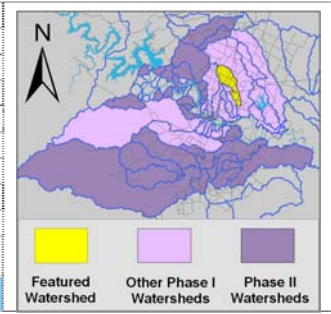


# Little Walnut Creek Watershed

## Watershed Overview

Catchment	Total area	11 square miles					
	Area in recharge	none					
	Creek length	9 miles					
Demographics	Receiving water	Walnut Creek					
	2000 population	63,827					
	2030 projected population	69,571					
Land Use	30 year projected % increase	9 %					
	Impervious cover (2003 estimate)	44.0 %					
	Impervious cover (2013 estimate)	50.2 %					
Overall EII Scores	2000	2003	2006	2009	2011	2013	2015
	70	63	67	65	63	70	67



## Flow Regime\* for Sample Sites on Little Walnut Creek Upstream to Downstream

Site	2001		2003					2006					2009					2010					2011					2013					2015				
	Feb	Feb	Feb	Mar	Mar	May	Sep	Dec	Feb	May	Jul	Aug	Nov	Feb	May	May	Jun	Oct	Dec	Dec	Mar	Jun	Jun	Sep	Jan	Apr	May	Jun	Jun	Sep	Jan	Apr	May	Jul	Sep		
838	B	B	B	B	B	B	B	B	B	B	B	n	B	B	B	B	B	B	B	B	n	B	n	B	B	B	B	n	B	B	B	B	B	n			
3860									B	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		
839	B	B	B	B	B	B	B	B																													
3857									B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
634	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
840	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 Little Walnut Creek Sites by Year

Reach	Site	Site Name	Year	Water Quality	Sediment t**	Contact Rec.	Non-Contact Rec.	Physical Integrity	Aquatic Life	Benthic subindex	Diatom subindex	Total EII Score
LWA1	634	Little Walnut Creek @ US183	1996	68	82	76	64	34	68	63	72	65
LWA1	840	Little Walnut @ US290	1996	60	82	17	80	77	66	51	80	64
LWA2	839	Little Walnut @ Hermitage Drive	1996	68	82	55	65	71	66	63	69	68
LWA4	838	Little Walnut @ Golden Meadow Rd	1996	56	82	11	68	61	29	29	23	51
LWA1	634	Little Walnut Creek @ US183	2000	75	92	89	84	35	54	49	58	72
LWA1	840	Little Walnut @ US290	2000	70	92	90	83	55	67	64	69	76
LWA2	839	Little Walnut @ Hermitage Drive	2000	67	92	91	64	31	68	64	71	69
LWA4	838	Little Walnut @ Golden Meadow Rd	2000	54	92	71	62	31	75	91	59	64
LWA1	634	Little Walnut Creek @ US183	2003	55	75	79	60	58	71	75	67	66
LWA1	840	Little Walnut @ US290	2003	58	75	72	77	67	48	50	46	66
LWA2	839	Little Walnut @ Hermitage Drive	2003	57	75	78	73	53	59	66	52	66
LWA4	838	Little Walnut @ Golden Meadow Rd	2003	54	75	35	58	48	54	61	46	54
LWA1	634	Little Walnut Creek @ US183	2006	67	80	63	73	45	91	91		70
LWA2	3857	Little Walnut @ Cameron Rd	2006	67	80	68	73	49	82	81	82	70
LWA3	3860	Little Walnut @ Georgian Dr	2006	63	80	55	72	53	83	82	84	68
LWA4	838	Little Walnut @ Golden Meadow Rd	2006	51	80	25	72	55	71	61	80	59
LWA1	634	Little Walnut Creek @ US183	2009	73	78	54	78	49	95	90	99	71
LWA2	3857	Little Walnut @ Cameron Rd	2009	69	78	44	70	58	79	75	82	66
LWA3	3860	Little Walnut @ Georgian Dr	2009	65	78	32	67	52	91	82	99	64
LWA4	838	Little Walnut @ Golden Meadow Rd	2009	59	78	27	70	54	71	64	77	60
LWA1	634	Little Walnut Creek @ US183	2011	71	80	74	33	47	50	50		59
LWA2	3857	Little Walnut @ Cameron Rd	2011	57	80	61	73	72	91	99	82	72
LWA3	3860	Little Walnut @ Georgian Dr	2011	74	80	50	54	49	77	71	83	64
LWA4	838	Little Walnut @ Golden Meadow Rd	2011	68	80	35	48	50	58	41	74	55
LWA1	634	Little Walnut Creek @ US183	2013	78	78	71	76	60	92	96	88	76
LWA2	3857	Little Walnut @ Cameron Rd	2013	71	78	66	63	72	92	86	97	74
LWA3	3860	Little Walnut @ Georgian Dr	2013	70	78	44	68	71	83	69	97	69
LWA4	838	Little Walnut @ Golden Meadow Rd	2013	68	78	25	75	43	66	52	79	59
LWA1	634	Little Walnut Creek @ US183	2015	66	72	80	79	66	89	84	94	75
LWA2	3857	Little Walnut @ Cameron Rd	2015	52	72	37	77	67	88	88	88	67
LWA3	3860	Little Walnut @ Georgian Dr	2015	49	72	37	86	65	90	90	90	67
LWA4	838	Little Walnut @ Golden Meadow Rd	2015	55	72	36	70	46	81	80	82	60

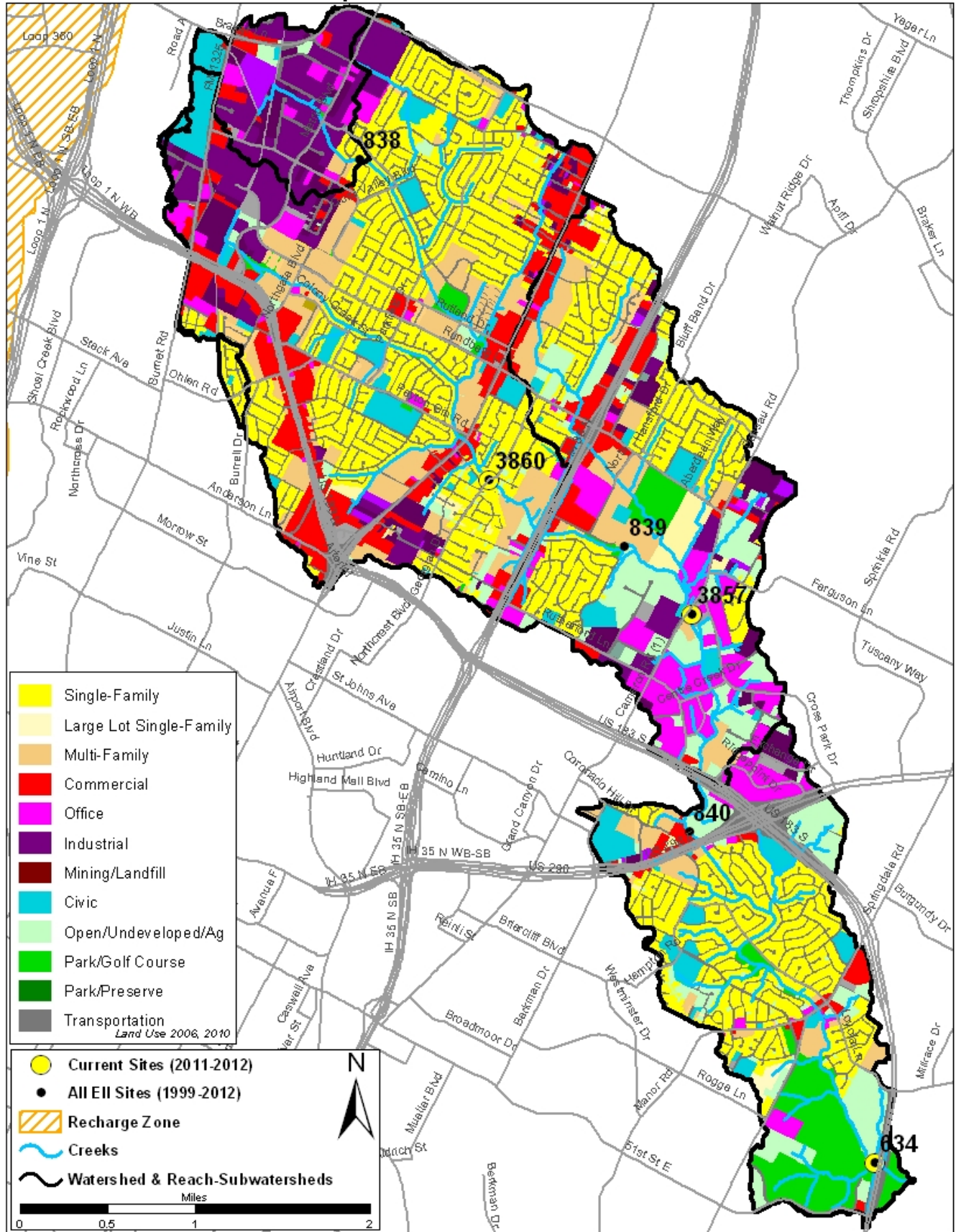
\* blank cells indicate parameter was not collected, blank row indicate site was dropped

