



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4  
ATLANTA FEDERAL CENTER  
61 FORSYTH STREET  
ATLANTA, GEORGIA 30303-8960

JUN 25 2018

CERTIFIED MAIL 7017 1450 0000 7973 3400  
RETURN RECEIPT REQUESTED

Mr. Jeffrey A. Rose, P.E.  
Interim Director, Waste Resources Division  
City of Chattanooga  
455 Moccasin Bend Road  
Chattanooga, Tennessee 37405

Re: Approval of the Supplemental Environmental Project (SEP) Completion Report  
U.S. District Court Civil Action 1:12-cv-00245

Dear Mr. Rose:

The U.S. Environmental Protection Agency Region 4 and the Tennessee Department of Environment and Conservation have reviewed and hereby approve the Supplemental Environmental Project Completion Report for the Agawela Drive Stream Restoration Project for the City of Chattanooga (the City) submitted May 17, 2018, pursuant to Section VIII of the subject Consent Decree above.

Please contact Ms. Sara Janovitz at (404) 562-9870 or via email at [janovitz.sara@epa.gov](mailto:janovitz.sara@epa.gov) if you have any questions.

Sincerely,

A handwritten signature in black ink that reads "David R. Phillips".

David R. Phillips, Acting Chief  
Municipal & Industrial Enforcement Section  
NPDES Permitting and Enforcement Branch

cc: See Attached List

**Mailing List:**

Mr. Karl Fingerhood  
U.S. Department of Justice  
Washington, D.C.

Mr. Phillip Hilliard  
Office of the Attorney General

Ms. Jessica Murphy  
Tennessee Department of Environment and Conservation

Mr. Donald L. Norris  
City of Chattanooga, Tennessee

Mr. Wade Hinton  
City of Chattanooga, Tennessee

Mr. Adam Sowatzka  
King & Spalding LLP

Ms. Stephanie Matheny  
Tennessee Clean Water Network



# City of Chattanooga

Mayor Andy Berke

May 8, 2018

VIA CERTIFIED MAIL

Ms. Sara Janovitz  
Environmental Engineer  
Clean Water Enforcement Branch  
US EPA-Region 4  
61 Forsyth Street, SW  
Atlanta, GA 30303

**Re: *United States of America et. al. v. City of Chattanooga, No. 1:12-cv-0024*  
SEP Completion Report – Agawela Drive Stream Restoration Project**

Dear Ms. Janovitz:

On behalf of the City of Chattanooga, Tennessee (“City”), and in accordance with the Consent Decree entered by the United States District Court for the Eastern District of Tennessee (Southern Division), on April 24, 2013, in the case styled the United States of America et. al. v. City of Chattanooga, No. 1:12-cv-0024 (“Consent Decree”), we are submitting to both the Environmental Protection Agency (“EPA”) and the Tennessee Department of Environment and Conservation (“TDEC”) the SEP Completion Report – Agawela Drive Stream Restoration Project (“SEP Report”).

As set forth in section VIII of the Consent Decree (“CD”), Chattanooga is to submit a SEP report within thirty (30) days after the date set for completion of the SEP to EPA and TDEC for review, comment, and approval. The SEP Report includes:

- A detailed description of the SEP as implemented.
- A description of any problems encountered in completing the SEP and the solutions thereto.
- An itemized list of all eligible SEP costs expended.
- Certification that the SEP has been fully implemented pursuant to the provisions of this Consent Decree.
- A description of the environmental and public health benefits resulting from implementation of the SEP (with a quantification of the benefits and pollutant reductions, if feasible).

The purpose of the SEP project is to stabilize a severely eroding stream channel, re-establish a more natural stream reach, improve the ecological function of the stream,

Ms. Sara Janovitz  
May 8, 2018  
Page Three

enhance the hydrologic floodplain, and reduce sediment in an impaired stream with a TMDL for sediment.

The City provided a copy of the SEP Report to the Public Document Repository ("PDR") for a period of thirty (30) days starting on March 28, 2018 and ending April 28, 2018. Chattanooga did not receive any public comments. For your reference, the PDR document can be found using the following link:

<http://www.chattanooga.gov/public-works/waste-resources/consent-decree/44-public-works/1050-consent-decree-document-repository>

*I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering such information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.*

We look forward to receiving EPA's and TDEC's approval of the SEP Report. In the meantime, please let me know if you have any questions regarding our submittal.

Sincerely,



Jeffrey A. Rose, P.E.  
Interim Director, Waste Resources Division

Enclosure

cc: Karl Fingerhood, Esq., US DOJ  
Chief, Environmental Enforcement Section, US DOJ  
Chief, Clean Water Enforcement Branch, US EPA Region 4  
Bill Bush, Esq., US EPA  
Sohnia Hong, Esq., Office of the Attorney General  
Enforcement Coordinator, Water Pollution Control, TDEC  
Shelby Ward, TN Clean Water Network  
Adam Sowatzka, Esq., King & Spalding  
Mike Marino, P.E., Jacobs Engineering



# **SEP Completion Report for the Agawela Drive Stream Restoration Project**

*Prepared for*

**United States Environmental Protection Agency  
and Tennessee Department of Environment and  
Conservation**

City of Chattanooga  
Waste Resources Division  
Consent Decree Program  
Case No. 1:12-cv-00245

*Prepared by*

**City of Chattanooga**  
Waste Resources Division

*Submitted by*

**JACOBS®**

Jacobs Engineering Group Inc.  
Consent Decree Program Manager

Chattanooga, Tennessee

March 19, 2018

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# 1.0 Project Description

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## 1.1 Background and Purpose

On April 24, 2013, the City of Chattanooga (City) entered into a consent decree with the United States and the State of Tennessee, in the case styled United States of America et. al. v. City of Chattanooga, No. 1:12-cv-00245 (“CD”). Pursuant to Paragraph 31 of the CD, Chattanooga agreed to undertake a stream restoration project involving over 1,500 linear feet of a tributary of South Chickamauga Creek designed to significantly improve water quality of the tributary and South Chickamauga Creek, as a Supplemental Environmental Project (“SEP”).

Urbanization and development led to significant bank erosion in South Chickamauga Creek, which caused a large amount of sediment to be deposited into the stream. As a result, South Chickamauga Creek was added to the 303(d) list for both habitat alteration and sediment and a Total Maximum Daily Load (“TMDL”) for sediment was developed for South Chickamauga Creek.

The primary goals of this stream restoration portion of the SEP were to:

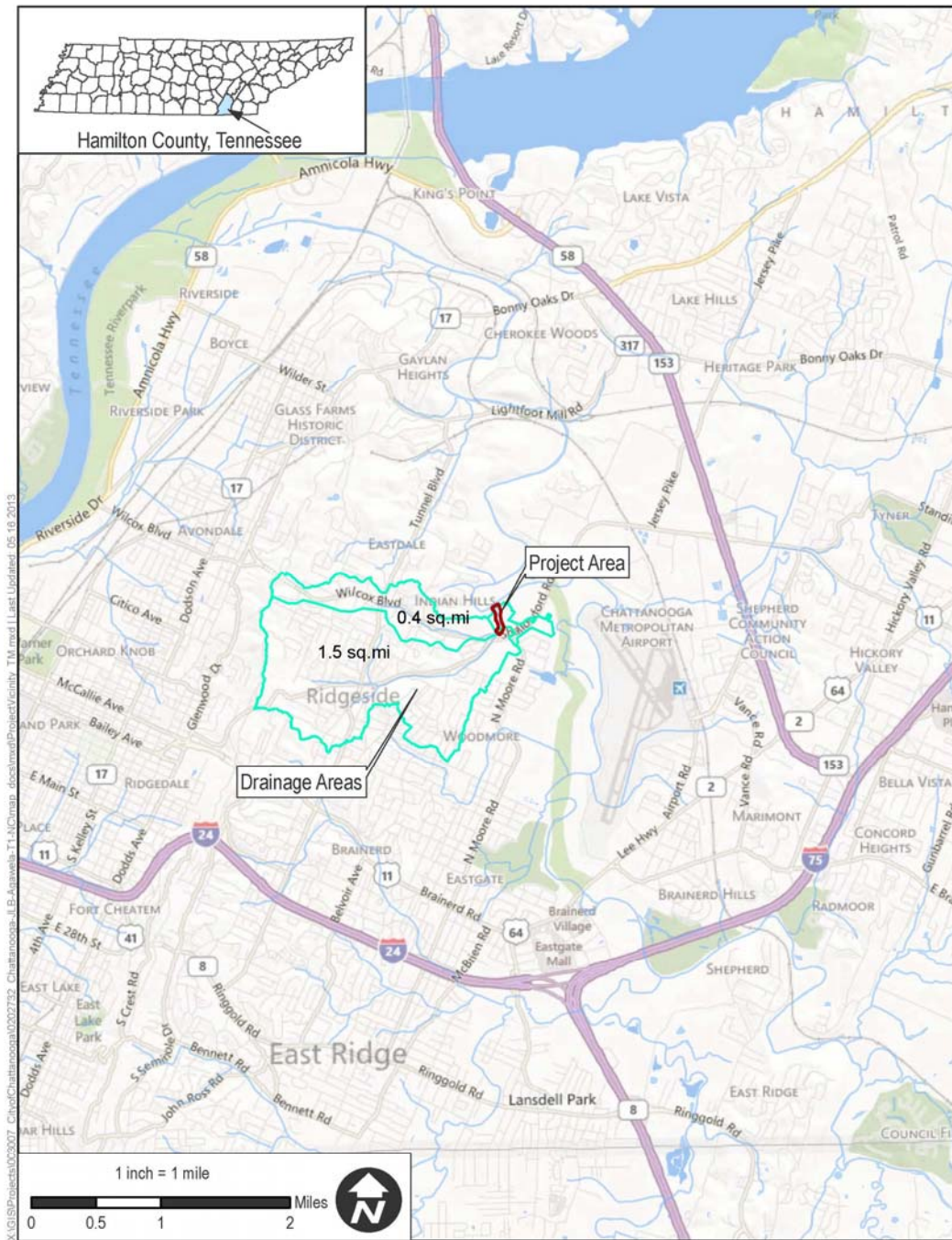
- Stabilize a severely eroding stream channel;
- Re-establish a more natural stream reach;
- Improve the ecological function of the stream;
- Enhance the hydrologic floodplain; and
- Reduce sediment in an impaired stream with a TMDL for sediment.

## 1.2 Project Location

The Project Area is located in the Ridge and Valley Physiographic Province, in the City of Chattanooga, Hamilton County, Tennessee. The project drainage area is part of the South Chickamauga Creek watershed that flows into the Tennessee River and is, therefore, part of the Tennessee River basin. The Project Site is located approximately 5 miles east of downtown of Chattanooga and 1 mile northwest from the Chattanooga Metropolitan Airport, see Figure 1 for reference. The 1,500 linear feet of stream is located near the 3800 block of Agawela Drive, downstream of Shallowford Road. The improvements took place on two channels. Improvement on the Un-named Tributary (“UT”) starts just upstream of a sanitary sewer (“SS”) crossing and continues downstream to the confluence with South Chickamauga Creek. The improvement on an Un-named Tributary to UT (“UT2UT”) starts immediately downstream of the Agawela Drive culvert continuing downstream to the confluence with UT.



Figure 1-1  
Project Vicinity Map



**HDR**  
ONE COMPANY | Many Solutions™

**Project Vicinity Map**  
Figure 1

City of Chattanooga | Agawela Stream Restoration Project | Technical Memo

## 1.3 Detailed Project Description

This project involved the restoration of a tributary of the South Chickamauga Creek and was designed to improve the water quality in the tributary and the creek by using natural channel design principles and bio-engineering techniques for stabilization and habitat enhancement.

The project scope included stream restoration and stabilization activities along approximately 1,500 linear feet of stream. Improvements included but were not limited to the following:

- Excavation and borrow embankment for channel construction;
- Installation of log and rock grade control structures;
- 60 linear feet of sanitary sewer replacement and encasement; and
- Live staking, tree & shrub planting, and sediment/erosion control measures.

Construction began July 2016 and ended in October 2016. Temporary vegetation was used for stabilization until the designed landscape could be installed in February 2017. The landscape plan consisted of four planting zones: stream banks, lower and upper riparian zones, and sanitary sewer easement. Ernst #511 (GA Ridge & Valley Riparian Mix) was used in the riparian areas and within the sewer easement. The stream banks were planted with 4,800 live stakes; over 2,300 trees/shrubs were planted within the riparian areas as either ball and burlap or 3 gallon container. Monitoring began in March 2017 and the first invasive plant species treatment occurred in July 2017.

Exhibit E of the CD required that Chattanooga purchase a Conservation Easement (“CE”) from adjoining property owners. The legal description and exhibit drawing for the CEs is included in Appendix B.

In addition, please refer to the City of Chattanooga’s Year 1 Monitoring Report included as Appendix A for additional project information including monitoring criteria, field data, and record drawings.

## 2.0 Problems Encountered and Solutions

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A description of the problems encountered in completing the SEP and their solutions are listed below:

- **Problem:** The 10" sewer pipe crossing of the stream bed was found to be six (6) inches higher in elevation than shown on the plans. This created a depth above the sewer to the stream bed to be only six inches.

**Solution:** To protect the new ductile iron sewer pipe, a 2.5' x 10' x 12" concrete cap was installed on top of the sewer with small rip-rap placed in the concrete for the stream channel surface. Reinforcement bars were placed and dowelled into the concrete cradle.

- **Problem:** Removal of trees created a fall risk for drivers along Agawela Drive.

**Solution:** The installation of 40 feet of Tennessee Department of Transportation ("TDOT") Type 2 guardrail with metal posts was added to the contract. The guardrail was installed across the culvert opening along Agawela Drive. In addition, 24 feet of 6 feet tall chain-link fence including two (2) 8-foot swing gates was added across the construction access road adjacent to the stream at Agawela Drive. The chain-link fence blocks driving access into the stream area to prevent vandalism and dumping.

- **Problem:** Drought conditions during the months of November and December 2016 directly impacted the scheduling of planting trees, shrubs and live stakes. The contract specified that plantings could only occur between November 15th and March 15th. Drought conditions did not allow the nursery to excavate the trees and shrubs until January 2017 which delayed delivery to the site until February 6, 2017

**Solution:** As specified in the contract documents, Section 00 72 00, Parts 12.02 and 12.03 the contract time may be extended due to adverse weather conditions. A contract change added seven (7) days for plant installation and another seven (7) days for cleanup, silt fence removal, etc. With the addition of 14 contract days, this extended the final completion date from February 22, 2017 to March 7, 2017.

- **Problem:** Heavy rains from February 27 through March 1, 2017, created wet conditions that did not allow the contractor to perform the work.

