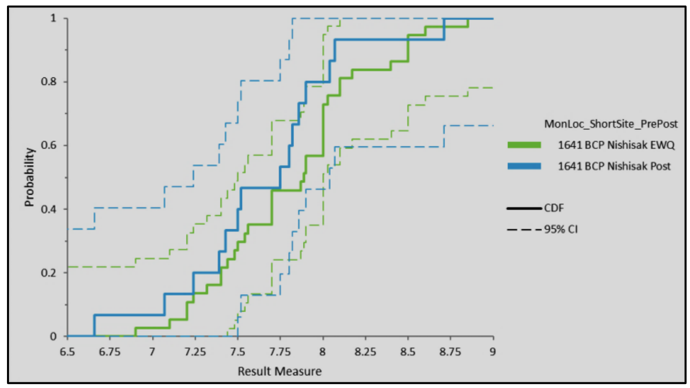






N 52

Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	6.90	7.47	7.89	8.05	8.85	0.59
1641 BCP Nishisak Post	6.66	7.40	7.75	7.89	8.71	0.50



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	37	86.3	2.33
1641 BCP Nishisak Post	15	212.8	14.19

H statistic	1.31
X^2 approximation	1.31
DF	1
p-value	0.2532 [1]

H0: $\theta_1 = \theta_2 = \theta\ldots$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Do not reject the null hypothesis at the 5% significance level.

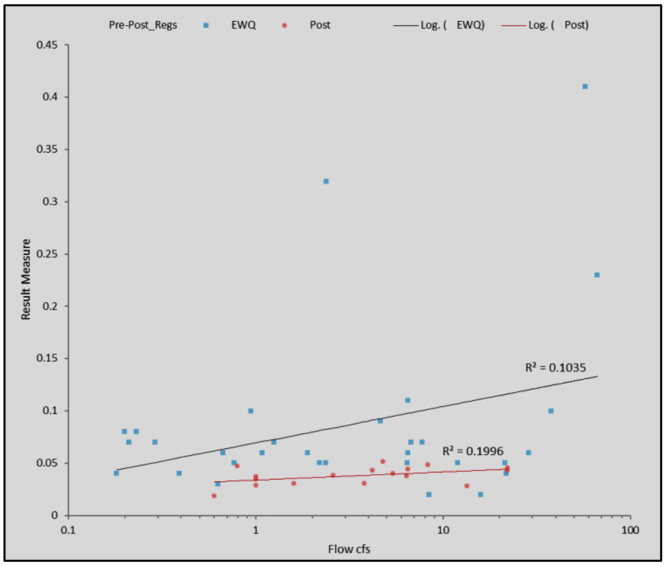
No water quality degradation is evident here. pH did not measurably change between the EWQ and post-EWQ periods. Analytical uncertainty was introduced by insufficient post-EWQ sampling (n=15). pH is unrelated to flow in both data sets. Flow is plotted on logarithmic scale. Post-EWQ median pH was within the EWQ 95% confidence intervals.

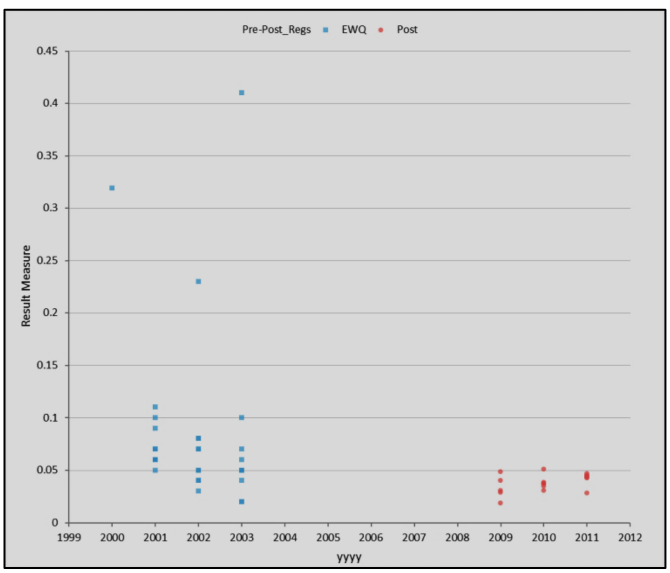
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

