COMPREHENSIVE MITIGATION PLAN

Sandymush Stream Mitigation Site
Buncombe County, North Carolina
DMS Project Identification Numbers: 732, 92683, and 92175
DENR Contract Number 004691

French Broad River Basin
Cataloging Unit 06010105

North Carolina Department of Environment and Natural Resources
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Prepared by:

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October 2015

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DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

October 20, 2015

Regulatory Division

Re: NCIRT Review and USACE Approval of the Sandy Mush HQP Site; SAW-2015-01585; DMS Project # 732, 92683, 92175

Mr. Tim Baumgartner
North Carolina Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Dear Mr. Baumgartner:

The purpose of this letter is to provide the North Carolina Division of Mitigation Services (NCDMS) with all comments generated by the North Carolina Interagency Review Team (NCIRT) during the 30-day comment period for the Sandy Mush HQP Site, which closed on 20 August, 2015. These comments are attached for your review.

Based on our review of these comments, we have determined that no major concerns have been identified with the Draft Mitigation Plan, which is considered approved with this correspondence. However, the State Historic Preservation Office (SHPO) has expressed concerns for archaeological sites that might be affected by implementation of the mitigation plan and has requested review prior to any ground-disturbing activities. Please include this requirement in the Final Mitigation Plan.

Based on the activities proposed in the plan, your project does not require a Department of the Army permit. However, you must still provide a copy of the Final Mitigation Plan, along with a copy of this letter, to the appropriate USACE field office at least 30 days in advance of beginning construction of the project. Issues identified above must be addressed in the Final Mitigation Plan and all changes made to the Final Mitigation Plan should be summarized in an errata sheet included at the beginning of the document. This letter provides initial approval for the Mitigation Plan, but this does not guarantee that the project will generate the requested amount of mitigation credit. As you are aware, unforeseen issues may arise during construction or monitoring of the project that may require maintenance or reconstruction that may lead to reduced credit.

Thank you for your prompt attention to this matter, and if you have any questions regarding this letter, the mitigation plan review process, or the requirements of the Mitigation Rule, please call me at 919-846-2564.

Sincerely,

HUGHES.ANDREA.WADE.1258339165

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Andrea Hughes
Mitigation Project Manager

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
Paul Wiesner, NCDMS

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

CESAW-RG/Hughes October 6, 2015

MEMORANDUM FOR RECORD

SUBJECT: Sandy Mush HQP Site - NCIRT Comments During 30-day Mitigation Plan Review

PURPOSE: The comments listed below were posted to the NCDMS Mitigation Plan Review Portal during the 30-day comment period in accordance with Section 332.8(g) of the 2008 Mitigation Rule.

NCDMS Project Name: Sandy Mush HQP Site, Buncombe County, NC

USACE AID#: SAW-2015-01585
NCDMS #: 732, 92683, 92175

30-Day Comment Deadline: 20 August 2015

Ginny Baker, NCDWR, 5 August, 2015:

1. NC DWR finds the long-term active management plan to be implemented by WRC to be an effective approach to stewardship. Signage in the encroachment areas that had food plots established should be maintained to avoid future intrusion into riparian buffer areas.
2. There are 66,702 feet of stream or 37% of the existing project streams proposed for EII at a 2.5-5:1 ratio according to the existing condition of the stream; good 2.5:1 for a metric score of 3-7, fair 3:1 for a metric score of 8-11, and poor 5:1 for a metric score of 12-17. A credit range of 3:1 for good, 4:1 for fair, and 5:1 for poor might be more appropriate for this scenario based on the scoring range and the fact that EII uplift is based on cattle removal and not planting or invasive treatment of enhancement areas. Another method would be to change the good score credit of 3:1 to 3.5:1 or 3.75:1 to better reflect the middle scoring range "good" represents.
3. The main concern NC DWR has with the Sandy Mush project is that there appear to be areas proposed for EII credit at varying levels that did not have cattle/livestock removed which was the main justification for enhancement level credit as discussed in the March 18, 2014 IRT meeting. NCDWR does understand some of the prescribed burns proposed by WRC will remove exotics, but this will likely be limited in the 30 foot riparian credit generating zone adjacent to streams and planting is not proposed. It was not entirely clear which EII reaches had cattle removed when the property was acquired 10 years

ago. According to the Riparian Area Assessment, Section 7.2.1, p.49, 29% of the property reaches were accessed by livestock which seems to include some of the preservation and non-credit generating stream feet along with some, but not all of the EII streams which account for 37% of the project. The Riparian Area Reach Condition Maps in Appendix C also indicate sections of EII stream had no cattle access historically. Areas 9, 10, and 12 which account for 13,522 EII stream feet had no cattle access and area 11 which accounts for 13,934 EII stream feet only had 10% cattle access. Please clarify exactly which EII areas, for each of the credit ranges, had cattle access.

Andrea Hughes, USACE, 24 September, 2015:

1. Long-term management is the responsibility of NCWRC and the mitigation plan indicates that NCWRC has a management plan that will be in effect for the next 10 years. The plan will be renewed/revised once the initial 10 year plan expires. The Corps should be provided the opportunity to review future revisions to the long-term management plan prior to implementation.
2. The mitigation plan indicates that the site will be managed with a focus on "continued improvement of wildlife habitats and restoration of native plant species". The plan also mentions the existence of food plots although the exact location of these areas is unclear. Food plots should not be located within or adjacent to mitigation areas.

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Andrea Hughes
Special Projects Manager
Regulatory Division

MEMORANDUM:

TO: Todd Tugwell, Chair, Interagency Review Team (IRT)

FROM: Paul Wiesner, DMS Western Project Management Supervisor

SUBJECT: Sandymush NCIRT Mitigation Plan Comment Response

DATE: October 15, 2015

We have compiled the following comments in response to the USACE memorandum dated October 6, 2015 regarding the mitigation plan for the Sandymush site (DMS Projects 732, 92683, 92175).

Response to Ginny Baker, NCDWR, 5 August, 2015:

Item 1 – Signage will be installed as necessary to eliminate any remaining encroachment within the riparian buffer areas. NCWRC will be responsible for maintaining signage and marking (as necessary) to avoid future intrusion into the riparian buffer areas.

Items 2 and 3 – DMS has presented what we consider fair and reasonable mitigation credit ratios based on riparian area conditions and the fact that the expected uplift will occur over a much longer term. Additionally, at the request of the IRT, enhancement stream credits have already been significantly reduced based the existing riparian conditions (a 2,426 SMU credit reduction from the previous 2014 mitigation plan submittal). As for suggested changes in the mitigation ratios, we do not believe they are justified solely by the perception that the impacts of cattle were limited to what was observed and described in the stream assessments that took place after the property was purchased. The analysis for the mitigation plan was based on a composite of observations during the initial stream channel assessments (which were conducted by Equinox staff in 2004), information obtained in development of the mitigation conceptual plan (conducted by Baker Engineering), analysis of period aerial photos, and field observations taken as part of the riparian assessments in 2012-13. These efforts did not reflect the fact that prior to its purchase, interior fences on the property were not well maintained and cattle roamed freely over most areas. As a consequence, cattle impacts were conservatively estimated with a focus on those areas where significant stream degradation was caused by livestock access. Although these impacts were not documented in detail for all areas of the Sandymush property, direct observations by Equinox staff confirms that cattle had initially impacted a majority of the site.

The riparian assessment described in Section 7.2.1 of the mitigation plan did not include any parts of streams being proposed for preservation (HQP or standard P), although it did include non-credit

generating stream reaches. Approximately 5,216 feet of stream reaches were completely excluded from the project mitigation credits due to crossings and power line right-of-ways. In addition, mitigation credit was not requested for 12,464 feet of Non HQP stream length where one side of the stream will be protected in perpetuity. When the assessment data for cattle impacts are examined (Table 1), approximately 29% of the streambank length were considered previously impacted. As can be seen, documented impacts from livestock vary widely between assessment areas. A compilation of streambank length with livestock impacts by areas is shown in Table 2 and reveals that livestock impact data for this analysis varied widely among areas. As was stated previously, livestock had access to most of the property, but the more subtle impacts could not be quantified.

It is not an accurate statement to say that the EII uplift is entirely dependent upon cattle removal and natural succession of riparian vegetation. Regular controlled burns to be conducted by the NCWRC will suppress non-native plant species growth on the property. The NCWRC also intends to consider the use of mechanical and chemical controls if deemed to be the most expedient manner of restoring native plant species. Once native tree species begin to develop they will create a canopy that will make it more difficult for some non-native plants to thrive. This should allow additional native species to gain a foothold. From a long-term perspective, all riparian areas will be conserved in perpetuity and the property as a whole will never be developed. As a consequence native woody plant species will eventually become reestablished across the entire site. Management by the NCWRC will help speed that process because their activities will act to suppress growth of nonnative species. Our credit reductions have already accounted for this.

We acknowledge that the 2,688+ acre Sandymush property is unique in its characteristics for use in stream mitigation. The disjunct nature of the parcels making up the property and its past land uses made it a challenge to quantify the resources and determine a feasible mitigation credit strategy. The proposed mitigation plan reveals those challenges, but we believe it is a logical approach that considers the resources being conserved and the benefits that are to accrue in perpetuity. DMS continues to believe that the mitigation ratios established in the mitigation plan are fair, reasonable, and have already been adjusted at the IRT's request. Accordingly, DMS respectfully requests that the IRT accept the mitigation ratios already established in the July 2015 mitigation plan.

Response to Andrea Hughes, USACE, 24 September, 2015:

Item 1 – The provision of giving the USACE the opportunity to review revisions of the NCWRC's management plan is reasonable and acceptable.

Item 2 – General locations of these encroachments are shown in Figure 7.1 of the mitigation plan. Detailed locations were not provided because these areas are being marked on the ground and wildlife management activities terminated. Food plot locations outside of the protected riparian

areas are not relevant to the mitigation plan; however, food plots will not be located or subsequently planned within riparian buffer areas subject to mitigation credit.

Table 1 Streambank Length of EII Reaches with Livestock Impacts

	Reach Length with Livestock Impacts by Area (feet)												
	Area 1	**Area 2**	**Area 3**	**Area 4**	**Area 5**	**Area 6**	**Area 7**	**Area 8**	**Area 9**	**Area 10**	**Area 11**	**Area 12**	**Totals**
Streambank Length with Cattle Impacts	4,593	1,034	8,041	9,164	7,002	4,441	3,381	3,109	-	-	4,214	-	44,979
Total Streambank Length	12,132	6,664	23,192	23,252	8,062	10,852	9,239	9,949	4,314	12,779	23,785	8,919	153,139
Percent of Length	38%	16%	35%	39%	87%	41%	37%	31%	0%	0%	18%	0%	29%

Note the numbers in this table were generated using the riparian assessment data. Separate assessments were made of each stream bank; therefore, the total length in the table is approximately twice the length of stream.

Table 2 Streambank Length of EII Reaches with Cattle Impacts by Area and Rating Category

	Length with Livestock Impacts					Percent of Total EII Length		
Area	**Good**	**Fair**	**Poor**	**Total**		**Good**	**Fair**	**Poor**
1	-	680	3,913	4,593		0%	6%	32%
2	-	1,034	-	1,034		0%	16%	0%
3	-	4,538	3,503	8,041		0%	20%	15%
4	1,412	3,975	3,777	9,164		6%	17%	16%
5	3,361	1,185	2,456	7,002		42%	15%	30%
6	744	1,187	2,511	4,441		7%	11%	23%
7	354	-	3,027	3,381		4%	0%	33%
8	-	449	2,659	3,109		0%	5%	27%
9	-	-	-	-		0%	0%	0%
10	-	-	-	-		0%	0%	0%
11	-	4,214	-	4,214		0%	18%	0%
12	-	-	-	-		0%	0%	0%
Totals	5,871	17,262	21,846	44,979		4%	11%	14%

EXECUTIVE SUMMARY

The Sandymush mitigation project is located in the French Broad River 06010105 cataloging unit. The 2,688+ acre tract is situated in northern Buncombe and southern Madison counties, approximately 12 miles northwest of the City of Asheville. Although the site is not within a North Carolina Department of Environment and Natural Resources, Division of Mitigation Services (DMS) targeted local watershed, the tract has a combination of relatively pristine areas and areas impacted by past agricultural land use practices that degraded riparian conditions. At the time of purchase, approximately 20% of the property was in agricultural use. These circumstances made the property a good candidate for mitigation. Pristine areas on the property encompass North Carolina Natural Heritage Program Natural Areas (NAs) having intact riparian areas worthy of preservation, whereas degraded stream reaches had riparian areas lacking woody vegetation, non-native invasive plant species, and widespread sedimentation and erosion caused by livestock with unfettered access to streams and were considered suitable for enhancement.

The Sandymush tract was purchased in 2004 for purposes of providing mitigation credits needed for impacts to streams under a new agreement between the U.S. Army Corp of Engineers (USACE) and the North Carolina Department of Environment and Natural Resources (DENR). Mitigation is provided by the State through DMS.

Observed habitats within the project site consist of fallow agricultural fields, Rich Cove Forest, Montane Oak-Hickory Forest, and Piedmont/Low Mountain Alluvial Forest. The tract was recognized as containing significant natural resources, most notably the Alexander Cliff and Slopes and Turkey Creek / Sandymush Gorge NAs and a number of rare plant species. The entire tract is now protected from development and other impacts by deed restrictions and a management agreement between the North Carolina Wildlife Resources Commission (NCWRC) and DENR. Under this agreement, the NCWRC will manage the tract for wildlife conservation and public uses in perpetuity.

Mitigation credits from the purchase of the Sandymush tract were originally proposed to be obtained under either the High Quality Preservation (HQP) or Enhancement II (EII) options. Streams qualifying as HQP contain riparian areas with high ecological function. Riparian areas of streams proposed for mitigation as EII contain some level of degradation consisting mostly of impacts from livestock, dense stands of non-native invasive plants, or both. The goals of this mitigation plan are consistent with those that address stressors as described in planning documents covering the upper French Broad cataloging unit. These goals include management of stream corridors that reduce sediment and nutrient runoff by managing riparian buffer plant communities, stabilizing stream banks, and excluding livestock from streams.

Riparian areas in the Sandymush EII category are in a state of transition since livestock were removed 10 years ago. The now fallow riparian areas are becoming revegetated, streambank stability has greatly improved, and additional stability is likely to be achieved and maintained as woody vegetation matures. The worst bank conditions are associated with stream channels that are highly entrenched and lack woody vegetation; however, these areas are scattered throughout the tract and no significant mass wasting areas were identified. Although the vegetation has improved streambank stability, riparian vegetation contains non-native plant species, including multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), and Oriental bittersweet (*Celastrus orbiculatus*). These species are abundant on adjacent upland areas and will be a continued source of seed.

Based on GIS calculations, a total of 172,993 linear feet of stream and the adjacent riparian area are eligible for mitigation on the Sandymush property. This total excludes 5,216 linear feet associated with powerline rights-of-way, culverts, and other stream crossings (fords, culverts, bridges).

A total of 77,036 feet of stream are proposed for mitigation as High Quality Preservation. Of those, 51,702 feet have riparian areas ≥300 feet on both sides of the stream (HQP-2), 25,334 feet have riparian areas ≥300 feet one side of the stream (HQP-1). An additional 16,792 feet of stream had riparian areas >30 feet but <300 feet in width on both sides of the stream and are proposed for mitigation under the standard Preservation (P) option. A total of 12,875 mitigation credits are being proposed under the HQP option; an additional 2,240 mitigation credits are being proposed under the P option (see table below for details).

A total of 83,357 linear feet of stream on the Sandymush tract were in areas considered for Enhancement II (EII) mitigation credit. Of that amount, 66,702 feet have a riparian buffer of at least 30 feet in width on both sides of the stream and qualify for credit. Riparian areas of these stream reaches were rated as being in Good, Fair, or Poor conditions based on field assessments (see Section 5.2.2); credit ratios of 2.5:1, 3:1, and 5:1 were used to calculate mitigation credits for each rating class. A total of 24,017 credits are being proposed under the EII option.

No mitigation credits are being proposed for 17,680 feet of streams on the Sandymush mitigation site. Of those, 12,464 are reaches that do not meet the minimum HQP, P, or EII criteria (generally too narrow, only one side is protected, or both); the remaining 5,216 are reaches that were excluded from the stream reach database because they are contained within powerline right-of-ways or stream crossings.

Category	Existing Footage/Acreage	Mitigation Credits/SMUs	Mitigation Ratio
HQP-2	51,702	10,340	5:1
HQP-1	25,334	2,535	10:1
P	16,791	2,240	7.5:1
EII-G	38,057	15,223	2.5:1
EII-F	23,003	7,667	3:1
EII-P	5,642	1,127	5:1
No Credit Totals (NQ-HQP and EII-1)	12,464	0	0:1
Exclusions	5,216	-	-
Totals	178,209	39,132	

A total of 39,132 stream mitigation credits are being requested for the Sandymush site.

Upon review of the non-native invasive plant assessment conducted on the site, DMS determined that a non-native invasive plant treatment plan for the riparian areas that did not address the upland invasive problems would not achieve the desired ecological uplift over the long term. If invasive plants in upland areas are not controlled, they will remain a seed source and it would be highly likely that those species would reinvade the riparian area and outcompete native species. Under those conditions, a long-term retreatment plan would be necessary. Because of these circumstances, DMS is proposing to implement a long-term non-native plant control plan that is integrated into the NCWRC's management plan for the Sandymush property. This proposal will allow the NCWRC to utilize streams throughout the Sandymush tract as fire lines for controlled burns. Such burns, if conducted on a 3-5 year basis, would suppress non-native invasive plants in both the upland and riparian areas and would eliminate the need to disturb upland areas by plowing fire lines. The burned areas will be allowed to revegetate naturally. It is expected that

suppression of the non-native plant species will release the native seed bank and allow those species to become reestablished.

Implementation of this mitigation plan will include ending livestock grazing (already completed), managing new livestock intrusions (procedure is in place), and discontinuing active wildlife improvement activities within the riparian areas (being implemented). To accomplish the last objective, the DMS has provided the NCWRC with digital maps delineating the protected buffer areas – 300 feet on High Quality Preservation reaches, 30-300 feet on Preservation reaches, and 30 feet on Enhancement reaches (including all one sided buffer reaches). Using these maps, the NCWRC will mark the buffer boundaries (as necessary) and terminate mowing and food plot cultivation activities and allow plant communities in these areas to naturally regenerate.

Long-term management and monitoring of the entire Sandymush tract will be the responsibility of the NCWRC. They will ensure that the property is used only for purposes that do not compromise the conservation goals of the tract, violate the deed restrictions, and will prohibit any uses that would degrade the existing natural resources present on the property.

Upon approval of this mitigation plan by the Interagency Review Team (IRT), the NCWRC will assume responsibility for its implementation. The existing MOA between the DMS and NCWRC also will be amended to clarify the legal definitions of the buffer widths for the HQP (300 feet), P (30-300), and Enhancement (30 feet) reaches. In ensuing years, the NCWRC will prepare an annual report documenting the management activities completed, including appropriate photo-logs, and delineate the plans for the upcoming year. The DMS and NCWRC will meet as necessary to ensure the management plan is in compliance with regulatory requirements, to discuss mitigation goals, and to identify any special maintenance issues.

This mitigation plan has been written in conformance with the requirements of the Memorandum of Agreement addressing compensatory mitigation for streams and wetlands between the North Carolina Department of Environment and Natural Resources, the North Carolina Department of Transportation, and the U.S. Army Corps of Engineers signed and dated July 23, 2003. This document and those referenced in the agreement govern DMS operations and procedures for the delivery of compensatory mitigation as related to the Sandymush project.

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1 PRESERVATION AND RESTORATION PROJECT GOALS AND OBJECTIVES

The Sandymush Mitigation Project is located in the 06010105 cataloging unit (CU) of the French Broad River Basin. While streams on the Sandymush site are not in a targeted local watershed of the most recent North Carolina Division of Mitigation Services (DMS; known as Ecosystem Enhancement Program [NCEEP] prior to March 2015) river basin restoration priority plan (NCEEP 2009), the State of North Carolina took the opportunity to purchase the site to meet the requirements of the new mitigation agreement between the U.S. Army Corps of Engineers (USACE) and the North Carolina Department of Environment and Natural Resources (DENR) for impacts to streams and wetlands (USACE-DENR 2003). That agreement allowed the State of North Carolina to purchase not only sites with stream restoration potential, but also sites with streams containing undisturbed riparian areas and worthy of preservation. Progress Energy Corporation offered the Sandymush Creek tract to the State as a way to divest itself of land previously purchased for a potential power plant site. Purchase of the site was recognized as an opportunity to meet DMS's mitigation needs in the upper French Broad River basin and the property was acquired in 2004.

Mitigation credits from this site are being obtained as part of three DMS projects. Streams with stable channels comprised of mature native plant communities are being protected under the "High Quality Preservation" (HQP) and standard Preservation (P) mitigation options as authorized in the 2003 USACE-DENR agreement. The HQP mitigation credits are being allocated between the Northern Mountains Ecoregion (Project Number 92175) and the Southern Mountains Ecoregion (Project Number 92683). Stream channels and riparian areas degraded by poor past land use practices and not meeting HQP or P criteria are being proposed under the Enhancement II mitigation option of the 2003 agreement and are included in DMS Project Number 732. This plan integrates all three mitigation options to provide the regulatory agencies a comprehensive review document for purposes of approving the proposed mitigation action plan and requested mitigation credits.

Most of the project streams in the Sandymush tract lay within the Sandymush Creek (06010105090030) and Turkey Creek (06010105090040) hydrologic units (HUCs). Several small streams draining directly to the French Broad River are in the 06010105090020 HUC. The area drained by these streams encompasses 51,824 acres.

In addition to providing mitigation credits, the Sandymush purchase also was intended to make these lands available for some outdoor recreational opportunities by placing them into the game lands program of the North Carolina Wildlife Resources Commission (NCWRC). This document integrates efforts to enhance ecological conditions on the Sandymush site by addressing the USACE preservation and enhancement mitigation guideline requirements and integrating them with the NCWRC strategies to manage the property as its permanent custodian. As such, the Sandymush property must be considered a unique "working" mitigation site in that it will be maintained and actively managed by the NCWRC in perpetuity.

The Sandymush and Turkey Creek watersheds, although not in a DMS targeted local watershed, have problems similar to those of the adjacent Newfound Creek watershed (HUC 06010105090020; NCEEP 2008; NCDWQ 2005) and as described below. Assets and problems known to exist within the project area include the following:

Assets:

- 68% forested land – 35,240 acres
- 5% publicly conserved land – 2,806 acres
- 10% privately conservation lands – 5,127 acres
- NCDWQ Water quality classifications – C for all streams except Little Sandymush Creek and the headwaters of Sandymush Creek, which are classified as C; Tr
- State Natural Areas (SNAs; NCNHP 2004)
    - Alexander Cliffs and Slopes
    - Turkey Creek/Sandymush Gorge
- Rare species known to occur (NCNHP 2004, 2012)
    - Piratebush (*Buckleya distichophylla*) – Federal Species of Concern; State Endangered
    - Carolina saxifrage (*Saxifraga caroliniana*) – Federal Species of Concern; considered Significantly Rare by the NCNHP
    - Branching draba (*Draba ramosissima*) – considered Significantly Rare by the NCNHP
    - Bleeding heart (*Dicentra eximia*) – considered Significantly Rare by the NCNHP
    - Southern zigzag salamander (*Plethodon ventralis*) – State Species of Concern
- Other species whose range includes the Sandymush tract (NCNHP 2012)
    - Baltimore Checkerspot (*Euphydryas phaeton*)
    - Cliff Spurge (*Euphorbia commutata*)
    - Eastern Small-footed (*Myotis leibii*)
    - Eastern Spiny Softshell (*Apalone spinifera spinifera*)
    - Giant Swallowtail (*Papilio cresphontes*)
    - Golden Banded-Skipper (*Autochton cellus*)
    - Gray Myotis (*Myotis grisescens*)
    - Hellbender (*Cryptobranchus alleganiensis*)
    - Least Weasel (*Mustela nivalis*)
    - Purpleleaf Willowherb (*Epilobium ciliatum*)
    - Shooting-star (*Primula meadia*)
    - Southern Blotched Chub (*Erimystax insignis eristigma*)
    - Sweet White Trillium (*Trillium simile*)
    - Tennessee Mountain-mint (*Pycnanthemum curvipes*)
    - Virginia Stickseed (*Hackelia virginiana*)

Problems:

- Extensive concentrations of non-native invasive plants in both riparian zones and upland areas
- Habitat degradation due to sedimentation
- Streambed scour
- Streambank erosion
- Excess fecal coliform bacteria
- Nutrient enrichment
- Habitat fragmentation
- Livestock access to creeks

Within the French Broad River 06010105 CU, development, urbanization, and agricultural activities are documented sources of non-point source pollution and sedimentation (NCDWQ 2005; NCWRC 2005). Toxic impacts from point and non-point sources have significantly impacted biological communities, including federally threatened and endangered species, are also described.

One major factor contributing to environmental impacts in watersheds of the French Broad River has been population growth. Between 1990 and 2012, the population of Buncombe County increased by 36% (Google.com 2013), whereas the population of the Leicester community (Zip Code 28748), the community closest to the Sandymush mitigation site, grew over 47% (Clearsearch.com 2013).

Restoration goals stated in the *2009 French Broad River Restoration Priorities* document (NCEEP 2009) are as follows:

- Implement wetland and stream restoration projects that reduce sources of sediment and nutrients by restoring riparian buffer vegetation, stabilizing stream banks, excluding livestock, and restoring natural geomorphology, especially in headwater streams.

- Restore and protect habitat for priority fish, mussel, snail, and crayfish species in the basin [see NCWRC (2005) for a complete list].

- Cooperate with land trusts and resource agencies to help leverage federal and state grant funding for watershed restoration and conservation efforts.

- Protect high quality habitats, especially those prioritized by the Natural Heritage Program as Significant Natural Heritage Areas.

Specific goals for 06010105 French Broad River CU include:

- Focus restoration efforts in the Mud Creek and South Hominy Creek Local Watershed Planning (LWP) areas.

- Work with local partners to improve management of stormwater runoff, controlling both stormwater volume and pollutants, and promote low impact development techniques to lessen impacts of new development, especially in the expanding areas of Asheville, Black Mountain, Fletcher, and Hendersonville.

A review of existing watershed planning documents (NCDWQ 2005; NCWRC 2005) revealed the purchase of the Sandymush mitigation site would allow DMS to address goals and stressors known to exist within the upper French Broad River watershed as well as meet some of its mitigation needs.

The goals of this project that address stressors identified in the upper French Broad River CU include the following:

- Implement wetland and stream restoration projects that reduce sources of sediment and nutrients by restoring riparian buffer vegetation, stabilizing stream banks, excluding livestock, and restoring natural geomorphology, especially in headwater streams.

- Restore and protect habitat for priority fish, mussel, snail, and crayfish species in the basin [see Wildlife Resource Commission (2005) for a complete list].

This document presents a comprehensive mitigation plan for the Sandymush property. It integrates HQP, P, and EII mitigation options with the NCWRC's management strategies (NCWRC 2014) to administer the property for wildlife benefits and public use. As such, the project goals are as follows:

- Place stable stream channels with highly functioning riparian areas under restrictions that ensure their preservation in perpetuity, allowing only management activities that do not jeopardize their conservation values.

- Reduce sedimentation caused by livestock access to the creeks (previously under lease to private landowners)

- Integrate non-native invasive plant management in riparian areas with the NCWRC's overall habitat management plan

- Enhance native plant communities in riparian areas using wildlife habitat management techniques, including prescribed burns, mechanical removal, and herbicides

- Stabilize degraded stream banks by reestablishing woody vegetation through natural regeneration

2 SITE SELECTION

2.1 Directions to Site

The Sandymush site is composed of several disjunct tracts of land (Figure 2.1) connected by a network of local secondary roads. General routes to reach the project area from different directions are described below. The Sandymush site is managed by the North Carolina Wildlife Resources Commission as part of their game lands program under an agreement with the Department of Environment and Natural Resources (DENR; Appendix A). Detailed maps of the area including local roads and user parking locations to access the site can be obtained from the NCWRC web site at http://216.27.39.120/mapbook/.

- From the East – North on Broadway from downtown Asheville for 1.5 miles onto Riverside Drive/Old Marshall Highway (NC251) for 8.7 miles; turn left onto Fletcher Martin Road (SR 1620/1634) and go 2.7 miles to the intersection of Old Highway 20 (SR 1629) and Cedar Hill Road (SR 1632).

- From the South – West on Patton Avenue/I-240 from downtown Asheville for 2.7 miles to its intersection with NC 63 (New Leicester Highway); go 8.4 miles on NC 63 to Martin Branch Road (SR 1610); turn right onto Martin Branch Road (SR 1610) and follow for 3.7 miles to the intersection with Bear Creek Road (SR 1607); turn left onto Bear Creek Road and travel 1.3 miles to the intersection with Old Turkey Creek Road (SR 1631).

- From the West - West on Patton Avenue/I-240 from downtown Asheville for 2.7 miles to intersection with NC 63 (New Leicester Highway); travel 12.9 miles on NC 63 to Meadows Town Road (SR 1001); turn right onto Meadows Town Road and follow for 1.7 miles.

- From the North – Take Baileys Branch Road (SR 1001) from downtown Marshall for 4.3 miles to the intersection with Bear Creek Road (SR 1114) and Meadows Town Road (SR 1001); turn left onto Bear Creek Road and follow for 1.3 miles

2.2 Site Selection and Characteristics

The following description of the Sandymush site historical conditions, site modifications, and evolutionary and successional trends were derived, with some modification, from the *Sandymush Stream Restoration Conceptual Mitigation Design* and *Sandymush Creek Restoration Project Environmental Resources Technical Report Buncombe and Madison Counties, North Carolina* (Baker 2007; NCEEP 2007) documents.

The Sandymush site encompasses several tracts of land totaling 2,688+ acres (Buncombe County Plat Book 108, Page 112) and was purchased by the State of North Carolina in 2004. The site is located in northern Buncombe and southern Madison counties near the Leicester community (Figures 2.1 and 2.2). The property is approximately 12 miles northwest of the City of Asheville. The primary streams found on the site are the French Broad River, which borders the property to the East; Sandymush Creek, which runs the county line through the property; and Turkey Creek, which lies in the southern part of the property and flows north to its confluence with Sandymush Creek. There are approximately 33.1 miles of intermittent and perennial streams on the Sandymush site (NCEEP 2007).

Observed habitats within the project site consist of fallow agricultural fields, Rich Cove Forest, Montane Oak-Hickory Forest, and Piedmont/Low Mountain Alluvial Forest as described by Schafale and Weakely (1990). The land use of all of the project property has been mixed forest and agriculture for at least the past 100 years.

A road following the French Broad River from east Tennessee through Asheville into upper South Carolina was the primary commerce route until regular rail service became available in 1886. This route was the main route for moving livestock on foot to markets in the south. To feed the livestock and earn a living, area landowners cleared the flatter portions of their land to grow crops (Blackmun 1977). Since then the agricultural land use changed from row-cropped grains to livestock grazing. Land too steep to graze cattle or raise row crops remained forested and relatively undisturbed. The land surrounding the Sandymush site continues to be a mosaic of cleared pastureland, second growth forests and residential home sites.

Over the last 20 years, land use patterns in the area have begun to change due to population growth. This change from agricultural land uses to single-family home development use is likely to continue.

The long-term use of much of the Sandymush site for agriculture is reflected in the morphological and biological condition of smaller streams on the property. Many of those stream channels have been straightened and moved to the edge of sideslopes to increase the amount of tillable and pasture lands. Approximately 20% of the land was in pasture at the time of purchase. Increased run-off from land clearing has caused most of the streams on the site to down-cut and become incised. Livestock with unfettered access to streams also destroyed much of the riparian vegetation and destabilized stream banks. Grade control for many of these streams is now bedrock. The State purchase of the Sandymush properties ensures that development of the property will not occur, pristine stream reaches will be preserved, degraded stream reaches enhanced, and wildlife and aquatic habitat will be managed with this conservation goal in mind.

Figure 2.1 Vicinity Map

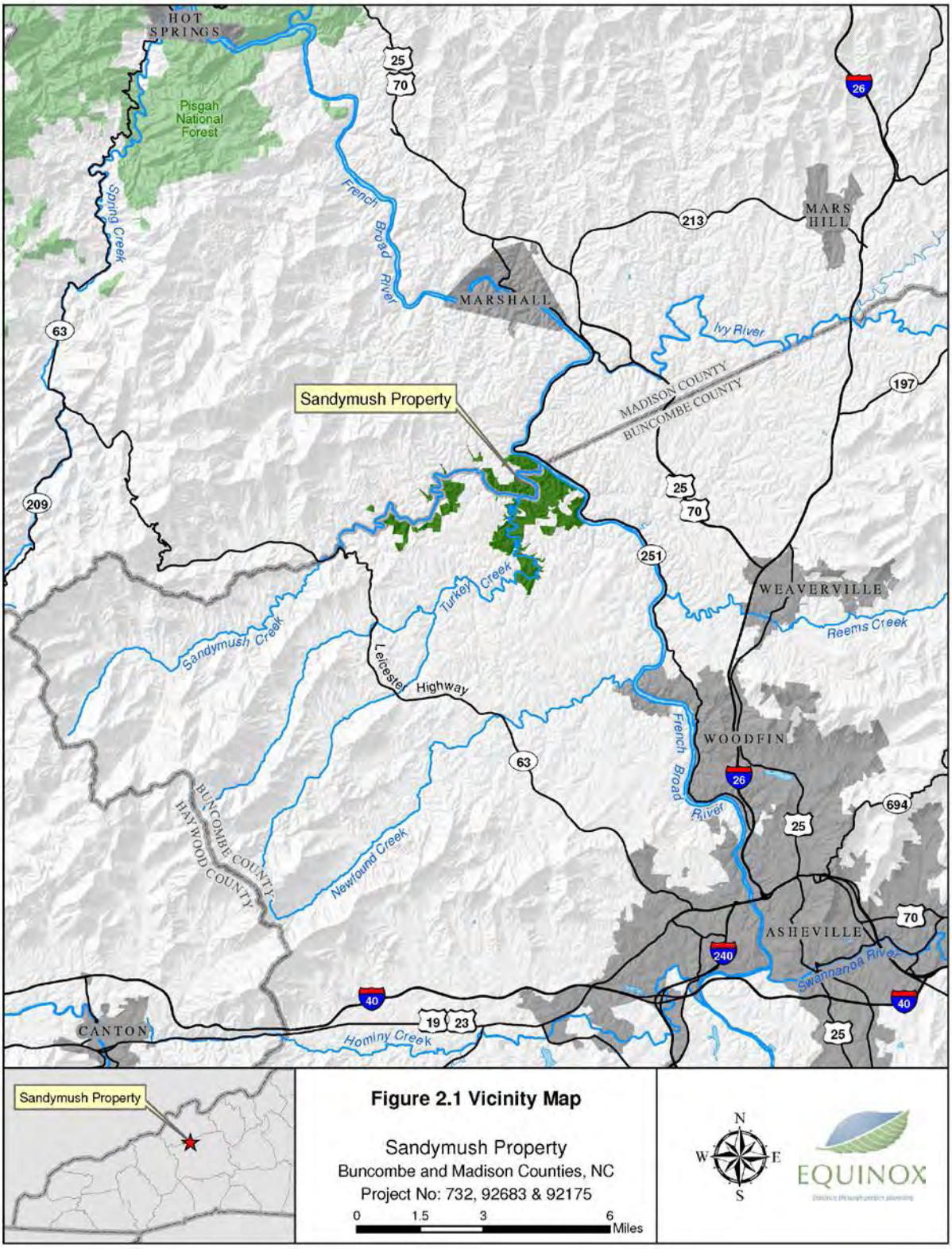
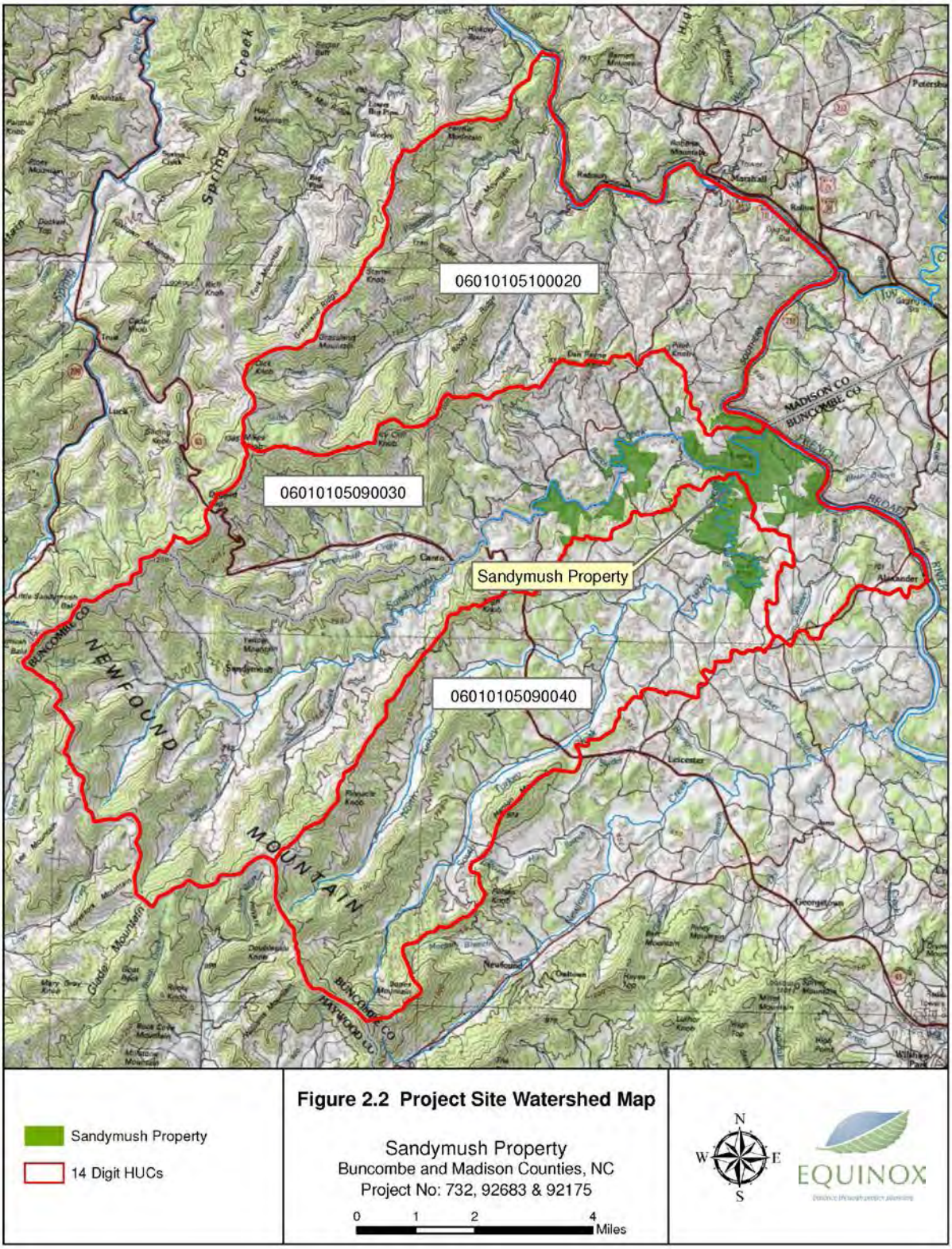


Figure 2.2 Drainages Associated with the Sandymush Mitigation Site



2.3 Soil Survey

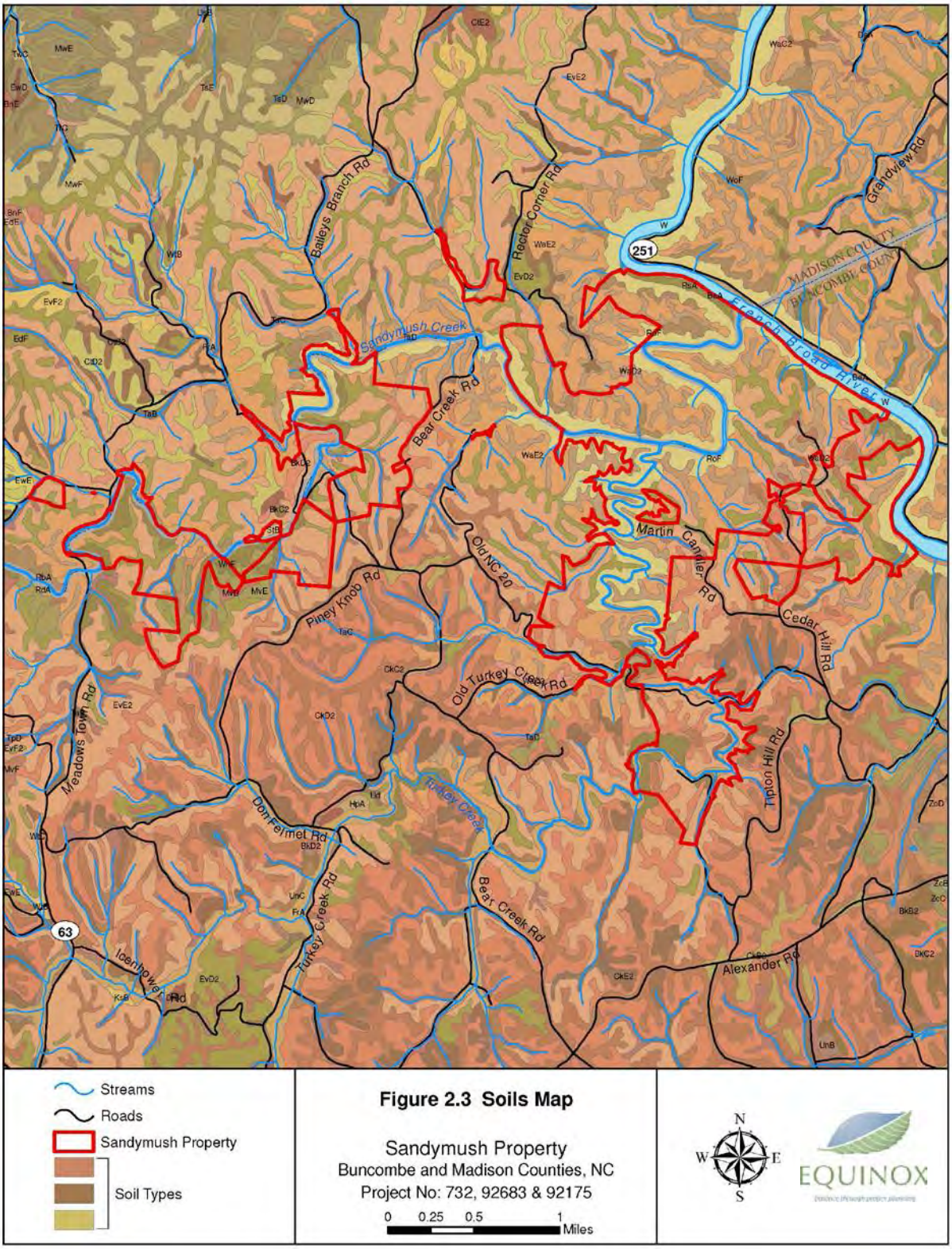
Soils data were obtained from the U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) web soil survey site. Because of the size of the project area, the number of reaches assessed in this report, the number of soil types, and the complicated distribution of soil types (Figure 2.3), Table 2.1 was compiled to show the soil types present and their characteristics. Soils associated with riparian areas are shown in bold.

Table 2.1 Symbols for Soils on the Sandymush Mitigation Site

Symbol[1]	Description	County
BaA	**Biltmore loamy sand; 0-3% slope; occasionally flooded**	**Madison**
BeA	**Biltmore loamy sand; 0-3% slopes; occasionally flooded**	**Buncombe**
BkB2	Braddock clay loam; 2-8% slope; moderately eroded	Madison
BkC2	Braddock clay loam; 8-15% slope; moderately eroded	Madison
BkD2	**Braddock clay loam; 15-30% slope; moderately eroded**	**Buncombe; Madison**
CkB2	Clifton clay loam; 2-8% slopes; moderately eroded	Buncombe
CkC2	**Clifton clay loam; 8-15% slope; moderately eroded**	**Buncombe**
CkD2	**Clifton clay loam; 15-30% slope; moderately eroded**	**Buncombe**
CkE2	**Clifton clay loam; 30-50% slope; moderately eroded**	**Buncombe**
CtC2	Clifton clay loam; 8-15% slope; moderately eroded	Madison
CtD2	Clifton clay loam; 15-30% slope; moderately eroded	Madison
CtE2	**Clifton clay loam; 30-50% slope; moderately eroded**	**Madison**
EvD2	**Evard-Cowee complex; 15-30% slope; moderately eroded**	**Buncombe; Madison**
EvE2	**Evard-Cowee complex; 30-50% slope; moderately eroded**	**Buncombe; Madison**
EvF2	Evard-Cowee complex; 50-95% slopes	Buncombe
EwD	Evard-Cowee complex; 15-30% slopes; stony	Buncombe
EwE	Evard-Cowee complex; 30-50% slope; stony	Madison
FrA	**French loam; 0-3% slope; occasionally flooded**	**Buncombe; Madison**
MvD	Mars Hill-Walnut complex; 15-30% slopes, stony	Buncombe
MvE	**Mars Hill-Walnut complex; 30-50% slopes, stony**	**Buncombe**
MvF	Mars Hill-Walnut complex; 50-95% slopes, stony	Buncombe
RbA	Reddies sandy loam; 0-3% slope; occasionally flooded	Madison
RdA	Reddies sandy loam; 0-3% slopes; occasionally flooded	Buncombe
RoF	**Rock outcrop-Unicoi complex; 30-95% slope; very bouldery**	**Buncombe; Madison**
RsA	**Rosman fine sandy loam; 0-3% slope; occasionally flooded**	**Madison**
StB	**Statler loam; 1-5% slope; rarely flooded**	**Madison**
TaB	**Tate loam; 2-8% slopes**	**Buncombe**
TaC	**Tate loam; 8-15% slopes**	**Buncombe; Madison**
TaD	**Tate loam; 15-30% slopes**	**Buncombe; Madison**
TpD	Toecane-Tusquittee complex; 15-30% slopes; very bouldery	Buncombe
TpE	Toecane-Tusquittee complex; 30-50% slopes; very bouldery	Buncombe
TuD	Tusquittee-Toecane complex; 15-30% slopes; stony	Buncombe
Ud	Udorthents: loamy	Buncombe
UnC	Unison loam, 8-15% slopes	Buncombe
W	Water	Buncombe; Madison
WaC2	**Walnut-Oteen-Mars Hill complex; 8-15% slopes; moderately eroded**	**Buncombe; Madison**
WaD2	**Walnut-Oteen-Mars Hill complex; 15-30% slopes; moderately eroded**	**Madison**
WaE2	**Walnut-Oteen-Mars Hill complex; 30-50% slopes; moderately eroded**	**Madison**
WnF	**Walnut-Oteen-Rock outcrop complex; 50-95% slopes**	**Buncombe**
WoF	**Walnut-Oteen-Rock outcrop complex; 50-95% slopes**	**Madison**
WtB	Whiteside loam; 2-8% slopes	Buncombe
WtC	Whiteside loam; 8-15% slopes	Buncombe
ZcB	Zillicoa loam; 2-8% slopes	Buncombe
ZcC	Zillicoa loam; 8-15% slopes	Buncombe
ZoD	**Zillicoa loam; 15-30% slopes**	**Buncombe**

[1]Soil types highlighted in bold are found within the 30 foot riparian area.

Figure 2.3 Soils Map



The following general soils complex description was taken from Baker (2007). Soils commonly associated with stream channels are primarily mapped as Oteen, Oteen complex-rock outcrops, Walnut, Mars Hill, Evard, Cowee, Unison, Tate loam, and French loam by the Natural Resources Conservation Service (NCEEP 2007). The following soils are described from the steeper slopes of the project area and are found at elevations of 1,400 to 4,000 feet at slopes typically between 15 and 50 percent. The Oteen series consists of shallow, well drained, moderately rapidly permeable soils. Oteen soils are strongly sloping to very steep and are on ridges and side slopes. The Walnut series consists of moderately deep, well drained soils with moderately rapid, permeable soils. The Mars Hill series consists of deep, well drained soils with moderately rapid permeability. Walnut and Mars Hill Soils are strongly sloping to very steep and are on ridges and side slopes. Elevations range from about 1,600 to 3,500 feet. The slope gradient commonly is 30 to 95 percent. The Evard series consists of very deep, well drained, moderately permeable soils. The Cowee series consists of moderately deep, well drained, moderately permeable soils. Evard and Cowee soils are on gently sloping to very steep ridges and side slopes of low and intermediate mountains.

Soils in the project area most often identified with third order and greater stream channels are in the following series. The Unison series are very deep and well drained. They are on mountain footslopes, alluvial fans, or stream terraces. Permeability of the soil is moderate. Slopes range from 0 to 45 percent. The Tate series consists of very deep, well drained, moderately permeable soils on benches, fans, and toe slopes in coves. They formed in colluvium weathered from metamorphic rocks. The French series consists of very deep, moderately-well to somewhat poorly drained, moderately over rapidly permeable soils with contrasting textures on the floodplains of small streams in the southern Appalachian and Blue Ridge Mountains. They formed in recent alluvial sediments. Slopes are 0 to 5 percent. Streams of the project area typically form on soil series that are associated with steep slopes including Oteen, Walnut, Mars Hill and others.

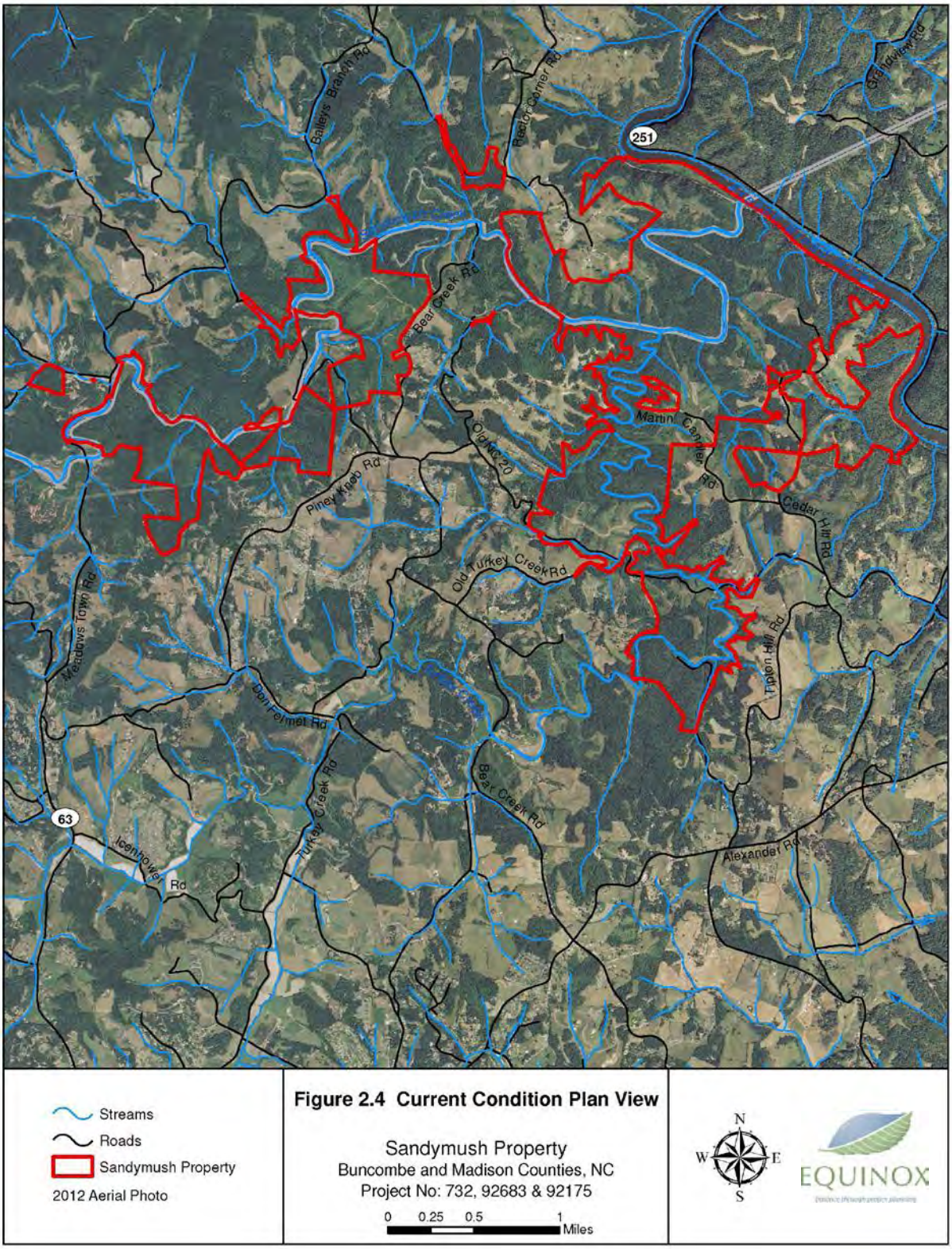
As streams increase in order they may cross several different soil types before entering the larger streams of the area. For example, steep ephemeral and intermittent reaches may be associated with Evard/Cowee soil complex; the mid-reaches may flow across a less steep colluvial valley composed of Tate loam, where the valley may then transition to a steep slope composed of a Walnut/Oteen/Mars Hill soil complex. As streams descend to Sandymush Creek it may become associated the French loam soils that makes up the floodplain. While each stream of the area is different, this illustrates a common pattern.

2.4 Current Conditions

2.4.1 General Environmental Conditions

The 2012 aerial photos reveal that land cover on the Sandymush property is approximately 80% forested and 20% pasture/shrubland (Figure 2.4). Shrubs and small trees are now present in most of the older pastures, reflecting the fact that livestock are no longer being grazed on the property. Most stream channels are dominated by bedrock, cobble, and gravels but sediment loads in nearly all of the streams observed are very high resulting in somewhat embedded riffles and shallow pools that would normally be deeper. Most of the sediment originated from active livestock grazing occurring on the property when it was purchased or from active pastures on neighboring upstream properties. Due to the steep nature of the A, Aa+, and B class stream channels on site (Rosgen 1996), it appears that fine sediments are being flushed from the immediate area, limiting the embeddedness of most riffle habitat.

Figure 2.4 Current Condition Plan View



An on-site assessment of stream channel conditions was completed in 2004 (Buck and Equinox 2004) where stream channels were categorized as to potential mitigation type – preservation or restoration/enhancement – for which each channel reach would qualify (Figure 2.5). Reference reach criteria were not used in evaluating these stream channels, primarily because upstream land disturbances were the source of the moderately high bed load and turbidity levels. In addition, livestock grazing was occurring on some reaches recommended for preservation; however, livestock grazing was to be terminated as a condition for obtaining mitigation credits for the site. Wetlands observed during the stream channel assessments also were inventoried as to location and general characteristics.

