Soil and Water Resources Report

For the Proposed

Union County Target Range Project

Prepared for:
USDA-Forest Service, Blue Ridge Ranger District

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PREFACE

This Soil and Water Resources Report was prepared by Nutter & Associates, Inc. as directed by the USDA-Forest Service to aid in their review of the proposed project and in development of the associated Environmental Assessment (EA) document. Establishment of the proposed project need, alternatives considered, and final content of the EA were tasks under the purview of the USDA-Forest Service, and not considered part of the scope of this evaluation. Inputs utilized in the reported are documented herein, and include publically available data and methodologies, personal communication with agency personnel, a limited site reconnaissance and soil sampling, and published documents and literature.

1.0 INTRODUCTION

This report presents and evaluates potential environmental consequences on soil and water resources that may result with implementation of the proposed Union County Target Range Project via issuance of a Special Use Permit (SUP). It examines two alternatives, 1) no action, and 2) establishing and operating a rifle and pistol target range at the selected site in Union County, Georgia. A detailed project description, along with project location, layout and topographic maps is provided in Appendix A.

The proposed site for this project is located off Highway 180 between mile markers 18 and 19 on Landlot 212, District 16, Section 1 south of Forest Service Road 292 and consists of approximately 14.5 acres of National Forest Service land. Specifically, this report addresses potential effects due to construction of an aggregate (gravel) access road and parking area, clubhouse, shelter, storage and vaulted toilet facilities, protective backstops, site and drainage modification and control structures, along with changes in land use from dense vegetation to grassed ranges, and soil inputs (lime, etc.) resulting from operation and maintenance, and decommissioning of the proposed target range.

The proposed project is subject to a number of relevant policy, laws and regulations including the Organic Administration Act of 1987, as amended, the Multiple-Use, Sustained Yield Act of 1960, the National Forest Management Act of 1976, as amended, Forest Service Manual 2500, Chapter 2550, and Forest Service Handbook 2509.18 for Region 8.

The Chattachoochee-Oconee National Forests Land and Resource Management Plan (USDA Forest Service, 2004), herein referred to as the Forest Plan, provides direction for soil and water resource management, including specific goals for soil and watershed management, and standards that must be met in implementing a proposed project.

The objectives of this report are to 1) identify and describe potential environmental impacts to soil and water resources imposed by the proposed project, 2) provide conclusions as to the potential impacts on management of soil and water resources within the bounds of analysis, and 3) describe proposed measures that would be implemented to ensure potential impacts are minimized and/or mitigated.

2.0 APPROACH

2.1 Potential Environmental Issues

The identified potential environmental issues form the basis for comparison of the alternatives. Four key issues were selected and are summarized below.

a) Soil Loss and Sediment Yield: Excessive soil loss can negatively impact the soil's ability to support root growth, development and microbial populations.

b) Soil Chemistry: Soil supports multiple functions in a given ecosystem including nutrient availability and cycling. Change in soil chemistry can impact nutrient availability and ultimately biological function in the soil.

c) Sedimentation and Water Quality: The soil plays a major role in storage and transmission of water on a landscape. Modifications to soil drainage can lead to impacts to surface water quality via stormwater runoff.

d) Lead Contamination: The soil supports human and ecosystem health through immobilization of compounds that may be detrimental. The addition of lead under certain circumstances can impact soil quality, and its mobilization and transport in soil water can lead to contamination of water resources.

2.2 Spatial and Temporal Bounding of Analysis Area

For this analysis, the spatial boundaries include soil resources within the specified project site and extend to water resources within the watershed/drainage basin as defined from the lower end of the project site on Gillam Branch at the Highway 180 crossing. Temporally, the analysis considers three time periods, construction, operation and maintenance, and decommission.

2.3 Assumptions

The analysis of Alternative 2 was completed making the following assumptions as listed in the project description provided in Appendix A:

- The Union County Target range would implement an approved Environmental Stewardship Plan (ESP) developed in accordance with US Environmental Protection Agency *Best Management Practices for Lead at Outdoor Shooting Ranges* (2001, revised 2005). Best management practices (BMPs) would include recycling/reclamation of lead, pH adjustment of soils within the range footprint and along artificial drainage features, bi-annual soil monitoring, an overhead containment baffle, maintenance of range and backstops with Forest Service approved grass mixes such that there is minimal bare ground surfaces, and no direct connection to surface waters in the stormwater and drainage control features that would be constructed on the site.

- Backstop soil material would be brought in from a source that is not of National Forest Service land and be tested prior to use for its quality both physically and chemically.

- Artificial drainage and stormwater controls and or site modifications would be provided temporarily for construction/decommissioning of the project, and permanently for operation and maintenance of the range. All sediment and erosion control measures, including any artificial drainage (e.g., vegetated buffers, turn outs, settling basins, etc.) would be designed, installed and maintained in accordance with both the Georgia Water Quality Control Act and appropriate Union County codes and ordinances for the construction/decommissioning periods. This includes an approved Erosion, Sedimentation, and Pollution Control (ESPC) Plan and Land Disturbance Permit (LDP) by Union County, a local issuing authority (LIA). It is assumed that in no case would there be a direct connection of construction site stormwater to naturally occurring surface water in the vicinity of the project, and compliance with the approved ESPC Plan would be maintained during construction or decommissioning of the project. Further, any permanent water control structure(s) that would remain or be constructed as part of the ongoing maintenance and operation of the facility would not provide a direct connection to surface water in the vicinity of the project.

- The access road and parking lot installed for Alternative 2 would be topped with a minimum of six inches of gravel approved by the Forest Service.

- Decommissioning the Union County Target Range would include complete removal of all structures, reuse of the backstop material, regrading and replanting of the site. A separate ESPC Plan and LDP would be obtained by Union County Government in association with the decommissioning plan. In accordance with the ESP, lead would be removed to the extent possible prior to decommission the facility. This would be verified via Forest Service and Union County Government monitoring.

2.4 Measures

Soil Loss

Soil loss or erosion refers to that which is transported from one location to another within a given area. Loss is typically measured in tons/acre/year. The USDA-Natural Resource Conservation Service (NRCS) provides an erosion T factor, which is an "estimate of the maximum average annual rate of soil loss by wind or water that can occur without affecting crop productivity over a sustained period" for each mapped soil series (USDA-NRCS, 1996). To determine impacts for each alternative, soil loss was estimated using the Revised Universal Soil Loss Equation (RUSLE) (Renard, et al., 1997). The RUSLE is a model developed based on empirical research data used to estimate soil loss on a designated hillslope given specific site and management features. A more detailed description of the model, its implementation, and results is provided in Appendix B.

The model was applied to the project site (hillslope) under current conditions (grassed and forested) and those projected under Alternative 2. Specifically, the modifications used in estimating loss in Alternative 2 include the change in vegetation to a cool season grass along the two ranges, the addition of impervious surfaces (i.e., roofs of range structures), and the addition of a gravel parking lot. Using the model, soil loss was estimated along with sediment yield. Sediment yield differs from soil loss in that it is defined as that which reaches the bottom of the hillslope. Both loss and yield are not to be confused with the deposition of sediment within surface waters, rather they are intended to characterize soil movement. For analysis, the

estimated soil loss was compared to the T factor for the soil series on the site. This is applicable to conditions following construction and during operation of the site.

Soil Chemistry

Two composite soil samples were collected for both surface and subsurface soil horizons within the proposed range site. Samples were analyzed for soil pH, cation exchange capacity, base saturation, available plant nutrients, and soil texture by the University of Georgia Soil, Plant and Water Laboratory using the Mehlich 1 extraction procedure and Hydrometer methodology. Laboratory analysis is provided in Appendix C. These data were used to describe current soil chemistry, plant nutrient availability and potential for immobilization of compounds. Projected changes to nutrient availability were estimated based on anticipated maintenance of soil pH between 6.5 and 8.5 under Alternative 2. These nutrient availability estimates are applicable to conditions during operation of the target range.

Sedimentation and Water Quality

Baseline properties are used to describe current and future conditions under Alternative 1. For Alternative 2, the conditions set forth in the Georgia Environmental Protection Division (GA EPD) General NPDES Permit No. GAR100001 were utilized to project potential impacts to water quality during construction and decommissioning periods along with BMPs specified in the *Manual for Erosion and Sediment Control in Georgia* developed by the Georgia Soil and Water Conservation Commission (2016). Published research values were used to project a range of sediment loss that might occur from operation of the access road. These projections are primarily applicable to conditions during construction and decommissioning of the site.

Lead Contamination

A summary of potential impacts from lead inputs is provided for Alternative 2. Rather than a quantitative analysis, an overview of proposed BMPs for lead control and containment is provided that would be incorporated into the ESP, pending approval by the Forest Service. These control and containment BMP procedures are applicable to the operation and decommission time period of the range.

3.0 AFFECTED ENVIRONMENT

The project site is located within the Blue Ridge physiographic region within the Tennessee River Basin. It is bordered to the west by Gillam Branch, a secondary trout stream, which would be buffered 125-feet from impacts of the proposed project (Appendix A). The stream is in the Hydrologic Unit HUC 060200020802 for the Town Creek subwatershed. No other "waters of the United States", as defined in the Clean Water Act are located within the proposed site. A segment of Town Creek, downstream of Gillam Branch is listed on the 2018 Georgia Environmental Protection Division (GEPD) 305(b)/303(d) integrated report for not supporting the designated use of fishing due to nonpoint source (NPS) pollution.

