

# Baseline and Year 1 Annual Monitoring Document

UT to Haw River (#747)

Alamance County



Data Collection Period: August 2012

Submission Date: December 7, 2012



North Carolina Department of  
Environment and Natural Resources  
Ecosystem Enhancement Program  
1652 Mail Service Center  
Raleigh, NC 27699-1652

Owner



NCDENR  
Ecosystem Enhancement Program  
1652 Mail Service Center  
Raleigh, NC 27699-1652

EEP Project Manager: Perry Sugg  
Phone: (919) 707-8937

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Monitoring Firm



Mulkey Engineers and Consultants  
6750 Tryon Road  
Cary, North Carolina 27518  
Phone: (919) 851-1912  
Fax: (919) 851-1918

Project Manager: Mark Mickley  
Phone: (919) 858-1797

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## 1.0 Executive Summary

The Unnamed Tributary (UT) to Haw River Stream Enhancement Site (Site) is a North Carolina Ecosystem Enhancement Program (EEP) stream mitigation site situated in the northwest corner of Alamance County, North Carolina, approximately 2.8 miles southeast of the Town of Ossipee and 3.1 miles northwest of the City of Burlington (Figure 1). The Site is located within the Cape Fear River Basin Cataloging Unit 03030002 and Local Watershed Unit 03030002030010, a Targeted Local Watershed in EEP's 2009 Cape Fear River Basin Restoration Priority report. The Site consists of 13 unnamed tributaries to the Haw River located on two privately owned parcels. Four conservation easement areas have been established to encompass all mitigation assets for the project: a Preservation Reach with two unnamed tributaries and three Enhancement Reaches containing the remaining 11 unnamed tributaries (Figures 2.0-2.5)

The goals of the UT to Haw River Stream Enhancement Site are to improve water quality and restore richness and diversity of the plant species within the riparian zone and upland buffers, and improve the overall wildlife habitat across the entire conservation easement. To achieve these goals, the project has the following objectives:

- Stabilize excessively eroded stream banks through bioengineering techniques and appropriate vegetation planting.
- Eliminate livestock access to project reaches and associated riparian buffers through the installation of cattle exclusion fencing.
- Effectively treat and eliminate approximately 4.2 acres of invasive plant species and replace with appropriate native plant material.
- Implement a specific planting plan that addresses immediate planting needs for 0.45 acres of stream bank, 1.06 acres of riparian buffer, 3.14 acres of upland buffer, and provides for supplemental planting of all vegetative zones based on site specific needs identified during project construction.
- Protect the completed enhancement activities at the Site through 39.4 acres of perpetual conservation easement.
- Implement a site specific farm management plan that compliments enhancement activities by providing alternative water sources, additional fencing, and at-grade permanent stream crossings.

Restoration activities were completed in December 2011 and included installation of exclusion fencing and alternative watering systems (prior to construction), invasive species treatment (July-December 2011), and buffer planting (December 2011). There were no significant deviations from the design plan. Because baseline monitoring was not conducted within 60 days of EEP/State Construction Office walk-through, this document serves as a combination Baseline/First Year monitoring document. Monitoring data were collected in August 2012. Second Year monitoring will be conducted between June 1 and September 31, 2013.

Four vegetation monitoring plots were established and data collected on August 14-15, 2012. Planted stem densities were 360 stems/acre in VP1, 480 stems/acre in VP2, 360 stems/acre in VP3, and 200 stems/acre in VP4.

Final mitigation assets for the project are 10,656 feet of stream enhancement (E2) and 1,843 feet of stream preservation for 4,631 stream mitigation units (SMU), and 39.4 acres of permanent conservation easement held by the State of North Carolina. The project also includes 0.04 acres of wetland enhancement and 0.24 acres of wetland preservation. Farm BMPs associated with the Enhancement Reaches include 21,248 feet of cattle exclusion fencing, multiple troughs and water lines for cattle. Farm best management practices (BMPs) at the Preservation Reach consist of 5,110 feet of cattle exclusion fencing.

## **2.0 Project Goals, Background, and Attributes**

### **2.1 Location and Setting**

The Unnamed Tributary (UT) to Haw River Stream Enhancement Site (Site) is a North Carolina Ecosystem Enhancement Program (EEP) stream mitigation site situated in the northwest corner of Alamance County, North Carolina, approximately 2.8 miles southeast of the Town of Ossipee and 3.1 miles northwest of the City of Burlington (Figure 1). The Site is located within the Cape Fear River Basin Cataloging Unit 03030002 and local watershed unit 03030002030010 (14-digit HUC). EEP identified this HUC as a Targeted Local Watershed in the 2009 Cape Fear River Basin Restoration Priority report. The Site consists of 13 unnamed tributaries to the Haw River located on two privately owned parcels. Four conservation easement areas have been established to encompass all mitigation assets for the project: a Preservation Reach with two unnamed tributaries and three Enhancement Reaches containing the remaining 11 unnamed tributaries (Figures 2.0-2.5)

The project watershed lies within the Southern Outer Piedmont Ecoregion of the Piedmont physiographic province (Griffith et al., 2002). Local geology consists of intrusive rocks of the Carolina Slate Belt. Topography associated with the Site consists of gently sloping hills and valleys. Elevations range from a high of 660 feet above mean sea level (msl) at the northeastern project boundary to a low of approximately 560 feet above msl along the Haw River.

The Preservation Reach includes two unnamed tributaries to the Haw River. *Main West* is a first order perennial stream with a rocky substrate. *Trib WI* is a first order intermittent stream that begins at a nick point near the easement boundary, and is influenced by a spring head near its confluence with *Main West*. Vegetation along this reach is a mesic mixed hardwood forest in upper portions of the reach transitioning to a mature Piedmont alluvial forest as it approached the Haw River.

The Enhancement Reaches at the Site are a combination of pasture, Piedmont alluvial forest, and mesic mixed hardwood forest. As outlined in the 2008 Restoration Plan, the main source of the bank degradation and stability issues throughout the reaches included cattle intrusion and lack of adequate riparian buffer. Based on visual observations, these impacts had resulted in substantial erosion along the stream banks, incision of the channels, channel widening in some areas, and poor bed form diversity throughout the Site. These reaches have been identified according to their position within the project landscape and are delimited where there are separate streams or where there are significant changes in stream characteristics along a given reach. The Enhancement II reaches, listed as they occur at the site from west to east, are defined as follows:

- *Main Center* is a large perennial tributary that enters the central “y-shaped” easement area from the northwest. Main Center is a first order stream when it enters the easement and becomes a second order stream at its confluence with Trib C1. Main Center flows southeast to its confluence with Trib C2 where it becomes a third order stream, then turns south and flows directly to the Haw River.
- *Trib C1* is a small, first order tributary that enters the western arm of the “y-shaped” center easement area from the northeast. Trib C1 is an intermittent tributary when it enters the easement, then becomes a perennial tributary at a distinct nick point as it flows southwest along the reach. Waters from Trib C1 feed an in-line pond then join Main Center immediately downstream of the pond.
- *Trib C2* is a large perennial tributary that enters the eastern arm of the “y-shaped” center easement area from the northeast. Trib C2 is a first order spring fed tributary that originates outside of the easement, becoming a second order stream at its confluence with Trib C2-a. Trib C2 flows southwest and feeds an in-line pond before ultimately reaching its confluence with Main Center.
- *Trib C2-a* is a very small, first order intermittent tributary that enters the central easement area from the east. Trib C2-a flows west to its confluence with Trib C2 in the northeastern portion of the “y-shaped” center easement area.
- *Trib C2-b* is a very small, first order intermittent tributary that enters the central easement area from the north. Trib C2-a flows south to its confluence with Trib C2 in the northeastern portion of the “y-shaped” center easement area just upstream of an in-line pond.
- *Trib C2-c* is a very small perennial tributary that enters the central easement area from the east. Trib C2-c is a first order spring fed tributary that flows west to its confluence with Trib C2 just upstream of where Trib C2 meets Main Center.
- *Southeast Trib* is a first order intermittent tributary located in the small vertical easement area that does not directly abut the Haw River. Southeast Trib flows south through the easement but loses definition and ultimately disappears at the southernmost portion of its easement area.
- *Main East* originates below a large farm pond and flows from north to south through the easternmost easement area. Main East enters the easement as a first order, undefined intermittent tributary. Main East becomes a second order perennial stream at its confluence with Trib E1 and ultimately has a direct confluence with the Haw River at the southern extent of the easement.
- *Trib E1* is a small, first order, spring-fed, perennial tributary located within the easternmost easement area and is positioned to the west of the Main East reach. Trib E1 flows south from its origin to its confluence with Main East.
- *Trib E2* is a small, first order, spring-fed, perennial tributary located within the easternmost easement area and is positioned to the east of the Main East reach. Trib E2 flows south from its origin to its confluence with Main East.

- *Trib E3* is a small, first order perennial tributary that enters the eastern easement area from the northeast. Trib E3 originates outside of the designated easement area and flows southwest to its confluence with Main East.

## **2.2 Project Goals and Objectives**

The goals of the UT to Haw River Stream Enhancement Site are to improve water quality and restore richness and diversity of the plant species within the riparian zone and upland buffers, and improve the overall wildlife habitat across the entire conservation easement. To achieve these goals, the project has the following objectives:

- Stabilize excessively eroded stream banks through bioengineering techniques and appropriate vegetation planting.
- Eliminate livestock access to project reaches and associated riparian buffers through the installation of cattle exclusion fencing.
- Effectively treat and eliminate approximately 4.2 acres of invasive plant species and replace with appropriate native plant material.
- Implement a specific planting plan that addresses immediate planting needs for 0.45 acres of stream bank, 1.06 acres of riparian buffer, 3.14 acres of upland buffer, and provides for supplemental planting of all vegetative zones based on site specific needs identified during project construction.
- Protect the completed enhancement activities at the Site through 39.4 acres of perpetual conservation easement.
- Implement a site specific farm management plan that compliments enhancement activities by providing alternative water sources, additional fencing, and at-grade permanent stream crossings.

## **2.3 Project Structure, Restoration Type, and Approach**

### **2.3.1 Project Structure**

Final mitigation assets for the project are 10,656 feet of stream enhancement (E2) and 1,843 feet of stream preservation for 4,631 stream mitigation units (SMU), and 39.4 acres of permanent conservation easement held by the State of North Carolina. The project also includes 0.04 acres of wetland enhancement and 0.24 acres of wetland preservation. Farm BMPs associated with the Enhancement Reaches include 21,248 feet of cattle exclusion fencing, multiple troughs and water lines for cattle. Farm BMPs at the Preservation Reach consist of 5,110 feet of cattle exclusion fencing. Details can be found in Figures 2.0-2.5 and in Tables 1a and 1b in Appendix A.

### **2.3.2 Restoration Type and Approach**

The enhancement level II stream restoration at the Site involved the installation of cattle exclusion fencing and a livestock watering system, invasive species treatment, and planting low-density areas. Native species selection was based on existing plant communities and used three reference plant communities provided by EEP and inventoried by the N.C. Natural Heritage Program (NHP): Altamahaw Alluvial Forest, Stony Creek Forest, and Williamsburg Alluvial Forest. The target plant community for riparian zones at the Site was Piedmont alluvial forest;



for the upland zones it was mesic mixed hardwood forest (Schafale and Weakley 1990). Planting areas were selected based on low woody stem density or lack of mature forest structure. All containerized planting in the riparian and upland zones were planted at a density of 454 stems/acre. Natural colonization was proposed for areas of dense mature canopy where the mortality rate of supplemental planting was expected to be high. These areas will be closely monitored and, if necessary, supplemented in the future if warranted by specific site conditions. Specific locations along the stream bank of the enhancement reaches were planted with live stakes at a density of 1,742 stems/acre. A number of wetland species were installed in five specific wetland seep areas located at the head of reaches C2-a, C2-c, SE Trib, E1 and E2. The final planting list can be found in Appendix B.

The approach taken at the preservation reach involved the installation of cattle exclusion fencing around the easement boundary and the supplemental planting of a small riparian wetland adjacent to the in-line pond on the Main West reach.

## ***2.4 Project History, Contacts, and Attribute Data***

The final restoration plan was submitted to the EEP in August 2008. Restoration activities were completed in December 2011 and included installation of exclusion fencing and alternative watering systems (prior to construction), invasive species treatment (July-December 2011), and buffer planting (December 2011). There were no significant deviations from the design plan. Because baseline monitoring was not conducted within 60 days of EEP/State Construction Office walk-through, this document serves as a combination Baseline/First Year monitoring document. Monitoring data were collected in August 2012. The site will be monitored for five years. Table 2.0 in Appendix A outlines the project activity and reporting history. Table 3.0 includes the designer and contractor information. Table 4.0 details the project attributes including watershed size and land uses, dominant soils, and NCDWQ classification.

## **3.0 Success Criteria**

UT to Haw River is a stream enhancement level II and preservation project. Success will be based on the establishment and preservation of the riparian plant community and the exclusion of cattle and other farm practices from the riparian buffer and streams.

### ***3.1 Morphological Parameters and Channel Stability***

Stream channel monitoring will determine the degree of success the project has achieved in meeting the objectives of providing proper channel function and increased habitat quality. The monitoring activities will evaluate the restored sections of the Site in regard to overall channel stability. This project included preservation and enhancement level II restoration. Since there were no changes made to dimension, pattern, or profile for any project reaches, morphological characteristics will not be measured. Instead, thorough visual assessments and established photopoints will focus on documenting evidence of aggradation, degradation, and bank erosion throughout the monitoring period.

### **3.2 *Vegetation***

Vegetation monitoring will be conducted according to the CVS-EEP Protocol for Recording Vegetation, Version 4.0 (Lee, M.T. et al., 2006). Four vegetation monitoring plots have been established along enhancement reaches at the Site (Figures 3.0-3.9). Following the 2003 USACE Stream Mitigation Guidelines, vegetation success will be measured for survivability over a five year monitoring period. Survivability will be based on achieving at least 320 stems per acre after three years and 260 stems per acre after five years (USACE 2003). Photos taken at each monitoring plot should indicate maturation of the riparian vegetation. A qualitative visual assessment of the enhancement and preservation reaches will be performed each year. Areas lacking cover, with low planted-stem density or vigor, or areas experiencing invasive species encroachment will be identified and mapped on the CCPV.

### **3.3 *Hydrology***

The UT to Haw River project is an enhancement level II project. No changes were made to stream channels at the Site. Therefore, hydrological evaluation is not required or necessary.

## **4.0 *Monitoring Plan Guidelines***

Annual data will be collected for the monitoring parameters below for five years after construction, unless otherwise stated or directed as part of the review process. Success criteria for the stream enhancement and preservation project will include photo documentation of riparian buffer and stream stability, and condition and collection of vegetation plot data.

### **4.1 *Stream Channel Stability and Geomorphology***

The UT to Haw River project included preservation and enhancement level II restoration. Since there were no changes made to dimension, pattern, or profile for any project reaches, morphological characteristics will not be measured. Instead, thorough visual assessments and established photopoints will focus on documenting evidence of aggradation, degradation, and bank erosion.

### **4.2 *Vegetation***

Vegetation monitoring will be conducted according to the CVS-EEP Protocol for Recording Vegetation, Version 4.0 (Lee, M.T. et al., 2006). Four 100 square meter vegetation monitoring plots were established, and data collected, along the enhancement reaches on August 14-15, 2012. Two plots measure ten meters by ten meters, and two plots measure five meters by 20 meters. The four corners of each plot are marked with one-half inch steel rebar. Level 2 (planted and volunteer woody stems) data collection was performed in all plots. Each planted woody stem location (x and y), height (cm), and live stem diameter (dbh) were recorded. All planted stems were identified with pink flagging and silver tree tags indicating tree species. Vegetation was identified using Weakley (Weakley 2007). Photos were taken of each vegetation plot. Data collected in these plots will serve as both baseline and first-year monitoring data.

A qualitative visual assessment of the enhancement and preservation reaches will be performed each year. Areas lacking cover, with low planted-stem density or vigor, or areas experiencing invasive species encroachment will be identified and mapped on the CCPV.

### **4.3 Hydrology**

The UT to Haw River project is an enhancement level II project. No changes were made to stream channels at the Site. Therefore, hydrological evaluation is not required or necessary.

### **4.4 Photo Stations**

Thirty (30) permanent photopoints have been established throughout the Site. These photopoints were not established until after construction was complete and therefore existing conditions photographs from these exact locations are not available. Instead, photos from the most current monitoring year will be included in the annual report alongside representative photos of reaches at the Site previously included in the Restoration Plan.

## **5.0 Maintenance and Contingency Plans**

If visual evaluations identify a high priority problem area, or monitoring findings indicate a failure to meet success criteria, then remedial action may be necessary. The appropriate remedial action for any vegetation problem will be resolved on a case-by-case basis. Any remedial action must be approved by EEP.

### **5.1 Vegetation Problems**

Vegetation problems may include planted vegetation not meeting success criteria, persistent barren areas with no herbaceous vegetation, and/or the presence of invasive species. These problem areas will be mapped as discreet polygons and included in the Current Conditions Plan View (CCPV) as part of the annual vegetation assessment. Upon determining the cause of the problems, the appropriate remedial actions will be initiated with the approval of EEP. These actions may include replanting woody stems, re-seeding, soil nutrient amendments, grading, and herbicide application to remove invasive vegetation.

### **5.2 Stream Problems**

The UT to Haw River project included preservation and enhancement level II restoration. Since there were no changes made to dimension, pattern, or profile for any project reaches, morphological characteristics will not be measured. Instead, thorough visual assessments and established photopoints will focus on documenting evidence of aggradation, degradation, and bank erosion. The consultant will refer any identified problems to EEP for possible remedial action.

## **6.0 Documenting the Baseline/First Year (Year 1) Condition**

Because baseline monitoring was not conducted within 60 days of EEP/State Construction Office walk-through, this document serves as a combination Baseline/First Year monitoring document. Therefore information contained in the appendices is inclusive of applicable content

requirements for both the baseline monitoring report and annual monitoring report. Monitoring data for the baseline/first year were collected in August 2012.

## **6.1 As-built/Record Drawings**

See Appendix D for Record Drawings.

## **6.2 Baseline/First Year Data Collection**

### **6.2.1 Morphological State of the Channel**

As outlined previously in this document, and in the 2008 Restoration Plan, the Preservation Reach at the Site consists of two unnamed tributaries to the Haw River. Enhancement reaches at the Site consist of 13 unnamed tributaries to the Haw River. Because these stream reaches were not altered during construction, no geomorphic data was collected for the existing condition or post-construction condition of these reaches. Instead, photos in the Restoration Plan and Figures 3.0-3.9 in this baseline/first year report document typical channel morphology.

Thirty photo point locations were established and subsequent photographs taken during August 2012 data collection at the Site. These photographs serve as documentation of the Year 1 stream condition as well as baseline photos for future monitoring years. Based on available data and visual comparison between Year 1 and pre-construction conditions, no new areas of channel instability were identified during the August 2012 site visits.

### **6.2.2 Vegetation**

Four vegetation monitoring plots were established and data collected on August 14-15, 2012. Planted stem densities were 360 stems/acre in VP1, 480 stems/acre in VP2, 360 stems/acre in VP3, and 200 stems/acre in VP4. At this time VP1, VP2, and VP3 are meeting required success criteria and VP4 is not. Photos were taken from the 0,0 corner of each plot. Vegetation photos are included in Appendix B and additional vegetation data is included in Appendix C.

In addition to the vegetation monitoring plots, visual assessments were conducted of all planted areas associated with enhancement reaches at the Site. Several low stem density areas and two invasive areas of concern were identified along project reaches as indicated in Table 5 and Figures 3.0-3.9 in Appendix B. A total of seven low stem density areas exist along the Main Center, Trib C2, Southeast Trib, Main East, and Trib E3 reaches. Additionally, two invasive areas of concern are located along the Trib C2 reach. *Ligustrum sinense* (high concern) was seen sporadically between the Trib C2 crossing and the Main Center reach. Evidence of this species was not overwhelming, however, Chinese privet was extremely dense along this section of the project prior to construction and will be observed closely throughout the monitoring phase of the project.

### **6.2.3 Photo Documentation**

Twenty-six permanent photopoints have been established along the Enhancement Reaches and four along the Preservation Reach. Locations were recorded using a sub-meter Trimble GPS. Initial photographs were taken during baseline/first year monitoring on August 14-15, 2012. These photos can be found in Appendix B.

### **6.2.4 Hydrology**

No crest gauges were installed at the Site as hydrology is not being evaluated for this project.

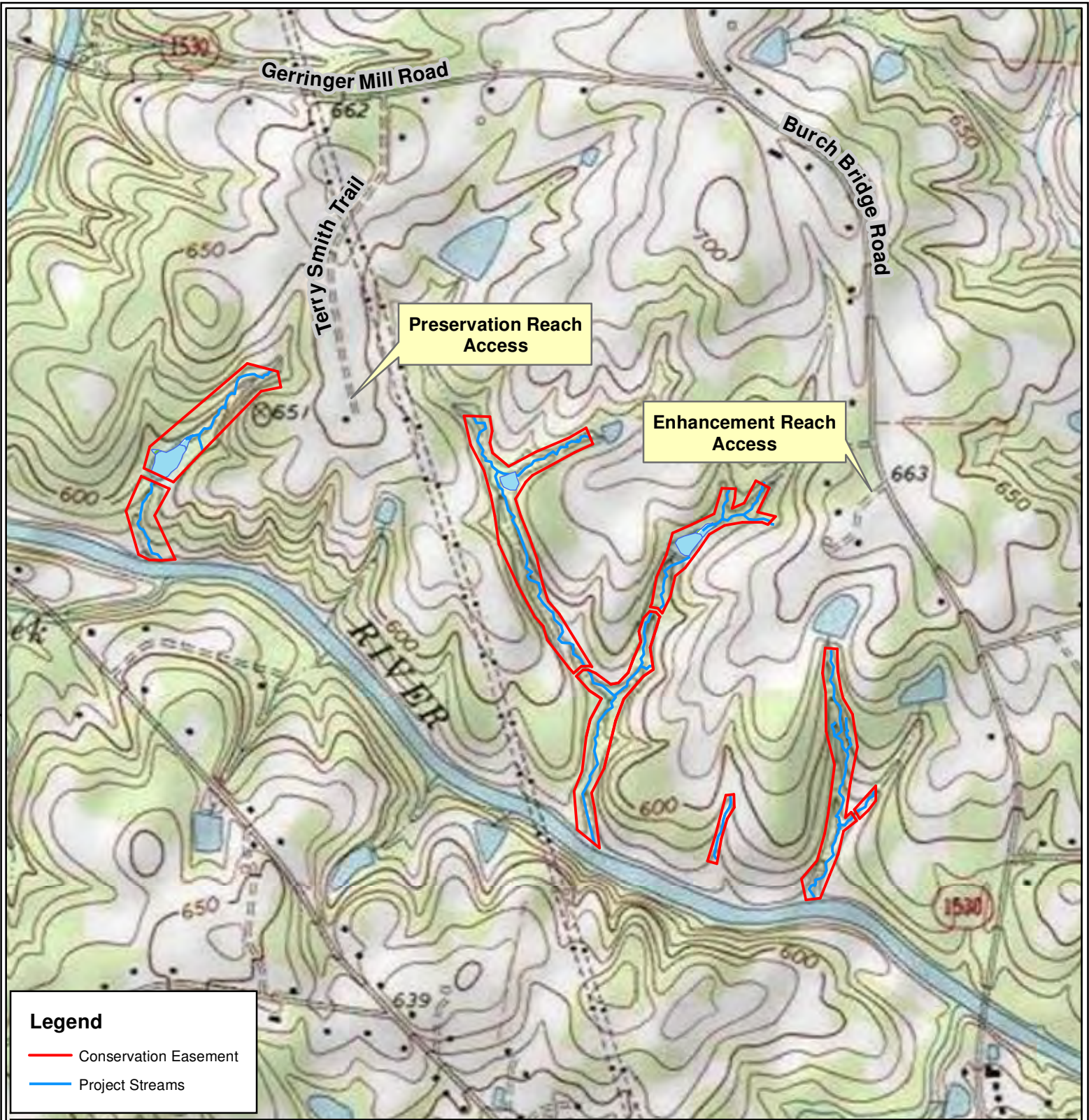
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## **APPENDIX A**

### **Project Vicinity Map and Background Tables**

Figure 1	Project Vicinity Map
Figure 2.0-2.5	Stream Assets, Photopoints, and Vegetation Monitoring Plots
Table 1a.	Project Components
Table 1b.	Component Summations
Table 2	Project Activity and Reporting History
Table 3	Project Contacts Table
Table 4	Project Attribute Table



**Legend**

- Conservation Easement
- Project Streams

**Directions to the Project:**  
 The project site is located directly adjacent to the Haw River approximately 2.8 miles southeast of the Town of Ossipee and 3.1 miles northwest of the City of Burlington in Alamance County. The approximate center of the project site is located at 36.14158° N Latitude and 79.47554° W Longitude. The site is bounded by Gerringer Mill Road (SR 1530) to the north, Burch Bridge Road (SR 1593) to the east, and the Haw River to the west and south.

Access to the conservation easement during all phases of the project will be maintained through the landowner's gated entrances to the Site. These entrances are located at the end of Terry Smith Trail and on Burch Bridge Road approximately 0.75 mile south of Gerringer Mill Road.

The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with EEP.

1 inch = 1,000 feet

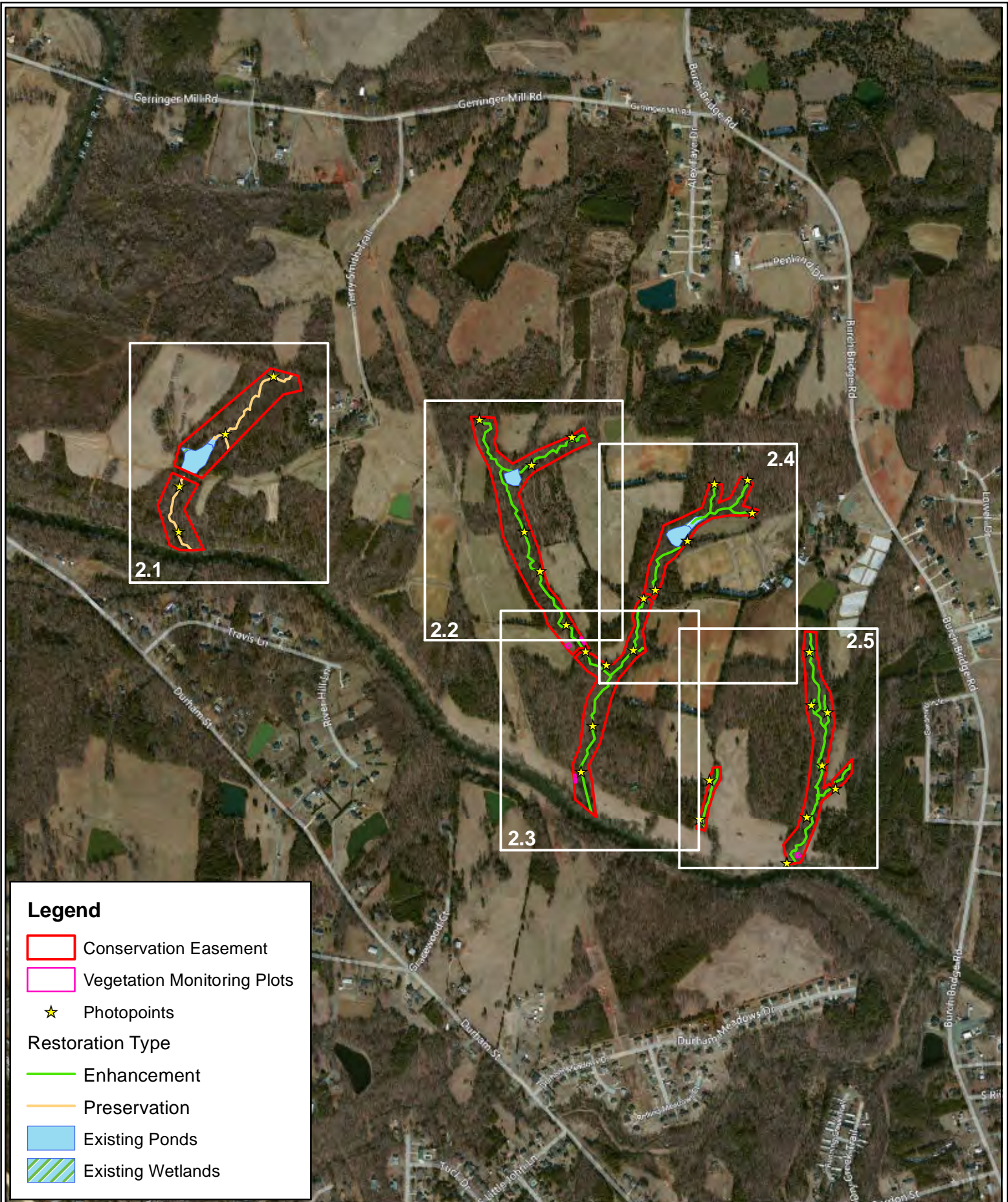
GRAPHIC SCALE

0      500      1,000  
 Feet



**PROJECT VICINITY MAP**  
 UT TO HAW RIVER  
 STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

**FIGURE**  
  
**1**

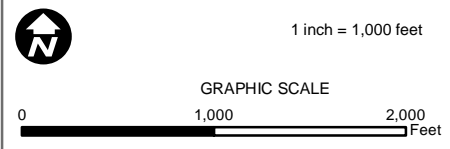


**Legend**

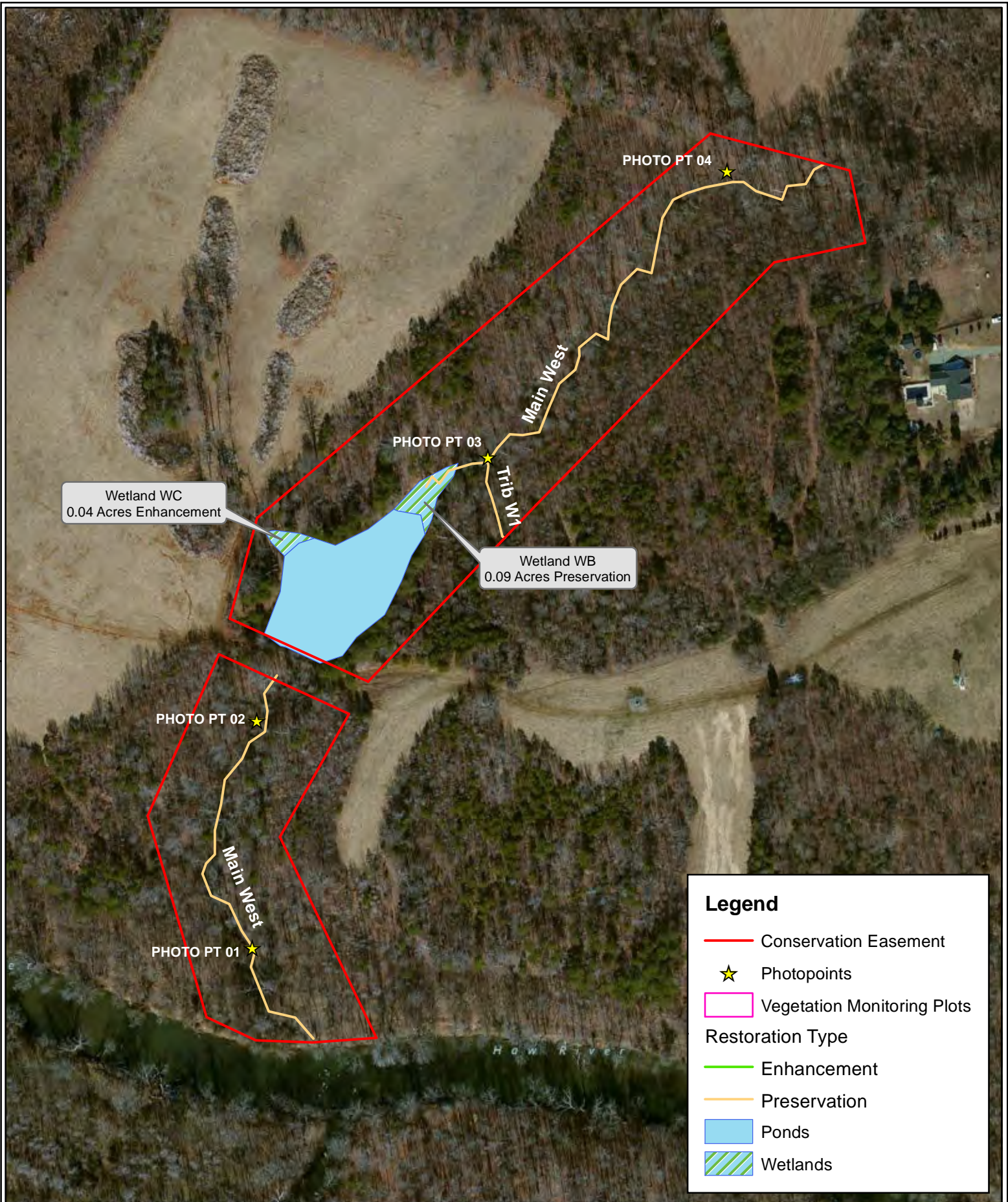
- Conservation Easement
  - Vegetation Monitoring Plots
  - ★ Photopoints
- Restoration Type
- Enhancement
  - Preservation
  - Existing Ponds
  - Existing Wetlands

**STREAM ASSETS, PHOTOPPOINTS, AND  
VEGETATION MONITORING PLOTS**  
 UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

**FIGURE  
2  
KEY**





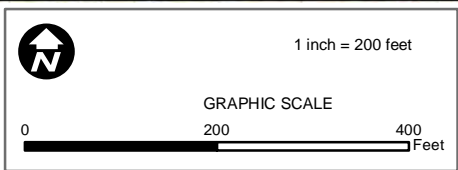


**Legend**

- Conservation Easement
- ★ Photopoints
- ▭ Vegetation Monitoring Plots

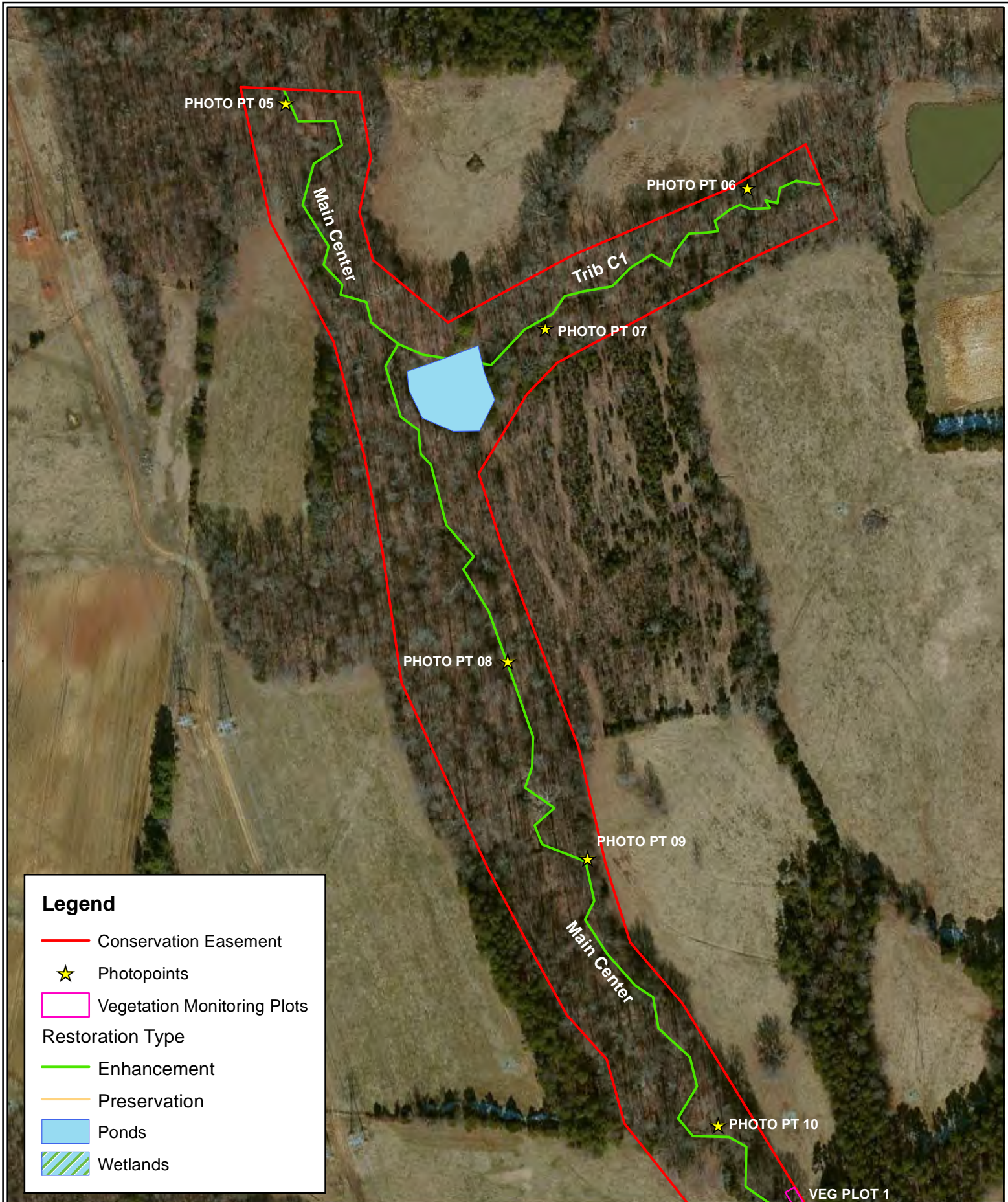
Restoration Type

- Enhancement
- Preservation
- ▭ Ponds
- ▨ Wetlands



**STREAM ASSETS, PHOTOPOINTS, AND VEGETATION MONITORING PLOTS**  
 UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

**FIGURE**  
**2.1**



**Legend**

- Conservation Easement
- ★ Photopoints
- Vegetation Monitoring Plots

Restoration Type

- Enhancement
- Preservation
- Ponds
- Wetlands

1 inch = 200 feet

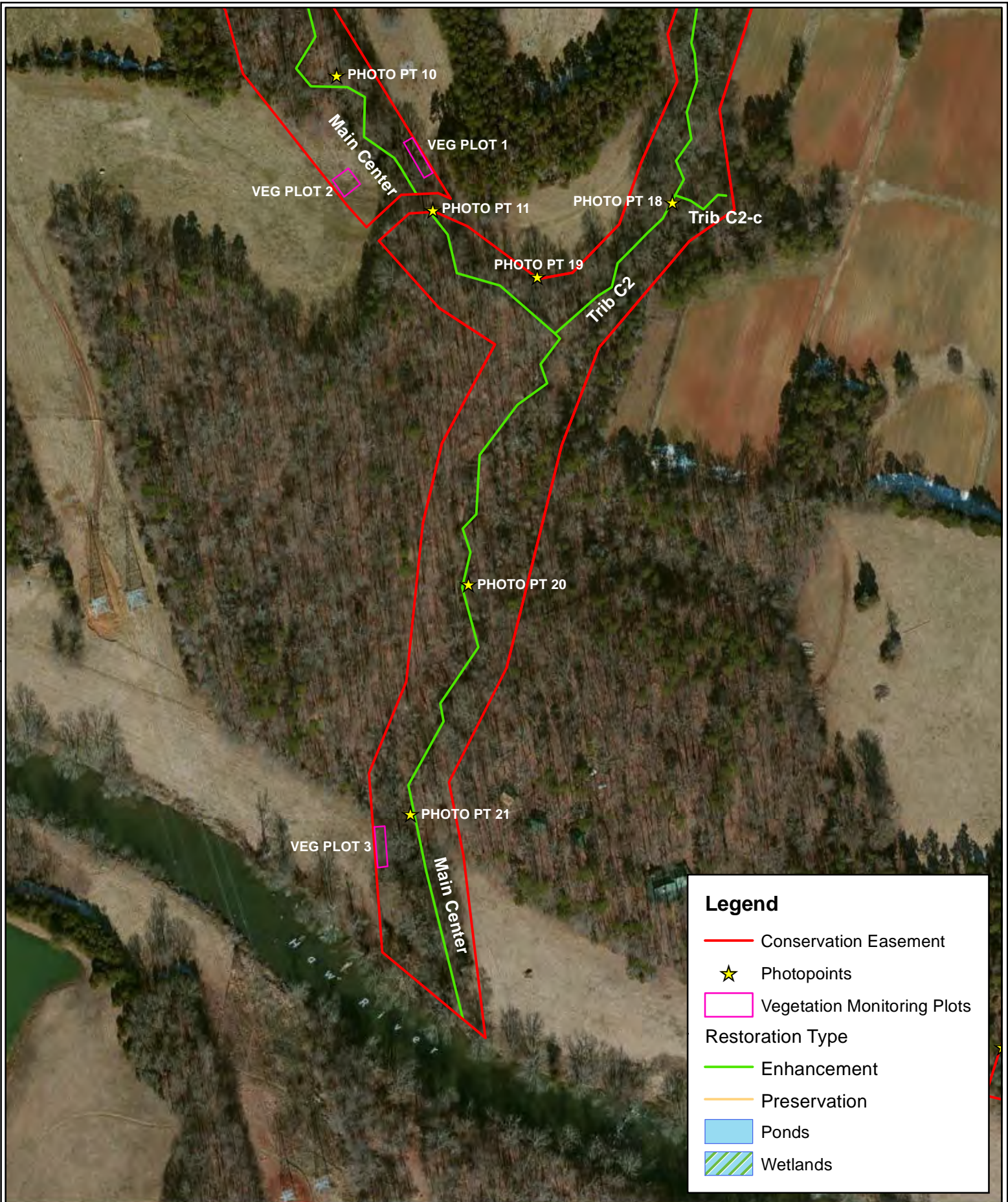
GRAPHIC SCALE

0      200      400  
Feet

**STREAM ASSETS, PHOTOPPOINTS, AND VEGETATION MONITORING PLOTS**  
 UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

**FIGURE**  
  
**22**





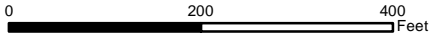
**Legend**

- Conservation Easement
- ★ Photopoints
- ▭ Vegetation Monitoring Plots
- Restoration Type
- Enhancement
- Preservation
- Ponds
- Wetlands



1 inch = 200 feet

GRAPHIC SCALE

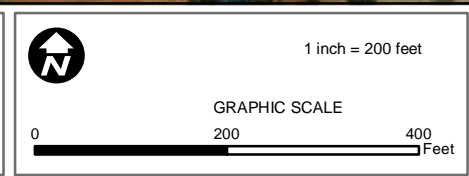
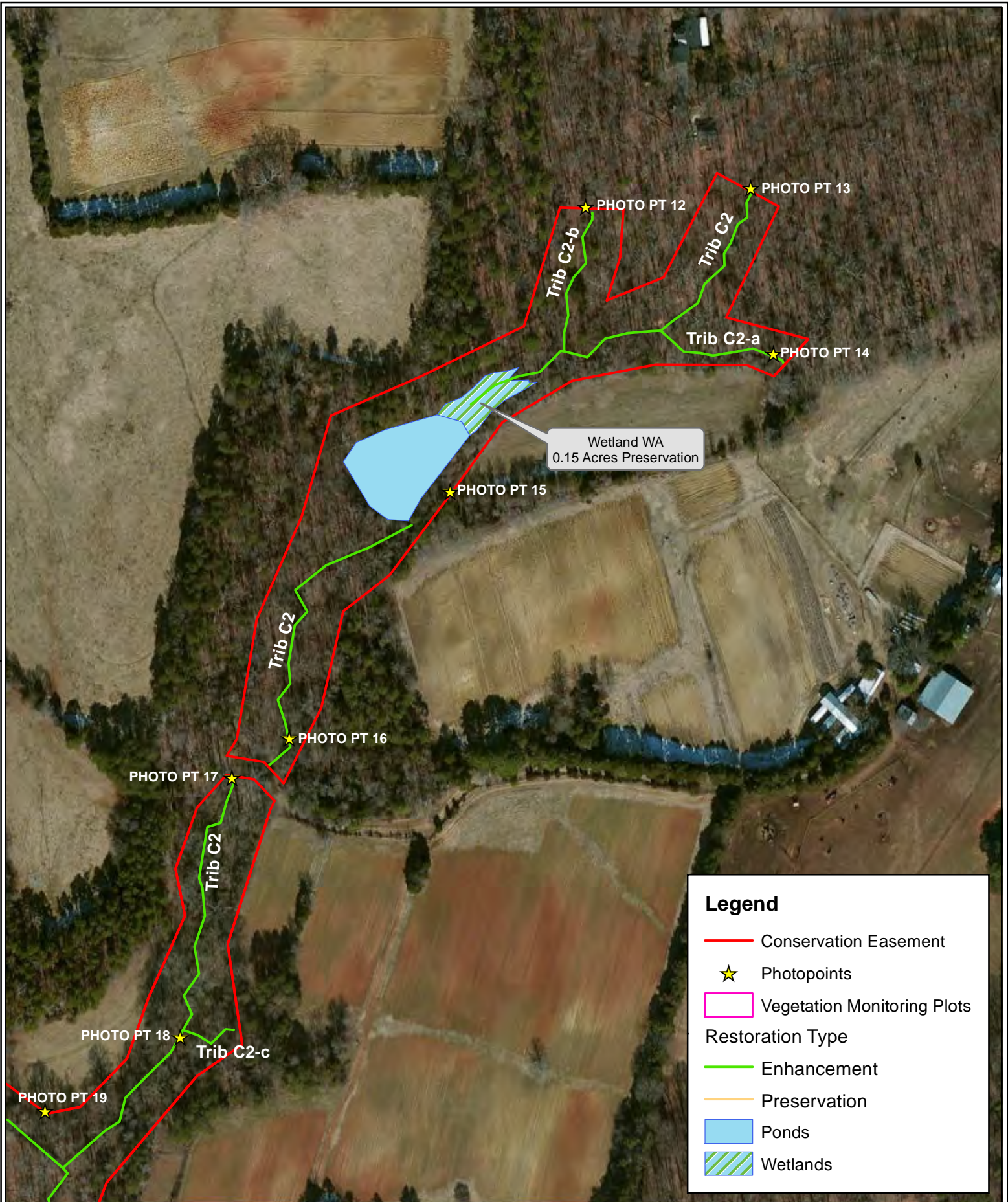


**STREAM ASSETS, PHOTOPOINTS, AND VEGETATION MONITORING PLOTS**  
 UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

FIGURE

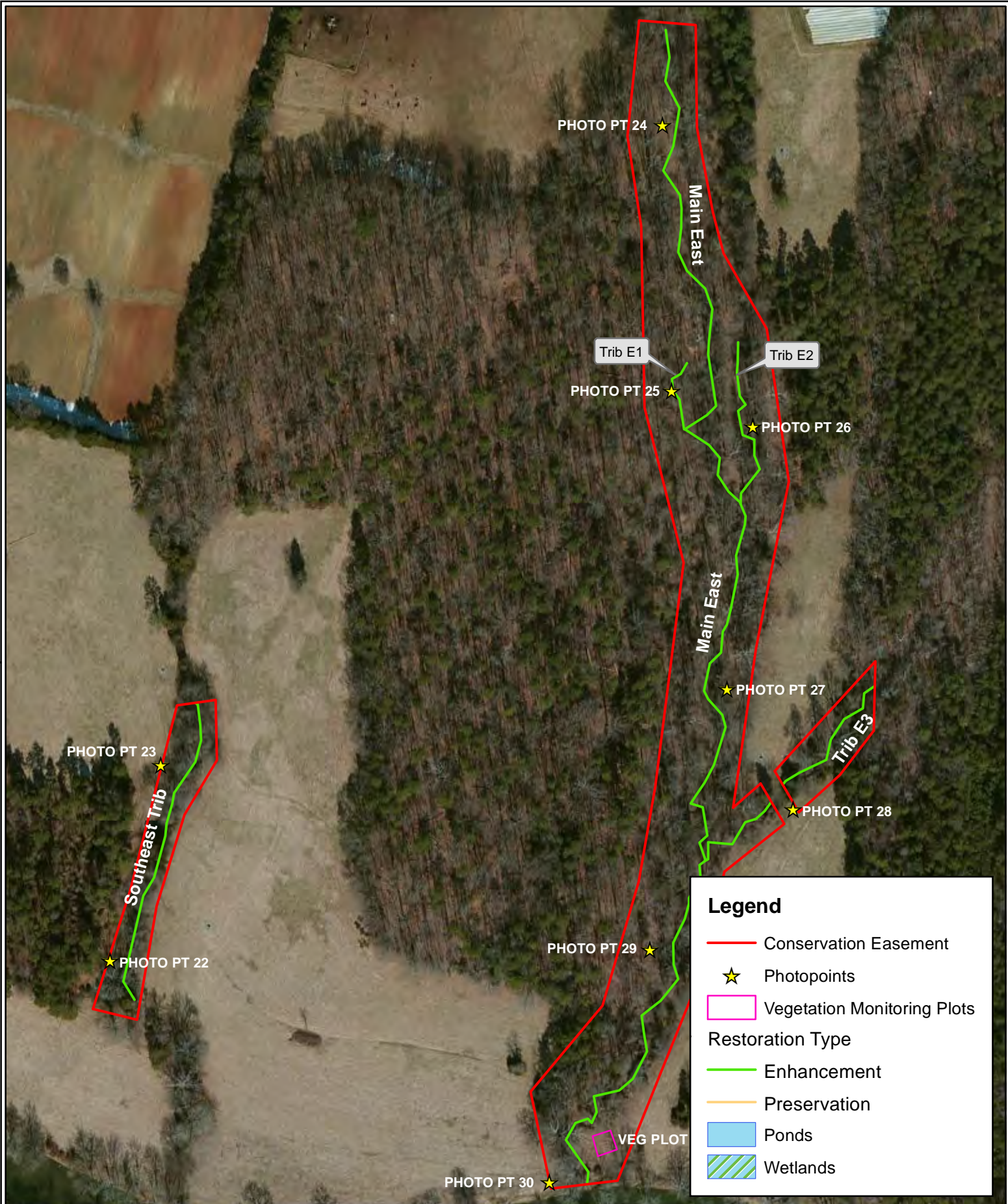
**2.3**





**STREAM ASSETS, PHOTOPOINTS, AND VEGETATION MONITORING PLOTS**  
 UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

**FIGURE**  
**2.4**

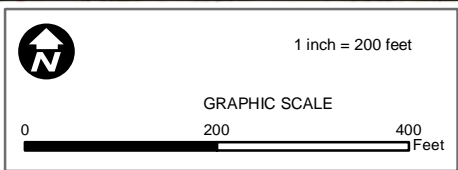


**Legend**

- Conservation Easement
- ★ Photopoints
- Vegetation Monitoring Plots

Restoration Type

- Enhancement
- Preservation
- Ponds
- Wetlands



**STREAM ASSETS, PHOTOPOINTS, AND VEGETATION MONITORING PLOTS**  
 UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

**FIGURE**  
**2.5**

**Table 1a. Project Components  
UT to Haw River Stream Enhancement Project (#747)**

Project Component or Reach ID	Existing <sup>1</sup> Length (ft)	Restoration Level	Approach	Mitigation Length (ft)	Stationing <sup>1</sup>	Mitigation Ratio	Mitigation Units	BMP Elements <sup>2</sup>	Comment
MAIN WEST	1768.2	P	N/A	1720.0	0+00 to 17+68.19	5:1	344.0	CF	Cattle exclusion fencing and one at-grade crossing.
TRIB W1	149.0	P	N/A	128.0	0+00 to 1+48.96	5:1	25.6	CF	
MAIN CENTER <sup>3</sup>	4102.0	E2	N/A	3952.5	0+00 to 41+02.00	2.5:1	1581.0	CF, WS	Invasive vegetation treatment, riparian buffer planting, cattle exclusion fencing, and three at-grade crossings.
TRIB C1	825.0	E2	N/A	792.0	0+00 to 8+24.99	2.5:1	316.8	CF, WS	
TRIB C2	2050.4	E2	N/A	1971.5	0+00 to 20+50.39	2.5:1	788.6	CF, WS	
TRIB C2-a	271.0	E2	N/A	221.0	0+00 to 2+70.96	2.5:1	88.4	CF, WS	
TRIB C2-b	239.4	E2	N/A	239.0	0+00 to 2+39.40	2.5:1	95.6	CF, WS	
TRIB C2-c	97.7	E2	N/A	97.5	0+00 to 0+97.70	2.5:1	39.0	CF, WS	
SOUTHEAST TRIB	516.2	E2	N/A	349.0	0+00 to 5+16.15	2.5:1	139.6	CF, WS	Invasive vegetation treatment, riparian buffer planting, cattle exclusion fencing.
MAIN EAST <sup>3</sup>	2163.8	E2	N/A	2163.5	0+00 to 21+63.83	2.5:1	865.4	CF, WS	Invasive vegetation treatment, riparian buffer planting, cattle exclusion fencing, and two at-grade crossings.
TRIB E1	121.2	E2	N/A	121.0	0+00 to 1+21.15	2.5:1	48.4	CF, WS	
TRIB E2	290.6	E2	N/A	290.5	0+00 to 2+90.55	2.5:1	116.2	CF, WS	
TRIB E3	447.3	E2	N/A	400.0	0+00 to 4+47.34	2.5:1	160.0	CF, WS	

1 = Indicates total length of stream delineated during initial project field surveys in 2007. Some footage extends beyond the conservation easement boundary.

2 = BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond;

FS = Filter Strip; Grassed Swale = S; LS = Level Spreader; NI = Natural Infiltration Area, O = Other

CF = Cattle Fencing; WS = Watering System; CH = Livestock Housing

3 = Mitigation length for Main Center and Main East includes linear footage to the point of confluence with the Haw River, slightly outside of the conservation easement boundary shown by plan view.

