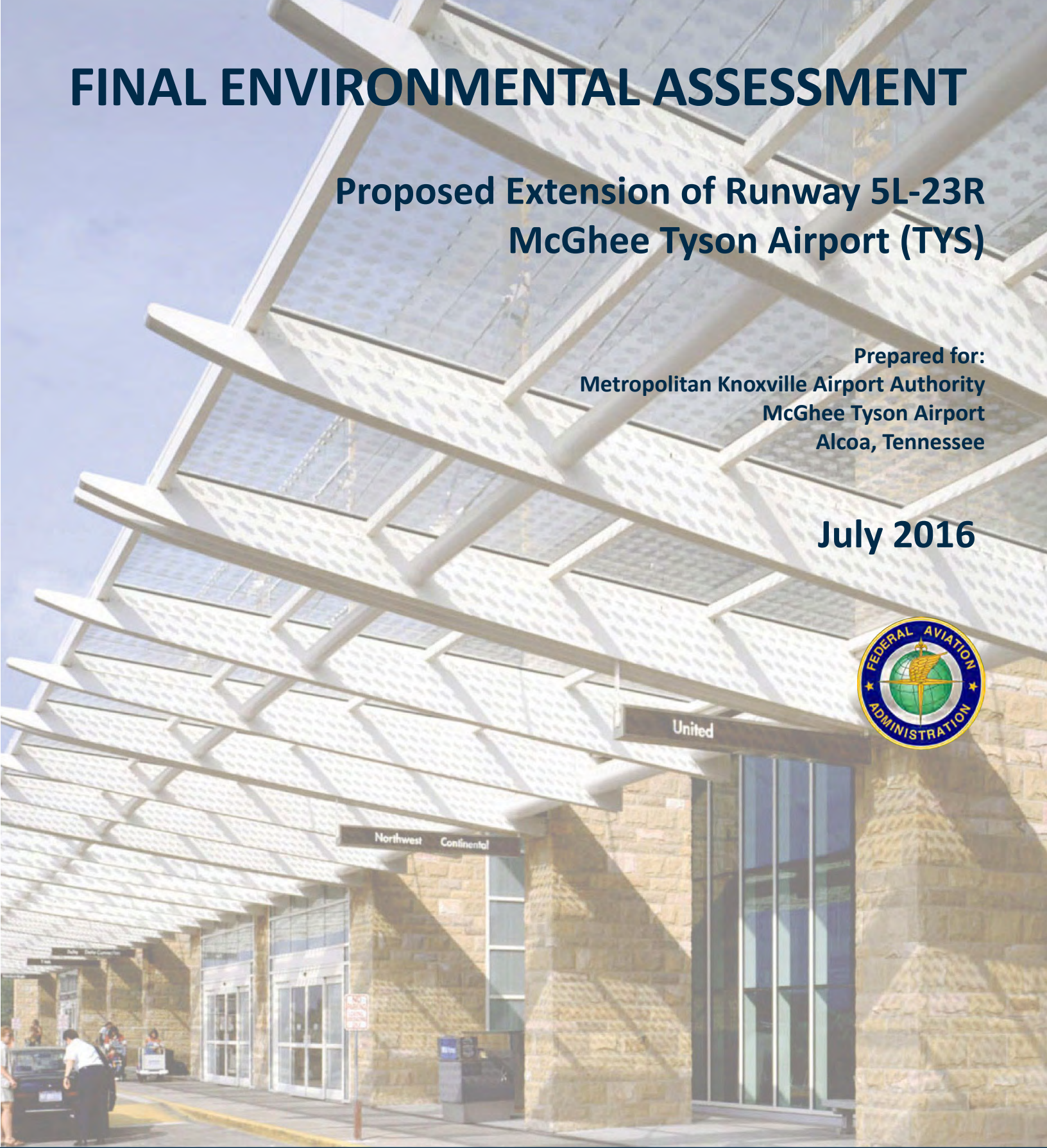


FINAL ENVIRONMENTAL ASSESSMENT

Proposed Extension of Runway 5L-23R McGhee Tyson Airport (TYS)

Prepared for:
Metropolitan Knoxville Airport Authority
McGhee Tyson Airport
Alcoa, Tennessee

July 2016



Prepared for:



METROPOLITAN
KNOXVILLE
AIRPORT
AUTHORITY

Prepared by:



**DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
FINDING OF NO SIGNIFICANT IMPACT (FONSI)
Runway 5L/23R Extension
McGhee Tyson Airport
Alcoa, Tennessee**

I. Introduction/Background

In accordance with the National Environmental Policy Act (NEPA), this Finding of No Significant Impact (FONSI) announces final agency determinations and approvals for those Federal Actions by the Federal Aviation Administration (FAA) that are necessary to support the proposed developments at the McGhee Tyson Airport in Alcoa, Tennessee.

II. Proposed Federal Action

The airport sponsor has requested FAA funding assistance and an Airport Layout Plan (ALP) change for the following project:

- Extending Runway 5L/23R from 9,003 feet to 10,000 feet in length. The existing usable runway length currently measures 9,003 feet and has paved overruns (non-usable runway) extending from both ends of the runway. The proposed action would involve converting the overruns to usable pavement by remarking them as runway. Specifically, the overruns would be marked as displaced threshold thereby allowing the overruns to be used for takeoff but not for landing. This would result in an effective runway length of 10,000 feet for aircraft departures.
- Extending the Runway Safety Area (RSA), an FAA design standard intended to support aircraft in the event of deviation from the runway, beyond the Runway 5L/23R ends. The RSA will measure 500 feet in width and 1,000 feet beyond the runway end.
- Relocate an airport road, known as Liberty Street, around the Runway 5L approach end.
- Construct three connector taxiways.
- Relocated the localizer antennae for Runways 5L and 23R.
- Modify the approach lighting system to the Runway 5L approach end.

III. Purpose and Need

The FAA has defined the purpose and need for implementing the proposed action as being necessary to better accommodate the operational needs of the KC-135 which are operated by the Tennessee Air National Guard (ANG). Pursuant to ANG operating requirements for the KC-135, a minimum of 10,000 feet of runway length is needed to support aircraft departures when it is at maximum takeoff weight.

IV. Alternatives

Federal guidelines concerning the environmental review process require that all reasonable and practicable alternatives that might accomplish the objectives of a proposed project be identified and evaluated. Such an examination ensures that alternatives are not prematurely dismissed and may lead to consideration of alternatives that fulfill the project's purpose and need as well as enhance environmental quality or have a less detrimental effect. The alternatives evaluated for this Environmental Assessment (EA) are listed below.

1. No build alternative.
2. Extend Runway 5L/23R to 10,000 feet (Preferred Alternative [described above in Section II])

These alternatives are described in Chapter 2 of the EA. A project element in the preferred alternative, the relocation of Liberty Street, features five sub-alternatives. Alternative A was identified as the preferred sub-alternative for the road relocation.

V. Environmental Impacts

The EA analyzed all environmental categories based on FAA Order 5050.4B, "*National Environmental Policy Act Implementing Instructions for Airport Projects*" (NEPA). Those Categories impacted by the Sponsor's preferred alternative are discussed below. Mitigation measures for the environmental impacts are discussed in Section VI.

V A. Air Quality

The proposed action will generate additional air emissions primarily due to construction activities. Emissions were estimated in the EA and were shown to be below *de minimus* levels.

V B. Hazardous Materials

The relocation of Liberty Street will impact monitoring wells that were placed to monitor contaminants from previous fuel spills. The monitoring wells will be altered during grading activities and will be raised or lowered as needed. Provisions for handling hazardous materials will be featured in construction documents in the event contaminants are encountered during construction.

V C. Solid Waste

Solid waste will be generated from construction activities. Local disposal facilities will be able to accommodate the waste from the project site.

V D. Land Use

The conversion of paved overruns to usable runway, marked as displaced thresholds, will modify the Runway Protection Zones (RPZ), an FAA design standard created to reduce structures that support public assembly immediately adjacent to runway ends. However, while the action will create additional RPZs, the new RPZs would be fully contained within the existing RPZs; therefore no new non-compatible land uses would be created.

As shown in page 34 of the EA, the runway extension is expected to result in an increase to the aircraft noise levels around the airport. However, based on noise modelling used in the preparation of the EA, significant impacts are not expected for non-compatible land uses near the airport.

V E. Water Resources

The proposed action will impact a stormwater basin located near the Runway 5L approach end. The impact to the basin will require additional coordination and permitting with the Tennessee Department of Environment and Conservation.

Due to the relocation of Liberty Street, the proposed action will result in encroachment on the Proffitt Spring floodplain. Impacts to the floodplain are expected to be minimal and significant impacts will not occur.

V F. Construction Impacts

The proposed project will result in short-term impacts to air quality, noise, and water quality. Best management practices will be utilized. Significant impacts are not expected.

VI. Environmental Mitigation

The Airport Sponsor shall be responsible for obtaining all necessary construction permits or certifications prior to initiating construction activities near or on the environmental resource requiring the permit. Project related permits, certifications, and other mitigation measures required for the proposed action are discussed below. It should be noted that best management practices (BMPs) are considered standard operating procedure and are not considered mitigation; therefore, they are not discussed in this section.

VI A. Permits and Certifications

The project will require the following permits or certifications:

A National Pollutant Discharge Elimination System (NPDES) permit, Stormwater Pollution Prevention Plan (SWPPP), and an application to Alter or Remove an Existing Dam will be filed with the State of Tennessee.

VI B. Mitigation

Without proper mitigation, the proposed action may exceed the threshold of significance. Mitigation shall be completed for the following environmental categories:

No mitigation is required for the proposed action.

VII. Public Involvement

The following agencies were consulted in the preparation of this EA:

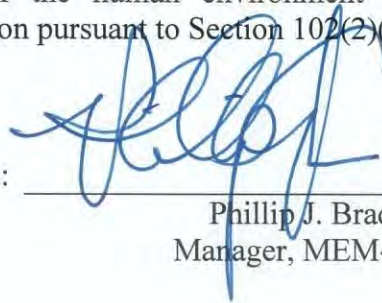
- Federal Aviation Administration
- Environmental Protection Agency
- U.S. Fish and Wildlife Service
- Tennessee Historical Commission
- Tennessee Wildlife Resources Agency
- Tennessee Department of Environment and Conservation
- Knox County Health Department
- Blount County Planning Department

A public notice was placed in the Daily Times Newspaper on May 26, 2016. The notice announced the FAA was accessing the project for potential environmental impacts. The notice stated the public could review a draft EA at various locations, issue comments, and request a public meeting. The public review period lasted for 30 days. No requests for a public meeting were received. One agency, U.S. Fish and Wildlife Service, issued a comment acknowledging the EA adequately addresses federally listed species. No other comments were made.

VIII. Decision

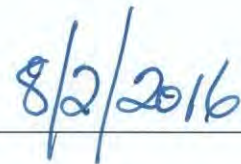
After careful and thorough consideration of the facts contained herein, the undersigned finds that approval of the proposed development is consistent with existing national environmental policies and objectives as set forth in Section 101(a) of the National Environmental Policy Act of 1969 (NEPA) and that it will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 102(2)(C) of NEPA.

Approved: _____



Phillip J. Braden
Manager, MEM-ADO

Date: _____



FINAL ENVIRONMENTAL ASSESSMENT

PROPOSED EXTENSION OF RUNWAY 5L/23R

McGhee Tyson Airport
Alcoa, Tennessee

Prepared for:

METROPOLITAN KNOXVILLE AIRPORT AUTHORITY

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

As lead Federal Agency pursuant to the National Environmental Policy Act of 1969

Prepared by:

CHA Consulting, Inc.

JULY 2016

This environmental assessment becomes a Federal document when evaluated, signed, and dated by the responsible FAA official.



Responsible FAA Official

8-2-16

Date

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1 PURPOSE AND NEED

1.1 INTRODUCTION

This Environmental Assessment (EA) has been prepared to assist the Federal Aviation Administration (FAA) in evaluating the proposed extension to Runway 5L/23R at McGhee Tyson Airport (TYS) in Alcoa, Tennessee. This EA has been prepared in accordance with the National Environmental Policy Act (NEPA; 42 United States Code 4321 et seq.) and the Council on Environmental Quality (CEQ; 40 Code of Federal Regulations 1500-1508) regulations. The FAA's *Environmental Impacts: Policies and Procedures* (FAA Order 1050.1F) and the *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* (FAA Order 5050.4B) were used as guidance for the format and content of this EA. The objectives of this section are to define the purpose and need of the proposed action, where "need" is defined as the problem and the purpose is defined as the solution to the problem. This section will also identify the Federal actions that are required, as well as outlining the timeframe in which the proposed actions discussed in this EA will take place.

1.2 BACKGROUND

According to the National Plan of Integrated Airport Systems (NPIAS), TYA is a small hub primary commercial service airport. The Airport is located approximately 12 miles south of downtown Knoxville bordered by the City of Louisville to the north and the City of Alcoa to the south (see **Figure 1-1**). The airport property is generally defined by the CSX Railroad and Louisville Road to the west, Airbase and Callahan Roads to the north, Alcoa Highway to the east and West Hunt Road to the south. According to the 2015 FAA's Terminal Area Forecasts (TAF), TYA will see approximately 823,852 passengers and 95,833 aircraft operations per year. Activity at the airport is expected to grow at a rate of approximately 2.5% per year according to the TAF by 2018 and fairly flat after that through 2023.

The airport currently has two parallel runways on approximately 2,680 acres of property owned and operated by the Metropolitan Knoxville Airport Authority (MKAA). Runway 5L/23R, the airport's north runway, currently has a published length for landing and takeoff of 9,003 feet and is equipped with an Instrument Landing System (ILS) and High Intensity Approach Lighting System With Sequenced Flashing Lights (ALSF-2) on both runway ends. Runway 5L/23R is predominantly used by the air cargo operations as well as the Tennessee Air National Guard (TANG), which are both located north of the runway. Runway 5R/23L, or the south parallel runway, is 9,000 feet long with a 400-foot displaced landing threshold on the 23L end. The commercial and general aviation traffic predominantly utilize this runway in non-instrument conditions as the terminal area is located on the south side of the airport. The TANG, located in the northwest corner of airport property, lease approximately 350 acres from the MKAA.

1.2.1 RUNWAY 5L/23R RECONSTRUCTION FINAL EA & FONSI

On July 9, 2014, the FAA issued a Finding of No Significant Impact (FONSI) for the Runway 5L/23R Reconstruction Program. The preferred alternative closed Runway 5L/23R for two construction seasons and included the following proposed actions:

- Rehabilitation/full-depth Reconstruction of Runway 5L/23R;
- Correction of line-of-sight design issue on Runway 5L/23R;
- Widening of Runway 5L/23R shoulders by 15 feet to a total width of 25 feet;
- Improvement of Runway 5L/23R paved overruns

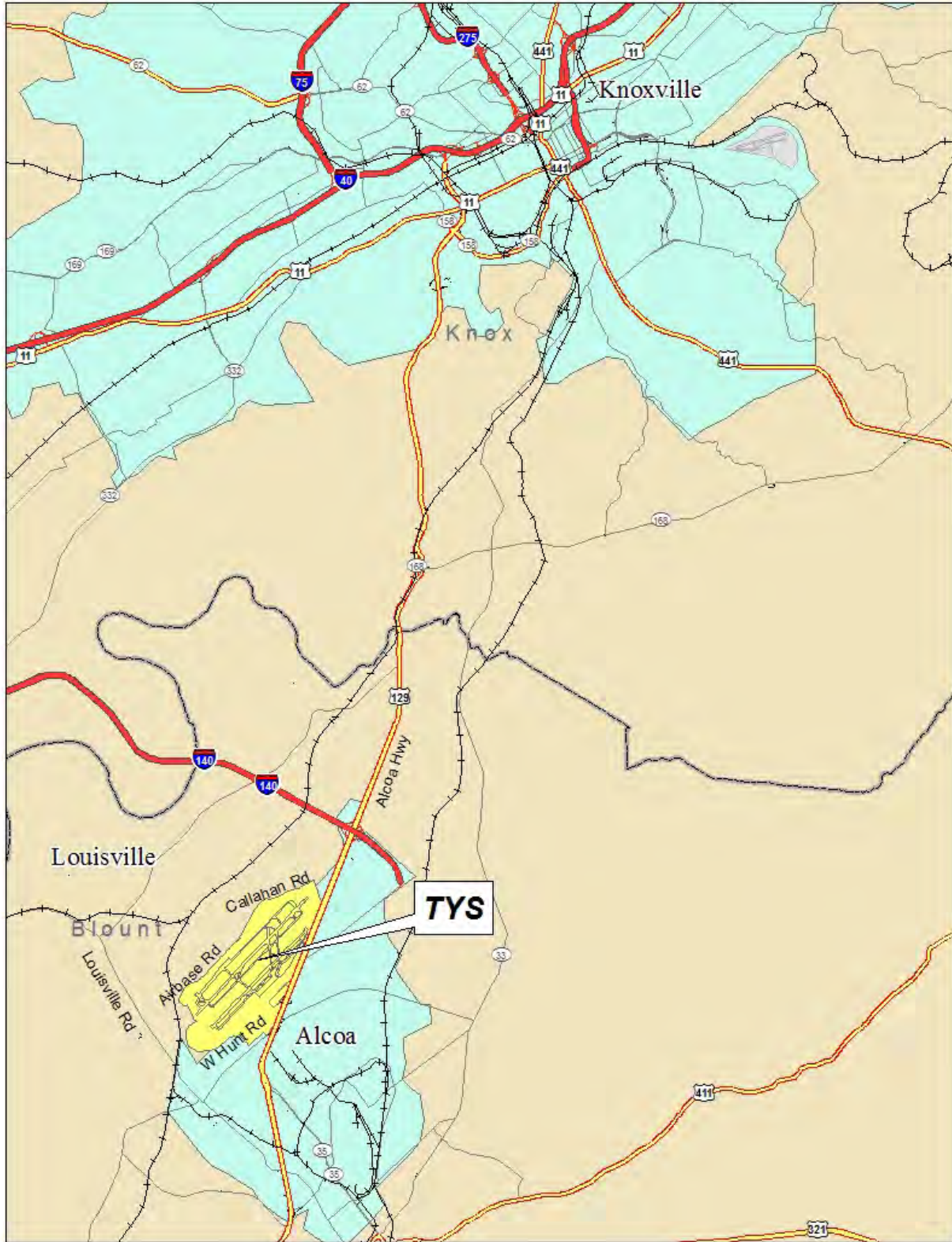


Figure 1-1: Location Map

- Upgrade of the existing ALS on the Runway 23R end with a new ALSF-2 system
- Pavement maintenance and installation of temporary ILS on Runway 5R/23L

According to the Final EA, the pavement rehabilitation and lighting improvements to the existing paved overruns for Runway 5L/23R were also included and analyzed as a connected action. Although the rehabilitation of these overrun areas for military use was discussed in the EA, the existing markings depicting non-usable runway pavement did not change as part of the project and the Airport Layout Plan (ALP) was not updated (see **Figure 1-2 & 1-3**). Therefore, the proposed FAA published runway lengths for departures/arrivals would remain the same when Runway 5L/23R re-opens in 2018.

1.2.2 TENNESSEE AIR NATIONAL GUARD

According to the 2014 Runway 5L/23R Reconstruction Final EA & Finding of No Significant Impact (FONSI), there are three missions located at the TANG facility, which are:

- 119th Command and Control Squadron
- 134th Air Refueling Wing
- 228th Combat Communications Squadron

The 134th Air Refueling Wing (134 ARW) is a unit of the Tennessee ANG stationed at McGhee Tyson Air National Guard Base located on the north side of TYS. If activated for federal service, the 134 ARW supports the United States Air Force Air Mobility Command. The 134 ARW's critical aircraft is the Boeing KC-135. The KC-135 provides the core aerial refueling capability for the United States Air Force and has excelled in this role for more than 50 years. The KC-135 is 136 feet in length, a wingspan of 130 feet and a maximum takeoff weight of 322,500 pounds.

1.3 PURPOSE AND NEED

The need for the proposed project (or the “problem”) is to accommodate the length requirements for the Tennessee ANG's KC-135. According to the *Air National Guard Handbook 32-1084, Facility Space Standards*, the KC-135 requires a minimum of 10,000 feet for fully loaded mission aircraft (Table 2-1: CATCODE 111-111). The existing Runway 5L/23R is published at 9,003 feet with a 500-foot paved overrun on both ends of the runway. The Tennessee ANG occasionally utilizes these overruns for departures; however, the overruns are currently marked as non-usable pavement with chevrons and therefore cannot be used in landing/takeoff calculations.








The purpose of the proposed action, or the solution to the identified problem, is to lengthen Runway 5L/23R by marking the existing non-usable runway pavement as “usable”. This is achieved by removing the chevron markings beyond both landing thresholds and marking with arrowheads. The paved overruns are currently being re-built as part of the on-going Runway 5L/23R Reconstruction Program. If these overruns are marked as usable pavement and standard Runway Safety Area (RSA) off each end can be achieved (1000' x 500'), Runway 5L/23R could be published at 10,000 feet for departures. By extending the usable runway length, the Tennessee ANG can fulfill its mission while complying with the Air National Guard requirements for the KC-135.

1.4 PROPOSED ACTION

The proposed action includes the extension of Runway 5L/23R to 10,000-foot runway by marking the existing paved overruns as usable pavement for aircraft operational calculations. The proposed elements of the proposed action are described below:



LEGEND

-  Construct New Taxiway
-  Reconstruct / Rehabilitate Taxiway & Overruns
-  Remove Taxiway
-  2014 Project Area
-  Airport Property Line
-  RSA Runway Safety Area
-  RPZ Runway Protection Zone

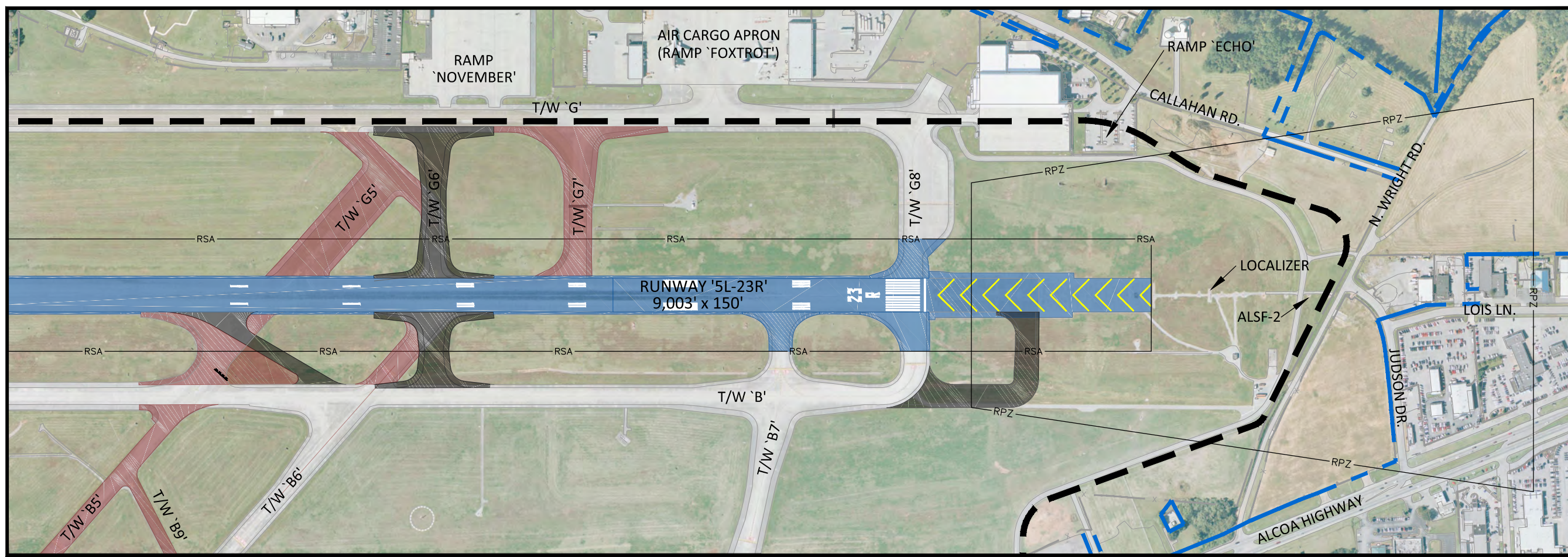







FIGURE 1-2

**2014 Environmental
Assessment
Runway End '23R'**



LEGEND

-  Reconstruct / Rehabilitate Taxiway & Overruns
-  2014 Project Area
-  Airport Property Line
-  Runway Safety Area
-  Runway Protection Zone

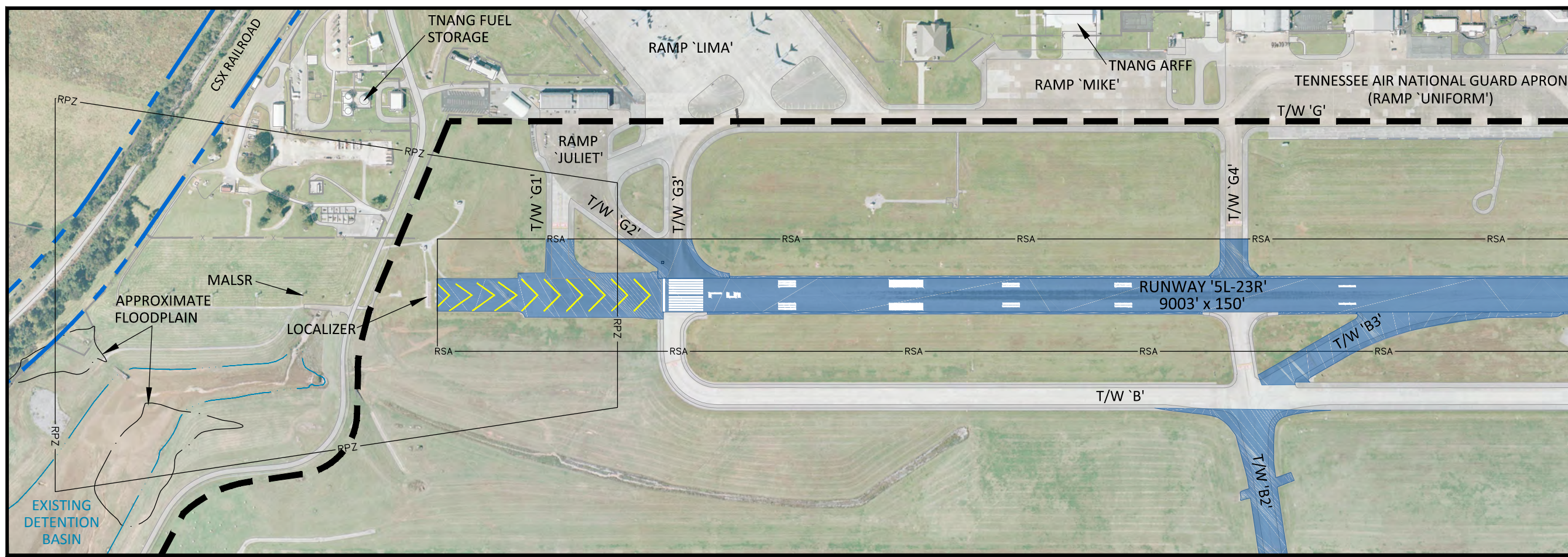


FIGURE 1-3

2014 Environmental Assessment Runway End '5L'

- Mark the paved overruns on both ends of Runway 5L/23R as usable pavement (extending the runway by 997') and declare 10,000' available for all operations except Landing Distance Available (LDA).
- Construct a standard Runway Safety Area (1,000' x 500') for Runway 5L & 23R Departure Ends
- Relocate Liberty Street
- Construct three (3) taxiway connectors to new runway ends.
- Relocate Localizer Antenna for Runway 23R & 5L
- Modify Runway 5L Approach Lighting System

1.5 REQUESTED FEDERAL ACTIONS

The requested federal action includes the following:

- Unconditional approval of the Draft Airport Layout submitted to the FAA in December 2015 depicting the proposed improvements pursuant to 49 USC § 40103(b), 44718, and 47107(a) and 14 CFR Part 77, Objects Affecting Navigable Airspace
- Approval of further processing of an application for federal assistance to implement those AIP eligible projects

1.6 TIMEFRAME OF THE PROPOSED ACTION

The Authority currently expects to submit the Final EA for the proposed improvements to the FAA in July 2016. If the FAA issues a favorable finding, elements of the proposed action will begin this fall with Runway 5L/23R opening in 2018.

2 ALTERNATIVES

The previous section described the need to construct the runway extension at TYS. This section presents a description and analysis of alternatives considered to meet the identified purpose and need. The alternatives that have been developed for this assessment are based on the requirements contained in the FAA Order 5050.4B and 10501.F Impacts to the airport and its surroundings will be assessed based on implementation of one of these alternatives.

The improvements to Runway 5L/23R will be discussed in terms of a No-Build Alternative and a Build Alternative, as depicted on the Draft Airport Layout Plan (ALP) submitted in December 2015. The No-Build Alternative is assessed under the guidance of Section 1502.14 (d) of the CEQ regulations, which requires that a “no-build alternative” be considered in development projects.

The description of alternatives presented in this section also includes advantages and disadvantages perceived for each, in terms of the ability to meet the purpose and need for the project, operational impacts, and environmental considerations. In order to be considered feasible for implementation, the alternatives must take into account many factors: development options must support the Airport’s role in the aviation system and be in compliance with applicable FAA airport design standards and other regulations. The placement of runways, taxiways, navigational aids is required to be constructed in accordance with the standard criteria included in FAA AC 150/5300-13A and FAR Part 77. Therefore, alternatives were also evaluated on their ability to maintain the requirements contained in these regulatory documents.

2.1 DECLARED DISTANCES

According to FAA Advisory Circular 150/5300-13A, Change 1, declared distances represent the maximum distances available and suitable for meeting takeoff, rejected takeoff, and landing distance performance requirements for turbine powered aircraft. The declared distances are Takeoff Run Available (TORA) and Takeoff Distance Available (TODA), which apply to takeoff; Accelerate Stop Distance Available (ASDA), which applies to a rejected takeoff; and Landing Distance Available (LDA), which applies to landing. A clearway may be included as part of the TODA. By treating these distances independently, declared distances is a design methodology that results in declaring and reporting the TORA, TODA, ASDA and LDA for each operational direction. These four “distances” are described in the following subsections.

2.1.1 TAKEOFF RUN AVAILABLE (TORA)

The takeoff run available (TORA) is the length of the runway that is declared available for takeoff run requirements, which is defined as the distance to accelerate from brake release to lift-off. Typically, the TORA is measured from the start of takeoff to a point 200 feet beyond the beginning of the departure RPZ. However, if a departure RPZ is not located at least 200 feet from the departure end of a runway, the TORA will be shorter than the actual runway length. In regards to RSA compliance, the TORA is not required to have a fully compliant RSA at either end of the runway.

2.1.2 TAKEOFF DISTANCE AVAILABLE (TODA)

The takeoff distance available (TODA) is defined as the length of the TORA plus the length of a clearway, if provided. A clearway, if available, is defined as an area beginning at the end of a runway which must be under the Sponsor’s control, at least 500 feet wide, cannot exceed 1,000 feet in length, and clear of any obstacle or terrain at an upward slope of 1.25 percent (or 80:1). Similar to the TORA, the TODA does not require a standard RSA beyond the runway end.

2.1.3 ACCELERATE STOP DISTANCE AVAILABLE (ASDA)

The accelerate-stop distance available (ASDA) is defined as the length of the TORA plus a stopway if available. A stopway is a rectangular area starting at the end of a runway, at a minimum must be as wide as the runway and must be prepared in a way that will not cause structural damage to an aircraft if it aborts takeoff. If existing obstacles are present, the ASDA length can be shorter than the runway length. This could accommodate standard RSA on one or both ends of a runway.

2.1.4 LANDING DISTANCE AVAILABLE (LDA)

The landing distance available (LDA) is defined as the runway length declared available for the ground run of an aircraft landing. The LDA cannot be longer than the runway, but with obstacles on the ground or in the approach of a given runway, the LDA can be shorter to provide standard RSA(s) and/or clear approach surfaces, which would also shorten the landing length for Runway 10-28.

2.2 RUNWAY MARKINGS

The FAA recommends the guidelines and standards contained AC 150/5340-1L: *Standards for Airport Markings* for the marking of airport runways, taxiways, and aprons. The use of these standards is the only method of compliance with the airfield markings for airports certificated under Title 14 Code of Federal Regulations Part 139, Certification of Airports (Part 139).

2.2.1 MARKINGS FOR BLAST PADS & STOPWAYS

Blast pads, also known as overrun areas or stopways are normally constructed just before the start of a runway where jet blast produced by large planes during the takeoff roll could otherwise erode the ground and eventually damage the runway. Stopway areas are also constructed at the end of runways as emergency space to slowly stop planes that overrun the runway on a landing or to slowly stop a plane on a rejected takeoff or a takeoff gone wrong. Aircraft are not permitted to taxiway taxi, take off, or land on stopways. These pavement areas are marked with yellow chevrons (see **Figure 2-1**). Currently, Runway 5L/23R has stopways on both ends of the runway marked with chevrons.

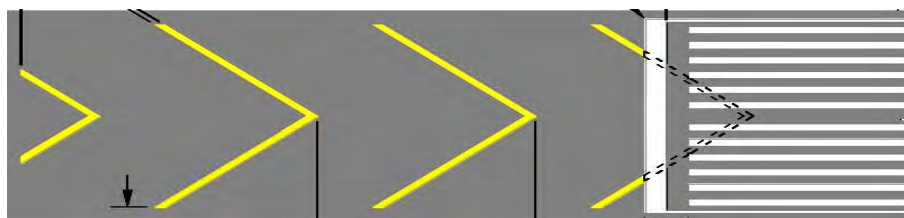


Figure 2-1: Stopway Markings

2.2.2 MARKINGS FOR DISPLACED RUNWAY THRESHOLDS

A displaced threshold is a point on the runway other than the physical beginning of the pavement where the landing threshold is located. The portion of runway that is displaced can be used for takeoff calculations; however, it cannot be used for touchdown as the aircraft must land at or beyond the threshold. Typically, a displaced threshold is delineated by white arrow heads that lead up to the beginning of the landing portion of the runway (see **Figure 2-2**).

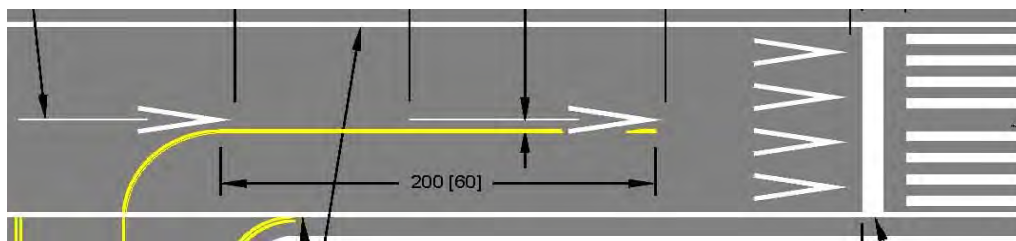


Figure 2-2: Displaced Landing Threshold Markings

2.3 RUNWAY SAFETY AREA(S)

According to FAA Order 5200.8 and FAA Advisory Circular (AC) 150/5300-13A, RSAs are intended to provide a measure of safety in the event of an aircraft's excursion from the runway by significantly reducing the extent of personal injury and aircraft damage during overruns, undershoots, and exits from the runway. The FAA requires a 500-foot wide RSA for the entire runway length and 1,000 feet beyond the runway end for type of aircraft that utilize Runway 5L/23R. For the first 200 feet of the RSA beyond the runway ends, the longitudinal grade is required to be between 0 and 3 percent, with any slope being downward from the ends. For the remainder of the safety area, the maximum allowable positive longitudinal grade is such that no part of the RSA penetrates any approach surface. The maximum allowable negative grade is 5.0 percent.

2.4 ALTERNATIVE 1 – EXTEND RUNWAY 5L/23R

Alternative 1 involves extending Runway 5L/23R from its existing length of 9,003 feet to length of 10,000 feet for TORA, TODA, and ASDA without adding additional pavement to the runway itself. The existing Runway 5L/23R has a 492-foot (Runway 23R Departure End) and a 505-foot (Runway 5L Departure End) paved overrun on either end that is currently marked as unusable pavement. As part of Alternative 1, these overruns will be marked as usable pavement (with arrow heads) allowing pilots to use this extra 997 feet of pavement on both ends for TORA, TODA, and ASDA. However, because both landing thresholds would remain in their existing condition, the LDA would have a declared distance of 9,508 feet for Runway 5L arrivals and 9,495 feet for Runway 23R arrivals (see **Figure 2-3** and **Table 2-1**). In addition to the proposed runway markings, there would also be runway lighting modifications to the runway pavement now marked as usable by adding red/yellow edge lighting.

Table 2-1: Proposed Declared Distances

Option Alignment	TORA	TODA	ASDA	LDA
Runway 5L Operation	10,000'	10,000'	10,000'	9,508
Runway 23R Operation	10,000'	10,000'	10,000'	9,495









There are also enabling actions to Alternative 1, which allows the Runway 5L/23R to obtain the full 10,000 feet. These actions/proposed projects are listed below and discussed in the following sub sections.

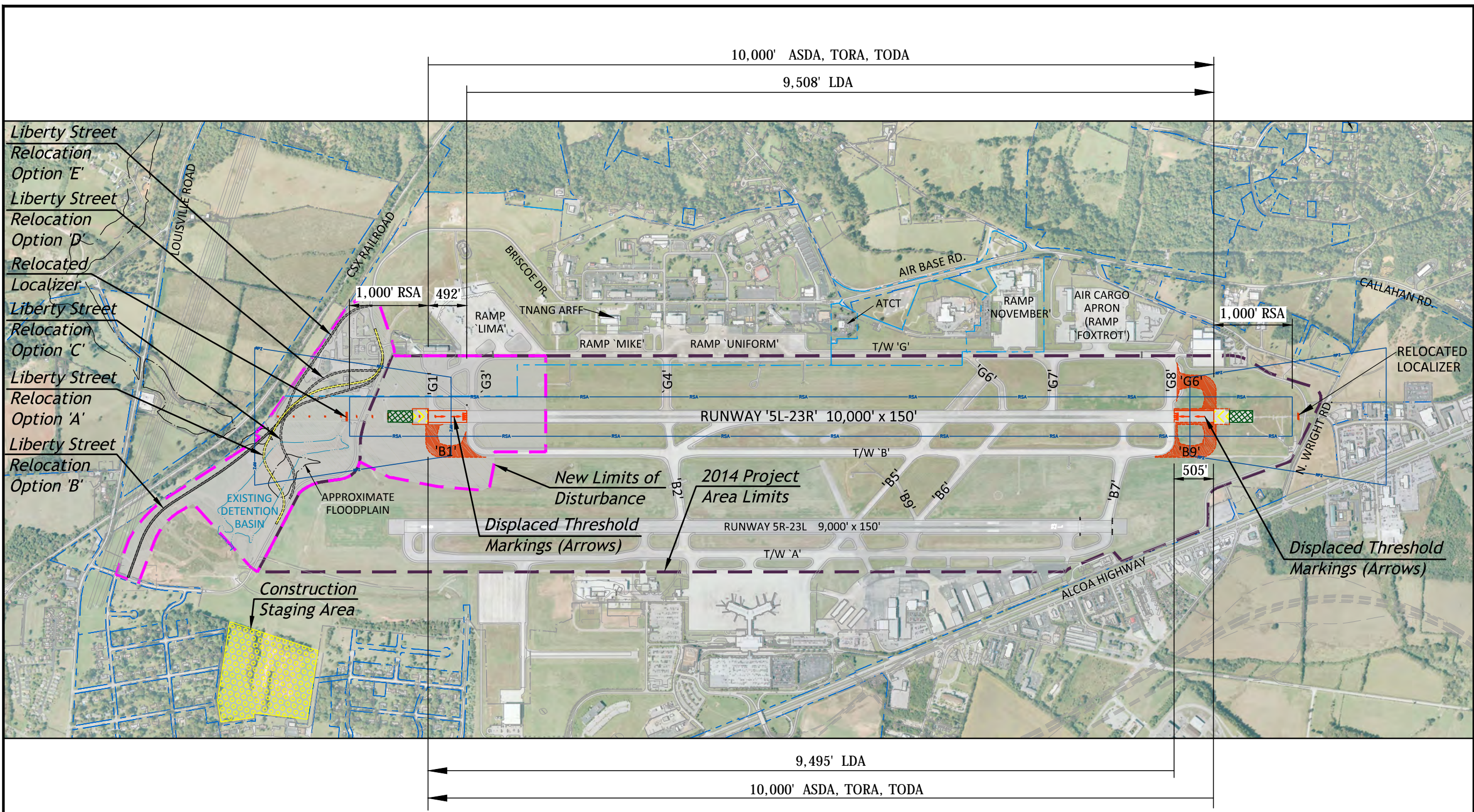
- Standard Runway 23R Departure End Safety Area
- Relocate Liberty Street
- Relocate Runway 23R Localizer Antenna
- Standard Runway 5L Departure End Safety Area
- Relocate Runway 5L Localizer Antenna
- Construct connector taxiway(s) to new declared end(s) of Runway 5L/23R



Drawing Not To Scale

LEGEND

-  Future Pavement
-  Demolish Pavement
-  Runway Safety Area
-  Runway Protection Zone
-  2014 Project Area
-  New Limits of Disturbance
-  Airport Property Line
-  TANG Lease Line



ABBREVIATIONS	
LDA	LANDING DISTANCE AVAILABLE
ASDA	ACCELERATE-STOP DISTANCE AVAILABLE
TORA	TAKE OFF RUN AVAILABLE
TODA	TAKE OFF DISTANCE AVAILABLE

NOTE

- RUNWAY '5L' AND '23R' DEPARTURE RPZ'S ARE SHIFTED 492' AND 504.5', RESPECTIVELY
- '5L-23R' ARRIVAL THRESHOLDS REMAIN IN EXISTING LOCATIONS.
- APPROACH RPZ'S AT BOTH ENDS REMAIN AT EXISTING LOCATIONS

FIGURE 2-3

Alternative 1: Extend Runway '5L-23R'

2.4.1 STANDARD RUNWAY 23R DEPARTURE END SAFETY AREA

During the final design for the Runway 5L/23R Reconstruction - Phase 2, it was determined that approximately 1,000,000 cubic yards of earth would be excavated to correct the various non-standard line of sight and gradient conditions on the existing runway. Although FAA AC 150/5300-13A, paragraph 313 recommends that airport sponsors consider placing excess earth where future development may occur, the 2014 Final EA/FONSI did not specify where the dirt would be placed. In order to waste as much of this dirt on site and eliminate contractor haul off, approximately 400,000 cubic yards will be placed as embankment to provide a full FAA standard 1,000-foot by 500-foot RSA. The 250' blast pad will also be demolished (see Figure 2-4). It should be noted that this embankment would be constructed and blast pad removed even if marking the runway overruns as usable pavement was not approved.

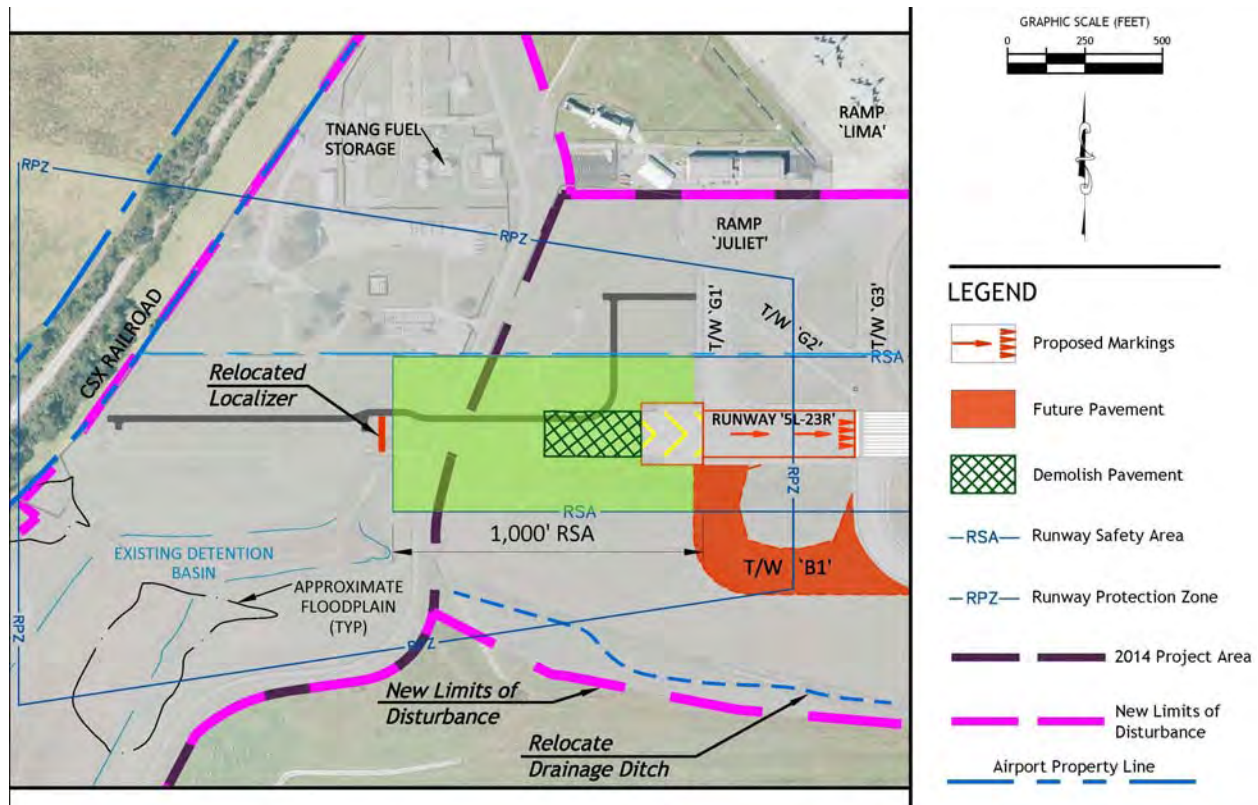


Figure 2-4: Runway 23R Departure End Safety Area Embankment

2.4.2 LIBERTY STREET RELOCATION

Liberty Street, located on the western side of the airport, serves as both a public road and an on-airport private road. Connecting to Louisville Road, the first 1,200 feet of Liberty Street provides access to a residential development just to the south of airport property. After the last residential street (Dogwood Street), there is an airport controlled gate at which point Liberty Road is controlled by the airport. The existing road from this point on the airfield is utilized by airport operations and the TANG accessing the northwest portion of their installation. The road is being relocated around the new/extended RSA (see Figure 2-5). The proposed road will be designed to support TANG fuel delivery trucks, oversized loads, and vehicle traffic with 35 mph design speed. The new road will have two 12-foot lanes with 2-foot shoulders. Each option will require the relocation of an existing sanitary lift station which is located within the extended Runway Object Free Area (ROFA). Each roadway option will also impact a mapped Zone A floodplain that is contained within the existing stormwater basin. Finally, the existing roadway that is

located inside of the extended RSA will be demolished. It should be noted that the Airport plans to modify the existing drainage systems and fill this basin overtime as it has been identified as a wildlife hazard. The different alternatives for the Liberty Street relocation are described below and presented in **Table 2-2**.

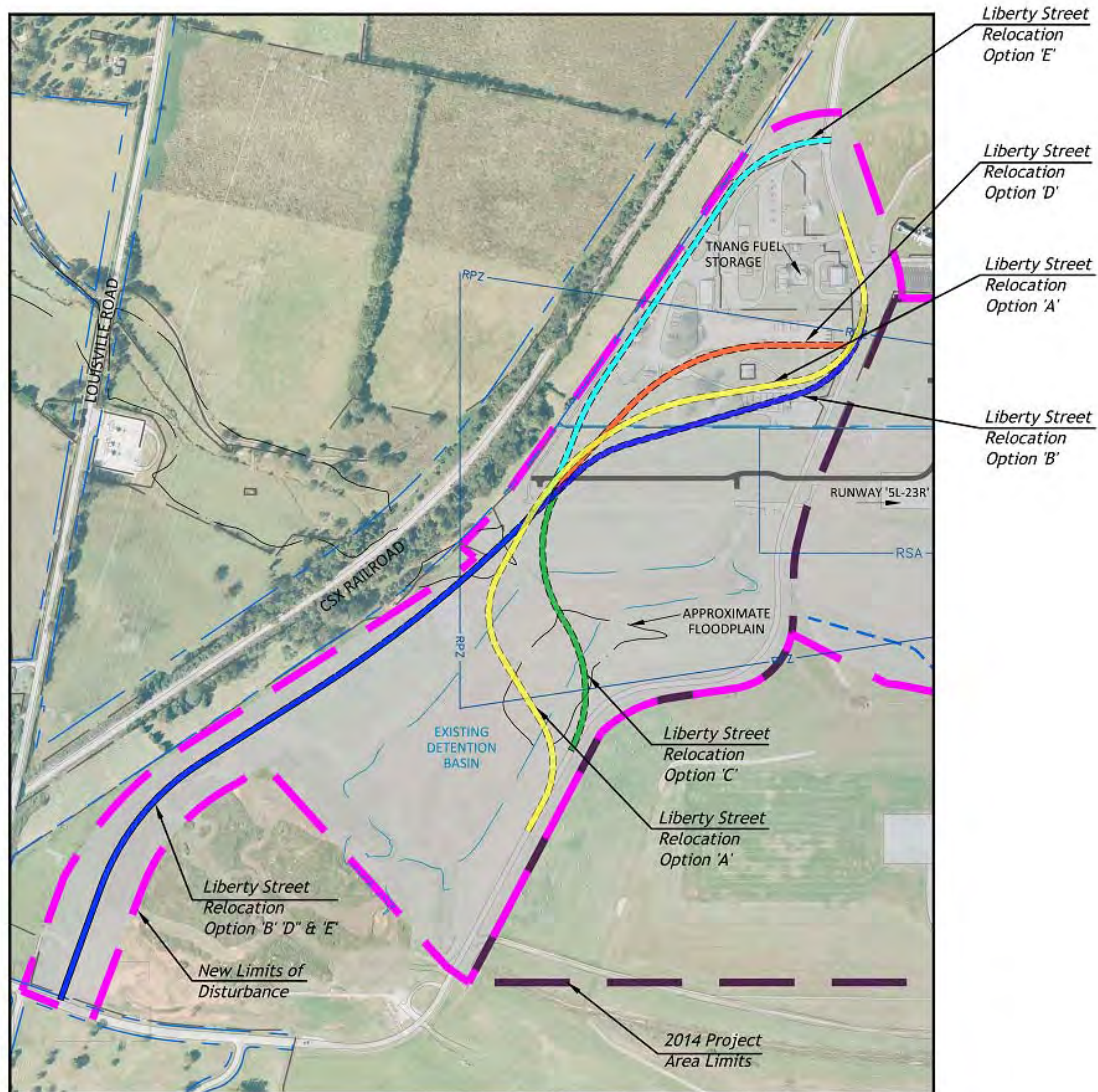


Figure 2-5: Liberty Street Relocation Options

2.4.2.1 Option A – Sponsor’s Preferred Alternative

Option A would relocate approximately 2,540 feet of Liberty Road around the extended safety area and would also be located outside of the Runway Object Free Area (ROFA). The relocation would impact the existing stormwater quality basin, existing waterline, and a sanitary lift station. This option would also impact a 100-year floodplain that is mapped within the existing stormwater/sediment basin. However; modeling completed during design indicated the alternative would not raise the base flood elevation by more than 1 foot, which is Blount County’s threshold for constructing in a floodplain. The total cost of the relocation is approximately \$3,424,000.

2.4.2.2 Option B

Option B would relocate approximately 4,480 feet of Liberty Road around the extended safety area. Under this alignment, the new road would parallel Louisville Road for the first 3,000 feet and tie back in to the existing road south of the TANG Fuel Storage area. Although this option would not impact the existing basin, it would impact a small portion of the floodplain. Option B would also impact the TANG emergency fuel spillway stormwater pond, waterline, and would be located within the Runway 5L/23R Runway Object Free Area (ROFA). The total cost of the relocation is approximately \$4,914,000.

2.4.2.3 Option C

Option C would relocate approximately 2,980 feet of Liberty Road around the extended safety area. The relocation would impact the existing stormwater quality basin, existing waterline, and would have the greatest impact on the approach lighting system for Runway 5L. The total cost of the relocation is approximately \$4,151,200.

2.4.2.4 Option D

Option D would relocate approximately 2,530 feet of Liberty Road and is the shortest relocation of the alternatives considered; however, this option is almost \$500,000 more expensive as this option requires more embankment. Option D would impact the existing waterline as well as underground electrical. The total cost of the relocation is approximately \$3,913,500

2.4.2.5 Option E

Option E follows the same alignment as Option B for approximately 3,000 linear feet but maintains a parallel path to Louisville Road and connects back into existing Liberty Street north of the TANG Fuel Storage facility. This option was the longest of the five options at 4,810 feet and the most expensive with an estimate of \$5,344,648. This option was studied to accommodate the TANG’s future plans of relocating their west side gates.

Table 2-2: Liberty Road Relocation Options

Option Alignment	Cost (\$)	Length of Relocation
A –Preferred	\$3,424,000	2,540’
B	\$4,914,000	4,488’
C	\$4,151,200	2,980’
D	\$3,919,500	2,530’
E	\$5,344,648	4,810’

2.4.3 RELOCATE RUNWAY 23R LOCALIZER ANTENNA

The localizer antenna is one of the main components of the Instrument Landing System for precision landings of aircraft. The localizer antenna handles the lateral guidance for incoming aircraft to align with runway centerline and is normally positioned on the opposite end of the approach runway (i.e. a localizer antenna serving an ILS for Runway 23R is at the opposite end of the runway on centerline). According to FAA Order 6750.16, the minimum distance a centerline extended localizer antenna must have from the stop end of the runway must be greater than 600 feet or the end of the safety area. The Runway 23R Localizer antenna is currently located 1,040’ from the existing stop end of the runway; however, the extended RSA will require the antenna to move approximately 550 feet. The relocated antenna would be located on runway centerline approximately 1,150 feet from the stop end of the runway (refer back to **Figure 2-4**).

2.4.4 MODIFY RUNWAY 5L APPROACH LIGHTING SYSTEM

The existing approach lights serving Runway 5L are a Medium-intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR). The existing MALSR, including, power and control equipment, all steady burning light fixtures (PAR 56, PAR 38, and in-pavement) and all sequenced flashers will be modified to coincide with the new Runway 5L threshold elevation. New power and control will be provided to the new equipment shelter site and the new light stations and a new access road will be provided to the new equipment shelter and to the new light stations. Although these modifications were disclosed in the Runway 5L/23R Reconstruction EA, their design/elevation are slightly different given the new embankment/blast pad removal for the extended Runway 23R departure end safety area.

2.4.5 STANDARD RUNWAY 5L DEPARTURE END SAFETY AREA

Similar to the Runway 23R departure end RSA, the Runway 5L departure end RSA will be graded and extended to meet FAA design standards in order to obtain 10,000 feet for ASDA, TORA, and TODA. This disturbance area was already discussed in the Runway 5L/23R Reconstruction EA and included in the project limits of disturbance. However, as part of the runway extension, the area is required to meet RSA standards (see **Figure 2-6**).

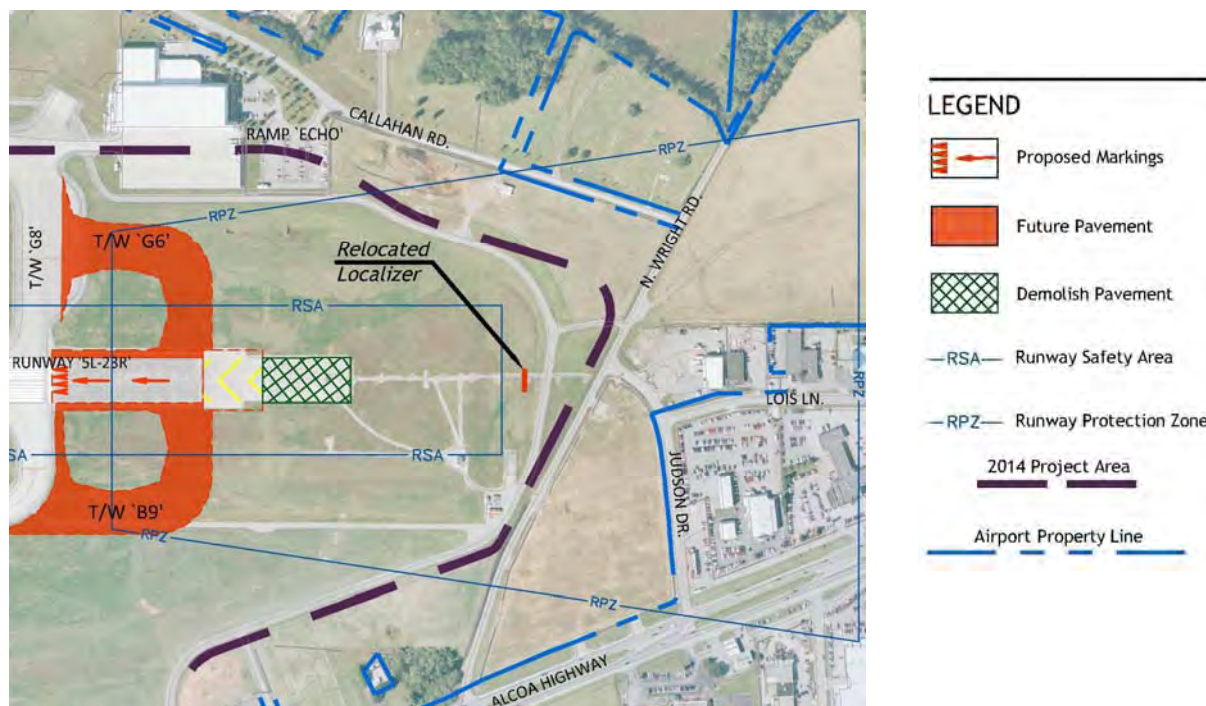


Figure 2-6: Runway 5L Departure End Safety Area

2.4.6 CONSTRUCT NEW CONNECTOR TAXIWAY(S) TO DECLARED RUNWAY END(S)

The final element to Alternative 1 are taxiway connectors to the new runway ends. A 500-foot extension to the parallel Taxiway B and new taxiway connector (B1) will be constructed to the Runway 5L end and two new taxiway connectors (G6 and B9) will be constructed to allow aircraft access to the Runway 23R end. Although both taxiway connectors on the 23R were included in the Runway 5L/23R LOD, the new connector (B1) will require the relocation of approximately 1,500 feet of an existing drainage ditch that

flows between the two parallel runways and empties into the existing stormwater basin (refer back to Figure 2-4).

2.5 ALTERNATIVE 2 – NO BUILD ALTERNATIVE

The No-Build Alternative is assessed under the guidance of Section 1502.14 (d) of the CEQ regulations, which requires that a “no-build alternative” be considered in development projects. The No-Build Alternative would maintain the existing markings on Runway 5L/23R and none of the proposed improvements identified in the Build Alternative discussion would be implemented. Although the No-Build Alternative would not create any foreseeable adverse impacts, the No-Build would not satisfy the stated Purpose and Need of the project. Although the Purpose and Need would not be satisfied as part of Alternative 2, all reasonable alternatives must be studied to meet NEPA requirements; therefore, it is included as an alternative in this EA.

3 AFFECTED ENVIRONMENT

This section describes the existing environmental conditions on and around Airport property potentially affected by the implementation of the proposed improvements. Blount County, Tennessee is located in extreme eastern Tennessee encompassing an area approximately 567 square miles. The City of Knoxville, Tennessee is located 12 miles north of the airport. TYS itself is located within the City of Alcoa limits encompassing approximately 2,680 acres of property. More specifically, the Airport is bordered by CSX Railroad and Louisville Road to the west, Airbase and Callahan Roads to the north and Alcoa Highway to the east and south.

3.1 PROJECT LOCATION

The affected environment at TYS includes all the areas on the Airport or in the immediate vicinity that could be directly or indirectly affected by the implementation of the proposed improvements. Most of the proposed project area was studied in the Runway 5L/23R Reconstruction EA/FONSI approved in July 2014; however, the proposed action does include some additional on-airport ground disturbance, which is discussed in the following subsections.

3.2 HUMAN ENVIRONMENT

This section describes the environmental resources on airport property and within the surrounding area that are related to the human environment.

3.2.1 EXISTING NOISE AND COMPATIBLE LAND USE

FAA Orders 5050.4B and 1050.1F, requires evaluation of potential noise impacts for existing and future airport conditions. The required FAA tool for evaluating noise exposure associated with airport activity is the Aviation Environmental Design Tool (AEDT). AEDT is designed to estimate long-term average effects using average daily input conditions. FAA's approved version at the time of project initiation, AEDT Version 2b was utilized to develop the noise analysis. A complete Noise Impact Analysis Report can be found in **Appendix A**.

3.2.1.1 Aviation Environmental Design Tool (AEDT)

AEDT works by first defining a network of reference points from which to measure noise at ground level around the airport. Flight tracks and aircraft performance profiles are created within the program based on operational conditions at the airport. AEDT then selects the shortest distance from each flight track to each reference point and computes the noise exposure generated by each aircraft operation. Adjustments are applied for airport climate and environmental characteristics, atmospheric acoustical attenuation, aircraft thrust variations, and time of operation. Night-time operations, those occurring between the hours of 10:00 p.m. and 7:00 a.m., are attributed a 10-decibel penalty (twice as loud). The noise exposure levels for each aircraft are then summed at each reference point to provide a day-night average sound level (DNL). DNL is a 24-hour logarithmic average sound level expressed in A-weighted decibels (dBA), as approved by the FAA. The cumulative noise exposure levels at all reference points are then used to plot noise exposure contours for selected DNL values, and superimposed onto a base map. Noise contours generated by the AEDT represent outdoor noise levels and depict generally expected average, daily noise exposure at a relative location, rather than noise levels for a single aircraft event. Noise exposure on any one day may be greater or less than the average day.

3.2.1.2 Operational Forecasts

In order to perform the noise analysis, existing and projected operations were obtained from the FAA Terminal Area Forecast (TAF), dated January, 2016. These operational projections are summarized in **Table 3-1**. Itinerant operations are arrivals or departures that do not remain within the airport traffic pattern and/or are originating from another airport (i.e., visiting aircraft). Local operations are those that remain within the airport traffic pattern and are mostly associated with training activity and flight instruction (e.g., touch-and-goes). In 2016, TYS is expected to see a total of 95,833 operations, consisting of 81,135 itinerant operations and 14,699 local operations. By 2023, these operations are projected to grow to 97,176 operations. For the purposes of this analysis, 2016 operations were utilized to evaluate existing conditions.

Table 3-1: Operational Forecasts

Year	Itinerant (IT) Operations					Local (LOC) Operations			Total Ops
	AC	AT	GA	MIL	Total	Civil	MIL	Total	
Existing Year	15,651	26,399	27,293	11,791	81,134	4,585	10,114	14,699	95,833
Year of Implementation	19,742	22,854	27,457	11,791	81,844	4,623	10,114	14,737	96,581
Year of Implementation +5 Years	36,739	5,943	27,871	11,791	82,344	4,718	10,114	14,832	97,176

AC – Air Carrier AT – Air Taxi GA – General Aviation MIL - Military
 Source: FAA Terminal Area Forecast, January 2016.

3.2.1.3 Fleet Mix

The AEDT fleet mix was determined by reviewing historical activity from the FAA’s Traffic Flow Management System Counts (TFMSC) database. The TFMSC database captures flight plan operations that are filed with the FAA when an aircraft/pilot intends to fly under Instrument Flight Rules (IFR) and/or in controlled airspace; consequently, the TFMSC database captures the majority of jet and turboprop operations. Several AEDT aircraft were selected to represent the airport’s fleet mix and were grouped into the categories Commercial (COMM), General Aviation Helicopter (GA-HEL), General Aviation Itinerant (GA-IT), Military Fixed Wing (MIL-FW), and Military Helicopter (MIL-HEL). Because it is not possible within AEDT to model every single type of aircraft that operates at TYS, each AEDT aircraft may represent several other aircraft with similar noise profiles. For example, the Airbus A319 (A319-131) was used to model the noise exposure of the Airbus A320 (A320-211), Boeing 737-800 (737800), and Airbus A321 (A321-232).

Using the fleet mix analysis, daytime/nighttime assumptions and operational forecasts, airport daily operations by representative aircraft type were determined for each noise study case year and input into AEDT. **Appendix A, Table 2** present airport daily operations for existing conditions.

3.2.1.4 Land Use Compatibility Guidelines

Federal Aviation Regulation, Part 150, *Airport Noise Compatibility Planning*, is the primary Federal regulation guiding and controlling planning for aviation noise compatibility on and around airports. Within this regulation, the FAA provides guidelines for evaluating various land uses inside aircraft noise exposure areas. These guidelines are reproduced here as **Figure 3-1**. Land use compatibility of various activities is keyed to DNL values calculated in AEDT. The guidelines reflect the statistical variability of the responses of large groups of people to noise. Therefore, any particular noise level might not accurately assess one individual’s perception of an actual noise environment.

All land uses are considered compatible with noise levels of less than 65 DNL. Residential, mobile home, and transient lodging uses are discouraged from 65 DNL and higher. Other noise sensitive uses such as hospitals, nursing homes, and churches are also discouraged in 65 DNL or greater. In certain cases, these uses may be permitted if the structure is designed with, or contains, adequate measures to achieve reduction of outdoor noise levels (soundproofing). Land uses that are less sensitive to noise levels, such as commercial use, are considered compatible with noise levels of 70 DNL without soundproofing and up to 80 DNL with soundproofing.

Figure 3-1: Land Use Compatibility Chart

Land Use	Yearly Day-Night Average Sound Level (DNL) vs. Decibels					
	<65	65-70	70-75	75-80	80-85	>85
<u>Residential Use</u>						
Residential other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
<u>Public Use</u>						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
<u>Commercial Use</u>						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail--building materials	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade--general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
<u>Manufacturing and Production</u>						
Manufacturing general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
<u>Recreational</u>						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

() NUMBERS IN PARENTHESE REFER TO NOTES BELOW

KEY TO TABLE

- Y (Yes) Land use and related structures compatible without restrictions.
- N (No) Land use and related structures are not compatible and should be prohibited.
- 25, 30, or 35 Land use and related structures generally compatible; measures to achieve Noise Level Reduction (NLR) of 25, 30, or 35 dB must be incorporated into design and construction of structure.

NOTES FOR TABLE

- (1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor NLR of at least 25 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.
- (2) Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
- (3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
- (4) Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
- (5) Land use compatible provided special sound reinforcement systems are installed.
- (6) Residential buildings require an NLR of 25 dB.
- (7) Residential buildings require an NLR of 30 dB.
- (8) Residential buildings not permitted.

