# RICH FORK(BODENHEIMER)

STREAM/WETLAND RESTORATION

DAVIDSON COUNTY

2005 REPORT

## EXECUTIVE SUMMARY

The Rich Fork Mitigation Project restored 21.49 acres of riverine wetland and 3,398 linear feet of stream and preserved an additional 1,972 linear feet of perennial stream in the Yadkin River Basin yielding 18.59 Wetland Management Units and, 3,792 Stream Management Units. The project was initiated in spring of 2000 and construction was completed in the spring of 2004. The goal of the project is to re-establish an integrated wetland-stream complex that will restore ecosystem processes, structure, and composition to mitigate for wetland functions and values that have been lost as a result of anthropogenic disturbances in this region of the Yadkin River Basin.

Activities in 2005 reflect the second year of monitoring following construction. Included in this report are analyses of both hydrologic and vegetation monitoring results, as well as local climate conditions throughout the growing season. Monitoring activities included sampling vegetation survivability at six locations, monitoring ground water elevations at six locations and documenting general site conditions at six permanent photo documentation points within the wetland restoration area.

The wetland restoration components of the project were evaluated to determine their compliance with the success criteria established for vegetation and hydrology (soils did not require success criteria). Climatic data for the 2005 growing season was analyzed in comparison with historical data to determine whether 2005 was a normal year in terms of climate conditions, as a precursor to validating the results of the wetland monitoring. The historical data was collected from the NRCS, Water and Climate Center, Climate Analysis for Wetlands by County website. This evaluation concluded 2005 was a below normal year for rainfall during the growing season. Rainfall was within the 30$^{th}$ to 70$^{th}$ percentile thresholds as the range of normal for the months of February, March, April, and August. Rainfall was less than the 30$^{th}$ percentile threshold in January, May, June, September, and November. Rainfall was greater than the 70$^{th}$ percentile threshold in July and October.

The site was planted at a density of 680 trees per acre. There were six (6) vegetation-monitoring plots established throughout the planting areas. The 2005 vegetation monitoring of the planted areas revealed an average density of 607 trees per acre, which is well above the minimum requirement of 260 trees per acre needed to meet the success criteria at the end of the five year monitoring period.

Wetland hydrology was monitored through the entire 2005 growing season with groundwater gauges. The result of this monitoring indicated that the water table is within 12 inches of the soil surface for greater than 12.5 % of the growing season at all six monitoring gauges. In addition, the site gauges closely mimic the hydroperiod of the reference wetland.

Soils in the restoration portion of the site have been determined to be Wehadkee and Chewacla. Since these soils are already considered hydric, no success criteria or monitoring is required.

The as-built survey was completed immediately prior to relocation of active flow into the channel in June 2004. Second year monitoring data was collected in September 2005 for cross sectional area, planform and profiles in four monitoring reaches and compared to the as-built condition. Three bankfull event occurred during this time. The permanent cross-sections, planform and profile showed minimal deviation from the as-built conditions indicating that the streams are maintaining a stable form with dimensions and characteristics. Extreme drought during the summer of 2005 created unsuitable conditions for collecting a representative benthic macroinvertebrate sample. A supplemental sample will be collected during the spring of 2006, after which an addendum to this monitoring report will be submitted to the EEP with the appropriate data.

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## 1.0 WETLANDS

The wetland restoration components of the project were evaluated to determine their compliance with the success criteria established for vegetation and hydrology (soils did not require success criteria). Climatic data for the 2005 growing season was analyzed in comparison with historical data to determine whether 2005 was a normal year in terms of climate conditions, as a precursor to validating the results of the wetland monitoring. The historical data was collected from the NRCS, Water and Climate Center, Climate Analysis for Wetlands by County website. This evaluation concluded 2005 was a below normal year for rainfall during the growing season. Rainfall was within the 30th to 70th percentile thresholds as the range of normal for the months of February, March, April, and August. Rainfall was less than the 30th percentile threshold in January, May, June, September, and November. Rainfall was greater than the 70th percentile threshold in July and October (Appendix B).

**1.1 Vegetation -** The 21.49-acre wetland restoration/creation/enhancement site was planted at a density of 680 trees per acre. There were six (6) vegetation-monitoring plots established throughout the planting areas. The 2005 vegetation monitoring of the planted areas revealed an average density of 607 trees per acre, which is well above the minimum requirement of 260 trees per acre (Appendix A). The 2005 vegetation monitoring counted one more tree in plot 2 than had been counted in the previous year. This is the result of either a planted tree that appeared dead in 2004 resprouted or the tree was not found during the 2004 monitoring. The average density for the Piedmont Bottomland Forest species was 607 trees per acre after two years (Table 1). Table 2 shows that there was no tree mortality between the 2004 and 2005 monitoring years. A total of 6.5 trees per vegetation-monitoring plot are needed to meet the 260 trees per acre minimum requirement.

**Table 1: Vegetation Monitoring Results**

| Plot # | Willow Oak | Swamp Chestnut Oak | Laurel Oak | Yellow Poplar | Swamp Blackgum | Black Willow | Silky Dogwood | Overcup Oak | Green Ash | Cherry bark Oak | Total (Year 2) | Total (at planting) | Density - Year 2 (Trees/Acre) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | | 12 | | 4 | | | | | 2 | | 18 | 18 | 720 |
| **2** | | 2 | 7 | | | | | | | 6 | 15 | 15 | 600 |
| **3** | 7 | 2 | 1 | | | | | | 6 | | 16 | 16 | 640 |
| **4** | | 3 | 3 | 2 | | 2 | 1 | | 4 | 2 | 17 | 18 | 680 |
| **5** | | 1 | | | | | | | 12 | | 13 | 13 | 520 |
| **6** | 2 | 7 | | 1 | | | | | 2 | | 12 | 12 | 480 |
| | | | | | | | | | | | **Total Year 2 Average** | | **607** |

**Table 2: Vegetation History (Trees/Acre)**

| Plot # | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| **1** | 720 | 720 | | | |
| **2** | 560 | 600* | | | |
| **3** | 640 | 640 | | | |
| **4** | 680 | 680 | | | |
| **5** | 520 | 520 | | | |
| **6** | 480 | 480 | | | |

* More trees/acre recorded in Year 2 because of either a resprout from a tree that was previously counted as dead or a missed tree from Year 1.

**1.2 Hydrology** Wetland hydrology was monitored through the entire 2005 growing season with groundwater gauges (Appendix B). The result of this monitoring indicated that the water table is within 12 inches of the soil surface for greater than 12.5 % of the growing season at all six monitoring gauges (Table 2). In addition the site gauges closely mimic the hydroperiod of the reference wetland.

**Table 3: Hydrologic Monitoring Results**

| Gauge # | 5% | 5% - 8% | 8% -12.5% | >12.5% | No. of Days | Dates Meeting Success |
|---|---|---|---|---|---|---|
| 1 | | | | X | 65 | 314-5/17 |
| 2 | | | | X | 65 and 56 | 3/14-5/17 and 7/3-8/28 |
| 3 | | | | X | 102 and 34 | 3/14-6/23 and 10/7-11/10 |
| 4 | | | | X | 66 | 3/14-5/18 |
| 5 | | | | X | 103 and 54 | 3/14-6/24 and 7/4-8/27 |
| 6 | | | | X | 65, 34, and 52 | 3/14-5/17, 5/20-6/23, and 7/4-8/24 |
| Ref. Wetland | | | | X | 80 | 3/14-6/1 |

**Table 4. Hydroperiod History**

| Gauge # | Pre-Restoration | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|
| 1 | <5% | >12.5% | >12.5% | | | |
| 2 | <5% | >12.5% | >12.5% | | | |
| 3 | <5% | >12.5% | >12.5% | | | |
| 4 | <5% | >12.5% | >12.5% | | | |
| 5 | <5% | >12.5% | >12.5% | | | |
| 6 | <5% | >12.5% | >12.5% | | | |
| Ref. Wetland | >12.5% | >12.5% | >12.5% | | | |

**1.3 Soils -** Soils in the restoration portion of the site have been determined to be Wehadkee and Chewacla. Wehadkee is a hydric soil shown on the state and federal hydric soils list and the Chewacla soils have hydric inclusions of poorly drained soils. The overburden and fill associated with the Chewacla soils was removed during construction to restore the hydric characteristics of the soil lost from filling and over bank flooding. As both soils are already considered hydric, no success criteria or monitoring was required.

## 2.0 STREAMS

The streams restored on site were monitored to evaluate their compliance with the success criteria established for physical stability (cross section, planform and profile) and biological.

**2.1 Physical** - The as-built survey was completed immediately prior to relocation of active flow into the channel in June 2004. Second year monitoring data was collected in September of 2005 for cross sectional area, planform and profiles in four monitoring reaches and compared to the as-built condition (Appendix C) Three bankfull events occurred during this time. The permanent cross-sections (Table 4), planform (Table 5) and profile (Table 6) showed minimal deviation from the as-built conditions indicating that the streams are maintaining a stable form with dimensions and characteristics.

**Table 5. Bankfull Cross Sectional Area**

| X-Section | As-Built | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|
| XS-1 Main Stem Up | 7.28 | 7.34 | 6.25 | | | |
| XS-2 Main Stem Up | 2.14 | 2.45 | 1.9 | | | |
| XS-3 Main Stem Down | 5.88 | 5.72 | 5.20 | | | |
| XS-4 Main Stem Down | 4.56 | 4.85 | 3.99 | | | |
| XS-1 Tributary Up | 1.79 | 1.55 | 2.69 | | | |
| XS-2 Tributary Up | 1.18 | 1.14 | 0.94 | | | |
| XS-3 Tributary Down | 2.61 | 2.71 | 1.57 | | | |
| XS-4 Tributary Down | 1.14 | 1.20 | 0.93 | | | |

**Table 6. Planform (Sinuosity/Radius of Curvature)**

| Reach | As-Built | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|
| Main Stem Up | 1.19/13.93 | 1.19/13.93 | 1.19/13.45 | | | |
| Main Stem Down | 1.20/13.00 | 1.20/13.08 | 1.20/14.86 | | | |
| Tributary Up | 1.24/7.39 | 1.24/7.39 | 1.24/8.71 | | | |
| Tributary Down | 1.35/7.27 | 1.35/7.27 | 1.35/7.63 | | | |

**Table 7. Profile (Average depth in feet from control elevation)**

| Reach | As-Built | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|
| Main Stem Up | 1.42 | 1.37 | 1.28 | | | |
| Main Stem Down | 0.87 | 0.82 | 0.82 | | | |
| Tributary Up | 0.87 | 0.82 | 0.79 | | | |
| Tributary Down | 1.15 | 1.09 | 0.86 | | | |

**2.2 Biological Monitoring –** Extreme drought during the summer of 2005 created unsuitable conditions for collecting a representative benthic macroinvertebrate sample. A supplemental sample will be collected during the spring of 2006, after which an addendum to this monitoring report will be submitted to the EEP with the appropriate data.

**Table 8. Summary Benthic Macroinvertebrate Data**

| Sampling Location | Total No. of Organisms | | | | | | Total Number of Taxa | | | | | | Biotic Index Assigned Values | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Pre | 1 | 2 | 3 | 4 | 5 | Pre | 1 | 2 | 3 | 4 | 5 | Pre | 1 | 2 | 3 | 4 | 5 |
| Upstream* | 24 | 33 | N/A | | | | 9 | 10 | N/A | | | | 6.61 | 7.47 | N/A | | | |
| Main Stem Up | N/A | 52 | N/A | | | | N/A | 17 | N/A | | | | N/A | 7.63 | N/A | | | |
| Tributary Up | N/A | 56 | N/A | | | | N/A | 18 | N/A | | | | N/A | 7.45 | N/A | | | |
| Confluence | N/A | 27 | N/A | | | | N/A | 13 | N/A | | | | N/A | 6.77 | N/A | | | |

*Upstream control site monitored pre-restoration

## 3.0 MAINTENANCE/MANAGEMENT ACTIONS

Maintenance actions conducted during the 2005 growing season included the application of a pre-emergent herbicide. This maintenance action resulted in decreased herbaceous competition with the planted trees, improving the growth for many of the planted species. A small number of trees experienced a burning of leaves due to contact with the herbicide. The few trees with burnt leaves are expected to fully recover.

## 4.0 CONCLUSIONS

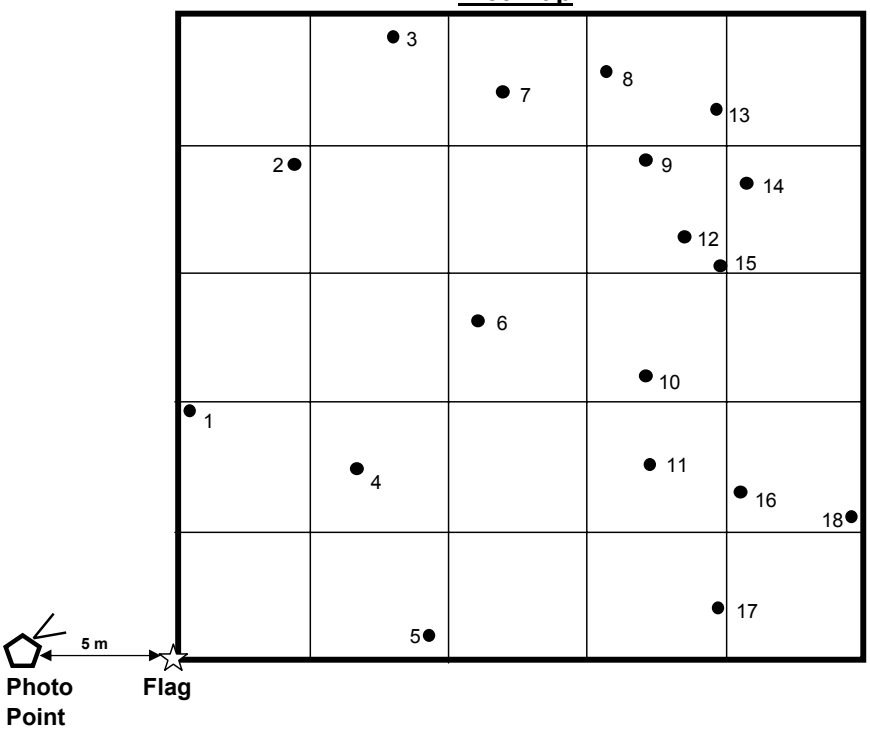
Findings from this monitoring year indicate that the project site is performing as designed. The survival of the planted species exceeds the density requirement of the success criteria and non-target species were not identified in any of the vegetation-monitoring plots. All six monitoring gauges exceeded the hydrologic success criteria of 8% of the growing season. Physical monitoring of the stream at four (4) permanent monitoring reaches documented minimal change in the cross section, planform or profile from the as-built conditions. The only observable change in the profile and cross sections was a slight aggrading within the pools of both the tributary and the main stream. This is not surprising due to the sediments brought onto the site from the flooding of Rich Fork Creek and dead organic debris from the densely vegetated banks. The stream is maintaining a stable form and accessing its floodplain. Instream structures are stable and functioning. Observations of stream bank vegetation indicate that live stake survivability is very good and the herbaceous vegetation is well developed on the stream banks. Biological diversity data was unable to be collected during the 2005 monitoring year. Supplemental data on biological diversity will be submitted in the spring of 2006.

