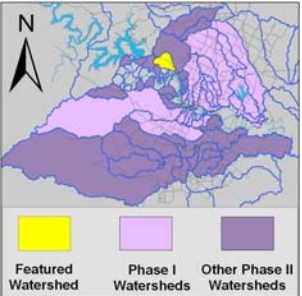


West Bull Creek Watershed

Watershed Overview

| | | | | | | | |
|--------------------|----------------------------------|---------------|------|------|------|------|------|
| Catchment | Total area | 6.9 sq. miles | | | | | |
| | Area in recharge | 2.7 sq. miles | | | | | |
| | Creek length | 5 miles | | | | | |
| | Receiving water | Bull Creek | | | | | |
| Demographics | 2000 population | 2,446 | | | | | |
| | 2030 projected population | 10,987 | | | | | |
| | 30 year projected % increase | 349 % | | | | | |
| Land Use | Impervious cover (2003 estimate) | 6.4 % | | | | | |
| | Impervious cover (2013 estimate) | 10.2 % | | | | | |
| Overall EII Scores | 2001 | 2004 | 2007 | 2010 | 2012 | 2014 | 2016 |
| | 81 | 78 | 75 | 75 | 76 | 74 | 77 |



Flow Regime* for Sample Sites on West Bull Creek

| Site | 1999 | | 2001 | | | | 2004 | | | | 2007 | | | | 2010 | | | | 2011 | | 2012 | | | | 2014 | | | | 2016 | | | | | | | | | | | |
|------|------|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| | Jan | Jan | Mar | Mar | Jun | Sep | Dec | Mar | May | May | Jun | Oct | Dec | Feb | May | Jun | Sep | Dec | Mar | May | May | Oct | Dec | Mar | Apr | May | Jul | Sep | Jan | Apr | May | Jun | Jul | Sep | Jan | Apr | Jun | Jul | Sep | |
| 148 | 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 | n | B | B | B | B | B | B | B | B | B | B | B | B | B |
| 343 | 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 | n | n | B | B | B | B | B | B | B | B | B | B | B | B |
| 1107 | B | B | B | B | B | B | B | B | B | B | B | B | B | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1030 | 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 West Bull Creek Sites by Year