3.2.1.5 Existing Noise Contours

The existing noise contours were evaluated on the current level of aircraft operations and operational characteristics (see **Figure 3-2**). The contours depict lines of noise exposure expressed in DNL of 65, 70, and 75.

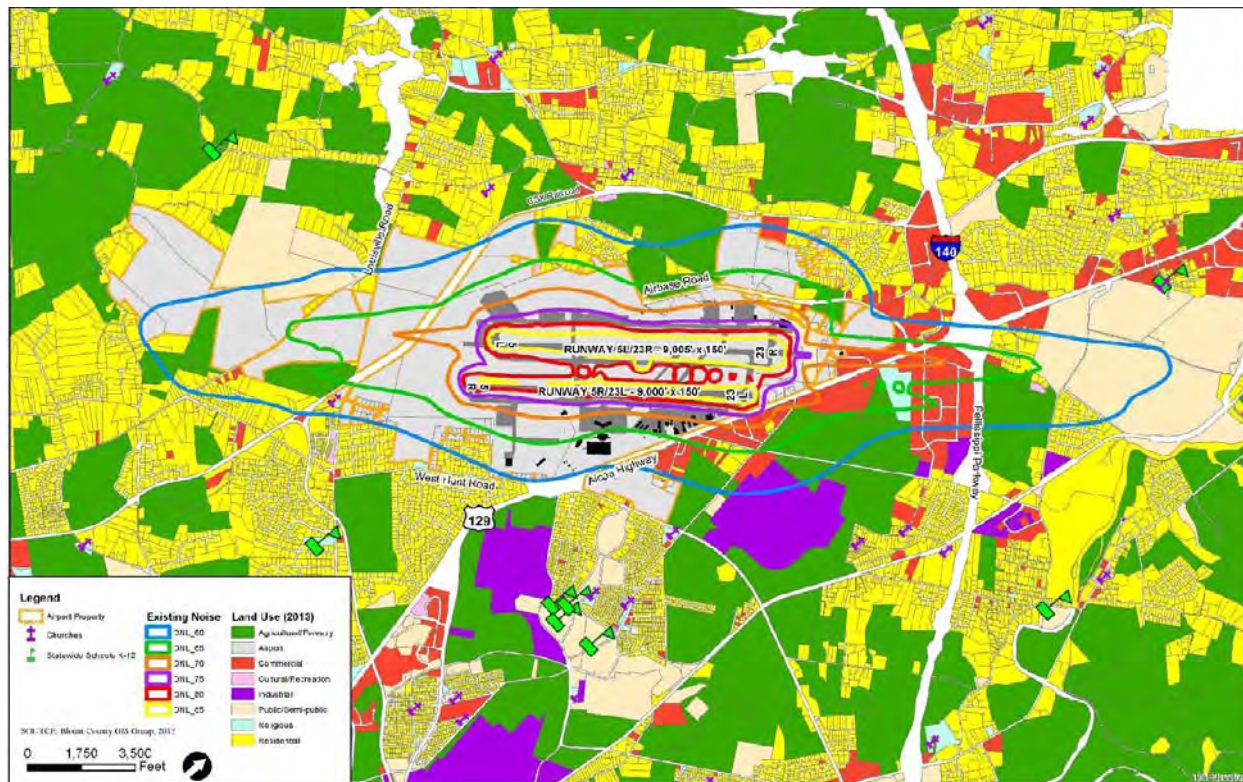


Figure 3-2: Existing Noise Exposure Map

3.2.2 HISTORIC RESOURCES

Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to take into account the effects of their undertakings on historic properties, and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. The historic preservation review process mandated by Section 106 is outlined in regulations issued by the ACHP. Revised regulations, Protection of Historic Properties (36 CFR Part 800), became effective January 11, 2001.

3.2.2.1 Area of Potential Effect

In order to take into account the effect an undertaking may have on properties listed on or eligible for listing on the National Register of Historic Places (NRHP), an Area of Potential Effect (APE) must first be identified. According to 36 CFR Part 800.16(d), the APE is the geographic area or areas within which an undertaking may directly or indirectly alter the character or use of historic properties. Such changes may include: physical destruction, damage, or alteration of a property; change in the character of the property's use or of physical features within its setting that contribute to its historic significance; and introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features [36 CFR 800.5(a)(2)]. The APE for this undertaking was coordinated with the

Tennessee Historical Commission utilizing the 2015 65 Day-Night Level (DNL) contour (see **Appendix B**).

Historic Resources

According to the 2014 Runway 5L/23R Reconstruction EA, the closest NRHP-listed site is the Samuel George House, which is located approximately 1.3 miles northwest of the airport on Topside Road and Pellissippi Highway. As part of the proposed action, no structures would be demolished and the view shed would not permanently change. In addition, there will be no structures that would have a greater than 1.5 DB change.

Archeological Resources

This site has been previously disturbed with the extension of Runway 5R, the construction of the existing sediment/drainage basin, and other airport improvements. Based on a review of the NHRP for Blount County, Tennessee, there were no properties listed on or eligible for the NRHP and no known, recorded archaeological sites located within the LOD. The archaeological disturbance assessment indicates that the entire LOD appears to have been previously disturbed and is no longer intact.

3.2.3 SECTION 4(F) PROPERTIES

Section 4(f) of the DOT Act of 1966 [recodified in 1983 as Title 49, Section 303(c) of the USC] provides for the protection of publicly owned recreational resources and requires the analysis of potential impacts to these resources arising from DOT actions. Resources protected under Section 4(f) include public parks and recreation areas, as well as wildlife and waterfowl refuges or management areas of national, state, or local significance. Section 4(f) also applies to historic sites of national, state, or local significance as determined by the official that has jurisdiction over these historic resources. Such sites include those that are listed or eligible for inclusion in the NRHP, as well as those identified by appropriate state or local agencies as having historic significance.

3.2.3.1 Public Park and Recreation Areas

There are no publically-owned parks or recreation areas within or adjacent to the proposed project area. According to the Maryville-Alcoa-Blount County Tennessee Parks & Recreation Commission mapping, the nearest park to the airport is Springbook Park/Pool & Duck Pond, which is located outside of the 65 DNL noise contour.

3.2.3.2 Wildlife Management Areas

According to Tennessee Department of Environment and Conservation (TDEC) mapping resources, there are no wildlife management areas within the vicinity of the project area.

3.2.3.3 Historic Sites

Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, affords protection of historic sites that are on or eligible for inclusion on the NRHP. According to correspondence received from the Tennessee Historical Commission, there are no NRHP listed or eligible resources that will be affected by the project.

3.2.4 SOCIAL & SOCIOECONOMIC CHARACTERISTICS

This section presents a discussion of the social, economic, and demographic characteristics surrounding the Airport. Potential socioeconomic impacts of an airport improvement project are primarily related to the direct effects on home and business relocation, transportation systems, utilities, and other cultural and

public facilities. It also involves consideration for potential effects on minority and low-income populations, as well as indirect impacts, such as changes in growth patterns and community disruption.

3.2.4.1 Community Profile

Environmental Justice laws, regulations, and policies are found in Title VI of the Civil Rights Act of 1964, the National Environmental Policy Act of 1969, Title 23 of the USC, Section 109(h), the Uniform Relocation, and Real Properties Acquisitions Policy Act of 1970, and most recently, Executive Order 12898: Federal Actions to Address Environmental Justice in Minority and Low Income Populations. Executive Order 12898 directs each Federal agency to develop a strategy addressing environmental justice concerns in its programs, policies, and regulations. The purpose of this Order is to avoid disproportionately high and adverse human health or environmental impacts on minority and low-income populations with respect to human health and the environment. On July 16, 1997, the DOT issued its Final Order on Environmental Justice as Order 5610.2. In an attempt to identify minority and low income populations in the project area, demographic data from the U.S. Bureau of Census, 2010-2014 American Community Survey 5-year Estimates, was reviewed and compiled.

To assess the data and determine the presence of environmental justice (EJ) populations the following criteria were applied. Affected communities (AC) that are more than 50% minority or low income are automatically designated as EJ populations. All other ACs are designated as an EJ population if the low-income or minority populations are 125% of the community of comparison (COC). In the case of this analysis, the project is wholly contained within Blount County, which most accurately represents the geographic, social, and economic environment of the project area. Therefore, Blount County was deemed the most appropriate COC. The AC was determined to include Census tracts 102, 103.01, 103.02, 116.04, and 9801. Census tracts were utilized for the ACs, as the information for the Block Groups was not available from the US Census Bureau’s American Fact Finder at the time of the analysis.

A reference threshold of 125% was calculated over the COC population to establish a threshold which was used to assess the presence of EJ populations. EJ populations were presumed to be present if the AC values exceeded the threshold. The results of this analysis appear in **Table 3-2**. Based on this data, there are two potential EJ populations within the study area for the proposed project.

Table 3-2: Minority and Low-Income Population Groups by Census Tract

	Blount County, Tennessee (COC)	Census Tract 102, (AC1)	Census Tract 103.01, (AC2)	Census Tract 103.02, (AC3)	Census Tract 116.04, (AC4)	Census Tract 9801, (AC5)
Total Population	124,435	5,767	5,266	3,169	4,159	5
Minority Persons	10,289	740	311	342	360	0
Percent Minority	8.27%	12.83%	5.91%	10.79%	8.66%	0.00%
125% of COC	10.34%					
Potential Minority EJ Impact?		Yes	No	Yes	No	No
Low-Income	14.44%	16.78%	17.93%	20.81%	7.17%	0.00%
125% of COC	18.05%					
Potential Low-income EJ Impact?		No	No	Yes	No	No

Source: U.S. Bureau of Census, 2010-2014 American Community Survey 5-year Estimates

3.3 NATURAL ENVIRONMENT

This section describes the environmental resources on airport property and within the surrounding area that are related to the natural environment.

3.3.1 AIR QUALITY

In accordance with the Clean Air Act (CAA) Amendments of 1990, all areas within Tennessee are designated with respect to compliance, or degree of noncompliance, with the National Ambient Air Quality Standards (NAAQS). NAAQS have been established for carbon monoxide (CO), sulfur oxides (SO_x), nitrogen oxides (NO_x), ozone (O₃), particulate matter with a diameter of ten microns or less (PM), and lead (Pb). These designations are either attainment, nonattainment, or unclassifiable. An area with air quality better than the NAAQS is designated as “attainment;” an area with air quality worse than the NAAQS is designated as “non-attainment.” Non-attainment areas are further classified as extreme, severe, serious, moderate, and marginal. An area may be designated as unclassifiable when there is a lack of data to form a basis of attainment status.

3.3.1.1 Attainment/Non-Attainment Status

The Airport is located in Blount County, Tennessee, which is a part of the Eastern Tennessee-Southwestern Virginia Intrastate Air Quality Control Region [40 CFR 81, Subpart B, §81.57]. According to the U.S. Environmental Protection Agency (EPA), Blount County is in attainment for all criteria pollutants with the exception of particulate matter (PM_{2.5}). In addition, 8-hour ozone (O₃) had previously been designated as marginal non-attainment, but in July 2015, it was re-designated as in attainment.

3.3.2 BIOLOGICAL RESOURCES

Section 7(c) of the Endangered Species Act of 1973 (16 USC 1531 et seq.) requires that the potential impacts to rare, threatened, and endangered species of flora and fauna and their critical habitats be identified to avoid adverse impacts to these species. Consultation with the US Fish and Wildlife Service (FWS) and the TDEC was conducted to determine the potential for rare, threatened, or endangered species to occur on or adjacent to the Airport. The State of Tennessee also has a designation for State Deemed in Need of Management. This list is managed by the Tennessee Wildlife Resource Agency (TWRA). Species are added to this list when the executive director of the TWRA determines a species or subspecies of nongame wildlife should be investigated in order to determine a better understanding of population, distribution, habitat needs, limiting factors and other biological and ecological data. This data is used to determine the necessary management measures to ensure their sustainability.

3.3.2.1 Federally-Protected Species & Critical Habitat

A thorough review of the rare species database maintained by TDEC indicated that a total of twelve (12) federally protected species are known to be found within Blount County, Tennessee. An analysis of these species, and their habitat requirements, indicates that the proposed project activities are not likely to have a detrimental impact on any federally protected species, or any listed Critical Habitat for those species. This was confirmed during the Early Coordination process with the USFWS (see **Appendix B**). Specifically, nine of the twelve species are aquatic species and are only found in perennial streams and rivers. Of the remaining three species, two represent species of bats (the Indiana bat, *Myotis sodalis*, and the northern long-eared bat, *Myotis septentrionalis*) that require standing trees with exfoliating bark as summer roosts. The proposed project does not include tree clearing and is therefore unlikely to impact the habitat of these species. The final federally listed species is the Carolina Northern Flying Squirrel (*Glaucomys sabrinus coloratus*), which is restricted to the higher elevations of the Appalachian Mountains and is unlikely to be present within the proposed project area.

3.3.2.2 State-Protected Species

A review of the rare species database maintained by TDEC indicated that a total of eighty-nine (89) state listed species are known to be found within Blount County, Tennessee. Of these eighty-nine species, a total of eleven (11) represent invertebrate animals, a total of thirty-three (33) represent vertebrate animals and one (1) represents an ecological resource (Great Blue Heron rookery). None of these species, or the identified ecological resource, were observed during the field investigations. An analysis of these species, and their habitat requirements, indicates that the proposed project activities are not likely to have a detrimental impact on any state listed zoological species.

The remaining forty-four (44) state listed species are comprised of nonvascular and vascular plants. A data search indicated only one state protected plant species is located within the limits of the Maryville, TN quadrangle map. The Torrey's Mountain-mint (*Pycnanthemum torrei*) is typically found growing on gravelly shores, meadows, dry to wet thickets, roadsides, and open woods. During the field investigations, this listed species was not identified. An analysis of the habitat requirements of these listed species indicates there is little likelihood of their occurrence within the proposed project area. Therefore, the proposed project activities are not likely to have a detrimental impact on any state listed botanical species.

3.3.2.3 Migratory Birds

As part of the Part 139 Certification process, McGhee Tyson Airport has developed and implemented a Wildlife Hazard Management Plan (WHMP). This plan describes the policies and procedures undertaken by the Airport to minimize the potential for hazardous wildlife, including migratory birds, to be present on or adjacent to the airfield. This includes the active hazing of migratory birds. The proposed project area lies within the area of management included in this WHMP. This will serve to reduce the likelihood of impacts to migratory birds from the proposed project activities.

3.3.3 WATER RESOURCES

This subsection describes the existing water resources located within the airport boundary and any water resources located within the footprint of the proposed limits of disturbance.

3.3.3.1 Surface Waters

The project area is located within the watershed sub-units of Lackey Creek and Little River-Roddy Branch. As shown in **Figure 3-3**, there are two main ditches that drain the airport to the west and south west named the north lateral ditch and south lateral ditch. These ditches drain into the south sediment pond.

The north lateral ditch is the main drainage route for Runway 5L/23R, Taxiway B, Taxiway G, and a portion of Runway 5R/23L. It is severely eroded and continues to erode as severe erosion, bank undercutting, and scouring was observed in the field. As part of the Runway 5L/23R safety area embankment, the re-grading of the slope to the ditch will be required and portions of the ditch will be relocated. The south lateral ditch does not exhibit the same erosive characteristics of the north ditch. Similar to the north lateral ditch, the south ditch is critical to the ultimate stormwater management plan and will be utilized as inline storage to potentially eliminate the basin both ditches drain to.

The south sediment pond was not initially constructed to function as a stormwater quantity control structure. The pond was intended to act as a temporary sediment control basin during the construction of the 5R Runway extension in 1998. Several complaints of heavy sediment loading in streams downstream

of TYS during the construction of the embankment for the 5R Runway extension initiated the design and construction of the basin. The basin remained after construction for two primary reasons which were to attenuate peak flows after construction was completed and detain any chemical spills that would occur at the airport. The basin is now listed as an airport wildlife hazard and will ultimately be removed as part of the Runway 5L/23R Reconstruction Program. The structure was of sufficient size to require a Safe Dam Permit from Tennessee Department of Health and Environment, Division of Water Supply (now TDEC). The “dam” is classified as a small (storage of less than 999 acre-feet and a height of 20-40 feet), category 2 dam according the 1973 Safe Dams Act. The law and the regulations define a “dam” as any “*artificial barrier, together with appurtenant works*”, which does or may impound or divert water, and which either (1) is or will be 20 feet or more in height from the natural bed of the stream or watercourse at the downstream toe of the barrier, or (2) has or will have an impounding capacity at a maximum water storage elevation of 30-acre feet or more”

According to the TYS Stormwater Management Plan, the feasibility of utilizing decentralized storage in place of this basin was studied and found that by providing in-line storage in the infield, the basin could be removed in the future. This would remove the issue of standing water from within the RPZ of both runways. In addition, the existing basin was determined to be a wildlife hazard in the airport’s latest Wildlife Hazard Assessment (WHA).



Figure 3-3: Project Area Surface Waters

3.3.3.2 Floodplains

Executive Order 11988 defines floodplains as the “lowland and relatively flat areas adjoining inland and coastal waters, including flood prone areas of offshore islands, including at a minimum, the area subject to a one percent or greater chance of flooding in a given year.” The intent of Order 11988 is to ensure that floodplains and floodways are kept clear of obstructions and facilities that could restrict or increase flow rates or volumes during flood conditions. Encroachment is defined as any action that would cause the 100-year water surface profile to rise by one foot or more. The 100-year floodplain has been adopted by the Federal Emergency Management Agency (FEMA) as the base flood for floodplain management. Both Federal and state laws regulate development within floodplains and floodways.

According to FEMA’s Flood Insurance Rate Maps (FIRM), dated September 19, 2007 (Panel Number 47009C0117C), a small area of the 100-year floodplain of Proffitt Spring is located within the south sediment pond (see **Figure 3-4**).



Figure 3-4: Floodplain Map

3.3.3.3 Wetlands

As indicated in Waters of the US Report, no wetlands were determined to be present within the proposed limits of disturbance (see **Appendix C**).

3.3.3.4 Groundwater

According to the Runway 5L/23R Reconstruction EA, the airport is located within the Valley and Ridge Physiographic Province with the airport itself atop of ridge. According to the EA, groundwater aquifers are typically located in the valleys and are rarely present within the ridge areas.

3.3.2.5 Wild and Scenic Rivers

The Wild and Scenic Rivers Act (PL 90-542, as amended) was implemented to facilitate the protection of rivers possessing “*outstandingly remarkable scenic, recreational, geological, fish and wildlife, historic, cultural, or any other similar values.*” The US Department of the Interior (DOI) maintains a national inventory of river segments that appear to qualify for inclusion in the National Wild and Scenic River System. According to data from the National Park Service National Rivers Inventory and TDEC there are no federally or state designated Wild and Scenic Rivers within the project area.

3.3.4 HAZARDOUS MATERIALS & SOLID WASTE

When describing the study area for hazardous materials, solid waste, and pollution prevention the FAA recommends considering existing contaminated sites at the proposed project site or in the immediate vicinity, and local disposal capacity for solid and hazardous wastes generated from the proposed action or alternative(s).

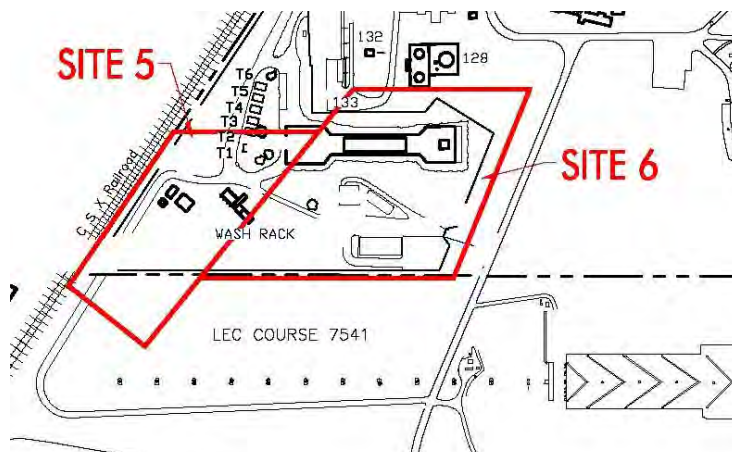


Figure 3-5: Existing ERP Sites

3.3.4.1 Hazardous Materials

Information was obtained from the Tennessee ANG on potential hazardous waste sites within the ground disturbance LOD. According to base environmental personnel, there are several Environmental Restoration Program (ERP) areas within the project LOD on the west side of the Airport (see **Figure 3-5** & **Figure 3-6**). Within these areas, there are several extraction wells, storage tanks, wash pads, and a capped landfill.

According to the *Long-Term Monitoring Report, McGhee Tyson Air National Guard Base (April 2016)*, Site 6 is located at the Main Petroleum Oil and Lubricant (POL) Storage Facility on the southern end of the TN ANG lease. This main storage facility is active and consists of three 210,000-gallon Jet A tanks; one 4,000-gallon product recovery tank; two 10,000-gallon diesel aboveground storage tanks (ASTs); one 2,000-gallon Jet AST; and several tanker truck loading and unloading stations. An oil/water separator (OWS) and an associated 4,000-gallon underground storage tank (UST) are also located within Site 6. The lower portion of the Site 6 is known as the “lower POL” area, which consists of gently sloping terrain toward the southeast and is covered with grass and a gravel obstacle course used by the ANG. In 1988, a site assessment was performed and identified three previous spills (130,000 gallons in 1960 from one of the ASTs; 7,000 gallons in 1976 from one of the Main POL storage tanks; and 5,000 gallons in 1976 from an overturned tanker truck).

Additional site inspections were conducted in 1992 and 1993, which included soil borings within the spill areas and the installation of three bedrock monitoring wells. Soil results indicated VOCs and semi-volatile organic compounds were present at varying depths southeast of the fuel storage tank and VOCs were detected in groundwater samples from two of the bedrock monitoring wells. Two additional bedrock monitoring wells were installed in 1996 and five soil borings were completed which showed that Total Petroleum Hydrocarbons (TPH) concentrations in groundwater exceeded the action level of 1,000 parts per billion (ppb).

The ANG completed remedial actions in 2000, which included excavating and disposing of approximately 500 cubic yards of soil impacted with VOCs. Additional soil sampling indicated that the remaining impacted soil was below the TDEC action levels. A remedial investigation was conducted from 2003 through 2004, and included installation of nine shallow groundwater monitoring wells and six soil borings within the lower POL area. TPH was detected in groundwater at multiple site monitoring wells. In 2005, the ANG began injecting an Oxygen Release Compound (ORC) to stimulate aerobic bioremediation. A second ORC injection was completed in March 2007 and finally in 2008, a more focused approach was implemented around monitoring wells MW6-04 and MW6-20.

In October 2015, groundwater samples were taken from the Site 6 monitoring wells MW6-04 and MW6-18 for TPH analysis. Concentrations of TPH were not detected above the former action level (1,000 µg/L) in the groundwater samples collected. The TPH concentrations in monitoring well MW6-04 have been less than former action levels since April 2013.

3.3.4.2 Solid Waste

None of the proposed alternatives would include any direct application to solid waste collection, disposal, or control other than that associated with construction generated debris. All of the project “build” alternatives would generate small amounts of solid waste that would be insubstantial to the infrastructure of the local landfills.

3.3.4.3 Pollution Prevention

The Airport currently uses a variety of hazardous materials, such as vehicle and aviation fuels and solvents, which could be released to the environment as a result of a spill, ground support equipment accident, etc. The MKAA addresses pollution prevention through stormwater management, proper storage and handling of hazardous materials, and best management practices for maintenance activities.

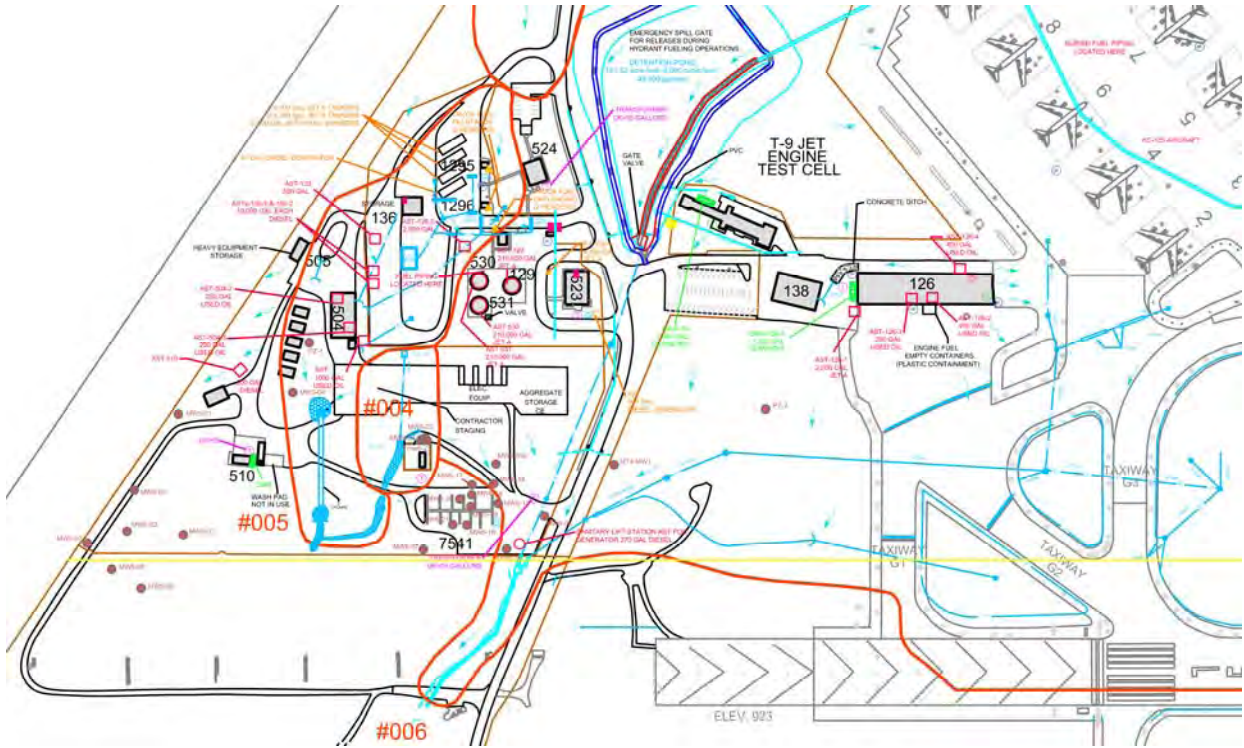


Figure 3-6: Hazardous Waste Sites

4 ENVIRONMENTAL CONSEQUENCES

This section presents an assessment of the potential environmental impacts from both the Build and No-Build Alternative. In accordance with FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, the resource categories below were assessed:

- Air Quality
- Biological Resources
- Climate
- Coastal Resources
- DOT Section 4(f) Lands
- Farmlands
- Hazardous Materials, Solid Waste, and Pollution Prevention
- Historical, Architectural, Archeological, and Cultural Resources
- Land Use
- Natural Resources & Energy Supply
- Noise & Noise Compatible Land Use
- Socioeconomic, Environmental Justice, and Children's Environmental Health and Safety
- Visual Effects
- Water Resources
- Cumulative Impacts

4.1 CATEGORIES WHERE NO IMPACTS WILL OCCUR

It was determined that the following resource categories would not be affected by the proposed development at TYS as they do not currently exist within the proposed project area. Therefore, no further impact analyses were conducted for these categories:

- **Biological Resources:** Section 7(c) of the Endangered Species Act of 1973 (16 USC 1531 et seq.) requires that the potential impacts to rare, threatened, and endangered species of flora and fauna and their critical habitats be identified to avoid adverse impacts to these species. Consultation with the US Fish and Wildlife Service (FWS), the Tennessee Department of Environment and Conservation (TEDC), and the Tennessee Wildlife Resource Agency (WRA) was conducted to determine the potential for rare, threatened, or endangered species to occur on or adjacent to the Airport. According to correspondence from these agencies, there will be no impact to Federal or state protected species or migratory birds. After an on-site investigation it was determined that due to the location, type and condition of habitat these species are not likely to be within the project area, furthermore no impacts to these species are likely (see **Appendix B**).
- **Coastal Resources:** The Coastal Zone Barrier Resources Act of 1982 prohibits Federal financial assistance for development within the undeveloped coastal zone barriers along the Atlantic, Gulf, and Great Lakes coasts. TYS does not lie within a coastal zone. Furthermore

Tennessee does not have a Coastal Zone Management Program.

- **Department of Transportation, Section 4(f):** Section 4(f) of the DOT Act of 1966 [recodified in 1983 as Title 49, Section 303(c) of the USC] provides for the protection of publicly owned recreational resources and requires the analysis of potential impacts to these resources arising from DOT actions. Resources protected under Section 4(f) include public parks and recreation areas, as well as wildlife and waterfowl refuges or management areas of national, state, or local significance. Section 4(f) also applies to historic sites of national, state, or local significance as determined by the official that has jurisdiction over these historic resources. Such sites include those that are listed or eligible for inclusion in the National Register of Historic Places (NRHP), as well as those identified by appropriate state or local agencies as having historic significance. The Build Alternative will not impact publicly owned land from a public parks, recreation areas, or wildlife or waterfowl refuges of national, state or local significance, or land of a historic site with national, state or local significance.
- **Farmlands:** The Farmland Protection Policy Act (FPPA) (7 USC 4201-4209) of 1984 was implemented to protect and preserve farmland for agricultural use as part of the 1980 Farm Bill (PL 97-98, Title XV, Subtitle I; 7 USC 4201-4209). This policy, however, does not apply to land already committed to urban development or water storage, regardless of its importance as defined by the Natural Resource Conservation Service. The project site is not drained for farmland use and is not an existing farm. Therefore, there will be no impacts to Prime and Unique Farmland.
- **Natural Resources & Energy Supply:** The use of natural resources, other than for fuel, should be analyzed only if the proposed project involved the need for unusual materials or natural resources in short supply. For this proposed project, as well as most airport actions, the changes in energy or other natural resource consumption will not result in significant impacts. The Build Alternative would not impact aircraft fuel consumption. There would be no significant increase in ground movements or run-up times for aircraft as a result of the proposed project. There would be no flight changes that would increase flight times.
- **Wetlands:** Section 404 of the Clean Water Act (CWA) establishes a program to regulate the discharge of dredge and fill material into waters of the US, including wetlands. Activities in Waters of the US that are regulated under this program include fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports), and conversion of wetlands to uplands for farming and forestry. According to the EPA's Section 404 (b) 1 guidelines, project proponents must avoid and minimize impacts to waters of the US at the project site to the maximum extent practicable. For those unavoidable impacts to waters of the US, including wetlands, compensatory mitigation may be required either through regional conditioning or on a case-by-case basis. A field determination along with available mapping determined that there are no regulated wetlands within the project limits of disturbance.
- **Wild and Scenic Rivers:** The Wild and Scenic Rivers Act (PL 90-542, as amended) was implemented to facilitate the protection of rivers possessing "outstandingly remarkable scenic, recreational, geological, fish and wildlife, historic, cultural, or any other similar values." The US Department of the Interior (DOI) maintains a national inventory of river segments that appear to qualify for inclusion in the National Wild and Scenic River System. No national

wild and scenic streams or rivers would be impacted by the proposed project.

4.2 AIR QUALITY

The Airport is located in Blount County, Tennessee, which is a part of the Eastern Tennessee-Southwestern Virginia Intrastate Air Quality Control Region [40 CFR 81, Subpart B, §81.57]. According to the U.S. Environmental Protection Agency (EPA), Blount County is in attainment for all criteria pollutants with the exception of particulate matter (PM_{2.5}). In addition, 8-hour ozone (O₃) had previously been designated as marginal non-attainment, but in July 2015, it was re-designated as in attainment.

There are two primary regulations that apply to air quality which are NEPA and the Clean Air Act (CAA). The need for an air quality assessment to satisfy NEPA depends on the nature of the project, the project area's non-attainment status, and the size of the airport. The CAA amendments of 1990 includes provisions to ensure emissions from Federally-funded actions within non-attainment areas comply with the goals and objectives of the State Implementation Plans (SIP) for the state the project is located in.

4.2.1 NATIONAL ENVIRONMENTAL POLICY ACT

Under the NEPA, the impact of a proposed action on air quality must be assessed by evaluating the impact of the proposed action to the NAAQS. The NAAQS are pollutant concentrations established to define maximum levels of pollutants in the ambient air over a period of time. According to the FAA's *Emissions and Air Quality Handbook*, Version 3, an operational emissions inventory is designed to quantify the amounts of criteria pollutant emissions associated with operational activity in the proposed project/action. The results are typically expressed in tons/year segregated by pollutant type, emission source [ex. aircraft engines, Auxiliary Power Units (APU), Ground Service Equipment (GSE), etc.], and alternative. When compared to the no-build alternative, the only operational change the proposed marking of Runway 5L/23R will have is allowing aircraft to use the existing paved overruns as usable pavement. There will be no changes in operations, GSE equipment, APU usage, the amount of people traveling to/from the airport, etc.

4.2.2 CLEAN AIR ACT

The CAA establishes regulations that apply to Federally-funded projects. These rules and regulations are intended to prevent the Federal government from approving or funding a project what will not comply with the State Implementation Plan (SIP). SIP(s) are developed to ensure that federally air quality standards will be met and maintained through the states. The rules established in the CAA, specifically the General Conformity Rule, apply to airport improvement projects when an airport is within a non-attainment or maintenance area for any of the criteria pollutants.

4.2.2.1 General Conformity

General Conformity refers to the specific requirements under Section 176(c) of the CAA for Federal agencies other than Federal Highway Administration and the Federal Transit Administration. Applicability of the General Conformity Rule is dependent on whether construction emissions will affect attainment as set forth in the SIP. The threshold levels, or *de minimis* levels, for each criteria pollutant were established under the CAA to determine if a proposed action could affect attainment status. **Table 4-1** depicts the *de minimis* thresholds for each criteria pollutant. The *de minimis* thresholds for which Blount County is classified as non-attainment or a maintenance area are highlighted.

Table 4-1: De Minimis Thresholds

Pollutants	De Minimis Levels	
	Non-Attainment	Maintenance
	(tons per year)	(tons per year)
Carbon Monoxide (CO)	100	100
Particulate Matter (PM₁₀)		
Moderate Non-Attainment	100	100
Serious Non-Attainment	70	
Particulate Matter (PM_{2.5})	100	100
Sulfur Dioxide (SO₂)	100	100
Nitrogen Oxide (NO₂)	100	100
Ozone (O₃)		
Volatile Organic Compounds (VOC)		
Nitrogen Oxides (NO _x)		
Serious Non-Attainment Area	50/50	
Severe Non-Attainment Area	25/25	50/100
Extreme Non-Attainment Area	10/10	
<u>Inside Ozone Transport Region</u>		
Marginal Non-Attainment	50/100	
Moderate Non-Attainment	50/100	
<u>Outside Ozone Transport Region</u>		
Marginal Non-Attainment Area	100/100	100/100
Moderate Non-Attainment Area	100/100	
Lead (Pb)	25	25

Source: 40 CFR Part 51.850; Part 81, Subpart B §81.37 and Subpart C, §81.323

4.2.2.2 Emissions Inventory

The construction of the proposed improvements at TYS would involve the disturbance and movement of soil, sediment, and rock) and various forms of solid waste and debris (e.g., vegetation, concrete, and asphalt). Air emissions associated with excavation, site preparation, paving, and other construction activities include dust from exposed soils and haul roads as well as exhaust from construction vehicles and equipment. The types and amounts of emissions generated will vary in time and by location depending on the nature of the operation, the level of activity, and the local weather conditions. The 2014 Runway 5L/23R Reconstruction EA completed a construction emissions inventory for the runway reconstruction program. The results of the 2014 Runway 5L/23R Reconstruction EA applicability analysis are shown in **Table 4-2**.

Table 4-2: Total Project Construction Emissions

	Pollutants (Tons per Year)			
	VOC	NO _x	PM _{2.5}	SO ₂
Project Totals	2.94	38.96	2.68	1.22
De minimis Thresholds	100	100	100	100

Source: Runway 5L/23R Reconstruction EA, July 2014; Michael Baker, Jr. Corp.

The additional projects contained in this EA would be the marking (i.e. painting) of the paved overruns on the ends of Runway 5L/23R and the relocation of Liberty Street. The proposed construction equipment for these additional projects were analyzed to determine whether they would exceed *de minimis* thresholds when combined with the runway reconstruction program already studied (see **Table 4-3**)

Table 4-3: Additional Projects

	Pollutants (Tons per Year)			
	VOC	NO _x	PM _{2.5}	SO ₂
Project Totals	5.11	2.60	0.36	.007
De minimis Thresholds	100	100	100	100

Source: CHA Consulting, 2016

4.2.2.3 General Conformity Applicability

The purpose of a General Conformity applicability analysis is to examine the results of the emissions inventory and establish the need for a General Conformity Determination for the proposed action. A General Conformity Determination must be completed if the annual net increase in emissions resulting from the proposed action exceeds the *de minimis* thresholds. **Table 4-2** and **Table 4-3** depicts the total pollutants (tons/year) for the Runway 5L/23R program and the additional projects contained in this EA. It can be reasonably assumed that marking the Runway 5L/23R and relocating Liberty Street will not increase the construction emissions in such a way where the *de minimis* thresholds would be met; therefore, a General Conformity Determination was not completed.

4.3 CLIMATE

Although there are no Federal standards for aviation-related Greenhouse Gas Emissions (GHG) emissions, it is well-established that GHG emissions can affect climate. The Council of Environmental Quality (CEQ) has indicated that climate should be considered in NEPA analyses. As noted by CEQ, "it is not currently useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions; as such direct linkage is difficult to isolate and to understand".

Based on FAA data, operations activity at TYS represents less than 1% of U.S. aviation activity. Therefore, assuming that GHGs occur in proportion to the level of activity, GHG emissions associated with future aviation activity from the runway extension would be expected to represent less than 0.03% of U.S. based GHG. Therefore, the emissions of GHG from this project are not expected to be significant. The construction of the Preferred Alternative would result in short term air quality impacts, such as fugitive dust and exhaust from construction equipment. These impacts will be minimized by seeding disturbed areas, covering haul trucks, and wetting down the construction areas.

4.4 HAZARDOUS MATERIALS, SOLID WASTE, & POLLUTION PREVENTION

This section discusses whether the proposed Build alternative would 1) disturb sites that may be used to store hazardous materials, or have been contaminated with hazardous wastes, 2) generate solid or hazardous wastes, and 3) make use of pollution prevention measures to avoid or reduce impacts to natural resources.

4.4.1 HAZARDOUS MATERIALS

The Site 6 Environmental Restoration Program (ERP) is within the project LOD on the west side of the Airport, as discussed in Section 3. None of the proposed project elements will affect any of these known hazardous waste sites except for the relocation of Liberty Street.

4.4.1.1 Liberty Street Relocation

According to mapping and information received from the ANG, the relocation of Liberty Street would impact a series of monitoring wells located north of Runway 5L/23R (see **Figure 4-1**). All the Liberty Street Relocation alternatives will impact existing monitoring wells in some capacity.

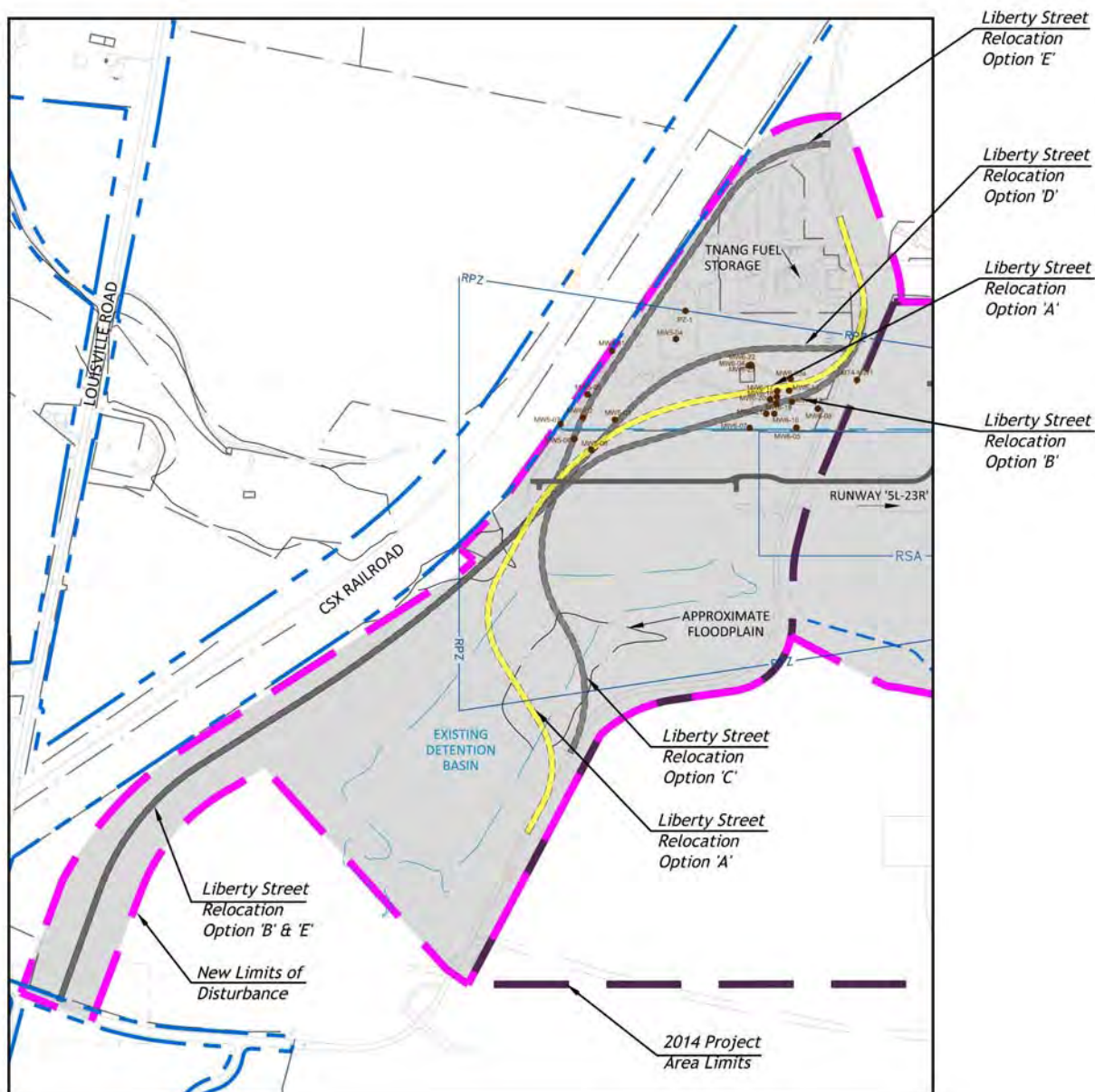


Figure 4-1: Monitoring Well Impacts

As discussed in Section 3, Site 6 is located at the POL Storage Facility on the southern end of the TN ANG lease. This main storage facility is active and consists of three 210,000-gallon Jet A tanks; one 4,000-gallon product recovery tank; two 10,000-gallon diesel aboveground storage tanks (ASTs); one 2,000-gallon Jet AST; and several tanker truck loading and unloading stations. An oil/water separator (OWS) and an associated 4,000-gallon underground storage tank (UST) are also located within Site 6. The lower portion of the Site 6 is known as the “lower POL” area, which consists of gently sloping terrain toward the southeast and is covered with grass and a gravel obstacle course used by the ANG. In 1988, a site assessment was performed and identified three previous spills (130,000 gallons in 1960 from one of the ASTs; 7,000 gallons in 1976 from one of the Main POL storage tanks; and 5,000 gallons in 1976 from an overturned tanker truck).

In the late early 1990s, it was determined that Total Petroleum Hydrocarbons (TPH) concentrations in groundwater exceeded the action level of 1,000 parts; therefore, existing contaminated soil was removed and a monitoring and restoration program was started by adding a series of monitoring wells. In October 2015, samples indicated groundwater was below action level. The Liberty Street relocation will impact a series of these wells. As part of the project, these wells would be raised (or lowered) depending on the required grade changes and left at their locations. The construction documents contain special specifications and instructions for the contractor in the event contaminated soils are found. Due to historically low ground water table elevation in this area, the depth of contamination is at the top of bedrock, which would make encountering contaminated soils very doubtful.

4.4.2 SOLID WASTE

Impacts to solid waste management relate to the increase in solid waste generated at an airport as a result of the construction of planned improvements and overall operation of the airport. It also addresses the location of existing and proposed solid waste disposal facilities relative to the Airport. Solid waste generated from the operation of the Airport would increase slightly due to future growth. However, levels of additional daily waste generated at the Airport as a result of the proposed improvements are not expected to be significant.

Solid waste would be generated from the construction of the proposed runway extension, terminal area development, and related improvements associated with the Build Alternative. Waste would be transported and disposed of as directed by the appropriate authorities. Typically, solid waste generated by airfield facilities (runways, taxiways, and ramps) is not significant. This project would have minimal solid waste such as fence, gates, some steel and concrete from the ANG obstacle course, concrete curb, and some metal pipe. None of the solid waste generated from construction at the Airport is anticipated to create capacity problems at the local landfill or require scheduled solid waste removal.

4.5 HISTORICAL, ARCHITECTURAL, ARCHEOLOGICAL, AND CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act (NHPA) of 1966 protects properties that are listed or determined to be eligible for inclusion in the National Register of Historic Places (NRHP). The NHPA requires Federal agencies to take into account the effects of their undertakings on historic properties and to consult with the State Historic Preservation Office (SHPO) and other parties to develop and evaluate alternatives and modifications to the undertaking that could avoid or minimize potential impacts to historic resources.

4.5.1 EFFECTS FINDING

An early coordination/scoping package was sent to the Tennessee Historical Commission (THC) on January 19, 2016 detailing the project and discussing the purpose and need. The package also included all of the Section 106 correspondence completed for the Runway 5L/23R Reconstruction EA/FONSI explaining that if there were noise impacts, the FAA would enter formal consultation with the THC. The THC concluded that no NRHP listed or eligible properties would be affected by the proposed undertaking on January 27, 2016 (see **Appendix B**). If any archeological artifacts or human remains are uncovered during construction, demolition, or earthmoving activities, construction in the immediate area should be stopped and the THC should be notified immediately.

4.5.2 PUBLIC INVOLVEMENT

The Section 106 effects finding [36 CFR 800.4(a) (1)] and the No Historic Properties Affected documentation [36 CFR 800.11(d)] was accepted by THC on January 27, 2016. In accordance with 36

CFR §800.8(3) (c), the EA will utilize the NEPA process to fulfill the requirements of Section 106. As such, the public notice for the Draft EA served as the notice of availability for the *No Historic Properties Effected finding*.

4.6 LAND USE

In addition to the impacts of noise on land use compatibility, other potential impacts of airport actions may also affect land use compatibility such as disruption of communities, relocation of residences and business, induced socioeconomic impacts, as well as land uses protected under Section 4(f).

4.6.1 REGULATORY SETTING

The FAA has not established a significance threshold for land use, and the FAA has not provided specific factors to consider in making a significance determination for land use; however, there is FAA guidance and regulations on Runway Protection Zones and Wildlife Attractants. A change in runway configuration or runway extension may require relocation of the Runway Protection Zone (RPZ) into a non-compatible land use. Although the FAA is currently developing long term guidelines for RPZs, interim guidance addresses when FAA review on RPZ land use compatibility is triggered. The criteria for FAA review and subsequent alternatives analysis are 1) a new land use enters the existing RPZ because of an airfield project, change in critical design aircraft, or new instrument procedure increasing the RPZ size and 2) the new land use is a building or structure, recreational land use, fuel or hazardous materials, waste water treatment plant, a transportation facility, or above ground utility such as solar panels.

4.6.2 ALTERNATIVE 1

As part of Alternative 1, the departure RPZ will shift with the declared end of runway as the departure RPZ starts 200 feet from the end of the TORA. This would impact both departure RPZs for Runway 5L and 23R; however, they would remain completely contained within both approach RPZs as they are today (see **Figure 4-2** and **4-3**). The Runway 5L departure RPZ already contains non-compatible land use such as businesses/real estate developments along Alcoa Highway and Wright's Ferry Road. Runway 23R departure RPZ contains a portion of the CSX Railroad, Liberty Street, and a portion of the existing Tennessee ANG obstacle course, which is proposed for relocation in the future. Pursuant to the RPZ guidance, a Runway 5L/23R Departure RPZ analysis was submitted to FAA in April 2016 and can be found in see **Appendix D**.



Figure 4-2: Runway 5L Departure RPZ



Figure 4-3: Runway 23R Departure RPZ

4.7 NOISE & NOISE COMPATIBLE LAND USE

4.7.1 REGULATORY SETTING

According to FAA environmental regulations, future conditions both with and without (no action) the proposed development and any reasonable alternative should be analyzed to identify if noise exposure levels are significant enough to pose as a hazardous impact. Such timeframes are usually the year of anticipated project implementation and five to ten years after implementation. The fundamental element of this noise analysis is a comparison of the 2018 (anticipated year of completion) and 2023 Build Alternative to the 2018 and 2023 No-Build Alternative in order to assess potential project-related noise effects. A “significant” noise impact is an increase of 1.5 dB or more occurring in noise-sensitive areas currently exposed to a DNL of 65 dB or greater.

4.7.2 IMPACT POTENTIAL

The proposed Runway 5L/23R extension is expected to be complete the end of 2018; therefore, this year was analyzed as part of the noise modeling as the implementation year. Using the assumptions and inputs discussed in **Section 3**, AEDT was utilized to generate noise contour maps for the implementation year (2018) and five years after implementation (see **Figure 4-4**, **4-5**, and **Appendix A**). The contours depict lines of contiguous noise exposure expressed in DNL. DNL, as previously mentioned, is the FAA approved method for land use compatibility determinations in airport noise studies. DNL noise contours are shown on the figure beginning at 60 DNL and increasing in 5 dB increments to 75 DNL. The 60 DNL is included for informational purposes only.

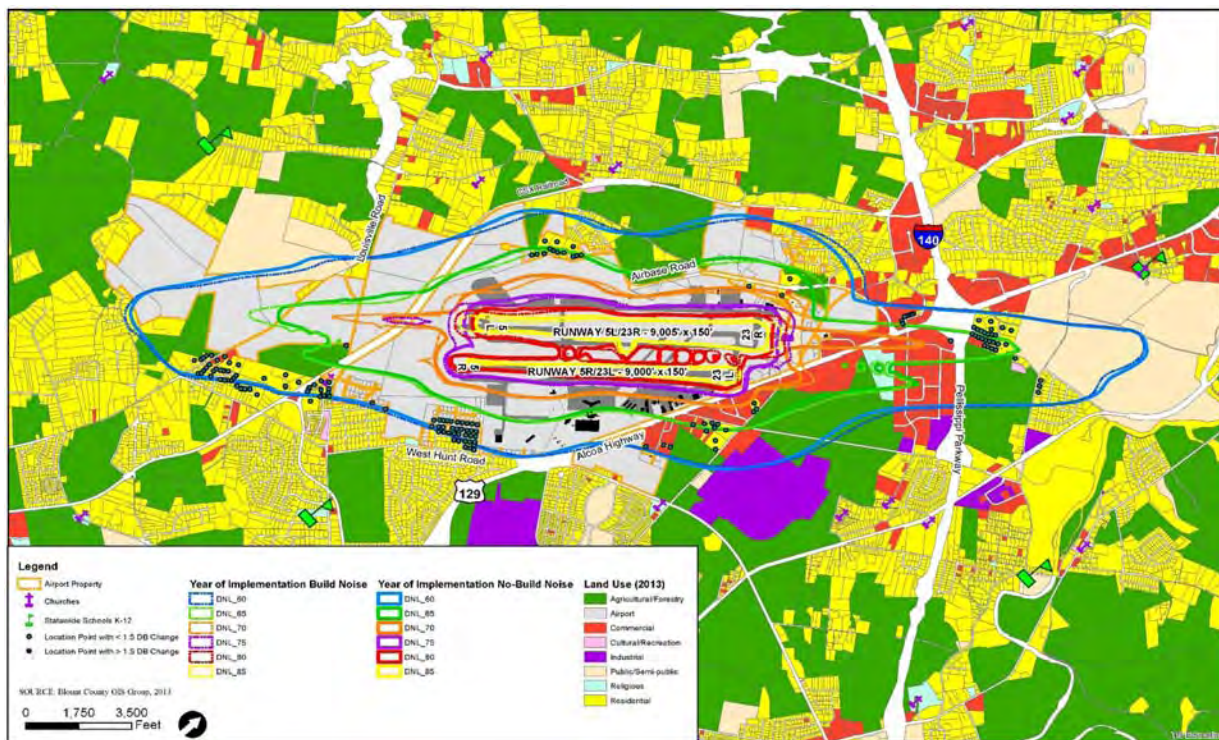


Figure 4-4: 2018 Noise Contours

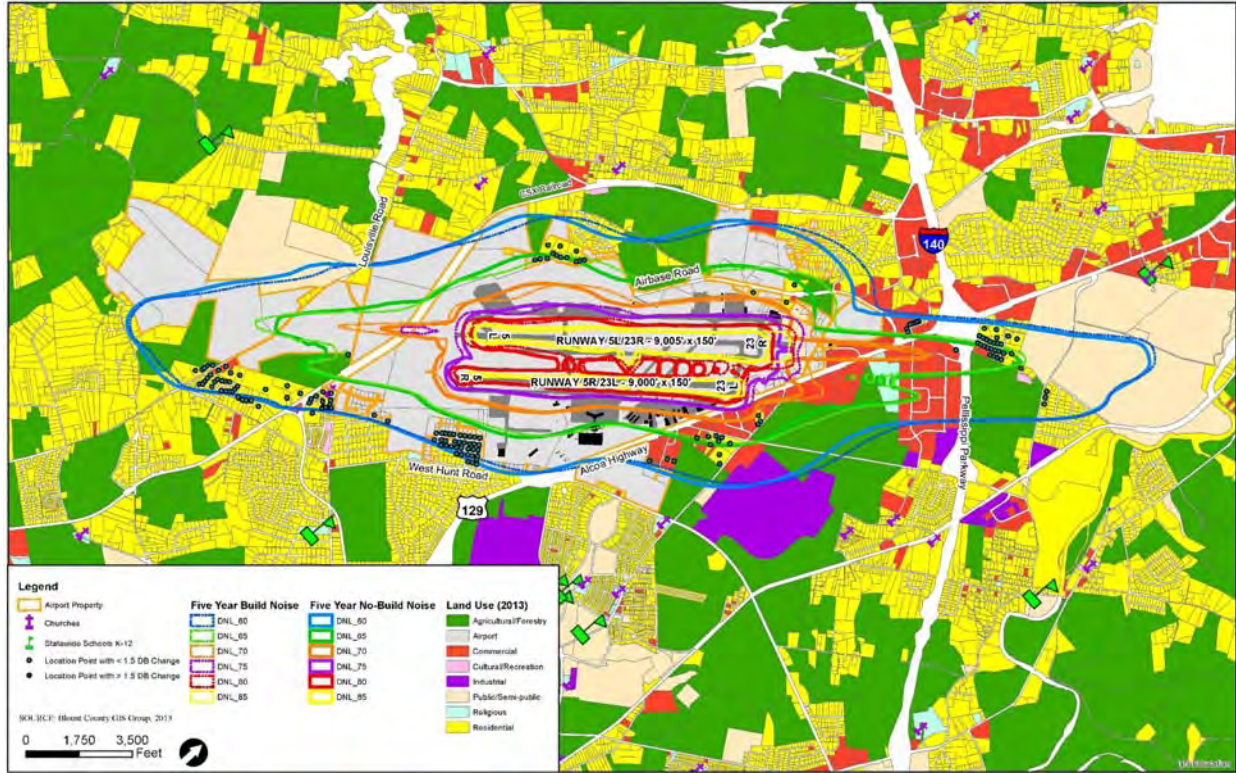


Figure 4-5: 2023 Noise Contours

Table 4-3 lists the acreages of noise exposure within the 65 DNL and greater for each future case. With implementation of the Build Alternative, total acreage of the 65 DNL and greater would increase from 1,998.3 acres to 2,019.5 acres. Five years after implementation of the Build Alternative, the 65 DNL and greater noise contour would increase from 1,999.3 acres to 2,020.3 acres when compared to the No-Build Alternative.

Table 4-3: Change in Noise Exposure

Day-Night Average Sound Level (DNL, in dBA)	Area Exposed to Given Noise Contours (Acres)					
	2018 Build	2018 No-Build	Change	2023Build	2023No-Build	Change
65-70	2019.5	1998.3	+20.2	2020.3	1999.2	+21.1
70-75	1070.0	1023.4	+46.6	1069.8	1024.4	+45.4
>75	703.5	663.3	+39.2	702.5	663.9	+38.6

*Michael Baker International, 2016

FAA Order 1050.1F provides guidance on environmental impacts at airports and considers an increase of 1.5 dB or greater over a noise sensitive area within the 65 DNL as a significant impact. Based on this guidance, 156 noise sensitive sites located within the 65 DNL noise contour were identified and assigned a location point within the noise model. Appendix A provides the expected change in noise levels at the 156 noise sensitive sites evaluated for the period five years after implementation of Alternative 1 (Build Alternative). According to the analysis, no sites would experience an increase of 1.5 dB DNL or greater if Alternate 1 was implemented. Since a 1.5 dB change is considered the threshold of significance by the

FAA, there would not be a significant change in noise conditions at noise sensitive sites. Based on the results of the noise analysis, Alternative 1 would not cause significant impacts to noise sensitive land uses.

4.8 SOCIOECONOMIC, ENVIRONMENTAL JUSTICE, AND CHILDREN'S HEALTH & SAFETY

The potential for socioeconomic impacts from an airport improvement project are primarily those related to the direct effects from the acquisition of land, the relocation of homes and/or businesses, transportation systems, and other cultural and public facilities. Disproportionate adverse impacts to minority and/or low-income populations must also be considered as part of the project's socioeconomic impact analysis. The Build Alternative is entirely within airport property and would not cause the acquisition of land, the relocation of homes or business or impact transportation or other public facilities. The No-Build Alternative would not result in any socioeconomic impacts.

4.8.1 ENVIRONMENTAL JUSTICE

The proposed project will have no disproportionately high and adverse impacts to minority or low-income populations based upon a review of US Census Data (2010). Although there is the potential for two EJ populations within the study area, all impacts will be contained to airport property. The noise analysis indicated no significant increases to the 65 DNL would be caused by the Build Alternative. Therefore, in accordance with the protections of Executive Order 12898, no further EJ analysis is required.

4.8.2 CHILDREN'S HEALTH & SAFETY

Pursuant to Executive Order 13045, Protection Of Children From Environmental Health Risks And Safety Risks (April 21, 1997), the FAA recently revised their policies and procedures for compliance with NEPA (FAA Order 1050.1F) to include the assessment of environmental health and safety risks resulting from airport development projects that may disproportionately affect children. According to 1050.1F, these risks include "risks to health or to safety that are attributable to products or substances that a child is likely to come in contact with or ingest, such as air, food, drinking water, recreational waters, soil, or products they might use or be exposed to." Currently, operations at the Airport have not been identified by any known source as adversely impacting the health or safety of children in the area. The Build Alternative and the No-Build Alternative would not cause an increase to children's environmental health or safety risk.

4.9 VISUAL EFFECTS

This section compares the light emissions and visual effects of implementing Alternative 1 or 2 to those of the No Action Alternative.

4.9.1 REGULATORY SETTING

Some visual resources are protected under Federal, state, or local regulations. According to FAA Order 1050.1F, these resources generally include, but are not limited to, Federal, state, or local scenic roadways/byways; Wild and Scenic Rivers; National Scenic Areas; protected trails; and biological resources; and features protected under other Federal, state, or local regulations. In addition to NEPA, laws protecting resources that may be affected by visual effects include Section 106 of the National Historic Preservation Act (NHPA), Section 4(f) of the DOT Act, the Wild and Scenic Rivers Act, and the Coastal Zone Management Act. In addition, there may be state and local regulations, policies, and zoning ordinances that apply to visual effects.

4.9.2 LIGHT EMISSIONS

Light emissions include any light that emanates from a light source into the surrounding environment. Examples of sources of light emissions include airfield and apron flood lighting, navigational aids, terminal lighting, parking facility lighting, roadway lighting, safety lighting on launch pads, additional lighting to support nighttime commercial space launches, and light generated from such launches. No new lighting systems are proposed with Alternative 1; therefore, impacts from new or relocated light emissions is not expected.

4.9.3 VISUAL RESOURCES AND VISUAL CHARACTER

Visual resources and visual character impacts are normally related to a decrease in the aesthetic quality of an area resulting from development, construction, or demolition. Analysis of visual impacts considers whether the alternatives would affect, obstruct, alter, or remove visual resources including buildings, historic sites, or other landscape features, such as topography, water bodies, or vegetation, that are visually important or have unique characteristics. During construction, an area that is owned and maintained by the airport will be used for construction equipment storage and staging for work being completed on the Runway 5L end of the runway (see **Figure 4-6**). Approximately 14 homes and Green Meadow Church would have direct line of sight to the construction staging area. According to FAA Order 1050.1F Desk Reference, the significant determination is dependent on the following criteria:

- Would the action have the potential to affect the visual character of the area, including the uniqueness and aesthetic value?
- Would the action have the potential to contrast with the visual resources in the area?
- Would the action have the potential to block or obstruct the views of visual resources?

The proposed construction staging area will not have significant impact on visual resources. Although residential areas would have an unobstructed view of construction equipment, it would be temporary in nature as the equipment would be removed at the end of the project and the area returned back to its current surroundings. There will be no tree removal or earth moving as part of this staging area. The area is currently airport property and has no visual value to the surrounding properties. Most of the properties currently have a clear view of the airport and any construction currently taking place.

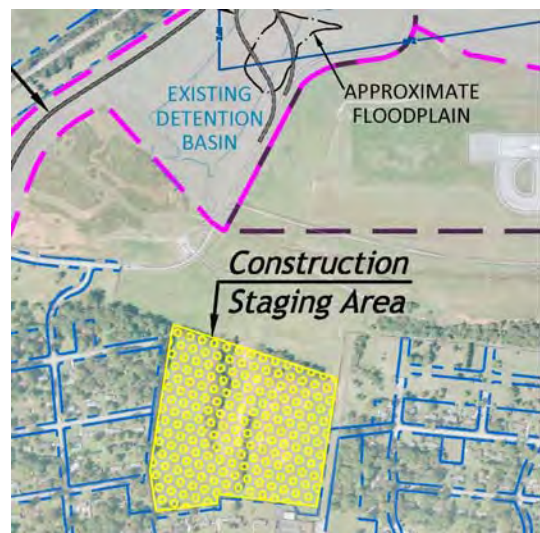


Figure 4-6: Construction Staging Area

4.10 WATER RESOURCES

Water resources are comprised of surface waters and groundwater that are important in providing drinking, recreation areas, essential habitat for wildlife, transportation avenues, and aquatic ecosystems. Wild and scenic rivers, surface water, groundwater, floodplains, and wetlands are all included under the water resources category. As discussed in Affected Environment, there are no wild and scenic rivers or wetlands in the project area and were disclosed in the beginning of this chapter as categories where no impacts would occur. However, two of the Liberty Road relocation options, a connected action to Alternative 1, will impact the stormwater basin, which is permitted under the Safe Dams Act of 1973, and a mapped 100-year floodplain.

4.10.1 SURFACE WATER & STORMWATER

An individual Stormwater Pollution Prevention Plan (SWPPP) will be completed and submitted as more than 50 acres will be disturbed as part of Alternate 1. This will address project related stormwater controls during construction. The SWPPP will meet the requirements of the state local regulations for stormwater pollution prevention during construction. Stormwater quality will be provided through designed stormwater management facilities. The south sediment pond was not initially constructed to function as a stormwater quantity control structure. The pond was intended to act as a temporary sediment control basin during the construction of the 5R Runway extension. As discussed in Section 3, the WHA determined the existing sediment basin is a wildlife hazard and ultimately should be removed from the airport. The airport is utilizing the Runway 5L/23R Reconstruction Program as an opportunity to reduce the amount of stormwater discharged to the pond by storing it upstream within the infield which ultimately reduces the flow and the amount of storage the existing basin needs.

Alternative 1 will require the relocation of Liberty Street. After coordinating with the TANG, the preferred option was Option A, which impacts the existing basin. Coordination with TDEC indicated the existing basin also acts as a regulated dam b/c of its size. Pursuant to the Tennessee Safe Dams Act, an Application to *Alter or Remove an Existing Dam* (CN-0821) will be completed and submitted to TDEC for approval. A preliminary permitting meeting was held with TDEC via conference call on April 4, 2016 to discuss the required submittals. A set of final design plans and a narrative will be submitted with the application to alter the dam.

4.10.2 FLOODPLAINS

As discussed in **Section 3**, according to FEMA's Flood Insurance Rate Maps (FIRM), dated September 19, 2007 (Panel Number 47009C0117C), a small area of the 100-year floodplain of Proffitt Spring encroaches onto airport property within the south sediment pond. On March 23, 2016, a coordination meeting was held with Blount County Planning Department, who regulates the National Flood Insurance Program (NFIP) for Blount County. It was concluded at that meeting that the on-airport floodplain was inadvertently included when the mapping was last updated. During the last detailed study, the Zone A limits upstream were estimated based on the next contour interval on the USGS quadrangle map and the Zone A limits should have ended at the CSX railroad just west of the project area. Coordination with FEMA indicated they had no data or history as to why they included the on-airport mapped floodplain in their mapping; therefore, the study team had to prove the base flood elevation would not increase by more than one foot. Based on HECRAS modeling and coordination with Blount County, the proposed project will not raise the base flood elevation by more than one-foot; therefore there will be no adverse impact to the floodplain. A permit to construct in the floodplain was issued by Blount County, pursuant to Blount County Zoning Regulations – Resolution 00-06-011, which was established to regulate the floodplain areas in Blount County, to minimize danger to life and property, and to establish eligibility in the National Flood Insurance Program (see **Appendix E**). The existing stormwater basin has been identified as a wildlife hazard by the TYS Wildlife Hazard Assessment; therefore, as part of this runway program, the existing airfield drainage is being modified to allow the Airport to fill the basin over time eliminating any floodplain characteristics.