**Solution:** As specified in the contract documents, Section 00 72 00, Parts 12.02 and 12.03 the contract time may be extended due to adverse weather conditions. The contract was extended for three (3) days due to weather. Also, due to staff availability and difficulty scheduling the final walk through on the last day of the contract, the final

completion date was extended for an additional five (5) days for a total of eight (8) days. This extended the final completion date from March 7, 2017 to March 15, 2017.

# 3.0 Expended Costs

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Pursuant to Paragraph 32(a) of the CD, Chattanooga agreed to spend \$800,000 in performing the SEP. By the end of the project, Chattanooga spent \$985,953.47 to perform the SEP, or \$185,953.47 more than what was required. An itemized list of all eligible SEP costs expended are listed below:

Table 3-1

Total Costs

Description	Fee
Engineering	\$218,435.28
Construction	\$767,518.19
<b>Total</b>	<b>\$985,953.47</b>

Table 3-2

Engineering Costs

Task	Description	Fee
Task 1	Data Collection, PER & Project Management	\$45,848.30
Task 2	Detailed Design Services	\$72,645.44
Task 3	Bidding Services	\$8,563.24
Task 4	Construction Administration Services	\$39,244.25
Task 5	Cultural Resources Services	\$5,499.99
Task 6	Resident Project Representative Services	\$39,352.45
Task 7	Additional Services	\$7,281.00
	<b>Total</b>	<b>\$218,435.28</b>

Table 3-3

## Construction Costs

Contract Item	Description	Unit Price	Quantity	Amount
1	Mobilization	\$79,000.00	1.00	\$79,000.00
2	Traffic Control	\$5,000.00	1.00	\$5,000.00
3	Construction Stakes, Lines and Grades	\$15,000.00	1.00	\$15,000.00
4	Clearing and Grubbing	\$25,000.00	1.00	\$25,000.00
5	Rock Check Dam	\$1,000.00	5.00	\$5,000.00
6	Enhanced Rock Check Dam	\$3,500.00	1.00	\$3,500.00
7	Silt Fence	\$5.85	2,328.00	\$13,618.80
8	Construction Fencing	\$10.00	112.00	\$1,120.00
9	Construction Entrance	\$18.00	500.00	\$9,000.00
10	Tree Protection	\$5.00	342.00	\$1,710.00
11	Stream Pump Around Systems	\$30,000.00	1.00	\$30,000.00
12	Excavation including Embankment	\$15.00	2,000.00	\$30,000.00
13	Borrow Embankment	\$30.00	2,109.40	\$63,282.00
17	Clay Check Dams	\$1,000.00	6.00	\$6,000.00
19	Stone Revetment (Rip-Rap for Plunge Pool)	\$40.00	476.03	\$19,041.20
20	Stone Revetment (Rip-Rap for Slope/Ditch Protection)	\$40.00	446.73	\$17,869.20
22	Coir Fiber Matting	\$2.00	6,492.87	\$12,985.74
23 (CRF1-2)	Rock Cross Vane (Complete in Place)	\$143.00	428.00	\$61,204.00
24 (CRF1-3)	Rock Vane (Complete in Place)	\$143.00	46.00	\$6,578.00
25 (CRF1-4)	Rock Cross A Vane (Complete in Place)	\$143.00	315.00	\$45,045.00
26 (CRF1-5)	Logs Cross Vane (Complete in Place)	\$125.00	230.00	\$28,750.00
27 (CRF1-6)	Constructed Riffle (Complete in Place)	\$72.00	525.00	\$37,800.00
29	Seeding and Mulching	\$3.42	12,000.00	\$41,040.00
30	Coir Log, 12" Diameter	\$16.00	1,764.00	\$28,224.00
31 (CRF1-8)	10-Inch Sanitary Sewer, Open Cut, PC 350 DIP, Includes Bypass Pumping	\$200.00	67.00	\$13,400.00
32	Concrete Encasement	\$300.00	8.00	\$2,400.00
33	Live Staking	\$18.60	2,300.00	\$42,780.00
34	Tree/Shrub (3 Gallon Container)	\$42.30	2,270.00	\$96,021.00
35	Ball and Burlap Tree Planting (1 to 1.5- inch Caliper)	\$174.00	75.00	\$13,050.00
36	Cash Allowance - Soil and Concrete Testing	\$15,000.00	0.1799367	\$2,699.05
37	Cash Allowance - Construction Verification Surveying	\$10,000.00	0.1555	\$1,555.00
39 (CRF1-1)	Concrete Cap with Rip-Rap Surface		1.00	\$2,500.00
40 (CRF2-1)	40 LF of Type 2 Guardrail		1.00	\$5,250.00
41 (CRF2-2)	24LF of 6-foot tall chainlink fence including two 8-foot swing gates		1.00	\$2,095.20
			<b>Total</b>	<b>\$767,518.19</b>

## 4.0 Implementation Certification

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As required by Paragraph 33.(d) of the CD, Chattanooga hereby certifies that the SEP has been fully implemented pursuant to the provisions of the CD and is in accordance with Section VIII and Appendix E of the CD.

## 5.0 Environmental and Public Health Benefits

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Due to the severely degraded condition of the stream channel, this stream restoration project aimed to significantly improve water quality of South Chickamauga Creek and the related tributary. The primary goals of the project were to:

- Stabilize a severely eroding stream channel;
- Re-establish a more natural stream reach;
- Improve the ecological function of the stream;
- Enhance the hydrologic floodplain; and
- Eliminate a significant contributor of sediment to an impaired stream with a siltation TMDL.

Environmental and public health benefits resulting from the project include the following:

- Reduction of siltation carried downstream – The stream banks have been reshaped and protected by new vegetation and rock structures. This has resulted in less sediment transported downstream to the South Chickamauga Creek.
- Improvement of fish and wildlife habitat – By removal of invasive species, introduction of native trees and grasses, and the re-creation of a more natural drop pool sequence in the stream, habitat has improved.
- Removal of invasive species – Invasive species found within the stream corridor included, but were not limited to Bradford pear, Chinese privet, Honeysuckle bush, Honeysuckle vine, Trumpet creeper vine, Rose of Sharon, and Mimosa. Post construction, the areas within the Limits of Disturbance (“LOD”) had low counts of visible invasive plants due to the amount of disturbance that occurred during construction. However, the seed bank of invasive plant species was still present. The City’s invasive plant control contractor only treated the area between the CE and the LOD for the first year post construction. The entire five acre CE will be treated and monitored during subsequent years. The base treatment occurred from July 18-July 27, 2017. Monitoring was performed on September 21, 2017 to allow the base treatment application to have full effect. It was determined that the efficacy rate for the treatment was greater than 95%.



# Appendix A

## TDEC/USACE Year 1 Monitoring Report

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# Year 1 Monitoring Report Agawela Drive Stream Restoration Project

USACE Permit No: 2013-01332

TVA Permit No: 276806

TDEC ARAP No: NRS15.032

TDEC NPDES No: TNR112855

Permittee: City of Chattanooga

## 1.0 Project Overview

The Agawela Drive Stream Restoration project is the Supplemental Environmental Project (SEP) mandated by the Environmental Protection Agency (EPA) as given in the City of Chattanooga's (City) consent decree filed on April 24, 2013. Due to urbanization and development within the South Chickamauga Creek (SCC) watershed, significant bank erosion has occurred within the tributaries and main stream of the creek. Large amounts of sediment have been deposited into the creek requiring it to be placed on the Tennessee Department of Environment and Conservation's (TDEC) 303(d) list for habitat alteration and sediment. A Total Maximum Daily Load (TMDL) for siltation has been developed for SCC.

Due to the severely degraded condition of the channel at Agawela Drive, Chattanooga conducted this stream restoration project in order to significantly improve water quality of the tributary and SCC. The primary goals of the project were to:

- Stabilize a severely eroding stream channel;
- Re-establish a more natural (representative) stream reach;
- Improve the ecological function of the stream;
- Enhance the hydrologic floodplain; and
- Eliminate a significant contributor of sediment to in an impaired stream with a siltation TMDL.

### 1.1 Timeline

Construction began July 2016 and ended in October 2016 with approximately 1500 linear feet of stream being restored to a more stable form. Temporary vegetation was used for stabilization until the designed landscape could be installed in February 2017. Monitoring began in March 2017 and the first invasive plant species treatment occurred in July 2017.

### 1.2 Monitoring Criteria

Monitoring was conducted in accordance with TDEC and USACE monitoring directive and guidelines. Monitoring consisted of the following primary areas: vegetation, hydrology, geomorphology, and channel stability. In-stream habitat and observed aquatic fauna were also documented on regular site visits.

The presence of trash was not a required monitoring criteria, but it was of notable concern. The urbanized watershed feeds the system with a regular volume of solid waste in the form of trash/debris. Large pieces were occasionally removed from the stream by hand. The City has researched the possibility of an end-of-pipe solution in the form of a trash net or possibly a watershed scale effort for curb inlet screens and citizen education.

### 1.2.1 Vegetation

The landscape plan consisted of four planting zones: stream banks, lower and upper riparian zones, and sanitary sewer easement. Ernst #511 (GA Ridge & Valley Riparian Mix) was used in the riparian areas and within the sewer easement. The stream banks were planted with 4,800 live stakes; over 2,300 trees/shrubs were planted within the riparian areas as either ball and burlap or 3 gallon container.

A post-construction survey of invasive species was conducted within the entire conservation easement. This area is larger than the Limits of Disturbance (LOD) held to by the contractor. Species identified included: Bradford pear, Chinese privet, Honeysuckle bush, Honeysuckle vine, English ivy, Winter creeper, Multiflora rose, Mimosa, Tree of heaven, Sweet autumn clematis, Wisteria, Kudzu, Lespedeza, Autumn olive, and Oriental bittersweet.

#### 1.2.1.1 *Presence of desirable native vegetation*

Two 600 square foot monitoring plots were established on each side (left bank and right bank) of the two representative riffles for a total sampling area of 2,400 square feet. Monitoring was conducted in September and October of 2017. The average stem count, including live stakes and native, desirable volunteers, was 2,977 stems per acre. A table providing species counts can be found in the appendix.

#### 1.2.1.2 *Presence of invasive non-native vegetation*

Invasive species found within the established monitoring plots included: Bradford pear, Chinese privet, Honeysuckle bush, Honeysuckle vine, Trumpet creeper vine, Rose of Sharon, and Mimosa. However, the areas within the LOD had low counts of invasive plants due to the amount of disturbance that occurred during construction. Therefore, the City's invasive plant control contractor only treated the area between the CE and the LOD for this first year. The entire five acre CE will be treated and monitored during subsequent years.

The base treatment occurred from July 18-July 27, 2017. Monitoring was performed on September 21, 2017 to allow the base treatment application to have full effect. It was determined that the efficacy rate for the treatment was greater than 95%.

### 1.2.2 Hydrology

Hydrologic determinations were performed on March 30, 2017. The main channel scored a 29.75 using secondary indicators, but the presence of fish along the majority of the reach could have been used as a primary indicator of a stream. The unnamed tributary flowing into the main stem of the channel scored a 17.75 using secondary indicators; the presence of water in this portion of channel was dependent on storm events. Groundwater was consistently seen entering the channel at the confluence of the two channels below the sanitary sewer line crossing. The hydrologic determination field sheets can be found in the appendix.

### 1.2.3 Geomorphology

Geomorphic parameters were surveyed to measure lateral stability, floodplain connectivity, and bed form diversity. Stream profiles were surveyed for both the unnamed tributary and the

main stem; the As-Built drawings for the profile and channel cross sections can be found in the appendix. These original As-Built data did not provide the detail needed for cross sections in order to calculate the needed dimensions, so City survey crews gathered detailed cross-sectional data for two representative riffles. As no representative riffle was found in the unnamed tributary, two locations were chosen on the main stem: 1) the first riffle below the confluence with the unnamed tributary (ST 0+61) and 2) the last riffle before the confluence with SCC (ST 5+88). Dimensions from these cross sections are found in the appendix.

#### 1.2.4 Channel Stability

The Pfankuch method was used to determine channel stability ratings for both the unnamed tributary and the main stem of the project (field sheets located in the appendix). The system evaluates the potential for mass wasting, excessive erosion, channel capacity, and detachability of bank/bed materials. The standard Pfankuch method scores a channel as follows: <38=Excellent, 39-76=Good, 77-114=Fair, and 115+=Poor. Both channels scored as Good under standard scoring. When using the modified Pfankuch system to take into account Rosgen stream types, the main stem of the channel scored on the top end of Fair. This is due to the structure failure and mass wasting that occurred at the lower end of the project near the confluence with SCC. It is theorized that this was due to the persistence of backwater flooding and frequent high flows from a rainy season prior to bank vegetation establishment. Repairs have been designed using rock toe protection, brush mattresses, and increased live stakes (see appendix for plan set). The City is currently in discussions with the Contractor for when repairs could be begin. Substrate was monitored through visual observations at regular site visits. There has been a fining of materials in pools and small gravel has filled some of the interstitial spacing within the riffle sections; embeddedness was not determined to be an problem.

#### 1.2.5 In-stream Habitat

The stream's hydrology was consistent enough to create in-stream fish habitat including a regular riffle-pool sequence with refugia downstream from all structures in the form of deep pools; undercut banks also appeared to be forming below the water line at some locations. Bank vegetation is currently providing an abundance of protective cover from predator species. Presence of anurans was documented through frog calls; *Acris gryllus* and *Rana sphenoccephala* were recorded.