Conditions of the preservation, wetland, and enhancement assets on the Sandymush mitigation site (Figure 2.5) are described in the sections that follow. The descriptions include notable changes that have occurred since the land was purchased in 2004.

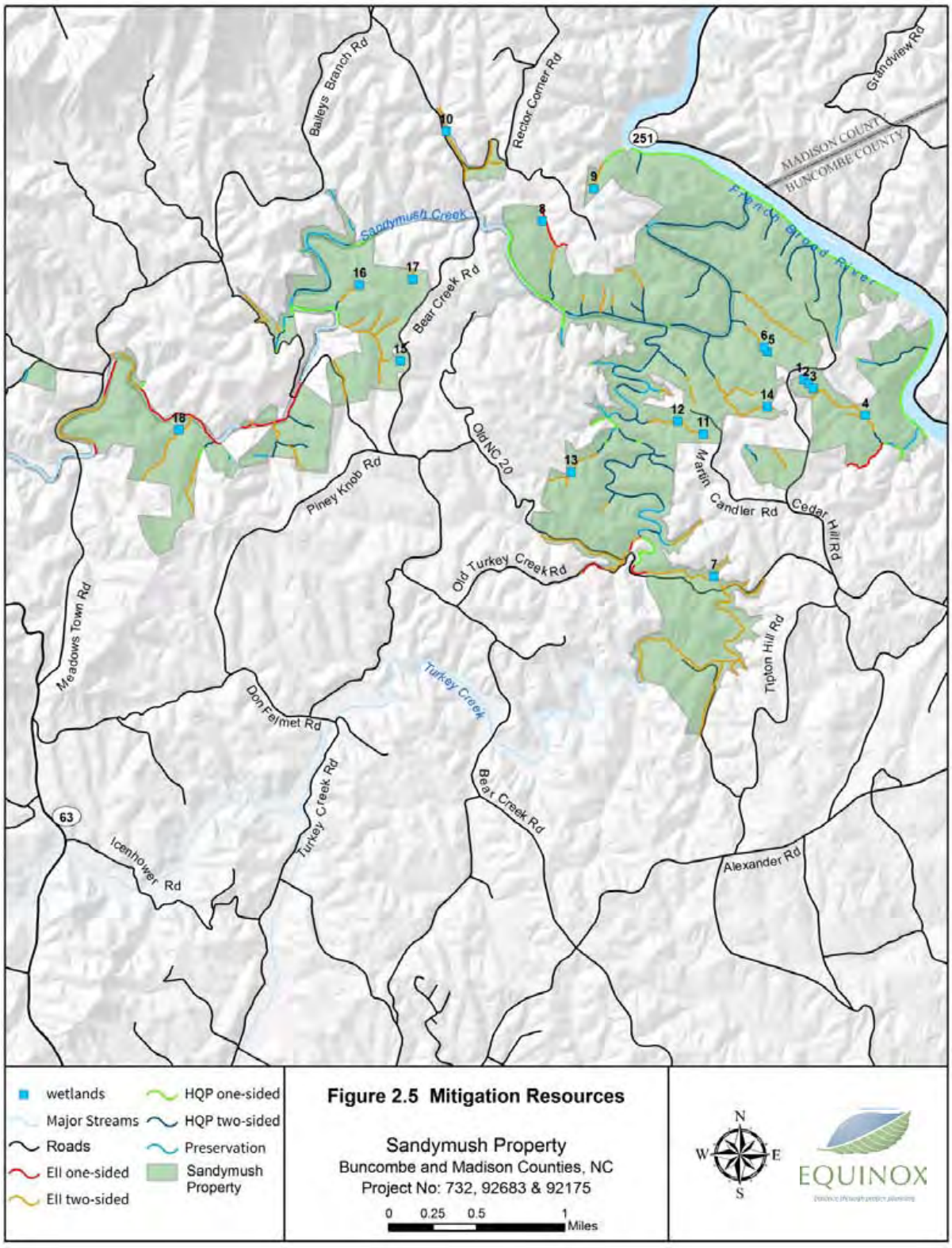
2.4.2 Stream Preservation

The Sandymush site is considered atypical of preservation sites because the property consists of multiple and disjunct parcels that are surrounded by privately held land. In addition, the property boundaries are highly irregular creating a situation whereby some portions of stream suitable for preservation have either less than 300 feet of buffer or are buffered only on one side (Figure 2.5). Most of the preservation reaches also are downstream of the reaches needing enhancement. The preservation portions of stream as described in the original feasibility study (Buck and Equinox 2004) and the Sandymush conceptual mitigation design plan (Baker 2007) were approved for mitigation by the Preservation Review Committee of the Interagency Review Team (IRT) in 2011. They justified preservation because of the project's overall size at 2,688+ acres and because it contains two important Natural Areas (NAs), notably the Sandymush / Turkey Creek Gorge and Alexander Cliffs and Slopes.

According to the North Carolina Natural Heritage Program (NCNHP), the two NAs on the Sandymush property have very high and moderate representational ratings. This rating provides an indication of the sites' potential to contribute to a collection of the best sites for the tracked elements (plant communities; threatened or endangered species) occurring within the state. The Sandymush / Turkey Creek Gorge and Alexander Cliffs and Slopes are known to contain the following five rare plants and one rare animal species (NCNHP 2004):

- Piratebush (*Buckleya distichophylla*) – state endangered and federal species of concern
- Carolina saxifrage (*Saxafraga caroliniana*) – considered significantly rare by NCNHP and a federal species of concern
- Branching draba (*Draba ramosissima*) - – considered significantly rare by NCNHP
- Bleeding heart (*Dicentra eximia*) - considered significantly rare by NCNHP
- Climbing fumitory (*Adlumia fungosa*) - considered significantly rare by NCNHP
- Southern zigzag salamander (*Plethodon ventralis*) – a North Carolina species of special concern

Figure 2.5 Mitigation Resources



Sandymush mitigation project Numbers 92175 and 92683 addressed the conservation of stable stream channels under the HQP mitigation option. These reaches have mature riparian vegetation that extends upland for at least 300 feet (Table 2.2) on one or both sides of streams and also have high ecological function. Stream channels in these reaches are very stable because of the mature riparian vegetation and bedrock outcroppings that occur within them. Non-native plant species, while present in some areas, are suppressed by the dense shading created by the full canopy created by trees and native shrubs that exist along these stream reaches. Some previously cultivated fields that encroach upon the defined protected areas are no longer being managed for wildlife benefits by the NCWRC. These areas have been allowed to revert to an undisturbed state.

Stream reaches having high functioning riparian buffers >30 feet but <300 feet in width on both sides of the stream are proposed for mitigation under the standard Preservation option. Stream reaches occurring within the designated HQP area but not meeting HQP or P criteria are not being proposed for mitigation credits.

Details of the calculations of mitigation credits being proposed for both High Quality and standard Preservation are described in Section 5.1.

Table 2.2 High Quality Preservation Riparian Area Conditions (Sheet 1 of 2)

Area 1, Reach 2; July 5, 2004

Area 4; June 30, 2004

Area 5; June 24, 2004

Area 6 Reach 3; June 26, 2004

Area 7, Reach 4; June 29, 2004

Area 8, Reach 2; July 1, 2004

Table 2.2 High Quality Preservation Riparian Area Conditions (Sheet 2 of 2)

Area 8, Reach 3; July 1, 2004

Area 9, Reach 3; July 5, 2004

Area 10, Reach 4; July 1, 2004

Area 12; June 30, 2004

2.4.3 Stream Enhancement

Riparian areas suitable for and in need of enhancement under DMS Project Number 732 of the Sandymush project are in a state of transition (Figure 2.4). Since livestock were removed from the tract 10 years ago, the riparian areas and upland pastures have been fallow and early successional plant growth has started. As a result, stream banks where grazing occurred have become revegetated and erosion has been greatly reduced. The regrowth of grasses, shrubs, and woody vegetation has resulted in the general stabilization of stream channels. While there are areas of bank erosion, no significant areas of mass wasting are known to exist. Most eroding stream banks occur within highly entrenched stream reaches and those reaches where woody vegetation regrowth has been slow to occur, but even in those areas the lengths of stream bank affected are generally not large. Overall, stream channels targeted for enhancement on the Sandymush property have stabilized and will continue to do so as woody vegetation matures.

Ongoing riparian impacts include minor encroachments from wildlife management activities and vegetation control within powerline right-of-ways. In many cases, the NCWRC encroachments are an artifact of maintenance of old agricultural fields that are either being mowed or cultivated as wildlife food plots. Generally, natural processes have resumed throughout the project area; however, the NCWRC has initiated a management plan for the property (NCWRC 2014) that includes the use of controlled burns to encourage reestablishment of shortleaf pine (*Pinus echinata*) communities. The management plan objectives also include general wildlife improvements and control of non-native plant species. Herbaceous vegetation has become reestablished throughout most riparian areas resulting in improved ecological function and significantly reduced erosion.

Unfortunately, non-native invasive plant species such as multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), and Oriental bittersweet (*Celastrus orbiculatus*) among others (see Appendix Table C-1 for a complete list) are present throughout the enhancement reaches. As a consequence, the existing plant species composition does not resemble the native plant communities described by Schafale and Weakley (1990), although it does provide food and cover for wildlife. In some areas, the non-native plants are preventing native species from becoming reestablished; climbing vines also are affecting the health of mature trees and making it difficult for shrubs and trees to regrow. Consequently, native plant communities are considered compromised and some areas are essentially devoid of native plant species.

The distribution of the non-native invasive plants is highly variable across the portions of Sandymush stream reaches and adjacent upland areas considered suitable for enhancement. Photographs show the variety of conditions observed and recorded during the field assessment completed for this mitigation plan (Table 2.3). The attributes that form the basis for this assessment include buffer width, livestock impacts, canopy conditions, managed areas, and percentage of the riparian area covered by non-native invasive plant species. Special issues of significance also present on the project site and assessed include numerous powerline right-of-ways, existing public and farm roads within riparian areas, and steep, rocky bluffs. Details of the riparian area assessment are presented in Section 7.2.1.

Table 2.3 Enhancement Area Riparian Conditions (Sheet 1 of 3)

 Area 1 – No woody vegetation buffer; powerline right-of way; high density of invasive species; November 8, 2012.	 Area 1 – Young and dense canopy condition; November 8, 2012.
 Area 2 – Sparse and mature canopy condition; December 13, 2012.	 Area 3 – State road encroachment into buffer; December 4, 2012.
 Area 3 – Mature and dense buffer; invasive species coverage very low; December 4, 2012.	 Area 3 – Wooded buffer less than 30 feet; climbing vines; December 4, 2012.

Table 2.3 Enhancement Area Riparian Conditions (Sheet 2 of 3)

Area 3 – Steep terrain covered with invasive plants; December 4, 2012.

Area 4 – State road right-of- way encroachment with dense invasive species; December 6, 2012.

Area 4 – Dense and mature riparian buffer; low coverage of invasive species; December 19, 2012.

Area 5 – Sparse and mature riparian buffer; high coverage of invasive species; December 19, 2012.

Area 5 – Active management within riparian buffer; December 19, 2012.

Area 5 – Non-public road encroachment into buffer; December 19, 2012.

Table 2.3 Enhancement Area Riparian Conditions (Sheet 3 of 3)

Area 6 – No canopy; dense invasive species; December 19, 2012.

Area 6 – No woody vegetation buffer; December 19, 2012.

Area 7 Powerline right-of-way; November 20, 2012.

Area 9 – Young and sparse canopy; invasive plant understory; January 24, 2013.

Area 11 – Non-highway road and culvert with invasive species; January 8, 2013.

Area 12 – Wooded buffer; no invasive species; January 11, 2013.

2.4.4 Wetlands

During stream assessments (Baker 2007), areas with wetland characteristics were identified; however the wetlands were not formally delineated or otherwise quantified. Eighteen wetland areas are known to be present on the Sandymush property (Figure 2.5). Plant species found on these areas and commonly associated with wetlands include soft rush (*Juncus* spp.), alders (*Alnus serrulata*), sedges (*Carax* spp.), jewelweed (*Impatiens* spp.), and spicebush (*Lindera benzoin*)

Based on the photos presented in Table 2.4 all of the wetlands appear well vegetated. Fourteen of the wetlands were recommended for preservation, although some enhancement value was thought possible if combined with recommended stream projects. The remaining four wetlands were thought to need restoration or enhancement work to improve their value, particularly if combined with projects to enhance adjacent streams.

Table 2.4 Wetland Conditions (Sheet 1 of 3)

Wetland 1, Area 1, Reach -1-A; 2006

Wetland 2, Area 1, Reach 1-A; 2006

Wetland 3, Area 1, Reach 1-A; 2006

Wetland 4, Area 1, Reach 1-B; 2006

Wetland 5, Area 2, Reach 1; 2006

Wetland 6, Area 2, Reach 1; 2006

Table 2.4 Wetland Conditions (Sheet 2 of 3)

Wetland 7, Area 4, Reach 5; 2006

Wetland 8, Area 5, Reach 9; 2006

Wetland 9, Area 6, Reach 1; 2006

Wetland 10, Area 6, Reaches 7/8; 2006

Wetland 11, Area 7, Reach 1; 2006

Wetland 12, Area 7 Reach 2; 2006

Table 2.4 Wetland Conditions (Sheet 3 of 3)

Wetland 13, Area 7, Reach 8; 2006

Wetland 14, Area 8, Reach 7-B, 2006

Wetland 15, Area 10, Reach 1-B; 2006

Wetland 16, Area 10, Reach 3; 2006

Wetland 17, Area 10 Reach 6; 2006

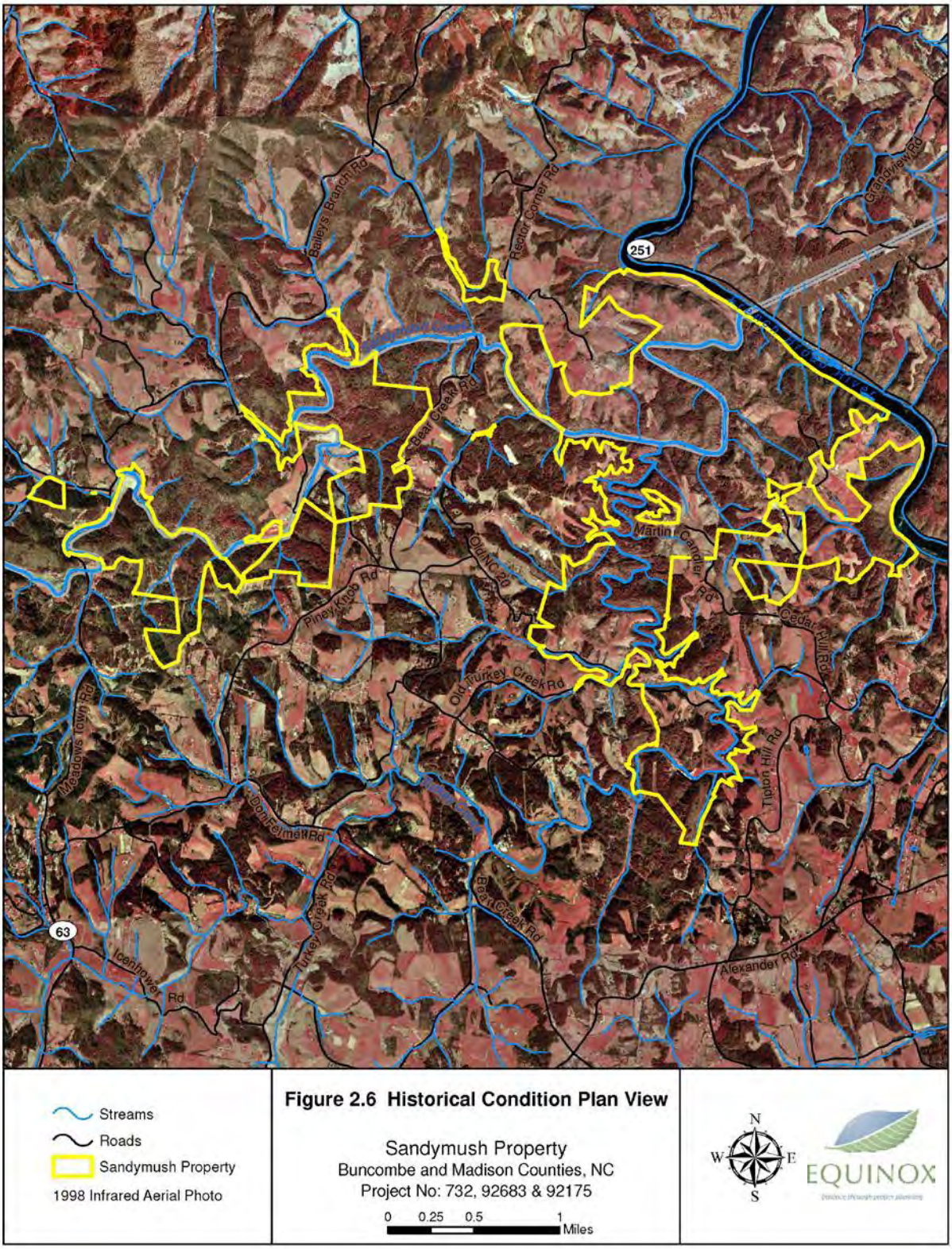
Wetland 18, Area 11, Reach 2; 2006

2.5 Historical Conditions

The Sandymush property has been in mixed agricultural and forest uses since it has been actively managed. To accommodate these uses, a network of mostly unimproved access roads was developed, a number of which cross streams. Some of the stream crossings are culverted, whereas others are unimproved fords. Cleared areas were historically used to produce agricultural crops and, more recently, leased for livestock grazing (Figure 2.6). Areas unsuitable for agricultural activities remained forested and undisturbed except when logging occurred. Because livestock had unfettered access to many riparian areas and streams, stream banks were severely eroded and often denuded of herbaceous vegetation, making them highly susceptible to erosion and polluted with livestock waste. As a result of this activity, many of the streams became severely entrenched, having eroded down to bedrock.

Over time, some parcels surrounding the numerous tracts making up the Sandymush property have been converted to residential properties where single family homes have been built. To provide electricity to those homes, high voltage transmission lines and secondary distribution lines were installed, many of them running through the Sandymush property, both crossing and paralleling stream corridors. The resulting maintenance of these powerline right-of-ways continues to impact the type and quality of riparian vegetation present. The primary impact from these activities is that these areas are maintained in early successional species such as Virginia pine (*Pinus virginiana*), black cherry (*Prunus serotina*), tulip poplar (*Liriodendron tuplipifera*), black locust (*Robinia pseudoacacia*), and red maple (*Acer rubrum*). These areas have also been prone to be dominated by non-native invasive plants.

Figure 2.6 Historical Condition Plan View



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3 SITE PROTECTION INSTRUMENTS

3.1 Site Protection Instruments Summary Information

The 28 parcels comprising the Sandymush Site were purchased fee simple by the State of North Carolina in 2004 from Progress Energy Corporation (with reserved easements for power lines) and are located in both Buncombe and Madison counties. Deeds for these properties can be found in Buncombe County Deed Book 3881 Pages 145-172 (BCROD 2004) and Madison County Deed Book 344 Pages 314-341 (MCROD 2004). Easement documents and deeds also are included in the NCWRC management plan (NCWRC 2014). The property was surveyed after closing; the survey index sheet was filed with the Buncombe County Register of Deeds and can be found in Buncombe County Plat Book108 Page 112 (BCROD 2004). The 28 detail sheets associated with the survey are available on the DMS web site (NCEEP 2005).

Supplemental Protection instruments - Besides being protected under ownership by the State of North Carolina, the streams and riparian areas within the Sandymush are further protected by deed restrictions and a management agreement between the Department of Environment and Natural Resources and the North Carolina Wildlife Resources Commission, the agency that is managing the Sandymush tract as part of its Game Lands Program. A copy of the deed restrictions and the DENR-NCWRC management agreement are included in Appendix A.

Due to the size of the Sandymush tract and the fact that the entire tract is protected from development by the State of North Carolina, a site protection instrument figure is not presented. Details of the site can be obtained from Figure 2.1 and the project plan sheets presented in Appendix D.

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4 BASELINE INFORMATION

Baseline information for this project was presented in the Environmental Resources Technical Report (NCEEP 2007) and is not duplicated in this document. Key regulatory issues are addressed in section 4.4.

4.1 Watershed Summary Information

Table 4.1 Watershed Attributes

Project Information		
Project Name		Sandymush
Counties		Buncombe and Madison
Project Area (acres)		2,688.027
Project Coordinates (latitude and longitude)		35.7262; -82.6757
Project Watershed Summary Information		
Physiographic Province		Blue Ridge Province (NCGS 2004)
River Basin		French Broad River
USGS Hydrologic Unit 8-digit code:	06010105	USGS Hydrologic Unit 14-digit codes: French Broad River tributaries – 06010105090020 Sandymush Creek -06010105090030 Turkey Creek – 06010105090040
NCDWQ Sub-basin		French Broad River 04-03-02; 04-03-04
Project Drainage Area (acres)		54,824
Project Drainage Area Percentage of Impervious Area		Estimated <1%
Center for Geographic Information and Analysis (CGIA) Land Use Classifications		Residential, Commercial and Services, Institutional, Transportation, Communication and Utilities, Industrial and Commercial Complexes, Mixed Urban or Developed Land, Public Assembly, Recreational, Cultural, and Entertainment, Cropland and Pasture, Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas, Confined Animal Operations, Other Agricultural Land, Active forest management and harvesting, Passive Use on Undisturbed Land

4.2 Area Summary Information

Table 4.2 Area Attributes (Sheet 1 of 3)

Area Summary Information[1]				
Parameters	**Area 1**	**Area 2**	**Area 3**	**Area 4**
Length of stream within area (linear feet)	16,613	19,178	11,695	18,018
High Quality Preservation[2]	7,613	15,098	0	2,189
Preservation[2]	1,882	739	0	3,015
Enhancement II[2]	6,285	3,341	11,548	11,376
Exclusions	833	0	147	1,438
Valley classification				
Drainage area (acres)	577	439	17,438	18,733
NCDWQ stream identification score				
NCDWQ Water Quality Classification	C	C	C	C
Morphological Description (stream type)				
Evolutionary trend				
Underlying mapped soils				
Drainage class				
Soil Hydric status				
Slope				
FEMA classification[3]				
Native vegetation community[4]				
Percent composition of exotic invasive vegetation	61	52	49	44
Wetland Summary[5]				
Parameter	**Area 1**	**Area 2**	**Area 3**	**Area 4**
Wetlands ID Numbers	1, 2, 3, 4	5, 6		7
Size of Wetland (acres)	Not Delineated	Not Delineated		Not Delineated
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian	Headwater		
Mapped Soil Series	2.5 YR 2.5/1	7.5 YR 2.5/1; Silty clay loam		
Drainage class				
Soil Hydric Status	Hydric	Hydric		
Source of Hydrology				
Hydrologic Impairment				
Native vegetation community	All scrub-shrub	Scrub-shrub; Emergent		Emergent
Percent composition of exotic invasive vegetation				

[1]Cells shaded in dark grey are not applicable to this project because no Priority I or II Restoration or Enhancement I activities are being proposed for this site.

[2]High Quality Preservation, Preservation, and Enhancement II stream lengths exclude powerline right-of-ways and other stream crossings in each area; length of exclusions are presented separately. The methods for calculating mitigation credits are described in Section 5.

[3]None of the streams within the project area fall within a defined FEMA floodplain.

[4]Native vegetation communities were not delineated due to the extent of non-native invasive plant species prevalent throughout the project area.

[5]Data derived from Conceptual Mitigation Design Report (Baker 2004); empty cells indicate that either the data was not taken or the value could not be determined from the report; non-standard terms are used for descriptive purposes.

Table 4.2 Area Attributes (Sheet 2 of 3)

Area Summary Information[1]				
Parameters	**Area 5**	**Area 6**	**Area 7**	**Area 8**
Length of stream within area (linear feet)	15,636	19,355	16,399	17,646
High Quality Preservation[2]	9,980	13,220	10,547	9,501
Preservation[2]	732	471	1,001	3,084
Enhancement II[2]	4,601	5,391	4,289	4,718
Exclusions	323	273	562	343
Valley classification				
Drainage area (acres)	28,620	418	19,289	19,695
NCDWQ stream identification score				
NCDWQ Water Quality Classification	C	C	C	C
Morphological Description (stream type)				
Evolutionary trend				
Underlying mapped soils				
Drainage class				
Soil Hydric status				
Slope				
FEMA classification[3]				
Native vegetation community[4]				
Percent composition of exotic invasive vegetation	34	41	37	64
Wetland Summary[5]				
Parameter	**Area 5**	**Area 6**	**Area 7**	**Area 8**
Wetlands ID Numbers	8	9, 10	11, 12, 13	14
Size of Wetland (acres)	Not Delineated	Not Delineated	Not Delineated	Not Delineated
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian	Riparian; unknown	Headwater seep; others unknown	Unknown
Mapped Soil Series	7.5 YR 2.5/1; Silty clay loam			
Drainage class				
Soil Hydric Status	Hydric			
Source of Hydrology				
Hydrologic Impairment				
Native vegetation community	Emergent	Emergent Emergent	Emergent; Shrub-scrub Emergent	Forested
Percent composition of exotic invasive vegetation				

[1]Cells shaded in dark grey are not applicable to this project because no Priority I or II Restoration or Enhancement I activities are being proposed for this site.

[2]High Quality Preservation, Preservation, and Enhancement II stream lengths exclude powerline right-of-ways and other stream crossings in each area; length of exclusions are presented separately. The methods for calculating mitigation credits are described in Section 5.

[3]None of the streams within the project area fall within a defined FEMA floodplain.

[4]Native vegetation communities were not delineated due to the extent of non-native invasive plant species prevalent throughout the project area.

[5]Data derived from Conceptual Mitigation Design Report (Baker 2004); empty cells indicate that either the data was not taken or the value could not be determined from the report; non-standard terms are used for descriptive purposes.

Table 4.2 Area Attributes (Sheet 3 of 3)

Area Summary Information[1]				
Parameters	**Area 9**	**Area 10**	**Area 11**	**Area 12**
Length of stream within area (linear feet)	11,025	7,881	16,097	8,665
High Quality Preservation[2]	3,788	1,906	1,145	2,429
Preservation[2]	4,916	0	580	371
Enhancement II[2]	1,854	5,824	13,966	5,592
Exclusions	467	151	406	273
Valley classification				
Drainage area (acres)	2,075	26,869	26,153	26,576
NCDWQ stream identification score				
NCDWQ Water Quality Classification	C	C	C	C
Morphological Description (stream type)				
Evolutionary trend				
Underlying mapped soils				
Drainage class				
Soil Hydric status				
Slope				
FEMA classification[3]				
Native vegetation community[4]				
Percent composition of exotic invasive vegetation	46	50	49	24
Wetland Summary[5]				
Parameter	**Area 9**	**Area 10**	**Area 11**	**Area 12**
Wetlands ID Numbers		15, 16, 17	18	
Size of Wetland (acres)		Not Delineated	Not Delineated	
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)		Headwater seeps	Seep	
Mapped Soil Series				
Drainage class				
Soil Hydric Status				
Source of Hydrology				
Hydrologic Impairment				
Native vegetation community		Scrub-shrub; Scrub-shrub; Emergent	Scrub-shrub	
Percent composition of exotic invasive vegetation				

[1]Cells shaded in dark grey are not applicable to this project because no Priority I or II Restoration or Enhancement I activities are being proposed for this site.

[2]High Quality Preservation, Preservation, and Enhancement II stream lengths exclude powerline right-of-ways and other stream crossings in each area; length of exclusions are presented separately. The methods for calculating mitigation credits are described in Section 5.

[3]None of the streams within the project area fall within a defined FEMA floodplain.

[4]Native vegetation communities were not delineated due to the extent of non-native invasive plant species prevalent throughout the project area.

[5]Data derived from Conceptual Mitigation Design Report (Baker 2004); empty cells indicate that either the data was not taken or the value could not be determined from the report; non-standard terms are used for descriptive purposes.

4.3 Regulatory Considerations

The Sandymush project site was purchased by the State of North Carolina in 2004 to offset mitigation needs for N.C. Department of Transportation impacts to streams and wetlands in cataloging unit 06010105 of the French Broad River. Under an agreement with the USACE, mitigation credits were to be obtained under three DMS projects. Streams with intact stream channels and high functioning riparian areas were to be acquired as High Quality Preservation under DMS Project Numbers 92683 (Southern Mountains Ecoregion) and 92175 (Northern Mountains Ecoregion). Mitigation credits for the remaining streams were to be acquired as Enhancement II under DMS Project Number 732. Upon further review, some stream reaches identified for HQP did not have the required 300 foot wide buffer on both stream banks. Those reaches have high functioning riparian areas 30-300 feet in width are being proposed for mitigation under the standard Preservation option. Regulatory issues related to Section 404, Section 401, Endangered Species Act, and the Historic Preservation Act for all streams on the Sandymush site were addressed in the Sandymush Creek Restoration Project Environmental Resources Technical Report (Table 4.3; NCEEP 2007). Because no earthmoving activities are proposed in this mitigation plan, regulatory considerations do not apply and all regulatory issues are considered resolved.

Table 4.3 Regulatory Factors

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	No	Yes	ERTR (NCEEP 2007)
Waters of the United States – Section 401	No	Yes	ERTR (NCEEP 2007)
Endangered Species Act	No	Yes	ERTR (NCEEP 2007)
Historic Preservation Act	No	Yes	ERTR (NCEEP 2007)
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	
FEMA Floodplain Compliance	No	N/A	
Essential Fisheries Habitat	No	N/A	

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5 DETERMINATION OF CREDITS

Prior to calculating mitigation credits, the following adjustments were made to the streams database:

- Stream reaches affected by crossings were delineated by the intersection of the crossing boundary using the criteria below. Stream length affected was measured from the boundary of the crossing regardless of the angle of the crossing to the stream channel.
- Legal right-of-ways (Figure 5.1) exclusion criteria were generally as follows:
    - 80 foot right-of-ways for transmission powerlines
    - 40 foot right-of-ways for distribution powerlines
    - 40 foot right-of-ways for public road crossings
- Criteria applied to crossings without formal agreements (Figure 5.1) were as follows:
    - 20 feet for culverted stream crossings (non-public)
    - 20 feet for fords
    - 20 feet for a proposed pedestrian bridge

5.1 High Quality Preservation

Mitigation credits in feet were calculated using GIS analysis based on the original field assessment (Baker 2007) and the North Carolina Streams Dataset (NCCGIA Undated). During those assessments stable stream channels having riparian areas with high ecological function and for which enhancement activities would provide little or no additional ecological uplift were mapped. Criteria and mitigation credit calculations for two categories in this class were as follows:

High Quality Preservation - 2 (HQP-2)

- Criteria
    - ≥300 foot wide riparian buffer on both sides of stream
- Credit Ratio
    - 5:1

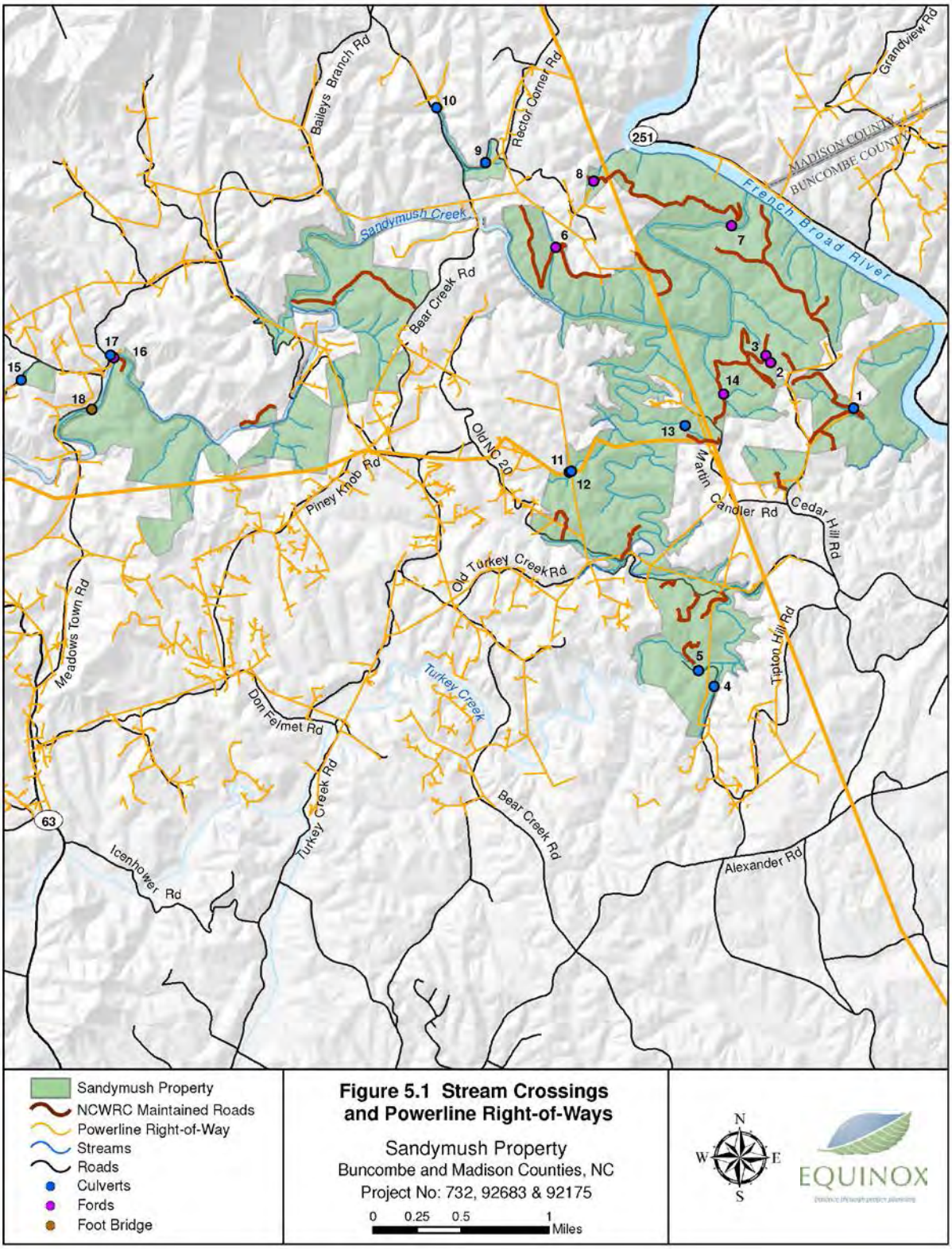
High Quality Preservation – 1 (HQP-1)

- Criteria
    - ≥300 foot wide riparian buffer on only one side of stream; opposite side of stream with limited or no buffer
- Credit Ratio
    - 10:1

Stream reaches originally identified as HQP were found to have riparian buffer widths of <300 feet, thus disqualifying them for full mitigation credit. Although those reaches qualified for reduced HQP mitigation credit based on buffer width under the IRT HQP Initiative guidance document, credits for these reaches are being proposed under the standard Preservation (P) option as part of DMS Project Number 732. Qualifying criteria and mitigation calculations are presented in Section 5.2.

High Quality Preservation mitigation credits were allocated between the Northern and Southern Ecoregions based on reach locations and category (HQP-2 or HQP-1). The total length of HQP reaches forming the boundary between the ecoregions was split evenly between them (50:50).

Figure 5.1 Stream Crossings and Powerline Right-of-Ways



5.2 Preservation and Enhancement

5.2.1 Preservation

Stream reaches with highly functioning riparian buffers but not meeting HQP criteria are being proposed for mitigation under the standard Preservation option. Criteria and mitigation credit ratios used in these calculations were as follows:

Preservation
- Criteria
  - 30-300 foot wide riparian buffer on both sides of stream
- Credit Ratio
  - 7.5:1

5.2.2 Enhancement

Stream reaches having degraded riparian areas are being proposed for mitigation under the EII approach. As defined by the USACE (2003), the Enhancement Level II mitigation category includes "activities that augment channel stability, water quality, and stream ecology in accordance with a reference condition but fall short of restoring both dimension and profile. Mitigation credit determinations for these reaches were calculated using GIS analysis techniques and are not based on formal field measurements. The calculations do take into account field assessments of riparian conditions presented in Section 7.2.1 and Appendix C. Based on that information, reaches were placed into one of two categories using the criteria as follows:

EII-2 - Riparian buffers ≥30 feet on both sides of the stream channel.
EII-1 - Minimum 30 foot riparian buffer on one side of the stream channel; <15 foot riparian buffer on opposite side of the stream channel (Note: Riparian areas on opposite side of stream >15 feet, but <30 feet in width comprised an insignificant amount of reach length).

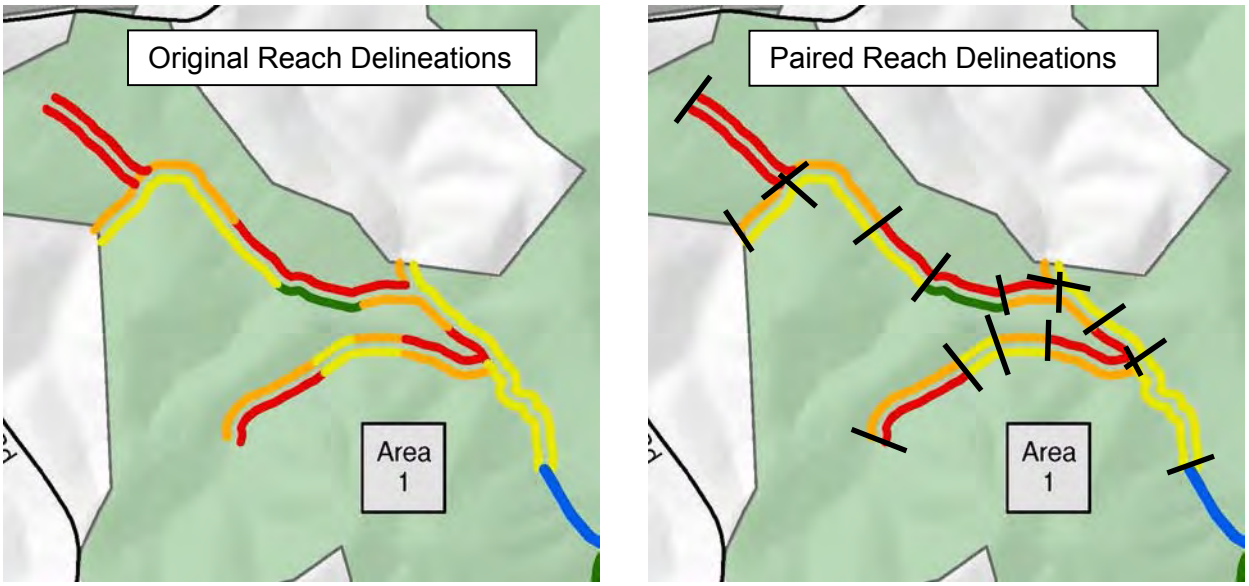
Stream reaches in the EII-2 category were then placed into one of three riparian condition classes for the purpose of calculating mitigation credits – Good (G), Fair (F), or Poor (P). These ratings were based on the average riparian condition within a delineated reach. Because riparian conditions on the left and right side of stream channels originally were assessed independently (Appendix C), the lengths of the assessments on opposite stream banks often differed. As a consequence, it was necessary to create paired reaches that would allow average riparian condition ratings to be calculated for a given reach and used in calculating mitigation credits. This was done using a four-step process as follows:

1. Create paired reaches of equal length using GIS techniques.
2. Calculate average metric scores for each newly-defined paired reach using the original metric scores for each stream bank.
3. Assign each reach to a riparian condition class – Good, Fair, or Poor - using the average riparian condition score calculated in Step 2.
4. Calculate mitigation credits for each riparian reach condition class.

Paired reaches of equal length were created as follows:

- Using the original riparian assessment reaches, reach breaks occurring on either side of the stream were extended to the opposite side of the stream perpendicular to the channel (See Figure 5.2).
- Reach breaks also were created at the confluence of stream channels.
- Each paired reach was given a new reach identification number.

Figure 5.2 Illustration of Original and Paired Riparian Area Reach Delineations



Average metric score for each newly created reach pair was calculated as follows:

- Riparian conditions variables were created for left and right banks.
- Original metric scores associated with those reaches were assigned to the new variables (Appendix C).
- Using the left and right bank scores, average score for each paired reach was calculated.

Each of the newly defined reaches was assigned to a riparian reach condition category using the following scoring criteria:

- Average score 3-7 – Good
- Average score 8-11 – Fair
- Average score 12-17 – Poor

Mitigation credits for each riparian reach condition category were calculated using the following ratios:

- Good 2.5:1
- Fair 3:1
- Poor 5:1

No mitigation credit is proposed for stream reaches in the EII-1 category.

No agricultural or other BMP elements are being proposed as mitigation for this site. Livestock have been removed from the property.

5.3 Wetlands

A total of 18 wetland areas are known to exist on the Sandymush site (Baker 2007). While no formal delineations of these wetlands were made during the stream assessment of the Sandymush tract, these wetlands appear to be seeps in the range of 0.1 acre in size, totaling an estimated 1.8 acres. All of the wetlands appear to be functioning, many contained standing water at the time of the assessments (June-July 2007), and several exhibited obvious drainage patterns.

As part of the mitigation plan, these wetlands are an important component of the project; their protection will contribute to enhancing water quality in the Sandymush Creek watershed. Although DMS is not seeking to obtain any wetland credits, the mitigation value of these resources cannot be overstated.

5.4 Mitigation Credit Summary

Under this mitigation plan, the DMS is proposing a total of 39,132 stream mitigation credits for the Sandymush site. No mitigation credits are being requested for 17,680 feet of stream channel (10% of total) with protected riparian areas on only one side of the stream, are too narrow, or are in right-of-ways or stream crossings. Of this amount 12,464 feet of stream channel are within areas targeted for EII or do not qualify for HQP; 5,216 feet of stream are either in formal right-of-ways or other stream crossings. The breakdown of the stream mitigation credits being requested are as follows:

High Quality Preservation – Under the HQP option, 12,875 mitigation credits are being proposed for the Sandymush site; 3,464 of them are to be applied to the Northern Mountain ecoregion, whereas 9,411 credits are to be applied to the Southern Mountains ecoregion.

Preservation - A total of 2,240 mitigation credits are being proposed under the preservation option. These areas have high functioning riparian areas of 30-300 feet on both sides of the stream channel and do not meet the HQP criteria.

Enhancement – Based on its rating of riparian area conditions of stream reaches meeting EII criteria, 24,017 mitigation credits are being proposed for the Sandymush site.

Wetlands – While 18 wetlands encompassing an estimated 1.8 acres exist on the site and are important to protecting water quality, no mitigation credits are being proposed for protection of these resources.

Table 5.1 Mitigation Credit Determination Summary

Sandymush, Buncombe/Madison County
DMS Project Numbers 732, 92683, and 92175

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals		39,132							

Project Components

Area ID	Buffer Category[1]	Station/Location	Existing Footage/Acreage[2]	Approach (PI, PII, etc.)	Restoration or Restoration Equivalents	Restoration Footage or Acreage	Mitigation Ratio
1	HQP-2	N/A	2,578	HQP	516		5:1
	HQP-1		5,035	HQP	504		10:1
	P		1,882	P	251		7.5:1
	EII-G		1,321	EII	528		2.5:1
	EII-F		2,259	EII	753		3:1
	EII-P		1,157	EII	231		5:1
	EII-1		1,548	EII	0		0:1
	NQ-HQP		0	HQP	0		0:1
2	HQP-2	N/A	9,757	HQP	1,951		5:1
	HQP-1		5,341	HQP	534		10:1
	P		739	P	99		7.5:1
	EII-G		2,633	EII	1,053		2.5:1
	EII-F		708	EII	236		3:1
	EII-P		0	EII	0		5:1
	EII-1		0	EII	0		0:1
	NQ-HQP		0	HQP	0		0:1
3	HQP-2	N/A	0	HQP	0		5:1
	HQP-1		0	HQP	0		10:1
	P		0	P	0		7.5:1
	EII-G		3,177	EII	1,271		2.5:1
	EII-F		8,077	EII	2,692		3:1
	EII-P		294	EII	59		5:1
	EII-1		0	EII	0		0:1
	NQ-HQP		0	0	0		
4	HQP-2	N/A	619	HQP	124		5:1
	HQP-1		1,570	HQP	157		10:1
	P		3,015	P	402		7.5:1
	EII-G		4,245	EII	1,698		2.5:1
	EII-F		4,964	EII	1,655		3:1
	EII-P		567	EII	113		5:1
	EII-1		1,600	EII	0		0:1
	NQ-HQP		0	HQP	0		0:1
5	HQP-2	N/A	6,085	HQP	1,217		5:1
	HQP-1		3,837	HQP	384		10:1
	P		732	P	98		7.5:1
	EII-G		1,614	EII	646		2.5:1
	EII-F		1,323	EII	441		3:1
	EII-P		0	EII	0		5:1
	EII-1		1,664	EII	0		0:1
	NQ-HQP		58	HQP	0		0:1
6	HQP-2	N/A	8,477	HQP	1,695		5:1
	HQP-1		4,743	HQP	474		10:1
	P		471	P	63		7.5:1
	EII-G		3,679	EII	1,472		2.5:1
	EII-F		455	EII	152		3:1
	EII-P		1,257	EII	251		5:1
	EII-1		0	EII	0		0:1
	NQ-HQP		0	HQP	0		0:1

Table 5.1 Mitigation Credit Determination Summary (Sheet 2 of 3)

Area ID	Buffer Category[1]	Station/Location	Existing Footage/Acreage[2]	Approach (PI, PII, etc.)	Restoration or Restoration Equivalents	Restoration Footage or Acreage	Mitigation Ratio
7	HQP-2	N/A	9,460	HQP	1,892		5:1
	HQP-1		1,087	HQP	109		10:1
	P		1,001	P	134		7.5:1
	EII-G		2,408	EII	963		2.5:1
	EII-F		825	EII	275		3:1
	EII-P		1,056	EII	211		5:1
	EII-1		0	EII	0		0:1
	NQ-HQP		0	HQP	0		0:1
8	HQP-2	N/A	9,386	HQP	1,877		5:1
	HQP-1		0	HQP	0		10:1
	P		3,084	P	411		7.5:1
	EII-G		3,326	EII	1,330		2.5:1
	EII-F		81	EII	27		3:1
	EII-P		1,311	EII	262		5:1
	EII-1		0	EII	0		0:1
	NQ-HQP		115	HQP	0		0:1
9	HQP-2	N/A	2,191	HQP	438		5:1
	HQP-1		1,437	HQP	144		10:1
	P		4,916	P	655		7.5:1
	EII-G		1,592	EII	637		2.5:1
	EII-F		262	EII	87		3:1
	EII-P		0	EII	0		5:1
	EII-1		0	EII	0		0:1
	NQ-HQP		160	HQP	0		0:1
10	HQP-2	N/A	317	HQP	63		5:1
	HQP-1		1,589	HQP	159		10:1
	P		0	P	0		7.5:1
	EII-G		4,992	EII	1,997		2.5:1
	EII-F		832	EII	277		3:1
	EII-P		0	EII	0		5:1
	EII-1		0	EII	0		0:1
	NQ-HQP		0	HQP	0		0:1
11	HQP-2	N/A	403	HQP	81		5:1
	HQP-1		695	HQP	70		10:1
	P		580	P	77		7.5:1
	EII-G		6,388	EII	2,555		2.5:1
	EII-F		2,818	EII	939		3:1
	EII-P		0	EII	0		5:1
	EII-1		4,760	EII	0		0:1
	NQ-HQP		47	HQP	0		0:1
12	HQP-2	N/A	2,429	HQP	486		5:1
	HQP-1		0	HQP	0		10:1
	P		371	P	50		7.5:1
	EII-G		2,682	EII	1,073		2.5:1
	EII-F		399	EII	133		3:1
	EII-P		0	EII	0		5:1
	EII-1		2,511	EII	0		0:1
	NQ-HQP		0	HQP	0		0:1

Table 5.1 Mitigation Credit Determination Summary (Sheet 3 of 3)

Area ID	Buffer Category[1]	Station/Location	Existing Footage/Acreage[2]	Approach (PI, PII, etc.)	Restoration or Restoration Equivalents	Restoration Footage or Acreage	Mitigation Ratio
HQP by Ecoregion[3] Project 92175 – Madison County-HQP Project 92683 – Buncombe County-HQP		N/A	 21,496[4] 55,539[4]	 HQP HQP	 3,464 9,411		
Total for HQP-2			51,702	HQP	10,340[6]		5:1
Total for HQP-1			25,334	HQP	2,535[6]		10:1
Total for P			16,791	P	2,240[6]		7.5:1
Total for EII-G			38,057	EII	15,223[6]		2.5:1
Total for EII-F			23,003	EII	7,667[6]		3:1
Total for EII-P			5,642	EII	1,127[6]		5:1
No Credit Totals (NQ-HQP and EII-1)[5]			12,464	-	0		0:1
Exclusions[7]			5,216	-	-		-
Total for All Categories			178,209		39,132		

[1]Buffer categories: HQP-2 – High Quality Preservation reaches with a minimum 300 foot buffer on both sides of stream; HQP-1 – High Quality Preservation reaches with a minimum 300 foot buffer one side of stream; P – High Quality Preservation reaches with a buffer <300 feet, but more than 30 feet wide on both sides of stream; EII-G, EII-F, EII-P – Enhancement II with a minimum 30 foot buffer on both sides of stream and rated at having Good (G), Fair (F), or Poor (P) riparian buffer conditions; EII-1 – Enhancement II with a minimum 30 foot buffer on only one side of stream; NQ-HQP – reaches in areas designated for HQP credits, but not meeting HQP criteria..

[2]Does not include portions of stream impacted due to powerline right-of-way crossings, public and private roads, culverts, fords, and a proposed footbridge crossing.

[3]High quality preservation credits of the Sandymush site are apportioned to DMS ecoregion location; Madison County is in the Northern Mountains, whereas Buncombe County is in the Southern Mountains ecoregion.

[4]Includes stream lengths of both HQP-2 at 5:1 and HQP-1 at 10:1 mitigation ratios.

[5]Total length of streams for which no mitigation credits are being requested. Includes EII-1 and HQP streams that do not meet HQP mitigation criteria.

[6]Total mitigation credits for each category calculated as the sum of each all areas in this column.

[7]Length of stream excluded from database of entire Sandymush tract; includes powerline and public and private road right-of-ways, fords, and a proposed footbridge crossing;

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration						
Enhancement						
Enhancement I						
Enhancement II	Category EII-G[1] – 38,057 Category EII-F[1] – 23,003 Category EII-P[1] – 5,642					
Creation						
Preservation	16,791					
High Quality Preservation[2]	Project 92175 – 21,496 Project 92683 – 55,539					

[1]Buffer Category EII-G, F, and P include streams where a minimum 30 foot vegetated buffer on both sides of the stream is under protection.

[2]High quality preservation stream footage comes from project numbers 92175 (Madison County; Northern Mountains Ecoregion) and 92683 (Buncombe County; Southern Mountains Ecoregion). See text for calculation methods.

BMP Elements[1]

Element	Location	Purpose/Function	Notes
N/A	N/A	N/A	N/A

BMP Elements Include the following:
BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spreader; NI = Natural Infiltration Area; FB = Forested Buffer

[1]No BMP elements are being proposed for this mitigation plan.

6 CREDIT RELEASE SCHEDULE and APPROVAL

The project was acquired prior to the current mitigation instrument (USACE-DENR 2010) that sets forth a specific schedule for releasing credits associated with preservation and enhancement projects and, therefore is not applicable to this project. However, the USACE District Engineer maintains the authority to make credit adjustments, based on site conditions, until the project has received closeout approval. Final mitigation credits amounts and their release will occur upon receipt of a closeout approval letter from the USACE.

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7 MITIGATION WORK PLAN

As previously described, the Sandymush tract is atypical of DMS mitigation sites and is considered a unique "working" mitigation site. This is borne out by the fact that it consists of multiple parcels with highly irregular boundaries, an interspersion of the stream reaches being conserved under HQP, Preservation, and Enhancement II options, and a mosaic of forested and open lands. Consequently, it would be more practical to apply management actions based on overall ecological needs rather than on defined mitigation alternatives. For these reasons, DMS has elected to present a comprehensive mitigation plan that applies management to all Sandymush streams. The DMS proposes that mitigation objectives will be achieved by implementation of the NCWRC's management plan for the Sandymush Game Land (NCWRC 2014; Section 14.7 Appendix E).

The primary goal of this comprehensive mitigation plan is to apply management actions that favor the reestablishment of native vegetation in degraded riparian areas to the extent practicable, improve wildlife habitat by enhancing the diversity of native plant species, and to improve riparian area function to stabilize stream banks and enhance and protect water quality. These improvements will result in ecological uplift that not only improves plant communities, but also benefits mammals, birds, amphibians, and other wildlife species as well as maintains or improves water quality and habitat conditions benefitting aquatic species. An important element of this plan is based on achieving ecological improvements in a cost effective manner and utilizing management activities described in the NCWRC management plan for the Sandymush game land (NCWRC 2014). The following sections lay the foundation for this approach and describe how this plan will be implemented.

7.1 Preliminary Analysis of Project Area

Immediately upon its purchase by the State of North Carolina in 2004, the DMS began assessing the Sandymush site conditions to determine the potential mitigation credits available for conserving the property. Initially, approximately 94,000 linear feet of stream reaches were identified as having minimal ground disturbances and low levels of non-native invasive plants (Baker 2007; NCEEP 2007), and recommended for mitigation as preservation. Subsequently, these reaches were recommended for protection under the High Quality Preservation option that is described in Sections 2.4.2 and 5.1 and Table 5.1.

Stream reaches not meeting the HQP criteria were further evaluated for mitigation as standard Preservation. That evaluation and the mitigation recommendations are previously described in Sections 2.4.2 and 5.2.1. Those assessments were documented in an Environmental Resource Technical Report (NCEEP 2007) and stream restoration conceptual design plan (Baker 2007). Those documents also described significant streambank degradation due to livestock access, stream channel entrenchment, and an abundance of non-native invasive plants as having the most significant impacts on the ecology of these stream reaches.

Further analysis of the stream restoration conceptual design plan found that due to the topography of the site, stream restoration activities would be difficult and costly to implement and that the risk of failures of the restoration work was high, not to mention the damage caused by equipment accessing the restoration reaches. It was determined that many of the entrenched stream channels had reached bedrock and were no longer downcutting. Because of these conditions, mitigation credits for those reaches are being requested under the Enhancement II option.

While some of the stream banks initially were found to be unstable and eroding, many of those areas now (10 years later) contain sufficient vegetation to prevent significant erosion or mass wasting. Additional stability is expected as woody vegetation in the riparian areas matures. There are, however, many reaches that are lacking a full tree canopy and are dominated by non-native invasive plant species or both.

Given the site conditions, DMS decided to reassess the EII stream reaches for enhancement of riparian area function by focusing on non-native invasive plant control and reestablishment of native plant communities that would eventually result in a fully restored wooded riparian zone. The following sections describe DMS's non-native invasive plant assessment of those stream reaches. Results of that assessment are described in the following sections.