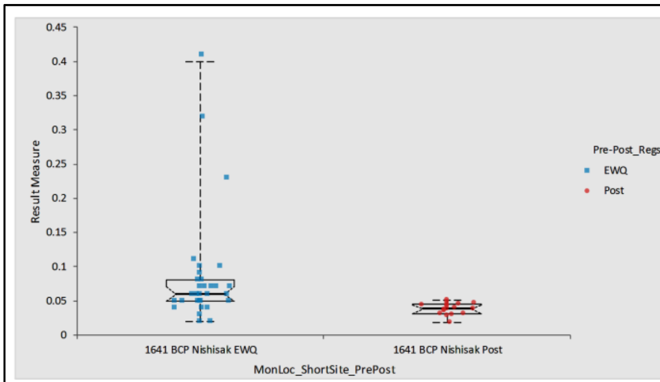
Phosphorus as P, Total (TP) mg/l

Existing Water Quality (Table 2P):

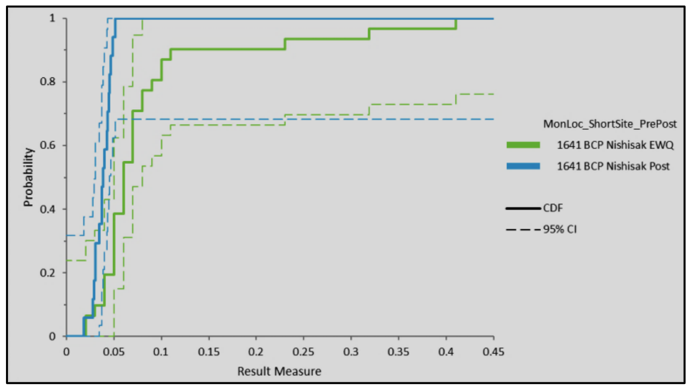
Median 0.06 mg/l
Lower 95% Confidence Interval 0.05 mg/l
Upper 95% Confidence Interval 0.07 mg/l







	N	48				
Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	0.020	0.050	0.060	0.080	0.410	0.030
1641 BCP Nishisak Post	0.019	0.031	0.038	0.045	0.051	0.014



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	31	1134.1	36.58
1641 BCP Nishisak Post	17	2068.0	121.65

H statistic	16.41
X^2 approximation	16.41
DF	1
p-value	<0.0001[1]

H0: $\theta_1 = \theta_2 = \theta$...
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

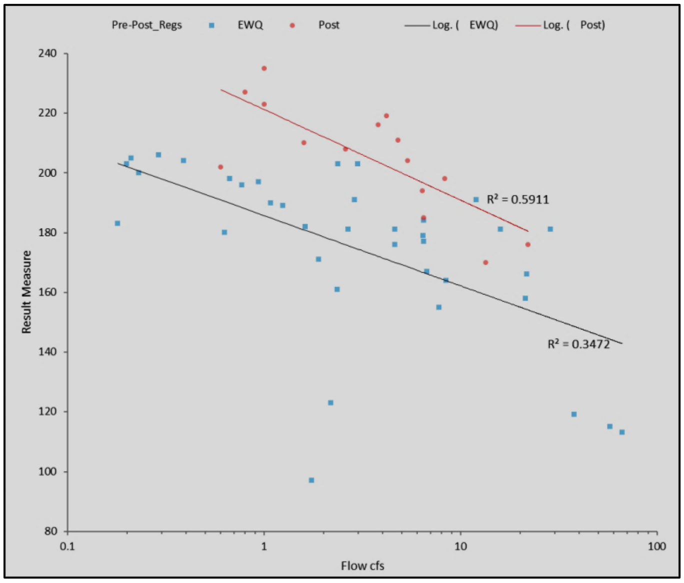
No water quality degradation is evident here. Total Phosphorus (TP) concentrations apparently declined between the EWQ and post-EWQ periods. However, potential laboratory artifacts and insufficient post-EWQ sampling frequency (n=17) introduced uncertainty into data comparisons. Post-EWQ median total phosphorus fell below the EWQ lower 95% confidence interval. TP is very weakly related to flow in both data sets. Flow is plotted on logarithmic scale. No independent data were available to confirm these results.