The USGS StreamStats database (available: https://streamstats.usgs.gov/ss/) was used to delineate the upper watershed boundary for the tributary to Gillam Branch at the lower end of the site, just north of Highway 180. Note that the tributary forms the western border of the project site. A generated watershed boundary map and associated streamflow statistics are provided in Appendix D. Based on the USGS delineation, the watershed area is approximately 0.82 square-miles and the mean annual flow is estimated to be 2 cubic-feet per second. Peak flow response to storms can be characterized as very responsive to precipitation (flashy), and quickly returning to baseflow.

The site consists of rolling topography with slopes ranging from 2 to 10 percent. Geologic mapping for the State of Georgia (Lawton et al., 1976) indicates that the site is underlain by crystalline, metamorphic rocks including gneiss and mica schists. The crystalline rocks of the Blue Ridge province have little or no inherent porosity or permeability and therefore, groundwater does not move through pore spaces within the unweathered rock. Instead, water occurs within pore spaces in soils and saprolite (weathered rock) developed on the rock or within voids (fractures or other discontinuities) in the unweathered rock.

Significant groundwater recharge areas within Georgia have been mapped by Davis et al. (1989). Similarly, the relative susceptibility of the shallow unconfined aquifers in Georgia to pollution from man-made sources has been mapped by Trent (1992). The project site is not located within any area mapped by Davis et al. (1989) as a significant groundwater recharge area. Pollution susceptibility for the entire site is considered low (Trent, 1992).

Based on the Soil Survey for Fannin and Union Counties (1996), the soils mapped on and in the vicinity of the site are the Thurmont, Cowee-Evard Complex and Bradson series. The publish soil survey for the site and associated watershed are included in Appendix D as obtained from the NRCS Web Soil Survey (available: https://websoilsurvey.nrcs.usda.gov/). Descriptions of each of the series listed above are included in Appendix E per the soil survey. As part of a site reconnaissance and collection of soil samples, several hand auger borings were advanced within the project site soils. Observed soil characteristics were generally consistent in color, structure and texture to those associated with the Thurmont soil series; however, the depth to bedrock (or potentially larger rocks) was generally between 2 and 3 feet below the soil surface. The surface horizon(s) were generally shallow and brown, with granular structure. The subsurface horizon(s) were sandy clay loam or clay loam in texture, yellowish red in color, with sub-angular blocky or massive structure. The noted erosion T factor for Thurmont soils is 4 tons/acre/year.

Based on soil characteristics and experience with similar landscapes within the region, soil water movement is characterized as follows. Precipitation enters the soil through infiltration, and percolates vertically and laterally through the surface horizon(s). In the case of the project site,

the surface horizon(s) are generally sandy loam or sandy clay loam in texture, and have a high permeability. This higher permeability is due to the presence of multiple root channels, macropores, and spacing between sand grains. The subsurface horizon(s) on the site are clay enriched, and water moves more slowly through them, primarily along soil structural units. When precipitation encounters the limiting subsurface horizon with reduced permeability, the water may perch briefly before percolating further towards the water table, or move laterally in the soil and eventually exfiltrate as return flow. Water movement in this manner occurs naturally on a hillslope (Dunne and Leopold 1978).

Two composite soil samples were collected for both surface (indicated as A samples) and subsurface (indicated as B samples) soil horizons within the proposed range site. Laboratory analysis is provided in Appendix C. The average pH in the surface and subsurface horizons was 7.2 and 6.8, respectively. The soil pH in all samples was much greater than would be expected in this area, which would generally be less than or equal to 5. The cation exchange capacity (CEC) averages were higher in the surface (24 meq/100g) and subsurface (6 meq/100g) horizons than would be expected. This also holds true for available plant nutrients concentrations in the soil, which suggests the site historically has been subject to fertilizer and/or other soil amendments as part of the management of the site. It should be noted that at the higher pH, some nutrients (e.g., phosphorus) may form insoluble compounds that are not plant available.

The project site is currently managed as a wildlife opening and mowed annually. No other management practices are employed, although it was indicated that the site was historical subject to regular lime amendments for pH adjustment.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Alternative 1 – No Action, Summary of Effects

Soil Loss

Soil loss and projected sediment yield were estimated using the RUSLE model (Appendix A). Soil loss is estimated to be less than 0.2 tons/acre/year in both the "dense grass" and "forested" coverage. This is well below the erosion T factor of 4 tons/acre/year for the Thurmont soils. This condition is expected to continue with no impacts under the current management prescription (annual mowing). Thus, soil productivity as a function of soil loss would not be impacted.

Soil Chemistry

Current soil chemistry is discussed above and laboratory analysis is from composite samples is provided in Appendix C. Without further soil amendments, the site would be subject to ordinary soil processes of nutrient cycling and immobilization. Over time, the soil pH is expected to decrease gradually, thus increasing availability of specific plant nutrients. The soil would continue to function in its role in nutrient cycling and supporting plant productivity.

Sedimentation and Water Quality

With no further expected changes to the site, the soil would continue to function in storage and transmission of water within the watershed such that water quality in the adjacent stream would be maintained.

Lead Management

Under the no action Alternative 1, there would be no inputs of lead, and therefore no impacts.

4.2 Alternative 2 – Proposed Action, Summary of Effects

Soil Loss

Soil loss is expected to increase under Alternative 2, due to the change in landscape features such as the addition of a gravel parking lot, change in vegetation to a cool season grass and the addition of impervious surfaces. Soil loss and sediment yield were estimated using the RUSLE model (Appendix B). In reviewing RUSLE results, it should be noted again that soil loss is an estimate of that which erodes within site, and sediment yield is that which reaches the bottom of the hillslope. In no case is this intended as a calculation of soil that reaches surface waters. Sediment that reaches the bottom of the hillslope would be subject to BMPs for sediment and erosion control implemented as part of the stormwater and drainage management plan for the site.

Based on the RUSLE modelling results (Appendix B), soil loss is estimated to be 3.9 tons/acre/year in both the pistol and rifle firing range hillslopes during operation of the range, and less than 0.2 tons/acre/year under the adjacent "forested" coverage. The estimated soil loss rates are below the erosion T factor of 4 tons/acre/year for the Thurmont soils. While the loss rate is projected to increase considerably over existing conditions, the rate is below that T factor where soil productivity is expected to be degraded. These model results apply only to the period of time where the target range is in operation, following completed construction and prior to decommissioning the site.

Soil Chemistry

Current soil chemistry is discussed above and laboratory analysis of composite samples is provided in Appendix C. Soil pH currently is greater than 7 in the surface horizon(s) on the project site. One of the selected BMPs that would be implemented as described in the ESP is soil pH adjustment through use of agricultural lime to a pH range between 6.5 and 8.5. Given that the site is currently maintained with a soil pH within the range specified in the ESP for the proposed action, the soil resource role in nutrient cycling and immobilization would continue unchanged during operation of the target range.

Sedimentation and Water Quality

The proposed target range would constitute a disturbance area greater than one acre, and thus would be subject to requirements of the Georgia Water Quality Control Act, O.C.G.A. § 12-5-20 and the Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6. Under these regulations, Union County Government would obtain a state general National Pollution Discharge Elimination System (NPDES) permit (No. GAR100001) for stormwater runoff resulting from activities during construction and decommissioning of the site. This includes development of an ESPC Plan that would be approved by the county as the LIA for a Land Disturbance Permit (see Union County Code, Chapter 30, Article II). The ESC Plan must be consistent with the *Manual for Sediment and Erosion Control in Georgia* (2016) and may include engineered controls such as the construction of containment traps or detention ponds, dams or dikes.

As stated in the assumptions above and included in the project description (Appendix A), all engineered controls would direct water away from the surface water, and there would be no direct connection to Gilliam Creek downgradient of the site. Any points of stormwater discharge would be allowed to dissipate and infiltrate within the upland portions of the site and/or within vegetated buffers, and function as non-point contributions to the stream. These contributions cannot be quantified without site specific ESC plans and other site information. Per the general permit, BMPs must be properly designed, installed and maintained. The permittee would be required to monitor turbidity and be in compliance with designated limitations in accordance with the permit. Turbidity measures the intensity of light scattered as it passes through a water sample. It is closely correlated with suspended sediment and is often used to assess cloudiness of water.

With engineered controls established it is unlikely that there would be impacts to the site soil's ability to function in storage and transmission of water within the watershed. Depending on timing, magnitude and duration of a given storm, stormwater runoff and sediment that is detached and transported may, as a non-point source, reach the downgradient stream during construction and decommissioning of the site, which would lead to a short-lived increase in surface water turbidity. These potential impacts would be temporary and subjected compliance with regulatory permit conditions as outlined above. During operation of the range, there would be continued increased inputs of stormwater and sediment as non-point sources to the downgradient stream system, but these are thought to be minimal as the site would be stabilized and vegetated fully (Appendix A), and there would be no direct connection to the adjacent surface water. Additionally buffers would remain intact.

The forest access road was located away from the tributary to Gillam Branch and would not cross any water feature. Runoff from road surfaces can transport sediment during storm events as non-point source pollution. Soil losses have been estimated from forest roads topped with aggregate under similar conditions in Coweeta (Swank and Crossley, 1988). Based on this study, soil loss is approximately 0.1 tons/acre/inch of rain with 6 inches of aggregate crushed

rock. As is the case with other site features (i.e., ranges, parking lot, etc.), soil loss does not necessary indicate sedimentation in the stream as discussed above. Potential impacts in the construction and decommissioning periods would be short-lived, and subject to regulatory compliance. During operations, the access road would be stabilized (Appendix A) and there would no direct connection to surface waters.