# Appendix A
# Vegetation Monitoring Plot Data Sheets

# Vegetation Monitoring Worksheet

**Site:** Richfork **Plot:** 1 **Date:** 9/14/2005

## Plot Map




| ID | Species | Height (m) | Collar Diameter (cm) | Comments (insect damage, disease, browsing) |
|---|---|---|---|---|
| 1 | Yellow Poplar (*Liriodendron tulipifera*) | 1.0 | 0.8 | healthy |
| 2 | Yellow Poplar (*Liriodendron tulipifera*) | 0.6 | 0.8 | healthy |
| 3 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.5 | 0.5 | healthy |
| 4 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.7 | 8.0 | healthy |
| 5 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.7 | 7.0 | healthy |
| 6 | Yellow Poplar (*Liriodendron tulipifera*) | 0.7 | 1.2 | healthy |
| 7 | Yellow Poplar (*Liriodendron tulipifera*) | 0.6 | 8.0 | healthy |
| 8 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.5 | 0.5 | healthy |
| 9 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.7 | 7.0 | healthy |
| 10 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.9 | 0.7 | healthy |
| 11 | Green Ash (*Fraxinus pennsylvanica*) | 1.0 | 1.0 | healthy |
| 12 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.8 | 0.7 | healthy |
| 13 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.8 | 0.7 | healthy |
| 14 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.8 | 8.0 | healthy |
| 15 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.6 | 0.4 | healthy |
| 16 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.8 | 0.6 | healthy |
| 17 | Green Ash (*Fraxinus pennsylvanica*) | 0.6 | 0.7 | healthy |
| 18 | Swamp Chestnut Oak (*Quercus michauxii*) | 1.1 | 1.5 | healthy |
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| Species | Percent of Total |
|---|---|
| Swamp Chestnut Oak (*Quercus michauxii*) | 67% |
| Yellow Poplar (*Liriodendron tulipifera*) | 22% |
| Green Ash (*Fraxinus pennsylvanica*) | 11% |
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## Density:

**Total Number of Trees** **18** / **0.025 acres** = **720** **trees / acre**

## Survivability:

**Total Number of Trees** **18** / **18 trees** x **100** = **100** **% survivability**

**Number of New Recruits :** _____

**Note :** Flag located N 38° E, 27' from monitoring well

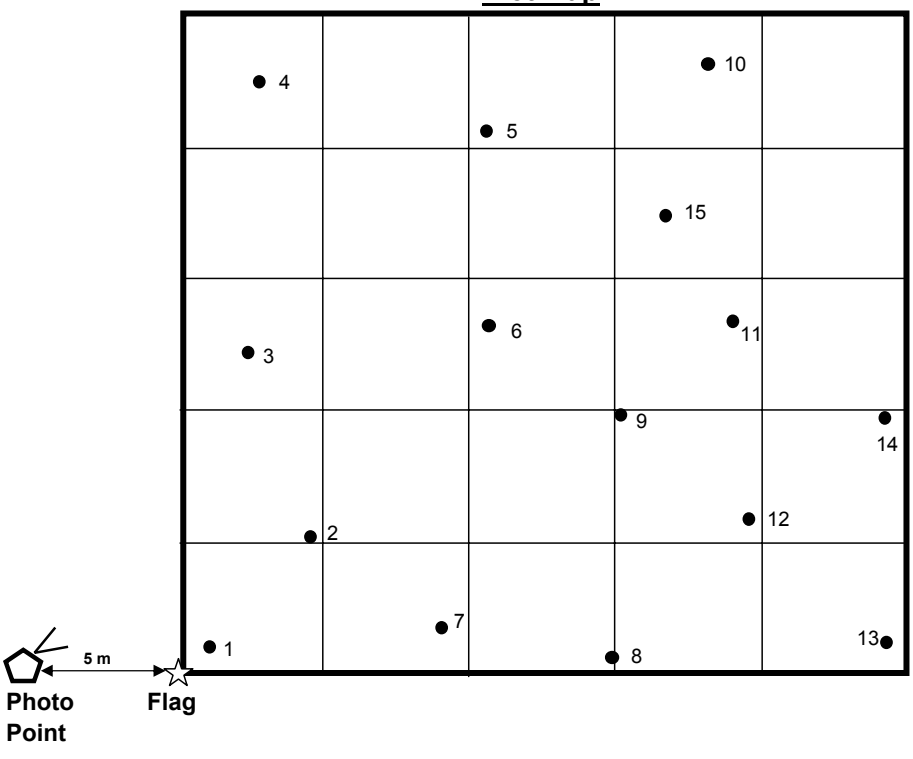
**1st Year Monitoring**

**2nd Year Monitoring**

# Vegetation Monitoring Worksheet

**Site:** Richfork **Plot:** 2 **Date:** 9/14/2005

## Plot Map




| ID | Species | Height (m) | Collar Diameter (cm) | Comments (insect damage, disease, browsing) |
|---|---|---|---|---|
| 1 | Laurel Oak (*Quercus laurifolia*) | 1.3 | 0.7 | healthy |
| 2 | Laurel Oak (*Quercus laurifolia*) | 0.7 | 1.0 | healthy |
| 3 | Cherrybark Oak (*Quercus falcata*) | 0.5 | 0.6 | healthy |
| 4 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.8 | 1.3 | healthy |
| 5 | Cherrybark Oak (*Quercus falcata*) | 0.4 | 0.6 | healthy |
| 6 | Laurel Oak (*Quercus laurifolia*) | 0.8 | 0.6 | healthy |
| 7 | Cherrybark Oak (*Quercus falcata*) | 0.7 | 0.6 | healthy |
| 8 | Cherrybark Oak (*Quercus falcata*) | 0.4 | 0.4 | healthy |
| 9 | Cherrybark Oak (*Quercus falcata*) | 0.7 | 0.8 | healthy |
| 10 | Laurel Oak (*Quercus laurifolia*) | 0.7 | 0.8 | healthy |
| 11 | Cherrybark Oak (*Quercus falcata*) | 0.5 | 0.6 | healthy |
| 12 | Laurel Oak (*Quercus laurifolia*) | 0.9 | 1.3 | healthy multistemed |
| 13 | Swamp Chestnut Oak (*Quercus michauxii*) | 1.5 | 1.7 | healthy |
| 14 | Laurel Oak (*Quercus laurifolia*) | 0.7 | 0.7 | healthy |
| 15 | Laurel Oak (*Quercus laurifolia*) | 1.3 | 1.0 | healthy |
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| Species | Percent of Total |
|---|---|
| Swamp Chestnut Oak (*Quercus michauxii* ) | 13% |
| Cherrybark Oak (*Quercus falcata* ) | 40% |
| Laurel Oak (*Quercus laurifolia* ) | 47% |
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## Density:

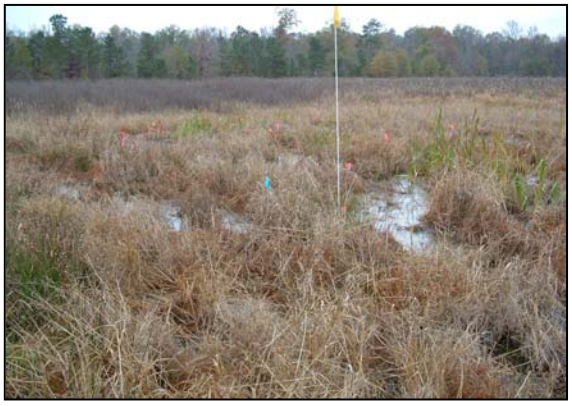
**Total Number of Trees** **15** / **0.025 acres** = **600** **trees / acre**

## Survivability:

**Total Number of Trees** **15** / **15 trees** x **100** = **100** **% survivability**

**Number of New Recruits :** _____

**Note :** Flag located W 270° N, 126' from monitoring well



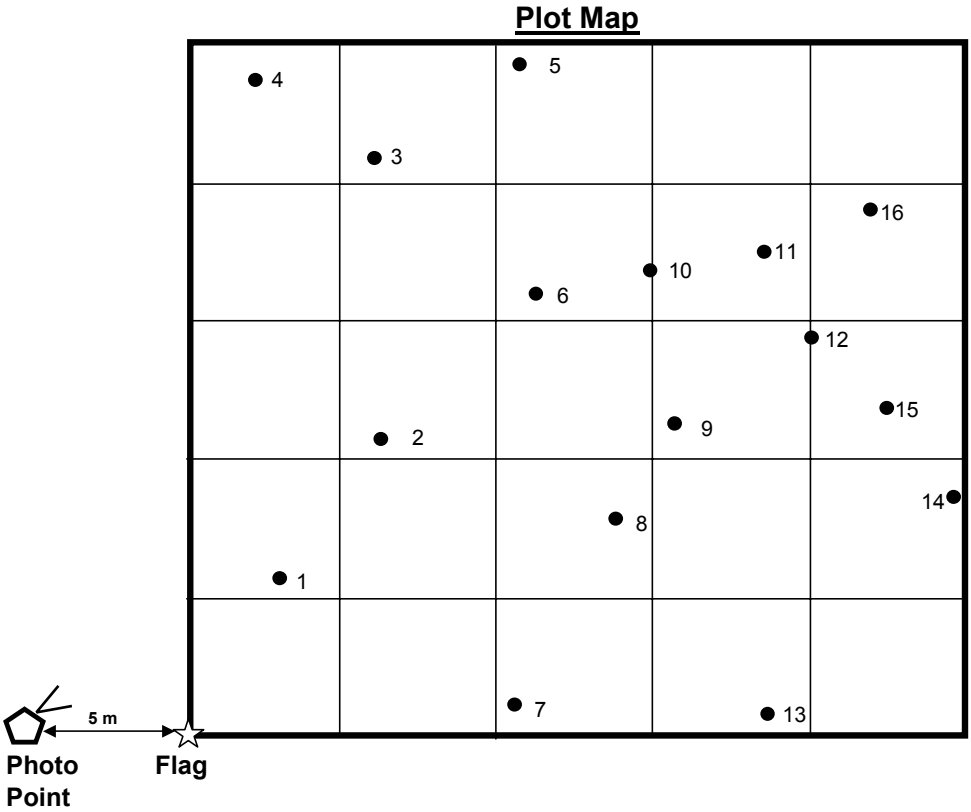
**1st Year Monitoring**

**2nd Year Monitoring**

# Vegetation Monitoring Worksheet

**Site:** Richfork **Plot:** 3 **Date:** 9/14/2005

## Plot Map




| ID | Species | Height (m) | Collar Diameter (cm) | Comments (insect damage, disease, browsing) |
|---|---|---|---|---|
| 1 | Willow Oak (*Quercus phellos*) | 0.8 | 1.0 | healthy |
| 2 | Laurel Oak (*Quercus laurifolia*) | 0.9 | 0.7 | almost all leaves brown |
| 3 | Willow Oak (*Quercus phellos*) | 0.7 | 0.7 | almost all leaves brown |
| 4 | Willow Oak (*Quercus phellos*) | 0.7 | 0.8 | almost all leaves brown |
| 5 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.9 | 0.7 | healthy |
| 6 | Willow Oak (*Quercus phellos*) | 0.5 | 0.5 | healthy |
| 7 | Green Ash (*Fraxinus pennsylvanica*) | 1.0 | 0.9 | healthy |
| 8 | Green Ash (*Fraxinus pennsylvanica*) | 1.0 | 1.1 | healthy |
| 9 | Green Ash (*Fraxinus pennsylvanica*) | 1.3 | 1.7 | healthy |
| 10 | Willow Oak (*Quercus phellos*) | 0.7 | 0.9 | healthy |
| 11 | Willow Oak (*Quercus phellos*) | 0.5 | 0.6 | healthy |
| 12 | Green Ash (*Fraxinus pennsylvanica*) | 1.6 | 1.7 | healthy |
| 13 | Green Ash (*Fraxinus pennsylvanica*) | 1.1 | 1.2 | healthy |
| 14 | Swamp Chestnut Oak (*Quercus michauxii*) | 1.3 | 1.5 | healthy |
| 15 | Green Ash (*Fraxinus pennsylvanica*) | 1.5 | 1.5 | healthy |
| 16 | Willow Oak (*Quercus phellos*) | 0.5 | 0.7 | healthy |
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| Species | Percent of Total |
|---|---|
| Swamp Chestnut Oak (*Quercus michauxii*) | 13% |
| Willow Oak (*Quercus phellos*) | 44% |
| Green Ash (*Fraxinus pennsylvanica*) | 38% |
| Laurel Oak (Quercus laurifolia) | 6% |
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## Density:

**Total Number of Trees** **16** / **0.025 acres** = **640** **trees / acre**

## Survivability:

**Total Number of Trees** **16** / **16 trees** x **100** = **100** **% survivability**

**Number of New Recruits :** _____

**Note :** Flag located N 38° E, 27' from monitoring well

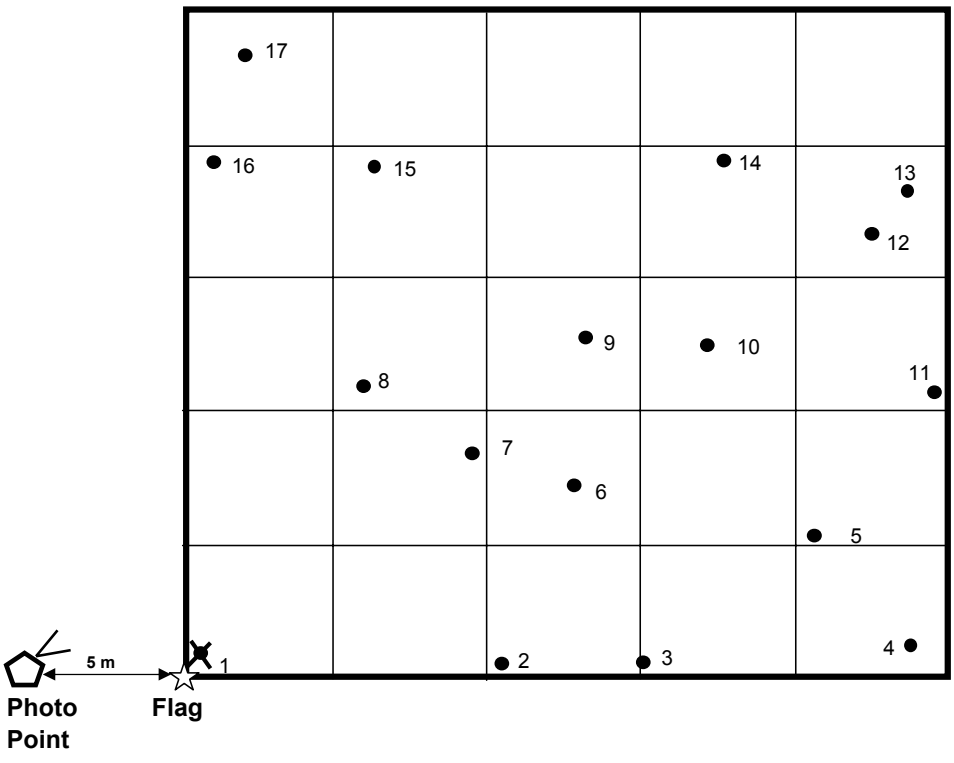
**1st Year Monitoring**

**2nd Year Monitoring**

# Vegetation Monitoring Worksheet

**Site:** Richfork **Plot:** 4 **Date:** 9/14/2005

## Plot Map




| ID | Species | Height (m) | Collar Diameter (cm) | Comments (insect damage, disease, browsing) |
|---|---|---|---|---|
| 1 | Swamp Black Gum (*Nyssa sylvatica*) | 0.5 | 0.6 | dead |
| 2 | Laurel Oak (*Quercus laurifolia*) | 0.6 | 0.4 | healthy two stems |
| 3 | Cherrybark Oak (*Quercus falcata*) | 1.1 | 0.6 | healthy |
| 4 | Black Willow (*Salix nigra*) | 1.9 | 2.0 | healthy multistem |
| 5 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.7 | 1.3 | healthy |
| 6 | Laurel Oak (*Quercus laurifolia*) | 0.6 | 0.4 | healthy |
| 7 | Swamp Chestnut Oak (*Quercus michauxii*) | 1.0 | 1.3 | healthy |
| 8 | Swamp Chestnut Oak (*Quercus michauxii*) | 1.2 | 1.4 | healthy |
| 9 | Yellow Poplar (*Liriodendron tulipifera*) | 0.6 | 2.2 | healthy |
| 10 | Yellow Poplar (*Liriodendron tulipifera*) | 0.5 | 1.3 | healthy |
| 11 | Cherrybark Oak (*Quercus falcata*) | 0.5 | 0.6 | healthy |
| 12 | Silky Dogwood (*Cornus amomum*) | 0.8 | 1.3 | healthy multistem |
| 13 | Green Ash (*Fraxinus pennsylvanica*) | 1.9 | 1.9 | healthy |
| 14 | Green Ash (*Fraxinus pennsylvanica*) | 1.2 | 1.6 | healthy |
| 15 | Cherrybark Oak (*Quercus falcata*) | 1.0 | 0.7 | healthy |
| 16 | Green Ash (*Fraxinus pennsylvanica*) | 1.0 | 1.3 | healthy multistem |
| 17 | Black Willow (*Salix nigra*) | 1.9 | 2.5 | healthy |
| 18 | Green Ash (*Fraxinus pennsylvanica*) | 1.4 | 1.2 | healthy |
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| Species | Percent of Total |
|---|---|
| Swamp Chestnut Oak (*Quercus michauxii*) | 18% |
| Green Ash (*Fraxinus pennsylvanica*) | 24% |
| Cherrybark Oak (*Quercus falcata*) | 12% |
| Swamp Black Gum (*Nyssa sylvatica*) | 0% |
| Silky Dogwood (*Cornus amomum*) | 6% |
| Black Willow (*Salix nigra*) | 12% |
| Yellow Poplar (*Liriodendron tulipifera*) | 12% |
| Laurel Oak (*Quercus laurifolia*) | 18% |