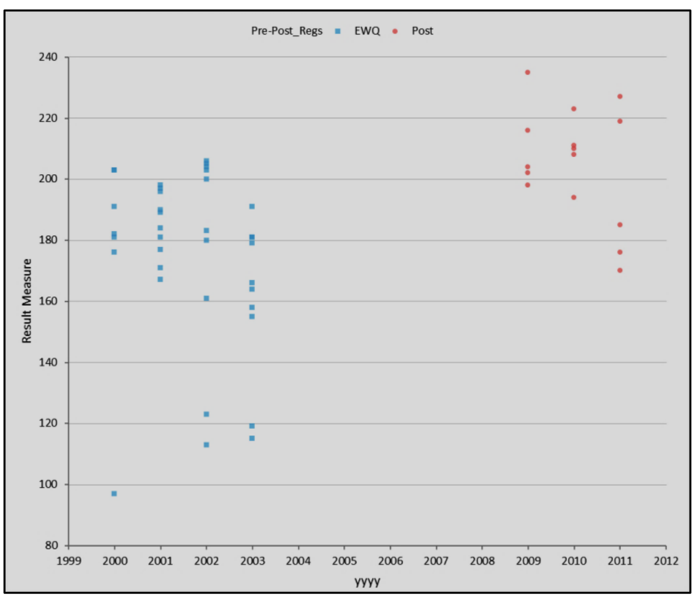
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

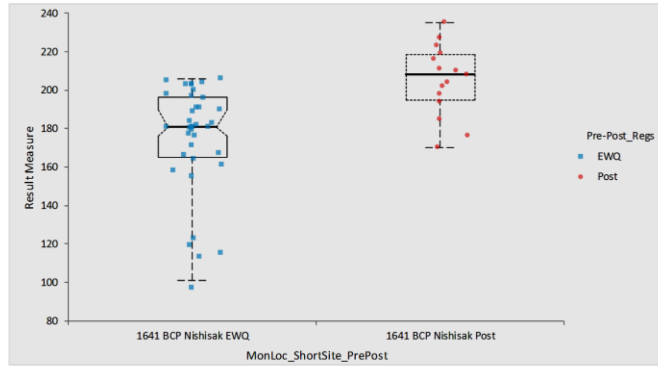
Specific Conductance µmho/cm

Existing Water Quality (Table 2P):

Median 181 µmho/cm
Lower 95% Confidence Interval 176 µmho/cm
Upper 95% Confidence Interval 190 µmho/cm
Defined in regulations as a flow-related parameter

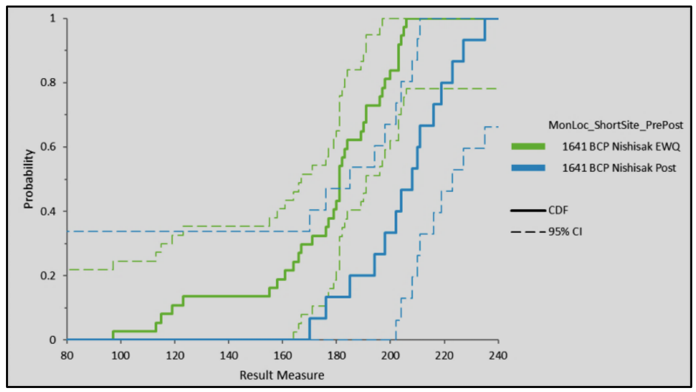






N 52

Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	97	165	181	196	206	31
1641 BCP Nishisak Post	170	195	208	219	235	24



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	37	945.1	25.54
1641 BCP Nishisak Post	15	2331.3	155.42

H statistic	14.28
X^2 approximation	14.28
DF	1
p-value	0.0002 [1]

H0: $\theta_1 = \theta_2 = \theta_{...}$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

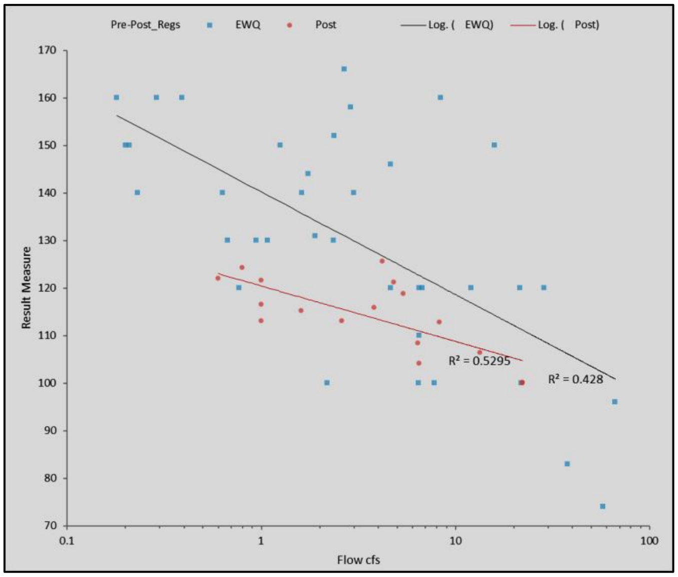
Water quality degradation is indicated here. Specific conductance rose above the EWQ upper 95% confidence interval between the EWQ and post-EWQ periods. However, insufficient post-EWQ sampling frequency (n=17) and under-representation of post-EWQ flow conditions introduced uncertainty into data comparisons. Specific conductance is inversely related to flow in both data sets. Flow is plotted on logarithmic scale. The rise in specific conductance may be partially attributable to the concurrent rise in chloride concentrations. Median specific conductance has risen from 181 to 208 µmhos/cm; a 15% increase.