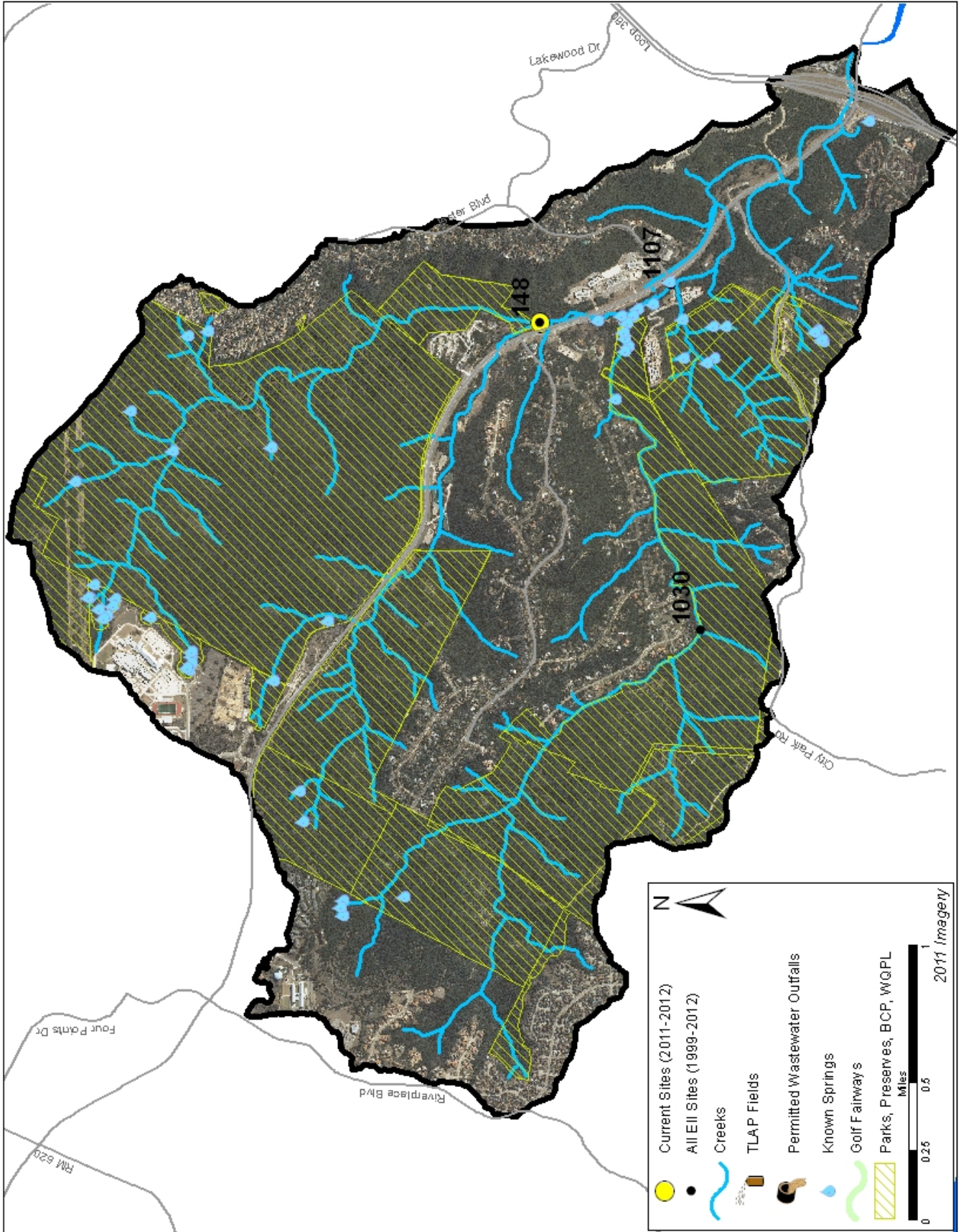
| Reach | Site | Site Name | Year | Water Quality | Sediment** | Contact Rec. | Non-Contact Rec. | Physical Integrity | Aquatic Life | Benthic subindex | Diatom subindex | Total EII Score |
|-------|------|---|------|---------------|------------|--------------|------------------|--------------------|--------------|------------------|-----------------|-----------------|
| COW1 | 1030 | Cow Fork Bull Creek @ Standing Rock Trail | 1998 | 69 | 85 | 79 | 93 | 76 | 88 | 84 | 92 | 82 |
| WBL1 | 343 | West Bull Creek Upstream of Bull Creek (EK) | 1998 | 72 | 85 | 65 | 86 | 76 | 92 | 98 | 86 | 79 |
| WBL1 | 1107 | West Bull Creek @ Jester Blvd | 1998 | 74 | 85 | 88 | 82 | 84 | 83 | 75 | 91 | 83 |
| WBL2 | 148 | West Bull Creek @ Bell Mt. Road (ED) | 1998 | 74 | 85 | 83 | 83 | 66 | 71 | 58 | 84 | 77 |
| COW1 | 1030 | Cow Fork Bull Creek @ Standing Rock Trail | 2001 | 66 | 91 | 88 | 80 | 47 | 76 | 60 | 92 | 73 |
| WBL1 | 343 | West Bull Creek Upstream of Bull Creek (EK) | 2001 | 69 | 91 | 89 | 87 | 85 | 89 | 90 | 87 | 81 |
| WBL1 | 1107 | West Bull Creek @ Jester Blvd | 2001 | 68 | 91 | 95 | 88 | 84 | 91 | 90 | 92 | 82 |
| WBL2 | 148 | West Bull Creek @ Bell Mt. Road (ED) | 2001 | 64 | 91 | 93 | 90 | 66 | 58 | 54 | 62 | 73 |
| COW1 | 1030 | Cow Fork Bull Creek @ Standing Rock Trail | 2004 | 65 | 84 | 52 | 88 | 86 | 87 | 80 | 93 | 77 |
| WBL1 | 343 | West Bull Creek Upstream of Bull Creek (EK) | 2004 | 75 | 84 | 47 | 83 | 89 | 95 | 90 | 99 | 79 |
| WBL1 | 1107 | West Bull Creek @ Jester Blvd | 2004 | 68 | 84 | 65 | 89 | 88 | 93 | 86 | 100 | 81 |
| WBL2 | 148 | West Bull Creek @ Bell Mt. Road (ED) | 2004 | 68 | 84 | 59 | 80 | 72 | 84 | 81 | 87 | 75 |
| WBL1 | 343 | West Bull Creek Upstream of Bull Creek (EK) | 2007 | 65 | 73 | 44 | 88 | 71 | 99 | 98 | 100 | 73 |
| WBL2 | 148 | West Bull Creek @ Bell Mt. Road (ED) | 2007 | 77 | 73 | 76 | 96 | 78 | 62 | 54 | 70 | 77 |
| WBL1 | 343 | West Bull Creek Upstream of Bull Creek (EK) | 2010 | 67 | 80 | 35 | 91 | 67 | 98 | 99 | 97 | 73 |
| WBL2 | 148 | West Bull Creek @ Bell Mt. Road (ED) | 2010 | 70 | 80 | 60 | 92 | 79 | 75 | 74 | 76 | 76 |
| WBL1 | 343 | West Bull Creek Upstream of Bull Creek (EK) | 2012 | 50 | 86 | 42 | 91 | 85 | 88 | 99 | 77 | 74 |