\*\*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 Walnut Creek Watershed

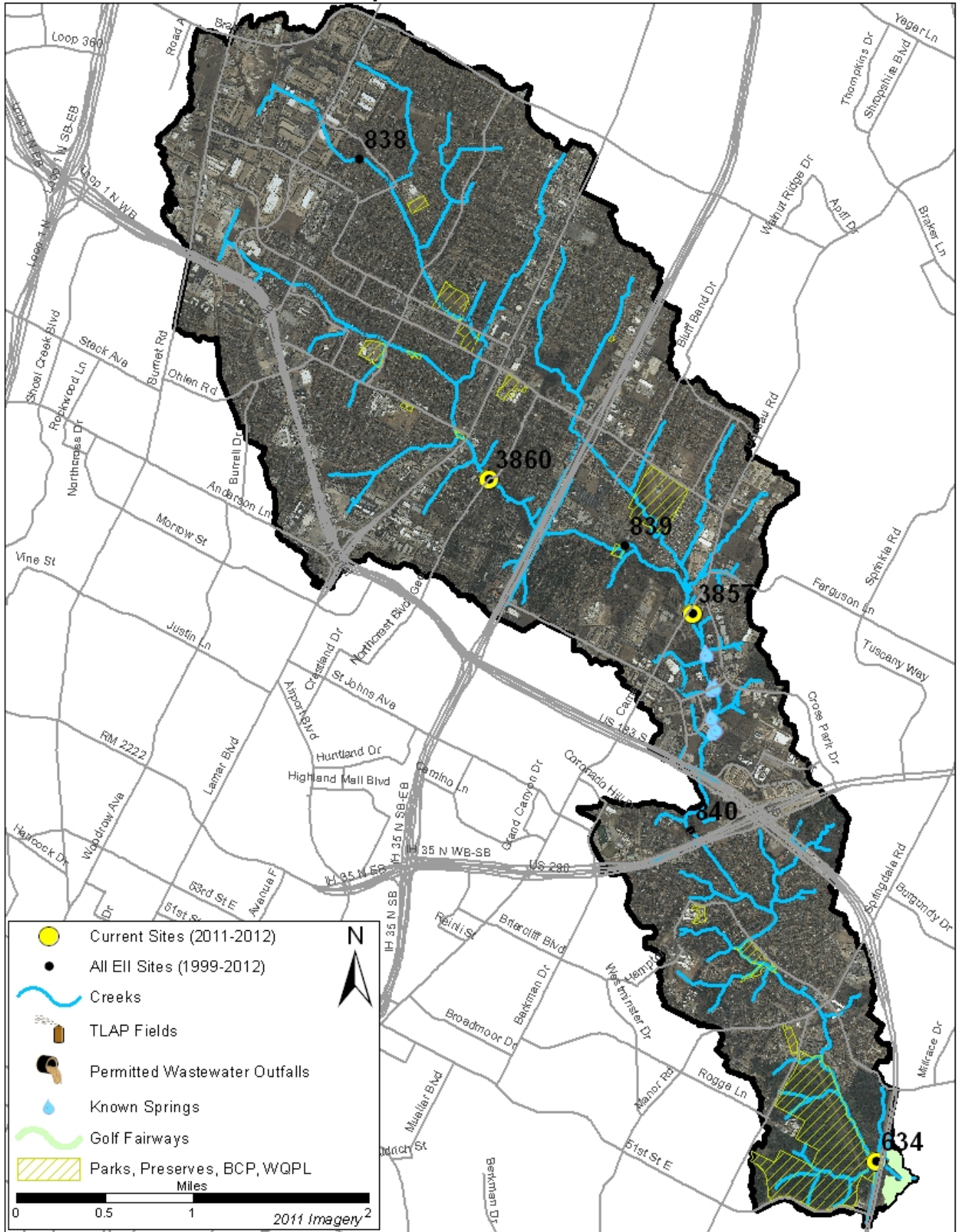
## Land Use Map





# Little Walnut Creek Watershed

## Aerial Map



# Little Walnut Creek Watershed

## Water Quality Data – Temperature, Conductivity, pH, Dissolved Oxygen & *E. coli* for 2015 Sample Sites (Downstream to Upstream)

Qualifiers to the left of the value	>	Greater than	Qualifiers to the right of the value	(blank)	Useable
	<	Less than		S	Exceeds standard range
	<J	Less than detected limit		R	Rejected, failed QC
	J	Estimated			

Watershed	Site	E.II Reach	Date	Temp. flag	Cond. flag	pH flag	D.O. flag	E. Coli flag
Little Walnut	634	LWA1	01/14/2015	6.8	554	8.26	11.4 R	58.8
Little Walnut	634	LWA1	04/15/2015	26.0	588	8.04	8.4	32.0
Little Walnut	634	LWA1	05/05/2015	23.0	552	8.06	9.5	
Little Walnut	634	LWA1	07/14/2015	33.2	668	7.94	8.3	12.2
Little Walnut	634	LWA1	09/09/2015	26.8	758	7.23	4.0	22.6
LWA1 Mean				23.2	624	7.91	8.3	31.4
Little Walnut	3857	LWA2	01/14/2015	9.0	673	7.94	10.6 R	613.1
Little Walnut	3857	LWA2	04/15/2015	19.5	700	7.66	7.8	27.2
Little Walnut	3857	LWA2	07/13/2015	27.7	739	7.68	7.8	
Little Walnut	3857	LWA2	07/14/2015	26.2	748	7.73	7.5	244.8
Little Walnut	3857	LWA2	09/09/2015	26.2	715	7.72	6.2	124.6
LWA2 Mean				21.7	715	7.75	8.0	277.4
Little Walnut	3860	LWA3	01/14/2015	8.7	696	8.03	10.8	95.9
Little Walnut	3860	LWA3	04/15/2015	20.3	733	7.95	11.0	80.1
Little Walnut	3860	LWA3	07/13/2015	26.6	754	7.97	10.2	
Little Walnut	3860	LWA3	07/14/2015	26.8	771	7.92	9.4	488.4
Little Walnut	3860	LWA3	09/09/2015	26.3	749	7.77	6.6	547.5
LWA3 Mean				21.7	741	7.93	9.6	303.0
Little Walnut	838	LWA4	01/14/2015	9.8	622	8.06	9.6	172.2
Little Walnut	838	LWA4	04/15/2015	17.9	676	7.74	6.5	275.5
Little Walnut	838	LWA4	07/13/2015	25.1	705	7.27	6.8	
Little Walnut	838	LWA4	07/14/2015	25.6	594	8.55	8.2	686.7
LWA4 Mean				19.6	649	7.90	7.8	378.1
Little Walnut Mean				21.7	684	7.87	8.4	238.8