## Density:

**Total Number of Trees** **17** / **0.025 acres** = **680** **trees / acre**

## Survivability:

**Total Number of Trees** **17** / **18 trees** x **100** = **94.4** **% survivability**

**Number of New Recruits :** _____

**Note :** Flag located E 158° S, 76' from monitoring well

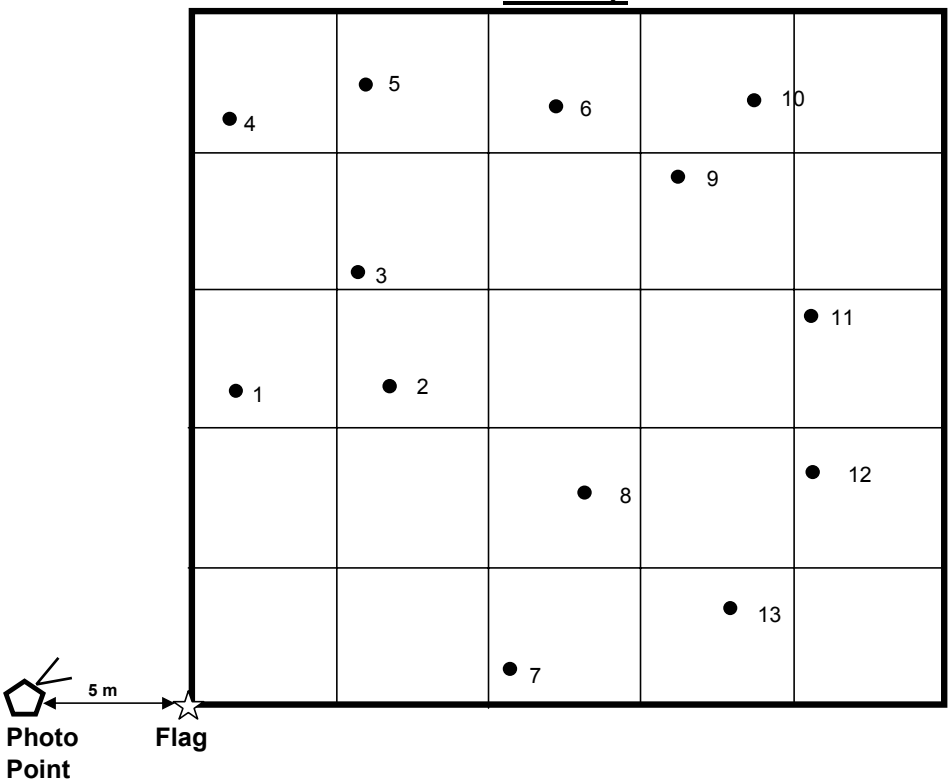
**1st Year Monitoring**

**2nd Year Monitoring**

# Vegetation Monitoring Worksheet

**Site:** Richfork **Plot:** 5 **Date:** 9/14/2005

## Plot Map




| ID | Species | Height (m) | Collar Diameter (cm) | Comments (insect damage, disease, browsing) |
|---|---|---|---|---|
| 1 | Green Ash (*Fraxinus pennsylvanica* ) | 0.8 | 0.9 | healthy |
| 2 | Green Ash (*Fraxinus pennsylvanica* ) | 1.0 | 0.9 | healthy |
| 3 | Green Ash (*Fraxinus pennsylvanica* ) | 1.0 | 1.3 | healthy |
| 4 | Green Ash (*Fraxinus pennsylvanica* ) | 0.6 | 0.8 | healthy |
| 5 | Green Ash (*Fraxinus pennsylvanica* ) | 0.8 | 1.0 | healthy |
| 6 | Green Ash (*Fraxinus pennsylvanica* ) | 0.8 | 1.2 | healthy |
| 7 | Green Ash (*Fraxinus pennsylvanica* ) | 0.8 | 1.1 | almost all leaves brown |
| 8 | Green Ash (*Fraxinus pennsylvanica* ) | 0.6 | 0.7 | healthy |
| 9 | Green Ash (*Fraxinus pennsylvanica* ) | 1.1 | 1.3 | healthy |
| 10 | Swamp Chestnut Oak (*Quercus michauxii* ) | 0.8 | 0.8 | healthy |
| 11 | Green Ash (*Fraxinus pennsylvanica* ) | 1.1 | 1.6 | healthy |
| 12 | Green Ash (*Fraxinus pennsylvanica* ) | 1.1 | 1.2 | healthy |
| 13 | Green Ash (*Fraxinus pennsylvanica* ) | 0.4 | 0.5 | healthy |
| | | | | |
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| | | | | |
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| | | | | |
| | | | | |
| | | | | |

| Species | Percent of Total |
|---|---|
| Swamp Chestnut Oak (*Quercus michauxii*) | 8 |
| Green Ash (*Fraxinus pennsylvanica*) | 92 |
| | |
| | |
| | |
| | |
| | |
| | |

## Density:

**Total Number of Trees** **13** / **0.025 acres** = **520** **trees / acre**

## Survivability:

**Total Number of Trees** **13** / **13 trees** x **100** = **100** **% survivability**

**Number of New Recruits :** _____

**Note :** Flag located N 38° E, 27' from monitoring well

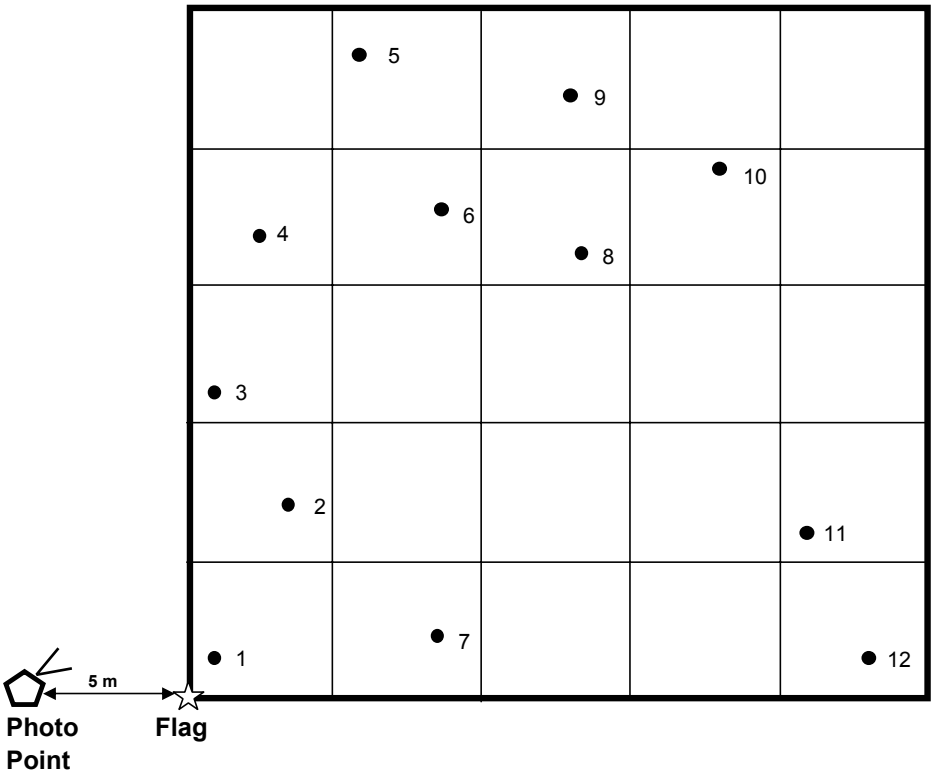
**1st Year Monitoring**

**2nd Year Monitoring**

# Vegetation Monitoring Worksheet

**Site:** Richfork **Plot:** 6 **Date:** 9/14/2005

## Plot Map




| ID | Species | Height (m) | Collar Diameter (cm) | Comments (insect damage, disease, browsing) |
|---|---|---|---|---|
| 1 | Swamp Chestnut Oak (*Quercus michauxii*) | 1.0 | 1.1 | healthy |
| 2 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.8 | 0.7 | healthy |
| 3 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.9 | 0.7 | healthy |
| 4 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.7 | 0.8 | top has died back, still alive |
| 5 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.8 | 1.3 | healthy |
| 6 | Willow Oak (*Quercus phellos*) | 0.5 | 0.7 | healthy |
| 7 | Swamp Chestnut Oak (*Quercus michauxii*) | 1.1 | 1.2 | healthy |
| 8 | Green Ash (*Fraxinus pennsylvanica*) | 1.1 | 1.1 | healthy |
| 9 | Yellow Poplar (*Liriodendron tulipifera*) | 0.4 | 0.7 | healthy |
| 10 | Swamp Chestnut Oak (*Quercus michauxii*) | 0.9 | 0.9 | top unhealthy, healthy root resprout |
| 11 | Green Ash (*Fraxinus pennsylvanica*) | 1.3 | 1.9 | healthy |
| 12 | Willow Oak (*Quercus phellos*) | 0.5 | 0.9 | healthy |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
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| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| Species | Percent of Total |
|---|---|
| Swamp Chestnut Oak (*Quercus michauxii*) | 58 |
| Green Ash (*Fraxinus pennsylvanica*) | 17 |
| Yellow Poplar (*Liriodendron tulipifera*) | 8 |
| Willow Oak (*Quercus phellos*) | 17 |
| | |
| | |
| | |
| | |

## Density:

**Total Number of Trees** **12** / **0.025 acres** = **480** **trees / acre**

## Survivability:

**Total Number of Trees** **12** / **12 trees** x **100** = **100** **% survivability**

**Number of New Recruits :** _____

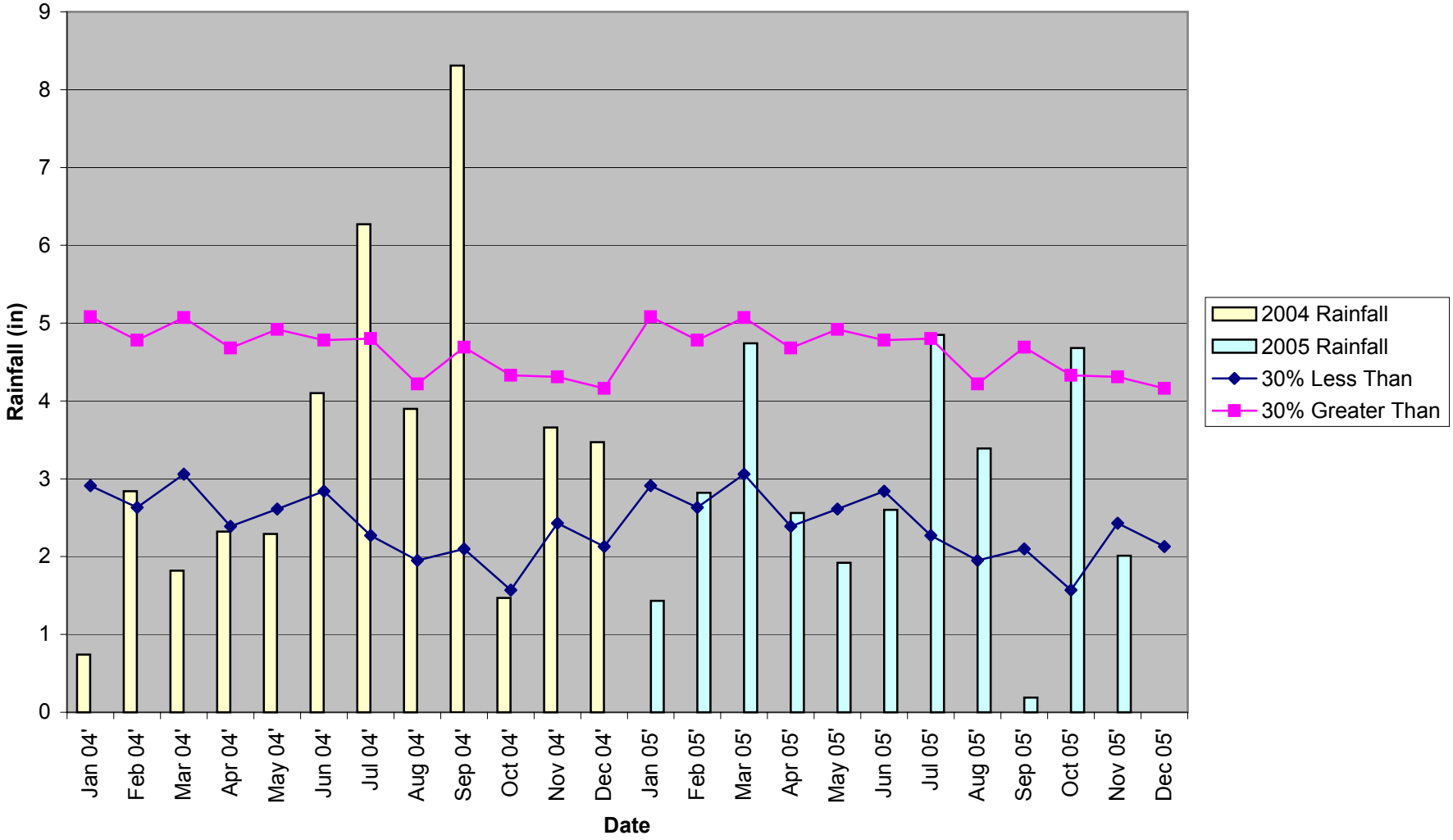
**Note :** Flag located N 38° E, 27' from monitoring well

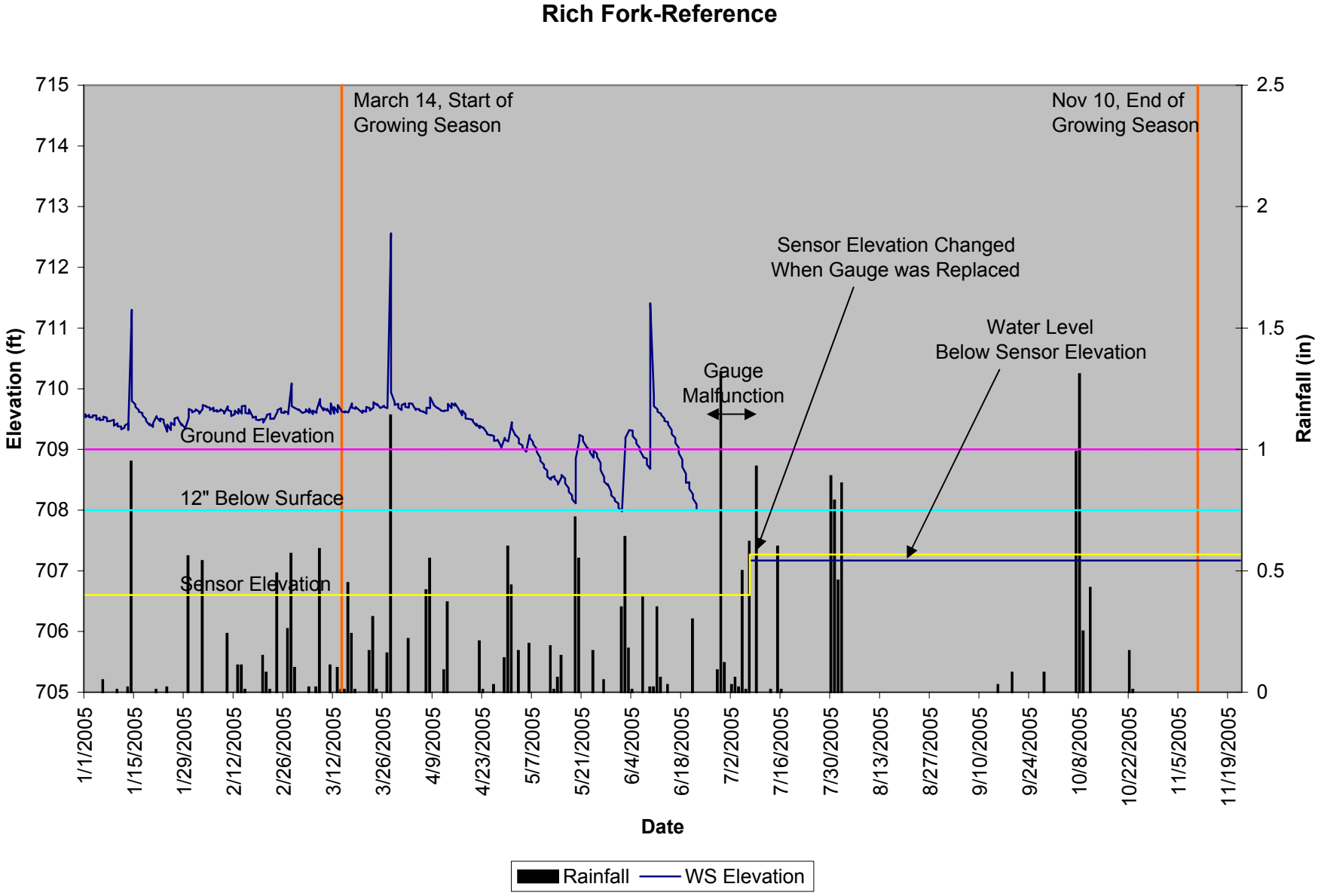
**1st Year Monitoring**

**2nd Year Monitoring**

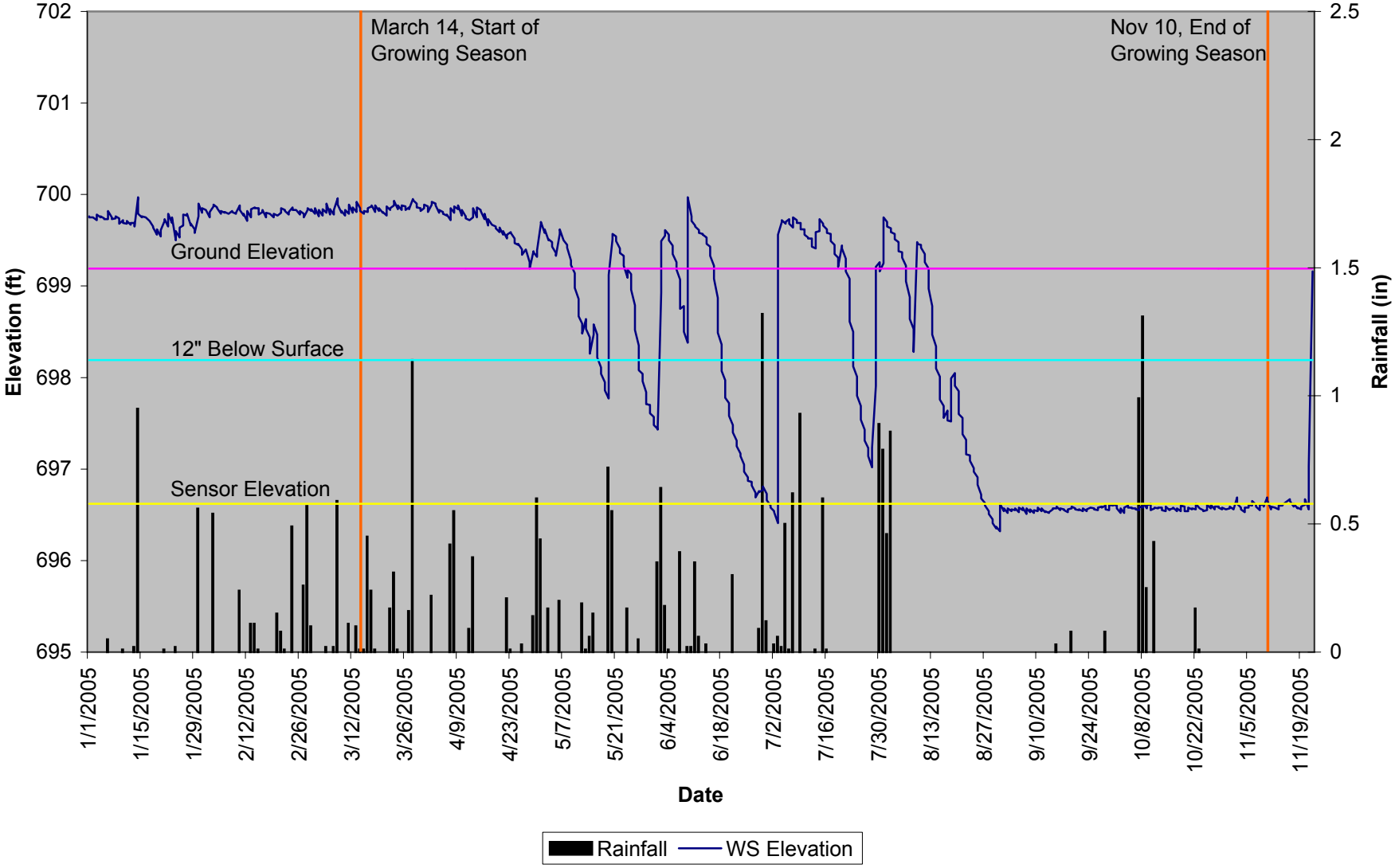
# Appendix B
# Hydrologic Monitoring and Hydroperiod