| WBL2 | 148 | West Bull Creek @ Bell Mt. Road (ED) | 2012 | 71 | 86 | 81 | 86 | 85 | 59 | 61 | 57 | 78 |
| WBL1 | 343 | West Bull Creek Upstream of Bull Creek (EK) | 2014 | 60 | 79 | 38 | 73 | 77 | 95 | 96 | 94 | 70 |
| WBL2 | 148 | West Bull Creek @ Bell Mt. Road (ED) | 2014 | 70 | 79 | 57 | 83 | 76 | 99 | 100 | 98 | 77 |
| WBL1 | 343 | West Bull Creek Upstream of Bull Creek (EK) | 2016 | 69 | 83 | 41 | 79 | 76 | 96 | 99 | 93 | 74 |
| WBL2 | 148 | West Bull Creek @ Bell Mt. Road (ED) | 2016 | 76 | 83 | 49 | 95 | 89 | 90 | 89 | 92 | 80 |

* 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

West Bull Creek Watershed

Aerial Map



West Bull Creek Watershed

Water Quality Data – Temperature, Conductivity, pH, Dissolved Oxygen & E. coli for 2016 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 | <> | Temp. | flag | <> | Cond. | flag | <> | pH | flag | <> | D.O. | flag | <> | E. Coli | flag |
|----------------|------|-----------|------------|----|-------|------|----|-------|------|----|------|------|----|------|------|----|---------|------|
| West Bull | 343 | WLB1 | 01/12/2016 | | 10.5 | | | 627 | | | 8.11 | | | 11.5 | | | 36.8 | |
| West Bull | 343 | WLB1 | 04/12/2016 | | 19.8 | | | 636 | | | 8.20 | | | 10.0 | | | 290.9 | |
| West Bull | 343 | WLB1 | 06/22/2016 | | 26.7 | | | 574 | | | 8.05 | | | 9.8 | | | | |
| West Bull | 343 | WLB1 | 07/12/2016 | | 26.8 | | | 615 | | | 7.98 | | | 6.9 | | | 866.4 | |
| West Bull | 343 | WLB1 | 09/13/2016 | | 26.6 | | | 577 | | | 8.14 | | | 8.5 | | | 547.5 | |
| WLB1 Mean | | | | | 22.1 | | | 606 | | | 8.10 | | | 9.3 | | | 435.4 | |
| West Bull | 148 | WLB2 | 01/12/2016 | | 10.0 | | | 587 | | | 8.06 | | | 11.3 | | | 26.9 | |
| West Bull | 148 | WLB2 | 04/12/2016 | | 18.2 | | | 583 | | | 8.06 | | | 9.4 | | | 125.9 | |
| West Bull | 148 | WLB2 | 06/22/2016 | | 26.7 | | | 551 | | | 8.00 | | | 8.0 | | | | |
| West Bull | 148 | WLB2 | 07/12/2016 | | 25.0 | | | 532 | | | 7.85 | | | 7.1 | | | 330.0 | |
| West Bull | 148 | WLB2 | 09/13/2016 | | 24.5 | | | 535 | | | 8.00 | | | 8.5 | | | 360.9 | |
| WLB2 Mean | | | | | 20.9 | | | 558 | | | 7.99 | | | 8.8 | | | 210.9 | |
| West Bull Mean | | | | | 21.5 | | | 582 | | | 8.04 | | | 9.1 | | | 323.2 | |