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

### Summary Statistics for all 2015-2016 E.I.I. Sites Combined

Parameter	2015-2016 Average	2015-2016 Minimum	2015-2016 Maximum	1 Standard Deviation Above	1 Standard Deviation Below
Temperature (C°)	20.7	5.8	34.2	27.5	
Conductivity (uS/cm)	722	160	3549	955	
pH (Standard units)	7.86	5.85	10.25	8.24	7.47
D.O. (mg/l)	7.9	0.1	18.7	10.4	5.5
<i>E. Coli</i> (col/100ml)	316.1	1.0	2420.0	883.7	

# Little Walnut Creek Watershed

## Water Quality Data – Ammonia, Nitrate / Nitrite, Ortho-Phosphorus, Total Suspended Solids & Turbidity for 2015 Sample Sites (Downstream to Upstream)

Qualifiers to the left of the value	>	Greater than	Qualifiers to the right of the value	(blank)	Useable
	<	Less than		S	Exceeds standard range
	<J	Less than detected limit		R	Rejected, failed QC
	J	Estimated			

Watershed	Site	EII Reach	Date	NH3-N		NO3/NO2		Ortho-P		T.S.S		Turb.		
				<	flag	<>	flag	<	flag	<>	flag	<	flag	
Little Walnut	634	LWA1	01/14/2015	<J	0.008		1.04	<J	0.004	<J	1.0		3.3	R
Little Walnut	634	LWA1	04/15/2015	<J	0.008		1.25	<J	0.004		1.0		1.9	
Little Walnut	634	LWA1	05/05/2015											
Little Walnut	634	LWA1	07/14/2015		0.025		2.90	<J	0.004		1.9		2.5	R
Little Walnut	634	LWA1	09/09/2015	<J	0.008		0.16	<J	0.004		2.5		8.3	R
LWA1 Mean					0.012		1.34		0.004		1.6		4.0	
Little Walnut	3857	LWA2	01/14/2015	<J	0.008		1.53	<J	0.004		3.8		4.8	R
Little Walnut	3857	LWA2	04/15/2015	<J	0.008		1.18	<J	0.004	<J	1.0		1.9	
Little Walnut	3857	LWA2	07/13/2015											
Little Walnut	3857	LWA2	07/14/2015		0.029		3.37	<J	0.004		1.8		2.4	R
Little Walnut	3857	LWA2	09/09/2015		0.025		2.50	<J	0.004		1.6		4.2	R
LWA2 Mean					0.018		2.14		0.004		2.0		3.3	
Little Walnut	3860	LWA3	01/14/2015	<J	0.008		2.07	<J	0.004	<J	1.0		1.0	R
Little Walnut	3860	LWA3	04/15/2015	<J	0.008		2.41	<J	0.004		1.1		0.7	
Little Walnut	3860	LWA3	07/13/2015											
Little Walnut	3860	LWA3	07/14/2015		0.031		5.23	<J	0.004		1.4		1.3	R
Little Walnut	3860	LWA3	09/09/2015		0.030		5.58	<J	0.004		2.3		5.9	R
LWA3 Mean					0.019		3.82		0.004		1.5		2.2	
Little Walnut	838	LWA4	01/14/2015	<J	0.008		0.95	<J	0.004	<J	1.1		1.8	R
Little Walnut	838	LWA4	04/15/2015		0.046		0.39	<J	0.004		2.7		7.3	
Little Walnut	838	LWA4	07/13/2015											
Little Walnut	838	LWA4	07/14/2015	<J	0.008		0.30	<J	0.004		2.4		2.3	R
LWA4 Mean					0.021		0.55		0.004		2.1		3.8	
Little Walnut Mean					0.017		2.06		0.004		1.8		3.3	

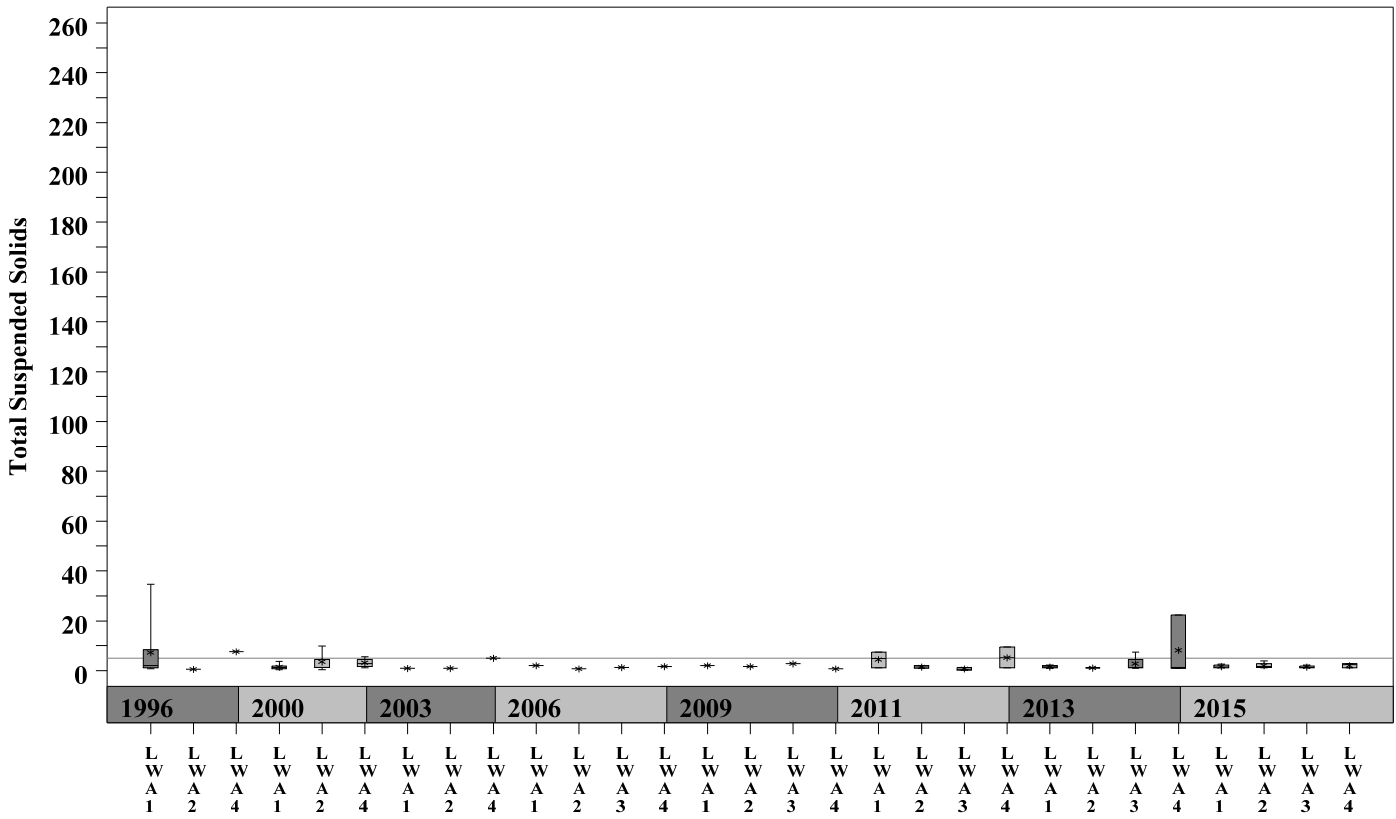
Gray highlighting indicates that the value exceeds one standard deviation from the mean of all E.I.I. sites combined.