7.2 Riparian Area Enhancement

The Sandymush mitigation site provides an opportunity for enhancing the ecological function of the riparian buffer on both sides of 66,702 linear feet of stream channel and 12,084 linear feet of riparian buffer on one side of stream channels. The site was divided into 12 assessment areas (Appendix D) for development of this mitigation plan. The DMS's conceptual plan for enhancing riparian areas on stream reaches not qualifying as HQP included removal of livestock from the project area (implemented in 2005), control of non-native invasive plant species to the extent practical, and enhancement of the native shrub and tree communities where such vegetation is lacking. It did not include any bank shaping or other streambank modifications. The objective of this assessment was to determine practical management measures that would facilitate the transition of riparian areas dominated by non-native invasive plant communities to ones that favor development of native plant communities, while maintaining streambank stability and enhancing water quality to the extent that it would provide improved aquatic and terrestrial habitats.

7.2.1 Riparian Area Assessment

Riparian conditions within 30 feet of streams in the Sandymush EII reaches were originally assessed as described in the study plan presented in Appendix C. A total of 254 reaches (riparian length on one side of the stream channel; see section 14.1 for a complete definition) were inventoried for their current condition with regards to buffer width, canopy condition, evidence of livestock access, presence of active management (mowing and crop cultivation associated with wildlife improvements), and percent non-native invasive plant cover. In addition, non-native invasive plant species were identified, and special issues that may affect management actions were documented. This included items such as powerline right-of-ways, road right-of-ways, bridges, culverts, and fords, beaver activity, and terrain challenges.

The four most common non-native invasive plant species present are privet, Japanese honeysuckle, multiflora rose, and oriental bittersweet. One to four of these species were dominant on 113 of the 254 reaches (44%) surveyed. Out of 254 reaches, 245 (95%) had four to nine non-native invasive plant species present. Only one reach was found to contain no non-native invasive plants. Overall, it was estimated that non-native invasive plants cover approximately 50% or about 53 acres of the riparian area within EII reaches. Among the 12 assessment areas, the percent coverage of non-native invasive plants ranged from 24% in Area 12 to 64% in Area 8 (Appendix C). While the assessment focused on invasive plants within the 30 foot buffer, observations revealed that the adjacent upland areas were also heavily populated with non-native invasive species.

Many reaches were found to have riparian areas that are not fully wooded. Approximately 31% of reaches surveyed contained a wooded riparian buffer that is 20 feet or less in width. Canopy condition within the entire 30 foot riparian area also was evaluated focusing on the density and maturity of woody plants present. Approximately 18% of the reaches were found to have either no or minimal canopy present.

Current and historic livestock access to streams was determined using field data and 1998 aerial photos. From this analysis, evidence of historic livestock access was estimated to occur on approximately 29% of the reaches surveyed. Current evidence of livestock accessing the Sandymush property was observed in a few areas where fences were broken or otherwise faulty. While many areas where livestock were previously accessing the creeks are now covered in herbaceous vegetation, woody vegetation has not become well established and non-native invasive plant species are often prevalent.

Active management encroachments were documented at many locations. Encroachments generally consisted of mowing and cultivated food plots along the outer edges of the riparian areas. In many cases, these were lands that were in agricultural production before the Sandymush property was purchased. Existing farm roads, which are allowed under the deed restrictions, were not considered encroachments.

Metric values were assigned to a range of observed values for the following five reach attributes: buffer width, livestock access, canopy condition, presence of active wildlife management, and percent coverage of non-native invasive plants (Appendix C). Overall riparian area condition was determined for each reach by totaling the attribute metric scores. Based on mean metric scores for all reaches occurring within an assessment area, the assessment areas were then ranked (Table 7.1). While the mean metric scores among the assessment areas have a relatively narrow range, metric values within each assessment area were highly variable. Because of this high variability, all of the assessment areas are considered to have non-native plant concentrations of such a magnitude that it would not be practical or cost effective to eradicate the undesirable species and reestablish native species.

Table 7.1 Mean Riparian Area Metric Scores and Ranking by Management Area

Rank	Management Area	Mean Metric Value	Metric Value Ranges[1]	Number of Reaches
1	1	9.3	3-17	27
2	8	8.8	4-15	14
3	6	8.1	3-13	24
3	5	8.1	5-14	18
3	7	8.1	3-14	28
4	4	7.9	4-14	36
5	3	7.3	4-12	29
6	9	7.2	4-15	6
7	12	6.2	4-16	18
8	2	6.1	3-9	8
9	10	6.0	3-11	26
10	11	5.9	3-11	20

[1]Minimum score possible = 3; maximum score possible = 17 (see Appendix C for details)

These findings reveal that the pervasiveness of non-native invasive plants in the riparian areas is enormous. The fact that invasive plants are so prevalent within the riparian areas and on the adjacent uplands makes it impractical to try to control them within only the riparian area. The

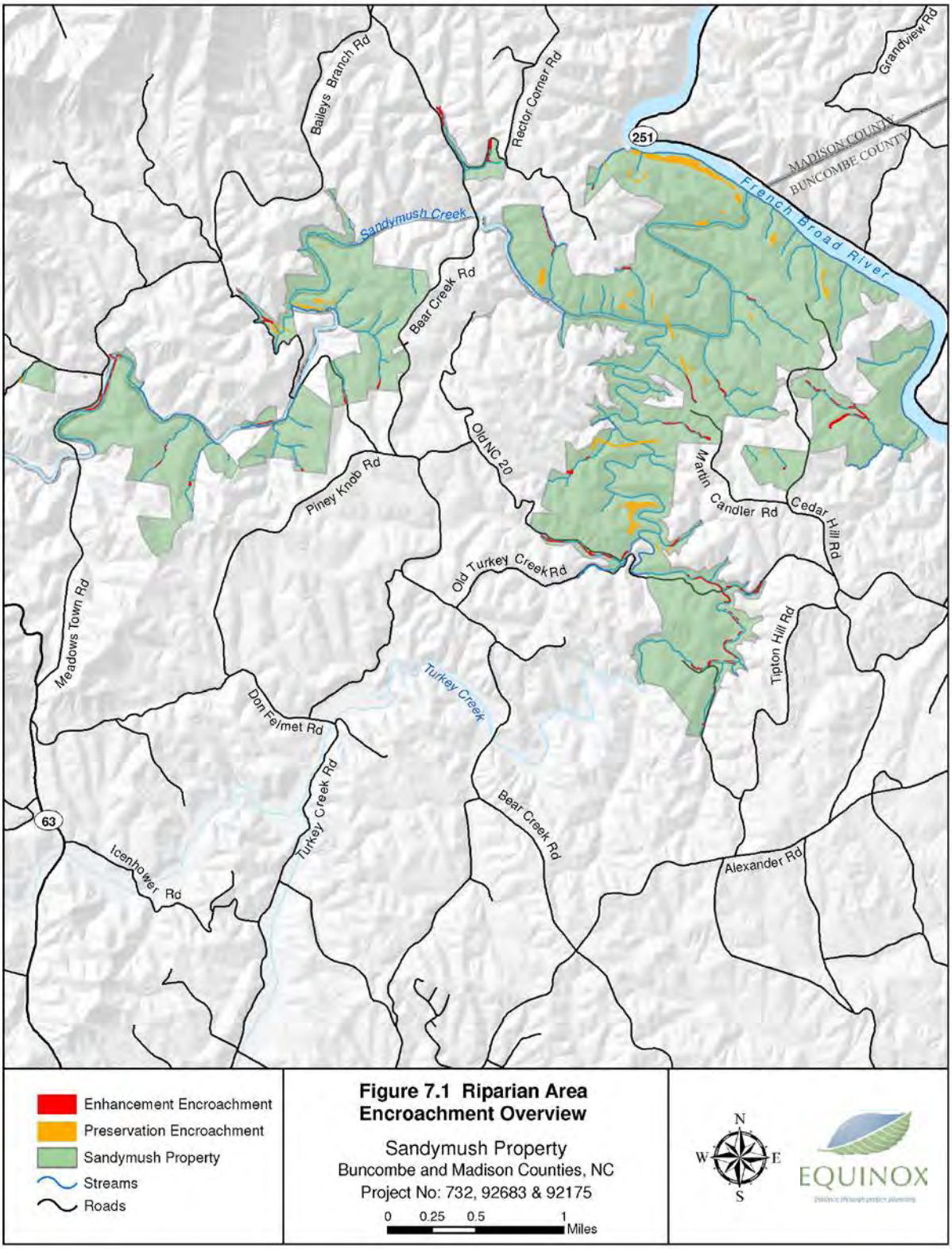
risk of those plants becoming reestablished after being treated is high. As a consequence significant retreatments would be required to suppress the invasive species sufficiently to give the native species an opportunity to become reestablished. Finally, there would be a temporary loss of ecological function while the new vegetation becomes reestablished. Such losses include increased erosion, bank instability, and degraded water quality, not to mention the volume of chemicals that would be required for treatment. Treatment of only the three areas ranked as having the worst invasive species problem would entail over 28,000 feet of stream bank covering almost 20 acres. The potential impact from mechanical and chemical treatments of invasive species of this magnitude only to restore the native plant community is not justified. As an alternative, DMS is proposing a low impact adaptive management strategy focusing on the use of controlled burning in conjunction with mechanical and chemical treatments (conducted by the NCWRC). Such an approach will favor the reestablishment of native plant communities over the long term, maintain stream bank stability, improve ecological function, and enhance water quality. This strategy is presented in Section 7.3.

7.2.2 Encroachments

Based on GIS analysis, active management by the NCWRC is occurring at 42 locations associated with enhancement reaches (Figure 7.1) and 27 locations within the preservation areas. As explained in the previous section, most of these encroachments are areas that were in agricultural uses prior to the acquisition of the Sandymush property and that the NCWRC has continued to manage for wildlife benefits. These infringements are generally at the outer edge of the riparian areas. Some of the identified locations may actually be part of a single management location or an artifact of mapping accuracy. As a consequence, the numbers stated above are likely an overestimate of the actual number of impacted locations. The boundaries of these areas were not marked prior to the NCWRC's assumption of management responsibility for the property. The DMS has provided the NCWRC with digital maps that delineate the riparian area boundaries so they can be marked on the ground (as necessary) and the encroaching activities terminated. The disturbed areas will be allowed to naturally revegetate. As specified in Exhibit D, Declaration and Restrictions, of the deed, existing roads and trails within the riparian areas can be maintained so as to reduce or eliminate erosion, but yet remain suitable for accessing remote portions of the property. Following USACE guidance, all stream crossings were excluded from the asset calculations.

The Sandymush property contains a significant number of powerlines, both major transmission lines and lower voltage distribution lines (Figure 5.1). As specified in deed Exhibit B, Reservation of Transmission and Distribution Easements, electric utilities can maintain powerline right-of-ways as necessary to keep poles, lines, and towers from being damaged by falling trees or limbs as well as keeping the areas within the right-of-ways clear of trees. These areas will be maintained by the electric utility companies and were not considered in the encroachment assessment or included in the mitigation credit determination.

Figure 7.1 Riparian Area Encroachments Overview



7.2.3 Stream Crossings

The 16 existing stream crossings and one proposed foot bridge on the Sandymush property have been excluded from the asset base (Figure 5.1). Two of the culverted crossings are on private drives that appear to cross the Sandymush property; three others are within powerline right-of-ways, while another two are on ephemeral stream channels. All crossings were in place at the time of purchase. While some of the roads are located in the riparian zone, they are an allowable use according to the deed restrictions. They are necessary to facilitate crossing stream channels to access remote portions of the property that are otherwise inaccessible. The location of a new foot bridge to be installed by the NCWRC has also been identified as a recreational improvement.

Table 7.2 Stream Crossing Characteristics and Locations

Crossing Number	DMS Management Area	NCWRC Management Area Number (Name)	Crossing Type	Location[1]	Latitude	Longitude
1	1	12 (Cedar Hill East)	Culvert	Enhancement	35.7203	-82.6564
2	2	8 (Cedar Hill West)	Ford	Ephemeral	35.7238	-82.6649
3	2	8 (Cedar Hill West)	Ford	Ephemeral	35.7243	-82.6654
4	3	11 (Turkey Creek South)	Culvert	Enhancement	35.6970	-82.6694
5	3	11 (Turkey Creek South)	Culvert	Enhancement	35.6982	-82.6711
6	5	5 (Madison South)	Ford	Enhancement	35.7326	-82.6871
7	6	6 (Madison North)	Ford	Preservation	35.7349	-82.6694
8	6	6 (Madison North)	Ford	Enhancement	35.7381	-82.6835
9	6	5 (Madison South)	Bridge	Enhancement	35.7393	-82.6945
10	6	5 (Madison South)	Culvert[2]	Enhancement	35.7437	-82.6996
11	7	10 (Turkey Creek North)	Culvert	Powerline ROW	35.7141	-82.6849
12	7	10 (Turkey Creek North)	Culvert	Powerline ROW	35.7142	-82.6846
13	7	9 (Martin Candler)	Culvert	Enhancement	35.7183	-82.6733
14	8	6 (Madison North)	Ford	Enhancement	35.7210	-82.6696
15	11	1 (Meadows Town)	Culvert[3]	Preservation	35.7200	-82.7406
16	11	1 (Meadows Town)	Ford	Powerline ROW	35.7221	-82.7313
17	11	1 (Meadows Town)	Culvert	Enhancement	35.7223	-82.7316
18	11	1 (Meadows Town)	Foot Bridge	Enhancement	Proposed	Proposed

[1]Stream crossings located within enhancement and preservation reaches were excluded from the mitigation credit calculations. Crossings within powerline right-of-ways (ROW) were excluded as part of that feature and not separately. Ephemeral stream crossings are listed for information purposes only; ephemeral streams were not eligible for mitigation credit.

[2]Due to the orientation of this culvert in relation to the reach characteristics, it was not excluded.

[3]This culvert has been removed.

7.3 Proposed Management Plan Details

For purposes of this plan, the Sandymush property is being considered a unique "working" mitigation site. Due to the complexity of the Sandymush property not only in terms of its physical layout, but the restrictions on stream buffers, and its inclusion in the NCWRC's game land program, DMS is proposing a comprehensive management plan that builds on wildlife habitat improvement activities described in the NCWRC Sandymush Game Land management plan (NCWRC 2014; Section 14.7 Appendix E). Unlike most DMS mitigation sites in which active management is generally terminated after 5-7 years (closeout), this site will be actively managed for the foreseeable future by the NCWRC as part of its game land program.

The NCWRC takes a holistic view in managing the vegetation on game lands in both the upland and riparian areas. Their plan uses habitat management techniques that favor native plant communities beneficial to wildlife, particularly shortleaf pine (*Pinus echinata*) and oak communities (*Quercus* spp.) and targets the suppression non-native invasive plants. This proposed mitigation plan incorporates, in part, the findings of the original stream assessment (Buck and Equinox 2004), original conceptual mitigation plan (Baker 2007), current conditions described in the non-native invasive plant assessment (Section 7.2), deed restrictions (BCROD 2004), the agreement between the NCWRC and DENR (Appendix A), and the NCWRC Sandy Mush Game Land management plan (NCWRC 2014).

In general, DMS proposes management actions that will be implemented by the NCWRC as part of their routine wildlife habitat management and improvement plan for the Sandymush game land. This proposal integrates management of both the upland and riparian areas that will meet game land and stream enhancement objectives. This approach is being proposed because non-native plants are so pervasive throughout the Sandymush property that to control them only in the riparian areas would be futile and not commensurate with the ecological benefits that would accrue from that approach.

The NCWRC Sandymush Game Land Management Plan is a 10-year science-based plan that includes the following as one of its main goals:

- Restore a diversity of habitat types and forest age classes using science-based land management practices that are properly interspersed and juxtaposed across the landscape to ensure that a wide variety of terrestrial and aquatic wildlife species are conserved on the game land.

This goal is consistent with the Declarations and Restrictions put on the property when it was purchased (Appendix A) that states the following:

- [Riparian buffers] …"will be forever conserved and managed in a manner that will improve and protect the quality of the waters of the Sandy Mush and Turkey Creek…"

and whose stated purpose is as follows:

- To maintain, restore, enhance, create and preserve wetland and/or riparian resources within the Restricted Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Restricted Area in its natural condition, consistent with these purposes; and to prevent any use of the Restricted Area that will significantly impair or interfere with these purposes.

Nothing in this plan shall restrict the NCWRC from conducting management activities, including controlled burns and mechanical or chemical treatments that will suppress non-native invasive plants so long as they do not violate the conservation objectives for the Sandymush mitigation site. Whenever such activities occur, native plant communities will be enhanced. The following sections describe the specific actions to be implemented by the NCWRC in coordination with the DMS.

Costs associated with the implementation of this mitigation plan and management of the Sandymush tract will be covered by funding from the NCWRC as part of its game lands program.

Once this mitigation plan is approved by the IRT, the existing Memorandum of Agreement between DMS and NCWRC will be amended to clearly establish that protective 300 foot buffers apply to stream reaches protected as HQP, whereas 30 foot buffers apply to those stream reaches being protected under the Preservation and Enhancement options.

7.3.1 Livestock Removal and Intrusions

An important component of all DMS mitigation plans is to eliminate livestock access to intermittent and perennial stream channels. Prior to its purchase, portions of the Sandymush tract were leased for agricultural purposes, particularly the grazing of livestock. Soon after its purchase and as part of DMS's watershed restoration strategy, the leases were terminated and the livestock removed. Since that time, significant improvements in stream bank stability have been achieved as was seen during recent riparian vegetation surveys. During the 10 years since its purchase, riparian vegetation on stream reaches impacted by livestock has become reestablished, resulting in a significant reduction in streambank erosion and stream sedimentation. The DMS removal of livestock alone likely achieved greater ecological uplift at a faster rate than would have been possible had the original conceptual restoration plan (Buck and Equinox 2004) been implemented.

While the livestock impacted areas have naturally revegetated, much of the vegetation is composed of non-native invasive plant species migrating from adjacent upland areas. However, despite the establishment of the invasive plants, ecological function has improved, water quality has been enhanced, stream banks have stabilized, and erosion has been greatly reduced.

While livestock have been removed from the Sandymush property, livestock are still grazed on adjacent pastures and occasional incursions are known to occur due to broken fencing. To minimize damage from these incursions, the NCWRC has a procedure in place whereby they notify landowners immediately when evidence of livestock is seen. The landowners are required to retrieve their livestock and repair the fences as soon as possible. The NCWRC follows-up to ensure the repairs have been made. These activities will be included in the annual report to the DMS.

7.3.2 Encroachment Elimination

One of the project goals is to stop active wildlife management improvement activities such as mowing and cultivation of food plots within the protected riparian areas. To accomplish this, DMS has provided the NCWRC with digital map data delineating the riparian boundaries for both sides of streams within the Sandymush property - 300 feet for preservation reaches and 30 feet for enhancement reaches. The DMS also will meet with the NCWRC to discuss the desired results to protect these areas. Based on these maps and as part of its ongoing management plans, the NCWRC will eliminate active wildlife habitat management activities from the protected

riparian areas. To prevent future incursions into the riparian areas, boundaries at the existing encroachment locations will be temporarily marked (posts, signs, flagging, etc.) so vegetation regrowth can occur naturally. Once these disturbances are eliminated, native herbaceous plants, trees, and shrubs are expected to become reestablished. If necessary, other management actions benefitting native plants will be implemented. No new food plots will be established within the riparian areas subject to mitigation credit.

The NCWRC will document the progress made to eliminate encroachments in their annual report to the DMS.

7.3.3 Stream Crossings

Sixteen stream crossings have been excluded from the mitigation asset base. Although they are not a formal part of this mitigation plan, they will be maintained by the NCWRC or power companies in a condition that will not jeopardize water quality. Such maintenance, including any required permitting, will be the responsibility of the users. It also will be the responsibility of these users to maintain roads in riparian areas and stream crossings in a condition whereby they do not contribute significant sediment to adjacent streams. Replaced culverts will be sized appropriately. When culverts are permanently removed, stream banks will be stabilized by grading and replanted with native plant materials. Two of the culverts are associated with private drives and appear to cross the Sandymush property. The culverts that are retained for access purposes will be periodically inspected to ensure they are functioning properly. The DMS will not seek additional mitigation credits for culverts that are removed and not replaced.

The NCWRC will document work done on culverts in their annual report to the DMS.

7.3.4 Non-native Invasive Plant Control

As documented by the riparian assessment, 50% of vegetative communities in the riparian buffer are dominated by non-native invasive plant species that are outcompeting native species. In addition, most of the adjacent upland areas also have significant concentrations of invasive plants, making the control of the invasive plants in only the riparian areas impractical. Instead, the DMS is proposing to integrate invasive plant control as part of the NCWRC's Sandymush game land management plan (NCWRC 2014).

Plant management in the NCWRC's plan focuses primarily on the use of controlled burns with supplemental herbicide application and mechanical removal as needed to improve wildlife habitat, food sources, and suppress non-native invasive plant species. Controlled burns imitate natural events and are consistent with management of the property. They are an efficient way of managing undesirable plant species and encouraging the regeneration of desirable plant species. To date, mechanical removal has been concentrated in upland areas for purposes of enhancing shortleaf pine regrowth. The NCWRC has just begun to implement chemical treatment of non-native invasive plants. Chemical treatments will involve spot spraying in the burn areas where non-native invasive plant regrowth is occurring to the detriment of native plants. Chemical treatments will be implemented as conditions warrant.

The NCWRC has established the boundaries for 19 burn units covering 482 acres of the Sandymush game land (Figure 7.2). Burn units include both forested and open habitats (NCWRC 2014, page 97) within both HQP and Enhancement streams. Since 2007 only portions of each unit have been burned, but when these portions are combined each unit can be considered to have received the equivalent of one full burn. It is expected that some burn unit

boundaries will be adjusted, but that the boundaries will eventually be standardized. Generally, burns will be conducted on a 3-5 year rotation.

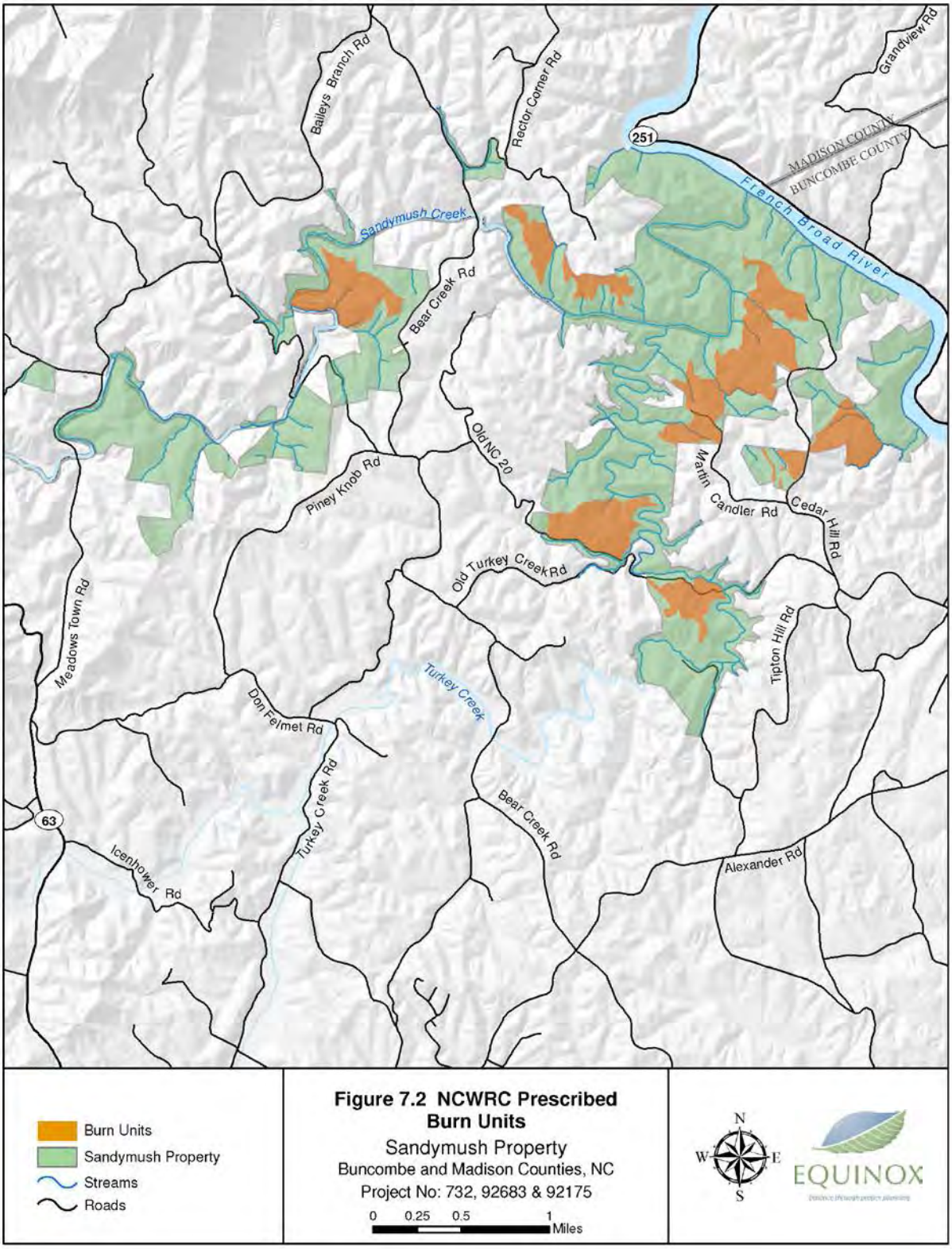
Based on the burn unit boundaries used by the NCWRC through 2013, approximately 27,500 feet or about 18% of riparian area (one side of the stream channel ≥30 feet wide) in the enhancement reaches will be regularly affected by the controlled burn program. According to the invasive plant assessment data, 55% of ground within those riparian areas is estimated to be covered by invasive plants. The burn units also include approximately 5,168 feet of riparian areas adjacent to HQP stream channels. Based on observations, nonnative invasive plants in these areas are much less pervasive and not considered a significant threat to the existing native plant communities.

To facilitate controlled burn activities, the DMS proposes allowing the NCWRC to utilize streams as firebreaks. Doing so will greatly reduce or eliminate the need for the plowing of firelines in adjacent upland areas, an activity that could result in erosion and stream sedimentation and one that complicates executing the burns. Fires will be allowed to burn into both the 30 foot riparian areas of the enhancement reaches and the 300 foot buffers of the HQP reaches. This will be done to temporarily reduce undesirable plant species and release native seeds for regeneration. While it is realized that this approach will not eliminate non-native invasive plants due to the wet conditions that exist in the riparian areas, repeated suppression of those species using controlled burns should favor reestablishment of native plants and will give fast growing native shrubs and trees an opportunity to become established. As the riparian canopy matures, shade intolerant non-native plants are expected to be replaced by shade tolerant native species. Controlled burns that include both upland and riparian areas have a better chance of reducing non-native plant species over the long term. Spot mechanical and chemical treatments may still be carried out, but at a much reduced rate than would otherwise be required. Such activities within the riparian zone are consistent with the deed restrictions for the Sandymush property.

7.3.5 Replanting Plan

Replanting of the riparian areas with containerized trees and shrubs are not part of the overall management plan. Following controlled burns, trees and shrubs will be allowed to become reestablished by natural regeneration. Based on NCWRC experience, native plant species will become established if given a chance to outcompete more aggressive non-native plant species. Typical native mountain species that likely will become reestablished in the riparian areas include northern red oak (*Quercus rubra*), green ash (*Fraxinus pennsylvanica*), river birch (*Betula nigra*), and American sycamore (*Plantanus occidentalis*).

Figure 7.2 NCWRC Prescribed Burn Units



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8 MAINTENANCE PLAN

Under the proposed management strategy, specific mitigation site maintenance plans beyond the routine activities described in the NCWRC management plan will be developed as the results of management activities are evaluated. The DMS and NCWRC shall have an initial meeting to discuss implementation of the NCWRC's management plan. The purpose of the meeting will be to review general management activities, to discuss specific activities proposed for the first year of the plan, and to identify specific maintenance needs not included in the management plan. Subsequent to this first meeting, the NCWRC will submit an annual report that documents activities completed during the previous year and describes proposed activities for the upcoming year.

The NCWRC generally has staff on the Sandymush property on a weekly basis. As a consequence, the NCWRC will be able to monitor site conditions as necessary and to take follow-up actions as needed. It will also allow them to routinely follow-up on livestock intrusions, making sure fence repairs are completed in a timely manner.

In general, management measures necessary to correct routine problems will be identified and plans to implement the corrective actions will be carried out independently by the NCWRC. Non-routine corrective actions will be presented to the DMS for approval prior to implementation. All maintenance or other corrective actions will be documented in the NCWRC's annual report to DMS. The DMS and NCWRC will meet as the need arises; either party may call for such a meeting.

9 PERFORMANCE STANDARDS

Under this mitigation plan riparian area non-native invasive plants will be controlled primarily through the use of controlled burns, with some supplemental mechanical and chemical controls. Native plant communities will be reestablished through natural regeneration. Any deviation from this approach will be considered part of an adaptive management approach for the Sandymush property. As a consequence, no specific performance standards are being required.

Site specific management actions will be evaluated by annual assessments made by visually observing the managed reaches and monitoring activities as described in Section 10.

10 MONITORING and REPORTING REQUIREMENTS

The NCWRC will routinely monitor the results of the management activities affecting riparian buffers. Those activities will be documented in an annual report that will address the following:

- Overall conditions of the riparian areas impacted by controlled burns within the last 5 years
- Management actions completed
- Corrective actions taken to address maintenance issues
- Assessment of ecological uplift obtained for wildlife benefits
- Photo-documentation of management actions in time series
- Proposed management activities for the next year

The NCWRC and DMS will meet as necessary to discuss issues related to management of the riparian areas.

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11 LONG-TERM MANAGEMENT PLAN

By a Memorandum of Agreement between the DMS and NCWRC (Appendix A) the NCWRC has been assigned management responsibility for the Sandymush mitigation site. Upon approval of this mitigation plan by the IRT, the NCWRC will assume responsibility for managing and monitoring the Sandymush property and will do so following their Sandy Mush Game Land Management Plan (NCWRC 2014). The NCWRC will be responsible for managing the entire tract in perpetuity for conservation purposes and to prohibit any uses of the property that would result in degradation of springs, seeps, streams, or wetlands on the property. Management will focus on the continued improvement of wildlife habitats and the restoration of native plant communities. To accomplish this, they will restrict the use of horses, bicycles, or motorized vehicles on the property to the extent that those activities do not to violate the deed restrictions or cause undue erosion or degrade water quality. They shall be responsible for periodic inspections of the site to ensure that restrictions specified in the deed document(s) and DENR-NCWRC Memorandum of Agreement are upheld. The NCWRC will submit an annual monitoring report describing the general conditions of the streams, wetlands, and upland areas as required and described in Section 10.

The current NCWRC management plan for the Sandy Mush Game Land is designed to cover a 10-year period. At the end of that period or whenever the plan is revised, the NCWRC shall consult with the DMS to ensure nothing in the plan revision abrogates the existing NCWRC-NCDENR MOA or deed restrictions as they apply to mitigation requirements. The USACE will be provided the opportunity to review plan revisions prior to implementation.

12 ADAPTIVE MANAGEMENT PLAN

Because all mitigation credits for the Sandymush projects will be released upon approval of this plan by the IRT, no formal adaptive management plans are being proposed. Management activities will be adapted by the NCWRC as conditions warrant and as described in their management plan (NCWRC 2014). These adaptations will be made to achieve ecological uplift that meet the NCWRC's management plan objectives and that are in concert with DMS objectives.

13 FINANCIAL ASSURANCES

Pursuant to Section IV H and Appendix III of the North Carolina Ecosystem Enhancement Program's In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the U.S. Army Corps of Engineers Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by DMS. This commitment provides financial assurance for all mitigation projects implemented by the program.

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14 OTHER INFORMATION

14.1 Definitions

Active Wildlife Management Activities – Includes the maintenance of openings by mowing or other clearing techniques; cultivation of grains or other crops as food for wildlife

Assessment Area – Comprised of 12 distinct portions of the Sandymush tract that were created for administrative and evaluation purposes.

Cataloging Unit (CU) – A six-digit code that identifies a portion of a river basin.

Enhancement Reach – a 30 foot wide strip of the riparian area on one side of the stream that has relatively uniform characteristics of topology and vegetation (trees, shrubs, and herbaceous plants). Depending on their characteristics, reaches on opposite sides of the stream may or may not begin or end in the same location.

Hydrologic Unit Code (HUC) – a sequence of numbers that identifies a portion of a river basin. Applied codes are fashioned in a hierarchical sequence; HUCs with more digits represent smaller portions of a river basin. In this document six digit cataloging units (CUs) and 12 digit HUCs are referenced.

Project Area – Consists of the entire 2,688+ acres of the Sandymush tract.

Riparian Buffer (Area) – a strip of land on either side of the stream channel that extends upland for a distance of 30 feet from the top of the bank along reaches classified as “enhancement” and 300 feet or to the property boundary for reaches classified as “preservation”.

State Natural Heritage Area - are an area of land or water that is important for the conservation of the natural biodiversity of North Carolina. These areas are is expected to contain the best populations of rare species, their habitat, and exemplary natural communities.

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14.3 APPENDIX A. Site Protection Instrument(s)

EXHIBIT D

DECLARATIONS AND RESTRICTIONS

The GRANTEE, State of North Carolina, sets aside, declares, reserves and recognizes, for all related State Agencies, and for the benefit of the people of the State, a perpetual riparian buffer on the Property, hereinafter identified as the "Restricted Area". The Restricted Area extends outwardly 300' (Three Hundred Feet) from both sides of the top of bank of Sandy Mush Creek, including all associated stream channels, creeks, rivers and all other identified tributaries. The Restricted Area also applies to any and all identified or defined wetlands on the Property. The Restricted Area as defined herein is subject to the restrictions set forth on this **Exhibit D** and will be forever conserved and managed in a manner that will improve and protect the quality of the waters of the Sandy Mush and Turkey Creeks, and otherwise promote the public purposes authorized under the provisions of N.C. General Statute § 143-214.8.

EXCEPTION TO DECLARATIONS AND RESTRICTIONS

The GRANTEE, State of North Carolina, and the N.C. Ecosystem Enhancement Program acknowledge and agree that the GRANTOR's Easements are hereby excepted from these Declarations and Restrictions and that the GRANTOR's Easements and all rights, privileges, and easements reserved unto GRANTOR in this Deed shall not be subject to, burdened, abridged, limited, restricted, prohibited, or otherwise affected in any manner by these Declarations and Restrictions.

PURPOSES OF RESTRICTIONS

The purposes of these restrictions are to maintain, restore, enhance, create and preserve wetland and/or riparian resources within the Restricted Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Restricted Area in its natural condition, consistent with these purposes; and to prevent any use of the Restricted Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

RESERVED USES AND RESTRICTED ACTIVITIES

A. Motorized Vehicles. Usage of motorized vehicles in the Restricted Area is prohibited, except as they are used exclusively for management, maintenance, or stewardship purposes, and on existing trails, paths or roads for the purposes recited above.

B. Vegetative Cutting. Except as related to the removal of non-native plants, diseased or damaged trees, and vegetation that obstructs, destabilizes or renders unsafe the Restricted Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Restricted Area is prohibited.

C. Industrial, Agricultural, Residential and Commercial Uses. All are prohibited in

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the Restricted Area.

D. New Construction. There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Restricted Area.

E. Roads and Trails. There shall be no new construction of roads, trails, walkways, or paving in the Restricted Area. Existing roads or trails located in the Restricted Area may be maintained in order to minimize runoff, sedimentation and for access to the interior of the Property for management, maintenance, stewardship purposes, or undeveloped recreational and educational uses of the Restricted Area. Existing roads, trails or paths may be maintained with loose gravel, soil, or permanent vegetation to stabilize or cover the surfaces.

F. Signs. No signs shall be permitted in the Restricted Area except interpretive signs describing restoration activities and the conservation values of the Restricted Area, signs identifying the owner of the Property, signs giving directions, or signs prescribing rules and regulations for the use of the Restricted Area may be allowed.

G. Dumping or Storing. Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances or machinery, or other material in the Restricted Area is prohibited.

H. Grading, Mineral Use, Excavation, Dredging. Unless related to approved restoration activities, there shall be no grading, filling, excavation, dredging, mining, or drilling within the Restricted Area.

I. Water Quality and Drainage Patterns. Unless related to approved restoration activities, there shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water in the Restricted Area. No altering or tampering with water control structures or devices, or disruption or alteration of the restored, enhanced, or created drainage patterns. Any use of pesticide or biocides is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Restricted Area may temporarily be used for good cause shown as needed for the survival of livestock and agricultural production.

J. Subdivision and Conveyance. No further subdivision, partitioning, or dividing of the Restricted Area is allowed.

K. Disturbance of Natural Features. Any change, disturbance, alteration or impairment of the natural features of the Restricted Area or any intentional introduction of non-native plants, trees and/or animal species is prohibited.

L. Restoration Activities Are Permitted. Includes but not limited to planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and

subterraneous water flow according to a restoration plan as provided, contracted, or managed by the N.C. Ecosystem Enhancement Program.

M. Permission. Permission to vary from the above restrictions may be granted by the N.C. Ecosystem Enhancement Program for good cause shown, provided that any such request is consistent with the purposes of these Restrictions. Permission and approval to vary must be obtained in writing from the N.C. Ecosystem Enhancement Program, whose mailing address is 1652 Mail Services Center, Raleigh, NC 27699-1652.

N. Enforcement. The right of enforcement of these Restrictions is hereby granted to and vested entirely with the N.C. Ecosystem Enhancement Program, its successors and assigns. The GRANTOR is not reserving any right of enforcement in these Declarations or Restrictions or any other right, title or interest in the Property, except for the GRANTOR's Easements or as otherwise set forth in this Deed.

DENR CONTRACT NO.: D06083

STATE OF NORTH CAROLINA
COUNTY OF WAKE

(11-066.00)

MEMORANDUM OF AGREEMENT

THIS MEMORANDUM OF AGREEMENT, made this the 18th day of January, 2005, by and between the NORTH CAROLINA WILDLIFE RESOURCES COMMISSION (hereinafter "WRC") AND THE DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES, ECOSYSTEM ENHANCEMENT PROGRAM (hereinafter "EEP"),

WITNESSETH:

NOW, THEREFORE, in consideration of the mutual promises, obligations and benefits hereunder exchanged and obtained, WRC and EEP mutually covenant and agree as follows:

Purpose:

EEP and WRC have common goals in the protection, enhancement and conservation of wildlife and fishery resources in North Carolina, and in the protection of plant and animal habitats throughout the State. The purpose of this Memorandum of Agreement (hereinafter "MOA") is to establish an understanding between EEP and WRC for the management and protection of the State-owned property purchased from Progress Energy by EEP in December 2004, being approximately 2,600 acres in Madison and Buncombe Counties, and referred to as the **Sandy Mush Tract** (hereinafter "Tract").

Background:

The Tract was purchased as compensatory mitigation for unavoidable losses in wetland and stream functions associated with NC DOT road improvements in the area. Restrictions in the deed of the Tract to the State provide for the protection of riparian buffers within 300' of the top of all stream banks as well as all wetlands on the Tract. Although some of the riparian area on the Tract is in very good condition, the majority of the streams on the Tract need to be restored or enhanced. There are three significant natural heritage areas on the Tract known as Turkey Creek Gorge, Sandy Mush Creek, and Alexander Cliffs and Slopes. These areas are not included in the restoration or enhancement activity. These three areas will be managed for the protection of the rare species or natural communities living there. Detailed reports listing the rare fish, animals and plants on the site are available from EEP or the Natural Heritage Program. Restoration and enhancement activities on the Tract will take place in several phases, with the first phase scheduled to begin on site in the winter of 2006.

Agreement:

1

Although the upland portions of the Tract are not subject to the deed restrictions, the entire Tract shall be managed for conservation purposes. Protection of intermittent streams and the uplands, as well as managing the entire Tract for natural resource values, is necessary to maintain and enhance the ecosystem benefits and maximize mitigation credits.

Proposed activities on the Tract by the N.C. Audubon Society, Quail Unlimited, and other interest groups will only be allowed if the activities are consistent with the goals of both EEP and WRC and the required ecosystem protections and benefits.

The parties to this MOA agree that there will be no sale by or through either of them or use of the uplands on the Tract for non-conservation purpose.

EEP Responsibilities:

- To restore and enhance certain streams on the Tract for the benefit and protection of water quality.
- To request that the NC Dept. of Administration allocate the entire Tract to WRC for management.

WRC Responsibilities:

- To protect the entire Tract for conservation purposes, either as non-game or endangered species habitat or as game land.
- To prohibit any use of the property that would result in degradation of springs, seeps, streams or wetlands on the Tract.
- To allow EEP, its contractors and assigns, reasonable access across the Tract to the restoration and enhancement sites, and allow them to carry out all necessary restoration and enhancement activities on the Tract.
- To coordinate with EEP to restrict hunting activities, if necessary, during periods of fieldwork to protect EEP, its contractors and assigns.
- To provide an annual monitoring report describing the general conditions of the streams, wetlands and upland areas on the Tract as required by the regulatory agencies. No other monitoring reports describing the restored or enhanced stream characteristics will be required unless EEP agrees to provide funding for the additional reports.

This document sets forth the entire agreement between EEP and WRC, and supplants any and all earlier agreements between the parties regarding use of this property.

All conflicts arising from the implementation of the MOA which cannot be resolved by senior staff of the two agencies shall be finally resolved by the EEP and WRC Directors.

No amendments to this MOA may be made except by mutual agreement in writing by the parties.

Termination for Cause

If either party fails to perform or comply with any condition of this agreement and such failure should continue more than 30-days after written notice from the other party, and if the non-compliant party should not within 30-days commence to cure the failure with due diligence, the aggrieved party may terminate this MOA on written notice to the non-compliant party, termination to be effective not less than 15 days from the date of the written termination notice.

The effective date of this MOA is the date of the last signature below.

1/06/06
Date

Richard B. Hamilton
Richard Hamilton, Director
NC Wildlife Resources Commission

1/12/06
Date

for William G. Ross, Secretary
Department of Environment and Natural Resources

14.4 APPENDIX B. Baseline Information Data

Baseline documentation for this project was reported in the Environmental Resources Technical Report (ERTR) prepared for NCEEP by Baker Engineering (NCEEP 2007). Key elements of the ERTR applicable to the mitigation plan are referenced from that report as follows:

NCDWQ Stream Classification Forms – Perennial and intermittent streams were identified using the NCDWQ methodology. The field forms used on the Sandymush tract are included in Appendix 2 of the ERTR.

FHWA Categorical Exclusion Form – Documentation supporting classifying this project as eligible for categorical exclusion is presented in Appendix 3 of the ERTR. It includes letters of concurrence from the following agencies:

- State Historic Preservation Office
- North Carolina Department of Cultural Resources
- Eastern Band of the Cherokee Indians
- U.S. Fish and Wildlife Service
- North Carolina Wildlife Resources Commission

A categorical exclusion form was not prepared. Although there was some concern regarding archaeological resources being impacted by stream restoration activities, those comments are not applicable to the current project proposal that does not involve any land disturbing activities.

Eighteen wetlands were identified in the ERTR as being present on the Sandymush property. However, neither the USACE Routine Wetland Determination Forms nor the NCDWQ Wetlands Assessment Methodology forms were applied during the stream and wetland inventory process. Since DMS is not pursuing mitigation credits for wetlands on this site, no additional wetland assessment is included in this report.

FEMA Compliance – The ERTR states that the project is not located within a regulatory floodplain; therefore, no additional floodplain information was prepared.

14.5 APPENDIX C. Enhancement Level Riparian Area Data Collection and Analyses

Background

The assessment work conducted for this mitigation plan addressed issues only related to Enhancement Level II activities. Because Restoration or Enhancement Level I activities are not proposed for the project site, no channel morphology, water surface modeling, sediment transport analysis, channel stability analysis, groundwater modeling, soil delineation or CVS vegetation assessments were conducted. The following describes the riparian assessment activities and data analyses that were completed to support development of this mitigation plan.

Field Data Collection and Map Preparation

Stream reaches and data collection areas from the *Sandymush Stream Restoration Conceptual Mitigation Design* document (Baker 2007) were used to guide field assessment activities. Field maps were prepared prior to field work showing stream enhancement reaches and aerial photos. Only Enhancement II reaches were observed in the field; preservation reaches were not visited.

Reaches were accessed from public roads, NCWRC managed dirt roads, or by walking along streams where roads were not present. One stream bank (right or left descending) was walked (upstream or downstream) while observing typical riparian conditions within 30 feet of the stream bank. Where both stream banks were observable, conditions were observed for each bank simultaneously. Photographs and latitude and longitude waypoints were taken at the start and end of each reach using a Global Positioning System (GPS) unit. Where conditions changed significantly (i.e. buffer width change, canopy change, percent cover of invasive plant change), a new reach was delineated. Unique identifiers were assigned according to a reach's area, stream, sequence of which it was observed, and stream bank (ex: 1-2A-1L). These identifiers do not necessarily follow any sequential progression from upstream to downstream or vice versa.

For each reach, data regarding riparian buffer vegetation, livestock access, invasive exotic plant presence, invasive exotic plant estimated percent cover, and management options was recorded on a data sheet (Appendix Figure C-1). Field data was entered into an Excel spreadsheet for analysis.

Data Analysis

Metric Development and Scoring

To quantitatively evaluate conditions within the riparian areas, a metric scoring system was devised from the field assessment data. Metrics were developed for five attributes of riparian area conditions – wooded buffer width, canopy condition, active riparian management, livestock access, and percent of the riparian area covered by non-native invasive plants as follows:

Buffer Width – The portion of the 30 foot riparian buffer containing woody vegetation. Buffer width was divided into three categories and metric scores applied as follows:

Category	Score
0-10 feet	3
11-20 feet	2
21-30 feet	1

Canopy Condition – Canopy cover was measured using combinations of tree density and maturity. Descriptive qualitative categories and metric scores for this attribute are as follows:

Category	Score
Little or no trees	5
Sparse and young trees	4
Sparse and mature trees	3
Dense and young trees	2
Dense and mature trees	1

Active Riparian Management – Management activities within the riparian area were documented in three categories with metric scores as follows:

Category	Score
Active	2
Historic	0
None	0

Livestock Access –Livestock access to streams and riparian areas was based on a combination of current survey observations and 1998 aerial photographs. This was necessary to account for successional changes in riparian vegetation that has occurred since livestock were removed shortly after purchase of the property. Livestock access categories and metric scores were as follows:

Category	Score
Yes, known livestock access	2
No, livestock access not evident	0

Percent Invasive Cover in Riparian Area – Impacts of non-native invasive plant species were based on the total percentage of the riparian area in each reach estimated to be covered by all species combined. Categories and metric scores were as follows:

Category	Score
81-100%	5
61-80%	4
41-60%	3
21-40%	2
0-20%	1

In addition to the metric scoring, dominant and secondary non-native plant species present in each reach were identified. These data were intended to be used in the development of treatment prescriptions.

Metric scores for all attributes were applied to each reach; the metric scores were then totaled for each reach to obtain a measure of each reach's overall condition. Possible total metric scores ranged from 3 to 17. The reach scores for each assessment area were then averaged to obtain an indicator of the relative condition among areas. Assessment areas were then ranked according to their average scores to determine potential priorities for the development of treatment prescriptions.

Results

General Findings - A total of 254 reaches were examined during the field assessment. Twenty-two species of non-native invasive plants were documented (Appendix Table C-1). The four most dominant species were privet, Japanese honeysuckle, multiflora rose, and oriental bittersweet. One to four of these species were dominant on 113 of the 254 reaches (44%) surveyed. In addition, 95% (245 of 254 reaches) had 4 to 9 non-native invasive plant species present, but that did not dominate the reach. Only one reach was found to contain no non-native invasive plants.

Appendix Table C-1. Non-native Invasive Plant Species

USDA Symbol[1]	Scientific Name	Common Name
LISI	*Ligustrum spp.*	Privet
LOJA	*Lonicera japonica*	Japanese Honeysuckle
ROMU	*Rosa multiflora*	Multiflora Rose
CEOR	*Celastrus orbiculatus*	Oriental Bittersweet
LOMA6	*Lonicera maakii*	Bush Honeysuckle
ELUM	*Elaeagnus umbellate*	Autumn Olive
MISI	*Miscanthus sinensis*	Chinese Silvergrass
CLTET2	*Clematis terniflora*	Sweet Autumn Virginsbower
POCU6	*Polygonum cuspidatum*	Japanese Knotweed
PATO2	*Paulownia tomentosa*	Princess Tree
AIAL	*Ailanthus altissima*	Tree of Heaven
MIVI	*Microstegium vimineum*	Japanese Stiltgrass
PUMO	*Puerariam montana*	Kudzu
SPBU2	*Spiraea japonica*	Japanese Spirea
ALPE4	*Alliaria petiolata*	Garlic Mustard
CIRSI	*Cirsium spp.*	Thistle
SOHA	*Sorghum halepense*	Johnson Grass
FESTU	*Festuca spp.*	Fescue
VIMI2	*Vinca minor*	Periwinkle
DIOP	*Dioscorea oppositifolia*	Chinese Yam
HEHE	*Hedera helix*	English Ivy
BETH	*Bereris thunbergii*	Japanese Barberry

[1]USDA, NRCS (2013)

Riparian Reach Conditions – Based on the general findings, all assessed riparian reaches show some level of ecological degradation, either from past livestock activities or presence of non-native invasive plants. Approximately 34% of the reaches had total metrics scores of 9 or greater indicating the severity of conditions in the riparian areas of the Sandymush tract (Appendix Table C-2).

Appendix Table C-2. Total Metric Score Distribution by Reach

Total Metric Score Group	Number of Reaches
3-4	54
5-8	113
9-12	59
13-17	28

Overall, mean total metric scores among areas ranged from 6-9, indicating that riparian area conditions are uniformly degraded across the Sandymush EII reaches (Appendix Table C-3); however, examination of individual reach values within each assessment area revealed that metric scores were highly variable in all areas. Such high variability within and among assessment areas suggests that most reaches would benefit from some type of treatment.

Mapping of the total metric scores (Appendix D) reveals that the distribution of the reaches with the highest total metric scores may provide a basis for prioritizing management activities.

Appendix Table C-3. Mean Total Metric Score by Area and Rank

Rank	Area	Mean Total Metric Score	Range of Total Scores	Number of Reaches
1	1	9.3	4-17	27
2	8	8.8	4-16	14
3	5	8.1	3-14	18
3	6	8.1	3-14	24
3	7	8.1	3-14	28
4	4	7.9	4-14	36
5	3	7.3	4-12	29
6	9	7.2	4-15	6
7	12	6.2	3-11	18
8	2	6.1	3-9	8
9	10	6.0	3-11	26
10	11	5.9	3-12	20

Special Issues - Unique or special items that would affect management of non-native invasive species management on each reach were documented, categorized, and summarized by area. Special issues fell into the following eight categories (Appendix Table C-4):

- Powerline right-of-way present (PL) – a right-of-way crosses or parallels the affected reach
- Road present (RD) – non-public road affecting the reach and considered to have an unstable surface, i.e. not grassed or graveled
- Public road right-of-way (ROW) – a public road right-of-way encroaches into the riparian area
- Bridge present (BR) – some type of bridge structure present
- Culvert present (CU) – a portion of the stream within the reach flows within a culvert
- Beaver activity present (BV) – active beaver activity observed

- Steep or rocky bluff terrain (TER) – conditions within the riparian reach that would make management of non-native invasive plants extremely difficult

Appendix Table C-4. Number of Reaches Impacted by Special Issues

Area	Number of Reaches Impacted	Powerline Right-of Way	Non-highway Road	Public Road	Bridge	Culvert	Beaver	Steep/Rocky Terrain
1	7 of 27	4	1			1		
2	2 of 8							
3	11 of 29	2	1		3	2	2	2
4	20 of 36	14		2	4		1	
5	6 of 18	4						
6	6 of 24	5		4		1		1
7	8 of 28	6				3		1
8	1 of 14	1						
9	4 of 6	4						
10	7 of 26	1	1					
11	8 of 20	6		1		2		
12	9 of 18	4	1	3				
Totals	89 of 254	51	4	10	7	9	3	4

Summary and Conclusions – Based on the data and general observations made during the field data, the following conclusions were reached:

- Riparian areas impacted by past livestock grazing have generally become revegetated with herbaceous plants, but woody plants have yet to become well established
- Unstable stream banks have stabilized and erosion is greatly reduced due to the regrowth of herbaceous vegetation and some woody plants
- Non-native invasive plants are pervasive and found on virtually all study reaches
- Non-native plants extend well beyond the 30 foot riparian zone
- Non-native plants on upland areas (outside of the 30 foot buffer) are widespread
- Non-native plants in upland areas will serve as a seed source for treated riparian areas even if an aggressive treatment plan is implemented
- Mechanical and chemical treatment of non-native invasive plants would be costly
- Access to some areas would be difficult
- Multiple treatments would be required in most cases, thus requiring an extended period of time and multiple site visits
- Given the extent of non-native plants on the Sandymush property, herbicide treatment of the dense growths of these plants would result in a temporary increase in erosion and sedimentation, thus negating the improvements that have occurred since the property was acquired
- Non-native invasive plants are providing the following ecological benefits:
    - ❖ Ground cover that reduces erosion
    - ❖ Stabilization of stream banks
    - ❖ Filtering of sediment
    - ❖ Reduced sediment loads leading to improved aquatic habitat conditions
    - ❖ Wildlife cover and food
    - ❖ Improvements in water quality

Recommendations – Control of non-native invasive plants within riparian areas at the scope and scale that exist on the Sandymush property appears impractical, would not produce the desired ecological uplift, and likely would be cost prohibitive. Controlling the non-native invasive plants at the expense of existing ecological benefits does not seem warranted. The risk of those species becoming reestablished from adjacent seed sources is high and hopes to establish native riparian plant communities without long-term management appears overly optimistic and impractical. As an alternative, DMS should work with the North Carolina Wildlife Resources Commission to incorporate management strategies, including prescribed burns, which will suppress the non-native plant species and favor native species both within and outside of the riparian areas. This can be achieved by incorporating those activities into the NCWRC's management plan for the Sandymush property. Doing so will maintain the physical and ecological improvements of the riparian areas that have been achieved since the property was acquired and livestock grazing terminated. It will also capitalize on funding the NCWRC already has allotted to managing the property.

Appendix Figure C-1. Field Assessment Data Sheet

Site Information

Area: _____ Start Waypoint: _____ Date: _____

Stream:_____ End Waypoint: _____ Staff: _____

Reach: _____ □ Right Bank Descending □ Left Bank Descending

Riparian Buffer Assessment

Management within the 30 ft buffer: □ Yes, active within 3 years □ Yes, historic (greater than 3 yrs) □ No

Average Riparian Buffer Width from top of stream bank: □ 0-10 □10-20 □20-30

Typical Vegetation of Riparian Buffer:

□ Diverse trees, shrubs, and herbaceous vegetation. Plants healthy with good root systems.