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 |
| E. Coli (col/100ml) | 316.1 | 1.0 | 2420.0 | 883.7 | |

West Bull Creek Watershed

Water Quality Data – Ammonia, Nitrate / Nitrite, Ortho-Phosphorus, Total Suspended Solids & Turbidity for 2016 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 | |
| West Bull | 343 | WLB1 | 01/12/2016 | <J | 0.008 | | 0.54 | <J | 0.004 | <J | 1.0 | | 0.5 | R |
| West Bull | 343 | WLB1 | 04/12/2016 | <J | 0.008 | | 0.14 | <J | 0.004 | <J | 1.0 | | 1.6 | |
| West Bull | 343 | WLB1 | 06/22/2016 | | | | | | | | | | | |
| West Bull | 343 | WLB1 | 07/12/2016 | <J | 0.008 | | 0.05 | <J | 0.004 | <J | 1.0 | | 0.8 | R |
| West Bull | 343 | WLB1 | 09/13/2016 | <J | 0.008 | | 0.04 | <J | 0.004 | | 7.0 | | 0.6 | |
| WLB1 Mean | | | | | 0.008 | | 0.19 | | 0.004 | | 2.5 | | 0.9 | |
| West Bull | 148 | WLB2 | 01/12/2016 | <J | 0.008 | | 0.34 | <J | 0.004 | <J | 1.0 | | 0.3 | R |
| West Bull | 148 | WLB2 | 04/12/2016 | <J | 0.008 | | 0.11 | <J | 0.004 | <J | 1.0 | | 0.4 | |
| West Bull | 148 | WLB2 | 06/22/2016 | | | | | | | | | | | |
| West Bull | 148 | WLB2 | 07/12/2016 | <J | 0.008 | | 0.05 | <J | 0.004 | <J | 1.0 | | 0.5 | R |
| West Bull | 148 | WLB2 | 09/13/2016 | <J | 0.008 | | 0.05 | <J | 0.004 | <J | 1.1 | | 1.4 | |
| WLB2 Mean | | | | | 0.008 | | 0.14 | | 0.004 | | 1.0 | | 0.6 | |
| West Bull Mean | | | | | 0.008 | | 0.17 | | 0.004 | | 1.8 | | 0.8 | |

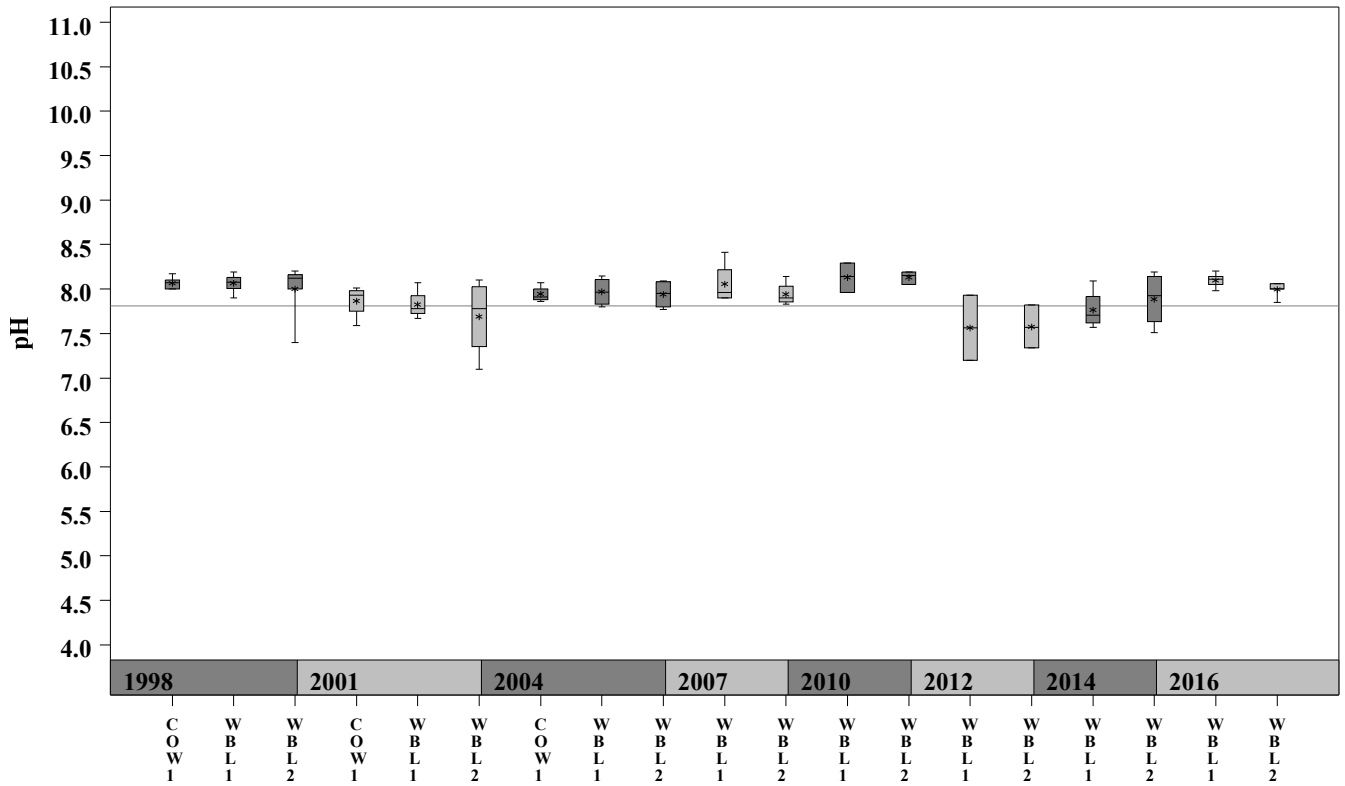
Gray highlighting indicates that the value exceeds one standard deviation from the mean of all E.I.I. sites combined.