It should be noted that despite full and effective implementation of erosion and sediment control measures and BMPs, the site would still be subject to extreme precipitation events. These rare occurrences may lead to soil erosion and runoff that could reach surface waters. Specific impacts would vary depending on time, duration and magnitude of the event.

Overall, there would likely be some increase in non-point source sediment pollution to the stream system due to construction activities, additions of impervious or near impervious surfaces on the site, and changes in land use and cover. This may indirectly impact water quality within the watershed. Temporary and permanent drainage and water control structure(s) that are installed during construction, and those that would remain or be constructed as part of the ongoing maintenance and operation of the facility would function to minimize potential non-point source sediment pollution via sedimentation, while maintaining no direct connection to surface water in the vicinity of the project.

Lead Contamination

Lead is the primary component in bullets used in rifle and pistol shooting. The physical and chemical characteristics of lead play an important role in determining the potential for negative environmental consequences at outdoor shooting ranges. According to the US Department of Health and Human Services (HHS, 2007), important characteristics include:

- Lead is a known toxicant that does not degrade leading to higher concentrations in the environment overtime;
- Lead has little effect on plants or herbaceous consumers. It is not biomagnified in the food chain;
- Lead releases to water constitute a much higher exposure risk than releases in soil;
- Lead solubility in water is a function of pH, hardness, salinity, and the presence of organic matter;
- Lead does not leach appreciably into the subsoil and groundwater. It is strongly adsorbed to the soil and is generally retained in upper layers of soil; and,
- The mobility of lead in soils is dependent upon organic matter content, pH, and CEC.

Lead mobility would increase in environments having low pH due to the enhanced solubility of lead under acidic conditions. A majority of lead is retained strongly in soil, and very little is transported through surface water runoff or leaching to groundwater except under acidic conditions. However, it may enter surface waters as a result of erosion of lead-containing soil particulates or airborne soil dust particles. Lead becomes soluble at a pH of 4 to 6 and may leach from backstops, thus being transported by runoff into groundwater or the surrounding surface water. Additionally, in soil types with low organic matter and CEC, lead is more mobile, especially at a pH of less than 6.5 or greater than 8.5 (EPA, 2001).

As stated previously, an approved ESP would be implemented for the target range to contain, control and remove lead. A summary of prescribed BMPs included in the plan follow.

- Lead Reclamation: The most important BMP to minimize lead migration is implementation of a lead reclamation program (EPA, 2001). Periodic lead removal activities are regularly planned and conducted to ensure no hazardous waste would be present on the site. This is accomplished by Union County through hand raking and sifting, a rental vacuum system, or professionally through contract vendors. Specific methodologies would be highlighted in the ESP.
- Bullet and Lead Containment: Union County would utilize the earthen backstops within the site for its bullet containment. Earthen backstops would be installed up to 20 feet high in the back of each range and up to 8 feet high along the sides of each range. Backstops would be maintained free of debris to ease reclamation activities and ensure proper safety. The addition of lime would be required to adjust soil pH on the backstops (see below). The operations plan includes good shooting practices and rules against shooting anything other than targets properly mounted on the target holders.
- Soil pH Adjustment and Monitoring Program: As previously discussed, lead is insoluble and not mobile at a pH range of 6.5 to 8.5. Therefore, proper management of soil pH is extremely important to reduce the risk of lead contamination of groundwater or surface water resources. Soil sampling would be conducted twice per year, once during the cooler and wetter winter months and once during the warmer and drier summer months. Samples would be tested by local extension laboratories which can make lime application recommendations based on site specific conditions. Agricultural lime would be applied at the specified rate to the ranges, backstops, and general vicinity of the facility.
- Runoff and Dust Control: BMPs that reduce soil erosion and loss by controlling onsite dust and surface water runoff are important in reducing lead migration. One of the most effective management measures for reducing soil erosion is using vegetative BMPs. Forest service approved grasses would be maintained on the ranges and backstops to control dust, slow runoff and stormflow velocities, thus aiding to prevent lead migration. Other engineered controls would be implemented as part of the drainage plan for the site. Examples include the construction of containment traps or detention ponds, a roof over the backstop at the back of each range, dams or dikes, or ground contouring. These engineering controls would be professionally designed and constructed to allow lead particles from runoff to settle and be contained prior to runoff leaving the site.

With effective implementation of the BMPs listed during operation of the range and reclamation prior to decommissioning, the project site would not be degraded such that it would be prohibited from any future use (e.g., conversion back to wildlife opening).

5.0 CONCLUSIONS

As described above, there are projected changes to soil and water resources upon implementation of Alternative 2. The Forest Plan (2004) highlights a number of goals and standards related to soil and water resources as highlighted in the introduction above. Provided that all the assumptions applied to this environmental review are applied as described (Appendix A), implementation of Alternative 2, the Union County Target Range would not prohibit the Forest Service in achieving these overarching goals, although there would be site-specific impacts as noted above.

6.0 LITERATURE CITED

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APPENDIX A.
Target Range Project Description

Project Description of the

Proposed Union County Government Target Range

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Introduction

The USDA-Forest Service is charged with evaluating a project proposed by the Union County Government to construct a target range facility on National Forest lands. Design plans and projected usage for the facility were not provided by the county; so to aid in the review process, the following project description was developed based on available sources listed below.

- The Union County Government Special Use Permit (SUP) application (Standard Form 299) and associated attachments, dated April 24, 2018;
- Proposed Shooting Range Location Map (Attachment A), which presents a conceptual site layout drawing of the facility, dated September 12, 2018;
- The Union County Gun Club Standard Operating Procedures (SOP), dated July 25, 2019;
- Personal communication with the USDA-Forest Service Interdisciplinary NEPA review team and the Blue Ridge Ranger District personnel;
- 2018 usage data for eight Georgia Department of Natural Resources (GDNR) ranges, including Ocmulgee, Dixon, Memorial, West Point, Cedar Creek, Wilson Shoals, Clybel, Chickasawhatchee, and Richmond Hill (Unpublished);
- National Shooting Sports Foundation's publication, *Environmental Aspects of Construction and Management of Outdoor Shooting Ranges,* Facility Development Series Number 2, published in 1997;
- National Rifle Association publication, *The NRA Range Source Book: A Guide to Planning and Construction*, published in 2012;
- The US Department of Energy's *Range Design Criteria*, published in 2012;
- The US Environmental Protection Agency's *Best Management Practices for Lead at Outdoor Target Ranges*, Report No. EPA-902-B-01-001, Region 2, originally published in January 2001, and revised June 2005; and
- The USDA-Forest Service's Built *Environmental Image Guide for National Forests and Grasslands* (BEIG), Publication No. FS-710, September 2001, Chapter 4.4 Southeast Mountain Province.

This description is intended for proposed project evaluation purposes only. It does not constitute a project design or operation plan. All of the items in this description have been

acknowledged by the USDA-Forest Service; however, final design and operation plans are to be completed by the SUP applicant, and are subject to USDA-Forest Service approval.

Proposed Project Location

The proposed site for this project is located off Highway 180 between mile markers 18 and 19 on Land lot 212, District 16, Section 1 south of FS Road 292 and consists of approximately 14.5 acres of National Forest land (Attachment A). The proposed site layout shows structures and features of the range and outlines the approximate 3-acre construction footprint. Gillam Branch serves as the western project boundary, but a buffer of 125-feet would be maintained and remain undisturbed for the life of the proposed project.

Implementation and Management

As proposed, the Union County Government would be the primary SUP holder and would assume the funding, maintenance and operation responsibilities, with the Union County Gun Club, a private entity, responsible for the day to day operation of the proposed target range. Per the permit application, the facility is designated for public use, but there are varying levels of membership for the Union County Gun Club.

The Union County Government would implement an approved Environmental Stewardship Plan (ESP) developed in accordance with *Best Management Practices for Lead at Outdoor Shooting Ranges* (US Environmental Protection Agency, 2001, revised 2005). The ESP is currently being developed by the USDA-Forest Service, and is subject to their approval prior to implementation.

Union County Government would also implement a site-specific operations and safety plan for users of the range (SOP), which is also subject to USDA-Forest Service approval prior to implementation. Included in those measures is a dedicated Range Safety Officer available during operation hours, who is certified by the NRA or similar organization.

Per the SUP application, the construction period is projected to be 60 to 90 days in length, and the specified site life is 100 years. Range operating hours would be limited to daylight times, seven days per week, throughout the year.

Decommissioning the Union County Government Target Range would include complete removal of all structures, reuse of the backstop material, and regrading and replanting of the site according to a USDA-Forest Service approved vegetation management plan. Lead would be removed/recycled in accordance with the ESP, and its removal would be confirmed through monitoring conducted by Union County.

Range Types

The project would include two shooting ranges, one for rifle usage (600 x 100 foot) and another for pistol usage (150 x 60 foot) (Attachment A). Per the Union County Gun Club SOP, the following gun would be permitted, as stated:

- *Single shot center fire and rim fire rifles and pistols less than .50 caliber.*
- *Bolt action or lever action, magazine fed, center fire rifles, rim fire rifles and pistols up to 50 caliber.*
- *Semiautomatic magazine fed, center fire rifles, rim fire rifles and pistols up to and including 50 caliber.*
- *Black powder muzzle loading rifles and pistols.*
- *Black powder muzzle loading smoothbore muskets.*

Projected Usage

Projected range usage was not provided by the Union County Government of the Union County Gun Club. Expected range use was estimated based on 2018 usage data for eight Georgia Department of Natural Resources (GDNR) ranges, including Ocmulgee, Dixon, Memorial, West Point, Cedar Creek, Wilson Shoals, Clybel, Chickasawhatchee, and Richmond Hill. Most of the ranges are closed on Mondays, and have varied operating hours. Three of the ranges closed for a portion of the year (2018) for repairs or other reasons. An overview of usage follows:

- Average total visitors per range (based on 5 ranges that were opened all of 2018) was approximately 5,000 users/year.
- Days of the week: Approximately 30 percent of the weekly visitation occurs on Saturdays, with Fridays and Sundays also receiving higher visitation. Tuesdays and Wednesdays had the lowest overall visitation.
- Hourly Visitation: In general, visitation peaked in the opening hour (9-10 am, Tuesday to Saturday, and 1-2 pm, Sunday), and tapered off during the late afternoon.
- Monthly Visitation: Use of the ranges peaked in autumn based on five ranges opened all of 2018 (see summary below).