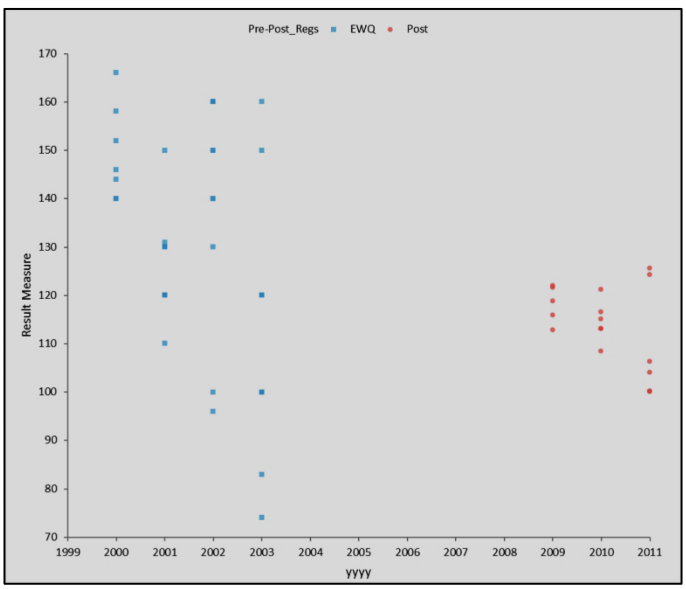
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

Total Dissolved Solids (TDS) mg/l

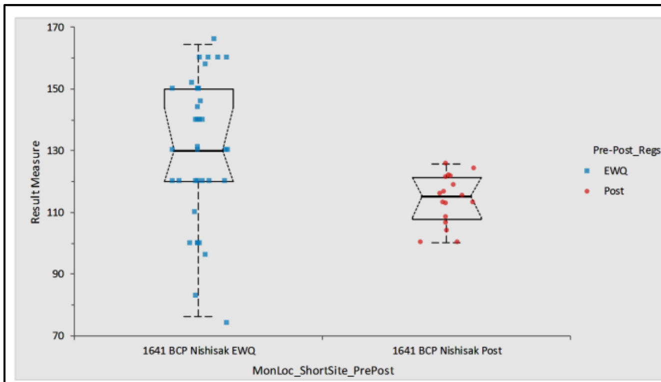
Existing Water Quality (Table 2P):

Median 130 mg/l
Lower 95% Confidence Interval 120 mg/l
Upper 95% Confidence Interval 144 mg/l
Defined in regulations as a flow-related parameter

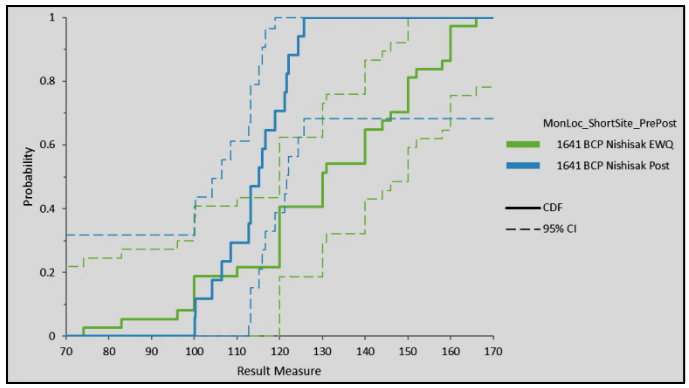




No water quality degradation is evident here. TDS apparently declined between the EWQ and post-EWQ periods. Potential laboratory artifacts, insufficient post-EWQ sampling frequency (n=17) and under-representation of post-EWQ flow conditions introduced uncertainty into data comparisons.