**Table 1b. Component Summations  
UT to Haw River Stream Enhancement Project (#747)**

Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Ripar (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration							
Enhancement							
Enhancement I							
Enhancement II	10597.5						
Creation							
Preservation	1848.0						
HQ Preservation							
<b>Totals (Feet/Acres)</b>	<b>12445.5</b>						
<b>MU Totals</b>	<b>4608</b>						
Non-Applicable							

**Table 2. Project Activity and Reporting History  
UT to Haw River Stream Enhancement Project (#747)**

<b>Activity or Deliverable</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
Environmental Resources Technical Report	Oct-07	Nov-07
Permanent Conservation Easement Executed & Recorded	N/A	Mar-08
Restoration Plan	N/A	Aug-08
Final Design – Construction Plans	N/A	Mar-11
Construction	N/A	Dec-11
Planting	N/A	Dec-11
Baseline/Year 1 Monitoring	Aug-12	Dec-12



**Table 3. Project Contacts Table**  
**UT to Haw River Stream Enhancement Project (#747)**

<b>Designer</b>	Mulkey Engineers and Consultants, Inc. 6750 Tryon Road Cary, NC 27518
Primary project design POC	Tom Barrett, (919) 858-1817
<b>Construction Contractor</b>	River Works, Inc. 8000 Regency Parkway, Suite 200 Cary, NC 27518
Construction contractor POC	William Pederson, (919) 459-9001
<b>Survey Contractor</b>	Level Cross Surveying, PLLC 668 March County Lane Randleman, NC 27317
Survey contractor POC	Jena Bundy, (336) 495-1713
<b>Planting/Seeding Contractor</b>	River Works, Inc. 8000 Regency Parkway, Suite 200 Cary, NC 27518
Planting/Seeding contractor POC	William Pederson, (919) 459-9001
<b>Seed Mix Sources</b>	Green Resources, (336) 855-6363
<b>Nursery Stock Suppliers</b>	Mellow Marsh Farms, Inc., (919) 742-1200 Cure Nursery, (919) 542-6186 Foggy Mountain Nursery, LLC, (336) 384-5323
<b>Monitoring Performers</b>	Mulkey Engineers and Consultants, Inc. 6750 Tryon Road Cary, NC 27518
Stream/Vegetation Monitoring POC	Mark Mickley, (919) 858-1797

**Table 4. Project Attribute Table - UT to Haw River Stream Enhancement Project (#747)**

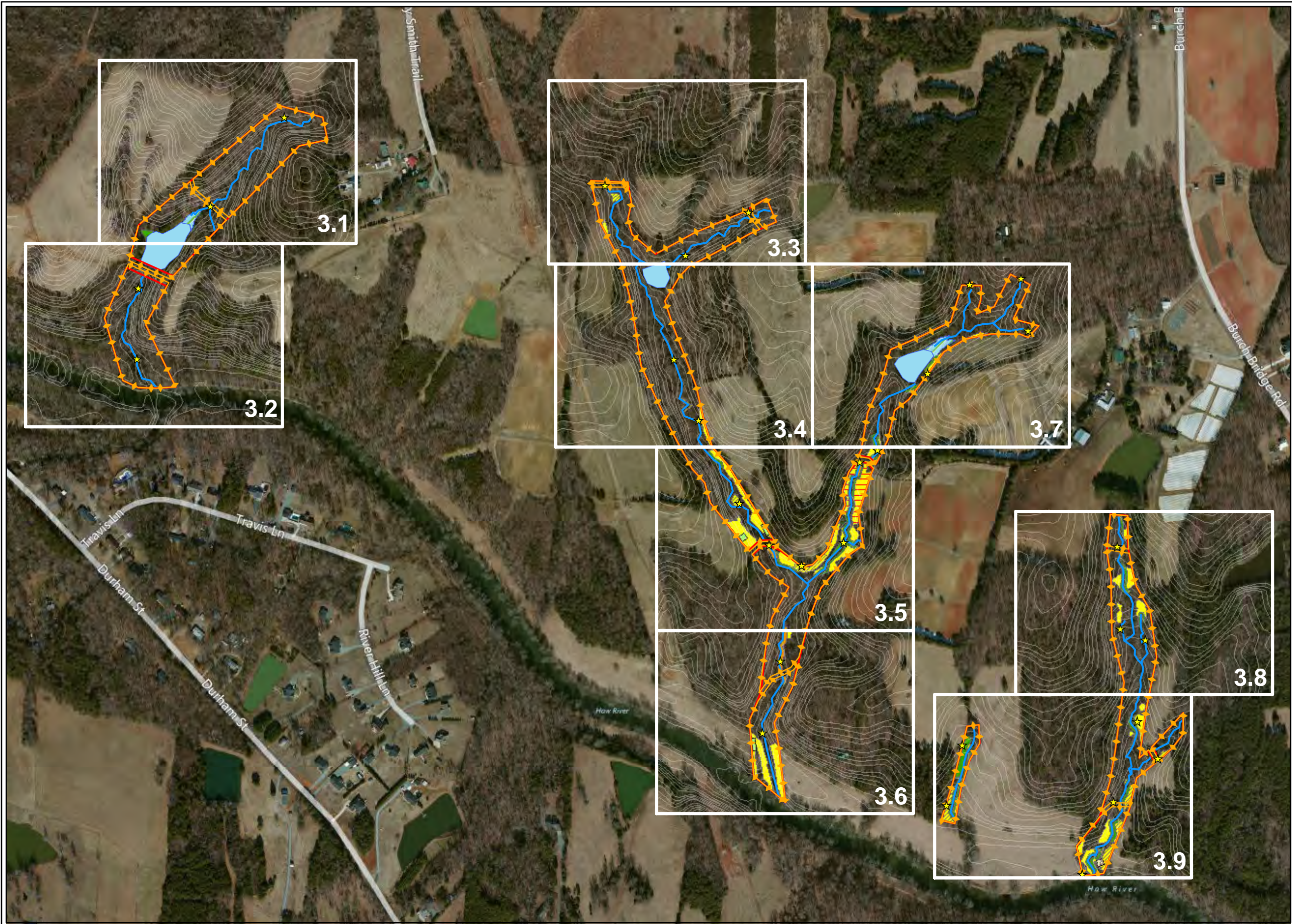
Project County	Alamance													
Physiographic Region	Piedmont													
Ecoregion	Carolina Slate Belt													
Project River Basin	Cape Fear													
USGS HUC for Project (14 digit)	3030002030010													
NCDWQ Sub-basin for Project	03-06-02													
Within extent of EEP Watershed Plan?	2009 Cape Fear River Basin Restoration Priority Report													
WRC Hab Class (Warm, Cool, Cold)	Warm													
% of project easement fenced or demarcated	100%													
Beaver activity observed during design phase?	No													
<b>Restoration Component Attribute Table</b>														
Reach	Main West	Trib W1	Main Center	Trib C1	Trib C2	Trib C2-a	Trib C2-b	Trib C2-c	Southeast Trib	Main East	Trib E1	Trib E2	Trib E3	
Drainage area (ac)	67.0	9.5	356.4	41.3	111.1	8.8	16.0	6.6	18.2	74.5	U	U	25.3	
Stream order	1 <sup>st</sup> /2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup> /3 <sup>rd</sup>	1 <sup>st</sup>	1 <sup>st</sup> /2 <sup>nd</sup>	1 <sup>st</sup>	1 <sup>st</sup>	1 <sup>st</sup>	1 <sup>st</sup>	1 <sup>st</sup> /2 <sup>nd</sup>	1 <sup>st</sup>	1 <sup>st</sup>	1 <sup>st</sup>	
Restored length (feet)	1720.0	128.0	3952.5	792.0	1971.5	221.0	239.0	97.5	349.0	2163.5	121.0	290.0	400.0	
Perennial or Intermittent	Per	Int	Per	Per/Int	Per	Int	Int	Per	Int	Int/Per	Per	Per	Per	
Watershed type (Rural, Urban, Developing etc.)	Rural		Rural						Rural	Rural				
Watershed LULC Distribution (e.g.)														
Residential	5%		8%						1%	2%				
Ag-Row Crop	0%		11%						6%	8%				
Ag-Livestock	37%		15%						46%	7%				
Forested	55%		61%						43%	80%				
Etc.	3%		5%						3%	3%				
Watershed impervious cover (%)	1%		4%						3%	1%				
NCDWQ AU/Index number	16-(1)d2		16-(1)d2						16-(1)d2	16-(1)d2				
NCDWQ classification	WS-V;NSW		WS-V;NSW						WS-V;NSW	WS-V;NSW				
303d listed?	No		No						No	No				
Upstream of a 303d listed segment?	No		No						No	No				
Reasons for 303d listing or stressor	N/A		N/A						N/A	N/A				
Total acreage of easement	10.02		21.78						0.73	6.84				
Total vegetated acreage within the easement	9.19		21.01						0.73	6.84				
Total planted acreage as part of the restoration	0.04		3.21						0.25	1.25				
Rosgen classification of pre-existing	N/A		N/A						N/A	N/A				
Rosgen classification of As-built	N/A		N/A						N/A	N/A				
Valley type	N/A		N/A						N/A	N/A				
Valley slope	N/A		N/A						N/A	N/A				
Valley side slope range (e.g. 2-3.%)	N/A		N/A						N/A	N/A				
Valley toe slope range (e.g. 2-3.%)	N/A		N/A						N/A	N/A				
Cowardin classification	N/A		N/A						N/A	N/A				
Trout waters designation	N/A		N/A						N/A	N/A				
Species of concern, endangered etc.? (Y/N)	No		No						No	No				
Dominant soil series and characteristics														
Series	Worsham	Worsham	Worsham	Worsham	Wilkes	Vance	Helena	Wilkes	Local Alluvial	Local Alluvial	Cecil	Local Alluvial	Local Alluvial	
Depth (in)	80	80	80	80	20-80	80	80	20-80	80	80	80	80	80	
Clay%	33.7	33.7	33.7	33.7	26.3	32.5	28.8	26.3	24.1	24.1	33.9	24.1	24.1	
K	0.37	0.37	0.37	0.37	0.24	0.24	0.24	0.24	0.32	0.32	0.24	0.32	0.32	
T	5	5	5	5	2	5	3	2	5	5	5	5	5	

N/A = Not Applicable, "-" = Unavailable, "U" = Unknown

## **APPENDIX B**

### **Visual Assessment Data**

Figure 3.0-3.9	Current Condition Plan View (CCPV)
Table 5	Vegetation Assessment
Photographic Log	Stream Station Photos
Photographic Log	Vegetation Plot Photos



**LEGEND**

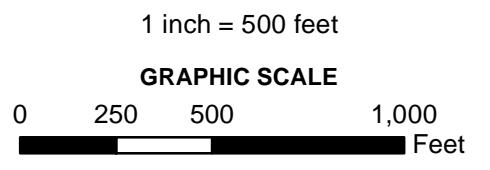
- Conservation Easement
  - Cattle Exclusion Fencing
  - Photopoints
  - Project Streams
  - Existing Ponds
  - Existing Wetlands
  - 2' Contour
- Planting Zones**
- Zone 1 - Stream Banks
  - Zone 2 - Riparian
  - Zone 3 - Upland
  - Zone 4 - Wetland Seep

**BASELINE/MY1 CONDITIONS**

- Vegetation Problem Areas**
- Low Stem Density Areas
  - Invasive Areas of Concern
- Vegetation Plot Condition**
- Criteria Met
  - Criteria Unmet
- In-Stream Structure Condition**
- At-grade Crossing (Stable)
  - Step Pool (Stable)

**NOTES:**  
 Aerial Imagery: 2010 Microsoft Corporation  
 Bing Maps provided by ESRI

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**CURRENT CONDITION PLAN VIEW**  
 UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

**FIGURE**  
**3**  
**KEY**

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**LEGEND**

- Conservation Easement
- Cattle Exclusion Fencing
- Photopoints
- Project Streams
- Existing Ponds
- Existing Wetlands
- 2' Contour
- Planting Zones**
- Zone 1 - Stream Banks
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**BASELINE/MY1 CONDITIONS**

**Vegetation Problem Areas**

- Low Stem Density Areas
- Invasive Areas of Concern

**Vegetation Plot Condition**

- Criteria Met
- Criteria Unmet

**In-Stream Structure Condition**

- At-grade Crossing (Stable)
- Step Pool (Stable)

**NOTES:**

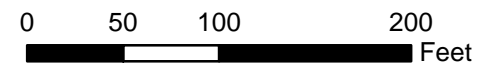
Aerial Imagery: 2010 Microsoft Corporation  
Bing Maps provided by ESRI

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1 inch = 100 feet

GRAPHIC SCALE



**CURRENT CONDITION PLAN VIEW**

UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
EEP PROJECT #747

ALAMANCE COUNTY, NC

FIGURE

3.1

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**LEGEND**

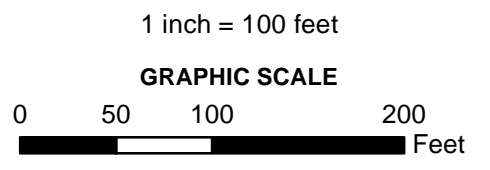
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  - Cattle Exclusion Fencing
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  - Existing Wetlands
  - 2' Contour
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**BASELINE/MY1 CONDITIONS**

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- Vegetation Plot Condition**
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  - Criteria Unmet
- In-Stream Structure Condition**
- At-grade Crossing (Stable)
  - Step Pool (Stable)

**NOTES:**  
 Aerial Imagery: 2010 Microsoft Corporation  
 Bing Maps provided by ESRI

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**CURRENT CONDITION PLAN VIEW**  
 UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

**FIGURE**

**3.2**

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**LEGEND**

- Conservation Easement
  - Cattle Exclusion Fencing
  - ★ Photopoints
  - Project Streams
  - Existing Ponds
  - Existing Wetlands
  - 2' Contour
- Planting Zones**
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  - Zone 3 - Upland
  - Zone 4 - Wetland Seep

**BASELINE/MY1 CONDITIONS**

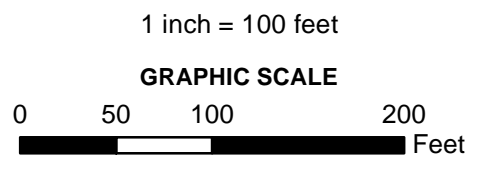
- Vegetation Problem Areas**
- Low Stem Density Areas
  - Invasive Areas of Concern
- Vegetation Plot Condition**
- Criteria Met
  - Criteria Unmet
- In-Stream Structure Condition**
- At-grade Crossing (Stable)
  - ⤴ Step Pool (Stable)

**NOTES:**

Aerial Imagery: 2010 Microsoft Corporation Bing Maps provided by ESRI

Planting areas present where woody stem densities are below Year 3, 4, and 5 requirements

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**CURRENT CONDITION PLAN VIEW**

UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
EEP PROJECT #747

ALAMANCE COUNTY, NC

**FIGURE**

**3.3**

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**LEGEND**

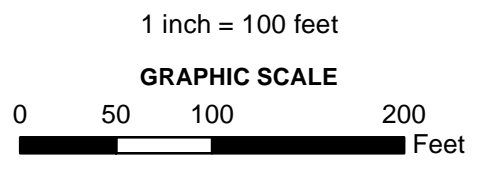
- Conservation Easement
- Cattle Exclusion Fencing
- Photopoints
- Project Streams
- Existing Ponds
- Existing Wetlands
- 2' Contour
- Planting Zones**
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**BASELINE/MY1 CONDITIONS**

- Vegetation Problem Areas**
- Low Stem Density Areas
- Invasive Areas of Concern
- Vegetation Plot Condition**
- Criteria Met
- Criteria Unmet
- In-Stream Structure Condition**
- At-grade Crossing (Stable)
- Step Pool (Stable)

**NOTES:**  
 Aerial Imagery: 2010 Microsoft Corporation  
 Bing Maps provided by ESRI

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**CURRENT CONDITION PLAN VIEW**  
 UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

**FIGURE**

**3.4**

MONITORED BY:







**LEGEND**

- Conservation Easement
  - Cattle Exclusion Fencing
  - ★ Photopoints
  - Project Streams
  - Existing Ponds
  - Existing Wetlands
  - 2' Contour
- Planting Zones**
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**BASELINE/MY1 CONDITIONS**

- Vegetation Problem Areas**
- Low Stem Density Areas
  - Invasive Areas of Concern
- Vegetation Plot Condition**
- Criteria Met
  - Criteria Unmet
- In-Stream Structure Condition**
- At-grade Crossing (Stable)
  - ▶ Step Pool (Stable)

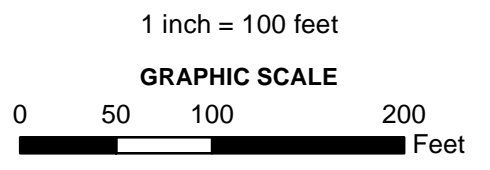
**NOTES:**

Aerial Imagery: 2010 Microsoft Corporation Bing Maps provided by ESRI

Planting areas present where woody stem densities are below Year 3, 4, and 5 requirements

Invasive species observed consisted of *Ligustrum sinense* (Chinese privet). This area of the easement was dense with Chinese privet prior to construction and needs to be observed closely during the monitoring period.

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**CURRENT CONDITION PLAN VIEW**

UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
EEP PROJECT #747

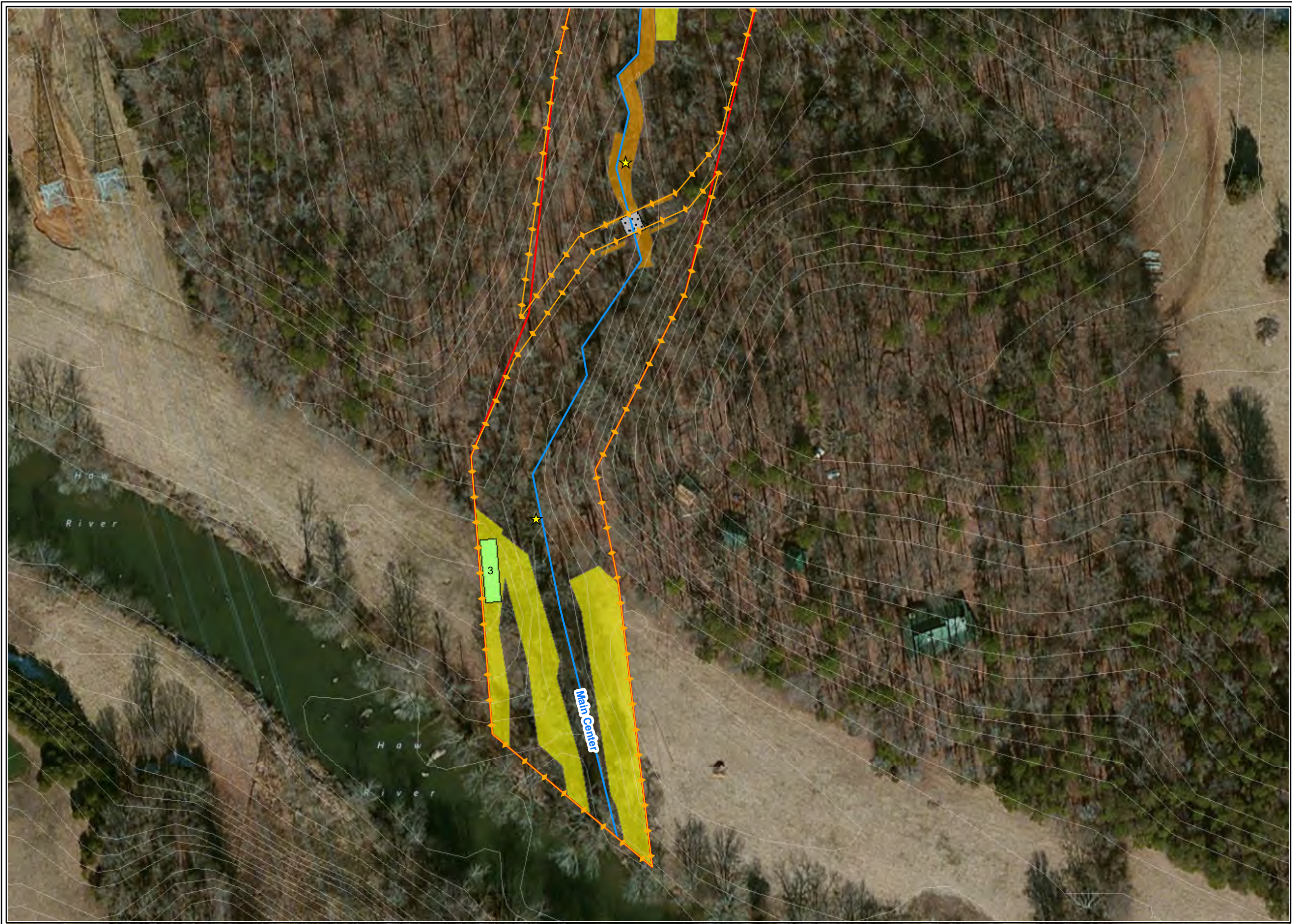
ALAMANCE COUNTY, NC

**FIGURE**

**3.5**

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**LEGEND**

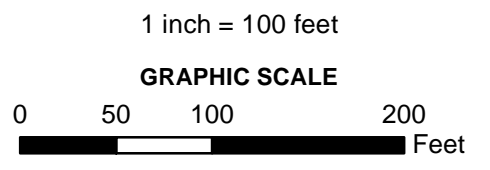
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- Cattle Exclusion Fencing
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**BASELINE/MY1 CONDITIONS**

- Vegetation Problem Areas**
- Low Stem Density Areas
- Invasive Areas of Concern
- Vegetation Plot Condition**
- Criteria Met
- Criteria Unmet
- In-Stream Structure Condition**
- At-grade Crossing (Stable)
- Step Pool (Stable)

**NOTES:**  
 Aerial Imagery: 2010 Microsoft Corporation  
 Bing Maps provided by ESRI

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**CURRENT CONDITION PLAN VIEW**  
 UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

**FIGURE**

**3.6**

MONITORED BY:





**LEGEND**

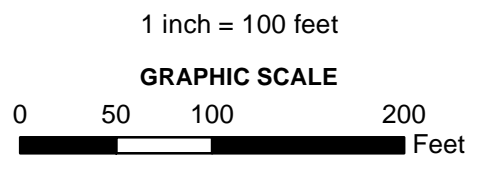
- Conservation Easement
  - Cattle Exclusion Fencing
  - Photopoints
  - Project Streams
  - Existing Ponds
  - Existing Wetlands
  - 2' Contour
- Planting Zones**
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  - Zone 3 - Upland
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**BASELINE/MY1 CONDITIONS**

- Vegetation Problem Areas**
- Low Stem Density Areas
  - Invasive Areas of Concern
- Vegetation Plot Condition**
- Criteria Met
  - Criteria Unmet
- In-Stream Structure Condition**
- At-grade Crossing (Stable)
  - Step Pool (Stable)

**NOTES:**  
 Aerial Imagery: 2010 Microsoft Corporation  
 Bing Maps provided by ESRI

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**CURRENT CONDITION PLAN VIEW**  
 UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

**FIGURE**

**3.7**

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**LEGEND**

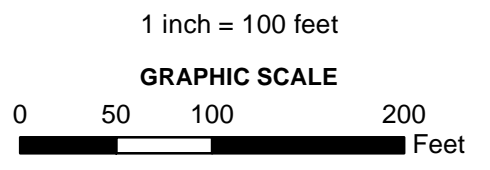
- Conservation Easement
  - Cattle Exclusion Fencing
  - Photopoints
  - Project Streams
  - Existing Ponds
  - Existing Wetlands
  - 2' Contour
- Planting Zones**
- Zone 1 - Stream Banks
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**BASELINE/MY1 CONDITIONS**

- Vegetation Problem Areas**
- Low Stem Density Areas
  - Invasive Areas of Concern
- Vegetation Plot Condition**
- Criteria Met
  - Criteria Unmet
- In-Stream Structure Condition**
- At-grade Crossing (Stable)
  - Step Pool (Stable)

**NOTES:**  
 Aerial Imagery: 2010 Microsoft Corporation  
 Bing Maps provided by ESRI

PREPARED FOR:



**CURRENT CONDITION PLAN VIEW**  
 UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
 EEP PROJECT #747  
 ALAMANCE COUNTY, NC

**FIGURE**

**3.8**

MONITORED BY:





**LEGEND**

- Conservation Easement
  - Cattle Exclusion Fencing
  - Photopoints
  - Project Streams
  - Existing Ponds
  - Existing Wetlands
  - 2' Contour
- Planting Zones**
- Zone 1 - Stream Banks
  - Zone 2 - Riparian
  - Zone 3 - Upland
  - Zone 4 - Wetland Seep

**BASELINE/MY1 CONDITIONS**

- Vegetation Problem Areas**
- Low Stem Density Areas
  - Invasive Areas of Concern
- Vegetation Plot Condition**
- Criteria Met
  - Criteria Unmet
- In-Stream Structure Condition**
- At-grade Crossing (Stable)
  - Step Pool (Stable)

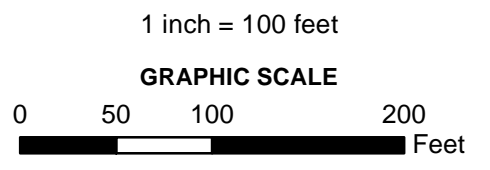
**NOTES:**

Aerial Imagery: 2010 Microsoft Corporation Bing Maps provided by ESRI

Planting areas present where woody stem densities are below Year 3, 4, and 5 requirements

Veg Plot 4 placement chosen as representative location of planted woody stems observed during Baseline/MY1 data collection. Planting Zone 3 boundary was enlarged during construction as indicated in the attached Record Drawings (and reflected in the CCPV); however, the Zone 3 boundaries shown are approximations only.

PREPARED FOR:



**CURRENT CONDITION PLAN VIEW**

UT TO HAW RIVER STREAM ENHANCEMENT PROJECT  
EEP PROJECT #747

ALAMANCE COUNTY, NC

**FIGURE**

**3.9**

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**Table 5. Vegetation Assessment - UT to Haw River Stream Enhancement Project (#747) - Baseline/MY1 (2012)**

**Planted Acreage<sup>1</sup> 5.03**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
<b>1. Bare Areas</b>	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0	0%
<b>2. Low Stem Density Areas</b>	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	7	0.60	12%
<b>Total</b>				<b>7</b>	<b>0.6</b>	<b>12%</b>
<b>3. Areas of Poor Growth Rates or Vigor</b>	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0	0%
<b>Cumulative Total</b>				<b>7</b>	<b>0.6</b>	<b>12%</b>

**Easement Acreage<sup>2</sup> 39.4**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
<b>4. Invasive Areas of Concern<sup>3</sup></b>	Areas or points (if too small to render as polygons at map scale).	1000 sf	Pattern and Color	2	0.44	1%
<b>5. Easement Encroachment Areas<sup>4</sup></b>	Areas or points (if too small to render as polygons at map scale).	None	Pattern and Color	0	0	0%

1 = Total planted acreage within the easement.

2 = Total acreage within the easement boundaries.

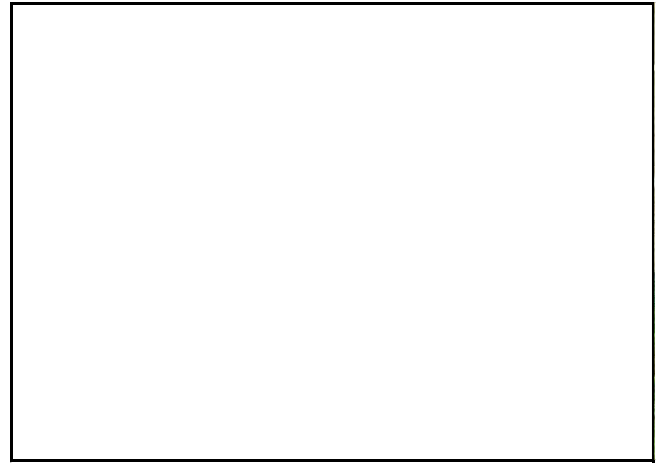
3 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage.

4 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage.

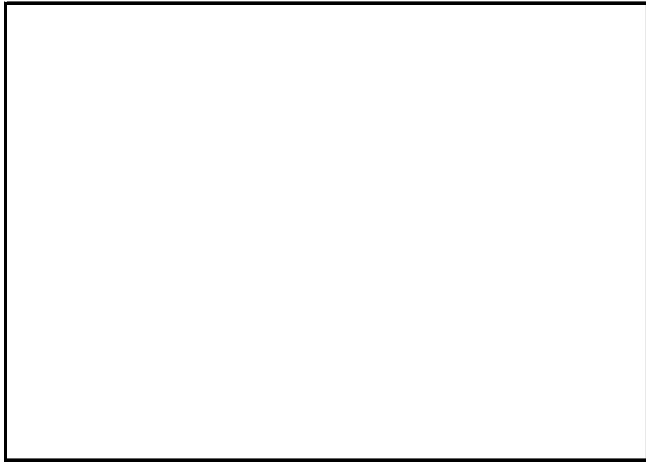
Photo Point 1; Looking Upstream on Main West



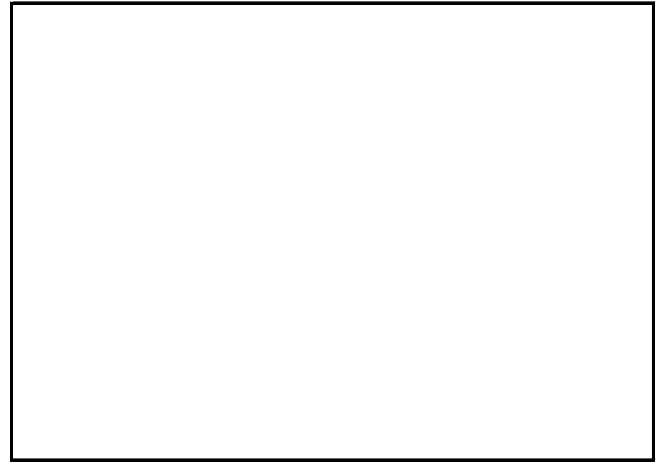
As-Built/Year 1 Survey: August 2012



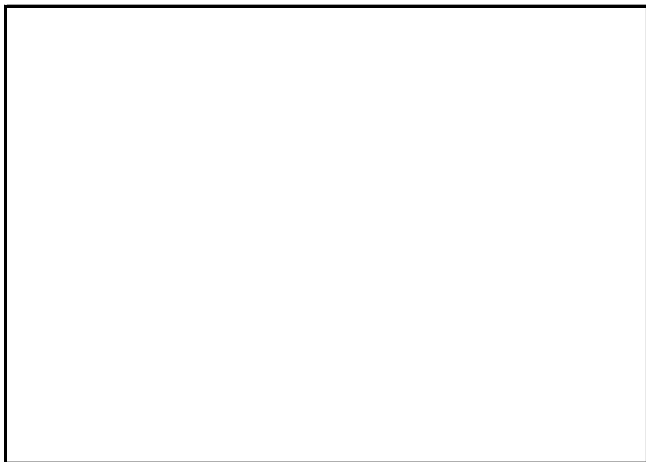
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

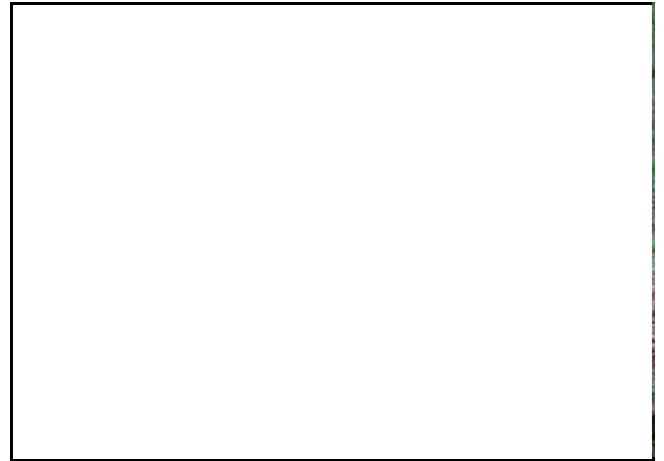


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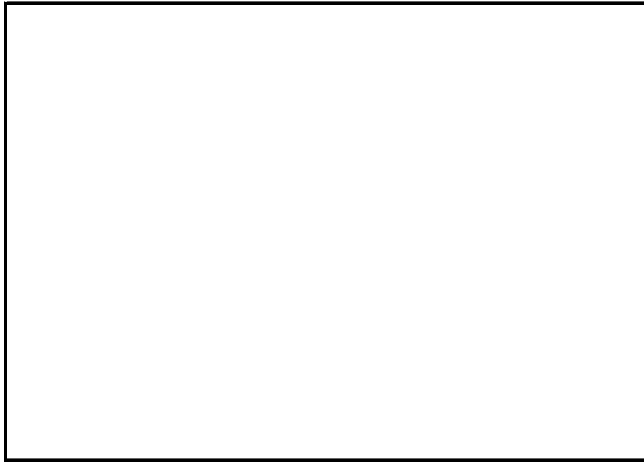
Photo Point 1; Looking Downstream on Main West



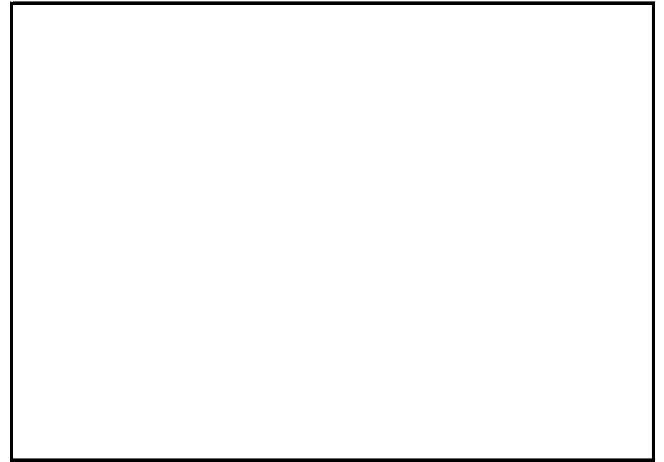
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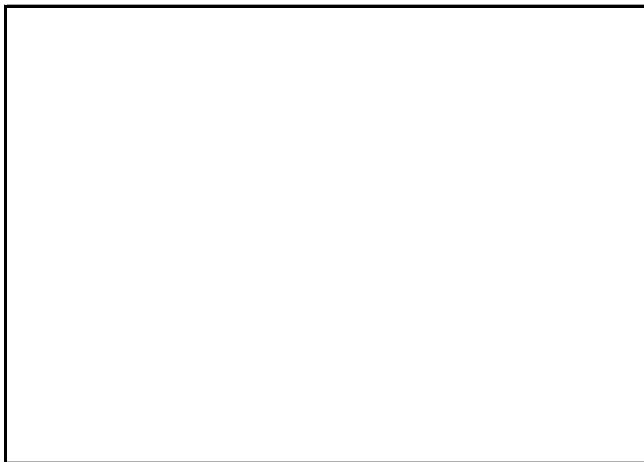
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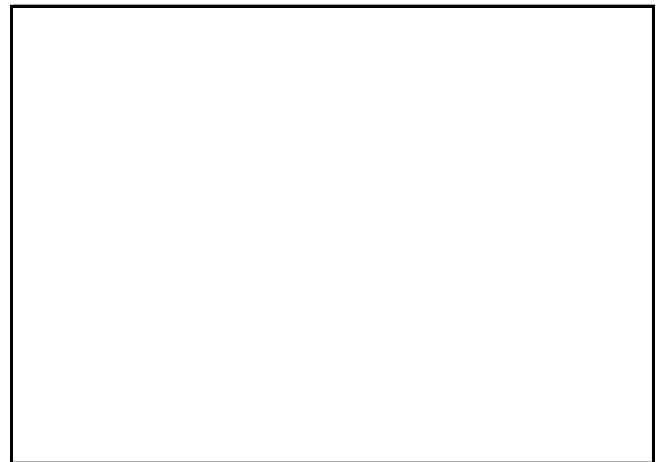
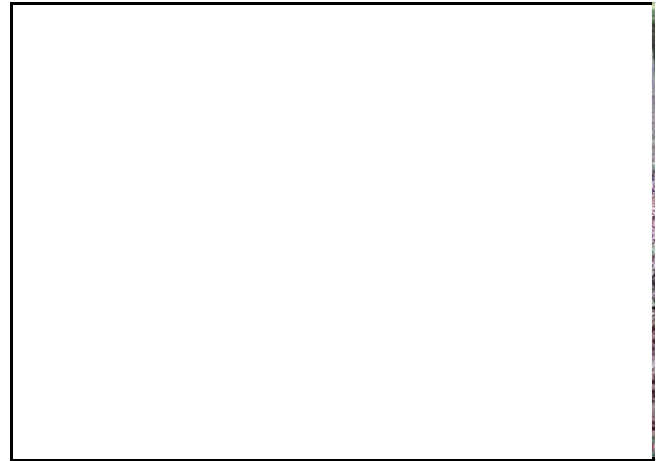




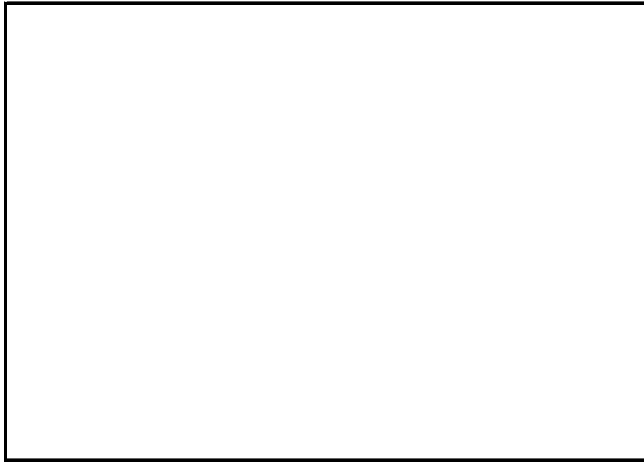
Photo Point 2; Looking Upstream on Main West/Gully



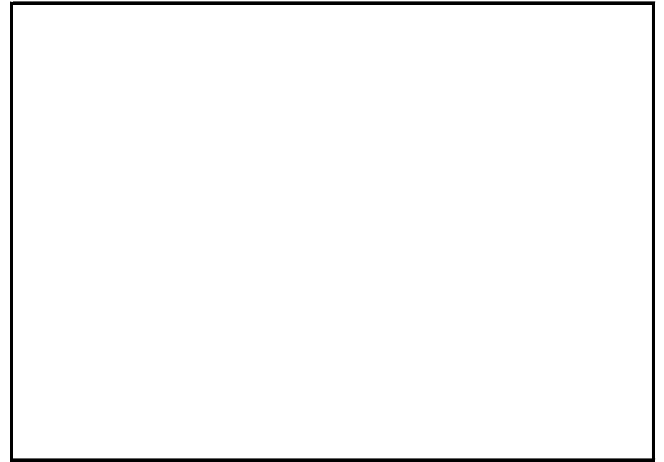
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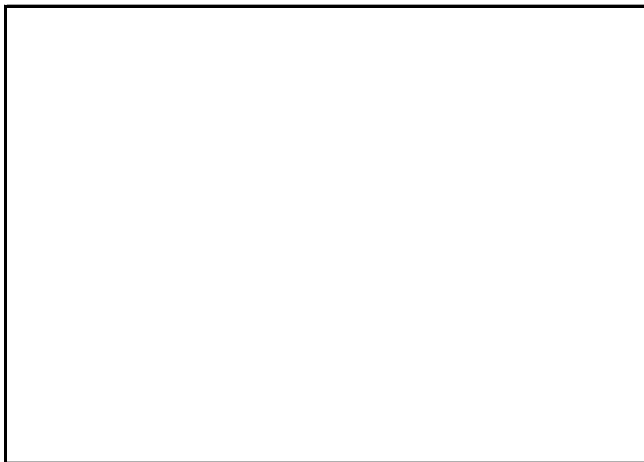
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

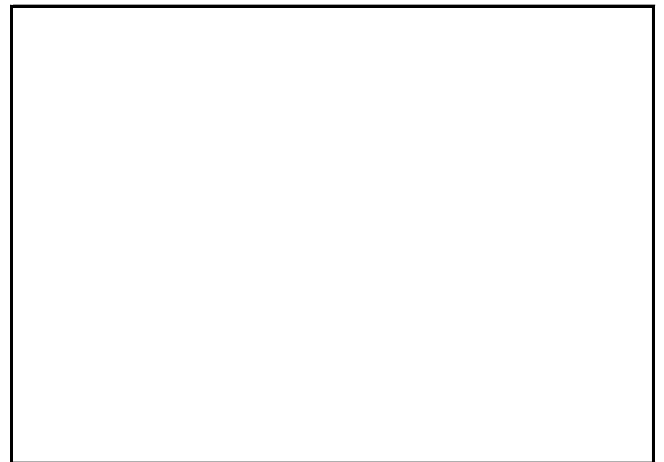
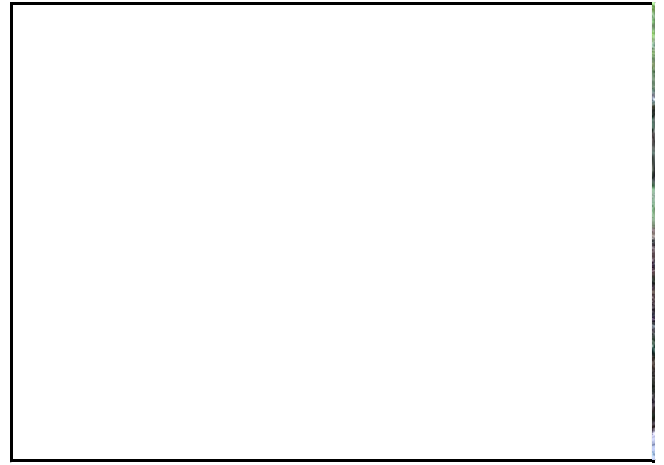


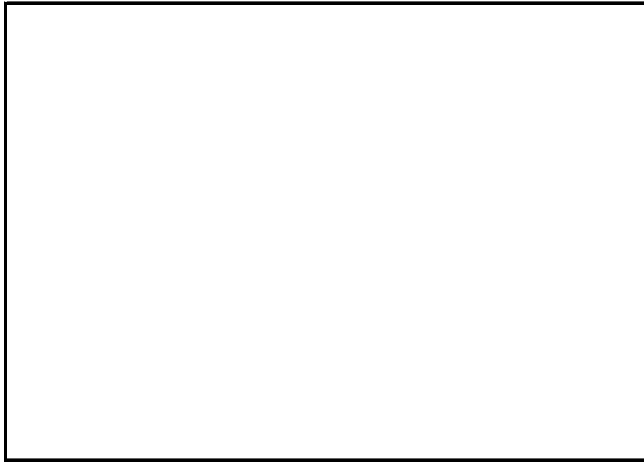
Photo Point 2; Looking Downstream on Main West



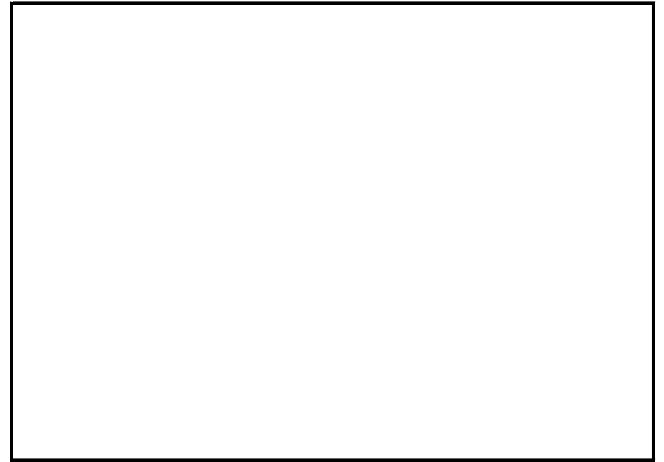
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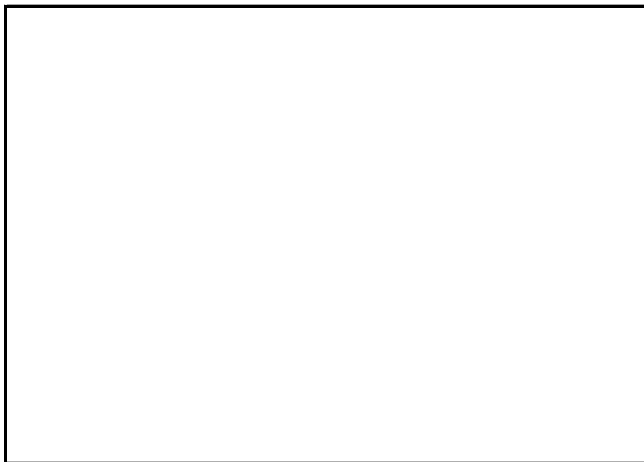
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Year 4 Monitoring:



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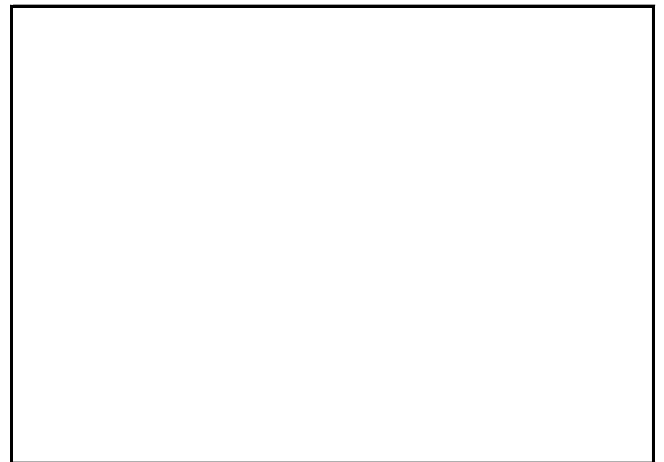
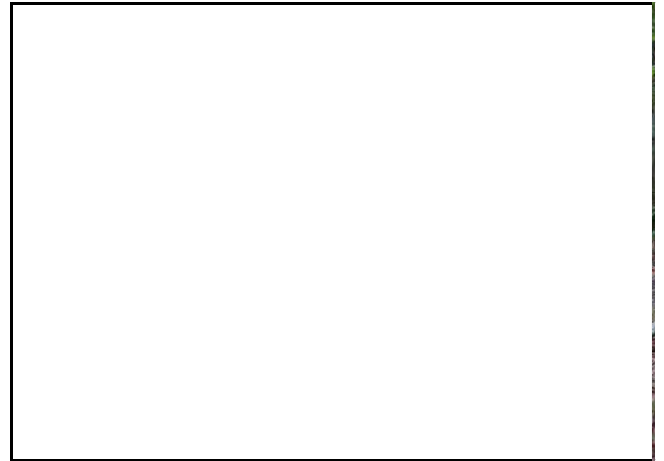


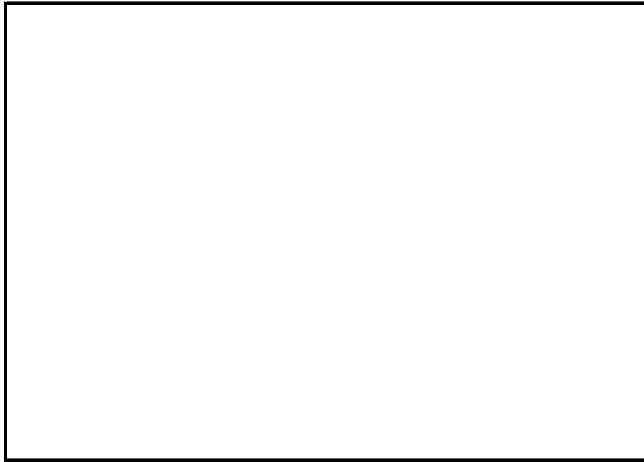
Photo Point 3; Looking Upstream Main West



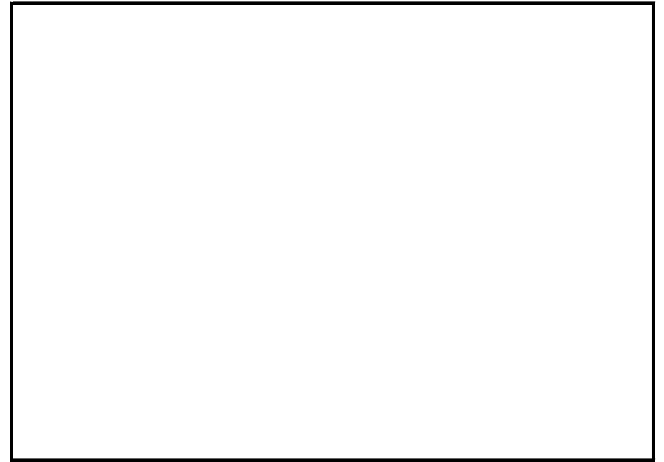
As-Built/Year 1 Survey: August 2012



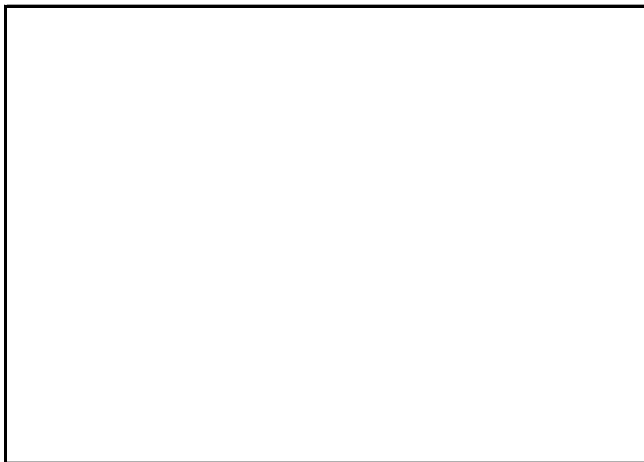
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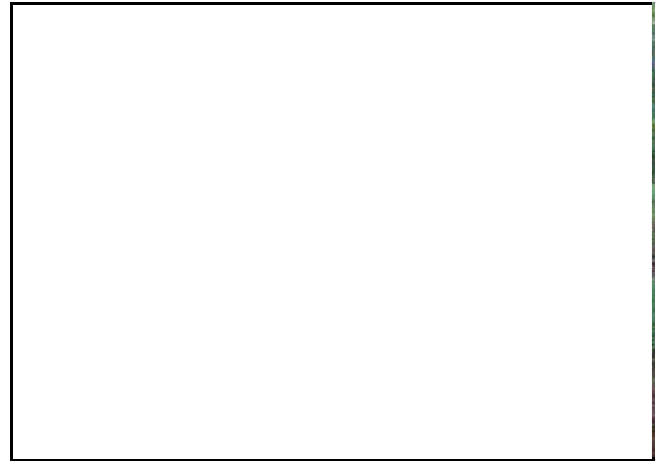


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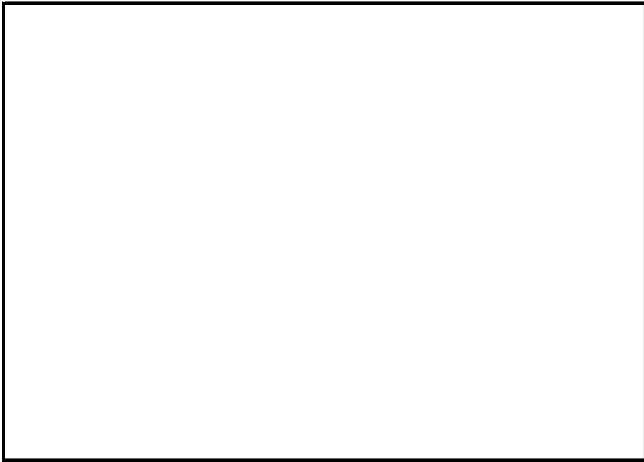
Photo Point 3; Looking Downstream Along Main West



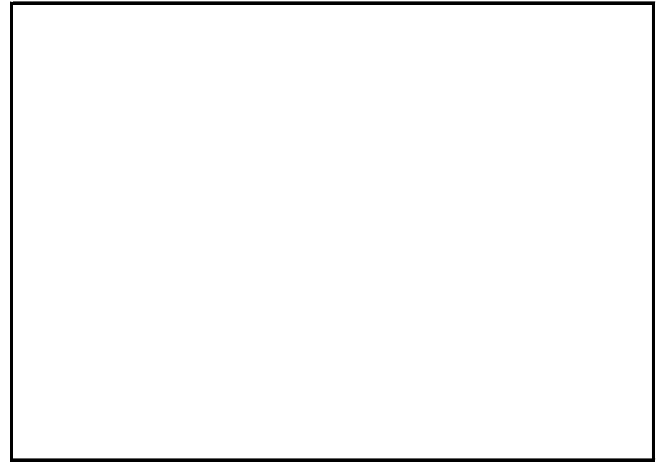
As-Built/Year 1 Survey: August 2012



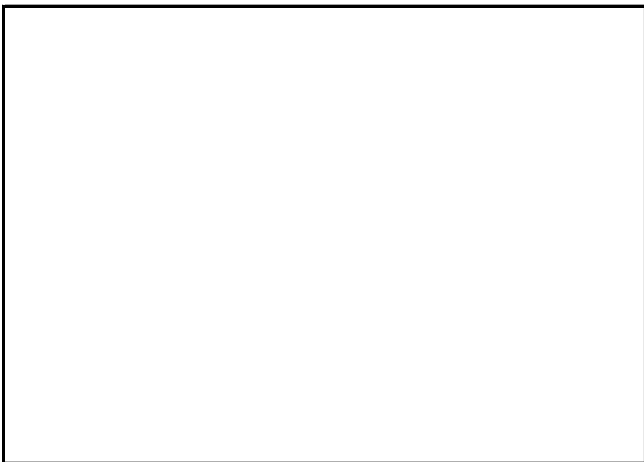
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Year 3 Monitoring:



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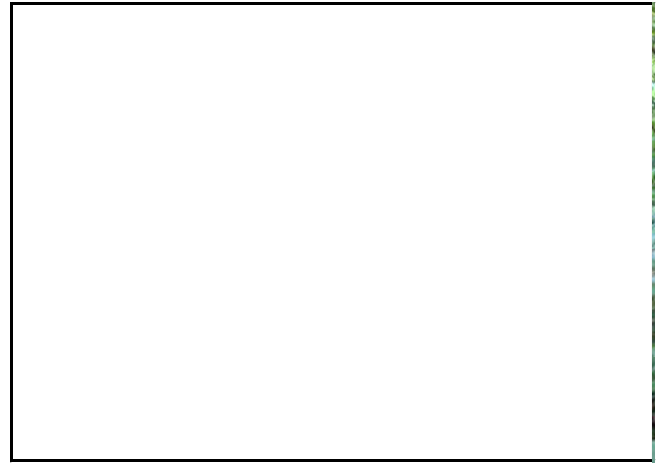


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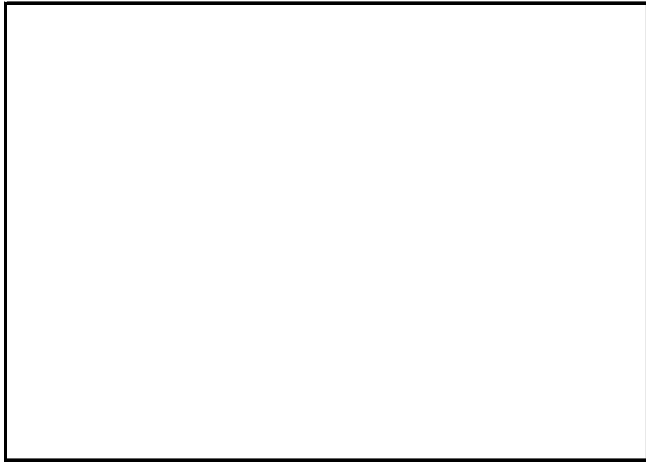
Photo Point 4; Looking Upstream Along Main West



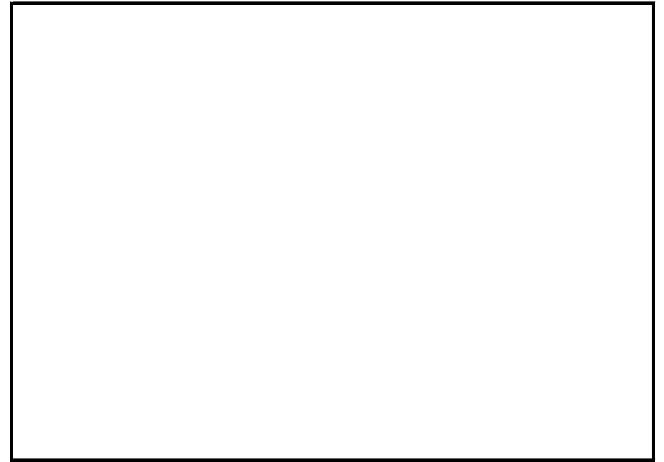
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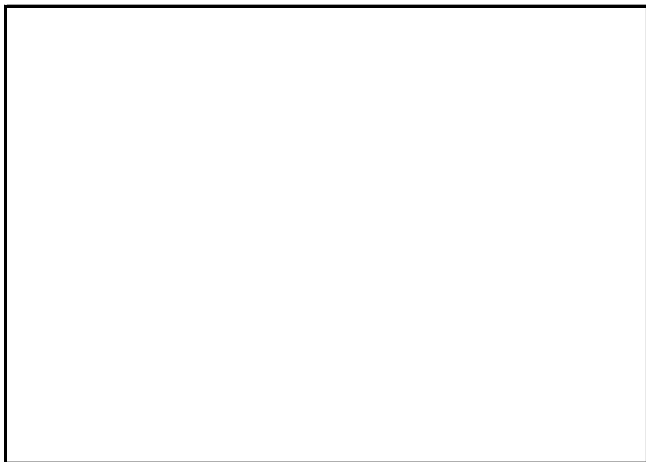
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Year 4 Monitoring:



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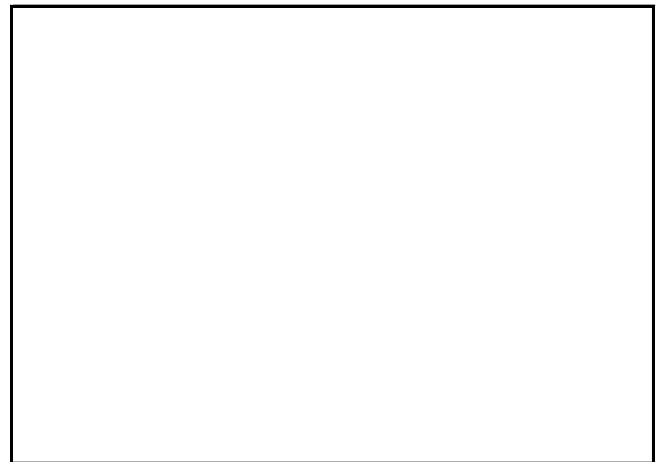
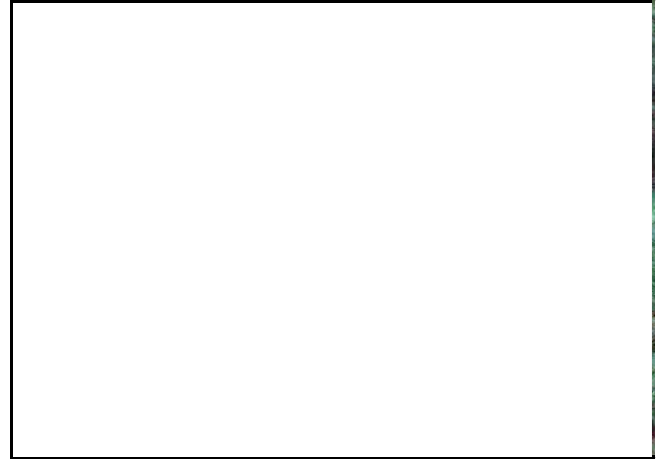


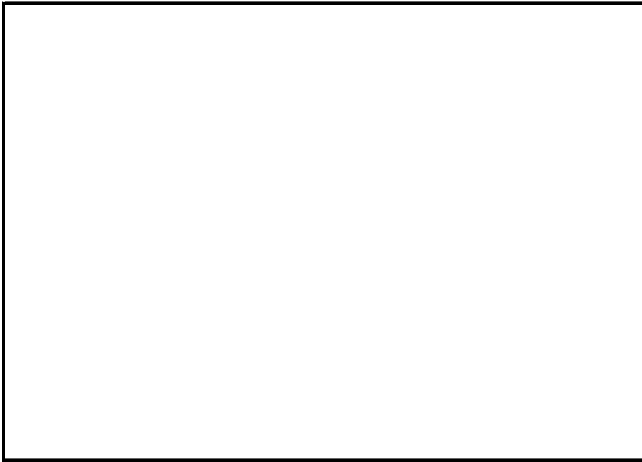
Photo Point 4; Looking Downstream Along Main West



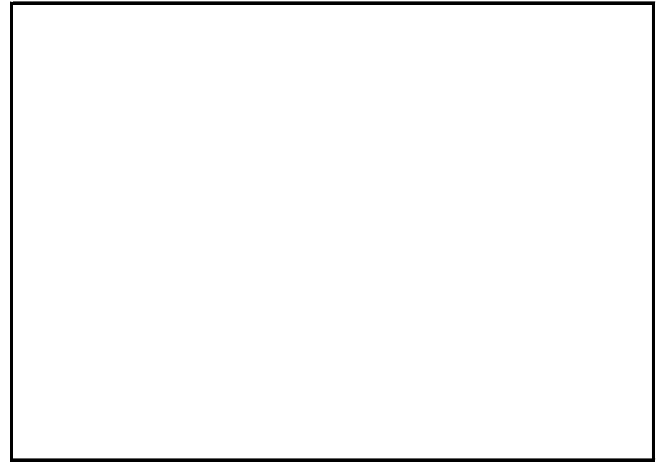
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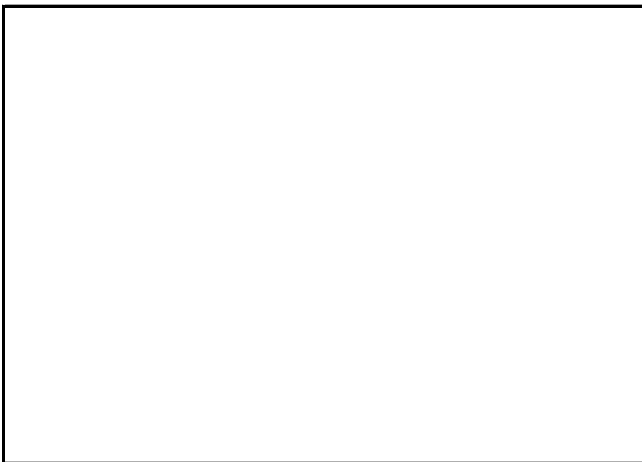
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

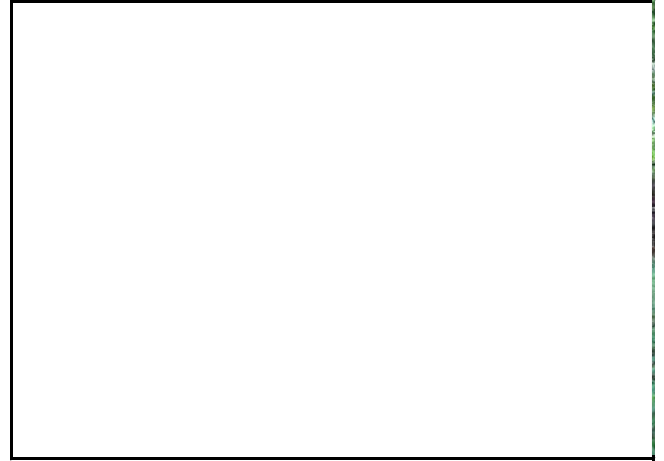


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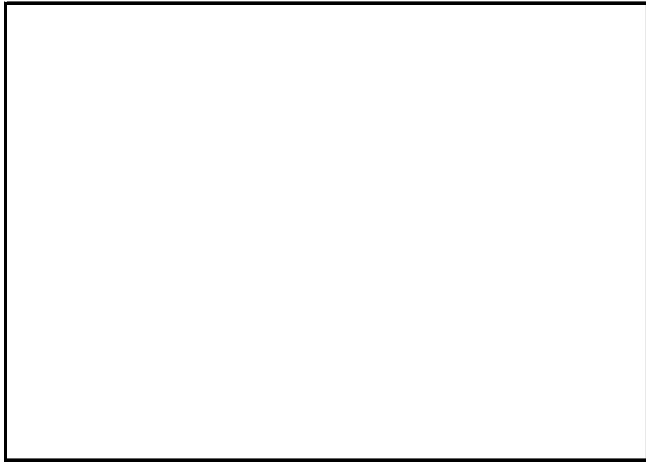
Photo Point 5; Looking Downstream Along Main Center



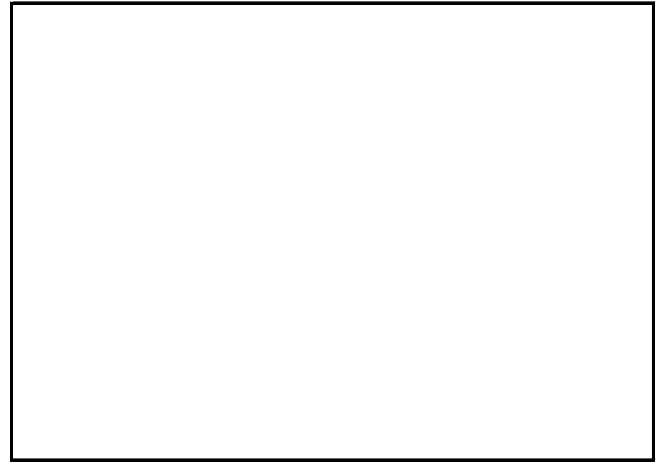
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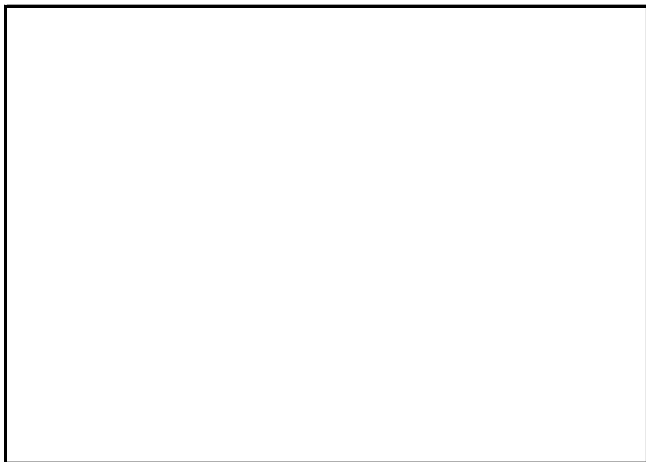
Year 2 Monitoring:



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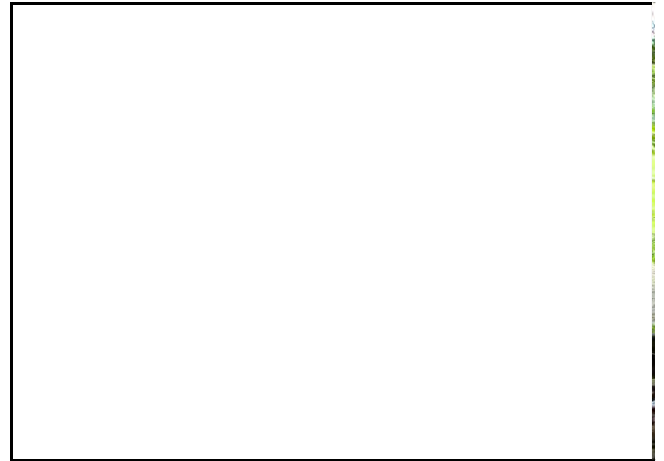


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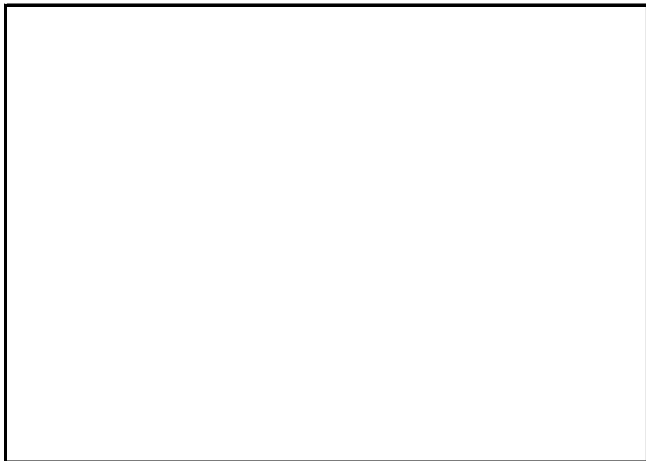
Photo Point 6; Looking Upstream Along Across C1 and Up crossing