Summary Statistics for all 2015-2016 E.I.I. Sites Combined				
Parameter	2015-2016 Average	2015-2016 Minimum	2015-2016 Maximum	1 Standard Deviation Above
NH3-N (mg/l)	0.018	0.008	0.881	0.085
NO3-N (mg/l)	1.14	0.01	12.0	3.16
Ortho-P (mg/l)	0.016	0.004	0.661	0.08
T.S.S. (mg/l)	3.7	1.0	58.2	9.7
Turbidity (NTU)	4.4	0.2	98.6	11.7

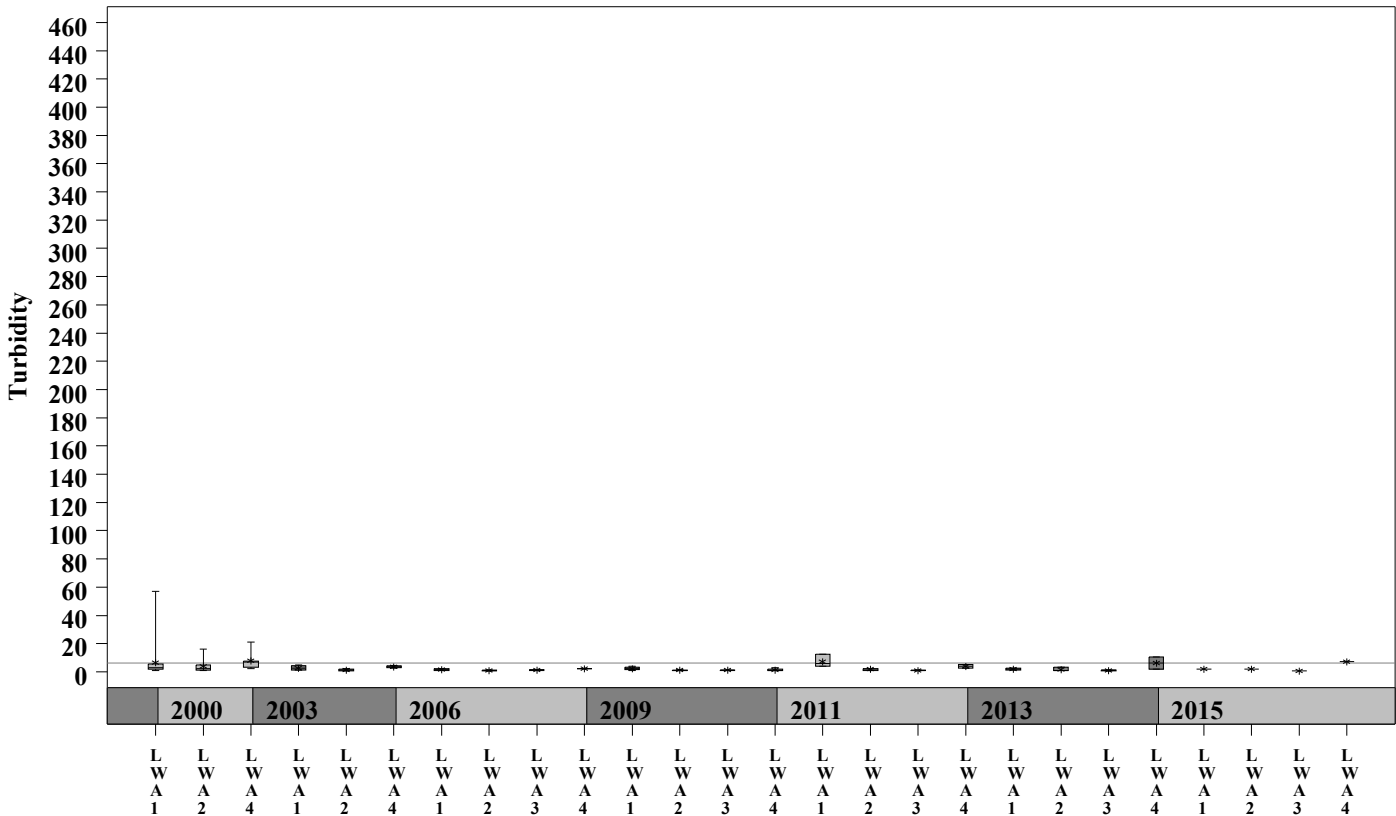
# Little Walnut Creek Watershed

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

Parameter = TOTAL SUSPENDED SOLIDS Unit = mg/L Watershed = Little Walnut



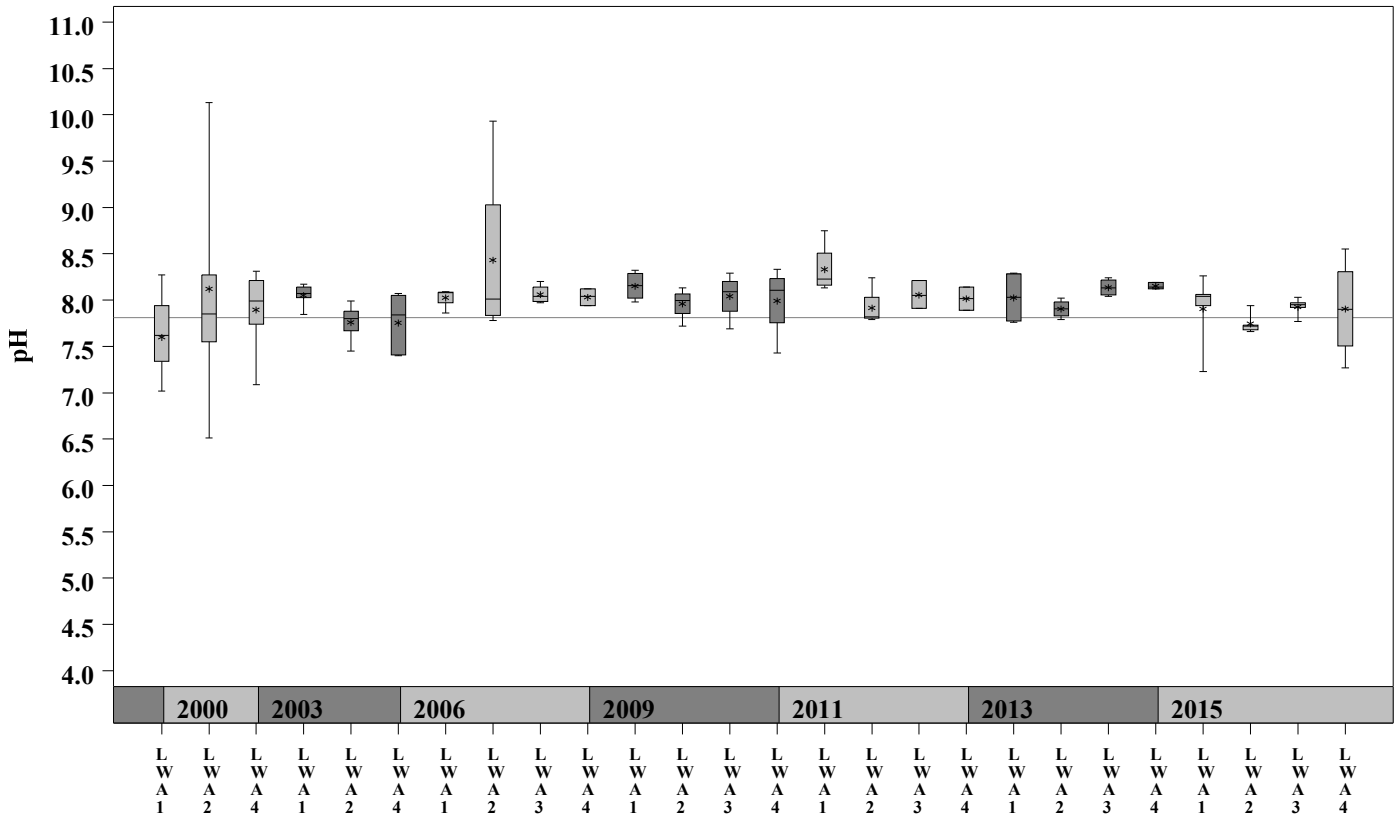
Parameter = TURBIDITY Unit = NTU Watershed = Little Walnut