N	54					
Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	74	120	130	150	166	30
1641 BCP Nishisak Post	100	108	115	121	126	14



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	37	596.0	16.11
1641 BCP Nishisak Post	17	1297.2	76.31

H statistic	7.68
X² approximation	7.68
DF	1
p-value	0.0056 [1]

H0: $\theta_1 = \theta_2 = \theta$...
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

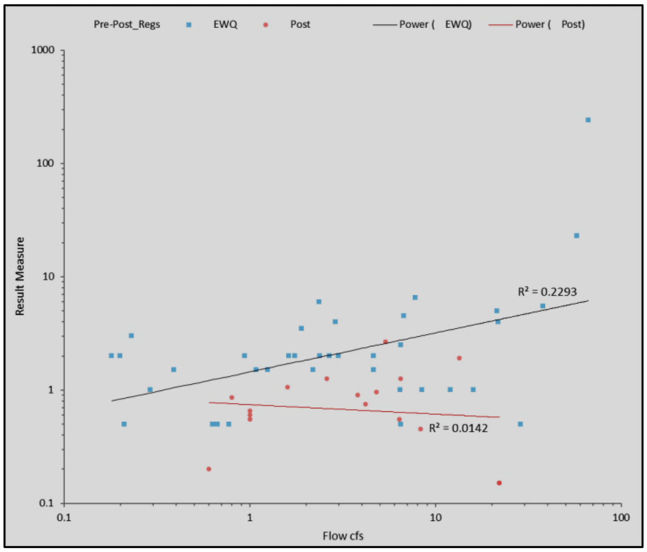
TDS is inversely related to flow in both data sets. Post-EWQ median TDS fell below the EWQ lower 95% lower confidence interval, and was much less variable than the baseline samples as well. Post-EWQ detection limits were lower than EWQ detection limits, though there were no non-detect results at any time.

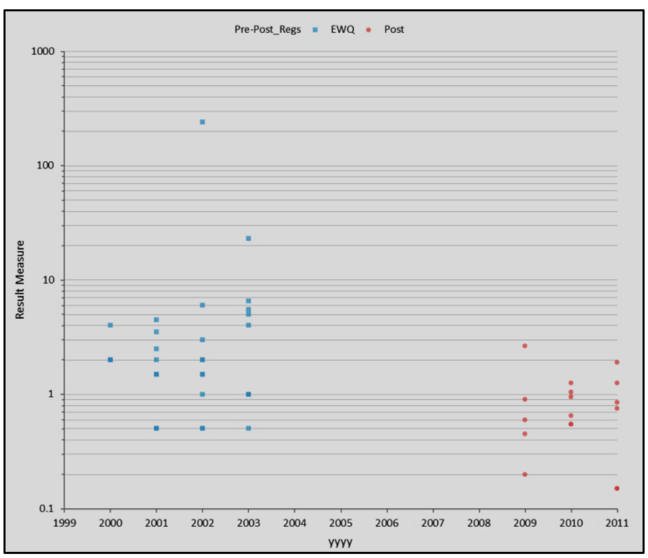
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

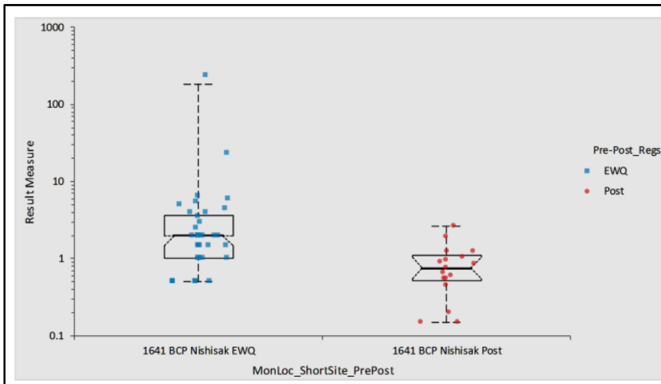
Total Suspended Solids (TSS) mg/l

Existing Water Quality (Table 2P):

Median 1.5 mg/l
Lower 95% Confidence Interval 1.0 mg/l
Upper 95% Confidence Interval 2.0 mg/l

