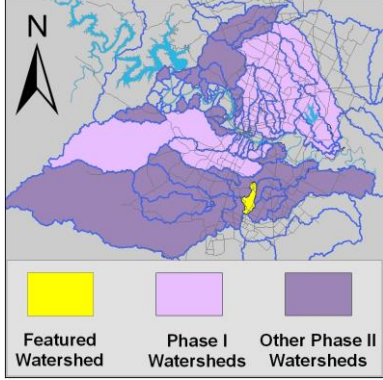


Marble Creek Watershed

Summary Sheet

Catchment	Total area	4 sq. miles					
	Area in recharge	0					
	Creek length	7 miles					
	Receiving water	Onion Creek					
Demographics	2000 population	1,028					
	2030 projected population	6,388					
	30 year projected % increase	521 %					
Land Use	Impervious cover (2003 estimate)	5.5 %					
	Impervious cover (2013 estimate)	8.0 %					
Overall EII Scores	1999	2002	2005	2008	2010	2012	2014
	60	61	59	58	67	67	65



Flow Regime* for Sample Sites on Marble Creek

Site	Site Name	2000		2002				2005				2008				2010				2011				2012				2014				
		Jun	Jun	Feb	Feb	May	Aug	Nov	Mar	Jun	Jun	Sep	Dec	Feb	May	Jun	Sep	Dec	Mar	May	May	Oct	Dec	Mar	May	Jul	Sep	Jan	Apr	May	Jul	Sep
		WQ	Bio	WQ	Bio	WQ	WQ	WQ	WQ	WQ	WQ	Bio	WQ	WQ	WQ	WQ	WQ	Bio	WQ	WQ	WQ	WQ	Bio	WQ	WQ	WQ	Bio	WQ	WQ	WQ	WQ	Bio
232	Thaxton		n	n	n	B	B	B	B	n	n	n	n	n	n	n	n	B	n	B	B	n	B	B	n	n	B	B	n	B	n	
231	Wm Cannon	S	B	B	B	B	B	B	B	B	B	B	B	B	B	n	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	

* B = baseflow n = no flow S = storm flow blue = Samples were taken light blue = Samples were not taken blank = not visited

Index scores* for Marble Creek Sites by Year

Reach	Site	Site Name	Year	Water Quality	Sediment**	Contact Rec.	Non-Contact Rec.	Physical Integrity	Aquatic Life	Benthic subindex	Diatom subindex	Total EII Score
MAR1	231	Marble Creek @ William Cannon	1999	47	84	93	53	65	32	36	28	62
MAR2	232	Marble Creek @ Thaxton Road (M2)	1999	62	84	92	58	43				57
MAR1	231	Marble Creek @ William Cannon	2002	43	83	82	58	72	60	44	75	66
MAR2	232	Marble Creek @ Thaxton Road (M2)	2002	58	83	97	58	33				55
MAR1	231	Marble Creek @ William Cannon	2005	46	84	54	58	74	57	41	72	62
MAR2	232	Marble Creek @ Thaxton Road (M2)	2005	65	84	92	41	48				55
MAR1	231	Marble Creek @ William Cannon	2008	47	61	50	73	72	71	57	85	62
MAR2	232	Marble Creek @ Thaxton Road (M2)	2008		61		53	56	55	55		56
MAR1	231	Marble Creek @ William Cannon	2010	49	68	55	67	60	83	76	89	64
MAR2	232	Marble Creek @ Thaxton Road (M2)	2010	69	68	76	63	67	73	55	91	69
MAR1	231	Marble Creek @ William Cannon	2012	51	76	42	68	78	85	98	71	67
MAR2	232	Marble Creek @ Thaxton Road (M2)	2012	68	76	48	72	54	83	85	80	67
MAR1	231	Marble Creek @ William Cannon	2014	45	78	41	73	61	64	50	78	60
MAR2	232	Marble Creek @ Thaxton Road (M2)	2014	76	78	95	53	45	68	44	91	69

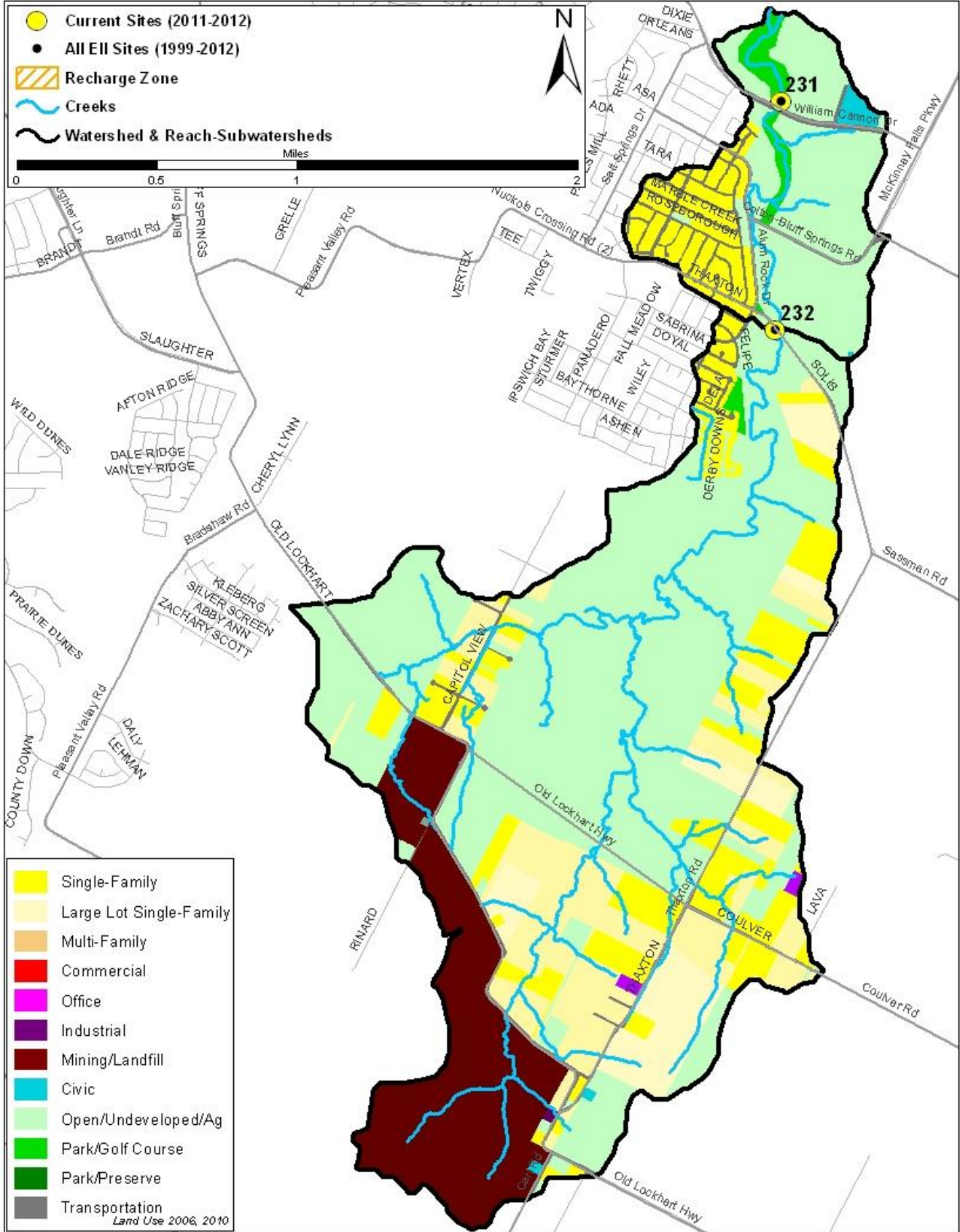
* blank cells indicate parameter was not collected, blank row indicate site was dropped