Monthly average percentage of of annual visitation occurrence			
Jan	7	Jul	7
Feb	7	Aug	8
Mar	9	Sep	9
Apr	8	Oct	12
May	7	Nov	11
Jun	7	Dec	8

Similar total, daily, hourly and seasonal usage patterns are expected for the Union County Target Range. For the purposes of evaluating the proposed project, an estimated 5,000 users per year is utilized, including repeat visitors, each utilizing a vehicle for access to the facility.

Site Features

Site specific design plans and construction details (e.g., equipment or materials to be used) were not provided by the Union County Government, and any engineering drawings or plans would be subject to USDA-Forest Service approval. The following site feature descriptions are presented based on the best information available, including the guidance documents and other sources listed above, and the proposed site layout (Attachment A). Details provided have been acknowledged by the USDA-Forest Service, and are intended for evaluation purposes only.

Access Road:

The access road that connects State Highway 180 to the designated parking lot would be approximately 500 feet in length, with double lanes, and topped with the appropriate aggregate material to a minimum depth of 6 inches. All design/engineering would be consistent with Forest Service standards. The connection of the access road to Highway 180 is subject to modification of the existing Georgia Department of Transportation (GDOT) SUP. Therefore potential impacts of the connection are not included in the evaluation of the proposed project. Ongoing required maintenance would be consistent with standards for Road Maintenance, Level 3. Construction would involve tree and boulder/rock removal, grubbing and filling as needed with appropriate materials, grading and shaping, temporary installation of erosion and sediment control measures, and permanent installation of necessary drainage structure(s) (culvert or dip) along with a secure access gate. Grading is projected to be minimal, such that the existing slope of the site would be maintained, and would not include substantial cut and fill of soil and subsurface material. If merchantable timber is to be removed, trees would be identified and designated for removal by USDA-Forest Service personnel.

Parking Lot:

The parking lot would consist of a 60 x 200 foot cleared and graded area, topped with aggregate material to a depth of 6 inches. The projected capacity would be up to 40 vehicles. Construction would include boulder and rock removal, grading and shaping, gravel laying and temporary installation of erosion and sediment control measures. Grading is projected to be minimal, such that the existing slope of the site would be maintained, and would not include substantial cut and fill of soil and subsurface material.

Vaulted toilets:

Vaulted toilets would include subsurface installation of a 1,500 gallon concrete tank that is cleaned out routinely by the Union County Government or Union County Gun Club for waste management. Design and material selection would be in accordance with the BEIG guidelines, such that appropriate construction materials and color schemes are utilized. Construction would include boulder and rock removal from the surface and subsurface removal of soil and bedrock, installation of concrete and impervious surfaces, rain water control features (so the tank does

not fill with storm water), and building of an enclosed structure. No water source wells would be installed and there would be no running water associated with the vaulted toilets.

Structures:

Structures on the site would include a 175 x 15 foot pole barn that houses 16 stalls total on the two ranges, a 2,500 square-foot clubhouse, and two smaller storage units. An overhead containment baffle structure would be installed on the roof of the pole barn structure over the stalls. Construction would include clearing and rock removal, grading and shaping, and installation of concrete flooring, wooden posts/beams, wood siding, and standing seam metal roofing materials. Grading is projected to be minimal, such that the existing slope of the site would be maintained, and would not include substantial cut and fill of soil and subsurface material. Design and material selection would be in accordance with the BEIG guidelines, such that appropriate construction materials and color schemes are utilized. There would be no power supply to any structures located at the proposed facility.

Shooting Ranges:

The proposed project would include two shooting ranges, one for rifle usage (600 x 100 foot) and another for pistol usage (150 x 60 foot). Construction would include clearing and removing rock and vegetation, grading and shaping, installation of an access path along the length of each of the ranges, and installation of site specific water control measures. Grading is projected to be minimal, such that the existing slope of the site would be maintained, and would not include cut and fill of soil and subsurface material. The grade of the shooting lanes as proposed would be greater than the 2 percent grade recommended in the US Department of Energy and NRA guidelines. The National Shoot Sports Foundation guidelines recommend that the ranges be “relatively flat.”

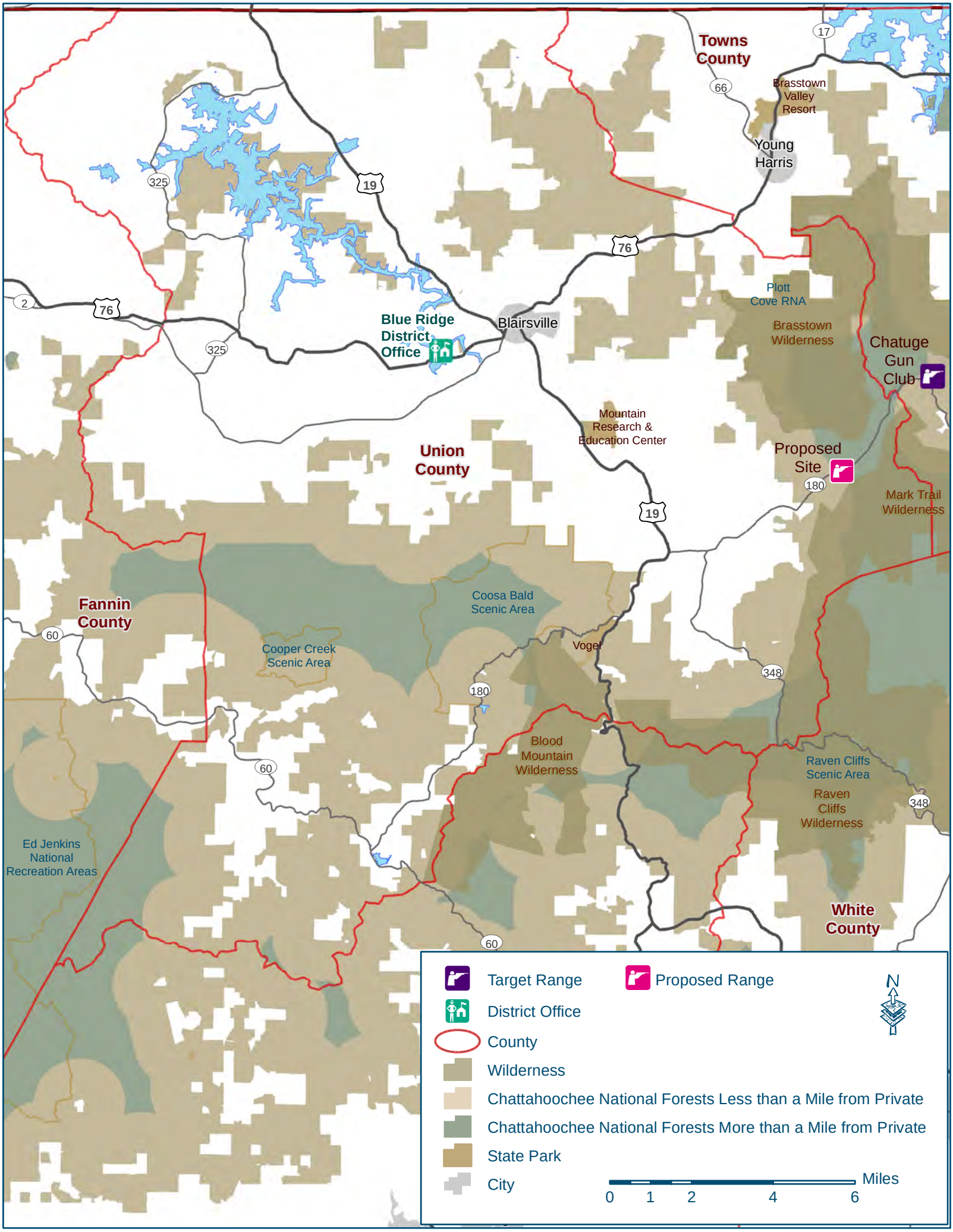
Protective backstops would be installed along the sides of each range to a minimum height of 8 feet, and along the primary back side of the range to a minimum height of 20 feet. Side slopes on the backstops are expected to be at a 1.5:1 ratio. Material for the backstops would be sourced locally, not originating from the USDA-Forest Service property, and tested for quality and appropriateness prior to use. Ballistic Sand may be utilized, as appropriate, on the primary backstops, as a cap. The anticipated volume of material (soil) to be sourced is estimated to be approximately 4,000 cubic-yards. The ranges and backstops would be grassed using a Forest Service approved Southeast Upland seed mix and maintained for full vegetative coverage of the site during operation of the range. Some example species include Brown top millet, Switchgrass, Big Bluestem, and Indiangrass for the spring and summer months, and Crimson clover, Hairy Vetch, and wheat for use during the fall and winter.