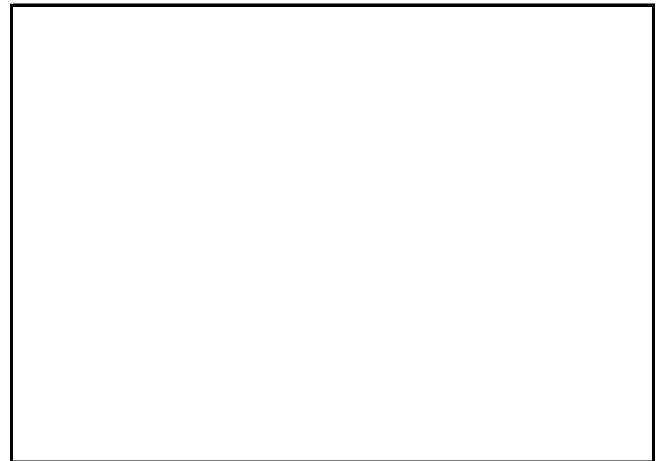
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Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



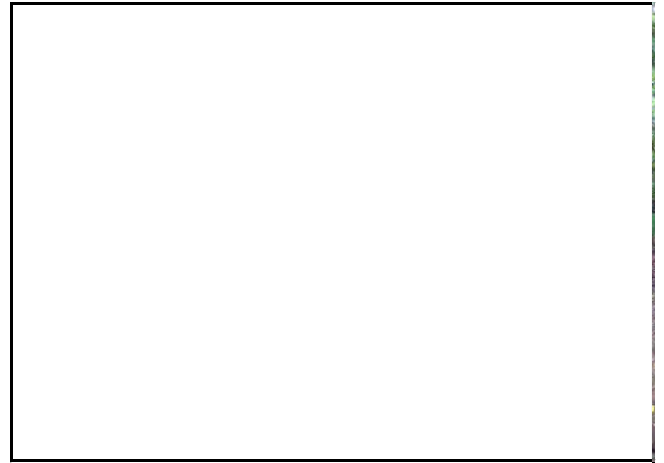
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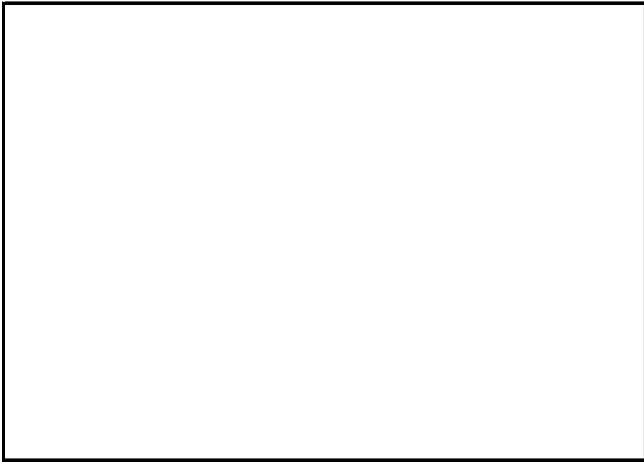
Photo Point 6; Looking Downstream Along C1



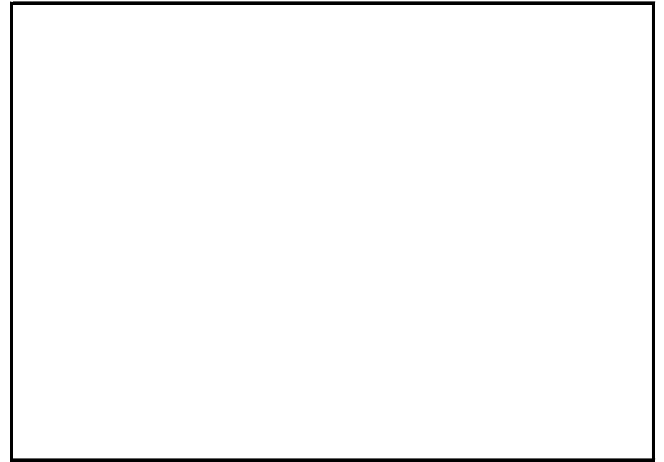
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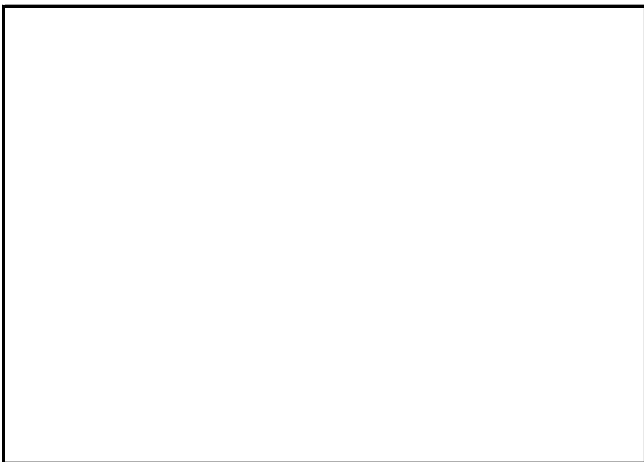
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

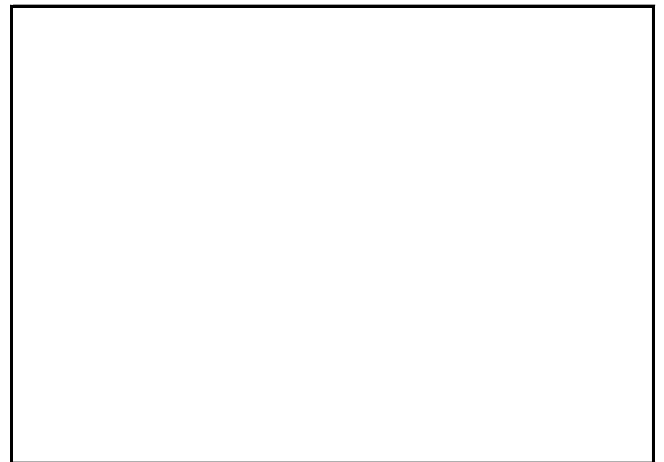
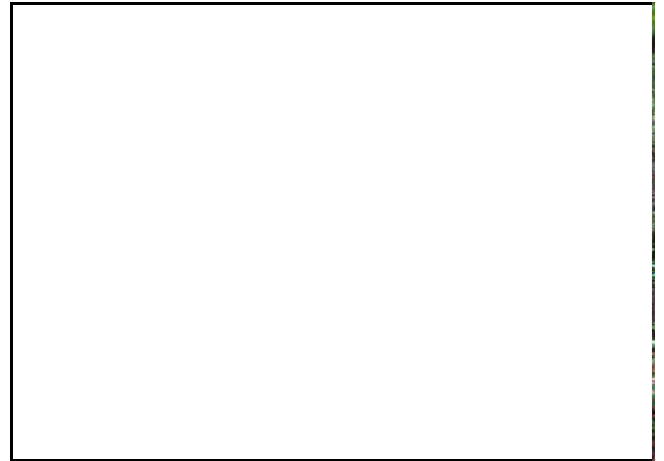


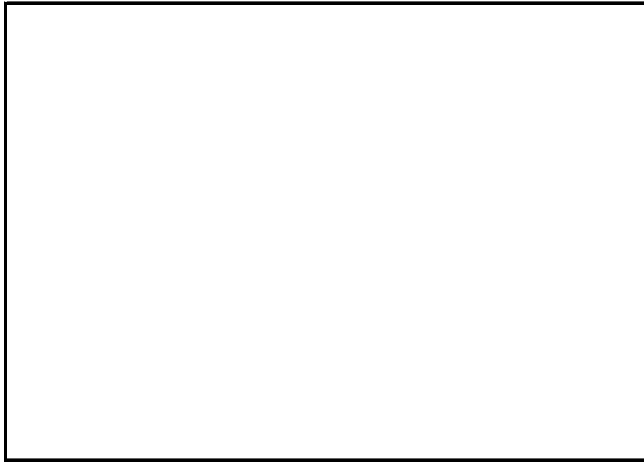
Photo Point 7; Looking Upstream Along C1 Above Pond



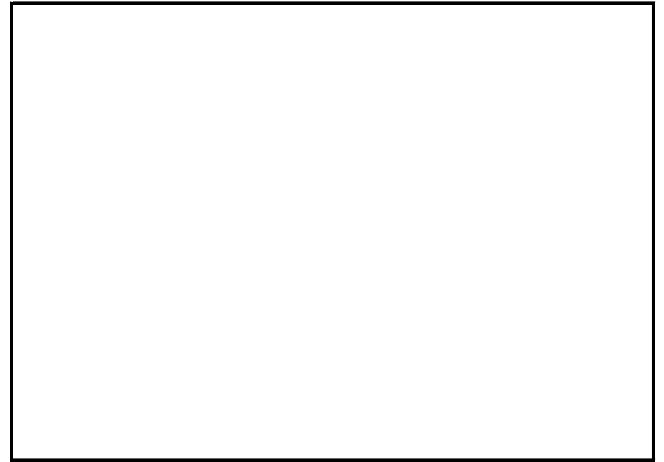
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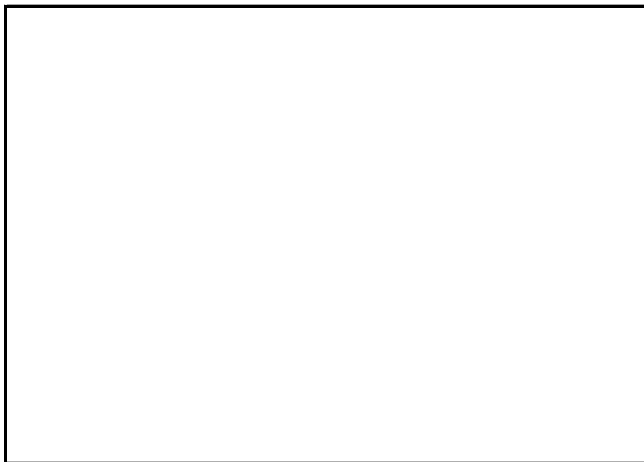
Year 2 Monitoring:



Year 2 Monitoring: November 2009



Year 4 Monitoring:



Year 5 Monitoring:

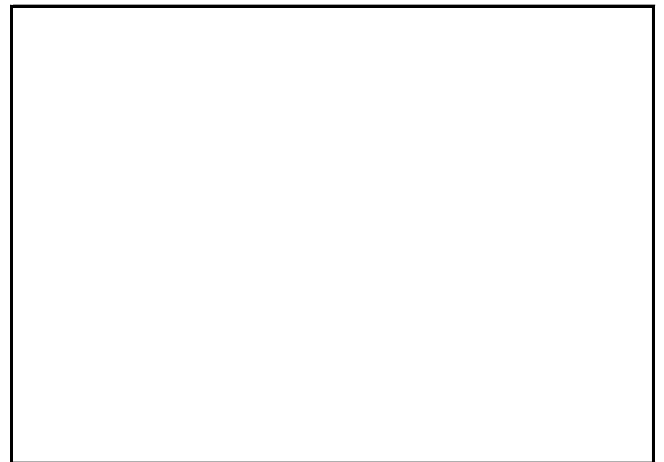
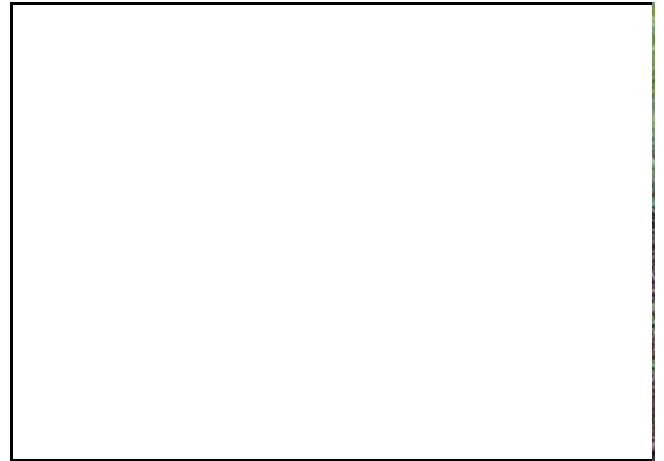


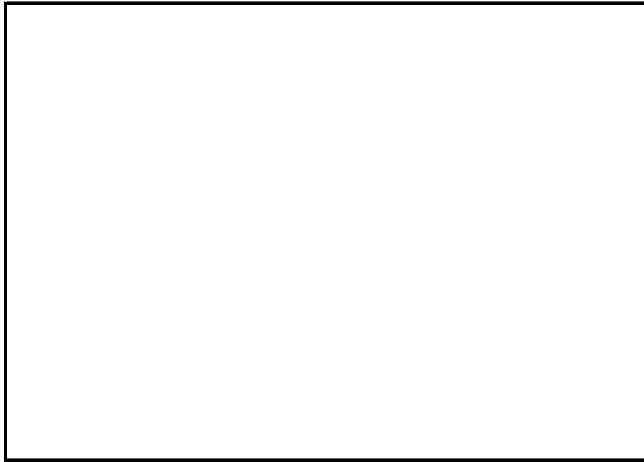
Photo Point 7; Looking Downstream Along C1 Above Pond



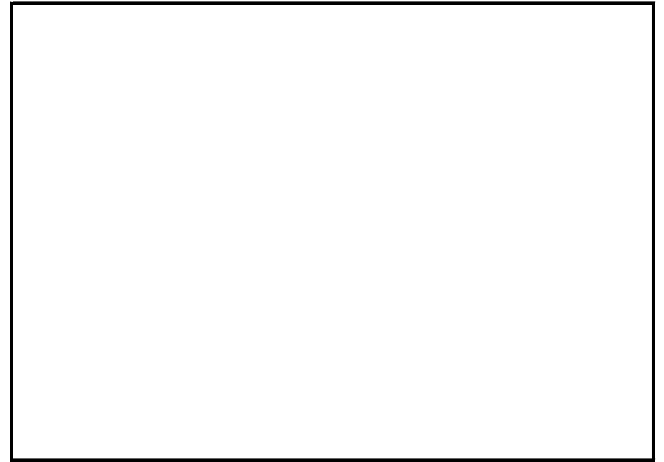
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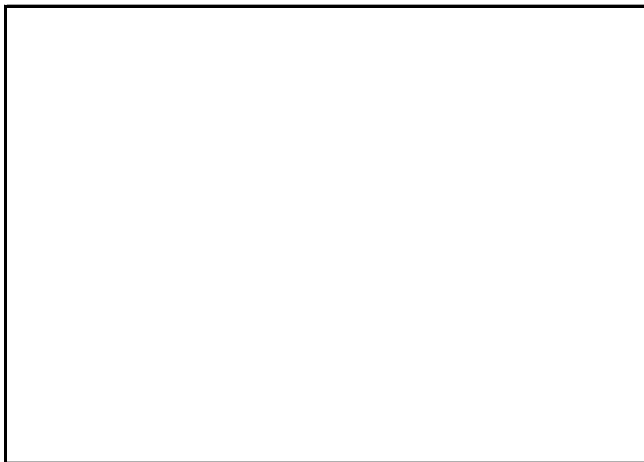
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



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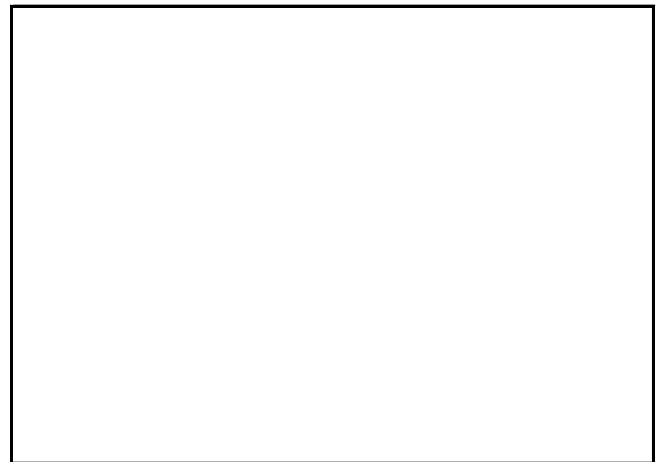
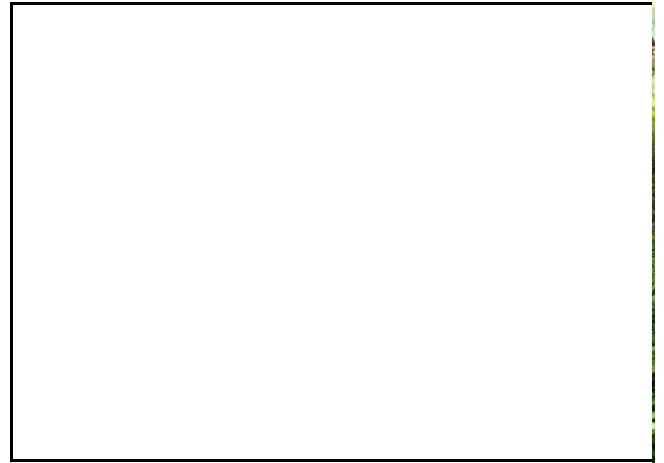


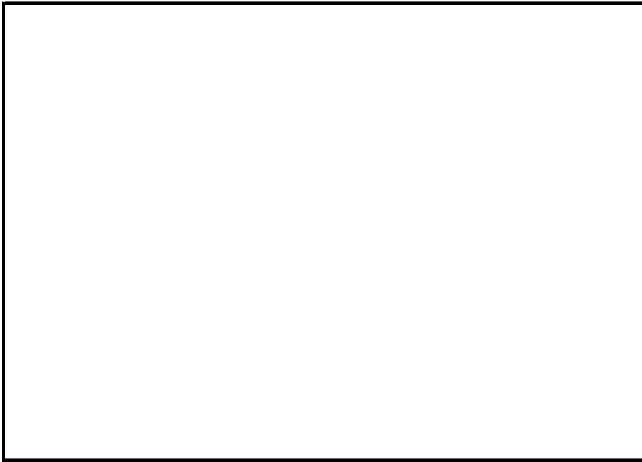
Photo Point 8; Looking Upstream Along Main Center



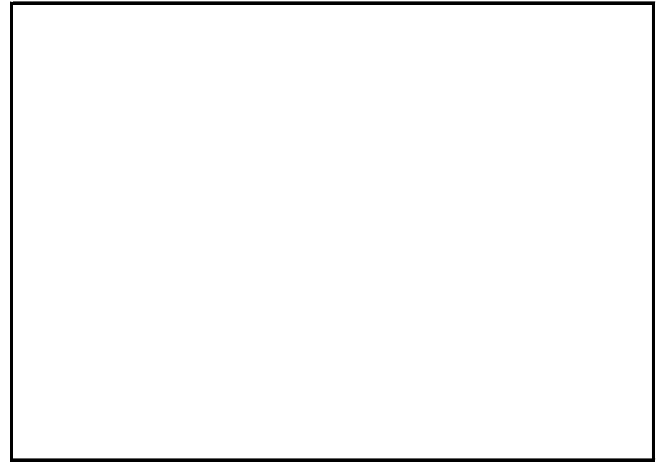
As-Built/Year 1 Survey: August 2012



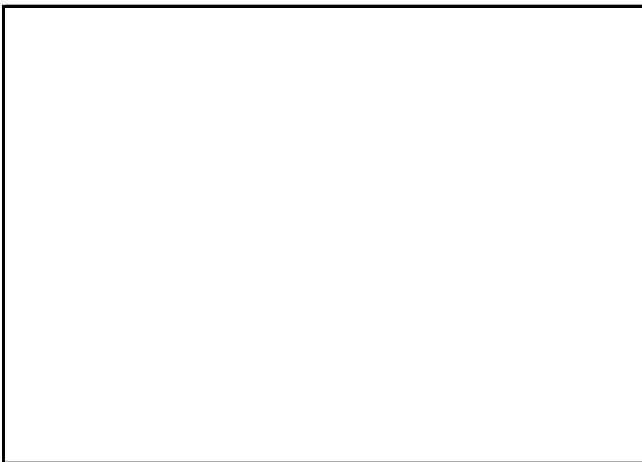
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Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

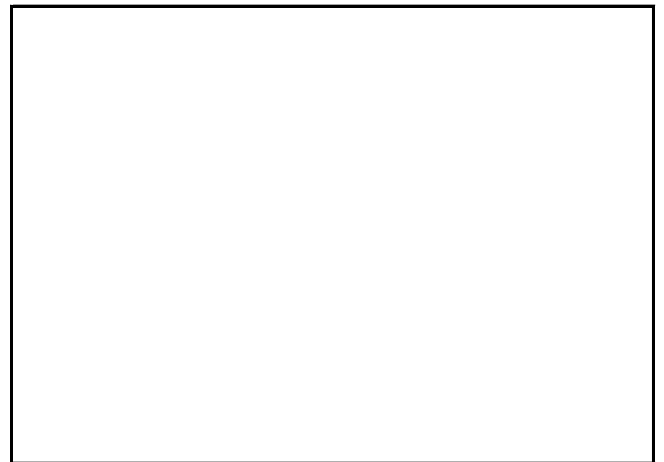
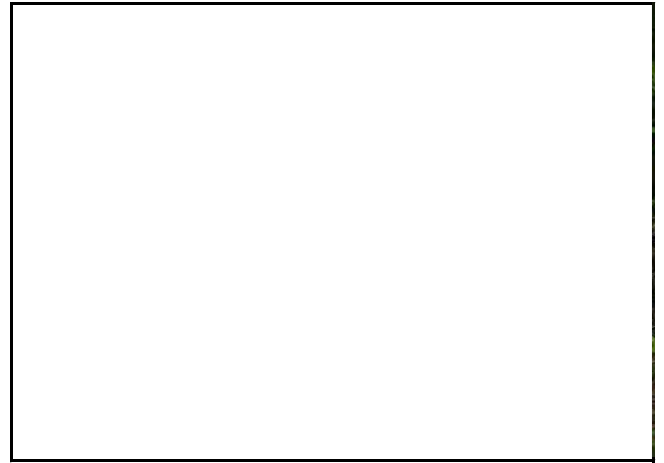


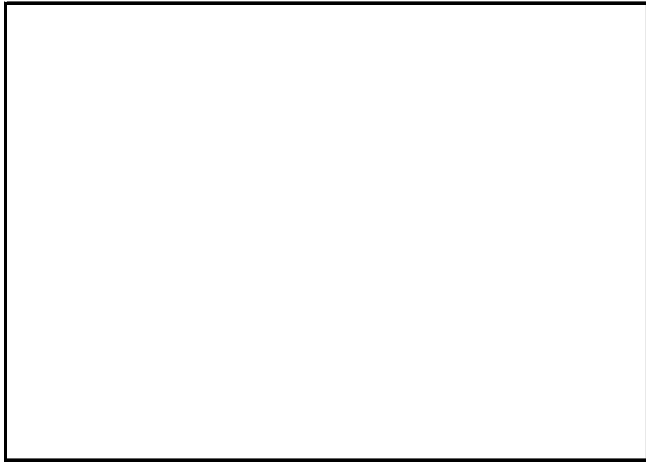
Photo Point 8; Looking Downstream Along Main Center



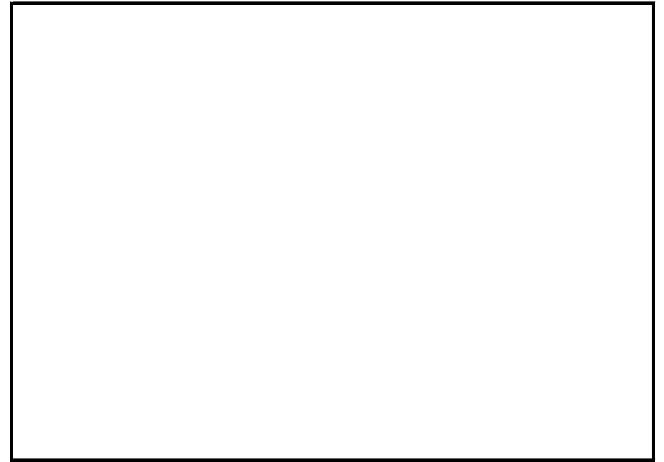
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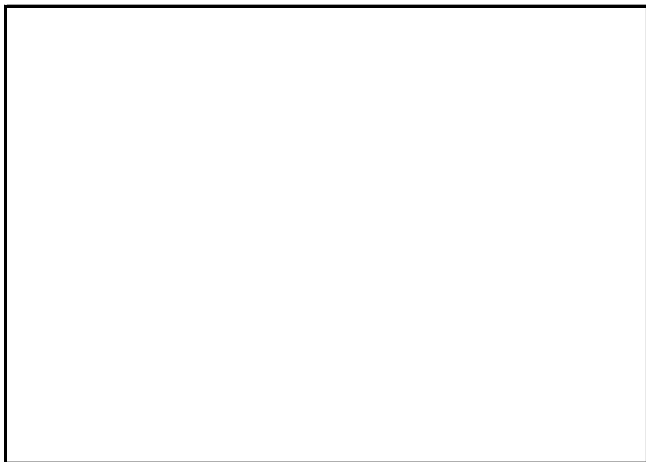
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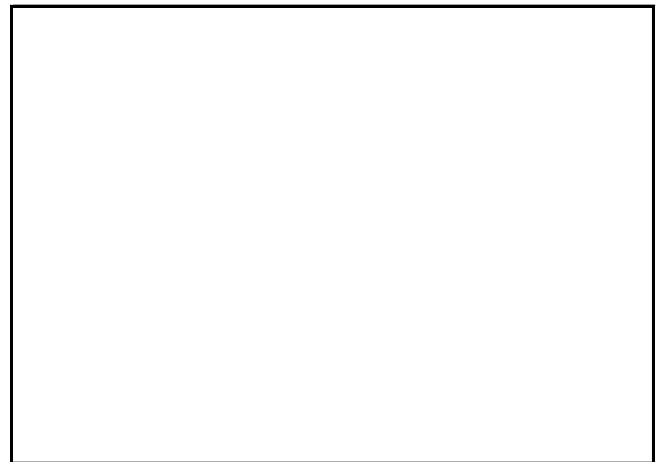
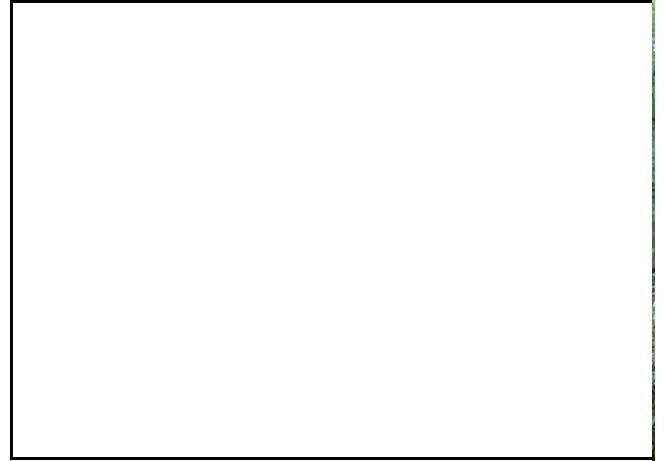


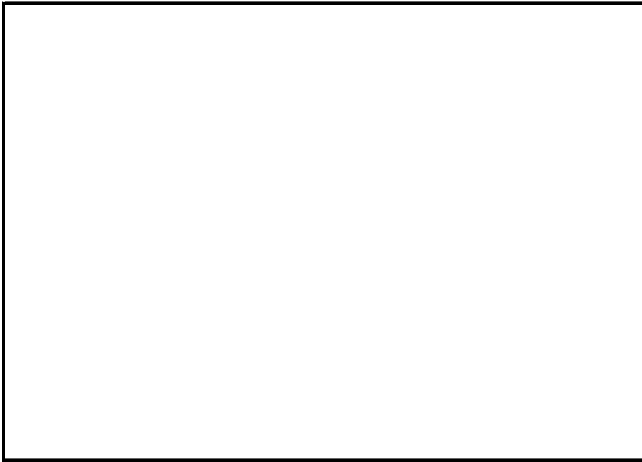
Photo Point 9; Looking Upstream Along Main Center



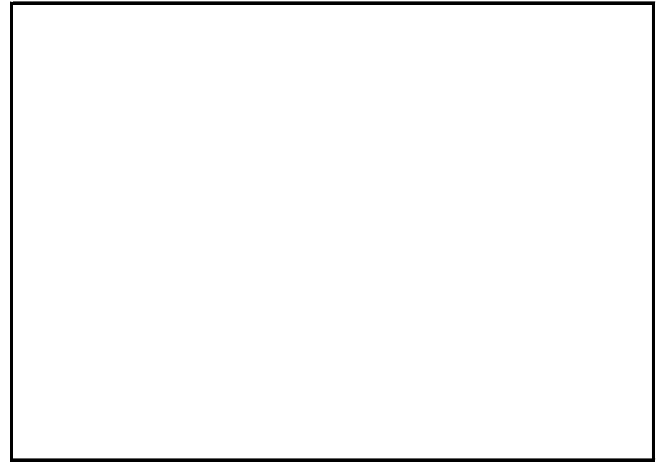
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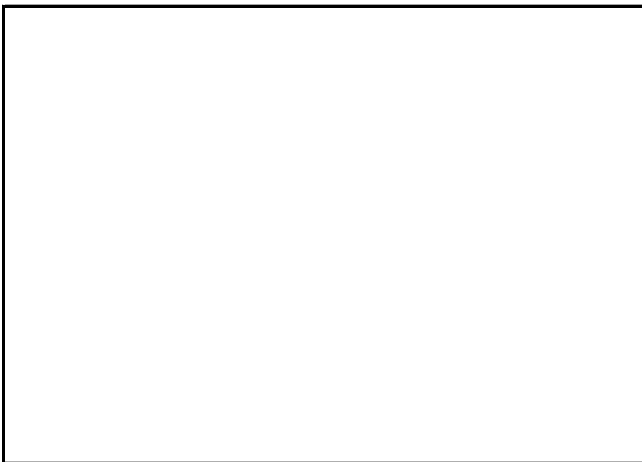
Year 2 Monitoring:



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Year 5 Monitoring:

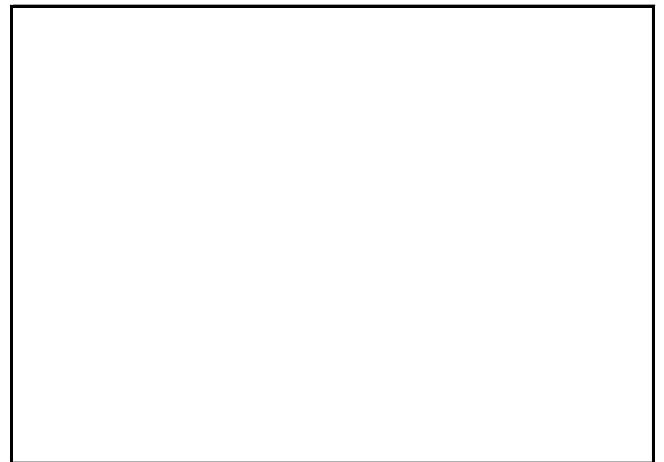
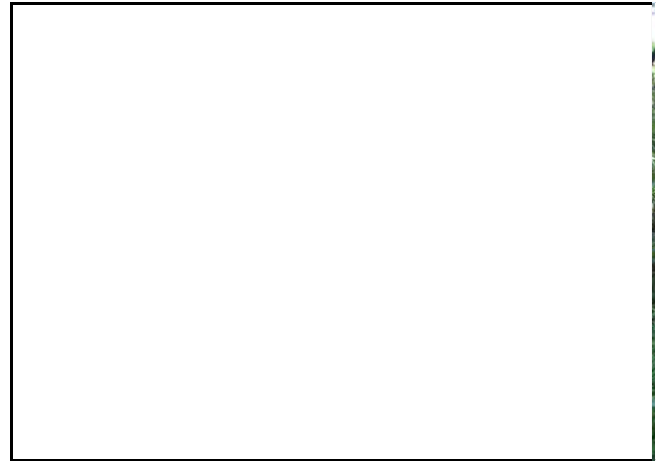


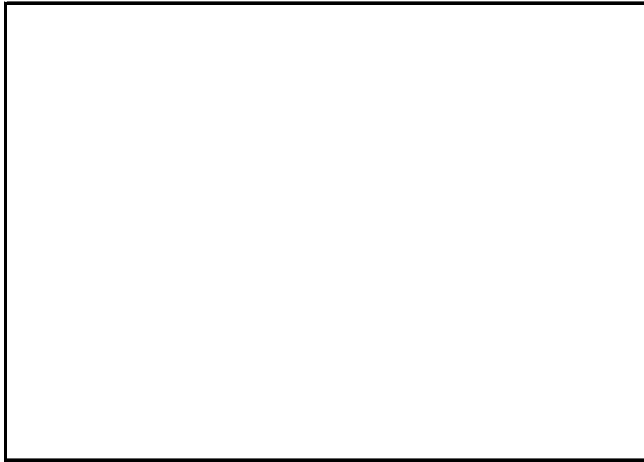
Photo Point 9; Looking Downstream Along Main Center



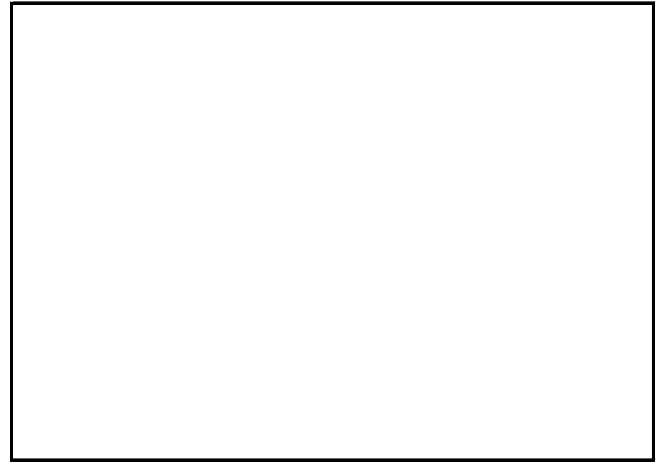
As-Built/Year 1 Survey: August 2012



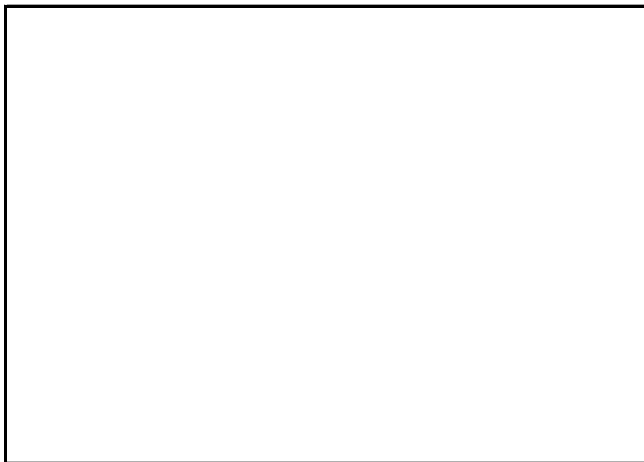
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

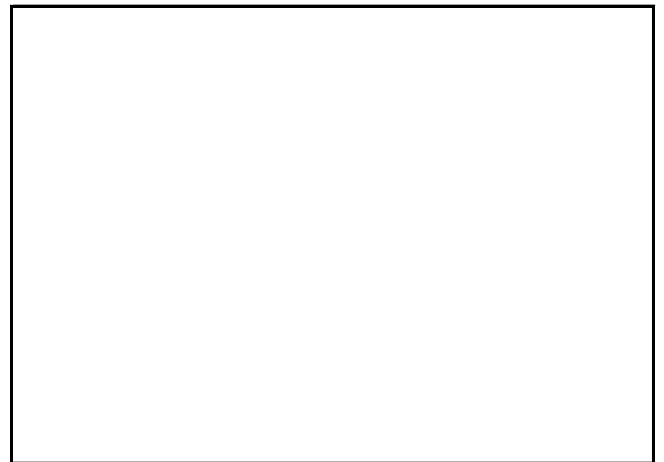
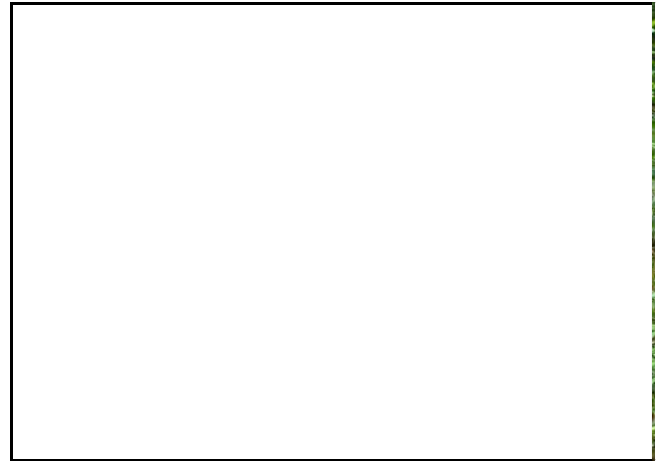


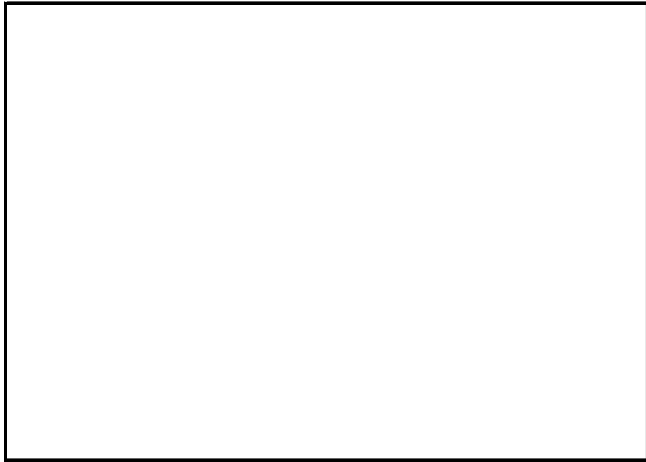
Photo Point 10; Looking Upstream Along Main Center (across planted area)



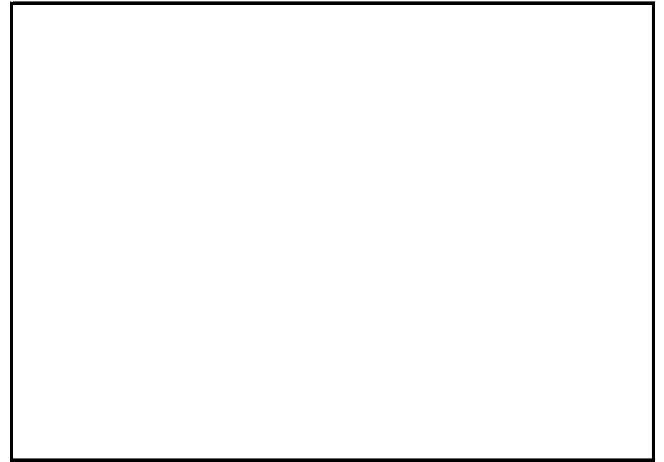
As-Built/Year 1 Survey: August 2012



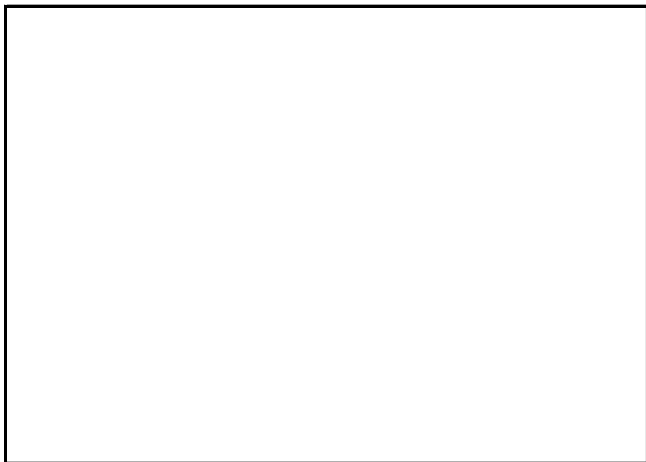
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

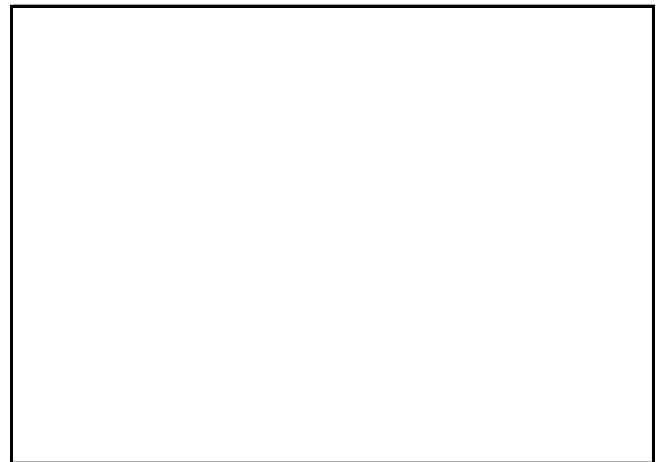
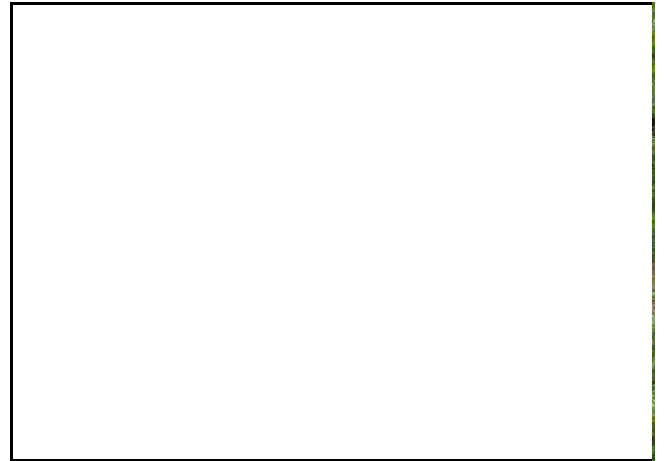




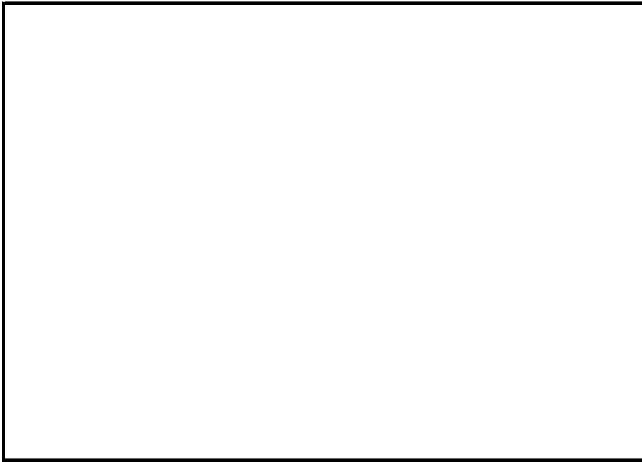
Photo Point 10; Looking Downstream Along Main Center



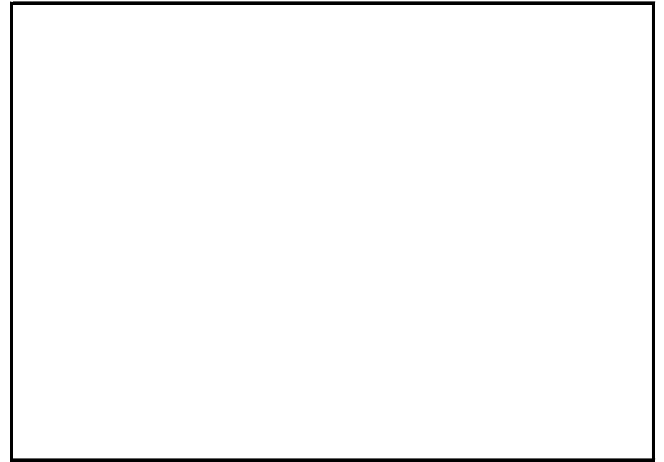
As-Built/Year 1 Survey: August 2012



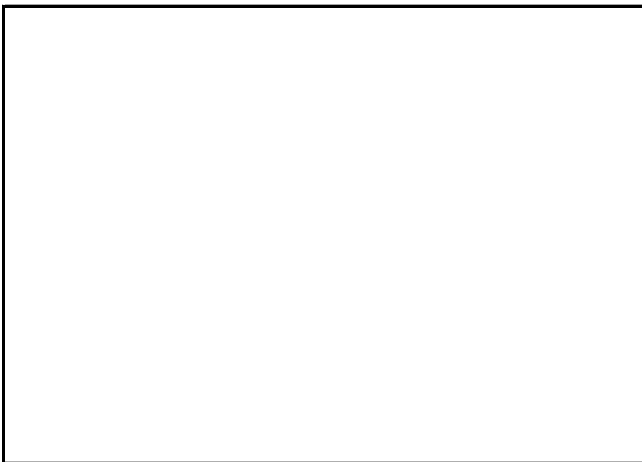
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

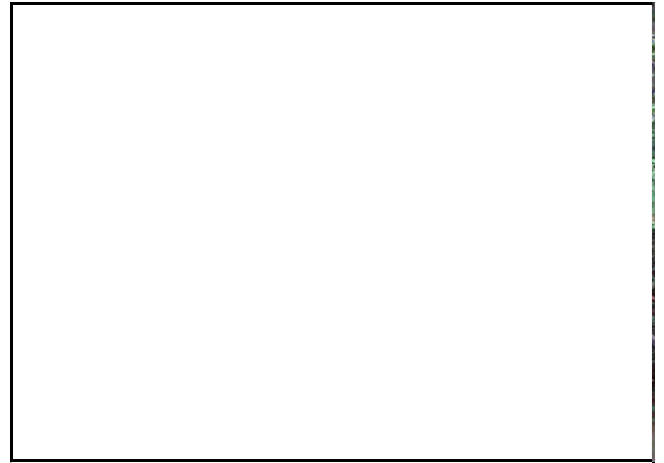


Year 5 Monitoring:

Photo Point 11; Looking Upstream Along Across Main Center Crossing



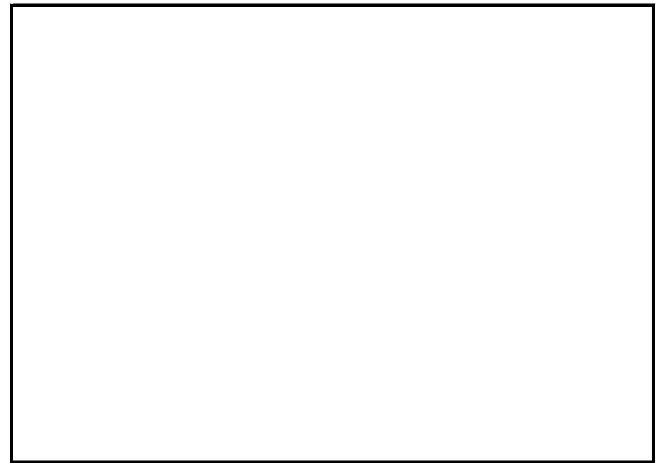
As-Built/Year 1 Survey: August 2012



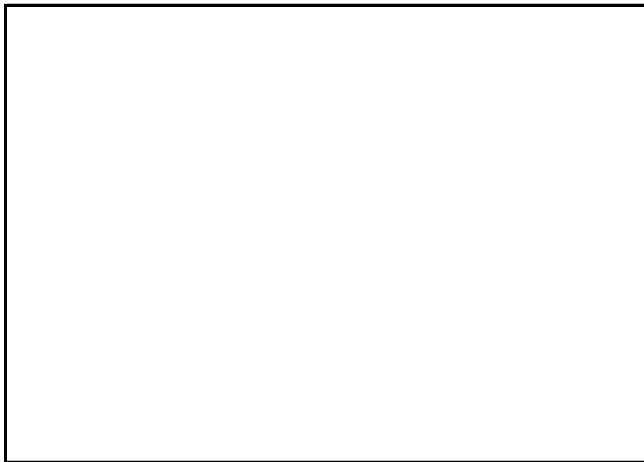
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

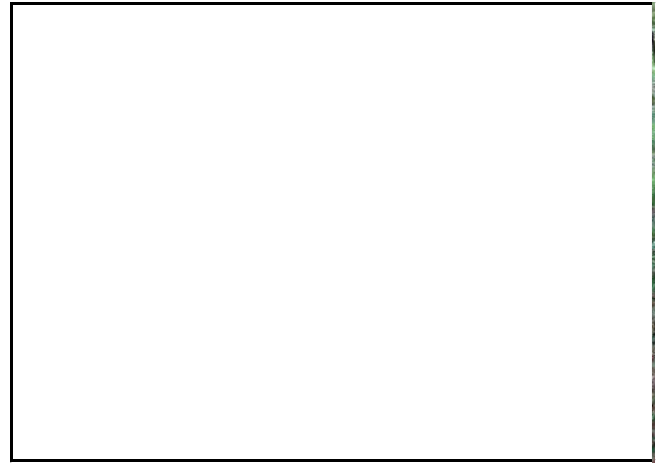


Year 5 Monitoring:

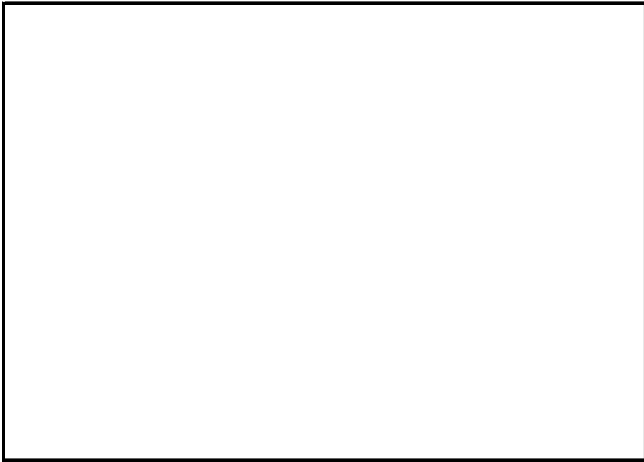
Photo Point 11; Looking Downstream Along Main Center



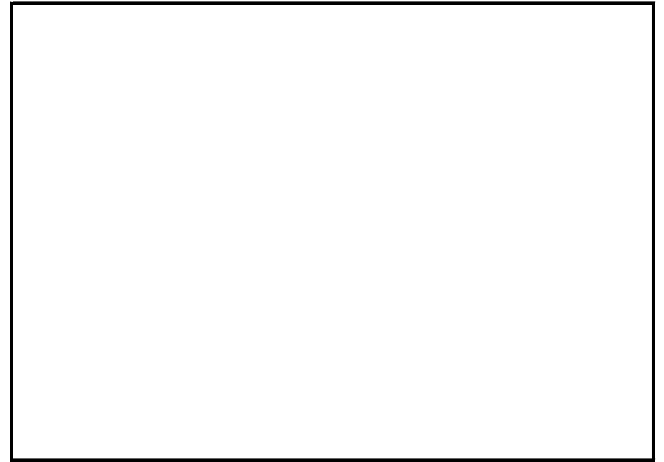
As-Built/Year 1 Survey: August 2012



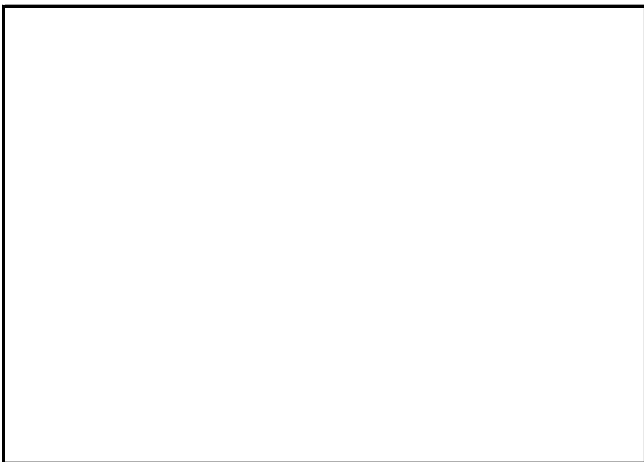
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

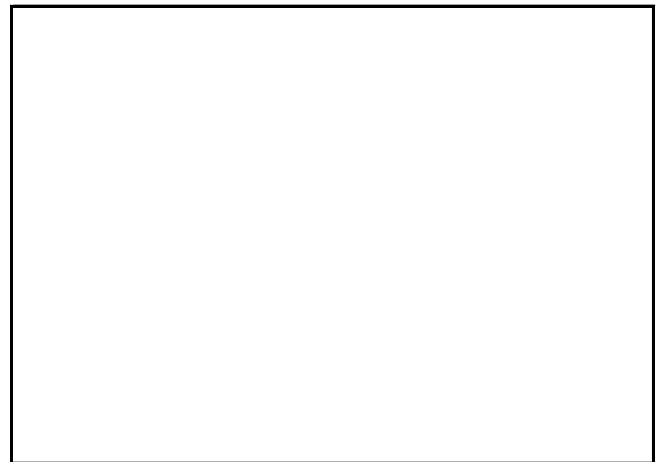
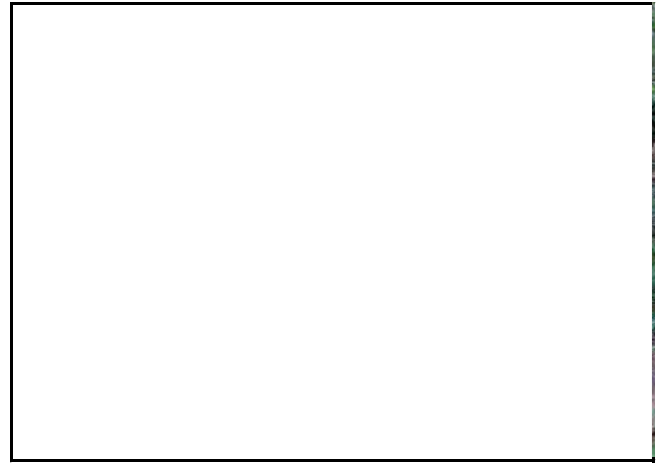
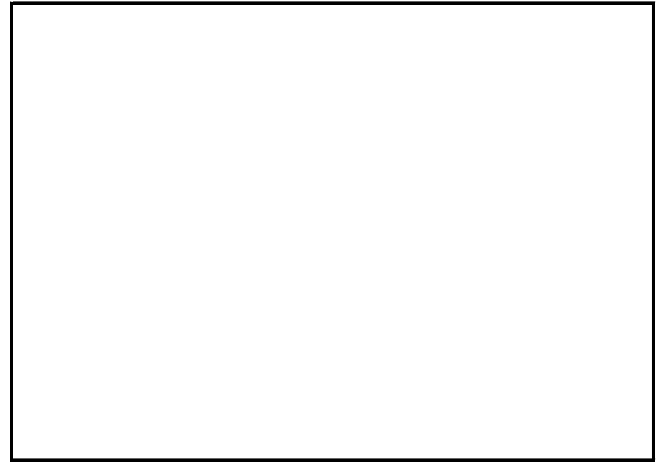
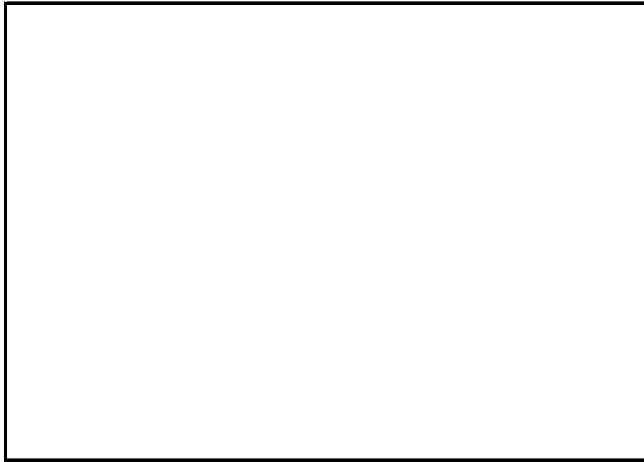


Photo Point 12; Looking Upstream Along C2-b



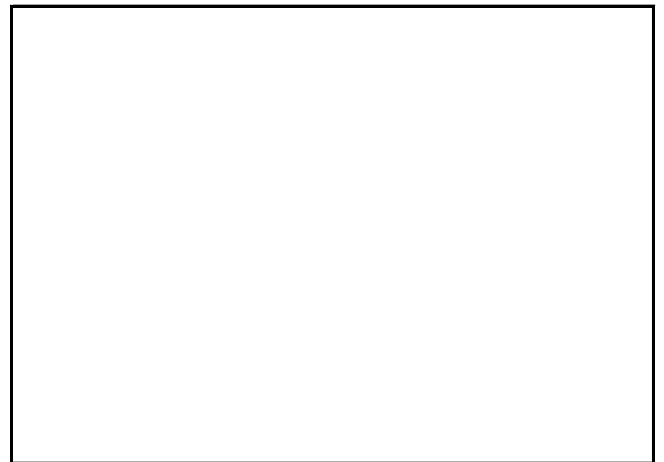
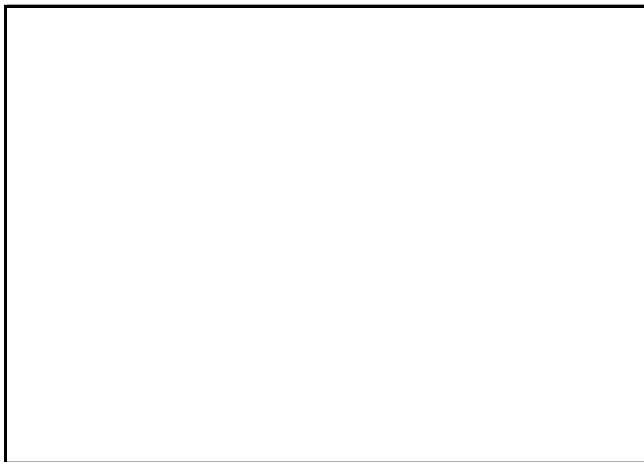
As-Built/Year 1 Survey: August 2012

Year 2 Monitoring:



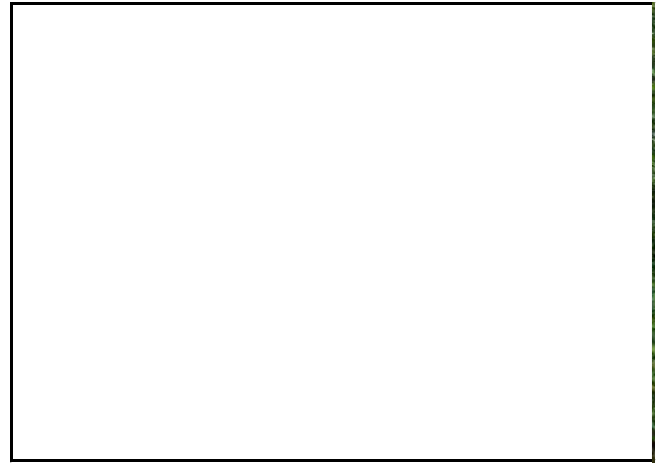
Year 3 Monitoring:

Year 4 Monitoring:



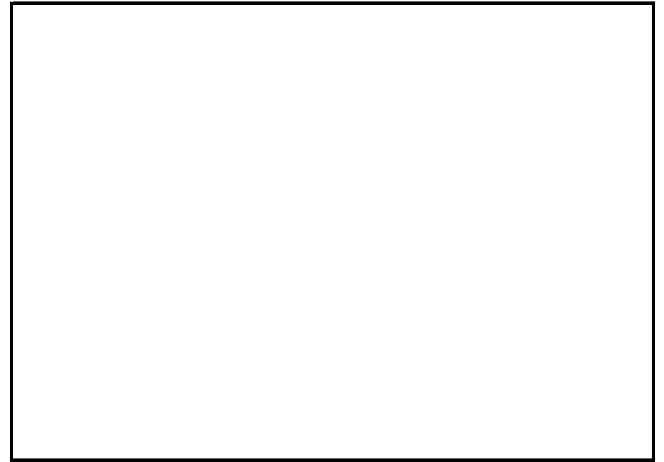
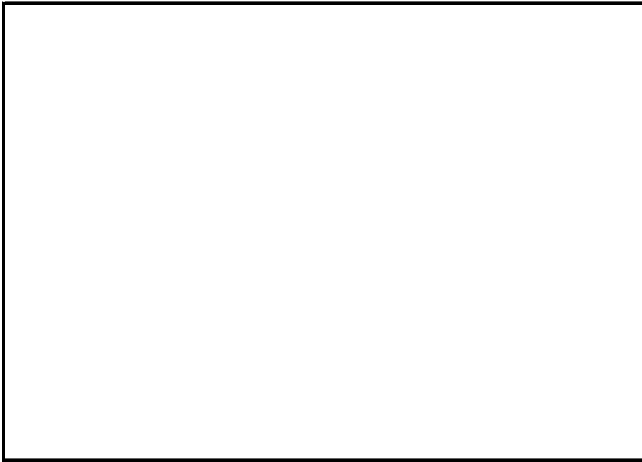
Year 5 Monitoring:

Photo Point 13; Looking Downstream Along C2



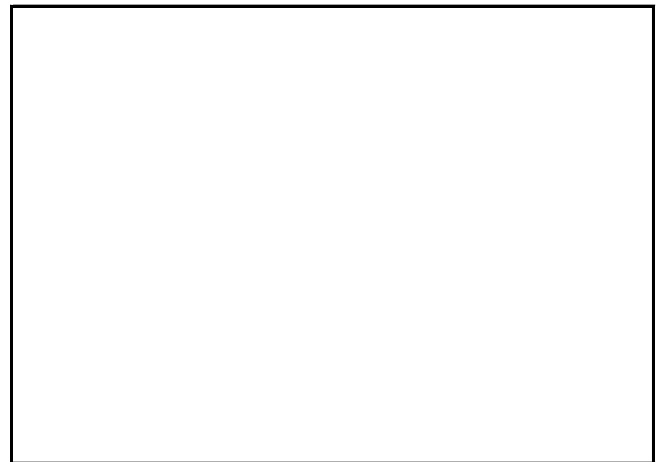
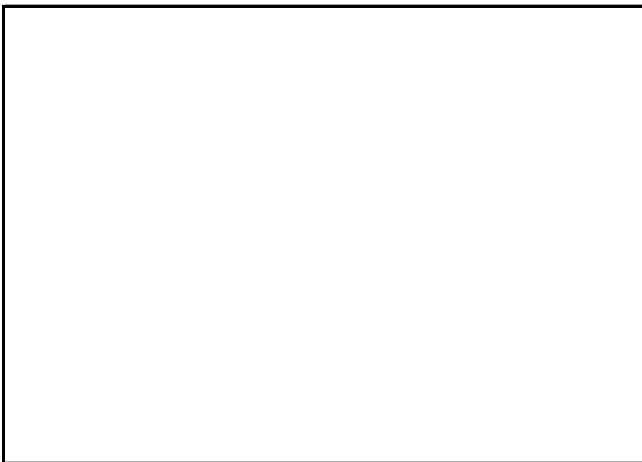
As-Built/Year 1 Survey: August 2012

Year 2 Monitoring:



Year 3 Monitoring:

Year 4 Monitoring:

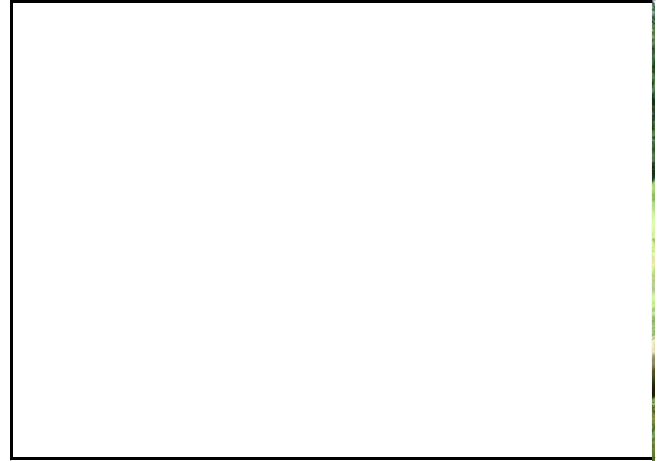


Year 5 Monitoring:

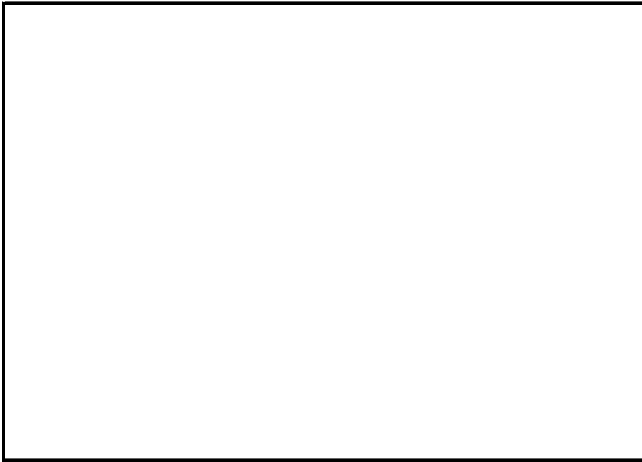
Photo Point 14; Looking Downstream Along C2-1



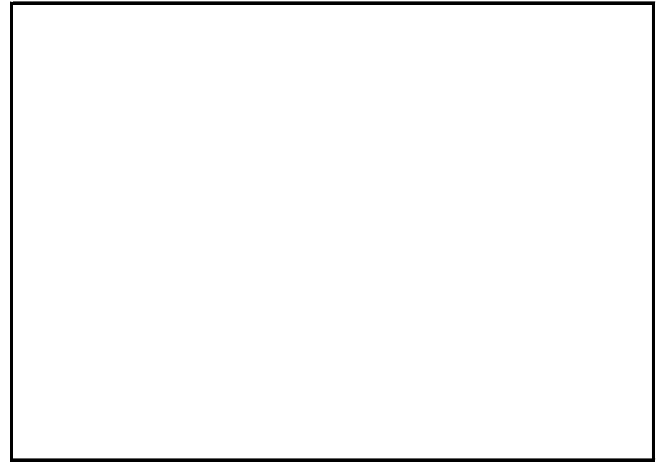
As-Built/Year 1 Survey: August 2012



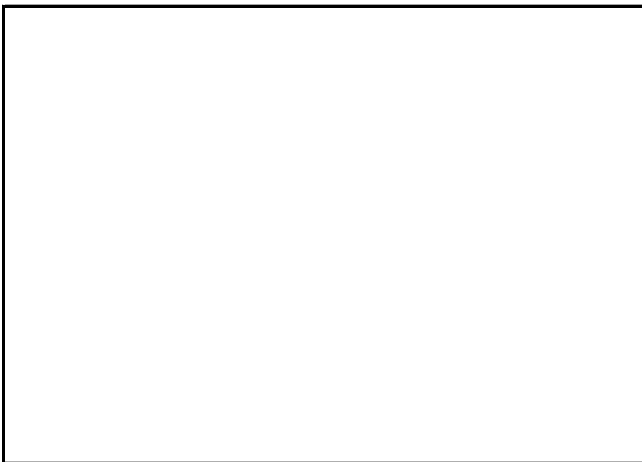
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

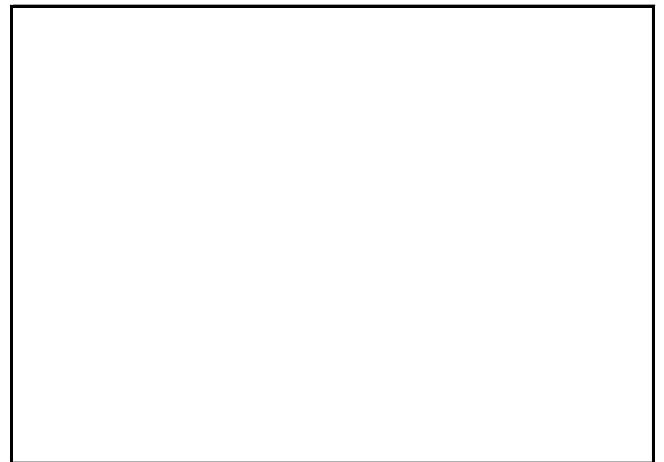
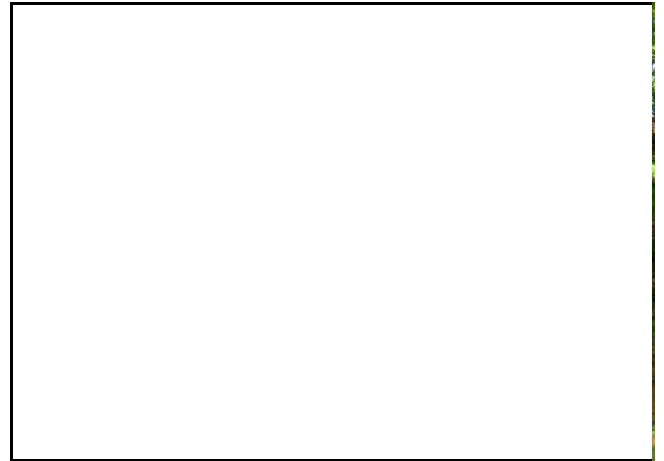


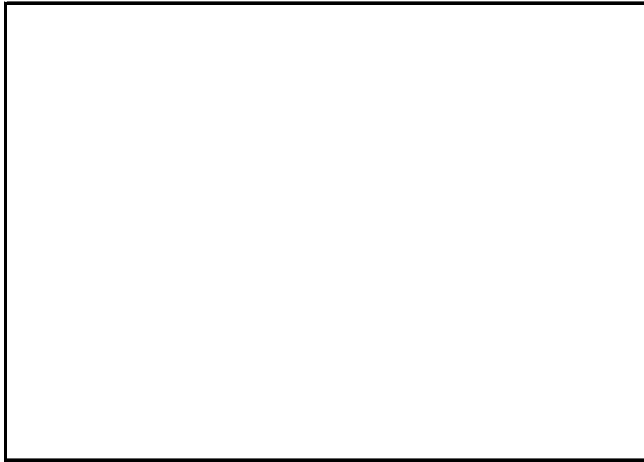
Photo Point 15; Looking Upstream Along Fence on C2/Pond



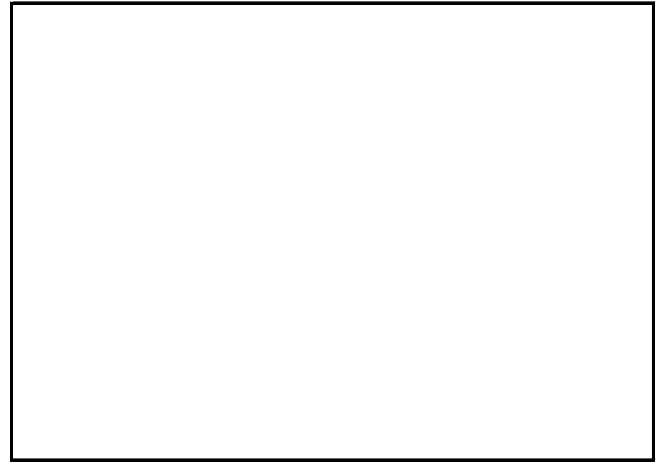
As-Built/Year 1 Survey: August 2012



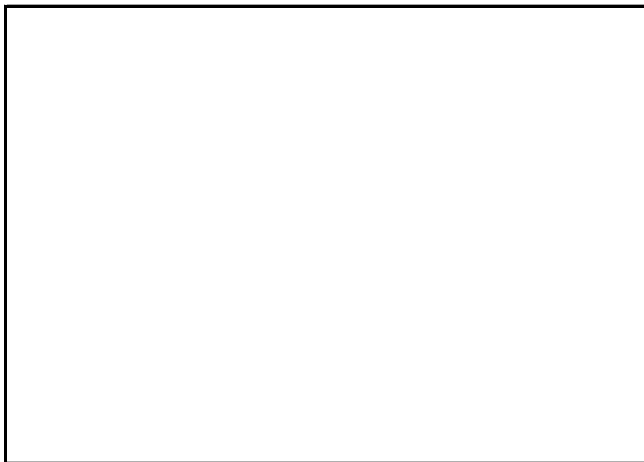
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

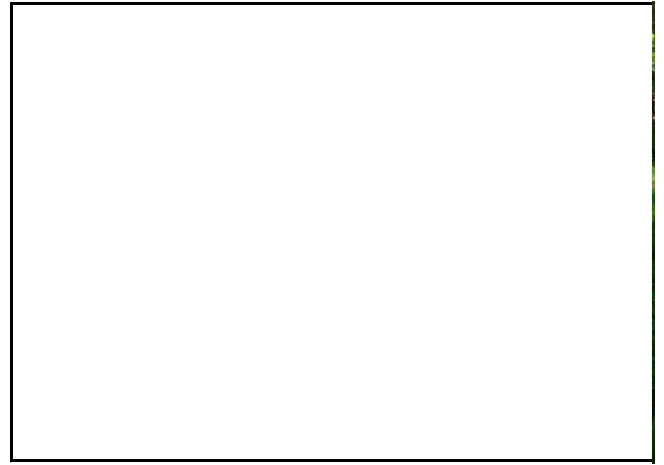


Year 5 Monitoring:

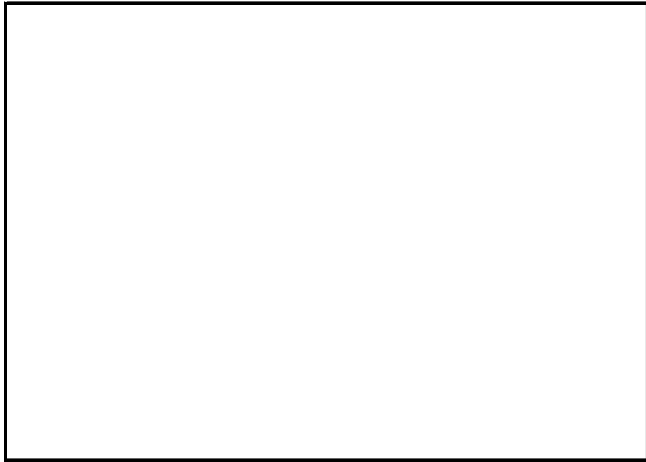
Photo Point 16; Looking Upstream Along C2



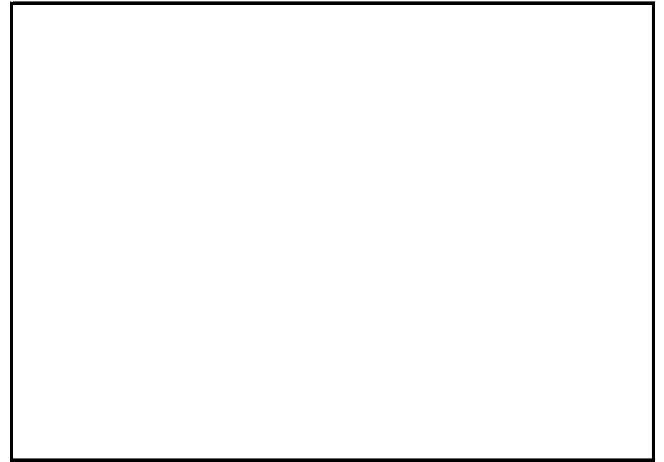
As-Built/Year 1 Survey: August 2012



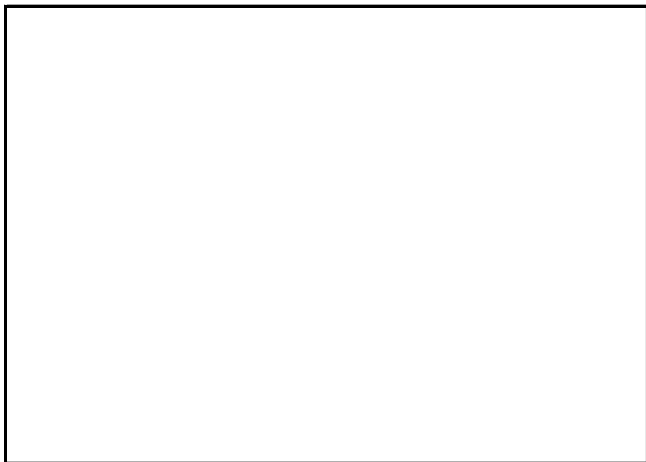
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

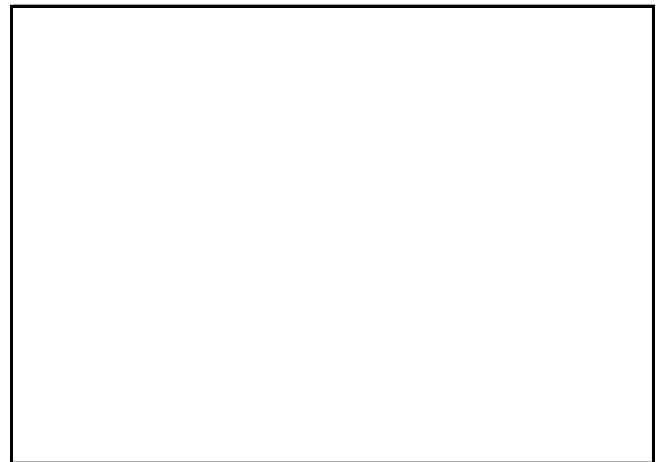
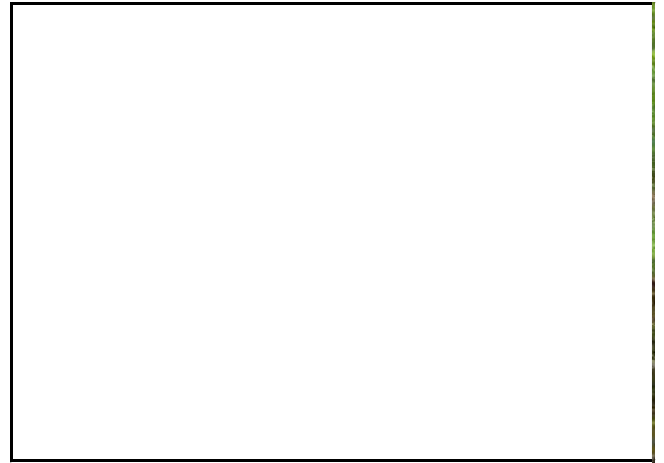




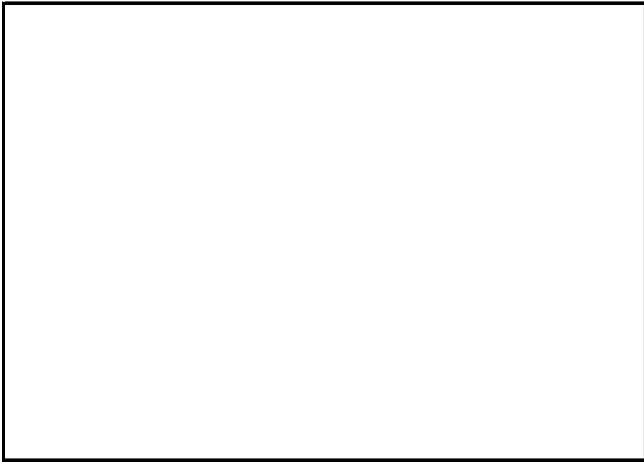
Photo Point 16; Looking Downstream Along C2



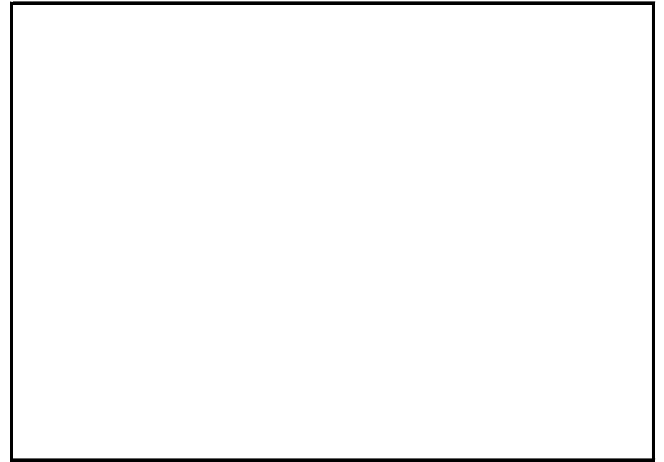
As-Built/Year 1 Survey: August 2012



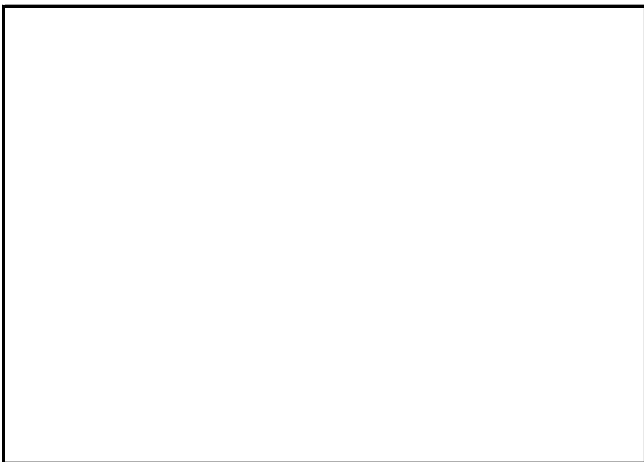
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

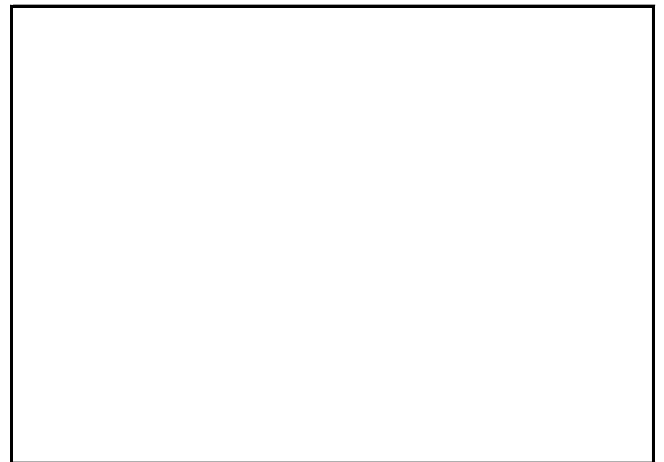
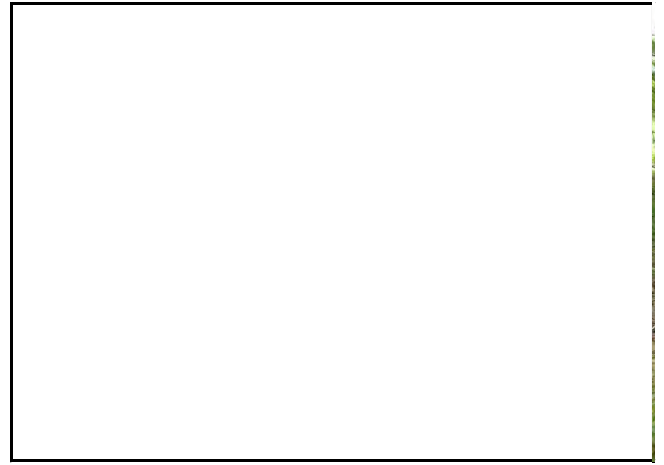


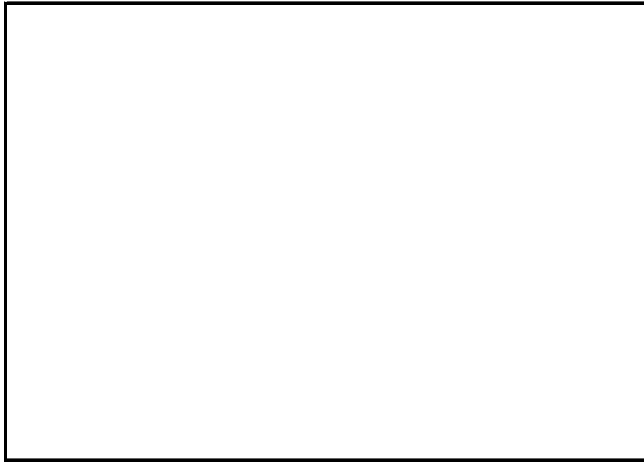
Photo Point 17; Looking Upstream Along C2/Step Pool



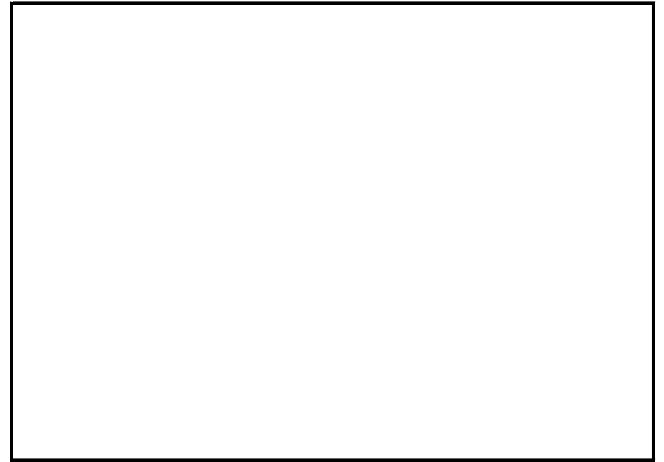
As-Built/Year 1 Survey: August 2012



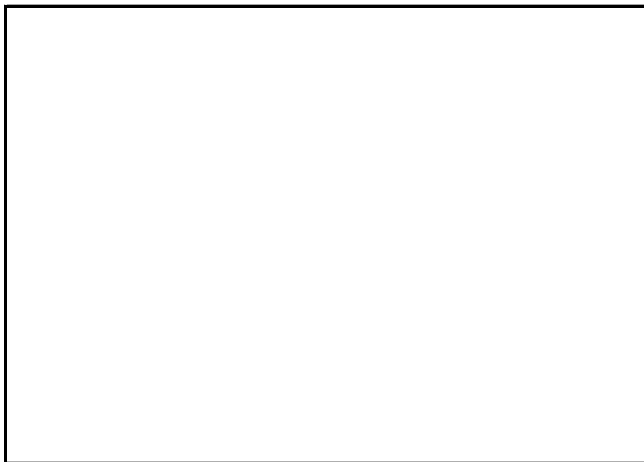
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

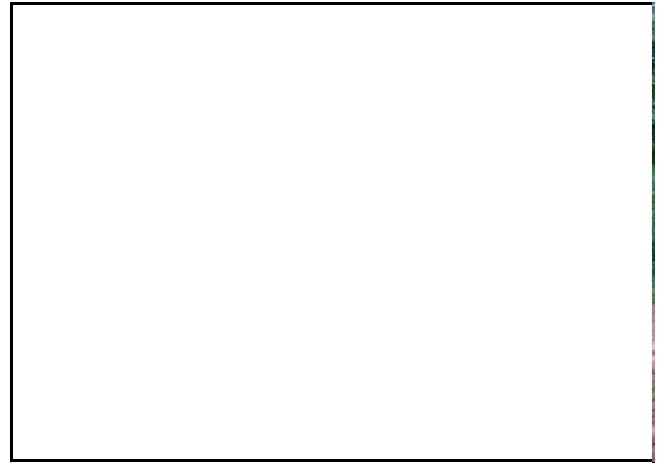


Year 5 Monitoring:

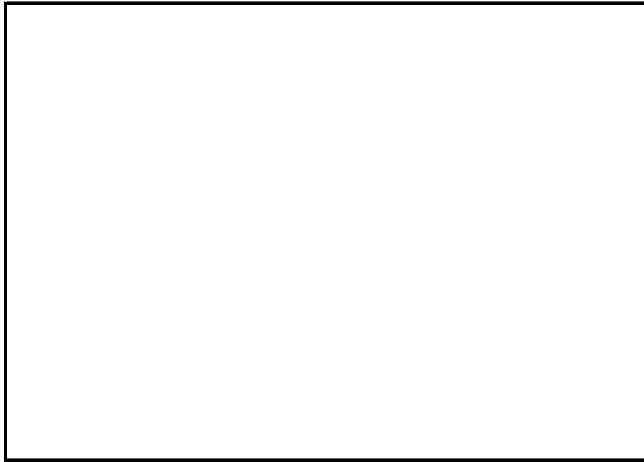
Photo Point 17; Looking Downstream Along C2



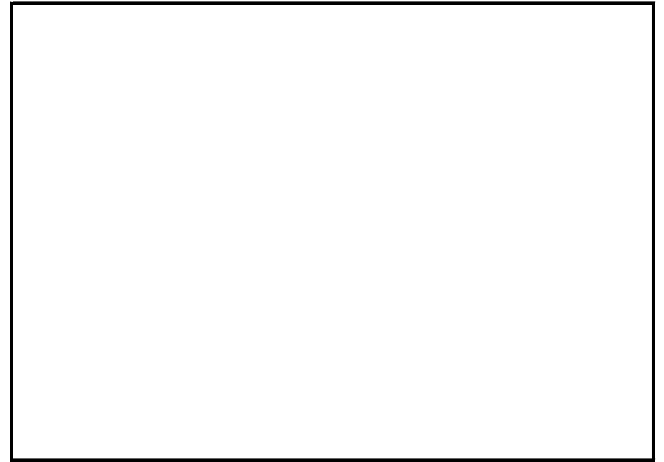
As-Built/Year 1 Survey: August 2012



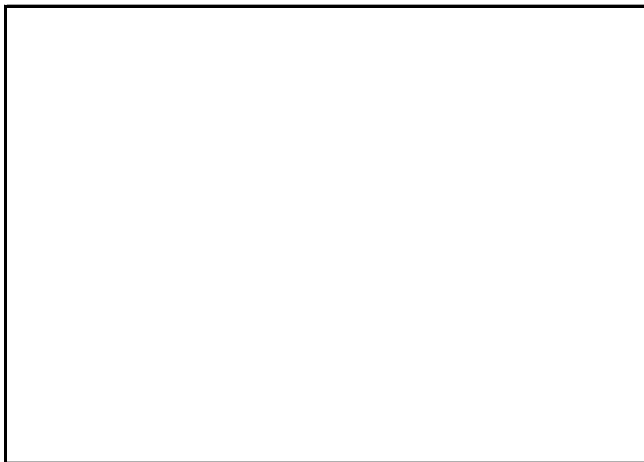
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

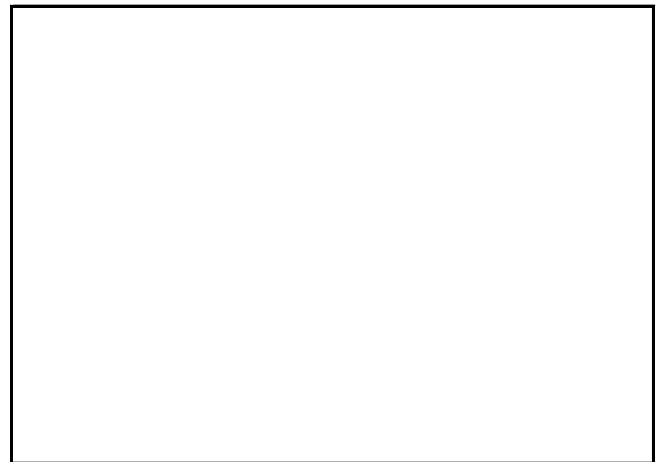
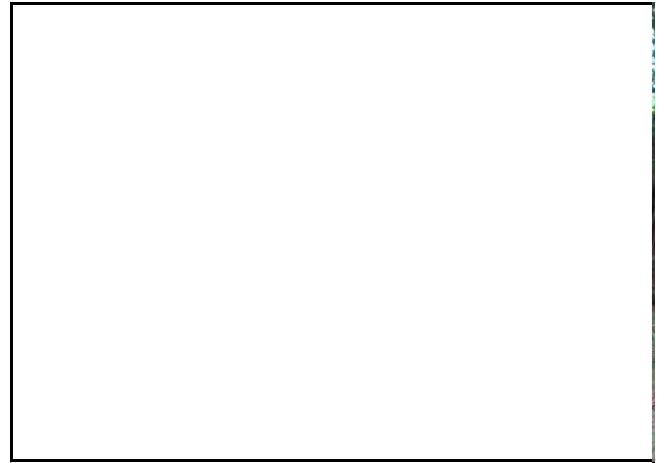


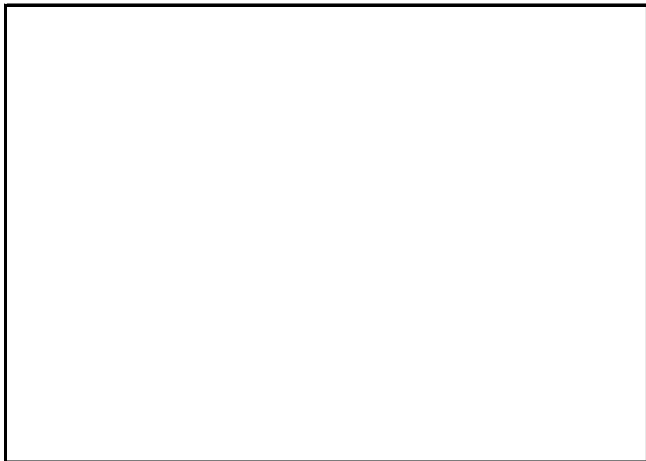
Photo Point 18; Looking Upstream Along C2



As-Built/Year 1 Survey: August 2012



Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

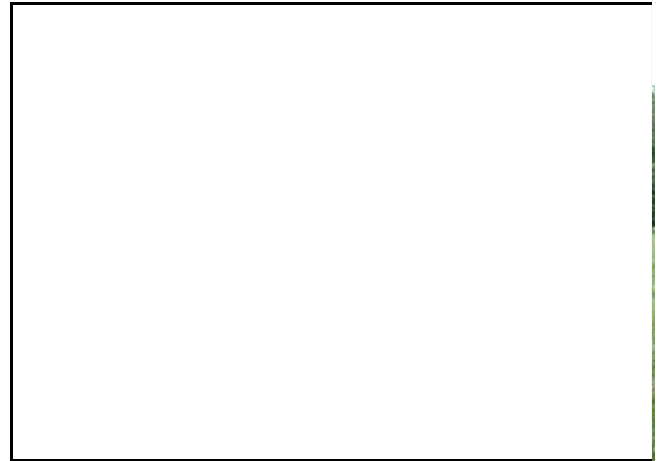


Year 5 Monitoring:

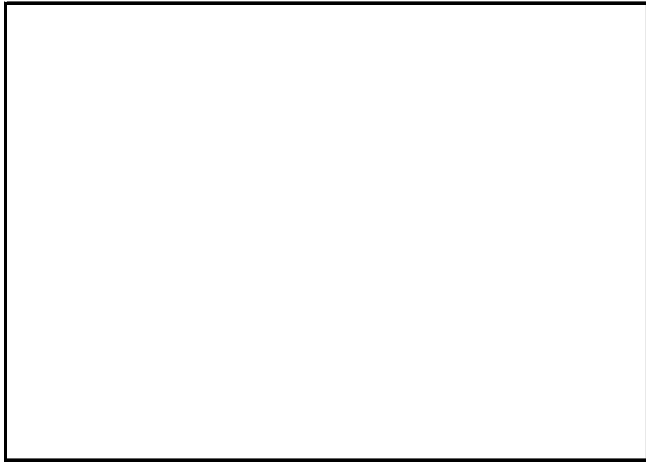
Photo Point 18; Looking Downstream Along C2



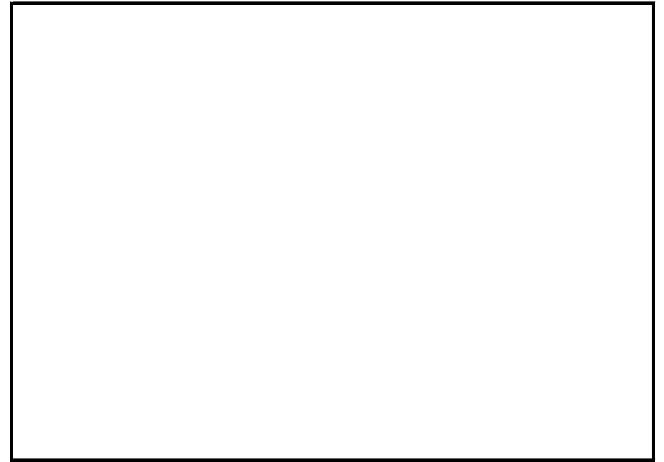
As-Built/Year 1 Survey: August 2012



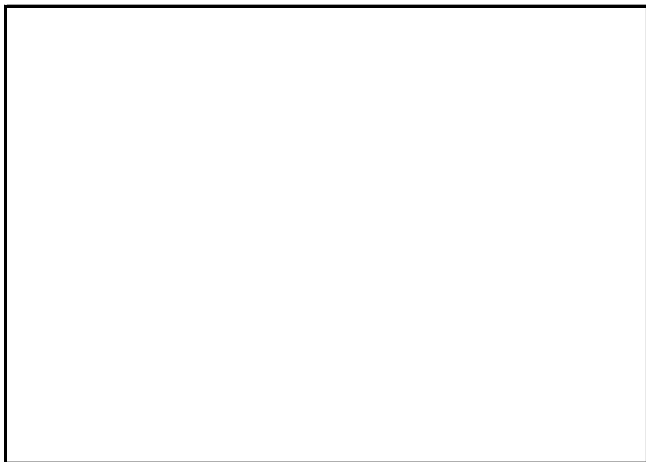
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

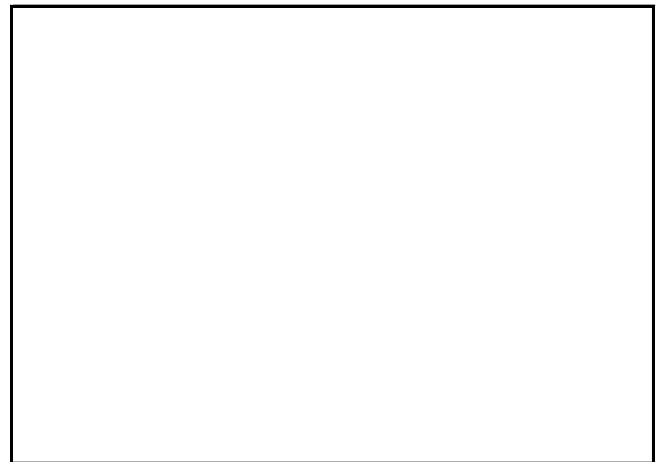
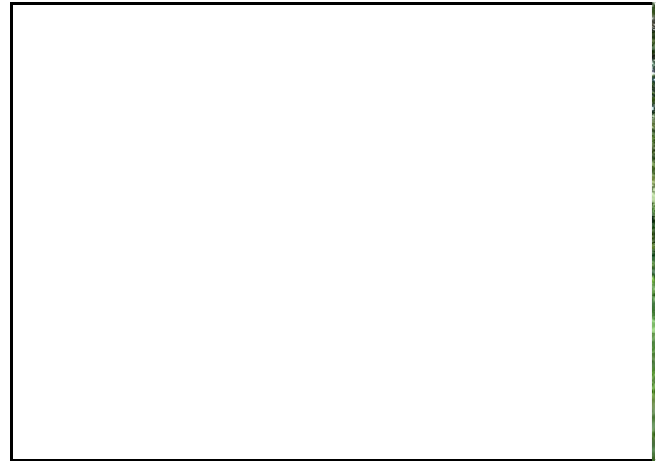


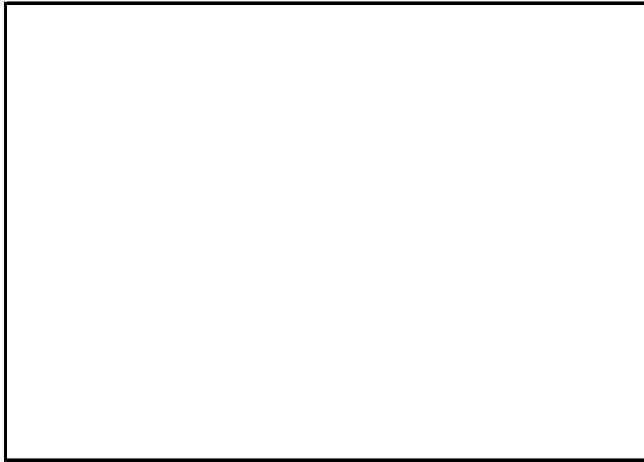
Photo Point 18; Looking Upstream Along C2-c



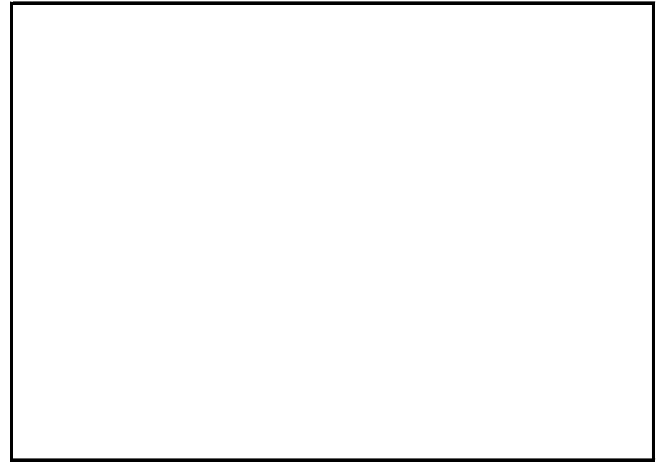
As-Built/Year 1 Survey: August 2012



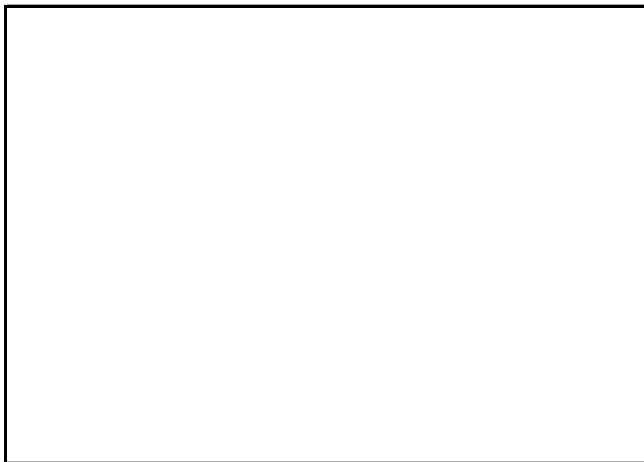
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

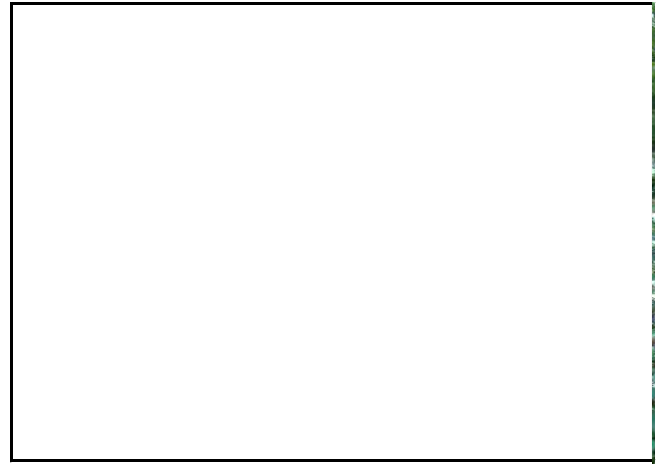


Year 5 Monitoring:

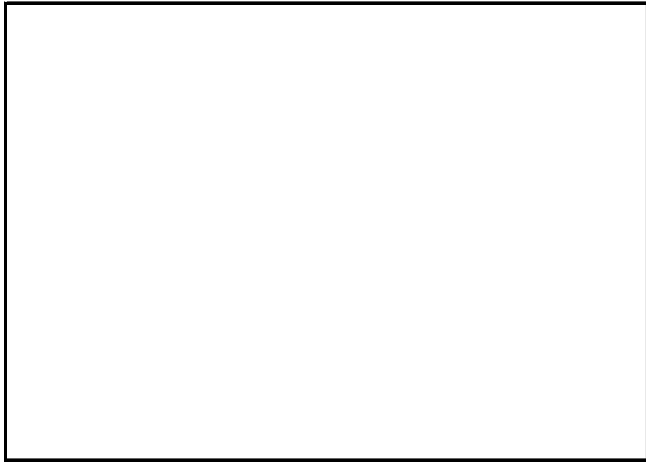
Photo Point 19; Looking Downstream Along Main Center - Invasive Management



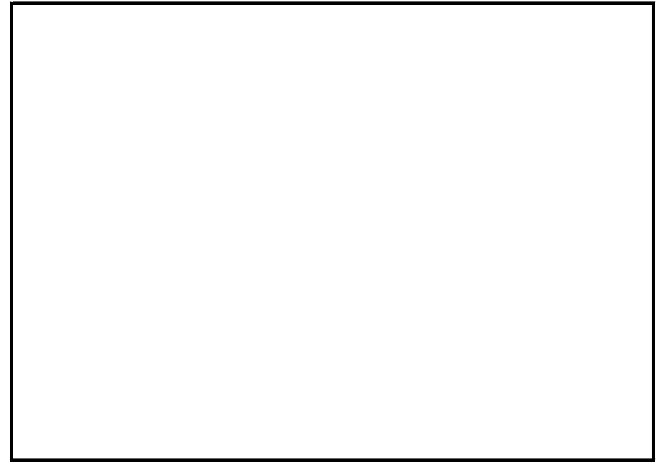
As-Built/Year 1 Survey: August 2012



Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

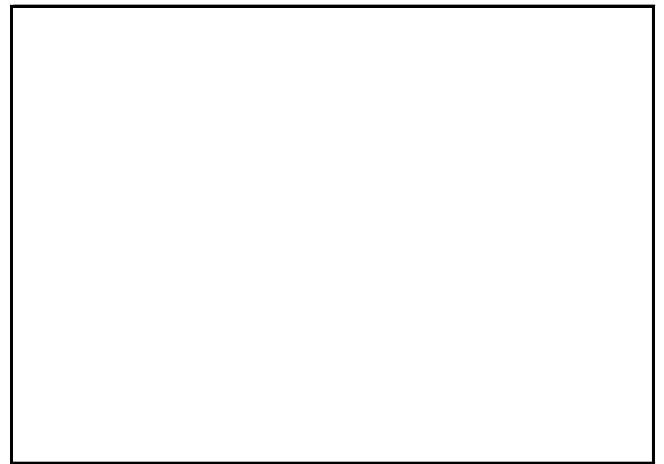


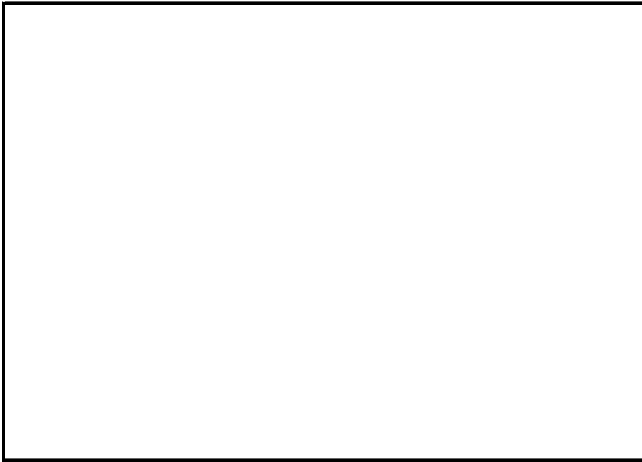
Photo Point 19; Looking Upstream Along C2 - Invasive Management



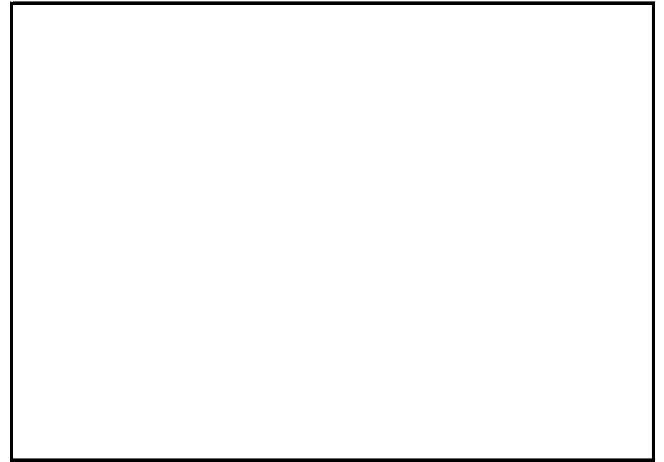
As-Built/Year 1 Survey: August 2012



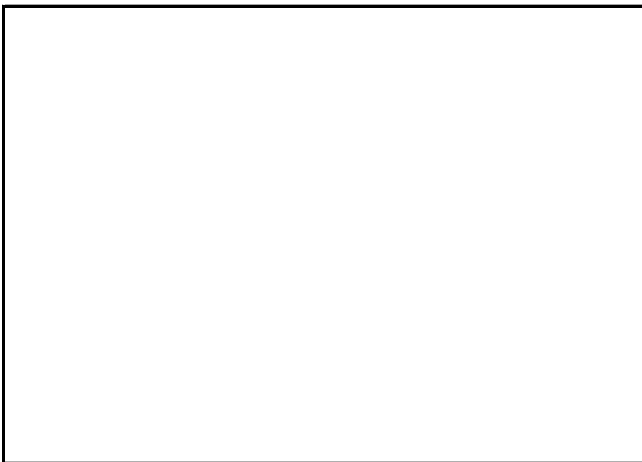
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

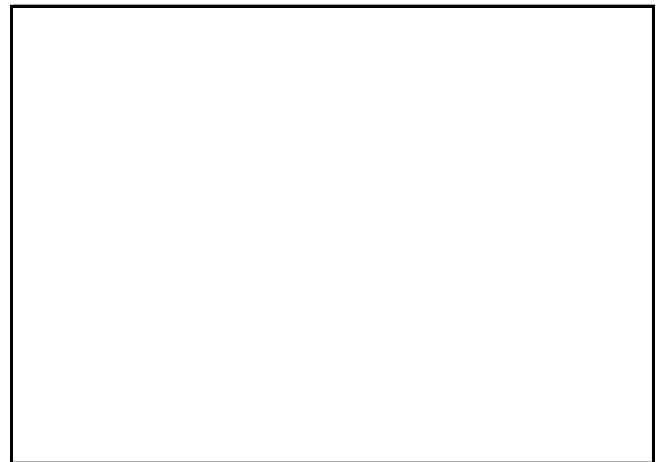
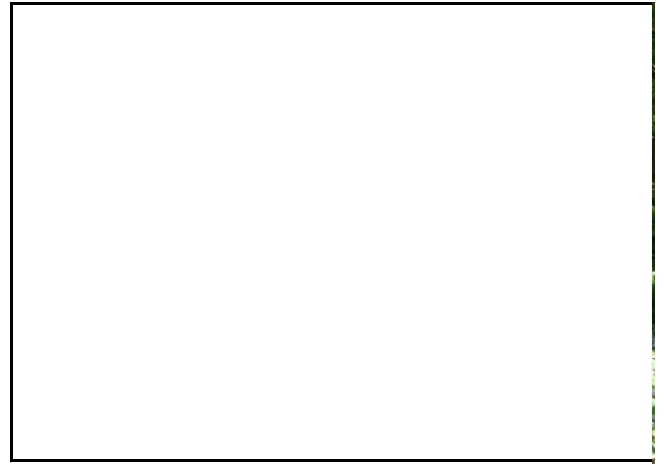




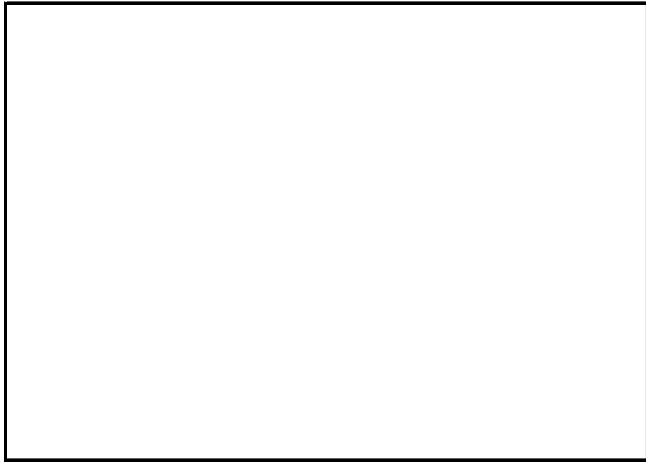
Photo Point 20; Looking Upstream Along Main Center



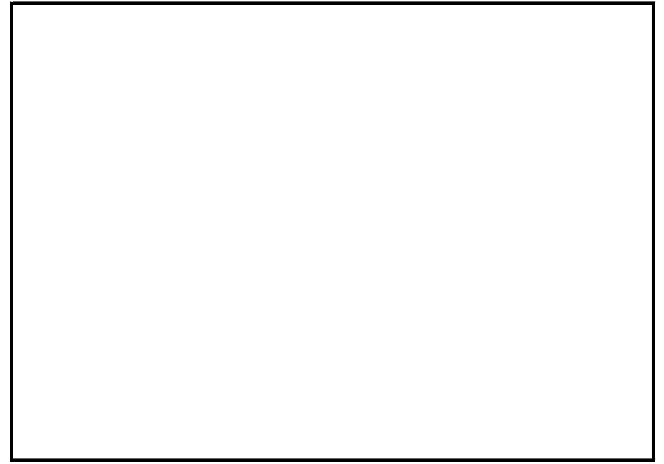
As-Built/Year 1 Survey: August 2012



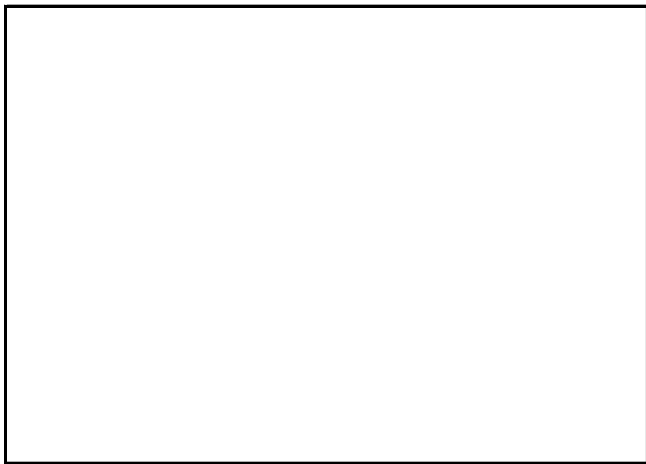
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

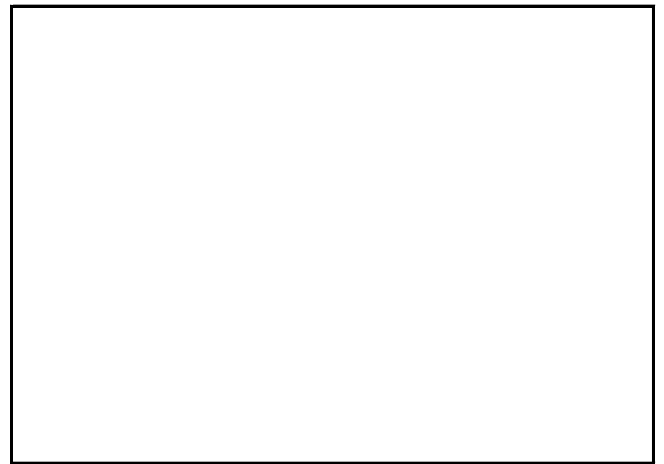
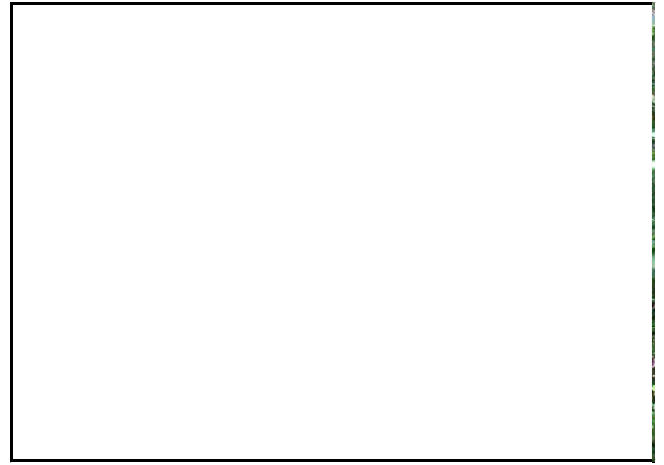
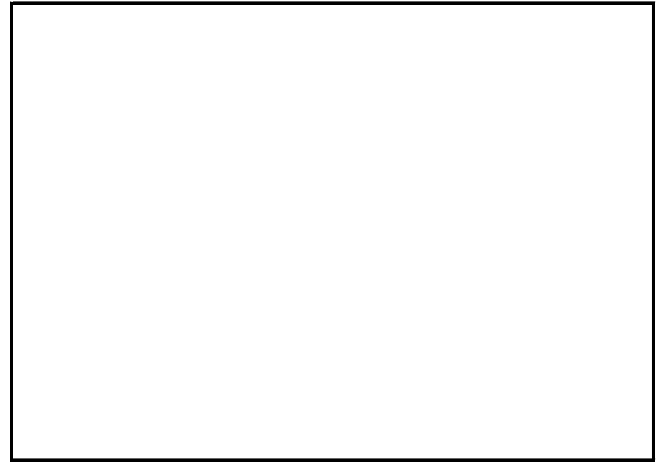
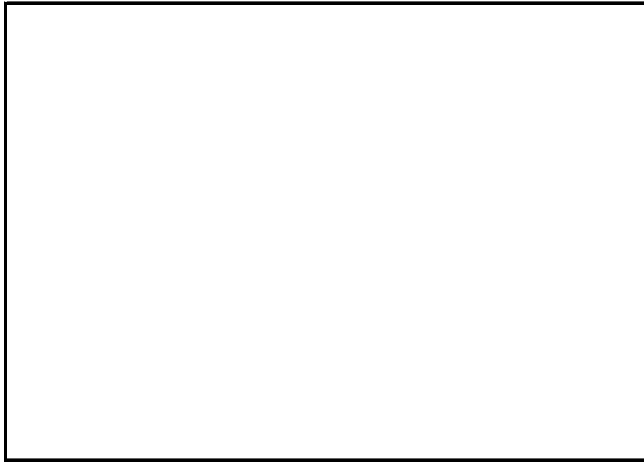


Photo Point 20; Looking Downstream Along Main Center



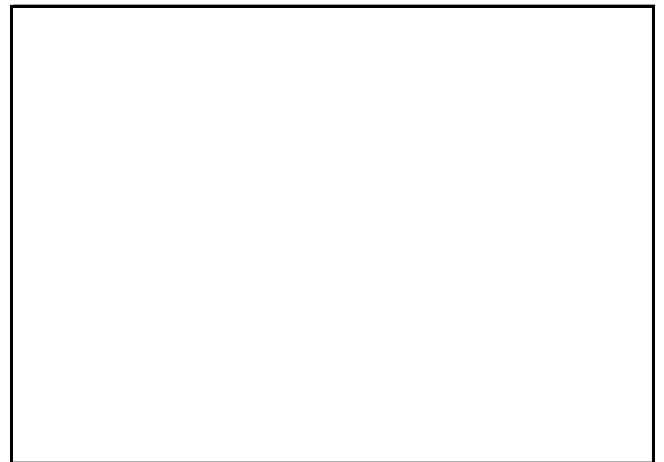
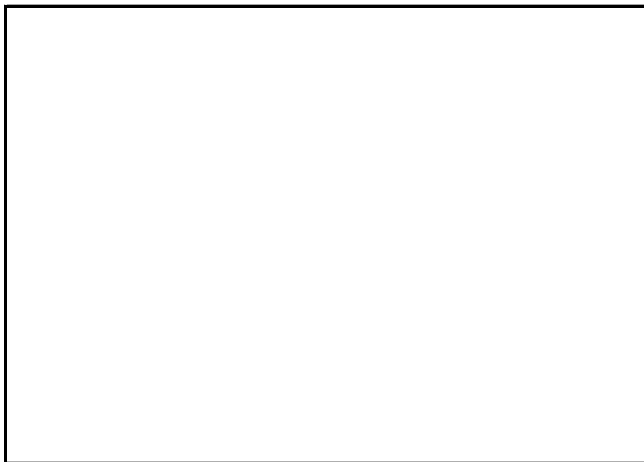
As-Built/Year 1 Survey: August 2012

Year 2 Monitoring:



Year 3 Monitoring:

Year 4 Monitoring:

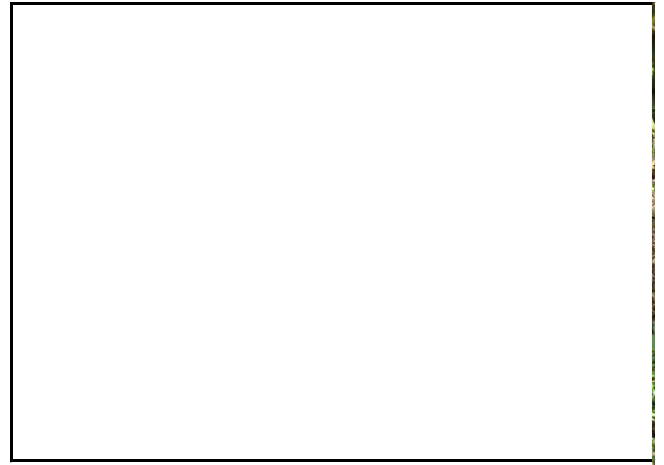


Year 5 Monitoring:

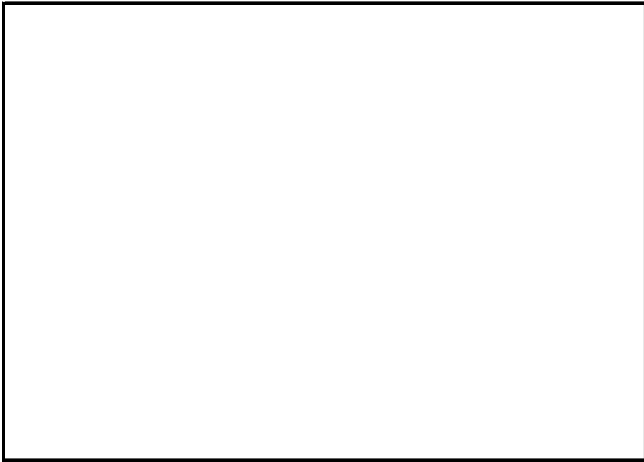
Photo Point 21; Looking Upstream Along Main Center



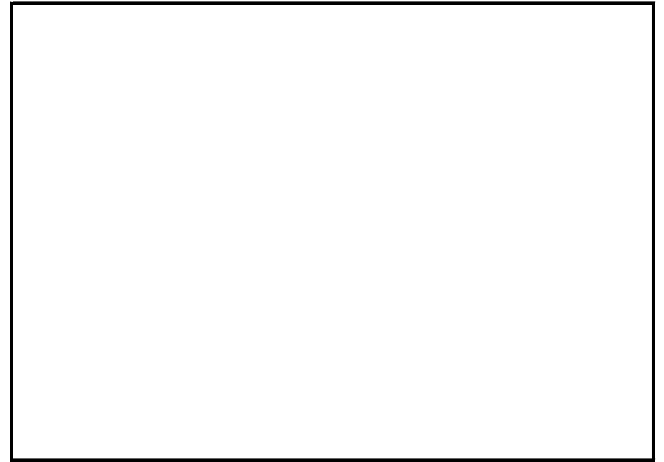
As-Built/Year 1 Survey: August 2012



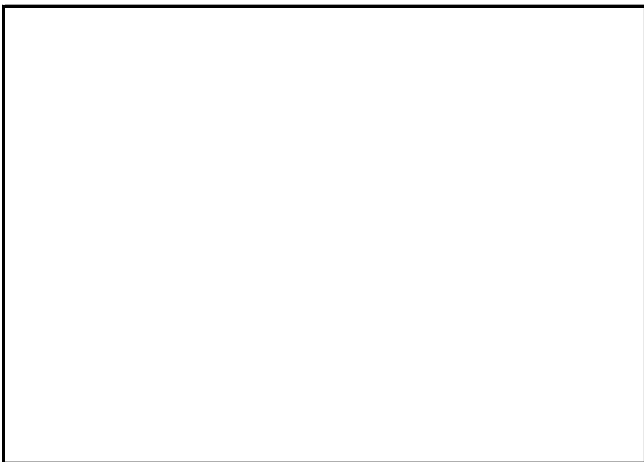
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

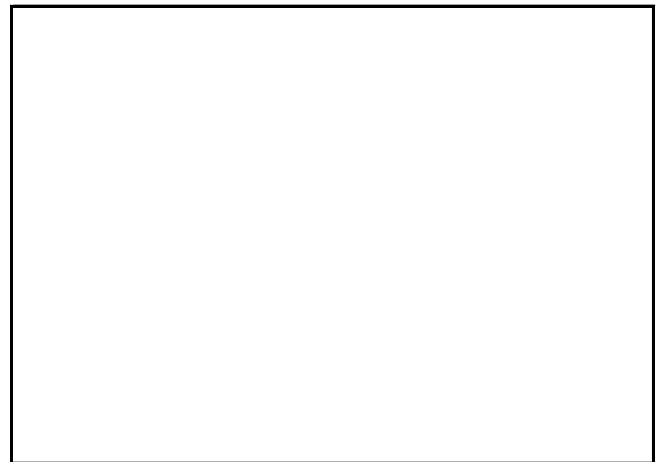
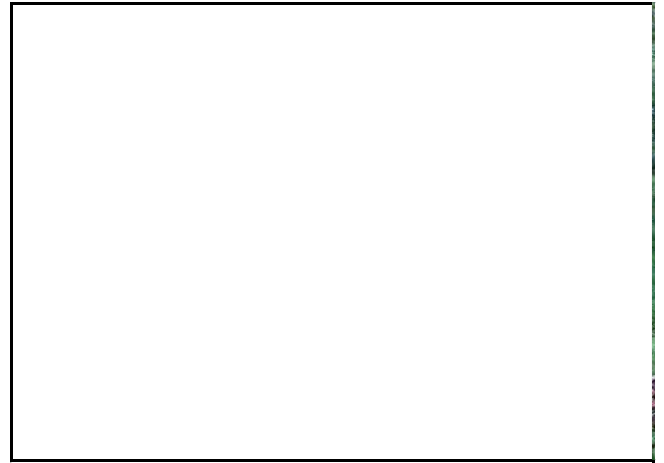
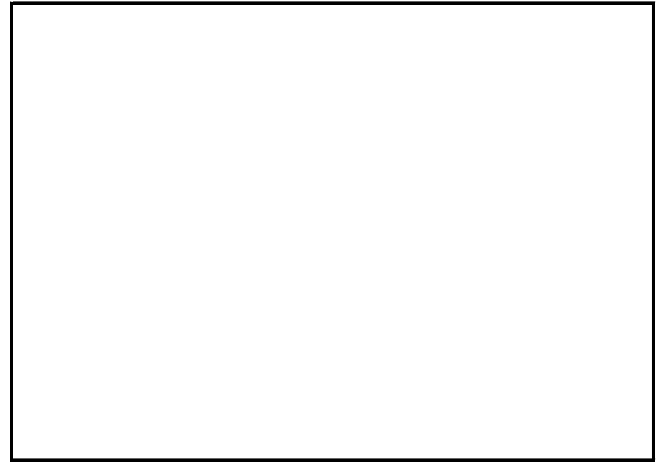
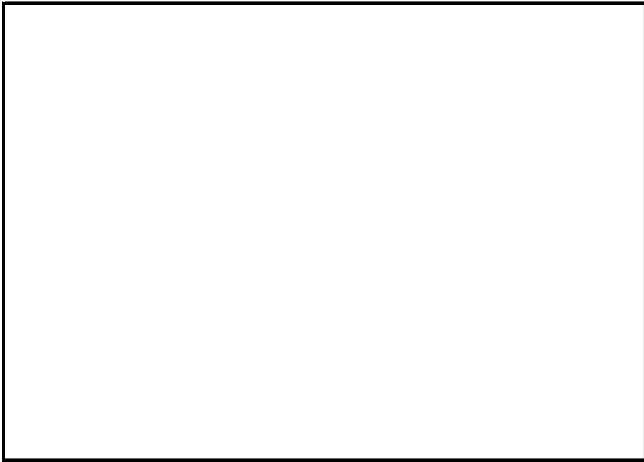


Photo Point 21; Looking Downstream Along Main Center



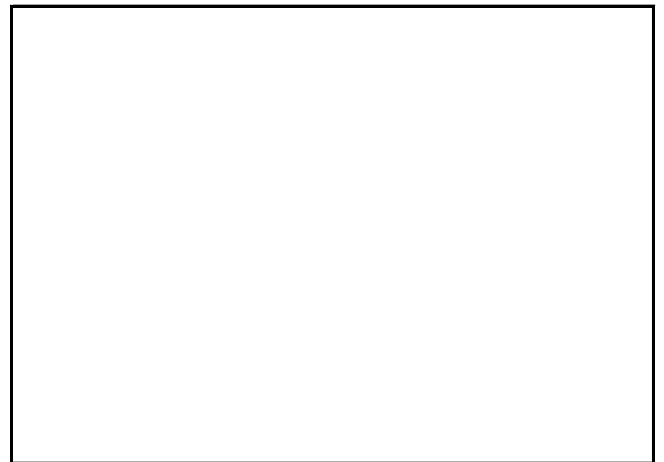
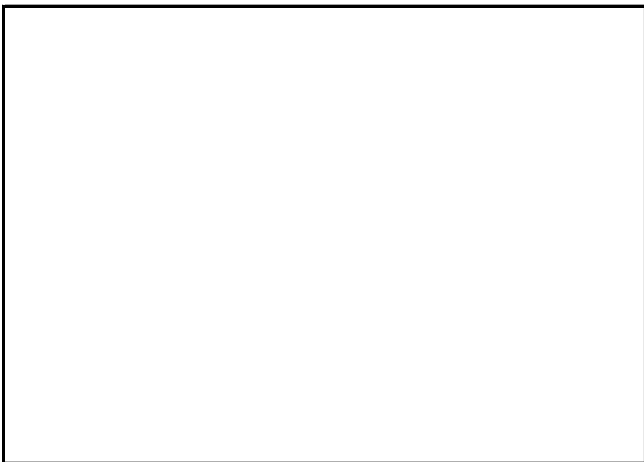
As-Built/Year 1 Survey: August 2012

Year 2 Monitoring:



Year 3 Monitoring:

Year 4 Monitoring:

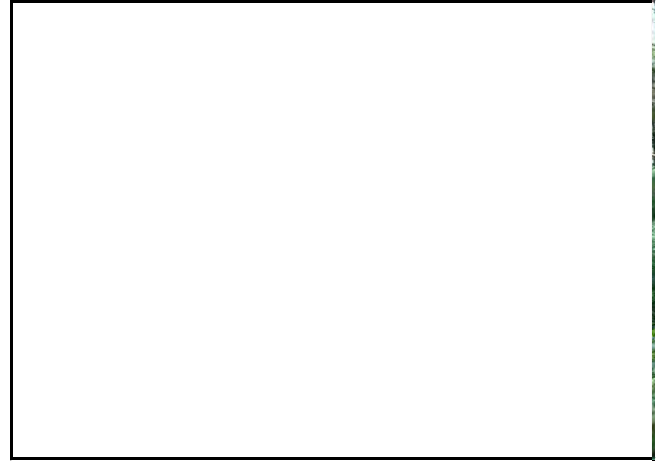


Year 5 Monitoring:

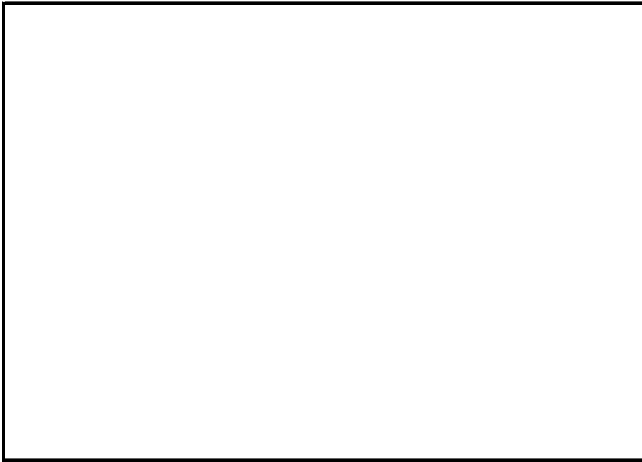
Photo Point 22; Looking Upstream Along Southeast Tributary



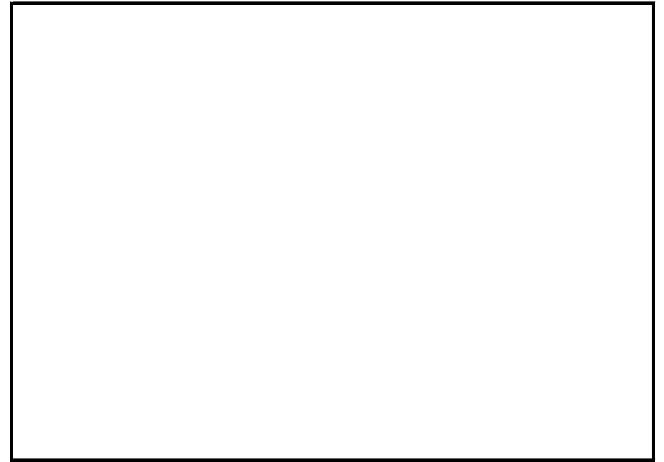
As-Built/Year 1 Survey: August 2012



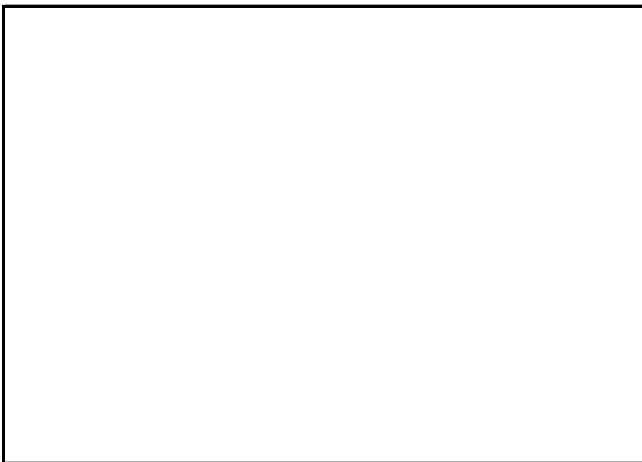
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

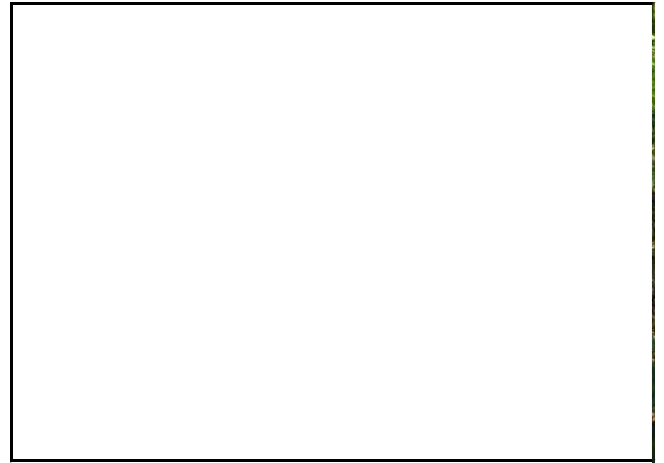


Year 5 Monitoring:

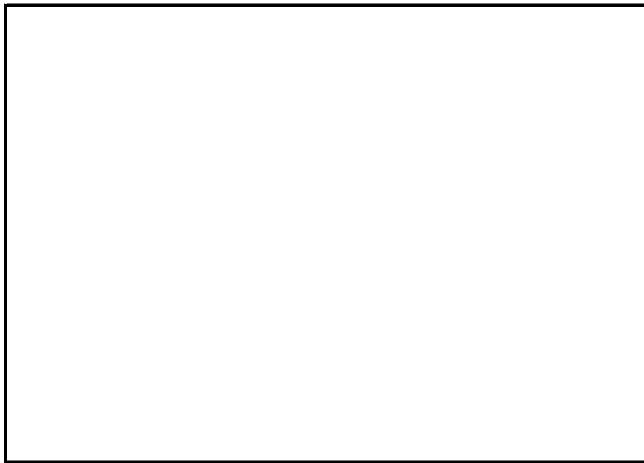
Photo Point 22; Looking Downstream Along Southeast Tributary



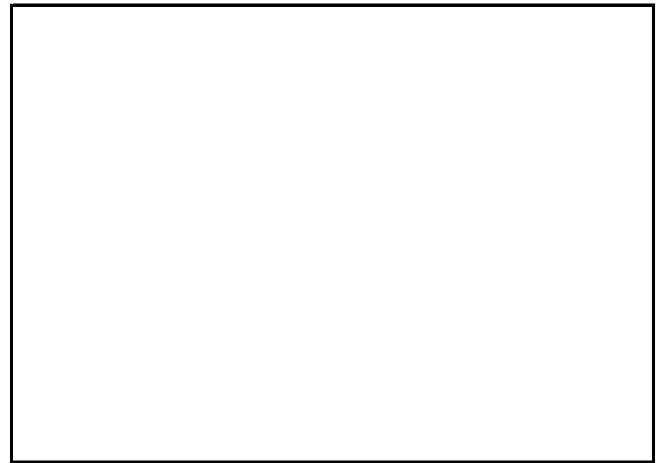
As-Built/Year 1 Survey: August 2012



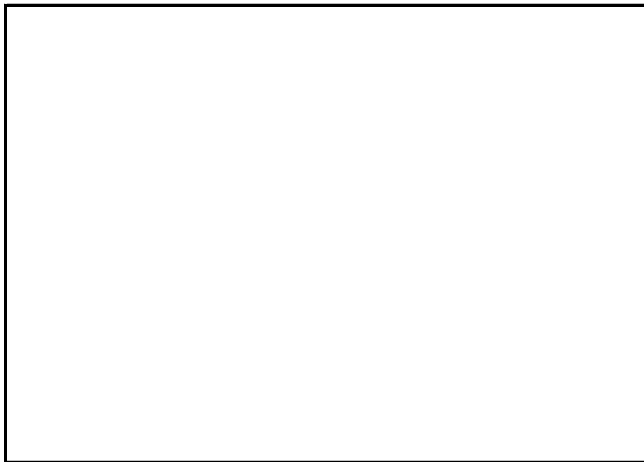
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

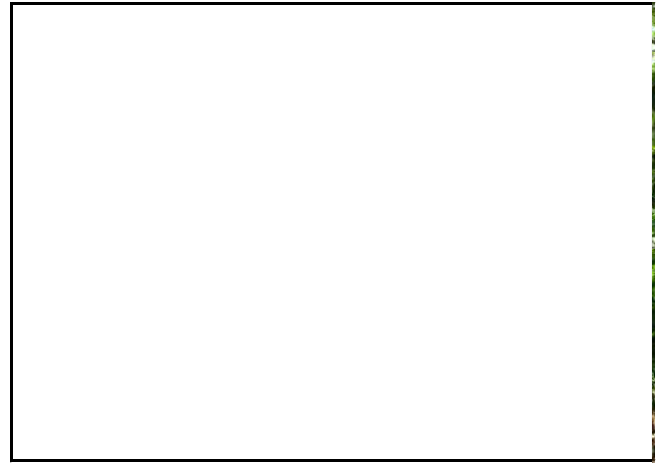


Year 5 Monitoring:

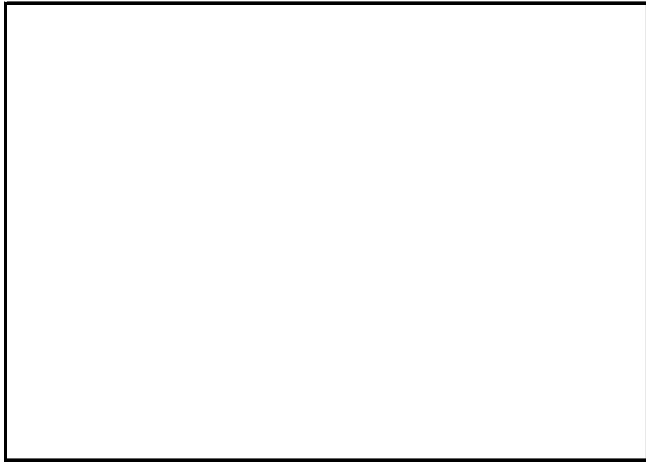
Photo Point 23; Looking Upstream Along Southeast Tributary



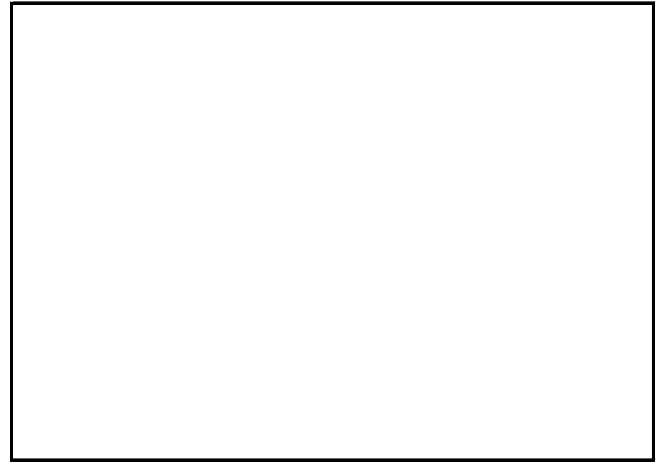
As-Built/Year 1 Survey: August 2012



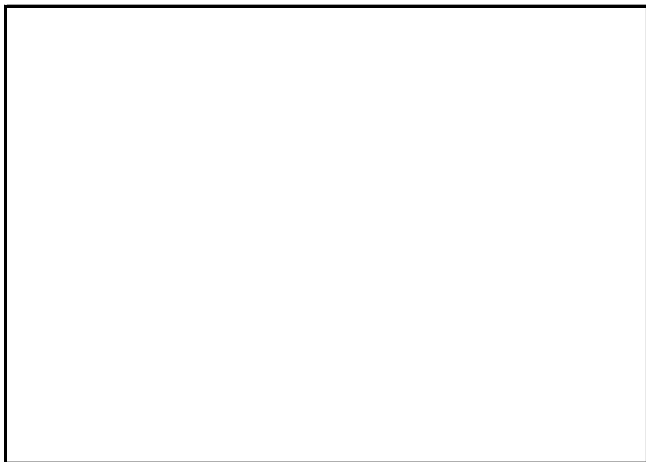
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

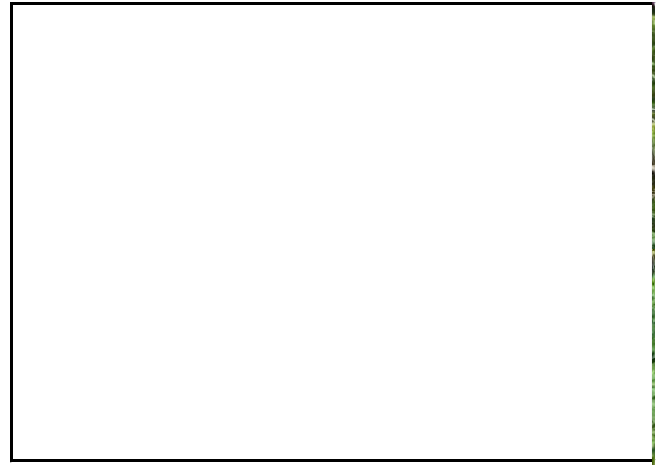


Year 5 Monitoring:

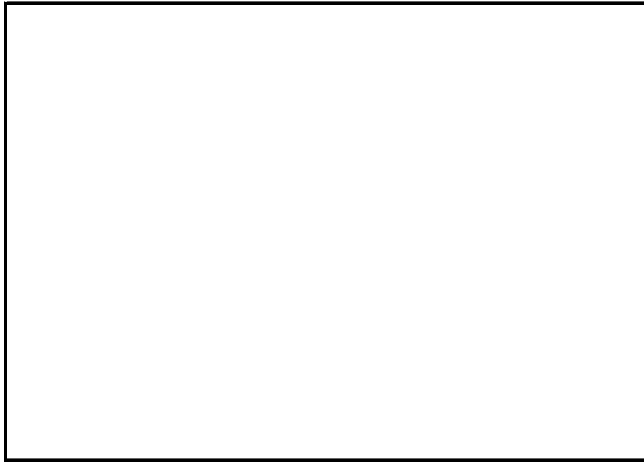
Photo Point 23; Looking Downstream Along Southeast Tributary



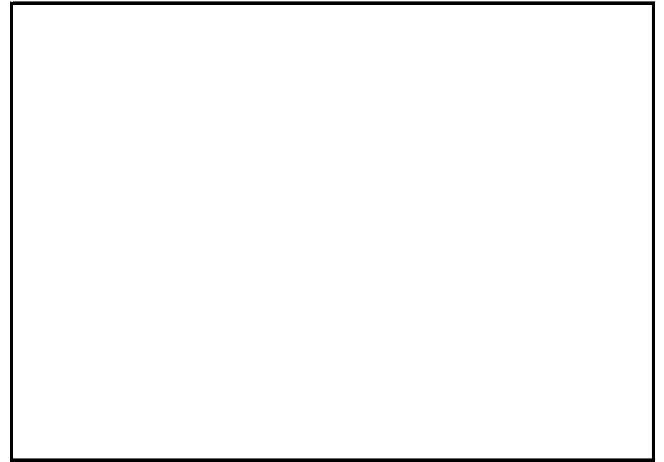
As-Built/Year 1 Survey: August 2012



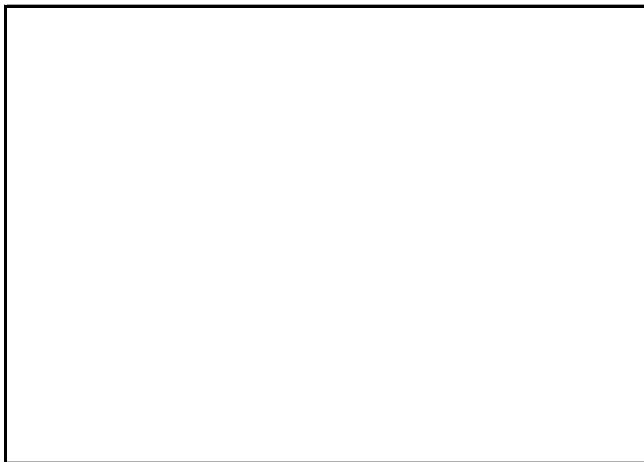
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

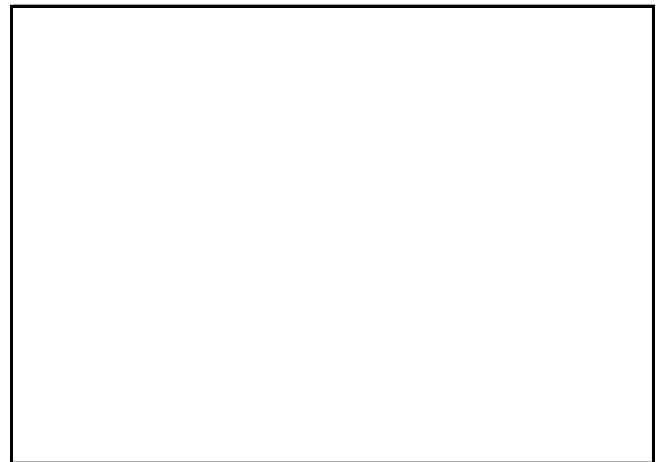
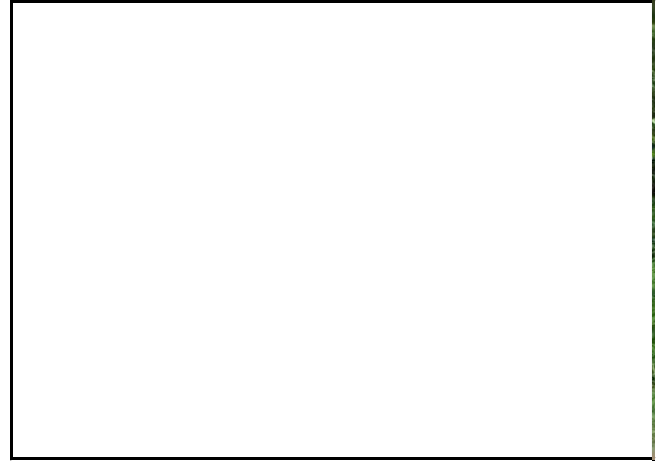




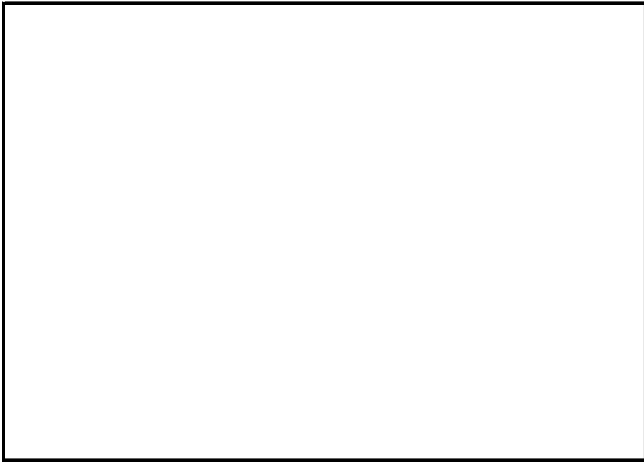
Photo Point 24; Looking Upstream Along Southeast Tributary



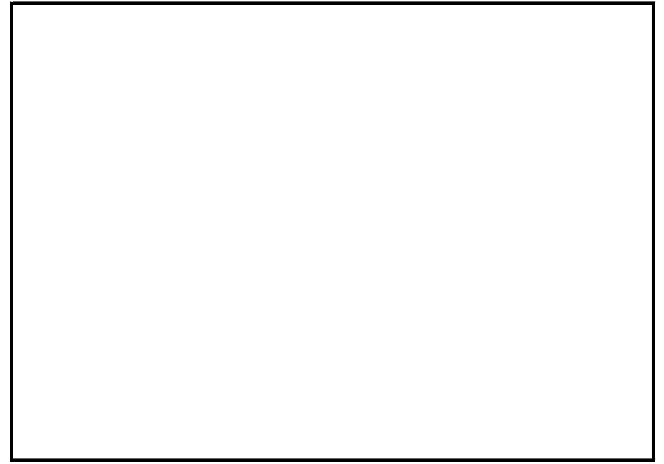
As-Built/Year 1 Survey: August 2012



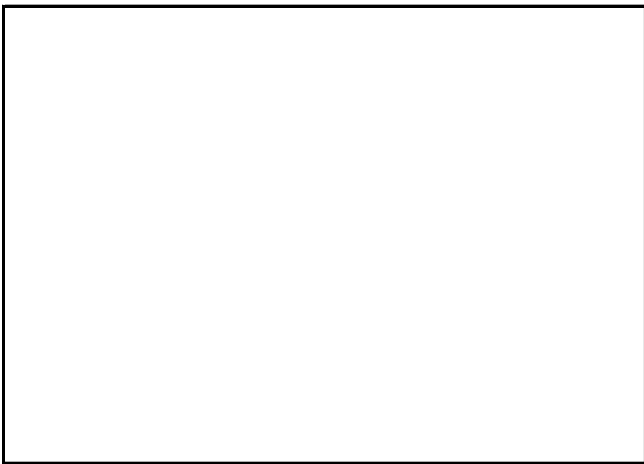
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

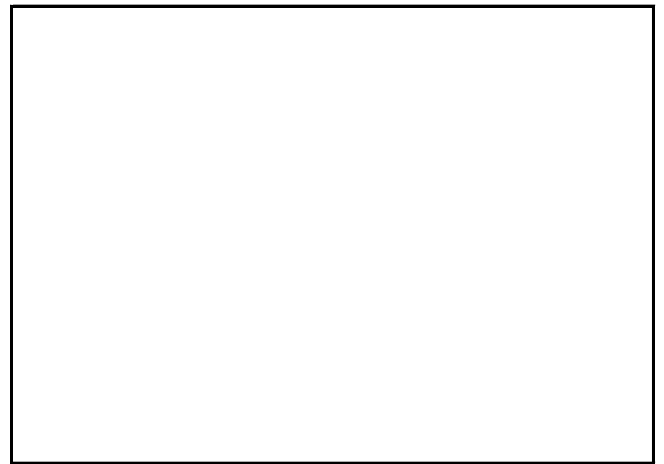
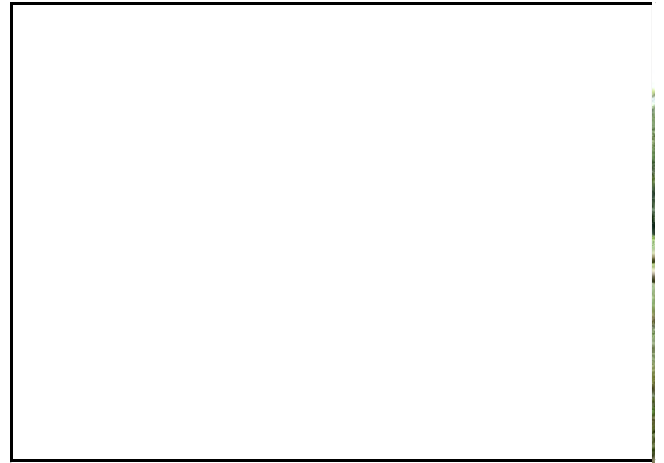


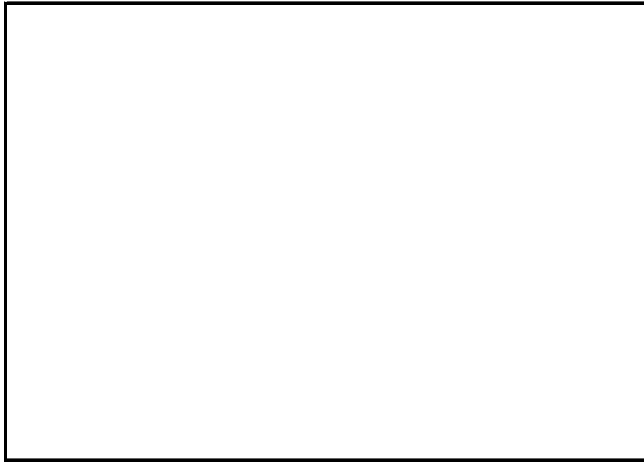
Photo Point 24; Looking Across Crossing on Southeast Tributary



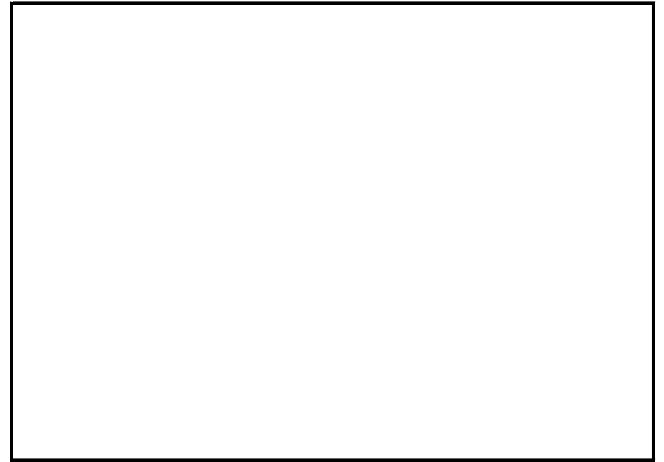
As-Built/Year 1 Survey: August 2012



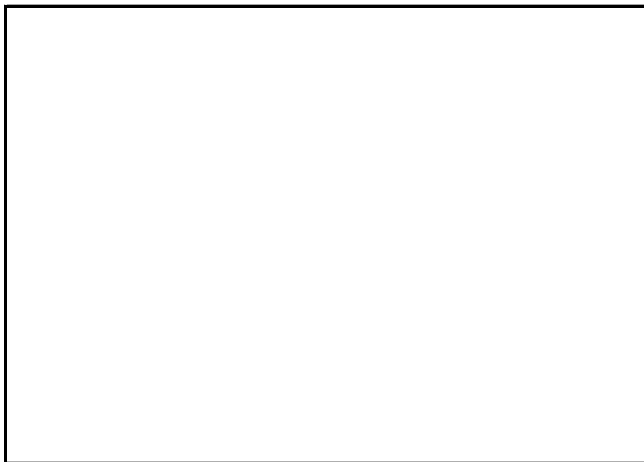
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

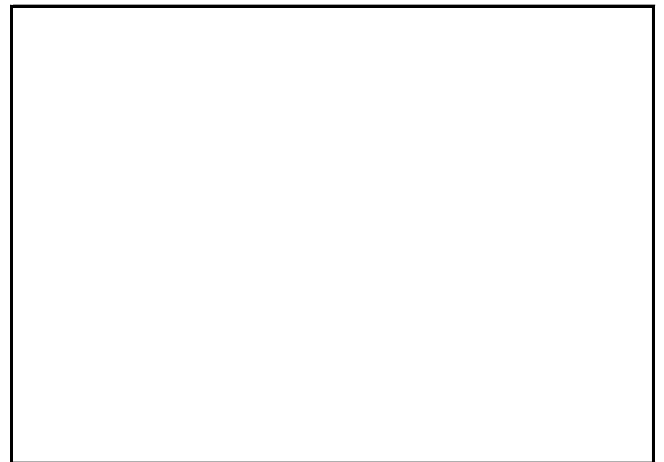
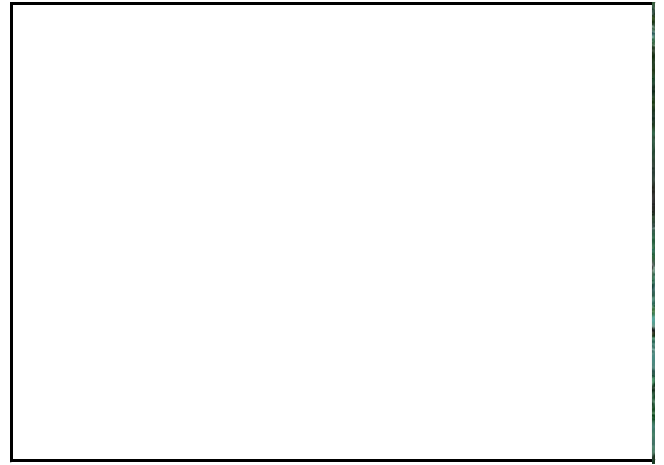


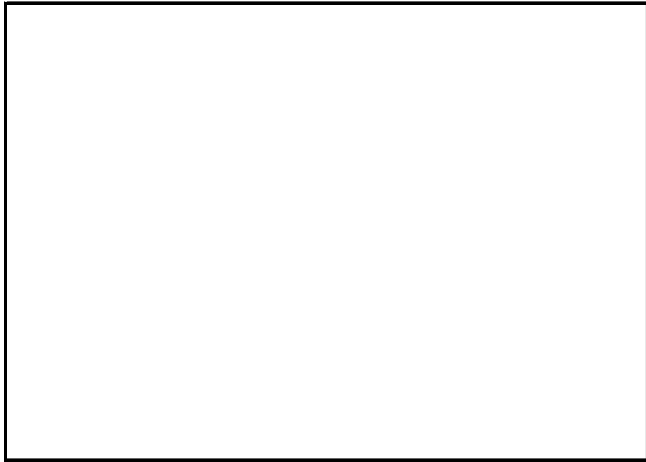
Photo Point 24; Looking Downstream Along Southeast Tributary



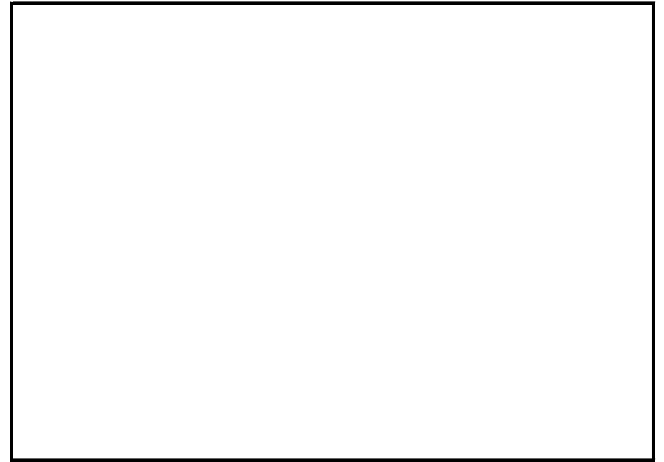
As-Built/Year 1 Survey: August 2012



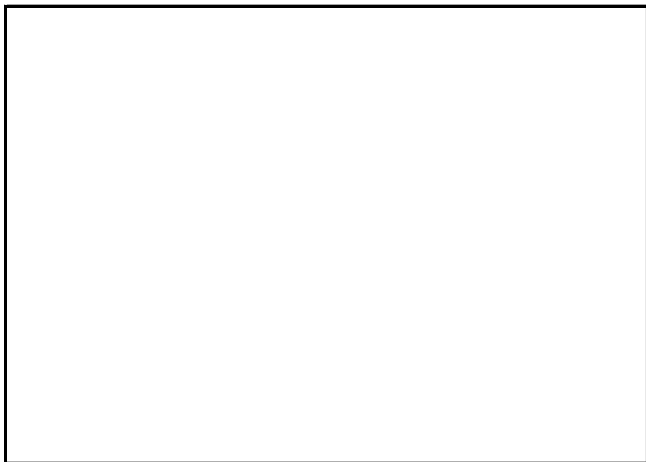
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

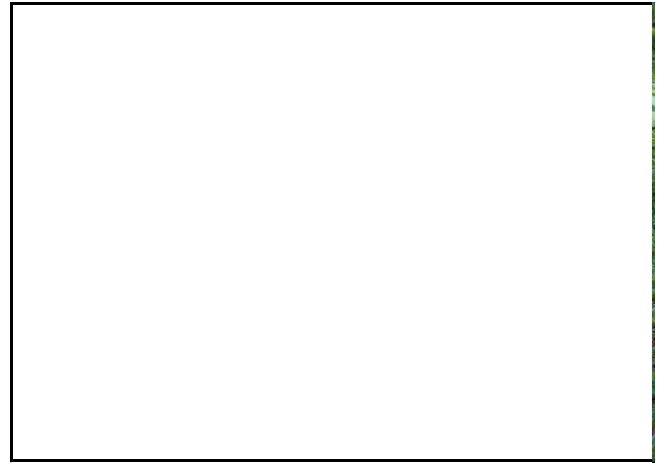


Year 5 Monitoring:

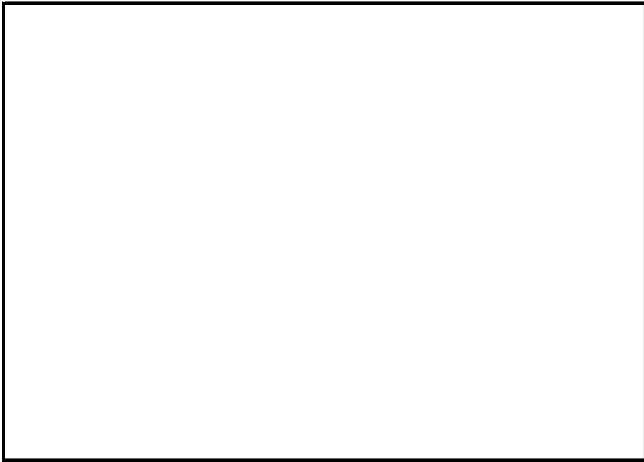
Photo Point 25; Looking Upstream Along East 1



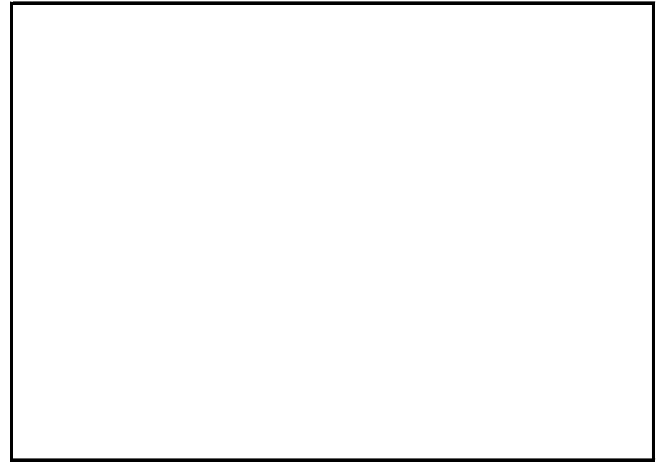
As-Built/Year 1 Survey: August 2012



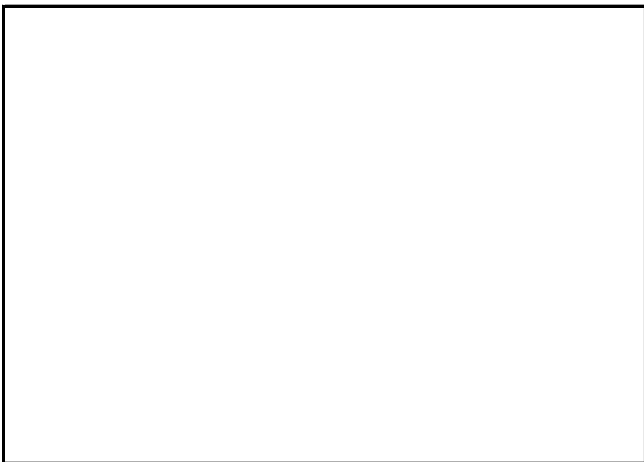
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

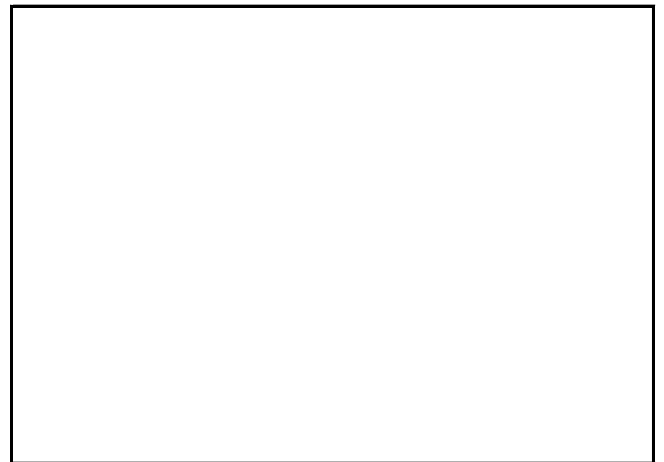
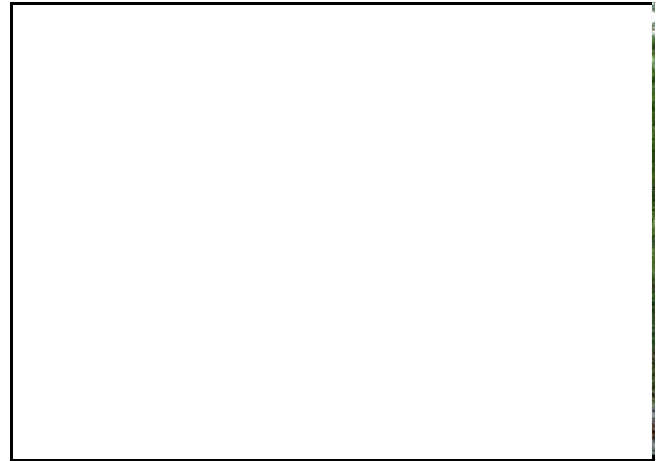


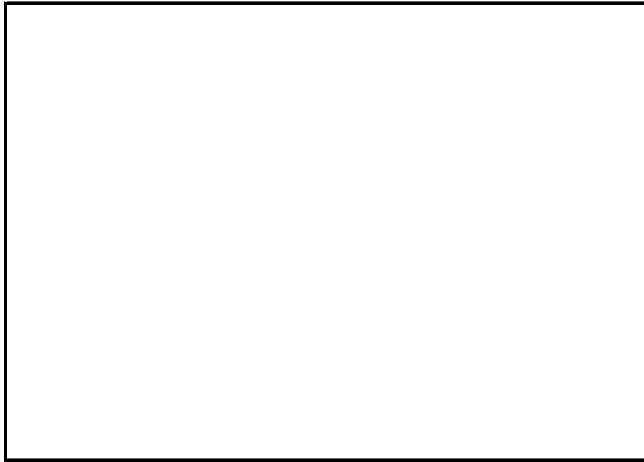
Photo Point 25; Looking Downstream Along East 1



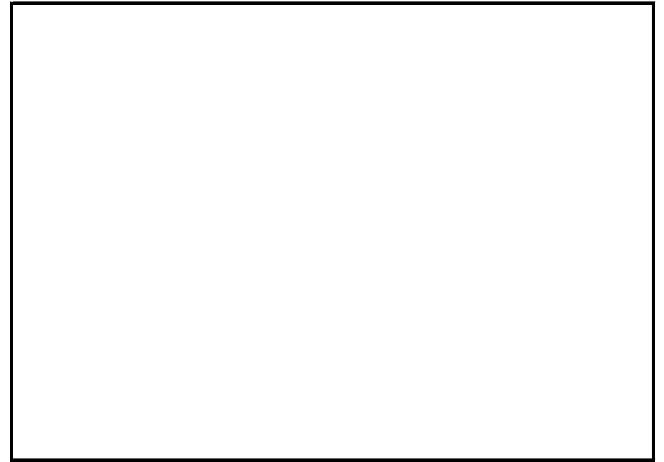
As-Built/Year 1 Survey: August 2012



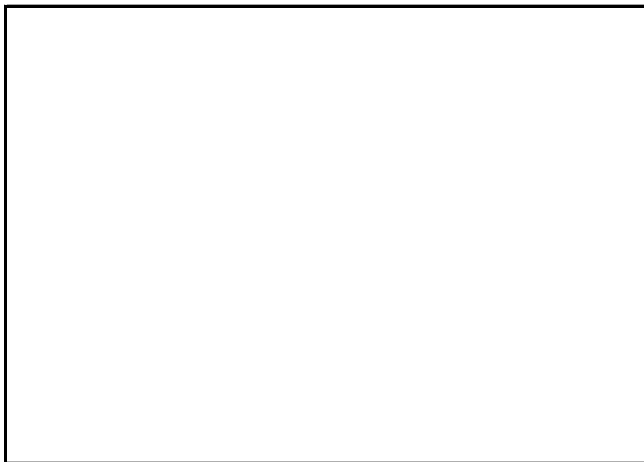
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

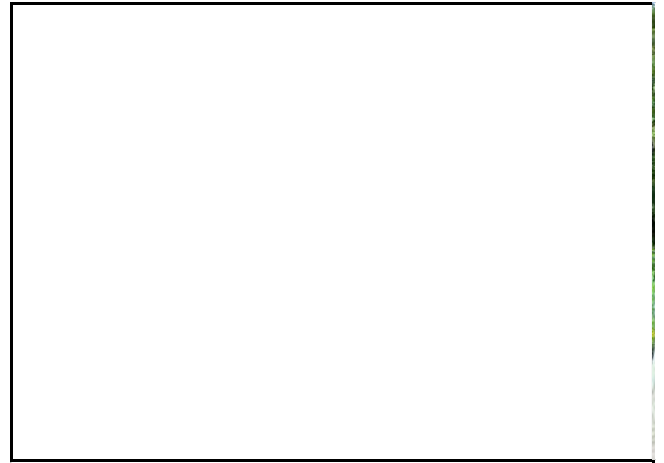


Year 5 Monitoring:

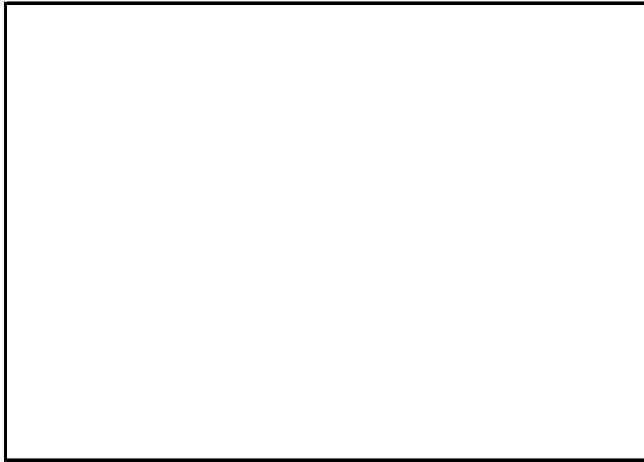
Photo Point 26; Looking Upstream Along East 2



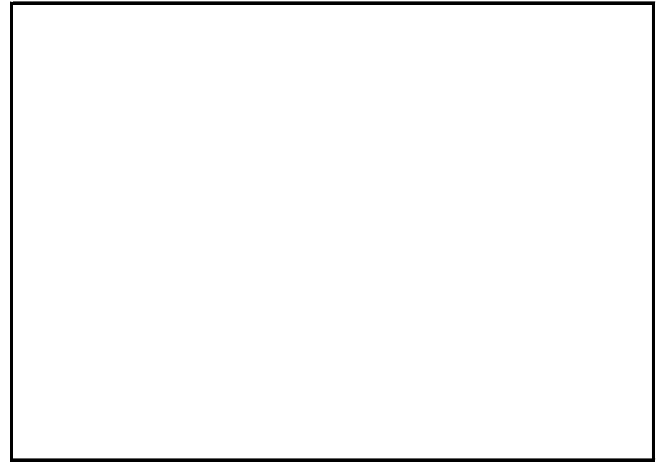
As-Built/Year 1 Survey: August 2012



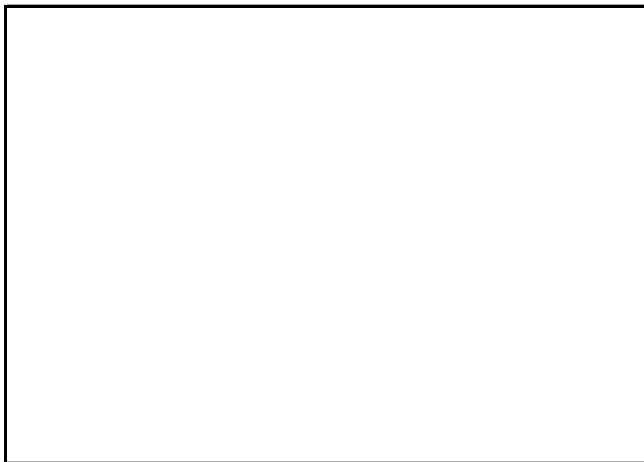
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

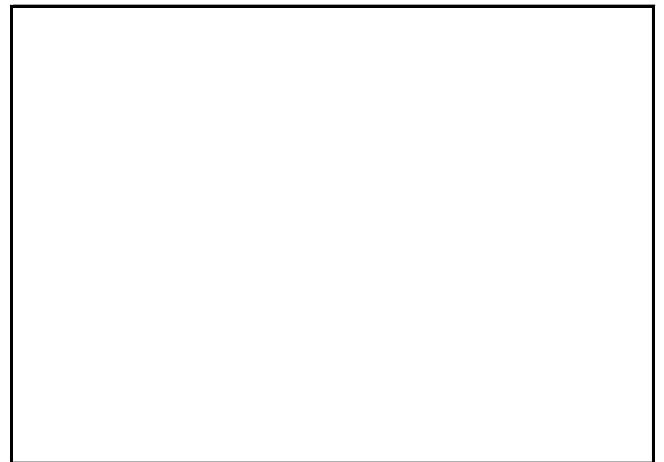
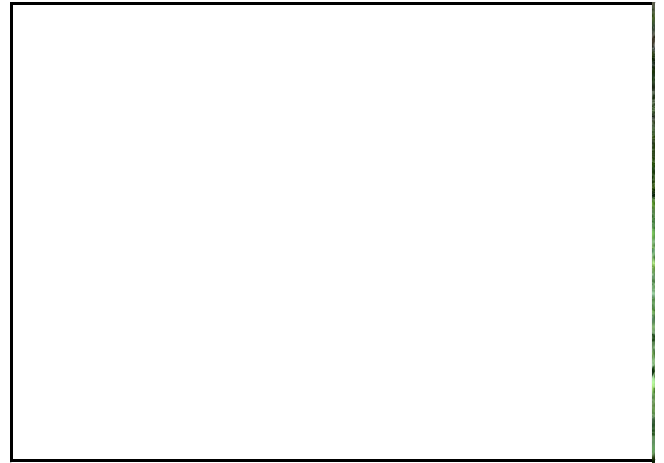


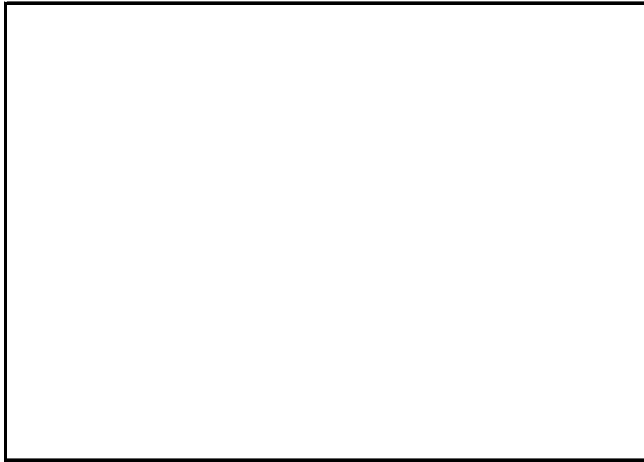
Photo Point 26; Looking Downstream Along East 2



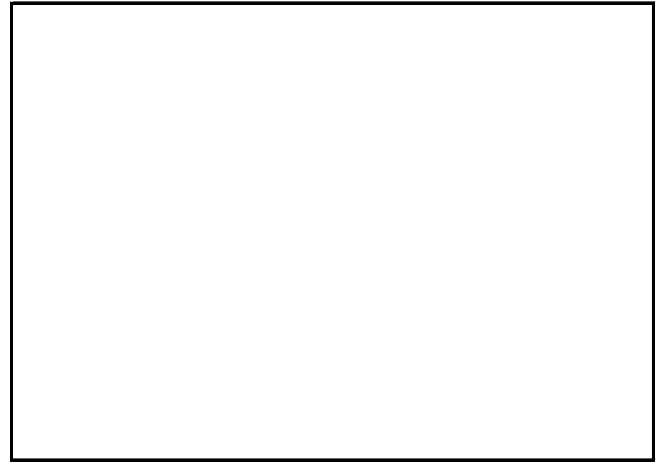
As-Built/Year 1 Survey: August 2012



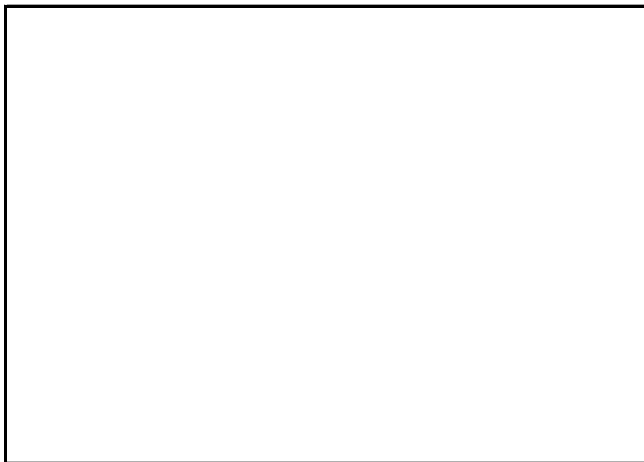
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

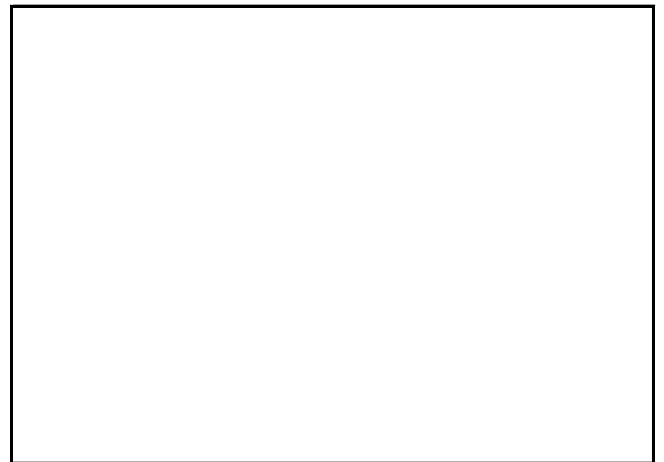
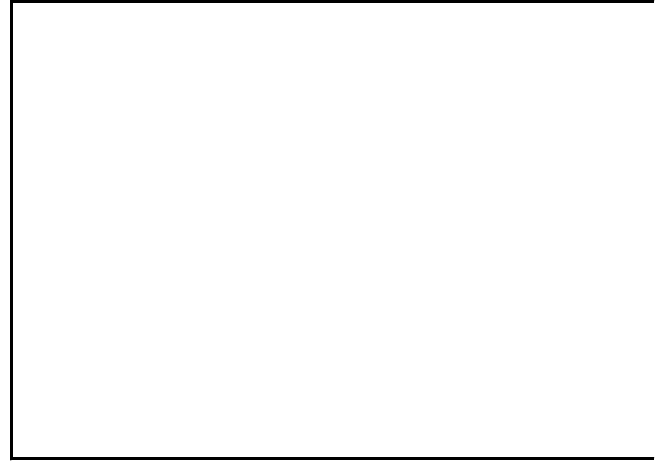


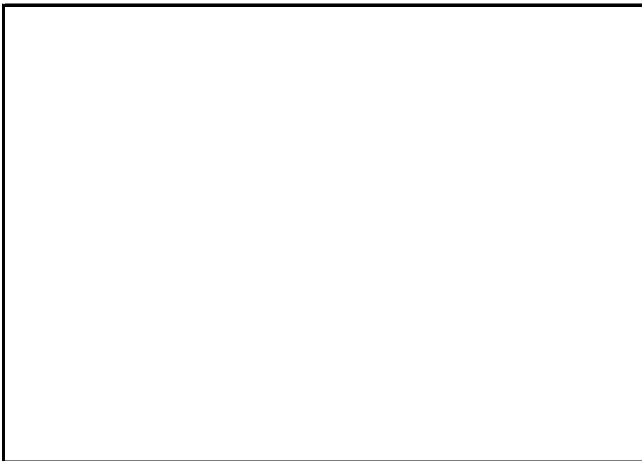
Photo Point 27; Looking Upstream Along Main East



