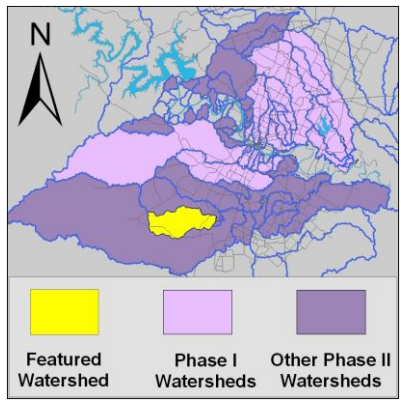


Little Bear Creek Watershed

Summary Sheet

Catchment	Total area	23.1 sq. miles				
	Area in recharge	18.8 sq. miles				
	Creek length	15 miles				
	Receiving water	Bear Creek				
Demographics	2000 population	4,232				
	2030 projected population	18,341				
	30 year projected % increase	333 %				
Land Use	Impervious cover (2003 estimate)	3.9 %				
	Impervious cover (2013 estimate)	4.0 %				
Overall EII Scores	2001	2004	2007	2010	2012	2014
	72	65	76	80	77	81



Flow Regime* for Sample Sites on Little Bear Creek

Site	Site Name	1999		2001				2004				2007				2010				2011		2012				2014									
		Jan	Jan	Mar	Mar	Jun	Sep	Dec	Mar	May	May	Jun	Oct	Dec	Feb	May	Jun	Jul	Sep	Dec	Mar	May	May	Oct	Dec	Mar	Apr	May	Jul	Sep	Jan	Apr	Jun	Jul	Sep
1103	FM 967	B	B	B	S			B	B	n																									
3374	Ashmun										B	B	B	n	B	B	B	B	B	B	n	B	B	B	n	B	B		n	n	n	n	B	n	n
1101	BER	B	B	B	B	B	B	B	B	n			B	n	B	B	B	B	B	B	B	B	B	n	B		B	B	n	B	B	B	B	n	
1102	Carpenter	n	B																																

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

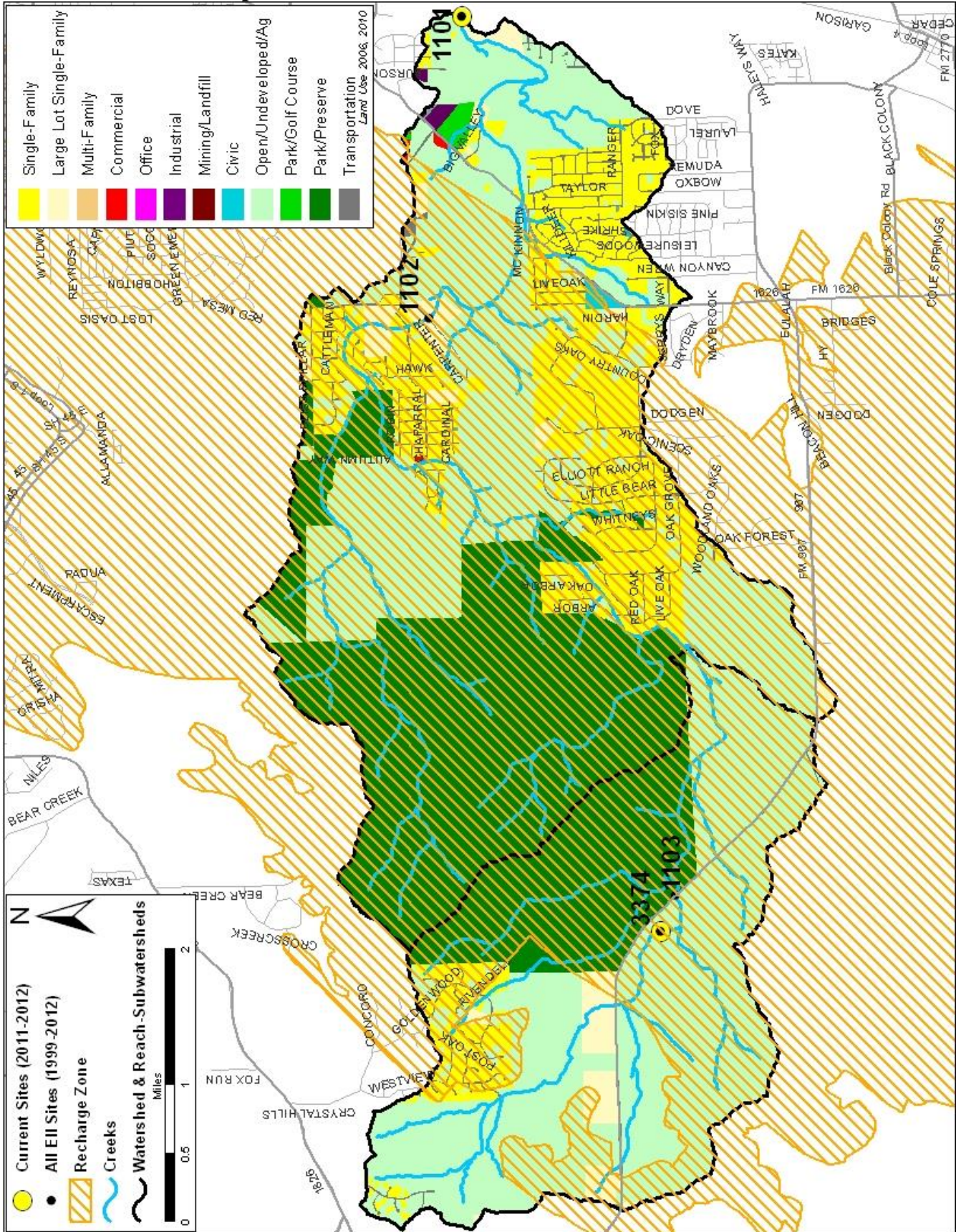
Index scores* for Little Bear Creek Sites by Year