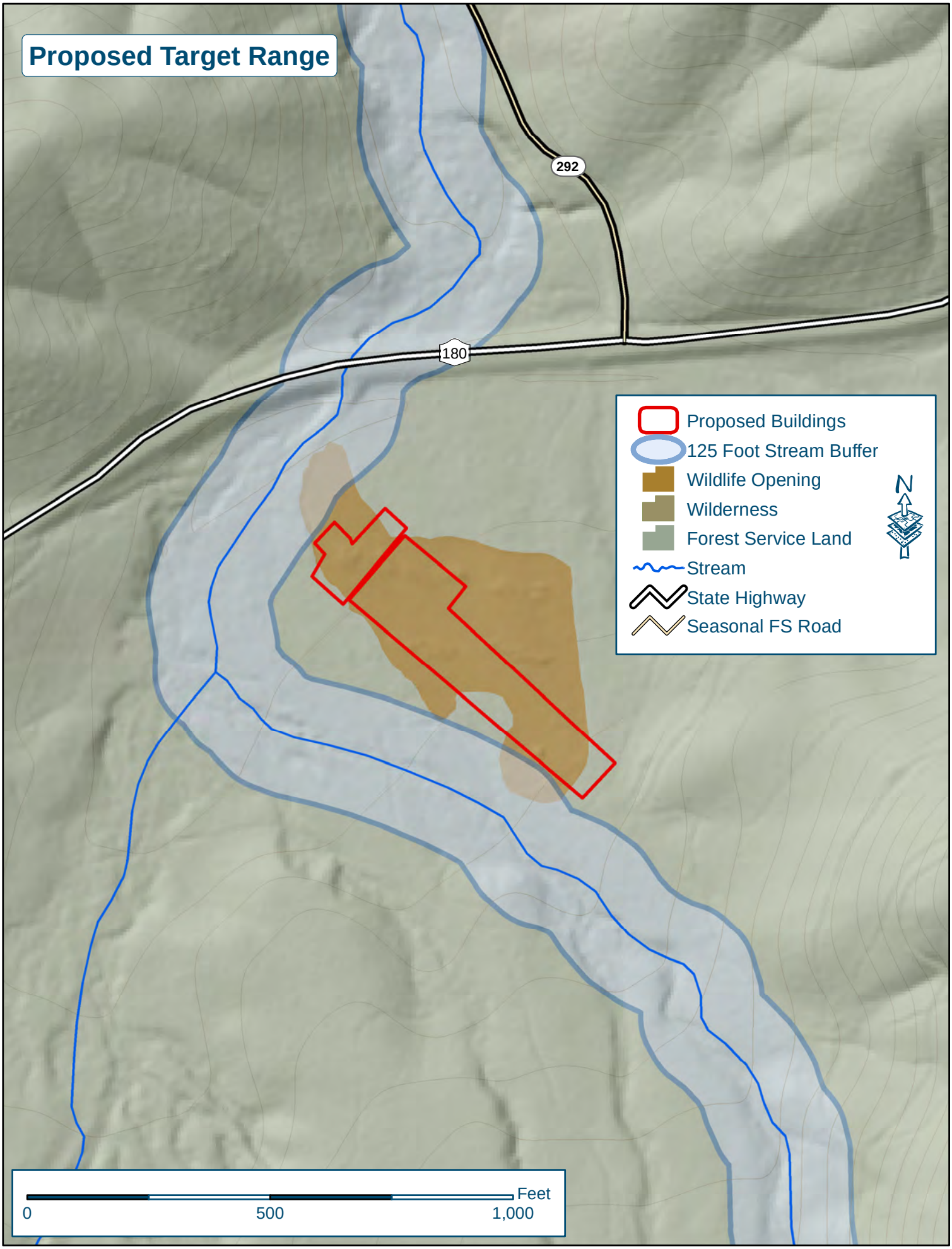
Drainage Management:

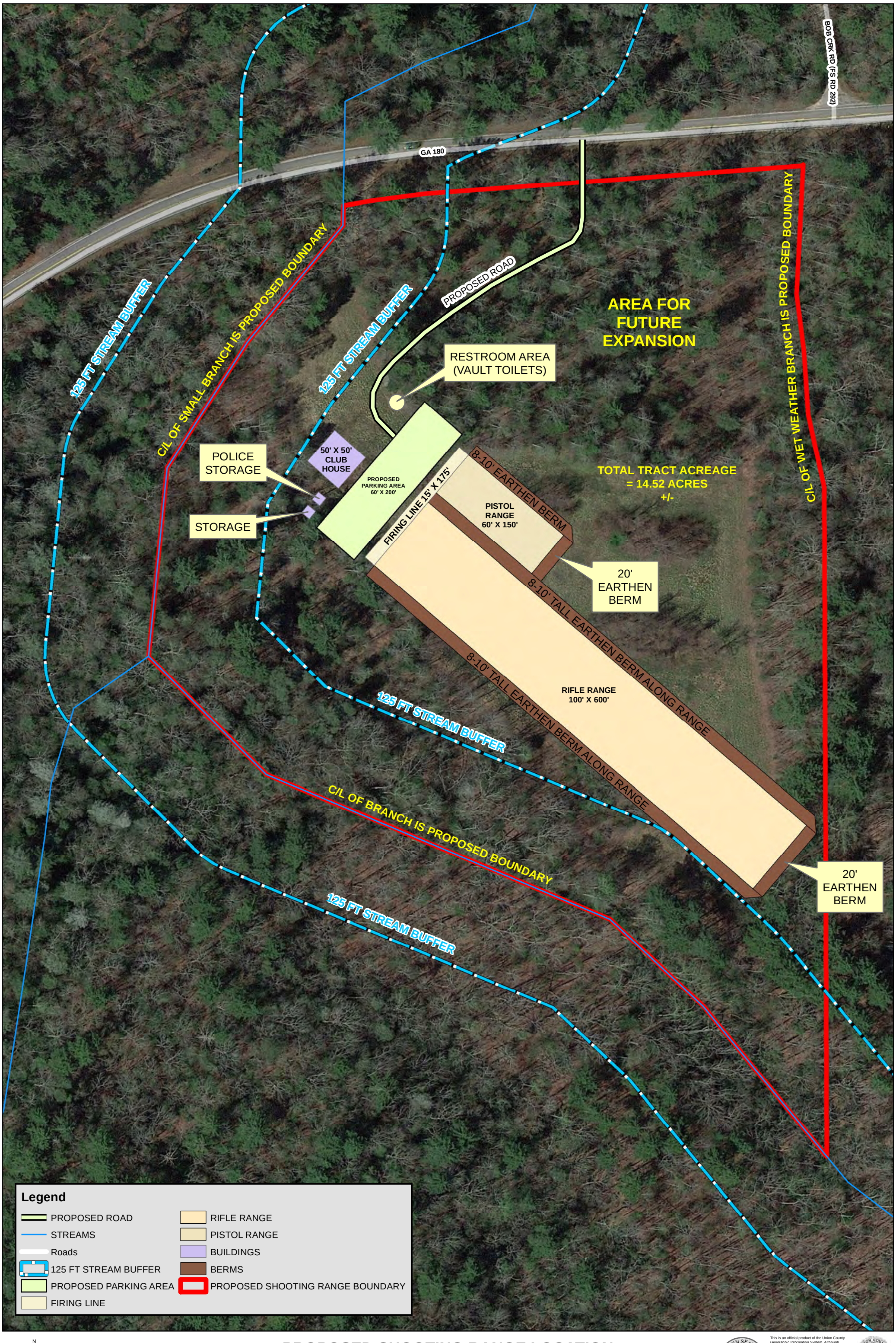
Water control structure(s) and drainage plans have not been developed for the facility. Artificial drainage would be provided temporarily for construction/decommissioning of the project, and permanently for operation and maintenance of the range. All sediment and erosion control measures, including any artificial drainage (e.g., vegetated buffers, turn outs, settling basins, etc.) would be designed, installed and maintained in accordance with both the Georgia Water Quality Control Act and appropriate Union County codes and ordinances. This includes an approved Erosion, Sedimentation and Pollution Control (ESPC) Plan and Land Disturbance Permit by Union County, a local issuing authority (LIA) during construction and decommissioning of the site. It is assumed that in no case would there be a direct connection of construction site stormwater to naturally occurring surface water in the vicinity of the project, and compliance with the approved ESPC Plan and the General Permit NPDES Permit No. GAR100001 would be maintained. Further, any permanent water control structure(s) that would remain or be constructed as part of the ongoing maintenance and operation of the facility would not provide a direct connection to surface water in the vicinity of the project.

Measures for Minimization/Mitigation of Potential Impacts

- Installed backstops/barriers would serve to aid in lead containment, lessen noise impacts, and add safety for users of the range.
- An overhead containment baffle unit would be installed on the pole barn roof above the shooting stalls to reduce noise impacts, and prevent to the extent possible, a weapon from firing directly out of a range.
- Vegetative tree plantings of appropriate native species are proposed in the area currently maintained as a wildlife opening. These trees, when mature, would lessen impacts from noise and provide for scenic resources.
- Tree removal associated with construction would not be allowed during the period of April 1st through July 31st to avoid potential impacts to bat species.
- Signage would be installed as needed to aid in safety for traffic and recreation users of the National Forest in the vicinity of the project.
- A security gate would be installed at the facility entrance to aid controlling access.
- Where appropriate, recommendations presented in the BEIG would be implemented in design and material selection to minimize scenic impacts.
- Access road placement would provide a minimum of a 400-foot line of site stopping distance to improve safety for thru-traffic and users of the proposed facility.
- Lead BMPs would include but are not limited to recycling/reclamation of lead, pH adjustment of soils within the range footprint and along artificial drainage features, bi-annual soil monitoring, maintenance of range and backstops with USDA-Forest Service approved grass mixes such that there is minimal bare ground surfaces for dust and erosion control, and no direct connection to surface waters in the stormwater and drainage control features that would be constructed on the site.