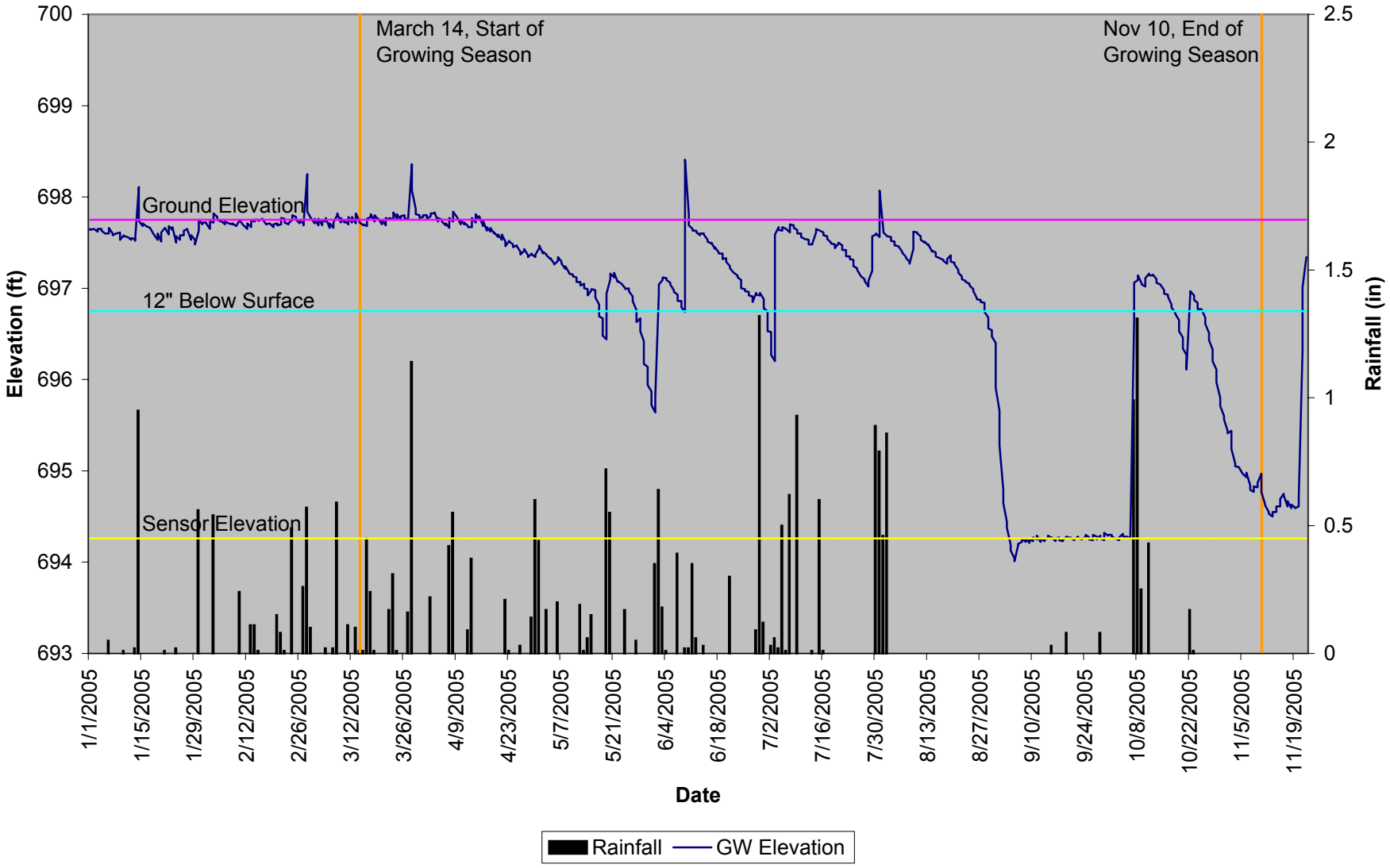
**Rich Fork Site 30-70 Percentile Graph 2004-2005**
**High Point, NC Monthly Rainfall**



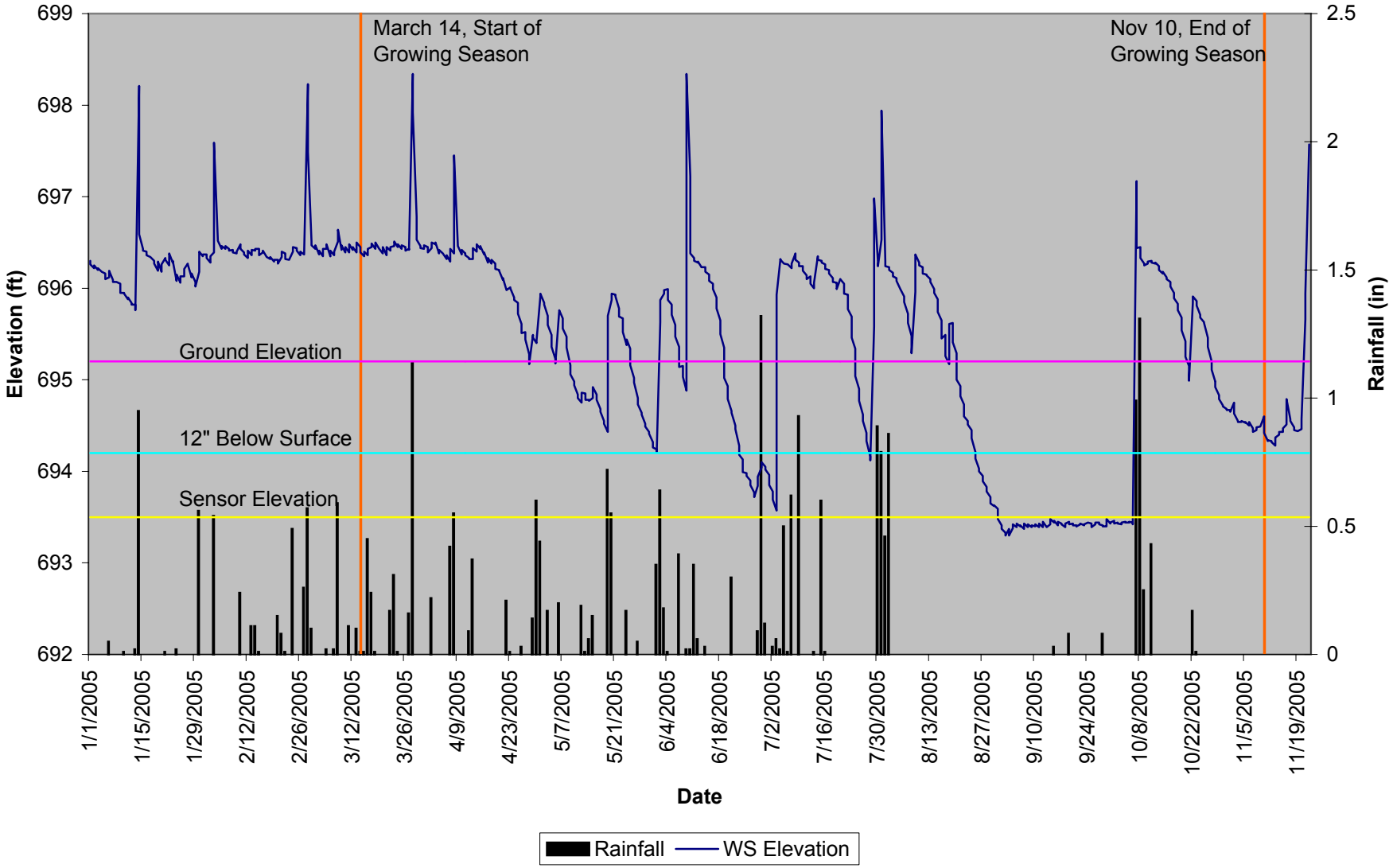

Rich Fork-Reference
March 14, Start of Growing Season
Nov 10, End of Growing Season
Sensor Elevation Changed When Gauge was Replaced
Water Level Below Sensor Elevation
Gauge Malfunction
Ground Elevation
12" Below Surface
Sensor Elevation
Elevation (ft)
Rainfall (in)
Date
Rainfall
WS Elevation

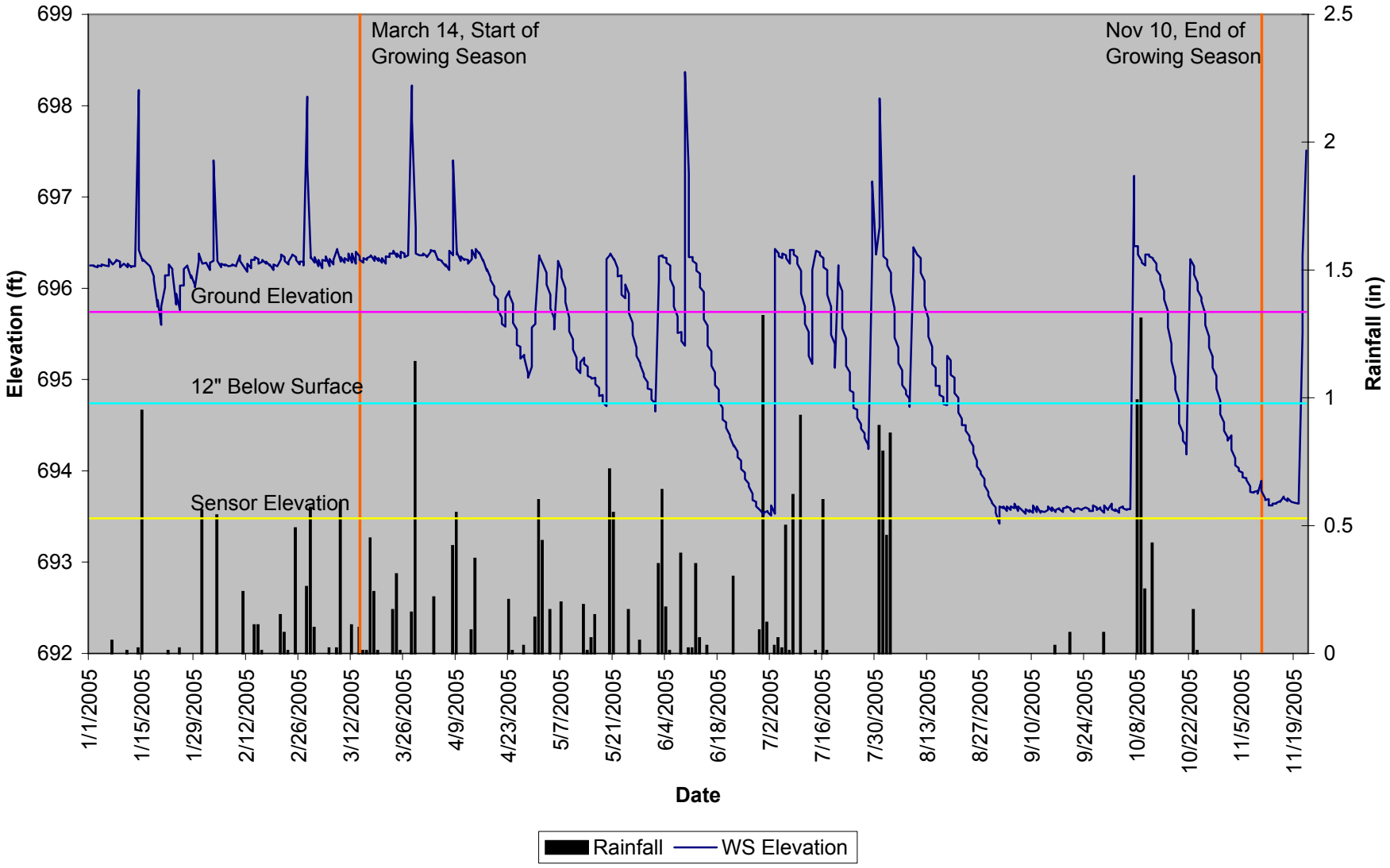
## Rich Fork-Gauge 1

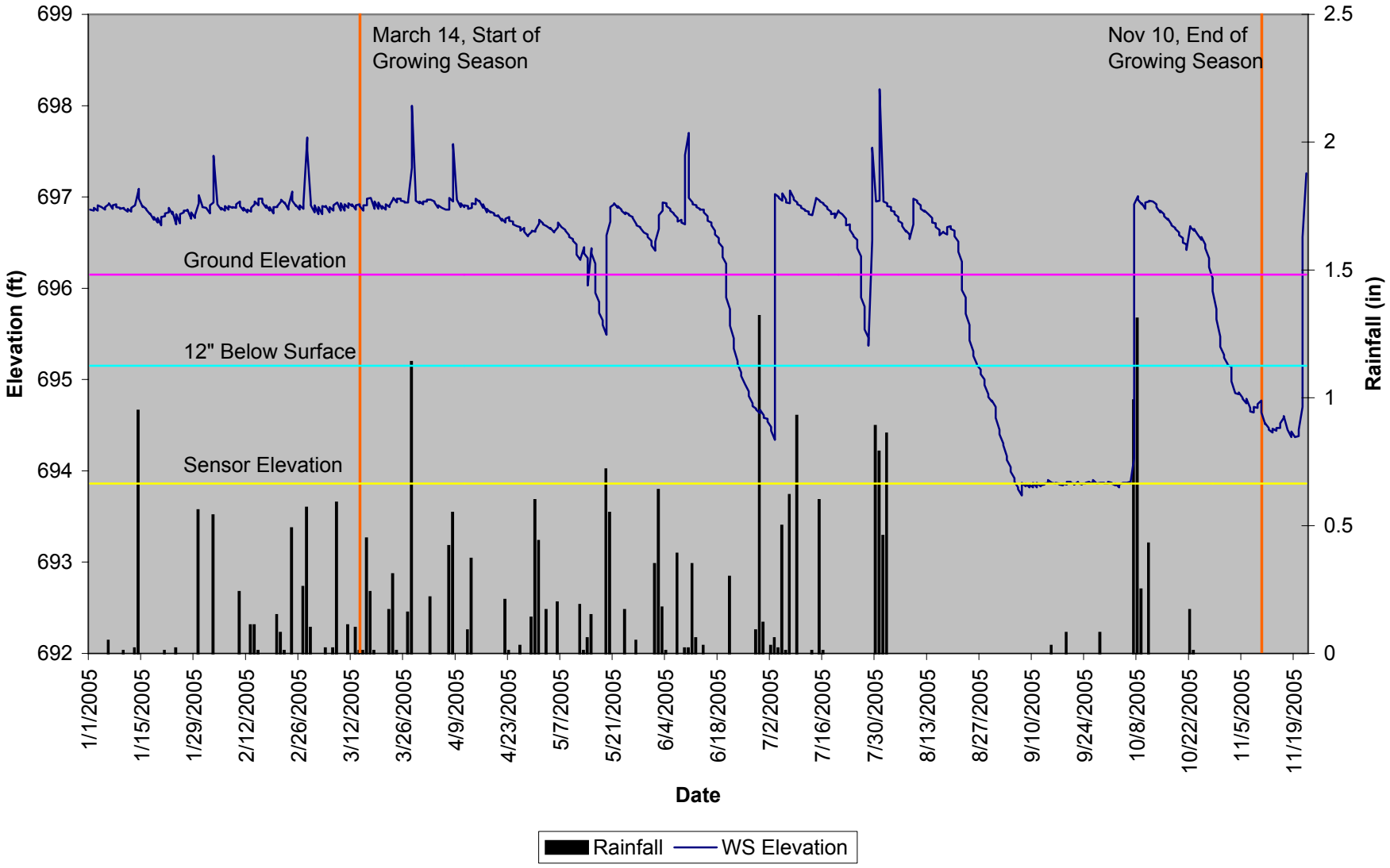



Rich Fork-Gauge 2
March 14, Start of Growing Season
Nov 10, End of Growing Season
Ground Elevation
12" Below Surface
Sensor Elevation
Elevation (ft)
Rainfall (in)
Date
Rainfall
GW Elevation
700
699
698
697
696
695
694
693
2.5
2
1.5
1
0.5
0
1/1/2005
1/15/2005
1/29/2005
2/12/2005
2/26/2005
3/12/2005
3/26/2005
4/9/2005
4/23/2005
5/7/2005
5/21/2005
6/4/2005
6/18/2005
7/2/2005
7/16/2005
7/30/2005
8/13/2005
8/27/2005
9/10/2005
9/24/2005
10/8/2005
10/22/2005
11/5/2005
11/19/2005