4.10.2. Floodplain Encroachment

Although Blount County has determined that there would be no adverse impact to the floodplain and the floodplain is contained within an existing on-airport stormwater basin, a “floodplain” encroachment still occurs. Therefore, the FAA must determine if the encroachment is a “significant floodplain encroachment” using the criteria contained in FAA Order 1050.1F and discussed below:

- A. **Impacts on human life and transportation facilities:** The impacted floodplain is within an existing stormwater management basin on the airport. This basin was constructed as a sediment pond for stormwater pollution prevention requirements when Runway 5R/23L was extended; however, the basin was never removed after construction, so it acts as a large stormwater pond today. The pond itself has the storage capacity well above what is required for the airport's existing system. In addition, as part of this project, the drainage within the airport infield is being modified to hold enough water up stream so the basin can eventually be filled over time. The existing basin has been identified in the TYS Wildlife Hazard Management Plan as a wildlife hazard. Since design measures are being taken to limit the amount of water that will be held in the basin, the proposed alternative will not have impact on human life or substantial encroachment related costs and/or damage. The proposed alternative would not cause flooding that would affect any airport facilities, access roads, or preventing people from entering or existing the airport. The ultimate design is to remove the basin entirely and address stormwater quantity and quality up stream; therefore, there will be no on-airport flooding that would affect aviation safety and the airport's use. Finally, there will not be flooding that would cause induced spills of hazardous material stored at the airport.
- B. **Impacts to a floodplain's natural and beneficial values:** There are no natural or beneficial values to the impacted floodplain. The floodplain is contained within an existing stormwater basin located within the airport fence. The basin doesn't support important ecological values benefiting human life and natural environment. Although the basin holds floodwaters today, stormwater modifications during this project will allow the water to be stored elsewhere on the airfield. The basin does not sustain agriculture, aquatic or terrestrial organisms, provide groundwater recharge, or provide recreational opportunities.
- C. **Factors to consider when assessing impacts on a floodplain's natural and beneficial values:**
1. Agricultural Activities: The proposed action would not containment floodplain substrate. The floodplain does not have any agricultural value.
 2. Aquaculture Activities: There are no aquaculture activities within the stormwater basin
 3. Aquatic or terrestrial organisms: The basin only provides food, cover, or water requirements to birds when there is standing water in the basin; however, this is why the FAA determined the basin to be a wildlife hazard and ultimately removed.
 4. Flood Control: The floodplain within the basin does currently act as a detention area to hold water during an event; however, the proposed project is re-designing the upstream, on-airport drainage to handle the appropriate storm flows and ultimately fill the basin because of its wildlife hazard status.
 5. Groundwater Recharge: There are no aquifers that would be affected by the removal of the stormwater basin.
 6. Water Quality: The proposed action would not disrupt the floodplain's capacity to maintain the desired water quality standards as the existing basin's requirement for providing water quality will shift to other locations within the airport's drainage systems as the basin is filled.

The other alternatives would all impact the "mapped" floodplain, although only Options A, C, and D would impact the floodplain in the existing basin. The drainage improvements upstream would ultimately impact the existing basin regardless of which Liberty Street alignments was selected. Based on the information

above and coordination from Blount County, it was determined that the floodplain encroachment would not have an adverse impact on natural or beneficial floodplain values.

4.11 CONSTRUCTION IMPACTS

Construction activities are temporary and variable depending on location, duration, and level of activity and are generally confined to a construction site and access/egress roadways. These emissions occur predominantly from the operation of heavy construction equipment (e.g., backhoes, bulldozers), on-and off-road vehicles used for the transport and delivery of supplies and material (e.g., cement trucks, dump trucks), and on-road vehicles used by construction workers getting to and from a construction site (e.g., cars, pick-up trucks). Construction emissions also include fugitive dust produced from construction materials staging, demolition, and earthwork activities, as well as evaporative emissions from asphalt paving operations.

4.11.1 AIR QUALITY

The Build Alternative would produce temporary fugitive dust emissions from construction activities and associated equipment. However, contractors would exercise Best Management Practices (BMPs) to reduce dust during the construction phase of the project. These BMPs would be covering the loads in trucks or wetting the material before being hauled, utilization speed inhibitors such as bump strips, and spraying construction vehicle as the enter and exit the site.

As discussed in **Section 4.2.2**, the construction emissions would be temporary and are not expected to adversely affect the area's air quality. There would be no construction impacts associated with the No-Build Alternative because no construction would take place.

4.11.2 NOISE

Noise from construction equipment and related activities on the site would be regulated through the development of a construction noise specification to minimize exposure outside of the construction area.

4.11.3 WATER QUALITY

All construction-related water quality impacts from the implementation of the Build Alternative would be temporary and indirect, and would result from the removal of vegetation and grading activities as well as the operation of earth-moving equipment. These temporary and indirect water quality impacts would likely result from soil erosion/sedimentation and the introduction of pollutants from construction machinery. As part of the SWPPP construction BMPs would be used to minimize temporary adverse effects. These construction BMPs will most likely consist of sediment and erosion controls such as silt fence and temporary stabilization. The appropriate stormwater and construction permits would be completed and submitted to TDEC.

4.12 CUMULATIVE IMPACTS

Cumulative effects are defined by the CEQ in 40 CFR 1508.7 as *impacts on the environment which result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.*

The CEQ regulations also state that the cumulative impacts addressed should not be limited to those from actual proposals, but must include impacts from actions being contemplated or that are reasonably foreseeable. The CEQ regulations further require that NEPA environmental analyses analyze connected, cumulative, and similar actions in the same document (40 CFR 1508.25). This requirement prohibits

segmentation of the project into smaller components to avoid required environmental analysis. CEQ suggests analyzing only those resources that could be incrementally affected by the proposed action and other actions within the same geographic area and time period. The proposed project, as documented throughout this section, will not cause a significant impact to any of the resource categories contained in FAA environmental orders. Nevertheless, a cumulative impact section should be included therefore the projects contained in the Airport's Capital Improvement Plan (CIP) were examined and documented.

4.12.1 PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

To identify and describe past, present, and reasonably foreseeable actions, CEQ suggests the use of best available information. Therefore, the most recent Airport Layout Plan, the Airport CIP, and coordination with airport staff were all used to identify past, present and foreseeable future projects. Over the last five years the airport has completed a new Air Rescue and Fire Fighting (ARFF) facility, Rehabilitation of Taxiway 'B' entrance road. The Airport is currently undertaking the first phase of the Runway 5L/23R Reconstruction, which will be the majority of the work over the next three years as well. According to the Airport Capital Improvement Plan (ACIP), the projects that are proposed in the next three years are listed below:

- Runway 5L/23R Reconstruction – Phase 2 (2016)
- Liberty Street Relocation (2016)
- Runway 5L/23R Reconstruction – Phase 3 (2017)
- Runway 5L/23R Reconstruction – Phase 4 (2018)
- Runway 5L/23R Reconstruction – Phase 5 (2019)
- Parallel Taxiway B (2019)
- Taxiways G3/B2 (2019)

According to the Runway 5L/23 Reconstruction Program Final EA, there are several roadway improvements planned for Blount County, including Alcoa Parkway (US 129/SR 115). This proposed roadway project would construct a new eight-lane limited access highway located east of the Airport with a new interchange for TYS. A review of the Knoxville Regional Transportation Planning Organization's Transportation Improvement Plan (TIP) and Long-Range Mobility Plan confirmed this project is still planned for 2018/2019.

4.12.2 POTENTIAL IMPACTS

The proposed Runway 5L/23R extension at TYS, in conjunction with the other past, present, and future planned projects will not have a significant cumulative impact on the environment. All future projects will funded by another federal agency will be required to undertake their own NEPA process, as well as complying with other Federal, State and local regulations. The projects on airport over the next 3 years are all associated with the Runway 5L/23R Program which are covered by the Runway 5L/23R Reconstruction Final EA/FONSI (2014) and this environmental document.

4.13 PERMITS

The following permits will be required before elements of Alternative 1 can be started:

- Pursuant to the EO 11988, *Floodplain Management* and Department of Transportation (DOT) Order 5650.2, *Floodplain Management and Protection*, the MKAA will submit hydrological modeling to Blount County to prove the project will not raise the base flood elevation by more than one foot.

- Pursuant to the Tennessee Safe Dams Act, an *Application to Alter or Remove an Existing Dam* (CN-0821) will be completed and submitted to TDEC for approval.
- Section 402 of the CWA compliance will be completed prior to construction. A Notice of Intent (NOI) requesting coverage under the Tennessee General Permit for construction activities that disturb one acre or more of land will be submitted. Construction can begin after TDEC has sent an approval letter stating that the project was covered under the construction general permit.

5 LIST OF PREPARERS

The names and responsibilities of the principal persons contributing information to this EA are identified below.

Preparer	Title	Responsibility
Metropolitan Knoxville Airport Authority		
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Federal Aviation Administration		
Kim Brockman	Program Manager, Memphis Airports District Office	FAA Document Review
Aaron Braswell	Environmental Protection Specialist, Memphis Airports District Office	FAA Document Review
CHA Consulting, Inc.		
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Laura Bravo	Design Manager	Exhibits/Graphics
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APPENDIX A

**NOISE IMPACT ANALYSIS FOR
ENVIRONMENTAL ASSESSMENT FOR PROPOSED IMPROVEMENTS AT
MCGHEE TYSON AIRPORT**

FINAL REPORT – MARCH 2016

PROJECT OVERVIEW

The Metropolitan Knoxville Airport Authority (MCAA) is undertaking an Environmental Assessment (EA) for proposed improvements at McGhee Tyson Airport (TYS). These improvements would include establishment of displaced thresholds to each end of Runway 5L-23R to provide additional runway length for aircraft operations (Proposed Action). Upon completion of the project, the useable runway length for takeoff in each direction would be increased to 10,000 feet and the useable landing distance would be increased to 9,508 feet and 9,495 feet for Runway 5L and 23R respectively.

FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, requires evaluation of potential noise impacts for existing and future airport conditions. The required FAA tool for evaluating noise exposure associated with airport activity is the Aviation Environmental Design Tool (AEDT). AEDT is designed to estimate long-term average effects using average daily input conditions. FAA's approved version at the time of project initiation, AEDT Version 2b was utilized to develop the noise analysis for the following timeframes:

- **Existing Conditions** – noise conditions as they exist today at TYS.
- **Year of Implementation**- noise conditions of the year in which the runway improvement described in the Proposed Action is completed and operational.
- **Year of Implementation plus Five Years** – noise conditions five years after completion of the runway improvement described in the Proposed Action.

For each future case, a No Build Alternative was included for comparison purposes and reflects airport noise conditions without implementation of the Proposed Action.

AVIATION ENVIRONMENTAL DESIGN TOOL (AEDT)

AEDT works by first defining a network of reference points from which to measure noise at ground level around the airport. Flight tracks and aircraft performance profiles are created within the program based on operational conditions at the airport. AEDT then selects the shortest distance from each flight track to each reference point and computes the noise exposure generated by each aircraft operation. Adjustments are applied for airport climate and environmental characteristics, atmospheric acoustical attenuation, aircraft thrust variations, and time of operation. Night-time operations, those occurring between the hours of 10:00 p.m. and 7:00 a.m., are attributed a 10-decibel penalty (twice as loud). The noise exposure levels for each aircraft are then summed at each reference point to provide a day-night average sound level (DNL). DNL is a 24-hour logarithmic average sound level expressed in A-weighted decibels (dBA), as approved by the FAA. The cumulative noise exposure levels at all reference points are then used to plot noise exposure contours for selected DNL values, and superimposed onto a base map. Noise contours generated by the AEDT represent outdoor noise levels and depict generally expected average, daily noise exposure at a relative location, rather than noise levels for a single aircraft event. Noise exposure on any one day may be greater or less than the average day.

AEDT ASSUMPTIONS AND INPUTS

Effectively modeling airport noise requires many simplifying assumptions to be made regarding the data for AEDT input variables. The following is a summary of the operational data utilized in the noise model for this report.

Airport Operations Forecasts

In order to perform the noise analysis, existing and projected operations were obtained from the FAA Terminal Area Forecast (TAF), dated January, 2016. These operational projections are summarized in **Table 1**. Itinerant operations are arrivals or departures that do not remain within the airport traffic pattern and/or are originating from another airport (i.e., visiting aircraft). Local operations are those that remain within the airport traffic pattern and are mostly associated with training activity and flight instruction (e.g., touch-and-goes). In 2016, TYS is expected to see a total of 95,833 operations, consisting of 81,135 itinerant operations and 14,699 local operations. By 2023, these operations are project to grow to 97,176 operations. For the purposes of analysis, 2016 operations was utilized to evaluate Existing Conditions. Projected operations for 2018 and 2023 were utilized to analyze Year of Implementation and Year of Implementation plus Five Years respectively.

Year	Itinerant (IT) Operations					Local (LOC) Operations			Total Ops
	AC	AT	GA	MIL	Total	Civil	MIL	Total	
Existing Year	15,651	26,399	27,293	11,791	81,134	4,585	10,114	14,699	95,833
Year of Implementation	19,742	22,854	27,457	11,791	81,844	4,623	10,114	14,737	96,581
Year of Implementation +5 Years	36,739	5,943	27,871	11,791	82,344	4,718	10,114	14,832	97,176
AC – Air Carrier AT – Air Taxi GA – General Aviation MIL - Military Source: FAA Terminal Area Forecast, January 2016.									

Fleet Mix

The AEDT fleet mix was determined by reviewing historical activity from the FAA’s TFMSC database. The TFMSC database captures flight plan operations that are filed with the FAA when an aircraft/pilot intends to fly under Instrument Flight Rules (IFR) and/or in controlled airspace; consequently, the TFMSC database captures the majority of jet and turboprop operations.

Several AEDT aircraft were selected to represent the airport’s fleet mix and were grouped into the categories Commercial (COMM), General Aviation Helicopter (GA-HEL), General Aviation Itinerant (GA-IT), Military Fixed Wing (MIL-FW), and Military Helicopter (MIL-HEL). Because it is not possible within AEDT to model every single type of aircraft that operates at TYS, each AEDT aircraft may represent several other aircraft with similar noise profiles. For example, the Airbus A319 (A319-131) was used to model the noise exposure of the Airbus A320 (A320-211), Boeing 737-800 (737800), and Airbus A321 (A321-232).

Time of Day

Within AEDT, daytime operations are considered those operations that occur between the hours of 7:00 a.m. and 10:00 p.m. and nighttime hours are those between 10:00 p.m. and 7:00 a.m. Commercial time of day operations were determined using the FAA's TFMSC database. General aviation operations were assumed to be 95 percent during daytime hours and 5 percent during nighttime hours. Based upon the most recent FAR Part 150 Study and Airport Master Plan, military operations were modeled during daytime hours only.

Airport Daily Operations

Using the fleet mix analysis, daytime/nighttime assumptions and operational forecasts, airport daily operations by representative aircraft type were determined for each noise study case year and input into AEDT. **Tables 2, 3, and 4** present airport daily operations for Existing Conditions, Year of Implementation and Year of Implementation plus Five Years.

**Table 2
TYS Average Daily Operations - Existing Conditions**

Representative Aircraft	Group	AEDT Code	Percent Use	Day Ops	Night Ops	Total Ops	% Day Ops	% Night Ops
CL601/CF34-3A	COMM	CL601	19.80%	36.30	15.70	52.00	70%	30%
EMBRAER 145 ER/ALLISON AE3007	COMM	EMB145	13.96%	22.88	13.77	36.65	62%	38%
DC9-30/JT8D-9	COMM	DC930	0.06%	0.13	0.04	0.17	75%	25%
BOEING 737-500/CFM56-3C-1	COMM	737500	1.09%	2.40	0.45	2.85	84%	16%
MD-83/JT8D-219	COMM	MD83	1.66%	2.92	1.45	4.37	67%	33%
A319-131\IAE V2522-A5	COMM	A319-131	0.62%	1.03	0.59	1.62	64%	36%
BOEING 757-200/PW2037	COMM	757PW	1.04%	1.44	1.29	2.72	53%	47%
A310-304\GE CF6-80 C2A2	COMM	A310-304	1.42%	2.04	1.69	3.73	55%	45%
BELL 206L LONG RANGER	GA-HEL	B206L	1.41%	3.53	0.19	3.71	95%	5%
MU300-10/JT15D-5	GA-IT	MU3001	1.61%	4.01	0.21	4.22	95%	5%
CIT 2/JT15D-4	GA-IT	CNA500	1.89%	4.73	0.25	4.98	95%	5%
LEAR 25/CJ610-8	GA-IT	LEAR25	0.06%	0.15	0.01	0.15	95%	5%
CESSNA CITATION ULTRA 560 / JT15D-5D	GA-IT	CNA560U	0.85%	2.12	0.11	2.23	95%	5%
LEAR 36/TFE731-2	GA-IT	LEAR35	4.44%	11.08	0.58	11.66	95%	5%
F100/TAY 620-15	GA-IT	F10062	1.81%	4.53	0.24	4.76	95%	5%
1985 1-ENG VP PROP	GA-IT	GASEPV	6.04%	15.07	0.79	15.87	95%	5%
PIPER TWIN COMANCHE	GA-IT	PA30	6.62%	16.51	0.87	17.38	95%	5%
CONQUEST II/TPE331-8	GA-IT	CNA441	6.31%	15.74	0.83	16.56	95%	5%
DASH 8-100/PW121	GA-IT	DHC8	0.44%	1.09	0.06	1.15	95%	5%
CESSNA 172R	GA-LOC	CNA172	2.66%	6.64	0.35	6.99	95%	5%
BARON 58P/TS10-520-L	GA-LOC	BEC58P	2.09%	5.22	0.27	5.49	95%	5%
NORTHROP TALON T-38A	MIL	T-38A	0.42%	1.11	0.00	1.11	100%	0%
MCDONNELL DOUGLAS HORNET F404-GE-400	MIL	F-18	3.32%	8.73	0.00	8.73	100%	0%
BOEING STRATOTANKER KC135R F108-CF100	MIL	KC-135	12.71%	33.37	0.00	33.37	100%	0%
BEECH MENTOR (BE45) PT6A-25	MIL	T34	3.03%	7.95	0.00	7.95	100%	0%
LOCKHEED HERCULES T56-A15	MIL	C130AD	1.59%	4.18	0.00	4.18	100%	0%
SIKORSKY S-70 BLACKHAWK (UH-60A)	MIL-HEL	S70	3.03%	7.95	0.00	7.95	100%	0%
			100.00%	222.83	39.73	262.56		

Source: Michael Baker International, 2016.

Table 3
TYS Average Daily Operations - Year of Implementation

Representative Aircraft	Group	AEDT Code	Percent Use	Day Ops	Night Ops	Total Ops	% Day Ops	% Night Ops
CL601/CF34-3A	COMM	CL601	19.80%	36.58	15.82	52.40	70%	30%
EMBRAER 145 ER/ALLISON AE3007	COMM	EMB145	13.96%	23.06	13.87	36.94	62%	38%
DC9-30/JT8D-9	COMM	DC930	0.06%	0.13	0.04	0.17	75%	25%
BOEING 737-500/CFM56-3C-1	COMM	737500	1.09%	2.42	0.45	2.87	84%	16%
MD-83/JT8D-219	COMM	MD83	1.66%	2.94	1.46	4.40	67%	33%
A319-131\IAE V2522-A5	COMM	A319-131	0.62%	1.04	0.59	1.63	64%	36%
BOEING 757-200/PW2037	COMM	757PW	1.04%	1.45	1.30	2.75	53%	47%
A310-304\GE CF6-80 C2A2	COMM	A310-304	1.42%	2.05	1.70	3.76	55%	45%
BELL 206L LONG RANGER	GA-HEL	B206L	1.41%	3.56	0.19	3.74	95%	5%
MU300-10/JT15D-5	GA-IT	MU3001	1.61%	4.04	0.21	4.25	95%	5%
CIT 2/JT15D-4	GA-IT	CNA500	1.89%	4.76	0.25	5.01	95%	5%
LEAR 25/CJ610-8	GA-IT	LEAR25	0.06%	0.15	0.01	0.15	95%	5%
CESSNA CITATION ULTRA 560 / JT15D-5D	GA-IT	CNA560U	0.85%	2.14	0.11	2.25	95%	5%
LEAR 36/TFE731-2	GA-IT	LEAR35	4.44%	11.16	0.59	11.75	95%	5%
F100/TAY 620-15	GA-IT	F10062	1.81%	4.56	0.24	4.80	95%	5%
1985 1-ENG VP PROP	GA-IT	GASEPV	6.04%	15.19	0.80	15.99	95%	5%
PIPER TWIN COMANCHE	GA-IT	PA30	6.62%	16.64	0.88	17.52	95%	5%
CONQUEST II/TPE331-8	GA-IT	CNA441	6.31%	15.86	0.83	16.69	95%	5%
DASH 8-100/PW121	GA-IT	DHC8	0.44%	1.10	0.06	1.15	95%	5%
CESSNA 172R	GA-LOC	CNA172	2.66%	6.69	0.35	7.04	95%	5%
BARON 58P/TS10-520-L	GA-LOC	BEC58P	2.09%	5.26	0.28	5.53	95%	5%
NORTHROP TALON T-38A	MIL	T-38A	0.42%	1.12	0.00	1.12	100%	0%
MCDONNELL DOUGLAS HORNET F404-GE-400	MIL	F-18	3.32%	8.79	0.00	8.79	100%	0%
BOEING STRATOTANKER KC135R F108-CF100	MIL	KC-135	12.71%	33.63	0.00	33.63	100%	0%
BEECH MENTOR (BE45) PT6A-25	MIL	T34	3.03%	8.02	0.00	8.02	100%	0%
LOCKHEED HERCULES T56-A15	MIL	C130AD	1.59%	4.21	0.00	4.21	100%	0%
SIKORSKY S-70 BLACKHAWK (UH-60A)	MIL-HEL	S70	3.03%	8.02	0.00	8.02	100%	0%
			100.00%	224.57	40.04	264.61		

Source: Michael Baker International, 2016.

Table 4
TYS Average Daily Operations - Year of Implementation plus Five Years

Representative Aircraft	Group	AEDT Code	Percent Use	Day Ops	Night Ops	Total Ops	% Day Ops	% Night Ops
CL601/CF34-3A	COMM	CL601	19.80%	36.80	15.92	52.73	70%	30%
EMBRAER 145 ER/ALLISON AE3007	COMM	EMB145	13.96%	23.20	13.96	37.16	62%	38%
DC9-30/JT8D-9	COMM	DC930	0.06%	0.13	0.04	0.17	75%	25%
BOEING 737-500/CFM56-3C-1	COMM	737500	1.09%	2.44	0.45	2.89	84%	16%
MD-83/JT8D-219	COMM	MD83	1.66%	2.96	1.47	4.43	67%	33%
A319-131/IAE V2522-A5	COMM	A319-131	0.62%	1.05	0.60	1.64	64%	36%
BOEING 757-200/PW2037	COMM	757PW	1.04%	1.46	1.30	2.76	53%	47%
A310-304/GE CF6-80 C2A2	COMM	A310-304	1.42%	2.07	1.72	3.78	55%	45%
BELL 206L LONG RANGER	GA-HEL	B206L	1.41%	3.58	0.19	3.77	95%	5%
MU300-10/JT15D-5	GA-IT	MU3001	1.61%	4.07	0.21	4.28	95%	5%
CIT 2/JT15D-4	GA-IT	CNA500	1.89%	4.79	0.25	5.04	95%	5%
LEAR 25/CJ610-8	GA-IT	LEAR25	0.06%	0.15	0.01	0.16	95%	5%
CESSNA CITATION ULTRA 560 / JT15D-5D	GA-IT	CNA560U	0.85%	2.15	0.11	2.26	95%	5%
LEAR 36/TFE731-2	GA-IT	LEAR35	4.44%	11.23	0.59	11.82	95%	5%
F100/TAY 620-15	GA-IT	F10062	1.81%	4.59	0.24	4.83	95%	5%
1985 1-ENG VP PROP	GA-IT	GASEPV	6.04%	15.28	0.80	16.09	95%	5%
PIPER TWIN COMANCHE	GA-IT	PA30	6.62%	16.74	0.88	17.63	95%	5%
CONQUEST II/TPE331-8	GA-IT	CNA441	6.31%	15.96	0.84	16.80	95%	5%
DASH 8-100/PW121	GA-IT	DHC8	0.44%	1.10	0.06	1.16	95%	5%
CESSNA 172R	GA-LOC	CNA172	2.66%	6.73	0.35	7.09	95%	5%
BARON 58P/TS10-520-L	GA-LOC	BEC58P	2.09%	5.29	0.28	5.57	95%	5%
NORTHROP TALON T-38A	MIL	T-38A	0.42%	1.12	0.00	1.12	100%	0%
MCDONNELL DOUGLAS HORNET F404-GE-400	MIL	F-18	3.32%	8.85	0.00	8.85	100%	0%
BOEING STRATOTANKER KC135R F108-CF100	MIL	KC-135	12.71%	33.84	0.00	33.84	100%	0%
BEECH MENTOR (BE45) PT6A-25	MIL	T34	3.03%	8.07	0.00	8.07	100%	0%
LOCKHEED HERCULES T56-A15	MIL	C130AD	1.59%	4.24	0.00	4.24	100%	0%
SIKORSKY S-70 BLACKHAWK (UH-60A)	MIL-HEL	S70	3.03%	8.07	0.00	8.07	100%	0%
			100.00%	225.95	40.28	266.24		

Source: Michael Baker International, 2016.

Runway Utilization

Runway utilization is the average percentage each runway is used for airport operations. Typically runway utilization is based upon prevalent meteorological conditions. For this analysis, runway utilization was taken from the most recent FAR Part 150 Study and Airport Master Plan prepared for TYS. **Table 5** provides a summary of airport runway utilization broken down by major fleet mix categories. TYS operates a parallel runway system which, according to ATCT staff, favors a higher percentage of military operations on Runway 5L-23R and a higher percentage of commercial and general aviation operations on 5R-23L. Runway utilization percentages are expected to remain similar with implementation of the Proposed Action.

	Runway 5L		Runway 23R		Runway 5R		Runway 23L	
	Day	Night	Day	Night	Day	Night	Day	Night
Commercial	5.80%	5.00%	23.35%	20.00%	14.20%	15.00%	56.65%	60.00%
General Aviation	5.80%	5.00%	23.35%	20.00%	14.20%	15.00%	56.65%	60.00%
Military	17.00%	17.00%	70.00%	70.00%	3.00%	3.00%	10.00%	10.00%

Source: Airport Master Plan, Wilbur Smith Associates, 2006.

Flight Tracks

A flight track is a projection of an aircraft's in-flight path, as if shown on the ground. Due to meteorological conditions, aircraft type, stage length, air traffic separation, and pilot judgment, flight tracks can be unique to each operation. For the purposes of this noise analysis, flight tracks were taken from the most recent FAR Part 150 Study and Airport Master Plan including arrival, departures and touch-and-go tracks. **Figures 1 to 4** depict the selected flight tracks selected for noise modeling.

LAND USE COMPATIBILITY GUIDELINES

Federal Aviation Regulation, Part 150, *Airport Noise Compatibility Planning*, is the primary Federal regulation guiding and controlling planning for aviation noise compatibility on and around airports. Within this regulation, the FAA provides guidelines for evaluating various land uses inside aircraft noise exposure areas. These guidelines are reproduced here as **Table 6**. Land use compatibility of various activities is keyed to DNL values calculated in AEDT. The guidelines reflect the statistical variability of the responses of large groups of people to noise. Therefore, any particular noise level might not accurately assess one individual's perception of an actual noise environment.

As **Table 6** describes, all land uses are considered compatible with noise levels of less than 65 DNL. Residential, mobile home, and transient lodging uses are discouraged from 65 DNL and higher. Other noise sensitive uses such as hospitals, nursing homes, and churches are also discouraged in 65 DNL or greater. In certain cases, these uses may be permitted if the habital structure is designed with, or contains, adequate measures to achieve reduction of outdoor noise levels (soundproofing). Land uses that are less sensitive to noise levels, such as commercial

use, are considered compatible with noise levels of 70 DNL without soundproofing and up to 80 DNL with soundproofing.

Figure 1 – Runway 5L/5R Approach and Departure Flight Tracks

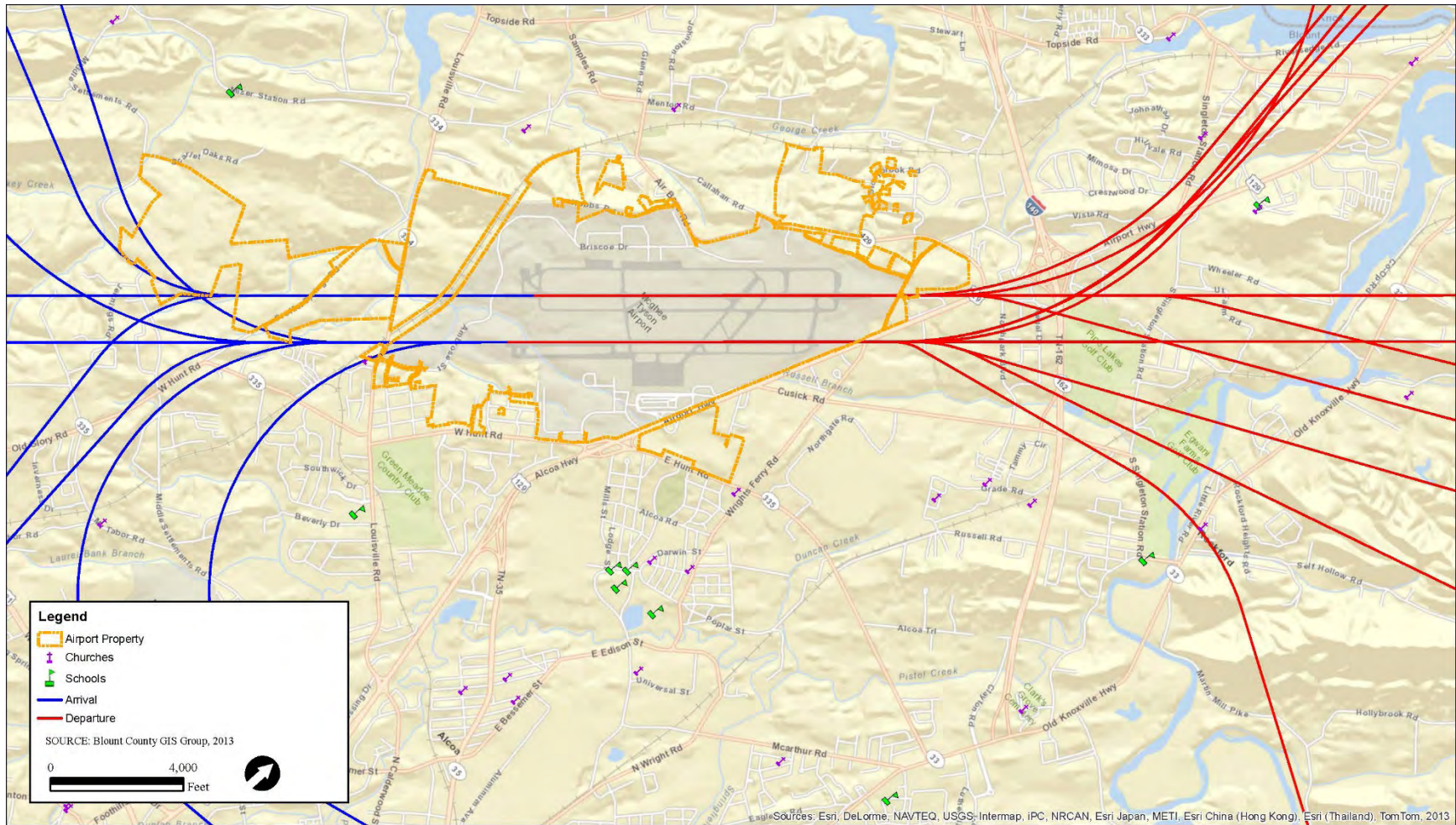


Figure 2 – Runway 23L/23R Approach and Departure Flight Tracks

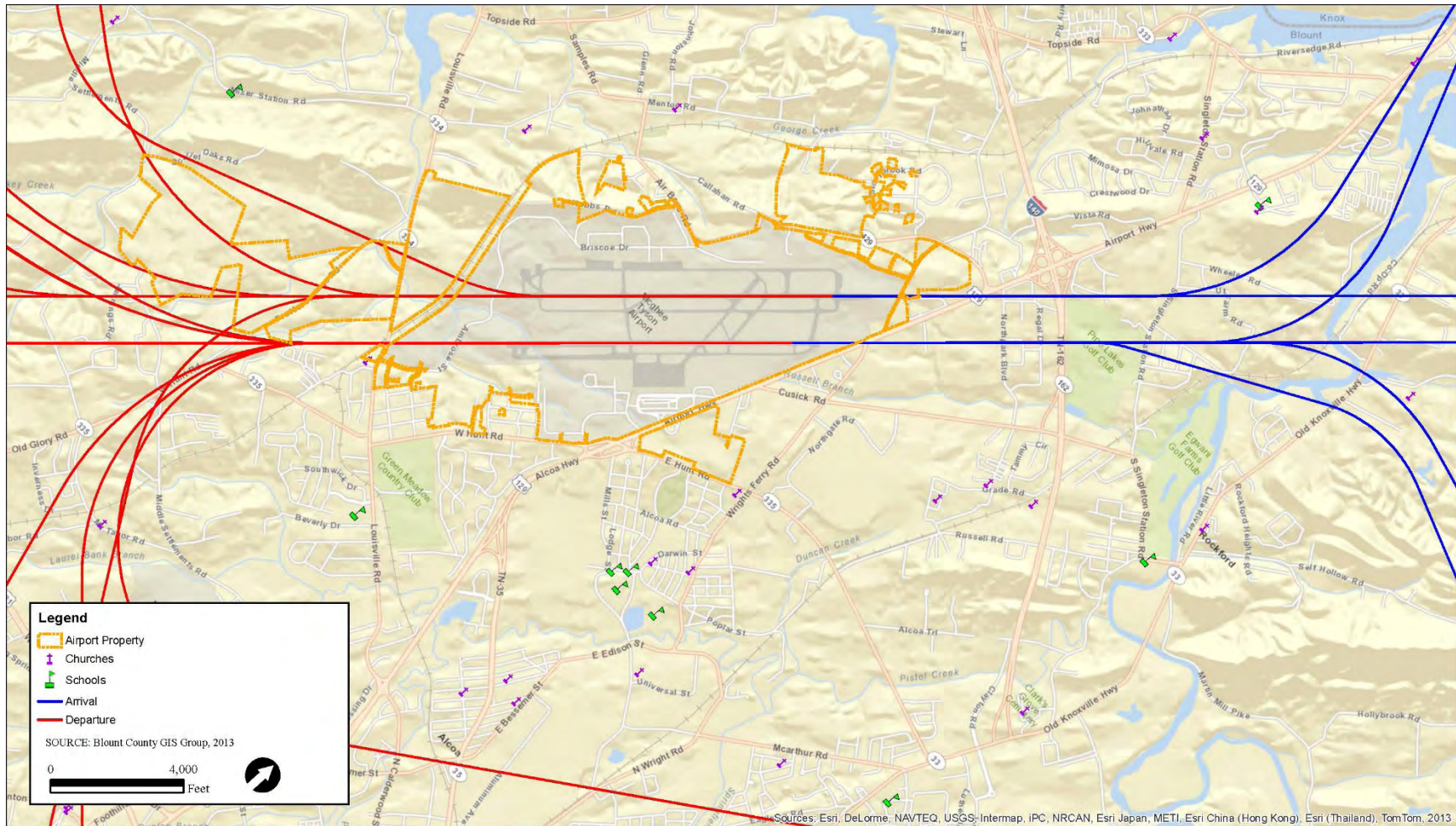


Figure 3 - Runway 5L/23R and 5R/23L Touch-and-Go Flight Tracks

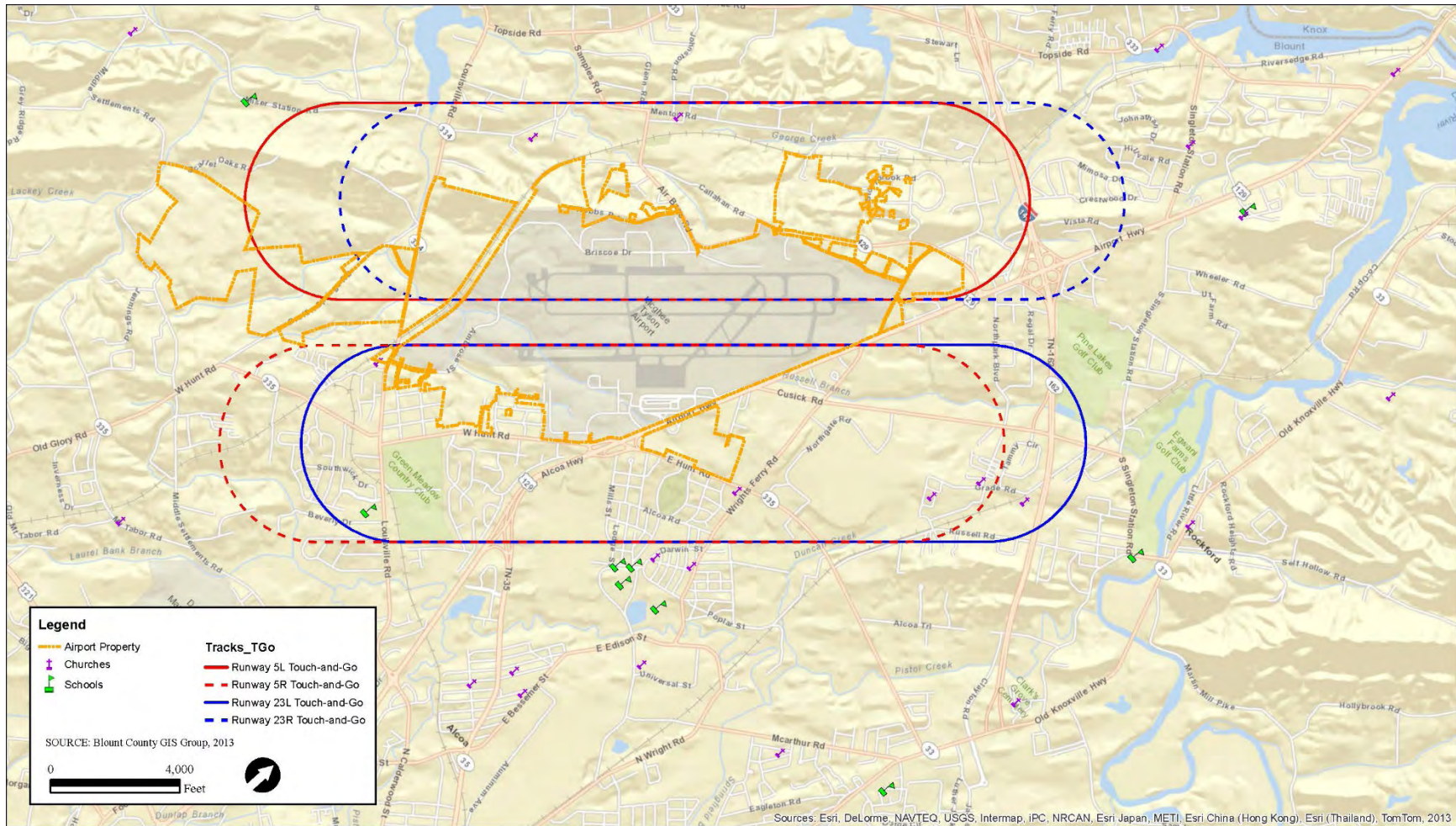


Figure 4 – Helicopter Approach and Departure Flight Tracks

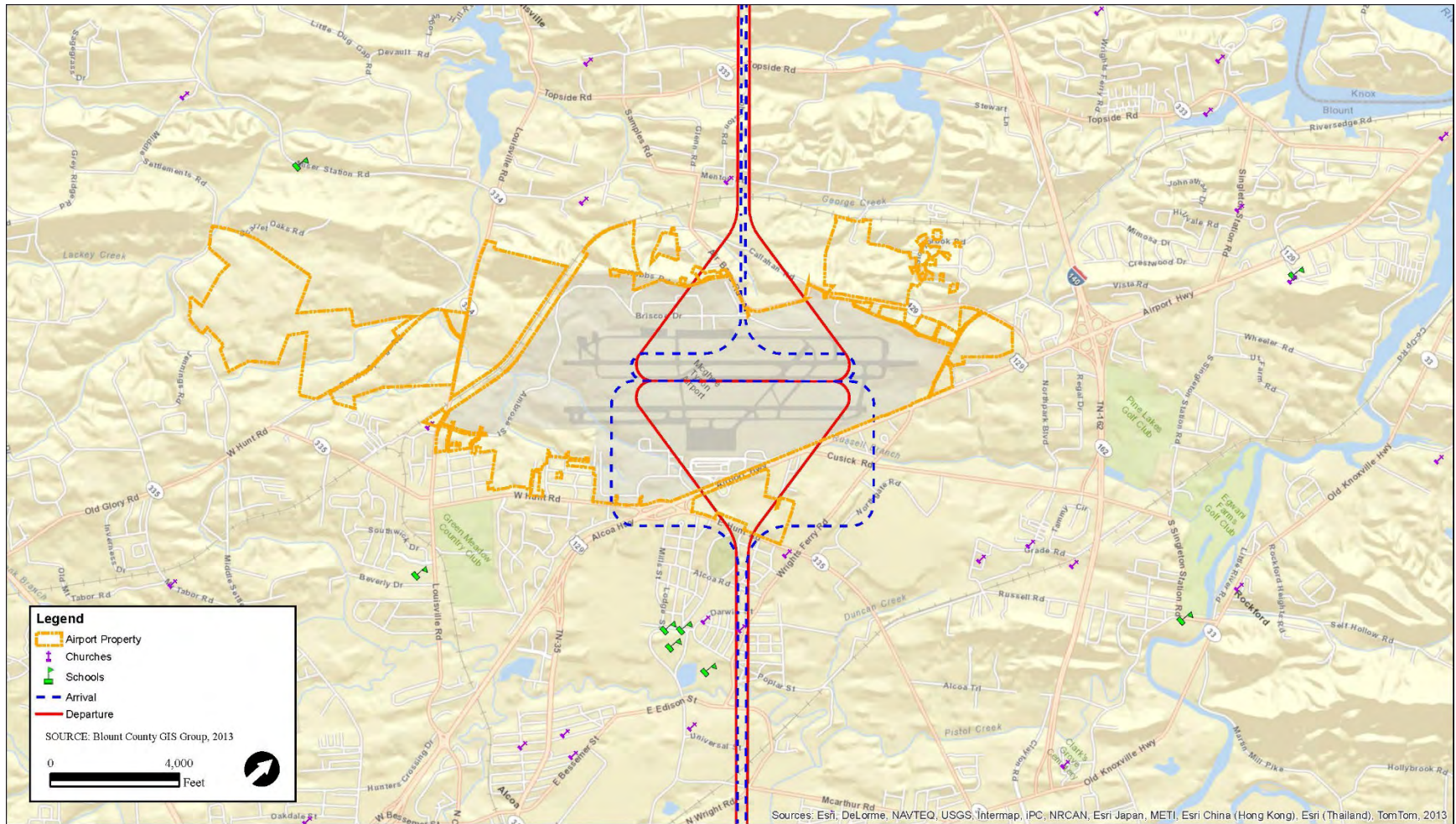


Table 6
Land Uses Normally Compatible With Various Noise Levels

LAND USE	Yearly day-night average sound level, DNL in decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
Residential Use						
Residential, other than mobile and transient lodgings	Y	N ⁽¹⁾	N ⁽¹⁾	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N ⁽¹⁾	N ⁽¹⁾	N ⁽¹⁾	N	N
Public Use						
Schools	Y	N ⁽¹⁾	N ⁽¹⁾	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30 N ⁽³⁾	N	N
Transportation	Y	Y	Y ⁽²⁾	Y ⁽³⁾	Y ⁽⁴⁾	Y ⁽⁴⁾
Parking	Y	Y	Y ⁽²⁾		Y ⁽⁴⁾	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale & retail - building materials, hardware, & farm equipment	Y	Y	Y ⁽²⁾	Y ⁽³⁾	Y ⁽⁴⁾	N
Retail trade - general	Y	Y	25	30	N	N
Utilities	Y	Y	Y ⁽²⁾	Y ⁽³⁾	Y ⁽⁴⁾	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing (general)	Y	Y	Y ⁽²⁾	Y ⁽³⁾	Y ⁽⁴⁾	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y ⁽⁶⁾	Y ⁽⁷⁾	Y ⁽⁸⁾	Y ⁽⁸⁾	Y ⁽⁸⁾
Livestock farming and breeding	Y	Y ⁽⁶⁾	Y ⁽⁷⁾	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y ⁽⁵⁾	Y ⁽⁵⁾	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables and water recreation	Y	Y	25	30	N	N

Notes:

- SLUCM Standard Land Use Coding Manual
 - Y (Yes) Land Use and related structures compatible without restrictions.
 - N (No) Land Use and related structures are not compatible and should be prohibited.
 - NLR Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
 - 25, 30 or 35 Land use and related structures generally compatible; measures to achieve NLR of 25, 30 or 35 must be incorporated into design and construction of structure.
 - (1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal construction can be expected to provide an NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.
 - (2) Measures to achieve NLR to 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
 - (3) Measures to achieve NLR to 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
 - (4) Measures to achieve NLR to 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
 - (5) Land uses compatible, provided special sound reinforcement systems are installed.
 - (6) Residential buildings require an NLR of 25.
 - (7) Residential buildings require an NLR of 30.
 - (8) Residential buildings not permitted.
- Source: 14 CFR Part 150.

NOISE CONTOURS

With the stated assumptions and inputs, AEDT was utilized to generate noise contour maps for each noise study case. The resulting Existing Conditions, Year of Implementation and Five Years After Implementation noise contours are shown on **Figures 5, 6, and 7**. These contours depict lines of contiguous noise exposure expressed in DNL. DNL, as previously mentioned, is the FAA approved method for land use compatibility determinations in airport noise studies. DNL noise contours are shown on the figure beginning at 60 DNL and increasing in 5 dB increments to 75 DNL. The 60 DNL is included for informational purposes only.

Change in Noise Exposure

Table 7 presents the acreages of noise exposure within the 65 DNL and greater for each future case. With implementation of the Proposed Action, total acreage of the 65 DNL and greater would increase from 1,998.3 acres to 2019.5 acres, a change of 20.2 acres. Five years after implementation of the Proposed Action, the 65 DNL and greater noise contour would increase from 1,999.3 acres to 2020.3 acres, a change of 21.1 acres.

Table 7 Change in DNL Acreage with Implementation of the Proposed Action (acres)						
	Year of Implementation			Five Years After Implementation		
DNL	Build	No Build	Change	Build	No Build	Change
65+	2018.5	1998.3	+20.2	2020.3	1999.2	+21.1
70+	1070.0	1023.4	+46.6	1069.8	1024.4	+45.4
75+	703.5	663.3	+39.2	702.5	663.9	+38.6

Source: Michael Baker International, 2016.

Table 8 presents the acreages of off-airport noise exposure within the 65 DNL and greater for each future case. With implementation of the Proposed Action, the total off-airport acreage would increase by 15.0 acres. Five years after implementation of the Proposed Action, the total off-airport change in noise exposure would increase by 15.3 acres.

Table 8 Change in Off-Airport Noise Exposure With Implementation of the Proposed Action (acres)						
	Year of Implementation			Five Years After Implementation		
	On Airport	Off Airport	Total	On Airport	Off Airport	Total
Build	1553.7	464.8	2018.5	1554.0	466.3	2020.3
No Build	1548.5	449.8	1998.3	1548.2	451.0	1999.2
Change	+5.2	+15.0	+20.2	+5.8	+15.3	+21.1

Source: Michael Baker International, 2016.

Figure 5 – Airport Noise Exposure – Existing Conditions

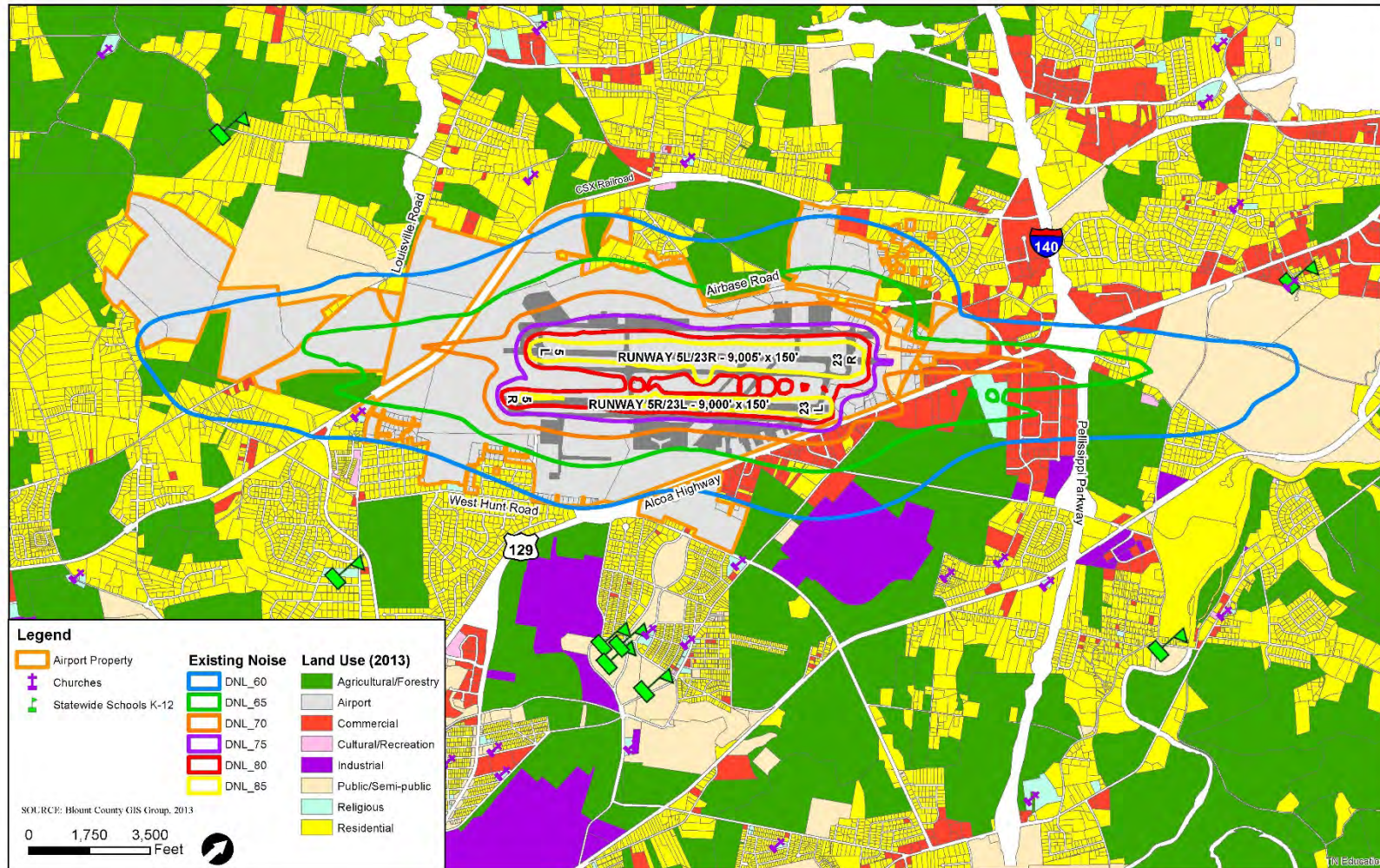


Figure 6 – Year of Implementation – Build vs. No Build

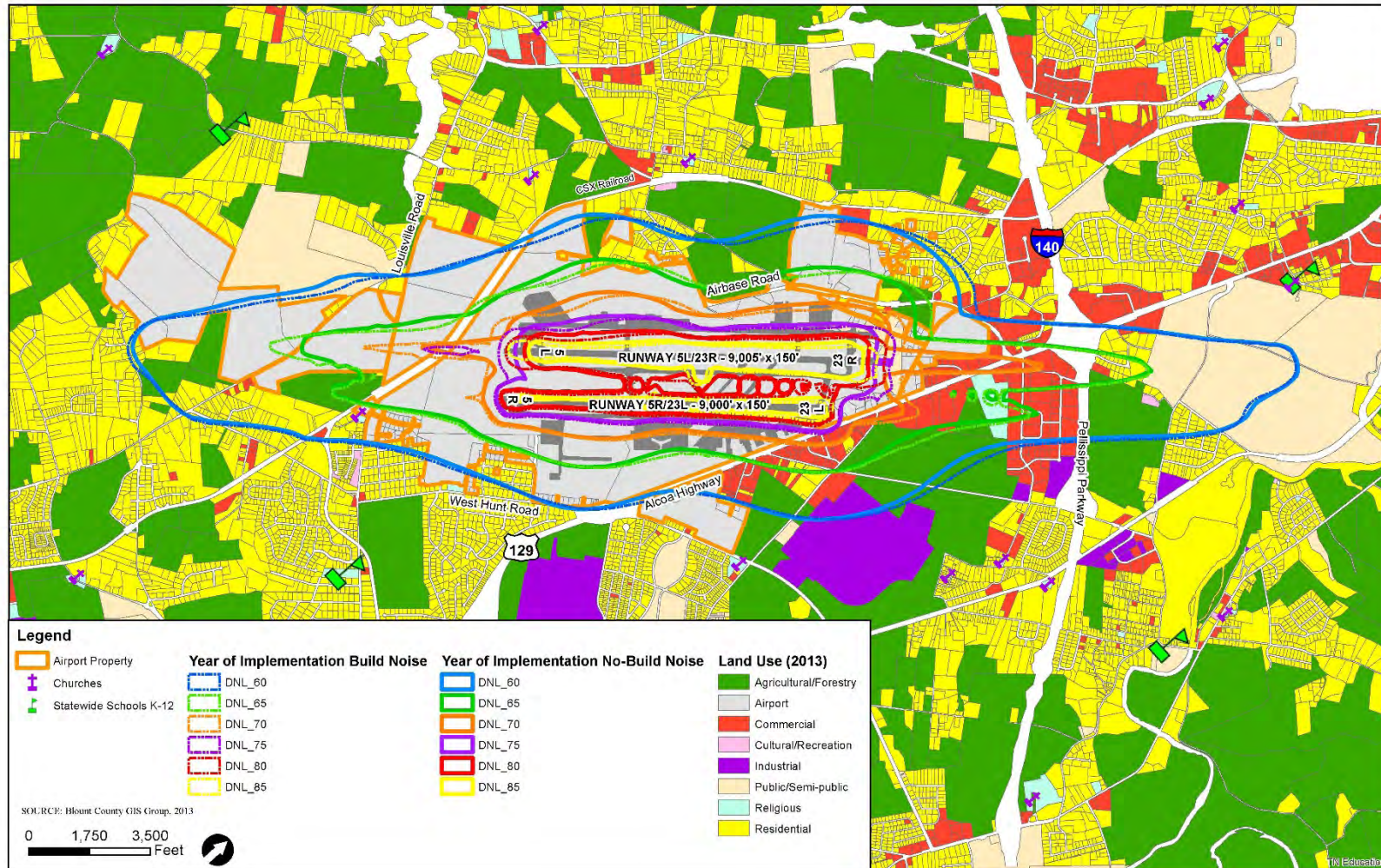
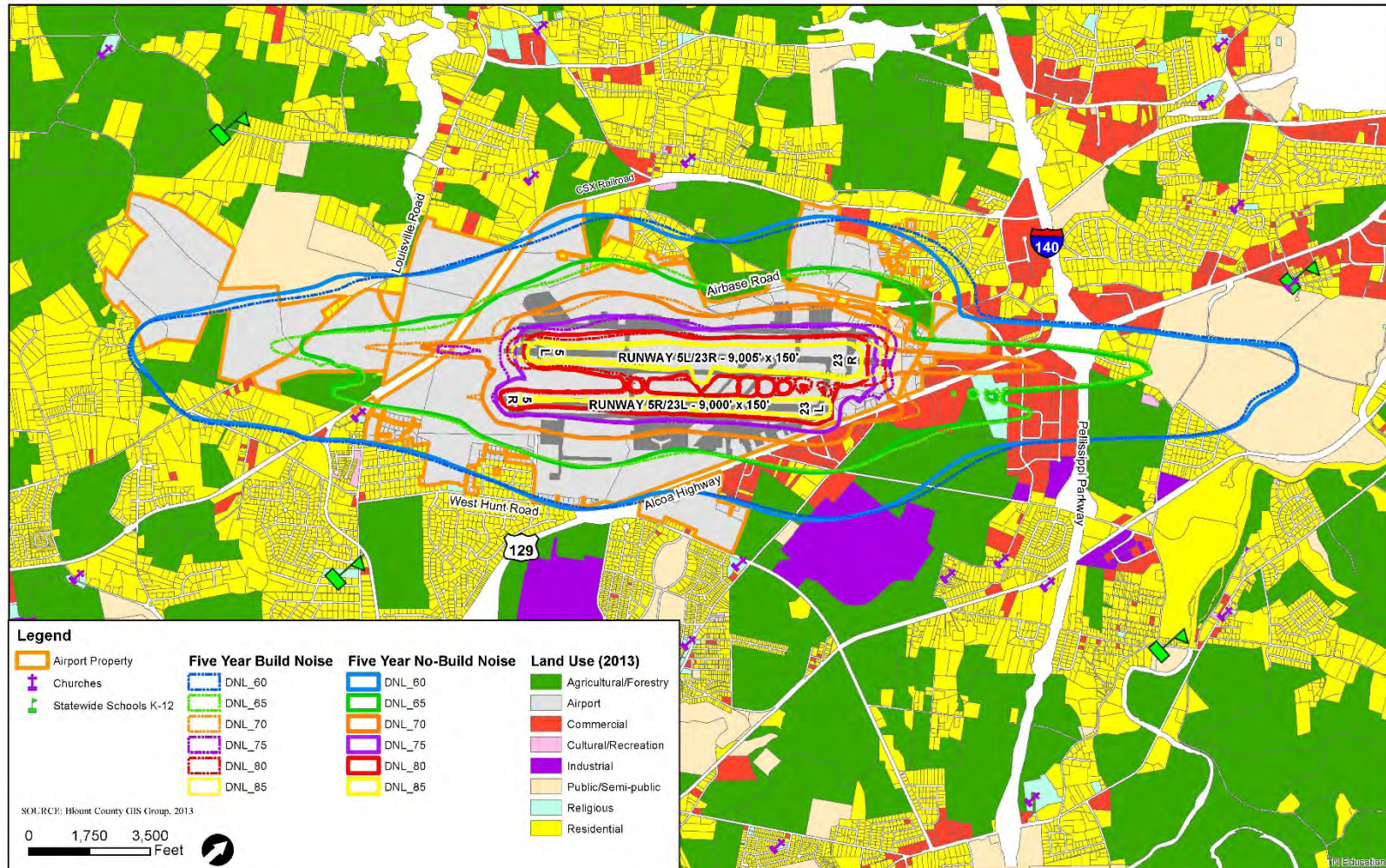


Figure 7 – Year of Implementation plus Five Years – Build vs. No Build



Location Point Analysis

FAA Order 1050.1F, *Environmental Policies and Procedures*, provides guidance on environmental impacts at airports and considers an increase of 1.5 dB or greater over a noise sensitive area within the 65 DNL as a significant impact. Based on this guidance, 156 noise sensitive sites located within the 65 DNL noise contour were identified and assigned a location point within the noise model. These areas are noted on **Figures 7** and **8** and include Armona Baptist Church and residential areas located at:

- Ambrose Road,
- Armona Road (including Silver Glen mobile home community),
- Benford Lane,
- Covey Court,
- Curie Street,
- Cusick Road,
- East Cunningham Street,
- Holloway Street,
- Link Drive,
- Louisville Road,
- Marcaro Lane,
- North Wright Road,
- Payne Road,
- Proffitt Springs Road,
- South Singleton Station
- Victoria Lane,
- West Hunt Road, and
- Wrights Ferry Road.

Table 10 provides the expected change in noise levels at the 156 noise sensitive sites evaluated for the period five years after implementation of the Proposed Action. As shown in the table, no sites would experience an increase of 1.5 dB DNL or greater as a result of the Proposed Action. Since a 1.5 dB change is considered the threshold of significance by the FAA, implementation of the Proposed Action would not cause a significant change in noise conditions at noise sensitive sites.

Table 9 Location Point Analysis Change in DNL at Noise Sensitive Sites				
Point ID#	Address	Implementation Plus Five Years		
		Build	No Build	Change
1	AIRBASE RD 1920	67.5	66.5	1.0
2	AIRBASE RD 1923 1925	71.2	69.8	1.4
3	AIRLINE DR	66.5	65.8	0.7
4	AIRLINE DR 1713	65.5	64.8	0.7
5	AIRLINE DR 1721	64	63.4	0.6
6	AIRLINE DR 1723	63.7	63.2	0.5
7	AIRLINE DR 1727	63.5	63	0.5
8	AIRLINE DR 1729	63.3	62.7	0.6
9	AIRLINE DR 1731	63.1	62.5	0.6
10	AIRPORT HWY	63.3	62.9	0.4
11	AMBROSE RD 1921	60	60.3	-0.3
12	ARMONA RD 1006	62.2	62.3	-0.1
13	ARMONA RD 1010	61.4	61.5	-0.1
14	ARMONA RD 170	61.9	61.9	0.0
15	ARMONA RD 520 624	62.9	63	-0.1
16	ARMONA RD 927	61.9	61.9	0.0
17	ARMONA RD 936	63.1	63.2	-0.1
18	ARMONA RD 962	62.5	62.5	0.0
19	ARMONA RD 980	62	62.1	-0.1
20	ARMONA RD 991	61.6	61.6	0.0
21	BELFOR CIR 100	68.8	68.9	-0.1
22	BENFORD LN 1975	60.7	60.7	0.0
23	BENFORD LN 1978	61	61	0.0
24	BENFORD LN 2011	61.7	61.6	0.1
25	CALLAHAN RD 2046	69.5	69.7	-0.2
26	COUNTRY CLUB RD	63.1	63.4	-0.3
27	COVEY CT 502	60.2	60.2	0.0
28	CRESCENT DR 909	64.4	64	0.4
29	CRESCENT DR 931	63.3	62.8	0.5
30	CURIE ST 1979	61.6	61.8	-0.2
31	CURIE ST 1980	61.7	61.9	-0.2
32	CUSICK RD	64.7	65.1	-0.4

Table 9 (Continued)				
Location Point Analysis				
Change in DNL at Noise Sensitive Sites				
Point ID#	Address	Implementation Plus Five Years		
		Build	No Build	Change
33	CUSICK RD	65.4	65.8	-0.4
34	CUSICK RD 154	64.7	65.1	-0.4
35	CUSICK RD 190	65.2	65.6	-0.4
36	CUSICK RD 198	64.1	64.5	-0.4
37	CUSICK RD 206	65.5	65.9	-0.4
38	E CUNNINGHAM ST 411	62	62.3	-0.3
39	E CUNNINGHAM ST 414	63	63.3	-0.3
40	E CUNNINGHAM ST 427	61.9	62.1	-0.2
41	E CUNNINGHAM ST 430	62.9	63.1	-0.2
42	E CUNNINGHAM ST 446	62.7	62.9	-0.2
43	E CUNNINGHAM ST 460	62.6	62.8	-0.2
44	E CUNNINGHAM ST 476	62.5	62.6	-0.1
45	E CUNNINGHAM ST 510	62.3	62.4	-0.1
46	E CUNNINGHAM ST 524	62.2	62.2	0.0
47	E CUNNINGHAM ST 526	62.1	62.1	0.0
48	E CUNNINGHAM ST 527	61.4	61.6	-0.2
49	E CUNNINGHAM ST 543	61.3	61.4	-0.1
50	E CUNNINGHAM ST 548	62	62	0.0
51	E CUNNINGHAM ST 571	61.1	61.1	0.0
52	HOBBS RD	65	65.5	-0.5
53	HOBBS RD	63.5	63.4	0.1
54	HOBBS RD 2446	64.1	63.5	0.6
55	HOBBS RD 2448	65.2	64.4	0.8
56	HOBBS RD 2502	65.5	64.9	0.6
57	HOBBS RD 2506	65.7	65.2	0.5
58	HOBBS RD 2518	65.2	64.9	0.3
59	HOBBS RD 2524	65.1	65	0.1
60	HOBBS RD 2530	64.8	64.9	-0.1
61	HOBBS RD 2536	64.5	64.6	-0.1
62	HOBBS RD 2540	63.2	63.5	-0.3
63	HOBBS RD 2541	65.4	65.8	-0.4
64	HOBBS RD 2555	64.7	65.1	-0.4

Table 9 (Continued)				
Location Point Analysis				
Change in DNL at Noise Sensitive Sites				
Point ID#	Address	Implementation Plus Five Years		
		Build	No Build	Change
65	HOLLOWAY ST 745	65.1	65.4	-0.3
66	HOLLOWAY ST 788	64.9	65.6	-0.7
67	KILLION ST 802	60.9	60.8	0.1
68	KILLION ST 807	61.2	61.1	0.1
69	KILLION ST 823	65.4	65.6	-0.2
70	KILLION ST 830	65.8	65.9	-0.1
71	LINK DR 410	65.1	64.6	0.5
72	LINK DR 411	64.3	63.8	0.5
73	LINK DR 428	61.3	61.6	-0.3
74	LINK DR 429	60.5	60.8	-0.3
75	LINK DR 443	61.2	61.4	-0.2
76	LINK DR 444	60.3	60.5	-0.2
77	LINK DR 503	60.2	60.4	-0.2
78	LINK DR 504	61	61.2	-0.2
79	LINK DR 517	60	60.1	-0.1
80	LINK DR 518	60.8	61	-0.2
81	LINK DR 536	59.8	60	-0.2
82	LINK DR 552	60.7	60.8	-0.1
83	LINK DR 564	60.5	60.6	-0.1
84	LOUISVILLE RD 2153	60.4	60.5	-0.1
85	LOUISVILLE RD 2165	60.3	60.3	0.0
86	LOUISVILLE RD 2177	61.1	61.1	0.0
87	LOUISVILLE RD 2431	61.5	61.5	0.0
88	MARCARO LN	62	62.1	-0.1
89	MARCARO LN 815	65.1	65.3	-0.2
90	MARCARO LN 819	61.9	61.9	0.0
91	MARCARO LN 824	61.1	61.1	0.0
92	MARCARO LN 827	61.6	61.6	0.0
93	MARCARO LN 828	61	61	0.0
94	MARCARO LN 831	61.9	61.9	0.0
95	MARCARO LN 832	61	61	0.0
96	MARCARO LN 835	61.9	61.9	0.0

Table 9 (Continued)				
Location Point Analysis				
Change in DNL at Noise Sensitive Sites				
Point ID#	Address	Implementation Plus Five Years		
		Build	No Build	Change
97	MARCARO LN 836	61	61	0.0
98	MARCARO LN 840	62	62	0.0
99	MARCARO LN 844	61	61	0.0
100	MIMOSA DR	61.3	61.3	0.0
101	MIMOSA DR	61.7	61.7	0.0
102	MIMOSA DR	66.1	66.4	-0.3
103	MIMOSA HEIGHTS DR	65.8	66	-0.2
104	MIMOSA HEIGHTS DR	64.9	65.3	-0.4
105	MIMOSA HEIGHTS DR 803	68.6	68.6	0.0
106	MIMOSA HEIGHTS DR 804	65.4	65.7	-0.3
107	MIMOSA HEIGHTS DR 809	66.2	66.2	0.0
108	MIMOSA HEIGHTS DR 810	65.9	65.6	0.3
109	MIMOSA HEIGHTS DR 814	66.4	66.4	0.0
110	MIMOSA HEIGHTS DR 815	66	65.7	0.3
111	MIMOSA HEIGHTS DR 819	66.1	65.7	0.4
112	MIMOSA HEIGHTS DR 820	66.7	66.6	0.1
113	MIMOSA HEIGHTS DR 825	66.9	66.7	0.2
114	MIMOSA HEIGHTS DR 826	66.1	65.6	0.5
115	MIMOSA HEIGHTS DR 827	67	66.7	0.3
116	MIMOSA HEIGHTS DR 832	65.9	65.4	0.5
117	MIMOSA HEIGHTS DR 833	67	66.7	0.3
118	MIMOSA HEIGHTS DR 834	65.7	65.2	0.5
119	N WRIGHT RD	67	66.5	0.5
120	N WRIGHT RD	65.4	64.8	0.6
121	N WRIGHT RD 2523	62.8	63.3	-0.5
122	N WRIGHT RD 2537	64.4	64.8	-0.4
123	PAYNE AVE 2151	67.2	67.3	-0.1
124	PAYNE AVE 2200	67.6	67.6	0.0
125	PAYNE AVE 2208	60.2	60.4	-0.2
126	PROFFITT SPRINGS RD	60.9	61.2	-0.3
127	PROFFITT SPRINGS RD	60.9	61.2	-0.3
128	PROFFITT SPRINGS RD	61.1	61.1	0.0

Table 9 (Continued) Location Point Analysis Change in DNL at Noise Sensitive Sites				
Point ID#	Address	Year of Implementation Plus Five Years		
		Build	No Build	Change
129	PROFFITT SPRINGS RD	62.9	62.9	0.0
130	PROFFITT SPRINGS RD 824	61	61	0.0
131	PROFFITT SPRINGS RD 827	61.5	61.6	-0.1
132	PROFFITT SPRINGS RD 832	61.3	61.3	0.0
133	PROFFITT SPRINGS RD 835	61.8	61.9	-0.1
134	PROFFITT SPRINGS RD 836	61.6	61.6	0.0
135	PROFFITT SPRINGS RD 842	61.9	61.9	0.0
136	PROFFITT SPRINGS RD 845	62	62.1	-0.1
137	PROFFITT SPRINGS RD 849	62.2	62.3	-0.1
138	PROFFITT SPRINGS RD 854 856	62.4	62.4	0.0
139	PROFFITT SPRINGS RD 872	62.7	62.7	0.0
140	S SINGLETON STATION RD 4138	60.9	60.9	0.0
141	S SINGLETON STATION RD 4144	61.4	61.5	-0.1
142	S SINGLETON STATION RD 4152	61.6	61.7	-0.1
143	VICTORIA LN	61.1	61.1	0.0
144	VICTORIA LN 2145	60.9	60.9	0.0
145	VICTORIA LN 2149	61.1	61.1	0.0
146	VICTORIA LN 2150	61.1	61.1	0.0
147	W HUNT RD	60.3	60.3	0.0
148	W HUNT RD 1210	59.9	59.9	0.0
149	W HUNT RD 1230	60.3	60.3	0.0
150	W HUNT RD 1234	60.3	60.3	0.0
151	W HUNT RD 1240	60.5	60.5	0.0
152	W HUNT RD 408	59.5	59.8	-0.3
153	W HUNT RD 424	59.5	59.8	-0.3
154	W HUNT RD 440	59.4	59.6	-0.2
155	WRIGHTS FERRY RD	61.8	62.2	-0.4
A	ARMONA BAPTIST CHURCH	63.1	63.2	-0.1

Source: Michael Baker International, 2016.