| 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 |
| 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 |

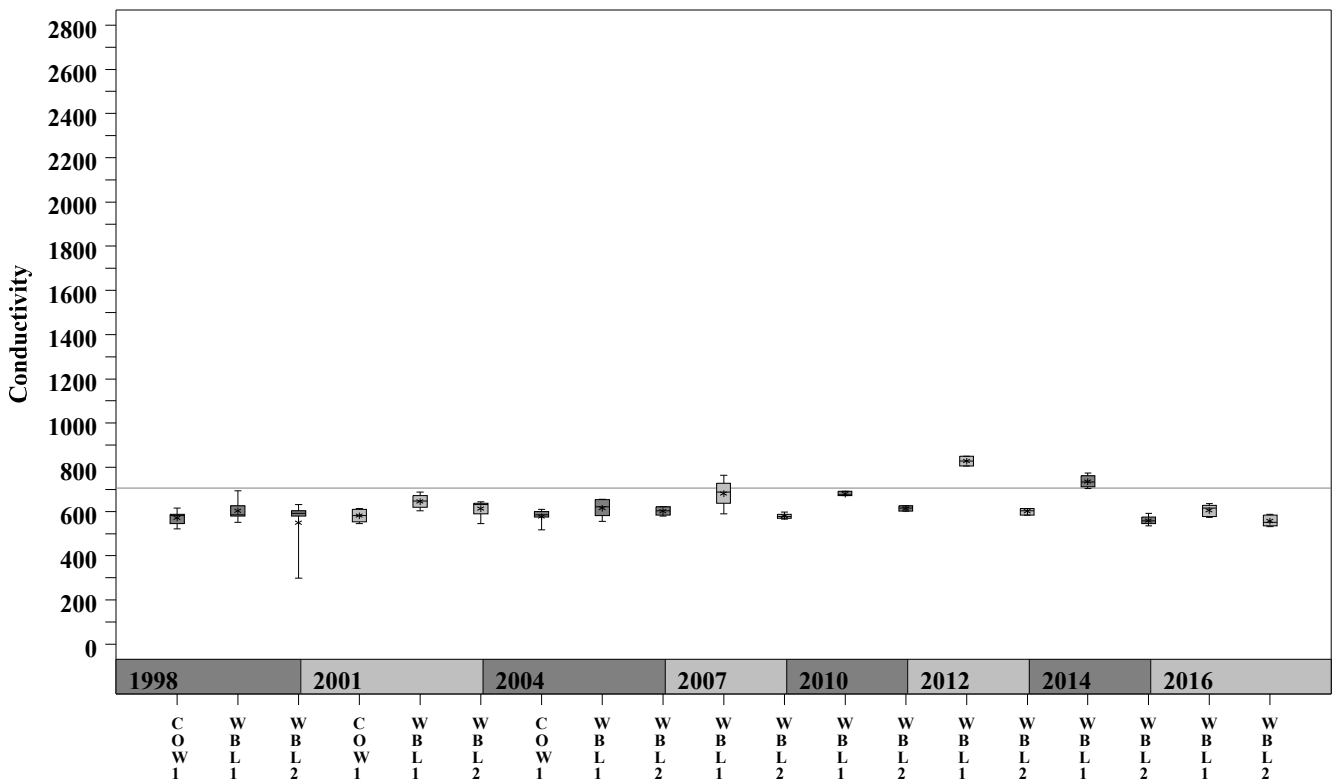
West Bull Creek Watershed

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

Parameter=**pH** Unit=Standard Units Watershed=**West Bull**



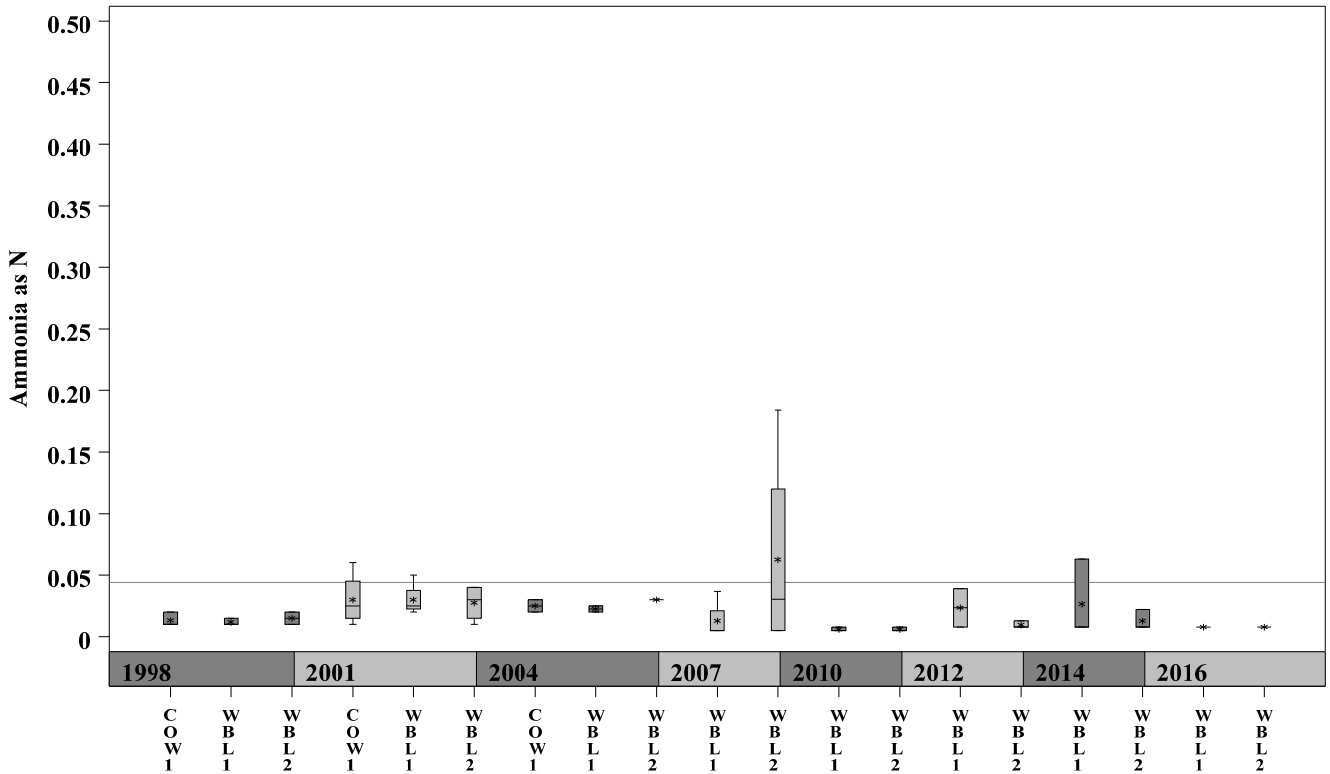
Parameter=**CONDUCTIVITY** Unit=**uS/cm** Watershed=**West Bull**