# Appendix

## Pictures, Tables, & Forms



*Figure 1 View of native vegetation sample plots #1 & 2 from LB*



*Figure 2 View of native vegetation sample plots #3 & 4 from LB*





*Figure 3 Invasive species management on the RB of main stem*



*Figure 4 Invasive species management on the LB of the main stem*





*Figure 5 Downstream view of unnamed tributary at the time of hydrologic determination*



*Figure 6 Downstream view of main stem at the time of hydrologic determination*





*Figure 7 Upstream view of lower riffle cross section (ST 5+88) marked with flags*



*Figure 8 Downstream view of upper riffle cross section (ST 0+61)*





*Figure 9 Aerial view of bank failure at end of project*



*Figure 10 Upstream of bank failure at end of project*





*Figure 11 Representative of good channel stability as seen upstream of the bank failure on the main stem*



*Figure 12 Upstream view of unnamed tributary showing stable structures*

### Stem counts of native vegetation (planted & volunteer)

Botanical Name	Common Name	Zone	Planted	Livestakes	Volunteer	Totals
<i>Alnus serrulata</i>	Tag alder	1 & 2	2			2
<i>Cornus amomum</i>	Silky dogwood	1 & 2	6	17		23
<i>Salix sericea</i>	Silky willow	1	0	27		27
<i>Asambucus canadensis</i>	Elderberry	1	3			3
<i>Acer rubrum</i>	Red maple	2	3		4	7
<i>Betula nigra</i>	River birch	2	3			3
<i>Celtis laevigata</i>	Sugarberry	2	0			0
<i>Juglans nigra</i>	Black walnut	2 & 3	2			2
<i>Platanus occidentalis</i>	Sycamore	2	2		5	7
<i>Ulmus americana</i>	American elm	2	4			4
<i>Cephalanthus occidentalis</i>	Buttonbush	2	1			1
<i>Ilex decidua</i>	Possumhaw	2	1			1
<i>Lindera benzoin</i>	Spicebush	2	0			0
<i>Viburnum dentatum</i>	Southern arrowwood	2	0			0
<i>Acer saccharinum</i>	Silver maple	3	4			4
<i>Quercus nigra</i>	Water oak	2 & 3	4		4	8
<i>Quercus phellos</i>	Willow oak	3	4			4
<i>Quercus alba</i>	White oak	3	10			10
<i>Callicarpa ammericana</i>	American beautyberry	3	3			3
<i>Carpinus caroliniana</i>	Ironwood	3	0			0
<i>Cornus florida</i>	Flowering dogwood	3	7			7
<i>Hamamelis virginiana</i>	Witch hazel	3	5			5
<i>Fraxinus americana</i>	American ash	2 & 3	0		8	8
<i>Liquidambar styraciflua</i>	American sweet gum	2 & 3	0		29	29
<i>Ulmus rubra</i>	Slippery elm	2 & 3	0		5	5
<i>Juniperus virginiana</i>	Eastern red cedar	3	0		1	1

**64                      44                      56                      164 stems per 2400 SF**  
**1161.6                      798.6                      1016.4                      2976.6 stems per acre**

**Hydrologic Determination Field Data Sheet**  
Tennessee Division of Water Pollution Control, Version 1.4

County: HAMILTON	Named Waterbody: S. CHICK	Date/Time: 3-30-17
Assessors/Affiliation: JOSHUA ROGERS	Project ID: YEAR 1 MONITORING	
Site Name/Description: AGAWELA / UT to UT		
Site Location: 3891 AGAWELA DR		
USGS quad: EAST CHATT	HUC (12 digit): 060200010905	Lat/Long: -85.2216, 35.0438 START -85.221, 35.0433 END
Previous Rainfall (7-days): 3/23-3/29 = 1.51"		
Precipitation this Season vs. Normal: very wet wet <u>average</u> dry drought unknown	Source of recent & seasonal precip data: NOAA	
Watershed Size: 1250 Ac	Photos: <u>Y</u> or N (circle) Number:	
Soil Type(s) / Geology: E+B / OCK	Source: USGS	
Surrounding Land Use: COMMERCIAL FILL L & R BANKS / RESIDENTIAL UPSTREAM		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes): <u>Severe</u> Moderate <u>Slight</u> Absent		

SEP Severe Moderate Slight Absent  
Historical

**Primary Field Indicators Observed**

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except <i>Gambusia</i> )	✓	Stream
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	NA	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

**NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4

<b>Overall Hydrologic Determination</b> = WWC
<b>Secondary Indicator Score (if applicable)</b> = 17.75

**Justification / Notes :**

Historically, the channel was on farm land and appears to have been straightened. Severe alteration of channel from stream restoration. Soil Type has been changed due to degree of fill for the restoration





**Hydrologic Determination Field Data Sheet**  
Tennessee Division of Water Pollution Control, Version 1.4

County: <b>HAMILTON</b>	Named Waterbody: <b>S. CHICK</b>	Date/Time: <b>3-30-17</b>
Assessors/Affiliation: <b>JOSHUA ROGERS</b>		Project ID:
Site Name/Description: <b>AGAWELA / UT</b>		<b>YEAR 1 MONITORING</b>
Site Location: <b>3891 AGAWELA DR</b>		
USGS quad: <b>EAST CHAT</b>	HUC (12 digit): <b>060200010905</b>	Lat/Long: -85.221, 35.0433 <b>START</b>
Previous Rainfall (7-days): <b>3/23-3/29 = 1.51"</b>		-85.2216, 35.0465 <b>END</b>
Precipitation this Season vs. Normal:    very wet    wet <b>average</b>		dry    drought    unknown
Source of recent & seasonal precip data :		
Watershed Size: <b>1250 AC</b>	Photos: <b>(Y)</b> or N (circle) Number :	
Soil Type(s) / Geology: <b>Tu/OLK</b>	Source: <b>USGS</b>	
Surrounding Land Use: <b>COMMERCIAL FILL L &amp; R BANKS / RESIDENTIAL UPSTREAM</b>		
Degree of historical alteration to natural channel morphology & hydrology (circle one & describe fully in Notes) :		
<b>(Severe)</b>	Moderate	<b>(Slight)</b> Absent

**Primary Field Indicators Observed**

Primary Indicators	NO	YES
1. Hydrologic feature exists solely due to a process discharge	✓	WWC
2. Defined bed and bank absent, dominated by upland vegetation / grass	✓	WWC
3. Watercourse dry anytime during February through April 15th, under normal precipitation / groundwater conditions	✓	WWC
4. Daily flow and precipitation records showing feature only flows in direct response to rainfall	✓	WWC
5. Presence of multiple populations of obligate lotic organisms with ≥ 2 month aquatic phase	✓	Stream
6. Presence of fish (except <i>Gambusia</i> )	✓	<b>(Stream)</b>
7. Presence of naturally occurring ground water table connection	✓	Stream
8. Flowing water in channel and 7 days since last precipitation in local watershed	NA	Stream
9. Evidence watercourse has been used as a supply of drinking water	✓	Stream

**NOTE : If any Primary Indicators 1-9 = "Yes", then STOP; absent directly contradictory evidence, determination is complete.**

In the absence of a primary indicator, or other definitive evidence, complete the secondary indicator table on page 2 of this sheet, and provide score below.

Guidance for the interpretation and scoring of both the primary & secondary indicators is provided in *TDEC-WPC Guidance For Making Hydrologic Determinations, Version 1.4*

<b>Overall Hydrologic Determination = <u>STREAM</u></b>
<b>Secondary Indicator Score (if applicable) = <u>29.75</u></b>

**Justification / Notes :**

Fish found in pools mid-way down reach & in most pools downstream of that

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## Secondary Field Indicator Evaluation

A. Geomorphology (Subtotal = 18)	Absent	Weak	Moderate	Strong
1. Continuous bed and bank	0	1	2	3
2. Sinuous channel	0	1	2	3
3. In-channel structure: riffle-pool sequences	0	1	2	3
4. Sorting of soil textures or other substrate	0	1	2	3
5. Active/relic floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Braided channel	0	1	2	3
8. Recent alluvial deposits	0	0.5	1	1.5
9. Natural levees	0	1	2	3
10. Headcuts	0	1	2	3
11. Grade controls	0	0.5	1	1.5
12. Natural valley or drainageway	0	0.5	1	1.5
13. At least second order channel on existing USGS or NRCS map	No = 0		Yes = 3	

B. Hydrology (Subtotal = 6.25)	Absent	Weak	Moderate	Strong
14. Subsurface flow/discharge into channel	0	1	2	3
15. Water in channel and >48 hours since sig. rain	0	1	2	3
16. Leaf litter in channel (January – September)	1.5	1	0.5	0
17. Sediment on plants or on debris	0	0.5	1	1.5
18. Organic debris lines or piles (wrack lines)	0	0.5	1	1.5
19. Hydric soils in stream bed or sides of channel	No = 0		Yes = 1.5	

C. Biology (Subtotal = 5.5)	Absent	Weak	Moderate	Strong
20. Fibrous roots in channel <sup>1</sup> NA (Do Not Count)	0	2	1	0
21. Rooted plants in channel <sup>1</sup>	0	2	1	0
22. Crayfish in stream (exclude in floodplain)	0	0.5	1	1.5
23. Bivalves/mussels	0	1	2	3
24. Amphibians	0	0.5	1	1.5
25. Macroinvertebrates (record type & abundance)	0	1	2	3
26. Filamentous algae; periphyton	0	1	2	3
27. Iron oxidizing bacteria/fungus	0	0.5	1	1.5
28. Wetland plants in channel <sup>2</sup>	0	0.5	1	2

<sup>1</sup> Focus is on the presence of upland plants.

<sup>2</sup> Focus is on the presence of aquatic or wetland plants.

Total Points = 24.75

*Under Normal Conditions, Watercourse is a Wet Weather Conveyance if Secondary Indicator Score < 19 points*

**Notes :**

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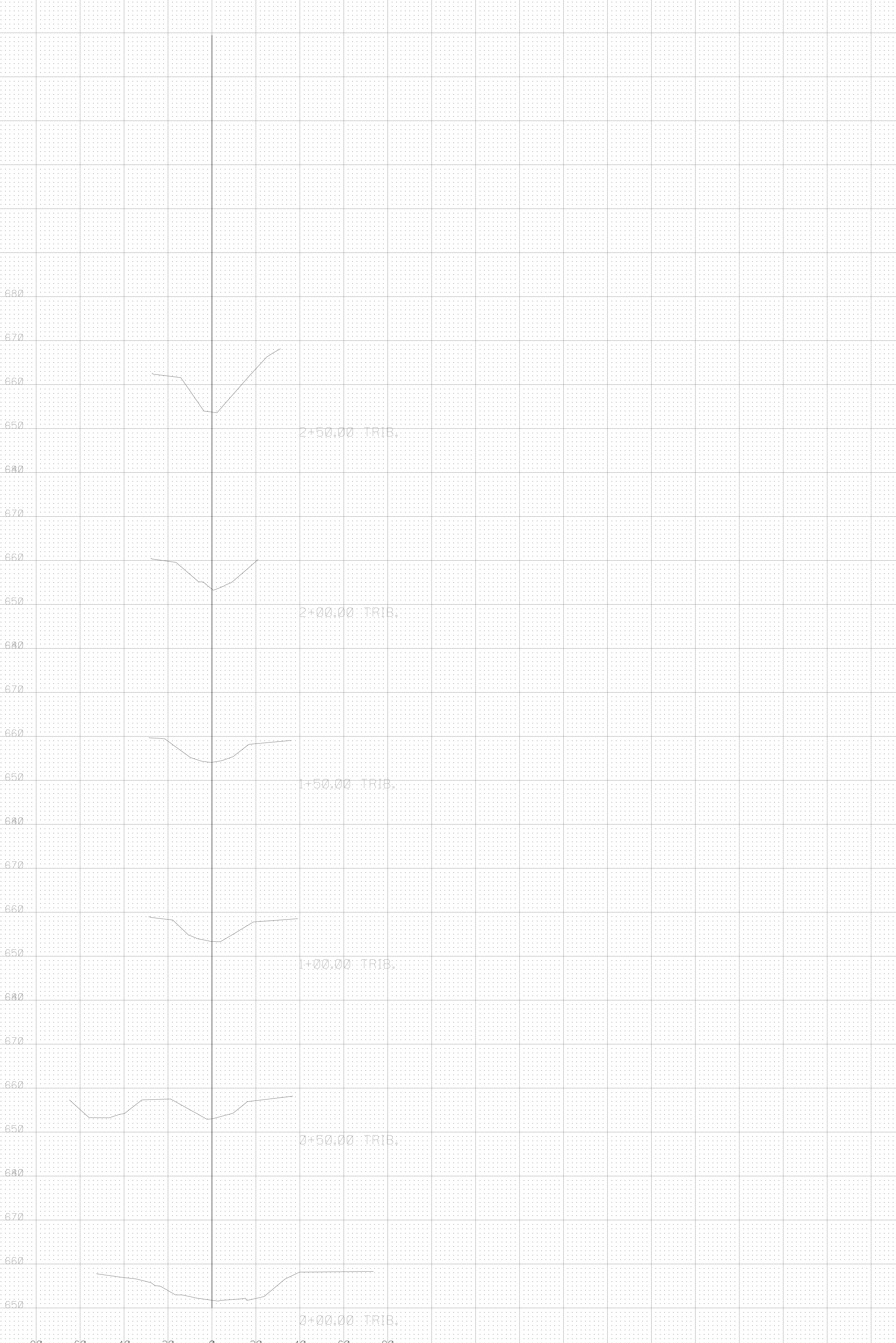


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Discoloration of material (plants & trash) along margins/banks



CROSS SECTIONS  
 3 OF 3  
 SHEET NO.