Reach	Site	Site Name	Year	Water Quality	Sediment**	Contact Rec.	Non-Contact Rec.	Physical Integrity	Aquatic Life	Benthic subindex	Diatom subindex	Total EII Score
LBR1	1101	Little Bear Creek @ Bear Creek	1998	50	86	80	63	78	42	49	34	67
LBR1	1102	Little Bear Creek @ Carpenter Rd	1998		86		65	76				57
LBR2	1103	Little Bear Creek @ FM 967	1998	71	86	94	81	76	81	70	92	82
LBR1	1101	Little Bear Creek @ Bear Creek	2001	63	81	84	71	74	39	45	33	66
LBR2	1103	Little Bear Creek @ FM 967	2001	53	81	78	88	75	68	61	75	70
LBR1	1101	Little Bear Creek @ Bear Creek	2004	55	84	53	62	58				52
LBR2	3374	Little Bear @ Ashmun Property	2004	71	84	55	92	87	82	75	89	79
LBR1	1101	Little Bear Creek @ Bear Creek	2007	58	76	59	83	78	66	71	61	70
LBR2	3374	Little Bear @ Ashmun Property	2007	78	76	86	95	78	76	69	82	82
LBR1	1101	Little Bear Creek @ Bear Creek	2010	68	83	90	78	76	70	89	51	78
LBR2	3374	Little Bear @ Ashmun Property	2010	79	83	56	96	88	86	85	86	81
LBR1	1101	Little Bear Creek @ Bear Creek	2012	68	80	59	81	93	77	98	55	76
LBR2	3374	Little Bear @ Ashmun Property	2012	67	80	57	98	89	72	92	52	77
LBR1	1101	Little Bear Creek @ Bear Creek	2014	70	79	82	98	85	85	100	70	83
LBR2	3374	Little Bear @ Ashmun Property	2014		79		88	69	89	96	81	81

* 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

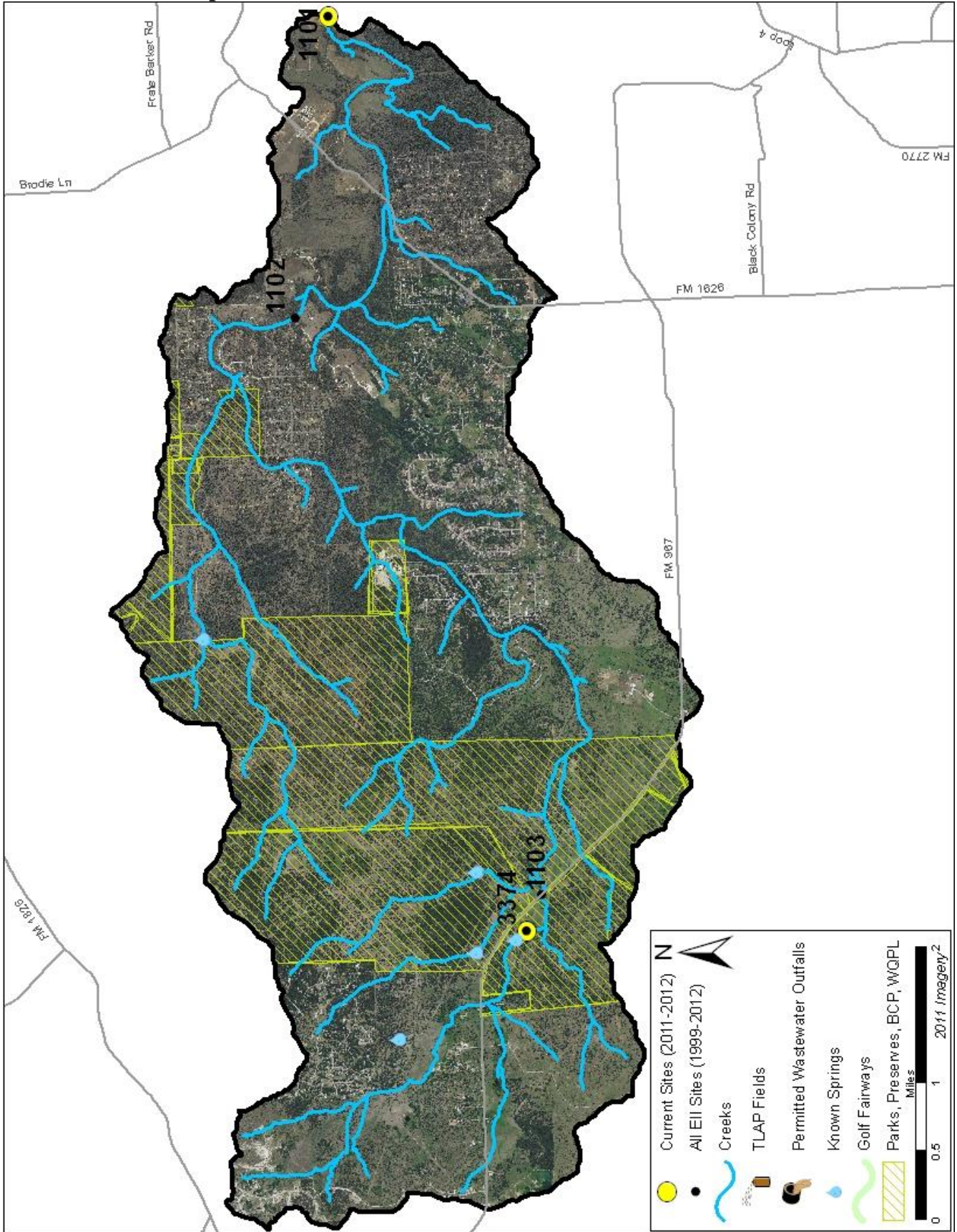
Little Bear Creek Watershed

Land Use Map



Little Bear Creek Watershed

Aerial Map



Little Bear 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	<> Value	flag
Little Bear @ Bear Creek	1101	LBR1	01/15/2014	10.3		495		7.67		10.5		38.4	
Little Bear @ Bear Creek	1101	LBR1	04/17/2014	17.8		502		7.22		3.0		17.3	
Little Bear @ Bear Creek	1101	LBR1	06/12/2014	27.5		486		7.53		7.3			
Little Bear @ Bear Creek	1101	LBR1	07/02/2014	27.8		534		7.32		5.5		32.3	
Site 1101 Mean				20.8		504		7.44		6.6		29.3	
Little Bear @ Ashmun	3374	LBR2	06/11/2014	23.7		617		7.65		6.5			
Site 3374 Mean				23.7		617		7.65		6.5			
Watershed Mean				21.4		527		7.48		6.5		29.3	