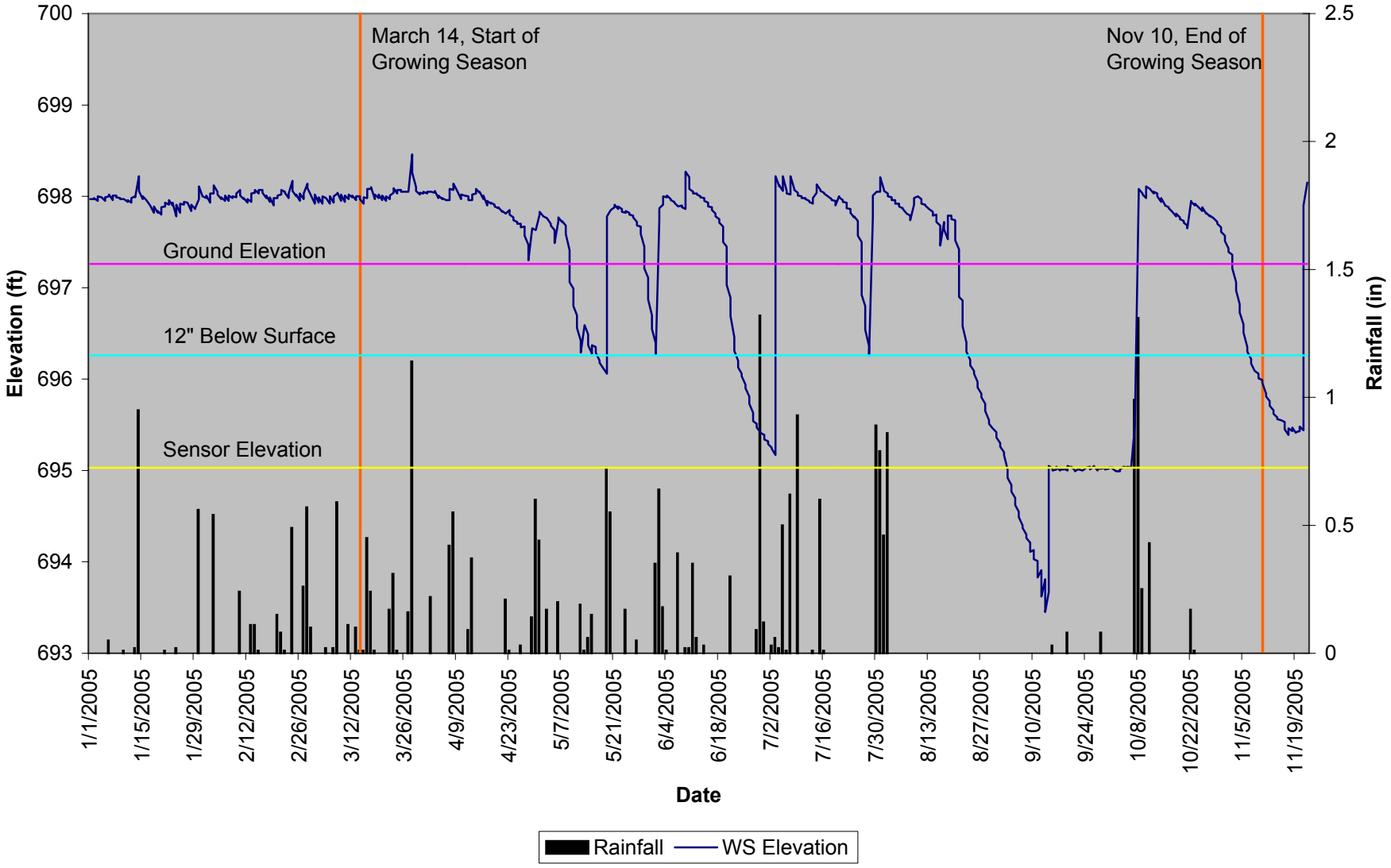
## Rich Fork-Gauge 3




Rich Fork-Gauge 4
March 14, Start of Growing Season
Nov 10, End of Growing Season
Ground Elevation
12" Below Surface
Sensor Elevation
Elevation (ft)
Rainfall (in)
Date
699
698
697
696
695
694
693
692
2.5
2
1.5
1
0.5
0
1/1/2005
1/15/2005
1/29/2005
2/12/2005
2/26/2005
3/12/2005
3/26/2005
4/9/2005
4/23/2005
5/7/2005
5/21/2005
6/4/2005
6/18/2005
7/2/2005
7/16/2005
7/30/2005
8/13/2005
8/27/2005
9/10/2005
9/24/2005
10/8/2005
10/22/2005
11/5/2005
11/19/2005
Rainfall
WS Elevation


Rich Fork-Gauge 5
March 14, Start of Growing Season
Nov 10, End of Growing Season
Ground Elevation
12" Below Surface
Sensor Elevation
Elevation (ft)
Rainfall (in)
699
698
697
696
695
694
693
692
2.5
2
1.5
1
0.5
0
1/1/2005
1/15/2005
1/29/2005
2/12/2005
2/26/2005
3/12/2005
3/26/2005
4/9/2005
4/23/2005
5/7/2005
5/21/2005
6/4/2005
6/18/2005
7/2/2005
7/16/2005
7/30/2005
8/13/2005
8/27/2005
9/10/2005
9/24/2005
10/8/2005
10/22/2005
11/5/2005
11/19/2005
Date
Rainfall
WS Elevation

# Rich Fork-Gauge 6



# Appendix C
# Stream Morphology

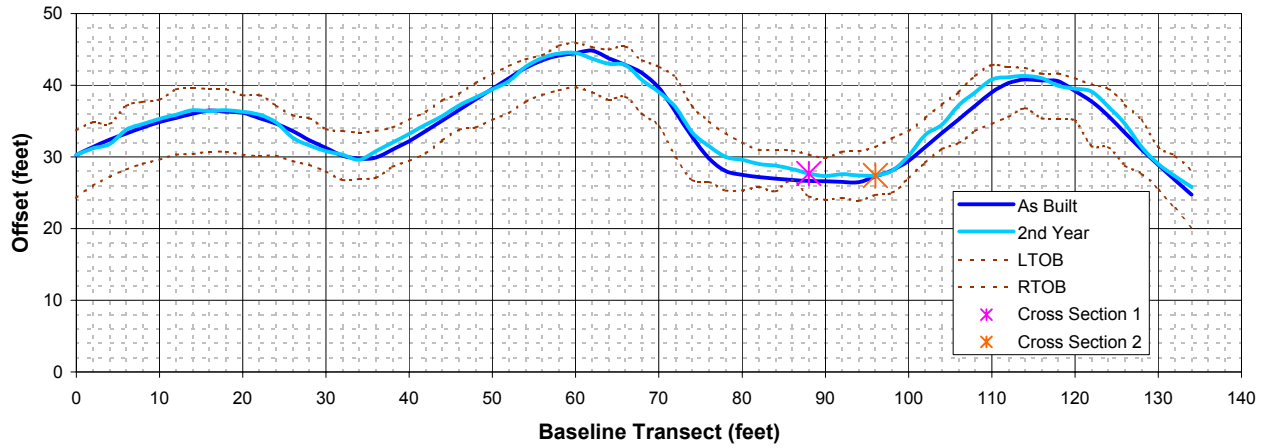
# *Rich Fork Creek Stream Monitoring*

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork |
| **Planform ID** | Main Up |
| **Date:** | 9/29/2005 |
| **Field Crew:** | AS, ZW |

| **SUMMARY DATA** | |
|---|---|
| **Stream Segment Length:** | 160.00 |
| **Distance Between Survey Points:** | 134.00 |
| **Distance Between Stations:** | 2.00 |
| **Sinuosity:** | 1.19 |
| **Mean Radius of Curvature:** | 13.45 |
| **Belt Width:** | 18.70 |

View of mainstem upstream planform section looking downstream

| | |
|---|---|
| **Stream Type:** | E5 |




**Comments:**

Very little water in stream at time of survey.

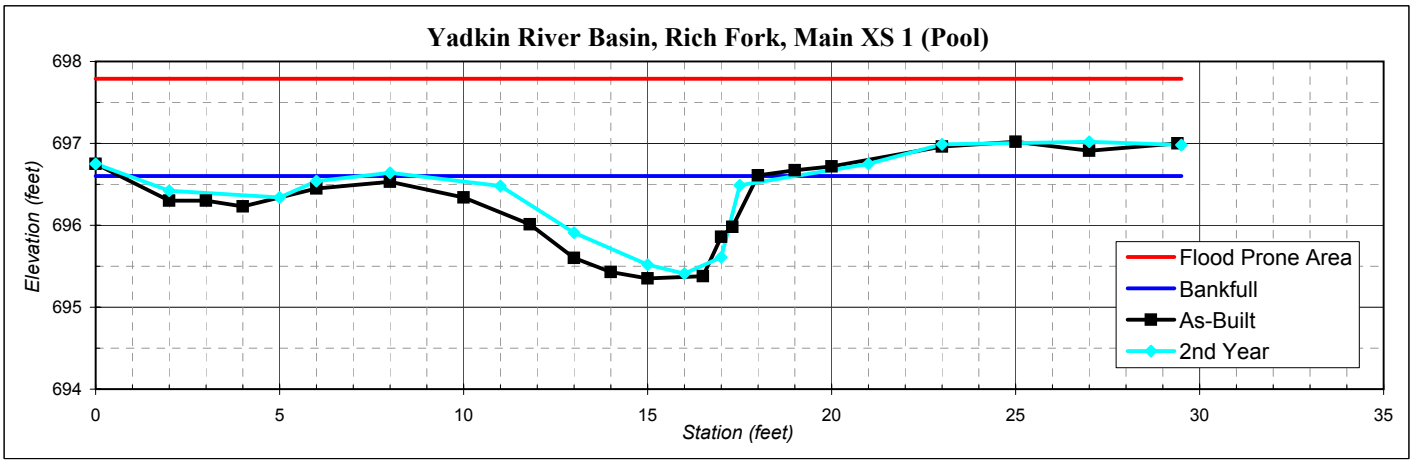
# *Rich Fork Creek Stream Monitoring*

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork |
| **XS ID** | Main XS 1 (Pool) |
| **Reach:** | Main Upstream |
| **Date:** | 9/28/2005 |
| **Field Crew:** | AS, ZW |

| **SUMMARY DATA** | |
|---|---|
| **Bankfull Elevation:** | 696.60 |
| **Bankfull Cross-Sectional Area:** | 6.25 |
| **Bankfull Width:** | 16.52 |
| **Flood Prone Area Elevation:** | 697.79 |
| **Flood Prone Width:** | 240.00 |
| **Max Depth at Bankfull:** | 1.19 |
| **Mean Depth at Bankfull:** | 0.38 |
| **W / D Ratio:** | 43.7 |
| **Entrenchment Ratio:** | 14.53 |
| **Bank Height Ratio:** | 0.91 |
| **Slope (ft/ft):** | 0.004 |
| **Discharge (cfs)** | 10 |

View of mainstem cross-section #1 looking upstream

| | |
|---|---|
| **Stream Type:** | E5c |



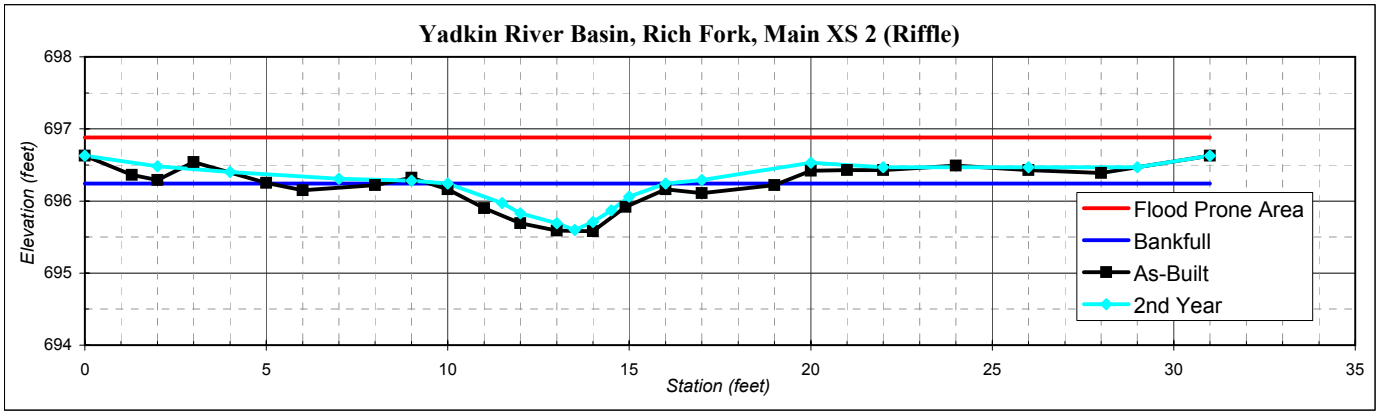
# *Rich Fork Creek Stream Monitoring*

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork |
| **XS ID** | Main XS 2 (Riffle) |
| **Reach:** | Main Upstream |
| **Date:** | 9/28/2005 |
| **Field Crew:** | AS, ZW |

| **SUMMARY DATA** | |
|---|---|
| **Bankfull Elevation:** | 696.24 |
| **Bankfull Cross-Sectional Area:** | 1.90 |
| **Bankfull Width:** | 6.00 |
| **Flood Prone Area Elevation:** | 696.88 |
| **Flood Prone Width:** | 240.00 |
| **Max Depth at Bankfull:** | 0.64 |
| **Mean Depth at Bankfull:** | 0.32 |
| **W / D Ratio:** | 19.0 |
| **Entrenchment Ratio:** | 40.00 |
| **Bank Height Ratio:** | 1.00 |
| **Slope (ft/ft):** | 0.004 |
| **Discharge (cfs)** | 3 |

View of mainstem cross-section #2 looking upstream

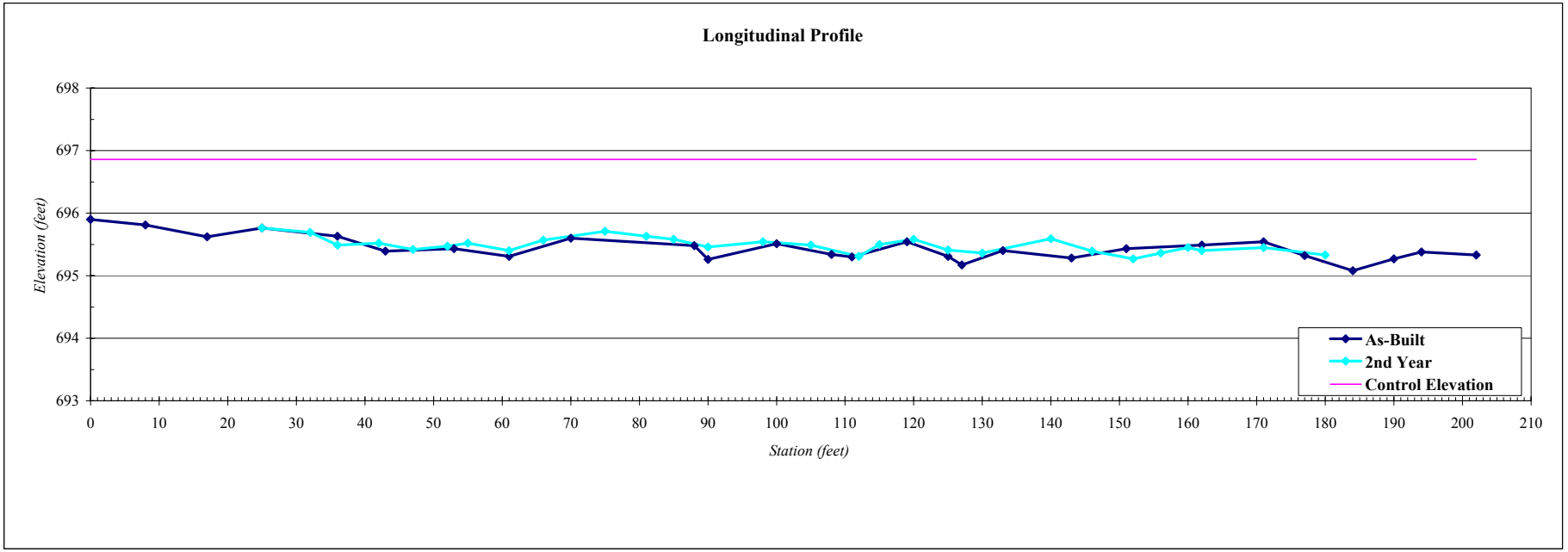
| | |
|---|---|
| **Stream Type:** | E5c |



*Rich Fork Stream Restoration Project*
*Longitudinal Profile*

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork Creek |
| **Reach:** | Mainstem |
| **Profile ID:** | Upstream |
| **Date:** | September-05 |
| **Field Crew:** | A. Spiller and Z. Wendling |
| **Control Elevation:** | 696.86 |

| | |
|---|---|
| **Average Slope:** | |
| **As-Built Avg. Depth:** | 1.42 |
| **2nd Year Avg. Depth:** | 1.28 |