CONCLUSION

Based on the results of the noise analysis, implementation of the Proposed Action would not cause significant impacts to noise sensitive land uses. **Table 9** provides a list of 156 noise sensitive sites analyzed and the associated increase/decreases. Since no increases are greater than 1.5 dB, there are no significant noise impacts.

APPENDIX B

0105



JAN 26 2016

No significant impacts to wetlands are anticipated from this proposal. No federally listed endangered or threatened species, or habitat suitable for such species, are known to exist in the project area.

January 19, 2016

Mr. Lee Barclay, Ph.D
Ecological Services Field Office
US Fish & Wildlife Service
446 Neal Street
Cookeville, TN 38501-4027

[Signature] 2/3/2016
for Field Supervisor Date
U.S. Fish and Wildlife Service
Cookeville, TN 38501

**Re: Proposed Extension to Runway 5L/23R
McGhee Tyson Airport
Environmental Assessment - Early Coordination Package**

Dear Mr. Barclay:

In accordance with the National Environmental Policy Act of 1969, the Council on Environmental Quality implementing regulations, and Federal Aviation Administration (FAA) Orders 1050.1F and 5050.4B, the Metropolitan Knoxville Airport Authority (MCAA) is preparing an Environmental Assessment (EA) analyzing the proposed extension to Runway 5L/23R at McGhee Tyson Airport (TYS).

Project Location

TYS is a small hub primary commercial service airport. The Airport is located approximately 12 miles south of downtown Knoxville bordered by the City of Louisville to the north and the City of Alcoa to the south. The airport property is generally defined by the CSX Railroad and Louisville Road to the west, Airbase and Callahan Roads to the north, Alcoa Highway to the east and West Hunt Road to the south.

Purpose and Need

The 134th Air Refueling Wing (134 ARW) is a unit of the Tennessee ANG stationed at McGhee Tyson Air National Guard Base located on the north side of TYS. If activated for federal service, the 134 ARW supports the United States Air Force Air Mobility Command. The 134 ARW's critical aircraft is the Boeing KC-135, which provides the aerial refueling capability for the United States Air Force. The KC-135 is 136 feet in length, has a wingspan of 130 feet, and a maximum takeoff weight of 322,500 pounds.

The need for the proposed project (or the "problem") is to accommodate the length requirements for the Tennessee ANG's KC-135. According to the *Air National Guard Handbook 32-1084, Facility Space Standards*, the KC-135 requires a minimum of 10,000 feet for fully loaded mission aircraft (see Table 2-1: CATCODE 111-111). The existing Runway 5L/23R is published at 9,003 feet with a 500-foot paved overrun on both ends of the runway. The Tennessee ANG occasionally utilizes these overruns for departures; however, the overruns are currently marked as non-usable pavement with chevrons and therefore cannot be used in landing/takeoff calculations.

The purpose of the proposed action, or the solution to the identified problem, is to lengthen Runway 5L/23R by marking the existing non-usable runway pavement as "usable". This is achieved by removing the chevron markings beyond both landing thresholds and painting arrows. The paved overruns are currently being re-built as part of the on-going Runway 5L/23R Reconstruction Program. If these overruns are marked as usable pavement and standard Runway Safety Area (RSA) off each end can be achieved (1000' x 500'), Runway 5L/23R could be published at 10,000 feet for departures. By extending the usable runway length, the Tennessee ANG can fulfill its mission while complying with the Air National Guard requirements for the KC-135.

Project History

On July 9, 2014, the FAA issued a Finding of No Significant Impact (FONSI) for the Runway 5L/23R

35.806286 - 84.000836
35° 48' 22.63" - 84° 00' 03.01"

Reconstruction Program. The preferred alternative closed Runway 5L/23R for two construction seasons and included the following proposed actions:

- Rehabilitation/full-depth Reconstruction of Runway 5L/23R;
- Correction of line-of-sight design issue on Runway 5L/23R;
- Widening of Runway 5L/23R shoulders by 15 feet to a total width of 25 feet;
- Improvement of Runway 5L/23R safety overruns;
- Gradient corrections on last ¼ of runway;
- Upgrade of the existing ALS on the Runway 23R end with a new ALSF-2 system
- Pavement maintenance and installation of temporary ILS on Runway 5L/23R

According to the Final EA, the pavement rehabilitation and lighting improvements to the existing safety overruns for Runway 5L/23R were also included and analyzed as a connected action. Although the rehabilitation of these overrun areas for military use was discussed in the EA, the existing markings depicting non-usable runway pavement did not change as part of the project and the Airport Layout Plan (ALP) was not updated (see **Exhibit 1 & 2**). Therefore, the proposed FAA published runway lengths for departures will remain the same when Runway 5L/23R re-opens. During the final design for Runway 5L/23R, it was determined there will be enough excess excavation to construct full Runway Safety Areas (RSA) off the ends of 5L/23R. The excess fill combined with marking both paved overruns as usable pavement would provide the runway an additional 500 feet on both ends. In this condition, Runway 5L/23R would be 10,000' for all operations except landing distance. Since the landing thresholds would remain in their current condition, the landing distances for both 5L and 23R would be 9,500'.

Proposed Project

The proposed development to be analyzed in this environmental assessment will include (see **Exhibit 3 & 4**):

- Marking the existing 500' overruns as usable pavement
- Grading & earthwork for the Runway 5L extended RSA
- Construction of connector taxiways B1, B9, and G6
- Localizer Antenna Relocations for Runway 5L & Runway 23R
- Relocate Liberty Street outside of the 5L RSA
- Reconfigure the drainage ditch and the existing stormwater management.

Early Coordination

As part of the early coordination process, we are requesting your review and comment of the proposed project. Based on our evaluation of the project area and the studies previously completed as part of the last EA, we feel that the proposed extension of Runway 5L/23R and its connected actions will not impact rare, threatened, or endangered species. All of the earth disturbance will be contained to airport property. We would greatly appreciate your timely review of the project information, as presented. Should you have any questions regarding this project or need additional information, please contact me at 216.443.1700 (x367).

Sincerely,
CHA Consulting, INC.



Mark Heckroth
Project Manager – Aviation

Enclosure

Cc: Ms. Kim McClintock, Federal Aviation Administration
Mr. Eric Williamson, MKAA





**TENNESSEE HISTORICAL COMMISSION
STATE HISTORIC PRESERVATION OFFICE
2941 LEBANON ROAD
NASHVILLE, TENNESSEE 37243-0442
OFFICE: (615) 532-1550**

January 27, 2016

Mr. Mark Heckroth
CHA
1501 N. Marginal Rd./200
Cleveland, Ohio, 44114

RE: FAA, MCGHEE-TYSON/RUNWAY 5L/23R/EXT., KNOXVILLE, KNOX COUNTY

Dear Mr. Heckroth:

In response to your request, received on Monday, January 25, 2016, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicant for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800. You may wish to familiarize yourself with these procedures (Federal Register, December 12, 2000, pages 77698-77739) if you are unsure about the Section 106 process.

After considering the documents you submitted, we determine that THERE ARE NO NATIONAL REGISTER OF HISTORIC PLACES LISTED OR ELIGIBLE PROPERTIES AFFECTED BY THIS UNDERTAKING. We have made this determination either because: the undertaking will not alter any characteristics of an identified eligible or listed Historic Property that qualify the property for listing in the National Register, the undertaking will not alter an eligible Historic Property's location, setting or use, the specific location, scope and/or nature of the undertaking precluded affect to Historic Properties, the size and nature of the undertaking's area of potential effects precluded affect to Historic Properties, or, no National Register listed or eligible Historic Properties exist within the undertaking's area of potential effects. Therefore, we have no objections to your proceeding with your undertaking.

If your agency proposes any modifications in current project plans or discovers any archaeological remains during the ground disturbance or construction phase, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act. If you are applying for federal funds, license or permit, you should submit this letter as evidence of consultation under Section 106 to the appropriate federal agency, which, in turn, should contact us as required by 36 CFR 800. If you represent a federal agency, you should submit a formal determination of eligibility and effect to us for comment. You may find additional information concerning the Section 106 process and the Tennessee SHPO's documentation requirements at <http://www.tennessee.gov/environment/hist/federal/sect106.shtm>. You may direct questions or comments to Joe Garrison (615) 770-1092. This office appreciates your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jyg

Heckroth, Mark

From: Lynne A. Liddington <laliddington@aqm.co.knox.tn.us>
Sent: Tuesday, March 01, 2016 2:44 PM
To: Heckroth, Mark
Subject: RE: Comments for the Air Quality from the website

Mr. Heckroth,

I have reviewed the documents and have no negative comments to this project related to ambient air quality. If you need additional information, please let me know.

Lynne A. Liddington

Director
Air Quality Management
Knox County Health Department
140 Dameron Ave.
Knoxville, TN 37917
865 215-5900 office
865 755-3631 cell



From: Heckroth, Mark [mailto:MHeckroth@chacompanies.com]
Sent: Tuesday, March 01, 2016 1:52 PM
To: aqm@aqm.co.knox.tn.us
Subject: Comments for the Air Quality from the website

Attached please find an early coordination package sent to your attention in January asking you to comment on the proposed Runway 5L/23R extension at McGhee Tyson Airport, Tennessee. The main focus of the proposed development is to lengthen Runway 5L/23R by marking pavement as usable for aircraft accelerate stop distance and take off run calculations. Currently, the runway has a 500-foot paved overrun at each end, but it is marked as "unusable" so pilots cannot use it to calculate their takeoff and landing distances. The need for the proposed project (or the "problem") is to accommodate the length requirements for the Tennessee ANG's KC-135.

If you could respond, I would greatly appreciate it. We are trying to have a draft EA to FAA for review by the end of March.

If you have any questions, please call me at 800-321-6959 x367

Best Regards,
Mark

Mark Heckroth
Regional Manager – Aviation Market
CHA ~ *design/construction solutions*
1501 N. Marginal Road, Suite 200

Heckroth, Mark

From: Planning <planning@blounttn.org>
Sent: Tuesday, March 01, 2016 3:16 PM
To: Heckroth, Mark
Subject: RE: TYS Runway 5L/23R Extension

Mark,

I do not know of any projects by Blount County in the past 3 years in the area you identified. I know of one project in the near future by the Blount County Industrial Development Board for land in part of the north western portion of the study area along Proffitt Springs Road – a new industrial plant in what is referred to as “Partnership Park North”. The contact number for the Industrial Development Board is 855-257-3964. The land is within the City of Alcoa, and the contact number for the Alcoa Planning Department is 865-380-4730.

John Lamb

From: Heckroth, Mark [mailto:MHeckroth@chacompanies.com]
Sent: Tuesday, March 01, 2016 11:16 AM
To: planning@blounttn.org
Subject: TYS Runway 5L/23R Extension

Mr. Lamb,

Please find attached an early coordination/scoping packet mailed to you in January for your review and comment. I have also attached a memo inquiring about past, present, and foreseeable projects your agency can disclose.

If you could respond to both requests (can be in the same letter response), I would appreciate it. We are trying to have a Draft Environmental Assessment for FAA review by the end of March.

If you have any questions, please call me at 1-800-321-6959 x367

Thank you for your input.

Mark

Mark Heckroth

Regional Manager – Aviation Market

CHA ~ *design/construction solutions*

1501 N. Marginal Road, Suite 200

Cleveland, OH, 44114

Office: 1.800.321.6959 x367

Cell: 1.216.904.6283

www.chacompanies.com



TENNESSEE WILDLIFE RESOURCES AGENCY

ELLINGTON AGRICULTURAL CENTER
P. O. BOX 40747
NASHVILLE, TENNESSEE 37204

February 16, 2016

Mark Heckroth
CHA
Burke Lakefront Airport
1501 North Marginal Road
Suite 200
Cleveland, OH 44114

Re: Proposed Extension to Runway 5L/23R
McGhee Tyson Airport
Response to Request for Environmental Assessment – Early Coordination Package

Dear Mr. Heckroth:

The Tennessee Wildlife Resources Agency has reviewed the information that you provided regarding the proposed extension to Runway 5L/23R at McGhee Tyson Airport and provides the following comments. We have reviewed our databases for documented occurrences of state listed species under our authority within a 5 mile radius of the proposed project location and the state and federally Endangered Gray Myotis (*Myotis grisescens*), the state and federally Endangered Finerayed Pigtoe (*Fusconaia cuneolus*), the state and federally Endangered Marbled Darter (*Etheostoma marmorinum*), the state and federally Threatened Snail Darter (*Percina tanasi*), the state Threatened Sickle Darter (*Percina williamsi*), the state Deemed-In-Need-Of-Management Barn Owl (*Tyto alba*), the state Deemed-In-Need-Of-Management Bald Eagle (*Haliaeetus leucocephalus*), the state Deemed-In-Need-Of-Management King Rail (*Rallus elegans*), the state Deemed-In-Need-Of-Management Least Bittern (*Ixobrychus exilis*), the state Deemed-In-Need-Of-Management Hellbender (*Cryptobranchus alleganiensis*), the state Deemed-In-Need-Of-Management Flame Chub (*Hemitremia flammea*), and the state Deemed-In-Need-Of-Management Tangerine Darter (*Percina aurantiaca*) were within this radius.

We do not anticipate adverse impacts to state listed species under our authority due to the proposed runway extension construction activities; provided that best management practices to address erosion and sediment are implemented and maintained during construction activities. Since it is proposed to reconfigure the drainage ditch and the existing stormwater management in this project, we encourage the consideration in the stormwater management design to include features to hold and treat runoff from rainfall, snowfall, and de-icing events to minimize potential contaminants from being discharged into aquatic systems inhabited by listed species.

Thank you for the opportunity to review and comment on this proposed project. If you have further questions regarding this matter, please contact me at 615-781-6572.

The State of Tennessee

IS AN EQUAL OPPORTUNITY, EQUAL ACCESS, AFFIRMATIVE ACTION EMPLOYER

Sincerely,

Robert M. Todd

Robert M. Todd
Fish and Wildlife Environmentalist

cc: Rob Lindbom, Region IV Habitat Biologist
John Gregory, Region IV Manager
Mary Jennings, USFWS

Heckroth, Mark

From: Gissentanna, Larry <Gissentanna.Larry@epa.gov>
Sent: Wednesday, March 02, 2016 11:31 AM
To: Heckroth, Mark
Cc: Militscher, Chris
Subject: Scoping Coordination for proposed Runway 5L/23R extension at McGhee Tyson Airport, Tennessee

Mark Heckroth
Regional Manager – Aviation Market
CHA design/construction solutions
1501 N. Marginal Road, Suite 200
Cleveland, OH, 44114

Dear Mr. Heckroth,

EPA Region 4, NEPA Program Office is in receipt of the Early Coordination Package for the proposed Runway 5L/23R extension at McGhee Tyson Airport, Tennessee. EPA understands that the proposed project consists of; Marking the existing 500' overruns as usable pavement; Grading & earthwork for the runway 5L extended RSA; Construction of connector taxiways B1, B9 and G6; Localizer Antenna Relocations for Runway 5L & Runway 23R; Relocate Liberty Street outside of the 5L RSA; Reconfiguring the drainage ditch and the existing stormwater management. The proposed project and associated improvements would address the need for additional runway length to better accommodate the Air National Guard requirement for the current fleet of KC-135 aircraft. We also understand that all portions of the proposed actions will be constructed entirely on airport property .

Upon initial review of the scoping/ coordination document you provided to this office, it appears that this project will not have a significant impact to human health and the environment; However, The Draft and Final Environmental Assessment should adequately address media areas such as noise, wetlands, and water/air quality, energy, climate change and environmental justice. Also, consider the following; Any contractor working onsite should use best management practices and should address any potential impacts to offsite streams and waterways. The site grading, excavation, and construction plans should include implementable measures to prevent erosion and sediment runoff from the various project sites both during and after construction. Local land disturbance and state construction stormwater permit(s) may also be required, and these should be referenced on the plans and in the specifications. Consider energy sustainable buildings, utilizing variable forms of proven renewable energy applicable for this project, for example, solar power for supplemental electricity and lighting in the parking lots and parking garage, airport aprons, taxiways, walkways and terminal building, etc. Please see attached link for additional info. http://www.wbdg.org/references/federal_mandates.php

Keep the local community informed and involved throughout the project process; by having community meetings and/or updating the community through local media (social media, radio, local paper and TV). Upon completion of your Draft and Final documents, please submit 2 hard and electronic copies of the NEPA documents to the NEPA Program Office (see address listed below).

Thank you again, for the opportunity to comment, If you have any questions, please contact me via the information below.

Larry O. Gissentanna
DoD and Federal Facilities, Project Manager

U.S. Environmental Protection Agency/ Region 4
Resource Conservation and Restoration Division
National Environmental Policy Act (NEPA) Program Office
61 Forsyth Street, SW
Atlanta, GA 30303-8960
Office: 404-562-8248
gissentanna.larry@epa.gov



STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES

William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243-1102

March 2, 2016

Mr. Mark Heckroth
CHA Consulting, INC.
1501 North Marginal Road, Suite 200
Cleveland, OH 44114

re: McGhee Tyson Airport Runway Extension Project

Dear Mr. Heckroth:

John LeCroy, TDEC Regional Director for External Affairs in Knoxville recently forwarded your request to me for an environmental review regarding the runway extension at the McGhee Tyson Airport outside of Knoxville, Tennessee. I am the environmental review coordinator for the Division of Water Resources. I have reviewed the information submitted in the letter. This project as proposed does not pose a significant impact on programs regulated by the Division of Water Resources. No wetlands were identified via our GIS coverage that would likely be impacted by the project. Review of the site location does not indicate that there are any issues with public water supplies, navigable waters or that the project would impact a river that is part of the Nationwide Rivers Inventory, any wild or scenic river or endangered species. There is an existing Tennessee Multi-Sector Stormwater Permit for the Airport, tracking number TNR053253, which should be able to be modified to address the construction stormwater activities. That permit is not due to expire until April 14, 2020.

You may wish to contact Mike Atchley in our Knoxville Office if you have further questions regarding the stormwater permit. He can be reached at (615) 594-5589 or michael.atchley@tn.gov.

If you have any further questions, I will be glad to try to assist you. You may reach me at (615) 532-0170 or tom.moss@tn.gov.

Sincerely,

Thomas A. Moss
Environmental Review Coordinator
Compliance and Enforcement Unit

cc: Mike Atchley, Knoxville DWR Environmental Field Office Manager
John LeCroy, Knoxville Regional Director for External Affairs

Heckroth, Mark

From: Robbie Sykes <robbie_sykes@fws.gov>
Sent: Tuesday, May 10, 2016 2:12 PM
To: Heckroth, Mark
Cc: Geoff Call
Subject: RE: TYS Runway 5L/23R Draft EA - Runway Extension

Mark,

Upon review of the description of the three trees, as well as the provided photos, the Service concurs that the trees required for removal for the relocation of Liberty Street do not possess the appropriate characteristics that would provide suitable roosting habitat of the Indiana or northern long-eared bat. A no effect determination is appropriate for these two bat species.

Our database does not indicate any other current federally listed species in the vicinity of the project that would be impacted by the project. Therefore, based on the best information available at this time, we believe that the requirements of the Fish and Wildlife Coordination Act and section 7 of the Endangered Species Act of 1973, as amended, are fulfilled. Obligations under section 7 of the Act must be reconsidered if (1) new information reveals impacts of the action that may affect listed species or critical habitat in a manner not previously considered, (2) the action is subsequently modified to include activities which were not considered during this consultation, or (3) new species are listed or critical habitat designated that might be affected by the action.

If you need anything else, please let me know.

Thanks,

Robbie Sykes
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, TN 38501
(tele. 931/525-4979)
(fax. 931/528-7075)

From: Heckroth, Mark [mailto:MHeckroth@chacompanies.com]
Sent: Monday, May 09, 2016 4:00 PM
To: robbie_sykes@fws.gov
Cc: geoff_call@fws.gov
Subject: TYS Runway 5L/23R Draft EA - Runway Extension

Robbie,

Your office received an early coordination letter in January 2016 requesting information and/or impact potential from a project at McGhee Tyson Airport (see attached letter). You responded with a stamp of "no significant impacts to federal listed endangered species or habitat suitable for such species are known to exist in the project area" on 2/3/16. An element of the project was the relocation of an on-airport service road (Liberty Street). Since January the road alignment has been refined and three trees will be removed as part of the road relocation. The FAA requested we assess the trees for potential bat habitat and re-coordinate with your office. Attached is a memo (with photos) completed by CHA's biologist which determined the three trees not to be suitable for bat habitat. If you could review and concur via email we would appreciate it. We are preparing to publish the draft EA next week. I apologize for the last minute request, but the potential bat habitat was a comment during FAA's review of the preliminary Draft EA.



MEMO

To: File/30377
From: Simon Davies, Wildlife Biologist
Project: TYS Runway 5L/23R Environmental Assessment
Subject: Liberty Street Relocation – Tree Clearing
Date: May 6, 2016

As part of the proposed Liberty Street Relocation at McGhee Tyson Airport (TYS) in Knoxville, Tennessee, three trees will be removed. Knoxville, Tennessee lies within the range of two federally listed bat species: the Indiana bat (*Myotis sodalists*) and the northern long-eared bat (*Myotis septentrionalis*). A field investigation of these trees was conducted to determine whether any individual tree provided potential summer roosting habitat for the above mentioned species.

Both of these *Myotis* species utilize similar habitat for their summer roosts. During these months, they roost singly or in colonies underneath exfoliating bark, in cavities, or in crevices of both live and dead trees. A tree can provide potential bat roosting habitat if it is greater than 3 inches in diameter and, either through growth characteristic of the species or environmental factors, provides one or more of the above listed habitat requirements.

The three trees (**photographs attached**) are all the same species; Sugarberry (*Celtis laevigata* var. *laevigata*). As can be seen, all three trees are healthy, with fully developed canopies, and intact branches and trunks. No specific evidence of crevices, splits, or cavities were observed in any of the trees. *Celtis* tree species (Sugarberry and Hackberry) do not typically develop exfoliating bark as a characteristic of the species and none was observed on these trees. Additionally, all three trees are located in an area subject to regular grounds maintenance, are geographically isolated from any adjacent forested areas, and are directly adjacent to an active airport access road and Air National Guard facility. This proximity indicates a high level of anthropogenic disturbance.

Based upon the lack of suitable *Myotis* roosting habitat within the trees and the degree of anthropogenic disturbance adjacent to these trees, it is unlikely that the removal of these trees would pose a significant threat to either the Indiana bat or the northern long-eared bat.

Site Photographs



Photo 1: View of three trees proposed for removal as part of the Liberty Road Relocation

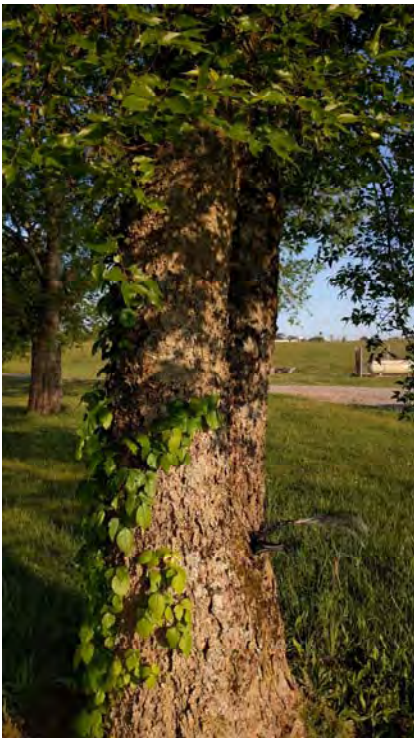


Photo 2: *Celtis laevigata*, 20" dbh



Photo 3: *Celtis laevigata*, 36" dbh



Photo 4: *Celtis laevigata*, 18" dbh



STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Division of Natural Areas
2nd Floor, William R. Snodgrass Tennessee Tower
312 Rosa Parks Blvd.
Nashville, Tennessee 37243
Phone 615/532-0431

May 17, 2016

Mark Heckroth
CHA
Burke Lakefront Airport
1501 North Marginal Road
Suite 200
Cleveland, OH 44114

RE: Proposed Extension to Runway 5L/23R
McGhee Tyson Airport

Dear Mr. Heckroth:

I am writing in response to your request for a rare species review of the proposed extension to Runway 5L/23R at McGhee Tyson Airport, located outside of Knoxville, Tennessee.

Reviews performed by the Tennessee Division of Natural Areas focus on potential impacts to rare species. Based on the information you provided and the location of the project, it is unlikely that this project would impact any state-listed plants or animals, provided that the BMPs were in place during construction.

Forests containing tree species with loose or exfoliating bark can be utilized as spring or summer maternity roosts by the federally endangered Indiana bat (*Myotis sodalis*). As the U.S. Fish and Wildlife Service has jurisdiction over federally listed animals, you may want to consult with them regarding the project if you have to remove trees for this project. Additionally, we ask that you coordinate this project with the Tennessee Wildlife Resources Agency (Rob Todd, rob.todd@tn.gov, 615-781-6577) to ensure that legal requirements for protection of state listed rare animals are addressed.

Should you have any questions, please do not hesitate to contact Stephanie at (615) 532-4799 or stephanie.ann.williams@tn.gov.

Sincerely,

Stephanie Williams

Stephanie A. Williams
Natural Heritage Data Manager

APPENDIX C

**Wetland and Waters of the US Report
McGhee Tyson Airport 5L/23R Runway Extension
Blount County, Tennessee**

MARCH 2016

Prepared for:



Metropolitan Knoxville Airport Authority
227 W. Jefferson Boulevard
County-City Building, Room 732
South Bend, IN 46601
Phone: 574-235-9626
Fax: 574-235-5057

Submitted by:



CHA Consulting, Inc.
Union Station / 300 South Meridian Street
Indianapolis, IN 46225
Phone: 317-780-7182
Fax: 317-788-0957

**Wetland and Waters of the US Report
McGhee Tyson Airport
Alcoa, Blount County, Tennessee
Investigated February 11, 2016
DRAFT SUBMITTED: March 18, 2016**

Introduction:

At the request of the Metropolitan Knoxville Airport Authority (MCAA), CHA conducted a Wetland and Waters of the US determination for the proposed extension to Runway 5L/23R at McGhee Tyson Airport (TYS) located in Alcoa, Tennessee.

The 134th Air Refueling Wing (134 ARW) is a unit of the Tennessee ANG stationed at McGhee Tyson Air National Guard Base located on the north side of TYS. If activated for federal service, the 134 ARW supports the United States Air Force Air Mobility Command. The 134 ARW's critical aircraft is the Boeing KC-135, which provides the aerial refueling capability for the United States Air Force. The KC-135 is 136 feet in length, has a wingspan of 130 feet, and a maximum takeoff weight of 322,500 pounds.

The need for the proposed project (or the "problem") is to accommodate the length requirements for the Tennessee ANG's KC-135. According to the *Air National Guard Handbook 32-1084, Facility Space Standards*, the KC-135 requires a minimum of 10,000 feet for fully loaded mission aircraft (see Table 2-1: CATCODE 111-111). The existing Runway 5L/23R is published at 9,003 feet with a 500-foot paved overrun on both ends of the runway. The Tennessee ANG occasionally utilizes these overruns for departures; however, the overruns are currently marked as non-usable pavement with chevrons and therefore cannot be used in landing/takeoff calculations.

The purpose of the proposed action, or the solution to the identified problem, is to lengthen Runway 5L/23R by marking the existing non-usable runway pavement as "usable". This is achieved by removing the chevron markings beyond both landing thresholds and painting arrows. The paved overruns are currently being re-built as part of the on-going Runway 5L/23R Reconstruction Program. If these overruns are marked as usable pavement and standard Runway Safety Area (RSA) off each end can be achieved (1000' x 500'), Runway 5L/23R could be published at 10,000 feet for departures. By extending the usable runway length, the Tennessee ANG can fulfill its mission while complying with the Air National Guard requirements for the KC-135. The purpose of this investigation was to identify wetlands and waterways within and adjacent to the project area. A routine wetland delineation, per the *1987 Corps of Engineers Wetland Delineation Manual (Y-87-1)* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region* (April 2012) was conducted. This report details the findings of the investigation.

TYS is a small hub primary commercial service airport. The Airport is located approximately 12 miles south of downtown Knoxville bordered by the City of Louisville to the north and the City of Alcoa to the south. The airport property is generally defined by the CSX Railroad and Louisville Road to the west, Airbase and Callahan Roads to the north, Alcoa Highway to the east and West Hunt Road to the south. The specific proposed project area, as shown on the attached maps, is located off the southwestern end of the existing airport runways and is wholly contained within airport property. Approximately 200 acres of area was inspected.

Existing Data:

7.5 Minute USGS Quadrangle Map

The attached USGS Quadrangle Map was reviewed to determine the topography of the project area and drainage patterns within the project area (See Attached, USGS Map). The USGS map indicates the elevation peaks at 940 feet at the ends of the existing runways and slopes to the west to about 900 feet. A total of three existing constructed drainageways are located within the project area. These drainage ditches convey stormwater from the north (the existing Air National Guard facility) and the two existing runways to the east. All three drainage ditches discharge into a constructed detention basin that comprises the majority of the area inspected. No other waterways or drainage patterns were identified within the project area. The discharge from the detention basin flows overland to the west to a culvert under the existing railroad tracks, eventually reaching Proffitt Spring.

National Wetland Inventory Map

The U.S. Fish and Wildlife Service (USFWS) Wetland Mapper was reviewed for the presence of potential jurisdictional wetlands within the project area (See Attached, NWI Map). One PEM1C (palustrine, emergent, persistent, seasonally flooded) wetland was mapped within the project area. No other NWI wetlands were identified within or adjacent to the project area.

County Soil Survey Map

The Natural Resources Conservation Service Web Soil Survey was reviewed to determine soil classification within the project area (See Attached, Soil Map). Seven soil types were identified within the project area (Table 1). As noted, there were no soils on the site identified as a fully hydric soil.

Table 1. Soil Summary

Soil Type	Drainage Rating	Hydrology	Depth to Water Table	Hydric
Airport (AIRPT)	N/A	N/A	N/A	N/A
Decatur silty clay loams, varying slopes (Dk, Dl, Dm)	Well drained	none	>6'	Not
Dewey Silty clay loams, varying slopes (Ds, Dt, Du,)	Well drained	none	>6'	Not
Emory silt loam, gently sloping phase (Eb)	Well drained	none	>6'	Not
Dunmore silty clay loams, varying slopes (Daa, Dab, Dac)	Well drained	none	>6'	Not
Greendale silt loam, gently sloping phase (Ga)	Well drained	none	>6'	Not
Minvale silt loam, gently sloping phase (Mc)	Well drained	none	>6'	Not

Flood Map

Floodplain information was obtained from the Flood Insurance Rate Maps (FIRM) produced by the Federal Emergency Management Agency (See Attached, FIRM Map). Due to the existing

stormwater detention basin, a portion of the Floodway of Proffitt Spring Floodzone A is located within the project area.

Methodology:

The project area was analyzed using methods outlined in the *1987 Corps of Engineers Wetland Delineation Manual (Y-87-1)* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region* (April 2012). These manuals require wetland boundaries to be delineated using a 3-parameter approach: hydrophytic vegetation, hydric soils, and wetland hydrology.

Hydrophytic Vegetation

This criterion is met by a dominance of visually sampled wetland plant species (for areas less than five acres). The indicator status of plant species is based on the estimated probabilities of that species occurring in wetland conditions. The indicator status categories are defined as follows.

1. Obligate wetland plants (OBL) almost always occur (estimated probability >99%) in a wetland under natural conditions.
2. Facultative wetland plants (FACW) usually occur in wetlands (estimated probability 67-99%), but occasionally are found in non-wetlands
3. Facultative plants (FAC) are equally likely to occur in wetland or non-wetlands (estimated probability 34-66%)
4. Facultative upland plants (FACU) usually occur in non-wetlands (estimated probability 67%-99%), but occasionally are found in wetlands (estimated probability 1-33%)
5. Obligate upland plants (UPL) almost always occur (estimated probability >99%) in non-wetlands under natural conditions.

Plants defined as OBL, FACW and FAC are considered wetland species. The percentage of the dominant wetland species in each vegetation layer determined the hydrophytic status of the plant community. If greater than 50 percent of the dominant plants are in the categories OBL, FACW, or FAC, the area is considered to have wetland vegetation.

Hydric Soils

This criterion is met with the presence of soils flooded for a long duration or very long duration during the growing season, all histosols (organic soils) except folists (organic soils formed from fallen foliage) and somewhat poorly drained to poorly drained soils with a water table between **the surface and 12" inches below the soil surface. Anaerobic conditions created by repeated or** prolonged saturation or flooding result in permanent changes in soil color and chemistry, which are used to determine the presence of hydric soils. Field indicators include color, mottling, gleying and sulfidic odor. Soil color is an indicator of hydric conditions: gleyed soils, soil with a matrix chroma of two or less with mottles, or a matrix chroma of one without mottles are typical indicators of hydric soils.

Wetland Hydrology

Typically, the presence of water for a week or more during the growing season creates anaerobic conditions. Anaerobic conditions lead to the prevalence of wetland vegetation. Hydrology is controlled by such factors as rainfall patterns, local geology and topography, soil type, local

water table, and drainage. Primary indicators of wetland hydrology include surface water, high water table, saturation, water marks, sediment deposits, drift deposits, algal mat or crust, iron deposits, inundation visible on aerial imagery, sparsely vegetated concave surface, water-stained leaves, aquatic fauna, true aquatic plants, hydrogen sulfide odor, oxidized rhizospheres on living roots, presence of reduced iron, recent iron reduction in tilled soils, thin muck surface and gauge or well data. Secondary indicators include surface soil cracks, drainage patterns, dry-season water table, crayfish burrows, saturation visible on aerial imagery, stunted or stressed plants, geomorphic position and the FAC-Neutral test. A single primary indicator or two secondary indicators are necessary to determine the presence of wetland hydrology.

Utilization of Criteria

All three criteria must be present for a site to be considered a regulated wetland. Representative sites are field inspected to document vegetative communities present, soil profiles to 20 inches or more, and hydrology. If the three criteria are met, then an upland point would be recorded to determine the boundary of the wetland area. The wetland is then marked with bright color flagging tied to woody vegetation or staked with lath and the boundary is surveyed.

Field Reconnaissance:

CHA staff conducted a field investigation on February 12, 2016 to determine the presence of wetlands and waters of the US within the proposed project area. Data points were taken when the ability to meet one or more criteria was apparent and recorded on a standardized Data Form (attached). Ground level and aerial photographs are attached.

Wetlands

Data Point 1:

Data Point 1 (DP-1) was located in the northwest portion of the detention basin approximately 30 feet from the existing water control structure. The only vegetation observed at this data point was *Lysimachia nummularia* (creeping jenny, FACW). This resulted in the data point meeting both the dominance and the prevalence index tests, indicating that hydrophytic vegetation was present. Two primary indicators of hydrology, water stained leaves and drift deposits were observed, indicating the presence of wetland hydrology. The soil survey did not reveal the presence of any hydric soil indicators, including any indicators associated with either Piedmont Floodplain soils or Red Parent Material soils. The absence of hydric soils indicates that DP-1 was not located within a wetland.

Data Point 2:

Data Point 2 (DP-2) was located approximately 250 feet south of DP-1, and was within the mapped NWI wetland. The dominant vegetation species was *Lysimachia nummularia* (creeping jenny, FACW). This resulted in the data point meeting both the dominance and the prevalence index tests, indicating that hydrophytic vegetation was present. DP-2 also met the hydrology criteria, due to the presence of both water stained leaves and drift deposits. However, the soil profile did not demonstrate any indicators of hydric soils, indicating that DP-2 was not located within a wetland.

Data Point 3:

Data Point 3 (DP-3) was located to the west of DP-1 approximately 10 feet upslope from the base of the detention basin. The dominant vegetation was *Festuca arundinacea* (tall fescue, FACU). Neither the dominance nor the prevalence index tests were met, indicating that hydrophytic vegetation was not present. The data point also failed to meet either the hydrology or hydric soil criteria, indicating that DP-3 was not located within a wetland.

Data Point 4 (Wetland C):

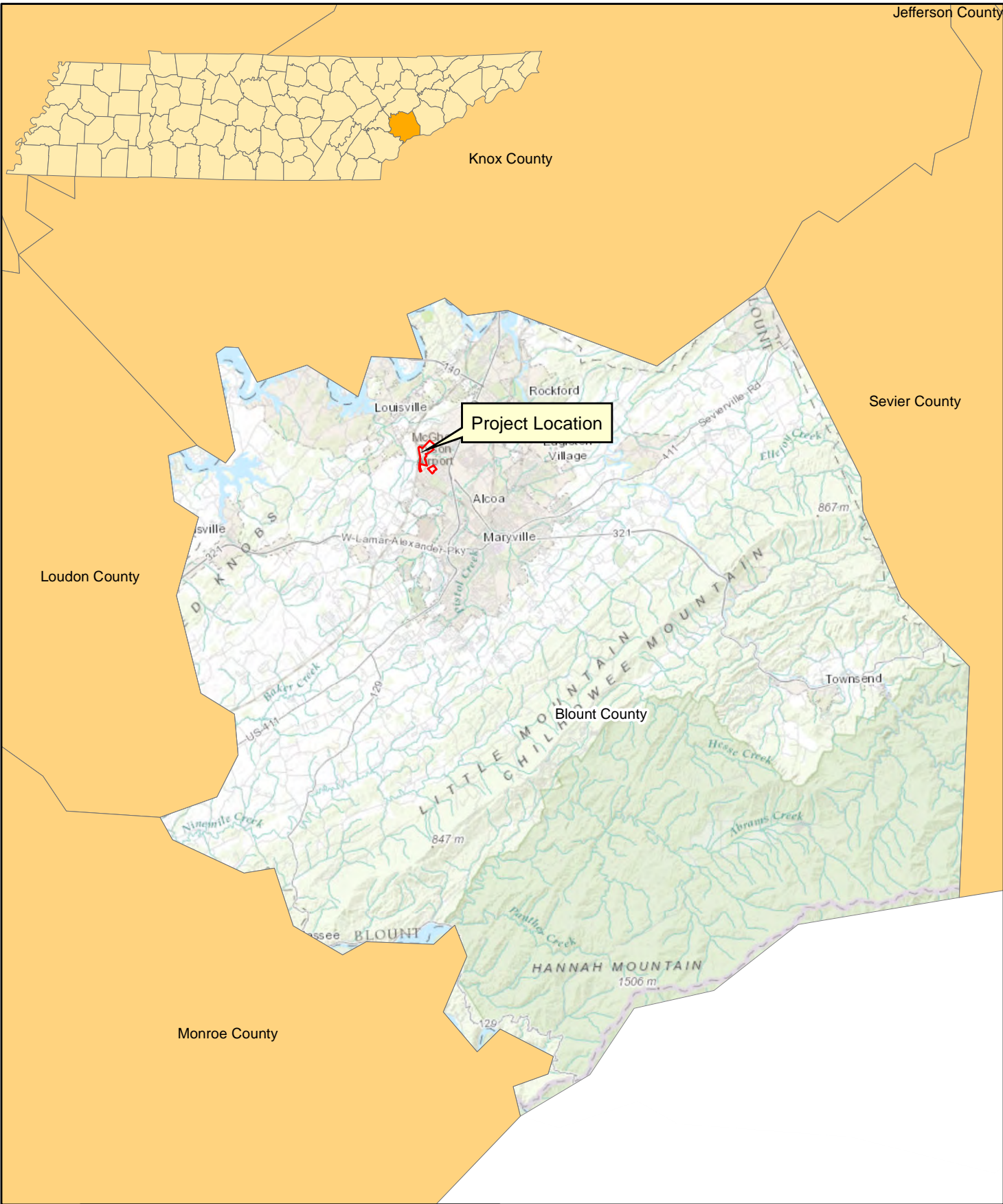
Other Waters

A total of three drainage ditches are located within the project area. All of these drainageways terminate in the existing detention basin, with all identifiable channel characteristics (including bed and bank, and an Ordinary High Water Mark) terminating at the detention basin. Estimated detention time is approximately 24 hours for a 100 year rain event. During the field investigation, no flow was observed in any of the drainage ditches, and no overland flow through the detention basin was observed. Ground level photos of these areas have been included with this report.

Conclusions:

No wetland areas were determined to be present within the proposed project area. The existing drainageways located within the project area did not possess a contiguous defined bend and bank, or Ordinary High Water Mark through the existing detention basin, and therefore are unlikely to be considered jurisdictional.

Please note that the final determination of jurisdictional waters is ultimately made by the USACE and this report is our best judgment based on the guidelines set forth by the USACE.



Project Location

Exhibit 1 - State Location Map

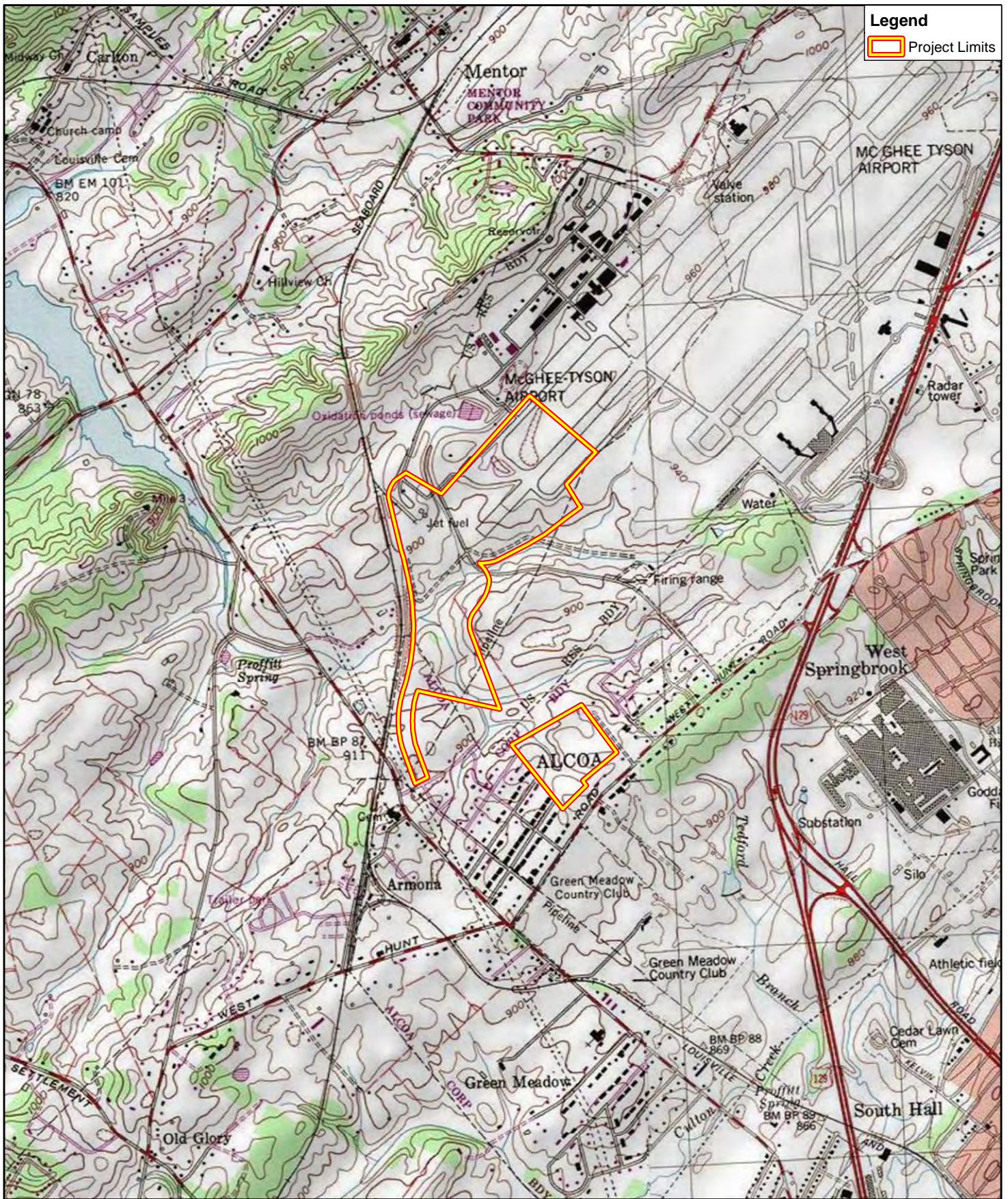
**McGhee Tyson Airport
Wetland and Waters of the US Determination
Alcoa, Blount County, TN**






Scale 1" = 25000'

**CHA No.
30377**

*County boundaries and transportation network
courtesy of Environmental Systems Research Institute (ESRI)*



Legend
 Project Limits

	 CIA design/construction solutions	<p align="center">USGS Project Location Map</p> <p align="center">McGhee Tyson Airport Wetland and Waters of the US Determination Alcoa, Blount County, TN</p>



Legend

- Project Location
- NWI Wetlands

NWI Wetlands Map

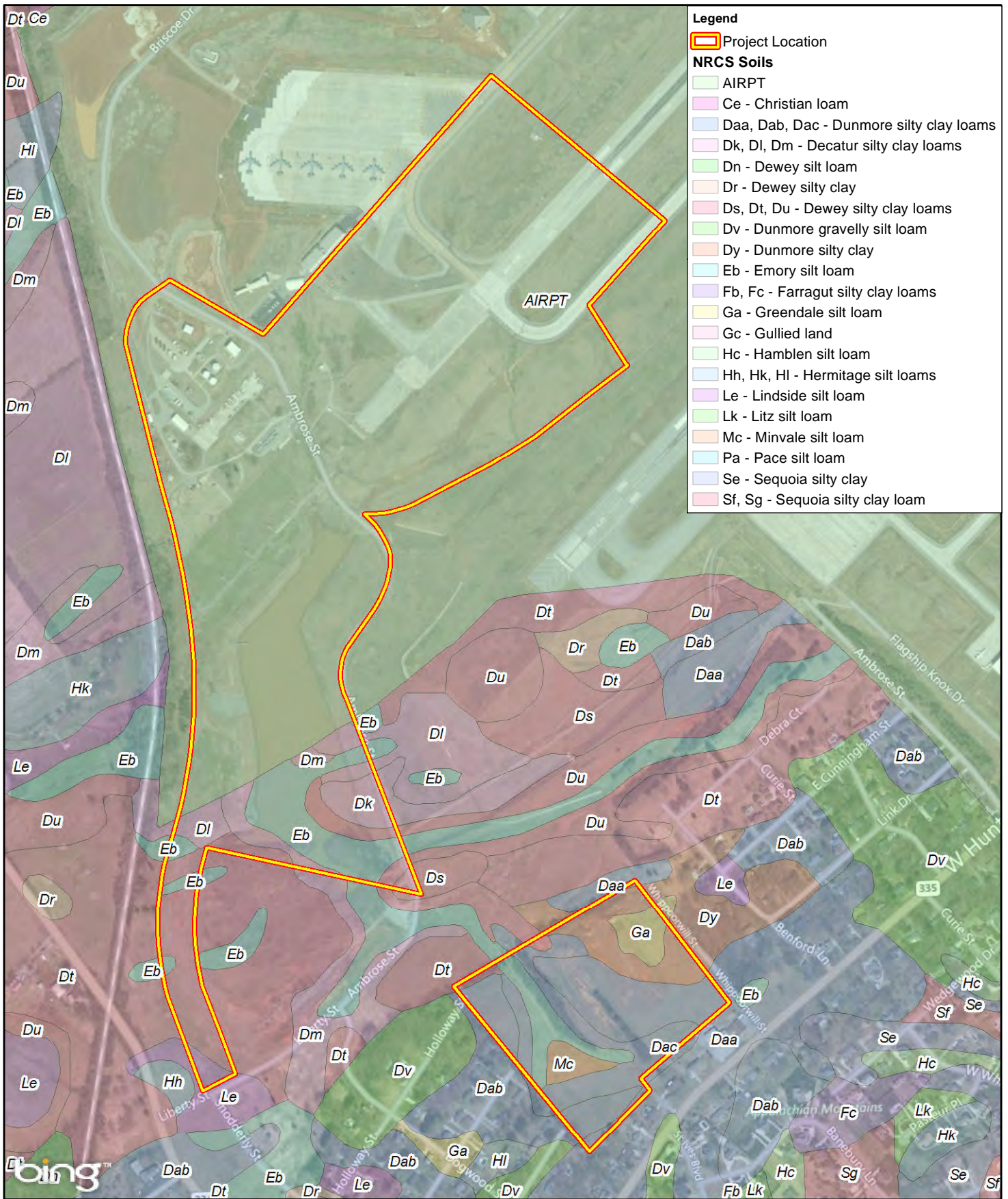
McGhee Tyson Airport
 Wetland and Waters of the US Determination
 Alcoa, Blount County, TN



Scale 1" = 1000'

CHA No.
30377

*Image Courtesy of USGS and of the IndianaMap Earthstar Geographics SIO
 © 2014 Nokia © Photo Date: 2014 NWI Wetland data courtesy of the
 National Wetlands Inventory produced by the U.S. Fish and Wildlife Service*



Legend

- Project Location
- NRCS Soils**
- AIRPT
- Ce - Christian loam
- Daa, Dab, Dac - Dunmore silty clay loams
- Dk, Dl, Dm - Decatur silty clay loams
- Dn - Dewey silt loam
- Dr - Dewey silty clay
- Ds, Dt, Du - Dewey silty clay loams
- Dv - Dunmore gravelly silt loam
- Dy - Dunmore silty clay
- Eb - Emory silt loam
- Fb, Fc - Farragut silty clay loams
- Ga - Greendale silt loam
- Gc - Gullied land
- Hc - Hamblen silt loam
- Hh, Hk, Hl - Hermitage silt loams
- Le - Lindsie silt loam
- Lk - Litz silt loam
- Mc - Minvale silt loam
- Pa - Pace silt loam
- Se - Sequoia silty clay
- Sf, Sg - Sequoia silty clay loam

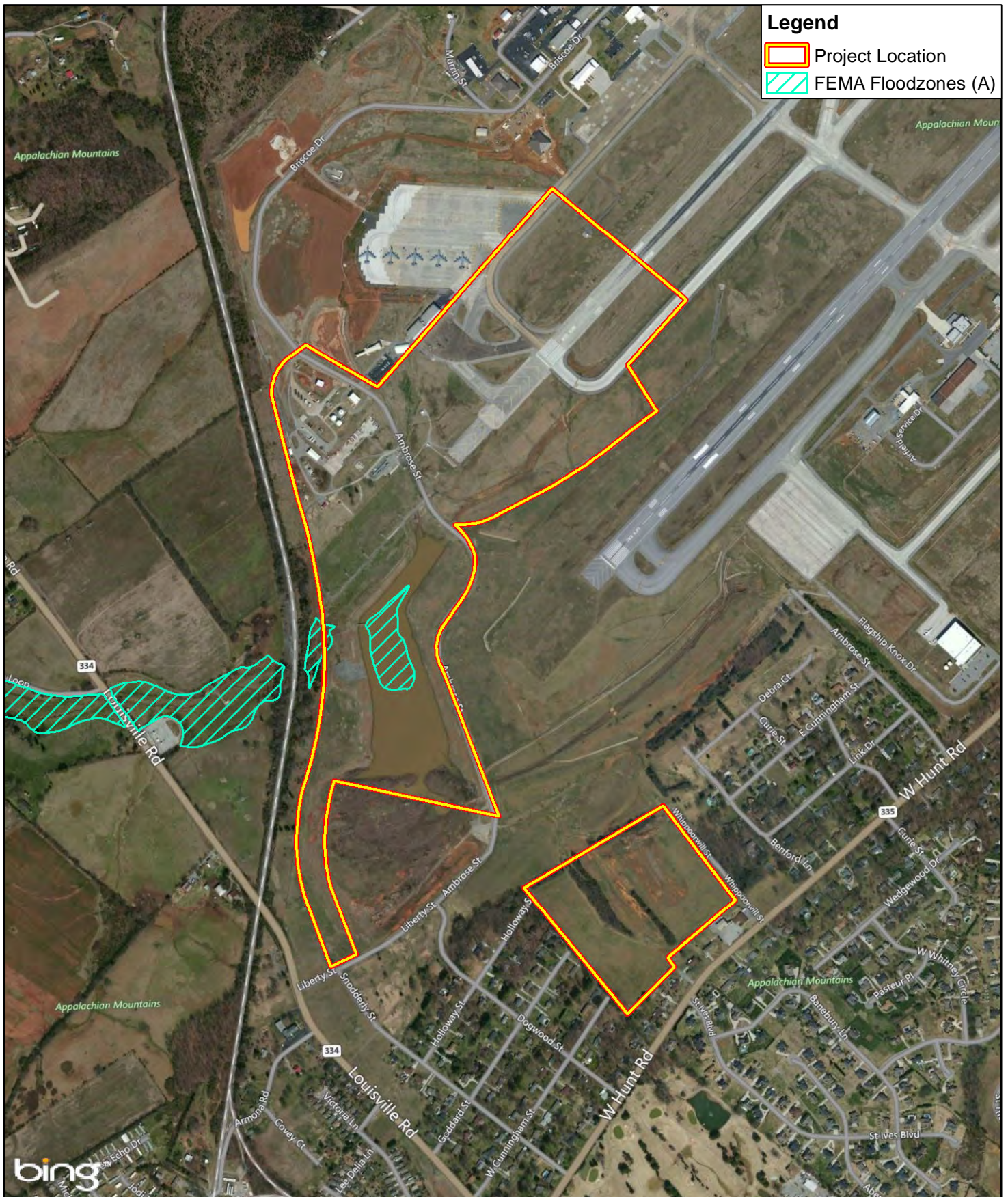


NRCS Soils Map
McGhee Tyson Airport
Wetland and Waters of the US Determination
Alcoa, Blount County, TN

Scale 1" = 1000'

CHA No.
30377

*Image Courtesy of USGS and the Indiana Map
 Earthstar Geographics SIO © 2014 Nokia © - Photo Date: 2014
 Soil Data Courtesy of the Natural Resource Conservation Service*



bing



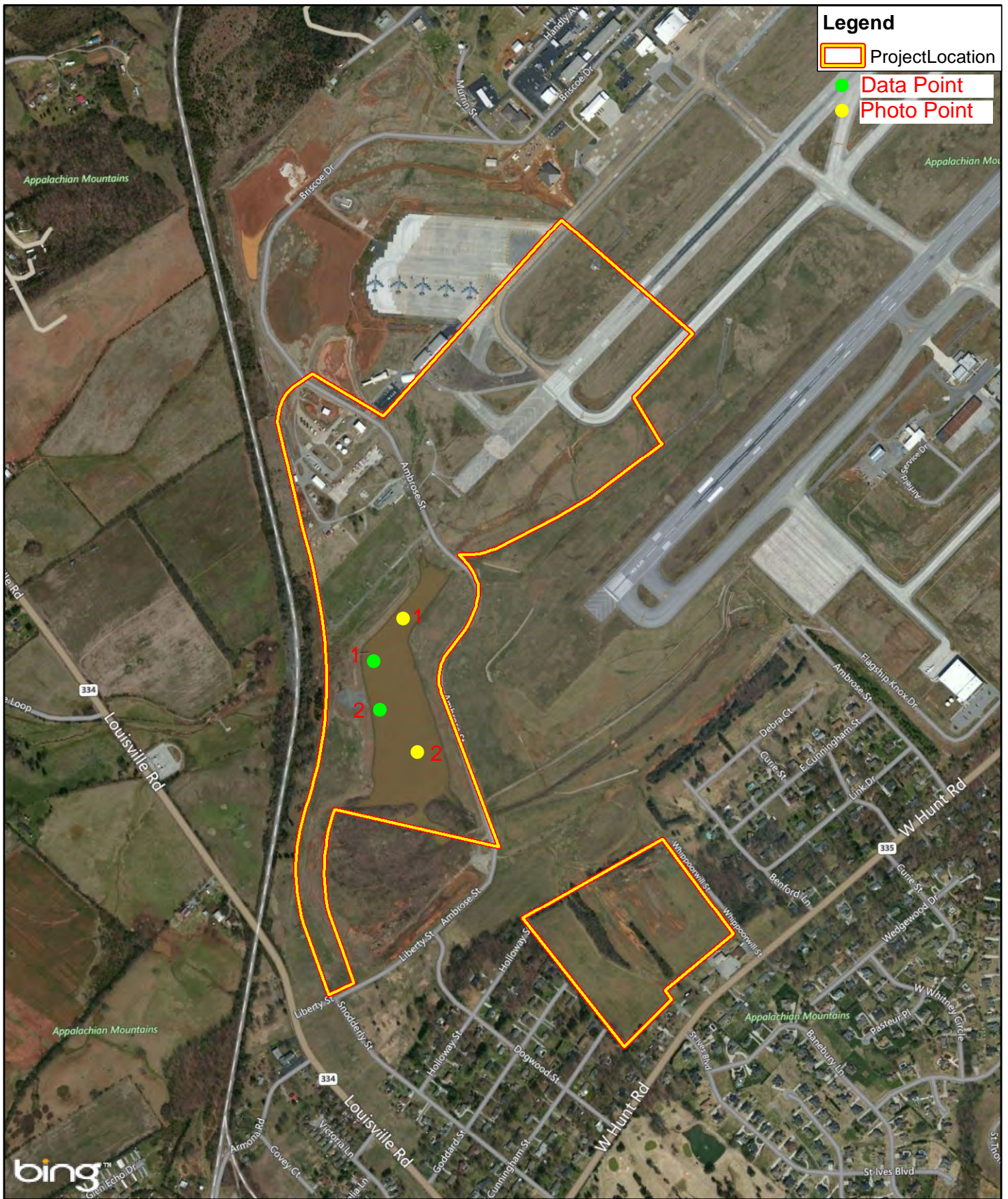
CHA
design/construction solutions

Scale 1" = 1000'

CHA No.
30377

FEMA Floodzone Map
McGhee Tyson Airport
Wetland and Waters of the US Determination
Alcoa, Blount County, TN

Image Courtesy of USGS and of the IndianaMap Earthstar
Geographics SIO © 2014 Nokia © - Photo Date: 2014
FEMA Floodzones Courtesy of Federal Emergency Mgmt Agency



Legend

- Project Location
- Data Point
- Photo Point



Aerial Location Map

**McGhee Tyson Airport
Wetland and Waters of the US Determination
Alcoa, Blount County, TN**

Scale 1" = 1000'

CHA No.
30377

Image Courtesy of USGS and of the IndianaMap
Earthstar Geographics SIO © 2014 Nokia ©
Photo Date: 2014

Photographs:



Photo 1: DP-1; Soil Pit



Photo 2: DP-1; looking east



Photo 3: DP-1; looking west

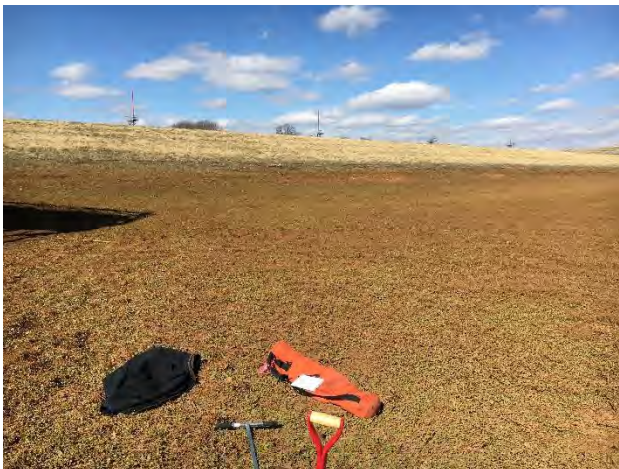


Photo 4: DP-1; looking north



Photo 5: DP-1; looking south



Photo 6: DP-2; Soil Pit



Photo 7: DP-2; looking north



Photo 8: DP-2; looking east



Photo 9: DP-2; looking south



Photo 10: DP-2; looking west



Photo 11: Photo Point 1; looking east



Photo 12: Photo Point 1; looking west



Photo 13: Photo Point 2; looking southeast



Photo 14: Photo Point 2; looking northwest

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: McGhee-Tyson Airport City/County: Alcoa, Blount County Sampling Date: 2/11/16
 Applicant/Owner: McGhee-Tyson Airport State: TN Sampling Point: DP-1
 Investigator(s): Simon Davies Section, Township, Range: _____
 Landform (hillslope, terrace, etc.) _____ Local relief (concave, convex, none): none Slope (%) 1
 Subregion (LLR or MLRA) _____ Lat: _____ Long: _____ Datum: NAD 83
 Soil Map Unit Name: AIRPT NWI classification: _____
 Are climatic/hydrologic conditions on the site typical for this time of year? Yes Y No _____ (IF no, explain in remarks.)
 Are Vegetation, _____ soils, _____ or hydrology _____ significantly disturbed? Are "Normal Circumstances" Present? _____
 Are Vegetation, _____ soils, _____ or hydrology _____ naturally problematic? (if needed, explain any answers in Remarks.)

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland?	
Hydric Soil Present?	Yes _____	No <u>X</u>	Yes _____	No <u>X</u>
Wetland Hydrology Present?	Yes <u>X</u>	No _____		
Remarks:				

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (Minimum of one is required; check all that apply)		Secondary Indicators (minimum of two required)
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> True Aquatic Plants (B14)	<input type="checkbox"/> Surface Soil Cracks(B6)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Sparsely Veg. Concave Surface (B8)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Moss Trim Lines (B16)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input checked="" type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Algal Mat or Crust (B4)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)		<input type="checkbox"/> Geomorphic Position (D2)
<input checked="" type="checkbox"/> Water Stained leaves (B9)		<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Aquatic Fauna (B13)		<input type="checkbox"/> Microtopographic Relief (D4)
		<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations:	
Surface water Present? Yes: _____ No: <u>X</u> Depth: _____	Wetland Hydrology Present? Yes <u>X</u> No _____
Water Table Present? Yes: _____ No: <u>X</u> Depth: _____	
Saturation Present? Yes: _____ No: <u>X</u> Depth: _____ (Includes Capillary Fringe)	

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Area serves as short term stormwater detention basin for airfield. Retention time is less than 24 hours.