**sediment samples only collected at the downstream site

100-87.5 Excellent 87.5-75 V. Good 75-62.5 Good 62.5-50 Fair 50-37.5 Marginal 37.5-25 Poor 25-12.5 Bad 12.5-0 V. Bad

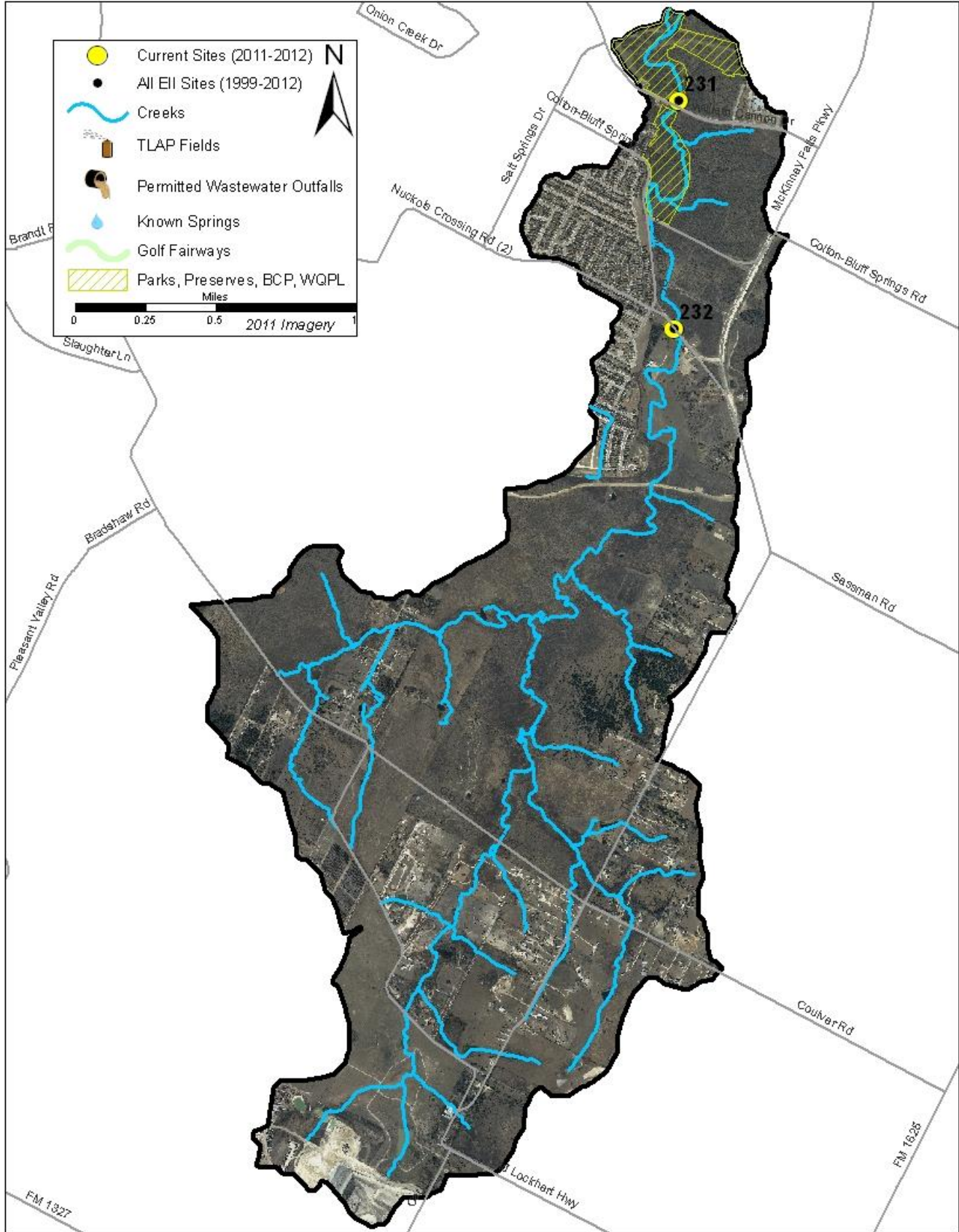
Marble Creek Watershed

Land Use Map



Marble Creek Watershed

Aerial Map



Marble Creek Watershed

Water Quality Data – Temperature, Conductivity, pH, Dissolved Oxygen & E. coli for 2014 Sample Sites (Downstream to Upstream)

Qualifiers to the left of value:	>	greater than	Qualifiers to the right of value:	(blank)	Useable
	<	less than		S	Exceeds standard range
	< J	less than detection limit		R	Rejected, failed QC
	J	Estimated			

Site Name	Site #	Reach	Date	Temp.		Cond.		pH		D.O.		E.coli	
				<> Value	flag	<> Value	flag	<> Value	flag	<> Value	flag		
Marble @ William Cannon	231	MAR1	01/15/2014	14.1		671		7.59				21.8	
Marble @ William Cannon	231	MAR1	04/17/2014	16.2		695		7.61		3.3		325.5	
Marble @ William Cannon	231	MAR1	05/06/2014	20.3		768		6.96		4.1			
Marble @ William Cannon	231	MAR1	07/02/2014	24.3		763		7.02		4.3		613.1	
Marble @ William Cannon	231	MAR1	09/10/2014	25.9		679		7.45		2.3		436.0	
Site 231 Mean				20.2		715		7.33		3.5		349.1	
Marble @ Thaxton Rd	232	MAR2	01/15/2014	13.9		677		8.35				6.3	
Marble @ Thaxton Rd	232	MAR2	04/17/2014	17.5		522		8.20		9.4		13.2	
Marble @ Thaxton Rd	232	MAR2	07/02/2014	26.9		563		7.47		4.2		6.0	
Site Mean				19.4		587		8.01		6.8		8.5	
Watershed Mean				19.9		667		7.58		4.6		203.1	

Orange highlighting indicates that the value exceeds one standard deviation from the mean of all E.I.I. sites combined.

Summary Statistics for all 2013 – 2014 E.I.I. Sites Combined.					
Parameter	2013-2014 Average	2013-2014 Minimum	2013-2014 Maximum	1 Standard Deviation Above	1 Standard Deviation Below
Temperature (C°)	19.6	8.6	34.0	25.8	
Conductivity (uS/cm)	711	107	1783	942	
pH (Standard units)	7.86	6.96	8.97	8.19	7.52
D.O. (mg/l)	8.1	1.2	30.5	11.4	4.8
E.coli. (col/100ml)	435	1	4840	1127	

Marble Creek Watershed

Water Quality Data – Ammonia, Nitrate / Nitrite, Ortho-Phosphorus, Total Suspended Solids & Turbidity for 2014 Sample Sites (Downstream to Upstream)

Qualifiers to the left of value:	>	greater than	Qualifiers to the right of value:	(blank)	Useable
	<	less than		S	Exceeds standard range
	< J	less than detection limit		R	Rejected, failed QC
	J	Estimated			

Site Name	Site #	Reach	Date	NH3-N		NO3/NO2		Ortho-P		T.S.S.		Turb.		
				<>	Value	flag	<>	Value	flag	<>	Value	flag	<>	Value
Marble @ William Cannon	231	MAR1	01/15/2014	<J	0.008		3.48	<J	0.004	<J	1.11		1.2	R
Marble @ William Cannon	231	MAR1	04/17/2014		0.063		2.29				2.10		1.6	R
Marble @ William Cannon	231	MAR1	05/06/2014											
Marble @ William Cannon	231	MAR1	07/02/2014		0.049		3.44	<J	0.004		6.89		1.9	
Marble @ William Cannon	231	MAR1	09/10/2014		0.215		0.31	<J	0.004		8.47		3.2	R
Site 231 Mean					0.084		2.38		0.004		4.64		2.0	
Marble @ Thaxton Rd	232	MAR2	01/15/2014	<J	0.008	<J	0.01	<J	0.004		2.94		3.2	R
Marble @ Thaxton Rd	232	MAR2	04/17/2014		0.079	<J	0.01	<J	0.004		19.00		6.7	R
Marble @ Thaxton Rd	232	MAR2	07/02/2014	<J	0.008	<J	0.01	<J	0.004		12.20		8.1	
Site 232 Mean					0.032		0.01		0.004		11.38		6.0	
Watershed Mean					0.061		1.36		0.004		7.53		3.7	