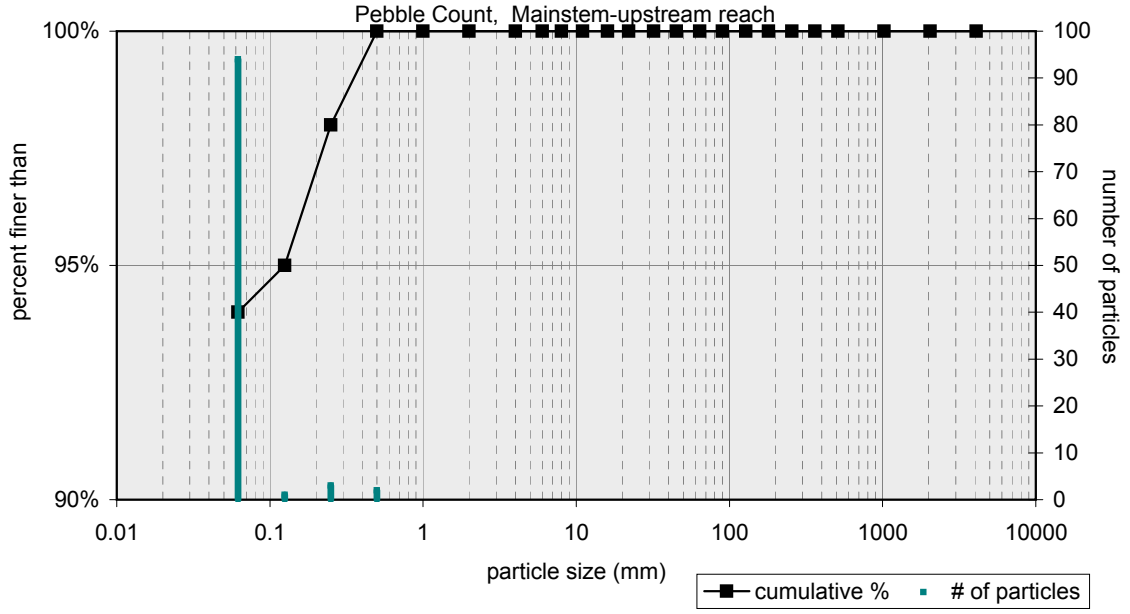
**Pebble Count of Channel Reach**

Pebble Count,

Mainstem-upstream reach
Rich Fork Creek
High Point, NC
Note: **9/28/2005**

| Material | Size Range (mm) | | Count | |
|---|---|---|---|---|
| silt/clay | 0 | 0.062 | **94** | ## |
| very fine sand | 0.062 | 0.13 | **1** | ## |
| fine sand | 0.13 | 0.25 | **3** | ## |
| medium sand | 0.25 | 0.5 | **2** | ## |
| coarse sand | 0.5 | 1 | | ## |
| very coarse sand | 1 | 2 | | ## |
| very fine gravel | 2 | 4 | | ## |
| fine gravel | 4 | 6 | | ## |
| fine gravel | 6 | 8 | | ## |
| medium gravel | 8 | 11 | | ## |
| medium gravel | 11 | 16 | | ## |
| coarse gravel | 16 | 22 | | ## |
| coarse gravel | 22 | 32 | | ## |
| very coarse gravel | 32 | 45 | | ## |
| very coarse gravel | 45 | 64 | | ## |
| small cobble | 64 | 90 | | ## |
| medium cobble | 90 | 128 | | ## |
| large cobble | 128 | 180 | | ## |
| very large cobble | 180 | 256 | | ## |
| small boulder | 256 | 362 | | ## |
| small boulder | 362 | 512 | | ## |
| medium boulder | 512 | 1024 | | ## |
| large boulder | 1024 | 2048 | | ## |
| very large boulder | 2048 | 4096 | | ## |
| | | total particle count: | 100 | |

| | | |
|---|---|---|
| bedrock | | |
| clay hardpan | | |
| detritus/wood | | |
| artificial | | |
| | total count: | 100 |




| based on sediment particles only | size percent less than (mm) | | | | | | particle size distribution | | |
|---|---|---|---|---|---|---|---|---|---|
| | D16 | D35 | D50 | D65 | D84 | D95 | gradation | geo mean | std dev |
| | 0.062 | 0.06 | 0.1 | 0 | 0 | 0 | 1.0 | 0.1 | 1.0 |

| based on total count | percent by substrate type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | silt/clay | sand | gravel | cobble | boulder | bedrock | hardpan | wood/det | artificial |
| | 94% | 6% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

# *Rich Fork Creek Stream Monitoring*

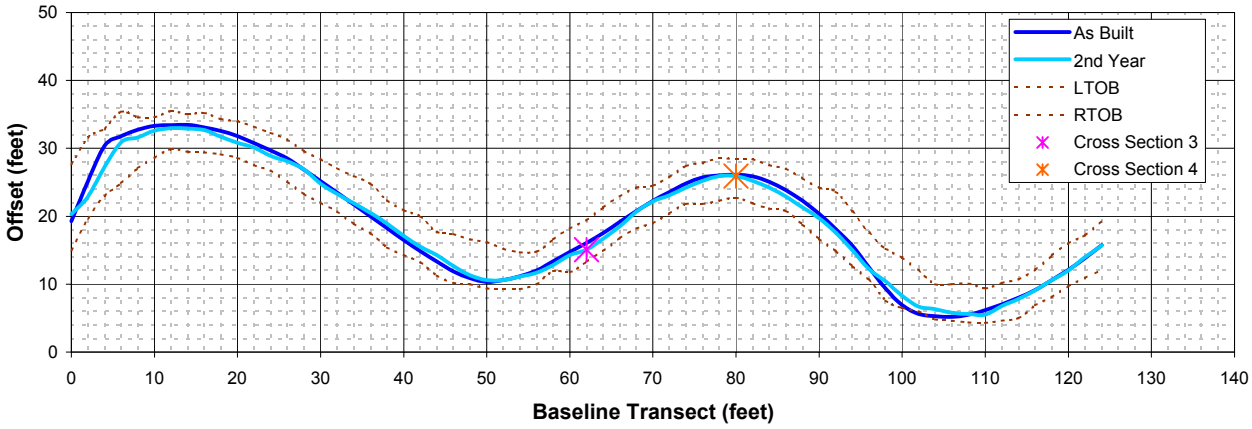
| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork |
| **Planform ID** | Main Dwn |
| **Date:** | 9/29/2005 |
| **Field Crew:** | AS, ZW |

| **SUMMARY DATA** | |
|---|---|
| **Stream Segment Length:** | 149.00 |
| **Distance Between Survey Points:** | 124.00 |
| **Distance Between Stations:** | 2.00 |
| **Sinuosity:** | 1.20 |
| **Mean Radius of Curvature:** | 14.86 |
| **Belt Width:** | 27.50 |

View of mainstem downstream planform section looking downstream

| | |
|---|---|
| **Stream Type:** | E5 |

**Stream Segment Planform**




**Comments:**

No water in stream at time of survey.

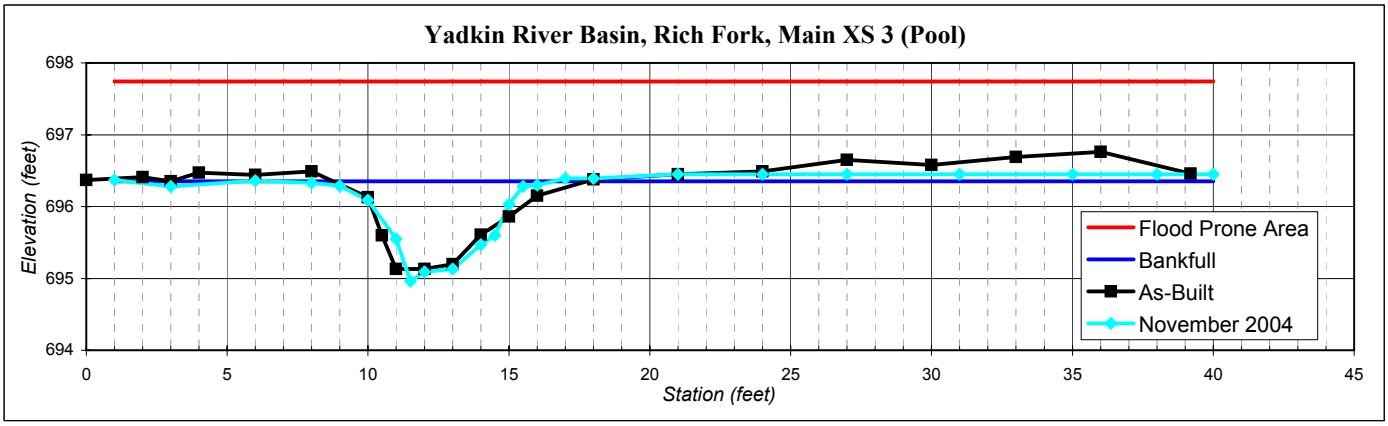
# *Rich Fork Creek Stream Monitoring*

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork |
| **XS ID** | Main XS 3 (Pool) |
| **Reach:** | Main Downstream |
| **Date:** | 9/29/2005 |
| **Field Crew:** | AS, ZW |

| **SUMMARY DATA** | |
|---|---|
| **Bankfull Elevation:** | 696.35 |
| **Bankfull Cross-Sectional Area:** | 5.21 |
| **Bankfull Width:** | 14.07 |
| **Flood Prone Area Elevation:** | 697.74 |
| **Flood Prone Width:** | 180.00 |
| **Max Depth at Bankfull:** | 1.39 |
| **Mean Depth at Bankfull:** | 0.37 |
| **W / D Ratio:** | 38.0 |
| **Entrenchment Ratio:** | 12.79 |
| **Bank Height Ratio:** | 0.95 |
| **Slope (ft/ft):** | 0.005 |
| **Discharge (cfs)** | 9 |

View of mainstem cross-section #3 looking upstream

| | |
|---|---|
| **Stream Type:** | E5c |



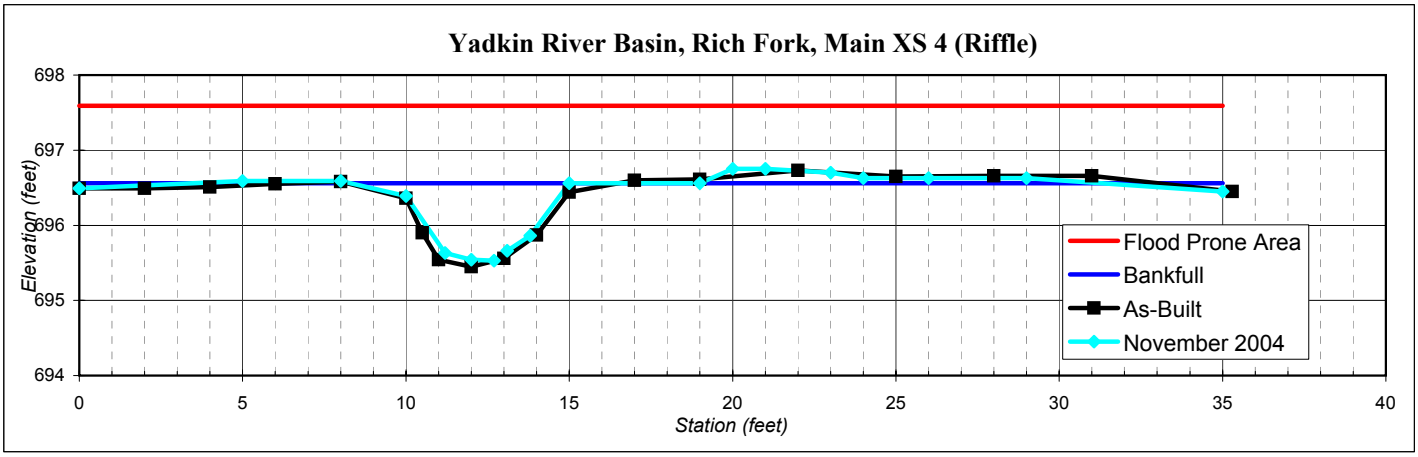
# *Rich Fork Creek Stream Monitoring*

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork |
| **XS ID** | Main XS 4 (Riffle) |
| **Reach:** | Main Downstream |
| **Date:** | 9/29/2005 |
| **Field Crew:** | AS, ZW |

| **SUMMARY DATA** | |
|---|---|
| **Bankfull Elevation:** | 696.56 |
| **Bankfull Cross-Sectional Area:** | 3.99 |
| **Bankfull Width:** | 13.87 |
| **Flood Prone Area Elevation:** | 697.59 |
| **Flood Prone Width:** | 130.00 |
| **Max Depth at Bankfull:** | 1.03 |
| **Mean Depth at Bankfull:** | 0.29 |
| **W / D Ratio:** | 48.2 |
| **Entrenchment Ratio:** | 9.37 |
| **Bank Height Ratio:** | 0.78 |
| **Slope (ft/ft):** | 0.005 |
| **Discharge (cfs)** | 6 |

View of mainstem cross-section #4 looking upstream

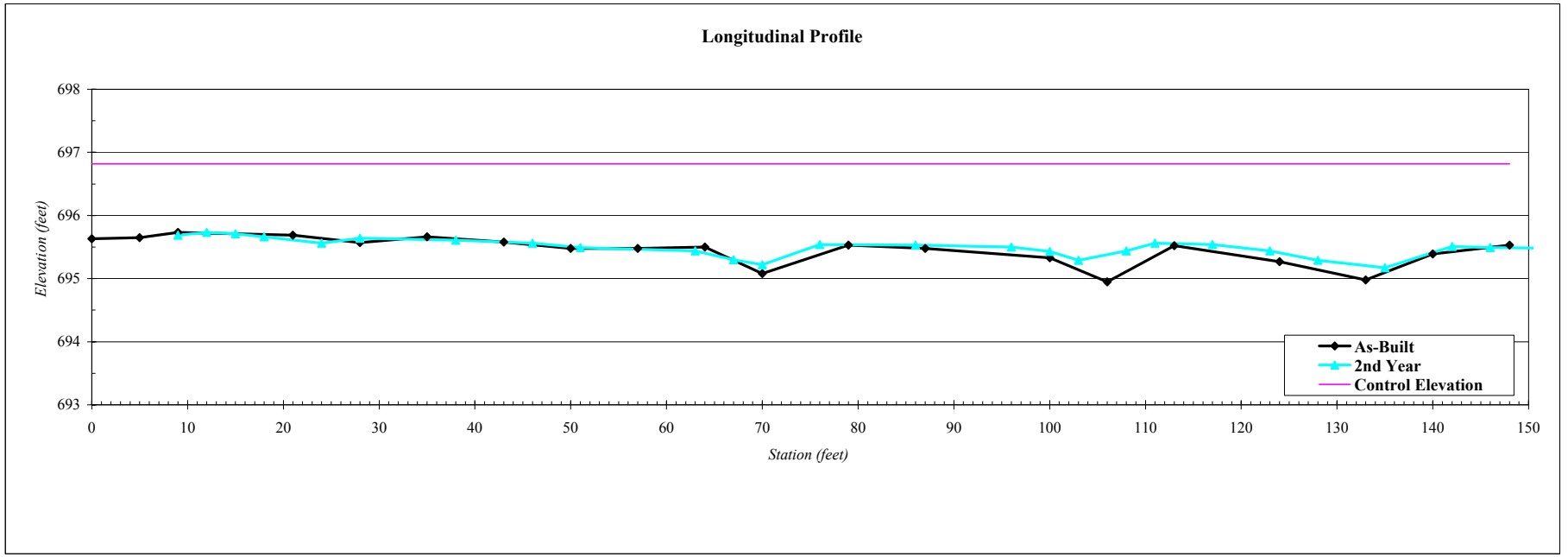
| | |
|---|---|
| **Stream Type:** | E5c |



***Rich Fork Stream Stream Restoration Project***
***Longitudinal Profile***

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork Creek |
| **Reach:** | Mainstem |
| **Profile ID:** | Downstream |
| **Date:** | September-05 |
| **Field Crew:** | A. Spiller and Z. Wendling |
| **Control Elevation:** | 696.82 |

| | |
|---|---|
| **Average Slope:** | |
| **As-Built Avg. Depth:** | 0.87 |
| **2nd Year Avg. Depth:** | 0.82 |

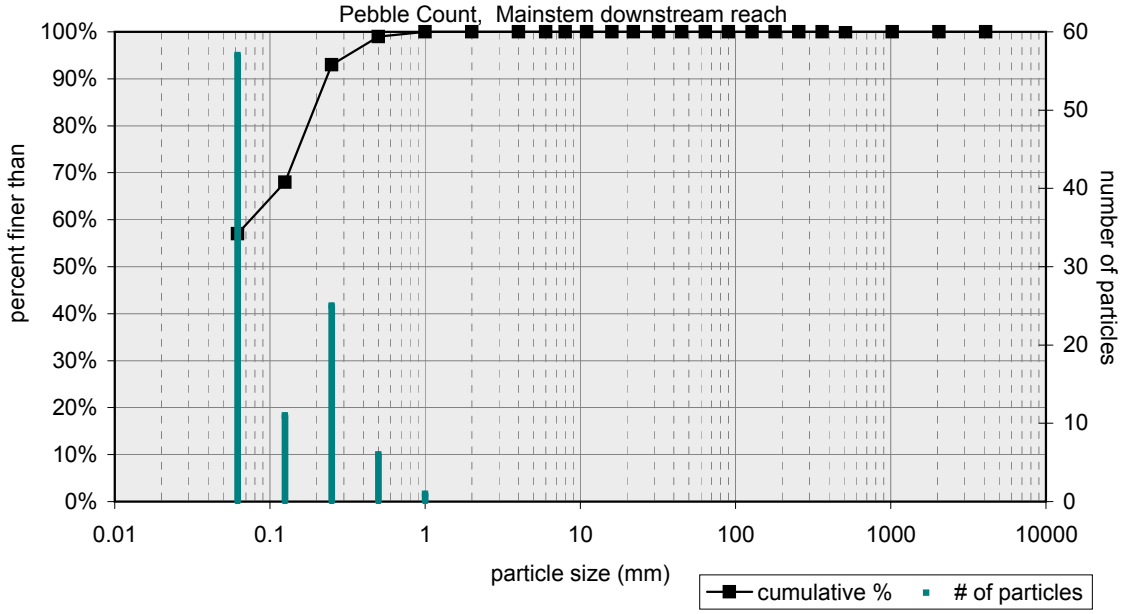


**Pebble Count of Channel Reach**

| Material | Size Range (mm) | | Count | |
|---|---|---|---|---|
| silt/clay | 0 | 0.062 | **57** | ## |
| very fine sand | 0.062 | 0.13 | **11** | ## |
| fine sand | 0.13 | 0.25 | **25** | ## |
| medium sand | 0.25 | 0.5 | **6** | ## |
| coarse sand | 0.5 | 1 | **1** | ## |
| very coarse sand | 1 | 2 | | ## |
| very fine gravel | 2 | 4 | | ## |
| fine gravel | 4 | 6 | | ## |
| fine gravel | 6 | 8 | | ## |
| medium gravel | 8 | 11 | | ## |
| medium gravel | 11 | 16 | | ## |
| coarse gravel | 16 | 22 | | ## |
| coarse gravel | 22 | 32 | | ## |
| very coarse gravel | 32 | 45 | | ## |
| very coarse gravel | 45 | 64 | | ## |
| small cobble | 64 | 90 | | ## |
| medium cobble | 90 | 128 | | ## |
| large cobble | 128 | 180 | | ## |
| very large cobble | 180 | 256 | | ## |
| small boulder | 256 | 362 | | ## |
| small boulder | 362 | 512 | | ## |
| medium boulder | 512 | 1024 | | ## |
| large boulder | 1024 | 2048 | | ## |
| very large boulder | 2048 | 4096 | | ## |
| | | total particle count: | 100 | |

| | | |
|---|---|---|
| bedrock | | |
| clay hardpan | | |
| detritus/wood | | |
| artificial | | |
| | total count: | 100 |