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	

Little Bear 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			

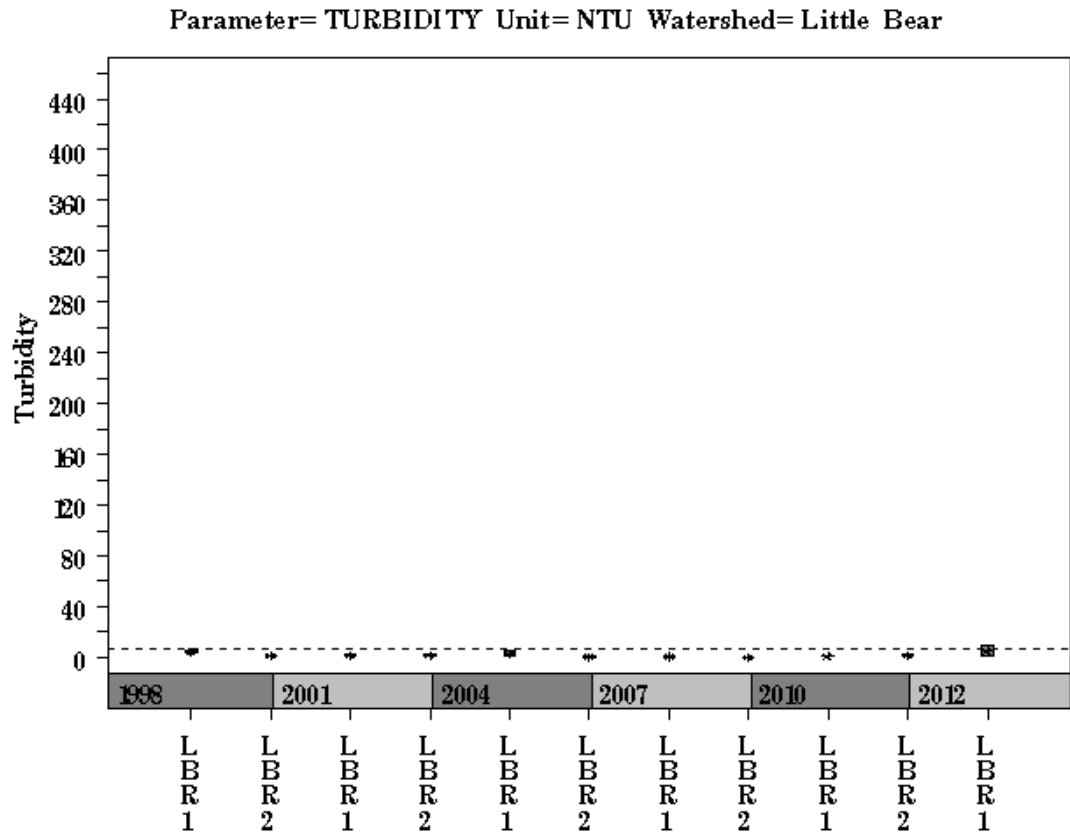
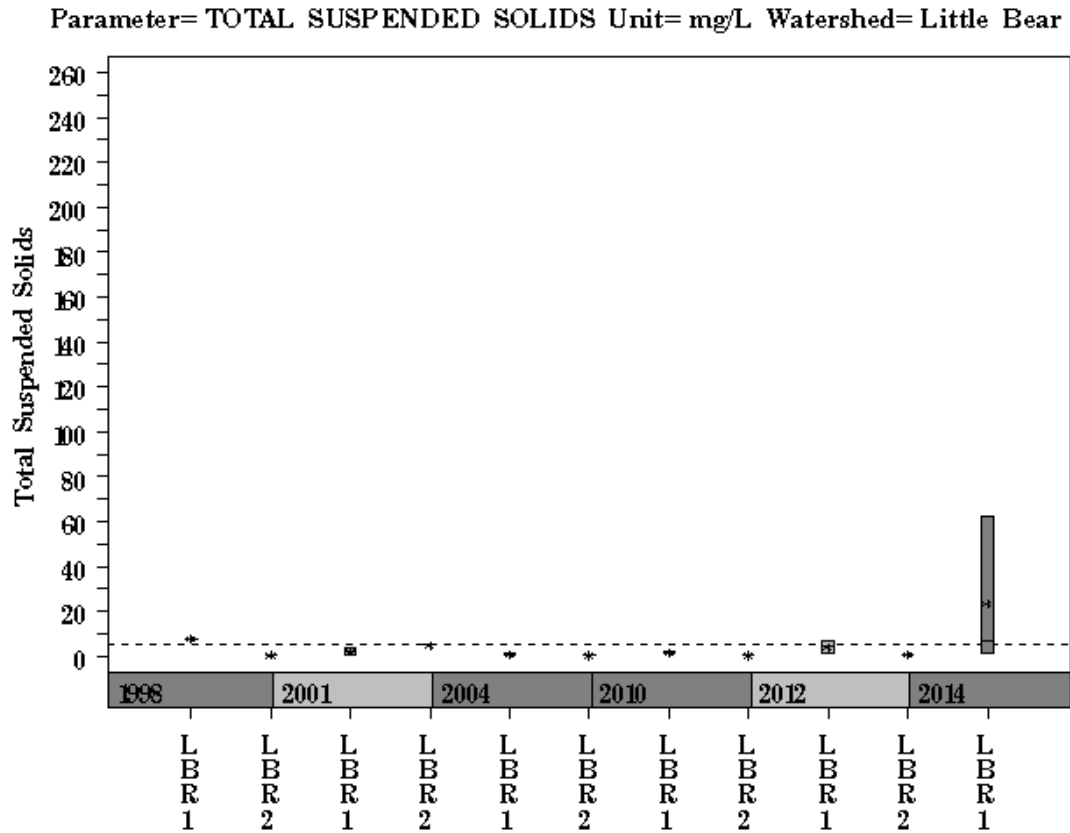
Site Name	Site #	Reach	Date	NH3-N		NO3/NO2		Ortho-P		T.S.S.		Turb.		
				<>	Value	flag	<>	Value	flag	<>	Value	flag	<>	Value
Little Bear @ Bear Creek	1101	LBR1	01/15/2014	<J	0.008		1.67	<J	0.004	<J	1.09		0.8	R
Little Bear @ Bear Creek	1101	LBR1	04/17/2014		0.123		<J	0.01		R	6.93		2.0	R
Little Bear @ Bear Creek	1101	LBR1	06/12/2014											
Little Bear @ Bear Creek	1101	LBR1	07/02/2014	<J	0.008		0.10		0.015		62.50		1.3	
Site 1101 Mean					0.046		0.59		0.011		23.51		1.4	
Little Bear @ Ashmun	3374	LBR2	06/11/2014											
Site 3374 Mean														
Watershed Mean					0.046		0.59		0.011		23.51		1.4	