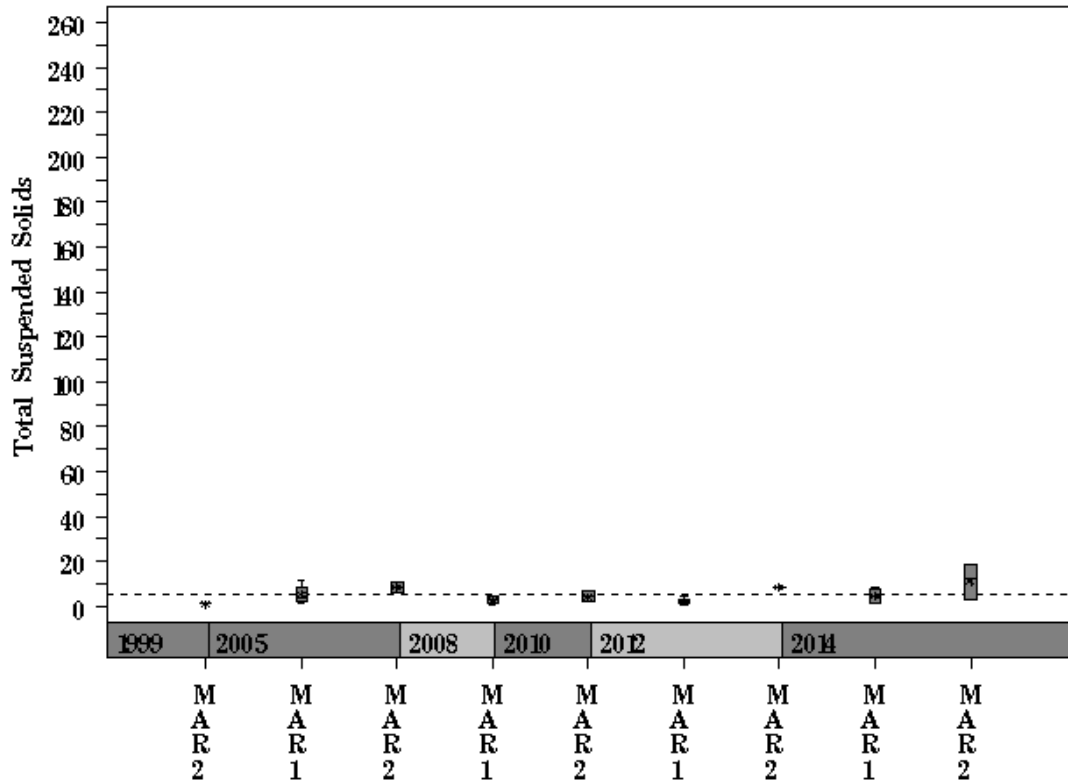
Orange highlighting indicates that the value exceeds one standard deviation from the mean of all E.I.I. sites combined.

Summary Statistics for all 2013 – 2014 E.I.I. Sites Combined.				
Parameter	2013-2014 Mean	2013-2014 Minimum	2013-2014 Maximum	1 Standard Deviation Above
NH3-M (mg/l)	0.031	0.008	2.250	0.150
NO3-N (mg/l)	1.16	0.01	16.30	4.02
Ortho-P (mg/l)	0.041	0.004	1.360	0.164
TSS (mg/l)	5.6	1.0	70.0	15.3
Turbidity (NTU)	4.5	0.0	97.1	13.2

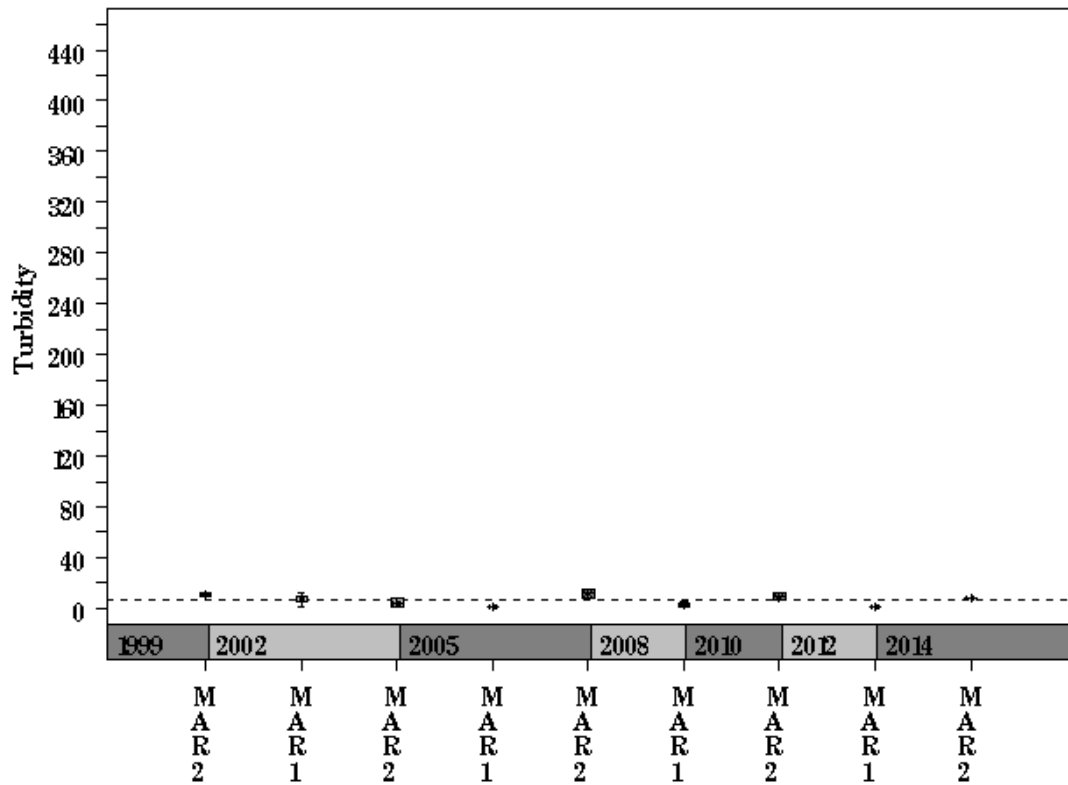
Marble Creek Watershed

Data Summary Graphs – Total Suspended Solids and Turbidity (Downstream to Upstream by Year)