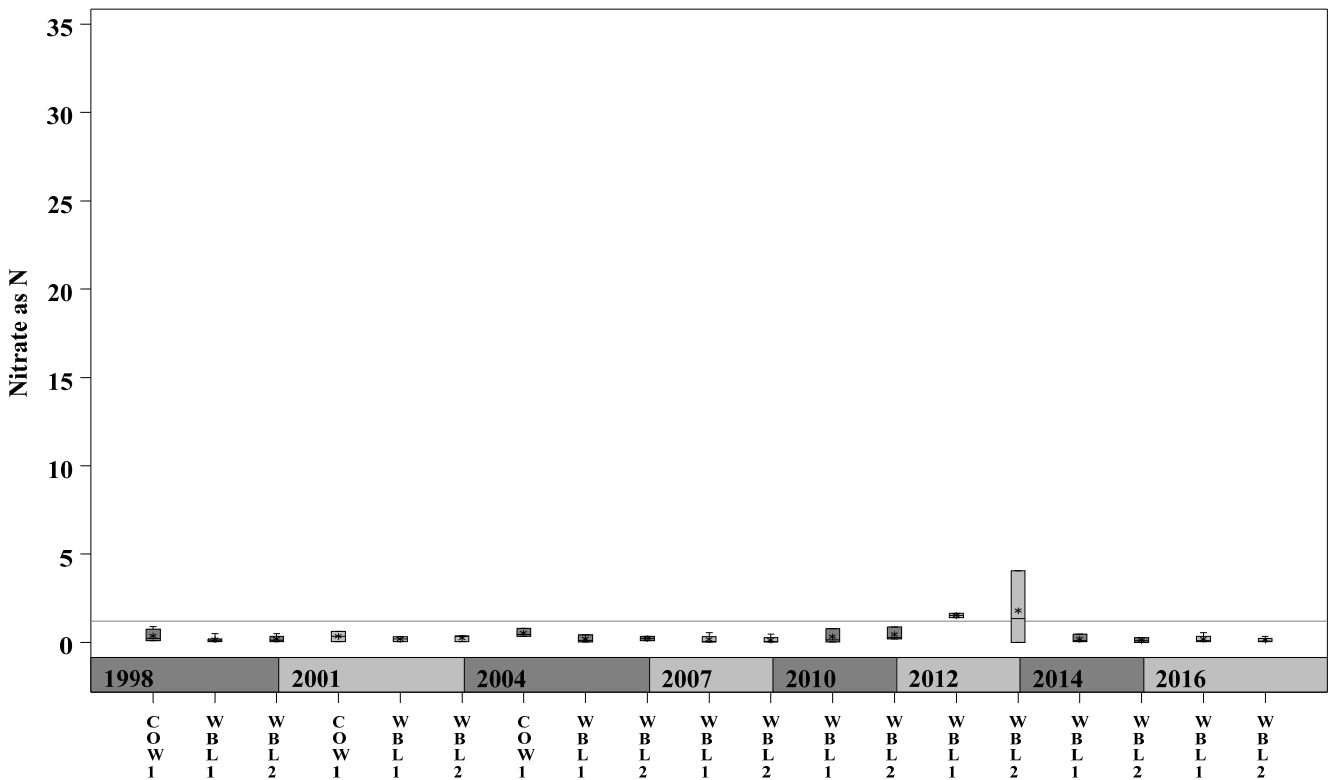
West Bull Creek Watershed

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

Parameter=AMMONIA AS N Unit =mg/L Watershed=West Bull



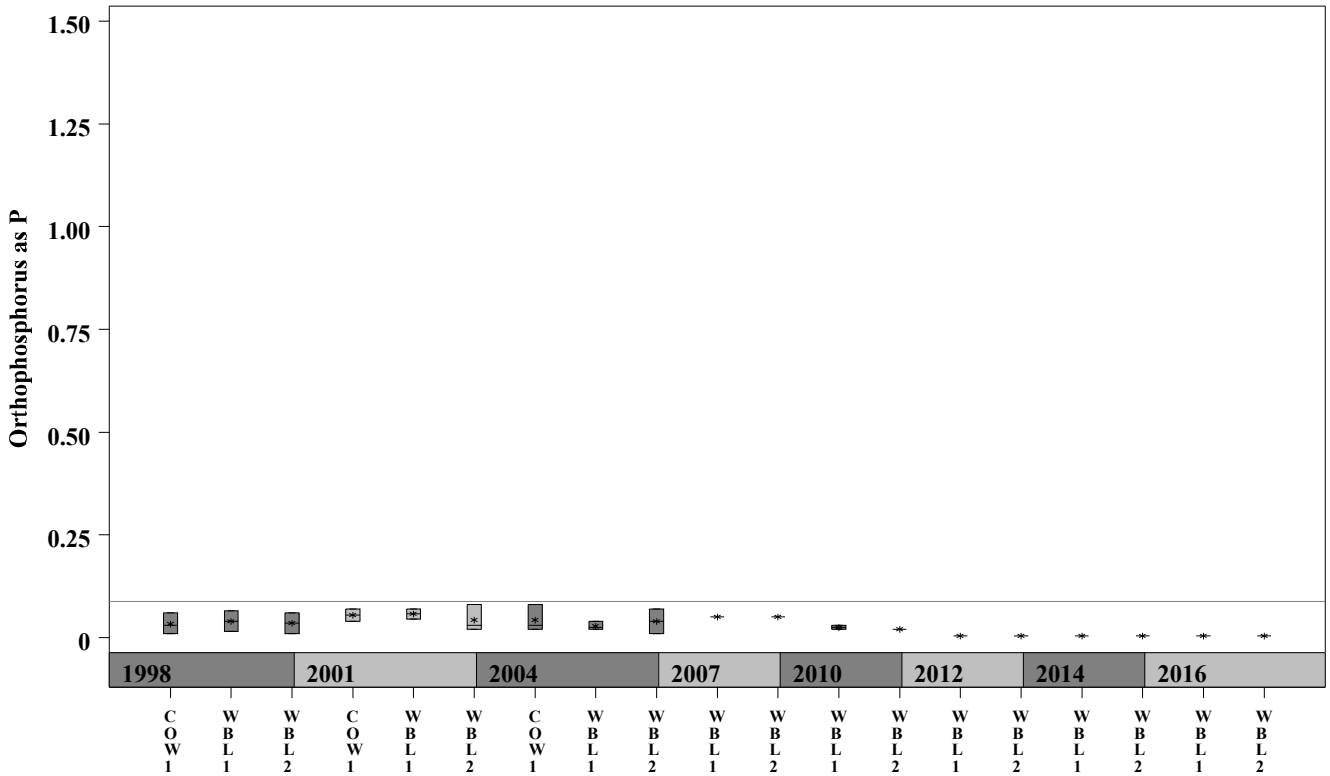
Parameter=NITRATE AS N Unit =mg/L Watershed=West Bull