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

Little Bear Creek Watershed

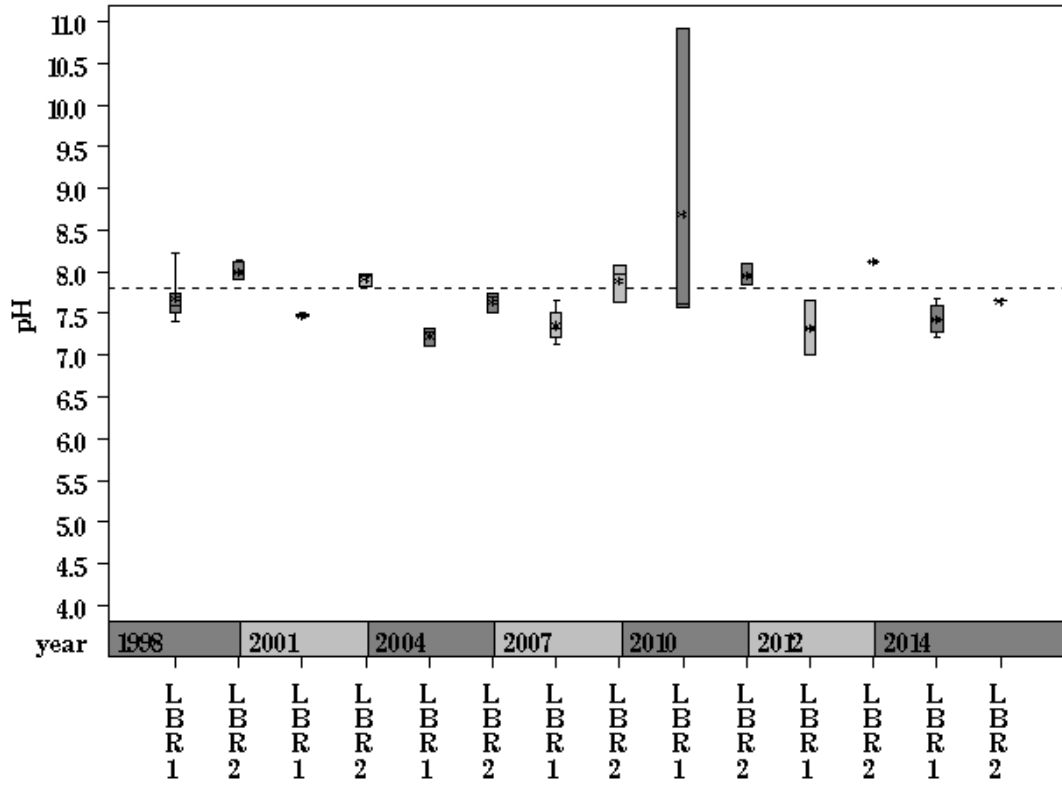
Data Summary Graphs – Total Suspended Solids and Turbidity (Downstream to Upstream by Year)



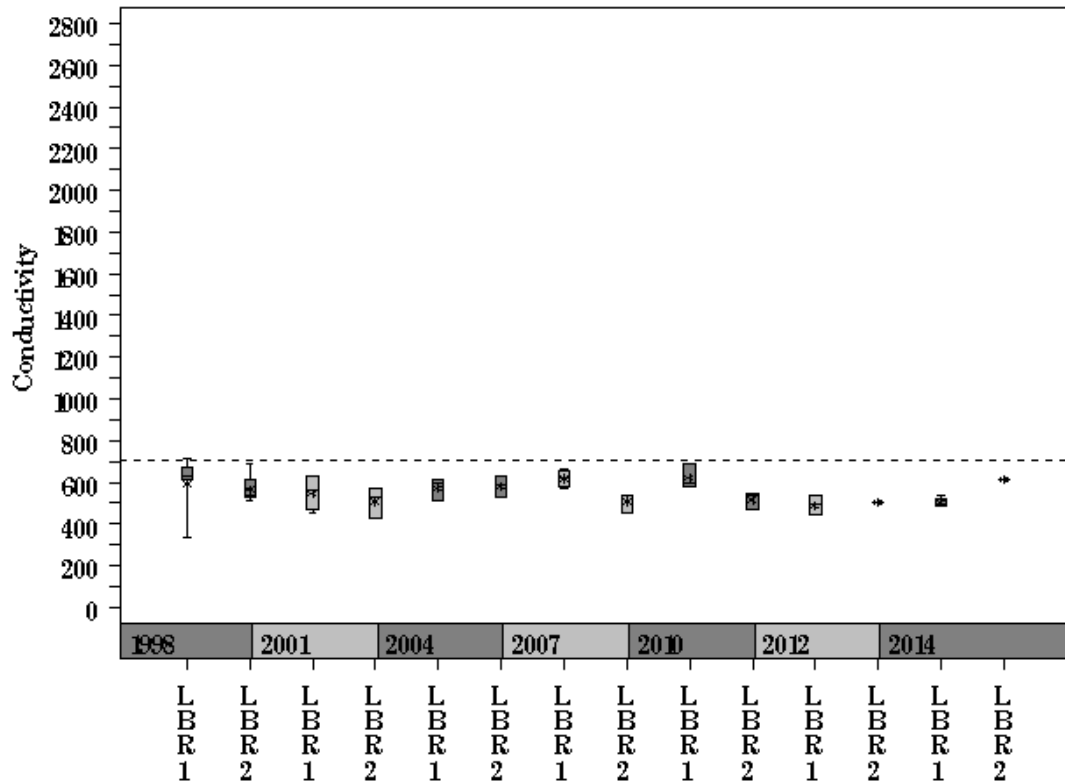
Little Bear Creek Watershed

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

Parameter= PH Unit= Standard units Watershed= Little Bear



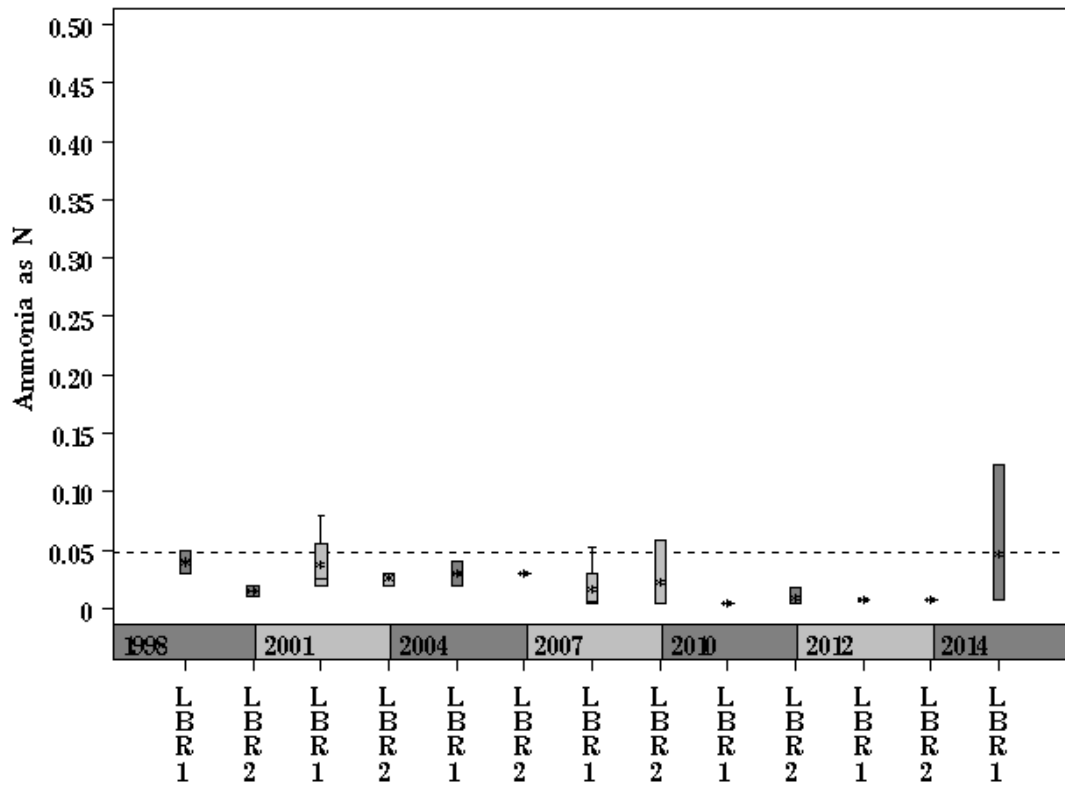
Parameter= CONDUCTIVITY Unit= uS/cm Watershed= Little Bear