**Agawela Drive Stream Restoration**  
 Chattanooga, TN



108 Beasley Drive  
 Franklin, TN  
 37064  
 615.794.2275

NO.	DATE	COMMENT



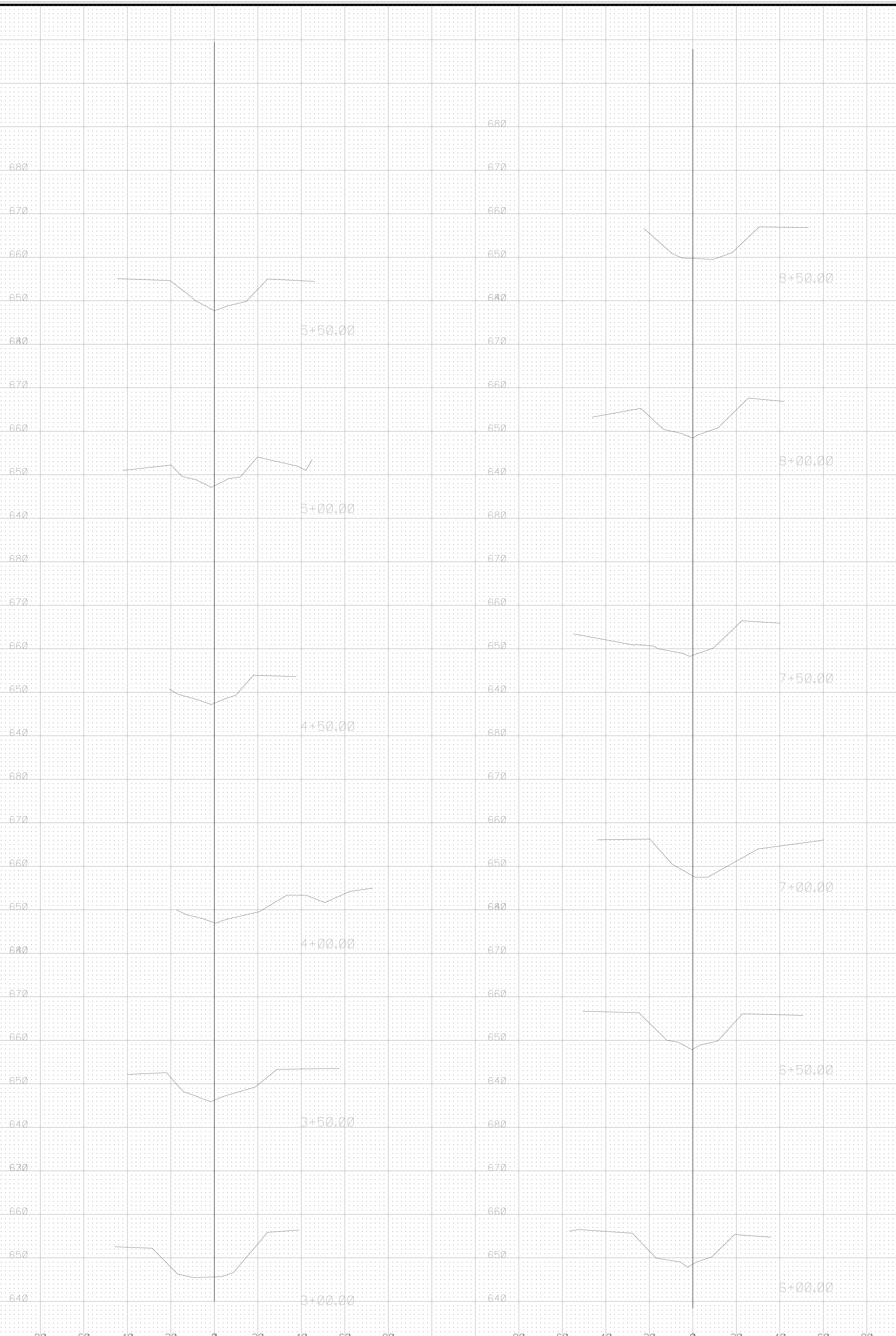
CROSS  
 SECTIONS  
 DRAWN BY: DPM  
 APP'D BY: JCW II  
 DATE: 3-16-17  
 PROJ. No.: 63916  
 SCALE: 1" = 20'  
 SHEET No.:  
**2 of 3**

**Agawela Drive Stream Restoration**  
 Chattanooga, TN



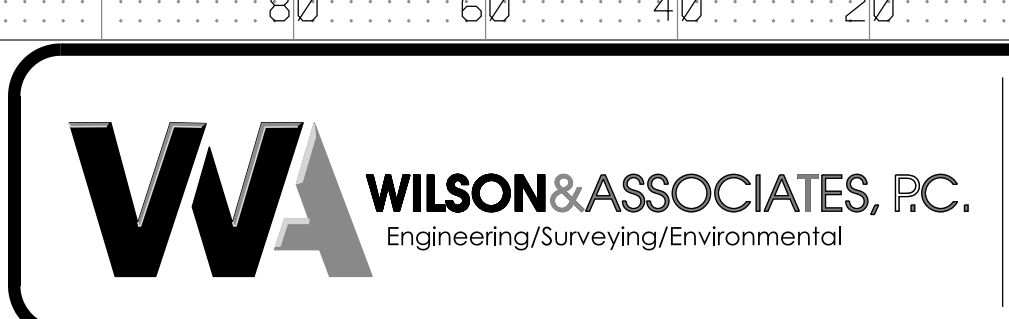
108 Beasley Drive  
 Franklin, TN  
 37064  
 615.794.2275

NO.	DATE	COMMENT



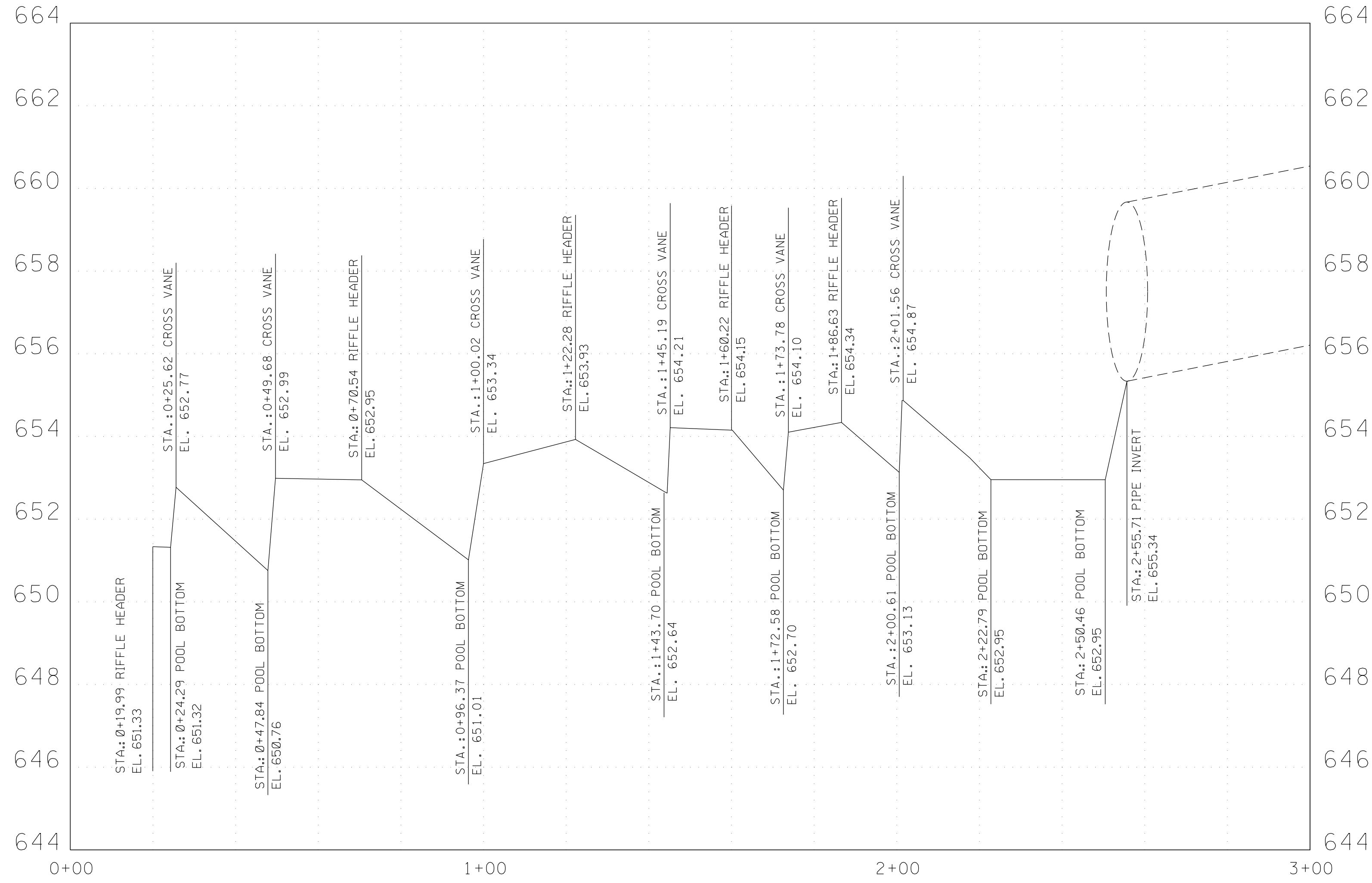
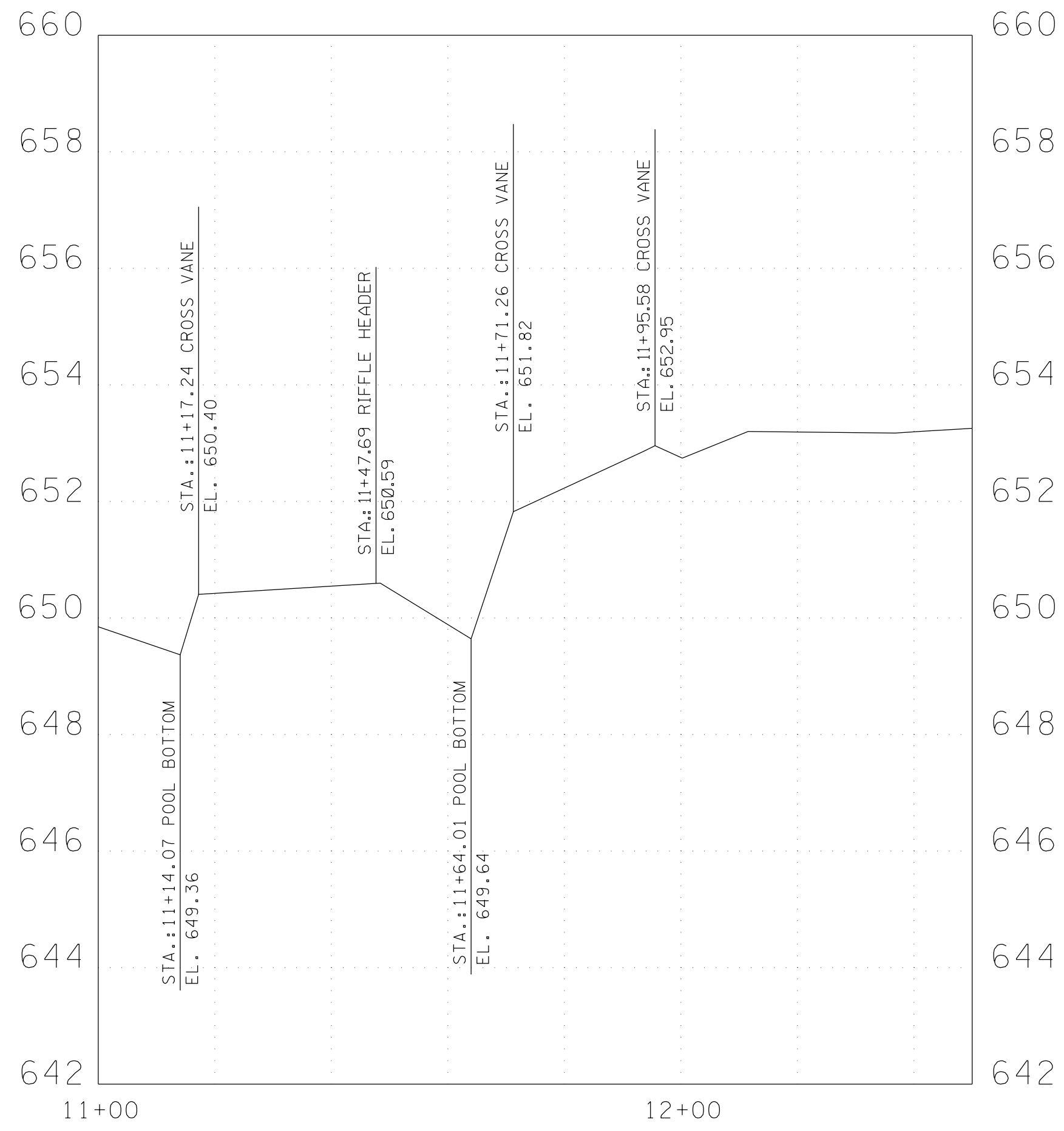
SHEET NO. 1 of 3  
 CROSS SECTIONS

**Agawela Drive Stream Restoration**  
 Chattanooga, TN



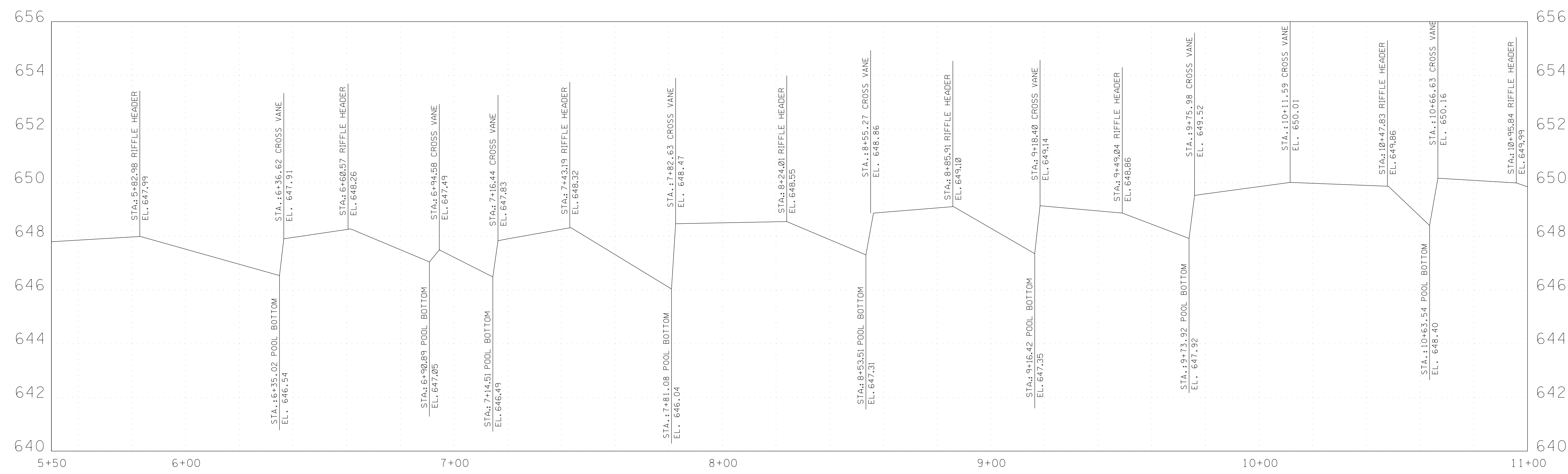
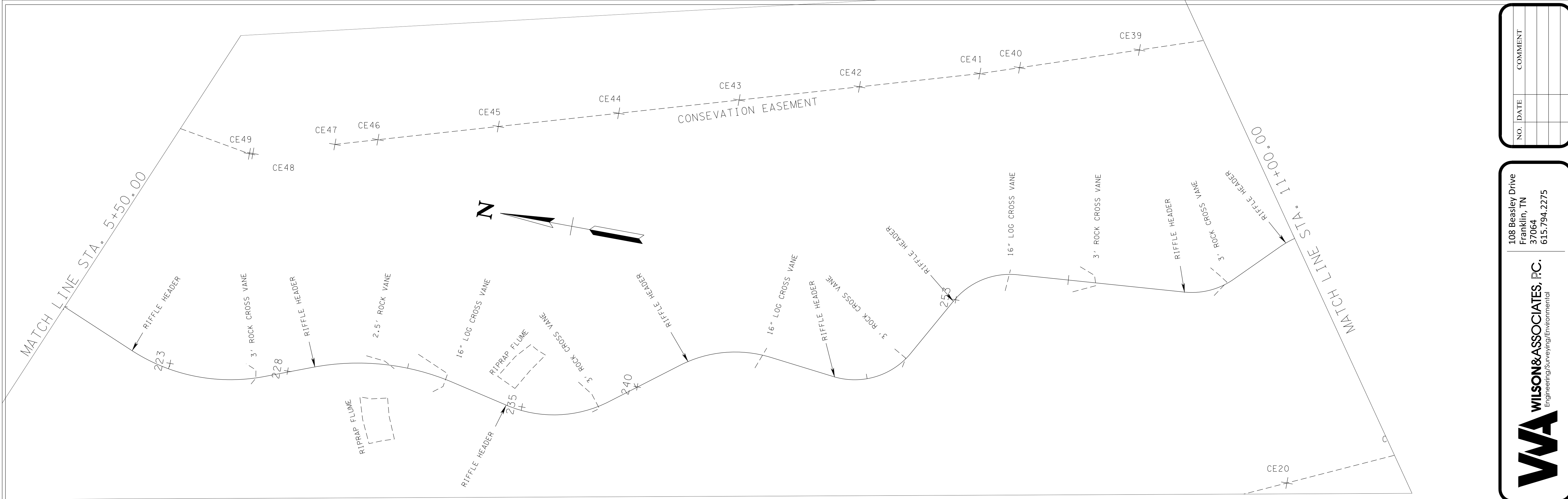
108 Beasley Drive  
 Franklin, TN 37064  
 615.794.2275