Parameter= TOTAL SUSPENDED SOLIDS Unit= mg/L Watershed= Marble



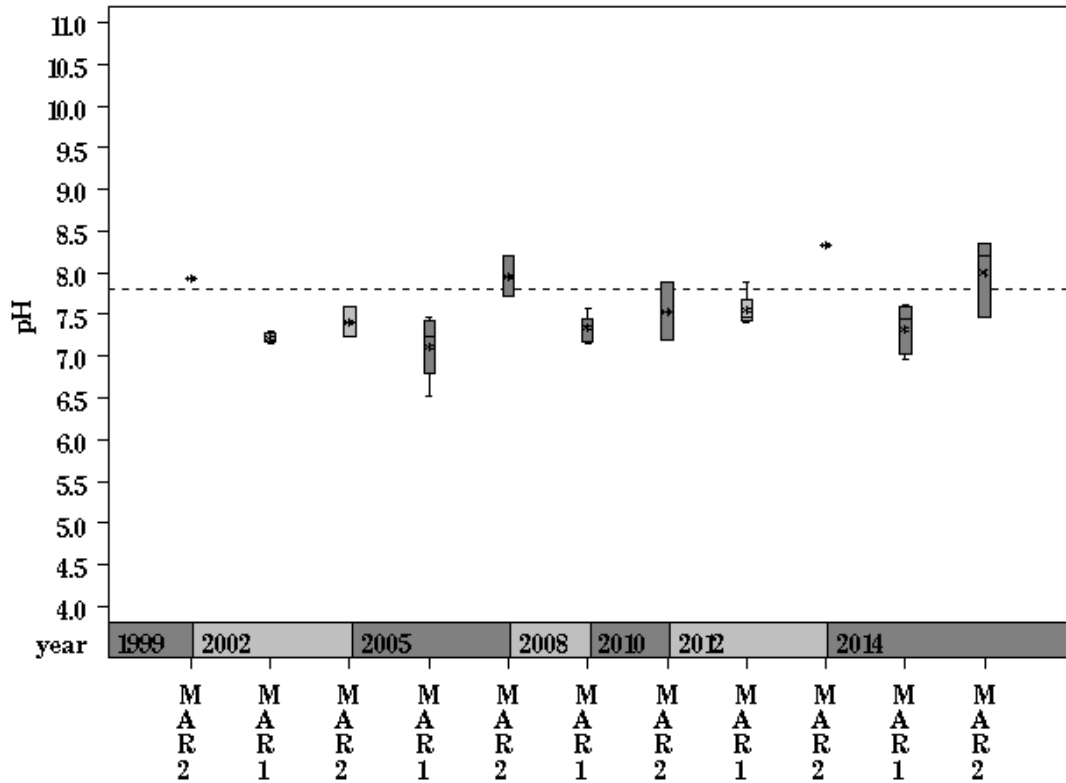
Parameter= TURBIDITY Unit= NTU Watershed= Marble



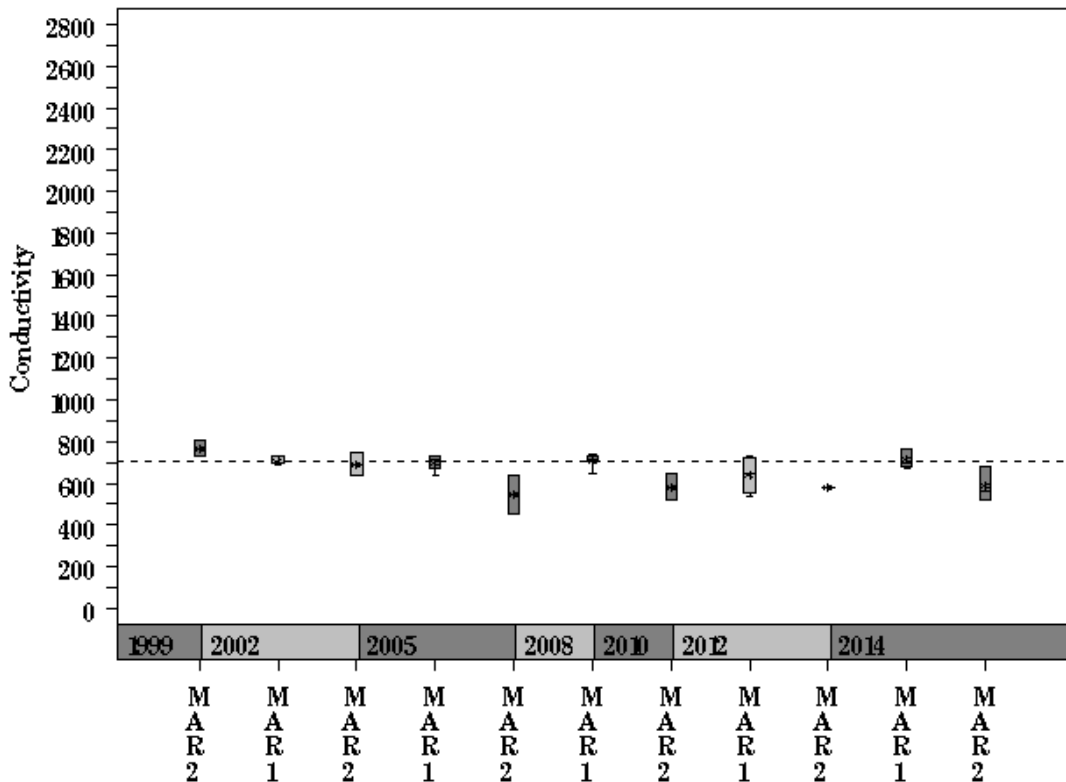
Marble Creek Watershed

Data Summary Graphs – pH and Conductivity (Downstream to Upstream by Year)

Parameter= PH Unit= Standard units Watershed= Marble



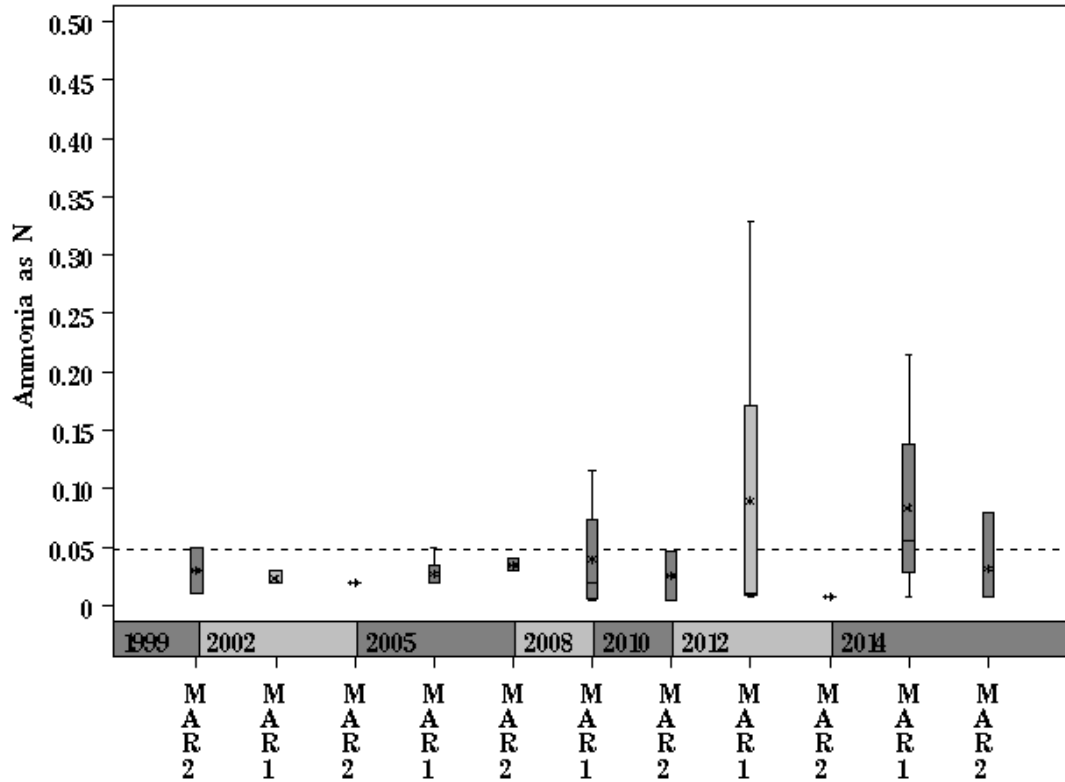
Parameter= CONDUCTIVITY Unit= uS/cm Watershed= Marble