Pebble Count,
Mainstem downstream reach
Rich Fork Creek
High Point, NC
Note: **9/29/2005**




| based on sediment particles only | size percent less than (mm) | | | | | | particle size distribution | | |
|---|---|---|---|---|---|---|---|---|---|
| | D16 | D35 | D50 | D65 | D84 | D95 | gradation | geo mean | std dev |
| | 0.062 | 0.06 | 0.1 | 0 | 0 | 0 | 2.1 | 0.1 | 1.8 |

| based on total count | percent by substrate type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | silt/clay | sand | gravel | cobble | boulder | bedrock | hardpan | wood/det | artificial |
| | 57% | 43% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

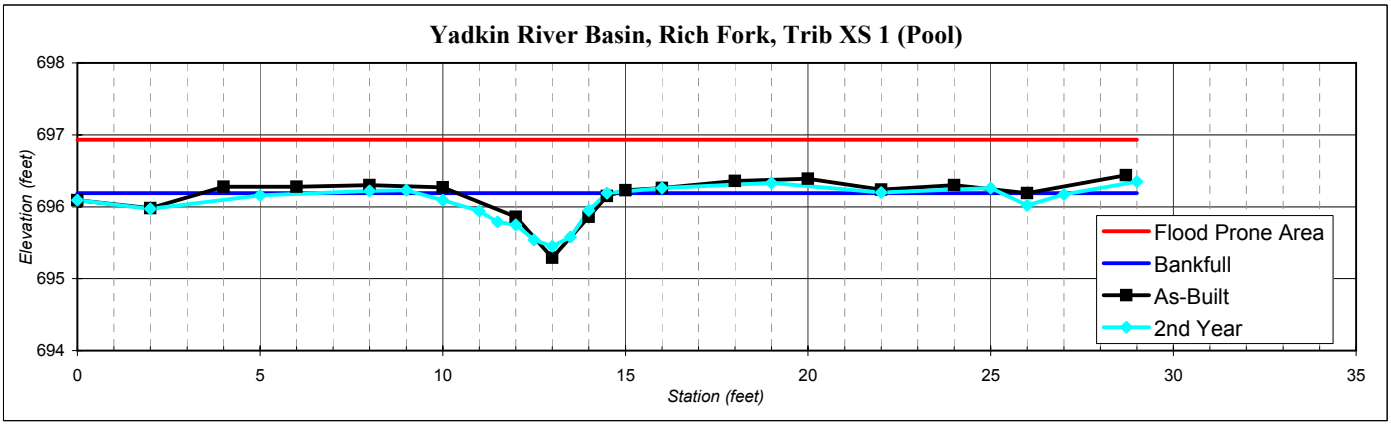
# *Rich Fork Creek Stream Monitoring*

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork |
| **XS ID** | Trib XS 1 (Pool) |
| **Reach:** | Trib Upstream |
| **Date:** | 9/29/2005 |
| **Field Crew:** | AS, ZW |

| **SUMMARY DATA** | |
|---|---|
| **Bankfull Elevation:** | 696.19 |
| **Bankfull Cross-Sectional Area:** | 2.69 |
| **Bankfull Width:** | 13.64 |
| **Flood Prone Area Elevation:** | 696.93 |
| **Flood Prone Width:** | 180.00 |
| **Max Depth at Bankfull:** | 0.74 |
| **Mean Depth at Bankfull:** | 0.20 |
| **W / D Ratio:** | 69.3 |
| **Entrenchment Ratio:** | 13.19 |
| **Bank Height Ratio:** | 1.00 |
| **Slope (ft/ft):** | 0.006 |
| **Discharge (cfs)** | 3 |

View of tributary cross-section #1 looking upstream

| | |
|---|---|
| **Stream Type:** | E5c |



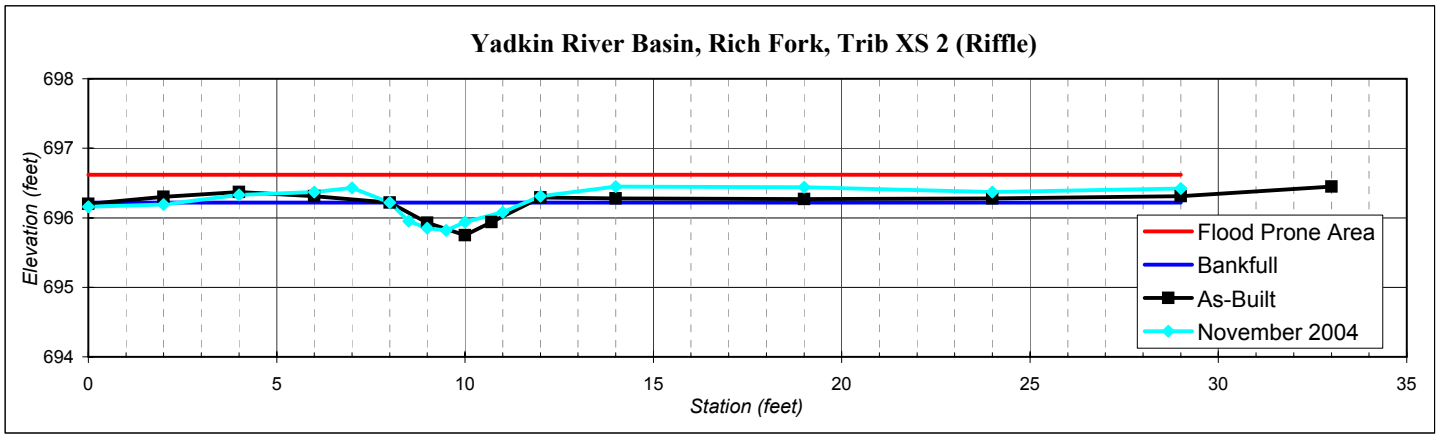
# *Rich Fork Creek Stream Monitoring*

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork |
| **XS ID** | Trib XS 2 (Riffle) |
| **Reach:** | Trib Upstream |
| **Date:** | 9/29/2005 |
| **Field Crew:** | AS, ZW |

| **SUMMARY DATA** | |
|---|---|
| **Bankfull Elevation:** | 696.22 |
| **Bankfull Cross-Sectional Area:** | 0.94 |
| **Bankfull Width:** | 6.04 |
| **Flood Prone Area Elevation:** | 696.62 |
| **Flood Prone Width:** | 240.00 |
| **Max Depth at Bankfull:** | 0.40 |
| **Mean Depth at Bankfull:** | 0.16 |
| **W / D Ratio:** | 38.8 |
| **Entrenchment Ratio:** | 39.75 |
| **Bank Height Ratio:** | 1.00 |
| **Slope (ft/ft):** | 0.006 |
| **Discharge (cfs)** | 1 |

View of tributary cross-section #2 looking upstream

| | |
|---|---|
| **Stream Type:** | E5c |



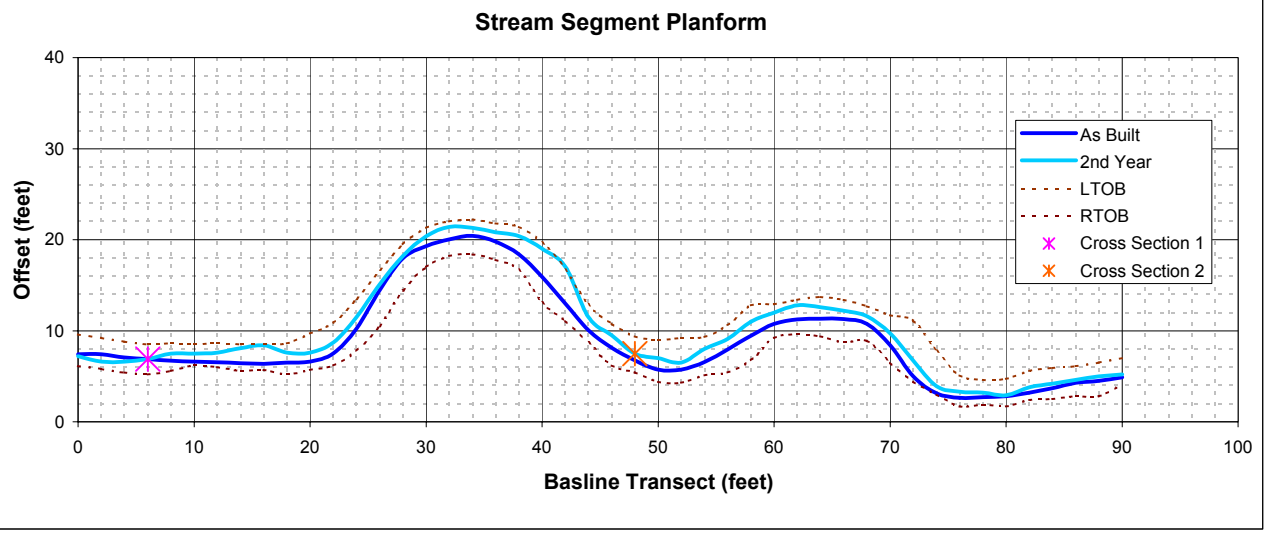
# *Rich Fork Creek Stream Monitoring*

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork |
| **Planform ID** | Trib Up |
| **Date:** | 9/29/2005 |
| **Field Crew:** | AS, ZW |

| **SUMMARY DATA** | |
|---|---|
| **Stream Segment Length:** | 112.00 |
| **Distance Between Survey Points:** | 90.00 |
| **Distance Between Stations:** | 2.00 |
| **Sinuosity:** | 1.24 |
| **Mean Radius of Curvature:** | 8.71 |
| **Belt Width:** | 18.50 |

View of tributary upstream planform section looking downstream

| | |
|---|---|
| **Stream Type:** | E5 |



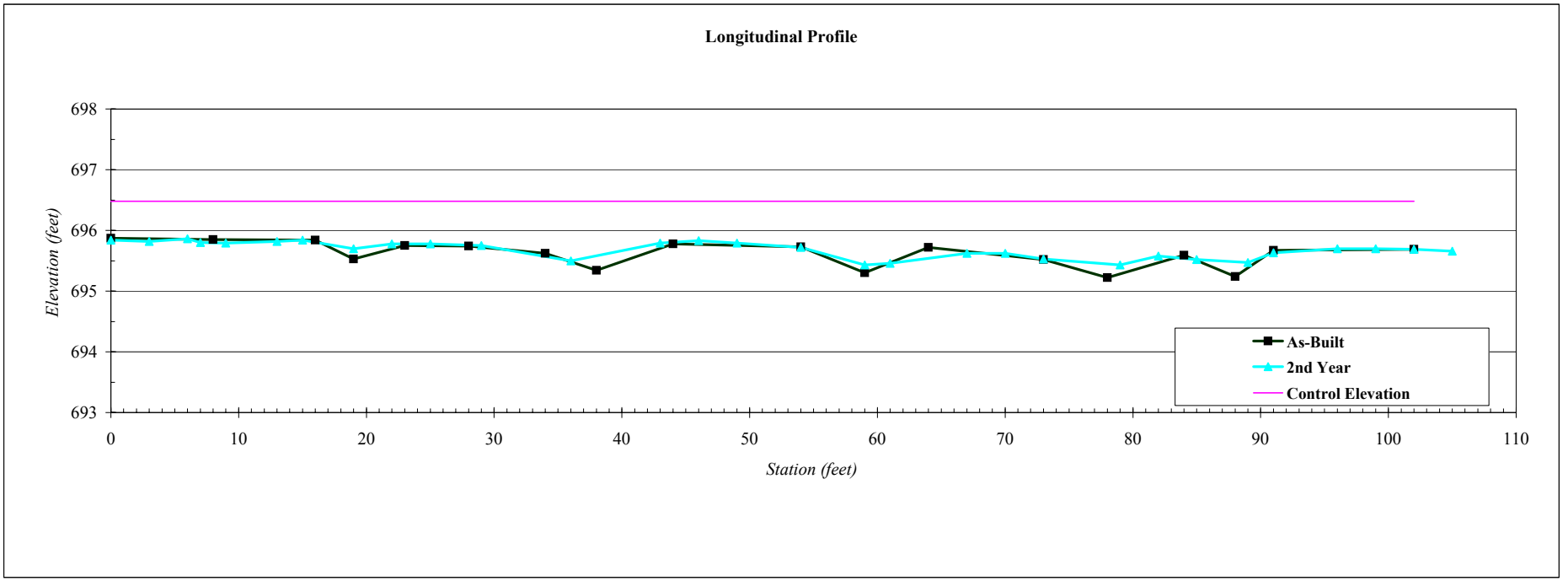

**Comments:**

No water in stream at time of survey.

***Rich Fork Stream Restoration Project***
***Longitudinal Profile***

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork Creek |
| **Reach:** | Tributary |
| **Profile ID:** | Upstream |
| **Date:** | September-05 |
| **Field Crew:** | A. Spiller and Z. Wendling |
| **Control Elevation:** | 696.48 |

| | |
|---|---|
| **Average Slope:** | |
| **As-Built Avg. Depth:** | 0.87 |
| **2nd Year Avg. Depth:** | 0.79 |

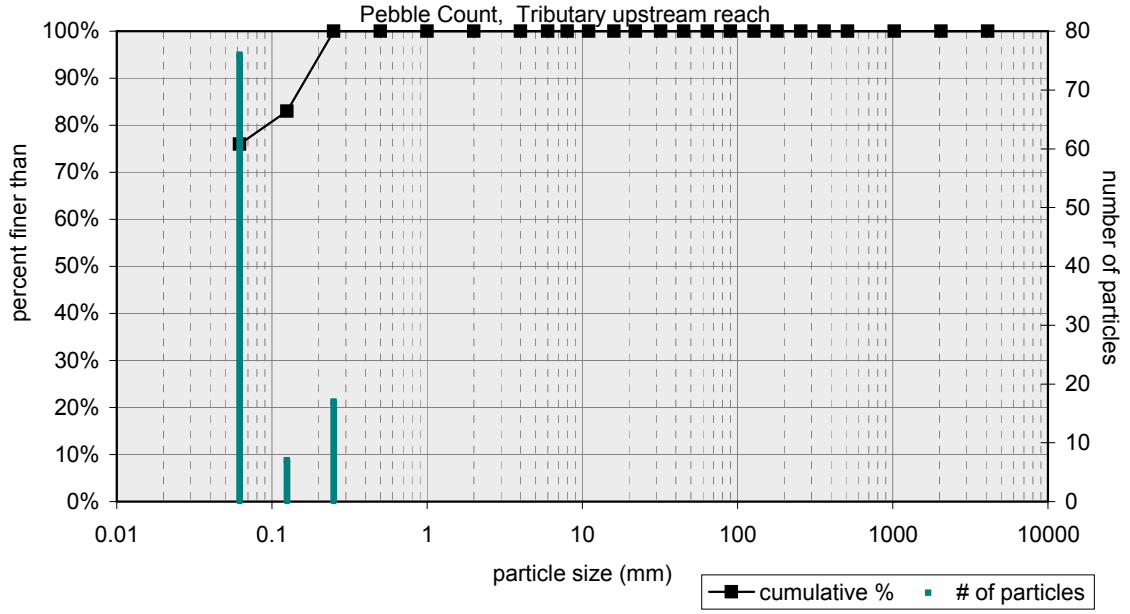


**Pebble Count of Channel Reach**

| Material | Size Range (mm) | | Count | |
|---|---|---|---|---|
| silt/clay | 0 | 0.062 | **76** | ## |
| very fine sand | 0.062 | 0.13 | **7** | ## |
| fine sand | 0.13 | 0.25 | **17** | ## |
| medium sand | 0.25 | 0.5 | | ## |
| coarse sand | 0.5 | 1 | | ## |
| very coarse sand | 1 | 2 | | ## |
| very fine gravel | 2 | 4 | | ## |
| fine gravel | 4 | 6 | | ## |
| fine gravel | 6 | 8 | | ## |
| medium gravel | 8 | 11 | | ## |
| medium gravel | 11 | 16 | | ## |
| coarse gravel | 16 | 22 | | ## |
| coarse gravel | 22 | 32 | | ## |
| very coarse gravel | 32 | 45 | | ## |
| very coarse gravel | 45 | 64 | | ## |
| small cobble | 64 | 90 | | ## |
| medium cobble | 90 | 128 | | ## |
| large cobble | 128 | 180 | | ## |
| very large cobble | 180 | 256 | | ## |
| small boulder | 256 | 362 | | ## |
| small boulder | 362 | 512 | | ## |
| medium boulder | 512 | 1024 | | ## |
| large boulder | 1024 | 2048 | | ## |
| very large boulder | 2048 | 4096 | | ## |
| | | total particle count: | 100 | |

| | | |
|---|---|---|
| bedrock | | |
| clay hardpan | | |
| detritus/wood | | |
| artificial | | |
| | total count: | 100 |