NO.	DATE	COMMENT



NO.	DATE	COMMENT





NO.	DATE	COMMENT

108 Beasley Drive  
Franklin, TN  
37064  
615.794.2275

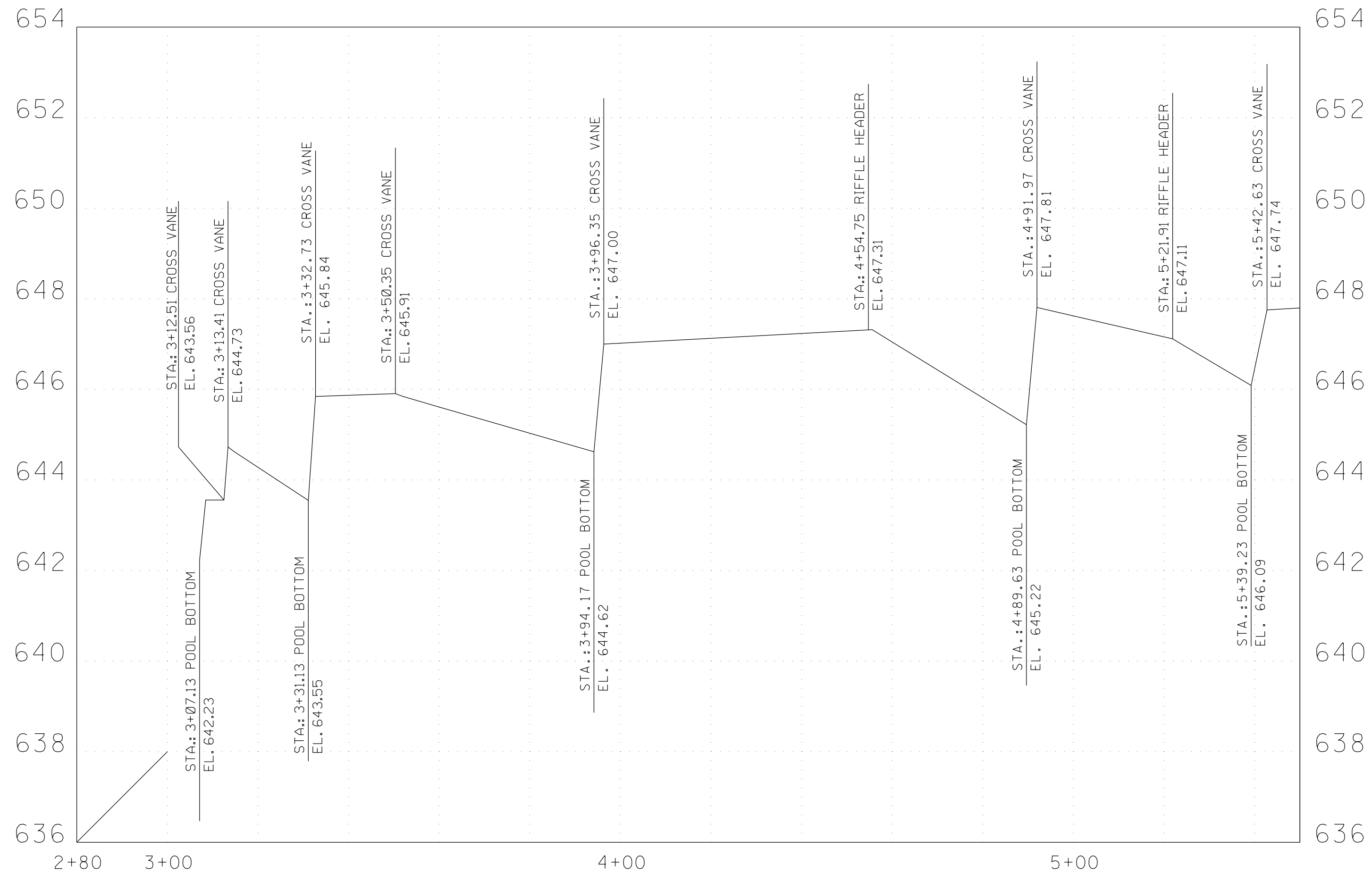
**WVA** WILSON & ASSOCIATES, P.C.  
Engineering/Surveying/Environmental

*Agawela Drive Stream Restoration*  
City of Chattanooga, TN

**As-Built Veiw**

DRAWN BY: DPM  
APPVD. BY: JCW II  
DATE 3-16-17  
PROJ. No. 63916  
SCALE: 1"= 10'

SHEET No.  
**2 OF 3**



NO.	DATE	COMMENT

108 Beasley Drive  
Franklin, TN  
37064  
615.794.2275

**WVA** WILSON & ASSOCIATES, P.C.  
Engineering/Surveying/Environmental

*Agawela Drive Stream Restoration*  
City of Chattanooga, TN

**As-Built Veiw**

DRAWN BY: DPM  
APPVD. BY: JCW II  
DATE 3-16-17  
PROJ. No. 63916  
SCALE: 1" = 10'

SHEET No.  
**1 OF 3**

Geomorphic Parameters as of 2017: Comparison of Proposed and Constructed

<b>Dimension Parameter</b>	<b>Existing Conditions</b>	<b>Proposed Design</b>	<b>2017</b>
Bankfull Width (ft)	16	17	15
Floodprone Width (ft)	18.5	32.25	30
Bankfull Mean Depth (ft)	1.17	1.13	1.18
Bankfull Max Depth (ft)	1.35	1.75	1.9
Bankfull Cross Sectional Area (ft <sup>2</sup> )	19	19.25	18.2
Width/Depth Ratio	14	15	17.1
Entrenchment Ratio	1.16	1.9	1.2



MODIFIED PFANKUCH STREAM REACH INVENTORY AND CHANNEL STABILITY EVALUATION

Stream:	WT to S. Chick	Observer(s):	JOSHUA ROGERS	Ex. Stream Type:		Ref. Stream Type:	
Reach:	Lower (main)	Comments:		Grand Total:	0.00	Stability Rating:	65 FAIR
Location:	Agawela Dr			Notes:			
Date:	10-20-17						

Location	Key	Category	Excellent			Good			Fair			Poor							
			Description	Rating	Score	Description	Rating	Score	Description	Rating	Score	Description	Rating	Score					
30 Upper Banks	1	Landform Slope	Bank slope gradient < 30%	2	3	Bank slope gradient 30-40%	4		Bank slope gradient 40-60%	6		Bank slope gradient > 60%	8						
	2	Mass Wasting	No evidence of past or future mass wasting	3		Infrequent. Mostly healed over. Low future potential.	6	6	Frequent or large, causing sediment nearly year long.	9		Frequent or large, causing sediment nearly year long OR imminent danger of same.	12						
	3	Debris Jam Potential	Essentially absent from immediate channel area.	2		Present, but mostly small twigs and limbs.	4	5	Moderate to heavy amounts, mostly larger sizes.	6		Moderate to heavy amounts, predominantly larger sizes.	8						
	4	Vegetative Bank Protection	> 90% plant density. Vigor and variety suggest a deep, dense soil binding root mass.	3		70-90% density. Fewer species or less vigor suggest less dense or deep root mass.	6	6	50-70% density. Lower vigor and fewer species from shallow, discontinuous root mass.	9		< 50% density plus fewer species and less vigor indicating poor, discontinuous, and shallow root mass.	12						
18 Lower Banks	5	Channel Capacity/Enlargement	Ample for present plus some increases. Peak flows contained. Ratio of wd ratio to reference wd ratio between 1.0-1.1. BHR = 1.0-1.1.	1		Adequate. Bank overflows are rare. Ratio of wd ratio to reference wd ratio between 1.1-1.2. BHR = 1.1-1.3.	2		Hardly contains present peaks. Occasional overbank floods. Ratio of wd ratio to reference wd ratio between 1.2-1.6. BHR = 1.3-1.5.	3	3	Inadequate. Overbank flows common. Ratio of wd ratio to reference wd ratio > 1.6. BHR > 1.5.	4						
			For incising channels, ratio of wd ratio to reference wd ratio between 0.8-1.0.	1		For incising channels, ratio of wd ratio to reference wd ratio between 0.6-0.8.	2		For incising channels, ratio of wd ratio to reference wd ratio between 0.4-0.6.	3		For incising channels, ratio of wd ratio to reference wd ratio between 0.2-0.4.	4						
	6	Bank Rock Content	> 65% with large angular boulders > 12" common.	2		40-65%. Mostly boulders and small cobbles 6-12"	4	4	20-40% with most in the 3-6" diameter class.	6		< 20% rock fragments of gravel sizes, 1-3" or less.	8						
	7	Obstructions to Flow	Rocks and logs firmly embedded. Flow pattern without cutting or deposition. Stable bed.	2	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4		Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	6		Frequent obstruction and deflectors cause bank erosion year long. Sediment traps full, channel migration occurring.	9						
	8	Cutting	Little or none. Infrequent raw banks < 6"	4	4	Some, intermittently at outcoves and constrictions. Raw banks may be up to 12"	6		Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident.	12		Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	16						
9	Deposition	Little or no enlargement of channel or point bars.	4	5	Some new bar increase, mostly from coarse gravel.	8		Moderate deposition of new gravel and coarse sand on old and some new bars.	12		Extensive deposit of predominantly fine particles. Accelerated bar development.	16							
27 Channel Bottom	10	Rock Angularity	Sharp edges and corners. Plane surfaces rough.	1	1	Rounded corners and edges, surfaces smooth, flat.	2		Corners and edges well rounded in 2 dimensions.	3		Well rounded in all dimensions, surfaces smooth.	4						
	11	Brightness	Surfaces dull, dark or stained. Generally not bright.	1		Mostly dull, but may have < 35% bright surfaces.	2	2	Mixture dull and bright, i.e. 35-65% mixture range.	3		Predominantly bright, > 65% exposed or scoured surfaces.	4						
	12	Cosolidation of Particles	Assorted sizes tightly packed or overlapping.	2		Moderately packed with some overlapping.	4	4	Mostly loose assortment with no apparent overlap.	6		No packing evident. Loose assortment easily moved.	8						
	13	Bottom Size Distribution	No size change evident. Stable material 80-100%.	4		Distribution shift slight. Stable material 50-80%.	8	6	Moderate change in sizes. Stable materials 20-50%.	12		Marked distribution change. Stable materials 0-20%. Sand deposition.	16						
	14	Scouring and Deposition	< 5% of bottom affected by scour or deposition.	6		5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	12	12	30-50% affected. Deposits and scour at obstructions, constriction and bends. Some filling of pools.	18		> 50% of the bottom in a state of flux or change nearly year long.	24						
15	Aquatic Vegetation	Abundant growth moss-like, dark green perennial. In swift water, too.	1		Common. Algae forms in low velocity and pool areas. Moss here, too.	2	2	Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	3		Perennial types scarce or absent. Yellow-green, short term bloom may be present.	4							
			Excellent Total	0				Good Total	0				Fair Total	0				Poor Total	0

Lower section @ S. Chick (confluence structure failure)

Agawela main channel																					
Good (Stable)	38-43	40-60	40-64	48-68	40-60	38-50	60-85	70-90	70-90	60-85	85-107	85-107	85-107								
Fair (Moderately Unstable)	44-47	44-47	91-129	96-132	96-142	81-110	46-58	46-58	61-78	65-84	69-88	61-78	51-61	54-61	86-105	91-110	91-110	86-105	108-132	108-132	108-132
Poor (Unstable)	48+	48+	130+	133+	143+	111+	59+	59+	79+	85+	89+	79+	62+	62+	106+	111+	111+	106+	133+	133+	133+
Stream Type	D6	DA3	DA4	DAS	DA6	E3	E4	E5	E6	F1	F2	F3	F4	F5	F6	G1	G2	G3	G4	G5	G6
Good (Stable)	67-98	40-63	40-63	40-63	40-63	40-63	50-75	50-75	40-63	60-85											
Fair (Moderately Unstable)	99-125	64-86	64-86	64-86	64-86	64-86	76-96	76-96	64-86	86-105						40-60	40-60	85-107	85-107	90-112	83-107
Poor (Unstable)	126+	87+	87+	87+	87+	87+	97+	97+	87+	106+						61-78	61-78	108-120	108-120	113-126	108-120
Agawela trib channel																					
																79+	79+	121+	121+	126+	121+

MODIFIED PFANKUCH STREAM REACH INVENTORY AND CHANNEL STABILITY EVALUATION

Stream:	UP TO UP TO S. Chick	Observer(s):	JOSHUA ROGERS	Ex. Stream Type:		Ref. Stream Type:	
Reach:	Upper (Trib)	Comments:		Grand Total:	0.00	61	
Location:	Agawela Dr			Stability Rating:		GOOD	
Date:	10-20-17			Notes:			