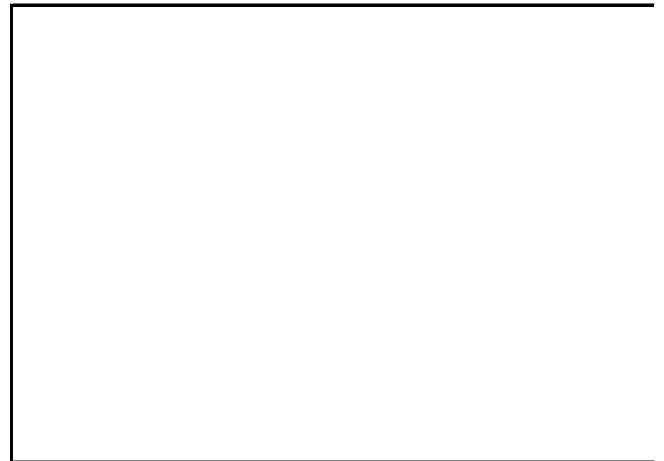
As-Built/Year 1 Survey: August 2012



Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



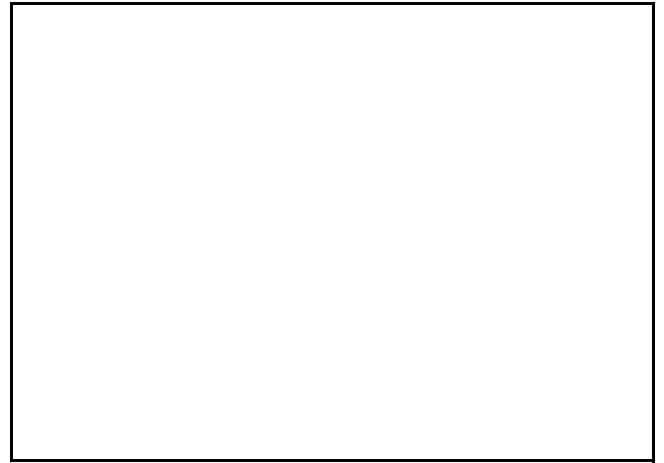
Year 5 Monitoring:



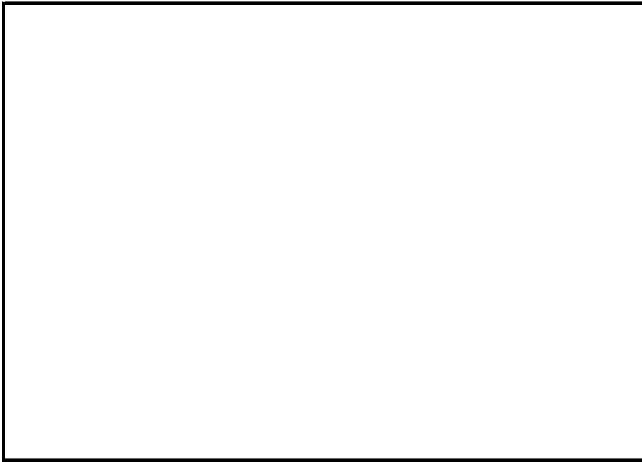
Photo Point 27; Looking Downstream Along Main East



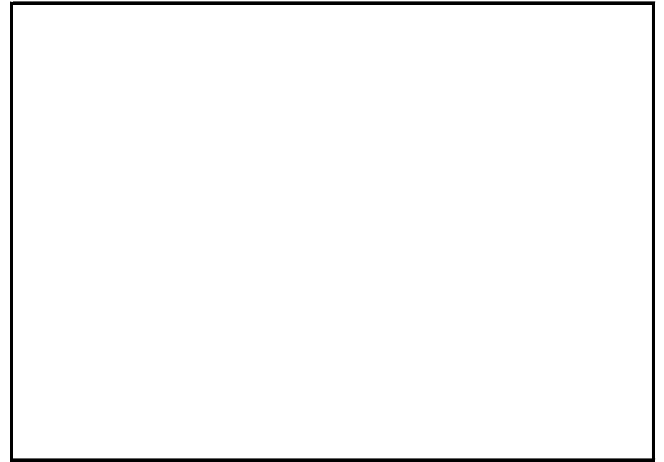
As-Built/Year 1 Survey: August 2012



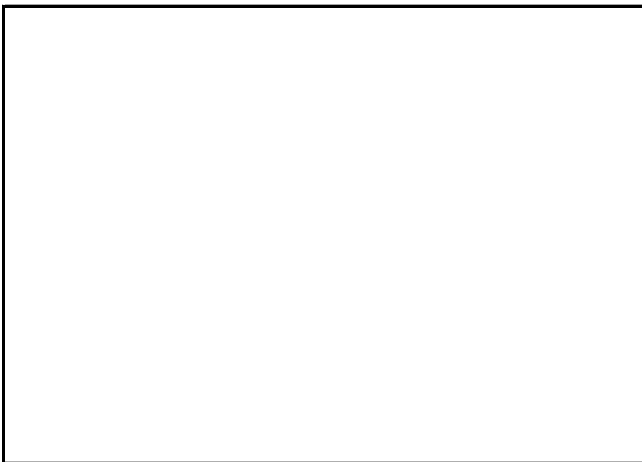
Year 2 Monitoring:



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Year 4 Monitoring:



Year 5 Monitoring:

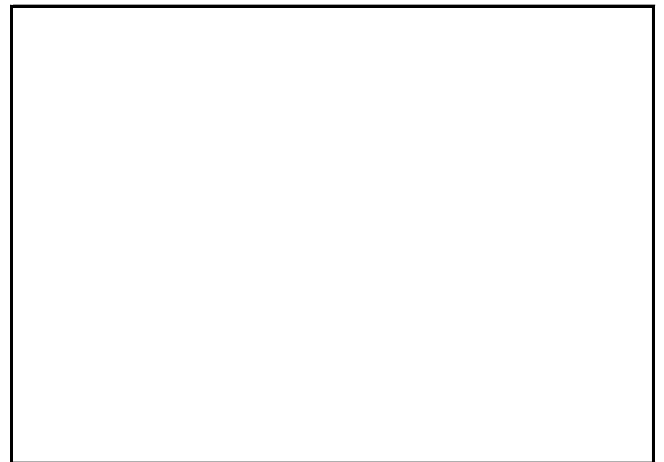
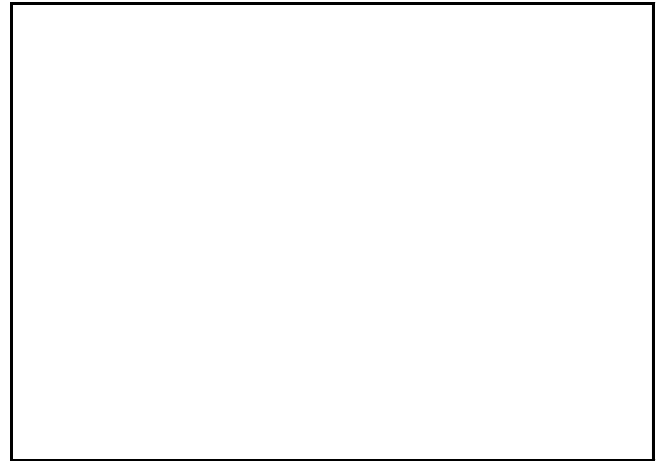


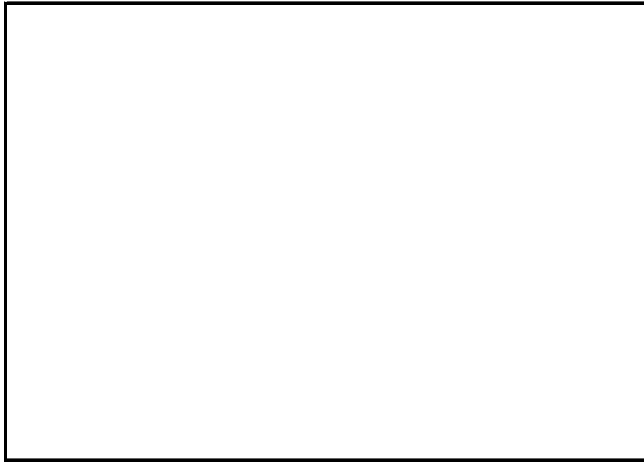
Photo Point 28; Looking Upstream Along East 3



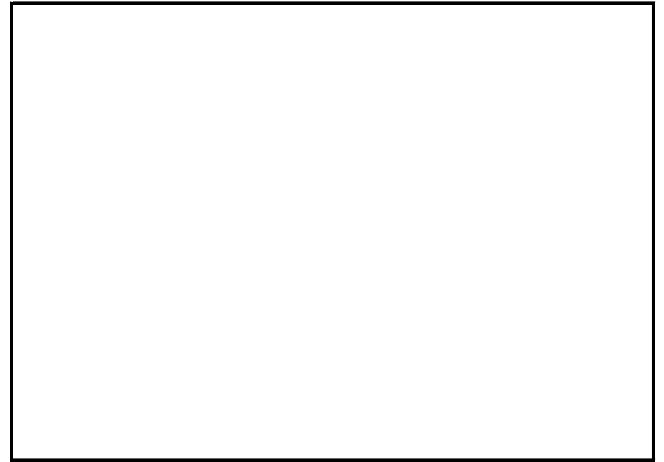
As-Built/Year 1 Survey: August 2012



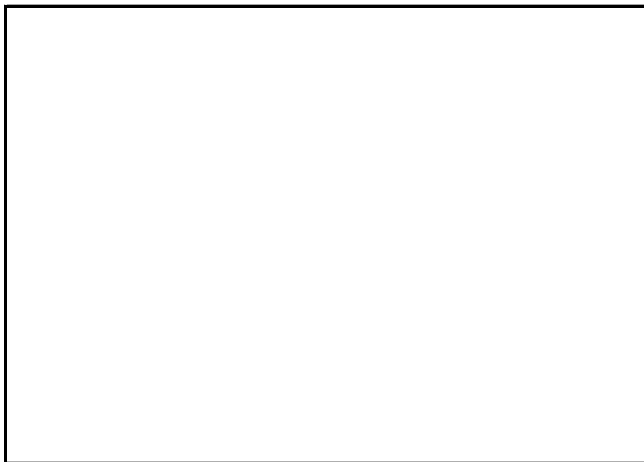
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

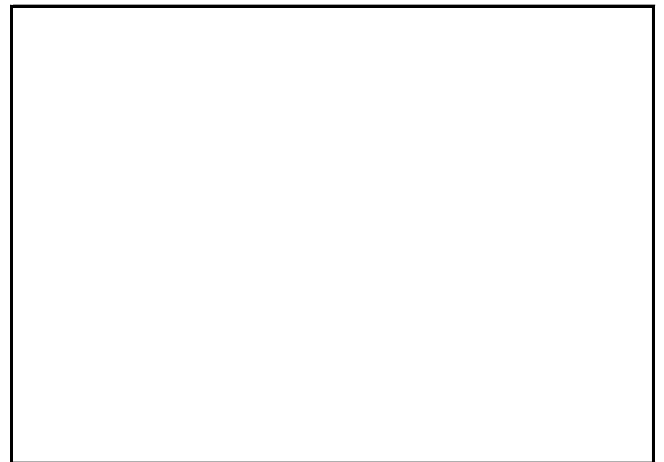
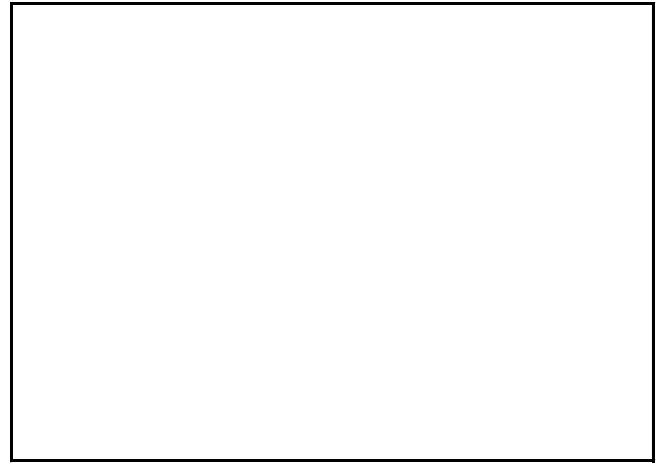


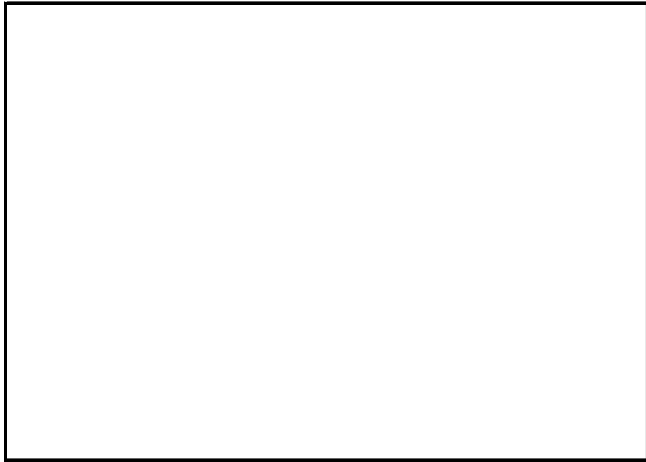
Photo Point 28; Looking Across Crossing Along East 3



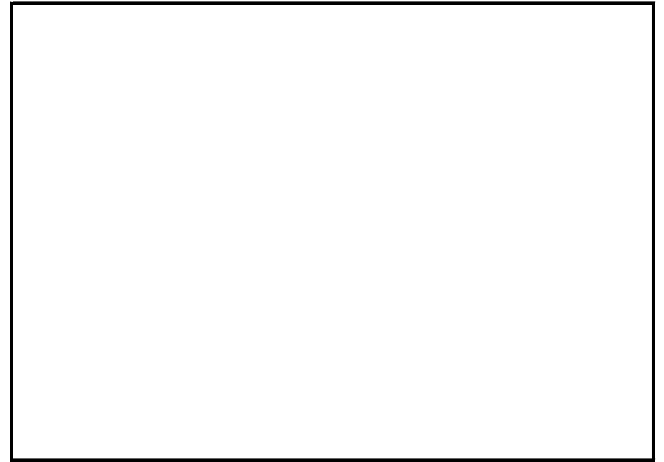
As-Built/Year 1 Survey: August 2012



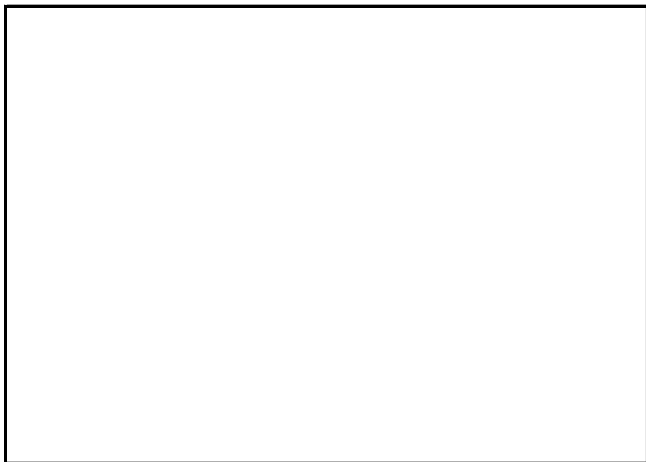
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

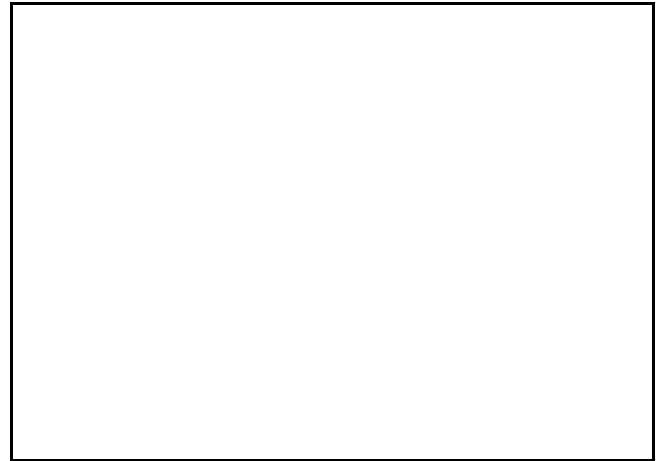


Year 5 Monitoring:

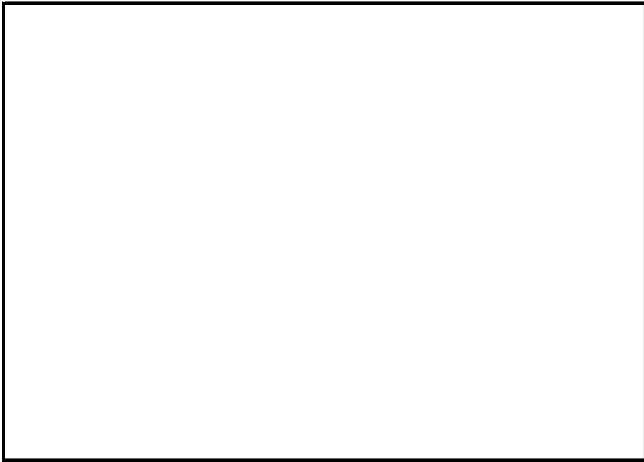
Photo Point 28; Looking Downstream Along East 3



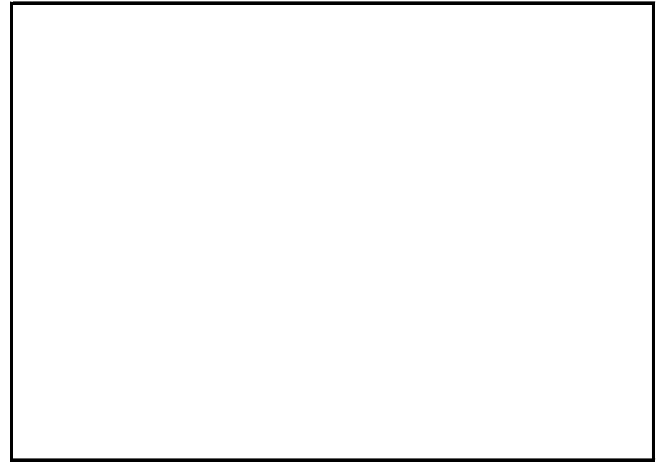
As-Built/Year 1 Survey: August 2012



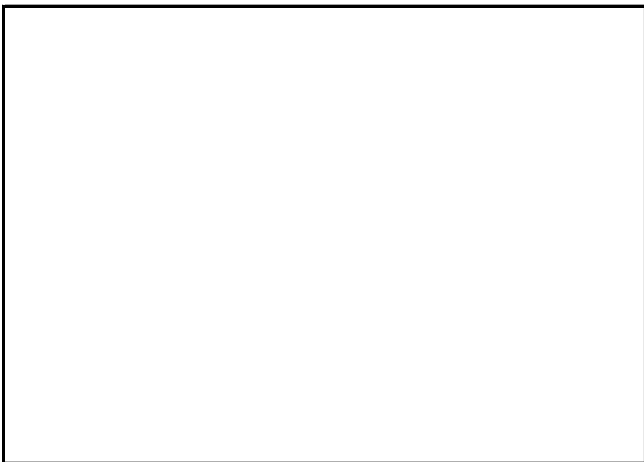
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

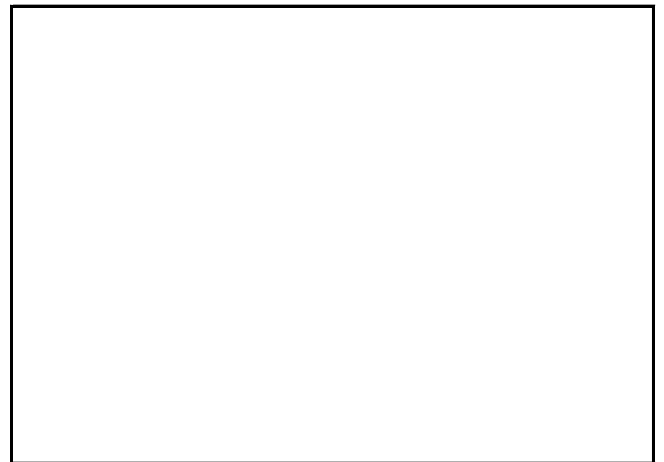
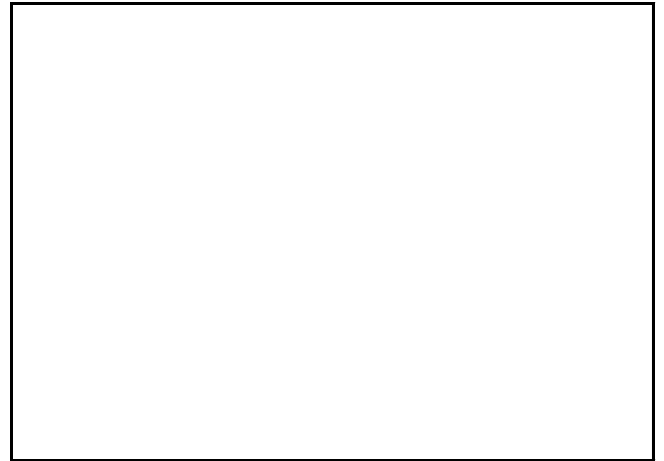


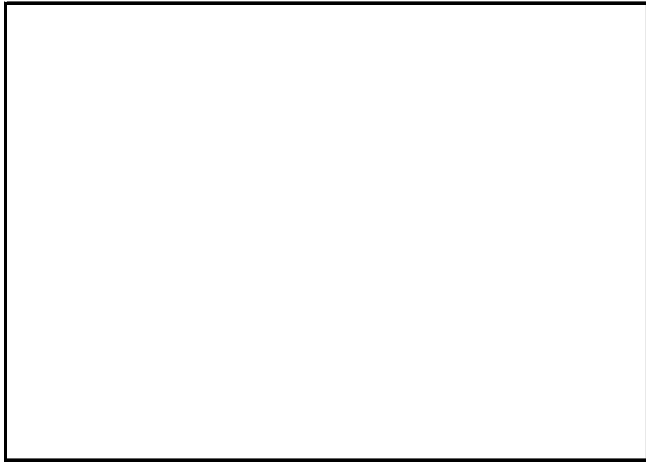
Photo Point 29; Looking Upstream Along Main East



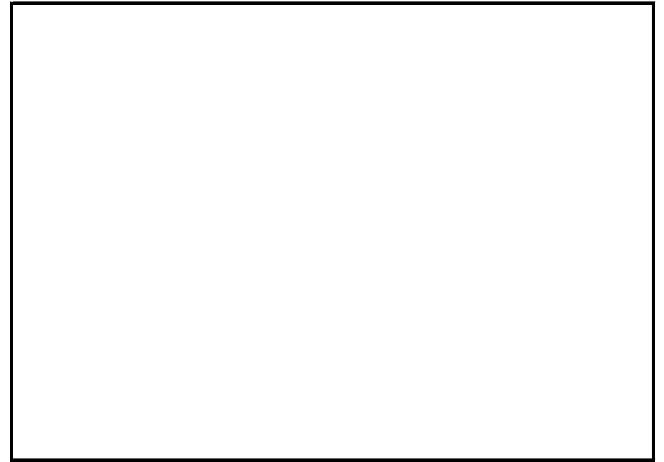
As-Built/Year 1 Survey: August 2012



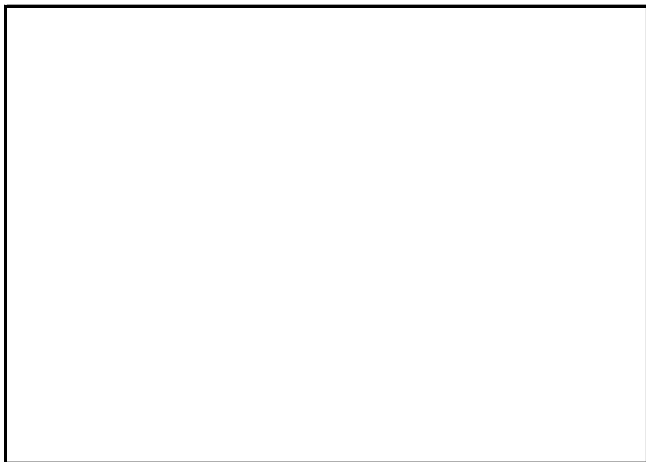
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

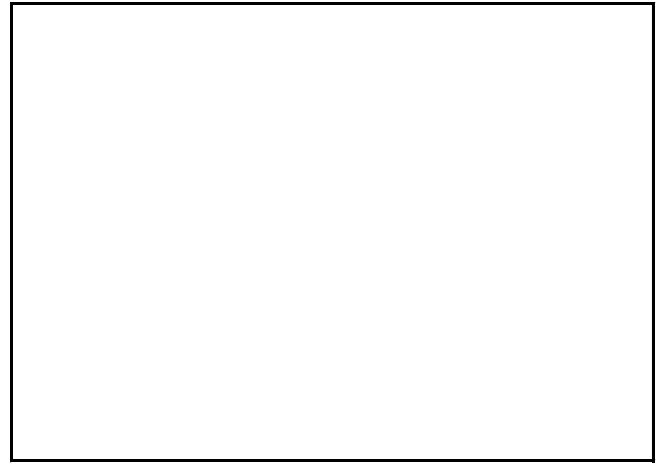


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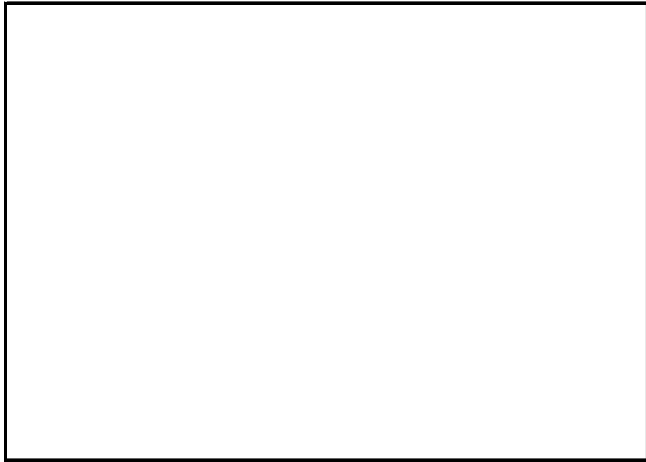
Photo Point 29; Looking Across Crossting Along Main East



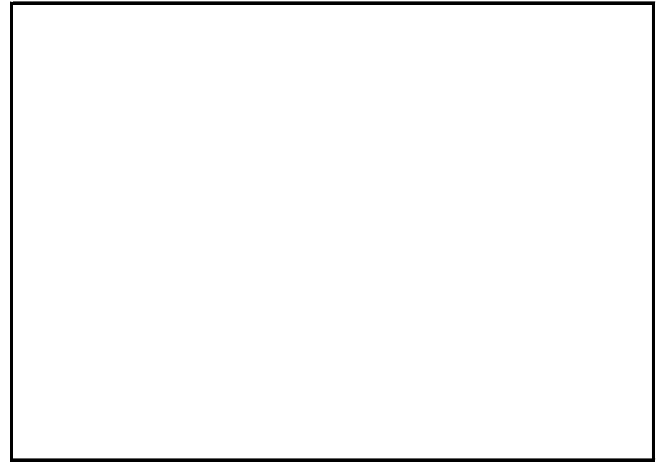
As-Built/Year 1 Survey: August 2012



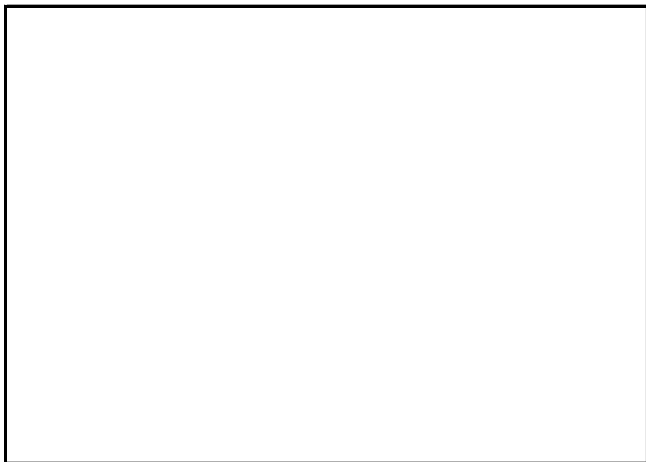
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Year 3 Monitoring:



Year 4 Monitoring:

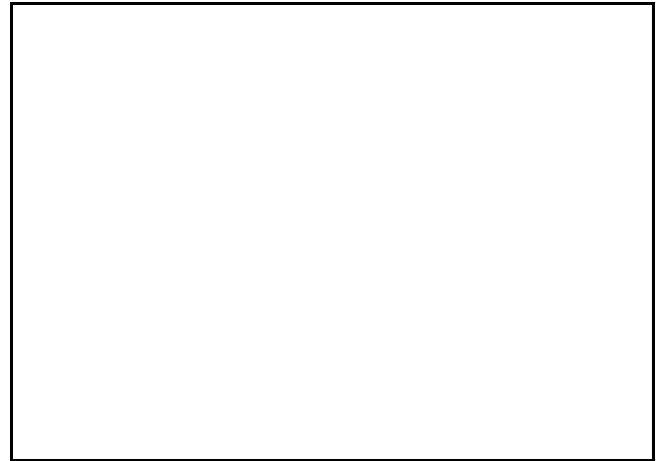


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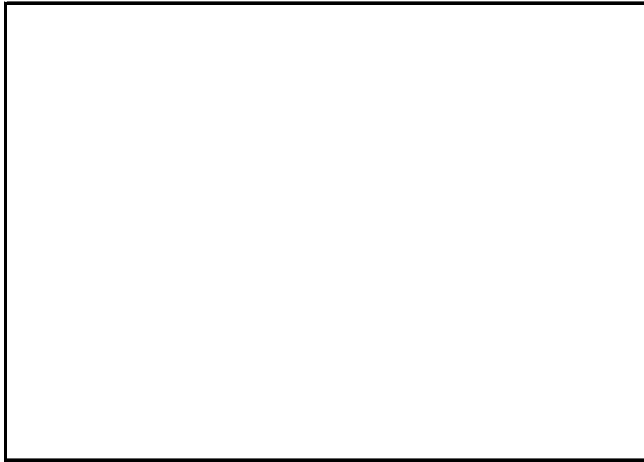
Photo Point 29; Looking Upstream Along Main East



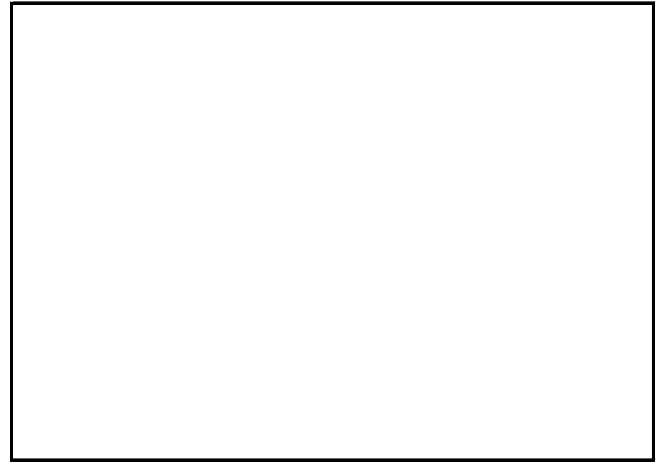
As-Built/Year 1 Survey: August 2012



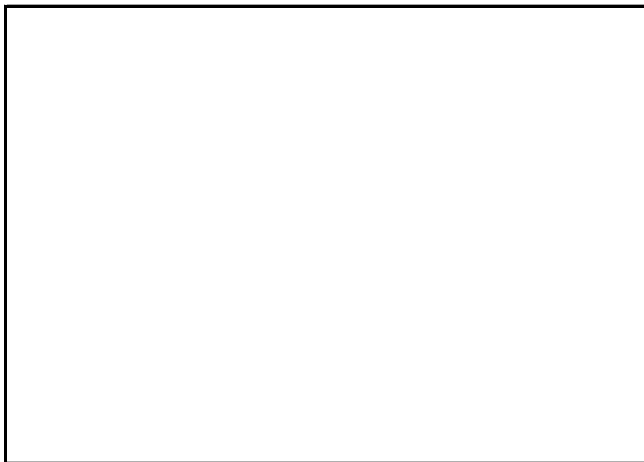
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

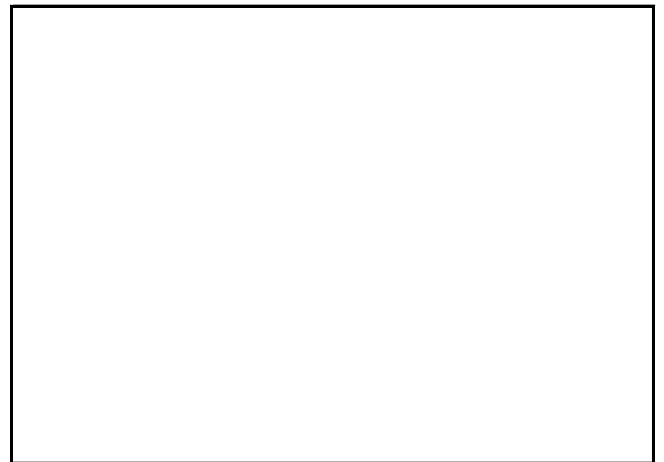
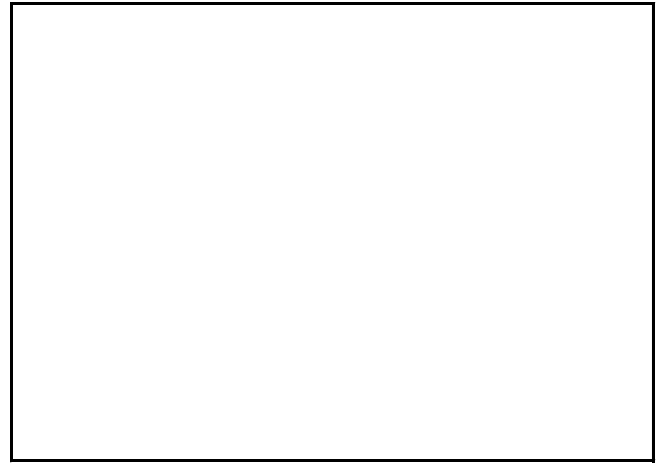


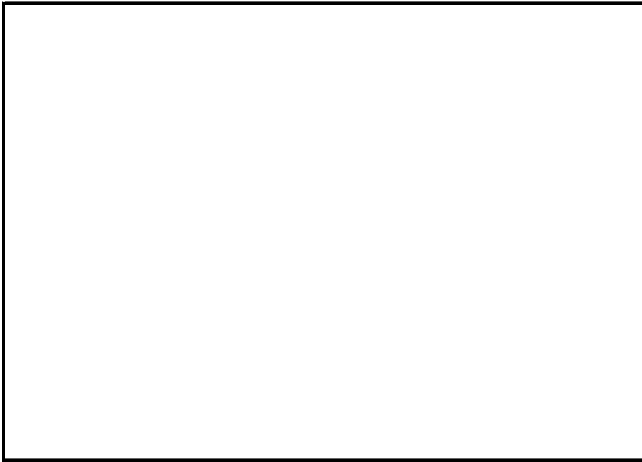
Photo Point 30; Looking Upstream Along Main East



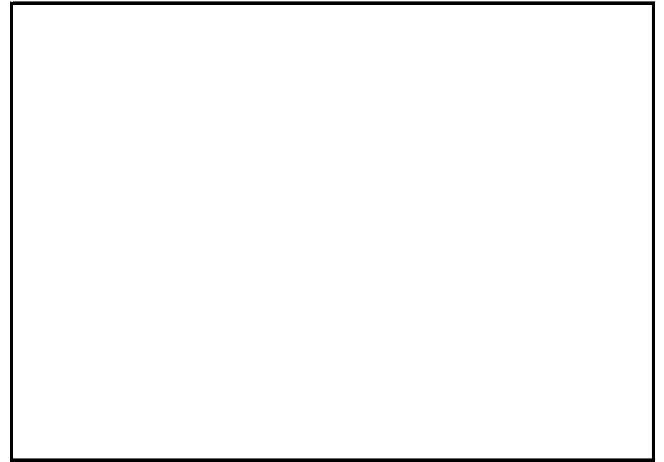
As-Built/Year 1 Survey: August 2012



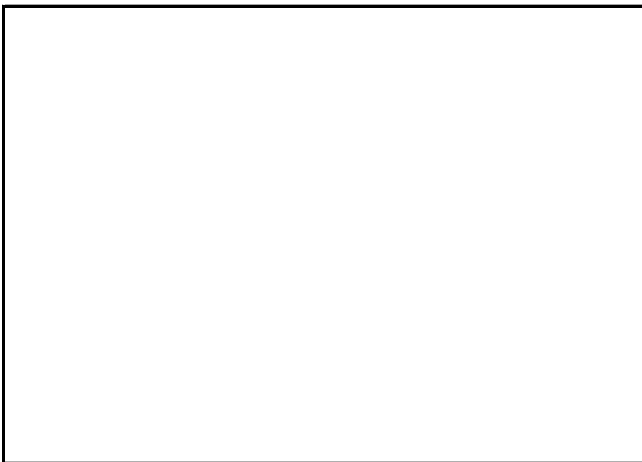
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

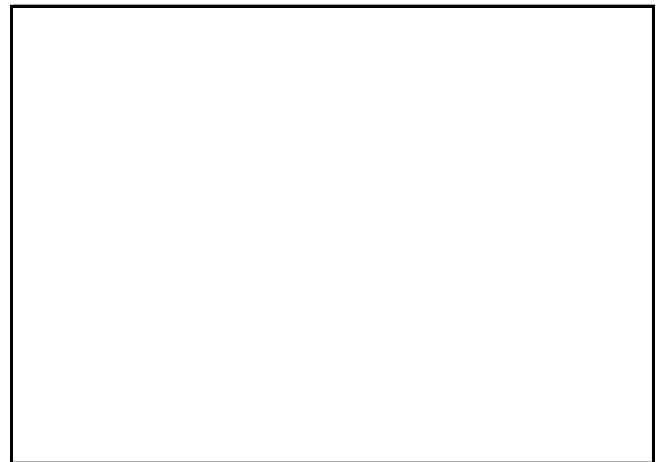
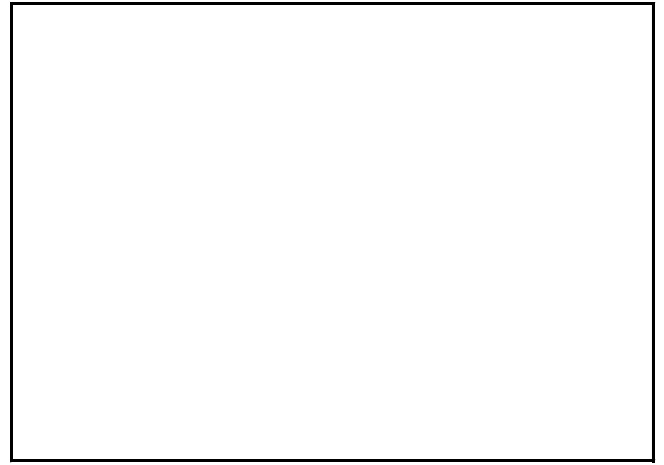




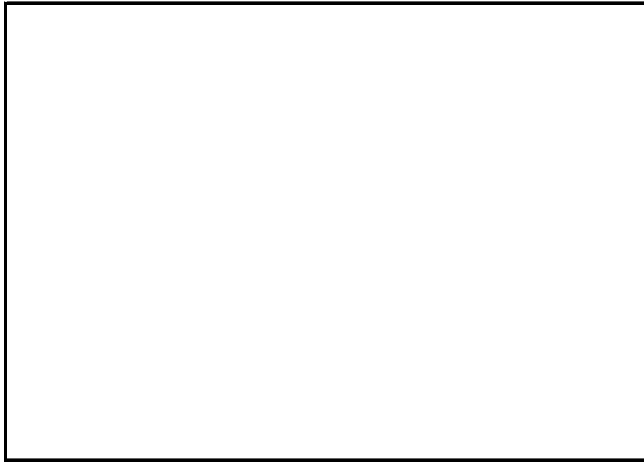
Photo Point 30; Looking Across Main East



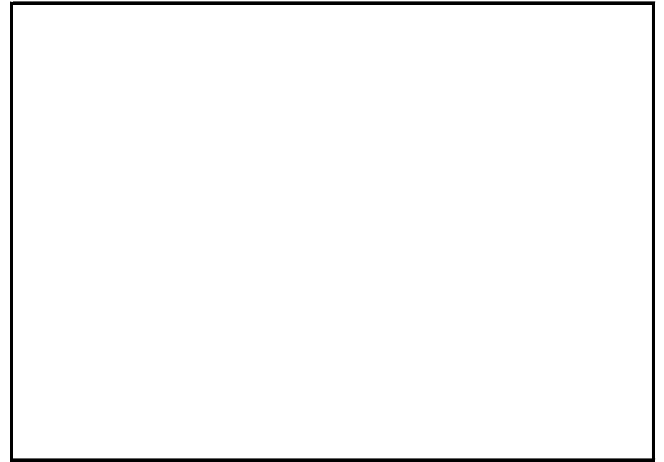
As-Built/Year 1 Survey: August 2012



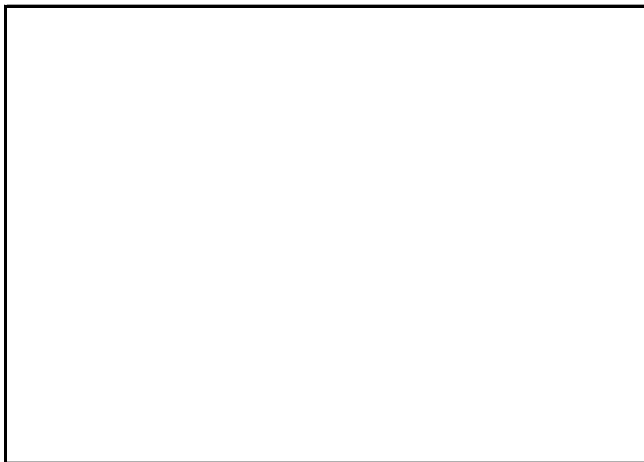
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

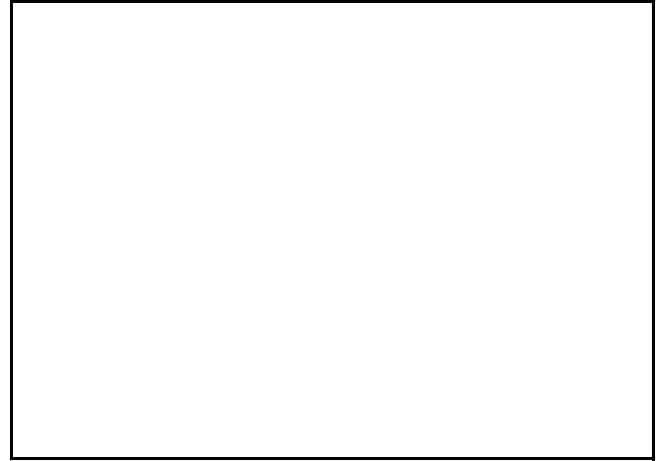


Year 5 Monitoring:

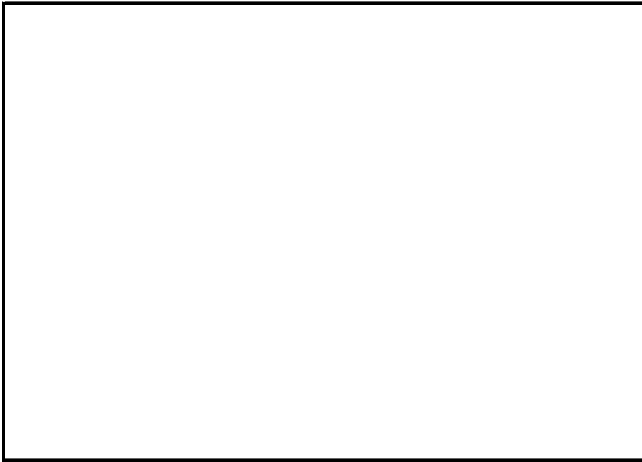
Vegetation Plot 1



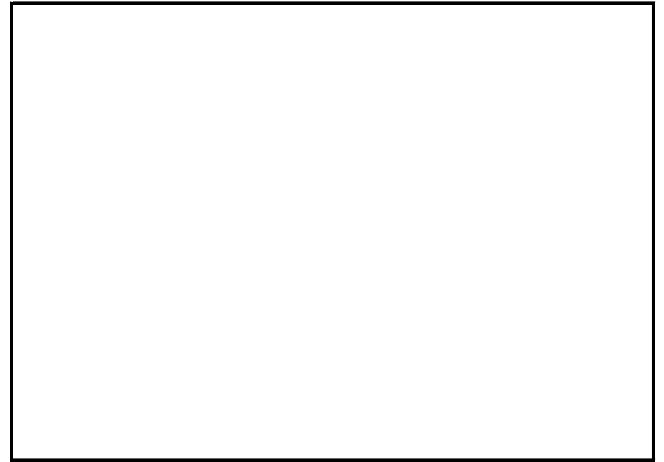
As-Built Survey/Year 1 Monitoring: September 2012



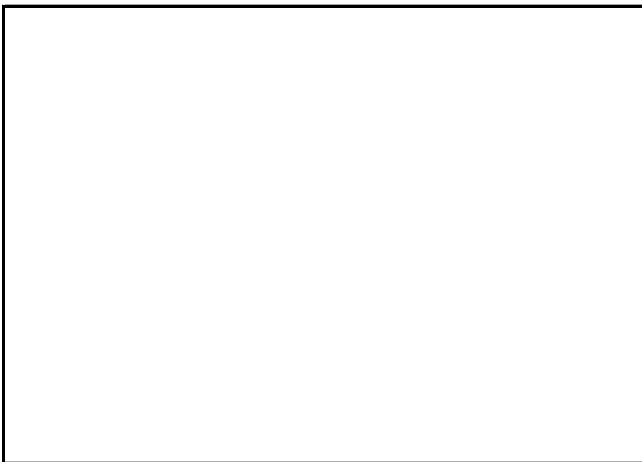
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

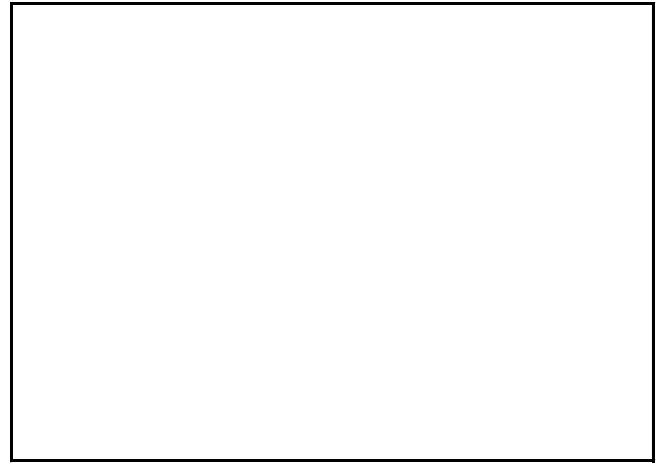


Year 5 Monitoring:

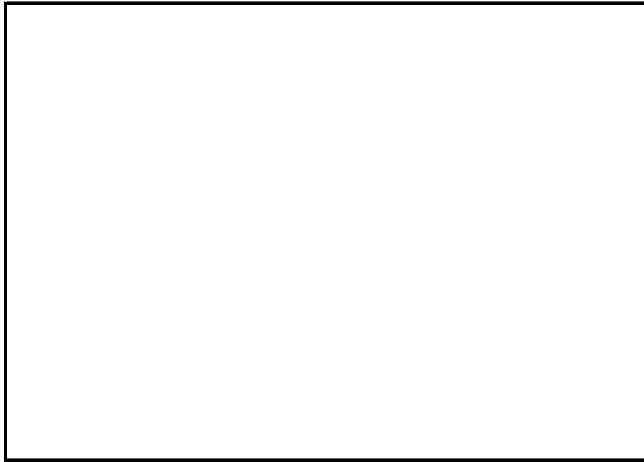
Vegetation Plot 2



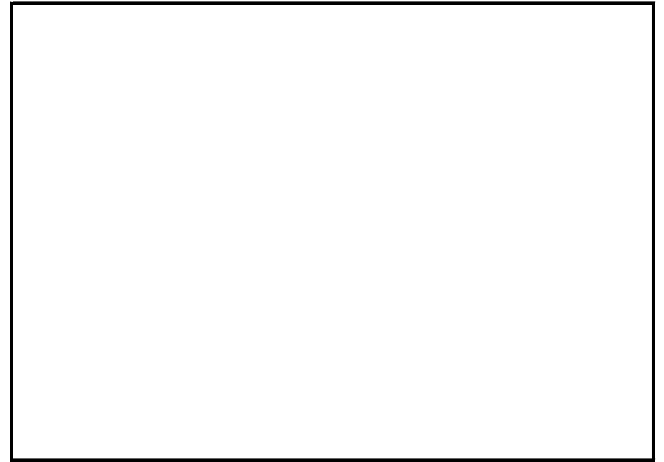
As-Built Survey/Year 1 Monitoring: September 2012



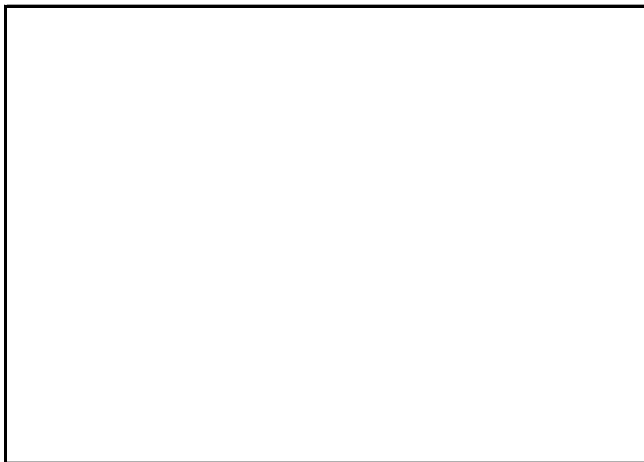
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

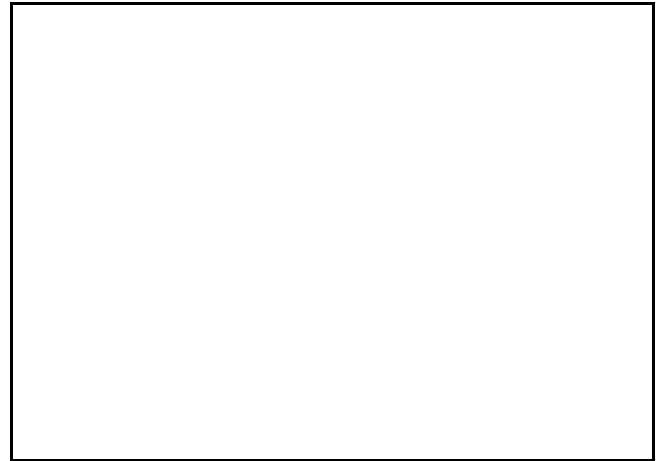


Year 5 Monitoring:

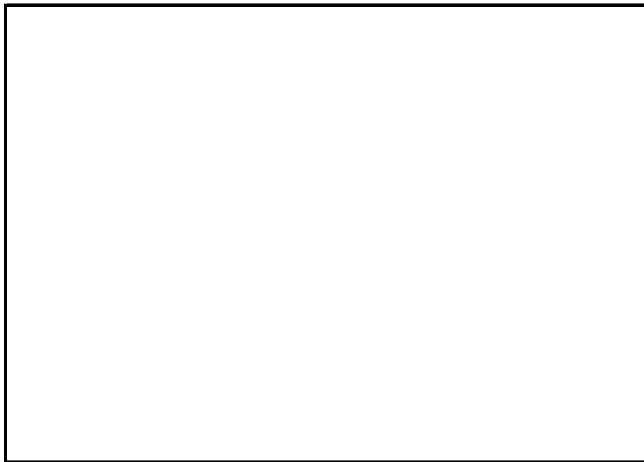
Vegetation Plot 3



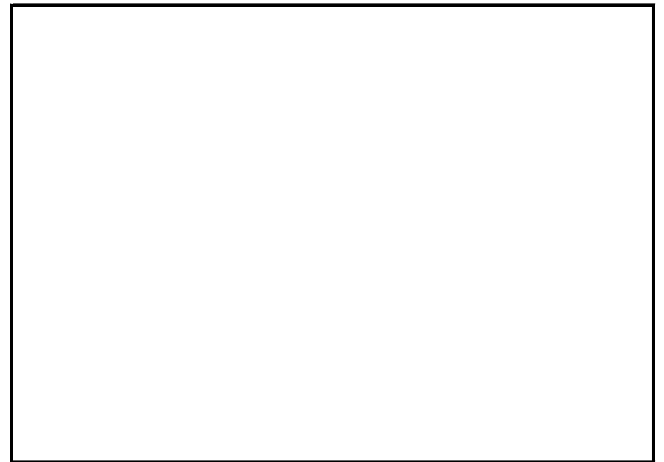
As-Built Survey/Year 1 Monitoring: September 2012



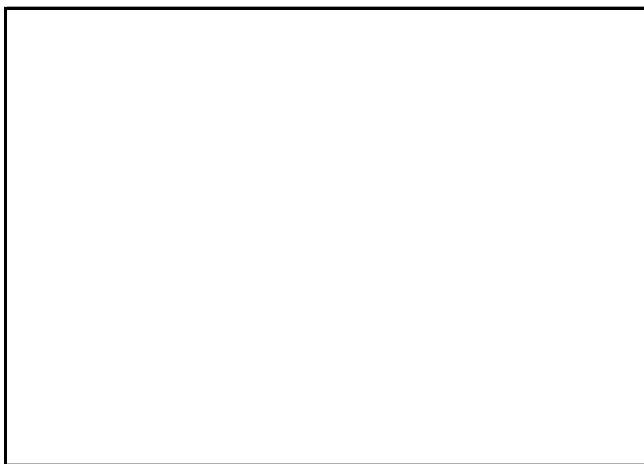
Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:

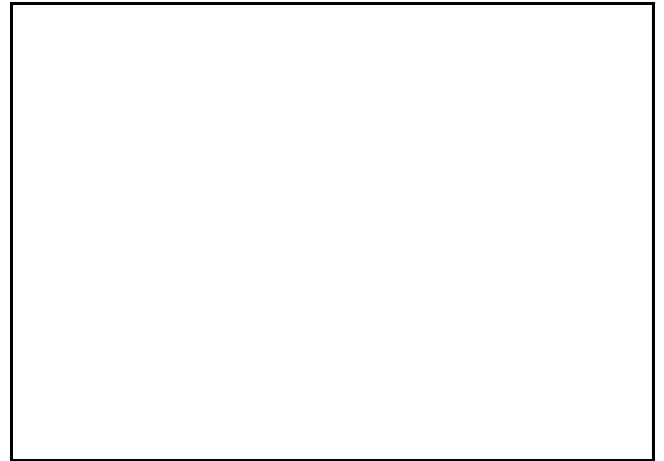


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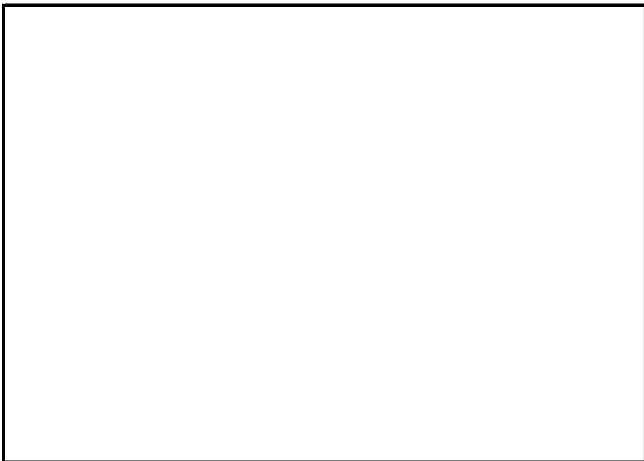
Vegetation Plot 4



As-Built Survey/Year 1 Monitoring: September 2012



Year 2 Monitoring:



Year 3 Monitoring:



Year 4 Monitoring:



Year 5 Monitoring:

## **APPENDIX C**

### **Vegetation Plot Data**

Table 6	Vegetation Plot Attributes and Criteria Attainment
Table 7	CVS Vegetation Metadata Table
Table 8	Planted and Total Stem Counts (Species by Plot with Annual Means)
Table 9	Final Plant List for UT to Haw River Stream Enhancement Project (#747)

**Table 6. Vegetation Plot Attributes and Criteria Attainment - Baseline/MY1 (2012)  
UT to Haw River Stream Enhancement Project (#747)**

<b>Plot ID</b>	<b>Community Type</b>	<b>Planting Zone ID</b>	<b>Reach ID</b>	<b>Associated Gauges(s)</b>	<b>Method</b>	<b>CVS Level</b>	<b>Survival Threshold Met?</b>	<b>Tract Mean</b>
1	Mesic Mixed Hardwood	3	Main Center	NA	CVS	I&II	Yes	100%
2	Mesic Mixed Hardwood	3	Main Center	NA	CVS	I&II	Yes	
3	Mesic Mixed Hardwood	3	Main Center	NA	CVS	I&II	Yes	
4	Mesic Mixed Hardwood	3	Main East	NA	CVS	I&II	No	0%

**Table 7. CVS Vegetation Metadata Table - UT to Haw River Stream Enhancement Project (#747)  
Baseline/MY1 (2012)**

<b>Report Prepared By</b>	Brian Dustin
<b>Date Prepared</b>	11/21/2012 13:02
<b>Database name</b>	cvs-eep-entrytool-v2.3.1.mdb
<b>Database location</b>	G:\Project\2012\2012058.00\ENV\MONITORING\Baseline&Monitoring Year 1\CVS Database\cvs-eep-entrytool-v2.3.1
<b>Computer name</b>	BDUSTIN7
<b>File size</b>	61079552
<b>DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----</b>	
<b>Metadata</b>	Description of database file, the report worksheets, and a summary of project(s) and project data.
<b>Proj, planted</b>	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
<b>Proj, total stems</b>	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
<b>Plots</b>	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
<b>Vigor</b>	Frequency distribution of vigor classes for stems for all plots.
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
<b>Damage by Spp</b>	Damage values tallied by type for each species.
<b>Damage by Plot</b>	Damage values tallied by type for each plot.
<b>Planted Stems by Plot and Spp</b>	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
<b>ALL Stems by Plot and spp</b>	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
<b>PROJECT SUMMARY-----</b>	
<b>Project Code</b>	747
<b>Project Name</b>	UT to Haw River
<b>Description</b>	The Unnamed Tributary (UT) to Haw River Stream Enhancement Site (Site) is situated in the northwest corner of Alamance County, North Carolina. Specifically, the Site is located on multiple UTs to the Haw River approximately 2.8 miles southeast of the Tow
<b>River Basin</b>	Cape Fear
<b>Length(ft)</b>	
<b>Stream-to-edge width (ft)</b>	
<b>Area (sq m)</b>	15742
<b>Required Plots (calculated)</b>	6
<b>Sampled Plots</b>	4



**Table 8. Planted and Total Stem Counts (Species by Plot with Annual Means) - UT to Haw River Stream Enhancement Project (#747) - Baseline/MY1 (2012)**

			Current Data (Baseline/MY1 2012)								Annual Means									
Species	Common Name	Type	Plot 1		Plot 2		Plot 3		Plot 4		Baseline/MY1		MY2		MY3		MY4		MY5	
			P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T
<i>Carpinus caroliniana</i>	Ironwood	T	1	1			1	1			2	2								
<i>Celtis laevigata</i>	Sugarberry	T			1	1					1	1								
<i>Cercis canadensis</i>	Redbud	S			2	2					2	2								
<i>Diospyros virginiana</i>	Persimmon	T	2	2	2	2					4	4								
<i>Fraxinus pennsylvanica</i>	Green ash	T							1	1	1	1								
<i>Hamamelis virginiana</i>	Witch hazel	S	4	4							4	4								
<i>Ilex decidua</i>	Deciduous holly								1	1	1	1								
<i>Ilex opaca</i>	American holly	T			1	1					1	1								
<i>Liriodendron tulipifera</i>	Tulip poplar	T			1	1					1	1								
<i>Quercus alba</i>	White oak	T	2	2	1	1	7	7			10	10								
<i>Quercus rubra</i>	Northern Red oak	T							1	1	1	1								
<i>Quercus nigra</i>	Water oak	T							1	1	1	1								
<i>Viburnum dentatum</i>	Arrow wood	S			1	1	1	1			2	2								
<i>Viburnum prunifolium</i>	Black haw	S							1	1	1	1								
	Uknown				1	1					1	1								
<b>Stem count</b>			9	9	10	10	9	9	5	5	33	33	0	0	0	0	0	0	0	0
<b>Size (ares)</b>			1		1		1		1		4									
<b>Size (acres)</b>			0.02		0.02		0.02		0.02		0.10									
<b>Species Count</b>			4	4	8	8	3	3	5	5	15	15								
<b>Stems per acre</b>			364.37	364.37	404.86	404.86	364.37	364.37	202.43	202.43	334.01	334.01								