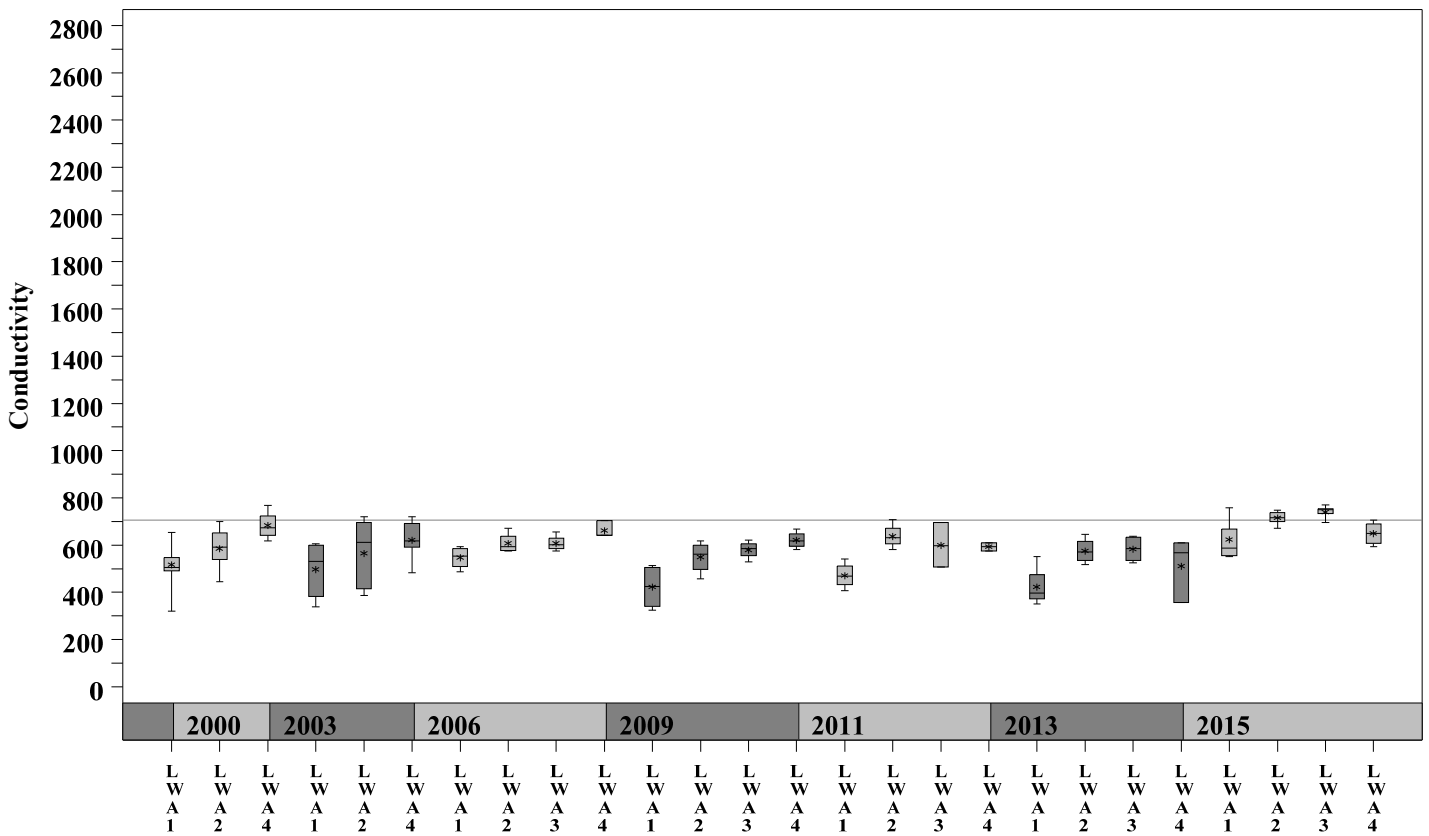
# Little Walnut Creek Watershed

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

Parameter = pH Unit = Standard Units Watershed = Little Walnut



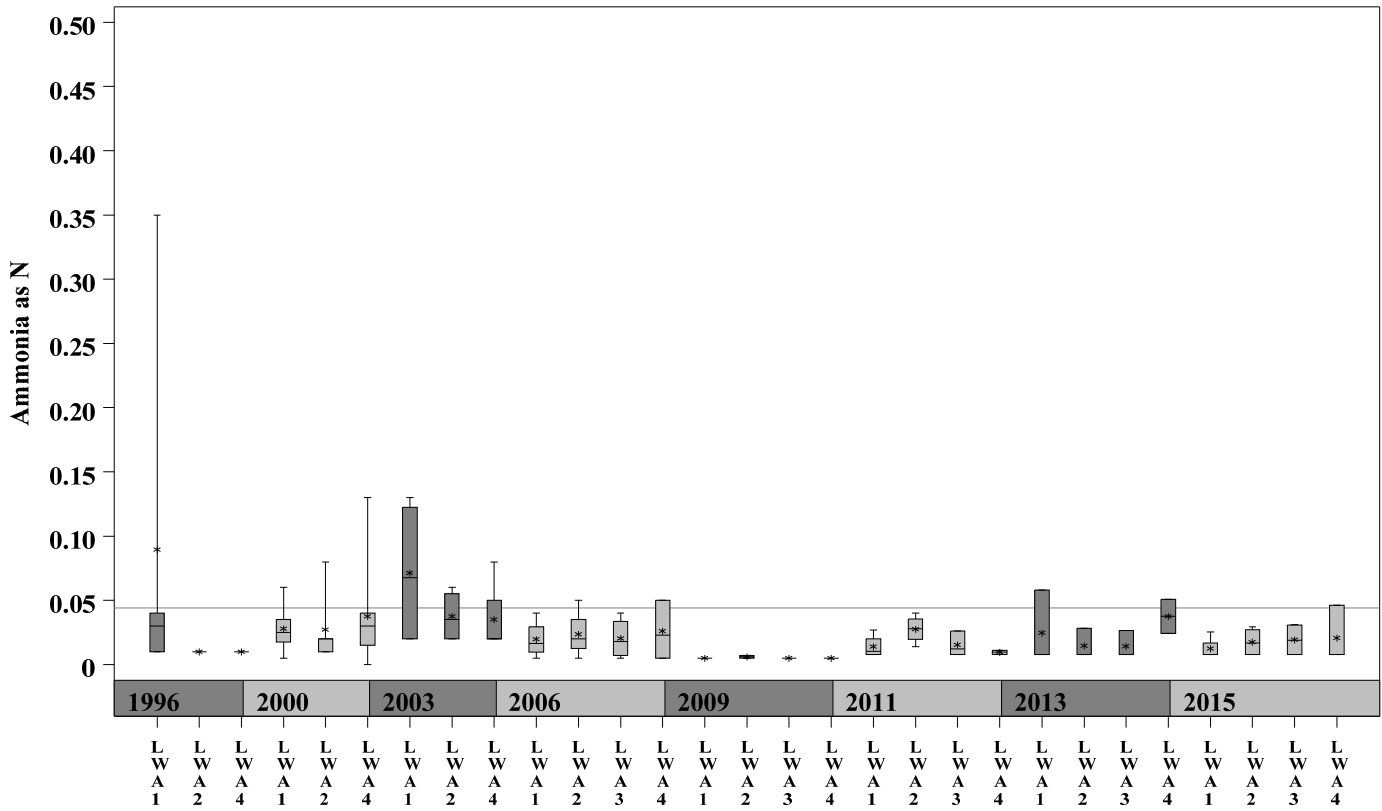
Parameter = CONDUCTIVITY Unit = uS/cm Watershed = Little Walnut