Location	Key	Category	Excellent			Good			Fair			Poor				
			Description	Rating	Score	Description	Rating	Score	Description	Rating	Score	Description	Rating	Score		
16	Upper Banks	1 Landform Slope	Bank slope gradient < 30%	2	3	Bank slope gradient 30-40%	4		Bank slope gradient 40-60%	6		Bank slope gradient > 60%	8			
		2 Mass Wasting	No evidence of past or future mass wasting	3	3	Infrequent. Mostly healed over. Low future potential.	6		Frequent or large, causing sediment nearly year long	9		Frequent or large, causing sediment nearly year long OR imminent danger of same.	12			
		3 Debris Jam Potential	Essentially absent from immediate channel area.	2		Present, but mostly small twigs and limbs.	4	4	Moderate to heavy amounts, mostly larger sizes.	6		Moderate to heavy amounts, predominantly larger sizes.	8			
		4 Vegetative Bank Protection	> 90% plant density. Vigor and variety suggest a deep, dense soil binding root mass.	3		70-90% density. Fewer species or less vigor suggest less dense or deep root mass.	6	6	50-70% density. Lower vigor and fewer species from shallow, discontinuous root mass.	9		< 50% density plus fewer species and less vigor indicating poor, discontinuous, and shallow root mass.	12			
19	Lower Banks	5 Channel Capacity/Enlargement	Ample for present plus some increases. Peak flows contained. Ratio of wd ratio to reference wd ratio between 1.0-1.1. BHR = 1.0-1.1.	1		Adequate. Bank overflows are rare. Ratio of wd ratio to reference wd ratio between 1.1-1.2. BHR = 1.1-1.3.	2		Barely contains present peaks. Occasional overbank floods. Ratio of wd ratio to reference wd ratio between 1.2-1.6. BHR = 1.3-1.5.	3	3	Inadequate. Overbank flows common. Ratio of wd ratio to reference wd ratio > 1.6. BHR > 1.5.	4			
			For incising channels, ratio of wd ratio to reference wd ratio between 0.8-1.0.	1		For incising channels, ratio of wd ratio to reference wd ratio between 0.6-0.8.	2		For incising channels, ratio of wd ratio to reference wd ratio between 0.4-0.6.	3		For incising channels, ratio of wd ratio to reference wd ratio between 0.2-0.4.	4			
		6 Bank Rock Content	> 65% with large angular boulders > 12" common.	2		40-65%. Mostly boulders and small cobbles 6-12"	4	4	20-40% with most in the 3-6" diameter class.	6		< 20% rock fragments of gravel sizes, 1-3" or less.	8			
		7 Obstructions to Flow	Rocks and logs fully imbedded. Flow pattern without cutting or deposition. Stable bed.	2	2	Some present causing erosive cross currents and minor pool filling. Obstructions fewer and less firm.	4		Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling.	6		Frequent obstruction and deflectors cause bank erosion year long. Sediment traps full, channel migration occurring.	9			
		8 Cutting	Little or none. Infrequent raw banks < 6"	4	4	Some, intermittently at outer curves and constrictions. Raw banks may be up to 12"	6		Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident.	12		Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	16			
9 Deposition	Little or no enlargement of channel or point bars. Plunge pool & 1st structure	4	6	Some new bar increase, mostly from coarse gravel.	8		Moderate deposition of new gravel and coarse sand on old and some new bars.	12		Extensive deposit of predominantly fine particles. Accelerated bar development.	16					
20	Channel Bottom	10 Rock Angularity	Sharp edges and corners. Plane surfaces rough.	1	1	Rounded corners and edges, surfaces smooth, flat.	2		Corners and edges well rounded in 2 dimensions.	3		Well rounded in all dimensions, surfaces smooth.	4			
		11 Brightness	Surfaces dull, dark or stained. Generally not bright.	1		Mostly dull, but may have < 35% bright surfaces.	2		Mixture dull and bright, i.e. 35-65% mixture range.	3	3	Predominantly bright, > 65% exposed or scoured surfaces.	4			
		12 Consolidation of Particles	Assorted sizes tightly packed or overlapping.	2	2	Moderately packed with some overlapping.	4		Mostly loose assortment with no apparent overlap.	6		No packing evident. Loose assortment easily moved.	8			
		13 Bottom Size Distribution	No size change evident. Stable material 80-100%.	4		Distribution shift light. Stable material 50-80%.	8	6	Moderate change in sizes. Stable materials 20-50%.	12		Marked distribution change. Stable materials 0-20%. Sand deposition.	16			
		14 Scouring and Deposition	< 5% of bottom affected by scour or deposition.	6		5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	12	10	50-50% affected. Deposits and scour at obstructions, constriction and bends. Some filling of pools.	18		> 50% of the bottom in a state of flux or change nearly year long.	24			
15 Aquatic Vegetation	Abundant growth moss-like, dark green perennial. In swift water, too.	1		Common. Algae forms in low velocity and pool areas. Moss here, too.	2		Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick.	3		Perennial types scarce or absent. Yellow-green, short term bloom may be present.	4	4				
			Excellent Total	0	Good Total			0	Fair Total			0	Poor Total			0

Trash more likely

Urban, Flashy, High Flows & Backwater Influence inc. freq. of BKF events

New rock from construction

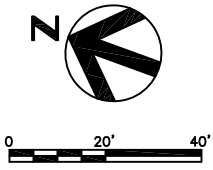
Absence of water/standing pools only

Stream Type	A1	A2	Agawela main channel																							
Good (Stable)	38-43	38-43	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	D3	D4	D5											
Fair (Moderately Unstable)	44-47	44-47	91-129	96-132	96-143	81+110	46-58	46-58	61-78	65-84	69-88	61-78	51-61	51-61	86-105	91-110	91-110	86-105	108-132	108-132	108-132					
Poor (Unstable)	48+	48+	130+	133+	143+	111+	59+	59+	79+	85+	89+	79+	62+	62+	106+	111+	111+	106+	133+	133+	133+					
Stream Type	D6	DA3	DA4	DA5	DA6	E3	E4	E5	E6	F1	F2	F3	F4	F5	F6	G1	G2	G3	G4	G5	G6					
Good (Stable)	67-98	40-63	40-63	40-63	40-63	40-63	50-75	50-75	50-75	40-63	60-85					40-60	40-60	85-107	85-107	90-112	85-107					
Fair (Moderately Unstable)	99-125	64-86	64-86	64-86	64-86	64-86	76-96	76-96	64-86	86-105	Agawela trib channel															
Poor (Unstable)	126+	87+	87+	87+	87+	87+	97+	97+	87+	106+	106+	120+	120+	117+	117+	79+	79+	121+	121+	126+	121+					



**NOTES:**

- 1) ACCESS TO THE SITE SHALL BE FROM THE YERBEY PROPERTY TO THE EAST.
- 2) DAMAGE TO EXISTING TREE AND SHRUB PLANTINGS SHALL BE CONSIDERED PART OF THE WORK AND SHALL BE KEPT A MINIMUM. COST FOR REPLACING DAMAGED PLANTS SHALL BE CONSIDERED INCIDENTAL TO THE WORK AND SHALL BE RESPONSIBILITY OF THE CONTRACTOR.
- 3) EQUIPMENT SHALL NOT CROSS THE STREAM. IF EQUIPMENT NEEDS TO ACCESS THE WEST SIDE OF THE STREAM ACCESS SHALL BE THROUGH THE CITY PROPERTY OFF AGAWELA DRIVE.
- 4) THE CONTRACTOR IS RESPONSIBLE TO RESTORE ACCESS PATHS TO EXISTING CONDITIONS INCLUDING TEMPORARY AND PERMANENT SEEDING.



RIFFLE ROCKS HAVE BEEN MOVED AROUND AND TRANSPORTED DOWNSTREAM. INSTALL NEW CLASS A1 RIP-RAP TO MEET REQUIREMENTS OF ORIGINAL DETAIL. SEE DETAIL 1 ON 00C-503. TYPICAL BOTH RIFFLE STRUCTURES

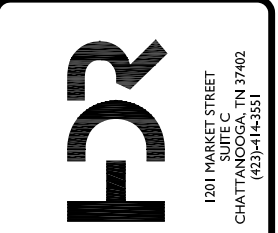
ADJUST BOULDERS AS NEEDED TO MATCH ORIGINAL LOCATIONS

ROCK TOE PROTECTION, SHEET SHEET 002  
113 L.F. +/-

CONTRACTOR IS RESPONSIBLE TO INSTALL AND MAINTAIN EROSION CONTROL MEASURES TO ENSURE SEDIMENT IS NOT TRANSPORTED DOWNSTREAM. SEE ORIGINAL CONTRACT FOR EROSION CONTROL NOTES THAT APPLY TO THIS WORK. IN-STREAM CHECK DAM, SILT FENCE, OR OTHER MEASURES MAY BE REQUIRED.

ROCK TOE PROTECTION, SEE SHEET 001  
72 L.F. +/-

REPAIR SLOPE TO ORIGINAL GRADES AS NEEDED, APPLY NEW MATTING, AND SEED/MULCH (BOTH SIDES)



AGAWELA DRIVE  
STREAM RESTORATION PROJECT  
CITY OF CHATTANOOGA, TN  
CONSENT DECREE PROGRAM



REV	DATE	REVISION DESCRIPTION
A	07/28/2017	ISSUED FOR G&E

THIS LINE IS ONE INCH LONG WHEN PLOTTED FULL SCALE  
THIS DRAWING MUST BE USED IN CONJUNCTION WITH THE APPLICABLE OR GOVERNING TECHNICAL SPECIFICATIONS AND OTHER CONTRACT DOCUMENTS.

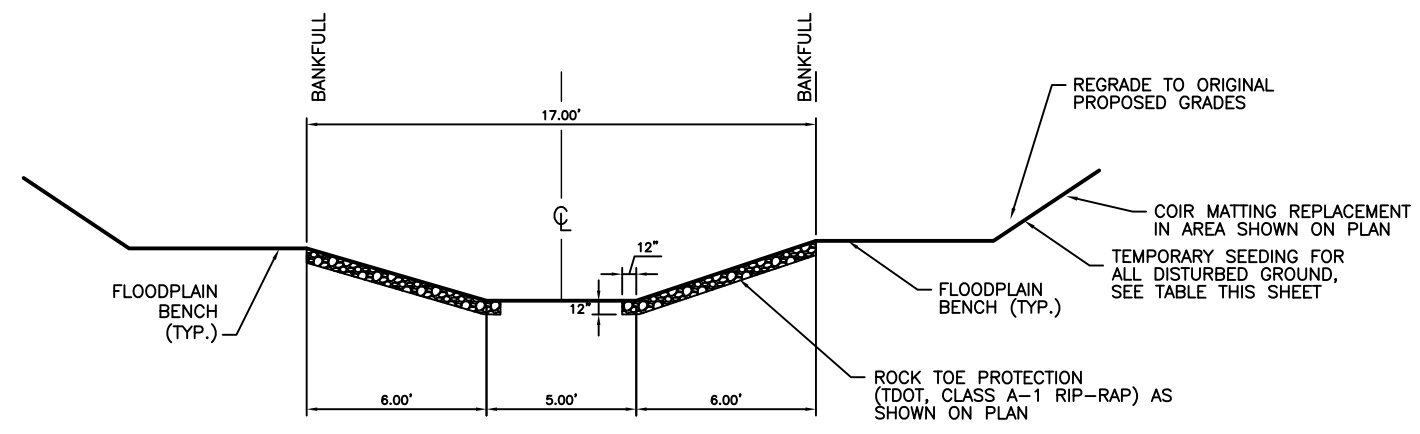
PROJ #: COC:W-12-018-201 HDR:202729-0214  
DATE: JULY 2017  
DISC. LEAD: DESIGNER: CHECKER:

SHEET TITLE  
CIVIL  
CHANNEL  
REPAIR  
EXHIBIT

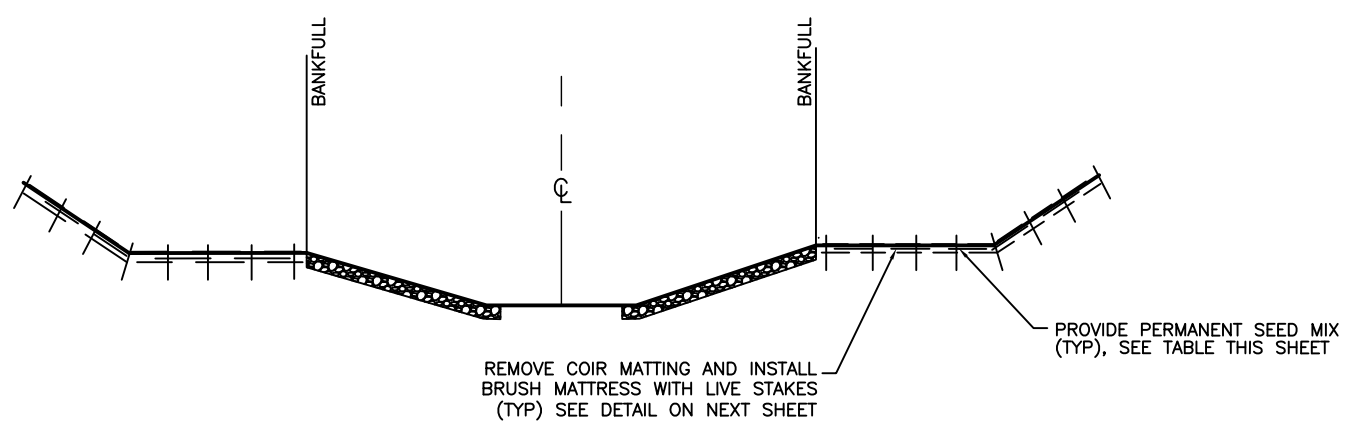


1201 MARKET STREET  
SUITE C  
CHATTANOOGA, TN 37402  
(423)-414-3551

AGAWELA DRIVE  
STREAM RESTORATION PROJECT  
CITY OF CHATTANOOGA, TN  
CONSENT DECREE PROGRAM



TYPICAL SECTION (RIFFLE) PHASE 1  
MAIN CHANNEL  
NOT TO SCALE



TYPICAL SECTION (RIFFLE) PHASE 2  
MAIN CHANNEL  
NOT TO SCALE

NOTES:

- 1) LIVE STAKES AND BRUSH MATTRESS SPECIES SHALL BE AS SPECIFIED IN THE TABLES BELOW.
- 2) PHASE 1 IS TO BE PERFORMED IMMEDIATELY WITH TEMPORARY VEGETATIVE SEED PLANTED AND MONITORED TO ENSURE THRIVING PLANT GROWTH. CONTRACTOR SHALL WATER SEED PER SEED COMPANY RECOMMENDATIONS BEING CAREFUL NOT TO OVER WATER, LETTING SEEDS DRY OUT BETWEEN WATERINGS. WATERING SHALL TAKE PLACE UNTIL DORMANT SEASON OR UNTIL GRASS HAS 75% COVER.
- 3) PHASE 2 TO BE PERFORMED IN DORMANT SEASON. TYPICALLY AFTER NOVEMBER 15TH AND BEFORE MARCH 15TH ANNUALLY OR AS DETERMINED BY AVAILABILITY OF PLANTS FROM NURSERY.