Type = T - Tree, S- Shrub, H - Herb, L - Livestake

P = Planted

T = Total

Table 9. Final Plant List for UT to Haw River Stream Enhancement Project (#747)

				Zone 1 Stream Banks		Zone 2 Riparian		Zone 3 Mesic Mixed Hardwoods		Zone 4 Wetland Seeps	
Species	Common Name	Wetland Indicator Status	Container Size	0.11 ac		0.54		3.32		0.01	
				No. Planted	%	No. Planted	%	No. Planted	%	No. Planted	%
<i>Aronia arbutifolia</i>	Choke cherry	FACW	Tubeling							16	14%
<i>Asimina triloba</i>	Common paw-paw	FAC	Gallon			10	2%				
<i>Betula nigra</i>	River birch	FACW	Gallon			24	5%				
<i>Carpinus caroliniana</i>	Ironwood	FAC	Gallon					93	6%		
<i>Carya tomentosa</i>	Mockernut hickory	UPL	Gallon					27	2%		
<i>Celtis laevigata</i>	Sugarberry	FACW	Gallon					62	4%		
<i>Cercis canadensis</i>	Redbud	FACU	Gallon					62	4%		
<i>Chionanthus virginicus</i>	White Fringetree	FACU	Gallon					12	1%		
<i>Cornus amomum</i>	Silky dogwood	FACW	Gallon/Live Stake	100	29%	48	10%				
<i>Corylus americana</i>	American hazelnut	FACU	Gallon					62	4%		
<i>Diospyros virginiana</i>	Persimmon	FAC	Gallon					230	15%		
<i>Fraxinus pennsylvanica</i>	Green ash	FACW	Gallon			48	10%				
<i>Hamamelis virginiana</i>	Witch hazel	FAC	Gallon					62	4%		
<i>Ilex decidua</i>	Deciduous holly	FACW	Gallon					58	4%		
<i>Ilex opaca</i>	American holly	FAC	Gallon					34	2%		
<i>Ilex verticillata</i>	Winterberry	FACW	Gallon			9	2%				
<i>Itea virginica</i>	Virginia sweetspire	FACW	Gallon			10	2%				
<i>Juniperus virginiana</i>	Eastern red cedar	FACU	Gallon					60	4%		
<i>Lindera benzoin</i>	Spice bush	FACW	Gallon			24	5%				
<i>Liriodendron tulipifera</i>	Tulip poplar	FAC	Gallon					62	4%		
<i>Lobelia cardinalis</i>	Cardinal flower	FACW	Gallon							25	22%
<i>Osmunda cinnamomea</i>	Cinnamon fern	FACW	Gallon							25	22%
<i>Plantanus occidentalis</i>	Sycamore	FACW	Gallon			48	10%				
<i>Physocarpus opulifolius</i>	Atlantic ninebark	FAC	Live Stake	50	14%						
<i>Prunus serotina</i>	Black cherry	FACU	Gallon					25	2%		
<i>Quercus alba</i>	White oak	FACU	Gallon					206	13%		
<i>Quercus falcata</i>	Southern red oak	FACU	Gallon								
<i>Quercus falcata var pagodifolia</i>	Cherrybark oak	FAC	Gallon			48	10%				
<i>Quercus michauxii</i>	Swamp chestnut oak	FACW	Gallon			48	10%				
<i>Quercus nigra</i>	Water oak	FAC	Gallon			48	10%	32	2%		
<i>Quercus phellos</i>	Willow oak	FACW	Gallon			26	5%				
<i>Quercus rubra</i>	Northern red oak	FACU	Gallon					221	14%		
<i>Salix nigra</i>	Black willow	OBL	Live Stake	25	7%						
<i>Salix serecis</i>	Silky willow	OBL	Live Stake	100	29%						
<i>Sambucus canadensis</i>	Elderberry	FACW	Gallon/Live Stake	75	21%	23	5%				
<i>Saururus cernuus</i>	Lizard tail	OBL	Gallon							25	22%
<i>Symphoricarpos orbiculatus</i>	Coralberry	OBL	Gallon							25	22%
<i>Ulmus americana</i>	American elm	FACW	Gallon			47	10%	14	1%		
<i>Vaccinium corymbosum</i>	Highbush blueberry	FACW	Gallon			10	2%				
<i>Viburnum dentatum</i>	Arrow wood	FAC	Gallon					124	8%		
<i>Viburnum prunifolium</i>	Black haw	FACU	Gallon					82	5%		
<i>Viburnum nudum</i>	Possum haw viburnum	FACW	Gallon			9	2%				
<i>Viburnum rufidulum</i>	Rusty black haw	FACU	Gallon					20	1%		

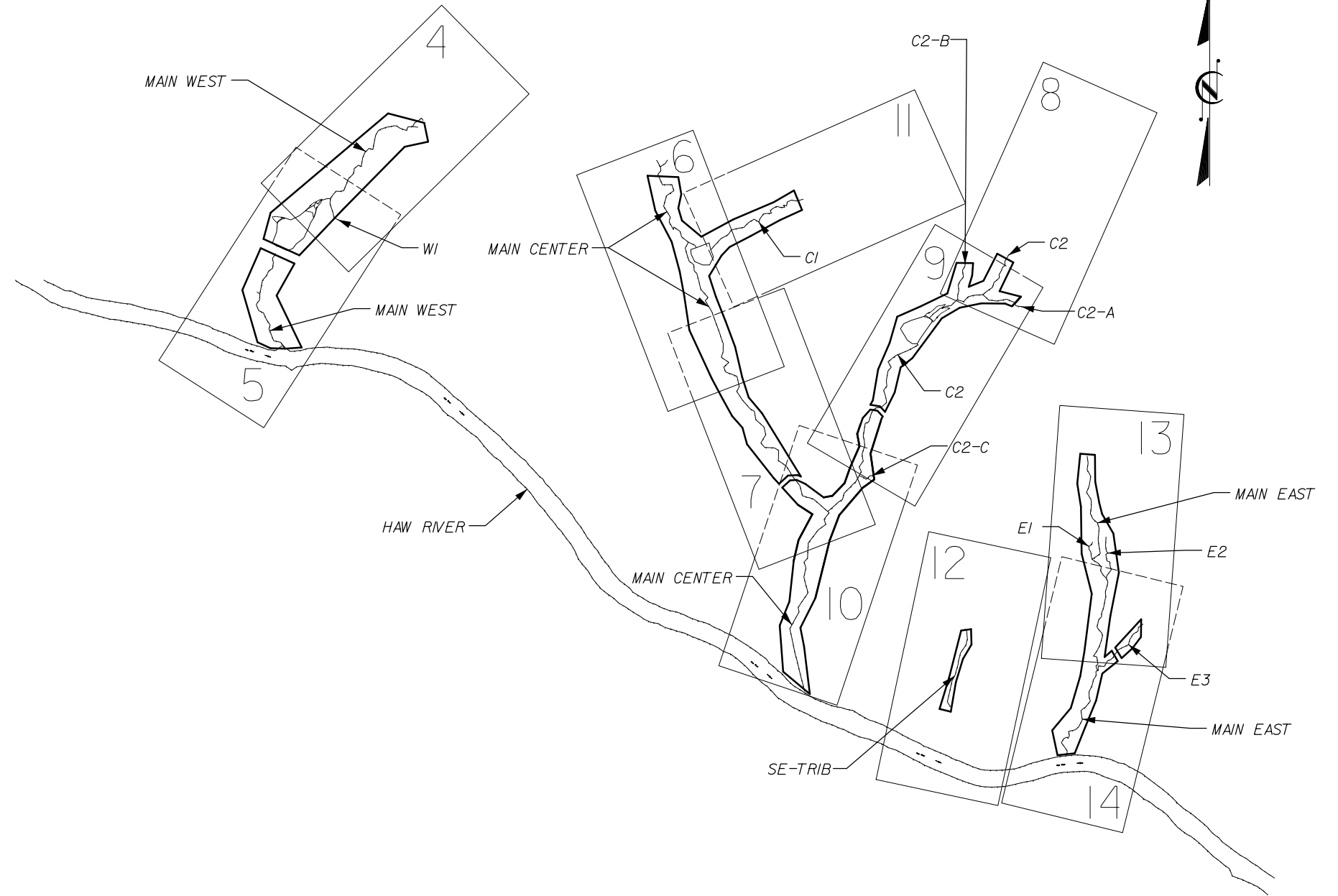
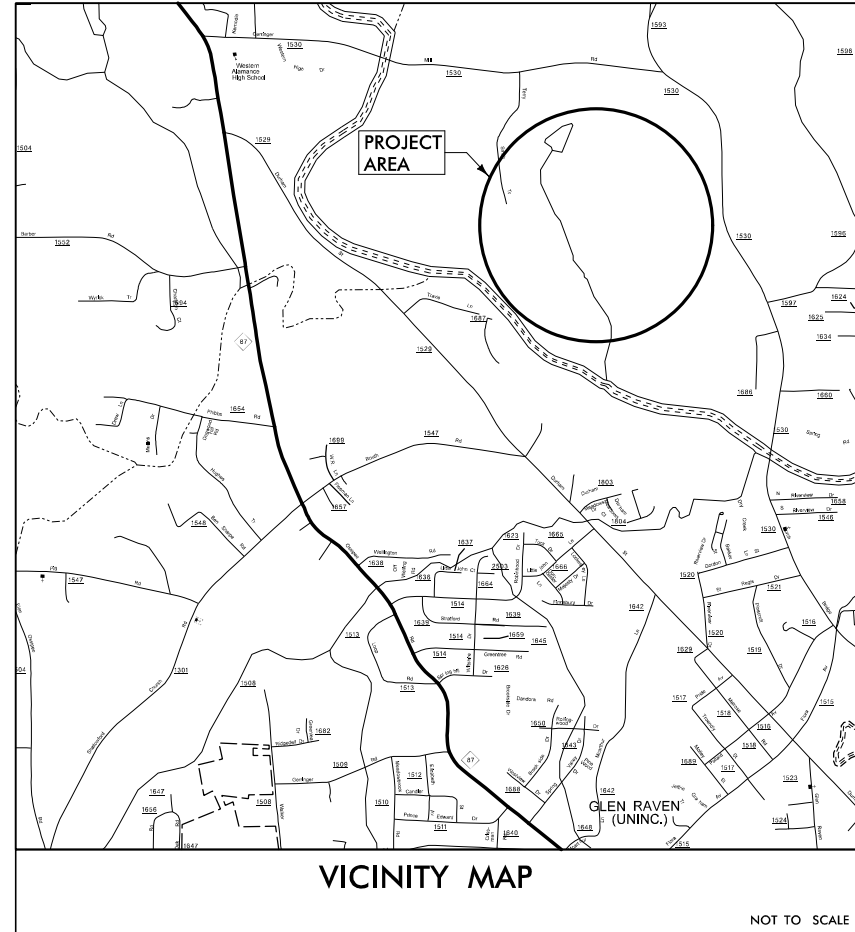
**APPENDIX D**  
**Record Drawing Plan Sheets**

# ALAMANCE COUNTY

## UT TO HAW RIVER STREAM ENHANCEMENT PROJECT

LOCATION: APPROXIMATELY 2.8 MILES SOUTHEAST OF THE TOWN OF OSSISPEE AND 3.1 MILES NORTHWEST OF THE CITY OF BURLINGTON

### RECORD DRAWINGS



INDEX OF SHEETS	
SHEET NUMBER	SHEET
1	TITLE SHEET
1A	LEGEND
4 - 15	PLAN AND CROSS SECTIONS
PLT-4 - PLT-14	PLANTING

DISTURBED AREA = +/- 19.5 ACRES

NOT TO SCALE

REVISIONS		SCALE AS SHOWN	PLANS PREPARED BY:	PROJECT ENGINEER	PLANS PREPARED FOR	
DATE	BY					DESCRIPTION
1/18/08	JTL	PRELIMINARY PLANS	<p><b>MULKEY</b> ENGINEERS &amp; CONSULTANTS</p> <p>PO BOX 33127 RALEIGH, N.C. 27636 (919) 851-1912 (919) 851-1918 (FAX) WWW.MULKEYINC.COM</p>	<p>MULKEY PROJECT MANAGER THOMAS BARRETT, RF</p> <p>MULKEY ENGINEER EMMETT PERDUE, PE</p> <p>MULKEY SENIOR SCIENTIST THOMAS BARRETT, RF</p>	<p>EHP PROJECT MANAGER PERRY SUGG</p> <p>EHP REVIEW COORDINATOR WYATT BROWN</p>	<p><b>Ecosystem Enhancement</b> PROGRAM</p>
3/27/09	EMP	ISSUED FOR PERMITTING				
6/17/09	EMP	REISSUED FOR PERMITTING				
6/22/09	EMP	REISSUED FOR PERMITTING				
4/06/10	EMP	REISSUED FOR PERMITTING				
6/25/10	MLM	REISSUED FOR PERMITTING	<p>MULKEY PROJECT NUMBER 2007063.00</p>			
10/29/10	EMP	ISSUED FOR BID				
3/04/11	MLM	ISSUED FOR CONSTRUCTION				
2/03/12	EMP	RECORD DRAWINGS				

TITLE SHEET

1 SHEET OF 25

**NOTE: NOT TO SCALE**  
 Not all symbols used in plans

# LEGEND

REVISIONS			PROJECT ENGINEER	PROJECT REFERENCE NO.	SHEET NO.
DATE	BY	DESCRIPTION		UT TO HAW RIVER	1A
1/18/08	JTL	PRELIMINARY PLANS			
3/27/09	EMP	ISSUED FOR PERMITTING			
6/17/09	EMP	REISSUED FOR PERMITTING			
4/06/10	EMP	REISSUED FOR PERMITTING			
6/25/10	MLM	REISSUED FOR PERMITTING			
10/29/10	EMP	ISSUED FOR BID			
3/04/11	MLM	ISSUED FOR CONSTRUCTION			

**MULKEY**  
 ENGINEERS & CONSULTANTS

PO BOX 33127  
 RALEIGH, N.C. 27636  
 (919) 851-1912  
 (919) 851-1918 (FAX)  
 WWW.MULKEYINC.COM

**BOUNDARIES AND PROPERTY:**

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin
- Property Corner
- Property Monument
- Existing Fence
- Temporary Fence
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Tree Protection Fence
- Existing Wetland Boundary
- Proposed Oxbow Wetland Boundary
- Proposed Conservation Easement
- Construction Limits
- Limits Of Disturbance
- Hand Removal of Vegetation
- Proposed Gate
- Benchmark

**BUILDINGS AND OTHER CULTURE:**

- Sign
- Well
- Foundation
- Area Outline
- Building
- School
- Church

**HYDROLOGY:**

- Stream or Body of Water
- Hydro, Pool or Reservoir
- River Basin Buffer
- Flow Arrow
- Disappearing Stream
- Spring
- Thalweg
- Top Of Bank
- Swamp Marsh
- Proposed Lateral, Tail, Head Ditch
- Bedrock

**RAILROADS:**

- Standard Gauge
- RR Signal Milepost
- Switch
- RR Abandoned

**ROADS AND RELATED FEATURES:**

- Existing Edge of Pavement
- Existing Curb
- Existing Soil Road
- Existing Metal Guardrail
- Existing Cable Guiderail

**VEGETATION:**

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard

**EXISTING STRUCTURES:**

- MAJOR:
  - Bridge, Tunnel or Box Culvert
  - Bridge Wing Wall, Head Wall and End Wall
- MINOR:
  - Head and End Wall
  - Pipe Culvert
  - Footbridge
  - Drainage Box: Catch Basin, DI or JB
  - Paved Ditch Gutter
  - Storm Sewer Manhole
  - Storm Sewer

**UTILITIES:**

- POWER:
  - Existing Power Pole
  - Existing Joint Use Pole
  - Power Manhole
  - Power Line Tower
  - Power Transformer
  - U/G Power Cable Hand Hole
  - H-Frame Pole
  - Recorded U/G Power Line
- GAS:
  - Gas Valve
  - Gas Meter
  - Recorded U/G Gas Line
  - Above Ground Gas Line

**TELEPHONE:**

- Existing Telephone Pole
- Telephone Manhole
- Telephone Booth
- Telephone Pedestal
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole
- Recorded U/G Telephone Cable
- Recorded U/G Telephone Conduit
- Recorded U/G Fiber Optics Cable

**WATER:**

- Water Manhole
- Water Meter
- Water Valve
- Water Hydrant
- Recorded U/G Water Line
- Above Ground Water Line

**TV:**

- TV Satellite Dish
- TV Pedestal
- TV Tower
- U/G TV Cable Hand Hole
- Recorded U/G TV Cable
- Recorded U/G Fiber Optic Cable

**MISCELLANEOUS:**

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box
- Utility Unknown U/G Line
- U/G Tank; Water, Gas, Oil
- A/G Tank; Water, Gas, Oil
- Abandoned According to Utility Records
- End of Information

**SANITARY SEWER:**

- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line
- Above Ground Sanitary Sewer
- Recorded SS Forced Main Line

**PROPOSED STREAM WORK:**

**STREAM STRUCTURES:**

- Rock Crossvane
- Rock Vane
- J Hook Rock Vane
- Double Log Drop
- Flood Plain Interceptor/Rock Step Pool
- W- Rock Cross Vane
- Constructed Riffle
- Root Wad
- Structure Number

**STREAM FEATURES:**

- Bankfull
- Vernal Pool
- Proposed Thalweg
- Culvert Pipe

**EROSION CONTROL FEATURES:**

- Permanent At Grade Stream Crossing
- Temporary Construction Entrance/Exit
- Silt Fence
- Straw Wattle
- Staging / Stockpile Area
- Impervious Dike
- Permanent Improved Gravel Road
- Temporary Gravel Road
- Temporary Rock Check Dam
- Impervious Stream Channel Plug
- Fill Existing Stream Channel
- Natural Rock Energy Dissipator Basin Pad

**PLANTING ZONES:**

- Stream Banks
- Upland
- Wetland Seep
- Riparian Buffer
- Invasive Vegetation to be Removed

+

+

\$DATE\$ \$TIME\$ \$FILE\$

REVISIONS		
DATE	BY	DESCRIPTION
1/18/08	JTL	PRELIMINARY PLANS
3/27/09	EMP	ISSUED FOR PERMITTING
6/17/09	EMP	REISSUED FOR PERMITTING
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6/25/10	MLM	REISSUED FOR PERMITTING
10/29/10	EMP	ISSUED FOR BID
3/04/11	MLM	ISSUED FOR CONSTRUCTION
02/03/12	EMP	RECORD DRAWINGS

PROJECT ENGINEER

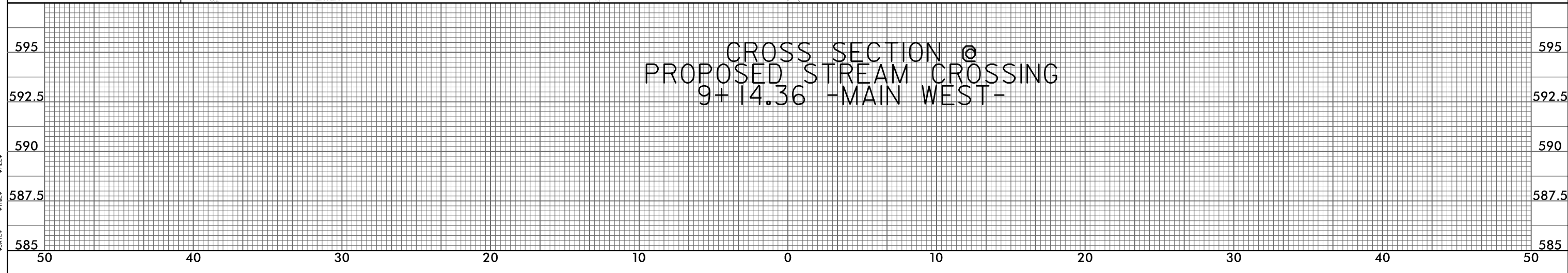
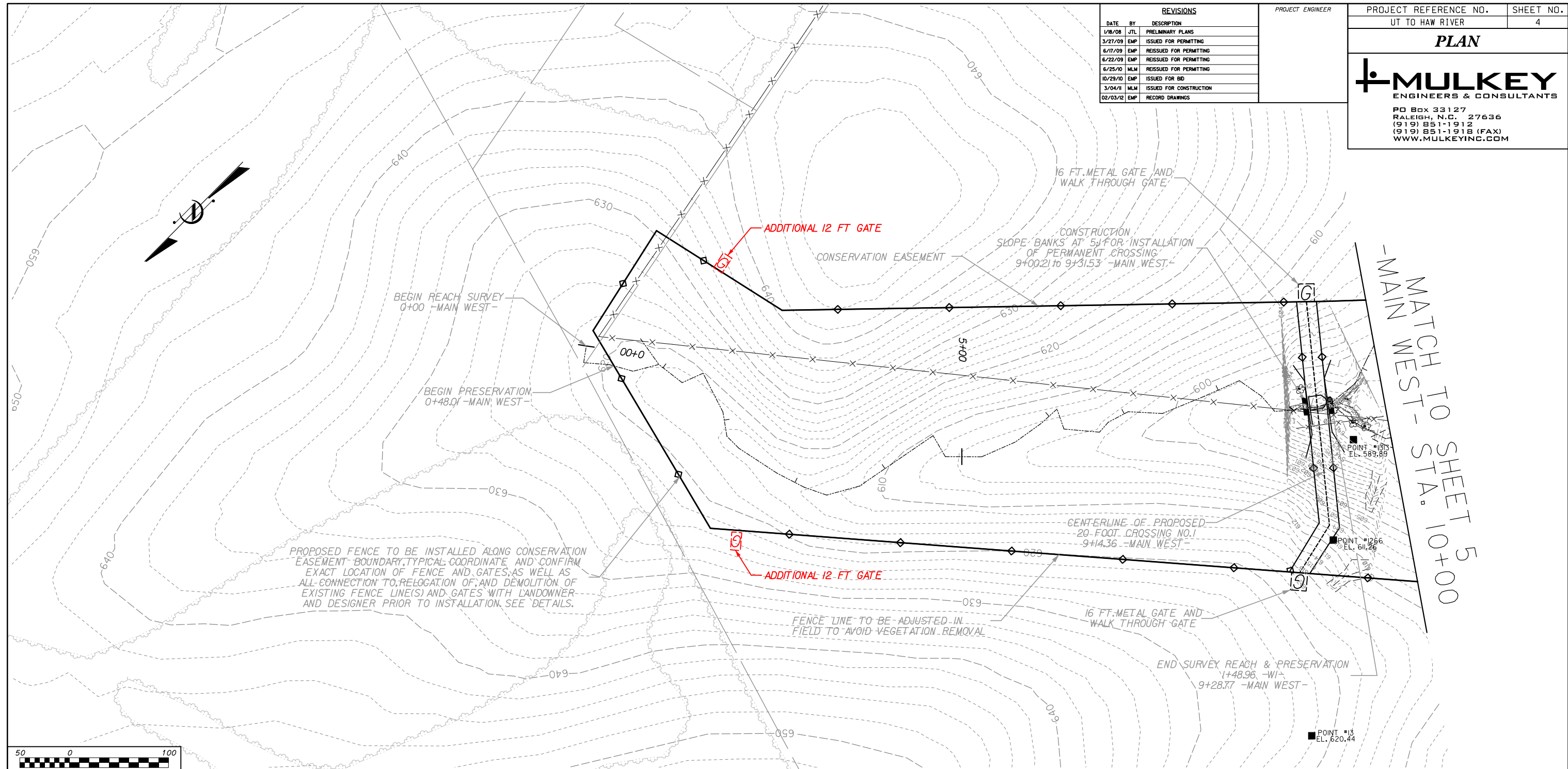
PROJECT REFERENCE NO. UT TO HAW RIVER SHEET NO. 4

**PLAN**



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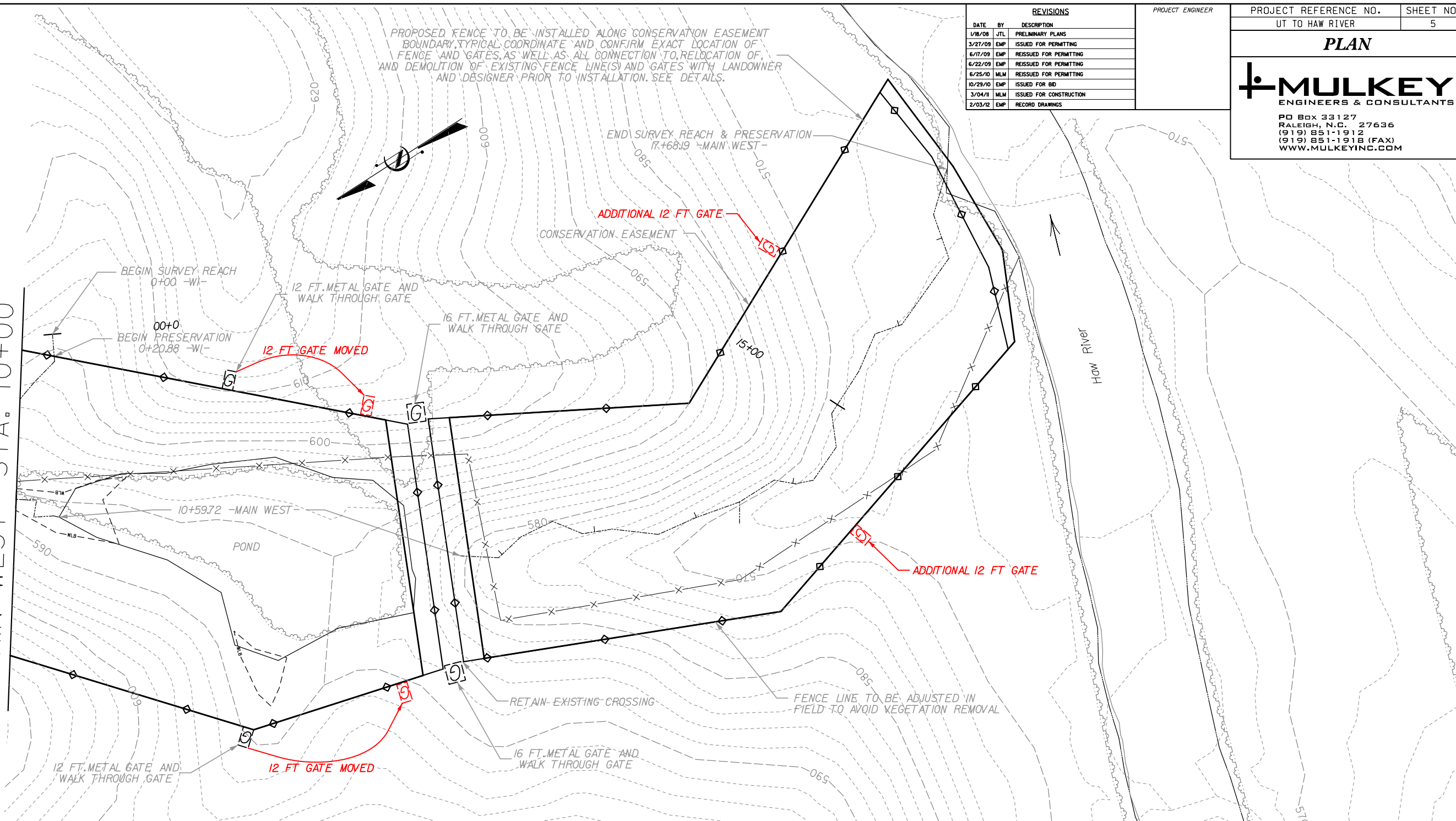
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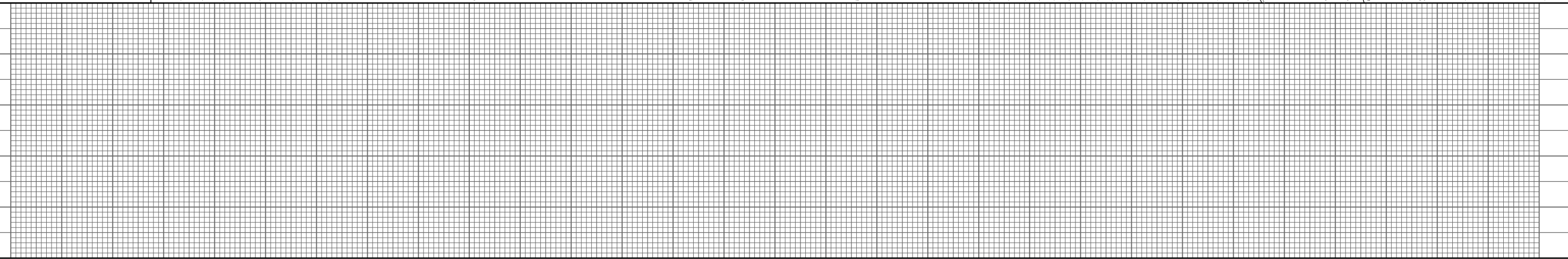
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3/04/11	MLM	ISSUED FOR CONSTRUCTION
2/03/12	EMP	RECORD DRAWINGS

PROPOSED FENCE TO BE INSTALLED ALONG CONSERVATION EASEMENT BOUNDARY. TYPICAL COORDINATE AND CONFIRM EXACT LOCATION OF FENCE AND GATES, AS WELL AS ALL CONNECTION TO, RELOCATION OF, AND DEMOLITION OF EXISTING FENCE LINE(S) AND GATES WITH LANDOWNER AND DESIGNER PRIOR TO INSTALLATION. SEE DETAILS.

MATCH TO SHEET 4  
-MAIN WEST- STA. 10+00



#DATE#  
#TIME#  
#FILE#



MATCH TO SHEET 11  
 -CI- STA. 6+50

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2/03/12	EMP	RECORD DRAWINGS

PROJECT ENGINEER

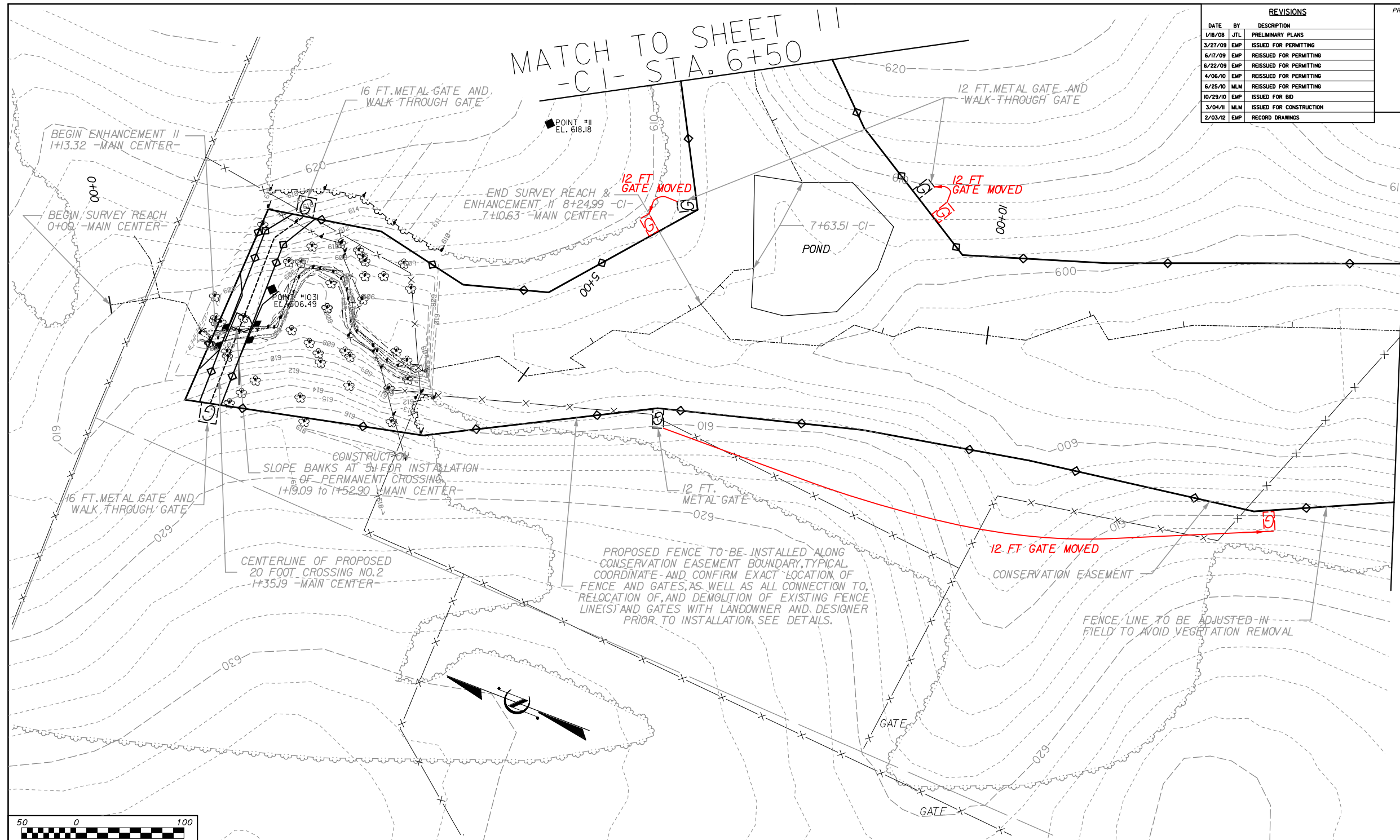
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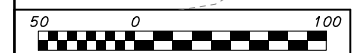


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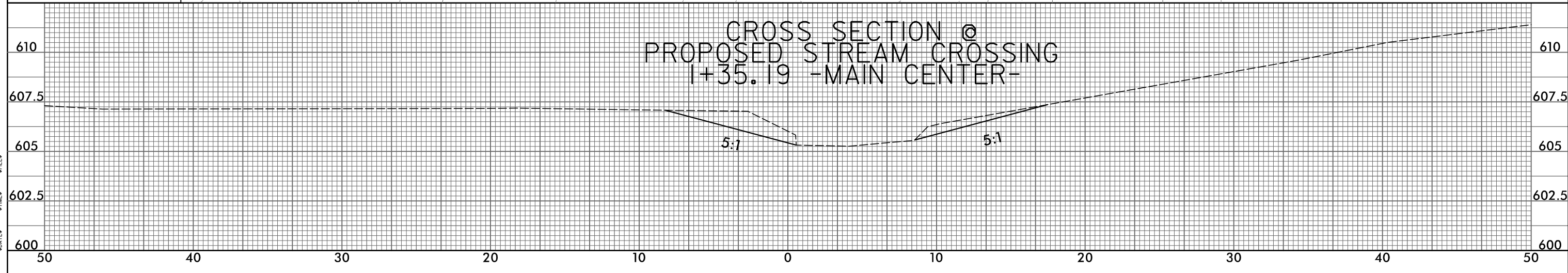
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MATCH TO SHEET 7  
 -MAIN CENTER- STA. 14+00



CROSS SECTION @  
 PROPOSED STREAM CROSSING  
 1+35.19 -MAIN CENTER-



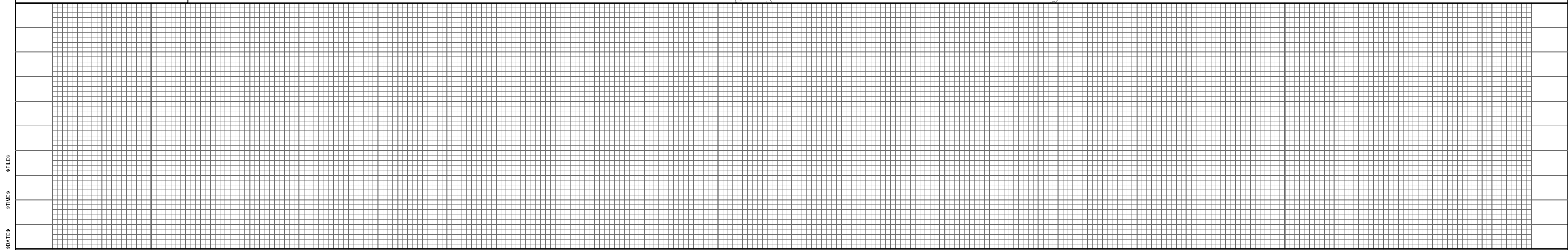
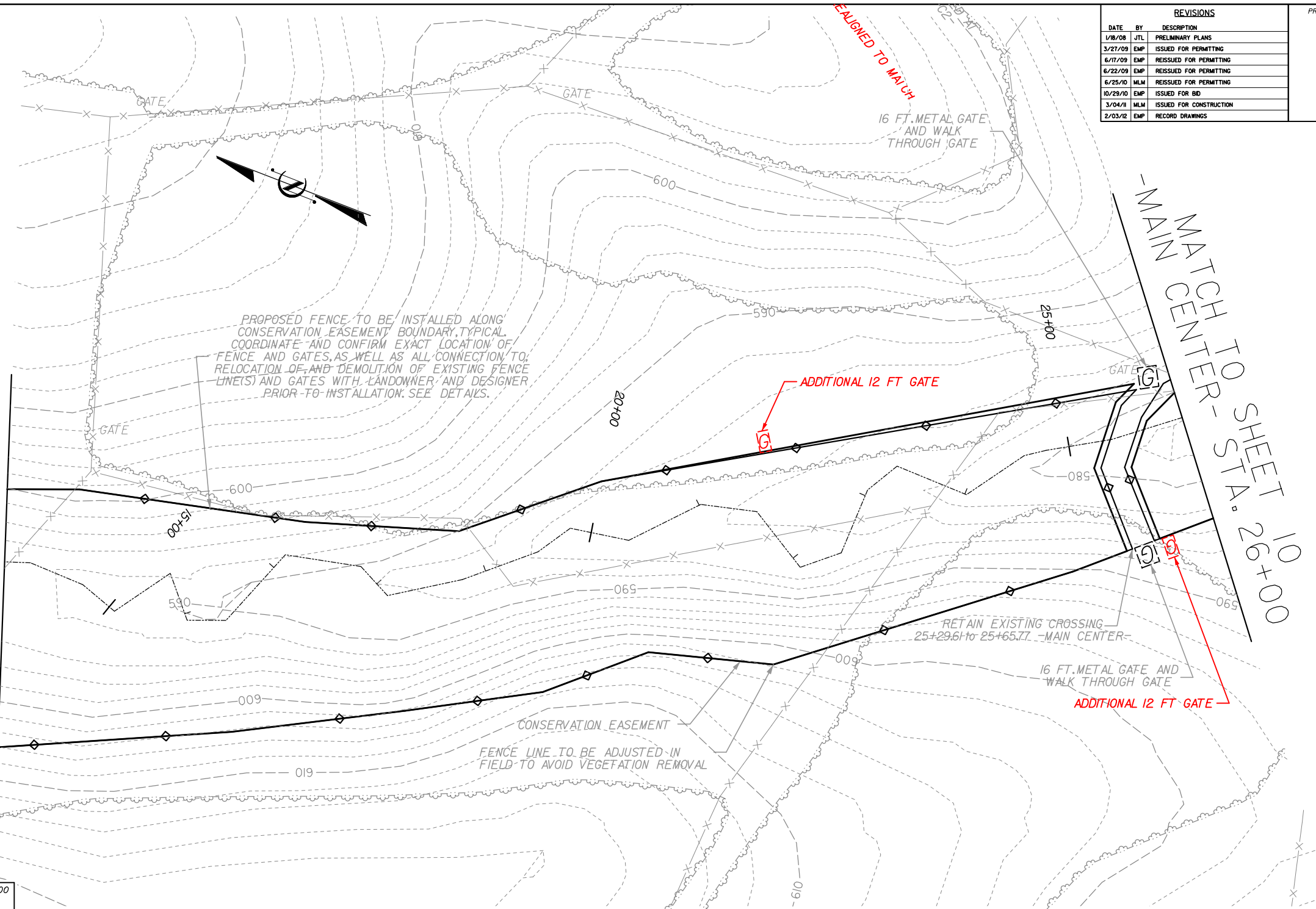


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3/04/11	MLM	ISSUED FOR CONSTRUCTION
2/03/12	EMP	RECORD DRAWINGS

PROJECT ENGINEER

MATCH TO SHEET 6  
-MAIN CENTER- STA. 14+00

-MAIN CENTER- STA. 26+00  
MATCH CENTER TO SHEET 10




#DATE# #TIME# #FILE#

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2/03/12	EMP	RECORD DRAWINGS

PROJECT ENGINEER

PROJECT REFERENCE NO. UT TO HAW RIVER SHEET NO. 8

**PLAN**

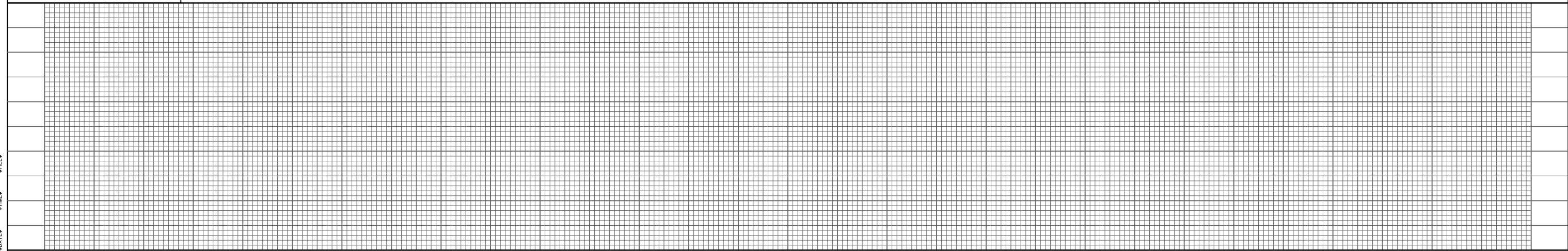
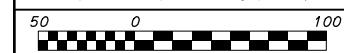


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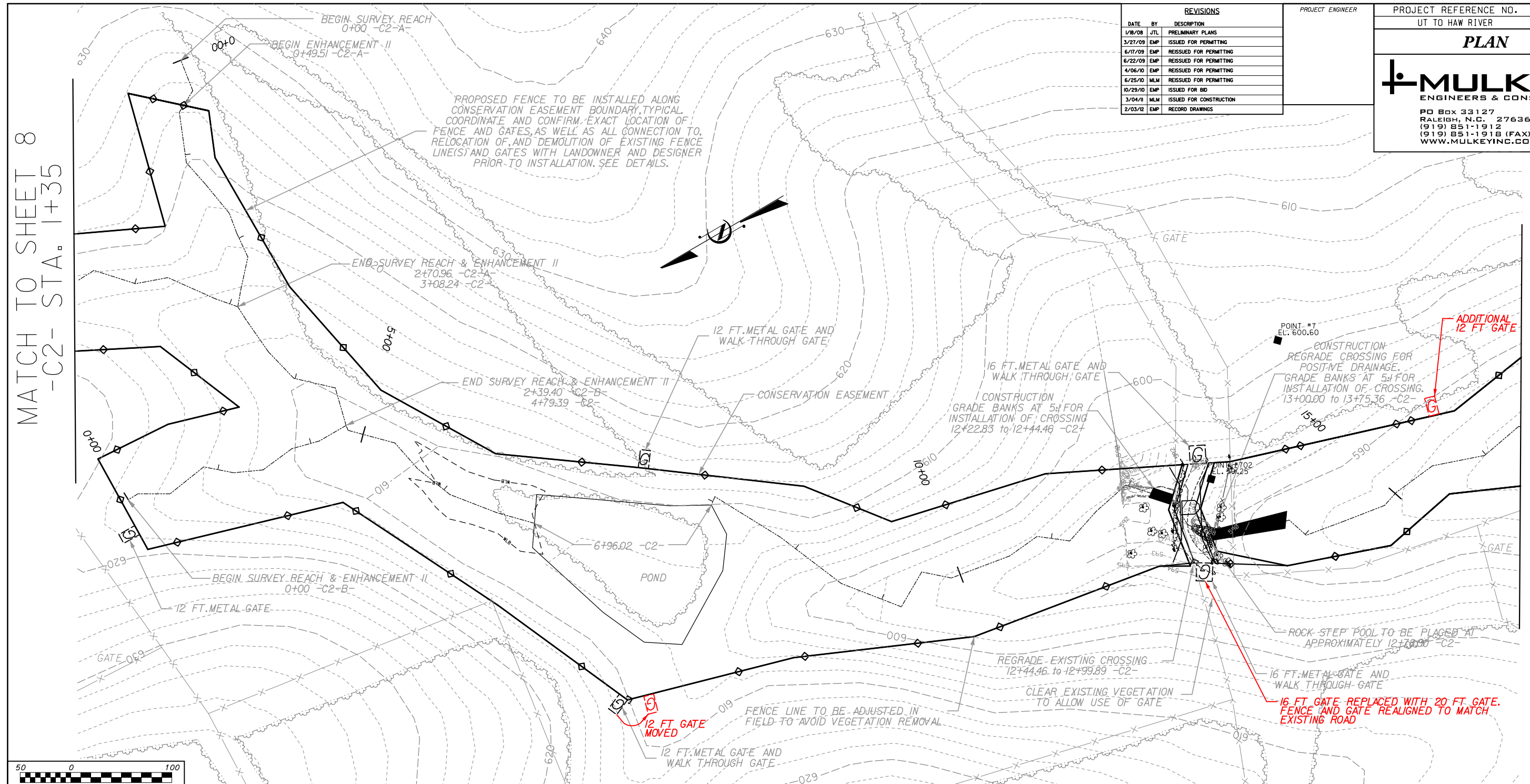


MATCH TO SHEET 9  
-C2- STA. 1+35



#DATE# #TIME# #FILE#

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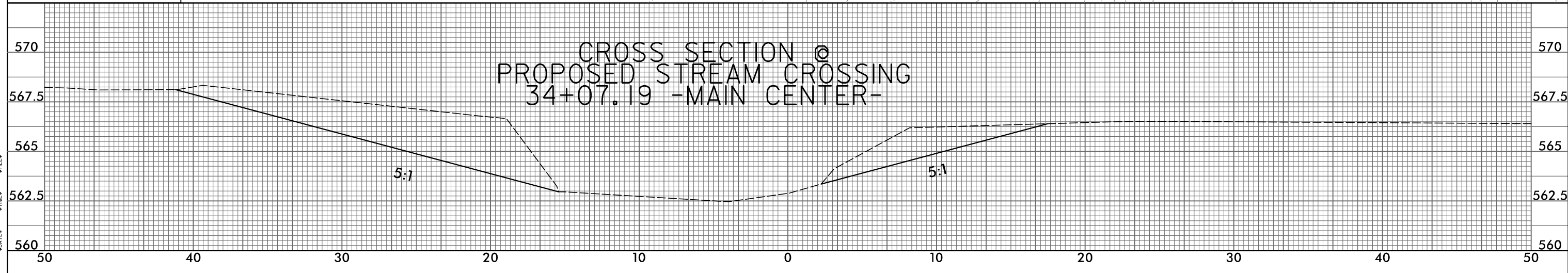
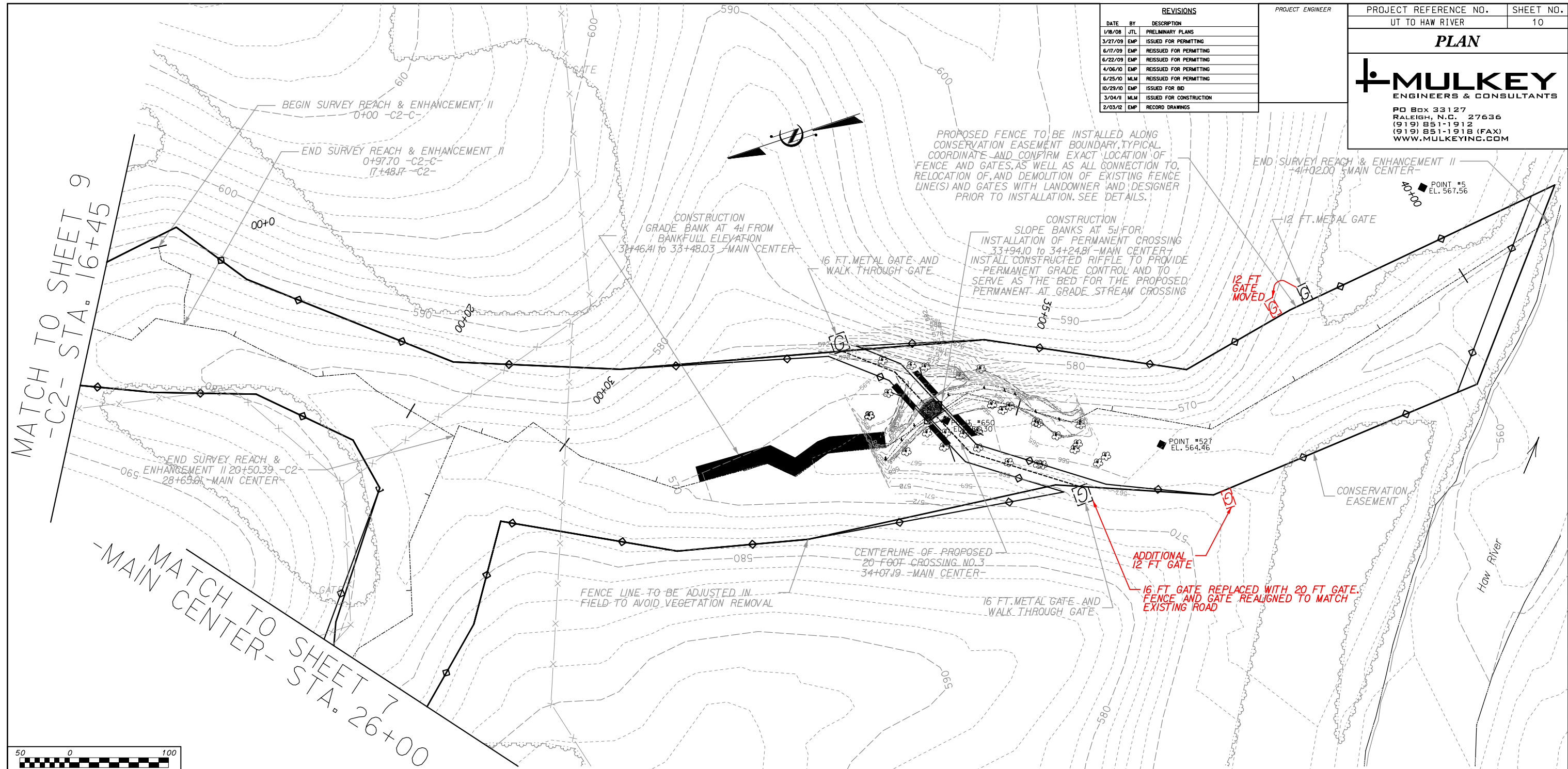
SEE PLANSHEET 15 FOR BOTH CROSS SECTIONS -C2-

#DATE# #TIME# #FILE#

MATCH TO SHEET 8  
 -C2- STA. 1+35

MATCH TO SHEET 10  
 -C2- STA. 16+45

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2/03/12	EMP	RECORD DRAWINGS

PROJECT ENGINEER

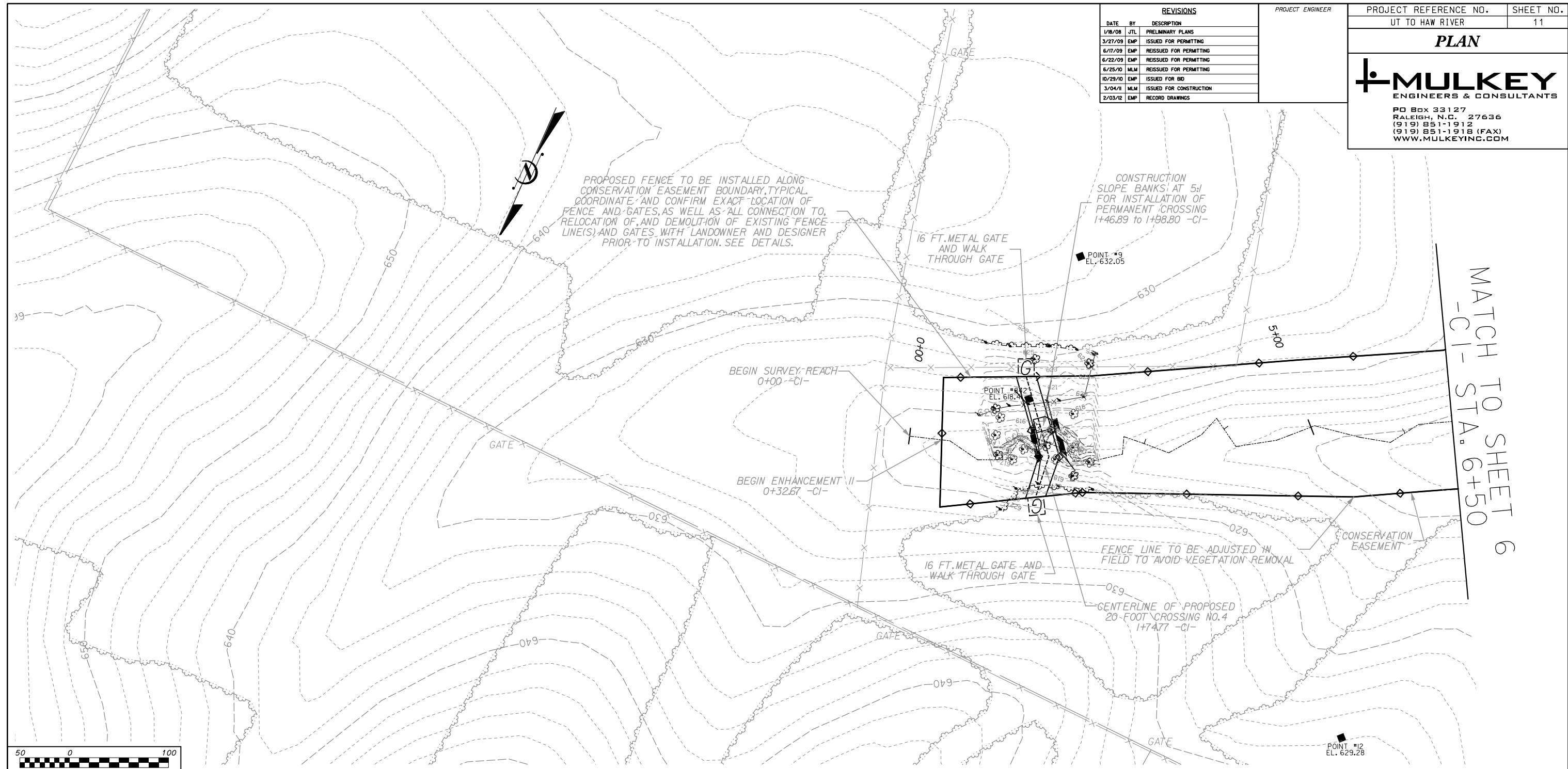
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SHEET NO. 11

**PLAN**

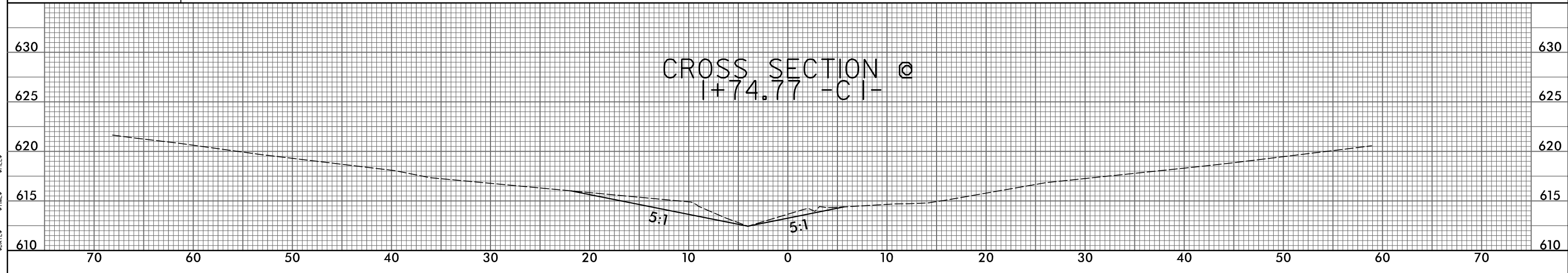


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MATCH TO SHEET 6  
-CI- STA. 6+50



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2/03/12	EMP	RECORD DRAWINGS

PROJECT ENGINEER

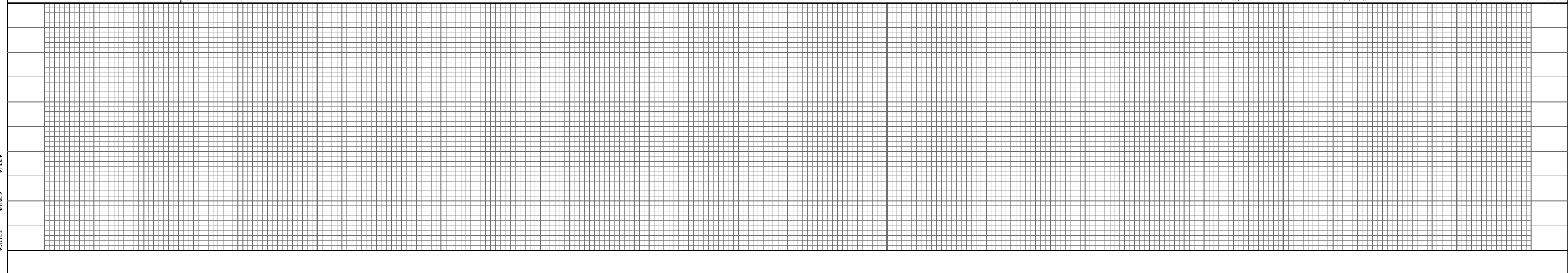
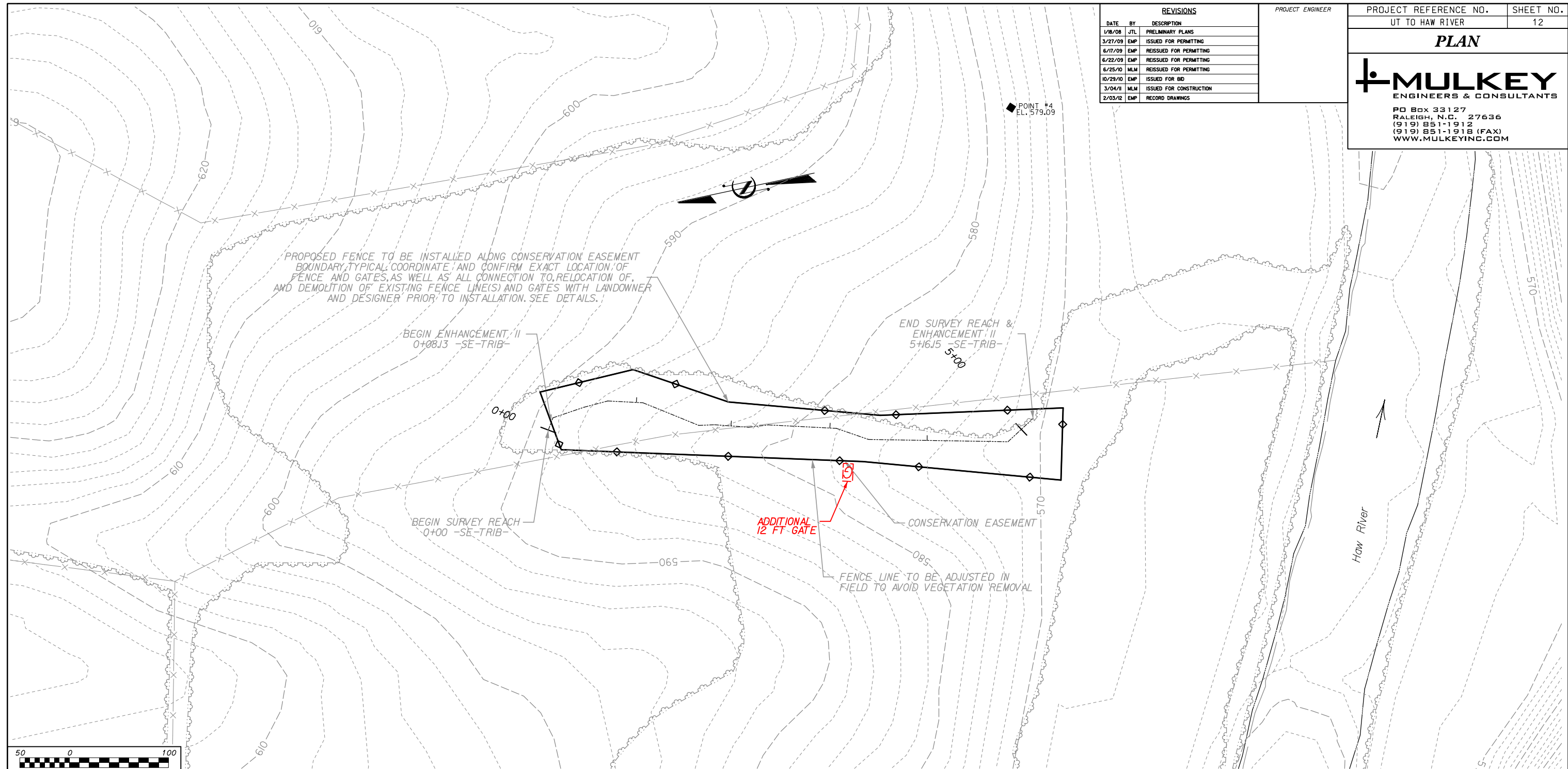
PROJECT REFERENCE NO. UT TO HAW RIVER SHEET NO. 12