Towns County
Brasstown Valley Resort
Young Harris
Blairsville
Blue Ridge District Office
Plott Cove RNA
Brasstown Wilderness
Chatuge Gun Club
Mountain Research & Education Center
Union County
Proposed Site
Mark Trail Wilderness
Fannin County
Coosa Bald Scenic Area
Cooper Creek Scenic Area
Vogel
Blood Mountain Wilderness
Raven Cliffs Scenic Area
Raven Cliffs Wilderness
Ed Jenkins National Recreation Areas
White County
17
66
19
76
2
325
180
348
60
Target Range
Proposed Range
District Office
County
Wilderness
Chattahoochee National Forests Less than a Mile from Private
Chattahoochee National Forests More than a Mile from Private
State Park
City
N
Miles
0
1
2
4
6


Proposed Target Range
292
180
Proposed Buildings
125 Foot Stream Buffer
Wildlife Opening
Wilderness
Forest Service Land
Stream
State Highway
Seasonal FS Road
N
0
500
1,000
Feet



N
W E
S

1 inch = 100 feet

PROPOSED SHOOTING RANGE LOCATION
GA HWY 180 E NEAR USFS RD 292
UNION COUNTY, GEORGIA

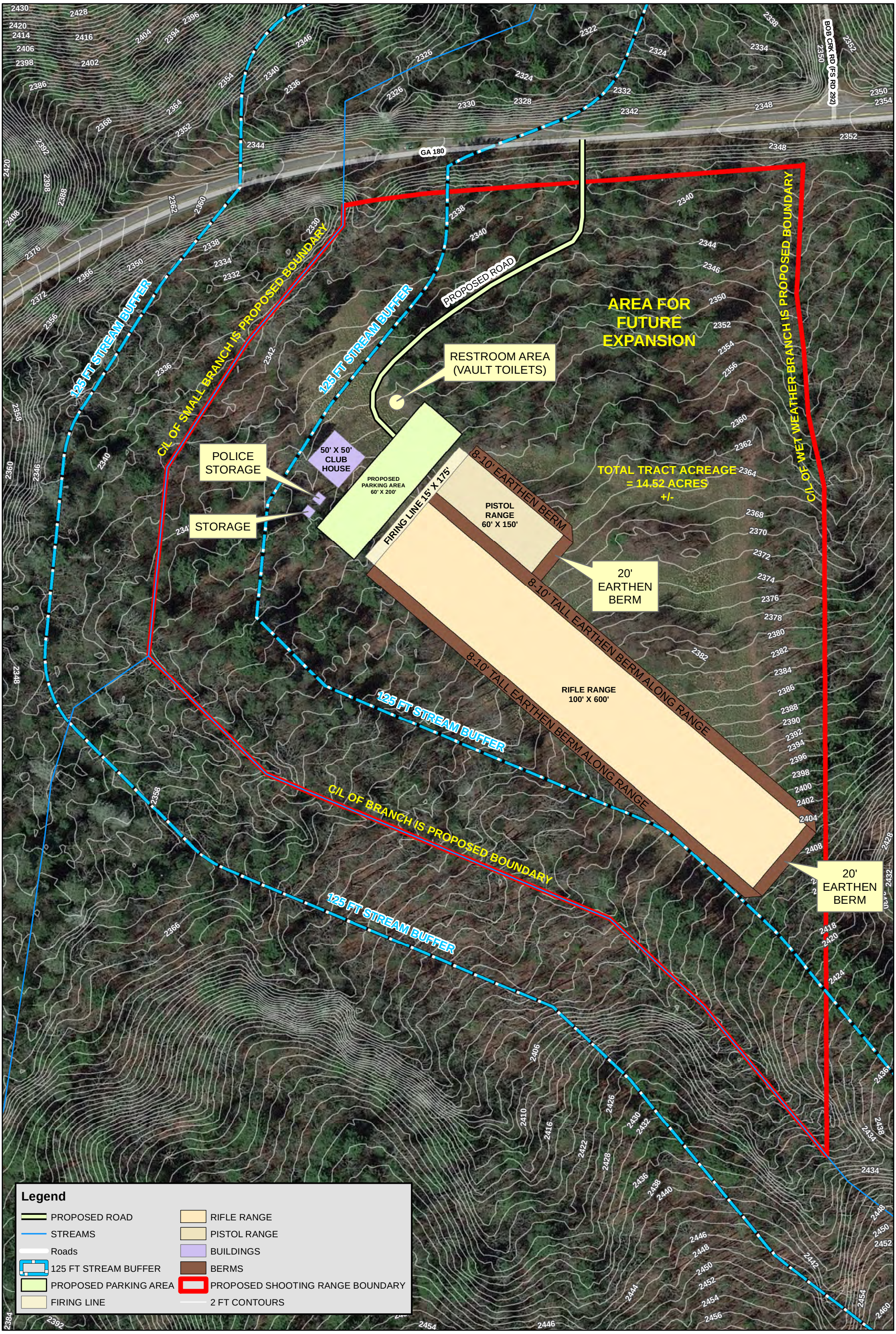
SHAWN SEABOLT CERTIFIED GISP

Date: 9/12/2018

This is an official product of the Union County Geographic Information System. Although Union County has made reasonable efforts to ensure the accuracy of the Union County GIS Database, the end USER understands that the Union County GIS Database may contain errors. Union County makes no warranty of any kind regarding the accuracy or reliability of the Union County GIS Database or any part thereof.

Shawn Seabolt, GISP Director
The Union County Geographic Information System

Print Date: 9/12/2018



N
W E
S

1 inch = 100 feet

PROPOSED SHOOTING RANGE LOCATION
GA HWY 180 E NEAR USFS RD 292
UNION COUNTY, GEORGIA

SHAWN SEABOLT
OFFICIAL PRODUCT UNION COUNTY, GEORGIA GIS DEPT
CERTIFICATION NO. 5819
CERTIFIED GISP

Date: 9/12/2018

This is an official product of the Union County Geographic Information System. Although Union County has made reasonable efforts to ensure the accuracy of the Union County GIS Database, the end USER understands that the Union County GIS Database may contain errors. Union County makes no warranty of any kind regarding the accuracy or reliability of the Union County GIS Database or any part thereof.

Shawn Seabolt, GISP Director
The Union County Geographic Information System

UNION COUNTY SEAL GOVERNMENT

Print Date: 9/12/2018

APPENDIX B.
RUSLE Overview and Results

RUSLE2 MODEL BACKGROUND AND SETUP

The Revised Universal Soil Loss Equation (RUSLE) was developed by soil scientists over decades of empirical research in order to predict soil loss from water erosion.

Revised Universal Soil Loss Equation (RUSLE)

RUSLE computes average annual erosion from field slopes in tons/acre/year (Renard, 1997)

$$A = R*K*(LS)*C*P$$

A = Computed Average Annual Soil Loss
R = Rainfall-Runoff Erosivity factor
K = Soil Erodibility Factor
L = Slope Length Factor
S = Slope Steepness Factor
C = Land Cover-Management Factor
P = Conservation Practice

The USDA and NRCS have developed the Revised Universal Soil Loss Equation version 2 (RUSLE2) program primarily for soil conservation planning, estimating sediment delivery, and predicting erosion rates based upon the fundamental variables in the original Revised Universal Soil Loss Equation (RUSLE). RUSLE2 improves upon its predecessor by employing a variety of subfactor cover management techniques in a standardized database. It also implements additional sediment-based deposition equations and daily interval determinations that give a more dynamic scenario for soil loss and sediment delivery calculations.

For modeling the potential changes in sediment runoff from the construction of the proposed target range, a series of slope segments representing varying surface coverage were constructed for the entire length of the site slope profile. Rainfall and Soil Erodibility parameters (“R” and “K” respectively) are automatically calculated based upon historical climate and soil data within the RUSLE2 MOSES 2016 database for Union County, GA. Slope lengths and average steepness (“L” and “S”) were derived from the USGS National Elevation Dataset 2010 (1/9 arc-second resolution) as well as proposed construction plans for the project site.

The mean slope steepness was specifically calculated by selecting elevation model values within the target construction areas, interpolating a per-pixel slope value based upon adjacent units with a geoprocessing toolset, and finally finding the average mean slope value for all units within the target area. The slope values within the target area ranged from 0.1 - 10.3% over approximately 2600 elevation units, with an average mean of 4.1% and a standard deviation of 1.3. With these factors and the “P” value held constant, the surface coverage values were changed to best represent a series of before and after scenarios for different sectors of the site.

The rifle range was modeled with an impervious roof surface over the upgradient backstop, cool season grass coverage over the active range, another impervious roof covering the firing line, rock and aggregate coverage for the proposed parking lot, and a natural vegetative barrier downgrade of the parking lot. The pistol range was similarly modeled with a significantly shorter

lateral length of cool season grass coverage. The adjacent forested slope was modeled with a vegetative barrier in excellent condition for its entire length.

Quantitative erosion predictions in RUSLE2 are given as total sediment mass delivery to the toe of the modeled slope as well as soil loss mass along the slope. Sediment delivery is expressed in annualized units of tons / acre / year while soil loss is measured tons / acre. These values differ because sediment delivery measures the actual mass of soil leaving the slope while soil loss only quantifies the movement of soil within overall the modeled area. For example, an unprotected slope could have significant soil loss due to erosive events, but management practices at the base of the slope (silt fences, check dams, vegetation, etc) or a 'flattening' of the topography, effectively capturing some of the eroded sediment, could result in much lower sediment delivery values.