Temporary Seed Mix	
Aug 15 - Feb 1	Oats, 30lb/acre
	Winter Wheat, 30lb/acre

Permanent Seed Mix	
Roundstone Seed Company, Southern Riparian Seed Mix No. 168	

Brush Mattress Species		
Botanical Name	Common Name	Form
<i>Salix nigra</i>	Black Willow	Brush Mattress
<i>Cephalanthus occidentalis</i>	Buttonbush	Brush Mattress
<i>Salix sericea</i>	Silky Willow	Brush Mattress
<i>Cornus amomum</i>	Silky Dogwood	Brush Mattress

Live Stake Species		
Botanical Name	Common Name	Form
<i>Cornus amomum</i>	Silky Dogwood	Live Stake
<i>Cephalanthus occidentalis</i>	Buttonbush	Live Stake
<i>Salix sericea</i>	Silky Willow	Live Stake
<i>Sambucus canadensis</i>	Elderberry	Live Stake

REV	DATE	REVISION DESCRIPTION
A	8/01/2017	ISSUED FOR GFE 6

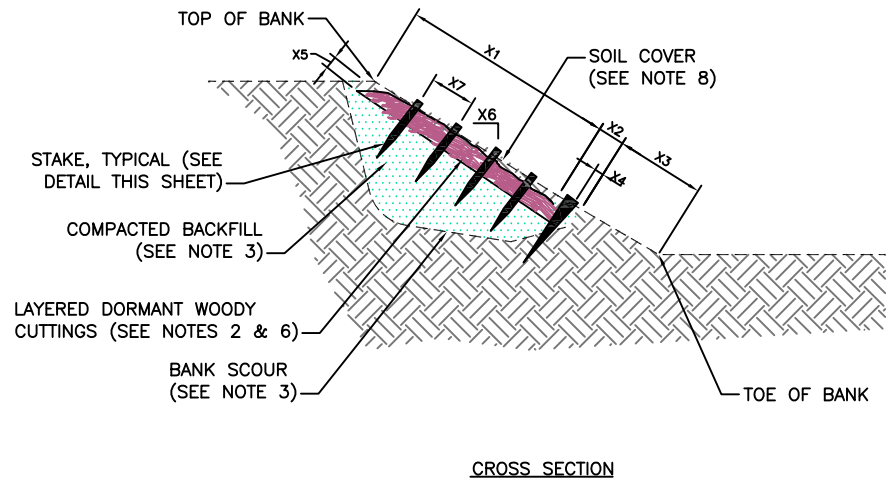
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THIS DRAWING MUST BE USED IN CONJUNCTION WITH THE APPLICABLE OR GOVERNING TECHNICAL SPECIFICATIONS AND OTHER CONTRACT DOCUMENTS.

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DATE: AUGUST 2017  
DISC. LEAD: JLB DESIGNER: SRW CHECKER: RAG

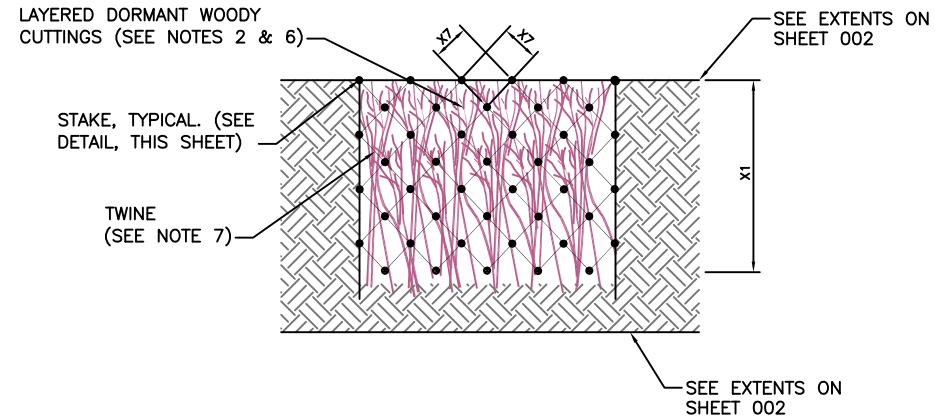
SHEET TITLE  
CIVIL  
EXHIBIT DETAILS



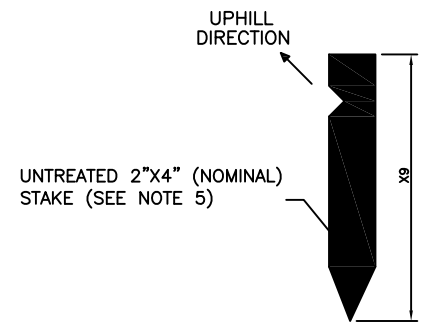
1201 MARKET STREET  
SUITE C  
CHATTANOOGA, TN 37402  
(423)-414-3551



DIMENSIONS (VALUES TO BE PROVIDED BY DESIGNER)			
VARIABLE	VALUES	TYPICAL UNITS	DESCRIPTION
X1	3	FT.	HEIGHT OF BRUSH MATTRESS
X2	NA	IN. OR FT.	HEIGHT OF OPTIONAL TOE PROTECTION
X3	NA	IN. OR FT.	BRUSH MATTRESS/OPTIONAL TOE PROTECTION RELATIONSHIP TO TOE OF BANK
X4	NA	IN. OR FT.	BRUSH MATTRESS/OPTIONAL TOE PROTECTION RELATIONSHIP TO APPROXIMATE BASE FLOW WATER LEVEL
X5	6	IN.	BRUSH MATTRESS THICKNESS
X6	NA	NONE	BANK SLOPE RATIO (HORIZONTAL COMPONENT)
X7	2	FT.	STAKE O.C. SPACING
X8			OMITTED
X9	30	IN.	STAKE LENGTH



PLAN VIEW



STAKE DETAIL

BRUSH MATTRESS DETAIL  
NOT TO SCALE



NOTES:

- BRUSH MATTRESS SHALL BE INSTALLED OVER GRADED AND PREPARED STREAM BANK. SOIL SHALL BE ROTO-TILLED, RAKED, AND AMENDED (WITH A 10-10-10 (N,P,K) COMMERCIAL FERTILIZER AT A RATE OF 20 LBS PER 1000 SF.
- BRUSH MATTRESS SHALL BE MADE FROM LIVE DORMANT CUTTINGS FROM WOODY PLANT SPECIES (TREES AND SHRUBS). THE CUTTINGS SHALL BE OF A SPECIFIED LENGTH AND DIAMETER, APPROPRIATELY SIZED ACCORDING TO THE HEIGHT OF THE CHANNEL BANKS.
- BACKFILL REQUIREMENTS IN THE ORIGINAL CONTRACT SPECIFICATION APPLY. BORROW BACKFILL MATERIAL SOURCE SHALL BE TESTED BY PROCTOR ANALYSIS TO CONFIRM SOIL COMPOSITION AND COMPACTION REQUIREMENTS. COST OF PROCTOR ANALYSIS AND FIELD TESTING SHALL BE COMPENSATED BY COST ALLOWANCE.
- TOE PROTECTION: SEE ROCK TOE PROTECTION ON PREVIOUS SHEET 002.
- STAKES SHALL BE INSTALLED, PER THE SPECIFIED PATTERN AND SPACING, INTO THE FACE OF THE STREAM BANK.
- A SPECIFIED NUMBER OF CUTTINGS PER UNIT AREA SHOULD BE PLACED FLUSH AGAINST THE SOIL OF THE STREAM BANK, WITH THE CUTTINGS LAID IN BETWEEN THE STAKES.
- THE CUTTINGS SHALL BE HELD IN PLACE BY COIR TWINE. THE TWINE SHOULD BE RUN PERPENDICULAR TO THE CUTTINGS AND DIAGONALLY FROM STAKE TO STAKE AND TIED BY USE OF A CLOVE-HITCH. WHEN THIS IS COMPLETE, THE STAKES SHOULD BE DRIVEN INTO THE GROUND A LITTLE FURTHER TO COMPRESS THE CUTTINGS TO THE SLOPE FACE.
- THE BRUSH MATTRESS, STAKES, AND COIR TWINE SHALL BE COVERED WITH A LAYER OF SOIL AND LIGHTLY COMPACTED SO THAT THERE IS CONTACT BETWEEN CUTTINGS AND THE SOIL TO PROMOTE MORE RAPID GROWTH. ALL BUT THE OUTER BRANCHES OF THE BRUSH MATTRESS SHOULD BE COVERED WITH SOIL.
- THE PLAN VIEW ILLUSTRATES A PERPENDICULAR PERSPECTIVE OF EACH SURFACE DEPICTED IN THE CROSS SECTION.

AGAWELA DRIVE  
STREAM RESTORATION PROJECT  
CITY OF CHATTANOOGA, TN  
CONSENT DECREE PROGRAM



REV	DATE	REVISION DESCRIPTION
A	07/28/2017	ISSUED FOR GPF 6

THIS LINE IS ONE INCH LONG WHEN PLOTTED FULL SCALE  
THIS DRAWING MUST BE USED IN CONJUNCTION WITH THE APPLICABLE OR GOVERNING TECHNICAL SPECIFICATIONS AND OTHER CONTRACT DOCUMENTS.

PROJ #: COCW-12-018-201 HDR:202729-0214

DATE: JULY 2017

DISC. LEAD: DESIGNER: CHECKER:

SHEET TITLE  
CIVIL

EXHIBIT DETAILS

## Appendix B

# Conservation Easement Legal Description and Exhibit Drawing

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## **Conservation Easement - A**

A conservation easement lying in and across a portion of a tract of land known as the City of Chattanooga property as recorded in Deed Book 1856, Page 515, in the Register's Office of Hamilton County, Tennessee and being more particularly described as follows:

Commencing at a capped iron rod found on the eastern right-of-way line of Agawela Drive, having a right-of-way width that varies, the same point being the southwestern corner of the aforementioned City of Chattanooga property; thence, leaving said point North 40 degrees 18 minutes 36 seconds East, 15.56 feet to a point; thence, South 34 degrees 30 minutes 54 seconds East, 50.67 feet to the POINT OF BEGINNING for the conservation easement being herein described; thence, North 38 degrees 13 minutes 29 seconds East, 60.68 feet to a point; thence, South 38 degrees 42 minutes 49 seconds East, 106.74 feet to a capped iron rod found, said point being the southeastern most corner of the aforementioned City of Chattanooga property; thence, leaving said point South 42 degrees 16 minutes 20 seconds West, 65.92 feet to a point; thence, North 35 degrees 23 minutes 35 seconds West, 103.53 feet to the POINT OF BEGINNING.

Said conservation easement herein described contains 6,488.12± Sq.Ft. or 0.15 Acres.

## **Conservation Easement - B**

A conservation easement lying in and across a portion of a tract of land known as the S & E Partnership property as recorded in Deed Book 8040, Page 269, in the Register's Office of Hamilton County, Tennessee and being more particularly described as follows:

Commencing at a capped iron rod found on the eastern right-of-way line of Agawela Drive, having a right-of-way width that varies, the same point being the southwestern corner of the City of Chattanooga property as described in Deed Book 1856, Page 515 in the Register's Office of Hamilton County, Tennessee; thence, leaving said point North 40 degrees 18 minutes 36 seconds East, 71.99 feet to a capped iron rod, said point being the northeastern most corner of the aforementioned City of Chattanooga property; thence, leaving said point South 38 degrees 42 minutes 49 seconds East, 47.57 feet to a point known as the POINT OF BEGINNING; thence, continuing on the following courses and distances: North 38 degrees 13 minutes 29 seconds East, 115.04 feet to a point; thence, North 24 degrees 49 minutes 23 seconds West, 198.93 feet to a point; thence, North 17 degrees 46 minutes 13 seconds West, 152.28 feet to a point; thence, North 04 degrees 12 minutes 47 seconds West, 178.05 feet to a point; thence, North 10 degrees 01 minutes 32 seconds East, 42.50 feet to a point located on the southern property line of the Jenette Pope property as recorded in Deed Book 10016, Page



335 in the Register's Office of Hamilton County, Tennessee; thence, North 59 degrees 28 minutes 40 seconds East, 101.07 feet to the center of an existing creek; thence, following the centerline of said creek the following chord distances and bearings: South 02 degrees 50 minutes 37 seconds West, 167.78 feet; thence, South 03 degrees 13 minutes 23 seconds East, 76.22 feet; thence, South 21 degrees 25 minutes 41 seconds East, 332.65 feet; thence, South 17 degrees 53 minutes 41 seconds East, 98.67 feet to a point; thence, leaving said centerline of creek, South 39 degrees 54 minutes 18 seconds West, 105.57 feet to an iron rod found on the southern property line of the aforementioned S & E Partnership property; thence, South 42 degrees 16 minutes 20 seconds West, 60.01 feet to an iron rod, said point being the southwestern most corner of the aforementioned S & E Partnership property; thence, North 38 degrees 42 minutes 49 seconds West, 106.74 feet to the POINT OF BEGINNING.

Said conservation easement herein described contains 70,953.97± Sq.Ft. or 1.63± Acres.

### Conservation Easement - C

A conservation easement lying in and across a portion of a tract of land known as the Jenette Pope property as recorded in Deed Book 10016, Page 335, in the Register's Office of Hamilton County, Tennessee and being more particularly described as follows:

Commencing at a capped iron rod found on the eastern right-of-way line of Agawela Drive, having a right-of-way width that varies, the same point being the southwestern corner of the City of Chattanooga property as described in Deed Book 1856, Page 515 in the Register's Office of Hamilton County, Tennessee; thence, leaving said point North 40 degrees 18 minutes 36 seconds East, 71.99 feet to a capped iron rod, said point being the northeastern most corner of the aforementioned City of Chattanooga property; thence, leaving said point the following bearings and distances across the S & E Partnership property as recorded in Deed Book 8040, Page 269 in the Register's Office of Hamilton County, Tennessee, South 38 degrees 42 minutes 49 seconds East, 47.57 feet to a point; thence, continuing on the following courses and distances: North 38 degrees 13 minutes 29 seconds East, 115.04 feet to a point; thence, North 24 degrees 49 minutes 23 seconds West, 198.93 feet to a point; thence, North 17 degrees 46 minutes 13 seconds West, 152.28 feet to a point; thence, North 04 degrees 12 minutes 47 seconds West, 178.05 feet to a point; thence, North 10 degrees 01 minutes 32 seconds East, 42.50 feet to a point located on the southern

property line of the aforementioned Jenette Pope property, said point known as the POINT OF BEGINNING; thence, leaving said point North 10 degrees 01 minutes 32 seconds East, 115.21 feet to a point; thence, North 64 degrees 05 minutes 53 seconds West, 200.78 feet to a point located on the southern bank of the South Chickamauga Creek; thence, following a chord bearing and distance of North 59 degrees 48 minutes 59 seconds East, 103.63 feet to an intersection point on the southern bank of the aforementioned South Chickamauga Creek and the western creek bank of the creek for which this conservation easement benefits; thence, South 41 degrees 50 minutes 44 seconds East, 78.57 feet to a point; thence, North 33 degrees 34 minutes 03 seconds East, 87.41 feet to a point; thence, South 33 degrees 40 minutes 34 seconds East, 138.30 feet to a point; thence, South 12 degrees 55 minutes 27 seconds West, 51.95 feet to a point; thence, South 51 degrees 40 minutes 06 seconds West, 31.57 feet to a point; thence, South 28 degrees 46 minutes 57 seconds East, 35.29 feet to a point; thence, South 59 degrees 28 minutes 40 seconds West, 101.07 feet to the POINT OF BEGINNING.