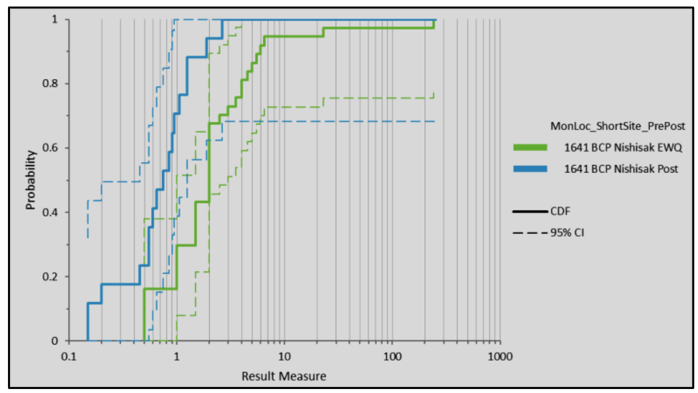






N 54

Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	0.5	1.0	2.0	3.7	240.0	2.7
1641 BCP Nishisak Post	0.1	0.5	0.8	1.1	2.7	0.6



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	37	991.1	26.79
1641 BCP Nishisak Post	17	2157.2	126.89

H statistic	12.82
X² approximation	12.82
DF	1
p-value	0.0003 [1]

H0: $\theta_1 = \theta_2 = \theta_{...}$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Reject the null hypothesis in favour of the alternative hypothesis at the 5% significance level.

No water quality degradation is evident here. TSS apparently declined between EWQ and post-EWQ periods. Potential laboratory artifacts, insufficient post-EWQ sampling frequency (n=17) and under-representation of post-EWQ flow conditions introduced uncertainty into data comparisons. TSS is unrelated to flow in both data sets.

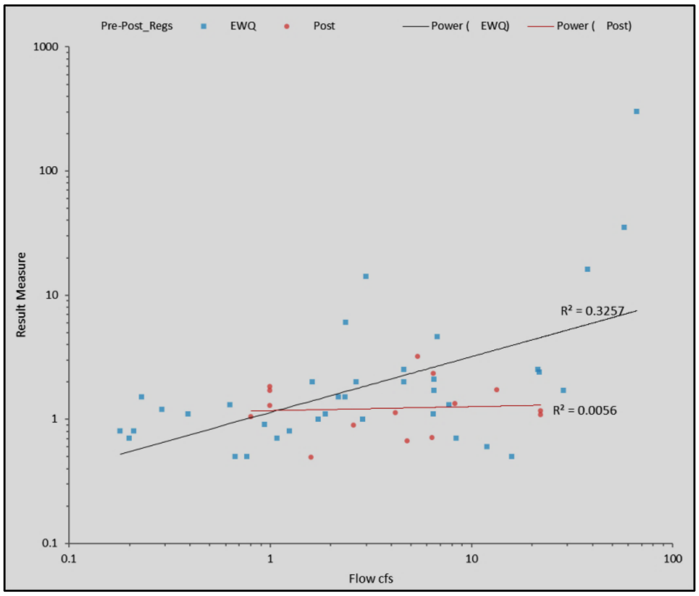
Post-EWQ median TSS fell below the lower EWQ 95% confidence interval and the difference in median concentrations was significant. Flows and concentrations are plotted on logarithmic scale. TSS should be related to flow, so it appears that too few samples were taken in both periods to fully characterize TSS for Nishisakawick Creek.

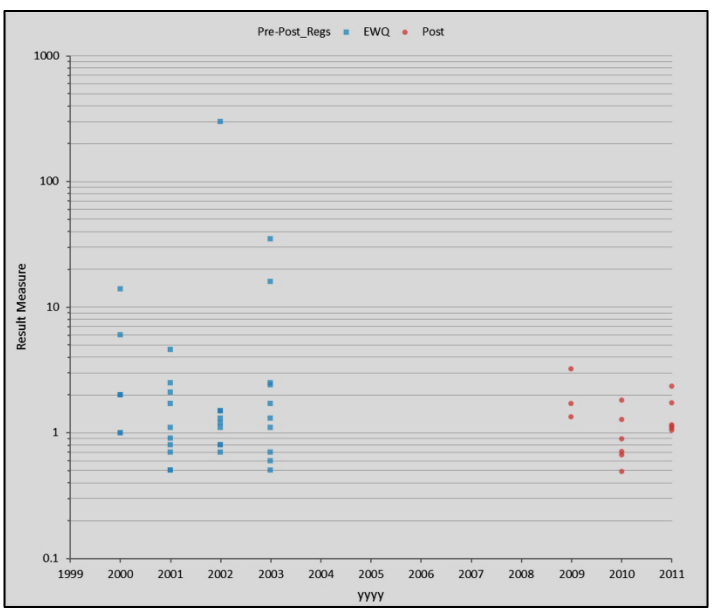
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