As with any erosion prediction model, topographic generalizations and coverage determinations were made to try and best reflect real-world conditions. The sediment loss rates should not be taken as an absolute numerical estimate of actual sediment delivery to the bottom of the slope. Rather, a comparative analysis between the rates gives a much better assessment of potential increases or decreases in soil loss when changes to land cover occur.

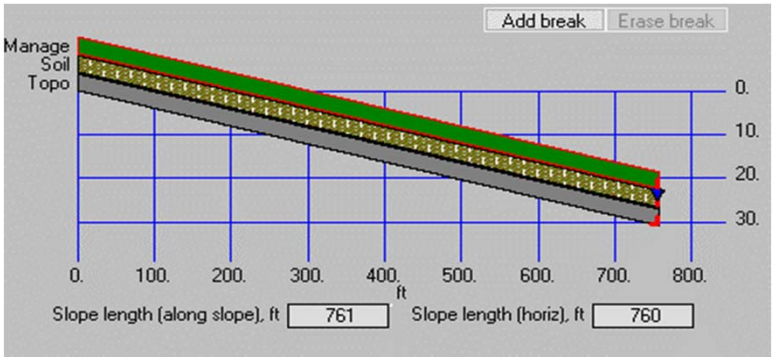
Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder coordinators. 1997. Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, Agricultural Handbook 703, 404 pp.

Sediment runoff estimates for Firing Range construction
Model: RUSLE2 v2.6.8.4
Erosivity (R) and Erodability (K) values provided by USDA MOSES2016 Database for Union County, GA
A mean slope steepness (S) of 4.1% is assumed for all segment lengths

ADJACENT FOREST SLOPE

	sed delivery (ton/acre/yr)	soil loss (ton/acre)
STATIC	0.13	0.13

Segment #	Segment Horizontal Length (ft)	Soil Type	Coverage
1	760	Thurmont fine sandy loam (2-6% slope)	vegetative barrier (excellent condition)

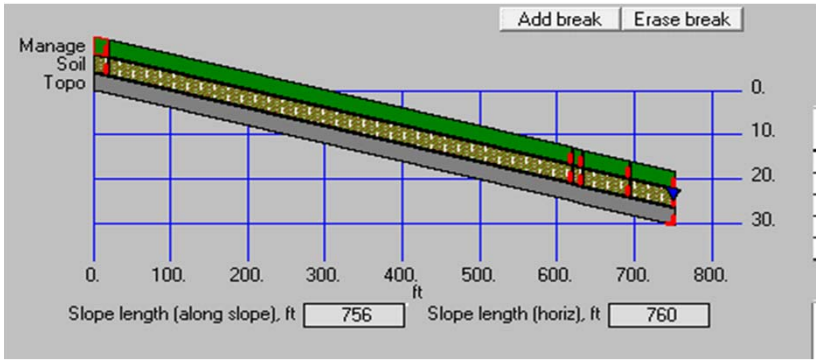


Example of generalized profile for adjacent forest slope in RUSLE2

RIFLE RANGE

	sed delivery (ton/acre/yr)	soil loss (ton/acre)
BEFORE	0.047	0.15
AFTER	0.055	3.9

Segment #	Segment Horizontal Length (ft)	Soil Type	Coverage BEFORE	Coverage AFTER
1	20	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	impervious (roof)
2	600	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	cool season grass
3	15	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	impervious (roof)
4	60	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	rock coverage (93%, parking area)
5	60	Thurmont fine sandy loam (2-6% slope)	vegetative barrier	vegetative barrier

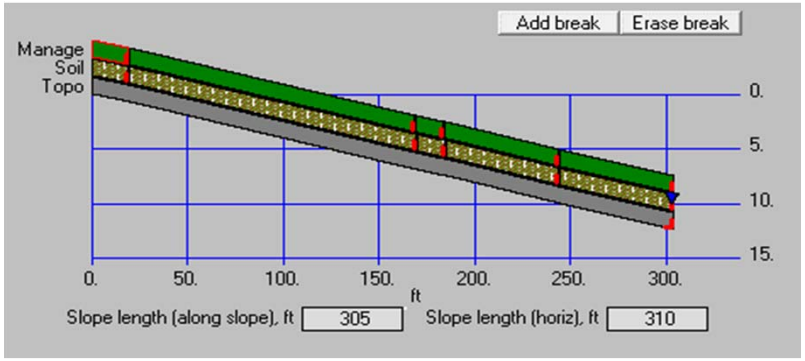


Example of generalized profile for rifle range in RUSLE2

PISTOL RANGE

	sed delivery (ton/acre/yr)	soil loss (ton/acre)
BEFORE	0.046	0.15
AFTER	0.0571	3.9

Segment #	Segment Horizontal Length (ft)	Soil Type	Coverage BEFORE	Coverage AFTER
1	20	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	impervious (roof)
2	150	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	cool season grass
3	15	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	impervious (roof)
4	60	Thurmont fine sandy loam (2-6% slope)	dense grass (not harvested)	rock coverage (93%, parking area)
5	60	Thurmont fine sandy loam (2-6% slope)	vegetative barrier	vegetative barrier



Example of generalized profile for pistol range in RUSLE2

APPENDIX C.
Soil Laboratory Analysis

Nutter & Associates, Inc.

UNIVERSITY OF GEORGIA EXTENSION

Ag & Environmental Services Labs
Soil, Plant, and Water Laboratory

2400 College Station Road
Athens, GA 30602
phone: 706-542-5350
email: soiltest@uga.edu
http://aesl.ces.uga.edu

Soil Samples

Completed: November 14, 2018

		ppm $CaCO_3$/pH			%	meq/ 100g	Mehlich 1 mg/kg (ppm)													
Lab	Sample	LBC [1]	LBCeq	pH [2]	Base Satur-ation	CEC	Ca	Cd	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	P	Pb	Zn
13089	TR1A	566	1641	7.03	100.0	21.55	3571	0.06	0.07	<0.28	8.76	186.4	380.8	53.00	<0.06	9.04	0.22	14.35	<0.02	3.29
13090	TR1B	379	1099	6.62	87.4	6.64	944	<0.05	<0.05	0.91	36.07	55.4	108.8	8.19	<0.05	9.53	0.11	0.94	0.30	0.53
13091	TR2A	594	1723	7.41	100.0	26.96	4811	<0.05	0.08	<0.27	7.47	228.9	274.3	50.01	<0.05	7.44	0.11	21.78	<0.02	2.51
13092	TR2B	368	1067	6.95	97.9	4.97	817	<0.05	<0.05	0.88	27.65	154.6	42.2	13.60	<0.05	6.59	0.06	1.83	0.18	0.37

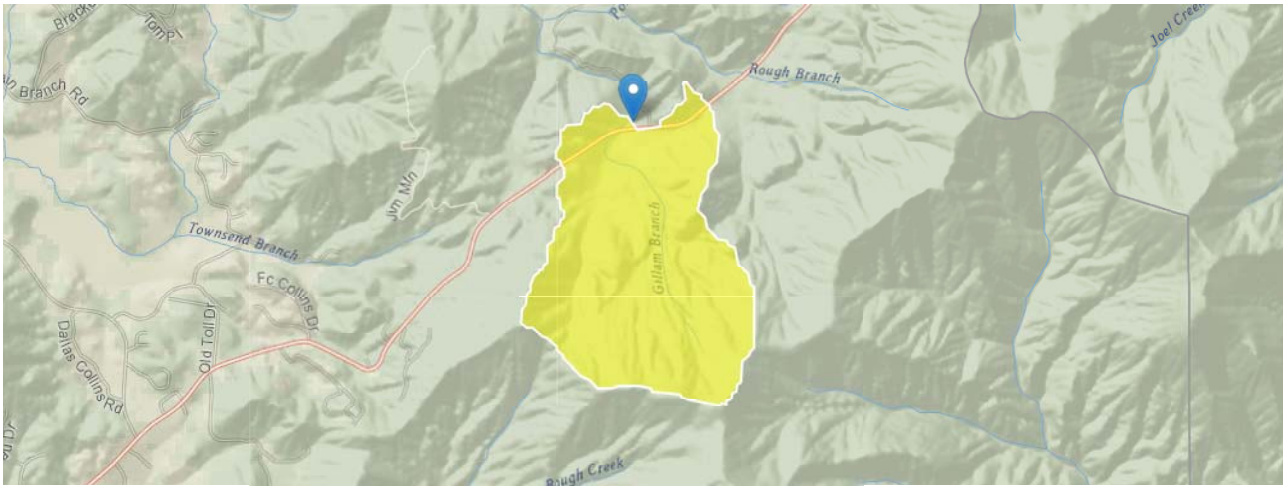
		%			
Lab	Sample	Sand	Silt	Clay	Soil Type
13089	TR1A	54.0	24.0	22.1	Sandy Clay Loam
13090	TR1B	44.0	20.0	36.0	Clay Loam
13091	TR2A	56.0	20.0	24.1	Sandy Clay Loam
13092	TR2B	56.0	17.9	26.1	Sandy Clay Loam

1. Soil Testing: Measurement of Lime Buffer Capacity (http://aesl.ces.uga.edu/publications/soilcirc/C874.asp)
2. Soil Testing: Soil pH and Salt Concentration (http://aesl.ces.uga.edu/publications/soilcirc/C875.asp)