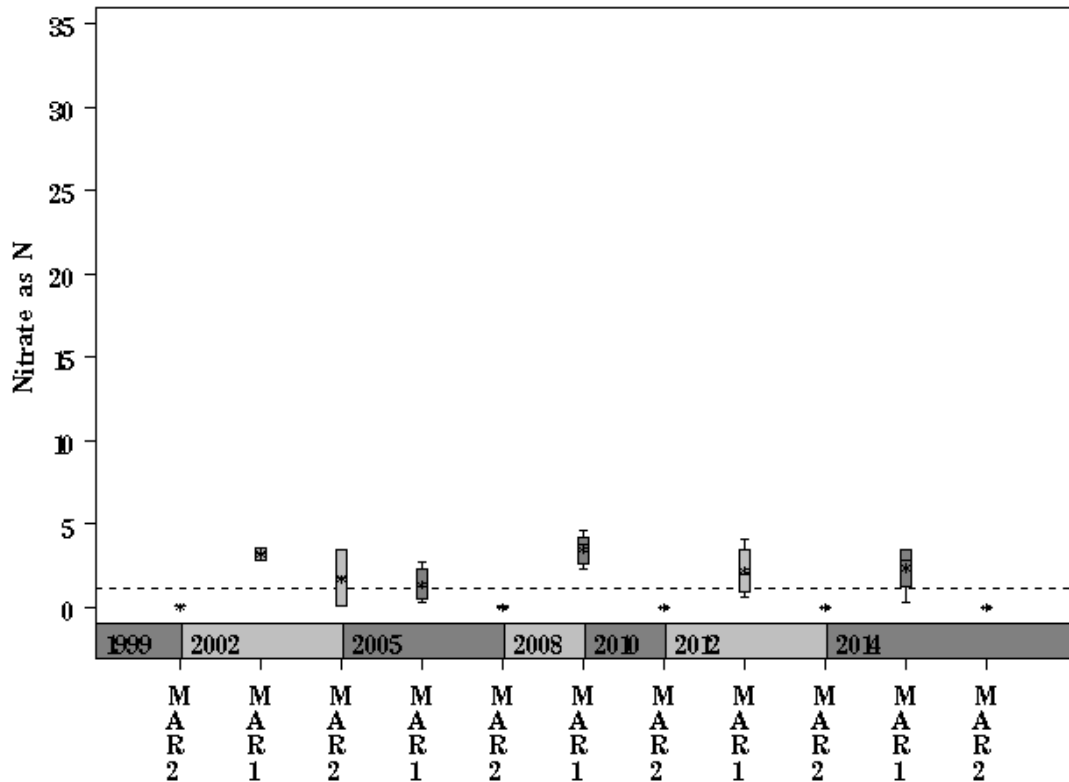
Marble Creek Watershed

Data Summary Graphs – Ammonia and Nitrate/Nitrite (Downstream to Upstream by Year)

Parameter= AMMONIA AS N Unit= mg/L Watershed= Marble



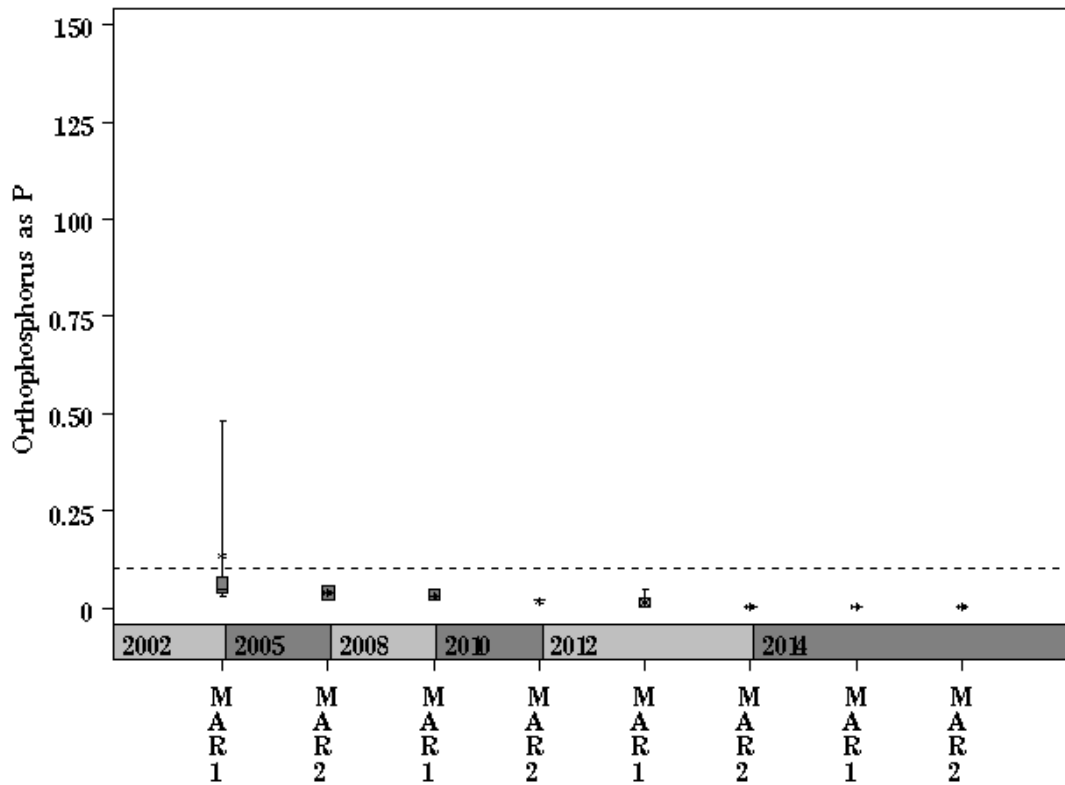
Parameter= NITRATE AS N Unit= mg/L Watershed= Marble



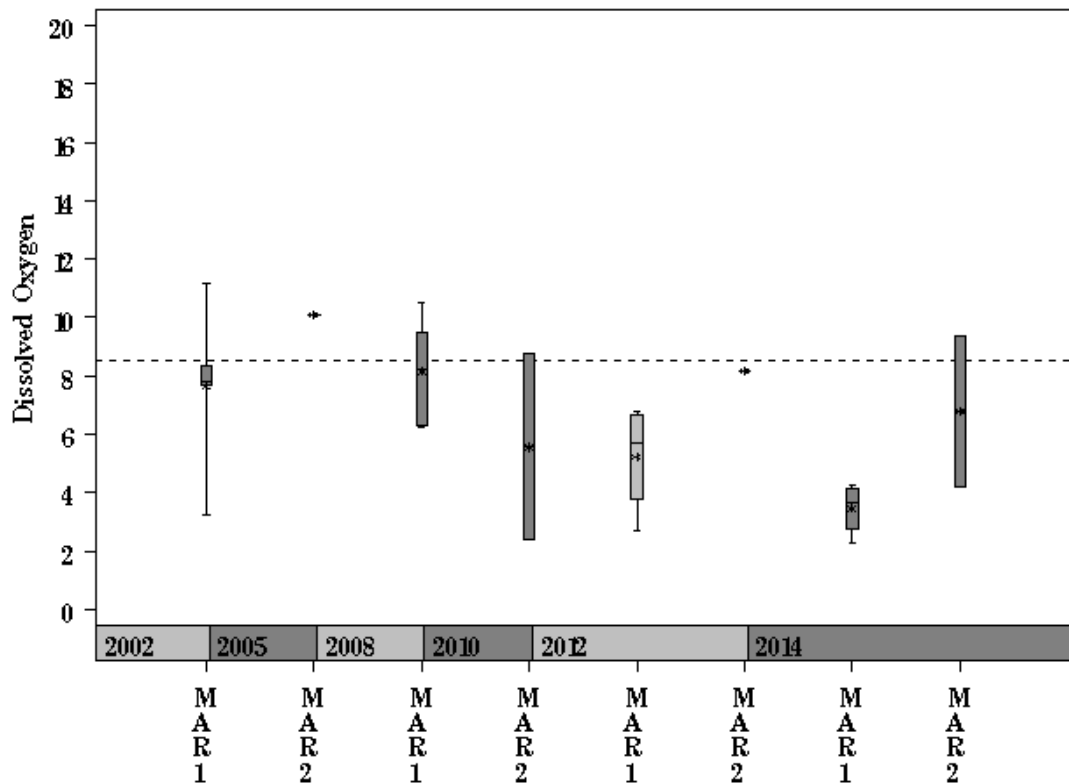
Marble Creek Watershed

Data Summary Graphs – Orthophosphate and Dissolved Oxygen (Downstream to Upstream by Year)