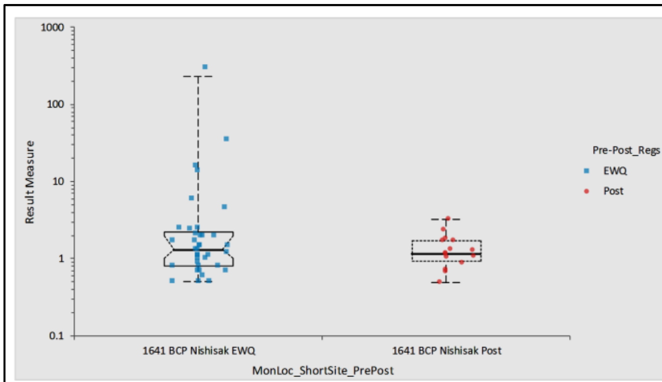
Turbidity NTU

Existing Water Quality (Table 2P):

Median 1.3 NTU
Lower 95% Confidence Interval 0.9 NTU
Upper 95% Confidence Interval 2.0 NTU
Defined in regulations as a flow-related parameter

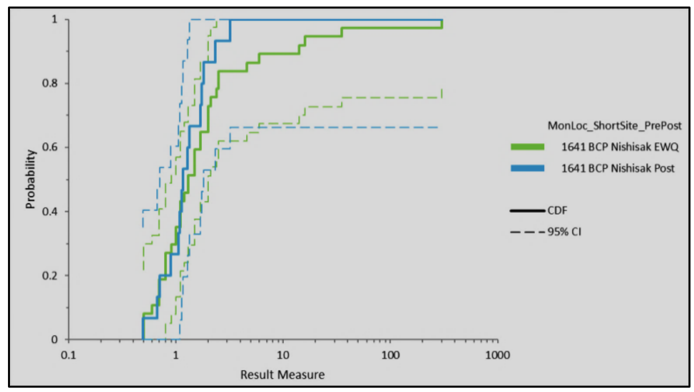






N 52

Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	0.50	0.80	1.30	2.20	300.00	1.40
1641 BCP Nishisak Post	0.49	0.92	1.16	1.73	3.21	0.81



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	37	28.5	0.77
1641 BCP Nishisak Post	15	70.4	4.69

H statistic	0.43
X² approximation	0.43
DF	1
p-value	0.5113 [1]

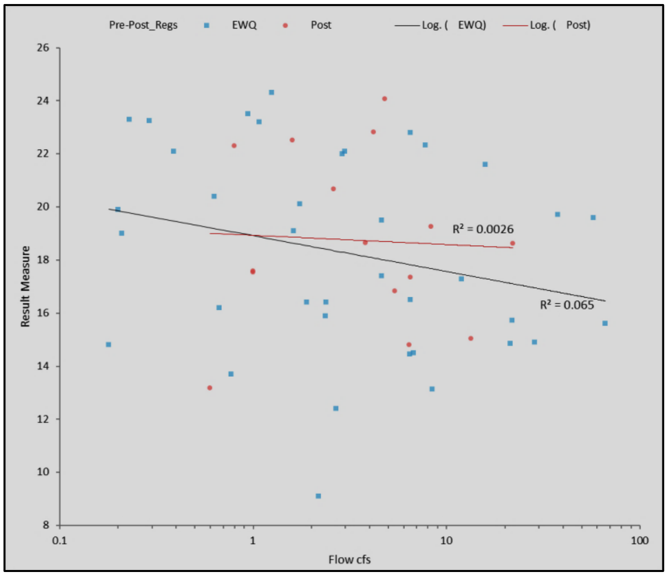
H0: $\theta_1 = \theta_2 = \theta_{...}$
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Do not reject the null hypothesis at the 5% significance level.