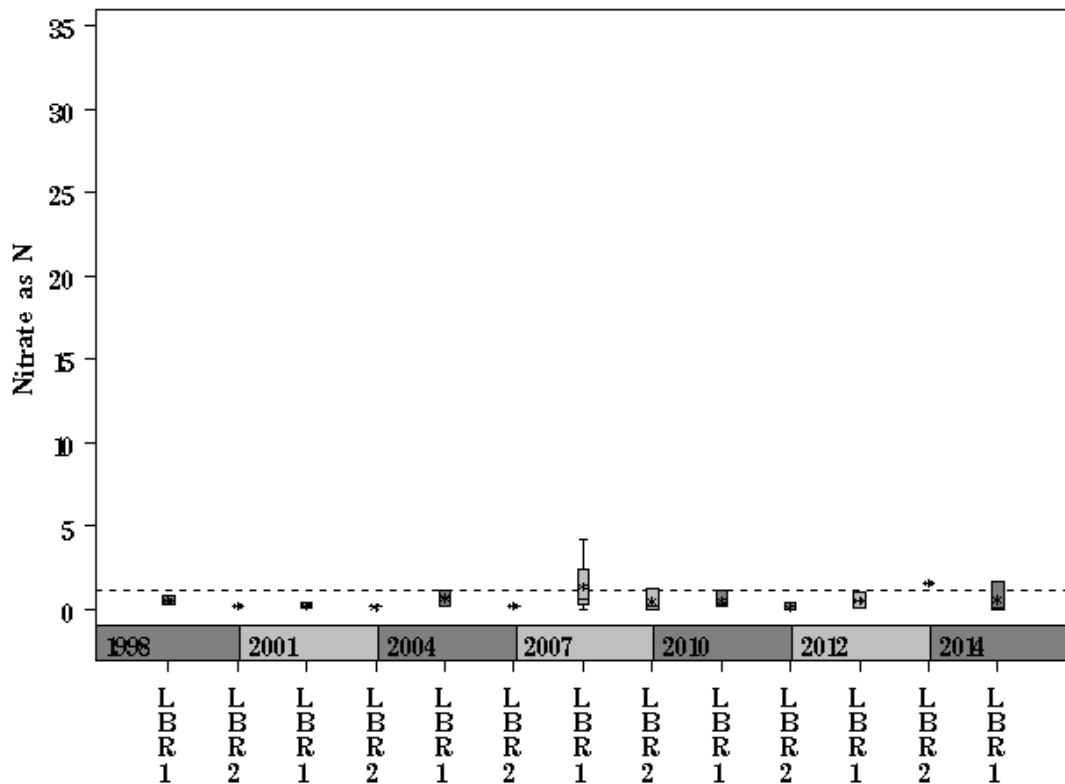
Little Bear Creek Watershed

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

Parameter= AMMONIA AS N Unit= mg/L Watershed= Little Bear



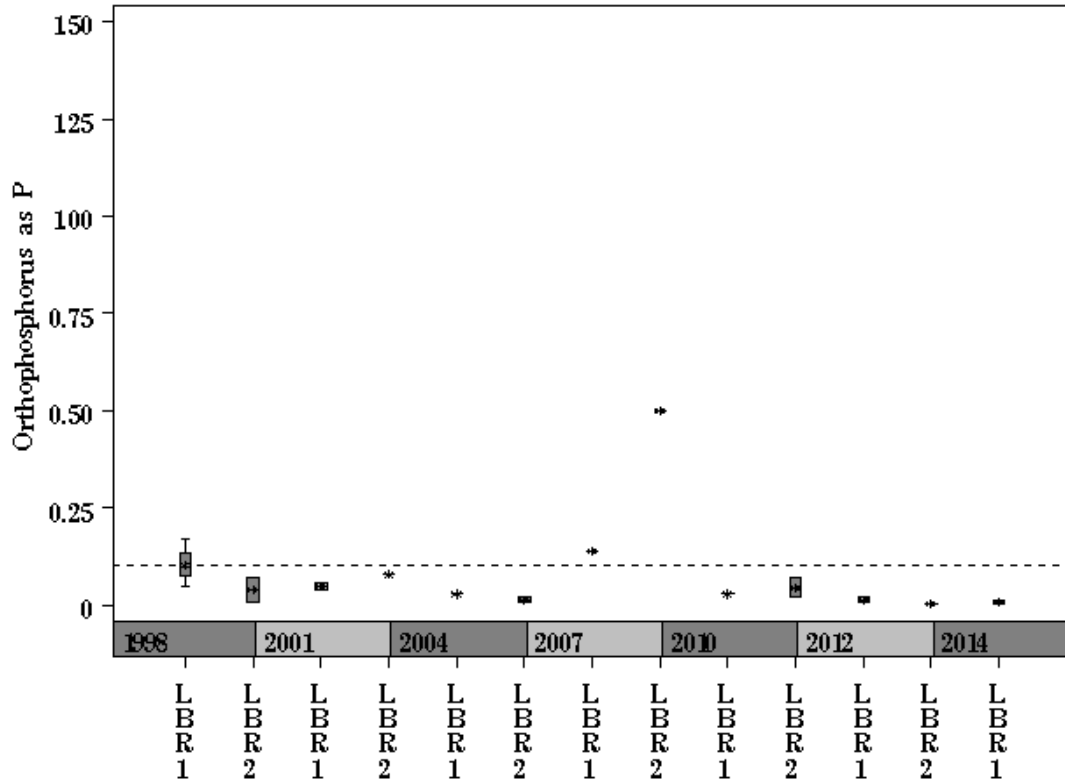
Parameter= NITRATE AS N Unit= mg/L Watershed= Little Bear