Parameter= ORTHOPHOSPHORUS AS P Unit= mg/L Watershed= Marble



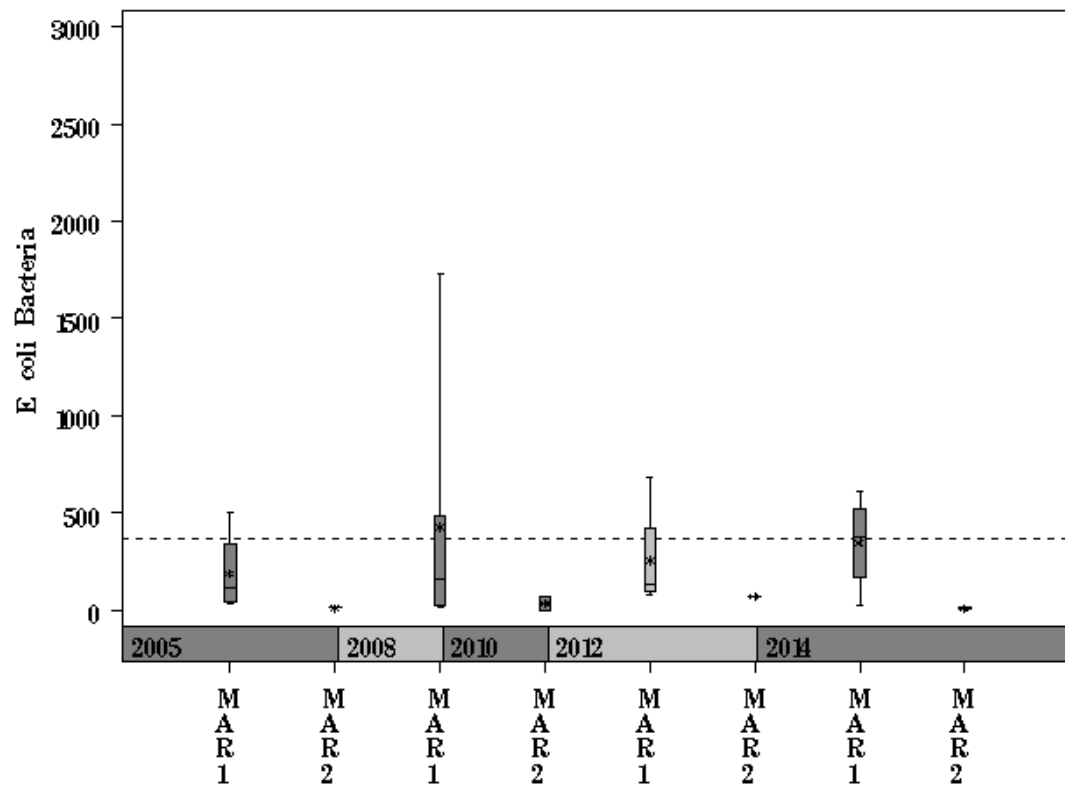
Parameter= DISSOLVED OXYGEN Unit= mg/L Watershed= Marble