□ Few trees or small trees and shrubs. Vegetation appears to be generally healthy.

□ Sparse mixed vegetation. Plant types and conditions suggest poor soil binding.

□ Mostly grasses and herbaceous vegetation. Few if any trees and shrubs.

□ Little or no vegetation; significant exposed bare soils.

Canopy Condition for Entire 30 ft Buffer: □ no canopy □ sparse and young □ sparse but mature □ dense and young □ dense and mature

Light Penetration of Riparian Buffer □ good canopy with some breaks for light □ full canopy with no light penetration

□ partial canopy with sunlight and shading essentially equal □ no canopy cover

□ minimal canopy with full sun in all but a few areas

Historic Livestock Access Evident: □ Yes □ No □ Unknown

Man-made structures or alterations: _____

Invasive Exotic Plant Assessment

Species Present (mark 1 if dominant and 2 if secondary):

___ Privet	___ Japanese Honeysuckle	___ Multiflora Rose
___ Oriental Bittersweet	___ Bush Honeysuckle	___ Autumn Olive
___ Chinese Silvergrass	___ Virginsbower Clematis	___ Japanese Knotweed
___ Princess Tree	___ Tree of Heaven	___ Japanese Stiltgrass
___ Kudzu	___ Japanese Spirea	___ Garlic Mustard

□ Other: _____

Percent Cover of Entire 30 ft Buffer: □ <1 □ 1-10 □ 11-20 □ 21-30 □ 31-40 □ 41-50 □ 51-60 □ 61-70 □ 71-80 □ 81-90 □ >90

Width of Invasive Cover within 30 ft Buffer: □ 0-10 □ 10-20 □ 20-30

Vines Climbing Over 8 ft: □ Yes □ No

DBH of Largest Invasive Tree or Shrub: □ 0-4 inches □ 4-8 inches □ >8 inches

Seed Bearing: □ Yes □ No

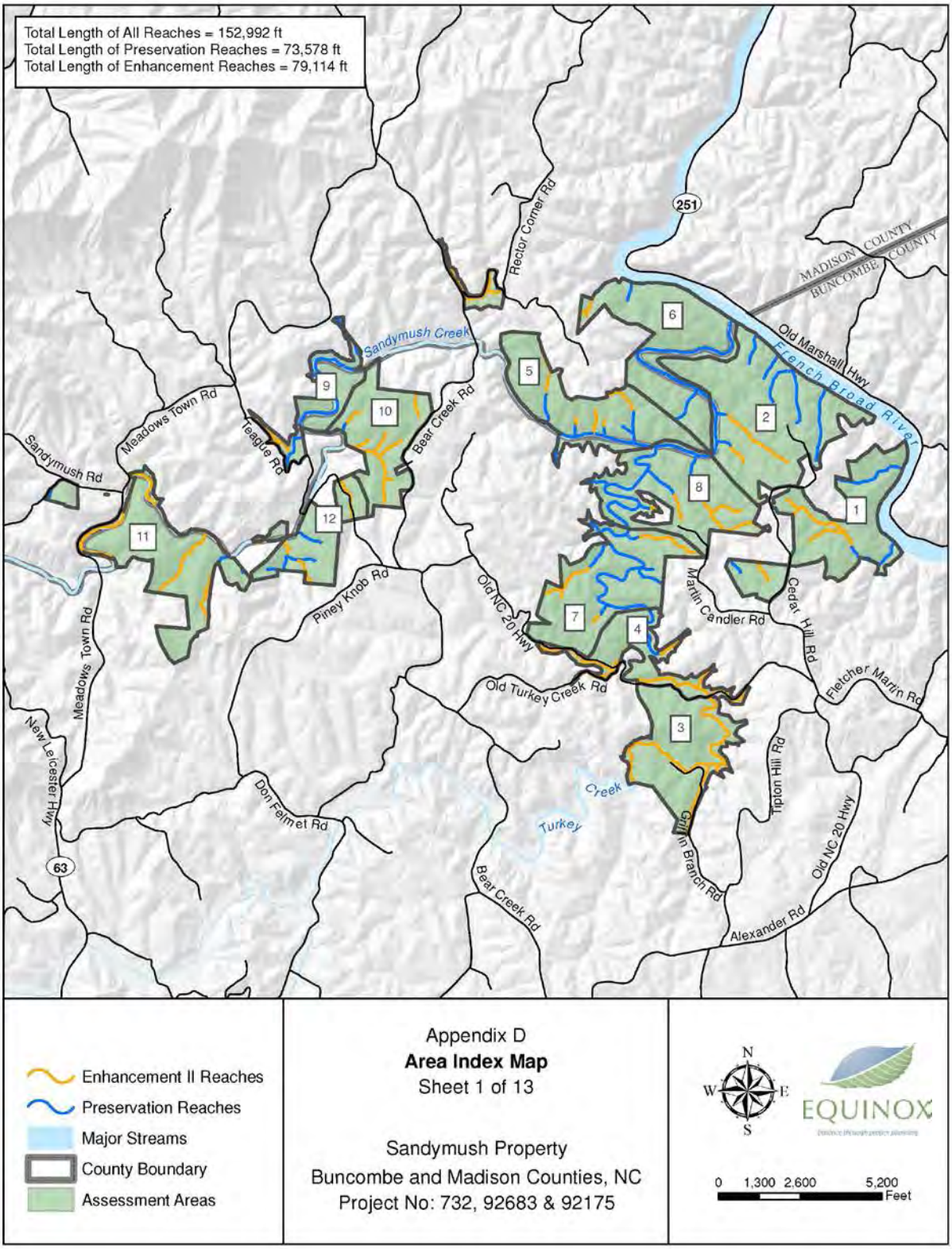
Treatment Type (check all that apply): □ Cut Stump with Chainsaw □ Cut Stump with Handsaw or Clippers □ Foliar □Basal Bark

Number of Treatments to achieve 80% control: □ 1-2 □ 3-4 □ 4-5 □ >5

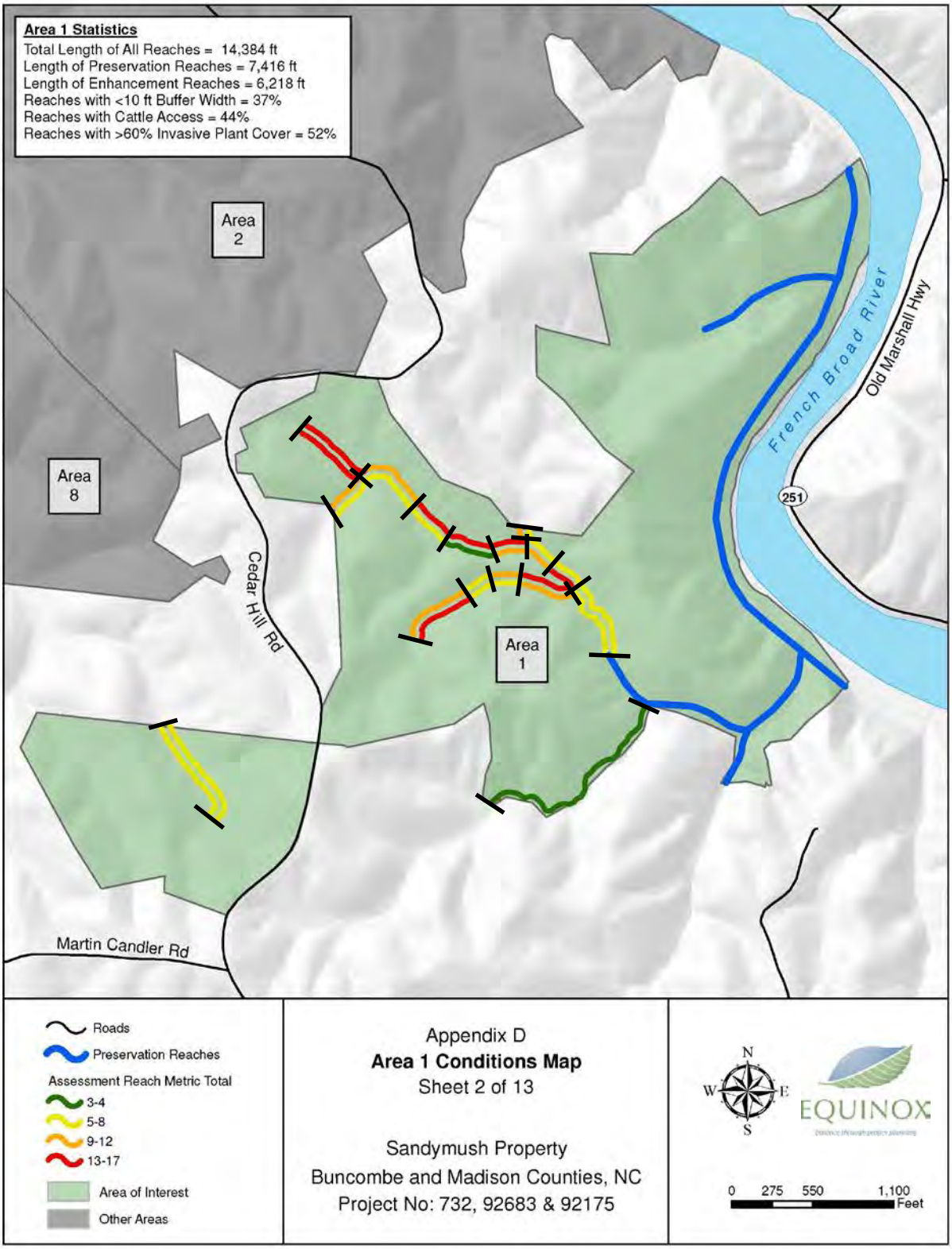
Field Based Management Priority Rating

Riparian Tree Planting:	□ High	□ Medium	□Low
Invasive Exotic Plant Control:	□ High	□ Medium	□Low

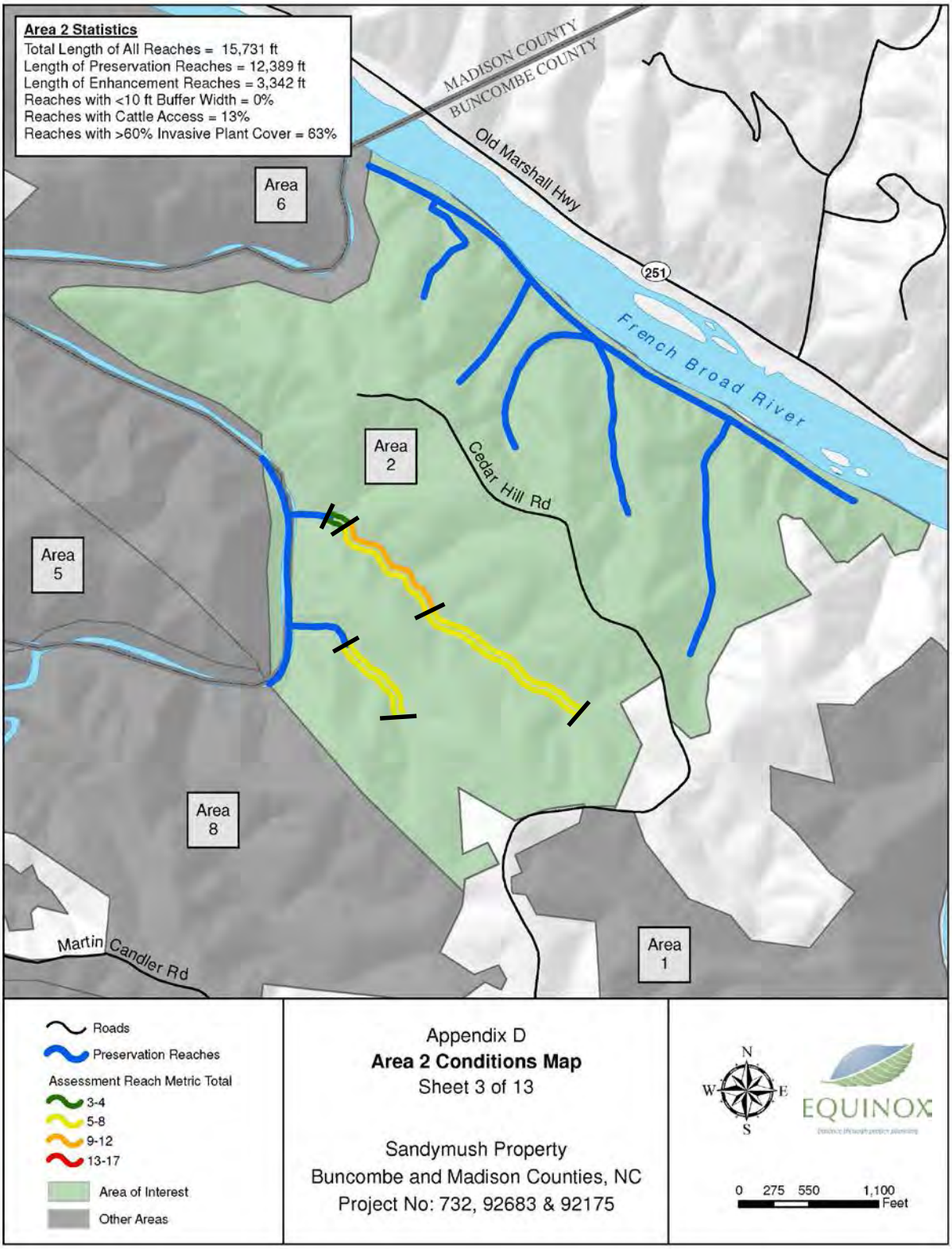
14.6 APPENDIX D. Riparian Area Reach Condition Maps (Sheet 1 of 13)



Riparian Area Reach Condition Maps (Sheet 2 of 13)



Riparian Area Reach Condition Maps (Sheet 3 of 13)



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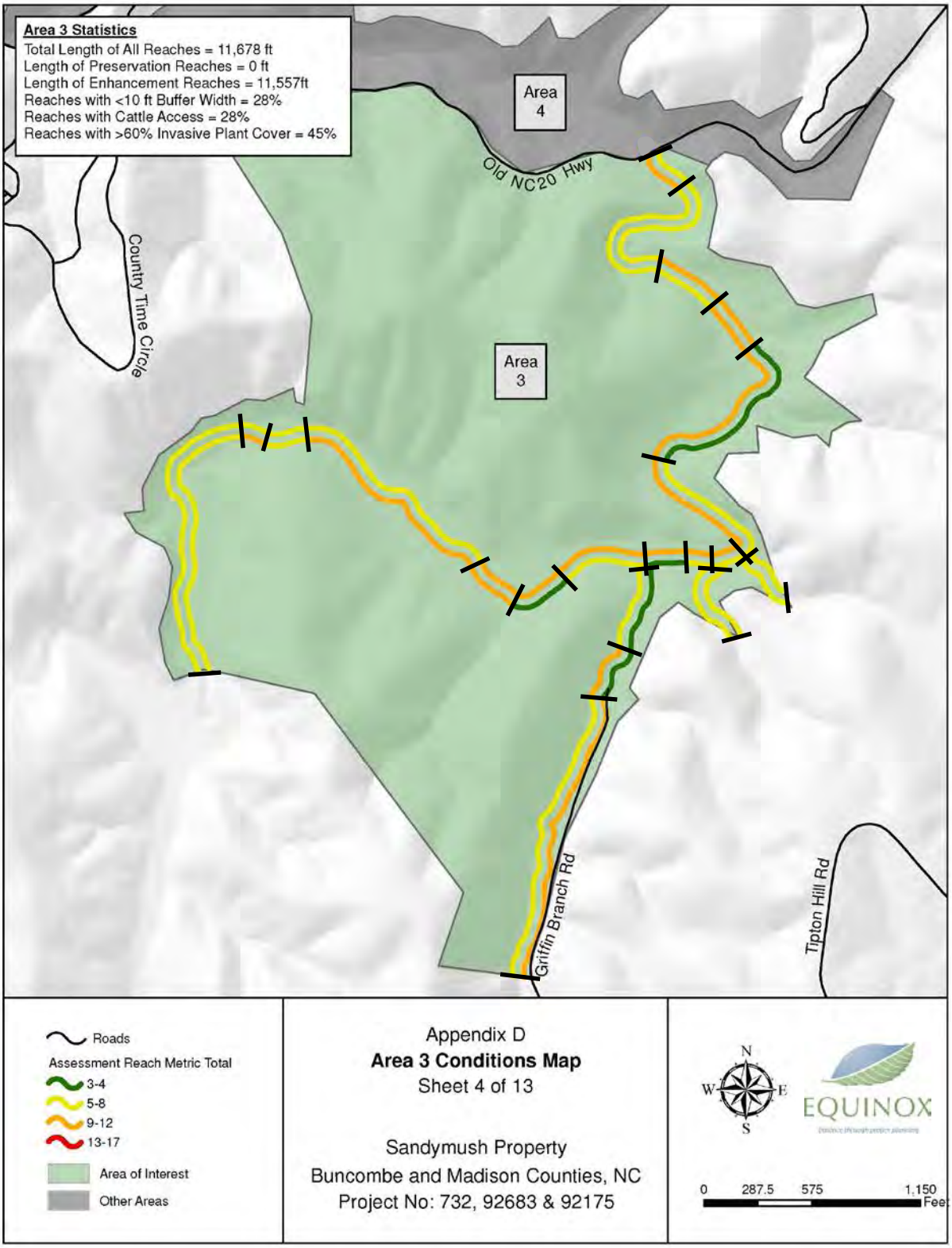

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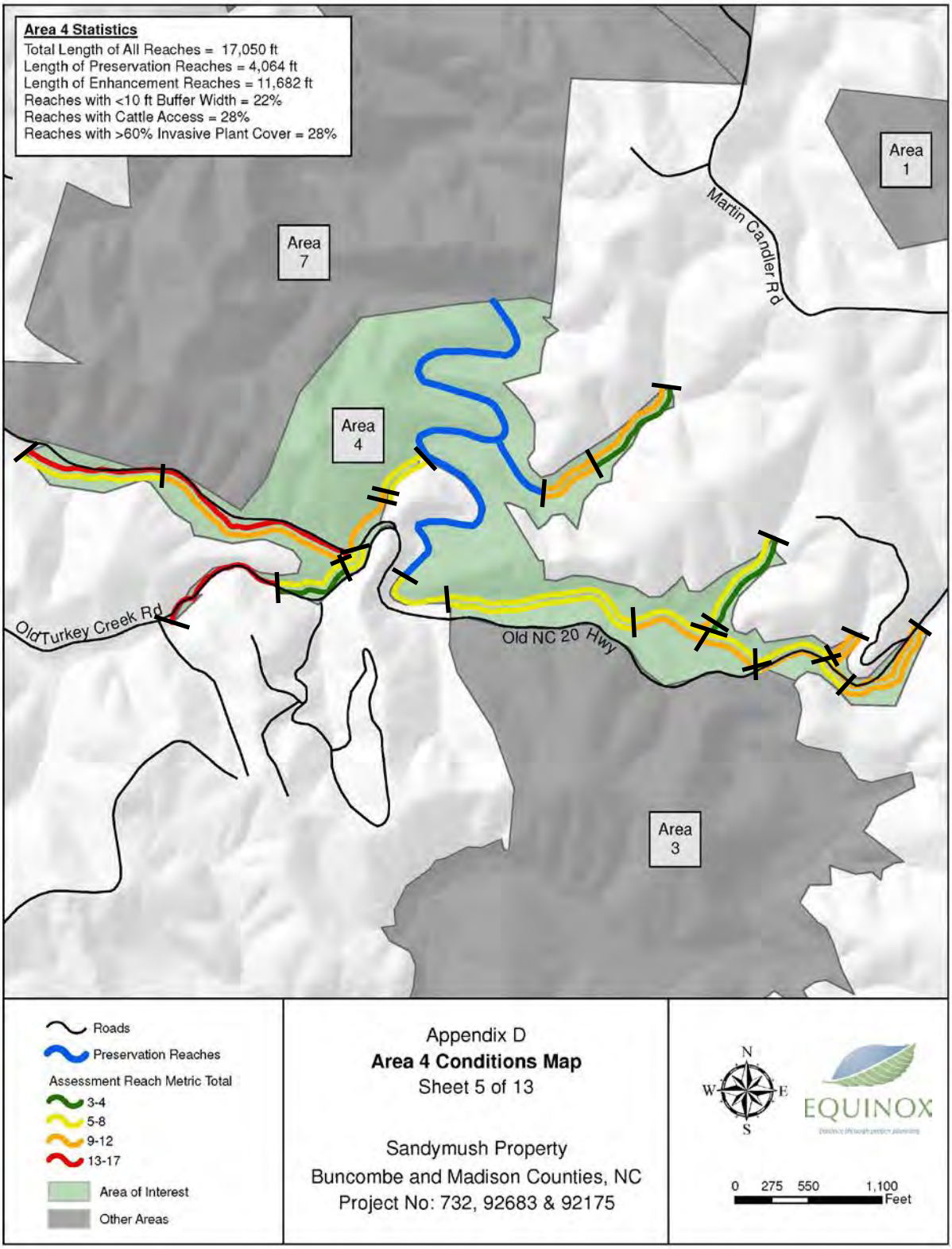

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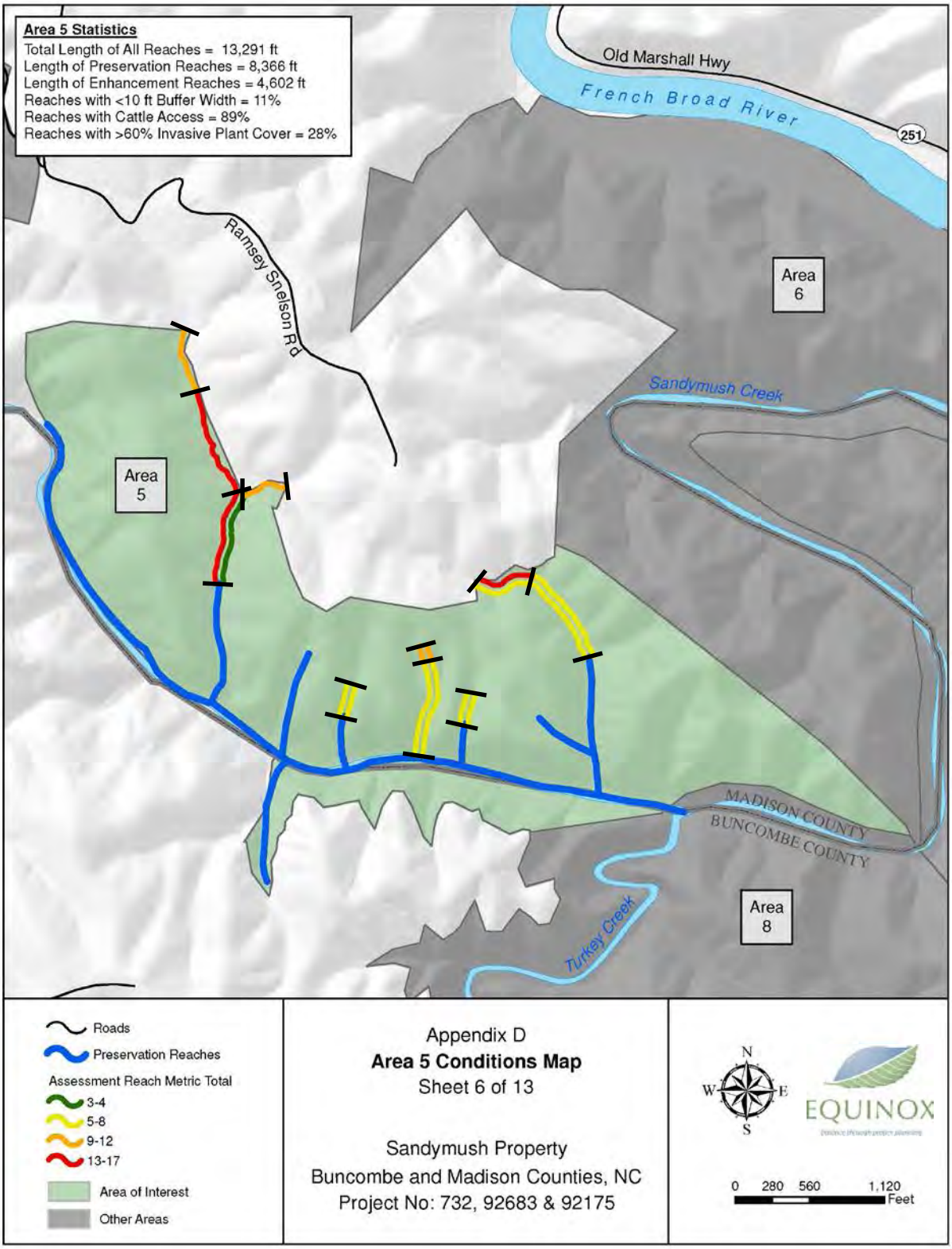

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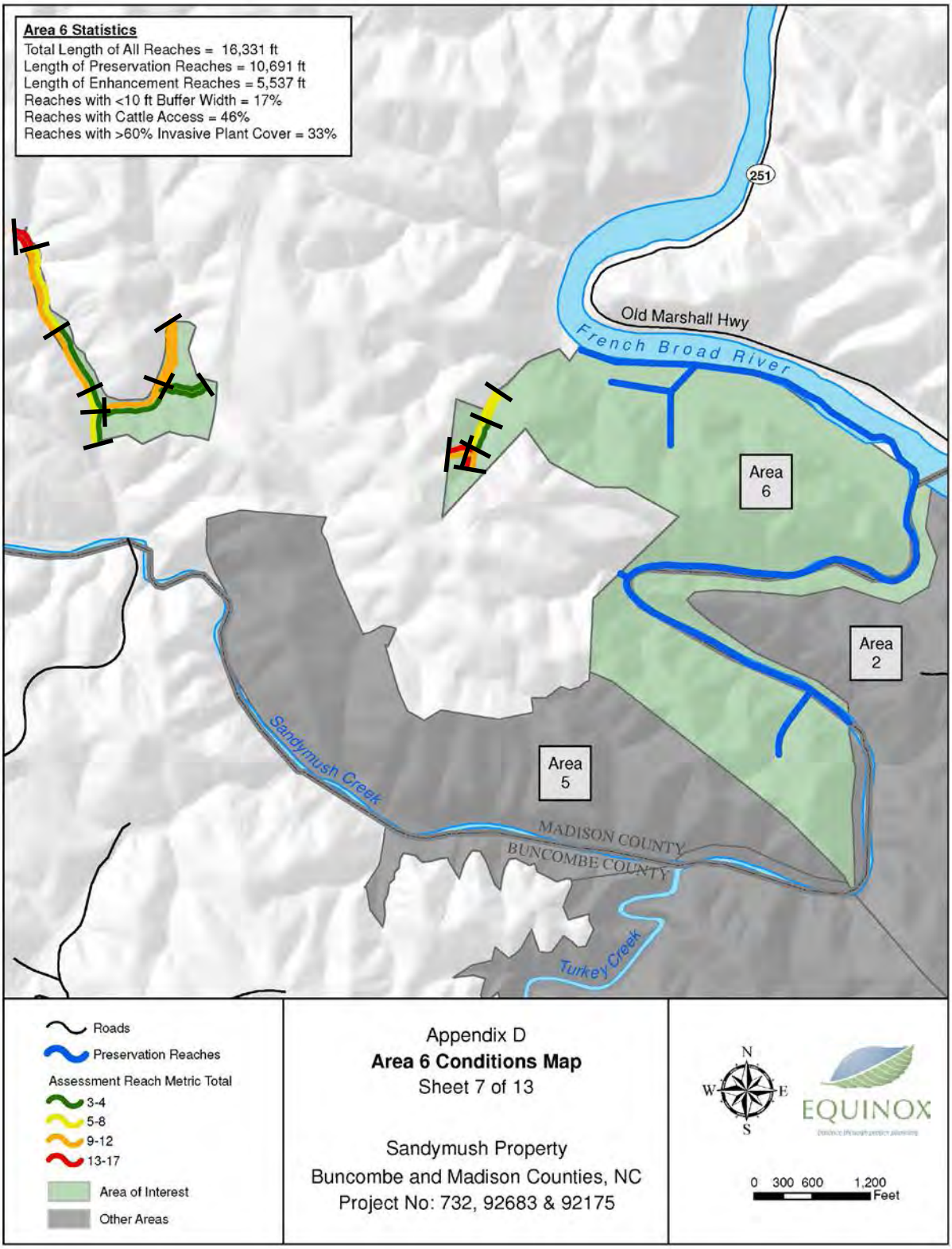

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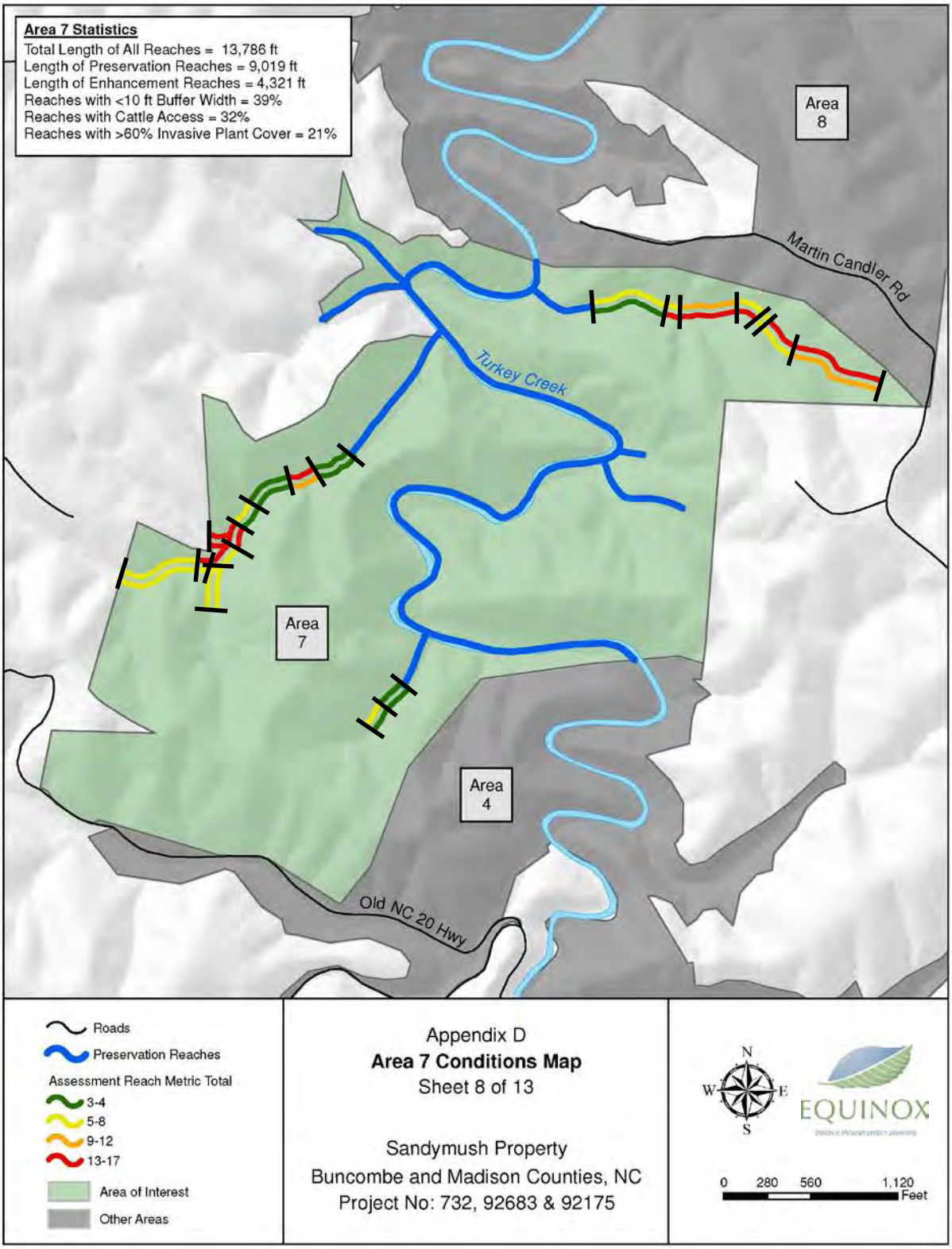

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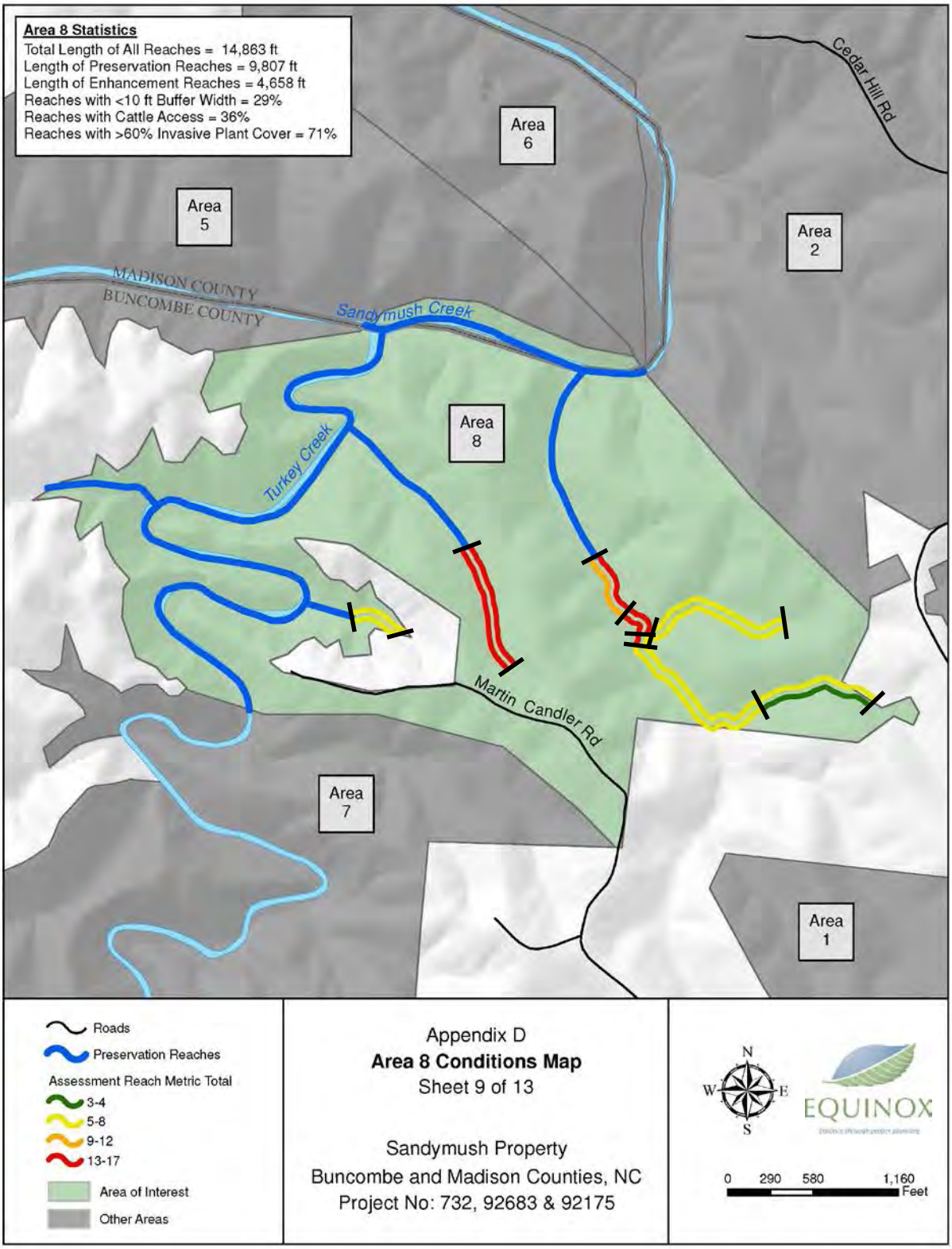

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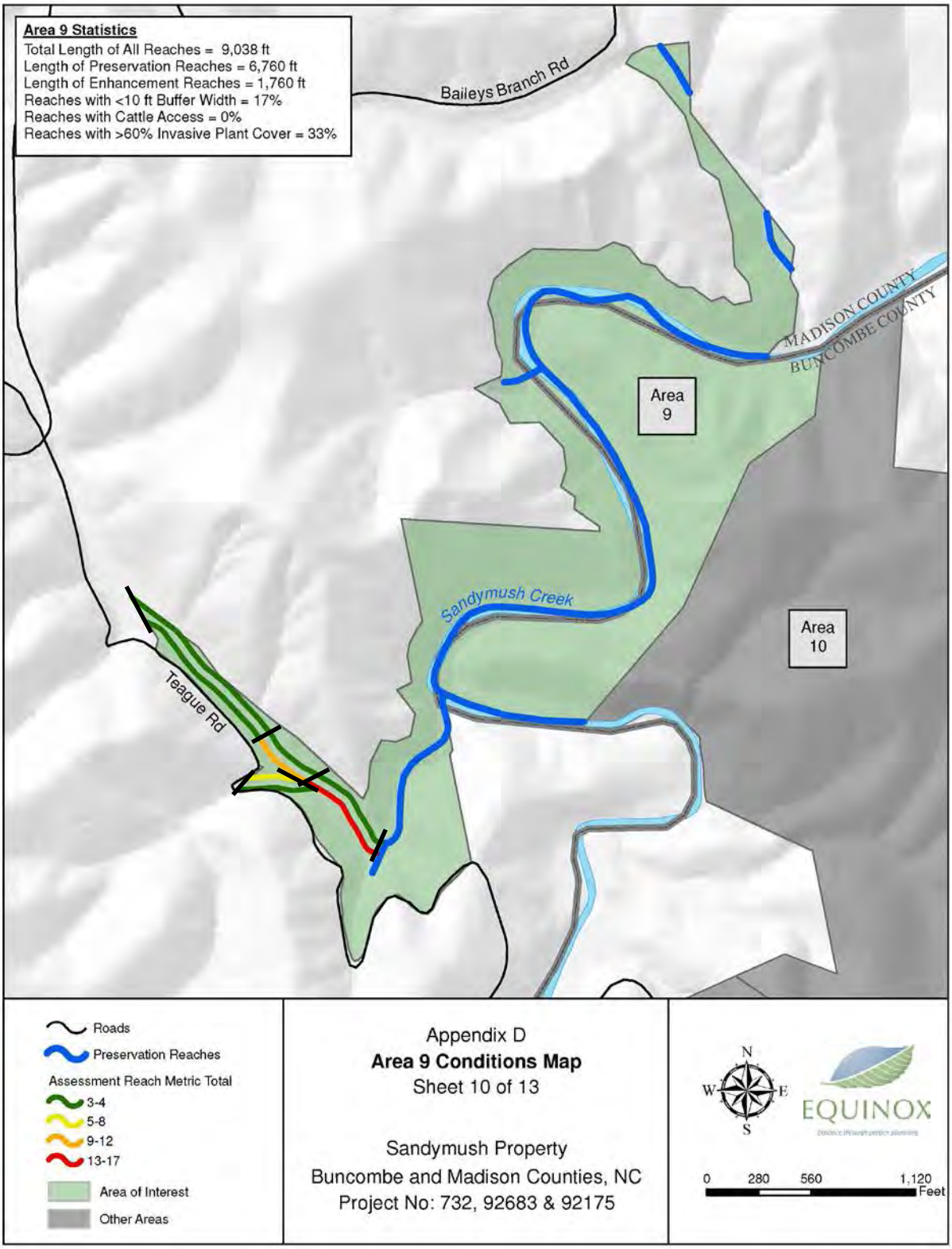

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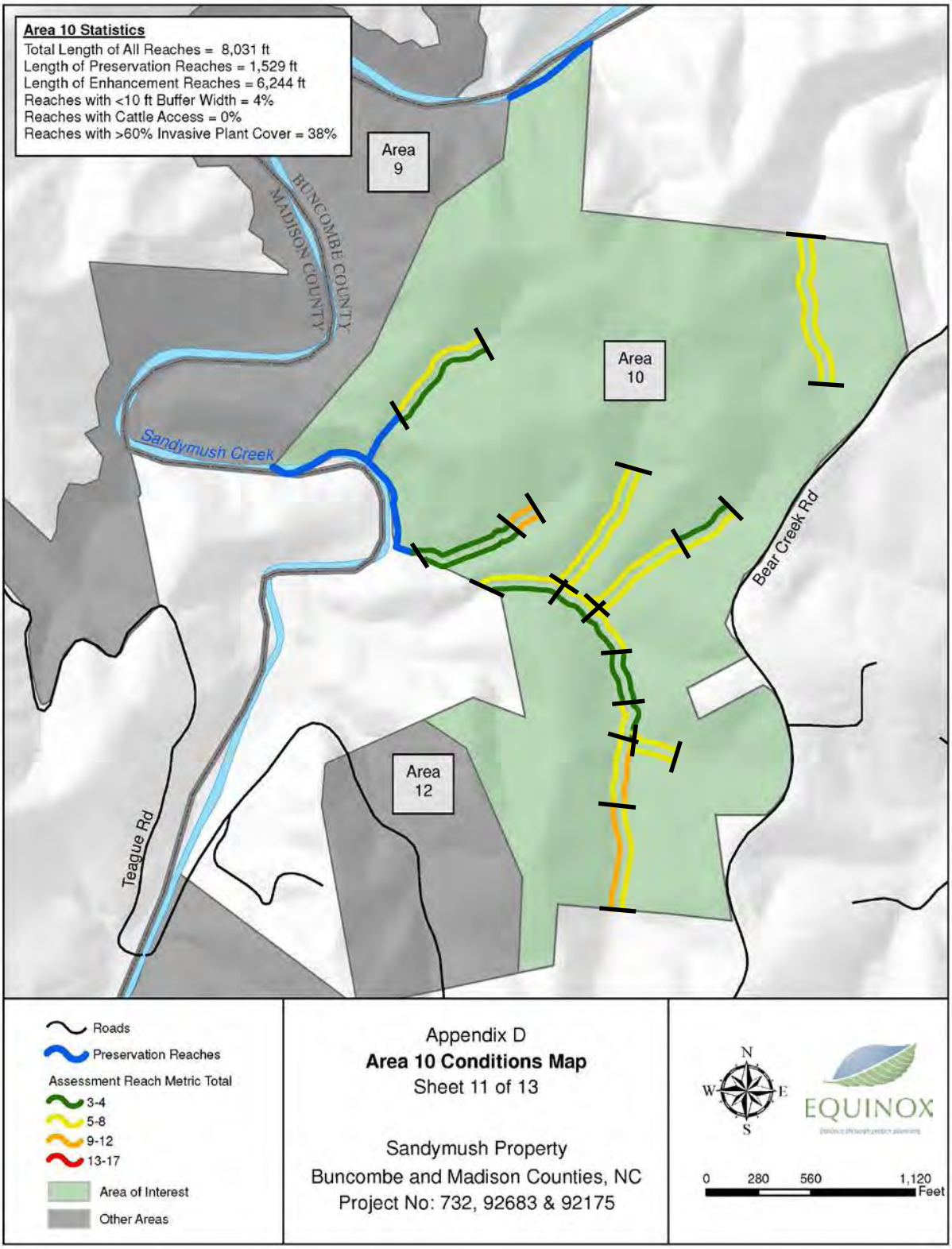

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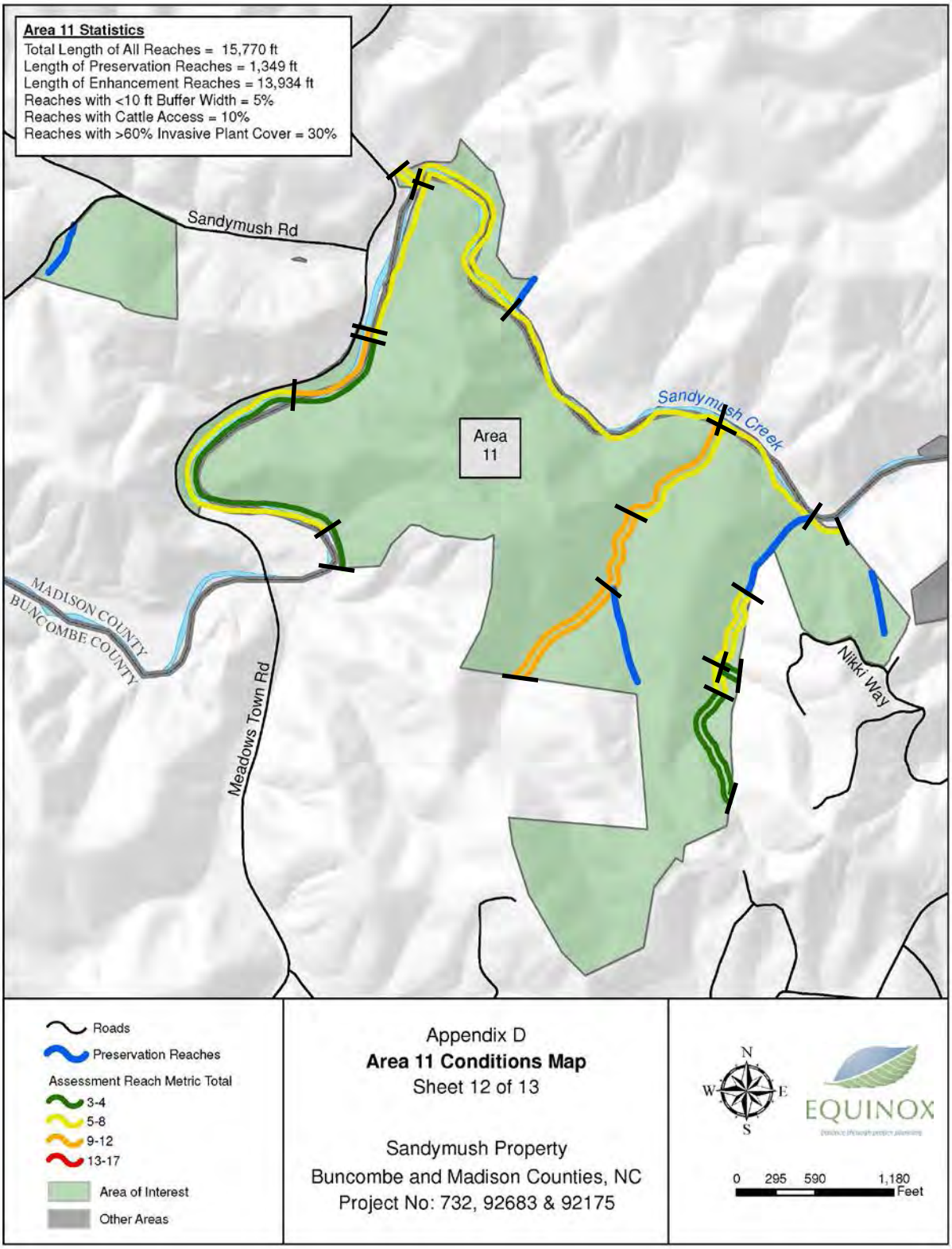
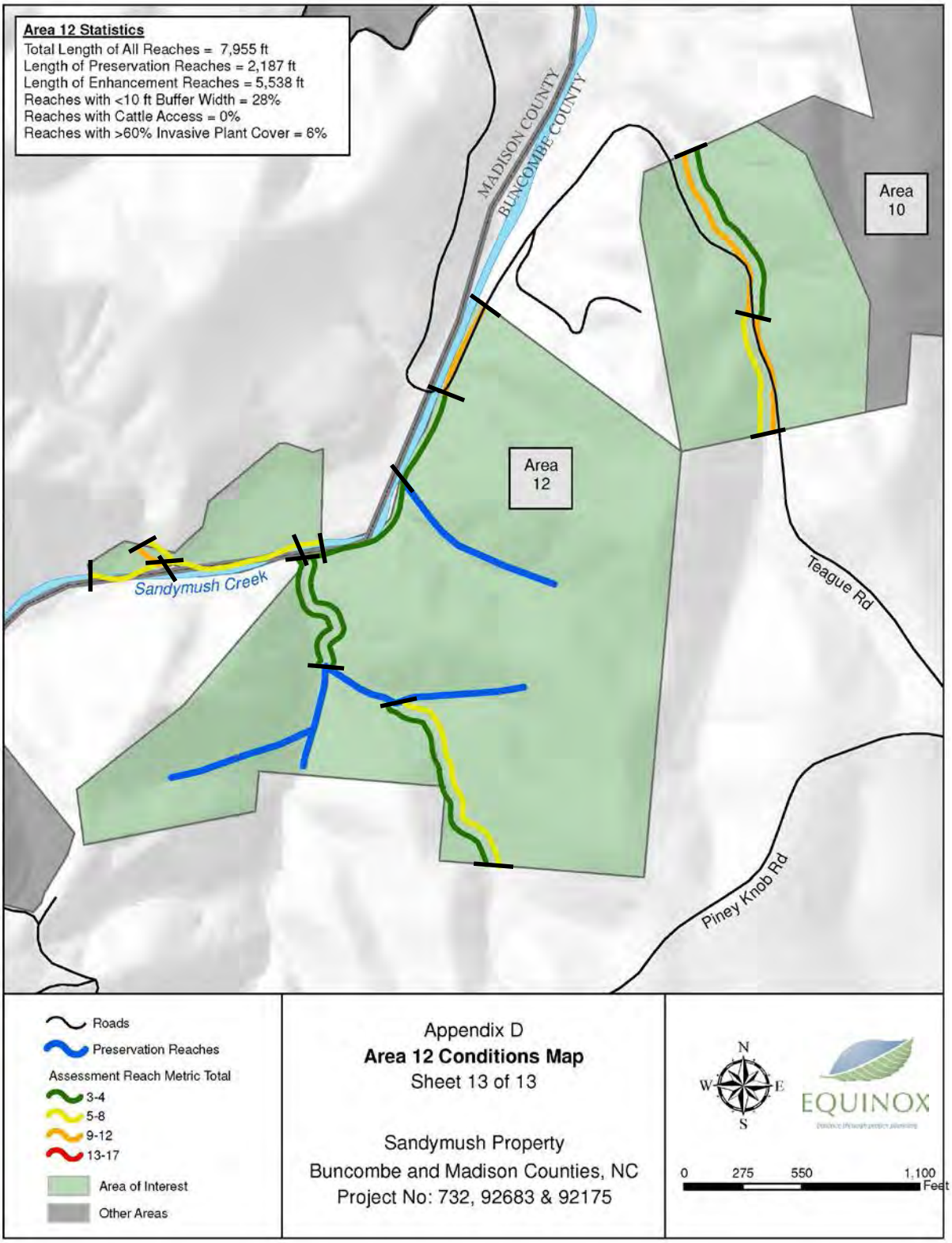


Riparian Area Reach Condition Maps (Sheet 13 of 13)



14.7 APPENDIX E. Sandy Mush Game Land Management Plan

Note: Does not include Appendices XIX - Deeds, XX - Easements, or XXI – Memorandum of Agreement as they are included as an appendix of the mitigation plan.

Sandy Mush Game Land Management Plan

2015 – 2025

North Carolina Wildlife Resources Commission Game Lands (NCWRC) An Overview

NC WILDLIFE'S CROWN JEWELS

North Carolina's game land system is based on science-driven management practices and is an exceptional asset for the people of the State of North Carolina. The 2 million acres of NCWRC owned and managed land create HIGH Ecosystem value in flood protection with positive effects on property values and air and water quality, while helping to prevent additional restrictive environmental regulations.

The primary purpose of our game lands is the conservation of North Carolina wildlife species and the provision of public hunting, trapping and fishing opportunities. Our game lands are important players in the preservation of rare, threatened and endangered species. Prescribed burning and early successional habitat management allow for healthy habitats for thriving wildlife. Fields left fallow and disked on alternating years promote natural herbaceous regeneration. Water levels of impounded wetlands are drawn down at appropriate times to create conditions beneficial to waterfowl. Protection of stream buffers ensures that precious fish species are protected and encouraged along with thriving game fishes. Heritage forest land is worked and preserved and rare forestlands are protected.

The game lands also provide broad expanses of public recreational opportunities. North Carolina has more acreage of managed game lands than all states east of the Mississippi, with the exceptions of Florida and Michigan, both of which include lake and ocean frontage as managed land. There is overwhelming public endorsement of conserving the land along with documentation of the economic benefits of doing so. According to the outdoor recreation industry, over $3.3 billion is spent annually on wildlife related recreation in our state alone. As North Carolina transitions from a traditional economy based on tobacco, furniture and textiles to a global economy driven by knowledge-based enterprises, our managed public game lands help preserve our economy and our way of life.

Game lands include:

- A great treasure in the largest intact and least disturbed bottomland forest ecosystem in the mid-Atlantic Region and some of the oldest cypress-tupelo trees on the East Coast, many at least 800 years old;
- One of the largest, most intact remnants of longleaf pine ecosystems in North Carolina, a high priority wildlife habitat in the Lands Management program. Among the species dependent upon this type of habitat are bobwhite quail, a variety of songbirds, fox squirrels and the federally endangered red-cockaded woodpecker;
- The densest populations of black bear, white-tailed deer and turkey, and the highest density of nesting birds in the state. Most of our 32 black bear sanctuaries are on game lands;
- A system of floating waterfowl blinds, 19 public hunting blinds for disabled sportsmen, 32 public boating access areas, 33 public fishing areas, six wildlife observation platforms, four public WRC shooting ranges with plans to build and manage many more as opportunities occur;
- And some of the finest examples of multiple conservation collaborations in the country.

As in the past, it is anticipated that future projected expenditures will be funded by North Carolina's apportionment of Pittman Robertson Federal Assistance in Wildlife Restoration funding and license receipts, as well as from contributions from various conservation partners. The opportunity provided by these managed public game lands to our mission of conserving North Carolina's wildlife and habitat for future generations is priceless.

North Carolina Wildlife Resources Commission staff contributed extensively to the development and preparation of this plan through their various fields of professional expertise. All content, management strategies, recommendations, goals, and needs for change were developed using the best available science and professional working knowledge of Sandy Mush Game Land, including its habitats, and terrestrial and aquatic species. Careful consideration has been given to all input received from the public, external agencies, and organizations that have an interest in or use the game land, to ensure a that comprehensive management program is administered. The successful implementation of the plan will depend on the continued feedback and support from all interested parties.