Said conservation easement herein described contains 27,241.42± Sq.Ft. or 0.62± Acres.

### **Conservation Easement - D**

A conservation easement lying in and across a portion of a tract of land known as the Yerbey Concrete Construction Inc. property as recorded in Deed Book 6441, Page 498, in the Register's Office of Hamilton County, Tennessee and being more particularly described as follows:

Commencing at a capped iron rod found on the eastern right-of-way line of Agawela Drive, having a right-of-way width that varies, the same point being the southwestern corner of the City of Chattanooga property as described in Deed Book 1856, Page 515 in the Register's Office of Hamilton County, Tennessee; thence, leaving said point North 40 degrees 18 minutes 36 seconds East, 71.99 feet to a capped iron rod, said point being the northeastern most corner of the aforementioned City of Chattanooga property; thence, leaving said point the following bearings and distances across the S & E Partnership property as recorded in Deed Book 8040, Page 269 in the Register's Office of Hamilton County, Tennessee, South 38 degrees 42 minutes 49 seconds East, 47.57 feet to a point; thence, continuing on the following courses and distances: North 38 degrees 13 minutes 29 seconds East, 115.04 feet to a point; thence, North 24

degrees 49 minutes 23 seconds West, 198.93 feet to a point; thence, North 17 degrees 46 minutes 13 seconds West, 152.28 feet to a point; thence, North 04 degrees 12 minutes 47 seconds West, 178.05 feet to a point; thence, North 10 degrees 01 minutes 32 seconds East, 42.50 feet to a point located on the southern property line of the Jenette Pope property as recorded in Deed book 10016, Page 335 in the Register's Office of Hamilton County, Tennessee; thence, North 59 degrees 28 minutes 40 seconds East, 101.07 feet to the POINT OF BEGINNING; thence, continuing along the following courses: North 28 degrees 46 minutes 57 seconds West, 35.29 feet to a point; thence, North 51 degrees 40 minutes 06 seconds East, 31.57 feet to a point; thence, North 12 degrees 55 minutes 27 seconds East, 51.95 feet to a point; thence, North 33 degrees 40 minutes 34 seconds West, 138.30 feet to a point; thence, South 33 degrees 34 minutes 03 seconds West, 87.41 feet to a point; thence, North 41 degrees 50 minutes 44 seconds West, 78.57 feet to an intersection point where the southern bank of the South Chickamauga Creek and the western creek bank of the creek for which this conservation easement benefits meet; thence, following the top of the southern creek bank on the South Chickamauga Creek a chord bearing and distance of North 53 degrees 33 minutes 37 seconds East, 196.23 feet to a point; thence, leaving said southern creek bank of the South Chickamauga Creek the following bearings and distances: South 35 degrees 40 minutes 12 second East, 217.61 feet to a point; thence, South 09 degrees 41 minutes 02 seconds West, 256.45 feet to a point; thence, South 20 degrees 46 minutes 53 seconds East, 31.07 feet to a point; thence, South 16 degrees 39 minutes 00 seconds East, 267.86 feet to a point; thence, South 18 degrees 48 minutes 26 seconds East, 166.59 feet to a point; thence, South 38 degrees 55 minutes 24 seconds West, 115.83 feet to a point; thence, North 17 degrees 53 minutes 41 seconds West, 98.67 feet to a point; thence, North 21 degrees 25 minutes 41 seconds West, 332.65 feet to a point; thence, North 03 degrees 13 minutes 23 seconds West, 76.22 feet to a point; thence, North 02 degrees 50 minutes 37 seconds East, 167.78 feet to a point; thence, South 59 degrees 28 minutes 40 seconds West, 5.19 feet to the POINT OF BEGINNING.

Said conservation easement herein described contains 103,845.89± Sq.Ft. or 2.38± Acres.

## **Conservation Easement - E**

**A conservation easement lying in and across a portion of a tract of land known as the Yerbey Concrete Construction Inc. property as recorded in Deed Book 6296, Page 587, in the Register's Office of Hamilton County, Tennessee and being more particularly described as follows:**

**Commencing at a capped iron rod found on the eastern right-of-way line of Agawela Drive, having a right-of-way width that varies, the same point being the southwestern corner of the City of Chattanooga property as described in Deed Book 1856, Page 515 in the Register's Office of Hamilton County, Tennessee; thence, leaving said point with and along the aforementioned eastern right-of-way line of Agawela Drive, South 35 degrees 08 minutes 45 seconds East, 153.63 feet to a point; thence, South 76 degrees 40 minutes 57 seconds East, 25.00 feet to a point; thence, South 24 degrees 02 minutes 59 seconds West, 25.00 feet to a point; thence, North 80 degrees 43 minutes 56 seconds East, 32.65 feet to a point known as the POINT OF BEGINNING; thence, North 42 degrees 16 minutes 20 seconds East, 129.74 feet to a point; thence, North 50 degrees 45 minutes 21 seconds West, 30.06 feet to a point; thence, North 39 degrees 54 minutes 18 seconds East, 105.74 feet to a point; thence, North 38 degrees 55 minutes 24 seconds East, 103.38 feet to a point; thence, South 18 degrees 48 minutes 26 seconds East, 86.18 feet to a point; thence, South 22 degrees 31 minutes 06 seconds West, 80.07 feet to a point; thence, South 42 degrees 16 minutes 20 seconds West, 220.92 feet to a point; thence, North 47 degrees 43 minutes 40 seconds West, 31.75 feet to a point; thence, North 11 degrees 04 minutes 04 seconds West, 24.34 feet to a point; thence, South 80 degrees 43 minutes 56 seconds West, 17.35 feet to the POINT OF BEGINNING.**

**Said conservation easement herein described contains 24,270.53± Sq.Ft. or 0.56± Acres.**

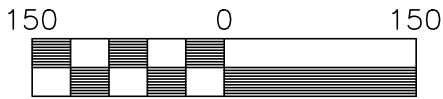
## **Temporary Construction Easement - F**

**A 25 foot wide temporary construction easement lying in and across a portion of a tract of land known as the Yerbey Concrete Construction Inc. property as recorded in Deed Book 6296, Page 587, in the Register's Office of Hamilton County, Tennessee and being more particularly described as follows:**

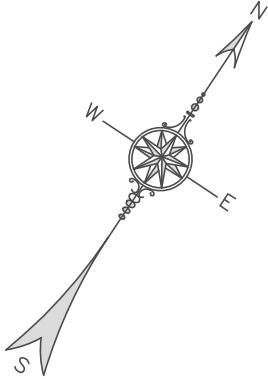
**Commencing at a capped iron rod found on the eastern right-of-way line of Agawela Drive, having a right-of-way width that varies, the same point being the southwestern corner of the City of Chattanooga property as described in Deed Book 1856, Page 515 in the Register's Office of Hamilton County, Tennessee; thence, leaving said point with and along the aforementioned eastern right-of-way line of Agawela Drive, South 35 degrees 08 minutes 45 seconds East, 153.63 feet to a point; thence, south 76 degrees 40 minutes 57 seconds East, 25.00 feet to a point; thence, south 24 degrees 02 minutes 59 seconds West, 25.00 feet to a point; thence, North 80 degrees 43 minutes 56 seconds East, 32.65 feet to a point; thence, North 42 degrees 16 minutes 20 seconds East, 129.74 feet to a point; thence, North 50 degrees 45 minutes 21 seconds West, 30.06 feet to a point; thence, North 39 degrees 54 minutes 18 seconds East, 105.74 feet to a point; thence, South 18 degrees 48 minutes 26 seconds East, 86.18 feet to a point known as the POINT OF BEGINNING; thence, South 18 degrees 48 minutes 26 seconds East, 93.72 feet to a point; thence, south 27 degrees 51 minutes 50 seconds West, 220.65 feet to a point; thence, South 09 degrees 30 minutes 20 seconds East, 94.12 feet to a point; thence, South 80 degrees 46 minutes 32 seconds West, 25.00 feet to a point; thence, North 09 degrees 30 minutes 20 seconds West, 102.45 feet to a point; thence, North 27 degrees 51 minutes 50 seconds East, 218.60 feet to a point; thence, North 19 degrees 01 minutes 34 seconds West, 54.31 feet to a point; thence, North 22 degrees 31 minutes 06 seconds East, 37.86 feet to the POINT OF BEGINNING.**

**Said temporary construction easement herein described contains 9,791.34± Sq.Ft. or 0.22± Acres.**

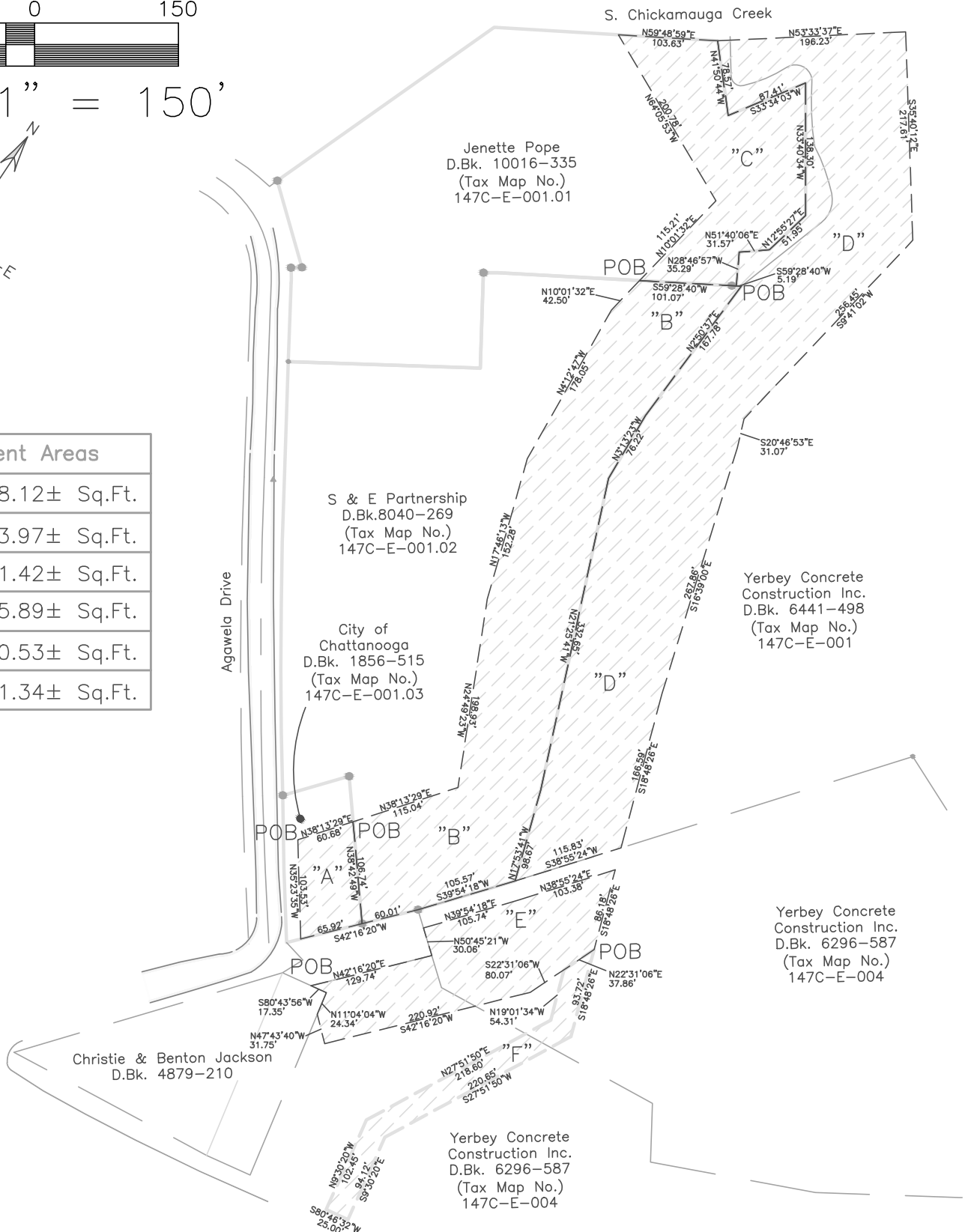




Scale 1" = 150'



Easement Areas	
A	6,488.12± Sq.Ft.
B	70,953.97± Sq.Ft.
C	27,241.42± Sq.Ft.
D	103,845.89± Sq.Ft.
E	24,270.53± Sq.Ft.
F	9,791.34± Sq.Ft.



● Iron Rod (Found)

Exhibit Drawing  
Conservation Easements  
Agawela Drive

Chattanooga, Hamilton County  
Tennessee

NOTES:

1. The Survey was done under the authority of TCA 62-18-126.
2. The survey is not a general property survey as defined under Rule 0820-3-.07.

This is to certify that this plat of survey meets the requirements set forth in the instrument executed in the name of the Chattanooga Land Title Association, dated February 2, 1981, and recorded in Book 2735, Page 804 in the Register's Office of Hamilton County, Tennessee. The undersigned hereby waives any defense afforded under any Limitations of Actions Statutes of the State of Tennessee, insofar as the same apply to any mortgage lender, making a loan on the property, and/or title insurance company which has relied upon this survey to insure any owner of the property of any such lender. This survey DOES NOT constitute a boundary line survey, is NOT made to be relied upon by the owners

DWG No. 13039A  
File Name Agawela Drive...  
Date 12-19-2013  
Rev Date 01-27-2014  
Scale 1" = 150'

**THE R·L·S GROUP**  
A Limited Liability Company  
LAND SURVEYING  
P.O. Box 10  
Hixson, Tennessee 37343  
Phone (423) 847-0155 - Fax (423) 847-0156  
www.therlsgroup.com