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

VEGETATION (Five Strata)- Use scientific names of plants

Sampling Point DP-1

		Absolute % Cover	Dominant Species?	Indicator Status	
Tree Stratum	Plot size: _____				Dominance Test Worksheet: Number of Dominant Species that are OBL, FACW, OR FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata <u>1</u> (B) Percent of Dominant Species that are OBL, FACW, OR FAC <u>100%</u> (A/B)
50% of total cover <u>0</u>		<u>0</u> = Total cover	<u>0</u> 20% of total cover		
Sapling Stratum	Plot size: _____				Prevalence Index Worksheet: Total % Cover of: Multiply by: OBL species <u>1</u> x 1 = <u>1</u> FACW species _____ x 2 = <u>0</u> FAC species _____ x 3 = <u>0</u> FACU species _____ x 4 = <u>0</u> UPL species _____ x 5 = <u>0</u> Totals <u>1</u> (A) <u>1</u> (B) Prevalence Index = B/A = <u>1</u>
50% of total cover <u>0</u>		<u>0</u> = Total cover	<u>0</u> 20% of total cover		
Shrub Stratum	Plot size: _____				Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Rapid Test <input checked="" type="checkbox"/> Dominance Test is >50% <input checked="" type="checkbox"/> Prevalence Index ≤ 3.0* Morphological Adaptations* (Provide supporting data in Remarks or on separate sheet) Problematic Hydrophytic Vegetation (explain)
50% of total cover <u>0</u>		<u>0</u> = Total cover	<u>0</u> 20% of total cover		
Herb Stratum	Plot size: _____				Definitions of Five Vegetation Strata: Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH) Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height. Woody vine - All woody vines, regardless of height.
<i>Lysimachia nummularia</i>		50	YES	FACW	
50% of total cover _____		<u>50</u> = Total cover	<u>10</u> 20% of total cover		
Woody Vine Stratum	Plot size: _____				Hydrophytic Vegetation Present? Yes <u>X</u> No _____
50% of total cover <u>0</u>		<u>0</u> = Total cover	<u>0</u> 20% of total cover		

Remarks: (Include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

SOIL

Sampling Point DP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Location ²		
0-8"	2.5 YR 3/6	100					clay loam	
9-10"	7.5 YR 5/1	98	2.5 YR 4/6	2	C	M	clay loam	
10-18"	2.5 YR 4/6	100					clay loam	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked sand grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils*:
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Dark Surface (S7)	<input type="checkbox"/> 2 cm Muck (A10) (MLRA 147)
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Polyvalue Below Surface (S8) (MLRA 147, 148)	<input type="checkbox"/> Coast Prairie Redox (A16)(MLRA 147, 148)
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Thin Dark Surface (S9) (MLRA 147, 148)	<input type="checkbox"/> Piedmont Floodplain Soils (F19)
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> (MLRA 136,147)
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)
<input type="checkbox"/> 2 cm Muck (A10) (LRR N)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)
<input type="checkbox"/> Depleted Below Dark surface (A11)	<input type="checkbox"/> Depleted Dark Surface (F7)	
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Depressions (F8)	
<input type="checkbox"/> Sandy Mucky Mineral (S1)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR N, MLRA 136)	
<input type="checkbox"/> (LLR N, MLRA 147, 148)	<input type="checkbox"/> Umbric Surface (F13) (MLRA 136, 122)	
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 148)	
<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> Red Parent Material (F21) (MLRA 127, 147)	
<input type="checkbox"/> Stripped matrix (S6)		

*Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):	Hydric Soil Present?
Type: _____	Yes _____ No X _____
Depth (in): _____	

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: McGhee-Tyson Airport City/County: Alcoa, Blount County Sampling Date: 2/11/16
 Applicant/Owner: McGhee-Tyson Airport State: TN Sampling Point: DP-2
 Investigator(s): Simon Davies Section, Township, Range: _____
 Landform (hillslope, terrace, etc.) _____ Local relief (concave, convex, none): none Slope (%) 1
 Subregion (LLR or MLRA) _____ Lat: _____ Long: _____ Datum: NAD 83
 Soil Map Unit Name: AIRPT NWI classification: _____
 Are climatic/hydrologic conditions on the site typical for this time of year? Yes Y No _____ (IF no, explain in remarks.)
 Are Vegetation, _____ soils, _____ or hydrology _____ significantly disturbed? Are "Normal Circumstances" Present? _____
 Are Vegetation, _____ soils, _____ or hydrology _____ naturally problematic? (if needed, explain any answers in Remarks.)

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland?	
Hydric Soil Present?	Yes _____	No <u>X</u>	Yes _____	No <u>X</u>
Wetland Hydrology Present?	Yes <u>X</u>	No _____		
Remarks:				

HYDROLOGY

Wetland Hydrology Indicators:		
<u>Primary Indicators (Minimum of one is required; check all that apply)</u>		<u>Secondary Indicators (minimum of two required)</u>
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> True Aquatic Plants (B14)	<input type="checkbox"/> Surface Soil Cracks(B6)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Sparsely Veg. Concave Surface (B8)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Moss Trim Lines (B16)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Dry-Season Water Table (C2)
<input checked="" type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Crayfish Burrows (C8)
<input type="checkbox"/> Algal Mat or Crust (B4)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)		<input type="checkbox"/> Geomorphic Position (D2)
<input checked="" type="checkbox"/> Water Stained leaves (B9)		<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Aquatic Fauna (B13)		<input type="checkbox"/> Microtopographic Relief (D4)
		<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations:				Wetland Hydrology Present? Yes <u>X</u> No _____
Surface water Present?	Yes: _____	No: <u>X</u>	Depth: _____	
Water Table Present?	Yes: _____	No: <u>X</u>	Depth: _____	
Saturation Present? (Includes Capillary Fringe)	Yes: _____	No: <u>X</u>	Depth: _____	

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Area serves as short term stormwater detention basin for airfield. Retention time is less than 24 hours.

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

VEGETATION (Five Strata)- Use scientific names of plants

Sampling Point DP-2

		Absolute % Cover	Dominant Species?	Indicator Status	
Tree Stratum	Plot size: _____				Dominance Test Worksheet: Number of Dominant Species that are OBL, FACW, OR FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata <u>1</u> (B) Percent of Dominant Species that are OBL, FACW, OR FAC <u>100%</u> (A/B)
	50% of total cover <u>0</u>	<u>0</u> = Total cover	<u>0</u> = 20% of total cover		
Sapling Stratum	Plot size: _____				Prevalence Index Worksheet: Total % Cover of: Multiply by: OBL species <u>1</u> x 1 = <u>1</u> FACW species _____ x 2 = <u>0</u> FAC species _____ x 3 = <u>0</u> FACU species _____ x 4 = <u>0</u> UPL species _____ x 5 = <u>0</u> Totals <u>1</u> (A) <u>1</u> (B) Prevalence Index = B/A = <u>1</u>
	50% of total cover <u>0</u>	<u>0</u> = Total cover	<u>0</u> = 20% of total cover		
Shrub Stratum	Plot size: _____				Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Rapid Test <input checked="" type="checkbox"/> Dominance Test is >50% <input checked="" type="checkbox"/> Prevalence Index ≤ 3.0* Morphological Adaptations* (Provide supporting data in Remarks or on separate sheet) Problematic Hydrophytic Vegetation (explain)
	50% of total cover <u>0</u>	<u>0</u> = Total cover	<u>0</u> = 20% of total cover		*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
Herb Stratum	Plot size: _____				Definitions of Five Vegetation Strata: Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH) Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height. Woody vine - All woody vines, regardless of height.
<i>Lysimachia nummularia</i>		50	YES	FACW	
	50% of total cover _____	<u>50</u> = Total cover	<u>10</u> = 20% of total cover		
Woody Vine Stratum	Plot size: _____				Hydrophytic Vegetation Present? Yes <u>X</u> No _____
	50% of total cover <u>0</u>	<u>0</u> = Total cover	<u>0</u> = 20% of total cover		

Remarks: (Include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

SOIL

Sampling Point DP-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
0-8"	2.5 YR 3/6	100				clay loam	
9-18"	2.5 YR 4/6	100				clay loam	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked sand grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils*:	
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Dark Surface (S7)	<input type="checkbox"/> 2 cm Muck (A10) (MLRA 147)	*Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Polyvalue Below Surface (S8) (MLRA 147, 148)	<input type="checkbox"/> Coast Prairie Redox (A16)(MLRA 147, 148)	
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Thin Dark Surface (S9) (MLRA 147, 148)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 136,147)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)	
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> 2 cm Muck (A10) (LRR N)	<input type="checkbox"/> Redox Dark Surface (F6)		
<input type="checkbox"/> Depleted Below Dark surface (A11)	<input type="checkbox"/> Depleted Dark Surface (F7)		
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Depressions (F8)		
<input type="checkbox"/> Sandy Mucky Mineral (S1) (LLR N, MLRA 147, 148)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR N, MLRA 136)		
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Umbric Surface (F13) (MLRA 136, 122)		
<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 148)		
<input type="checkbox"/> Stripped matrix (S6)	<input type="checkbox"/> Red Parent Material (F21) (MLRA 127, 147)		

Restrictive Layer (if observed):	Hydric Soil Present? Yes _____ No X _____
Type: _____	
Depth (in): _____	

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: McGhee-Tyson Airport City/County: Alcoa, Blount County Sampling Date: 2/11/16
 Applicant/Owner: McGhee-Tyson Airport State: TN Sampling Point: DP-3
 Investigator(s): Simon Davies Section, Township, Range: _____
 Landform (hillslope, terrace, etc.) hillslope Local relief (concave, convex, none): slope Slope (%) 10
 Subregion (LLR or MLRA) _____ Lat: _____ Long: _____ Datum: NAD 83
 Soil Map Unit Name: AIRPT NWI classification: _____

Are climatic/hydrologic conditions on the site typical for this time of year? Yes Y No _____ (IF no, explain in remarks.)

Are Vegetation, _____ soils, _____ or hydrology _____ significantly disturbed? Are "Normal Circumstances" Present? _____

Are Vegetation, _____ soils, _____ or hydrology _____ naturally problematic? (if needed, explain any answers in Remarks.)

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation present?	Yes _____	No <u>X</u>	Is the Sampled Area within a Wetland?	
Hydric Soil Present?	Yes _____	No <u>X</u>	Yes _____	No <u>X</u>
Wetland Hydrology Present?	Yes <u>X</u>	No _____		
Remarks:				

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (Minimum of one is required; check all that apply)

Secondary Indicators (minimum of two required)

- | | | |
|--|---|--|
| <input type="checkbox"/> Surface Water (A1) | <input type="checkbox"/> True Aquatic Plants (B14) | <input type="checkbox"/> Surface Soil Cracks(B6) |
| <input type="checkbox"/> High Water Table (A2) | <input type="checkbox"/> Hydrogen Sulfide Odor (C1) | <input type="checkbox"/> Sparsely Veg. Concave Surface (B8) |
| <input type="checkbox"/> Saturation (A3) | <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) | <input type="checkbox"/> Drainage Patterns (B10) |
| <input type="checkbox"/> Water Marks (B1) | <input type="checkbox"/> Presence of Reduced Iron (C4) | <input type="checkbox"/> Moss Trim Lines (B16) |
| <input type="checkbox"/> Sediment Deposits (B2) | <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) | <input type="checkbox"/> Dry-Season Water Table (C2) |
| <input checked="" type="checkbox"/> Drift Deposits (B3) | <input type="checkbox"/> Thin Muck Surface (C7) | <input type="checkbox"/> Crayfish Burrows (C8) |
| <input type="checkbox"/> Algal Mat or Crust (B4) | <input type="checkbox"/> Other (Explain in Remarks) | <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) |
| <input type="checkbox"/> Iron Deposits (B5) | | <input type="checkbox"/> Stunted or Stressed Plants (D1) |
| <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) | | <input type="checkbox"/> Geomorphic Position (D2) |
| <input checked="" type="checkbox"/> Water Stained leaves (B9) | | <input type="checkbox"/> Shallow Aquitard (D3) |
| <input type="checkbox"/> Aquatic Fauna (B13) | | <input type="checkbox"/> Microtopographic Relief (D4) |
| | | <input type="checkbox"/> FAC-Neutral Test (D5) |

Field Observations:

Surface water Present?	Yes: _____	No: <u>X</u>	Depth: _____	Wetland Hydrology Present? Yes <u>X</u> No _____
Water Table Present?	Yes: _____	No: <u>X</u>	Depth: _____	
Saturation Present? (Includes Capillary Fringe)	Yes: _____	No: <u>X</u>	Depth: _____	

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Area serves as short term stormwater detention basin for airfield. Retention time is less than 24 hours.

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

VEGETATION (Five Strata)- Use scientific names of plants

Sampling Point DP-3

		Absolute % Cover	Dominant Species?	Indicator Status		
Tree Stratum	Plot size: _____				Dominance Test Worksheet: Number of Dominant Species that are OBL, FACW, OR FAC: <u>0</u> (A) Total Number of Dominant Species Across All Strata <u>1</u> (B) Percent of Dominant Species that are OBL, FACW, OR FAC <u>0%</u> (A/B)	
	50% of total cover <u>0</u>	<u>0</u> = Total cover		<u>0</u> 20% of total cover		
Sapling Stratum	Plot size: _____				Prevalence Index Worksheet: Total % Cover of: Multiply by: OBL species _____ x 1 = <u>0</u> FACW species _____ x 2 = <u>0</u> FAC species _____ x 3 = <u>0</u> FACU species <u>1</u> x 4 = <u>4</u> UPL species _____ x 5 = <u>0</u> Totals <u>1</u> (A) <u>4</u> (B) Prevalence Index = B/A = <u>4</u>	
	50% of total cover <u>0</u>	<u>0</u> = Total cover		<u>0</u> 20% of total cover		
Shrub Stratum	Plot size: _____				Hydrophytic Vegetation Indicators: Rapid Test Dominance Test is >50% Prevalence Index ≤ 3.0* Morphological Adaptations* (Provide supporting data in Remarks or on separate sheet) Problematic Hydrophytic Vegetation (explain)	
	50% of total cover <u>0</u>	<u>0</u> = Total cover		<u>0</u> 20% of total cover	*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.	
Herb Stratum	Plot size: _____				Definitions of Five Vegetation Strata: Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH) Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height. Woody vine - All woody vines, regardless of height.	
<i>Festuca arundinacea</i>		100	YES	FACU		
	50% of total cover _____	<u>100</u> = Total cover		<u>20</u> 20% of total cover		
Woody Vine Stratum	Plot size: _____				Hydrophytic Vegetation Present? Yes _____ No <u>X</u>	
	50% of total cover <u>0</u>	<u>0</u> = Total cover		<u>0</u> 20% of total cover		

Remarks: (Include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

SOIL

Sampling Point DP-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (in)	Matrix Color		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
0-8"	2.5 YR 3/6	100					silty clay
9-18"	2.5 YR 4/6	100					silty clay

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked sand grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils*:	
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Dark Surface (S7)	<input type="checkbox"/> 2 cm Muck (A10) (MLRA 147)	*Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Polyvalue Below Surface (S8) (MLRA 147, 148)	<input type="checkbox"/> Coast Prairie Redox (A16)(MLRA 147, 148)	
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Thin Dark Surface (S9) (MLRA 147, 148)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 136,147)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)	
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> 2 cm Muck (A10) (LRR N)	<input type="checkbox"/> Redox Dark Surface (F6)		
<input type="checkbox"/> Depleted Below Dark surface (A11)	<input type="checkbox"/> Depleted Dark Surface (F7)		
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Depressions (F8)		
<input type="checkbox"/> Sandy Mucky Mineral (S1) (LLR N, MLRA 147, 148)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR N, MLRA 136)		
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Umbric Surface (F13) (MLRA 136, 122)		
<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 148)		
<input type="checkbox"/> Stripped matrix (S6)	<input type="checkbox"/> Red Parent Material (F21) (MLRA 127, 147)		

Restrictive Layer (if observed):	Hydric Soil Present? Yes _____ No <u>X</u> _____
Type: _____	
Depth (in): _____	

Remarks:

APPENDIX D

Runway Protection Zone Modified Land Use Analysis

**McGhee Tyson Airport
Alcoa, Tennessee**

Prepared for:

METROPOLITAN KNOXVILLE AIRPORT AUTHORITY

**U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION**

Prepared by:

CHA Consulting, Inc.



APRIL 2016

AIRPORT INFORMATION

Airport: McGhee Tyson Airport
Location: Knoxville, TN
LOC ID: TYS
Sponsor: Metropolitan Knoxville Airport Authority (MCAA)
Effectuated Runway: 5L-23R

RPZ Dimensions:

RPZ Dimension	5L		23R	
	Approach RPZ	Departure RPZ	Approach RPZ	Departure RPZ
Length (FT)	2500	1700	2500	1700
Inner Width (FT)	1000	500	1000	500
Outer Width (FT)	1750	1010	1750	1010
Area (AC)	78.914	29.465	78.914	29.465

Design Aircraft: D-IV (B757 / A300 Civilian) (KC135 Military)

Latest ALP: ALP Update currently under FAA review specifically for this project

Triggering Event: Proposed Extension to Runway 5L-23R from 9,003.5 feet to 10,000 feet

Additional length is required by the 134th Air Refueling Wing of the Tennessee Air National Guard (TN ANG for the KC 135 and the KC 46A. 504.5 feet added to the 23R Approach End and 492.0 feet added to the 5L Approach End.

RUNWAY EXTENSION ALTERNATIVES

Runway 5L-23R at McGhee Tyson Airport is 9,003.5 feet long and is bounded on the southwest by property owned and controlled by CSX Railroad, and on the northeast by private commercial development and Alcoa Highway. During the Runway 5L-23R Reconstruction Program Development completed in 2015, several alternatives to achieve the desired 10,000 feet runway were investigated. Options included do nothing, extending the runway to the southwest, extending to the northeast, and extending on both ends.

Do Nothing – This option does not support the need of a major tenant of the airport, a significant employer and economic generator of the Metro Knoxville Region, and a strategic asset of the US Air Force. Leaving the runway at 9,003.5 feet does not meet the operational criteria for the mission of the 134th Air Refueling Wing and **decreases** safety during operations of their critical aircraft. The TN ANG has agreed to fund the construction of the runway extension during the Runway 5L-23R reconstruction. MCAA supports the TN ANG with this desire provided the extension can be completed in a manner that is supported by the local community and the FAA.

Extending to the southwest requires off site borrow to construct the required safety area and creates approach obstruction concerns with existing high tension TVA power lines. Extending to the northeast encroaches on existing Wrights Ferry Road (N. Wright Road) and existing commercial real estate developments. Extending approximately 500 feet in both directions eliminates or greatly reduces the approach and community impacts of the runway extension.

To farther reduce community impacts, the Metropolitan Knoxville Airport Authority and the TN ANG agreed to keep the arrival thresholds for both 5L and 23R at their existing horizontal locations. The line of site and gradient correction work included with the runway reconstruction will raise the elevation of both runway ends. This compromise was achieved because the landing length requirement for the TN ANG aircraft is not as critical as the departure length. Using declared distances at this time to achieve 10,000 feet for TORA, TODA, and ASDA is acceptable to the MKAA and to the TN ANG. This compromise led to the preferred option to extend the runway 492 feet to the southeast (5L end) and 504.5 feet to the northeast (23R end), while utilizing displaced thresholds for arrivals on both ends. The proposed Future ALP depicting Runway 5L-23R at 10,000 feet with displaced thresholds on both ends is provided as Exhibit 1.

RPZ ANALYSIS

The proposed extension to Runway 5L-23R does not alter the location or shape of the Approach RPZ's on either end. The MKAA's decision to keep the arrival thresholds in their existing horizontal locations using displaced thresholds is the reason the Approach RPZ's are identical. There are no new land uses that are inconsistent with RPZ standards proposed within the Approach RPZ's.

The runway extensions do shift the Departure RPZ's equidistant with the proposed extensions (492 feet to the southwest and 504.5 feet to the northeast. On the southeast end (Runway 23R Departure RPZ) the runway extension and the extended runway safety area necessitates the relocation of the controlled airport access and operations known as Liberty Street. This road is only accessible by authorized personal with security clearance. The gates to the road are locked except when guards with the TN ANG man the entrance gate. Several alternatives were considered when selecting the preferred alignment of the replacement airport controlled roadway. The CSX railroad prohibits locating the replacement road outside of the RPZ, therefore the road was located as far from the runway end as considered reasonable considering environmental hazards with the TN ANG Landfill.

The stormwater management basin in the RPZ will be significantly reduced through the completion of the runway reconstruction and extension project.

The TNANG Leadership Training Course located in the Central Portion of the RPZ is removed along with the FAA Emergency Generator building. Other remaining land uses include TN ANG facilities for concrete washouts, the landfill, and equipment storage, and the CSX railroad. No remaining land used in the 5L Approach and 23R Departure RPZ contain concentrations of people. Exhibits 2 and 3 provide the existing and future conditions for the 5L Approach and 23R Departure RPZ's.

On the northeast end (Runway 5L Departure RPZ), the project area is bounded by the Airport Perimeter Road, and existing Wright's Ferry Road. The shift in the departure RPZ incorporates Airport Equipment Buildings and a Storage Area, along with approximately 3 acres of an auto dealership. The auto dealership is already within the existing 23R Approach RPZ and identified to be acquired in the long term. This property will not be acquired with this runway extension project. The Airport Equipment Buildings

have already been removed as part of the work completed in 2015, and the equipment storage area will be removed and grassed later in 2016.

The MKAA approached the City of Alcoa about closing Wright's Ferry Road in 2015 and the City was not receptive to the request at this time. The City of Alcoa is receptive to closing Wright's Ferry Road when TDOT completes the State Route 115 (US 129) Relocated Alcoa Highway project. According to TDOT's website, the relocation of State Route 115 (US 129/Alcoa Highway) consists of three roadway projects. Each project is currently in the Design phase. On August 8, 2011, the Federal Highway Administration (FHWA) approved the Finding of No Significant Impact (FONSI) for the relocation of State Route 115 (US 129/Alcoa Highway), completing the process in compliance with the National Environmental Policy Act (NEPA). This TDOT roadway improvement project is scheduled to begin construction within the next few years. Additional information can be found on the TDOT website:

<http://www.tn.gov/tdot/article/relocated-alcoa-highway-sr-115-update>

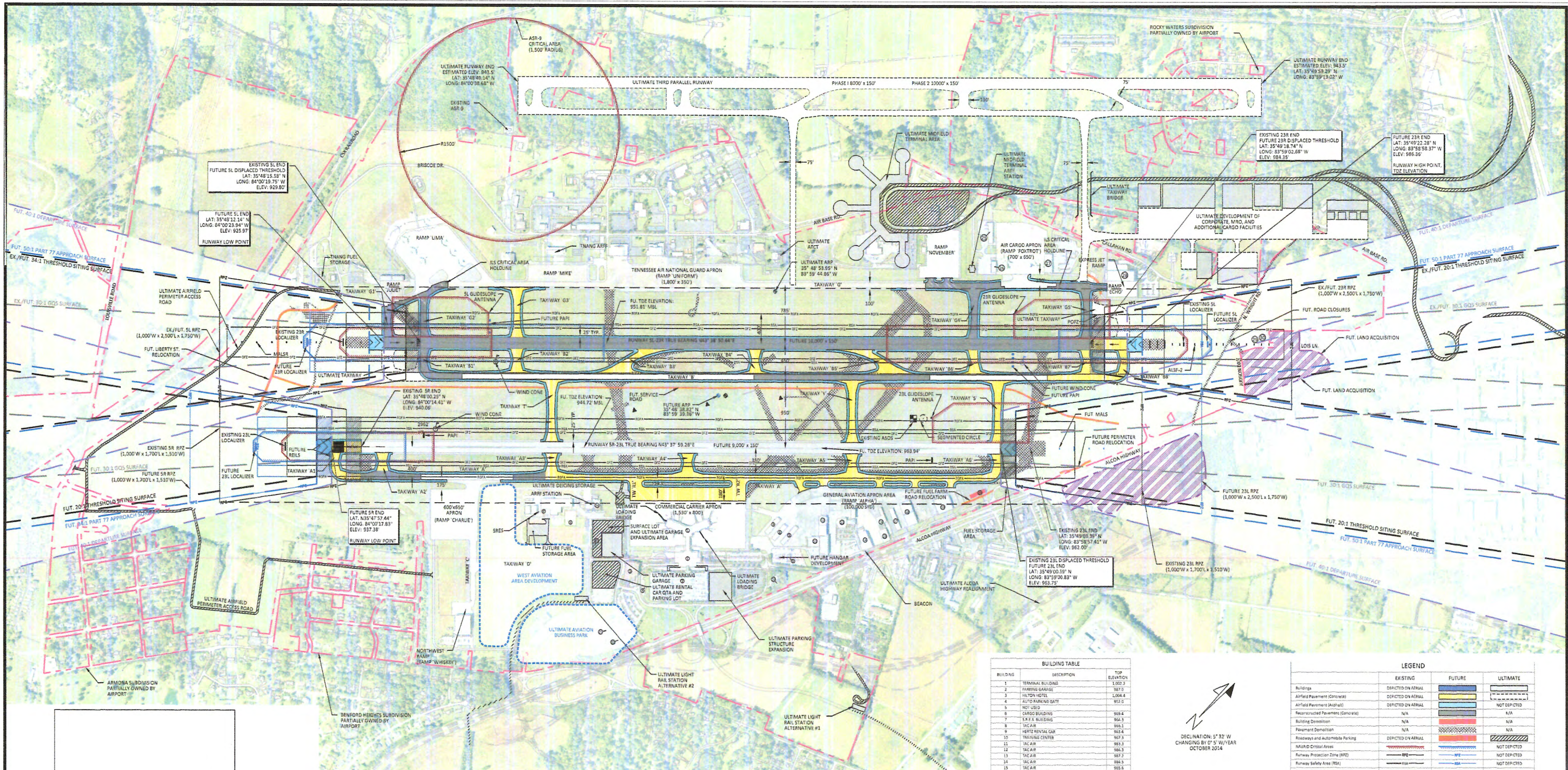
A segment of Callahan Road that includes the area within the RPZ has been closed permanently with the Runway 5L-23R reconstruction project.

Purchasing and relocating the commercial development between Wright's Ferry Road and Alcoa Highway is currently considered unreasonable due to community concerns. The MKAA will continue to monitor the desire of the property owner's to sell voluntarily and will pursue the purchase of the property if and when it becomes available. Relocating Alcoa Highway is considered unreasonable. The TDOT project to relocate Alcoa highway will significantly reduce the traffic on the portion of existing Alcoa Highway that is within the RPZ. Exhibits 4 and 5 provide the existing and future conditions for the 23R Approach and 5L Departure RPZ's.

Improvements to the RPZ's incorporated into the scope of the project are presented below:

Southwest End		
Improvement	5L Approach RPZ	23R Departure RPZ
Airport Controlled Access Road	Moved 400 feet farther from the Runway 5L End.	Moved 400 feet farther from the Runway 5L End.
Stormwater Management Basin	Reduced area from 11.5 to 1 acres	Removed
TN ANG Leadership Training Course	Removed	Removed
FAA Emergency Generator	Removed	Removed
Northeast End		
Improvement	23R Approach RPZ	5L Departure RPZ
FAA Storage Units	Removed	Not inside Departure RPZ
Callahan Road	Removed	Not inside Departure RPZ
Airport Equipment Buildings and Storage Area	Removed	Removed

In summary, the MKAA has incorporated improvements to the RPZ's on Runway 5L-23R as part of the reconstruction and extension project. The overall dimensions of the RPZ's do not change with the project and land uses are improved. No new incompatible land uses are introduced within the governing Approach RPZ dimension since the Departure RPZ's are fully contained within the Approach RPZ's.



**SPACE RESERVED FOR
FAA APPROVAL STAMP**

APPROVED
AIRPORT LAYOUT PLAN APPROVAL

DATE	AGENCY
	METROPOLITAN KNOXVILLE AIRPORT AUTHORITY
	FEDERAL AVIATION ADMINISTRATION
	TENNESSEE DEPARTMENT OF TRANSPORTATION

FAA DISCLAIMER
 "THE PREPARATION OF THIS DOCUMENT WAS FINANCED IN PART THROUGH AN AIRPORT IMPROVEMENT PROGRAM GRANT FROM THE FEDERAL AVIATION ADMINISTRATION (FAA) AS PROVIDED UNDER SECTION 47204 OF TITLE 49 UNITED STATES CODE. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THIS DOCUMENT BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED THEREIN NOR DOES IT INDICATE THAT ANY PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS."

BUILDING TABLE

BUILDING	DESCRIPTION	TOP ELEVATION
1	TERMINAL BUILDINGS	1,000.2
2	PARKING GARAGE	987.0
3	HILTON HOTEL	1,008.8
4	AUTO PARKING GATE	987.0
5	NOT USED	
6	CARGO BUILDINGS	969.4
7	OFFICE BUILDINGS	966.3
8	TAC AIR	966.2
9	HERTZ RENTAL CAR	963.4
10	TAC AIR	967.3
11	TAC AIR	969.3
12	TAC AIR	968.3
13	TAC AIR	967.3
14	TAC AIR	968.3
15	TAC AIR	965.6
16	TAC AIR	972.5
17	TAC AIR	974.4
18	TAC AIR	964.2
19	TAC AIR HANGAR	966.4
20	TAC AIR T-HANGAR (TO BE REMOVED)	974.3
21	AVIS RENTAL CAR	951.0
22	NATIONAL RENTAL CAR	947.6
23	AUTO PARKING GATE	912.9
24	ARRIVAL STATION	1007.4
25	DRILL	1,008.0
26	CONCRETE SERVICE	1,005.0
27	FEDERAL EXPRESS	1,002.0
28	CONVENTIONAL EXPRESS	1,022.0
29	EMERGENCY MAINTENANCE (TO BE REMOVED)	983.3
30	AIRPORT MAINTENANCE (TO BE REMOVED)	982.1



- NOTES:**
- THIS AIP UPDATED DECEMBER, 2013 ONLY INCLUDES UPDATES TO THE RUNWAY AND TAXIWAY SYSTEM BASED ON THE SCOPE OF THE AIRFIELD MODERNIZATION PROGRAM (AMP).
 - THE AMP TIMELINE IS DRIVEN BY THE CONDITION OF THE AIRFIELD PAVEMENTS.
 - FUTURE RUNWAY 51-23R MODIFICATIONS ARE SCHEDULED TO BEGIN IN 2015.
 - ONLY FUTURE AND UNCHANGED EXISTING AIRSPACE SURFACES AND OBSTACLE PROTECTION ZONE ARE DEPICTED. PLEASE SEE SHEET 4 "EXISTING AIRPORT LAYOUT PLAN" FOR DEPICTION OF EXISTING AIRSPACE SURFACES AND OZS.
 - DEPARTURE RUNWAY PROTECTION ZONES (RPZ) ARE NOT DEPICTED IF WITHIN THE APPROACH AREA FOR THAT RUNWAY END.

LEGEND

	EXISTING	FUTURE	ULTIMATE
Buildings	DEPICTED ON AERIAL	DEPICTED ON AERIAL	DEPICTED ON AERIAL
Airfield Pavement (Concrete)	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
Airfield Pavement (Asphalt)	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
Reconstructed Pavement (Concrete)	N/A	DEPICTED ON AERIAL	N/A
Building Demolition	N/A	DEPICTED ON AERIAL	N/A
Future Demolition	N/A	DEPICTED ON AERIAL	N/A
Roadways and Automobile Parking	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
Utility Obstacle Area	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
Runway Protection Zone (RPZ)	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
Runway Safety Area (RSA)	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
Runway Obstacle Free Area (ROFA)	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
Runway Obstacle Free Zone (OFZ)	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
Precision Obstacle Free Zone (POFZ)	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
35' Building Obstacle Line (BOL)	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
Alpen Reference Point (ARP)	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
Windrose	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
FAA Part 77 Approach Surface	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
Threshold Strip Approach Surface	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
TERPS GDS Surface	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
TERPS Surface	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED
Survey Markers	DEPICTED ON AERIAL	DEPICTED ON AERIAL	NOT DEPICTED

NO.	DATE	REVISION	BY	CHK	APPR

CH A Consulting, Inc.
 3008 Topside Business Park Drive
 Suite E
 Louisville, TN 37777
 www.chaconsulting.com

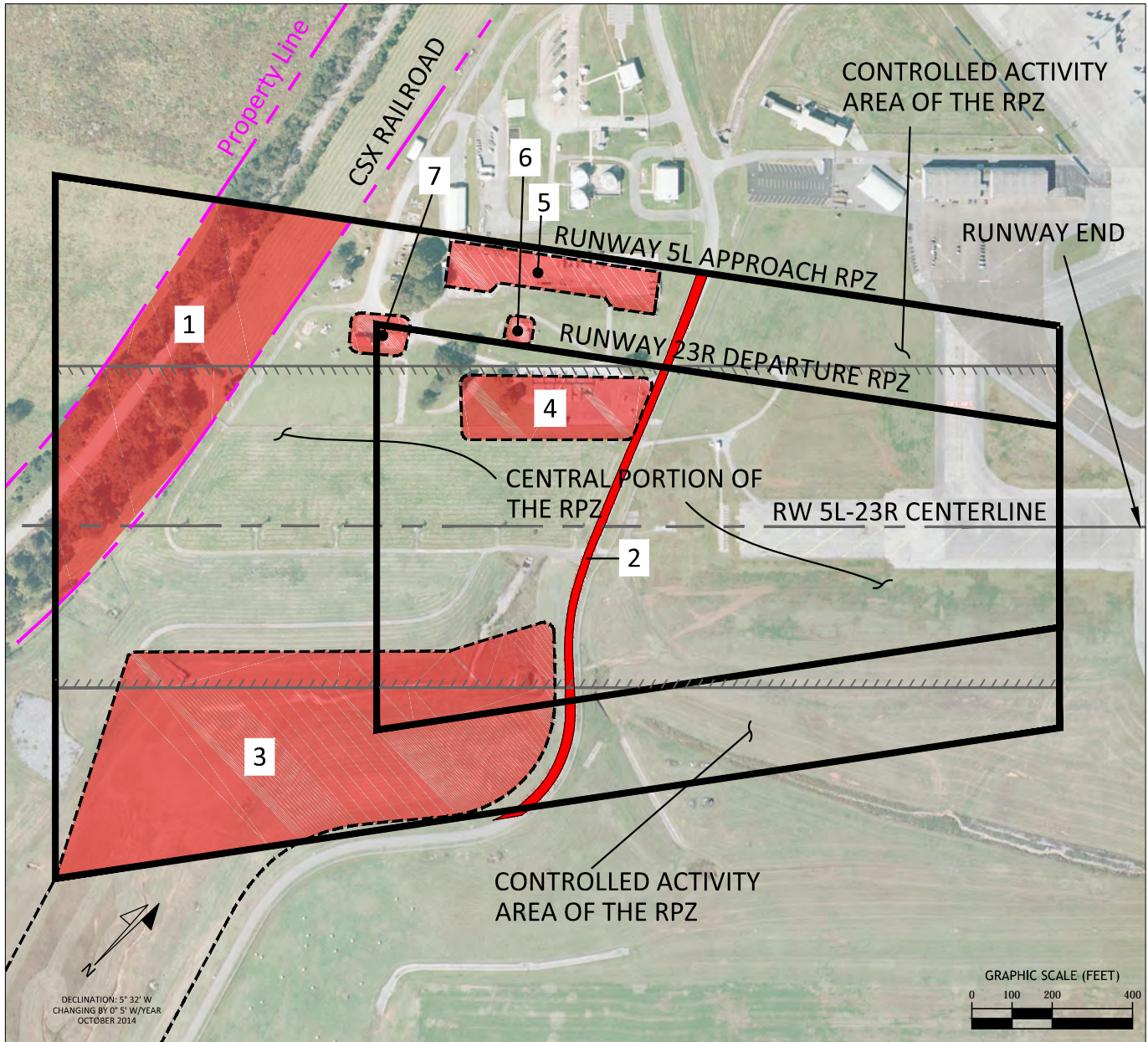
McGhee Tyson Airport
 METROPOLITAN
 KNOXVILLE
 AIRPORT
 AUTHORITY

PROJECT NAME: **McGHEE TYSON AIRPORT LAYOUT PLAN UPDATE**
 STATUS: **DRAFT**
 JOB NO: **30377** DATE: **JANUARY 2016**
EXHIBIT 1

McGHEE TYSON AIRPORT (TYS) KNOXVILLE, TN

EXHIBIT 2

RUNWAY 5L APPROACH RPZ - RUNWAY 23R DEPARTURE RPZ EXISTING CONDITIONS

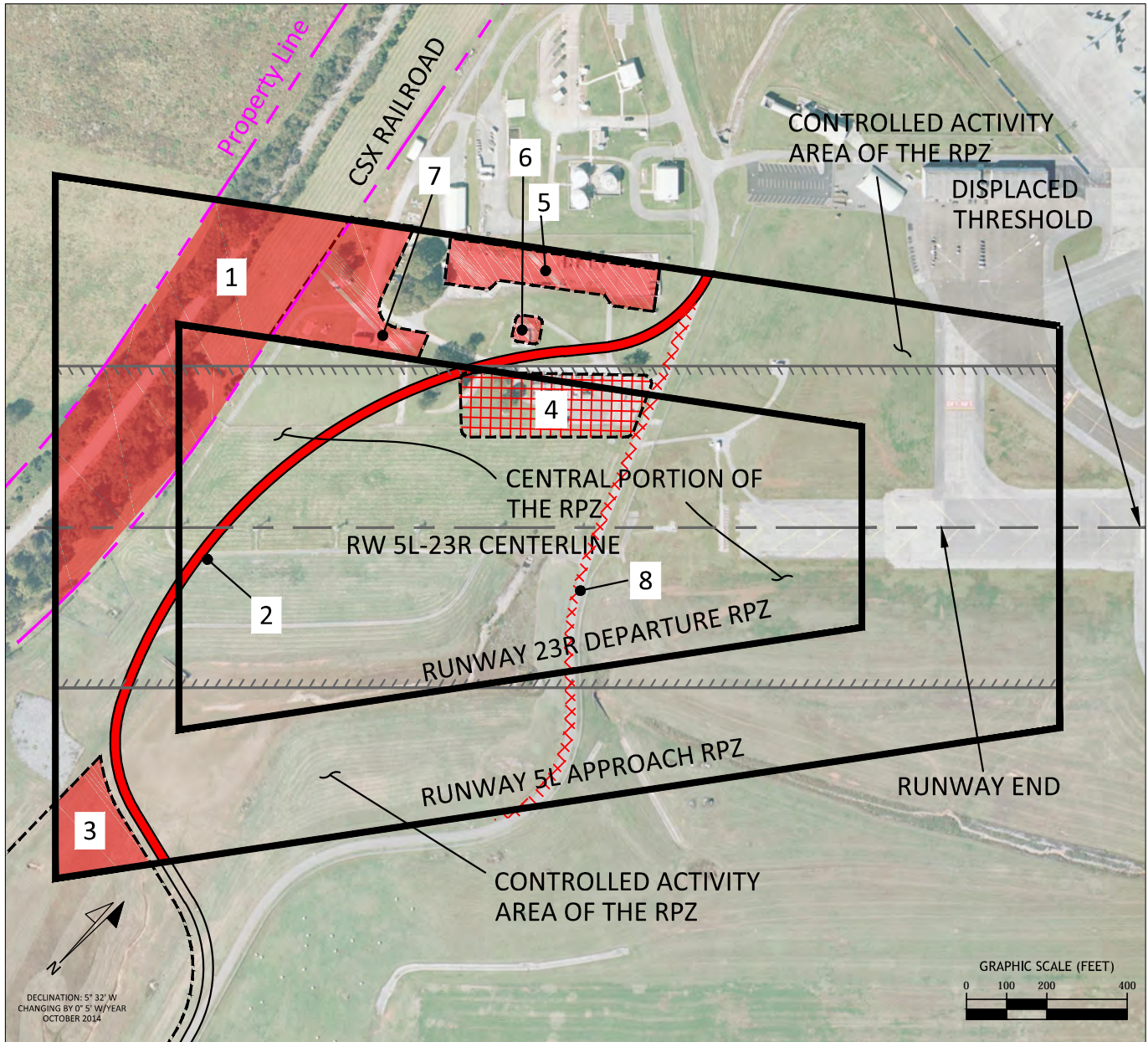


Existing RPZ Land Uses

- | | |
|--|---|
| <ul style="list-style-type: none">1. CSX Railroad Right-of-Way2. Airport Controlled Access & Operations Road (non-public) - Aprox. 1300' from RW end3. Stormwater Management Basin4. TN A.N.G. Leadership Training Course | <ul style="list-style-type: none">5. TN A.N.G. Aggregate & Electrical Equipment Storage6. FAA Emergency Generator7. TN A.N.G. Concrete Wash Pad and Oil/Water Separator |
|--|---|

McGHEE TYSON AIRPORT (TYS) KNOXVILLE, TN

EXHIBIT 3 RUNWAY 5L APPROACH RPZ - RUNWAY 23R DEPARTURE RPZ FUTURE CONDITIONS



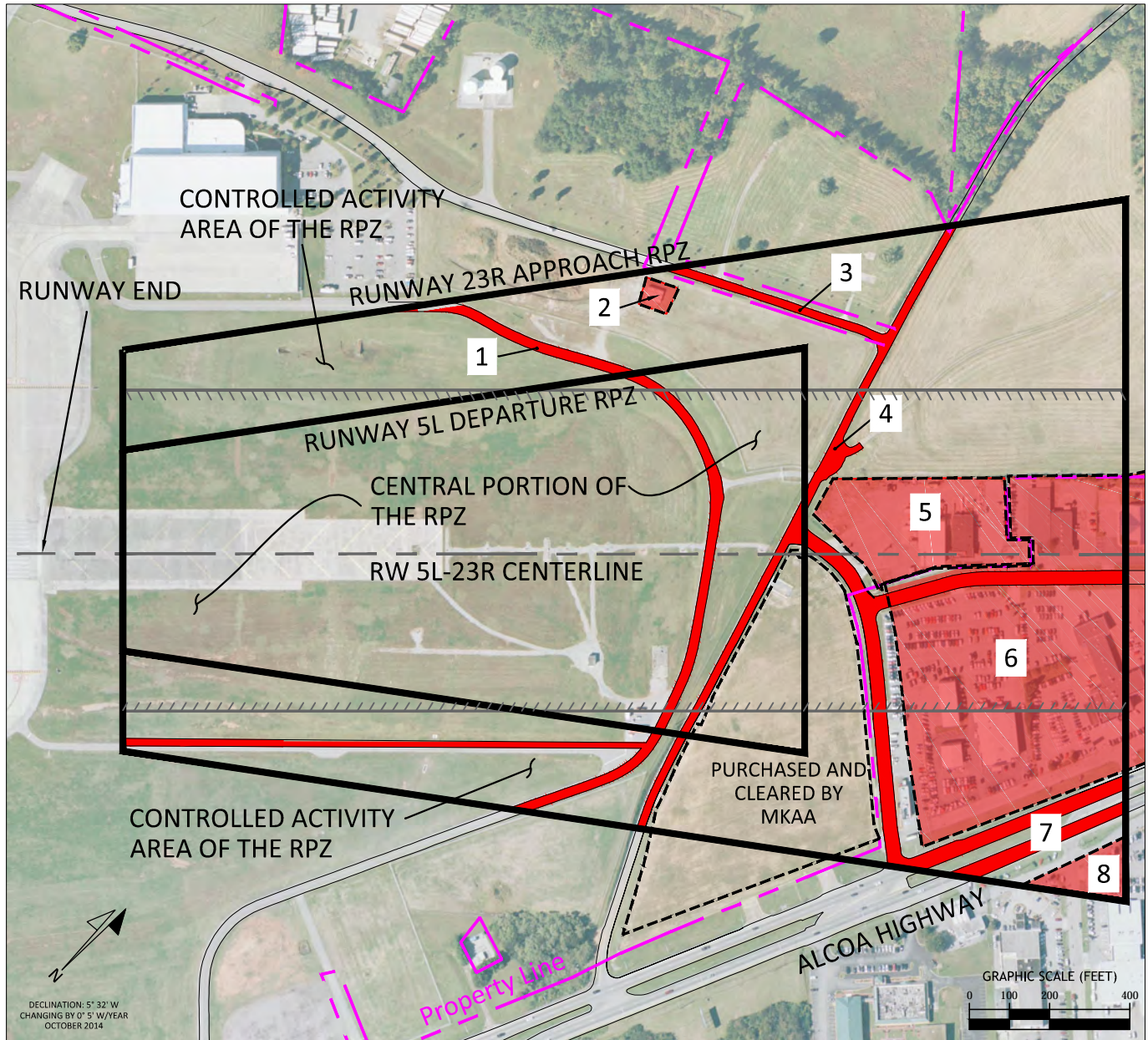
Future RPZ Land Uses

- | | |
|--|---|
| <ul style="list-style-type: none"> 1. CSX Railroad Right-of-Way 2. Airport Controlled Access & Operations Road (non-public) - Aprox. 1700' from RW end 3. Stormwater Management Basin (Reduced Area) 4. Removed - TN A.N.G. Leadership Training Course | <ul style="list-style-type: none"> 5. TN A.N.G. Aggregate & Electrical Equipment Storage 6. Removed - FAA Emergency Generator 7. TN A.N.G. Concrete Wash Pad and Oil/Water Separator 8. Removed - Existing Road |
|--|---|

McGHEE TYSON AIRPORT (TYS) KNOXVILLE, TN

EXHIBIT 4

RUNWAY 23R APPROACH RPZ - RUNWAY 5L DEPARTURE RPZ EXISTING CONDITIONS (PRIOR TO 2015 GRANT)



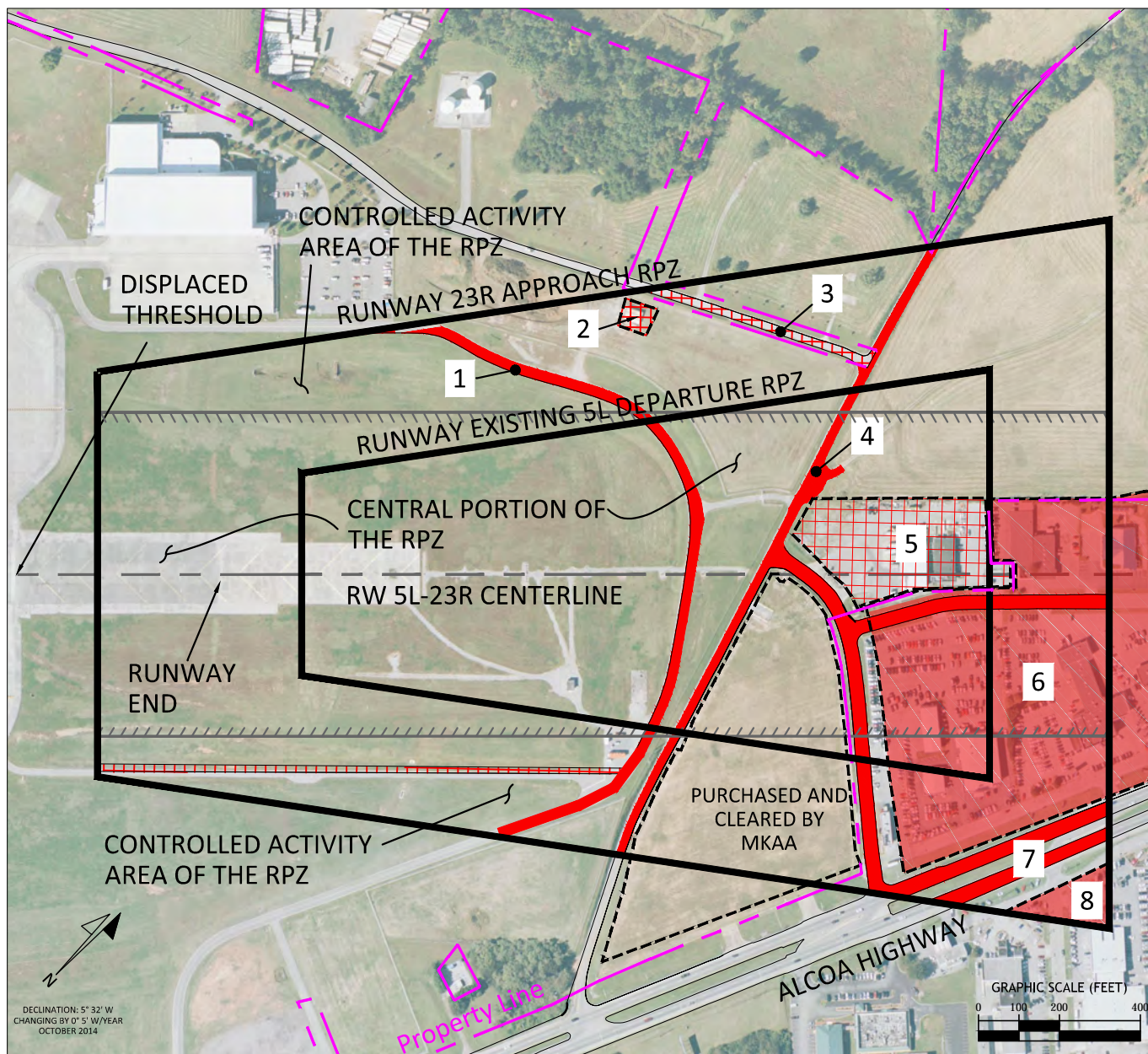
Existing RPZ Land Uses

- | | |
|---|--|
| 1. Airport Perimeter Road | 6. Commercial Development (Car Dealers, Restaurant, Auto Repair) |
| 2. FAA Storage Units | 7. Alcoa Highway |
| 3. Callahan Road | 8. Commercial Auto Parking Area |
| 4. Wright's Ferry Road | |
| 5. Airport Equipment Buildings and Storage Area | |

McGHEE TYSON AIRPORT (TYS) KNOXVILLE, TN

EXHIBIT 5

RUNWAY 23R APPROACH RPZ - RUNWAY 5L DEPARTURE RPZ FUTURE CONDITIONS



Future RPZ Land Uses

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Airport Perimeter Road 2. Removed - FAA Storage Units 3. Closed Callahan Road 4. Wright's Ferry Road* 5. Removed Airport Equipment Buildings and Storage Area | <ol style="list-style-type: none"> 6. Commercial Development (Long-Term Plan to Acquire and Remove) 7. Alcoa Highway - Future Traffic Reduction 8. Commercial Auto Parking Area |
|--|--|

*MCAA and City of Alcoa Discussing Permanent Closure After TDOT Alcoa Highway Project

APPENDIX E



MEMO

PROJECT:	TYS Runway 5L/23R EA	PROJECT NO.:	30377
DATE:	May 13, 2016		
RE:	Floodplain Mapping Coordination History		
TO:	Aaron Braswell, FAA Memphis Airports District Office		
BY:	Mark Heckroth, CHA Consulting, Inc.		

- On March 23, 2016, Metropolitan Knoxville Airport Authority (MCAA) and CHA Consulting met with Blount County to discuss the mapped floodplain with the existing sediment basin and why we felt the map was incorrect. Blount County instructed the project team to submit a request to FEMA for more information and the validity of Zone A.
- CHA contacted FEMA via on April 14, 2016 questioning the legitimacy of Zone A on TYS property since it was mapped and contained within an existing sediment basin. The correspondence pointed out that the mapped Zone A was well upstream from the FEMA detailed study limits (2007) and we inquired about the method FEMA used to justify anything mapped past those limits.
- FEMA responded to CHA instructing we purchase work progress maps and drawings from FEMA, which they used to develop the detailed study and floodplain map depicting the Zone A on TYS property.
- On April 25, 2016, CHA submitted the request to FEMA (and \$400) to obtain access to their working file in their archive
- FEMA responded on April 26, 2016 stating they “extensively and diligently” searched their archived files and no “original working file” documents exist.
- Since there is no data to prove the map is correct or incorrect, CHA must prepare existing and proposed HECRAS models of Lackey Creek Tributary #1 to prove to Blount County the project will not increase the 100-year elevation by more than 1-foot. This work was submitted to Blount County on May 11, 2016 (attached).
- A permit to construct in the floodplain was issued by Blount County, pursuant to Blount County Zoning Regulations – Resolution 00-06-011, which was established to regulate the floodplain areas in Blount County, to minimize danger to life and property, and to establish eligibility in the National Flood Insurance Program.



Building, Zoning, Grading Combination Permit Application

Department of Building Safety, 1221 McArthur Rd, Maryville, TN 37804

Phone: 865-681-9301

Fax: 865-681-9502

Project Name (if applicable): _____

LOCATION	Street Address <u>2055 Alcoa Hwy</u>	OWNER	Name <u>Metropolitan Knoxville Airport Authority</u>
	Lot # and Block # _____		Street Address <u>2055 Alcoa Hwy</u>
	Subdivision/Shopping Ctr. _____		City, State, Zip <u>Alcoa, TN 37701</u>
	Tax Map # <u>026</u> Parcel <u>042.00</u>		Area Code, Telephone # <u>(865) 342-3000</u>

CONTRACTOR	Name _____	ARCHITECT/ENGINEER	Name _____
	Street Address _____		Street Address _____
	City, State, Zip _____		City, State, Zip _____
	Email _____		Area Code, Telephone # () _____
	Area Code, Telephone # () _____		License # _____ Exp Date _____
	License # _____ Exp Date _____		Received Valid Workman's Comp Certificate: Y N

PLUMBER (LLP)	Name _____	MECHANICAL	Name _____
	Street Address _____		Street Address _____
	City, State, Zip _____		City, State, Zip _____
	Area Code, Telephone # () _____		Area Code, Telephone # () _____
	License # _____ Exp Date _____		License # _____ Exp Date _____

BUILDING:		ICC CONSTRUCTION TYPE	
<input type="checkbox"/> New One&Two Family Residential	<input type="checkbox"/> New Commercial	Occupancy Classification _____	<input type="checkbox"/> Type 1 <input type="checkbox"/> A
<input type="checkbox"/> Residential Addition	<input type="checkbox"/> Commercial Addition	Group _____	<input type="checkbox"/> Type 2 <input type="checkbox"/> B
<input type="checkbox"/> Residential Alteration	<input type="checkbox"/> Commercial Alteration	Floor Area Sq. Ft. _____	<input type="checkbox"/> Type 3 _____
<input type="checkbox"/> Residential Repair	<input type="checkbox"/> Commercial Repair	Number of Stories _____	<input type="checkbox"/> Type 4 <input type="checkbox"/> Sprinkled
<input type="checkbox"/> Accessory Structure	<input type="checkbox"/> Demolition	Estimated Cost of Construction: \$ _____	<input type="checkbox"/> Type 5 <input type="checkbox"/> Unsprinkled
<input type="checkbox"/> Gas/Mechanical Only	<input checked="" type="checkbox"/> Other <u>Flood zone permit</u>		

Number of Plumbing Fixtures: _____ Number of Gas Taps: _____ Sewer Connection: **Yes** **No** Number of Bedrooms: _____

ZONING: CLASSIFICATION: AIR **Comment Notes:**

Setbacks	Front	Rear	Left Side	Right Side
Required	—	—	—	—
Shown				

Flood zone permit only

Although not required, a survey can identify actual property boundaries. It is the responsibility of the owner or authorized applicant to determine the correct property boundaries for the purpose of measuring setbacks. Setbacks may be subject to field inspection for confirmation. **SEE BACK OF PERMIT**

Maximum Building Height: 35 feet from the highest adjacent grade

Number of **EXISTING** dwellings on parcel: _____
 Foundation Survey Required: **Yes** **No** Flood Plain: **Yes** **No** (If yes, then additional permit fee and elevation certificate is required)

GRADING: (Grading Permit must be issued prior to any land disturbing activity) **Comment Notes:**

Responsible Person for Erosion & Sedimentation Control: _____
 Area Code, Telephone # () _____

Total Acres (acres or sq. ft.): _____ Area to be Disturbed (acres or sq. ft.): _____
 Are there any water bodies, wetlands, or sinkholes in the area of the site? **Yes** **No**

If the land-disturbing activity is equal to or greater than one-tenth (0.1) acre (4,356 sf) and less than one (1) acre in size, please supply a site plan of proposed activity on the supplemental page of this application.

The applicant of this permit does hereby covenant and agree to comply with the resolutions and laws of this jurisdiction pertaining to said building and site and to construct the proposed building or structure or to make the proposed change or alteration in accordance with the plans and specifications submitted herewith. I (the applicant) have read and understand the reverse side of this form and certify that the information and statements given on this application, drawings, and specifications are to the best of my knowledge, true and correct. I (the applicant) understood and agreed that any error, misstatement, or misrepresentation of fact either with or without intention on my part, such as might if known, cause a refusal of this application or any alteration or change in plans made without approval of the Building Official or designee subsequent to the issuance of the building permit, shall constitute sufficient grounds for revocation of such permit. This permit shall expire after 180 days if work has not commenced or if it has been abandoned or suspended for a period of 180 days after work has commenced.

Residential: Must submit TWO (2) Site Plans and ONE (1) Construction Plan. Commercial: Must submit TWO (2) of each

Name of Applicant (Signature) _____ Date: _____
 Name of Applicant (Clearly Print) _____

BELOW OFFICE USE ONLY

Environmental Review _____ Date: _____ Zoning Review RT Date: 5-17-16
 Stormwater Review _____ Date: _____ Building Safety Review _____ Date: _____

Building Permit Fee: \$ _____ Permit Number # 254700 Type of Certificate Required: _____
 Other Fees: \$ _____ Map Page # _____ Grid _____ **C of O** **C of C**

TOTAL FEE: \$ _____ Pre-Approved Plans Number # _____

REVERSE SIDE of Building Permit Application

Zoning Information:

Front Setbacks – A line delineating the minimum allowable distance between a street right of way or an official future street right of way line and the front of a building (roof overhang if any) on a lot. The front building setback line extends the full width of the lot and is parallel to or concentric with the street right of way. If the front property line is not clearly determinable, please contact the appropriate Department of Blount County Government.

Rear Setbacks – A line delineating the minimum allowable distance between the rear property line and a building (roof overhang if any) on a lot (other than for a permitted accessory structure). The rear setback extends the full width of the lot.

Side Setbacks – A line delineating the minimum distance between the side property line and a building on a lot. The side line extends from the front building setback line to the rear building setback line.

Although not initially required, a foundation survey may be required by Blount County Government if actual property boundaries cannot be readily identified. It is the responsibility of the owner or authorized applicant to determine the correct boundaries for the purpose of measuring setbacks. Setbacks may be subject to additional field inspections for confirmation. **Note:** Private deed restrictions or private subdivision restrictions are not enforceable under this permit or building codes.

Stormwater Information:

Grading Permit Criteria – If the site is equal to or greater than one (1) acre, a Tennessee Department of Environmental and Conservation stormwater construction permit is required prior to applying for this permit. This grading permit shall expire one (1) year from the date of issue. After one (1) year, reapplication is required.

- The complete Sediment and Erosion control requirements are set fourth in the Blount County Soil Erosion and Sediment Control Resolution, Resolution No. 04-12-016 (www.blounttn.org).

- Grading will not be allowed until erosion and sediment control measures have been installed according to approved plans and inspected.

- The contractor is required to follow the Tennessee Erosion & Sediment Control Handbook, latest edition.

- For land disturbance of one (1) acre or more, a specific individual shall be designated to be responsible for erosion and sediment control on each site. This individual shall have a minimum training of the Level 1 – Fundamentals of Erosion Prevention and Sediment Control Workshop sponsored by TDEC or approved equivalent course. The responsible person must possess a valid certificate of completion.

- The tracking of mud or other debris onto public Right-of-Way will not be tolerated. If that should occur, the contractor must immediately clean such roadway or public Right-of-Way.

- Inspections – The permit holder shall perform inspection of erosion and sediment control measures weekly in dry periods, before anticipated storm events (or a series of storm events as intermittent showers over one (1) or more days) and within twenty-four (24) hours after any rainfall of on-half (0.5) inch or greater within a twenty-four (24) hour period. During prolonged rainfall, daily inspections are necessary. All erosion control shall be repaired as necessary. The permit holder shall maintain record of such checks and repairs.

- An undisturbed vegetative buffer of twenty-five (25) feet (as measured from the top of bank) shall be maintained adjacent to all free flowing waters of the state.

Enforcement – If the permit holder has failed to properly install, maintain, or use proper structural and/or vegetative erosion and sediment control measures as specified on the approved plans, the following shall occur:

- First Offense – Written Warning (Maximum of two (2) days for compliance). If conditions warrant, a Stop Work Order shall be issued immediately.

- Second Offense – Notice of Violation Issued, Stop Work Order issued, and Tennessee Department of Environment and Conservation (TDEC) notification.

- Third Offense – Assessment of a Civil Penalty for each day work continues.

- Each Additional Offense – Civil Penalty for each day of work continues and suspension of the issuance of subsequent permits.

- Failure to Clean Up Site – Permit holder liable for three (3) time the cost of clean up starting with the first offense.

Penalties – Any person who violates any provisions of the Soil Erosion and Sedimentation Control Resolution or any permit condition or limitation or who fails to comply with any order issued by the Inspector shall be liable for civil penalty not to exceed two thousand five hundred dollars (\$5,000.00) for each violation per day. Each day during which the violation and/or failure to comply continues shall constitute a separate violation.

Building Safety Information:

- ♦ As a general rule, all inspections must be scheduled a minimum of one (1) business day in advance. Cancellations must be called into the Codes Office a minimum of one (1) hour before the scheduled inspection time or a re-inspection fee will be assessed. Inspection times are scheduled on a first come – first serve basis.

- ♦ The Building Official is authorized to issue a permit for the construction of foundations or any other part of a building or structure before the construction documents for the whole building or structure have been submitted, provided that adequate information and detailed statements have been filed complying with pertinent requirements of the adopted codes. The permit holder of such permit shall proceed at the holder's own risk with the building operation and without assurance that a permit for the entire structure will be granted.

- ♦ Lot and/or Address numbers must be clearly posted on each permitted site at all times and for each inspection or an automatic rejection will be assessed. Permanent address numbers minimum 3.5 inches are required to be marked, posted, or attached on a contrasting color surface of the building before final inspection.

- ♦ Portable toilets must be provided if no other approved facility is available for immediate convenient use by workers, employees, staff, or sub-contractors.

- ♦ Approved plans and permit card must be on site at all times and available for each inspection.

- ♦ Any building code inspection may be waived if an inspection letter approving work is signed and submitted by an Engineer or Architect for that project currently registered in the State of Tennessee.

- ♦ Safe and Accessible project sites are mandatory. If the Inspector cannot reasonably access the building site by normal means of transportation, then a rejection of that inspection will result. If the inspector notices any unsafe act(s) or condition(s) at the inspection site, then a rejection of that inspection may result and a complaint will be filed against the permit holder to OSHA by the Blount County Department of Building Safety.

- ♦ **No building or structure shall be used or occupied, and no change in the existing occupancy classification of a building or structure or portion thereof shall be made without approval for a Certificate of Occupancy or Certificate of Completion issued by the Building Official or his designee.**

McGhee Tyson Airport HEC-RAS Analysis CSX RR Culvert to Louisville Rd Culvert

Prepared For:



**METROPOLITAN
KNOXVILLE
AIRPORT
AUTHORITY**

2055 Alcoa Highway
Alcoa, Tennessee 37701

Prepared By:



216 Centerview Drive
Building #7, Suite 250
Brentwood, TN 37027

DRAFT

May 10, 2016

PROFESSIONAL CERTIFICATION

METROPOLITAN KNOXVILLE AIRPORT AUTHORITY

**HEC-RAS Analysis
CSX Railroad Culvert
to
Louisville Road Culvert**

Prepared by:



216 Centerview Drive
Building #7, Suite 250
Brentwood, TN 37027

PH (615) 377-1320
FX (615) 337-3630

Matthew D. McCutcheon, PE

TN Professional Engineer No. 118566

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Professional Certification PEC-1

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Section 1: Introduction

Current airfield improvements undertaken by Metropolitan Knoxville Airport Authority (MCAA) at McGhee Tyson Airport (TYS) impact the drainage downstream of the South Sediment Pond (SSP) and CSX Railroad culvert. Decentralized stormwater management facilities were designed as part of the runway improvements and extension project, to replace the centralized storage of the SSP. The SSP is a wildlife attractant and its location creates a potential hazard to arriving and departing aircraft.

Relocation of Liberty Street to avoid the required fill necessary to extend Runway 5L is possible because a significant volume of the SSP storage was relocated upstream to the infield and North Lateral Ditch (NLD). The redesign of Liberty Street proposed the new alignment through an existing Federal Emergency Management Association (FEMA) floodplain, which will be eliminated by the new stormwater management facilities designed for TYS. Nevertheless, a downstream flooding water surface elevation (WSEL) analysis was required to show that the airfield improvements would not increase the 100-year WSEL more than 1-foot at any given location downstream.

This report documents the hydraulic analysis performed to verify the airfield improvements would not increase the 100-year WSEL more than 1-foot downstream of the SSP location. The previously conducted Stormwater Management project details the reduction in WSEL upstream of the SSP outlet. The discharge from the SSP forms the Lackey Creek Unnamed Tributary #1 (LCUT1) which was not studied in detail at the time FEMA prepared the Flood Insurance Study (FIS) mapping. The future conditions downstream of the SSP must comply with Blount County, Tennessee Zoning Regulations Resolution 00-06-011, Blount County Floodplain Zoning Resolution, a resolution adopted pursuant to Sections 13-7-110 through 13-7-115 of the Tennessee Code Annotated for the purpose of regulating the floodplain areas of Blount County, Tennessee to minimize danger to life and property and to establish eligibility in the National Flood Insurance Program.

1.1 Purpose

MCAA contracted with CHA to develop a hydraulic model of the LCUT1 system downstream of the SSP. The model is intended to be used to assist in evaluating the impact of providing stormwater improvements in the airfield (relocated storage from the SSP) on flow patterns extending from immediately downstream of the SSP to Louisville Road.

The goal of the analysis is to show the provided distributed storage does not increase the WSEL in the SSP or downstream of the SSP outlet by greater than 1-foot.

1.2 HEC-RAS Software

The hydraulic model was developed using the one-dimensional U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC) River Analysis System (RAS), HEC-RAS version 4.1.0. HEC-RAS allows the user to perform one-dimensional steady flow, one and two-dimensional unsteady flow calculations, sediment transport/mobile bed computations, and water temperature/water quality modeling.

Section 2: Model Development and Analysis

This section provides a description of the methodology used to develop the hydraulic model for the LCUT1 WSEL analysis. The objective was to produce an accurate hydraulic model for both the channel and overbanks that reflects the inherent complexities of the local topography as well as the sharp bends of the channel.

The HEC-RAS model was used to simulate the LCUT1 100-year WSEL for the existing and future conditions. The hydraulic modeling was performed using USACE's HEC-RAS Version 4.0.1 steady state option. The following components were included in the model and are described in detail in the following sub-sections:

- HEC-RAS model parameters
- Modeling hydraulic structures
- Data for defining LCUT1 cross sections
- HEC-RAS model results

2.1 Model Development

The LCUT1 HEC-RAS model simulates the routing of peak flows (steady flow conditions), extending from the SSP outlet structure to the downstream model boundary, approximately 200 feet downstream of the Louisville Road culvert. The downstream model boundary is at a sufficient distance to clearly establish the water surface elevation at the downstream terminus of the analysis.

2.1.1 HEC-RAS Model Parameters

HEC-RAS model data requirements can be summarized in nine model parameters listed in the following table which also shows the methods to develop the required data. The LCUT1 parameters were developed using a combination of manual procedures with automation tools such as Autodesk AutoCAD and Civil 3D.