Sandy Mush Game Land
Management Plan Development Team

Jeff Ferguson- Engineer, Division of Engineering Services and Lands Management

Steve Fraley- Western Aquatic Nongame Coordinator, Division of Inland Fisheries

Andrew Helton- Area 2, District 9 Sergeant, Division of Enforcement

Chris Henline- Conservation Technician II, Burnsville Depot, Division of Engineering Services and Lands Management

Ryan Jacobs- Mountain Ecoregion Wildlife Forest Manager, Division of Engineering Services and Lands Management

Scott Loftis- Watershed Enhancement Coordinator, Division of Inland Fisheries

John Macemore- Southern Mountains Technician Supervisor, Division of Engineering Services and Lands Management

Michael Tipton- Conservation Technician I, Burnsville Depot, Division of Engineering Services and Lands Management

Joe Tomcho- Conservation Technician I, Burnsville Depot, Division of Engineering Services and Lands Management

T.R. Russ- Western Aquatic Nongame Biologist, Division of Inland Fisheries

David Stewart- Southern Mountains Land Management Biologist, Division of Engineering Services and Lands Management

Gordon Warburton- Mountain Ecoregion Supervisor, Division of Engineering Services and Lands Management

Kendrick Weeks- Mountain Wildlife Diversity Supervisor, Division of Wildlife Management

Powell Wheeler- District 9 Fisheries Biologist, Division of Inland Fisheries

Executive Summary

Sandy Mush Game Land consists of 2,767 acres lying along the Blue Ridge Escarpment in Buncombe and Madison counties and is owned by the State of North Carolina with the N.C. Wildlife Resources Commission being the primary custodian. The property contains three significant and designated waterways which include, the French Broad River, Sandymush creek, and Turkey creek. The game land is a popular destination for the public and is actively used by hunters, fishermen, and wildlife watchers. Popular game species occurring on the game land include deer, wild turkey, and mourning dove. The game land is 71% forested with oak forests being the most predominant forest type (44%). Fifteen endangered, threatened, or rare species are found on Sandy Mush Game Land. Management goals for the game land include providing for a diversity of habitat types and forest age classes though science based land management that are properly interspersed and positioned across the landscape, conserve popular sport fish and game species at huntable/fishable levels, provide quality habitat for endangered, threatened, and rare species, and provide sufficient infrastructure and opportunity to allow all game lands users a quality experience while on the game land. To ensure these goals are met WRC will need to collect various types of information regarding wildlife species and game land users, secure funding to accomplish management goals, acquire additional properties as they become available, maintain and develop regulations that promote sustained use of natural resources, and develop relationships with conservation partners that help meet management goals.

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INTRODUCTION

GAME LAND PROGRAM MISSION STATEMENT

Consistent with the original establishment legislation (G.S. 143-239) for the North Carolina Wildlife Resources Commission (NCWRC), the mission of the game lands program is to enhance, facilitate, and augment delivery of comprehensive and sound wildlife conservation programs. Inherent in delivery of a land conservation program consistent with this mission is the feasibility and desirability of multiple uses on lands owned by the state within the game land system. In addition to hunting, fishing, trapping, and wildlife viewing as primary uses, we recognize the desirability of providing opportunities for other activities on state-owned game lands that are feasible and consistent with the agency's mission, and compatible with these traditional uses.

GAME LAND PROGRAM MANAGEMENT OBJECTIVES

- To provide, protect, and actively manage habitats and habitat conditions to benefit aquatic and terrestrial wildlife resources
- To provide public opportunities for hunting, fishing, trapping, and wildlife viewing
- To provide for other resource-based game land uses to the extent that such uses are compatible with the conservation of natural resources and can be employed without displacing primary users
- To provide an optimally sustainable yield of forest products where feasible and appropriate as directed by wildlife management objectives

GAME LAND PROGRAM HISTORY

Prior to 1971, public hunting areas in North Carolina were limited to designated and tightly controlled Wildlife Management Areas. The current Game Lands Program was established in 1971. This change involved the expanding the area of game lands from about 700,000 acres to 1.5 million acres, changing regulations, and reducing fees for hunters and fishermen (Dean 1971). The old Wildlife Management Areas were incorporated into the new Game Lands Program, but the new program also allowed NCWRC to lease/incorporate additional lands as game lands to expand the land base. Beginning in the 1980's, land owners (both corporate and private) realized they could lease their properties for higher rates to hunting clubs and private individuals and began to remove their properties from the Game Lands Program. Fortunately, the Natural Heritage Trust Fund was established in 1987 and the Clean Water Management Trust Fund in 1996. These funds provided money for the fee simple acquisition of select properties, many of which have been incorporated into the Game Lands Program. These Funds greatly compensated for the loss of game lands leased from the private sector and currently approximately 2 million acres are enrolled in the Game Lands Program.

While operating under the Management Area system, NCWRC staff was housed on each management area. These personnel were assigned both law enforcement and habitat management duties on their respective areas. Under the administration of the Game Lands Program, NCWRC depots were strategically established in the vicinity of all game lands in the

state. These depots housed equipment and habitat development crews which were assigned to the management of multiple game lands. All law enforcement on these properties then became assigned to the new Division of Law Enforcement. With some minor organizational changes, this system remained intact until 2012. In 2012, land management staff in the Division of Wildlife Management and certain similar positions in the Division of Inland Fisheries were merged with Division of Engineering staff into the Division of Engineering and Lands Management. This organizational change was made to deliver a more comprehensive and efficient wildlife and fisheries management program on all public lands and waters in the state. Depots remained at former locations with the establishment of new depots/crews at certain remote locations to improve the efficiency of NCWRC programs.

PURPOSE AND NEED FOR PLAN

A comprehensive game land management plan is needed for Sandy Mush Game Land to implement the NCWRC Strategic Plan and accomplish game land program objectives in a timely and efficient manner. Another major driver for the development of this plan was the creation of the North Carolina Wildlife Action Plan (WAP) in 2005. The NCWAP is a comprehensive wildlife conservation plan that prioritizes species native to North Carolina for which there is a concern of population decline either due to known declines or suspected declines (i.e. Species of Greatest Conservation Need [SGCN]). Approval of this plan by the United State Fish and Wildlife Service makes the agency eligible for State Wildlife Grant funding to address SGCN species through inventory, monitoring, and/or research. For the purposes of this plan a ten year planning horizon was used, with the need for review and amendments to the plan being made as needed.

REGIONAL CONTEXT

Sandy Mush Game Land (SMGL) lies within the NCWRC Mountain Ecoregion and the Northern Mountains work area (*Appendix I*). This work area includes 20 counties or portions of counties within the Blue Ridge Mountains and along the transition zone between the Blue Ridge Mountains and the Piedmont. Approximately 4,200 mi^2 of the work area lies within the Blue Ridge physiographic province (Griffith et al., 2002), with the remaining 2,690 mi^2 contained within the Piedmont physiographic province. The work area contains portions or all of the following river basins: Broad (998 mi^2), Catawba (1,594 mi^2), French Broad (1,433 mi^2), New (753 mi^2), Roanoke (15 mi^2), Watauga (205 mi^2), and Yadkin (1,901 mi^2). Thirteen game lands containing approximately 415,991 acres are located within the work area. Approximately 97% of game lands within the work area are contained in the Blue Ridge physiographic province, with the remainder in the Piedmont province (Griffith et al., 2002).

The State of North Carolina, with NCWRC as the primary custodian, owns in fee simple 66,641 acres of game lands within the Northern Mountains work area. Approximately 347,504 acres of game lands within the work area are owned by the USDA Forest Service and managed as game lands under a cooperative agreement. The remaining 1,846 acres of game lands are leased from other governmental agencies or the private sector. The work area also contains 13 public boating access areas, 50 public fishing access areas, and 3 fish hatcheries; with staff located strategically at 7 work depots throughout the Ecoregion. Seventeen permanent staff under the direction of an Ecoregion supervisor are stationed in the Northern Mountains work area, which also includes two wildlife foresters.

REGIONAL CONSERVATION PARTNERSHIPS

The Game Lands Program is vital to many conservation efforts and partnerships within the Mountain Ecoregion. NCWRC enjoys a long standing alliance with the USDA Forest Service with wildlife resources on forest service lands cooperatively managed by both agencies. The Natural Heritage and Clean Water Management Trust Funds along with the Ecosystem Enhancement Program have all provided significant and critical funding for the acquisition of key properties that have been added to the Game Lands Program. Many of the properties acquired with these funding sources have been established as or have enhanced existing State Natural Heritage Areas and/or have been dedicated as Nature Preserves by the N.C. Natural Heritage Program. Many nonprofit land conservancies within the ecoregion have played vital roles to acquire properties that have been added to the Game Lands Program such as Southern Appalachian Highlands Conservancy. Other conservation partnerships that important to the game lands program include the United States Forest Service (USFS) Southern Research Station, North Carolina State University (NCSU), The University of Tennessee, Western Carolina University, the Ruffed Grouse Society, Quality Deer Management Association, National Wild Turkey Federation, Partners in Amphibian and Reptile Conservation, Partners in Flight, Appalachian Mountains Joint Venture, Eastern Brook Trout Joint Venture, The Nature Conservancy, and Appalachian Landscape Conservation Cooperative.

GOALS

- Restore a diversity of habitat types and forest age classes using science based land management practices that are properly interspersed and juxtaposed across the landscape to ensure that a wide variety of terrestrial and aquatic wildlife species are conserved on the game land.
- Manage popular game species and sport fish at huntable/fishable levels through science based land management and sound regulations.
- Provide quality habitat for endangered, threatened, and rare species located on the game land to ensure their continued existence and recovery.
- Provide sufficient infrastructure and opportunity to allow all game lands users a quality experience while on the game land with minimal habitat degradation and minimal conflict among user groups.

MEASURES OF SUCCESS

- Wildlife and fish inventories/surveys indicate that a wide variety of species are present at sustained levels and are properly managed for on the game land.
- Inventories of forest communities show progress towards accomplishing restoration goals.

- Monitoring and surveys of target sport fish and game species indicate that population levels of these species are being managed at sustained levels.
- Monitoring and surveys indicate that populations of endangered, threatened, and rare species found on the game land are stable or increasing.
- Monitoring and surveys indicate that previously unknown populations or previously unknown endangered, threatened, and rare species are found on the game land.
- Infrastructure is provided and maintained at a level that allows the public to reasonably access and enjoy the game land.
- Public use of the game land is managed so that minimal conflicts among game land users occur.
- Agreements with conservation partners are initiated that allow game land goals to be reached more expediently.
- Valid public complaints regarding management of the game land are minimal.
- Increased compliance with wildlife regulations and laws.

GENERAL GAME LAND INFORMATION

LOCATION

Sandy Mush Game Land (SMGL) is located approximately 12 miles northwest of Asheville, North Carolina, near the Alexander and Leicester communities, in northern Buncombe and southern Madison counties (*Appendix II*). The game land is located in the northwestern corner of the Northern Mountains work area and managed by staff located at the Burnsville Depot. Of the 2,767 total acres of game land, 2,679acres are owned by the State of North Carolina with the remainder owned by the Southern Appalachian Highlands Conservancy (*Appendix III*). This later tract of game land, referred to as the Norco tract, is 88 acres.

PURPOSE OF GAME LAND

The purpose of Sandy Mush Game Land is to manage habitats to benefit aquatic and terrestrial wildlife resources and flora on the property. The game land provides opportunities for public hunting, fishing, trapping, wildlife viewing, and other wildlife based recreational activities. These are the primary public uses of the game land. The game land also provides other public outdoor recreational opportunities to the extent that these uses are compatible with the conservation and management of the resources located there and do not displace primary users. The game land also provides a sustainable yield of forest products as allowed by topography and other factors. All forestry conducted on the game land is directed by wildlife management objectives.

HISTORY OF GAME LAND

Early historical accounts of the Sandy Mush area describe a road that followed the French Broad River from east Tennessee through Asheville into upper South Carolina as a primary commerce route until regular rail service became available in 1886. This route was the main route for moving livestock on foot to markets in the south (Equinox Environmental Consultation & Design, Inc. 2013). To feed the livestock and earn a living, area landowners cleared their land to grow crops (Blackmun 1977). For at least the past 100 years, land use on the game land has consisted of both mixed forest and agriculture (Equinox Environmental Consultation & Design, Inc. 2013). Decades of past cattle grazing on the area has likely had one of the greatest impacts on the current state of the game land. Even large portions of the forested land across the area were fenced in allowing cattle to graze through the understory. These practices often had extreme negative impacts to tree regeneration, herbaceous plant layer production, available hard mast for wildlife, and soil erosion and impaction. These impacts are still evident in the understory of many of the small woodlots, wetland areas, spring seeps, and other riparian areas. The historic grazing of cattle across the game land and surrounding areas has also resulted in the establishment of numerous non-native invasive plants including: multi-flora rose, Chinese privet, oriental plume grasses, kudzu, and various pasture grasses such as orchard grass and tall fescue.

Another historical use impacting the current state of the game land has been the abandonment of old fields and pastures over the past 50 to 100 years. Many of the forested stands currently on the game land were once open fields or pastures. This is evidenced by the remnant barbed wire fence and large "wolf" trees that still persist along these old fence rows. Often these abandoned fields were quickly established by pioneering tree species such as White Pine, Poplar, and Virginia pine which took advantage of the open conditions and or poor soil quality of these sites.

In 2004, the 28 parcels making up SMGL were purchased fee simple by the State of North Carolina from Progress Energy Corporation (with reserved easements for power lines and railroads) with the sole purpose of providing stream mitigation credits needed under a new mitigation agreement between the U.S. Army Corp of Engineers and the State of North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program (EEP). Then in 2006 management responsibilities were transferred from EEP to NCWRC (*Appendixes XIX- XXII*). At the time of purchase, approximately 35% of the property consisted of row crops, hayed fields, or as pasture. The remaining property consisted of woodlots or small tracts of forest land. Timber management activities implemented by Progress Energy just prior to the NCWRC receiving the property included the harvest of approximately 185 acres in the western portion of the property bordering Bear Creek Road and the Teague Road. The majority of these acres were clear-cut and replanted to white pine, which is now approximately 10 years old. Other wooded areas do show signs of past timber harvest during recent times, but these were likely a result of field maintenance as well as possibly for the collection of firewood. Initial habitat management activities immediately following the purchase of the property included establishing and maintaining wildlife openings on many of the old farm areas, pruning and releasing fruiting shrubs and trees around many of the old home sites. Boundary lines were chopped, painted, and posted to facilitate use of the area by game land users.

LANDSCAPE CONTEXT

Sandy Mush Game Land is located within the Southern Blue Ridge (SBR) province. This province covers over 9.4 million acres and is one of the most biologically significant and diverse landscapes in the United States. Elevations of the province range from 1,500 to 6,684 feet and receive the highest rainfall amounts in the United States, east of the Cascade Mountains. The SBR province has a wide range of climate types from warm temperate to boreal, as well approximately 4,000 species of plants, of which 400 species are listed as rare and over 250 being endemic. The SBR province has the second highest hardwood and conifer diversity in North America as well as the third highest number of endemic hardwood and conifer species. The area also has the world's highest salamander diversity, the highest number of snail species, and more than 400 endemic species, the most found in any other province in North America. More than 130 natural terrestrial communities have been defined within the SBR with over 90% of these occurring nowhere else. A total of 66 at-risk aquatic species occur in the SBR, 20 of which are federally-listed as threatened or endangered (LandScope America). Nearly 35% of the landscape is in public ownership, with the largest public land management agency being the US Forest Service, which manages 26% of all public lands here.

SURROUNDING LAND USE

Land use adjacent Sandy Mush Game Land continues to be largely agricultural. Hay fields and pasturelands are the more dominant agricultural uses (*Appendix IV*). Non-industrial private forests also dominate the landscape surrounding the game land, with residential housing also being a growing use of the surrounding lands. Many of the residents of the area work in or around the city of Asheville, which is a major factor in the growing population of the surrounding area. Between 1990 and 2012 the population of Buncombe County increased by 36%, whereas the population in the areas near Sandy Mush grew over 47% (U.S Census Bureau 2013).

PHYSICAL ATTRIBUTES

Topography of Sandy Mush Game Land can be generally characterized as having rolling hills and moderately sloped ridges to areas of steep slope, particularly along major drainages (*Appendix V*). Narrow ridges and valleys run throughout the game land and range in slope from little to no slope along river bottomlands to rocky cliffs and bluffs with as much as 70% slope in the Sandymush Creek Gorge (*Appendix VI*). Elevations on the game land range from 1,730 feet to 2,375 feet. The lowest elevation occurs along the French Broad River, and the highest elevation occurring along a leading ridge of Piney Knob. Significant physical attributes of the game land include the Alexander Cliff and Slopes and Turkey Creek/Sandymush Creek Gorge.

CLIMATE

Climate of the game land is classified as humid subtropical ("Climate Zones of the Continental United States", 2013). The normal monthly mean temperature is 55.7° F and normal monthly maximum and minimum temperatures are 66.3° F. and 45.1° F. respectively. Average monthly precipitation for the area ranges from 2.4 inches in October to 4.89 inches in March. Average annual precipitation is 37.3 inches and is generally well distributed throughout the year

(NOAA, 2002). The average annual humidity is 76.25% and the average annual snow fall is 9.70 inches (USA.com 2013).

SOILS

The following soil types are described from the steeper slopes of the Sandy Mush area and are typically found at elevations of 1,400 to 4,000 feet at slopes typically between 15 and 50 percent. The Oteen series consists of shallow, well drained, moderately to rapidly permeable soils. Oteen soils occur on strongly sloping to very steep on ridges and side slopes, and are highly erosive. The Walnut series consists of moderately deep, well drained soils with moderately, rapid permeable soils. The Mars Hill series consists of deep, well drained soils with moderately, rapid permeability. Walnut and Mars Hill Soils occur on strongly sloping to very steep ridges and side slopes and often have limited productivity. These soils can be found at an elevation range from about 1,600 to 3,500 feet. The slope gradient commonly is 30 to 95 percent. The Evard series consists of very deep, well drained, moderately permeable soils. The Cowee series consists of moderately deep, well drained, moderately permeable soils. Evard and Cowee soils occur on gently sloping to very steep ridges and side slopes of low and intermediate mountains. These soils are somewhat productive and do have a moderate erosion potential (Equinox Environmental Consultation & Design, Inc. 2013).

Soils in the Sandy Mush area most often identified with third order and greater, stream channels include the Unison, Tate, and French soil series. The Unison series are very deep and well drained soils occurring on mountain foot slopes, alluvial fans, or stream terraces. Permeability of the soil is moderate, with slopes that range from 0 to 45 percent. These soils can be highly productive but are often easily erodible as they consist largely of sedimentary deposits. The Tate series consists of very deep, well drained, moderately permeable soils found on benches, fans, and toe slopes in coves. They formed in colluvium weathered from metamorphic rocks and have good productivity and moderate erosion potential. The French series consists of very deep, moderately-well to somewhat poorly drained soils with contrasting textures found throughout floodplains of small streams in the southern Appalachian and Blue Ridge Mountains. They formed in recent alluvial sediments. Slopes are 0 to 5 percent. Streams of the Sandy Mush area typically form on soil series that are associated with steep slopes including Oteen, Walnut, Mars Hill and others (Equinox Environmental Consultation & Design, Inc. 2013).

The streams at Sandy Mush may cross several different soil types before entering the larger streams of the area. For example, steep ephemeral and intermittent reaches may be associated with Evard/Cowee soil complex; the mid-reaches may flow across a less steep colluvial valley composed of Tate loam, where the valley may then transition to a steep slope composed of a Walnut/Oteen/Mars Hill soil complex. As streams descend to Sandymush Creek it may become associated the French loam soils that makes up the floodplain. While each stream of the area is different, this illustrates a common pattern (Equinox Environmental Consultation & Design, Inc. 2013).

HYDROLOGY

Sandy Mush Game Land lies within the French Broad River Basin which spans some 2809 square miles (11% of the state) and contains the second largest number of stream miles (4113 miles) for any basin in North Carolina. Many streams with in the basin are classified as High

Quality or Outstanding Resource Waters for their abundant trout populations. Primary streams found on Sandy Mush Game Land include the French Broad River, which borders the property to the East; Sandymush Creek, which forms the northern Buncombe and southern Madison county boundary through the property before its confluence with the French Broad River; Turkey Creek, which lies in the southern part of the game land and flows north to its confluence with Sandymush Creek; and Simmons Branch, a primary tributary to Sandymush Creek. There are also numerous other unnamed streams and tributaries that make up the rest of the surface hydrology across the game land. A total of 33 miles of intermittent and perennial streams are located on the game land, having a total area drained by these streams, including those portions outside the game land boundary, of 81 square miles (Equinox Environmental Consultation & Design, Inc. 2013).

HABITATS

Major habitats within SMGL consist of fallow agricultural fields, Rich Cove Forest, Montane Oak-Hickory Forest, and Piedmont/Low Mountain Alluvial Forest as described by Schafale and Weakely (1990). Habitats identified in the NCWRC Wildlife Action Plan include Cove Forest, Early Successional Habitats, Dry Coniferous Woodlands, Oak Forests, Bogs and Associated Wetlands, Floodplain Forest, and Riverine Aquatic Communities (*Appendix VII*). Of the 2,767 acres that make up SMGL, 1,949 acres (71%) is forested habitat, 729 acres (26%) is open habitat, 67 acres is aquatic habitat (2%), and 25 acres (1%) is developed open space or unusable habitat (*Appendix VIII*). Specific information regarding habitats found on SMGL is included in the Habitat Description section of this document.

UNIQUE VALUES AND DESIGNATIONS

An abundance of natural resources are located on SMGL as it contains excellent natural values and biodiversity. Within the game land are two designated State Natural Heritage Areas which include the Alexander Cliffs and Slopes, and Turkey Creek/Sandy Mush Creek Gorge State Natural Heritage Areas. One of the most unique values of SMGL was the abundance of land that was already cleared, which afforded numerous opportunities to create and maintain critical early successional habitats (NCWRC 2005). As stated previously, the game land contains and borders three significant and designated waterways which include, the French Broad River, Sandymush creek, and Turkey creek. These waterways have been classified through the NC Division of Water Quality (NCDWQ) Classifications and Standards Unit which protects these waters for fishing, wildlife, fish consumption, aquatic life, propagation of aquatic life, survival and maintenance of biological integrity, and agriculture. The French Broad River has a "B" surface water classification which receive further protection for "primary recreation" activities which include swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis (NCDWQ 2013). Both Sandymush Creek and Turkey Creek have a "C" surface water classification from the NCDWQ classifications and standards unit (NCDWQ 2013). Class C waters are protected for "secondary recreation" which includes wading and boating and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner. A classification of "C" is the lowest water quality designation assigned by the NCDWQ.

Because SMGL was purchased to provide stream mitigation credits needed to fulfill a mitigation agreement between the U.S. Army Corp of Engineers and the State of North Carolina Ecosystem Enhancement Program, the riparian buffers of all stream channels on the property are subject to limited use and management activities. Under the NC Ecosystem Enhancement Mitigation Plan, stream channels are classified as either "High Quality Preservation" or "Enhancement Level II mitigations" (NCEEP 2014 DRAFT). "High Quality Preservation" streams are protected by a 300 foot riparian buffer that restricts all activities that may potentially cause impacts to the vegetation and sediments to enter the stream. "Enhancement Level II" streams and riparian buffers are protected in the same way as "High Quality Preservation" streams but the riparian buffer width is reduced to 30 feet (*Appendix IX*).

Sandy Mush Game Land also serves as an important ecological reservoir for a number of endangered, threatened, or rare species. A table of rare species known to occur at Sandy Mush is listed below:

Taxonomic Group	Scientific Name	Common Name	NC Status	US Status	NC Ranking	US Ranking	Habitat Type
Amphibian	Plethodon ventralis	Southern Zigzag Salamander	SC		S1	G4	Terrestrial
Bird	Tyto alba	Barn Owl	SR		S2S3B,S3N	G5	Terrestrial
Butterfly	Euphydryas phaeton	Baltimore Checkerspot	SR		S2	G4	Terrestrial
Butterfly	Satyrium caryaevorus	Hickory Hairstreak	SR		S1	G4	Terrestrial
Freshwater Fish	Polyodon spathula	Paddlefish	E	FSC	SH	G4	Aquatic
Mammal	Mustela nivalis	Least Weasel	SR-G		S2	G5	Terrestrial
Mammal	Myotis grisescens	Gray Myotis	E	E	S1	G3	Terrestrial
Mammal	Myotis leibii	Eastern Small-footed Myotis	SC	FSC	S2	G1G3	Terrestrial
Mammal	Myotis septentrionalis	Northern Myotis	SR		S3	G3	Terrestrial
Reptile	Apalone spinifera spinifera	Eastern Spiny Softshell	SC		S1	G5T5	Wetland
Vascular Plant	Adlumia fungosa	Climbing Fumitory	SC-V		S2	G4	Terrestrial
Vascular Plant	Buckleya distichophylla	Piratebush	T	FSC	S2	G2	Terrestrial
Vascular Plant	Dicentra eximia	Bleeding Heart	SR-P		S3	G4	Terrestrial
Vascular Plant	Draba ramosissima	Branching Draba	SC-V		S2	G4	Terrestrial
Vascular Plant	Micranthes caroliniana	Carolina Saxifrage	SR-T	FSC	S3	G3	Terrestrial
Natural Community	Acidic Cove Forest				S4	G5	Terrestrial
Natural Community	Montane Alluvial Forest				S1	G3	Wetland
Natural Community	Montane Mafic Cliff				S3	G3	Terrestrial
Natural Community	Rich Cove Forest				S4	G4	Terrestrial

Common to fairly common "Species of Greatest Conservation Need"(SGNC) birds on SMGL include Northern bobwhite quail (*Colinus virginianus*), sharp-shinned hawk (*Accipiter striatus*), Copper's hawk (*Accipiter cooperii*), American kestrel (*Falco sparverius*), yellow-billed cuckoo (*Coccyzus americanus*), Eastern whip-poor-will (*Caprimulgus vociferus*), chimney swift (*Chaetura pelagica*), hairy woodpecker (*Picoides villosus*), Northern flicker (*Colaptes auratus*), Eastern wood-pewee (*Contopus virens*), Eastern kingbird (*Tyrannus tyrannus*), brown-headed nuthatch (*Sitta pusilla*), wood thrush (*Hylocichla mustelina*), worm-eating warbler (*Helmitheros vermivorum*), hooded warbler (*Setophaga citrina*), prairie warbler (*Setophaga discolor*), field sparrow (*Spizella pusilla*), blue grosbeak (*Passerina caerulea*), Grasshopper sparrow (*Ammodramus savannarum*), Willow flycatcher (*Empidonax traillii*), Orchard oriole (*Icterus spurius*), Kentucky warbler (*Geothlypis formosa*), American woodcock (*Scolopax minor*), Blue-winged warbler (*Vermivora cyanoptera*), and Eastern meadowlark (*Sturnella magna*). SGCN mammals found on the property include Southern Rock vole (*Microtus chrotorrhinus*), Eastern small-footed myotis, gray myotis, and least weasel. SGCN amphibians and reptiles found on the property include Southern zigzag salamander, Eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*), Eastern box turtle (*Terrapene carolina*), and Eastern spiny softshell.

HABITAT TYPES

Forested Habitats

Approximately 71% of the total area of Sandy Mush Game Land is forested. This area totals 1949 acres and consists of 5 main habitat types. These include: Oak Forests (44%), Cove Forests (21%), Dry Coniferous Woodlands (26%), Floodplain Forests (3%), and Open Canopy Early Successional Habitats (6%) (*Appendix VII*).

OAK FORESTS

Oak forests account for the largest habitat type found on Sandy Mush Game Land. This type totals 847 acres and encompasses approximately 31% of the total game land. Oak forests on the game land consist of two main classifications: Southern Appalachian Oak Forests and Dry Oak Forests (*Appendix XV*). This habitat type covers a wide range of moisture and topographic gradients, from xeric (dry) to mesic (wet), with the driest sites often dominated by Chestnut oak (*Quercus prinus*) and Scarlet oak (*Quercus coccinea*) and moister sites dominated by White oak (*Quercus alba*) and hickories (*Carya sp.*). Understory vegetation is quite diverse and supports a wide variety of species such as flowering dogwood (*Cornus florida*), blueberry (*Vaccinium spp.*) and huckleberry (*Gaylussacia baccata*) (NCNHP 2001). Oak forests are of great importance to wildlife across Sandy Mush Game Land because of its predominance, the variety of conditions in which it is found, and its overall mast (acorn) production capacity. This habitat type produces vast quantities of acorns, hickory nuts, and a wide variety of associated soft mast forage for wildlife and is often a critical habitat type for a variety of wildlife species (NCWRC WAP 2005).

Southern Appalachian Oak Forests

Southern Appalachian oak forests (SAOF) make up approximately 66% (555 acres) of all oak forests across the game land. They occur on open slopes, ridge tops, low-elevation peaks, and higher parts of broad valley bottoms; and are found at low to moderate elevations. Soils in

these forests are usually deep residual soils, but are often rocky. Moisture levels are somewhat mesic in range and are often located on intermediate slopes between coves and dry ridges. Topography, elevation, and soil depth are the most important factors separating this system from other forested systems (NatureServe 2007).

Vegetation of SAOF's is dominated by oak species, most typically White oak, Southern red Oak (*Quercus falcate*), and Northern red oak (*Quercus rubra*) on higher elevations. Hickories are often a co-dominant species within these forests, as well as having varying amounts of Black walnut (*Juglans nigra*), Eastern white pine (*Pinus strobus*), and Red maple (*Acer rubrum*). Prior to the blight, American chestnut (*Castanea dentate*) was once the dominant or co-dominant species of these forests (NatureServe 2007). Sub-canopies and shrub layers are usually well-developed with some having associations of dense evergreen shrubs such as mountain laurel (*Kalmia latifolia*), while others have open shrub layers. Herbs are usually sparse to moderate in density. Fire occurs fairly frequently in this type forest and is usually of low to moderate intensity that is typically non-catastrophic (Abrams 1992, Delcourt and Delcourt 1997). Fire is often an important factor for favoring oak dominance over more mesophytic (moisture adapted) tree species within these forests and can be expected to have a moderate effect on vegetation structure, producing a somewhat more open canopy and less dense understory and shrub layer. Past logging may have greatly affected these forests in many instances by changing canopies to a more even-aged, structure (NatureServe 2007).

Southern Appalachian oak forests often occur along intermediate slopes between the ridge tops and coves at Sandy Mush. A reserve oak shelterwood harvest is implemented in a southern Appalachian oak forest stand to improve understory diversity encourage regeneration of oak and hickory species, and create uneven-aged conditions (right).

- *Desired Future Condition (DFC)*- Comprised largely of both closed canopy (basal area (BA) > 60) and woodland (BA 30- 60) over-story conditions. Over-story consists of a diversity of hardwood species including soft mast producing species such as Black cherry (*Prunus serotina*), Black gum (*Nyssa sylvatica*), and persimmon (*Diospyros virginiana*), with the primarily over-story species being that of oak and hickory. Understories contain a diversity of herbs and forbs with adequate regeneration of oak and hickory throughout. Relative over-all abundance of mountain laurel and rhododendron (*Rhododendron spp.*) is reduced throughout areas managed as woodlands.

- *Target Game Species*- Whitetail deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallopavo*) , black bear (*Ursus americanus*), Eastern gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), and Ruffed grouse (*Bonasa umbellus*)

- *Target Non-Game Species-* Eastern wood-pewee, Cooper's hawk, chimney swift, Northern flicker, field sparrow, red-headed woodpecker, yellow-billed cuckoo, worm-eating warbler, wood thrush, hairy woodpecker, Southern zigzag salamander, least weasel, and Eastern box turtle

- *Management Strategies and Needs-* Increase timber harvest in suitable areas (see Forest Management section). Implement appropriate applications of herbicide to sites where there is a need to control competitive vegetation and non-native invasive species. Increase prescribed burning at appropriate locations, frequencies, intensities, and seasonality. Implement strategies that favor and maintain oak species.

- *Infrastructure Needs-* Increased planning, identification, and development of fire lines and access to suitable stands and potential burn units. Temporary logging roads and landings.

- *Management Challenges* - Limited management allowed within EEP buffer areas. Increased establishment and spread of non-native invasive species. Increased development and adjacent private/ urban interface along game land boundary. Limitations due to topography and access. Air quality standards for Buncombe County limiting number of burn days. Impacts from disease and insects such as: southern pine beetle (*Dendroctonus frontalis Zimmermann*), gypsy moth (*Lymantria dispar*), sudden oak death syndrome, hypoxylon canker (*Hypoxylon spp.*), and regional oak decline.

Dry Oak Forests

This type of oak forest makes up approximately 34% (292 acres) of all oak forests across the game land. This forest system occurs at much drier settings than that of other oak matrix forests. It is characteristic of coarse and infertile soils that are often shallow and associated with acidic igneous or metamorphic rock. They are generally positioned on exposed ridges and convex slopes that are generally well drained, which contributes to the dry conditions of these forests (Schafale and Weakley 1990).

Dry oak forests are typical of many of the ridge tops at Sandy Mush and vary in understory density and diversity.

These forests are often dominated by oak species such as Chestnut oak, Scarlet oak, and White oak with cohorts of co-dominant tree species such as Mockernut hickory (Carya *tomentosa*), Shortleaf pine (*Pinus echinata*), and Virginia pine (*Pinus virginiana*). Dry oak forests occur with varying conditions and structure, from open savannah like conditions to closed

canopy. Understory in these forests commonly consists of a sparse to moderate herb layer with associations of heath type shrubs such as blueberry, huckleberry, and mountain laurel particularly on the driest sites. More open stands where fire is common grasses may also be found. In areas where fire has been suppressed Red maple and White pine are often common canopy species (NatureServe 2007). Fires in this system occur more frequently than those of more mesic oak forests, with fire occurring most often with in the dormant season but having an occasional growing season fire once or twice every 20- 25 years (Croy and Frost 2007).

- *Desired Future Condition (DFC)*- Over-story is comprised largely of woodland and "savannah like" conditions (BA 20- 60) with areas located within the EEP buffers and areas that are limited by access and topography remaining in closed canopy conditions. Composition consists predominantly by that of oak and hickory. Understories contain a diversity of herbs, forbs, and grasses with adequate regeneration of oak and hickory throughout. On drier sites a greater abundance of Vaccinium species such as blueberry and huckleberry are found in the understory. Relative over-all abundance of mountain laurel and rhododendron is reduced throughout all areas.

- *Target Game Species*- Whitetail deer, wild turkey, black bear, Eastern gray squirrel, Ruffed grouse, Eastern cottontail rabbit (*Sylvilagus floridanus*), and Bobwhite quail

- *Target Non-Game Species*- Eastern wood-pewee, Cooper's hawk, chimney swift, Northern flicker, red-headed woodpecker (*Melanerpes erythrocephalus*), Eastern kingbird, yellow-billed cuckoo, hairy woodpecker, Eastern whip-poor-will, brown-headed nuthatch, least shrew, least weasel, Eastern hognose snake (*Heterodon platirhinos*), mole kingsnake (*Lampropeltis calligaster*), and Eastern box turtle

- *Management Strategies and Needs*- Increase timber harvest in suitable areas (see Forest Management section). Implement appropriate applications of herbicide to sites where there is a need to control competitive vegetation and non-native invasive species. Increase prescribed burning at appropriate locations, frequencies, intensities, and seasonality. Implement strategies that favor and maintain oak species.

- *Infrastructure Needs*- Increased planning, identification, and development of fire lines and access to suitable stands and potential burn units. Temporary logging roads and landings.

- *Management Challenges* - Limited management allowed within EEP buffer areas. Increased establishment and spread of non-native invasive species. Increased development and adjacent private/ urban interface along game land boundary. Limitations due to topography and access. Air quality standards for Buncombe County limiting number of burn days. Impacts from disease and insects such as: southern pine beetle, gypsy moth, sudden oak death syndrome, hypoxylon canker, and regional oak decline.

COVE FORESTS

Cove forests make up approximately 15% of Sandy Mush Game Land and encompass an area of 417 acres. This type habitat includes two classifications types: Appalachian Hemlock-Hardwood Forests, which totals 44% of all cove forests on the game land, and Southern Appalachian Cove Forests, which accounts for 56% of cove forest habitat. These classifications

are primarily distinguished by soil acidity, with hemlock- hardwood forests having the highest soil acidity of the two. Cove forests typically occur on concave and topographically protected mixed- mesophytic slopes (NatureServe 2007) and have generally higher associations of herbs and forbs in the understory as compared to other forest types. Depending on soil acidity, cove forests may contain a shrub layer consisting of mountain laurel and rhododendron. On richer sites, Spicebush (*Lindera benzoin*) is often a dominant shrub species (The Encyclopedia of Southern Appalachian Forest Ecosystems 2004). Cove forests in general, provide high amounts of herbaceous forage for wildlife, and often have high species diversity of both plants and animals. Small vertebrates, such as salamanders, birds, and small mammals, can be particularly abundant and diverse with in these forests (The Encyclopedia of Southern Appalachian Forest Ecosystems 2004).

Cove forests are typically closed canopy systems with very diverse canopies often consisting of Yellow Poplar (*Liriodendron tulipifera*), Carolina Silverbell (*Halesia carolina*), Northern Red Oak, Eastern Hemlock (*Tsuga canadensis*), Basswood (*Tilia americana*), White Ash (*Fraxinus americana*), and American Beech (*Fagus grandifolia*) (Clebsch and Busing 1989). Many of these forests exhibit a more un-even aged structure than other forest types and regeneration is commonly regulated through gap-phase dynamics and patch openings created by wind and ice. Although fire plays a lesser role in this habitat type, it may have occurred in these forests at low to moderate frequencies. Fire effects in these habitats were likely minimal as many of the species that occur in these type habitats are some of the most fire-intolerant in the region (NatureServe 2007).

Cove forests are extremely diverse and occur on a variety of soil types from acidic (left) to rich (right).

- *Desired Future Condition (DFC)*- Over-story is comprised largely of closed canopy conditions (BA <60) with some small areas located outside of EEP buffers and areas where topography and access permit, being converted to woodland conditions (BA 30- 60). Composition consists of a wide diversity of species including yellow poplar, ash, white pine, American beech, Northern red oak, Black cherry, Black walnut, and Eastern hemlock. Understories are extremely lush containing a wide diversity of herbs and forbs. In areas where woodland conditions exist, Northern red oak will be the primary over-story species with under-stories that have adequate amounts of oak regeneration.

- *Target Game Species*- Whitetail deer, Wild turkey, Black bear, Eastern Gray squirrel, Ruffed grouse, Raccoon, and American woodcock

- *Target Non-Game Species*- Eastern wood-pewee, Cooper's hawk, chimney swift, Northern flicker, yellow-billed cuckoo, wood thrush, hairy woodpecker, Swainson's warbler (*Limnothlypis swainsonii*), hooded warbler, smoky shrew (*Sorex fumeus*), Southern zigzag salamander, spotted salamander (*Ambystoma maculatum*), and Eastern box turtle

- *Management Strategies and Needs*- Increase timber harvest in suitable areas (see Forest Management section). Implement appropriate applications of herbicide to sites where there is a need to control competitive vegetation and non-native invasive species. Improve diversity of species composition and implement strategies to encourage and maintain oak species.

- *Infrastructure Needs*- Increased planning, identification, and development of access to suitable stands. Temporary logging roads and landings.

- *Management Challenges* - Limited management allowed within EEP buffer areas. Increased establishment and spread of non-native invasive species. Increased development and adjacent private/ urban interface along game land boundary. Limitations due to topography and access. Proliferation of Hemlock Wooly adelgid (*Adelges tsugae*) killing Eastern hemlock trees.

DRY CONIFEROUS WOODLANDS

Dry Coniferous Woodland habitat includes the Southern Appalachian Low Elevation Pine classification. This habitat type represents approximately 19% of the total game land area, equaling 515 acres, and tends to occupy the southern exposures and broader ridge tops of gently rolling terrains. They are often associated with shallow and generally sandy soils, and found at mid to low elevations less than 3000 feet (Fryar 2004). The dominant tree species in this forest type include Shortleaf pine, which typically occupies more than 50% of the over-story, Pitch pine (*Pinus rigida*), Virginia pine, and occasionally Eastern white pine. On some sites, oaks and hickories may also occur in the over-story.

Dry slopes and ridges with shallow soils are typical of dry coniferous woodland forests at Sandy Mush. Restoring understory diversity and natural woodland over-story conditions in pine forests (right) is a focus of habitat management across the game land.

Under natural fire regimes, where fire occurred more frequently, these systems likely consisted of herbaceous (grassy) understories, with a relatively sparse woody shrub layer (Fryar 2004). However, acidic-tolerant shrubs such as blueberry and huckleberry may also be well-

developed in these forests. The amount of herbs and shrubs is greatly linked to the frequency of fire, with stands that burn more frequently having a greater abundance of grasses and herbs and stands with less frequency of fire having a greater abundance of shrubs (NatureServe 2007). In the absence of fire, understory species are often fire-intolerant and shade-tolerant hardwoods such as dogwood, red maple, sassafras (*Sassafras albidum*), sourwood (*Oxydendrum arboreum*), Black gum, and others. Following over-story replacement events, Virginia pine, if previously a component or in adjacent stands, can quickly replace native shortleaf communities (Frost 2005). Fire is clearly an important influence in these forests, and may be the sole factor determining the occurrence of this system rather than that of hardwood forests. Natural fires were likely frequent and of low intensity, or a mix of low and higher intensity. Settlement, logging, pine beetle outbreaks, and fire suppression have potentially altered the character and blurred the boundaries of these type forests more than most other systems in the region (NatureServe 2007).

- *Desired Future Condition (DFC)*- Over-story is comprised largely of woodland and "savannah like" conditions (BA 20- 60) with areas located within the EEP buffers and areas that are limited by topography and access remaining in closed canopy conditions. Composition consists predominantly of mountain yellow pine species but includes some dry oak species such as scarlet oak, chestnut oak, and white oak. Understories contain a diversity of herbs and forbs as well as an abundance of grasses. On drier sites an abundance of Vaccinium species such as blueberry and huckleberry are found. Increased regeneration of shortleaf and pitch pine are found throughout the under-story, and relative over-all abundance of mountain laurel and rhododendron is reduced.

- *Target Game Species*- Bobwhite quail, Whitetail deer, Wild turkey, Black bear, Eastern Cottontail rabbit, and Mourning dove (*Zenaida macroura*)

- *Target Non-Game Species*- Eastern wood-pewee, Cooper's hawk, chimney swift, Northern flicker, red-headed woodpecker, Eastern whip-poor-will, prairie warbler, hairy woodpecker, brown headed nuthatch, least shrew, least weasel, Eastern hognose snake, mole kingsnake, and Eastern box turtle

- *Management Strategies and Needs*- Increase prescribed burning in conjunction with increased timber harvests, particularly thinning, throughout all suitable areas (see Forest Management section). Implement appropriate applications of herbicide to sites where there is a need to control competitive vegetation and non-native invasive species.

- *Infrastructure Needs*- Increased planning, identification, and development of access and firebreaks in to suitable stands and potential burn units.

- *Management Challenges*- Increased establishment and spread of non-native invasive species. Proliferation of Virginia pine on Shortleaf pine sites. Increased development and adjacent private/ urban interface along game land boundary. Limitations due to topography and access. Air quality standards for Buncombe County limiting number of burn days. Impacts from southern pine beetle infestations.

FLOODPLAIN FORESTS

Floodplain forests of Sandy Mush Game Land make up approximately 2% of all forested areas, and total 54 acres. It includes two classifications: South- Central Interior Large Floodplain forests (11%) and South- Central Interior Small Stream and Riparian forests (89%). These forests occur along large rivers and streams where topography and alluvial processes have resulted in a well-developed floodplain as well as along small streams and floodplains with low to moderately high gradients (NatureServe 2007). Due to its topographical position, Sandy Mush Game Land exhibits characteristics of both upland and lowland floodplain forests. Most of these forests along the French Broad appear to be intermediate in characteristic, containing both montane and pied-montane elements (Schafale and Weakley 1990).

Canopies in these forests vary greatly along topographical gradients and among various soil types which consist primarily of flood-carried sediments. Dominant tree species include a mixture of bottomland and mesophytic hardwoods such as: American sycamore (*Platanus occidentalis*), yellow poplar, American beech, white ash, American elm (*Ulmas americana*), river birch (*Betula nigra*), box elder (*Acer negundo*), red maple, and black walnut. Other common trees include; green ash (*Fraxinus pennsylvanica*), American holly (*Ilex opaca*), Southern hackberry (*Celtis laevigata*), American hornbeam (*Carpinus caroliniana*), and to a lesser extent some oaks and hickories. The herbaceous and shrub layers in these forests can be extremely diverse, with the density and abundance of species closely linked to the level of disturbance and soil type (NatureServe 2007). Understories can range from densely closed thickets to open woodlands and may consist of such species as, Spicebush, Strawberry-bush (*Euonymus americanus*), Dog-hobble (*Leucothoe fontanesiana*), alder (*Alnus spp.*), and a variety of herbs and forbs. Vines are also particularly common in floodplain forests and typically include Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Toxicodendron radicans*), and *Smilax* spp. (Schafale and Weakley 1990).

Seasonal flooding and disturbance caused by beavers are important factors that shape the composition and structure of floodplain forests.

These forests are rarely impacted by fire except under extreme drought conditions, but are more commonly regulated and maintained by seasonal and annual flooding events. Not only do these flooding events effect soil movement and deposition, but they also play a major role in seed dispersal, plant successional processes, and the creation of vernal pools. Beavers can also be an important disturbance factor in these forests, setting back succession, creating canopy gaps, and developing semi-permanent wetlands within these forests (Schafale and Weakley 1990).

Floodplain forests are particularly important habitats for breeding amphibians and the American woodcock in the region, especially where there are inclusions of floodplain pools and semi-permanent impoundments. These temporarily flooded areas provide critical breeding habitat for many species of salamanders and frogs (NCWRC WAP 2005).

- *Desired Future Condition (DFC)*- Because the majority of the Floodplain forests located across the game land occur within EEP buffers and streamside management zones, over-story of this forest type will remain comprised predominantly of closed canopy conditions. Natural disturbances such as flooding, sediment deposition, and beavers will continue to occur, dictating forest composition and structure. Natural hydrologic functions of these forests are maintained. Over-story and understory composition consists of a wide diversity of species suited to hydric soils. Where allowed, non-native exotic species are controlled.

- *Target Game Species*- Whitetail deer, Wild turkey, Black bear, American woodcock, beaver (*Castor canadensis*), River otter (*Lontra Canadensis*), Raccoon, and various waterfowl species

- *Target Non-Game Species*- Cooper's hawk, chimney swift, Northern flicker, red-headed woodpecker, yellow-billed cuckoo, worm-eating warbler, wood thrush, hairy woodpecker, spotted salamander, mole salamander, bald eagle (*Haliaeetus leucocephalus*), Willow flycatcher, Kentucky warbler, Swainson's warbler, hoary bat (*Lasiurus cinereus*), and Eastern box turtle

- *Management Strategies and Needs*- Implement limited forestry activities where permitted to develop woodcock and other wildlife habitat. Implement appropriate applications of herbicide to sites where there is a need to control competitive vegetation and non-native invasive species.

- *Infrastructure Needs*- Increased planning, identification, and development of access to suitable stands.

- *Management Challenges* - Limited management allowed within EEP buffer areas. Increased establishment and spread of non-native invasive species. Limitations due to topography, access, and stream side management zone buffers. Siltation.

OPEN OVER-STORY, EARLY SUCCESSIONAL FORESTS

Open over-story, early successional habitats account for approximately 4% of the total area of Sandy Mush Game Land and total 116 acres. This habitat type is unique because it is representative of an overall habitat condition rather than a specific habitat type, as it exists within multiple forest types, specifically those associated with fire and increased disturbances. On SMGL these include primarily the Dry- Oak forests and Dry Coniferous Woodland forests, and to a lesser extent the Southern Appalachian Oak forests. This habitat type consists of forests with a developed over-story of trees that are widely spaced, and have moderate to large sized canopy gaps.

This system is specifically unique to wildlife as it includes characteristics of both forested and early successional systems. Structure of this habitat type is characteristic of "savannah like" conditions, having basal areas that range between 10 and 30 square feet. Because of the wide

spacing of canopy trees, conditions in the understory more closely resemble that of open early successional habitats than other forested or woodland type habitats. The understory in this habitat consists of a dense herbaceous layer made up of forbs and grasses that include species such as Little bluestem (*Schizachyrium scoparium*), Big bluestem (*Andropogon gerardii*), and Indian grass (*Sorghastrum nutans*). Shrub layers are often low to moderate in density and consist of regenerating pine and oak species, and on drier sites may include huckleberry and blueberry. Shrub species such as chinquapin (*Castanea pumila*) may occur. Over-story in these habitats primarily consists of fire tolerant pine and oak species such as, shortleaf pine, pitch pine, white oak, chestnut oak, and scarlet oak. Hickories may also be a component in these systems as well.

Disturbance from fire plays an extremely important role in both the creation and maintenance of these habitats, and occurs at higher frequencies and somewhat higher intensities than other forested habitats. Combinations of regular, low and moderate intensity fires maintain the open canopy structure as well as set back succession in the understory. In some situations, higher intensity fires may occur, creating new canopy gaps and thinning some of the over-story. These type fires are often localized and occur in a mosaic type pattern. Short, infrequent periods of fire exclusion occur to allow for some regeneration to advance and position themselves to replace dominant trees once they have fallen out of the canopy. These conditions were prevalent prior to European settlement when native Americans burned regularly creating expansive areas for large ungulates such as bison and elk.

Managing for a diversity of habitats across the game land includes restoring and maintaining open "savannah" like habitats that provide structural components of both open and forested ecosystems.

Open over-story, early successional habitats are particularly important habitats for wildlife as they provide a forested structure with a predominantly open mid-story and developed understory. These conditions are often extremely limiting across the landscape and are important habitats particularly for a variety of bird species such as brown-headed nuthatches and vesper sparrows. These habitats provide great opportunities for foraging as well as provide perching and nesting sites. Also included in this habitat type are areas that have undergone silvicultural treatments to reduce basal area of stands and promote regeneration of pine and oak species beneficial to wildlife. These silviculturally treated areas will be included in this habitat type until cohorts of regenerating trees become dominate in the understory.

- *Desired Future Condition (DFC)*- Increase the total amount of habitat occurring across the game land. Over-story occurs in an open "savannah like" condition (BA 20- 40) comprised of oak, hickory, and yellow pine species. Over-story contains a diversity of uneven-aged

trees. Understories are lush and highly diverse containing an abundance of grasses, forbs, and herbs and having varied vertical structure. On drier sites an abundance of Vaccinium species such as blueberry and huckleberry are found. Regeneration of oaks, hickories, and mountain yellow pine species are found throughout, and relative over-all abundance of mountain laurel and rhododendron is controlled.

- *Target Game Species*- Ruffed grouse, Bobwhite quail, Whitetail deer, Wild turkey, Black bear, Eastern Cottontail rabbit, Mourning dove, and American woodcock

- *Target Non-Game Species*- Common nighthawk (*Chordeiles minor*), American kestrel, barn owl, Eastern whip-poor-will, Eastern kingbird, prairie warbler, field sparrow, blue grosbeak, orchard oriole, Eastern kingsnake, Eastern box turtle, and least weasel

- *Management Strategies and Needs*- Significant increases in both prescribed burning and timber harvest areas (see Forest Management section) to be conducted jointly across all areas. Implement appropriate applications of herbicide to sites where there is a need to control competitive vegetation and non-native invasive species.

- *Infrastructure Needs*- Increased planning, identification, and development of access and firebreaks in to suitable stands and potential burn units.

- *Management Challenges* - Increased establishment and spread of non-native invasive species. Increased development and adjacent private/ urban interface along game land boundary. Limitations due to topography and access. Air quality standards for Buncombe County limiting number of burn days.

Open Habitats

Open habitats on Sandy Mush Game Land are habitats that do not contain a developed, forested, over-story, and includes all areas of non-forested early succession habitat. Open habitats make up approximately 26% of the total area of game land (727 acres).

NON-FORESTED EARLY SUCCESSION

Although the combined amount of early successional habitat (ESH) across the game land totals around 30% (843 acres), non-forested early successional habitats account for approximately 26% (727 acres) of SMGL. These open habitats consist of three main classifications which include: Herbaceous Early Succession (36% of ESH), Shrub Early Succession (27% of ESH), and Woody Early Succession (37% of ESH) (*Appendix XVI*). Maintained phone and power line right-of-ways that intersect and cross the game land (39.33 acres) are also included in the category of non-forested early successional habitat. For the purpose of this plan, early successional habitat is generally defined as areas that are between 0-18 years of age and located structurally between bare ground and young forests.

Within different types of ESH, structure and plant composition differ considerably, consisting of grasses, forbs, shrubs, woody stems and sprouts, or a mix of herbaceous and developing woody vegetation. However, between different types of early successional habitat,

there are two common factors. First, these habitats will have a well-developed ground cover layer that does not have a closed, mature tree canopy; and second, early successional habitats are created and or maintained by intense or recurring disturbances (Greenberg 2011). These disturbances include varying types and intensities of natural disturbances such as wind, ice, disease, and fire; as well as human caused disturbances such as timber harvest, prescribed burns, land clearing, and cattle grazing. Topographic position, soil characteristics, and climate may also play an important role in the creation and maintenance of early successional areas (NCWAP 2005). Depending on the type of disturbance and other ecological and environmental factors, the size and distribution of these type habitats may range from small canopy openings to large meadows and grasslands. Early successional plant composition consists primarily of herbaceous annuals and perennials immediately following disturbance, and then succeed in the absence of continued disturbance towards a composition of woody vegetation.

ESH is an extremely important habitat type as it is one of the most endangered types of ecosystems in the United States (NCRCS 2007). It is a priority habitat for numerous birds and other wildlife species. In fact, over 120 bird species in the southeast have been recognized to be associated with grassland, shrub-scrub, and other early successional habitats (Hunter et al. 2001). These communities are highly ephemeral and are constantly changing in structure, composition, and location across the landscape. This is also true at Sandy Mush, where early successional habitats are continually transitioning. Each year, areas of herbaceous early successional habitat succeed to shrub habitats, shrub habitats to woody habitats, and without management or disturbance, woody habitats to young forests. Therefore frequent disturbances of these habitats are needed to "reset" or suppress succession and maintain open habitat conditions. Continued disturbances across the game land are critical not just for maintaining current early successional habitats, but for creating new areas of habitat to replace those that are transitioning to forested conditions.

Many of the wildlife species closely linked to this type of habitat are also disturbance-adapted wildlife species, and with the lack of disturbance, the attractiveness and productivity of these habitats decline (NRCS 2007). Many species of invertebrates particularly butterflies and moths are also dependent on specific hosts and forage plants that are often only found within early successional plant communities. These type habitats produce an abundance of seeds and attract assemblies of insects that are critical forage for birds and small mammals. The absence of a closed canopy is also important as it allows both light and heat to penetrate to ground level, an essential feature in this habitat for reptiles that depend on heat for temperature regulation (NRCS 2007). These habitats are also important areas for many interior forest bird species that use these areas for fledgling and migration habitats.

Herbaceous Early Succession

Herbaceous ESH covers approximately 9% of the total area of SMGL and totals 259 acres. This habitat type includes areas with vegetation age classes between 0- 4 years and differs from shrub and woody early successional types by having a composition consisting predominantly of grasses, forbs, and other annual and perennial vegetation. Areas such as grasslands, meadows, fallow fields, and food plots are all included in this habitat type. Herbaceous early successional habitats have the shortest fire return interval or frequency of disturbance of any habitat across the game land, occurring annually or biannually. Frequent prescribed fires, annual mowing, and agricultural planting are all tools commonly used for the creation and maintenance of this habitat

type. Also included in the herbaceous early successional habitat designation are some power line and telephone right-of-ways, which account for 9.45 acres.