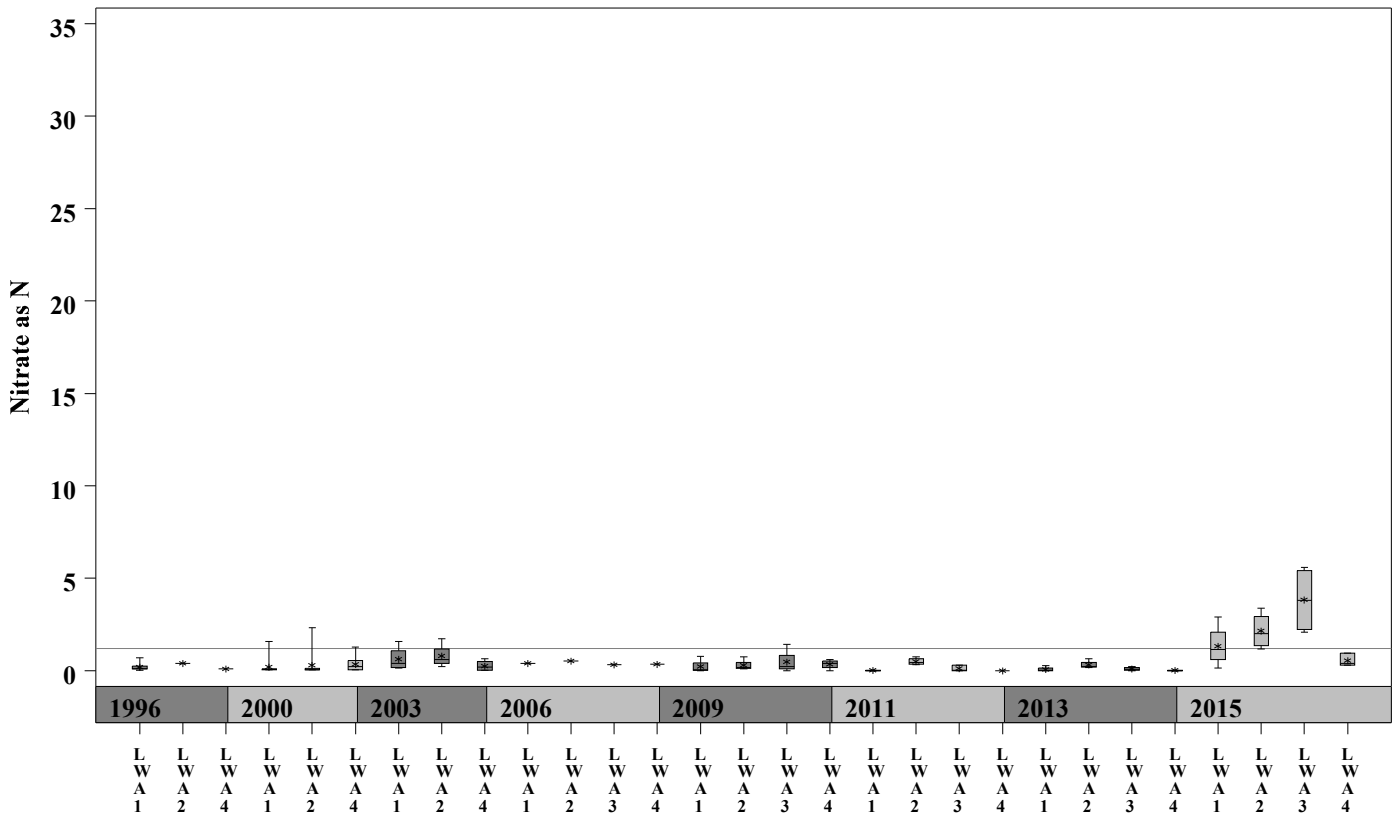
# Little Walnut Creek Watershed

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

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



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

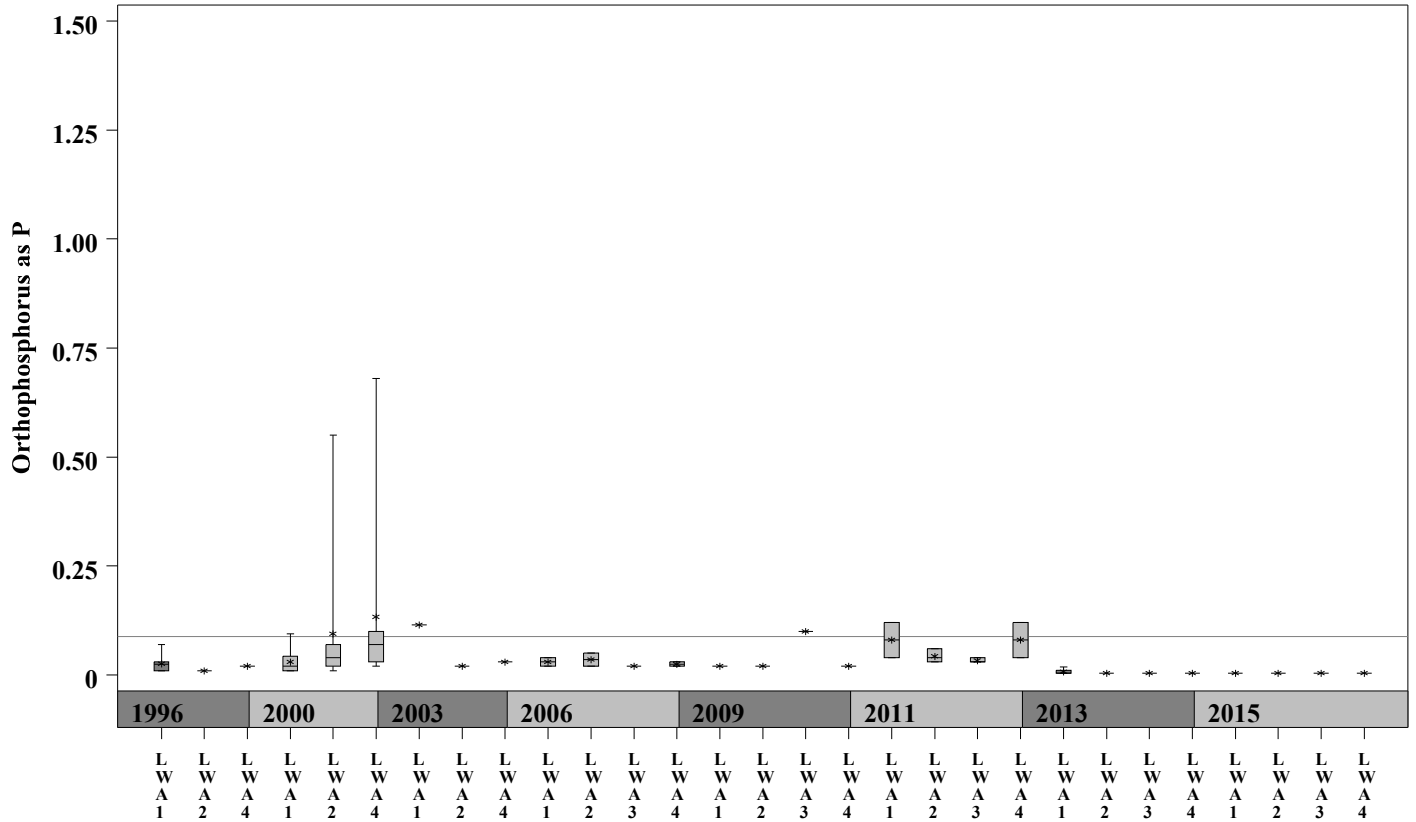




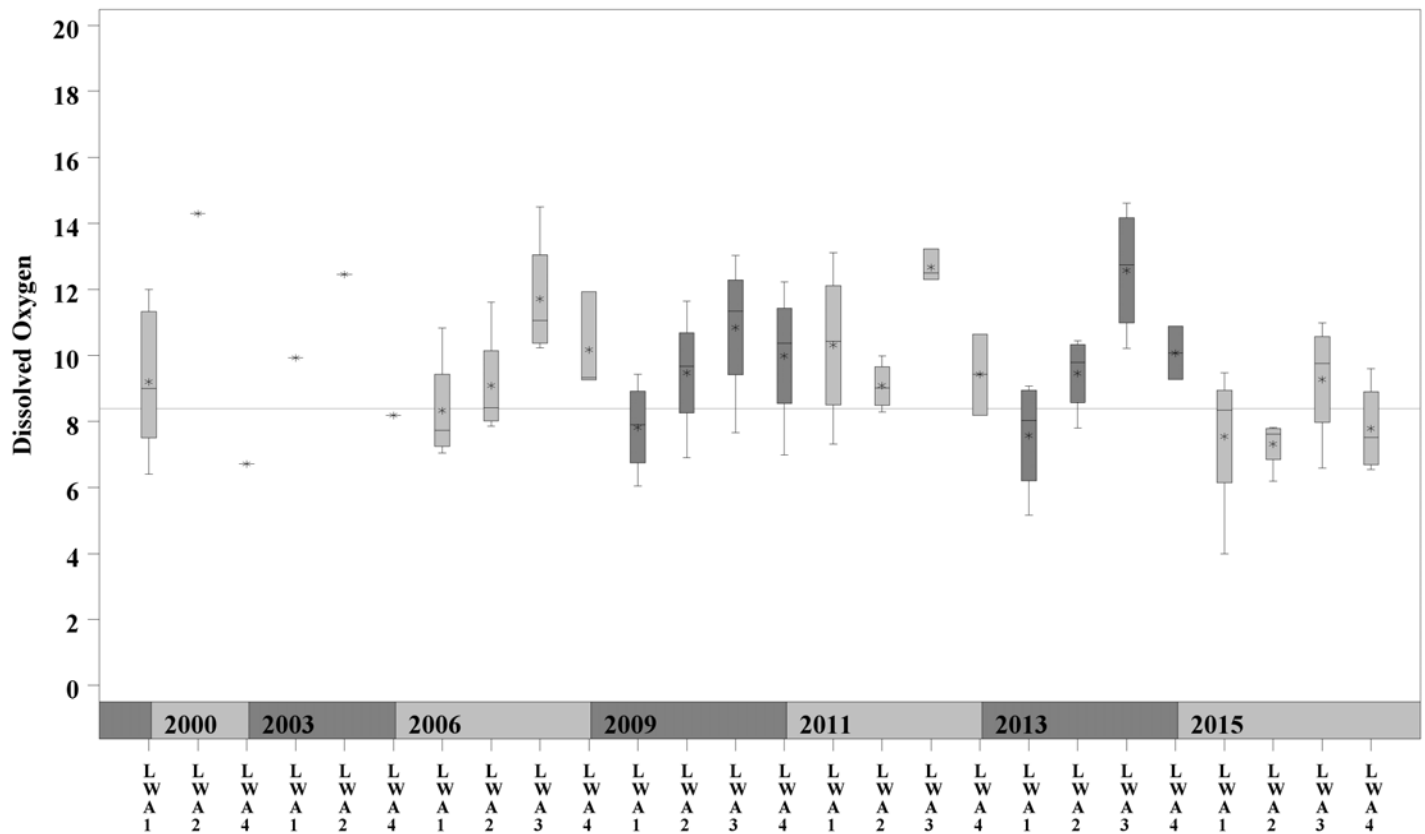