Marble Creek Watershed

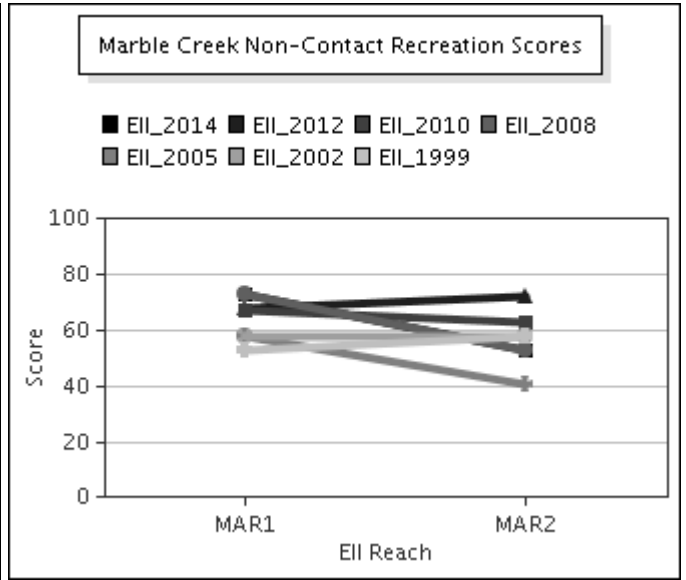
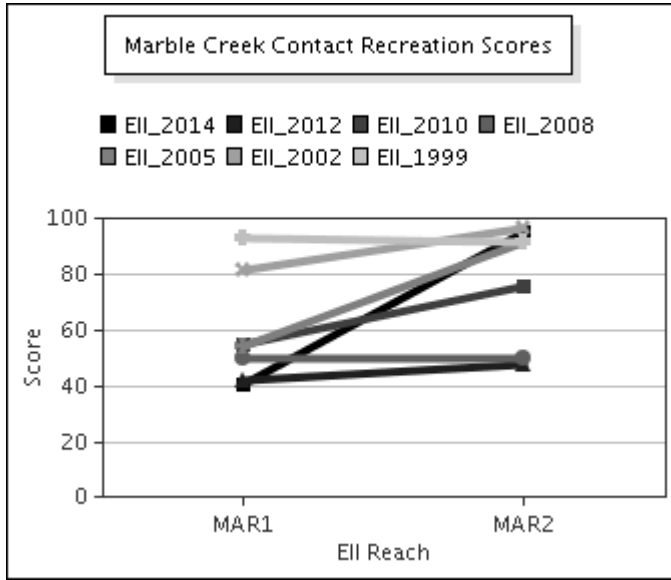
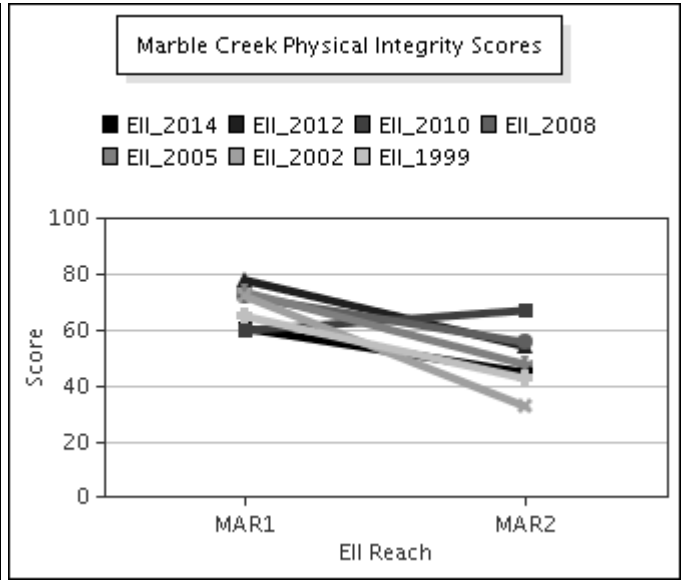
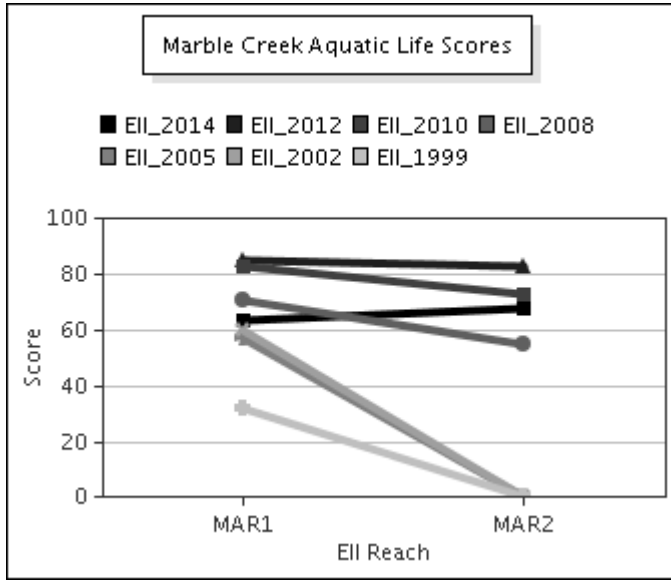
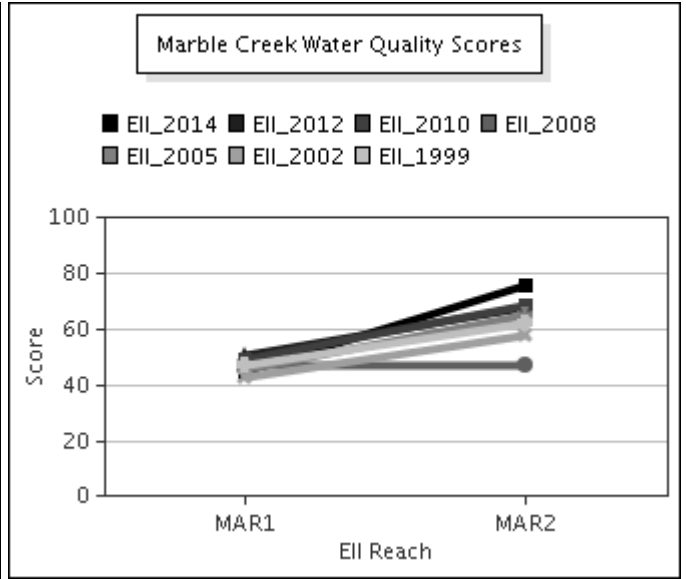
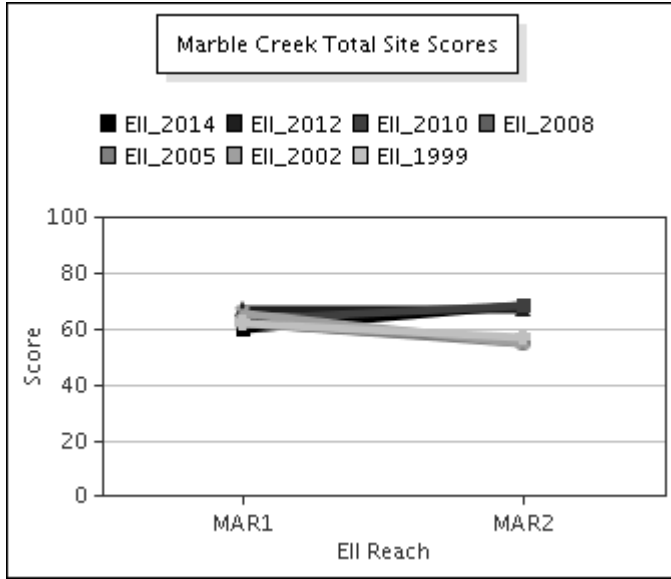
Data Summary Graphs – *E.coli* (Downstream to Upstream by Year)

Parameter= E COLI BACTERIA Unit= MPN/100mL Watershed= Marble



Marble Creek Watershed

Score Summary – Reach scores for each sample year



Marble Creek Watershed

Benthic Macroinvertebrates – Taxa List, Pollution Tolerance Index & Functional Feeding Group for 2014 Sample Sites (Downstream to Upstream)

Benthic Macroinvertebrate ID	PTI	FFG	Marble @ William Cannon (Site 231)	Marble @ Thaxton Rd (Site 232)
<i>Hydroptila</i> sp.	2	SC,PI	1	
<i>Callibaetis</i> sp.	4	CG		3
Copepoda	4	SC	1	
<i>Falceon quilleri</i>	4	SC,CG	8	
<i>Simulium</i> sp.	4	FC	19	
<i>Trichocorixa</i> sp.	5	P,CG		3
<i>Argia</i> sp.	6	P	1	
Chironomidae	6	P,FC	134	71
<i>Enallagma</i> sp.	6	P		6
<i>Microvelia</i> sp.	6	P	7	5
<i>Probezzia</i> sp.	6	P	1	
Tanypodinae	6	P	8	22
<i>Caenis</i> sp.	7	SC,CG	4	63
<i>Culicoides</i> sp.	7	P,CG		1
<i>Helisoma trivolvis</i>	7	SC		1
<i>Anopheles</i> sp.	8	FC	3	
Cladocera	8	FC	3	
<i>Hyalella</i> sp.	8	SH,CG	1	3
Oligochaeta	8	CG	2	
<i>Physella</i> sp.	9	SC		14
Collembola	10	CG		1
<i>Dugesia</i> sp.		P,CG	9	

Marble Creek Watershed

Benthic Macroinvertebrates – Metric Summary for 2014 Sample Sites (Downstream to Upstream)

Scoring Metric	Marble @ William Cannon (Site 231)	Marble @ Thaxton Rd (Site 232)
Number of Taxa *	14	10
Hilsenhoff Biotic Index *	5.8	6.5
Number of Ephemeroptera Taxa *	2	2
Percent of Total as Chironomidae *	70	48
Number of EPT Taxa *	3	2
Percent of Total as EPT *	6	34
Percent of Total as Predator *	79	56
Number of Intolerant Taxa *	4	1
Percent Dominance (Top 3 Taxa) *	80	77
EPT / EPT + Chironomidae	0	0
Number of Diptera Taxa	4	2
Number of Non-Insect Taxa	5	3
Number of Organisms	202	192
Percent Dominance (Top 1 Taxa)	66	37
Percent of Total as Collector / Gatherer	12	38
Percent of Total as Dominant Guild (FFG)	83	56
Percent of Total as Elmidae	0	0
Percent of Total as Filterers	83	48
Percent of Total as Grazers (PI & SC)	7	41
Percent of Total as Tolerant Organisms	0	7
Percent of Trichoptera as Hydropsychidae	0	0
Ratio of Intolerant : Tolerant Organisms	0.17	0.03
TCEQ Qualitative Aquatic Life Use Score	18	16
TCEQ Quantitative Aquatic Life Use Score	15	27

* **EII scoring parameter: Nine metric parameters are used in the calculation of the EII Benthic Subindex score. Other metrics are shown to supplement evaluation.**