**PLAN**



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\*DATE\*  
\*TIME\*  
\*FILE\*

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2/03/12	EMP	RECORD DRAWINGS

PROJECT ENGINEER

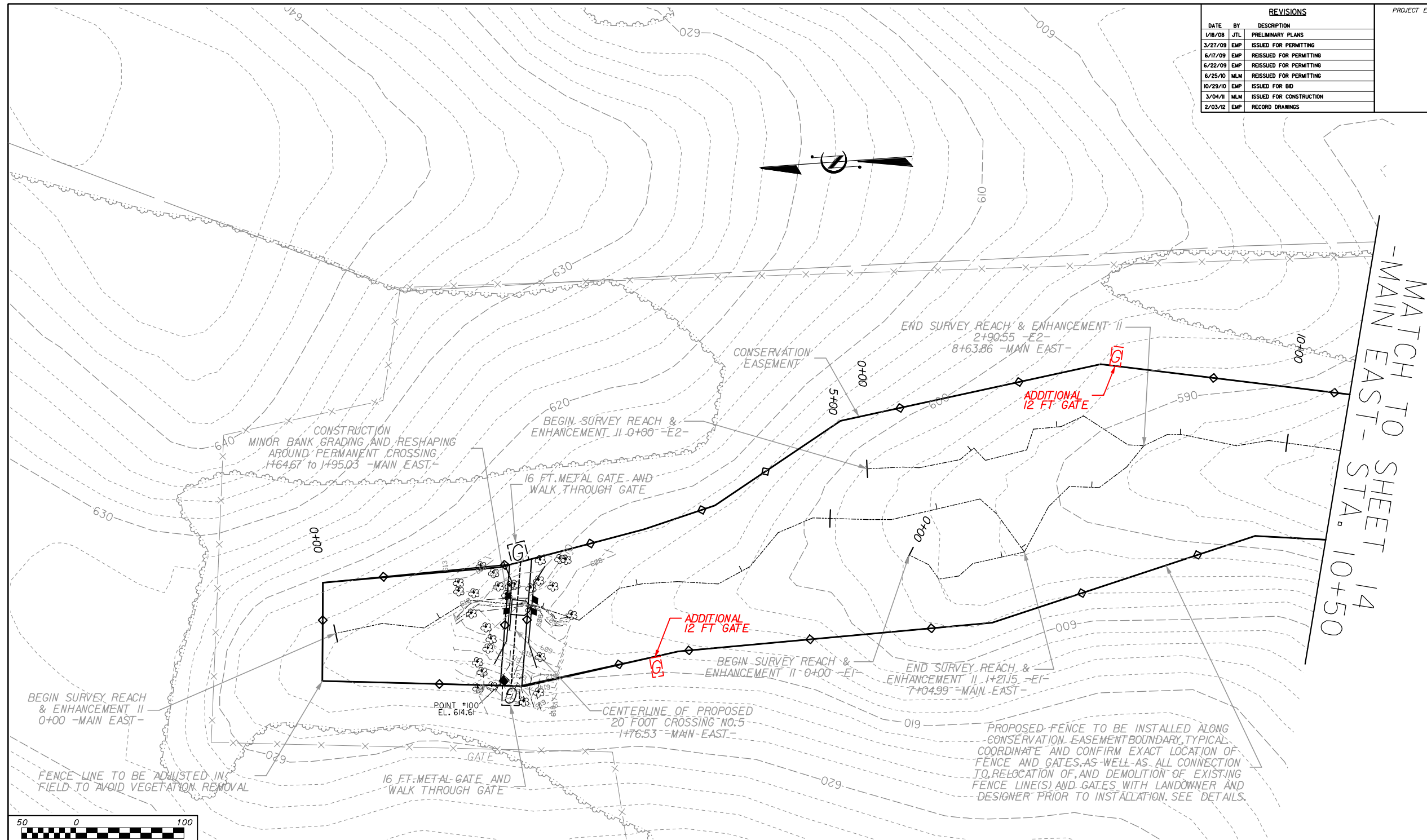
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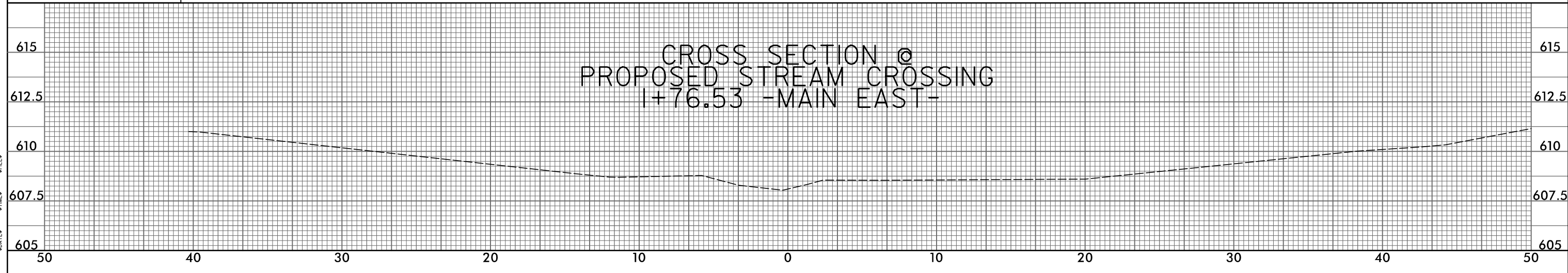


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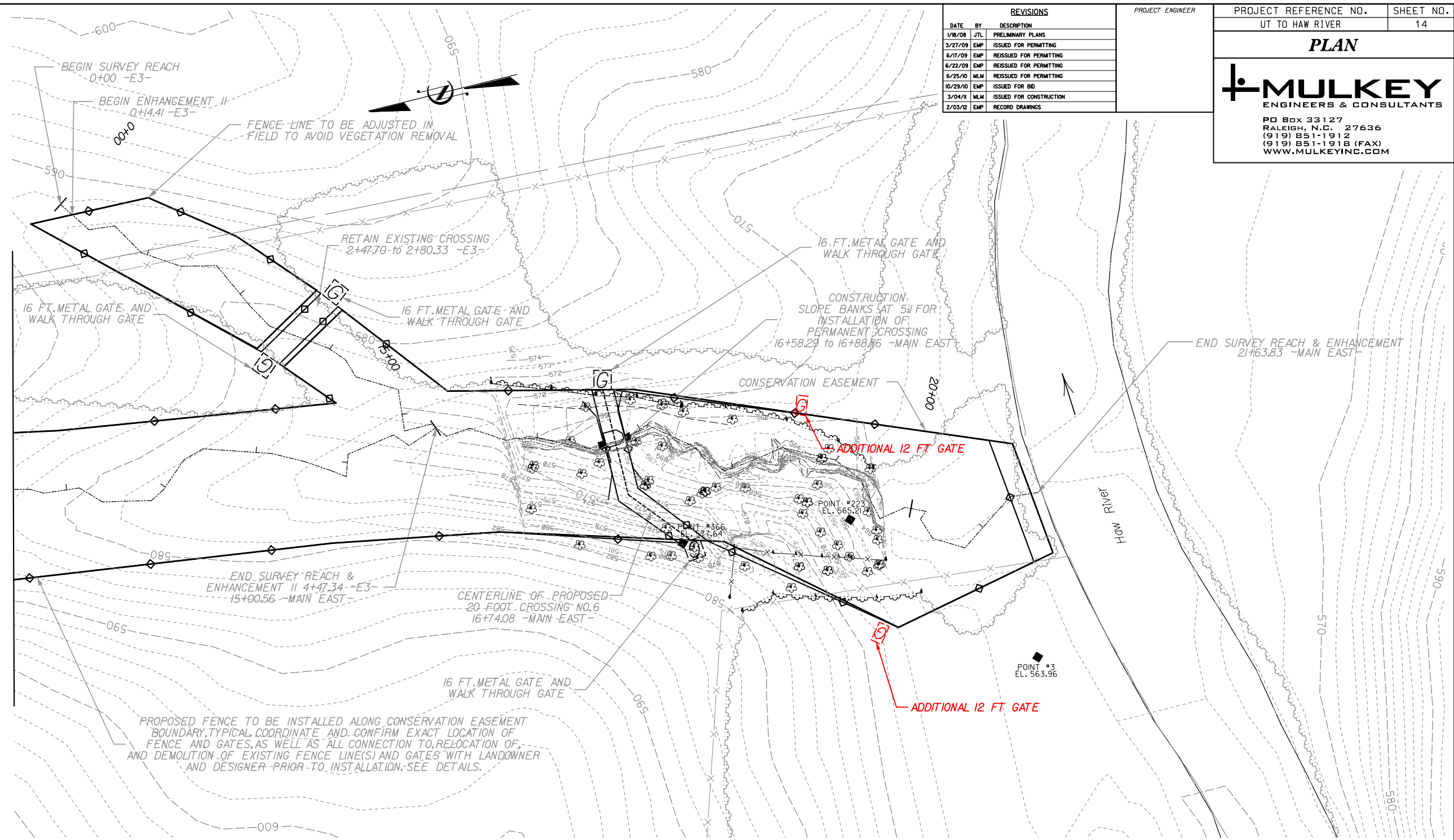


MATCH TO SHEET 14  
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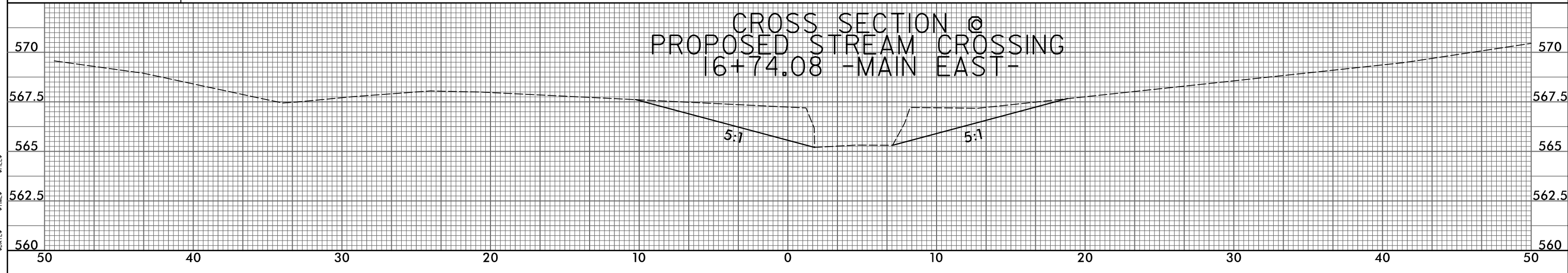


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3/04/11	MLM	ISSUED FOR CONSTRUCTION
2/03/12	EMP	RECORD DRAWINGS

MATCH TO SHEET 13  
 -MAIN EAST- STA. 10+50



**CROSS SECTION @  
 PROPOSED STREAM CROSSING  
 16+74.08 -MAIN EAST-**





# CROSS SECTIONS

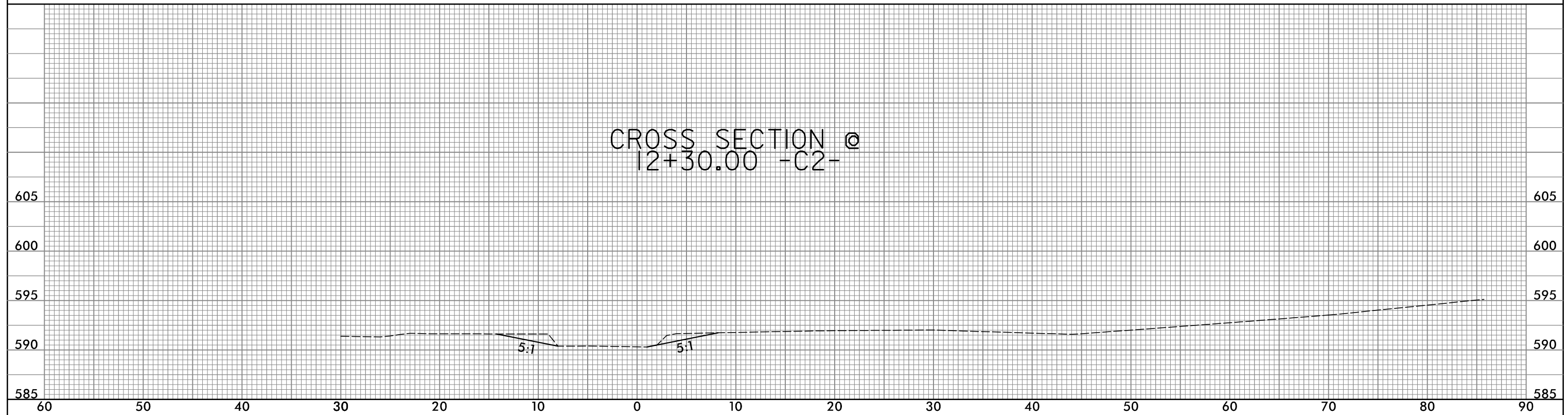
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2/03/12	EMP	RECORD DRAWINGS

PROJECT ENGINEER

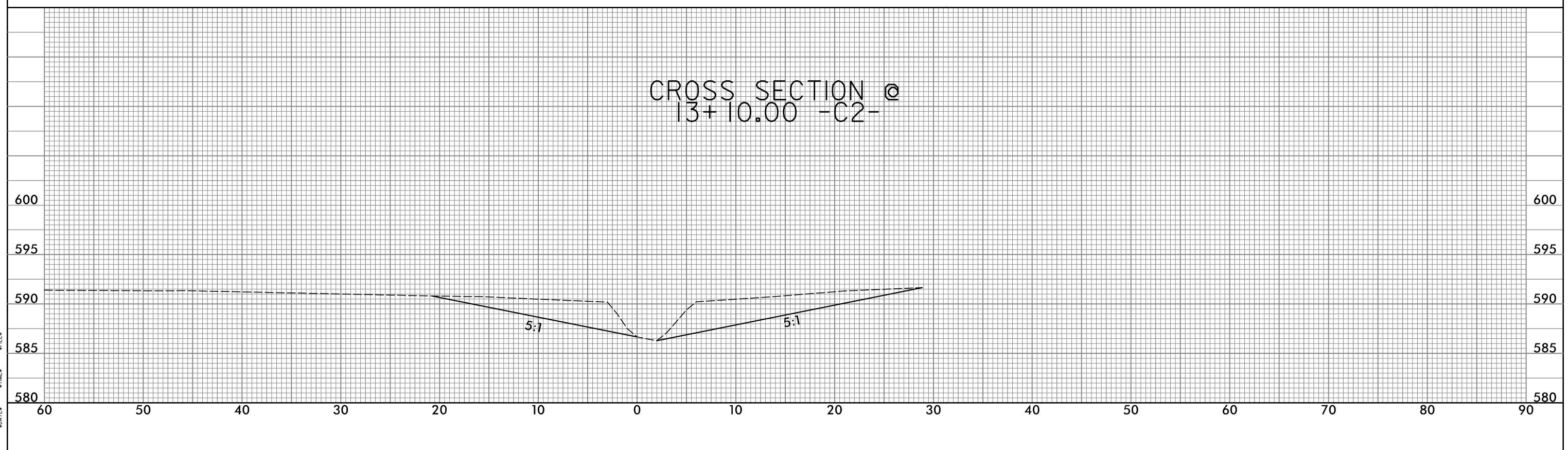
PROJECT REFERENCE NO. UT TO HAW RIVER SHEET NO. 15



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\*DATE\* \*TIME\* \*FILE\*

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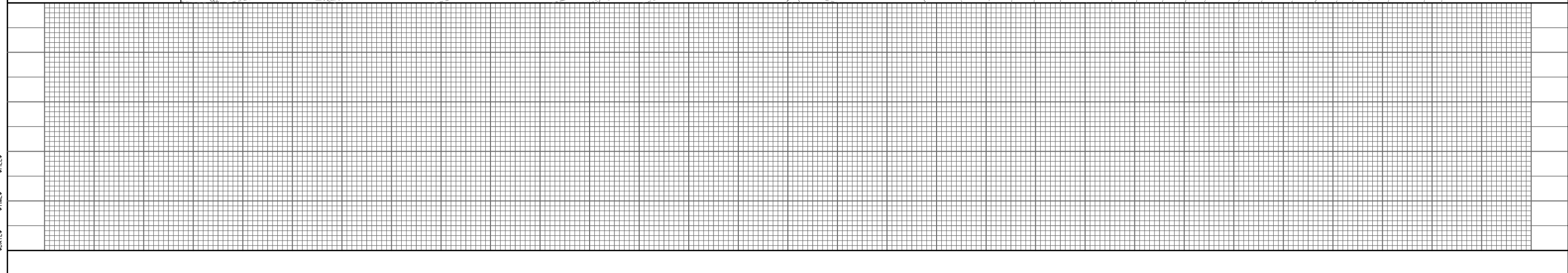
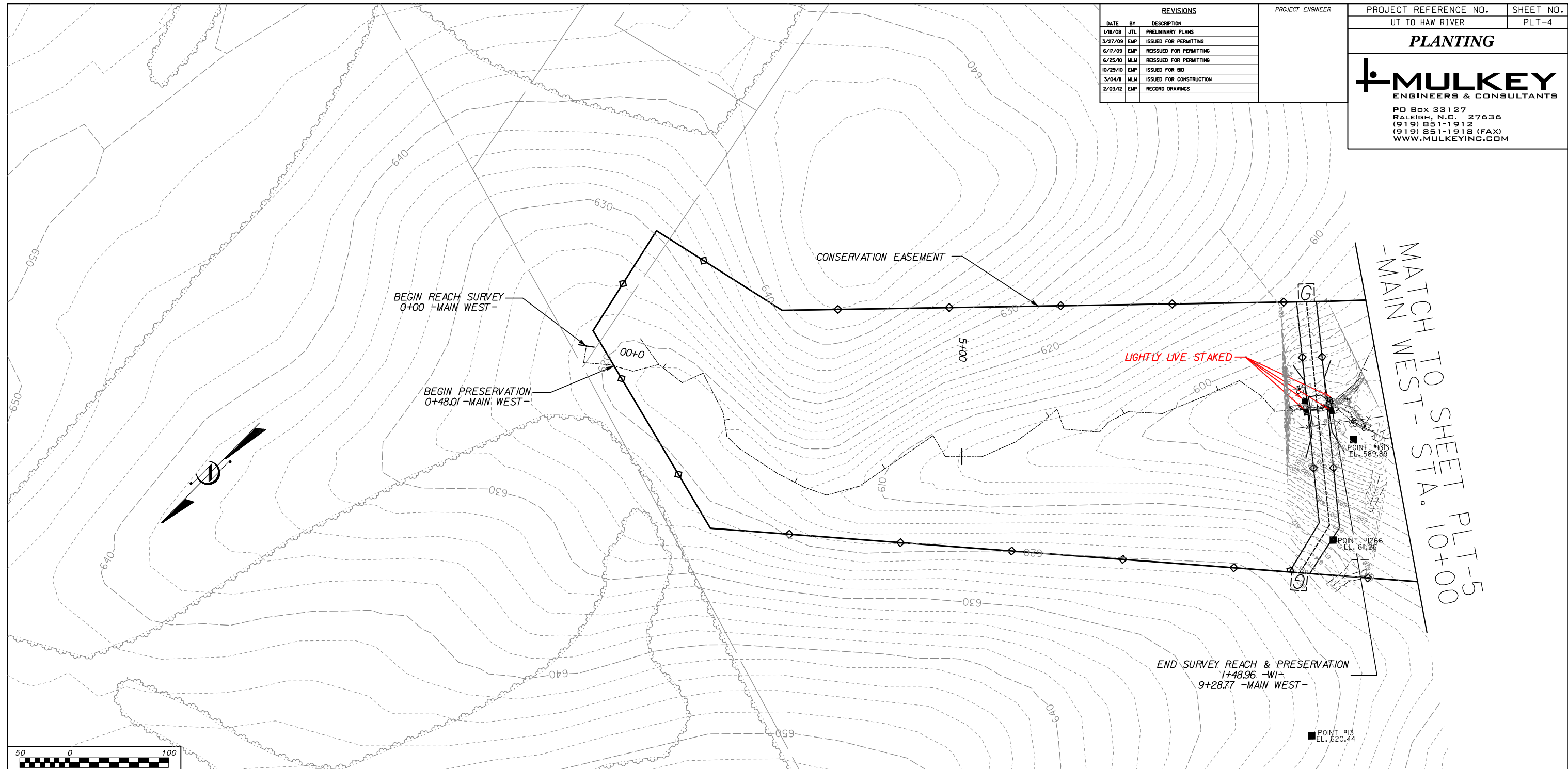
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PROJECT REFERENCE NO. UT TO HAW RIVER SHEET NO. PLT-4

**PLANTING**



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DATE	BY	DESCRIPTION
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2/03/12	EMP	RECORD DRAWINGS

PROJECT ENGINEER

PROJECT REFERENCE NO. UT TO HAW RIVER SHEET NO. PLT-5

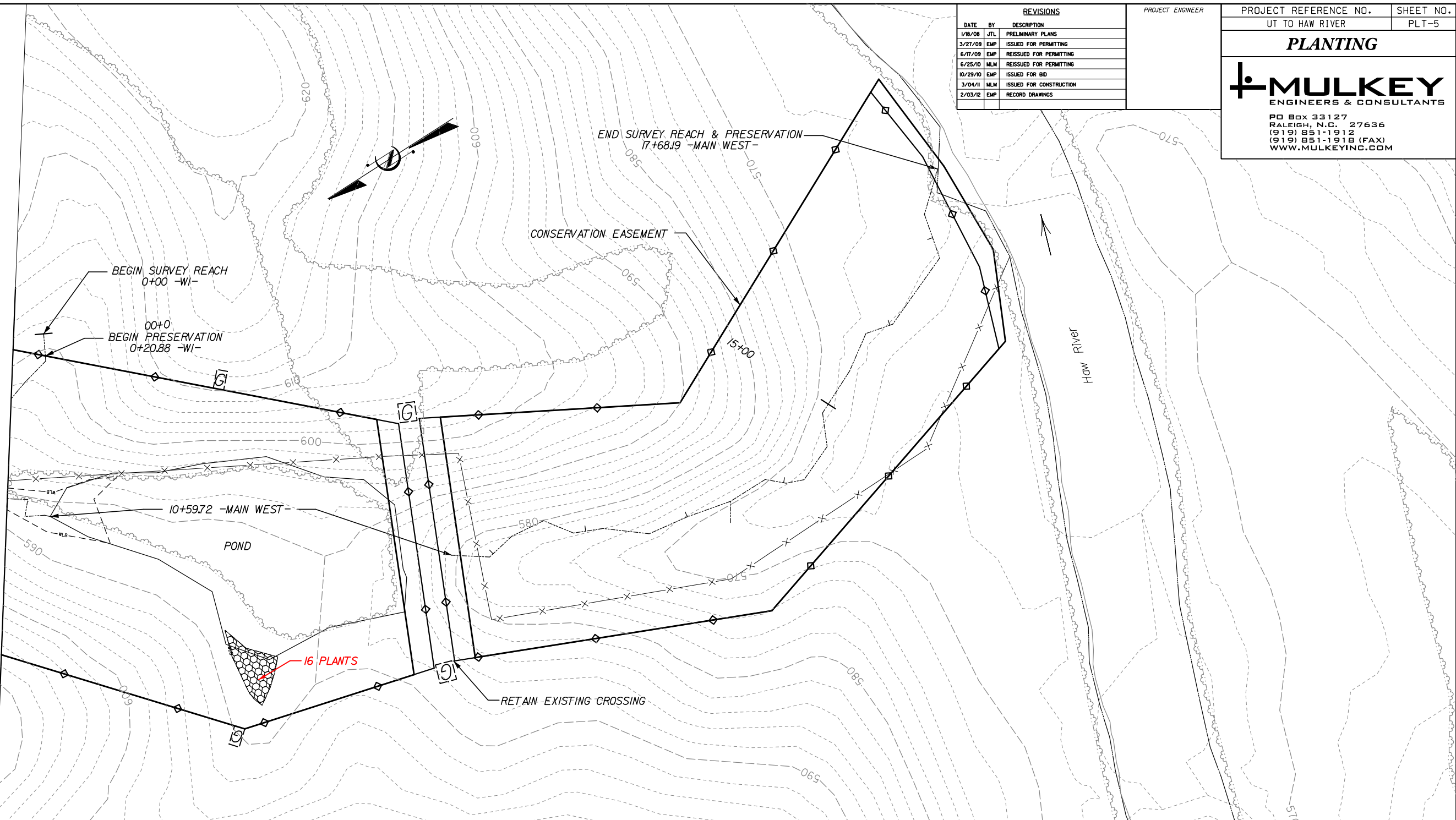
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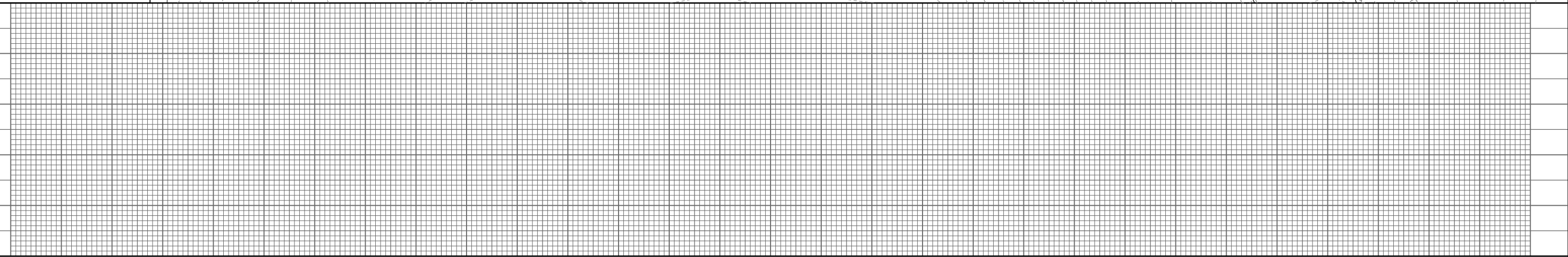
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MATCH TO SHEET PLT-4  
-MAIN WEST- STA. 10+00



#DATE# #TIME# #FILE#



MATCH TO SHEET PLT-11  
-CI- STA. 6+50

REVISIONS		
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PROJECT ENGINEER

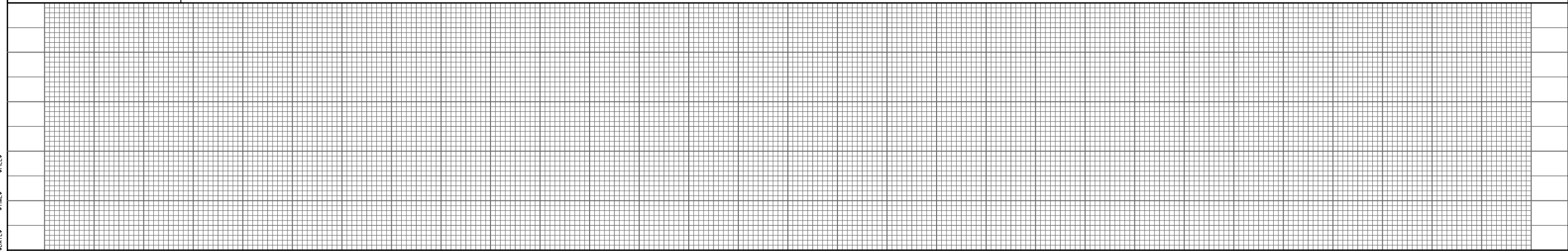
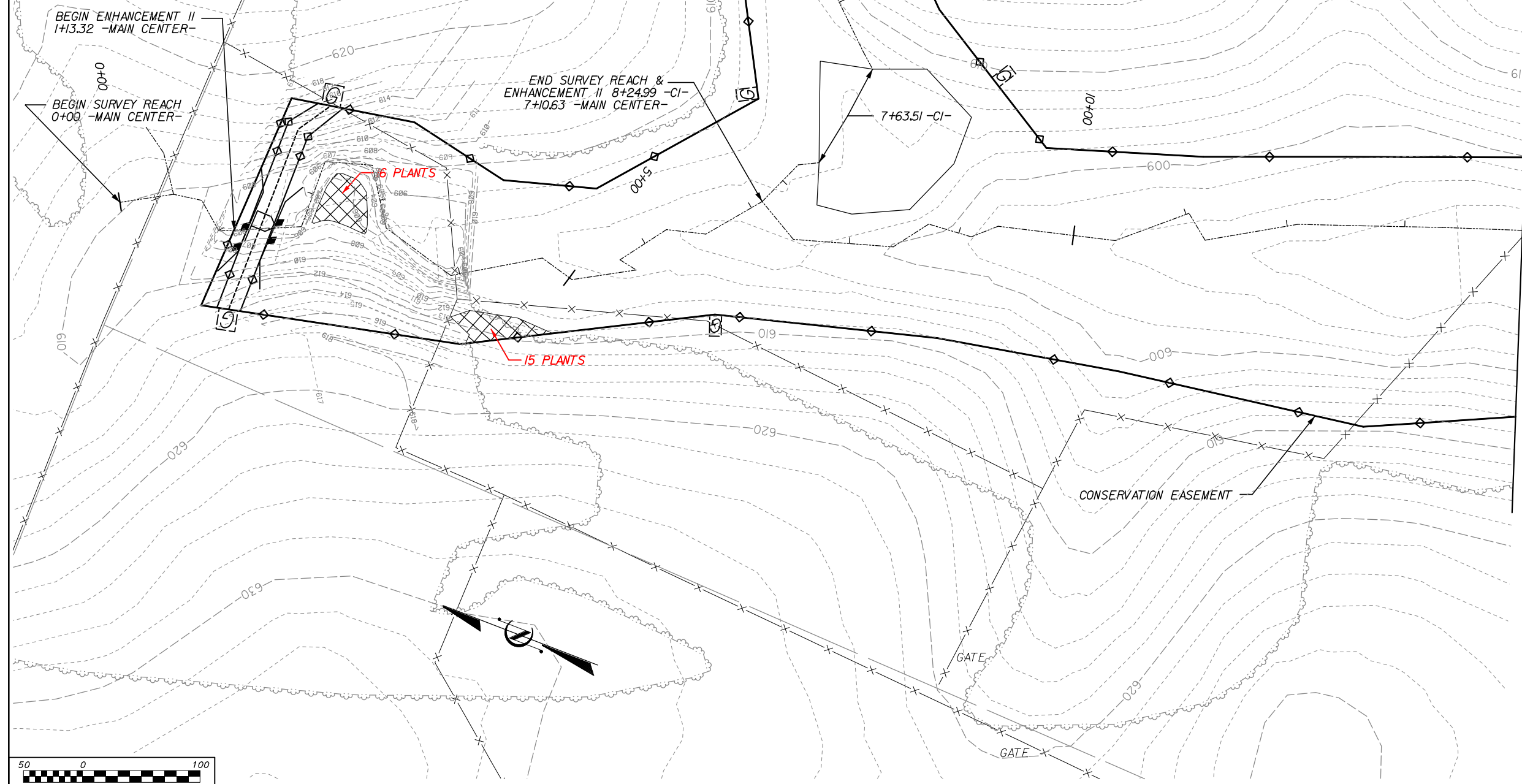
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UT TO HAW RIVER PLT-6

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MATCH TO SHEET PLT-7  
-MAIN CENTER- STA. 14+00



#DATE# #TIME# #FILE#

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2/03/12	EMP	RECORD DRAWINGS

PROJECT ENGINEER

PROJECT REFERENCE NO. UT TO HAW RIVER SHEET NO. PLT-7

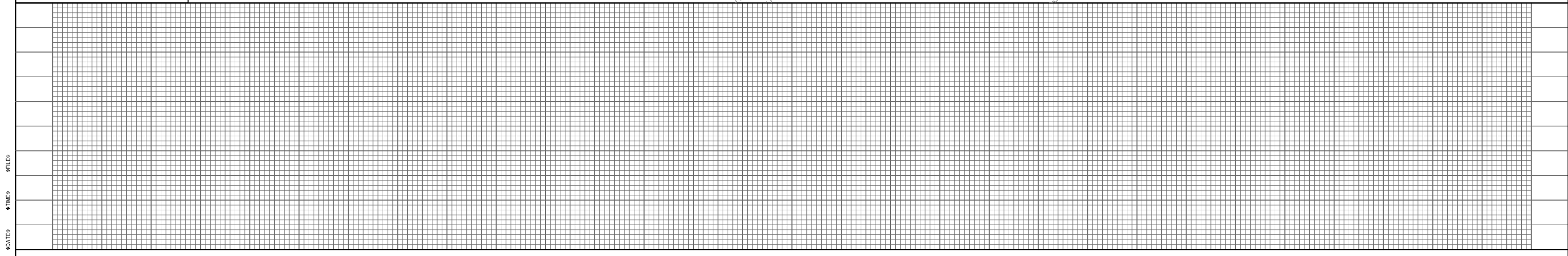
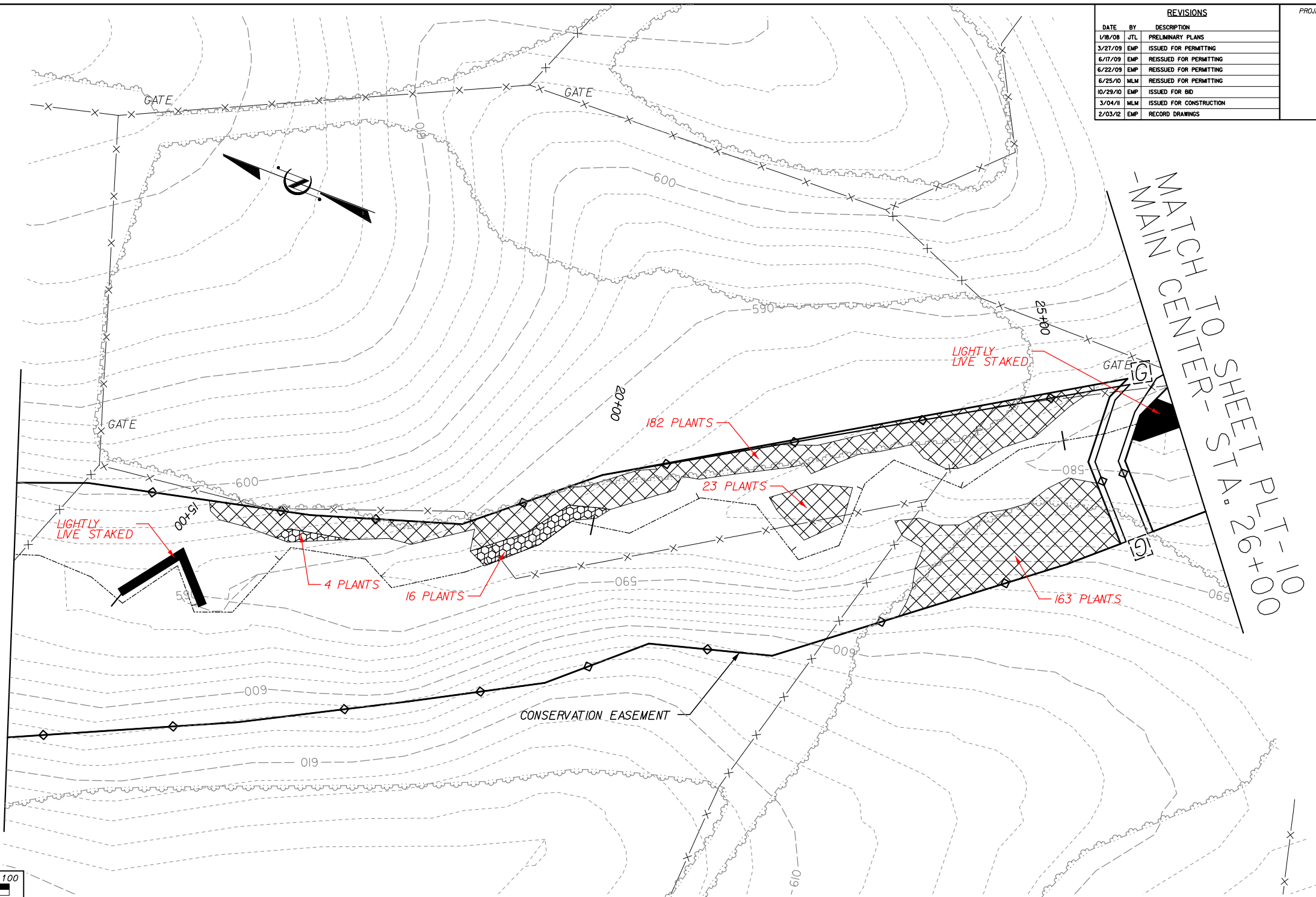
**PLANTING**



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MATCH TO SHEET PLT-6  
 -MAIN CENTER- STA. 14+00

MATCH CENTER- STA. 26+100  
 SHEET PLT-10



#DATE# #TIME# #FILE#

REVISIONS		
DATE	BY	DESCRIPTION
1/8/08	JTL	PRELIMINARY PLANS
3/27/09	EMP	ISSUED FOR PERMITTING
6/17/09	EMP	REISSUED FOR PERMITTING
6/25/10	MLM	REISSUED FOR PERMITTING
10/29/10	EMP	ISSUED FOR BID
3/04/11	MLM	ISSUED FOR CONSTRUCTION
2/03/12	EMP	RECORD DRAWINGS

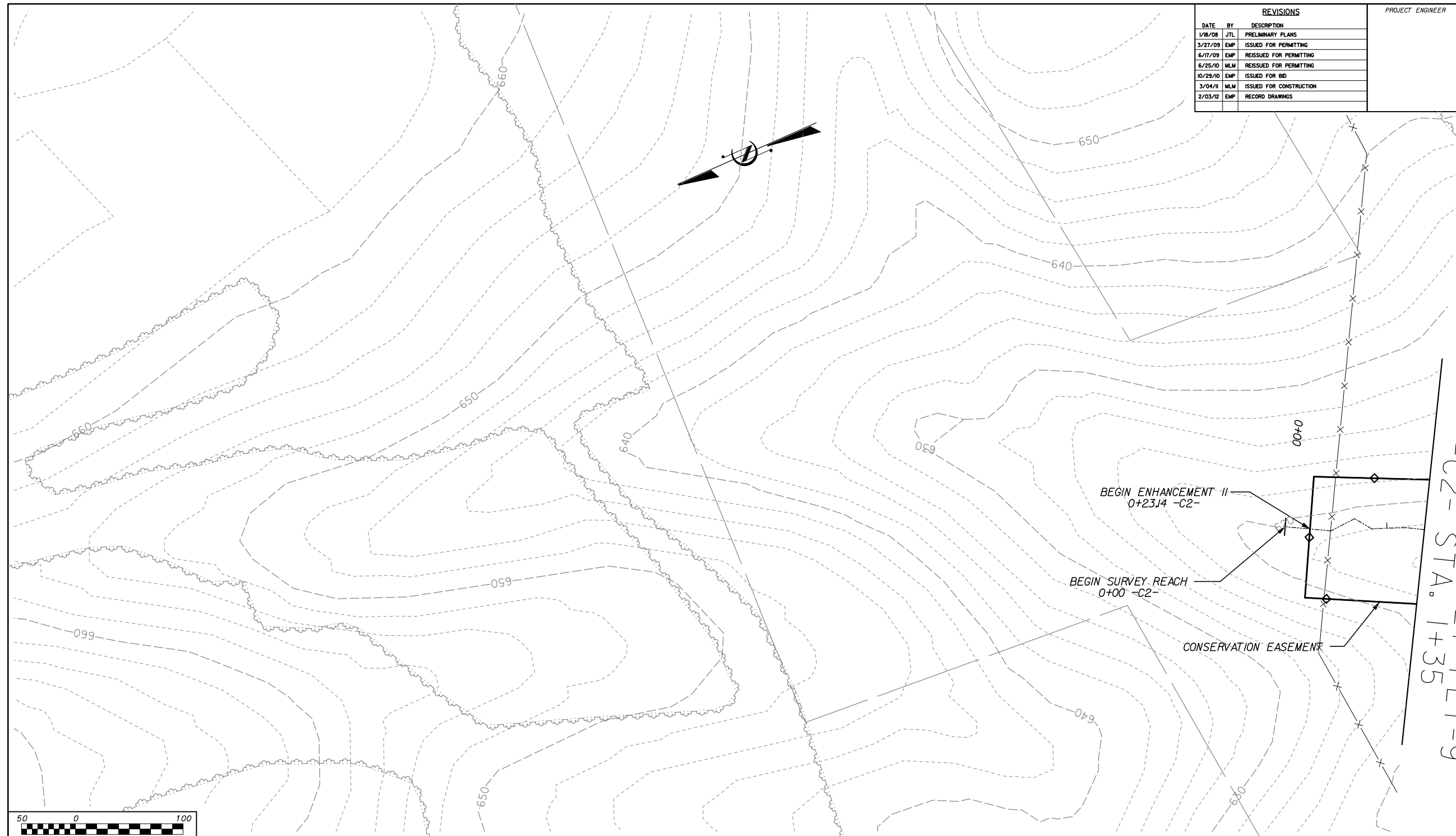
PROJECT ENGINEER

PROJECT REFERENCE NO. UT TO HAW RIVER SHEET NO. PLT-8

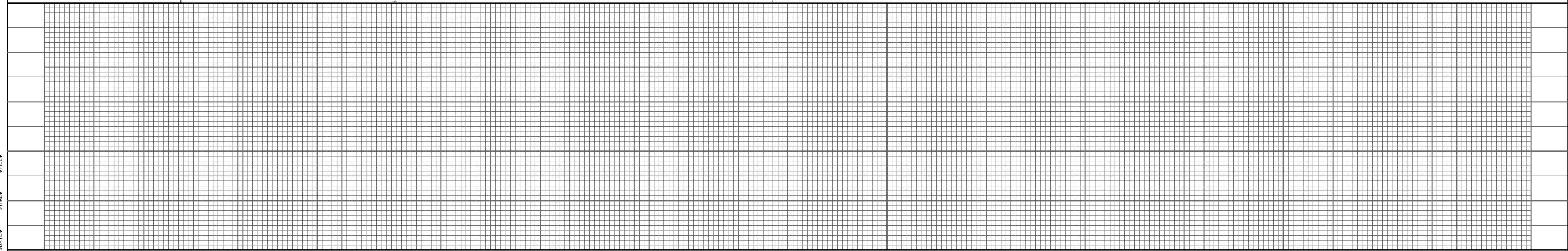
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MATCH TO SHEET PLT-9  
-C2- STA. 1+35



#DATE# #TIME# #FILE#







REVISIONS		
DATE	BY	DESCRIPTION
1/8/08	JTL	PRELIMINARY PLANS
3/27/09	EMP	ISSUED FOR PERMITTING
6/17/09	EMP	REISSUED FOR PERMITTING
6/25/10	MLM	REISSUED FOR PERMITTING
10/29/10	EMP	ISSUED FOR BID
3/04/11	MLM	ISSUED FOR CONSTRUCTION
2/03/12	EMP	RECORD DRAWINGS

PROJECT ENGINEER

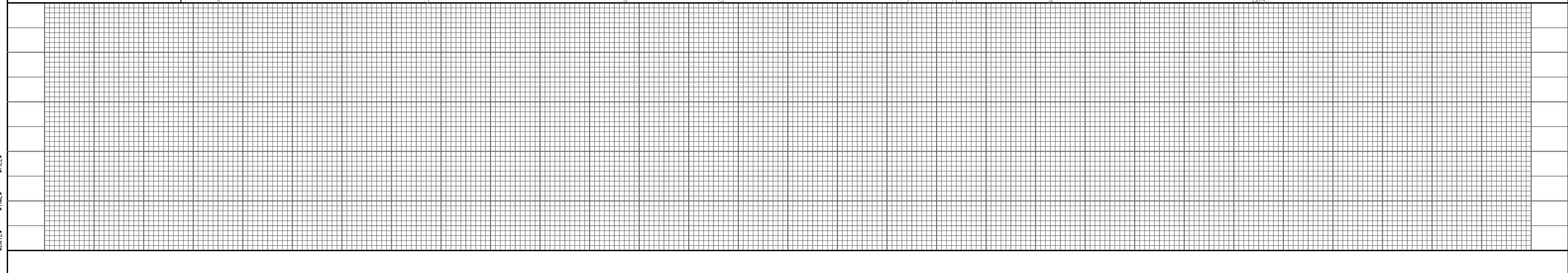
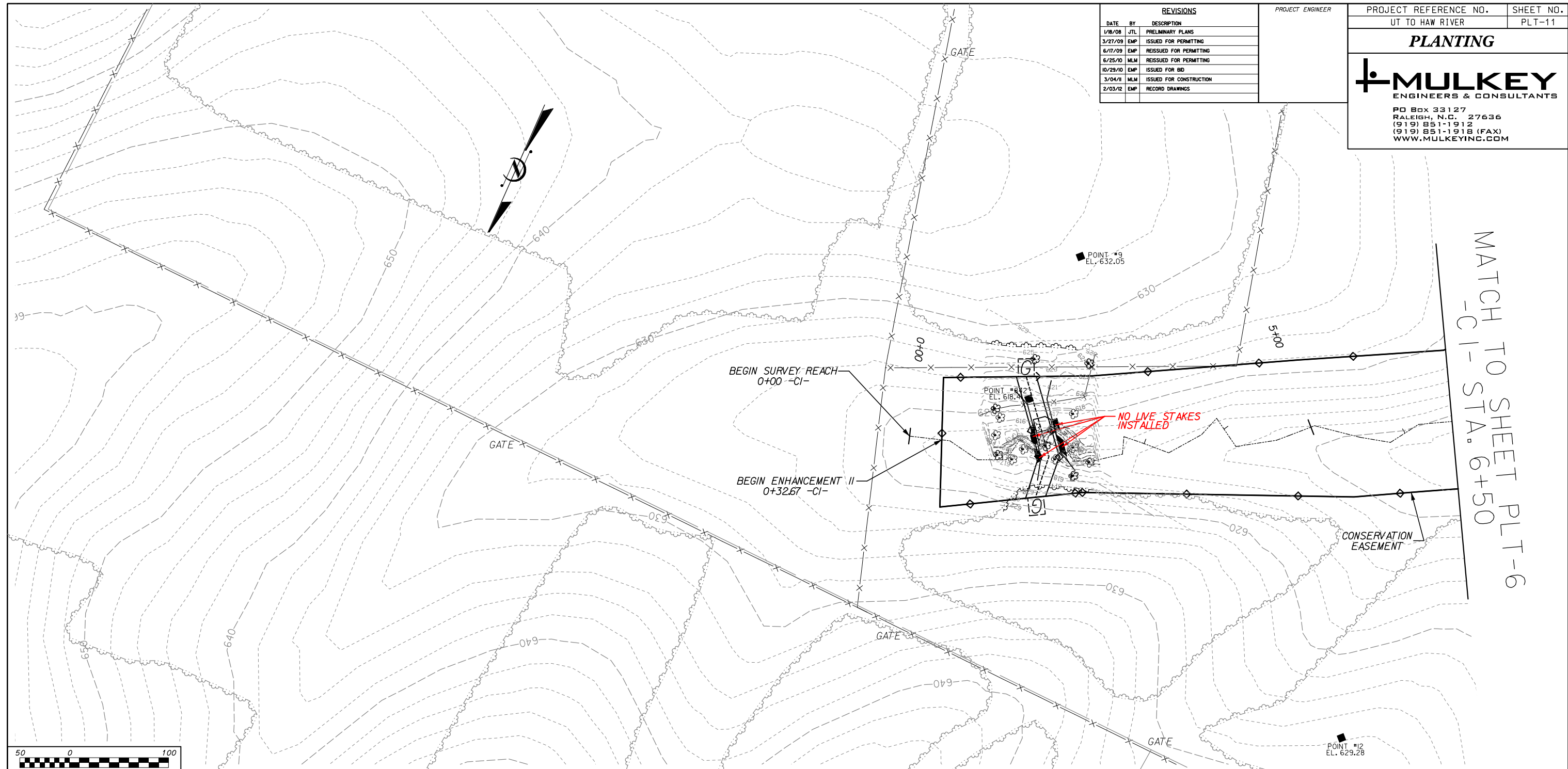
PROJECT REFERENCE NO. UT TO HAW RIVER SHEET NO. PLT-11

**PLANTING**



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#DATE# #TIME# #FILE#

REVISIONS		
DATE	BY	DESCRIPTION
1/8/08	JTL	PRELIMINARY PLANS
3/27/09	EMP	ISSUED FOR PERMITTING
6/17/09	EMP	REISSUED FOR PERMITTING
4/06/10	EMP	REISSUED FOR PERMITTING
6/25/10	MLM	REISSUED FOR PERMITTING
10/29/10	EMP	ISSUED FOR BID
3/04/11	MLM	ISSUED FOR CONSTRUCTION
2/03/12	EMP	RECORD DRAWINGS

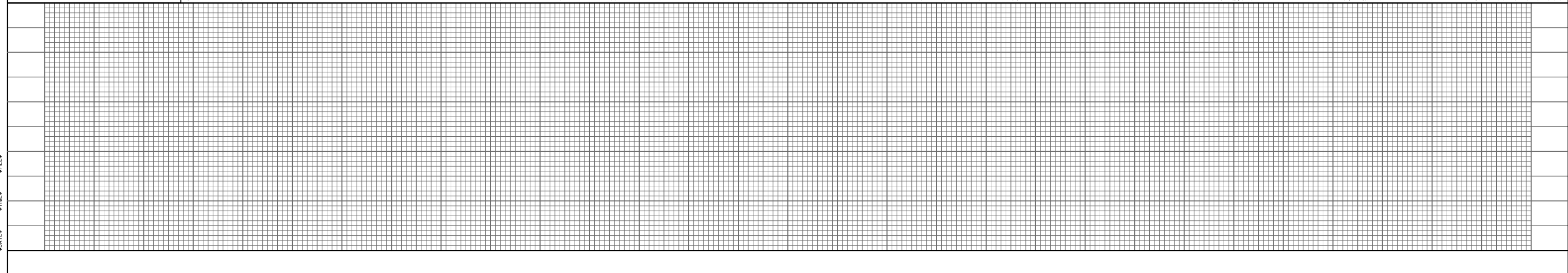
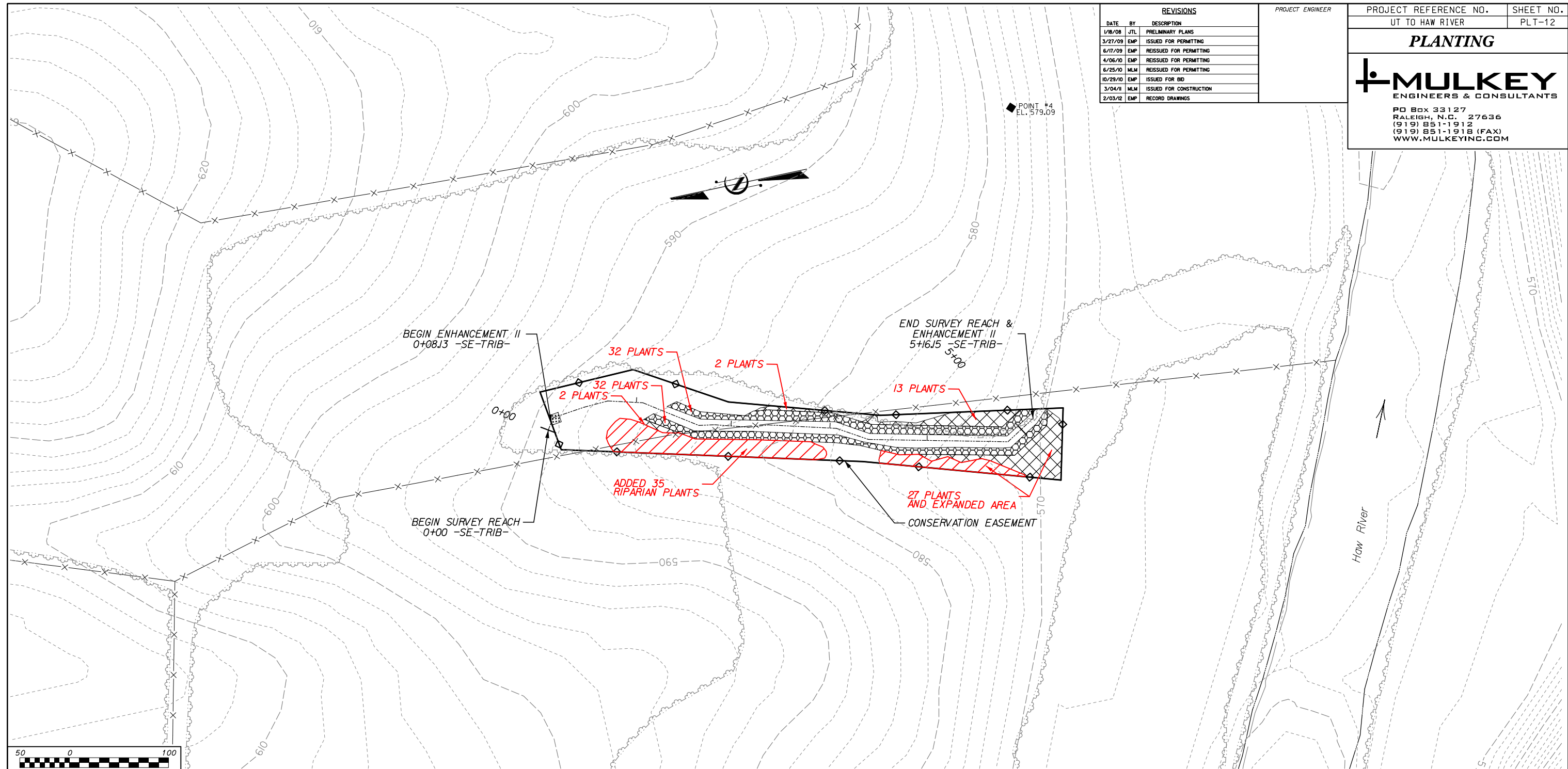
PROJECT ENGINEER

PROJECT REFERENCE NO. UT TO HAW RIVER  
SHEET NO. PLT-12

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#DATE# #TIME# #FILE#

REVISIONS		
DATE	BY	DESCRIPTION
1/18/08	JTL	PRELIMINARY PLANS
3/27/09	EMP	ISSUED FOR PERMITTING
6/17/09	EMP	REISSUED FOR PERMITTING
4/06/10	EMP	REISSUED FOR PERMITTING
6/25/10	MLM	REISSUED FOR PERMITTING
10/29/10	EMP	ISSUED FOR BID
3/04/11	MLM	ISSUED FOR CONSTRUCTION
2/03/12	EMP	RECORD DRAWINGS

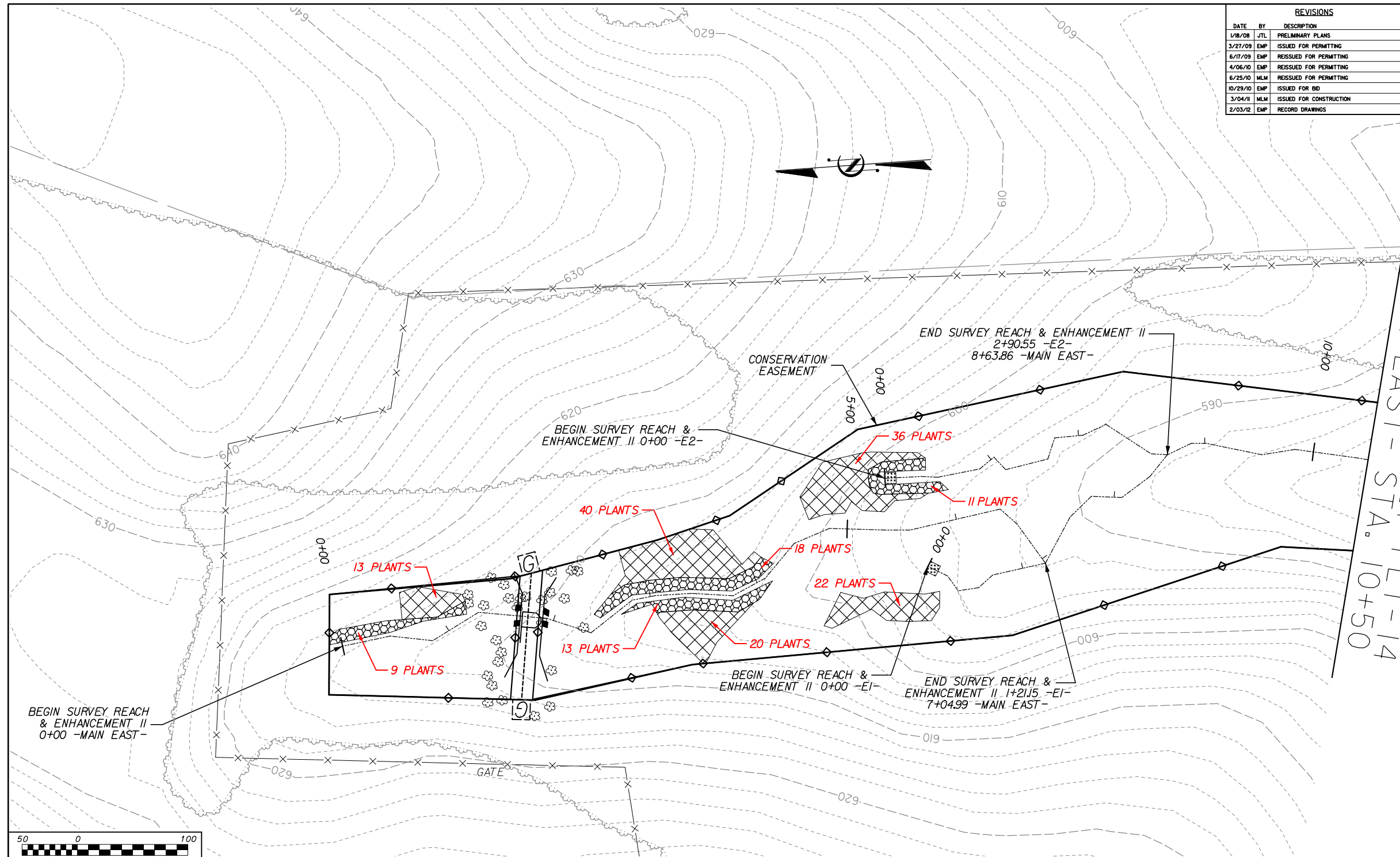
PROJECT ENGINEER

PROJECT REFERENCE NO. UT TO HAW RIVER SHEET NO. PLT-13

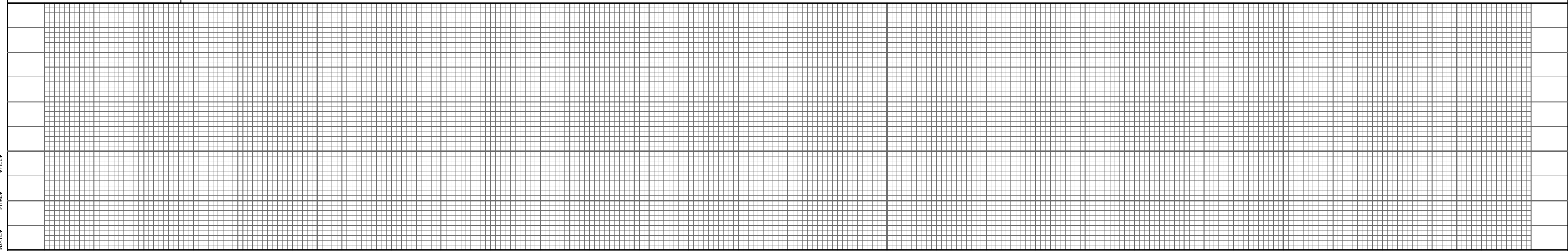
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MATCH TO SHEET PLT-14  
-MAIN EAST- STA. 10+50



#DATE# #TIME# #FILE#

REVISIONS		
DATE	BY	DESCRIPTION
1/8/08	JTL	PRELIMINARY PLANS
3/27/09	EMP	ISSUED FOR PERMITTING
6/17/09	EMP	REISSUED FOR PERMITTING
6/25/10	MLM	REISSUED FOR PERMITTING
10/23/10	EMP	ISSUED FOR BID
3/04/11	MLM	ISSUED FOR CONSTRUCTION
2/03/12	EMP	RECORD DRAWINGS

PROJECT ENGINEER

PROJECT REFERENCE NO. UT TO HAW RIVER  
SHEET NO. PLT-14

**PLANTING**



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MATCH TO SHEET PLT-13  
-MAIN EAST- STA. 10+50