APPENDIX D.
StreamStats Watershed, Union County Target Range

Union County Target Range

Region ID:	GA
Workspace ID:	GA20190422152141935000
Clicked Point (Latitude, Longitude):	34.82411, -83.82030
Time:	2019-04-22 11:21:57 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.82	square miles
PRECPRIS00	Basin average mean annual precipitation for 1971 to 2000 from PRISM	67.2	inches
BSLDEM10M	Mean basin slope computed from 10 m DEM	37.608	percent
CSL10_85	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	1010	feet per mi
ELEV	Mean Basin Elevation	2816	feet
ELEVMAX	Maximum basin elevation	3868	feet
GWHEAD	Mean basin elevation minus minimum basin elevation	493	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	9.29	inches
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	6.1	inches
I24H25Y	Maximum 24-hour precipitation that occurs on average once in 25 years	7.3	inches
I24H50Y	Maximum 24-hour precipitation that occurs on average once in 50 years	8.27	inches
LC06AGRI	Percent agriculture computed as total of grass, pasture, and crops, NLCD classes 71, 81 and 82	0	percent
LC06DEV	Percentage of land-use from NLCD 2006 classes 21-24	2.594	percent
LC06FOREST	Percentage of forest from NLCD 2006 classes 41-43	96.651	percent
LC06IMP	Percentage of impervious area determined from NLCD 2006 impervious dataset	0.05	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	2.63	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.055	percent
MINBELEV	Minimum basin elevation	2323	feet
PCTREG1	Percentage of drainage area located in Region 1	0	percent
PCTREG2	Percentage of drainage area located in Region 2	100	percent
PCTREG3	Percentage of drainage area located in Region 3	0	percent
PCTREG4	Percentage of drainage area located in Region 4	0	percent
PCTREG5	Percentage of drainage area located in Region 5	0	percent
RELIEF	Maximum - minimum elevation	1545	feet
RRMEAN	Relief ratio defined as (ELEV-MINBELEV)/(ELEVMAX-MINBELEV)	0.319	dimensionless

Annual Flow Statistics Parameters [N Georgia mean flow 2017 5001]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.82	square miles	1.67	576
PRECPRIS00	Mean Annual Precip PRISM 1971 2000	67.2	inches	47.6	81.6

Annual Flow Statistics Disclaimers [N Georgia mean flow 2017 5001]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Annual Flow Statistics Flow Report [N Georgia mean flow 2017 5001]

Statistic	Value	Unit
Mean Annual Flow	2.02	ft^3/s

Annual Flow Statistics Citations

Gotvald, A.J.,2017, Methods for estimating selected low-flow frequency statistics and mean annual flow for ungaged locations on streams in North Georgia: U.S. Geological Survey Scientific Investigations Report 2017–5001, 25 p. (https://doi.org/10.3133/sir20175001)

USGS Data Disclaimer: Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for release by the U.S. Geological Survey (USGS), no warranty expressed or implied is made regarding the display or utility of the data for other purposes, nor on all computer systems, nor shall the act of distribution constitute any such warranty.

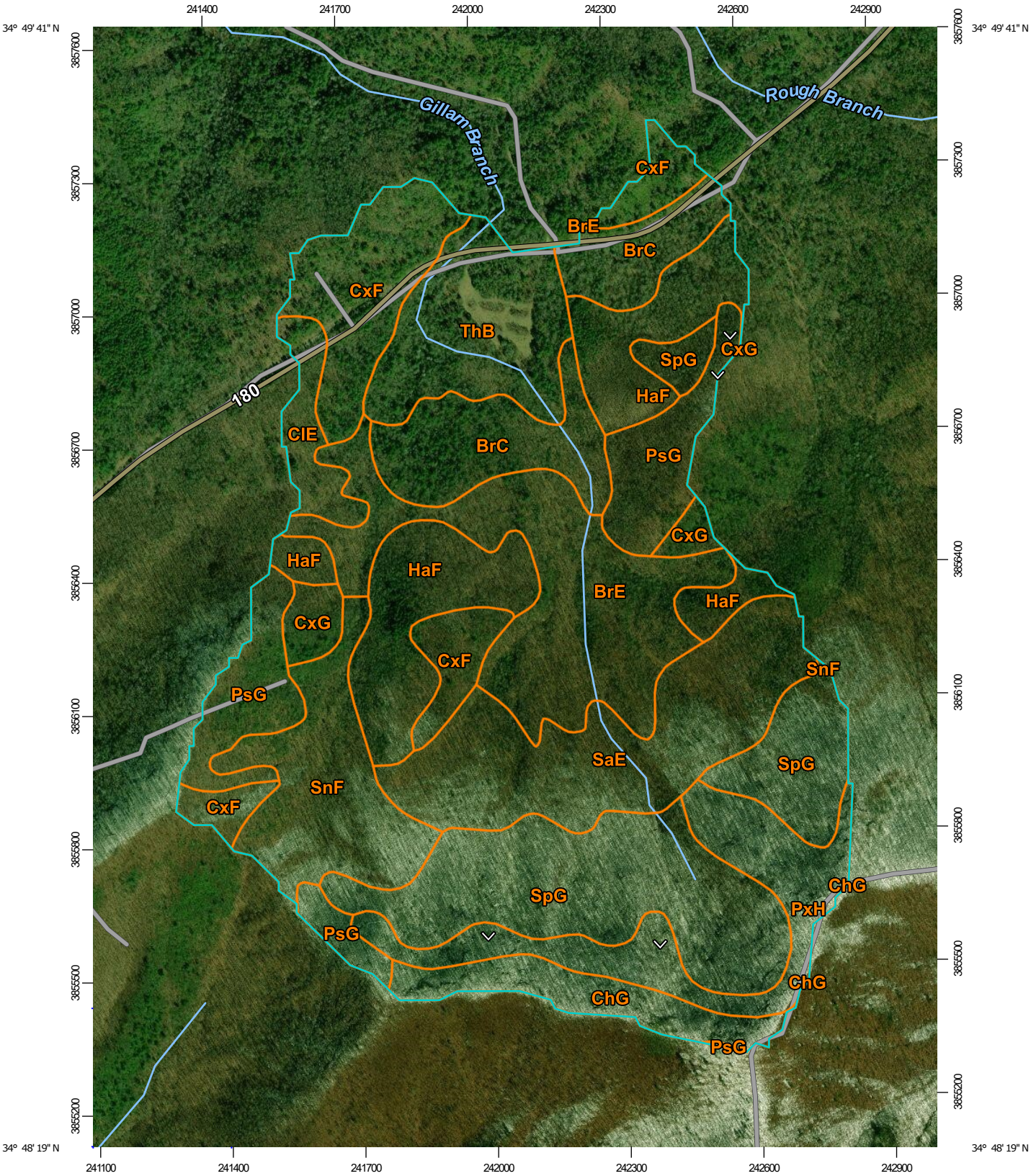
USGS Software Disclaimer: This software has been approved for release by the U.S. Geological Survey (USGS). Although the software has been subjected to rigorous review, the USGS reserves the right to update the software as needed pursuant to further analysis and review. No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the software and related material nor shall the fact of release constitute any such warranty. Furthermore, the software is released on condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from its authorized or unauthorized use.

USGS Product Names Disclaimer: Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Application Version: 4.3.0

APPENDIX E.
Web Soil Survey Mapping, Union County Target Range

Soil Map—Fannin and Union Counties, Georgia
(Union County Target Range)



Map Scale: 1:12,300 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Fannin and Union Counties, Georgia
Survey Area Data: Version 11, Sep 4, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 20, 2015—Oct 26, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Fannin and Union Counties, Georgia

ThB—Thurmont fine sandy loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: kvcg
Elevation: 800 to 2,000 feet
Mean annual precipitation: 52 to 68 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 160 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Thurmont and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Thurmont

Setting

Landform: Mountains
Landform position (three-dimensional): Mountainbase
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Colluvium

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 29 inches: gravelly sandy clay loam
H3 - 29 to 42 inches: gravelly sandy clay loam
H4 - 42 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Hydric soil rating: No

Data Source Information

Soil Survey Area: Fannin and Union Counties, Georgia
Survey Area Data: Version 11, Sep 4, 2018

Fannin and Union Counties, Georgia

CxF—Cowee-Evard complex, 25 to 45 percent slopes

Map Unit Setting

National map unit symbol: 2vx4t
Elevation: 1,460 to 3,770 feet
Mean annual precipitation: 54 to 80 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 160 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Cowee and similar soils: 50 percent
Evard and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cowee

Setting

Landform: Ridges, hillslopes
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Mountaintop, crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Residuum weathered from granite and gneiss and/or residuum weathered from schist

Typical profile

A - 0 to 7 inches: fine sandy loam
Bt - 7 to 26 inches: sandy clay loam
Cr - 26 to 80 inches: bedrock

Properties and qualities

Slope: 25 to 45 percent
Depth to restrictive feature: 20 to 38 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Hydric soil rating: No

Fannin and Union Counties, Georgia

BrC—Bradson loam, 6 to 10 percent slopes

Map Unit Setting

National map unit symbol: kvbc
Elevation: 1,200 to 3,000 feet
Mean annual precipitation: 52 to 68 inches
Mean annual air temperature: 54 to 59 degrees F
Frost-free period: 160 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Bradson and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bradson

Setting

Landform: Coves
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Slope alluvium

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 52 inches: clay
H3 - 52 to 66 inches: sandy loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Data Source Information

Soil Survey Area: Fannin and Union Counties, Georgia
Survey Area Data: Version 11, Sep 4, 2018