# Little Walnut Creek Watershed

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

Parameter= **ORTHOPHOSPHORUS AS P** Unit= **mg/L** Watershed= **Little Walnut**



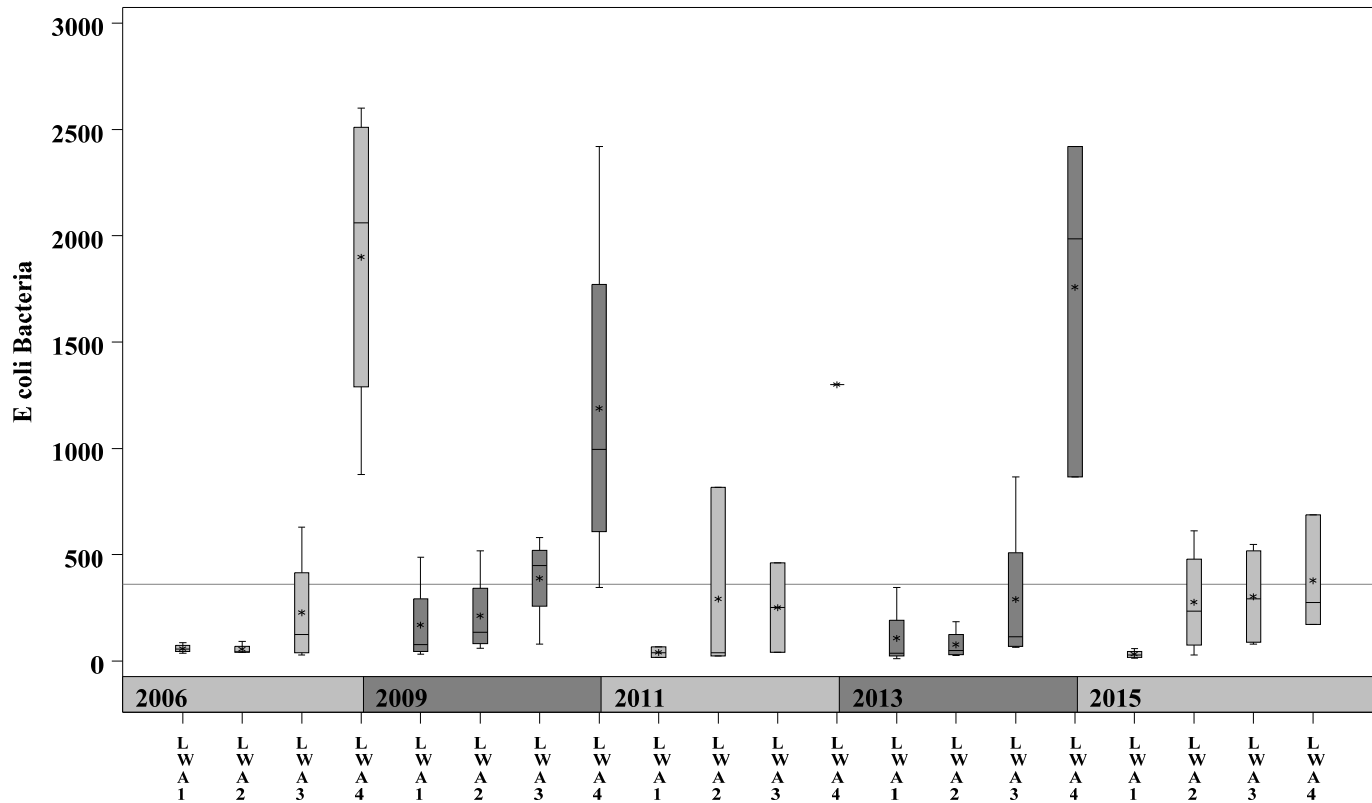
Parameter= **DISSOLVED OXYGEN** Unit= **mg/L** Watershed= **Little Walnut**