Open pastures once dominated by tall fescue are restored to native forbs and grasses which were present in the seed bank and stimulated following prescribed burns.

- *Desired Future Condition (DFC)*- Total amount of habitat occurring on the game land remains relatively stable to slightly decreasing, with some acres transitioning back and forth between shrub and woody type early succession. Tall fescue (*Festuca arundinacea*) has been removed from all sites and fire adapted communities and plant associations have been restored to areas that are not maintained through agricultural practices (food plots). Overall abundance of non-native invasive species is reduced.

- *Target Game Species*- Bobwhite quail, Whitetail deer, Wild turkey, Black bear, Eastern Cottontail rabbit, Mourning dove, and American woodcock

- *Target Non-Game Species*- American kestrel, barn owl, Eastern whip-poor-will, Eastern kingbird, prairie warbler, field sparrow, Eastern meadowlark, Meadow jumping mouse (*Zapus hudsonius*), least weasel, and Eastern box turtle

- *Management Strategies and Needs*- Implement short interval prescribed burn rotations on all areas not maintained as wildlife food plots. Maintain existing food plots and planted areas using appropriate agricultural practices. Implement appropriate applications of herbicide to sites where there is a need to control unwanted vegetation and non-native invasive species.

- *Infrastructure Needs*- Increased planning, identification, and development of access and firebreaks in to suitable stands and potential burn units.

- *Management Challenges*- Increased establishment and spread of non-native invasive species. Increased development and adjacent private/ urban interface along game land boundary. Limitations due to topography and access. Air quality standards for Buncombe County limiting number of burn days.

Shrub Early Succession

Shrub ESH covers approximately 7% of the total area of Sandy Mush Game Land and totals 196 acres. This habitat type includes areas with vegetation age classes between 4- 10 years. It differs from herbaceous and woody early successional types by having a composition consisting predominantly of shrub type vegetation, but may also contain remnant components of grasses and forbs along with some woody regeneration beginning to establish. Areas such as hedge rows, old fields, and routinely maintained field borders are all included in this type of habitat. These areas have relatively short fire return intervals or frequencies of disturbance that occur every 3-5 years. Regular prescribed fires, infrequent mowing, applications of herbicide, and KG blading are common tools used for the creation and maintenance for this type habitat. Also included in this habitat designation are some power line and telephone right-of-ways, these areas account for 29.88 acres of this type of habitat.

Shrub early succession is a critical habitat type for many priority songbird species and is often a limiting habitat type across the landscape.

- *Desired Future Condition (DFC)*- Total amount of habitat occurring on the game land is increased, with some acres transitioning back and forth between shrub and woody type early succession. Tall fescue has been removed from all sites and fire adapted communities and plant associations have been restored to all areas. Overall abundance of non-native invasive species is reduced.

- *Target Game Species*- Bobwhite quail, Whitetail deer, Wild turkey, Black bear, Eastern Cottontail rabbit, and American woodcock

- *Target Non-Game Species*- American kestrel, barn owl, Eastern whip-poor-will, Eastern kingbird, prairie warbler, field sparrow, orchard oriole, blue-winged warbler, least weasel, and Eastern box turtle

- *Management Strategies and Needs*- Implement short interval prescribed burn rotations on all areas. Implement appropriate applications of herbicide to sites where there is a need to control unwanted vegetation and non-native invasive species.

- *Infrastructure Needs*- Increased planning, identification, and development of access and firebreaks in to suitable stands and potential burn units.

- *Management Challenges*- Increased establishment and spread of non-native invasive species. Increased development and adjacent private/ urban interface along game land boundary. Limitations due to topography and access. Air quality standards for Buncombe County limiting number of burn days.

Woody Early Succession

Woody ESH covers approximately 10% of the total area of Sandy Mush Game Land and totals 272 acres. This habitat type includes areas with vegetation age classes between 11- 18 years. It differs from herbaceous and shrub early successional types by having a composition consisting predominantly of regenerative, woody vegetation with some assemblages of shrubs, and to a much lesser extent, remnant grasses and forbs. Areas such as abandoned fields and secondary successional areas such as clear-cuts are included in this type of habitat. These areas have fire return intervals or frequencies of disturbance that occur every 6-8 years to maintain. Often these areas are created by removing disturbances from and allowing other early successional areas to succeed. Much of the woody early successional habitat on Sandy Mush Game Land has established from old pastures and fields that are not being managed due to deed restrictions, inaccessibility, or other limitations that prevent them from being maintained. Regular low intensity prescribed fires, clear-cutting, and KG blading are common tools used for the creation and maintenance for this type habitat.

The establishment of tree saplings in woody early successional habitat signals the first stages of a young forest and provides beneficial cover for many wildlife species.

- *Desired Future Condition (DFC):* Total amount of habitat occurring on the game land remains relatively stable to slightly decreasing, with some acres transitioning back and forth between shrub and woody type early succession. Tall fescue has been removed from all sites and fire adapted communities and plant associations have been restored to all areas. Overall abundance of non-native invasive species is reduced.

- *Target Game Species*- Bobwhite quail, Whitetail deer, Wild turkey, Black bear, Eastern Cottontail rabbit, Ruffed grouse, and American woodcock

- *Target Non-Game Species*- Eastern whip-poor-will, field sparrow, wood thrush, hairy woodpecker, yellow-billed cuckoo, Eastern kingsnake, least weasel, and Eastern box turtle

- *Management Strategies and Needs*- Implement short interval prescribed burn rotations on all areas. Implement appropriate applications of herbicide to sites where there is a need to control unwanted vegetation and non-native invasive species.

- *Infrastructure Needs*- Increased planning, identification, and development of access and firebreaks in to suitable stands and potential burn units.

- *Management Challenges*- Increased establishment and spread of non-native invasive species. Increased development and adjacent private/ urban interface along game land boundary. Limitations due to topography and access. Air quality standards for Buncombe County limiting number of burn days.

Aquatic Habitats

Aquatic habitats account for approximately 2% of the total game land (66.75 acres) and include two classifications: Riverine and Aquatic Communities and Bogs and Associated Wetlands (*Appendix VIII*).

RIVERINE AND AQUATIC COMMUNITIES

Riverine and Aquatic Communities represent the vast majority of the aquatic habitats on Sandy Mush Game Land accounting for 66.11 acres. This primarily consists of the areas defined by Sandymush and Turkey creeks, but all riverine aquatic communities across the entire game land including the area of the French Broad River that adjoins the property to the east will also be incorporated into the description of this habitat type. To date, no surveys have identified any priority or federal or state listed aquatic species in streams on Sandy Mush Game Land.

Pictured above is the confluence of Sandy Mush creek and the French Broad river (left) showing sediment deposition, and Turkey creek (right).

French Broad River

Sandy Mush Game Land is bordered by 2.8 miles of the French Broad River. The river is a popular destination for a wide array of recreationalists such as; wildlife viewers, paddling sport enthusiasts, and sport fishermen. Although the French Broad River as a whole contains fairly

good aquatic habitat and supports a wide diversity of aquatic organisms and game fish, the section of the river located along the game lands does have reduced species diversity. This can be primarily attributed to the two hydropower dams (Craggy and Capitola) which isolate the reach, degrade habitats, and limit the possibility of rare fishes immigrating back into this section of the river and into Sandymush Creek. Some assisted restoration would likely be required for many native species to return to these areas.

- *Desired Future Condition (DFC)*- Overall amount of fine sediment and other non-point source pollutants into the river are reduced and controlled. Diversity and productivity of aquatic communities are enhanced and restored. Public fishing opportunities are increased through improved access.

- *Target Game Species*- Anglers target a diversity of fish species on the French Broad River including muskellunge (*Esox masquinongy*), smallmouth bass (*Micropterus dolomieu*), redbreast sunfish (*Lepomis auritus*), channel catfish (*Ictalurus punctatus*), and flathead catfish (*Pylodictis olivaris*).

- *Target Non-Game Species*- French Broad crayfish (*Cambarus reburrus*) and Olive darter (*Percina squamata*) have been found in the vicinity, but have not been confirmed adjacent to the property.

- *Management Strategies and Needs*- Aquatic game species are managed through NCWRC regulations. Aquatic habitat and water quality necessary for target game and non-game species, alike, can be improved and protected by observing Forestry Best Management Practices on game land property and by working cooperatively with other governmental agencies, non-governmental organizations, and landowners to protect and improve riparian areas throughout the watershed.

- *Infrastructure Needs*- There is need for the NCWRC to identify opportunities to facilitate recreational use of the French Broad River, including the potential to include a small portion of the game land adjacent to the river into the North Carolina Paddle Trail program. The Paddle Trail program is a river trail (blue-way) stretching from the headwaters of the river to the state line where it connects with a blue-way in Tennessee. The paddle trail provides opportunities for riverside camping, hiking, and wildlife viewing.

- *Management Challenges*- Increasing amounts of fine sediment pollution from erosion in the watershed which is commonly a result of poor agricultural, development, and forestry practices. Overall size of river basin which extends upstream through a large area of western North Carolina where there are numerous non-point sources of pollution and sedimentation.

Sandymush Creek

Aquatic habitats within Sandymush Creek have been significantly impacted by human activities throughout the watershed. Historically, large portions of the watershed were used for agricultural activities that included cattle watering in the creek. In more recent years, development has resulted in continued erosion and fine sediment deposition which blankets much the natural stream substrate, occupies pool habitat, and reduces the abundance and diversity of aquatic organisms in the stream. These impacts have degraded the natural habitat

complexity necessary to support diverse aquatic communities. As a result, biodiversity is very low in Sandymush Creek. In addition, although the stream is large enough to support smallmouth bass near its confluence with the French Broad River, the available pool habitat is occupied by fine sediment deposits and as a result there tends to be little to no recreational fishing opportunity.

- *Desired Future Condition (DFC)*- Overall amount of fine sediment and other non-point source pollutants into the stream are reduced and controlled. Diversity and productivity of aquatic communities are enhanced and restored. Public fishing opportunities are increased through the stocking of trout in appropriate areas with adequate access provided.

- *Target Game Species*- Near its confluence with the French Broad River, Sandy Mush Creek contains smallmouth bass and redbreast sunfish; however, their abundance is too low to support quality fishing which is directly correlated to the abundance of fine sediment deposition.

- *Target Non-Game Species*- A suite of species that are currently either extremely rare or extirpated from the Sandymush Creek system could be improved or restored if habitat conditions were improved. These include: French Broad crayfish, Olive darter, Southern blotched chub (*Erimystax insignis eristigma*), Gilt darter (*Percina evides*), Banded darter (*Etheostoma zonale*), Redline darter (*Etheostoma rufilineatum*), Greenside darter (*Etheostoma blennioides*), Tangerine darter (*Percina aurantiaca*), Silver shiner (*Notropis photogenis*), Highland shiner (*Notropis micropteryx*), Telescope shiner (*Notropis telescopus*), and Fatlips minnow (*Phenacobius crassilabrum*).

- *Management Strategies and Needs*- Trout fishing is limited in northern Buncombe and southern Madison Counties. Improved public access to Sandymush Creek may allow NCWRC to expand its Public Mountain Trout Water Program and create a Hatchery Supported trout fishery. Fine sediment pollution is degrading aquatic habitat and fish communities throughout most of the Sandymush Creek system. NCWRC should seek opportunities to cooperate with other governmental agencies, non-governmental organizations, and private land owners to control these sediment sources by repairing and enhancing upstream riparian areas. If sediment sources within the watershed are controlled and fine sediment deposits are allowed to naturally be transported downstream, sport-fishing would likely improve.

- *Infrastructure Needs*- Angler access to Sandymush Creek needs to be improved on the game land. In general anglers need safe parking locations and trails to streams. In addition, trout stocking would require access for stocking trucks.

- *Management Challenges*- Continued fine sediment deposition and other non-point source pollution from erosion throughout the watershed. Ongoing erosion of soils caused by poor agricultural, development, and forestry practices. Much of the watershed where sedimentation and non-point pollutants are entering the creek occur up stream, off of the game land.

Turkey Creek

Aquatic habitat in Turkey Creek is also severely degraded by fine sediment deposits which blanket much the natural stream substrate, occupies pool habitat, and reduces the abundance and diversity of aquatic organisms. These habitats have been significantly impacted by human activities throughout the watershed. Portions of the watershed were also used for agricultural activities that included cattle watering in the creek. In more recent years, development has resulted in continued erosion and fine sediment deposition. These impacts have degraded the natural habitat complexity necessary to support diverse aquatic communities.

- *Desired Future Condition (DFC)*- Overall amount of fine sediment and other non-point source pollutants into the stream are reduced and controlled. Diversity and productivity of aquatic communities are enhanced and restored. Public fishing opportunities are increased through the stocking of trout in appropriate areas with adequate access provided.

- *Target Game Species*- Turkey Creek offers very little to no angling opportunities. Due to its small in size and warm temperatures smallmouth bass and wild trout are not supported in the creek.

- *Target Non-Game Species*- A similar suite of species that are currently either extremely rare or extirpated from the Sandymush Creek system could also return to Turkey Creek if habitat conditions were improved. These include: French Broad crayfish, Southern blotched chub, Gilt darter, Banded darter, Redline darter, Greenside darter, Tennessee shiner (*Notropis leuciodus*),and Telescope shiner.

- *Management Strategies and Needs*- Trout fishing is limited in northern Buncombe and southern Madison Counties. Improved public access to Turkey Creek may allow NCWRC to expand its Public Mountain Trout Water Program and create a Hatchery Supported trout fishery. Fine sediment pollution is degrading aquatic habitat and fish communities throughout most of the Turkey Creek system. NCWRC should seek opportunities to cooperate with other governmental agencies, non-governmental organizations, and private landowners to control these sediment sources by repairing and enhancing upstream riparian areas. If sediment sources within the watershed are controlled and fine sediment deposits are allowed to naturally be transported downstream, sport-fishing opportunities could potentially be created.

- *Infrastructure Needs*- Angler access to Turkey Creek needs to be improved on the game land. In general anglers need safe parking locations and trails to streams. In addition, trout stocking would require access for stocking trucks.

- *Management Challenges*- Continued fine sediment deposition and other non-point source pollution from erosion throughout the watershed. Ongoing erosion of soils caused by poor agricultural, development, and forestry practices. Much of the watershed where sedimentation and non-point pollutants are entering the creek occur up stream, off of the game land.

BOGS AND ASSOCIATED WETLANDS

Bogs and associated wetlands on Sandy Mush total 0.64 acres and primarily consist of one bog and three small ponds. The bog and one small pond are located on the Norco tract, while the second pond is located on the state owned portion of the game land. Although the boundaries have not been delineated, EEP has also classified 18 other significant wetland areas across the game land which includes upland seeps and springs as well as lowland drainages and depressions. Acres for these areas are included in the acres of both forested and open habitats. Hydrology in these areas range from permanently saturated to intermittently dry in the bog area to permanently flooded or pooled in the ponds. The bog is generally fed by seepage water, whereas the ponds and wetlands are feed through surface run off or sub surface seeps. Vegetation in these areas may range from dense shrub thickets to highly diverse herb and sedge dominated areas that may contain dense mats of Sphagnum moss (*Sphagnum flexuosum*). Tree species such as Red maple, Eastern white pine, and Eastern hemlock are commonly found along the edges. Little is known about the factors and disturbance that contribute to the maintenance of these wetland areas, in particularly those that influence the creation of bogs. Most bogs and wetlands in the area are being threatened by the succession of shrubs, trees, and invasive exotic species which alter natural water flows and act to dry out wetlands. The tendency for these areas to experience relatively quick plant succession may suggest that some form of periodic disturbance is needed to keep these areas open and functioning naturally. Such disturbances include flooding caused by beavers, grazing by herds of large mammals, fire, and clearing by Indians (Schafale and Weakley 1990). A complete survey of the bog and other wetlands has yet to be completed, and is necessary to assess habitat condition and species occupancy.

Seasonal hydrological changes occur at the Norco wetland between drier periods during the fall months (left) and wetter periods during the spring months (right).

- *Desired Future Condition (DFC):* Natural hydrologic processes are restored on existing and other potential wetland areas. Relative abundance of non-native invasive species is reduced. Native plant, aquatic, and wildlife populations are maintained and restored.

- *Target Game Species*- Various waterfowl species, Raccoon

- *Target Non-Game Species*- spotted salamander, mole salamander (*Ambystoma talpoideum*), three-lined salamander (*Eurycea guttolineata*), four-toed salamander (*Hemidactylium scutatum*), and common ribbon snake (*Thamnophis sauritus*)

- *Management Strategies and Needs*- Identify, delineate, and map current, non-identified, and potential restoration areas.

- *Infrastructure Needs*- Currently none is known to occur, but will depend upon complete assessment of all bogs and other wetlands present on the game land. However, any infrastructure developments in these areas would be limited to include soft or hard engineered water control structures needed to facilitate the restoration of natural hydrologic processes and functions. Platforms or board walks to facilitate wildlife study and viewing.

- *Management Challenges*- Proliferation and encroachment of plant succession and the introduction of non-native invasive species. Limited management allowed within EEP buffer areas.

Geologic Habitats

LOW ELEVATION CLIFFS AND ROCK OUTCROPS

There are 22 Low Elevation Cliffs and Rock Outcrops identified on Sandy Mush Game Land. With the majority occurring along the Sandy Mush and Turkey Creek gorge. Overall areas of these habitats have not mapped and are included in the forested acres of the game land (*Appendix XIII*). These habitats on Sandy Mush include very steep to near vertical, rock slopes of mafic, basic igneous or metamorphic origin. Hydrology of these habits vary based on slope and aspect, with northern slopes creating cool, moist microclimates to increasingly dry microsites on southern slopes. On some sites wet seepages occur. Vegetation is typically limited to non-existent due to the extreme slopes and rocky substrates, and in some cases may be too dry to allow for growth of vegetation, particularly to a closed canopy condition. Plants that do occur in these areas are largely limited to crevices, small pockets of soil, margins between rock faces, and the cliffs, and bases. Disturbances within these habitats are common and routinely include landslides, falling rock, erosion from run-off, and undercutting by streams (Schafale and Weakley 1990). A complete survey of the cliffs and rock outcrops has yet to be completed, and is necessary to assess habitat condition and species occupancy in these areas.

Many large cliffs and rock outcrops occur across the game land, particularly along the French Broad River drainage (left) and the Turkey and Sandy Mush creek gorges (right).

- *Desired Future Condition (DFC):* Natural hydrologic and geologic functions associated with these type habitats are maintained and protected. Adjacent soils and waters surrounding these areas are preserved as well as adequate buffers are maintained.
- *Target Game Species*- Black bear, Gray fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus*)
- *Target Non-Game Species*- Eastern small-footed myotis, least weasel, three-lined salamander, Southern zigzag salamander
- *Management Strategies and Needs*- Identify, delineate, and map current, non-identified, and potential restoration areas. Protect areas from disturbance.
- *Infrastructure Needs*- None known to exist.
- *Management Challenges*- Potential disturbance from unwanted recreational use. Limited management allowed within EEP buffer areas.

Developed Habitats

This designation includes all areas on the game land that are unsuitable habitat for wildlife and have otherwise been developed. These include areas such as roads, rail ways, and parking areas, and total 25.5 acres or <1% of the total game land. Of the 25.5 acres, the railroad tract and right-of- way along the east side of the game lands that parallels the French Broad River, encompasses 11.56 acres. Needs for developed habitats are included in the Infrastructure section of this document.

FOREST MANAGEMENT

As stated previously, the game land is divided into 12 management units (*Appendix X*), which range in size from 89 acres to 330 acres. These units are delineated by tract boundaries, watershed drainages, large streams, power line right-of-ways, and roads. Due to factors such as inaccessibility, EEP buffer restrictions, steep terrain, and or unsuitable timber, not all areas in each management unit are conducive for forest management. Although early successional habitat is a primary focus of the game land, because approximately 71% of Sandy Mush Game Land is forested, forest management also plays an important role in the creation and maintenance of wildlife habitat. To date there has been no forest inventory data collected for the game land, but the majority of forested areas across the game land are naturally established. As described previously, many of the forested stands have been harvested previously or established from the abandonment of fields over the past 100 years. Forested areas that were too steep to graze or harvest, such as those bordering the Sandymush creek and Turkey creek gorges, are likely the only areas across the game land that have not been impacted from wide scale human disturbance. However, these areas are likely to have been impacted in the past from natural and anthropomorphic fires. Since Wildlife Resources Commission ownership, much of the forest management across the game land has occurred on an individual, stand by stand basis that has been based upon priorities for wildlife habitat enhancement, ecosystem restoration, timber stand improvement, accessibility, or at adjoining landowner requests.

One of the primary focuses of forest management on the game land is restoring ecosystem functionality and improving wildlife habitat within the oak and mountain yellow pine forest communities. Due to the lack of recent disturbances and past poor land use practices, many of the oak and shortleaf pine communities across the game land are degraded, dying, and or being replaced by more shade tolerant, mesic tree species such as Yellow poplar, Eastern white pine, and Red maple. To restore, enhance, and encourage the regeneration of these critically important wildlife communities, forest management practices such as prescribed fire, timber harvest, reforestation, herbicide applications, KG blading, and mechanical release are all needed.

PRESCRIBED FIRE

The use of prescribed fire is of primary importance for restoring and maintaining ecosystem and habitat diversity across the game land and along with timber harvest, is one of the main tools used by NCWRC to manage the property. Many of the habitats across the game land, in particularly those that are the most degraded and most lacking, require regular fire for propagation, enhancement, and maintenance. These include such habitats as oak and mountain yellow pine communities as well as the early successional habitats that are critical for wildlife across the game land. Burning with prescribed fire also helps reduce hazardous forest fuel loads that have the potential to carry wildfire from or across the game land to the many surrounding private lands, houses, and developments that have surrounded the property and continue to increase in number.

Prescribed burns are implemented to improve wildlife habitat and restore native vegetation.

Burning is also an important forest management tool for site preparation prior to regenerative forest plantings. Fire also serves as a means to reduce competition from less desirable tree species such as yellow poplar, white pine, and red maple as well to control off site establishment of mountain laurel and rhododendron. The use of fire also helps to control the spread and establishment of many of the non-native, invasive species that have proliferated across the game land. Currently there are 19 prescribed burn units across the game land that total approximately 482 acres, with an additional 94 acres scheduled to be burned but yet to be implemented. These additional 94 acres consist of 56 acres located on the Norco and 38 acres that would expand two existing units to include areas recently harvested during the 2013 Sandy Mush Timber Sale (*Appendix XVII*). The 19 prescribed burn units across the game land include both forested and open habitats, and are currently being conducted under a restoration and maintenance burning regime that is completed on a 2-5 year rotation. It is also important to note that prescribed burns

are often conducted in conjunction with nearly all of the other forest management practices used on Sandy Mush, as doing so enhances the effect of both the prescribed burn and other forest management practices that are implemented.

TIMBER HARVEST

Timber harvest is also an integral part of forest management across the game land. To date there have been two implemented sales on SMGL that have occurred in 2010 and 2013. These two sales consist of 10 units totaling a combined 48.14 acres (*Appendix XVIII).*Of all acres harvested across the game land, 21.8 acres have been clear-cut and 26.3 acres have been thinned. Of the acres clear-cut, 5.68 acres have been reforested to white pine, 8.12 acres reforested to shortleaf pine, 7.4 acres reforested to northern red oak, and .6 acres allowed to naturally regenerate. Units that have been thinned were implemented as reserve shelterwood harvests that were completed to create a varied forest structure, ranging from woodland to "savanna like" conditions that selected for oak, hickory, and shortleaf pine. Although timber harvest is an important forest management tool for the game land, opportunities to increase the acres and size of harvest areas are limited. This is due to several factors such as inoperable terrain, lack of access, proximity to private residences, and EEP restrictions. Of the roughly 2,679 acres of game land owned by the North Carolina Wildlife Resources Commission, 1,058 acres occur within established EEP buffers and 1,621 acres outside of EEP restrictions (1,047acres are currently forested). Less than 55% of all forested stands on SMGL are available to potential timber harvest (*Appendix IX*).

Some general guidelines for timber harvest on SMGL include:

1. Shelter-wood, selection type harvests, and various thinning regimes generally select leave trees that are beneficial to wildlife (mast producers, etc.), although in some cases may include conifer species (hemlock, shortleaf pine, table mountain pine, etc.) where restoration is the goal.

2. Clear-cut units will be less than 25 acres in size and will be distributed across the game land to provide habitat diversity and early successional habitat needs on the landscape.

3. Sites of proposed clear-cutting will be reviewed for significant cultural resources and all sites of proposed timber harvest will be reviewed with appropriate staff regarding issues of protected plants, animals, significant natural and cultural resources, non-game species, potential management conflicts, etc.

4. Firewood harvests will be administered through the sale of firewood permits on designated sites (usually along roads and at log landings where personal fuel wood is easily available).

5. Riparian buffer zones will be left at widths of no less than those recommended by North Carolina Forest Service Forestry Best Management Practices and all North Carolina Forest Practices Guidelines will be applied where applicable.

2013 Oak reserve shelterwood harvest areas implemented to improve forest structure and encourage oak regeneration.

REFORESTATION

Generally, stands that are clear-cut will either be planted back to either shortleaf pine or and oak species. In some situations clear-cut sites may be planted back in varying arrangements of oak and pine, with pine being planted on the ridges and drier sites of the harvested areas. In rare situations and where appropriate white pine may be planted. In these situations white pines are planted to provide cover and roosting places, but they also develop into small pockets of highly value timber. In many instances the incorporation these highly valued white pine stands into timber sales provide loggers with an additional incentive to harvest stands of less valuable timber that are needed to implement important forest restoration management activities across the game land. In most all situations, a varying arrangement of a mixed pine/hardwood stand will be desired. Sites that are planted back with pine will occur on a wide spacing of 14 by 14 feet to encourage development of mixed pine/hardwood stands, which provide better habitat diversity than pure pine stands. Additionally, sites to be planted with pines are often site prepared by prescribed burning, which will generally occur during summer and fall months outside of the nesting season. However, areas planted with oaks are often planted on a somewhat tighter spacing (typically 12x12) than those areas planted with pines to account for dead loss. Natural regeneration has and will continue to be a major form of reforestation on the game land. In some cases herbicide use, mechanical release, and prescribed burning will be used to enhance both natural and planted regeneration (both pre and post-harvest) as needed.

HERBICIDE TREATMENTS

Applications of herbicide for forest management are another tool that is being implemented on SMGL. These practices are generally carried out through contracts with the North Carolina Forest Service in conjunction with both site preparation services and or tree planting services. The use of herbicide for forest management purposes is particularly important with regards to controlling the wide variety and excessive amounts of non-native invasive species that are found throughout the game land. Controlling invasive species is a critical component of habitat restoration and a pivotal step in ensuring the success of reforestation plantings following timber harvest. Herbicide is also beneficial in helping to control competition to planted seedlings from fast growing tree species such as yellow poplar and white pine following timber harvests.

Applications of herbicide to control competition are typically carried out following reforestation plantings, but are also being implemented prior to timber harvest as well.

Applications of herbicide are used prior to timber harvest to control competition and non-native invasive species such as Oriental bittersweet (*Celastrus orbiculatus*) (right).

KG BLADING

The use of a KG blade to set back succession and aid in forest and habitat restoration has also been an implemented forest management technique used on SMGL. Although there are some limitations due to access, topography, and EEP buffers; the use of a KG blade has proved very helpful in setting back plant and tree succession and converting several old field areas overgrown with Virginia pine back to open conditions. The use of the KG blade in conjunction with prescribed fire to increase the fuel load in carries fire and consumes unwanted vegetation. By doing so, the effects of the prescribed burn are increased and conversion to a more wildlife beneficial habitat was enhanced and hastened. All KG work on the game land to date; have been implemented through contracts with the North Carolina Forest Service.

Before and after pictures of a Virginia pine stand that received a KG blade treatment followed by an implemented prescribed burn to restore to an open condition.

as across the region. As with oak forests, timber harvests (primarily shelter-wood cutting and/or thinning), herbicide use (to control competition with other regeneration), mechanical release, prescribed burning (to enhance forest stand structure and promote reproduction), and planting of shortleaf will be needed to promote healthy and diverse pine forests.

There is also an immediate need to conduct accurate forest resources inventories and stand maps for the entire game land. This will provide important information for planning and directing forestry and wildlife habitat management on Sandy Mush. Additionally, opportunities for forest management and wildlife habitat research have and should continue to be encouraged on the game land.

GAME LAND INFRASTRUCTURE

Sandy Mush Game Land is divided into 12 management units (*Appendix X*), which are delineated by tract boundaries, watershed drainages, large streams, power line right-of-ways, and roads. For the purposes of this document, infrastructure assessments and recommendations will be addressed by management unit. Existing infrastructure assessments for SMGL were conducted by Engineering & Lands Management staff in 2013. The results of these assessments along with recommendations for maintenance and improvements are discussed by category below. Maps of current and future infrastructure planned on SMGL can be found in appendixes *XI- XIII*.

Roads

The management units that make up SMGL are connected and accessed via a combination of improved roads maintained by NCDOT and access roads that are maintained by NCWRC. All NCWRC access roads except one (the Ramsey Shelson road) are closed to public vehicle traffic. Locations of maintained and unimproved roads that have been identified on SMGL are included in Appendixes XI- XIII. Approximately 10.9 miles of roads are identified as maintained roads which are regularly used by NCWRC staff for management purposes. Many of these maintained roads have been graded and left with a dirt/grass surface and have minimal drainage improvements. These maintained roads are important as they facilitate NCWRC staff to conduct maintenance and conservation work, but also for use by the public as pedestrian pathways for hunting, fishing, wildlife viewing, and other activities. An additional 20 miles of unimproved roads consisting of logging roads, fire breaks, and old road beds, have been identified on the game land. For the purpose of this infrastructure assessment, fire lines/breaks and unimproved logging roads have not been inspected, but are discussed in other sections of this management plan.

EXISTING ROAD CONDITIONS

Most of the NCWRC maintained access roads on SMGL have been minimally improved for a level of service limited to maintenance and conservation access for staff and pedestrian access for public users. Hard surfacing and other improvements have been avoided or limited in keeping their locations in managed linear wildlife openings or designated buffer areas. Some were recently maintained or improved following timber harvesting. The major NCWRC maintained access roads that are in the best condition include the following:

Cedar Hill

The Cedar Hill West management unit is located along the northeastern extents of the Sandy Mush Game Land. The access road follows a ridge line adjacent to managed dove fields for approximately three quarters of a mile. This road also serves as the primary administrative access to the French Broad River. The area between the access road and the river is designated buffer. This road is well maintained for its level of service. Some gravel has been placed at locations where needed.

Bear Creek

The Bear Creek management unit, located in the western half of the game land, was harvested for timber shortly before being acquired by NCWRC. The major NCWRC maintained road runs for 0.9 miles across the tract. A good sized parking area and gate are located at the eastern end of this road which provides pedestrian access for deer and rabbit hunters. The road has been cleared and graded with water breaks installed, and is maintained well for its level of service.

FUTURE ROAD IMPROVEMENTS

Maintenance and needs for future improvements were identified on the remaining existing sections of NCWRC access roads. Many of these roads provide direct access to management units of the game land. Other tracts lack improved access because they are either isolated from NCDOT maintained roads by private property or the lack of improved stream crossings. The recommendations for improvements to existing maintained roads and for the development of new access roads (Appendixes XI- XIII) are discussed in this section and are grouped by priority as follows:

High Priority

Based on assessments of the current condition, level of use and anticipated use of existing roads on SMGL; the following should be considered the highest priority for upgrade over the next ten years:

- Madison South Management Unit - Seasonal Access Road
- Madison North Management Unit - Right of Way to Connect
- Meadows Town Management Unit - Ford Improvement

Madison South Management Unit - Seasonal Access Road

The 0.45 mile section of Ramsey Snelson Road that is maintained by NCWRC is open seasonally to public vehicle traffic. This is the only NCWRC maintained access road on SMGL that is currently open to public vehicles. Access to the road is seasonal, and is currently controlled by the placement of two gates.

The first section of this access road begins at the end of the NCDOT maintained section of Ramsey Snellson Rd, and runs for one quarter of a mile to the gate at the game land boundary. This section is a right of way through private property, and has an improved gravel surface. For the last 500' before the game land boundary, the width of the road is limited and drainage work

has been restricted by topography and proximity to the property owner's residence. The cut bank along this section of the road (at N35.73224°, W82.67946°) is steep and unstable. This has made it impractical to install or maintain a ditch line. Ideally, the road should be widened enough to establish a shoulder, ditching and stable bank slopes. If it is not possible to widen the road toward the cut bank, then NCWRC staff should assess whether it is feasible and permissible to realign this section of the access road away from the cut bank.

After passing through the gate at the game land boundary, this access road continues for an additional 0.20 miles to end at a small parking area/turn around. The unimproved road continues past the parking area and a large barn. A gate prevents public vehicle access beyond this point. This section of improved road is in relatively good condition. Being that it is the only road on SMGL that is open to public vehicles, improvements such as widening, crowning, installation of ditches and drainage culverts should be considered a high priority in order to maintain that level of service. Additional improvements such as expanding the parking area or providing disabled hunter access should be considered for this site. Estimated cost for road improvements is $30,000.

Madison North Management Unit - Right of Way to Connect

A 1.25 mile section of NCWRC maintained access road runs along the length of the 241 acre Madison North management unit. This road and tract of the game land is cut off from access to NC SR-1115 or any other NCWRC access roads by private property. NCWRC staff currently access this road for management of several linear fields with informal permission to cross through 1,000' of adjacent private property. NCWRC holds no right of way or easement through this property, and public access through this private land is not currently allowed.

Obtaining a permanent easement or right of way to provide the public with access to this section of SMGL should be a high priority. If this can be achieved, then it should be feasible to develop parking and install a gate just beyond the game land boundary. The need for further improvements to the existing road should be decided based on whether public access can be acquired.

Meadows Town Management Unit - Ford Improvement

The 247 acre Meadows Town management unit is located on the western side of SMGL Sandymush Creek runs along the western boundary of this tract. The creek is a barrier that currently prevents administrative or public access to the tract from Meadows Town Road (SR-1001). The game land boundary extends beyond the creek to the NCDOT right of way in several locations, but there is no improved crossing to access the main portion of this tract.

An existing ford crossing of Sandymush Creek has been identified (N35.72217°, W82.73132°). The ford crosses at a shallow section of the creek, but has not been used for some time. The approaches to the ford are overgrown, and the bed of the creek has shifted making the ford impassible in its current condition. The width of the creek at this location is approximately 90' from bank to bank. Rehabilitation of this ford will restore administrative access to the Meadows Town management unit for maintenance and conservation work. Development of a parking area and foot bridge at a site 0.35 miles upstream of the ford location will provide the public with access to the Meadows Town unit. Restoration of the ford crossing will involve improving the approaches for approximately 200 feet on each side of the ford. In stream work

may involve construction of a rock sill to maintain a riffle feature at the ford location or installation of pre-cast concrete slabs across the stream bed. Beyond the approach of the Meadows Town unit, existing road beds will require some improvement to meet the desired level of service. The estimated cost for the approach road and ford improvements is $20,000. The costs for road improvements on the Meadows Town unit will be determined based on the needs and the conditions of existing road beds once access is restored.

Medium Priority

The following roads should be considered as medium priority for upgrade after completion of improvements to the listed high priority road projects:

- Cedar Hill East Management Unit Access Road

Cedar Hill East Management Unit Access Road

Approximately 350 feet of access road connects Cedar Hill Road (SR-1632) to a small parking area which provides access to the managed dove fields within the Cedar Hill East management unit. Currently this access road and parking area have been improved with a gravel surface. A small section of the access road needs to be realigned to remove a difficult bend near the point where it splits at a gate and the entrance of the parking area. In addition to the realignment of the access road, an old road bed exists which follows the ridge top through a stand of timber that is currently planned to be included into a future timber sale. The future implementation of a timber sale in this area would provide an opportunity to improve the old road, provide additional access for game land users, and provide a means of expanding the existing parking area. Adjustments and improvements to the access road are estimated at $8,000.

Low Priority

The remaining NCWRC roads throughout SMGL should be considered as low priorities for improvement. Maintenance of most of these access roads involves grading, bush hogging and occasional placement of stone where needed to stabilize soft areas. This maintenance approach is adequate for current management and conservation practices where public access is limited to foot traffic. If management practices or intended public uses change in certain areas, additional maintenance or improvements to these roads may be required. NCWRC management staff should routinely inspect the condition of these access roads for indications of surface instability or drainage problems. Engineering staff should be notified if problem areas are identified that may change the prioritization these access roads.

NEW ROAD CONSTRUCTION

Due to the extents of the designated buffer areas throughout SMGL, the steep topography and the presence of NCDOT and NCWRC maintained access, there are few options for the development of new access roads. Some areas of the game land that do not currently have road access are isolated tracts that are cut off from existing roads by private property or natural barriers. Acquiring easements or rights of way along existing roads or driveways should be the first priority for securing access to these tracts. Building fords or bridges to access those tracts cut off by streams should also be investigated, but may be problematic due to cost and buffer restrictions. In these buffer areas, road construction is typically restricted to improvement of

existing road beds or crossings. Short lengths of new road construction may be required at areas where new parking areas are proposed for development. These areas are addressed in the "Parking Areas" section of this document.

ROAD MAINTENANCE

All roads require inspection and maintenance to function well and avoid damage and deterioration. Maintenance should be performed regularly, as the longer the delay in needed maintenance, the more damage will occur and the more costly the repairs will be.

Below is a list of typical road maintenance practices:

- Inspect Roads regularly, especially before the winter season and following heavy rains.
- Keep ditches and culverts free from debris (see Culvert section).
- Remove sediment from the road or ditches where it blocks normal drainage.
- Re-grade and shape the road surface periodically to maintain proper surface drainage.
    - Typical road should be crowned at approximately 4%, or ½" per foot.
    - Some roads may not require a crown, but should have a constant cross slope (super-elevation).
    - Gravel should be distributed at an even depth across the road.
    - Gravel should have an even distribution of fine and course materials.
    - Keep downhill side of the road free of berms, unless intentionally placed to control drainage.
    - Proper maintenance and grading of the road will require a motor grader and a roller.
- Avoid disturbing soil and vegetation in ditches, shoulders, and cut/fill slopes to minimize erosion.
- Maintain shoulders on both sides of the road to ensure oncoming vehicles have enough room to pass. Shoulders should be relatively flat, with a mowed grass surface.
- Maintain an erosion-resistant surfacing such as grass or rip rap in ditches.
- If it is determined that a road needs major repairs or upgrade, contact Regional Supervisor and Design Services to schedule an assessment.

Parking Areas

There are currently eleven identified parking areas maintained by NCWRC on SMGL. The larger parking areas such as Turkey Creek, Cedar Hill, and Bear Creek range in capacity from 10 to 20 vehicles. Smaller cul-de-sac and roadside pull-off areas may only have the capacity for 2 to 4 vehicles each. All of the existing parking areas that were inspected have a gravel surface and are in good condition. Most of the existing parking areas are located at the head of maintained access roads. Gates are located at the edges of the parking areas where these access roads begin. The perimeters of many of the parking areas are defined either by set post and cables or by

reused power cables that are anchored to trees. These barriers are intended to prevent bypassing the gates on all-terrain vehicles.

Parking areas, such as this one located off of Cedar Hill road, are regularly maintained with gravel.

The following areas have been identified for development of new or expansion of existing parking facilities:

- The Meadows Town management unit is currently cut off from and public access by Sandymush Creek. An area on the game land located (N35.71813°, W82.73303°) between Sandymush Creek and Meadows Town Road (SR-1001) has been identified for development as a parking area. This area is relatively level bottom land, but the elevation of Meadows Town Road and its steep embankment will require construction of approximately 100 feet of entrance road. The space required for the entrance road and buffer restrictions will limit the potential capacity of this parking area to around 10 vehicles. Estimated cost for construction of the entrance road and parking area is $20,000. Construction of a foot bridge across Sandymush Creek at this location will also be necessary as to provide pedestrian access from the parking area to the Meadows Town management unit. The width of Sandymush Creek at this site is approximately 60 feet from bank to bank. Buffer restrictions may require extending the span beyond the protected areas. Estimated cost for design and construction of the pedestrian bridge is $30,000 to $50,000.

- A NCWRC maintained access road beyond a gate along Old HWY 20 leads to a popular hunting field on the North Turkey Creek management unit. Parking is currently limited to the portion of the access road just before the gate and along Old HWY 20. A site with potential for development has been identified adjacent to the access road beyond the existing gate. This site is on open pasture, but it is sloped. A level area would need to be graded across this slope to create up to 10 parking spaces. A post & cable barrier and a second gate would also need to be installed. Estimated cost for this development is $20,000.

- The existing parking area located on the Cedar Hill East management unit (also known as the Orchard parking area) has been identified with potential for expansion. The area can currently accommodate 2 to 4 vehicles. Following the proposed timber harvest, the parking capacity could potentially be doubled. Realignment of the existing access road should be done in coordination with the parking area expansion. Installation of new

post & cable barriers and a second gate will also be needed. Estimated cost for this parking area expansion and installation of post/ cable barriers and a new gate is $10,000.

Gates

Lockable gates are installed at or near the entrance of each NCWRC maintained access road. These gates limit access in these areas to maintenance and conservation staff except for those areas where seasonal public vehicle access is permitted. All gates are constructed of steel pipe with concealed locks, and are in good condition.

Pictured above is a gate located on Sandy Mush Game Land. This set up is typical of most gates on the game land, and is used to restrict motorized access to the public.

Structures

Fourteen barns or other structures have been identified within SMGL, and are shown on the infrastructure maps in the Appendixes XI- XIII. The NCWRC safety officer inspected these structures soon after the game lands were acquired, and a majority of these structures are of sound condition.

The following structures however have suffered storm damage or have otherwise partially collapsed. These should be demolished and removed from the game land:

- Martin Candler Barn – Left Side (N35.71761°, W82.67210°)
- Don Snellson – Second Barn (N35.73644°, W82.67229°)
- Don Snellson House (N35.73709°, W82.66843°)
- Meadows Town Barn (N35.72189°, W82.73016°) *currently inaccessible

The estimated cost for demolition and removal of these four buildings is $40,000.

All of the other standing barns located on the game land are either know or potential habitat for barn owls, which are a species of concern. Rather than razing the structurally sound barns, their doorways have been boarded over and the barns have been posted to prevent trespassing.


Two of the structures slated for removal from the game land are the Don Snellson- second barn (left) and the Martin Candler barn (right). Pictures above are from several years ago and since then both structures have become even more dilapidated and pose a potential liability to the public.

Drainage Structures

DAMS

There are no dams located within SMGL.

IMPOUNDMENTS

There are no impoundments, managed ponds, or lakes located within SMGL.

CULVERTS

Many of the NCWRC maintained access roads on SMGL are out sloped with water breaks installed for drainage. Some culverts were installed prior to NCWRC acquisition of the particular tract. Existing stream crossings have also been identified. Buffer restrictions may prevent the installation of culverts at the stream crossing locations.

Two of the identified culverts are in good working condition. The third culvert located (N35.71997°, W82.74064°) on a perennial tributary on a block of the Meadows Town management unit has been identified for removal. This culvert is of unknown size and length as both the inlet and outlet have been silted over. Private individuals have been crossing the game land at this culvert to reach a dumping site located just beyond the game land boundary. This is an ongoing problem and an issue that is being addressed.

Since the culvert no longer functions, it has been recommended that NCWRC remove it completely and restore approximately 80 linear feet of the tributary channel to a natural state. Restoring this channel and installing a gate at the beginning of the existing road grade should block access to this dump site. Refuse and debris at the existing dump site should be removed before the culvert and channel work commences, and the gate should also be installed before the site is cleaned. The bulk of the dumped trash lies just beyond the game land boundary. Some research will be required to determine whether NCWRC is legally able to remove this waste or if

it is the responsibility of the adjacent property owner or County solid waste management department. The estimated cost for removal of the existing culvert; channel restoration design, permitting and construction; gate installation and trash clean-up is $10,000.

Regular culvert maintenance should be performed to extend the life and ensure proper function of installed drainage structures. The accumulation of sediment and/or debris at the inlet or outlet of a culvert or damage such as crimping of the pipe effectively reduces the diameter and flow capacity of the pipe. Culvert maintenance includes removal of accumulated sediment and/or debris that prevents passage of water (and organisms) through culvert inlets, outlets and connected drainage ways. It may also include reinforcement of eroding inlets and outlets by installing riprap or other erosion control measures. Damaged culverts and culverts requiring frequent repeat maintenance should be considered for future remediation via redesign and reinstallation.

The following items should be checked for and addressed as part of routine culvert maintenance inspections:

- partial or complete blockage of the inlet or outlet of the pipe with sediment, stone, leaves, woody debris, refuse, or any other items that could affect flow through the culvert
- evidence of scour, bank or channel bed erosion near the inlet or outlet of the culvert
- evidence of flow overtopping the road at the culvert location
- damage to the pipe including crimping of the inlet or outlet, crushing or piercing of the pipe
- severe corrosion of the pipe
- damage to headwalls

Staff should inspect ditches and culverts as part of their regular road maintenance activities. This inspection is especially important during leaf fall and following periods of heavy rain. Staff should consider the location of the culvert before performing maintenance using heavy equipment. Culverts located in active stream channels, dedicated or critical habitat areas may require special permission or installation of erosion control measures before maintenance can commence.

Leaves and woody debris that have accumulated in or around the inlet of the culvert should be removed immediately using hand tools if possible. Removal of accumulated silt and/or gravel from ditches approaching the culvert inlet should be performed using a small excavator, backhoe or a tractor equipped with a scrape blade. Sediment in or around the immediate vicinity of the pipe inlet or outlet should be removed using hand tools to prevent damaging the culvert. Cleaned out material is to be pulled away from the culvert then hauled and spread at a site where it cannot be washed back to the culvert area.

Repeat problems with sediment collecting around the inlet may indicate the existence of an erosion problem originating from the slopes, streams or ditch lines in the vicinity of the culvert. Identification and stabilization of these problem areas through practices such as seeding or matting could improve performance of the culvert and reduce maintenance requirements. Flow overtopping the road at the culvert location generally indicates that the pipe is undersized and

could warrant resizing and replacement. Any damage to the culvert, as described above, may also necessitate replacement of the pipe. If maintenance staff identifies any culverts that may need replacement, they should contact engineering staff to calculate the peak flow capacity and diameter of the new pipe. Any culvert upgrade consisting of a single pipe 36 inches and greater, or a crossing utilizing multiple lines of pipe, should include design considerations for fish passage. Specific considerations can be obtained by contacting the Division of Inland Fisheries, Habitat Conservation Program- Technical Guidance section.

Recreation Facilities

The Sandy Mush Game Land provides a variety of opportunities for public recreation. This section will review existing recreation facilities and describe sites identified for potential new development.

BOATING ACCESS AREAS

There are no boating access areas within the Sandy Mush Game Lands. The creeks and rivers within or bordering the game land are not suitable for motor boat navigation. A railroad easement separates the eastern units of the game land from the French Broad River. Opportunities for recreational paddling or float fishing access on Sandy Mush Creek are limited. The steepness and condition of existing logging roads or trails that lead from the maintained access roads to Sandy Mush Creek and the distances from any parking areas to these potential access points are currently prohibitive factors.

PUBLIC FISHING PIERS

There are currently no public fishing piers or platforms located on streams or rivers in the Sandy Mush Game Land. Locations where parking is in proximity to potentially fishable streams include Turkey Creek and the proposed parking area along Sandy Mush Creek at Meadows Town Road. Inland Fisheries staff should coordinate with Division of Engineering and Land Management staff to assess these and any other potential sites for development of accessible bank fishing platforms.

SHOOTING RANGES

There are currently no designated shooting ranges on the Sandy Mush Game Land. The terrain of the area along with the presence of buffers and proximity to residences has essentially eliminated any potential for the development of firing ranges on the game land.

CAMPING AREAS

There are currently no designated camping areas on the Sandy Mush Game Land. No potential sites for development of primitive camping facilities have been identified.

TRAILS

There are over 20 miles of undeveloped remnants of roads within the Sandy Mush Game Land. Several of these old road beds connect to maintained access roads and lead to sites within the gorge along Sandy Mush Creek. Clearing and stabilization of these road beds could improve access to these remote areas for anglers, paddlers and hikers. Clearing and maintenance of these trails could be facilitated through agreements with volunteer groups.

RECREATIONAL FACILITIES MAINTENANCE

Maintenance of recreational facilities is critical to the overall operation of the game land program. Typical use of the game lands is dispersed, however, recreational facilities concentrates users on a specific area or feature. This concentration of users, whether it is a boating access, fishing access, shooting range, or other use, results in a need to ensure the facility is safe and functional. Routine site visits for inspection and maintenance will accomplish this goal. Site visits should consist of two actions: (1) Inspection for safety issues and functionality; (2) Actual maintenance activities.

1. Inspections should examine the following items
   a. Safety inspection items:
      Facility components
      - Decking
      - Handrails
      - Structural supports (piles, substructure, and floats)
      - Fasteners (bolts, screws, and nails)

      Slip or trip hazards
      - Uneven walking surfaces
      - Mud on walking surfaces
      - Ponded water on walking surfaces
      - Drop offs

      Overhead
      - Dead trees or limbs
      - Overhead utilities

   b. Functionality Inspection Items
      Parking
      - Surface condition (ruts, potholes, gravel)
      - Delineation (wheel stops, paint)

      Ramp
      - Blockages (sediment, wood)
      - Surface condition

      Pier/Dock
      - Bollards
      - Wooden components
      - Bumpers

Shooting range
- Berms
- Target area
- Benches
- Shelter (roof, structure, and floor)

Signage
- Kiosk (entrance, regulation and information)
  - ADA
  - No Parking
  - Keep Ramp Clear

2. Maintenance activities should include routine and corrective activities
   a. Routine Activities include:
      - Litter and debris removal
      - Grass mowing
      - Woody vegetative growth control
   b. Corrective activities can include but not be limited to:
      - Lumber replacement
      - Sign replacement
      - Minor grading
      - Tree or limb removal

Over time recreational facilities degrade to the point that routine maintenance activities cannot provide corrective action. Examples of this level of degradation include but are not limited to: structural problems, persistent and/or severe erosion issues, and broken/or severely degraded concrete. Once this level of degradation is reached, supervisory personnel should inspect the facility and determine the scope of the needed repairs. If major repairs are required supervisor personnel should contact an engineer for assistance.

Game Land Use and Development

PUBLIC USE

Hunting/ Trapping

Hunters and trappers are considered to be a primary user group for Sandy Mush Game Land, with white-tailed deer and wild turkey (*Meleagris gallopavo*) being the two primary hunted game species. Deer harvested between the 2010 and 2012 hunting seasons has averaged approximately 20 deer. Turkeys are also found in good numbers across the game land and have had an average harvest of 15 gobblers over the same time period. Black bear have increased their range over the past 20 years in North Carolina and are present on Sandy Mush Game Land, however at low numbers. Since 2008, only 4 bears have been harvested on the game land. Although limited trapping does occur on Sandy Mush, the last several years have seen an increase in interest from trappers using the game land, in particularly, those trappers who are

pursuing predator species such as coyotes and bobcats. Beavers are also another commonly sought after furbearer species. Small game and furbearer species such as: Gray squirrel Eastern cottontail rabbit, Northern bobwhite quail, ruffed grouse mourning dove, American woodcock, red fox (*Vulpes vulpes*), gray fox, raccoon, and Virginia opossum (*Didelphis virginiana*) are all found across the game land and actively hunted and trapped. Dove hunting, an extremely popular hunting activity on the game land, is partially regulated through a permit hunt system which occurs from opening day through the second Saturday of the hunting season. Some waterfowl species occur on the game lands but hunting pressure for these species is light. Sandy Mush Game Land is designated as a "Three-Day per Week" game land, where all hunting is restricted to only Monday, Wednesday, and Saturday of each week of the hunting season, as well as the holidays of Thanksgiving, Christmas, New Years, and Martin Luther King Day.

Management strategies directed towards hunting and trapping should include those that help to maintain or increase the current numbers of hunters and trappers using the game land. Acquisition of properties or easements that provide for better access to remote areas of the game land would be a primary means to help increase the available use of the game land by hunters and trappers. The construction of several new parking areas will help provide better access and increase use, while the construction of a foot bridge in the Meadow Town section of the game land would address a concern to one of the least accessible areas of the game land (see Infrastructure section). Although approximately 87% of those that attended the public meeting felt that the current level of access to the game land is satisfactory; there are several recommended actions which would help increase access to the game land. In addition, locations that will enhance disabled hunter opportunities will also be a primary focus of game land development, and strategies to improve disabled access will be considered when implementing infrastructure improvement and development projects across the game land. A focus on active habitat management will ensure that adequate numbers of game and furbearer species are present to help keep hunter and trapper interest high. Challenges to a quality hunting or trapping experience include conflicts with other game land users as well as low numbers of game species that can be managed for on the game land.

Fishing

Anglers are considered to be a primary user group of Sandy Mush Game Land although there are currently a limited number of fishing opportunities on the game land. The majority of existing angling use occurs along the French Broad River as well as some areas of Sandymush Creek and Turkey Creek. The primary fish species being sought after by most anglers on Sandy Mush include: Smallmouth bass, catfish, and sunfish. Management strategies that increase, where appropriate, the number of fishermen using the game land should be adopted. One strategy being explored is the feasibility of stocking trout in suitable areas along Sandymush Creek and Turkey Creek.

Wildlife Viewing

Wildlife viewing includes activities such as birding, wildlife photography, and general wildlife viewing. Many wildlife viewing enthusiasts come to SMGL to view and to study birds, butterflies, and other wildlife species associated with early successional habitat types. Wildlife viewers are considered to be a primary user group at Sandy Mush Game Land, and management strategies to increase the number of wildlife viewers utilizing the game land will be implemented. In 2009, the game land was designated as part of North Carolina Birding Trail, and

has become an increasingly popular destination for birders and wildlife viewers because of the diversity of habitats found there. Strategies to increase and enhance wildlife viewing opportunities include: continue to maintain and to develop partnerships with wildlife viewing groups and public, establish directional signage along roads that provide access to the game land, establish informational signage regarding wildlife viewing opportunities at key access locations (i.e. parking areas), increase efforts using all media outlets to better publicize Sandy Mush as an NC Birding Trail destination, and identify key waypoints along birding routes as a means to educate and enhance the viewing experiences. Infrastructure improvements needed to better facilitate wildlife viewers include signage as noted above, development of parking areas (see infrastructure section), and the establishment of additional kiosks at key access locations. The continuation of active habitat management will ensure that adequate numbers and a high diversity of wildlife species are present on the game land and will serve to keep viewer interest high. Efforts to provide viewing opportunities near public access will also greatly help to build this new constituency. Some challenges to a quality wildlife viewing experience include conflicts with other user groups on the game land, overcrowding, and potential loss of popular viewing areas to succession.