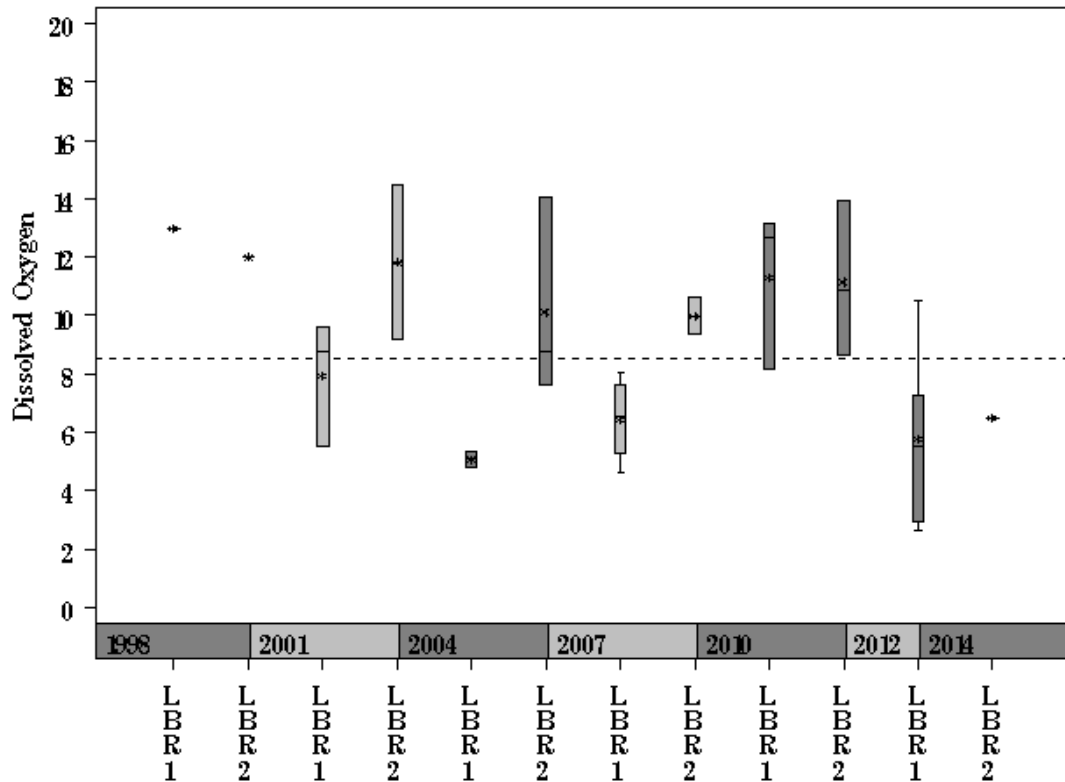
Little Bear Creek Watershed

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

Parameter= ORTHOPHOSPHORUS AS P Unit= mg/L Watershed= Little Bear

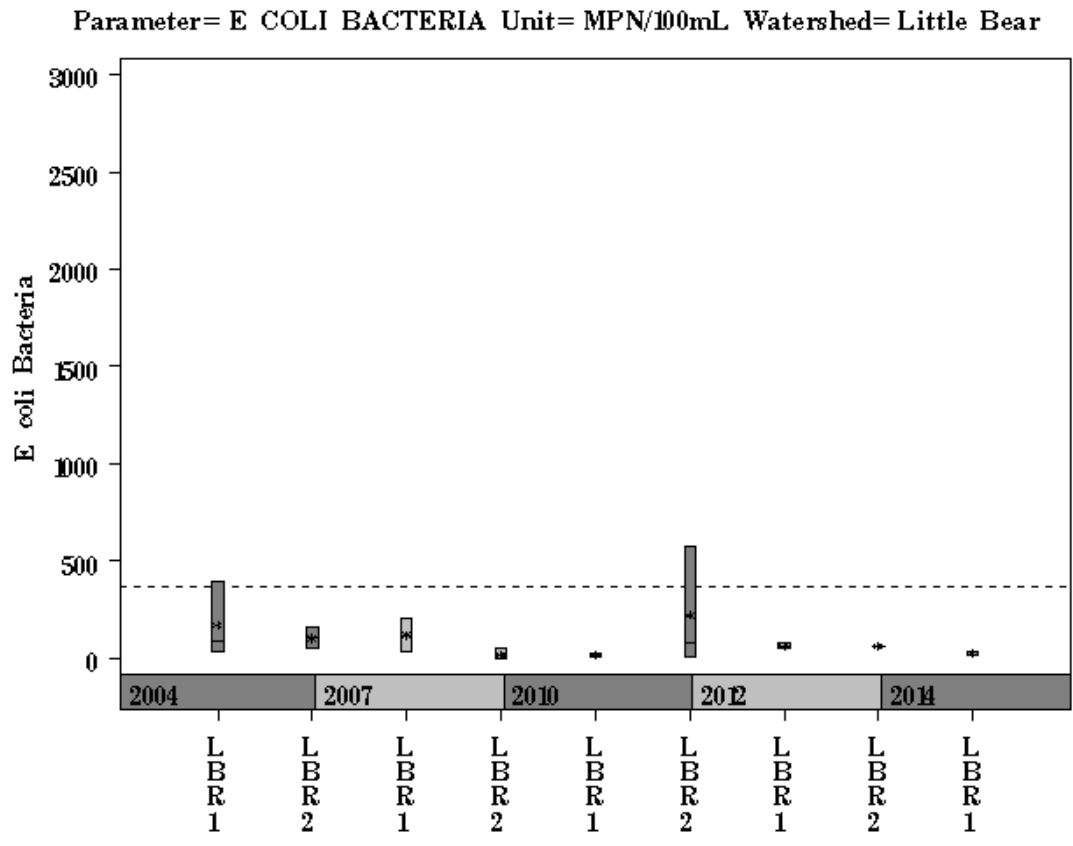


Parameter= DISSOLVED OXYGEN Unit= mg/L Watershed= Little Bear