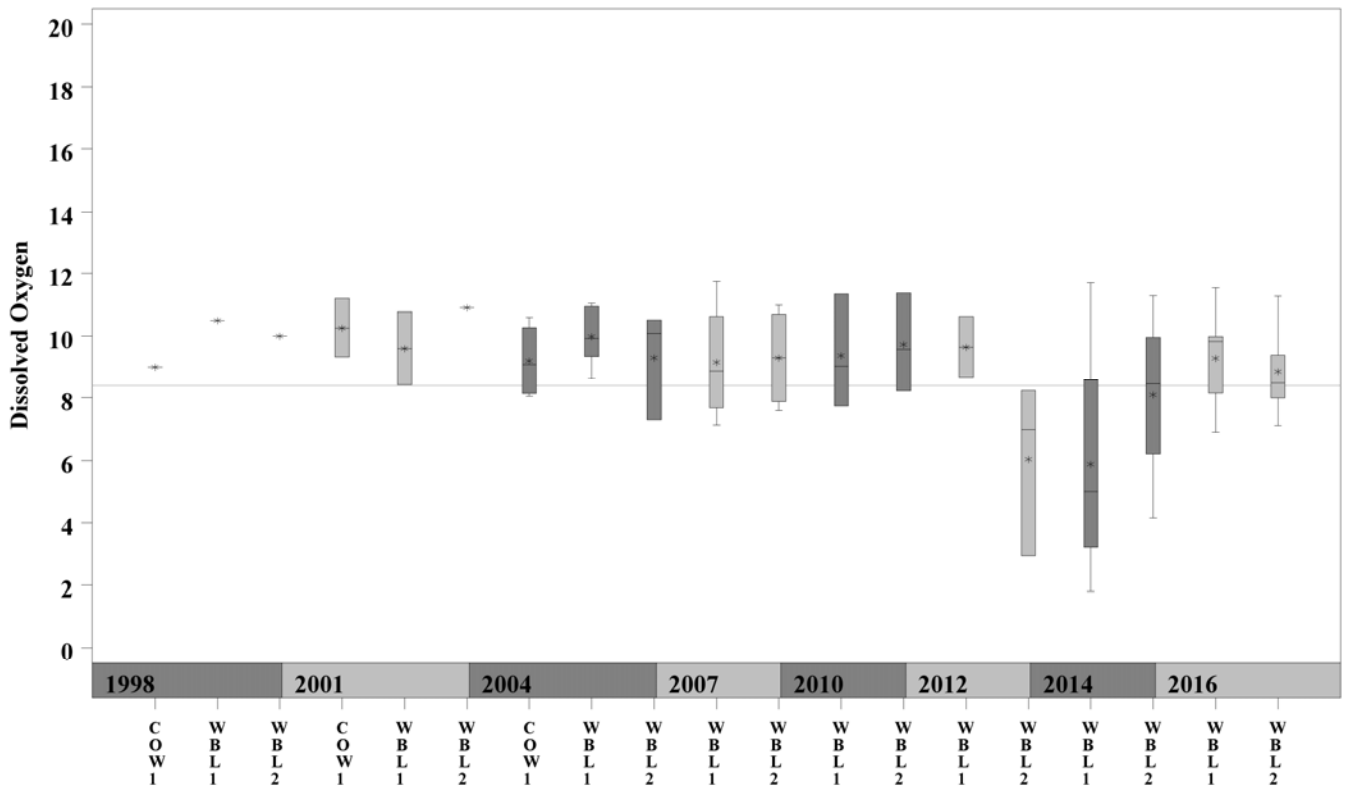
West Bull Creek Watershed

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

Parameter = ORTHOPHOSPHORUS AS P Unit = mg/L Watershed = West Bull



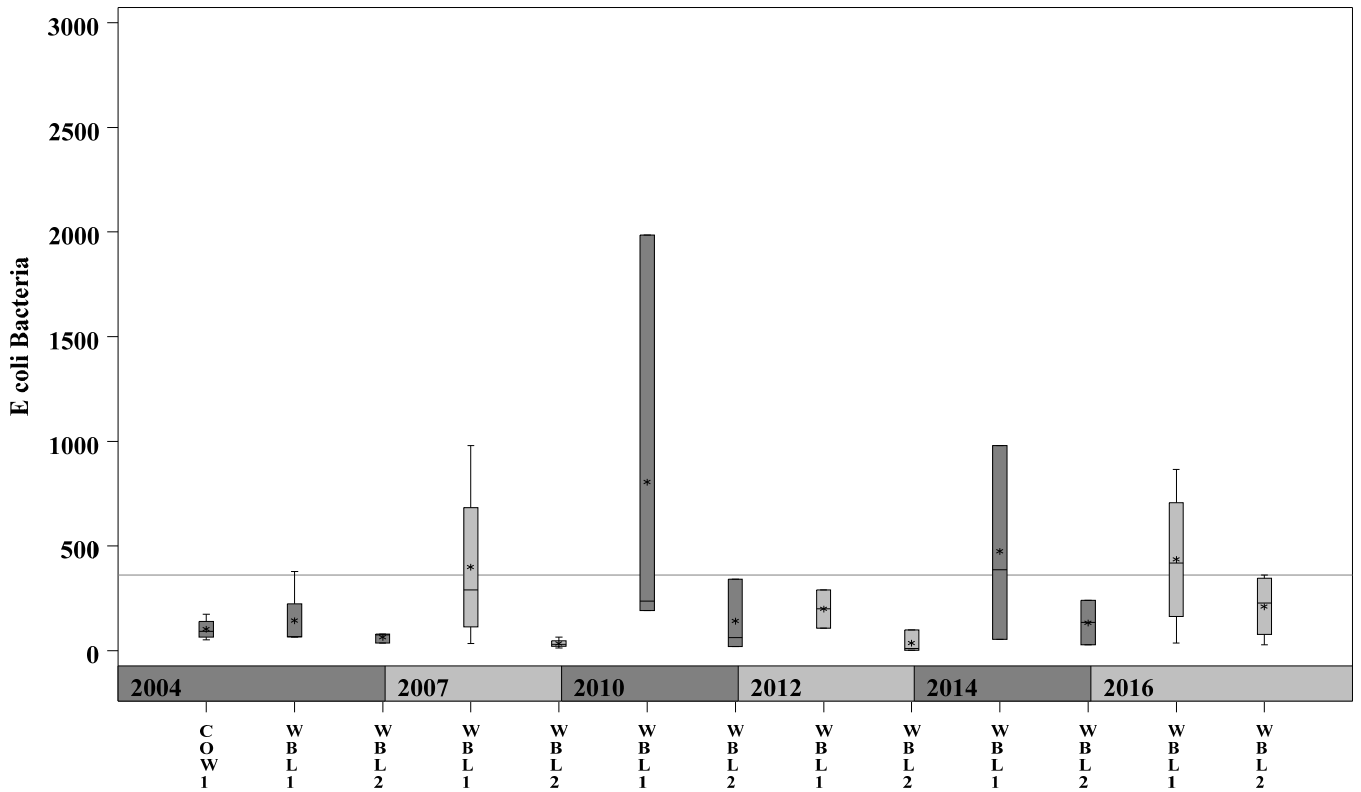
Parameter = DISSOLVED OXYGEN Unit = mg/L Watershed = West Bull