1. # of Taxa: Higher diversity (number of taxa) correlates with greater biological integrity. The average number of taxa per site for 2013/2014 samples was 15; the lowest value was 5 and the highest value was 30.
2. Hilsenhoff Biotic Index (HBI): HBI values range from 0 to 10. Low HBI values reflect a higher abundance of taxa that are sensitive to organic (nutrient) pollution, thus a lower level of this type of pollution. The average HBI per site for 2013/2014 samples was 5.4; the lowest value was 3.7 and the highest value was 8.1.
3. # of Ephemeroptera taxa: A higher number of Ephemeroptera (mayfly) taxa correlates with greater biological integrity. The average number of taxa per site for 2013/2014 samples was 2; the lowest value was 0 and the highest value was 7.
4. % of total as Chironomidae: The percentage of the sample represented by the Dipteran family Chironomidae will increase with a decrease in biological integrity. The average percent Chironomidae per site for 2013/2014 samples was 16%; the lowest value was 0% and the highest value was 77%.
5. # of EPT Taxa: A higher number of Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) taxa correlates with greater biological integrity. The average number of EPT taxa per site for 2013/2014 samples was 4; the lowest value was 0 and the highest value was 12.
6. % of total as EPT: The percentage of the sample represented by the insect orders Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) will decrease with a decrease in biological integrity. The average percent EPT taxa per site for 2013/2014 samples was 46%; the lowest value was 0% and the highest value was 89%.
7. % of total as Predator: The percentage of the sample represented by predators is variable with regard to biological integrity. The average percent predator per site for 2013/2014 samples was 31%; the lowest value was 3% and the highest value was 82%.
8. # of Intolerant Taxa: A higher number of pollution intolerant taxa correlates with greater biological integrity. The average number of intolerant taxa per site for 2013/2014 samples was 5; the lowest value was 0 and the highest value was 15.
9. % Dominance (top 3 taxa): The percentage of the sample represented by the three most abundant taxa will increase with a decrease in biological integrity. The average percent of sample dominated by the top three taxa per site for 2013/2014 samples was 72%; the lowest value was 39% and the highest value was 96%.

Marble Creek Watershed

Diatoms – Taxa List & Pollution Tolerance Index for 2014 Sample Sites (Downstream to Upstream)

Diatom Species Name	PTI	Marble @ William Cannon (Site 231)	Marble @ Thaxton Rd (Site 232)
<i>Amphora inariensis</i>	4	15	
<i>Pinnularia acrosphaeria</i>	4	2	
<i>Rhopalodia parallela</i>	3.2		10
<i>Achnanthyidium altergracillimum</i>	3	4	69
<i>Achnanthyidium minutissimum</i>	3	94	53
<i>Achnanthyidium pyrenaicum</i>	3	2	
<i>Amphipleura pellucida</i>	3		14
<i>Amphora ovalis</i>	3		5
<i>Amphora pediculus</i>	3	65	
<i>Caloneis bacillum</i>	3	2	
<i>Caloneis ventricosa</i>	3		24
<i>Cymatopleura elliptica</i>	3		2
<i>Denticula kuetzingii</i>	3	86	47
<i>Diploneis parma</i>	3	2	
<i>Diploneis puella</i>	3		43
<i>Encyonema silesiacum</i>	3		37
<i>Encyonema triangulum</i>	3		2
<i>Encyonopsis microcephala</i>	3		24
<i>Fragilaria delicatissima</i>	3	16	7
<i>Gomphonema insigne</i>	3	2	
<i>Halamphora montana</i>	3		1
<i>Navicula cryptocephala</i>	3		5
<i>Navicula cryptotenella</i>	3	1	4
<i>Navicula radiosa</i>	3		35
<i>Navicula stroemii</i>	3	2	
<i>Nitzschia dissipata</i>	3		1
<i>Reimeria sinuata</i>	3	8	2
<i>Surirella spiralis</i>	3	2	
<i>Tabularia fasciculata</i>	3	1	
<i>Tryblionella angustata</i>	3	2	3
<i>Craticula buderi</i>	2		5
<i>Cyclotella meneghiniana</i>	2		6
<i>Diadismis confervacea</i>	2	2	
<i>Fragilaria capucina</i> var. <i>mesolepta</i>	2	88	
<i>Gyrosigma acuminatum</i>	2		7
<i>Melosira varians</i>	2	40	
<i>Navicula recens</i>	2	2	5
<i>Navicula trivialis</i>	2		5
<i>Navicula veneta</i>	2	2	4
<i>Nitzschia amphibia</i>	2	6	6
<i>Nitzschia filiformis</i>	2		2
<i>Nitzschia frustulum</i>	2	4	2
<i>Nitzschia inconspicua</i>	2	4	
<i>Nitzschia paleacea</i>	2		12
<i>Nitzschia sigma</i>	2		1
<i>Nitzschia tropica</i>	2		1
<i>Sellaphora laevissima</i>	2	2	
<i>Sellaphora pupula</i>	2		4
<i>Surirella angusta</i>	2	6	
<i>Surirella brebissonii</i>	2	1	
<i>Tryblionella apiculata</i>	2	4	7
<i>Gomphonema parvulum</i>	1	2	3
<i>Nitzschia palea</i>	1		14
<i>Amphora copulata</i>		1	1
<i>Biremis circumtexta</i>			4
<i>Eolimna minima</i>		14	
<i>Navicula lanceolata</i>			20
<i>Navicula rostellata</i>			1
<i>Pleurosigma elongatum</i>			2
<i>Ulnaria ulna</i>		16	

Marble Creek Watershed

Diatoms – Metric Summary for 2014 Sample Sites (Downstream to Upstream)

Scoring Metric	Marble @ William Cannon (Site 231)	Marble @ Thaxton Rd (Site 232)
<i>Cymbella</i> Richness	1	4
Number of organisms	500	500
Number of taxa	33	41
Percent motile taxa	8	23
Percent similarity to reference condition	35	38
Pollution tolerance index	2.68	2.79

* **EII scoring parameter: Four metric parameters are used in the calculation of the EII Diatom Subindex score: *Cymbella* richness, percent motile taxa, percent similarity to reference condition and pollution tolerance index. Number of taxa is non-scoring, but is shown to supplement evaluation. The number of organisms is typically a sample of 500, but occasionally differs due to sample conditions.**

1. *Cymbella* Richness: The Cymbelloid taxa include species in the genus *Cymbella*, in addition to some species belonging to the genera *Cymbellopsis*, *Cymbopleura*, *Encyonema*, *Encyonemopsis*, *Navicymbula* and *Reimeria*. Their presence highlights the presence of sensitive species, especially with regard to impervious cover, and this value increases with an increase in overall water quality. The average number of Cymbelloid taxa per site for 2013/2014 samples was 3; the lowest value was 0 and the highest value was 7.
2. % Motile Taxa: This is a siltation index showing the relative abundance of genera that are able to move towards the surface if covered by silt. A higher percentage is indicative of a degraded condition caused by increased silt pollution. The average percent motile taxa per site for 2013/2014 samples was 16%; the lowest value was 0% and the highest value was 77%.
3. % similarity to reference condition: This percentage compares a site to reference sites that are selected based on having low percent impervious cover. A higher percentage reflects greater biological integrity. The average percent similarity per site for 2013/2014 samples was 31%; the lowest value was 6% and the highest value was 57%.
4. Pollution Tolerance Index (PTI): This is a total value for a sample, which is a function of the abundance of each taxon (usually species) in a sample and the individual PTI's for each of those taxa. Individual PTI's for each taxon range from 1 (most pollution tolerant) to 4 (most pollution sensitive), thus higher total PTI's for a site reflect greater biological integrity. The average PTI per site for 2013/2014 samples was 2.76; the lowest value was 1.70 and the highest value was 3.45.

Marble Creek Watershed

Site Photographs



231_t00-ds-03_28_2002



231_t00-ur-03_28_2002



231_t00-us-06_16_2005



231_t0-us-06_16_2008



231_00-us-05_18_2010



231_00-ds-05_18_2010

Marble Creek Watershed

Site Photographs



232_t00-na-03_28_2002



232_t00-us-03_28_2002



232_t00-ds-06_15_2005



232_t0-us-06_16_2008



232_00-us-05_19_2010



232_00-ds-05_19_2010

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