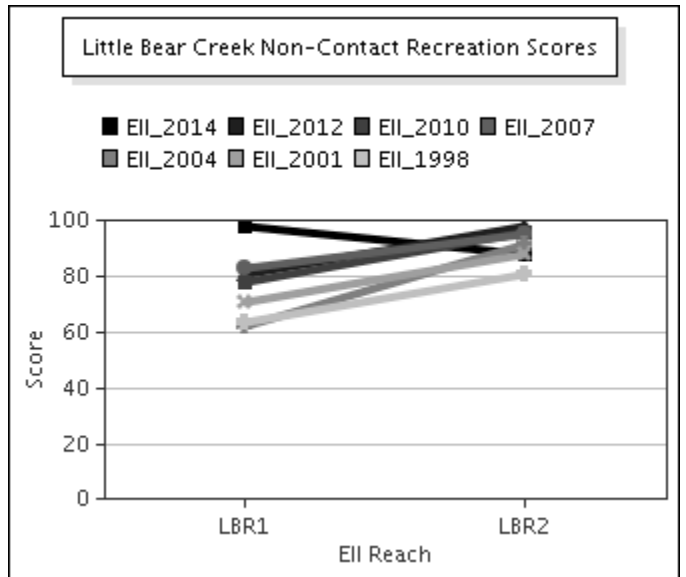
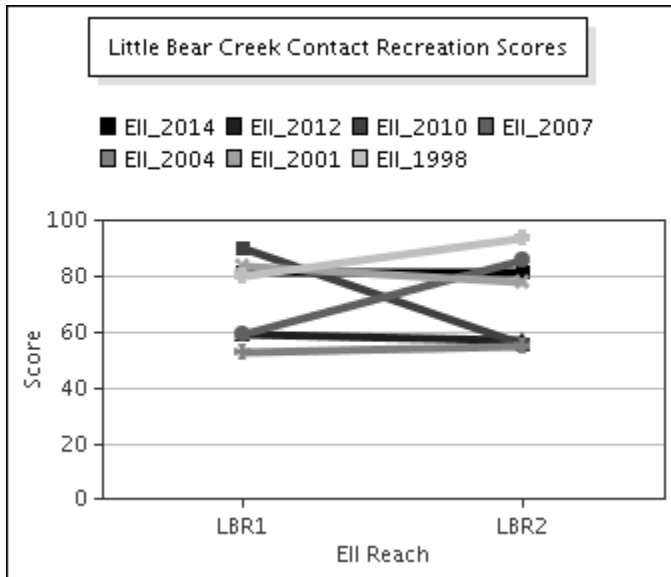
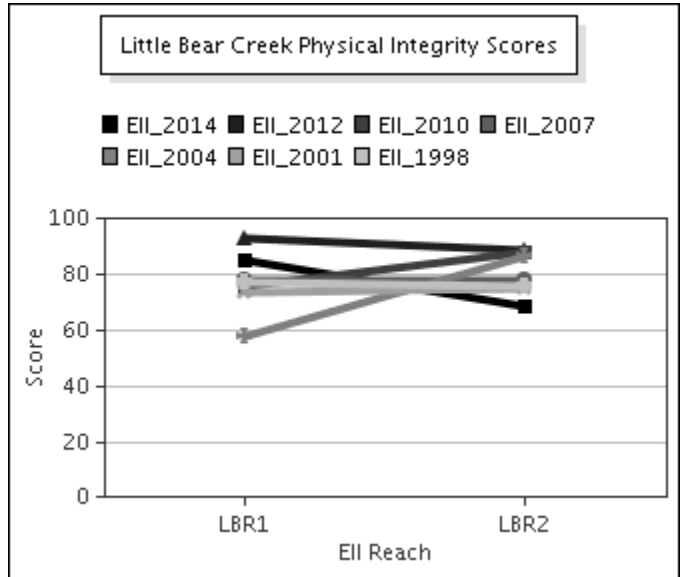
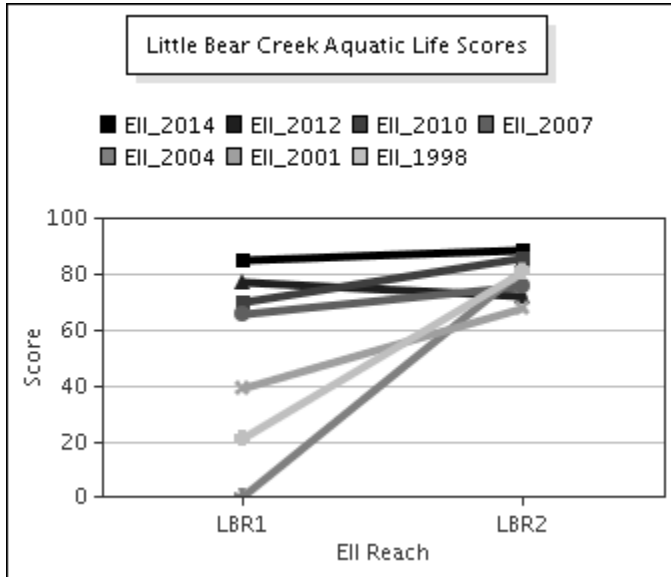
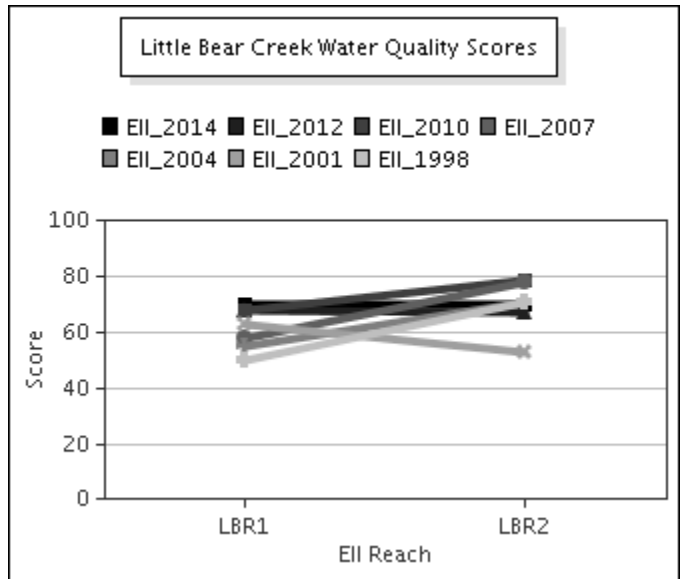
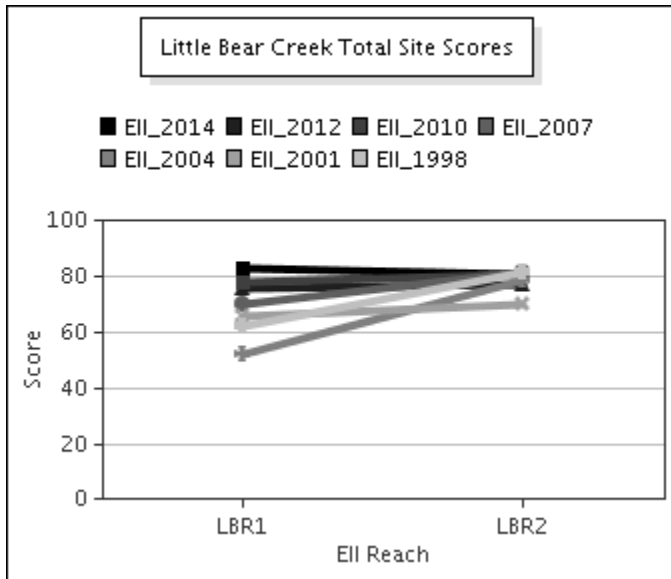
Little Bear Creek Watershed