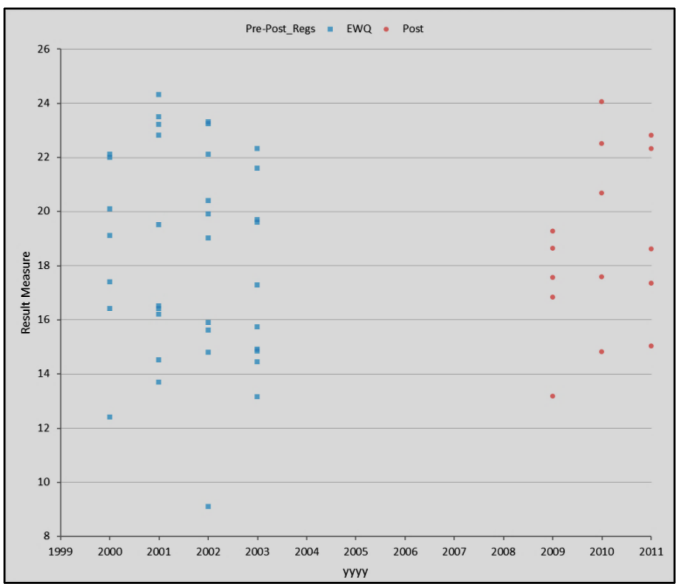
No water quality degradation is evident here. Turbidity did not measurably change between the EWQ and post-EWQ periods. The post-EWQ median turbidity fell within the EWQ 95% confidence intervals of the median. Turbidity is weakly related to flow in the EWQ data set and unrelated to flow in the post-EWQ data set. There were too few samples taken in the post-EWQ period, and post-EWQ flow conditions were not fully represented. Concentrations and flows are represented on logarithmic scale.

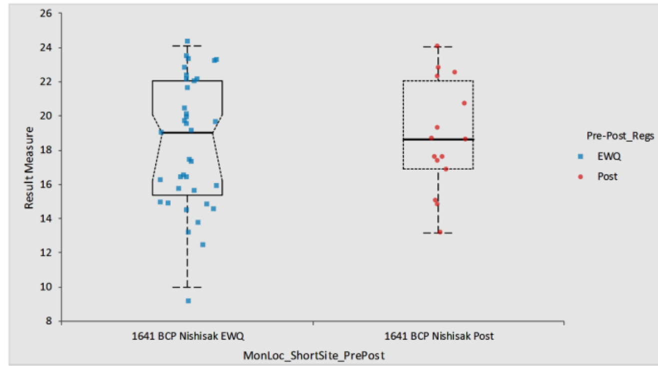
Chapter 11: 1641 BCP Nishisakawick Creek, NJ

Water Temperature, degrees C

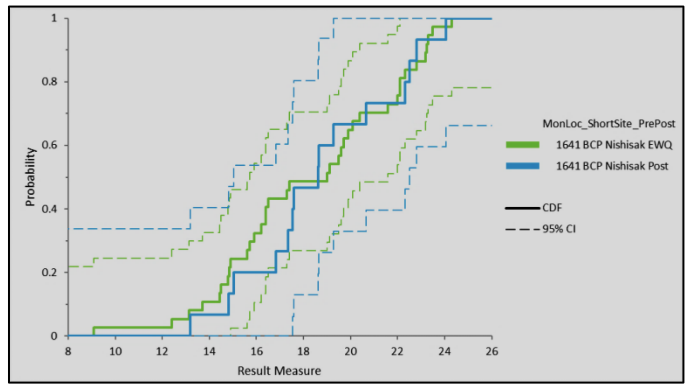
Not included in DRBC Existing Water Quality rules







N	52					
Result Measure by MonLoc_ShortSite_PrePost	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
1641 BCP Nishisak EWQ	9.1	15.4	19.0	22.0	24.3	6.7
1641 BCP Nishisak Post	13.2	16.9	18.6	22.0	24.1	5.1



Kruskal-Wallis test

Result Measure by MonLoc_ShortSite_PrePost	n	Rank sum	Mean rank
1641 BCP Nishisak EWQ	37	12.5	0.34
1641 BCP Nishisak Post	15	30.8	2.05

H statistic	0.19
X² approximation	0.19
DF	1
p-value	0.6641 [1]

H0: $\theta_1 = \theta_2 = \theta$...
The median of the populations are all equal.
H1: $\theta_i \neq \theta_j$ for at least one i,j
The median of the populations are not all equal.
[1] Do not reject the null hypothesis at the 5% significance level.

No water quality degradation is evident here. Water temperature did not measurably change between the EWQ and post-EWQ periods. There were too few post-EWQ samples (n=15). Water temperature is unrelated to flow in both data sets. Flow is plotted on logarithmic scale.