West Bull Creek Watershed

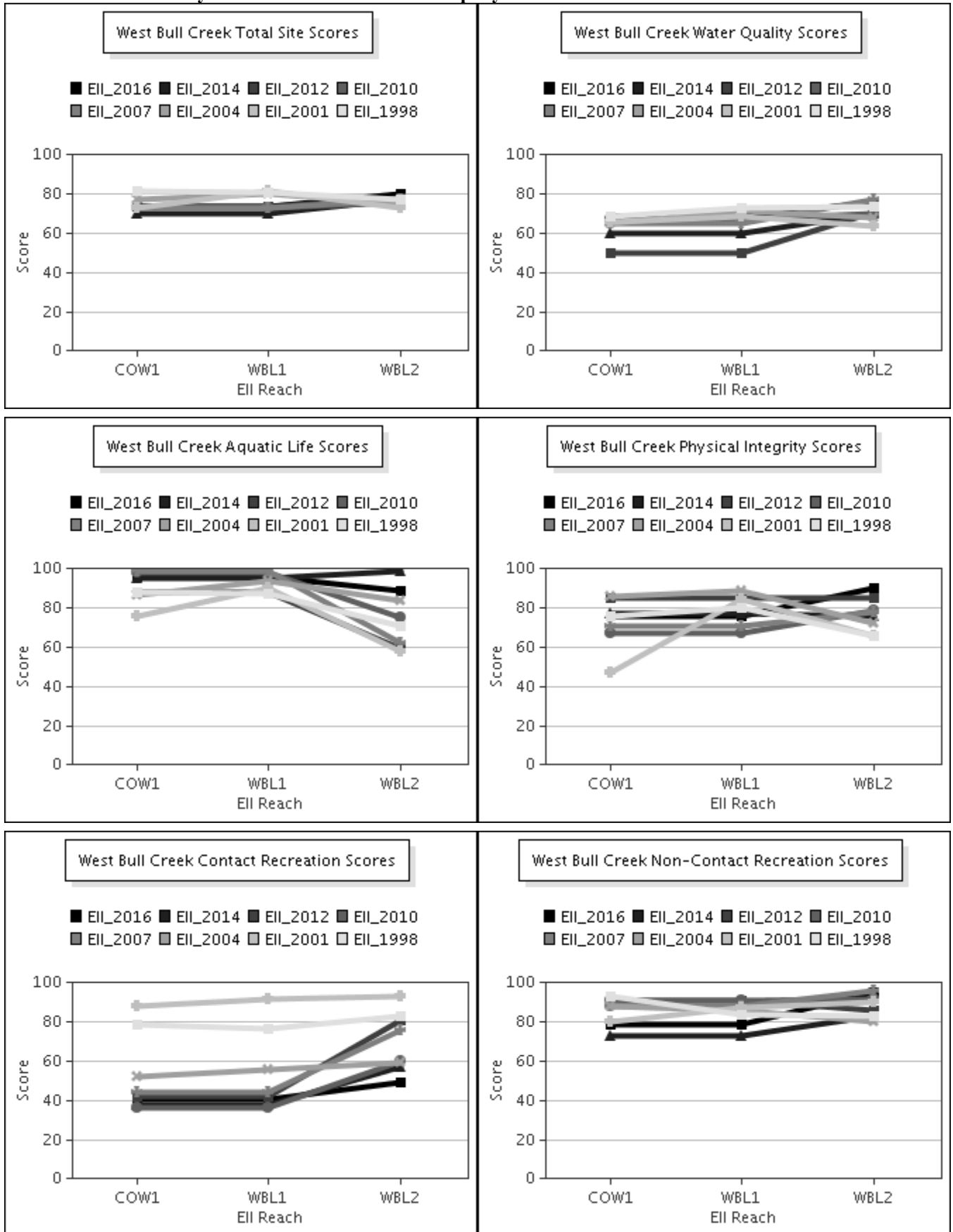
Data Summary Graphs – *E.coli* (Downstream to Upstream by Year)

Parameter = E COLI BACTERIA Unit = MPN/100mL Watershed = West Bull



West Bull Creek Watershed

Score Summary – Reach scores for each sample year



West Bull Creek Watershed

Benthic Macroinvertebrates – Taxa List, Pollution Tolerance Index & Functional Feeding Group for 2016 Sample Sites (Downstream to Upstream)

| Benthic Macroinvertebrates - West Bull Creek | | | WBL @ Bell Mt (148) 06/22/2016 (WRE) | WBL us BUL (343) 06/22/2016 (WRE) |
|--|-----|-------|---|--------------------------------------|
| Benthic Macroinvertebrate ID | PTI | FFG | | |
| Perlesta | 0 | P | | 1 |
| Chimarra | 2 | FC | 5 | 7 |
| Microcylloepus Pusillus | 2 | CG,SC | | 1 |
| Phylloicus Ornatus | 2 | SH | 3 | |
| Polycentropus / Cernotina | 3 | FC,P | 1 | 1 |
| Suragina Concinna | 3 | P | | 1 |
| Baetodes | 4 | SC | 1 | 4 |
| Camelobaetidius | 4 | CG | 2 | 5 |
| Fallceon | 4 | CG,SC | 3 | 16 |
| Mayatrichia | 4 | SC | | 3 |
| Simulium | 4 | FC | 136 | 20 |
| Aquarius | 5 | P | 1 | |
| Lutrochus | 5 | CG | | 2 |
| Notonecta | 5 | P | 2 | |
| Petrophila (Moth) | 5 | SC | | 3 |
| Archilestes | 6 | P | 1 | |
| Argia | 6 | P | 4 | 4 |
| Brechmorhoga Mendax | 6 | P | | 3 |
| Cheumatopsyche | 6 | FC | 8 | 70 |
| Chironomidae | 6 | FC,P | | 2 |
| Hydracarina | 6 | | 1 | 8 |
| Rhagovelia | 6 | P | 6 | 1 |
| Stenelmis | 7 | CG,SC | | 3 |
| Caloparyphus/Euparyphus | 8 | CG,SC | 4 | 1 |
| Oligochaeta | 8 | CG | 1 | 3 |
| Cambaridae | | CG | 1 | |
| Dugesia | | CG,P | | 1 |
| Nematomorpha | | | | 1 |

West Bull Creek Watershed

Site Photographs



148_t00-us-05_20_2004



148_t00-ds-05_20_2004



148_00-ur-05_26_2010



148_00-ds-05_26_2010



1030_t00-us-05_20_2004



1030_t00-ds-05_20_2004

West Bull Creek Watershed

Site Photographs



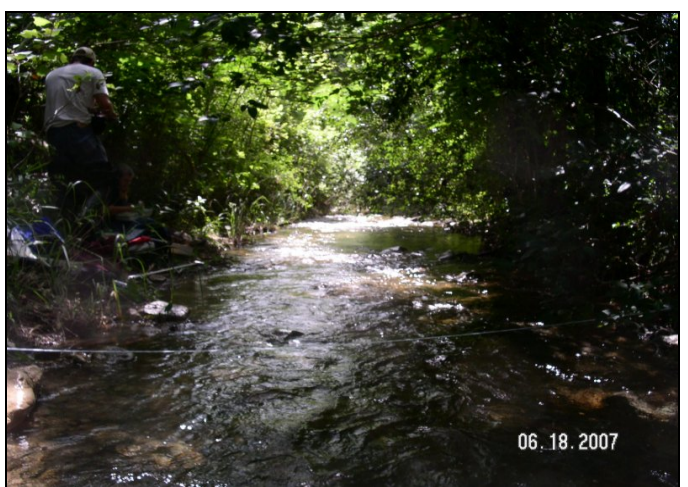
1107_t00-us-05_20_2004



1107_t00-ds-05_20_2004



343_t00-us-05_19_2004



343_ds_06_18_2007



343_00-ur-05_26_2010



343_00-ds-05_26_2010