HEC-RAS Model Parameters and Data Requirements

HEC-RAS Model Parameter	Development Method	Data Requirements
Stream Network	AutoCAD/Civil 3D	Stream centerline with unique stream reach names
Cross Sections	AutoCAD/Civil 3D	Surface with cross section cut lines
Channel Bank Stations	Manual input using standard procedures and engineering judgement	Cross section geometry
Downstream Reach Lengths	AutoCAD/Civil 3D	Stream centerline and overbank (left and right) flow paths
Manning's Roughness	FEMA FIS for Lackey Creek	Manning's n assigned by FEMA
Culvert Crossings	AutoCAD, Manual Input, and Field Visits	Embankment profile and culvert opening geometry
Expansion and Contraction Coefficients	Manual input using standard values and engineering judgement	Contours and cross section cut lines
Ineffective Flow Areas	Manual input using standard values and engineering judgement	Contours and cross section cut lines
Normal Depth Boundary Conditions	AutoCAD/Civil 3D	Contours, stream centerline, and cross section cut lines

2.1.2 Stream Network

The initial step to develop a HEC-RAS model was to input the stream network into the model's geometry file. The geometry file contains the stream network, cross section river stations, cross section geometries, and downstream reach lengths of the channel, left, and right overbanks. This project used Autodesk AutoCAD/Civil 3D to manually trace the stream bed for input directly into HEC-RAS.

The stream network defines the extent of the LCUT1 modeled as part of this project. The stream centerline was manually digitized in Autodesk AutoCAD/Civil 3D to represent the thalweg of the main channel. HEC-RAS requires a river name and reach name be assigned to each reach created in the model. For this project, the river name was assigned "Lackey Creek" and the reach name was assigned "Unnamed Tributary #1." The defined reach length of LCUT1 modeled for this project was 2,200 linear feet from most upstream location to most downstream location modeled. A total of 2.20 square miles drains through the most downstream location of the model.

2.1.3 Cross Sections

The cross section coverage identifies the location and extent of each cross section. The cross sections were generated in Autodesk AutoCAD/Civil 3D and manually input into HEC-RAS from in Autodesk AutoCAD/Civil 3D output. While automated routines are available for other software, such as ArcGIS, manual input into HEC-RAS allowed for quality control of the CAD generated cross sections. Cross section locations were placed along LCUT1 at control points (i.e. locations where there are abrupt changes in channel or floodplain geometry, slope, and/or discharge) and locations that represent the average geometry of the stream. Available aerial photography and contour information were utilized in the layout of the cross sections. An effort was made to limit the distance between cross sections to a maximum of 500 feet. However, cross sections that were located at structures and control points were placed with less distance between each other to capture the more rapidly changing flow characteristics. Each cross section is labeled with a river station, stream name, and reach name. The river station for each cross section is the cumulative distance in feet measured from the downstream terminus. A total of 24 cross sections were used for the LCUT1 analysis.

2.1.4 Channel Bank Stations

Channel bank stations are used to determine where the channel ends and the overbank begins. These locations are typically visible in the field and are a representation of where the Manning's roughness coefficient significantly changes. The bank stations were located and entered manually by editing the cross sections within HEC-RAS. The channel bank stations were verified by the Autodesk AutoCAD/Civil 3D cross section geometry and field visit photographs.

2.1.5 Downstream Reach Lengths

The downstream reach lengths are specified for each cross section for the centerline, the left overbank, and the right overbank. The centerline reach length is simply the distance between the current cross section and the next downstream along the defined stream reach. The overbank reach length was created in Autodesk AutoCAD/Civil 3D and represents the distance to the next downstream cross section measured along the path of the center of mass for the overbank flow. The downstream reach length for the left and right overbanks was approximated based upon the estimated width of the local floodplain.

2.1.6 Manning's Roughness

The Manning's Roughness Coefficient (n-value) was used to help calculate the energy losses between cross sections due to friction. The Manning's Roughness Coefficient depends on a number of factors which include: surface roughness; vegetation; channel irregularities; degree of meander; obstructions; size and shape of the channel. For the LCUT1 analysis, Manning's n values for the channel and overbank flow areas were assigned based on the FEMA FIS data for Lackey Creek and its tributaries.

2.1.7 Culvert Crossings

Roadway and railroad embankments and culvert openings along with road/rail profiles were developed using data collected during field surveys and the AutoCAD/Civil 3D surface generated based on the County's 1-ft contours. Field survey data for culverts included culvert type and geometry, and upstream and downstream inverts. All of the surveyed information was manually entered into the HEC-RAS model. For instances where the surveyed data did not extend far enough horizontally to capture the extents of the overbank flow, AutoCAD/Civil 3D surface information was imported to supply the remainder of the required geometries.

HEC-RAS requires four cross sections be entered to define each hydraulic structure. The four cross sections include a downstream cross section where flow is fully expanded, a cross section at the downstream face of the structure, a cross section at the upstream face of the structure, and an upstream cross section before flow contracts.

The reach lengths between the upstream and downstream culvert cross sections was determined using Autodesk AutoCAD/Civil 3D. The location of the culvert in river stations was estimated by the distance between the culvert and the upstream cross section.

2.1.8 Expansion and Contraction Coefficients

The contraction and expansion of flow due to changes in the cross sectional geometry is a typical cause for the loss of energy between two cross sections. To assist in computing this loss, HEC-RAS requires the user to define an expansion and contraction coefficient at each cross section. The expansion and contraction coefficients were estimated based on the ratio of the expansion and contraction of the effective flow area between two cross sections and are typical of values used in similar projects. The coefficients used in the LCUT1 analysis are 0.1 and 0.3 for contraction and expansion, respectively.

2.1.9 Ineffective Flow Areas

Ineffective flow areas can be defined as areas of a cross section that provide little or no conveyance of flow in the downstream direction. In the LCUT1 analysis, ineffective flow areas were utilized where the following instances occurred:

- Ineffective areas were initially placed within the bounding cross sections of all culvert crossings. Using a contraction ratio of 1:1 (reach length: width) and expansion ratio of 2:1, ineffective areas were calculated from the edges of the culvert openings. This process was carried through to the next upstream or downstream cross section until the flow was completely expanded. However, in the case of a roadway overtop, the downstream ineffective areas were established at the edge of the road overtop.
- Reaches experiencing drastic changes in width. The locations of these areas were set using the contraction and expansion ratios of 1:1 and 2:1, respectively, as well as engineering judgment.

- Areas located within cross sections that were not hydraulically connected to the upstream or downstream cross sections. The locations of such areas were determined using the cross sectional geometries as well as the available surface and contour data.

Ineffective flow areas were input manually using the HEC-RAS cross section editor.

2.1.10 Normal Depth Boundary Conditions

Normal depth was used as the downstream boundary condition. This boundary condition requires the input of the energy grade line slope at the downstream boundary. The downstream energy grade line slope can be approximated as the channel invert slope from the contour data. The slope of the channel between the two most downstream cross sections was used to calculate the slope (0.0126 ft/ft) used for the normal depth boundary condition.

2.2 SWMM Model

The USEPA SWMM Model was used to analyze stormwater runoff from the TYS airport under existing conditions and future conditions, after the Runway 5L reconstruction project. The results of the USEPA SWMM model were used as the inputs for the HEC-RAS model downstream of the SSP.

2.2.1 Existing Conditions

Establishing existing conditions provides a baseline scenario to evaluate stormwater management at TYS. The existing conditions analysis established peak flows and total runoff volumes to compare to the future development conditions analysis.

All catchments draining to the same outlet create a drainage basin. The following table presents the area and impervious characteristic of each drainage basin.

Summary of Existing Condition Basin Tributary Areas

Drainage Basin ID	Tributary Area (acres)	Average Impervious (Percentage)
Basin 02 (CSX RR)	1,443.27	41
D/S¹ of Basin 02 (Louisville Rd.)	1,518.98	39

1. D/S = Downstream

Once the hydrologic and hydraulic representation of the TYS stormwater collection system was complete, the 100-year 24-hour SCS Type II synthetic precipitation event was applied to the system to establish baseline runoff conditions (peak flow and total volume) under the existing conditions.

The following table presents the existing conditions peak flow at the SSP at the CSX Railroad crossing.

Summary of Existing Condition Stormwater Runoff at SSP – at CSX RR Culvert

Precipitation Event	Peak Flow (cfs)
Water Quality	194.0
02-YR, 24-HR SCS Type II	851.8
10-YR, 24-HR SCS Type II	1,242
25-YR, 24-HR SCS Type II	1,333
100-YR, 24-HR SCS Type II	1,501

The following table presents the existing conditions peak flow at the Louisville Road crossing.

Summary of Existing Condition Stormwater Runoff at Louisville Road Culvert

Precipitation Event	Peak Flow (cfs)
Water Quality	181.5
02-YR, 24-HR SCS Type II	716.5
10-YR, 24-HR SCS Type II	1,144
25-YR, 24-HR SCS Type II	1,285
100-YR, 24-HR SCS Type II	1,439

The previous tables are shown in this report to establish that the peak flow rates between the CSX Railroad culvert and Louisville Road are attenuated. For the existing conditions HEC-RAS analysis, the higher flows from the location at the CSX Railroad culvert were used for analysis.

The existing conditions for the Stormwater Management Plan SWMM model were evaluated as the conditions that existed prior to construction of the SSP and its associated outlet control structure to reduce stormwater sediment loading by regulating stormwater discharge flow rates. The same existing conditions are applicable to the downstream WSEL analysis. The SSP is considered to be the first detention facility constructed at the airport according to available record plans and historical knowledge of the development at TYS. Prior to the construction of the SSP, it is understood stormwater runoff flowed unregulated to the existing 12-ft. (W) x 14-ft. (H) arch-topped culvert underneath the CSX railroad tracks adjoining the airport property before ultimately draining to Fort Loudon Lake. Under the existing conditions, the WSEL in the SSP was determined to be 855.3.

2.2.2 Future Conditions

The “*future development conditions*” were defined and evaluated as the conditions at TYS at the completion of Project 4 of the 5L-23R Runway Reconstruction Project and the future buildout condition specified in the McGhee Tyson Airport Master Plan Update – Airport Layout Plan completed in 2006 by Wilbur Smith Associates and updated in 2015 by CHA. Modeled *future development conditions* at TYS include almost 2,065 acres with nearly 980 acres of impervious cover.

Overall, under *future development conditions*, there is a nine percent increase in imperviousness compared to the existing conditions model. The following table presents the area and impervious characteristic of each drainage basin.

Summary of Future Development Condition Basin Tributary Areas

Drainage Basin ID	Tributary Area (acres)	Average Impervious (Percentage)
Basin 02 (CSX RR)	1,432.68	50
D/S of Basin 02 (Louisville Rd.)	1,508.38	48

The following table presents the developed conditions peak flow at the SSP at the CSX Railroad crossing.

Summary of Developed Condition Stormwater Runoff at SSP – at CSX RR Culvert

Precipitation Event	Peak Flow (cfs)
Water Quality	182.8
02-YR, 24-HR SCS Type II	607.3
10-YR, 24-HR SCS Type II	905.2
25-YR, 24-HR SCS Type II	1,009
100-YR, 24-HR SCS Type II	1,176

The following table presents the developed conditions peak flow at the Louisville Road crossing.

Summary of Developed Condition Stormwater Runoff at Louisville Road Culvert

Precipitation Event	Peak Flow (cfs)
Water Quality	145.7
02-YR, 24-HR SCS Type II	479.7
10-YR, 24-HR SCS Type II	748.5
25-YR, 24-HR SCS Type II	893.6
100-YR, 24-HR SCS Type II	1,069

The previous tables are shown in this report to establish that the peak flow rates between the CSX Railroad culvert and Louisville Road are attenuated. For the future conditions HEC-RAS analysis, the higher flows from the location at the CSX Railroad culvert were used for analysis.

The proposed stormwater storage improvements in the TYS airfield reduce the peak flows to the SSP. By removing stormwater storage volume from the SSP and distributing it throughout the infield, the volume storage (and the WSEL at the SSP) are lowered under the future conditions. Under the future conditions, the WSEL in the SSP was determined to be 841.0 (reduced from 855.3 as stated in existing conditions). The SWMM future conditions were applied to the HEC-RAS WSEL analysis of LCUT1.

2.3 HEC-RAS Model Analysis and Results

The LCUT1 HEC-RAS model simulates the routing of peak flows (steady flow conditions), extending from the SSP outlet structure to the downstream model boundary, approximately 200 feet downstream of the Louisville Road culvert. The downstream model boundary is at a sufficient distance to clearly establish the water surface elevation at the downstream terminus of the analysis.

2.3.1 Existing Conditions

The LCUT1 existing conditions WSEL was evaluated with a steady flow of 1,501 cubic feet per second input at the upstream cross section (outlet of the SSP). The detailed data and results from HEC-RAS are presented in **Appendix A – HEC-RAS Data and Results**.

2.3.2 Future Conditions

The LCUT1 future conditions WSEL was evaluated with a steady flow of 1,176 cubic feet per second input at the upstream cross section (outlet of the SSP). The detailed data and results from HEC-RAS are also presented in Appendix A.

2.3.3 HEC-RAS Modeling Results and Summary

A HEC-RAS model was developed to represent existing (pre-construction) conditions and future (post-construction) conditions. Inputs for the HEC-RAS model were taken from a previous SWMM hydrologic and hydraulic (H&H) study of the entire drainage basin upstream of the Louisville Road and CSX RR culverts. The SWMM H&H analysis determined stormwater improvements on the TYS infield will reduce the peak flow downstream of the SSP location (the ultimate goal is to eliminate the SSP as it is a wildlife attractant and hazard to arriving and departing aircraft).

The future conditions downstream of the SSP must comply with Blount County, Tennessee Zoning Regulations Resolution 00-06-011, Blount County Floodplain Zoning Resolution, a resolution adopted pursuant to Sections 13-7-110 through 13-7-115 of the Tennessee Code Annotated for the purpose of regulating the floodplain areas of Blount County, Tennessee to minimize danger to life and property and to establish eligibility in the National Flood Insurance Program. Construction activities are not permitted to raise the 100-year WSEL more than 1-foot from the existing 100-year WSEL. The HEC-RAS modeling shows a reduction in the future condition WSEL compared to the existing conditions at each cross section analyzed.

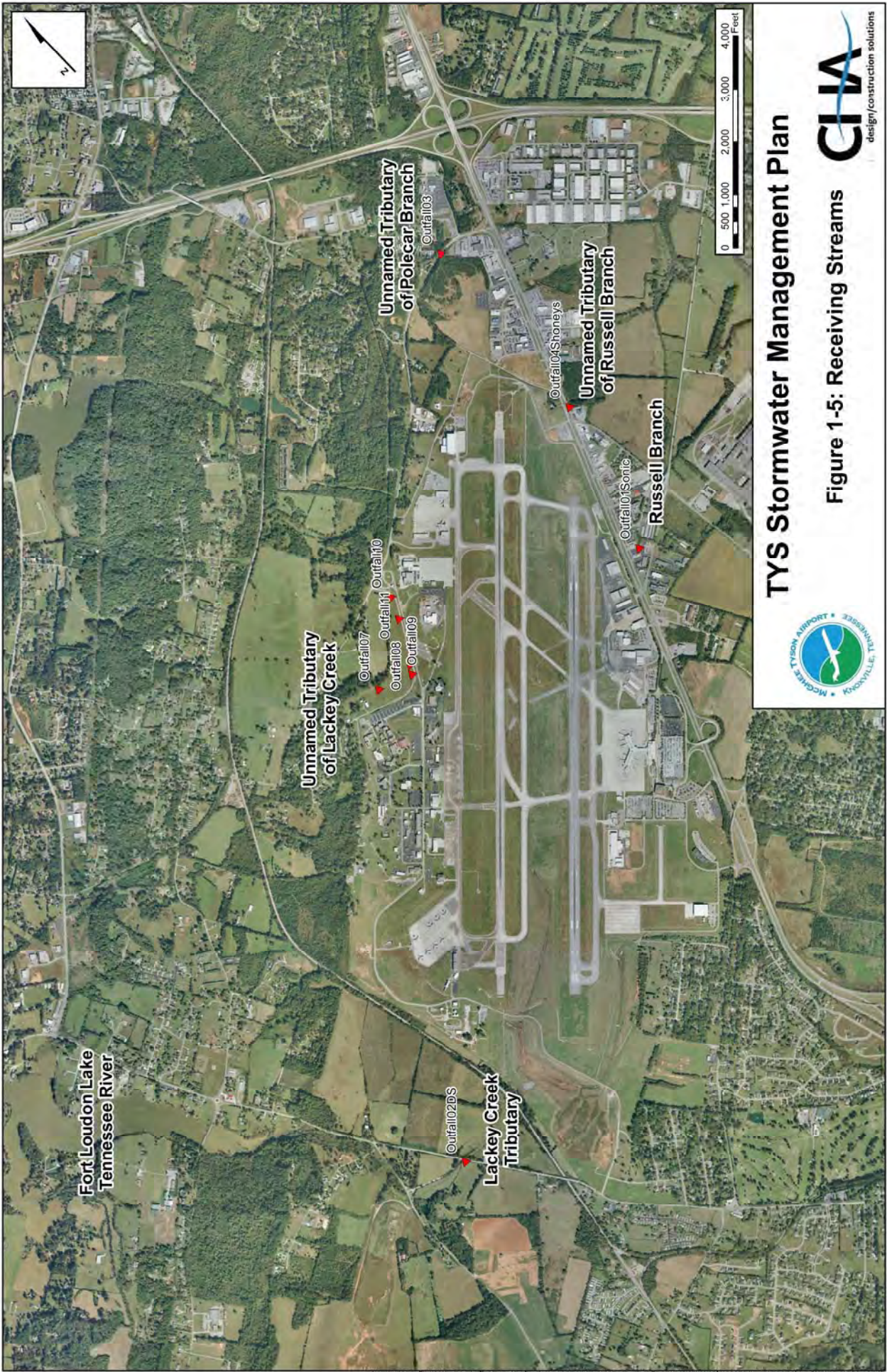
C:\Users\5311\Desktop\Projects\30377 - McGhee Tyson Master Drainage Plan\05_Deliverables\2015-11-12\Figures\MXD\Figure1-01_TYS_Location_Map.mxd



TYS Stormwater Management Plan

Figure 1-1: McGhee Tyson Airport Vicinity Map





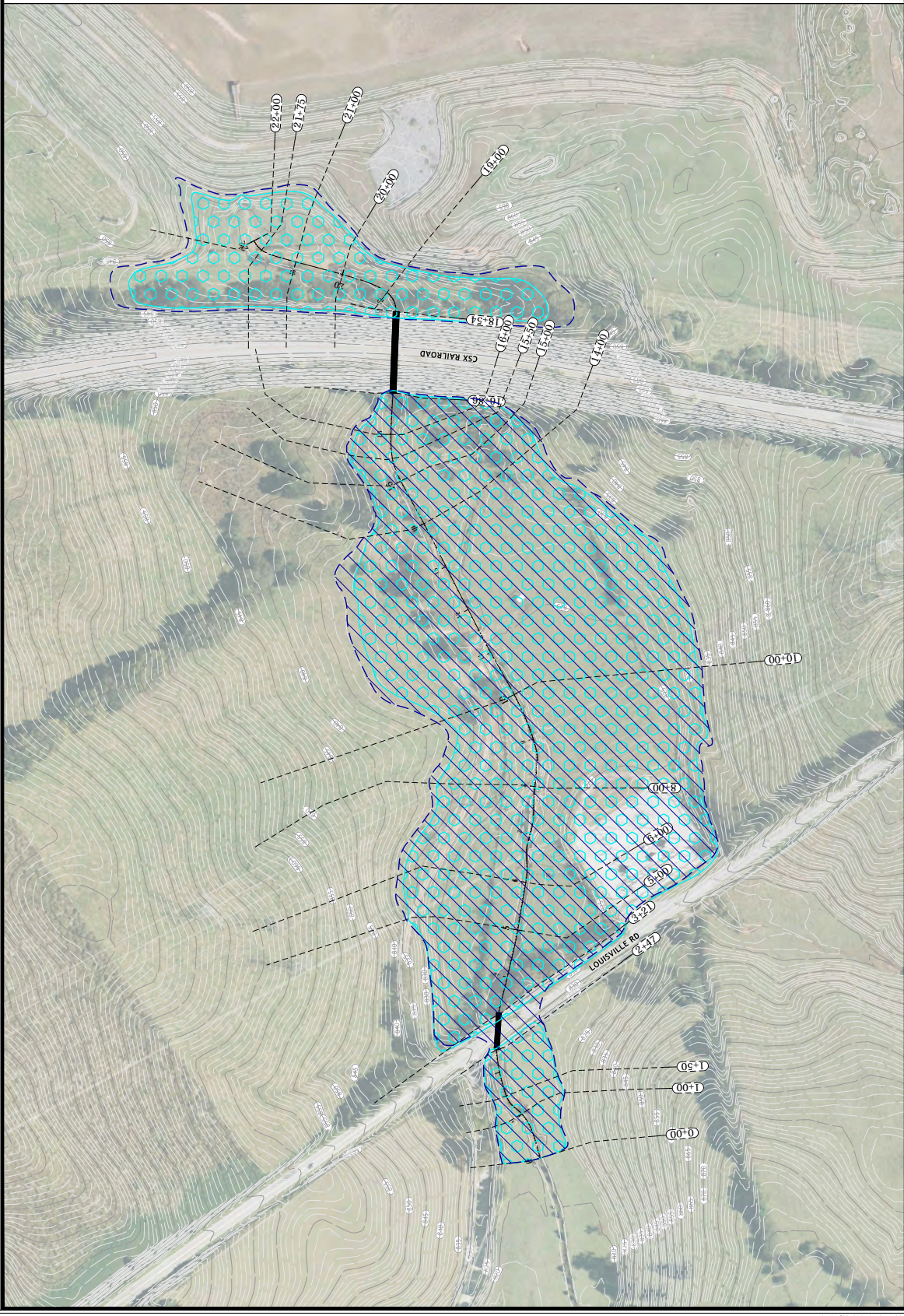
TYS Stormwater Management Plan

Figure 1-5: Receiving Streams





EXISTING WATER SURFACE ELEVATION
 FUTURE WATER SURFACE ELEVATION



PROJECT NAME AIRFIELD MODERNIZATION PROGRAM RUNWAY 5L-23R RECONSTRUCTION - PROJECT 2		DATE 5/11/2016
SHEET NO. 30377	SHEET TITLE MODELED 100-YEAR WATER SURFACE ELEVATIONS	DATE PLOTTED 5/11/2016
PROJECT LOCATION McGhee Tyson Airport METROPOLITAN KNOXVILLE AIRPORT AUTHORITY		
		
		
NOT FOR CONSTRUCTION		
DRAWN BY DATE	CHECKED BY DATE	APPROVED BY DATE
TITLE 00'	DATE 00'	DATE 00'
FILE NAME V:\Projects\1822\1822Proj1\182277\CADD, A\CAD\1\work\N\B\F\F X-Sections 2.dwg - Layout1	MODIFIED BY May 10, 2016 1:35:52 PM / 5158	PLOTTED BY May 10, 2016 1:35:58 PM / Bhubalesh, Nathan

Appendix A:

HEC-RAS Data and Results

HEC-RAS Plan: Plan 01 River: LackeyCreek Reach: UnnamedTrib_01

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
UnnamedTrib_01	2200	Existing Cond.	1501.00	833.30	842.94	836.72	842.97	0.000133	1.83	1672.71	270.89	0.11
UnnamedTrib_01	2200	Future Cond.	1174.00	833.30	840.84	836.39	840.88	0.000230	2.01	1134.34	242.47	0.14
UnnamedTrib_01	2175	Existing Cond.	1501.00	833.10	842.94		842.97	0.000095	1.56	1870.93	278.24	0.09
UnnamedTrib_01	2175	Future Cond.	1174.00	833.10	840.85		840.88	0.000158	1.68	1310.46	256.68	0.11
UnnamedTrib_01	2100	Existing Cond.	1501.00	832.10	842.93		842.96	0.000086	1.58	1878.59	254.41	0.09
UnnamedTrib_01	2100	Future Cond.	1174.00	832.10	840.84		840.86	0.000128	1.64	1367.50	233.20	0.10
UnnamedTrib_01	2000	Existing Cond.	1501.00	831.60	842.91		842.95	0.000096	1.75	1366.88	169.27	0.09
UnnamedTrib_01	2000	Future Cond.	1174.00	831.60	840.81		840.85	0.000130	1.76	1024.39	156.97	0.11
UnnamedTrib_01	1900	Existing Cond.	1501.00	829.40	842.84		842.93	0.000156	2.48	667.98	117.64	0.12
UnnamedTrib_01	1900	Future Cond.	1174.00	829.40	840.75		840.83	0.000178	2.33	551.15	111.52	0.13
UnnamedTrib_01	1854.3	Existing Cond.	1501.00	829.00	841.09	836.87	842.76	0.003318	10.34	145.14	216.69	0.52
UnnamedTrib_01	1854.3	Future Cond.	1174.00	829.00	839.27	835.65	840.68	0.003505	9.53	123.21	216.69	0.52
UnnamedTrib_01	1850	Culvert										
UnnamedTrib_01	1685.8	Existing Cond.	1501.00	826.10	831.89	833.94	839.13	0.042238	21.59	69.52	149.48	1.58
UnnamedTrib_01	1685.8	Future Cond.	1174.00	826.10	830.90	832.77	837.35	0.048275	20.37	57.64	146.38	1.64
UnnamedTrib_01	1600	Existing Cond.	1501.00	826.00	832.92	830.06	833.15	0.001190	4.07	484.94	279.99	0.30
UnnamedTrib_01	1600	Future Cond.	1174.00	826.00	832.11	829.64	832.31	0.001253	3.76	405.59	270.71	0.30
UnnamedTrib_01	1550	Existing Cond.	1501.00	826.00	832.96		833.08	0.000659	3.04	720.07	350.47	0.22
UnnamedTrib_01	1550	Future Cond.	1174.00	826.00	832.13		832.24	0.000703	2.84	598.21	339.82	0.23
UnnamedTrib_01	1500	Existing Cond.	1501.00	826.00	832.97		833.03	0.000443	2.59	1090.07	360.73	0.19
UnnamedTrib_01	1500	Future Cond.	1174.00	826.00	832.14		832.20	0.000456	2.38	926.11	351.15	0.18
UnnamedTrib_01	1400	Existing Cond.	1501.00	824.60	832.97		833.00	0.000171	1.82	2083.62	433.23	0.12
UnnamedTrib_01	1400	Future Cond.	1174.00	824.60	832.14		832.16	0.000172	1.68	1732.55	409.72	0.12
UnnamedTrib_01	1000	Existing Cond.	1501.00	821.10	832.96		832.97	0.000032	1.00	4012.63	567.10	0.05
UnnamedTrib_01	1000	Future Cond.	1174.00	821.10	832.13		832.13	0.000028	0.88	3550.32	545.08	0.05
UnnamedTrib_01	800	Existing Cond.	1501.00	820.10	832.91		832.93	0.000041	1.19	3050.23	385.58	0.06
UnnamedTrib_01	800	Future Cond.	1174.00	820.10	832.09		832.10	0.000034	1.04	2732.50	385.58	0.06
UnnamedTrib_01	600	Existing Cond.	1501.00	819.10	832.91		832.92	0.000020	0.90	4070.00	514.16	0.04
UnnamedTrib_01	600	Future Cond.	1174.00	819.10	832.09		832.09	0.000017	0.78	3669.47	504.16	0.04
UnnamedTrib_01	500	Existing Cond.	1501.00	819.10	832.91		832.92	0.000019	0.87	3708.49	505.26	0.04

HEC-RAS Plan: Plan 01 River: LackeyCreek Reach: UnnamedTrib_01 (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
UnnamedTrib_01	500	Future Cond.	1174.00	819.10	832.09		832.09	0.000015	0.74	3405.21	505.10	0.04
UnnamedTrib_01	320.8	Existing Cond.	1501.00	819.10	828.89	827.97	832.54	0.008953	15.34	97.88	430.15	0.86
UnnamedTrib_01	320.8	Future Cond.	1174.00	819.10	830.16	826.63	831.91	0.003648	10.62	110.57	444.75	0.56
UnnamedTrib_01	310		Culvert									
UnnamedTrib_01	246.6	Existing Cond.	1501.00	818.40	827.27	827.27	831.72	0.014611	16.92	88.69	348.58	1.00
UnnamedTrib_01	246.6	Future Cond.	1174.00	818.40	824.87	825.93	829.98	0.025562	18.14	64.71	317.34	1.26
UnnamedTrib_01	150	Existing Cond.	1501.00	818.10	821.60	823.32	828.32	0.129791	20.81	72.12	143.82	2.63
UnnamedTrib_01	150	Future Cond.	1174.00	818.10	821.61	822.81	825.67	0.077986	16.17	72.61	144.19	2.04
UnnamedTrib_01	100	Existing Cond.	1501.00	818.10	822.62	822.13	823.36	0.008556	7.32	277.74	163.30	0.73
UnnamedTrib_01	100	Future Cond.	1174.00	818.10	822.25	821.80	822.87	0.008283	6.62	235.12	158.38	0.70
UnnamedTrib_01	0	Existing Cond.	1501.00	817.10	821.35	821.26	822.31	0.012614	8.17	245.27	137.51	0.87
UnnamedTrib_01	0	Future Cond.	1174.00	817.10	821.01	820.90	821.83	0.012605	7.47	199.37	131.45	0.85

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 2200 Profile: Existing Cond.

E.G. Elev (ft)	842.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	842.94	Reach Len. (ft)	9.55	25.00	40.60
Crit W.S. (ft)	836.72	Flow Area (sq ft)	568.20	515.63	588.88
E.G. Slope (ft/ft)	0.000133	Area (sq ft)	568.20	515.63	588.88
Q Total (cfs)	1501.00	Flow (cfs)	287.67	942.65	270.69
Top Width (ft)	270.89	Top Width (ft)	96.49	58.45	115.95
Vel Total (ft/s)	0.90	Avg. Vel. (ft/s)	0.51	1.83	0.46
Max Chl Dpth (ft)	9.64	Hydr. Depth (ft)	5.89	8.82	5.08
Conv. Total (cfs)	130073.5	Conv. (cfs)	24928.9	81687.6	23457.0
Length Wtd. (ft)	24.80	Wetted Per. (ft)	97.07	58.55	116.29
Min Ch El (ft)	833.30	Shear (lb/sq ft)	0.05	0.07	0.04
Alpha	2.71	Stream Power (lb/ft s)	416.66	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	160.20	23.18	27.15
C & E Loss (ft)	0.00	Cum SA (acres)	23.02	2.46	5.19

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 2200 Profile: Future Cond.

E.G. Elev (ft)	840.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	840.84	Reach Len. (ft)	9.55	25.00	40.60
Crit W.S. (ft)	836.39	Flow Area (sq ft)	377.26	393.09	364.00
E.G. Slope (ft/ft)	0.000230	Area (sq ft)	377.26	393.09	364.00
Q Total (cfs)	1174.00	Flow (cfs)	207.15	788.60	178.26
Top Width (ft)	242.47	Top Width (ft)	85.67	58.45	98.36
Vel Total (ft/s)	1.03	Avg. Vel. (ft/s)	0.55	2.01	0.49
Max Chl Dpth (ft)	7.54	Hydr. Depth (ft)	4.40	6.73	3.70
Conv. Total (cfs)	77367.1	Conv. (cfs)	13651.0	51969.0	11747.1
Length Wtd. (ft)	24.68	Wetted Per. (ft)	86.05	58.55	98.57
Min Ch El (ft)	833.30	Shear (lb/sq ft)	0.06	0.10	0.05
Alpha	2.61	Stream Power (lb/ft s)	416.66	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	142.07	20.28	23.29
C & E Loss (ft)	0.00	Cum SA (acres)	22.56	2.46	4.93

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 2175 Profile: Existing Cond.

E.G. Elev (ft)	842.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	842.94	Reach Len. (ft)	61.32	75.00	88.68
Crit W.S. (ft)		Flow Area (sq ft)	662.26	611.84	596.82
E.G. Slope (ft/ft)	0.000095	Area (sq ft)	662.26	611.84	596.82
Q Total (cfs)	1501.00	Flow (cfs)	286.17	955.15	259.68
Top Width (ft)	278.24	Top Width (ft)	111.06	68.37	98.81
Vel Total (ft/s)	0.80	Avg. Vel. (ft/s)	0.43	1.56	0.44
Max Chl Dpth (ft)	9.84	Hydr. Depth (ft)	5.96	8.95	6.04
Conv. Total (cfs)	153810.6	Conv. (cfs)	29324.7	97876.3	26609.6
Length Wtd. (ft)	74.34	Wetted Per. (ft)	111.59	68.47	99.53
Min Ch El (ft)	833.10	Shear (lb/sq ft)	0.04	0.05	0.04
Alpha	2.52	Stream Power (lb/ft s)	404.45	0.00	0.00

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 2175 Profile: Existing Cond. (Continued)

Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	160.07	22.85	26.60
C & E Loss (ft)	0.00	Cum SA (acres)	22.99	2.43	5.09

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 2175 Profile: Future Cond.

E.G. Elev (ft)	840.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	840.85	Reach Len. (ft)	61.32	75.00	88.68
Crit W.S. (ft)		Flow Area (sq ft)	442.94	468.57	398.94
E.G. Slope (ft/ft)	0.000158	Area (sq ft)	442.94	468.57	398.94
Q Total (cfs)	1174.00	Flow (cfs)	204.49	787.67	181.85
Top Width (ft)	256.68	Top Width (ft)	98.26	68.37	90.05
Vel Total (ft/s)	0.90	Avg. Vel. (ft/s)	0.46	1.68	0.46
Max Chl Dpth (ft)	7.75	Hydr. Depth (ft)	4.51	6.85	4.43
Conv. Total (cfs)	93518.6	Conv. (cfs)	16289.0	62744.0	14485.5
Length Wtd. (ft)	74.32	Wetted Per. (ft)	98.61	68.47	90.53
Min Ch El (ft)	833.10	Shear (lb/sq ft)	0.04	0.07	0.04
Alpha	2.45	Stream Power (lb/ft s)	404.45	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	141.98	20.04	22.94
C & E Loss (ft)	0.00	Cum SA (acres)	22.54	2.43	4.84

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 2100 Profile: Existing Cond.

E.G. Elev (ft)	842.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	842.93	Reach Len. (ft)	100.55	100.00	99.55
Crit W.S. (ft)		Flow Area (sq ft)	783.27	590.83	504.50
E.G. Slope (ft/ft)	0.000086	Area (sq ft)	783.27	590.83	504.50
Q Total (cfs)	1501.00	Flow (cfs)	342.96	934.34	223.70
Top Width (ft)	254.41	Top Width (ft)	119.49	60.08	74.84
Vel Total (ft/s)	0.80	Avg. Vel. (ft/s)	0.44	1.58	0.44
Max Chl Dpth (ft)	10.83	Hydr. Depth (ft)	6.56	9.83	6.74
Conv. Total (cfs)	161602.1	Conv. (cfs)	36924.3	100593.6	24084.2
Length Wtd. (ft)	100.04	Wetted Per. (ft)	120.15	60.21	75.94
Min Ch El (ft)	832.10	Shear (lb/sq ft)	0.04	0.05	0.04
Alpha	2.55	Stream Power (lb/ft s)	419.48	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	159.05	21.82	25.48
C & E Loss (ft)	0.00	Cum SA (acres)	22.83	2.32	4.91

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 2100 Profile: Future Cond.

E.G. Elev (ft)	840.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	840.84	Reach Len. (ft)	100.55	100.00	99.55
Crit W.S. (ft)		Flow Area (sq ft)	549.01	464.81	353.68
E.G. Slope (ft/ft)	0.000128	Area (sq ft)	549.01	464.81	353.68
Q Total (cfs)	1174.00	Flow (cfs)	252.87	761.76	159.37
Top Width (ft)	233.20	Top Width (ft)	104.15	60.08	68.96
Vel Total (ft/s)	0.86	Avg. Vel. (ft/s)	0.46	1.64	0.45
Max Chl Dpth (ft)	8.74	Hydr. Depth (ft)	5.27	7.74	5.13

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 2100 Profile: Future Cond. (Continued)

Conv. Total (cfs)	103939.6	Conv. (cfs)	22388.1	67441.9	14109.6
Length Wtd. (ft)	100.04	Wetted Per. (ft)	104.67	60.21	69.69
Min Ch El (ft)	832.10	Shear (lb/sq ft)	0.04	0.06	0.04
Alpha	2.46	Stream Power (lb/ft s)	419.48	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	141.29	19.23	22.17
C & E Loss (ft)	0.00	Cum SA (acres)	22.40	2.32	4.68

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 2000 Profile: Existing Cond.

E.G. Elev (ft)	842.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	842.91	Reach Len. (ft)	113.15	100.00	86.77
Crit W.S. (ft)		Flow Area (sq ft)	368.90	677.15	320.83
E.G. Slope (ft/ft)	0.000096	Area (sq ft)	368.90	677.15	320.83
Q Total (cfs)	1501.00	Flow (cfs)	168.06	1186.21	146.73
Top Width (ft)	169.27	Top Width (ft)	56.63	64.12	48.52
Vel Total (ft/s)	1.10	Avg. Vel. (ft/s)	0.46	1.75	0.46
Max Chl Dpth (ft)	11.31	Hydr. Depth (ft)	6.51	10.56	6.61
Conv. Total (cfs)	153101.6	Conv. (cfs)	17141.8	120993.0	14966.8
Length Wtd. (ft)	99.93	Wetted Per. (ft)	57.82	64.19	49.99
Min Ch El (ft)	831.60	Shear (lb/sq ft)	0.04	0.06	0.04
Alpha	2.05	Stream Power (lb/ft s)	233.63	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	157.72	20.36	24.54
C & E Loss (ft)	0.01	Cum SA (acres)	22.63	2.17	4.77

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 2000 Profile: Future Cond.

E.G. Elev (ft)	840.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	840.81	Reach Len. (ft)	113.15	100.00	86.77
Crit W.S. (ft)		Flow Area (sq ft)	257.48	542.52	224.39
E.G. Slope (ft/ft)	0.000130	Area (sq ft)	257.48	542.52	224.39
Q Total (cfs)	1174.00	Flow (cfs)	117.76	954.36	101.88
Top Width (ft)	156.97	Top Width (ft)	49.50	64.12	43.34
Vel Total (ft/s)	1.15	Avg. Vel. (ft/s)	0.46	1.76	0.45
Max Chl Dpth (ft)	9.21	Hydr. Depth (ft)	5.20	8.46	5.18
Conv. Total (cfs)	102865.3	Conv. (cfs)	10318.2	83620.9	8926.3
Length Wtd. (ft)	99.93	Wetted Per. (ft)	50.39	64.19	44.40
Min Ch El (ft)	831.60	Shear (lb/sq ft)	0.04	0.07	0.04
Alpha	1.94	Stream Power (lb/ft s)	233.63	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	140.36	18.08	21.51
C & E Loss (ft)	0.00	Cum SA (acres)	22.22	2.17	4.55

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1900 Profile: Existing Cond.

E.G. Elev (ft)	842.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.040	0.110
W.S. Elev (ft)	842.84	Reach Len. (ft)	81.89	45.70	8.97
Crit W.S. (ft)		Flow Area (sq ft)		591.75	76.23
E.G. Slope (ft/ft)	0.000156	Area (sq ft)	184.74	916.29	76.23

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1900 Profile: Existing Cond. (Continued)

Q Total (cfs)	1501.00	Flow (cfs)		1465.58	35.42
Top Width (ft)	117.64	Top Width (ft)	33.89	75.80	7.95
Vel Total (ft/s)	2.25	Avg. Vel. (ft/s)		2.48	0.46
Max Chl Dpth (ft)	13.44	Hydr. Depth (ft)		12.34	9.59
Conv. Total (cfs)	119993.0	Conv. (cfs)		117161.3	2831.8
Length Wtd. (ft)	45.27	Wetted Per. (ft)		48.09	16.71
Min Ch El (ft)	829.40	Shear (lb/sq ft)		0.12	0.04
Alpha	1.19	Stream Power (lb/ft s)	144.34	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	157.00	18.53	24.14
C & E Loss (ft)	0.16	Cum SA (acres)	22.51	2.01	4.71

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1900 Profile: Future Cond.

E.G. Elev (ft)	840.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.		0.040	0.110
W.S. Elev (ft)	840.75	Reach Len. (ft)	81.89	45.70	8.97
Crit W.S. (ft)		Flow Area (sq ft)		491.54	59.61
E.G. Slope (ft/ft)	0.000178	Area (sq ft)	120.07	757.90	59.61
Q Total (cfs)	1174.00	Flow (cfs)		1146.60	27.40
Top Width (ft)	111.52	Top Width (ft)	27.77	75.80	7.95
Vel Total (ft/s)	2.13	Avg. Vel. (ft/s)		2.33	0.46
Max Chl Dpth (ft)	11.35	Hydr. Depth (ft)		10.25	7.50
Conv. Total (cfs)	88050.4	Conv. (cfs)		85995.5	2054.9
Length Wtd. (ft)	45.27	Wetted Per. (ft)		48.09	14.62
Min Ch El (ft)	829.40	Shear (lb/sq ft)		0.11	0.05
Alpha	1.17	Stream Power (lb/ft s)	144.34	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	139.87	16.58	21.23
C & E Loss (ft)	0.13	Cum SA (acres)	22.12	2.01	4.50

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1854.3 Profile: Existing Cond.

E.G. Elev (ft)	842.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.66	Wt. n-Val.		0.040	
W.S. Elev (ft)	841.09	Reach Len. (ft)	168.53	169.92	173.29
Crit W.S. (ft)	836.87	Flow Area (sq ft)		145.14	
E.G. Slope (ft/ft)	0.003318	Area (sq ft)	917.79	145.14	638.39
Q Total (cfs)	1501.00	Flow (cfs)		1501.00	
Top Width (ft)	216.69	Top Width (ft)	114.95	12.00	89.74
Vel Total (ft/s)	10.34	Avg. Vel. (ft/s)		10.34	
Max Chl Dpth (ft)	12.09	Hydr. Depth (ft)		12.09	
Conv. Total (cfs)	26056.9	Conv. (cfs)		26056.9	
Length Wtd. (ft)	169.92	Wetted Per. (ft)		13.66	
Min Ch El (ft)	829.00	Shear (lb/sq ft)		2.20	
Alpha	1.00	Stream Power (lb/ft s)	216.69	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	155.97	17.98	24.07
C & E Loss (ft)		Cum SA (acres)	22.37	1.97	4.70

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1854.3 Profile: Future Cond.

E.G. Elev (ft)	840.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.41	Wt. n-Val.		0.040	
W.S. Elev (ft)	839.27	Reach Len. (ft)	168.53	169.92	173.29
Crit W.S. (ft)	835.65	Flow Area (sq ft)		123.21	
E.G. Slope (ft/ft)	0.003505	Area (sq ft)	707.73	123.21	474.39
Q Total (cfs)	1174.00	Flow (cfs)		1174.00	
Top Width (ft)	216.69	Top Width (ft)	114.95	12.00	89.74
Vel Total (ft/s)	9.53	Avg. Vel. (ft/s)		9.53	
Max Chl Dpth (ft)	10.27	Hydr. Depth (ft)		10.27	
Conv. Total (cfs)	19831.4	Conv. (cfs)		19831.4	
Length Wtd. (ft)	169.92	Wetted Per. (ft)		13.66	
Min Ch El (ft)	829.00	Shear (lb/sq ft)		1.97	
Alpha	1.00	Stream Power (lb/ft s)	216.69	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	139.09	16.12	21.17
C & E Loss (ft)		Cum SA (acres)	21.99	1.97	4.49

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1685.8 Profile: Existing Cond.

E.G. Elev (ft)	839.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	7.24	Wt. n-Val.		0.040	
W.S. Elev (ft)	831.89	Reach Len. (ft)	76.93	85.80	86.03
Crit W.S. (ft)	833.94	Flow Area (sq ft)		69.52	
E.G. Slope (ft/ft)	0.042238	Area (sq ft)	289.73	69.52	23.45
Q Total (cfs)	1501.00	Flow (cfs)		1501.00	
Top Width (ft)	149.48	Top Width (ft)	125.37	12.00	12.11
Vel Total (ft/s)	21.59	Avg. Vel. (ft/s)		21.59	
Max Chl Dpth (ft)	5.79	Hydr. Depth (ft)		5.79	
Conv. Total (cfs)	7303.5	Conv. (cfs)		7303.5	
Length Wtd. (ft)	85.80	Wetted Per. (ft)		14.62	
Min Ch El (ft)	826.10	Shear (lb/sq ft)		12.54	
Alpha	1.00	Stream Power (lb/ft s)	314.97	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	155.97	17.49	24.07
C & E Loss (ft)		Cum SA (acres)	21.90	1.92	4.50

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1685.8 Profile: Future Cond.

E.G. Elev (ft)	837.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	6.44	Wt. n-Val.		0.040	
W.S. Elev (ft)	830.90	Reach Len. (ft)	76.93	85.80	86.03
Crit W.S. (ft)	832.77	Flow Area (sq ft)		57.64	
E.G. Slope (ft/ft)	0.048275	Area (sq ft)	165.54	57.64	12.99
Q Total (cfs)	1174.00	Flow (cfs)		1174.00	
Top Width (ft)	146.38	Top Width (ft)	125.37	12.00	9.01
Vel Total (ft/s)	20.37	Avg. Vel. (ft/s)		20.37	
Max Chl Dpth (ft)	4.80	Hydr. Depth (ft)		4.80	
Conv. Total (cfs)	5343.3	Conv. (cfs)		5343.3	
Length Wtd. (ft)	85.80	Wetted Per. (ft)		14.62	
Min Ch El (ft)	826.10	Shear (lb/sq ft)		11.88	
Alpha	1.00	Stream Power (lb/ft s)	314.97	0.00	0.00

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1685.8 Profile: Future Cond. (Continued)

Frctn Loss (ft)		Cum Volume (acre-ft)	139.09	15.73	21.17
C & E Loss (ft)		Cum SA (acres)	21.52	1.92	4.29

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1600 Profile: Existing Cond.

E.G. Elev (ft)	833.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.92	Reach Len. (ft)	41.81	50.00	50.20
Crit W.S. (ft)	830.06	Flow Area (sq ft)	94.18	322.98	67.78
E.G. Slope (ft/ft)	0.001190	Area (sq ft)	792.99	322.98	113.87
Q Total (cfs)	1501.00	Flow (cfs)	109.16	1313.01	78.83
Top Width (ft)	279.99	Top Width (ft)	177.10	56.90	45.99
Vel Total (ft/s)	3.10	Avg. Vel. (ft/s)	1.16	4.07	1.16
Max Chl Dpth (ft)	6.92	Hydr. Depth (ft)	3.92	5.68	3.96
Conv. Total (cfs)	43518.7	Conv. (cfs)	3164.9	38068.2	2285.6
Length Wtd. (ft)	49.16	Wetted Per. (ft)	24.00	57.15	17.19
Min Ch El (ft)	826.00	Shear (lb/sq ft)	0.29	0.42	0.29
Alpha	1.53	Stream Power (lb/ft s)	561.55	0.00	0.00
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	155.01	17.11	23.93
C & E Loss (ft)	0.03	Cum SA (acres)	21.64	1.85	4.44

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1600 Profile: Future Cond.

E.G. Elev (ft)	832.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.11	Reach Len. (ft)	41.81	50.00	50.20
Crit W.S. (ft)	829.64	Flow Area (sq ft)	74.74	276.91	53.94
E.G. Slope (ft/ft)	0.001253	Area (sq ft)	650.45	276.91	79.54
Q Total (cfs)	1174.00	Flow (cfs)	76.21	1042.52	55.28
Top Width (ft)	270.71	Top Width (ft)	175.00	56.90	38.81
Vel Total (ft/s)	2.89	Avg. Vel. (ft/s)	1.02	3.76	1.02
Max Chl Dpth (ft)	6.11	Hydr. Depth (ft)	3.11	4.87	3.15
Conv. Total (cfs)	33170.3	Conv. (cfs)	2153.2	29455.3	1561.8
Length Wtd. (ft)	49.21	Wetted Per. (ft)	24.00	57.15	17.19
Min Ch El (ft)	826.00	Shear (lb/sq ft)	0.24	0.38	0.25
Alpha	1.52	Stream Power (lb/ft s)	561.55	0.00	0.00
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	138.37	15.40	21.08
C & E Loss (ft)	0.03	Cum SA (acres)	21.26	1.85	4.25

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1550 Profile: Existing Cond.

E.G. Elev (ft)	833.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.96	Reach Len. (ft)	45.21	50.00	60.22
Crit W.S. (ft)		Flow Area (sq ft)	203.00	396.53	120.55
E.G. Slope (ft/ft)	0.000659	Area (sq ft)	1191.32	396.53	141.91
Q Total (cfs)	1501.00	Flow (cfs)	201.86	1207.21	91.93
Top Width (ft)	350.47	Top Width (ft)	224.13	69.32	57.02
Vel Total (ft/s)	2.08	Avg. Vel. (ft/s)	0.99	3.04	0.76
Max Chl Dpth (ft)	6.96	Hydr. Depth (ft)	4.86	5.72	3.27

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1550 Profile: Existing Cond. (Continued)

Conv. Total (cfs)	58482.0	Conv. (cfs)	7865.1	47035.2	3581.8
Length Wtd. (ft)	49.22	Wetted Per. (ft)	41.79	69.49	36.95
Min Ch El (ft)	826.00	Shear (lb/sq ft)	0.20	0.23	0.13
Alpha	1.75	Stream Power (lb/ft s)	453.93	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	154.06	16.69	23.79
C & E Loss (ft)	0.02	Cum SA (acres)	21.45	1.78	4.38

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1550 Profile: Future Cond.

E.G. Elev (ft)	832.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.13	Reach Len. (ft)	45.21	50.00	60.22
Crit W.S. (ft)		Flow Area (sq ft)	168.59	339.45	90.17
E.G. Slope (ft/ft)	0.000703	Area (sq ft)	1007.59	339.45	98.18
Q Total (cfs)	1174.00	Flow (cfs)	153.01	962.46	58.53
Top Width (ft)	339.82	Top Width (ft)	221.29	69.32	49.21
Vel Total (ft/s)	1.96	Avg. Vel. (ft/s)	0.91	2.84	0.65
Max Chl Dpth (ft)	6.13	Hydr. Depth (ft)	4.03	4.90	2.44
Conv. Total (cfs)	44280.1	Conv. (cfs)	5771.1	36301.3	2207.7
Length Wtd. (ft)	49.14	Wetted Per. (ft)	41.79	69.49	36.95
Min Ch El (ft)	826.00	Shear (lb/sq ft)	0.18	0.21	0.11
Alpha	1.74	Stream Power (lb/ft s)	453.93	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	137.57	15.05	20.98
C & E Loss (ft)	0.02	Cum SA (acres)	21.07	1.78	4.20

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1500 Profile: Existing Cond.

E.G. Elev (ft)	833.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.97	Reach Len. (ft)	98.75	100.00	103.92
Crit W.S. (ft)		Flow Area (sq ft)	683.35	320.22	86.50
E.G. Slope (ft/ft)	0.000443	Area (sq ft)	1730.85	320.22	133.13
Q Total (cfs)	1501.00	Flow (cfs)	612.62	829.02	59.36
Top Width (ft)	360.73	Top Width (ft)	257.79	52.99	49.95
Vel Total (ft/s)	1.38	Avg. Vel. (ft/s)	0.90	2.59	0.69
Max Chl Dpth (ft)	7.87	Hydr. Depth (ft)	5.60	6.04	3.76
Conv. Total (cfs)	71322.3	Conv. (cfs)	29109.8	39391.9	2820.6
Length Wtd. (ft)	99.70	Wetted Per. (ft)	122.03	53.14	23.06
Min Ch El (ft)	826.00	Shear (lb/sq ft)	0.15	0.17	0.10
Alpha	2.14	Stream Power (lb/ft s)	639.02	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	152.54	16.28	23.60
C & E Loss (ft)	0.01	Cum SA (acres)	21.20	1.71	4.31

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1500 Profile: Future Cond.

E.G. Elev (ft)	832.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.14	Reach Len. (ft)	98.75	100.00	103.92
Crit W.S. (ft)		Flow Area (sq ft)	582.34	276.34	67.43
E.G. Slope (ft/ft)	0.000456	Area (sq ft)	1518.74	276.34	94.37

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1500 Profile: Future Cond. (Continued)

Q Total (cfs)	1174.00	Flow (cfs)	476.19	658.04	39.77
Top Width (ft)	351.15	Top Width (ft)	254.51	52.99	43.65
Vel Total (ft/s)	1.27	Avg. Vel. (ft/s)	0.82	2.38	0.59
Max Chl Dpth (ft)	7.04	Hydr. Depth (ft)	4.77	5.21	2.93
Conv. Total (cfs)	54973.4	Conv. (cfs)	22298.0	30813.1	1862.3
Length Wtd. (ft)	99.68	Wetted Per. (ft)	122.03	53.14	23.06
Min Ch El (ft)	826.00	Shear (lb/sq ft)	0.14	0.15	0.08
Alpha	2.15	Stream Power (lb/ft s)	639.02	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	136.26	14.69	20.85
C & E Loss (ft)	0.01	Cum SA (acres)	20.82	1.71	4.13

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1400 Profile: Existing Cond.

E.G. Elev (ft)	833.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.97	Reach Len. (ft)	400.70	400.00	399.99
Crit W.S. (ft)		Flow Area (sq ft)	1371.74	363.55	348.33
E.G. Slope (ft/ft)	0.000171	Area (sq ft)	1513.88	363.55	348.33
Q Total (cfs)	1501.00	Flow (cfs)	706.08	660.73	134.18
Top Width (ft)	433.23	Top Width (ft)	275.30	50.00	107.93
Vel Total (ft/s)	0.72	Avg. Vel. (ft/s)	0.51	1.82	0.39
Max Chl Dpth (ft)	8.37	Hydr. Depth (ft)	4.98	7.27	3.23
Conv. Total (cfs)	114832.8	Conv. (cfs)	54018.3	50549.0	10265.6
Length Wtd. (ft)	400.36	Wetted Per. (ft)	275.60	50.20	108.09
Min Ch El (ft)	824.60	Shear (lb/sq ft)	0.05	0.08	0.03
Alpha	3.07	Stream Power (lb/ft s)	687.95	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	148.86	15.50	23.02
C & E Loss (ft)	0.01	Cum SA (acres)	20.59	1.59	4.12

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1400 Profile: Future Cond.

E.G. Elev (ft)	832.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.14	Reach Len. (ft)	400.70	400.00	399.99
Crit W.S. (ft)		Flow Area (sq ft)	1147.18	321.90	263.47
E.G. Slope (ft/ft)	0.000172	Area (sq ft)	1289.32	321.90	263.47
Q Total (cfs)	1174.00	Flow (cfs)	541.08	541.38	91.54
Top Width (ft)	409.72	Top Width (ft)	263.90	50.00	95.82
Vel Total (ft/s)	0.68	Avg. Vel. (ft/s)	0.47	1.68	0.35
Max Chl Dpth (ft)	7.54	Hydr. Depth (ft)	4.35	6.44	2.75
Conv. Total (cfs)	89498.1	Conv. (cfs)	41248.5	41271.0	6978.7
Length Wtd. (ft)	400.35	Wetted Per. (ft)	264.16	50.20	95.96
Min Ch El (ft)	824.60	Shear (lb/sq ft)	0.05	0.07	0.03
Alpha	3.08	Stream Power (lb/ft s)	687.95	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	133.08	14.01	20.42
C & E Loss (ft)	0.01	Cum SA (acres)	20.23	1.59	3.97

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1000 Profile: Existing Cond.

E.G. Elev (ft)	832.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.96	Reach Len. (ft)	2200.70	200.00	181.47
Crit W.S. (ft)		Flow Area (sq ft)	2797.10	528.96	686.57
E.G. Slope (ft/ft)	0.000032	Area (sq ft)	2797.10	528.96	686.57
Q Total (cfs)	1501.00	Flow (cfs)	824.14	528.66	148.20
Top Width (ft)	567.10	Top Width (ft)	371.16	50.94	145.00
Vel Total (ft/s)	0.37	Avg. Vel. (ft/s)	0.29	1.00	0.22
Max Chl Dpth (ft)	11.86	Hydr. Depth (ft)	7.54	10.38	4.73
Conv. Total (cfs)	264366.8	Conv. (cfs)	145152.7	93111.5	26102.6
Length Wtd. (ft)	1088.99	Wetted Per. (ft)	371.48	51.28	145.41
Min Ch El (ft)	821.10	Shear (lb/sq ft)	0.02	0.02	0.01
Alpha	2.89	Stream Power (lb/ft s)	798.83	0.00	0.00
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	129.03	11.40	18.27
C & E Loss (ft)	0.00	Cum SA (acres)	17.62	1.13	2.96

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1000 Profile: Future Cond.

E.G. Elev (ft)	832.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.13	Reach Len. (ft)	2200.70	200.00	181.47
Crit W.S. (ft)		Flow Area (sq ft)	2491.92	486.61	571.80
E.G. Slope (ft/ft)	0.000028	Area (sq ft)	2491.92	486.61	571.80
Q Total (cfs)	1174.00	Flow (cfs)	639.41	426.32	108.27
Top Width (ft)	545.08	Top Width (ft)	363.02	50.94	131.12
Vel Total (ft/s)	0.33	Avg. Vel. (ft/s)	0.26	0.88	0.19
Max Chl Dpth (ft)	11.03	Hydr. Depth (ft)	6.86	9.55	4.36
Conv. Total (cfs)	223118.8	Conv. (cfs)	121520.0	81021.7	20577.1
Length Wtd. (ft)	1080.41	Wetted Per. (ft)	363.30	51.28	131.50
Min Ch El (ft)	821.10	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	2.91	Stream Power (lb/ft s)	798.83	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	115.69	10.30	16.59
C & E Loss (ft)	0.00	Cum SA (acres)	17.35	1.13	2.92

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 800 Profile: Existing Cond.

E.G. Elev (ft)	832.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.91	Reach Len. (ft)	201.23	200.00	197.90
Crit W.S. (ft)		Flow Area (sq ft)	1498.73	594.66	956.83
E.G. Slope (ft/ft)	0.000041	Area (sq ft)	1498.73	594.66	956.83
Q Total (cfs)	1501.00	Flow (cfs)	513.73	707.89	279.39
Top Width (ft)	385.58	Top Width (ft)	182.36	52.56	150.66
Vel Total (ft/s)	0.49	Avg. Vel. (ft/s)	0.34	1.19	0.29
Max Chl Dpth (ft)	12.81	Hydr. Depth (ft)	8.22	11.31	6.35
Conv. Total (cfs)	235044.9	Conv. (cfs)	80445.7	110849.3	43749.8
Length Wtd. (ft)	199.93	Wetted Per. (ft)	189.22	52.90	153.65
Min Ch El (ft)	820.10	Shear (lb/sq ft)	0.02	0.03	0.02
Alpha	2.99	Stream Power (lb/ft s)	385.58	0.00	0.00

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 800 Profile: Existing Cond. (Continued)

Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	20.52	8.82	14.85
C & E Loss (ft)	0.00	Cum SA (acres)	3.64	0.89	2.34

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 800 Profile: Future Cond.

E.G. Elev (ft)	832.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.09	Reach Len. (ft)	201.23	200.00	197.90
Crit W.S. (ft)		Flow Area (sq ft)	1348.46	551.35	832.69
E.G. Slope (ft/ft)	0.000034	Area (sq ft)	1348.46	551.35	832.69
Q Total (cfs)	1174.00	Flow (cfs)	396.72	573.04	204.24
Top Width (ft)	385.58	Top Width (ft)	182.36	52.56	150.66
Vel Total (ft/s)	0.43	Avg. Vel. (ft/s)	0.29	1.04	0.25
Max Chl Dpth (ft)	11.99	Hydr. Depth (ft)	7.39	10.49	5.53
Conv. Total (cfs)	200205.2	Conv. (cfs)	67653.5	97722.7	34829.0
Length Wtd. (ft)	199.94	Wetted Per. (ft)	188.39	52.90	152.83
Min Ch El (ft)	820.10	Shear (lb/sq ft)	0.02	0.02	0.01
Alpha	3.07	Stream Power (lb/ft s)	385.58	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	18.68	7.91	13.66
C & E Loss (ft)	0.00	Cum SA (acres)	3.57	0.89	2.34

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 600 Profile: Existing Cond.

E.G. Elev (ft)	832.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.91	Reach Len. (ft)	99.87	100.00	101.98
Crit W.S. (ft)		Flow Area (sq ft)	1634.49	813.38	1622.13
E.G. Slope (ft/ft)	0.000020	Area (sq ft)	1756.18	813.38	1622.13
Q Total (cfs)	1501.00	Flow (cfs)	407.45	731.08	362.48
Top Width (ft)	514.16	Top Width (ft)	219.40	65.01	229.75
Vel Total (ft/s)	0.37	Avg. Vel. (ft/s)	0.25	0.90	0.22
Max Chl Dpth (ft)	13.81	Hydr. Depth (ft)	8.32	12.51	7.06
Conv. Total (cfs)	333609.6	Conv. (cfs)	90558.5	162487.4	80563.6
Length Wtd. (ft)	100.46	Wetted Per. (ft)	196.77	65.22	230.10
Min Ch El (ft)	819.10	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	3.11	Stream Power (lb/ft s)	518.87	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	13.00	5.59	8.99
C & E Loss (ft)	0.00	Cum SA (acres)	2.71	0.62	1.48

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 600 Profile: Future Cond.

E.G. Elev (ft)	832.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.09	Reach Len. (ft)	99.87	100.00	101.98
Crit W.S. (ft)		Flow Area (sq ft)	1472.63	759.83	1437.00
E.G. Slope (ft/ft)	0.000017	Area (sq ft)	1575.45	759.83	1437.00
Q Total (cfs)	1174.00	Flow (cfs)	309.21	589.29	275.51
Top Width (ft)	504.16	Top Width (ft)	219.40	65.01	219.75
Vel Total (ft/s)	0.32	Avg. Vel. (ft/s)	0.21	0.78	0.19
Max Chl Dpth (ft)	12.99	Hydr. Depth (ft)	7.49	11.69	6.54

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 600 Profile: Future Cond. (Continued)

Conv. Total (cfs)	288979.2	Conv. (cfs)	76111.6	145052.1	67815.5
Length Wtd. (ft)	100.45	Wetted Per. (ft)	196.77	65.22	220.07
Min Ch El (ft)	819.10	Shear (lb/sq ft)	0.01	0.01	0.01
Alpha	3.15	Stream Power (lb/ft s)	518.87	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	11.92	4.90	8.50
C & E Loss (ft)	0.00	Cum SA (acres)	2.65	0.62	1.50

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 500 Profile: Existing Cond.

E.G. Elev (ft)	832.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.91	Reach Len. (ft)	139.60	179.20	209.45
Crit W.S. (ft)		Flow Area (sq ft)	1265.14	873.31	1570.04
E.G. Slope (ft/ft)	0.000019	Area (sq ft)	2072.47	873.31	1589.77
Q Total (cfs)	1501.00	Flow (cfs)	357.35	758.33	385.32
Top Width (ft)	505.26	Top Width (ft)	241.30	69.00	194.96
Vel Total (ft/s)	0.40	Avg. Vel. (ft/s)	0.28	0.87	0.25
Max Chl Dpth (ft)	13.81	Hydr. Depth (ft)	10.69	12.66	8.67
Conv. Total (cfs)	348225.2	Conv. (cfs)	82903.2	175929.5	89392.5
Length Wtd. (ft)	178.37	Wetted Per. (ft)	118.41	69.15	181.44
Min Ch El (ft)	819.10	Shear (lb/sq ft)	0.01	0.01	0.01
Alpha	2.54	Stream Power (lb/ft s)	505.26	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	8.61	3.65	5.23
C & E Loss (ft)	0.36	Cum SA (acres)	2.18	0.47	0.98

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 500 Profile: Future Cond.

E.G. Elev (ft)	832.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	832.09	Reach Len. (ft)	139.60	179.20	209.45
Crit W.S. (ft)		Flow Area (sq ft)	1167.67	816.50	1421.03
E.G. Slope (ft/ft)	0.000015	Area (sq ft)	1873.82	816.50	1429.27
Q Total (cfs)	1174.00	Flow (cfs)	278.73	604.36	290.91
Top Width (ft)	505.10	Top Width (ft)	241.30	69.00	194.80
Vel Total (ft/s)	0.34	Avg. Vel. (ft/s)	0.24	0.74	0.20
Max Chl Dpth (ft)	12.99	Hydr. Depth (ft)	9.86	11.83	7.85
Conv. Total (cfs)	305512.6	Conv. (cfs)	72534.4	157274.0	75704.1
Length Wtd. (ft)	178.25	Wetted Per. (ft)	118.41	69.15	181.44
Min Ch El (ft)	819.10	Shear (lb/sq ft)	0.01	0.01	0.01
Alpha	2.57	Stream Power (lb/ft s)	505.26	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	7.97	3.09	5.15
C & E Loss (ft)	0.17	Cum SA (acres)	2.12	0.47	1.01

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 320.8 Profile: Existing Cond.

E.G. Elev (ft)	832.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.65	Wt. n-Val.		0.040	
W.S. Elev (ft)	828.89	Reach Len. (ft)	88.20	74.20	70.43
Crit W.S. (ft)	827.97	Flow Area (sq ft)		97.88	
E.G. Slope (ft/ft)	0.008953	Area (sq ft)	1931.61	97.88	505.29

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 320.8 Profile: Existing Cond. (Continued)

Q Total (cfs)	1501.00	Flow (cfs)		1501.00	
Top Width (ft)	430.15	Top Width (ft)	302.11	10.00	118.04
Vel Total (ft/s)	15.34	Avg. Vel. (ft/s)		15.34	
Max Chl Dpth (ft)	9.79	Hydr. Depth (ft)		9.79	
Conv. Total (cfs)	15863.5	Conv. (cfs)		15863.5	
Length Wtd. (ft)	74.20	Wetted Per. (ft)		10.74	
Min Ch El (ft)	819.10	Shear (lb/sq ft)		5.09	
Alpha	1.00	Stream Power (lb/ft s)	459.41	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	2.20	1.65	0.19
C & E Loss (ft)		Cum SA (acres)	1.31	0.30	0.23

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 320.8 Profile: Future Cond.