Other Outdoor Recreation

Hiking is a popular activity on the game land and occurs year round. There are no designated hiking trails currently located at Sandy Mush Game Land. However, there are approximately 11 miles of maintained paths, roads, and linear wildlife openings available for hiking. Although there are restrictions by the Ecosystem Enhancement Program, that limit new trail construction, opportunities to upgrade unmaintained, existing paths and roads to a maintained status will be explored to provide increased walking and hiking opportunities to the public. Other strategies to increase and enhance hiking opportunities include: adding directional signage along roads that provide access to the game land, providing informational signage regarding maintained paths at key access locations (i.e. parking areas), publicizing trails in local outlets and other media sources, and adding user information at kiosks that indicate the best times of the year for hiking. Infrastructure improvements that will be provided to encourage this user group includes: upgrading selected paths and log roads to trails, developing signage as noted above, establishing parking areas (see infrastructure section), and the establishing additional kiosks at key access locations. Conflicts among hunters and hikers may occasionally occur, but increasing game land information available to the public through online resources and kiosks at key access locations may help reduce this source of conflict among user groups.

Mountain biking currently occurs at Sandy Mush Game Land, but at low levels. The current level of mountain biking is not causing any immediate resource issues and therefore should not be increased for several reasons. First, due to the erosive nature of many of the soil types found on the game land (see soil section) and based on an intensive staff review, there have been no suitable trail locations identified. The creation of new biking trails on the game land could also potentially create conflicts with hikers, hunters, and wildlife watchers, as well as degrade wildlife habitat improvements especially in sensitive areas. Additionally, trail development restrictions within EEP buffers further limit available options to provide for these users. Ample opportunities for mountain biking can be found on the nearby Pisgah National Forest and this activity should not be featured on Sandy Mush Game Land.

There are currently no designated horseback riding areas on Sandy Mush Game Land. The development of opportunities for horseback riders to use the game land and specific

recommendations from the public input meeting (very few comments were received requesting horseback riding opportunities) were reviewed and discussed by NCWRC staff. The review of the SMGL revealed a lack of suitable roads of sufficient length and character (loop opportunities) for horse trails. Additionally, stream buffer restrictions placed on the game land by EEP prohibit trails and activities causing erosion in these areas which further reduced potential opportunities for establishing horse trails. Allowing horseback riding on maintained trails would create additional erosion issues, damage to linear wildlife openings, and conflicts with hikers, hunters, and wildlife watchers. Horseback riding also increases the probability of introducing additional exotic species on the game land. Therefore due to the lack of suitable trails, trail development restrictions and the potential negative impacts, horseback trails will not be developed on SMGL. Ample opportunities for horseback riding on the nearby Pisgah National Forest and other public lands in the region offset the lack of opportunities on Sandy Mush Game Land.

Geocaching is also a popular outdoor recreational activity that is occurring on the game land. For this activity participants use Global Positioning Systems (GPS) or other mobile devices to hide and seek containers called "caches". Currently there are 12 geocache locations on Sandy Mush, with the vast majority located near the end of Cedar Hill Road. Most of these caches are located in safe locations just off the main road; however, there are several that are located in somewhat unsafe locations. Caches located in potentially hazardous locations will be discouraged. When administered in appropriate areas, geocaching is a great outdoor activity that could be used to promote and educate the public about management activities occurring on game lands. Currently NCWRC is developing a statewide policy to regulate geochaching on game lands, and SMGL will follow these guidelines.

Wildlife/Habitat Inventory and Monitoring Needs

White-tailed deer and wild turkey are featured big game species on SMGL. Big game harvest records are an important tool utilized to monitor population levels and trends and make management decisions. However, additional surveys (camera traps, hunter surveys.) would augment current information and help WRC staff better manage and make more informed decisions about appropriate harvest levels for both species.

We currently lack adequate information regarding small mammals, amphibians and reptiles on SMGL. General Surveys to inventory and monitor these species and their habitats are warranted. With basic inventory information on these species, we can develop target population levels and develop habitat management strategies to achieve those levels where feasible..

There are a number of invasive plants that are well established on SMGL. Control efforts for some of these plants are ongoing. Other invasive plants are so established and widespread on SMGL that total control is not possible. It is important to rapidly detect and eradicate new invasive species before they become entrenched. Enhanced monitoring of these invasive species is needed to identify problem areas and better guide control strategies and efforts.

Monitoring land use and community planning efforts adjacent SMGL is needed. These include local government land use, long range transportation plans, zoning changes, and new commercial and residential development. To the extent that these uses and plans may affect the success of game land management goals and objectives, appropriate bodies should be

informed how to minimize impacts to the game land where possible. Monitoring of local development and transportation plans and proposed projects in terms of how they may affect important wildlife corridors between regional conservation lands is also important.

Wildlife/Habitat Management Needs

Habitat management needs are summarized within each habitat section and goals described in the "desired future conditions" subsection. The overall management objective for SMGL will focus on restoration and enhancement of critical habitats and communities (oak forests, early successional, aquatic, rock outcrops, etc.). Researching areas for development of critical habitat types and monitoring the success and impacts of habitat and community restoration activities will be needed. Species specific management focus will continue to be on popular game species (white-tailed deer, wild turkey, gray squirrel, cottontail rabbit, mourning dove, etc.), WAP priority species, and threatened and endangered plants.

User Group Needs

Listed below are key needs identified to address public use of Sandy Mush Game Land:

- Construct kiosks with relevant game land information
- Provide additional signage to address the needs of a variety of user groups
- Implement and promote opportunities for disabled sportsmen
- Develop a means to inform the public of current and future management activities planned on the game land. (Ex. Prescribed Burning)
- Develop clear, understandable, and enforceable regulations
- Perform regular user group surveys to stay up to date with changing user group needs

ENFORCEMENT AND REGULATIOINS

Currently there are two primary assigned Wildlife Enforcement Officers to work Sandy Mush Game Land. One is stationed in Madison County and the other in Buncombe County. In addition, there are also three more Wildlife Enforcement Officers and three supervisory staff including a Captain, Lieutenant, and Sergeant which routinely assist with enforcement and enforcement issues pertaining to the game land. Primary enforcement activities on the game land include: aircraft patrols for bait, check points for license and game compliance, foot patrols, remote camera setups on bait and littering sites, nighttime poaching setups and surveillance, ATV patrols, kayak patrols, and routine road patrols. These activities occur throughout the year across the game land, with the highest frequency of enforcement activities occurring during hunting seasons. Critical times for the Enforcement Division on the game land occur during the first two weeks of dove season, the gun-deer season, raccoon season, and the turkey season.

As with most game lands, the major enforcement problems on Sandy Mush pertain to littering, regulations violations, dogs running unleashed, and adjoining landowner issues and conflicts. Enforcement issues particular to Sandy Mush include: shot from dove hunters impacting roof tops and houses adjacent to the Martin Candler dove fields, illegal dumping at the Bear Creek, Turkey Creek, Teague Road, and Meadows Town Road access areas, and illegal hunting during days of the week when the game land is closed.

The following is a list of regulations specifically related to Sandy Mush Game Land:

- Dove hunting is by permit only from the opening day through the second Saturday of the season
- Designated as a three day per week game land
- Gun either sex deer season falls under introductory season regulations
- Horseback riding is prohibited except on designated trails
- Dogs may only be trained on Mondays, Wednesdays and Saturdays and only during that time period when dog training is allowed on game lands

The following areas for possible regulation changes have been identified on SMGL to address user conflicts, conserve wildlife populations, and provide additional game user opportunities:

- Regulations pertaining to dog training
- Regulations pertaining to permit dove hunts
- Regulations pertaining to designating Turkey Creek and Sandymush Creek as hatchery supported trout waters

PARTNERSHIPS AND COLLABORATIONS

Partnerships and collaborations among various conservation groups, universities, state and federal agencies, non- governmental agencies, non-profit groups, national organizations, clubs, and private citizens are and will continue to be an important aspect of management at SMGL. Newly created and continued partnerships between the NCWRC and these groups will be essential for meeting the goals and needs outlined in this document. A list of current and potential partnerships for Sandy Mush is listed below:

- Carolina Bird Club
- Ducks Unlimited
- Elisha Mitchel Chapter of the Audubon Society
- Haywood Technical Community College
- Local birding groups
- Local conservation organizations
- Local fire departments
- Local hiking clubs
- Local landowners
- National Wild Turkey Federation
- N.C. Bow Hunters Association
- N.C. Ecosystem Enhancement Program
- N.C. Forestry Association
- N.C. Forest Service
- NC State University

- Quail Unlimited
- Quality Deer Management Association
- Regional Land Trusts
- Ruffed Grouse Society
- Shortleaf Pine Restoration Initiative
- Southern Appalachian Highlands Conservancy
- Southern Appalachian Raptor Research
- Trout Unlimited
- UNC Asheville
- USFS- Southern Research Station
- Western Carolina University

RESEARCH AND SURVEYS

Research and surveys provide critical information necessary for the management and conservation of fish and wildlife resources at SMGL. Research and survey projects are needed to make sound scientific decisions, prescriptions, and assessments of these resources across the game land to meet the goals and objectives of this plan. A large component of research and surveys on all game lands is to provide information for adaptive management, where monitoring is used to evaluate the effects of management in order to improve future actions for conservation. Current and ongoing research and survey projects on SMGL include: a Northern Red oak regeneration and establishment study, bird surveys, butterfly surveys, nest box surveys, game fish and aquatic species surveys, black bear surveys, dove hunter surveys, amphibian surveys, bird and waterfowl banding, and small mammal surveys.

Bird surveys have been conducted on Sandy Mush in conjunction with Northern bobwhite quail surveys since 2007 and in conjunction with efforts of the Elisha Mitchell Audubon Society, have helped to generate species checklists and known occurrences of priority bird species. American kestrels are a priority raptor species known to occur on the game land and a nest box program for the species was established in 2009. Through these efforts American kestrel populations have more than doubled. Barn owls also occur on the property and a nest box program directed towards increasing numbers initiated in 2009, has also been successful. Expanding both the establishment and monitoring of these nest boxes across the game land is planned over the next 10 years. Small mammal surveys were conducted in 2013 by Haywood Community College students and future surveys are planned annually. Game fish surveys across the Game Land have revealed a poor smallmouth bass population in Sandymush creek upstream from its confluence with the French Broad River, very few crayfishes, no mussels, and few nongame fish species.

Below is a list of current research and survey projects occurring on Sandy Mush Game Land:

- Black bear bait station index
- Song bird surveys
- Quail surveys
- Kestrel project

- Barn Own nest box project
- Butterfly Checklist
- Bird Checklist
- Small mammal surveys
- Northern Red oak research project
- Game Fish surveys
- Aquatic Diversity surveys
- Barn Owl Pellet analysis
- Night Jar survey
- Salamander surveys
- Mourning Dove and Wood Duck banding
- Dove hunter surveys
- EEP Draft Mitigation Plan
- Eastern Blue Bird nest box project
- Wood Duck nest box project

Although there have been several studies conducted and numerous surveys and projects implemented, there is still a need to continue to improve inventories and monitoring as well as continue to gather knowledge and information regarding wildlife and aquatic resources across the game land. We plan to use camera traps to estimated deer densities and hunter numbers, and in combination with our harvest data we will develop a solid deer harvest management system. Bat surveys are needed and could be accomplished through establishing a North Carolina Bat Acoustic Monitoring Program route, monitoring bat roosts (including installation of bat houses), and mist-netting. Although some salamander surveys have been conducted in localized areas such as those prior to timber harvest, more wide-ranging surveys are needed to document important breeding areas and provide baseline data prior to management. Reptile surveys have not been conducted across the game land and are needed. In particular, aquatic turtle nesting habitat should be identified and protected, rock outcrops surveyed, and cover board transects need to be established. Continued aquatic surveys of the streams, at intervals, across the Game Land will be needed to monitor aquatic habitat quality, aquatic communities, and the potential for restoration of priority aquatic species. Surveys and inventories of unique habitats such as wetlands, rock outcrops, and cliffs are also key lacking areas of knowledge that need to be addressed.

A list of research and survey needs for Sandy Mush Game Land is listed below:

- Additional and continued inventory of small mammals, reptiles, and amphibians
- Monitor establishment and restoration of shortleaf pine community types and their impacts on wildlife populations
- Monitoring of important game species
- Implement the use of camera traps to evaluate wildlife populations
- Inventory and delineate wetland habitats

- Inventory and delineate rock outcrops
- Survey and identify aquatic turtle nesting habitat
- Implement American woodcock surveys
- Initiate a MAPS (Monitoring Avian Productivity and Survivorship) station
- Initiate fall quail covey counts
- Initiate bat survey routes
- Inventory, identify, and monitor invasive species
- Implement research and monitoring of wildlife openings
- Expand research and knowledge of critical habitat types (vernal pools, early successional, etc.)
- Continue and expand surveys and monitoring of user group numbers and activities
- Develop accurate forest wide stand maps and inventories for all forested systems
- Develop photo points within EEP buffer areas to monitor invasive species as well as other vegetative changes

ACQUISITION PLAN

Due to the continual expansion of urbanized areas in the proximity the game land, increasing demand for public use areas, and in keeping with the objectives of the NCWRC's Game Lands Program to provide, protect, and actively manage habitats to benefit aquatic and terrestrial wildlife resources, there is a need to expand Sandy Mush Game Land. A total of 46 tracts totaling 3,324 acres have been identified as priority property acquisitions on SMGL (*Appendix XIV*). These tracts range in size from 2 to 315 acres.

Priority property acquisitions have been identified and categorized based upon the potential to improve game land access, enhance connectivity of the game land, and or contain critical habitats. Tracts identified as Level 1 acquisitions are the highest priority. These tracts are generally inholdings or adjacent tracts that provide key game land access or that enhance connectivity of current holdings. Level 2 tracts are those that provide additional game land access and enhance connectivity to existing holdings, but aren't considered as high priority as Level 1 tracts. Level 3 tracts are large tracts immediately adjacent to the game land that provide important additional acreage, but do not provide key access to or enhance connectivity of existing holdings. Twelve have been identified as level 1 priority tracts, nine as level 2 priorities, and twenty-five as level 3 (*Appendix XIV*). Tracts adjacent the game land that are not identified on the map and are offered for acquisition should be evaluated on a case by case basis to determine if they address a significant game land and/or conservation need. In a broader sense, any property that may be offered for acquisition should be evaluated in terms of its ability to provide connectivity or corridors between the game land and other regional conservation lands and/or its ability to provide critical habitat for threatened or endangered species.

ASSETS

While it is important to note that, no NCWRC staff are solely assigned to Sandy Mush Game Land, the current level of staff needed to meet the objectives of the plan are deemed to be

adequate. Current NCWRC staff which have Sandy Mush Game Land assigned to their work area include:

- 1 Eco Region Supervisor
- 1 Wildlife Forester
- 1 Land Management Biologist
- 1 Conservation Technician Supervisor
- 3 Conservation Technicians
- 1 District Fish Biologist
- 1 Fisheries Bio I
- 1 Aquatic Nongame Coordinator
- 1 Aquatic Nongame Biologist
- 4 Wildlife Diversity Staff
- 5 Wildlife Enforcement Officers
- 1 Field Engineer

Additional asset and funding needs necessary to meet the goals and objectives of this plan are listed below:

- Mower/mulcher (i.e. Fecon mower for early successional habitat development and maintenance)
- Funds needed to replace aging equipment as needed
- Small Dozer to implement forestry and firebreak work
- Kiosks and signage as needed to direct and inform game land users
- Educational materials for kiosks
- Funds to repair and stabilize roads and trails
- Construction/upgrades to public parking areas
- Construction of one foot bridge
- Funds to purchase gravel, culverts, gates (for routine maintenance and new construction)
- Additional and ongoing training of employees (equipment operation, forestry practices, habitat work, etc.)
- Hire a seasonal employee to assist with maintenance activities and prescribed burning
- Funding for land acquisition
- Funding for contract boundary maintenance
- Funding for 30 trail cameras to facilitate wildlife population monitoring and user group surveys and activity level monitoring.
- Funding for research and surveys
- Funding for forest inventory and stand mapping

FUNDING NEEDS

Current and future estimated expenditures for managing SMGL through 2025 are presented in the table on the following page.

Sandy Mush Game Land

Financial Summary of Activities

Habitat Activities

Project	Description	Activity	Quantity	Unit	Unit Cost	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total
H	Firebreaks	Maintain firebreaks	2	mi	$ 525	1050	1076	1103	1130	1158	1187	1216	1246	1277	1309	$ 11,753
H	Herbaceous Seeding	Seed or maintain dove fields	42	ac	$ 175	7350	7532	7719	7911	8107	8308	8514	8725	8941	9163	$ 82,269
H	Herbaceous Seeding	Seed or maintain	40	ac	$ 175	7000	7174	7352	7534	7721	7912	8108	8309	8516	8727	$ 78,352
H	Trees/Shrubs	Planting and Maintenance	100	GL	$ 6	600	615	630	646	662	678	695	712	730	748	$ 6,716
H	Vegetation Control	Prescribe burning	100	ac	$ 150	15000	15372	15753	16144	16544	16955	17375	17806	18248	18700	$ 167,897
H	Develop Clearings	develop openings	5	ac	$ 3,000	15000	15372	15753	16144	16544	16955	17375	17806	18248	18700	$ 167,897
H	Develop Clearings	maintain openings	2	ac	$ 200	400	410	420	431	441	452	463	475	487	499	$ 4,477
															Subtotal	$ 519,360

Operation and Maintenance Activities

Project	Description	Activity	Quantity	Unit	Unit Cost	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total
O & M	Bridges	Replace Culvert	1	culvert	$ 2,500	2500	2562	2626	2691	2757	2826	2896	2968	3041	3117	$ 27,983
O & M	Nesting Structures	Nest Box Maintenance	75	each	$ 30	2250	2306	2363	2422	2482	2543	2606	2671	2737	2805	$ 25,184
O & M	Signs and Boundaries	Maintain boundary	2	mi	$ 135	270	277	284	291	298	305	313	321	328	337	$ 3,022
O & M	Public Use Facilities	Maintain parking areas	11	each	$ 225	2475	2536	2599	2664	2730	2798	2867	2938	3011	3086	$ 27,703
O & M	Road and Trails	Maintain gates	5	each	$ 100	500	512	525	538	551	565	579	594	608	623	$ 5,597
O & M	Road and Trails	Maintain roads and trails	3	mi	$ 2,500	7500	7686	7877	8072	8272	8477	8688	8903	9124	9350	$ 83,948
															Subtotal	$ 173,437.17

Development Activities

Project	Description	Activity	Quantity	Unit	Unit Cost	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total
D	Road Upgrade	Ramsey Snelson Rd repair	0.5	mi	$ 30,000				30,000							$ 30,000.00
D	Road Upgrade	Meesows Town Ford repair	1	each	$ 20,000			20,000								$ 20,000.00
D	Road Upgrade	Orchard Road repairs	0.1	mi	$ 8,000		8,000									$ 8,000.00
D	Parking Areas	New Meadows Town parking	1	each	$ 20,000					20,000						$ 20,000.00
D	Parking Areas	New parking Old Hwy #20	1	each	$ 20,000						20,000					$ 20,000.00
D	Parking Areas	Orchard parking area repair	1	each	$ 10,000		10,000									$ 10,000.00
D	Bridges	Meadows Town foot bridge	1	each	$ 60,000				60,000							$ 60,000.00
															Subtotal	$ 168,000.00
														Grand Total		$ 660,797.25

PUBLIC COMMENT

As part of the Sandy Mush Management Plan development process NCWRC sought to gather information and comments from the public. This public input provided valuable information about different user groups and user group needs for SMGL. To gather this input, a public meeting was held in Marshall NC, and was advertised to individuals, groups, and businesses through various news outlets and prominent businesses where potential game land users were likely to visit. A list of locations where the meeting was advertised is included below:

- Hunter Banks Outfitters
- Wal-Mart
- Diamond Brand Outfitters
- Mast General Store
- National Wild Turkey Federation
- Ruffed Grouse Society
- Local Ducks Unlimited Chapter
- WLOS- News 13
- The Asheville Citizen Times newspaper
- Pisgah Chapter of Trout Unlimited
- Carolina Bird Club
- NC Forestry Association
- Southern Appalachian Highlands Conservancy
- Buncombe and Madison Co. Cooperative Extension
- NC Bow-hunters Association
- Federation of Fly Fishers
- Quality Deer Management Association
- Email to successful big game hunters (turkey & deer)
- Appalachian Houndsmans Assoc.
- NCWRC website and press releases
- Dicks Sporting Goods
- Coopers store
- Curtis Wrights Outfitter
- The Madison Sentinel newspaper
- Cherokee Trading Post
- Reeves Convenient Store
- Country Food Store
- Leicester Grill
- Gosset's Gas Station
- Red Oak Crossing store
- AB Tech – Madison Campus
- D and D convenient store
- Various community leaders
- Various adjacent landowners

- Various user group blogs and informational websites
- Various locations around the game land

SUMMARY OF PUBLIC INPUT

The public input meeting was held at the Asheville-Buncombe Technical Community College, Madison County satellite campus in Marshall, NC at 7:00 PM on July 30th, 2013. Forty-nine people were in attendance. During the meeting this group of interested public was presented with a power point presentation which provided information about the game land and the management activities which occur there. Following the initial presentation, the audience was divided into five groups. These "break out" groups were presented with a list of questions and asked to fill out sheets with each person's answers to the questions. Individuals were then asked to discuss their answers among the group and provided with an opportunity to ask any questions they may have. The public was also given the opportunity to write down any additional comments or questions they may have on the questionnaire. In total, thirty-six comment sheets were turned in to NCWRC staff from the meeting. For those who were not able to attend the public input meeting, a website was created that allowed the public to provide input on-line. The plan development team later reviewed all questions and comments, and all comments that pertained to the NCWRC mission and objectives were considered. A list all comments received from the public are outlined below:

1. **What habitats do you think are most important to protect and/or improve on the Sandy Mush Game Land?**

Q1	Responses
Early Successional (Quail/Grouse)	15
More replanting post logging	1
Stop logging	1
Diversity/Variety Habitats (Game/Nongame)	16
Brush Piles/Scrub Cover	1
Eliminate Invasive Plants	1
Sandymush Creek- Water Quality Protection	4
Big Game Habitats	5
Food Plots	4
Controlled Burns	4

2. **Considering those that live on land and in water, what species do you think are most important to protect and/or improve on Sandy Mush Game Land?**

Q2	Responses
Game Birds (Quail/Grouse)	14
Trout	7
Waterfowl	2
Predators	2
Big Game	14
Fish	1
All	6
Songbirds	5
Raptors	2
Small Game	3
Dove	3

3. **How do you use Sandy Mush Game Land?**

Q3	Responses
Hunting	11
Big Game Hunting	1
Small Game Hunting	5
Warm Water Fishing	4
Cold Water Fishing	2
Wildlife Viewing (Photo/Birds)	15
Deer	12
Turkey	10
Quail	5
Grouse	8
Dove	12
Rabbit	2
Squirrel	2
Hiking	8
Trap	1
Horse	1
Boating	1
Bike	1
Plants	3
Other (nontraditional)	4

4. **Please explain why you think the current level of access is, or is not, satisfactory on Sandy Mush Game Land?**

Q4	Responses
Satisfactory/Adequate	14
Too Much	1
Too Little	2

Q4 Comment	Plan Team Response
Due to close proximity to Asheville I think 3 days per week is good.	
Too much on Cedar Hill Road.	Current level of access on Cedar Hill is appropriate
Access is satisfactory - no more is needed - enough money has been spent on parking lots and gates.	
The walks are good and access is good for that. (Scouting). The sunflowers and others	
I think level of access is adequate.	
3 days a week good for hunting. Open archery trail off Cedar Hill. Improve trail Cedar Hill to French Broad.	We are aware of and plan to address the issue
Mowing and keeping trails open.	Addressed in plan
Do not know.	
Access is fine.	
It has enough access.	
is satisfactory	
Limited access is good.	
No enter from Meadow Town side and other roads.	Addressed in plan
Adequately covered in group discussion.	
How does one know which days are for hunting? I wouldn't want to get shot. More signage would be helpful. We get lost.	Addressed in plan- Will be erecting additional information kiosks
I think the access is good the way it is. A fine nature experience does not include cut trails.	
Some areas near French Broad River are not easily accessible	Access to French Broad is adequate in some areas, although additional access is needed
Hard to tell where actual game lands are. Parking?	Addressed in plan
OK the way it is.	
It is still difficult to know what is or is not the Game Lands. Maps lack delineation. Markers along boarders are hard to find.	Addressed in plan
The current level is satisfactory	
Very satisfied	
Involve volunteers to maintain and develop hiking trails	Volunteers are addressed in plan

Q4 Comment (cont)	Plan Team Response (cont)
Access is good	
Parking along Meadowstown Road, Trails for horseback riding and hiking	Horseback riding has been evaluated by NCWRC and is addressed in the plan
I think more signage is needed so people will know where to enter the Game Lands. Also, trails would be helpful.	Issue is currently being addressed
don't know	
?	
No comment	
Satisfactory, clean out log roads for walking	Addressed in plan
Access is good and the game lands are well posted.	
I think the access is satisfactory. If people are serious about hunting the area they will make the effort regardless of how easy or difficult it is to access	
Access is satisfactory to accommodate multi-use and non-hunting activities	
In most areas access is good.	
current access very good	
Access is o.k. Some access points are a little confusing. Not sure if the NCWRC or a private individual owns some of the access points.	
Myself and others in the community feel that the access is very limited and would like to see access to the river areas especially for the disabled hunters and fishermen to have the access to the river. Although these Fathers/mothers have permanent disabilities we still want to mentor our children and others for future hunters and fishermen and this land area can provide both with access to the river area.	Current trails to the river are not in a condition to allow public vehicular traffic. Also EEP restrictions do not allow for additional road or trail construction into designated areas.
Sandy Mush currently has excellent access much of the property. Some access could be added by purchase of property or right of ways on the northern side of the property.	Land acquisition is addressed in the plan
Access is appropriate, and parking mostly adequate.	

5. **What suggestions, if any, do you have for changing how the Sandy Mush Game Land is managed and maintained?**

Q5 Comment	Response
Archery Only area	3
Trapping season with no dogs	1
Horseback riding	2
Plant more corn	2
Maps/More information	2
Burning/Mgmt... at Bear Creek access	2
Plant hardwoods	2
More Quail food plots	2
More invasive plant control	1
Add more land	1
Disabled sportsman areas	1
More enforcement officers	3
More days to hunt	1
E-mail notifications about management	2
Trail maintenance	1
No more logging	1
Shooting range	1

Q5 Comment	Plan Team Response
If some land is unsuitable for wildlife habitat, please consider a shooting range similar to one on Cold Mtn. Game Land.	Sandy Mush has been determined to be unsuitable for a shooting range due to conflicts with the close proximity of homes and residential areas
Better communication regarding burning, logging, etc.	Is addressed in plan. Possible news releases and information posted on kiosk are likely solutions.
No more logging - a permanent Sandy Mush only game warden.	Timber harvest is an important management tool that is addressed in the plan. A permanent wildlife enforcement officer would not be feasible, currently there are 5 wildlife enforcement officers dedicated to work at Sandy Mush
Better trail maintenance - more food plots. Is there any way to have more grouse and quail on Game Land?	The issue of trails is addressed in the plan. Agricultural wildlife openings are addressed in the plan. Opportunities to create additional wildlife openings and expand existing wildlife openings are evaluated were feasible. Topography is often a limiting factor. Quail and grouse management are priority game species managed for at Sandy Mush

Q5 Comment (cont)	Plan Team Response (cont)
Email notifications for any spraying or logging.	Increasing information regarding upcoming management activities on the game land will be addressed.
Law enforcement. Shooting on non-shooting days.	
Keep up the good work.	
None.	
Bear Creek Road clear cut - needs to be developed with food plots for birds, quail - and woods thinned.	Due to poor soil quality and compaction from past logging practices it has been determine these sites are not practical for agricultural wildlife openings. Openings with natural vegetation will be managed for in these areas. The issue of thinning will be addressed through continual prescribed burning which in time will improve condition.
Have more days to hunt.	
More wildlife officers - Be on game land more often.	
None.	
Some of it needs to be in disabled area.	The issue of increased opportunities for the disabled is addressed in the plan.
Add more land - connect gaps with land acquisition - time is now, before land gets more fragmented and more difficult to acquire. Therefore, more funding for acquisition. This will help access well as wildlife corridors.	Agreed
More attention to invasive plant species control. More "permit "hunting for certain species at certain times.	Will be considered
Reforestation, hardwoods and softwoods alike.	Is addressed in the plan
Better signage to protect all users. Improved trails.	Is addressed in the plan
More oak trees. More corn.	Is addressed in the plan
More quail food plots, bicolor Lespedeza, Partridge pees, buck wheat, rag weed. Grouse clear cutting.	Is addressed in the plan
Plant hardwood trees, oak, hickory, beech. Sunflower. Berries. Native grasses.	Is addressed in the plan
None.	
Need to be bow hunting for deer one day and bird hunting another day, not the same.	Solutions to reduce hunter conflicts are being considered
Sandy Mush is managed very well	
Bear Creek area needs improvement - burn and regrow	Will be considered
Better maps. More information for hikers and wildlife viewers results of surveys	Is addressed in the plan

Q5 Comment (cont)	Plan Team Response(cont)
Plant more corn and sunflowers	
Horseback riding	Horseback riding has been evaluated by NCWRC and is addressed in the plan
Bow hunting only	Although the idea of making some game lands bow hunting only areas has been discussed, NCWRC feels that doing so would limit opportunities available to other hunters. Increasing hunting opportunities is a primary objective of NCWRC
I like the direction you seem to be headed.	
I would like to feel secure that bears won't come visit my home	Precautions to avoid bear conflicts should be taken and solutions can be found www.ncwildlife.org
? Stop the drive by shooting	
Horseback riding	Is addressed in the plan
Short trapping season with no dog access	Solutions to limit conflicts between hunters and trappers will be considered
No high powered rifles, archery only for deer, trophy buck only separate hunting and non-hunting.	NCWRC feels that doing so would limit opportunities available to other hunters. Increasing hunting opportunities is a primary objective of NCWRC
go to permit hunting	
Non-native invasive vegetation is an issue in a few areas, especially multiflora rose, and some privet. It would be nice to consolidate WRC land holdings, or acquire additional parcels if possible, to reduce fragmentation.	Addressed in the plan
Please continue to plant food plots.	
It is hard to manage and maintain any game lands with the budget you are working with, the only solution to maintain much needed access roads, food plots, UNWANTED trash, and enforcement etc. is to empower an organized group or person that can and are willing to donate their time help maintain the area. I can assure you WE are out there.	Will be considered. Some liability issues are a concern.
There should be continued emphasis on creating quality early successional habitat and improving existing woodlots on the area through timber management. This may require removal of some woodlots and timber stand replacement as many woodlots are extremely degraded.	
I approve of the lottery for dove hunts and think that system should be applied to deer hunting. It would increase the quality of the hunting experience while maintaining a proper herd population and ratio.	Biological data will need to be collected and analyzed for a change in deer hunting regulations to occur. Potential changes are being reviewed.

Q5 Comment (cont)	Plan Team Response (cont)
None at this time. I love what you folks have done to increase the quail populations. I also like the 3 days a week access. All game animals should get a break. I would like to see the land patrolled more by the game wardens.	
Consistent management of dove fields - planting and plowing to coincide with opening day and season splits	
please allow 6 day a wk. deer hunting, access is good, but with very limited parking. present 3 day per week will only allow 8 days of hunting of 20 day season	Would create many issues with over hunting due to small size of the game land and close proximity to major urbanized areas. Increased parking access addressed in the plan.
Monitorl big game harvest of deer and turkey better. I have seen a decline in numbers of deer. It might mean no doe kills and changing buck kills to more like trophy hunts.	Increased population monitoring of deer is a goal that is addressed in the plan
NCWRC should keep Sandy Mush 3-days-a-week. I would like to see the NCWRC plant warm season grasses and other cover plants on the logging roads in the cutovers at Bear Creek area. These clay logging roads should be planted for wildlife.	Will be considered
the game lands should be managed and protected for all wildlife, not just game animals - the amphibians and reptiles in particular are important	Management activities at Sandy Mush are directed towards benefiting all species including game and non-game.

6. **What would encourage you to start using Sandy Mush Game Land, or to continue using it more actively?**

Q6	Responses
Hunting	6
Fishing	2
Access	3
Habitat	2
Satisfied	5
Dove	1
Grouse	3
Quail	2
Trails/Hiking	5
Turkey	1
Deer	5
Coyote	1
Shooting Range	1
Archery/Bow Only	3
Signage/Info	1

Q6 Comment	Plan Team Response
Continue focus on wildlife habitat. You are doing a good job now. Don't go backwards. Strongly support hatchery trout water initiative.	
I'm fine with the way it is except for logging.	
More activity of animals especially dove and grouse. Good access to the hunting places.	Issue of access is addressed in the plan.
I like the idea of bow hunting for deer only - small area - extra nice challenge for hunters	Although the idea of making some game lands bow hunting only areas has been discussed, NCWRC feels that doing so would limit opportunities available to other hunters. Increasing hunting opportunities is a primary objective of NCWRC
Again - trails maintenance.	Is being considered
Quail and grouse.	
More days a week open to hunt.	It is the position of the NCWRC that opening the game land up to more days of hunting would create many issues with over hunting due to the small size of the game land and close proximity to major urbanized areas.
More days to hunt.	
None	
More places to enter from.	Addressed in plan
Improved fishing, improve grouse and pheasant populations, fall turkey season.	Increased fishing opportunities are addressed in the plan. Wildlife populations will benefit from continued habitat work. Changing turkey season would require a regulation change and there is little evidence to biologically support a change.
As mentioned above (referring to answer in Q5)	
Better quail hunting.	
I use it as much as I can.	
Put in hiking trails.	Is addressed in the plan
Change deer hunting to bow hunting only.	NCWRC feels that doing so would limit opportunities available to other hunters. Increasing hunting opportunities is a primary objective of NCWRC.
A target/rifle range past 100 yards. Better coyote hunting opportunities	Sandy Mush has been determined to be unsuitable for a shooting range due to conflicts with the close proximity of homes and residential areas. There are currently good opportunities for coyote hunting.
Hiking trails	Addressed the in the plan
Continue good management	
All of the above	
Improve deer herd	Continued habitat management will help to improve numbers.
More designated access points and better trails.	Addressed in the plan

Q6 Comment (cont)	Plan Team Response (cont)
trophy buck archery only for deer	NCWRC feels that doing so would limit opportunities available to other hunters. Increasing hunting opportunities is a primary objective of NCWRC.
natural surface pedestrian trails, open during times that are closed to hunters (for the safety of the recreational users)	These opportunities currently exist outside of hunting seasons and days closed to hunting during the season.
Increase the deer population.	
It would be encouraging being able to see more game and or sign of game when I hunt there.	
Improvement of grouse habitat	
Stock the Sandy Mush Creek with trout. Many years ago the stream was considered general waters and was stocked. Plant more dove fields.	Issue of trout stocking is addressed in the plan. Prospective ways to increase dove hunting will be explored.
Encouragement ideas would again come from better access, food plot areas and a designated area to train our future hunters to handle firearms safely, as firearms education / training is becoming a forgot about part of our heritage.	
Remove the 3-day/week restriction for hunters.	Opening the game land up to more days of hunting would create many issues with over hunting due to the small size of the game land and close proximity to major urbanized areas.
Expansion of opportunities to 6-day per week hunting would fit better with my schedule, and reduce "crowding".	It is the position of the NCWRC that opening the game land up to more days of hunting would create many issues with over hunting due to the small size of the game land and close proximity to major urbanized areas.
permit hunting	

7. What additional comments do you have about Sandy Mush Game Land?

Comment	Plan Team Response
Publish all the maps.	Currently there are maps of the game lands available online, and opportunities to provide additional resources and information to the public are being explored and addressed in the plan.
We as a community need accountability for actions / non actions on the gamelands- i.e. who do we call in Raleigh or here when someone makes a lame brain decision to log gamelands - what is their phone # address, etc.	Forest management activities are reviewed by numerous NCWRC staff from various divisions prior to timber harvests being implemented. Any questions regarding forestry activities on game lands can be answered by NCWRC regional foresters. Additional information regarding the purpose and need for forest management activities at Sandy Mush are included in the plan.

Comment (cont)	Plan Team Response (cont)
More notice of meetings - more than a sheet of paper at the end of a road.	The public meeting was well publicized. Addressed in plan.
It's great. There just need to be more accessible for handicap people that can't walk to far. (suggestion) Communication on fires and clearings on the website please.	The issue of disabled access is currently being reviewed and is addressed within the plan. Ways to better inform the public of management occurring on the game land are being considered. Issue is also addressed in the plan.
It really is a small area; I like the idea of keeping it a secret.	Sandy Mush Game Land is public property and therefore is open to the public.
Remember I want that logging map!	
Wonderful wildlife area.	
Great area - well managed. A site on the website for Sandy Mush calendar for burning, logging maps, etc.	Ways to better inform the public of management occurring on the game land are being considered. Issue is also addressed in the plan.
Preserve existing structures and old home sites	NCWRC is required to protect any known cultural resources on the property that are identified by the NC Dept. of Cultural Resources.
Their no area for disabled hunter to hunt part of this land would be very nice.	This issue is currently being reviewed and is addressed within the plan.
Chris Henline and David Stewart are very professional, accommodating and do a great job of establishing a working relationship with SAHC, the local land trust.	
Arch. And cultural resources considered? Will be glad to discuss further. Great job overall! Good interactions with every NCWRC person that I have run into while on the property.	See above
I regularly follow the e-bird posting. That has been very helpful to me.	
I think the Wildlife Commission has done a great job on the Sandy Mush Game Land.	
Establish "Friends of the Sandy Mush" - similar to 'Friends of the Smokiest".	Such an effort would need to be initiated externally from NCWRC.
Need better parking areas.	Is addressed in the plan.
* Thank you for what you do to make this land as good as it is. Great Job!!	
Great service of NC Wildlife Resources to make it a more natural habitat	
Permit hunting during gun deer season	NCWRC staff does not see a need for this approach at this time.
Maps on NC Wildlife.org	Game land maps currently exist on website
I appreciate what you are doing.	
There's a dump site on Sandy Mush near Worley Cove that needs to be cleaned up.	Is being addressed

Comment (cont)	Plan Team Response (cont)
separate hunting and non-hunting activities by days of the week	Under the current system this is already occurring during the non- hunt days (Tues, Thurs, Fri, Sun).
I think the dove hunting opportunity is fantastic and well run. Please continue as you have in the past - it is a unique hunt in the mountains. Thanks for a good job!	
Time and money priority should be given to agricultural and early successional habitat development on Sandy Mush GL as this currently is the ONLY Game Land in the Mountains that has potential for this type of habitat development. The only other Game Lands close to this area with some quality hunting are located in the Mountain foothills and Piedmont sections of the state.	
I hunt quail, grouse, woodcock and ducks. I think the way that the game lands are being managed right now is great. I would like to commend you on a job well done. I have lived my whole life within 15 minutes of all the game lands and have hunted it going back to when the land was owned by CP&L. There has never been as much game as there is right now. The only thing I would like to see changed is to see if it's feasible to start stocking trout back into Sandy Mush Creek. I think it is a great idea for it to remain a 3 day week game land so the wildlife is not as pressured as it is on other game lands. Again, I would like to commend everyone on a great job.	
Select cut some timber therefore creating more/better habitat for big and small game animals. Other than that the land looks great.	
maintain current level of prescribed burning	
I think people who use the area for non-hunting activities should have to share the cost in the upkeep and management of wild life management areas	Is being considered.
Hunters pay 40 dollars a year to use game lands. Hikers, bikers and anyone else using game lands should have to pay a fee also. Otherwise hunters should not have to pay to use game lands.	
Down through the years you have tried to please hunters by making hunting seasons longer and increasing bag limits. That would be good if we had the game but here in western NC we have less deer on game land now than when I started hunting some 45 years ago.	

Comment (cont)	Plan Team Response (cont)
The geographic diversity of Sandy Mush makes it an ideal property to manage for multiple species and user groups. I recognize the challenge for NC Wildlife to balance these interests. I hope that Sandy Mush can be promoted as an example of landowner and user group cooperation near an urban center.	
Lots of wild turkeys, dove, and other birds. I would like to see the WRC expand Sandy Mush and other lands in Buncombe and Madison Counties. Expansion of Sandy Mush, if possible, should be explored by the WRC. Lots of wildlife habitat being developed in Buncombe County and lost to sportsmen I live in Buncombe County and enjoy visiting Sandy Mush. Thank you for allowing me to comment.	

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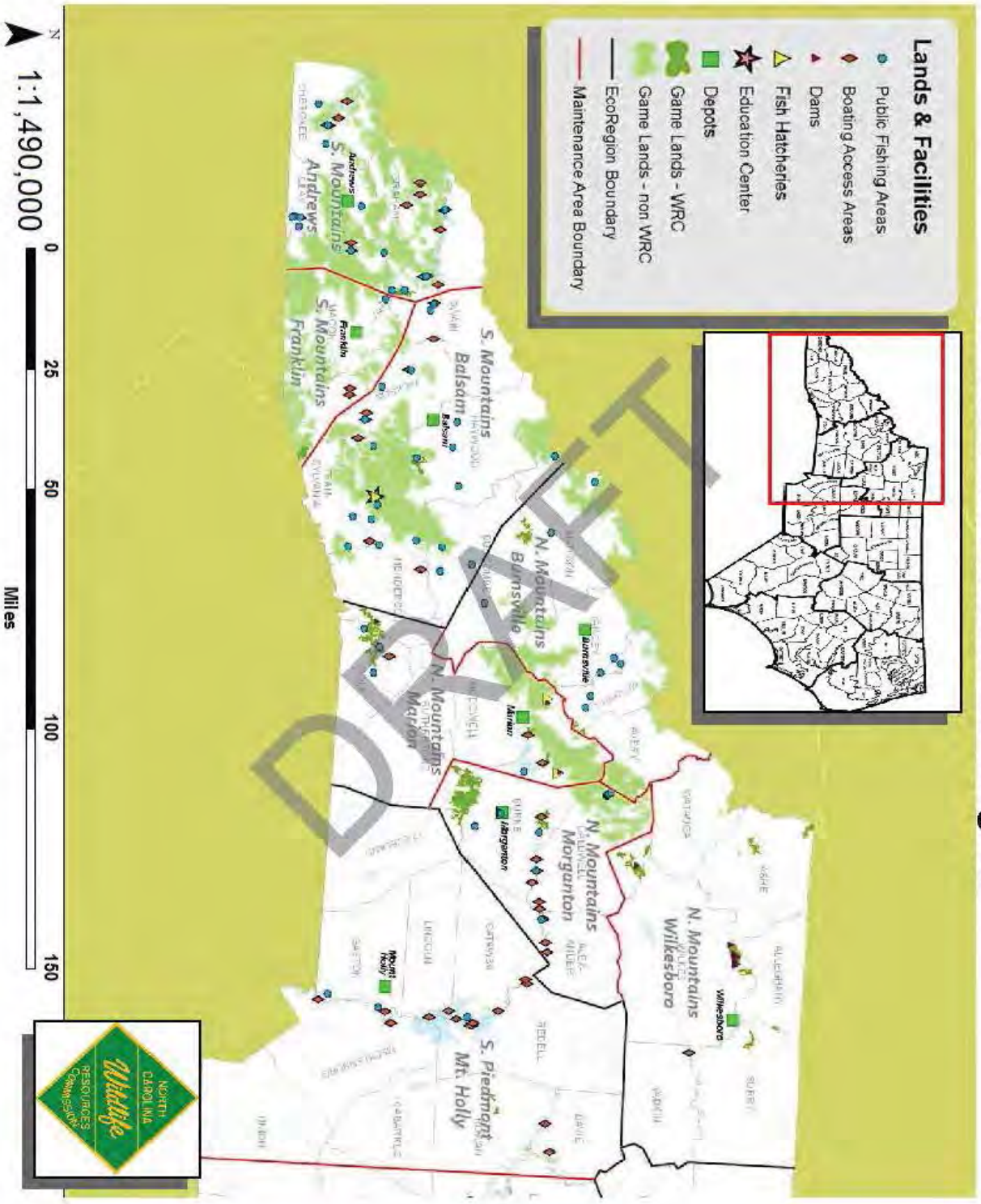
Appendix I


NCWRC Mountain Eco-Region
Lands & Facilities
Public Fishing Areas
Boating Access Areas
Dams
Fish Hatcheries
Education Center
Depots
Game Lands - WRC
Game Lands - non WRC
EcoRegion Boundary
Maintenance Area Boundary
S. Mountains Andrews
S. Mountains Franklin
S. Mountains Balsam
N. Mountains Burnsville
N. Mountains Marion
N. Mountains Morganton
N. Mountains Wilkesboro
S. Piedmont Mt. Holly
DRAFT
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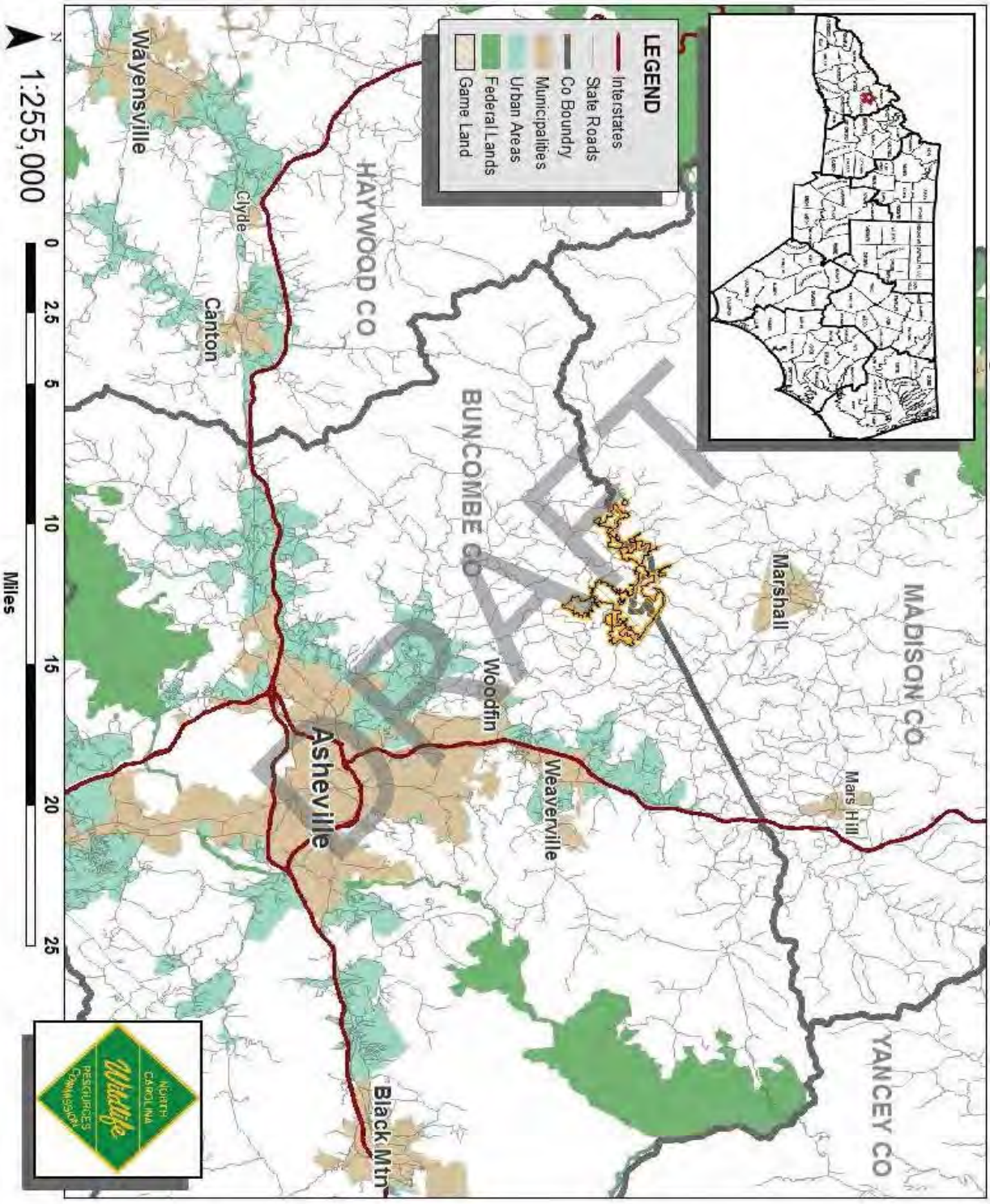
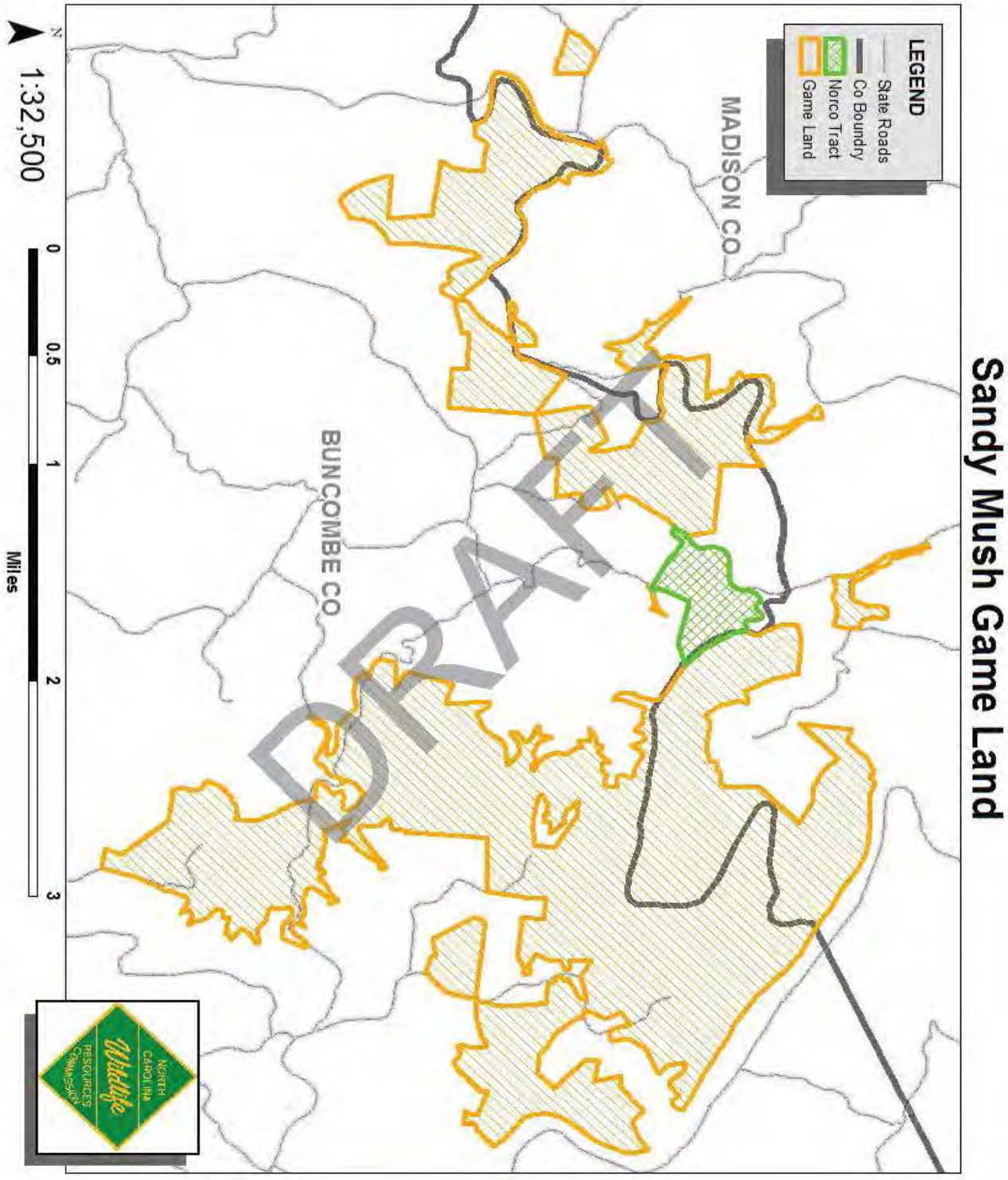
25
50
100
150
Miles
N
NORTH CAROLINA Wildlife RESOURCES COMMISSION

Appendix II


Sandy Mush Game Land- Area Map
LEGEND
Interstates
State Roads
Co Boundry
Municipalities
Urban Areas
Federal Lands
Game Land
1:255,000
Miles
0
2.5
5
10
15
20
25
N
MADISON CO
YANCEY CO
HAYWOOD CO
BUNCOMBE CO
Marshall
Mars Hill
Woodfin
Weaverville
Asheville
Black Mtn
Clyde
Canton
Waynesville
DRAFT

Appendix III



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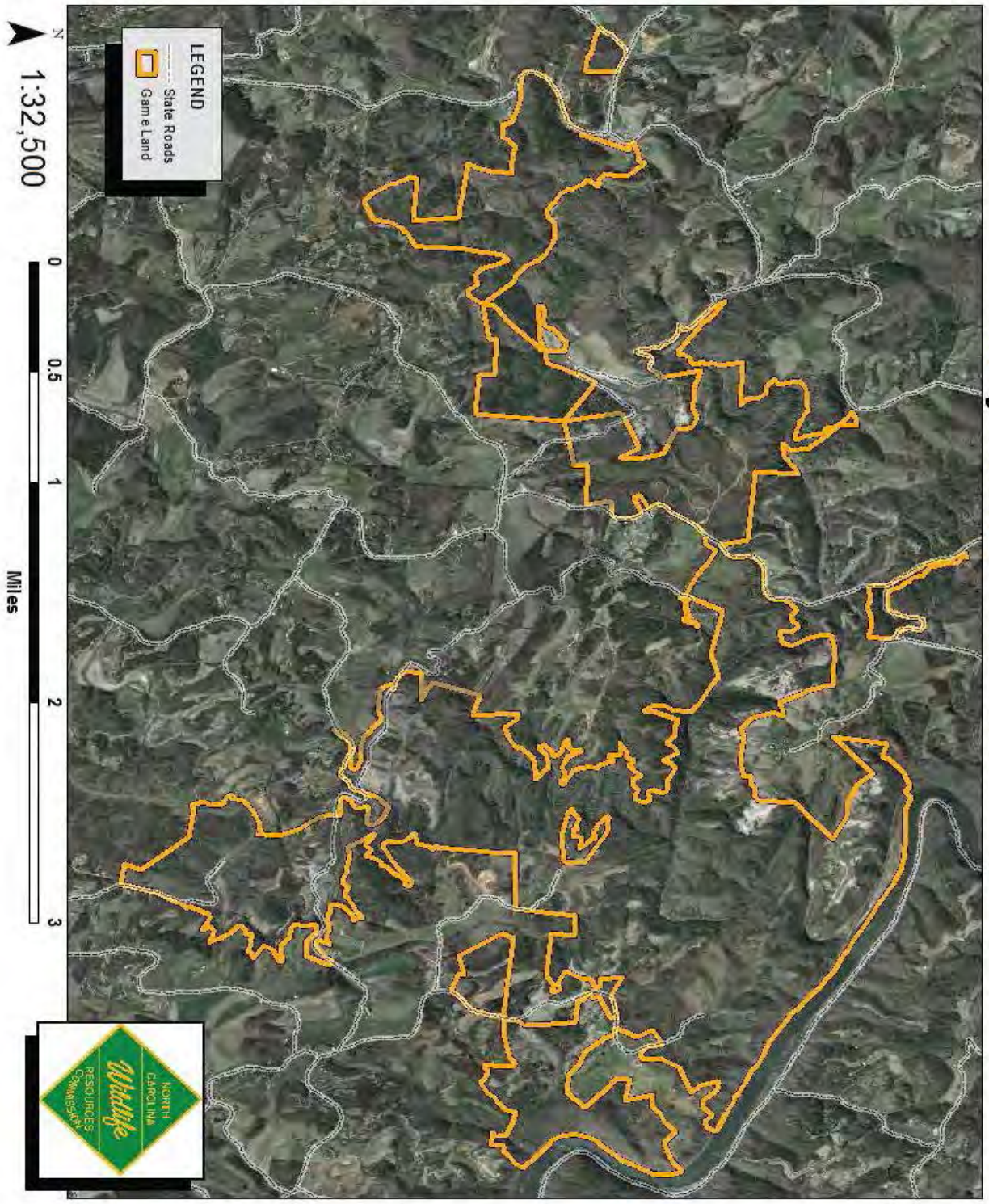