Pebble Count,
Tributary upstream reach
Rich Fork Creek
High Point, NC
Note: **9/29/2005**




| based on sediment particles only | size percent less than (mm) D16 | D35 | D50 | D65 | D84 | D95 | particle size distribution gradation | geo mean | std dev |
|---|---|---|---|---|---|---|---|---|---|
| | 0.062 | 0.06 | 0.1 | 0 | 0 | 0 | 1.6 | 0.1 | 1.4 |

| based on total count | percent by substrate type silt/clay | sand | gravel | cobble | boulder | bedrock | hardpan | wood/det | artificial |
|---|---|---|---|---|---|---|---|---|---|
| | 76% | 24% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

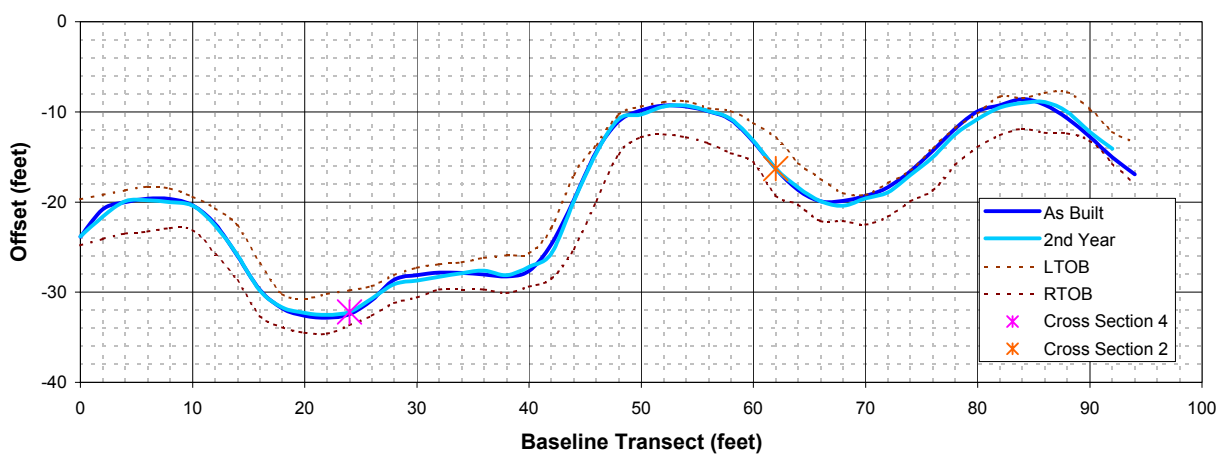
# *Rich Fork Creek Stream Monitoring*

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork |
| **Planform ID** | Trib Dwn |
| **Date:** | 9/30/2005 |
| **Field Crew:** | AS, ZW |

| **SUMMARY DATA** | |
|---|---|
| **Stream Segment Length:** | 127.00 |
| **Distance Between Survey Points:** | 94.00 |
| **Distance Between Stations:** | 2.00 |
| **Sinuosity:** | 1.35 |
| **Mean Radius of Curvature:** | 7.63 |
| **Belt Width:** | 23.60 |

View of tributary downstream planform section looking downstream

| | |
|---|---|
| **Stream Type:** | E5 |




**Comments:**

No water in stream at time of survey.

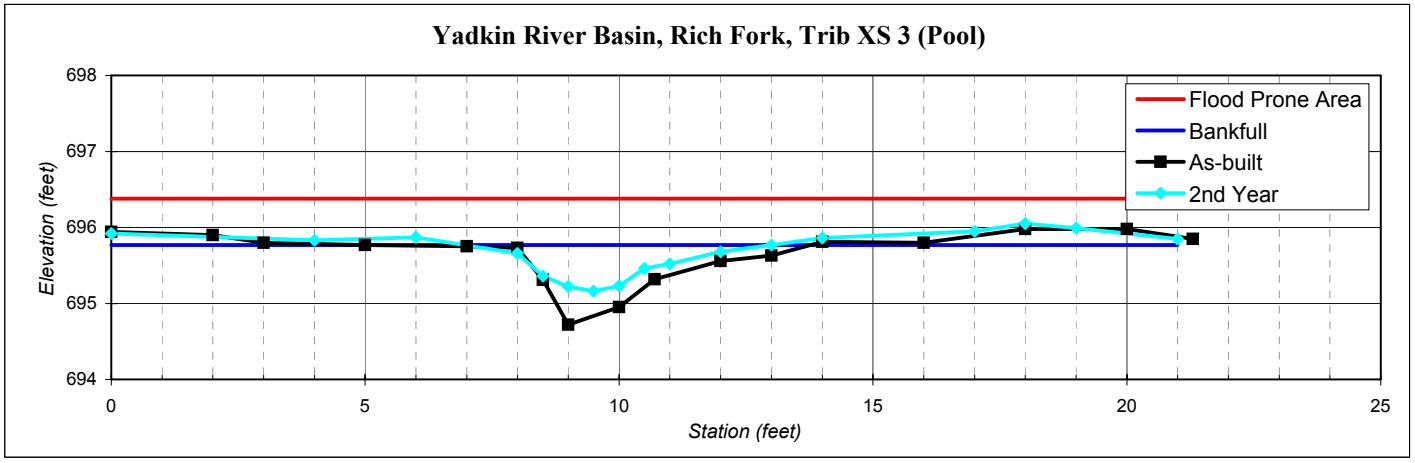
# *Rich Fork Creek Stream Monitoring*

| | |
|---|---|
| **XS ID** | Trib XS 3 (Pool) |
| **Reach:** | Trib Downstream |
| **Date:** | 9/30/2005 |
| **Field Crew:** | AS, ZW |

| **SUMMARY DATA** | |
|---|---|
| **Bankfull Elevation:** | 695.77 |
| **Bankfull Cross-Sectional Area:** | 1.57 |
| **Bankfull Width:** | 6.05 |
| **Flood Prone Area Elevation:** | 696.38 |
| **Flood Prone Width:** | 240.00 |
| **Max Depth at Bankfull:** | 0.61 |
| **Mean Depth at Bankfull:** | 0.26 |
| **W / D Ratio:** | 23.3 |
| **Entrenchment Ratio:** | 39.69 |
| **Bank Height Ratio:** | 0.80 |
| **Slope (ft/ft):** | 0.006 |
| **Discharge (cfs)** | 2 |

View of tributary cross-section #3 looking upstream

| | |
|---|---|
| **Stream Type:** | E6c |



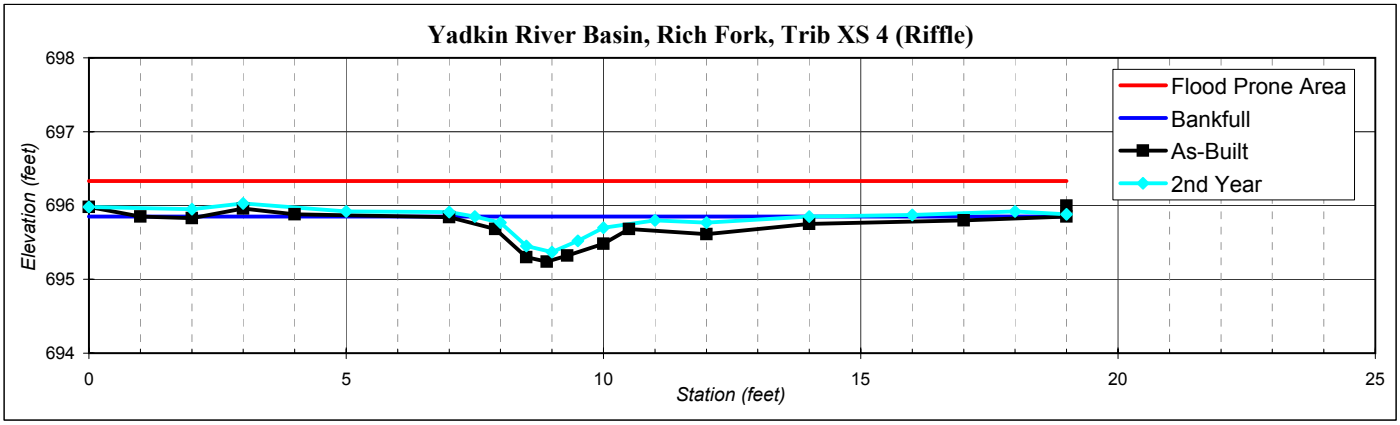
# *Rich Fork Creek Stream Monitoring*

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork |
| **XS ID** | Trib XS 4 (Riffle) |
| **Reach:** | Trib Downstream |
| **Date:** | 9/30/2005 |
| **Field Crew:** | AS, ZW |

| **SUMMARY DATA** | |
|---|---|
| **Bankfull Elevation:** | 695.85 |
| **Bankfull Cross-Sectional Area:** | 0.93 |
| **Bankfull Width:** | 6.50 |
| **Flood Prone Area Elevation:** | 696.33 |
| **Flood Prone Width:** | 240.00 |
| **Max Depth at Bankfull:** | 0.48 |
| **Mean Depth at Bankfull:** | 0.14 |
| **W / D Ratio:** | 45.6 |
| **Entrenchment Ratio:** | 36.92 |
| **Bank Height Ratio:** | 0.92 |
| **Slope (ft/ft):** | 0.006 |
| **Discharge (cfs)** | 1 |

View of tributary cross-section #4 looking upstream

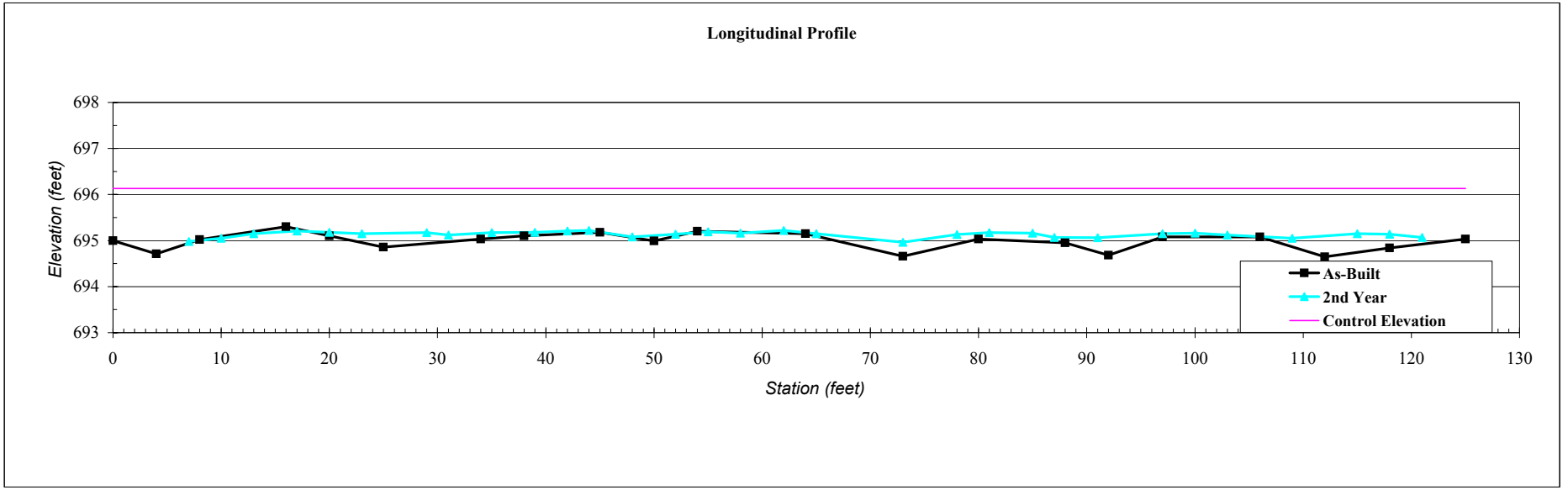
| | |
|---|---|
| **Stream Type:** | E5c |



***Rich Fork Stream Restoration Project***
***Longitudinal Profile***

| | |
|---|---|
| **River Basin:** | Yadkin |
| **Watershed:** | Rich Fork Creek |
| **Reach:** | Tributary |
| **Profile ID:** | Downstream |
| **Date:** | September-05 |
| **Field Crew:** | A. Spiller and Z. Wendling |
| **Control Elevation:** | 696.13 |

| | |
|---|---|
| **Average Slope:** | |
| **As-Built Avg. Depth:** | 1.15 |
| **2nd Year Avg. Depth:** | 0.86 |



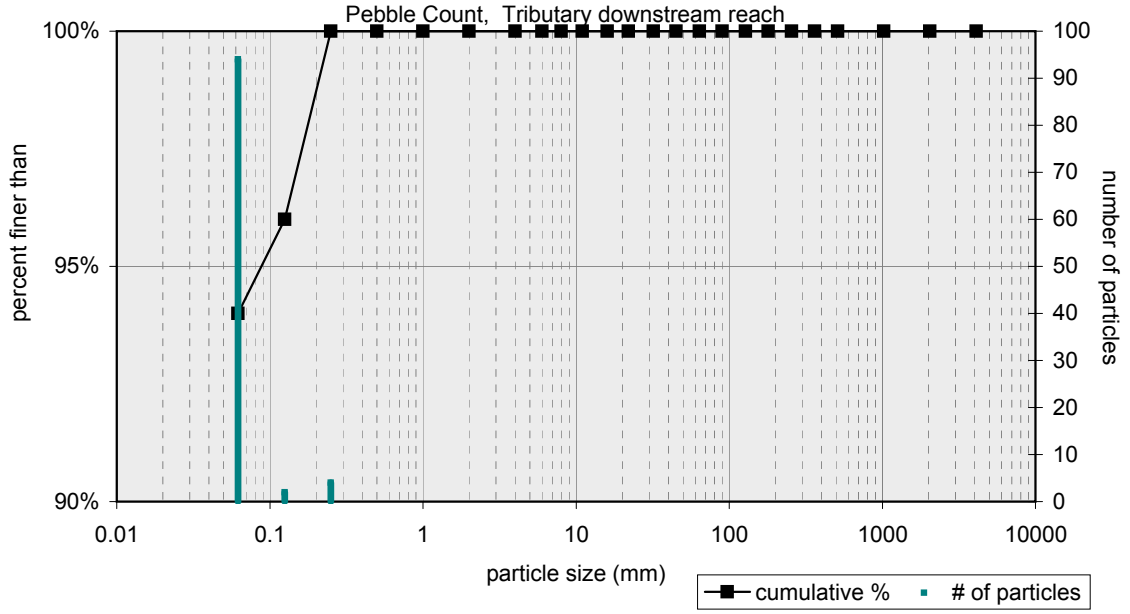
**Pebble Count of Channel Reach**

Pebble Count,

Tributary downstream reach
Rich Fork Creek
High Point, NC
Note: **9/30/2005**

| Material | Size Range (mm) | | Count | |
|---|---|---|---|---|
| silt/clay | 0 | 0.062 | **94** | ## |
| very fine sand | 0.062 | 0.13 | **2** | ## |
| fine sand | 0.13 | 0.25 | **4** | ## |
| medium sand | 0.25 | 0.5 | | ## |
| coarse sand | 0.5 | 1 | | ## |
| very coarse sand | 1 | 2 | | ## |
| very fine gravel | 2 | 4 | | ## |
| fine gravel | 4 | 6 | | ## |
| fine gravel | 6 | 8 | | ## |
| medium gravel | 8 | 11 | | ## |
| medium gravel | 11 | 16 | | ## |
| coarse gravel | 16 | 22 | | ## |
| coarse gravel | 22 | 32 | | ## |
| very coarse gravel | 32 | 45 | | ## |
| very coarse gravel | 45 | 64 | | ## |
| small cobble | 64 | 90 | | ## |
| medium cobble | 90 | 128 | | ## |
| large cobble | 128 | 180 | | ## |
| very large cobble | 180 | 256 | | ## |
| small boulder | 256 | 362 | | ## |
| small boulder | 362 | 512 | | ## |
| medium boulder | 512 | 1024 | | ## |
| large boulder | 1024 | 2048 | | ## |
| very large boulder | 2048 | 4096 | | ## |
| | | total particle count: | 100 | |

| | | |
|---|---|---|
| bedrock | | |
| clay hardpan | | |
| detritus/wood | | |
| artificial | | |
| | total count: | 100 |




| based on sediment particles only | size percent less than (mm) | | | | | | particle size distribution | | |
|---|---|---|---|---|---|---|---|---|---|
| | D16 | D35 | D50 | D65 | D84 | D95 | gradation | geo mean | std dev |
| | 0.062 | 0.06 | 0.1 | 0 | 0 | 0 | 1.0 | 0.1 | 1.0 |

| based on total count | percent by substrate type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | silt/clay | sand | gravel | cobble | boulder | bedrock | hardpan | wood/det | artificial |
| | 94% | 6% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

# Appendix D
# Permanent Photo Documentation Points

**Photo Location 1: View looking toward large cedar and restored channel at confluence with Rich Fork Creek**

**Photo Location 2, Photo 1: View looking toward large cedar and vegetation monitoring plot #6.**

**Photo Location 2, Photo 2: View looking toward vegetation-monitoring plot #1 identified by a yellow flag in left center of the photo.**

**Photo Location 3: View looking east along the wetland preservation area.**

**Photo Location 4: View looking east with large cedar shown in the upper left corner of the photo.**

**Photo Location 5: View looking north toward tree line of wetland preservation area.**

**Photo Location 6, Photo 1:  View looking west toward large cedar.**

**Photo Location 6, Photo 2: View looking from Rich Fork toward photo point #2 at the spoil pile.**