E.G. Elev (ft)	831.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.75	Wt. n-Val.		0.040	
W.S. Elev (ft)	830.16	Reach Len. (ft)	88.20	74.20	70.43
Crit W.S. (ft)	826.63	Flow Area (sq ft)		110.57	
E.G. Slope (ft/ft)	0.003648	Area (sq ft)	2315.00	110.57	664.75
Q Total (cfs)	1174.00	Flow (cfs)		1174.00	
Top Width (ft)	444.75	Top Width (ft)	302.11	10.00	132.64
Vel Total (ft/s)	10.62	Avg. Vel. (ft/s)		10.62	
Max Chl Dpth (ft)	11.06	Hydr. Depth (ft)		11.06	
Conv. Total (cfs)	19437.7	Conv. (cfs)		19437.7	
Length Wtd. (ft)	74.20	Wetted Per. (ft)		10.74	
Min Ch El (ft)	819.10	Shear (lb/sq ft)		2.34	
Alpha	1.00	Stream Power (lb/ft s)	459.41	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	1.26	1.19	0.11
C & E Loss (ft)		Cum SA (acres)	1.25	0.30	0.22

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 246.6 Profile: Existing Cond.

E.G. Elev (ft)	831.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	4.45	Wt. n-Val.		0.040	
W.S. Elev (ft)	827.27	Reach Len. (ft)	103.00	96.60	87.32
Crit W.S. (ft)	827.27	Flow Area (sq ft)		88.69	
E.G. Slope (ft/ft)	0.014611	Area (sq ft)	1498.81	88.69	78.77
Q Total (cfs)	1501.00	Flow (cfs)		1501.00	
Top Width (ft)	348.58	Top Width (ft)	316.49	10.00	22.09
Vel Total (ft/s)	16.92	Avg. Vel. (ft/s)		16.92	
Max Chl Dpth (ft)	8.87	Hydr. Depth (ft)		8.87	
Conv. Total (cfs)	12417.7	Conv. (cfs)		12417.7	
Length Wtd. (ft)	96.60	Wetted Per. (ft)		12.12	
Min Ch El (ft)	818.40	Shear (lb/sq ft)		6.67	
Alpha	1.00	Stream Power (lb/ft s)	373.15	0.00	0.00
Frctn Loss (ft)	1.45	Cum Volume (acre-ft)	2.20	0.81	0.19
C & E Loss (ft)	0.83	Cum SA (acres)	0.68	0.29	0.12

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 246.6 Profile: Future Cond.

E.G. Elev (ft)	829.98	Element	Left OB	Channel	Right OB
Vel Head (ft)	5.11	Wt. n-Val.		0.040	
W.S. Elev (ft)	824.87	Reach Len. (ft)	103.00	96.60	87.32
Crit W.S. (ft)	825.93	Flow Area (sq ft)		64.71	
E.G. Slope (ft/ft)	0.025562	Area (sq ft)	753.27	64.71	35.11
Q Total (cfs)	1174.00	Flow (cfs)		1174.00	
Top Width (ft)	317.34	Top Width (ft)	292.77	10.00	14.57
Vel Total (ft/s)	18.14	Avg. Vel. (ft/s)		18.14	
Max Chl Dpth (ft)	6.47	Hydr. Depth (ft)		6.47	
Conv. Total (cfs)	7342.9	Conv. (cfs)		7342.9	
Length Wtd. (ft)	96.60	Wetted Per. (ft)		12.12	
Min Ch El (ft)	818.40	Shear (lb/sq ft)		8.52	
Alpha	1.00	Stream Power (lb/ft s)	373.15	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	1.26	0.72	0.11
C & E Loss (ft)		Cum SA (acres)	0.65	0.29	0.10

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 150 Profile: Existing Cond.

E.G. Elev (ft)	828.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	6.73	Wt. n-Val.		0.040	
W.S. Elev (ft)	821.60	Reach Len. (ft)	41.72	50.00	56.55
Crit W.S. (ft)	823.32	Flow Area (sq ft)		72.12	
E.G. Slope (ft/ft)	0.129791	Area (sq ft)	82.92	121.92	
Q Total (cfs)	1501.00	Flow (cfs)		1501.00	
Top Width (ft)	143.82	Top Width (ft)	81.04	62.78	
Vel Total (ft/s)	20.81	Avg. Vel. (ft/s)		20.81	
Max Chl Dpth (ft)	3.50	Hydr. Depth (ft)		1.95	
Conv. Total (cfs)	4166.4	Conv. (cfs)		4166.4	
Length Wtd. (ft)	49.86	Wetted Per. (ft)		37.19	
Min Ch El (ft)	818.10	Shear (lb/sq ft)		15.71	
Alpha	1.00	Stream Power (lb/ft s)	323.25	0.00	0.00
Frctn Loss (ft)	3.17	Cum Volume (acre-ft)	0.33	0.58	0.11
C & E Loss (ft)	0.23	Cum SA (acres)	0.21	0.21	0.10

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 150 Profile: Future Cond.

E.G. Elev (ft)	825.67	Element	Left OB	Channel	Right OB
Vel Head (ft)	4.06	Wt. n-Val.		0.040	
W.S. Elev (ft)	821.61	Reach Len. (ft)	41.72	50.00	56.55
Crit W.S. (ft)	822.81	Flow Area (sq ft)		72.61	
E.G. Slope (ft/ft)	0.077986	Area (sq ft)	83.98	122.74	
Q Total (cfs)	1174.00	Flow (cfs)		1174.00	
Top Width (ft)	144.19	Top Width (ft)	81.28	62.90	
Vel Total (ft/s)	16.17	Avg. Vel. (ft/s)		16.17	
Max Chl Dpth (ft)	3.51	Hydr. Depth (ft)		1.96	
Conv. Total (cfs)	4204.0	Conv. (cfs)		4204.0	
Length Wtd. (ft)	49.85	Wetted Per. (ft)		37.31	
Min Ch El (ft)	818.10	Shear (lb/sq ft)		9.47	
Alpha	1.00	Stream Power (lb/ft s)	323.25	0.00	0.00

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 150 Profile: Future Cond. (Continued)

Frctn Loss (ft)	3.99	Cum Volume (acre-ft)	0.27	0.52	0.08
C & E Loss (ft)	0.32	Cum SA (acres)	0.20	0.21	0.09

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 100 Profile: Existing Cond.

E.G. Elev (ft)	823.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.74	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	822.62	Reach Len. (ft)	110.02	100.00	89.94
Crit W.S. (ft)	822.13	Flow Area (sq ft)	51.46	180.90	45.37
E.G. Slope (ft/ft)	0.008556	Area (sq ft)	135.40	180.90	45.37
Q Total (cfs)	1501.00	Flow (cfs)	107.78	1324.45	68.77
Top Width (ft)	163.30	Top Width (ft)	71.59	57.89	33.82
Vel Total (ft/s)	5.40	Avg. Vel. (ft/s)	2.09	7.32	1.52
Max Chl Dpth (ft)	4.52	Hydr. Depth (ft)	2.17	3.12	1.34
Conv. Total (cfs)	16227.1	Conv. (cfs)	1165.2	14318.4	743.5
Length Wtd. (ft)	100.17	Wetted Per. (ft)	23.72	58.16	33.97
Min Ch El (ft)	818.10	Shear (lb/sq ft)	1.16	1.66	0.71
Alpha	1.63	Stream Power (lb/ft s)	293.70	0.00	0.00
Frctn Loss (ft)	1.03	Cum Volume (acre-ft)	0.22	0.40	0.08
C & E Loss (ft)	0.02	Cum SA (acres)	0.14	0.14	0.07

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 100 Profile: Future Cond.

E.G. Elev (ft)	822.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.62	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	822.25	Reach Len. (ft)	110.02	100.00	89.94
Crit W.S. (ft)	821.80	Flow Area (sq ft)	42.63	159.34	33.15
E.G. Slope (ft/ft)	0.008283	Area (sq ft)	109.29	159.34	33.15
Q Total (cfs)	1174.00	Flow (cfs)	77.50	1054.75	41.76
Top Width (ft)	158.38	Top Width (ft)	68.64	57.89	31.85
Vel Total (ft/s)	4.99	Avg. Vel. (ft/s)	1.82	6.62	1.26
Max Chl Dpth (ft)	4.15	Hydr. Depth (ft)	1.80	2.75	1.04
Conv. Total (cfs)	12899.5	Conv. (cfs)	851.5	11589.2	458.8
Length Wtd. (ft)	100.19	Wetted Per. (ft)	23.72	58.16	31.96
Min Ch El (ft)	818.10	Shear (lb/sq ft)	0.93	1.42	0.54
Alpha	1.59	Stream Power (lb/ft s)	293.70	0.00	0.00
Frctn Loss (ft)	1.01	Cum Volume (acre-ft)	0.17	0.35	0.06
C & E Loss (ft)	0.02	Cum SA (acres)	0.13	0.14	0.07

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 0 Profile: Existing Cond.

E.G. Elev (ft)	822.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.96	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	821.35	Reach Len. (ft)			
Crit W.S. (ft)	821.26	Flow Area (sq ft)	40.43	169.81	35.04
E.G. Slope (ft/ft)	0.012614	Area (sq ft)	40.43	169.81	35.04
Q Total (cfs)	1501.00	Flow (cfs)	63.05	1386.81	51.13
Top Width (ft)	137.51	Top Width (ft)	38.72	61.70	37.09
Vel Total (ft/s)	6.12	Avg. Vel. (ft/s)	1.56	8.17	1.46
Max Chl Dpth (ft)	4.25	Hydr. Depth (ft)	1.04	2.75	0.94

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 0 Profile: Existing Cond. (Continued)

Conv. Total (cfs)	13364.7	Conv. (cfs)	561.4	12348.0	455.3
Length Wtd. (ft)		Wetted Per. (ft)	38.78	62.00	37.14
Min Ch El (ft)	817.10	Shear (lb/sq ft)	0.82	2.16	0.74
Alpha	1.65	Stream Power (lb/ft s)	280.24	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 0 Profile: Future Cond.

E.G. Elev (ft)	821.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.82	Wt. n-Val.	0.110	0.040	0.110
W.S. Elev (ft)	821.01	Reach Len. (ft)			
Crit W.S. (ft)	820.90	Flow Area (sq ft)	27.81	148.74	22.81
E.G. Slope (ft/ft)	0.012605	Area (sq ft)	27.81	148.74	22.81
Q Total (cfs)	1174.00	Flow (cfs)	36.00	1111.78	26.22
Top Width (ft)	131.45	Top Width (ft)	35.21	61.70	34.54
Vel Total (ft/s)	5.89	Avg. Vel. (ft/s)	1.29	7.47	1.15
Max Chl Dpth (ft)	3.91	Hydr. Depth (ft)	0.79	2.41	0.66
Conv. Total (cfs)	10456.6	Conv. (cfs)	320.7	9902.4	233.6
Length Wtd. (ft)		Wetted Per. (ft)	35.26	62.00	34.58
Min Ch El (ft)	817.10	Shear (lb/sq ft)	0.62	1.89	0.52
Alpha	1.53	Stream Power (lb/ft s)	280.24	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1850 Culv Group: Culvert #1 Profile: Existing Cond.

Q Culv Group (cfs)	1501.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	15.91
Q Barrel (cfs)	1501.00	Culv Vel DS (ft/s)	21.60
E.G. US. (ft)	842.76	Culv Inv El Up (ft)	829.00
W.S. US. (ft)	841.09	Culv Inv El Dn (ft)	826.10
E.G. DS (ft)	837.89	Culv Frctn Ls (ft)	1.66
W.S. DS (ft)	833.96	Culv Exit Loss (ft)	1.24
Delta EG (ft)	4.87	Culv Entr Loss (ft)	1.97
Delta WS (ft)	7.13	Q Weir (cfs)	
E.G. IC (ft)	841.18	Weir Sta Lft (ft)	
E.G. OC (ft)	842.76	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	836.86	Weir Max Depth (ft)	
Culv WS Outlet (ft)	831.89	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	5.08	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	7.86	Min El Weir Flow (ft)	850.01

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 1850 Culv Group: Culvert #1 Profile: Future Cond.

Q Culv Group (cfs)	1174.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	14.66
Q Barrel (cfs)	1174.00	Culv Vel DS (ft/s)	20.38
E.G. US. (ft)	840.68	Culv Inv El Up (ft)	829.00
W.S. US. (ft)	839.27	Culv Inv El Dn (ft)	826.10
E.G. DS (ft)	836.11	Culv Frctn Ls (ft)	1.66
W.S. DS (ft)	832.77	Culv Exit Loss (ft)	1.24
Delta EG (ft)	4.57	Culv Entr Loss (ft)	1.67
Delta WS (ft)	6.50	Q Weir (cfs)	
E.G. IC (ft)	839.34	Weir Sta Lft (ft)	
E.G. OC (ft)	840.68	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	835.67	Weir Max Depth (ft)	
Culv WS Outlet (ft)	830.90	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	4.25	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	6.67	Min El Weir Flow (ft)	850.01

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 310 Culv Group: LouisvilleRd Profile: Existing Cond.

Q Culv Group (cfs)	1025.20	Culv Full Len (ft)	64.20
# Barrels	1	Culv Vel US (ft/s)	10.25
Q Barrel (cfs)	1025.20	Culv Vel DS (ft/s)	10.25
E.G. US. (ft)	832.55	Culv Inv El Up (ft)	819.10
W.S. US. (ft)	828.89	Culv Inv El Dn (ft)	818.40
E.G. DS (ft)	831.72	Culv Frctn Ls (ft)	0.18
W.S. DS (ft)	827.27	Culv Exit Loss (ft)	0.00
Delta EG (ft)	0.83	Culv Entr Loss (ft)	0.65
Delta WS (ft)	1.62	Q Weir (cfs)	475.81
E.G. IC (ft)	832.37	Weir Sta Lft (ft)	0.00
E.G. OC (ft)	832.55	Weir Sta Rgt (ft)	459.41

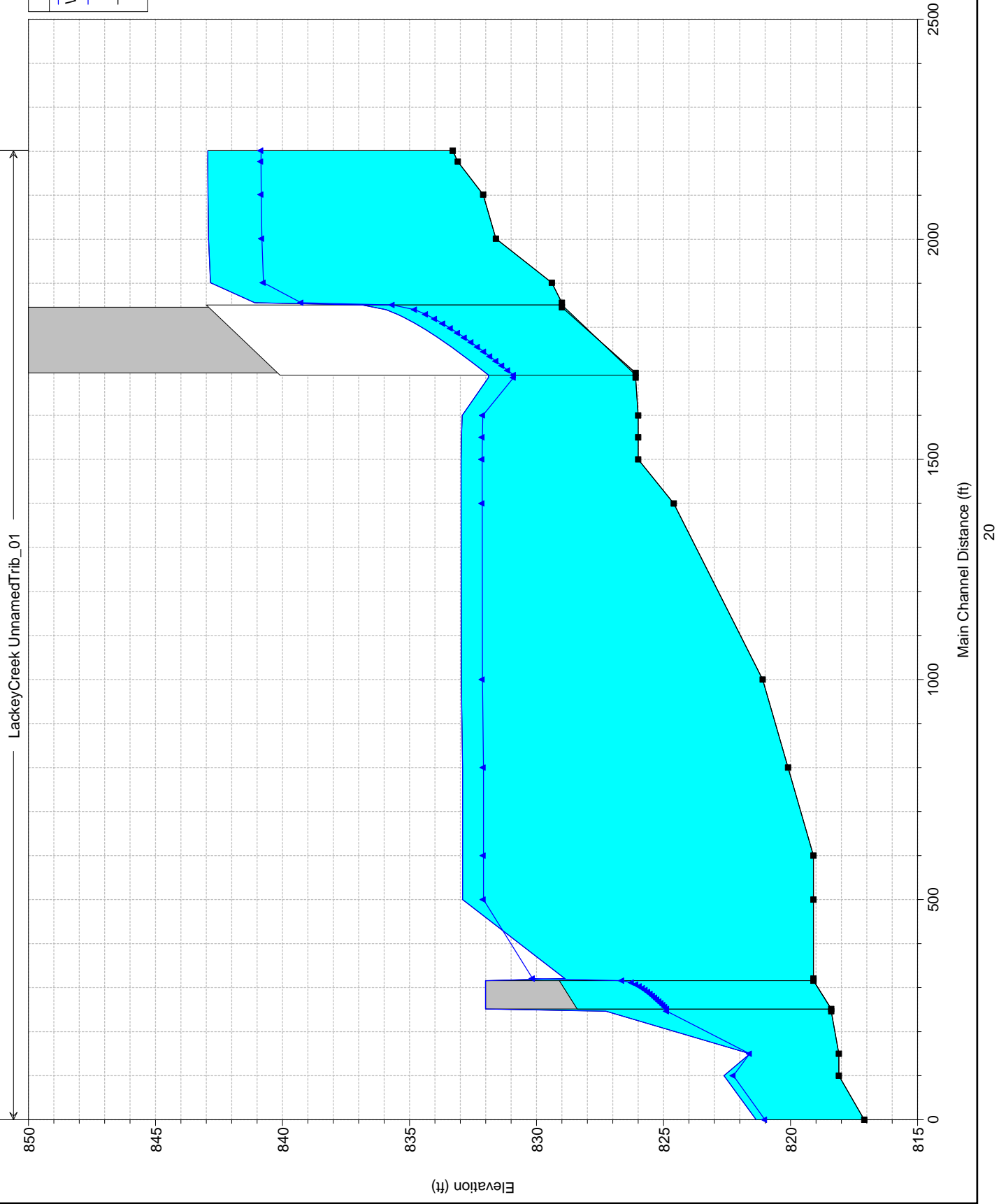
Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 310 Culv Group: LouisvilleRd Profile: Existing Cond. (Continued)

Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	829.10	Weir Max Depth (ft)	0.54
Culv WS Outlet (ft)	830.08	Weir Avg Depth (ft)	0.54
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	248.72
Culv Crt Depth (ft)	6.89	Min El Weir Flow (ft)	832.01

Plan: Plan 01 LackeyCreek UnnamedTrib_01 RS: 310 Culv Group: LouisvilleRd Profile: Future Cond.

Q Culv Group (cfs)	1174.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	15.58
Q Barrel (cfs)	1174.00	Culv Vel DS (ft/s)	18.15
E.G. US. (ft)	831.91	Culv Inv El Up (ft)	819.10
W.S. US. (ft)	830.16	Culv Inv El Dn (ft)	818.40
E.G. DS (ft)	829.70	Culv Frctn Ls (ft)	0.42
W.S. DS (ft)	825.93	Culv Exit Loss (ft)	0.28
Delta EG (ft)	2.21	Culv Entr Loss (ft)	1.51
Delta WS (ft)	4.23	Q Weir (cfs)	
E.G. IC (ft)	831.79	Weir Sta Lft (ft)	
E.G. OC (ft)	831.91	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	826.64	Weir Max Depth (ft)	
Culv WS Outlet (ft)	824.87	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	5.56	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	7.54	Min El Weir Flow (ft)	832.01

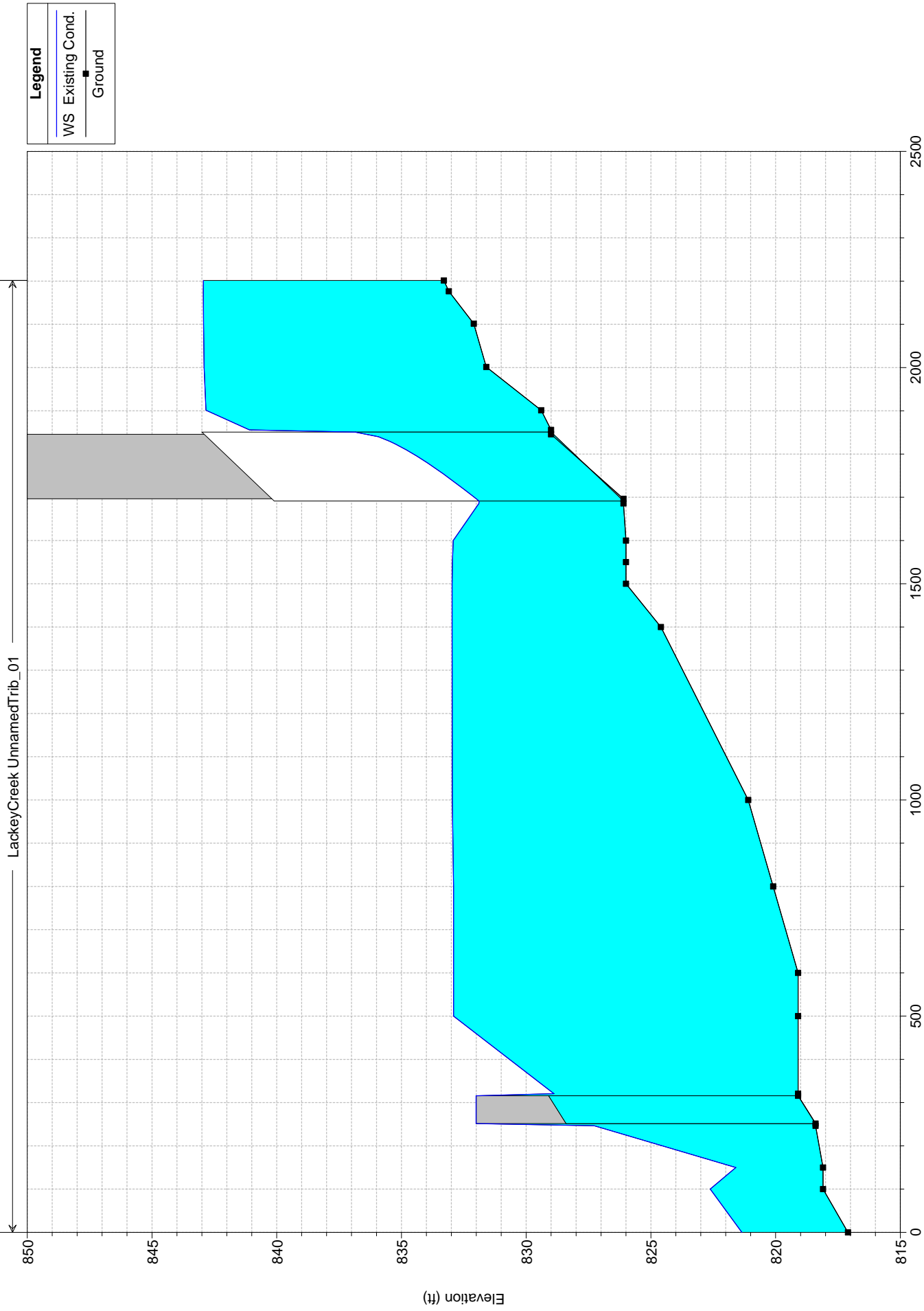
2016-05-09_100Yr_WSEL



Legend

- WS Existing Cond.
- WS Future Cond.
- Ground

2016-05-09_100Yr_WSEL



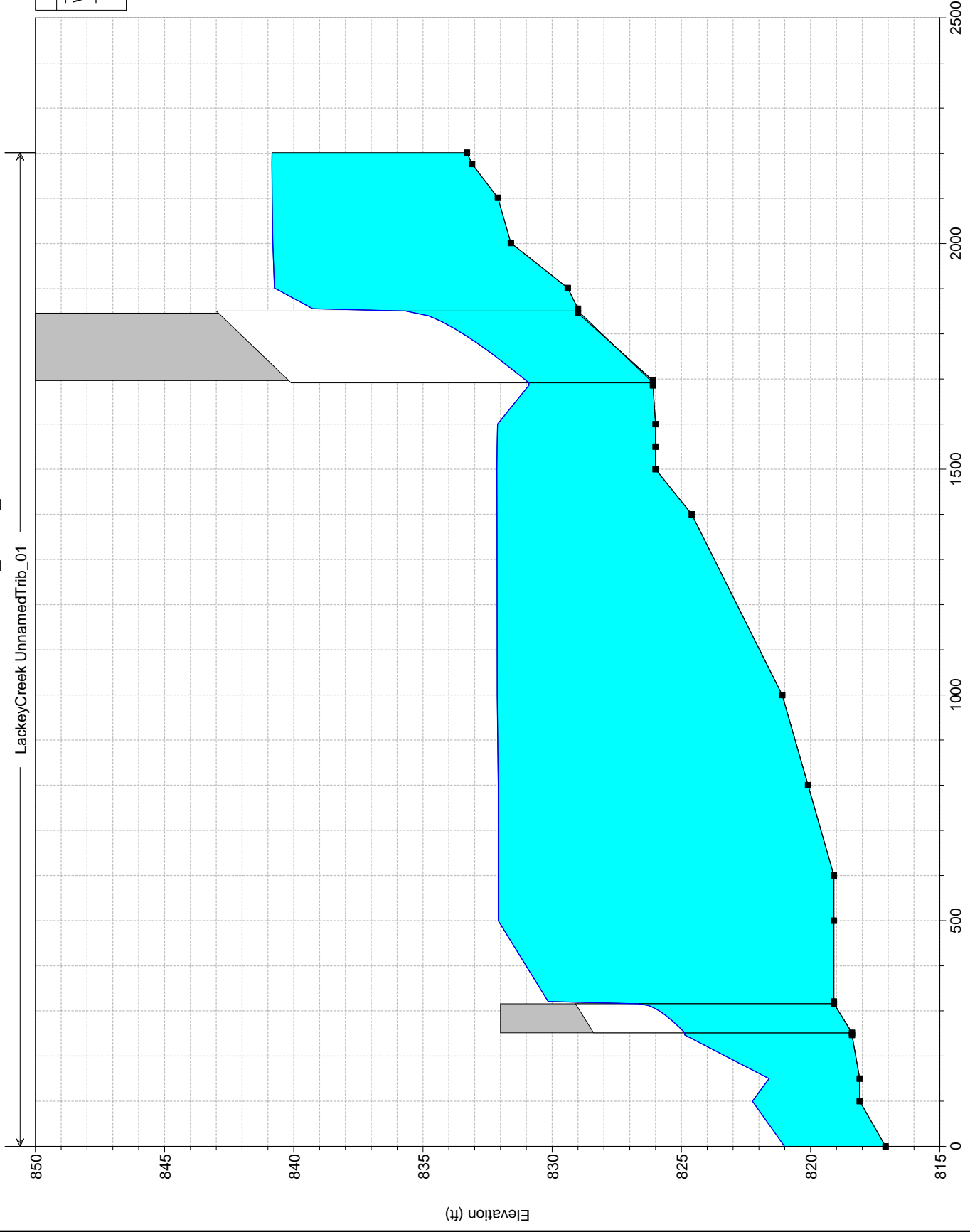
Main Channel Distance (ft)

2016-05-09_100Yr_WSEL

LackeyCreek UnnamedTrib_01

Legend

- WS Future Cond.
- Ground

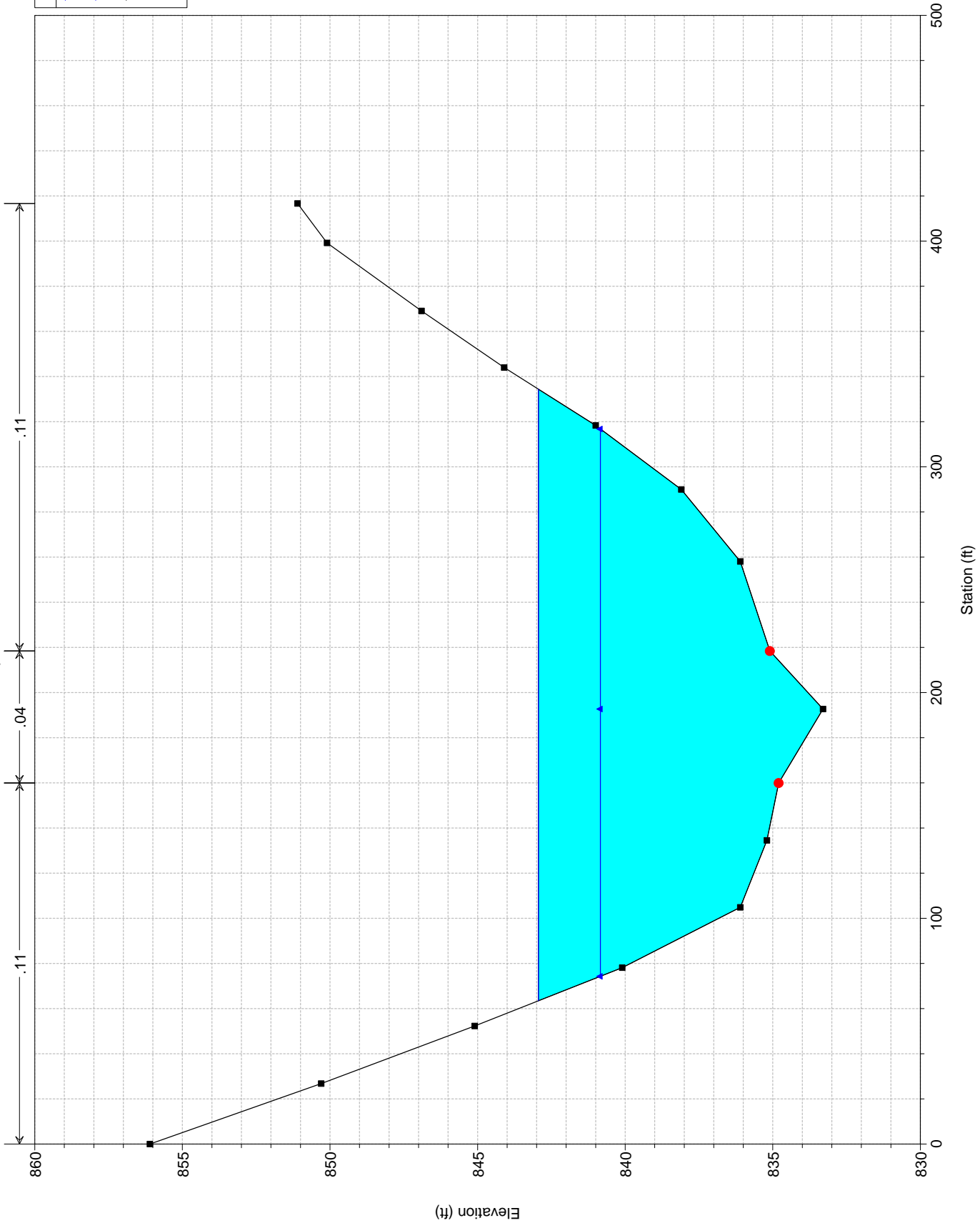


Main Channel Distance (ft)

Elevation (ft)

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 2200

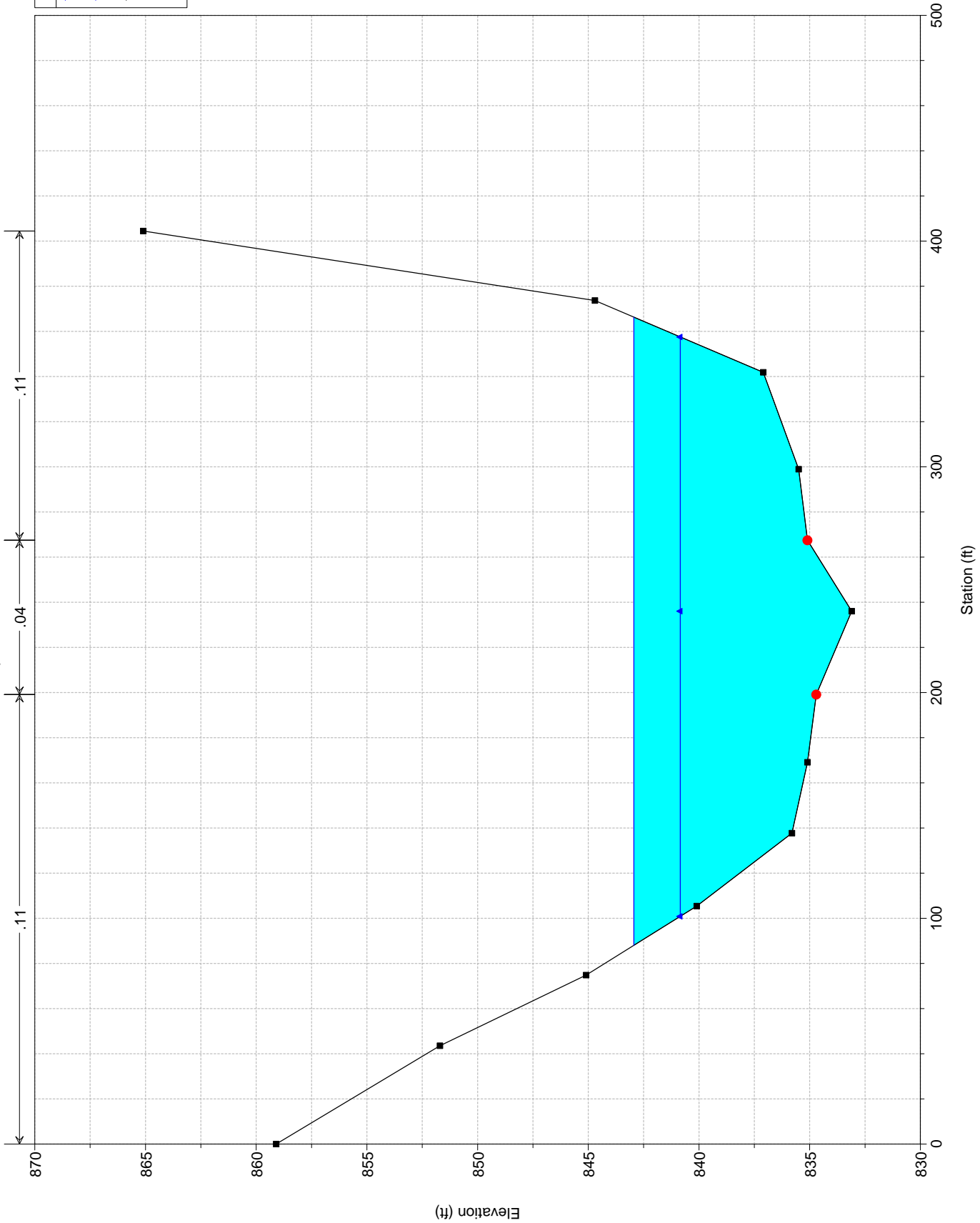


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 2175

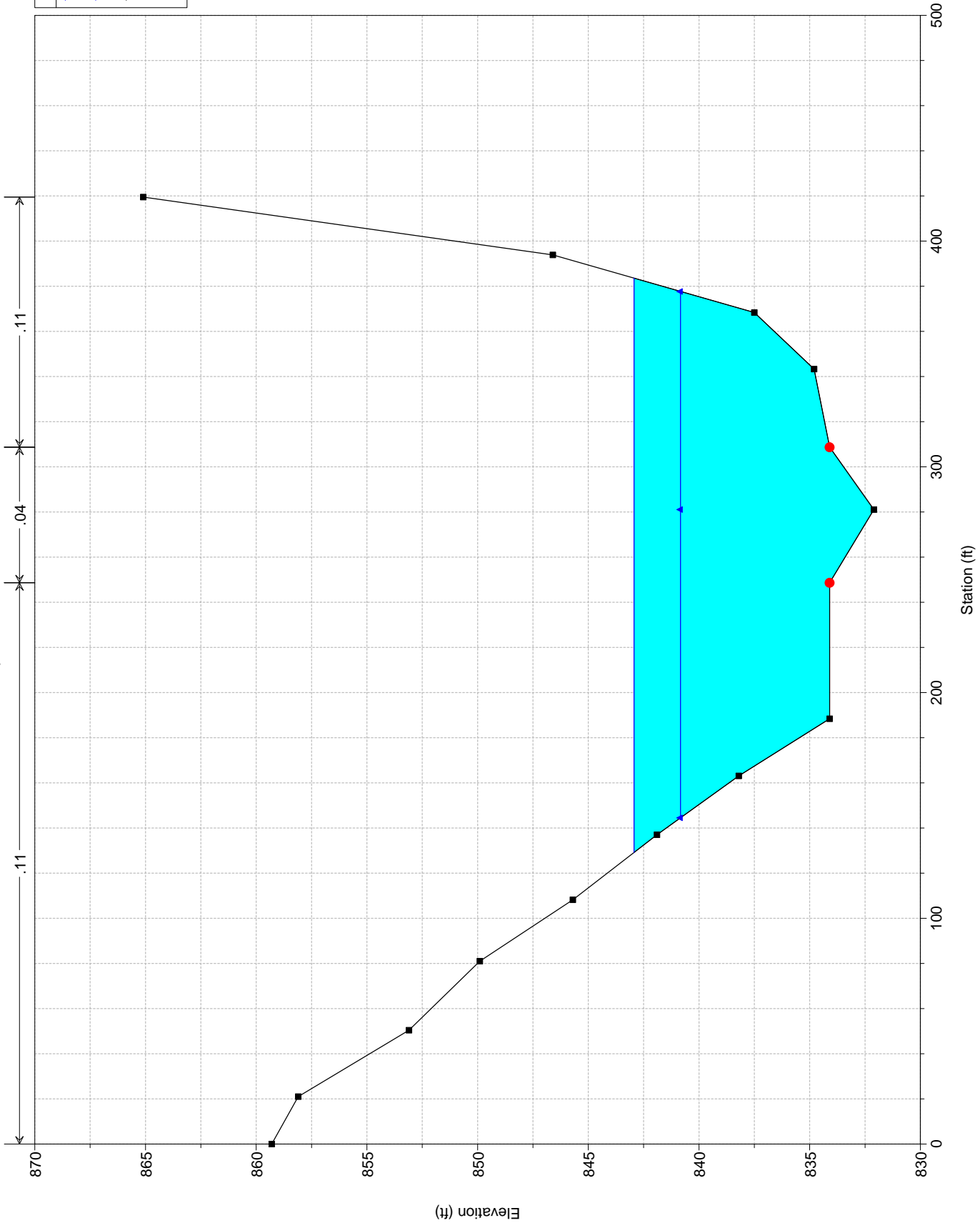


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 2100

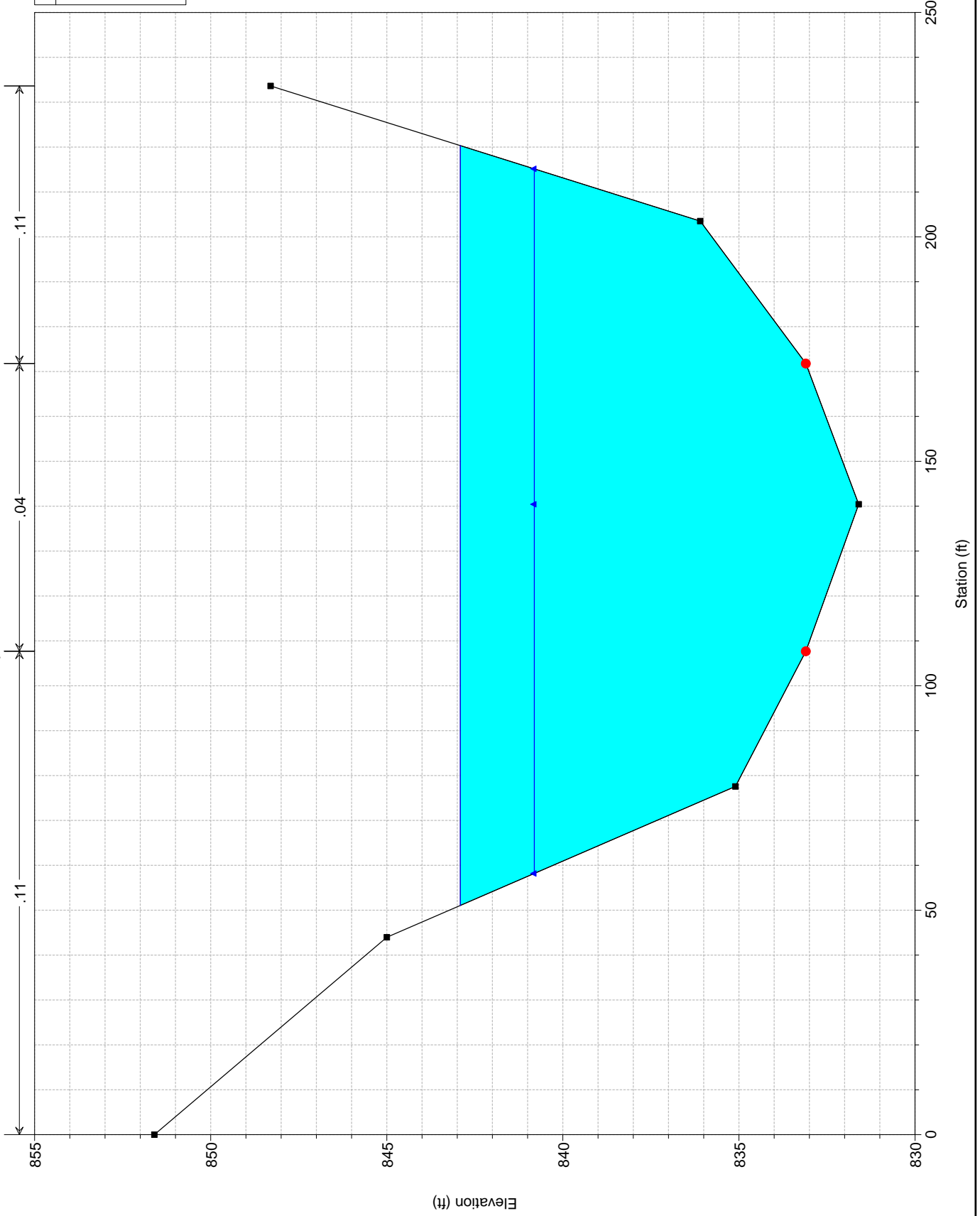


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Bank Sta

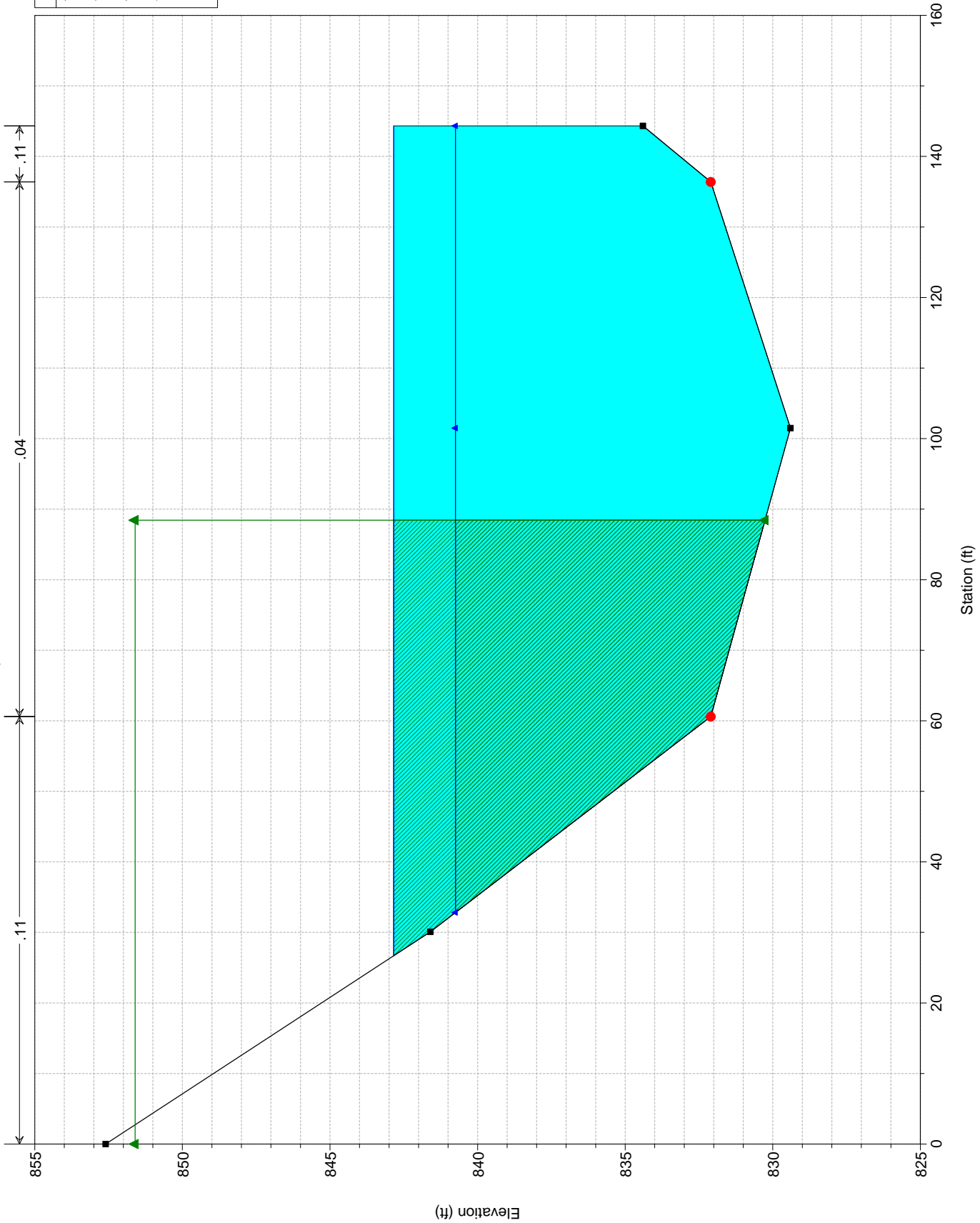
2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 2000



2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 1900

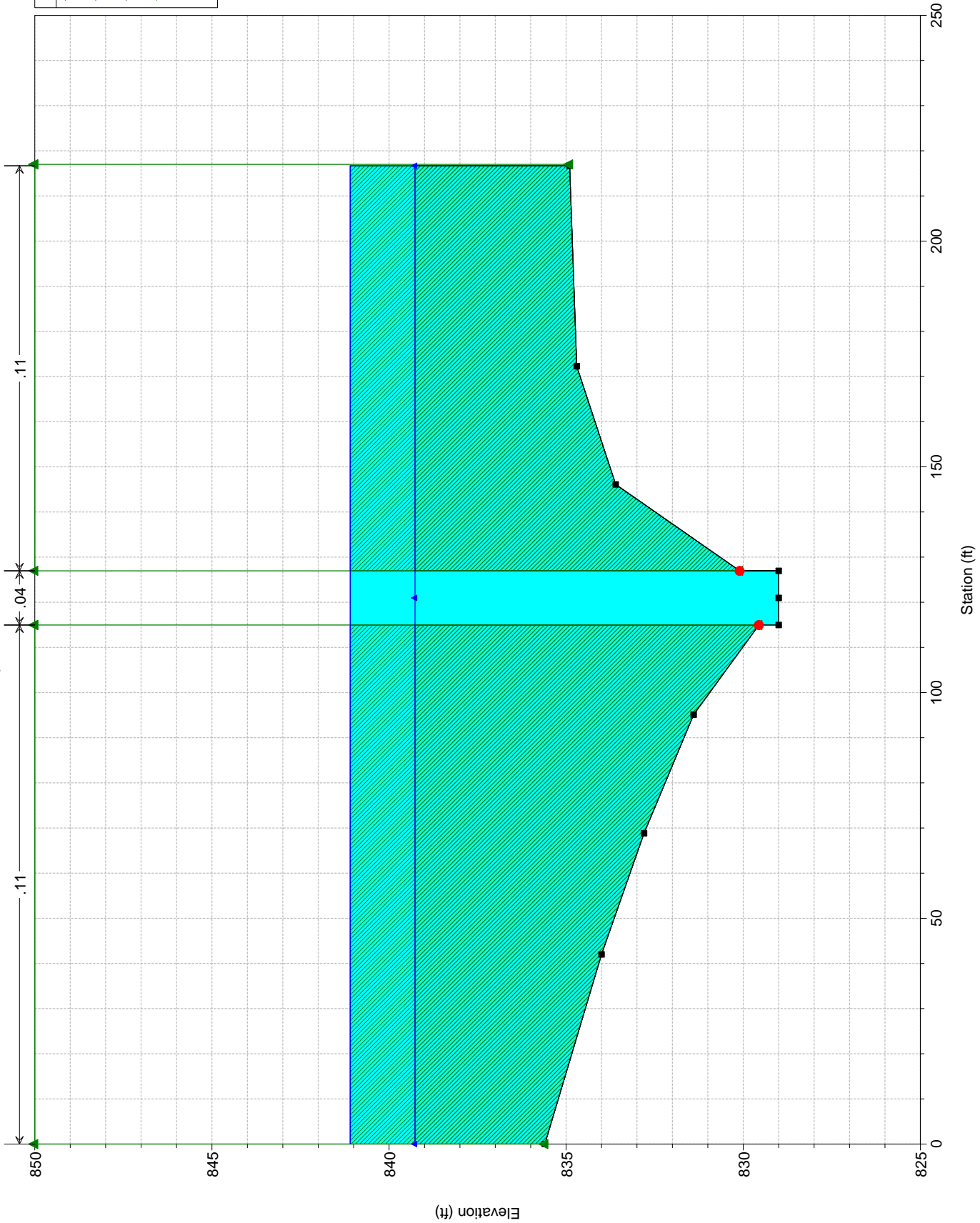


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Ineff
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 1854.3

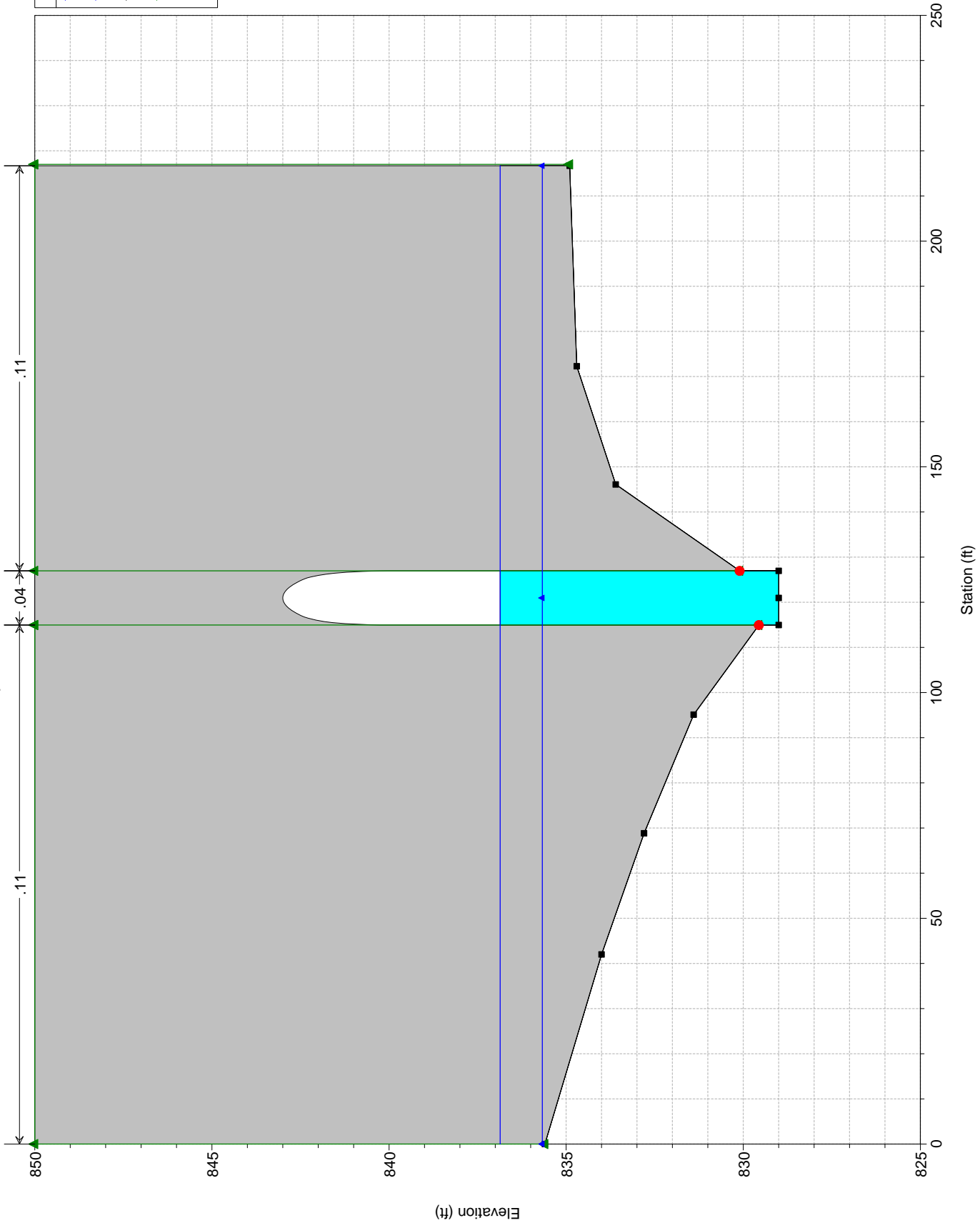


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Ineff
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 1850 Culv

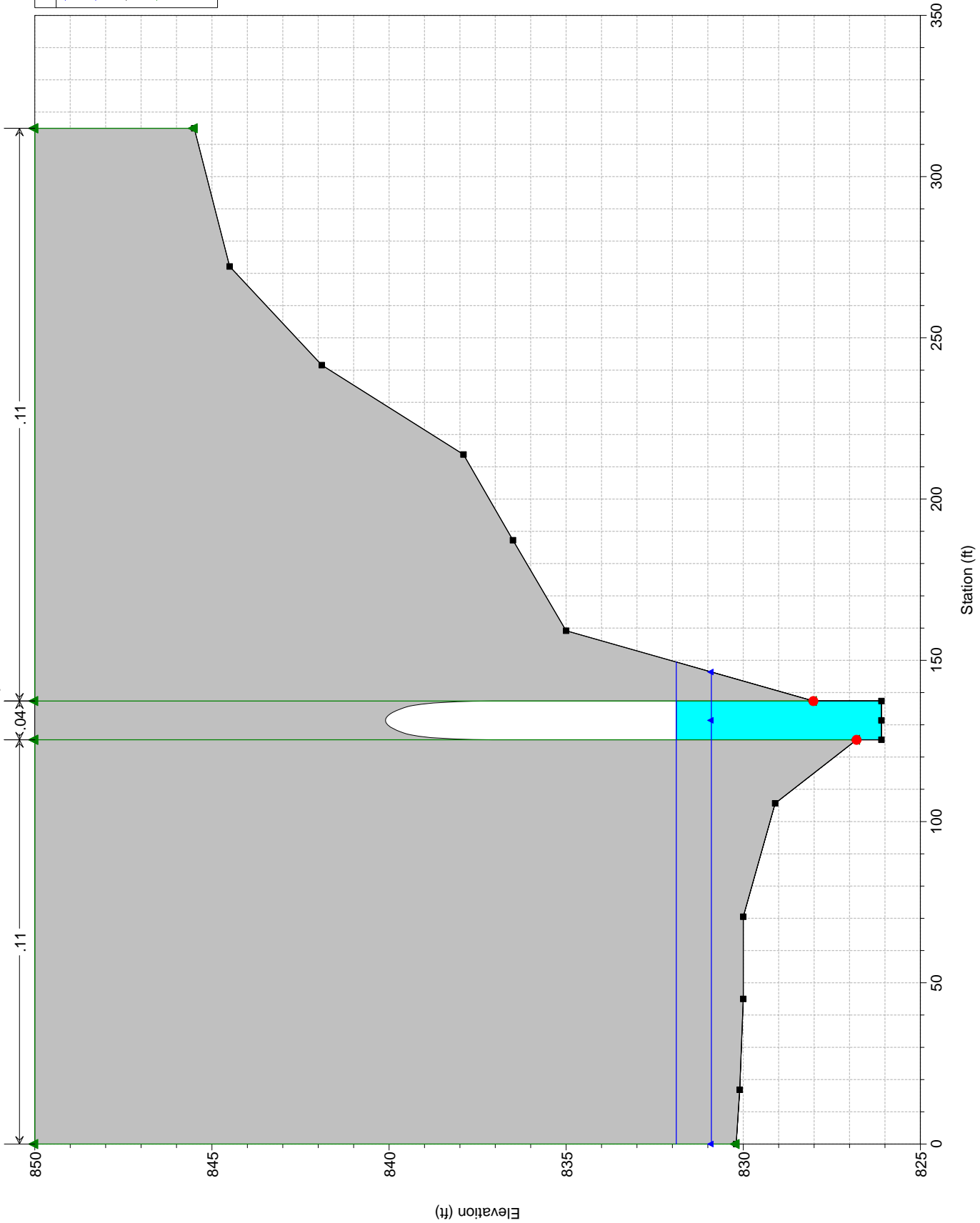


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Ineff
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 1850 Culv



Legend

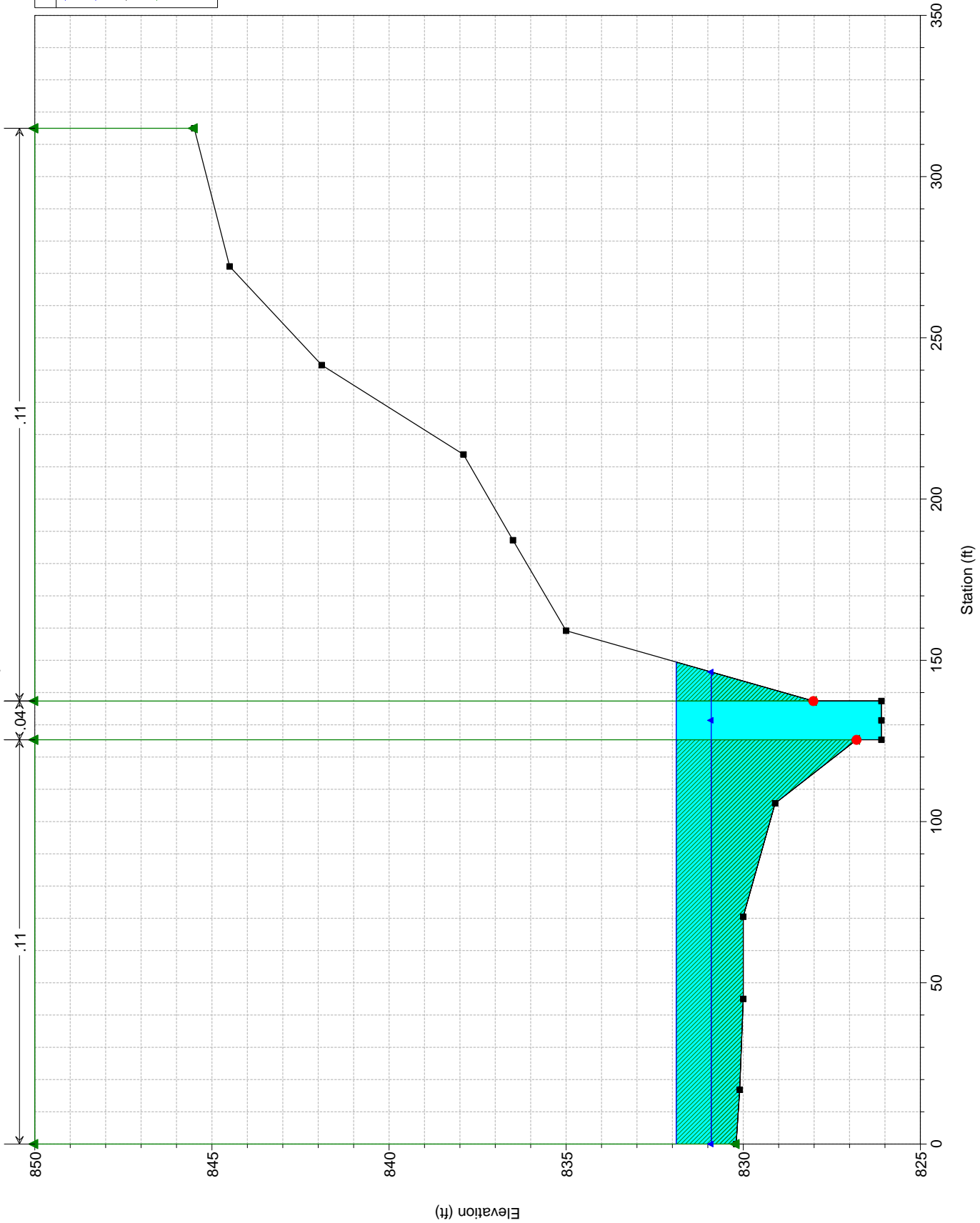
- WS Existing Cond.
- WS Future Cond.
- Ground
- Ineff
- Bank Sta

Station (ft)

30

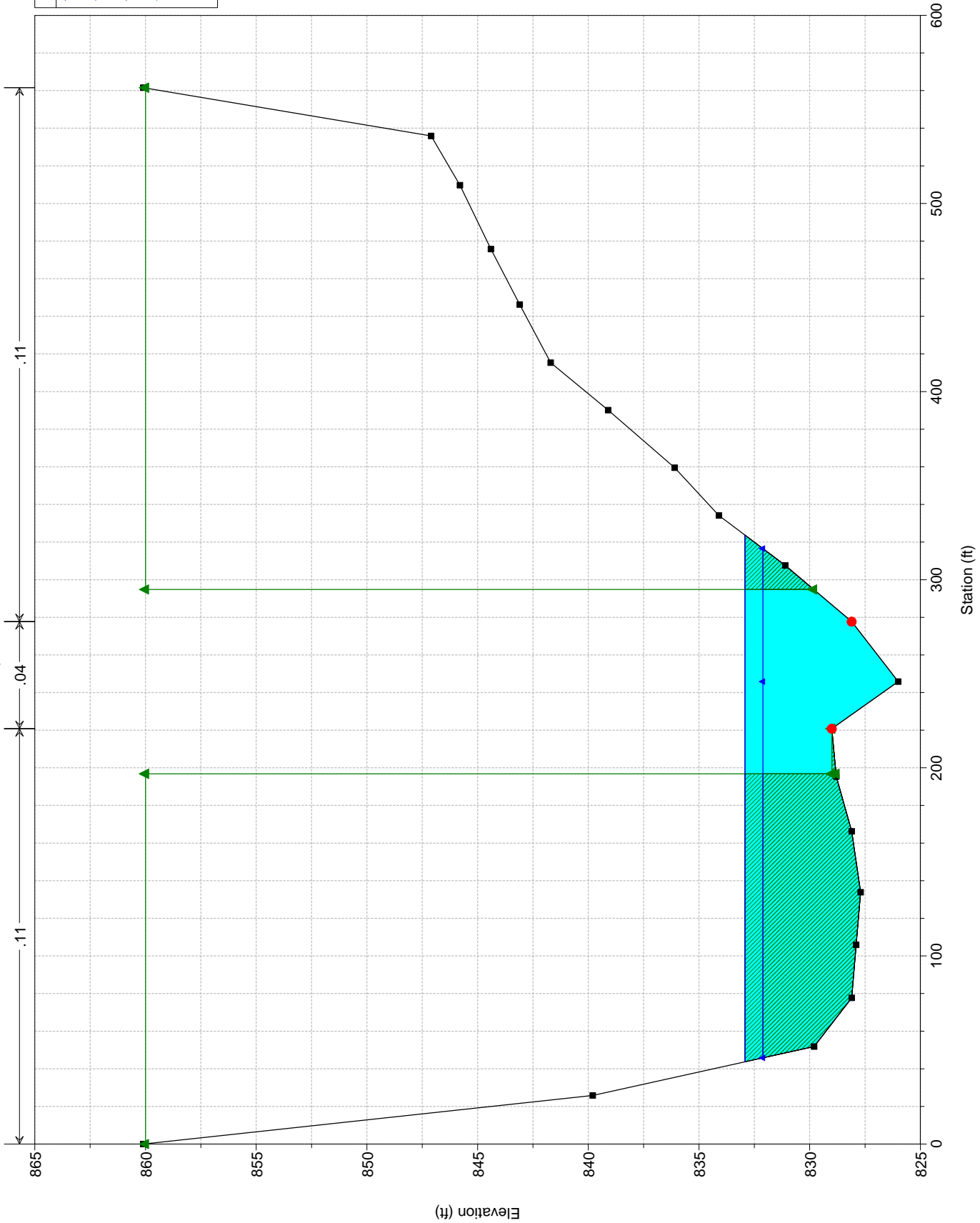
2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 1685.8



2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 1600

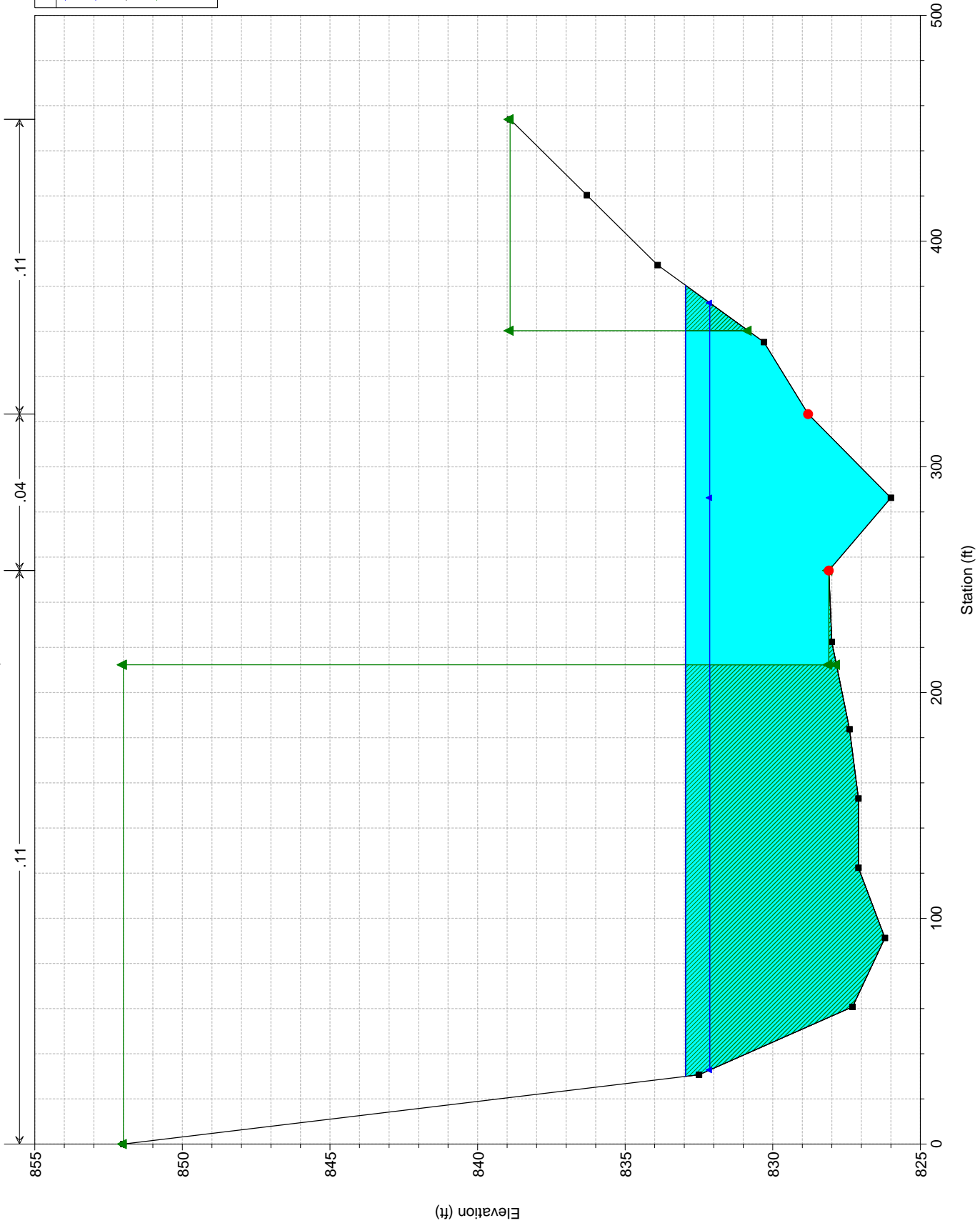


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Ineff
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 1550