# Little Walnut Creek Watershed

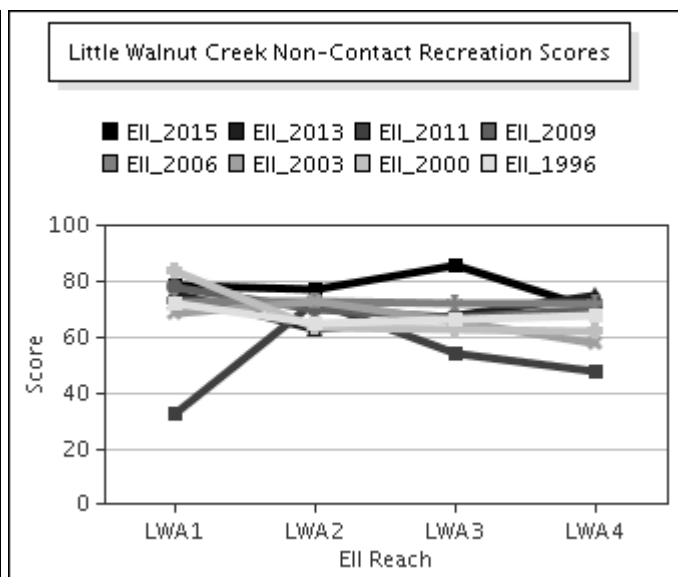
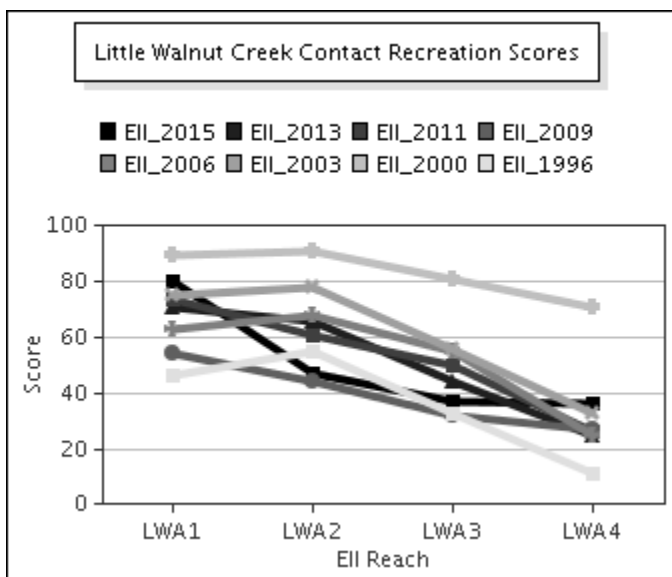
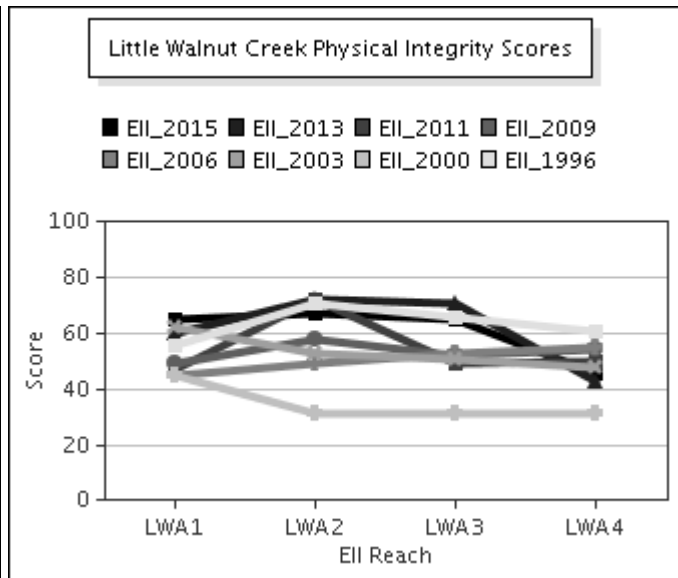
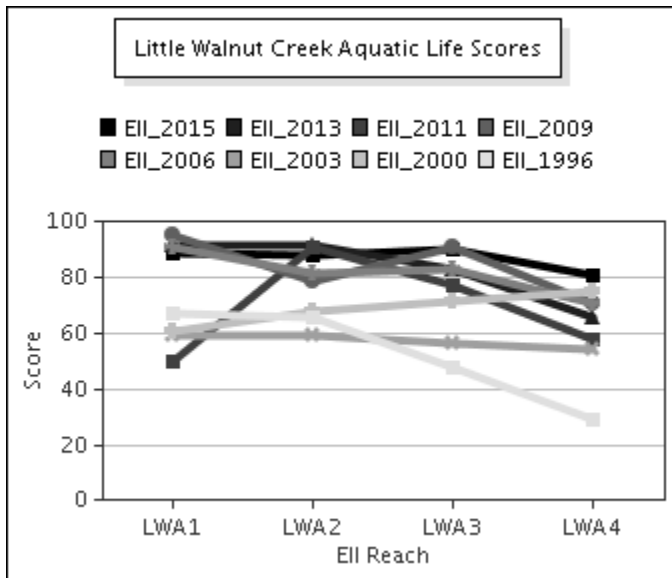
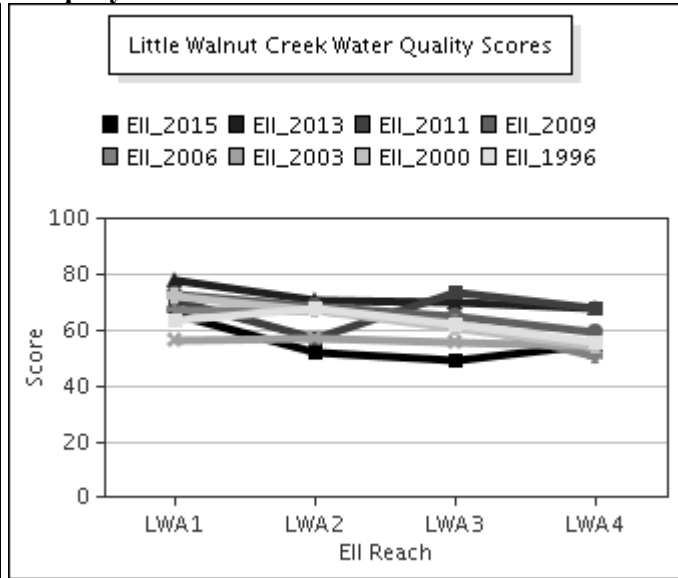
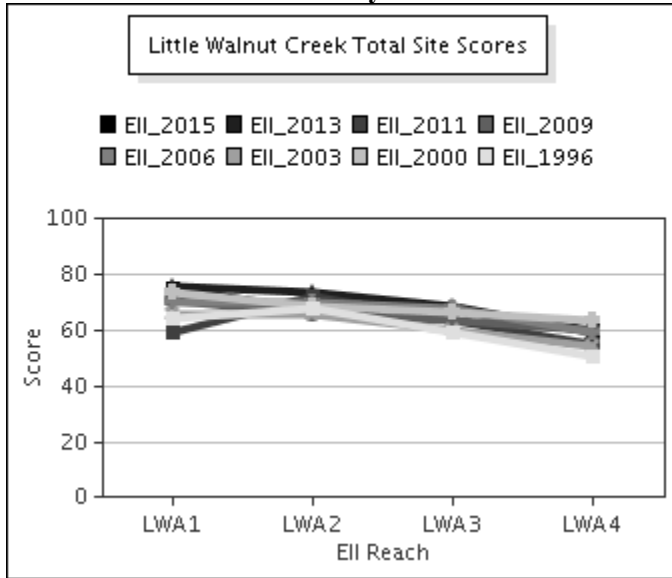
Data Summary Graphs – *E.coli* (Downstream to Upstream by Year)

Parameter = E COLI BACTERIA Unit = MPN/100mL Watershed = Little Walnut



# Little Walnut Creek Watershed

## Score Summary – Reach scores for each sample year



# Little Walnut Creek Watershed

## Benthic Macroinvertebrates – Taxa List, Pollution Tolerance Index & Functional Feeding Group for 2015 Sample Sites (Downstream to Upstream)

Benthic Macroinvertebrates - Little Walnut Creek			LWA @ Golden Meadow (838) 07/06/2015 (WRE)	LWA @ Georgian (3860) 07/08/2015 (WRE)	LWA @ Cameron (3857) 07/13/2015 (WRE)	LWA @ US183 (634) 05/05/2015 (WRE)
Benthic Macroinvertebrate ID	PTI	FFG				
Chimarra	2	FC		10	82	49
Thraulodes Gonzalesi	2	CG,SC		1	1	
Camelobaetidius	4	CG	19	77	5	12
Fallceon	4	CG,SC	180	141	4	53
Neochoroterpes	4	CG	3	6	5	16
Ostracoda	4	CG,FC	1			
Simulium	4	FC	4	2	62	58
Aquarius	5	P	2			
Petrophila (Moth)	5	SC		13		
Argia	6	P	27	27	9	
Brechmorhoga Mendax	6	P	2	1		
Cheumatopsyche	6	FC		28	44	8
Chironomidae	6	FC,P	19	56	16	27
Hetaerina	6	P	3	3		
Tanypodinae	6	P	9	14	3	4
Stenelmis	7	CG,SC	12			
Caloparyphus/Euparyphus	8	CG,SC	1			
Hyalella	8	CG,SH	3			
Oligochaeta	8	CG		1		
Dugesia		CG,P	62	27	2	
Melanoides Tuberculatus		SC	2			

# Little Walnut Creek Watershed

## Site Photographs



838\_t00-us-07\_10\_2006



838\_t00-ds-07\_10\_2006



3860\_t00-us-05-27-2009



3860\_t00-ds-05-27-2009



839\_t00-us-02\_20\_2001



839\_t00-na-02\_19\_2003



# Little Walnut Creek Watershed

## Site Photographs



3857\_t00-us1-07\_11\_2006



3857\_t00-us-07\_11\_2006



840\_t00-us-02\_19\_2003



840\_t00-ds-02\_20\_2001



634\_t00-us-07\_06\_2006



634\_t00-ds-07\_06\_2006