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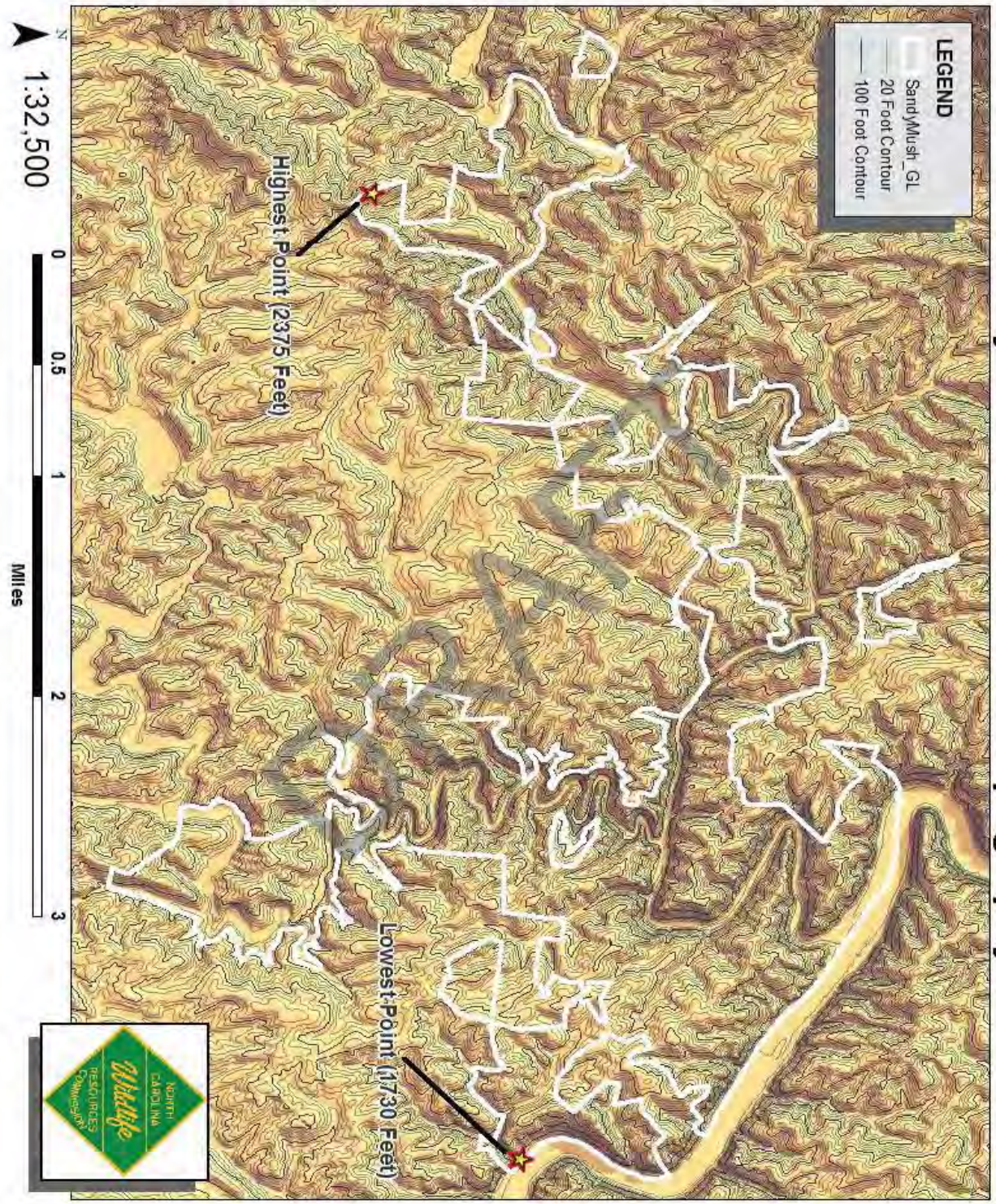
Appendix V



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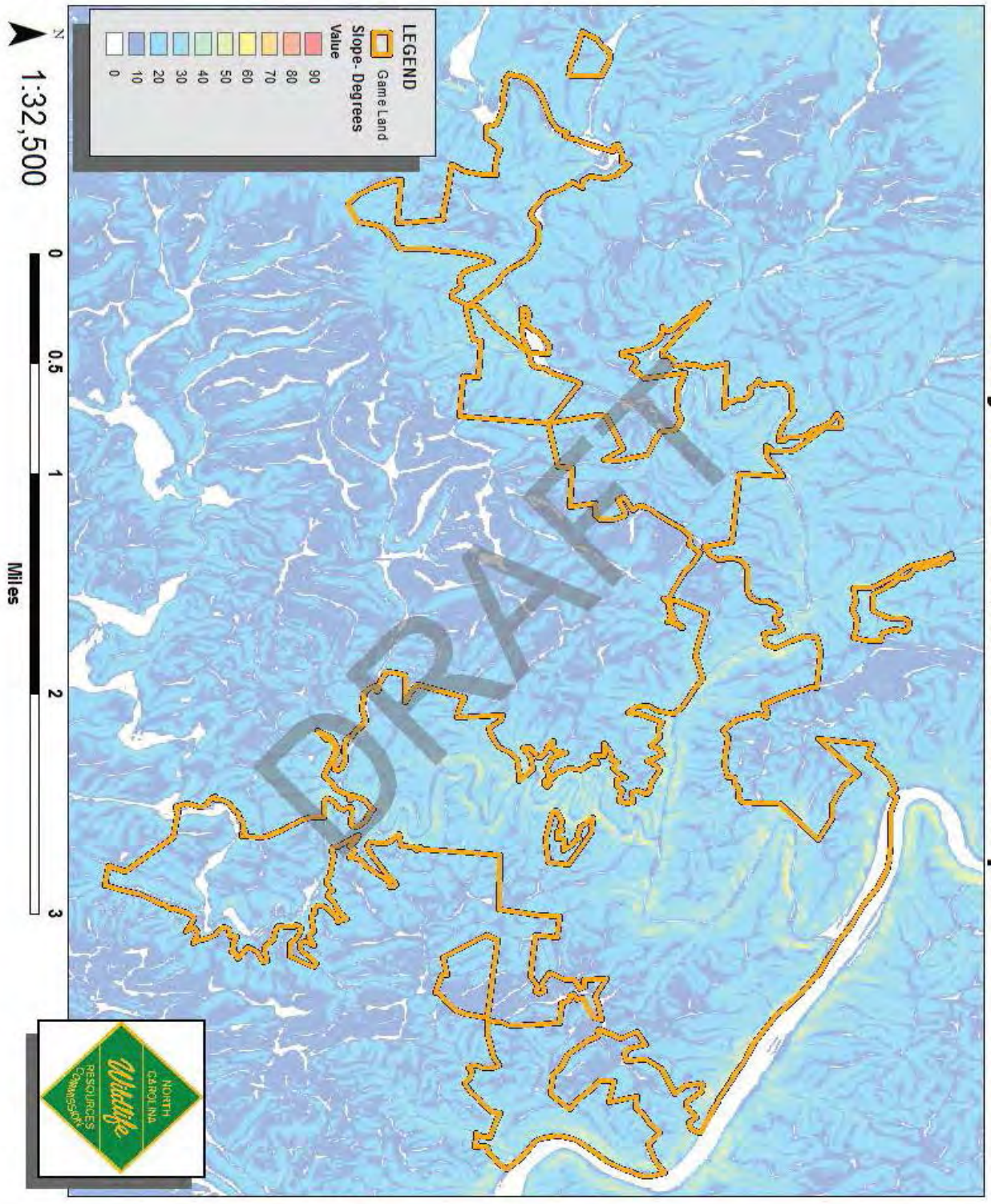
Sandy Mush Game Land- Slope
LEGEND
Game Land
Slope- Degrees
Value
0
10
20
30
40
50
60
70
80
90
N
1:32,500
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0.5
1
2
3
Miles
DRAFT
NORTH CAROLINA
Wildlife
RESOURCES COMMISSION

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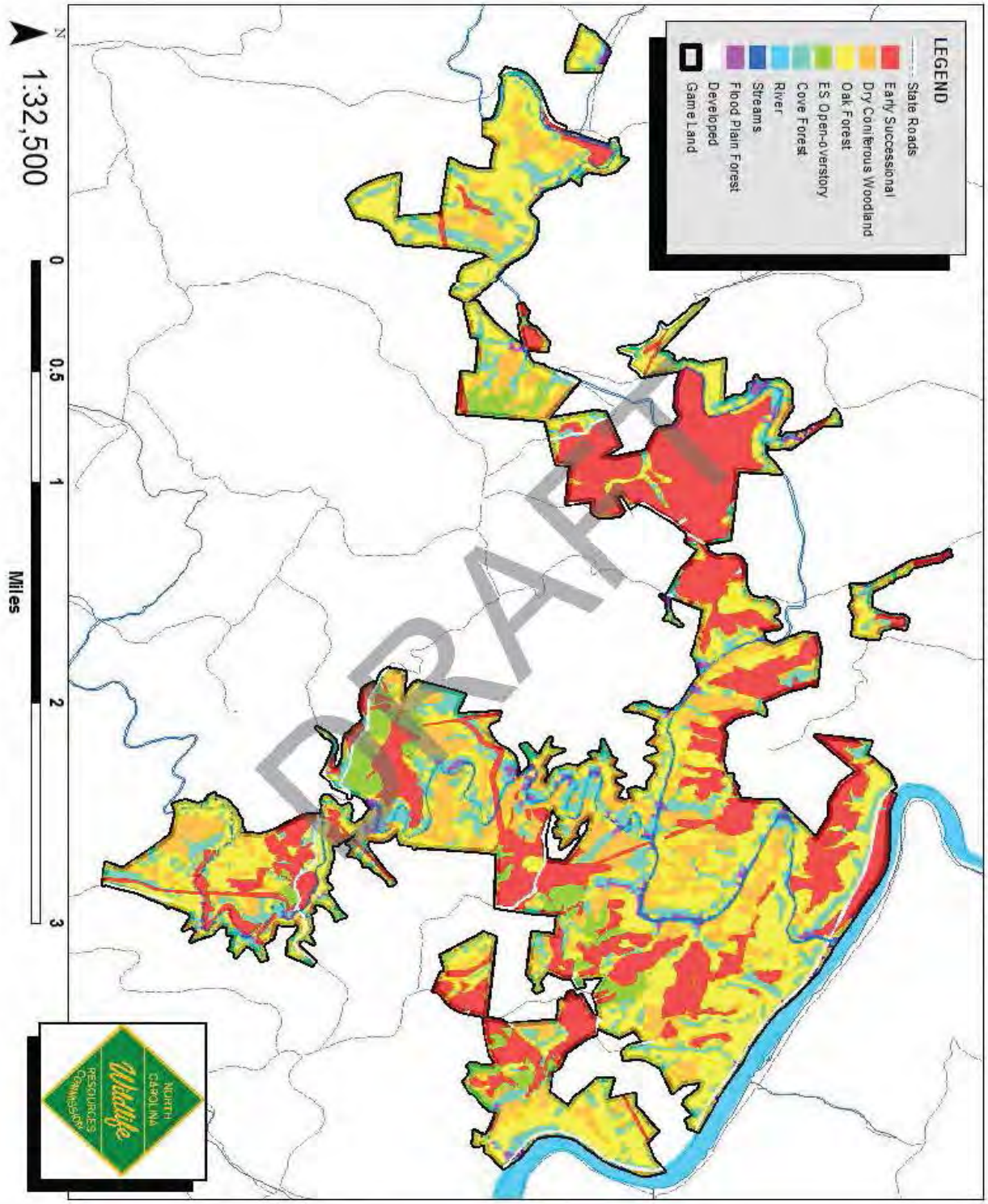
Appendix VII



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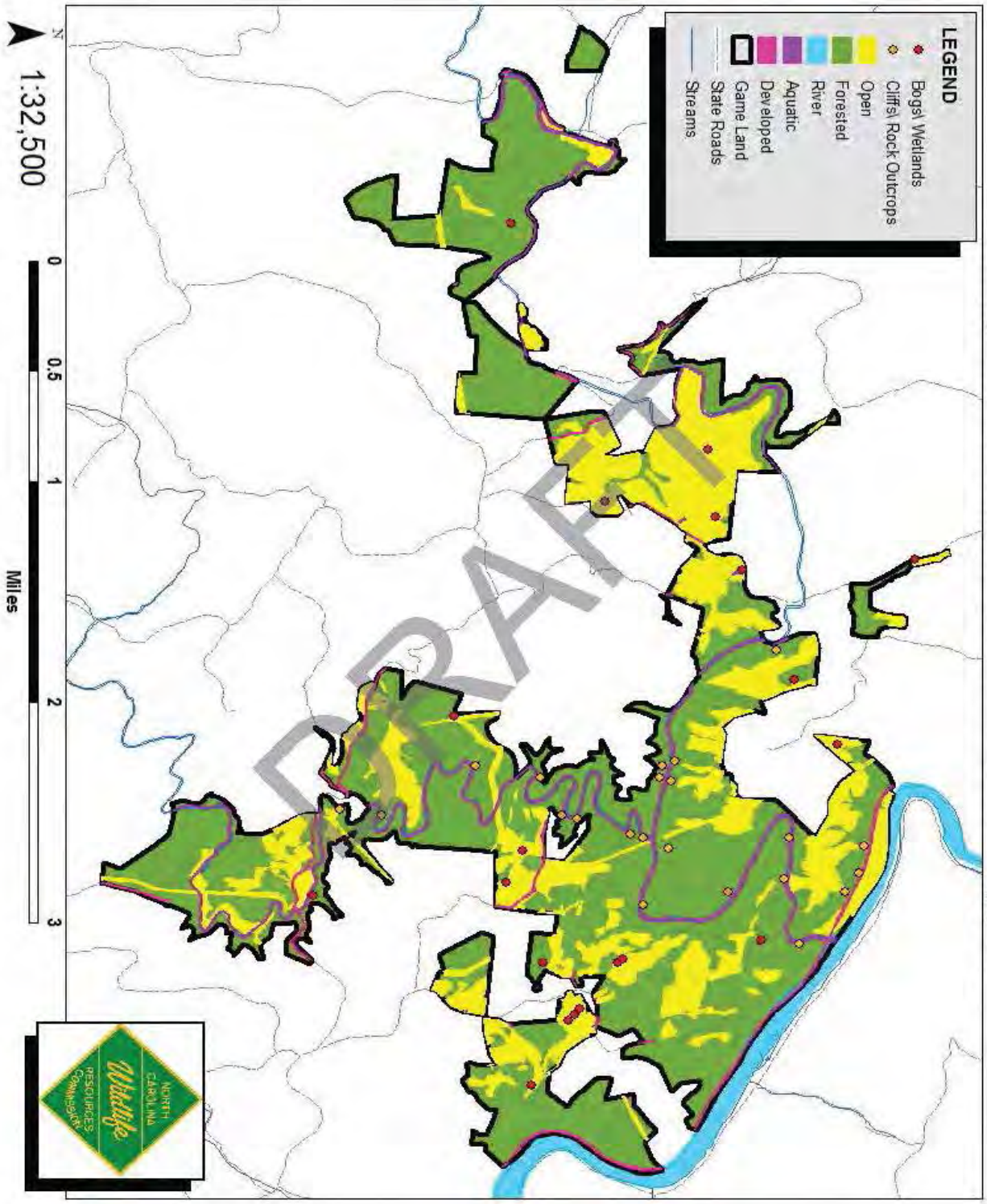
Appendix VIII



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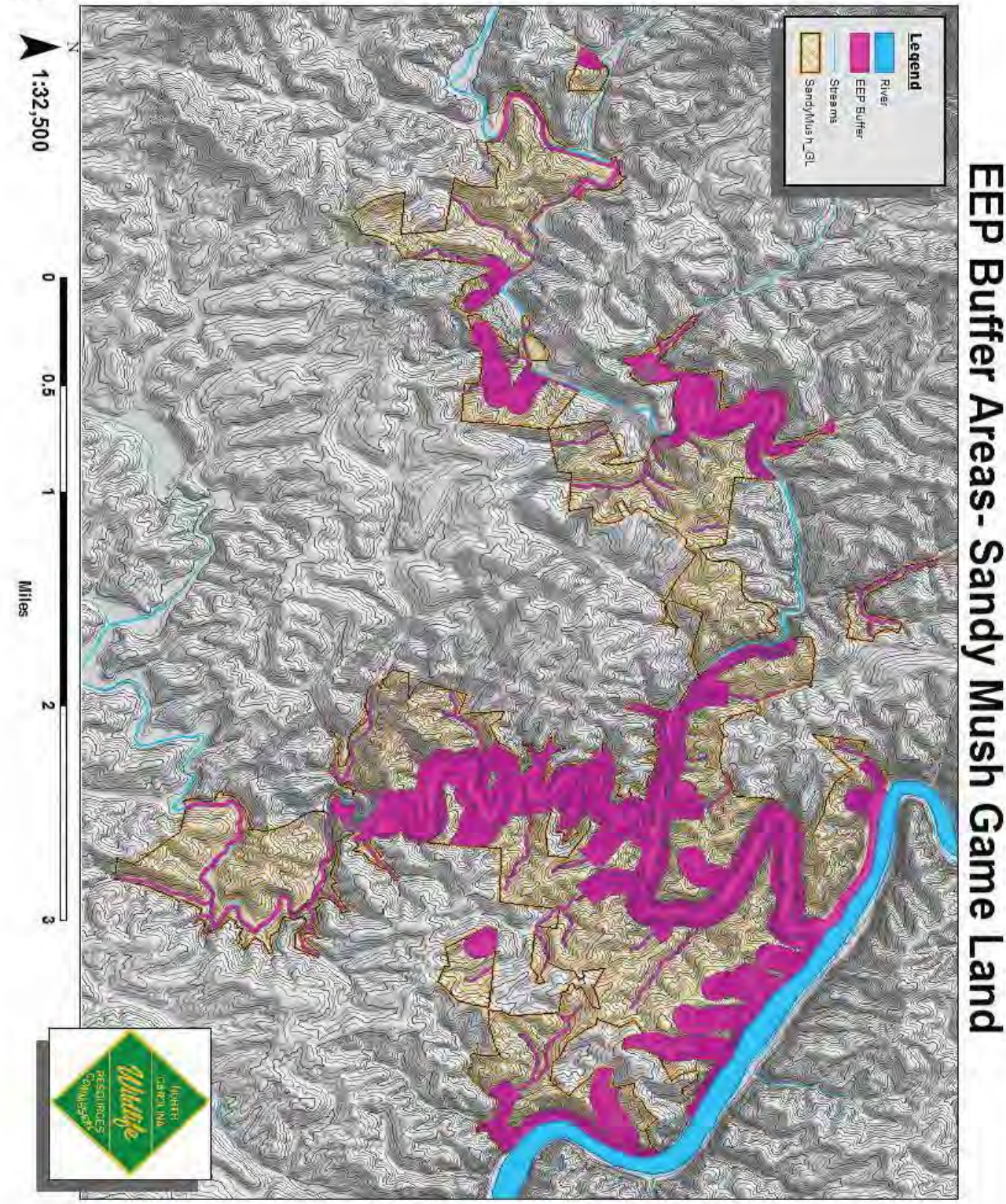
Appendix IX



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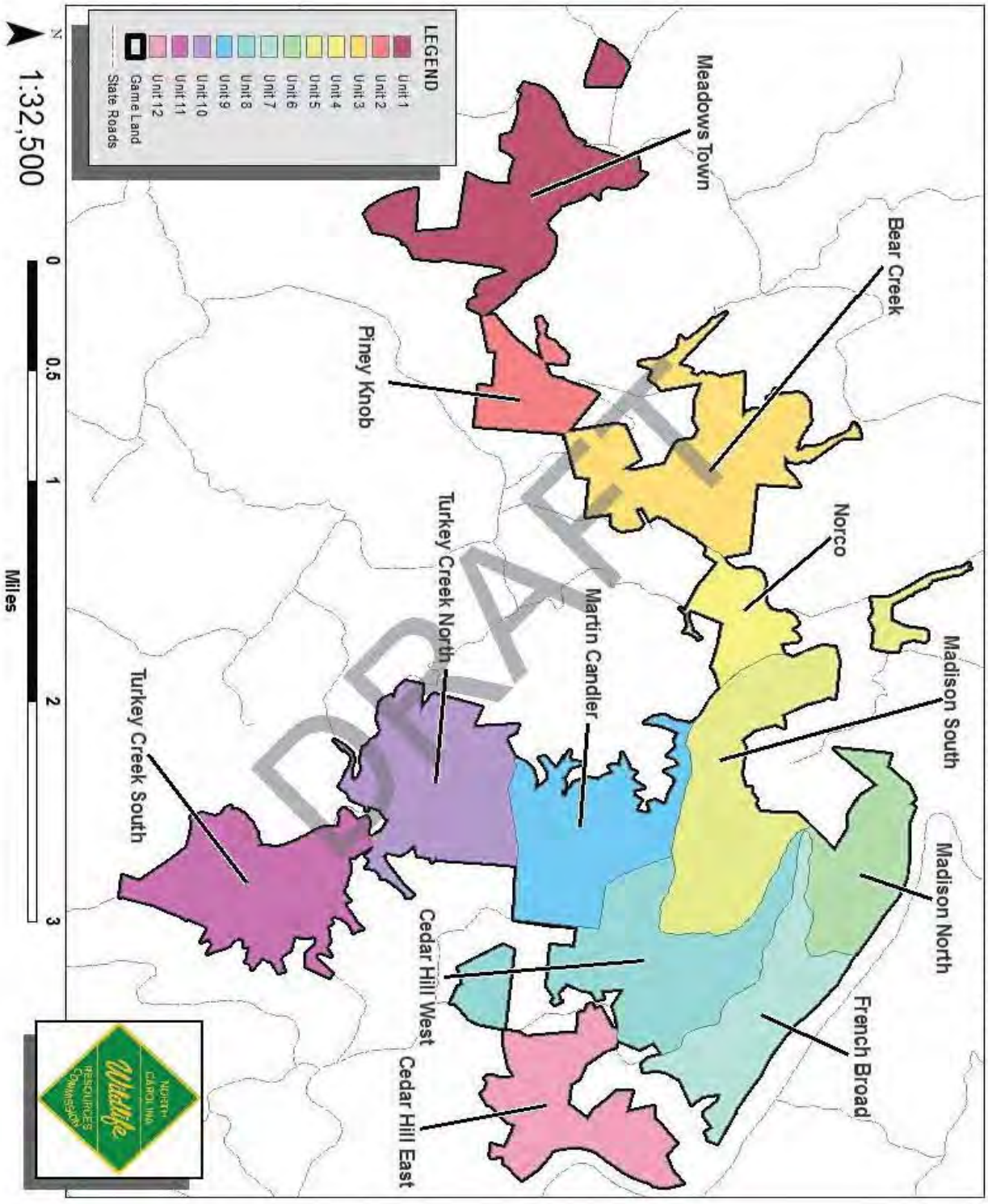
Appendix X



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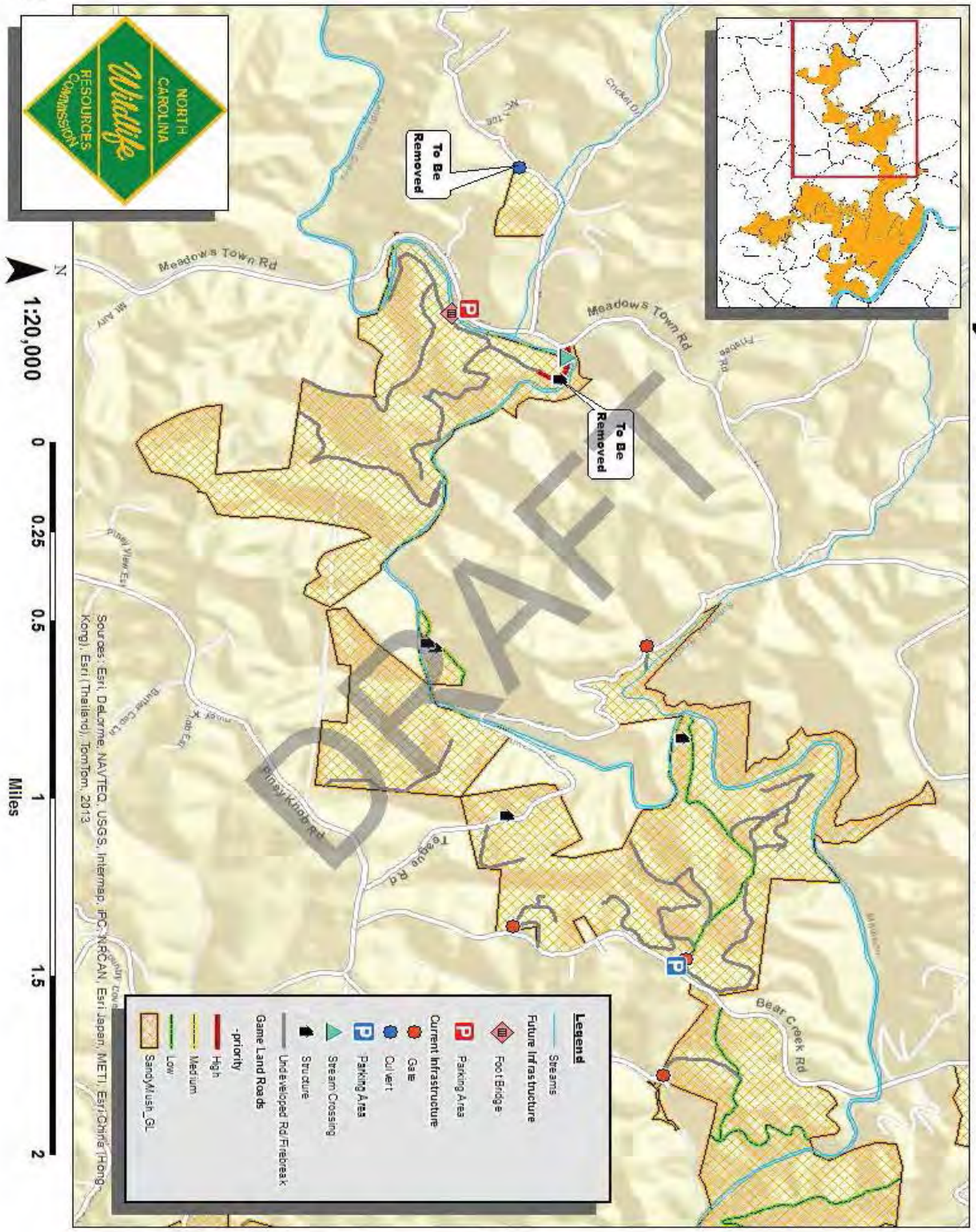
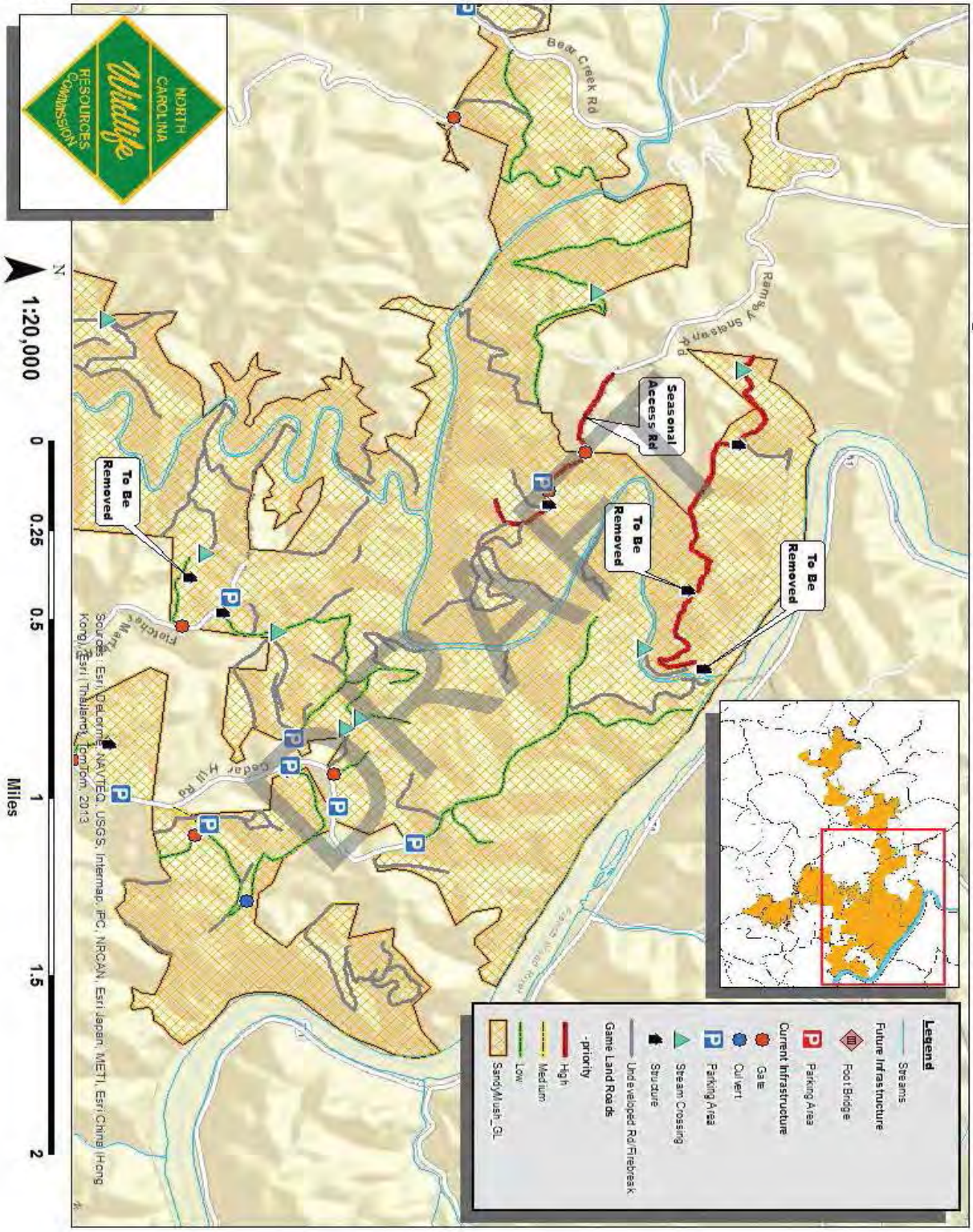

Sandy Mush Game Land- Infrastructure
NORTH CAROLINA Wildlife RESOURCES Commission
To Be Removed
To Be Removed
Meadows Town Rd
Meadows Town Rd
Bear Creek Rd
Teague Rd
Rimey Knob Rd
DRAFT
N
1:20,000
0
0.25
0.5
1
1.5
2
Miles
Legend
Streams
Future Infrastructure
Foot Bridge
Parking Area
Current Infrastructure
Gate
Culvert
Parking Area
Stream Crossing
Structure
Undeveloped Rd/Firebreak
Game Land Roads
-priority
High
Medium
Low
SandyMush_GL
Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Appendix XII



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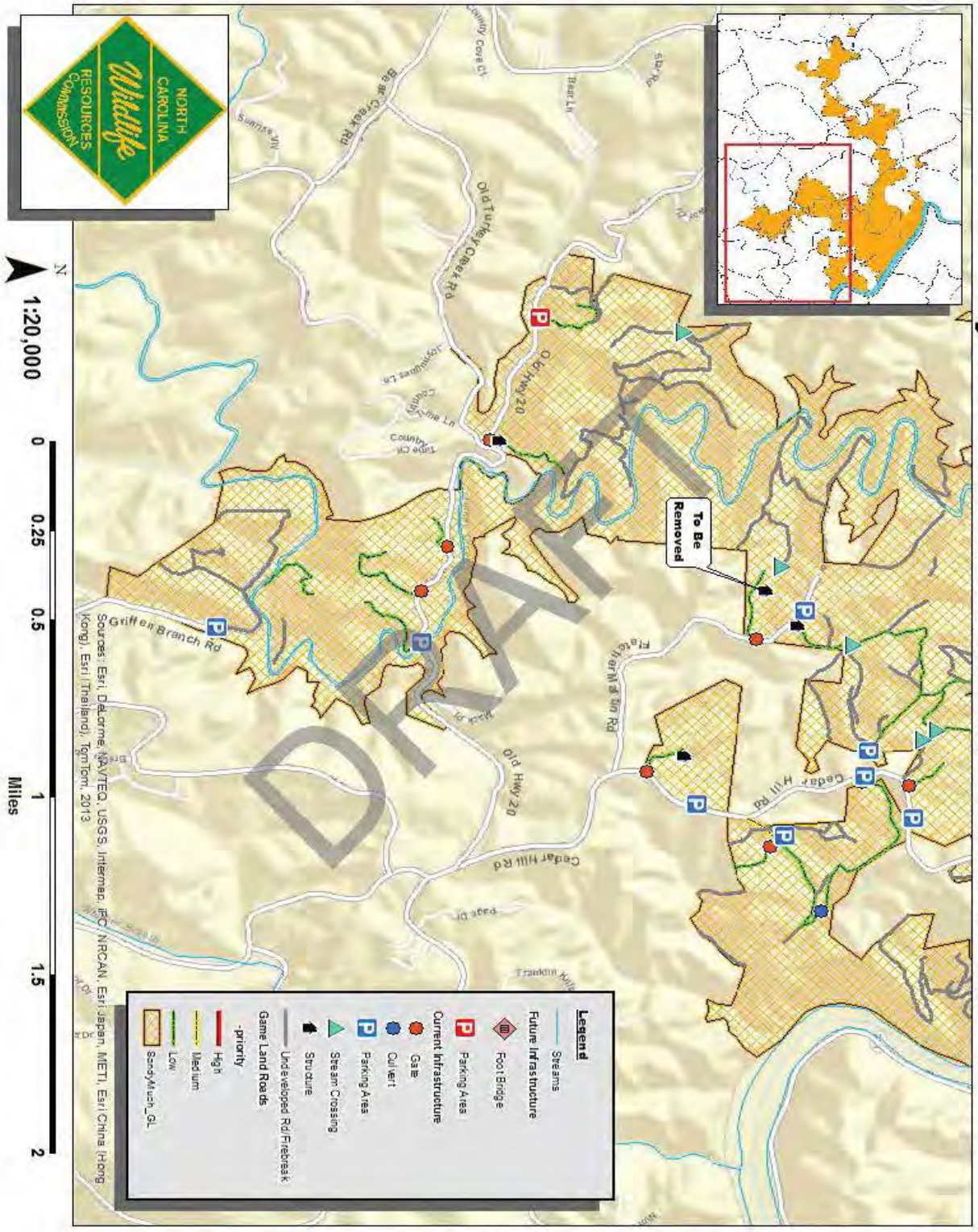
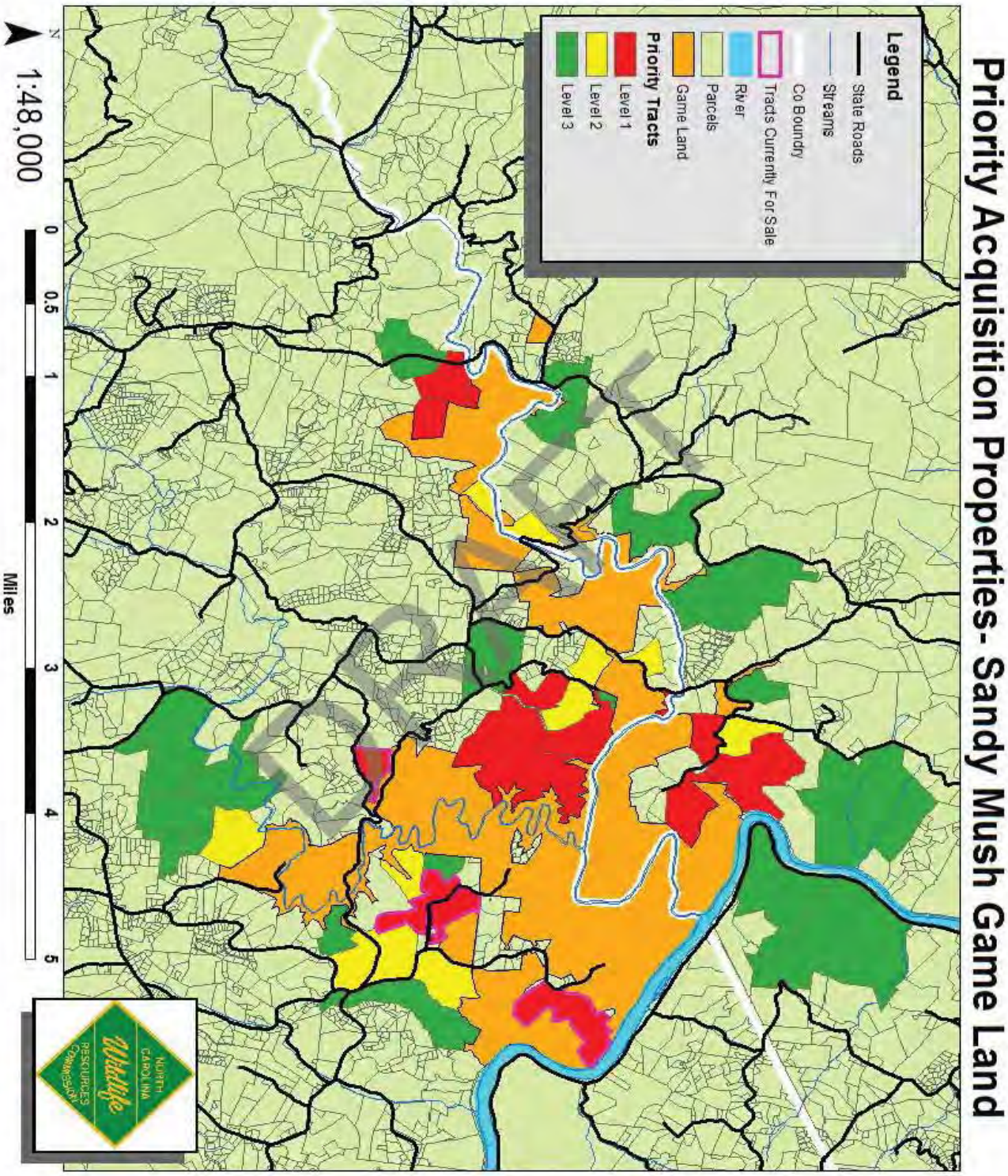
Appendix XIII



Appendix XIV



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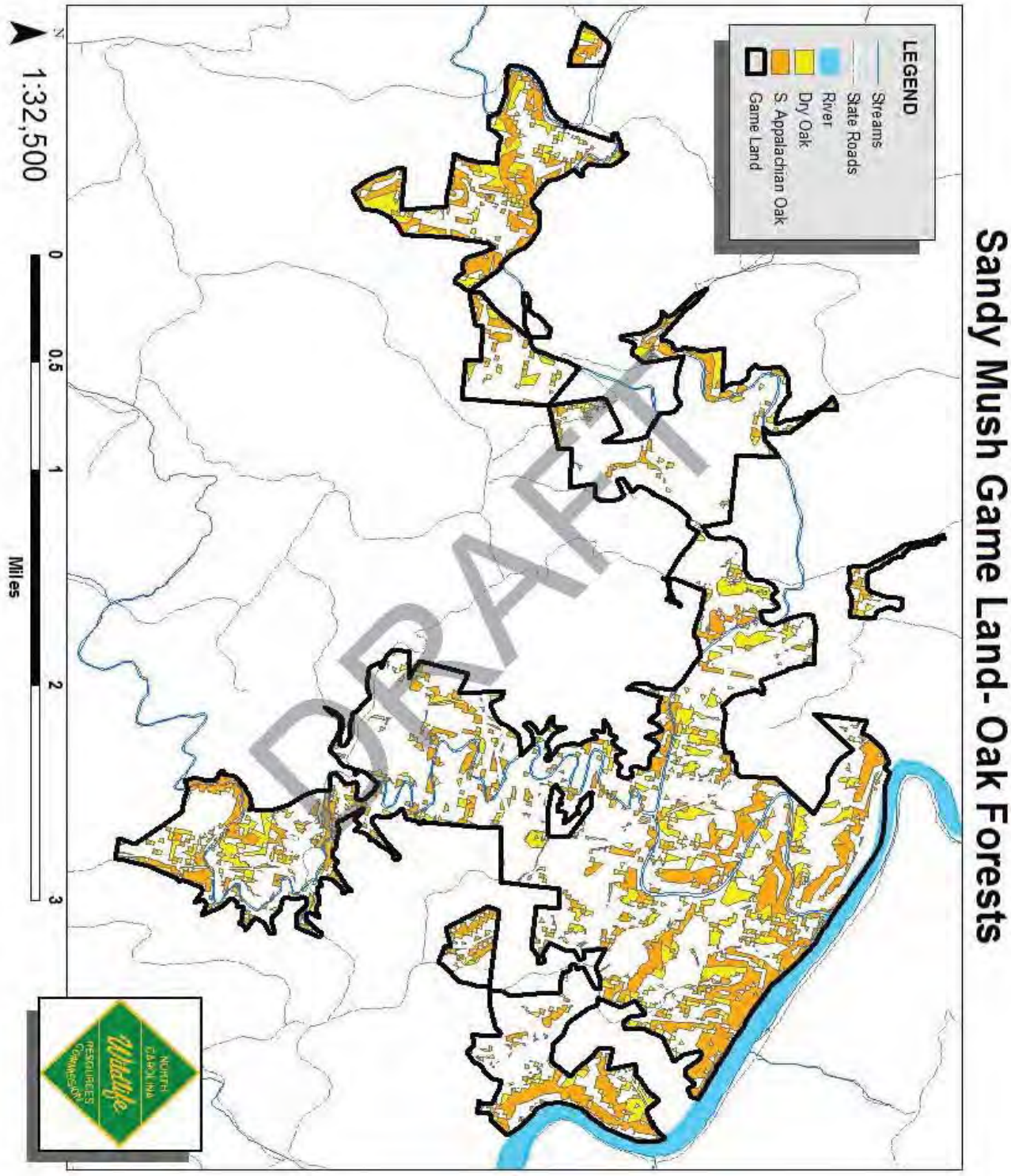
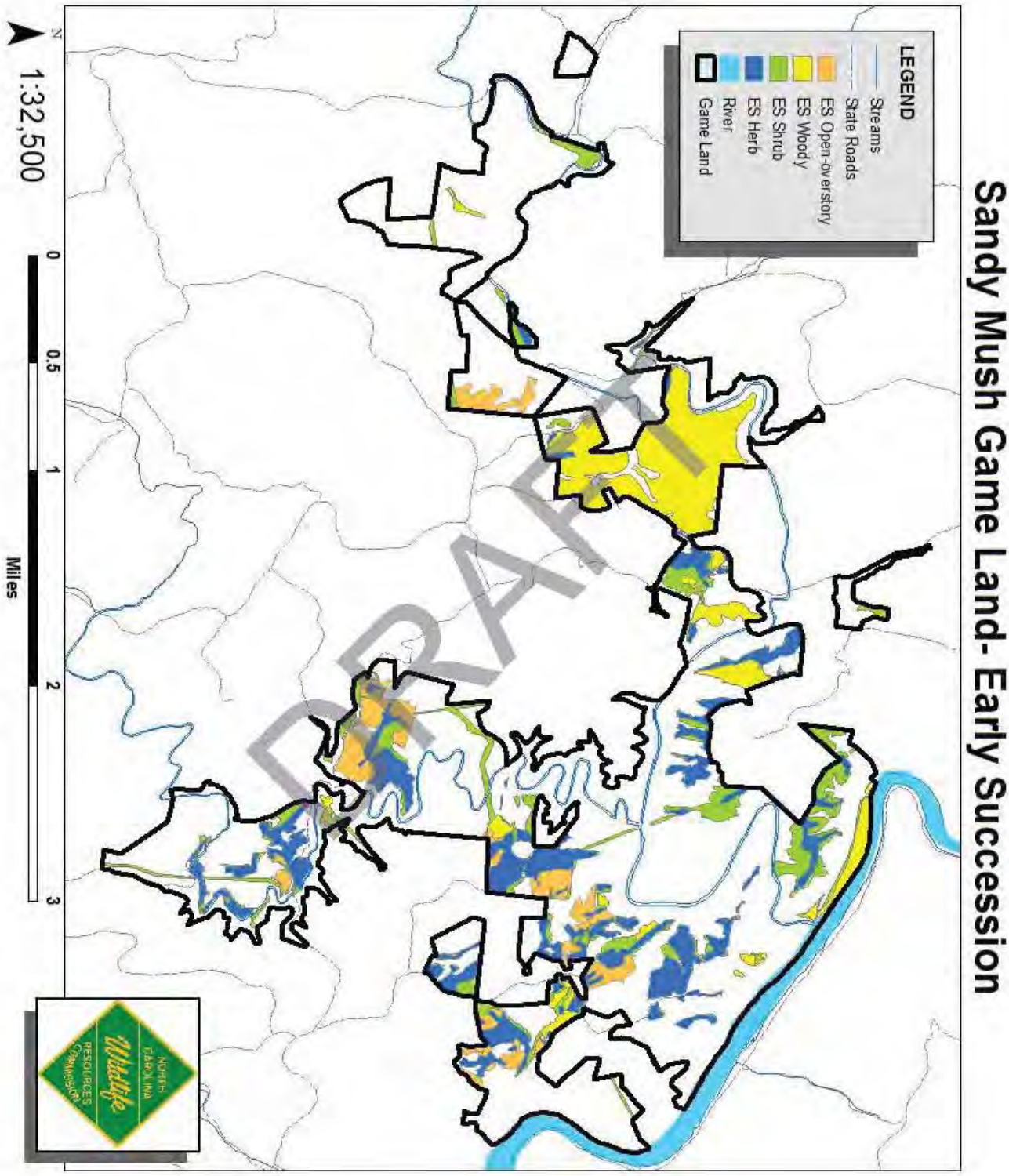
Appendix XV

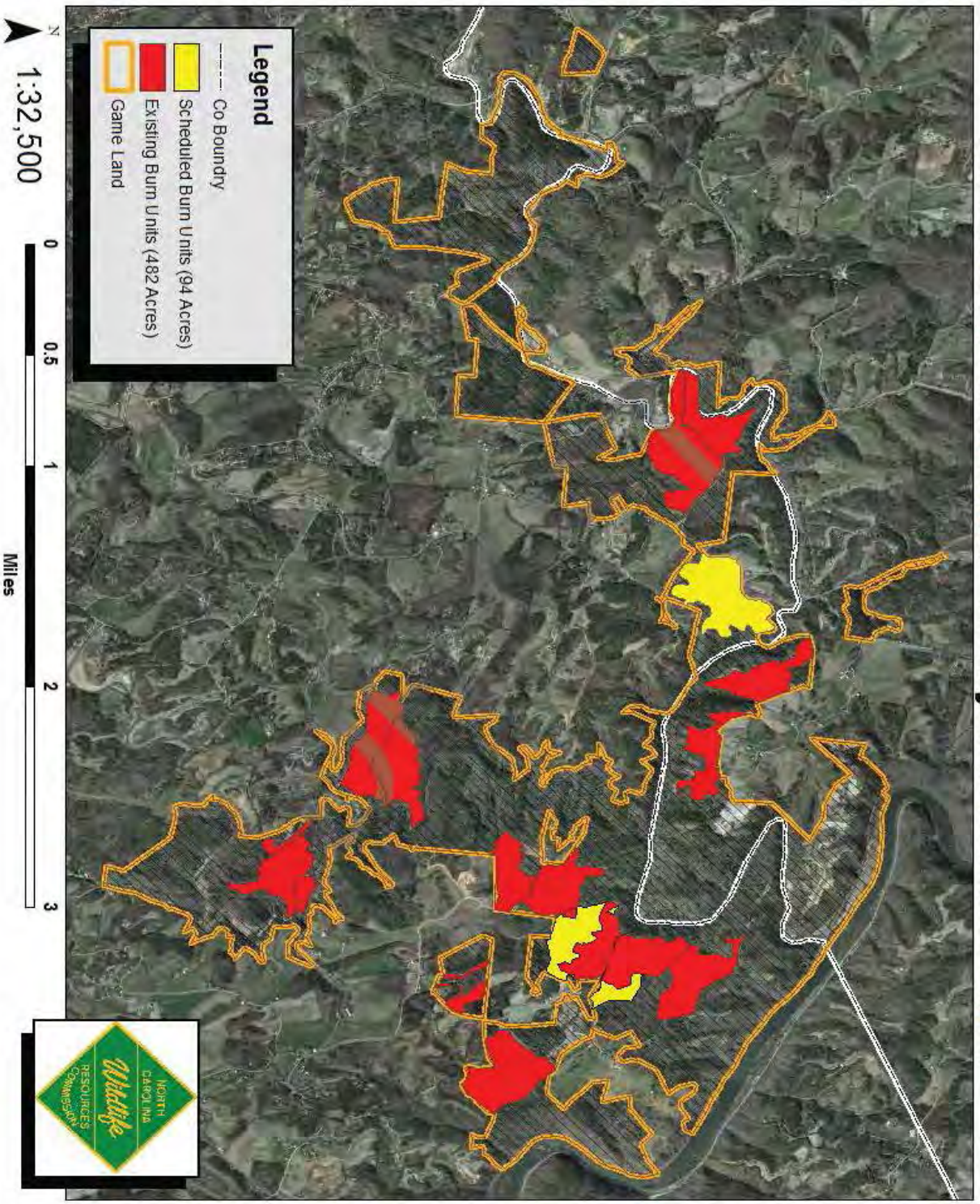


95

Appendix XVI

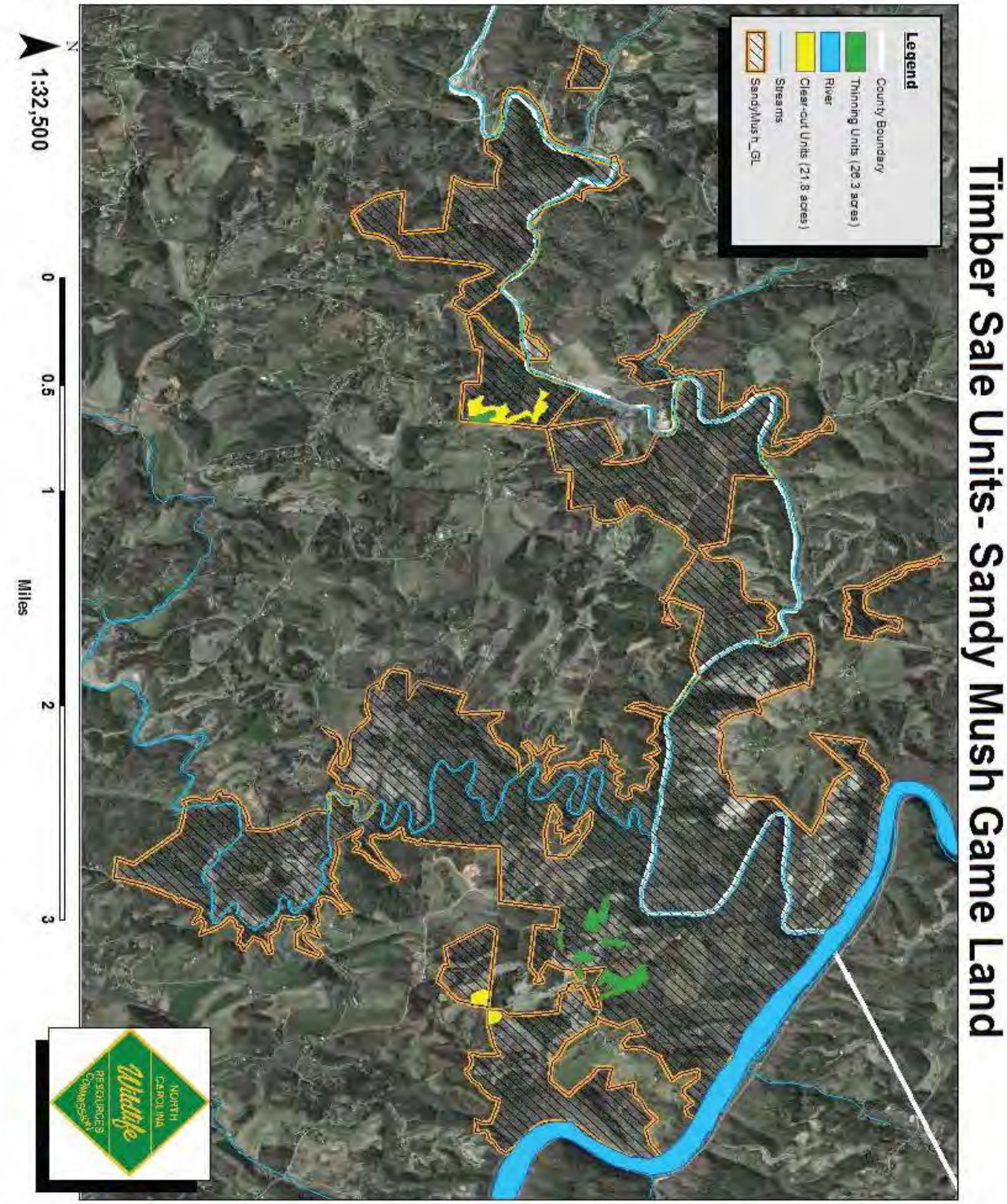


96


Prescribed Burn Units- Sandy Mush Game Land
Legend
Co Boundry
Scheduled Burn Units (94 Acres)
Existing Burn Units (482 Acres)
Game Land
N
1:32,500
0
0.5
1
2
3
Miles
Wildlife
North Carolina
Resources Commission

97

Appendix XVIII



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