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



Little Bear Creek Watershed

Score Summary – Reach scores for each sample year



Little Bear Creek Watershed

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

Benthic Macroinvertebrate ID	PTI	FFG	Little Bear @ Bear Creek (Site 1101)	Little Bear @ Ashmun (Site 3374)
<i>Chimarra</i> sp.	2	FC	74	2
<i>Hydroptila</i> sp.	2	SC,PI	5	
<i>Camelobaetidius</i> sp.	4	CG	4	8
<i>Fallceon quilleri</i>	4	SC,CG	47	17
<i>Psephenus</i> sp.	4	SC	3	
<i>Simulium</i> sp.	4	FC	87	23
<i>Helochaers</i> sp.	5	CG		1
<i>Argia</i> sp.	6	P	17	
<i>Cheumatopsyche</i> sp.	6	FC	29	
Chironomidae	6	P,FC	28	1
<i>Fossaria</i> sp.	6	SC	1	
Hydracarina	6		2	1
<i>Microvelia</i> sp.	6	P		1
<i>Stenonema femoratum</i>	6	SC,CG	30	20
Tanypodinae	6	P	4	
<i>Bezzia</i> sp. / <i>Palpomyia</i> sp.	7	P,CG		1
<i>Caenis</i> sp.	7	SC,CG	36	2
<i>Helisoma anceps</i>	7	SC	1	
<i>Helisoma trivolvis</i>	7	SC	4	
<i>Stenelmis</i> sp.	7	SC,CG	1	
Hirudinea	8	P	1	
<i>Hyalella</i> sp.	8	SH,CG	5	
Oligochaeta	8	CG	8	3
<i>Berosus</i> sp.	9	CG	1	
<i>Physella</i> sp.	9	SC	50	10
<i>Trepobates</i> sp.	10	P		1

Little Bear Creek Watershed

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

Scoring Metric	Little Bear @ Bear Creek (Site 1101)	Little Bear @ Ashmun (Site 3374)
Number of Taxa *	21	14
Hilsenhoff Biotic Index *	5.1	5.3
Number of Ephemeroptera Taxa *	4	4
Percent of Total as Chironomidae *	7	1
Number of EPT Taxa *	7	5
Percent of Total as EPT *	51	54
Percent of Total as Predator *	11	4
Number of Intolerant Taxa *	6	4
Percent Dominance (Top 3 Taxa) *	48	66
EPT / EPT + Chironomidae	1	1
Number of Diptera Taxa	2	3
Number of Non-Insect Taxa	8	3
Number of Organisms	438	91
Percent Dominance (Top 1 Taxa)	20	25
Percent of Total as Collector / Gatherer	30	57
Percent of Total as Dominant Guild (FFG)	51	57
Percent of Total as Elmidae	0	0
Percent of Total as Filterers	51	29
Percent of Total as Grazers (PI & SC)	41	54
Percent of Total as Tolerant Organisms	12	12
Percent of Trichoptera as Hydropsychidae	27	0
Ratio of Intolerant : Tolerant Organisms	1.00	1.27
TCEQ Qualitative Aquatic Life Use Score	33	20
TCEQ Quantitative Aquatic Life Use Score	31	29

* **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%.

Little Bear Creek Watershed

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

Diatom Species Name	PTI	Little Bear @ Bear Creek (Site 1101)	Little Bear @ Ashmun (Site 3374)
<i>Amphora inariensis</i>	4	6	
<i>Eunotia arcus</i>	4	1	
<i>Achnanthydium alteragracillimum</i>	3		1
<i>Amphora pediculus</i>	3	3	
<i>Caloneis bacillum</i>	3		6
<i>Cocconeis pediculus</i>	3	2	
<i>Cymbella hustedtii</i>	3	1	18
<i>Denticula kuetzingii</i>	3		371
<i>Diploneis puella</i>	3		2
<i>Encyonema silesiacum</i>	3		37
<i>Encyonema triangulum</i>	3	2	4
<i>Eunotia bilunaris</i>	3	1	
<i>Gomphonema affine</i>	3	227	8
<i>Gomphonema clavatum</i>	3	39	
<i>Gomphonema gracile</i>	3	8	
<i>Reimeria sinuata</i>	3	1	
<i>Rhoicosphenia abbreviata</i>	3	7	
<i>Fragilaria vaucheriae</i>	2	1	
<i>Gomphonema angustatum</i>	2	51	10
<i>Nitzschia amphibia</i>	2	30	
<i>Gomphonema parvulum</i>	1	73	
<i>Cocconeis placentula</i> var. <i>euglypta</i>		37	
<i>Cymbella excisa</i>			4
<i>Delicata delicatula</i>			16
<i>Gomphonema lagenula</i>		6	
<i>Gomphonema lateripunctatum</i>			2
<i>Ulnaria acus</i>		1	4
<i>Ulnaria ulna</i>		3	17

Little Bear Creek Watershed

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

Scoring Metric	Little Bear @ Bear Creek (Site 1101)	Little Bear @ Ashmun (Site 3374)
<i>Cymbella</i> Richness	3	4
Number of organisms	500	500
Number of taxa	20	14
Percent motile taxa	6	0
Percent similarity to reference condition	15	21
Pollution tolerance index	2.51	2.98

* **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.

Little Bear Creek Watershed

Site Photographs



3374_t00-ds-05_25_2004



3374_t00-us-05_25_2004



3374_00-ur-05_20_2010



3374_ur_06_27_2007



3374_00-ds-05_20_2010



3374_00-us-05_20_2010

Little Bear Creek Watershed

Site Photographs



1103_t00-ds-05_17_2004



1103_t00-us-05_17_2004



1101_t00-us-05_25_2004



1101_us_07_13_2007



1101_00-us-05_28_2010



1101_00-ds-05_28_2010

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