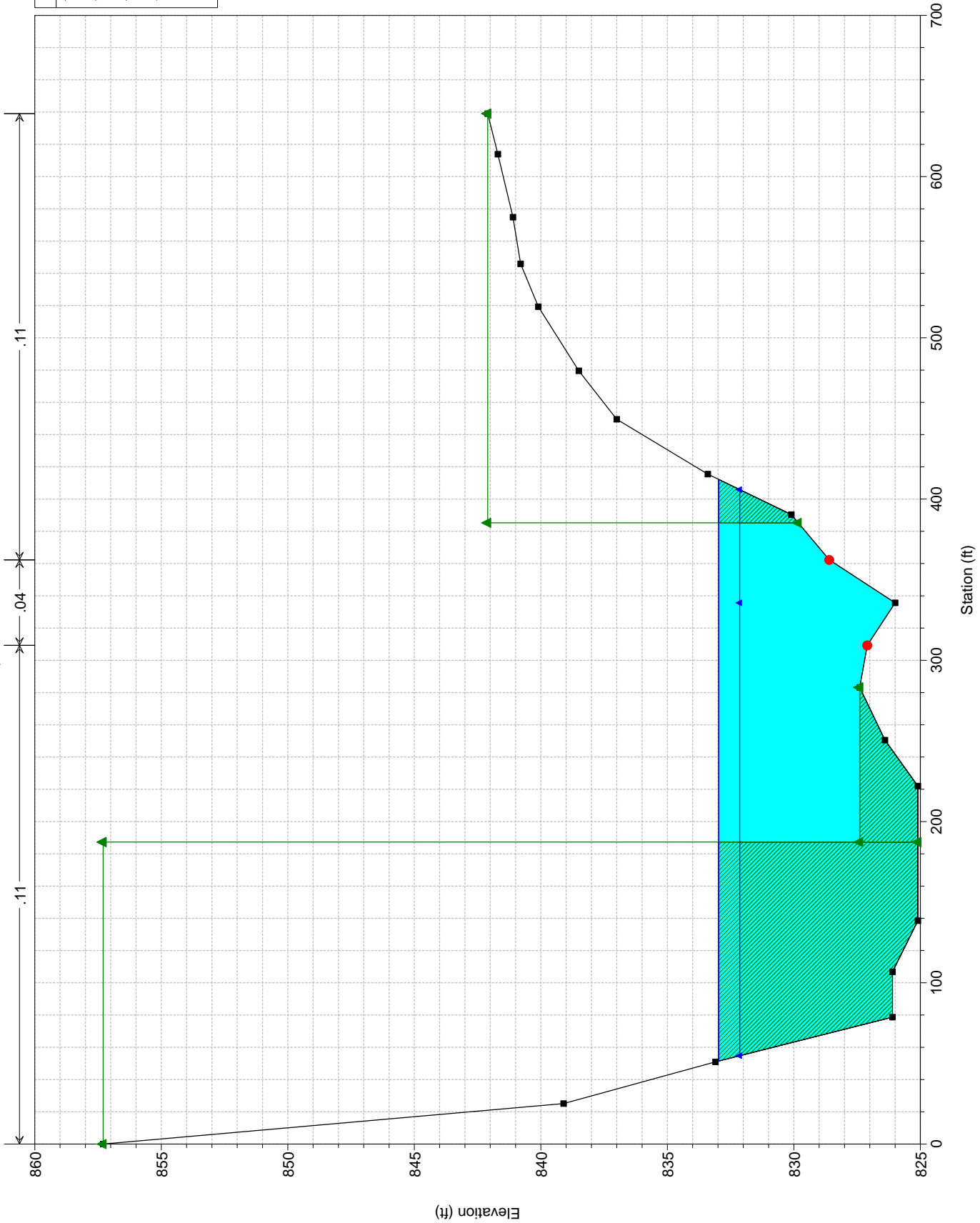
Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Ineff
- Bank Sta

2016-05-09_100Yr_WSEL

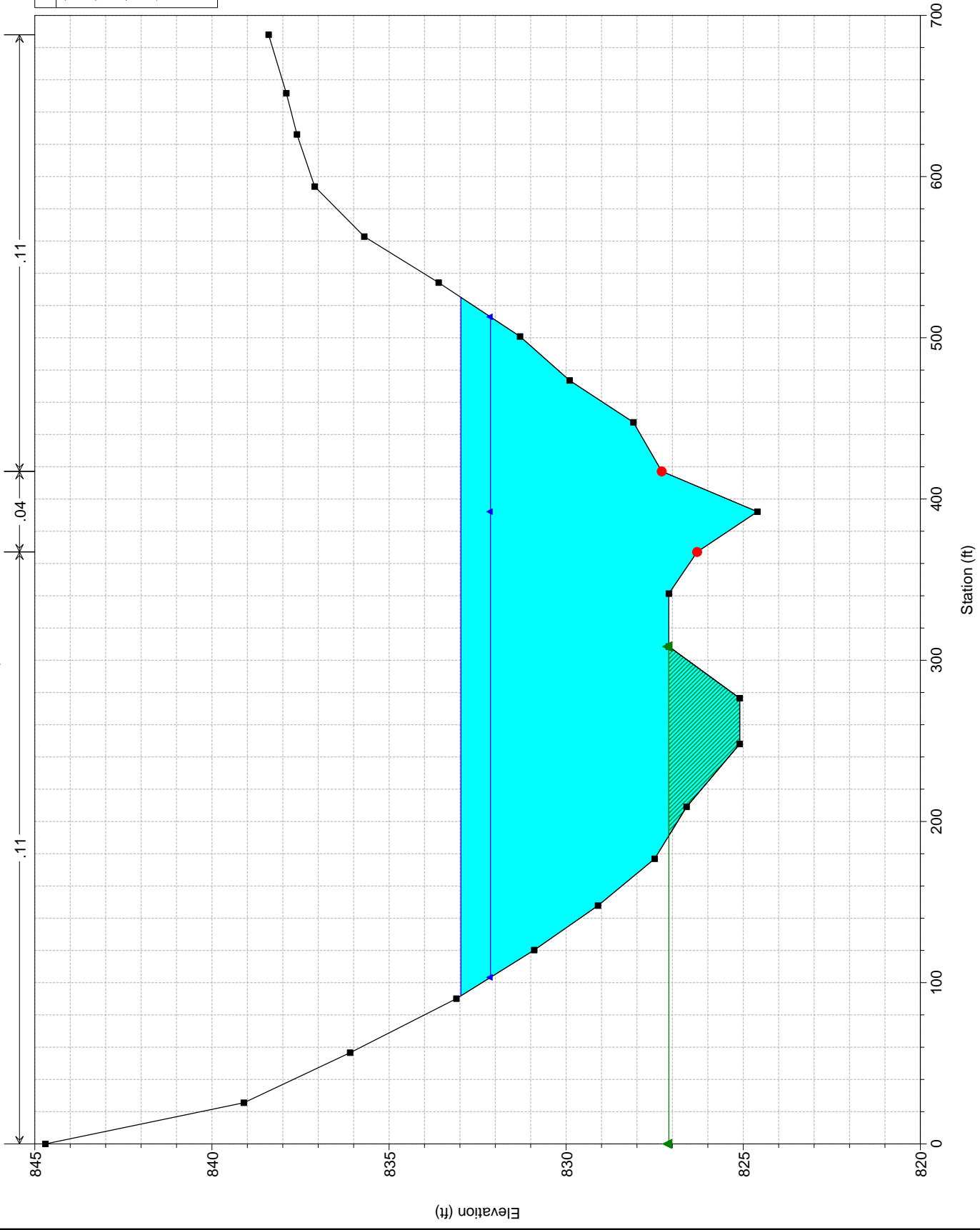
River = LackeyCreek Reach = UnnamedTrib_01

RS = 1500



2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 1400

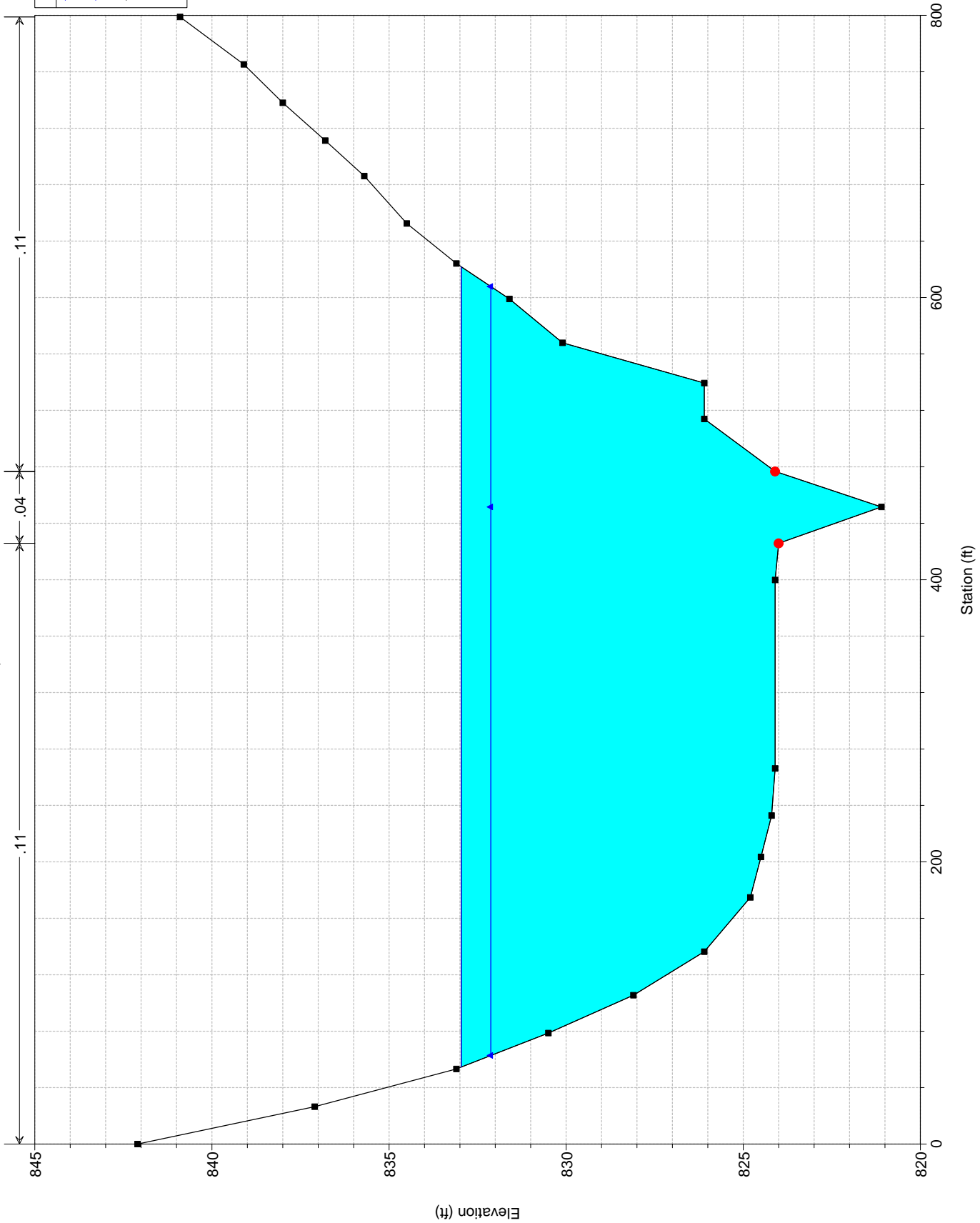


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Ineff
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 1000

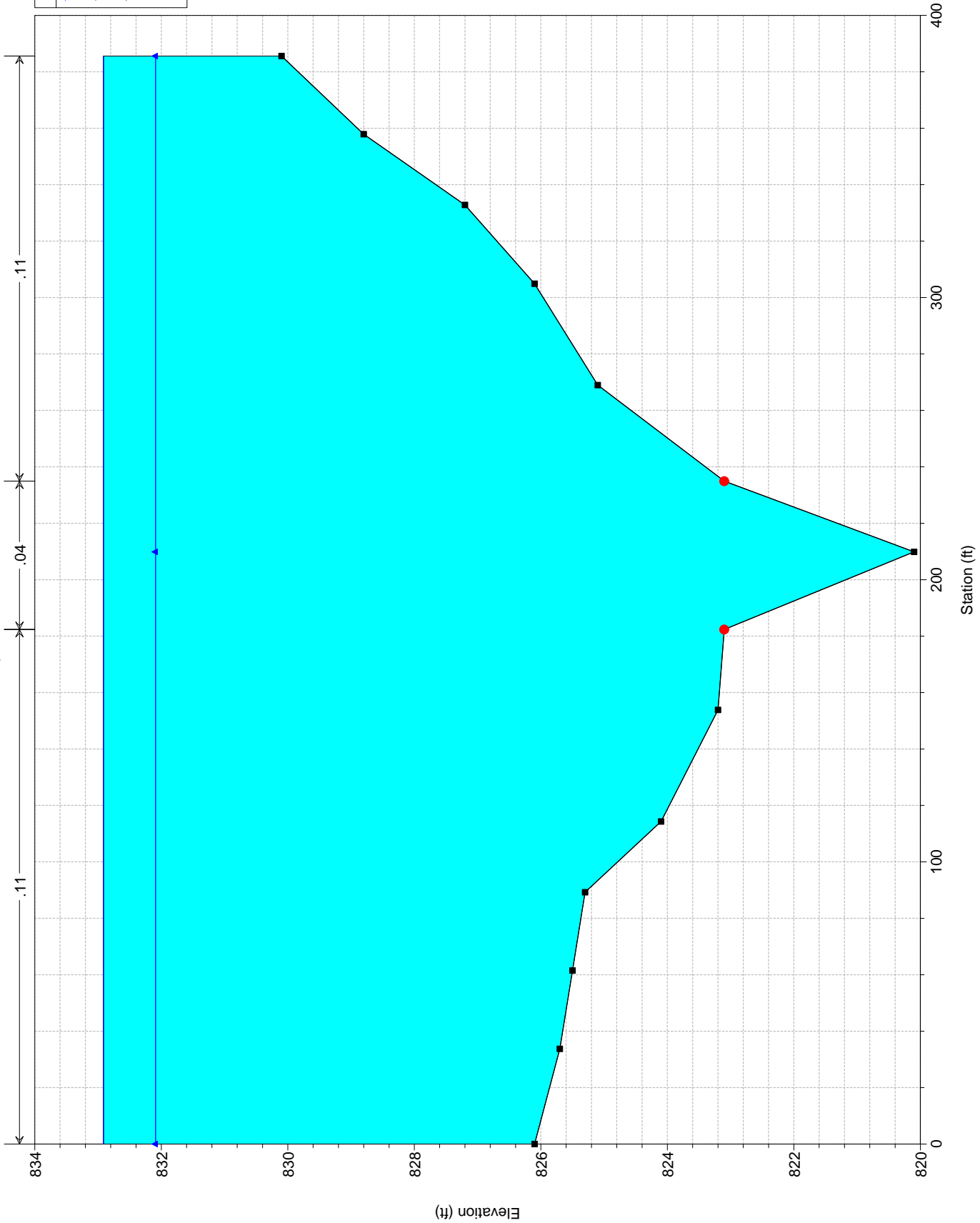


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 800



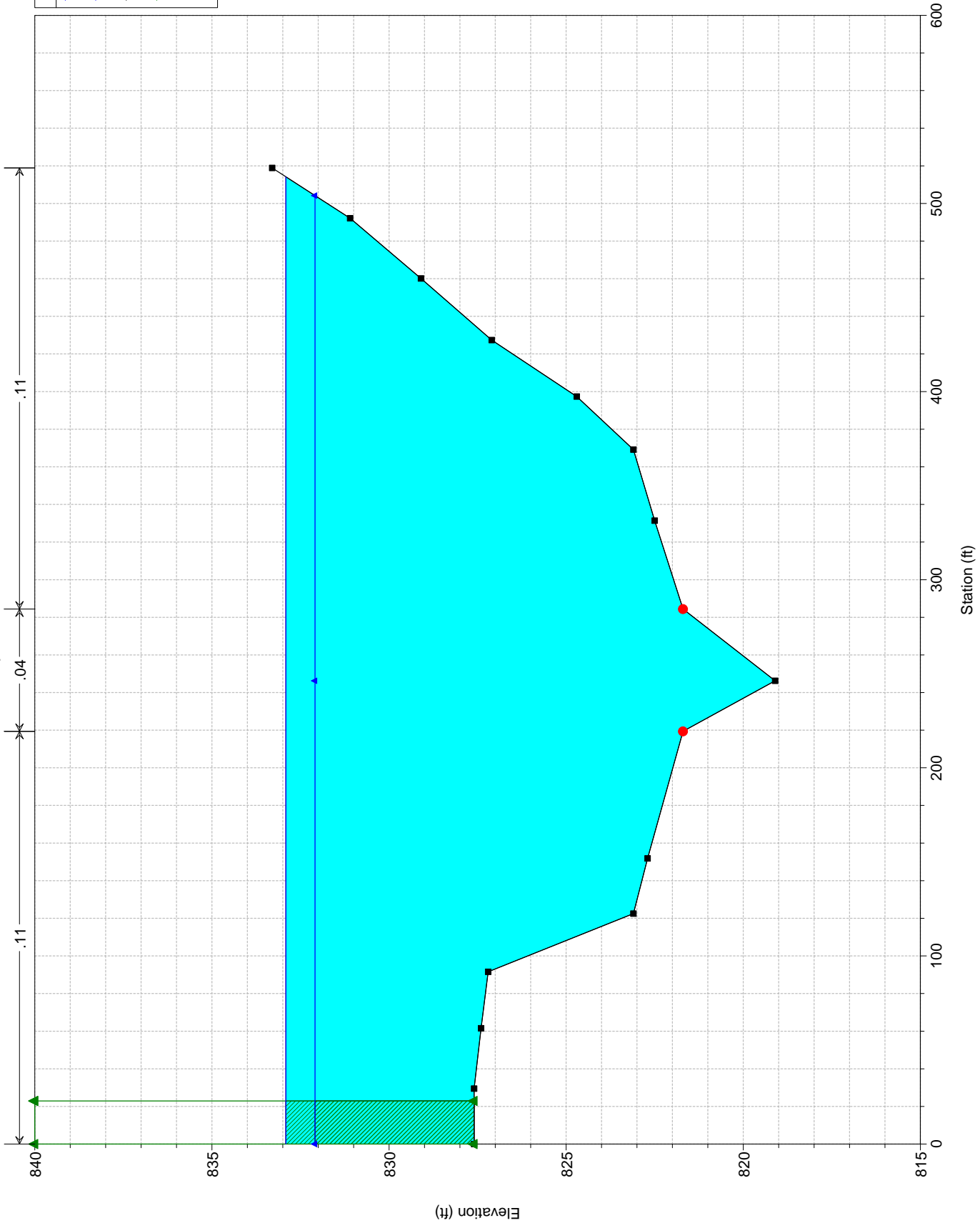
Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Bank Sta

Station (ft)

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 600

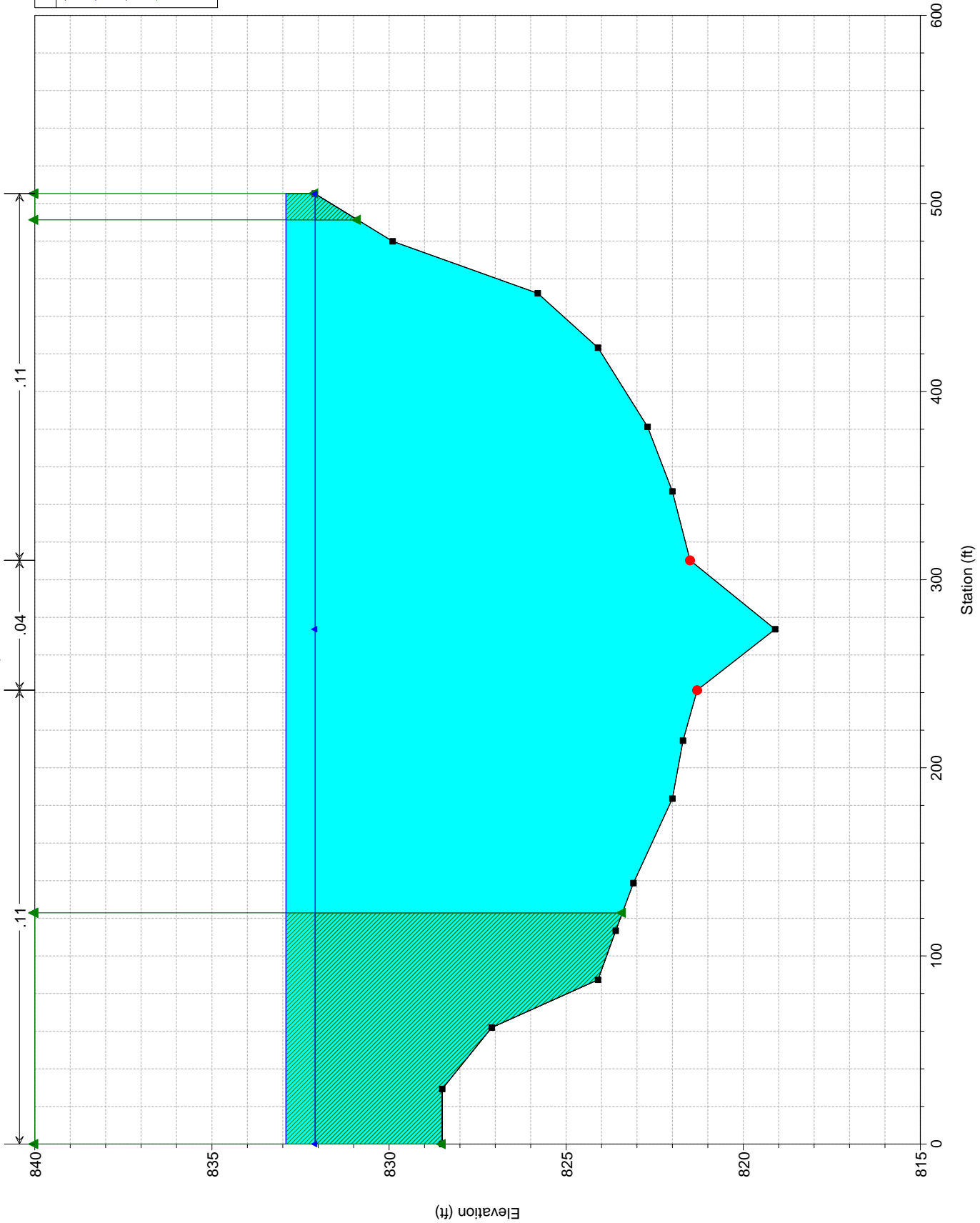


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Ineff
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 500

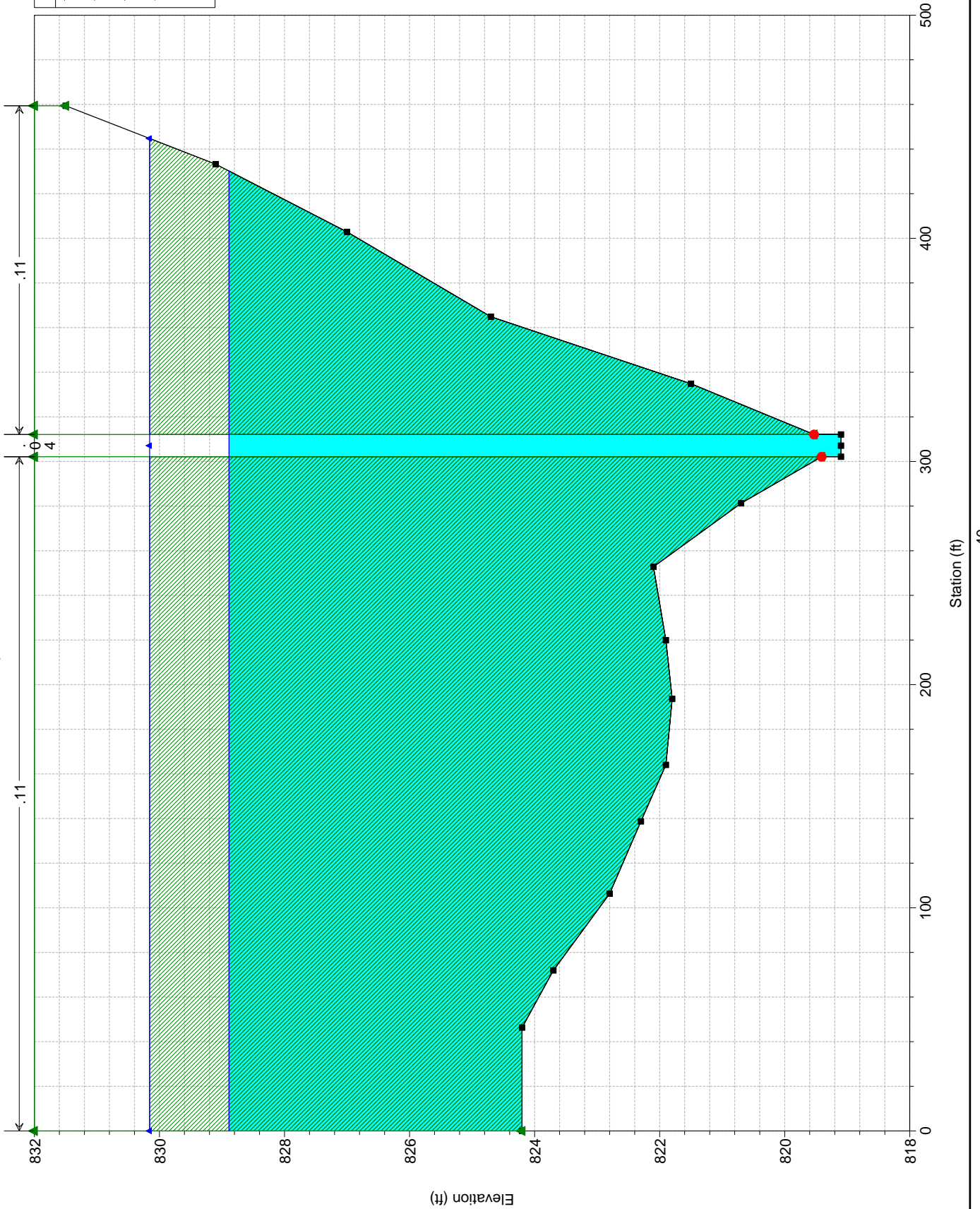


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Ineff
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 320.8

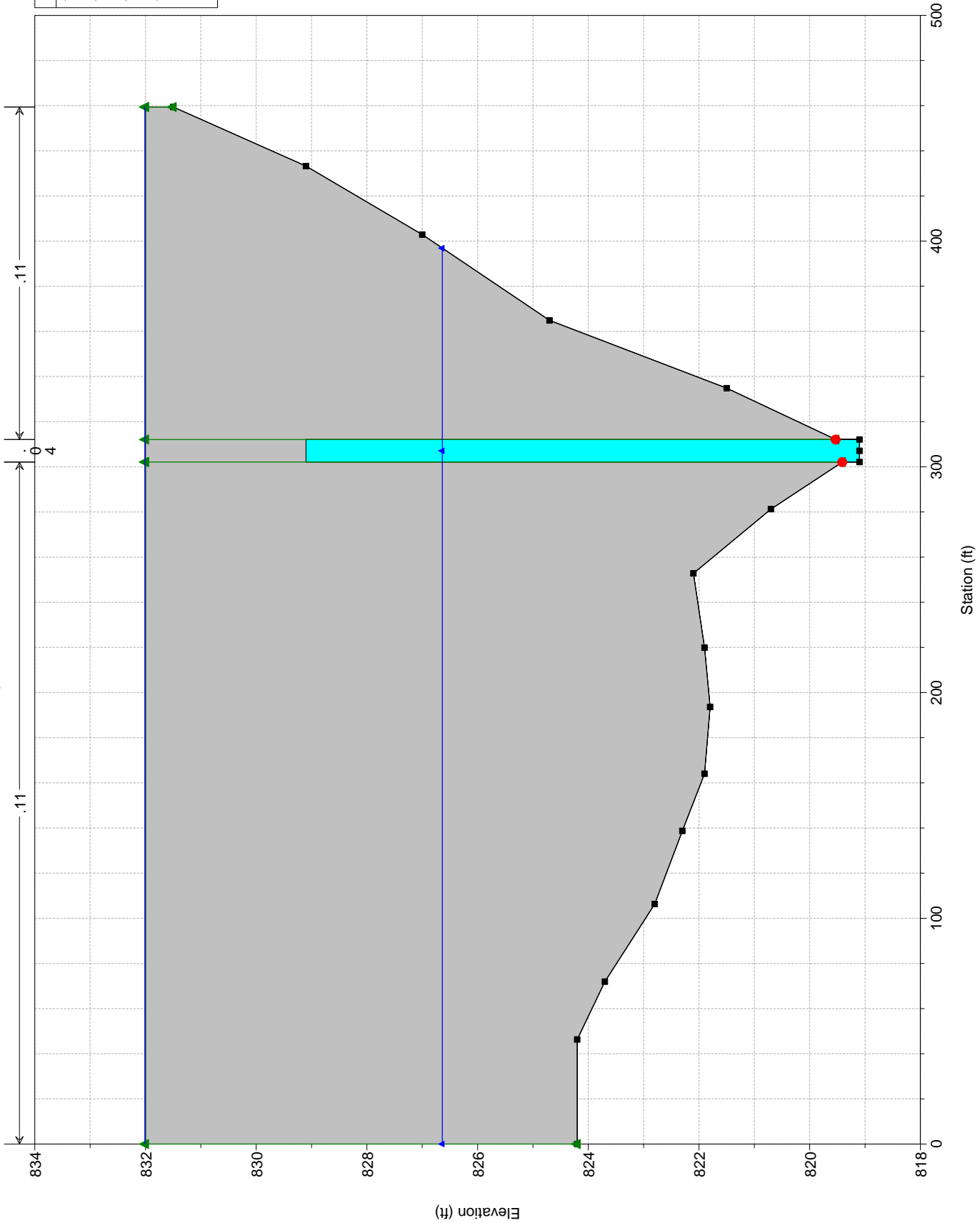


Legend

- WS Future Cond.
- WS Existing Cond.
- Ground
- Ineff
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 310 Culv

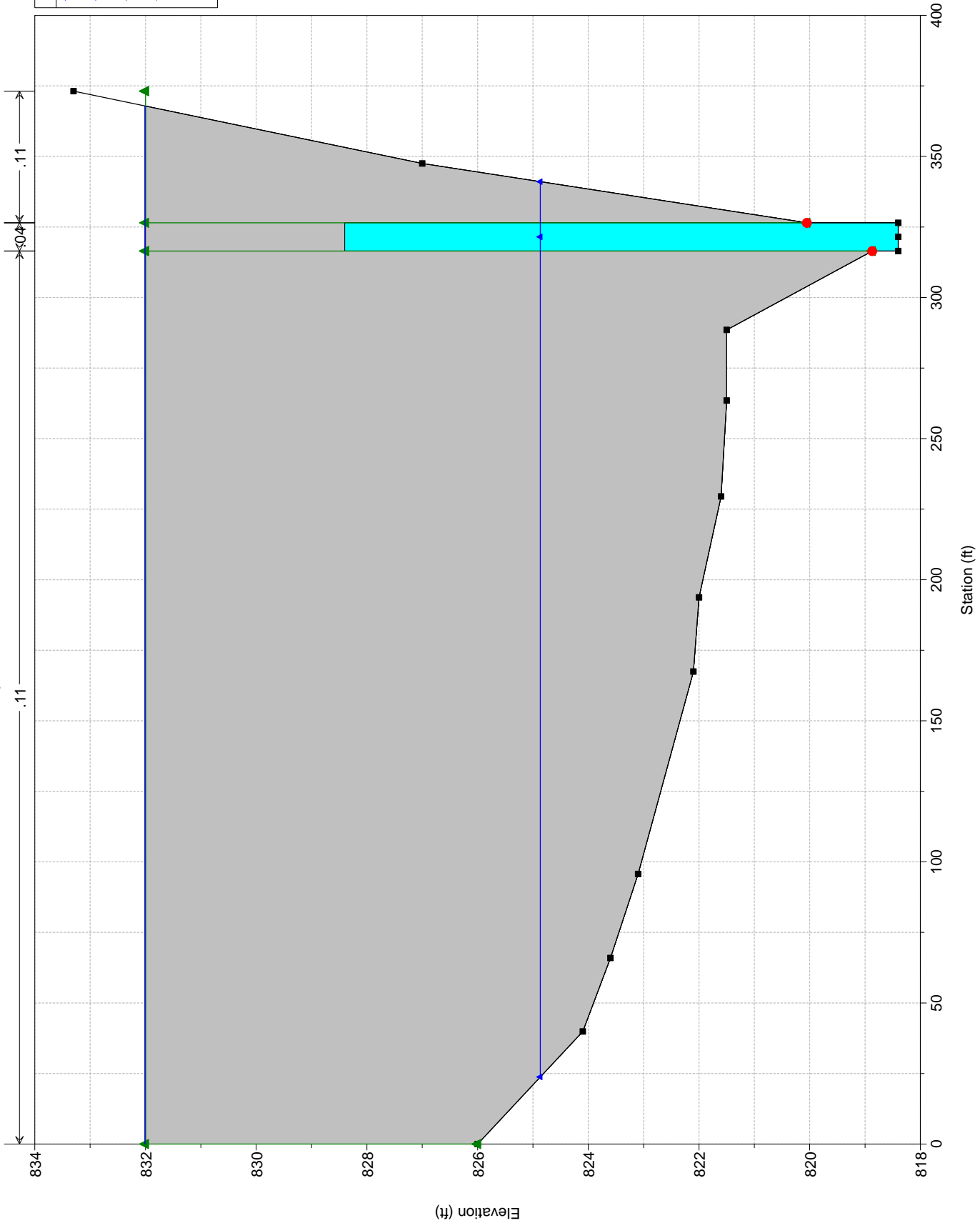


Station (ft)

41

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 310 Culv

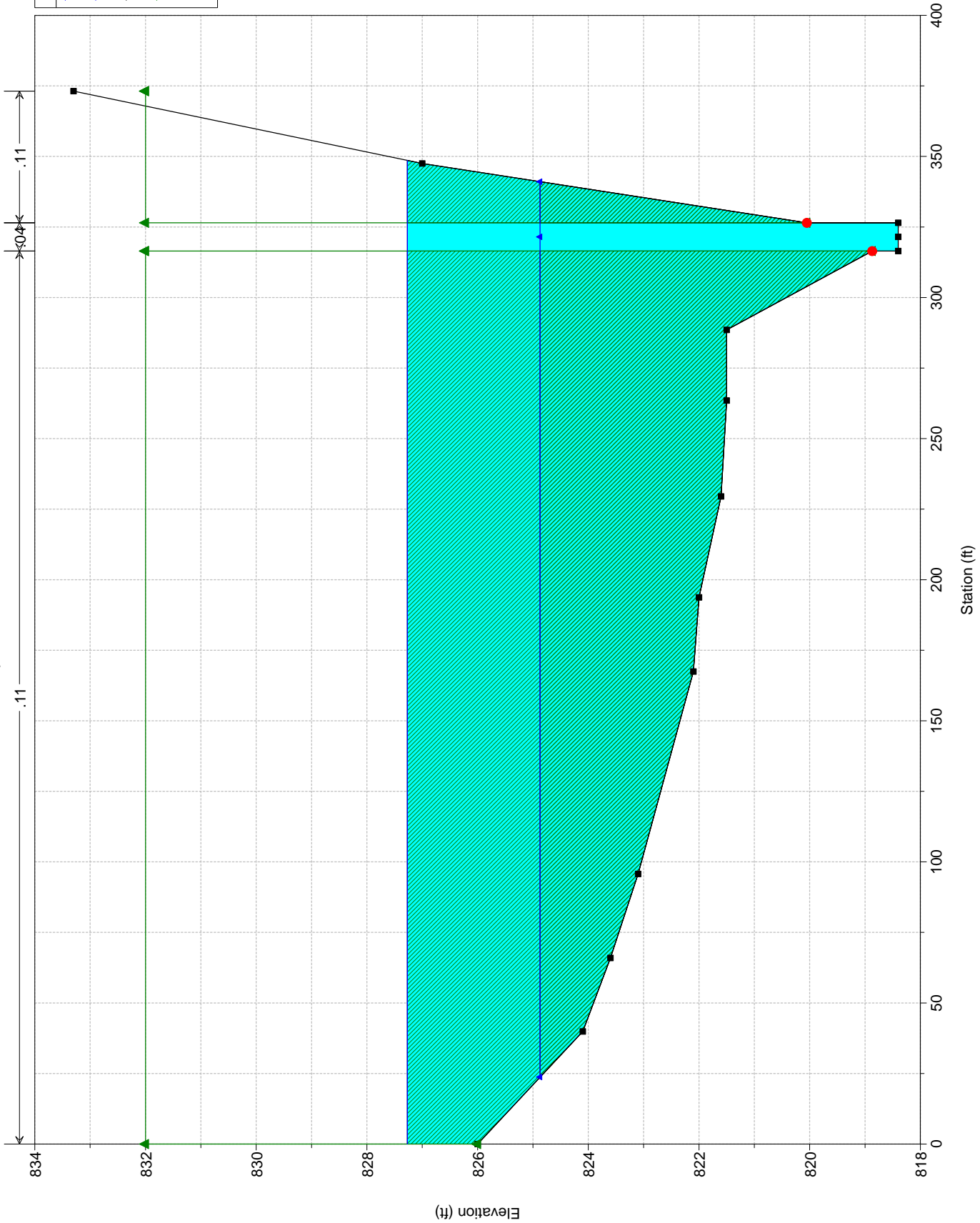


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Ineff
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 246.6

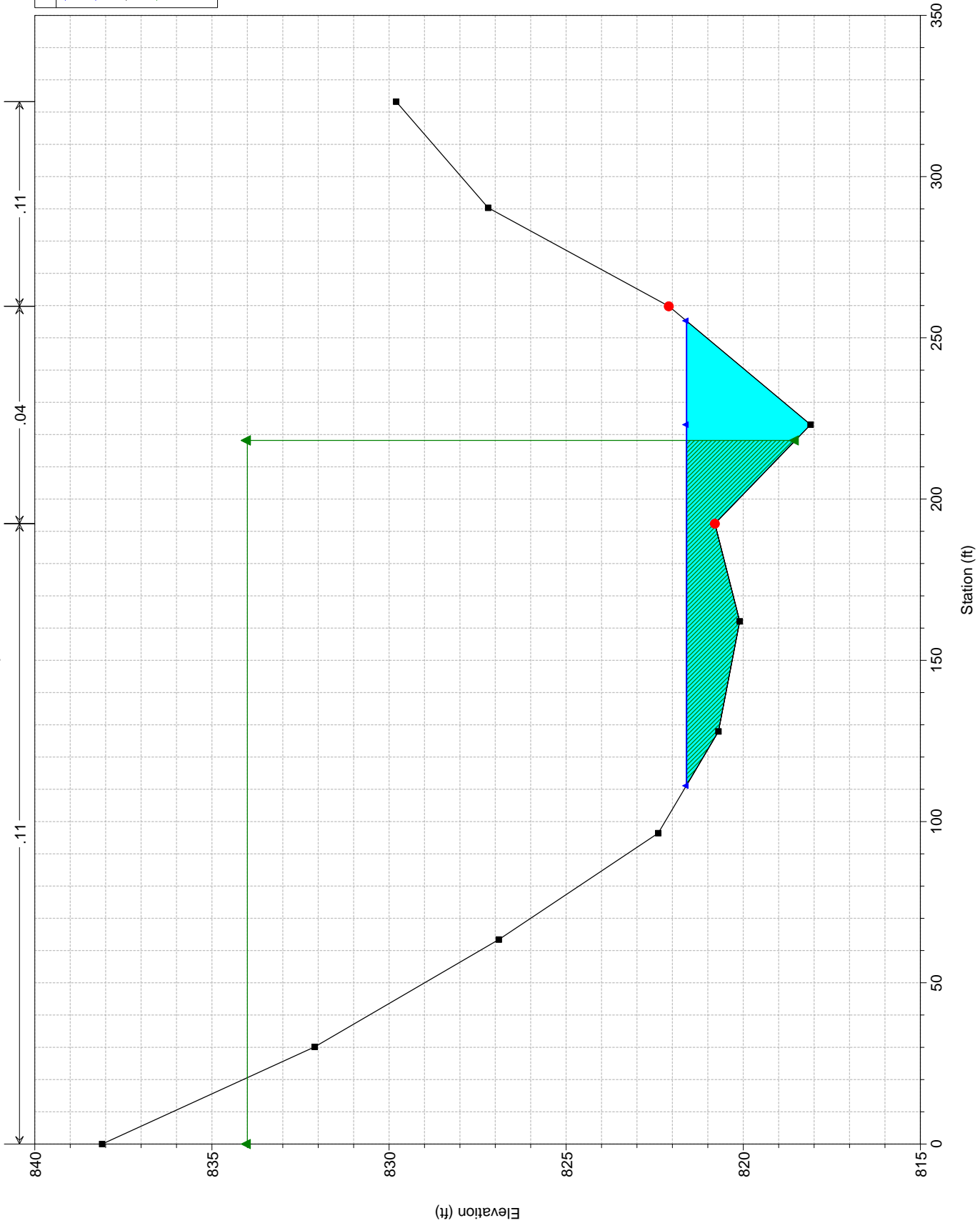


Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Ineff
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 150

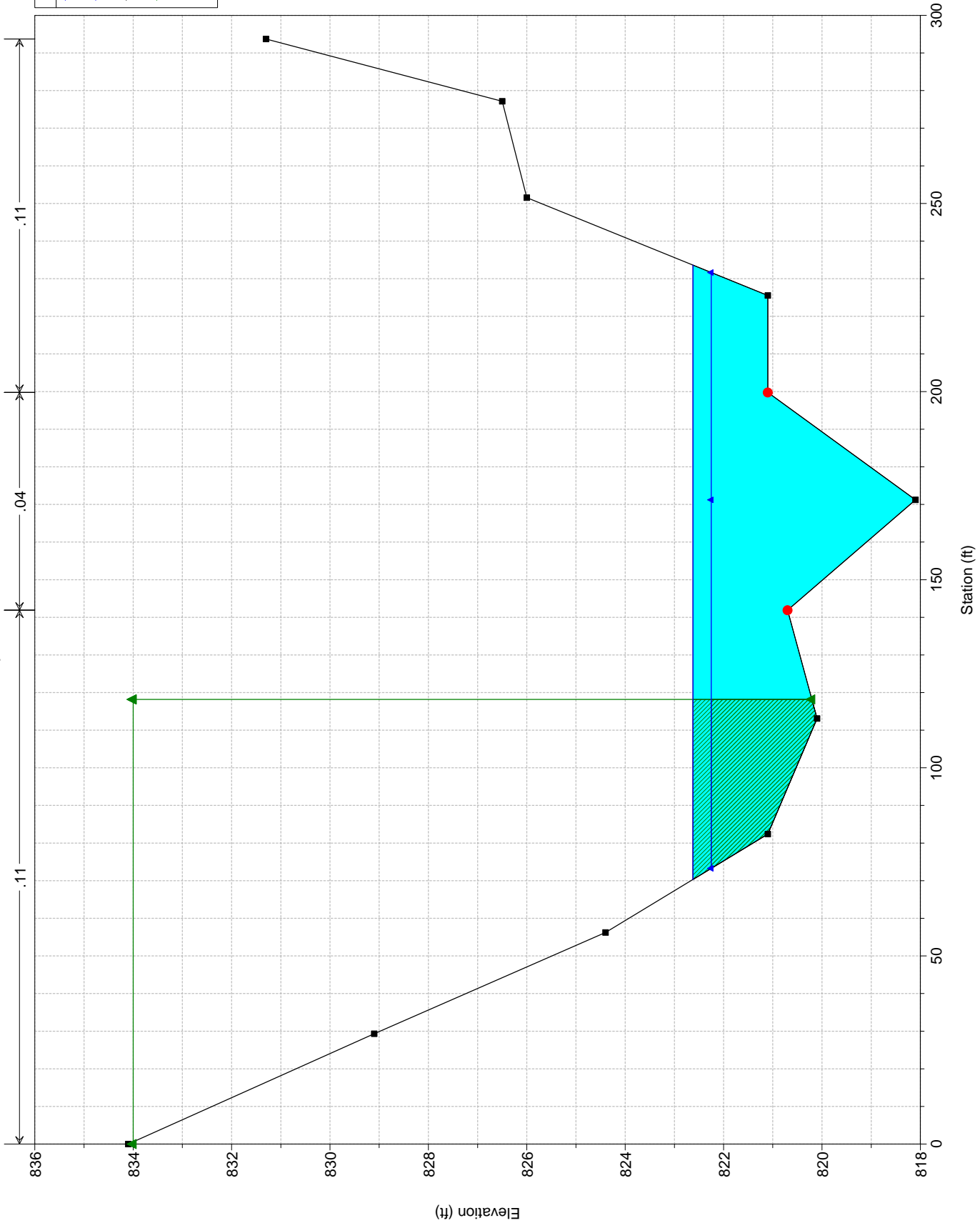


Legend

- WS Future Cond.
- WS Existing Cond.
- Ground
- Ineff
- Bank Sta

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 100

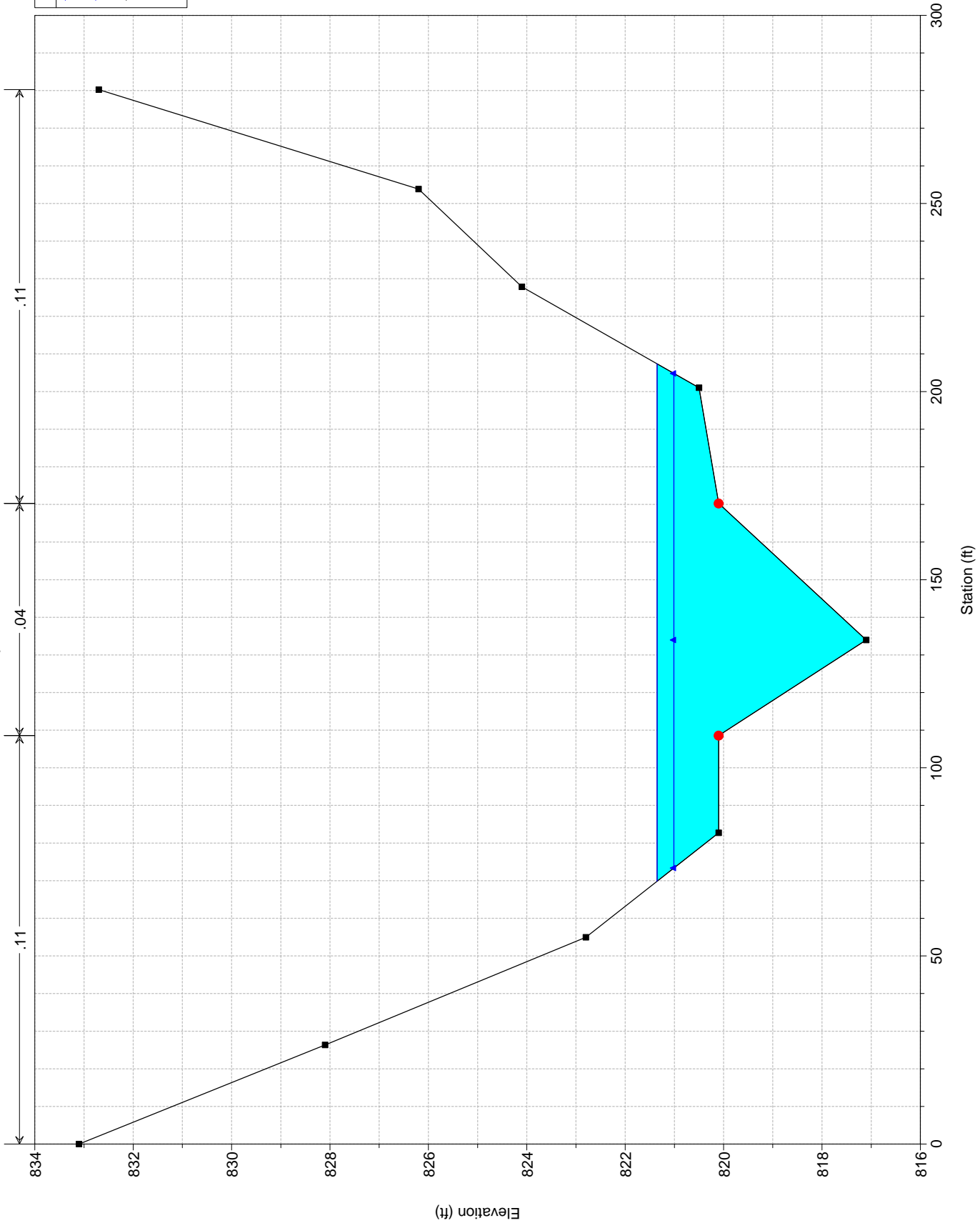


Station (ft)

45

2016-05-09_100Yr_WSEL

River = LackeyCreek Reach = UnnamedTrib_01 RS = 0



Legend

- WS Existing Cond.
- WS Future Cond.
- Ground
- Bank Sta

StreamStats Version 3.0

Flow Statistics Ungaged Site Report

Date: Tues May 10, 2016 8:25:02 AM GMT-4

Study Area: Tennessee

NAD 1983 Latitude: 35.7987 (35 47 55)

NAD 1983 Longitude: -84.0111 (-84 00 40)

Drainage Area: 2.07 mi²

Peak Flow Region Basin Characteristics			
100% MultiVariable Area 1 (2.07 mi ²)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Contributing Drainage Area (square miles)	2.07	0.2	9000
Stream Slope 10 and 85 Method (feet per mi)	71.89	3.29	950
Tennessee Climate Factor 2 Year (dimensionless)	2.247	2.06	2.32

Low-flow Regions Basin Characteristics			
100% Low Flow Central and East Regions 2009 5159 (2.07 mi ²)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	2.07	1.3	14441
Recession Index (days per log cycle)	140	32	175
2 Yr climate factor LK1990 (dimensionless)	2.247	2.056	2.46
Average Soil Permeability (inches per hour)	1.263	0.45	9.72
Percent permeability gte 2 in per hr (percent)	92.042	2	100

Peak Flow Region Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
PK2	202	ft ³ /s	39	1.7	108	378
PK5	327	ft ³ /s	38	2.6	176	608
PK10	421	ft ³ /s	40	3.4	222	799
PK25	552	ft ³ /s	43	4.3	280	1090
PK50	655	ft ³ /s	45	4.9	321	1340
PK100	772	ft ³ /s	48	5.3	363	1640
PK500	1060	ft ³ /s	55	5.8	450	2490

<http://pubs.usgs.gov/wri/wri034176/> (<http://pubs.usgs.gov/wri/wri034176/>)

Law, G.S., and Tasker, G.D., 2003. Flood-Frequency Prediction Methods for Unregulated Streams of Tennessee, 2000: U.S. Geological Survey Water-Resources Investigations Report 03-4176, 79p.

Low-flow Regions Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
M7D10Y	0.43	ft ³ /s	89			

M30D5Y	0.53	ft3/s	70			
QA	2.86	ft3/s	26			
MNSUMMER	1.5	ft3/s	43			
D99 5	0.4	ft3/s	86			
D99	0.43	ft3/s	78			
D98	0.48	ft3/s	72			
D95	0.53	ft3/s	66			
D90	0.6	ft3/s	60			
D80	0.7	ft3/s	54			
D70	0.85	ft3/s	51			
D60	1.07	ft3/s	49			
D50	1.41	ft3/s	43			
D40	1.87	ft3/s	36			
D30	2.56	ft3/s	28			
D20	3.65	ft3/s	23			
D10	5.85	ft3/s	21			

<http://pubs.usgs.gov/sir/2009/5159/> (<http://pubs.usgs.gov/sir/2009/5159/>)

Law_ G.S._ Tasker_ G.D._ and Ladd_ D.E._ 2009_ Streamflow-characteristic estimation methods for unregulated streams of Tennessee: U.S. Geological Survey Scientific Investigations Report 2009-5159_ 212 p._ 1 pl.

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Basin Characteristics Ungaged Site Report

Date: Tues May 10, 2016 8:23:43 AM GMT-4

Study Area: Tennessee

NAD 1983 Latitude: 35.7987 (35 47 55)

NAD 1983 Longitude: -84.0111 (-84 00 40)

Label	Value	Units	Definition
DRNAREA	2.07	square miles	Area that drains to a point on a stream
SOILPERM	1.263	inches per hour	Average Soil Permeability
CSL10_85	71.89	feet per mi	Change in elevation divided by length between points 10 and 85 percent of distance along main channel to basin divide - main channel method not known
TNSOILFAC	92	dimensionless	Tennessee soil factor, percentage of area underlain by a soil permeability greater than or equal to 2 inches per hour
CLIMFAC2YR	2.247	dimensionless	Two-year climate factor from Litchy and Karlinger (1990)
CONDA	2.07	square miles	Area that contributes flow to a point on a stream (total drainage area minus non-contributing areas within basin)
RECESS	140	days per log cycle	Number of days required for streamflow to recede one order of magnitude when hydrograph is plotted on logarithmic scale
TNCLFACT2	2.247	dimensionless	2-Year Climate Factor for Tennessee
PERMGTE2IN	92.042	percent	Percent of area underlain by soils with permeability greater than or equal to 2 inches per hour

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Flow Statistics Ungaged Site Report

Date: Tues May 10, 2016 8:20:43 AM GMT-4

Study Area: Tennessee

NAD 1983 Latitude: 35.7967 (35 47 48)

NAD 1983 Longitude: -84.0148 (-84 00 54)

Drainage Area: 2.17 mi²

Peak Flow Region Basin Characteristics			
100% MultiVariable Area 1 (2.17 mi ²)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Contributing Drainage Area (square miles)	2.17	0.2	9000
Stream Slope 10 and 85 Method (feet per mi)	72.00	3.29	950
Tennessee Climate Factor 2 Year (dimensionless)	2.247	2.06	2.32

Low-flow Regions Basin Characteristics			
100% Low Flow Central and East Regions 2009 5159 (2.17 mi ²)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	2.17	1.3	14441
Recession Index (days per log cycle)	140	32	175
2 Yr climate factor LK1990 (dimensionless)	2.247	2.056	2.46
Average Soil Permeability (inches per hour)	1.264	0.45	9.72
Percent permeability gte 2 in per hr (percent)	92.355	2	100

Peak Flow Region Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
PK2	210	ft ³ /s	39	1.7	113	392
PK5	339	ft ³ /s	38	2.6	182	631
PK10	437	ft ³ /s	40	3.4	231	829
PK25	572	ft ³ /s	43	4.3	291	1130
PK50	679	ft ³ /s	45	4.9	333	1390
PK100	800	ft ³ /s	48	5.3	377	1700
PK500	1100	ft ³ /s	55	5.8	466	2580

<http://pubs.usgs.gov/wri/wri034176/> (<http://pubs.usgs.gov/wri/wri034176/>)

Law, G.S., and Tasker, G.D., 2003, Flood-Frequency Prediction Methods for Unregulated Streams of Tennessee, 2000: U.S. Geological Survey Water-Resources Investigations Report 03-4176, 79p.

Low-flow Regions Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
M7D10Y	0.45	ft ³ /s	89			

M30D5Y	0.56	ft3/s	70			
QA	3	ft3/s	26			
MNSUMMER	1.58	ft3/s	43			
D99 5	0.42	ft3/s	86			
D99	0.45	ft3/s	78			
D98	0.5	ft3/s	72			
D95	0.56	ft3/s	66			
D90	0.63	ft3/s	60			
D80	0.73	ft3/s	54			
D70	0.9	ft3/s	51			
D60	1.12	ft3/s	49			
D50	1.48	ft3/s	43			
D40	1.97	ft3/s	36			
D30	2.69	ft3/s	28			
D20	3.82	ft3/s	23			
D10	6.13	ft3/s	21			

<http://pubs.usgs.gov/sir/2009/5159/> (<http://pubs.usgs.gov/sir/2009/5159/>)

Law_ G.S._ Tasker_ G.D._ and Ladd_ D.E._ 2009_ Streamflow-characteristic estimation methods for unregulated streams of Tennessee: U.S. Geological Survey Scientific Investigations Report 2009-5159_ 212 p._ 1 pl.

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Basin Characteristics Ungaged Site Report

Date: Tues May 10, 2016 8:19:39 AM GMT-4

Study Area: Tennessee

NAD 1983 Latitude: 35.7967 (35 47 48)

NAD 1983 Longitude: -84.0148 (-84 00 54)

Label	Value	Units	Definition
DRNAREA	2.17	square miles	Area that drains to a point on a stream
SOILPERM	1.264	inches per hour	Average Soil Permeability
CSL10_85	72	feet per mi	Change in elevation divided by length between points 10 and 85 percent of distance along main channel to basin divide - main channel method not known
TNSOILFAC	92	dimensionless	Tennessee soil factor, percentage of area underlain by a soil permeability greater than or equal to 2 inches per hour
CLIMFAC2YR	2.247	dimensionless	Two-year climate factor from Litchy and Karlinger (1990)
CONDA	2.17	square miles	Area that contributes flow to a point on a stream (total drainage area minus non-contributing areas within basin)
RECESS	140	days per log cycle	Number of days required for streamflow to recede one order of magnitude when hydrograph is plotted on logarithmic scale
TNCLFACT2	2.247	dimensionless	2-Year Climate Factor for Tennessee
PERMGTE2IN	92.355	percent	Percent of area underlain by soils with permeability greater than or equal to 2 inches per hour

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Flow Statistics Ungaged Site Report

Date: Tues May 10, 2016 8:12:22 AM GMT-4

Study Area: Tennessee

NAD 1983 Latitude: 35.7975 (35 47 51)

NAD 1983 Longitude: -84.0171 (-84 01 02)

Drainage Area: 2.77 mi²

Peak Flow Region Basin Characteristics			
100% MultiVariable Area 1 (2.77 mi ²)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Contributing Drainage Area (square miles)	2.77	0.2	9000
Stream Slope 10 and 85 Method (feet per mi)	67.12	3.29	950
Tennessee Climate Factor 2 Year (dimensionless)	2.247	2.06	2.32

Low-flow Regions Basin Characteristics			
100% Low Flow Central and East Regions 2009 5159 (2.77 mi ²)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	2.77	1.3	14441
Recession Index (days per log cycle)	140	32	175
2 Yr climate factor LK1990 (dimensionless)	2.247	2.056	2.46
Average Soil Permeability (inches per hour)	1.270	0.45	9.72
Percent permeability gte 2 in per hr (percent)	93.802	2	100

Peak Flow Region Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
PK2	253	ft ³ /s	39	1.7	136	473
PK5	407	ft ³ /s	38	2.6	219	757
PK10	524	ft ³ /s	40	3.4	277	993
PK25	684	ft ³ /s	43	4.3	348	1350
PK50	811	ft ³ /s	45	4.9	398	1650
PK100	954	ft ³ /s	48	5.3	450	2020
PK500	1300	ft ³ /s	55	5.8	555	3060

<http://pubs.usgs.gov/wri/wri034176/> (<http://pubs.usgs.gov/wri/wri034176/>)

Law G.S. and Tasker G.D., 2003, Flood-Frequency Prediction Methods for Unregulated Streams of Tennessee, 2000: U.S. Geological Survey Water-Resources Investigations Report 03-4176_79p.

Low-flow Regions Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
M7D10Y	0.58	ft ³ /s	89			

M30D5Y	0.72	ft3/s	70			
QA	3.85	ft3/s	26			
MNSUMMER	2.04	ft3/s	43			
D99 5	0.55	ft3/s	86			
D99	0.59	ft3/s	78			
D98	0.65	ft3/s	72			
D95	0.72	ft3/s	66			
D90	0.81	ft3/s	60			
D80	0.95	ft3/s	54			
D70	1.16	ft3/s	51			
D60	1.46	ft3/s	49			
D50	1.91	ft3/s	43			
D40	2.54	ft3/s	36			
D30	3.46	ft3/s	28			
D20	4.9	ft3/s	23			
D10	7.85	ft3/s	21			

<http://pubs.usgs.gov/sir/2009/5159/> (<http://pubs.usgs.gov/sir/2009/5159/>)

Law_ G.S._ Tasker_ G.D._ and Ladd_ D.E._ 2009_ Streamflow-characteristic estimation methods for unregulated streams of Tennessee: U.S. Geological Survey Scientific Investigations Report 2009-5159_ 212 p._ 1 pl.

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Basin Characteristics Ungaged Site Report

Date: Tues May 10, 2016 7:59:15 AM GMT-4

Study Area: Tennessee

NAD 1983 Latitude: 35.7975 (35 47 51)

NAD 1983 Longitude: -84.0171 (-84 01 02)

Label	Value	Units	Definition
DRNAREA	2.77	square miles	Area that drains to a point on a stream
SOILPERM	1.27	inches per hour	Average Soil Permeability
CSL10_85	67.12	feet per mi	Change in elevation divided by length between points 10 and 85 percent of distance along main channel to basin divide - main channel method not known
TNSOILFAC	94	dimensionless	Tennessee soil factor, percentage of area underlain by a soil permeability greater than or equal to 2 inches per hour
CLIMFAC2YR	2.247	dimensionless	Two-year climate factor from Litchy and Karlinger (1990)
CONDA	2.77	square miles	Area that contributes flow to a point on a stream (total drainage area minus non-contributing areas within basin)
RECESS	140	days per log cycle	Number of days required for streamflow to recede one order of magnitude when hydrograph is plotted on logarithmic scale
TNCLFACT2	2.247	dimensionless	2-Year Climate Factor for Tennessee
PERMGTE2IN	93.802	percent	Percent of area underlain by soils with permeability greater than or equal to 2 inches per hour

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APPENDIX F

Attn: Eric Williamson
To: METROPOLITAN KNOXVILLE AIRPORT

(Advertising) Public Notice Public Notice of Avail (Ref No: 1107278)

P.O.#:

PUBLISHER'S AFFIDAVIT

State of Tennessee }
County of Knox } S.S

Before me, the undersigned, a Notary Public in and for said county, this day personall Atkins first duly sworn, according to law, says that he/she is a duly authorized represe Knoxville News-Sentinel, a daily newspaper published at Knoxville, in said county and the advertisement of:

(The Above-Referenced)

of which the annexed is a copy, was published in said paper on the following date(s):

05/26/2016

and that the statement of account herewith is correct to the best of his/her knowledge, belief,

Wayne Atkins

Subscribed and sworn to before me this 3rd day of June

Karen Dixon

Notary Public

MY COMMISSION EXPIRES: June 26, 2017

My commission expires _____ 20____

PUBLIC NOTICE
Public Notice of Availability
Draft Environmental Assessment
Proposed Extension
of Runway 5L/23R
McGhee Tyson Airport

The Metropolitan Knoxville Airport Authority (MKAA), in coordination with the Federal Aviation Administration (FAA), has completed a Draft Environmental Assessment (EA) for the proposed extension of Runway 5L/23R at McGhee Tyson Airport, Alcoa, Tennessee. The Draft EA was completed pursuant to the National Environmental Policy Act of 1969, FAA Order 1050.1F, Environmental Impacts, Policies, and Procedures, and FAA Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Projects. Any person desiring to review the EA may do so on the Airport's website at <http://www.flyknoxville.com/tvs/work-with-the-airport/mcgee-tyson-airport-documents/> under the "McGhee Tyson Airport Current Working Documents" or during normal working hours at the following location:

Metropolitan Knoxville Airport Authority
 McGhee Tyson Airport
 2055 Alcoa Highway
 Alcoa, TN 37701

Blount County Public Library
 508 N. Cusick Street
 Maryville, TN 37804

Knox County Public Library
 7732 Martin Mill Pike
 Knoxville, TN 37920

According to FAA Order 5050.4B, Chapter 404(a)(5), the public has the opportunity to request a public hearing within 15 days from the date of the public notice. Any hearing requests should be sent to Mr. Aaron Braswell, Federal Aviation Administration, Memphis Airports District Office, 2600 Thousand Oaks Boulevard, Suite 2250, Memphis, Tennessee 38118. This request must be in writing and post-marked no later than June 10, 2016.

All comments received will be addressed and the results included in the Final EA. Written comments on the Draft EA may be submitted to Mr. Aaron Braswell in writing or via email at Aaron.Braswell@faa.gov. All comments on the Draft EA must be received on or before June 25, 2016.



Heckroth, Mark

From: Robbie Sykes <robbie_sykes@fws.gov>
Sent: Monday, June 27, 2016 1:48 PM
To: Aaron.Braswell@faa.gov
Cc: Heckroth, Mark
Subject: RE: McGhee Tyson Airport - Draft EA

Mr. Braswell,

The Tennessee Ecological Services Field Office of the U.S. Fish and Wildlife Service (Service) has reviewed the McGhee Tyson Airport Draft EA for the extension of Runway 5L/23R. The Draft EA adequately addresses federally listed species concerns. As indicated in early coordination with our office, no records of federally listed species, or their critical habitat occurs near the airport and no suitable habitat for species known to occur in Blount County exists at the site.

The Service has no concerns with moving forward with the proposed runway extension project.

If you have any questions, please do not hesitate to contact me.

Thanks,

Robbie Sykes
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, TN 38501
(tele. 931/525-4979)
(fax. 931/528-7075)

From: Heckroth, Mark [mailto:MHeckroth@chacompanies.com]
Sent: Wednesday, June 01, 2016 5:37 PM
Subject: McGhee Tyson Airport - Draft EA

If you are receiving this email, you responded to early coordination packages distributed In January 2016 for the proposed extension of Runway 5L/23R at McGhee Tyson Airport. A link is below to the Draft EA.

<http://www.flyknoxville.com/tys/work-with-the-airport/mcghee-tyson-airport-documents/>

Comments will be received until June 25, 2016 and should be sent (in writing or via email) to:

Mr. Aaron Braswell
Federal Aviation Administration
Memphis Airports District Office
2600 Thousand Oaks Boulevard, Suite 2250
Memphis, Tennessee, 38118.
Aaron.Braswell@faa.gov.

Thank you for your assistance with this project.

Mark Heckroth
Office: 1.800.321.6959 x367
Cell: 1.216.904.6283